FANUC Series 30*i*-MODEL B
FANUC Series 31*i*-MODEL B
FANUC Series 32*i*-MODEL B
FANUC Series 35*i*-MODEL B
FANUC Power Motion *i*-MODEL A
FANUC Series 0*i*-MODEL F

PMC
PROGRAMMING MANUAL

B-64513EN/03

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The products in this manual are manufactured under strict quality control. However, when using any of the products in a facility in which a serious accident or loss is predicted due to a failure of the product, install a safety device.

In this manual we have tried as much as possible to describe all the various matters.
However, we cannot describe all the matters which must not be done, or which cannot be done, because there are so many possibilities.
Therefore, matters which are not especially described as possible in this manual should be regarded as "impossible".

SAFETY PRECAUTIONS

DEFINITION OF WARNING, CAUTION, AND NOTE

This manual includes safety precautions for protecting the user and preventing damage to the machine. Precautions are classified into Warning and Caution according to their bearing on safety. Also, supplementary information is described as a Note. Read the Warning, Caution, and Note thoroughly before attempting to use the machine.

> ⚠ **WARNING**
> Applied when there is a danger of the user being injured or when there is a danger of both the user being injured and the equipment being damaged if the approved procedure is not observed.

> ⚠ **CAUTION**
> Applied when there is a danger of the equipment being damaged, if the approved procedure is not observed.

> **NOTE**
> The Note is used to indicate supplementary information other than Warning and Caution.

- Read this manual carefully, and store it in a safe place.

GENERAL WARNINGS FOR CNC APPLICATION DEVELOPMENT

⚠ **WARNING**

Be careful enough for the following warnings when you develop two or more applications or use networks.
If you neglect them, there is a danger of the user being injured or there is a danger of both the user being injured and the equipment being damaged.

1 Be careful enough if you write an identical NC data, an identical PMC data or a series of related data set by two or more above applications including network functions. Because they are executed based on each individual cycles (in other words, asynchronous cycles), there is a possibility that the data will be written in an unexpected order.

   Therefore, do NOT write above data in the following cases.
   - Applications and network functions
   - Two or more applications
   - Two or more network functions

   Data, applications and network functions of interest are listed in below. However, all may not be listed completely because new features will be added in the future.

2 Be careful enough that you must prevent PMC signals in the same byte from being written by the following two or more applications including network functions. While an application reads and writes one byte of PMC signals, other applications may write the same byte.

3 Be careful enough if you process a PMC signal set that is related to a NC function by using the following two or more applications including network functions. Because they are executed based on each individual cycles (in other words, asynchronous cycles), there is a possibility that the NC may receive the PMC signal set in an unexpected order.

4 Generally, when multi-byte data are read or written at once among the following two or more applications including network functions, the coherency of the read multi-byte data (in other words, reading all latest data at once) is not guaranteed. To ensure the coherency of the multi-byte data, prepare flags to notify the completion of reading or writing process that is separated from the entity of the data and make the handshaking process to access the data by using the flags.

Data List Table

Category	Data
General data for NC	Parameter, Tool compensation value and related data, Work zero offset value and related data, Workpiece coordinate system shift value and related data, Macro variable, P-CODE variable, Program and related data, Tool management function data, Tool life management data, Error compensation related data, Overtravel check (Interference check) related data, Software operator's panel related data
PMC data	PMC signal, PMC parameter
Data for Laser, Punch press or Wire cut	Tool data for punch press and related data, Safety zone data and related data, Laser cutting condition data and related data, Laser oscillator setting data and related data, Wire consumption compensation data, Guide position compensation data, Workpiece leveling data
Other data	Parameters for Data Server, Parameters for network setting

List Table of Applications and Network Functions

Category	Functions
Applications	PMC Ladder, Macro Executor, C Language Executor, FANUC PICTURE, FOCAS2
Network functions	FL-net, EtherNet/IP, PROFINET, Modbus/TCP, PROFIBUS-DP, DeviceNet, CC-Link

5 CNC has functions that read or write PMC signals in other than the G/F address. Be careful enough if the above mentioned applications and network read or write PMC signals used by these functions. When reading or writing the same PMC signal, applications or CNC functions may work in an unexpected manner. For details of these CNC functions, refer to "APPENDIX C".

GENERAL WARNINGS OR NOTES FOR LADDER PROGRAM

⚠ **WARNING**

1 If the ladder program is stopped while the machine is operating, the machine may behave in an unexpected working. Before stopping the ladder program, ensure that there are no people near the machine and that the tool cannot collide with the work piece or machine.
Otherwise, there is an operator's extreme risk of death or serious injury, and tool, work piece, and machine may be damaged.

2 You have to pay special attention to modify running the ladder program. If you modify the ladder program in wrong way, or update the ladder program with the machine in improper status, it may cause unexpected working of the machine. You have to make it sure that modifications you make on the ladder program is appropriate, the machine is in proper status, and nobody is near the machine, when you update the ladder program.

3 If macro variables, NC parameters, tool offsets, and etc. which can influence working of machine, are written with the PMC window instructions, the machine may behave in an unexpected working. You have to make it sure that the writing of these data is safety and proper, when modifying these data with the instructions.
The NC Data are listed in below. However, all may not be listed completely because new features will be added in the future.

Category	Data
General data for NC	Parameter, Tool compensation value and related data, Work zero offset value and related data, Workpiece coordinate system shift value and related data, Macro variable, P-CODE variable, Program and related data, Tool management function data, Tool life management data, Error compensation related data, Overtravel check (Interference check) related data, Software operator's panel related data

NOTE

Ladder programs, PMC parameters, Multi-language message data and I/O configuration data (I/O Link i assignment data) are stored in non-volatile memory in the CNC unit. Usually, they are retained even if the power is turned off. Such data may be deleted by misoperation, however, or it may prove necessary to delete all data from non-volatile memory as part of error recovery. To guard against the occurrence of the above, and assure quick restoration of deleted data, backup all vital data, and keep the backup copy in a safe place.

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APPENDIX

1 OVERVIEW OF PMC

1.1 WHAT IS PMC?

The programmable machine controller (PMC) is a programmable controller (PC) built into a CNC to perform sequence control for a machine tool (spindle rotation, tool change, machine operator's panel control, and so on).
Sequence control is to perform control steps successively in a predetermined sequence or according to the logic operation.
Programs for performing sequence control for machine tools are called sequence programs. Generally, sequence programs coded in the Ladder language are used.

1.1.1 Basic Configuration of PMC

The following is the basic configuration of the PMC:

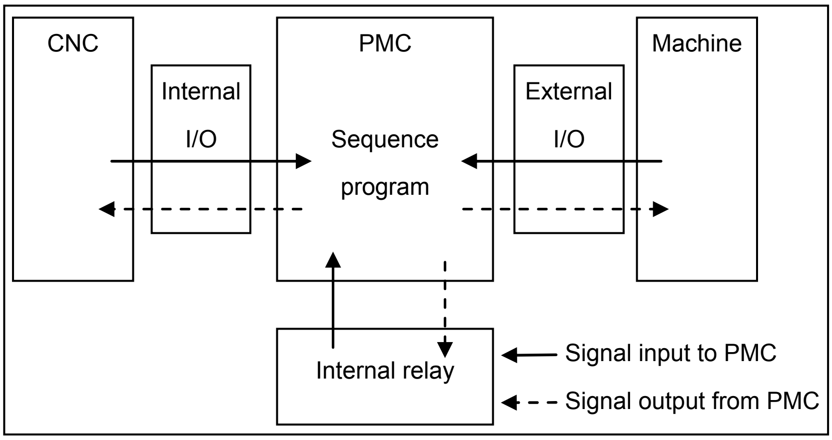


Fig. 1.1.1 Basic configuration of PMC

The sequence program reads input signals, performs operations, and outputs results in a predetermined sequence.

1.1.2 I/O Signals of PMC

Input signals of the PMC include signals input from the CNC (such as M and T function signals) and signals input from the machine (such as the cycle start button and feed hold signal button). Output signals of the PMC include signals output to the CNC (such as the cycle start command and feed hold signal command) and signals output to the machine (such as turret rotation and spindle stop). The PMC controls these I/O signals by executing a sequence program to control the machine tool.

1.1.3 PMC Signal Addresses

PMC signal addresses indicate the locations of I/O signals exchanged with the machine, I/O signals exchanged with the CNC, and signals for internal relays and data (PMC parameters) in nonvolatile memory. PMC addresses are roughly classified as shown in Fig. 1.1.3 (a).

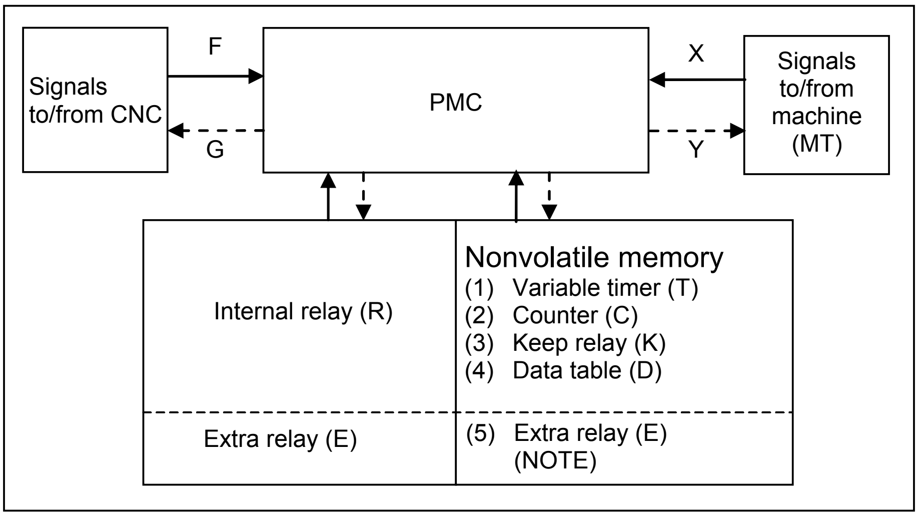


Fig. 1.1.3 (a) PMC-related addresses

> **NOTE**
> Optionally, extra relays (E) may be assigned to nonvolatile memory locations.

The PMC signal address format consists of an address number and bit number (0 to 7) as follows:

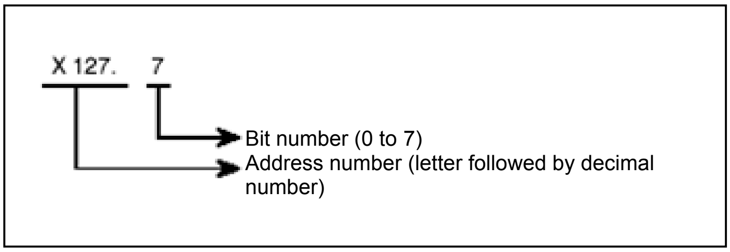


Fig. 1.1.3 (b) PMC address format

The first letter of an address number represents the type of the signal.
In sequence programs, an address of a byte may be specified. In the above example, specify X127 to specify a byte address. In this case, the period "." and bit number are unnecessary.

Table 1.1.3 lists the address symbols and corresponding signals.

Table 1.1.3 Address Symbols and signal types

Symbol	Signal type
F	Input signal from CNC to PMC (CNC → PMC)
G	Output signal from PMC to CNC (PMC → CNC)
X	Input signal from machine to PMC (MT → PMC)
Y	Output signal from PMC to machine (PMC → MT)
R	Internal relay
E	Extra relay
A	Message display
T	Variable timer
C	Counter
K	Keep relay
D	Data table
M	Input signal from another PMC path
N	Output signal to another PMC path
L	Label number
P	Subprogram number

(1) Addresses of signals between the PMC and CNC (F and G)
These addresses are assigned to interface signals between the CNC and PMC. The relationships between the signals and addresses are defined by the CNC.
F indicates an input signal from the CNC to PMC.
G indicates an output signal from the PMC to CNC.

(2) Addresses of signals between the PMC and machine (X and Y)
I/O signals exchanged with an externally connected machine can be assigned to any addresses within an available range to control the machine.
X indicates an input signal from the machine to PMC.
Y indicates an output signal from the PMC to machine.

(3) Addresses of internal relays and extra relays (R and E)
These addresses are used to temporarily store operation results during sequence program execution processing.
Optionally, E addresses may be assigned to nonvolatile memory locations.
The address locations of internal relays also include a reserved area used by the PMC system software. The signals in the reserved area cannot be written by sequence programs.

(4) Signal addresses for message display (A)
Instruction “DISPB” used in sequence programs include instructions to display a message on the CNC screen. These addresses are used by such instructions.

(5) Nonvolatile memory addresses
The contents of these address locations are not erased even when the power is turned off.
These addresses are used for management of the data items listed below. These data items are called PMC parameters.
(a) Variable timer (T)
(b) Counter (C)
(c) Keep relay (K)
A reserved area used by the PMC system software is partly included.
(d) Data table (D)
(e) Extra relay (E)
Optionally, E addresses may be assigned to nonvolatile memory locations.
These addresses are used to temporarily store operation results during sequence program execution processing.

(6) Multi-path PMC interface address (M, N)
These addresses are used to the Multi-path PMC interface.
M indicates an input signal from another PMC path.
N indicates an output signal to another PMC path.

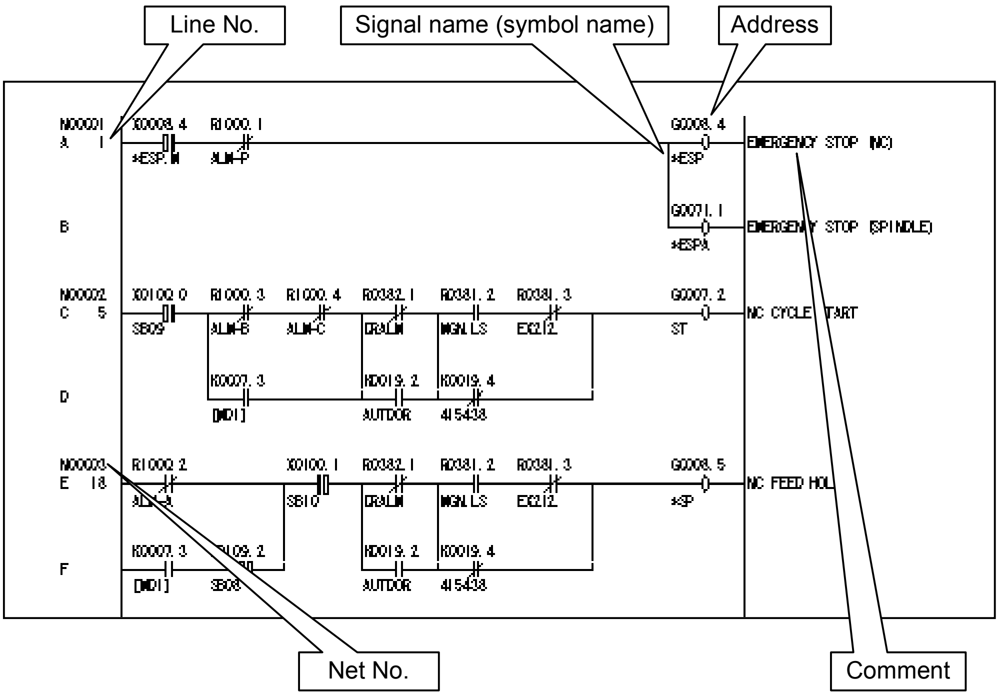
(7) Other addresses
(a) Label number (L)
Sequence program instructions include an instruction to cause a jump to a specified position in the middle of processing. This address indicates the jump destination used by this instruction. The contents of L address cannot be read/written in sequence program.
(b) Subprogram number (P)
In sequence programs, a main program can call subprograms. P addresses indicate the numbers of these subprograms. The contents of P address cannot be read/written in sequence program.

1.2 WHAT IS LADDER LANGUAGE?

The Ladder language is one of sequence programming languages. This programming language, which represents the sequence and logic operations of I/O signals by ladder diagrams, is widely used by sequence control engineers. This language is mainly used for PMCs.

1.2.1 Ladder Diagram Format

Designers develop and see ladder diagrams in the design stage. However, other people (for example, many maintenance engineers) have much more chances to see ladder diagrams than the designers of the ladder diagrams have. Therefore, the designers should create ladder diagrams so that these diagrams are intelligible to any one.
The following is the format of ladder diagrams:



The meanings of ladder diagram contents will be described later.

1.2.2 Signal Name (Symbol Name)

Symbol names representing I/O signal names can be assigned to PMC addresses. It is recommended that signal names (symbol names) suitable for I/O signals be assigned as explained below.

(1) Signal names may consist of any alphanumeric characters and the special symbols. The number of characters that can be entered varies depending on the PMC model. For the allowable number of characters, see the table in Subsection 2.1.1.

(2) As the names of the signals between the CNC and PMC, use the signal names indicated in the address table of the PMC without modifications.

(3) Some CNC signals are input from the machine or output to the machine. The names of these signals are distinguished by prefixing X or Y to the names of signals between the CNC and PMC.
For example, a single block input signal is represented as XSBK by prefixing X, while a start lamp output signal is represented as YSTL by prefixing Y.

The names of some signals between the CNC and PMC, however, exceed the maximum allowable number of characters as a result of prefixing X or Y to the names. In such a case, delete the last character of the signal name.
(*SECLP → X*SECL)

(4) The same signal name (symbol name) cannot be assigned to more than one signal address.

1.2.3 Comment

A comment can be added to each symbol in the symbol table so that it can be indicated as a comment on a relay or coil in the sequence program. The number of characters that can be entered varies depending on the PMC model. For the number of characters that can be entered, see the table in Subsection 2.1.1.
For all relays and coils that are output signals to the machine, add a comment to provide a detailed signal explanation. For other auxiliary relays, provide explanations of the signals if these relays have significant meanings in sequence control.
In particular for machine-related input signals, be sure to provide a detailed signal explanation as a comment in the symbol table.
Add detailed comments to signals dedicated to the machine so that one can guess the meanings of these signals just from the symbol names.

1.2.4 Graphic Symbols of Relays and Coils

Ladder diagrams use the following relay symbols:

Relays (contacts)

Instruction representation	Function
-| |-	Normally open contact (contact A)
-|/ |-	Normally closed contact (contact B)

Coils

Instruction representation	Function
-O-	Coil
-○O-	Negated coil
-(S)-	Set coil
-(R)-	Reset coil

These instructions perform a 1-bit operation and are called basic instructions.
In addition, there are functional instructions that enable easy programming of complicated operations for processing byte, word, and double-word data, which are difficult to program just using basic instructions. The symbol formats of the functional instructions are slightly different from instruction to instruction. For details, see the description of each functional instruction in Chapter 4.

1.2.5 Line Number and Net Number

A line number is indicated in every line of ladder diagrams.
A continuous ladder circuit from a contact to a coil is called a net. A net number is also indicated for each net.

1.2.6 Difference Between Relay Sequence Circuit and Ladder Sequence Program

In general relay sequence circuits, because of a limited number of relay contacts, one contact may be shared by several relays to minimize the number of contacts used. Fig. 1.2.6 (a) gives an example.

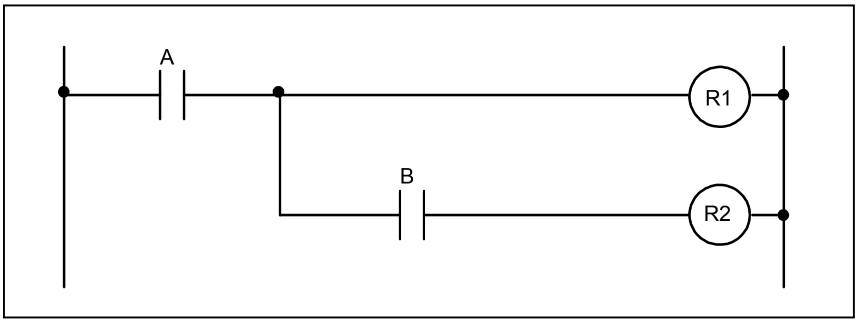


Fig. 1.2.6 (a)

With the PMC, relay contacts are considered to be unlimited, so ladder diagrams are created as shown in Fig. 1.2.6 (b).

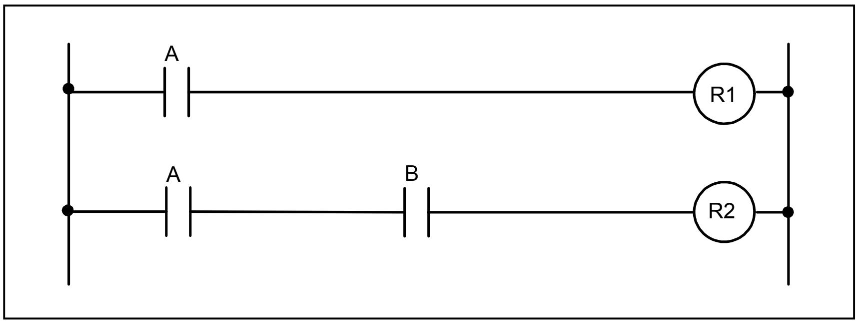


Fig. 1.2.6 (b)

In a relay sequence circuit having no contact between a branch point and a coil as shown in Fig. 1.2.6 (c), a similar ladder diagram can be created even for the PMC.

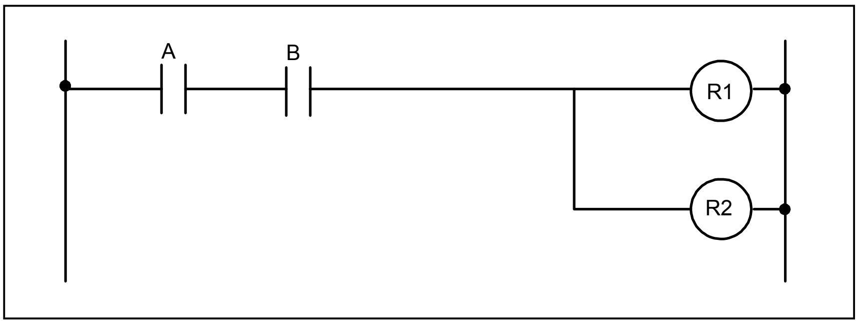


Fig. 1.2.6 (c)

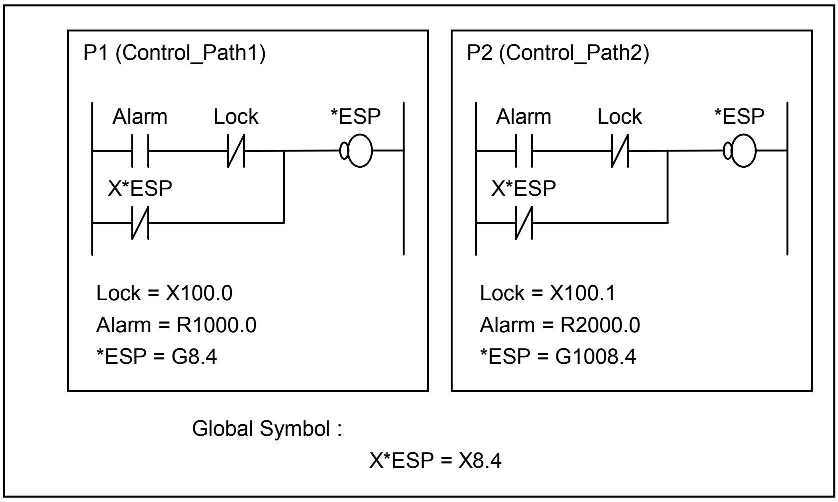
> **NOTE**
> The extended PMC ladder instruction function allows the sequence circuits like Fig. 1.2.6(a). For details, see 8.3.4.

1.2.7 Specification of Extended Symbol and Comment

Using extended symbol and comment, you can use following functions.

- Local symbols effective in sub programs
- Extension of maximum character length of symbol and comment
- Multi-language support of comment
- Multiple definitions of symbol and comment to one signal
- Data type definition
- Automatic address assignment at compiling on FANUC LADDER-III

(1) Local symbols effective in sub programs
You can define local symbols effective only in a sub program. So you can define local symbols having same string in other sub programs. Local symbols defined in different sub programs do not conflict.



Using local symbols, symbol conflict does not occur. Therefore, it is easy to develop ladder in modular programming technique. In addition, it is easy to reuse sequence programs. When you have to program a similar program in some sub programs, copy the logic to another sub program, redefine the local symbols, and compile on FANUC LADDER-III.

NOTE
1. Same local symbol names are not allowed in the same sub program.
2. Same symbol name of global symbol and local symbol are not allowed.
3. Local symbol cannot be defined to address P. Symbol definition to address P must be global symbol.
4. You cannot create a sequence program using extended symbol and comment only with CNC. To create it, you have to use FANUC LADDER-III.
5. When you use the function block function, it becomes extended symbol and comment form automatically.

(2) Extension of maximum character length of symbol and comment
Maximum character length of a symbol and comment is extended as follows. So you can describe in details.

Kind	Extended type	Basic type
symbol	40 characters in maximum	16 characters in maximum
comment	4 set 255 characters in maximum	1 set 30 characters in maximum

(3) Multi language support
One symbol entry has four comments set in maximum.
Displaying comment set can automatically selected by display language setting in CNC. By describing each comment set in different languages, you can display comment in all PMC screens in multi languages. This is very useful in maintenance.

NOTE
For the language attribute, refer to "APPENDIX B. LANGUAGE ID TABLE".

(4) Multiple definitions of symbol and comment to one signal
You can define multiple symbols and comments to the same signal.

NOTE
When multiple symbol and comment are defined to the same signal, you can search the names by each symbol. On the other hand the symbol on PMC screen is displayed one of these symbol names. So if you search symbols, displayed symbol name on searched position may be different from searched word.

(5) Data type definition
You can define symbol and comment with data type definition.

Data type	Meaning
BOOL	Boolean
BYTE	8 bits integer
WORD	16 bits integer
DWORD	32 bits integer
LABEL	Label (Address L)
PROG	Sub program (Address P)

NOTE
1 In ladder editing screen, for example, BYTE type symbol can be set to the WORD type parameter of a function. But it is recommended that data type of the symbol should be consistent with the data type of the parameter that it is assigned to.
2 When two or more symbols are defined with a signal and these symbols have different data types the symbol name of largest data type is displayed on PMC screens.

(6) Automatic address assignment at compiling on FANUC LADDER-III
On FANUC LADDER-III, when programming by symbol names without actual addresses, this function assigns addresses to them automatically.

⚠ CAUTION
The assignment of address may change by modifying symbol / comment data.

NOTE
By setting 1 to K903.5 of system keep relay, the signal state of the symbols whose addresses are assigned automatically can be initialized when updating sequence program to the one of different symbol / comment data.
In this case, changing the symbol / comment data whose address is not assigned automatically will also initialize all signal states of the address range for automatic assignment to 0.

(7) Available characters
Those characters can be used.

- Available characters for symbol:

<table>
<tr><th>Kind</th><th>Extended type</th><th>Basic type</th></tr>
<tr><td>The character that can be used as the symbol</td><td>A to Z, a to z, 0 to 9, _
! ” # & ’ ( ) * + , - < = > ? @ [/] ^ ` { | } ~ (Note)</td><td>A to Z, a to z, 0 to 9, _ Space,<br>! ” # $ % & ’ ( ) * + , . - < = > ? @ [ / ] ^ ` { | } ~ ; :</td></tr>
<tr><td>The character that cannot be used for the first character of the symbol</td><td>% $</td><td></td></tr>
<tr><td>The character that cannot be used for the symbol</td><td>Space,
; : .</td><td></td></tr>
</table>

NOTE
Although it is allowed to use special characters in symbol, using only alphabets, digits and _(underscore) to comply with the variable name defined in IEC61131-3 is recommended.

- Available characters for comment:

(a) English comment and Japanese comment:

<table>
<tr><th>Kind</th><th>Extended type</th><th>Basic type</th></tr>
<tr><td>The character that can be used as the comment</td><td>A to Z, a to z, 0 to 9, Space
! ” # & ’ ( ) * + , . - < = > ? @ [/] ^ _ ` { | } ~ ; :</td><td>A to Z, a to z, 0 to 9, Space,<br>! ” # $ % & ’ ( ) * + , . - < = > ? @ [ / ] ^ _ ` { | } ~ ; :</td></tr>
</table>

(b) Multi-language comment:
Refer to "Appendix A. CHARACTER CODE TABLE".

1.3 SEQUENCE PROGRAM CREATION PROCEDURE

This section briefly explains how to create a program for providing sequence control for a machine tool by using the Ladder language as an example. When creating a sequence program, see the necessary manual for editing after understanding the contents of this chapter thoroughly.

1.3.1 Determining Specification

First, determine the specifications of the control target. Calculate the number of I/O signals, and determine the interfaces of the I/O signals.
In this step, creation of interface specifications is recommended.

1.3.2 Creating Ladder Diagram

After determining specifications, represent control operations with a ladder diagram. Timer, counter, and other functions that cannot be represented by relay symbols are called functional instructions. Represent these functional instructions with corresponding symbols.
When using offline programmer or built-in edit function explained in "Editing Sequence Program" in the next subsection, you can enter a sequence program in a ladder diagram form. At the time of sequence program editing, you can make entry while creating a ladder diagram on the display screen, so you need not prepare a ladder diagram in advance.
If you want to create a sequence program efficiently, however, it is recommended that you should create a ladder diagram in advance.
Ladder diagrams are referenced as maintenance drawings by FANUC maintenance engineers, maintenance engineers of machine tool builders, and maintenance engineers of end users not only domestically but also in foreign countries. Therefore, try to create as intelligible ladder diagrams as possible.

1.3.3 Editing Sequence Program

A sequence program in the Ladder language is edited with one of the following two methods:

(1) PC programmer
FANUC supplies FANUC LADDER-III as sequence program development software for FANUC PMC. Use of FANUC LADDER-III allows you to edit a program in the Ladder language on a personal computer.

(2) Built-in programmer
The PMC software built into the CNC has a built-in edit function. With this function, a program in the Ladder language can be edited.

By using either of these editing methods, a sequence program can be entered in a ladder diagram form from the EDITOR screen. FANUC LADDER-III can also output an entered sequence program to a printer in a ladder diagram form.
Furthermore, FANUC LADDER-III provides a function for converting a program in a ladder diagram form to mnemonic form or vice versa. By using this function, you can edit the program in mnemonic form with a text editor.
Fig. 1.3.3 shows an example of a ladder diagram, and Table 1.3.3 shows an example of a mnemonic form.

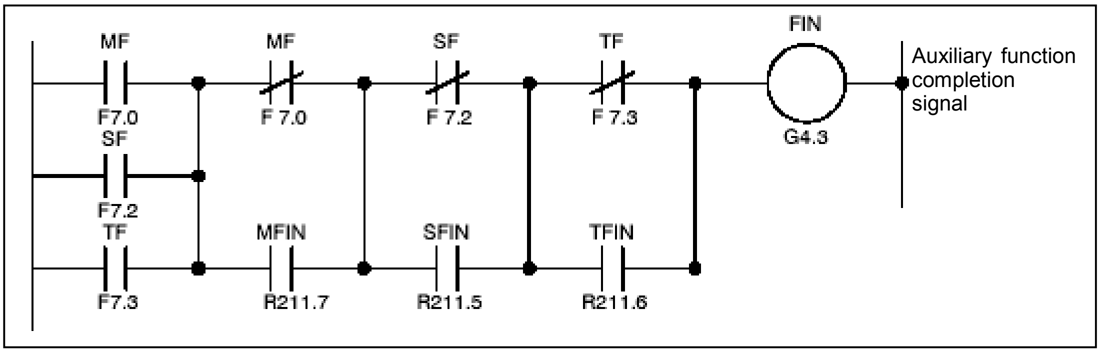


Fig. 1.3.3

Table 1.3.3

Step No.	Instruction	Address No. & bit No.	Remarks
1	RD	F7.0	MF
2	OR	F7.2	SF
3	OR	F7.3	TF
4	RD.NOT.STK	F7.0	MF
5	OR	R211.7	MFIN
6	AND.STK		
7	RD.NOT.STK	F7.2	SF
8	OR	R211.5	SFIN
9	AND.STK		
10	RD.NOT.STK	F7.3	TF
11	OR	R211.6	TFIN
12	AND.STK		
13	WRT	G4.3	FIN

During sequence program editing, signal names (symbols) and comments can be entered for I/O signals, relays, and coils. Easy-to-understand signal names and comments should be entered to improve program maintainability.

1.3.4 Transferring and Writing Sequence Program to PMC

After completing editing for the sequence program, input (transfer) the program to the PMC. This operation is unnecessary when you have edited the program by using the built-in programmer.
When you have edited the sequence program by using the PC programmer, input the sequence program from the editing environment (the personal computer (PC)) to the PMC. The following input methods can be used:

(1) Input from the I/O screen
The sequence program on the PC is input to the PMC via a memory card or a USB memory.

(2) Input from the online monitor screen
For data input, connect the PC containing the sequence program to the CNC via Ethernet or RS-232C.

After inputting the sequence program, write it in the flash ROM. This operation can be done with the DATA I/O screen of the PMC.

1.3.5 Checking Sequence Program

After writing the sequence program in the flash ROM, check the sequence program.
The sequence program can be checked in the following two ways:

(1) Checking with a simulator
Connect a simulator (consisting of lamps and switches) instead of the machine. Instead of using input signals from the machine, turn the switches on and off to input signals, and confirm output signals by checking the on/off states of the lamps.

(2) Checking by system operation
Connect the machine to make checks. Before starting the operation, take safety measures because when the sequence program is executed for the first time, an unpredictable motion can occur.

1.3.6 Storage and Management of Sequence Program

When the sequence program is completed after checking, it should be stored and managed by the machine tool builder.
The sequence program can be output to the printer in a ladder diagram form by using the PC programmer.
The output ladder diagram should be attached as a maintenance drawing to the machine together with other attached materials such as a power magnetic cabinet circuit diagram.

1.4 EXECUTION OF SEQUENCE PROGRAM

Sequence programs in the Ladder language are executed in the order of instructions coded in the ladder diagrams.
Fig. 1.4 shows how a sequence program is executed.

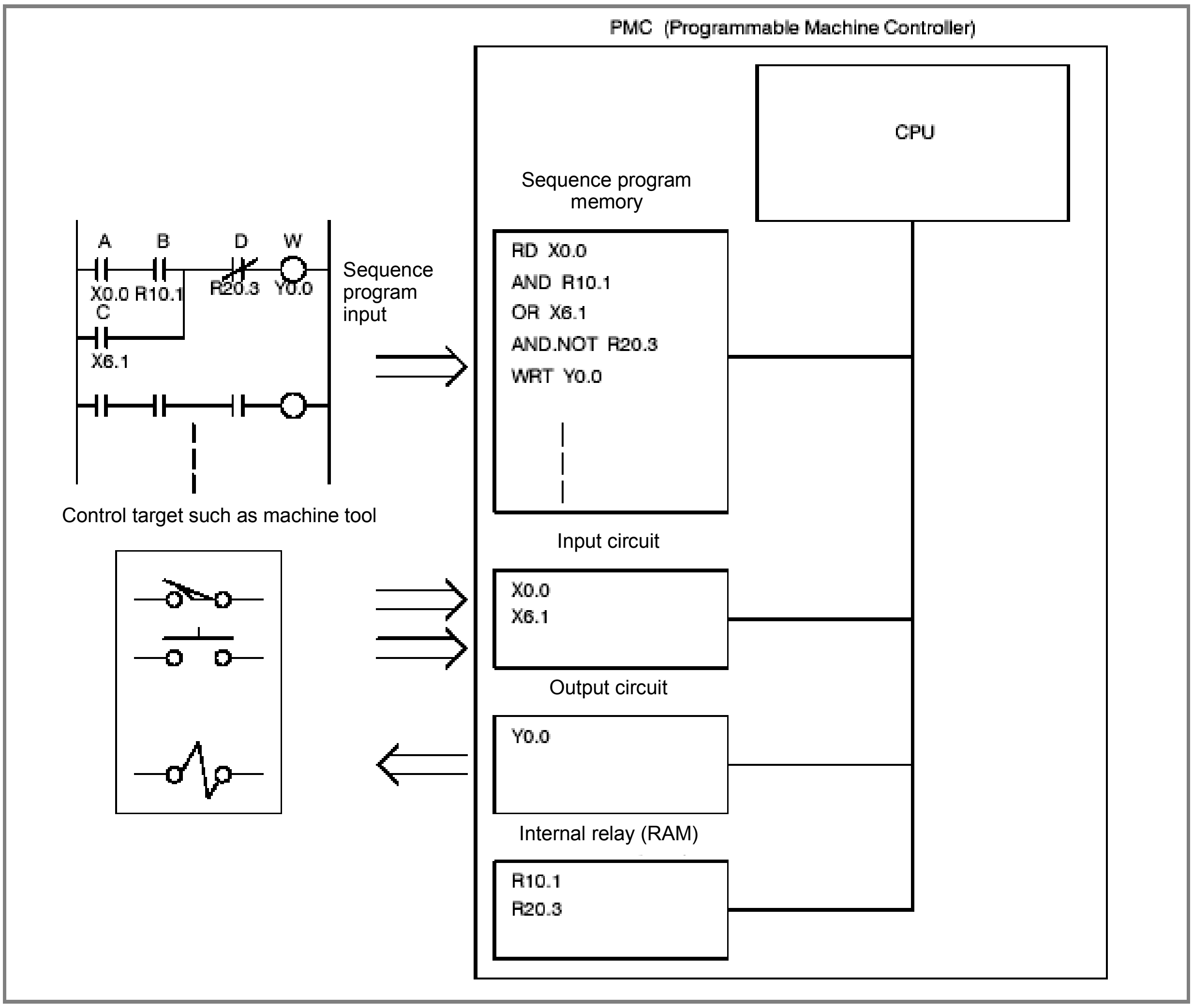


Fig. 1.4 Sequence program execution by PMC

The RD instruction causes the CPU to read the signal of the input circuit at address X0.0 and set the read data in the operation register. Next, the AND instruction causes the CPU to AND the set data with the internal relay state at address R10.1 and set the result in the operation register. The CPU then executes the subsequent instructions at high speed, and the operation result is output to the output circuit at address Y0.0.

1.4.1 Execution Procedure of Sequence Program

In general relay sequence circuits, relays operate at exactly the same time. This means that when relay A operates in the following figure, relays D and E operate at exactly the same time (when contacts B and C are both off).

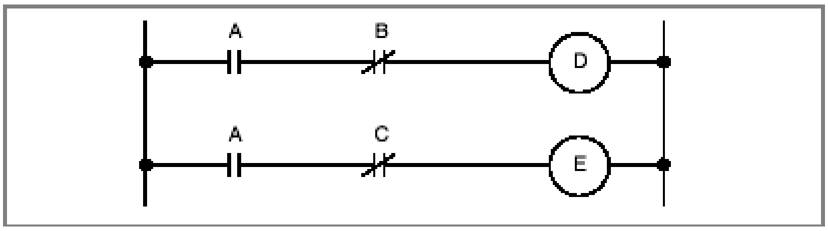


Fig 1.4.1 (a)

In PMC sequence control, on the other hand, relays in the circuit operate sequentially. When relay A in Fig. 1.4.1 (a) operates, relay D operates, then relay E operates.
Therefore, in PMC sequence control, relays operate in the order coded in the ladder diagram (the order of programming). The sequential operations in this sequence are performed at high speed, but some instructions are affected by the execution order.
Accordingly, in the ladder diagrams shown in Fig. 1.4.1 (b), there is a distinctive difference in operation between the PMC sequence and the sequence of the relay circuit.

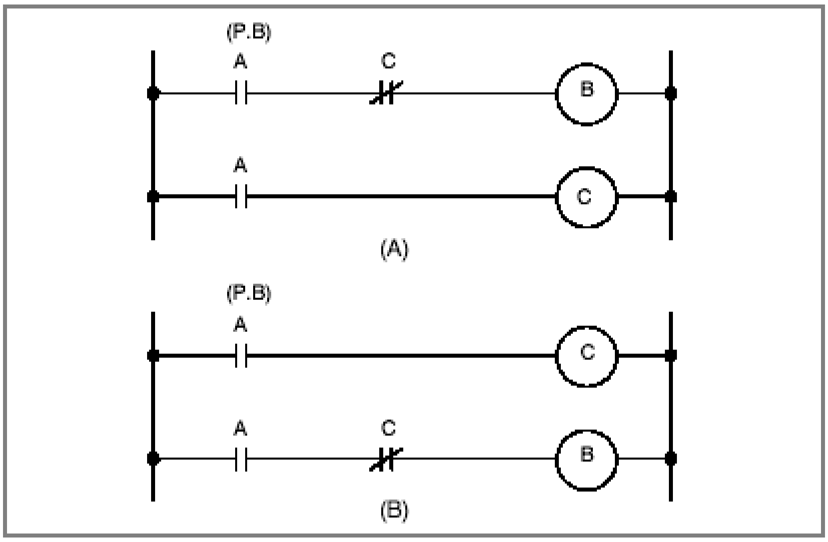


Fig. 1.4.1 (b) Circuit examples

(1) For relay sequence circuit
(A) and (B) in Fig. 1.4.1 (b) operate in the same manner. When A (P.B) is turned on, current flows through coils B and C, turning on B and C simultaneously. After C is turned on (after relay operation time), B is turned off.

(2) For PMC programming
In (A) in Fig. 1.4.1 (b), as with the relay sequence circuit, when A (P.B) is turned on, B and C are turned on, then B is turned off after a certain time elapses (after a time required for one cycle of the PMC sequence). In (B) in Fig. 1.4.1 (b), turning on A (P.B) turns on C but does not turn on B even momentarily.

1.4.2 Repetitive Operation

A sequence program is executed until the end of the ladder diagram (the end of the program) is reached, then program execution is repeated from the beginning of the ladder diagram (the beginning of the program).
The execution time from the beginning to the end of the ladder diagram (the time required for one cycle) is a time for processing the sequence program once and is called a scan.
This processing time depends on the sequence control scale (the number of steps) and the size of the 1st level sequence described below. A shorter processing time results in a better signal response in the sequence.

1.4.3 Processing Priority (1st Level, 2nd Level, and 3rd Level)

A sequence program consists of two operation parts: a high-speed sequence part called the 1st level, which is executed every several msec, and a normal sequence part called the 2nd level. When the model used allows use of the 3rd level, the 3rd level sequence part is added. (See Fig. 1.4.3 (a).)

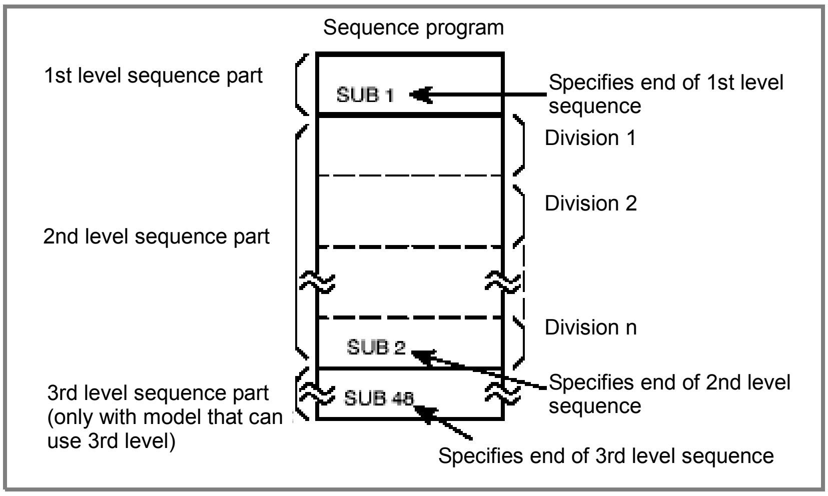


Fig. 1.4.3 (a) Sequence program structure

The 1st level sequence part is a high-speed sequence part that is executed every ladder execution cycle. The ladder execution cycle is 1, 2, 4 or 8 msec, which is set in a CNC parameter. If the execution of the 1st level program requires a long time, the overall execution time including the 2nd level (sequence processing time) is extended. So, the 1st level sequence part should be created so that it can be processed in a short time where possible. The 2nd level sequence part is executed every (ladder execution cycle × n) msec (where n is the number by which the 2nd level is divided). The 3rd level sequence part is executed when the PMC is idle.

(1) Division of the 2nd level program
The 2nd level program must be divided to execute the 1st level program. The order of sequence program execution is illustrated in Fig. 1.4.3 (b), where the number of divisions is assumed to be n. After the last division (division n) of the 2nd level program is executed, the sequence program is executed from the beginning. Therefore, when the number of divisions is n, the execution cycle of the overall sequence program is expressed as the ladder execution cycle × n msec.

As the amount of the 1st level sequence part increases, the amount of the 2nd level sequence portion executed within the ladder execution cycle decreases. As a result, the number of divisions n increases, which increases the overall execution time including the 2nd level (sequence processing time). Therefore, the 1st level sequence program part should be minimized where possible. The division number of 2nd level may be indefinite because of changing of the working condition of functional instructions in 1st level and 2nd level.

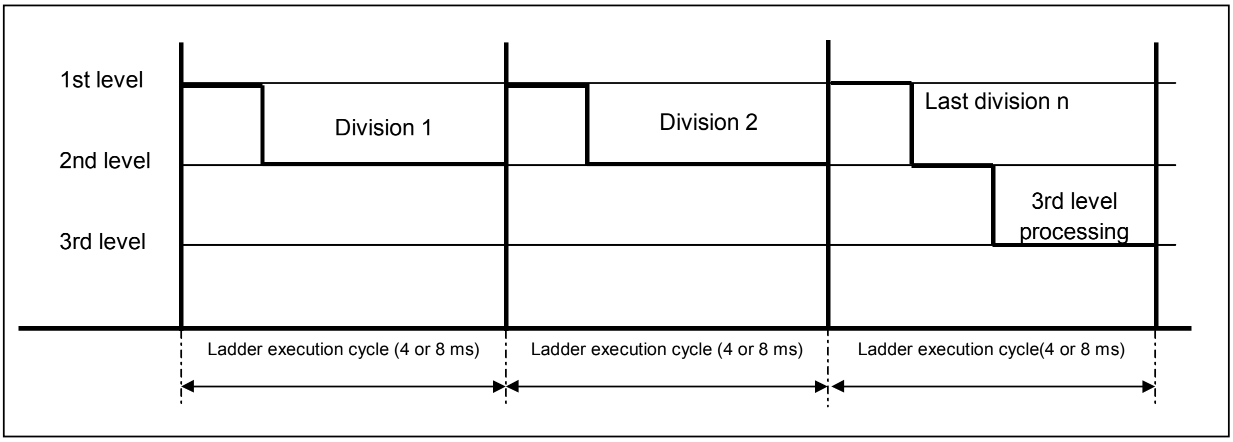


Fig. 1.4.3 (b) Sequence program execution order

(2) 1st level sequence part
It is high-speed sequence operation. Only high-speed sequence processing such as processing of a pulse signal with a short signal width in time is performed.
These signals include emergency stop and feed hold signals.

(3) 3rd level sequence part
The 3rd level sequence processing is performed during the remaining time from the end of the last division (n) of the 2nd level until the 1st level processing restarts (see Fig. 1.4.3 (b)).
It is possible to program the 3rd level, but the execution cycle period of time for processing the 3rd level sequence part is not guaranteed to maintain program compatibility with conventional models. Therefore, the 1st and 2nd level sequence parts should be programmed without using the 3rd level sequence part.

NOTE

1 The ladder program is executed initially to set the input signals for the CNC (G signals) like the following chart until the beginning of cyclic operation of the CNC from the power on of the CNC. The initial execution is different from the cyclic execution. Therefore the ladder program is not executed at the constant period and is continuously and repeatedly executed. The execution of each level of the ladder program is not divided. They are executed from the top of the program to the end of the program in the order of the following chart. After finishing the initial execution of the ladder, the CNC starts the cyclic operation.

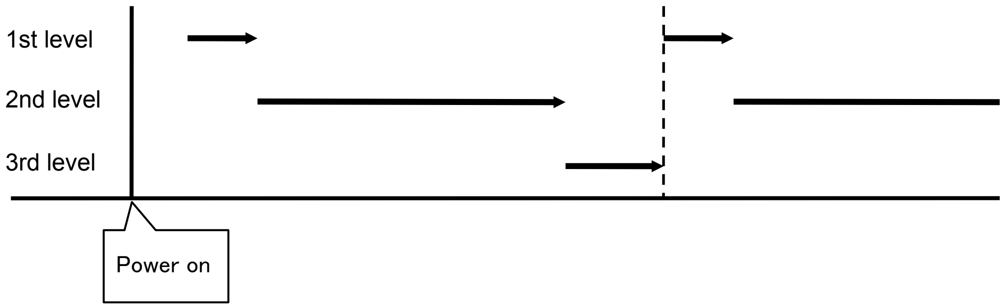
2 In the initial execution of the ladder program, the operations of the following functional instructions are different from the normal operations.

- TMR、TMRB、TMRC、TMRST、TMRSS

  The timer is not executed and the time is always 0 in the initial execution.

- WINDR、WINDW、AXCTL、EXIN、DISPB、PSGNL、PSGN2

  They are executed as the NOP instruction (No operation) in the initial execution.



1.4.4 Structured Sequence Program

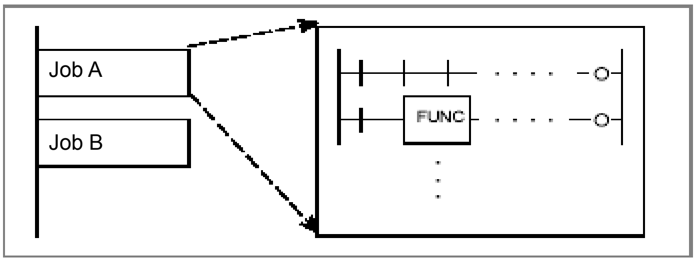
Structured ladder coding has the following advantages:

- Programming is easy to understand, therefore programming becomes easier.
- Program errors can be found easily.
- Troubleshooting can be done easily.

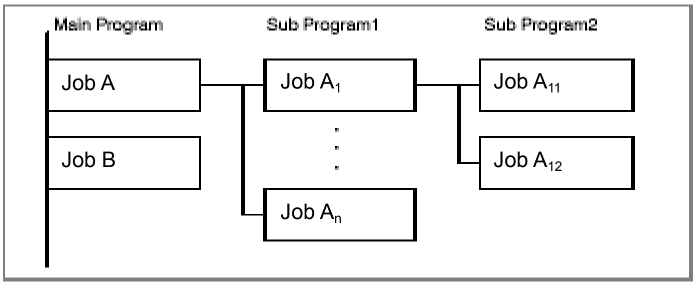
1.4.4.1 Implementation

Three major implementation techniques are supported.

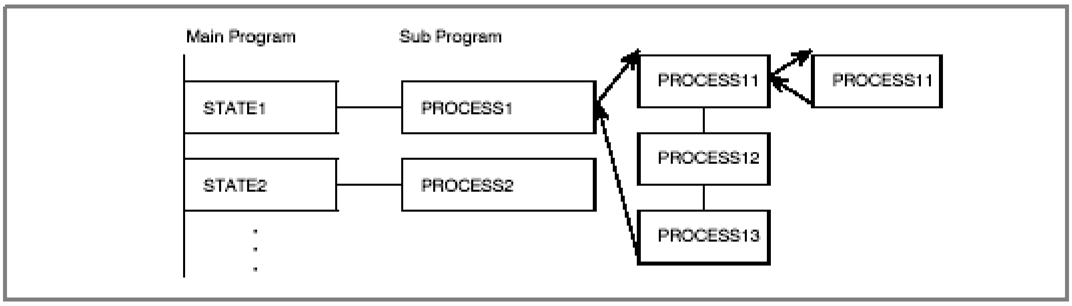
(1) Use of routines
Ladder sequence processing units are created so that they can be treated as routines.



(2) Nesting
Ladder routines created in (1) are connected to configure a ladder sequence.



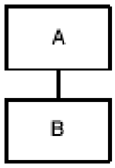
(3) Conditional branch
The main program loops and determines conditions. If conditions are satisfied, a subprogram process is executed. If the conditions are not satisfied, the subprogram process is skipped.



Application example

(1) Example

Suppose that there are four major jobs.



If Y0 is 1, workpiece machining request is assumed to be issued, and processing is performed. (Conditional)

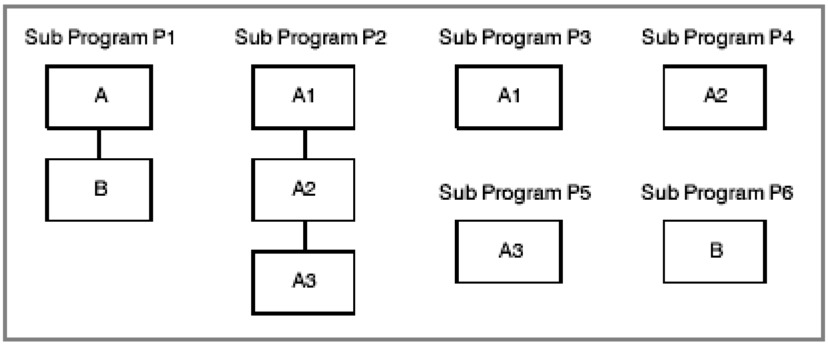
A: <1> Pick up workpiece from pallet. (A1)

<2> Machine workpiece. (A2)

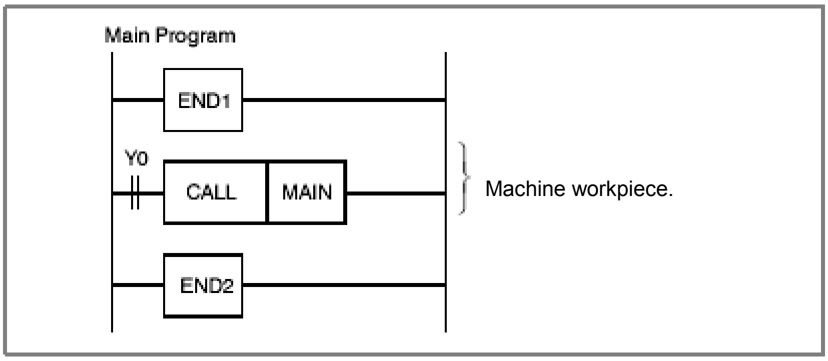
<3> Return workpiece to pallet. (A3)

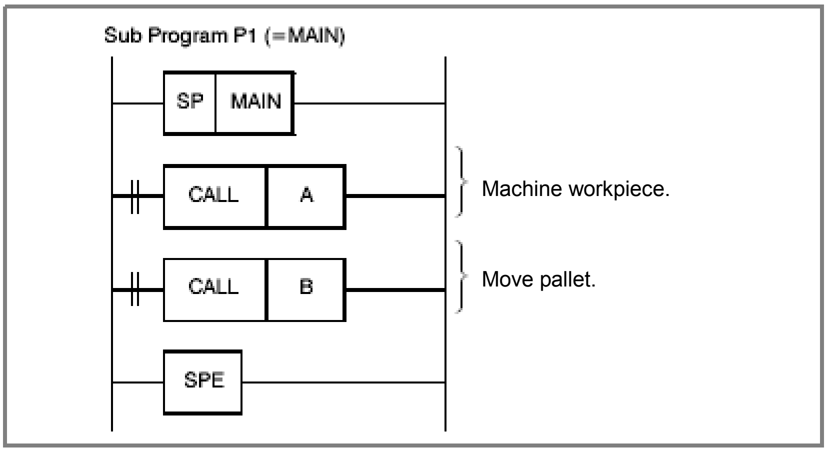
B: <4> Move pallet.

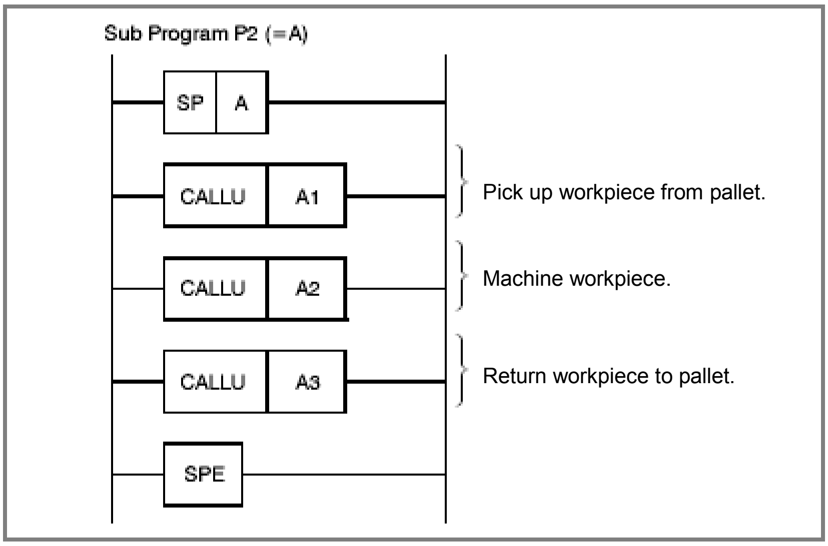
(2) Program configuration

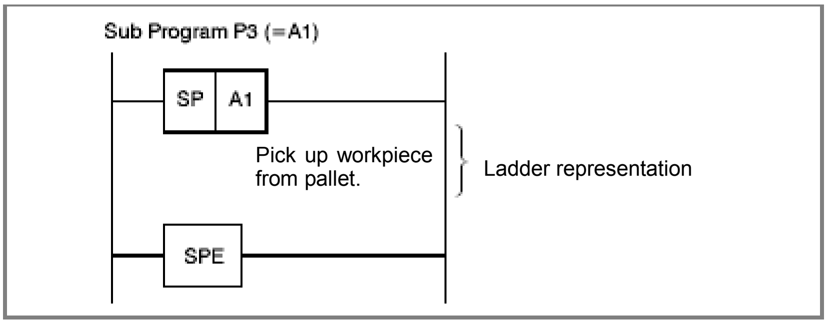


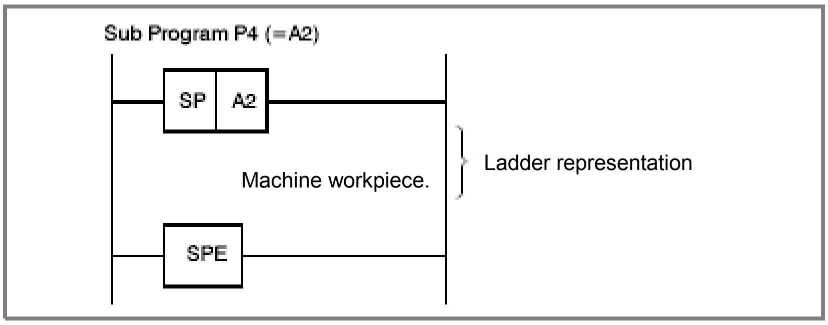
(3) Program coding

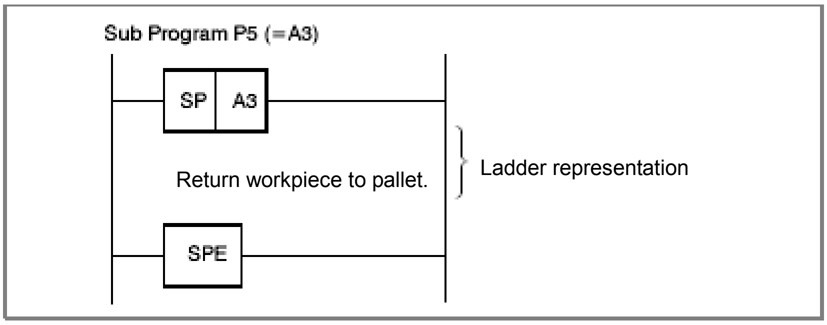


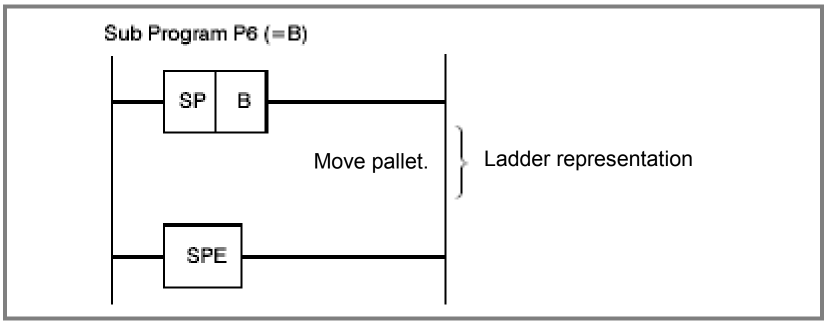



Sub Program P2 (=A)
SP
A
CALLU
A1
Pick up workpiece from pallet.
CALLU
A2
Machine workpiece.
CALLU
A3
Return workpiece to pallet.
SPE


Sub Program P3 (=A1)
SP
A1
Pick up workpiece from pallet.
Ladder representation
SPE


Sub Program P4 (=A2)
SP
A2
Machine workpiece.
Ladder representation
SPE


Sub Program P5 (=A3)
SP
A3
Return workpiece to pallet.
Ladder representation
SPE



Specifications

(1) Main program
A ladder program consisting of the 1st ladder level and 2nd ladder level is called a main program. You can create just one main program. Subprogram calls from the 1st ladder level are not allowed. Any number of subprogram calls from the 2nd ladder level may be made. Functional instructions JMP and COM must be closed within the main program and each subprogram.

(2) Subprogram
Programs called from the 2nd ladder level are referred to as subprograms. A subprogram is a program unit enclosed by functional instructions SP and SPE. Up to 512 or 5000 subprograms can be created for one PMC.

(3) Nesting
A subprogram can call another subprogram.
Up to eight levels of subprograms can be nested.
Recursive calls are not permitted.

(4) Programming order when subprograms are used

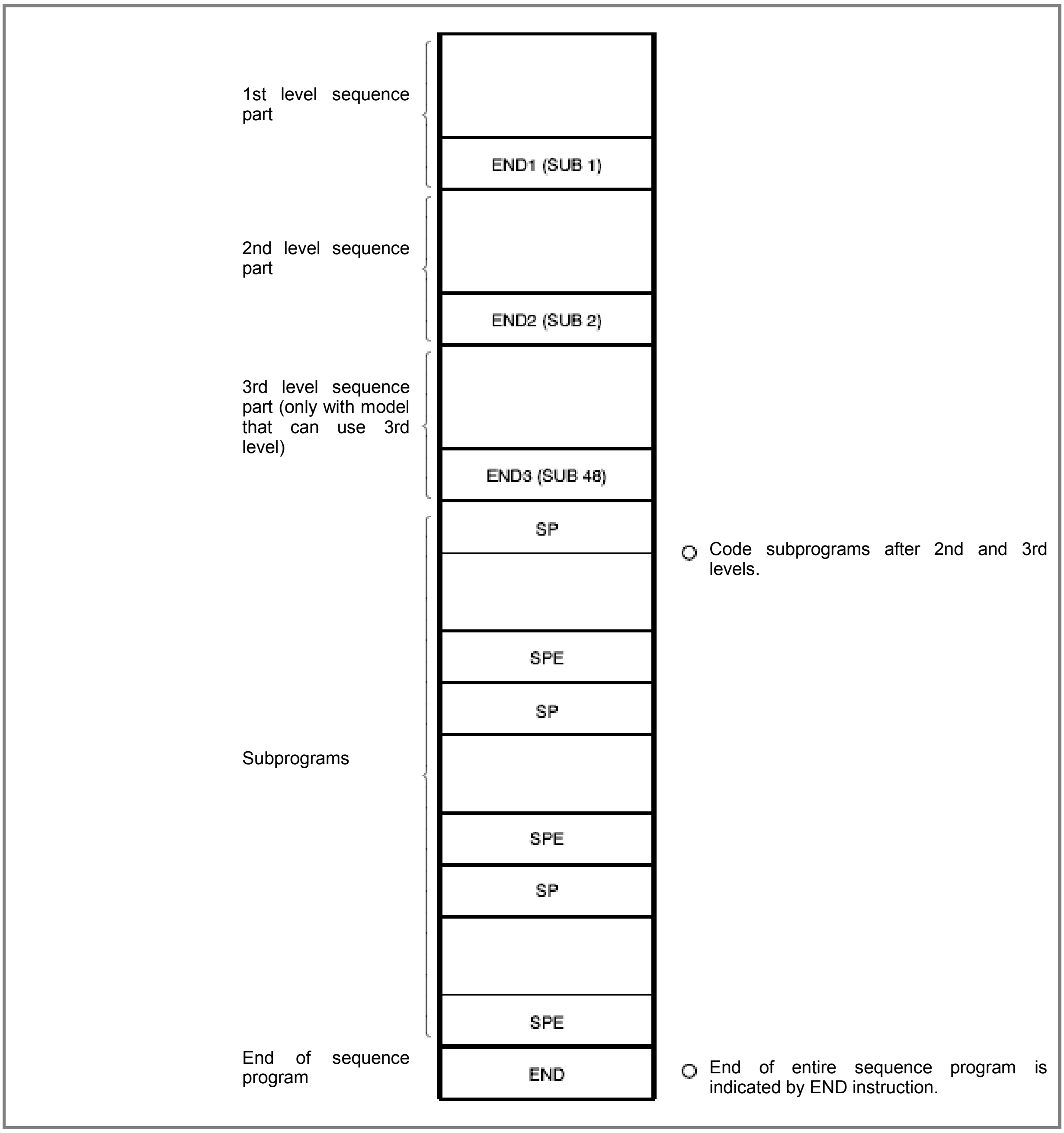


Fig. 1.4.4.1

1.4.4.2 Sub programming and nesting

Function

A conditional call (or unconditional call) is coded in the main program, and the name of a subprogram to be executed is specified. In the subprogram, the subprogram name and a ladder sequence to be executed are coded.
When a conditional call specifying Pn (representing a program name) is made, a subprogram named Pn is called and executed.
A subroutine name can be assigned by adding a symbol or comment to Pn.
In the example shown in Fig. 1.4.4.2 (a), the main program calls three subprograms. These calls are all conditional calls. Subprogram P1 is named SUBPRO. Subprogram P1 calls subprogram PROCS1 unconditionally.

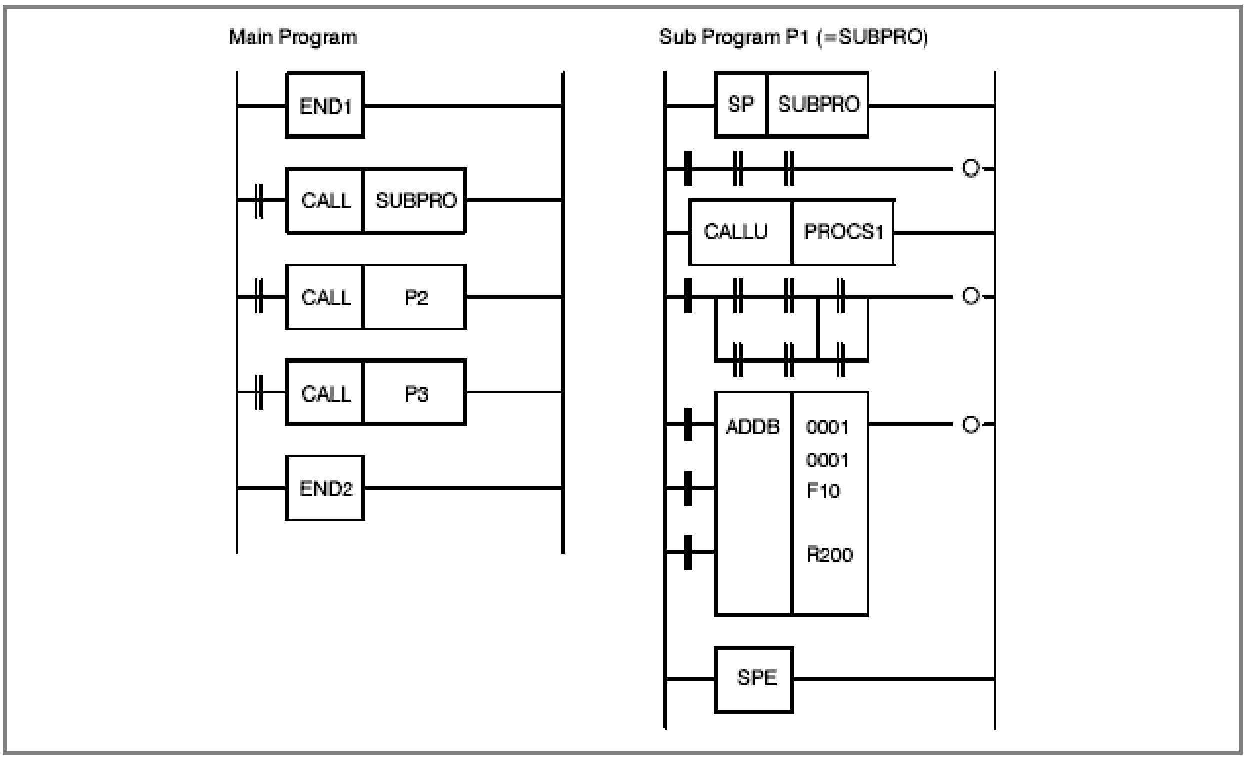
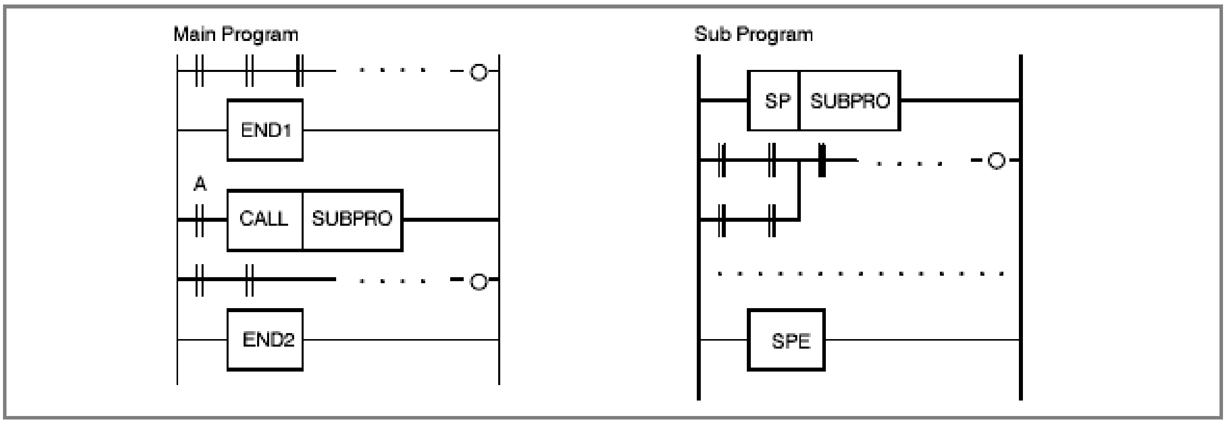
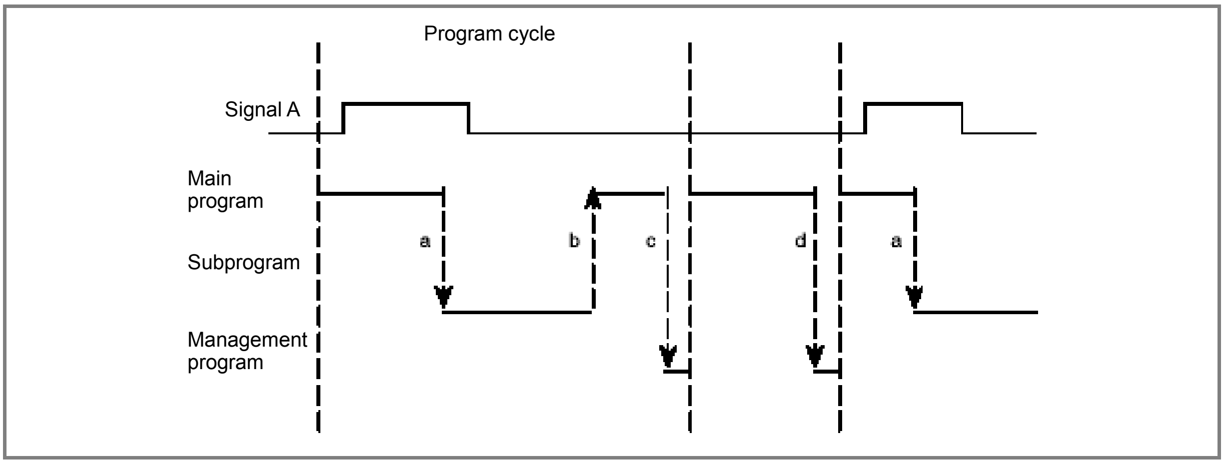


Fig. 1.4.4.2 (a) Example of subprogramming and nesting

Execution method

The main program is always active. Subprograms are active only when called by another program.
In the following example, subprogram SUBPRO is called by signal A.





Execution flow

(1) A subprogram call by functional instruction CALL transfers control to the subprogram.

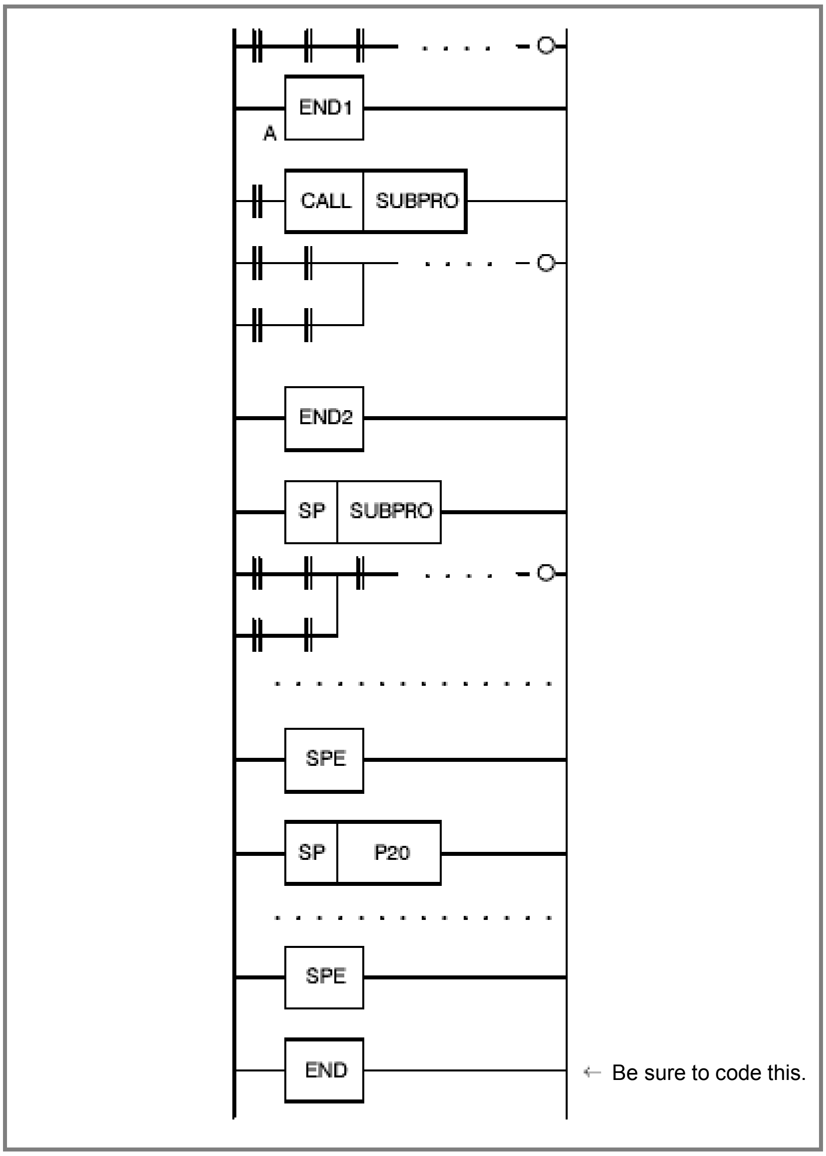
(2) When the execution of the subprogram is completed, control is returned to the main program.

(3) When the execution of the main program is completed, the ladder program post processing is performed.

Creating a program

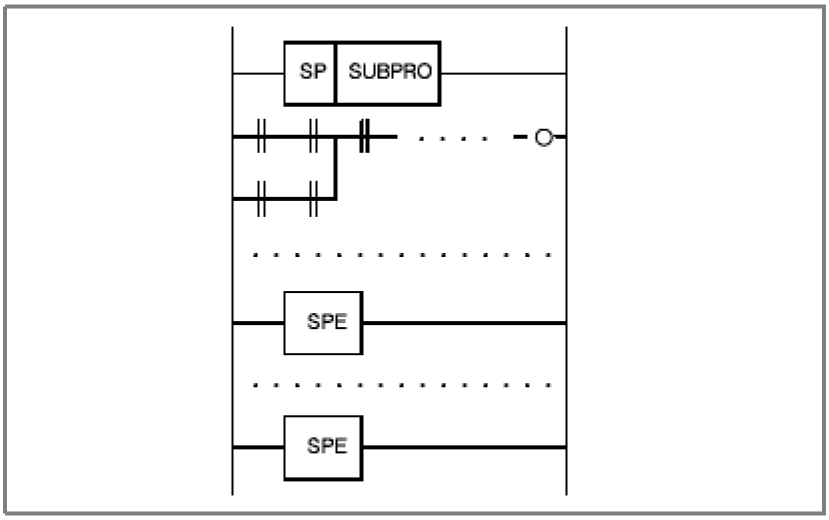
After the 1st, 2nd, and 3rd level ladder programs, create subprograms in the similar manner.

Creation example

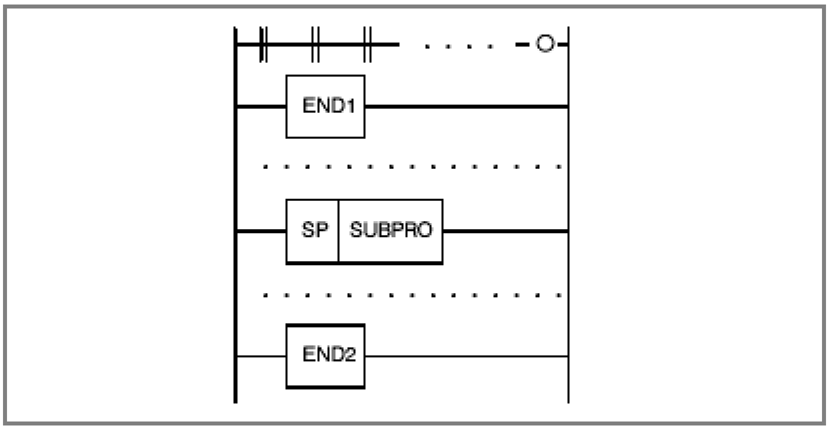


Inhibit items

(1) Subprograms are nested.



(2) A subprogram is created within the 1st, 2nd, or 3rd level ladder program.



1.4.4.3 Notes on using subroutines

(1) DISPB
(2) EXIN
(3) WINDR (low-speed type only)
(4) WINDW (low-speed type only)
(5) AXCTL

For the above functional instructions, ACT = 1 must be held until transfer completion information (coil) is set to 1.
When using these functional instructions in subprograms, note the following prohibition:

(1) When one of the above functional instructions is being used within a subprogram and is not yet completed (processing is in progress), the subprogram call is canceled. (ACT for the CALL instruction is set to 0.)

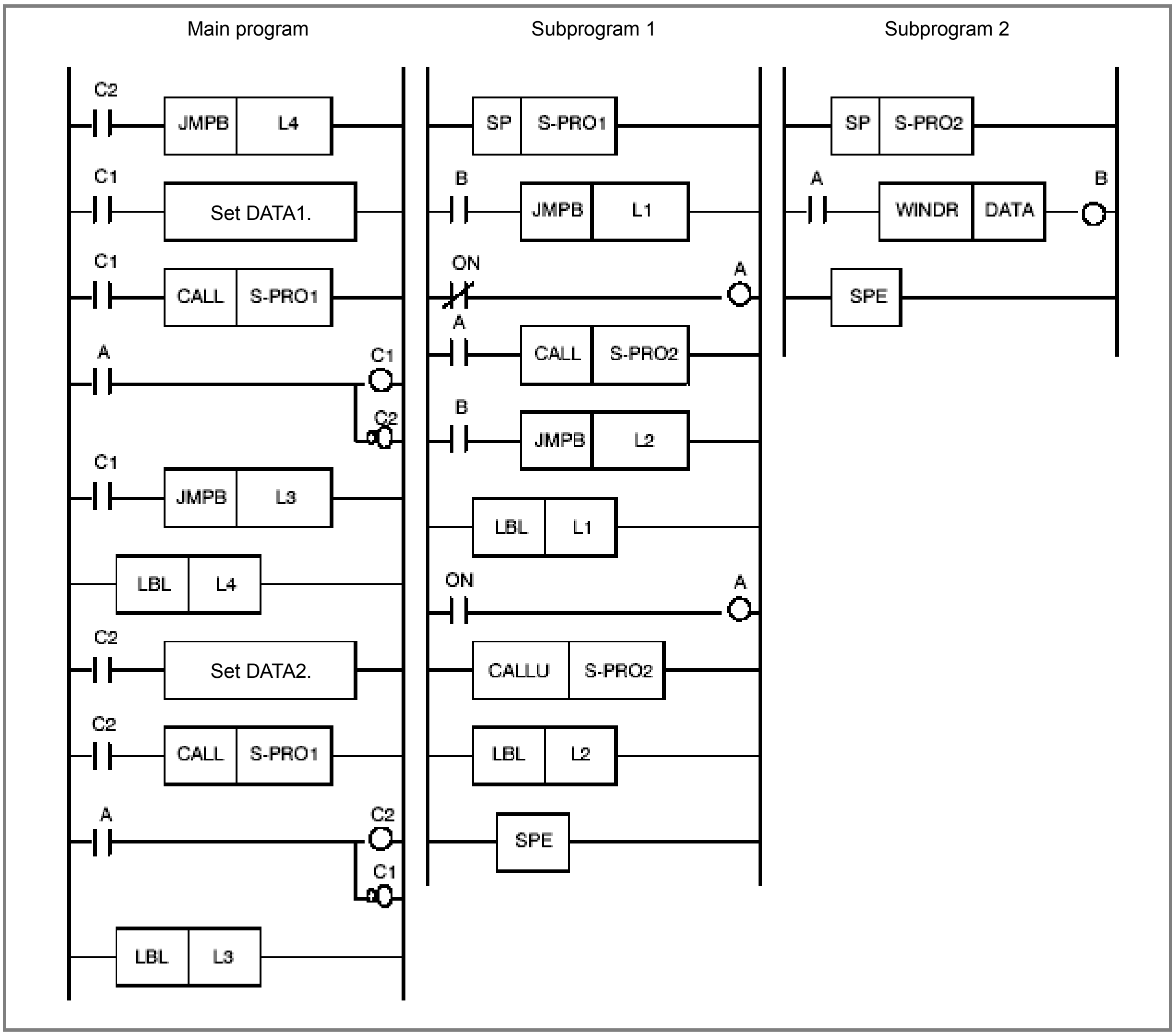
> ⚠ **CAUTION**
> The subsequent operation of the above functional instruction is not guaranteed.

(2) When one of the above functional instructions is being used within a subprogram and is not yet completed (processing is in progress), the subroutine is called from another subprogram.

> ⚠ **CAUTION**
> Because the preceding function is being processed, the subsequent operation of the above functional instruction is not guaranteed.

When a subprogram using the above functional instructions is called from more than one place, exclusive control is required. An example of using the WINDR instruction (low-speed type) is given below.

Example:
A subprogram is called from two places. (When the WINDR instruction is used)



Explanation:
Subprogram 1 controls ACT (A) and W1 (B) of WINDR (subprogram 2).
The main program determines which data (C1 or C2) is to be used according to A controlled by subprogram 1. Upon completion of the WINDR instruction, the next data is set, and the other CALL instruction is executed. In the subsequent operation, these steps are repeated.

1.4.5 Synchronization Processing of I/O Signals

Signals input to the PMC include input signals from the CNC (such as M function and T function signals) and input signals from the machine (such as cycle start and feed hold signals). Signals output from the PMC include output signals to the CNC (such as cycle start and feed hold signals) and output signals to the machine (such as turret rotation and spindle stop signals).
The relationships between these signals and the PMC are shown in Fig. 1.4.5 (a), in which input signals are input to the input memory of the PMC, and output signals are issued from the PMC.
As shown in Fig. 1.4.5 (a), the input signals are synchronized during 1 scan of the 2nd level sequence part.

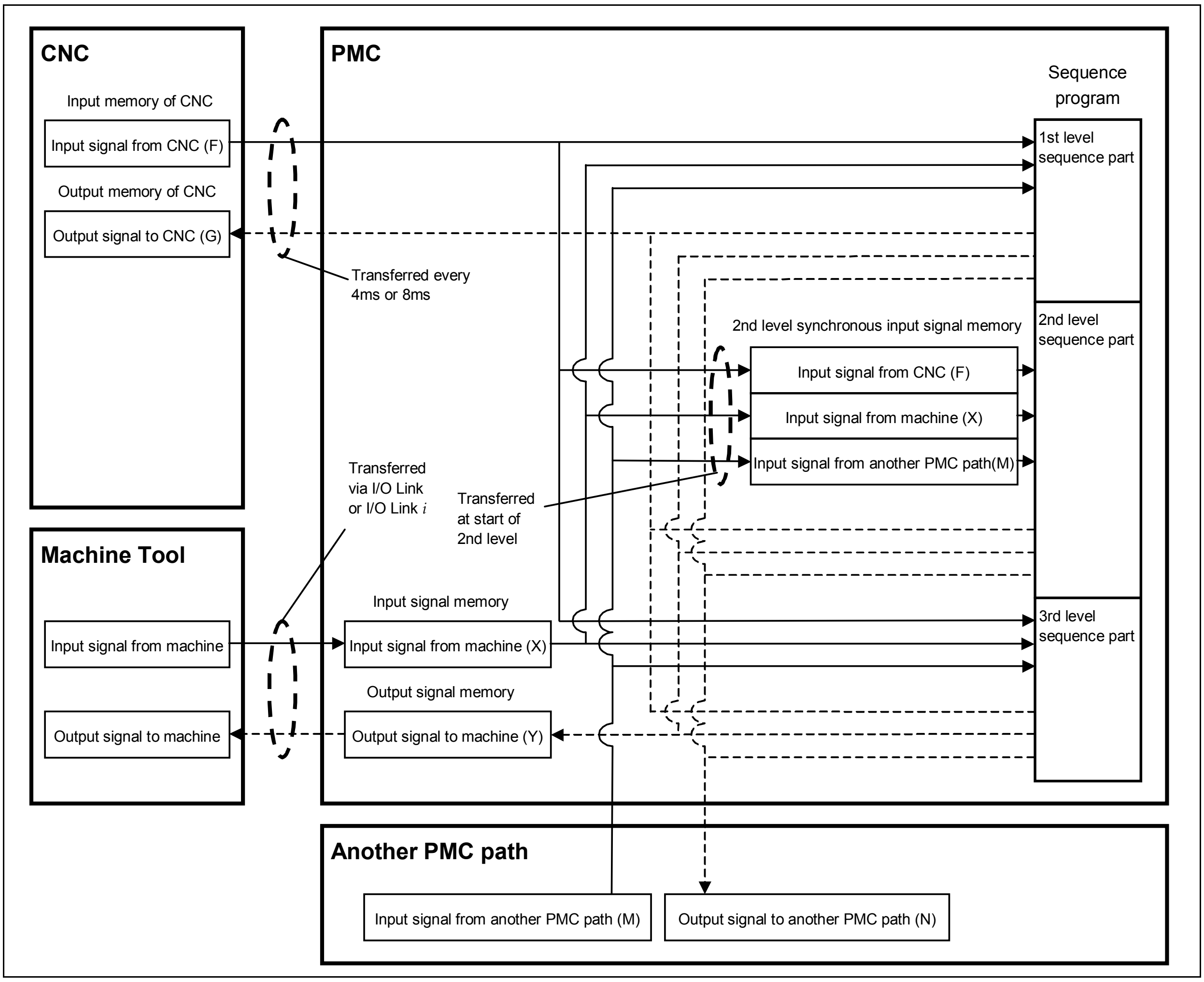


Fig. 1.4.5 (a) I/O signals of PMC

> **NOTE**
> The 2nd level synchronous input signal memories are F, X, and M address. Other addresses are not synchronous input signals.

Input signal processing

(1) Input memory of the CNC
Signals input from the CNC to PMC are set in the memory of the CNC and are normally transmitted to the PMC at intervals of 4 or 8 msec. Since the 1st and 3rd level sequence parts directly reference and process these signals, these signals are not synchronized with input signals from the CNC. See the description of following “Notes on programming asynchronous I/O signals”.

(2) Input signals from the machine (I/O Link or I/O Link *i*)
Signals input from the machine are transmitted to the input signal memory via the input circuit (I/O Link or I/O Link *i*). The 1st and 3rd level sequence parts read the input signals from the input signal memory and process them.

(3) Input signal memory
The input signal memory stores signals transmitted from the machine at regular intervals.
The 1st and 3rd level sequence parts of the PMC read and process signals stored in this memory. In this case, the signal set in the input signal memory is not synchronized with the 1st and 3rd level sequence parts. For notes on asynchronous processing, see the description of following “Notes on programming asynchronous I/O signals”.

> **NOTE**
> In case of the I/O link *i*, there are two modes for the transmission cycle of input signals. They are the normal mode (2msec) and the high speed mode (0.5msec). In case of the I/O link channel 1 and 2, the transmission cycle of the input signals is 2msec. In case of the I/O link channel 3, it depends on the execution cycle of 1st level ladder (4msec or 8msec).

(4) 2nd level synchronous input signal memory
The 2nd level synchronous input signal memory stores signals processed by the 2nd level sequence part of the PMC. Signals synchronized with the 2nd level sequence part are set in this memory.
Input signals in the input signal memory and input signals from the CNC are automatically transmitted to the 2nd level synchronous input signal memory at the beginning of the 2nd level sequence part. Therefore, the status of the 2nd level synchronous input signal memory is kept unchanged during the time from the beginning of the 2nd level sequence part until the end of the sequence part.
The programmer function automatically performs processing so that the 1st and 3rd level sequence parts use input signals in the input signal memory and input signals from the CNC while the 2nd level sequence part uses the 2nd level synchronous input signal memory. (This need not be considered during programming.)

> **NOTE**
> The 2nd level synchronous input signal memories are F, X, and M address. Other addresses are not synchronous input signals.

Output signal processing

(1) Output memory to the CNC
Signals output from the PMC to CNC are set in the output memory of the CNC. Normally, the PMC transmits signals to the output memory of the CNC at intervals of 4 or 8 msec.

(2) Output signals to the machine (I/O Link or I/O Link *i*)
Signals output to the machine are transmitted from the output signal memory of the PMC to the output circuit (I/O Link or I/O Link *i*).

> ⚠ **CAUTION**
> The output signals, which are just being updated in sequence program, may be transmitted to I/O device. Please take care when referring to plural signals at the I/O device.

(3) Output signal memory
The output signal memory is set by the sequence program of the PMC. Signals set in the output signal memory are transmitted to the machine at regular intervals.

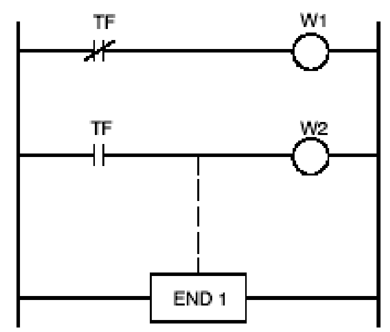
NOTE

1 The statuses of the input memory of the CNC, input signals from the machine, output memory of the CNC, and output signals to the machine can be viewed on the SIGNAL STATUS screen of the PMC. For the SIGNAL STATUS screen, see Section 7.1.

2 In case of the I/O link *i*, there are two modes for the transmission cycle of I/O signals exchanged with the machine. They are the normal mode (2msec) and the high speed mode (0.5msec). In case of the I/O Link, the transmission cycle of I/O signals exchanged with the machine is normally 2msec. However, it depends on the setting of the channel of the I/O Link. For details, see Section 3.2.

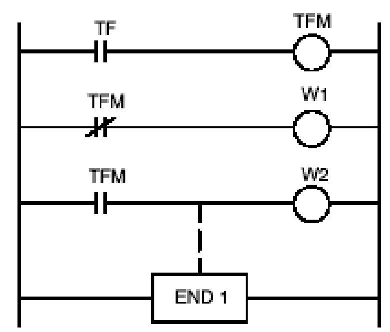
Notes on programming asynchronous I/O signals

Normal input signals from the CNC are transmitted to the PMC at intervals of 4 or 8 msec. Normal output signals to the CNC are transmitted from the PMC at intervals of 4 or 8 msec. Therefore, I/O signals exchanged with the CNC are usually transmitted at intervals of 4 or 8 msec. When creating a sequence program, note that the input signals from the CNC are not synchronized with the 1st and 3rd level sequence program parts. Because the input signals from the CNC are asynchronous, the status of an input signal from the CNC may change during execution of the 1st level sequence program part, which can lead to a problem as shown in Fig. 1.4.5 (b). To prevent such a problem, write the TF signal to an internal relay at the beginning of the 1st level sequence part so that the subsequent operation of the 1st level sequence program part references the internal relay. Then, the TF signal can be treated as a synchronous signal. See Fig. 1.4.5 (c).
Signals input from the machine via the I/O Link and signals input from other control units over a network are also asynchronous, so these signals should be treated in a similar manner.



If the TF status changes to 1 after TF=0 is read first, W1 and W2 may be set to 1 momentarily.

Fig. 1.4.5 (b)



When the TF signal is made synchronized, neither W1 nor W2 is set to 1.

Fig. 1.4.5 (c)

Difference in signal status between 1st level and 2nd level sequence parts

The status of the same input signal may become different between the 1st and 2nd level sequence parts. The 1st level sequence part uses the input signal memory for signal processing while the 2nd level sequence part uses the 2nd level synchronous input signal memory. Therefore, it is possible that an input signal for the 2nd level sequence part lags behind the input signal for the 1st level sequence part by a cycle of the 2nd level sequence execution at the worst.

When creating a sequence program, note the following:

Signal status

A.M	On (pulse signal with short pulse width in time)
B	Off
C	On

When the 1st level is executed, the following difference can occur between Fig. 1.4.5 (d) and Fig. 1.4.5 (e):

(1) For Fig. 1.4.5 (d)
Even when W1 = 1, W2 may not be 1. (This is because the A.M signal may differ between the 1st level and 2nd level.)

(2) For Fig. 1.4.5 (e)
If W1 = 1, W2 is always 1.
When performing the sequence shown in Fig. 1.4.5 (d), do the following:
At the 1st level, perform the high-speed sequence processing applied when the A.M signal status changes (operating).
At the 2nd level, perform the sequence processing applied when the A.M signal status does not change (stopped).

> **NOTE**
> In the middle of 1st level processing, a signal status change may occur asynchronously with the sequence program processing. For details, see Subsection 1.4.7.

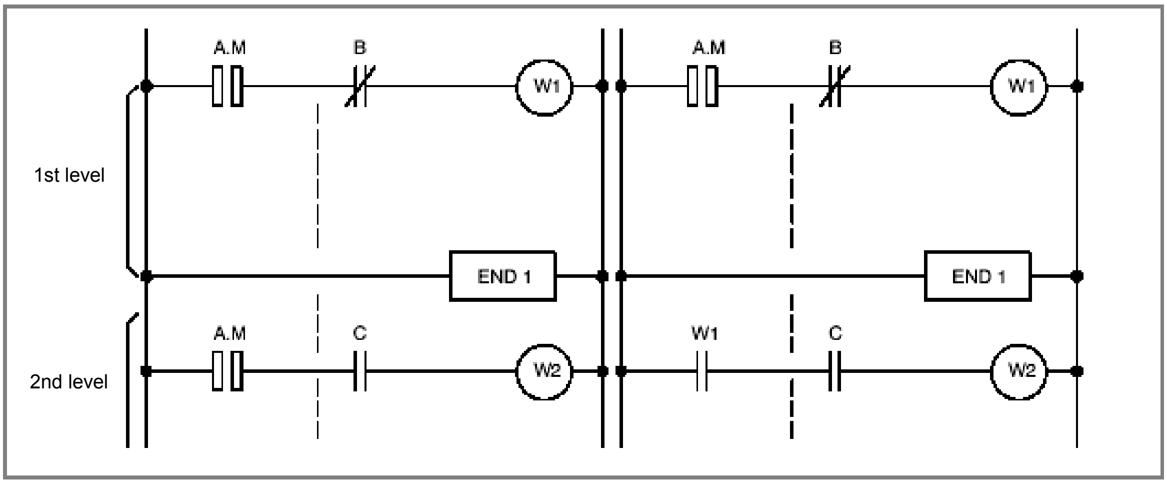


Fig. 1.4.5 (d) Fig. 1.4.5 (e)

1.4.6 Interlock

In sequence control, considering how to provide an interlock is a key design issue from the safety point of view. Of course, an interlock must be provided by sequence programs. Furthermore, an interlock must also be provided at the end of the electrical circuit in the power magnetic cabinet of the machine. Even when an interlock is provided logically by a sequence program (software), the interlock by the sequence program will not work if the hardware for executing the sequence program fails for a certain cause. Therefore, be sure to provide an interlock within the power magnetic cabinet of the machine to ensure safety of the operator and prevent machine damage.

1.4.7 Notes on I/O Signals Updated by Other Than PMC

I/O signals transmitted over networks (Note1) are directly updated with network boards, independently of PMC sequence program execution.
Similarly, other applications (Note1) directly update I/O signals independently of PMC sequence program execution. PMC sequence program and other applications are executed with individual cycle, i.e. asynchronous.
Therefore, when PMC sequence program uses signals updated via network or other applications, or network or other applications use signals updated PMC sequence program, the following should be noted:

> ⚠ **WARNING**
> When you develop these applications, please take care of the following notes. If the following notes are ignored, the machine may behave in an unexpected manner and also tools, work pieces, and the machine may be damaged.
> As for details, refer to “SAFETY PRECAUTIONS”.

> **NOTE**
> 1 As for kinds of networks and other applications, refer to “SAFETY PRECAUTIONS”.
> 2 As for CNC functions using PMC signals other than G/F address, refer to “APPENDIX C”.

(1) Note on input signals
Signals, which are already written with PMC sequence program, must not be written with networks or other applications.
When an input signal transmitted via a network or another application is referenced at more than one place in the PMC sequence program, the same value is not guaranteed to be referenced within the same cycle of the sequence program.
To refer to the same value of the input signal within the same cycle, store the input signal status in temporary area such as internal relay and refer to it.

(2) Note on output signals
When output signals are updated via a network or other applications, the output signals, which are just being updated, may be transmitted to I/O device, just like PMC sequence program. Please take care when referring to plural signals at the I/O device.

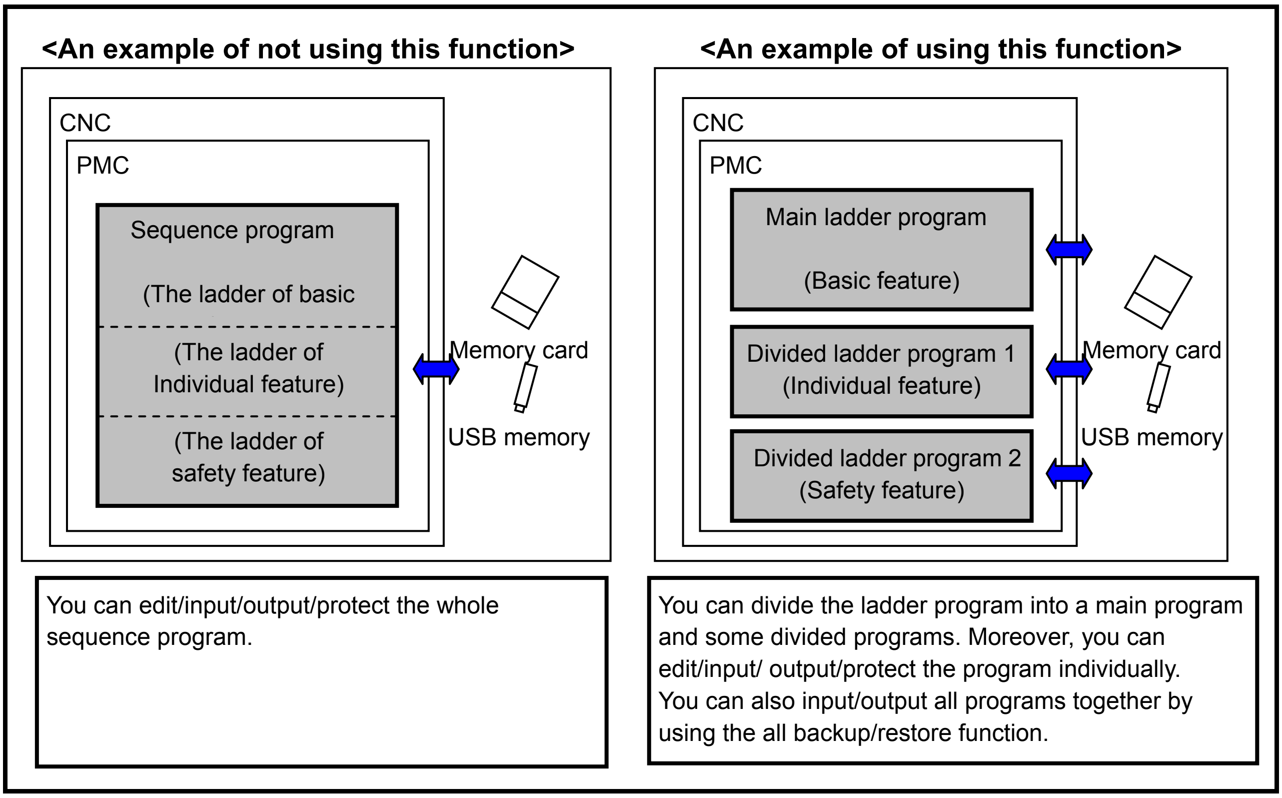
(3) Note on multi-byte data
Generally, when multi-byte data ate input at once via a network or another application, the coherency of the read multi-byte data (in other words, reading all latest data at once) is not guaranteed. To ensure the coherency of multi-byte data, prepare flags to notify of the completion of read or write process that is separated from the entity of data and make the handshaking process to access the data by using the flags.

(4) Distributed processing of signals
Be careful enough that you process a PMC signal set that is related to a NC function by using two or more applications (ladder program and other applications). Because they are executed based on individual cycle (asynchronous cycle), the PMC signal set may be passed to the NC in an unexpected order.

(5) Note when writing bit signals
Do not write bit signals in the same byte address from two or more programs such as PMC sequence program, network and other applications. If bit signals written by the ladder program are being written from other applications, there is a possibility that each the bit signals are not written correctly.

1.5 LADDER DIVIDING MANAGEMENT FUNCTION

The ladder dividing management function enables you to divide the ladder program into plural files and input/output each file and set the protection by a password individually.
You can manage the sequence program as a main ladder program and some divided ladder programs by using this function.



1.5.1 Divided Ladder Program

The divided ladder programs include a part of the ladder program and a part of symbols and comments and are handled as individual files. You can set the system parameters and title data to every divided program individually.

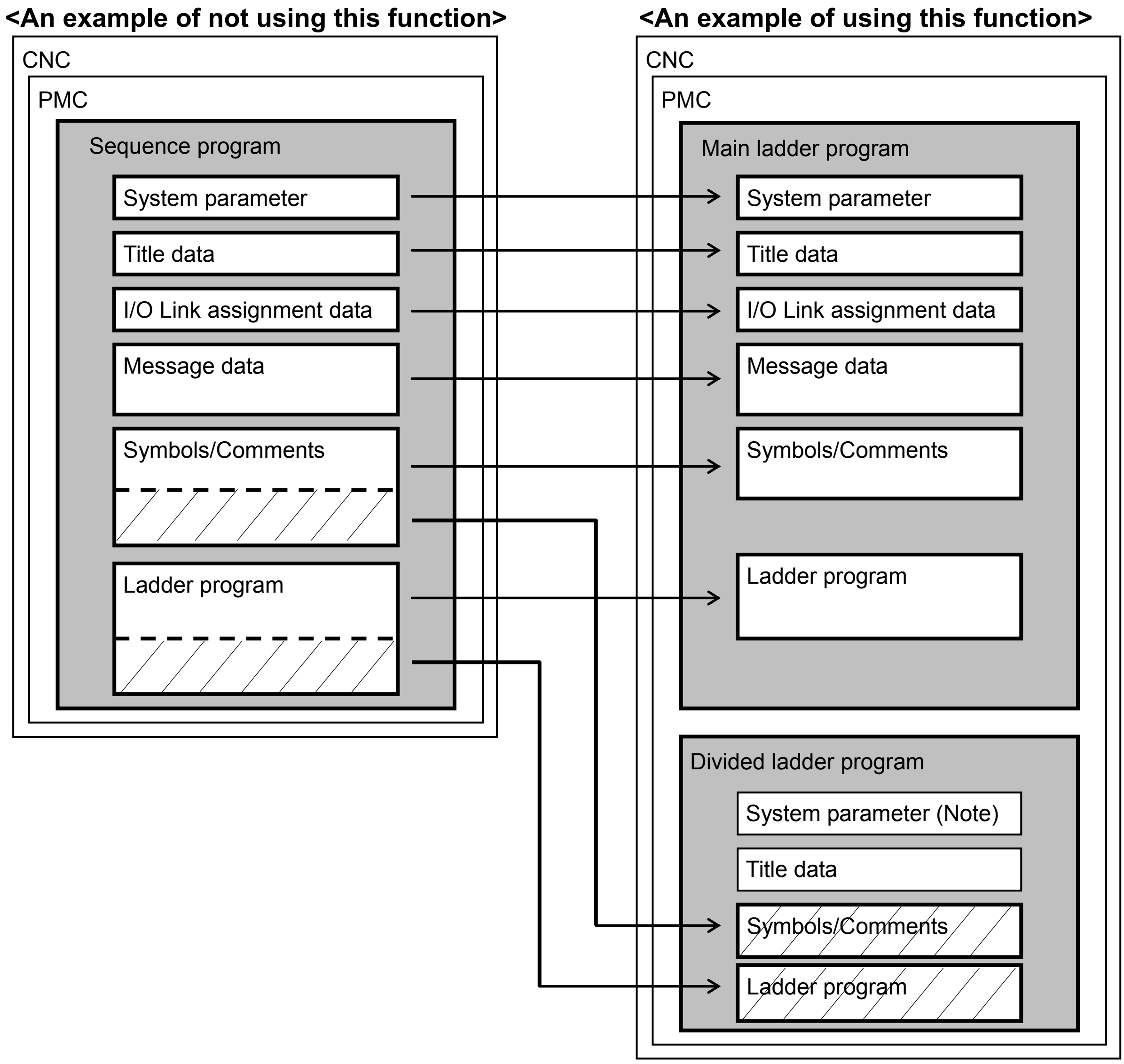


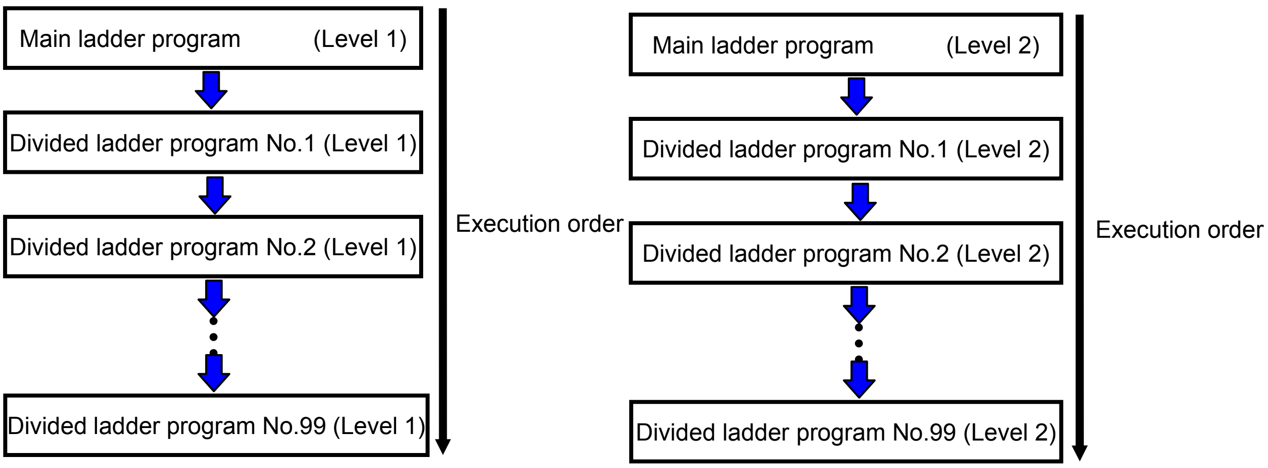
Fig. 1.5.1 Notion of the ladder dividing management function

> **NOTE**
> The system parameters, which can be set in the divided ladder program, are "Setting of comment display language", "Assignment address of symbols" and "Assignment address of function blocks". These parameters can be set on FANUC LADDER-III.

1.5.2 Program Execution when Using Ladder Dividing Management

When executing the program of ladder dividing management function, these are combined into one program at every execution levels.

At first, the main program is executed, and the divided ladder programs are executed in order of program number. The program number of divided ladder program is specified when making the sequence program on FANUC LADDER-III.



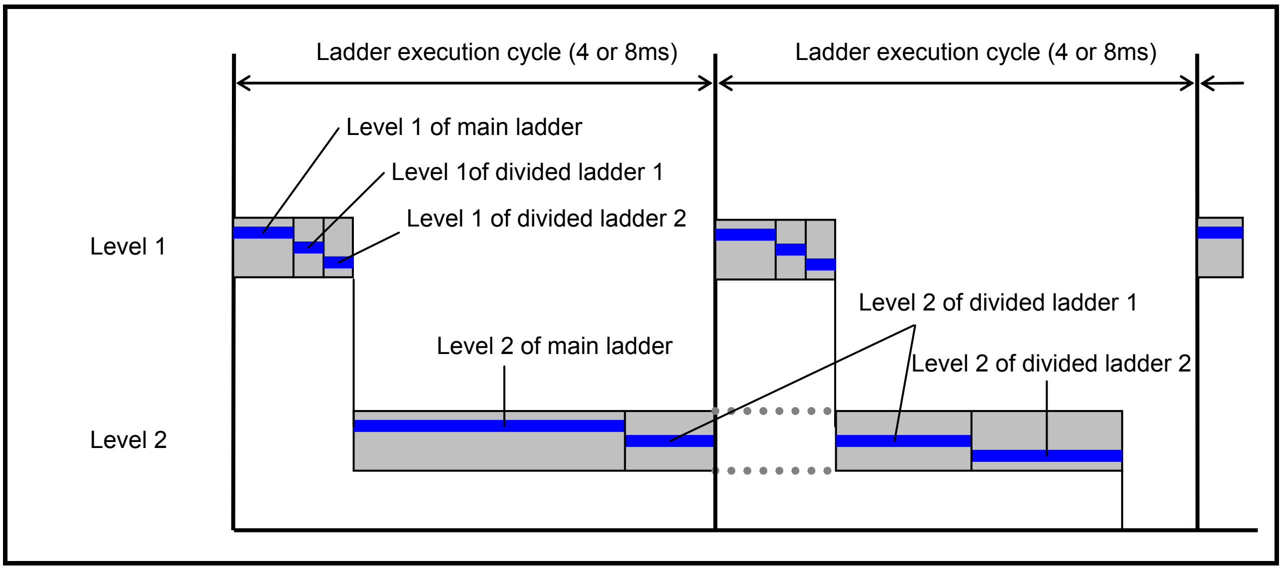


Fig. 1.5.2 (a) Ladder execution of the ladder dividing management function

The program numbers do not need to be consecutive. For instance, three divided ladder program number can be set to No.10, 20 and 30. In this case, non-exist divided program number is skipped and the program of the next number is executed.

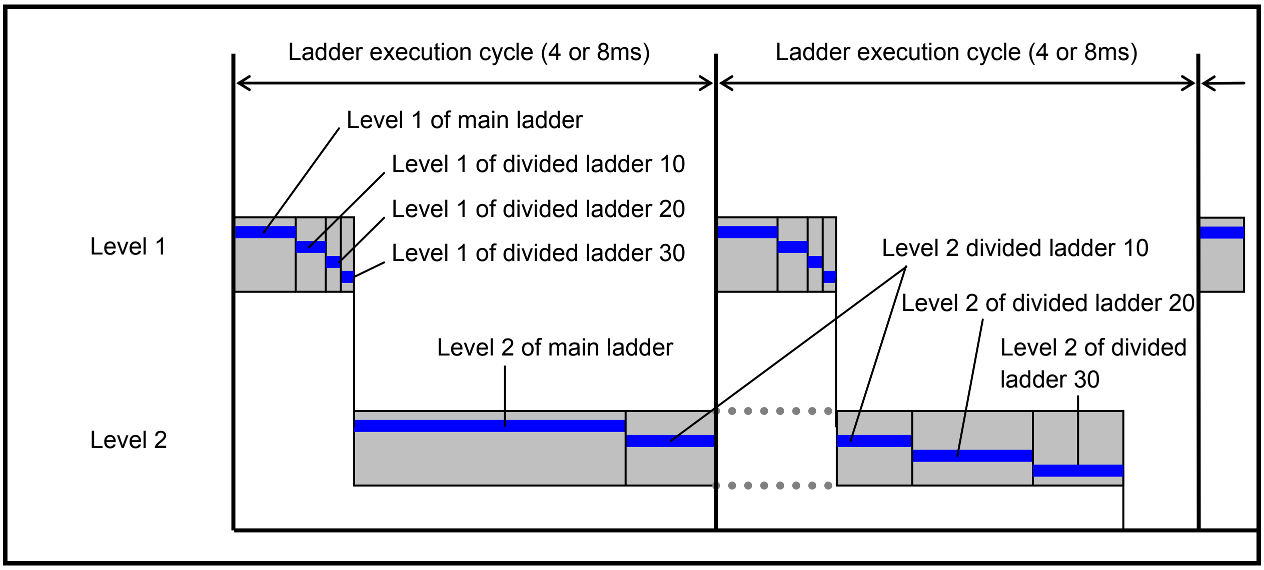


Fig. 1.5.2 (b) Ladder execution when discontinuous number of divided ladder program

> **NOTE**
> When an error occurs in one ladder program, none of these ladder programs will start the execution.

Execution start order of ladder program when a power-on.

The ladder program is executed initially to set the input signals for the CNC (G signals) like the following chart until the beginning of cyclic operation of the CNC from the power on of the CNC. The initial execution is different from the cyclic execution. Therefore the ladder program is not executed at the constant period and is continuously and repeatedly executed. The execution of each level of the ladder program is not divided. They are executed from the top of the program to the end of the program in the order of the following chart. After finishing the initial execution of the ladder, the CNC starts the cyclic operation.

In the initial execution of the ladder program, the operations of the following functional instructions are different from the normal operations.

- TMR、TMRB、TMRC、TMRST、TMRSS
  The timer is not executed and the time is always 0 in the initial execution.
- WINDR、WINDW、AXCTL、EXIN、DISPB、PSGNL、PSGN2
  They are executed as the NOP instruction (No operation) in the initial execution.

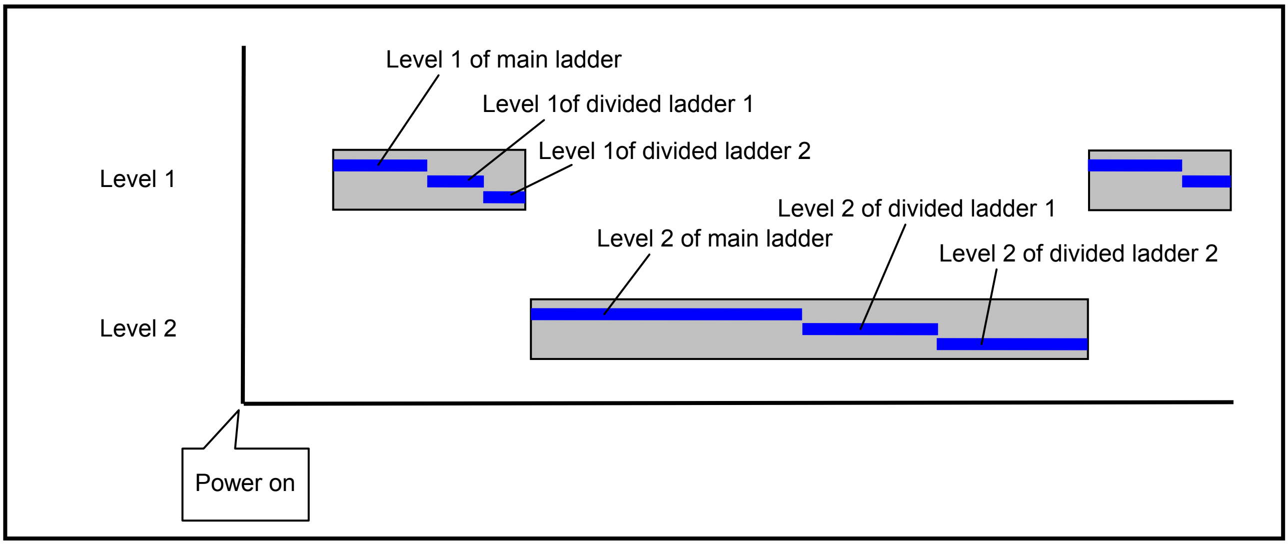


Fig.1.5.2 (c) Execution start order of ladder program when a power on.
(when using the ladder dividing management function)

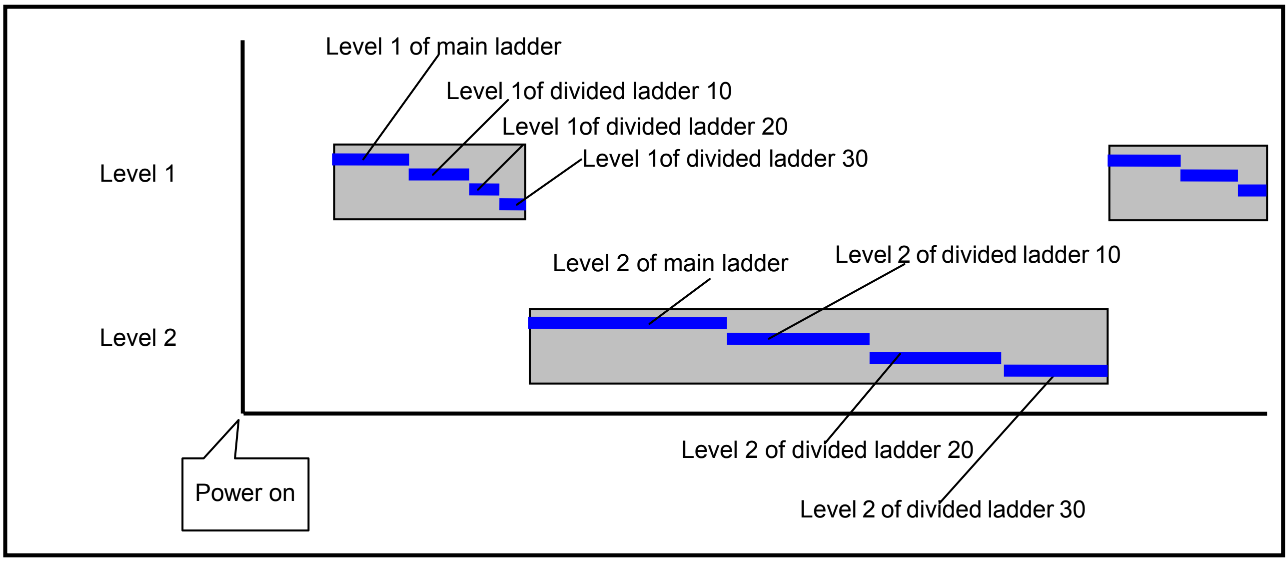


Fig.1.5.2 (d) Execution start order of ladder program when a power-on.
(when discontinuous number of divided ladder program)

1.5.3 PMC Memory when Using Ladder Dividing Management

On the ladder dividing management function, referred PMC memories are common memories.

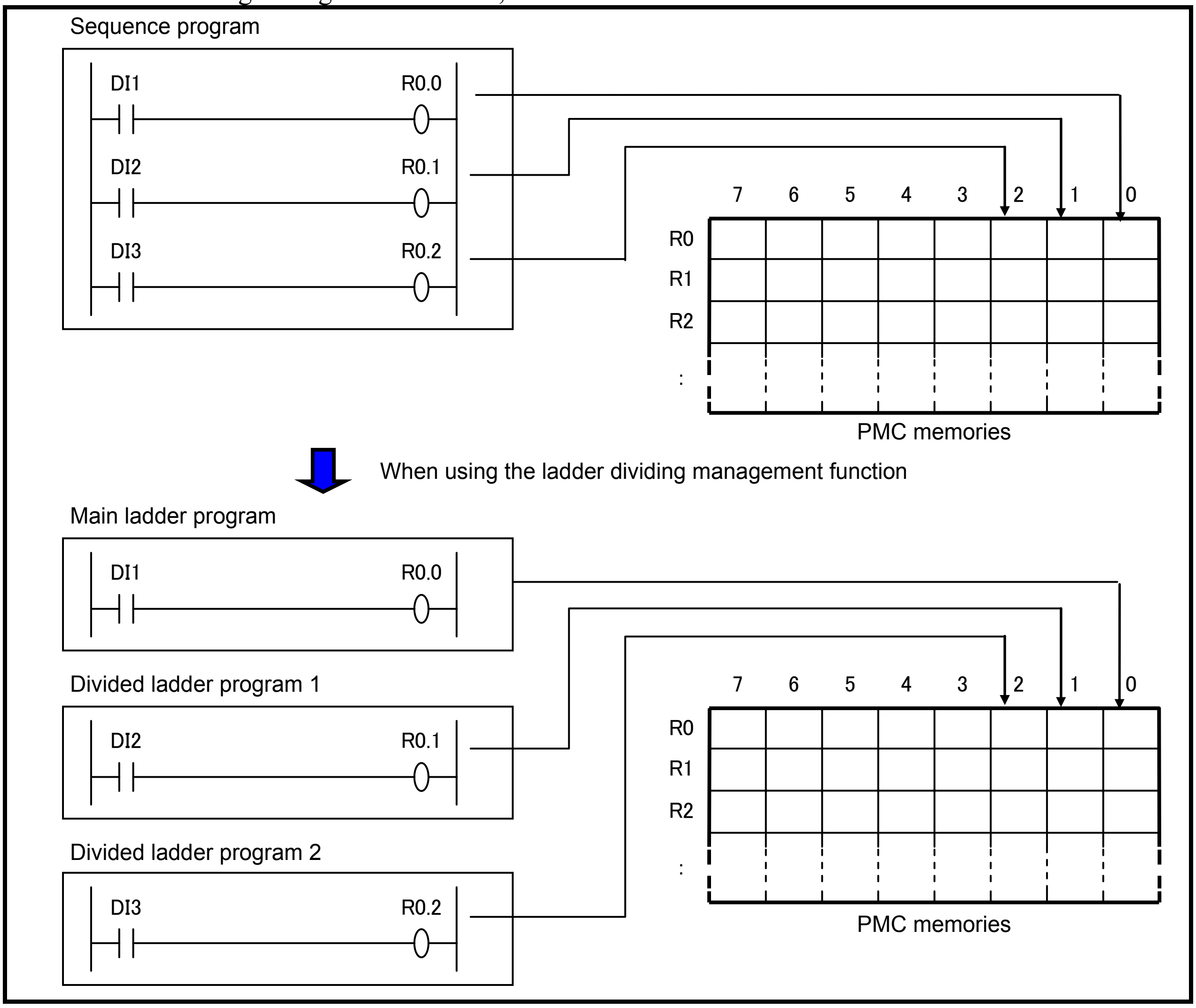


Fig. 1.5.3 PMC memory access when using the ladder dividing management function

The following data are also shared between some divided programs.

- PMC parameters
- Functional instructions using PMC parameters, such as TMR(SUB 3), CTR(SUB 5) and CTRB(SUB 56)
- Programmer protection function (System Keep Relay)

> ⚠**CAUTION**
> 1 You should not overwrite the same PMC memory from two or more ladder programs.
> 2 You should not duplicate the timer number of TMR(SUB 3), the counter number of CTR(SUB 5) and CTRB(SUB 56) over all of ladder programs. However, the timer number of TMRB(SUB 24), TMRBF(SUB 77), and the rising edge number of DIFU(SUB 57) and the falling edge number of DIFD(SUB 58) can be same number between main and divided ladder programs.

1.5.4 Sub Program in Divided Ladder

To use the ladder dividing management function, you can make programs of level 1, level 2 and subprograms in every divided ladder programs.
The subprogram number can be defined separately in main ladder program and every divided ladder program. However, a subprogram defined in other ladder program cannot be called.

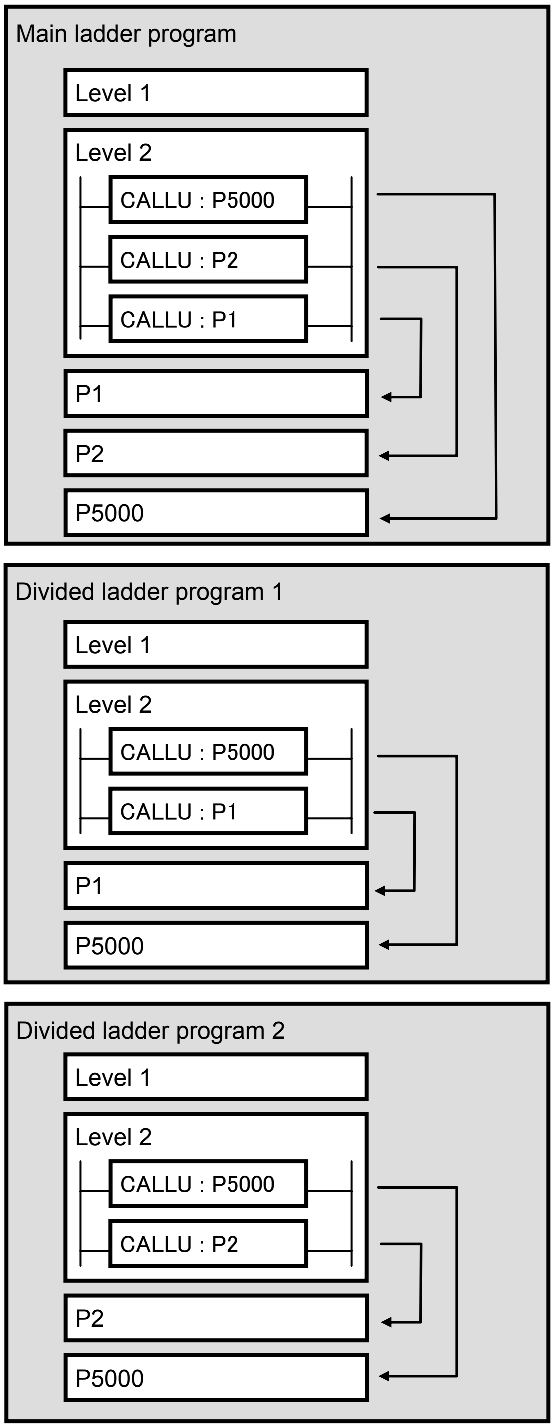


Fig. 1.5.4 Definition of sub programs using the ladder dividing management function

1.5.5 Message Display Function (DISPB instruction) when Using Ladder Dividing Management Function

When using the ladder dividing management function, the message data is defined in the main ladder program.
By switching on the request memory of message display (A address) from a divided ladder program, the messages, which are defined in the main ladder program, can be displayed.

NOTE
You do not need to program DISPB instruction in every divided ladder program. You can program DISPB instruction only in main ladder program. As for details of DISPB instruction, refer to the section "4.11.1".

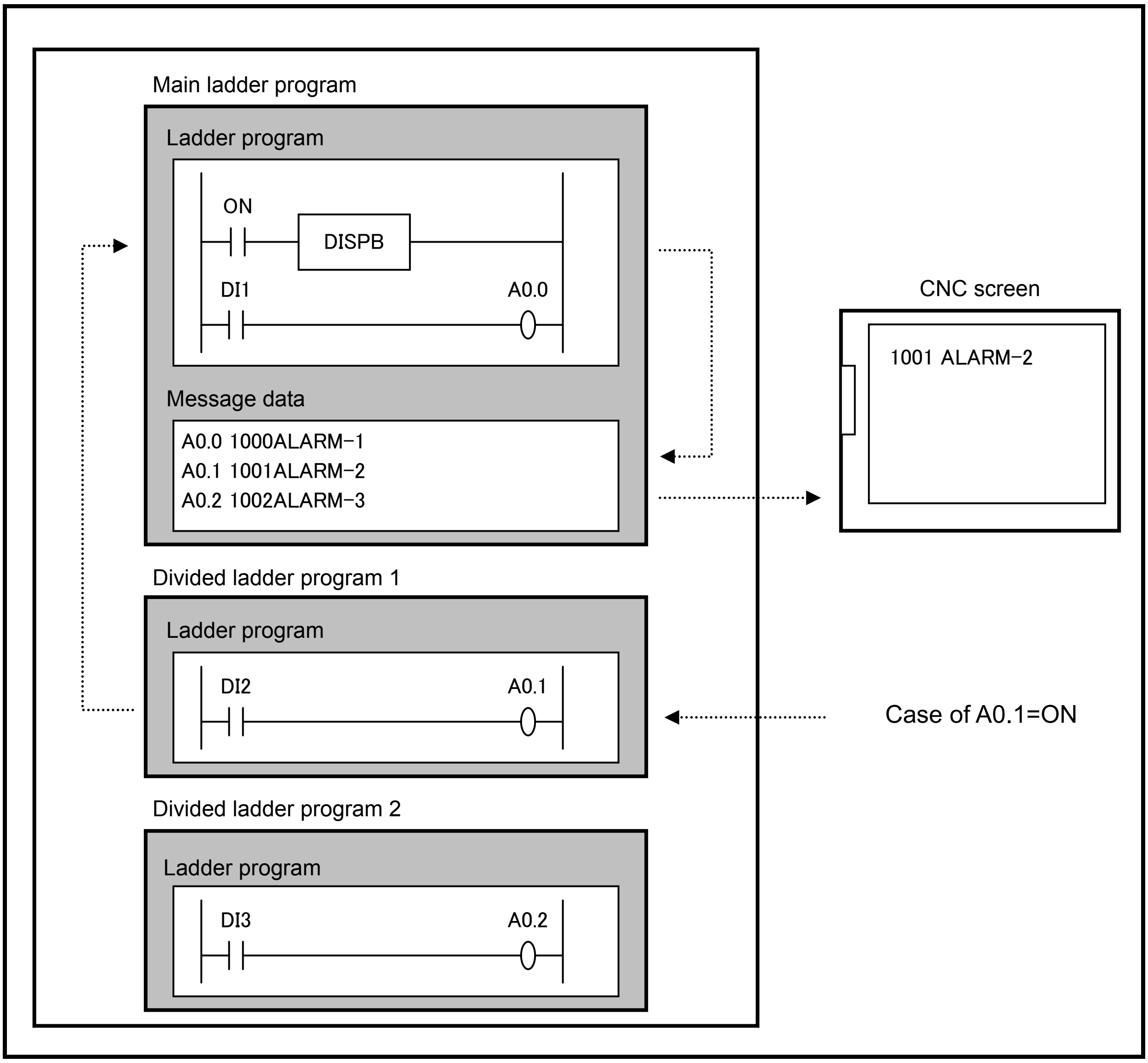
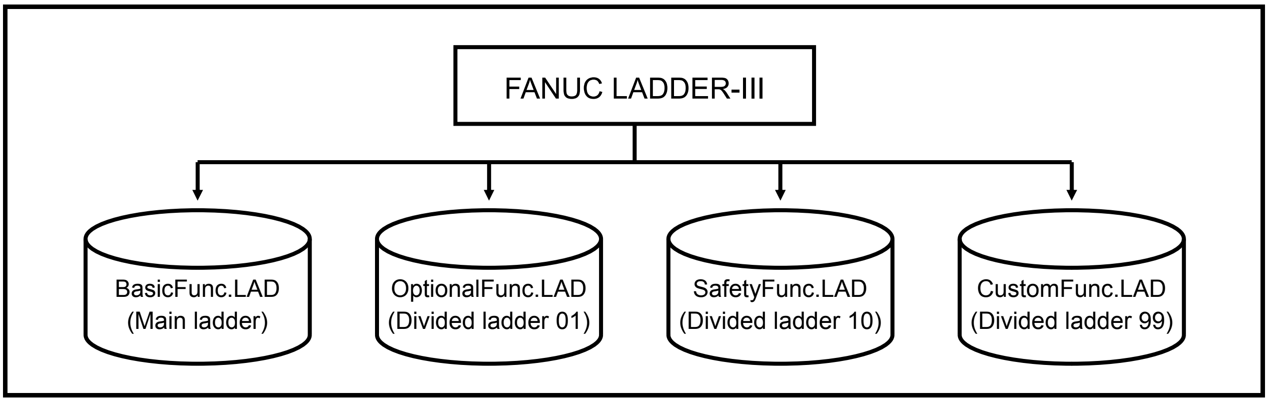


Fig. 1.5.5 Message display using the ladder dividing management function

1.5.6 Making Method of Divided Ladder Program

When using the ladder dividing management function, you can use FANUC LADDER-III to make some program files for a main ladder and some divided ladders.



Making main ladder is the same way as making ladder when not using this function.
When making new divided ladder program on FANUC LADDER-III, the following information are required.

(1) PMC path
Specify the PMC path of the target PMC.

(2) PMC memory type
Specify the PMC memory type of the target PMC.

(3) Divide ladder program number
Specify a divided number of the ladder program.
When executing ladder program, divided ladder programs are executed in order of the number.
This number decides the file name for flash ROM on CNC.

NOTE

1 You can make new divided ladder program on FANUC LADDER-III. On PMC screen, You can edit the divided ladder program but cannot make new divided ladder program.
2 Divided ladder program number can be changed in system parameter screen on FANUC LADDER-III. To modify the PMC path or the PMC memory, use “PMC Type changed and save” on FANUC LADDER-III.
3 The range of divided ladder program number is 1 to 99. When storing the flash ROM, the file of same name is overwritten. Therefore, you should set different number to each divided ladder program file. You can use any number within the range.
4 When using multi-path PMC, the same number can be used in every PMC path.

1.5.7 Adding/Updating/Deleting Divided Ladder Program

To add/update/delete divided ladder program on CNC, you can use the following features.

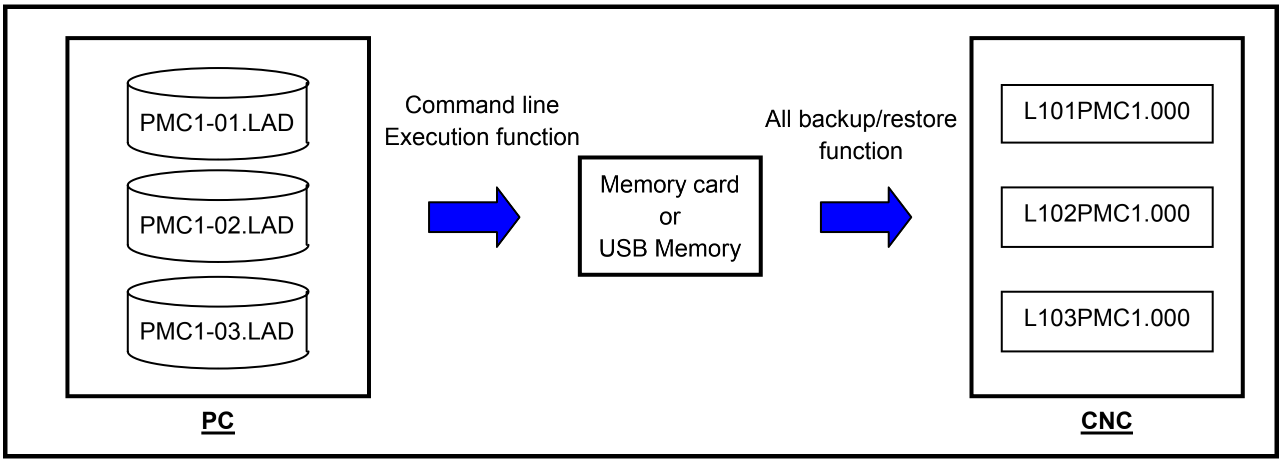
		Boot system	All backup/restore function (IPL screen)	PMC I/O screen
Operation	Adding	○	◎	−
	Update	○	◎	○
	Deletion	○	−	−
Utilize Media	Memory Card	○	◎	○
	USB Memory	−	◎	○

(○: Available(Operation for one file), ◎:Available (Operation for all files), −: Unavailable)

NOTE
For details of the boot system and the IPL screen, refer to the maintenance manual of each CNC series.

1.5.8 Input/Output of All Divided Ladder Programs

Divided ladder programs can be input/output to/from CNC by the all backup/restore function on the IPL screen.
By using the command line execution function in FANUC LADDER-III, plural LAD files can be compiled and exported to USB memory or memory card at once.
By these functions, plural divided ladder programs, which are created with FANUC LADDER-III, can be written to the CNC collectively.



Example: Inputting plural divided programs to CNC using memory card

The following example is the procedure of exporting three divided ladder programs (PMC1-01.LAD, PMC1-02.LAD, PMC1-03.LAD) to the memory card on "E" drive of PC and writing them to CNC collectively.

(1) Attach an empty memory card to PC. (Note1)
(2) Make a command file (export_all.txt) as follows. (Note2,3)

```
FlOpen PMC1-01.LAD
Compile
Export /MemData E:\L101PMC1.000
FlClose

FlOpen PMC1-02.LAD
Compile
Export /MemData E:\L102PMC1.000
FlClose

FlOpen PMC1-03.LAD
Compile
Export /MemData E:\L103PMC1.000
FlClose
```

(3) At the command prompt, specify the command file of the item (2) and execute FANUC LADDER-III.

```
C:\> "C:\Program Files\FANUC PMC Programmer\FANUC LADDER-3\Fladder.exe" /cmdfile=export_all.txt
```

(4) Attach the memory card to CNC and turn the power on with pressing "." and "-" on the MDI keys
(5) The IPL screen appears. Select "12. BATCH DATA BACKUP/RESTORE".
(6) The BATCH DATA BACKUP/RESTORE MENU appears and select "2. BATCH DATA RESTORE(MEMORY CARD → CNC)".
(7) "BATCH DATA RESTORE OK ? (NO=0,YES=1)" appears and select "1".
(8) "POWER MUST BE OFF" appears and reboot the power of the CNC.

NOTE

1. In the all backup/restore function, all files, which are at root directory of memory card or USB memory, are written to CNC. Therefore, you should use empty memory card or USB card because the CNC do not execute correctly when there are some unnecessary files in the memory card or the USB memory.
2. You can use arbitrary command file name of FANUC LADDER-III.
   If changing to other name, change the name specified in the item (3), too.
3. The ladder file name specified in the export command (Ex: L101PMC1.000) is used in PC, memory card or USB memory. You can use arbitrary file name regardless of the dividing ladder program number for the registration of CNC.
   To change the divided ladder number, change the setting of divided ladder number in the system parameter screen on FANUC LADDER-III.
4. We recommend the ladder file name for outputting from CNC by the all backup/restore function to the file name in the export command if there is no special reason. In the all backup/restore function, the file having the name on flash ROM of CNC with the extension ".000" is output. For the file name on flash ROM, refer to "2.9".

1.6 MULTI-PATH PMC FUNCTION

The multi-path PMC function allows one PMC system to execute multiple sequence programs at the same time.

PMC memory for each sequence program is basically independent, and the same PMC address can be used for different purposes of the individual PMCs. Extra relays (E addresses) can be shared among PMCs as shared memory. All PMCs can read from and write to this area, so the area can be used for the interface between the PMCs. M,N addresses can be also used for the interface between the PMCs.

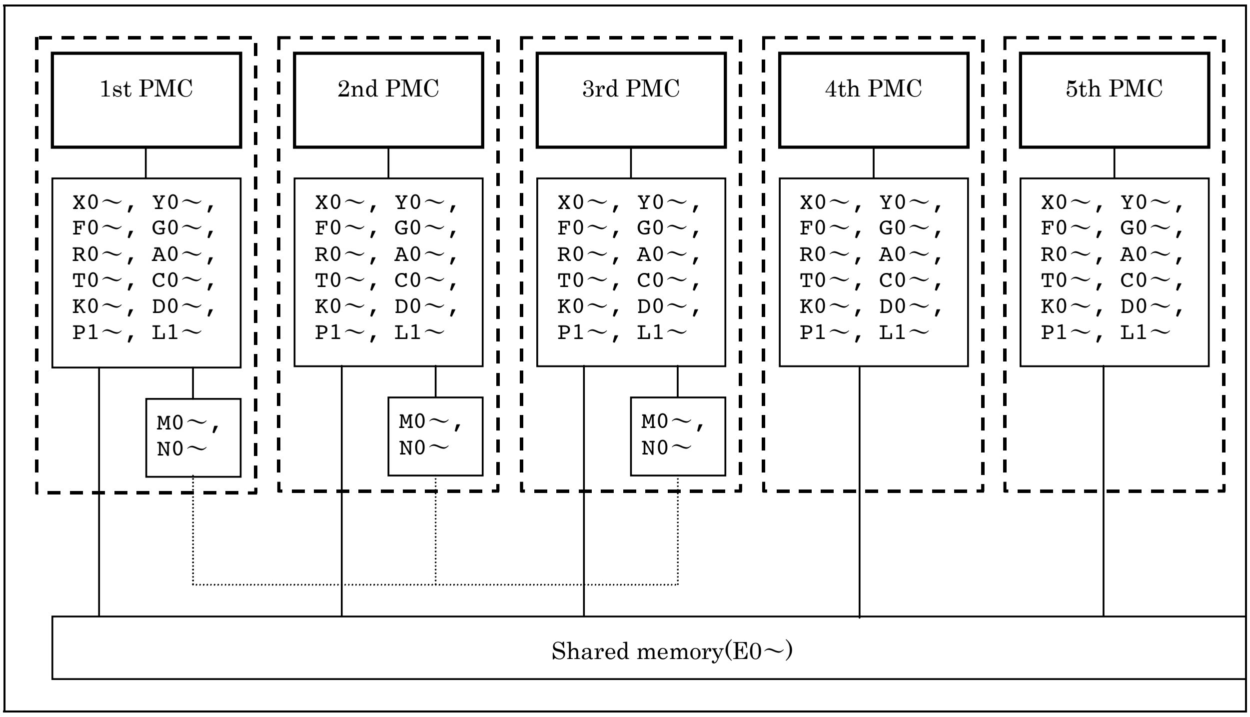


Fig. 1.6 (a) PMC memory of multi-path PMC function

A program for each PMC is saved as an independent file and can be edited, updated, and backed up separately.

The CNC systems and the I/O Link channels to be controlled by PMCs can be changed by CNC parameter setting. In a parameter-set configuration, one PMC may control all CNC systems, or each PMC may control a different CNC system.

Fig. 1.6 (b) shows a configuration example.

NOTE
The multi-path PMC function is the option function.
In Series 30*i*/31*i*/32*i*/35*i*-B, Power Motion *i*-A, the maximum path number is 5 paths. In Series 0*i*-F, the maximum path number is 3 paths.

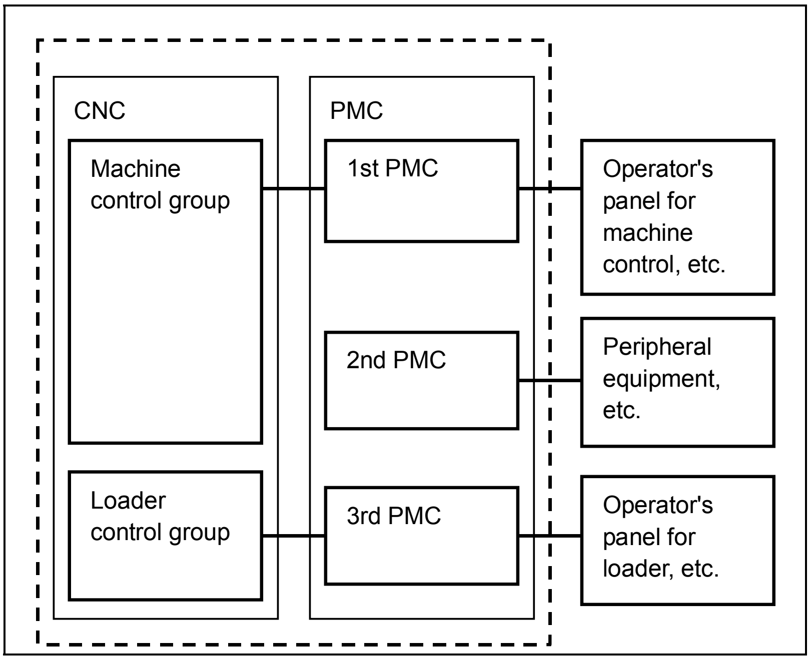


Fig. 1.6 (b) Multi-path PMC function configuration example

If the series 30*i*/31*i*/32*i*/35*i*-B, the Power Motion *i*-A or the series 0*i*-F system is used to control more than one CNC path, some paths can be grouped to share data within a group and to stop all the paths in the group if an alarm condition occurs in one of the paths. The group is referred to as the machine group.
The system supports up to 3 machine groups. Each group has a separate emergency stop signal address.
A PMC is basically assigned to each machine group.

1.6.1 Execution Order and Execution Time Percentage

For the multi-path PMC function, the order of PMC execution and execution time percentages of the PMCs can be set with CNC parameters.

Execution order

If parameters related to the execution order are not set (0 is set), the following order sequence is assumed by default:

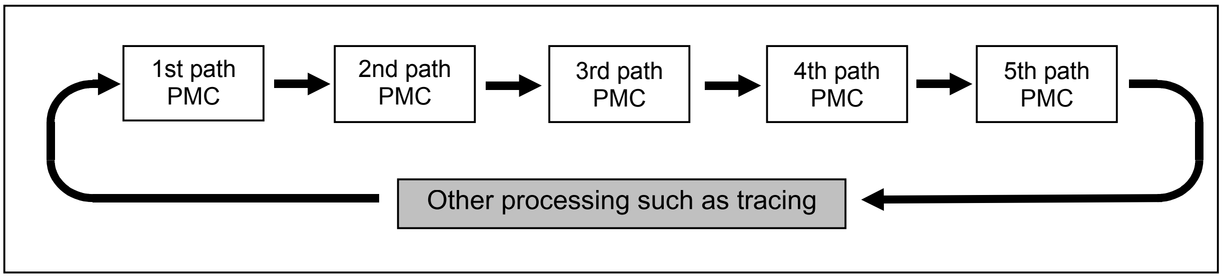


Fig. 1.6.1 (a) Default execution order of multiple PMCs

Execution time percentage

If parameters related to execution time percentages are not set (0 is set), the following execution time percentages are assumed by default:

Table 1.6.1 (a) Execution time percentages of multiple PMCs

The number of PMC path	PMC path of the 1st order of execution	PMC path of the 2nd order of execution	PMC path of the 3rd order of execution	PMC path of the 4th order of execution	PMC path of the 5th order of execution
1 path	100%				
2 paths	85%	15%			
3 paths	75%	15%	10%		
4 paths	70%	10%	10%	10%	
5 paths	60%	10%	10%	10%	10%

An example of changing the execution order and execution time percentages by setting CNC parameters is explained below. In the following, sequence programs are executed in the order from the third PMC to the first PMC to the second PMC with the execution time percentage of the third PMC set to 30%, the percentage of the first PMC to 50%, and the percentage of the second PMC to 20%:

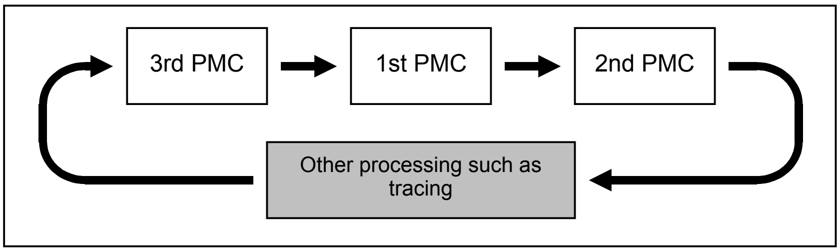


Fig. 1.6.1 (b) Example of setting execution order of multiple PMCs

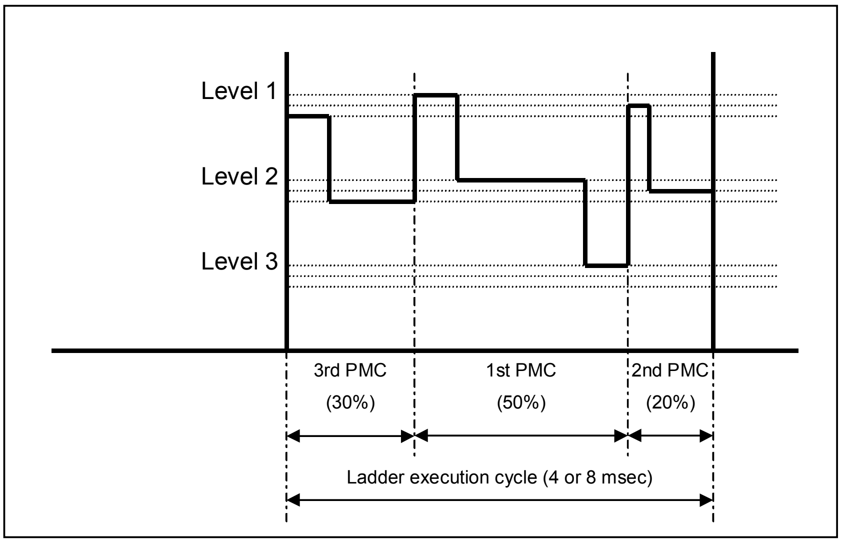


Fig. 1.6.1 (c) Example of setting execution time percentages of multiple PMCs

For details of parameter setting, see Subsection 2.4.3.

1.6.2 Interface Between CNC and PMC

The PMC to control the interface between the CNC and PMC and PMC addresses (F/G addresses) can be set with CNC parameters.
With these parameter settings, a desired interface control system can be built, in which the entire CNC-PMC interface of the CNC may be controlled by a single PMC or the CNC-PMC interface may be controlled by multiple PMCs.
For the CNC-PMC interface, a memory area consisting of 10 blocks, each of which is an addressable, 768-byte DI/DO area, is provided.
When viewed from the ladder program in each PMC, these addresses begin with 0.
If these parameters are not set (0 is set), the initial settings are assumed, where the F/G addresses of the CNC equals the F/G addresses of the first PMC as follows:

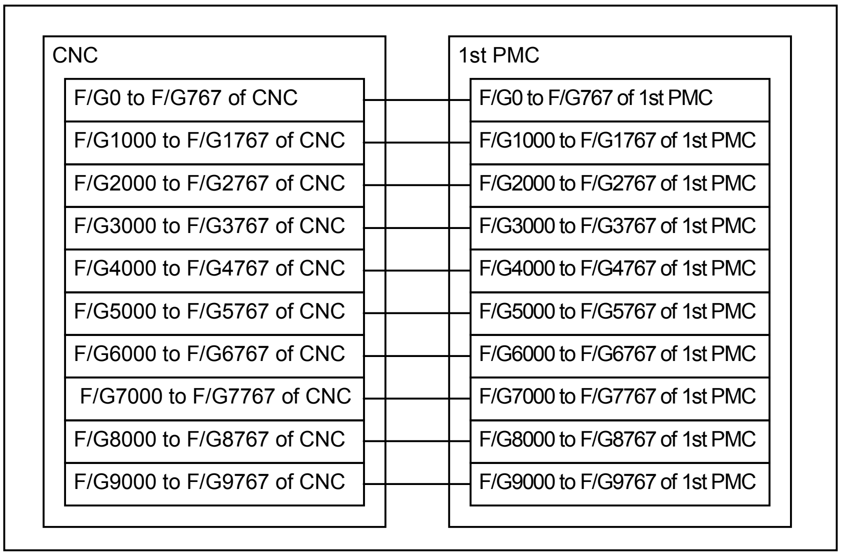


Fig. 1.6.2 (a) Initial settings for CNC-PMC interface

In the following example, F/G0 to F/G767 and F/G1000 to F/G1767 of the CNC are assigned to F/G0 to F/G767 and F/G1000 to F/G1767 of the first PMC, and F/G2000 to F/G2767 of the CNC are assigned to F/G0 to F/G767 of the second PMC:

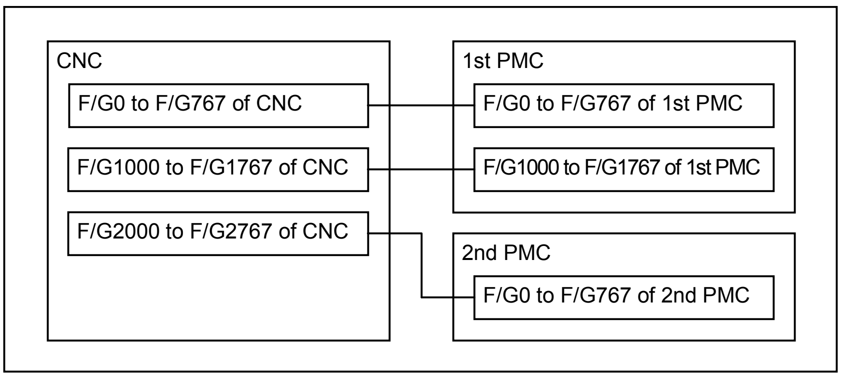


Fig. 1.6.2 (b) Setting example for CNC-PMC interface

For details of parameter setting, see Subsection 2.4.3.

1.6.3 Multi-Path PMC Interface

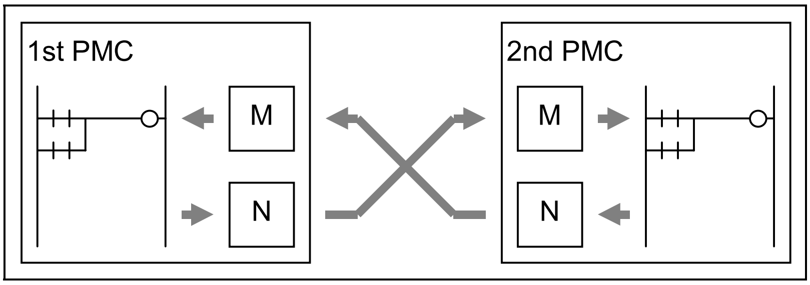
The multi-path PMC interface is the communication means between two PMC paths.

Generally, each path of multi-path PMC system has individual PMC memory space except E address. And, E address can be used to share data of multi-path PMC system. However, this method has a risk that the memory is over written by other PMC path inappropriately.

NOTE
This interface cannot be used in 4th-path PMC and 5th-path PMC.

When using this function, the input and output signals of each path become definitely. Therefore, you can send or receive the data on between two PMC paths safely.
When you output data to N address at one of PMC paths, it can be referenced by M address in other PMC path.

Ex.) When using this function with 1st PMC and 2nd PMC :



Moreover, signals of M address are synchronized during 1 scan of 2nd level program. Therefore, you can reference the same signal status on the first step and the last step of level2 program, like as X and F address.

For details of setting for two PMC paths, see Subsection 2.4.3.

⚠ WARNING
The E address can be used to share data of multi-path PMC system. However, The E address is not synchronized during 1 scan of 2nd level program. Therefore, the value of the address may be changed during execution of 2nd level program. You must take care that the memory is not overwritten by other PMC path in multi-path PMC system.

1.6.4 Common PMC Memory Mode of Multi-Path PMC

On the 2nd-path and 3rd-path PMC, the "Common PMC Memory mode" to share all the PMC Memory with 1st-path PMC has become selectable.
When using the Common PMC Memory mode, a program that controls a related process can be divided to multi-path Sequence Programs.
And, those Sequence Programs can be inputted/outputted, edited and saved independently.

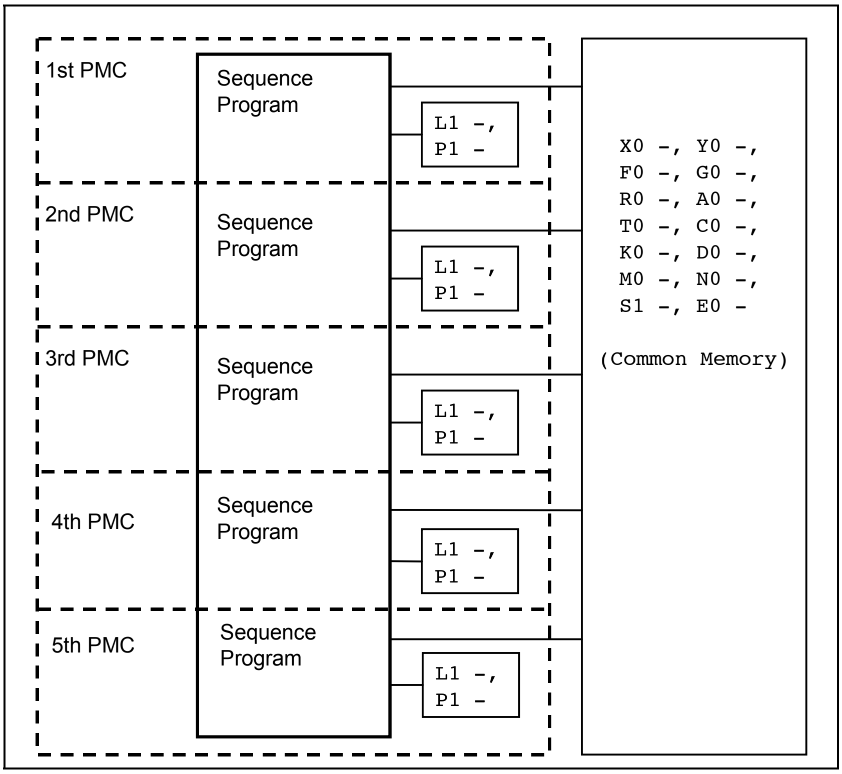


Fig. 1.5.4 (a) Configuration of the Common PMC Memory mode

See "9.9.5 Setting the PMC Memory Type" to enable the Common PMC Memory mode.
There are come differences in the following specifications in the Independent PMC Memory mode and the Common PMC Memory mode.

Table 1.6.4 (a) Comparison of Independent PMC Memory mode and Common PMC Memory mode

Data and Functions		Independent PMC Memory mode	Common PMC Memory mode
Sequence program	Ladder	each PMC path	each PMC path
	(TMR, CTR, CTRB)	each PMC path	shared by all PMC paths
	(DISPB)	each PMC path	program to 1st-path PMC
	Title	each PMC path	each PMC path
	Symbol & Comment	each PMC path	each PMC path
	Message data	each PMC path	each PMC path
	I/O Link assignment	each PMC path	each PMC path
	System parameter	each PMC path	each PMC path
	(Counter data type)	each PMC path	1st-path PMC is effective
	- Inputting/Outputting	each PMC path	each PMC path
	- Password function	each PMC path	each PMC path
	- Programmer protection	each PMC path	1st-path PMC is effective
	- Protection of data at 8 levels	each PMC path	each PMC path

Data and Functions		Independent PMC Memory mode	Common PMC Memory mode
PMC Parameter	Timer	each PMC path	shared by all PMC paths
	Counter	each PMC path	shared by all PMC paths
	Keep Relay	each PMC path	shared by all PMC paths
	Data Table	each PMC path	shared by all PMC paths
	Data Table control data	each PMC path	shared by all PMC paths
	Setting Parameter	each PMC path	shared by all PMC paths
	- Inputting/Outputting	each PMC path	1st-path PMC is effective
	- Programmer protection	each PMC path	1st-path PMC is effective
	- Protection of data at 8 levels	each PMC path	1st-path PMC is effective

⚠ WARNING

1 Please separate the range of PMC Memory that will be written by each PMC path. And, don't write to the same address from other PMC paths because it will often cause a problem. If making such a program it will be difficult to fix a problem.

2 When using the Common PMC Memory mode, the memory of PMC Parameter is shared by those PMC paths, too. Therefore, don't set any duplicated number of functional instructions that is used for PMC Parameter in those PMC paths.
<Functional instructions using PMC Parameter>
- TMR (Timer : SUB 3)
- CTR (Counter : SUB 5)
- CTRB (Fixed Counter : SUB 56)

But, the instruction number of the following functional instructions can be used for each PMC path, also in the Common PMC Memory mode.
<Functional instructions numbered each PMC path>
- TMRB (Fixed Timer : SUB 24)
- TMRBF (Off Delay Fixed Timer : SUB 77)
- DIFU (Rising Edge Detection : SUB 57)
- DIFD (Falling Edge Detection : SUB 58)

NOTE

1 To use the Common PMC Memory mode in the 2nd to 5th-path PMC, select the same PMC type as 1st-path PMC on FANUC LADDER-III.

2 The Data Table Control data is also shared between PMC paths that are used in the Common PMC Memory mode.

3 L address and P address, that is used for the labels of jump or sub-program call, can be used for each PMC path independently in the Common PMC Memory mode, too.

1.7 COMMUNICATION METHOD for EXTERNAL I/O DEVICE

1.7.1 I/O Link *i* and I/O Link

For the high-speed serial interface which transmits input/output signals between the PMC and each I/O device, there are two communication methods. They are the FANUC I/O Link *i* and the FANUC I/O Link. You can use up to three channels for the serial interface. The communication method for the channel 1 and the channel 2 can be specified by the CNC parameter. The channel 3 can be used only for the I/O Link. For the details of the setting of the CNC parameter, see subsection "2.4.3".

As for the transmission cycle of the signals from the I/O Link *i*, you can choose from the normal mode (2msec) and the high-speed mode (0.5msec). You can specify the mode for each group of I/O devices. The transmission cycle of the signals from the I/O Link is "2msec" for the channel 1 and 2. For the channel 3, it depends on the ladder execution period (4msec/8msec).

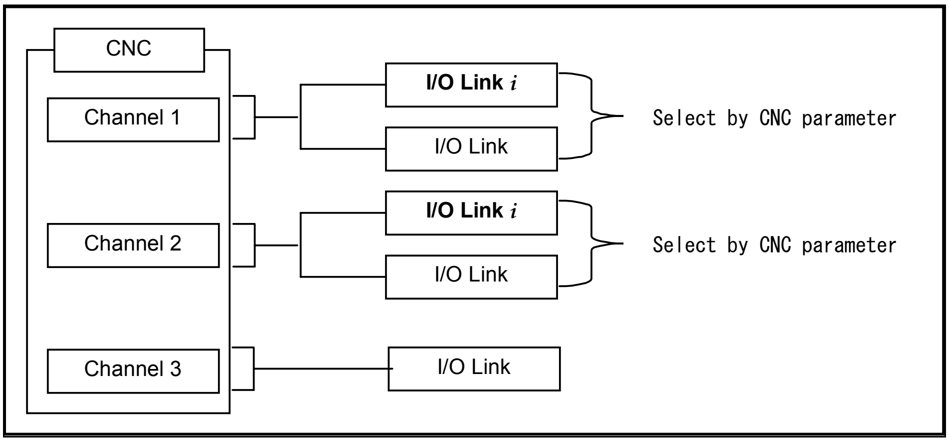


Fig. 1.7.1 (a) Setting of the communication method for each channels

The maximum I/O points of the I/O Link *i* are 2048 poins/2048 points for each channel. The maximum I/O points of the I/O Link are 1024 points/1024 points for each channel.
The maximum I/O points for a system are 4096 points/4096 points (0*i*-F: 2048 points/2048 points) in total. You can use one or more channels of the I/O Link *i* and the I/O Link, however the total points cannot exceed the maximum points of the PMC system.

[The example of the selectable case of the I/O Link *i* and the I/O Link]

Channel 1	Channel 2	Channel 3	Total points (DI / DO)
I/O Link *i*	I/O Link *i*	—	4096 / 4096 (Note)
I/O Link *i*	I/O Link	I/O Link	4096 / 4096 (Note)
I/O Link *i*	I/O Link	—	3072 / 3072 (Note)
I/O Link	I/O Link	I/O Link	3072 / 3072 (Note)
I/O Link *i*	—	—	2048 / 2048
I/O Link	I/O Link	—	2048 / 2048
I/O Link	—	I/O Link	2048 / 2048
I/O Link	—	—	1024 / 1024

NOTE
For the series 0*i*-F, the total points (DI/DO) are 2048/2048 points.

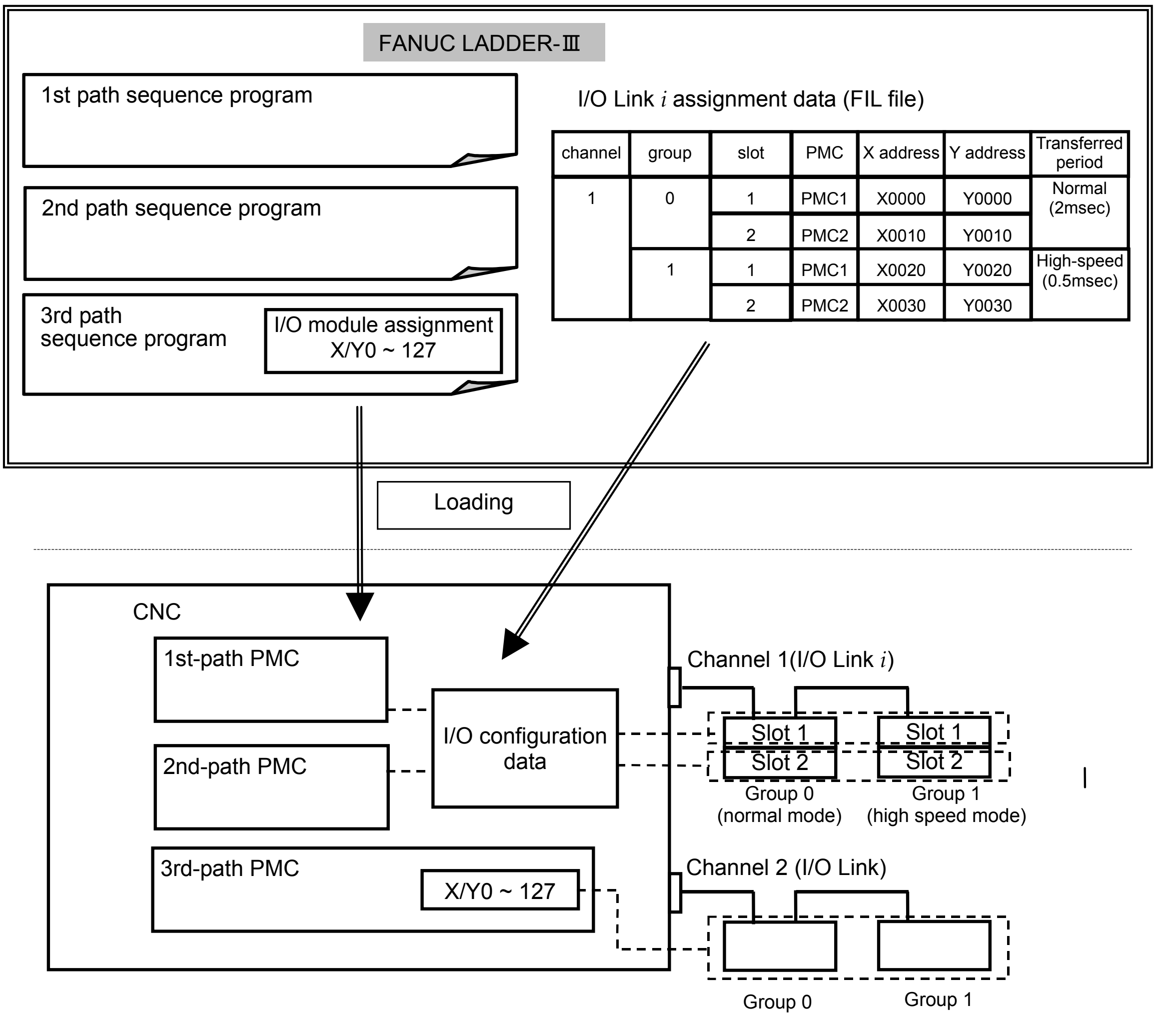
1.7.2 Setting I/O Address for I/O Link *i*

For the I/O addresses assignment of the I/O Link *i* channels, you set the I/O addresses and the PMC path to each group and the slot of I/O devices which is connected to channels for the I/O Link *i*. The assignment is operated in the FANUC LADDER-III and is programmed independent of the sequence program (.LAD file). For the details, see the FANUC LADDER-III Operation's Manual (B-66234EN).
The assignment date of the I/O Link *i* is loaded to a CNC as a I/O configuration data. I/O signals of the I/O Link *i* are controlled by the I/O configuration data.
For details of I/O Link *i*, see Subsection 3.3.
For details of the setting operation of the I/O configuration data on the CNC screen, see Subsection 9.10.

The following figure is the multi-path PMC system overview using the I/O Link *i*.

- 1st PMC: The sequence program using I/O devices connected to the channel 1(I/O Link *i*)
- 2nd PMC: The sequence program using I/O devices connected to the channel 1(I/O Link *i*)
- 3rd PMC: The sequence program using I/O devices connected to the channel 2(I/O Link)

NOTE
The multi-path PMC function is an optional function.



1.7.3 Setting I/O Address for I/O Link

The I/O addresses of I/O Link channels can be assigned with CNC parameters. Moreover, setting the dual assignment can divide one I/O link channel into two blocks and assign them to different PMC path.
For details of setting, see Subsection 9.9.3.For details of parameter setting, see Subsection 2.4.3.

> **NOTE**
> This function cannot be used for the I/O Link *i*.

Assign one I/O link channel to one PMC path

The I/O addresses of I/O Link channels can be assigned with CNC parameters.
If these parameters are not set (0 is set), all channels are assigned to the first PMC by default as follows:

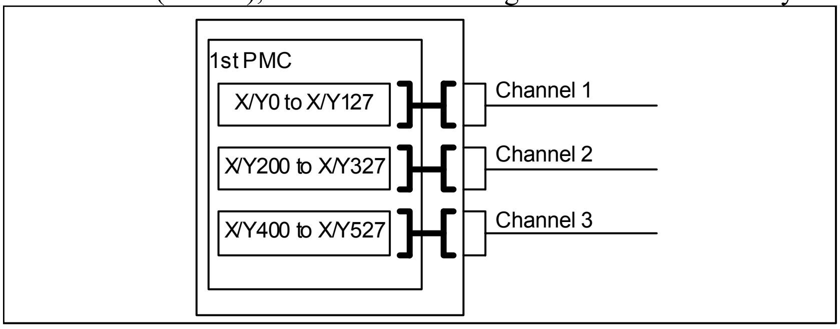


Fig. 1.7.3 (a) Default I/O addresses of I/O Link channels

In the following example, channel 1 is assigned to X/Y0 to X/Y127 of the first PMC, channel 2 is assigned to X/Y200 to X/Y327 of the first PMC, and channel 3 is assigned to X/Y0 to X/Y127 of the second PMC:

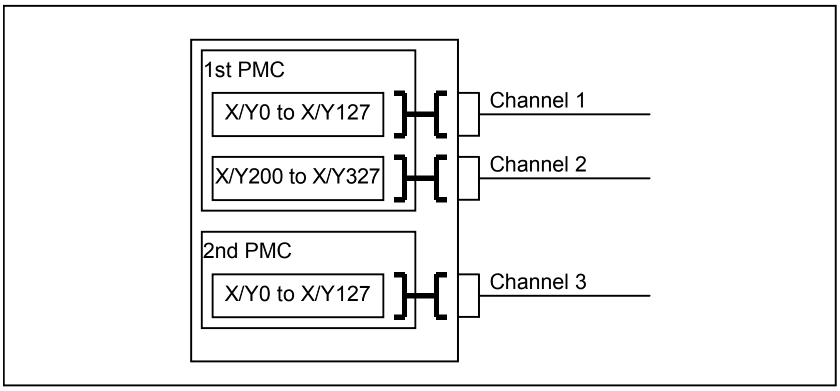


Fig. 1.7.3 (b) Example of I/O address assignment for I/O Link channels

Assign one I/O link channel to two PMC paths

When multi-path path PMC function is used, you can use plural channels. However, there is the case of the wasteful assignment in which the number of I/O link channel is lacking and the assigned I/O points are few. The dual assignment of I/O Link channel can assign I/O devices on one I/O link channel to two PMC paths effectively. To do so, the rest parts of one channel can be used in another PMC path and it is not necessary to use more channels than it is needed. The dual assignment of I/O Link channel can be assigned with CNC parameters.
In the following example, channel 1 is assigned to X/Y0 to X/Y127 of the first PMC and channel 2 is assigned to X/Y200 to X/Y327 of the first PMC and X/Y0 to X/Y127 of the second PMC. As for the channel 2, the former collection of the groups is referred to as "first block" and the latter is referred to as "second block".

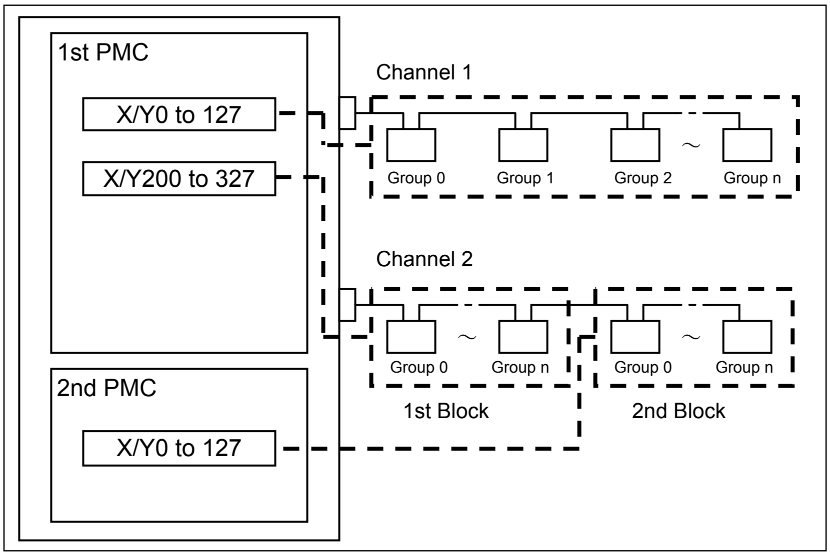


Fig. 1.7.3 (c) Example of Dual Assignment of I/O Link Channel

For details of parameter setting, see Subsection 3.2.4.3.

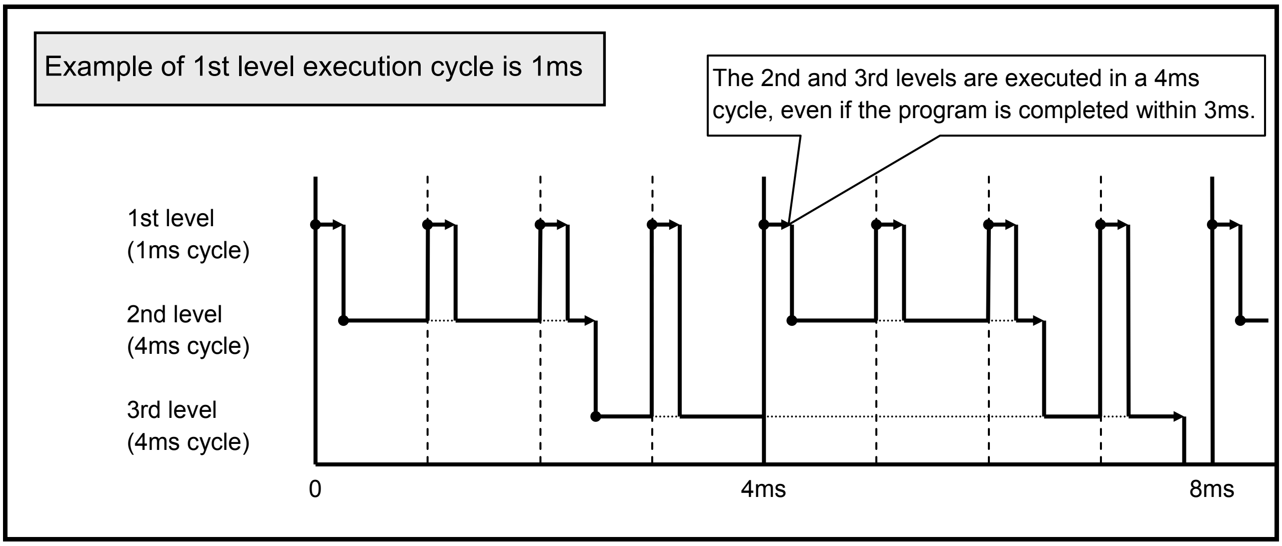
1.8 1st LEVEL EXECUTION CYCLE of LADDER in 1ms/2ms

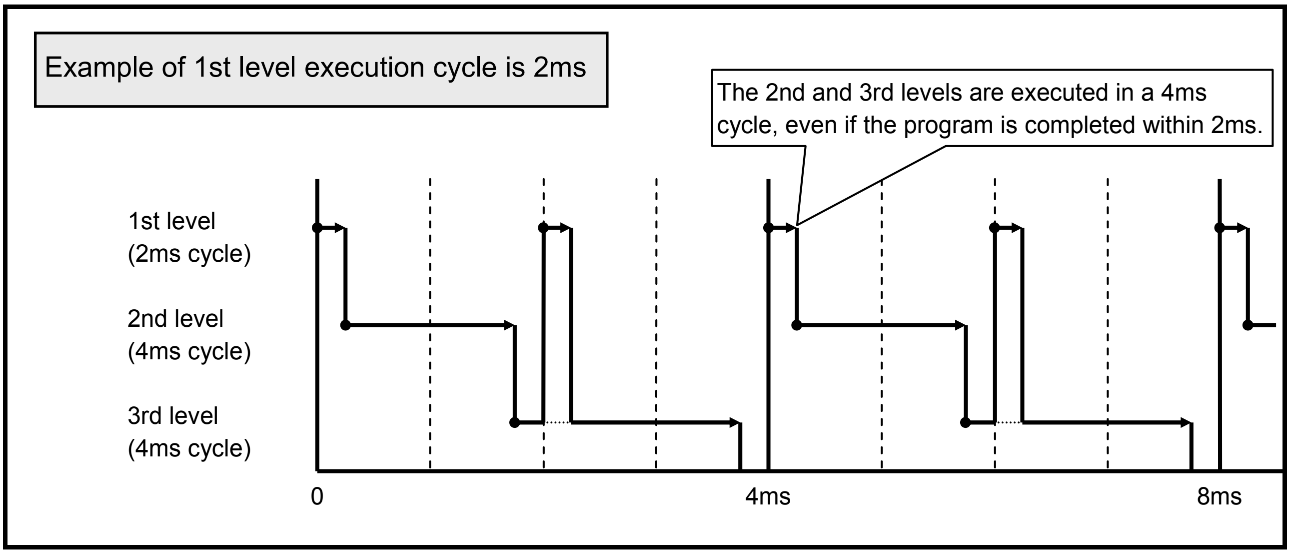
The 1st level execution cycle of a ladder program can be chosen from 1ms, 2ms, 4ms, or 8ms with a CNC parameter.
The 1ms or 2ms of the 1st level execution cycle, a part of specifications differ to the 4ms or 8ms of the 1st level execution cycle.

NOTE
This function cannot be used for the Series 0*i*-F.

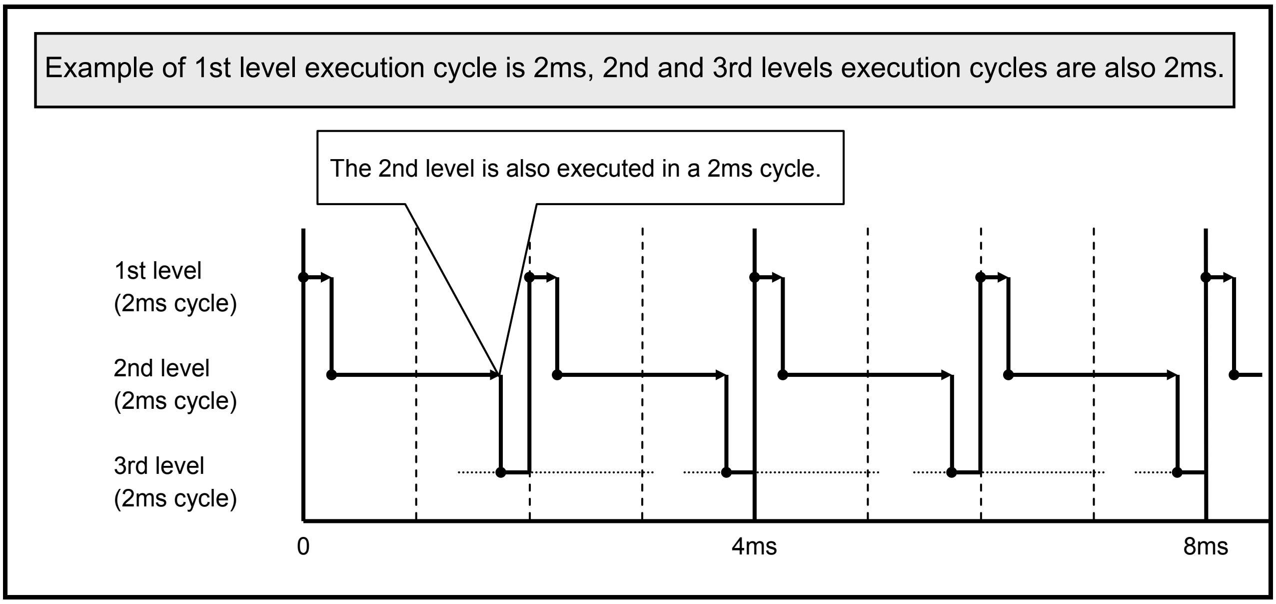
1.8.1 Execution cycle of a ladder

When the setting of the 1st level execution cycle is 1ms or 2ms, the 1st level is executed in a 1ms or 2ms cycle, and the 2nd and 3rd levels are executed in a 4ms cycle.





When the execution cycle of the 1st level is 2ms, the 2nd and 3rd levels can also be executed in a 2ms cycle by setting of a CNC parameter. Please refer to "3.4 CNC Parameters Related to the PMCs" of this document for details.

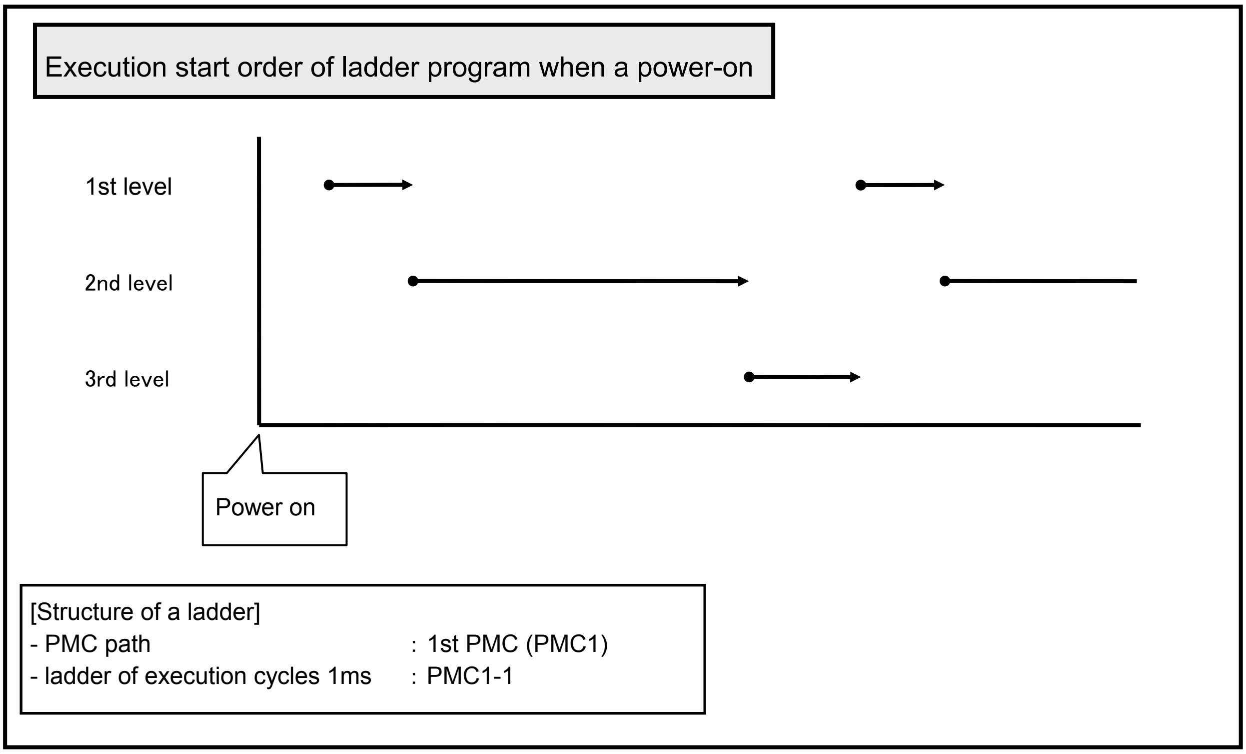


Execution start order of ladder program when a power-on.

The ladder program is executed initially to set the input signals for the CNC (G signals) like the following chart until the beginning of cyclic operation of the CNC from the power on of the CNC. The initial execution is different from the cyclic execution. Therefore the ladder program is not executed at the constant period and is continuously and repeatedly executed. The execution of each level of the ladder program is not divided. They are executed from the top of the program to the end of the program in the order of the following chart. After finishing the initial execution of the ladder, the CNC starts the cyclic operation.

In the initial execution of the ladder program, the operations of the following functional instructions are different from the normal operations.

- TMR、TMRB、TMRC、TMRST、TMRSS
  The timer is not executed and the time is always 0 in the initial execution.
- WINDR、WINDW、AXCTL、EXIN、DISPB、PSGNL、PSGN2
  They are executed as the NOP instruction (No operation) in the initial execution.



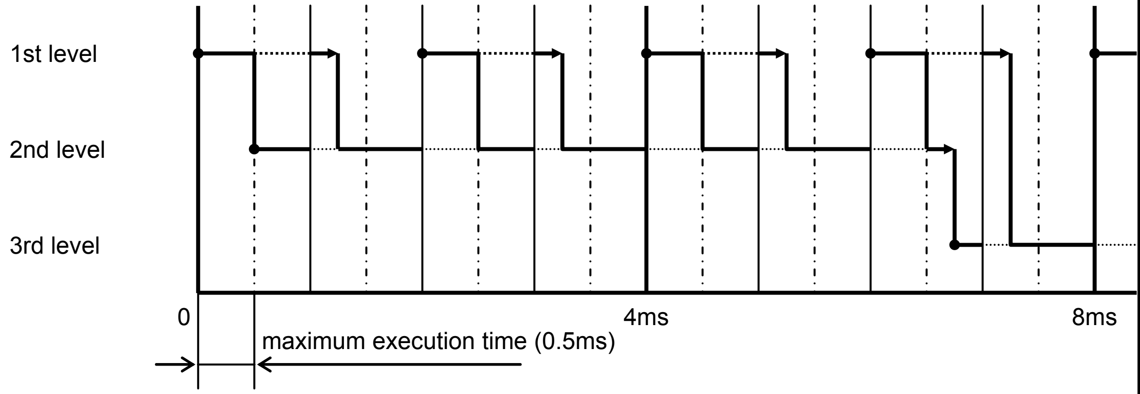
1.8.2 Maximum execution time

When a setting of an execution cycle is 1ms, the maximum execution time of the 1st level of ladder is 0.5ms. And when a setting of an execution cycle is 2ms, the maximum execution time of the 1st level of ladder is 1ms. Because the 1st level of ladder has high execution frequency, it badly affects the scan time of the 2nd level of ladder. Therefore, please make the 1st level of ladder execute as fast as possible.

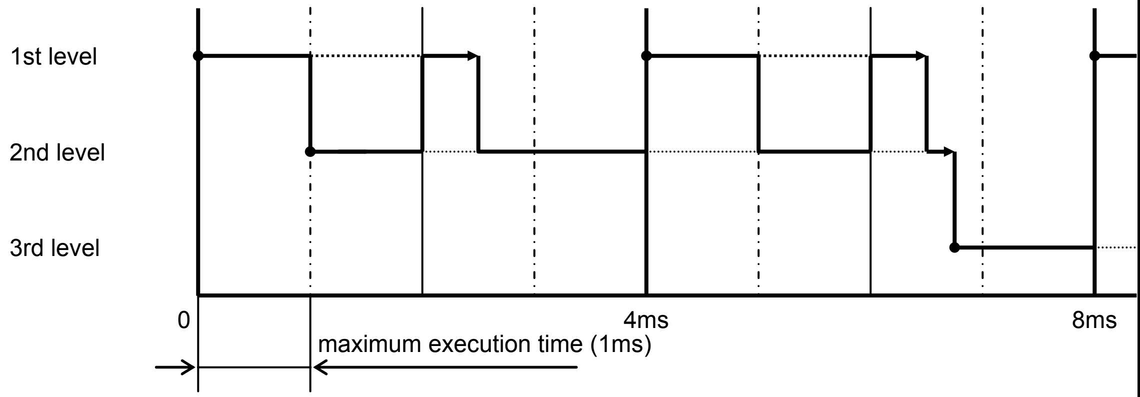
Note

1 When the 1st level of ladder whose execution cycle is 1ms or 2ms exceeds the maximum execution time, execution is divided to the next cycle.

Example when the 1st level of ladder whose execution cycle is 1ms exceeds the maximum execution time (0.5ms).



Example when the 1st level of ladder whose execution cycle is 2ms exceeds the maximum execution time (1ms).



2 The execution time of the 1st level of ladder whose execution cycle is 1ms or 2ms can be checked on the PMC status (1,2ms ladder) screen. Please refer to "9.6.2 Displaying the status of the 1st level execution cycle in 1ms/2ms ([PMC status (1,2ms ladder)] screen)" of this document for details.

1.8.3 Notice in programming of the 1st level

Because the 1st level of ladder whose execution cycle is 1ms or 2ms has high execution frequency, it badly affects the scan time of the 2nd level of ladder. Therefore, please make the 1st level of ladder execute as fast as possible.

Generally, processing of functional instructions takes longer time than basic instructions. Therefore, please make the 1st level of ladder whose execution cycle is 1ms and 2ms with fewer functional instructions.

Moreover, the performance will not be improved even if the following functional instructions execute in the cycle faster than the execution cycle of CNCs because they operate by exchanging data between CNC and PMC. Therefore, please do not use the following functional instructions in the 1st level of ladder whose execution cycle is 1ms or 2ms. If these functional instructions are used on the 1st level of ladder whose execution cycle is 1ms or 2ms, they are processed as NOP instructions. If you want to refer to the result of following functional instructions in the 1st level of ladder, these functional instructions should be programmed in 2nd level and refer to the result in 1st level.

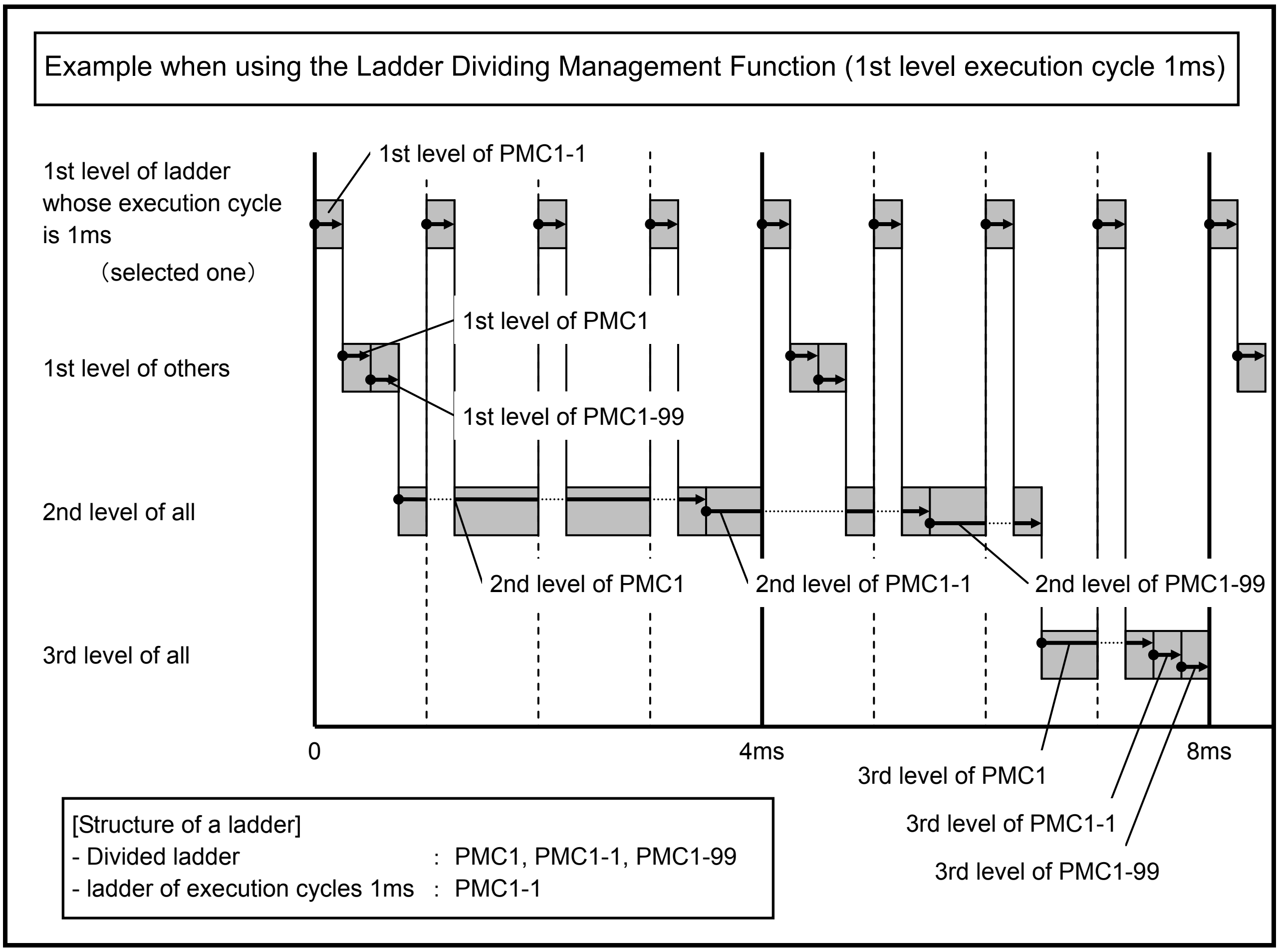
Sub number	Instruction name
41	DISPB
42	EXIN
51	WINDR
52	WINDW
53	AXCTL
50	PSGNL
63	PSGN2

NOTE

The execution time of the 1st level of ladder whose execution cycle is 1ms or 2ms can be checked on the PMC status (1,2ms ladder) screen. Please refer to "9.6.2 Displaying the status of the 1st level execution cycles 1ms/2ms ([PMC status (1,2ms ladder)] screen)" of this document for details.

1.8.4 Operation when using the Ladder Dividing Management Function

When using the 1st level execution cycle in 1ms, 2ms and the Ladder Dividing Management Function, you can select one ladder from main ladder and divided ladder programs, and can execute it in 1ms or 2ms cycle. The 1st level of other ladder programs, and the 2nd and 3rd level of all ladder programs are executed in a 4ms cycle.



> **NOTE**
> The 1st level of ladder that is executed in 1ms or 2ms cycle is selected by CNC parameter No.11945 and 11946. Please refer to "2.4.3 CNC Parameters Related to the PMCs" for details.

Execution start order of ladder program when a power-on.

The ladder program is executed initially to set the input signals for the CNC (G signals) like the following chart until the beginning of cyclic operation of the CNC from the power on of the CNC. The initial execution is different from the cyclic execution. Therefore the ladder program is not executed at the constant period and is continuously and repeatedly executed. The execution of each level of the ladder program is not divided. They are executed from the top of the program to the end of the program in the order of the following chart. After finishing the initial execution of the ladder, the CNC starts the cyclic operation.

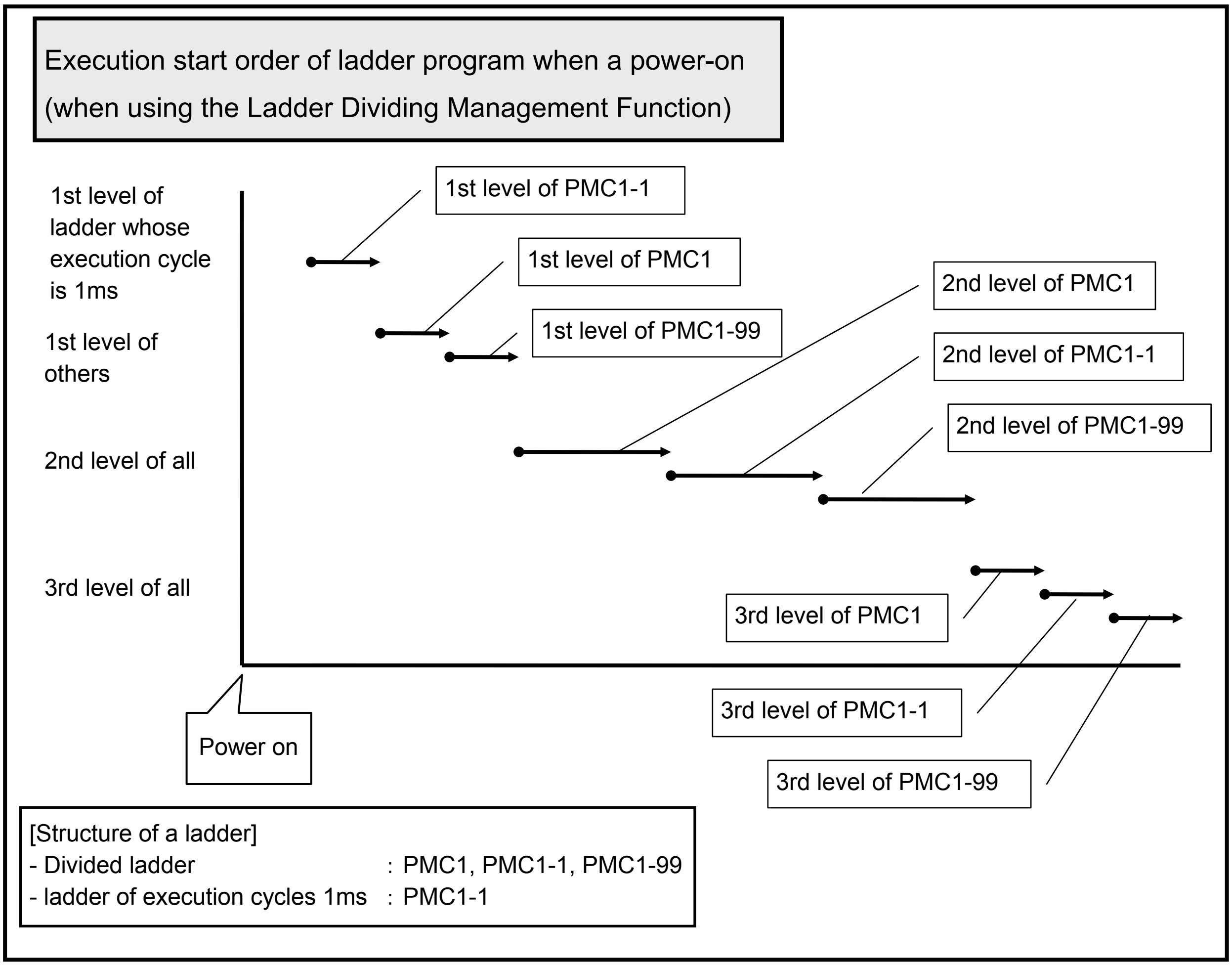
In the initial execution of the ladder program, the operations of the following functional instructions are different from the normal operations.

- TMR、TMRB、TMRC、TMRST、TMRSS

  The timer is not executed and the time is always 0 in the initial execution.

- WINDR、WINDW、AXCTL、EXIN、DISPB、PSGNL、PSGN2

  They are executed as the NOP instruction (No operation) in the initial execution.

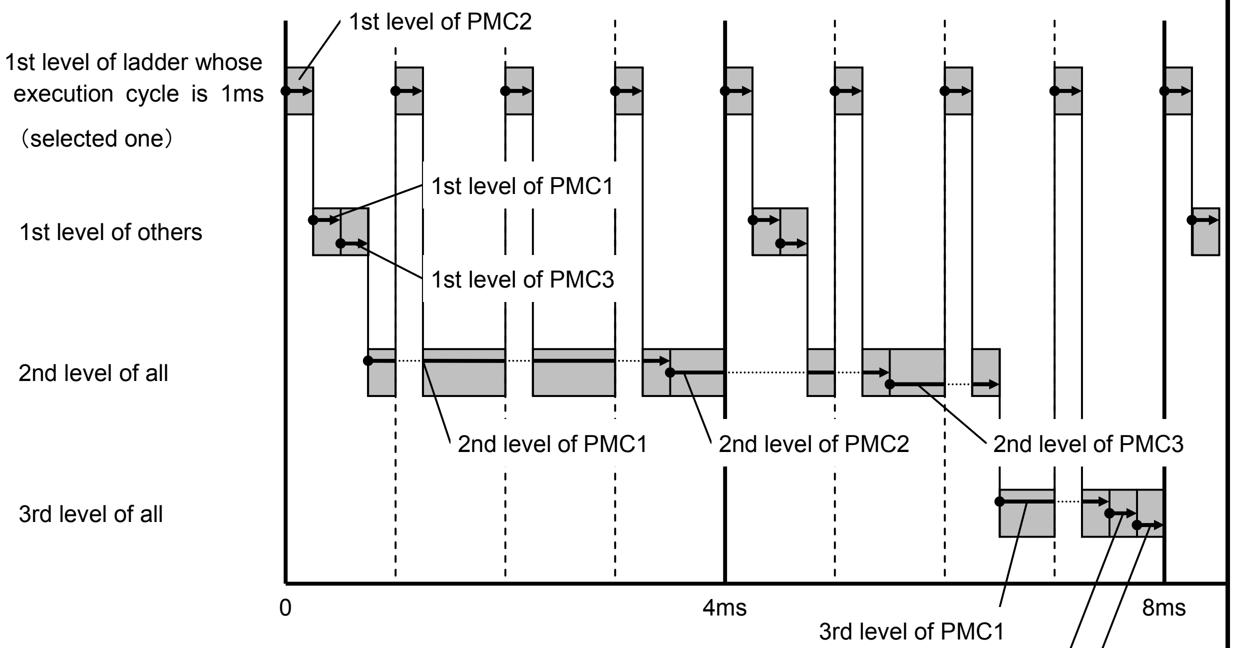


1.8.5 Operation when using the Multi-path PMC Function

When using the 1st level execution cycle in 1ms, 2ms and the Multi-path PMC Function, you can select one PMC path from multi-path PMC (except for DCSPMC), and can execute it in 1ms or 2ms cycle. The 1st level of other PMC path, and the 2nd and 3rd level of all PMC paths are executed in a 4ms cycle.

In this case, ladder programs of all PMC paths are executed continuously for each ladder execution level. Therefore, the setting (CNC parameter No.11905-11909) of the execution time rate for each PMC path is ineffective.

Example when using the Multi-path PMC Function (1st level execution cycle 1ms)



[Structure of a ladder]
- Multi-path PMC : 3Paths(PMC1 to PMC3)
- ladder of execution cycles 1ms : PMC2

NOTE

1 The 1st level of ladder that is executed in 1ms or 2ms cycle is selected by CNC parameter No.11945 and 11946. Please refer to "2.4.3 CNC Parameters Related to the PMCs" for details.

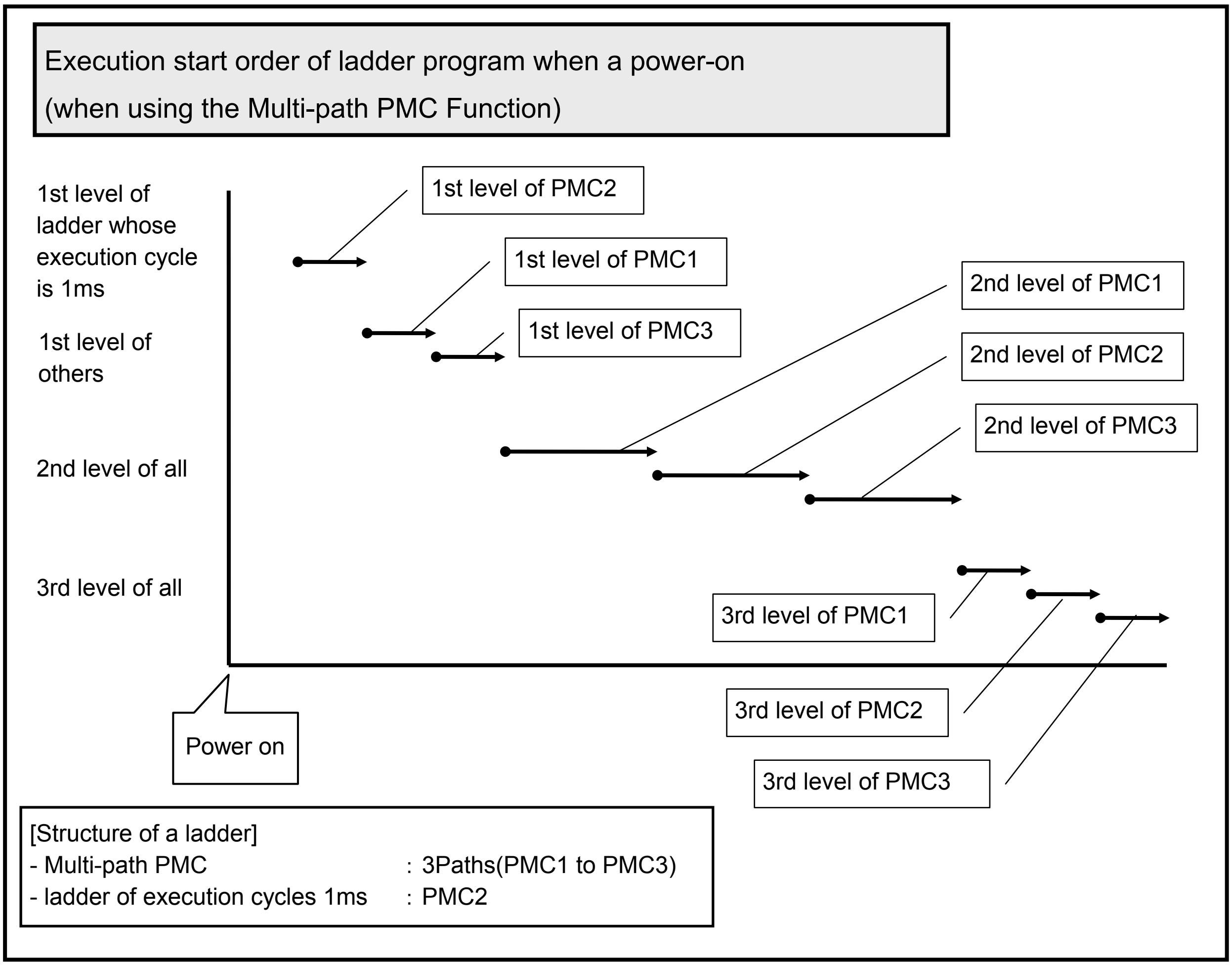
2 When using both the multi-path PMC function and ladder dividing management function, the 1st level execution cycle in 1ms, 2ms can be used. In this case, one 1st level of ladder is selected from all ladder programs by setting CNC parameter No.11945 and No.11946.

Execution start order of ladder program when a power-on.

The ladder program is executed initially to set the input signals for the CNC (G signals) like the following chart until the beginning of cyclic operation of the CNC from the power on of the CNC. The initial execution is different from the cyclic execution. Therefore the ladder program is not executed at the constant period and is continuously and repeatedly executed. The execution of each level of the ladder program is not divided. They are executed from the top of the program to the end of the program in the order of the following chart. After finishing the initial execution of the ladder, the CNC starts the cyclic operation.

In the initial execution of the ladder program, the operations of the following functional instructions are different from the normal operations.

- TMR、TMRB、TMRC、TMRST、TMRSS
  The timer is not executed and the time is always 0 in the initial execution.
- WINDR、WINDW、AXCTL、EXIN、DISPB、PSGNL、PSGN2
  They are executed as the NOP instruction (No operation) in the initial execution.



2 PMC SPECIFICATIONS

2.1 SPECIFICATIONS

2.1.1 Basic Specifications

Table 2.1.1 (a) Basic specifications of each PMC path

Function	1st to 5th path PMC	DCSPMC (Note1)	Reference
Multi-Path PMC function	Maximum 5 paths (0*i*-F:Maximum 3 paths)	-	1.6
PMC Memory Type	1st PMC PMC Memory-B, C, D 2nd to 5th PMC PMC Memory-A, B, C Common PMC Memory with 1st PMC	-	2.1.3
Programming language	Ladder Step sequence(Note2) Function block	Ladder Function block	4 10 11
Divided ladder program - Number of programs - File number	 40(0*i*-F:16) 1 to 99	 None	2.1.4
Number of ladder levels	3	2 (Note3)	1.4.3
Level 1 execution period	1ms, 2ms, 4ms or 8ms (0*i*-F:4ms or 8ms)	8ms	1.8, 2.4.3
Processing power - Basic instruction processing speed (transition contact)	 9.1ns/step (0*i*-F:18.2ns/step)	 1μs/step	-
Program capacity - Ladder - Symbol & Comment - Message	 Up to about 300,000 steps (0*i*-F:100,000steps) At least 1KB At least 8KB	 Up to about 5,000 steps At least 1KB At least 8KB	2.1.2, 2.1.4
Instructions - Basic instructions - Functional instructions	 24 218	 24 210	 2.1.7 2.1.8, 2.1.9
CNC interface - Inputs (F) - Outputs (G)	 768 bytes × 10 768 bytes × 10	 768 bytes 768 bytes	2.2.1
DI/DO - Inputs (X) - Outputs(Y)	 Up to 4,096 points (0*i*-F:2,048 points) Up to 4,096 points (0*i*-F:2,048 points)	 Up to 896 points Up to 896 points	2.2.2, 3
Symbol & Comment - Number of symbol characters - Number of comment characters	 40 255 × 4	 40 255 × 4	1.2.7, 2.1.5
Program storage area (Flash ROM)	Max. 5MB (total size of sequence program of all PMC paths and PMC message multi-language data)	128 KB	2.1.4

NOTE
1 This PMC is used for Dual Check Safety function (option) and handles the safety related signals.
2 The Step Sequence is available in the main ladder of 1st PMC.
3 A program can be created on level 3 to maintain source-level compatibility with programs for other models, but it is not executed.

Table 2.1.1 (b) Basic specifications of each PMC Memory Type

Function	1st to 5th PMC				DCSPMC
	PMC Memory-A	PMC Memory-B	PMC Memory-C	PMC Memory-D	(Note 1)
PMC Memory					
• Internal relay (R)	1,500 bytes	8,000 bytes	16,000 bytes	60,000 bytes	1,500 bytes
• System Relay (R9000 or Z)	500 bytes	500 bytes	500 bytes	500 bytes	500 bytes
• Extra relay (E) (Note2)	10,000 bytes	10,000 bytes	10,000 bytes	10,000 bytes	(Note 3)
• Message display (A) · Display requests · Status displays	 2,000 points 2,000 points	 2,000 points 2,000 points	 4,000 points 4,000 points	 6,000 points 6,000 points	 (Note 4) (Note 4)
• Nonvolatile memory					
• Timer (T) · Variable timer · Variable timer precision	 80 bytes (40 pieces) 80 bytes (40 pieces)	 500 bytes (250 pieces) 500 bytes (250 pieces)	 1,000 bytes (500 pieces) 1,000 bytes (500 pieces)	 1,000 bytes (500 pieces) 1,000 bytes (500 pieces)	 80 bytes (40 pieces) 80 bytes (40 pieces)
• Counter (C) · Variable counter · Fixed counter	 80 bytes (20 pieces) 40 bytes (20 pieces)	 400 bytes (100 pieces) 200 bytes (100 pieces)	 800 bytes (200 pieces) 400 bytes (200 pieces)	 1200 bytes (300 pieces) 600 bytes (300 pieces)	 80 bytes (20 pieces) 40 bytes (20 pieces)
• Keep relay (K) · User area · System area	 20 bytes 100 bytes	 100 bytes 100 bytes	 200 bytes 100 bytes	 300 bytes 100 bytes	 20 bytes 100 bytes
• Data table (D)	3,000 bytes	10,000 bytes	20,000 bytes (Note 5)	60,000 bytes (Note 5)	3,000 bytes
• Step sequence · Step number (S)	 (None)	 2,000 bytes	 2,000 bytes	 2,000 bytes	 (None)
Functional instructions					
• Variable timers (TMR)	40 pieces	250 pieces	500 pieces	500 pieces	40 pieces
• Fixed timers (TMRB/TMRBF)	100 pieces	500 pieces	1,000 pieces	1,500 pieces	100 pieces
• Variable counters (CTR)	20 pieces	100 pieces	200 pieces	300 pieces	20 pieces
• Fixed counters (CTRB)	20 pieces	100 pieces	200 pieces	300 pieces	20 pieces
• Rising/Falling edge detection (DIFU/DIFD)	256 pieces	1,000 pieces	2,000 pieces	3,000 pieces	256 pieces
• Labels (LBL)	9,999 pieces	9,999 pieces	9,999 pieces	9,999 pieces	9,999 pieces
• Subprograms (SP)	512 pieces	5,000 pieces	5,000 pieces	5,000 pieces	512 pieces

NOTE

1 This PMC is used for Dual Check Safety function (option).
2 The extra relay is common memory for the multi-PMC function. This means that its size covers all of PMCs. Moreover, It is possible to use the extra relay as nonvolatile memory by the option.
3 No extra relay is available for DCS PMC.
4 The message display relay is ineffective in DCS PMC because the message display function is unavailable in it.
5 Under the configuration having two or more paths of PMC Memory-C or one path of PMC Memory-D, specify the "Nonvolatile PMC data table area expansion 40KB" option. If this option is not added, the expanded data table area (D10000~) is not kept after rebooting CNC. Refer to subsection 2.1.3 for details.

2.1.2 Total Ladder Steps of Multi-path PMC

For the multi-path PMC system, you can specify a ladder step option by the total step of all of PMCs.

Option name	Specification	Maximum ladder size
PMC Ladder Function 24,000 Step	Basic	102KB
PMC Ladder Function 32,000 Step	H990#32K	136KB
PMC Ladder Function 64,000 Step	H990#64K	272KB
PMC Ladder Function 100,000 Step	H990#100K	425KB
PMC Ladder Function 300,000 Step (Note)	H990#300K	1,275KB

NOTE

The option “PMC Ladder Function 300,000 Steps” is not supported for the Series 0*i*-F.

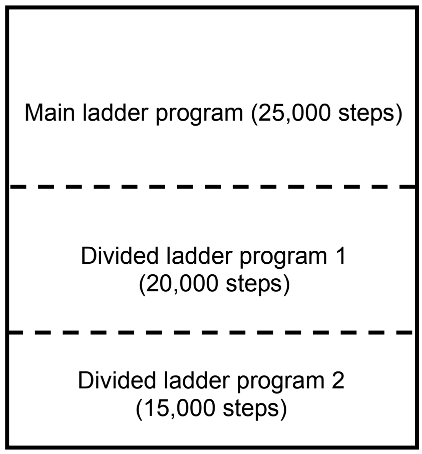
Example 1 (The case of using ladder dividing management function)

A main ladder and two divided ladder programs are used. When the main ladder program requires 25,000 steps and the 1st divided ladder program requires 20,000 steps and the 2nd divided ladder program requires 15,000 steps, the “PMC ladder function 64,000 step” option is necessary.

Ladder steps of each program

	Ladder steps
Main ladder	25,000 steps
Divided ladder 1	20,000 steps
Divided ladder 2	15,000 steps
Total	60,000 steps

PMC Ladder 64,000 steps option



NOTE

Total size of main ladder program and some divided ladder programs are limited by the maximum size of specified step option.

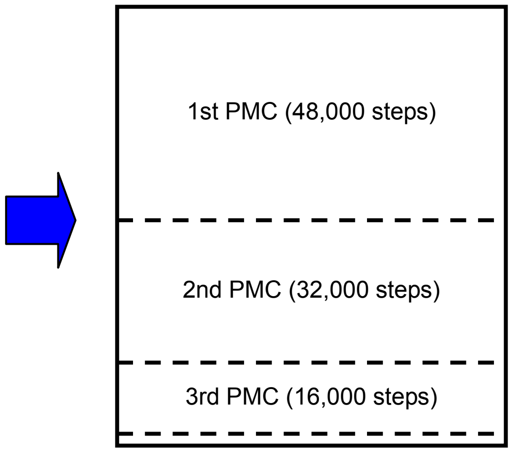
Example 2 (The case of using multi-path PMC)

When the 1st PMC requires 48,000 steps, the 2nd PMC requires 32,000 steps and the 3rd PMC requires 16,000 steps on 3-path PMC system, the "PMC ladder function 100,000 step" option is necessary.

Ladder steps of each PMC path

	Ladder steps
1st PMC	48,000 steps
2nd PMC	32,000 steps
3rd PMC	16,000 steps
Total	96,000 steps

PMC Ladder 100,000 steps option



> **NOTE**
> Total size of main ladder program and some divided ladder programs are limited by the maximum size of specified step option.

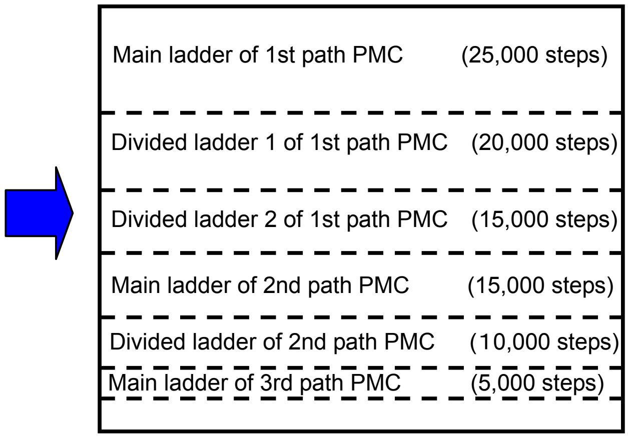
Example 3 (The case of using ladder dividing management function and Multi-path PMC function together)

The following case uses three PMC paths and six sequence programs. When the total steps are 90,000 steps, the "PMC ladder function 100,000 step" option is necessary.

Ladder steps of each program

	Steps
Main ladder of 1st path PMC	25,000 steps
Divided ladder 1 of 1st path PMC	20,000 steps
Divided ladder 2 of 1st path PMC	15,000 steps
Main ladder of 2nd path PMC	15,000 steps
Divided ladder of 2nd path PMC	10,000 steps
Main ladder of 3rd path PMC	5,000 steps
Total	90,000 steps

100,000 step option



> **NOTE**
> 1 Total size of main ladder program and some divided ladder programs are limited by the maximum size of specified step option.
> 2 If the total steps of sequence programs exceed the step number of specified step option, the PMC alarm "ER03 PROGRAM SIZE ERROR(OPTION)" occurs in the path just when the excess of steps is detected. The sequence program of the PMC path, in which the alarm occurs, will not be executed.
> 3 The total steps does not include the ladder steps of dual check safety PMC.

2.1.3 Determination of PMC Memory Type

PMC memory type

There are four PMC memory types i.e. memory-A, memory-B, memory-C and memory-D. These memory types differ in the size of PMC address. For the 2nd to 5th path PMC, the PMC memory can be also shared with the 1st path PMC. The DCS PMC does not have plural PMC memory types.
For the details of the PMC memory type, refer to subsection “2.1.1”. As for the CNC parameter for the PMC memory type, refer to subsection “2.4.3”.

The following is the selectable PMC memory types in each PMC path.

1st path PMC	2nd to 5th path PMC	Remark
PMC-memory B (default) PMC-memory C	PMC-memory A (default) PMC-memory B PMC-memory C Shared with 1st path PMC	You can specify up to three paths both of PMC-memory B and C in total.
PMC-memory D	Shared with 1st path PMC	

Nonvolatile area of the data table in each PMC memory type

The following table is the data table number and basic nonvolatile area of each PMC memory type.

Table 2.1.3 (a) Data table number of each PMC memory type

PMC memory type	Data Table	Basic nonvolatile area
PMC memory-A	3,000 bytes	3,000 bytes
PMC memory-B	10,000 bytes	10,000 bytes
PMC memory-C	20,000 bytes	20,000 bytes (In case of using one path of PMC-memory C) 10,000 bytes (In case of using two or more paths of PMC-memory C)
PMC memory-D	60,000 bytes	10,000 bytes

NOTE

To use two or more paths of PMC memory-C or one path of PMC memory-D, specify the option “Nonvolatile PMC data table area expansion (40KB)”. If this option is not specified, the data at D10000 and subsequent addresses is not saved.

2.1.4 Program Capacity

All of the memory size, to which save the sequence program and multi-language PMC message data for all PMC paths, is specified as the combination of the following two options. The size of each data is calculated per 128KB.
Minimum unit of the size of divided ladder program is also 128KB. You can make up to 40(Note1) programs of main ladder and divided ladder within specified total memory size.

(1) PMC Ladder step option

Option name	Memory size
PMC Ladder Function 24,000 Steps (Basic)	256 KB
PMC Ladder Function 32,000 Steps	384 KB
PMC Ladder Function 64,000 Steps	768 KB
PMC Ladder Function 100,000 Steps	1 MB (1,024 KB)
PMC Ladder Function 300,000 Steps (Note2)	3 MB (3,072 KB)

(2) PMC Symbol, Comment and Message capacity expansion option

Option name	Memory size
PMC Symbol, Comment and Message capacity expansion (512KB)	512KB
PMC Symbol, Comment and Message capacity expansion (1MB)	1MB (1,024KB)
PMC Symbol, Comment and Message capacity expansion (2MB) (Note2)	2MB (2,048KB)

NOTE
1 For the series 0*i*-F, up to 16 programs can be made.
2 These options are not supported for the Series 0*i*-F.

Configuration example 1 (Basic configuration)

Kind of data	Ladder steps	Memory size
Sequence program	50,000 steps	640KB

The following option is required for above configuration.

(1) "PMC Ladder Function 64,000 Steps"
Specify the ladder steps.

Configuration Example 2 (The case of using ladder dividing management function)

Kind of data	Ladder steps	Memory size
Main ladder program	30,000 steps	384KB
Divided ladder program 1	10,000 steps	128KB
Divided ladder program 2	10,000 steps	128KB
(Total)	50,000 steps	640KB

The following option is required for above configuration.

(1) "PMC Ladder Function 64,000 Steps"
Specify the total ladder steps.

Configuration example 3 (The case of using PMC message multi language display function)

Kind of data	Ladder steps	Memory size
Main ladder program	30,000 steps	384KB
Divided ladder program 1	10,000 steps	128KB
Divided ladder program 2	10,000 steps	128KB
PMC message multi-language display data	0	256KB
(Total)	50,000 steps	896KB

The following options are required for above configuration.

(1) "PMC Ladder Function 64,000 Steps"
Specify the total ladder steps.
(2) "PMC Symbol, Comment and Message capacity expansion 512KB"
Specify the memory capacity to add to "PMC Ladder Function Step Option". The memory size of "PMC Ladder Function 64,000 steps" is 768KB. Therefore, this option is necessary because it is short of memory by 128KB.

Configuration example 4 (The case of using multi-path PMC)

Kind of data	Ladder steps	Memory size
Main ladder program of 1st path PMC	30,000 steps	384KB
Divided ladder program 1 of 1st path PMC	10,000 steps	128KB
Divided ladder program 2 of 1st path PMC	10,000 steps	128KB
Sequence program of 2nd path PMC	30,000 steps	384KB
Sequence program of 3rd path PMC	15,000 steps	128KB
PMC message multi-language display data of 1st path PMC	0	256KB
PMC message multi-language display data of 2nd path PMC	0	128KB
(Total)	95,000 steps	1,536KB

The following options are required for above configuration.

(1) "Multi-Path PMC Function (3-Paths)"
Specify the path number according to using PMC path.
(2) "PMC Ladder Function 100,000 Steps"
Specify the total ladder steps.
(3) "PMC Symbol, Comment and Message capacity expansion 512KB"
Specify the memory capacity to add to "PMC Ladder Function Step Option". The memory size of "PMC Ladder Function 100,000 steps" is 1024KB. Therefore, this option is necessary because it is short of memory by 512KB.

NOTE

1 When the total size is exceed the specified memory capacity by options, the alarm "ER02 PROGRAM SIZE OVER" or "WN64 MESSAGE FILE SIZE OVER" occurs in the PMC path in which detected the error.
2 When plural data are edited, inputted or outputted at the same time using CNC screen or FANUC LADDER-III, the data may not be expanded even if the total size is under the specified memory capacity. In this case, stop the simultaneous operations and retry the modification one by one.
3 Above memory size does not include the memory for DCS PMC. The memory size of DCS PMC is 128KB.

2.1.5 Used Memory Size of Sequence Program

The following table lists the memory capacity used by sequence programs. When creating the sequence programs, keep their total size within this memory capacity.

Table 2.1.5 (a) Used memory size for each data

Category	Item	Required memory size (Note 1)
Ladder (Note 2)	Basic instruction	Refer to table 2.1.8.
	Functional instruction	Refer to table 2.1.9 and table2.1.10.
	Functional instruction parameter	4 bytes
Symbol/comment conventional type (Note 2)	One definition of symbol/comment (Including symbol string)	24 bytes
	One comment character	1 byte (Note 3)
Symbol/comment extended type (Note 2)	One definition of symbol/comment	16 - 23 bytes (Note 5)
	One symbol character	1 byte
	One comment character	1 byte (Note 3)
	One sub-program	8 bytes (Note 6)
Message (Note 2)	One message character (alphanumeric characters)	1 byte (Note 4)
Others	Area used by the system	About 16K bytes (PMC Memory-A, B, DCS PMC)
		About 24K bytes (Note 7) (PMC Memory-C)
		About 32K bytes (Note 7) (PMC Memory-D)

NOTE

1 The total sequence program size (including all items such as ladders, symbols/comments, and messages) cannot exceed the sequence program memory storage capacity. If a ladder, symbol/ comment, or message is large, the size of other categories may be limited.

2 The PMC programmer may adjust arrangement of these items in the sequence program memory to improve processing efficiency. As a result, up to 1K byte (1024 bytes) may be added to the sum of the sizes of individual items.

3 Each full-size character takes a memory capacity of 2 bytes.

4 For Japanese and special characters, each character in a character code notation (including leading and trailing "@" characters) takes a memory capacity of one byte. See descriptions about the DISPB function instructions for the character input code notation.

5 One definition of extended symbol and comment takes 16-23 bytes plus the memory according to the length of symbol and comment.

6 8 bytes are taken for a sub-program when local symbols are defined in the sub-program.

7 In the PMC Memory-C, the system area is expanded by about 8KB from PMC Memory-A or B. In the PMC Memory-D, the area is expanded by about 16KB from PMC Memory-A or B. Therefore, available memory size for Symbol, Comment and Message data is smaller than PMC Memory-A and B. If the program overflowed by converting PMC Memory Type, decrease the Symbol, Comment or Message data, or upgrade the Ladder step option to larger size.

2.1.6 PMC Addresses

Table 2.1.6 (a) PMC Address list (1)

Signals	Symbol	1st to 5th path PMC				DCSPMC (Note 1)
		PMC Memory-A	PMC Memory-B	PMC Memory-C	PMC Memory-D	
Input signal to the PMC from the machine	X	X0 ~ X127 X200 ~ X327 X400 ~ X527 X600 ~ X727	X0 ~ X127 X200 ~ X327 X400 ~ X527 X600 ~ X727	X0 ~ X127 X200 ~ X327 X400 ~ X527 X600 ~ X727	X0 ~ X127 X200 ~ X327 X400 ~ X527 X600 ~ X727	X0 ~ X127
		X1000 ~ X1127 (Note 2)	X1000 ~ X1127 (Note 2)	X1000 ~ X1127 (Note 2)	X1000 ~ X1127 (Note 2)	
Output signal from the PMC to the machine	Y	Y0 ~ Y127 Y200 ~ Y327 Y400 ~ Y527 Y600 ~ Y727	Y0 ~ Y127 Y200 ~ Y327 Y400 ~ Y527 Y600 ~ Y727	Y0 ~ Y127 Y200 ~ Y327 Y400 ~ Y527 Y600 ~ Y727	Y0 ~ Y127 Y200 ~ Y327 Y400 ~ Y527 Y600 ~ Y727	Y0 ~ Y127
		Y1000 ~ Y1127 (Note 2)	Y1000 ~ Y1127 (Note 2)	Y1000 ~ Y1127 (Note 2)	Y1000 ~ Y1127 (Note 2)	
Input signal to the PMC from the CNC	F	F0 ~ F767 F1000 ~ F1767 F2000 ~ F2767 F3000 ~ F3767 F4000 ~ F4767 F5000 ~ F5767 F6000 ~ F6767 F7000 ~ F7767 F8000 ~ F8767 F9000 ~ F9767	F0 ~ F767 F1000 ~ F1767 F2000 ~ F2767 F3000 ~ F3767 F4000 ~ F4767 F5000 ~ F5767 F6000 ~ F6767 F7000 ~ F7767 F8000 ~ F8767 F9000 ~ F9767	F0 ~ F767 F1000 ~ F1767 F2000 ~ F2767 F3000 ~ F3767 F4000 ~ F4767 F5000 ~ F5767 F6000 ~ F6767 F7000 ~ F7767 F8000 ~ F8767 F9000 ~ F9767	F0 ~ F767 F1000 ~ F1767 F2000 ~ F2767 F3000 ~ F3767 F4000 ~ F4767 F5000 ~ F5767 F6000 ~ F6767 F7000 ~ F7767 F8000 ~ F8767 F9000 ~ F9767	F0 ~ F767
Output signal from the PMC to the CNC	G	G0 ~ G767 G1000 ~ G1767 G2000 ~ G2767 G3000 ~ G3767 G4000 ~ G4767 G5000 ~ G5767 G6000 ~ G6767 G7000 ~ G7767 G8000 ~ G8767 G9000 ~ G9767	G0 ~ G767 G1000 ~ G1767 G2000 ~ G2767 G3000 ~ G3767 G4000 ~ G4767 G5000 ~ G5767 G6000 ~ G6767 G7000 ~ G7767 G8000 ~ G8767 G9000 ~ G9767	G0 ~ G767 G1000 ~ G1767 G2000 ~ G2767 G3000 ~ G3767 G4000 ~ G4767 G5000 ~ G5767 G6000 ~ G6767 G7000 ~ G7767 G8000 ~ G8767 G9000 ~ G9767	G0 ~ G767 G1000 ~ G1767 G2000 ~ G2767 G3000 ~ G3767 G4000 ~ G4767 G5000 ~ G5767 G6000 ~ G6767 G7000 ~ G7767 G8000 ~ G8767 G9000 ~ G9767	G0 ~ G767
Input signal from other PMC path	M	M0 ~ M767 (Note 3)	M0 ~ M767 (Note 3)	M0 ~ M767 (Note 3)	M0 ~ M767 (Note 3)	
Output signal to other PMC path	N	N0 ~ N767 (Note 3)	N0 ~ N767 (Note 3)	N0 ~ N767 (Note 3)	N0 ~ N767 (Note 3)	
Internal relay	R	R0 ~ R1499	R0 ~ R7999	R0 ~ R15999	R0 ~ R59999	R0 ~ R1499
System relay	R / Z	R9000 ~ R9499	R9000 ~ R9499	Z0 ~ Z499	Z0 ~ Z499	R9000 ~ R9499
Extra relay	E	E0 ~ E9999 (Note 4)	E0 ~ E9999 (Note 4)	E0 ~ E9999 (Note 4)	E0 ~ E9999 (Note 4)	(Note 5)
Message display ・Display request ・Display status	A	A0 ~ A249 A9000 ~ A9249	A0 ~ A249 A9000 ~ A9249	A0 ~ A499 A9000 ~ A9499	A0 ~ A749 A9000 ~ A9749	A0 ~ A249 A9000 ~ A9249

Table 2.1.6 (b) PMC Address list (2)

Signals	Symbol	1st to 5th path PMC				DCSPMC (Note 1)
		PMC Memory-A	PMC Memory-B	PMC Memory-C	PMC Memory-D	
Timer ・Variable timer ・Variable timer precision (Note 6)	T	T0 ~ T79 T9000 ~ T9499	T0 ~ T499 T9000 ~ T9499	T0 ~ T999 T9000 ~ T9999	T0 ~ T999 T9000 ~ T9999	T0 ~ T79 T9000 ~ T9079
Counter ・Variable counter ・Fixed counter	C	C0 ~ C79 C5000 ~ C5199	C0 ~ C399 C5000 ~ C5199	C0 ~ C799 C5000 ~ C5399	C0～C1199 C5000～C5599	C0 ~ C79 C5000 ~ C5039
Keep relay ・User area ・System area	K	K0 ~ K19 K900 ~ K999	K0 ~ K99 K900 ~ K999	K0 ~ K199 K900 ~ K999	K0 ~ K299 K900 ~ K999	K0 ~ K19 K900 ~ K999
Data table	D	D0 ~ D2999	D0 ~ D9999	D0 ~ D19999 (Note7)	D0 ~ D59999 (Note7)	D0 ~ D2999
Label	L	L1 ~ L9999	L1 ~ L9999	L1 ~ L9999	L1 ~ L9999	L1 ~ L9999
Subprogram	P	P1 ~ P512	P1 ~ P5000	P1 ~ P5000	P1 ~ P5000	P1 ~ P512
Step number (Step sequence)	S	(none)	S1 ~ S2000	S1 ~ S2000	S1 ~ S2000	(none)

NOTE

1. This PMC is used for Dual Check Safety function (option).
2. This area is reserved for PMC management software. Do not use it in user programs.
3. The M/N addresses cannot be used in 4th and 5th path PMC.
4. This area is common memory for the multi-path PMC function. Each program can write and read the same value in the area.
5. No extra relay is available for the Dual Check Safety PMC.
6. This area is used to specify the precision of a variable timer.
   - Don't modify the value of active timer and its precision except for writing same value.
   - Don't set the value other than the following range.
   - If above rules are violated, the behavior of the timer is not guaranteed.

   The value of precision
   0: Default (8msec or 48msec)
   1: 1msec
   2: 10msec
   3: 100msec
   4: 1sec
   5: 1min

7. To save all area of the data table, the “Nonvolatile PMC data table area expansion (40KB)” option may be necessary.

2.1.7 Basic Instructions

Table 2.1.7 Basic instruction list

Instruction name	Required memory size	1st to 5th path PMC	DCSPMC (Note)
RD	4 bytes	○	○
RD.NOT	4 bytes	○	○
WRT	4 bytes	○	○
WRT.NOT	4 bytes	○	○
AND	4 bytes	○	○
AND.NOT	4 bytes	○	○
OR	4 bytes	○	○
OR.NOT	4 bytes	○	○
RD.STK	4 bytes	○	○
RD.NOT.STK	4 bytes	○	○
AND.STK	4 bytes	○	○
OR.STK	4 bytes	○	○
SET	4 bytes	○	○
RST	4 bytes	○	○
RDPT	12 bytes	●	●
ANDPT	12 bytes	●	●
ORPT	12 bytes	●	●
RDPT.STK	12 bytes	●	●
RDNT	12 bytes	●	●
ANDNT	12 bytes	●	●
ORNT	12 bytes	●	●
RDNT.STK	12 bytes	●	●
PUSH	4 bytes	●	●
POP	4 bytes	●	●

(○: Usable. ●: The Extended PMC Ladder Instruction Function. ×: Unusable.)

NOTE
This PMC is used for Dual Check Safety function (option). See "Dual Check Safety Connection Manual" of each CNC series for details.

2.1.8 Functional Instructions (Arranged in Sequence of Instruction Group)

Table 2.1.8 (a) Functional instruction list (arranged in sequence of instruction group) (1)

Instruction group		Instruction name	SUB No.	Processing	Required memory size (byte)	1st to 5th PMC	DCS PMC (Note1)
Timer	1	TMR	3	On-delay timer	8	○	○
	2	TMRB	24	Fixed on-delay timer	12	○	○
	3	TMRBF	77	Fixed off-delay timer	12	○	○
	4	TMRC	54	On-delay timer	16	○	○
	5	TMRST	221	Stop watch timer (1 ms accuracy)	20	●	●
	6	TMRSS	222	Stop watch timer (1 sec accuracy)	20	●	●
Counter	1	CTR	5	Counter processing	8	○	○
	2	CTRB	56	Counter processing	12	○	○
	3	CTRC	55	Counter processing	12	○	○
	4	CTRD	223	Counter processing (4 byte length)	12	●	●
Data transfer	1	MOVB	43	1-byte transfer	12	○	○
	2	MOVW	44	2-byte transfer	12	○	○
	3	MOVD	47	4-byte transfer	12	○	○
	4	MOVN	45	Transfer of arbitrary number of bytes	16	○	○
	5	MOVE	8	Data transfer after logical product	20	○	○
	6	MOVOR	28	Data transfer after logical sum	16	○	○
	7	XMOVB	35	Index modification binary data transfer	24	○	○
	8	XMOV	18	Index modification data transfer	20	○	○
	9	MOVBT	224	Bit transfer	24	●	●
	10	SETNB	225	Data setting (1 byte length)	20	●	●
	11	SETNW	226	Data setting (2 byte length)	20	●	●
	12	SETND	227	Data setting (4 byte length)	20	●	●
	13	XCHGB	228	Data exchange (1 byte length)	12	●	●
	14	XCHGW	229	Data exchange (2 byte length)	12	●	●
	15	XCHGD	230	Data exchange (4 byte length)	12	●	●
	16	SWAPW	231	Data swap (2 byte length)	16	●	●
	17	SWAPD	232	Data swap (4 byte length)	16	●	●
	18	DSCHB	34	Binary data search	24	○	○
	19	DSCH	17	Data search	20	○	○
Table Data	1	TBLRB	233	Reading data from table (1 byte length)	24	●	●
	2	TBLRW	234	Reading data from table (2 byte length)	24	●	●
	3	TBLRD	235	Reading data from table (4 byte length)	24	●	●
	4	TBLRN	236	Reading data from table (Arbitrary byte length)	28	●	●
	5	TBLWB	237	Writing data to table (1 byte length)	24	●	●
	6	TBLWW	238	Writing data to table (2 byte length)	24	●	●
	7	TBLWD	239	Writing data to table (4 byte length)	24	●	●
	8	TBLWN	240	Writing data to table (Arbitrary byte length)	28	●	●
	9	DSEQB	241	Searching data from table (=) (1 byte length)	28	●	●
	10	DSEQW	242	Searching data from table (=) (2 byte length)	28	●	●

(○: Usable. ●: The Extended PMC Ladder Instruction Function. Δ: Executed as NOP instruction (Note 2). ×: Unusable.)

Table 2.1.8 (b) Functional instruction list (arranged in sequence of instruction group) (2)

Instruction group		Instruction name	SUB No.	Processing	Required memory size (byte)	1st to 5th PMC	DCS PMC (Note1)
Table Data	11	DSEQD	243	Searching data from table (=) (4 byte length)	28	●	●
	12	DSNEB	244	Searching data from table (≠) (1 byte length)	28	●	●
	13	DSNEW	245	Searching data from table (≠) (2 byte length)	28	●	●
	14	DSNED	246	Searching data from table (≠) (4 byte length)	28	●	●
	15	DSGTB	247	Searching data from table (>) (1 byte length)	28	●	●
	16	DSGTW	248	Searching data from table (>) (2 byte length)	28	●	●
	17	DSGTD	249	Searching data from table (>) (4 byte length)	28	●	●
	18	DSLTB	250	Searching data from table (<) (1 byte length)	28	●	●
	19	DSLTW	251	Searching data from table (<) (2 byte length)	28	●	●
	20	DSLTD	252	Searching data from table (<) (4 byte length)	28	●	●
	21	DSGEB	253	Searching data from table (≧) (1 byte length)	28	●	●
	22	DSGEW	254	Searching data from table (≧) (2 byte length)	28	●	●
	23	DSGED	255	Searching data from table (≧) (4 byte length)	28	●	●
	24	DSLEB	256	Searching data from table (≦) (1 byte length)	28	●	●
	25	DSLEW	257	Searching data from table (≦) (2 byte length)	28	●	●
	26	DSLED	258	Searching data from table (≦) (4 byte length)	28	●	●
	27	DMAXB	259	Maximum data (1 byte length)	28	●	●
	28	DMAXW	260	Maximum data (2 byte length)	28	●	●
	29	DMAXD	261	Maximum data (4 byte length)	28	●	●
	30	DMINB	262	Minimum data (1 byte length)	28	●	●
	31	DMINW	263	Minimum data (2 byte length)	28	●	●
	32	DMIND	264	Minimum data (4 byte length)	28	●	●

(○: Usable. ●: The Extended PMC Ladder Instruction Function. Δ: Executed as NOP instruction (Note 2). ×: Unusable.)

Table 2.1.8 (c) Functional instruction list (arranged in sequence of instruction group) (3)

Instruction group		Instruction name	SUB No.	Processing	Required memory size (byte)	1st to 5th PMC	DCS PMC (Note1)
Comparison	1	EQB	200	Signed Binary Comparison (=) (1 byte length)	16	○	○
	2	EQW	201	Signed Binary Comparison (=) (2 byte length)	16	○	○
	3	EQD	202	Signed Binary Comparison (=) (4 byte length)	16	○	○
	4	NEB	203	Signed Binary Comparison (≠) (1 byte length)	16	○	○
	5	NEW	204	Signed Binary Comparison (≠) (2 byte length)	16	○	○
	6	NED	205	Signed Binary Comparison (≠) (4 byte length)	16	○	○
	7	GTB	206	Signed Binary Comparison (>) (1 byte length)	16	○	○
	8	GTW	207	Signed Binary Comparison (>) (2 byte length)	16	○	○
	9	GTD	208	Signed Binary Comparison (>) (4 byte length)	16	○	○
	10	LTB	209	Signed Binary Comparison (<) (1 byte length)	16	○	○
	11	LTW	210	Signed Binary Comparison (<) (2 byte length)	16	○	○
	12	LTD	211	Signed Binary Comparison (<) (4 byte length)	16	○	○
	13	GEB	212	Signed Binary Comparison (≧) (1 byte length)	16	○	○
	14	GEW	213	Signed Binary Comparison (≧) (2 byte length)	16	○	○
	15	GED	214	Signed Binary Comparison (≧) (4 byte length)	16	○	○
	16	LEB	215	Signed Binary Comparison (≦) (1 byte length)	16	○	○
	17	LEW	216	Signed Binary Comparison (≦) (2 byte length)	16	○	○
	18	LED	217	Signed Binary Comparison (≦) (4 byte length)	16	○	○
	19	RNGB	218	Signed Binary Comparison (range) (1 byte length)	20	○	○
	20	RNGW	219	Signed Binary Comparison (range) (2 byte length)	20	○	○
	21	RNGD	220	Signed Binary Comparison (range) (4 byte length)	20	○	○
	22	COMPB	32	Comparison between binary data	20	○	○
	23	COMP	15	Comparison	16	○	○
	24	COIN	16	Coincidence check	16	○	○

(○: Usable. ●: The Extended PMC Ladder Instruction Function. Δ: Executed as NOP instruction (Note 2). ×: Unusable.)

Table 2.1.8 (d) Functional instruction list (arranged in sequence of instruction group) (4)

Instruction group		Instruction name	SUB No.	Processing	Required memory size (byte)	1st to 5th PMC	DCS PMC (Note1)
Bit operation	1	DIFU	57	Rising-edge detection	8	○	○
	2	DIFD	58	Falling-edge detection	8	○	○
	3	EOR	59	Exclusive OR	20	○	○
	4	AND	60	Logical AND	20	○	○
	5	OR	61	Logical OR	20	○	○
	6	NOT	62	Logical NOT	16	○	○
	7	PARI	11	Parity check	8	○	○
	8	SFT	33	Shift register	8	○	○
	9	EORB	265	Exclusive OR (1 byte length)	20	●	●
	10	EORW	266	Exclusive OR (2 byte length)	20	●	●
	11	EORD	267	Exclusive OR (4 byte length)	20	●	●
	12	ANDB	268	Logical AND (1 byte length)	20	●	●
	13	ANDW	269	Logical AND (2 byte length)	20	●	●
	14	ANDD	270	Logical AND (4 byte length)	20	●	●
	15	ORB	271	Logical OR (1 byte length)	20	●	●
	16	ORW	272	Logical OR (2 byte length)	20	●	●
	17	ORD	273	Logical OR (4 byte length)	20	●	●
	18	NOTB	274	Logical NOT (1 byte length)	16	●	●
	19	NOTW	275	Logical NOT (2 byte length)	16	●	●
	20	NOTD	276	Logical NOT (4 byte length)	16	●	●
	21	SHLB	277	Bit shift left (1 byte length)	20	●	●
	22	SHLW	278	Bit shift left (2 byte length)	20	●	●
	23	SHLD	279	Bit shift left (4 byte length)	20	●	●
	24	SHLN	280	Bit shift left (Arbitrary byte length)	24	●	●
	25	SHRB	281	Bit shift right (1 byte length)	20	●	●
	26	SHRW	282	Bit shift right (2 byte length)	20	●	●
	27	SHRD	283	Bit shift right (4 byte length)	20	●	●
	28	SHRN	284	Bit shift right (Arbitrary byte length)	24	●	●
	29	ROLB	285	Bit rotation left (1 byte length)	20	●	●
	30	ROLW	286	Bit rotation left (2 byte length)	20	●	●
	31	ROLD	287	Bit rotation left (4 byte length)	20	●	●
	32	ROLN	288	Bit rotation left (Arbitrary byte length)	24	●	●
	33	RORB	289	Bit rotation right (1 byte length)	20	●	●
	34	RORW	290	Bit rotation right (2 byte length)	20	●	●
	35	RORD	291	Bit rotation right (4 byte length)	20	●	●
	36	RORN	292	Bit rotation right (Arbitrary byte length)	24	●	●
	37	BSETB	293	Bit set (1 byte length)	16	●	●
	38	BSETW	294	Bit set (2 byte length)	16	●	●
	39	BSETD	295	Bit set (4 byte length)	16	●	●
	40	BSETN	296	Bit set (Arbitrary byte length)	20	●	●
	41	BRSTB	297	Bit reset (1 byte length)	16	●	●
	42	BRSTW	298	Bit reset (2 byte length)	16	●	●
	43	BRSTD	299	Bit reset (4 byte length)	16	●	●
	44	BRSTN	300	Bit reset (Arbitrary byte length)	20	●	●
	45	BTSTB	301	Bit test (1 byte length)	16	●	●
	46	BTSTW	302	Bit test (2 byte length)	16	●	●
	47	BTSTD	303	Bit test (4 byte length)	16	●	●

(○: Usable. ●: The Extended PMC Ladder Instruction Function. Δ: Executed as NOP instruction (Note 2). ×: Unusable.)

Table 2.1.8 (e) Functional instruction list (arranged in sequence of instruction group) (5)

Instruction group		Instruction name	SUB No.	Processing	Required memory size (byte)	1st to 5th PMC	DCS PMC (Note1)
Bit operation	48	BTSTN	304	Bit test (Arbitrary byte length)	20	●	●
	49	BPOSB	305	Bit search (1 byte length)	12	●	●
	50	BPOSW	306	Bit search (2 byte length)	12	●	●
	51	BPOSD	307	Bit search (4 byte length)	12	●	●
	52	BPOSN	308	Bit search (Arbitrary byte length)	16	●	●
	53	BCNTB	309	Bit count (1 byte length)	12	●	●
	54	BCNTW	310	Bit count (2 byte length)	12	●	●
	55	BCNTD	311	Bit count (4 byte length)	12	●	●
	56	BCNTN	312	Bit count (Arbitrary byte length)	16	●	●
Code conversion	1	COD	7	Code conversion	16+n (Note5)	○	○
	2	CODB	27	Binary code conversion	20+n (Note5)	○	○
	3	DCNV	14	Data conversion	12	○	○
	4	DCNVB	31	Extended data conversion	16	○	○
	5	DEC	4	Decoding	12	○	○
	6	DECB	25	Binary decoding	20	○	○
	7	TBCDB	313	Binary to BCD conversion (1 byte length)	16	●	●
	8	TBCDW	314	Binary to BCD conversion (2 byte length)	16	●	●
	9	TBCDD	315	Binary to BCD conversion (4 byte length)	16	●	●
	10	FBCDB	316	BCD to Binary conversion (1 byte length)	16	●	●
	11	FBCDW	317	BCD to Binary conversion (2 byte length)	16	●	●
	12	FBCDD	318	BCD to Binary conversion (4 byte length)	16	●	●
Operation	1	ADDB	36	Binary addition	20	○	○
	2	SUBB	37	Binary subtraction	20	○	○
	3	MULB	38	Binary multiplication	20	○	○
	4	DIVB	39	Binary division	20	○	○
	5	ADD	19	BCD addition	20	○	○
	6	SUB	20	BCD subtraction	20	○	○
	7	MUL	21	BCD multiplication	20	○	○
	8	DIV	22	BCD division	20	○	○
	9	NUMEB	40	Binary constant definition	16	○	○
	10	NUME	23	BCD-constant definition	12	○	○
	11	ADDSB	319	Addition (1 byte length)	20	●	●
	12	ADDSW	320	Addition (2 byte length)	20	●	●
	13	ADDSD	321	Addition (4 byte length)	20	●	●
	14	SUBSB	322	Subtraction (1 byte length)	20	●	●
	15	SUBSW	323	Subtraction (2 byte length)	20	●	●
	16	SUBSD	324	Subtraction (3 byte length)	20	●	●
	17	MULSB	325	Multiplication (1 byte length)	20	●	●
	18	MULSW	326	Multiplication (2 byte length)	20	●	●
	19	MULSD	327	Multiplication (4 byte length)	20	●	●

(○: Usable. ●: The Extended PMC Ladder Instruction Function. Δ: Executed as NOP instruction (Note 2). ×: Unusable.)

Table 2.1.8 (f) Functional instruction list (arranged in sequence of instruction group) (6)

Instruction group		Instruction name	SUB No.	Processing	Required memory size (byte)	1st to 5th PMC	DCS PMC (Note1)
Operation	20	DIVSB	328	Division (1 byte length)	20	●	●
	21	DIVSW	329	Division (2 byte length)	20	●	●
	22	DIVSD	330	Division (4 byte length)	20	●	●
	23	MODSB	331	Remainder (1 byte length)	20	●	●
	24	MODSW	332	Remainder (2 byte length)	20	●	●
	25	MODSD	333	Remainder (4 byte length)	20	●	●
	26	INCSB	334	Increment (1 byte length)	8	●	●
	27	INCSW	335	Increment (2 byte length)	8	●	●
	28	INCSD	336	Increment (4 byte length)	8	●	●
	29	DECSB	337	Decrement (1 byte length)	8	●	●
	30	DECSW	338	Decrement (2 byte length)	8	●	●
	31	DECSD	339	Decrement (4 byte length)	8	●	●
	32	ABSSB	340	Absolute value (1 byte length)	16	●	●
	33	ABSSW	341	Absolute value (2 byte length)	16	●	●
	34	ABSSD	342	Absolute value (4 byte length)	16	●	●
	35	NEGSB	343	Sign inversion (1 byte length)	16	●	●
	36	NEGSW	344	Sign inversion (2 byte length)	16	●	●
	37	NEGSD	345	Sign inversion (4 byte length)	16	●	●
CNC Function	1	DISPB	41	Message display	8	○	Δ
	2	EXIN	42	External data input	8	○	Δ
	3	WINDR	51	CNC window data read	8	○	Δ
	4	WINDW	52	CNC window data write	8	○	Δ
	5	AXCTL	53	PMC axis control	12	○	Δ
	6	PSGN2	63	Position signal	8	○	Δ
	7	PSGNL	50	Position signal	12	○	Δ
Program control	1	COM	9	Common line control	8	○	○
	2	COME	29	End of common line control	4	○	○
	3	JMP	10	Jump	12	○	○
	4	JMPE	30	End of jump	4	○	○
	5	JMPB	68	Label jump 1	16	○	○
	6	JMPC	73	Label jump 2	16	○	○
	7	LBL	69	Label	12	○	○
	8	CALL	65	Conditional subprogram call	12	○	○
	9	CALLU	66	Unconditional subprogram call	12	○	○
	10	SP	71	Subprogram	8	○	○
	11	SPE	72	End of subprogram	4	○	○
	12	END1	1	End of first-level program	4	○	○
	13	END2	2	End of second-level program	4	○	○

(○: Usable. ●: The Extended PMC Ladder Instruction Function. Δ: Executed as NOP instruction (Note 2). ×: Unusable.)

Table 2.1.8 (g) Functional instruction list (arranged in sequence of instruction group) (7)

Instruction group		Instruction name	SUB No.	Processing	Required memory size (byte)	1st to 5th PMC	DCS PMC (Note1)
Program control	14	END3	48	End of third-level program	4	○ (Note 3)	Δ (Note4)
	15	END	64	End of ladder program	4	○	○
	16	NOP	70	No operation	8	○	○
	17	CS	74	Case call	8	○	○
	18	CM	75	Sub program call in case call	12	○	○
	19	CE	76	End of case call	4	○	○
Rotation control	1	ROT	6	Rotation control	20	○	○
	2	ROTB	26	Binary rotation control	24	○	○
Invalid instruction	1	SPCNT	46	Spindle control	16	Δ	Δ
	2	DISP	49	Message display	16+n (Note5)	Δ	Δ
	3	MMCWR	98	MMC window data read	12	Δ	Δ
	4	MMCWW	99	MMC window data write	12	Δ	Δ
	5	FNC90	90	Arbitrary-function instruction 1	8	Δ	Δ
	6	FNC91	91	Arbitrary-function instruction 2	8	Δ	Δ
	7	FNC92	92	Arbitrary-function instruction 3	8	Δ	Δ
	8	FNC93	93	Arbitrary-function instruction 4	8	Δ	Δ
	9	FNC94	94	Arbitrary-function instruction 5	8	Δ	Δ
	10	FNC95	95	Arbitrary-function instruction 6	8	Δ	Δ
	11	FNC96	96	Arbitrary-function instruction 7	8	Δ	Δ
	12	FNC97	97	Arbitrary-function instruction 8	8	Δ	Δ

(○: Usable. ●: The Extended PMC Ladder Instruction Function. Δ: Executed as NOP instruction (Note 2). ×: Unusable.)

NOTE

1. This term stands for the Dual Check Safety PMC (option).
2. These instructions are intended to maintain source-level compatibility with programs for conventional models. They are treated as a NOP instruction (instruction that performs no operation).
3. The 3rd level sequence part is available for the compatibility with programs for conventional models. However, the execution cycle period for processing the 3rd level sequence part is not guaranteed. See Section 1.4.3 "Processing priority".
4. This instruction is intended to maintain source-level compatibility with programs for other models. A program can be created on level 3, but it is not executed.
5. Memory size increases by the number of data tables to be used. In the COD instruction, CODB instruction (1byte length), CODB instruction (2byte length), or DISP instruction, 2 bytes are added for each data. And, when the number of data is odd, 2 bytes are added moreover. In the CODB instruction, 4 bytes are added for each data.

2.1.9 Functional Instructions (Arranged in Sequence of SUB No.)

Table 2.1.9 (a) Functional instruction list (arranged in sequence of SUB No.) (1)

Instruction name	SUB No.	Processing	Required memory size (byte)	1st to 5th PMC	DCSPMC (Note1)
END1	1	End of first-level program	4	○	○
END2	2	End of second-level program	4	○	○
TMR	3	Timer processing	8	○	○
DEC	4	Decoding	12	○	○
CTR	5	Counter processing	8	○	○
ROT	6	Rotation control	20	○	○
COD	7	Code conversion	16+n (Note5)	○	○
MOVE	8	Data transfer after logical product	20	○	○
COM	9	Common line control	8	○	○
JMP	10	Jump	12	○	○
PARI	11	Parity check	8	○	○
DCNV	14	Data conversion	12	○	○
COMP	15	Comparison	16	○	○
COIN	16	Coincidence check	16	○	○
DSCH	17	Data search	20	○	○
XMOV	18	Index modification data transfer	20	○	○
ADD	19	Addition	20	○	○
SUB	20	Subtraction	20	○	○
MUL	21	Multiplication	20	○	○
DIV	22	Division	20	○	○
NUME	23	Constant definition	12	○	○
TMRB	24	Fixed-timer processing	12	○	○
DECB	25	Binary decoding	20	○	○
ROTB	26	Binary rotation control	24	○	○
CODB	27	Binary code conversion	20+n (Note5)	○	○
MOVOR	28	Data transfer after logical sum	16	○	○
COME	29	End of common line control	4	○	○
JMPE	30	End of jump	4	○	○
DCNVB	31	Extended data conversion	16	○	○
COMPB	32	Binary comparison	20	○	○
SFT	33	Shift register	8	○	○
DSCHB	34	Binary data search	24	○	○
XMOVB	35	Index modification binary data transfer	24	○	○
ADDB	36	Binary addition	20	○	○
SUBB	37	Binary subtraction	20	○	○
MULB	38	Binary multiplication	20	○	○
DIVB	39	Binary division	20	○	○
NUMEB	40	Binary constant definition	16	○	○
DISPB	41	Message display	8	○	Δ
EXIN	42	External data input	8	○	Δ
MOVB	43	1-byte transfer	12	○	○
MOVW	44	2-byte transfer	12	○	○
MOVN	45	Transfer of arbitrary number of bytes	16	○	○

(○: Usable. ●: The Extended PMC Ladder Instruction Function. Δ: Executed as NOP instruction (Note 2). ×: Unusable.)

Table 2.1.9 (b) Functional instruction list (arranged in sequence of SUB No.) (2)

Instruction name	SUB No.	Processing	Required memory size (byte)	1st to 5th PMC	DCS PMC (Note1)
SPCNT	46	Spindle control	16	Δ	Δ
MOVD	47	4-byte transfer	12	○	○
END3	48	End of third-level program	4	○ (Note3)	Δ (Note4)
DISP	49	Message display	16+n (Note5)	Δ	Δ
PSGNL	50	Position signal	12	○	Δ
WINDR	51	CNC window data read	8	○	Δ
WINDW	52	CNC window data write	8	○	Δ
AXCTL	53	PMC axis control	12	○	Δ
TMRC	54	Timer processing	16	○	○
CTRC	55	Counter processing	12	○	○
CTRB	56	Counter processing	12	○	○
DIFU	57	Rising-edge detection	8	○	○
DIFD	58	Falling-edge detection	8	○	○
EOR	59	Exclusive OR	20	○	○
AND	60	Logical AND	20	○	○
OR	61	Logical OR	20	○	○
NOT	62	Logical NOT	16	○	○
PSGN2	63	Position signal	8	○	Δ
END	64	End of ladder program	4	○	○
CALL	65	Conditional subprogram call	12	○	○
CALLU	66	Unconditional subprogram call	12	○	○
JMPB	68	Label jump 1	16	○	○
LBL	69	Label	12	○	○
NOP	70	No operation	8	○	○
SP	71	Subprogram	8	○	○
SPE	72	End of subprogram	4	○	○
JMPC	73	Label jump 2	16	○	○
CS	74	Case call	8	○	○
CM	75	Sub program call in case call	12	○	○
CE	76	End of case call	4	○	○
TMRBF	77	Fixed off-delay timer	12	○	○
FNC90	90	Arbitrary-function instruction 1	8	Δ	Δ
FNC91	91	Arbitrary-function instruction 2	8	Δ	Δ
FNC92	92	Arbitrary-function instruction 3	8	Δ	Δ
FNC93	93	Arbitrary-function instruction 4	8	Δ	Δ
FNC94	94	Arbitrary-function instruction 5	8	Δ	Δ
FNC95	95	Arbitrary-function instruction 6	8	Δ	Δ
FNC96	96	Arbitrary-function instruction 7	8	Δ	Δ
FNC97	97	Arbitrary-function instruction 8	8	Δ	Δ
MMCWR	98	MMC window data read	12	Δ	Δ
MMCWW	99	MMC window data write	12	Δ	Δ

(○: Usable. ●: The Extended PMC Ladder Instruction Function. Δ: Executed as NOP instruction (Note 2). ×: Unusable.)

Table 2.1.9 (c) Functional instruction list (arranged in sequence of SUB No.) (3)

Instruction name	SUB No.	Processing	Required memory size (byte)	1st to 5th PMC	DCSPMC (Note1)
EQB	200	Signed Binary Comparison (=)(1 byte length)	16	○	○
EQW	201	Signed Binary Comparison (=)(2 byte length)	16	○	○
EQD	202	Signed Binary Comparison (=)(4 byte length)	16	○	○
NEB	203	Signed Binary Comparison (≠)(1 byte length)	16	○	○
NEW	204	Signed Binary Comparison (≠)(2 byte length)	16	○	○
NED	205	Signed Binary Comparison (≠)(4 byte length)	16	○	○
GTB	206	Signed Binary Comparison (>)(1 byte length)	16	○	○
GTW	207	Signed Binary Comparison (>)(2 byte length)	16	○	○
GTD	208	Signed Binary Comparison (>)(4 byte length)	16	○	○
LTB	209	Signed Binary Comparison (<)(1 byte length)	16	○	○
LTW	210	Signed Binary Comparison (<)(2 byte length)	16	○	○
LTD	211	Signed Binary Comparison (<)(4 byte length)	16	○	○
GEB	212	Signed Binary Comparison (≧)(1 byte length)	16	○	○
GEW	213	Signed Binary Comparison (≧)(2 byte length)	16	○	○
GED	214	Signed Binary Comparison (≧)(4 byte length)	16	○	○
LEB	215	Signed Binary Comparison (≦)(1 byte length)	16	○	○
LEW	216	Signed Binary Comparison (≦)(2 byte length)	16	○	○
LED	217	Signed Binary Comparison (≦)(4 byte length)	16	○	○
RNGB	218	Signed Binary Comparison (range)(1 byte length)	20	○	○
RNGW	219	Signed Binary Comparison (range)(2 byte length)	20	○	○
RNGB	220	Signed Binary Comparison (range)(4 byte length)	20	○	○
TMRST	221	Stop watch timer (1 ms accuracy)	20	●	●
TMRSS	222	Stop watch timer (1 sec accuracy)	20	●	●
CTRD	223	Counter processing (4 byte length)	12	●	●
MOVBT	224	Bit transfer	24	●	●
SETNB	225	Data setting (1 byte length)	20	●	●
SETNW	226	Data setting (2 byte length)	20	●	●
SETND	227	Data setting (4 byte length)	20	●	●
XCHGB	228	Data exchange (1 byte length)	12	●	●
XCHGW	229	Data exchange (2 byte length)	12	●	●
XCHGD	230	Data exchange (4 byte length)	12	●	●
SWAPW	231	Data swap (2 byte length)	16	●	●
SWAPD	232	Data swap (4 byte length)	16	●	●
TBLRB	233	Reading data from table (1 byte length)	24	●	●
TBLRW	234	Reading data from table (2 byte length)	24	●	●
TBLRD	235	Reading data from table (4 byte length)	24	●	●
TBLRN	236	Reading data from table (Arbitrary byte length)	28	●	●
TBLWB	237	Writing data to table (1 byte length)	24	●	●
TBLWW	238	Writing data to table (2 byte length)	24	●	●
TBLWD	239	Writing data to table (4 byte length)	24	●	●

(○: Usable. ●: The Extended PMC Ladder Instruction Function. Δ: Executed as NOP instruction (Note 2). ×: Unusable.)

Table 2.1.9 (d) Functional instruction list (arranged in sequence of SUB No.) (4)

Instruction name	SUB No.	Processing	Required memory size (byte)	1st to 5th PMC	DCSPMC (Note1)
TBLWN	240	Writing data to table (Arbitrary byte length)	28	●	●
DSEQB	241	Searching data from table (=)(1 byte length)	28	●	●
DSEQW	242	Searching data from table (=)(2 byte length)	28	●	●
DSEQD	243	Searching data from table (=)(4 byte length)	28	●	●
DSNEB	244	Searching data from table (≠)(1 byte length)	28	●	●
DSNEW	245	Searching data from table (≠)(2 byte length)	28	●	●
DSNED	246	Searching data from table (≠)(4 byte length)	28	●	●
DSGTB	247	Searching data from table (>)(1 byte length)	28	●	●
DSGTW	248	Searching data from table (>)(2 byte length)	28	●	●
DSGTD	249	Searching data from table (>)(4 byte length)	28	●	●
DSLTB	250	Searching data from table (<)(1 byte length)	28	●	●
DSLTW	251	Searching data from table (<)(2 byte length)	28	●	●
DSLTD	252	Searching data from table (<)(4 byte length)	28	●	●
DSGEB	253	Searching data from table (≧)(1 byte length)	28	●	●
DSGEW	254	Searching data from table (≧)(2 byte length)	28	●	●
DSGED	255	Searching data from table (≧)(4 byte length)	28	●	●
DSLEB	256	Searching data from table (≦)(1 byte length)	28	●	●
DSLEW	257	Searching data from table (≦)(2 byte length)	28	●	●
DSLED	258	Searching data from table (≦)(4 byte length)	28	●	●
DMAXB	259	Maximum data (1 byte length)	28	●	●
DMAXW	260	Maximum data (2 byte length)	28	●	●
DMAXD	261	Maximum data (4 byte length)	28	●	●
DMINB	262	Minimum data (1 byte length)	28	●	●
DMINW	263	Minimum data (2 byte length)	28	●	●
DMIND	264	Minimum data (4 byte length)	28	●	●
EORB	265	Exclusive OR (1 byte length)	20	●	●
EORW	266	Exclusive OR (2 byte length)	20	●	●
EORD	267	Exclusive OR (4 byte length)	20	●	●
ANDB	268	Logical AND (1 byte length)	20	●	●
ANDW	269	Logical AND (2 byte length)	20	●	●
ANDD	270	Logical AND (4 byte length)	20	●	●
ORB	271	Logical OR (1 byte length)	20	●	●
ORW	272	Logical OR (2 byte length)	20	●	●
ORD	273	Logical OR (4 byte length)	20	●	●
NOTB	274	Logical NOT (1 byte length)	16	●	●
NOTW	275	Logical NOT (2 byte length)	16	●	●
NOTD	276	Logical NOT (4 byte length)	16	●	●
SHLB	277	Bit shift left (1 byte length)	20	●	●
SHLW	278	Bit shift left (2 byte length)	20	●	●
SHLD	279	Bit shift left (4 byte length)	20	●	●

(○: Usable. ●: The Extended PMC Ladder Instruction Function. Δ: Executed as NOP instruction (Note 2). ×: Unusable.)

Table 2.1.9 (e) Functional instruction list (arranged in sequence of SUB No.) (5)

Instruction name	SUB No.	Processing	Required memory size (byte)	1st to 5th PMC	DCSPMC (Note1)
SHLN	280	Bit shift left (Arbitrary byte length)	24	●	●
SHRB	281	Bit shift right (1 byte length)	20	●	●
SHRW	282	Bit shift right (2 byte length)	20	●	●
SHRD	283	Bit shift right (4 byte length)	20	●	●
SHRN	284	Bit shift right (Arbitrary byte length)	24	●	●
ROLB	285	Bit rotation left (1 byte length)	20	●	●
ROLW	286	Bit rotation left (2 byte length)	20	●	●
ROLD	287	Bit rotation left (4 byte length)	20	●	●
ROLN	288	Bit rotation left (Arbitrary byte length)	24	●	●
RORB	289	Bit rotation right (1 byte length)	20	●	●
RORW	290	Bit rotation right (2 byte length)	20	●	●
RORD	291	Bit rotation right (4 byte length)	20	●	●
RORN	292	Bit rotation right (Arbitrary byte length)	24	●	●
BSETB	293	Bit set (1 byte length)	16	●	●
BSETW	294	Bit set (2 byte length)	16	●	●
BSETD	295	Bit set (4 byte length)	16	●	●
BSETN	296	Bit set (Arbitrary byte length)	20	●	●
BRSTB	297	Bit reset (1 byte length)	16	●	●
BRSTW	298	Bit reset (2 byte length)	16	●	●
BRSTD	299	Bit reset (4 byte length)	16	●	●
BRSTN	300	Bit reset (Arbitrary byte length)	20	●	●
BTSTB	301	Bit test (1 byte length)	16	●	●
BTSTW	302	Bit test (2 byte length)	16	●	●
BTSTD	303	Bit test (4 byte length)	16	●	●
BTSTN	304	Bit test (Arbitrary byte length)	20	●	●
BPOSB	305	Bit search (1 byte length)	12	●	●
BPOSW	306	Bit search (2 byte length)	12	●	●
BPOSD	307	Bit search (4 byte length)	12	●	●
BPOSN	308	Bit search (Arbitrary byte length)	16	●	●
BCNTB	309	Bit count (1 byte length)	12	●	●
BCNTW	310	Bit count (2 byte length)	12	●	●
BCNTD	311	Bit count (4 byte length)	12	●	●
BCNTN	312	Bit count (Arbitrary byte length)	16	●	●
TBCDB	313	Binary to BCD conversion (1 byte length)	16	●	●
TBCDW	314	Binary to BCD conversion (2 byte length)	16	●	●
TBCDD	315	Binary to BCD conversion (4 byte length)	16	●	●
FBCDB	316	BCD to Binary conversion (1 byte length)	16	●	●
FBCDW	317	BCD to Binary conversion (2 byte length)	16	●	●
FBCDD	318	BCD to Binary conversion (4 byte length)	16	●	●
ADDSB	319	Addition (1 byte length)	20	●	●

(○: Usable. ●: The Extended PMC Ladder Instruction Function. Δ: Executed as NOP instruction (Note 2). ×: Unusable.)

Table 2.1.9 (f) Functional instruction list (arranged in sequence of SUB No.) (6)

Instruction name	SUB No.	Processing	Required memory size (byte)	1st to 5th PMC	DCSPMC (Note1)
ADDSW	320	Addition (2 byte length)	20	●	●
ADDSD	321	Addition (4 byte length)	20	●	●
SUBSB	322	Subtraction (1 byte length)	20	●	●
SUBSW	323	Subtraction (2 byte length)	20	●	●
SUBSD	324	Subtraction (3 byte length)	20	●	●
MULSB	325	Multiplication (1 byte length)	20	●	●
MULSW	326	Multiplication (2 byte length)	20	●	●
MULSD	327	Multiplication (4 byte length)	20	●	●
DIVSB	328	Division (1 byte length)	20	●	●
DIVSW	329	Division (2 byte length)	20	●	●
DIVSD	330	Division (4 byte length)	20	●	●
MODSB	331	Remainder (1 byte length)	20	●	●
MODSW	332	Remainder (2 byte length)	20	●	●
MODSD	333	Remainder (4 byte length)	20	●	●
INCSB	334	Increment (1 byte length)	8	●	●
INCSW	335	Increment (2 byte length)	8	●	●
INCSD	336	Increment (4 byte length)	8	●	●
DECSB	337	Decrement (1 byte length)	8	●	●
DECSW	338	Decrement (2 byte length)	8	●	●
DECSD	339	Decrement (4 byte length)	8	●	●
ABSSB	340	Absolute value (1 byte length)	16	●	●
ABSSW	341	Absolute value (2 byte length)	16	●	●
ABSSD	342	Absolute value (4 byte length)	16	●	●
NEGSB	343	Sign inversion (1 byte length)	16	●	●
NEGSW	344	Sign inversion (2 byte length)	16	●	●
NEGSD	345	Sign inversion (4 byte length)	16	●	●

(○: Usable. ●: The Extended PMC Ladder Instruction Function. Δ: Executed as NOP instruction (Note 2). ×: Unusable.)

NOTE

1 This term stands for the Dual Check Safety PMC (option).
2 These instructions are intended to maintain source-level compatibility with programs for conventional models. They are treated as a NOP instruction (instruction that performs no operation).
3 The 3rd level sequence part is available for the compatibility with programs for conventional models. However, the execution cycle period for processing the 3rd level sequence part is not guaranteed. See Section 1.4.3 "Processing priority".
4 This instruction is intended to maintain source-level compatibility with programs for other models. A program can be created on level 3, but it is not executed.
5 Memory size increases by the number of data tables to be used. In the COD instruction, CODB instruction (1byte length), CODB instruction (2byte length), or DISP instruction, 2 bytes are added for each data. And, when the number of data is odd, 2 bytes are added moreover. In the CODB instruction, 4 bytes are added for each data.

2.2 PMC SIGNAL ADDRESSES

This section describes the use of each PMC address. See Subsection 2.1.6 for explanations about all address types and ranges.

2.2.1 Addresses for Signals Between the PMC and CNC (F, G)

These addresses are interface areas between PMC and CNC. Refer to the applicable CNC connection manual for details.

(1) Signals from the CNC to the PMC

Data kind	1st path PMC	2nd to 5th path PMC (Option)	DCSPMC (Option)
Input signals from CNC to PMC	F0 ~ F767 F1000 ~ F1767 F2000 ~ F2767 F3000 ~ F3767 F4000 ~ F4767 F5000 ~ F5767 F6000 ~ F6767 F7000 ~ F7767 F8000 ~ F8767 F9000 ~ F9767	F0 ~ F767 F1000 ~ F1767 F2000 ~ F2767 F3000 ~ F3767 F4000 ~ F4767 F5000 ~ F5767 F6000 ~ F6767 F7000 ~ F7767 F8000 ~ F8767 F9000 ~ F9767	F0 ~ F767

(2) Signals from the PMC to the CNC

Data kind	1st path PMC	2nd to 5th path PMC (Option)	DCSPMC (Option)
Output signals to CNC from PMC	G0 ~ G767 G1000 ~ G1767 G2000 ~ G2767 G3000 ~ G3767 G4000 ~ G4767 G5000 ~ G5767 G6000 ~ G6767 G7000 ~ G7767 G8000 ~ G8767 G9000 ~ G9767	G0 ~ G767 G1000 ~ G1767 G2000 ~ G2767 G3000 ~ G3767 G4000 ~ G4767 G5000 ~ G5767 G6000 ~ G6767 G7000 ~ G7767 G8000 ~ G8767 G9000 ~ G9767	G0 ~ G767

NOTE

The PMC paths corresponding to each CNC path to be controlled can be set. As for details, refer to “CNC Parameters Related to the PMCs” in subsection “2.4.3”.

2.2.2 Addresses of Signals Between the PMC and Machine (X, Y)

These addresses are interface areas between PMC and machines.

(1) Assignment of the FANUC I/O Link / I/O Link *i*

(a) Signals input from the machine to the PMC

1st to 5th path PMC

The addresses for four channels, X0 to X127, X200 to X327, X400 to X527, and X600 to X727, can be used for the signals input to PMCs. Each address is not fixed at a specific channel. They can be assigned to any channel. See "I/O Link input/output addresses" in Subsection 2.4.3 for details. As for I/O Link *i*, see subsection “3.3.6”.

Dual-check safety (DCS)

The addresses for one channel, X0 to X127, are used for the signals input to the DCS. These addresses can be assigned to channel 3 for I/O Link. As for I/O Link *i*, see subsection “3.3.6”.

(b) Signals output from the PMC to the machine

1st to 5th path PMC

The addresses for four channels, Y0 to Y127, Y200 to Y327, Y400 to Y527, and Y600 to Y727, can be used for signals output from PMCs. Each address is not fixed at a specific channel. They can be assigned to any channel. See "I/O Link input/output addresses" in Subsection 2.4.3 for details. As for I/O Link *i*, see subsection “3.3.6”.

Dual-check safety (DCS)

The addresses for one channel, Y0 to Y127, are used for the signals output from the DCS. These addresses can be assigned to channel 3 for I/O Link. As for I/O Link *i*, see subsection “3.3.6”.

NOTE

X/Y addresses can be also used for network devices. As for details, refer to “The input/output address used by network device” in subsection “2.4.3”.

(2) Address-fixed CNC signals input from the machine

The CNC processes signals input from the machine (listed in Table 2.2.2) by referencing fixed addresses. Be sure to assign specified addresses.

Table 2.2.2 Address-fixed input signals

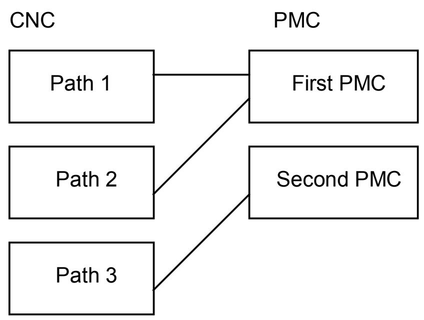
	Signal name	Symbol	Address		
			NC Path 1	NC Path 2	NC Path 3
Common to T/M	Skip signal	SKIP	X4.7	X13.7	X11.7
	Emergency stop signal (machine group 1)	*ESP	X8.4 (Note 1)		
	Emergency stop signal (machine group 2)	*ESP	X8.0 (Note 1)		
	Emergency stop signal (machine group 3)	*ESP	X8.1 (Note 1)		
	Deceleration signal for 1st-axis reference position return	*DEC1	X9.0	X7.0	X10.0
	Deceleration signal for 2nd-axis reference position return	*DEC2	X9.1	X7.1	X10.1
	Deceleration signal for 3rd-axis reference position return	*DEC3	X9.2	X7.2	X10.2
	Deceleration signal for 4th-axis reference position return	*DEC4	X9.3	X7.3	X10.3

	Signal name	Symbol	Address		
			NC Path 1	NC Path 2	NC Path 3
	Deceleration signal for 5th-axis reference position return	*DEC5	X9.4	X7.4	X10.4
	Deceleration signal for 6th-axis reference position return	*DEC6	X9.5	X7.5	X10.5
	Deceleration signal for 7th-axis reference position return	*DEC7	X9.6	X7.6	X10.6
	Deceleration signal for 8th-axis reference position return	*DEC8	X9.7	X7.7	X10.7

NOTE

1 If the Series 30*i*/31*i*/32*i*/35*i*-B, the Power Motion *i*-A or the Series 0*i*-F system is used to control more than one NC path, some NC paths can be grouped to share data within the group and to stop all the paths in the group if an alarm condition occurs in one of the paths. The group is referred to as a machine group.
The system supports up to 3 machine groups. Each group has a separate emergency stop signal address.

2 The emergency stop signal address is common signal address in a machine group. But other signals has individual address with each NC path. For example, in the following configuration, X11.7 does not mean “the skip signal” in first PMCs. In second PMCs, it means “the skip signal”.



3 Path-specific, X address-based input signals are assigned to up to 3 NC paths. For additional NC paths, therefore, bit 2 of CNC parameter No. 3008 must be used to assign such input signals.

4 The X address for an axis-specific deceleration signal (*DECn) for reference position return is assigned to 8 axes of each of up to 3 NC paths. For additional paths and axes, therefore, bit 2 of CNC parameter No. 3008, CNC parameter Nos. 3013 and 3014 must be used to assign the X address.

2.2.3 Internal Relay Addresses (R)

These addresses are a work area used in sequence programs.
Signals that interface with other control units can be assigned to these bytes over the FA network. It can also be used as the interface with the C language executor and FOCAS2 functions.
Turning on the power clears these areas to 0.

NOTE
This address is not synchronized in the 2nd level ladder. A value of a signal in this address may change during the execution of 2nd level ladder same as 1st and 3rd level ladder when it is written by other program (Ex. Network function, C language executor).

Data kind	1st to 5th path PMC				DCSPMC
	PMC Memory-A	PMC Memory-B	PMC Memory-C	PMC Memory-D	
User area	R0 to R1499	R0 to R7999	R0 to R15999	R0 to R59999	R0 to R1499

2.2.4 System Relay Addresses (R9000, Z0)

These addresses are a system information area. The area cannot be written from sequence programs.

Table 2.2.4 Address of System Relay

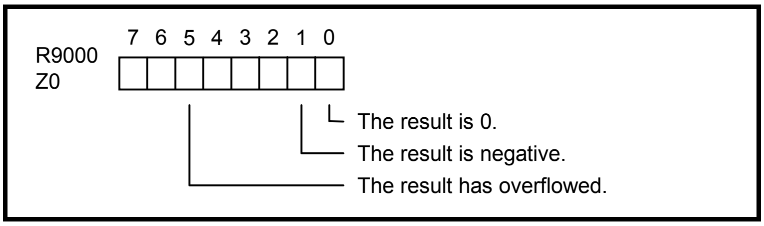
Data kind	1st to 5th path PMC				DCSPMC
	PMC Memory-A	PMC Memory-B	PMC Memory-C	PMC Memory-D	
System relays	R9000 to R9499	R9000 to R9499	Z0 to Z499	Z0 to Z499	R9000 to R9499

NOTE
1 The address conversion of the System Relays is necessary when a Sequence Program is changed between PMC Memory-A/B and PMC Memory-C/D.

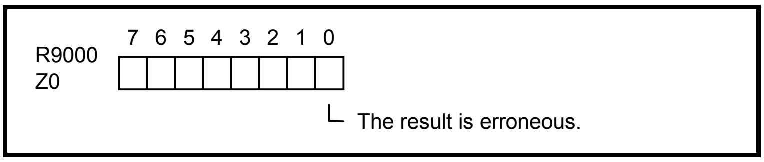
Operation results of functional instructions

This area holds information necessary for individual ladder levels, such as the operation results of functional instructions. This information is saved/restored when the task is switched.

(1) R9000, Z0 (operation output register for the ADDB, SUBB, MULB, DIVB, and COMPB functional instructions)



(2) R9000, Z0 (error output for the EXIN, WINDR, and WINDW functional instructions)

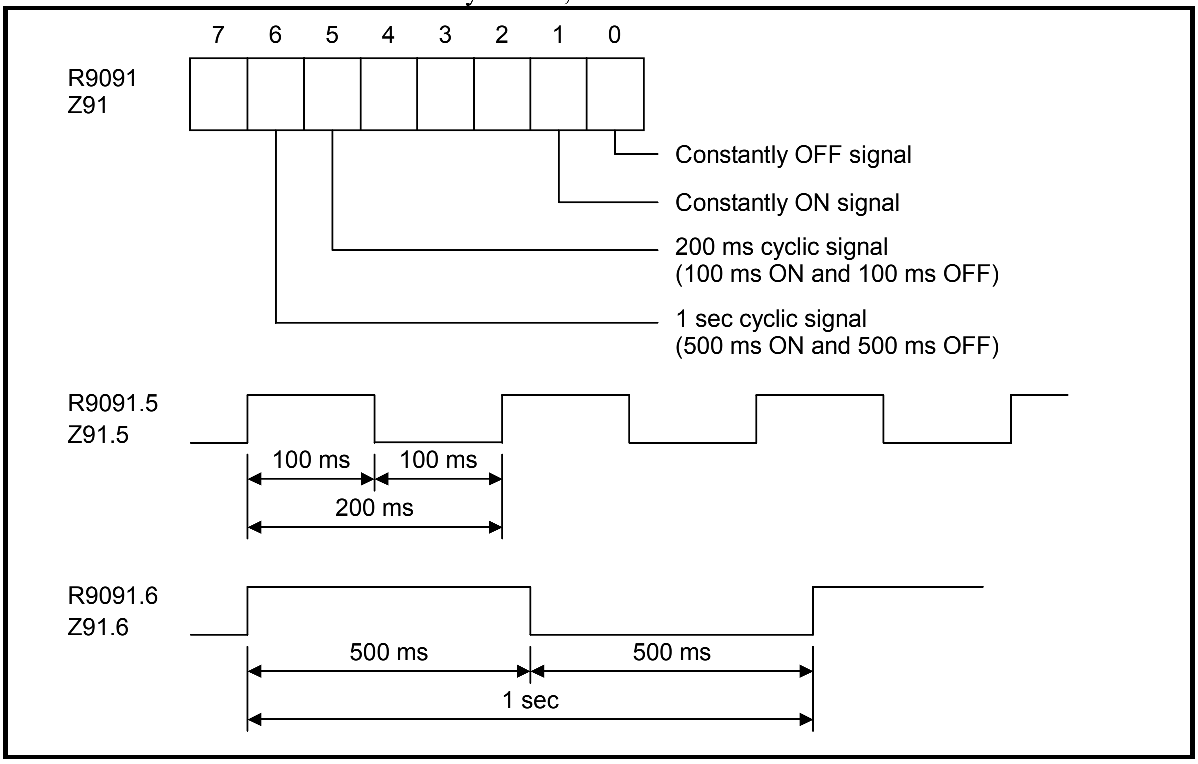


(3) R9002 to R9005, Z2 to Z5 (operation output registers for the DIVB functional instruction)
The remainder of a division performed with the DIVB functional instruction is output to these addresses.

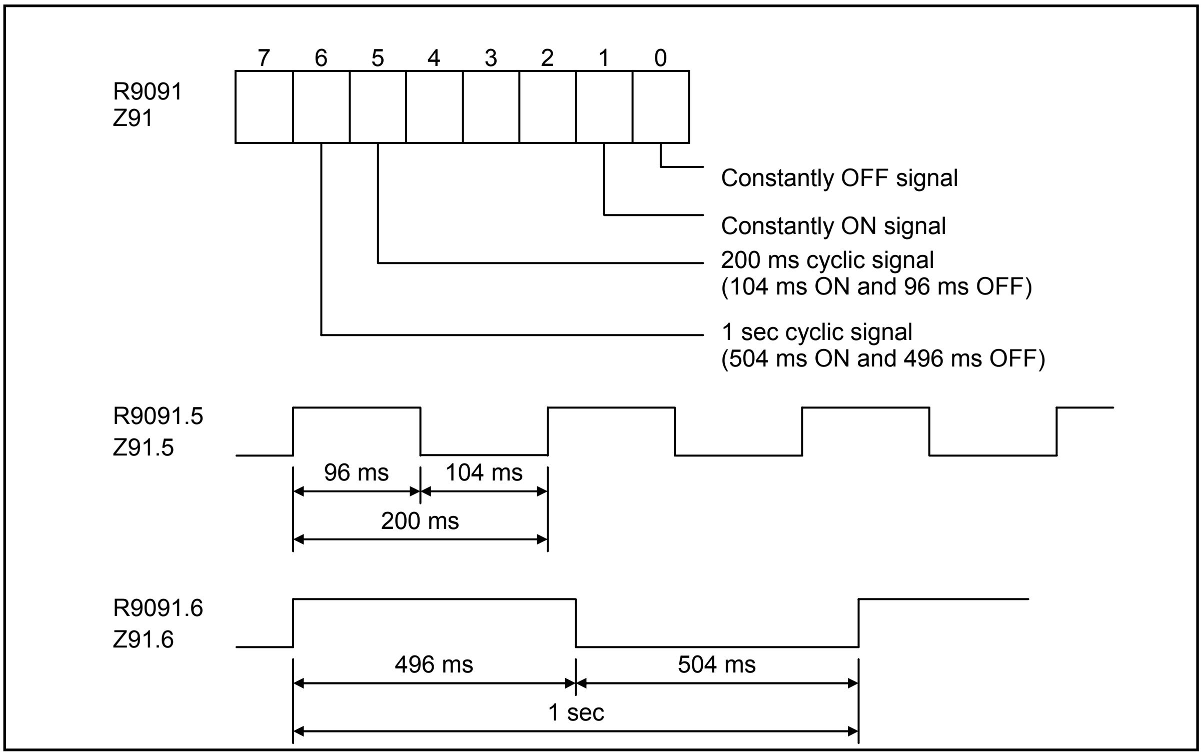
System timers

Four signals can be used as system timers.
Their specifications are as follows.

(1) The case that the 1st level execution cycle is 1, 2 or 4ms.



(2) The case that the 1st level execution cycle is 8ms.

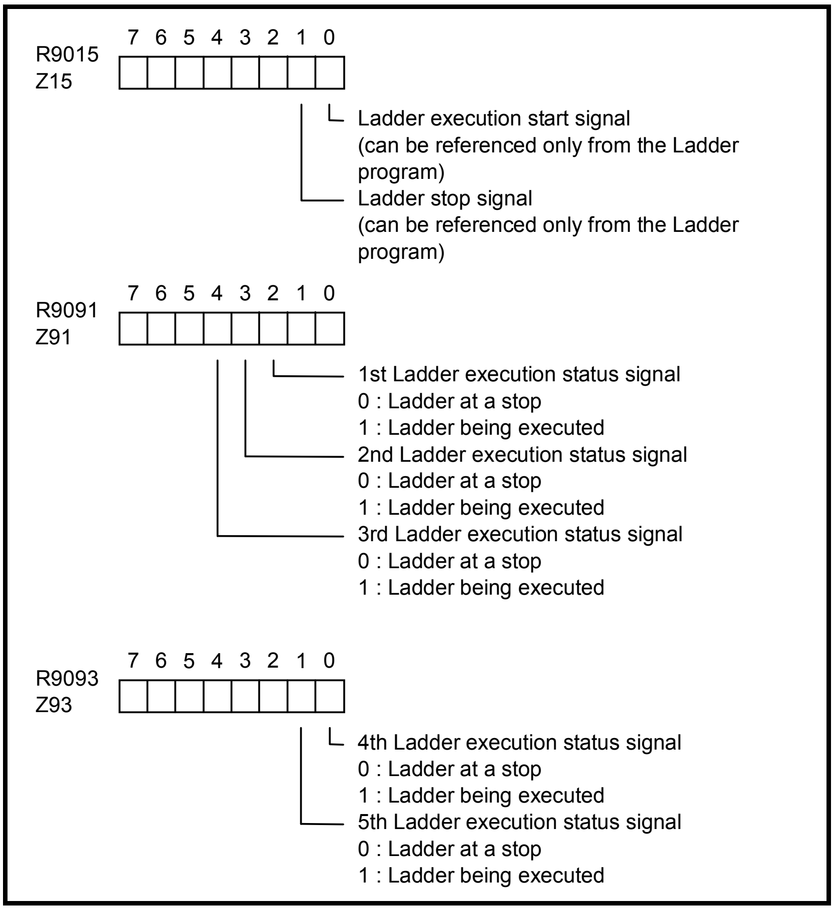


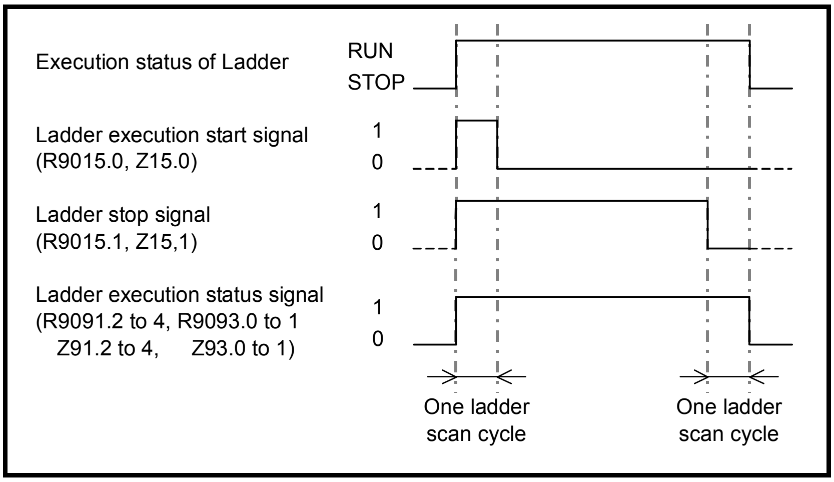
⚠ CAUTION

1 Each signal is initially OFF.
2 The signals R9091.0, R9091.1, Z91.0 and Z91.1 are set at the beginning of the 1st level of ladder on every cycle.
3 Each pulse signal (ON-OFF signal) may have an error of ±1, 2, 4 or 8 ms (ladder execution cycle).

Ladder execution start signal
Ladder stop signal
Ladder execution status signal

Using the ladder execution start and stop signals in a ladder program can detect when the ladder program starts and stops.
Referencing the ladder execution status signal from an external system or program, such as the network board, C Language executor program, FOCAS2 Ethernet, or HSSB library, can detect the execution status of the ladder program.





(1) Ladder execution start signal (R9015.0, Z15.0)
When directed to start ladder program execution, the system software starts executing the ladder program, turns on this signal, and keeps it on for the first one scan cycle. Like R9000 and Z0, this signal indicates the status of ladder execution corresponding to each ladder execution level. For this reason, this signal is securely turned on for the first one scan cycle after the start of execution no matter on what execution level the signal is referenced. This signal is turned on when:

(a) Ladder execution begins at power turn-on.

(b) The [RUN] soft key on the PMC screen is pressed.

(c) FANUC LADDER-III or a ladder editing package directs the ladder to start.

Referring this signal in a ladder program can detect when ladder execution has begun, making it possible to program preprocessing related to ladder execution.

> ⚠ **CAUTION**
> This signal can be referred only from the ladder program. Do not refer to it from an external system or program, such as the network board, the C Language executor program or the PMC signal trace function, as it indicates the status of ladder execution separately for each ladder execution level.

(2) Ladder stop signal (R9015.1, Z15.1)
When directed to stop ladder program execution, the system software turns off this signal and keeps it off for the last one scan before stopping ladder program execution. Like R9000 and Z0, this signal indicates the status of ladder execution corresponding to each ladder execution level. For this reason, this signal is securely turned off for the last one scan before the stop of execution no matter on what execution level the signal is referenced. This signal is turned off when:

(a) The [STOP] soft key on the PMC screen is pressed.

(b) FANUC LADDER-III or a ladder editing package directs the ladder to stop.

(c) On the PMC DATA I/O screen, the ladder program is loaded to the PMC.

(d) FANUC LADDER-III or a ladder editing package stores the ladder program to the PMC.

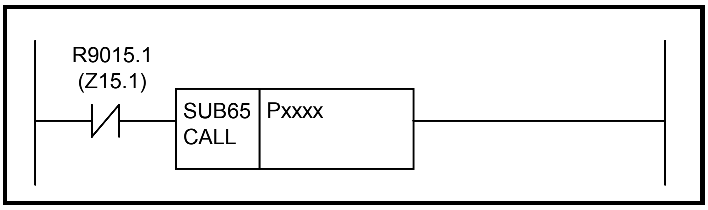
Referencing this signal in a ladder program can detect when ladder execution stops, making it possible to program post processing related to ladder execution (that is, preprocessing for ladder execution stop). Before the ladder is stopped, for example, it is possible to put signals in a proper state for safety purposes.

> ⚠ **CAUTION**
> 1 This signal can be referred only from the ladder program. Do not refer to it from an external system or program, such as the network board, the C Language executor program or the PMC signal trace function, as it indicates the status of ladder execution separately for each ladder execution level.
> 2 If the power is turned off or a CNC system alarm occurs, ladder execution and I/O signal transfer are immediately stopped for safety purposes. In this case, therefore, this signal cannot be used.

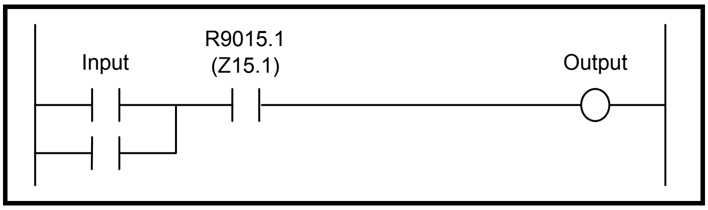
> **NOTE**
> This signal is not turned off in above-mentioned (c) and (d) on the setting that a ladder program can be updated without stopping the ladder program (CNC parameter No.11933#5 = 1). For details of the parameter, refer to “2.4.3”.

(3) Ladder execution status signal (R9091.2 to 4, R9093.0 to 1, Z91.2 to 4, Z93.0 to 1)
Referring this signal from an external system or program, such as the network board, C language executor program, FOCAS2 Ethernet, or HSSB library, can detect the execution status of the ladder program.

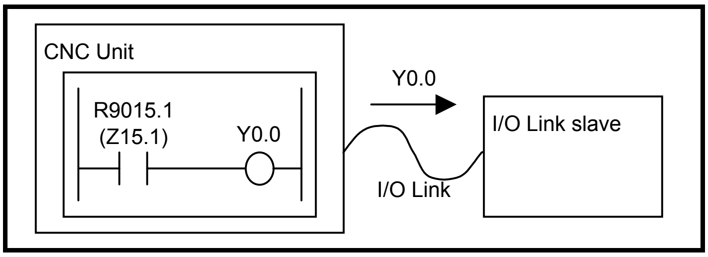
(4) Example of using the signals
(a) Example of calling a subprogram just before the ladder stops



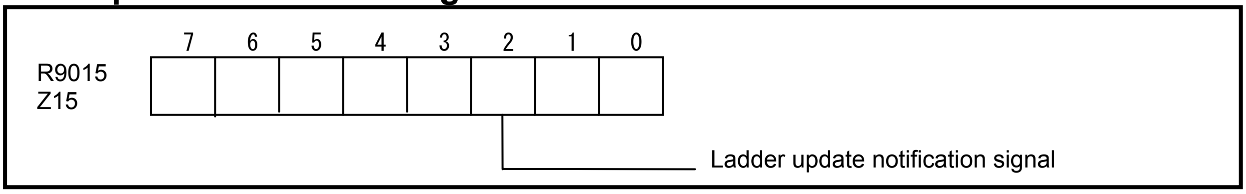
(b) Example of forcibly turning off an output signal programmed on the first ladder level just before the ladder stops

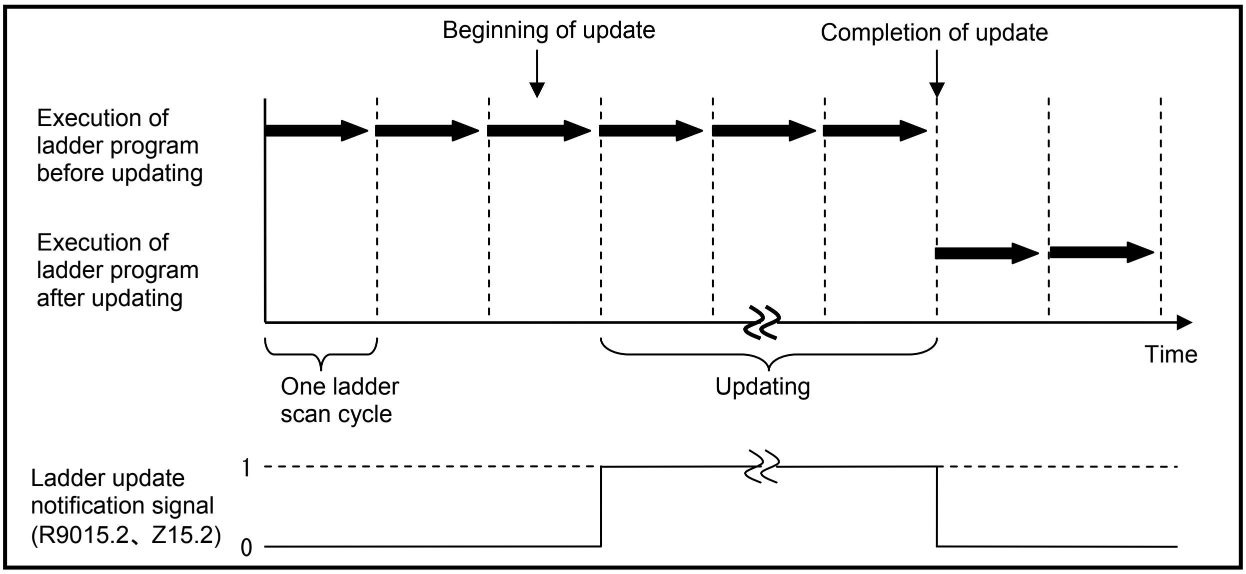


(c) Example of sending an execution-in-progress signal to the outside
Outputting the status of this signal as the DO signal (output address from the PMC) assigned to the I/O Link causes the CNC unit to be interlocked with an external system.



Ladder update notification signal





When the updating of a ladder program is directed, the system software turns on the ladder update notification signal and keeps it on until the updating of the ladder program is completed. The signal is turned on in the following case.

(a) A ladder program is edited on the PMC ladder editing function.
(b) A ladder program is edited on the online editing function of FANUC LADDER-III or Ladder Editing Package.

When CNC parameter No.11933#5 = 1, the setting that a ladder program can be updated without stopping the ladder program, this signal is also turned on in the following case.

(c) On the PMC DATA I/O screen, the ladder program is loaded to the PMC.
(d) FANUC LADDER-III or Ladder Editing Package stores a ladder program to the PMC.

To refer to the signal in a ladder program, the update timing of the ladder program can be detected.
Therefore, you can program some procedures which are necessary to update the ladder program. For example, you can program a procedure which makes the machine a status of the emergency stop.

> ⚠ **CAUTION**
> The signal can be referred only from the ladder program. Do not refer to it from an external system or program, such as the network board, the C Language executor program or the PMC signal trace function, as it indicates the status of ladder execution separately for each ladder execution level.

NOTE
1 The period that the signal has being turned on, is not fixed. It depends on the size of the ladder program, etc.
2 When using the ladder dividing management function, the signal is valid in all the ladder programs.
3 When using the multi-path PMC function, the signal is valid in only the program of the PMC path, and invalid in other PMC paths.

PMC alarm / warning status

You can know the status of the alarm and warning of PMC.

(1) 1st PMC to 5th PMC

	7	6	5	4	3	2	1	0
R9080 Z80								

Bit 0: Alarm / warning occurrence state of the 1st PMC
0 : No alarm / warning
1 : Alarm / warning occurs

	7	6	5	4	3	2	1	0
R9130 Z130								

Bit 0: Alarm / warning occurrence state of the 2nd PMC
0 : No alarm / warning
1 : Alarm / warning occurs

	7	6	5	4	3	2	1	0
R9144 Z144								

Bit 0: Alarm / warning occurrence state of the 3rd PMC
0 : No alarm / warning
1 : Alarm / warning occurs

	7	6	5	4	3	2	1	0
R9158 Z158								

Bit 0: Alarm / warning occurrence state of the 4th PMC
0 : No alarm / warning
1 : Alarm / warning occurs

	7	6	5	4	3	2	1	0
R9304 Z304								

Bit 0: Alarm / warning occurrence state of the 5th PMC
0 : No alarm / warning
1 : Alarm / warning occurs

(2) DCSPMC

	7	6	5	4	3	2	1	0
R9080 Z80								

Bit 0: Alarm / warning occurrence state of the DCSPMC
0 : No alarm / warning
1 : Alarm / warning occurs

I/O Link *i* Status Alarm: detected abnormalities information

You can know the status alarm of the I/O Link *i*.
Channel 1: R9268 to R9275 (Z268 to Z275)
Channel 2: R9276 to R9283 (Z276 to Z283)
Refer to "Status Alarm" of each CNC model's CONNECTION MANUAL (HARDWARE) for more information.

NOTE
1 The status alarm is not cleared until you turn off the power.
2 The information output to the system relay area is only one group per a channel. The group is that the status alarm is most detected first.
3 The address of status alarm is the common address regardless of the PMC path. it is the same address in all of the PMC paths including the DCSPMC.

2.2.5 Extra Relay Addresses (E)

These addresses are a work area used in sequence programs. When using the multi-path PMC function, the area becomes a common memory. The same value can be read and written in sequence programs of each PMC path.
Extra relays can be used in the same manner as for internal relays.
Signals that interface with other control units can be assigned to these bytes over the FA network. It can also be used as the interface with the C language executor and FOCAS2 functions.
Turning on the power clears this area to 0. (Note2)

> **NOTE**
> 1 These addresses are not synchronized in the 2nd level ladder. A value of a signal in these addresses may change during the execution of 2nd level ladder same as 1st and 3rd level ladder when it is written in other program (Ex. Network function, C language executor).
> 2 The extra relay addresses (E) can be optionally configured as nonvolatile. When they are nonvolatile, turning off the power does not erase the memory contents.

Table 2.2.5 Address of Extra Relay

Data kind	1st to 5th path PMC				DCSPMC
	PMC Memory-A	PMC Memory-B	PMC Memory-C	PMC Memory-D	
Extra relays	E0 to E9999	E0 to E9999	E0 to E9999	E0 to E9999	-

System Keep Relays related to Extra Relays

The following system keep relays have influence on managing extra relays.

K906.3 EOUTPUT (Available on 1st PMC only)
- 0: On the I/O screen, the E address is output when PMC parameters are output.
- 1: On the I/O screen, the E address is not output when PMC parameters are output.

K906.7 EXRELAYCTLOUT (Available on 1st PMC only)
- 0 : Extra relay control data will not be included in PMC parameter output.
- 1 : Extra relay control data will be included in PMC parameter output.

K909.5 EXRELAYSCRENBL (Available on 1st to 5th PMC)
- 0 : Data table screen does not show extra relays.
- 1 : Data table screen shows extra relays also.

Control data for Extra Relay

Similarly to the data table (D) address, extra relays can be displayed and modified in proper format for their usage by extra relay control data. To enable the extra relay control data, set 1 to system keep relay K909.5, and it will reveal the soft key to reach EXTRA RELAY CONTROL screen in DATA TABLE CONTROL screen, and one to reach EXTRA RELAY screen in DATA TABLE screen.

(1) Extra relay control configuration
Extra relays can be displayed and modified in EXTRA RELAY screen. You can change the data format (such as “Binary” or “BCD”) and the size of each extra relay group, using the extra relay control data.
The extra relay control data are not accessible from the sequence program. However, they can be stored and loaded to/from a memory card as a part of a PMC parameter file.
General configuration of extra relays controlled by extra relay control data is shown in figure 2.2.5 (a), and its details in figure 2.2.5 (b).

NOTE
1 Although an address of odd number can be set to the start address of an extra relay table, it is not recommended because the functional instructions such as DSCHB work faster at even addresses than at odd addresses.
2 Extra relays (E) can be included only in PMC parameter output from 1st PMC. If you set 1 to the system keep relay K906.3, no information of extra relays is included in PMC parameter output.
3 You have an option on the format of the extra relays when you include the extra relays in the PMC parameter output. See “2.3.2 PMC Parameter Format” for the detail of the format of the extra relays.
4 Even if the extra relays are not configured as non-volatile memory, their control data are non-volatile.

(2) Table control data
Table control data are the data to control the extra relay tables.
Unless these data are properly set, you can not properly view or edit the contents of extra relay tables described in (3) below.
First, you configure the table control data properly, referring to the explanation in this section.
You can reach EXTRA RELAY CONTROL screen by [EXTRA RELAY] soft key in DATA TABLE CONTROL screen. The soft key is displayed when 1 is set to the system keep relay K909.5.

(a) Number of table groups
Set number of groups that you are planning to divide the extra relays. The maximum number is 100.

(b) Table group 1 control data – Table group *n* control data
Each extra relay table has its table control data. Each table control data consists of the same items; table start address, table parameter, data type, and the number of data items.

(i) Table start address
This item decides the start address of the area used for each extra relay table.

(ii) Table parameter

#7	#6	#5	#4	#3	#2	#1	#0
				SIGN	HEX	MASK	COD

COD
- 0: Data in this table are displayed in binary format.
- 1: Data in this table are displayed in BCD format.

MASK
- 0: The contents of this table are not protected.
- 1: The contents of this table are protected.

HEX
- 0: Data in this table are displayed in binary or BCD format. (COD is effective)
- 1: Data in this table are displayed in hexadecimal format.

SIGN
- 0: Data in this table are displayed as signed numbers.
- 1: Data in this table are displayed as unsigned numbers.

NOTE
1 The setting of COD (bit 0) is effective when HEX (bit 2) = 0.
2 The setting of SIGN (bit 3) is effective when COD (bit 0) = 0 and HEX (bit 2) = 0.

(iii) Data type
This item decides the length of data in this table.
0 : 1 byte length
1 : 2 bytes length
2 : 4 bytes length
3 : 8 bits

(iv) Number of data items
This item decides the number of data items in this table.

(3) Extra relay table
You can create groups of extra relays dividing the area of extra relays (E address).
"Number of table groups" in the table control data decides the number of these groups of extra relays.
You can reach EXTRA RELAY screen by [EXTRA RELAY] soft key in DATA TABLE screen. The soft key is displayed when 1 is set to the system keep relay K909.5.

2.2.6 Message Display Addresses (A)

These addresses are areas used for requesting a message display and outputting a message status.
See descriptions about the DISPB functional instruction in Chapter 4 for explanations about how to use this area.
Turning on the power clears this area to 0.

Table 2.2.6 Address of Message display

Data kind	1st to 5th path PMC				DCSPMC
	PMC Memory-A	PMC Memory-B	PMC Memory-C	PMC Memory-D	
Message display request (points)	A0 to A249 (2,000 points)	A0 to A249 (2,000 points)	A0 to A499 (4,000 points)	A0 to A749 (6,000 points)	-
Message display status	A9000 to A9249	A9000 to A9249	A9000 to A9499	A9000 to A9749	-

2.2.7 Timer Addresses (T)

These addresses are areas for setting values and the precision of variable timers (the TMR instruction).
The memory contents are kept even if turning off the power.

Table 2.2.7 Address of variable timer

Data kind	1st to 5th path PMC				DCSPMC
	PMC Memory-A	PMC Memory-B	PMC Memory-C	PMC Memory-D	
Variable timer (Number of timers)	T0 to T79 (40 pieces)	T0 to 499 (250 pieces)	T0 to T999 (500 pieces)	T0 to T999 (500 pieces)	T0 to T79 (40 pieces)
precision	T9000 to T9079	T9000 to 9499	T0 to T9999	T0 to T9999	T9000 to T9079

2.2.8 Counter Addresses (C)

These addresses are areas used for variable counters (the CTR instruction) and fixed counters (the CTRB instruction).
The memory contents are kept even if turning off the power.

Table 2.2.8 Address of counters

Data kind	1st to 5th path PMC				DCSPMC
	PMC Memory-A	PMC Memory-B	PMC Memory-C	PMC Memory-D	
Variable counter (Number of counters)	C0 to C79 (20 pieces)	C0 to C399 (100 pieces)	C0 to C799 (200 pieces)	C0 to C1199 (300 pieces)	C0 to C79 (20 pieces)
Fixed counter (Number of counters)	C5000 to C5039 (20 pieces)	C5000 to C5199 (100 pieces)	C5000 to C5399 (200 pieces)	C5000 to C5599 (300 pieces)	C5000 to C5039 (20 pieces)

2.2.9 Keep Relay Addresses (K)

These addresses are a work area in which data are kept even if turning the power off.

Table 2.2.9 Address of keep relays

Data kind	1st to 5th path PMC				DCSPMC
	PMC Memory-A	PMC Memory-B	PMC Memory-C	PMC Memory-D	
Keep relays	K0 to K19	K0 to K99	K0 to K199	K0 to K299	K0 to K19

2.2.10 Nonvolatile Memory Control Address (K)

This address is intended to be used in, for example, the configuration in which the position of a movable mechanical part (such as a lathe turret) is stored as code data (such as BCD) to nonvolatile memory to preserve the current machine position even when the power is turned off.

	#7	#6	#5	#4	#3	#2	#1	#0
K909	MWRTF2	MWRTF						

On the KEEP RELAY screen, it is possible to set and display the address of the nonvolatile memory. It is also possible for a sequence program to read or write the address.
If the power is accidentally turned off when the turret is rotating, the turret stops at an unexpected position and a mismatch occurs between the current position stored in the memory and the actual turret position. When the power is resumed and a normal operation begins, the mismatch results in an incorrect sequence operation.
To prevent such a malfunction, make a check by using nonvolatile memory control in a sequence program as follows:

(1) Write "1" to MWRTF for the nonvolatile memory control before the turret starts moving.
(2) Start the turret.
(3) After the turret has stopped, reset MWRTF to "0".
(4) If the power is turned off after the turret has started, therefore, MWRTF stays at "1".
(5) When the CNC power is turned on, MWRTF2 is set to "1" automatically if MWRTF is "1", thus informing the sequence program of the failure.
To sum up, the sequence program performs steps (1) to (4) and checks for an abnormal condition, using MWRTF2. If an abnormal condition (NWRTF2 = 1) is detected, an alarm is raised to the operator, using a user-created alarm output program.

(6) Recognizing the alarm, the operator resets MWRTF and MWRTF2 to "0" on the KEEP RELAY screen.
(7) After making the memory content match the actual turret position, restart operation.

2.2.11 System Keep Relay Addresses (K)

These addresses are an area for the setting of PMC system.
The memory contents are kept even if turning off the power.

Table 2.2.11 Address of System keep relay

Data kind	1st to 5th path PMC				DCSPMC
	PMC Memory-A	PMC Memory-B	PMC Memory-C	PMC Memory-D	
System keep relays	K900 to K999	K900 to K999	K900 to K999	K900 to K999	K900 to K999

Explained below is the meaning of each bit of the system keep relay address. The bits and addresses left unused are reserved for use by the system.
The system keep relays indicated with an asterisk (*) can be set up, using setting parameters.

	#7	#6	#5	#4	#3	#2	#1	#0
K900	DTBLDSP			MEMINP		AUTORUN	PRGRAM	LADMASK

[Data type] Bit

LADMASK PMC program view inhibit(*)
- 0: The sequence program is allowed to be viewed.
- 1: The sequence program is inhibited from being viewed.

PRGRAM Programmer function enable(*)
- 0: The built-in programmer function is disabled.
- 1: The built-in programmer function is enabled.

AUTORUN PMC program execute(*)
- 0: The sequence program is automatically started when the power is turned on.
- 1: The sequence program is started, using the sequence program execution soft key.

MEMINP Memory write permit(*)
- 0: The forcing and override functions are disabled.
- 1: The forcing and override functions are enabled.

NOTE
Using the override function requires setting "Override enable" (K906.0).

DTBLDSP Data table GRP setting display(*)
- 0: The DATA TABLE CONTROL screen is displayed.
- 1: The DATA TABLE CONTROL screen is not displayed.

	#7	#6	#5	#4	#3	#2	#1	#0
K901		EDTENBL						

[Data type] Bit

EDTENBL Editing permit(*)
- 0: The sequence program is inhibited from being changed.
- 1: The sequence program is allowed to be changed.

	#7	#6	#5	#4	#3	#2	#1	#0
K902	PROTPRM	HIDEPRM				ALLWSTOP		FROM-WRT

[Data type] Bit

FROM-WRT Save after edit(*)

0: After being edited, the sequence program is not automatically written to flash ROM.

1: After being edited, the sequence program is automatically written to flash ROM.

ALLWSTOP PMC stop enable(*)

0: The sequence program is inhibited from being started/stopped.

1: The sequence program is allowed to be started/stopped.

HIDEPRM PMC parameter view inhibit(*)

0: PMC parameters are allowed to be displayed and sent to the outside.

1: PMC parameters are inhibited from being displayed or sent to the outside.

PROTPRM PMC parameter change inhibit(*)

0: PMC parameters are allowed to be changed and read.

1: PMC parameters are inhibited from being changed or read.

	#7	#6	#5	#4	#3	#2	#1	#0
K903			CLRATVAR	CLRFBVAR		ASKPASS	SYMEX DISP	

[Data type] Bit

SYMEXDISP Displaying type of Additional Information Line when using Basic type of Symbol and Comment data.

0: Displays Symbol and Comment with fixed length.

1: Displays left justified Symbol and Comment with flexible length (like an Extended type Symbol and Comment data).

```
1NET:G0078.0:Spd1Orientation (Spindle orienta)=OFF
```

Fig. 2.2.11 (a) Additional Information Line with K903.1=0

```
1NET : G0078.0 : Spd1Orientation = OFF (Spindle orientation external S)
```

Fig. 2.2.11 (b) Additional Information Line with K903.1=1

> **NOTE**
> To make the setting of K903.1 effective, turn off and on power of the CNC.

ASKPASS Asking for password

0: You are asked to enter password for the program protected by password.

1: You are not asked to enter password for the program protected by password.

CLRFBVAR Initialization of FB variable area at updating sequence program

0: Clear FB variable area when FB variable is changed.

1: Not clear FB variable area.

> **NOTE**
> Refer to “11.1.4 Assignment of FB variable” about address assignment of FB variable.

CLRATVAR Initialization of the memory area for automatic address assignment at updating sequence program
0: Not clear the area to which addresses are assigned automatically.
1: Clear the area to which addresses are assigned automatically when changing symbol data other than FB variable.

> **NOTE**
> Refer to “(6) Automatic address assignment at compiling on FANUC LADDER-III” of “1.2.7 Extension of a symbol and comment” about automatic address assignment.

	#7	#6	#5	#4	#3	#2	#1	#0
K906	EXRELAY CTLOUT	KEEPSYS	TRCST		EOUTPUT	IOLNKCHK	IOGRPSEL	OVRRID

[Data type] Bit
OVRRID Override enable(*)
0: The override function is disabled.
1: The override function is enabled.

> **NOTE**
> Using the override function requires setting "Memory write permit" (K900.4).

IOGRPSEL IO GROUP SELECTION screen(*)
0: The selectable I/O Link assignment function setting screen is not displayed.
1: The selectable I/O Link assignment function setting screen is displayed.
IOLNKCHK
0: The I/O Link / I/O Link *i* connection check function is enabled.
1: The I/O Link / I/O Link *i* connection check function is disabled.
EOUTPUT (Available only on 1st PMC)
0: On the I/O screen, the E address is output when PMC parameters are output.
1: On the I/O screen, the E address is not output when PMC parameters are output.
TRCST Trace function start(*) (Available only on 1st PMC)
0: The trace function is not executed when the power is turned on.
1: The trace function is automatically executed when the power is turned on.
KEEPSYS KEEP RELAY (SYSTEM) (*)
0: The KEEP RELAY (K900-K919) screen is not displayed.
1: The KEEP RELAY (K900-K919) screen is displayed..

EXRELAYCTLOUT (Available only on 1st PMC)
0: Extra relay control data will not be included in PMC parameter output.
1: Extra relay control data will be included in PMC parameter output.

	#7	#6	#5	#4	#3	#2	#1	#0
K907								IOCNFEDT

[Data type] Bit
IOCNFEDT Editing of I/O configuration data (*) (Available only on 1st PMC)
0: Forbids editing of I/O configuration data.
1: Allows editing of I/O configuration data.

		#7	#6	#5	#4	#3	#2	#1	#0
K909		MWRTF2	MWRTF	EXRELAY SCRENBL	LADSET INDPNT				

[Data type] Bit

LADSETINDPNT

0: All PMC paths use a common configuration of Ladder diagram display format.
1: Each PMC path uses an individual configuration of Ladder diagram display format.

EXRELAYSCRENBL

0: Data table screen does not show extra relays.
1: Data table screen shows extra relays also.

MWRTF For nonvolatile memory control. See Subsection “2.2.10”.
MWRTF2 For nonvolatile memory control. See Subsection “2.2.10”.

K916	Message shift start address (LOW)
K917	Message shift start address (HIGH)

Message shift start address(*)

[Valid data range] Range of the A addresses

This area is used to specify the message shift start address value (word type) by converting it to bit data form.
The bit offset for the A addresses is calculated as follows:

A address	Calculation		Bit offset
Ax.y	x × 8 + y	=	z

Example:

A0.0	0 × 8 + 0	=	0
A249.7	249 × 8 + 7	=	1999

K918	Message shift amount (LOW)
K919	Message shift amount (HIGH)

Message shift amount(*)

[Valid data range] 1 to 9999

This area is used to specify the message shift amount value (word type) by converting it to bit data form.

	#7	#6	#5	#4	#3	#2	#1	#0
K920	Group 7	Group 6	Group 5	Group 4	Group 3	Group 2	Group 1	Group 0

[Data type] Bit

Group 0 to 7 For the selectable I/O Link assignment function, whether to enable or disable assignment of group 0 to 7 to addresses X/Y0 to X/Y127 is specified. (*)

0: Assignment of each group to the corresponding bit position is disabled.
1: Assignment of each group to the corresponding bit position is enabled

	#7	#6	#5	#4	#3	#2	#1	#0
K921	Group 15	Group 14	Group 13	Group 12	Group 11	Group 10	Group 9	Group 8

[Data type] Bit

Group 8 to 15 For the selectable I/O Link assignment function, whether to enable or disable assignment of group 8 to 15 to addresses X/Y0 to X/Y127 is specified. (*)

0: Assignment of each group to the corresponding bit position is disabled.
1: Assignment of each group to the corresponding bit position is enabled.

	#7	#6	#5	#4	#3	#2	#1	#0
K922	Group 15	Group 14	Group 13	Group 12	Group 11	Group 10	Group 9	Group 8

[Data type] Bit

Group 0 to 7 For the selectable I/O Link assignment function, whether to enable or disable assignment of group 0 to 7 to addresses X/Y200 to X/Y327 is specified. (*)

0: Assignment of each group to the corresponding bit position is disabled.
1: Assignment of each group to the corresponding bit position is enabled.

	#7	#6	#5	#4	#3	#2	#1	#0
K923	Group 15	Group 14	Group 13	Group 12	Group 11	Group 10	Group 9	Group 8

[Data type] Bit

Group 8 to 15 For the selectable I/O Link assignment function, whether to enable or disable assignment of group 8 to 15 to addresses X/Y200 to X/Y327 is specified. (*)

0: Assignment of each group to the corresponding bit position is disabled.
1: Assignment of each group to the corresponding bit position is enabled.

	#7	#6	#5	#4	#3	#2	#1	#0
K924	Group 7	Group 6	Group 5	Group 4	Group 3	Group 2	Group 1	Group 0

[Data type] Bit

Group 0 to 7 For the selectable I/O Link assignment function, whether to enable or disable assignment of group 0 to 7 to addresses X/Y400 to X/Y527 is specified. (*)

0: Assignment of each group to the corresponding bit position is enabled.
1: Assignment of each group to the corresponding bit position is enabled.

	#7	#6	#5	#4	#3	#2	#1	#0
K925	Group 15	Group 14	Group 13	Group 12	Group 11	Group 10	Group 9	Group 8

[Data type] Bit

Group 8 to 15 For the selectable I/O Link assignment function, whether to enable or disable assignment of group 8 to 15 to addresses X/Y400 to X/Y527 is specified. (*)

0: Assignment of each group to the corresponding bit position is disabled.
1: Assignment of each group to the corresponding bit position is enabled.

	#7	#6	#5	#4	#3	#2	#1	#0
K926	Group 7	Group 6	Group 5	Group 4	Group 3	Group 2	Group 1	Group 0

[Data type] Bit

Group 0 to 7 For the selectable I/O Link assignment function, whether to enable or disable assignment of group 0 to 7 to addresses X/Y600 to X/Y727 is specified. (*)

0: Assignment of each group to the corresponding bit position is disabled.
1: Assignment of each group to the corresponding bit position is enabled.

	#7	#6	#5	#4	#3	#2	#1	#0
K927	Group 15	Group 14	Group 13	Group 12	Group 11	Group 10	Group 9	Group 8

[Data type] Bit

Group 8 to 15 For the selectable I/O Link assignment function, whether to enable or disable assignment of group 8 to 15 to addresses X/Y600 to X/Y727 is specified. (*)

0: Assignment of each group to the corresponding bit position is disabled.
1: Assignment of each group to the corresponding bit position is enabled.

	#7	#6	#5	#4	#3	#2	#1	#0
K928	Group 7	Group 6	Group 5	Group 4	Group 3	Group 2	Group 1	Group 0

[Data type] Bit

Group 0 to 7 For the selectable I/O Link *i* assignment function, whether to enable or disable assignment of group 0 to 7 of channel 1 is specified.

0: Assignment of each group to the corresponding bit position is disabled.
1: Assignment of each group to the corresponding bit position is enabled.

	#7	#6	#5	#4	#3	#2	#1	#0
K929	Group 15	Group 14	Group 13	Group 12	Group 11	Group 10	Group 9	Group 8

[Data type] Bit

Group 8 to 15 For the selectable I/O Link *i* assignment function, whether to enable or disable assignment of group 8 to 15 of channel 1 is specified.

0: Assignment of each group to the corresponding bit position is disabled.
1: Assignment of each group to the corresponding bit position is enabled.

	#7	#6	#5	#4	#3	#2	#1	#0
K930	Group 23	Group 22	Group 21	Group 20	Group 19	Group 18	Group 17	Group 16

[Data type] Bit

Group 16 to 23 For the selectable I/O Link *i* assignment function, whether to enable or disable assignment of group 16 to 23 of channel 1 is specified.

0: Assignment of each group to the corresponding bit position is disabled.
1: Assignment of each group to the corresponding bit position is enabled.

	#7	#6	#5	#4	#3	#2	#1	#0
K932	Group 7	Group 6	Group 5	Group 4	Group 3	Group 2	Group 1	Group 0

[Data type] Bit

Group 0 to 7 For the selectable I/O Link *i* assignment function, whether to enable or disable assignment of group 0 to 7 of channel 2 is specified.

0: Assignment of each group to the corresponding bit position is disabled.
1: Assignment of each group to the corresponding bit position is enabled.

	#7	#6	#5	#4	#3	#2	#1	#0
K933	Group 15	Group 14	Group 13	Group 12	Group 11	Group 10	Group 9	Group 8

[Data type] Bit

Group 8 to 15 For the selectable I/O Link *i* assignment function, whether to enable or disable assignment of group 8 to 15 of channel 2 is specified.

0: Assignment of each group to the corresponding bit position is disabled.
1: Assignment of each group to the corresponding bit position is enabled.

	#7	#6	#5	#4	#3	#2	#1	#0
K934	**Group 23**	**Group 22**	**Group 21**	**Group 20**	**Group 19**	**Group 18**	**Group 17**	**Group 16**

[Data type] Bit

Group 16 to 23 For the selectable I/O Link *i* assignment function, whether to enable or disable assignment of group 16 to 23 of channel 2 is specified.

0: Assignment of each group to the corresponding bit position is disabled.

1: Assignment of each group to the corresponding bit position is enabled.

	#7	#6	#5	#4	#3	#2	#1	#0
K935							**REGIODEV**	**SELPMC**

[Data type] Bit

SELPMC Displaying PMC program list screen (Only the setting in the first path PMC is available.)

0: When pressing the [SWITCH PMC] soft key, selected sequence program switches.

1: When pressing the [SWITCH PMC] soft key, PMC program list screen is displayed.

Note

1 This soft key is displayed when using ladder dividing management function or multi-path PMC function.

2 At 8-level protection setting screen, this soft key switches PMC path whether K935.0=0 or 1.

When inputting PMC path number / divided number and pressing the [SWITCH PMC] soft key, it becomes the following actions whether K935.0=0 or 1.

Operation	Action
Inputting “PMC path number” and pressing [SWITCH PMC]	It selects specified main ladder of PMC path.
Inputting “PMC path number” - “divided number” and pressing [SWITCH PMC]	It selects specified divided ladder.

REGIODEV Register of I/O device configuration. (*) (Available only on 1st PMC)

0: Forbids register of I/O device configuration.

1: Allows register/deletion of I/O device configuration.

2.2.12 Data Table Addresses (D)

These addresses are work areas in which data are kept even if turning the power off.
PMC sequence control sometimes requires a sizable amount of numeric data (hereinafter referred to as data table). If the contents of a data table can be set or read freely, they can be used as various PMC sequence control data, such as tool numbers of tools on the ATC magazine.
Each table can have an arbitrary size as long as it fits the data table memory, and 1-, 2-, and 4-byte binary and BCD data can be used for each table separately; so it is possible to configure efficient, easy-to-use tables.
Data in a data table can be set or displayed on the DATA TABLE screen.
Data set in data tables can also be easily read and written with the sequence program using functional instructions such as data search (DSCHB) and index modification data transfer (XMOVB).
The following table lists the number of bytes that can be used.
Signals that interface with other control units can be assigned to these bytes over the FA network. It can also be used as the interface with the C language executor and FOCAS2 functions.

NOTE
These addresses are not synchronized in the 2nd level ladder. A value of a signal in these addresses may change during the execution of 2nd level ladder same as 1st and 3rd level ladder when it is written in other program (Ex. Network function, C language executor).

Table 2.2.12 Address of Data table

Data kind	1st to 5th path PMC				DCSPMC
	PMC Memory-A	PMC Memory-B	PMC Memory-C	PMC Memory-D	
Data table	D0 to D2999	D0 to D9999	D0 to D19999	D0 to D59999	D0 to D2999

NOTE
The basic nonvolatile area is 10,000bytes. To make a nonvolatile area of D10000 or more, you should specify the option “Nonvolatile PMC Data Table Area Expansion (40KB)”. Refer to subsection “2.1.3” for details.

(1) Data table configuration
The PMC data table consists of table control data and data tables. The table control data manages the data form (binary or BCD) and size of each table.
Creating a data table requires first setting up table control data from the DATA TABLE CONTROL screen.
The sequence program cannot read or write the table control data. If the USB memory, and so on, are used to read or write the contents of the nonvolatile memory, however, the table control data is read or written together.

NOTE
In some cases, the start address of a data table is odd. If an odd number of 1-byte data tables are created, for example, the start address of the next data table may be odd. This setting is acceptable. However, an even start address assures faster operations than an odd start address. We recommend you use even start addresses whenever possible.

(2) Table control data
The table control data is used to manage data tables.
Unless this data is correctly set up, it is impossible to create data tables, explained in (3), correctly.
While referencing the descriptions in this item, first set up table control data and then data tables.

(a) Number of table groups
This item specifies how many groups are to form the data table, using a binary number.

(b) Table group 1 control data to table group n control data
Each data table is provided with table control data. The meaning of data (table start address, table parameter, data type, and the number of data items) set up as table control data is the same for all table groups.

(i) Table start address
This item specifies the start address of a data area used for each data table.

(ii) Table parameter

#7	#6	#5	#4	#3	#2	#1	#0
				SIGN	HEX	MASK	COD

COD
0: Data in the data table is in binary form.
1: Data in the data table is in BCD form.

MASK
0: The contents of the data table is not protected.
1: The contents of the data table is protected.

HEX
0: Data in the data table is in binary or BCD form.
1: Data in the data table is in HEX form.

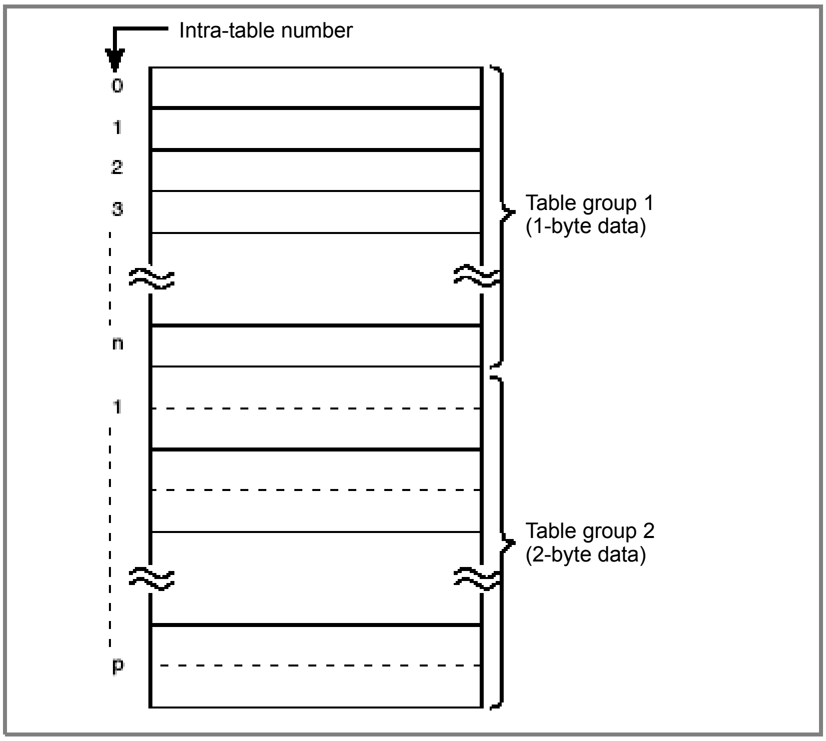
SIGN
0: Data in the data table is signed.
1: Data in the data table is unsigned.

NOTE
1 The setting of COD (bit 0) is valid if HEX (bit 2) = 0.
2 The setting of SIGN (bit 3) is valid if COD (bit 0) = 0 and HEX (bit 2) = 0.

(iii) Data type
This item specifies the length of data in the data table.
0 : 1 byte long
1 : 2 bytes long
2 : 4 bytes long
3 : 8 bits

(iv) Number of data items
This item specifies the number of data items in the data table.

(3) Data table
A data table can be divided into several groups, and each group can be created within the memory range (address D) for the data table.
The number of groups is determined according to the number of table control data table groups.



Data in each data table can be 1-, 2, or 4-byte data depending on the data type of the corresponding table control data.
If the table data is 1-byte data, one intra-table number in the corresponding data table is assigned to one byte of data. If the table data is 2-byte data, one intra-table number is assigned to two bytes of data.

(4) Creating data for a data table
Data for a data table is created by specifying an intra-table number for the data table and entering the data into the table from the DATA TABLE screen. A specific method for specifying intra-table numbers is available for individual data table groups separately.

NOTE
The sequence program can also read and write the data table.

2.2.13 Addresses for Multi-path PMC Interface (M, N)

These addresses are used to the Multi-path PMC interface area.

(1) Input signals from another PMC path

Data kind	1st to 3rd path PMC				DCSPMC
	PMC Memory-A	PMC Memory-B	PMC Memory-C	PMC Memory-D	
Input signals	M0 to M767	M0 to M767	M0 to M767	M0 to M767	(unavailable)

(2) Output signals to another PMC path

Data kind	1st to 3rd path PMC				DCSPMC
	PMC Memory-A	PMC Memory-B	PMC Memory-C	PMC Memory-D	
Output signals	N0 to N767	N0 to N767	N0 to N767	N0 to N767	(unavailable)

NOTE
These interfaces cannot be used in 4th and 5th path PMC.

2.2.14 Subprogram Number Addresses (P)

These addresses are subprogram number for specifying the subprogram.
The subprogram number is used in the CALL, CALLU and CM instructions and applied subprogram is called.

Data kind	1st to 5th path PMC				DCSPMC
	PMC Memory-A	PMC Memory-B	PMC Memory-C	PMC Memory-D	
Subprogram number	P1 to P512	P1 to P5000	P1 to P5000	P1 to P5000	P1 to P512

2.2.15 Label Number Addresses (L)

These addresses are label number for specifying the label (LBL instruction).
The label number is used in the JMPB and JMPC instructions and jumps to applied LBL instruction.
The same label number can be specified for different instructions as long as the instructions are not within the same program unit (main program or subprogram).

Data kind	1st to 5th path PMC				DCSPMC
	PMC Memory-A	PMC Memory-B	PMC Memory-C	PMC Memory-D	
Label number	L1 to L9999	L1 to L9999	L1 to L9999	L1 to L9999	L1 to L9999

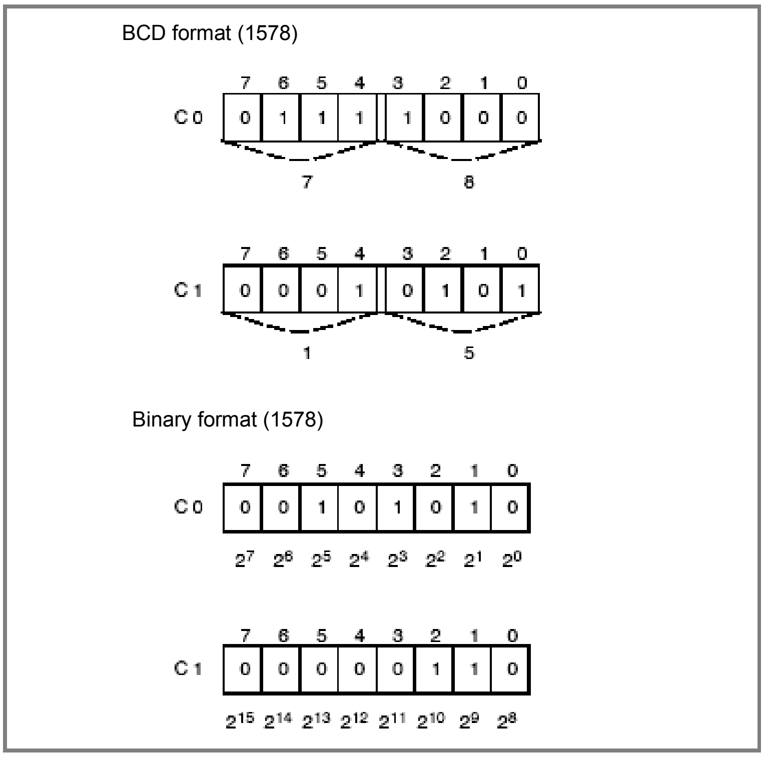
2.3 PMC PARAMETERS

The term "PMC parameter" refers to any of the timer, counter, keep relay parameters, and data table. PMC parameters are held in nonvolatile memory, whose contents are not lost even when the power is turned off.

(1) Timer
This parameter specifies a timer value.
It is possible to set and display the timer value on the TIMER screen.
The sequence program can read and write the timer setting.

(2) Counter
This parameter is used for a counter preset value and cumulative value. It is possible to set and display these values on the COUNTER screen. Sequence program instructions can also read and write these settings. See Subsection 2.2.8 for details of the counter addresses.
Counter data is two bytes in ether BCD or binary form. Higher-order bits are held at higher addresses. Whether the counter address is BCD or binary is determined according to the corresponding PMC system parameter.
The default setting is binary form.

(Example) If the counter addresses of the PMC are C0 and C1, and the preset value is 1578



To change the lower digit of the preset value to a certain value, using a 1-byte processing instruction in the sequence program, write the new data by specifying C0 with an output address in the parameter of a functional instruction.

(3) Keep relay
This parameter is used for parameters for sequence control, keep relays, and others.
It can be set and displayed from the KEEP RELAY screen.
It can also be read and written, using instructions in the sequence program.

The data set up or displayed from the KEEP RELAY screen is 8-bit binary data. On the KEEP RELAY screen, therefore, each of the eighth digits is set or displayed as 0 or 1.

(4) Data table
The data table enables a set of numeric data (data table) to be used for PMC sequence control.
See Subsection “2.2.12”for details.

(5) Extra relay
Extra relays are volatile memory, which can be used as extension of ordinary internal relays, or as common memory for the interface of PMC paths. Because the extra relays can be non-volatile by option, and you can also use them as extension of data table or keep relays.
See “2.2.5 Extra Relay Addresses (E)” for more detail about extra relays.

2.3.1 Cautions for Reading from/Writing to Nonvolatile Memory

All data in the nonvolatile memory can be read and written with the sequence program. The memory from which the sequence program reads and to which it writes is not nonvolatile in effect. It has the same data as in the nonvolatile memory in a form of nonvolatile memory image (RAM). For this reason, turning off the power lets the data of nonvolatile memory image disappear. However, data is sent from the nonvolatile memory as nonvolatile memory image immediately after the power is resumed, thus restoring the previous data correctly.
If the sequence program rewrites the nonvolatile memory image, the changed data is automatically sent to the nonvolatile memory.
Data at more than one address in the nonvolatile memory image can be rewritten at any time. The changed data is automatically sent to the nonvolatile memory.
Therefore, reading from and writing to the nonvolatile memory with the sequence program does not require any special processing. Writing to the nonvolatile memory takes time (about 200 msec), however.

2.3.2 PMC Parameter Format

This subsection describes the format used in outputting the contents of the PMC parameter to an external device. As for the operation of output, refer to section 7 "sequence program and PMC parameter I/O".

(1) Header information

The data begins with header information. Its format is as follows:

[Format]

%

(PMC = xxx, MSID = n)

PMC = xxx "xxx" is the model name of the PMC.

MSID = n "n" is ID information.

The following table lists values that can be set as "xxx" or "n".

PMC Series	"xxx"
30*i*-B PMC	30I-B
31*i*-B PMC	31I-B
32*i*-B PMC	32I-B
35*i*-B PMC	35I-B
Power Motion *i*-A PMC	PMI-A
0*i*-F PMC	0I-F

PMC Path	"n"
1st path PMC	1
2nd path PMC	2
3rd path PMC	3
4th path PMC	4
5th path PMC	5
DCS PMC	9

(2) Timer (T)

[Format]

N60xxxx Pnnnnn;

N600xxxx Pnnnnn;

[Data Contents]

N60xxxx or N600xxxx : parameter number

Specify the sum of the timer address (T) offset and 600000 or 6000000. The number in the following table can be used.

	1st to 5th path PMC				DCSPMC
	PMC Memory-A	PMC Memory-B	PMC Memory-C	PMC Memory-D	
Timer setting value	N600000 to N600078	N600000 to N600498	N600000 to N600998	N6000000 to N6000998	N600000 to N600078
Timer accuracy	N609000 to N609078	N609000 to N609498	N609000 to N609998	N6009000 to N6009998	N609000 to N609078

Pnnnnn The numbers from N600000 mean the timer value

The unit of the value depends on the timer accuracy which are numbers from N609000. For example, when the timer accuracy is 3(100ms) and this value is 5, the timer value means 500ms. The range of effective value is from 0 to 32767.

The numbers from N609000 mean the timer accuracy. Each value is the following timer accuracy.

Value	Timer accuracy
0	Timer number1～8 : 48ms Timer number9～ : 8ms
1	1ms
2	10ms
3	100ms
4	1 sec.
5	1 min.

(Example)

N600000 P1; (Timer number 1 T0)
N600002 P20; (Timer number 2 T2)
.
N600498 P32767; (Timer number 250 T498)

N609000 P0; (Timer number 1 T9000)
N609002 P0; (Timer number 2 T9002)
.
N609498 P0; (Timer number 250 T9498)

(3) Counter (C)

[Format]

N61xxxx Pnnnnn;
N610xxxx Pnnnnn;

[Data Contents]

N61xxxx or N610xxxx; parameter number

Specify the sum of the counter address (C) offset and 610000 or 6100000. The number in the following table can be used.

	1st to 5th path PMC				DCSPMC
	PMC Memory-A	PMC Memory-B	PMC Memory-C	PMC Memory-D	
Variable counter (CTR)	N610000 to N610078	N610000 to N610398	N610000 to N610798	N6100000 to N6101198	N610000 to N610078
Fixed counter (CTRB)	N615000 to N615038	N615000 to N615198	N615000 to N615398	N6105000 to N6105598	N615000 to N615038

Pnnnnn Counter address value in decimal notation

For the variable counter, the preset and current values appear alternately. For the fixed counter, only the current values appear.

It has a size of 2 bytes and can range from 0 to 32767 for a range. The counter addresses are assumed to be binary for input/output no matter whether the counter data type is specified as BCD or binary.

(Example)

N610000 P7; (Counter number 1 C0)
N610002 P7; (C2)
.

N610396 P9999; (Counter number 100 C396)
N610398 P0; (C398)

N615000 P7; (Fixed-counter number 1 C5000)
N615002 P20; (Fixed-counter number 2 C5002)
.
N615198 P9999; (Fixed-counter number 100 C5198)

(4) Keep relay (K)
[Format]
N62xxxx Pnnnnnnnn;
N620xxxx Pnnnnnnnn;

[Data Contents]
N62xxxx or N620xxxx Parameter number
Specify the sum of the keep relay address (K) offset and 620000 or 6200000. The number in the following table can be used.

	1st to 5th path PMC				DCSPMC
	PMC Memory-A	PMC Memory-B	PMC Memory-C	PMC Memory-D	
User area	N620000 to N620019	N620000 to N620099	N620000 to N620199	N6200000 to N6200299	N620000 to N620019
System area	N620900 to N620999	N620900 to N620999	N620900 to N620999	N6200900 to N6200999	N620900 to N620999

Pnnnnnnnn Keep relay address value in binary notation
It can range from 00000000 to 11111111.

(Example)
N620000 P00000000; (K0)
N620001 P11111111; (K1)
.
N620099 P10101010; (K99)

N620900 P00000000; (K900)
N620901 P11111111; (K901)
.
N620999 P10101010; (K999)

(5) Data (D)

(a) Data table control

[Format]

N630xxx Pnnnnn;
N6300xxx Pnnnnn;

[Data Contents]

N630xxx or N6300xxx Parameter Number

Parameter number		Contents
PMC Memory-A,B,C, DCSPMC	PMC Memory-D	
N630000	N6300000	The group number
N630002	N6300002	Parameter of group1
N630003	N6300003	Data type of group 1
N630004	N6300004	Data size of group 1 (byte)
N630006	N6300006	Start address of group 1
N630010	N6300010	Parameter of group2
N630011	N6300011	Data type of group 2
N630012	N6300012	Data size of group 2 (byte)
N630014	N6300014	Start address of group 2
…	…	…
N630002 + ((n-1)×8)	N6300002 + ((n-1)×8)	Parameter of group n
N630003 + ((n-1)×8)	N6300003 + ((n-1)×8)	Data type of group n
N630004 + ((n-1)×8)	N6300004 + ((n-1)×8)	Data size of group n (byte)
N630006 + ((n-1)×8)	N6300006 + ((n-1)×8)	Start address of group n
…	…	…
N630794	N6300794	Parameter of group 100
N630795	N6300795	Data type of group 100
N630796	N6300796	Data size of group 100 (byte)
N630798	N6300798	Start address of group 100

Pnnnnn Control data table address value.

The range of "The group number" is 1 to 100.
The range of "Table parameter" is 00000000 to 11111111.
The range of "Data type" is as follows.

Data type	Data table output format	Range
0	1 byte signed decimal number	-128 to 127
1	2 byte signed decimal number	-32768 to 32767
2	4 byte signed decimal number	-2147483648 to 2147483647
3	Binary notation	00000000 to 11111111

The range of "Data size" and "Start address" is as follows.

	1st to 5th path PMC				DCSPMC
	PMC Memory-A	PMC Memory-B	PMC Memory-C	PMC Memory-D	
Data Size	1 to 3000	1 to 10000	1 to 20000	1 to 60000	1 to 3000
Start address	0 to 2999	0 to 9999	0 to 19999	0 to 59999	0 to 2999

(Example)

N630000 P2;
N630002 P00000000;
N630003 P0;

N630004 P10;
N630006 P0;
N630010 P00000001;
N630011 P0;
N630012 P10;
N630014 P10;

(b) Data table
[Format]
N64xxxx Pnnnnn;
N64xxxxx Pnnnnn;

[Data Contents]
N64xxxx to N65xxxx or N64xxxxx Parameter number
Specify the sum of the data table address (D) offset and 640000 or 6400000. The number in the following table can be used.

	1st to 5th path PMC				DCSPMC
	PMC Memory-A	PMC Memory-B	PMC Memory-C	PMC Memory-D	
Data table	N640000 to N642999	N640000 to N649999	N640000 to N659999	N6400000 to N6459999	N640000 to N642999

Pnnnnn Data table address value
Its size depends on the "data type" of data table control data.

Data type	Data table output format	Range
0	1 byte signed decimal number	-128 to 127
1	2 byte signed decimal number	-32768 to 32767
2	4 byte signed decimal number	-2147483648 to 2147483647
3	Binary notation	00000000 to 11111111

(Example)
N640000 P-128;
N640001 P100;
N640002 P0;
.
N640010 P1000;
N640012 P-1;
.
N649992 P50000000;
N649996 P50000000;

(6) Extra memory (E)
You can choose how the extra relays are stored in PMC parameter file by settings of system keep relays as follows:

Output format of extra relays		Output extra relay K906.3	
		0 (yes)	**1 (no)**
Output extra relay control data K906.7	**0 (no)**	Byte format	No output
	1 (yes)	Table format	No output

In “Byte format”, all extra relays are stored as byte data, and no information of extra relay control data is included.

In “Table format”, extra relays are stored in the same manner as the data table; they are stored in the format according to the extra relay control data, and the information of the control data is also included.
If you choose “No output”, no information about extra relays are included in PMC parameter file.

> **NOTE**
> Extra relays (E) can be included only in PMC parameter output from 1st PMC.

The details of these formats are as follows:

(a) Byte format
[Format]
N69xxxx Pnnnnn;
N690xxxx Pnnnnn;

[Data Contents]
N69xxxx or N690xxxx Parameter number
Specify the sum of the offset number of the extra relay and 690000 or 6900000. The number in the following table can be used.

	1st to 5th path PMC				DCSPMC
	PMC Memory-A	PMC Memory-B	PMC Memory-C	PMC Memory-D	
Extra relay	N690000 to N699999	N690000 to N699999	N690000 to N699999	N6900000 to N6909999	N690000 to N699999

Pnnnnn The value of the extra relay
It is shown in signed decimal number. Its valid range is –128 to 127.

(Example)
N690000 P-128;
N690001 P100;
•
N699998 P127;
N699999 P0;
%

(b) Table format (Control data part)
[Format]
N635xxx Pnnnnn;
N6305xxx Pnnnnn;

[Data Contents]
N635xxx or N6305xxx Parameter Number

Parameter number		Contents
PMC Memory-A,B,C, DCSPMC	PMC Memory-D	
N635000	N6305000	The group number
N635002	N6305002	Parameter of group1
N635003	N6305003	Data type of group 1
N635004	N6305004	Data size of group 1 (byte)
N635006	N6305006	Start address of group 1

Parameter number		Contents
PMC Memory-A,B,C, DCSPMC	PMC Memory-D	
N635010	N6305010	Parameter of group2
N635011	N6305011	Data type of group 2
N635012	N6305012	Data size of group 2 (byte)
N635014	N6305014	Start address of group 2
…	…	…
N635002 + ((n-1)×8)	N6305002 + ((n-1)×8)	Parameter of group n
N635003 + ((n-1)×8)	N6305003 + ((n-1)×8)	Data type of group n
N635004 + ((n-1)×8)	N6305004 + ((n-1)×8)	Data size of group n (byte)
N635006 + ((n-1)×8)	N6305006 + ((n-1)×8)	Start address of group n
…	…	…
N635794	N6305794	Parameter of group 100
N635795	N6305795	Data type of group 100
N635796	N6305796	Data size of group 100 (byte)
N635798	N6305798	Start address of group 100

Pnnnnn Control data table address value.

The range of "The group number" is 1 to 100.
The range of "Table parameter" is 00000000 to 11111111.
The range of "Data type" is as follows.

Data type	Data table output format	Range
0	1 byte signed decimal number	-128 to 127
1	2 byte signed decimal number	-32768 to 32767
2	4 byte signed decimal number	-2147483648 to 2147483647
3	Binary notation	00000000 to 11111111

The range of "Data size" and "Start address" is as follows.

	1st to 5th path PMC				DCSPMC
	PMC Memory-A	PMC Memory-B	PMC Memory-C	PMC Memory-D	
Data Size	1 to 3000	1 to 10000	1 to 20000	1 to 60000	1 to 3000
Start address	0 to 2999	0 to 9999	0 to 19999	0 to 59999	0 to 2999

(Example)

N635000 P2;
N635002 P00000000;
N635003 P0;
N635004 P10;
N635006 P0;
N635010 P00000001;
N635011 P0;
N635012 P10;
N635014 P10;

(c) Table format (Extra relay part)

[Format]

N69xxxx Pnnnnn;

N690xxxx Pnnnnn;

[Data Contents]

N69xxxx or N690xxxx Parameter Number

Specify the sum of the offset number of the extra relay and 690000 or 6900000. The number in the following table can be used.

	1st to 5th path PMC				DCSPMC
	PMC Memory-A	PMC Memory-B	PMC Memory-C	PMC Memory-D	
Data table	N690000 to N699999	N690000 to N699999	N690000 to N699999	N6900000 to N6909999	N690000 to N699999

Pnnnnn The value of the extra relay

Its data size depends on the "Data type" of the control data that the extra relay belongs to.

Data type	Data table output format	Range
0	1 byte signed decimal number	-128 to 127
1	2 byte signed decimal number	-32768 to 32767
2	4 byte signed decimal number	-2147483648 to 2147483647
3	Binary notation	00000000 to 11111111

(Example)

N690000 P-128;
N690001 P100;
N690002 P0;
•
N690010 P1000;
N690012 P-1;
•
N699992 P50000000;
N699996 P50000000;

2.4 PARAMETERS FOR THE PMC SYSTEM

2.4.1 Setting Parameters

The parameters set up on the PMC SETTING screen are called the setting parameters. Part of the system keep relays described earlier can be set up using setting parameters.
This subsection describes the setting parameters for each setup menu.
See Section 9.5 for explanations about the setting screen and how to use it.

(1) Trace function start (K906.5 0: Manual. 1: Automatic.)
This item specifies whether to allow the trace function to be executed automatically when the power is turned on. The default setting is "Manual" (not automatic execution).

(2) Editing permit (K901.6 0: No. 1: Yes.)
This item specifies whether to enable the functions related to program editing. The default setting is "No" (not to enable).

(3) Save after edit (K902.0 0: No. 1: Yes.)
This item specifies whether to perform an automatic write to flash ROM after program editing. The default setting is "No" (not to perform an automatic write).

(4) Memory write permit (K900.4 0: No. 1: Yes.)
This item specifies whether to enable the forcing and override functions. The default setting is "No" (not to enable).

NOTE
Using the override function requires setting "Override enable" (K906.0).

(5) Data table GRP setting display (K900.7 0: Yes. 1: No.)
This item specifies whether to display the DATA TABLE CONTROL screen. The default setting is "Yes" (to display).

(6) PMC parameter view inhibit (K902.6 0: No. 1: Yes.)
This item specifies whether to inhibit the PMC PARAM screens (TIMER, COUNTER, KEEP RELAY, DATA TABLE screens) from being displayed and the PMC parameter data from being sent to the outside. The default setting is "No" (not to inhibit).

(7) PMC parameter change inhibit (K902.7 0: No. 1: Yes.)
This item specifies whether to inhibit data from being input from the PMC PARAM screens (TIMER, COUNTER, KEEP RELAY, and DATA TABLE screens) and the PMC parameter data from being input from the outside. The default setting is "No" (no to inhibit).

(8) PMC program view inhibit (K900.0 0: No. 1: Yes.)
This item specifies whether to inhibit the sequence program from being viewed. The default setting is "No" (not to inhibit).

(9) IO GROUP SELECTION screen (K906.1 0: Hide. 1: Display.)
This item specifies whether to display the selectable I/O Link assignment function setting screen or the I/O configuration viewer (I/O link *i* selectable I/O). The default setting is "Hide" (not to display).

(10) PMC program execute (K900.2 0: Automatic. 1: Manual.)
This item specifies whether to cause the sequence program to be started automatically when the power is turned on. The default setting is "Automatic" (to cause automatic start).

(11) PMC stop enable (K902.2 0: No. 1: Yes.)
This item specifies whether to allow the sequence program to start/stop. The default setting is "No" (not to allow).

(12) Programmer function enable (K900.1 0: No. 1: Yes.)
This item specifies whether to enable the built-in programmer function. The default setting is "No" (not to enable).

(13) Override enable (K906.0 0: No. 1: Yes.)
This item specifies whether to enable the override function. The default setting is "No" (not to enable).

NOTE
Using the override function requires setting "Memory write permit" (K900.4).

(14) I/O configuration data edit enable (K907.0 0: No. 1: Yes.)
This item specifies whether to enable the editing of I/O configuration data. The default setting is "No" (not to enable).

(15) I/O device configuration register enable (K935.1 0: No. 1: Yes.)
This item specifies whether to enable the register/deletion of I/O device configuration. The default setting is "No" (not to enable).

(16) Message shift amount (K918, K919)
This item specifies how much to shift the message display request bits in displaying language-specific information, using the DISPB functional instruction. No default setting is available.

(17) Message shift start address (K916, K917)
This item lets you input the start bit address for the area of message display request bits to be shifted in displaying language-specific information, using the DISPB functional instruction. No default setting is available.

(18) Selectable I/O Link assignment function: Selecting a valid group: (K920-K927 0:No. 1:Yes.)
This item specifies a group to be enabled or disabled for the selectable I/O Link assignment function for individual addresses. The default setting is 0 (disable) for all groups.

See subsection 3.2.5 for the selectable I/O Link assignment function.

(19) Keep relay (system) (K906.6 0: Hide. 1: Show.)
If you set " KEEP RELAY (SYSTEM)" to "SHOW", The KEEP RELAY (K900-K919) screen is enabled.
The default setting is "Hide" (not to display).

2.4.2 PMC System Parameters

The parameters set up on the PMC SYSTEM PARAMETER screen are called the system parameters.
This subsection describes the system parameters for each setup menu.
See Section 9.8 for explanations about the how to operate the SYSTEM PARAMETER screen.

(1) Counter type
This item specifies the data type of a counter value used on the COUNTER screen (CTR functional instruction). It can be represented in either binary or BCD form.

(2) FS0-compatible operator's panel
This item specifies whether to connect an operator's panel for the FS0. If the setting is "Yes", specify also the DI/DO address to which the operator's panel is actually connected, the address of the KEY image transferred from the operator's panel, and the address of the LED image to be transferred to the operator's panel.

(a) DI address
This item specifies the start address of the external DI to which the operator's panel is actually connected, using PMC addresses (X0 to X127, X200 to X327, X400 to X527, or X600 to X727).

(b) DO address
This item specifies the start address of the external DO to which the operator's panel is actually connected, using PMC addresses (Y0 to Y127, Y200 to Y327, Y400 to Y527, or Y600 to Y727).

(c) Key input image address
This item specifies the start address of the KEY image to be referenced by the user program, using a PMC address. Usually, set up an arbitrary internal relay (R) area.

(d) LED output image address
This item specifies the start address of the LED image generated by the user program, using PMC addresses. Usually, set up an arbitrary internal relay area (R).

(3) Selectable I/O Link assignment function
This item specifies whether to enable/disable the selectable I/O Link assignment function for each address and the number of the related basic groups.

(a) Function enable
This item specifies whether to enable/disable the selectable I/O Link assignment function.

(b) Number of basic groups
This item specifies the number of groups that are always enabled no matter what machine configuration is employed.

See subsection 3.2.5 for explanations about the selectable I/O Link assignment function.

2.4.3 CNC Parameters Related to the PMCs

The CNC parameters related to the PMCs can be divided into those for controlling communication with FANUC LADDER-III and ladder editing package and those for setting up the PMCs.

The following table summaries the CNC parameters related to the PMCs.

Table 2.4.3 (a) Summary of the CNC parameters related to the PMCs

No.	Use	Remarks
24	Setting up communication with ladder development tools	PMC online connection function
11900 to 11904	Execution sequence for multiple PMCs	1st to 5th path PMC
11905 to 11909	Percent execution time for multiple PMCs	1st to 5th path PMC
11910 to 11912	I/O Link input/output address	Channels 1 to 3
11914 (Note)	2nd, 3rd level execution cycle of ladder	Common to 1st to 5th path PMC
11915 to 11917	Input/output address of dual assignment of I/O Link channel	Second Block of Channels 1 to 3
11920 to 11929	CNC interface control address	CNC10 system
11930	Ladder 1st level execution period	1st to 5th path PMC
11931#0	Run/stop of Ladder	1st to 5th path PMC
11931#1	The display number of external alarms/operator messages	External data input, External message
11931#5	Ladder dividing management function	Common to 1st to 5th path PMC
11931#7	Clearing of PMC nonvolatile memory	
11932	Multi path PMC interface	
11933#0,#1	I/O Link communication method	Channel 1, 2
11933#5	Running/stopping of ladder program when updating	
11936	The number of PMC paths	
11937 to 11939	The input / output address used by network devices	1st to 5 th path PMC, X/Y0 to 727
11940 to 11944	PMC Memory Type	1st to 5th path PMC
11945 (Note)	The PMC path that the 1st level execution cycle in 1ms or 2ms is applied when using multi-path PMC function.	1st to 5th path PMC
11946 (Note)	The divided ladder that the 1st level execution cycle in 1ms or 2ms is applied when using ladder dividing management function.	Divided ladder program 1 to 99

NOTE
These parameters are unavailable for the series 0*i*-F.

Communication parameters

00024	Setting up communication with ladder development tools (FANUC LADDER-III and ladder editing package)

[Input type] Setting input
[Data type] Integer
[Valid data range] 0 to 255

This item specifies whether to enable/disable the PMC online connection function. Entering this parameter makes it possible to enable/disable the PMC online setup function without displaying the PMC online setup screen.

Setting	RS-232C	High-speed interface
0	The settings on the PMC online setup screen are changed.	
1	To be used (channel 1)	Not to be used
2	To be used (channel 2)	Not to be used
10	Not to be used	To be used
11	To be used (channel 1)	To be used
12	To be used (channel 2)	To be used
255	Communication is forced to stop (equivalent to the [EMG STOP] soft key).	

NOTE

1 The setting of this parameter is put into effect when it is changed or the power is turned on. It is unnecessary to turn the power off and on again after the parameter is re-set.
2 The setting changed on the PMC online setup screen is not reflected to this parameter.
3 As for the RS-232C, the communication settings, such as a baud rate, specified on the PMC online setup screen are valid. The valid settings are a baud rate of 9600 bps, no parity, and two stop bits if no change has been made on the PMC online setup screen since installation.

PMC setup parameters

Execution sequence for multiple PMCs

11900	PMC having the first priority in execution sequence
11901	PMC having the second priority in execution sequence
11902	PMC having the third priority in execution sequence
11903	PMC having the fourth priority in execution sequence
11904	PMC having the fifth priority in execution sequence

NOTE
Once any of these parameters is re-set, it is necessary to turn the power off and on again.

[Input type] Parameter input
[Data type] Integer
[Valid data range] 0 to 5

This item specifies the execution sequence for each PMC if the multi-path PMC function is used.

Setting	PMC
0	Standard setting (see below)
1	1st PMC
2	2nd PMC
3	3rd PMC
4	4th PMC
5	5th PMC

When all these parameters are 0, the standard execution sequence setting shown below is used.

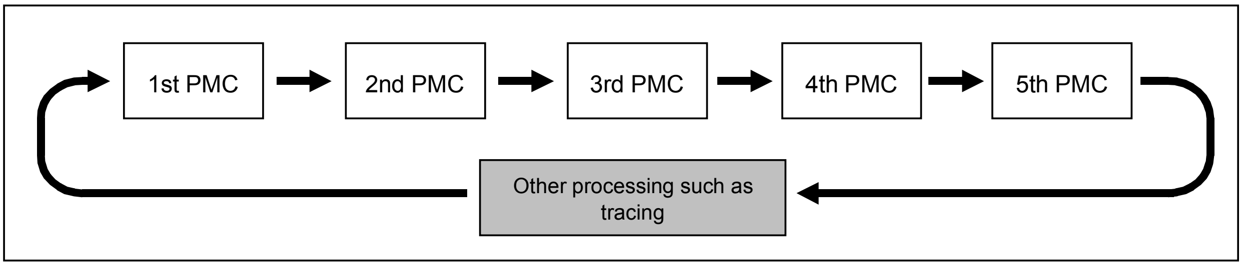


Fig. 2.4.3 (a) Standard execution sequence for multiple PMCs

⚠ **CAUTION**
If any of these parameters is nonzero, a duplicate or missing number results in the PMC alarm "ER50 PMC EXECUTION ORDER ERROR", thus disabling all the PMCs from starting.

Percent execution time for multiple PMCs

11905	Percent execution time for the PMC having the first priority in execution sequence
11906	Percent execution time for the PMC having the second priority in execution sequence
11907	Percent execution time for the PMC having the third priority in execution sequence
11908	Percent execution time for the PMC having the fourth priority in execution sequence
11909	Percent execution time for the PMC having the fifth priority in execution sequence

NOTE
Once any of these parameters is re-set, it is necessary to turn the power off and on again.

[Input type] Parameter input
[Data type] Byte
[Valid data range] 0 to 100

This item specifies the percent execution time for each PMC if the multi-path PMC function is used.

When all these parameters are 0, the standard execution time settings listed below are used.

Table 2.4.3 (b) Standard settings of the percent execution time for multiple PMCs

The number of PMC path	PMC path of the 1st order of execution	PMC path of the 2nd order of execution	PMC path of the 3rd order of execution	PMC path of the 4th order of execution	PMC path of the 5th order of execution
1 path	100%				
2 paths	85%	15%			
3 paths	75%	15%	10%		
4 paths	70%	10%	10%	10%	
5 paths	60%	10%	10%	10%	10%

NOTE
1. If these parameters are set to too low a value, it may be impossible to start the first level on every scan.
2. Even if you input the same program in both second and third PMC, the scan time of both programs may not correspond because of changing of the waiting time by execution timing.
3. If the sum of these parameter settings exceeds 100, the PMC alarm "ER51 PMC EXECUTION PERCENTAGE ERROR" occurs, thus disabling all PMC from starting.
4. When using the Common PMC Memory mode, the execution time of those PMCs are merged, and programs are sequentially executed within the merged time.

I/O Link input/output addresses

11910	I/O Link channel 1 input/output addresses

11911	I/O Link channel 2 input/output addresses

11912	I/O Link channel 3 input/output addresses

NOTE
Once any of these parameters is re-set, it is necessary to turn the power off and on again.

[Input type] Parameter input
[Data type] Word
[Valid data range] 0, 100 to 103, 200 to 203, 300 to 303, 400 to 403, 500 to 503, 900

This item specifies input/output addresses for an I/O Link channel.
The channel in which I/O Link *i* is used is not required this item.

Table 2.4.3 (c) I/O Link channel input/output addresses

Setting	Input/output address
0	Standard setting (see below)
100	X0 to X127/Y0 to Y127 for the 1st PMC
101	X200 to X327/Y200 to Y327 for the 1st PMC
102	X400 to X527/Y400 to Y527 for the 1st PMC
103	X600 to X727/Y600 to Y727 for the 1st PMC
200	X0 to X127/Y0 to Y127 for the 2nd PMC
201	X200 to X327/Y200 to Y327 for the 2nd PMC
202	X400 to X527/Y400 to Y527 for the 2nd PMC
203	X600 to X727/Y600 to Y727 for the 2nd PMC
300	X0 to X127/Y0 to Y127 for the 3rd PMC
301	X200 to X327/Y200 to Y327 for the 3rd PMC
302	X400 to X527/Y400 to Y527 for the 3rd PMC
303	X600 to X727/Y600 to Y727 for the 3rd PMC
400	X0 to X127/Y0 to Y127 for the 4th PMC
401	X200 to X327/Y200 to Y327 for the 4th PMC
402	X400 to X527/Y400 to Y527 for the 4th PMC
403	X600 to X727/Y600 to Y727 for the 4th PMC
500	X0 to X127/Y0 to Y127 for the 5th PMC
501	X200 to X327/Y200 to Y327 for the 5th PMC
502	X400 to X527/Y400 to Y527 for the 5th PMC
503	X600 to X727/Y600 to Y727 for the 5th PMC
900	X0 to X127/Y0 to Y127 for the dual-check safety PMC

If all these parameters are 0, all channels are assigned to the 1st PMC (standard setting) as shown below.

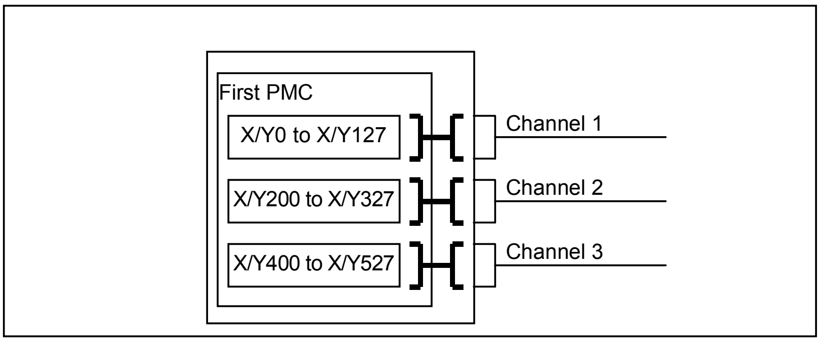


Fig. 2.4.3 (b) Standard input/output address setting for the I/O Link channel

> ⚠ **CAUTION**
> 1 If any of these parameters is nonzero, a duplicate number results in the PMC alarm "ER52 I/O Link CHANNEL ASSIGNMENT ERROR", thus disabling all the PMCs from starting.
> 2 If these parameters are not set up in part, it is impossible to assign a PMC address to the related channel.

2nd, 3rd level execution cycle

11914	2nd / 3rd level execution cycle of ladder

> **NOTE**
> 1 Once this parameter is set, it is necessary to turn off and on the power.
> 2 This parameter is unavailable for the series 0*i*-F.

[Input type] Byte input
[Data type] Byte
[Valid data range] 0, 2, 4

When using the 1st level of ladder execution cycle in 2ms, the execution cycle of the following ladder programs is specified.
- 2nd level ladder of all
- 3rd level ladder of all
- The 1st level of ladder when using the Ladder Dividing Management Function or Multi-path PMC Function and not using the 1st level of ladder execution cycle in 2ms.

Setting	Meaning
2	Executed at a 2ms cycle.
4	Executed at a 4ms cycle.
0	Executed at a standard (4ms) cycle.

> ⚠ **CAUTION**
> 1 Setting this parameter to a value other than 0, 2, or 4 results in the PMC alarm "ER55 LADDER EXECUTION CYCLE SETTING ERROR", and all PMCs are not executed.

Input/output addresses of dual assignment of I/O Link channel

11915	Input/output addresses of the second block of I/O Link channel 1
11916	Input/output addresses of the second block of I/O Link channel 2
11917	Input/output addresses of the second block of I/O Link channel 3

NOTE

Once any of these parameters is re-set, it is necessary to turn the power off and on again.

[Input type] Parameter input
[Data type] Word
[Valid data range] 0, 100 to 103, 200 to 203, 300 to 303, 400 to 403, 500 to 503

This item specifies input/output addresses for an I/O Link channel.
The channel in which I/O Link *i* is used is not required this item.

Table 2.4.3 (d) I/O Link channel input/output addresses

Setting	Input/output address
0	Standard setting (see below)
100	X0 to X127/Y0 to Y127 for the 1st PMC
101	X200 to X327/Y200 to Y327 for the 1st PMC
102	X400 to X527/Y400 to Y527 for the 1st PMC
103	X600 to X727/Y600 to Y727 for the 1st PMC
200	X0 to X127/Y0 to Y127 for the 2nd PMC
201	X200 to X327/Y200 to Y327 for the 2nd PMC
202	X400 to X527/Y400 to Y527 for the 2nd PMC
203	X600 to X727/Y600 to Y727 for the 2nd PMC
300	X0 to X127/Y0 to Y127 for the 3rd PMC
301	X200 to X327/Y200 to Y327 for the 3rd PMC
302	X400 to X527/Y400 to Y527 for the 3rd PMC
303	X600 to X727/Y600 to Y727 for the 3rd PMC
400	X0 to X127/Y0 to Y127 for the 4th PMC
401	X200 to X327/Y200 to Y327 for the 4th PMC
402	X400 to X527/Y400 to Y527 for the 4th PMC
403	X600 to X727/Y600 to Y727 for the 4th PMC
500	X0 to X127/Y0 to Y127 for the 5th PMC
501	X200 to X327/Y200 to Y327 for the 5th PMC
502	X400 to X527/Y400 to Y527 for the 5th PMC
503	X600 to X727/Y600 to Y727 for the 5th PMC

If these parameters are 0, the dual assignment of I/O link channel is invalid.

⚠ CAUTION

1 If any of these parameters and parameter no. 11910 to 11913 is nonzero, a duplicate number results in the PMC alarm "ER52 I/O Link CHANNEL ASSIGNMENT ERROR", thus disabling all the PMCs from starting.
2 If the second block of channel 3 is used in the 1st to 5th path PMC when the first block of channel 3 is used in DCS PMC, do not assign to the safe-related I/O signals of DCS function.

CNC-PMC interface

11920	CNC-PMC interface 1 input/output address
11921	CNC-PMC interface 2 input/output address
11922	CNC-PMC interface 3 input/output address
11923	CNC-PMC interface 4 input/output address
11924	CNC-PMC interface 5 input/output address
11925	CNC-PMC interface 6 input/output address
11926	CNC-PMC interface 7 input/output address
11927	CNC-PMC interface 8 input/output address
11928	CNC-PMC interface 9 input/output address
11929	CNC-PMC interface 10 input/output address

NOTE
Once any of these parameters is re-set, it is necessary to turn the power off and on again.

[Input type] Parameter input
[Data type] Word
[Valid data range] 0, 100 to 109, 200 to 209, 300 to 309, 400 to 409, 500 to 509

This item assigns a PMC F/G address to a CNC F/G address.

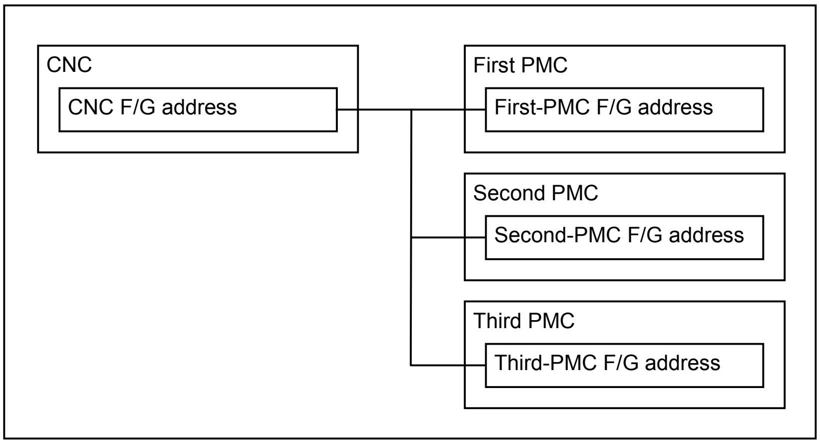


Fig. 2.4.3 (c) CNC-PMC interface assignment concept

Table 2.4.3 (e) CNC-PMC interface input/output address

Setting	Input/output address
0	Standard setting (see below)
100	F0 to 767/G0 to G767 for the 1st PMC
101	F1000 to F1767/G1000 to G1767 for the 1st PMC

Setting	Input/output address
102	F2000 to F2767/G2000 to G2767 for the 1st PMC
103	F3000 to F3767/G3000 to G3767 for the 1st PMC
104	F4000 to F4767/G4000 to G4767 for the 1st PMC
105	F5000 to F5767/G5000 to G5767 for the 1st PMC
106	F6000 to F6767/G6000 to G6767 for the 1st PMC
107	F7000 to F7767/G7000 to G7767 for the 1st PMC
108	F8000 to F8767/G8000 to G8767 for the 1st PMC
109	F9000 to F9767/G9000 to G9767 for the 1st PMC
200	F0 to F767/G0 to G767 for the 2nd PMC
201	F1000 to F1767/G1000 to G1767 for the 2nd PMC
202	F2000 to F2767/G2000 to G2767 for the 2nd PMC
203	F3000 to F3767/G3000 to G3767 for the 2nd PMC
204	F4000 to F4767/G4000 to G4767 for the 2nd PMC
205	F5000 to F5767/G5000 to G5767 for the 2nd PMC
206	F6000 to F6767/G6000 to G6767 for the 2nd PMC
207	F7000 to F7767/G7000 to G7767 for the 2nd PMC
208	F8000 to F8767/G8000 to G8767 for the 2nd PMC
209	F9000 to F9767/G9000 to G9767 for the 2nd PMC
300	F0 to F767/G0 to G767 for the 3rd PMC
301	F1000 to F1767/G1000 to G1767 for the 3rd PMC
302	F2000 to F2767/G2000 to G2767 for the 3rd PMC
303	F3000 to F3767/G3000 to G3767 for the 3rd PMC
304	F4000 to F4767/G4000 to G4767 for the 3rd PMC
305	F5000 to F5767/G5000 to G5767 for the 3rd PMC
306	F6000 to F6767/G6000 to G6767 for the 3rd PMC
307	F7000 to F7767/G7000 to G7767 for the 3rd PMC
308	F8000 to F8767/G8000 to G8767 for the 3rd PMC
309	F9000 to F9767/G9000 to G9767 for the 3rd PMC
400	F0 to F767/G0 to G767 for the 4th PMC
401	F1000 to F1767/G1000 to G1767 for the 4th PMC
402	F2000 to F2767/G2000 to G2767 for the 4th PMC
403	F3000 to F3767/G3000 to G3767 for the 4th PMC
404	F4000 to F4767/G4000 to G4767 for the 4th PMC
405	F5000 to F5767/G5000 to G5767 for the 4th PMC
406	F6000 to F6767/G6000 to G6767 for the 4th PMC
407	F7000 to F7767/G7000 to G7767 for the 4th PMC
408	F8000 to F8767/G8000 to G8767 for the 4th PMC
409	F9000 to F9767/G9000 to G9767 for the 4th PMC
500	F0 to F767/G0 to G767 for the 5th PMC
501	F1000 to F1767/G1000 to G1767 for the 5th PMC
502	F2000 to F2767/G2000 to G2767 for the 5th PMC
503	F3000 to F3767/G3000 to G3767 for the 5th PMC
504	F4000 to F4767/G4000 to G4767 for the 5th PMC
505	F5000 to F5767/G5000 to G5767 for the 5th PMC
506	F6000 to F6767/G6000 to G6767 for the 5th PMC
507	F7000 to F7767/G7000 to G7767 for the 5th PMC
508	F8000 to F8767/G8000 to G8767 for the 5th PMC
509	F9000 to F9767/G9000 to G9767 for the 5th PMC

If all these parameters are 0, the standard setting is used, that is, "CNC F/G address = 1st PMC F/G address" is satisfied.

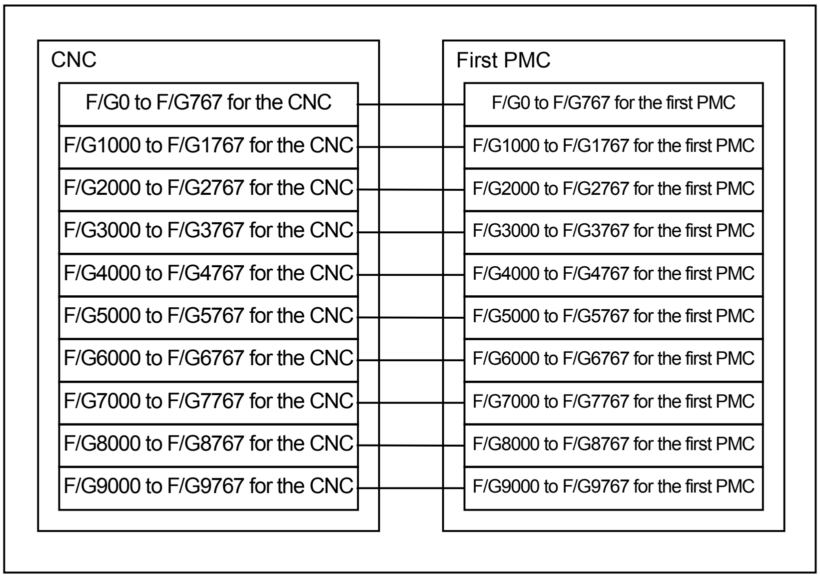


Fig. 2.4.3 (d) CNC-PMC interface initial settings

> ⚠ **CAUTION**
> 1 If any of these parameters is nonzero, a duplicate number results in the PMC alarm "ER54 NC-PMC I/F ASSIGNMENT ERROR", thus disabling all the PMCs from starting.
> 2 If these parameters are not set up in part, it is impossible to assign a PMC address to the related CNC F/G address.

Level 1 execution period

11930	Ladder level execution period

> **NOTE**
> Once this parameter is re-set, it is necessary to turn the power off and on again.

[Input type] Byte input
[Data type] Byte
[Valid data range] 0, 1, 2, 4, 8

This item specifies an execution period for ladder level 1.

Setting	Meaning
1 (Note2,3)	Executed at a 1ms cycle.
2 (Note2,3)	Executed at a 2ms cycle.
4	Executed at a 4-msec interval.
0, 8	Executed at an 8-msec interval.

NOTE
1 The level 1 execution period cannot be set for each PMC path independently.
2 Refer to "1.8" when this parameter is set to a value "1" or "2".
3 The value "1" and "2" are unavailable for the series 0*i*-F.

⚠ **CAUTION**
1 Setting this parameter to a value other than 0,1,2,4, or 8 results in the PMC alarm "ER55 LEVEL1 EXECUTION CYCLE ERROR", and all PMCs are not executed.

Start or stop of the ladder

	#7	#6	#5	#4	#3	#2	#1	#0
11931	NMC		LDV				M16	PCC

[Data type] Bit

#0 PCC This item specifies start or stop of the ladder as follows:
0: The ladder is started or stopped independently for each PMC.
1: The ladders in all PMCs are started or stopped together.

NOTE
1 Once this parameters is re-set, it is necessary to turn the power off and on again.
2 When using the Common PMC Memory mode, those programs are started or stopped together regardless of this parameter.

#1 M16 For the external data input function or the external message function, the maximum number of the external alarm messages and the external operator's messages which can be displayed is as follows:
0: 4
1: 16

#**5 LDV** Ladder dividing management function is:
0: Not available
1: Available

NOTE
If this parameter changed, it is necessary to turn the power off and on again. When setting to "0" in this parameter, the divided ladder programs in the flash ROM are ignored and only main ladder program is executed and displayed.

#7 NMC When the PMC alarm "ER09 PMC LABEL CHECK ERROR" occurs, the nonvolatile memory of PMC is cleared by:
0: Turning on power of CNC with pressing "O" and "Z" MDI keys
1: Turning on power of CNC without any operation

> **NOTE**
> Set NMC = 0 generally.
> If you change some PMC setting, such as number of PMC paths, PMC memory type, etc., the PMC alarm "ER09 PMC LABEL CHECK ERROR" occurs and nonvolatile memory of PMC have to be cleared. To clear the nonvolatile memory of PMC, you have to turn on power of CNC with pressing "O" and "Z" MDI keys generally.
> If NMC = 1, the nonvolatile memory of PMC is cleared automatically at the turning on power of CNC when the PMC alarm "ER09" occurs. Note that the setting NMC = 1 may cause undesirable clear of nonvolatile memory of PMC by unintended change of PMC setting.

Multi-path PMC interface

11932	Multi-path PMC interface

> **NOTE**
> Once this parameters is re-set, it is necessary to turn the power off and on again.

[Input type] Parameter input
[Data type] Integer
[Valid data range] 0, 1, 2, 3

Select the PMC path to use the Multi-path PMC interface.

Setting	Meaning
0	Not use the Multi-path PMC interface
1	Use the Multi-path PMC interface between 1ST and 2ND PMC.
2	Use the Multi-path PMC interface between 1ST and 3RD PMC.
3	Use the Multi-path PMC interface between 2ND and 3RD PMC.

> ⚠**CAUTION**
> When you set an inappropriate value to this parameter, the PMC alarm "ER57 MULTI-PATH PMC I/F ASSIGNMENT ERROR" occurs and all PMC paths are stopped.
> If the PMC path specified by this parameter is not available, the PMC alarm "ER57 MULTI-PATH PMC I/F ASSIGNMENT ERROR" also occurs and all PMC paths are stopped.

> **NOTE**
> When using the Common PMC Memory mode, this function is unavailable between those PMCs.

Communication method with I/O device
Running/stopping of ladder program when updating

	#7	#6	#5	#4	#3	#2	#1	#0
11933			SRL				C2T	C1T

[Input type] Parameter input
[Data type] Bit

> **NOTE**
> Once these parameters are re-set, it is necessary to turn the power off and on again.

#0 C1T Specifies the communication method of channel 1.
0 : I/O Link is used.
1 : I/O Link *i* is used.

#1 C2T Specifies the communication method of channel 2.
0 : I/O Link is used.
1 : I/O Link *i* is used.

> **NOTE**
> 1 When you set the channel to “use I/O Link”, set the parameter no.11910 to 11912, also.
> 2 For the series 0*i*-F, the default value of these parameters is “1”.

#5 SRL When reading a ladder program in the I/O screen or by other operations:
0 : The execution of the ladder program is stopped automatically.
1 : The execution of the ladder program is not stopped. The ladder program is exchanged and running continuously after the completion of reading of the ladder program.

> **NOTE**
> 1 When you set the channel to “use I/O Link”, set the parameter no.11910 to 11912, also.
> 2 For the series 0*i*-F, the default value of these parameters is “1”.

The number of PMC paths

11936	The number of PMC paths

> **NOTE**
> Once this parameter is re-set, it is necessary to turn the power off and on again.

[Data type] Integer
[Valid data range] 0, 1, 2, 3, 4, 5

This item specifies the number of PMC paths within the option of multi-path PMC function. When the value is 0 or out of valid data range, all of PMC paths which is specified by a multi-path PMC option is effective.

The input / output address used by network device

	#7	#6	#5	#4	#3	#2	#1	#0
11937	P24	P23	P22	P21	P14	P13	P12	P11

[Data type] Bit

Input and output signals of network devices, such as Profibus, Profinet or iPendant etc., can be assigned to X/Y address area, such as X0-X127/Y0-Y127 or X200-327/Y200-327 etc. Network devices can be assigned to the X/Y address area to which any I/O Link and I/O Link *i* devices are not assigned.

When you assign network device to X/Y address area, you have to set 1 to this parameter for the corresponding area.

#0 P11 X/Y 0 to 127 of the 1st path PMC are:
0: Not used
1: Used

#1 P12 X/Y 200 to 327 of the 1st path PMC are:
0: Not used
1: Used

#2 P13 X/Y 400 to 527 of the 1st path PMC are:
0: Not used
1: Used

#3 P14 X/Y 600 to 727 of the 1st path PMC are:
0: Not used
1: Used

#4 P21 X/Y 0 to 127 of the 2nd path PMC are:
0: Not used
1: Used

#5 P22 X/Y 200 to 327 of the 2nd path PMC are:
0: Not used
1: Used

#6 P23 X/Y 400 to 527 of the 2nd path PMC are:
0: Not used
1: Used

#7 P24 X/Y 600 to 727 of the 2nd path PMC are:
0: Not used
1: Used

	#7	#6	#5	#4	#3	#2	#1	#0
11938	P44	P43	P42	P41	P34	P33	P32	P31

[Data type] Bit

#0 P31 X/Y 0 to 127 of the 3rd path PMC are:
0: Not used
1: Used

#1 **P32** X/Y 200 to 327 of the 3rd path PMC are:
0: Not used
1: Used

#2 **P33** X/Y 400 to 527 of the 3rd path PMC are:
0: Not used
1: Used

#3 **P34** X/Y 600 to 727 of the 3rd path PMC are:
0: Not used
1: Used

#4 **P41** X/Y 0 to 127 of the 4th path PMC are:
0: Not used
1: Used

#5 **P42** X/Y 200 to 327 of the 4th path PMC are:
0: Not used
1: Used

#6 **P43** X/Y 400 to 527 of the 4th path PMC are:
0: Not used
1: Used

#7 **P44** X/Y 600 to 727 of the 4th path PMC are:
0: Not used
1: Used

	#7	#6	#5	#4	#3	#2	#1	#0
11939					P54	P53	P52	P51

[Data type] Bit

#0 **P51** X/Y 0 to 127 of the 5th path PMC are:
0: Not used
1: Used

#1 **P52** X/Y 200 to 327 of the 5th path PMC are:
0: Not used
1: Used

#2 **P53** X/Y 400 to 527 of the 5th path PMC are:
0: Not used
1: Used

#3 **P54** X/Y 600 to 727 of the 5th path PMC are:
0: Not used
1: Used

NOTE

1 Once these parameters are set, it is necessary to turn off and on the power.
2 This parameter should be set only for the X /Y address area to which the network device is assigned, because this parameter may affect the ladder execution performance.
3 Network devices cannot be assigned to the X/Y address area to which any I/O Link and I/O Link *i* are assigned.
4 In case of using I/O Link *i*, assign network devices to the X/Y address area to which any I/O Link *i* devices are not assigned, then set this parameter for corresponding area.
5 In case of using I/O Link and the parameter No.11910-11912 are set to 0 (default setting), I/O Link devices are assigned to X0-X127/Y0-Y127, X200-X327/Y200-Y327 and X400-X527/Y400-Y527 area of 1st PMC path. In this case for 1st PMC path, network devices can only be assigned to X600-X727/Y600-Y727 area.
If all parameters are not set to 0, network devices can be assigned to the X/Y address area to which any I/O Link channels are not assigned, and set this parameter for corresponding area accordingly.
Example) When I/O Link channel 1 is assigned to X0-X127/Y0-Y127 of 1st PMC path, and network device can be assigned to X200-327/Y200-327,
set the parameter No.11910=100, No.11911=0, No.11912=0, No.11937#1=1.

PMC Memory Type

11940	PMC Memory Type of 1st PMC
11941	PMC Memory Type of 2nd PMC
11942	PMC Memory Type of 3rd PMC
11943	PMC Memory Type of 4th PMC
11944	PMC Memory Type of 5th PMC

NOTE

Once this parameters is re-set, it is necessary to turn the power off and on again.

[Input type] Parameter input
[Data type] Integer
[Valid data range] -1, 0, 1, 2, 3, 4

Select a PMC Memory Type of each PMC path. Refer to "Table 2.1.1 Basic specification of each PMC Memory Type" for details of each PMC Memory Type.

Setting	Meaning
0	Use standard setting of PMC Memory Type.
1	Use PMC Memory-A.
2	Use PMC Memory-B.
3	Use PMC Memory-C.
4	Use PMC Memory-D.

Setting	Meaning
-1	The 2nd to 5th paths PMC share the PMC Memory with 1st path PMC.

The following is the selectable PMC memory types in each PMC path.

1st path PMC	2nd to 5th path PMC	Remark
PMC-memory B (default) PMC-memory C (note)	PMC-memory A (default) PMC-memory B PMC-memory C (note) Shared with 1st path PMC	You can specify up to three paths both of PMC-memory B and C in total.
PMC-memory D (note)	Shared with 1st path PMC	

⚠ **CAUTION**

1. Setting an invalid value to this parameter results in the PMC alarm "ER58 PMC MEMORY TYPE SETTING ERROR" and all sequence programs for each PMC will not be started.
2. PMC nonvolatile memory must be initialized after changing PMC Memory Type. Therefore, make a backup of PMC parameter before changing PMC Memory Type. Refer to the "2.7 DATA BACKED UP BY THE BATTERY" of PMC Programming Manual about the operation of initializing PMC nonvolatile memory.

NOTE

1. To use all data table area as nonvolatile memory with PMC Memory-C/D, specify the option "Nonvolatile PMC data table area expansion (40KB)". If this option does not be specified, the expanded data table area (D10000 or more) does not keep the memory after rebooting CNC.

The PMC path that the 1st level execution cycle in 1ms or 2ms is applied when using multi-path PMC function

11945	The PMC path that the 1st level execution cycle in 1ms or 2ms is applied when using multi-path PMC function

NOTE

1. Once this parameter is set, it is necessary to turn off and on the power.
2. This parameter is unavailable for the series 0*i*-F.

[Data type] Integer
[Valid data range] 0, 1 to 5

When using the 1st level execution cycle in 1ms, 2ms and the Multi-path PMC Function, the PMC path that 1st level of ladder executed in 1ms or 2ms cycle is specified.
If 0 is set for this parameter, the 1st path PMC is selected.

NOTE

1. Refer to "3 The 1st level execution cycles of ladder in 1ms/2ms" of this document about operation of the Ladder 1st level execution cycle in 1ms or 2ms.
2. When you use the ladder dividing management function, set CNC parameter No.11946.

⚠ **CAUTION**

Setting this parameter to an invalid value results in the PMC alarm "ER55 LADDER EXECUTION CYCLE SETTING ERROR", and all PMCs are not executed.

The divided ladder that the 1st level execution cycle in 1ms or 2ms is applied when using ladder dividing management function

11946	The divided ladder that the 1st level execution cycle in 1ms or 2ms is applied when using ladder dividing management function

NOTE

1. Once this parameter is set, it is necessary to turn off and on the power.
2. This parameter is unavailable for the series 0*i*-F.

[Data type] Integer
[Valid data range] 0, 1 to 99

When using the 1st level execution cycle in 1ms, 2ms and the ladder dividing management function, the divided ladder (or main ladder program) that 1st level of ladder executed in 1ms or 2ms cycle is specified.
If 0 is set for this parameter, the main ladder program is selected.

NOTE

1. Refer to "1.8" for operation of the Ladder 1st level execution cycle in 1ms or 2ms.
2. When you use the multi-path PMC function, set CNC parameter No.11945.

⚠ **CAUTION**

Setting this parameter to an invalid value results in the PMC alarm "ER55 LADDER EXECUTION CYCLE SETTING ERROR", and all PMCs are not executed.

2.5 COMPATIBILITY BETWEEN PMC MEMORY TYPE

2.5.1 Compatibility between PMC Memory-A and PMC Memory-B

The sequence program for the PMC Memory-B has highly compatibility of the source program with the one for the PMC Memory-A.
You can convert a sequence program for the PMC Memory-A to one for the PMC Memory-B by using the conversion function of FANUC LADDER-III.

> ⚠ **WARNING**
> A little difference of execution timing may exist between PMC Memory Types. Therefore, you should check again whether the program works correctly after changing the PMC Memory Types even if the program worked fine before changing the PMC Memory Type.

PMC parameter compatibility

PMC parameters outputted from on the PMC Memory-A can be loaded into the PMC Memory-B without any modification.
When loading PMC parameters outputted on the PMC Memory-B to the PMC Memory-A, the data outside the address range will be lost.

2.5.2 Compatibility between PMC Memory-B and PMC Memory-C/D

The sequence program for the PMC Memory-C and PMC Memory-D has highly compatibility of the source program with the one for the PMC Memory-B.
A sequence program for the PMC Memory-B can be used on the PMC Memory-C or PMC Memory-D by converting PMC type and changing addresses R9000 - R9499 to Z0 - Z499 with FANUC LADDER-III.

> ⚠ **WARNING**
> A little difference of execution timing may exist between PMC Memory Types. Therefore, you should check again whether the program works correctly after changing the PMC Memory Types even if the program worked fine before changing the PMC Memory Type.

> ⚠ **CAUTION**
> 1 In the PMC Memory-C or PMC Memory-D, the System Relay is changed to Z0-Z499 from R9000-R9499 because the size of Internal Relay (R Address) is expanded.
> 2 In the PMC Memory-C or PMC Memory-D, the system used area increases 8KB from PMC Memory-B. Therefore, available memory size for Symbol, Comment and Message data is smaller than the PMC Memory-B. If the program overflowed by converting PMC Memory Type, decrease the size of Symbol, Comment or Message data, or upgrade the Ladder step option to larger size.

PMC parameter compatibility

PMC parameters outputted from on the PMC Memory-B can be loaded into the PMC Memory-C or PMC Memory-D without any modification.
When loading PMC parameters outputted on the PMC Memory-C or PMC Memory-D to the PMC Memory-B, the data outside the address range will be lost.

2.5.3 Compatibility with PMC Memory-C and PMC Memory-D

The sequence program for the PMC Memory-D has highly compatibility of the source program with the one for the PMC Memory-C.
You can convert a sequence program for the PMC Memory-C to one for the PMC Memory-D using the conversion function of FANUC LADDER-III.

> ⚠ **WARNING**
> A little difference of execution timing may exist between PMC Memory Types. Therefore, you should check again whether the program works correctly after changing the PMC Memory Types even if the program worked fine before changing the PMC Memory Types.

PMC parameter compatibility

PMC parameters outputted from on the PMC Memory-C can be loaded into the PMC Memory-D without any modification.
When loading PMC parameters outputted on the PMC Memory-D to the PMC Memory-C, the data outside the address range will be lost.

2.6 COMPATIBILITY WITH CONVENTIONAL MODELS

2.6.1 Compatibility with Series 30*i*/31*i*/32*i*-A PMC

Ladder program compatibility

The series 30*i*/31*i*/32*i*/35*i*-B PMC is highly compatible with the series 30*i*/31*i*/32*i*-A PMC on the source level.
You can use the sequence program of the series 30*i*/31*i*/32*i*-A PMC on the series 30*i*/31*i*/32*i*/35*i*-B by changing the PMC model using FANUC LADDER-III.
Transporting programs require modification because the specifications of the following functions have been changed.

(1) In case of 30*i*/31*i*/32*i*-A PMC, the basic instruction execution speed is 25 ns/step. In case of the series 30*i*/31*i*/32*i*/35*i*-B PMC, it is 9.1ns/step.
(2) As the execution speed of instructions become fast, the following items about execution timing may be changed.
  - The execution cycle of both first and second level of ladder
  - The timing of the execution cycle of first level of ladder according to the partition of second level ladder
  - The timing between ladder execution and I/O transfer or F,G signals
  - The timing between ladder execution and DCSPMC ladder execution

  The working test of the machine is necessary.
(3) As the execution speed of CNC or PMC become fast, the execution timing between the CNC processing and the ladder execution or the DSCPMC ladder execution may be changed.
(4) When setting an illegal value, that is not written in the programming manual, into parameters of functional instructions, the result may be different from the series 30*i*/31*i*/32*i*-A PMC.

PMC parameter compatibility

PMC parameters outputted from the series 30*i*/31*i*/32*i*-A PMC can be loaded into the series 30*i*/31*i*/32*i*/35*i*-B PMC without any modification.
The compatibility between PMC memory B and C of the series 30*i*/31*i*/32*i*/35*i*-B PMC is same as the compatibility between PMC memory B and C of the series 30*i*/31*i*/32*i*-A PMC.

File names in PMC [I/O] screen

In 30*i*/31*i*/32*ii*/35*i*-B PMC, PMC file names, which are created in PMC [I/O] screen, are different from the names in 30*i*/31*i*/32*i*-A PMC. For details, refer to subsection ”7.4”.

Kind of data	PMC path	File name of 30*i*/31*i*/32*i*-A PMC	File name of 30*i*/31*i*/32*i*/35*i*-B PMC
Sequence program	1st path PMC	PMC1_LAD.xxx	PMC1.xxx
	2nd path PMC	PMC2_LAD.xxx	PMC2.xxx
	3rd path PMC	PMC3_LAD.xxx	PMC3.xxx
	4th path PMC	－	PMC4.xxx
	5th path PMC	－	PMC5.xxx
	DCS PMC	PMCS_LAD.xxx	PMCS.xxx
Message data for multi-language display	1st path PMC	PMC1_MSG.xxx	M1PMCMSG.xxx
	2nd path PMC	PMC2_MSG.xxx	M2PMCMSG.xxx
	3rd path PMC	PMC3_MSG.xxx	M3PMCMSG.xxx
	4th path PMC	－	M4PMCMSG.xxx
	5th path PMC	－	M5PMCMSG.xxx

（xxx：Data number in three-digit）

2.6.2 Compatibility between 30*i*/31*i*/32*i*-A DCSPMC and 30*i*/31*i*/32*i*/35*i*-B, 0*i*-F DCSPMC

Ladder program compatibility

The series 30*i*/31*i*/32*i*/35*i*-B, 0*i*-F DCSPMC is highly compatible with the series 30*i*/31*i*/32*i*-A DCSPMC on the source level.
You can use the sequence program of the series 30*i*/31*i*/32*i*-A DCSPMC on the series 30*i*/31*i*/32*i*-B by changing the PMC model using FANUC LADDER-III.
Transporting programs require modification because the specifications of the following functions have been changed.

(1) As the execution speed of instructions become fast, the following items about execution timing may be changed.
- The execution cycle of both first and second level of ladder
- The timing of the execution cycle of first level of ladder according to the partition of second level ladder
- The timing between ladder execution and I/O transfer

The working test of the machine is necessary.

(2) As the execution speed of CNC or PMC become fast, the execution timing between the CNC processing and the ladder execution or the DSCPMC ladder execution may be changed.
(3) The level 1execution period for DCSPMC is only 8msec, and is unrelated to the setting of the level 1 execution period for PMC ladder.
(4) When setting an illegal value, that is not written in the programming manual, into parameters of functional instructions, the result may be different from the series 30*i*/31*i*/32*i*-A DCSPMC.

PMC parameter compatibility

PMC parameters output from the series 30*i*/31*i*/32*i*-A DCSPMC can be loaded into the series 30*i*/31*i*/32*i*/35*i*-B DCSPMC without any modification.

2.6.3 Compatibility with the PMCs for the 16*i*/18*i*/21*i*-B

The series 30*i*/31*i*/32*i*/35*i*-B PMC is highly compatible with the PMC-MODEL SB7 (PMC-SB7) and PMC-MODEL SA1 (PMC-SA1) for the Series 16*i*/18*i*/21*i*-MODEL B (16*i*/18*i*/21*i*-B) on the source level.
Transporting programs require modification because the specifications of the following functions have been changed.

(1) In case of PMC-SB7 and PMC-SA1, the first level execution period is fixed at 8 msec. In case of the series 30*i*/31*i*/32*i*/35*i*-B PMC, it can be switched between 4 and 8 msec, using a CNC parameter.
(2) In case of PMC-SB7, the basic instruction execution speed is 33 ns/step. In case of PMC-SA1, the basic instruction execution speed is 5.0 μ s/step. In case of the series 30*i*/31*i*/32*i*/35*i*-B PMC, it is 9.1ns/step. The execution speed of functional instructions becomes fast.
(3) As the execution speed of instructions become fast, the following items about execution timing may be changed.
- The execution cycle of both first and second level of ladder
- The timing of the execution cycle of first level of ladder according to the partition of second level ladder
- The timing between ladder execution and I/O transfer

The working test of the machine is necessary.

(4) The used size of system, some functional instructions and symbol/comment are changed. Generally, the program size of the series 30*i*/31*i*/32*i*/35*i*-B PMC becomes bigger than one for PMC-SB7 even if

the same source program is converted. If the program size exceeds the capacity of the flash ROM, change the ladder step option or reduce the symbol and comment.

(5) For the PMC-SB7 and PMC-SA1, the timer precision defined with the TMR functional instruction is fixed at a certain value. For the series 30*i*/31*i*/32*i*/35*i*-B PMC, the timer precision can be set up for each timer number separately. See Subsection 4.3.1 for details.

(6) The nonvolatile memory control keep relay (MWRTF and MWRTF2) has been changed from K16 to K909.

(7) In the PMC-SA1 and loader control PMCs, the keep relay system area has been changed from "K17 to K20" to "K900 to K999".

(8) Window function "Reading diagnosis data" is a Low-speed response type.

(9) When using Window function "No.30 Reading the servo delay for controlled axes" with the data number N=0, the data is read with input unit. When using the function with the data number N=1, the data is read with detection unit. On the series 16*i*/18*i*/21*i*-B, the data is always read with detection unit.

(10) When using Window function "No.31 Reading the acceleration / deceleration delay on controlled axes" with the data number N=0, the data is read with input unit. When using the function with the data number N=1, the data is read with detection unit. On the series 16*i*/18*i*/21*i*-B, the data is always read with machine unit.

(11) A part of window function for PMC-MODEL SB7 and SA1 is not supported. See “5 Window function” for available window function.

(12) The contents of the completion codes for some window functions are changed. See “5 Window function” for the completion codes.

(13) The MMCWR, MMCWW, and FNC90 to FNC97 functional instructions are treated as a NOP.

(14) Programs can be created on the third level because of program compatibility. The operations on the third level are not guaranteed with respect to timing, however. Use only the first and second levels in programming.

(15) When setting an illegal value, that is not written in the programming manual, into parameters of functional instructions, the result may be different from PMC-SB7 and PMC-SA1.

PMC parameter compatibility

Table 2.6.3 Compatibility with the PMCs for the Series 16*i*/18*i*/21*i*-MODEL B

Model	1st PMC	2nd to 5th PMC (option)	Dual-check safety PMC (option)
PMC-SA1	○	○	○
PMC-SB7	○	△	▲

(○: Upward-compatible. ▲: Partly compatible △: Partly compatible for some PMC memory types)

Parameters prepared for conventional PMC models can be loaded to the series 30*i*/31*i*/32*i*/35*i*-B PMC.
The series 30*i*/31*i*/32*i*/35*i*-B PMC has a smaller address range than the PMC-SB7 indicated as "Partly compatible" in Table 2.6.3. Therefore, the parameters prepared for these models can be loaded partly into the series 30*i*/31*i*/32*i*/35*i*-B PMC. Any data that does not fit the address range is discarded.
In case of the PMC memory-A of the 2nd to 5th PMC, the address range is a smaller than one of the PMC-SB7. Therefore, the parameters prepared for these models can be loaded partly into the series 30*i*/31*i*/32*i*/35*i*-B PMC. Any data that does not fit the address range is discarded.
See Subsection 2.3.2. for the parameter format.

2.6.4 Compatibility with the PMCs for the 15*i*-A/B

The series 30*i*/31*i*/32*i*/35*i*-B PMC is compatible with the PMC-MODEL NB6 (PMC-NB6) for the series 15*i*-MODEL A/B (15*i*-A/B) with respect to instructions on the source level except for some functions. The specifications of these functions have been changed, thus requiring modification in transporting programs. In addition, the arrangement and specifications of the DI/DO signals (addresses G and F) used with the CNC vary between the series 30*i*/31*i*/32*i*/35*i*-B and 15*i*-A/B. For their sequences, it is necessary to modify signal addresses and control logic.

(1) In case of 15*i*-A/B, the first level execution period is fixed at 8 msec. In case of the series 30*i*/31*i*/32*i*/35*i*-B PMC, it can be switched between 4 and 8 msec, using a CNC parameter.
(2) In case of PMC-NB6, the basic instruction execution speed is 85 ns/step. In case of the series 30*i*/31*i*/32*i*/35*i*-B PMC, it is 9.1ns/step. The execution speed of functional instructions becomes fast.
(3) As the execution speed of instructions become fast, the following items about execution timing may be changed.
  - The execution cycle of both first and second level of ladder
  - The timing of the execution cycle of first level of ladder according to the partition of second level ladder
  - The timing between ladder execution and I/O transfer

  The working test of the machine is necessary.
(4) The used size of system, some functional instructions and symbol/comment are changed. Generally, the program size of the series 30*i*/31*i*/32*i*/35*i*-B PMC becomes bigger than one for PMC-NB6 even if the same source program is converted. If the program size exceeds the capacity of the flash ROM, change the ladder step option or reduce the symbol and comment.
(5) In case of PMC-NB6, the timer precision defined with the TMR functional instruction is fixed at a certain value. In case of the series 30*i*/31*i*/32*i*/35*i*-B PMC, the timer precision can be set up for each timer number separately. See Subsection 4.3.1 for details.
(6) The arrangement and specifications of the DI/DO signals (addresses G and F) used with the CNC vary between the series 30*i*/31*i*/32*i*/35*i*-B and 15i-A/B. Refer to the respective connection manuals.
(7) The nonvolatile memory control keep relay (MWRTF and MWRTF2) has been changed from K16 to K909.
(8) The SPCNT functional instruction is not supported. It is treated as a NOP.
(9) As for the WINDR and WINDW functional instructions, there is no compatibility between the new and conventional PMC models, because the structures of their control data are different.
(10) Programs can be created on the third level because of program compatibility. The operations on the third level are not guaranteed with respect to timing, however. Use only the first and second levels in programming.
(11) When setting an illegal value, that is not written in the programming manual, into parameters of functional instructions, the result may be different from PMC-NB6.

PMC parameter compatibility

The format of the data table control data is different between the PMC-NB6 and the series 30*i*/31*i*/32*i*/35*i*-B PMC. In case of the PMC-NB6, the data size of each group set in the data table control screen is output. In case of the series 30*i*/31*i*/32*i*/35*i*-B, the data size and the data type of each group set in the data table control screen is output. Refer to subsection “2.3.2”, for details of the format of the data table for the series 30*i*/31*i*/32*i*/35*i*-B.

2.6.5 Compatibility with series 0*i*-D PMC

Ladder program compatibility

The series 30*i*/31*i*/32*i*/35*i*-B and 0*i*-F PMC is highly compatible with the series 0*i*-D PMC on the source level.

You can use the sequence program of the series 0*i*-D PMC on the series 30*i*/31*i*/32*i*/35*i*-B and 0*i*-F by changing the PMC model using FANUC LADDER-III.

Transporting programs require modification because the specifications of the following functions have been changed.

(1) In case of 0*i*-D PMC, the basic instruction execution speed is 25 ns/step. In case of the series 30*i*/31*i*/32*i*/35*i*-B PMC and 0*i*-F, it is 9.1ns/step.

(2) As the execution speed of instructions become fast, the following items about execution timing may be changed.
- The execution cycle of both first and second level of ladder
- The timing of the execution cycle of first level of ladder according to the partition of second level ladder
- The timing between ladder execution and I/O transfer or F,G signals
- The timing between ladder execution and DCSPMC ladder execution

The working test of the machine is necessary.

(3) As the execution speed of CNC or PMC become fast, the execution timing between the CNC processing and the ladder execution or the DSCPMC ladder execution may be changed.

(4) When setting an illegal value, that is not written in the programming manual, into parameters of functional instructions, the result may be different from the series 0*i*-D PMC.

PMC parameter compatibility

PMC parameters outputted from the series 0*i*-D PMC can be loaded into the series 30*i*/31*i*/32*i*/35*i*-B and 0*i*-F PMC without any modification.

2.6.6 Compatibility between 0*i*-D DCSPMC and 30*i*/31*i*/32*i*/35*i*-B DCSPMC

Ladder program compatibility

The series 30*i*/31*i*/32*i*/35*i*-B and 0*i*-F DCSPMC is highly compatible with the series 0*i*-D DCSPMC on the source level.

You can use the sequence program of the series 0*i*-D DCSPMC on the series 30*i*/31*i*/32*i*-B and 0*i*-F by changing the PMC model using FANUC LADDER-III.

Transporting programs require modification because the specifications of the following functions have been changed.

(1) As the execution speed of instructions become fast, the following items about execution timing may be changed.
- The execution cycle of both first and second level of ladder
- The timing of the execution cycle of first level of ladder according to the partition of second level ladder
- The timing between ladder execution and I/O transfer

The working test of the machine is necessary.

(2) As the execution speed of CNC or PMC become fast, the execution timing between the CNC processing and the ladder execution or the DSCPMC ladder execution may be changed.

(3) The level 1execution period for DCSPMC is only 8msec, and is unrelated to the setting of the level 1 execution period for PMC ladder.

(4) When setting an illegal value, that is not written in the programming manual, into parameters of functional instructions, the result may be different from the series 0*i*-D DCSPMC.

PMC parameter compatibility

PMC parameters output from the series 0*i*-D DCSPMC can be loaded into the series 30*i*/31*i*/32*i*/35*i*-B and 0*i*-F DCSPMC without any modification.

2.6.7 Compatibility between 35*i*-B PMC and PMC-SB5/SB6 for Power Mate *i*-D

The series 35*i*-B PMC is highly compatible with the PMC-MODEL SB5/SB6 (PMC-SB5/SB6) for the series Power Mate *i*-MODEL D (Power Mate *i*-D) on the source level.
Transporting programs require modification because the specifications of the following functions have been changed.

(1) In case of PMC-SB5/SB6, the first level execution period is fixed at 8 msec. In case of the series 35*i*-B PMC, it can be switched between 4 and 8 msec, using a CNC parameter.
(2) In case of PMC-SB5/SB6, the basic instruction execution speed is 85 ns/step. In case of the series 35*i*-B PMC, it is 9.1ns/step. The execution speed of functional instructions becomes fast.
(3) As the execution speed of instructions become fast, the following items about execution timing may be changed.
    - The execution cycle of both first and second level of ladder
    - The timing of the execution cycle of first level of ladder according to the partition of second level ladder
    - The timing between ladder execution and I/O transfer or F,G signals

    The working test of the machine is necessary.
(4) The used size of system, some functional instructions and symbol/comment are changed. Generally, the program size of the series 35*i*-B PMC becomes bigger than one for PMC-SB5/SB6 even if the same source program is converted. If the program size exceeds the capacity of the flash ROM, change the ladder step option or reduce the symbol and comment.
(5) The functional instruction “DISP” in the PMC-SB5/SB6 is not supported on the series 35*i*-B PMC. Convert into the instruction “DISPB”.
(6) The meaning of the following system keep relays is changed for the improvement of some functions.

- Improvement of the signal trace function

Keep relays	PMC-SB5/SB6	35*i*-B PMC
K900.5/K17.5	Signal trace function starts automatically.	—
K900.6/K17.6	Signal Analysis function starts automatically.	—
K906.5	—	Signal trace function for embedded screen starts automatically.

- Improvement of the programmer protection function

Keep relays	PMC-SB5/SB6	35*i*-B PMC
K900/K17.0	Hide ladder program.	The sequence program is inhibited from being viewed

- Improvement of the I/O Link selectable assignment function

Keep relays	PMC-SB5/SB6	35*i*-B PMC
K904 to K905	Effective group selection	—
K920 to K927	—	Enable or disable assignment for the selectable I/O Link assignment function

(7) The meaning of the NC parameter No.24 is changed.

Value	PMC-SB5/SB6	35*i*-B PMC
0	Disables ”RS–232C” and enables ”HIGH SPEED I/F”. However, enables ”HIGH SPEED I/F” if the LADDER EDITING PACKAGE or the Ethernet option exists.	The settings on the online monitor setting screen are effective.
1	Enables ”Channel 1 of RS–232C” and disables ”HIGH SPEED I/F”.	The same meaning as the left.
2	Enables ”Channel 2 of RS–232C” and disables ”HIGH SPEED I/F”.	The same meaning as the left.
10	Reserve (Don’t use this setting.)	Disables ”RS–232C” and enables ”HIGH SPEED I/F”.
11	Enables ”Channel 1 of RS–232C” and ”HIGH SPEED I/F”.	The same meaning as the left.
12	Enables ”Channel 2 of RS–232C” and ”HIGH SPEED I/F”.	The same meaning as the left.
255	Terminates communication forcibly. It is the same effect as soft key [EMG ST].	The same meaning as the left.

(8) The built-in I/O card is not supported on the series 35*i*-B PMC. Use external I/O devices of I/O Link or I/O Link *i*.
(9) For the PMC-SB5/SB6, the timer precision defined with the TMR functional instruction is fixed at a certain value. For the series 35*i*-B PMC, the timer precision can be set up for each timer number separately. See Subsection 4.3.1 for details.
(10) The nonvolatile memory control keep relay (MWRTF and MWRTF2) has been changed from K16 to K909.
(11) Window function "Reading diagnosis data" is a Low-speed response type.
(12) When using Window function "No.30 Reading the servo delay for controlled axes" with the data number N=0, the data is read with input unit. When using the function with the data number N=1, the data is read with detection unit. On PMC-SB5/SB6, the data is always read with detection unit.
(13) When using Window function "No.31 Reading the acceleration / deceleration delay on controlled axes" with the data number N=0, the data is read with input unit. When using the function with the data number N=1, the data is read with detection unit. On PMC-SB5/SB6, the data is always read with machine unit.
(14) A part of window function for PMC-SB5/SB6 is not supported. See “5 Window function” for available window function.
(15) The contents of the completion codes for some window functions are changed. See “5 Window function” for the completion codes.
(16) The MMCWR, MMCWW, and FNC90 to FNC97 functional instructions are treated as a NOP.
(17) When setting an illegal value, that is not written in the programming manual, into parameters of functional instructions, the result may be different from PMC-SB5/SB6.

PMC parameter compatibility

Parameters prepared for PMC-SB5/SB6 can be loaded to the series 35*i*-B PMC.

2.6.8 Compatibility between Power Motion *i*-A PMC and PMC-SB5/SB6 for Power Mate *i*-H

The series 35*i*-B PMC is highly compatible with the PMC-MODEL SB5/SB6 (PMC-SB5/SB6) for the Power Mate *i*-MODEL D (Power Mate *i*-D) on the source level.
Transporting programs require modification because the specifications of the following functions have been changed.

(1) In case of PMC-SB5/SB6, the first level execution period is fixed at 8 msec. In case of the series 35*i*-B PMC, it can be switched between 4 and 8 msec, using a CNC parameter.
(2) The interrupt-type PMC function is not supported.
(3) In case of PMC-SB5/SB6, the basic instruction execution speed is 85 ns/step. In case of the series 35*i*-B PMC, it is 9.1ns/step. The execution speed of functional instructions becomes fast.
(4) As the execution speed of instructions become fast, the following items about execution timing may be changed.
 - The execution cycle of both first and second level of ladder
 - The timing of the execution cycle of first level of ladder according to the partition of second level ladder
 - The timing between ladder execution and I/O transfer or F,G signals

 The working test of the machine is necessary.
(5) The used size of system, some functional instructions and symbol/comment are changed. Generally, the program size of the series 35*i*-B PMC becomes bigger than one for PMC-SB5/SB6 even if the same source program is converted. If the program size exceeds the capacity of the flash ROM, change the ladder step option or reduce the symbol and comment.
(6) The functional instruction “DISP” in the PMC-SB5/SB6 is not supported on the series 35*i*-B PMC. Convert into the instruction “DISPB”.
(7) The meaning of the following system keep relays is changed for the improvement of some functions.

- Improvement of the signal trace function

Keep relays	PMC-SB5/SB6	35*i*-B PMC
K900.5/K17.5	Signal trace function starts automatically.	−
K900.6/K17.6	Signal Analysis function starts automatically.	−
K906.5	−	Signal trace function for embedded screen starts automatically.

- Improvement of the programmer protection function

Keep relays	PMC-SB5/SB6	35*i*-B PMC
K900/K17.0	Hide ladder program.	The sequence program is inhibited from being viewed

- Improvement of the I/O Link selectable assignment function

Keep relays	PMC-SB5/SB6	35*i*-B PMC
K904 to K905	Effective group selection	−
K920 to K927	−	Enable or disable assignment for the selectable I/O Link assignment function

(8) The meaning of the NC parameter No.24 is changed.

Value	PMC-SB5/SB6	35*i*-B PMC
0	Disables "RS–232C" and enables "HIGH SPEED I/F". However, enables "HIGH SPEED I/F" if the LADDER EDITING PACKAGE or the Ethernet option exists.	The settings on the online monitor setting screen are effective.
1	Enables "Channel 1 of RS–232C" and disables "HIGH SPEED I/F".	The same meaning as the left.
2	Enables "Channel 2 of RS–232C" and disables "HIGH SPEED I/F".	The same meaning as the left.
10	Reserve (Don't use this setting.)	Disables "RS–232C" and enables "HIGH SPEED I/F".
11	Enables "Channel 1 of RS–232C" and "HIGH SPEED I/F".	The same meaning as the left.
12	Enables "Channel 2 of RS–232C" and "HIGH SPEED I/F".	The same meaning as the left.
255	Terminates communication forcibly. It is the same effect as soft key [EMG ST].	The same meaning as the left.

(9) The built-in I/O card is not supported on the series 35*i*-B PMC. Use external I/O devices of I/O Link or I/O Link *i*.
(10) The slave function of I/O Link is not supported. For communication with CNC, use I/O Link connection unit or Fl-net.
(11) For the PMC-SB5/SB6, the timer precision defined with the TMR functional instruction is fixed at a certain value. For the series 35*i*-B PMC, the timer precision can be set up for each timer number separately. See Subsection 4.3.1 for details.
(12) The functional instruction PSGNL and PSGN2 do not support the actual position load function of absolute position detector.
(13) The nonvolatile memory control keep relay (MWRTF and MWRTF2) has been changed from K16 to K909.
(14) Window function "Reading diagnosis data" is a Low-speed response type.
(15) When using Window function "No.30 Reading the servo delay for controlled axes" with the data number N=0, the data is read with input unit. When using the function with the data number N=1, the data is read with detection unit. On PMC-SB5/SB6, the data is always read with detection unit.
(16) When using Window function "No.31 Reading the acceleration / deceleration delay on controlled axes" with the data number N=0, the data is read with input unit. When using the function with the data number N=1, the data is read with detection unit. On PMC-SB5/SB6, the data is always read with machine unit.
(17) A part of window function for PMC-SB5/SB6 is not supported. See "3.4 Window function" for available window function.
(18) The contents of the completion codes for some window functions are changed. See "3.4 Window function" for the completion codes.
(19) The MMCWR, MMCWW, and FNC90 to FNC97 functional instructions are treated as a NOP.

PMC parameter compatibility

Parameters prepared for PMC-SB5/SB6 can be loaded to the series 35*i*-B PMC.

2.6.9 Compatibility between 0*i*-F PMC and 30*i*/31*i*/32*i*/35*i*-B PMC

Ladder program compatibility

The series 0*i*-F PMC is highly compatible with the series 30*i*/31*i*/32*i*/35*i*-B PMC on the source level.

You can use the sequence program of the series 30*i*/31*i*/32*i*/35*i*-B PMC on the series 0*i*-F PMC by changing the PMC model using FANUC LADDER-III.

As the execution speed of instructions is different, the following items about execution timing may be changed.

- The execution cycle of both first and second level of ladder
- The timing of the execution cycle of first level of ladder according to the partition of second level ladder
- The timing between ladder execution and I/O transfer

The working test of the machine is necessary.

PMC parameter compatibility

PMC parameters outputted from the series 30*i*/31*i*/32*i*/35*i*-B PMC can be loaded into the series 0*i*-F PMC without any modification.

2.6.10 Compatibility between 0*i*-F DCSPMC and 30*i*/31*i*/32*i*/35*i*-B DCSPMC

Ladder program compatibility

The series 0*i*-F DCSPMC is equal to the series 30*i*/31*i*/32*i*/35*i*-B DCSPMC.

The series 0*i*-F DCSPMC is highly compatible with the series 30*i*/31*i*/32*i*/35*i*-B DCSPMC on the source level.

You can use the sequence program of the series 30*i*/31*i*/32*i*-B DCSPMC on the series 0*i*-F by changing the PMC model using FANUC LADDER-III.

As the execution speed of instructions is different, the following items about execution timing may be changed.

- The execution cycle of both first and second level of ladder
- The timing of the execution cycle of first level of ladder according to the partition of second level ladder
- The timing between ladder execution and I/O transfer

The working test of the machine is necessary.

PMC parameter compatibility

PMC parameters output from the series 30*i*/31*i*/32*i*/35*i*-B DCSPMC can be loaded into 0*i*-F DCSPMC without any modification.

2.6.11 The Convert Method of Source Program Using FANUC LADDER-III

The version of FANUC LADDER-III applied to the series 30*i*/31*i*/32*i*/35*i*-B PMC is 6.30.

Name	Drawing number	Note
FANUC LADDER-III	A08B-9210-J505	For one PC
FANUC LADDER-III (10 users)	A08B-9210-J541	For 10 PCs
FANUC LADDER-III (20 users)	A08B-9210-J542	For 20 PCs
FANUC LADDER-III (Site license)	A08B-9210-J543	For unlimited PC numbers in a site of a corporation
FANUC LADDER-III Upgrade	A08B-9210-J544	For upgrade your software to the latest version

FANUC LADDER-III is used to convert a sequence program of other PMC models to the one of the series 30*i*/31*i*/32*i*/35*i*-B, 0*i*-F PMC.
Changing PMC model is possible easily with using the "PMC Type changed and save" function of FANUC LADDER-III.

(1) Converting with "PMC type changed and save" function.

The conversion procedure to the first PMC of the series 30*i*-B from PMC-SB7 is as follows.

i) Activate FANUC LADDER-III, and open the original ladder program for PMC-SB7.
ii) Select [File] - [PMC Type changed and save].
iii) Input the destination ladder program name, and select PMC Type, PMC Path and PMC Memory, and press the [Ok] button.

NOTE
For detailed operation, see the section "3.18 PMC TYPE CHANGED AND SAVE" of "FANUC LADDER-III OPERATOR'S MANUAL(B-66234EN)".

(2) Converting with mnemonic conversion

The sequence of the conversion to the first PMC of the series 30*i*-B from PMC-SB7 is as follows.

i) Convert a source program into the mnemonic file by FANUC LADDER-III.([Tool]->[Source Program Convert])

ii) Change the system parameters in the mnemonic file for PMC-SB7 by text editor. (“4 PMC-SB7” -> “4 30i-B PMC”)

If the mnemonic file has insufficient parameters for the first PMC of the series 30*i*-B from PMC-SB7, the initial values are set with conversion for the source program.
The mnemonic file format of the system parameter for the first PMC of the series 30*i*-B is as follows.

%@0		
2 BINARY	2: Counter type	(BINARY or BCD)
3 NO	3: Operator panel	(YES or NO)
4 30i-B PMC	4: PMC type	(30i-B PMC)
31 1	31: Number of display language (comment)	(1-16)
32 -1	32: CNC display language number 1	(-1, 0-127)
33 0	33: Comment set number 1	(0-16)
%		

iii) Create a new LAD file for the first PMC of the series 30*i*-B by FANUC LADDER-III.
iv) Convert the mnemonic file to the source program.([Tool] -> [Mnemonic Convert])

NOTE
For detailed operation, see the section "11.19 HOW TO CONVERT FROM CONVENTIONAL MODEL" of "FANUC LADDER-III OPERATOR'S MANUAL (B-66234EN)".

2.7 PMC MESSAGE MULTI-LANGUAGE DISPLAY FUNCTION

The PMC message multi-language display function manages the language of alarm message and operator message, switching the language according to the language setting of CNC using message data defined in various languages. The message data for this function is stored into a memory card format data, separated from the data of ladder program, and loaded into CNC individually. Up to 6,000 messages can be registered for each language.
This function, when compared with the conventional multi-language display capability based on the message shift function, has the following features:

- Because “A” address area does not need to be divided for messages of each language, all bits of “A” address can be used for each language, and available number of message is increased.
- Switching the language of alarm messages and operator messages do not need power cycle of CNC, and the language follows the setting of CNC display language dynamically.
- A message data file can be replaced, independently of ladder program.

2.7.1 Usage of PMC Message Multi-Language Display Function

To utilize the PMC message multi-language display function, you need to prepare the data files with FANUC LADDER-III and store them into CNC as described below:

Step 1) At first, prepare a ladder program. The message data in the ladder program must have alarm numbers associated.

Step 2) Prepare a mnemonic file of multi-language message data. The mnemonic file is a text file, and can be created and edited by some text editor application on PC. The alarm numbers in the mnemonic file must correspond with the alarm numbers in the message data of the ladder program.

Step 3) Make the memory card format file of the ladder program by compile process on FANUC LADDER-III as usual.

Step 4) Make the memory card format file of the multi-language message data using “Multi-language PMC Message Creation Tool” included in FANUC LADDER-III which supports this function.

Step 5) Store these memory card format files created in step 3 and 4. You can use Boot Menu to store them directly into Flash ROM, or you can use PMC I/O screen to read them into the memory, and then write them into Flash ROM.

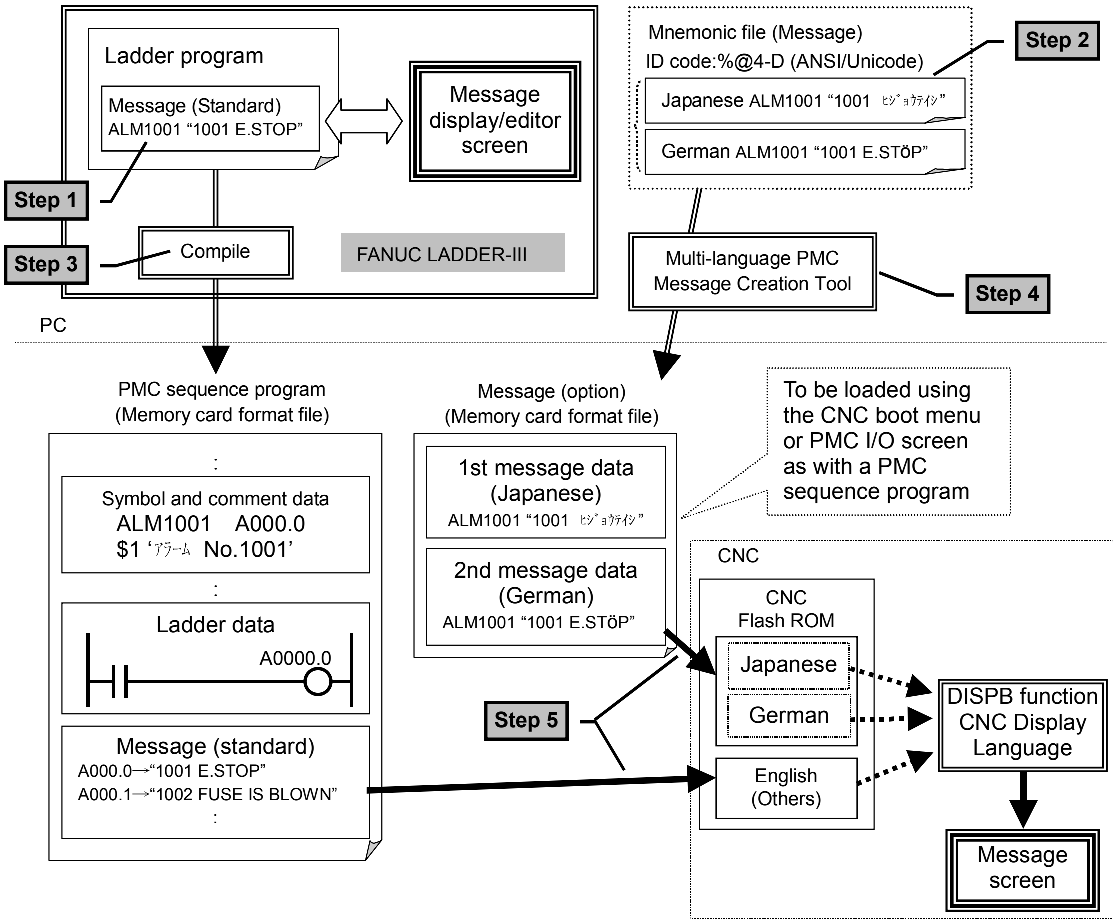
You can store two or more language sets of messages into a multi-language message data file. And you can prepare two or more multi-language message data files to enable switching the available language of the messages by altering the message file in CNC afterwards.

NOTE

1. Message data for multi-language display cannot be created, browsed, or edited on the CNC screen. To create or edit the message data, FANUC LADDER-III is required.
2. If the ladder program uses the extended symbol and comment feature, you can use symbols in multi-language message data instead of "A" address notation. Otherwise, you have to use "A" address notation only. On the ladder dividing management function, the symbols defined in main ladder program can be used for the message data for multi-language display.
3. For instructions of FANUC LADDER-III and file format of multi-language message data mnemonic file, refer to the following manual:

Manual title	Drawing No.
FANUC LADDER-III Operator's Manual	B-66234EN

Outline of the process flow from data creation to display them with PMC message multi-language display function



2.7.2 Multi-Language Display

By setting the display language attribute for each message data item for multi-language display to be edited, the language of alarm/operator messages to be displayed can be dynamically switched to match the CNC display language. Up to 6,000 messages can be registered for each language.
Language attribute (language ID) of message data is specified in mnemonic file of multi-language message data.

NOTE
1 For the language ID, refer to "APPENDIX B. LANGUAGE ID TABLE".
2 The message data, in which unsupported language ID is specified, is not displayed.

Alarm number setting

To display messages of multi-language message data, alarm numbers at least have to be defined at the corresponding entries in ordinary message data in ladder program. And each alarm number of “A” address has to have identical alarm number in multi-language message data and in ordinary message data. If they differ with each other, alarm number of ordinary message data will be used.

Selection of language

If messages of required language are not found in multi-language message data, English messages will be used instead. If English messages are not found either, messages in ordinary message data in ladder program will be used.

NOTE
1 A message defined in multi-language message data will not be displayed unless the corresponding message data in ladder program has valid alarm number.
2 If messages of current language has no corresponding message entry to the bit of “A” address that has turned on, alarm message without any message will be issued, with the alarm number that is defined at corresponding entry in ordinary message data. If ordinary message data has no valid alarm number at the entry, no alarm is issued.
3 It may take a while to change the language of alarm and operator messages after changing display language of CNC. The more messages per a language are defined especially using symbol, the longer time it tends to take to switch them.

2.7.3 Maximum Number of Message

The number of displayable alarm messages and the number of displayable operator messages can be extended to 16 by the following NC parameter:

NC parameter No. 11931 bit 1 = 0: Displays up to 4 messages (conventional specification).
1: Displays up to 16 messages.

> **NOTE**
> To increase the number of displayable messages on the CNC screen, the relevant NC parameter needs to be set. If the number of displayable messages is increased by setting the NC parameter, the number of displayable messages also increases with DISPB instruction, even without using multi-language display function.

2.7.4 Display of European Characters

With the conventional PMC message function, for example a European character such as “À” can be edited only in the code format notation, enclosing the character code between “**@0D**” and “**01@**”. With the PMC message multi-language display function, you can edit these characters as a normal character to create message data on personal computer.
The European characters, which are available on CNC screen, are listed in the following table:

Table 2.7.4(a) European character type1 code table

Character Code	+0	+1	+2	+3	+4	+5	+6	+7	+8	+9	+A	+B	+C	+D	+E	+F
A0	À	Á	Ã	Â	Æ	Ç	È	É	Ê	Ë	Ì	Í	Î	Ï	Ò	Ó
B0	Ô	Õ	Œ	Ø	Ù	Ú	Û	Ÿ	ß	à	á	â	ã	ä	å	æ
C0	Å	Ä	Ö	Ü	Ñ	¿	ç	è	é	ê	ë	ì	í	î	ï	ñ
D0	ò	ó	ô	õ	ö	œ	ø	ù	ú	û	ü	ÿ	¡			

* The character code in the table is for the code format notation. which is enclosed by "@0D" and "01@"

Table 2.7.4 (b) European character type2 code table

Character Code	+0	+1	+2	+3	+4	+5	+6	+7	+8	+9	+A	+B	+C	+D	+E	+F
A0	Б	Г	Д	Ж	З	И	Й	К	Л	М	П	У	Ф	Ц	Ч	Ш
B0	Щ	Ъ	Ы	Ь	Э	Ю	Я									

* The character code in the table is for the code format notation which is enclosed by "@0E" and "01@"

Table 2.7.4 (c) European character type 3 code table

Character Code	+0	+1	+2	+3	+4	+5	+6	+7	+8	+9	+A	+B	+C	+D	+E	+F
60	Ą	Ă	Ć	Č	Ċ	Ĉ	Đ	Ď	Ę	Ě	Ē	Ğ	Ġ	Ĝ	Ģ	Ĥ
70	İ	Ĩ	Į	Ī	Ĵ	Ķ	Ł	Ľ	Ĺ	Ļ	Ń	Ň	Ņ	Ő	Ō	Ŕ
80	Ř	Ŗ	Ś	Š	Ş	Ŝ	Ť	Ţ	Ŧ	Ů	Ű	Ŭ	Ų	Ũ	Ū	Ý
90	Ź	Ž	Ż	ą	ă	ā	ć	č	ċ	ĉ	ď	d̆	đ	ę	ě	ğ
A0	ġ	ĝ	ħ	ĥ	ı	į	ī	ĵ	ķ	Ĭ	Í	ł	ń	ň	ņ	ő
B0	ō	p	þ	ŕ	ř	ŗ	ś	š	ş	ŝ	ť	ţ	ů	ű	μ	ŭ
C0	ų	ũ	ū	ý	ź	ž	ż	b	Ѓ	Є	Љ	Њ	Ћ	Ќ	Ў	Џ

Character Code	+0	+1	+2	+3	+4	+5	+6	+7	+8	+9	+A	+B	+C	+D	+E	+F
D0					Б	Г	Д	З	И	Й	Л	Ф	Ц	Ч	Ш	Щ
E0	Ъ	Ы	Э	Ю	Я	№	Ђ	Ѓ	Є	Љ	Њ	Ћ	Ќ	§	Ў	Џ
F0	В	Ж	К	М	Н	П	Т	У								

* The character code in the table is for the code format notation which is enclosed by "@05" and "01@"

NOTE

1 The characters that can be displayed on CNC screen are as same as ones that can be displayed by conventional DISPB function. If code of a character that can not be displayed is contained in message data, the character will not be displayed.

2 For instructions for editing message data on personal computer, refer to the following manual:

Manual title	Drawing No.
FANUC LADDER-III Operator's Manual	B-66234EN

2.7.5 Display of Simplified Chinese and Korean (Hangul Characters)

With the PMC message multi-language display function, you can edit Simplified Chinese and Korean (Hangul characters) as a normal character to create message data on personal computer. All Multi-byte characters of Simplified Chinese code (GB2312) can be displayed on CNC. But some Korean (Hangul) characters cannot be displayed on CNC. The Korean (Hangul characters) which are available on CNC screen are listed in the following table.

NOTE

For instructions for editing message data of Simplified Chinese and Korean (Hangul characters) on personal computer, refer to the following manual:

Manual title	Drawing No.
FANUC LADDER-III Operator's Manual	B-66234EN

가	각	간	갈	감	갑	값	강	갖	같	개	객	갱	거	건	걸	검	겁	것	게	겨	격	견	결
겸	겹	경	계	고	곡	곤	골	곰	곳	공	과	곽	관	괄	광	괘	교	구	국	군	굴	굵	굽
권	궤	귀	규	균	그	극	근	글	금	급	기	길	깊	까	깎	깥	깨	꾸	끈	끊	끝	나	낙
난	날	남	납	낭	낮	내	냄	냉	너	넌	넓	넘	넣	네	넷	녀	년	념	노	녹	논	놀	농
높	놓	누	눈	뉴	늄	느	는	늘	늠	능	늦	니	님	다	닦	단	닫	달	닮	담	답	당	닿
대	댐	더	덮	도	독	돈	돌	동	되	된	될	됨	두	둑	둔	둘	둥	뒤	뒷	득	든	듣	들
등	디	딘	딜	따	딴	때	떠	떤	떻	또	뚜	뚫	뛰	뜨	띄	라	락	란	람	랑	래	램	략
량	러	렇	레	력	련	렴	령	로	록	론	롱	뢰	료	루	류	률	르	른	를	름	리	릭	린
림	립	링	마	막	만	많	말	망	맞	맡	매	맹	먹	먼	멈	멍	메	며	면	멸	명	몇	모
목	몫	몰	몹	못	몽	묘	무	묵	문	물	뭄	뭉	므	미	믹	민	믿	밀	밍	및	밑	바	박
밖	반	받	발	밝	밤	방	배	백	버	번	벌	범	법	벗	베	벼	벽	변	별	병	보	복	본
볼	봉	부	북	분	불	붓	붙	브	블	비	빗	빠	빨	빼	뿌	뿐	사	삭	산	살	삼	삽	상
새	색	샘	생	서	석	섞	선	설	섬	섭	성	세	센	셀	셈	셋	셔	소	속	손	솔	솜	솟
송	쇠	수	숙	순	술	숫	쉬	스	슨	습	슷	승	시	식	신	실	싫	심	싸	쌍	써	쏘	쑤
쓰	쓴	씀	씌	씨	씩	씻	아	악	안	앉	않	알	암	압	았	앙	앞	애	액	야	약	얀	얇
양	어	억	언	없	얹	얻	얼	엄	업	었	에	여	역	연	열	염	엽	였	영	옆	에	오	옥
온	올	옮	옴	옷	와	완	왕	왜	외	왼	용	우	욱	운	울	웅	워	원	월	위	유	육	윤
율	융	으	은	을	음	응	의	이	익	인	일	읽	잃	임	입	있	잊	잎	자	작	잔	잘	잠
잡	장	재	쟁	저	적	전	절	점	접	젔	정	제	져	조	족	존	졸	좀	좁	종	좋	좌	주
준	줄	중	증	지	직	진	질	짐	집	짓	짙	짜	짝	짧	째	쪽	쯤	차	착	찬	찰	참	창
찾	채	책	처	척	천	철	첫	청	체	쳐	초	촉	촌	총	최	추	축	출	충	취	측	층	치
칙	친	침	카	칸	캠	커	컴	컵	켜	코	쿠	퀴	크	큰	클	큼	키	타	탁	탄	탈	탕	태
택	터	턱	턴	테	토	톤	톱	통	퇴	투	트	특	튼	틀	틈	티	팀	파	판	팔	패	펌	펜
펴	편	평	폐	포	폭	표	푸	풀	품	풍	퓨	프	피	필	하	凸	凹	할	함	합	항	해	핵
했	행	향	허	헌	험	혁	현	협	형	호	혹	혼	홈	홍	화	확	환	활	황	회	횟	횡	효
후	훈	휘	휴	흑	흔	흠	흥	희	흰	히	힘	갭	겁	괸	굼	궂	궈	깍	깝	곰	곳	낵	냎
넥	놉	놋	눅	눔	눗	댈	댑	댕	덟	덥	돗	둡	듸	딤	딥	딱	떰	뗀	뗄	뜀	뜸	릭	맆
맬	멎	뫼	묽	믄	믐	빔	쉰	쌈	썬	썼	춥	칩	〃	킥	킵	탭	탶	틀	핍	헉	흘	쩨	학
한	쐐	쐬	얕	엊	엳	옳	왔	웜	윗	잭	쬐	째	찻	쿡	팁	펀	폼	헝	훅	데	드	옵	십
려	켠	션	페	밎	칭	머	큽	엔	런	헤	덱	룹	닙	캔	챔	캐	펄	벨	럽	됩	팅	런	케

Hangul characters that can be displayed on CNC screen

2.8 BATTERY BACKUP DATA

Some data on the CNC is preserved by the battery so that the data will not be lost even when the main power is turned off.
The battery backup data is lost when the battery voltage decreases. Therefore, the data needs to be saved to an external device periodically, and the battery needs to be replaced with a new one.

> **NOTE**
> For the method of battery replacement, refer to "Maintenance Manual" of each CNC series.

With the PMC, the following data is preserved by the battery:

Type of data	Data item
PMC parameters (Note 1)	Timer (T) Counter (C) Keep relay (K) Data table (D) Data table control data Extra relay (E) (Note 2)
Settings of various functions and screens	Setting of the PMC data I/O function Setting of the online function Setting of the trace function Setting of the ladder diagram screen Setting of the I/O diagnosis screen

> **NOTE**
> 1 A delay occurs in PMC parameter backup operation. For details, see Subsection 2.3.1, "Cautions for Reading from/Writing to Nonvolatile Memory ".
> 2 The data is preserved when using the nonvolatile PMC extra relay function (option).

By the following functions, battery backup data can be saved to an external device.

Type of data	External device	Function	Remarks
PMC parameters	Memory card Handy File RS-232C device	Writing PMC parameters from the PMC data I/O screen	For details, see Section 7.4.
	Personal Computer	Loading PMC parameters with FANUC LADDER-III	For details, see FANUC LADDER-III OPERATOR'S MANUAL (B-66234EN)".
All CNC data (including PMC parameters and the settings of various functions and screens)	Memory card	Backing up the S-RAM with the boot system	For details, see MAINTENANCE MANUAL (30*i*/31*i*/32*i*-B:B-64485EN, 35*i*-B:B-64525EN)".

PMC battery backup data can be cleared by the following operation:

Type of data	Operation
PMC parameters, Settings of various functions and screens	Select [3.CLEAR FILE] - [5:PMC-PARA.DAT] from the IPL menu.
	Hold down "O" and "Z" when turning on the power to the CNC.

WARNING

Take special care when clearing PMC parameters. When PMC parameters are cleared, the machine may malfunction. After clearing PMC parameters, be sure to set the correct values again.

NOTE

PMC battery backup data is also cleared when the entire memory of the CNC is cleared. For operation to clear the entire memory of the CNC, refer to "Maintenance Manual (30*i*/31*i*/32*i*-B:B-64485EN, 35*i*-B:B-64525EN)".

2.9 File Name of Flash ROM related to PMC

The file names of flash ROM related to PMC are as follows.

Kind of data		File name of flash ROM
Sequence program (Main ladder program)	1st path PMC	PMC1
	2nd path PMC	PMC2
	3rd path PMC	PMC3
	4th path PMC	PMC4
	5th path PMC	PMC5
	DCSPMC	PMCS
Sequence program (Divided ladder program)	Divided ladder program number 1 of 1st path PMC	L101PMC1
	Divided ladder program number 2 of 1st path PMC	L102PMC1
	Divided ladder program number 3 of 1st path PMC	L103PMC1
	:	:
	Divided ladder program number 98 of 1st path PMC	L198PMC1
	Divided ladder program number 99 of 1st path PMC	L199PMC1
	Divided ladder program number 1 of 2nd path PMC	L201PMC2
	:	:
	Divided ladder program number 99 of 2nd path PMC	L299PMC2
	Divided ladder program number 1 of 3rd path PMC	L301PMC3
	:	:
	Divided ladder program number 99 of 3rd path PMC	L399PMC3
	Divided ladder program number 1 of 4th path PMC	L401PMC4
	:	:
	Divided ladder program number 99 of 4th path PMC	L499PMC4
	Divided ladder program number 1 of 5th path PMC	L501PMC5
	:	:
	Divided ladder program number 99 of 5th path PMC	L599PMC5
Message data for multi-language display	1st path PMC	M1PMCMSG
	2nd path PMC	M2PMCMSG
	3rd path PMC	M3PMCMSG
	4th path PMC	M4PMCMSG
	5th path PMC	M5PMCMSG
I/O configuration data		IOCONF

3 COMMUNICATION WITH I/O DEVICE

3.1 I/O Link *i* and I/O Link

There are two communication methods for the high-speed serial interface which transmits input/output signals between the PMC and I/O devices. They are the FANUC I/O Link *i* and the FANUC I/O Link.
You can use up to three channels for the serial interface. The communication method for channel 1 and channel 2 can be specified by the CNC parameter. The channel 3 can be used only for the I/O Link.
For the details of the setting of the CNC parameter, see subsection "2.4.3".

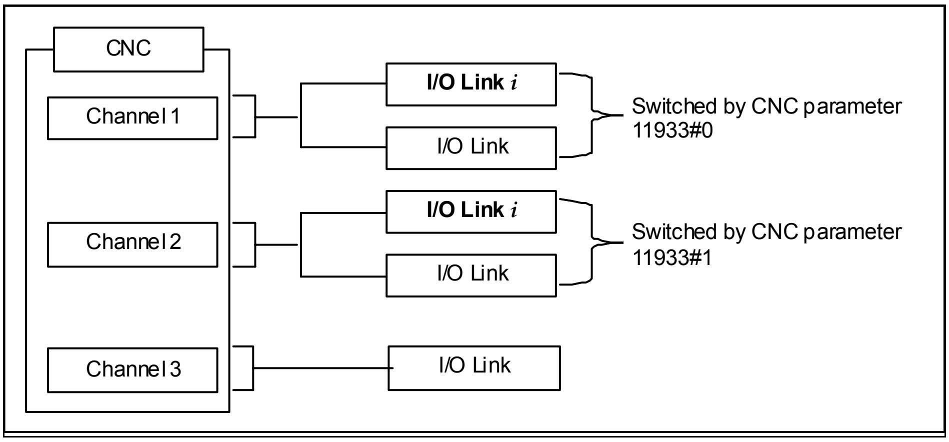


Fig. 3.1 Setting of communication method for each channel

The maximum I/O points of the I/O Link *i* are 2048 poins/2048 points for each channel. The maximum I/O points of the I/O Link are 1024 points/1024 points for each channel. The maximum I/O points for a PMC system are 4096 points/4096 points (0*i*-F: 2048 points/2048 points). You can use one or more channels of the I/O Link *i* and the I/O Link however the total points cannot exceed the maximum points of the PMC system.

[Example of the selectable case of the I/O Link *i* and the I/O Link]

Channel 1	Channel 2	Channel 3	Total points (DI / DO)
I/O Link *i*	I/O Link *i*	–	4096 / 4096 (Note)
I/O Link *i*	I/O Link	I/O Link	4096 / 4096 (Note)
I/O Link *i*	I/O Link	–	3072 / 3072 (Note)
I/O Link	I/O Link	I/O Link	3072 / 3072 (Note)
I/O Link *i*	–	–	2048 / 2048
I/O Link	I/O Link	–	2048 / 2048
I/O Link	–	I/O Link	2048 / 2048
I/O Link	–	–	1024 / 1024

NOTE
For the series 0*i*-F, the total points (DI/DO) are 2048/2048 points.

For the multi-path PMC, the DI/DO of one channel can be assigned to plural PMC paths efficiently using the I/O Link *i*. The connect position of I/O devices can be defined as group/slot number.
As for the transmission cycle of the signals from the I/O Link *i*, there are two modes of the normal mode (2msec) and the high-speed mode (0.5msec). You can specify the mode for each group of I/O devices.
For details, refer to subsection "3.3.3".

⚠ **CAUTION**

1 For an I/O Link *i* channel, You should use I/O devices applied to the I/O Link *i*. Or for an I/O Link channel, you should use I/O devices applied to the I/O Link. If you use an inadaptable I/O device, all of I/O devices after the device cannot be connected.

2 In case of using the dual check safety function, you can build the system by using only devices of the I/O Link *i* or only devices of the I/O Link. You cannot build the system by using both the I/O Link *i* and the I/O Link. If you use I/O Link, I/O devices for DCSPMC must be connected to channel 3.

3.2 WHAT IS THE I/O LINK?

The FANUC I/O Link is one of the serial interfaces and transmits input/output signals between the PMC and each I/O device at a high speed.
Available channels are three channels and for each channel, up to 1024 DI points and up to 1024 DO points can be connected and controlled from the PMC.

The update cycle of the signals from I/O Link depends on the combination with each PMC and each I/O Link channel. The following table shows the update cycle of the signals from I/O Link when each PMC uses each I/O Link channel.

Table 3.2 (a) Update cycle of the signals from I/O Link

	1st to 5th path PMC	DCSPMC
Channel 1	2msec	(cannot use)
Channel 2		
Channel 3	Ladder 1st level execution cycle is 1, 2 or 4ms : 4ms Ladder 1st level execution cycle is 8ms : 8ms	2msec

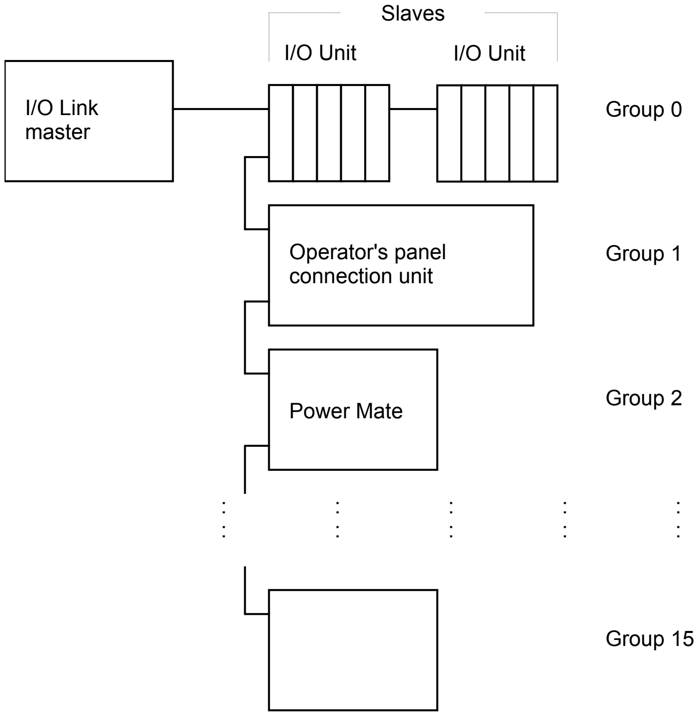
NOTE

1 When the 1st to 5th path PMC uses I/O Link channel 3, the update cycle of the signals from I/O Link channel 3 becomes 4 msec or 8 msec. In this case, note that the response of the CNC for the changing of the direct reference signals, such as skip signals, reference position return deceleration signals and emergency stop signals, becomes slower than the using of channel 1 or 2.

2 When using the I/O Link, the last 1byte of the X address for which no I/O device is assigned (normally X127, X327, X527 or X727) is used by the system. Therefore, some bits at these X addresses may be changed. Do not use X addresses for which no I/O device is assigned.

3.2.1 Configuration of an I/O Link

The following figure shows a basic configuration of the I/O Link.



(1) The I/O Link consists of one master and multiple slaves.
Master: CNC (such as Series 30*i*-B)
Slaves: I/O Unit-MODEL A, Power Mate, operator's panel connection unit, and other devices

(2) Up to 16 groups of slaves can be connected to one I/O Link.
Group numbers 0 to 15 are sequentially assigned. Number 0 is assigned to the group nearest to the master.
The number of connected slaves in a group differs depending on the types of slaves.

(3) Any slave can be connected in any group. One group must consist of slaves of the same type, however.

NOTE
1 Turn the power to the slaves and master on simultaneously or turn the power to the slaves on before turning the power to the master.
2 When turning the power to the master off, also turn the power to all slaves off. Turn the power to all slaves on again before turning the power to the master on or turn the power to all slaves and the master on simultaneously. Turn the power to the master on after turning the power to all slaves on or turn the power to the master and all slaves on simultaneously.
3 For the maximum number of slaves per group that can be connected, refer to the hardware connection manual for each I/O device used as a slave.

3.2.2 Numbers of Input Points and of Output Points of the I/O Link

The I/O Link has up to 1024 input points and up to 1024 output points for each channel when viewed from the master. These I/O points can be assigned to each slave to periodically pass I/O data between the master and each slave.
Each slave occupies the predetermined number of I/O points.
The total number of I/O points occupied by all slaves connected to one channel is up to 1024 points (128 bytes) for each of input and output.
The number of I/O points occupied by one group is up to 256 points (32 bytes) for each of input and output.

Obtain the number of occupied I/O points as follows.

[Number of output points]

Total number of points required for output modules used in one group	Number of occupied I/O points
0 to 32	32
40 to 64	64
72 to 128	128
136 to 256	256

NOTE
When obtaining the number of points, assume that the number of points required for AOA05E is 8 and that of points required for AOA12F is 16.

[Number of input points]

Total number of points required for input modules used in one group	Number of occupied I/O points
0 to 32	32
40 to 64	64
72 to 128	128
136 to 256	256

NOTE
The number of occupied I/O points may differ from the actual number of I/O points. For example, if the number of input points is smaller than or equal to that of output points for a group, the number of input points is assumed equal to that of output points. For this reason, when the number of input points for the actually connected hardware components is 128 and that of output points is 256, the number of occupied input points is assumed to be 256 because there is the following relationship between the numbers of input points and of output points:

128 (number of input points) $\leqq$ 256 (number of output points)

For more specific rules, see Section 3.2.3.

3.2.3 Assignment Method

To use an I/O device as a slave, assign connection information to X addresses (input) and Y addresses (output) of the PMC. The machine tool builder should determine addresses to be used for input/output of each I/O device in a sequence program. Connection information can be assigned to these determined addresses using the PMC screen or FANUC LADDER-III. The information is written in the flash ROM together with the sequence program. For this reason, the set information is not changed unless the sequence program is changed.
Information to be set to addresses includes the connection location and module name of each I/O device.
The connection location of an I/O device is represented by its group, base, and slot numbers. For the module name, set a name representing connected I/O device.

Setting the connection location

I/O devices can roughly be divided into the following three types according to the method for specifying the connection location.

(1) Type of I/O device whose connection location is specified with its group, base, and slot numbers
I/O Unit-MODEL A is of this type. Specify the connection location with its group, base, and slot numbers.
The range of valid settings of each item is as follows:
Group = 0 to 15
Base = 0 and 1
Slot = 1 to 10 (number of a slot on a I/O Unit-MODEL A base board)

(2) Type of I/O device whose connection location is specified with its group and slot numbers
I/O Unit-MODEL B and handy machine operator's panels are of this type. Always set the base number to 0.
The range of valid settings of each item is as follows:
Group = 0 to 15
Base = 0 (Always set 0.)
Slot = 0 to 30 (NOTE)

> **NOTE**
> For detailed information on settings, see Subsections 3.2.3.2 and 3.2.3.6.

(3) Type of I/O device whose connection location is specified with its group number
Machine operator's panel interface unit, I/O Link connection unit, Power Mate, and other devices are of this type. One unit of this type occupies one group. When using this type, always set the base number to 0 and the slot number to 1.
The range of valid settings of each item is as follows:
Group = 0 to 15
Base = 0 (Always set 0.)
Slot = 1 (Always set 1.)

Setting the module name

Set the module name at the X or Y address assigned as input/output of each I/O device. For the module name, see Tables 3.2 (a) to (c).
The number of bytes of the address occupied is determined for each module name. The number of occupied I/O points per byte is 8.
These module names are able to replace modules having same number of points.

Module name	Occupied address
/1 to /8	1 to 8 bytes for input 1 to 8 bytes for output
/12	12 bytes for input 12 bytes for output
/16	16 bytes for input 16 bytes for output
/20	20 bytes for input 20 bytes for output
/24	24 bytes for input 24 bytes for output
/28	28 bytes for input 28 bytes for output
/32	32 bytes for input 32 bytes for output

NOTE

1. Assign the start byte of an analog input module (AD04A) or analog output module (DA02A) to an even input address (X□□□) or even output address (Y□□□).
2. Always read an A/D converted digital value from an input address (X□□□) or write a digital value to be converted to an analog value to an output address (Y□□□) in word (16-bit) units.

For details of the assignment method, see the assignment method for each I/O device described later.

When you want to set assignment data using the I/O module screen, for required operations, see Section 9.4.

Table 3.2.3 (a) Module names (1)

Name	Module name (actual module name)		Occupied address	Specifications
Input modules for I/O Unit-MODEL A	ID32A	(AID32A1)	4 bytes for input	A03B-0807-J101
	ID32B	(AID32B1)	4 bytes for input	A03B-0807-J102
	ID16C	(AID16C)	2 bytes for input	A03B-0807-J103
	ID16D	(AID16D)	2 bytes for input	A03B-0807-J104
	ID32E	(AID32E1)	4 bytes for input	A03B-0807-J105
	ID32E	(AID32E2)	4 bytes for input	A03B-0807-J110
	ID32F	(AID32F1)	4 bytes for input	A03B-0807-J106
	ID32F	(AID32F2)	4 bytes for input	A03B-0807-J109
	IA16G	(AIA16G)	2 bytes for input	A03B-0807-J107
	AD04A	(AAD04A)	8 bytes for input	A03B-0807-J051
	AD04A	(AAD04B)	8 bytes for input	A03B-0819-J063
	ES01A	(AES01A)	1 byte for input	A03B-0807-C108
	ID08F	(AID08F)	1 byte for input	A03B-0807-C112
Output modules for I/O Unit-MODEL A	OD32A	(AOD32A1)	4 bytes for output	A03B-0807-J162
	OD08C	(AOD08C)	1 byte for output	A03B-0807-J151
	OD08D	(AOD08D)	1 byte for output	A03B-0807-J152
	OD16C	(AOD16C)	2 bytes for output	A03B-0807-J153
	OD16D	(AOD16D)	2 bytes for output	A03B-0807-J154
	OD32C	(AOD32C1)	4 bytes for output	A03B-0807-J155
	OD32C	(AOD32C2)	4 bytes for output	A03B-0807-J172
	OD32D	(AOD32D1)	4 bytes for output	A03B-0807-J156
	OD32D	(AOD32D2)	4 bytes for output	A03B-0807-J167
	OA05E	(AOA05E)	1 byte for output	A03B-0807-J157
	OA08E	(AOA08E)	1 byte for output	A03B-0807-J158
	OA12F	(AOA12F)	2 bytes for output	A03B-0807-J159
	OR08G	(AOR08G)	1 byte for output	A03B-0807-J160
	OR16G	(AOR16G)	2 bytes for output	A03B-0807-J161
	DA02A	(ADA02A)	4 bytes for output	A03B-0807-J052
	DA02A	(ADA02B)	4 bytes for output	A03B-0819-J060
	BK01A	(ABK01A)	1 byte for output	A03B-0807-C164
	OA08K	(AOA08K)	1 byte for output	A03B-0807-C169
	OD08L	(AOD08L)	1 byte for output	A03B-0807-C170
	OD16D	(AOD16D2)	2 bytes for output	A03B-0807-C171
	OR08I	(AOR08I3)	1 byte for output	A03B-0807-C166
	OR08J	(AOR08J3)	1 byte for output	A03B-0807-C168
Output modules with an output protection function for I/O Unit-MODEL A	/2	(AOD16DP)	2 bytes for output	A03B-0807-J182
	/1	(AOD08DP)	1 byte for input	A03B-0819-J183
	/1	(AOD08DP)	1 byte for output	
Input/output module for I/O Unit-MODEL A	IO24I	(AIO40A)	3 bytes for input	A03B-0807-C200
	IO16O	(AIO40A)	2 bytes for output	

Table 3.2.3 (b) Module names (2)

Name	Module name (actual module name)	Occupied address	Specifications
FANUC CNC SYSTEM FANUC Power Mate	FS04A	4 bytes for input 4 bytes for output	FANUC Series 0-C (compatible with the FANUC I/O Link) FANUC Power Mate-MODEL A/B/C/D/E/F/H
	FS08A	8 bytes for input 8 bytes for output	
	OC02I	16 bytes for input	FANUC Power Mate *i*-MODEL D/H
	OC02O	16 bytes for output	
	OC03I	32 bytes for input	
	OC03O	32 bytes for output	
	/□	12 bytes for input 12 bytes for output	Specify a value of 12, 16, 20, 24, 28 or 32 for □ indicating the number of bytes for input/output.
		16 bytes for input 16 bytes for output	
		20 bytes for input 20 bytes for output	
		24 bytes for input 24 bytes for output	
		28 bytes for input 28 bytes for output	
		32 bytes for input 32 bytes for output	
I/O Link β amplifier	OC02I	16 bytes for input	FANUC SERVO MOTOR β series I/O Link option
	OC02O	16 bytes for output	
Connection unit 1	CN01I	12 bytes for input	A20B-1005-0310
	CN01O	8 bytes for output	
Connection unit 2	CN02I	24 bytes for input	A20B-1003-0200
	CN02O	16 bytes for output	
Operator's panel connection unit A	/8	8 bytes for input	A16B-2200-0661 (sink type)
	/4	4 bytes for output	A16B-2201-0731 (source type)
Operator's panel connection unit B	CN01I	12 bytes for input	A16B-2200-0660 (sink type)
	CN01O	8 bytes for output	A16B-2201-0730 (source type)
Machine operator's panel interface unit	OC02I	16 bytes for input	A16B-2201-0110
	OC02O	16 bytes for output	
	OC03I	32 bytes for input	
	OC03O	32 bytes for output	
Modules for I/O Unit-MODEL B	#□	□ bytes for input □ bytes for output	Specify a value of 1 to 8 indicating the number of bytes for input/output for □.
	##	4 bytes for input	Specify an area for reading the power on-off state of each unit of I/O Unit-MODEL B.
I/O Link connection unit	/□	1 to 8 bytes for input 1 to 8 bytes for output	Specify a value of 1 to 8, 12, 16, 20, 24, 28 or 32 for □ indicating the number of bytes for input/output.
		12 bytes for input 12 bytes for output	
		16 bytes for input 16 bytes for output	
		20 bytes for input 20 bytes for output	
		24 bytes for input 24 bytes for output	
		28 bytes for input 28 bytes for output	
		32 bytes for input 32 bytes for output	
	OC02I	16 bytes for input	

Table 3.2.3 (c) Module names (3)

Name	Module name (actual module name)	Occupied address	Specifications
I/O Link connection unit	OC02O	16 bytes for output	
	OC03I	32 bytes for input	
	OC03O	32 bytes for output	
Distribution I/O connection panel I/O modules	CM03I	3 bytes for input	Basic unit only
	CM06I	6 bytes for input	Uses expansion unit 1.
	CM09I	9 bytes for input	Uses expansion unit 2.
	CM12I	12 bytes for input	Uses expansion unit 3.
	CM13I	13 bytes for input	Uses the first MPG.
	CM14I	14 bytes for input	Uses the second MPG.
	CM15I	15 bytes for input	Uses the third MPG.
	CM16I	16 bytes for input	Uses DO alarm detection.
	CM02O	2 bytes for output	Basic unit only
	CM04O	4 bytes for output	Uses expansion unit 1.
	CM06O	6 bytes for output	Uses expansion unit 2.
	CM08O	8 bytes for output	Uses expansion unit 3.
Distribution I/O operator's panel I/O modules	CM06I	6 bytes for input	
	CM13I	13 bytes for input	Uses the first MPG.
	CM14I	14 bytes for input	Uses the second MPG.
	CM15I	15 bytes for input	Uses the third MPG.
	CM16I	16 bytes for input	Uses DO alarm detection.
	CM04O	4 bytes for output	
	CM08O	8 bytes for output	
External I/O cards A and D for the Power Mate	/6	6 bytes for input	A16B-2201-0071 (A)
	/4	4 bytes for output	A16B-2202-0733 (D)
External I/O cards B and E for the Power Mate	OC01I	12 bytes for input	A16B-2201-0070 (B)
	OC01O	8 bytes for output	A16B-2202-0732 (E)
External I/O cards C and F for the Power Mate	/3	3 bytes for input	A16B-2600-0150(C)
	/2	2 bytes for output	A16B-2600-0170 (F)
Handy machine operator's panel (NOTE 3)	#2	2 bytes for input	
		2 bytes for output	
	##	4 bytes for input	
AS-i converter unit	OC03I	32 bytes for input	
	OC03O	32 bytes for output	

NOTE

1. For the specifications and connection of each I/O device, refer to the relevant hardware connection manual.
2. For the assignment method for each I/O device, see Subsections 3.2.3.1 to 3.2.3.8.
3. As assignment data for a handy machine operator's panel, assign multiple module names successively. For details, see Subsection 3.2.3.6.

3.2.3.1 Assignment Method for I/O Unit-MODEL A

Fig. 3.2.3.1 (a) and 3.2.3.1 (b) show sample configurations of I/O Unit-MODEL A.

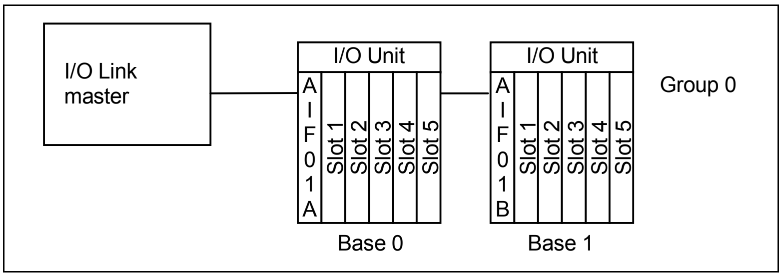


Fig. 3.2.3.1 (a)

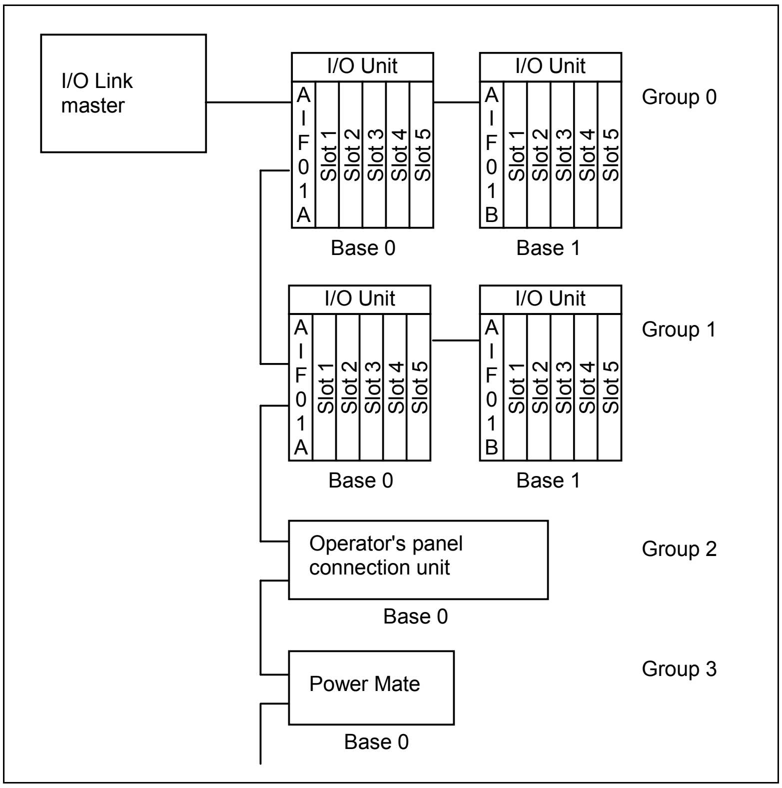


Fig. 3.2.3.1 (b)

Assignment method

(1) Group number

For I/O Unit-MODEL A, up to two I/O units can be connected when interface module AIF01A is used as the basic unit and expansion interface module AIF01B is also used. This is called the base expansion function. This set of up to two I/O units comprises one group (see Fig. 3.2.3.1 (a)). When required I/O modules cannot be contained only in one group or when multiple I/O units are to be distributed at distant locations on the machine side, the second AIF01A can be connected to the first AIF01A using a cable to add a group. (See Fig. 3.2.3.1 (b).)

(2) Base number
One group consists of up to two I/O base units. The base number of the I/O unit on which interface module AIF01A is mounted is 0; the base number of the other I/O unit is 1.
In other words, when the base expansion function is used, the base number of the basic unit is always 0 and that of the expansion unit is always 1. When the base expansion function is not used, the base number is always 0.

(3) Slot number
On one I/O base unit, up to five (ABU05A) or ten (ABU10A) I/O modules can be mounted depending on the type of I/O base unit. The location of each module on the I/O base unit is represented by a slot number. For each base unit, the location of the I/O interface module is 0 and slot numbers 1 to 10 are assigned from left to right. Each module can be mounted into any desired slot. I/O modules may not be mounted closely from left to right. An intermediate slot may not be used.

(4) Module name
For module names, see Tables 3.2.3 (a) to (c) in Section 3.2.3 above. Actual module names begin with A. When setting a module name, remove this A. Some actual module names may end with a numeric character. In this case, when setting a module name, also remove the numeric character.
(Example 1) To set module AID16D, enter ID16D.
(Example 2) To set module AID32A1, enter ID32A.

NOTE
For I/O Unit-MODEL A, when assigning 3, 5, 6, or 7 bytes, change the module name as follows.
Do not use IO24I, /3, /5, /6, or /7 as a module name.

Module names

Before change	→	After change
IO24I	→	/4
/3	→	/4
/5	→	/8
/6	→	/8
/7	→	/8

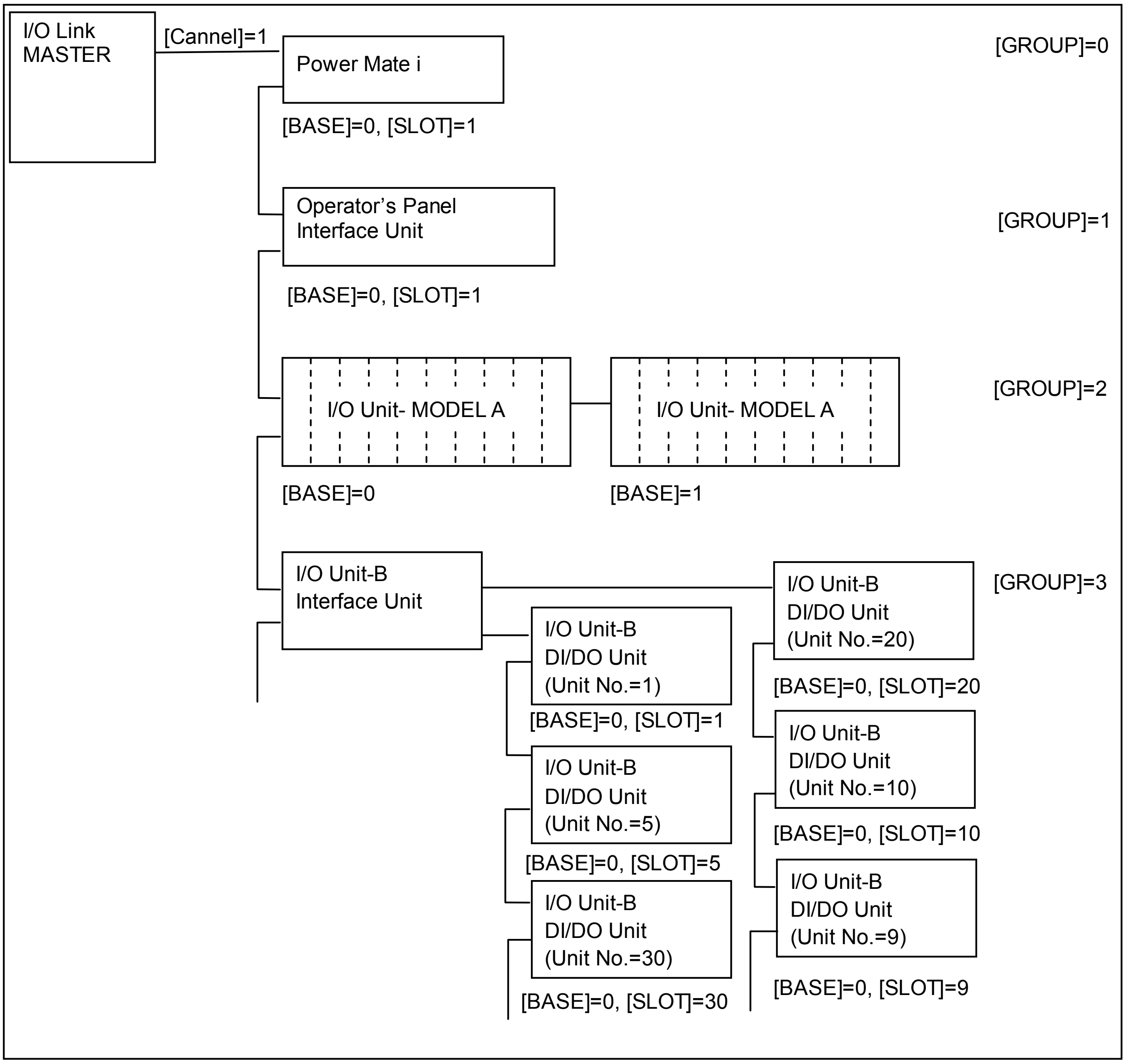
Related hardware manual

"FANUC I/O Unit-MODEL A Connection and Maintenance Manual" (B-61813E)

NOTE
For the specifications and connection of I/O Unit-MODEL A and related I/O modules, refer to the hardware connection manual for each I/O device.

3.2.3.2 Assignment Method for I/O Unit-MODEL B

I/O Unit-MODEL B can be used together with I/O Link devices such as the Power Mate, operator's panel interface unit, connection unit, and I/O Unit-MODEL A. In this case, I/O Unit-MODEL B comprises one group and other units cannot be contained in the group.
An example of connection is shown below.



Assignment method

As the group number, set the group number used in the configuration. As the base number, always set 0. As the slot number, set the unit number of a DI/DO unit of I/O Unit-MODEL B. To assign power on-off information, set 0 for the slot number.
Set the following values for the slot number and assignment name:
Slot number:
0: Power on-off information
1 to 30: Unit number
Assignment name:
Module name representing the address occupied by the I/O Unit-MODEL B DI/DO unit (see Table 3.2.3 (b).)

Number of input or output points required for [basic unit] + [expansion unit]	Assignment name	Occupied address
1 byte	#1	1 byte for input/output
2 bytes	#2	2 bytes for input/output
3 bytes	#3	3 bytes for input/output
4 bytes	#4	4 bytes for input/output
6 bytes	#6	6 bytes for input/output
8 bytes	#8	8 bytes for input/output
10 bytes	#10	10 bytes for input/output
Power on-off information	##	4 bytes for input

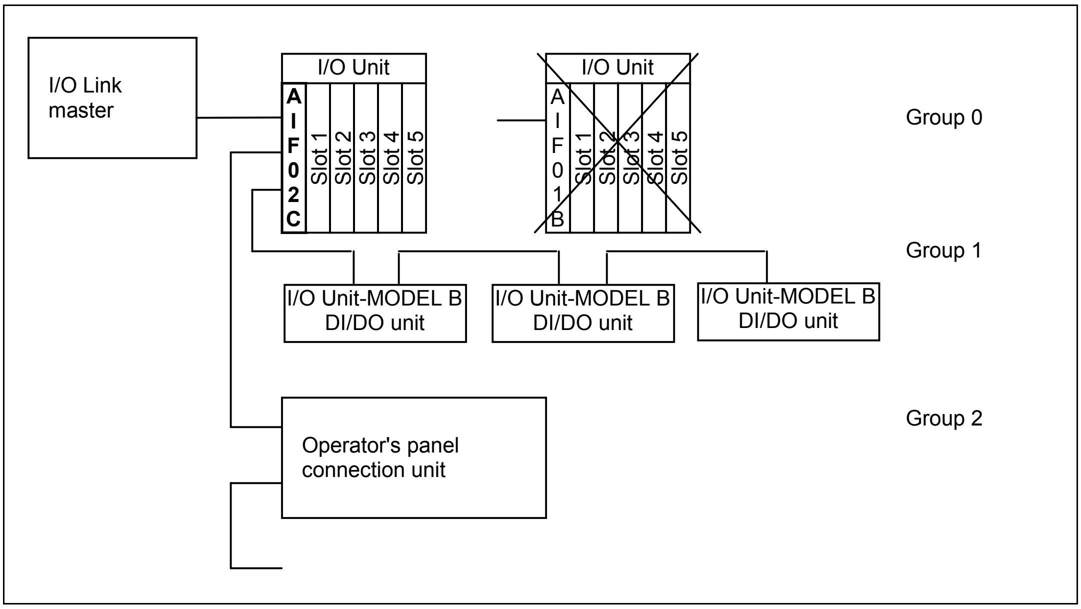
Example of setting

To connect an I/O Unit-MODEL B DI/DO unit with unit number 10 whose occupied address is 3 bytes in GROUP=1:
Enter 1.0.10.#3.

NOTE
When channel 2 and 3 are also used to connect I/O devices, the maximum total number of groups used for connecting I/O Unit-MODEL B with channels 1 to 3 is 8.

Interface module incorporating I/O Unit-MODEL A

Interface module AIF02C can control communication both with I/O Unit-MODEL A and with I/O Unit-MODEL B.



For the AIF02C, the base expansion function of the AIF02A is removed and the functions of the I/O Unit-MODEL B interface unit are added.
You cannot use only the I/O Unit-MODEL B without using the I/O Unit-MODEL A. The base expansion function cannot also be used.
The AIF02C occupies two groups. Assignment is required for each of I/O Unit-MODEL A and I/O Unit-MODEL B.

> **NOTE**
> For details of the AIF02C, refer to "FANUC I/O Unit-MODEL A Connection and Maintenance Manual" (B-61813E).

Related hardware manual

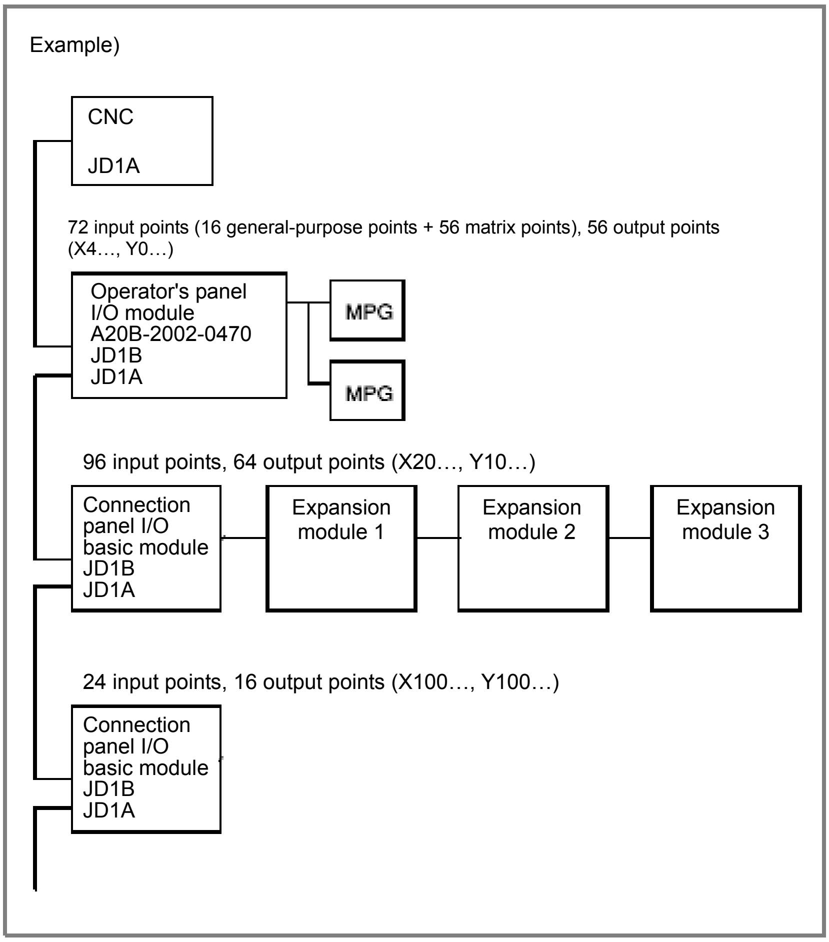
"FANUC I/O Unit-MODEL B Connection Manual" (B-62163E)

> **NOTE**
> For the setting of each I/O Unit-MODEL B unit and the specifications and connection of related I/O modules, refer to the hardware connection manual for each I/O device in addition to the above connection manual.

3.2.3.3 Assignment Method for Distribution I/O Connection Panel I/O Modules and Distribution I/O Operator's Panel I/O Modules

For the I/O Link, when assigning connection information of a connection panel or operator's panel I/O module, set an I/O Link serial number (0 for the module nearest to the I/O Link master CNC) for the group number, always set 0 for the base number, and always set 1 for the slot number. When basic and expansion connection panel I/O modules are used, assign one connection information item for all modules in one I/O Link group. For a distribution I/O module unlike I/O Unit-MODEL A, the slot number need not be specified. For the module name used to set assignment data, see "Distribution I/O connection panel I/O modules" in Table 3.2.1(b).
An example of assignment is shown below.

Example of assignment



	Group number	Base number	Slot number	Assignment name
X004	0	0	1	CM14I
X020	1	0	1	CM12I
X100	2	0	1	CM03I
Y000	0	0	1	CM08O
Y010	1	0	1	CM08O
Y100	2	0	1	CM02O

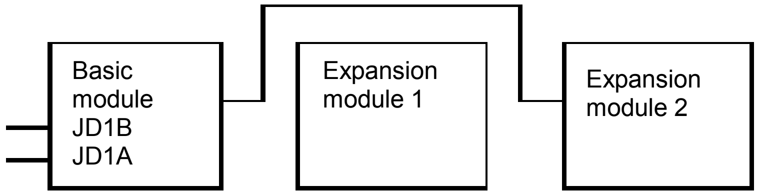
Connection panel I/O modules

For signal mapping of connection panel I/O modules, refer to the connection manual (hardware) for the CNC used as the I/O Link master.

Assignment data is described below for each configuration of basic and expansion modules.

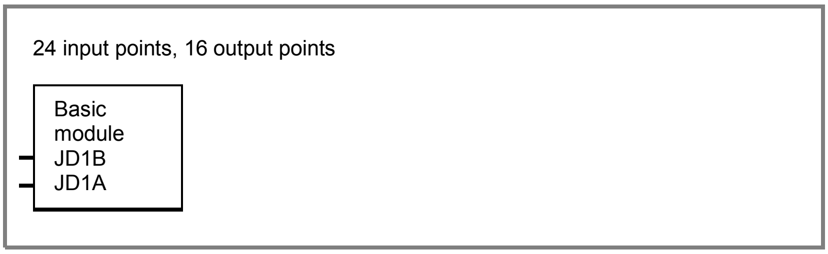
⚠CAUTION

Always connect expansion modules 1, 2, and 3 in this order closely. Any intermediate expansion module cannot be skipped.



You may want to make the above configuration so that expansion module 1 is not yet mounted and assign only expansion module 2, but such configuration does not work.

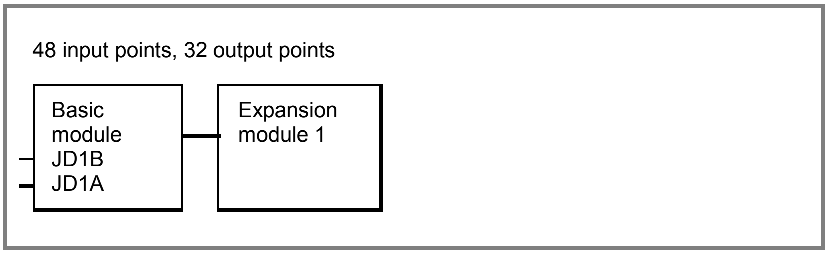
(1) Only basic module



(a) When DO alarm detection is not used
- When no manual pulse generator is used
  Input: X=CM03I, output: Y=CM02O

(b) When DO alarm detection is used
- Regardless of the number of manual pulse generators
  Input: X=CM16I, output: Y=CM02O

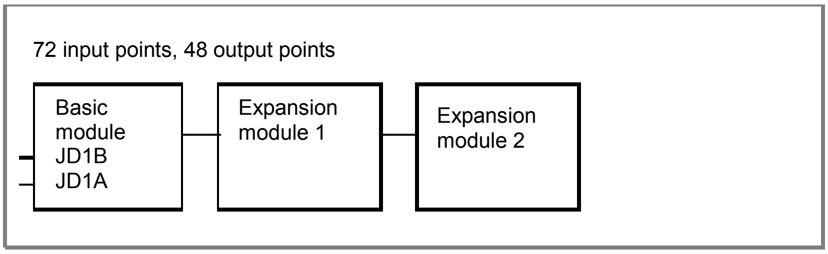
(2) Basic module + expansion module 1



(a) When DO alarm detection is not used
- When no manual pulse generator is used
  Input: X=CM06I, output: Y=CM04O
- When one manual pulse generator is used
  Input: X=CM13I, output: Y=CM04O

(b) When DO alarm detection is used
- Regardless of the number of manual pulse generators
  Input: X=CM16I, output: Y=CM04O

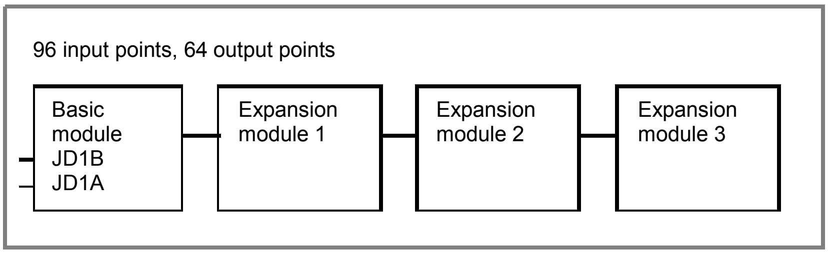
(3) Basic module + expansion module 1 + expansion module 2



(a) When DO alarm detection is not used
- When no manual pulse generator is used
  Input: X=CM09I, output: Y=CM06O
- When one manual pulse generator is used
  Input: X=CM13I, output: Y=CM06O
- When two manual pulse generators are used
  Input: X=CM14I, output: Y=CM06O

(b) When DO alarm detection is used
- Regardless of the number of manual pulse generators
  Input: X=CM16I, output: Y=CM06O

(4) Basic module + expansion module 1 + expansion module 2 + expansion module 3



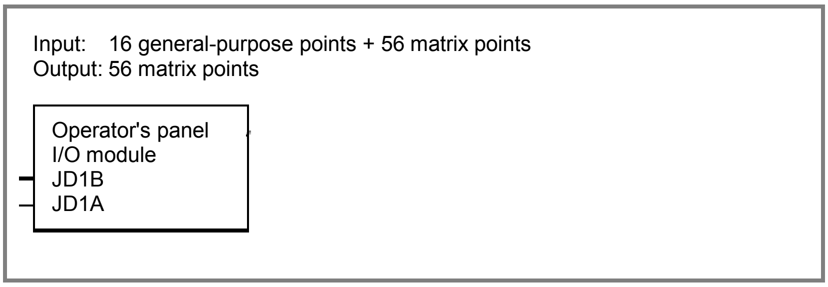
(a) When DO alarm detection is not used
- When no manual pulse generator is used
  Input: X=CM12I, output: Y=CM08O
- When one manual pulse generator is used
  Input: X=CM13I, output: Y=CM08O
- When two manual pulse generators are used
  Input: X=CM14I, output: Y=CM08O
- When three manual pulse generators are used
  Input: X=CM15I, output: Y=CM08O

(b) When DO alarm detection is used
- Regardless of the number of manual pulse generators
  Input: X=CM16I, output: Y=CM08O

Operator's panel I/O modules

For signal mapping of operator's panel I/O modules, refer to the connection manual (hardware) for the CNC used as the I/O Link master.

(1) Operator's panel I/O module (compatible with matrix input, A20B-2002-0470)



(a) When DO alarm detection is not used
- When no manual pulse generator is used
  Input: X=CM12I, output: Y=CM08O
- When one manual pulse generator is used
  Input: X=CM13I, output: Y=CM08O
- When two manual pulse generators are used
  Input: X=CM14I, output: Y=CM08O
- When three manual pulse generators are used
  Input: X=CM15I, output: Y=CM08O

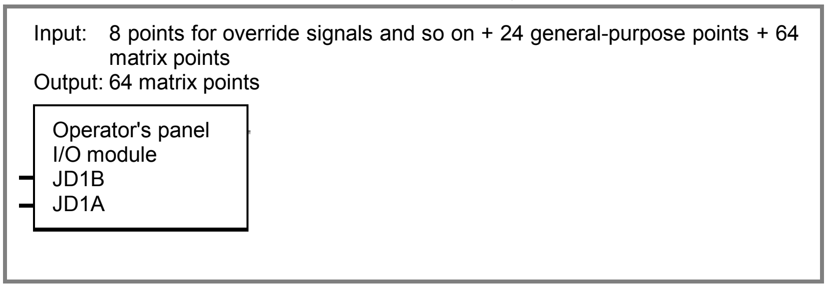
(b) When DO alarm detection is used
- Regardless of the number of manual pulse generators
  Input: X=CM16I, output: Y=CM08O

(2) Operator's panel I/O module (A20B-2002-0520, A20B-2002-0521)

(a) When DO alarm detection is not used
- When no manual pulse generator is used
  Input: X=CM06I, output: Y=CM04O
- When one manual pulse generator is used
  Input: X=CM13I, output: Y=CM04O
- When two manual pulse generators are used
  Input: X=CM14I, output: Y=CM04O
- When three manual pulse generators are used
  Input: X=CM15I, output: Y=CM04O

(b) When DO alarm detection is used
- Regardless of the number of manual pulse generators
  Input: X=CM16I, output: Y=CM04O

(3) Distribution I/O machine operator's panel
(A20B-8001-0721, A20B-8001-0720, A20B-8001-0210)

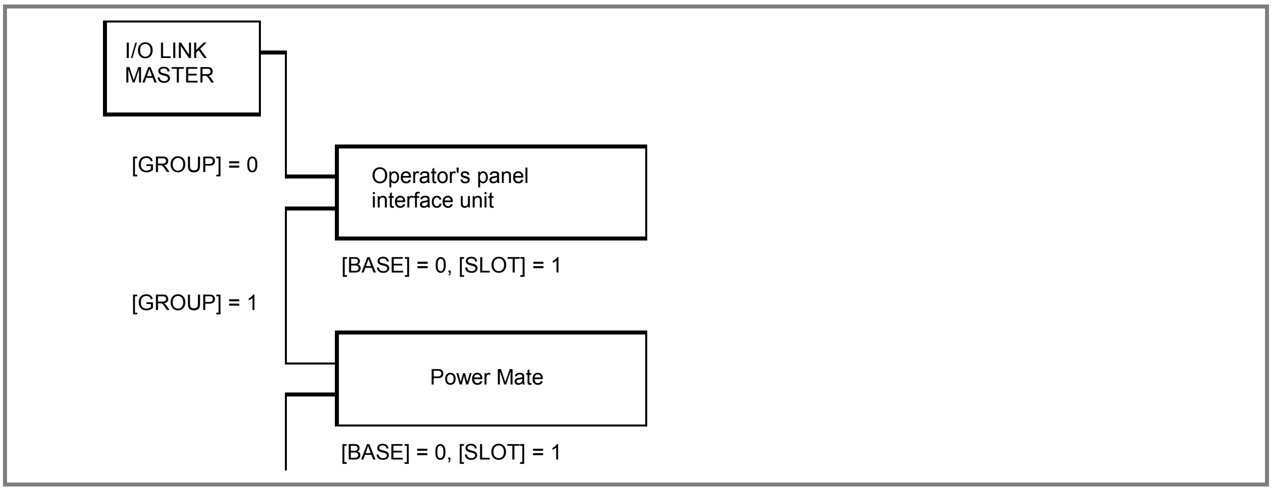


(a) When DO alarm detection is not used
- When no manual pulse generator is used
  Input: X=CM12I, output: Y=CM08O
- When one manual pulse generator is used
  Input: X=CM13I, output: Y=CM08O
- When two manual pulse generators are used
  Input: X=CM14I, output: Y=CM08O
- When three manual pulse generators are used
  Input: X=CM15I, output: Y=CM08O

(b) When DO alarm detection is used
- Regardless of the number of manual pulse generators
  Input: X=CM16I, output: Y=CM08O

3.2.3.4 Assignment Method for the Power Mate

To use Power Mate-MODEL D/H, Power Mate *i*-MODEL D/H, or I/O Link β amplifier as an I/O Link slave, assign its connection information on the I/O Link master.
On the I/O Link slave, assignment is not required because the addresses are fixed.
An example of connection is shown below.



Assignment method

For the group number, set the group number used in the configuration.
For the base number, always set 0.
For the slot number, always set 1.

Number of input/output points (input/output)	Input device assignment name (module name)	Output device assignment name (module name)
32/32	FS04A	FS04A
64/64	FS08A	FS08A
96/96	/12	/12
128/128	OC02I or /16	OC02O or /16
160/160	/20	/20
192/192	/24	/24
224/224	/28	/28
256/256	OC03I or /32	OC03O or /32

NOTE
1. Assign input and output module names with the same number of points.
2. For the I/O Link β amplifier, assign OC02I/OC02O.

Examples of settings

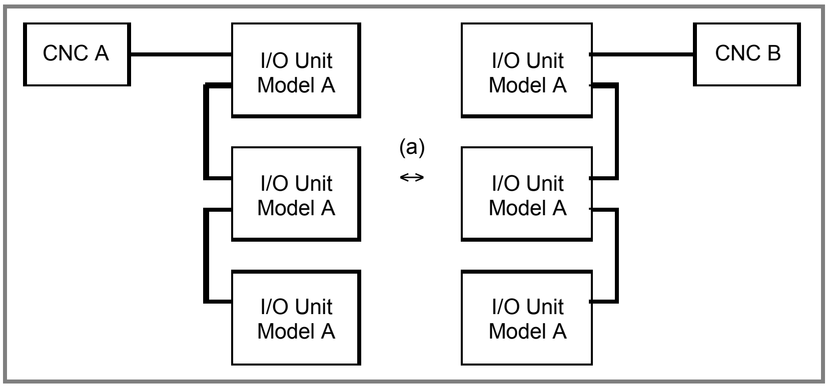
To connect Power Mate *i*-D with 256/256 points in group 1:
Enter 1.0.1.OC03I for input and 1.0.1.OC03O for output.

To connect Power Mate *i*-D with 224/224 points in group 2:
Enter 2.0.1. /28 for input and 2.0.1. /28 for output.

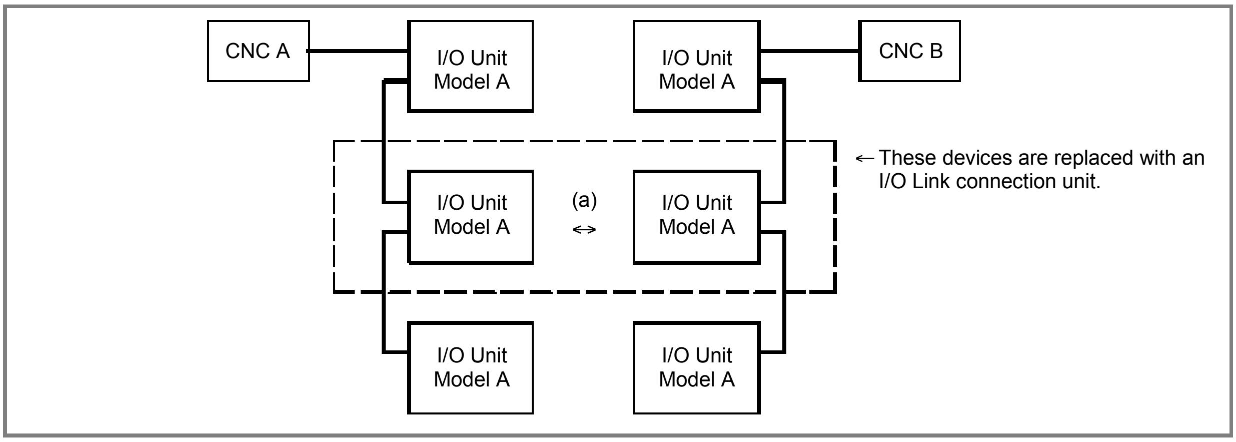
To connect an I/O Link *β* amplifier in group 1:
Enter 1.0.1.OC02I for input and 1.0.1.OC02O for output.

3.2.3.5 Assignment Method for I/O Link Connection Units

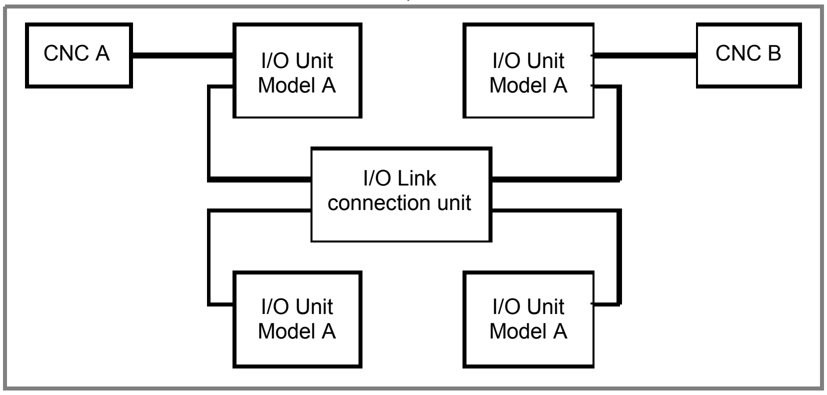
Conventionally, to exchange data between CNCs A and B, the devices indicated by (a) in the figure below must be connected. (Any I/O units can be used to exchange data.)



An I/O Link connection unit replaces the connected devices to eliminate cable connection and enable the power to each master or slave to be turned on and off independently.



Therefore, when an I/O Link connection unit is used, the connection is as follows.



Assignment method

Assignment data is determined according to the types of I/O devices replaced with an I/O Link connection unit.

Occupied address	Input device assignment name	Output device assignment name
1 to 8	/ □ (□:Numeric character 1 to 8)	/ □ (□:Numeric character 1 to 8)
12	/12	/12
16	OC02I or /16	OC02O or /16
20	/20	/20
24	/24	/24
28	/28	/28
32	OC03I or /32	OC03O or /32

Example of setting

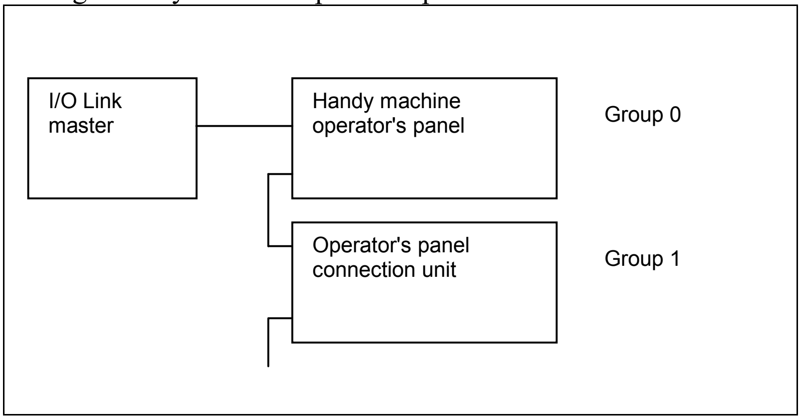
To connect a connection unit whose occupied address is 16 bytes in GROUP=1 as an input device:
Enter 1.0.1.OC02I.

To connect a connection unit whose occupied address is 28 bytes in GROUP=1 as an input device:
Enter 1.0.1. /28.

NOTE
For details of the hardware connection method, particularly connection of a power supply, refer to the hardware connection manual for each related master/slave device.

3.2.3.6 Assignment Method for a Handy Machine Operator's Panel

An example of connecting a handy machine operator's panel to the I/O Link is shown below.



Assignment method

Assign 16 bytes to X addresses and 32 bytes to Y addresses contiguously starting from any address for each group. Set the group number used in the configuration for the group number and always set 0 for the base number. Set the slot number and assignment name as shown in the table below. The number of occupied input points for each group is 32 bytes, which is the same as that of output points, because of limitations of the I/O Link.

[Examples of assigning X addresses]

X address	Slot number	Assignment name	Occupied address
Xn+0	0	##	4 bytes
Xn+4	1	#2	2 bytes
Xn+6	2	#2	2 bytes
Xn+8	3	#2	2 bytes
Xn+10	4	#2	2 bytes
Xn+12	5	#2	2 bytes
Xn+14	6	#2	2 bytes

[Examples of assigning Y addresses]

Y address	Slot number	Assignment name	Occupied address
Yn+0	7	#2	2 bytes
Yn+2	8	#2	2 bytes
Yn+4	9	#2	2 bytes
Yn+6	10	#2	2 bytes
Yn+8	11	#2	2 bytes
Yn+10	12	#2	2 bytes
Yn+12	13	#2	2 bytes
Yn+14	14	#2	2 bytes
Yn+16	15	#2	2 bytes
Yn+18	16	#2	2 bytes
Yn+20	17	#2	2 bytes
Yn+22	18	#2	2 bytes
Yn+24	19	#2	2 bytes
Yn+26	20	#2	2 bytes
Yn+28	21	#2	2 bytes
Yn+30	22	#2	2 bytes

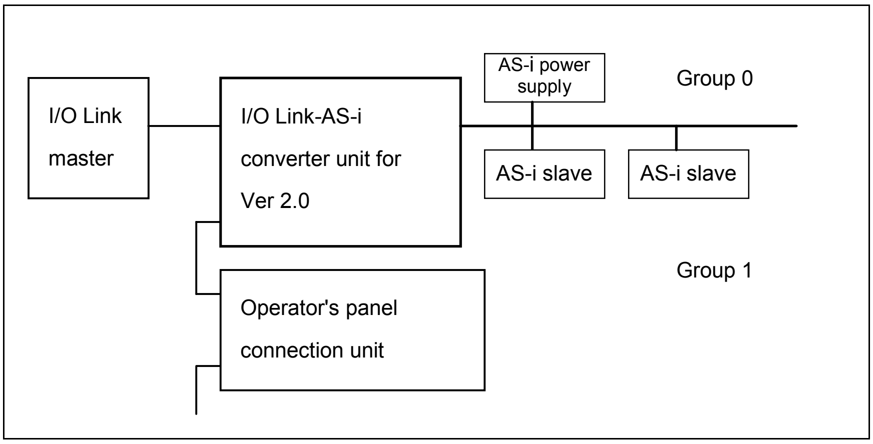
3.2.3.7 Assignment Method for an AS-i Converter Unit

An I/O Link-AS-i converter unit converts I/O from the I/O Link to the AS-Interface (called AS-i below) to enable the use of AS-i slave module DI/DO signals as a standalone unit.
The AS-i comes in two main versions: Ver. 2.0 and Ver. 2.1. Two types of I/O Link-AS-i converter units are available for each of these versions.
An I/O Link-AS-i converter unit for Ver. 2.0 differs from that for Ver. 2.1 in the following points.

	For Ver. 2.0	For Ver. 2.1
Number of input/output points	256 input points/256 output points	512 input points/512 output points
Occupied groups	1 group	Contiguous 2 groups

For each version, an example of connection is shown and the assignment method is described below.

Example of connection for Ver. 2.0

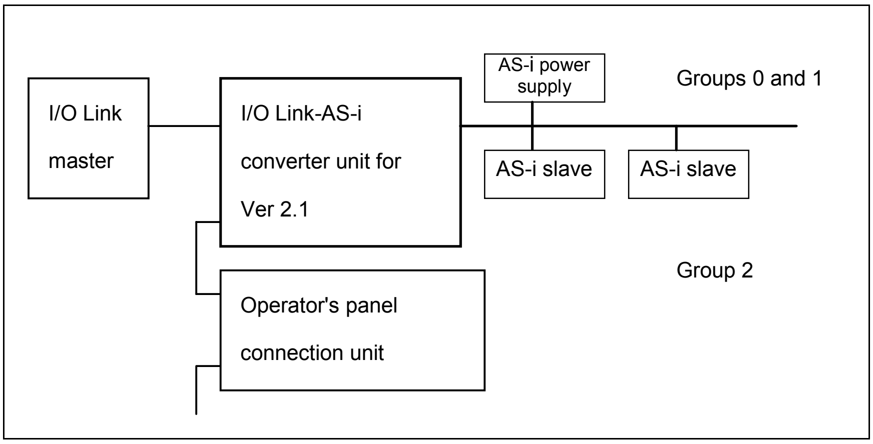


Assignment method for Ver. 2.0

For the group number ([GROUP]), set the group number used in the configuration. (Set 0 for the above example of connection.)
For the base number ([BASE]), always set 0.
For the slot number ([SLOT]), always set 1.
An I/O Link-AS-i converter unit occupies 256 points (32 bytes) for both input and output. Therefore, the assignment names are as follows.

Input device assignment name	Output device assignment name
OC03I	OC03O

Example of connection for Ver. 2.1



Assignment method for Ver. 2.1

For the group number ([GROUP]), set the numbers for two contiguous groups in the configuration. Set 0 and 1 for the above example of connection.
For the base number ([BASE]), always set 0.
For the slot number ([SLOT]), always set 1.
An I/O Link-AS-i converter unit occupies 512 points for both input and output, 256 points (32 bytes) per group. Therefore, the assignment names per group are the same as for an I/O Link-AS-i converter unit for Ver. 2.0. Set the same assignment names for each occupied group number.

Group number	Input device assignment name	Output device assignment name
n	OC03I	OC03O
n + 1	OC03I	OC03O

NOTE
An I/O Link-AS-i converter unit for Ver. 2.1 cannot be used as a converter unit for Ver. 2.0 with assignment data for Ver. 2.0.

3.2.3.8 FS0 Operator's Panel

The FS0 operator's panel consists of many key-operated switches, LEDs, a rotary switch, and other components. The status of each of key-operated switches and lamps is coded and as many signal lines as the number of actual switches are not required to connect the operator's panel to a CNC. PMC management software automatically codes the status and transfers data.
These operations require only that simple bit images indicating the switches, LEDs, and other components to be operated by a PMC ladder program.

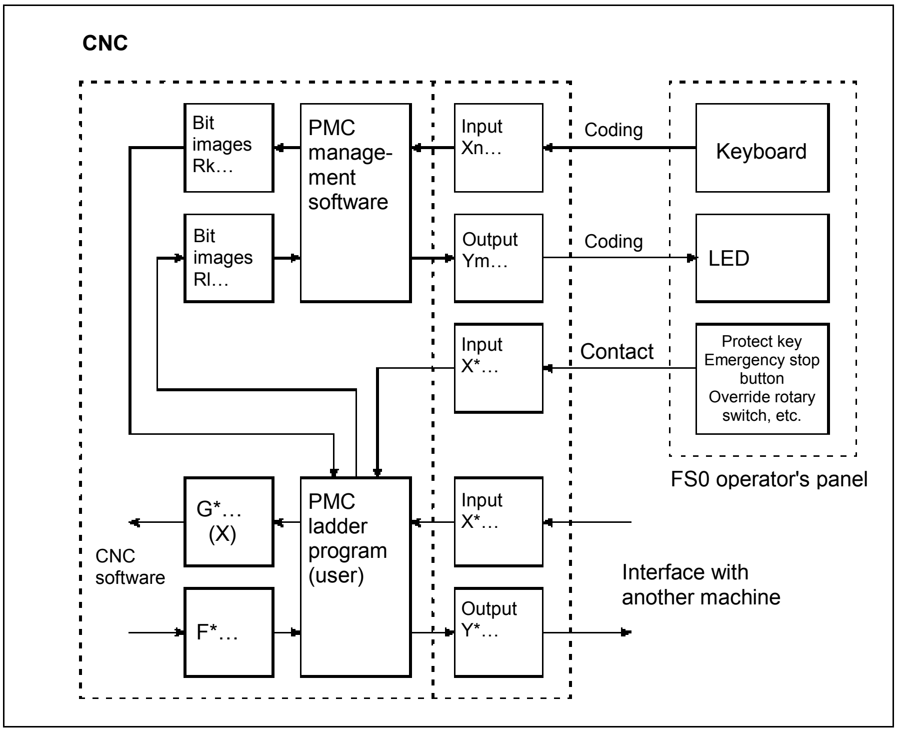


Fig. 3.2.3.8 (a) Block diagram of connection of an operator's panel

An operator's panel consists of the following keys, LEDs, and other components:

- Key-operated switches (sheet keys)
  42 keys (0-TC)
  46 keys (0-MC)
- LEDs (red) on all key-operated switches
- Override rotary switch (4 bits)
- Emergency stop button (1 bit)
- Program protect key (1 bit)

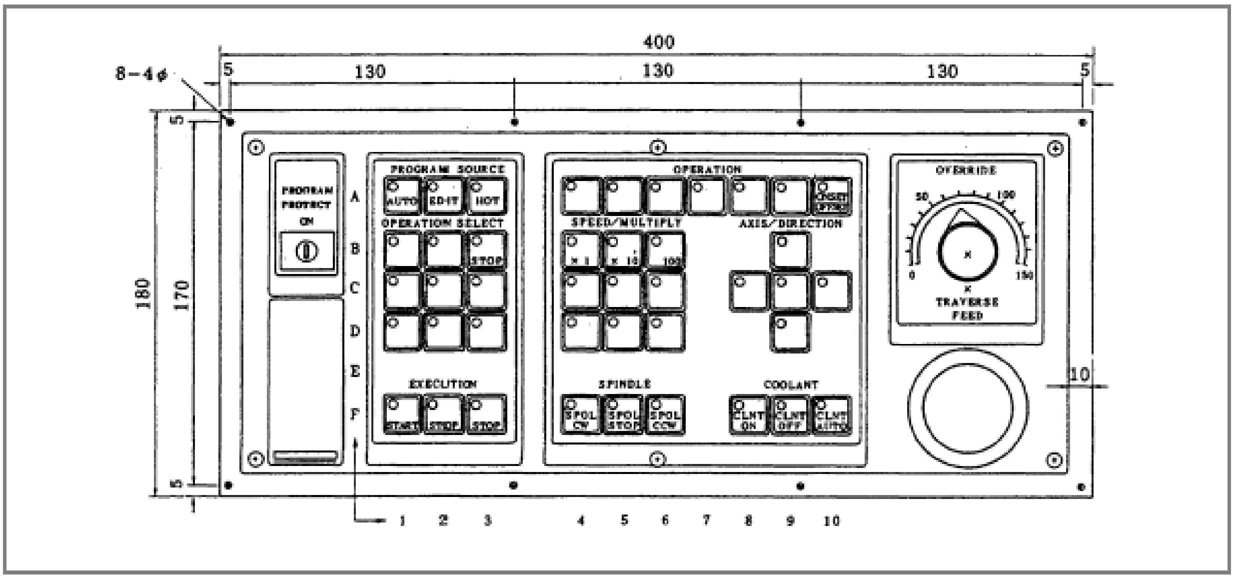


Fig. 3.2.3.8 (b) Operator's panel for 0-TC

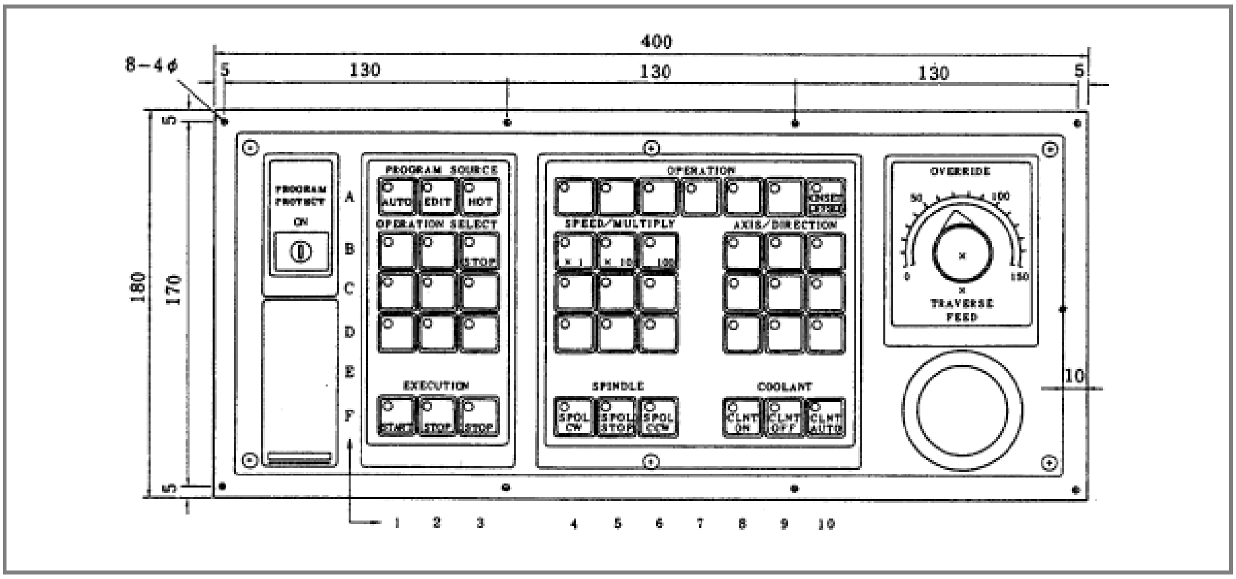


Fig. 3.2.3.8 (c) Operator's panel for 0-MC

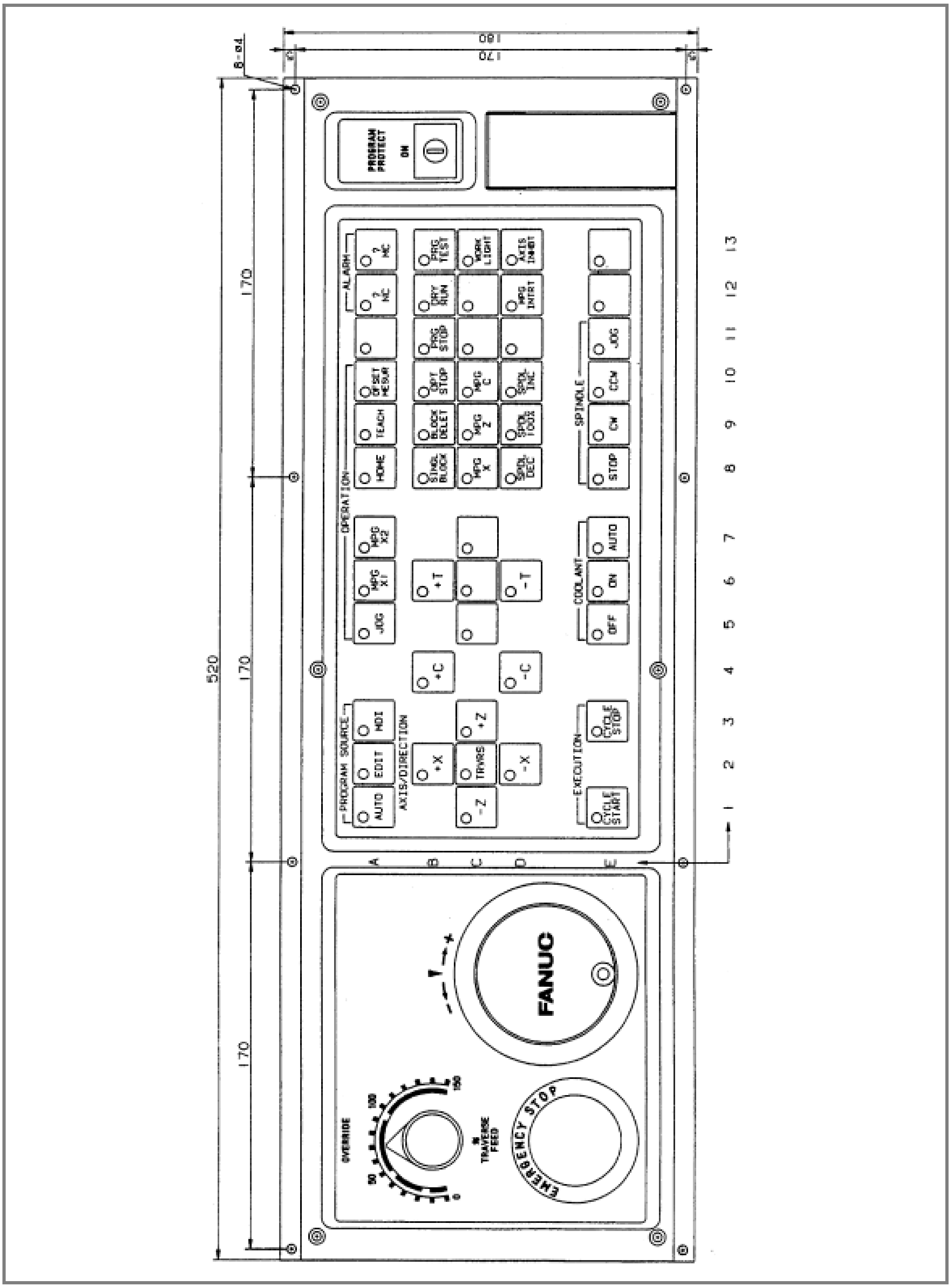


Fig. 3.2.3.8 (d) Machine operator's panel for the 0-TC full-keyboard 9-inch CRT/MDI unit

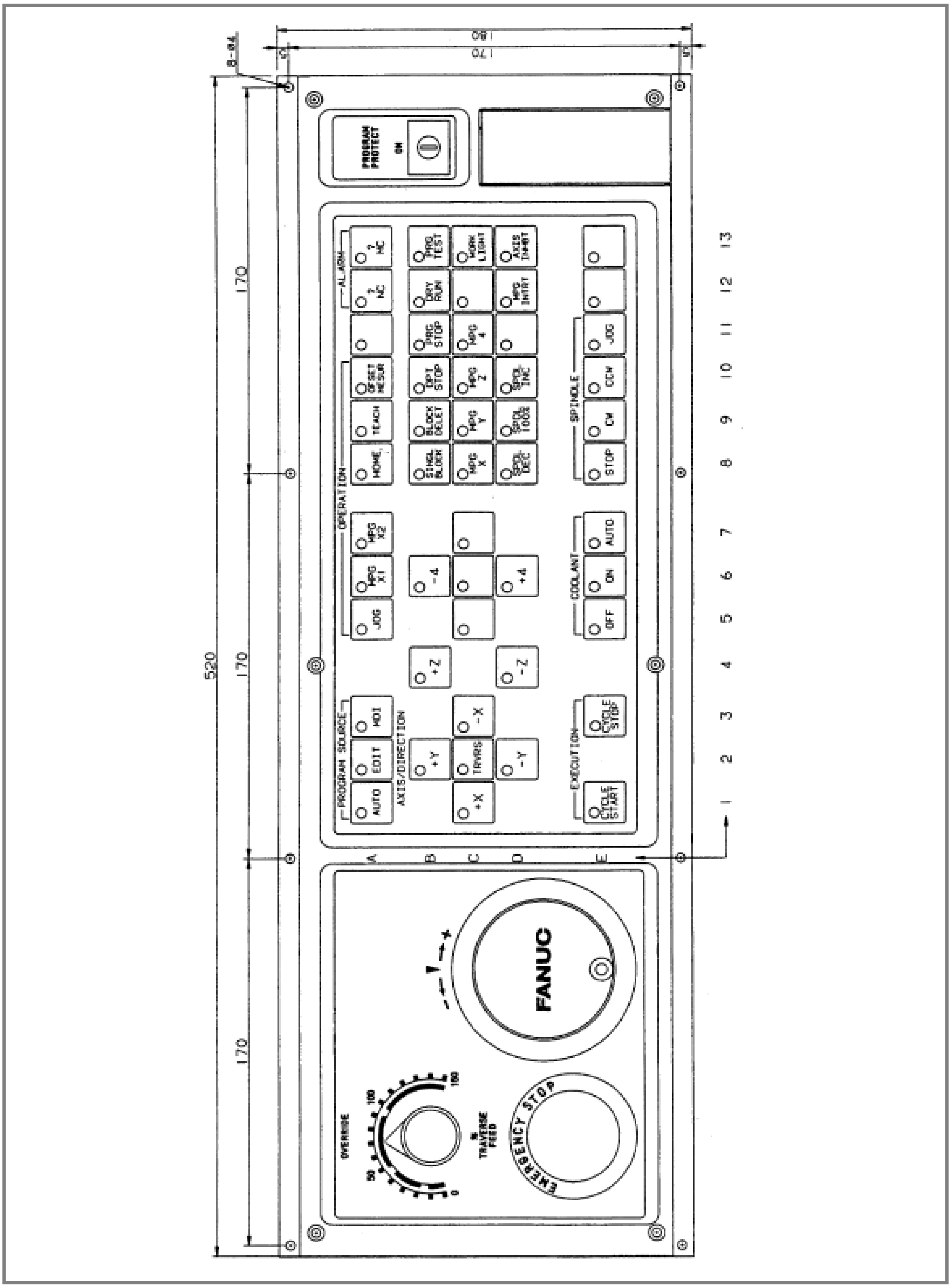
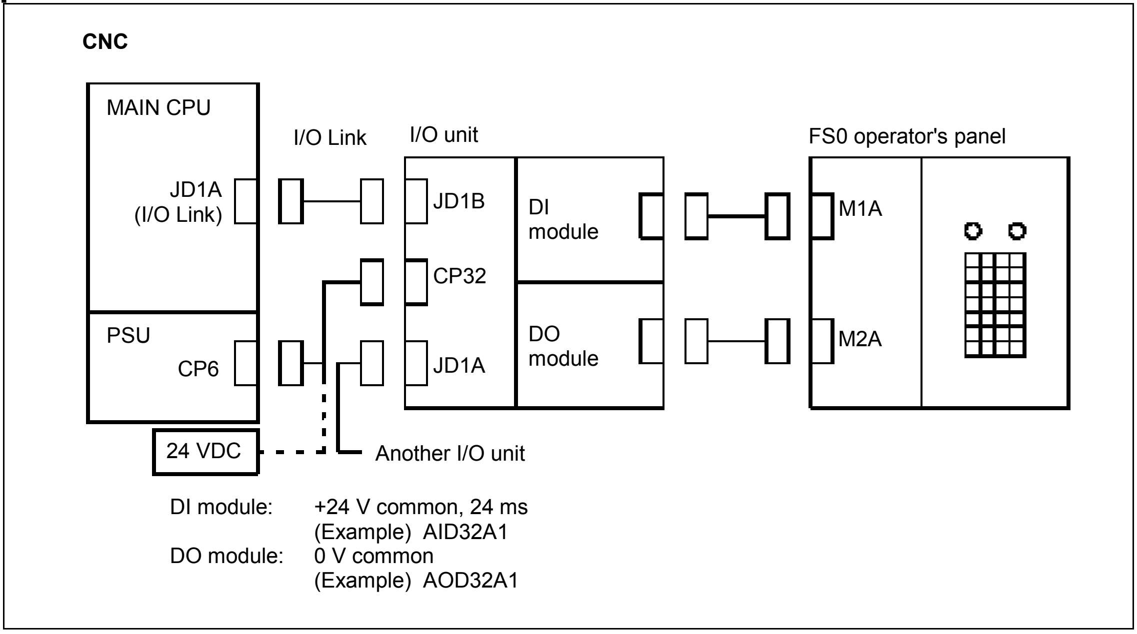


Fig. 3.2.3.8 (e) Machine operator's panel for the 0-MC full-keyboard 9-inch CRT/MDI unit

Example of connection



Assignment method

For the group number ([GROUP]), set the group number used in the configuration.
For the base number ([BASE]), always set 0.
For the slot number ([SLOT]), always set 1.
For the above example of connection, the FS0 operator's panel occupies 32 points (4 bytes) for both input and output. Therefore, the assignment names are as follows.

Input device assignment name	Output device assignment name
ID32A	OD32A

Operator's panel connection signals

- Emergency stop signal (*ESP)

This signal is directly monitored by the CNC and is assigned at the fixed address.
For connection, refer to the section describing the interface between the CNC and PMC in the CNC connection manual.

- Override signals (*OV1 to *OV8) and program protect key signal (KEY)

For these signals, the relevant key-operated switch contact signals are directly input to the PMC. Directly process these signals with a PMC ladder program.
For connection, refer to the section describing the interface between the CNC and PMC in the CNC connection manual.

- Key-operated switch signals (Xn, Xn+2)

Each key-operated switch signal is coded by PMC management software and input to the relevant PMC address R as a bit image.
Whether a required key is pressed can be determined by checking the bit image of the key-operated switch using the user PMC ladder program. (See Tables 3.2.3.8(a), 3.2.3.8(b), and 3.2.3.8(c).) When a key is pressed, the bit corresponding to the key is 1.
Up to two keys can be input simultaneously. Do not use any keyboard input method for a user PMC program that requires simultaneous pressing of three or more keys. If three or more keys are pressed simultaneously, they are not input correctly.
It takes up to 60 ms until the bit corresponding to a key is set to 1 (0) after the key is pressed (released).

The address of a key-operated switch signal (Xn to Xn+2: Table 3.2.3.8(a)) and the address of its bit image (Rk to Rk+7: Tables 3.2.3.8(b) and (c)) can be defined as the fixed address or an unused address without restrictions.

- LED signals (Ym)

Create each LED signal at PMC address R as a bit image in the user PMC ladder program. PMC management software converts the bit image of the LED signal to a coded output signal. (See Tables 3.2.3.8(a), (b), and (c).) When a value of 1 is written in an LED bit image, the corresponding LED is automatically turned on. In the same way, when a value of 0 is written, the LED is turned off. All LEDs are off at power-on.
It takes up to 200 ms until an LED is turned on (off) after a value of 1 (0) is written in the corresponding bit image by the PMC.

The address of an LED signal (Ym: Table 3.2.3.8(a)) and the address of its bit image (Rl to Rl+7: Tables 3.2.3.8(b) and (c)) can be defined as the fixed address or an unused address without restrictions.

Table 3.2.3.8(a) Key-operated switch and LED signal addresses

	#7	#6	#5	#4	#3	#2	#1	#0
Xn	KD7	KD6	KD5	KD4	KD3	KD2	KD1	KD0
Xn+1								
Xn+2	KST				KA3	KA2	KA1	KA0
Ym	LD7	LD6	LD5	LD4	LD3	LD2	LD1	LD0

Table 3.2.3.8(b) Key-operated switch and LED signal bit image addresses (For a compact operator's panel)

KEY/LED	#7	#6	#5	#4	#3	#2	#1	#0
Rk/Rl	F3	F2	F1		D1	C1	B1	A1
Rk+1/Rl+1	F4				D2	C2	B2	A2
Rk+2/Rl+2	D4	D3	C4	C3	B4	B3	A4	A3
Rk+3/Rl+3		F6	F5		D5	C5	B5	A5
Rk+4/Rl+4	F8				D6	C6	B6	A6
Rk+5/Rl+5	D8		C8		B8		A8	A7
Rk+6/Rl+6			F9		D9	C9	B9	A9
Rk+7/Rl+7			F10		D10	C10	B10	A10

Table 3.2.3.8(c) Key-operated switch and LED signal bit image addresses (for a full-keyboard operator's panel)

KEY/LED	#7	#6	#5	#4	#3	#2	#1	#0
Rk/Rl	E1	C1	A1	E6	D6	C6	B6	A6
Rk+1/Rl+1	E2	C2	A2	E7	D7	C7	B7	A7
Rk+2/Rl+2	E3	C3	A3	E8	D8	C8	B8	A8
Rk+3/Rl+3	E5	C4	A4	E9	D9	C9	B9	A9
Rk+4/Rl+4	D2	C5	A5	E10	D10	C10	B10	A10
Rk+5/Rl+5	D4	D5	B2	E11	D11	C11	B11	A11
Rk+6/Rl+6	D1	B1	B4	E12	D12	C12	B12	A12
Rk+7/Rl+7	D3	B3	B5	E13	D13	C13	B13	A13

Setting addresses

Use the system parameter screen to set key-operated switch and LED signal addresses and bit image addresses.

For details of screen operations, see Section 9.8 described later. For details of parameters to be set, see Section 2.4 described earlier.

The following simply describes how values set on the system parameter screen are set at addresses shown in Tables 3.2.3.8(a), (b), and (c).

Example:

On the system parameter screen, specify that the FS0 operator's panel is to be used. Then, set the start key-operated switch address for "DI address", start LED signal address for "DO address", start key-operated switch bit image address for "key input image address", and start LED signal bit image address for "LED output image address".

When the following values are set:

DI address:	X0
DO address:	Y0
Key input image address:	R900
LED output image address:	R910

The addresses shown in Tables 3.2.3.8(a), (b), and (c) are set to the following PMC addresses:

Xn	→	X0000
Xn+1	→	X0001
Xn+2	→	X0002
Ym	→	Y0000
Rk / Rl	→	R0900 / R0910
Rk+1 / Rl+1	→	R0901 / R0911
Rk+2 / Rl+2	→	R0902 / R0912
Rk+3 / Rl+3	→	R0903 / R0913
Rk+4 / Rl+4	→	R0904 / R0914
Rk+5 / Rl+5	→	R0905 / R0915
Rk+6 / Rl+6	→	R0906 / R0916
Rk+7 / Rl+7	→	R0907 / R0917

3.2.4 Setting I/O Address For I/O Link Channel

3.2.4.1 Outline

Interface between PMC and external I/O devices consists of I/O address of 128 bytes of X/Y0 to X/Y127, X/Y200 to X/Y327, X/Y400 to X/Y527, and X/Y600 to X/Y727 as shown below.

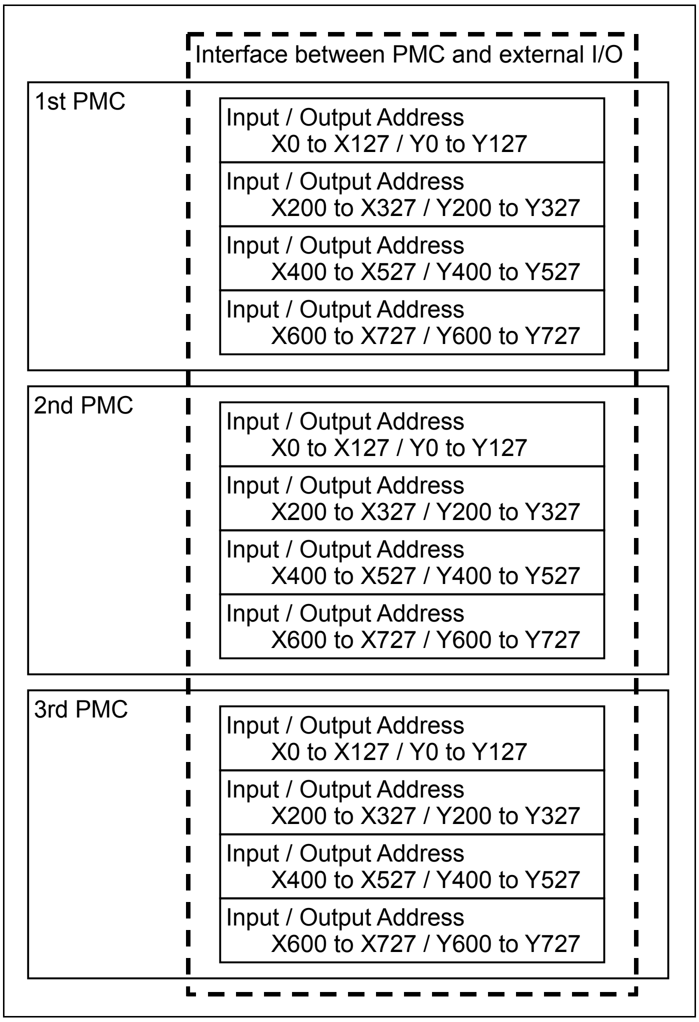


Fig. 3.2.4.1 Interface between PMC and external I/O

To use I/O Link, it is necessary to set the I/O addresses in each channel. They can be set in the Configuration parameter screen. The setting information of each channel is PMC path and I/O addresses of 128 bytes. The information is reflected to CNC parameter. The setting is made effective at the next power-on.

3.2.4.2 Assignment Method

In the following example, channel 1 is set to X/Y0 to X/Y127 of the first PMC, channel 2 is set to X/Y200 to X/Y327 of the first PMC, and channel 3 is set to X/Y0 to X/Y127 of the second PMC on the configuration parameter screen.

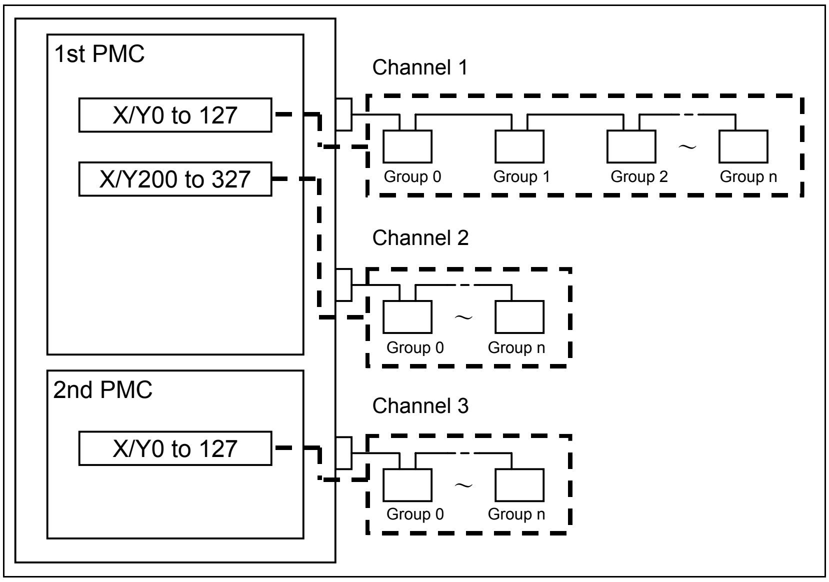


Fig. 3.2.4.2 Example of using 2 PMCs and 3 I/O Link Channels

For details of setting, see Subsection 9.9.3.

3.2.4.3 Dual Assignment of I/O Link Channel

When multi-path PMC function is used, plural I/O link channels may be necessary. However, there is the case of the wasteful assignment in which the number of I/O link channel is lacking and the assigned I/O points are few.
The dual assignment of I/O Link channel can assign I/O devices of one I/O link channel to two PMC paths effectively. To do so, the rest parts of one channel can be used in another PMC path and it is not necessary to add more options than it is needed. The dual assignment of I/O Link channel can be assigned with CNC parameters.
In the following Fig. 3.2.4.3(a) is the example that shows how to use two channels by dividing channel 2 into two blocks in the configuration of Fig. 3.2.4.3

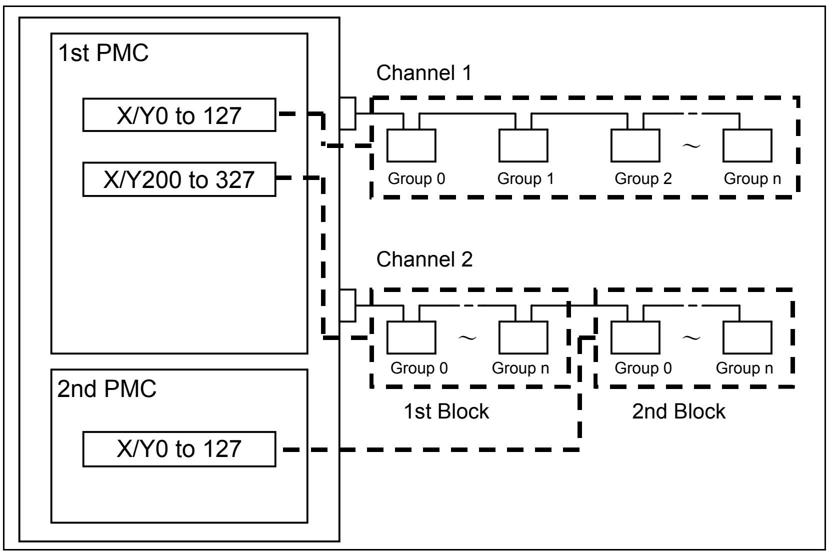


Fig. 3.2.4.3 (a) Example of using 2 PMCs and 2 I/O Link Channels

NOTE
1 Up to 2 blocks are available in one channel.
2 Up to 16 groups of slaves can be connected to total of first and second block. The total number of I/O points occupied by all slaves connected to total of first and second block is up to 1024 points for each of input and output. (For details of I/O points, refer to "FANUC I/O Unit-MODEL A Connection and Maintenance Manual" (B-61813E)).
3 When second block is used and any alarm occurs, group no of the alarm message is displayed according to the I/O device wiring group no.
4 When second block is used, the selectable I/O Link assignment function is available in each block independently.
5 The OVERRIDE function of the forced input/output function is available even if second block is used.
6 When second block is used, it is recommended to enable the I/O Link connection check function to prevent a malfunction about the mistake of the setting.

Setting of dual assignment

To use the second block, see the following procedure.

(1) I/O module assignment
The module assignment is edited on FANUC LADDER-III or built-in edit function and is saved with the sequence program in the same way as not using the second block. Take care of the total group number and total points of each slave.

(2) Setting the machine signal interface
Set the input/output addresses to first and second block for each channel of I/O link in configuration parameter screen.

(3) Re-boot the CNC and confirmation

The example that is assigned like followings is explained here.

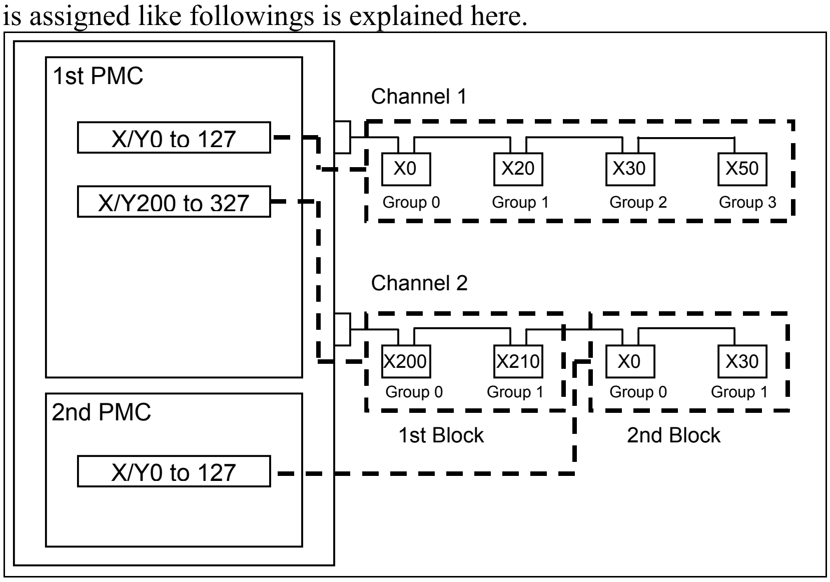


Fig. 3.2.4.3(b) Example of using 2 PMCs and 2 I/O Link Channels

Step1 I/O module assignment

The group number from 0 is set to the assigned data in each block. On the I/O MODULE EDITOR screen, channel 1 is assigned to X/Y0 to X/Y127 of the first PMC and channel 2 is assigned to X/Y200 to X/Y327 of the first PMC and X/Y0 to X/Y127 of the second PMC.

1st PMC

・Assignment of X/Y0 to 127

Address	Group	Base	Slot	Name
X0000	0	0	1	/2
:	:	:	:	:
X0020	1	0	1	FS08A
:	:	:	:	:
X0030	2	0	1	CM16I
:	:	:	:	:
X0050	3	0	1	/8
:	:	:	:	:

・Assignment of X/Y200 to 327

Address	Group	Base	Slot	Name
X0200	0	0	1	/2
:	:	:	:	:
X0210	1	0	1	CM16I
:	:	:	:	:

2nd PMC

・Assignment of X/Y0 to 127

Address	Group	Base	Slot	Name
X0000	0	0	1	/2
:	:	:	:	:
X0030	1	0	1	CM16I
:	:	:	:	:

Set group number 0 to the top I/O device of second block.

For details of setting, see Subsection 9.4.2.

Step2 Setting the machine signal interface

Set the input/output addresses of the I/O Link to each channel, on the PMC CONFIGRATION PARAMETER (MACHINE INTERFACE) screen.

(1) Assign X0/Y0 of the first PMC to channel 1.
(2) Assign X200/Y200 of the first PMC to the first block of channel 2.
(3) Assign X0/Y0 of the second PMC to the second block of channel 2.

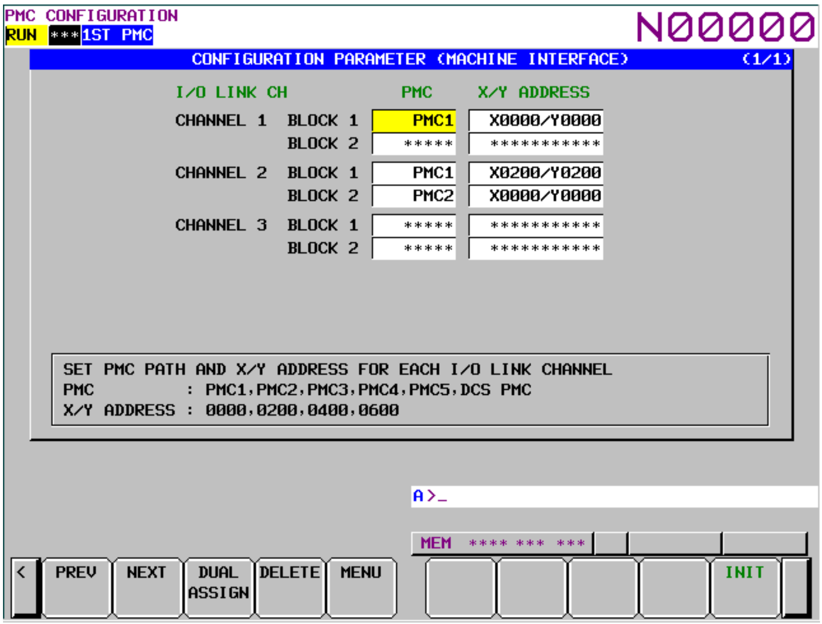


Fig. 3.2.4.3(c) Setting of the PMC configuration parameter setting screen

For details of setting, see Subsection 9.9.3.

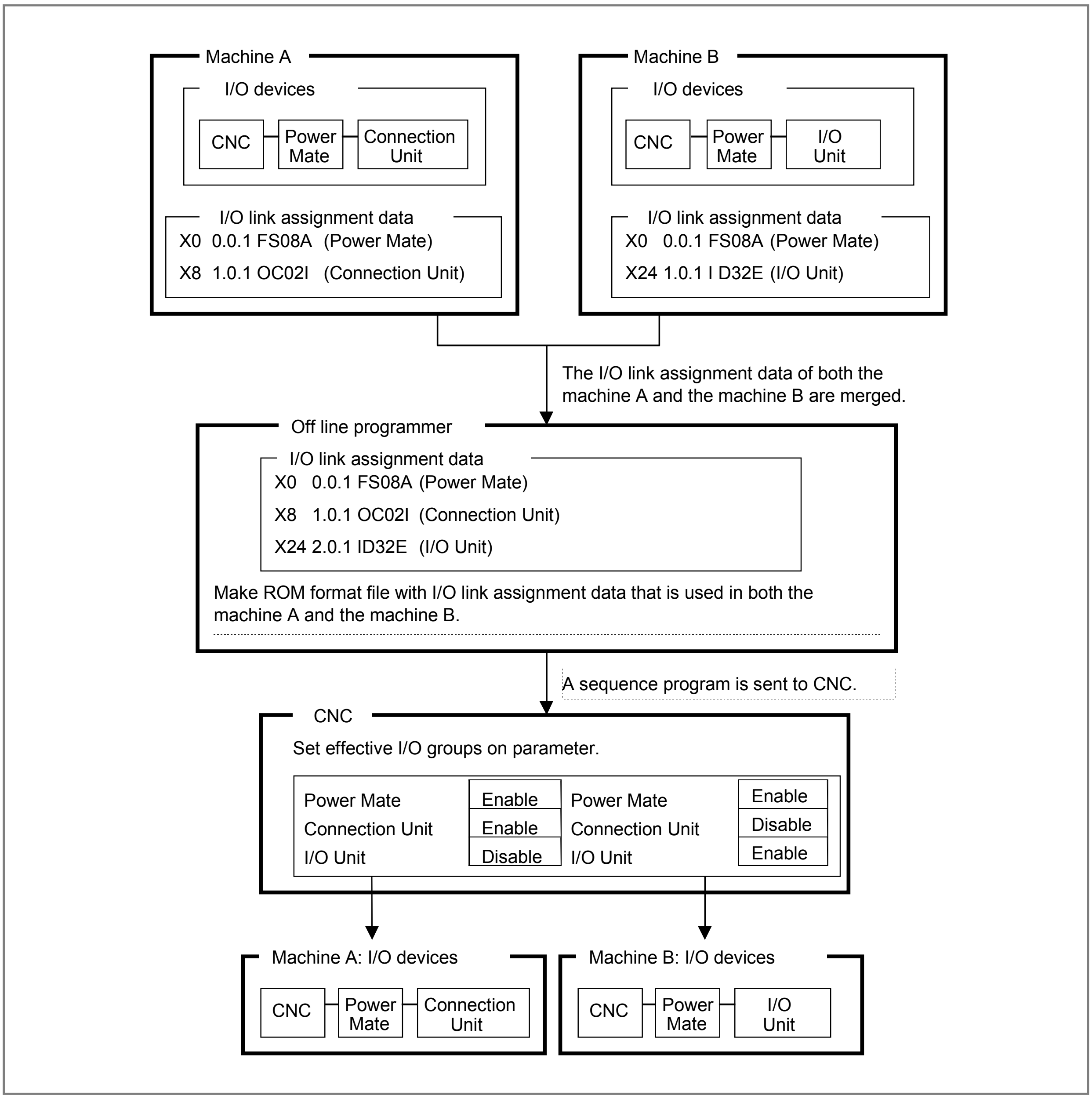
Step3 Re-boot the CNC and confirmation

To reflect the setting data, reboot the CNC. Check the input/output signals of each I/O Link channel and confirm the reflection of the setting.

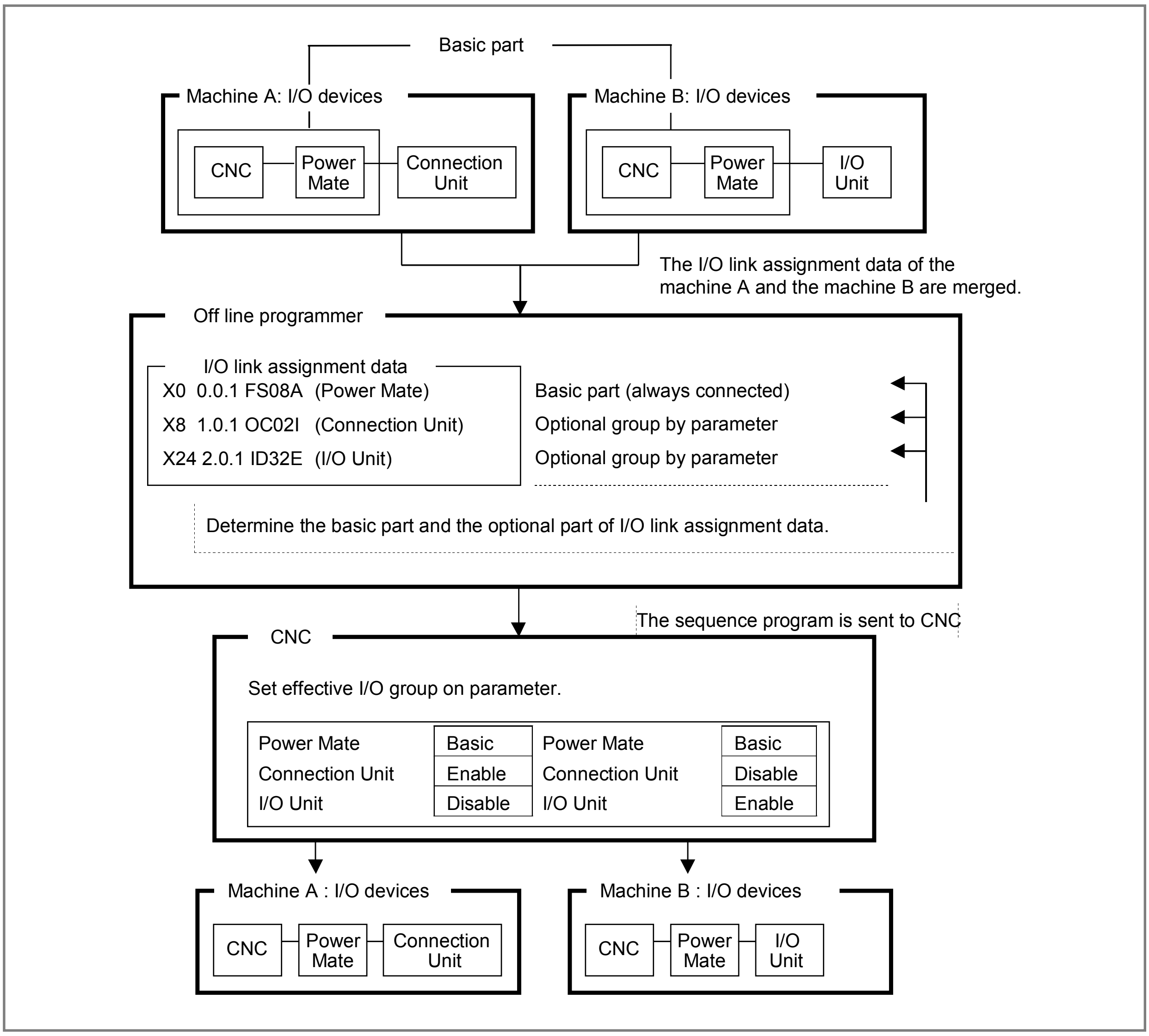
3.2.5 Selectable I/O Link Assignment Function

3.2.5.1 Outline

This function enables the common use of a sequence program for several machines which have different I/O device configuration with each other, by setting the parameter to enable/disable each group in I/O link assignment data.

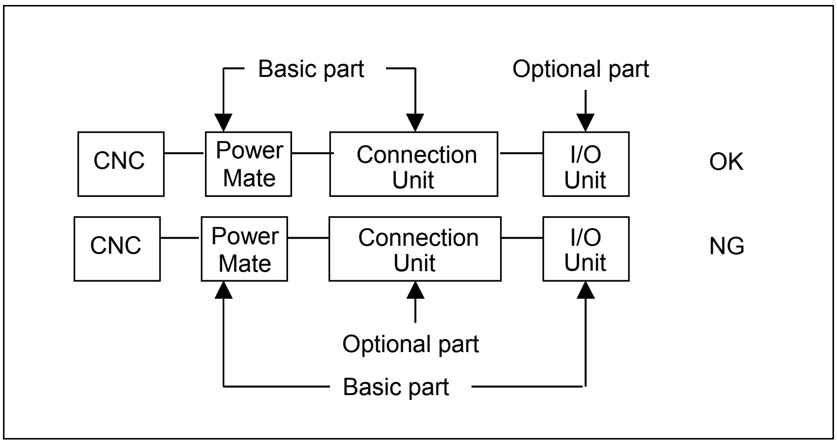


The I/O devices that are used in all machines can be set as basic part of configuration that is always effective.



NOTE

When you set a basic part, you have to assign devices of basic part continuously from group 0. And the basic part is connected with the top of the link.



This function requires setting the following parameters. These parameters can be set for each channel. For details of each parameter, see Sections 2.4 and 9.5.

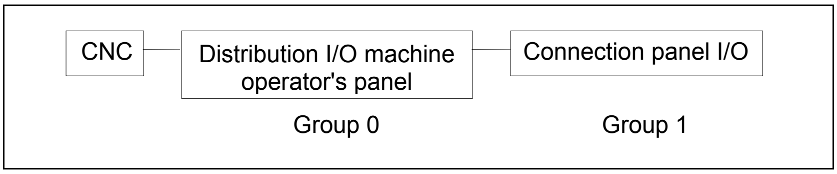
(1) ENABLE SELECTION:
Enables/Disables this function in the system parameter.
(2) BASIC GROUP COUNT:
Sets the counts of group in basic part in the system parameter. (This part must be assigned continuously from group 0.) The basic groups in I/O link assignment data are always effective on all machine configurations.
(3) EFFECTIVE GROUP SELECTION:
Sets the group of optional I/O device that is connected with each machine in the setting parameter. This parameter doesn't affect the basic part.

3.2.5.2 Example

There are three machines which have different configurations of I/O devices, each other.

- Configuration A
A machine which has a distribution I/O machine operator's panel and a connection panel I/O connected with channel 1 of NC.

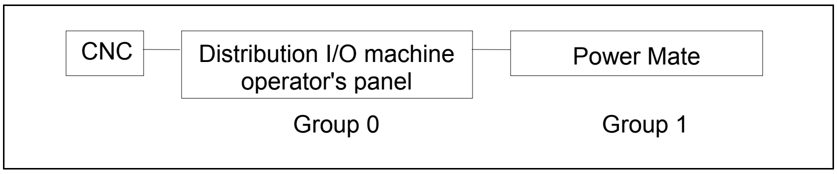
Channel 1



Channel 2
No connection

- Configuration B
A machine which has a distribution I/O machine operator's panel and a Power Mate connected with channel 1 of NC.

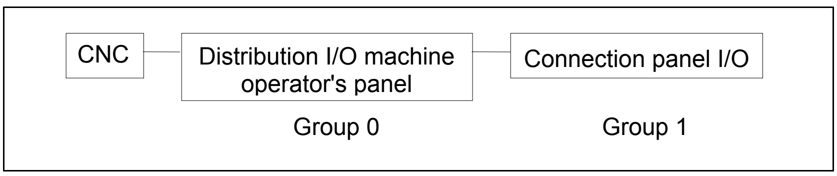
Channel 1



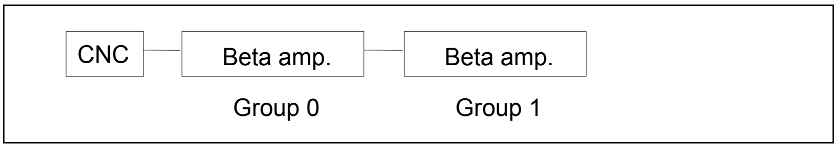
Channel 2
No connection

- Configuration C
A machine which has the configuration A on channel 1 and two beta amplifiers on channel 2.

Channel 1



Channel 2



These machines can use a common sequence program which has I/O link assignment data that includes all I/O device configurations. The contents of parameters for each I/O device configuration are as shown below.

(1) The contents of I/O link assignment data in sequence program
Channel 1

Address	Group	Base	Slot	Name	I/O device
X0000	0	0	1	CM12I	Distribution I/O machine operator's panel
:	:	:	:	:	:
X0020	1	0	1	CM03I	Connection panel I/O
:	:	:	:	:	:
X0030	2	0	1	FS08A	Power Mate
:	:	:	:	:	:

Channel 2

Address	Group	Base	Slot	Name	I/O device
X0200	0	0	1	OC02I	Beta amp.
:	:	:	:	:	:
X0220	1	0	1	OC02I	Beta amp.
:	:	:	:	:	:

(2) The contents of parameter

- Configuration A
  - System parameter
    X0000/Y0000
    ENABLE SELECTION = YES
    BASIC GROUP COUNT = 1
    X0200/Y0200
    ENABLE SELECTION = YES
    BASIC GROUP COUNT = 0
  - Setting parameter

Group NO.:	00	01	02	03	04	05	06	07
X0000/Y0000	*	1	0	0	0	0	0	0
	08	09	10	11	12	13	14	15
	0	0	0	0	0	0	0	0
Group NO.:	00	01	02	03	04	05	06	07
X0200/Y0200	0	0	0	0	0	0	0	0
	08	09	10	11	12	13	14	15
	0	0	0	0	0	0	0	0

- Configuration B
  - System parameter
    X0000/Y0000
    ENABLE SELECTION = YES
    BASIC GROUP COUNT = 1
    X0200/Y0200
    ENABLE SELECTION = YES
    BASIC GROUP COUNT = 0
  - Setting parameter

Group NO.:	00	01	02	03	04	05	06	07
X0000/Y0000	*	0	1	0	0	0	0	0
	08	09	10	11	12	13	14	15
	0	0	0	0	0	0	0	0
Group NO.:	00	01	02	03	04	05	06	07
X0200/Y0200	0	0	0	0	0	0	0	0
	08	09	10	11	12	13	14	15
	0	0	0	0	0	0	0	0

- Configuration C
  - System parameter
    X0000/Y0000
    ENABLE SELECTION = YES
    BASIC GROUP COUNT = 1
    X0200/Y0200
    ENABLE SELECTION = YES
    BASIC GROUP COUNT = 0
  - Setting parameter

Group NO.:	00	01	02	03	04	05	06	07
X0000/Y0000	*	1	0	0	0	0	0	0
	08	09	10	11	12	13	14	15
	0	0	0	0	0	0	0	0
Group NO.:	00	01	02	03	04	05	06	07
X0200/Y0200	1	1	0	0	0	0	0	0
	08	09	10	11	12	13	14	15
	0	0	0	0	0	0	0	0

(3) The actual contents of I/O link assignment data modified by the parameter

- Configuration A
  Channel 1

Address	Group	Base	Slot	Name	I/O device
X0000	0	0	1	CM12I	Distribution I/O machine operator's panel
:	:	:	:	:	:
X0020	1	0	1	CM03I	Connection panel I/O
:	:	:	:	:	:

Channel 2
No connection

- Configuration B
  Channel 1

Address	Group	Base	Slot	Name	I/O device
X0000	0	0	1	CM12I	Distribution I/O machine operator's panel
:	:	:	:	:	:
X0030	1	0	1	FS08A	Power Mate
:	:	:	:	:	:

Channel 2
No connection

- Configuration C
  Channel 1

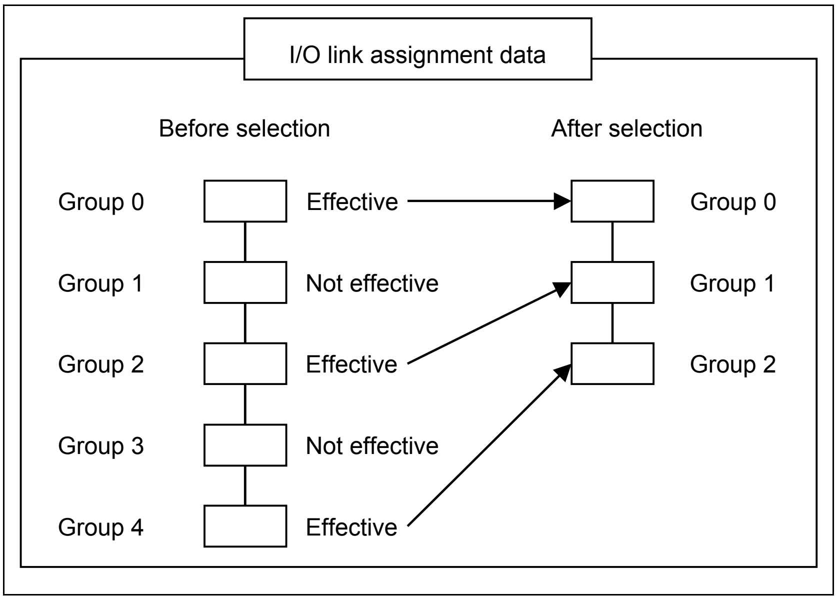
Address	Group	Base	Slot	Name	I/O device
X0000	0	0	1	CM12I	Distribution I/O machine operator's panel
:	:	:	:	:	:
X0020	1	0	1	CM03I	Connection panel I/O
:	:	:	:	:	:

Channel 2

Address	Group	Base	Slot	Name	I/O device
X0200	0	0	1	OC02I	Beta amp.
:	:	:	:	:	:
X0220	1	0	1	OC02I	Beta amp.
:	:	:	:	:	:

3.2.5.3 Notes

(1) If PMC-parameters are cleared, cycling the power of CNC links only the basic part.
(2) After selecting the assignment data, the I/O devices are linked with shifted group number of effective I/O link assignment data.
You can check the actual result of connection using the I/O Link connection display screen.



(3) You can not exchange the order of the I/O group number.

> ⚠ **WARNING**
> 1 If the machine is linked again with incorrect setting of I/O link assignment parameters, the machine may perform unexpected operation. If you want to have the machine linked with I/O devices under the selected I/O link assignment data, you have to turn off and on power after the confirmation of the correct connection of the I/O devices.
> 2 To prevent any operator error caused in a case as described in "WARNING 1" above, it is recommended that the "I/O Link connection check function" be enabled. For details, see Section 3.4.

3.3 WHAT IS I/O Link *i* ?

The I/O Link *i* is one of the serial interfaces which transmits input/output signals at a high speed between the PMC and I/O devices.
Available channels are two channels and for each channel, up to 2048 DI points and up to 2048 DO points can be connected and controlled from the PMC.

As for the transmission cycle of the signals from I/O Link *i*, there are two modes of the normal mode (2msec) and the high-speed mode (0.5msec). You can specify the mode for each group of I/O devices.

Fig. 3.3 Outline of specification of I/O Link *i*

Item	I/O Link *i*		I/O Link
	Normal mode	High-speed mode	
Transmit speed	12Mbps		1.5Mbps
Update cycle(Note 2)	2ms	0.5ms	2ms
I/O points for one channel	2048 / 2048	512 / 512	1024 / 1024 (64 / 64) (Note 3)
I/O points for one group	512 / 512 (224 /224) (Note 3)		256 / 256
Maximum groups for one channel (Note 3, Note4)	24 (4)	5 (4)	16
PMC control address	1st path PMC to 5th path PMC		
	DI: X0～X127 X200～X327 X400～X527 X600～X727		
	DO: Y0～Y127 Y200～Y327 Y400～Y527 Y600～Y727		
Selection of effective group	I/O link selectable assignment data function		

NOTE

1 You can select a communication method from either the I/O Link *i* or the I/O Link for each channel by setting the CNC parameter "Communication method of I/O Device". The default setting is the I/O Link mode (0*i*-F: I/O Link *i* mode). For details of the parameter, refer to subsection "2.4.3". For example, you can use the channel 1 as the I/O Link *i*, and the channel 2 as the I/O Link. In this case, the total I/O points are 3072 points / 3072 points (0*i*-F: 2048 points / 2048 points).

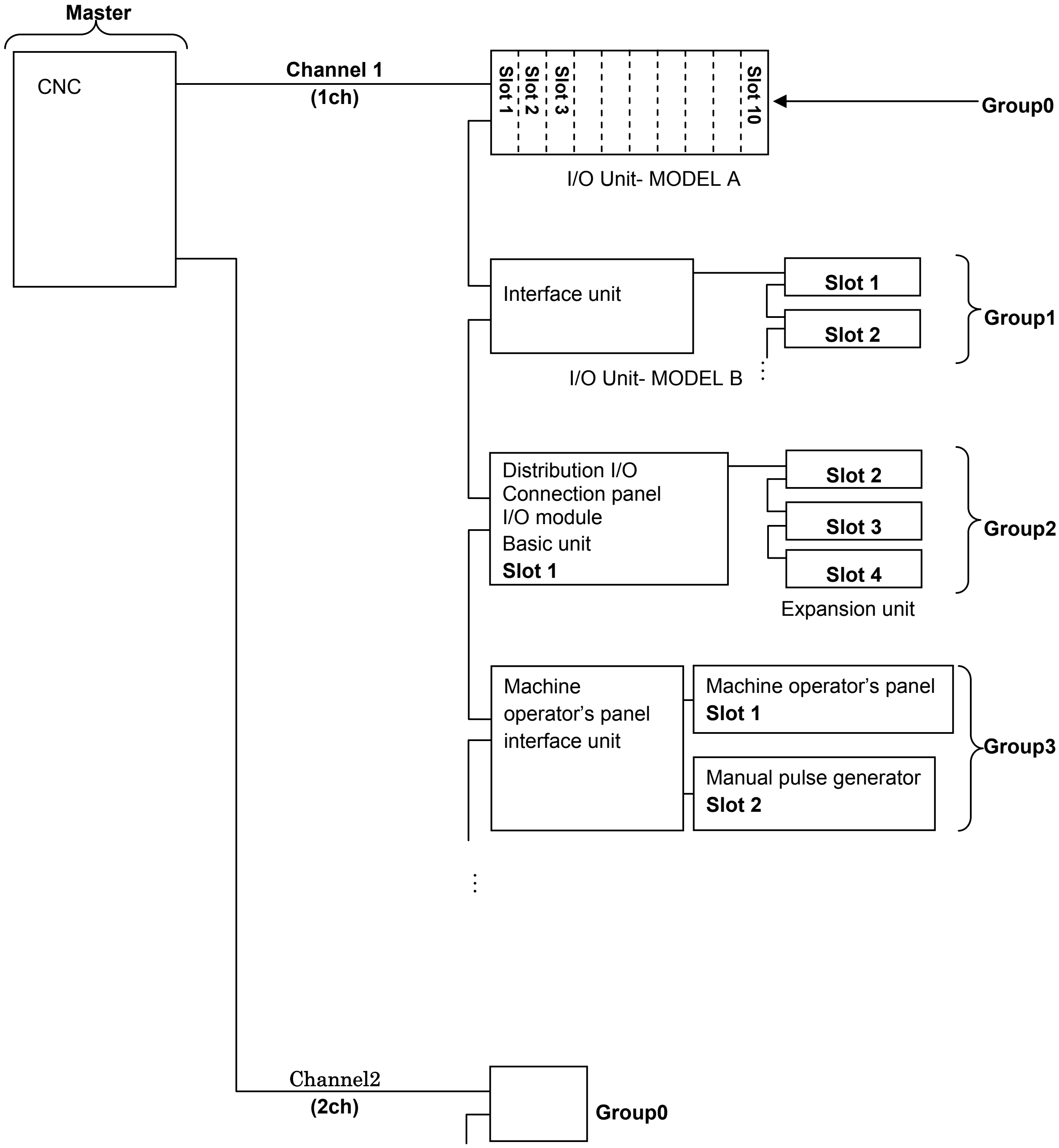
2 You can select an update cycle mode from either the normal mode or the high-speed mode for each group. You can make use of two modes in one channel. For details, refer to subsection "3.3.3".

3 The Inside of "( )" is the specification of dual check safety.

4 If you build the dual check safety system using the I/O Link *i*, you can make use of up to 4 groups for DCSPMC. If you use two channels of the I/O Link *i*, the maximum number of available groups is 4 groups. For details of the directions for the dual check safety of I/O Link *i*, refer to subsection "3.3.7".

3.3.1 Configuration of I/O Link *i*

The following shows a basic configuration example of the I/O Link *i*.



(1) One master and several slaves constitute an I/O Link *i* network.
Master: CNC (such as Series30*i*-B).
Slave: I/O Unit-MODEL A, Machine operator's panel interface unit, etc.
(2) The slave of up to 24 groups can be connected to one channel for the I/O Link *i*.
The group number is assigned to 0 to 23 in order near the master.
The number of slave, which can be connected in one group, is not fixed.
(3) It is not necessary to care the order of connected slaves. However, slaves of a different kind cannot be connected in one group.

NOTE
1 The power of slaves should be turned on simultaneously with or before the power supply of a master.
2 When the power of a master is turned off, the power of all of slaves should be turned off.
3 For the maximum number of slaves which can be connected in one group, refer to connection manual of each I/O devices.

3.3.2 Input / Output Points

The input/output points of I/O Link *i* are 2048 points/ 2048 points for each channel. By assigning the I/O points to each slave, the I/O data can be communicated periodically between the master and slaves.
Each I/O devices occupies some I/O points.
The maximum I/O points, which can be occupied in one group, are 512 points / 512 points (64bytes/64bytes).
And, the numbers of I/O points, which can be occupied in one group, are arranged with a multiple of 8 points. For example, if actual I/O points are 10 points, occupied I/O points are 16 points.

NOTE
1 When you use the high-speed mode, the maximum group number and I/O points show in the following table. If you use both of the normal mode and the high-speed mode, the maximum group number and I/O points are changed. For details, refer to subsection "3.3.3".

The group number of high-speed mode	Maximum group number	Maximum I/O points (all of groups)
Non	24 group	2048 / 2048
1 group	17 group	512 to 2048 / 512 to 2048
2 group	14 group	
3 group	11 group	
4 group	8 group	
5 group	5 group	512 / 512

2 The "safety I/O" used in the dual check safety function are assigned at a group unit. The maximum I/O points of the "safety I/O" group are 224 points/224 points. The "safety I/O" can be specified up to 4 groups for PMC1 to PMC5, and 4 groups for the DCSPMC. For details, refer to subsection "3.3.4".

3.3.3 Update Cycle of Signals

You can choose an update cycle from two modes of the normal mode (2msec cycle) and the high-speed mode (0.5msec cycle) for each group unit. When the high-speed mode is used, the maximum number of groups and I/O points are changed.

Transmission in only normal mode

If you can specify the normal mode for all of groups in one channel, the signal of all groups is transmitted sequentially in group number order in a cycle of 2msec. In this case, it can connect a maximum of 24 groups, and the total number of a maximum of I/O points becomes 2048 points / 2048 points.

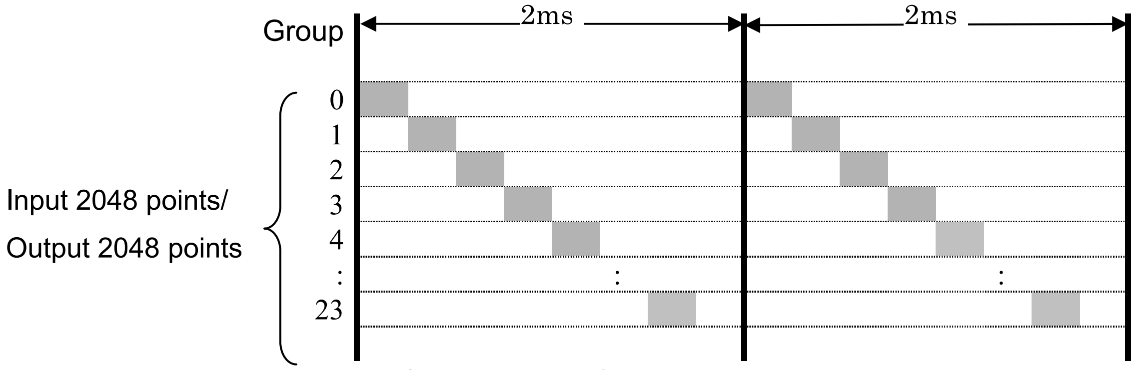


Fig. 3.3.3(a) I/O transmission of Normal mode(24 groups)

Transmission in only high-speed mode

If you can specify the high-speed mode for all of groups in one channel, the signal of all groups is transmitted sequentially in group number order in a cycle of 0.5msec. In this case, it can connect a maximum of 5 groups, and the total number of a maximum of I/O points becomes 512 points / 512 points.

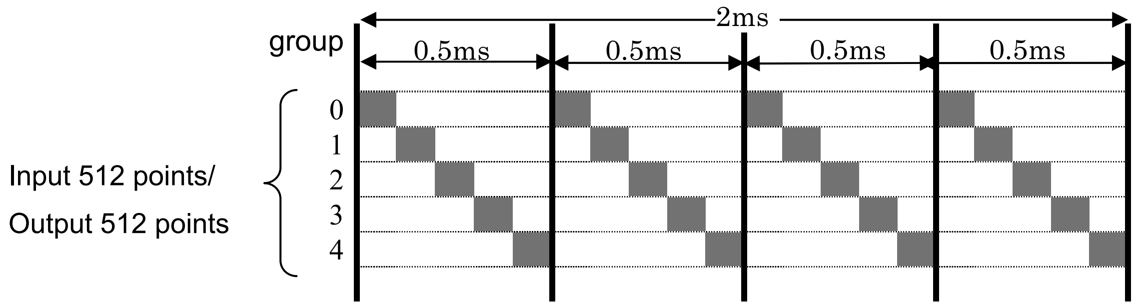


Fig. 3.3.3(b) I/O transmission of high-speed mode (5 groups)

Transmission in mixed modes

When the groups of the normal mode and the high-speed mode are mixed in one channel, the signal of all groups is transmitted sequentially in a cycle of 0.5msec. In groups of the high-speed mode, they are transmitted every 0.5msec from low group number. In the case of group in the normal mode, they are transmitted in one of 4 times in cycle of 0.5msec, it means a cycle of 2msec. At this time, the signals, that are subtracting the total points of high-speed mode from 512 points, can be transmitted in one cycle of 0.5msec.

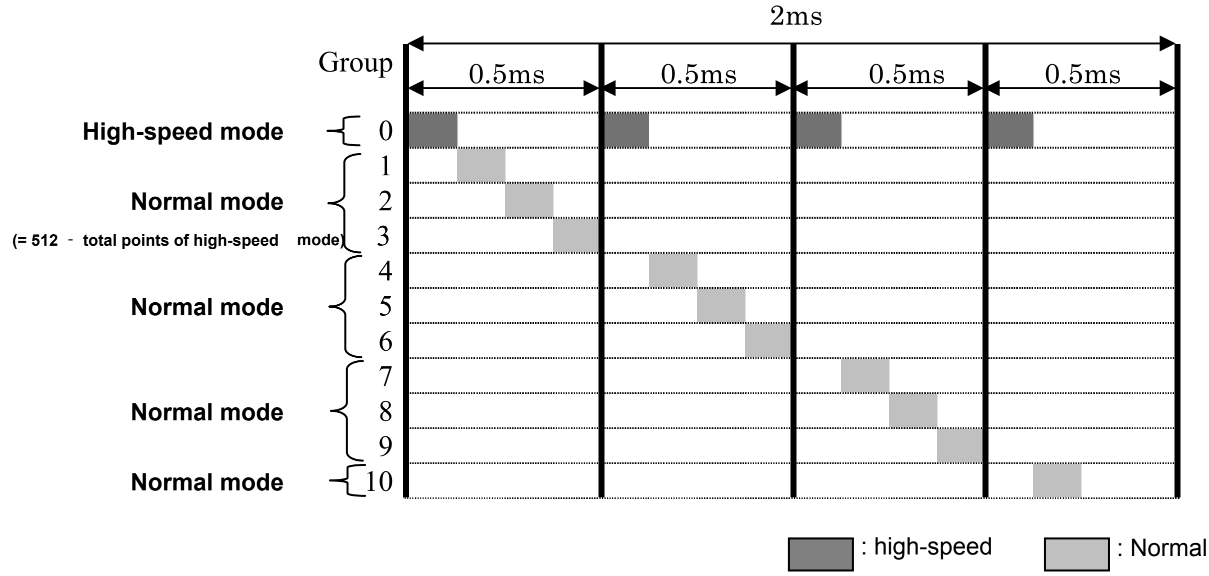


Fig. 3.3.3(c) high-speed mode 1group, normal mode 10group

When the groups of the normal mode and the high-speed mode are mixed, the number is converted in the normal mode, and a maximum of 20 groups can be connected, and a maximum of I/O points are 2048 points/2048 points. The number of groups and I/O points of the normal mode is four times of number of the high-speed mode. For example, 2 groups and 64/64 of I/O points in the high-speed mode equivalent to 8 groups and 256/256 of I/O points in the normal mode.

NOTE

1 The signals are transmitted in the group number order. If the sum total of input or output points are exceeds 512 points, the group will be assigned to next cycle time. For this reason, even if the total number of groups and I/O points is not over maximum number, the PMC alarm “ER35”,”ER36”, “ER38” or “ER39” may occur.

2 In the group of “safety I/O” for the dual check safety function, the redundant data are added at the time of transmission. The data length of the redundant data is 4 bytes or 5 bytes in order to be even bytes. To calculate the total I/O points, add the redundant data. For “safety I/O”, refer to subsection “3.3.4”.
The followings are the example of calculation of I/O points for “safety I/O”.
- In case of 64 points (8 bytes of real data):
  Total 96 points (4 bytes of redundant data)
- In case of 88 points (11 bytes of real data):
  Total 128 points (5 bytes of redundant data)

3.3.4 Safety I/O

In the I/O Link *i*, the “safety I/O” which performs more reliable communication can be specified for a group unit. The maximum I/O points of the “safety I/O” points are 224 points /224 points. The “safety I/O” can be specified up to 4 groups for PMC1 to PMC5, and 4 groups for the DCSPMC.
It is necessary to specify this “safety I/O” to be a safety signals used in the dual check safety function.
For details of the dual check safety function in the I/O Link *i*, refer to subsection “3.3.7”.

NOTE

Redundant data is added to the group which is specified as “safety I/O”. The length of added redundant data is 4 bytes or 5 bytes. It means that the length of actual data becomes even-numbered bytes. The followings are example of actual I/O points of the group specified as “safety I/O”.

- The case that the points of safety I/O are 64 points (8 bytes):
  Actual I/O points are 96 points and redundant data is 4 bytes.
- The case that the points of safety I/O are 88 points (11 bytes):
  Actual I/O points are 128 points and redundant data is 5 bytes.
- The case that the points of safety I/O are 224 points (28 bytes):
  Actual I/O points are 256 points and redundant data is 4 bytes.

Safety I/O group status

You can confirm the groups which communicate as the “safety I/O” by the following system relays.

Address	Contents
R9232.0	Group 0 of Channel 1 is the “safety I/O”.
R9232.1	Group 1 of Channel 1 is the “safety I/O”.
R9232.2	Group 2 of Channel 1 is the “safety I/O”.
R9232.3	Group 3 of Channel 1 is the “safety I/O”.
R9232.4	Group 4 of Channel 1 is the “safety I/O”.
R9232.5	Group 5 of Channel 1 is the “safety I/O”.
R9232.6	Group 6 of Channel 1 is the “safety I/O”.
R9232.7	Group 7 of Channel 1 is the “safety I/O”.
R9233.0	Group 8 of Channel 1 is the “safety I/O”.
R9233.1	Group 9 of Channel 1 is the “safety I/O”.
R9233.2	Group 10 of Channel 1 is the “safety I/O”.
R9233.3	Group 11 of Channel 1 is the “safety I/O”.
R9233.4	Group 12 of Channel 1 is the “safety I/O”.
R9233.5	Group 13 of Channel 1 is the “safety I/O”.
R9233.6	Group 14 of Channel 1 is the “safety I/O”.
R9233.7	Group 15 of Channel 1 is the “safety I/O”.
R9234.0	Group 16 of Channel 1 is the “safety I/O”.
R9234.1	Group 17 of Channel 1 is the “safety I/O”.
R9234.2	Group 18 of Channel 1 is the “safety I/O”.
R9234.3	Group 19 of Channel 1 is the “safety I/O”.
R9234.4	Group 20 of Channel 1 is the “safety I/O”.
R9234.5	Group 21 of Channel 1 is the “safety I/O”.
R9234.6	Group 22 of Channel 1 is the “safety I/O”.
R9234.7	Group 23 of Channel 1 is the “safety I/O”.
R9235.0	Group 0 of Channel 2 is the “safety I/O”.
R9235.1	Group 1 of Channel 2 is the “safety I/O”.
R9235.2	Group 2 of Channel 2 is the “safety I/O”.
R9235.3	Group 3 of Channel 2 is the “safety I/O”.
R9235.4	Group 4 of Channel 2 is the “safety I/O”.

Address	Contents
R9235.5	Group 5 of Channel 2 is the “safety I/O”.
R9235.6	Group 6 of Channel 2 is the “safety I/O”.
R9235.7	Group 7 of Channel 2 is the “safety I/O”.
R9236.0	Group 8 of Channel 2 is the “safety I/O”.
R9236.1	Group 9 of Channel 2 is the “safety I/O”.
R9236.2	Group 10 of Channel 2 is the “safety I/O”.
R9236.3	Group 11 of Channel 2 is the “safety I/O”.
R9236.4	Group 12 of Channel 2 is the “safety I/O”.
R9236.5	Group 13 of Channel 2 is the “safety I/O”.
R9236.6	Group 14 of Channel 2 is the “safety I/O”.
R9236.7	Group 15 of Channel 2 is the “safety I/O”.
R9237.0	Group 16 of Channel 2 is the “safety I/O”.
R9237.1	Group 17 of Channel 2 is the “safety I/O”.
R9237.2	Group 18 of Channel 2 is the “safety I/O”.
R9237.3	Group 19 of Channel 2 is the “safety I/O”.
R9237.4	Group 20 of Channel 2 is the “safety I/O”.
R9237.5	Group 21 of Channel 2 is the “safety I/O”.
R9237.6	Group 22 of Channel 2 is the “safety I/O”.
R9237.7	Group 23 of Channel 2 is the “safety I/O”.

3.3.5 I/O Link *i* Selectable Assignment Data Function

You can set the validity of the I/O assignment data of each group of the I/O Link *i*.
In order to communize the I/O assignment data for several machines which have different I/O device configuration with each other, you can specify all of the I/O assignment data (a maximum of 24 groups) in order to fill full set of configuration beforehand. According to the specification of each machine, this function determines effective groups.
At this time, the number of effective I/O link assignment data is optimized, and applied I/O device is linked. You can confirm the actual result of connection by the I/O Link connection status screen.

Confirmation of I/O Link *i* Selectable Assignment Function

The channel setting of the assignment data for the I/O Link *i* is used to enable this function.

Basic group number

On the channel setting of the assignment data of the I/O Link *i*, you can set the number of the basic configuration groups. It must be to connect continuously from group 0. The assignment data of basic group is effective in all of machine configuration.

Selection of effective groups

The selection of effective groups (own I/O device groups for each machine) is to set the system keep relays (K928 to K933) of PMC1. The setting of this parameter is not effect to the basic groups.

	#7	#6	#5	#4	#3	#2	#1	#0
K928	Group 7	Group 6	Group 5	Group 4	Group 3	Group 2	Group 1	Group 0

[Data type] Bit

Group 0 to 7 For the selectable I/O Link *i* assignment function, whether to enable or disable assignment of group 0 to 7 of channel 1.

0: Assignment of each group to the corresponding bit position is disabled.

1: Assignment of each group to the corresponding bit position is enabled.

	#7	#6	#5	#4	#3	#2	#1	#0
K929	Group 15	Group 14	Group 13	Group 12	Group 11	Group 10	Group 9	Group 8

[Data type] Bit

Group 8 to 15 For the selectable I/O Link *i* assignment function, whether to enable or disable assignment of group 8 to 15 of channel 1.

0: Assignment of each group to the corresponding bit position is disabled.
1: Assignment of each group to the corresponding bit position is enabled.

	#7	#6	#5	#4	#3	#2	#1	#0
K930	Group 23	Group 22	Group 21	Group 20	Group 19	Group 18	Group 17	Group 16

[Data type] Bit

Group 16 to 23 For the selectable I/O Link *i* assignment function, whether to enable or disable assignment of group 16 to 23 of channel 1.

0: Assignment of each group to the corresponding bit position is disabled.
1: Assignment of each group to the corresponding bit position is enabled.

	#7	#6	#5	#4	#3	#2	#1	#0
K932	Group 7	Group 6	Group 5	Group 4	Group 3	Group 2	Group 1	Group 0

[Data type] Bit

Group 0 to 7 For the selectable I/O Link *i* assignment function, whether to enable or disable assignment of group 0 to 7 of channel 2.

0: Assignment of each group to the corresponding bit position is disabled.
1: Assignment of each group to the corresponding bit position is enabled.

	#7	#6	#5	#4	#3	#2	#1	#0
K933	Group 15	Group 14	Group 13	Group 12	Group 11	Group 10	Group 9	Group 8

[Data type] Bit

Group 8 to 15 For the selectable I/O Link *i* assignment function, whether to enable or disable assignment of group 8 to 15 of channel 2.

0: Assignment of each group to the corresponding bit position is disabled.
1: Assignment of each group to the corresponding bit position is enabled.

	#7	#6	#5	#4	#3	#2	#1	#0
K934	Group 23	Group 22	Group 21	Group 20	Group 19	Group 18	Group 17	Group 16

[Data type] Bit

Group 16 to 23 For the selectable I/O Link *i* assignment function, whether to enable or disable assignment of group 16 to 23 of channel 2.

0: Assignment of each group to the corresponding bit position is disabled.
1: Assignment of each group to the corresponding bit position is enabled.

3.3.6 Assignment Method of I/O Link *i*

When you use some I/O devices for slaves, it is necessary to set the I/O assignment data as the connection information for each I/O device. In the connection information, there are “Connection location”, “High-speed mode”, “Safety I/O mode”, “PMC path”, “X address (input)”, “Y address (output)”, “Data length”, ”Use or not use of manual pulse module” and “Comment”. These information can be set in the PMC screen or the FANUC LADDER-III. Moreover, you can set a password in order to protect the assignment data and title data in the FANUC LADDER-III. The I/O assignment data for the I/O Link *i* can be written into the flash ROM without the sequence program.

I/O Link *i* Assignment data

Title

Password

CHANNEL 1

Channel setting

Selectable assignment	Number of basic groups
Effective	2

Group setting

Group	High-speed Mode	Safety I/O Mode	MPG
0	*		*
1			
2			
3		PMC	
4			
5		DCSPMC	
6			
7			
8			
:			
:			
23			

Set the group information and slot information separately. The “zoom” can move to the “Slot information screen” from the “Group information screen”

Slot setting

Slot	PMC	X address	Length	Y address	Length	Comment
1	PMC1	X0	13	Y0	8	Distribution
MPG	PMC1	X14	3		0	MPG
1	PMC2	X0	16	Y0	16	2201-0110
1	PMC3	X0	6	Y0	2	Distribution
1	PMC1	X200	2		0	0807-J103
2	PMC2	X200	2		0	0807-J103
3	PMC1		0	Y200	2	0807-J103
4	PMC2		0	Y200	2	0807-J103
1	PMC1	X300	8	Y300	8	PowerMate
1	DCSPMC	X0	2		0	DCSMAIN
2	DCSPMC	X8	2		0	DCSMAIN
3	DCSPMC		0	Y0	2	DCSMAIN
4	DCSPMC		0	Y8	2	DCSMAIN

CHANNEL 2

Channel setting

Selectable assignment	Number of Basic groups
Non-effective	0

Group setting

Group	High-speed Mode	Safety I/O Mode	MPG
0			
:			
23			

Slot setting

Slot	PMC	X address	Length	Y address	Length	Comment

Fig. 3.3.6 Outline of assignment for I/O Link *i*

The assignment data for I/O Link *i* are set in each channel data, group data, and slot data separately.

Item of channel setting

(1) Selectable assignment function
Set effective/non-effective of selectable assignment function for I/O Link *i*.

(2) Basic group number
Set the number of basic groups for selectable assignment.

Item of group setting

(1) Connection location "group"
Set the group number of connection location.

(2) High-speed mode "high-speed mode"
Set the mode of update cycle for each group by the soft-key.
In the column "High-speed mode", the mode is shown as the following.
Space: Normal mode (2msec) (Default)
* : High-speed mode (0.5msec)
For details of update cycle, refer to subsection "3.3.3".

(3) Safety I/O mode "Safety I/O"
Set the safety I/O mode for each group by the soft-key.
Space: Normal I/O (Default)
DCSPMC: Safety I/O for DCSPMC
PMC: Safety I/O for 1st PMC to 5th PMC

For the groups which is set to " " or "PMC", you assign X/Y address of 1st PMC to 5th PMC. The X/Y address of plural PMC path can be assigned in these groups.
For the group which is set to "DCSPMC", the X/Y address of only DCSPMC can be assigned. The maximum I/O points of the groups, which are set to "DCSPMC" or "PMC", are 224 points/224 points.

(3) Manual pulse module "MPG"
Set the manual pulse module by the soft-key.
Space: Not use of the manual pulse module (Default)
* : Use of the manual pulse module

The "use of the manual pulse module" is set, "MPG" is displayed in the column "Slot" in the slot data. The assignment data for the manual pulse module is set in the slot.

Example) In case that 3bytes from X14 is assigned for "MPG".

Slot	PMC	X address	X size	Y address	Y size
MPG	PMC1	X14	3		

Item of Slot setting

(1) Connection location “Slot”
Set the slot number of connection location. For multi-path PMC, PMC path and address can be assigned for each slot. You can use the addresses for plural PMC path in one channel.

> **Note**
> In group setting, “MPG” is displayed in the slot when the “use of manual pulse module” is set.

(2) PMC path “PMC”
Set the PMC path.
“PMC1” to “PMC5” is set for each slot except setting “DCSPMC” in safety I/O mode.
“DCSPMC” is set for the group which is set “DCSPMC” in safety I/O mode.

(3) X address, Y address “X address, Y address”
Set the X address (input) and Y address (output) which is assigned to each I/O device. The ranges of the address are X/Y0 to 127, X/Y200 to 327, X/Y400 to 527 and X/Y600 to 727.

> **Note**
> 1 The X/Y address, which is set for the interface of I/O Link in PMC configuration parameter, cannot be used. When some address is duplicated between I/O Link *i* and I/O Link, the PMC alarm occurs at the power on.

(4) Data length “X size, Y size”
Set the data length by byte unit.

(5) Comment “Comment”
Set the comments up to 40 characters for I/O device. Available characters are as follows.
A to Z, a to z, 0 to 9, _!”#&’()”+,-< = >?@[/]^{|}~
Example) Drawing of Operator’s panel connection unit A
A16B-2200-0661

Others

The title and password can be set in FANUC LADDER-III.

(1) Title
Up 255 characters of title information can be set for title information of the assignment data.
Available characters are as follows.
A～Z, a～z, 0～9, space, Kana, Chinese character (a part), _!”#&$’()”+,-< = >?@[/]^{|}~

The contents of the title information can be confirmed in the I/O Link *i* assignment screen.

(2) Password protection
By the password, you can protect against the viewing or editing of the assignment data of I/O Link *i*.

3.3.7 Directions for Use of I/O Link *i* in Dual Check Safety Function

Summary

You can build the system for the dual check safety using either the I/O Link or the I/O Link *i*.
When you use the I/O Link for dual check safety, the I/O devices used in PMC1 to PMC5 are connected to channel 1or 2, and the I/O devices used in DCSPMC are connected to channel 3. Therefore, two or more channels are necessary for the dual check safety.

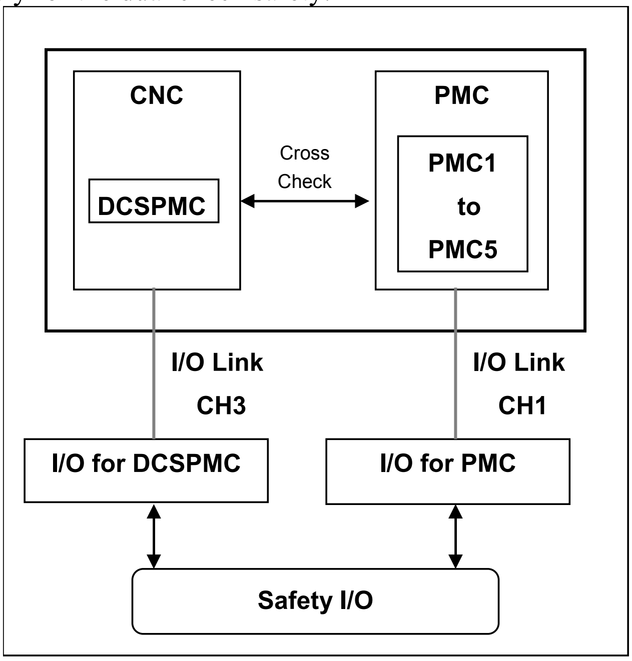


Fig. 3.3.7 (a) Dual check safety using 2 channel in I/O Link

When you use the I/O Link *i* for dual check safety, the I/O devices used in PMC1 to PMC5 are connected to same channel used I/O devices for the DCSPMC. Therefore, only one channel is necessary for the dual check safety.

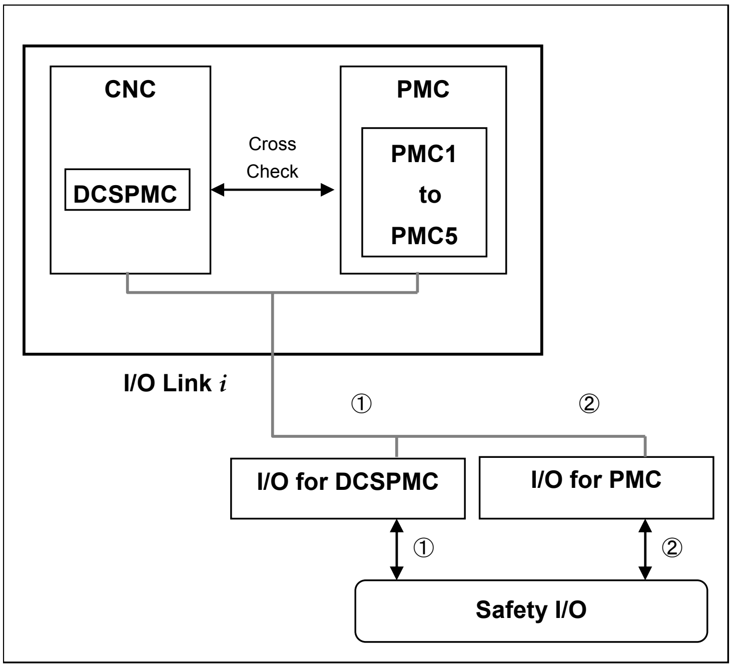


Fig. 3.3.7 (a) Dual check safety using 1 channel in I/O Link *i*

Assignment for dual check safety

For the groups using in the dual check safety, you can set the “DCSPMC” or the “PMC” in the “safety I/O mode” of the I/O assignment data. In the slots of the group that is set to the “DCSPMC” or the “PMC”, the following PMC can be set.

DCSPMC:	DCSPMC
PMC:	PMC1 to PMC5

The maximum I/O points of the groups, which is set to the “DCSPMC” or the “PMC”, are 224 points /224 points.

3.4 I/O Link / I/O Link *i* CONNECTION CHECK FUNCTION

The I/O Link / I/O Link *i* connection check function always checks whether the number of I/O Link / I/O Link *i* groups defined in a sequence program is the same as that of actually connected groups. When the selectable I/O Link / I/O Link *i* assignment function is used, the I/O Link connection check function compares the number of selected groups with that of connected groups.
If these numbers of groups do not match, the PMC alarm "ER97 I/O Link FAILURE (CHn Gxx)" is issued. For action to be taken, see Section 12.1.

NOTE
1 All I/O devices connected to the channel in which this alarm occurs are not linked.
2 The ladder program is executed regardless of whether this alarm occurs.

The execution of this function can be controlled using keep relay K906.2.

K906.2
- 0: Enables the I/O Link / I/O Link *i* connection check function. (Initial value)
- 1: Disables the I/O Link / I/O Link *i* connection check function.

⚠ **CAUTION**
If I/O devices are linked in the status in which an I/O device error or I/O device connection error occurs or the setting of an I/O device is changed due to an unintentional operation, the machine may not operate normally. This function can always be operated to detect an I/O device error at power-on. To troubleshoot problems with I/O devices easily, it is recommended that keep relay K906.2 be set to the initial value (0).

3.5 ASSIGNMENT OF NETWORK DEVICES TO X/Y ADDRESS

Input and output signals of network devices, such as a PROFIBUS, a PROFINET or an iPendant etc., can be assigned to X/Y address area, such as X0-X127/Y0-Y127 or X200-327/Y200-327 etc. Network devices can be assigned to the X/Y address area to which any I/O Link and I/O Link *i* devices are not assigned.
When you assign network device to X/Y address area, you have to set 1 to the CNC parameter 11937 to 11939 for the corresponding area. For details, refer to “The input/output address used by network device” of “2.4.3”.

NOTE

1 Once these parameters are set, it is necessary to turn off and on the power.
2 This parameter should be set only for the X /Y address area to which the network device is assigned, because this parameter may affect the ladder execution performance.
3 Network devices cannot be assigned to the X/Y address area to which any I/O Link and I/O Link *i* are assigned.
4 In case of using I/O Link *i*, assign network devices to the X/Y address area to which any I/O Link *i* devices are not assigned, then set this parameter for corresponding area.
5 In case of using I/O Link and the parameter No.11910-11912 are set to 0 (default setting), I/O Link devices are assigned to X0-X127/Y0-Y127, X200-X327/Y200-Y327 and X400-X527/Y400-Y527 area of 1st PMC path. In this case for 1st PMC path, network devices can only be assigned to X600-X727/Y600-Y727 area.
If all parameters are not set to 0, network devices can be assigned to the X/Y address area to which any I/O Link channels are not assigned, and set this parameter for corresponding area accordingly.
Example) When I/O Link channel 1 is assigned to X0-X127/Y0-Y127 of 1st PMC path, and network device can be assigned to X200-327/Y200-327, set the parameter No.11910=100, No.11911=0, No.11912=0, No.11937#1=1.

4 LADDER LANGUAGE

4.1 BASIC INSTRUCTIONS

Designing a sequence program entails drawing a ladder diagram. Draw a ladder diagram by using relay contact symbols as well as symbols representing the functional instructions described later. The logic laid out in the ladder diagram is input to the programmer as a sequence program.
You can input a sequence program to the programmer in two ways - the relay symbol input method whereby relay contact symbols and functional instruction symbols drawn in the ladder diagram are used as they are (–| |–, –|/|–, –O–, etc.) and the mnemonic format input method that uses the mnemonic language (PMC instructions such as RD, AND, and OR).
The relay symbol input method allows the ladder diagram format to be used as it is, thus letting you input a sequence program in an intuitive, easy-to-understand manner. You will virtually have no trouble creating a program even if you have little or no knowledge of the PMC instructions (basic instructions such as RD, AND, and OR).
In fact, however, the content of a sequence program that is input using the relay symbol input method is internally converted to instructions that are equivalent to the corresponding PMC instructions. Also, you need to fully understand the functionalities of the functional instructions that are described later. It is therefore necessary for you to carefully read the descriptions of the basic and functional instructions that are given later in this manual.
For information about how to input PMC instructions to the programmer using relay and other symbols, see Chapter 8.
When reading the descriptions of the PMC instructions, keep the following in mind.

(1) Signal addresses
An address is assigned to every relay coil and contact - that is, every signal - drawn in a ladder diagram (see Fig. 4.1 (a)). An address consists of an address number and a bit number. A zero at the beginning of an address may be omitted. For detailed information about addresses, see Section 2.2.

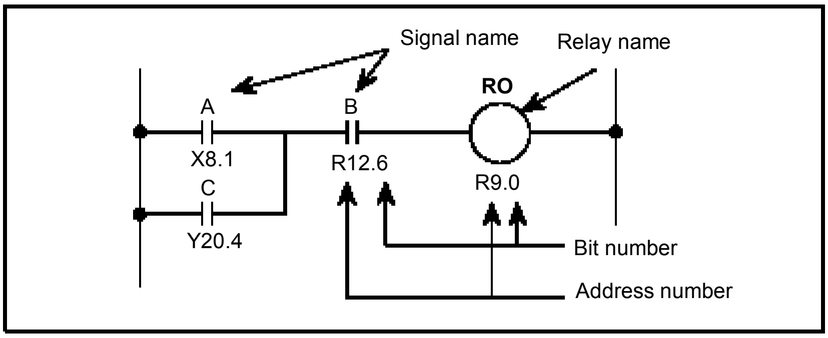


Fig. 4.1 (a) Signal addresses

(2) Types of instruction
There are two types of PMC instruction - basic instructions and functional instructions.
(a) Basic instructions
The basic instructions are most frequently used in designing a sequence program. There are 24 instructions, including AND and OR, each of which performs a one-bit operation.
(b) Functional instructions
The functional instructions are intended to make it easy to program those machine operations that are difficult to code with the basic instructions alone. For the types of functional instructions, see Subsection 2.1.8 or 2.1.9.

(3) Storage of logical operation results
There is a register that stores the interim results of logical operations during the execution of a sequence program.
This register consists of a total of nine bits, which is divided into a one-bit segment and an eight-bit segment as shown in Fig. 4.1 (b).

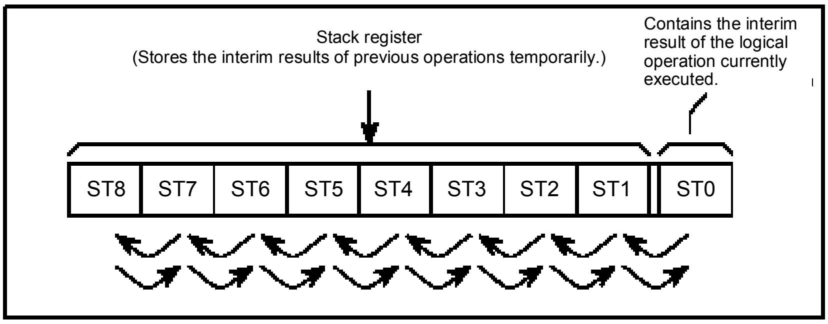


Fig. 4.1 (b) Structure of the register storing the results of logical operations

When an instruction (such as RD.STK) that temporarily stores the interim result of a logical operation is executed, the current content of the register is shifted to the left and the interim logical operation result is stacked in the register, as shown in the above figure. Conversely, when an instruction (such as AND.STK) that retrieves a stacked signal is executed, the register content is shifted to the right and the signal is retrieved. The last stacked signal is retrieved first. For information about the actual uses and operations of these instructions, see the relevant descriptions in this manual.

4.1.1 Details of the Basic Instructions

Table 4.1.1 lists the types of the basic instructions and explains the processing they perform.
The difference between the two types of formats shown under Instruction is described below.

Mnemonic format:
The instructions are displayed in this format when you edit or print a ladder program that has been converted to the mnemonic format with FANUC LADDER-III, by using a commercially available text editor.
Mnemonic format (abbreviated):
These are the abbreviated forms of instructions that you can use when editing a ladder program that has been converted to the mnemonic format with FANUC LADDER-III, by using a commercially available text editor. If you input a file in this abbreviated format and convert it again to the ladder diagram format with FANUC LADDER-III, the code in the file can still be recognized as being written in the valid mnemonic format.

Detailed explanations of the individual basic instructions follow.

Table 4.1.1

No.	Instruction		Processing
	Mnemonic format	Mnemonic format (abbreviated)	
1	RD	R	Reads the status of the specified signal and sets it in the ST0 bit.
2	RD.NOT	RN	Reads and reverses the logical status of the specified signal and sets it in the ST0 bit.
3	WRT	W	Outputs the logical operation result (the status of the ST0 bit) to the specified address.
4	WRT.NOT	WN	Reverses and outputs the logical operation result (the status of the ST0 bit) to the specified address.
5	AND	A	Produces a logical product.
6	AND.NOT	AN	Reverses the logical status of the specified signal and produces a logical product.
7	OR	O	Produces a logical sum.
8	OR.NOT	ON	Reverses the logical status of the specified signal and produces a logical sum.
9	RD.STK	RS	Shifts the register content one bit to the left and sets the status of the signal at the specified address in the ST0 bit.
10	RD.STK.NOT (RD.NOT.STK)	RSN (RNS)	Shifts the register content one bit to the left, reads and reverses the logical status of the signal at the specified address, and sets it in the ST0 bit.
11	AND.STK	AS	Sets the logical product of the ST0 and ST1 bits in the ST1 bit and shifts the register content one bit to the right.
12	OR.STK	OS	Sets the logical sum of the ST0 and ST1 bits in the ST1 bit and shifts the register content one bit to the right.
13	SET	SET	Finds the logical sum of the ST0 bit and the status of the signal at the specified address and outputs it to the specified address.
14	RST	RST	Finds the logical product of the reversed status of the ST0 bit and the status of the signal at the specified address and outputs it to the specified address.
15	RDPT	RPT	Positive transition contact instruction. When rising transition (0→1) of the specified signal is detected, "1" is set to the ST0 bit. Otherwise "0" is set to the ST0 bit.
16	ANDPT	APT	Positive transition contact instruction. When rising transition (0→1) of the specified signal is detected, ST0 bit is not changed. Otherwise "0" is set to the ST0 bit.

No.	Instruction		Processing
	Mnemonic format	Mnemonic format (abbreviated)	
17	ORPT	OPT	Positive transition contact instruction. When rising transition (0→1) of the specified signal is detected, "1" is set to the ST0 bit. Otherwise ST0 bit is not changed.
18	RDPT.STK	RPTS	Positive transition contact instruction. Shifts the stack register content one bit to the left and when rising transition (0→1) of the specified signal is detected, "1" is set to the ST0 bit. Otherwise "0" is set to the ST0 bit.
19	RDNT	RNT	Negative transition contact instruction. When falling transition (1→0) of the specified signal is detected, "1" is set to the ST0 bit. Otherwise "0" is set to the ST0 bit.
20	ANDNT	ANT	Negative transition contact instruction. When falling transition (1→0) of the specified signal is detected ST0 bit is not changed. Otherwise "0" is set to the ST0 bit.
21	ORNT	ONT	Negative transition contact instruction. When falling transition (1→0) of the specified signal is detected, "1" is set to the ST0 bit. Otherwise ST0 bit is not changed.
22	RDNT.STK	RNTS	Negative transition contact instruction. Shifts the stack register content one bit to the left and when falling transition (1→0) of the specified signal is detected, "1" is set to the ST0 bit. Otherwise "0" is set to the ST0 bit.
23	PUSH	PS	Instruction to make a branch of circuit. Shifts the stack register one bit to the left. The contents of ST0 bit are not changed.
24	POP	PP	Instruction to make a branch of circuit. Shifts the stack register content one bit to the right. (ST1→ST0)

4.1.2 RD Instruction

Format

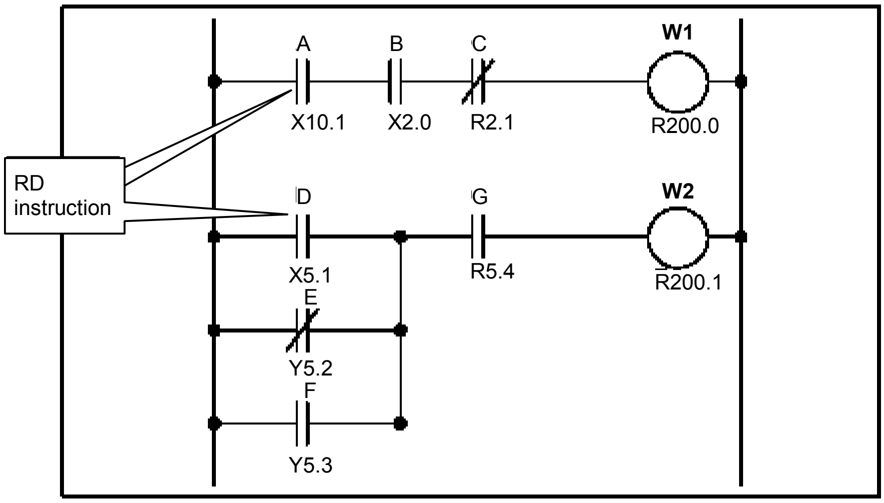


Fig. 4.1.2

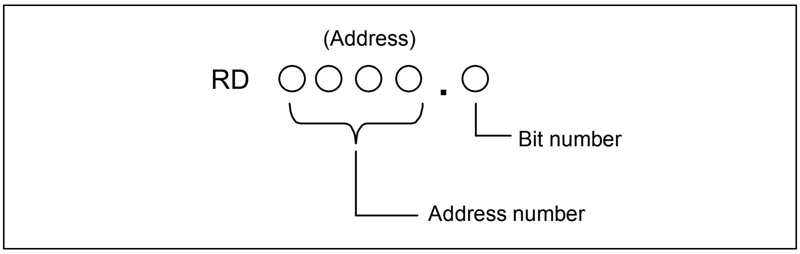


Table 4.1.2

Mnemonic format / **Status of operation result**

Step number	Instruction	Address No.	Bit No.	Remarks	ST2	ST1	ST0
1	RD	X10	.1	A			A
2	AND	X2	.0	B			$A\cdot B$
3	AND.NOT	R2	.1	C			$A\cdot B\cdot \overline{C}$
4	WRT	R200	.0	W1 output			$A\cdot B\cdot \overline{C}$
5	RD	X5	.1	D			D
6	OR.NOT	Y5	.2	E			$D + \overline{E}$
7	OR	Y5	.3	F			$D + \overline{E} + F$
8	AND	R5	.4	G			$(D + \overline{E} + F)\cdot G$
9	WRT	R200	.1	W2 output			$(D + \overline{E} + F)\cdot G$

Operation

(1) Use this instruction to start coding from contact A (–││–). For examples of how the RD instruction is used, see the ladder diagram shown in Fig. 4.1.2 and the input example in the mnemonic format given in Table 4.1.2.

(2) The instruction reads the status (0 or 1) of the signal at the specified address and sets it in the ST0 bit.

4.1.3 RD.NOT Instruction

Format

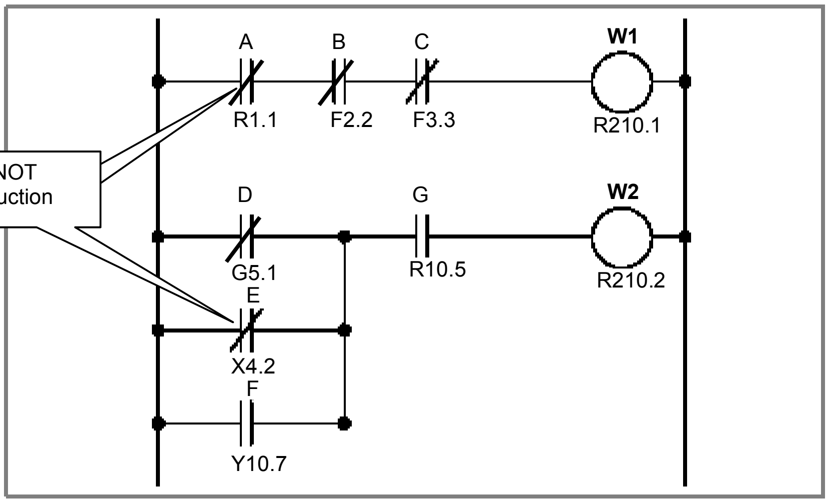


Fig. 4.1.3

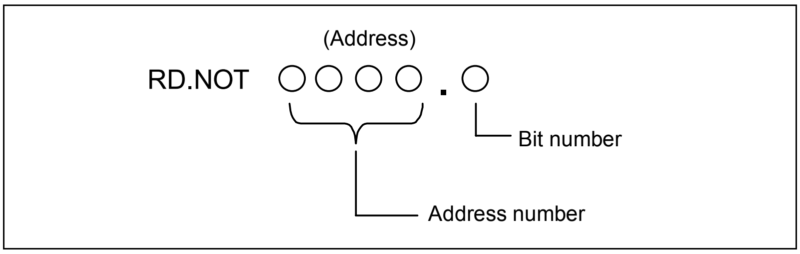


Table 4.1.3

Step number	Instruction	Address No.	Bit No.	Remarks	ST2	ST1	ST0
1	RD.NOT	R1	.1	A			$\overline{A}$
2	AND.NOT	F2	.2	B			$\overline{A}\cdot\overline{B}$
3	AND.NOT	F3	.3	C			$\overline{A}\cdot\overline{B}\cdot\overline{C}$
4	WRT	R210	.1	W1 output			$\overline{A}\cdot\overline{B}\cdot\overline{C}$
5	RD.NOT	G5	.1	D			$\overline{D}$
6	OR.NOT	X4	.2	E			$\overline{D}+\overline{E}$
7	OR	Y10	.7	F			$\overline{D}+\overline{E}+F$
8	AND	R10	.5	G			$(\overline{D}+\overline{E}+F)\cdot G$
9	WRT	R210	.2	W2 output			$(\overline{D}+\overline{E}+F)\cdot G$

Operation

(1) Use this instruction to start coding from contact B (–|/|–). For examples of how the RD.NOT instruction is used, see the ladder diagram shown in Fig. 4.1.3 and the input example in the mnemonic format given in Table 4.1.3.

(2) The instruction reads and reverses the logical status of the signal at the specified address and sets it in the ST0 bit.

4.1.4 WRT Instruction

Format

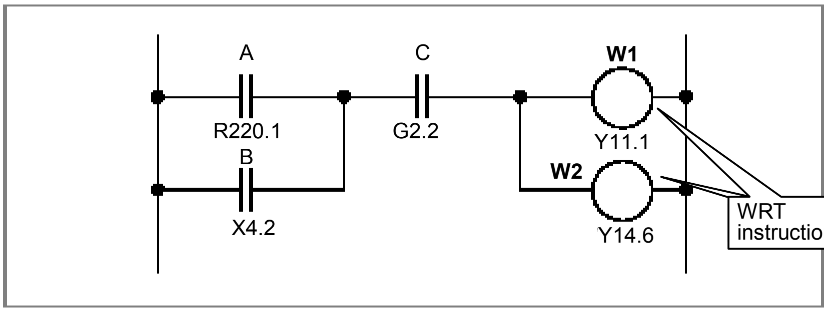


Fig. 4.1.4

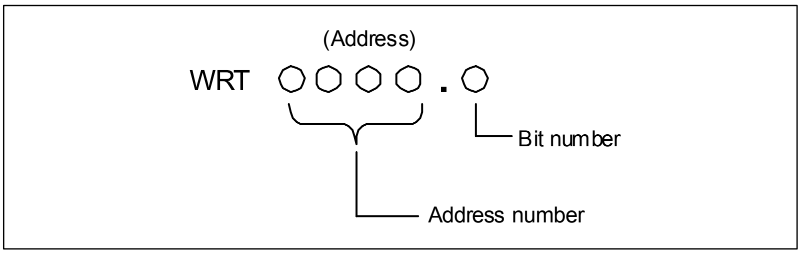


Table 4.1.4

Mnemonic format

Step number	Instruction	Address No.	Bit No.	Remarks
1	RD	R220	.1	A
2	OR	X4	.2	B
3	AND	G2	.2	C
4	WRT	Y11	.1	W1 output
5	WRT	Y14	.6	W2 output

Status of operation result

ST2	ST1	ST0
		A
		A + B
		(A + B)·C
		(A + B)·C
		(A + B)·C

Operation

(1) The WRT instruction outputs the result of the logical operation, namely the status of the ST0 bit (0 or 1), to the specified address.

(2) The instruction can also output a logical operation result to two or more addresses simultaneously. In that case, use the WRT instruction as shown in Fig. 4.1.4 and Table 4.1.4.

> ⚠**CAUTION**
> In each WRT,WRT.NOT instruction, specify different address. Double coil, which means a coil with an address is often used in one ladder program, may occur troubles of the execution timing in the sequence program. Don't use "double coil".

4.1.5 WRT.NOT Instruction

Format

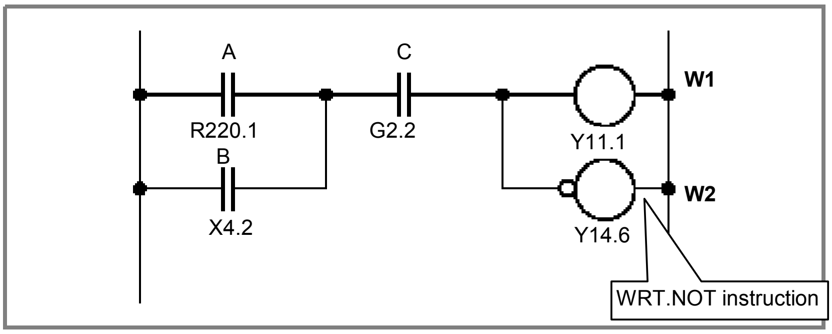


Fig. 4.1.5

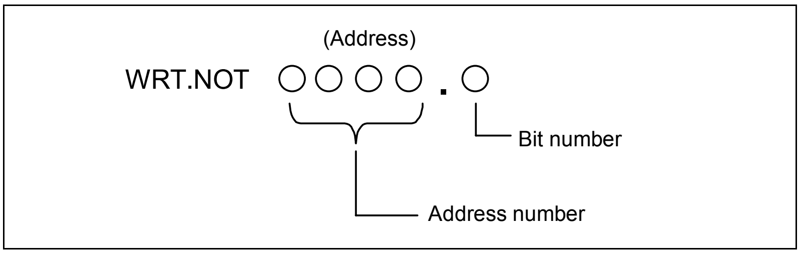


Table 4.1.5

Mnemonic format

Step number	Instruction	Address No.	Bit No.	Remarks
1	RD	R220	.1	A
2	OR	X4	.2	B
3	AND	G2	.2	C
4	WRT	Y11	.1	W1 output
5	WRT.NOT	Y14	.6	W2 output

Status of operation result

ST2	ST1	ST0
		A
		A + B
		(A + B)·C
		(A + B)·C
		(A + B)·C

Operation

The WRT.NOT instruction reverses and outputs the result of the logical operation, namely the status of the ST0 bit, to the specified address. Fig. 4.1.5 and Table 4.1.5 show examples of how the WRT.NOT instruction is used.

> ⚠**CAUTION**
> In each WRT,WRT.NOT instruction, specify different address. Double coil, which means a coil with an address is often used in one ladder program, may occur troubles of the execution timing in the sequence program. Don't use "double coil".

4.1.6 AND Instruction

Format

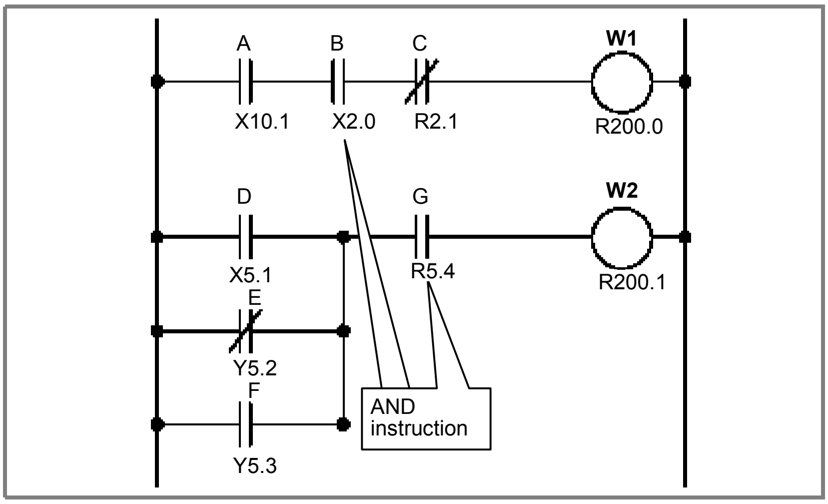


Fig. 4.1.6

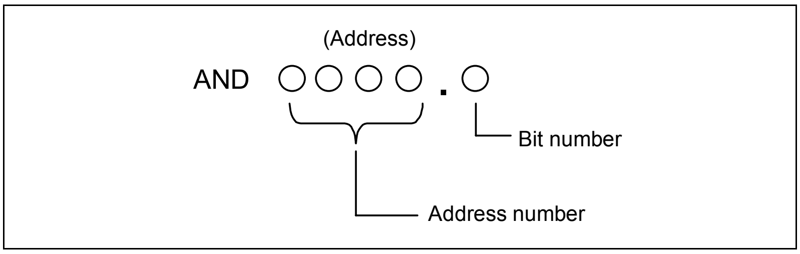


Table 4.1.6

Mnemonic format

Step number	Instruction	Address No.	Bit No.	Remarks
1	RD	X10	.1	A
2	AND	X2	.0	B
3	AND.NOT	R2	.1	C
4	WRT	R200	.0	W1 output
5	RD	X5	.1	D
6	OR.NOT	Y5	.2	E
7	OR	Y5	.3	F
8	AND	R5	.4	G
9	WRT	R200	.1	W2 output

Status of operation result

ST2	ST1	ST0
		A
		A·B
		$A \cdot B \cdot \overline{C}$
		$A \cdot B \cdot \overline{C}$
		D
		$D + \overline{E}$
		$D + \overline{E} + F$
		$(D + \overline{E} + F) \cdot G$
		$(D + \overline{E} + F) \cdot G$

Operation

(1) This instruction produces a logical product.
(2) For examples of how the AND instruction is used, see Fig. 4.1.6 and Table 4.1.6.

4.1.7 AND.NOT Instruction

Format

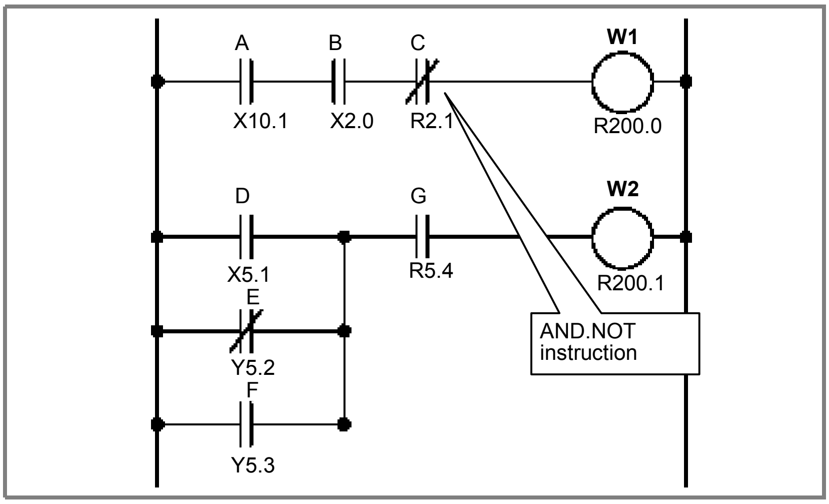


Fig. 4.1.7

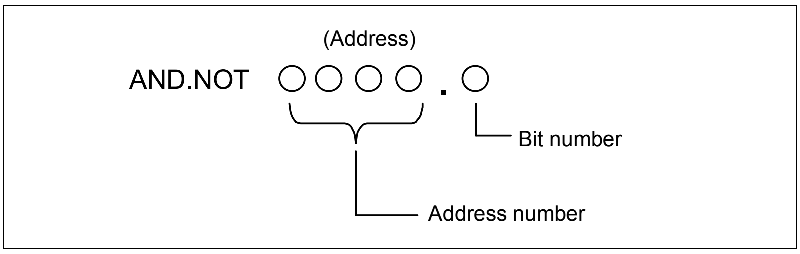


Table 4.1.7

Mnemonic format

Step number	Instruction	Address No.	Bit No.	Remarks
1	RD	X10	.1	A
2	AND	X2	.0	B
3	AND.NOT	R2	.1	C
4	WRT	R200	.0	W1 output
5	RD	X5	.1	D
6	OR.NOT	Y5	.2	E
7	OR	Y5	.3	F
8	AND	R5	.4	G
9	WRT	R200	.1	W2 output

Status of operation result

ST2	ST1	ST0
		A
		$A \cdot B$
		$A \cdot B \cdot \overline{C}$
		$A \cdot B \cdot \overline{C}$
		D
		$D + \overline{E}$
		$D + \overline{E} + F$
		$(D + \overline{E} + F) \cdot G$
		$(D + \overline{E} + F) \cdot G$

Operation

(1) This instruction reverses the status of the signal at the specified address and produces a logical product.

(2) For examples of how the AND.NOT instruction is used, see Fig. 4.1.7 and Table 4.1.7.

4.1.8 OR Instruction

Format

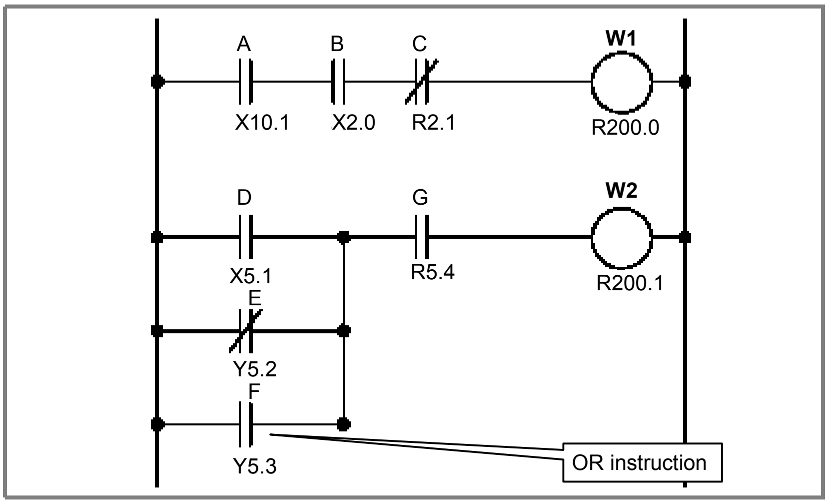


Fig. 4.1.8

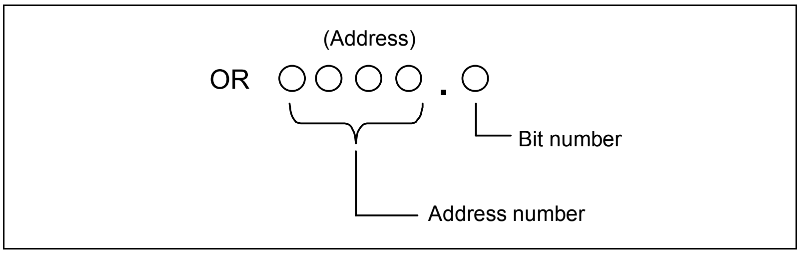


Table 4.1.8

Mnemonic format

Step number	Instruction	Address No.	Bit No.	Remarks
1	RD	X10	.1	A
2	AND	X2	.0	B
3	AND.NOT	R2	.1	C
4	WRT	R200	.0	W1 output
5	RD	X5	.1	D
6	OR.NOT	Y5	.2	E
7	OR	Y5	.3	F
8	AND	R5	.4	G
9	WRT	R200	.1	W2 output

Status of operation result

ST2	ST1	ST0
		A
		$A \cdot B$
		$A \cdot B \cdot \overline{C}$
		$A \cdot B \cdot \overline{C}$
		D
		$D + \overline{E}$
		$D + \overline{E} + F$
		$(D + \overline{E} + F) \cdot G$
		$(D + \overline{E} + F) \cdot G$

Operation

(1) This instruction produces a logical sum.
(2) For examples of how the OR instruction is used, see Fig. 4.1.8 and Table 4.1.8.

4.1.9 OR.NOT Instruction

Format

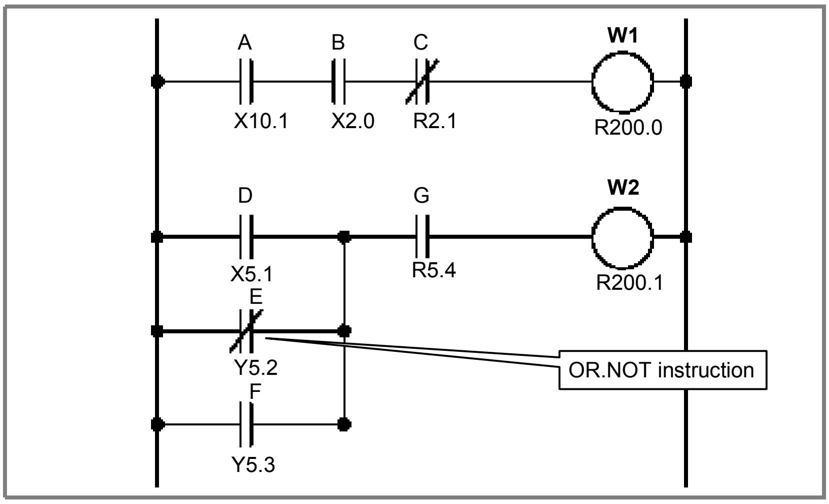


Fig. 4.1.9

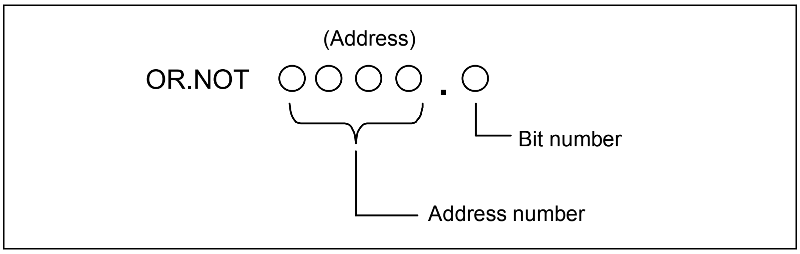


Table 4.1.9

Mnemonic format

Step number	Instruction	Address No.	Bit No.	Remarks
1	RD	X10	.1	A
2	AND	X2	.0	B
3	AND.NOT	R2	.1	C
4	WRT	R200	.0	W1 output
5	RD	X5	.1	D
6	OR.NOT	Y5	.2	E
7	OR	Y5	.3	F
8	AND	R5	.4	G
9	WRT	R200	.1	W2 output

Status of operation result

ST2	ST1	ST0
		A
		A·B
		$A \cdot B \cdot \overline{C}$
		$A \cdot B \cdot \overline{C}$
		D
		$D + \overline{E}$
		$D + \overline{E} + F$
		$(D + \overline{E} + F) \cdot G$
		$(D + \overline{E} + F) \cdot G$

Operation

(1) This instruction reverses the status of the signal at the specified address and produces a logical sum.
(2) For examples of how the OR.NOT instruction is used, see Fig. 4.1.9 and Table 4.1.9.

4.1.10 RD.STK Instruction

Format

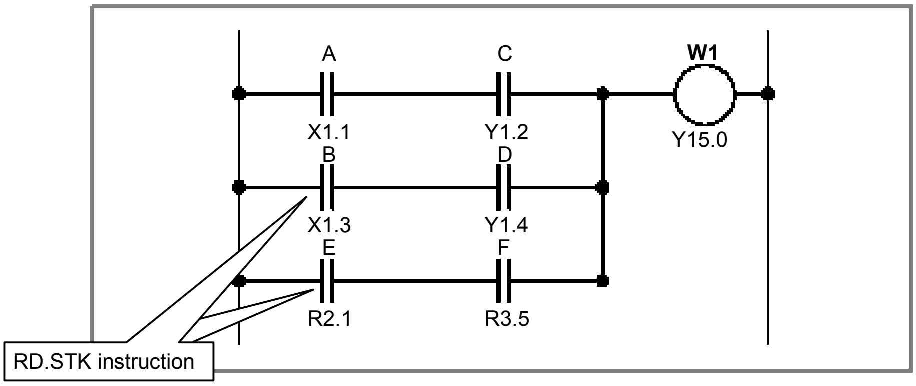


Fig. 4.1.10

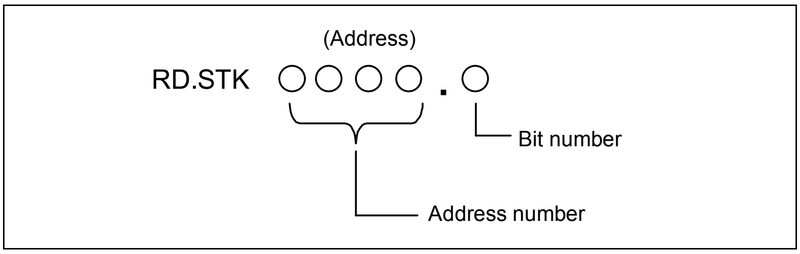


Table 4.1.10

Mnemonic format

Step number	Instruction	Address No.	Bit No.	Remarks
1	RD	X1	.1	A
2	AND	Y1	.2	C
3	RD.STK	X1	.3	B
4	AND	Y1	.4	D
5	OR.STK			
6	RD.STK	R2	.1	E
7	AND	R3	.5	F
8	OR.STK			
9	WRT	Y15	.0	W1 output

Status of operation result

ST2	ST1	ST0
		A
		A·C
	A·C	B
	A·C	B·D
		A·C + B·D
	A·C + B·D	E
	A·C + B·D	E·F
		A·C + B·D + E·F
		A·C + B·D + E·F

Operation

(1) The RD.STK instruction stacks the interim result of a logical operation. Use this instruction when the signal you specify is contact A (–| |–). After shifting the register content one bit to the left, the instruction sets the status of the signal at the specified address in the ST0 bit.

(2) For examples of how the RD.STK instruction is used, see Fig. 4.1.10 and Table 4.1.10.

4.1.11 RD.STK.NOT Instruction

Format

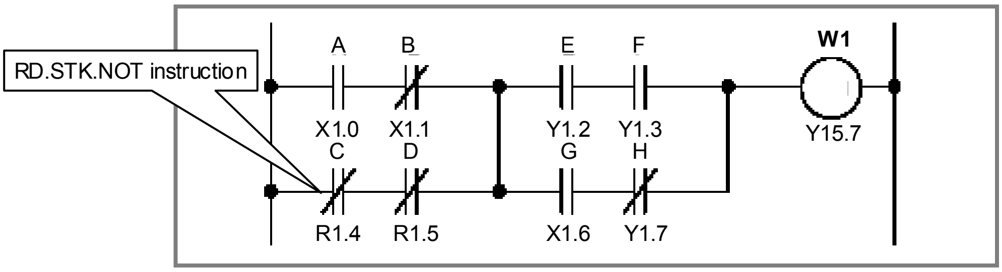


Fig. 4.1.11

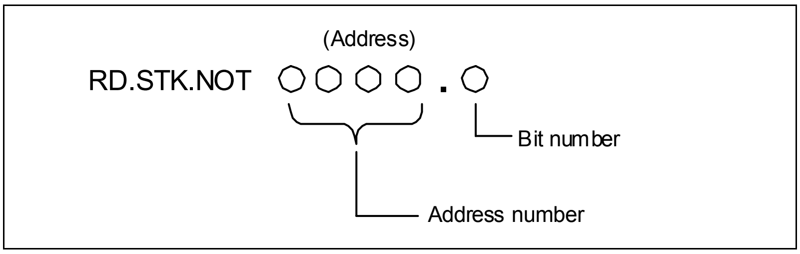


Table 4.1.11

Mnemonic format

Step number	Instruction	Address No.	Bit No.	Remarks
1	RD	X1	.0	A
2	AND.NOT	X1	.1	B
3	RD.STK.NOT	R1	.4	C
4	AND.NOT	R1	.5	D
5	OR.STK			
6	RD.STK	Y1	.2	E
7	AND	Y1	.3	F
8	RD.STK	X1	.6	G
9	AND.NOT	Y1	.7	H
10	OR.STK			
11	AND.STK			
12	WRT	Y15	.7	W1 output

Status of operation result

ST2	ST1	ST0
		A
		$A \cdot \overline{B}$
	$A \cdot \overline{B}$	$\overline{C}$
	$A \cdot \overline{B}$	$\overline{C} \cdot \overline{D}$
		$A \cdot \overline{B} + \overline{C} \cdot \overline{D}$
	$A \cdot \overline{B} + \overline{C} \cdot \overline{D}$	E
	$A \cdot \overline{B} + \overline{C} \cdot \overline{D}$	$E \cdot F$
$A \cdot \overline{B} + \overline{C} \cdot \overline{D}$	$E \cdot F$	G
$A \cdot \overline{B} + \overline{C} \cdot \overline{D}$	$E \cdot F$	$G \cdot \overline{H}$
	$A \cdot \overline{B} + \overline{C} \cdot \overline{D}$	$E \cdot F + G \cdot \overline{H}$
		$(A \cdot \overline{B} + \overline{C} \cdot \overline{D}) \cdot (E \cdot F + G \cdot \overline{H})$
		$(A \cdot \overline{B} + \overline{C} \cdot \overline{D}) \cdot (E \cdot F + G \cdot \overline{H})$

Operation

(1) The RD.NOT.STK instruction stacks the interim result of a logical operation. Use this instruction when the signal you specify is contact B (–|/|–). After shifting the register content one bit to the left, the instruction reverses the status of the signal at the specified address and sets it in the ST0 bit.

(2) For examples of how the RD.NOT.STK instruction is used, see Fig. 4.1.11 and Table 4.1.11.

NOTE
This instruction is effective even if describing as “RD.NOT.STK”.

4.1.12 AND.STK Instruction

Format

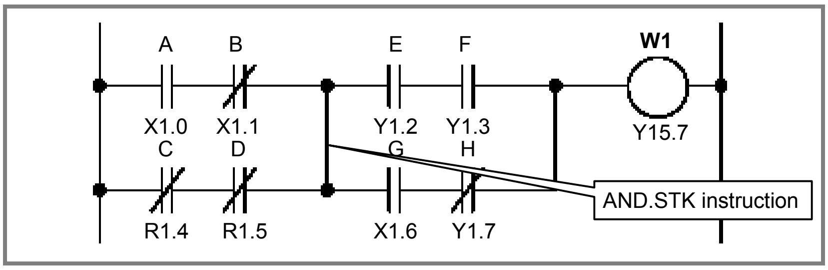


Fig. 4.1.12 (a)

AND.STK

Table 4.1.12

Mnemonic format

Step number	Instruction	Address No.	Bit No.	Remarks
1	RD	X1	.0	A
2	AND.NOT	X1	.1	B
3	RD.NOT.STK	R1	.4	C
4	AND.NOT	R1	.5	D
5	OR.STK			
6	RD.STK	Y1	.2	E
7	AND	Y1	.3	F
8	RD.STK	X1	.6	G
9	AND.NOT	Y1	.7	H
10	OR.STK			
11	AND.STK			
12	WRT	Y15	.7	W1 output

Status of operation result

ST2	ST1	ST0
		A
		$A \cdot \overline{B}$
	$A \cdot \overline{B}$	$\overline{C}$
	$A \cdot \overline{B}$	$\overline{C} \cdot \overline{D}$
		$A \cdot \overline{B} + \overline{C} \cdot \overline{D}$
	$A \cdot \overline{B} + \overline{C} \cdot \overline{D}$	E
	$A \cdot \overline{B} + \overline{C} \cdot \overline{D}$	$E \cdot F$
$A \cdot \overline{B} + \overline{C} \cdot \overline{D}$	$E \cdot F$	G
$A \cdot \overline{B} + \overline{C} \cdot \overline{D}$	$E \cdot F$	$G \cdot \overline{H}$
	$A \cdot \overline{B} + \overline{C} \cdot \overline{D}$	$E \cdot F + G \cdot \overline{H}$
		$(A \cdot \overline{B} + \overline{C} \cdot \overline{D}) \cdot (E \cdot F + G \cdot \overline{H})$
		$(A \cdot \overline{B} + \overline{C} \cdot \overline{D}) \cdot (E \cdot F + G \cdot \overline{H})$

Operation

(1) The AND.STK instruction finds the logical product of the operation result stored in the ST0 bit and that stored in the ST1 bit and sets it in the ST1 bit. The instruction then shifts the register content one bit to the right and puts the resulting logical product into the ST0 bit. Fig. 4.1.12 (b) shows a detailed image of what is shown in Fig. 4.1.12 (a).

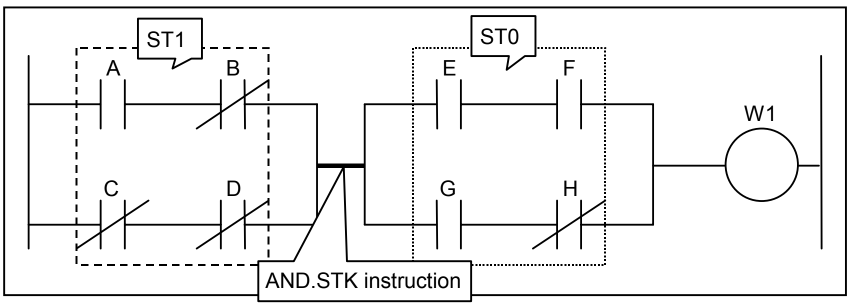


Fig. 4.1.12 (b)

(2) For examples of how the AND.STK instruction is used, see Fig. 4.1.12 (a) and Table 4.1.12.

4.1.13 OR.STK Instruction

Format

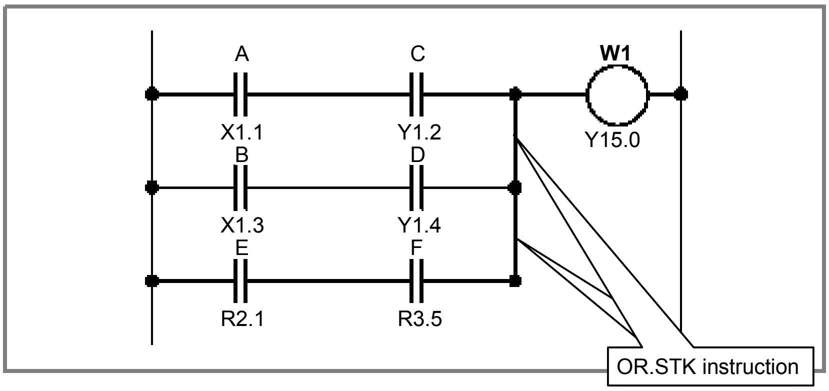


Fig. 4.1.13 (a)

OR.STK

Table 4.1.13

Mnemonic format

Step number	Instruction	Address No.	Bit No.	Remarks
1	RD	X1	.1	A
2	AND	Y1	.2	C
3	RD.STK	X1	.3	B
4	AND	Y1	.4	D
5	OR.STK			
6	RD.STK	R2	.1	E
7	AND	R3	.5	F
8	OR.STK			
9	WRT	Y15	.0	W1 output

Status of operation result

ST2	ST1	ST0
		A
		A·C
	A·C	B
	A·C	B·D
		A·C + B·D
	A·C + B·D	E
	A·C + B·D	E·F
		A·C + B·D + E·F
		A·C + B·D + E·F

Operation

(1) The OR.STK instruction finds the logical sum of the operation result stored in the ST0 bit and that stored in the ST1 bit and sets it in the ST1 bit. The instruction then shifts the register content one bit to the right and puts the resulting logical sum into the ST0 bit. Fig. 4.1.13 (b) shows a detailed image of what is shown in Fig. 4.1.13 (a).

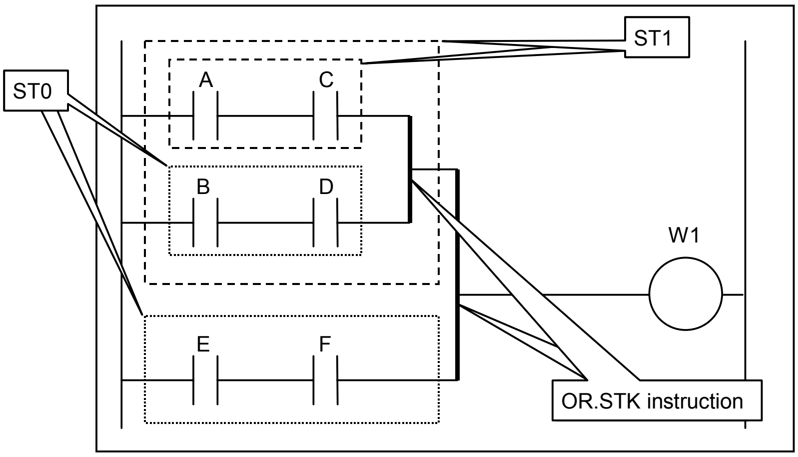


Fig. 4.1.13 (b)

(2) For examples of how the OR.STK instruction is used, see Fig. 4.1.13 (a) and Table 4.1.13.

> ⚠**CAUTION**
> In the example shown in Table 4.1.13, the OR.STK instruction is specified at step number 5. You will obtain the same result if you place the OR.STK instruction between step numbers 7 and 8. However, coding similar instructions, such as OR.STK and AND.STK, successively makes you prone to errors. It is therefore recommended to code your program as shown in Table 4.1.13.

4.1.14 SET Instruction

Format

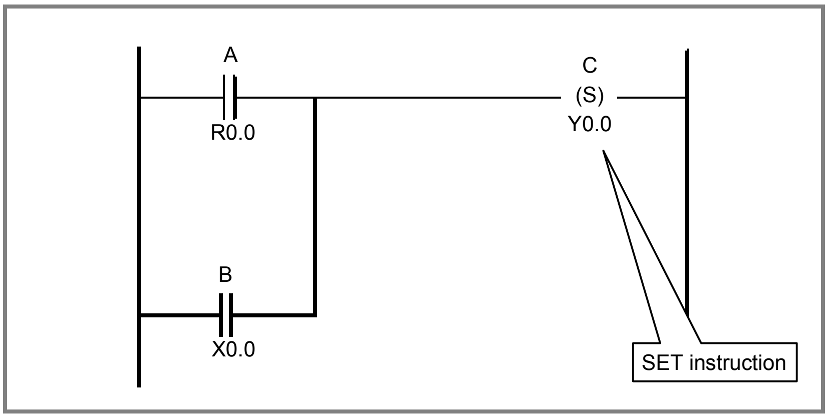


Fig. 4.1.14

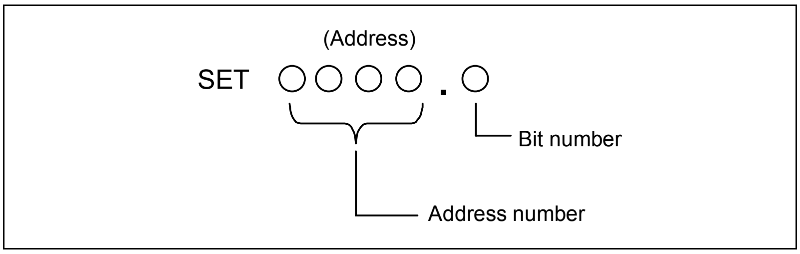


Table 4.1.14

Mnemonic format

Step number	Instruction	Address No.	Bit No.	Remarks
1	RD	R0	.0	A
2	OR	X0	.0	B
3	SET	Y0	.0	Y0.0 output

Status of operation result

ST2	ST1	ST0
		A
		A + B
		A + B

Operation

(1) This instruction keeps the status of the specified address to ON. It finds the logical sum of the operation result (ST0) and the specified address and outputs it to the specified address.
(2) For examples of how the SET instruction is used, see Fig. 4.1.14 and Table 4.1.14.
(3) Caution
- Relationship with COM and COME
  When placed between the COM and COME instructions, the SET instruction behaves as follows:
  When the COM condition is set to ON (ACT = 1), the SET instruction runs normally.
  When the COM condition is set to OFF (ACT = 0), the SET instruction does not run.

4.1.15 RST Instruction

Format

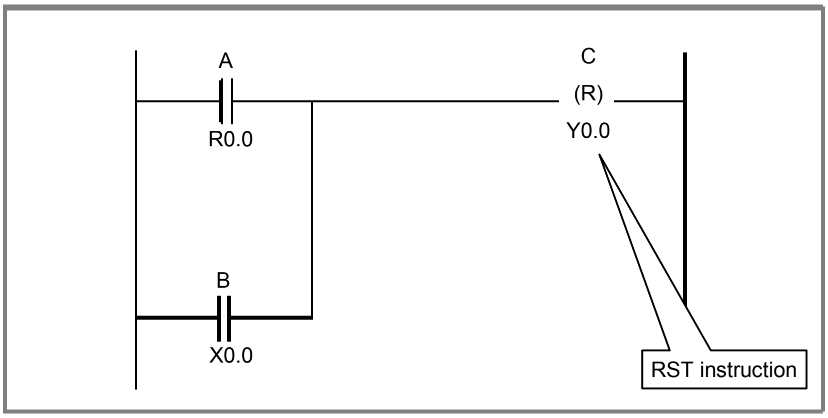


Fig. 4.1.15

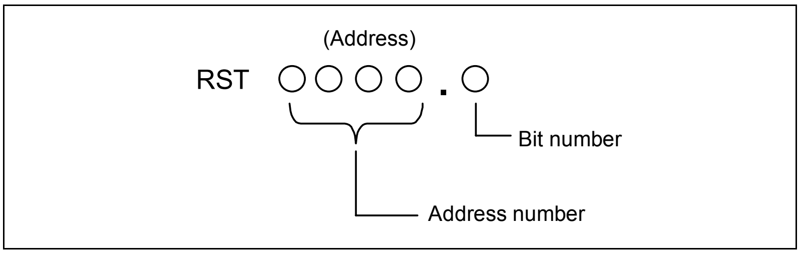


Table 4.1.15

Mnemonic format

Step number	Instruction	Address No.	Bit No.	Remarks
1	RD	R0	.0	A
2	OR	X0	.0	B
3	RST	Y0	.0	Y0.0 output

Status of operation result

ST2	ST1	ST0
		A
		A + B
		A + B

Operation

(1) This instruction keeps the status of the specified address to OFF. It finds the logical product of the operation result (ST0) and the specified reversed address and outputs it to the specified address.

(2) For examples of how the RST instruction is used, see Fig. 4.1.15 and Table 4.1.15.

(3) Caution

- Relationship with COM and COME
  When placed between the COM and COME instructions, the RST instruction behaves as follows:
  When the COM condition is set to ON (ACT = 1), the RST instruction runs normally.
  When the COM condition is set to OFF (ACT = 0), the RST instruction does not run.

4.1.16 RDPT Instruction

Positive transition contact instruction. When rising transition (0→1) of the specified signal is detected, "1" is set to the ST0 bit. Otherwise "0" is set to the ST0 bit.
This instruction can specify the same address in two or more point in ladder circuit.

Format

Fig. 4.1.16(a) shows the ladder format and Table 4.1.16(a) shows the mnemonic format.

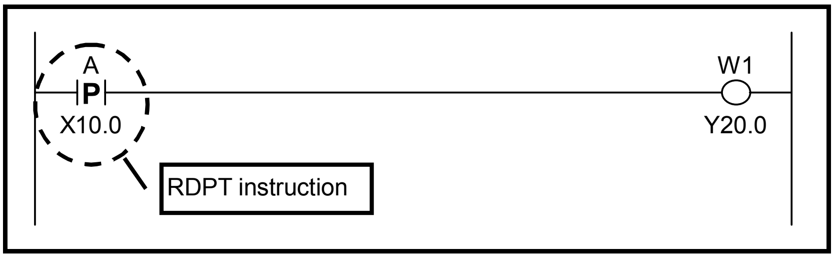


Fig. 4.1.16 (a) Format of RDPT instruction

Table4.1.16 (a) Mnemonic of RDPT instruction

Mnemonic format

Step number	Instruction	Address No.	Bit No.	Remarks
1	RDPT	X10	.0	A
2	WRT	Y20	.0	W1 output

Status of operation result

ST2	ST1	ST0
		A(PT)
		A(PT)

Operation

Timing chart in the above example is as follows.

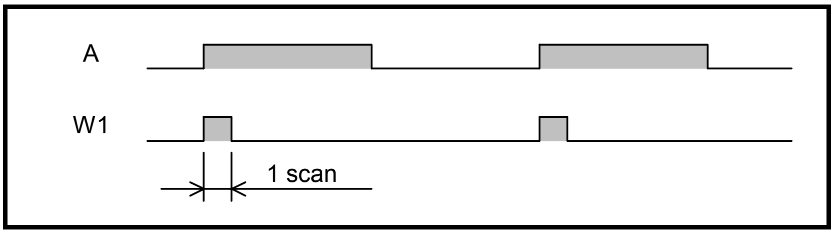


Fig. 4.1.16 (b) Timing chart of RDPT instruction

⚠**CAUTION**

1 The bit, already turned on when a program is started after program reading by the Input/Output function or Power ON, turns on the output with the scan at the beginning just after starting.
2 An output may not be turned on when a bit changes with OFF→ON→OFF during 1 scan. Moreover, when validating the result of ladder edit, a scanning time temporarily becomes larger.
3 In ladder edit, when the bit of the edited contact turns on, an output is turned on with the scan of the beginning after edit.
4 When this instruction is skipped by Jump instruction or subroutine call instruction, this instruction is not executed and the output of instruction does not change.
5 This instruction uses a work memory internally in order to detect bit transition. The PMC Software or the FANUC LADDER-III searches the work memory automatically in the domain which can be used, and is assigned. Therefore, the program edited in a different procedure becomes mismatching at the comparing, even when the appearance of ladder diagram is the same.

4.1.17 ANDPT Instruction

Positive transition contact instruction.
This instruction produces a logical product from rising transition (0→1) of the specified signal and can specify the same address in two or more point in ladder circuit.

Format

Fig. 4.1.17(a) shows the ladder format and Table 4.1.17(a) shows the mnemonic format.

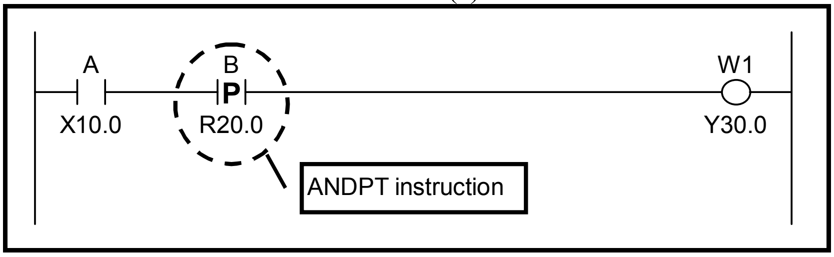


Fig. 4.1.17 (a) Format of ANDPT Instruction

Table 4.1.17 (a) Mnemonic of ANDPT Instruction

Mnemonic format					Status of operation result		
Step number	**Instruction**	**Address No.**	**Bit No.**	**Remarks**	**ST2**	**ST1**	**ST0**
1	RD	X10	.0	A			A
2	ANDPT	R20	.0	B			A • B (PT)
3	WRT	Y30	.0	W1 output			A • B (PT)

Operation

Timing chart in the above example is as follows.

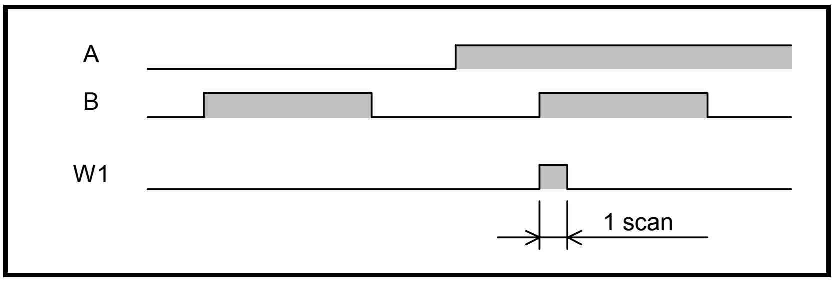


Fig. 4.1.17 (b) Timing chart of ANDPT Instruction

> **NOTE**
> Refer to "4.1.16 RDPT Instruction" notes about this instruction.

4.1.18 ORPT Instruction

Positive transition contact instruction.
This instruction produces a logical sum from rising transition (0→1) of the specified signal and can specify the same address in two or more point in ladder circuit.

Format

Fig. 4.1.18(a) shows the ladder format and Table 4.1.18(a) shows the mnemonic format.

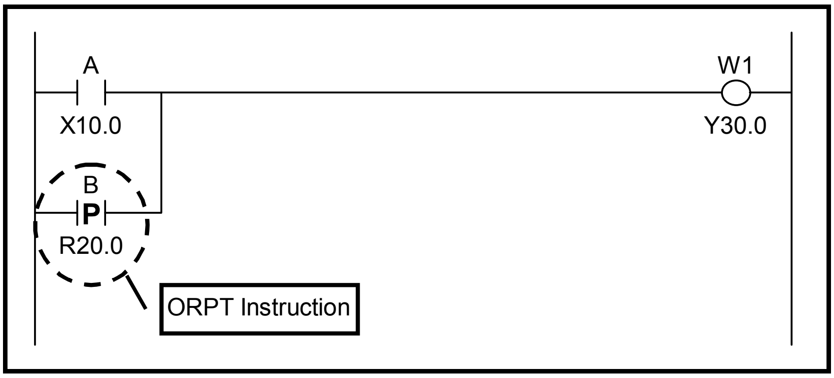


Fig. 4.1.18 (a) Format of ORPT Instruction

Table 4.1.18 (a) Mnemonic of ORPT Instruction

Mnemonic format					Status of operation result		
Step number	**Instruction**	**Address No.**	**Bit No.**	**Remarks**	**ST2**	**ST1**	**ST0**
1	RD	X10	.0	A			A
2	ORPT	R20	.0	B			A + B (PT)
3	WRT	Y30	.0	W1 output			A + B (PT)

Operation

Timing chart in the above example is as follows.

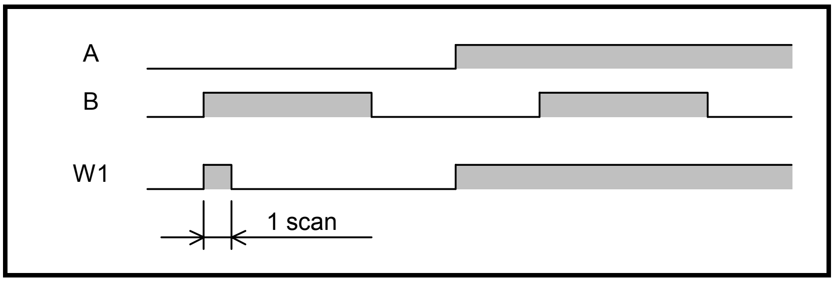


Fig. 4.1.18 (b) Timing chart of ORPT Instruction

> **NOTE**
> Refer to "4.1.16 RDPT Instruction" notes about this instruction.

4.1.19 RDPT.STK Instruction

Positive transition contact instruction. Shifts the stack register content one bit to the left and when rising transition (0→1) of the specified signal is detected, "1" is set to the ST0 bit. Otherwise "0" is set to the ST0 bit.
This instruction can specify the same address in two or more point in ladder circuit.

Format

Fig. 4.1.19(a) shows the ladder format and Table 4.1.19(a) shows the mnemonic format.

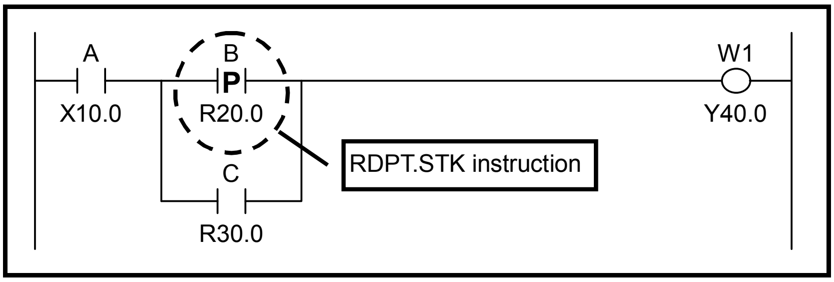


Fig. 4.1.19 (a) Format of RDPT.STK Instruction

Table 4.1.19 (a) Mnemonic of RDPT.STK Instruction

Mnemonic format

Step number	Instruction	Address No.	Bit No.	Remarks
1	RD	X10	.0	A
2	RDPT.STK	R20	.0	B
3	OR	R30	.0	C
4	AND.STK			
5	WRT	Y40	.0	W1 output

Status of operation result

ST2	ST1	ST0
		A
	A	B(PT)
	A	B(PT) + C
		A • (B(PT) + C)
		A • (B(PT) + C)

Operation

Timing chart in the above example is as follows.

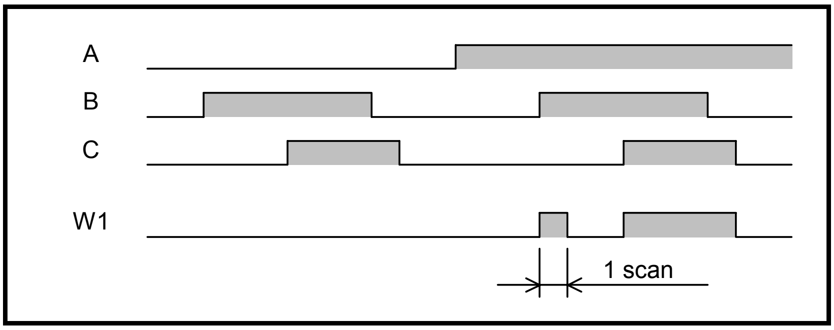


Fig. 4.1.19 (b) Timing chart of RDPT.STK Instruction

NOTE
Refer to "4.1.16 RDPT Instruction" notes about this instruction.

4.1.20 RDNT Instruction

This is negative transition contact instruction. When falling transition (1→0) of the specified signal is detected, "1" is set to the ST0 bit. Otherwise "0" is set to the ST0 bit.
This instruction can specify the same address in two or more point in ladder circuit.

Format

Fig. 4.1.20(a) shows the ladder format and Table 4.1.20(a) shows the mnemonic format.

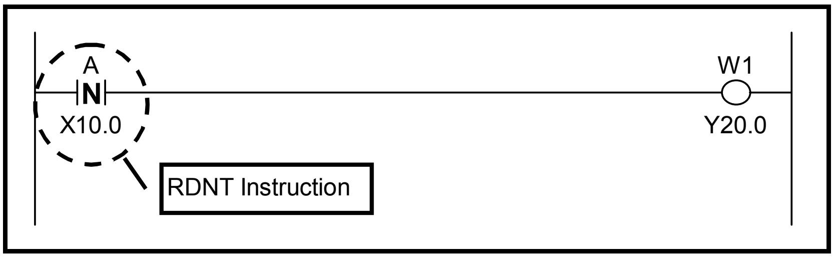


Fig. 4.1.20 (a) Format of RDNT Instruction

Table 4.1.20 (a) Mnemonic of RDNT Instruction

Mnemonic format

Step number	Instruction	Address No.	Bit No.	Remarks
1	RDNT	X10	.0	A
2	WRT	Y20	.0	W1 output

Status of operation result

ST2	ST1	ST0
		A(NT)
		A(NT)

Operation

Timing chart in the above example is as follows.

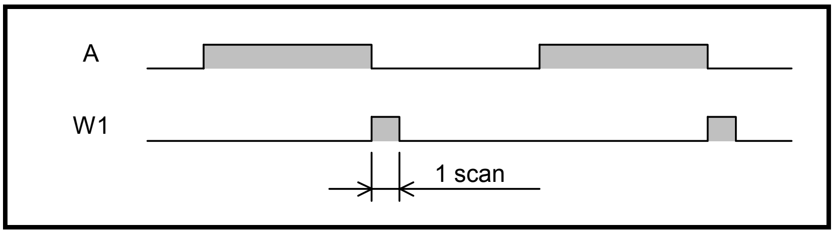


Fig. 4.1.20 (b) Timing chart of RDNT Instruction

⚠**CAUTION**

1 The bit, already turned off when a program is started after program reading by the Input/Output function or Power ON, turns on the output with the scan at the beginning just after starting.
2 An output may not be turned on when a bit changes with ON→OFF→ON during 1 scan. Moreover, when validating the result of ladder edit, a scanning time temporarily becomes larger.
3 In ladder edit, when the bit contained in the edited ladder net has already turned off, only the edited contact does not turned on with the scan of the beginning after edit.
4 When this instruction is skipped by Jump instruction or subroutine call instruction, this instruction is not executed and the output of instruction does not change.
5 This instruction uses a work memory internally in order to detect bit transition. The PMC Software or the FANUC LADDER-III searches the work memory automatically in the domain which can be used, and is assigned. Therefore, the program edited in a different procedure becomes mismatching at the comparing, even when the appearance of ladder diagram is the same.

4.1.21 ANDNT Instruction

This is negative transition contact instruction.
This instruction produces a logical product from falling transition (1→0) of the specified signal and can specify the same address in two or more point in ladder circuit.

Format

Fig. 4.1.21(a) shows the ladder format and Table 4.1.21(a) shows the mnemonic format.

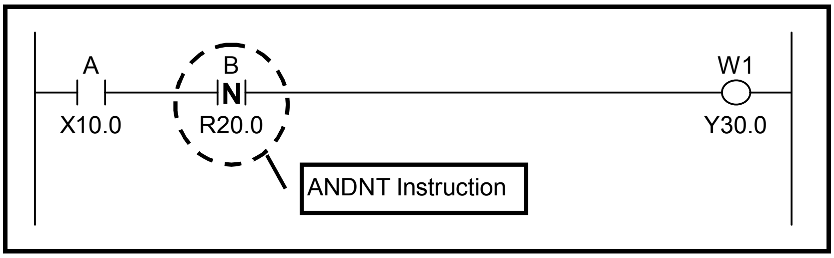


Fig. 4.1.21 (a) Format of ANDNT Instruction

Table4.1.21 (a) Mnemonic of ANDNT Instruction

Mnemonic format

Step number	Instruction	Address No.	Bit No.	Remarks
1	RD	X10	.0	A
2	ANDNT	R20	.0	B
3	WRT	Y30	.0	W1 output

Status of operation result

ST2	ST1	ST0
		A
		A • B (NT)
		A • B (NT)

Operation

Timing chart in the above example is as follows.

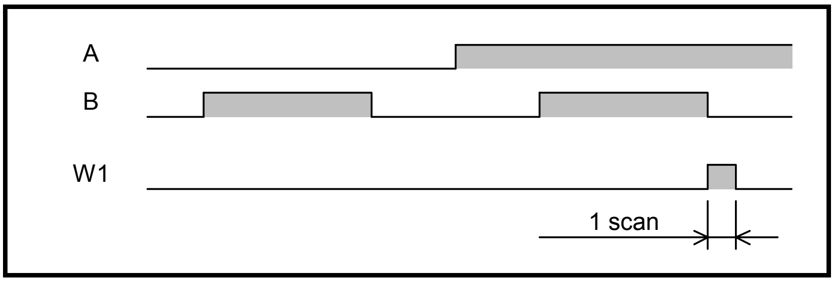


Fig. 4.1.21 (b) Timing chart of ANDNT Instruction

> **NOTE**
> Refer to "4.1.20 RDNT Instruction" notes about this instruction.

4.1.22 ORNT Instruction

This is negative transition contact instruction.
This instruction produces a logical sum from falling transition (1→0) of the specified signal and can specify the same address in two or more point in ladder circuit.

Format

Fig. 4.1.22(a) shows the ladder format and Table 4.1.22(a) shows the mnemonic format.

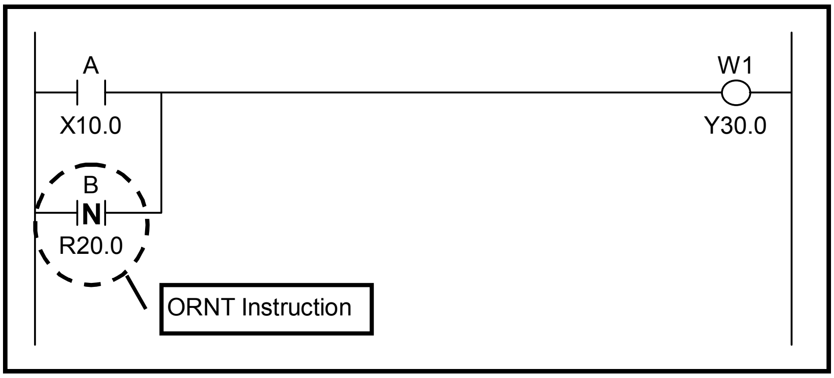


Fig. 4.1.22 (a) Format of ORNT Instruction

Table 4.1.22 (a) Mnemonic of ORNT Instruction

Mnemonic format					Status of operation result		
Step number	**Instruction**	**Address No.**	**Bit No.**	**Remarks**	**ST2**	**ST1**	**ST0**
1	RD	X10	.0	A			A
2	ORNT	R20	.0	B			A + B (NT)
3	WRT	Y30	.0	W1 output			A + B (NT)

Operation

Timing chart in the above example is as follows.

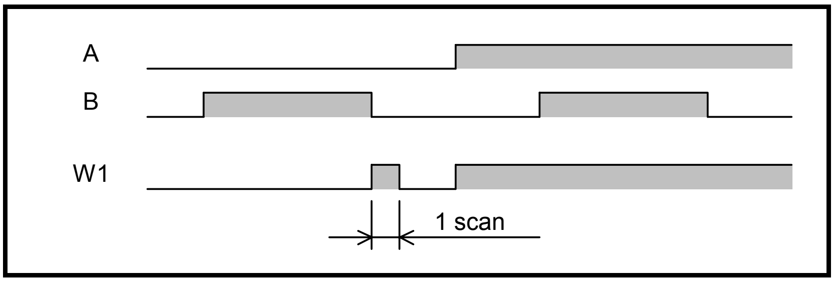


Fig. 4.1.22 (b) Timing chart of ORNT Instruction

> **NOTE**
> Refer to "4.1.20 RDNT Instruction" notes about this instruction.

4.1.23 RDNT.STK Instruction

This is negative transition contact instruction. Shifts the stack register content one bit to the left and when falling transition (1→0) of the specified signal is detected, "1" is set to the ST0 bit. Otherwise "0" is set to the ST0 bit.
This instruction can specify the same address in two or more point in ladder circuit.

Format

Fig. 4.1.23(a) shows the ladder format and Table 4.1.23(a) shows the mnemonic format.

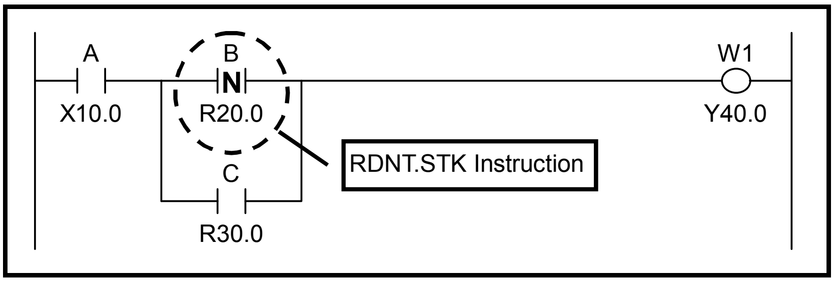


Fig. 4.1.23 (a) Format of RDNT.STK Instruction

Table 4.1.23 (a) Mnemonic of RDNT.STK Instruction

Mnemonic format					Status of operation result		
Step number	**Instruction**	**Address No.**	**Bit No.**	**Remarks**	**ST2**	**ST1**	**ST0**
1	RD	X10	.0	A			A
2	RDNT.STK	R20	.0	B		A	B(NT)
3	OR	R30	.0	C		A	B(NT) + C
4	AND.STK						A • (B(NT) + C)
5	WRT	Y40	.0	W1 output			A • (B(NT) + C)

Operation

Timing chart in the above example is as follows.

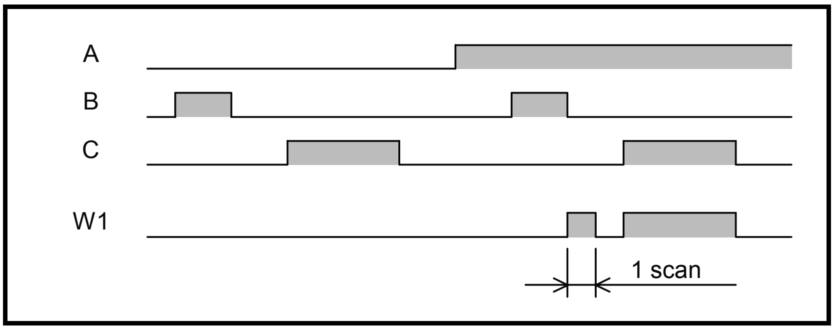


Fig. 4.1.23 (b) Timing chart of RDNT.STK Instruction

> **NOTE**
> Refer to "4.1.20 RDNT Instruction" notes about this instruction.

4.1.24 PUSH Instruction / POP Instruction

This is an instruction to make a branch of circuit.
A PUSH instruction shifts the stack register one bit to the left. The current operation result (ST0) is not changed.
A POP instruction shifts the stack register one bit to the right

Format

Fig. 4.1.24(a) shows the ladder format and Table 4.1.24(a) shows the mnemonic format.

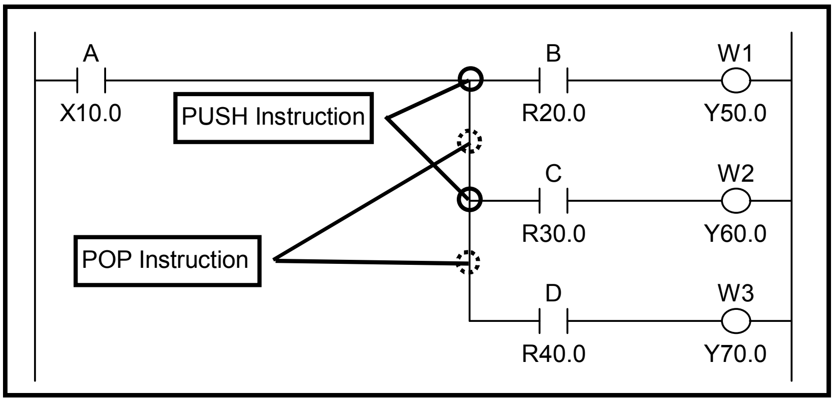


Fig. 4.1.24 (a) Format of PUSH and POP Instructions

Table 4.1.24 (a) Mnemonic of PUSH and POP Instructions

Mnemonic format

Step number	Instruction	Address No.	Bit No.	Remarks
1	RD	X10	.0	A
2	PUSH			
3	AND	R20	.0	B
4	WRT	Y50	.0	W1 output
5	POP			
6	PUSH			
7	AND	R30	.0	C
8	WRT	Y60	.0	W2 output
9	POP			
10	AND	R40	.0	D
11	WRT	Y70	.0	W3 output

Status of operation result

ST2	ST1	ST0
		A
	A	A
	A	A • B
	A	A • B
		A
	A	A
	A	A • C
	A	A • C
		A
		A • D
		A • D

Operation

(1) In the above example, the value of A stored in ST0 is shift to ST1 by PUSH instruction before performing the logical product of A and B. The value of ST0 is not changed.
(2) After outputting the operation result of the logical product of A and B to W1, the value of A stored in ST1 is shifted to ST0 by POP instruction.
(3) Before performing the logical product of A and C, the value of A stored in ST0 is shifted to ST1 by PUSH instruction. The value of ST0 is not changed.
(4) After outputting the operation result of the logical product of A and C to W2, the value of A stored in ST1 is shifted to ST0 by POP instruction.
(5) The logical product of A and D is performed and an operation result is outputted to W3.

4.2 FUNCTIONAL INSTRUCTIONS

When creating a sequence program, you may find it difficult to code certain types of functions with the basic instructions alone that perform a one-bit logical operation each. One example is a shortcut control function for a rotating part that involves numeric and other complex operations. To facilitate the programming of these functions that are difficult to code with the basic instructions alone, a set of functional instructions are available.
This section describes how to use each functional instruction. For a list of the functional instructions and information about their specifications, see Subsection 2.1.8 or 2.1.9.

4.2.1 Format of the Functional Instructions

Before detailed descriptions of the individual functional instructions are given, this subsection explains the format of the functional instructions and their general specifications.

> **NOTE**
> Read this subsection surely because it contains important information such as the rules regarding the use of the functional instructions.

(1) Format of the functional instructions
Since the functional instructions cannot be represented using relay symbols, they need to be represented in the format shown in Fig. 4.2.1 (a). The structure of a functional instruction consists of control conditions, an instruction, parameters, an output coil (W1), a functional instruction operation result register (R9000 to R9005 or Z0 to Z5).

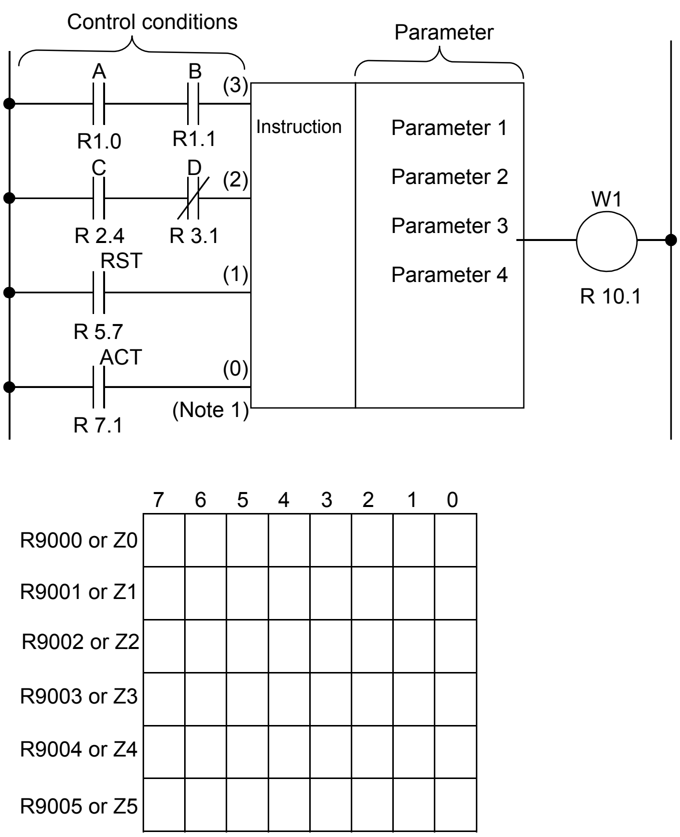


Fig. 4.2.1 (a) Structure of a functional instruction

Table 4.2.1 (a) Coding format of the functional instructions

Mnemonic format

Step number	Instruction	Address No.	Bit No.	Remarks
1	RD	R1. 0		A
2	AND	R1. 1		B
3	RD.STK	R2. 4		C
4	AND.NOT	R3. 1		D
5	RD.STK	R5. 7		RST
6	RD.STK	R7. 1		ACT
7	SUB	OO		Instruction
8	(PRM) (Note 2)	OOOO		Parameter 1
9	(PRM)	OOOO		Parameter 2
10	(PRM)	OOOO		Parameter 3
11	(PRM)	OOOO		Parameter 4
12	WRT	R10. 1		W1 output

Status of operation result

ST3	ST2	ST1	ST0
			A
			A·B
		A·B	C
		A·B	C·$\overline{D}$
	A·B	C·$\overline{D}$	RST
A·B	C·$\overline{D}$	RST	ACT
A·B	C·$\overline{D}$	RST	ACT
A·B	C·$\overline{D}$	RST	ACT
A·B	C·$\overline{D}$	RST	ACT
A·B	C·$\overline{D}$	RST	ACT
A·B	C·$\overline{D}$	RST	ACT
A·B	C·$\overline{D}$	RST	W1

NOTE

1 The number within each pair of parentheses shown for the control conditions represents the position in the register where the result is to be stored.

2 The term (PRM) in the Instruction fields for step numbers 8 to 11 means a parameter. You do not need to input the term (PRM); just enter an address or numeric data.

(2) Control conditions

The number of control conditions and the meanings of those conditions differ for each functional instruction.

The control conditions are stored in the register, as shown in Table 4.2.1 (a). Once set, therefore, the sequence of the control conditions is fixed. You cannot change the sequence or omit any of the control conditions.

⚠ CAUTION

All functional instructions give precedence to the RST processing when they include RST in their control conditions. Therefore, when RST = 1, the functional instruction carries out the RST processing even if ACT = 0.

(3) Instruction

For the types of functional instructions, see Subsection 2.1.8 or 2.1.9.

To input the instruction with relay symbols, use the soft keys of the programmer.

(4) Parameters

Unlike the basic instructions, the functional instructions deal with numeric values. Therefore, reference data values and addresses storing data may be entered in their parameters. The number of parameters and the meanings of those parameters differ for each functional instruction.

(5) W1

W1 is the destination to which the functional instruction outputs its operation result when that result can be represented by a one-bit value, 0 or 1. The designer can freely decide the address of W1. The meaning of W1 differs for each functional instruction. Some functional instructions do not have the W1 output.

(6) Data to be processed
The data processed by the functional instructions is in two formats - binary coded decimal (BCD) format and binary format. Formerly, the PMC system handled numeric data mainly in the BCD format. However, dealing with all numeric data in the binary format is now recommended for the following reasons.

(a) The numeric data exchanged between NC and PMC (M, S, T, and B codes) is in the binary format.

(b) The CPU carries out all numeric data operations in the binary format. Therefore, if data is provided in the binary format, the conversion between the BCD and binary formats becomes unnecessary, thus speeding up the PMC processing.

(c) The use of binary format data allows you to handle a wider range of numeric data while at the same time making it easier to deal with negative numeric data. This leads to an enhanced operation capability. In principle, binary numeric data is handled in units of one byte (−128 to +127), two bytes (−32,768 to +32,767), or four bytes (−2,147,483,648 to +2,147,483,647).

(d) When you enter numeric data using the CNC screen keys or display numeric data on the CNC screen, you will experience no inconvenience because binary numeric data values are <u>all set and displayed in the decimal format</u>. It is just that the data stored in the internal memory is written in the binary format. You only need to exercise care when the sequence program references memory. See item (7) for examples of numeric data. For the reasons mentioned above, all the functional instructions described in this manual are designed to deal with binary data and handle mainly binary data.

(7) Examples of numeric data

(a) BCD format data
Basically, the data processed in the BCD format is handled in units of one byte (0 to 99), two bytes (0 to 9999), or four bytes (0 to 99,999,999; for the DCNVB instruction only). A four-digit BCD data block is stored in two bytes of consecutive addresses, as in the following example.

(Example) When BCD data 1234 is stored at addresses R250 and R251

	7	6	5	4	3	2	1	0
R250	0	0	1	1	0	1	0	0
	3				4			

	7	6	5	4	3	2	1	0
R251	0	0	0	1	0	0	1	0
	1				2			

In the functional instruction, specify the address having the smaller number, R250.
Note) The low-order digits are stored in the smaller number address.

(b) Binary format data
Basically, the data processed in the binary format is handled in units of one byte (−128 to +127), two bytes (−32,768 to +32,767), or four bytes (−2,147,483,648 to +2,147,483,647). The data is stored at addresses R200, R201, R202, and R203, as shown below. Note that negative numbers are set as two's complements.

One-byte data (−128 to +127)

	7	6	5	4	3	2	1	0
R200	±	2^6	2^5	2^4	2^3	2^2	2^1	2^0

Sign: 0: Positive, 1: Negative

Two-byte data (−32,768 to +32,767)

	7	6	5	4	3	2	1	0
R200	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
R201	±	2^{14}	2^{13}	2^{12}	2^{11}	2^{10}	2^9	2^8

Four-byte data (−2,147,483,648 to +2,147,483,647)

	7	6	5	4	3	2	1	0
R200	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
R201	2^{15}	2^{14}	2^{13}	2^{12}	2^{11}	2^{10}	2^9	2^8
R202	2^{23}	2^{22}	2^{21}	2^{20}	2^{19}	2^{18}	2^{17}	2^{16}
R203	±	2^{30}	2^{29}	2^{28}	2^{27}	2^{26}	2^{25}	2^{24}

In the functional instruction, specify the address having the smallest number, R200.

(Example) One-byte data

7	6	5	4	3	2	1	0	
0	0	0	0	0	0	0	1	(+1)
1	1	1	1	1	1	1	1	(- 1)
0	1	1	1	1	1	1	1	(+127)
1	0	0	0	0	0	0	1	(- 127)

(8) Addresses of numeric data processed by functional instructions

When the numeric data to be processed by a functional instruction consists of two or four bytes, it is recommended to specify an even number or a multiple of four as the address of the numeric data in the relevant parameter of that functional instruction. Specifying an even-numbered or multiple-of-four address causes the functional instruction to execute slightly faster.

In the case of a functional instruction that mainly deals with binary data, such a parameter is marked with an asterisk (*) in the parameter field of the diagram illustrating the format of the functional instruction, as shown below.

An even-numbered or multiple-of-four address means that the letter R is followed by an even number or a multiple of four in the case of an internal relay, or that the letter D is followed by an even number or a multiple of four in the case of a data table.

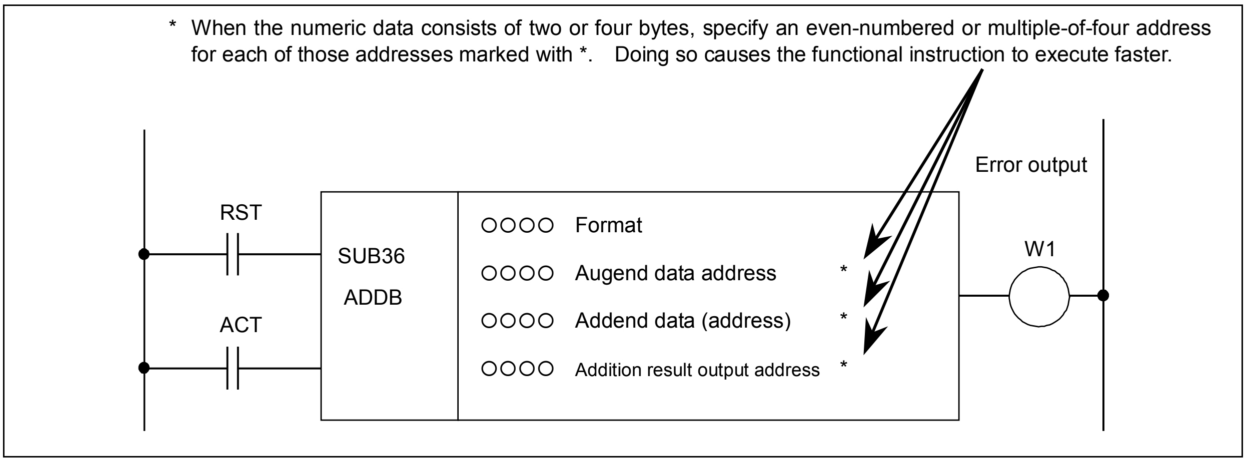


Fig. 4.2.1 (b)

(9) Functional instruction operation result register
(R9000 to R9005, Z0 to Z5) (See Fig. 4.2.1 (c).)
The results of executing functional instructions are set in this register. The register is shared by all the functional instructions. Therefore, if you do not reference the register immediately after executing the target functional instruction, the operation data of that instruction is erased as a subsequent functional instruction is executed.
Also note that the operation data of this register cannot be exchanged between sequence programs of different levels. For example, when the subtraction instruction (SUBB) is executed in a first level program and the result of its execution is set in the register, a second level program cannot reference the set operation data by reading the register in the R9000 or Z0 range.
The operation data set in this register can be shared by sequence programs of the same level and is maintained until immediately before a functional instruction is executed that sets subsequent operation data in the register. The operation data to be set in this register differs for each functional instruction. The sequence program can read this data but not write to this register.

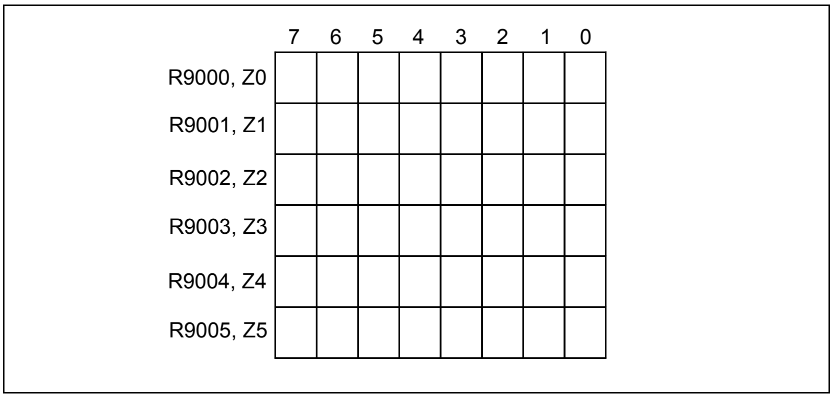


Fig. 4.2.1 (c)

This register consists of six bytes, from R9000 to R9005 or Z0 to Z5. A single block of data can be read from the register in bits or bytes at a time.
To read the data of the first bit of R9000, for example, specify RD R9000.1.

NOTE
In detailed explanation of each functional instruction, there are some functional instructions which do not have description for “Operation Output Register (R9000 to R9005, Z0 to Z5)”. As for these functional instructions, result of the operation output register just after execution of the functional instruction is uncertain.

4.3 TIMER

The following types of timer instruction are available. Use any of these instructions as appropriate for your purpose.

	Instruction name	Sub number	Processing
1	TMR	3	On-delay timer
2	TMRB	24	Fixed on-delay timer
3	TMRBF	77	Fixed off-delay timer
4	TMRC	54	On-delay timer
5	TMRST	221	Stop watch timer (1 ms accuracy)
6	TMRSS	222	Stop watch timer (1 sec accuracy)

4.3.1 TMR (On-delay Timer: SUB 3)

This is an on-delay timer.
Since you set the time in nonvolatile memory (T address) using the timer screen, you can change the set time without changing the ladder diagram.
The timer number you specify in the parameter is a number displayed on the timer screen. The data type in this instruction is binary type.

Format

The followings are the ladder format and the mnemonic format. In case of extended type format, another functional instruction can be connected instead of a W1.

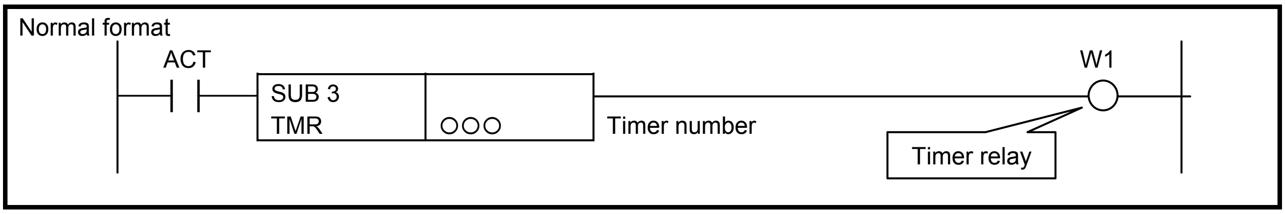


Fig. 4.3.1 (a) Format of TMR instruction (Normal format)

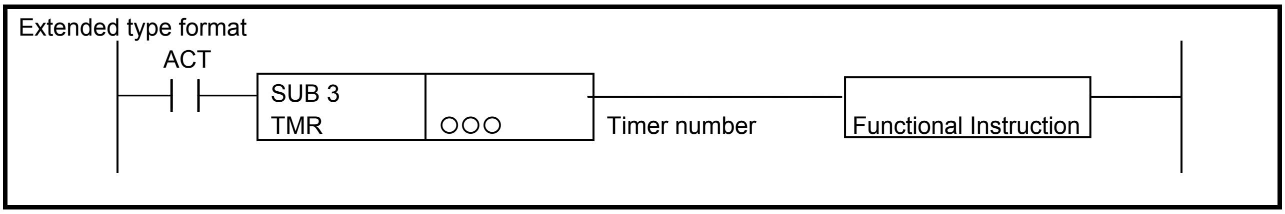


Fig. 4.3.1 (b) Format of TMR instruction (Extended type format)

Table 4.3.1 Mnemonic of TMR instruction (Normal format)

Mnemonic format					Memory status of control condition			
Step number	**Instruction**	**Address No.**	**Bit No.**	**Remarks**	**ST3**	**ST2**	**ST1**	**ST0**
1	RD	○○○○	.○	ACT				ACT
2	TMR	○○○		Timer number				↓
3	WRT	○○○○	.○	Timer relay output				W1

In the above mnemonic format, instruction name "TMR" at step number 2 can be abbreviated as "T".

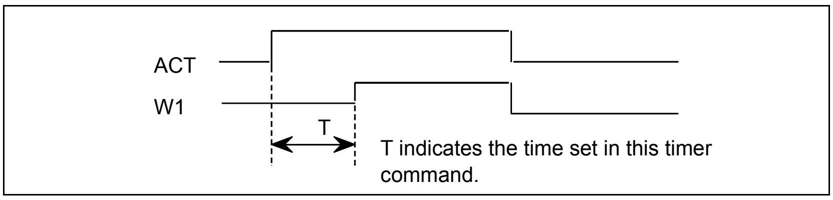


Fig. 4.3.1 (c) Operation of the timer

Control condition

ACT = 0: Turns off W1.
ACT = 1: Starts the timer.

Parameter

Set the timer number.

> ⚠**WARNING**
> 1 If the timer number is duplicated, or falls outside the valid range, the operation will be unpredictable.
> 2 When using the ladder dividing management function, do not use the duplicated timer number in different divided ladder programs on the same PMC path.
> 3 When using the Common PMC Memory mode, don't use the duplicated timer number in multiple PMC paths.

Setting timers

The initial value of the timer setting time can be set in steps of 48 msec for timer numbers 1 to 8 and in steps of 8 msec for timer numbers 9 and later. (For information about the number of timers of each PMC, see the table below.) The setting time value is rounded down to a multiple of the unit time.
For example, if 38 msec is set, the remainder 6 (38 = 8 × 4 + 6) is discarded, and only 32 msec is actually set.

Initial number of the timer setting time	1st to 5th path PMC				Dual check safety PMC
	PMC Memory-A	PMC Memory-B	PMC Memory-C	PMC Memory-D	
48-msec timer number	1 to 8	1 to 8	1 to 8	1 to 8	1 to 8
8-msec timer number	9 to 40	9 to 250	9 to 500	9 to 500	9 to 40

Timer accuracy

The timer screen allows you to set the accuracy of each timer individually. The setting time range and error are as shown below. For detailed information about how to set the timer accuracy, see Subsection 7.3.1.

Timer type and number	Setting time	Maximum error
48 msec (1 to 8) (initial value)	48 msec to 1572.8 sec	1st level execution cycle (1, 2, 4 or 8ms)
8 msec (9 or larger) (initial value)	8 msec to 262.1 sec	1st level execution cycle (1, 2, 4 or 8ms)
1 msec (1 or larger)	1 msec to 32.7 sec	1st level execution cycle (1, 2, 4 or 8ms)
10 msec (1 or larger)	10 msec to 327.7 sec	1st level execution cycle (1, 2, 4 or 8ms)
100 msec (1 or larger)	100 msec to 54.6 min	1st level execution cycle (1, 2, 4 or 8ms)
1 sec (1 or larger)	1 sec to 546 min	1st level execution cycle (1, 2, 4 or 8ms)
1 min (1 or larger)	1 min to 546 h	1 sec

Error is caused only by operation time of the timer instruction. For example, when a timer instruction is used in the 2nd level sequence part, the variation does not include the delay time (Max. 2nd level sequence one cycle time) until the sequence actuates after the set time is reached.

Timer relay (W1)

When the time preset is reached with ACT = 1, the timer relay turns on. The designer can freely decide the address of W1. In case of extended type format, another functional instruction can be connected instead of a W1.

4.3.2 TMRB (Fixed On-delay Timer: SUB 24)

This timer is used as a fixed on-delay timer.
Time present in this fixed timer is written to the memory together with the sequence program, so the time once set cannot be changed unless the whole sequence program is exchanged. The data type in this instruction is binary type.

Format

The followings are the ladder format and the mnemonic format. In case of extended type format, another functional instruction can be connected instead of a W1.

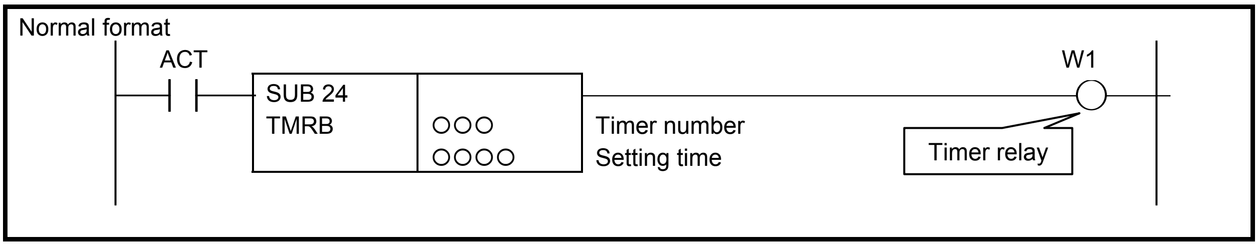


Fig. 4.3.2 (a) Format of TMRB instruction (Normal format)

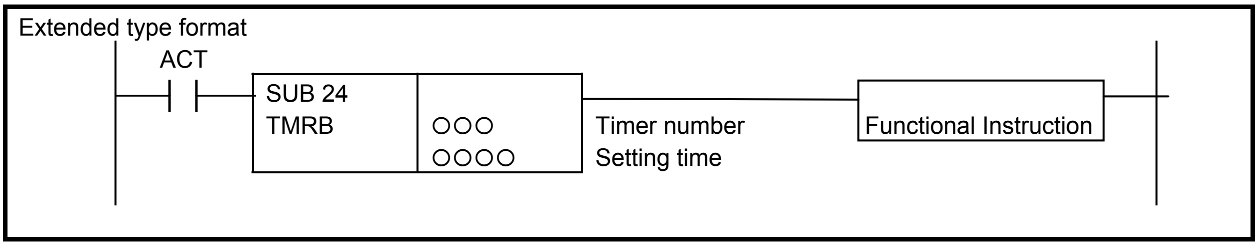


Fig. 4.3.2 (b) Format of TMRB instruction (Extended type format)

Table 4.3.2 Mnemonic of TMRB instruction (Normal format)

Mnemonic format					Memory status of control condition			
Step number	Instruction	Address No.	Bit No.	Remarks	ST3	ST2	ST1	ST0
1	RD	○○○○	.○	ACT				ACT
2	SUB	24		TMRB instruction				↓
3	(PRM)	○○○		Timer number				↓
4	(PRM)	○○○○		Setting time				↓
5	WRT	○○○○	.○	Timer relay output				W1

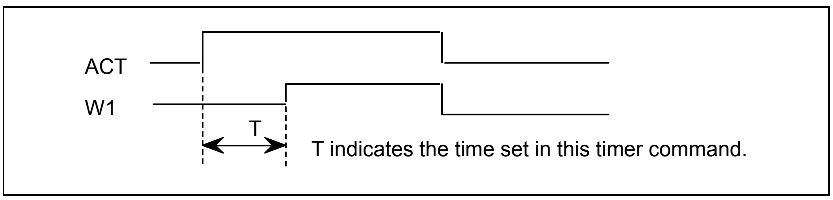


Fig. 4.3.2 (c) Timer operation

Control condition

ACT = 0: Turns off W1.
ACT = 1: Starts the timer.

Parameters

Specify the timer number of a fixed timer. The timer numbers and the setting time range are as shown below.

	1st to 5th path PMC				Dual check safety PMC
	PMC Memory-A	PMC Memory-B	PMC Memory-C	PMC Memory-D	
Timer number	1 to 100	1 to 500	1 to 1000	1 to 1500	1 to 100
Setting time	1 to 32,760,000 (msec)	1 to 32,760,000 (msec)	1 to 32,760,000 (msec)	1 to 32,760,000 (msec)	1 to 32,760,000 (msec)

⚠**WARNING**

If the same timer number is used more than once or if a timer number out of the valid range is used, operation is unpredictable.

The maximum setting time is approximately 546 minutes.

Error of the timer

This instruction has the following error. Moreover, the execution time until the timer instruction is executed in a sequence program (the maximum is the time of one cycle of each ladder execution level) is added to the error.

Timer instruction	Maximum Error
TMRB	1st level execution cycle (1, 2, 4 or 8ms)

Timer relay (W1)

The output W1 is turned on after certain time preset in the parameter of this instruction pasts after ACT = 1. The designer can freely decide the address of W1. In case of extended type format, another functional instruction can be connected instead of a W1.

4.3.3 TMRBF (Fixed Off-delay Timer: SUB 77)

This is the off-delay timer function whose timer preset value is fixed.
The timer preset value is written into the sequence program memory. Therefore, you have to modify sequence program if you want to change the timer value. The data type in this instruction is binary type.

Format

The followings are the ladder format and the mnemonic format. In case of extended type format, another functional instruction can be connected instead of a W1.

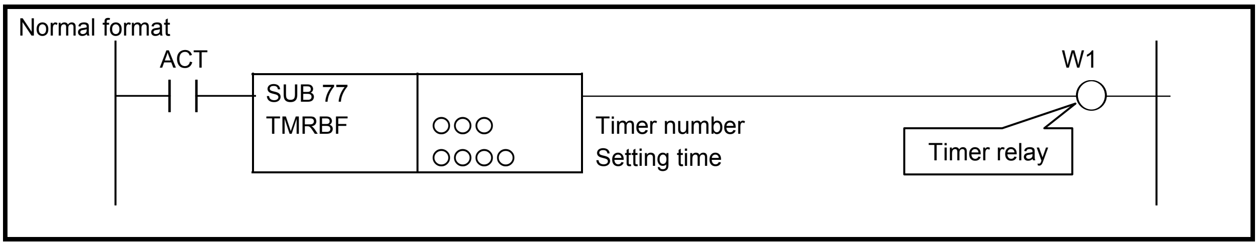


Fig. 4.3.3 (a) Format of TMRBF instruction (Normal format)

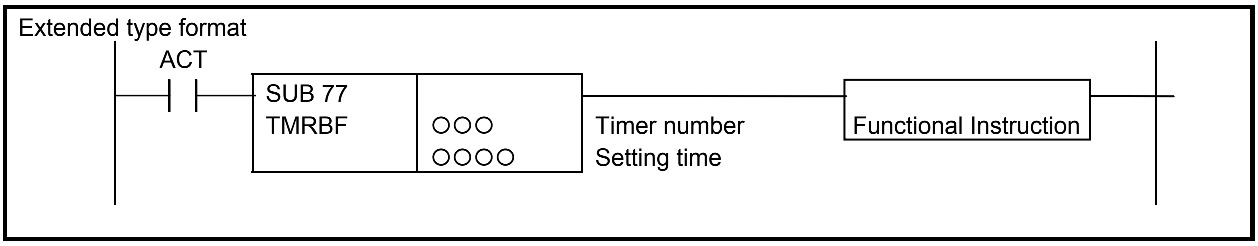


Fig. 4.3.3 (b) Format of TMRBF instruction (Extended type format)

Table 4.3.3 Mnemonic of TMRBF instruction (Normal format)

Mnemonic format

Step number	Instruction	Address No.	Bit No.	Remarks
1	RD	○○○○	.○	ACT
2	SUB	77		TMRBF instruction
3	(PRM)	○○○		Timer number
4	(PRM)	○○○○		Setting time
5	WRT	○○○○	.○	Timer relay output

Memory status of control condition

ST3	ST2	ST1	ST0
			ACT
			↓
			↓
			↓
			W1

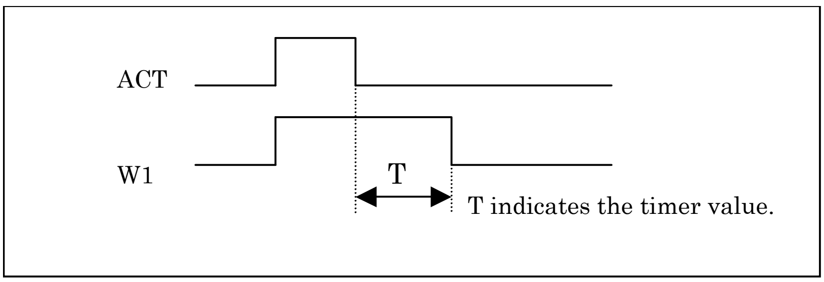


Fig. 4.3.3 (c) Timer operation

Control condition

ACT=0: Starts the timer.
ACT=1: Reset the timer and turn on W1.

Parameters

Specify the timer number of the fixed timer to the 1st parameter. You have to specify the unique timer number for all the TMRB (SUB 24) and TMRBF (SUB 77) instructions.
Specify the timer value of the fixed timer to the 2nd parameter. The unit is millisecond.
The available timer number and timer value is shown below.

	1st to 5th path PMC				Dual check safety PMC
	PMC Memory-A	PMC Memory-B	PMC Memory-C	PMC Memory-D	
Timer number	1 to 100	1 to 500	1 to 1000	1 to 1500	1 to 100
Setting time	1 to 32,760,000 (msec)	1 to 32,760,000 (msec)	1 to 32,760,000 (msec)	1 to 32,760,000 (msec)	1 to 32,760,000 (msec)

> ⚠ **WARNING**
> If the timer number of TMRB or TMRBF is conflicted or if the timer number is out of range, the operation is not guaranteed.

The maximum timer value is approximately 546 minutes.

Error of the timer

This instruction has the following error. Moreover, the execution time until the timer instruction is executed in a sequence program (the maximum is the time of one cycle of each ladder execution level) is added to the error.

Timer instruction	Maximum Error
TMRBF	1st level execution cycle (1, 2, 4 or 8ms)

Timer relay (W1)

When the input ACT is turned on, the output W1 will be turned on immediately and the timer instruction will be reset. After that, when the input ACT is turned off, the timer instruction will be started and the output W1 will be turned off after the specified time. If the input ACT is turned on again before the time-up, the timer will be reset.
You can use any valid coil address for the W1. In case of extended type format, another functional instruction can be connected instead of a W1.

4.3.4 TMRC (On-delay Timer: SUB 54)

This is the on-delay timer.
A timer setting time is set at an arbitrary address. There is no limit to the number of timers as long as memory areas can be allocated for the timer instruction to use. The data type in this instruction is binary type.

Format

The followings are the ladder format and the mnemonic format. In case of extended type format, another functional instruction can be connected instead of a W1.

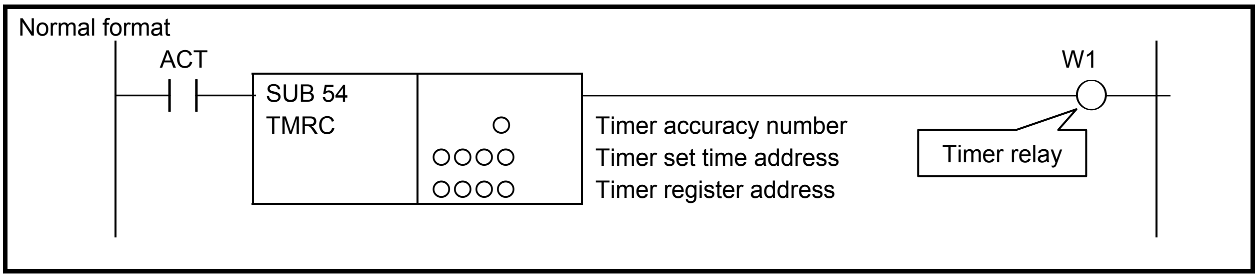


Fig. 4.3.4 (a) Format of TMRC instruction (Normal format)

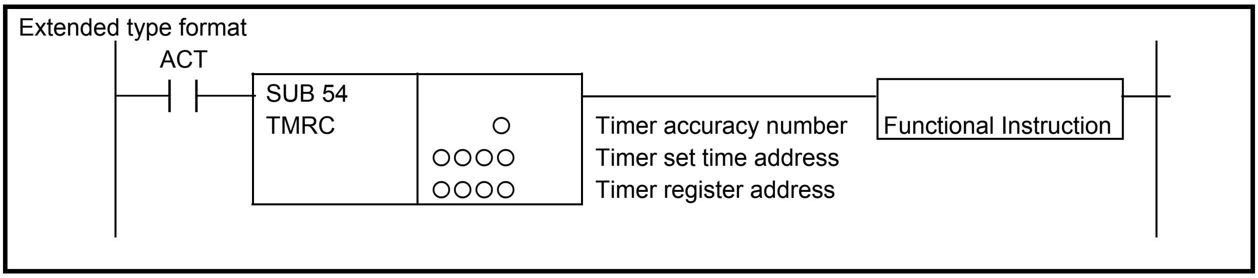


Fig. 4.3.4 (b) Format of TMRC instruction (Extended format)

Table 4.3.4 Mnemonic of TMRC instruction (Normal format)

Mnemonic format

Step number	Instruction	Address No.	Bit No.	Remarks
1	RD	○○○○	.○	ACT
2	SUB	54		TMRC instruction
3	(PRM)	○○○		Timer accuracy number
4	(PRM)	○○○○		Timer set time address
5	(PRM)	○○○○		Timer register address
6	WRT	○○○○	.○	Timer relay output

Memory status of control condition

ST3	ST2	ST1	ST0
			ACT
			↓
			↓
			↓
			↓
			W1

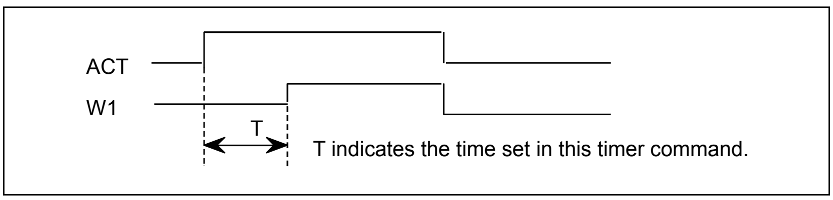


Fig. 4.3.4 (c) Timer operation

Control condition

ACT = 0: Turns off W1.
ACT = 1: Starts the timer.

Parameters

(a) Timer accuracy

The timer accuracy values, setting time range, and error are as shown below.

Timer accuracy	Setting number	The range of setting time (Note)	Margin of error
8 msec	0	8 msec to about 262.1 sec	1st level execution cycle (1, 2, 4 or 8ms)
48 msec	1	48 msec to about 26.2 min	1st level execution cycle (1, 2, 4 or 8ms)
1 sec	2	1 sec to about 546 min	1st level execution cycle (1, 2, 4 or 8ms)
10 sec	3	10 sec to about 91 h	1st level execution cycle (1, 2, 4 or 8ms)
1 min	4	1 min to about 546 h	1 sec
1 msec	5	1 msec to about 32.7 sec	1st level execution cycle (1, 2, 4 or 8ms)
10 msec	6	10 msec to about 327.7 sec	1st level execution cycle (1, 2, 4 or 8ms)
100 msec	7	100 msec to about 54.6 min	1st level execution cycle (1, 2, 4 or 8ms)

This instruction has the above error. Moreover, the execution time until the timer instruction is executed in a sequence program (the maximum is the time of one cycle of each ladder execution level) is added to the error.

NOTE

The value range of the setting time is between 0 and 32,767 for all timer accuracies. For example, when the timer accuracy is 8 msec, the value 0 means 8 msec and the value 32,767 means 262,136 msec.

(b) Timer set time address

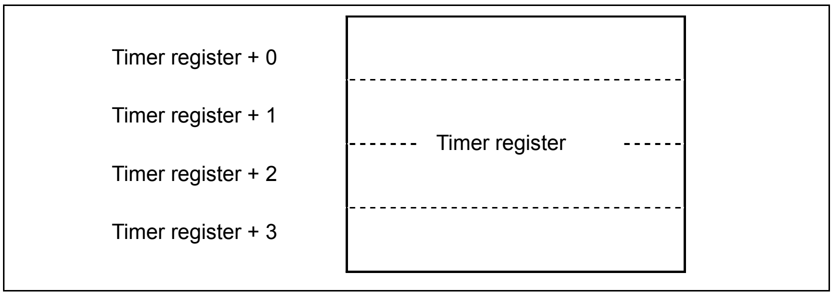
Sets the first address of the timer set time field.
The continuous 2-bytes memory space is required for the timer set time field.
The data table (field D) is normally used as this field.

Timer set time + 0
Timer set time + 1
-------------- TIME ----------------
TIME: Timer set time (1 to 32,767)

The timer setting time is converted to the binary format based on the timer accuracy (in units of 8 msec, 48 msec, etc.).
The timer setting time is shown as follows:

8 msec	8 to 262,136 msec
48 msec	48 to 1,572,816 msec
1 sec	1 to 32,767 sec
10 sec	10 to 327,670 sec
1 min	1 to 32,767 min
1 msec	1 to 32,767 msec
10 msec	10 to 327,670 msec
100 msec	100 to 3,276,700 msec

(c) Timer register address
Set the start address of a timer register area.
A timer register area must be allocated to a continuous 4 bytes memory area starting from the set address. The user area (R area) is used as a timer register area. This area should be used by the PMC system, and therefore should not be used by the sequence program.



Timer relay (W1)

The output W1 is turned on when the time specified in the parameter of this instruction elapses after ACT is set to 1. The designer can freely decide the address of W1. In case of extended type format, another functional instruction can be connected instead of a W1.

4.3.5 TMRST (Stop Watch Timer (1ms Accuracy) : SUB 221) TMRSS (Stop Watch Timer (1sec Accuracy) : SUB 222)

This is stop watch timer.
The stop watch timer instruction accumulates periods of time during which ACT=1 is set, and preserves the cumulative value as an integration time. The integration time is not cleared when ACT=0. Instead, when ACT=1 is set again, a continued measurement is made.

In "Setting time", a constant or a PMC memory address for storing data can be specified. An integration time is output to a specified PMC address, so that the integration time can be output to the outside or used for another operation.
When the integration time has reached "Setting time", timer relay W1=1 is set. If ACT=1 even when the integration time has exceeded "Setting time", a measurement is continued until a maximum time is reached. During this period as well, timer relay W1=1 is set.
To reset the integration time and timer relay to 0, set RST (Reset)=1.
As indicated below, two types of the stop watch timer instructions are available according to the timer accuracy.

Table4.3.5 (a) Kinds of stop watch timer

	Instruction name	SUB No.	Timer accuracy
1	TMRST	221	1 millisecond (ms)
2	TMRSS	222	1 sec

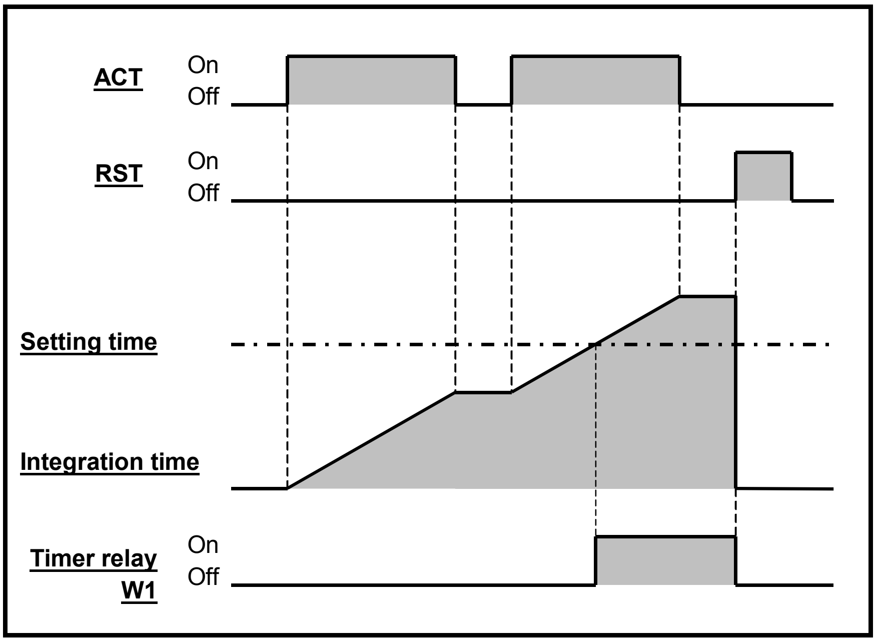


Fig. 4.3.5 (a) Time chart of TMRST and TMRSS Instruction

Format

Fig. 4.3.5 (b) shows the ladder format and Table 4.3.5 (b) shows the mnemonic format.

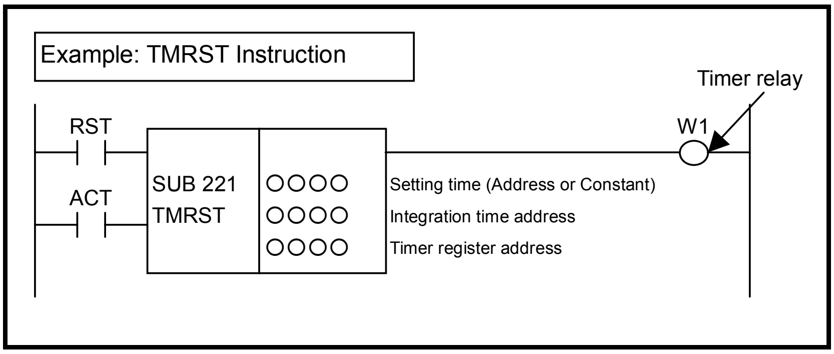


Fig. 4.3.5 (b) Format of TMRST and TMRSS instruction

Table4.3.5 (b) Mnemonic of TMRST and TMRSS instruction

Mnemonic format

Step number	Instruction	Address No.	Bit No.	Remarks
1	RD	○○○○	.○	RST
2	RD.STK	○○○○	.○	ACT
3	SUB	221		SUB No. (TMRST Instruction)
4	(PRM)	○○○○		Setting time (Address or Constant)
5	(PRM)	○○○○		Integration time address
6	(PRM)	○○○○		Timer register address
7	WRT	○○○○	.○	Timer relay output

Memory status of control condition

ST3	ST2	ST1	ST0
			RST
		RST	ACT
			W1

Control condition

(a) Reset (RST)
RST=0: Reset operation is canceled.
RST=1: Reset operation is executed.
The integration time is reset to 0.
Even when input signal ACT=1 is set, reset operation has priority, and the stop watch timer is stopped. W1=0 is also set.

(b) Input signal (ACT)
ACT=0: Integration is stopped.
ACT=1: Integration is started.

> **NOTE**
> Set RST to 1 only when reset operation is needed. Usually, set RST to 0.

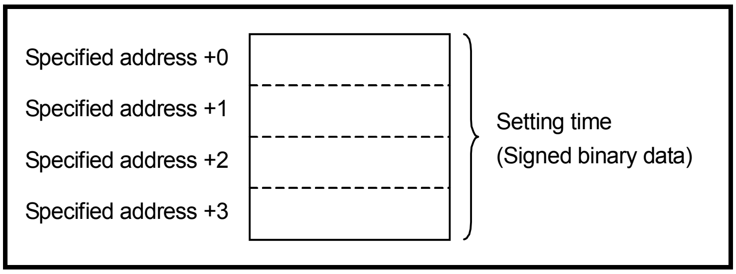
Parameters

(a) Setting time

Specify a time-out period for the timer. A value from 0 to 2147483647 may be specified. If a value out of this range is specified, integration operation is performed but timer relay W1=0 is set at all times.

In this parameter, a constant or a PMC memory address for storing data can be specified.

If an address is specified, specify "Setting time" as signed binary data by using the contiguous four bytes of memory starting from the specified address.



Instruction name	Setting time
TMRST	0 to 2147483647 millisecond
TMRSS	0 to 2147483647 second

NOTE

When a Setting time is rewritten during execution of instruction, the result is reflected immediately.

(b) Integration time address

Specify a PMC memory address for storing the integration time of the timer. One integration time count corresponds to the timer accuracy.

An integration time address must be allocated to a continuous four bytes memory area starting from the set address.

To preserve the integration time when the power to the CNC is turned on/off, the D area is usually used. However, the delay corresponding to the cycle of backup of D area may cause an error at the Integration time after turning on a power supply again when a power supply is turned off in integration.

The figure below shows the relationships of the actual accumulation of integration time, ladder execution cycle, ACT On/Off operation, and timer relay output.

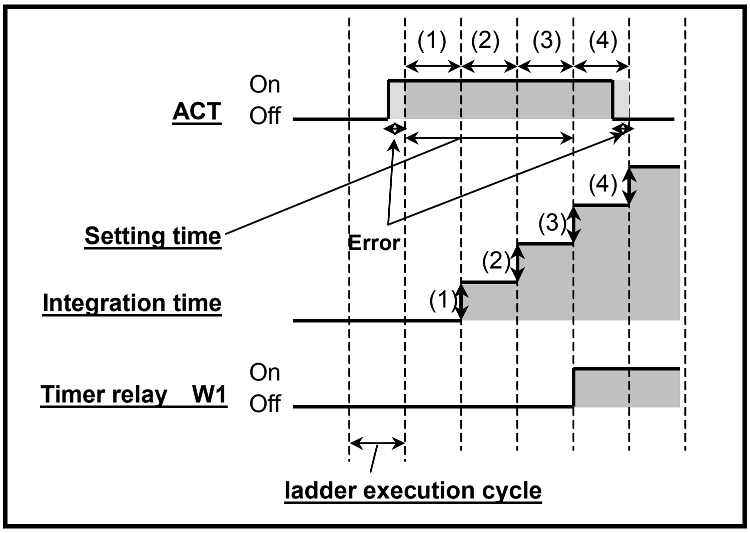


Fig. 4.3.5 (c) Increment of Integration time

Integration time accumulation starts in the execution cycle immediately after ACT=1 (On) is set, and continues until an execution cycle where ACT=0 (Off) is set. Timer relay W1=1 (On) is set when the integration time has reached "Setting time".
A maximum error per measurement section (pair of ACT On/Off) is "±ladder execution cycle time".

NOTE
Do not perform rewriting of integration time during execution of instruction.

(c) Timer register address (work memory)
Specify the address of a 2 bytes PMC memory area to be used for integration time calculation. The sequence program should not use this area. Usually, the R area is used.

Timer relay (W1)

W1 is turned on when the integration time has reached the set time.

NOTE
W1 must not be omitted.

4.4 COUNTER

The following types of counter instruction are available. Use any of these instructions as appropriate for your purpose.

	Instruction name	Sub number	Processing
1	CTR	5	Counter processing
2	CTRB	56	Fixed counter processing
3	CTRC	55	Counter processing
4	CTRD	223	Counter processing (4 bytes length)

4.4.1 CTR (Counter: SUB 5)

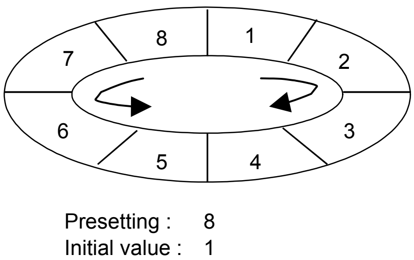
CTR is used as a counter. Counters are used for various purposes for NC machine tools.
Numerical data such as preset values and count values can be used with either BCD format or binary format by a system parameter of PMC.

> **⚠WARNING**
> When an incorrect BCD data was set to a BCD type counter, the movement of CTR cannot be sure.
> If changing the counter type, be sure to reconfigure the preset value and count value.

This counter has the following functions to meet various applications.

(a) Preset counter
A signal is output when the preset count is reached. The number can be preset from the counter screen, or set in the sequence program.
(b) Ring counter
Upon reaching the preset count, returns to the initial value by issuing another count signal.
(c) Up/down counter
The count can be either up or down.
(d) Selection of initial value
Select the initial value as either 0 or 1.

A combination of the preceding functions results in the ring counter below.



Such a counter permits the position of a rotor to be memorized.

Format

The followings are the ladder format and the mnemonic format.

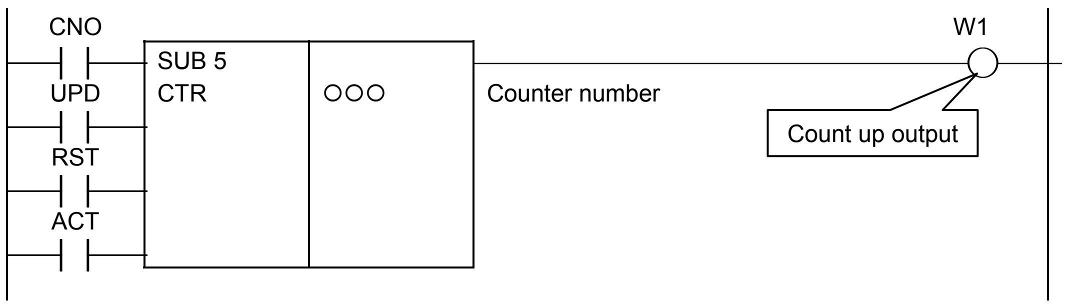


Fig. 4.4.1 (a) Format of CTR instruction

Table 4.4.1 Mnemonic of CTR instruction

Step number	Instruction	Address No.	Bit No.	Remarks	ST3	ST2	ST1	ST0
		Mnemonic format			**Memory status of control condition**			
1	RD	○○○○	.○	CNO				CNO
2	RD.STK	○○○○	.○	UPD			CNO	UPD
3	RD.STK	○○○○	.○	RST		CNO	UPD	RST
4	RD.STK	○○○○	.○	ACT	CNO	UPD	RST	ACT
5	SUB	5		CTR instruction				
6	(PRM)	○○○		Counter number				▼
7	WRT	○○○○	.○	Counter output	▼	▼	▼	W1

Control conditions

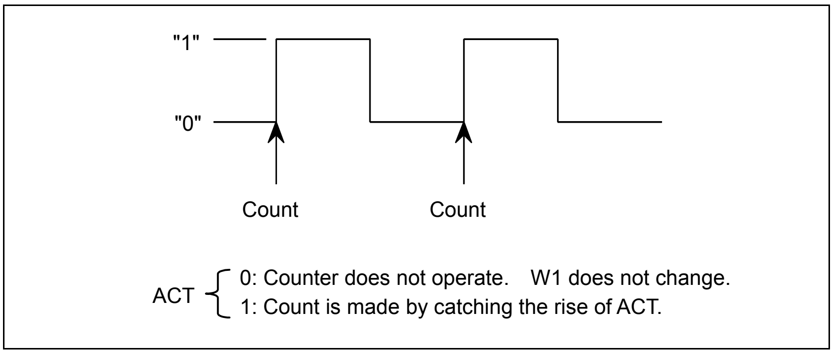
(a) Specify the initial value. (CNO)
CNO = 0: Begins the value of the counter with 0.
0, 1, 2, 3, ..., n.
CNO = 1: Begins the value of the counter with 1 (0 is not used).
1, 2, 3, ..., n.

(b) Specify up or down counter. (UPDOWM)
UPD = 0: Up counter. The counter begins with 0 when CNO = 0; 1 when CNO =1.
UPD = 1: Down counter. The counter begins with the preset value.

(c) Reset (RST)
RST = 0: Releases reset.
RST = 1: Enables reset.
W1 becomes 0.
The integrated value is reset to the initial value.

> ⚠ **CAUTION**
> Set RST to 1, only when reset is required.

(d) Count signal (ACT)



Parameter

(a) Counter number

The numbers that can be used are shown below.

	1st to 5th path PMC				Dual check safety PMC
	PMC Memory-A	PMC Memory-B	PMC Memory-C	PMC Memory-D	
Counter number	1 to 20	1 to 100	1 to 200	1 to 300	1 to 20

The preset value and cumulative value that can be set are as follows:

Binary counter: 0 to 32,767

BCD counter: 0 to 9,999

⚠**WARNING**

1 If the counter number is duplicated, or falls outside the valid range, the operation will be unpredictable.

2 When using the ladder dividing management function, do not use the duplicated counter number in different divided ladder programs on the same PMC path.

3 When using the Common PMC Memory mode, don't use the duplicated timer number in multiple PMC paths.

Count up output (W1)

In case of up counter mode (UPD=0), when the count is up to a preset value, W1 = 1.

In case of down counter mode (UPD=1) and initial value 0(CNO=0), when the counter reaches 0, W1 is set to 1.

In case of down counter mode (UPD=1) and initial value 1(CNO=1), when the counter reaches 1, W1 is set to 1.

The address of W1 can be determined arbitrarily.

⚠ **CAUTION**

Two or more coils, WRT, WRT.NOT, SET or RST, that follow this instruction are prohibited. You have to place a single coil instruction as the output of this instruction.

Examples of using the counter

[Example 1]

A preset counter

The number of work pieces to be machined is counted. When the number reaches the preset count, a signal is output.

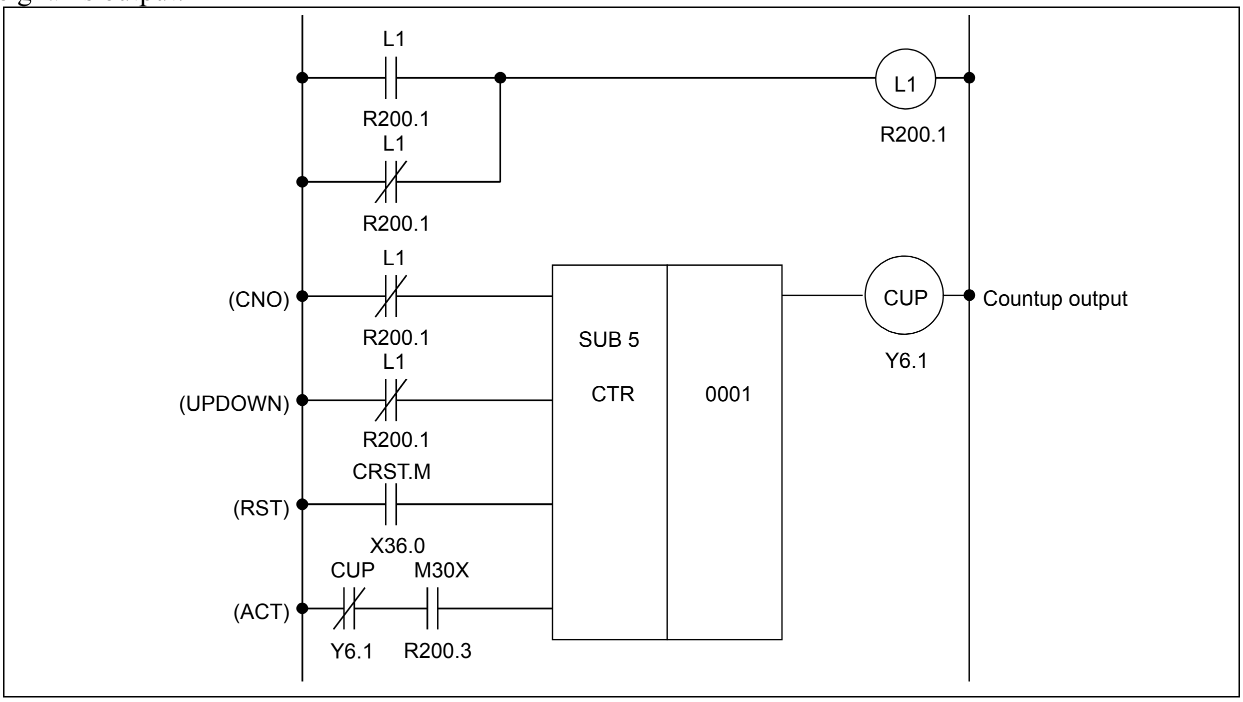


Fig. 4.4.1 (b) Ladder diagram for the counter, example 1

(1) Control conditions
L1 is a circuit to make logic 1.
(a) Count start number
Since the count ranges from 0 to 9,999, contact B of L1 is used for making CNO = 0.
(b) Specify up and down
Since it is to be up counter, contact B of L1 is used make UPD = 0.
(c) Reset
The reset signal of the counter uses input signal CRST.M from the machine tool.
(d) Count signal
The count signal is M30X, which was decoded from the NC output M code. M30X contains contact B of CUP to prevent counting past the preset value, as long as reset is not enabled after count up.

(2) Counter number and W1
In this example, the first counter is used. The result of W1 is not used, but its address must be determined.

(3) Operation
The number of work pieces to be machined is counted and when the number reaches 9999, CUP is output.

[Example 2]
Using of the counter to store the position of a rotor.

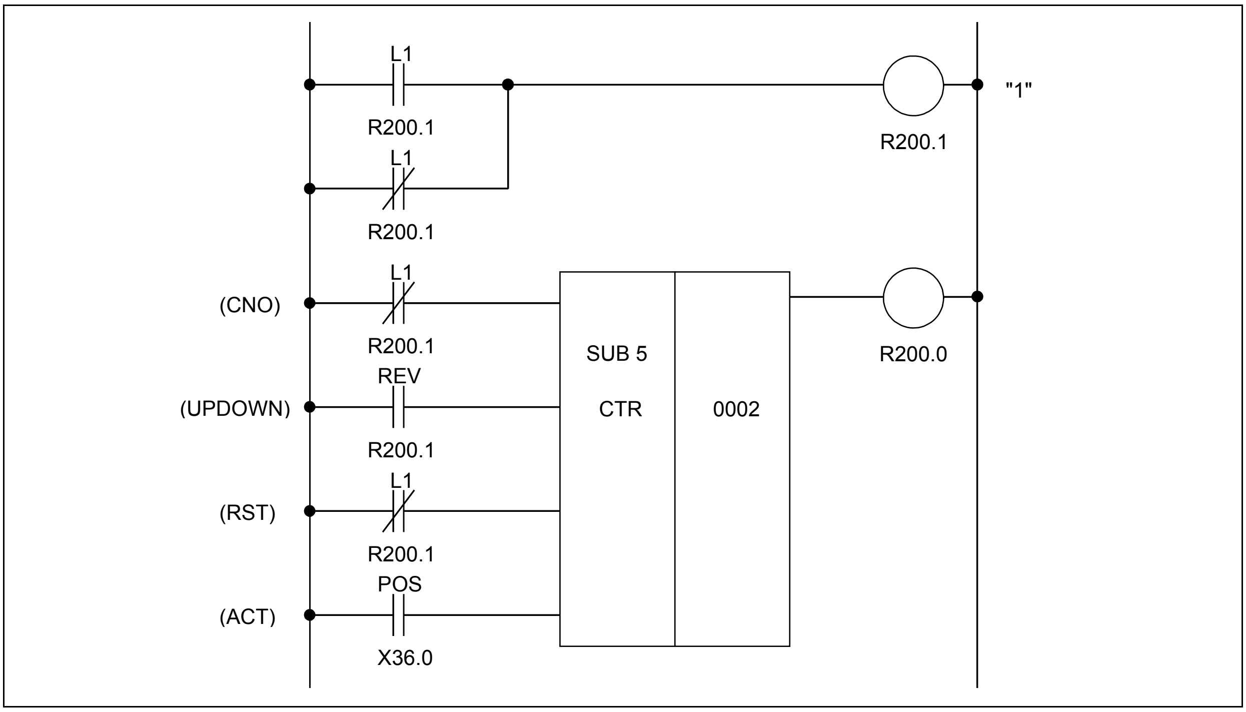


Fig. 4.4.1 (c) Ladder diagram for the counter, example 2

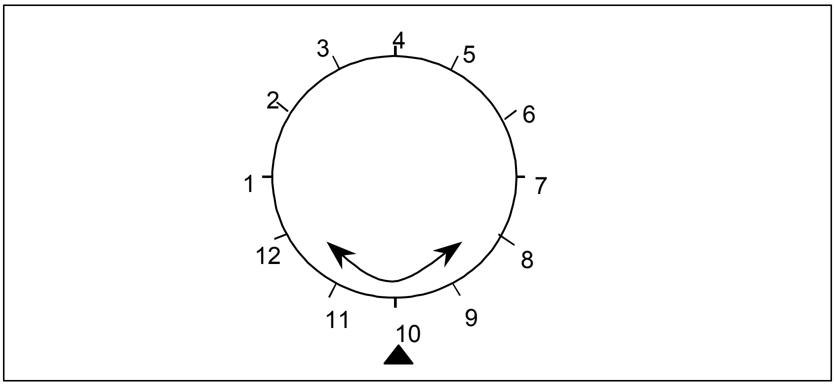


Fig. 4.4.1 (d) Indexing for a rotor

Fig. 4.4.1 (c) shows a ladder diagram for a counter to store the position of a rotor of Fig. 4.4.1 (d).

(1) Control conditions
   (a) Count start number
   When a 12-angle rotor shown in Fig. 4.4.1 (d) is used, the count starting number is 1. Contact A of L1 is used for making CNO = 1.
   (b) Specify up and down
   The signal REV changes according to the then direction of rotation. It becomes 0 for forward rotation and 1 for reverse rotation. Thus, the counter is an up counter for forward rotation and a down counter for reverse rotation.
   (c) Reset
   In this example, since W1 is not used, RST = 0, and contact B of L1 is used.
   (d) Count signal
   The count signal POS turns on and off 12 times each time the rotor rotates once.

(2) Counter number and W1
In this example, the second counter is used. The result of W1 is not used, but its address must be determined.

(3) Operation
(a) Setting the preset value
Since the rotor to be controlled is 12-angle as shown in Fig. 4.4.1 (d), 12 must be preset in the counter. It is set from the counter screen.
(b) Setting the current value
When the power is turned on, the position of the rotor must be equated with the count on the counter. The count is set via the counter screen. Once a current value is set, then correct current positions will be loaded to the counter every time.
(c) The POS signal turns on and off each time the rotor rotates.
The number of times of the POS signal turns on and off is counted by the counter 2, as below.
1, 2, 3, . . . 11, 12, 1, 2, . . .
For forward rotation
1, 12, 11, . . . 3, 2, 1, 12 . . .
For reverse rotation

4.4.2 CTRB (Fixed Counter: SUB 56)

CTRB is used as a counter. Numerical data such as preset values and count values can be used with binary format. This counter has the following functions to meet various applications.

(a) Preset counter
Preset the count value. If the count reaches this preset value, outputs to show that.

(b) Ring counter
This is the ring counter which is reset to the initial value when the count signal is input after the count reaches the preset value.

(c) Up/down counter
This is the reversible counter to be used as both up counter and down counter.

(d) Selection of initial value
Either 0 or 1 can be selected as the initial value.

Format

The followings are the ladder format the mnemonic format.

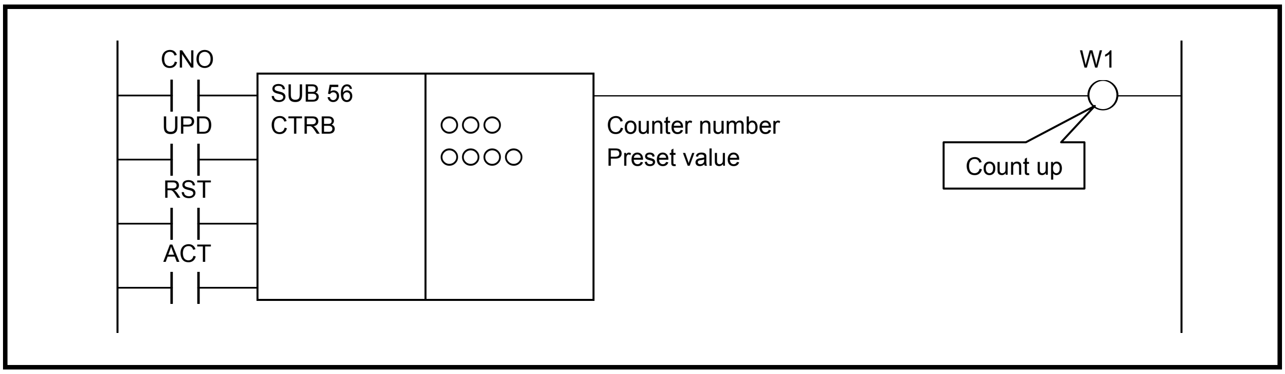


Fig. 4.4.2 Format of CTRB instruction

Table 4.4.2 Mnemonic of CTRB instruction

Mnemonic format

Step number	Instruction	Address No.	Bit No.	Remarks
1	RD	○○○○	.○	CNO
2	RD.STK	○○○○	.○	UPD
3	RD.STK	○○○○	.○	RST
4	RD.STK	○○○○	.○	ACT
5	SUB	56		CTRB instruction
6	(PRM)	○○○		Counter number
7	(PRM)	○○○○		Preset value
8	WRT	○○○○	.○	Count up output

Memory status of control condition

ST3	ST2	ST1	ST0
			CNO
		CNO	UPD
	CNO	UPD	RST
CNO	UPD	RST	ACT
			▼
▼	▼	▼	W1

Control conditions

(a) Specifying the initial value (CNO)
CNO = 0: The counter value starts with "0". 0,1,2,3,.......,n
CNO = 1: The counter value starts with "1". 1,2,3,.........,n

(b) Specifying up or down (UPD)
UPD = 0: Up counter
The initial value is "0" when CNO = 0 or "1" when CNO = 1.
UPD = 1: Down counter
The initial value is the preset value.

(c) Reset (RST)
RST = 0: Cancels reset.
RST = 1: Resets. W1 is reset to 0. The accumulated value is reset to the initial value.

⚠ **CAUTION**
Set RST to 1, only when reset is required.

(d) Count signal (ACT)
ACT = 0: The counter does not operate. W1 does not change.
ACT = 1: The counter operates at the rise of this signal.

Parameters

(a) Counter number
The numbers that can be used are shown below.

	1st to 5th path PMC				Dual check safety PMC
	PMC Memory-A	PMC Memory-B	PMC Memory-C	PMC Memory-D	
Counter number	1 to 20	1 to 100	1 to 200	1 to 300	1 to 20

⚠ **WARNING**
1 If the counter number is duplicated, or falls outside the valid range, the operation will be unpredictable.
2 When using the ladder dividing management function, do not use the duplicated counter number in different divided ladder programs on the same PMC path.
3 When using the Common PMC Memory mode, don't use the duplicated counter number in multiple PMC paths.

(b) Preset value
Following value can be set as preset value.
Binary counter: 0 to 32,767
* CTRB is always binary counter. System parameter is ineffective.

Count up output (W1)

In case of the up counter mode (UPD=0), when the counter value reaches the preset value, W1 is set to 1.
In case of the down counter mode (UPD=1) and initial value 0(CNO=0), when the counter value reaches 0, W1 is set to 1.
In case of the down counter mode (UPD=1) and initial value 1(CNO=1), when the counter value reaches 1, W1 is set to 1.
The W1 address can be specified arbitrarily.

⚠ **CAUTION**
Two or more coils, WRT, WRT.NOT, SET or RST, that follow this instruction are prohibited. You have to place a single coil instruction as the output of this instruction.

Accumulate value

The address C5000s are used for accumulate value of the CTRB. Each CTRB consumes 2 bytes.
CTRB of counter number 1 uses C5000-5001 and CTRB of number 2 uses C5002-5003 for their accumulate values.

4.4.3 CTRC (Counter: SUB 55)

The numeral data of this counter are all binary. This counter has the following functions and can be used according to the application:

(a) Preset counter
Preset the count value and if the count reaches this preset value, outputs to show that.

(b) Ring counter
This is the ring counter which is reset to the initial value when the count signal is input after the count reaches the preset value.

(c) Up/down counter
This is the reversible counter to be used as both the up counter and down counter.

(d) Selection of the initial value
Either 0 or 1 can be selected as the initial value.

Format

The followings are the ladder format and the mnemonic format.

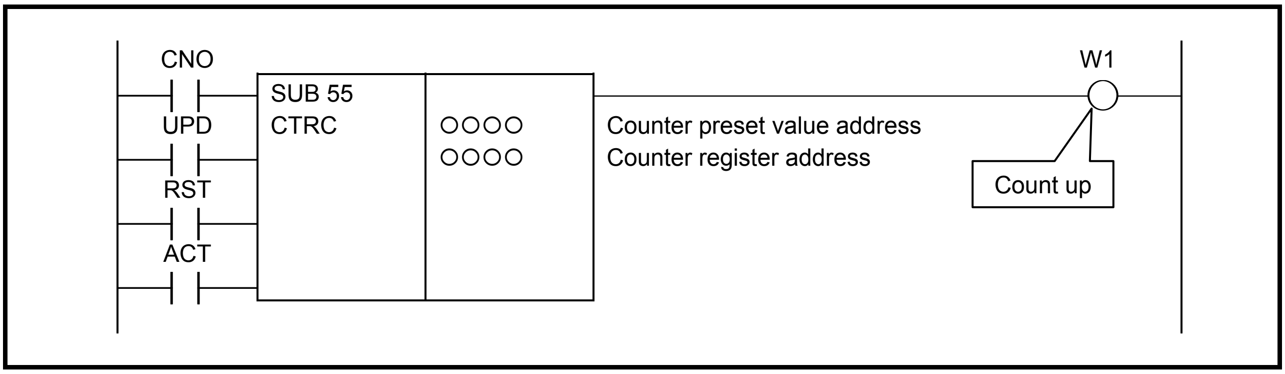


Fig. 4.4.3 Format of CTRC instruction

Table 4.4.3 Mnemonic of CTRC instruction

Step number	Instruction	Address No.	Bit No.	Remarks	ST3	ST2	ST1	ST0
		Mnemonic format			**Memory status of control condition**			
1	RD	○○○○	.○	CNO				CNO
2	RD.STK	○○○○	.○	UPD			CNO	UPD
3	RD.STK	○○○○	.○	RST		CNO	UPD	RST
4	RD.STK	○○○○	.○	ACT	CNO	UPD	RST	ACT
5	SUB	55		CTRC instruction				
6	(PRM)	○○○○		Counter preset value address				
7	(PRM)	○○○○		Counter register address				▼
8	WRT	○○○○	.○	Count up output	▼	▼	▼	W1

Control conditions

(a) Specifying the initial value (CNO)
CNO = 0: The count value starts with "0". 0, 1, 2, 3, . . . n
CNO = 1: The count value starts with "1". 1, 2, 3, . . . n

(b) Specifying up or down count (UPD)
UPD = 0: Up counter. The initial value is "0" when CNO = 0 or "1" when CNO = 1.
UPD = 1: Down counter. The initial value is the preset value.

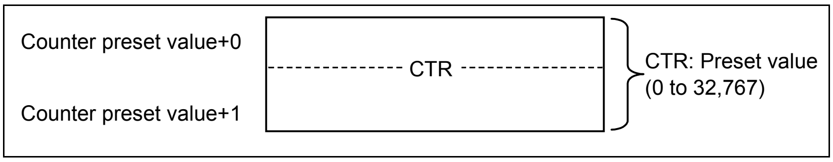
(c) Reset (RST)
RST = 0: Reset cancelled.
RST = 1: Reset. W1 is reset to "0". The accumulated value is reset to the initial value.

> ⚠ **CAUTION**
> Set RST to 1, only when reset is required.

(d) Count signal (ACT)
ACT = 0: The counter does not operate. W1 does not change.
ACT = 1: The counter operates at the rise of this signal.

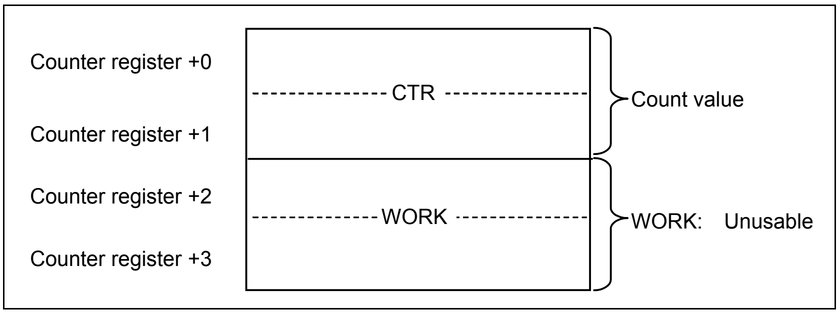
Parameters

(a) Counter preset value address
The first address of the counter preset value field is set.
The continuous 2-byte memory space from the first address is required for this field. Field D is normally used.



The counter preset value is binary. Therefore, it ranges from 0 to 32,767.

(b) Counter register address
The first address of the counter register field is set.
The continuous 4-byte memory space from the first address is required for this field. Field D is normally used.



> ⚠ **CAUTION**
> When R address is specified as the counter register address, the counter starts with count value "0" at power on.

Count up output (W1)

In case of the up counter mode (UPD=0), when the counter value reaches the preset value, W1 is set to 1.
In case of the down counter mode (UPD=1) and initial value 0(CNO=0), when the counter value reaches 0, W1 is set to 1.
In case of the down counter mode (UPD=1) and initial value 1(CNO=1), when the counter value reaches 1, W1 is set to 1.
The W1 address can be specified arbitrarily.

> ⚠ **CAUTION**
> Two or more coils, WRT, WRT.NOT, SET or RST, that follow this instruction are prohibited. You have to place a single coil instruction as the output of this instruction.

4.4.4 CTRD (Counter (4 Bytes Length) : SUB 223)

This instruction is a counter of 4 bytes length binary data. This counter has the following functions and can be used according to the application:

(a) Preset counter
Preset the count value and if the count reaches this preset value, outputs to show that.

(b) Ring counter
This is the ring counter which is reset to the initial value when the count signal is input after the count reaches the preset value.

(c) Up/down counter
This is the reversible counter to be used as both the up counter and down counter.

(d) Selection of the initial value
Either 0 or 1 can be selected as the initial value.

Format

Fig. 4.4.4 shows the ladder format and Table 4.4.4 shows the mnemonic format.

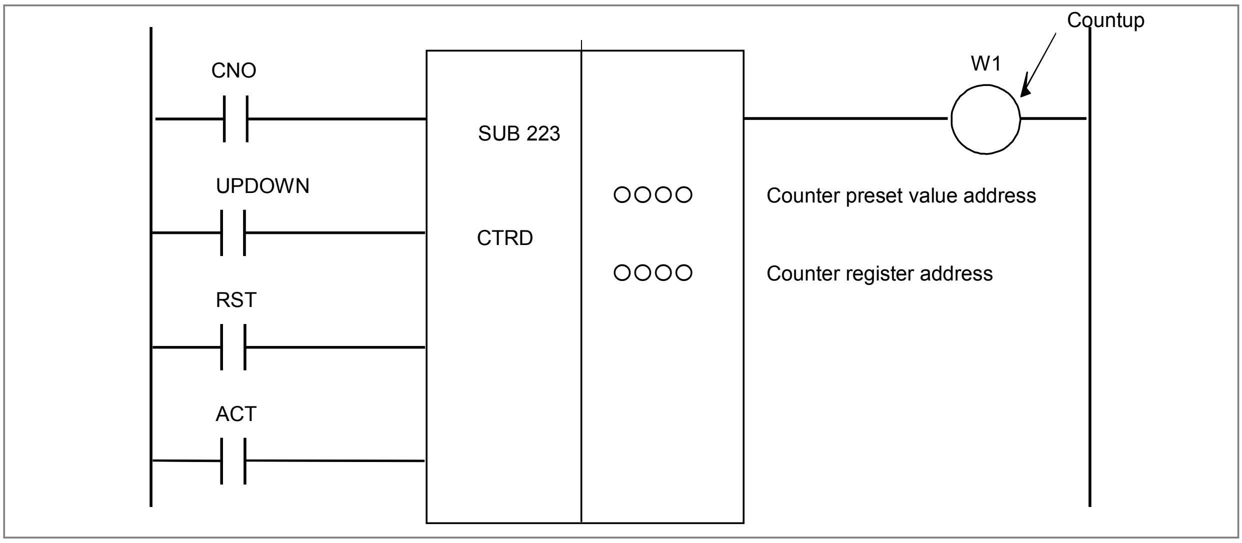


Fig. 4.4.4 Format of CTRD instruction

Table 4.4.4 Mnemonic of CTRD instruction

Mnemonic format

Step number	Instruction	Address No.	Bit No.	Remarks
1	RD	○○○○	.○	CNO
2	RD. STK	○○○○	.○	UPDOWN
3	RD. STK	○○○○	.○	RST
4	RD. STK	○○○○	.○	ACT
5	SUB	223		CTRD instruction
6	(PRM)	○○○○		Counter preset value address
7	(PRM)	○○○○		Counter register address
8	WRT	○○○○	.○	Count up output

Memory status of control condition

ST3	ST2	ST1	ST0
			CNO
		CNO	UPDOWN
	CNO	UPDOWN	RST
CNO	UPDOWN	RST	ACT
			W1

Control conditions

(a) Specifying the initial value (CNO)
CNO = 0: The count value starts with "0". 0, 1, 2, 3, . . . n
CNO = 1: The count value starts with "1". 1, 2, 3, . . . n

(b) Specifying up or down count (UPDOWN)
UPDOWN = 0: Up counter. The initial value is "0" when CNO = 0 or "1" when CNO = 1.
UPDOWN = 1: Down counter. The initial value is the preset value.

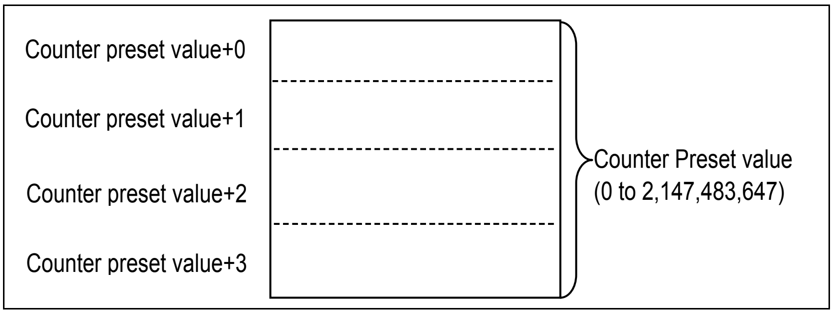
(c) Reset (RST)
RST = 0: Reset cancelled.
RST = 1: Reset. W1 is reset to "0". The accumulated value is reset to the initial value.

> ⚠ **CAUTION**
> Set RST to 1, only when reset is required.

(d) Count signal (ACT)
ACT = 0: The counter does not operate. W1 does not change.
ACT = 1: The counter operates at the rise of this signal.

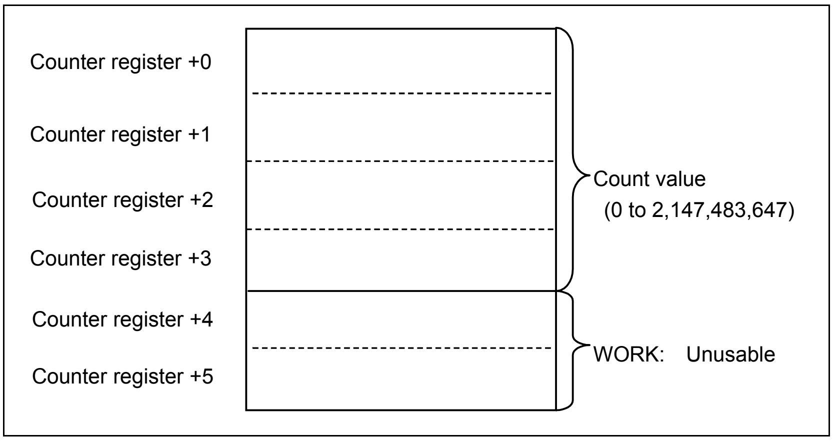
Parameters

(a) Counter preset value address
The first address of the counter preset value field is set.
The continuous 4-byte memory space from the first address is required for this field. Address D is normally used.



The counter preset value is binary. Therefore, it ranges from 0 to 2,147,483,647.

(b) Counter register address
The first address of the counter register field is set.
The continuous 6-byte memory space from the first address is required for this field. Address D is normally used.



> ⚠ **CAUTION**
> When R address is specified as the counter register address, the counter starts with count value "0" at power on.

Count up output (W1)

In case of the up counter mode (UPDOWN=0), when the counter value reaches the preset value, W1 is set to 1.
In case of the down counter mode (UPDOWN=1) and initial value 0(CNO=0), when the counter value reaches 0, W1 is set to 1.
In case of the down counter mode (UPDOWN=1) and initial value 1(CNO=1), when the counter value reaches 1, W1 is set to 1.
The W1 address can be specified arbitrarily.

NOTE
W1 is not omissible.

⚠ **CAUTION**
Two or more coils, WRT, WRT.NOT, SET or RST, that follow this instruction are prohibited. You have to place a single coil instruction as the output of this instruction.

4.5 DATA TRANSFER

The following types of data transfer instruction are available. Use any of these instructions as appropriate for your purpose.

	Instruction name	Sub number	Processing
1	MOVB	43	Transfer of 1 byte
2	MOVW	44	Transfer of 2 bytes
3	MOVD	47	Transfer of 4 bytes
4	MOVN	45	Transfer of an arbitrary number of bytes
5	MOVE	8	Logical product transfer
6	MOVOR	28	Data transfer after logical sum
7	XMOVB	35	Binary index modifier data transfer
8	XMOV	18	Indexed data transfer
9	MOVBT	224	Bit transfer
10	SETNB	225	Data setting (1 byte length)
11	SETNW	226	Data setting (2 bytes length)
12	SETND	227	Data setting (4 bytes length)
13	XCHGB	228	Data exchange (1 byte length)
14	XCHGW	229	Data exchange (2 bytes length)
15	XCHGD	230	Data exchange (4 bytes length)
16	SWAPW	231	Data swap (2 bytes length)
17	SWAPD	232	Data swap (4 bytes length)
18	DSCHB	34	Binary data search
19	DSCH	17	Data search

4.5.1 MOVB (Transfer of 1 Byte: SUB 43)

The MOVB instruction transfers 1-byte data from a specified source address to a specified destination address.

Format

The followings are the ladder format and the mnemonic format.

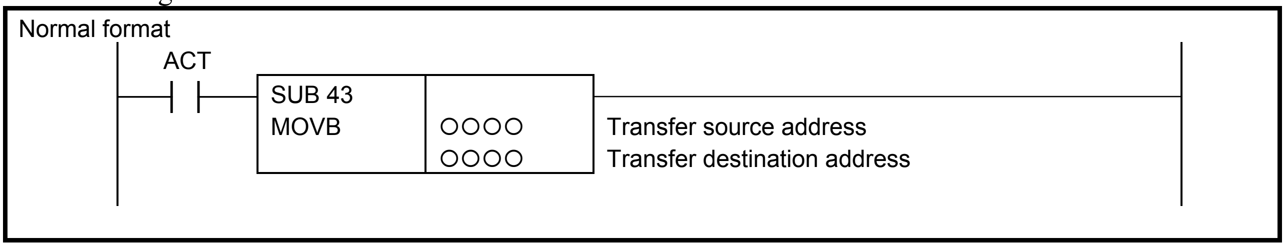


Fig. 4.5.1(a) Format of MOVB instruction (Normal format)

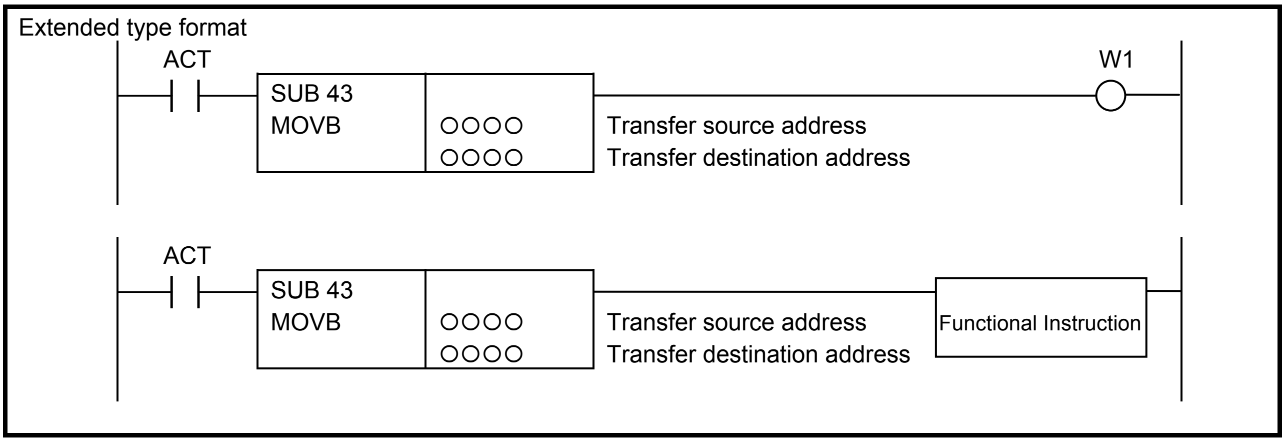


Fig. 4.5.1(b) Format of MOVB instruction (Extended type format)

Table 4.5.1 Mnemonic of MOVB instruction (Normal format)

Mnemonic format					Memory status of control condition			
Step number	**Instruction**	**Address No.**	**Bit No.**	**Remarks**	**ST3**	**ST2**	**ST1**	**ST0**
1	RD	○○○○	.○	ACT				ACT
2	SUB	43		MOVB instruction				↓
3	(PRM)	○○○○		Transfer source address				↓
4	(PRM)	○○○○		Transfer destination address				↓

Control condition

(a) Execution specification
ACT = 0: No data is transferred.
ACT = 1: One-byte data is transferred.

Parameters

(a) Transfer source address
Specify the source address for the transfer.
(b) Transfer destination address
Specify the destination address for the transfer.

Output (W1)

When the instruction is executed, W1=1 is set. W1 may be omitted.

4.5.2 MOVW (Transfer of 2 Bytes: SUB 44)

The MOVW instruction transfers 2-byte data from a specified source address to a specified destination address.

Format

Fig. 4.5.2 shows the ladder format and Table 4.5.2 shows the mnemonic format.

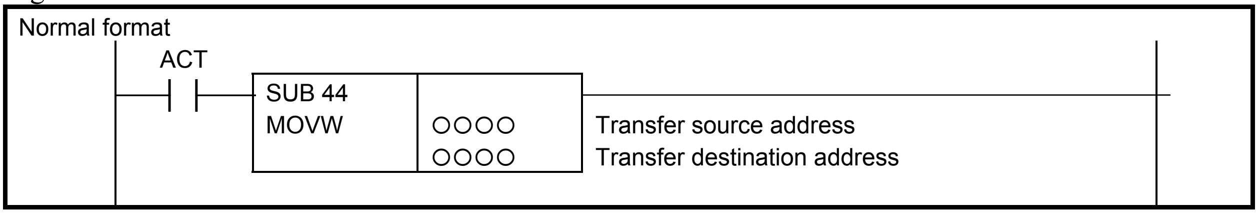


Fig. 4.5.2 (a) Format of MOVW instruction (Normal format)

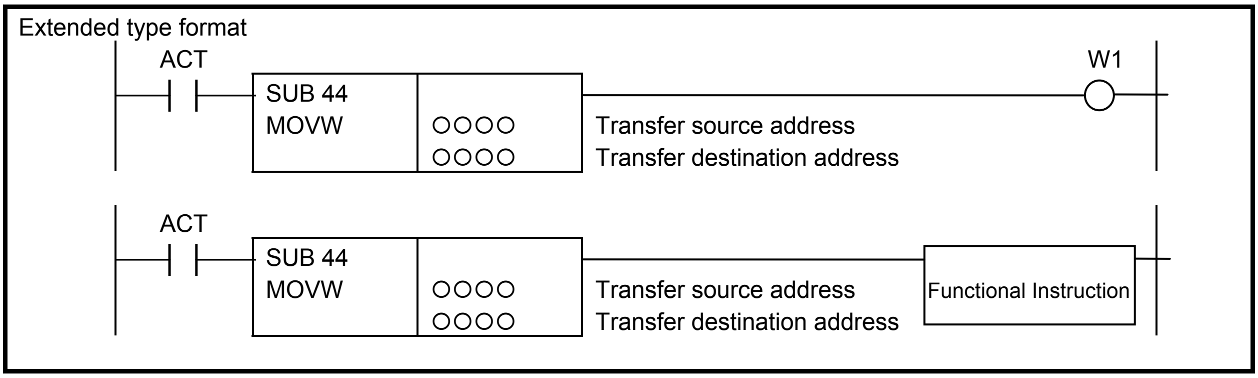


Fig. 4.5.2(b) Format of MOVW instruction (Extended type format)

Table 4.5.2 Mnemonic of MOVW instruction (Normal format)

Mnemonic format					Memory status of control condition			
Step number	Instruction	Address No.	Bit No.	Remarks	ST3	ST2	ST1	ST0
1	RD	○○○○	.○	ACT				ACT
2	SUB	44		MOVW instruction				↓
3	(PRM)	○○○○		Transfer source address				↓
4	(PRM)	○○○○		Transfer destination address				↓

Control condition

(a) Execution specification
ACT = 0: No data is transferred.
ACT = 1: Two-byte data is transferred.

Parameters

(a) Transfer source address
Specify the source address for the transfer.
(b) Transfer destination address
Specify the destination address for the transfer.

> **NOTE**
> Take care not to specify overlapped areas for source and destination. If the source and destination areas are overlapped with each other, the result is not guaranteed.

Output (W1)

When the instruction is executed, W1=1 is set. W1 may be omitted.

4.5.3 MOVD (Transfer of 4 Bytes: SUB 47)

The MOVD instruction transfers 4-byte data from a specified source address to a specified destination address.

Format

Fig. 4.5.3 shows the ladder format and Table 4.5.3 shows the mnemonic format.

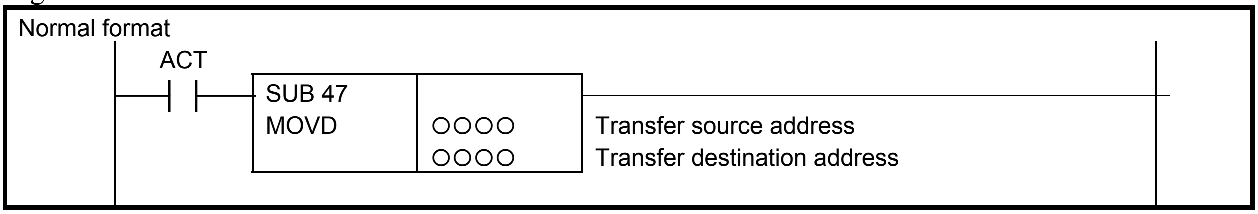


Fig. 4.5.3 (a) Format of MOVD instruction (Normal format)

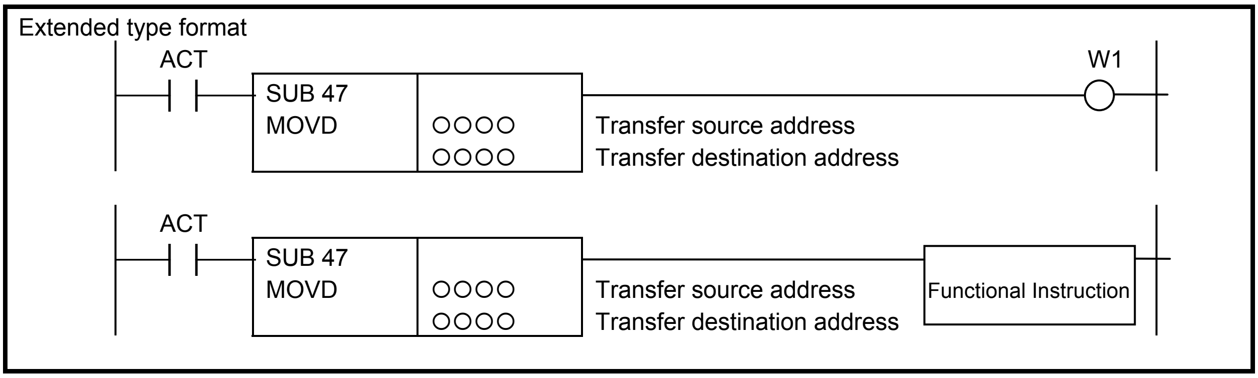


Fig. 4.5.3(b) Format of MOVD instruction (Extended type format)

Table 4.5.3 Mnemonic of MOVD instruction (Normal format)

Mnemonic format					Memory status of control condition			
Step number	**Instruction**	**Address No.**	**Bit No.**	**Remarks**	**ST3**	**ST2**	**ST1**	**ST0**
1	RD	○○○○	.○	ACT				ACT
2	SUB	47		MOVD instruction				↓
3	(PRM)	○○○○		Transfer source address				↓
4	(PRM)	○○○○		Transfer destination address				↓

Control condition

(a) Execution specification
ACT = 0: No data is transferred.
ACT = 1: Four-byte data is transferred.

Parameters

(a) Transfer source address
Specify the source address for the transfer.
(b) Transfer destination address
Specify the destination address for the transfer.

> **NOTE**
> Take care not to specify overlapped areas for source and destination. If the source and destination areas are overlapped with each other, the result is not guaranteed.

Output (W1)

When the instruction is executed, W1=1 is set. W1 may be omitted.

4.5.4 MOVN (Transfer of an Arbitrary Number of Bytes: SUB 45)

The MOVN instruction transfers data consisting of an arbitrary number of bytes from a specified source address to a specified destination address.

Format

Fig. 4.5.4 shows the ladder format and Table 4.5.4 shows the mnemonic format.

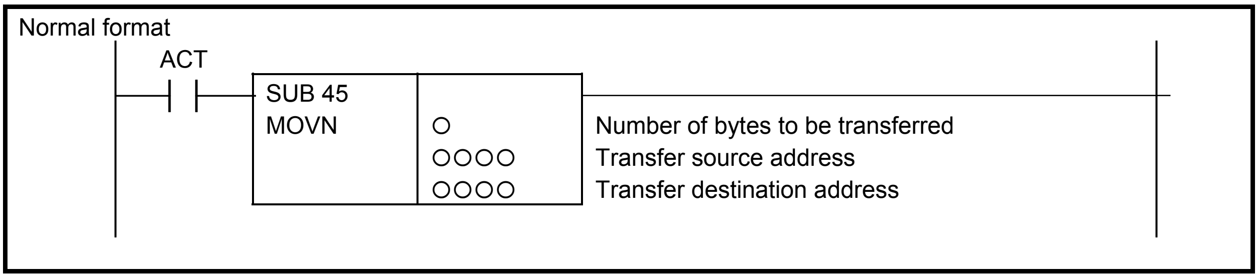


Fig. 4.5.4 (a) Format of MOVN instruction (Normal format)

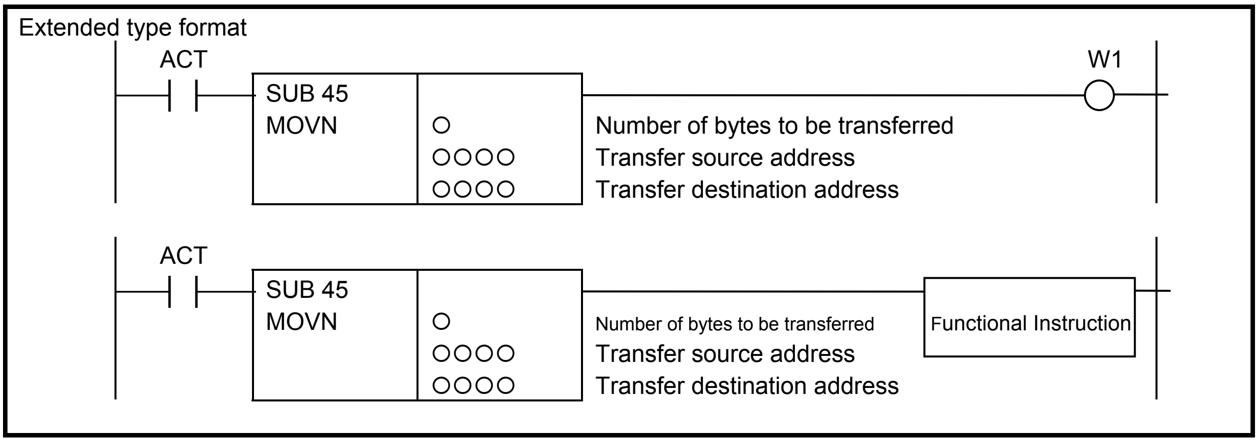


Fig. 4.5.4(b) Format of MOVN instruction (Extended type format)

Table 4.5.4 Mnemonic of MOVN instruction (Normal format)

Mnemonic format

Step number	Instruction	Address No.	Bit No.	Remarks
1	RD	○○○○	.○	ACT
2	SUB	45		MOVN instruction
3		○		Number of bytes to be transferred
4	(PRM)	○○○○		Transfer source address
5	(PRM)	○○○○		Transfer destination address

Memory status of control condition

ST3	ST2	ST1	ST0
			ACT

Control condition

(a) Execution specification
ACT = 0: No data is transferred.
ACT = 1: A specified number of bytes are transferred.

Parameters

(a) Number of bytes to be transferred
Specify the number of bytes to be transferred. An odd number can also be specified. A number from 1 to 9,999 can be specified.

> ⚠ **CAUTION**
> Make sure that the source data area and destination data area are within the PMC address range.

(b) Transfer source address
Specify the source address for the transfer.

(c) Transfer destination address
Specify the destination address for the transfer.

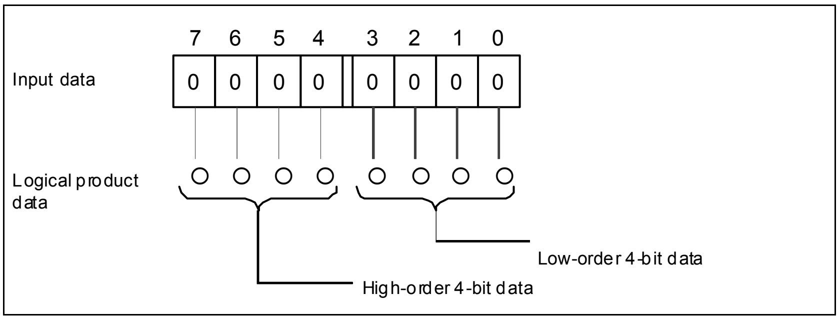
> **NOTE**
> Take care not to specify overlapped areas for source and destination. If the source and destination areas are overlapped with each other, the result is not guaranteed.

Output (W1)

When the instruction is executed, W1=1 is set. W1 may be omitted.

4.5.5 MOVE (Logical Product Transfer: SUB 8)

The MOVE instruction executes logical product between a logical product data and an input data, and outputs the results to a specified address. This instruction can be used to remove unnecessary bits from eight-bit signals in a specific address, etc.
The input data is one byte (eight bits).



Format

Fig. 4.5.5 (a) shows the ladder format and Table 4.5.5 shows the mnemonic format.

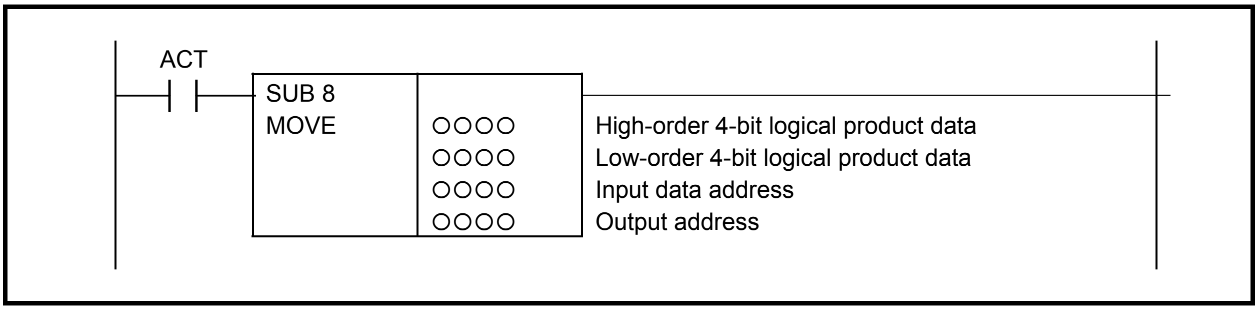


Fig. 4.5.5 (a) Format of MOVE instruction

Table 4.5.5 Mnemonic of MOVE instruction

Mnemonic format					Memory status of control condition			
Step number	Instruction	Address No.	Bit No.	Remarks	ST3	ST2	ST1	ST0
1	RD	○○○○	.○	ACT				ACT
2	SUB	8		MOVE instruction				
3	(PRM)	○○○○		High-order 4-bit logical product data				
4	(PRM)	○○○○		Low-order 4 bit logical product data				
5	(PRM)	○○○○		Input data address				
6	(PRM)	○○○○		Output address				

Execution specification

ACT = 0: MOVE instruction not executed.
ACT = 1: Executed.

Example of using the MOVE instruction

If a code signal and another signal co-exist at address X35 for an input signal from the machine tool, to compare the code signal and a code signal at another address, the rest of signals in address X35 become unnecessary. Thus, the MOVE instruction can be used to output only the code signal at address X35 address R210.

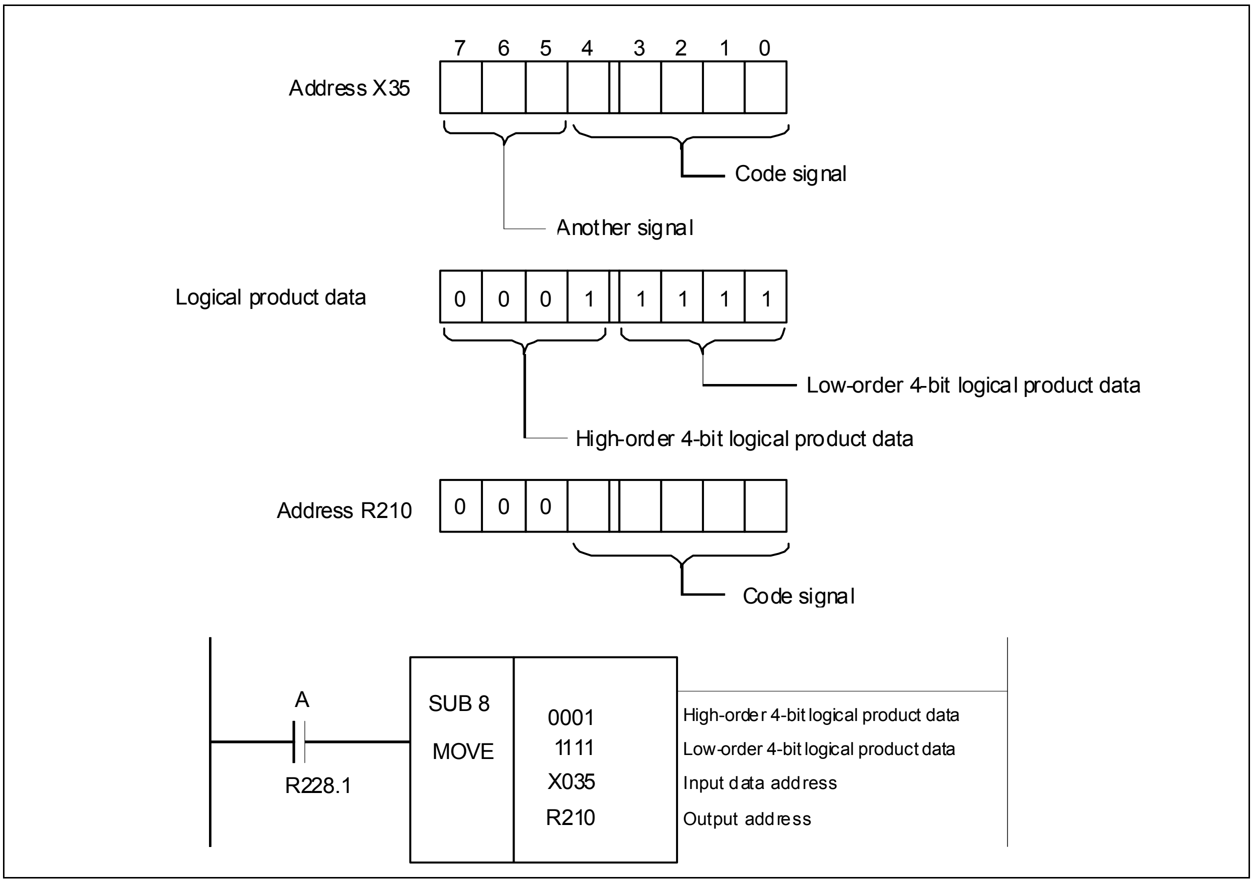
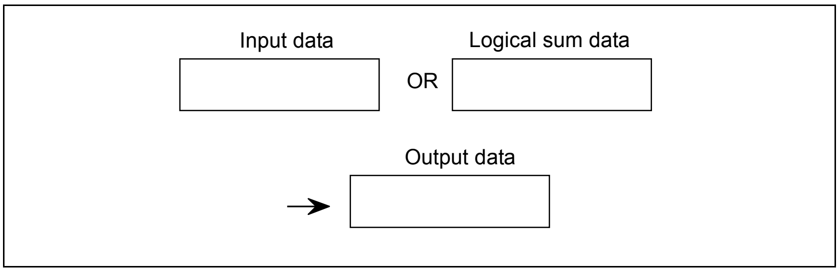


Fig. 4.5.5 (b) MOVE instruction ladder diagram

4.5.6 MOVOR (Data Transfer After Logical Sum: SUB 28)

This instruction executes logical sum between an input data and a logical sum data and transfers the result to the destination.



Format

Fig. 4.5.6 shows the ladder format and Table 4.5.6 shows the mnemonic format.

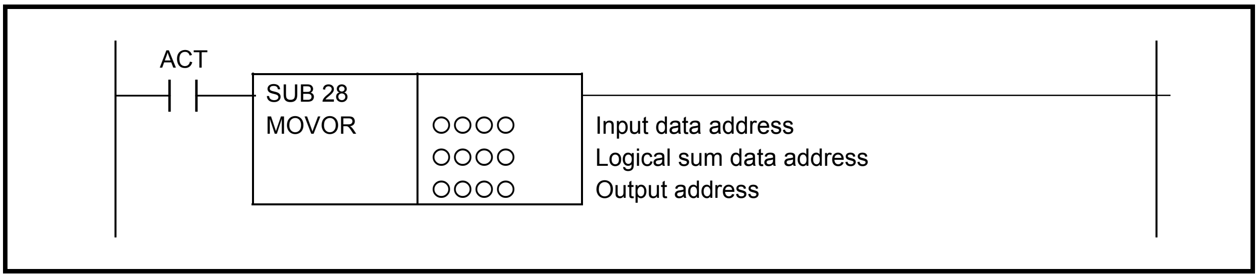


Fig. 4.5.6 Format of MOVOR instruction

Table 4.5.6 Mnemonic of MOVOR instruction

Mnemonic format					Memory status of control condition			
Step number	**Instruction**	**Address No.**	**Bit No.**	**Remarks**	**ST3**	**ST2**	**ST1**	**ST0**
1	RD	○○○○	.○	ACT				ACT
2	SUB	28		MOVOR instruction				
3	(PRM)	○○○○		Input data address				
4	(PRM)	○○○○		Logical sum data address				
5	(PRM)	○○○○		Output address				▼

Control condition

(a) Execution specification (ACT)
ACT = 0: Do not execute MOVOR.
ACT = 1: Execute MOVOR.

Parameters

(a) Input data address
Specify the address for the input data.
(b) Logical sum data address
Specifies the address of the logical sum data with which to OR the transferred data.
(c) Output address
This is the address to contain the logical sum obtained. It is also possible to obtain the logical sum (OR) of the input and the logical sum data and output the result in the logical sum data address. For this, you must set the logical sum data address for the output address.

4.5.7 XMOVB (Binary Index Modifier Data Transfer: SUB 35)

Reads or rewrites the contents of the data table. The value type in this instruction is binary.
There are two specifications - basic specification and extended specification - for setting the format specification parameter in the XMOVB instruction. The extended specification allows two or more sets of data to be read or written with a single instruction. For the details of the setting of a format specification parameter, see the description of parameters.

(a) Read data from data table

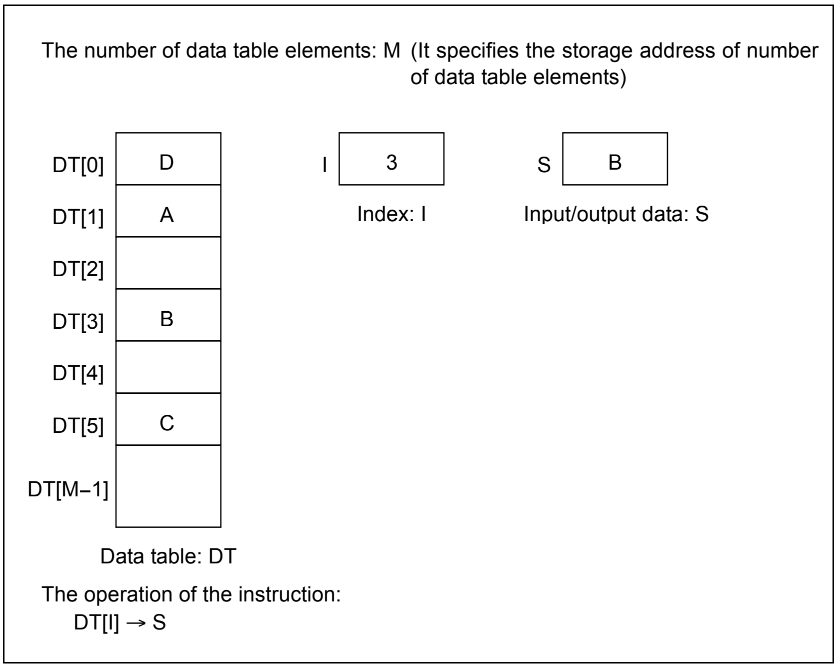


Fig. 4.5.7 (a) Read data from data table (basic specification)

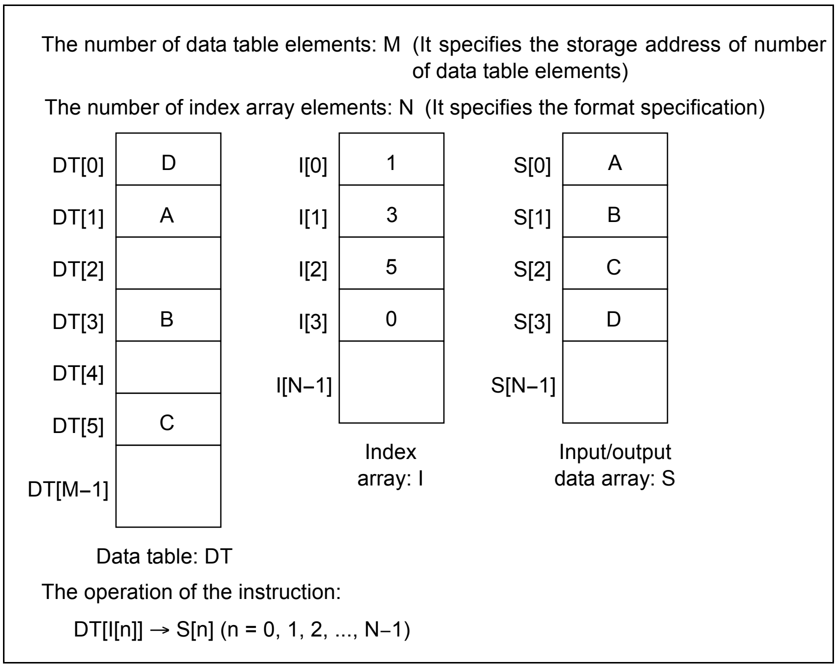


Fig. 4.5.7 (b) Read data from data table (extended specification)

(b) Write data to data table

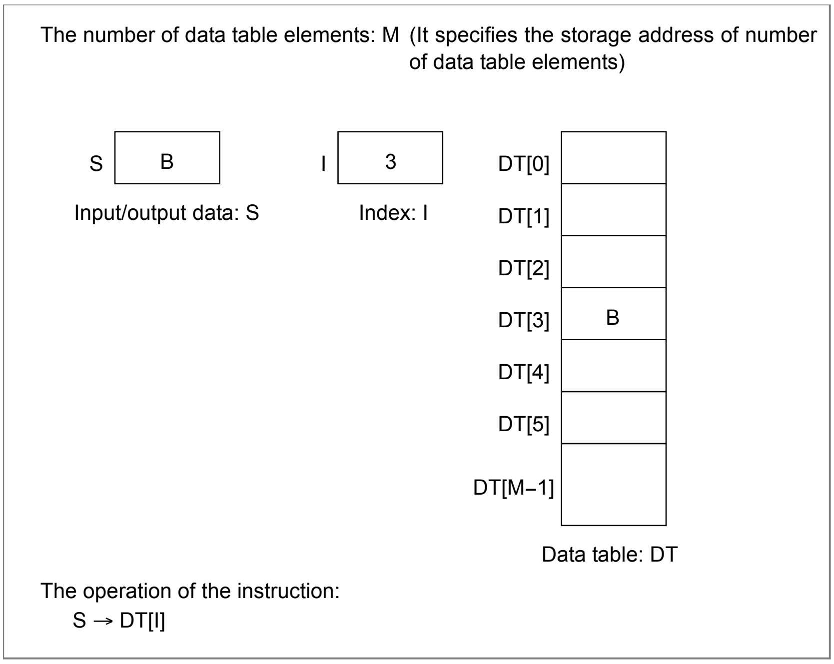


Fig. 4.5.7 (c) Write data to data table (basic specification)

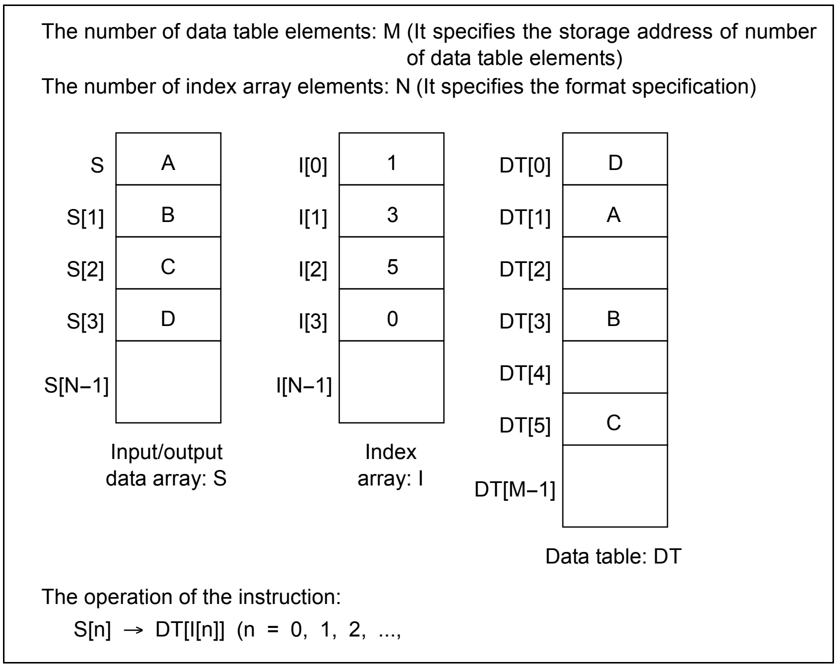


Fig. 4.5.7 (d) Write data to data table (extended specification)

Format

Figs. 4.5.7 (e) and (f) show the ladder format and Tables 4.5.7 (a) and (b) show the mnemonic format.

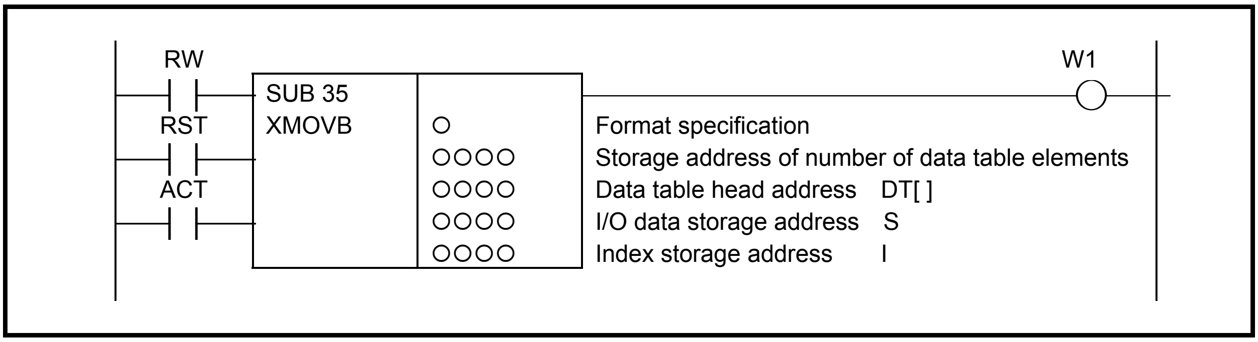


Fig. 4.5.7 (e) Format of XMOVB instruction (basic specification)

Table 4.5.7 (a) Mnemonic of MOVOR instruction (basic specification)

Mnemonic format					Memory status of control condition			
Step number	**Instruction**	**Address No.**	**Bit No.**	**Remarks**	**ST3**	**ST2**	**ST1**	**ST0**
1	RD	○○○○	.○	RW				RW
2	RD.STK	○○○○	.○	RST			RW	RST
3	RD.STK	○○○○	.○	ACT		RW	RST	ACT
4	SUB	35		XMOVB instruction				
5	(PRM)	○		Format specification				
6	(PRM)	○○○○		Storage address of number of data table elements				
7	(PRM)	○○○○		Data table head address				
8	(PRM)	○○○○		I/O data storage address				
9	(PRM)	○○○○		Index storage address				
10	WRT	○○○○	.○	Error output				W1

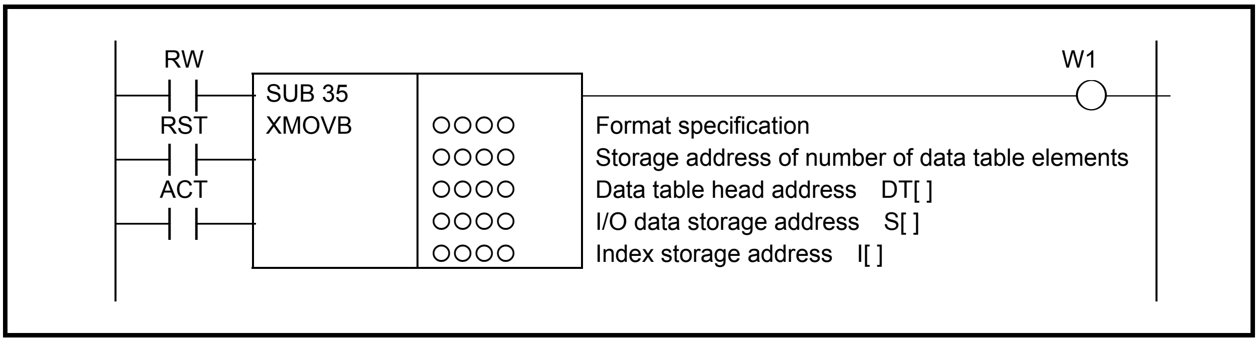


Fig. 4.5.7 (f) Format of XMOVB instruction (extended specification)

Table 4.5.7 (b) Mnemonic of MOVOR instruction (extended specification)

Step number	Instruction	Address No.	Bit No.	Remarks	ST3	ST2	ST1	ST0
1	RD	○○○○	.○	RW				RW
2	RD.STK	○○○○	.○	RST			RW	RST
3	RD.STK	○○○○	.○	ACT		RW	RST	ACT
4	SUB	35		XMOVB instruction				
5	(PRM)	○○○○		Format specification				
6	(PRM)	○○○○		Storage address of number of data table elements				
7	(PRM)	○○○○		Data table head address				
8	(PRM)	○○○○		I/O data storage address				
9	(PRM)	○○○○		Index storage address				
10	WRT	○○○○	.○	Error output				W1

Control conditions

(a) Read, write designation (RW)
RW = 0: Read data from data table.
RW = 1: Write data to data table.

(b) Reset (RST)
RST = 0: Reset release.
RST = 1: Reset. W1 = 0.

(c) Execution specification (ACT)
ACT = 0: Do not execute XMOVB instruction. There is no change in W1.
ACT = 1: Execute XMOVB instruction.

Parameters

(a) Format specification
Specify the data length in the first digit of the parameter.
0001:1-byte length data
0002:2-byte length data
0004:4-byte length data
When setting format specification in the following extended format, XMOVB can read/write multiple data in data table in 1 instruction.
Specify the data length (1, 2, or 4) to the 1st digit as above-mentioned. Specifies the number of the index array elements to the 2nd and 3rd digit. Specifies 0 to the 4th digit.
0nn1:In case of reading/writing multiple (nn) data in data table by 1 byte length
0nn2:In case of reading/writing multiple (nn) data in data table by 2 bytes length
0nn4:In case of reading/writing multiple (nn) data in data table by 4 bytes length
The nn is the numerical value from 02 to 99. When setting 00 or 01, it works as the basic specification in which one data transfer is performed by one instruction.

```
Format specification (extended specification):
    0  n  n  x
       └──┬─┘  ┬
          │    The byte length setting
          │      1: 1 byte length
          │      2: 2 byte length
          │      4: 4 byte length
          │
    The number of the index array elements
      00-01:
        It works as the basic specification.
      02-99:
        Read/Write multiple (nn) data from/to data table.
```

> ⚠ **CAUTION**
> Do not set an illegal value, that is not indicated above, into the "(a) Format specification".

(b) Storage address of number of data table elements
Set to the memory at the byte length which set the number of the data table elements in "(a) Format specification" and set the address to this parameter. The value which you can set depends on the "(a) Format specification" setting.
1 byte length: 1 to 255
2 bytes length: 1 to 16384
4 bytes length: 1 to 16384

(c) Data table head address
Sets head address in the data table.
The memory of (byte length) × (number of data table elements) which was set in "(a) Format specification" and "(b) Storage address of number of data table elements" is necessary.

(d) Input/Output data storage address
In case of the reading, set the address of the memory which stores a reading result. In case of the writing, set the address of the memory which stores a writing result. The memory with the byte length which set in "(a) Format specification" is necessary.
When setting format specification in the extended format, set the head address of the array. (In case of the reading, set the head address of the array in which a reading result is stored. In case of the writing, set the head address of the array in which a writing result is stored.) The memory of (byte length) × (number of index array elements) which was set in "(a) Format specification" is necessary.

(e) Index storage address
Set the address of the memory in which an index value is stored. The memory with the byte length set in "(a) Format specification" is necessary. The effective range of number of data in index is as follows according to the byte length set in "(a) Format specification".
Actually, set the value which is smaller than the value to set in "(b) Storage address of number of data table elements" to the index.
When setting an index value above the value to set in "(b) Storage address of number of data table elements", it causes an error output W1 = 1 in instruction execution.
1 byte length: 0 to 254
2 bytes length: 0 to 32,766
4 bytes length: 0 to 2,147,483,646
When setting format specification in the extended format, set an address at the head of the array in which an index value is stored. The memory of (byte length) × (number of data in index array) which was set in "(a) Format specification" is necessary.

> ⚠ **WARNING**
> 1 You can not specify the table that includes different kind of address type or discontinuous address area. In this case, operation is not guaranteed.
> 2 You have to set the "Storage address of number of data table elements" and the "Data table head address" not to exceed the limit of its continuous address area. If the table exceeds the limit of the continuous address area, operation is not guaranteed. For example, when a range of address R is 0 to 7999 and the "Format specification" is set to 1 and the "Data table head address" is set to "R7990", you can set 10 or less to the "Storage address of number of data table elements".

Error output (W1)

W1 = 0: No error

W1 = 1: Error found.

In the case where the index value set in "(e) Index storage address" exceeds the value set in "(b) Storage address of number of data table elements", it becomes W1 = 1. The reading or writing of the data table isn't executed.

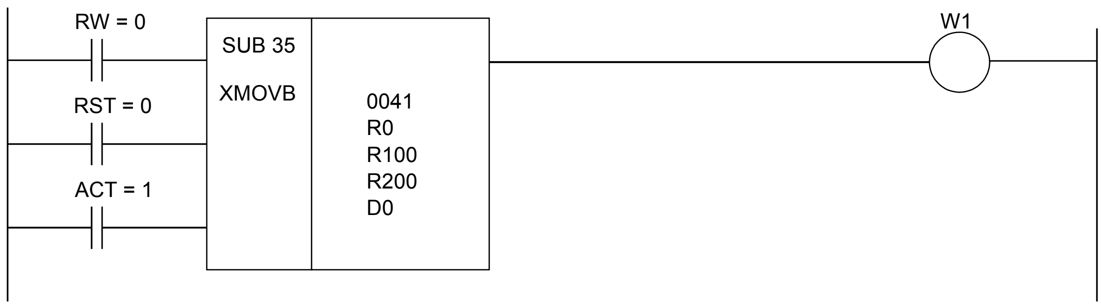
When "(a) Format specification" is used for operation in the extended format, if the values of one or more elements in the index array specified in (e) are greater than the value set in "(b) Storage address of number of data table elements", it becomes W1 = 1. The reading or writing of a data table is executed for the normal index values but not executed as for the wrong index values.

> ⚠ **CAUTION**
> Two or more coils, WRT, WRT.NOT, SET or RST, that follow this instruction are prohibited. You have to place a single coil instruction as the output of this instruction.

Example for extended specification

(a) Read data from data table (extended specification)

The number of data table elements: R0 = 9
The number of index array elements: 4



Data table

R100	D
R101	
R102	A
R103	
R104	
R105	B
R106	
R107	
R108	C

Index array

D0	2
D1	5
D2	8
D3	0

Input/output data array

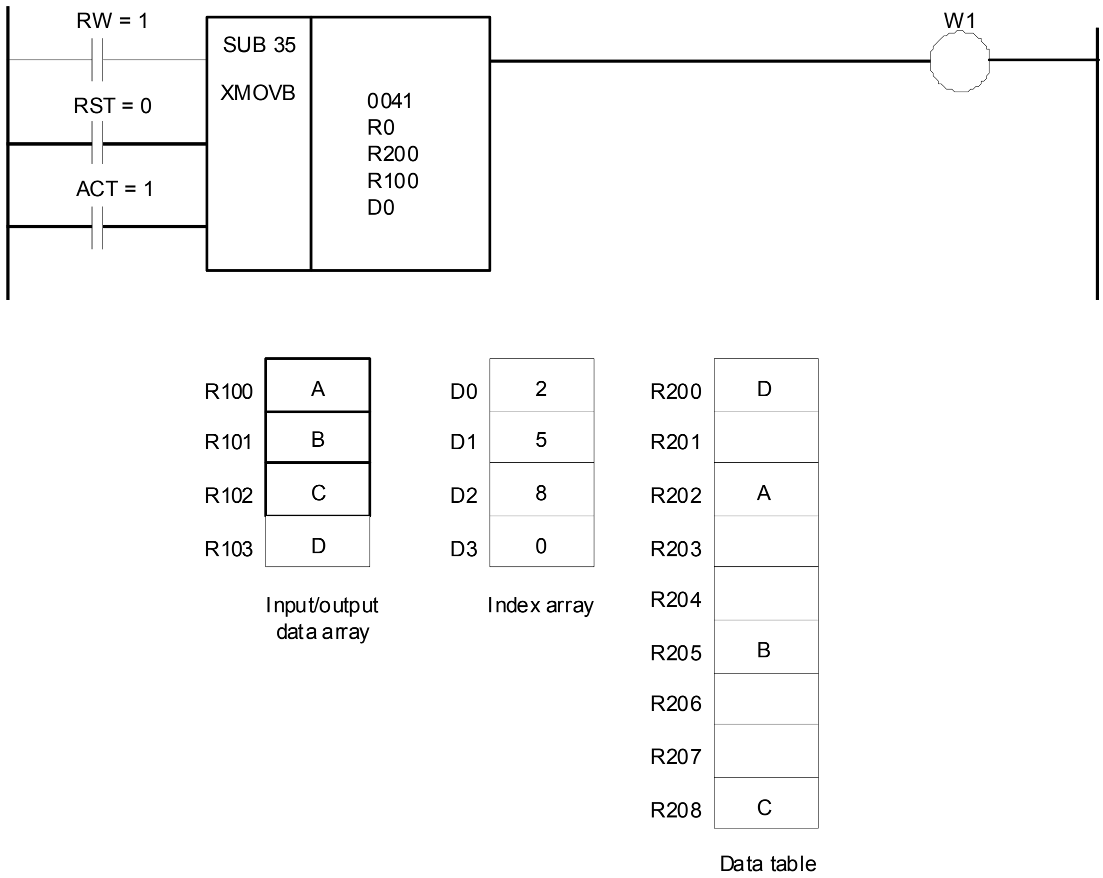
R200	A
R201	B
R202	C
R203	D

The operation of the instruction:
(1) R102 → R200
(2) R105 → R201
(3) R108 → R202
(4) R100 → R203

Fig. 4.5.7 (g) Example for XMOVB instruction (extended specification)

(b) Write data to data table (extended specification)

The number of data table elements: R0 = 9
The number of index array elements: 4



The operation of the instruction:

(1) R100 → R202
(2) R101 → R205
(3) R102 → R208
(4) R103 → R200

Fig. 4.5.7 (h) Example for XMOVB instruction (extended specification)

4.5.8 XMOV (Indexed Data Transfer: SUB 18)

This instruction reads or rewrites the contents of the data table. The value type in this instruction is BCD type.

> ⚠**CAUTION**
> The data table heading address specified here is table internal number 0. The table internal number specified here, however, is different from that mentioned in Subsection 2.2.12.

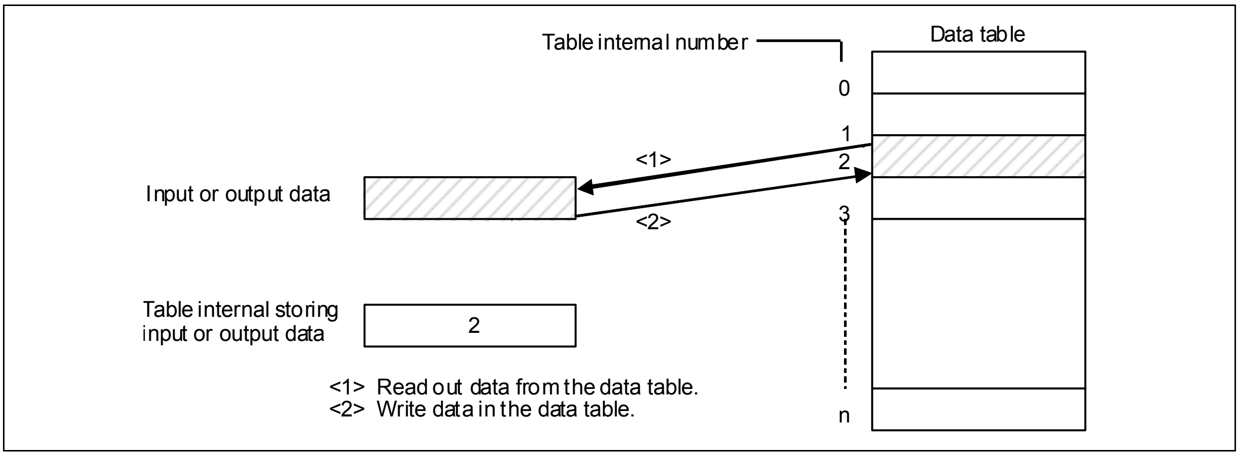


Fig. 4.5.8 (a) Reading and writing of data

Format

Fig. 4.5.8 (b) shows the ladder format and Table 4.5.8 shows the mnemonic format.

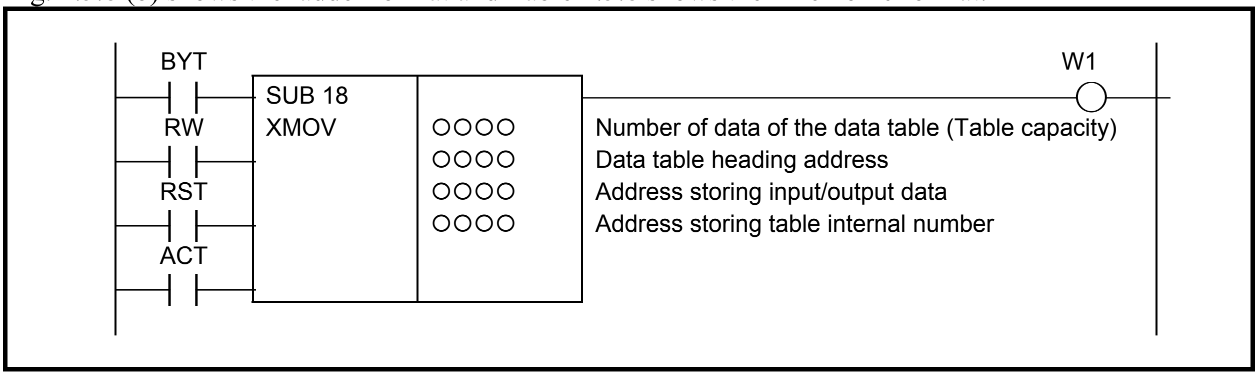


Fig. 4.5.8 (b) Format of XMOV instruction

Table 4.5.8 Mnemonic of XMOV instruction

Mnemonic format					Memory status of control condition			
Step number	Instruction	Address No.	Bit No.	Remarks	ST3	ST2	ST1	ST0
1	RD	○○○○	.○	BYT				BYT
2	RD.STK	○○○○	.○	RW			BYT	RW
3	RD.STK	○○○○	.○	RST		BYT	RW	RST
4	RD.STK	○○○○	.○	ACT	BYT	RW	RST	ACT
5	SUB	18		XMOV instruction				
6	(PRM)	○○○○		Number of data of the data table				
7	(PRM)	○○○○		Data table heading address				
8	(PRM)	○○○○		Address storing input/output data				
9	(PRM)	○○○○		Address storing table internal number				
10	WRT	○○○○	.○	Error output				W1

Control conditions

(a) Specify the number of digits of data. (BYT)
BYT = 0: Data stored in the data table, BCD in two digits long.
BYT = 1: Data stored in the data table, BCD in four digits long.

(b) Specify read or write (RW)
RW = 0: Data is read from the data table.
RW = 1: Data is written in the data table.

(c) Reset (RST)
RST = 0: Release reset.
RST = 1: Enables reset, that is, sets W1 to 0.

(d) Execution specification (ACT)
ACT = 0: The XMOV instruction is not executed. W1 does not change.
ACT = 1: The XMOV instruction is executed.

Parameters

(a) Number of data of the data table
Specifies the size of the data table. If the beginning of the data table is 0 and the end is n, n + 1 is set as the number of data of the data table. The value, which you can set, depends on the control condition "BYT".
BYT=0: 1 to 99
BYT=1: 1 to 9999

(b) Data table heading address
The address that can be used in a data table is fixed. When preparing a data table, the addresses to be used must be determined beforehand, and the head address placed in that data table.

(c) Address storing input/output data
The input/output data storage address is the address storing the specified data, and is external to the data table. The contents of the data table is read or rewritten.

(d) Address storing table internal number
The table internal number storage address is the address storing the table internal number of the data to be read or rewritten.
This address requires memory specified by the number-of-digits designation (BYT).

⚠ **WARNING**

1 You can not specify the table that includes different kind of address type or discontinuous address area. In this case, operation is not guaranteed.
2 You have to set the "Number of data of the data table" and the "Data table heading address" not to exceed the limit of its continuous address area. If the table exceeds the limit of the continuous address area, operation is not guaranteed. For example, when a range of address R is 0 to 7999 and the control condition "BYT" is set to 0 and the "Data table heading address" is set to "R7990", you can set 10 or less to the "Number of data of the data table".

Error output

W1 = 0: There is no error.
W1 = 1: There is an error.
An error occurs if a table internal number exceeding the previously programmed number of the data table is specified.

⚠ **CAUTION**

Two or more coils, WRT, WRT.NOT, SET or RST, that follow this instruction are prohibited. You have to place a single coil instruction as the output of this instruction.

4.5.9 MOVBT (Bit Transfer: SUB 224)

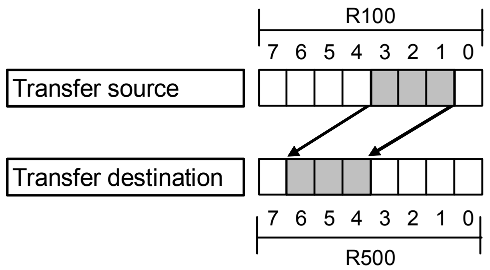
The Bit transfer instruction transfers multiple successive bits at a specified position to a destination address.

Transfer source data is specified in "Transfer source address" and "Transfer source bit position". Transfer destination data is specified in "Transfer destination address" and "Transfer destination bit position".

From "Transfer source bit position", data consisting of successive bits as many as "Number of bits to be transferred" is transferred to "Transfer destination address".

When 3 bits are transferred from R100.1 to R500.4:

Number of bits to be transferred	= 3
Transfer source address	= R100
Transfer source bit position	= 1
Transfer destination address	= R500
Transfer destination bit position	= 4

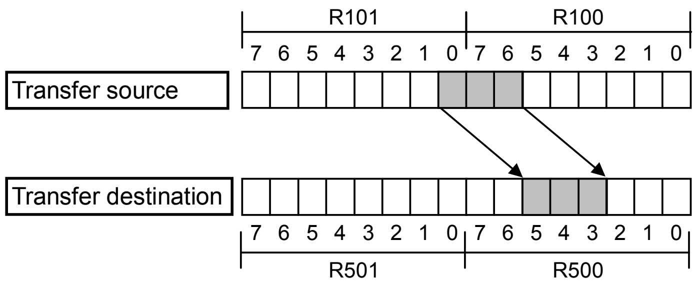


Positions other than R500.4-6 remain unchanged.

Fig. 4.5.9 (a) Example of MOVBT instruction (1)

When 3 bits are transferred from R100.6 to R500.3:

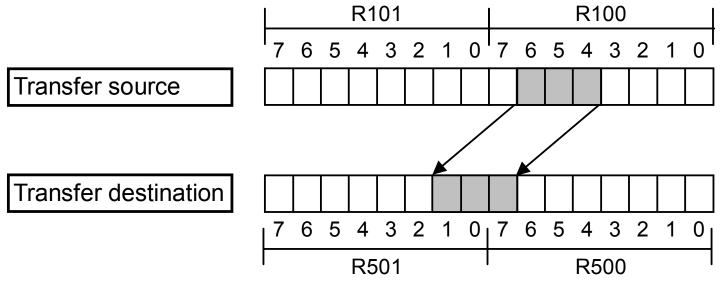
Number of bits to be transferred	= 3
Transfer source address	= R100
Transfer source bit position	= 6
Transfer destination address	= R500
Transfer destination bit position	= 3



Positions other than R500.3-5 remain unchanged.

Fig. 4.5.9 (b) Example of MOVBT instruction (2)

When 3 bits are transferred from R100.4 to R500.7:
Number of bits to be transferred = 3
Transfer source address = R100
Transfer source bit position = 4
Transfer destination address = R500
Transfer destination bit position = 7



Positions other than R500.7, R501.0, and R501.1 remain unchanged.

Fig. 4.5.9 (c) Example of MOVBT instruction (3)

Format

Fig. 4.5.9(d) shows the ladder format and Table 4.5.9 shows the mnemonic format.

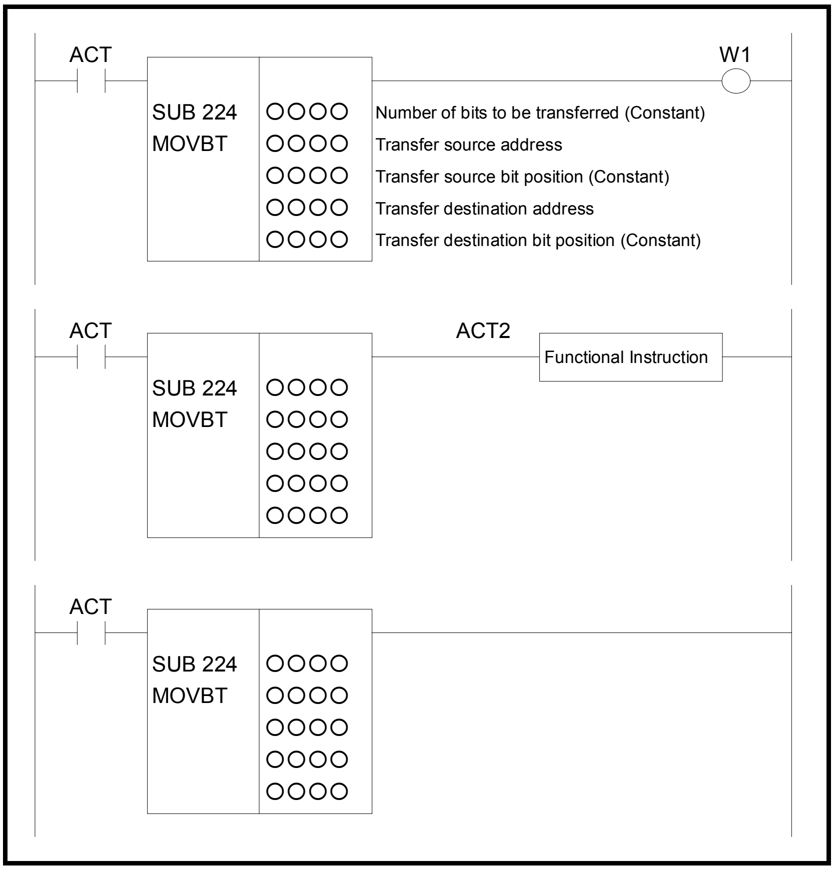


Fig. 4.5.9 (d) Format of MOVBT instruction

Table 4.5.9 Mnemonic of MOVBT instruction

Mnemonic format / **Memory status of control condition**

Step number	Instruction	Address No.	Bit No.	Remarks	ST3	ST2	ST1	ST0
1	RD	○○○○	.○	ACT				ACT
2	SUB	224		MOVBT instruction				
3	(PRM)	○○○○		Number of bits to be transferred				
4	(PRM)	○○○○		Transfer source address				
5	(PRM)	○○○○		Transfer source bit position				
6	(PRM)	○○○○		Transfer destination address				
7	(PRM)	○○○○		Transfer destination bit position				▼
8	WRT	○○○○	.○	Normal end output				W1

Control condition

(a) Execution specification
ACT = 0: Instruction not executed.
ACT = 1: Executed.

Parameters

(a) Number of bits to be transferred
Specify the number of bits to be transferred. A number from 1 to 256 may be specified.

(b) Transfer source address
Specify the source address for the transfer.

> **NOTE**
> Bits are transferred even when "Transfer source address" and "Transfer destination address" overlap each other.

(c) Transfer source bit position
Specify the transfer start bit position of transfer source data. A number from 0 to 7 may be specified.

(d) Transfer destination address
Specify the destination address for the transfer.

> **NOTE**
> Bits are transferred even when "Transfer source address" and "Transfer destination address" overlap each other.

(e) Transfer destination bit position
Specify the top bit position of transfer destination data. A number from 0 to 7 may be specified.

Output (W1)

When the instruction is executed, W1=1 is set. That is, W1 always assumes the same state as ACT.

> **NOTE**
> W1 may be omitted. Moreover, another functional instruction can be connected instead of a coil.

4.5.10 SETNB (Data Setting (1 Byte Length) : SUB 225) SETNW (Data Setting (2 Bytes Length) : SUB 226) SETND (Data Setting (4 Bytes Length) : SUB 227)

The data setting instruction sets the same value in multiple data items at contiguous addresses.
In "Setting data", a constant or a PMC memory address for storing data can be specified.
As indicated below, three types of data setting instructions are available according to the type of data to be set. In each instruction, "Setting data" and the data at "Setting destination address" are of the same data type.

Table4.5.10 (a) Kinds of data setting instruction

	Instruction name	SUB No.	Data type
1	SETNB	225	1 byte length data
2	SETNW	226	2 bytes length data
3	SETND	227	4 bytes length data

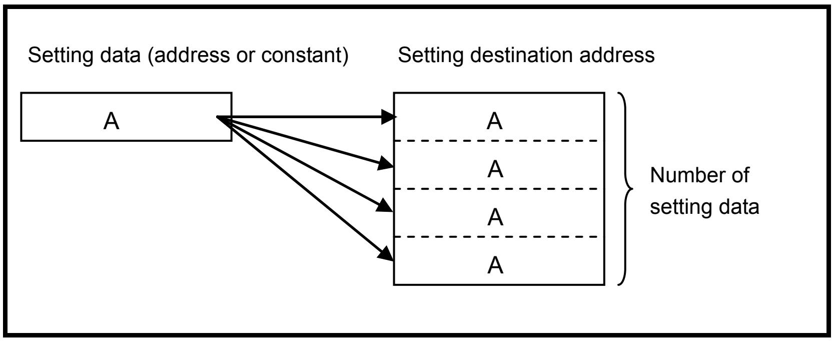


Fig. 4.5.10 (a) Example of data setting instruction

Format

Fig. 4.5.10(b) shows the ladder format and Table 4.5.10(b) shows the mnemonic format.

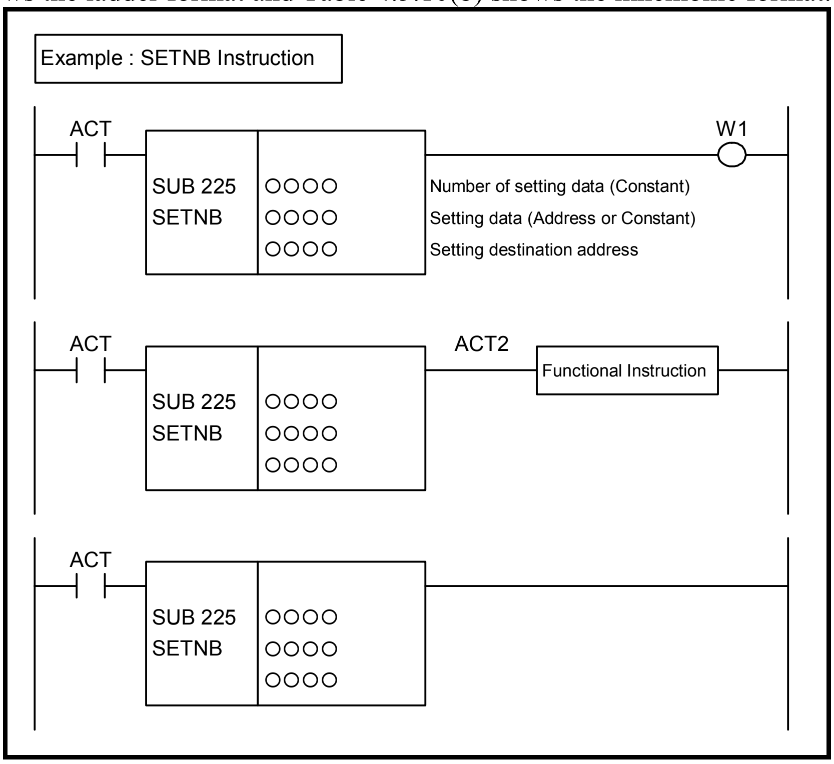


Fig. 4.5.10 (b) Format of SETNB, SETNW, SETND instruction

Table 4.5.10 (b) Mnemonic of SETNB, SETNW, SETND instruction

Mnemonic format

Step number	Instruction	Address No.	Bit No.	Remarks
1	RD	○○○○	.○	ACT
2	SUB	225		SUB No. (SETNB instruction)
3	(PRM)	○○○○		Number of setting data (Constant)
4	(PRM)	○○○○		Setting data (Address or Constant)
5	(PRM)	○○○○		Setting destination address
6	WRT	○○○○	.○	Normal end output

Memory status of control condition

ST3	ST2	ST1	ST0
			ACT
			↓
			W1

Control condition

(a) Execution specification
ACT = 0: Instruction not executed.
ACT = 1: Executed.

Parameters

(a) Number of setting data
Specify the number of setting data items. A number from 1 to 256 may be specified.

> **NOTE**
> Specify a valid number to the "Number of setting data", so that the area from "Setting destination address" may be arranged within valid address range.

(b) Setting data
Specify data to be set. In this parameter, a constant or a PMC memory address for storing data can be specified. Specify data by using signed binary data. A value within the following range may be specified:

Instruction name	Available values
SETNB	-128 to 127
SETNW	-32768 to 32767
SETND	-2147483648 to 2147483647

(c) Setting destination address
Specify a setting destination address.

Output (W1)

When the instruction is executed, W1=1 is set. That is, W1 always assumes the same state as ACT.

> **NOTE**
> W1 may be omitted. Moreover, another functional instruction can be connected instead of a coil.

4.5.11 XCHGB (Data Exchange (1 Byte Length) : SUB 228) XCHGW (Data Exchange (2 Bytes Length) : SUB 229) XCHGD (Data Exchange (4 Bytes Length) : SUB 230)

The data exchange instruction exchanges data between two specified addresses.
As indicated below, three types of data exchange instructions are available according to the type of data to be exchanged. In each instruction, the data items at exchange addresses are of the same data type.

Table4.5.11 (a) Kinds of data exchange instruction

	Instruction name	SUB No.	Data type
1	XCHGB	228	1 byte length data
2	XCHGW	229	2 bytes length data
3	XCHGD	230	4 bytes length data

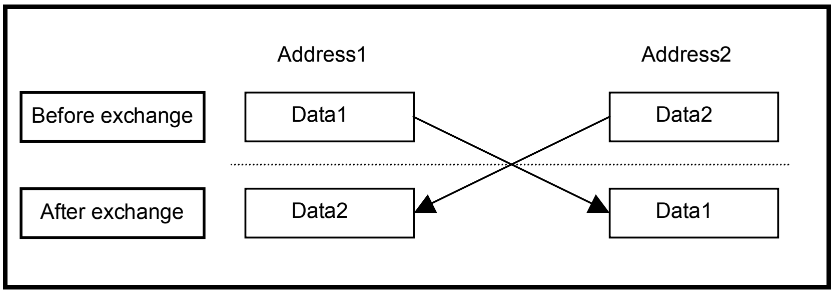


Fig. 4.5.11 (a) Example of data exchange instruction

Format

Fig. 4.5.11(b) shows the ladder format and Table 4.5.11(b) shows the mnemonic format.

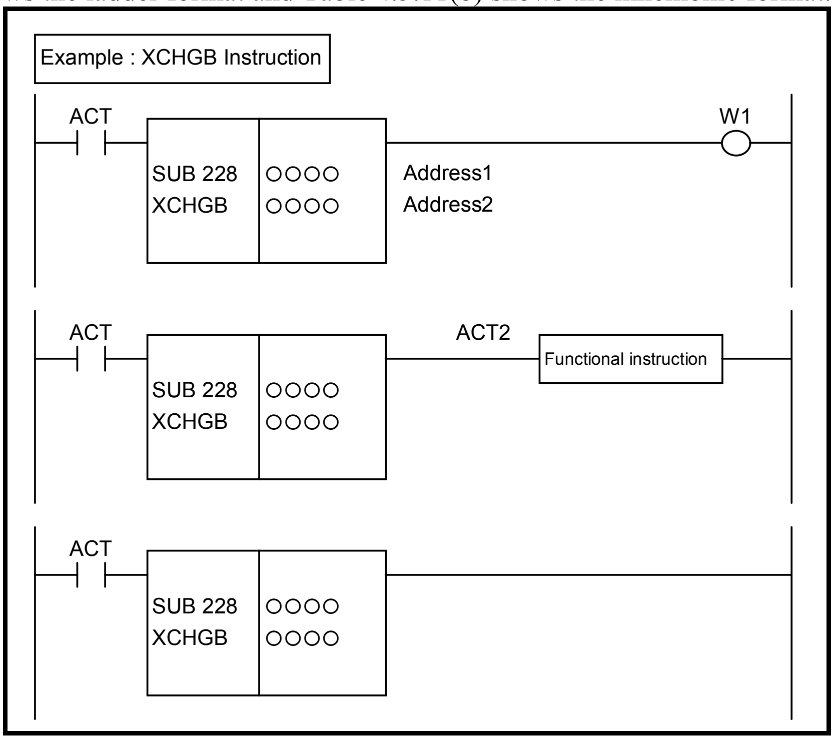


Fig. 4.5.11 (b) Format of XCHGB, XCHGW, XCHGD instruction

Table 4.5.11(b) Mnemonic of XCHGB, XCHGW, XCHGD instruction

Mnemonic format

Step number	Instruction	Address No.	Bit No.	Remarks
1	RD	○○○○	.○	ACT
2	SUB	228		SUB No. (XCHGB instruction)
3	(PRM)	○○○○		Address 1
4	(PRM)	○○○○		Address 2
5	WRT	○○○○	.○	Normal end output

Memory status of control condition

ST3	ST2	ST1	ST0
			ACT
			↓
			↓
			↓
			W1

Control condition

(a) Execution specification
ACT = 0: Instruction not executed.
ACT = 1: Executed.

> **NOTE**
> Data is exchanged in every cycle while ACT is kept on.

Parameters

(a) Address 1
Specify the 1st address which exchanges data.

(b) Address 2
Specify the 2nd address which exchanges data.

> **NOTE**
> If Address 1 and Address 2 areas are overlapped with each other, the result is not guaranteed.

Output (W1)

When the instruction is executed, W1=1 is set. That is, W1 always assumes the same state as ACT.

> **NOTE**
> W1 may be omitted. Moreover, another functional instruction can be connected instead of a coil.

4.5.12 SWAPW (Data Swap (2 Bytes Length) : SUB 231) SWAPD (Data Swap (4 Bytes Length) : SUB 232)

The data swap instruction swaps the high-order data and low-order data of multiple data items at contiguous addresses with each other.

The number of data items to be swapped is specified using a constant. Swap source data and a result output destination are specified using addresses.
As indicated below, two types of data swap instructions are available according to the type of data to be swapped. The SWAPW instruction swaps the higher one byte and lower one byte of each data item with each other. The SWAPD instruction swaps the higher two bytes and lower two bytes of each data item with each other.
In each instruction, source data and output data are of the same data type.

Table 4.5.12 (a) Kinds of data swap instruction

	Instruction name	SUB No.	Data type
1	SWAPW	231	2 bytes length data
2	SWAPD	232	4 bytes length data

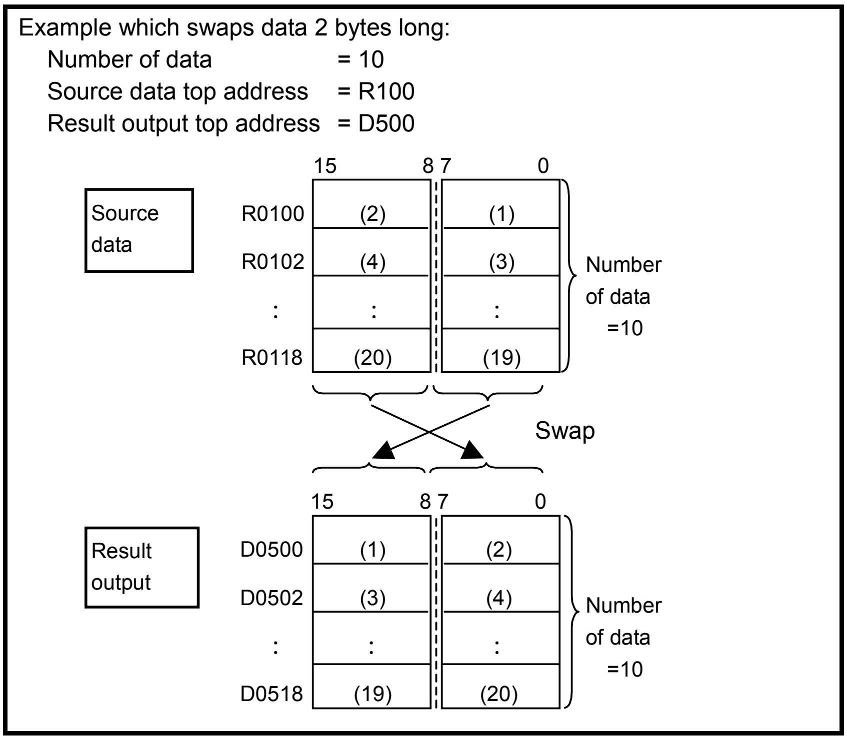


Fig. 4.5.12 (a) Example of SWAPW instruction

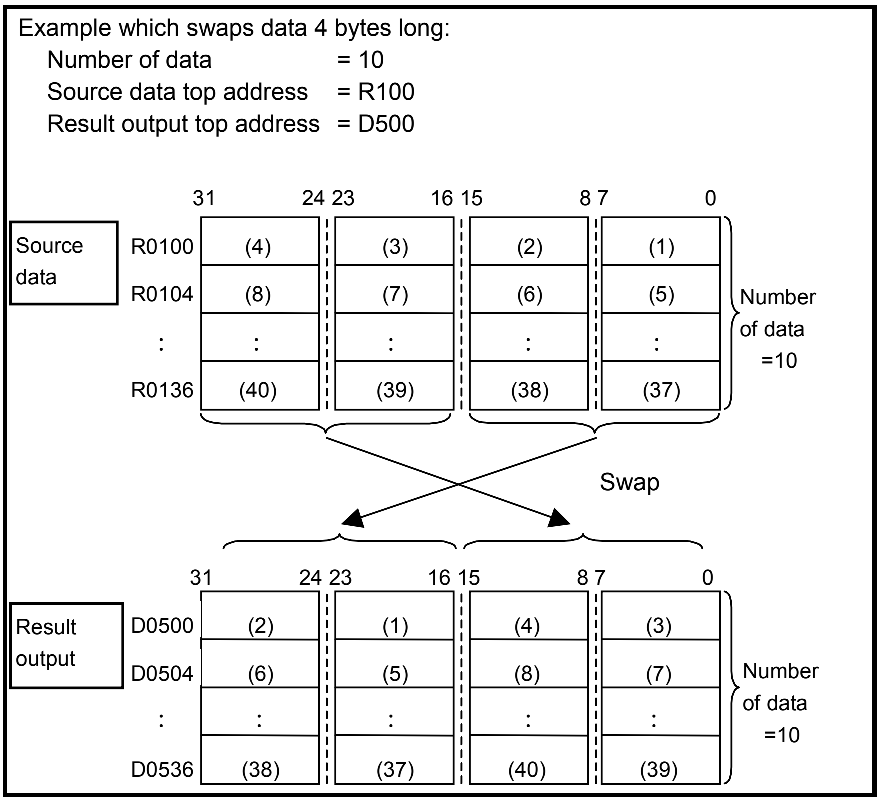


Fig. 4.5.12 (b) Example of SWAPD instruction

Format

Fig. 4.5.12(c) shows the ladder format and Table 4.5.12(b) shows the mnemonic format.

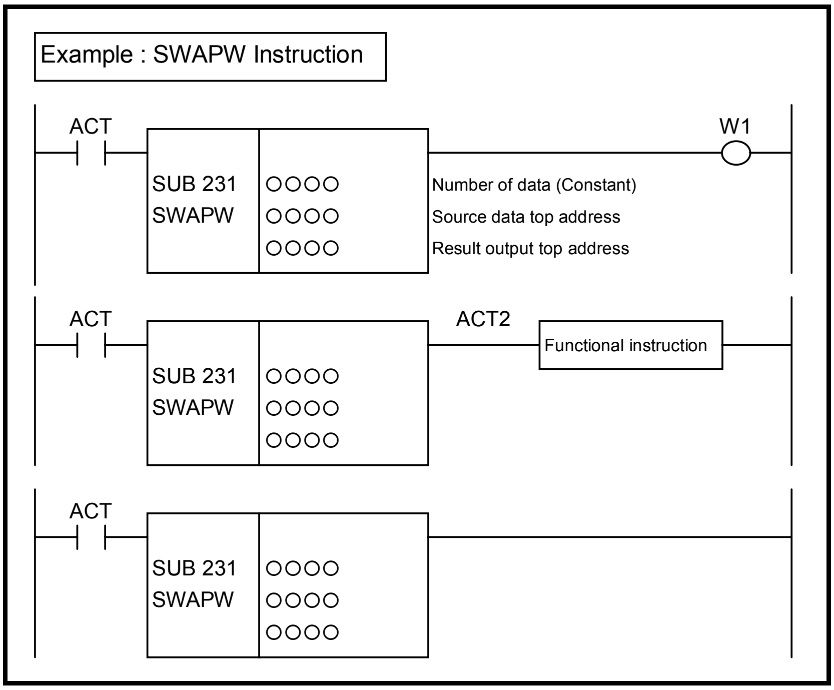


Fig. 4.5.12 (c) Format of SWAPW, SWAPD instruction

Table 4.5.12 (b) Mnemonic of SWAPW, SWAPD instruction

Mnemonic format

Step number	Instruction	Address No.	Bit No.	Remarks
1	RD	○○○○	.○	ACT
2	SUB	231		SUB No. (SWAPW instruction)
3	(PRM)	○○○○		Number of data (Constant)
4	(PRM)	○○○○		Source data top address
5	(PRM)	○○○○		Result output top address
6	WRT	○○○○	.○	Normal end output

Memory status of control condition

ST3	ST2	ST1	ST0
			ACT
			W1

Control condition

(a) Execution specification
ACT = 0: Instruction not executed.
ACT = 1: Executed.

Parameters

(a) Number of data
Specify the number of data items to be swapped. A number from 1 to 256 may be specified.

> **NOTE**
> Specify a valid number to the "Number of data", so that both of the area from "Source data top address" and the area from "Result output top address" may be arranged within valid address range.

(b) Source data top address
Specify the top address in which the swap data is stored.

(c) Result output top address
Specify the top of address which stores the result of an operation.

> **NOTE**
> If "Source data top address" and "Result output top address" match each other completely, the instruction is executed normally. If the source data area partially overlaps the result output area, normal operation of the instruction is not guaranteed.

Output (W1)

When the instruction is executed, W1=1 is set. That is, W1 always assumes the same state as ACT.

> **NOTE**
> W1 may be omitted. Moreover, another functional instruction can be connected instead of a coil.

4.5.13 DSCHB (Binary Data Search: SUB 34)

This function instruction instructs data search in the data table. DSCHB searches the data table for a specified data, outputs an address storing it counting from the beginning of the data table. If the data cannot be found, an output is made accordingly.
The numerical data handled in this instruction are all in binary format and number of data (table capacity) in the data table can be specified by specifying the address, thus allowing change in table capacity even after writing the sequence program in the flash ROM.

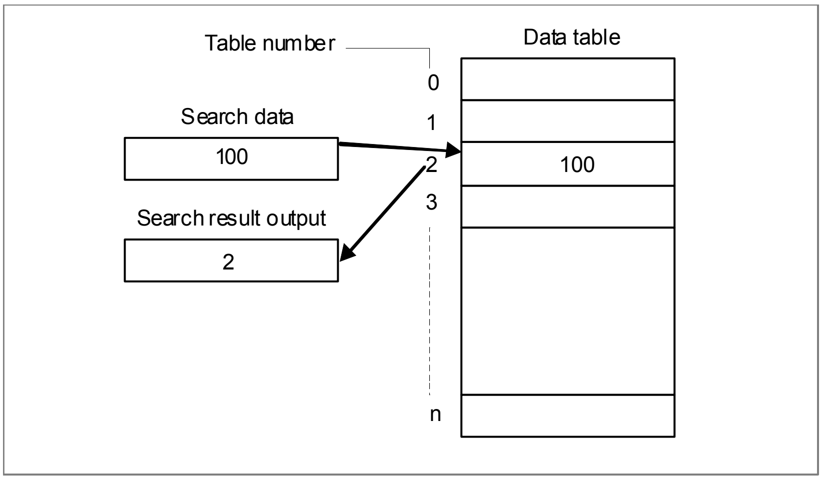


Fig. 4.5.13 (a)

> ⚠ **CAUTION**
> You can specify any R,E and D address for the data table in this functional instruction.

Format

Fig. 4.5.13 (b) shows the ladder format and Table 4.5.13 shows the mnemonic format.

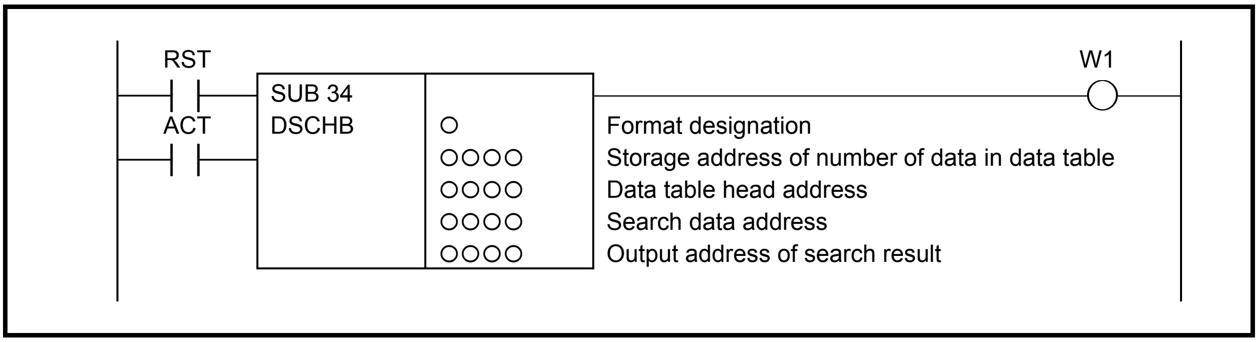


Fig. 4.5.13 (b) Format of DSCHB instruction

Table 4.5.13 Mnemonic of DSCHB instruction

Step number	Instruction	Address No.	Bit No.	Remarks	ST3	ST2	ST1	ST0
		Mnemonic format			**Memory status of control condition**			
1	RD	○○○○	.○	RST				RST
2	RD.STK	○○○○	.○	ACT			RST	ACT
3	SUB	34		DSCHB instruction				
4	(PRM)	○		Format designation				
5	(PRM)	○○○○		Storage address of number of data in data table				
6	(PRM)	○○○○		Data table head address				
7	(PRM)	○○○○		Search data address				
8	(PRM)	○○○○		Output address of search result				
9	WRT	○○○○	.○	Search result				W1

Control conditions

(a) Reset (RST)
RST = 0: Release reset
RST = 1: Reset. W1 = "0".

(b) Execution specification (ACT)
ACT = 0: Do not execute DSCHB instruction. W1 does not change.
ACT = 1: Execute DSCHB instruction. If the search data is found, table number where the data is stored will be output. If the search data is not found, W1 becomes 1.

Parameters

(a) Format specification
Specifies data length. Specify byte length in the first digit of the parameter.
1: 1 byte length
2: 2 bytes length
4: 4 bytes length

> ⚠ **CAUTION**
> Do not set an illegal value, that is not indicated above, into the "(a) Format specification".

(b) Storage address of number of data in data table
Specifies address in which number of data in the data table is set.
This address requires memory of number of byte according to the format designation.
Number of data in the table is n + 1 (head number in the table is 0 and the last number is n). The value which you can set depends on the "(a) Format designation".
1 byte length: 1 to 255
2 bytes length: 1 to 16384
3 bytes length: 1 to 16384

(c) Data table head address
Sets head address of data table.

(d) Search data address
The address in which search data is set.

(e) Output address of search result
After searching, if search data is found, the table number where the data is stored will be output. The searched table number is output in this search result output address. This address requires memory of number of byte according to the format designation.

> ⚠ **WARNING**
> 1 You can not specify the table that includes different kind of address type or discontinuous address area. In this case, operation is not guaranteed.
> 2 You have to set the "Storage address of number of data table elements" and the "Data table head address" not to exceed the limit of its continuous address area. If the table exceeds the limit of the continuous address area, operation is not guaranteed. For example, when a range of address R is 0 to 7999 and the "Format specification" is set to 1 and the "Data table head address" is set to "R7990", you can set 10 or less to the "Storage address of number of data table elements".

Search result (W1)

W1 = 0: Search data found.
W1 = 1: Search data not found.

> ⚠ **CAUTION**
> Two or more coils, WRT, WRT.NOT, SET or RST, that follow this instruction are prohibited. You have to place a single coil instruction as the output of this instruction.

4.5.14 DSCH (Data Search: SUB 17)

This function instruction instructs data search in the data table. DSCH searches the data table for a specified data, outputs an address storing it counting from the beginning of the data table. If the data cannot be found, an output is made accordingly. The value type in this instruction is BCD.

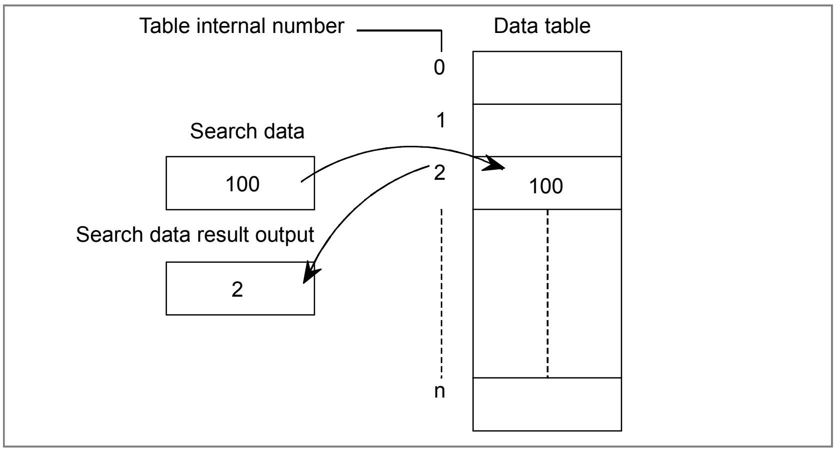


Fig. 4.5.14 (a)

> ⚠**CAUTION**
> You can specify any R,E and D address for the data table in this functional instruction.

Format

Fig. 4.5.14 (b) shows the ladder format and Table 4.5.14 shows the mnemonic format.

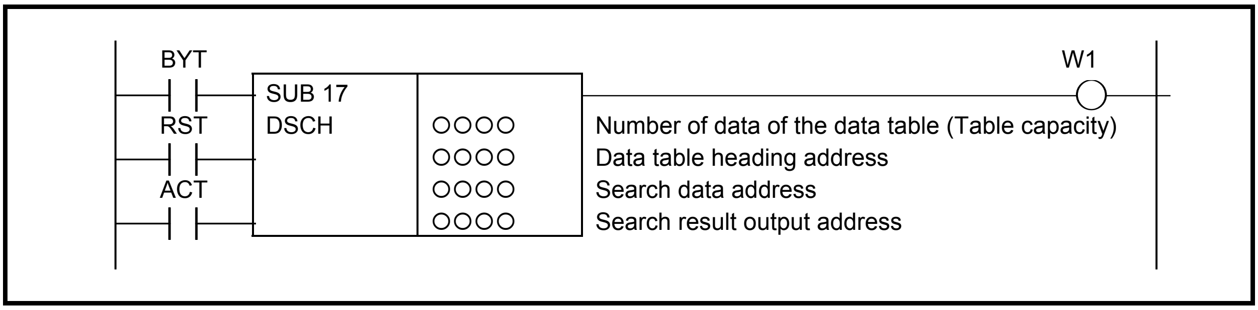


Fig. 4.5.14 (b) Format of DSCH instruction

Table 4.5.14 Mnemonic of DSCH instruction

Mnemonic format					Memory status of control condition			
Step number	**Instruction**	**Address No.**	**Bit No.**	**Remarks**	**ST3**	**ST2**	**ST1**	**ST0**
1	RD	○○○○	.○	BYT				BYT
2	RD.STK	○○○○	.○	RST			BYT	RST
3	RD.STK	○○○○	.○	ACT		BYT	RST	ACT
4	SUB	17		DSCH instruction				
5	(PRM)	○○○○		Number of data of the data table				
6	(PRM)	○○○○		Data table heading address				
7	(PRM)	○○○○		Search data address				
8	(PRM)	○○○○		Search result output address				
9	WRT	○○○○	.○	Search result				W1

Control conditions

(a) Specify data size. (BYT)
BYT = 0: Data stored in the data table, BCD two digits long.
BYT = 1: Data stored in the data table, BCD four digits long.

(b) Reset (RST)
RST = 0: Release reset
RST = 1: Enables a reset, that is, sets W1 to 0.

(c) Execution specification (ACT)
ACT = 0: The DSCH instruction is not executed. W1 does not change.
ACT = 1: The DSCH is executed, and the table internal number storing the desired data is output. If the data cannot be found, W1 = 1.

Parameters

(a) Number of data of the data table
Specify the size of the data table. If the beginning of the data table is 0 and the end is n, n + 1 is set as the number of data of the data table. The value which you can set depends on the control condition "BYT".
BYT=0: 1 to 99
BYT=1: 1 to 9999

(b) Data table heading address
Addresses that can be used in a data table are fixed. When preparing a data table, the addresses to be used must be determined beforehand, specify the head address of a data table here.

(c) Search data address
Specify the address of the data to be searched.

(d) Search result output address
If the data being searched for is found, the internal number of the table storing the data is output to this field. This address field is called a search result output address field.
The search result output address field requires memory whose size is the number of bytes conforming to the size of the data specified by BYT.

> ⚠ **WARNING**
> 1 You can not specify the table that includes different kind of address type or discontinuous address area. In this case, operation is not guaranteed.
> 2 You have to set the "Number of data of the data table" and the "Data table heading address" not to exceed the limit of its continuous address area. If the table exceeds the limit of the continuous address area, operation is not guaranteed. For example, when a range of address R is 0 to 7999 and the control condition "BYT" is set to 0 and the "Data table heading address" is set to "R7990", you can set 10 or less to the "Number of data of the data table".

Search result (W1)

W1 = 0: Search data found.
W1 = 1: Search data not found.

> ⚠ **CAUTION**
> Two or more coils, WRT, WRT.NOT, SET or RST, that follow this instruction are prohibited. You have to place a single coil instruction as the output of this instruction.

4.6 TABLE DATA

The following types of table data instruction are available. Use any of these instructions as appropriate for your purpose.

	Instruction name	Sub number	Processing
1	TBLRB	233	Reading data from table (1 byte length)
2	TBLRW	234	Reading data from table (2 bytes length)
3	TBLRD	235	Reading data from table (4 bytes length)
4	TBLRN	236	Reading data from table (Arbitrary byte length)
5	TBLWB	237	Writing data to table (1 byte length)
6	TBLWW	238	Writing data to table (2 bytes length)
7	TBLWD	239	Writing data to table (4 bytes length)
8	TBLWN	240	Writing data to table (Arbitrary byte length)
9	DSEQB	241	Searching data from table (=)(1 byte length)
10	DSEQW	242	Searching data from table (=)(2 bytes length)
11	DSEQD	243	Searching data from table (=)(4 bytes length)
12	DSNEB	244	Searching data from table (≠)(1 byte length)
13	DSNEW	245	Searching data from table (≠)(2 bytes length)
14	DSNED	246	Searching data from table (≠)(4 bytes length)
15	DSGTB	247	Searching data from table (>)(1 byte length)
16	DSGTW	248	Searching data from table (>)(2 bytes length)
17	DSGTD	249	Searching data from table (>)(4 bytes length)
18	DSLTB	250	Searching data from table (<)(1 byte length)
19	DSLTW	251	Searching data from table (<)(2 bytes length)
20	DSLTD	252	Searching data from table (<)(4 bytes length)
21	DSGEB	253	Searching data from table (≧)(1 byte length)
22	DSGEW	254	Searching data from table (≧)(2 bytes length)
23	DSGED	255	Searching data from table (≧)(4 bytes length)
24	DSLEB	256	Searching data from table (≦)(1 byte length)
25	DSLEW	257	Searching data from table (≦)(2 bytes length)
26	DSLED	258	Searching data from table (≦)(4 bytes length)
27	DMAXB	259	Maximum data (1 byte length)
28	DMAXW	260	Maximum data (2 bytes length)
29	DMAXD	261	Maximum data (4 bytes length)
30	DMINB	262	Minimum data (1 byte length)
31	DMINW	263	Minimum data (2 bytes length)
32	DMIND	264	Minimum data (4 bytes length)

4.6.1 TBLRB (Reading Data from Table (1 Byte Length) : SUB 233) TBLRW (Reading Data from Table (2 Bytes Length) : SUB 234) TBLRD (Reading Data from Table (4 Bytes Length) : SUB 235)

The Reading data from table instruction transfers data from a specified position in a table to another address.

The top of a table is specified in "Table top address". In "Reading position", a data position is specified relative to the top data position assumed to be 0.
In "Reading position", a constant or a PMC memory address for storing data can be specified.
As indicated below, three types of Reading data from table instructions are available according to the type of data to be read from a table. In each instruction, the data in the table and data at "Transfer destination address" are of the same data type. However, the data type of "Reading position" is two-byte signed binary data at all times.

Table4.6.1 (a) Kinds of Reading data from table instruction

	Instruction name	SUB No.	Data type
1	TBLRB	233	1 byte length data
2	TBLRW	234	2 bytes length data
3	TBLRD	235	4 bytes length data

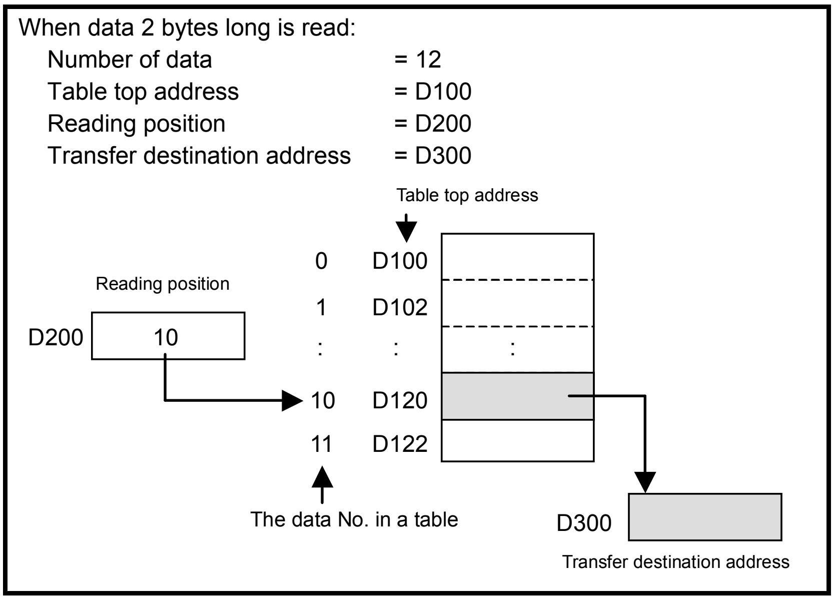


Fig. 4.6.1 (a) Example of TBLRW instruction

Format

Fig. 4.6.1(b) shows the ladder format and Table 4.6.1(b) shows the mnemonic format.

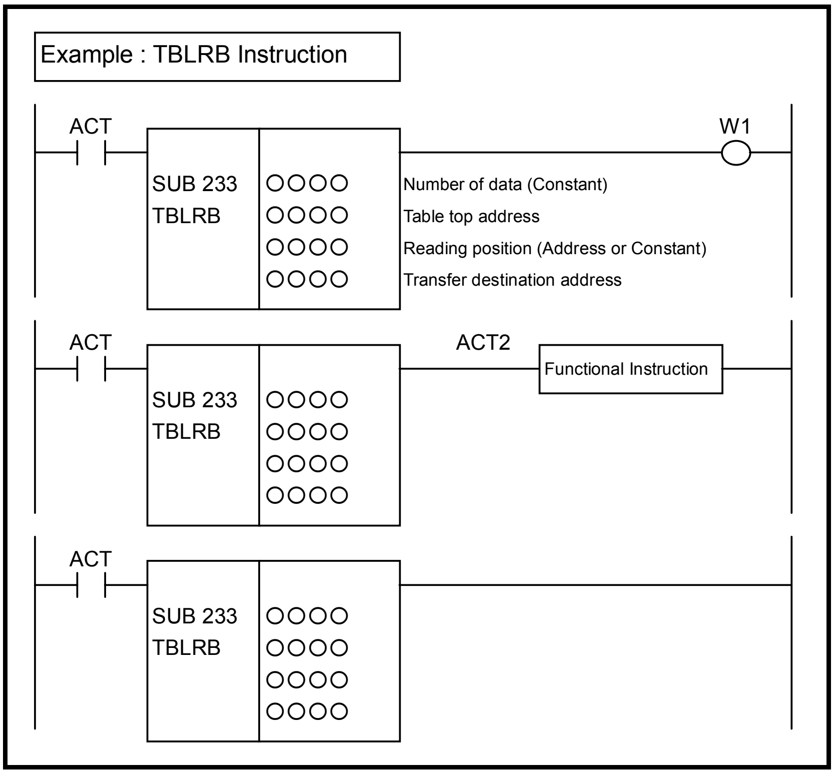


Fig. 4.6.1 (b) Format of TBLRB, TBLRW, TBLRD instruction

Table 4.6.1 (b) Mnemonic of TBLRB, TBLRW, TBLRD instruction

Mnemonic format

Step number	Instruction	Address No.	Bit No.	Remarks
1	RD	○○○○	.○	ACT
2	SUB	233		SUB No. (TBLRB instruction)
3	(PRM)	○○○○		Number of data (Constant)
4	(PRM)	○○○○		Table top address
5	(PRM)	○○○○		Reading position (Address or Constant)
6	(PRM)	○○○○		Transfer destination address
7	WRT	○○○○	.○	Normal end output

Memory status of control condition

ST3	ST2	ST1	ST0
			ACT
			↓
			W1

Control condition

(a) Execution specification

ACT = 0: Instruction not executed.

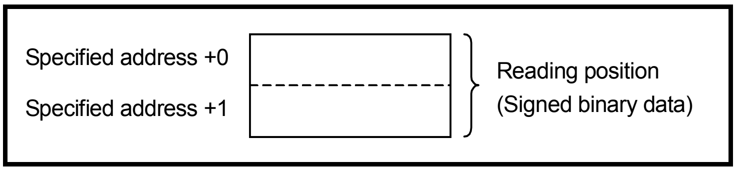
ACT = 1: Executed.

Parameters

(a) Number of data
Specify the number of data items in a table. Ensure that the entire table is within the valid address range.

(b) Table top address
Specify the top address of a table.

(c) Reading position
Specify a data position relative to the top data position assumed to be 0. A value from 0 to the number of data items less 1 may be specified. If a value not within this valid range is specified, no transfer operation is performed, and W1=0 is set.
In this parameter, a constant or a PMC memory address can be specified.
If an address is specified, specify "Reading position" as signed binary data by using the contiguous two bytes of memory starting from the specified address.



(d) Transfer destination address
Specify the destination address for the read data.

Output (W1)

W1=1: A transfer operation is terminated normally
W1=0: No transfer operation is executed (ACT=0)
A value not within the valid range is specified in "Reading position"

> **NOTE**
> W1 may be omitted. Moreover, another functional instruction can be connected instead of a coil.

4.6.2 TBLRN (Reading Data from Table (Arbitrary Bytes Length) : SUB 236)

The Reading data from table instruction transfers data of a specified size from a specified position in a table to another address.

The top of a table is specified in "Table top address". In "Reading position", a data position is specified relative to the top data position assumed to be 0. In "Reading position", a constant or a PMC memory address for storing data can be specified.
The byte length of data to be read from the table is specified in "Data size". The data in the table and data at "Transfer destination address" are of the same data length. However, the data type of "Reading position" is two-byte signed binary data at all times.

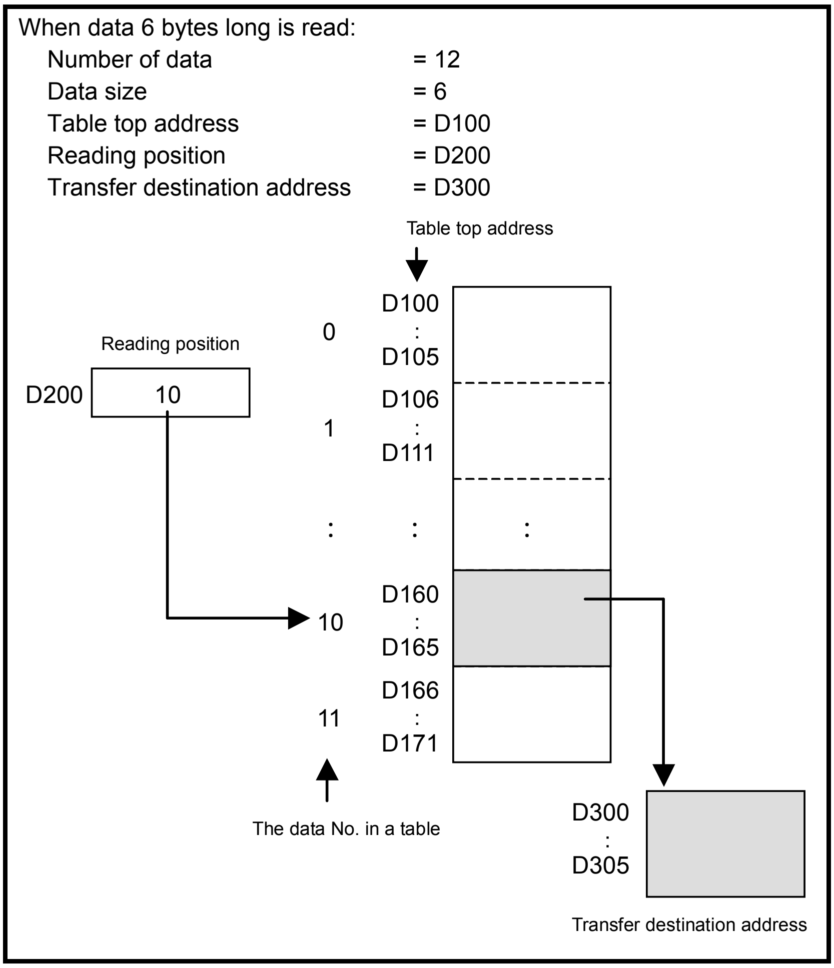


Fig. 4.6.2 (a) Example of TBLRN instruction

Format

Fig. 4.6.2(b) shows the ladder format and Table 4.6.2(a) shows the mnemonic format.

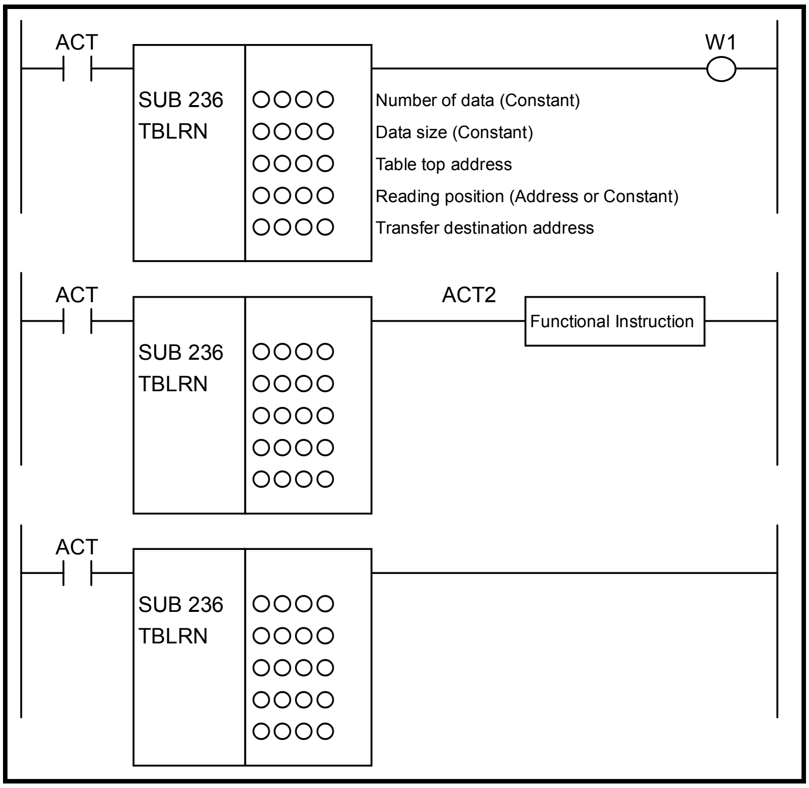


Fig. 4.6.2 (b) Format of TBLRN instruction

Table 4.6.2 (a) Mnemonic of TBLRN instruction

Mnemonic format

Step number	Instruction	Address No.	Bit No.	Remarks
1	RD	○○○○	.○	ACT
2	SUB	236		SUB No. (TBLRN instruction)
3	(PRM)	○○○○		Number of data (Constant)
4	(PRM)	○○○○		Data size (Constant)
5	(PRM)	○○○○		Table top address
6	(PRM)	○○○○		Reading position (Address or Constant)
7	(PRM)	○○○○		Transfer destination address
8	WRT	○○○○	.○	Normal end output

Memory status of control condition

ST3	ST2	ST1	ST0
			ACT
			W1

Control condition

(a) Execution specification
ACT = 0: Instruction not executed.
ACT = 1: Executed.

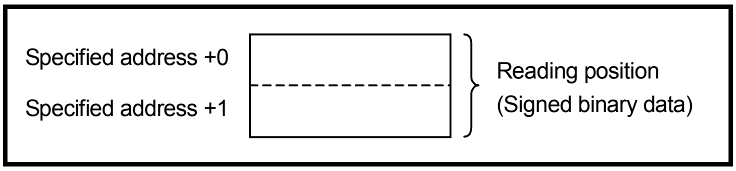
Parameters

(a) Number of data
Specify the number of data items in a table. Ensure that the entire table is within the valid address range.

(b) Data size
Specify the byte length of data to be read. A value from 1 to 256 may be specified.

(c) Table top address
Specify the top address of a table.

(d) Reading position
Specify a data position relative to the top data position assumed to be 0. A value from 0 to the number of data items less 1 may be specified. If a value not within this valid range is specified, no transfer operation is performed, and W1=0 is set.
In this parameter, a constant or a PMC memory address can be specified.
If an address is specified, specify "Reading position" as signed binary data by using the contiguous two bytes of memory starting from the specified address.



(e) Transfer destination address
Specify the destination address for the read data.

> **NOTE**
> The operation of the instruction is not guaranteed if "Transfer destination address" overlaps the table. Specify "Transfer destination address" that does not overlap the table.

Output (W1)

W1=1: A transfer operation is terminated normally
W1=0: No transfer operation is executed (ACT=0)
A value not within the valid range is specified in "Reading position"

> **NOTE**
> W1 may be omitted. Moreover, another functional instruction can be connected instead of a coil.

4.6.3 TBLWB (Writing Data to Table (1 Byte Length) : SUB 237) TBLWW (Writing Data to Table (2 Bytes Length) : SUB 238) TBLWD (Writing Data to Table (4 Bytes Length) : SUB 239)

The Writing data to table instruction writes data to a specified position in a table.

The top of a table is specified in "Table top address". In "Writing position", a data position is specified relative to the top data position assumed to be 0. In "Writing position", a constant or a PMC memory address for storing data can be specified.
As indicated below, three types of writing data to table instructions are available according to the type of data to be written to a table. In each instruction, the data in the table and transfer data are of the same data type. However, the data type of "Writing position" is two-byte signed binary data at all times.

Table4.6.3 (a) Kinds of writing data to table instruction

	Instruction name	SUB No.	Data type
1	TBLWB	237	1 byte length data
2	TBLWW	238	2 bytes length data
3	TBLWD	239	4 bytes length data

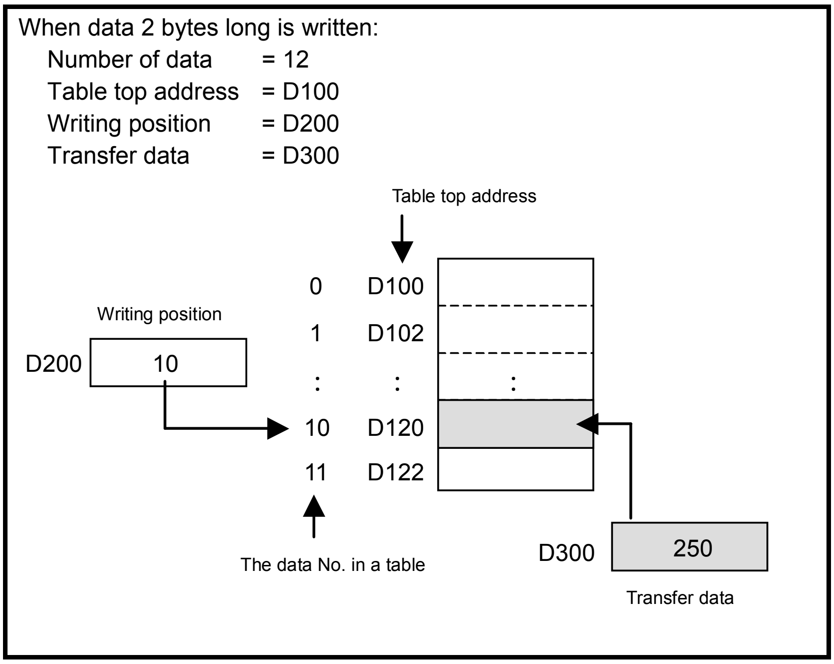


Fig. 4.6.3 (a) Example of TBLWW instruction

Format

Fig. 4.6.3(b) shows the ladder format and Table 4.6.3(b) shows the mnemonic format.

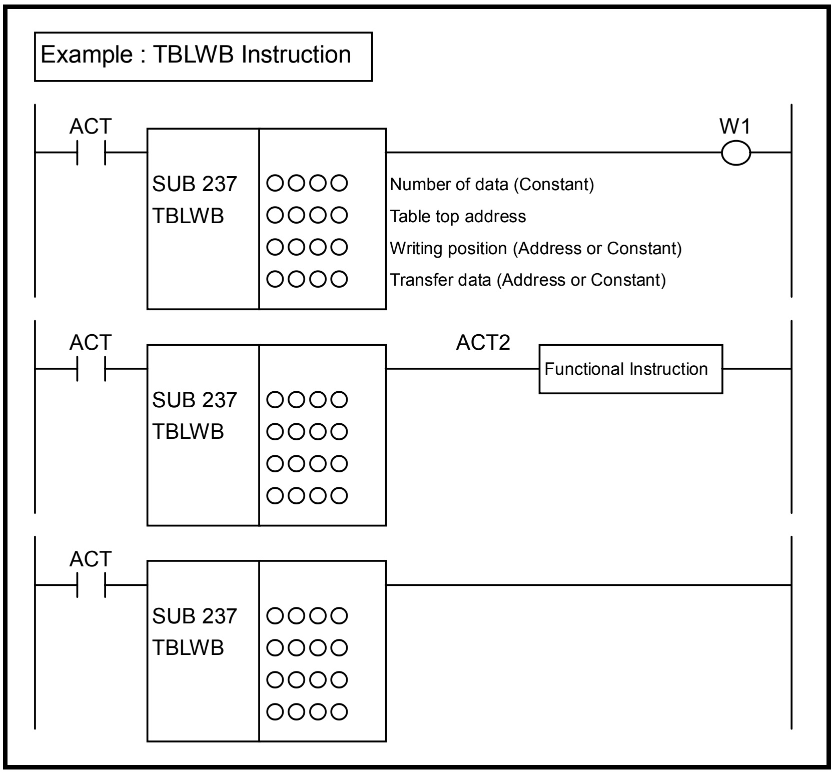


Fig. 4.6.3 (b) Format of TBLWB, TBLWW, TBLWD instruction

Table 4.6.3 (b) Mnemonic of TBLWB, TBLWW, TBLWD instruction

Mnemonic format

Step number	Instruction	Address No.	Bit No.	Remarks
1	RD	○○○○	.○	ACT
2	SUB	237		SUB No. (TBLWB instruction)
3	(PRM)	○○○○		Number of data (Constant)
4	(PRM)	○○○○		Table top address
5	(PRM)	○○○○		Writing position (Address or Constant)
6	(PRM)	○○○○		Transfer data (Address or Constant)
7	WRT	○○○○	.○	Normal end output

Memory status of control condition

ST3	ST2	ST1	ST0
			ACT
			W1

Control condition

(a) Execution specification

ACT = 0: Instruction not executed.

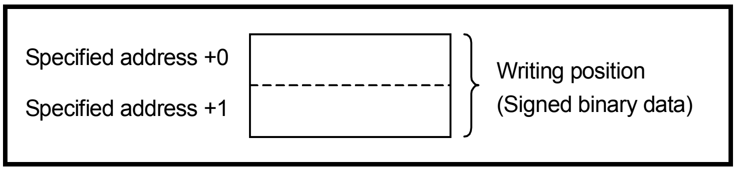
ACT = 1: Executed.

Parameters

(a) Number of data
Specify the number of data items in a table. Ensure that the entire table is within the valid address range.

(b) Table top address
Specify the top address of a table.

(c) Writing position
Specify a data position relative to the top data position assumed to be 0. A value from 0 to the number of data items less 1 may be specified. If a value not within this valid range is specified, no transfer operation is performed, and W1=0 is set.
In this parameter, a constant or a PMC memory address can be specified.
If an address is specified, specify "Writing position" as signed binary data by using the contiguous two bytes of memory starting from the specified address.



(d) Transfer data
Specify data to be written. In this parameter, a constant or a PMC memory address for storing data can be specified. Specify data by using signed binary data. A value within the following range may be specified:

Instruction name	Available value
TBLWB	-128 to 127
TBLWW	-32768 to 32767
TBLWD	-2147483648 to 2147483647

Output (W1)

W1=1: A transfer operation is terminated normally
W1=0: No transfer operation is executed (ACT=0)
A value not within the valid range is specified in "Writing position"

NOTE
W1 may be omitted. Moreover, another functional instruction can be connected instead of a coil.

4.6.4 TBLWN (Writing Data to Table (Arbitrary Bytes Length) : SUB 240)

The Writing data to table instruction writes data of a specified size to a specified position in a table.

The top of a table is specified in "Table top address". In "Writing position", a data position is specified relative to the top data position assumed to be 0. In "Writing position", a constant or a PMC memory address for storing data can be specified.
The byte length of data to be written to the table is specified in "Data size". The data in the table and data at "Transfer data top address" are of the same data length. However, the data type of "Writing position" is two-byte signed binary data at all times.

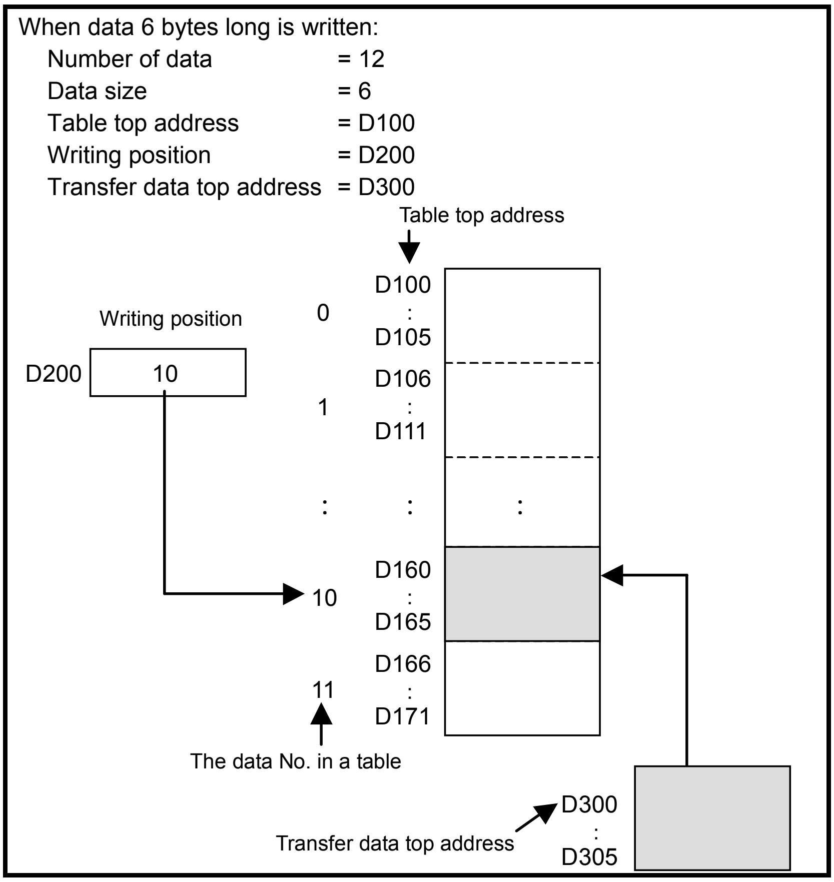


Fig. 4.6.4 (a) Example of TBLWN instruction

Format

Fig. 4.6.4(b) shows the ladder format and Table 4.6.4 shows the mnemonic format.

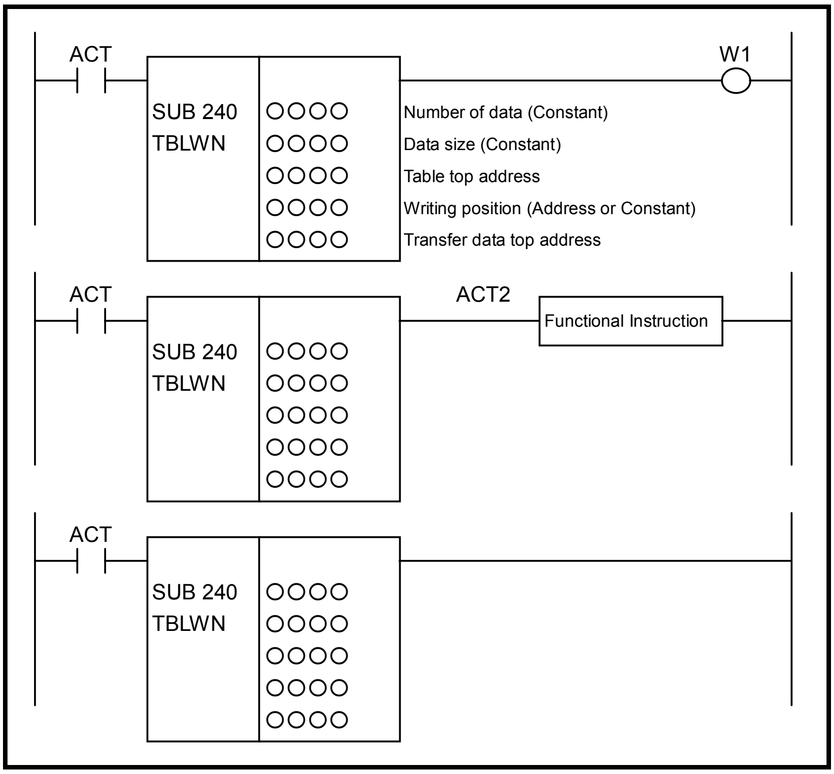


Fig. 4.6.4 (b) Format of TBLWN instruction

Table 4.6.4 Mnemonic of TBLWN instruction

Mnemonic format

Step number	Instruction	Address No.	Bit No.	Remarks
1	RD	○○○○	.○	ACT
2	SUB	240		SUB No. (TBLWN instruction)
3	(PRM)	○○○○		Number of data (Constant)
4	(PRM)	○○○○		Data size (Constant)
5	(PRM)	○○○○		Table top address
6	(PRM)	○○○○		Writing position (Address or Constant)
7	(PRM)	○○○○		Transfer data top address
8	WRT	○○○○	.○	Normal end output

Memory status of control condition

ST3	ST2	ST1	ST0
			ACT
			W1

Control condition

(a) Execution specification

ACT = 0: Instruction not executed.

ACT = 1: Executed.

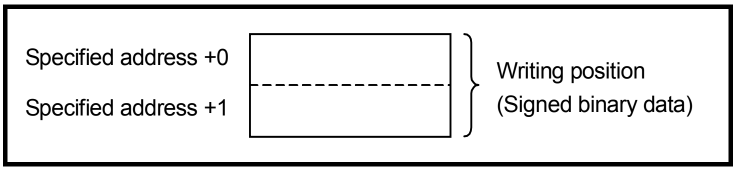
Parameters

(a) Number of data
Specify the number of data items in a table. Ensure that the entire table is within the valid address range.

(b) Data size
Specify the byte length of data to be written. A value from 1 to 256 may be specified.

(c) Table top address
Specify the top address of a table.

(d) Writing position
Specify a data position relative to the top data position assumed to be 0. A value from 0 to the number of data items less 1 may be specified. If a value not within this valid range is specified, no transfer operation is performed, and W1=0 is set.
In this parameter, a constant or a PMC memory address can be specified.
If an address is specified, specify "Writing position" as signed binary data by using the contiguous two bytes of memory starting from the specified address.



(e) Transfer data top address
Specify the start address of data to be written.

> **NOTE**
> The operation of the instruction is not guaranteed if "Transfer data top address" overlaps the table. Specify "Transfer data top address" that does not overlap the table.

Output (W1)

W1=1: A transfer operation is terminated normally
W1=0: No transfer operation is executed (ACT=0)
A value not within the valid range is specified in "Writing position"

> **NOTE**
> W1 may be omitted. Moreover, another functional instruction can be connected instead of a coil.

4.6.5 DSEQB(Searching Data from Table(=)(1 Byte Length):SUB 241)
DSEQW(Searching Data from Table(=)(2 Bytes Length):SUB 242)
DSEQD(Searching Data from Table(=)(4 Bytes Length):SUB 243)
DSNEB(Searching Data from Table(≠)(1 Byte Length):SUB 244)
DSNEW(Searching Data from Table(≠)(2 Bytes Length):SUB 245)
DSNED(Searching Data from Table(≠)(4 Bytes Length):SUB 246)
DSGTB(Searching Data from Table(>)(1 Byte Length):SUB 247)
DSGTW(Searching Data from Table(>)(2 Bytes Length):SUB 248)
DSGTD(Searching Data from Table(>)(4 Bytes Length):SUB 249)
DSLTB(Searching Data from Table(<)(1 Byte Length):SUB 250)
DSLTW(Searching Data from Table(<)(2 Bytes Length):SUB 251)
DSLTD(Searching Data from Table(<)(4 Bytes Length):SUB 252)
DSGEB(Searching Data from Table(≥)(1 Byte Length):SUB 253)
DSGEW(Searching Data from Table(≥)(2 Bytes Length):SUB 254)
DSGED(Searching Data from Table(≥)(4 Bytes Length) :SUB 255)
DSLEB(Searching Data from Table(≤)(1 Byte Length) :SUB 256)
DSLEW(Searching Data from Table(≤)(2 Bytes Length) :SUB 257)
DSLED(Searching Data from Table(≤)(4 Bytes Length) :SUB 258)

The instruction searches a table for data that satisfies a specified condition and acquires the position of found data.
As indicated below, eighteen types of Searching data from table instructions are available according to the search condition and data type. In each instruction, the data in the table and "Search data" are of the same data type. However, the data type of "Search starting position" and "Find position output address" is two-byte signed binary data at all times.

Table4.6.5 (a) Kinds of Searching data from table instruction

	Instruction name	SUB No.	Search condition	Data type
1	DSEQB	241	=	1 byte length signed binary data
2	DSEQW	242		2 bytes length signed binary data
3	DSEQD	243		4 bytes length signed binary data
4	DSNEB	244	≠	1 byte length signed binary data
5	DSNEW	245		2 bytes length signed binary data
6	DSNED	246		4 bytes length signed binary data
7	DSGTB	247	>	1 byte length signed binary data
8	DSGTW	248		2 bytes length signed binary data
9	DSGTD	249		4 bytes length signed binary data
10	DSLTB	250	<	1 byte length signed binary data
11	DSLTW	251		2 bytes length signed binary data
12	DSLTD	252		4 bytes length signed binary data
13	DSGEB	253	≧	1 byte length signed binary data
14	DSGEW	254		2 bytes length signed binary data
15	DSGED	255		4 bytes length signed binary data
16	DSLEB	256	≦	1 byte length signed binary data
17	DSLEW	257		2 bytes length signed binary data
18	DSLED	258		4 bytes length signed binary data

Table4.6.5 (b) Concurrence conditions of search data

Instruction	Search condition	Concurrence conditions
DSEQx	=	Table data = search data
DSNEx	≠	Table data ≠ search data
DSGTx	>	Table data > search data
DSLTx	<	Table data < search data
DSGEx	≧	Table data ≧ search data
DSLEx	≦	Table data ≦ search data

The top of a table is specified in "Table top address". In "Search starting position", a data position is specified relative to the top data position assumed to be 0. A value output to "Find position output address" is also indicated as a data position relative to the top data position assumed to be 0. In "Search starting position", a constant or a PMC memory address for storing data can be specified.

If a value not within the valid range is specified in "Search starting position", -1 is output to "Find position output address", and W1=0 is set.
Moreover, if data that satisfies a specified condition is not found in the area from "Search starting position" to the end of the table as a result of search operation, -1 is output to "Find position output address", and W1=0 is set.

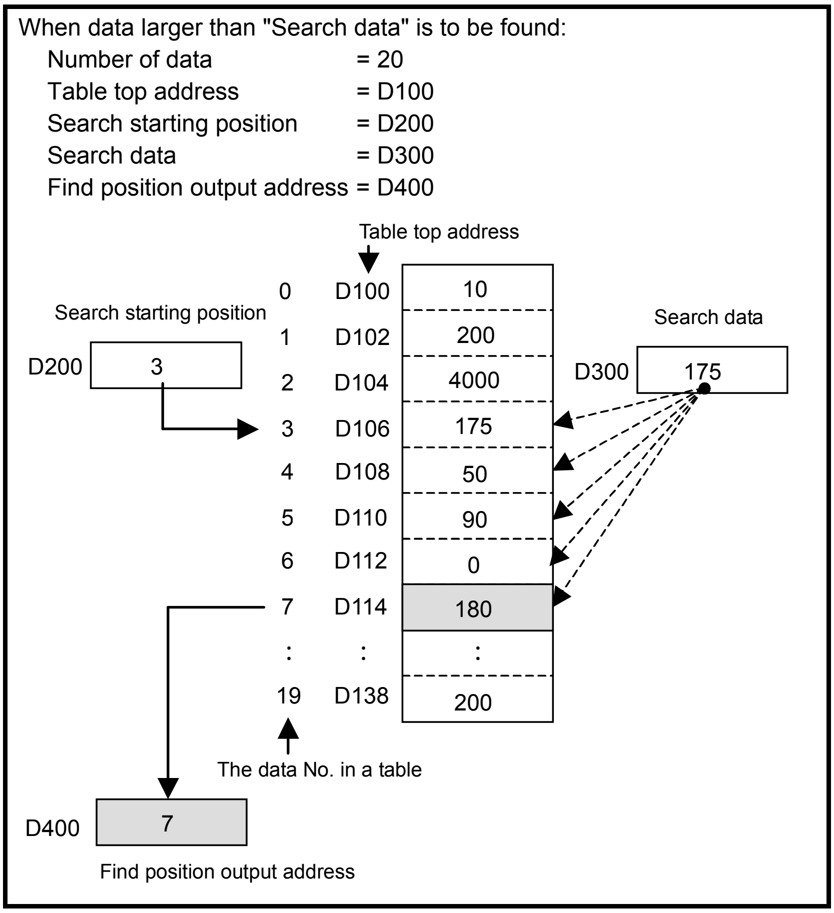


Fig. 4.6.5 (a) Example of DSGTW instruction

Format

Fig. 4.6.5(b) shows the ladder format and Table 4.6.5(c) shows the mnemonic format.

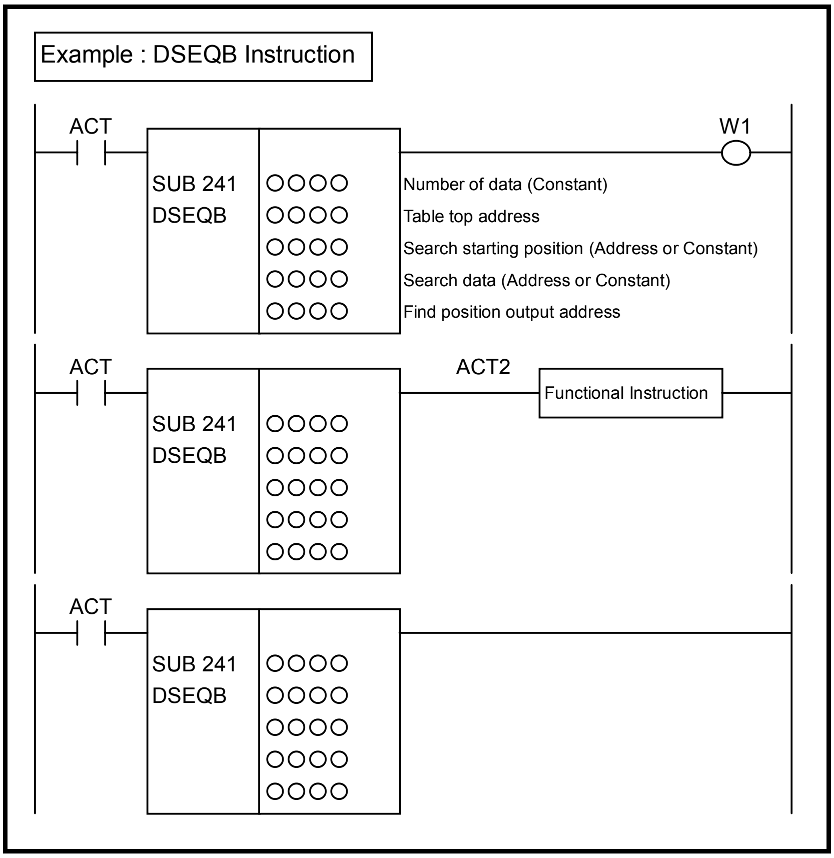


Fig. 4.6.5 (b) Format of DSEQx, DSNEx, DSGTx, DSLTx, DSGEx, DSLEx instruction

Table 4.6.5 (c) Mnemonic of DSEQx, DSNEx, DSGTx, DSLTx, DSGEx, DSLEx instruction

Mnemonic format

Step number	Instruction	Address No.	Bit No.	Remarks
1	RD	○○○○	.○	ACT
2	SUB	241		SUB No. (DSEQB instruction)
3	(PRM)	○○○○		Number of data (Constant)
4	(PRM)	○○○○		Table top address
5	(PRM)	○○○○		Search starting position (Address or Constant)
6	(PRM)	○○○○		Search data (Address or Constant)
7	(PRM)	○○○○		Find position output address
8	WRT	○○○○	.○	Result output

Memory status of control condition

ST3	ST2	ST1	ST0
			ACT
			W1

Control condition

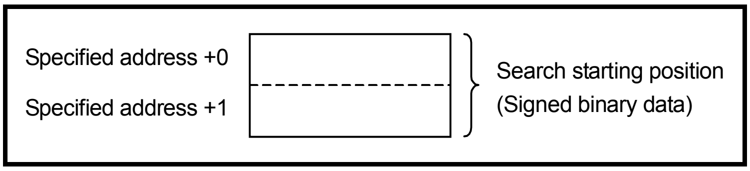
(a) Execution specification
ACT = 0: Instruction not executed.
ACT = 1: Executed.

Parameters

(a) Number of data
Specify the number of data items in a table. Ensure that the entire table is within the valid address range.

(b) Table top address
Specify the top address of a table.

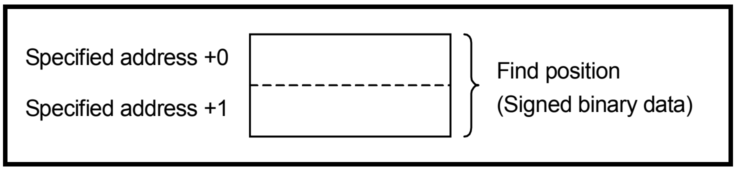
(c) Search starting position
Specify a search start data position relative to the top data position assumed to be 0. A value from 0 to the number of data items less 1 may be specified. If a value not within this valid range is specified, no search operation is performed, -1 is output to "Find position output address", and W1=0 is set.
In this parameter, a constant or a PMC memory address can be specified.
If an address is specified, specify "Search starting position" as signed binary data by using the contiguous two bytes of memory starting from the specified address.



(d) Search data
Specify a value to be compared with in search operation. A comparison is made with this data according to the search condition of each instruction, and the position of data that satisfies the search condition is acquired.
In this parameter, a constant or a PMC memory address for storing data can be specified. Specify data by using signed binary data. A value within the following range may be specified:

Instruction name	Available value
DSEQB DSNEB DSGTB DSLTB DSGEB DSLEB	-128 to 127
DSEQW DSNEW DSGTW DSLTW DSGEW DSLEW	-32768 to 32767
DSEQD DSNED DSGTD DSLTD DSGED DSLED	-2147483648 to 2147483647

(e) Find position output address
Specify the address for outputting data that satisfies the specified condition as a result of search.
A find position is output as two-bye signed binary data.
If no data satisfies the specified condition, -1 is output, and W1=0 is set.



Output (W1)

W1=1: Data that satisfies a specified condition is found
W1=0: No search operation is executed (ACT=0)
Data that satisfies a specified condition is not found in the area from "Search starting position" to the end of the table
A value not within the valid range is set in "Search starting position"

> **NOTE**
> W1 may be omitted. Moreover, another functional instruction can be connected instead of a coil.

4.6.6 DMAXB (Maximum Data (1 Byte Length): SUB 259) DMAXW (Maximum Data (2 Bytes Length) : SUB 260) DMAXD (Maximum Data (4 Bytes Length) : SUB 261)

The Maximum data instruction searches a table for maximum data and acquires the value and position of found maximum data.
The top of a table is specified in "Table top address". A value output to "Find position output address" is indicated as a data position relative to the top data position assumed to be 0.
A search is made starting at the top of a table. In "Number of search data", the number of data items to be searched in the area from the top of a table to a desired search position is specified.
As indicated below, three types of Maximum data instructions are available according to the data type of a table to be searched. In each instruction, the data in the table and data at "Maximum data output address" are of the same data type. However, the data type of "Number of search data" and "Find position output address" is two-byte signed binary data at all times.

Table4.6.6 (a) Kinds of Maximum data instruction

	Instruction name	SUB No.	Data type
1	DMAXB	259	1 byte length signed data
2	DMAXW	260	2 bytes length signed data
3	DMAXD	261	4 bytes length signed data

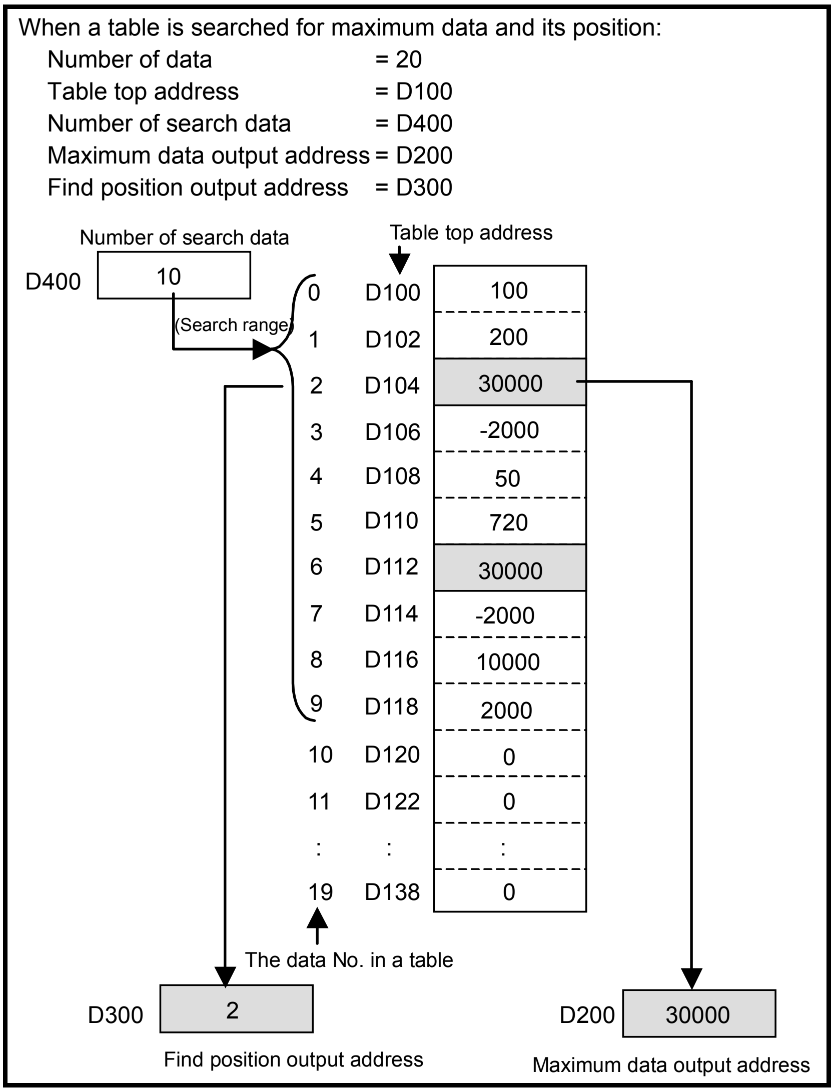


Fig. 4.6.6 (a) Example of DMAXW instruction

Format

Fig. 4.6.6(b) shows the ladder format and Table 4.6.6(b) shows the mnemonic format.

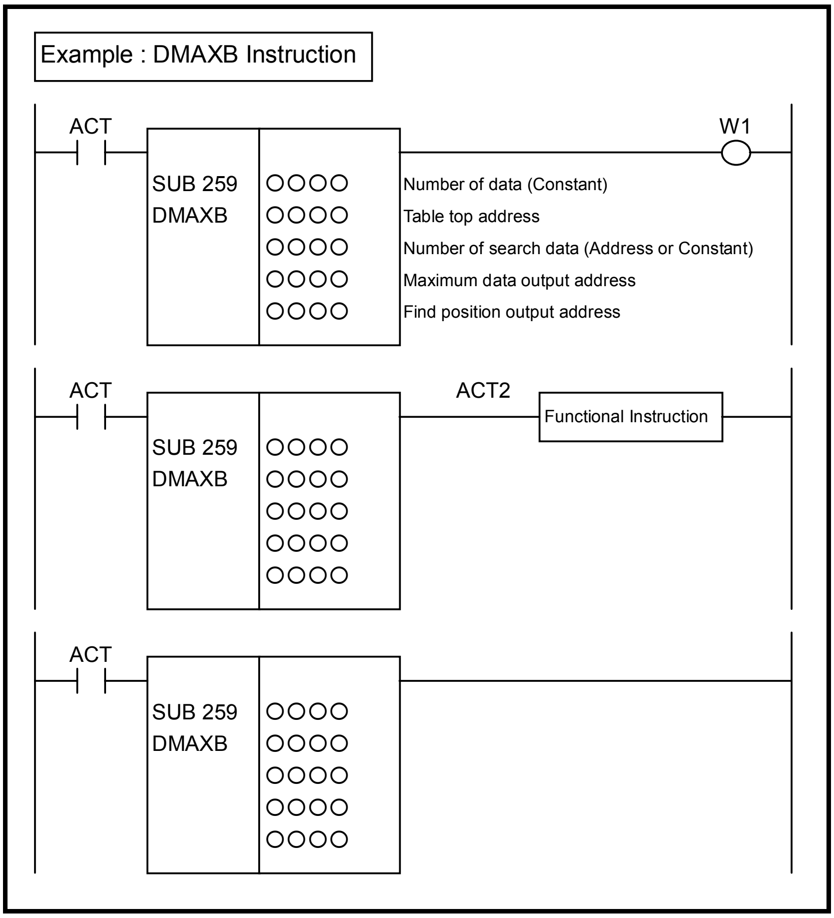


Fig. 4.6.6 (b) Format of DMAXB, DMAXW, DMAXD instruction

Table 4.6.6 (b) Mnemonic of DMAXB, DMAXW, DMAXD instruction

Mnemonic format

Step number	Instruction	Address No.	Bit No.	Remarks
1	RD	○○○○	.○	ACT
2	SUB	259		SUB No. (DMAXB instruction)
3	(PRM)	○○○○		Number of data (Constant)
4	(PRM)	○○○○		Table top address
5	(PRM)	○○○○		Number of search data (Address or Constant)
6	(PRM)	○○○○		Maximum data output address
7	(PRM)	○○○○		Find position output address
8	WRT	○○○○	.○	Normal end output

Memory status of control condition

ST3	ST2	ST1	ST0
			ACT
			W1

Control condition

(a) Execution specification

ACT = 0: Instruction not executed.

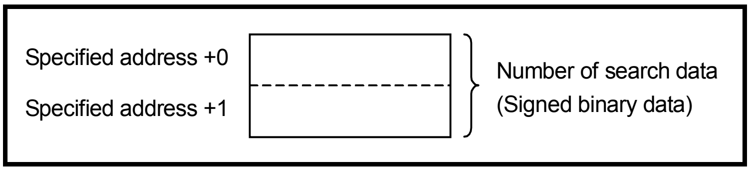
ACT = 1: Executed.

Parameters

(a) Number of data
Specify the number of data items in a table. Ensure that the entire table is within the valid address range.
This parameter indicates the total number of data items of a table. A data range to be searched is specified using the "Number of search data" parameter.

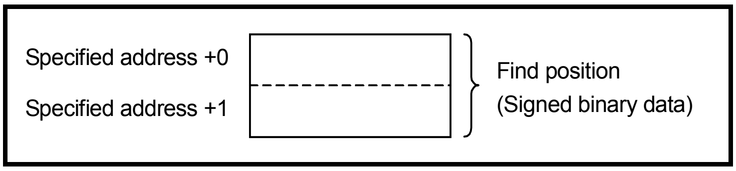
(b) Table top address
Specify the top address of a table.

(c) Number of search data
Specify the number of data items to be searched for maximum data in a table. A value from 1 to the value specified in the "Number of data" parameter may be specified. If a value not within this valid range is specified, 0 is output to "Maximum data output address", -1 is output to "Find position output address", and W1=0 is set.
In this parameter, a constant or a PMC memory address for storing data can be specified.
If an address is specified, specify a search range as signed binary data by using the contiguous two bytes of memory starting from the specified address.



(d) Maximum data output address
Specify the address to which maximum data is to be output as a result of search operation.

(e) Find position output address
Specify the address to which the position of maximum data is to be output as a result of search operation.
A find position is output as two-bye signed binary data.
As data position information, the top of the table is indicated as 0, and the end of the table is indicated as the number of data items less 1. If multiple maximum data items are found, the position nearest to the top of the table is output.



Output (W1)

W1=1: A search operation is terminated normally
W1=0: No search operation is executed (ACT=0)
A value not within the valid range is set in "Number of search data"

> **NOTE**
> W1 may be omitted. Moreover, another functional instruction can be connected instead of a coil.

4.6.7 DMINB (Minimum Data (1 Byte Length): SUB 262) DMINW (Minimum Data (2 Bytes Length): SUB 263) DMIND (Minimum Data (4 Bytes Length): SUB 264)

The Minimum data instruction searches a table for minimum data and acquires the value and position of found minimum data.
The top of a table is specified in "Table top address". A value output to "Find position output address" is indicated as a data position relative to the top data position assumed to be 0.
A search is made starting at the top of a table. In "Number of search data", the number of data items to be searched in the area from the top of a table to a desired search position is specified.
As indicated below, three types of Minimum data instructions are available according to the data type of a table to be searched. In each instruction, the data in the table and data at "Minimum data output address" are of the same data type. However, the data type of "Number of search data" and "Find position output address" is two-byte signed binary data at all times.

Table4.6.7 (a) Kinds of Minimum data instruction

	Instruction name	SUB No.	Data type
1	DMINB	262	1 byte length signed data
2	DMINW	263	2 bytes length signed data
3	DMIND	264	4 bytes length signed data

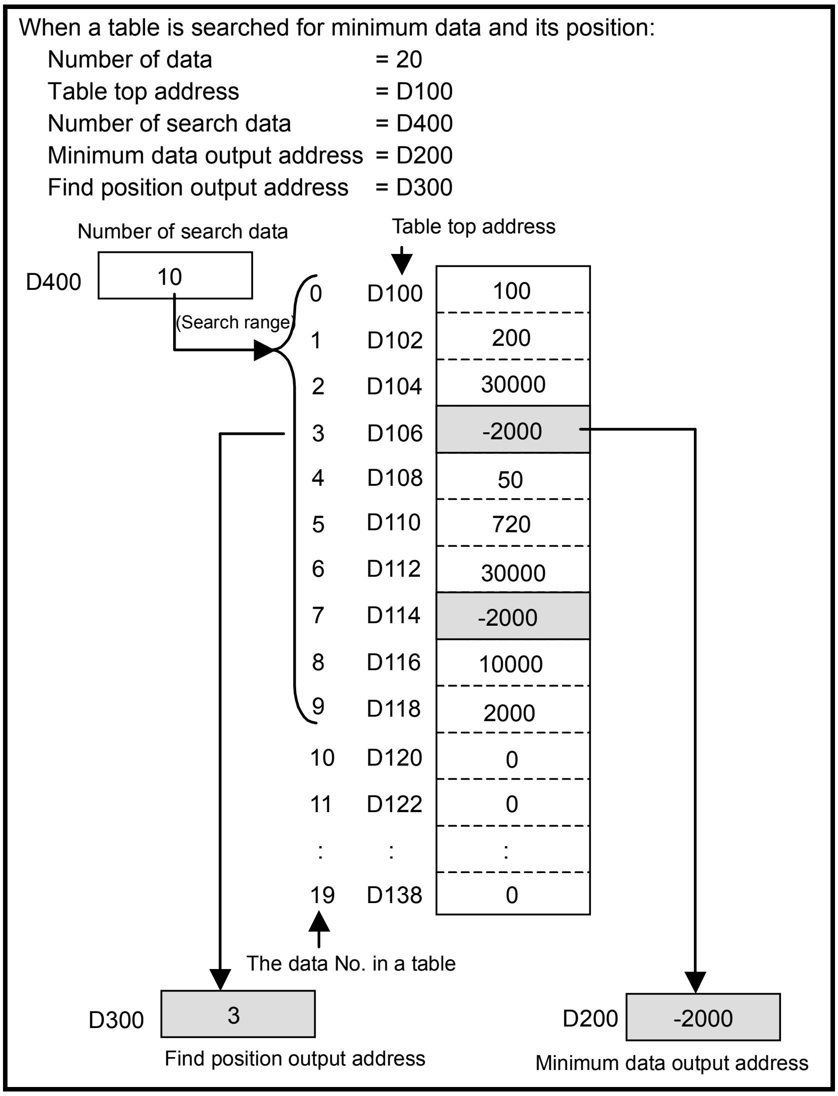


Fig. 4.6.7 (a) Example of DMINW instruction

Format

Fig. 4.6.7(b) shows the ladder format and Table 4.6.7(b) shows the mnemonic format.

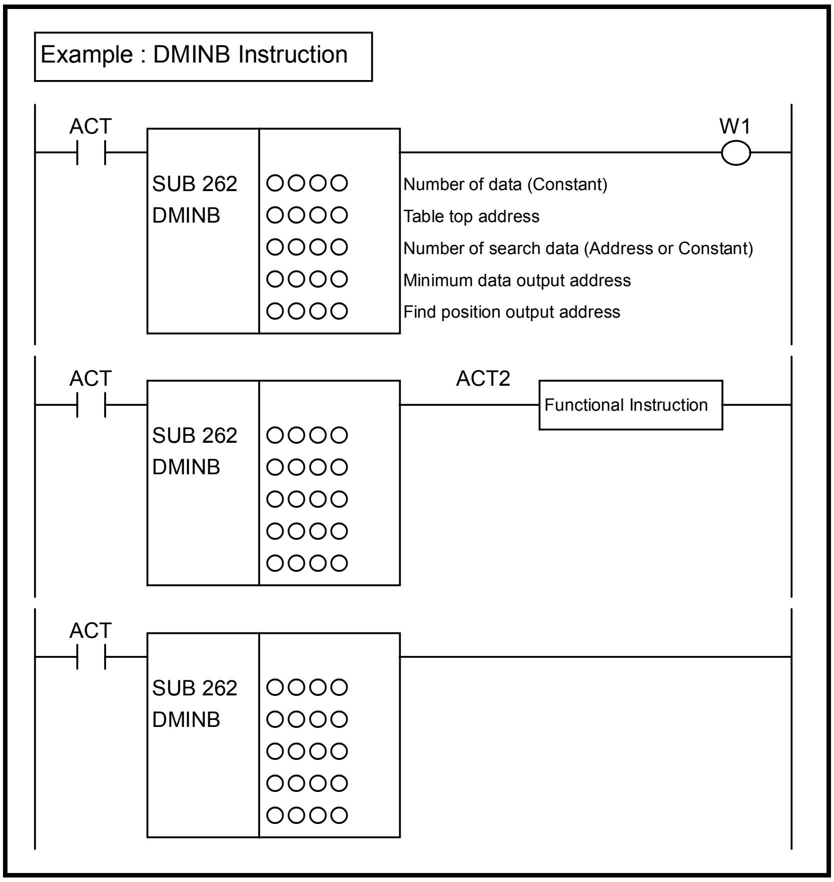


Fig. 4.6.7 (b) Format of DMINB, DMINW, DMIND instruction

Table 4.6.7 (b) Mnemonic of DMINB, DMINW, DMIND instruction

Mnemonic format

Step number	Instruction	Address No.	Bit No.	Remarks
1	RD	OOOO	.O	ACT
2	SUB	262		SUB No. (DMINB instruction)
3	(PRM)	OOOO		Number of data (Constant)
4	(PRM)	OOOO		Table top address
5	(PRM)	OOOO		Number of search data (Address or Constant)
6	(PRM)	OOOO		Minimum data output address
7	(PRM)	OOOO		Find position output address
8	WRT	OOOO	.O	Normal end output

Memory status of control condition

ST3	ST2	ST1	ST0
			ACT
			W1

Control condition

(a) Execution specification

ACT = 0: Instruction not executed.

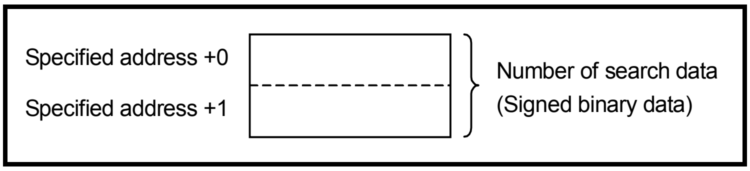
ACT = 1: Executed.

Parameters

(a) Number of data
Specify the number of data items in a table. Ensure that the entire table is within the valid address range.
This parameter indicates the total number of data items of a table. A data range to be searched is specified using the "Number of search data" parameter.

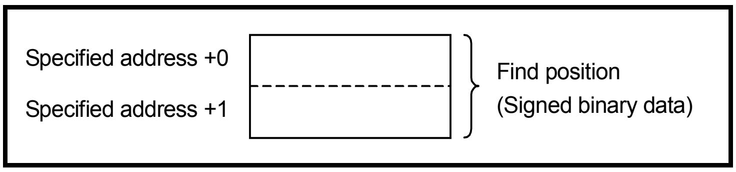
(b) Table top address
Specify the top address of a table.

(c) Number of search data
Specify the number of data items to be searched for minimum data in a table. A value from 1 to the value specified in the "Number of data" parameter may be specified. If an invalid value is specified, 0 is output to "Minimum data output address", -1 is output to "Find position output address", and W1=0 is set.
In this parameter, a constant or a PMC memory address for storing data can be specified.
If an address is specified, specify a search range as signed binary data by using the contiguous two bytes of memory starting from the specified address.



(d) Minimum data output address
Specify the address to which minimum data is to be output as a result of search operation.

(e) Find position output address
Specify the address to which the position of minimum data is to be output as a result of search operation.
A find position is output as two-bye signed binary data.
As data position information, the top of the table is indicated as 0, and the end of the table is indicated as the number of data items less 1. If multiple minimum data items are found, the position nearest to the top of the table is output.



Output (W1)

W1=1: A search operation is terminated normally
W1=0: No search operation is executed (ACT=0)
A value not within the valid range is set in "Number of search data"

> **NOTE**
> W1 may be omitted. Moreover, another functional instruction can be connected instead of a coil.

4.7 COMPARISON

The following types of comparison instruction are available. Use any of these instructions as appropriate for your purpose.

	Instruction name	Sub number	Processing
1	EQB	200	1 byte Binary comparison (equal) (*1)
2	EQW	201	2 byte Binary comparison (equal) (*1)
3	EQD	202	4 byte Binary comparison (equal) (*1)
4	NEB	203	1 byte Binary comparison (not equal) (*1)
5	NEW	204	2 byte Binary comparison (not equal) (*1)
6	NED	205	4 byte Binary comparison (not equal) (*1)
7	GTB	206	1 byte Binary comparison (greater than) (*1)
8	GTW	207	2 byte Binary comparison (greater than) (*1)
9	GTD	208	4 byte Binary comparison (greater than) (*1)
10	LTB	209	1 byte Binary comparison (less than) (*1)
11	LTW	210	2 byte Binary comparison (less than) (*1)
12	LTD	211	4 byte Binary comparison (less than) (*1)
13	GEB	212	1 byte Binary comparison (greater or equal) (*1)
14	GEW	213	2 byte Binary comparison (greater or equal) (*1)
15	GED	214	4 byte Binary comparison (greater or equal) (*1)
16	LEB	215	1 byte Binary comparison (less or equal) (*1)
17	LEW	216	2 byte Binary comparison (less or equal) (*1)
18	LED	217	4 byte Binary comparison (less or equal) (*1)
19	RNGB	218	1 byte Binary comparison (range) (*1)
20	RNGW	219	2 byte Binary comparison (range) (*1)
21	RNGD	220	4 byte Binary comparison (range) (*1)
22	COMPB	32	Comparison between binary data
23	COMP	15	Comparison
24	COIN	16	Coincidence check

NOTE

1 You can set either constant or address to each parameter for the "(*1)" marked instruction. When you input a number to its parameter on LADDER editing screen, the input is recognized as a constant parameter. When you input a symbol that is composed of digits and that may be considered as a number, the input is recognized as a number and treated as a constant parameter too. If you want to set such address that has a confusing symbol, you have to input the address, not the symbol, to the parameter.

4.7.1 Signed Binary Comparison (=) EQB (1 Byte Length: SUB 200) EQW (2 Bytes Length: SUB 201) EQD (4 Bytes Length: SUB 202)

Using this instruction, you can know whether the "Data 1" equals to the "Data 2" or not.
The EQB instruction handles 1 byte length signed binary data.
The EQW instruction handles 2 bytes length signed binary data.
The EQD instruction handles 4 bytes length signed binary data.

Format

Fig. 4.7.1 shows the ladder format and Table 4.7.1 shows the mnemonic format.

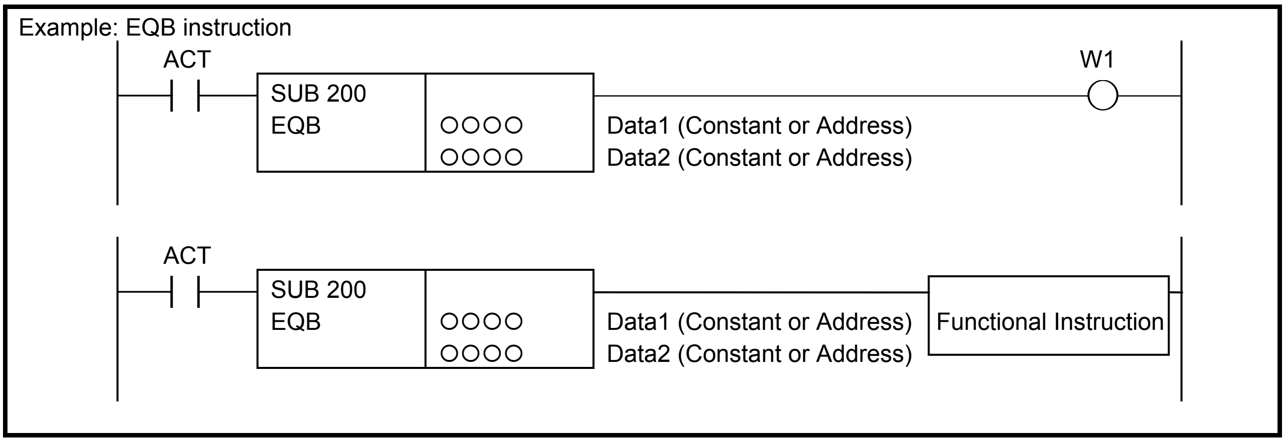


Fig. 4.7.1 Format of EQB, EQW and EQD instructions

Table 4.7.1 Mnemonic of EQB, EQW and EQD instructions

Mnemonic format					Memory status of control condition			
Step number	**Instruction**	**Address No.**	**Bit No.**	**Remarks**	**ST3**	**ST2**	**ST1**	**ST0**
1	RD	○○○○	.○	ACT				ACT
2	SUB	200 201 202		EQB instruction EQW instruction EQD instruction				
3	(PRM)	○○○○		Data1 (Constant or Address)				
4	(PRM)	○○○○		Data2 (Constant or Address)				
5	WRT	○○○○	.○	Result				W1

Control condition

(a) Execution specification (ACT)
ACT=0: Do not execute the instruction. The W1 becomes 0.
ACT=1: Execute the instruction. The result is output to W1.

Parameters

(a) Data 1
(b) Data 2
You can specify the constant or any address. The valid data range is shown below.
EQB: -128 to 127
EQW: -32768 to 32767
EQD: -2147483648 to 2147483647

Output (W1)

The result is output to W1.

W1=1: - ACT=1 and "Data 1" = "Data 2"

W1=0: - ACT=0

- ACT=1 and "Data 1" ≠ "Data2"

Operation Output Register (R9000, Z0)

This instruction does not update the operation output register. So, the operation output register will not change after this instruction.

4.7.2 Signed Binary Comparison (≠) NEB (1 Byte Length: SUB 203) NEW (2 Bytes Length: SUB 204) NED (4 Bytes Length: SUB 205)

Using this instruction, you can know whether the "Data 1" does not equal to the "Data 2" or not.
The NEB instruction handles 1 byte length signed binary data.
The NEW instruction handles 2 bytes length signed binary data.
The NED instruction handles 4 bytes length signed binary data.

Format

Fig. 4.7.2 shows the ladder format and Table 4.7.2 shows the mnemonic format.

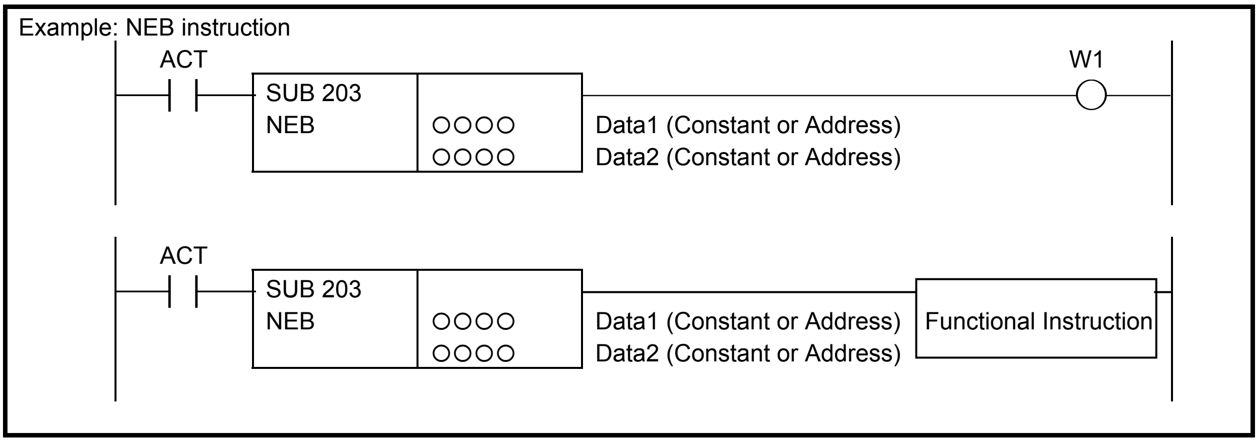


Fig. 4.7.2 Format of NEB, NEW and NED instructions

Table 4.7.2 Mnemonic of NEB, NEW and NED instructions

Mnemonic format

Step number	Instruction	Address No.	Bit No.	Remarks
1	RD	○○○○	.○	ACT
2	SUB	203 204 205		NEB instruction NEW instruction NED instruction
3	(PRM)	○○○○		Data1 (Constant or Address)
4	(PRM)	○○○○		Data2 (Constant or Address)
5	WRT	○○○○	.○	Result

Memory status of control condition

ST3	ST2	ST1	ST0
			ACT
			▼
			W1

Control condition

(a) Execution specification (ACT)
ACT=0: Do not execute the instruction. The W1 becomes 0.
ACT=1: Execute the instruction. The result is output to W1.

Parameters

(a) Data 1
(b) Data 2
You can specify the constant or any address. The valid data range is shown below.
NEB: -128 to 127
NEW: -32768 to 32767
NED: -2147483648 to 2147483647

Output (W1)

The result is output to W1.

W1=1: - ACT=1 and "Data 1" ≠ "Data 2"

W1=0: - ACT=0

- ACT=1 and "Data 1" = "Data2"

Operation Output Register (R9000, Z0)

This instruction does not update the operation output register. So, the operation output register will not change after this instruction.

4.7.3 Signed Binary Comparison (>) GTB (1 Byte Length: SUB 206) GTW (2 Bytes Length: SUB 207) GTD (4 Bytes Length: SUB 208)

Using this instruction, you can know whether the "Data 1" is greater than the "Data 2" or not.
The GTB instruction handles 1 byte length signed binary data.
The GTW instruction handles 2 bytes length signed binary data.
The GTD instruction handles 4 bytes length signed binary data.

Format

Fig. 4.7.3 shows the ladder format and Table 4.7.3 shows the mnemonic format.

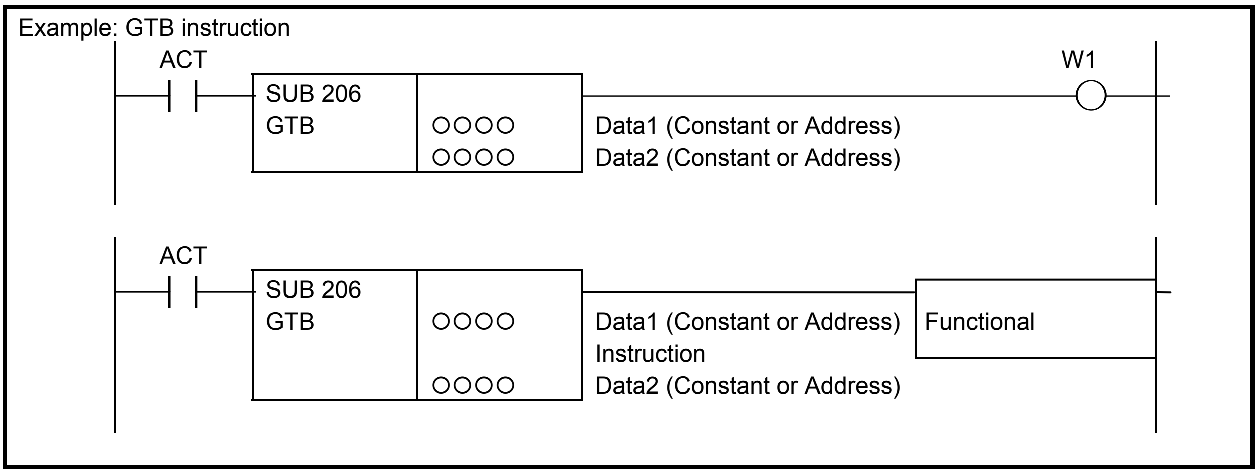


Fig. 4.7.3 Format of GTB, GTW and GTD instructions

Table 4.7.3 Mnemonic of GTB, GTW and GTD instructions

Mnemonic format

Step number	Instruction	Address No.	Bit No.	Remarks
1	RD	○○○○	.○	ACT
2	SUB	206 207 208		GTB instruction GTW instruction GTD instruction
3	(PRM)	○○○○		Data1 (Constant or Address)
4	(PRM)	○○○○		Data2 (Constant or Address)
5	WRT	○○○○	.○	Result

Memory status of control condition

ST3	ST2	ST1	ST0
			ACT
			▼
			W1

Control condition

(a) Execution specification (ACT)
ACT=0: Do not execute the instruction. The W1 becomes 0.
ACT=1: Execute the instruction. The result is output to W1.

Parameters

(a) Data 1
(b) Data 2
You can specify the constant or any address. The valid data range is shown below.
GTB: -128 to 127
GTW: -32768 to 32767
GTD: -2147483648 to 2147483647

Output (W1)

The result is output to W1.

W1=1: - ACT=1 and "Data 1" > "Data 2"

W1=0: - ACT=0

- ACT=1 and "Data 1" ≦ "Data2"

Operation Output Register (R9000, Z0)

This instruction does not update the operation output register. So, the operation output register will not change after this instruction.

4.7.4 Signed Binary Comparison (<) LTB (1 Byte Length: SUB 209) LTW (2 Bytes Length: SUB 210) LTD (4 Bytes Length: SUB 211)

Using this instruction, you can know whether the "Data 1" is smaller than the "Data 2" or not.
The LTB instruction handles 1 byte length signed binary data.
The LTW instruction handles 2 bytes length signed binary data.
The LTD instruction handles 4 bytes length signed binary data.

Format

Fig. 4.7.4 shows the ladder format and Table 4.7.4 shows the mnemonic format.

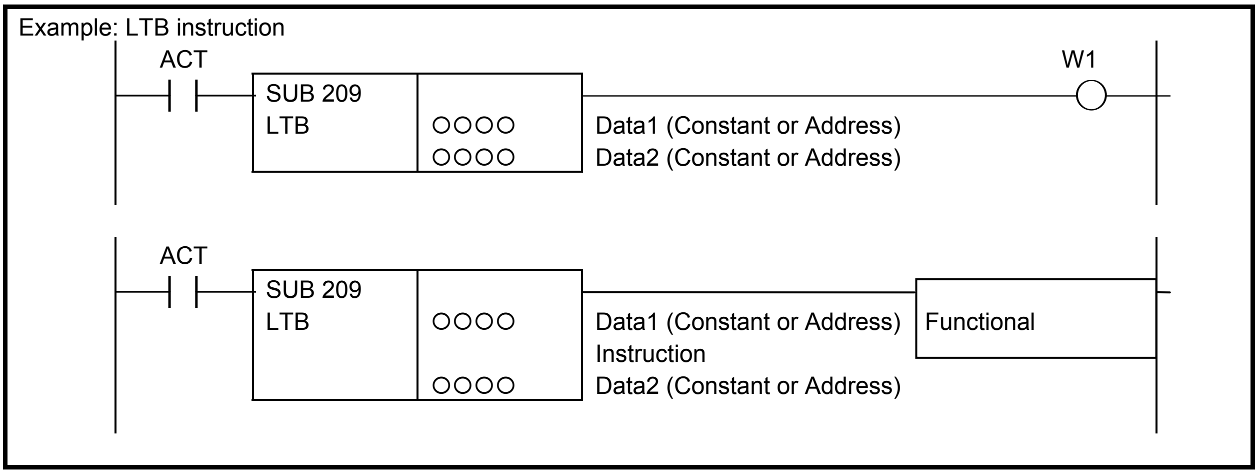


Fig. 4.7.4 Format of LTB, LTW and LTD instructions

Table 4.7.4 Mnemonic of LTB, LTW and LTD instructions

Mnemonic format					Memory status of control condition			
Step number	**Instruction**	**Address No.**	**Bit No.**	**Remarks**	**ST3**	**ST2**	**ST1**	**ST0**
1	RD	○○○○	.○	ACT				ACT
2	SUB	209 210 211		LTB instruction LTW instruction LTD instruction				
3	(PRM)	○○○○		Data1 (Constant or Address)				
4	(PRM)	○○○○		Data2 (Constant or Address)				▼
5	WRT	○○○○	.○	Result				W1

Control condition

(a) Execution specification (ACT)
ACT=0: Do not execute the instruction. The W1 becomes 0.
ACT=1: Execute the instruction. The result is output to W1.

Parameters

(a) Data 1
(b) Data 2
You can specify the constant or any address. The valid data range is shown below.
LTB: -128 to 127
LTW: -32768 to 32767
LTD: -2147483648 to 2147483647

Output (W1)

The result is output to W1.

W1=1: - ACT=1 and "Data 1" < "Data 2"

W1=0: - ACT=0

- ACT=1 and "Data 1" ≧ "Data2"

Operation Output Register (R9000, Z0)

This instruction does not update the operation output register. So, the operation output register will not change after this instruction.

4.7.5 Signed Binary Comparison (≥) GEB (1 Byte Length: SUB 212) GEW (2 Bytes Length: SUB 213) GED (4 Bytes Length: SUB 214)

Using this instruction, you can know whether the "Data 1" is equal or greater than the "Data 2" or not.
The GEB instruction handles 1 byte length signed binary data.
The GEW instruction handles 2 bytes length signed binary data.
The GED instruction handles 4 bytes length signed binary data.

Format

Fig. 4.7.5 shows the ladder format and Table 4.7.5 shows the mnemonic format.

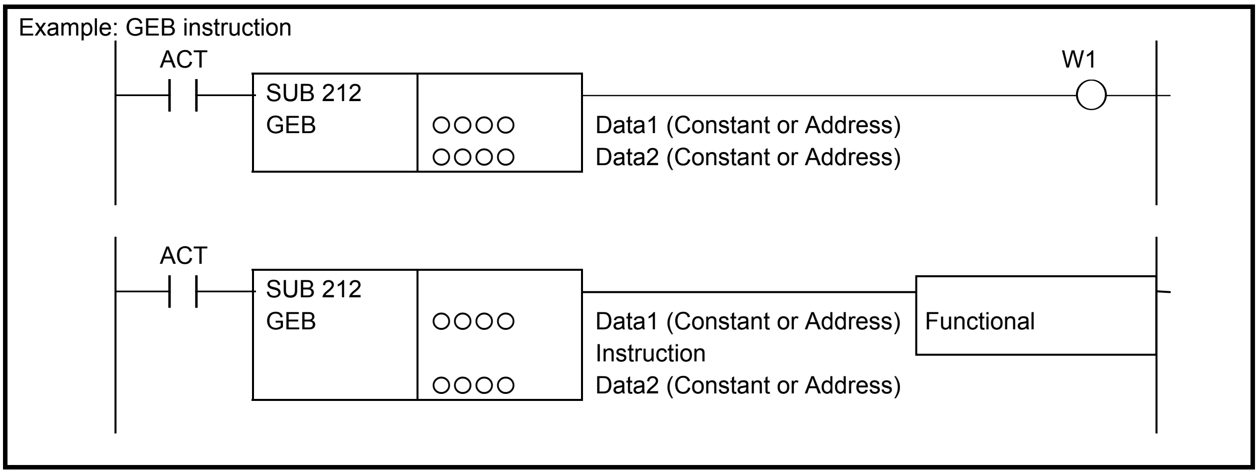


Fig. 4.7.5 Format of GEB, GEW and GED instructions

Table 4.7.5 Mnemonic of GEB, GEW and GED instructions

Mnemonic format					Memory status of control condition			
Step number	**Instruction**	**Address No.**	**Bit No.**	**Remarks**	**ST3**	**ST2**	**ST1**	**ST0**
1	RD	○○○○	.○	ACT				ACT
2	SUB	212 213 214		GEB instruction GEW instruction GED instruction				
3	(PRM)	○○○○		Data1 (Constant or Address)				
4	(PRM)	○○○○		Data2 (Constant or Address)				
5	WRT	○○○○	.○	Result				W1

Control condition

(a) Execution specification (ACT)
ACT=0: Do not execute the instruction. The W1 becomes 0.
ACT=1: Execute the instruction. The result is output to W1.

Parameters

(a) Data 1
(b) Data 2
You can specify the constant or any address. The valid data range is shown below.
GEB: -128 to 127
GEW: -32768 to 32767
GED: -2147483648 to 2147483647

Output (W1)

The result is output to W1.

W1=1: - ACT=1 and "Data 1" ≧ "Data 2"

W1=0: - ACT=0

- ACT=1 and "Data 1" < "Data2"

Operation Output Register (R9000, Z0)

This instruction does not update the operation output register. So, the operation output register will not change after this instruction.

4.7.6 Signed Binary Comparison (≤) LEB (1 Byte Length: SUB 215) LEW (2 Bytes Length: SUB 216) LED (4 Bytes Length: SUB 217)

Using this instruction, you can know whether the "Data 1" is equal or smaller than the "Data 2" or not.
The LEB instruction handles 1 byte length signed binary data.
The LEW instruction handles 2 bytes length signed binary data.
The LED instruction handles 4 bytes length signed binary data.

Format

Fig. 4.7.6 shows the ladder format and Table 4.7.6 shows the mnemonic format.

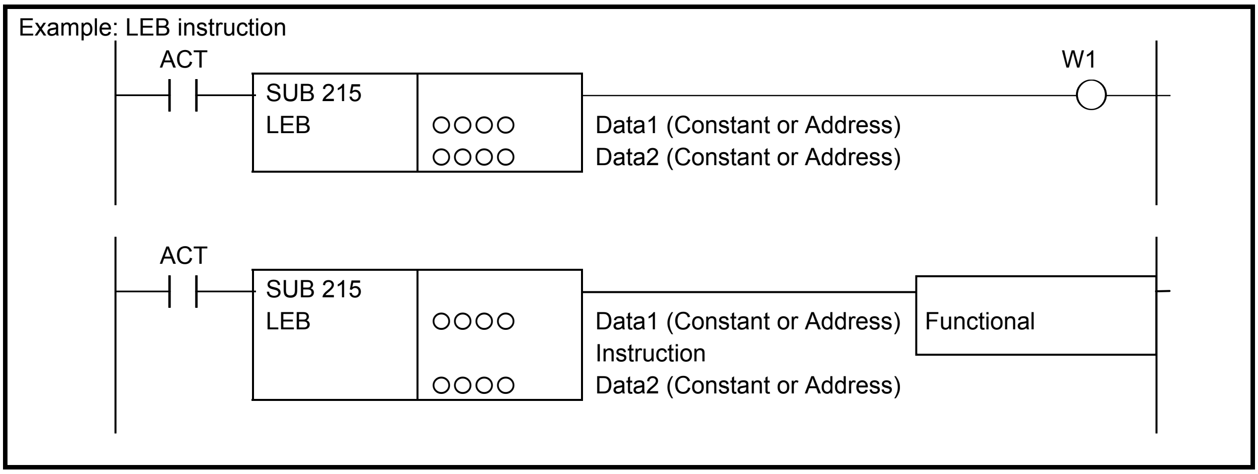


Fig. 4.7.6 Format of LEB, LEW and LED instructions

Table 4.7.6 Mnemonic of LEB, LEW and LED instructions

Mnemonic format					Memory status of control condition			
Step number	**Instruction**	**Address No.**	**Bit No.**	**Remarks**	**ST3**	**ST2**	**ST1**	**ST0**
1	RD	○○○○	.○	ACT				ACT
2	SUB	215 216 217		LEB instruction LEW instruction LED instruction				
3	(PRM)	○○○○		Data1 (Constant or Address)				
4	(PRM)	○○○○		Data2 (Constant or Address)				▼
5	WRT	○○○○	.○	Result				W1

Control condition

(a) Execution specification (ACT)
ACT=0: Do not execute the instruction. The W1 becomes 0.
ACT=1: Execute the instruction. The result is output to W1.

Parameters

(a) Data 1
(b) Data 2
You can specify the constant or any address. The valid data range is shown below.
LEB: -128 to 127
LEW: -32768 to 32767
LED: -2147483648 to 2147483647

Output (W1)

The result is output to W1.

W1=1: - ACT=1 and "Data 1" ≦ "Data 2"

W1=0: - ACT=0

- ACT=1 and "Data 1" > "Data2"

Operation Output Register (R9000, Z0)

This instruction does not update the operation output register. So, the operation output register will not change after this instruction.

4.7.7 Signed Binary Comparison (Range) RNGB (1 Byte Length: SUB 218) RNGW (2 Bytes Length: SUB 219) RNGD (4 Bytes Length: SUB 220)

This instruction is the range comparison function. When following data conditions, the output W1 becomes 1.

- "Data 1" ≦ "Input data" ≦ "Data 2" or
  "Data 2" ≦ "Input data" ≦ "Data 1"

The RNGB instruction handles 1 byte length signed binary data.
The RNGW instruction handles 2 bytes length signed binary data.
The RNGD instruction handles 4 bytes length signed binary data.

Format

Fig. 4.7.7 shows the ladder format and Table 4.7.7 shows the mnemonic format.

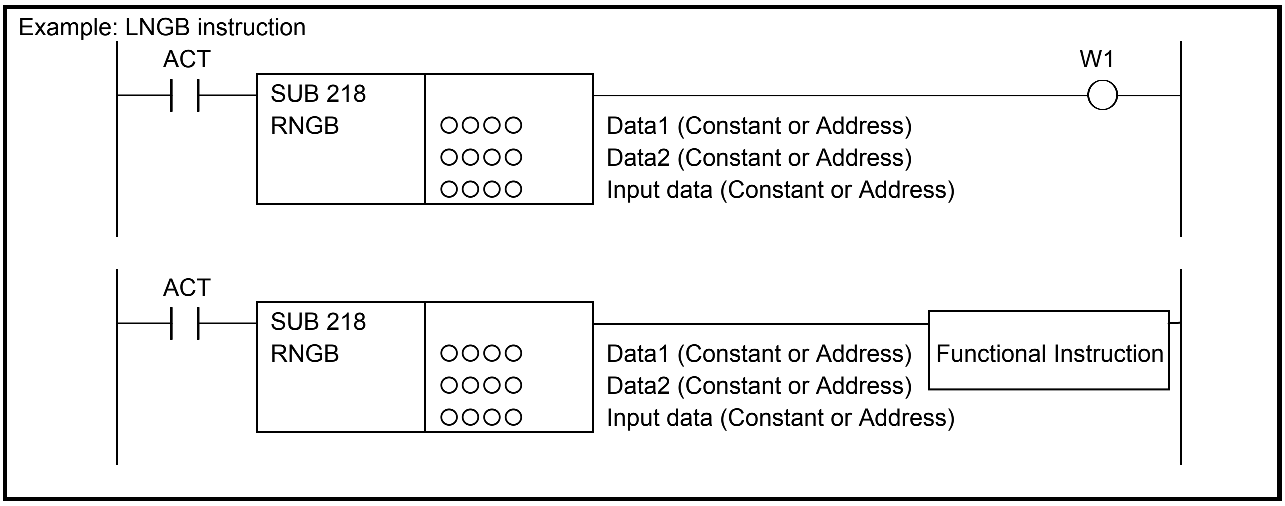


Fig. 4.7.7 Format of RNGB, RNGW and RNGD instructions

Table 4.7.7 Mnemonic of RNGB, RNGW and RNGD instructions

Mnemonic format					Memory status of control condition			
Step number	**Instruction**	**Address No.**	**Bit No.**	**Remarks**	**ST3**	**ST2**	**ST1**	**ST0**
1	RD	○○○○	.○	ACT				ACT
2	SUB	215 216 217		LEB instruction LEW instruction LED instruction				
3	(PRM)	○○○○		Data1 (Constant or Address)				
4	(PRM)	○○○○		Data2 (Constant or Address)				
5	(PRM)	○○○○		Input data (Constant or Address)				
6	WRT	○○○○	.○	Result				W1

Control condition

(a) Execution specification (ACT)
ACT=0: Do not execute the instruction. The W1 becomes 0.
ACT=1: Execute the instruction. The result is output to W1.

Parameters

(a) Data 1
(b) Data 2
(c) Input data
You can specify the constant or any address. The valid data range is shown below.
RNGB: -128 to 127
RNGW: -32768 to 32767
RNGD: -2147483648 to 2147483647

Output (W1)

The result is output to W1.

W1=1: - ACT=1 and "Data 1 ≦ Input data ≦ Data 2"
- ACT=1 and "Data 2 ≦ Input data ≦ Data 1"

W1=0: - ACT=0
- ACT=1 and except for above condition.

Operation Output Register (R9000, Z0)

This instruction does not update the operation output register. So, the operation output register will not change after this instruction.

4.7.8 COMPB (Comparison Between Binary Data: SUB 32)

This instruction compares 1, 2, and 4 byte binary data with one another. Results of comparison are set in the operation output register (R9000, Z0). Sufficient numbers of bytes are necessary in the memory to hold the input data and comparison data.

> **Note**
> To get detail comparison result for this instruction, it is necessary to program ladder diagram using operation output register. For getting comparison result easily, use above-mentioned binary comparison instructions.

Format

Fig. 4.7.8 shows the ladder format and Table 4.7.8 shows the mnemonic format.

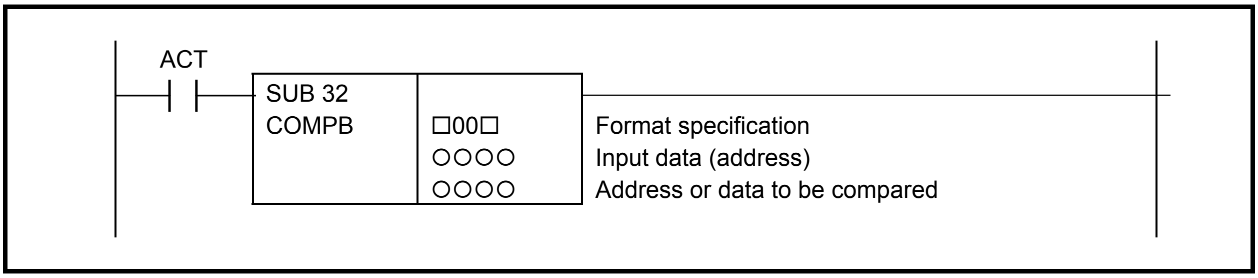


Fig. 4.7.8 Format of COMPB instruction

Table 4.7.8 Mnemonic of COMPB instruction

Mnemonic format

Step number	Instruction	Address No.	Bit No.	Remarks
1	RD	○○○○	.○	ACT
2	SUB	32		COMPB instruction
3	(PRM)	□00□		Format specification
4	(PRM)	○○○○		Input data (address)
5	(PRM)	○○○○		Address of data to be compared

Memory status of control condition

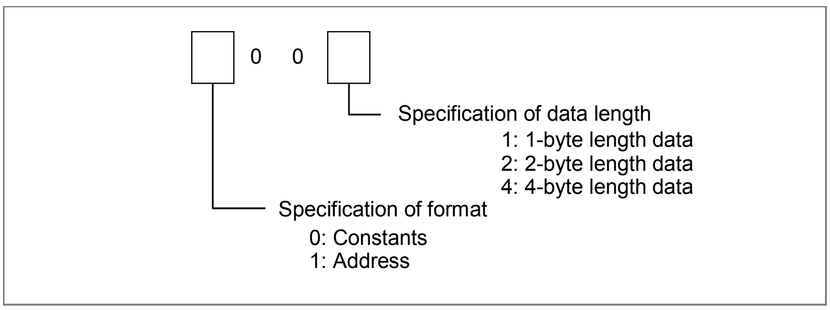
ST3	ST2	ST1	ST0
			ACT
			W1

Control condition

(a) Execution specification (ACT)
ACT = 0: Do not execute COMPB.
ACT = 1: Execute COMPB.

Parameters

(a) Format specification
Specify data length (1,2, or 4 bytes) and format for the input data ('constants data' or 'address data').

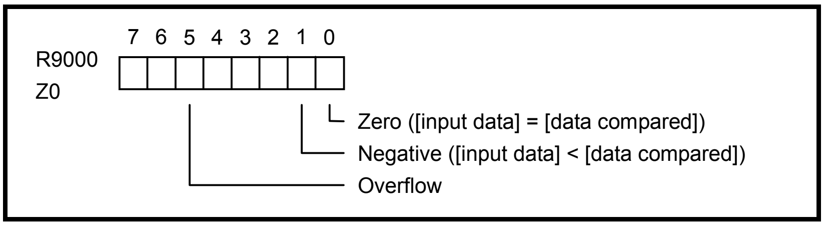


> ⚠ **CAUTION**
> Do not set an illegal value, that is not indicated above, into the "(a) Format specification".

(b) Input data (address)
Format for the input data is determined by the specification in (a).
(c) Address of data to be compared
Indicates the address in which the comparison data is stored.

Operation output register (R9000, Z0)

The data involved in the operation are set in this register. This register is set with data on operation. If register bit 1 is on, they indicate the following:



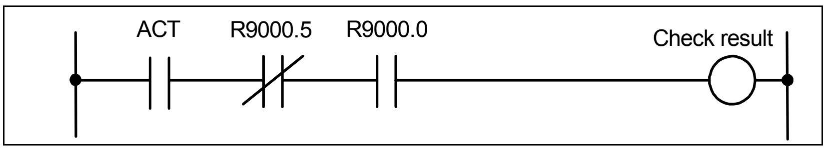
The following table shows the relationship among the [input data], [data compared], and operation output register.

	R9000.5 Z0.5	R9000.1 Z0.1	R9000.0 Z0.0
[Input data] = [data compared]	0	0	1
[Input data] > [data compared]	0	0	0
[Input data] < [data compared]	0	1	0
Overflow	1	0	0

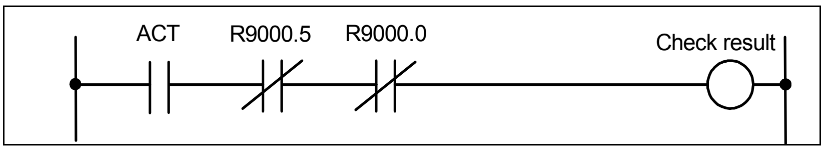
> **Note**
> Overflow would occur when difference between input data and data compared exceeds specified data lengths.

Programming examples for the operation output register
Programming examples of comparison between two positive values are shown bellow.

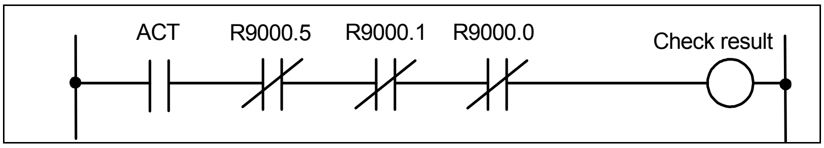
(1) When checking that [input data] = [data compared]



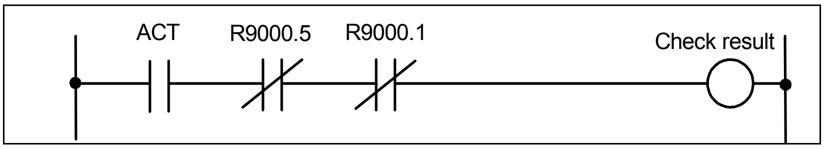
(2) When checking that [input data] ≠ [data compared]



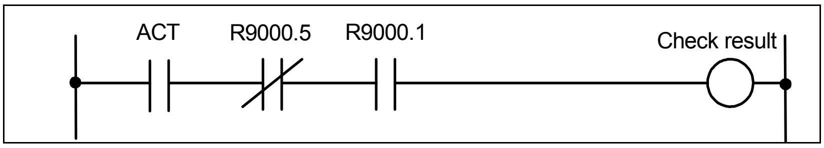
(3) When checking that [input data] > [data compared]



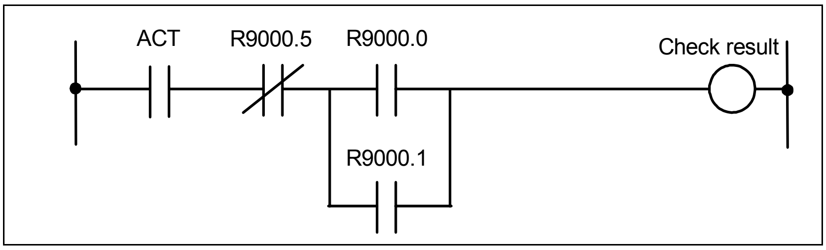
(4) When checking that [input data] ≧ [data compared]



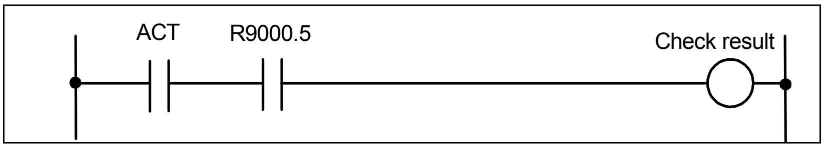
(5) When checking that [input data] < [data compared]



(6) When checking that [input data] ≦ [data compared]



(7) When checking for an overflow of the comparison operation



4.7.9 COMP (Comparison: SUB 15)

Compares input and comparison values. The value type in this instruction is BCD.

Format

Fig. 4.7.9 shows the ladder format and Table 4.7.9 shows the mnemonic format.

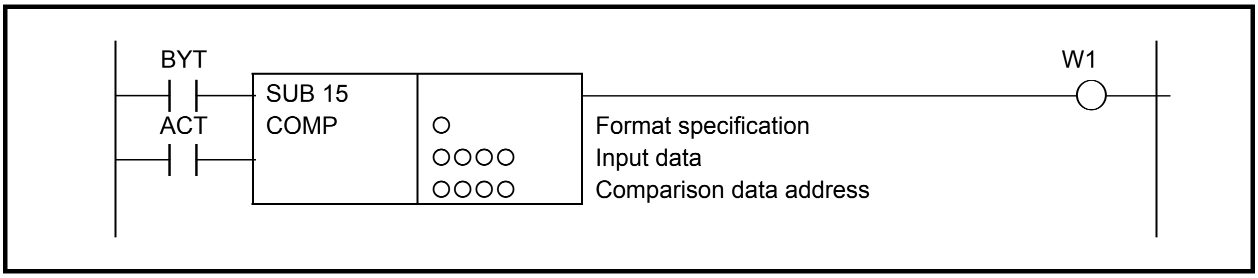


Fig. 4.7.9 Format of COMP instruction

Table 4.7.9 Mnemonic of COMP instruction

Mnemonic format					Memory status of control condition			
Step number	**Instruction**	**Address No.**	**Bit No.**	**Remarks**	**ST3**	**ST2**	**ST1**	**ST0**
1	RD	○○○○	.○	BYT				BYT
2	RD.STK	○○○○	.○	ACT			BYT	ACT
3	SUB	15		COMP instruction				
4	(PRM)	○		Format specification				
5	(PRM)	○○○○		Input data				
6	(PRM)	○○○○		Comparison data address				
7	WRT	○○○○	.○	Comparison result output				W1

Control conditions

(a) Specify the data size. (BYT)
BYT = 0: Process data (input value and comparison value) is BCD two digits long.
BYT = 1: Process data (input value and comparison value) is BCD four digits long.

(b) Execution specification (ACT)
ACT = 0: The COMP instruction is not executed. W1 does not alter.
ACT = 1: The COMP instruction is executed and the result is output to W1.

Parameters

(a) Format specification
0: Specify input data with a constant.
1: Specify input data with an address
Not specify input data directly, but specify an address storing input data.

> ⚠ **CAUTION**
> Do not set an illegal value, that is not indicated above, into the "(a) Format specification".

(b) Input data
The input data can be specified as either a constant or the address storing it. The selection is made by a parameter of format specification.

(c) Comparison data address
Specify the address storing the comparison data.

Comparison result output(W1)

W1 = 0: Input data > Comparison data

W1 = 1: Input data ≦Comparison data

4.7.10 COIN (Coincidence Check: SUB 16)

This instruction checks whether the input value and comparison value coincide.
The value type in this instruction is BCD.

Format

Fig. 4.7.10 shows the ladder format and Table 4.7.10 shows the mnemonic format.

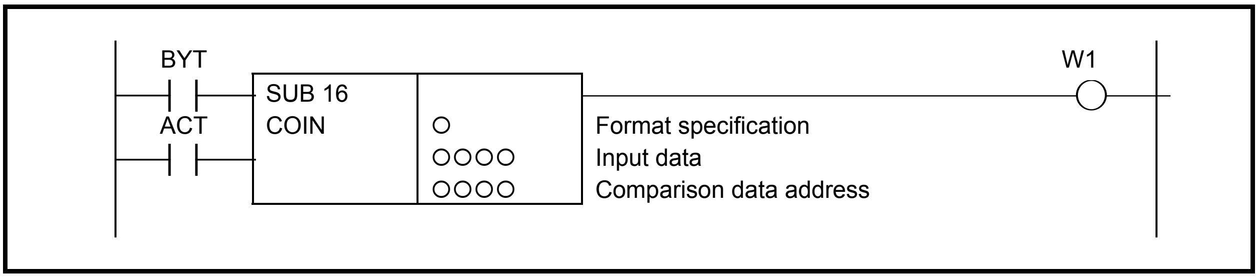


Fig. 4.7.10 Format of COIN instruction

Table 4.7.10 Mnemonic of COIN instruction

Mnemonic format					Memory status of control condition			
Step number	**Instruction**	**Address No.**	**Bit No.**	**Remarks**	**ST3**	**ST2**	**ST1**	**ST0**
1	RD	○○○○	.○	BYT				BYT
2	RD.STK	○○○○	.○	ACT			BYT	ACT
3	SUB	16		COIN instruction				
4	(PRM)	○		Format specification				
5	(PRM)	○○○○		Input data				
6	(PRM)	○○○○		Comparison data address				▼
7	WRT	○○○○	.○	Comparison result output			▼	W1

Control conditions

(a) Specify the data size.
  BYT = 0: Process data (input value, and comparison values).
  Each BCD is two digits long.
  BYT = 1: Each BCD four digits long.

(b) Execution specification
  ACT = 0: The COIN instruction is not executed. W1 does not change.
  ACT = 1: The COIN instruction is executed and the result is output to W1.

Parameters

(a) Format specification
  0: Specifies input data as a constant.
  1: Specifies input data as an address.

> ⚠ **CAUTION**
> Do not set an illegal value, that is not indicated above, into the "(a) Format specification".

(b) Input data
  The input data can be specified as either a constant or an address storing it. The selection is made by a parameter of format designation.

(c) Comparison data address
  Specify the address storing the comparison data.

Comparison result output (W1)

W1 = 0: Input data ≠ Comparison data
W1 = 1: Input data = Comparison data

4.8 BIT OPERATION

The following types of bit operation instruction are available. Use any of these instructions as appropriate for your purpose.

	Instruction name	Sub number	Processing
1	DIFU	57	Rising edge detection
2	DIFD	58	Falling edge detection
3	EOR	59	Exclusive OR
4	AND	60	Logical AND
5	OR	61	Logical OR
6	NOT	62	Logical NOT
7	PARI	11	Parity check
8	SFT	33	Shift register
9	EORB	265	Exclusive OR (1 byte length)
10	EORW	266	Exclusive OR (2 bytes length)
11	EORD	267	Exclusive OR (4 bytes length)
12	ANDB	268	Logical AND (1 byte length)
13	ANDW	269	Logical AND (2 bytes length)
14	ANDD	270	Logical AND (4 bytes length)
15	ORB	271	Logical OR (1 byte length)
16	ORW	272	Logical OR (2 bytes length)
17	ORD	273	Logical OR (4 bytes length)
18	NOTB	274	Logical NOT (1 byte length)
19	NOTW	275	Logical NOT (2 bytes length)
20	NOTD	276	Logical NOT (4 bytes length)
21	SHLB	277	Bit shift left (1 byte length)
22	SHLW	278	Bit shift left (2 bytes length)
23	SHLD	279	Bit shift left (4 bytes length)
24	SHLN	280	Bit shift left (Arbitrary bytes length)
25	SHRB	281	Bit shift right (1 byte length)
26	SHRW	282	Bit shift right (2 bytes length)
27	SHRD	283	Bit shift right (4 bytes length)
28	SHRN	284	Bit shift right (Arbitrary bytes length)
29	ROLB	285	Bit rotation left (1 byte length)
30	ROLW	286	Bit rotation left (2 bytes length)
31	ROLD	287	Bit rotation left (4 bytes length)
32	ROLN	288	Bit rotation left (Arbitrary bytes length)
33	RORB	289	Bit rotation right (1 byte length)
34	RORW	290	Bit rotation right (2 bytes length)
35	RORD	291	Bit rotation right (4 bytes length)
36	RORN	292	Bit rotation right (Arbitrary bytes length)
37	BSETB	293	Bit set (1 byte length)
38	BSETW	294	Bit set (2 bytes length)
39	BSETD	295	Bit set (4 bytes length)
40	BSETN	296	Bit set (Arbitrary bytes length)
41	BRSTB	297	Bit reset (1 byte length)
42	BRSTW	298	Bit reset (2 bytes length)
43	BRSTD	299	Bit reset (4 bytes length)
44	BRSTN	300	Bit reset (Arbitrary bytes length)
45	BTSTB	301	Bit test (1 byte length)
46	BTSTW	302	Bit test (2 bytes length)
47	BTSTD	303	Bit test (4 bytes length)
48	BTSTN	304	Bit test (Arbitrary bytes length)

	Instruction name	Sub number	Processing
49	BPOSB	305	Bit search (1 byte length)
50	BPOSW	306	Bit search (2 bytes length)
51	BPOSD	307	Bit search (4 bytes length)
52	BPOSN	308	Bit search (Arbitrary bytes length)
53	BCNTB	309	Bit count (1 byte length)
54	BCNTW	310	Bit count (2 bytes length)
55	BCNTD	311	Bit count (4 bytes length)
56	BCNTN	312	Bit count (Arbitrary bytes length)

4.8.1 DIFU (Rising Edge Detection: SUB 57)

The DIFU instruction sets the output signal to 1 for one scanning cycle on a rising edge of the input signal.

Format

The followings are the ladder format and the mnemonic format.

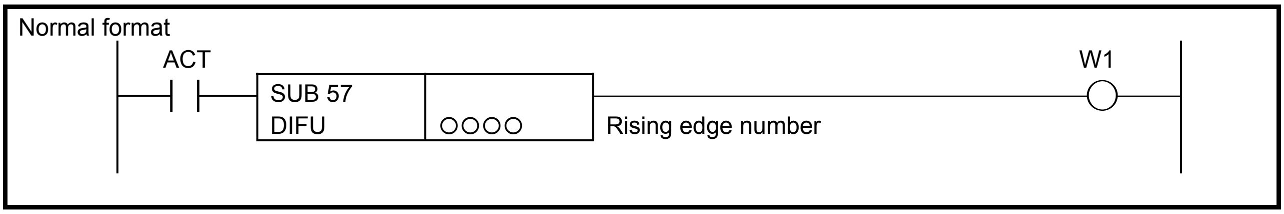


Fig. 4.8.1 (a) Format of DIFU instruction (Normal format)

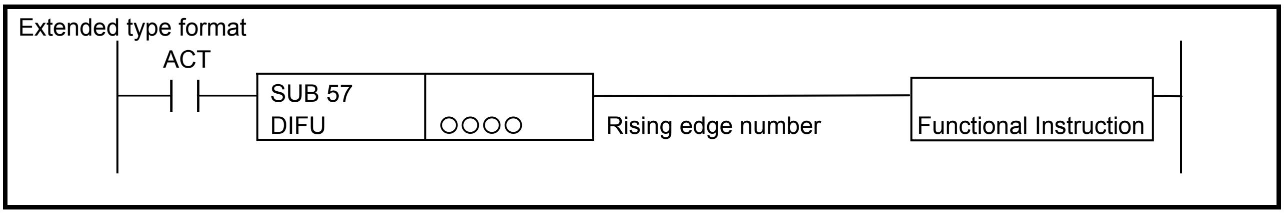


Fig. 4.8.1 (b) Format of DIFU instruction (Extended type format)

Table 4.8.1 Mnemonic of DIFU instruction (Normal format)

Mnemonic format					Memory status of control condition			
Step number	Instruction	Address No.	Bit No.	Remarks	ST3	ST2	ST1	ST0
1	RD	○○○○	.○	ACT				ACT
2	SUB	57		DIFU instruction				↓
3	(PRM)	○○○○		Rising edge number				↓
4	WRT	○○○○	.○	W1				W1

Control conditions

(a) Input signal (ACT)
On a rising edge (0 → 1) of the input signal, the output signal is set to 1.

Detection result

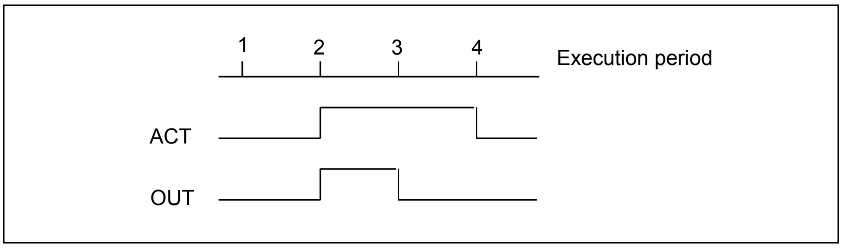
(a) Output signal (W1)
The output signal level remains at 1 for one scanning cycle of the ladder level where this functional instruction is operating. Another functional instruction can be connected instead of W1.

Parameters

	1st to 5th path PMC				Dual check safety PMC
	PMC Memory-A	PMC Memory-B	PMC Memory-C	PMC Memory-D	
Rising edge number	1 to 256	1 to 1000	1 to 2000	1 to 3000	1 to 256

> ⚠ **WARNING**
> If the same number is used for another DIFU instruction or a DIFD instruction (described later) in one Ladder diagram, operation is not guaranteed.

Operation



4.8.2 DIFD (Falling Edge Detection: SUB 58)

The DIFD instruction set the output signal to 1 for one scanning period on a falling edge of the input signal.

Format

The followings are the ladder format and the mnemonic format.

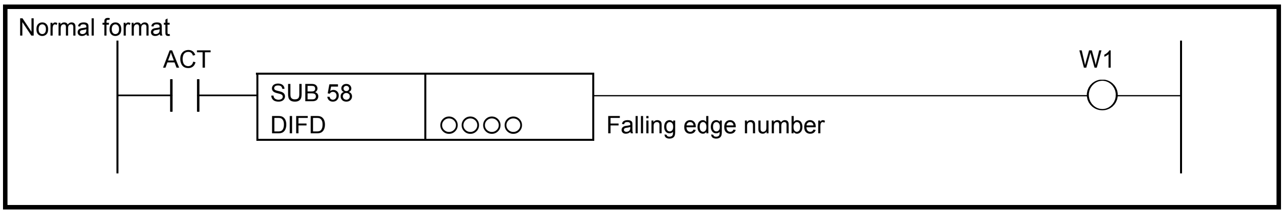


Fig. 4.8.2 (a) Format of DIFD instruction (Normal format)

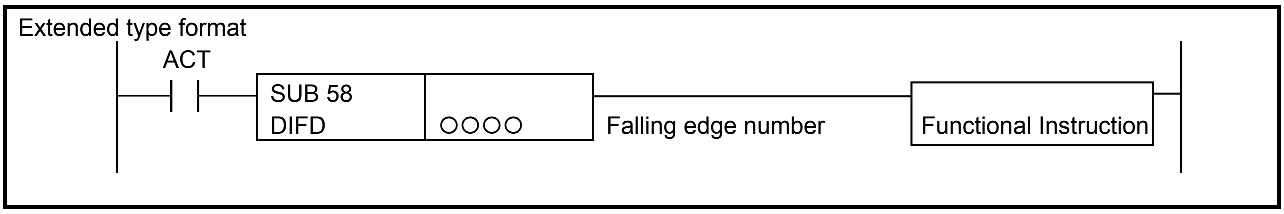


Fig. 4.8.2 (b) Format of DIFD instruction (Extended type format)

Table 4.8.2 Mnemonic of DIFD instruction

Mnemonic format					Memory status of control condition			
Step number	**Instruction**	**Address No.**	**Bit No.**	**Remarks**	**ST3**	**ST2**	**ST1**	**ST0**
1	RD	○○○○	.○	ACT				ACT
2	SUB	58		DIFD instruction				↓
3	(PRM)	○○○○		Falling edge number				↓
4	WRT	○○○○	.○	W1				W1

Control conditions

(a) Input signal (ACT)
On a falling edge (1→0) of the input signal, the output signal is set to 1.

Detection result

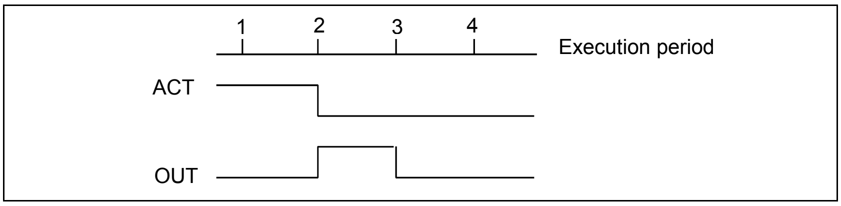
(a) Output signal (W1)
The output signal level remains at 1 for one scanning period of the ladder level where this functional instruction is operating. Another functional instruction can be connected instead of W1.

Parameters

	1st to 5th path PMC				Dual check safety PMC
	PMC Memory-A	**PMC Memory-B**	**PMC Memory-C**	**PMC Memory-D**	
Falling edge number	1 to 256	1 to 1000	1 to 2000	1 to 3000	1 to 256

> ⚠ **WARNING**
> If the same number is used for another DIFD instruction or a DIFU instruction (described above) in one ladder diagram, operation is not guaranteed.

Operation



4.8.3 EOR (Exclusive OR: SUB 59)

The EOR instruction exclusive-ORs the contents of address A with a constant (or the contents of address B), and stores the result at address C. The value type in this instruction is binary.

Format

Fig. 4.8.3 shows the ladder format and Table 4.8.3 shows the mnemonic format.

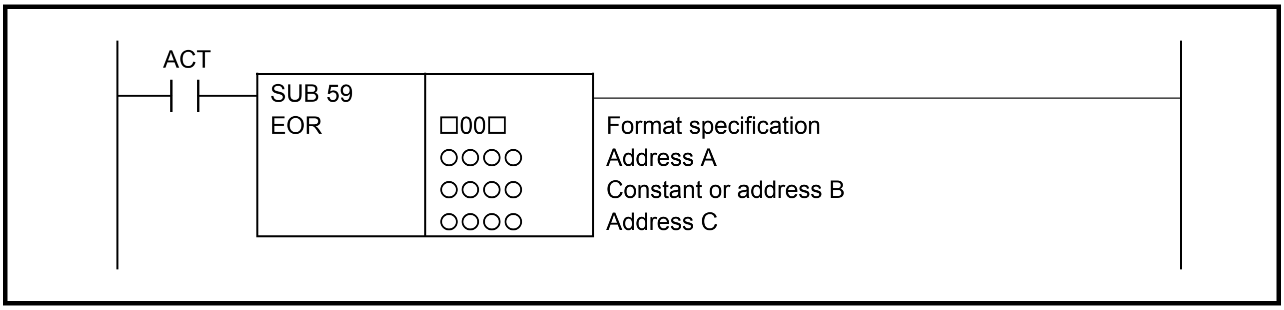


Fig. 4.8.3 Format of EOR instruction

Table 4.8.3 Mnemonic of EOR instruction

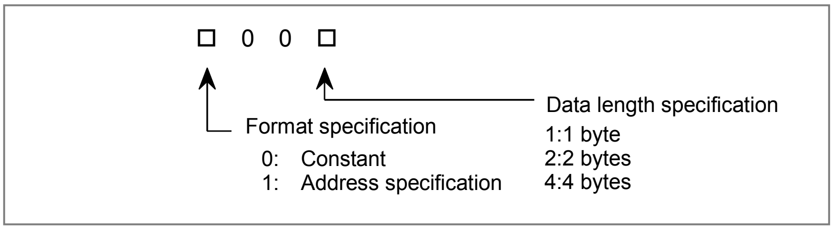
Step number	Instruction	Address No.	Bit No.	Remarks	ST3	ST2	ST1	ST0
	Mnemonic format				**Memory status of control condition**			
1	RD	○○○○	.○	ACT				ACT
2	SUB	59		EOR instruction				
3	(PRM)	□00□		Format specification				
4	(PRM)	○○○○		Address A				
5	(PRM)	○○○○		Constant or address B				
6	(PRM)	○○○○		Address C				

Control conditions

(a) Input signal (ACT)
ACT=0: The EOR instruction is not executed.
ACT=1: The EOR instruction is executed.

Parameters

(a) Format specification
Specify a data length (1, 2, or 4 bytes), and an input data format (constant or address specification).



> ⚠ **CAUTION**
> Do not set an illegal value, that is not indicated above, into the "(a) Format specification".

(b) Address A
Address stored input data to be exclusive-ORed. The data length is specified in the format specification.

(c) Constant or address B
Constant data or address stored input data to be exclusive-ORed with data of the item (b). When address specification is selected in the format specification, the data would be treated as specified data length.

(d) Address C
Address used to store the result of an exclusive OR operation. The result of the exclusive OR operation is output with the length specified in the format specification.

Operation

When address A and address B hold the following data:

Address A	1	1	1	0	0	0	1	1
Address B	0	1	0	1	0	1	0	1

The result of the exclusive OR operation is as follows:

Address C	1	0	1	1	0	1	1	0

4.8.4 AND (Logical AND: SUB 60)

The AND instruction ANDs the contents of address A with a constant (or the contents of address B), and stores the result at address C. The value type in this instruction is binary.

Format

Fig. 4.8.4 shows the ladder format and Table 4.8.4 shows the mnemonic format.

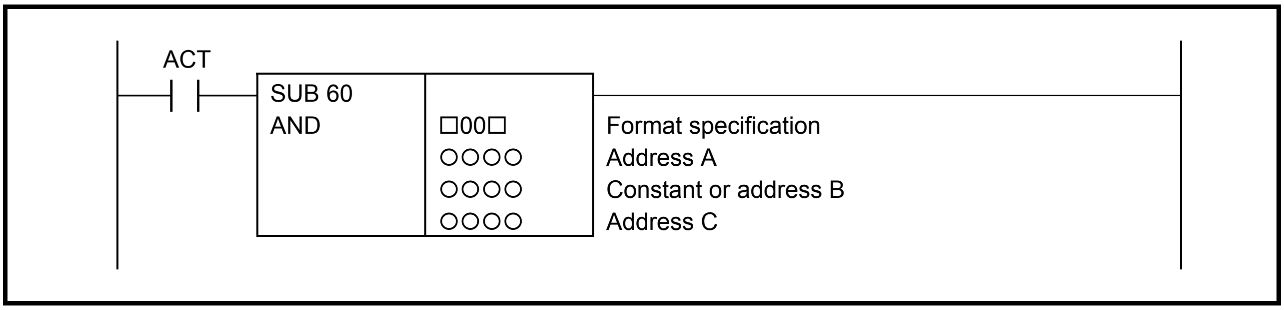


Fig. 4.8.4 Format of AND instruction

Table 4.8.4 Mnemonic of AND instruction

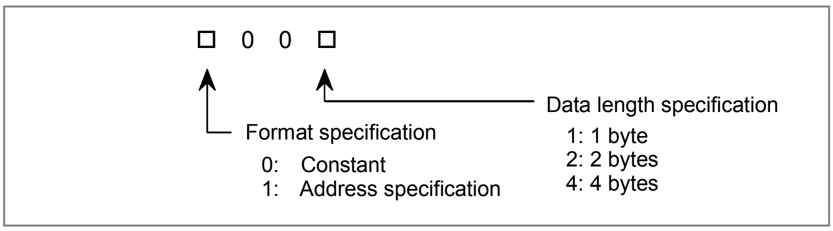
Step number	Instruction	Address No.	Bit No.	Remarks	ST3	ST2	ST1	ST0
	Mnemonic format				**Memory status of control condition**			
1	RD	○○○○	.○	ACT				ACT
2	SUB	60		AND instruction				
3	(PRM)	□00□		Format specification				
4	(PRM)	○○○○		Address A				
5	(PRM)	○○○○		Constant or address B				
6	(PRM)	○○○○		Address C				

Control conditions

(a) Input signal (ACT)
ACT=0: The AND instruction is not executed.
ACT=1: The AND instruction is executed.

Parameters

(a) Format specification
Specify a data length (1, 2, or 4 bytes), and an input data format (constant or address specification).



> ⚠ **CAUTION**
> Do not set an illegal value, that is not indicated above, into the "(a) Format specification".

(b) Address A
Address stored input data to be ANDed. The data length is specified in the format specification.

(c) Constant or address B
Constant data or address stored input data to be ANDed with. When address specification is selected in the format specification, the data would be treated as specified data length.

(d) Address C
Address used to store the result of an AND operation. The result of the AND operation is output with the length specified in the format specification.

Operation

When address A and address B hold the following data:

Address A	1	1	1	0	0	0	1	1
Address B	0	1	0	1	0	1	0	1

The result of the AND operation is as follows:

Address C	0	1	0	0	0	0	0	1

4.8.5 OR (Logical OR: SUB 61)

The OR instruction ORs the contents of address A with a constant (or the contents of address B), and stores the result at address C. The value type in this instruction is binary.

Format

Fig. 4.8.5 shows the ladder format and Table 4.8.5 shows the mnemonic format.

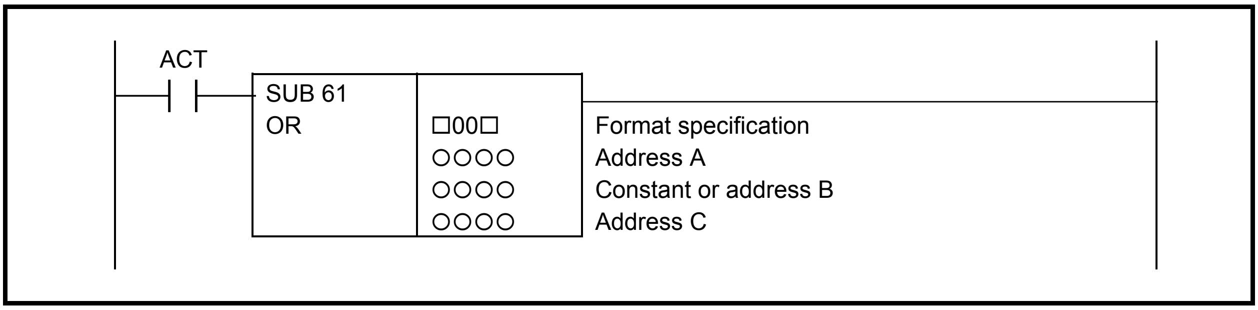


Fig. 4.8.5 Format of OR instruction

Table 4.8.5 Mnemonic of OR instruction

Mnemonic format / **Memory status of control condition**

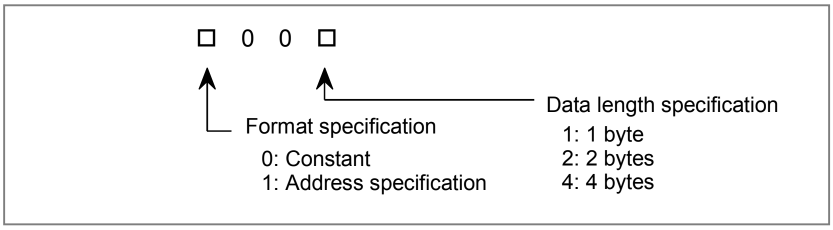
Step number	Instruction	Address No.	Bit No.	Remarks	ST3	ST2	ST1	ST0
1	RD	○○○○	.○	ACT				ACT
2	SUB	61		OR instruction				
3	(PRM)	□00□		Format specification				
4	(PRM)	○○○○		Address A				
5	(PRM)	○○○○		Constant or address B				
6	(PRM)	○○○○		Address C				

Control conditions

(a) Input signal (ACT)
ACT=0: The OR instruction is not executed.
ACT=1: The OR instruction is executed.

Parameters

(a) Format specification
Specify a data length (1, 2, or 4 bytes), and an input data format (constant or address specification).



> ⚠ **CAUTION**
> Do not set an illegal value, that is not indicated above, into the "(a) Format specification".

(b) Address A
Address stored input data to be ORed. The data length is specified in the format specification.

(c) Constant or address B
Input data to be ORed with. When address specification is selected in the format specification, the data would be treated as specified data length.

(d) Address C
Address used to store the result of an OR operation. The result is output with the length specified in the format specification.

Operation

When address A and address B hold the following data:

Address A	1	1	1	0	0	0	1	1
Address B	0	1	0	1	0	1	0	1

The result of the OR operation is as follows:

Address C	1	1	1	1	0	1	1	1

4.8.6 NOT (Logical NOT: SUB 62)

The NOT instruction inverts each bit of the contents of address A, and stores the result at address B.

Format

Fig. 4.8.6 shows the ladder format and Table 4.8.6 shows the mnemonic format.

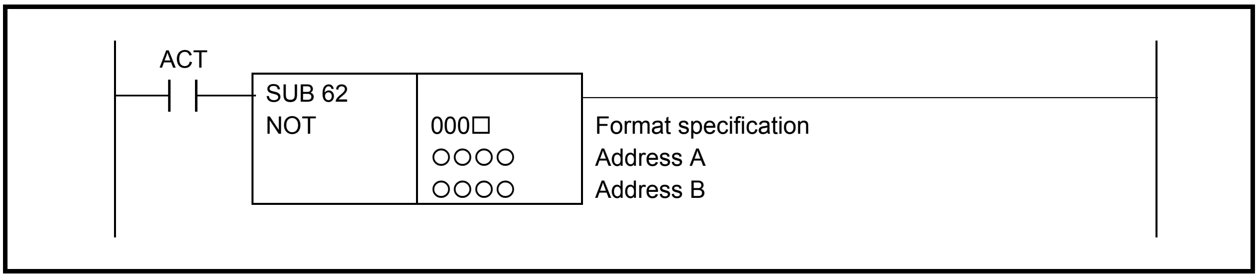


Fig. 4.8.6 Format of NOT instruction

Table 4.8.6 Mnemonic of NOT instruction

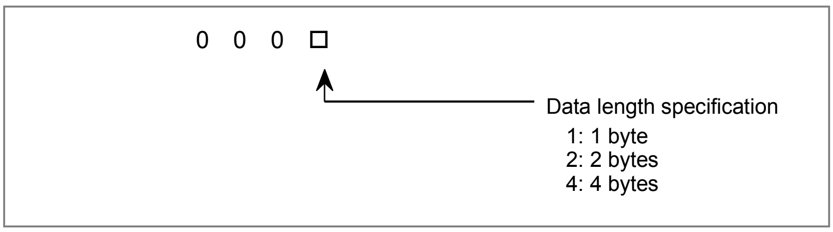
Mnemonic format					Memory status of control condition			
Step number	**Instruction**	**Address No.**	**Bit No.**	**Remarks**	**ST3**	**ST2**	**ST1**	**ST0**
1	RD	○○○○	.○	ACT				ACT
2	SUB	62		NOT instruction				↓
3	(PRM)	000□		Format specification				↓
4	(PRM)	○○○○		Address A				↓
5	(PRM)	○○○○		Address C				↓

Control conditions

(a) Input signal (ACT)
ACT=0: The NOT instruction is not executed.
ACT=1: The NOT instruction is executed.

Parameters

(a) Format specification
Specify a data length (1, 2, or 4 bytes).



⚠ CAUTION
Do not set an illegal value, that is not indicated above, into the "(a) Format specification".

(b) Address A
Address stored input data to be inverted bit by bit. The data length is specified in the format specification.

(c) Address B
Address used to output the result of a NOT operation. The result length of the NOT operation is output with the length specified in the format specification.

Operation

When address A holds the following data:

Address A	1	1	1	0	0	0	1	1

The result of the NOT operation is as follows:

Address B	0	0	0	1	1	1	0	0

4.8.7 PARI (Parity Check: SUB 11)

This instruction checks the parity of code signals, and outputs an error if an abnormality is detected. You can specify either an even- or odd-parity check. Only 1 byte (eight bits) of data can be checked.

Format

Fig. 4.8.7 (a) shows the ladder format and Table 4.8.7 shows the mnemonic format.

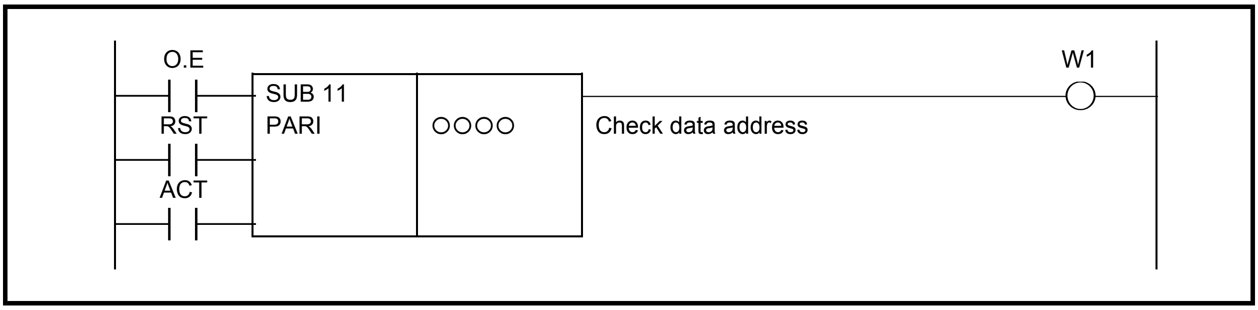


Fig. 4.8.7 (a) Format of PARI instruction

Table 4.8.7 Mnemonic of PARI instruction

Mnemonic format

Step number	Instruction	Address No.	Bit No.	Remarks
1	RD	○○○○	.○	O.E
2	RD.STK	○○○○	.○	RST
3	RD.STK	○○○○	.○	ACT
4	SUB	11		PARI instruction
5	(PRM)	○○○○		Check data address
6	WRT	○○○○	.○	Error output

Memory status of control condition

ST3	ST2	ST1	ST0
			O.E
		O.E	RST
	O.E	RST	ACT
			W1

Control conditions

(a) Specify even or odd. (O.E)
O.E=0: Even-parity check
O.E=1: Odd-parity check

(b) Reset (RST)
RST=0:
Disables reset.
RST=1:
Sets error output W1 to 0. That is, when a parity error occurs, setting RST to 1 results in resetting.

(c) Execution command (ACT)
ACT=0: Parity checks are not performed. W1 does not alter.
ACT=1: Executes the PARI instruction, performing a parity check.

Error output (W1)

If the results of executing the PARI instruction is abnormal, W1=1 and an error is posted. The W1 address can be determined arbitrarily.

> ⚠ **CAUTION**
> Two or more coils, WRT, WRT.NOT, SET or RST, that follow this instruction are prohibited. You have to place a single coil instruction as the output of this instruction.

Example of using the PARI instruction

Fig. 4.8.7 (b) shows odd-parity checking of a code signal entered at address X036.

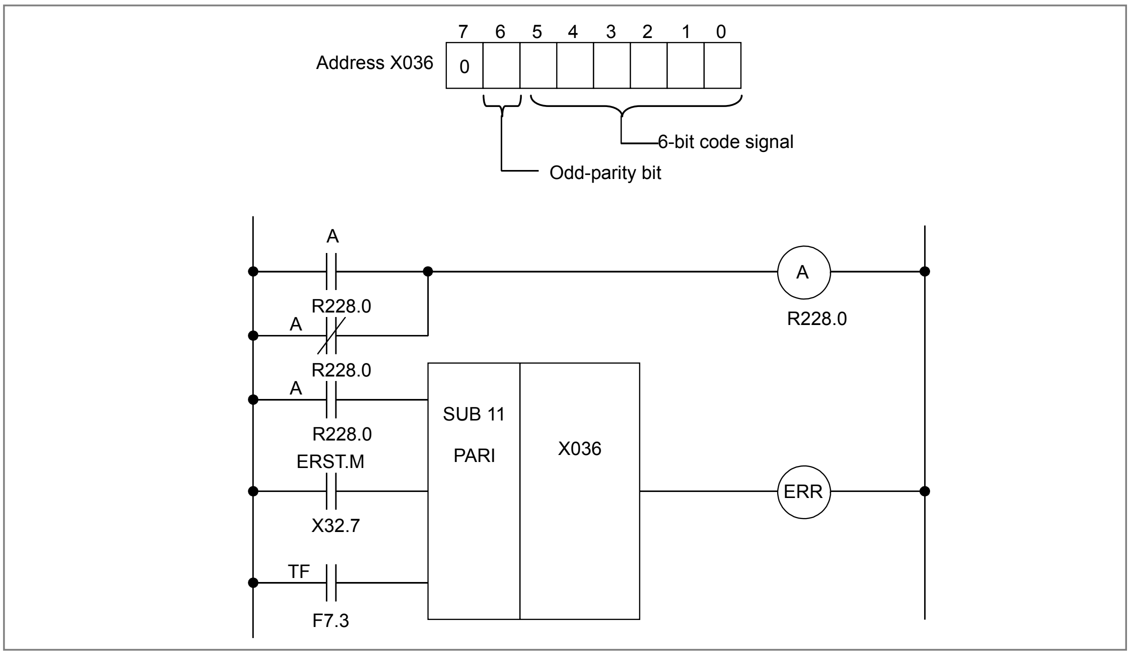


Fig. 4.8.7 (b) Ladder diagram for the PARI instruction

> ⚠ **NOTE**
> For bits 0 to 7, bits other than those for the parity check must be 0.

4.8.8 SFT (Shift Register: SUB 33)

This instruction shifts 2 bytes (16-bit) data by a bit to the left or right. Note that W1=1 when data "1" is shifted from the left extremity (bit 15) in left shift or from the right extremity (bit 0) in right shift.

Format

Fig. 4.8.8 shows the ladder format and Table 4.8.8 shows the mnemonic format.

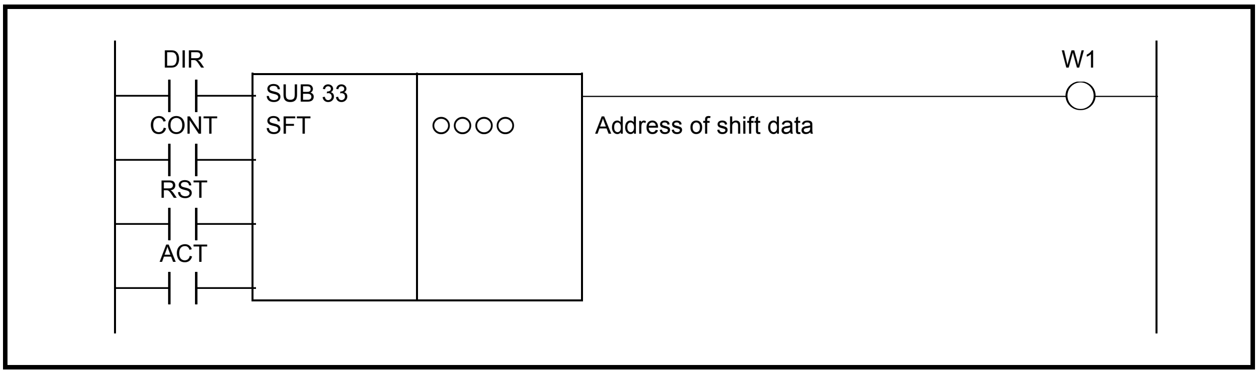


Fig. 4.8.8 Format of SFT instruction

Table 4.8.8 Mnemonic of SFT instruction

Mnemonic format

Step number	Instruction	Address No.	Bit No.	Remarks
1	RD	○○○○	.○	DIR
2	RD.STK	○○○○	.○	CONT
3	RD.STK	○○○○	.○	RST
4	RD.STK	○○○○	.○	ACT
5	SUB	33		SFT instruction
6	(PRM)	○○○○		Address of shift data
7	WRT	○○○○	.○	Shifted-out output

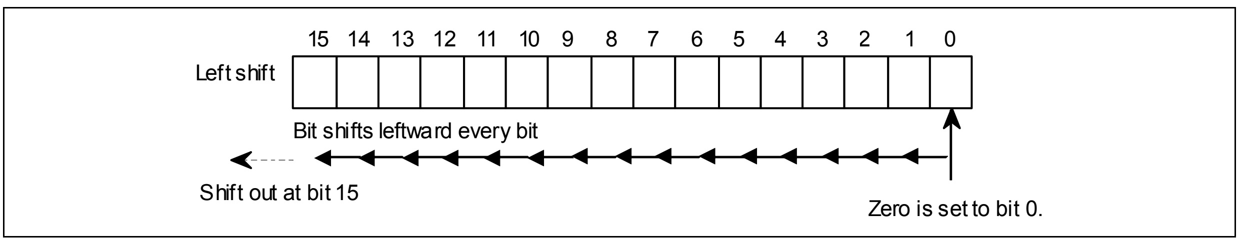
Memory status of control condition

ST3	ST2	ST1	ST0
			DIR
		DIR	CONT
	DIR	CONT	RST
DIR	CONT	RST	ACT
			W1

Control conditions

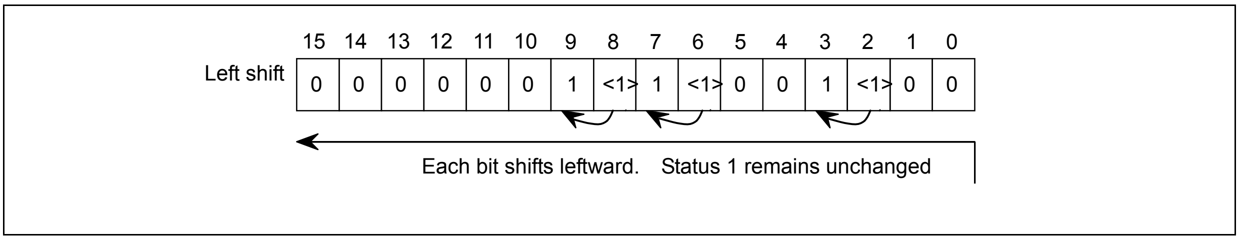
(a) Shift direction specification (DIR)]
DIR=0: Left shift
DIR=1: Right shift

(b) Condition specification (CONT)
CONT=0:
On "1" bit shifts by one bit in the specified direction.
The condition of an adjacent bit (either right or left adjacent bit according to the specification of shift direction DIR) is set to the original bit position of the on "1" bit.
Also, "0" is set to bit 0 after shifting in the left direction or set to hit 15 after shifting in the right direction.



CONT=1:

Shift is the same as above, but 1s are set to shifted bits.



(c) Reset (RST)

The shifted out data (W1=1) is reset (W1=0).

RST=0: W1 is not reset.

RST=1: W1 is reset (W1=0).

(d) Actuation signal (ACT)

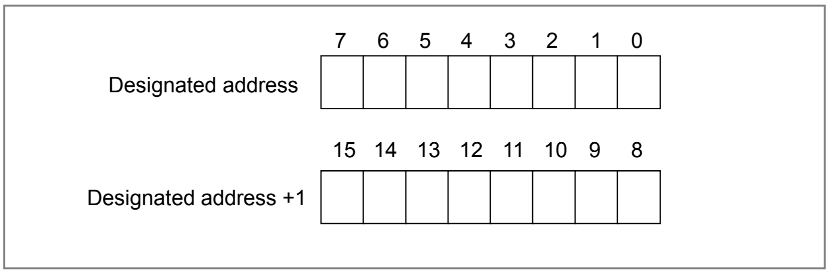
Shift processing is done when ACT=1. For shifting one bit only, execute an instruction when ACT=1, and then, set ACT to 0 (ACT=0).

Parameters

(a) Shift data addresses

Sets shift data addresses. These designated addresses require a continuous 2 bytes memory for shift data.

Bit numbers are represented by bit 0 to 15 as shown below. When addresses are designated for programming, an address number is attached every 8 bits, and the designable bit numbers are 0 to 7.



Shifted out (W1)

W1=0: "0" was shifted out for the shift operation.

W1=1: "1" was shifted out for the shift operation.

> ⚠ **CAUTION**
> Two or more coils, WRT, WRT.NOT, SET or RST, that follow this instruction are prohibited. You have to place a single coil instruction as the output of this instruction.

4.8.9 EORB (Exclusive OR (1 Byte Length) : SUB 265) EORW (Exclusive OR (2 Bytes Length) : SUB 266) EORD (Exclusive OR (4 Bytes Length) : SUB 267)

The Exclusive OR instruction exclusive-ORs "Data A" with "Data B", and outputs the result to "Address C".
In "Data A" and "Data B", a constant or a PMC memory address for storing data can be specified.
As indicated below, three types of Exclusive OR instructions are available according to the type of data to be operated. In each instruction, "Data A", "Data B", and the data at "Address C" are of the same data type.

Table4.8.9 (a) Kinds of Exclusive OR instruction

	Instruction name	SUB No.	Data type
1	EORB	265	1 byte length
2	EORW	266	2 bytes length
3	EORD	267	4 bytes length

Format

The followings are the ladder format and the mnemonic format.

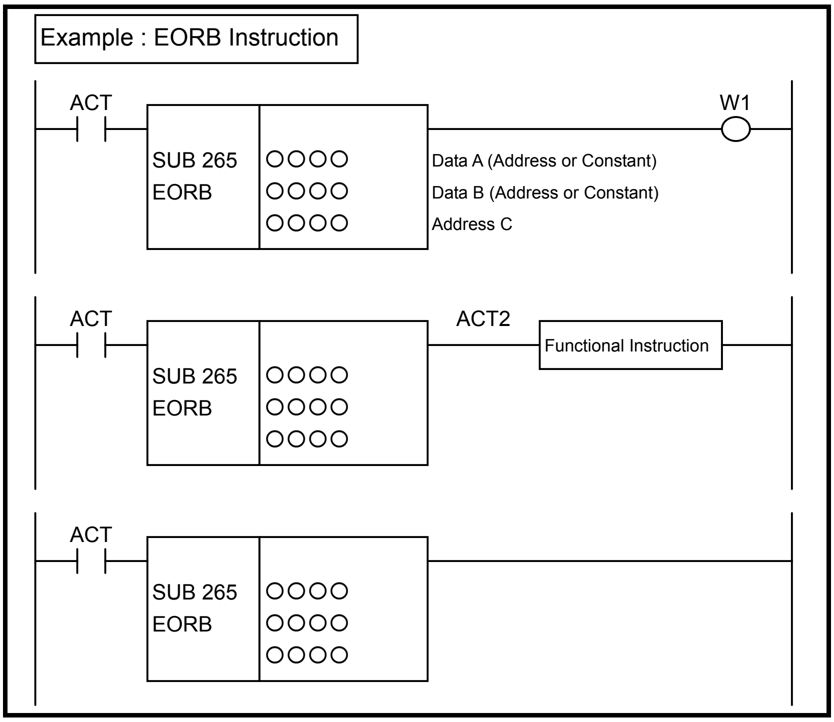


Fig. 4.8.9 (a) Format of EORB, EORW, EORD instruction

Table 4.8.9(b) Mnemonic of EORB, EORW, EORD instruction

Mnemonic format

Step number	Instruction	Address No.	Bit No.	Remarks
1	RD	○○○○	.○	ACT
2	SUB	265		SUB No. (EORB instruction)
3	(PRM)	○○○○		Data A (Address or Constant)
4	(PRM)	○○○○		Data B (Address or Constant)
5	(PRM)	○○○○		Address C
6	WRT	○○○○	.○	Normal end output

Memory status of control condition

ST3	ST2	ST1	ST0
			ACT
			↓
			↓
			↓
			↓
			W1

Control conditions

(a) Input signal (ACT)
ACT = 0: Instruction not executed.
ACT = 1: Executed.

Parameters

(a) Data A
Specify input data to be exclusive-ORed. In this parameter, a constant or a PMC memory address for storing data can be specified. In case of constant, specify signed binary data. A value within the following range may be specified:

Instruction name	Available value
EORB	-128 to 127
EORW	-32768 to 32767
EORD	-2147483648 to 2147483647

(b) Data B
Specify input data to be exclusive-ORed. In this parameter, a constant or a PMC memory address for storing data can be specified. In case of constant, specify signed binary data. A value within the same range as for "Data A" may be specified.

(c) Address C
Specify the address to which the result of exclusive-OR operation is to be output.

Output (W1)

When the instruction is executed, W1=1 is set. That is, W1 always assumes the same state as ACT.

> **NOTE**
> W1 may be omitted. Moreover, another functional instruction can be connected instead of a coil.

Operation

When "Data A" and "Data B" hold the following values, the value indicated below is output to "Address C":

									Binary data
Data A	1	1	1	0	0	0	1	1	(-29)
Data B	0	1	0	1	0	1	0	1	(85)
Address C	1	0	1	1	0	1	1	0	(-74)

Fig. 4.8.9 (b) Example of operation of the EORB, EORW, and EORD instructions

4.8.10 ANDB (Logical AND (1 Byte Length) : SUB 268) ANDW (Logical AND (2 Bytes Length) : SUB 269) ANDD (Logical AND (4 Bytes Length) : SUB 270)

The Logical AND instruction logical-ANDs "Data A" with "Data B", and outputs the result to "Address C".
In "Data A" and "Data B", a constant or a PMC memory address for storing data can be specified.
As indicated below, three types of Logical AND instructions are available according to the type of data to be operated. In each instruction, "Data A", "Data B", and the data at "Address C" are of the same data type.

Table4.8.10 (a) Kinds of Logical AND instruction

	Instruction name	SUB No.	Data type
1	ANDB	268	1 byte length
2	ANDW	269	2 bytes length
3	ANDD	270	4 bytes length

Format

The followings are the ladder format and the mnemonic format.

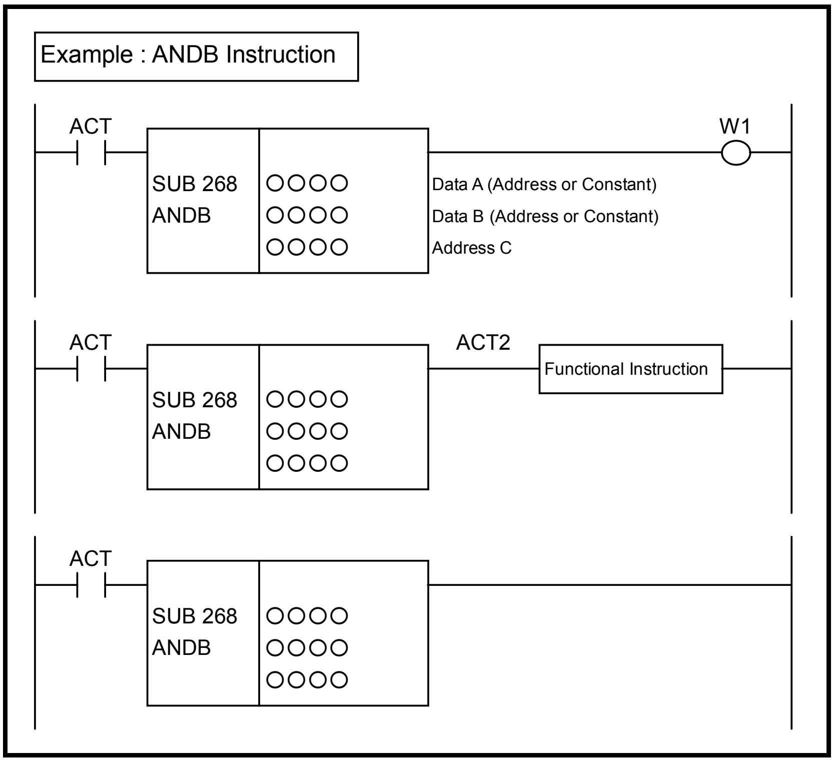


Fig. 4.8.10 (a) Format of ANDB, ANDW, ANDD instruction

Table 4.8.10(b) Mnemonic of ANDB, ANDW, ANDD instruction

Mnemonic format

Step number	Instruction	Address No.	Bit No.	Remarks
1	RD	○○○○	.○	ACT
2	SUB	268		SUB No. (ANDB instruction)
3	(PRM)	○○○○		Data A (Address or Constant)
4	(PRM)	○○○○		Data B (Address or Constant)
5	(PRM)	○○○○		Address C
6	WRT	○○○○	.○	Normal end output

Memory status of control condition

ST3	ST2	ST1	ST0
			ACT
			↓
			↓
			↓
			↓
			W1

Control conditions

(a) Input signal (ACT)
ACT = 0: Instruction not executed.
ACT = 1: Executed.

Parameters

(a) Data A
Specify input data to be logical-ANDed. In this parameter, a constant or a PMC memory address for storing data can be specified. In case of constant, specify signed binary data. A value within the following range may be specified:

Instruction name	Available value
ANDB	-128 to 127
ANDW	-32768 to 32767
ANDD	-2147483648 to 2147483647

(b) Data B
Specify input data to be logical-ANDed. In this parameter, a constant or a PMC memory address for storing data can be specified. In case of constant, specify signed binary data. A value within the same range as for "Data A" may be specified.

(c) Address C
Specify the address to which the result of logical-AND operation is to be output.

Output (W1)

When the instruction is executed, W1=1 is set. That is, W1 always assumes the same state as ACT.

NOTE
W1 may be omitted. Moreover, another functional instruction can be connected instead of a coil.

Operation

When "Data A" and "Data B" hold the following values, the value indicated below is output to "Address C":

									Binary data
Data A	1	1	1	0	0	0	1	1	(-29)
Data B	0	1	0	1	0	1	0	1	(85)
Address C	0	1	0	0	0	0	0	1	(65)

Fig. 4.8.10 (b) Example of operation of the ANDB, ANDW, and ANDD instructions

4.8.11 ORB (Logical OR (1 Byte Length) : SUB 271) ORW (Logical OR (2 Bytes Length) : SUB 272) ORD (Logical OR (4 Bytes Length) : SUB 273)

The Logical OR instruction logical-ORs "Data A" with "Data B", and outputs the result to "Address C".
In "Data A" and "Data B", a constant or a PMC memory address for storing data can be specified.
As indicated below, three types of Logical OR instructions are available according to the type of data to be operated. In each instruction, "Data A", "Data B", and the data at "Address C" are of the same data type.

Table4.8.11 (a) Kinds of Logical OR instruction

	Instruction name	SUB No.	Data type
1	ORB	271	1 byte length
2	ORW	272	2 bytes length
3	ORD	273	4 bytes length

Format

The followings are the ladder format and the mnemonic format.

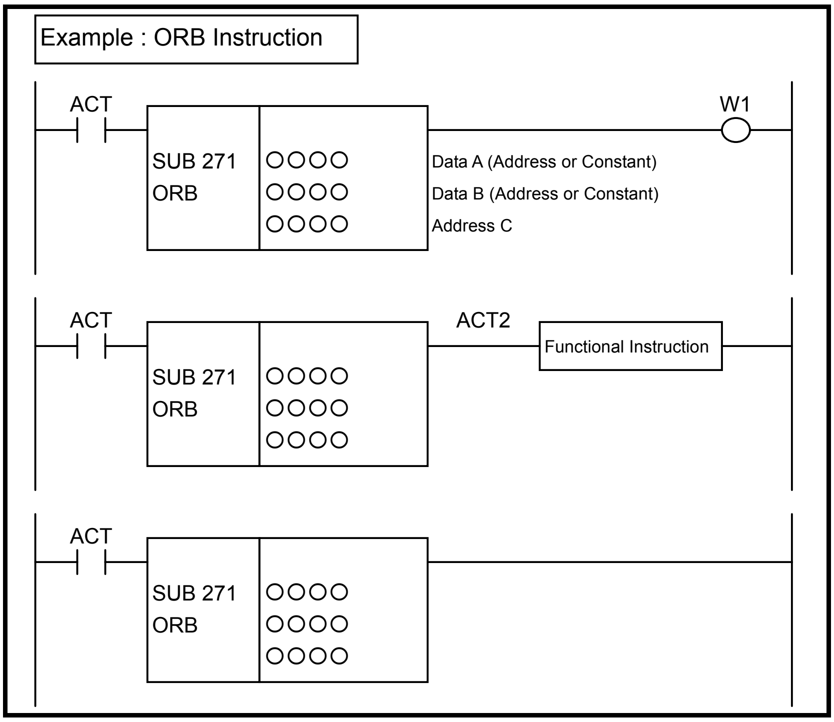


Fig. 4.8.11 (a) Format of ORB, ORW, ORD instruction

Table 4.8.11(b) Mnemonic of ORB, ORW, ORD instruction

Mnemonic format

Step number	Instruction	Address No.	Bit No.	Remarks
1	RD	○○○○	.○	ACT
2	SUB	271		SUB No. (ORB instruction)
3	(PRM)	○○○○		Data A (Address or Constant)
4	(PRM)	○○○○		Data B (Address or Constant)
5	(PRM)	○○○○		Address C
6	WRT	○○○○	.○	Normal end output

Memory status of control condition

ST3	ST2	ST1	ST0
			ACT
			W1

Control conditions

(a) Input signal (ACT)
ACT = 0: Instruction not executed.
ACT = 1: Executed.

Parameters

(a) Data A
Specify input data to be logical-ORed. In this parameter, a constant or a PMC memory address for storing data can be specified. In case of constant, specify signed binary data. A value within the following range may be specified:

Instruction name	Available value
ORB	-128 to 127
ORW	-32768 to 32767
ORD	-2147483648 to 2147483647

(b) Data B
Specify input data to be logical-ORed. In this parameter, a constant or a PMC memory address for storing data can be specified. In case of constant, specify signed binary data. A value within the same range as for "Data A" may be specified.

(c) Address C
Specify the address to which the result of logical-OR operation is to be output.

Output (W1)

When the instruction is executed, W1=1 is set. That is, W1 always assumes the same state as ACT.

> **NOTE**
> W1 may be omitted. Moreover, another functional instruction can be connected instead of a coil.

Operation

When "Data A" and "Data B" hold the following values, the value indicated below is output to "Address C":

									Binary data
Data A	1	1	1	0	0	0	1	1	(-29)
Data B	0	1	0	1	0	1	0	1	(85)
Address C	1	1	1	1	0	1	1	1	(-9)

Fig. 4.8.11 (b) Example of operation of the ORB, ORW, and ORD instructions

4.8.12 NOTB (Logical NOT (1 Byte Length) : SUB 274) NOTW (Logical NOT (2 Bytes Length) : SUB 275) NOTD (Logical NOT (4 Bytes Length) : SUB 276)

The Logical NOT instruction performs a logical-NOT operation on "Data A" and outputs the result to "Address B".
In "Data A", a constant or a PMC memory address for storing data can be specified.
As indicated below, three types of Logical NOT instructions are available according to the type of data to be operated. In each instruction, "Data A" and the data at "Address B" are of the same data type.

Table4.8.12 (a) Kinds of Logical NOT instruction

	Instruction name	SUB No.	Data type
1	NOTB	274	1 byte length
2	NOTW	275	2 bytes length
3	NOTD	276	4 bytes length

Format

The followings are the ladder format and the mnemonic format.

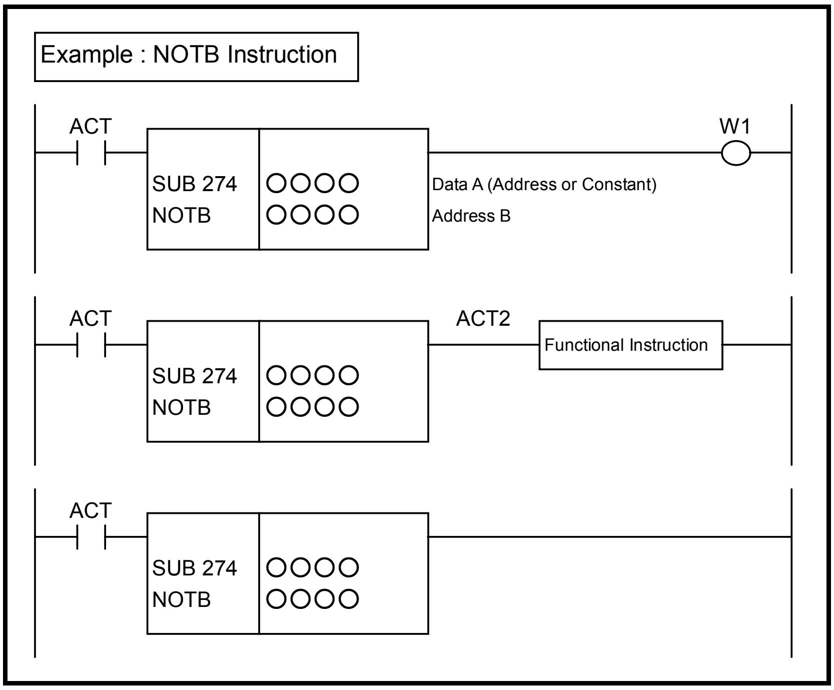


Fig. 4.8.12 (a) Format of NOTB, NOTW, NOTD instruction

Table 4.8.12(b) Mnemonic of NOTB, NOTW, NOTD instruction

Mnemonic format

Step number	Instruction	Address No.	Bit No.	Remarks
1	RD	○○○○	.○	ACT
2	SUB	274		SUB No. (ORB instruction)
3	(PRM)	○○○○		Data A (Address or Constant)
4	(PRM)	○○○○		Address B
5	WRT	○○○○	.○	Normal end output

Memory status of control condition

ST3	ST2	ST1	ST0
			ACT
			W1

Control conditions

(a) Input signal (ACT)
ACT = 0: Instruction not executed.
ACT = 1: Executed.

Parameters

(a) Data A
Specify input data on which a logical-NOT operation is to be performed. In this parameter, a constant or a PMC memory address for storing data can be specified. In case of constant, specify signed binary data. A value within the following range may be specified:

Instruction name	Available value
NOTB	-128 to 127
NOTW	-32768 to 32767
NOTD	-2147483648 to 2147483647

(b) Address B
Specify the address to which the result of logical-NOT operation is to be output.

Output (W1)

When the instruction is executed, W1=1 is set. That is, W1 always assumes the same state as ACT.

NOTE
W1 may be omitted. Moreover, another functional instruction can be connected instead of a coil.

Operation

When "Data A" holds the following value, the value indicated below is output to "Address B":

									Binary data
Data A	1	1	1	0	0	0	1	1	(-29)
Address B	0	0	0	1	1	1	0	0	(28)

Fig. 4.8.12 (b) Example of operation of the NOTB, NOTW, and NOTD instructions

4.8.13 SHLB (Bit Shift Left (1 Byte Length) : SUB 277) SHLW (Bit Shift Left (2 Bytes Length) : SUB 278) SHLD (Bit Shift Left (4 Bytes Length) : SUB 279)

The Bit shift left instruction shifts bit data to the left by a specified number of bits. In the empty bit position(s) after shift operation, 0 is shifted in. The result of shift operation is output to a specified address.
As indicated below, three types of Bit shift left instructions are available according to the type of data to be operated. Shift source bit data and the data at a shift result output address are of the same data type.

Table4.8.13 (a) Kinds of Bit shift left instruction

	Instruction name	SUB No.	Data type
1	SHLB	277	1 byte length data
2	SHLW	278	2 bytes length data
3	SHLD	279	4 bytes length data

The value of the last bit shifted out by a shift operation is output to W1. The value(s) of the preceding left-side bit(s) are lost.

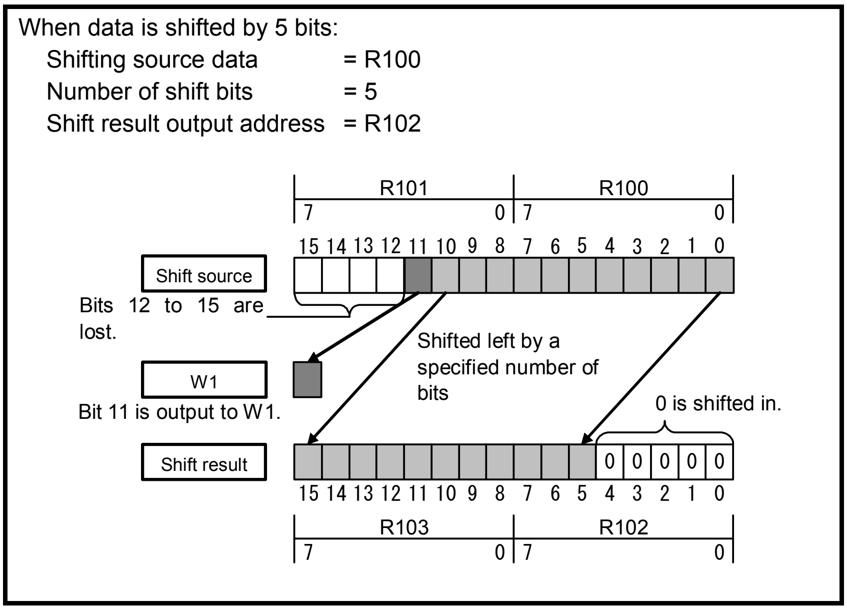


Fig. 4.8.13 (a) Example of SHLW instruction

If 0 or a negative value is specified in "Number of shift bits", the data specified in "Shift source data" is output to "Shift result output address" without modification, and W1=0 is set.

Format

The followings are the ladder format and the mnemonic format.

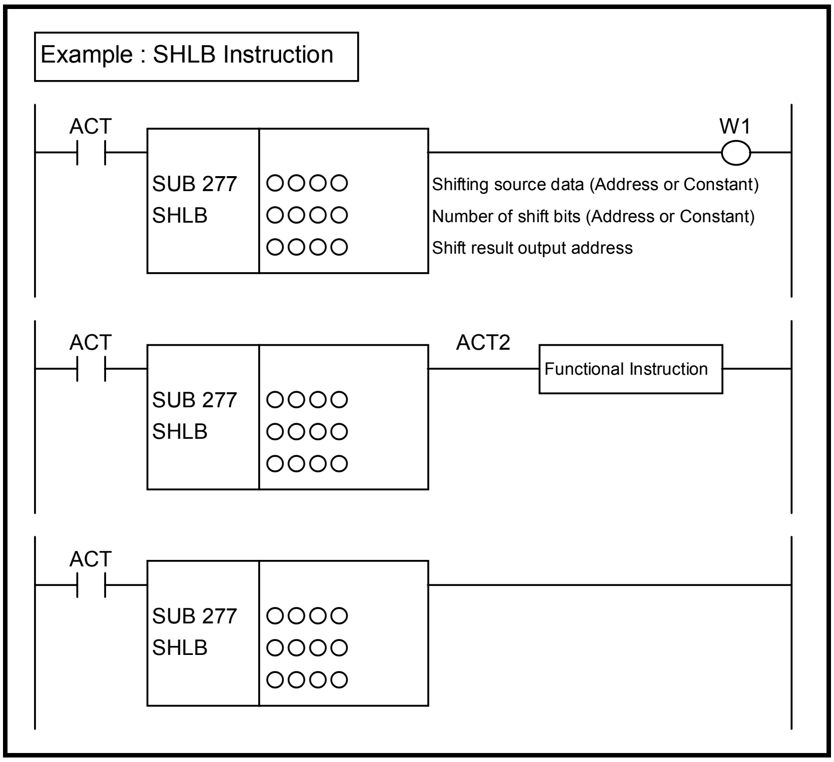


Fig. 4.8.13 (b) Format of SHLB, SHLW, SHLD instruction

Table 4.8.13(b) Mnemonic of SHLB, SHLW, SHLD instruction

Mnemonic format / **Memory status of control condition**

Step number	Instruction	Address No.	Bit No.	Remarks	ST3	ST2	ST1	ST0
1	RD	○○○○	.○	ACT				ACT
2	SUB	277		SUB No. (SHLB instruction)				
3	(PRM)	○○○○		Shifting source data (Address or Constant)				
4	(PRM)	○○○○		Number of shift bits (Address or Constant)				
5	(PRM)	○○○○		Shift result output address				
6	WRT	○○○○	.○	Shift out status output				W1

Control conditions

(a) Input signal (ACT)
ACT = 0: Instruction not executed.
ACT = 1: Executed.

Parameters

(a) Shifting source data
Specify bit shift source data. In this parameter, a constant or a PMC memory address for storing data can be specified. Specify signed binary data. A value within the following range may be specified:

Instruction name	Available value
SHLB	-128 to 127
SHLW	-32768 to 32767
SHLD	-2147483648 to 2147483647

(b) Number of shift bits
By using signed binary data, specify the number of bits to be shifted. In this parameter, specify 0 or a greater value. If a value greater than 0 is specified, the data specified in "Shifting source data" is shifted by a specified number of bits, and the result of shift operation is output to "Shift result output address". If 0 is specified, the data specified in "Shifting source data" is output to "Shift result output address" without modification, and W1=0 is set.
If a negative value is specified in this parameter, the data specified in "Shifting source data" is output to "Shift result output address" without modification, and W1=0 is set as in the case where 0 is specified in this parameter. No shift operation in the opposite direction is performed.
In this parameter, a constant or a PMC memory address for storing data can be specified.
If an address is specified in this parameter, specify "Number of shift bits" by using memory of the same size as for data type handled by each instruction. For example, with the SHLW instruction, specify "Number of shift bits" by using memory 2 bytes long.

(c) Shift result output address
Specify the address to which the result of bit shift operation is to be output. The result of shift operation is output to memory of the same size as for "Shifting source data".

Output (W1)

W1=1: The value of the last bit shifted out is 1.
W1=0: No shift operation is executed (ACT=0).
The value of the last bit shifted out is 0.
“0” or a negative value is specified in "Number of shift bits".

NOTE
W1 may be omitted. Moreover, another functional instruction can be connected instead of a coil.

4.8.14 SHLN (Bit Shift Left (Arbitrary Bytes Length) : SUB 280)

The Bit shift left instruction shifts bit data to the left by a specified number of bits. In the empty bit position(s) after shift operation, 0 is shifted in. The result of shift operation is output to a specified address.
The Bit shift left instruction performs a bit shift operation on a bit string of a specified data size.
Shifting source data and the result of shift operation are of the same data size.

The value of the last bit shifted out by shift operation is output to W1. The value(s) of the preceding left-side bit(s) are lost.

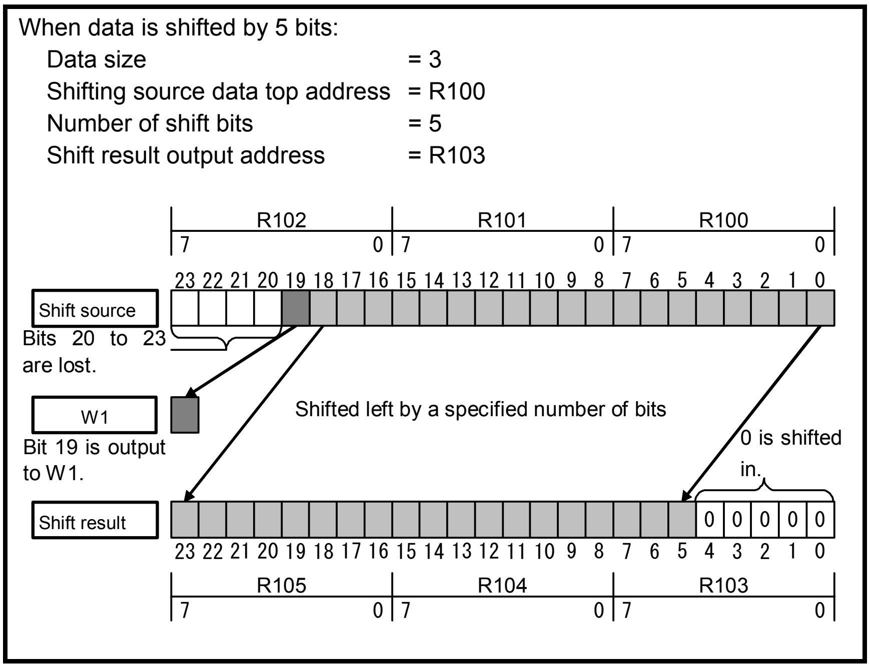


Fig. 4.8.14 (a) Example of SHLN instruction

If 0 or a negative value is specified in "Number of shift bits", the shift source data is output to "Shift result output address" without modification, and W1=0 is set.

Format

The followings are the ladder format and the mnemonic format.

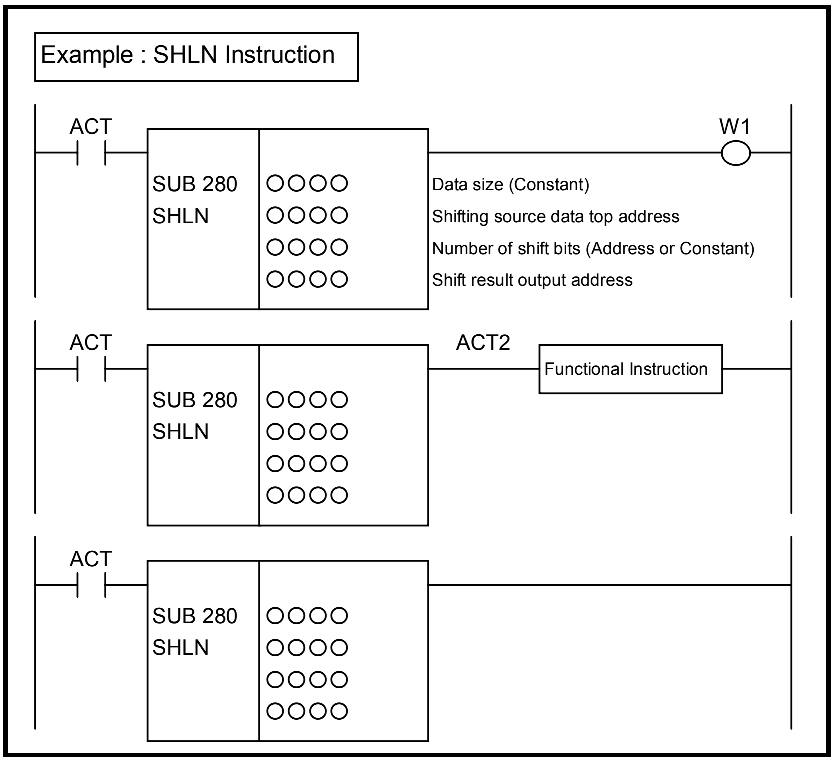


Fig. 4.8.14 (b) Format of SHLN instruction

Table 4.8.14 Mnemonic of SHLN instruction

Mnemonic format

Step number	Instruction	Address No.	Bit No.	Remarks
1	RD	○○○○	.○	ACT
2	SUB	280		SUB No. (SHLN instruction)
3	(PRM)	○○○○		Data size (Constant)
4	(PRM)	○○○○		Shifting source data top address
5	(PRM)	○○○○		Number of shift bits (Address or Constant)
6	(PRM)	○○○○		Shift result output address
7	WRT	○○○○	.○	Shift out status output

Memory status of control condition

ST3	ST2	ST1	ST0
			ACT
			W1

Control conditions

(a) Input signal (ACT)
ACT = 0: Instruction not executed.
ACT = 1: Executed.

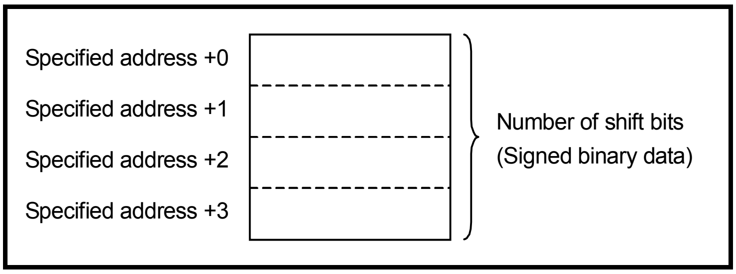
Parameters

(a) Data size
Specify the number of bytes of data on which a bit shift operation is to be performed. A value from 1 to 256 may be specified.

> **NOTE**
> Specify a valid number to the "Data size", so that both of the area from "Shifting source data top address" and the area from "Shift result output address" may be arranged within valid address range.

(b) Shifting source data top address
Specify the start address of bit shift source data.
Specify a data size in "Data size" mentioned in (a) above.

(c) Number of shift bits
By using 4 bytes signed binary data, specify the number of bits to be shifted. In this parameter, specify 0 or a greater value. If a value greater than 0 is specified, the shifting source data is shifted by a specified number of bits, and the result of shift operation is output to "Shift result output address". A value from 1 to ("Data size" × 8) may be specified. For example, if 6 is specified in "Data size", a value from 1 to 48 may be specified in this parameter. If a value greater than the valid range is specified, 0 is output to "Shift result output address", and W1=0 is set.
If 0 is specified, the shifting source data is output to "Shift result output address" without modification, and W1=0 is set.
If a negative value is specified in this parameter, the shifting source data is output to "Shift result output address" without modification, and W1=0 is set as in the case where 0 is specified in this parameter. No shift operation in the opposite direction is performed.
In this parameter, a constant or a PMC memory address for storing data can be specified.



(d) Shift result output address
Specify the start address of an area to which the result of bit shift operation is to be output. The result of shift operation is output to memory of the same size as for shifting source data.

Output (W1)

W1=1: The value of the last bit shifted out is 1.
W1=0: No shift operation is executed (ACT=0).
The value of the last bit shifted out is 0.
“0” or a negative value is specified in "Number of shift bits".

> **NOTE**
> W1 may be omitted. Moreover, another functional instruction can be connected instead of a coil.

4.8.15 SHRB (Bit Shift Right (1 Byte Length) : SUB 281) SHRW (Bit Shift Right (2 Bytes Length) : SUB 282) SHRD (Bit Shift Right (4 Bytes Length) : SUB 283)

The Bit shift right instruction shifts bit data to the right by a specified number of bits. In the empty bit position(s) after shift operation, 0 is shifted in. The result of shift operation is output to a specified address.
As indicated below, three types of Bit shift right instructions are available according to the type of data to be operated. Shift source bit data and the data at a shift result output address are of the same data type.

Table4.8.15 (a) Kinds of Bit shift right instruction

	Instruction name	SUB No.	Data type
1	SHRB	281	1 byte length data
2	SHRW	282	2 bytes length data
3	SHRD	283	4 bytes length data

The value of the last bit shifted out by shift operation is output to W1. The value(s) of the following right-side bit(s) are lost.

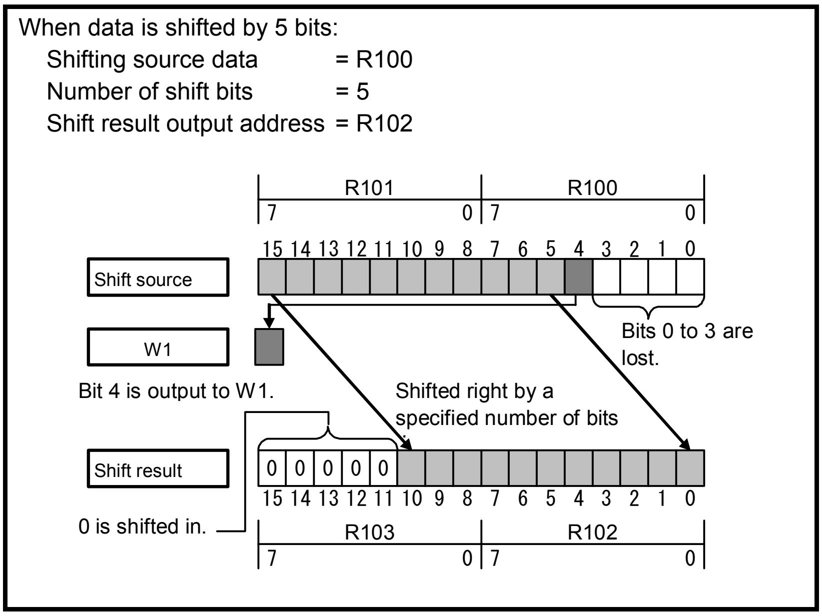


Fig. 4.8.15 (a) Example of SHRW instruction

If 0 or a negative value is specified in "Number of shift bits", the shift source data is output to "Shift result output address" without modification, and W1=0 is set.

Format

The followings are the ladder format and the mnemonic format.

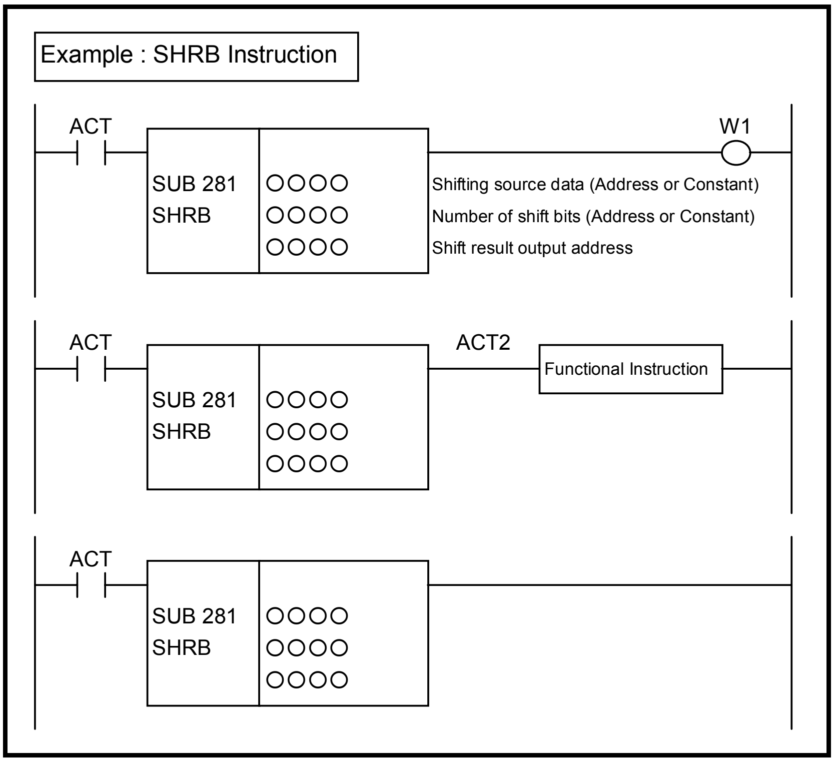


Fig. 4.8.15 (b) Format of SHRB, SHRW, SHRD instruction

Table 4.8.15(b) Mnemonic of SHRB, SHRW, SHRD instruction

Mnemonic format

Step number	Instruction	Address No.	Bit No.	Remarks
1	RD	○○○○	.○	ACT
2	SUB	281		SUB No. (SHRB instruction)
3	(PRM)	○○○○		Shifting source data (Address or Constant)
4	(PRM)	○○○○		Number of shift bits (Address or Constant)
5	(PRM)	○○○○		Shift result output address
6	WRT	○○○○	.○	Shift out status output

Memory status of control condition

ST3	ST2	ST1	ST0
			ACT
			↓
			↓
			↓
			↓
			W1

Control conditions

(a) Input signal (ACT)
ACT = 0: Instruction not executed.
ACT = 1: Executed.

Parameters

(a) Shifting source data
Specify bit shift source data. In this parameter, a constant or a PMC memory address for storing data can be specified.
Specify signed binary data. A value within the following range may be specified:

Instruction name	Available value
SHRB	-128 to 127
SHRW	-32768 to 32767
SHRD	-2147483648 to 2147483647

(b) Number of shift bits
By using signed binary data, specify the number of bits to be shifted. In this parameter, specify 0 or a greater value. If a value greater than 0 is specified, the data specified in "Shifting source data" is shifted by a specified number of bits, and the result of shift operation is output to "Shift result output address". If 0 is specified, the data specified in "Shifting source data" is output to "Shift result output address" without modification, and W1=0 is set.
If a negative value is specified in this parameter, the data specified in "Shifting source data" is output to "Shift result output address" without modification, and W1=0 is set as in the case where 0 is specified in this parameter. No shift operation in the opposite direction is performed.
In this parameter, a constant or a PMC memory address for storing data can be specified.
If an address is specified in this parameter, specify "Number of shift bits" by using signed binary data of the same size as for data type handled by each instruction. For example, with the SHRW instruction, specify "Number of shift bits" by using 2 bytes signed binary data.

(c) Shift result output address
Specify the address to which the result of bit shift operation is to be output. The result of shift operation is output to memory of the same size as for "Shifting source data".

Output (W1)

W1=1: The value of the last bit shifted out is 1.
W1=0: No shift operation is executed (ACT=0).
The value of the last bit shifted out is 0.
"0" or a negative value is specified in "Number of shift bits".

> **NOTE**
> W1 may be omitted. Moreover, another functional instruction can be connected instead of a coil.

4.8.16 SHRN (Bit Shift Right (Arbitrary Bytes Length) : SUB 284)

The Bit shift right instruction shifts bit data to the right by a specified number of bits. In the empty bit position(s) after shift operation, 0 is shifted in. The result of shift operation is output to a specified address.
The Bit shift right instruction performs a bit shift operation on a bit string of a specified data size.
Shifting source data and the result of shift operation are of the same data size.

The value of the last bit shifted out by shift operation is output to W1. The value(s) of the following right-side bit(s) are lost.

When data is shifted by 5 bits:

Data size	= 3
Shifting source data top address	= R100
Number of shift bits	= 5
Shift result output address	= R103

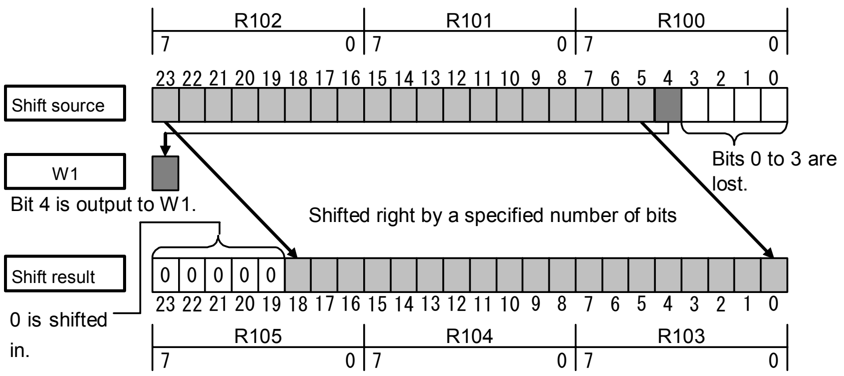


Fig. 4.8.16 (a) Example of SHRN instruction

If 0 or a negative value is specified in "Number of shift bits", the shift source data is output to "Shift result output address" without modification, and W1=0 is set.

Format

The followings are the ladder format and the mnemonic format.

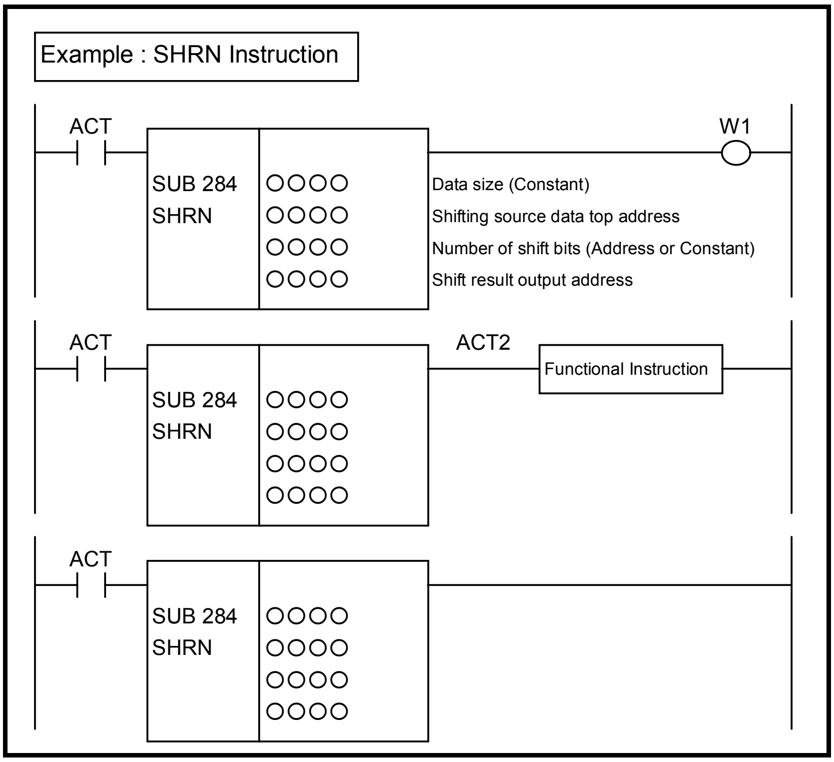


Fig. 4.8.16 (b) Format of SHRN instruction

Table 4.8.16 Mnemonic of SHRN instruction

Mnemonic format

Step number	Instruction	Address No.	Bit No.	Remarks
1	RD	○○○○	.○	ACT
2	SUB	284		SUB No. (SHRN instruction)
3	(PRM)	○○○○		Data size (Constant)
4	(PRM)	○○○○		Shifting source data top address
5	(PRM)	○○○○		Number of shift bits (Address or Constant)
6	(PRM)	○○○○		Shift result output address
7	WRT	○○○○	.○	Shift out status output

Memory status of control condition

ST3	ST2	ST1	ST0
			ACT
			↓
			↓
			↓
			↓
			↓
			W1

Control conditions

(a) Input signal (ACT)
ACT = 0: Instruction not executed.
ACT = 1: Executed.

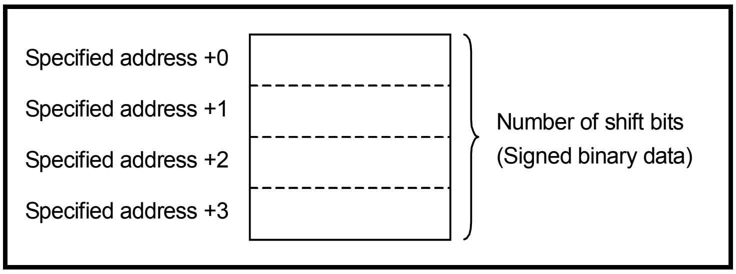
Parameters

(a) Data size
Specify the number of bytes of data on which a bit shift operation is to be performed. A value from 1 to 256 may be specified.

> **NOTE**
> Specify a valid number to the "Data size", so that both of the area from "Shifting source data top address" and the area from "Shift result output address" may be arranged within valid address range.

(b) Shifting source data top address
Specify the start address of bit shift source data.
Specify a data size in "Data size" mentioned in (a) above.

(c) Number of shift bits
By using 4 bytes signed binary data, specify the number of bits to be shifted. In this parameter, specify 0 or a greater value. If a value greater than 0 is specified, the shifting source data is shifted by a specified number of bits, and the result of shift operation is output to "Shift result output address". A value from 1 to ("Data size" × 8) may be specified. For example, if 6 is specified in "Data size", a value from 1 to 48 may be specified in this parameter. If a value greater than the valid range is specified, 0 is output to "Shift result output address", and W1=0 is set.
If 0 is specified, the shifting source data is output to "Shift result output address" without modification, and W1=0 is set.
If a negative value is specified in this parameter, the shifting source data is output to "Shift result output address" without modification, and W1=0 is set as in the case where 0 is specified in this parameter. No shift operation in the opposite direction is performed.
In this parameter, a constant or a PMC memory address for storing data can be specified.



(d) Shift result output address
Specify the start address of an area to which the result of bit shift operation is to be output. The result of shift operation is output to memory of the same size as for shifting source data.

Output (W1)

W1=1: The value of the last bit shifted out is 1.
W1=0: No shift operation is executed (ACT=0).
The value of the last bit shifted out is 0.
"0" or a negative value is specified in "Number of shift bits".

> **NOTE**
> W1 may be omitted. Moreover, another functional instruction can be connected instead of a coil.

4.8.17 ROLB (Bit Rotation Left (1 Byte Length) : SUB 285) ROLW (Bit Rotation Left (2 Bytes Length) : SUB 286) ROLD (Bit Rotation Left (4 Bytes Length) : SUB 287)

The Bit rotation left instruction rotates bit data to the left by a specified number of bits. The result of rotation operation is output to a specified address.
As indicated below, three types of Bit rotation left instructions are available according to the type of data to be operated. Rotation source bit data and the data at a rotation result output address are of the same data type.

Table4.8.17 (a) Kinds of Bit rotation left instruction

	Instruction name	SUB No.	Data type
1	ROLB	285	1 byte length data
2	ROLW	286	2 bytes length data
3	ROLD	287	4 bytes length data

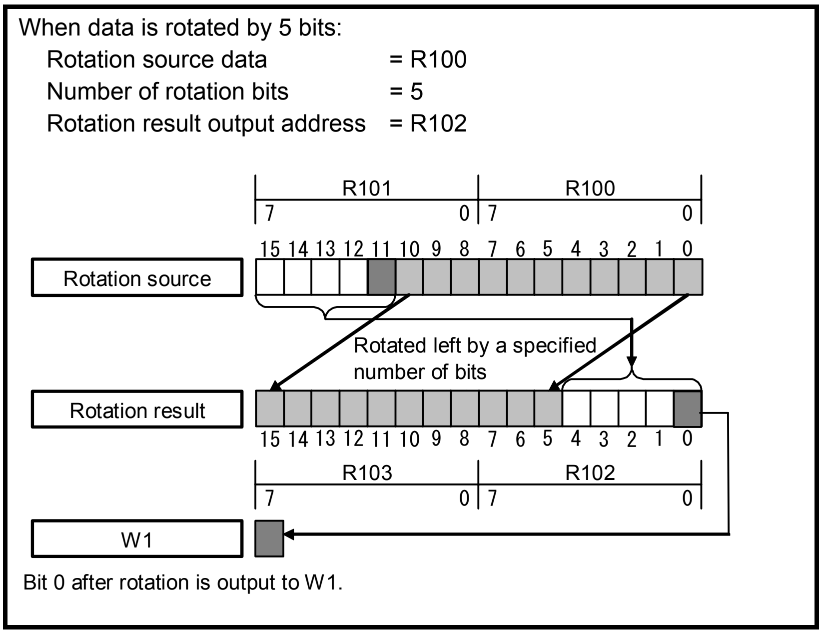


Fig. 4.8.17 (a) Example of ROLW instruction

The value of bit 0 after rotation is output to W1.
If 0 is specified in "Number of rotation bits", the data specified in "Rotation source data" is output to "Rotation result output address" without modification, and W1=0 is set.

Format

The followings are the ladder format and the mnemonic format.

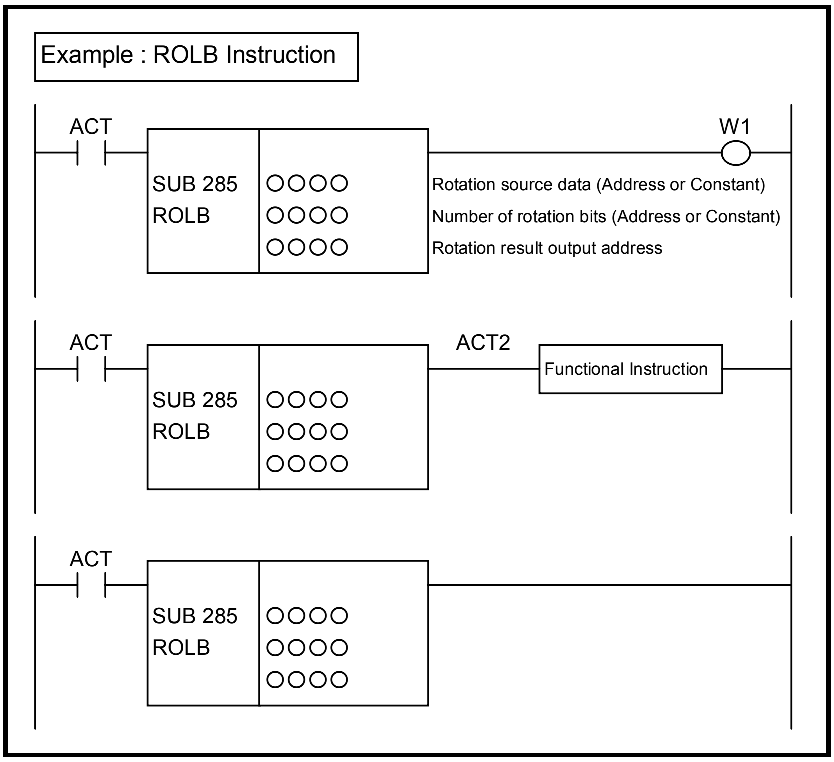


Fig. 4.8.17 (b) Format of ROLB, ROLW, ROLD instruction

Table 4.8.17(b) Mnemonic of ROLB, ROLW, ROLD instruction

Mnemonic format

Step number	Instruction	Address No.	Bit No.	Remarks
1	RD	○○○○	.○	ACT
2	SUB	285		SUB No. (ROLB instruction)
3	(PRM)	○○○○		Rotation source data (Address or Constant)
4	(PRM)	○○○○		Number of rotation bits (Address or Constant)
5	(PRM)	○○○○		Rotation result output address
6	WRT	○○○○	.○	Last rotation bit output

Memory status of control condition

ST3	ST2	ST1	ST0
			ACT
			W1

Control conditions

(a) Input signal (ACT)

ACT = 0: Instruction not executed.

ACT = 1: Executed.

Parameters

(a) Rotation source data
Specify bit rotation source data. In this parameter, a constant or a PMC memory address for storing data can be specified.
Specify signed binary data. A value within the following range may be specified:

Instruction name	Available value
ROLB	-128 to 127
ROLW	-32768 to 32767
ROLD	-2147483648 to 2147483647

(b) Number of rotation bits
By using signed binary data, specify the number of bits to be rotated. In this parameter, specify 0 or a greater value. If a value greater than 0 is specified, the data specified in "Rotation source data" is rotated by a specified number of bits, and the result of rotation operation is output to "Rotation result output address". If 0 is specified, the data specified in "Rotation source data" is output to "Rotation result output address" without modification, and W1=0 is set.
If a negative value is specified in this parameter, the data specified in "Rotation source data" is output to "Rotation result output address" without modification, and W1=0 is set as in the case where 0 is specified in this parameter. No rotation operation in the opposite direction is performed.
In this parameter, a constant or a PMC memory address for storing data can be specified.
If an address is specified in this parameter, specify "Number of rotation bits" by using signed binary data of the same size as for data type handled by each instruction. For example, with the ROLW instruction, specify "Number of rotation bits" by using 2 bytes signed binary data.

(c) Rotation result output address
Specify the address to which the result of rotation operation is to be output. The result of rotation operation is output to memory of the same size as for "Rotation source data".

Output (W1)

W1=1: The value of bit 0 after rotation is 1.
W1=0: No rotation operation is executed (ACT=0).
The value of bit 0 after rotation is 0.
“0” or a negative value is specified in "Number of rotation bits".

NOTE
W1 may be omitted. Moreover, another functional instruction can be connected instead of a coil.

4.8.18 ROLN (Bit Rotation Left (Arbitrary Bytes Length) : SUB 288)

The Bit rotation left instruction rotates bit data to the left by a specified number of bits. The result of rotation operation is output to a specified address.
The Bit rotation left instruction performs a bit rotation operation on a bit string of a specified data size.
Rotation source data and the result of rotation operation are of the same data size.

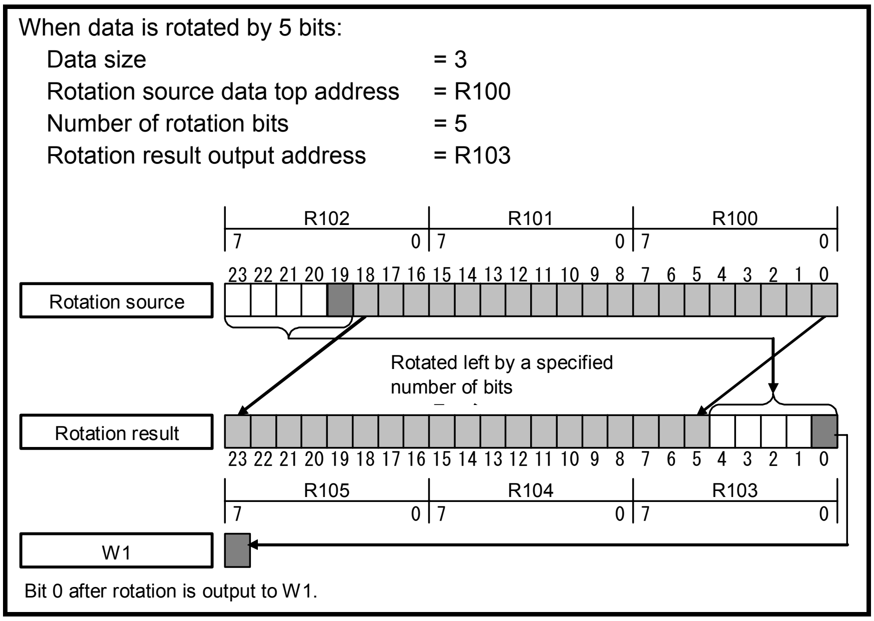


Fig. 4.8.18 (a) Example of ROLN instruction

The value of bit 0 after rotation is output to W1.
If 0 is specified in "Number of rotation bits", the rotation source data is output to "Rotation result output address" without modification, and W1=0 is set.

Format

The followings are the ladder format and the mnemonic format.

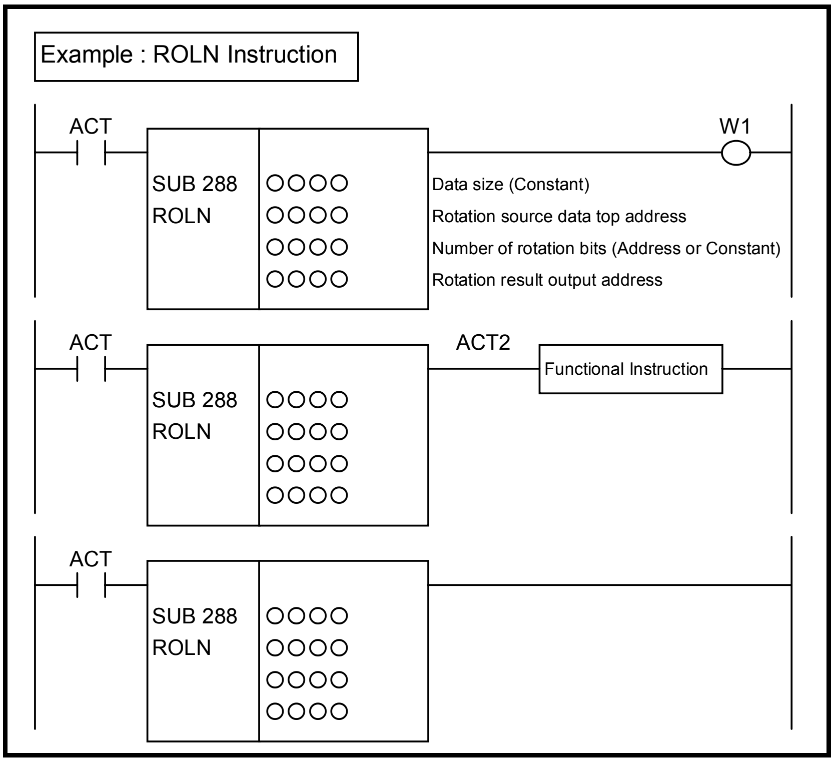


Fig. 4.8.18 (b) Format of ROLN instruction

Table 4.8.18 Mnemonic of ROLN instruction

Mnemonic format

Step number	Instruction	Address No.	Bit No.	Remarks
1	RD	○○○○	.○	ACT
2	SUB	288		SUB No. (ROLN instruction)
3	(PRM)	○○○○		Data size (Constant)
4	(PRM)	○○○○		Rotation source data top address
5	(PRM)	○○○○		Number of rotation bits (Address or Constant)
6	(PRM)	○○○○		Rotation result output address
7	WRT	○○○○	.○	Last rotation bit output

Memory status of control condition

ST3	ST2	ST1	ST0
			ACT
			W1

Control conditions

(a) Input signal (ACT)
ACT = 0: Instruction not executed.
ACT = 1: Executed.

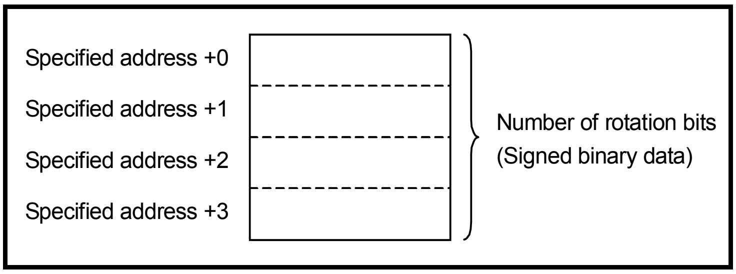
Parameters

(a) Data size
Specify the number of bytes of data on which a bit rotation operation is to be performed. A value from 1 to 256 may be specified.

> **NOTE**
> Specify a valid number to the "Data size", so that both of the area from "Rotation source data top address" and the area from "Rotation result output address" may be arranged within valid address range.

(b) Rotation source data top address
Specify the start address of rotation source data. Specify a data size in "Data size" mentioned in (a) above.

(c) Number of rotation bits
By using 4 bytes signed binary data, specify the number of bits to be rotated. In this parameter, specify 0 or a greater value. If a value greater than 0 is specified, the rotation source data is rotated by a specified number of bits, and the result of rotation operation is output to "Rotation result output address". A value from 1 to ("Data size" × 8) may be specified. For example, if 6 is specified in "Data size", a value from 1 to 48 may be specified in this parameter. If a value greater than the valid range is specified, the number of specified bits is divided by the value obtained by "Data size" × 8 then a rotation operation is performed using the remainder as the specified number of bits. If 0 is specified, the rotation source data is output to "Rotation result output address" without modification, and W1=0 is set.
If a negative value is specified in this parameter, the rotation source data is output to "Rotation result output address" without modification, and W1=0 is set as in the case where 0 is specified in this parameter. No rotation operation in the opposite direction is performed.
In this parameter, a constant or a PMC memory address for storing data can be specified.



(d) Rotation result output address
Specify the start address of an area to which the result of rotation operation is to be output. The result of rotation operation is output to memory of the same size as for rotation source data.

Output (W1)

W1=1: The value of bit 0 after rotation is 1.
W1=0: No rotation operation is executed (ACT=0).
The value of bit 0 after rotation is 0.
"0" or a negative value is specified in "Number of rotation bits".

> **NOTE**
> W1 may be omitted. Moreover, another functional instruction can be connected instead of a coil.

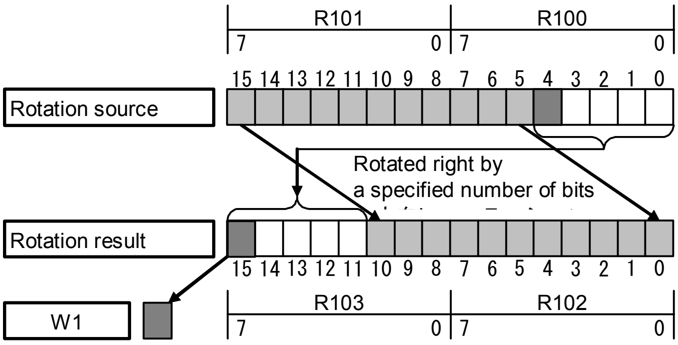
4.8.19 RORB (Bit Rotation Right (1 Byte Length) : SUB 289) RORW (Bit Rotation Right (2 Bytes Length) : SUB 290) RORD (Bit Rotation Right (4 Bytes Length) : SUB 291)

The Bit rotation right instruction rotates bit data to the right by a specified number of bits. The result of rotation operation is output to a specified address.
As indicated below, three types of Bit rotation right instructions are available according to the type of data to be operated. Rotation source bit data and the data at a rotation result output address are of the same data type.

Table4.8.19 (a) Kinds of Bit rotation right instruction

	Instruction name	SUB No.	Data type
1	RORB	289	1 byte length data
2	RORW	290	2 bytes length data
3	RORD	291	4 bytes length data

When data is rotated by 5 bits:
Rotation source data = R100
Number of rotation bits = 5
Rotation result output address = R102



The most significant bit after rotation is output to W1.

Fig. 4.8.19 (a) Example of RORW instruction

The value of the most significant bit (bit 15 in the example above) after rotation is output to W1.
If 0 is specified in "Number of rotation bits", the data specified in "Rotation source data" is output to "Rotation result output address" without modification, and W1=0 is set.

Format

The followings are the ladder format and the mnemonic format.

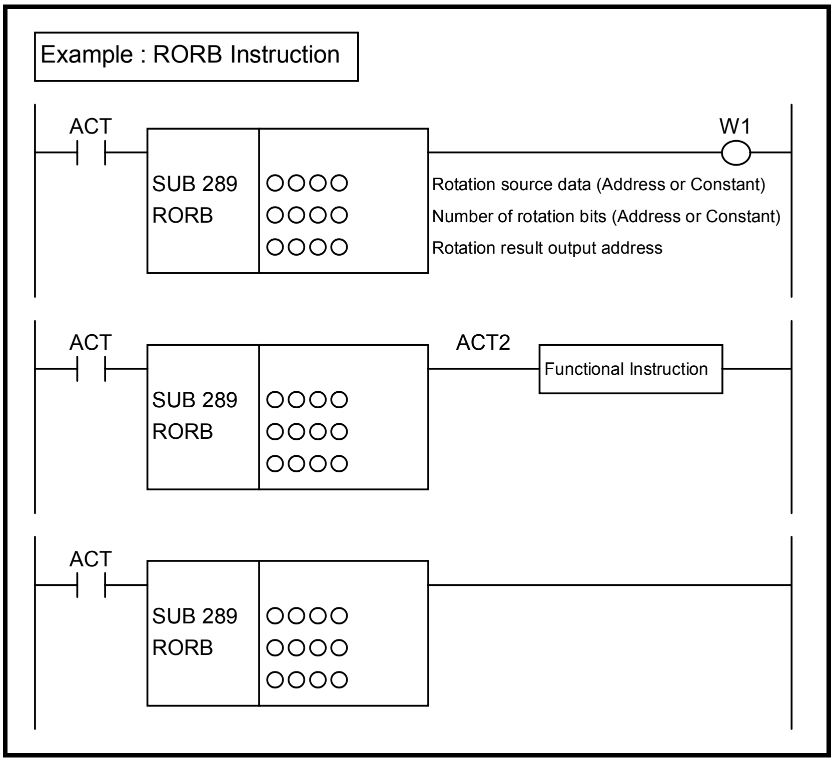


Fig. 4.8.19 (b) Format of RORB, RORW, RORD instruction

Table 4.8.19(b) Mnemonic of RORB, RORW, RORD instruction

Mnemonic format

Step number	Instruction	Address No.	Bit No.	Remarks
1	RD	○○○○	.○	ACT
2	SUB	289		SUB No. (RORB instruction)
3	(PRM)	○○○○		Rotation source data (Address or Constant)
4	(PRM)	○○○○		Number of rotation bits (Address or Constant)
5	(PRM)	○○○○		Rotation result output address
6	WRT	○○○○	.○	Last rotation bit output

Memory status of control condition

ST3	ST2	ST1	ST0
			ACT
			↓
			↓
			↓
			↓
			W1

Control conditions

(a) Input signal (ACT)

ACT = 0: Instruction not executed.

ACT = 1: Executed.

Parameters

(a) Rotation source data
Specify bit rotation source data. In this parameter, a constant or a PMC memory address for storing data can be specified.
Specify signed binary data. A value within the following range may be specified:

Instruction name	Available value
RORB	-128 to 127
RORW	-32768 to 32767
RORD	-2147483648 to 2147483647

(b) Number of rotation bits
By using signed binary data, specify the number of bits to be rotated. In this parameter, specify 0 or a greater value. If a value greater than 0 is specified, the data specified in "Rotation source data" is rotated by a specified number of bits, and the result of rotation operation is output to "Rotation result output address". If 0 is specified, the data specified in "Rotation source data" is output to "Rotation result output address" without modification, and W1=0 is set.
If a negative value is specified in this parameter, the data specified in "Rotation source data" is output to "Rotation result output address" without modification, and W1=0 is set as in the case where 0 is specified in this parameter. No rotation operation in the opposite direction is performed.
In this parameter, a constant or a PMC memory address for storing data can be specified.
If an address is specified in this parameter, specify "Number of rotation bits" by using signed binary data of the same size as for data type handled by each instruction. For example, with the RORW instruction, specify "Number of rotation bits" by using 2 bytes signed binary data.

(c) Rotation result output address
Specify the address to which the result of rotation operation is to be output. The result of rotation operation is output to memory of the same size as for "Rotation source data".

Output (W1)

W1=1: The value of the most significant bit after rotation is 1.
W1=0: No rotation operation is executed (ACT=0).
The value of the most significant bit after rotation is 0.
“0” or a negative value is specified in "Number of rotation bits".

NOTE
W1 may be omitted. Moreover, another functional instruction can be connected instead of a coil.

4.8.20 RORN (Bit Rotation Right (Arbitrary Bytes Length) : SUB 292)

The Bit rotation right instruction rotates bit data to the right by a specified number of bits. The result of rotation operation is output to a specified address.
The Bit rotation right instruction performs a bit rotation operation on a bit string of a specified data size. Rotation source data and the result of rotation operation are of the same data size.

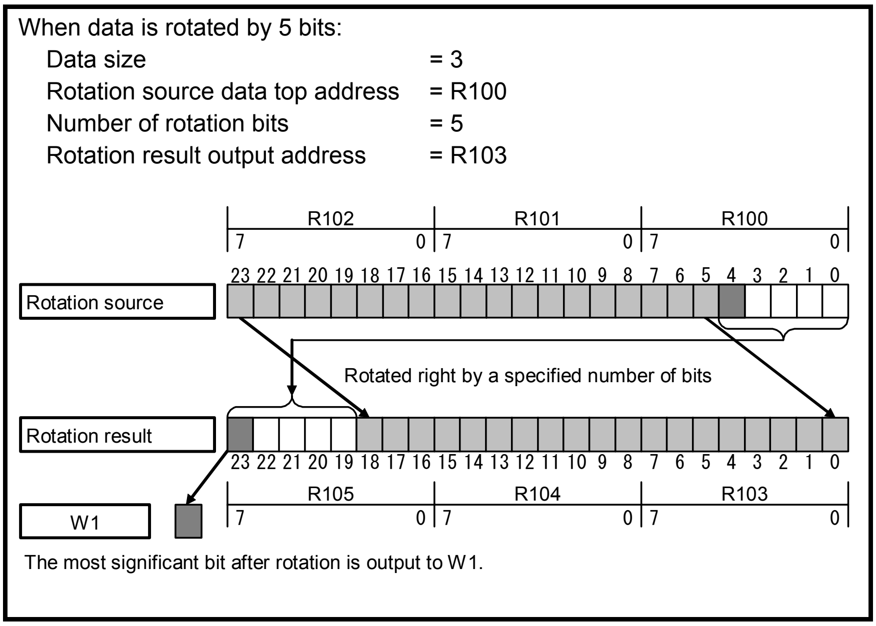


Fig. 4.8.20 (a) Example of RORN instruction

The value of the most significant bit (bit 15 in the example above) at the last address after rotation is output to W1.
If 0 is specified in "Number of rotation bits", the rotation source data is output to "Rotation result output address" without modification, and W1=0 is set.

Format

The followings are the ladder format and the mnemonic format.

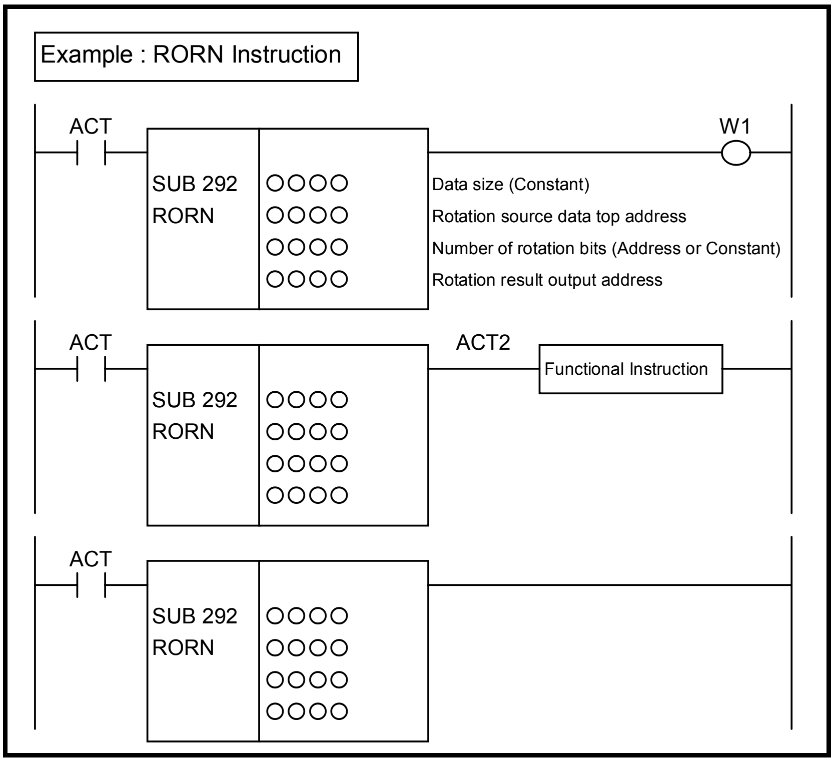


Fig. 4.8.20(b) Format of RORN instruction

Table 4.8.20 Mnemonic of RORN instruction

Mnemonic format

Step number	Instruction	Address No.	Bit No.	Remarks
1	RD	○○○○	.○	ACT
2	SUB	292		SUB No. (RORN instruction)
3	(PRM)	○○○○		Data size (Constant)
4	(PRM)	○○○○		Rotation source data top address
5	(PRM)	○○○○		Number of rotation bits (Address or Constant)
6	(PRM)	○○○○		Rotation result output address
7	WRT	○○○○	.○	Last rotation bit output

Memory status of control condition

ST3	ST2	ST1	ST0
			ACT
			W1

Control conditions

(a) Input signal (ACT)

ACT = 0: Instruction not executed.

ACT = 1: Executed.

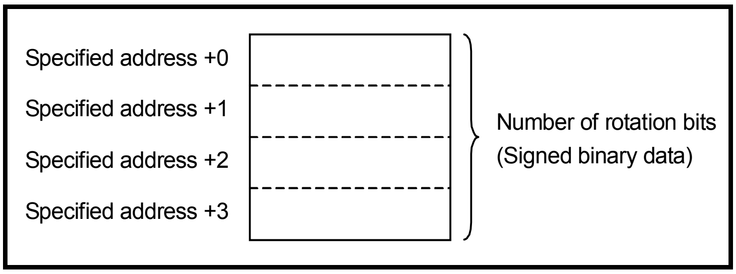
Parameters

(a) Data size
Specify the number of bytes of data on which a bit rotation operation is to be performed. A value from 1 to 256 may be specified.

> **NOTE**
> Specify a valid number to the "Data size", so that both of the area from "Rotation source data top address" and the area from "Rotation result output address" may be arranged within valid address range.

(b) Rotation source data top address
Specify the start address of rotation source data. Specify a data size in "Data size" mentioned in (a) above.

(c) Number of rotation bits
By using 4 bytes signed binary data, specify the number of bits to be rotated. In this parameter, specify 0 or a greater value. If a value greater than 0 is specified, the rotation source data is rotated by a specified number of bits, and the result of rotation operation is output to "Rotation result output address". A value from 1 to ("Data size" × 8) may be specified. For example, if 6 is specified in "Data size", a value from 1 to 48 may be specified in this parameter. If a value greater than the valid range is specified, the number of specified bits is divided by the value obtained by "Data size" × 8 then a rotation operation is performed using the remainder as the specified number of bits. If 0 is specified, the rotation source data is output to "Rotation result output address" without modification, and W1=0 is set.
If a negative value is specified in this parameter, the rotation source data is output to "Rotation result output address" without modification, and W1=0 is set as in the case where 0 is specified in this parameter. No rotation operation in the opposite direction is performed.
In this parameter, a constant or a PMC memory address for storing data can be specified.



(d) Rotation result output address
Specify the start address of an area to which the result of rotation operation is to be output. The result of rotation operation is output to memory of the same size as for rotation source data.

Output (W1)

W1=1: The value of the most significant bit at the last address after rotation is 1.
W1=0: No rotation operation is executed (ACT=0).
The value of the most significant bit at the last address after rotation is 0.
"0" or a negative value is specified in "Number of rotation bits".

> **NOTE**
> W1 may be omitted. Moreover, another functional instruction can be connected instead of a coil.

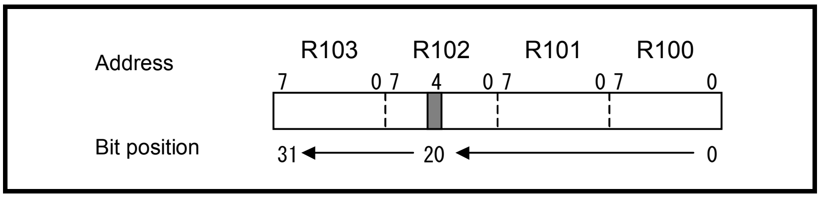
4.8.21 BSETB (Bit Set (1 Byte Length) : SUB 293) BSETW (Bit Set (2 Bytes Length) : SUB 294) BSETD (Bit Set (4 Bytes Length) : SUB 295)

The Bit set instruction sets the bit at a specified bit position to ON (=1).
As indicated below, three types of Bit set instructions are available according to the type of data to be operated.

Table4.8.21 (a) Kinds of Bit set instruction

	Instruction name	SUB No.	Data type	Useful range of bit position
1	BSETB	293	1 byte length data	0 to 7
2	BSETW	294	2 bytes length data	0 to 15
3	BSETD	295	4 bytes length data	0 to 31

A bit position is identified by sequentially counting bit positions, starting with 0, from the least significant bit of a specified address.
For example, if R100 is specified in "Data address", and 20 is specified in "Bit position" with the BSETD instruction, R102.4 is set to ON.



Format

The followings are the ladder format and the mnemonic format.

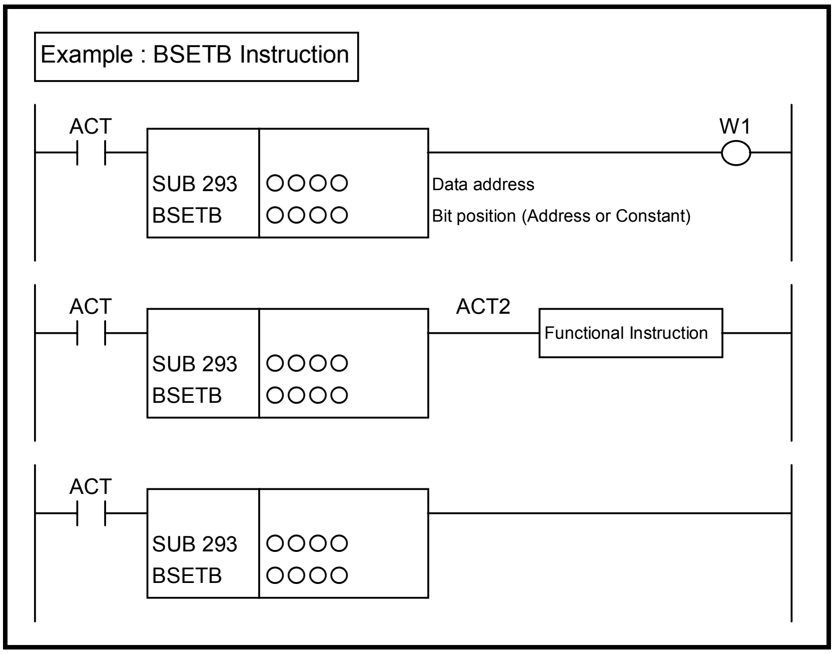


Fig. 4.8.21 (a) Format of BSETB, BSETW, BSETD instruction

Table 4.8.21(b) Mnemonic of BSETB, BSETW, BSETD instruction

Step number	Instruction	Address No.	Bit No.	Remarks	ST3	ST2	ST1	ST0
		Mnemonic format			Memory status of control condition			
1	RD	○○○○	.○	ACT				ACT
2	SUB	293		SUB No. (BSETB instruction)				
3	(PRM)	○○○○		Data address				
4	(PRM)	○○○○		Bit position (Address or Constant)				↓
5	WRT	○○○○	.○	Normal end output				W1

Control conditions

(a) Input signal (ACT)
ACT = 0: Instruction not executed.
ACT = 1: Executed.

Parameters

(a) Data address
Specify the address of data on which a bit operation is to be performed.

(b) Bit position
Specify the position of a bit to be set to ON. Specify 0 or a greater value in "Bit position". For the range of values specifiable in "Bit position", see Table 4.8.21 (a), "Kinds of Bit set instruction".
In this parameter, a constant or a PMC memory address for storing data can be specified.
If an address is specified in this parameter, specify "Bit position" by using signed binary data of the same size as for data type handled by each instruction. For example, with the BSETW instruction, specify "Bit position" by using 2 bytes signed binary data.

If a value not within the valid range is specified in this parameter, the data is not modified, and W1=0 is set.

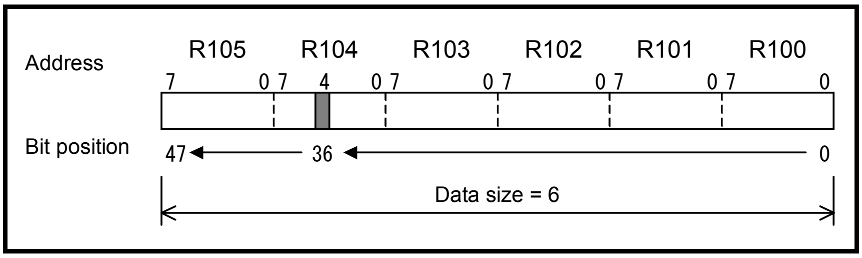
Output (W1)

W1=1: The operation is terminated normally.
W1=0: No operation is executed (ACT=0).
The "Bit position" is not within the valid range.

> **NOTE**
> W1 may be omitted. Moreover, another functional instruction can be connected instead of a coil.

4.8.22 BSETN (Bit Set (Arbitrary Bytes Length) : SUB 296)

The Bit set instruction sets the bit at a specified bit position in a bit string of the size specified in "Data size" to ON (=1).
A bit position is identified by sequentially counting bit positions, starting with 0, from the least significant bit of the start address.
For example, if R100 is specified in "Data top address", 6 is specified in "Data size", and 36 is specified in "Bit position", R104.4 is set to ON.



Format

The followings are the ladder format and the mnemonic format.

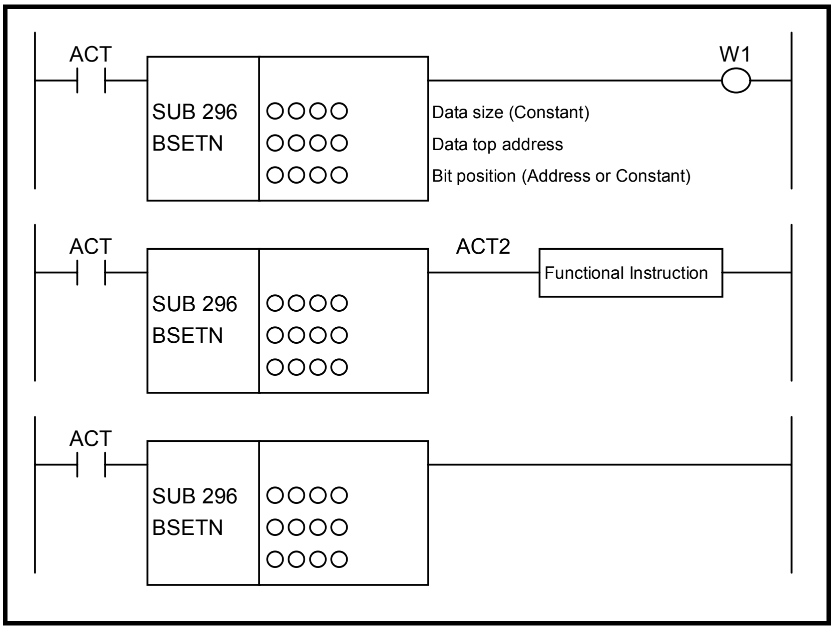


Fig. 4.8.22 Format of BSETN instruction

Table 4.8.22 Mnemonic of BSETN instruction

Mnemonic format

Step number	Instruction	Address No.	Bit No.	Remarks
1	RD	○○○○	.○	ACT
2	SUB	296		SUB No. (BSETN instruction)
3	(PRM)	○○○○		Data size (Constant)
4	(PRM)	○○○○		Data top address
5	(PRM)	○○○○		Bit position (Address or Constant)
6	WRT	○○○○	.○	Normal end output

Memory status of control condition

ST3	ST2	ST1	ST0
			ACT
			W1

Control conditions

(a) Input signal (ACT)
ACT = 0: Instruction not executed.
ACT = 1: Executed.

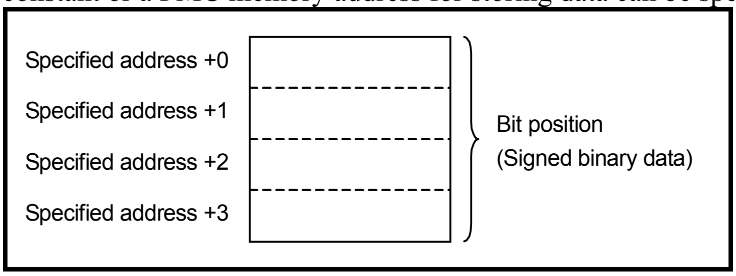
Parameters

(a) Data size
Specify the number of bytes of data on which a bit operation is to be performed. A value from 1 to 256 may be specified.

> **NOTE**
> Specify a valid number to the "Data size", so that the area from "Data top address" may be arranged within valid address range.

(b) Data top address
Specify the start address of data.

(c) Bit position
By using 4 bytes signed binary data, specify the position of a bit to be set to ON. A value from 0 to ("Data size"×8 - 1) may be specified. For example, if 6 is specified in "Data size", a value from 0 to 47 may be specified.
In this parameter, a constant or a PMC memory address for storing data can be specified.



If a value not within the valid range is specified in this parameter, the data is not modified, and W1=0 is set.

Output (W1)

W1=1: The operation is terminated normally.
W1=0: No operation is executed (ACT=0).
The "Bit position" is not within the valid range.

> **NOTE**
> W1 may be omitted. Moreover, another functional instruction can be connected instead of a coil.

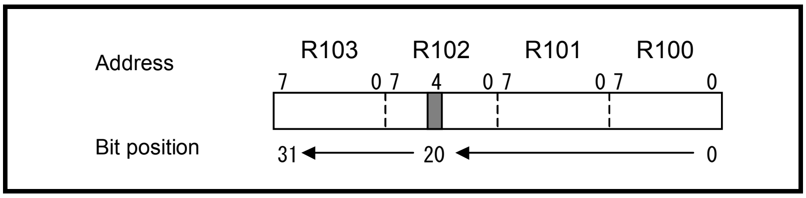
4.8.23 BRSTB (Bit Reset (1 Byte Length) : SUB 297) BRSTW (Bit Reset (2 Bytes Length) : SUB 298) BRSTD (Bit Reset (4 Bytes Length) : SUB 299)

The Bit reset instruction sets the bit at a specified bit position to OFF (=0).
As indicated below, three types of Bit reset instructions are available according to the type of data to be operated.

Table4.8.23 (a) Kinds of Bit reset instruction

	Instruction name	SUB No.	Data type	Useful range of bit position
1	BRSTB	297	1 byte length data	0 to 7
2	BRSTW	298	2 bytes length data	0 to 15
3	BRSTD	299	4 bytes length data	0 to 31

A bit position is identified by sequentially counting bit positions, starting with 0, from the least significant bit of a specified address.
For example, if R100 is specified in "Data address", and 20 is specified in "Bit position" with the BRSTD instruction, R102.4 is set to OFF.



Format

The followings are the ladder format and the mnemonic format.

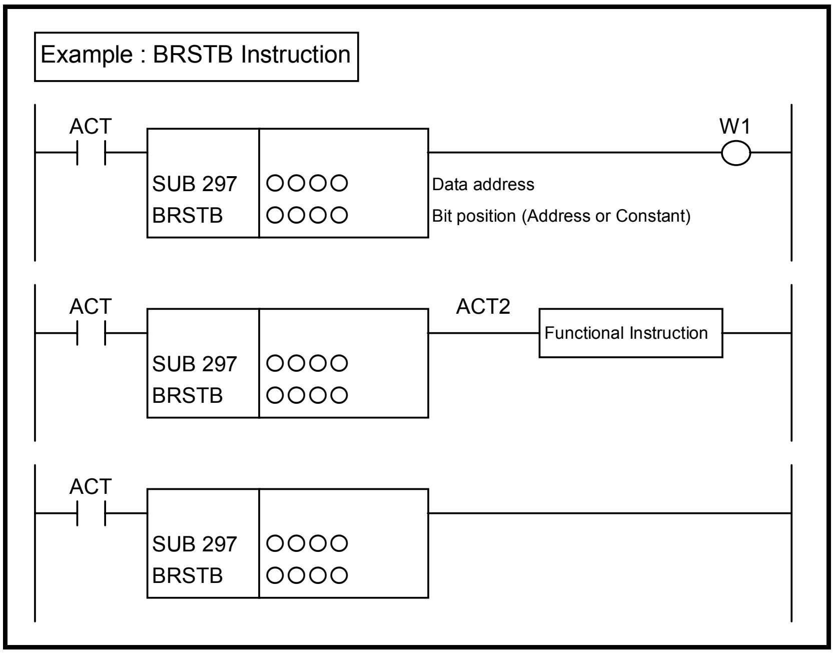


Fig. 4.8.23 Format of BRSTB, BRSTW, BRSTD instruction

Table 4.8.23(b) Mnemonic of BRSTB, BRSTW, BRSTD instruction

Mnemonic format

Step number	Instruction	Address No.	Bit No.	Remarks
1	RD	○○○○	.○	ACT
2	SUB	297		SUB No. (BRSTB instruction)
3	(PRM)	○○○○		Data address
4	(PRM)	○○○○		Bit position (Address or Constant)
5	WRT	○○○○	.○	Normal end output

Memory status of control condition

ST3	ST2	ST1	ST0
			ACT
			↓
			↓
			↓
			W1

Control conditions

(a) Input signal (ACT)
ACT = 0: Instruction not executed.
ACT = 1: Executed.

Parameters

(a) Data address
Specify the address of data on which a bit operation is to be performed.

(b) Bit position
Specify the position of a bit to be set to OFF. Specify 0 or a greater value in "Bit position". For the range of values specifiable in "Bit position", see Table 4.8.23 (a), "Kinds of Bit reset instruction".
In this parameter, a constant or a PMC memory address for storing data can be specified.
If an address is specified in this parameter, specify "Bit position" by using signed binary data of the same size as for data type handled by each instruction. For example, with the BRSTW instruction, specify "Bit position" by using 2 bytes signed binary data.

If a value not within the valid range is specified in this parameter, the data is not modified, and W1=0 is set.

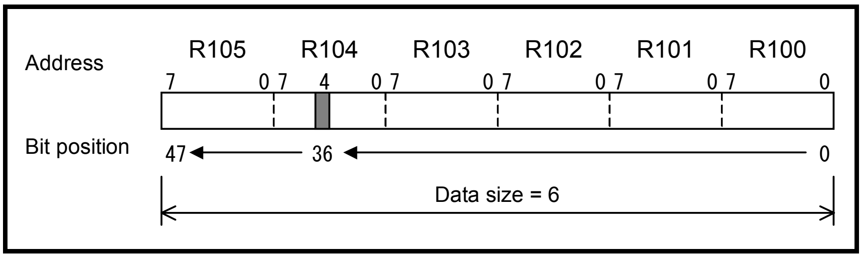
Output (W1)

W1=1: The operation is terminated normally.
W1=0: No operation is executed (ACT=0).
The "Bit position" is not within the valid range.

> **NOTE**
> W1 may be omitted. Moreover, another functional instruction can be connected instead of a coil.

4.8.24 BRSTN (Bit Reset (Arbitrary Bytes Length) : SUB 300)

The Bit reset instruction sets the bit at a specified bit position in a bit string of the size specified in "Data size" to OFF (=0).
A bit position is identified by sequentially counting bit positions, starting with 0, from the least significant bit of the start address.
For example, if R100 is specified in "Data top address", 6 is specified in "Data size", and 36 is specified in "Bit position", R104.4 is set to OFF.



Format

The followings are the ladder format and the mnemonic format.

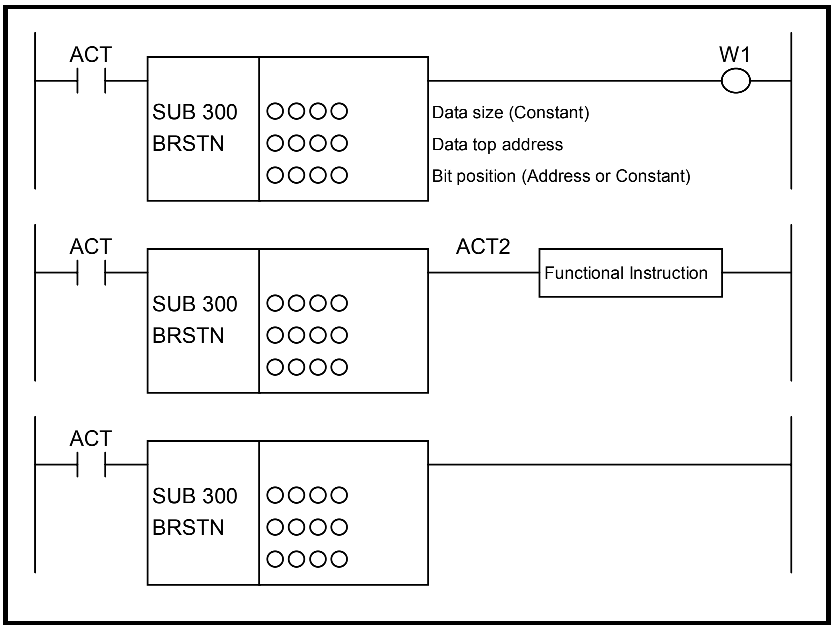


Fig. 4.8.24 Format of BRSTN instruction

Table 4.8.24 Mnemonic of BRSTN instruction

Mnemonic format

Step number	Instruction	Address No.	Bit No.	Remarks
1	RD	○○○○	.○	ACT
2	SUB	300		SUB No. (BRSTN instruction)
3	(PRM)	○○○○		Data size (Constant)
4	(PRM)	○○○○		Data top address
5	(PRM)	○○○○		Bit position (Address or Constant)
6	WRT	○○○○	.○	Normal end output

Memory status of control condition

ST3	ST2	ST1	ST0
			ACT
			W1

Control conditions

(a) Input signal (ACT)
ACT = 0: Instruction not executed.
ACT = 1: Executed.

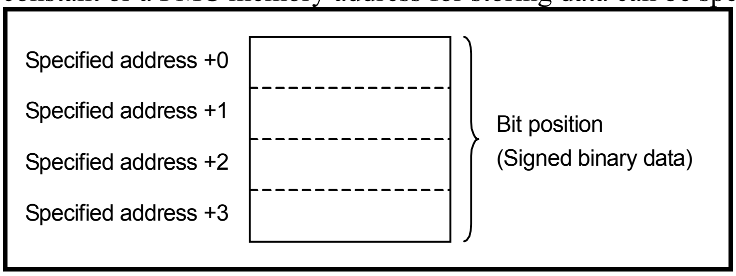
Parameters

(a) Data size
Specify the number of bytes of data on which a bit operation is to be performed. A value from 1 to 256 may be specified.

> **NOTE**
> Specify a valid number to the "Data size", so that the area from "Data top address" may be arranged within valid address range.

(b) Data top address
Specify the start address of data.

(c) Bit position
By using 4 bytes signed binary data, specify the position of a bit to be set to OFF. A value from 0 to ("Data size"×8 - 1) may be specified. For example, if 6 is specified in "Data size", a value from 0 to 47 may be specified.
In this parameter, a constant or a PMC memory address for storing data can be specified.



If a value not within the valid range is specified in this parameter, the data is not modified, and W1=0 is set.

Output (W1)

W1=1: The operation is terminated normally.
W1=0: No operation is executed (ACT=0).
The "Bit position" is not within the valid range.

> **NOTE**
> W1 may be omitted. Moreover, another functional instruction can be connected instead of a coil.

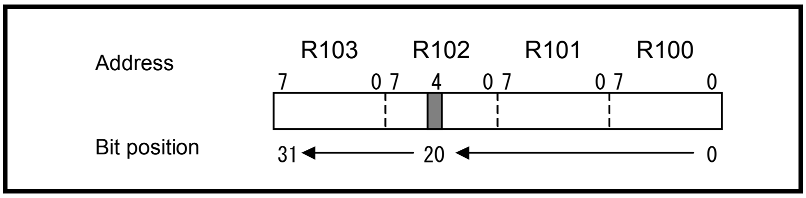
4.8.25 BTSTB (Bit Test (1 Byte Length) : SUB 301) BTSTW (Bit Test (2 Bytes Length) : SUB 302) BTSTD (Bit Test (4 Bytes Length) : SUB 303)

The Bit test instruction outputs the value of the bit at a specified bit position.
As indicated below, three types of Bit test instructions are available according to the type of data to be operated.

Table4.8.25 (a) Kinds of Bit test instruction

	Instruction name	SUB No.	Data type	Useful range of bit position
1	BTSTB	301	1 byte length data	0 to 7
2	BTSTW	302	2 bytes length data	0 to 15
3	BTSTD	303	4 bytes length data	0 to 31

A bit position is identified by sequentially counting bit positions, starting with 0, from the least significant bit of a specified address.
For example, if R100 is specified in "Data address", and 20 is specified in "Bit position" with the BTSTD instruction, the state of R102.4 is output.



Format

The followings are the ladder format and the mnemonic format.

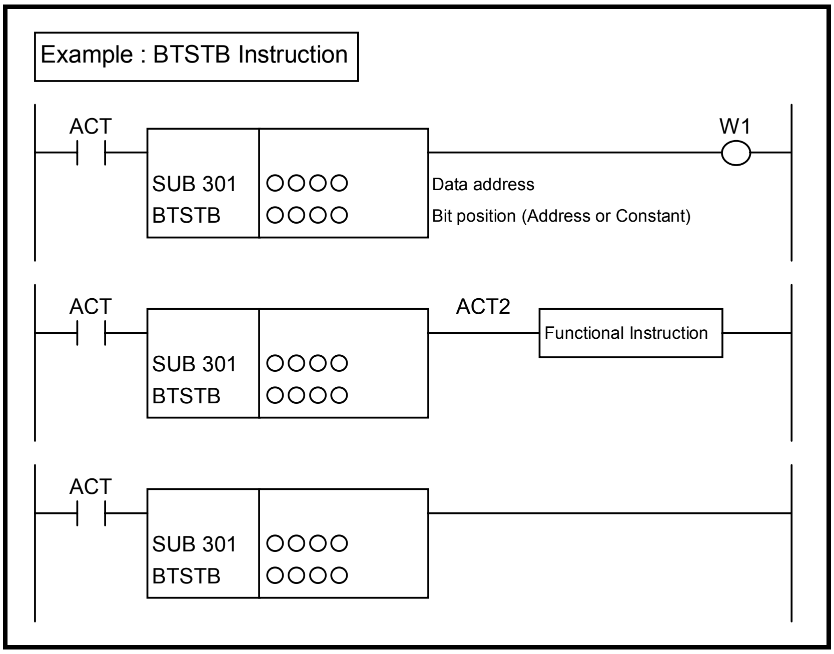


Fig. 4.8.25 Format of BTSTB, BTSTW, BTSTD instruction

Table 4.8.25 (b) Mnemonic of BTSTB, BTSTW, BTSTD instruction

Mnemonic format **Memory status of control condition**

Step number	Instruction	Address No.	Bit No.	Remarks	ST3	ST2	ST1	ST0
1	RD	○○○○	.○	ACT				ACT
2	SUB	301		SUB No. (BTSTB instruction)				
3	(PRM)	○○○○		Data address				
4	(PRM)	○○○○		Bit position (Address or Constant)				↓
5	WRT	○○○○	.○	Bit status output				W1

Control conditions

(a) Input signal (ACT)
ACT = 0: Instruction not executed.
ACT = 1: Executed.

Parameters

(a) Data address
Specify the address of data on which a bit operation is to be performed.

(b) Bit position
Specify the position of a bit whose state is to be output. Specify 0 or a greater value in "Bit position". For the range of values specifiable in "Bit position", see Table 4.8.25 (a), "Kinds of Bit test instruction".
In this parameter, a constant or a PMC memory address for storing data can be specified.
If an address is specified in this parameter, specify "Bit position" by using signed binary data of the same size as for data type handled by each instruction. For example, with the BTSTW instruction, specify "Bit position" by using 2 bytes signed binary data.

If a value not within the valid range is specified in this parameter, W1=0 is set.

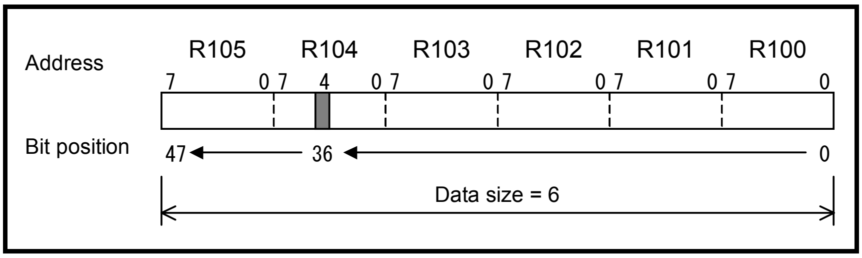
Output (W1)

W1=1: Specified bit is 1.
W1=0: Specified bit is 0.
No operation is executed (ACT=0).
The "Bit position" is not within the valid range.

> **NOTE**
> W1 may be omitted. Moreover, another functional instruction can be connected instead of a coil.

4.8.26 BTSTN (Bit Test (Arbitrary Bytes Length) : SUB 304)

The Bit test instruction outputs the value of the bit at a specified bit position in a bit string of the size specified in "Data size".
A bit position is identified by sequentially counting bit positions, starting with 0, from the least significant bit of the start address.
For example, if R100 is specified in "Data top address", 6 is specified in "Data size", and 36 is specified in "Bit position", the bit state of R104.4 is output.



Format

The followings are the ladder format and the mnemonic format.

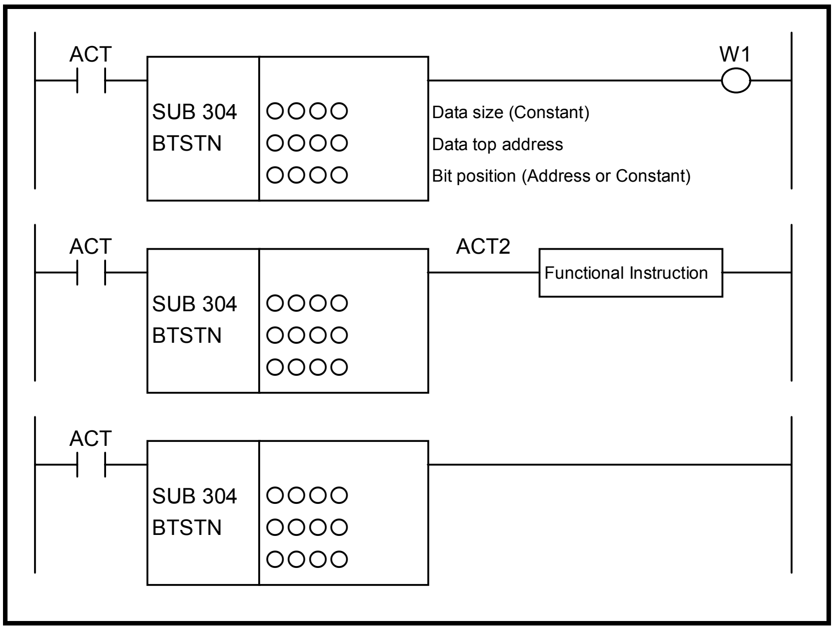


Fig. 4.8.26 Format of BTSTN instruction

Table 4.8.26 Mnemonic of BTSTN instruction

Mnemonic format

Step number	Instruction	Address No.	Bit No.	Remarks
1	RD	○○○○	.○	ACT
2	SUB	304		SUB No. (BTSTN instruction)
3	(PRM)	○○○○		Data size (Constant)
4	(PRM)	○○○○		Data top address
5	(PRM)	○○○○		Bit position (Address or Constant)
6	WRT	○○○○	.○	Normal end output

Memory status of control condition

ST3	ST2	ST1	ST0
			ACT
			▼
			W1

Control conditions

(a) Input signal (ACT)
ACT = 0: Instruction not executed.
ACT = 1: Executed.

Parameters

(a) Data size
Specify the number of bytes of data on which a bit operation is to be performed. A value from 1 to 256 may be specified.

> **NOTE**
> Specify a valid number to the "Data size", so that the area from "Data top address" may be arranged within valid address range.

(b) Data top address
Specify the start address of data.

(c) Bit position
By using 4 bytes signed binary data, specify the position of a bit whose state is to be output. A value from 0 to ("Data size"×8 - 1) may be specified. For example, if 6 is specified in "Data size", a value from 0 to 47 may be specified.
In this parameter, a constant or a PMC memory address for storing data can be specified.

Specified address +0		Bit position (Signed binary data)
Specified address +1		
Specified address +2		
Specified address +3		

If a value not within the valid range is specified in this parameter, W1=0 is set.

Output (W1)

W1=1: Specified bit is 1.
W1=0: Specified bit is 0.
No operation is executed (ACT=0).
The "Bit position" is not within the valid range.

> **NOTE**
> W1 may be omitted. Moreover, another functional instruction can be connected instead of a coil.

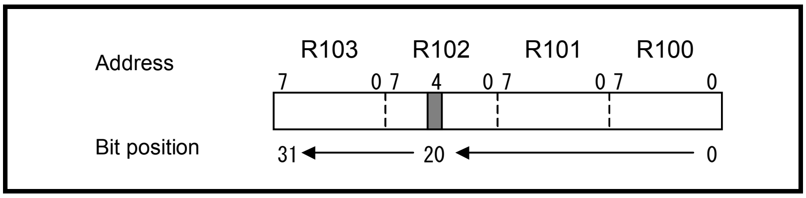
4.8.27 BPOSB (Bit Search (1 Byte Length) : SUB 305) BPOSW (Bit Search (2 Bytes Length) : SUB 306) BPOSD (Bit Search (4 Bytes Length) : SUB 307)

The Bit search instruction acquires the bit position of a bit set to ON (=1).
As indicated below, three types of Bit search instructions are available according to the type of data to be operated.

Table4.8.27 (a) Kinds of Bit search instruction

	Instruction name	SUB No.	Data type	Useful range of bit position
1	BPOSB	305	1 byte length data	0 to 7
2	BPOSW	306	2 bytes length data	0 to 15
3	BPOSD	307	4 bytes length data	0 to 31

Bits are searched in the order from bit 0 to bit 7 at the data top address then bits are searched in the order from bit 0 to bit 7 at the next address. In this way, bit search operation is further performed for up to bit 7 of the last address.
The bit position of the bit that is first found to be ON is output.
A bit position is identified by sequentially counting bit positions, starting with 0, from the least significant bit of the start address.
For example, if R100 is specified in "Data address" with the BPOSD instruction, and only R102.4 is set to ON, 20 is output to "Bit position output address".



Format

The followings are the ladder format and the mnemonic format.

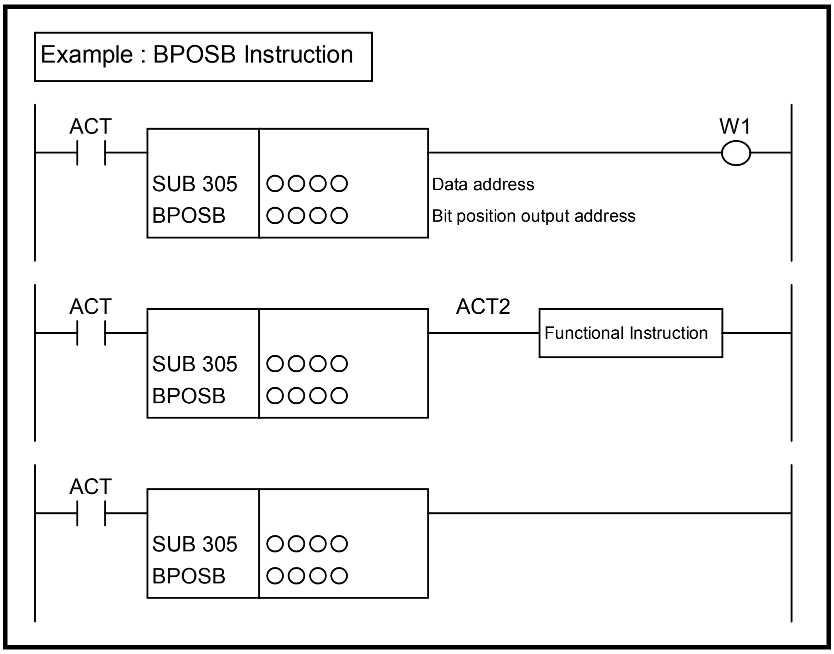


Fig. 4.8.27 Format of BPOSB, BPOSW, BPOSD instruction

Table 4.8.27(b) Mnemonic of BPOSB, BPOSW, BPOSD instruction

Mnemonic format

Step number	Instruction	Address No.	Bit No.	Remarks
1	RD	○○○○	.○	ACT
2	SUB	305		SUB No. (BPOSB instruction)
3	(PRM)	○○○○		Data address
4	(PRM)	○○○○		Bit position output address
5	WRT	○○○○	.○	Normal end output

Memory status of control condition

ST3	ST2	ST1	ST0
			ACT
			↓
			↓
			↓
			W1

Control conditions

(a) Input signal (ACT)
ACT = 0: Instruction not executed.
ACT = 1: Executed.

Parameters

(a) Data address
Specify the address of data on which a bit operation is to be performed.

(b) Bit position output address
Specify the address to which the position of a bit found to be ON as the result of search operation is to be output. Starting at the specified address, a bit position is output by using signed binary data of the same size as for data type handled by each instruction. For example, with the BPOSW instruction, a bit position is output by using 2 bytes signed binary data.
The start bit position number is 0.
If no bit is found to be ON as the result of search operation, -1 is output, and W1=0 is set.

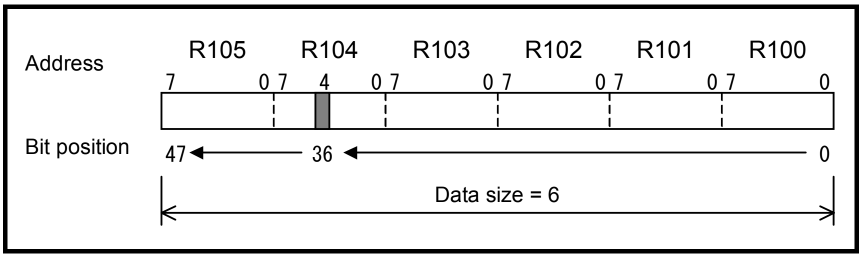
Output (W1)

W1=1: The instruction is terminated normally.
W1=0: No operation is executed (ACT=0)
There is no bit set to ON.

NOTE
W1 may be omitted. Moreover, another functional instruction can be connected instead of a coil.

4.8.28 BPOSN (Bit Search (Arbitrary Bytes Length) : SUB 308)

The Bit search instruction acquires the bit position of a bit set to ON (=1) in a bit string of the size specified in "Data size".
Bits are searched in the order from bit 0 to bit 7 at "Data top address" then bits are searched in the order from bit 0 to bit 7 at the next address. In this way, bit search operation is further performed for up to bit 7 of the last address.
The bit position of the bit that is first found to be ON is output.
A bit position is identified by sequentially counting bit positions, starting with 0, from the least significant bit of the start address.
For example, if R100 is specified in "Data top address", 6 is specified in "Data size", and only R104.4 is set to ON, 36 is output to "Bit position output address".



Format

The followings are the ladder format and the mnemonic format.

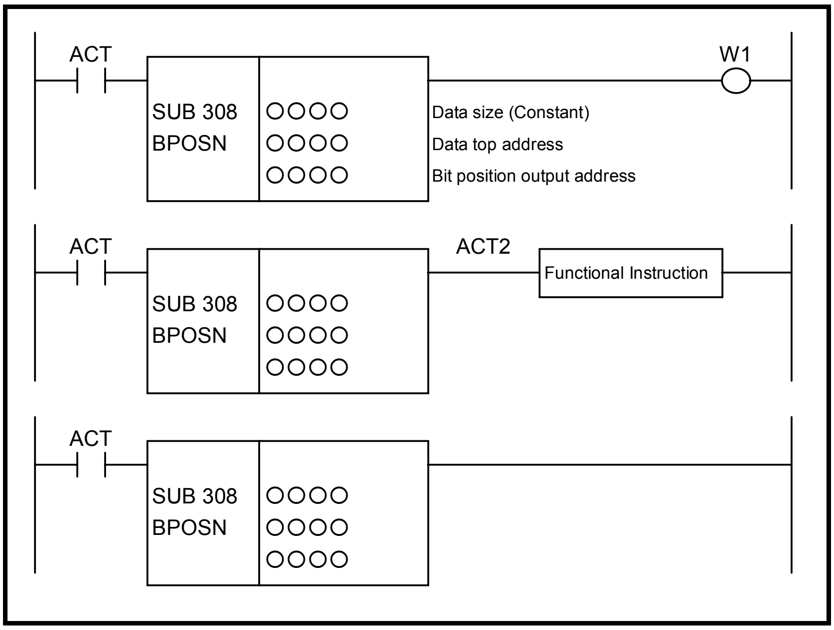


Fig. 4.8.28 Format of BPOSN instruction

Table 4.8.28 Mnemonic of BPOSN instruction

Mnemonic format **Memory status of control condition**

Step number	Instruction	Address No.	Bit No.	Remarks	ST3	ST2	ST1	ST0
1	RD	○○○○	.○	ACT				ACT
2	SUB	308		SUB No. (BPOSN instruction)				
3	(PRM)	○○○○		Data size (Constant)				
4	(PRM)	○○○○		Data top address				
5	(PRM)	○○○○		Bit position output address				
6	WRT	○○○○	.○	Normal end output				W1

Control conditions

(a) Input signal (ACT)
ACT = 0: Instruction not executed.
ACT = 1: Executed.

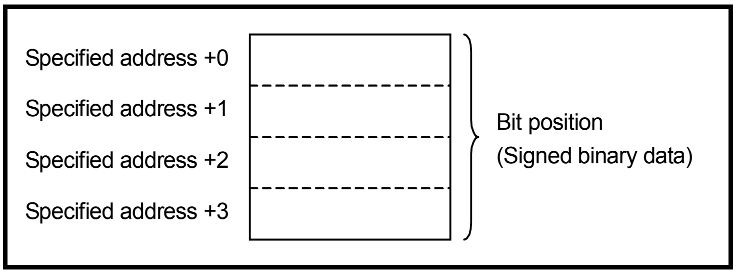
Parameters

(a) Data size
Specify the number of bytes of data on which a bit operation is to be performed. A value from 1 to 256 may be specified.

> **NOTE**
> Specify a valid number to the "Data size", so that the area from "Data top address" may be arranged within valid address range.

(b) Data top address
Specify the start address of data.

(c) Bit position output address
Specify the address to which a found bit position is to be output. A bit position is output by using 4 bytes signed binary data.
The start bit position number is 0.
If no bit is found to be ON as the result of search operation, -1 is output, and W1=0 is set.



Output (W1)

W1=1: The operation is terminated normally.
W1=0: No operation is executed (ACT=0).
There is no bit set to ON.

> **NOTE**
> W1 may be omitted. Moreover, another functional instruction can be connected instead of a coil.

4.8.29 BCNTB (Bit Count (1 Byte Length) : SUB 309) BCNTW (Bit Count (2 Bytes Length) : SUB 310) BCNTD (Bit Count (4 Bytes Length) : SUB 311)

The Bit count instruction acquires the number of bits set to ON (=1).
As indicated below, three types of Bit count instructions are available according to the type of data to be operated.

Table4.8.29 (a) Kinds of Bit count instruction

	Instruction name	SUB No.	Data type	Useful range of bit position
1	BCNTB	309	1 byte length data	0 to 7
2	BCNTW	310	2 bytes length data	0 to 15
3	BCNTD	311	4 bytes length data	0 to 31

Format

The followings are the ladder format and the mnemonic format.

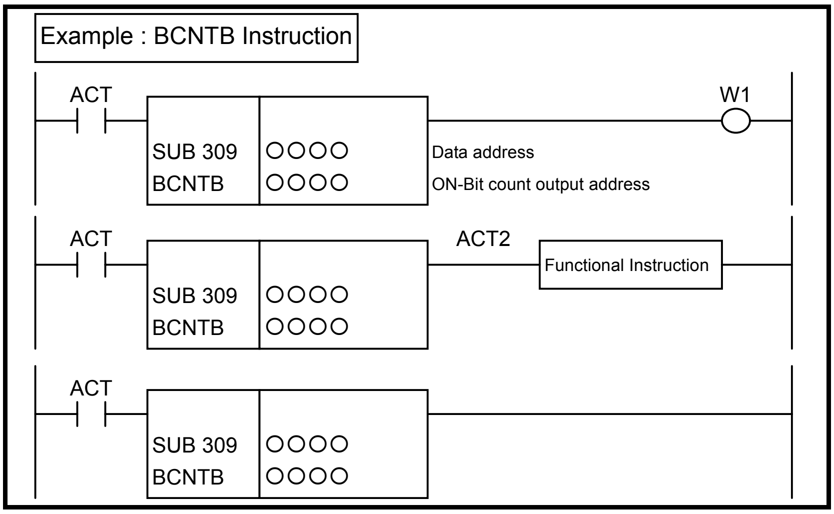


Fig. 4.8.29 Format of BCNTB, BCNTW, BCNTD instruction

Table 4.8.29(b) Mnemonic BCNTB, BCNTW, BCNTD instruction

Mnemonic format

Step number	Instruction	Address No.	Bit No.	Remarks
1	RD	○○○○	.○	ACT
2	SUB	309		SUB No. (BCNTB instruction)
3	(PRM)	○○○○		Data address
4	(PRM)	○○○○		ON-Bit count output address
5	WRT	○○○○	.○	Normal end output

Memory status of control condition

ST3	ST2	ST1	ST0
			ACT
			W1

Control conditions

(a) Input signal (ACT)
ACT = 0: Instruction not executed.
ACT = 1: Executed.

Parameters

(a) Data address
Specify the address of data on which a bit operation is to be performed.

(b) ON-Bit count output address
Specify the address to which the number of bits set to ON is to be output. Starting at the specified address, the number of bits set to ON is output to memory of the same size as for data type handled by each instruction. For example, with the BCNTW instruction, the number of bits set to ON is output by using 2 bytes signed binary data.

Output (W1)

W1=1: The operation is executed (ACT=1).
W1=0: No operation is executed (ACT=0).

NOTE
W1 may be omitted. Moreover, another functional instruction can be connected instead of a coil.

4.8.30 BCNTN (Bit Count (Arbitrary Bytes Length) : SUB 312)

The Bit count instruction acquires the number of bits set to ON (=1) in a bit string of the size specified in "Data size".

Format

The followings are the ladder format and the mnemonic format.

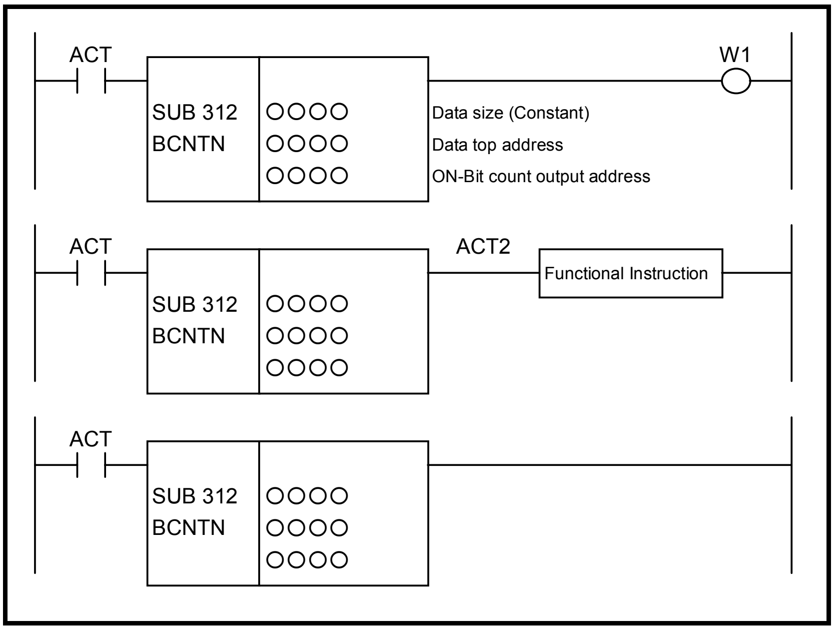


Fig. 4.8.30 Format of BCNTN instruction

Table 4.8.30 Mnemonic of BCNTN instruction

Mnemonic format / **Memory status of control condition**

Step number	Instruction	Address No.	Bit No.	Remarks	ST3	ST2	ST1	ST0
1	RD	○○○○	.○	ACT				ACT
2	SUB	312		SUB No. (BCNTN instruction)				
3	(PRM)	○○○○		Data size (Constant)				
4	(PRM)	○○○○		Data top address				
5	(PRM)	○○○○		ON-Bit count output address				↓
6	WRT	○○○○	.○	Normal end output				W1

Control conditions

(a) Input signal (ACT)
ACT = 0: Instruction not executed.
ACT = 1: Executed.

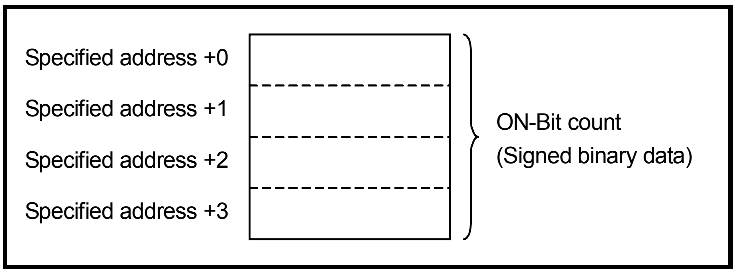
Parameters

(a) Data size
Specify the number of bytes of data on which a bit operation is to be performed. A value from 1 to 256 may be specified.

> **NOTE**
> Specify a valid number to the "Data size", so that both of the area from "Data top address" and the area from "Shift result output address" may be arranged within valid address range.

(b) Data top address
Specify the start address of data.

(c) ON-Bit count output address
Specify the address to which the number of bits set to ON is to be output. The number of bits set to ON is output by using 4 bytes signed binary data.



Output (W1)

W1=1: The operation is executed (ACT=1).
W1=0: No operation is executed (ACT=0).

> **NOTE**
> W1 may be omitted. Moreover, another functional instruction can be connected instead of a coil.

4.9 CODE CONVERSION

The following types of code conversion instruction are available. Use any of these instructions as appropriate for your purpose.

	Instruction name	Sub number	Processing
1	COD	7	Code conversion
2	CODB	27	Binary code conversion
3	DCNV	14	Data conversion
4	DCNVB	31	Extended data conversion
5	DEC	4	Decoding
6	DECB	25	Binary decoding
7	TBCDB	313	Binary to BCD conversion (1 byte length)
8	TBCDW	314	Binary to BCD conversion (2 bytes length)
9	TBCDD	315	Binary to BCD conversion (4 bytes length)
10	FBCDB	316	BCD to Binary conversion (1 byte length)
11	FBCDW	317	BCD to Binary conversion (2 bytes length)
12	FBCDD	318	BCD to Binary conversion (4 bytes length)

4.9.1 COD (Code Conversion: SUB 7)

This instruction converts BCD codes into an arbitrary two- or four-digits BCD numbers. For code conversion shown in Fig. 4.9.1 (a) the conversion input data address, conversion table, and convert data output address must be provided.
Set a table address, in which the data to be retrieved from the conversion table is contained, to conversion table input data address in a two-digits BCD number. The conversion table is entered in sequence with the numbers to be retrieved in the two- or four-digits number. The contents of the conversion table of the number entered in the conversion input data address is output to the convert data output address. As shown in Fig. 4.9.1 (a), when 3 is entered in the conversion input data address, the contents 137 located at 3 in the conversion table is output to the convert data output address.

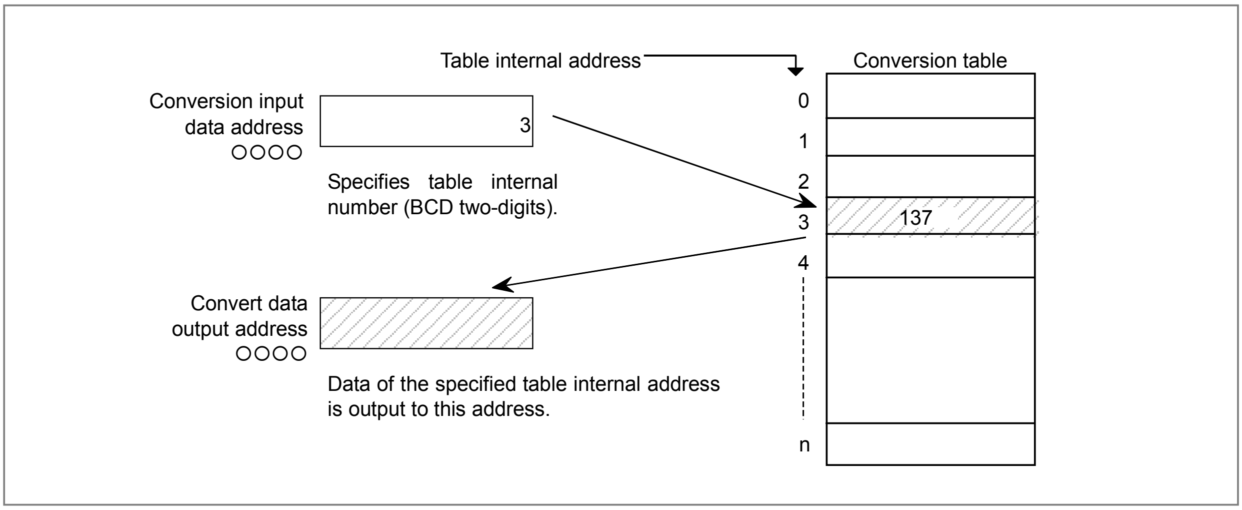


Fig. 4.9.1 (a) Code conversion diagram

Format

Fig. 4.9.1 (b) shows the ladder format and Table 4.9.1 shows the mnemonic format.

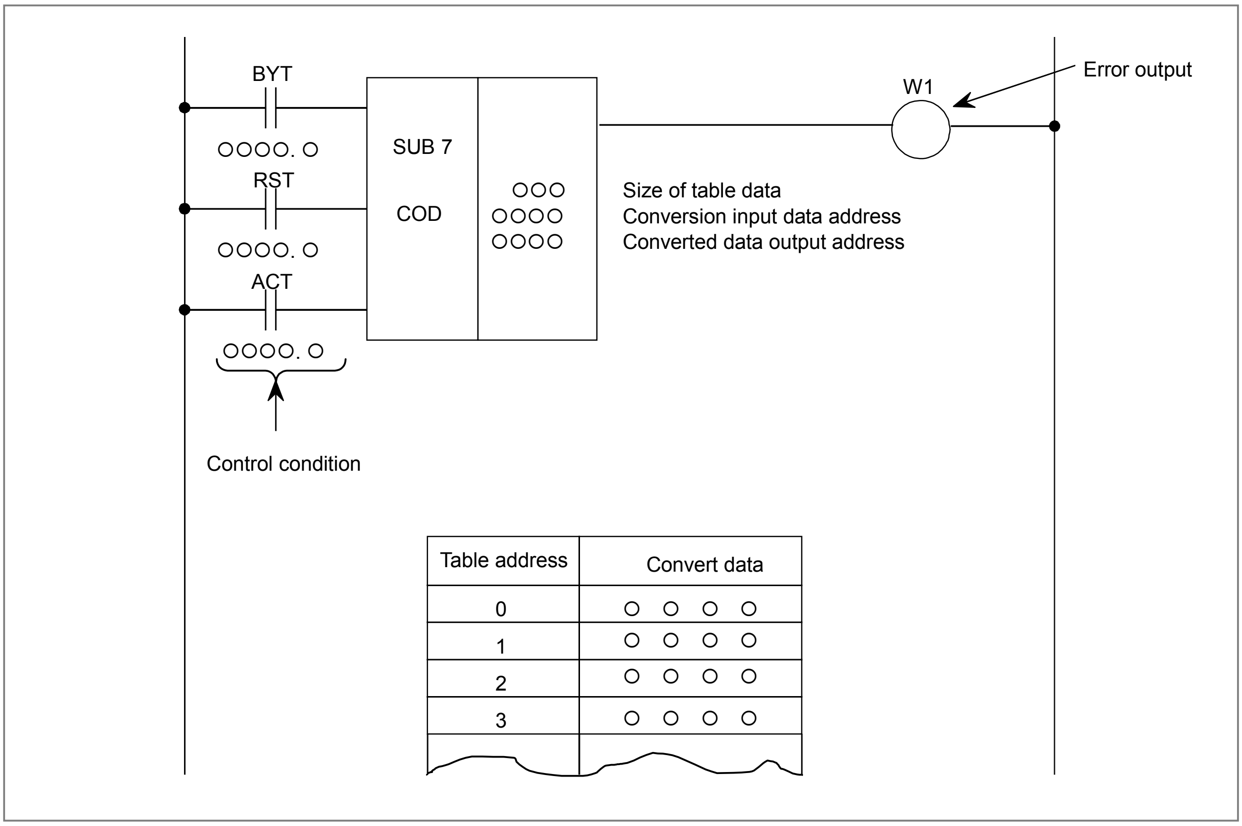


Fig. 4.9.1 (b) Format of COD instruction

Table 4.9.1 Mnemonic of COD instruction

Mnemonic format					Memory status of control condition			
Step number	**Instruction**	**Address No.**	**Bit No.**	**Remarks**	**ST3**	**ST2**	**ST1**	**ST0**
1	RD	○○○○	.○	BYT				BYT
2	RD.STK	○○○○	.○	RST			BYT	RST
3	RD.STK	○○○○	.○	ACT		BYT	RST	ACT
4	SUB	7		COD instruction				
5	(PRM)	○○○		Size of table data				
6	(PRM)	○○○○		Conversion input data address				
7	(PRM)	○○○○		Convert data output address				
8	(PRM)	○○○○		Convert data at table address 0				
9	(PRM)	○○○○		Convert data at table address 1				
:	:	:		:				
7 + n	(PRM)	○○○○		Data at (n (convert data at table address) - 1)				
7 + n + 1	WRT	○○○○	.○	Error output				W1

Control conditions

(a) Specify the data size. (BYT)
BYT=0: The conversion table data is to be BCD 2 digits.
BYT=1: The conversion table data is to be BCD 4 digits.

(b) Error output reset (RST)
RST=0: Disable reset
RST=1: Sets error output W1 to 0 (resets).

(c) Execution command (ACT)
ACT=0: The COD instruction is not executed. W1 does not change.
ACT=1: Executed.

Parameters

(a) Size of table data
A conversion table data address from 00 to 99 can be specified.
Specify n+1 as the size of table when n is the last table internal number.

(b) Conversion input data address
Specify the data address which includes the table number of BCD 2 digits (1-byte).

(c) Convert data output address
Specify the convert data output address. The convert data for BCD 2 digits requires 1-byte memory.
The convert data for BCD 4 digits requires 2-bytes memory.

Error output (W1)

W1=0: No operation is executed (ACT=0).
The conversion is completed normally.
W1=1: The number in the conversion input address is not within the conversion table range.

> ⚠ **CAUTION**
> Two or more coils, WRT, WRT.NOT, SET or RST, that follow this instruction are prohibited. You have to place a single coil instruction as the output of this instruction.

Conversion data table

The size of the conversion data table is from 00 to 99.
The conversion data can be either BCD two digits or four digits, which is specified depends on the control conditions.

4.9.2 CODB (Binary Code Conversion: SUB 27)

This instruction converts data in binary format to an optional binary format 1 byte, 2 bytes or 4 bytes data.
Conversion input data address, conversion table, and conversion data output address are necessary for data conversion; as shown in Fig. 4.9.2 (a).
Compared to the "COD Function Instruction", this CODB function instruction handles numerical data 1, 2 and 4 bytes length binary format data, and the conversion table can be extended to maximum 256.

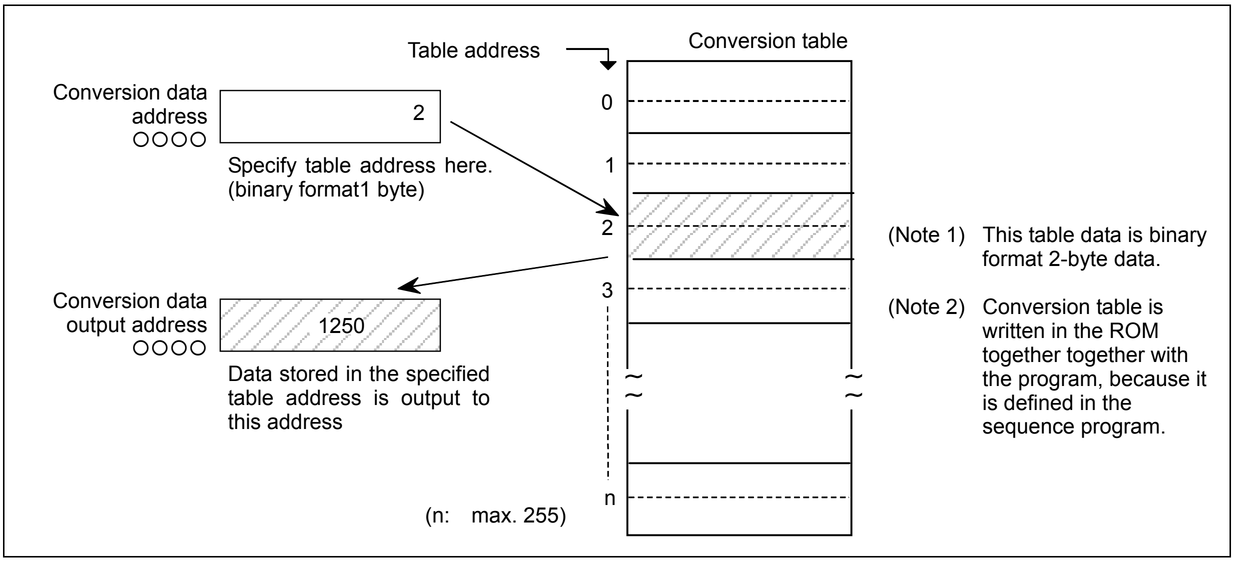


Fig. 4.9.2 (a) Code conversion diagram

Format

Fig. 4.9.2 (b) shows the ladder format and Table 4.9.2 shows the mnemonic format.

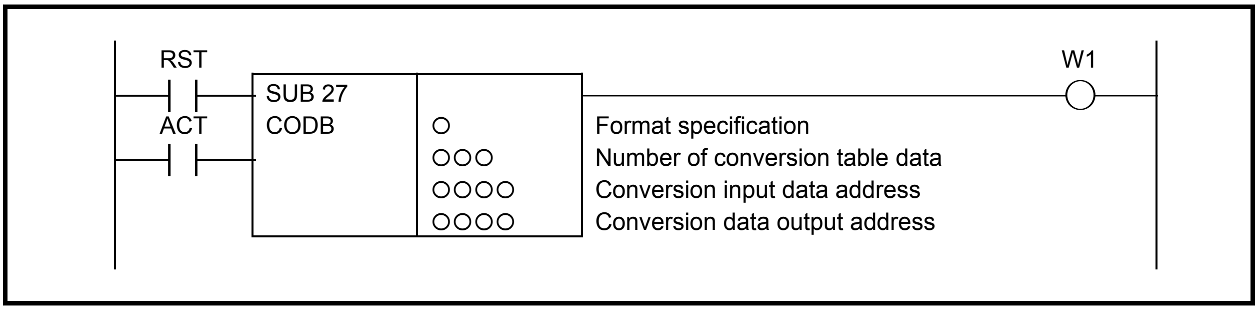


Fig. 4.9.2 (b) Format of CODB instruction

Table 4.9.2 Mnemonic of CODB instruction

Step number	Instruction	Address No.	Bit No.	Remarks	ST3	ST2	ST1	ST0
1	RD	○○○○	.○	RST				RST
2	RD.STK	○○○○	.○	ACT			RST	ACT
3	SUB	27		CODB instruction			↓	↓
4	(PRM)	○		Format specification				
5	(PRM)	○○○		Size of table data				
6	(PRM)	○○○○		Conversion input data address				
7	(PRM)	○○○○		Convert data output address				
8	(PRM)	○○○○		Convert data at table address 0				
9	(PRM)	○○○○		Convert data at table address 1				
:	:	:		:				
7 + n	(PRM)	○○○○		Data at (n (convert data at table address) - 1)				↓
7 + n + 1	WRT	○○○○	.○	Timer relay output			↓	W1

(Columns Step number through Remarks: Mnemonic format; columns ST3–ST0: Memory status of control condition)

Control conditions

(a) Reset (RST)
RST=0: Do not reset error output W1.
RST=1: Reset error output W1 (W1=0).

(b) Activate command (ACT)
ACT=0: Do not execute CODB instruction
ACT=1: Execute CODB instruction.

Parameters

(a) Format specification
Specify the binary data size in the conversion table.
1: Numerical data is binary 1 byte data.
2: Numerical data is binary 2 bytes data.
4: Numerical data is binary 4 bytes data.

> ⚠ **CAUTION**
> Do not set an illegal value, that is not indicated above, into the "(a) Format specification".

(b) Number of conversion table data
Specify the size of conversion table (0 to 255).

(c) Conversion input data address
Specify the data address which includes the table number.

(d) Conversion data output address
Specify the convert data output address. The memory size, which is specified in the format specification, is necessary.

Conversion data table

Size of the conversion data table is maximum 256 (from 0 to 255).

Error output (W1)

W1=0: No operation is executed (ACT=0).
The conversion is completed normally.
W1=1: The number in the conversion data table is not within the conversion table range.

If the table number in the conversion input data address exceeds the number of the conversion table data when executing the CODB instruction, W1=1.

> ⚠ **CAUTION**
> Two or more coils, WRT, WRT.NOT, SET or RST, that follow this instruction are prohibited. You have to place a single coil instruction as the output of this instruction.

4.9.3 DCNV (Data Conversion: SUB 14)

This instruction converts binary-code into BCD-code and vice versa.

Format

Fig. 4.9.3 shows the ladder format and Table 4.9.3 shows the mnemonic format.

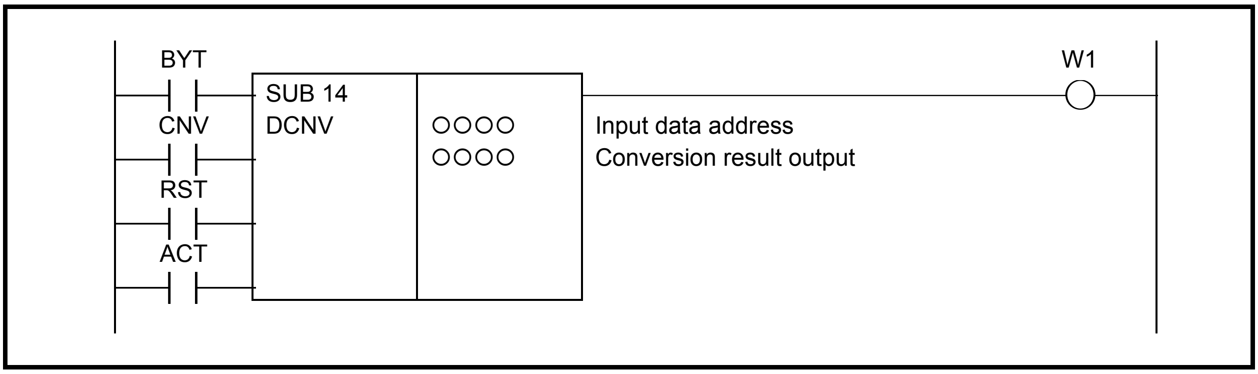


Fig. 4.9.3 Format of DCNV instruction

Table 4.9.3 Mnemonic of DCNV instruction

Mnemonic format

Step number	Instruction	Address No.	Bit No.	Remarks
1	RD	○○○○	.○	BYT
2	RD.STK	○○○○	.○	CNV
3	RD.STK	○○○○	.○	RST
4	RD.STK	○○○○	.○	ACT
5	SUB	14		DCNV instruction
6	(PRM)	○○○○		Input data address
7	(PRM)	○○○○		Conversion result output address
8	WRT	○○○○	.○	W1 error output

Memory status of control condition

ST3	ST2	ST1	ST0
			BYT
		BYT	CNV
	BYT	CNV	RST
BYT	CNV	RST	ACT
			↓
↓	↓	↓	W1

Control conditions

(a) Specify data size. (BYT)
BYT=0: Process data in length of 1 byte (8 bits)
BYT=1: Process data in length of 2 bytes (16 bits)

(b) Specify the type of conversion (CNV)
CNV=0: Convert binary-code into BCD-code.
CNV=1: Convert BCD-code into binary-code.

(c) Reset (RST)
RST=0: Do not reset error output W1.
RST=1: Reset error output W1. That is, setting RST to 1 when W1=1, makes W1=0.

(d) Execution command (ACT)
ACT=0: Data is not converted. W1 will not alter.
ACT=1: Data is converted.

Parameters

(a) Input data address
Specify the address of the input data

(b) Output address after conversion
Specify the address output data converted into BCD or binary type

Error output (W1)

W1=0: Normal complete
W1=1: Conversion error
The input data which should be BCD data, is binary data, or the data size (byte length) specified in advance exceeds when converting binary data into BCD data.

> ⚠ **CAUTION**
> Two or more coils, WRT, WRT.NOT, SET or RST, that follow this instruction are prohibited. You have to place a single coil instruction as the output of this instruction.

4.9.4 DCNVB (Extended Data Conversion: SUB 31)

This instruction converts 1, 2, or 4 bytes binary code into BCD code or vice versa. To execute this instruction, you must preserve the necessary number of bytes in the memory for the conversion result output data.

Format

Fig. 4.9.4 shows the ladder format and Table 4.9.4 shows the mnemonic format.

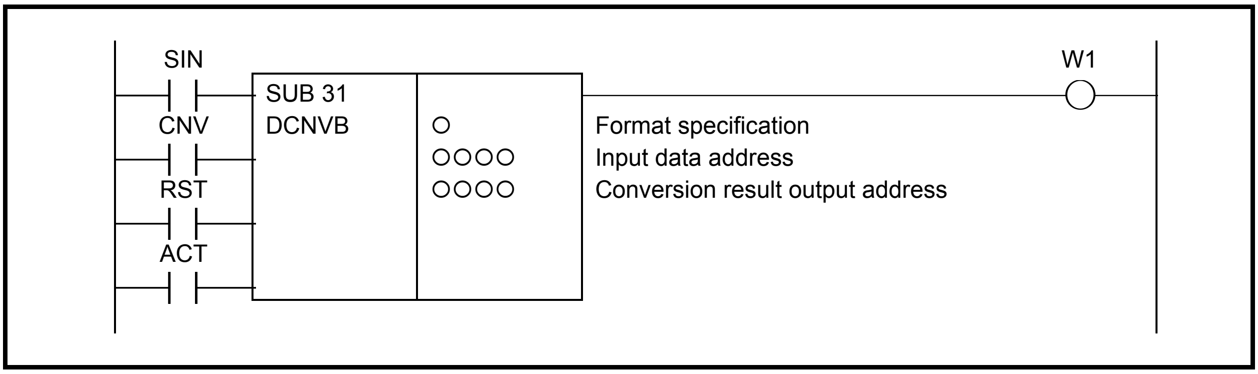


Fig. 4.9.4 Format of DCNVB instruction

Table 4.9.4 Mnemonic of DCNVB instruction

Mnemonic format					Memory status of control condition			
Step number	**Instruction**	**Address No.**	**Bit No.**	**Remarks**	**ST3**	**ST2**	**ST1**	**ST0**
1	RD	○○○○	.○	SIN				SIN
2	RD.STK	○○○○	.○	CNV			SIN	CNV
3	RD.STK	○○○○	.○	RST		SIN	CNV	RST
4	RD.STK	○○○○	.○	ACT	SIN	CNV	RST	ACT
5	SUB	31		DCNVB instruction				
6	(PRM)	○		Size of table data				
7	(PRM)	○○○○		Conversion input data address				
8	(PRM)	○○○○		Conversion data output address				↓
9	WRT	○○○○	.○	Error output	↓	↓	↓	W1

Control conditions

(a) Sign of the data to be converted (SIN)
This parameter is significant only when you are converting BCD data into binary coded data. It gives the sign of the BCD data.
Note that though it is insignificant when you are converting binary into BCD data, you cannot omit it.
SIN=0: Data (BCD code) to be input is positive.
SIN=1: Data (BCD code) to be input is negative.

(b) Type of conversion (CNV)
CNV=0: Convert binary data into BCD data
CNV=1: Convert BCD data into binary data.

(c) Reset (RST)
RST=0: Do not reset error output W1.
RST=1: Reset error output W1. In other words, set W1=0.

(d) Execution command (ACT)
ACT=0: Data is not converted. The value of W1 remains unchanged.
ACT=1: Data is converted.

Parameters

(a) Format specification
Specify data length (1,2, or 4 bytes).
Use the first digit of the parameter to specify byte length.
1: 1 byte
2: 2 bytes
4: 4 bytes

> ⚠ **CAUTION**
> Do not set an illegal value, that is not indicated above, into the "(a) Format specification".

(b) Input data address
Specify the address containing the input data address.

(c) Address for the conversion result output
Specify the address to output the data converted to BCD or binary format.

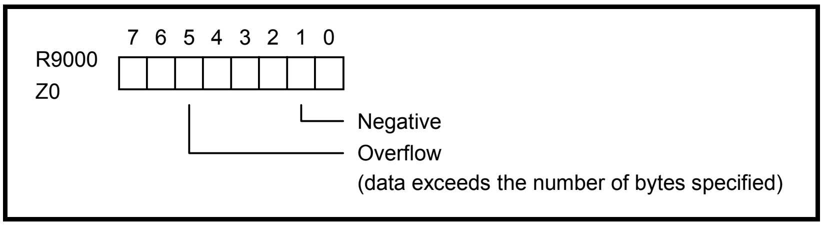
Error output (W1)

W1=0: Normal complete
W1=1: Conversion error
The data to be converted is specified as BCD data but is found to be binary data, or the specified number of bytes cannot contain (and hence an overflow occurs) the BCD data into which a binary data is converted.

> ⚠ **CAUTION**
> Two or more coils, WRT, WRT.NOT, SET or RST, that follow this instruction are prohibited. You have to place a single coil instruction as the output of this instruction.

Operation output register (R9000, Z0)

This register is set with data on operation. If register bit 1 is on, they signify the following.
For the positive/negative signs when binary data is converted into BCD data, see R9000 or Z0.



4.9.5 DEC (Decode: SUB 4)

This instruction outputs 1 when the two-digit BCD code signal is equal to a specified number and 0 when not. This is used mainly to decode M or T function. The value type in this instruction is BCD.

Format

Fig. 4.9.5 (a) shows the ladder format and Table 4.9.5 (a) shows the mnemonic format.

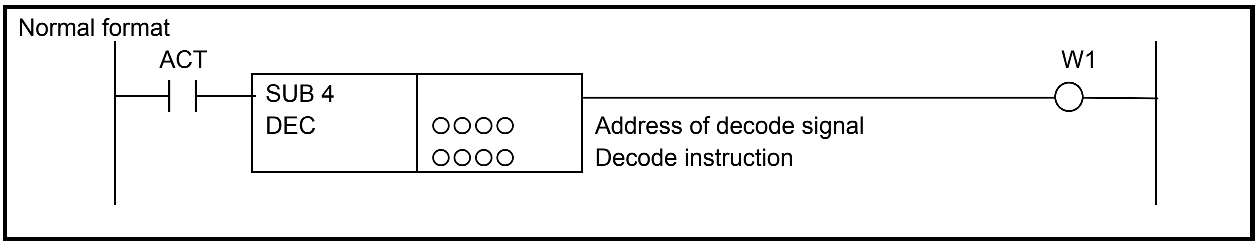


Fig. 4.9.5 (a) Format of DEC instruction (Normal format)

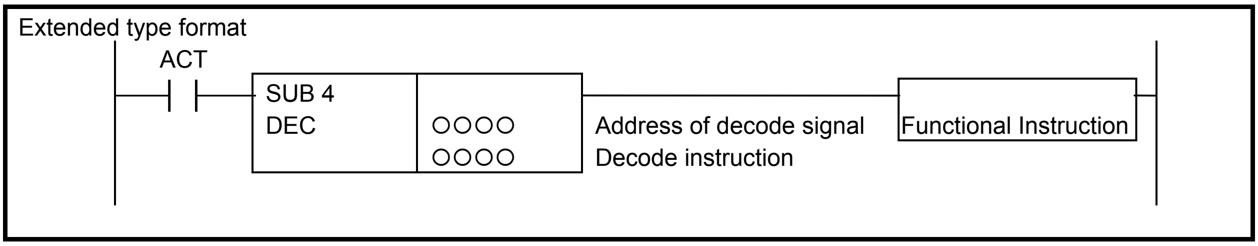


Fig. 4.9.5 (b) Format of DEC instruction (Extended type format)

Table 4.9.5 (a) Mnemonic of DEC instruction (Normal format)

Mnemonic format					Memory status of control condition			
Step number	**Instruction**	**Address No.**	**Bit No.**	**Remarks**	**ST3**	**ST2**	**ST1**	**ST0**
1	RD	○○○○	.○	ACT				ACT
2	DEC	○○○○		Code signal address				
3	(PRM)	○○○○		Decode specification				
4	WRT	○○○○	.○	W1, decoding result output				W1

The mnemonic-format instruction name "DEC" for step number 2 above may be abbreviated as "D".

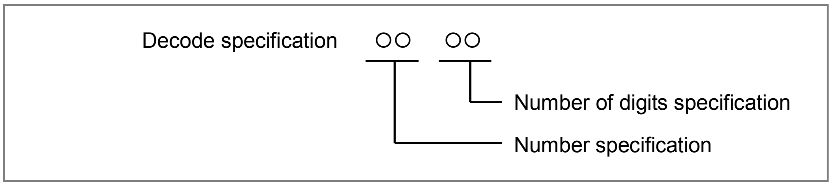
Control condition

ACT=0: Turns the decoding result output off (W1).
ACT=1: Performs decoding.
When the specified number is equal to the code signal, W1=1; when not, W1=0.

Parameters

(a) Code signal address
Specify the address containing two-digit BCD code signals.

(b) Decode specification
There are two paths, the number and the number of digits.



(i) Number:
Specify the decode number.
It must always be decoded in two digits.

(ii) Number of digits:
01: The high-order digit of two decimal digits is set to 0 and only the low-order digit is decoded.
10: The low-order digit is set to 0 and only the high-order digit is decoded.
11: Two decimal digits are decoded.

Decoding result output (W1)

W1=1: The status of the code signal at a specified address is equal to a specified number.
W1=0: The status of the code signal at a specified address is not equal to a specified number.

Example

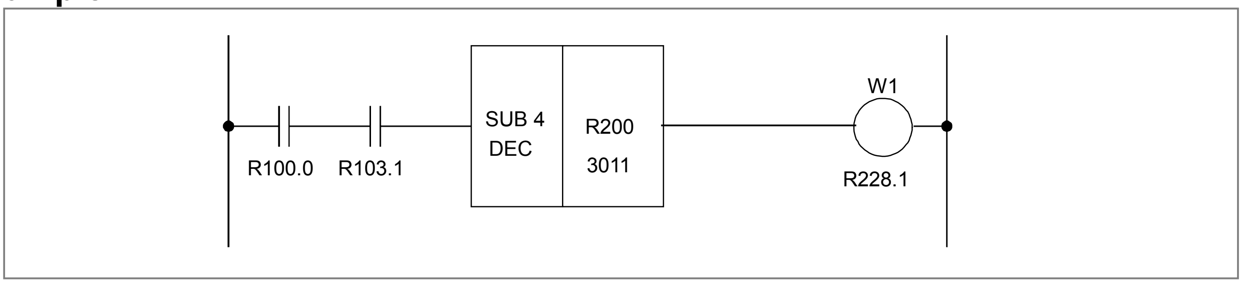


Fig. 4.9.5 (c) Ladder diagram using the DEC instruction

Table 4.9.5 (b) Mnemonic for Fig. 4.9.5 (b)

Step number	Instruction	Address No.	Bit No.	Remarks
1	RD	R100	.0	
2	AND	R103	.1	
3	DEC	R200		
4	(PRM)	3011		
5	WRT	R228	.1	

4.9.6 DECB (Binary Decoding: SUB 25)

DECB decodes 1, 2 or 4 bytes binary code data. When one of the specified eight consecutive numbers matches the code data, a logical high value (value 1) is set in the output data bit which corresponds to the specified number. When these numbers do not match, a logical low value (value 0) is set.
Use this instruction for decoding data of the M or T function.
There are two specifications - basic specification and extended specification - for setting the format specification parameter in the DECB instruction. The extended specification allows 8n consecutive values to be decoded at a time. For the details of the setting of a format specification parameter, see the description of parameters.

Format

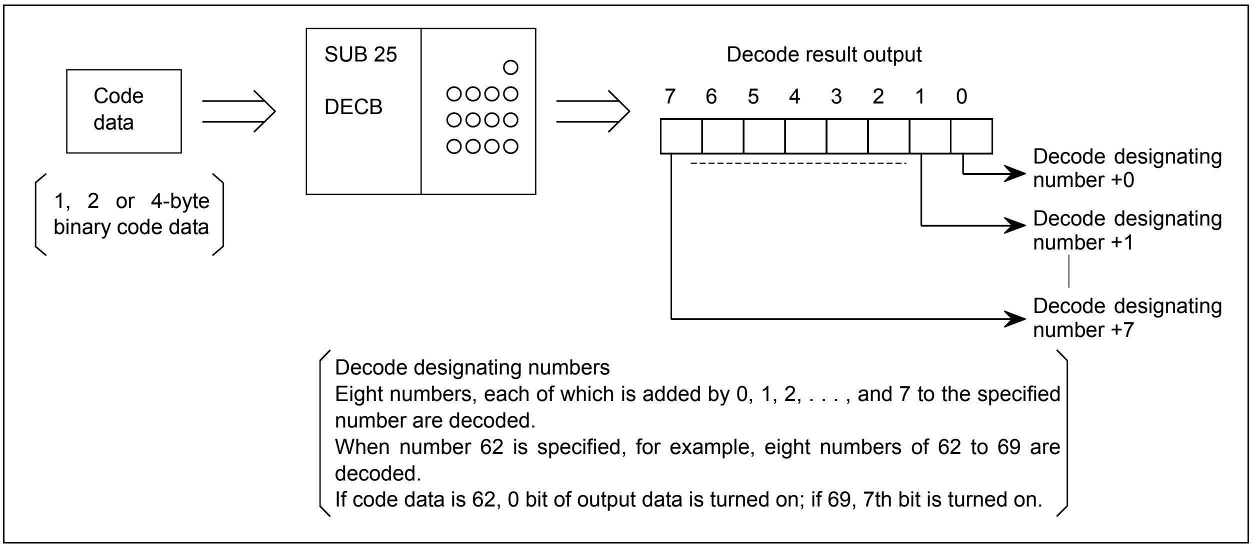


Fig. 4.9.6 (a) Function of DECB instruction (basic specification)

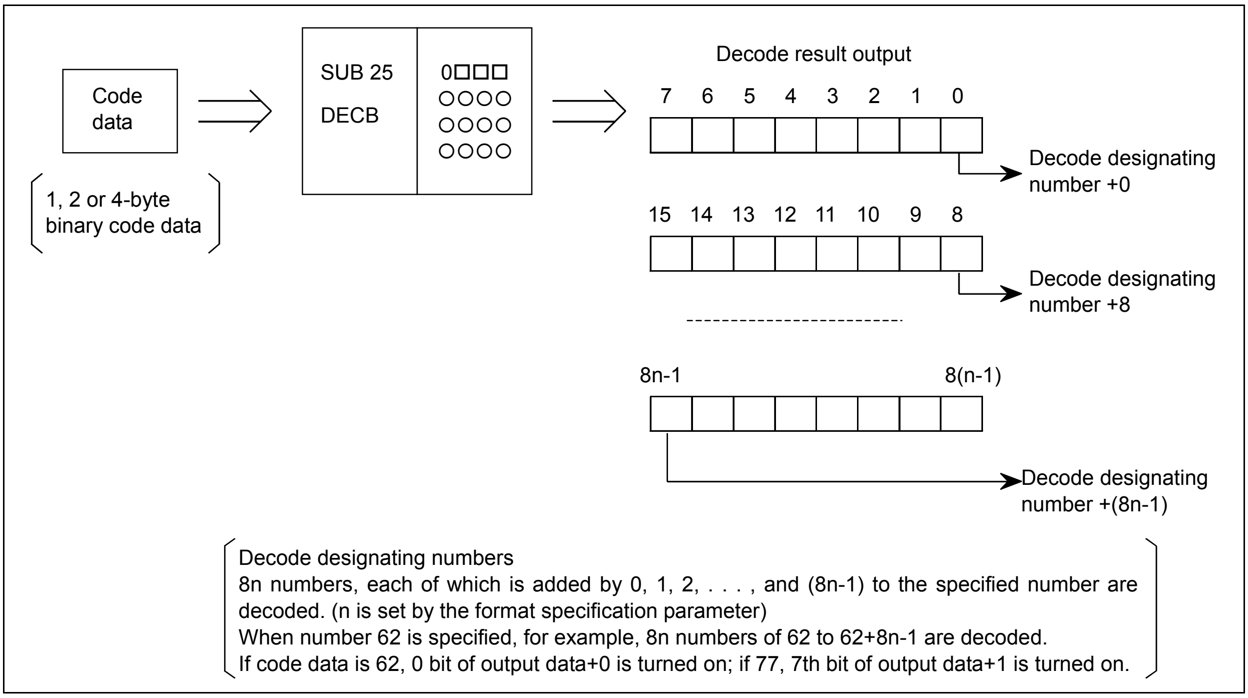


Fig. 4.9.6 (b) Function of DECB instruction (extended specification)

Figs. 4.9.6 (c) and (d) show the ladder formats and Tables 4.9.6 (a) and (b) show the mnemonic formats.

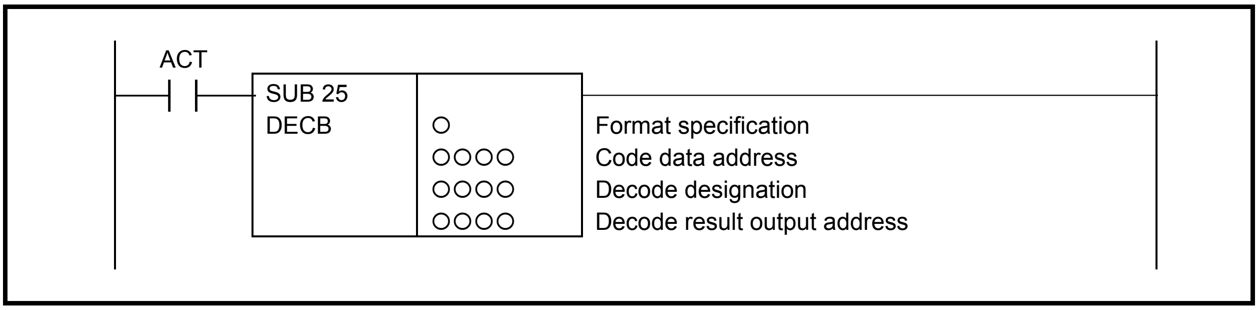


Fig. 4.9.6 (c) Format of DECB instruction (basic specification)

Table 4.9.6 (a) Mnemonic of DECB instruction (basic specification)

Mnemonic format					Memory status of control condition			
Step number	**Instruction**	**Address No.**	**Bit No.**	**Remarks**	**ST3**	**ST2**	**ST1**	**ST0**
1	RD	○○○○	.○	ACT				ACT
2	SUB	25		DECB instruction				
3	(PRM)	○		Format specification				
4	(PRM)	○○○○		Code data address				
5	(PRM)	○○○○		Decode designation				
6	(PRM)	○○○○		Decode result output address				

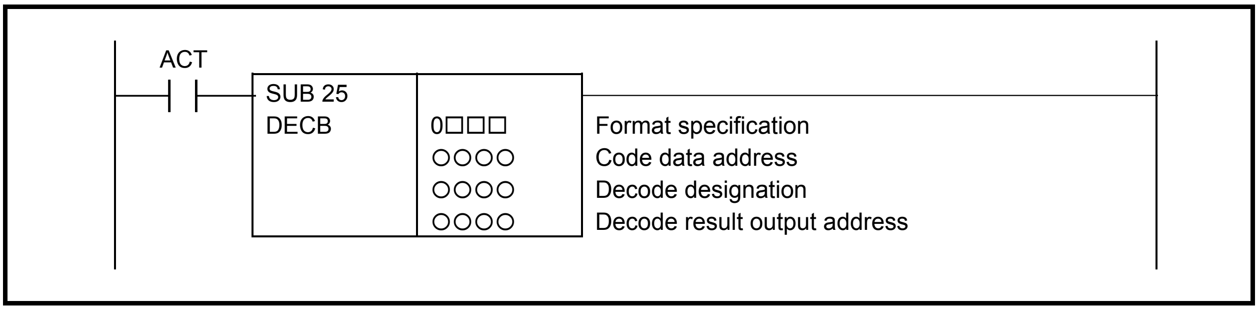


Fig. 4.9.6 (d) Format of DECB instruction (extended specification)

Table 4.9.6 (b) Mnemonic of DECB instruction (extended specification)

Mnemonic format					Memory status of control condition			
Step number	**Instruction**	**Address No.**	**Bit No.**	**Remarks**	**ST3**	**ST2**	**ST1**	**ST0**
1	RD	○○○○	.○	ACT				ACT
2	SUB	25		DECB instruction				
3	(PRM)	0□□□		Format specification				
4	(PRM)	○○○○		Code data address				
5	(PRM)	○○○○		Decode designation				
6	(PRM)	○○○○		Decode result output address				

Control conditions

(a) Command (ACT)

ACT=0: Resets all the output data bits.

ACT=1: Decodes data. The results of processing are set in the output data address.

Parameters

(a) Format specification

Set the size of code data to the 1st digit of the parameter.

0001: Code data is in binary format of 1 byte length

0002: Code data is in binary format of 2 bytes length

0004: Code data is in binary format of 4 bytes length

When setting format specification in the following extended format, DECB can decode multiple (8 × n) bytes by 1 instruction.

0nn1: In case of decoding multiple (8 × nn) bytes and code data is binary format of 1 byte length

0nn2: In case of decoding multiple (8 × nn) bytes and code data is binary format of 2 bytes length

0nn4: In case of decoding multiple (8 × nn) bytes and code data is binary format of 4 bytes length

The nn is the numerical value from 02 to 99. When setting 00 or 01, it works for decoding 8 numbers.

Format specification (extended specification) :

0 n n X

The byte length setting of code data
1: 1 byte length
2: 2 byte length
4: 4 byte length

The multiple decoding number setting
00-01:
It decodes 8 continuous numbers.
The decode result output address needs a memory of 1 byte length.
02-99:
It decodes multiple (8×nn) continuous numbers.
The decode result output address needs a memory of nn bytes length.

> ⚠ **CAUTION**
> Do not set an illegal value, that is not indicated above, into the "(a) Format specification".

(b) Code data address

Specify the numbers to be decoded.

(c) Number specification decode designation

Specify the numbers to be decoded.

(d) Decode result address

Specify an address where the decoded result shall be output.

One byte area is necessary in the memory for the output.

When executing this instruction in extended specification, the area of setting by the format specification for the “nn” bytes is necessary.

4.9.7 TBCDB (Binary to BCD Conversion (1 Byte Length) : SUB 313) TBCDW (Binary to BCD Conversion (2 Bytes Length) : SUB 314) TBCDD (Binary to BCD Conversion (4 Bytes Length) : SUB 315)

The Binary to BCD conversion instruction converts binary data to BCD format data.
As indicated below, three types of Binary to BCD conversion instructions are available according to the type of data to be converted.

Table 4.9.7 (a) Kinds of Binary to BCD conversion instruction

	Instruction name	SUB No.	Data type	
			Source	Destination
1	TBCDB	313	1 byte length signed binary	2-digit BCD
2	TBCDW	314	2 bytes length signed binary	4-digit BCD
3	TBCDD	315	4 bytes length signed binary	8-digit BCD

If conversion source binary data is not within the valid BCD format data range (if source binary data is a negative value or is greater than the maximum allowable value), the result of conversion is not output, and W1=0 is set.

Format

Fig. 4.9.7 shows the ladder format and Table 4.9.7(b) shows the mnemonic format.

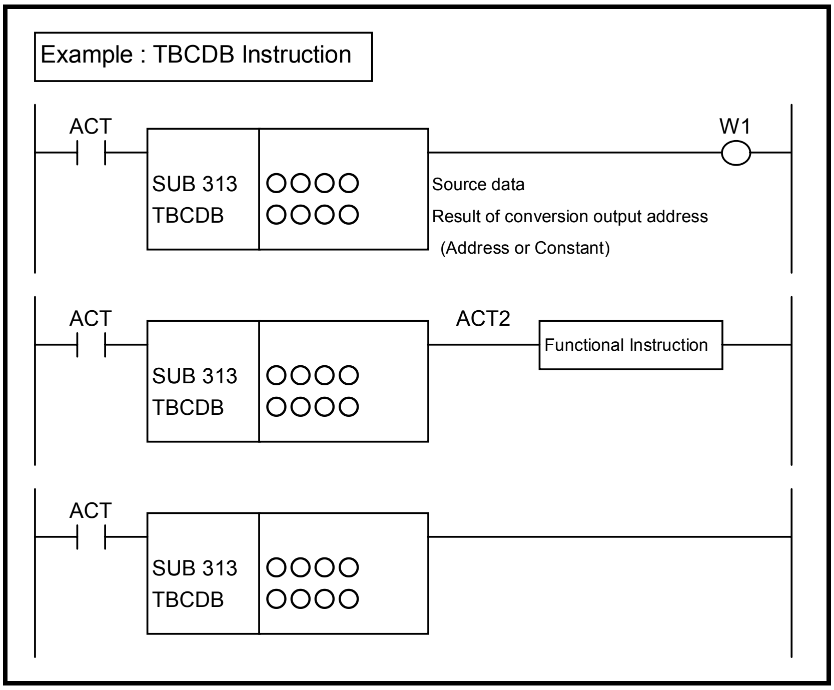


Fig. 4.9.7 Format of TBCDB, TBCDW, TBCDD instruction

Table 4.9.7(b) Mnemonic of TBCDB, TBCDW, TBCDD instruction

Mnemonic format

Step number	Instruction	Address No.	Bit No.	Remarks
1	RD	○○○○	.○	ACT
2	SUB	313		SUB No. (TBCDB instruction)
3	(PRM)	○○○○		Source data
4	(PRM)	○○○○		Result of conversion output address (Address or Constant)
5	WRT	○○○○	.○	Normal end output

Memory status of control condition

ST3	ST2	ST1	ST0
			ACT
			↓
			↓
			↓
			W1

Control conditions

(a) Input signal (ACT)
ACT = 0: Instruction not executed.
ACT = 1: Executed.

Parameters

(a) Source data
Specify conversion source binary data. In this parameter, a constant or a PMC memory address for storing data can be specified.

(b) Result of conversion output address
Specify the address to which BCD format data produced as the result of conversion is to be output.

Output (W1)

W1=1: The operation is terminated normally.
W1=0: No operation is executed. (ACT=0)
The conversion source data is not within the valid BCD format data range.

> **NOTE**
> 1 W1 may be omitted. Moreover, another functional instruction can be connected instead of a coil.
> 2 With the similar functional instruction DCNVB, W1=1 is set when an operation is terminated abnormally. With TBCDB, TBCDW, and TBCDD, W1=1 is set when an operation is terminated normally.
> 3 No data is output to the operation output registers (R9000, Z0).

4.9.8 FBCDB (BCD to Binary Conversion (1 Byte Length) : SUB 313) FBCDW (BCD to Binary Conversion (2 Bytes Length) : SUB 314) FBCDD (BCD to Binary Conversion (4 Bytes Length) : SUB 315)

The BCD to Binary conversion instruction converts BCD format data to binary data.
As indicated below, three types of BCD to Binary conversion instructions are available according to the type of data to be converted.

Table 4.9.8 (a) Kinds of BCD to Binary conversion instruction

	Instruction name	SUB No.	Data type	
			Source	Destination
1	FBCDB	316	2-digit BCD	1 byte length signed binary
2	FBCDW	317	4-digit BCD	2 bytes length signed binary
3	FBCDD	318	8-digit BCD	4 bytes length signed binary

If conversion source data is invalid as BCD format data, the result of conversion is not output, and W1=0 is set.

Format

Fig. 4.9.8 shows the ladder format and Table 4.9.8(b) shows the mnemonic format.

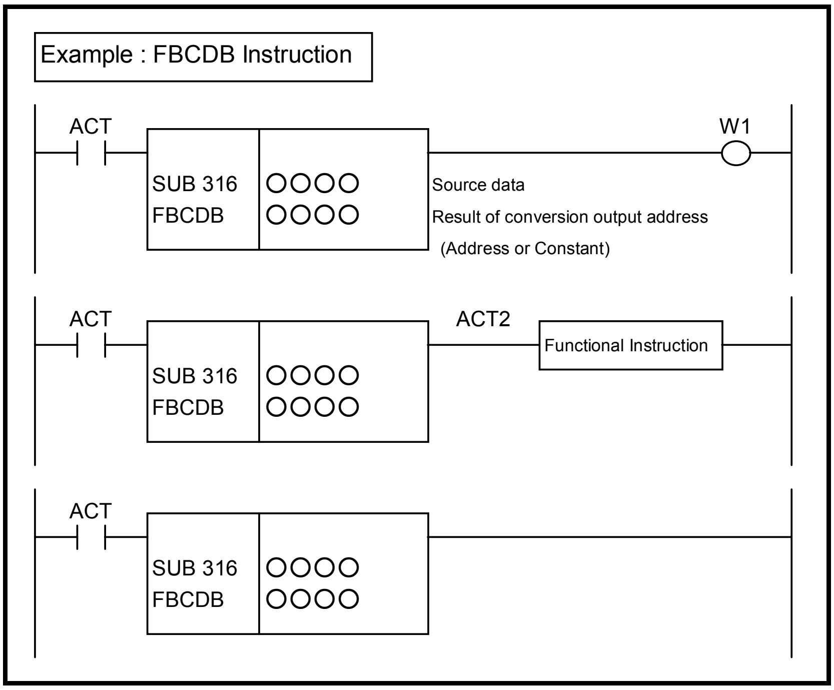


Fig. 4.9.8 Format of FBCDB, FBCDW, FBCDD instruction

Table 4.9.8(b) Mnemonic of FBCDB, FBCDW, FBCDD instruction

Mnemonic format

Step number	Instruction	Address No.	Bit No.	Remarks
1	RD	○○○○	.○	ACT
2	SUB	316		SUB No. (FBCDB instruction)
3	(PRM)	○○○○		Source data
4	(PRM)	○○○○		Result of conversion output address (Address or Constant)
5	WRT	○○○○	.○	Normal end output

Memory status of control condition

ST3	ST2	ST1	ST0
			ACT
			↓
			W1

Control conditions

(a) Input signal (ACT)
ACT = 0: Instruction not executed.
ACT = 1: Executed.

Parameters

(a) Source data
Specify conversion source BCD format data. In this parameter, a constant or a PMC memory address for storing data can be specified.

(b) Result of conversion output address
Specify the address to which binary data produced as the result of conversion is to be output.

Output (W1)

W1=1: The operation is terminated normally.
W1=0: No operation is executed. (ACT=0)
The conversion source data is invalid as BCD format data.

NOTE
1 W1 may be omitted. Moreover, another functional instruction can be connected instead of a coil.
2 With the similar functional instruction DCNVB, W1=1 is set when an operation is terminated abnormally. With FBCDB, FBCDW, and FBCDD, W1=1 is set when an operation is terminated normally.
3 No sign is specified for binary data output as the result of conversion. Invert the sign by using NEGSx after conversion if necessary.
4 No data is output to the operation output registers (R9000, Z0).

4.10 OPERATION INSTRUCTION

The following types of operation instruction are available. Use any of these instructions as appropriate for your purpose.

	Instruction name	Sub number	Processing
1	ADDB	36	Binary addition
2	SUBB	37	Binary subtraction
3	MULB	38	Binary multiplication
4	DIVB	39	Binary division
5	ADD	19	BCD addition
6	SUB	20	BCD subtraction
7	MUL	21	BCD multiplication
8	DIV	22	BCD division
9	NUMEB	40	Definition of binary constants
10	NUME	23	Definition of BCD constants
11	ADDSB	319	Addition (1 byte length)
12	ADDSW	320	Addition (2 bytes length)
13	ADDSD	321	Addition (4 bytes length)
14	SUBSB	322	Subtraction (1 byte length)
15	SUBSW	323	Subtraction (2 bytes length)
16	SUBSD	324	Subtraction (3 byte length)
17	MULSB	325	Multiplication (1 byte length)
18	MULSW	326	Multiplication (2 bytes length)
19	MULSD	327	Multiplication (4 bytes length)
20	DIVSB	328	Division (1 byte length)
21	DIVSW	329	Division (2 bytes length)
22	DIVSD	330	Division (4 bytes length)
23	MODSB	331	Remainder (1 byte length)
24	MODSW	332	Remainder (2 bytes length)
25	MODSD	333	Remainder (4 bytes length)
26	INCSB	334	Increment (1 byte length)
27	INCSW	335	Increment (2 bytes length)
28	INCSD	336	Increment (4 bytes length)
29	DECSB	337	Decrement (1 byte length)
30	DECSW	338	Decrement (2 bytes length)
31	DECSD	339	Decrement (4 bytes length)
32	ABSSB	340	Absolute value (1 byte length)
33	ABSSW	341	Absolute value (2 bytes length)
34	ABSSD	342	Absolute value (4 bytes length)
35	NEGSB	343	Sign inversion (1 byte length)
36	NEGSW	344	Sign inversion (2 bytes length)
37	NEGSD	345	Sign inversion (4 bytes length)

4.10.1 ADDB (Binary Addition: SUB 36)

This instruction performs binary addition between 1, 2, and 4 bytes data. In the operation result register (R9000, Z0), operating data is set besides the numerical data representing the operation results. The required number of bytes is necessary to store each augend, the added, and the operation output data.

Format

Fig. 4.10.1 shows the ladder format and Table 4.10.1 shows the mnemonic format.

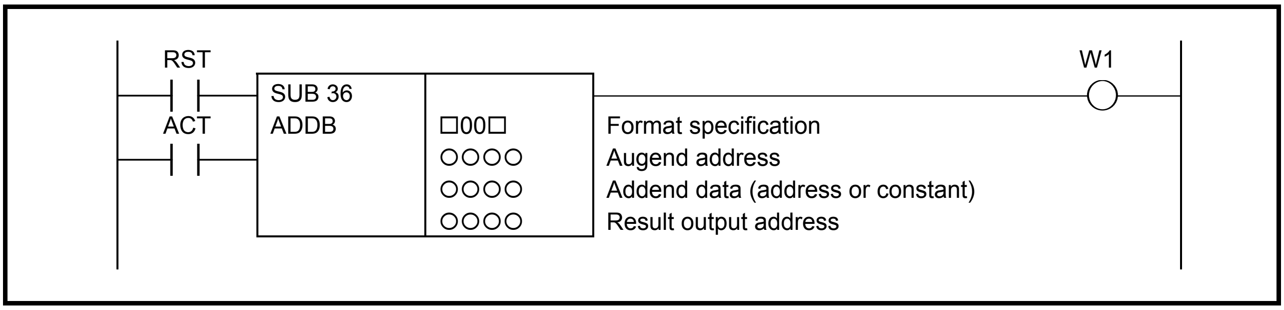


Fig. 4.10.1 Format of ADDB instruction

Table 4.10.1 Mnemonic of ADDB instruction

Mnemonic format

Step number	Instruction	Address No.	Bit No.	Remarks
1	RD	○○○○	.○	RST
2	RD.STK	○○○○	.○	ACT
3	SUB	36		ADDB instruction
4	(PRM)	□00□		Format specification
5	(PRM)	○○○○		Augend address
6	(PRM)	○○○○		Addend data (address or constant)
7	(PRM)	○○○○		Result output address
8	WRT	○○○○	.○	Error output

Memory status of control condition

ST3	ST2	ST1	ST0
			RST
		RST	ACT
			W1

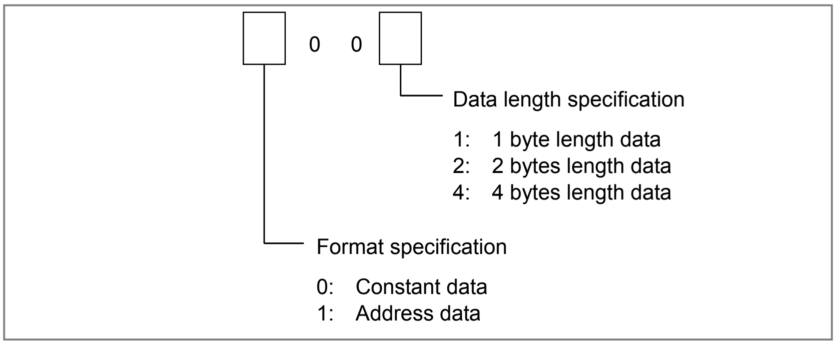
Control conditions

(a) Reset (RST)
RST=0: Do not reset error output W1.
RST=1: Reset error output W1. That is, W1=0.

(b) Command (ACT)
ACT=0: Do not execute ADDB. W1 does not change.
ACT=1: Execute ADDB.

Parameters

(a) Format specification
Specify data length (1, 2, and 4 bytes) and the format for the addend (constant or address).



> ⚠ **CAUTION**
> Do not set an illegal value, that is not indicated above, into the "(a) Format specification".

(b) Augend address
Specify the address of the augend.

(c) Addend data (address or constant)
Specification in (a) determines the format of the addend.

(d) Result output address
Specify the address of the result of operation.

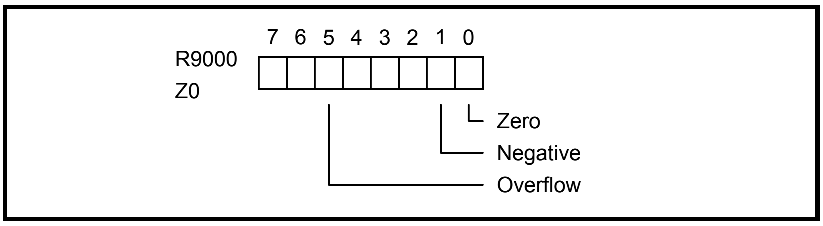
Error output (W1)

W1=0: Operation correct
W1=1: Operation incorrect
W1 goes on (W1=1) if the result of addition exceeds the specified data length. Then, the result will be output and the overflow flag and other flags will be output to the operation output register.

> ⚠ **CAUTION**
> Two or more coils, WRT, WRT.NOT, SET or RST, that follow this instruction are prohibited. You have to place a single coil instruction as the output of this instruction.

Operation output register (R9000, Z0)

This register is set with data on operation. If register bit is on, they signify the following operation data:



4.10.2 SUBB (Binary Subtraction: SUB 37)

This instruction subtracts one data from another, both data being in the binary format of 1, 2 or 4 bytes.
In the operation result register (R9000, Z0), operation data is set besides the numerical data representing the operation. A required number of bytes is necessary to store the subtrahend, minuend, and the result (difference).

Format

Fig. 4.10.2 shows the ladder format and Table 4.10.2 shows the mnemonic format.

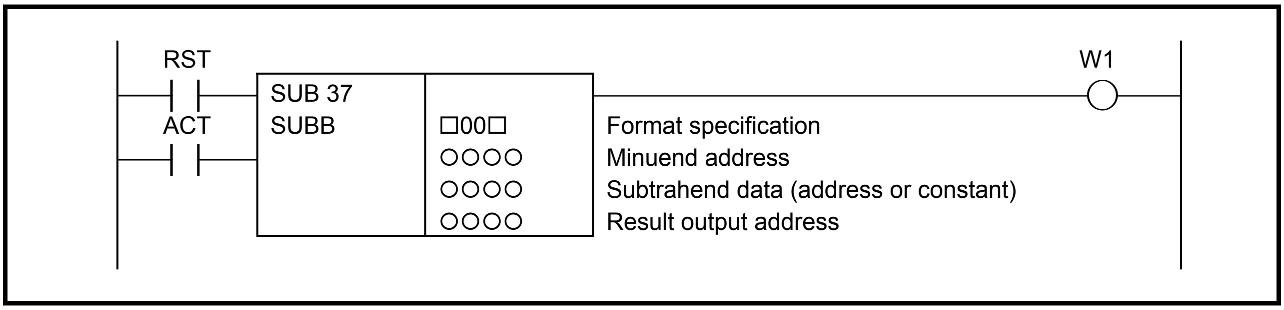


Fig. 4.10.2 Format of SUBB instruction

Table 4.10.2 Mnemonic of SUBB instruction

Mnemonic format					Memory status of control condition			
Step number	**Instruction**	**Address No.**	**Bit No.**	**Remarks**	**ST3**	**ST2**	**ST1**	**ST0**
1	RD	○○○○	.○	RST				RST
2	RD.STK	○○○○	.○	ACT			RST	ACT
3	SUB	37		SUBB instruction				
4	(PRM)	□00□		Format specification				
5	(PRM)	○○○○		Minuend address				
6	(PRM)	○○○○		Subtrahend data (address or constant)				
7	(PRM)	○○○○		Result output address				
8	WRT	○○○○	.○	Error output				W1

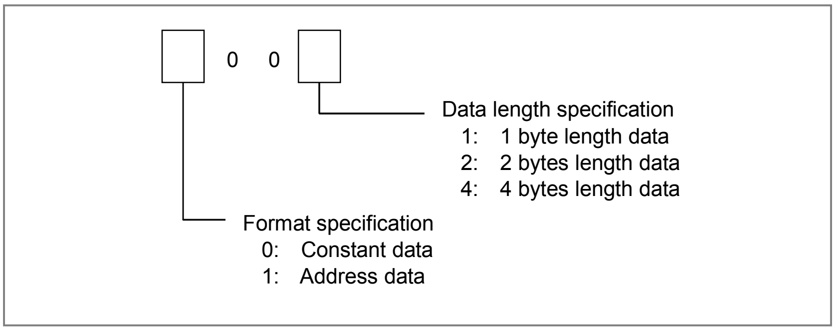
Control conditions

(a) Reset (RST)
RST=0: Do not reset error output W1.
RST=1: Reset error output W1. That is, W1=0.

(b) Command (ACT)
ACT=0: Do not execute SUBB. W1 does not change.
ACT=1: Execute SUBB.

Parameters

(a) Format specification
Specify data length (1, 2, and 4 bytes) and the format for the subtrahend (constant or address).



> ⚠ **CAUTION**
> Do not set an illegal value, that is not indicated above, into the "(a) Format specification".

(b) Minuend address
Specify the address of the minuend.

(c) Subtrahend data (address or constant)
Specification in (a) determines the format of the Subtrahend.

(d) Result output address
Specify the address of the result of operation.

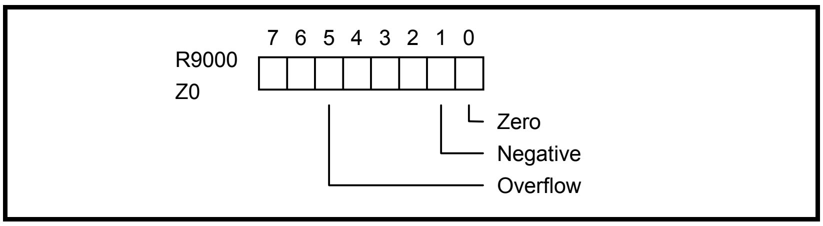
Error output (W1)

W1=0: Operation correct
W1=1: Operation incorrect
W1 goes on (W1=1) if the result of subtraction exceeds the specified data length. Then, the result will be output and the overflow flag and other flags will be output to the operation output register.

> ⚠ **CAUTION**
> Two or more coils, WRT, WRT.NOT, SET or RST, that follow this instruction are prohibited. You have to place a single coil instruction as the output of this instruction.

Operation output register (R9000, Z0)

This register is set with data on operation. If register bit is on, they signify the following operation data:



4.10.3 MULB (Binary Multiplication: SUB 38)

This instruction multiplies 1, 2, and 4 bytes binary data items. In the operation result register (R9000, Z0), operation data is set besides the numerical data representing the operation.
A required number of bytes is necessary to store multiplicand, multiplier, and the result (product).

Format

Fig. 4.10.3 shows the ladder format and Table 4.10.3 shows the mnemonic format.

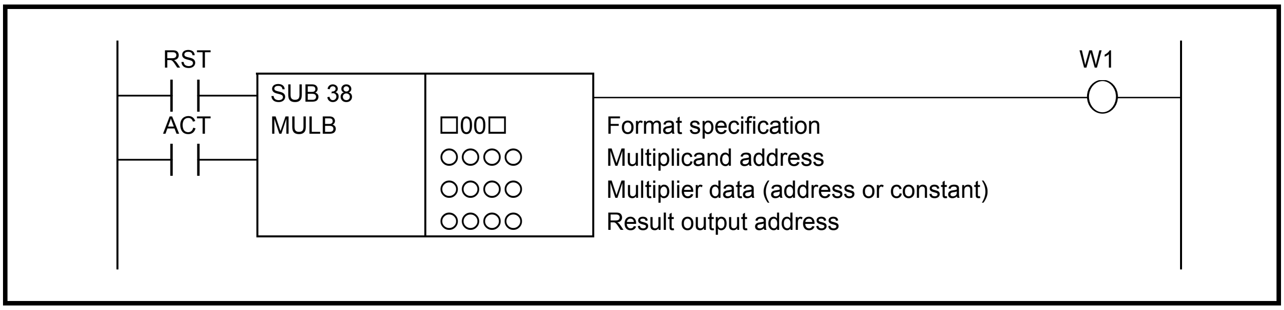


Fig. 4.10.3 Format of MULB instruction

Table 4.10.3 Mnemonic of MULB instruction

Mnemonic format

Step number	Instruction	Address No.	Bit No.	Remarks
1	RD	○○○○	.○	RST
2	RD.STK	○○○○	.○	ACT
3	SUB	38		MULB instruction
4	(PRM)	□00□		Format specification
5	(PRM)	○○○○		Multiplicand address
6	(PRM)	○○○○		Multiplier data (address or constant)
7	(PRM)	○○○○		Result output address
8	WRT	○○○○	.○	Error output

Memory status of control condition

ST3	ST2	ST1	ST0
			RST
		RST	ACT
			W1

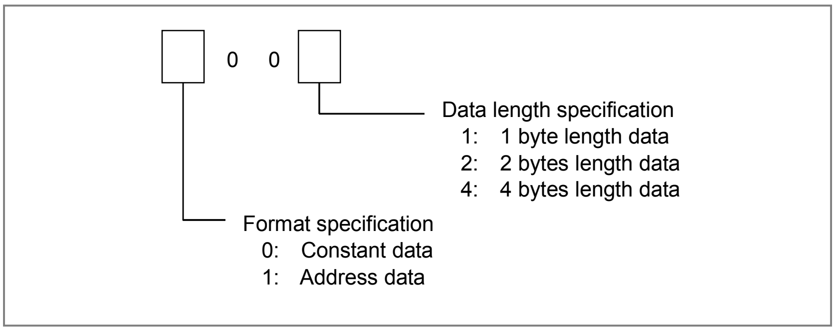
Control conditions

(a) Reset (RST)
RST=0: Do not reset error output W1.
RST=1: Reset error output W1. That is, W1=0.

(b) Command (ACT)
ACT=0: Do not execute MULB. W1 does not change.
ACT=1: Execute MULB.

Parameters

(a) Format specification
Specify data length (1, 2, and 4 bytes) and the format for the multiplier (constant or address).



> ⚠ **CAUTION**
> Do not set an illegal value, that is not indicated above, into the "(a) Format specification".

(b) Multiplicand address
Specify the address of the multiplicand.

(c) Multiplier data (address or constant)
Specification in (a) determines the format of the multiplier.

(d) Result output address
Specify the address of the result of operation.

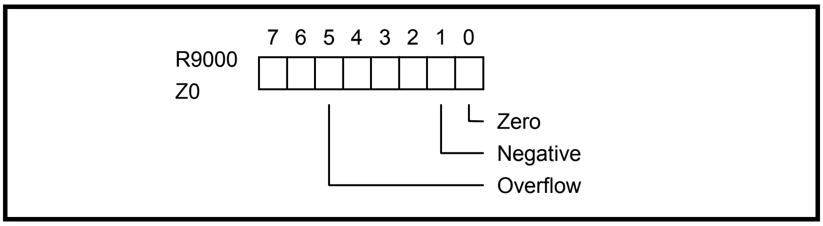
Error output (W1)

W1=0: Operation correct
W1=1: Operation incorrect
W1 goes on (W1=1) if the result of multiplication exceeds the specified data length. Then, the result will not be output and the overflow flag and other flags will be output to the operation output register.

> ⚠ **CAUTION**
> Two or more coils, WRT, WRT.NOT, SET or RST, that follow this instruction are prohibited. You have to place a single coil instruction as the output of this instruction.

Operation output register (R9000, Z0)

This register is set with data on operation. If register bit is on, they signify the following operation data:



4.10.4 DIVB (Binary Division: SUB 39)

This instruction divides binary data items 1, 2, and 4 bytes in length. In the operation result register (R9000, Z0), operation data is set and remainder is set to R9002 and following addresses.
A required number of bytes is necessary to store the dividend, divisor, and the result (quotient).

Format

Fig. 4.10.4 shows the ladder format and Table 4.10.4 shows the mnemonic format.

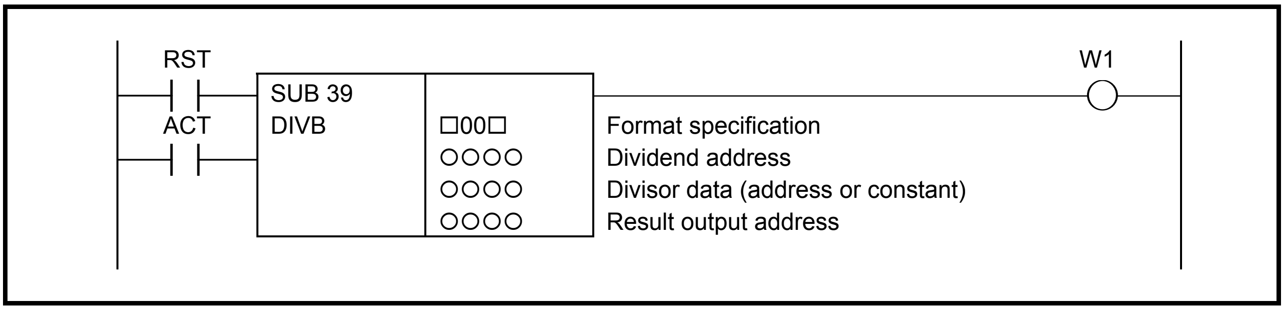


Fig. 4.10.4 Format of DIVB instruction

Table 4.10.4 Mnemonic of DIVB instruction

Mnemonic format					Memory status of control condition			
Step number	**Instruction**	**Address No.**	**Bit No.**	**Remarks**	**ST3**	**ST2**	**ST1**	**ST0**
1	RD	○○○○	.○	RST				RST
2	RD.STK	○○○○	.○	ACT			RST	ACT
3	SUB	39		DIVB instruction				
4	(PRM)	□00□		Format specification				
5	(PRM)	○○○○		Dividend address				
6	(PRM)	○○○○		Divisor data (address or constant)				
7	(PRM)	○○○○		Result output address				↓
8	WRT	○○○○	.○	Error output			↓	W1

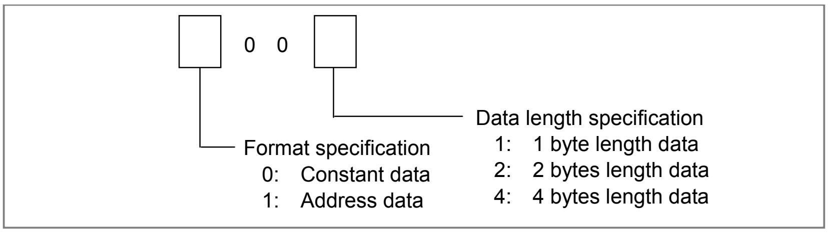
Control conditions

(a) Reset (RST)
RST=0: Do not reset error output W1.
RST=1: Reset error output W1. That is, W1=0.

(b) Command (ACT)
ACT=0: Do not execute DIVB. W1 does not change.
ACT=1: Execute DIVB.

Parameters

(a) Format specification
Specify data length (1, 2, and 4 bytes) and the format for the divisor (constant or address).



> ⚠ **CAUTION**
> Do not set an illegal value, that is not indicated above, into the "(a) Format specification".

(b) Dividend address
Specify the address of the dividend.

(c) Divisor data (address or constant)
Specification in (a) determines the format of the divisor.

(d) Result output address
Specify the address of the result of operation.

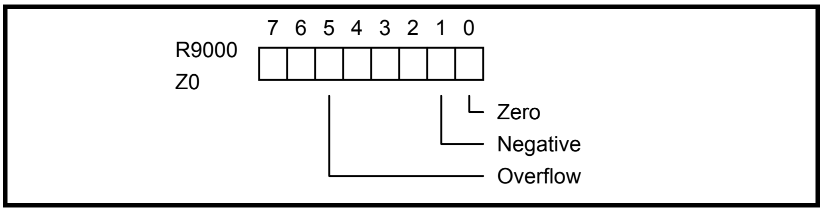
Error output (W1)

W1=0: Operation correct
W1=1: Operation incorrect
W1 goes on (W1=1) if the result exceeds the specified data length or zero is set to the divisor data. Then, the result will not be output and the overflow flag and other flags will be output to the operation output register.

> ⚠ **CAUTION**
> Two or more coils, WRT, WRT.NOT, SET or RST, that follow this instruction are prohibited. You have to place a single coil instruction as the output of this instruction.

Operation output register (R9000, Z0)

This register is set with data on operation. If register bit is on, they signify the following operation data:



Remainder output address

Depending on its length, the remainder is stored in one or more of registers R9002 to R9005 or Z2 to Z5.

4.10.5 ADD (BCD Addition: SUB 19)

This instruction adds BCD 2 or 4 digits data.

Format

Fig. 4.10.5 shows the ladder format and Table 4.10.5 shows the mnemonic format.

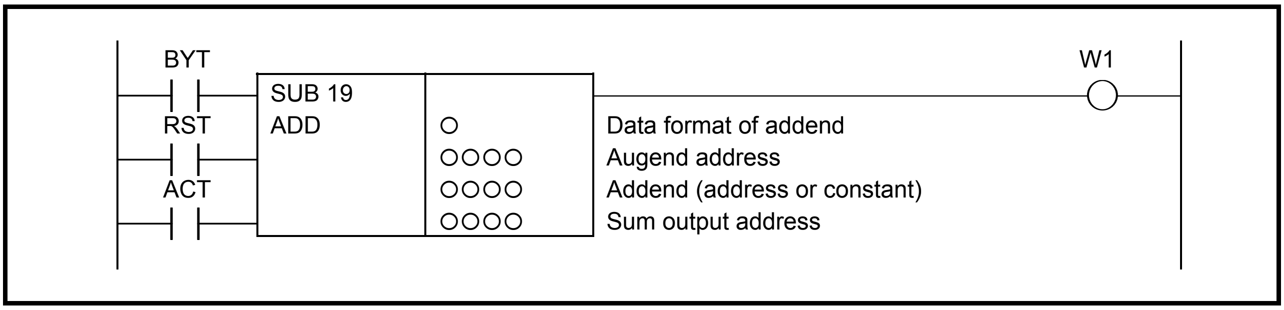


Fig. 4.10.5 Format of ADD instruction

Table 4.10.5 Mnemonic of ADD instruction

Mnemonic format					Memory status of control condition			
Step number	**Instruction**	**Address No.**	**Bit No.**	**Remarks**	**ST3**	**ST2**	**ST1**	**ST0**
1	RD	○○○○	.○	BYT				BYT
2	RD.STK	○○○○	.○	RST			BYT	RST
3	RD.STK	○○○○	.○	ACT		BYT	RST	ACT
4	SUB	19		ADD instruction				
5	(PRM)	○		Addend format				
6	(PRM)	○○○○		Augend address				
7	(PRM)	○○○○		Addend (address or constant)				
8	(PRM)	○○○○		Sum output address				
9	WRT	○○○○	.○	Error output				W1

Control conditions

(a) The number of digits of data. (BYT)
BYT=0: Data is BCD 2 digits long.
BYT=1: Data is BCD 4 digits long.

(b) Reset (RST)
RST=0: Do not reset error output W1.
RST=1: Reset error output W1, that is, W1=0.

(c) Execution command (ACT)
ACT=0: The ADD instruction is not executed. W1 does not change.
ACT=1: The ADD instruction is executed.

Parameters

(a) Data format of addend
- 0: Specify addend with a constant.
- 1: Specify addend with an address.

> ⚠ **CAUTION**
> Do not set an illegal value, that is not indicated above, into the "(a) Data format of addend".

(b) Augend address
Specify the address storing the augend.

(c) Addend (address or constant)
Specify the addend depends on above (a).

(d) Sum output address
Specify the address to which the sum is to be output.

Error output

W1=0: Normal operation
W1=1: Abnormal operation. W1 is set to 1 to indicate an error, e.g. if the result of the addition exceeds the data size specified for control condition (a) described above.

> ⚠ **CAUTION**
> Two or more coils, WRT, WRT.NOT, SET or RST, that follow this instruction are prohibited. You have to place a single coil instruction as the output of this instruction.

4.10.6 SUB (BCD Subtraction: SUB 20)

This instruction subtracts BCD 2 or 4 digits data.

Format

Fig. 4.10.6 shows the ladder format and Table 4.10.6 shows the mnemonic format.

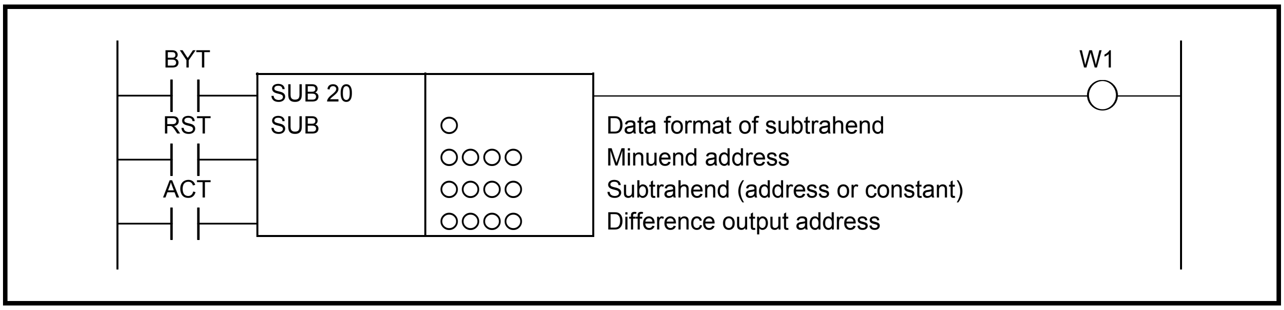


Fig. 4.10.6 Format of SUB instruction

Table 4.10.6 Mnemonic of SUB instruction

Mnemonic format					Memory status of control condition			
Step number	**Instruction**	**Address No.**	**Bit No.**	**Remarks**	**ST3**	**ST2**	**ST1**	**ST0**
1	RD	○○○○	.○	BYT				BYT
2	RD.STK	○○○○	.○	RST			BYT	RST
3	RD.STK	○○○○	.○	ACT		BYT	RST	ACT
4	SUB	20		SUB instruction				
5	(PRM)	○		Data format of subtrahend				
6	(PRM)	○○○○		Minuend address				
7	(PRM)	○○○○		Subtrahend (address or constant)				
8	(PRM)	○○○○		Difference output address				↓
9	WRT	○○○○	.○	Error output		↓	↓	W1

Control conditions

(a) The number of digits of data. (BYT)
BYT=0: Data is BCD 2 digits long
BYT=1: Data is BCD 4 digits long

(b) Reset (RST)
RST=0: Do not reset error output W1.
RST=1: Reset error output W1, that is, W1=0.

(c) Execution command (ACT)
ACT=0: The SUB instruction is not executed. W1 does not change.
ACT=1: The SUB instruction is executed.

Parameters

(a) Data format of subtrahend
  0: Specify subtrahend with a constant.
  1: Specify subtrahend with an address.

> ⚠ **CAUTION**
> Do not set an illegal value, that is not indicated above, into the "(a) Data format of subtrahend".

(b) Minuend address
  Specify the address of the minuend.

(c) Subtrahend (address)
  Specify the subtrahend depends on above (a).

(d) Difference output address
  Specify the address to which the difference is output.

Error output (W1)

W1=0: Normal operation
W1=1: Abnormal operation. W1 is set 1 to indicate an error if the difference is negative.

> ⚠ **CAUTION**
> Two or more coils, WRT, WRT.NOT, SET or RST, that follow this instruction are prohibited. You have to place a single coil instruction as the output of this instruction.

4.10.7 MUL (BCD Multiplication: SUB 21)

This instruction multiplies BCD 2 or 4 digits data. The product must also be BCD 2 or 4 digits data.

Format

Fig. 4.10.7 shows the ladder format and Table 4.10.7 shows the mnemonic format.

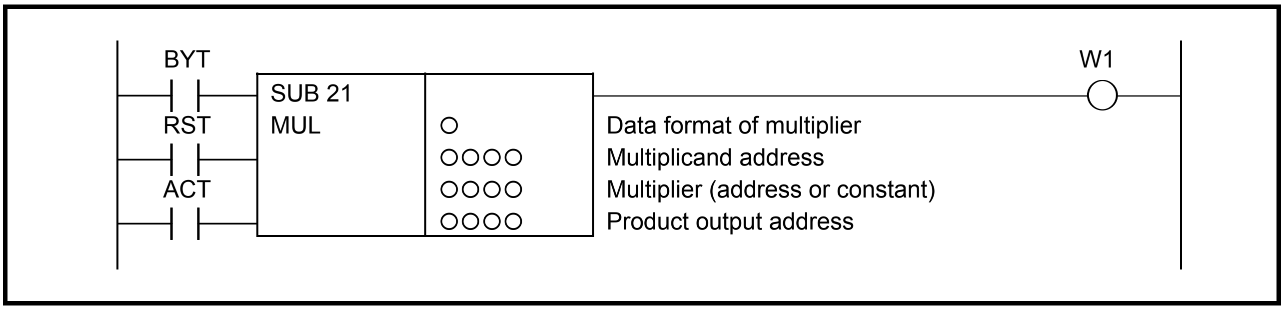


Fig. 4.10.7 Format of MUL instruction

Table 4.10.7 Mnemonic of MUL instruction

Mnemonic format					Memory status of control condition			
Step number	Instruction	Address No.	Bit No.	Remarks	ST3	ST2	ST1	ST0
1	RD	○○○○	.○	BYT				BYT
2	RD.STK	○○○○	.○	RST			BYT	RST
3	RD.STK	○○○○	.○	ACT		BYT	RST	ACT
4	SUB	21		MUL instruction				
5	(PRM)	○		Data format of multiplier				
6	(PRM)	○○○○		Multiplicand address				
7	(PRM)	○○○○		Multiplier (address or constant)				
8	(PRM)	○○○○		Product output address				
9	WRT	○○○○	.○	Error output				W1

Control conditions

(a) The number of digits of data. (BYT)
BYT=0: Data is BCD 2 digits long.
BYT=1: Data is BCD 4 digits long.

(b) Reset (RST)
RST=0: Do not reset error output W1.
RST=1: Reset error output W1, that is, W1=0.

(c) Execution command (ACT)
ACT=0: The MUL instruction is not executed. W1 does not change.
ACT=1: The MUL instruction is executed.

Parameters

(a) Data format of multiplier
 0: Specify multiplier with a constant.
 1: Specify multiplier with an address.

> ⚠ **CAUTION**
> Do not set an illegal value, that is not indicated above, into the "(a) Data format of multiplier".

(b) Multiplicand address
Specify the address storing the multiplicand.

(c) Multiplier (address or constant)
Specify the multiplier depends on above (a).

(d) Product output address
Specify the address to which the product is output.

Error output

W1=0: Normal operation
W1=1: Abnormal operation. W1=1 is set to indicate an error if the product exceeds the specified size.

> ⚠ **CAUTION**
> Two or more coils, WRT, WRT.NOT, SET or RST, that follow this instruction are prohibited. You have to place a single coil instruction as the output of this instruction.

4.10.8 DIV (BCD Division: SUB 22)

This instruction divides BCD 2 or 4 digits data. Remainders are discarded.

Format

Fig. 4.10.8 shows the ladder format and Table 4.10.8 shows the mnemonic format.

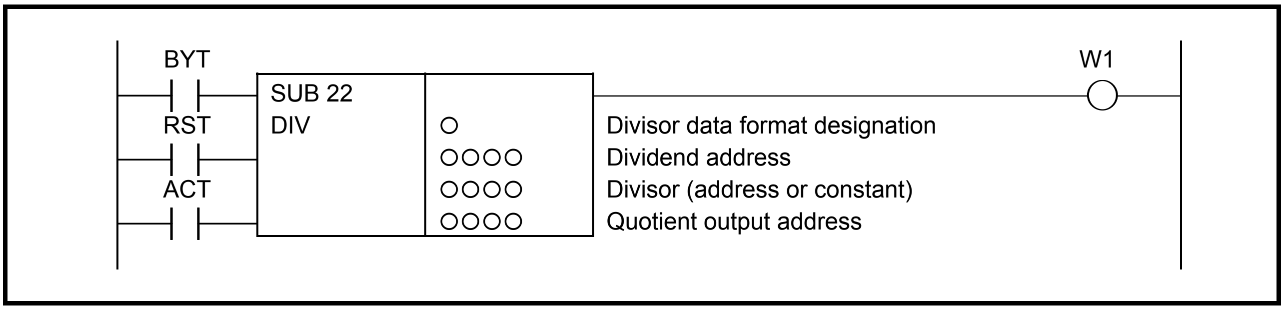


Fig. 4.10.8 Format of DIV instruction

Table 4.10.8 Mnemonic of DIV instruction

Mnemonic format					Memory status of control condition			
Step number	**Instruction**	**Address No.**	**Bit No.**	**Remarks**	**ST3**	**ST2**	**ST1**	**ST0**
1	RD	○○○○	.○	BYT				BYT
2	RD.STK	○○○○	.○	RST			BYT	RST
3	RD.STK	○○○○	.○	ACT		BYT	RST	ACT
4	SUB	22		DIV instruction				
5	(PRM)	○		Divisor data format designation				
6	(PRM)	○○○○		Dividend address				
7	(PRM)	○○○○		Divider (address or constant)				
8	(PRM)	○○○○		Quotient output address				
9	WRT	○○○○	.○	Error output				W1

Control conditions

(a) The number of digits of data. (BYT)
BYT=0: Data is BCD 2 digits long.
BYT=1: Data is BCD 4 digits long.

(b) Reset (RST)
RST=0: Do not reset error output W1.
RST=1: Reset error output W1. That is, W1=0.

(c) Execution command (ACT)
ACT=0: The DIV instruction is not executed. W1 does not change.
ACT=1: The DIV instruction is executed.

Parameters

(a) Divisor data format designation
  0: Specify divisor data by constant.
  1: Specify divisor data by address.

> ⚠ **CAUTION**
> Do not set an illegal value, that is not indicated above, into the "(a) Divisor data format designation".

(b) Dividend address
Specify the address storing the dividend.

(c) Divisor (address or constant)
Specify the divisor depends on above (a).

(d) Quotient output address
Specify the address to which the quotient is output.

Error output

W1=0: Normal operation
W1=1: Abnormal operation. W1=1 is set to indicate an error if the divider is 0.

> ⚠ **CAUTION**
> Two or more coils, WRT, WRT.NOT, SET or RST, that follow this instruction are prohibited. You have to place a single coil instruction as the output of this instruction.

4.10.9 NUMEB (Definition of Binary Constants: SUB 40)

This instruction defines 1, 2, or 4 bytes long binary constant. Data entered in decimal during programming is converted into binary data during program execution. The binary data is stored in the specified memory address(es).
There are two specifications - basic specification and extended specification - for setting the format specification parameter in the NUMEB instruction. The extended specification allows all the set constants to be defined simultaneously in an array having n elements. This extended specification is effective when initializing a large memory area with value. For the details of the setting of a format specification parameter, see the description of parameters.

Format

Figs. 4.10.9 (a) and (b) show the ladder formats and Tables 4.10.9 (a) and (b) show the mnemonic formats.

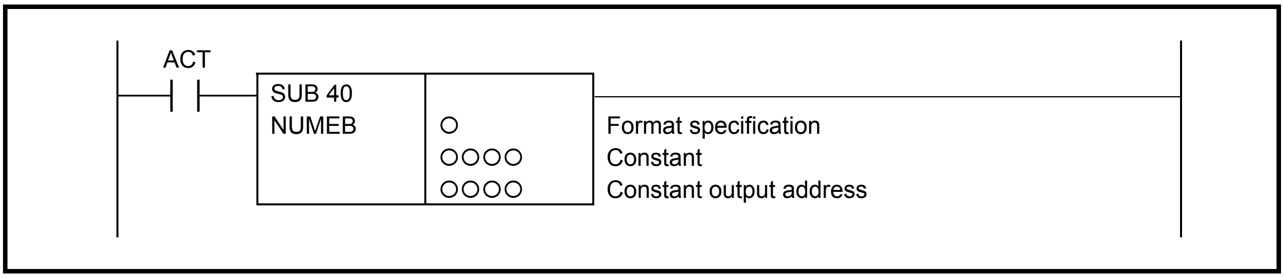


Fig. 4.10.9 (a) Format of NUMEB instruction (basic specification)

Table 4.10.9 (a) Mnemonic of NUMEB instruction (basic specification)

Mnemonic format					Memory status of control condition			
Step number	**Instruction**	**Address No.**	**Bit No.**	**Remarks**	**ST3**	**ST2**	**ST1**	**ST0**
1	RD	○○○○	.○	ACT				ACT
2	SUB	40		NUMEB instruction				
3	(PRM)	○		Format specification				
4	(PRM)	○○○○		Constant				
5	(PRM)	○○○○		Constant output address				▼

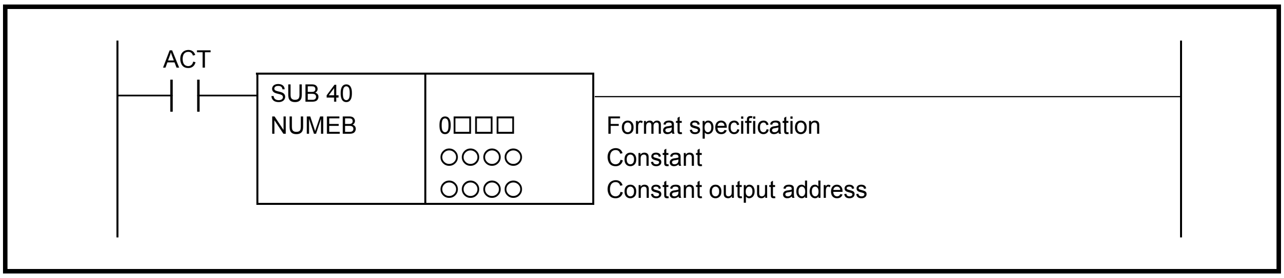


Fig. 4.10.9 (b) Format of NUMEB instruction (extended specification)

Table 4.10.9 (b) Mnemonic of NUMEB instruction (extended specification)

Mnemonic format					Memory status of control condition			
Step number	**Instruction**	**Address No.**	**Bit No.**	**Remarks**	**ST3**	**ST2**	**ST1**	**ST0**
1	RD	○○○○	.○	ACT				ACT
2	SUB	40		NUMEB instruction				
3	(PRM)	0□□□		Format specification				
4	(PRM)	○○○○		Constant				
5	(PRM)	○○○○		Constant output address				▼

Control conditions

(a) Command (ACT)
ACT=0: Do not execute NUMEB.
ACT=1: Execute NUMEB.

Parameters

(a) Format specification
Specify data length (1, 2, or 4 bytes).
Use the first parameter digit to specify byte length:
0001: Binary data of 1 byte length
0002: Binary data of 2 bytes length
0004: Binary data of 4 bytes length

When setting format specification in the following extended format, NUMEB can define all the set constants simultaneously in an array having nn elements.
Specify data length (1, 2, or 4) to the 1st digit as above-mentioned.
Specify the number of the array in which is a constant to the 2nd and 3rd digit is defines.
Specify 0 to the 4th digit.
0nn1: In case of defining multiple (nn) data by 1 byte length
0nn2: In case of defining multiple (nn) data by 2 bytes length
0nn4: In case of defining multiple (nn) data by 4 bytes length

The n is the numerical value from 02 to 99. When setting 00 or 01, it works as the basic specification that works for one data.

Format specification (extended specification):
0 n n x

The byte length setting of constant
1: 1 byte length
2: 2 byte length
4: 4 byte length

Number of data in the array
00-01 :
It defines constant at 1 memory.
02-99 :
It defines constants at multiple (nn) memory.

⚠ **CAUTION**
Do not set an illegal value, that is not indicated above, into the "(a) Format specification".

(b) Constant
Define constants in decimal format. Set a constant data within the effective range for the byte length which is set in above (a).

(c) Constant output address
Specify the address of the area for output of the binary data. The memory of the number of bytes which is set in above (a) is necessary.
When setting format specification in the extended format, it is necessary to reserve memory of (byte length) × (number of array elements which define constant) which was set in above (a).

4.10.10 NUME (BCD Definition of Constant: SUB 23)

This instruction defines constant of BCD type. Specified constant is set in specified constant output address.

Format

Fig. 4.10.10 shows the ladder format and Table 4.10.10 shows the mnemonic format.

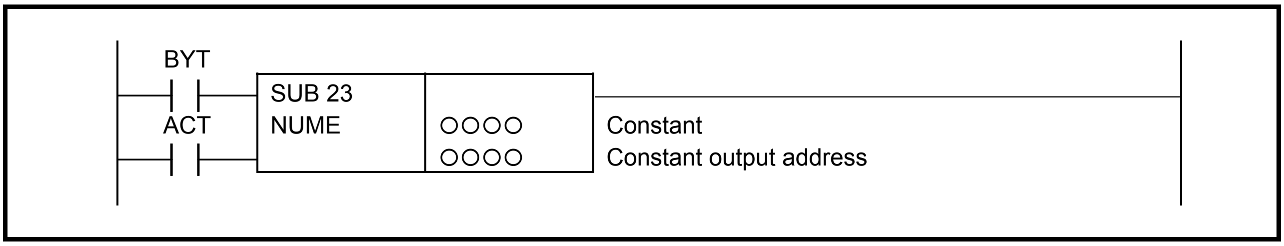


Fig. 4.10.10 Format of NUME instruction

Table 4.10.10 Mnemonic of NUME instruction

Mnemonic format					Memory status of control condition			
Step number	**Instruction**	**Address No.**	**Bit No.**	**Remarks**	**ST3**	**ST2**	**ST1**	**ST0**
1	RD	○○○○	.○	BYT				BYT
2	RD.STK	○○○○	.○	ACT			BYT	ACT
3	SUB	23		NUME instruction				
4	(PRM)	○○○○		Constant				
5	(PRM)	○○○○		Constant output address				

Control conditions

(a) Specify the number of digits of a constant. (BYT)
BYT=0: Constant is BCD 2 digits long.
BYT=1: Constant is BCD 4 digits long.

(b) Execution command (ACT)
ACT=0: The NUME instruction is not executed.
ACT=1: The NUME instruction is executed.

Parameters

(a) Constant
Specify the constant as the number of digits specified for control condition (a).

(b) Constant output address
Specify the address to which the constant defined in parameter (a) is output.

4.10.11 ADDSB (Addition (1 Byte Length) : SUB 319) ADDSW (Addition (2 Bytes Length) : SUB 320) ADDSD (Addition (4 Bytes Length) : SUB 321)

The Addition instruction adds signed binary data.

In "Augend data" and "Addend data", a constant or a PMC memory address for storing data can be specified.
As indicated below, three types of Addition instructions are available according to the type of data to be operated. In each instruction, "Augend data", "Addend data", and the data at "Result output address" are of the same data type.

Table4.10.11 (a) Kinds of Addition instruction

	Instruction name	SUB No.	Data type
1	ADDSB	319	1 byte length signed binary data
2	ADDSW	320	2 bytes length signed binary data
3	ADDSD	321	4 bytes length signed binary data

If an operation results in a positive overflow, the maximum value of each data type is output to "Result output address", and W1=0 is set.
If an operation results in a negative overflow, the minimum value of each data type is output to "Result output address", and W1=0 is set.

Format

Fig. 4.10.11 shows the ladder format and Table 4.10.11(b) shows the mnemonic format.

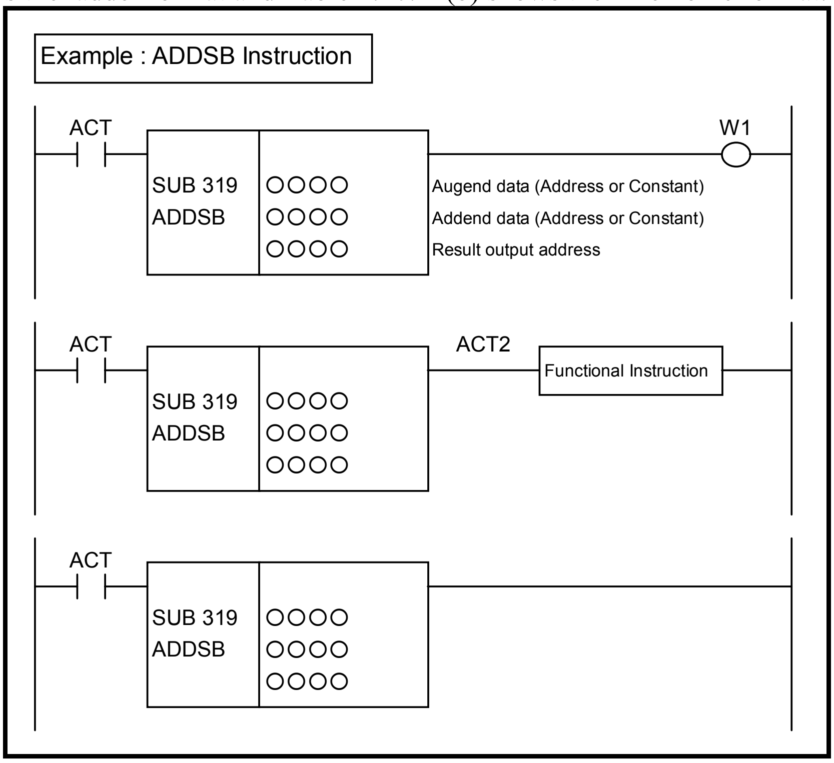


Fig. 4.10.11 Format of ADDSB, ADDSW, ADDSD instruction

Table 4.10.11(b) Mnemonic of ADDSB, ADDSW, ADDSD instruction

Mnemonic format **Memory status of control condition**

Step number	Instruction	Address No.	Bit No.	Remarks	ST3	ST2	ST1	ST0
1	RD	○○○○	.○	ACT				ACT
2	SUB	319		SUB No. (ADDSB instruction)				
3	(PRM)	○○○○		Augend data (Address or Constant)				
4	(PRM)	○○○○		Addend data (Address or Constant)				
5	(PRM)	○○○○		Result output address				▼
6	WRT	○○○○	.○	Normal end output				W1

Control conditions

(a) Input signal (ACT)
ACT = 0: Instruction not executed.
ACT = 1: Executed.

Parameters

(a) Augend data
Specify an augend for addition operation. In this parameter, a constant or a PMC memory address for storing data can be specified.

(b) Addend data
Specify an addend for addition operation. In this parameter, a constant or a PMC memory address for storing data can be specified.

(c) Result output address
Specify the address to which the result of operation is to be output.

Output (W1)

W1=1: The operation is terminated normally.
W1=0: No operation is executed. (ACT=0)
The operation results in an overflow.

NOTE
1. W1 may be omitted. Moreover, another functional instruction can be connected instead of a coil.
2. With the similar functional instruction ADDB, W1=1 is set when an operation is terminated abnormally. With ADDSB, ADDSW, and ADDSD, W1=1 is set when an operation is terminated normally.
3. No data is output to the operation output registers (R9000, Z0).

4.10.12 SUBSB (Subtraction (1 Byte Length) : SUB 322) SUBSW (Subtraction (2 Bytes Length) : SUB 323) SUBSD (Subtraction (4 Bytes Length) : SUB 324)

The Subtraction instruction subtracts signed binary data.
In "Minuend" and "Subtrahend", a constant or a PMC memory address for storing data can be specified.
As indicated below, three types of Subtraction instructions are available according to the type of data to be operated. In each instruction, "Minuend", "Subtrahend", and the data at "Result output address" are of the same data type.

Table4.10.12 (a) Kinds of Subtraction instruction

	Instruction name	SUB No.	Data type
1	SUBSB	322	1 byte length signed binary data
2	SUBSW	323	2 bytes length signed binary data
3	SUBSD	324	4 bytes length signed binary data

If an operation results in a positive overflow, the maximum value of each data type is output to "Result output address", and W1=0 is set.
If an operation results in a negative overflow, the minimum value of each data type is output to "Result output address", and W1=0 is set.

Format

Fig. 4.10.12 shows the ladder format and Table 4.10.12(b) shows the mnemonic format.

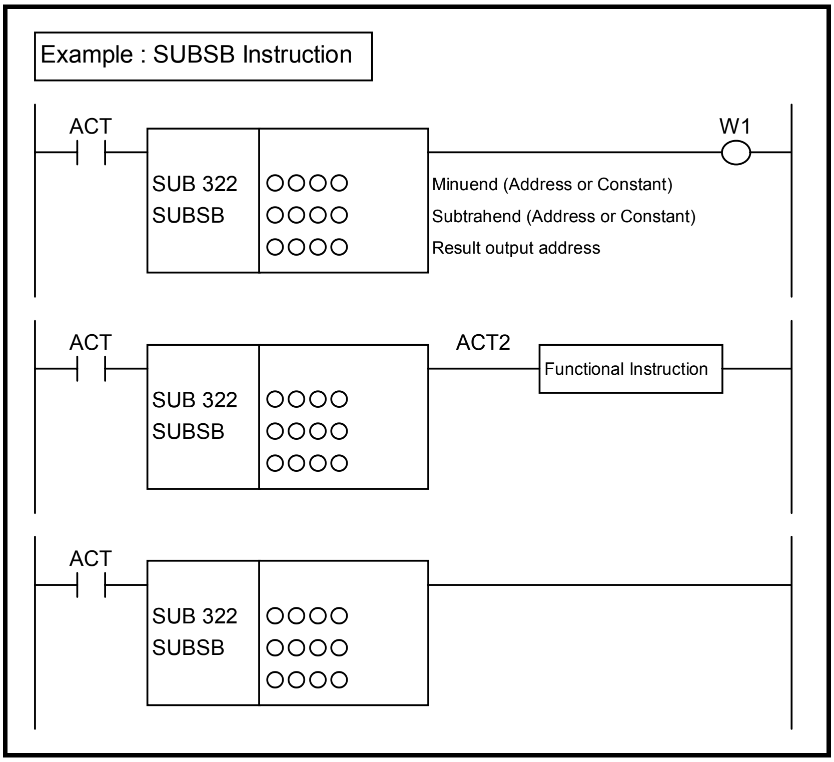


Fig. 4.10.12 Format of SUBSB, SUBSW, SUBSD instruction

Table 4.10.12(b) Mnemonic of SUBSB, SUBSW, SUBSD instruction

Mnemonic format

Step number	Instruction	Address No.	Bit No.	Remarks
1	RD	○○○○	.○	ACT
2	SUB	322		SUB No. (SUBSB instruction)
3	(PRM)	○○○○		Minuend (Address or Constant)
4	(PRM)	○○○○		Subtrahend (Address or Constant)
5	(PRM)	○○○○		Result output address
6	WRT	○○○○	.○	Normal end output

Memory status of control condition

ST3	ST2	ST1	ST0
			ACT
			↓
			▼
			W1

Control conditions

(a) Input signal (ACT)
ACT = 0: Instruction not executed.
ACT = 1: Executed.

Parameters

(a) Minuend
Specify a minuend for subtraction operation. In this parameter, a constant or a PMC memory address for storing data can be specified.

(b) Subtrahend
Specify a subtrahend for subtraction operation. In this parameter, a constant or a PMC memory address for storing data can be specified.

(c) Result output address
Specify the address to which the result of operation is to be output.

Output (W1)

W1=1: The operation is terminated normally.
W1=0: No operation is executed. (ACT=0)
The operation results in an overflow.

NOTE
1. W1 may be omitted. Moreover, another functional instruction can be connected instead of a coil.
2. With the similar functional instruction SUBB, W1=1 is set when an operation is terminated abnormally. With SUBSB, SUBSW, and SUBSD, W1=1 is set when an operation is terminated normally.
3. No data is output to the operation output registers (R9000, Z0).

4.10.13 MULSB (Multiplication (1 Byte Length) : SUB 325) MULSW (Multiplication (2 Bytes Length) : SUB 326) MULSD (Multiplication (4 Bytes Length) : SUB 327)

The Multiplication instruction multiplies signed binary data.
In "Multiplicand" and "Multiplier", a constant or a PMC memory address for storing data can be specified.
As indicated below, three types of Multiplication instructions are available according to the type of data to be operated. In each instruction, "Multiplicand", "Multiplier", and the data at "Result output address" are of the same data type.

Table 4.10.13 (a) Kinds of Multiplication instruction

	Instruction name	SUB No.	Data type
1	MULSB	325	1 byte length signed binary data
2	MULSW	326	2 bytes length signed binary data
3	MULSD	327	4 bytes length signed binary data

If an operation results in a positive overflow, the maximum value of each data type is output to "Result output address", and W1=0 is set.
If an operation results in a negative overflow, the minimum value of each data type is output to "Result output address", and W1=0 is set.

Format

Fig. 4.10.13 shows the ladder format and Table 4.10.13(b) shows the mnemonic format.

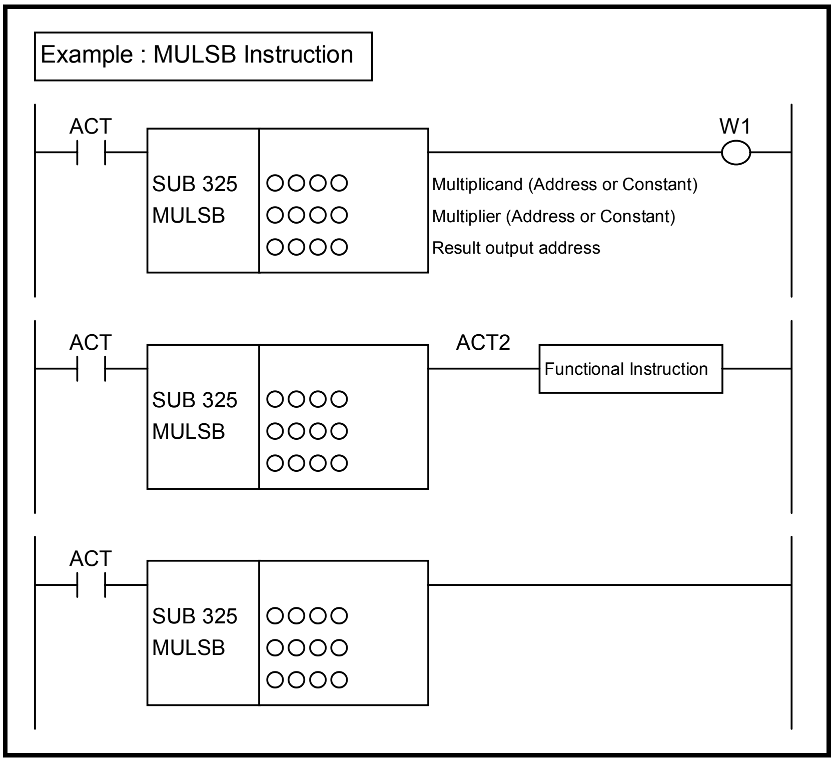


Fig. 4.10.13 Format of MULSB, MULSW, MULSD instruction

Table 4.10.13(b) Mnemonic of MULSB, MULSW, MULSD instruction

Mnemonic format

Step number	Instruction	Address No.	Bit No.	Remarks
1	RD	○○○○	.○	ACT
2	SUB	325		SUB No. (MULSB instruction)
3	(PRM)	○○○○		Multiplicand (Address or Constant)
4	(PRM)	○○○○		Multiplier (Address or Constant)
5	(PRM)	○○○○		Result output address
6	WRT	○○○○	.○	Normal end output

Memory status of control condition

ST3	ST2	ST1	ST0
			ACT
			↓
			W1

Control conditions

(a) Input signal (ACT)
ACT = 0: Instruction not executed.
ACT = 1: Executed.

Parameters

(a) Multiplicand
Specify a multiplicand for multiplication operation. In this parameter, a constant or a PMC memory address for storing data can be specified.

(b) Multiplier
Specify a multiplier for multiplication operation. In this parameter, a constant or a PMC memory address for storing data can be specified.

(c) Result output address
Specify the address to which the result of operation is to be output.

Output (W1)

W1=1: The operation is terminated normally.
W1=0: No operation is executed. (ACT=0)
The operation results in an overflow.

NOTE

1 W1 may be omitted. Moreover, another functional instruction can be connected instead of a coil.
2 With the similar functional instruction MULB, W1=1 is set when an operation is terminated abnormally. With MULSB, MULSW, and MULSD, W1=1 is set when an operation is terminated normally.
3 No data is output to the operation output registers (R9000, Z0).

4.10.14 DIVSB (Division (1 Byte Length) : SUB 328) DIVSW (Division (2 Bytes Length) : SUB 329) DIVSD (Division (4 Bytes Length) : SUB 330)

The Division instruction divides signed binary data.
In "Dividend" and "Divisor", a constant or a PMC memory address for storing data can be specified.
As indicated below, three types of Division instructions are available according to the type of data to be operated. In each instruction, "Dividend", "Divisor", and the data at "Result output address" are of the same data type.

Table 4.10.14 (a) Kinds of Division instruction

	Instruction name	SUB No.	Data type
1	DIVSB	328	1 byte length signed binary data
2	DIVSW	329	2 bytes length signed binary data
3	DIVSD	330	4 bytes length signed binary data

If an operation results in an overflow, the maximum value of each data type is output to "Result output address", and W1=0 is set.
If the divisor is 0, and the dividend is 0 or a positive value, the maximum value of each data type is output to "Result output address", and W1=0 is set.
If the divisor is 0, and the dividend is a negative value, the minimum value of each data type is output to "Result output address", and W1=0 is set.

Format

Fig. 4.10.14 shows the ladder format and Table 4.10.14(b) shows the mnemonic format.

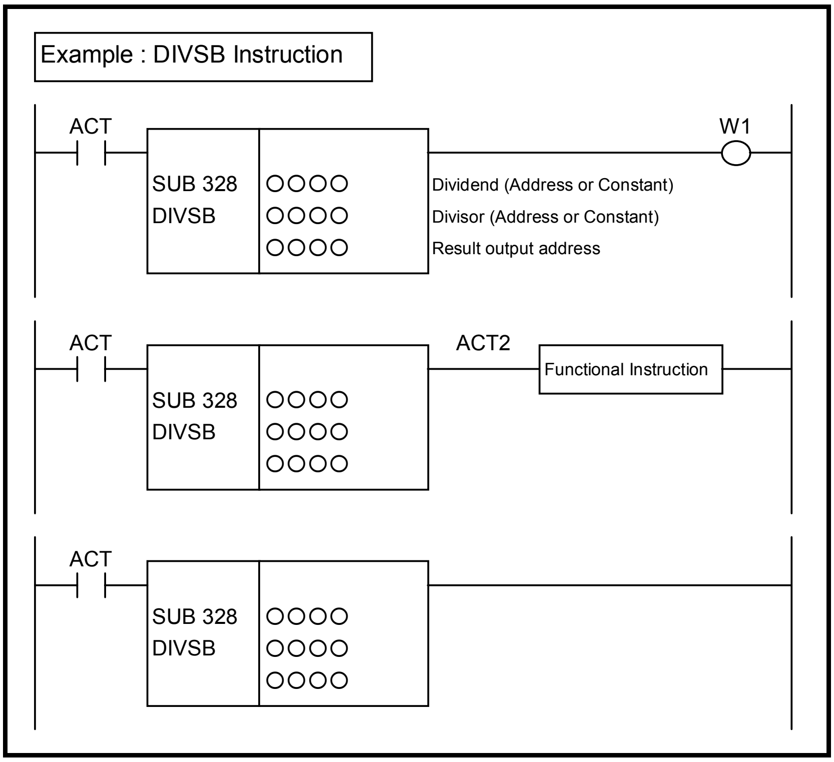


Fig. 4.10.14 Format of DIVSB, DIVSW, DIVSD instruction

Table 4.10.14(b) Mnemonic of DIVSB, DIVSW, DIVSD instruction

Mnemonic format

Step number	Instruction	Address No.	Bit No.	Remarks
1	RD	○○○○	.○	ACT
2	SUB	328		SUB No. (DIVSB instruction)
3	(PRM)	○○○○		Dividend (Address or Constant)
4	(PRM)	○○○○		Divisor (Address or Constant)
5	(PRM)	○○○○		Result output address
6	WRT	○○○○	.○	Normal end output

Memory status of control condition

ST3	ST2	ST1	ST0
			ACT
			↓
			↓
			↓
			↓
			W1

Control conditions

(a) Input signal (ACT)
ACT = 0: Instruction not executed.
ACT = 1: Executed.

Parameters

(a) Dividend
Specify a dividend for division operation. In this parameter, a constant or a PMC memory address for storing data can be specified.

(b) Divisor
Specify a divisor for division operation. In this parameter, a constant or a PMC memory address for storing data can be specified.

(c) Result output address
Specify the address to which the result of operation is to be output.

Output (W1)

W1=1: The operation is terminated normally.
W1=0: No operation is executed. (ACT=0)
The divisor is 0, or the operation results in an overflow.

NOTE
1. W1 may be omitted. Moreover, another functional instruction can be connected instead of a coil.
2. With the similar functional instruction DIVB, W1=1 is set when an operation is terminated abnormally. With DIVSB, DIVSW, and DIVSD, W1=1 is set when an operation is terminated normally.
3. No data is output to the operation output registers (R9000, Z0).
4. No data is output to the remainder output addresses (R9002-R9005, Z2-Z5). To calculate remainder data, use the MODSB, MODSW, or MODSD instruction.

Operation

The result of each operation depends on the signs of the dividend and divisor as indicated below.

Table 4.10.14 (c) State of sign in division operation (example)

Dividend	Divisor	Result of DIVSx Instruction	Result of MODSx Instruction
20	3	6	2
20	-3	-6	2
-20	3	-6	-2
-20	-3	6	-2

4.10.15 MODSB (Remainder (1 Byte Length) : SUB 331) MODSW (Remainder (2 Bytes Length) : SUB 332) MODSD (Remainder (4 Bytes Length) : SUB 333)

The Remainder instruction divides signed binary data and calculates remainder data.
In "Dividend" and "Divisor", a constant or a PMC memory address for storing data can be specified.
As indicated below, three types of Remainder instructions are available according to the type of data to be operated. In each instruction, "Dividend", "Divisor", and the data at "Result output address" are of the same data type.

Table 4.10.15 (a) Kinds of Remainder instruction

	Instruction name	SUB No.	Data type
1	MODSB	331	1 byte length signed binary data
2	MODSW	332	2 bytes length signed binary data
3	MODSD	333	4 bytes length signed binary data

If the quotient of a division operation results in an overflow (if "Dividend" is the minimum value of each data type or the divisor is -1), 0 is output to "Result output address", and W1=1 is set.
If "Divisor" is 0, and "Dividend" is 0 or a positive value, the maximum value of each data type is output to "Result output address", and W1=0 is set.
If "Divisor" is 0, and "Dividend" is a negative value, the minimum value of each data type is output to "Result output address", and W1=0.

Format
Fig. 4.10.15 shows the ladder format and Table 4.10.15(b) shows the mnemonic format.

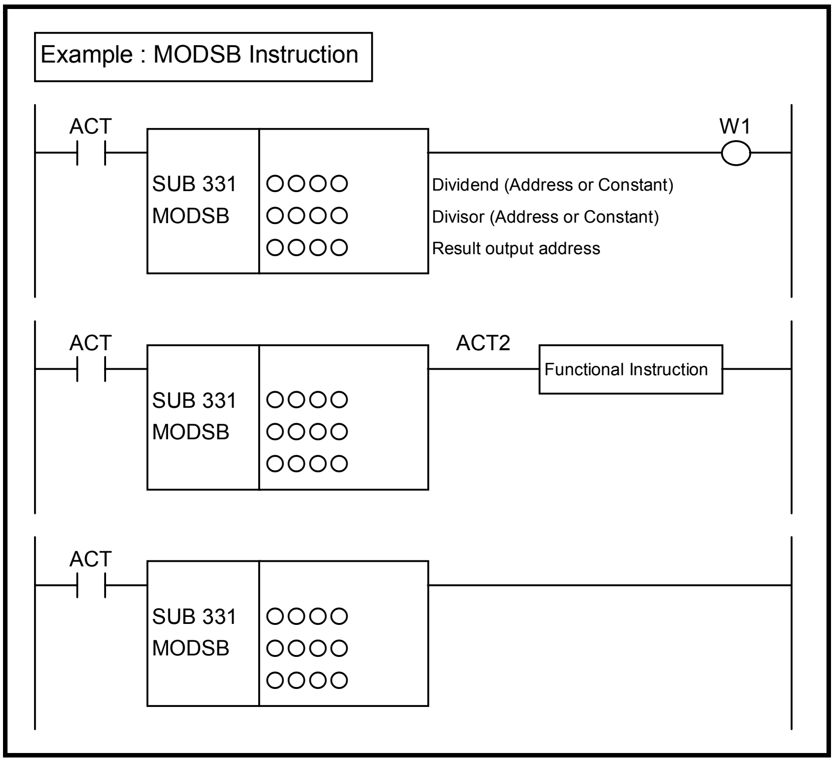


Fig. 4.10.15 Format of MODSB, MODSW, MODSD instruction

Table 4.10.15(b) Mnemonic of MODSB, MODSW, MODSD instruction

Mnemonic format **Memory status of control condition**

Step number	Instruction	Address No.	Bit No.	Remarks	ST3	ST2	ST1	ST0
1	RD	○○○○	.○	ACT				ACT
2	SUB	331		SUB No. (MODSB instruction)				
3	(PRM)	○○○○		Dividend (Address or Constant)				
4	(PRM)	○○○○		Divisor (Address or Constant)				
5	(PRM)	○○○○		Result output address				▼
6	WRT	○○○○	.○	Normal end output				W1

Control conditions

(a) Input signal (ACT)
ACT = 0: Instruction not executed.
ACT = 1: Executed.

Parameters

(a) Dividend
Specify a dividend for remainder operation. In this parameter, a constant or a PMC memory address for storing data can be specified.

(b) Divisor
Specify a divisor for remainder operation. In this parameter, a constant or a PMC memory address for storing data can be specified.

(c) Result output address
Specify the address to which the result of operation is to be output.

Output (W1)

W1=1: The operation is terminated normally.
W1=0: No operation is executed. (ACT=0)
The divisor is 0.

> **NOTE**
> 1 W1 may be omitted. Moreover, another functional instruction can be connected instead of a coil.
> 2 With the similar functional instruction DIVB, W1=1 is set when an operation is terminated abnormally. With MODSB, MODSW, and MODSD, W1=1 is set when an operation is terminated normally.
> 3 No data is output to the operation output registers (R9000, Z0).
> 4 No data is output to the remainder output addresses (R9002-R9005, Z2-Z5).

Operation

The result of each operation depends on the signs of the dividend and divisor as indicated below.

Table 4.10.15 (c) State of sign in division operation (example)

Dividend	Divisor	Result of DIVSx Instruction	Result of MODSx Instruction
20	3	6	2
20	-3	-6	2
-20	3	-6	-2
-20	-3	6	-2

4.10.16 INCSB (Increment (1 Byte Length) : SUB 334) INCSW (Increment (2 Bytes Length) : SUB 335) INCSD (Increment (4 Bytes Length) : SUB 336)

The Increment instruction increments signed binary data by 1.
As indicated below, three types of Increment instructions are available according to the type of data to be operated.

Table 4.10.16 (a) Kinds of Increment instruction

	Instruction name	SUB No.	Data type
1	INCSB	334	1 byte length signed binary data
2	INCSW	335	2 bytes length signed binary data
3	INCSD	336	4 bytes length signed binary data

If the Increment instruction is executed when data to be operated is the maximum value of a data type, the data to be operated remains unchanged from the maximum value, and W1=0 is set.
For example, if data to be operated by the INCSW instruction is 32767, the data remains unchanged from 32767 as the result of operation, and W1=0 is set.

Format

Fig. 4.10.16 shows the ladder format and Table 4.10.16(b) shows the mnemonic format.

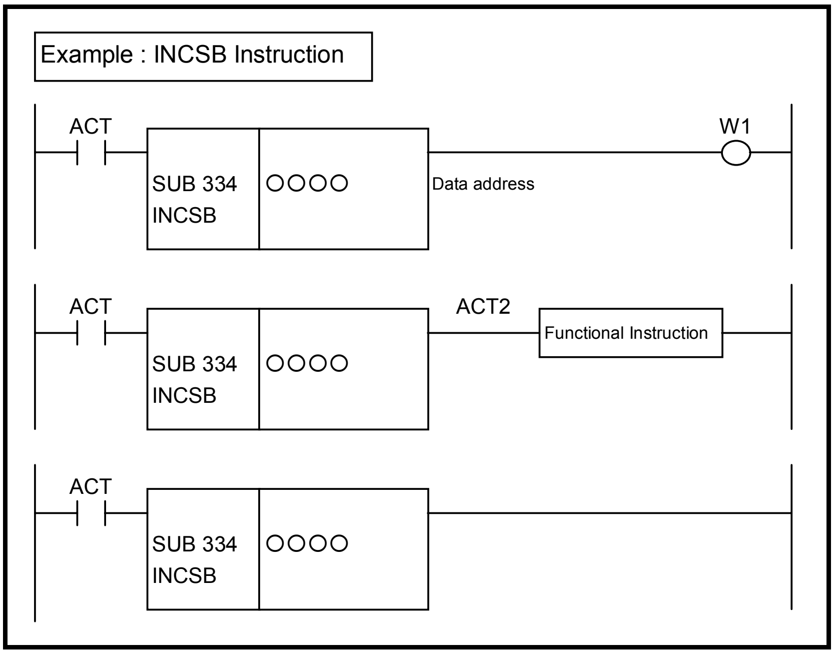


Fig. 4.10.16 Format of INCSB, INCSW, INCSD instruction

Table 4.10.16(b) Mnemonic of INCSB, INCSW, INCSD instruction

Mnemonic format

Step number	Instruction	Address No.	Bit No.	Remarks
1	RD	○○○○	.○	ACT
2	SUB	334		SUB No. (INCSB instruction)
3	(PRM)	○○○○		Data address
4	WRT	○○○○	.○	Normal end output

Memory status of control condition

ST3	ST2	ST1	ST0
			ACT
			↓
			↓
			W1

Control conditions

(a) Input signal (ACT)
ACT = 0: Instruction not executed.
ACT = 1: Executed.

Parameters

(a) Data address
Specify the PMC memory address the value at which is to be incremented.

Output (W1)

W1=1: The operation is terminated normally.
W1=0: No operation is executed. (ACT=0)
The operation results in an overflow.

> **NOTE**
> W1 may be omitted. Moreover, another functional instruction can be connected instead of a coil.

4.10.17 DECSB (Decrement (1 Byte Length) : SUB 337) DECSW (Decrement (2 Bytes Length) : SUB 338) DECSD (Decrement (4 Bytes Length) : SUB 339)

The Decrement instruction decrements signed binary data by 1.
As indicated below, three types of Decrement instructions are available according to the type of data to be operated.

Table 4.10.17 (a) Kinds of Decrement instruction

	Instruction name	SUB No.	Data type
1	DECSB	337	1 byte length signed binary data
2	DECSW	338	2 bytes length signed binary data
3	DECSD	339	4 bytes length signed binary data

If the Decrement instruction is executed when data to be operated is the minimum value of a data type, the data to be operated remains unchanged from the minimum value, and W1=0 is set.
For example, if data to be operated by the DECSW instruction is -32768, the data remains unchanged from -32768 as the result of operation, and W1=0 is set.

Format

Fig. 4.10.17 shows the ladder format and Table 4.10.17(b) shows the mnemonic format.

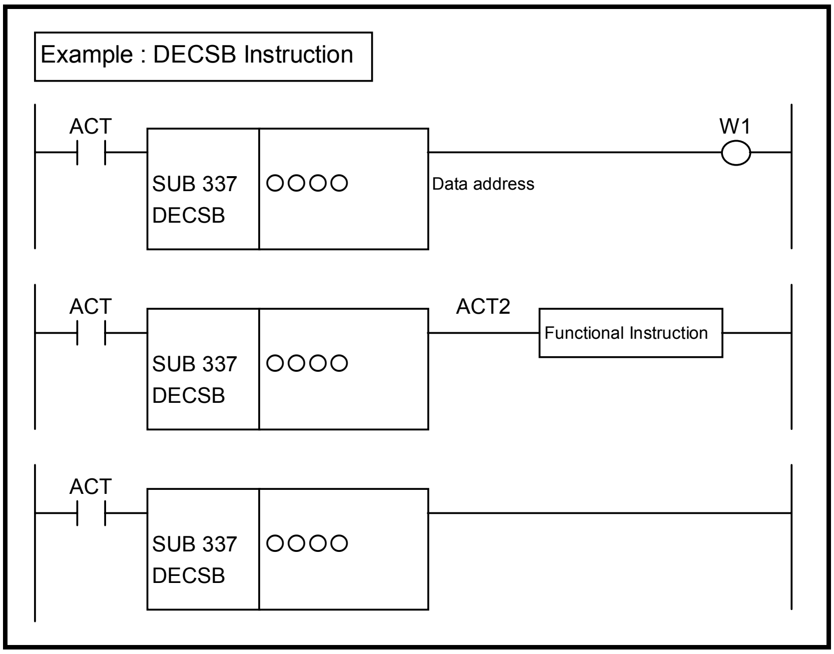


Fig. 4.10.17 Format of DECSB, DECSW, DECSD instruction

Table 4.10.17(b) Mnemonic of DECSB, DECSW, DECSD instruction

Mnemonic format

Step number	Instruction	Address No.	Bit No.	Remarks
1	RD	○○○○	.○	ACT
2	SUB	337		SUB No. (DECSB instruction)
3	(PRM)	○○○○		Data address
4	WRT	○○○○	.○	Normal end output

Memory status of control condition

ST3	ST2	ST1	ST0
			ACT
			↓
			↓
			W1

Control conditions

(a) Input signal (ACT)
ACT = 0: Instruction not executed.
ACT = 1: Executed.

Parameters

(a) Data address
Specify the PMC memory address the value at which is to be decremented.

Output (W1)

W1=1: The operation is terminated normally.
W1=0: No operation is executed. (ACT=0)
The operation results in an overflow.

> **NOTE**
> W1 may be omitted. Moreover, another functional instruction can be connected instead of a coil.

4.10.18 ABSSB (Absolute Value (1 Byte Length) : SUB 340) ABSSW (Absolute Value (2 Bytes Length) : SUB 341) ABSSD (Absolute Value (4 Bytes Length) : SUB 342)

The Absolute value instruction calculates the absolute value of signed binary data.
In "Source data", a constant or a PMC memory address for storing data can be specified.
As indicated below, three types of Absolute value instructions are available according to the type of data to be operated. In each instruction, "Source data" and the data at "Result output address" are of the same data type.

Table 4.10.18 (a) Kinds of Absolute value instruction

	Instruction name	SUB No.	Data type
1	ABSSB	340	1 byte length signed binary data
2	ABSSW	341	2 bytes length signed binary data
3	ABSSD	342	4 bytes length signed binary data

If an operation results in an overflow (if the minimum value of a data type is converted), the maximum value of the data type is output to "Result output address", and W1=0 is set.

Format

Fig. 4.10.18 shows the ladder format and Table 4.10.18(b) shows the mnemonic format.

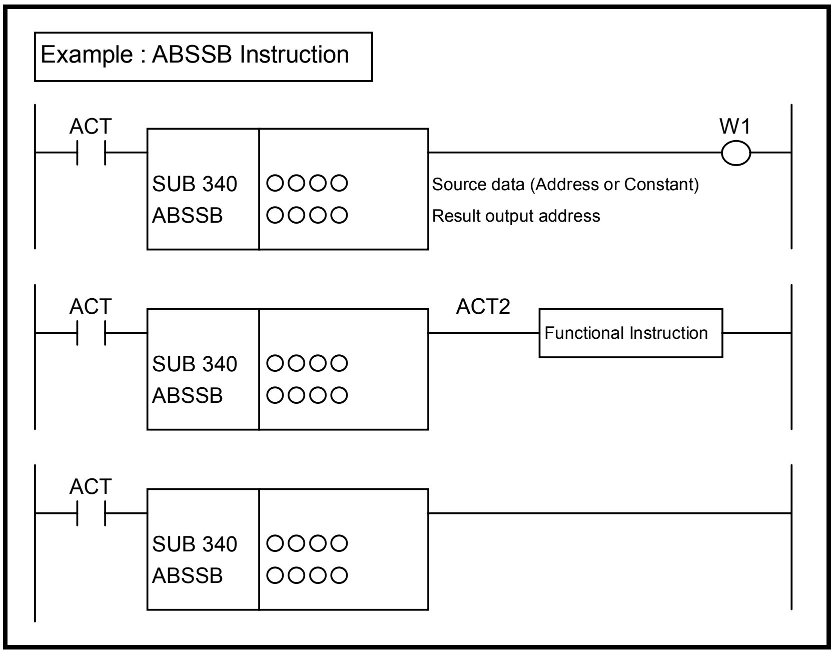


Fig. 4.10.18 Format of ABSSB, ABSSW, ABSSD instruction

Table 4.10.18(b) Mnemonic of ABSSB, ABSSW, ABSSD instruction

Mnemonic format

Step number	Instruction	Address No.	Bit No.	Remarks
1	RD	○○○○	.○	ACT
2	SUB	340		SUB No. (ABSSB instruction)
3	(PRM)	○○○○		Source data (Address or Constant)
4	(PRM)	○○○○		Result output address
5	WRT	○○○○	.○	Normal end output

Memory status of control condition

ST3	ST2	ST1	ST0
			ACT
			W1

Control conditions

(a) Input signal (ACT)
ACT = 0: Instruction not executed.
ACT = 1: Executed.

Parameters

(a) Source data
Specify source data to be converted to an absolute value. In this parameter, a constant or a PMC memory address for storing data can be specified.

(b) Result output address
Specify the address to which the result of operation is to be output.

Output (W1)

W1=1: The operation is terminated normally.
W1=0: No operation is executed. (ACT=0)
The operation results in an overflow.

NOTE
W1 may be omitted. Moreover, another functional instruction can be connected instead of a coil.

4.10.19 NEGSB (Sign Inversion (1 Byte Length) : SUB 343) NEGSW (Sign Inversion (2 Bytes Length) : SUB 344) NEGSD (Sign Inversion (4 Bytes Length) : SUB 345)

The Sign inversion instruction inverts the sign of signed binary data.
In "Source data", a constant or a PMC memory address for storing data can be specified.
As indicated below, three types of Sign inversion instructions are available according to the type of data to be operated. In each instruction, "Source data" and the data at "Result output address" are of the same data type.

Table 4.10.19 (a) Kinds of Sign inversion instruction

	Instruction name	SUB No.	Data type
1	NEGSB	343	1 byte length signed binary data
2	NEGSW	344	2 bytes length signed binary data
3	NEGSD	345	4 bytes length signed binary data

If an operation results in an overflow (if the minimum value of a data type is converted), the maximum value of the data type is output to "Result output address", and W1=0 is set.

Format

Fig. 4.10.19 shows the ladder format and Table 4.10.19(b) shows the mnemonic format.

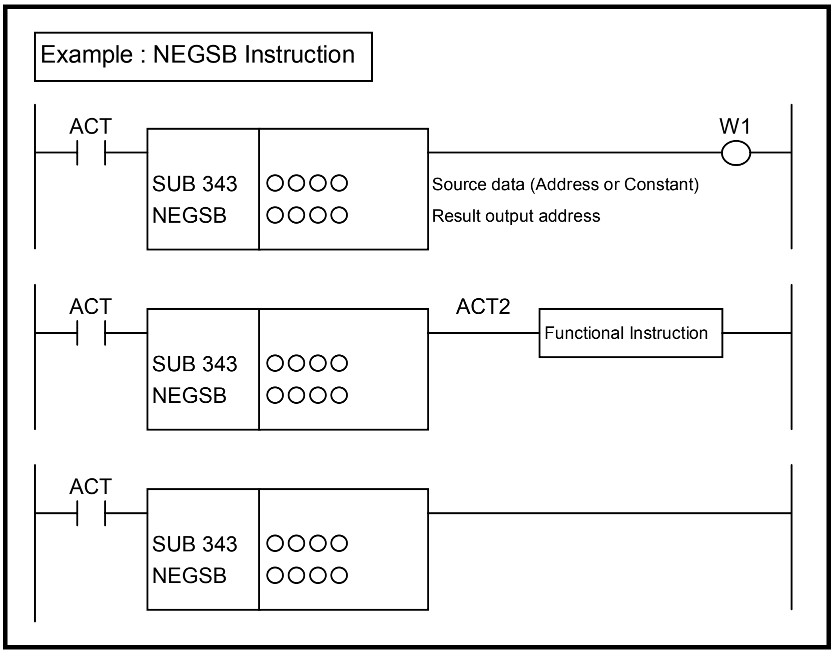


Fig. 4.10.19 Format of NEGSB, NEGSW, NEGSD instruction

Table 4.10.19(b) Mnemonic of NEGSB, NEGSW, NEGSD instruction

Mnemonic format

Step number	Instruction	Address No.	Bit No.	Remarks
1	RD	○○○○	.○	ACT
2	SUB	343		SUB No. (NEGSB instruction)
3	(PRM)	○○○○		Source data (Address or Constant)
4	(PRM)	○○○○		Result output address
5	WRT	○○○○	.○	Normal end output

Memory status of control condition

ST3	ST2	ST1	ST0
			ACT
			↓
			↓
			↓
			W1

Control conditions

(a) Input signal (ACT)
ACT = 0: Instruction not executed.
ACT = 1: Executed.

Parameters

(a) Source data
Specify source data whose sign is to be inverted. In this parameter, a constant or a PMC memory address for storing data can be specified.

(b) Result output address
Specify the address to which the result of operation is to be output.

Output (W1)

W1=1: The operation is terminated normally.
W1=0: No operation is executed. (ACT=0)
The operation results in an overflow.

> **NOTE**
> W1 may be omitted. Moreover, another functional instruction can be connected instead of a coil.

4.11 INSTRUCTIONS RELATED TO CNC FUNCTIONS

The functions of the CNC can be used by means of the functional instructions of the PMC system. The following types of instruction are available. Use any of these instructions as appropriate for your purpose.

	Instruction name	Sub number	Processing
1	DISPB	41	Message display
2	EXIN	42	External data input
3	WINDR	51	Reading of CNC window data
4	WINDW	52	Writing of CNC window data
5	AXCTL	53	PMC axis control
6	PSGN2	63	Position signal
7	PSGNL	50	Position signal

4.11.1 DISPB (Display Message: SUB 41)

This instruction displays messages on the CNC screen. You can also specify the message number to generate an alarm in the CNC.
You can program up to 6000 messages according to PMC memory type. You must use the special message addresses in your program to simplify use of the messages. The following are the features of this function.

> **NOTE**
> 1 To use this instruction requires that the external data input option or external message option be set on the CNC side.
> 2 Program this instruction in the 2nd level, because it takes a lot of processing time.
> 3 This instruction cannot be used in the 1st level whose execution cycle is 1ms or 2ms. It is processed as an NOP instruction.

(a) In the program, specify 0 in the parameter and set ACT to 1. See Fig. 4.11.1 (a).
If you set any bit of the message display request memory (addresses A) to "1" when ACT = 1, the instruction displays the message data defined in the message data table corresponding to that bit. While the message is displayed, the bit of the message display status memory corresponding to that message remains to be "1".
Even if multiple messages are requested simultaneously, the instruction does not necessarily display all the requested messages. The number of messages that can be displayed simultaneously is determined by the specifications of the CNC screen. For example, if the CNC is designed to display up to four messages on its screen at a time, a fifth message cannot be displayed unless any of the four currently displayed messages is cleared. This way, you can display the sixth and subsequent messages as you clear the currently displayed messages one by one.

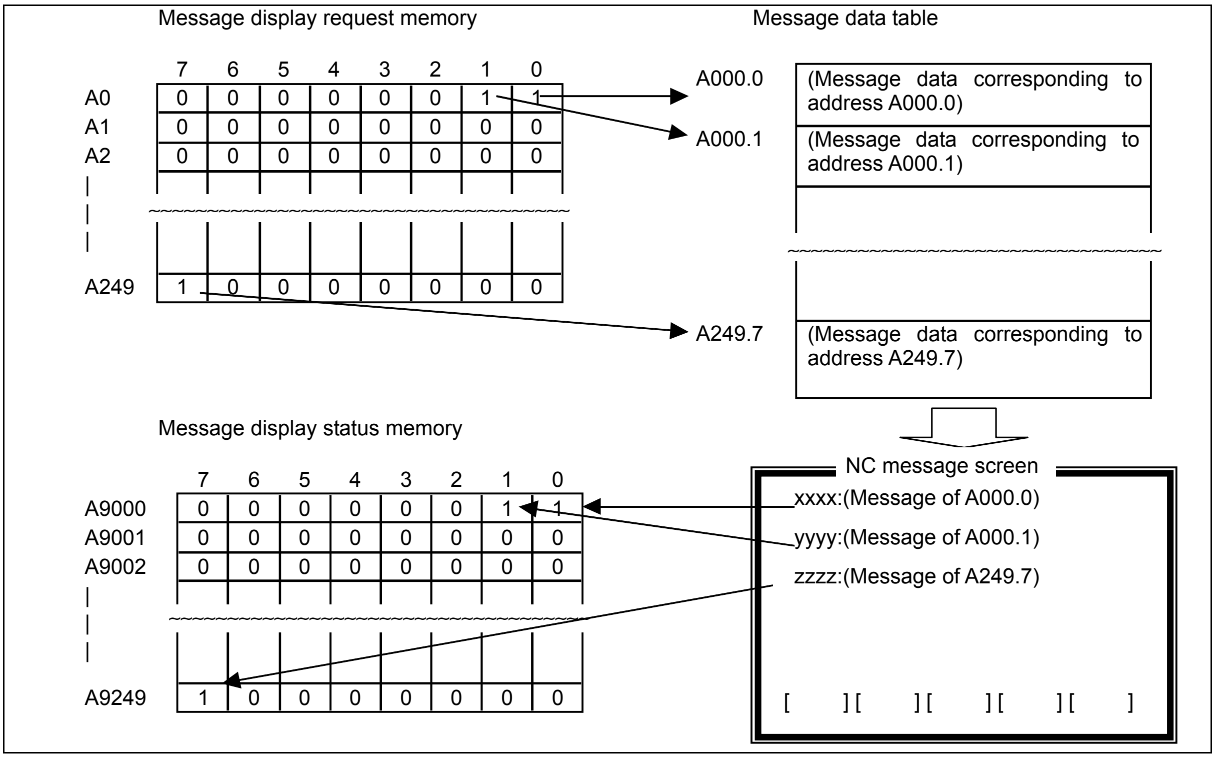


Fig. 4.11.1 (a) Message display request memory, message display status memory, and message data table

> **NOTE**
> When ACT = 0, no message display processing is performed at all. Make sure that ACT is always set to "1" and code the program so that the message display can be enabled or disabled by setting the data in the message display request memory.

(i) Message display request memory
The message display request memory consists bits at A addresses on each PMC model. One bit corresponds to one type of message data.
If you want to display a message on the CNC screen, set the corresponding display request memory 1. Set 0 to erase the message of CNC screen.

(ii) Message display status memory
This memory locates at 2000 bits of the address A9000 to A9249, or at 4000 bits of the address A9000 to A9499. Each bit corresponds to a message. While displaying a message in CNC screen, the corresponding bit is set to 1. The ladder can not write on this memory.

(iii) Message data table
This table stores messages corresponding to the message display request bits. The table is stored in the EPROM together with the sequence program. Message data table numbers correspond to the message display request memory addresses.
The message data table capacity is 256 characters (256 bytes). A message number and a message character string are defined within this capacity.
A character prepared in CNC screen key consists of one byte, and 4 bytes are necessary for a message number (consisting of 4 characters) in the next item. A character not covered by the CNC screen keys requires two bytes (a half-width kana character and a European character) or four bytes (a kanji character or other full-width character). For details, see the column "Defining characters not found in the CNC screen" described later.

(iv) Message number
There are two specifications of standard specification and extended specification. When the number of paths to be controlled is three or less, the standard specification can be applied to set message numbers. When four or more paths are to be controlled, however, message numbers must be set based on the extended specification.

- Standard specification (applicable when the number of paths to be controlled is three or less)
  This message number consisting of 4 digits must always be defined at the start of each message data. Using this four-digit number, set the type and number of the message and the CNC screen on which the message is to be displayed. The CNC screen is as specified below by this message number.

Message number	CNC screen	Display contents
1000 to 1999	Alarm screen (on path 1)	Alarm message • Path 1 is placed in the alarm state.
2000 to 2099(*Note)	Operator message screen	Operator message
2100 to 2999(*Note)		Operator message (with no message number)
5000 to 5999	Alarm screen (on path 2)	Alarm message • Path 2 is placed in the alarm state. • The displayed message number is a specified number from which 4000 is subtracted.
7000 to 7999	Alarm screen (on path 3)	Alarm message • Path 3 is placed in the alarm state. • The displayed message number is a specified number from which 6000 is subtracted.

NOTE
1. Normally, the number of the operator message with the message number is 100 (2000 to 2099) and the number of it without the message number is 900 (2100 to 2999). By setting into the CNC parameter No. 6310 "The number of the operator message with the message number", you can change the number of it with the message number.
   (Example)
   400 is set into the CNC parameter No.6310
   - 2000 to 2399 displaying with the number
   - 2400 to 2999 displaying without the number
2. You can change the specifications about message number and operator number with CNC parameter No. 6301#0 or #1. For details, refer to “the parameter manual”.

- Extended specification (The message with a machine group number)
  Set the following string format at the start of each set of message data to indicate the type and number of the message and the CNC screen on which the message is to be displayed.
  The format is as follows:
  Alarm message
  AL1+000=
  Operator message
  OP1+000=
  Explanation:
  AL 1 + 000 =
  <1> <2> <3>
  <1>: The first two characters indicate whether the message is an alarm message or operator message.
  <2>: Represents a path number. In the case of an alarm message, specify a path number. In the case of an operator message, specify the top path number in a machine group number. (Note)
  <3>: This value represents a message number with a maximum of four characters. In the case of an operator message, it indicates whether the message has a message number or not.

NOTE
1. The path number specified with alarm message and operator message is the interface path number in PMC side.
2. For the path number for the operator message, Specify the top path number. If you specify other path number except the top, the operator message is not displayed.

The following table shows the message numbers and the corresponding CNC screens.

Message number	CNC screen	Display contents
AL1+0= to AL1+4095=	Alarm screen (Path 1)	Alarm message • Path 1 is placed in the alarm state.
AL2+0= to AL2+4095=	Alarm screen (Path 2)	Alarm message • Path 2 is placed in the alarm state.
AL3+0= to AL3+4095=	Alarm screen (Path 3)	Alarm message • Path 3 is placed in the alarm state.
AL4+0= to AL4+4095=	Alarm screen (Path 4)	Alarm message • Path 4 is placed in the alarm state.
AL5+0= to AL5+4095=	Alarm screen (Path 5)	Alarm message • Path 5 is placed in the alarm state.
AL6+0= to AL6+4095=	Alarm screen (Path 6)	Alarm message • Path 6 is placed in the alarm state.
AL7+0= to AL7+4095=	Alarm screen (Path 7)	Alarm message • Path 7 is placed in the alarm state.
AL8+0= to AL8+4095=	Alarm screen (Path 8)	Alarm message • Path 8 is placed in the alarm state.
AL9+0= to AL9+4095=	Alarm screen (Path 9)	Alarm message • Path 9 is placed in the alarm state.
AL10+0= to AL10+4095=	Alarm screen (Path 10)	Alarm message • Path 10 is placed in the alarm state.
OPn+0= to OPn+4095=	Operator message screen	Operator message • Specify the top of path number of NC machine group to display the operator message to the "n".

NOTE

1 The message number may have leading zeros like "001".
2 Valid numbers of external alarm message are from 0 to 999 by default. You can expand of message number the range to 0 to 4095 by setting 1 to CNC parameter No.6301#0.
3 Valid numbers of external operator message are from 0 to 999 by default. You can expand of message number the range to 0 to 4095 by setting 1 to CNC parameter No.6301#1.
4 Valid numbers of external operator message with message number are from 0 to 99 by default. You can change the range of message number by CNC parameter No.6310.

(b) You need not use numerical codes for message data input. Instead, when programming, directly key in the characters making up the messages (from the CNC screen keyboard). For the characters that CNC screen does not provide for, you must enter these characters by numerical data with special symbols "@". For details, see the column "Defining characters not found in the CNC screen" described later.

(c) If you write the message data items in the ROM after programming, you cannot change them any more (they will become fixed data items). The only exception is numerical values you want to use as variables. You can display these values, existing in memory at the time when the message display starts, by defining their memory addresses in the message data. Note, however, that their values in memory cannot be displayed in real time. For details, refer to the following “Numerical data display”.

(d) A message is displayed on the NC alarm message/operator message screen.
When using the DISPB instruction, you must satisfy the following conditions:
To use DISPB, the optional External Data Input function or External Message Display is necessary for NC.

Format

Fig. 4.11.1(b) shows the ladder format and Table 4.11.1(a) shows the mnemonic format.

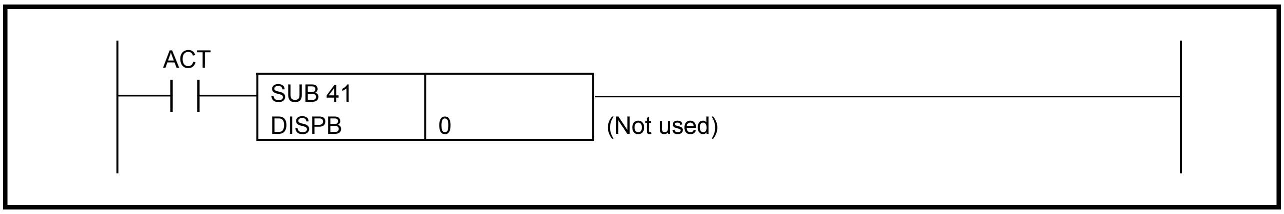


Fig. 4.11.1 (b) Format of DISPB instruction

Table 4.11.1 (a) Mnemonic of DISPB instruction

Mnemonic format					Memory status of control condition			
Step number	**Instruction**	**Address No.**	**Bit No.**	**Remarks**	**ST3**	**ST2**	**ST1**	**ST0**
1	RD	○○○○	.○	ACT				ACT
2	SUB	41		DISPB instruction				↓
3	(PRM)	0		(Not used)				

Control conditions

ACT=0: Do not display messages on the CNC screen.
ACT=1: Display the messages on the CNC screen.

Parameter

This parameter is not used.
Enter "0" as the input value. (NOTE)

> **NOTE**
> Thanks to the compatibility with the former models, the instruction runs normally if the entered value is in the range between 1 and 2000.

4.11.1.1 Numerical data display

Some of variable numerical data can be displayed in the message.
To define the numerical data, enter the number of digits for the data and the data address in the messages.
To differentiate between the numerical data from the other message data, write it within [ ] in the message.
Since the brackets [ ] are used to contain numerical data, they are not themselves treated as symbols to be included in the messages.

(a) Numerical data format

(i) Signed

[Ibid, ○○○○]

→ Address where the numerical data is stored
Set binary data in the specified address.

→ Set the "bid" data after the letter "I":

b: Number of bytes (1, 2, or 4)
i: Number of digits in the integer part (0 to 8)
d: Number of digits in the decimal part (0 to 8)

(ii) Unsigned

[Ubid, ○○○○]

→ Address where the numerical data is stored
Set binary data in the specified address.

→ Set the "bid" data after the letter "U".

b: Number of bytes (1, 2, or 4)
i: Number of digits in the integer part (0 to 8)
d: Number of digits in the decimal part (0 to 8)

NOTE
1 Sum of integer part digits and fractional part digits must be within 8.
2 Blank is displayed for digits exceeding 8 digits.
3 Do not use any space between the brackets, [ ].

Example of Numerical data display

The following message includes 3 digits of tool number and offset data for this tool.
Each data is put in memory of 2bytes. The address R500 is used for the tool number and R502 is used for the offset data, and No. 1000 is used for the alarm number.

[Message definition]

A0000.0 1000 SPINDLE TOOL NO=[I230,R500]@0A@OFFSET DATA=[I212,R502]

Message number First line of message Renew line code Second message line

[Display on the NC alarm screen when A0000.0 is set on]

EX1000 SPINDLE TOOL NO.=110
OFFSET DATA=3.33

4.11.1.2 Defining characters not found in the CNC MDI keys

Message characters not covered by the CNC MDI keys (kanji and half-width kana characters and European character) can be input as follows:

(a) Half-width kana characters
- (i) Data format
  Numerical code enclosed with @ and @
- (ii) Input method
  Enter the numerical codes corresponding to the characters to be input, by referring to the character code table (Table 4.11.1.2(a)). Each character requires two bytes.
  Characters covered by the CNC screen keys can also be input this way.
- (iii) Example
  To input ATC? ﾁｮｳｻ OK when characters A, T, C, O, and K are registered in the CNC screen unit, enter the following:

```
ATC  @20  3F  CI  AE  B3  BB@OK
      ┬    ┬   ┬   ┬   ┬   ┬
      _    ?   ﾁ   ｮ   ｳ   ｻ
```

> **NOTE**
> Spaces are used between each numerical code in example to understand easily, but do not use them actually.

(b) Kanji (full-width) characters
- (i) Data format
  Numerical code enclosed with @02 and 01@
- (ii) Input method
  Enter the codes corresponding to the characters to input, in accordance with JIS level-1/2 kanji set. Each character requires four bytes.

> **NOTE**
> 1 It recommends that Kanji character is input from FANUC LADDER-III.
> 2 Some Kanji characters cannot be displayed. These characters can be checked by “Invalid kanji character check button” on FANUC LADDER-III.
> 3 For operation of FANUC LADDER-III , refer to the following manual:

Manual title	Drawing No.
FANUC LADDER-III Operator's Manual	B-66234EN

- (iii) Example
  To input ATC? 調査 OK when characters A, T, C, O, and K are registered in the CNC screen, enter the following:

```
ATC  @20  3F@@02  4434  3A3A  01@OK
      ┬    ┬        ┬     ┬
ATC   _    ?        調    査
```

(c) The European characters type 1
 (i) Data format
 Numerical code enclosed with @0D and 01@.
 (ii) Input method
 Enter the numerical codes corresponding to the characters to input, by referring to the character code table (Table 4.11.1.2 (b)) which includes characters for writing languages such as German, French, Italian, etc. Each character requires two bytes.
 (iii) Example
 To input “UNZULÄSSIGE” when characters U,N,Z,U,L,S,I,G , and E are registered in the CNC screen, enter the following:

UNZUL @0D C1 01@ SSIGE

UNZUL Ä SSIGE

> **NOTE**
> You can only input the character code described in the character code table (Table 4.11.1.2 (b)) between “@0D” and “01@”.

(d) The European characters type 2
 (i) Data format
 Numerical code enclosed with @0E and 01@.
 (ii) Input method
 Enter the numerical codes corresponding to the characters to input, by referring to the character code table (Table 4.11.1.2 (c)) which includes characters for writing Russian language. Each character requires two bytes.
 (iii) Example
 To input “СИМВОЛ” when characters C,M,B, and O are registered in the CNC screen, enter the following:

C @0E A5 01@ MBO @0E A8 01@

С И МВО Л

> **NOTE**
> You can only input the character code described in the character code table (Table 4.11.1.2 (c)) between “@0E” and “01@”.

(e) The European characters type 3
 (i) Data format
 Numerical code enclosed with @05 and 01@.
 (ii) Input method
 Enter the numerical codes corresponding to the characters to input, by referring to the character code table (Table 4.11.1.2 (d)) which includes characters for writing languages such as Turkish, Russian, etc. Each character requires two bytes.
 (iii) Example
 To input § 123” when characters 1,2, and 3 are registered in the CNC screen, enter the following:

@05 ED 01@ 123

§ 123

NOTE

You can only input the character code described in the character code table (Table 4.11.1.2 (d)) between “@05” and “01@”.

⚠ **CAUTION**

1 To define @, enter @40...@, where 40 is the code corresponding to
@40 . . . . @
Code for @
2 To renew the message line displayed on the CNC screen, input as:@ 0A @ at the end of the data.
3 When using numerical codes, @ code occupies 1 byte, and space code occupies 2 bytes. (Space code = 20, 2 and 0 occupies 1 byte each).
4 The following control codes are used:
02: 2-byte code (kanji and hiragana characters)
0D: 1-byte code (European characters type 1)
0E: 1-byte code (European characters type 2)
05: 1-byte code (European characters type 3)
01: 1-byte code (alphanumeric and half-width kana characters)
Do not specify control code between control codes as follows. The characters may not be correctly displayed.
@02 ... 02 ... 01@ @0D ... 0D ... 01@ @0E ... 0E ... 01@ @05 ... 05 ... 01@
@02 ... 01 ... 01@
5 Spaces are used between each numerical code in example to understand easily, but do not use them actually.
6 Do not specify the character strings for numerical data display between control codes such as @ and @, @02 and 01@, and etc.

Table 4.11.1.2 (a) Character code table

	2	3	4	5	A	B	C	D
0	Space	0	@	P	～	ー (*3)	タ	ミ
1	!	1	A	Q	。	ア	チ	ム
2	”	2	B	R	「	イ	ツ	メ
3	#	3	C	S	」	ウ	テ	モ
4	$	4	D	T	、	エ	ト	ヤ
5	%	5	E	U	・	オ	ナ	ユ
6	&	6	F	V	ヲ	カ	ニ	ヨ
7	’	7	G	W	ァ	キ	ヌ	ラ
8	(	8	H	X	ィ	ク	ネ	リ
9	)	9	I	Y	ゥ	ケ	ノ	ル
A	*	:	J	Z	ェ	コ	ハ	レ
B	+	;	K	[	ォ	サ	ヒ	ロ
C	,	<	L	¥	ャ	シ	フ	ワ
D	ー (*1)	=	M	]	ュ	ス	ヘ	ン
E	ǂ	>	N	∧	ョ	セ	ホ	゛ (*4)
F	/	?	O	_ (*2)	ッ	ソ	マ	゜ (*5)

*1) Minus, *2) Under bar, *3) Long bar *4) Dakuten *5) Han-dakuten

Table 4.11.1.2 (b) European character type1 code table

Character Code	+0	+1	+2	+3	+4	+5	+6	+7	+8	+9	+A	+B	+C	+D	+E	+F
A0	À	Á	Ã	Â	Æ	Ç	È	É	Ê	Ë	Ì	Í	Î	Ï	Ò	Ó
B0	Ô	Õ	Œ	Ø	Ù	Ú	Û	Ÿ	ß	à	á	â	ã	ä	å	æ
C0	Å	Ä	Ö	Ü	Ñ	¿	ç	è	é	ê	ë	ì	í	î	ï	ñ
D0	ò	ó	ô	õ	ö	œ	ø	ù	ú	û	ü	ÿ	¡			

Table 4.11.1.2 (c) European character type2 code table

Character Code	+0	+1	+2	+3	+4	+5	+6	+7	+8	+9	+A	+B	+C	+D	+E	+F
A0	Б	Г	Д	Ж	З	И	Й	К	Л	М	П	У	Ф	Ц	Ч	Ш
B0	Щ	Ъ	Ы	Ь	Э	Ю	Я									

Table 4.11.1.2 (d) European character type3 code table

Character Code	+0	+1	+2	+3	+4	+5	+6	+7	+8	+9	+A	+B	+C	+D	+E	+F
60	Ą	Ă	Ć	Č	Ċ	Ĉ	Đ	Ď	Ę	Ě	Ē	Ğ	Ġ	Ĝ	Ģ	Ĥ
70	İ	Ĩ	Į	Ī	Ĵ	Ķ	Ł	Ľ	Ĺ	Ļ	Ń	Ň	Ņ	Ő	Ō	Ŕ
80	Ř	Ŗ	Ś	Š	Ş	Ŝ	Ť	Ţ	Ŧ	Ů	Ű	Ŭ	Ų	Ũ	Ū	Ý
90	Ź	Ž	Ż	ą	ă	ā	ć	č	ċ	ĉ	ď	ď	đ	ę	ě	ğ
A0	ġ	ĝ	ħ	ĥ	ı	į	ī	ĵ	ķ	ĭ	í	ł	ń	ň	ņ	ő
B0	ō	p	þ	ŕ	ř	ŗ	ś	š	ş	ŝ	ť	ţ	ů	ű	µ	ŭ
C0	ų	ũ	ū	ý	ź	ž	ż	Ь	Ѓ	Є	Љ	Њ	Ћ	Ќ	Ў	Џ
D0					Б	Г	Д	З	И	Й	Л	Ф	Ц	Ч	Ш	Щ
E0	ъ	ы	э	ю	я	Ñ	ь	ѓ	є	љ	њ	ћ	ќ	§	ў	џ
F0	в	ж	к	м	н	п	т	у								

4.11.1.3 Notes when this functional instruction is used in subroutine

See Subsection 1.4.4.3 for details.

4.11.1.4 Message shift function

(a) General

In the message data areas corresponding to contiguous message display request memory locations, message data can be displayed in any of several languages.

The language in which a message is displayed is selected by shifting the message display request bit according to the address bit shift amount set the parameter in setting screen.

A0.0 Language 1 A0.1 Language 2 A0.2 Language 3 A0.3 Language 4 A0.4 Language 5	When A0.0 is turned on after setting the message display request bit shift amount to 2, the message display request bit is shifted by 2 bits to display language 3.

The parameters set on the setting screen are listed below. See Subsection 2.4.1 and Section 9.5 for details.

- Message shift value
  Message display request bit shift amount
- Message shift start address
  Start bit address of the message display request bit area to be shifted

(b) Examples

Example 1:

Message data in any of four languages is set starting at A0.0 in the order of Japanese, English, Italian, German, Japanese and so on. The Italian message data is displayed.
Set the parameters as follows:
Message shift value : 2
Message shift start address : A0.0
(Message shift value = 0:Japanese/1:English/2:Italian/ 3:German)
Manipulate A0.0, A0.4, A1.0, and A1.4 with the ladder.

Message table

A0.0	Japanese 1
A0.1	English 1
A0.2	Italian 1
A0.3	German 1
A0.4	Japanese 2
A0.5	English 2
A0.6	Italian 2
A0.7	German 2
:	:
Am.n	:

When A0.0 is turned on, Italian 1 is displayed. (The message data is shifted by 2 bits).

When A0.4 is turned on, Italian 2 is displayed. (The message data is shifted by 2 bits).

Example 2:

As common alarm messages, English message data is displayed with A0.0 through A9.7. Operator messages are set starting at A10.0 in the order of Japanese, English, Italian, German and so on, and German message data is displayed.
Set the parameters as follows:
Message shift value : 3
Message shift start address : A10.0
(Message shift value = 0:Japanese/1:English/ 2:Italian/3:German)
Manipulate A10.0, A10.4, A11.0, A11.4, and so forth with the ladder.
When any of A0.0 to A9.7 is turned on, the message corresponding to the bit is displayed.

Message table

A0.0	English A	(ALARM)
A0.1	English B	(ALARM)
A0.2	English C	(ALARM)
~		~
A10.0	Japanese 1	(OPE)
A10.1	English 1	(OPE)
A10.2	Italian 1	(OPE)
A10.3	German 1	(OPE)
A10.4	Japanese 2	(OPE)
A10.5	English 2	(OPE)
A10.6	Italian 2	(OPE)
A10.7	German 2	(OPE)
:	:	
:	:	
A m.n	:	

When A0.1 is turned on, English B is displayed.

When A10.0 is turned on, German 1 is displayed. (The message data is shifted by 3 bits).

When A10.4 is turned on, German 2 is displayed. (The message data is shifted by 3 bits).

Example 3:

As common alarm messages, English message data is displayed with A0.0 through A9.7. Operator messages are set starting at A10.0 in the order of Japanese, English, Italian, German and so on, with 40 successive messages assigned to each language. For these messages, German message data is displayed.

Set the parameters as follows:

Message shift value : 120 (40 × 3)

Message shift start address : A10.0

(Message shift value = 0:Japanese/40:English/ 80:Italian/120:German)

Manipulate A10.0 through A14.7 with the ladder.

When any of A0.0 to A9.7 is turned on, the message corresponding to the bit is displayed.

Message table

A0.0	English A	(ALARM)
A0.1	English B	(ALARM)
A0.2	English C	(ALARM)
~		~
A10.0	Japanese 1	(OPE)
A10.1	Japanese 2	(OPE)
~		~
A15.0	English 1	(OPE)
A15.1	English 2	(OPE)
~		~
A20.0	Italian 1	(OPE)
A20.1	Italian 2	(OPE)
~		~
A25.0	German 1	(OPE)
A25.1	German 2	(OPE)
:	:	
Am.n	:	

When A0.1 is turned on, English B is displayed.

When A10.0 is turned on, German 1 is displayed.
When A10.1 is turned on, German 2 is displayed.
(The message data is shifted by 120 bits).

(c) Notes

The same message number should be assigned to a message in each language that has the same meaning.

Message table

A0.0	1000	English A	(ALARM)
A0.1	1001	English B	(ALARM)
~			~
A10.0	1000	Japanese 1	(OPE)
A10.1	1001	Japanese 2	(OPE)

4.11.1.5 PMC message multi-language display function

The PMC message multi-language display function manages the language of alarm message and operator message stored in a separate file from ladder program, switching the language according to the language setting of CNC using the message data defined in various languages.
For more details about this function, refer to "2.7 PMC MESSAGE MULTI-LANGUAGE DISPLAY FUNCTION".

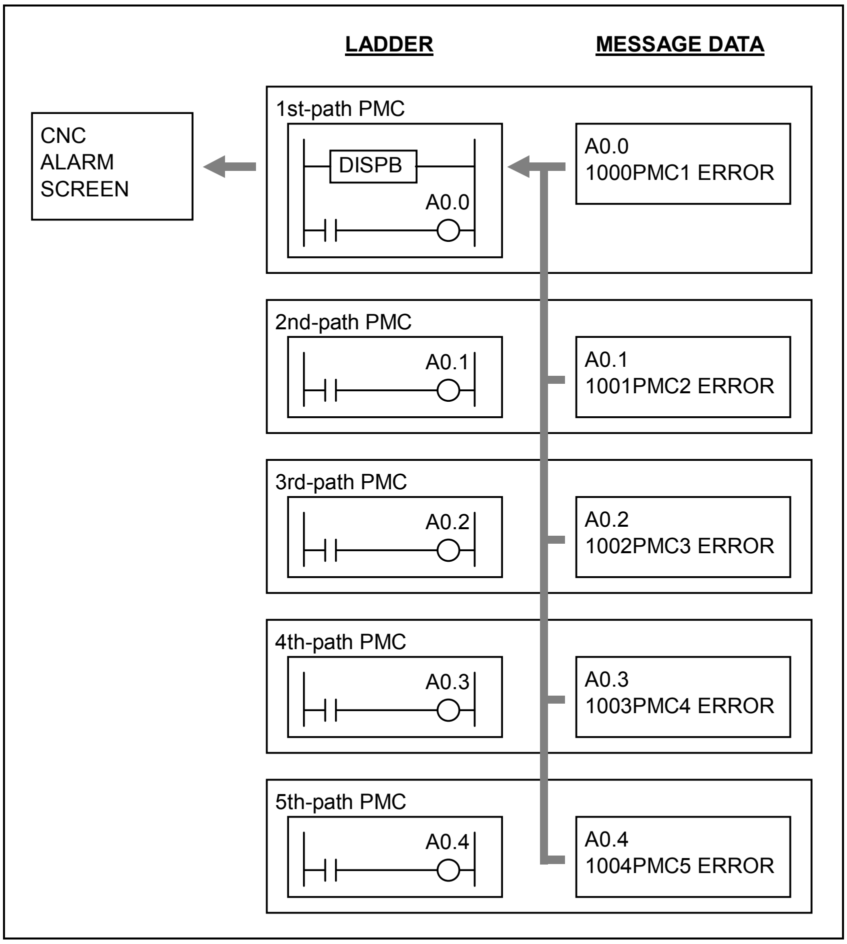
4.11.1.6 Ladder dividing management function

When using the ladder dividing management function, refer to "1.5.5 Message Display Function (DISPB) instruction) when Using Ladder Dividing Management Function".

4.11.1.7 Common PMC Memory mode of Multi-path PMC

When using the Common PMC Memory mode, the Message Data can be defined at each PMC path. In this case, make the program of DISPB functional instruction in the 1st-path PMC. As a result, it displays message data of all PMC paths.

The following figure is an example in which the message of A0.0 in 1st-path PMC, the message of A0.1 in 2nd-path PMC, the message of A0.2 in 3rd-path PMC, the message of A0.3 in 4th-path PMC, and the message of A0.4 in 5th-path PMC are defined.



When A0.0 is turned ON, the message of A0.0 defined in 1st-path PMC is displayed.
And, when A0.1 is turned ON, the message of A0.1 defined in 2nd-path PMC is displayed.
And, when A0.2 is turned ON, the message of A0.2 defined in 3rd-path PMC is displayed.

And, when A0.3 is turned ON, the message of A0.3 defined in 4th-path PMC is displayed.
Similarly, when A0.4 is turned ON, the message of A0.4 defined in 5th-path PMC is displayed.
Moreover, the A0.0 message defined in 1st-path PMC can be displayed from 2nd-path PMC, too.

> ⚠ **CAUTION**
> When using the Common PMC Memory mode, don't define message to the same A Address from multiple PMC paths. If message is defined in multiple PMC paths, only message defined in least numbered PMC path is displayed.
> For example, if A0.1 is defined in the 1st-path PMC in the above case, the message defined in the 1st-path PMC is displayed when A0.1 is turned on in 2nd-path PMC.

4.11.2 EXIN (External Data Input: SUB 42)

This instruction enables the use of the external data input functions (options) of the CNC. It controls the "external data input signals" to be exchanged between CNC and PMC and automatically executes the CNC-PMC handshake sequence. The use of this instruction facilitates the execution of the external data input functions.

> ⚠ **WARNING**
> When you use this instruction in ladder program, do not write the "external data input signals" with other applications.
> If you process the PMC signal set related to this function by using two or more applications, this function may execute incorrectly and it may cause an unexpected machine behavior.
> As for details, refer to “SAFETY PRECAUTIONS”.

> **NOTE**
> 1 When you use this instruction, do not directly write the "external data input signals" to be exchanged between CNC and PMC. Writing these signals directly causes an adverse effect on the handshake sequence, potentially disabling the external data input functions or causing them to malfunction.
> 2 This instruction cannot be used in the 1st level whose execution cycle is 1ms or 2ms. It is processed as an NOP instruction.

You can use the EXIN instruction only when optional external data input function is provided with NC. Four-byte control data as described below is required for external data input function (option).
In addition to the basic specification, the extended specification is also supported that needs six bytes of control data. With this setting, the extended operation can use ED16 to ED31 signals (for program number O8 digits etc.). To use the extended specification, it is necessary to set to CNC parameter 6300#7 (EEX)=1.

CNC parameter

	#7	#6	#5	#4	#3	#2	#1	#0
6300	EEX							

[Data format] Bit type
EEX EXIN function of PMC
0: basic specification
1: extended specification

> **NOTE**
> 1 To enable 8 digits of program number, set 1 to the CNC parameter No. 11304#3 (ON8).
> 2 To handle 8 digits of program number for EXIN instruction, set 1 to the CNC parameter No. 6300#7 (EEX). This setting will be effective after cycling power of CNC.

Format

Fig. 4.11.2 shows the ladder format and Table 4.11.2 shows the mnemonic format.

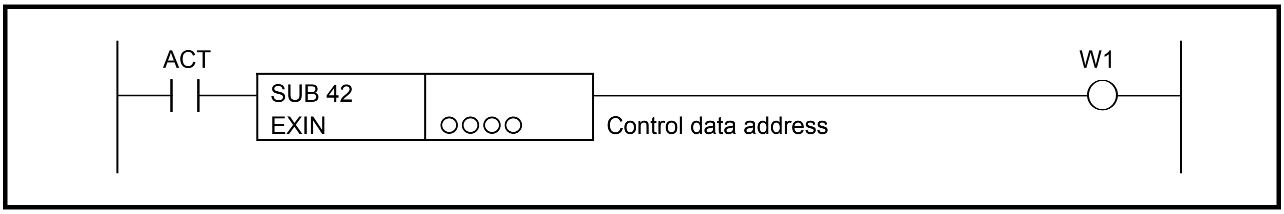


Fig. 4.11.2 Format of EXIN instruction

Table 4.11.2 Mnemonic of EXIN instruction

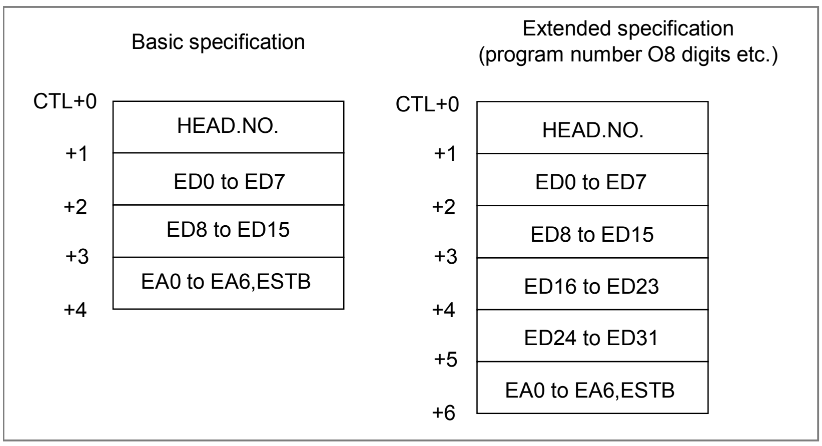
Mnemonic format					Memory status of control condition			
Step number	**Instruction**	**Address No.**	**Bit No.**	**Remarks**	**ST3**	**ST2**	**ST1**	**ST0**
1	RD	○○○○	.○	ACT				ACT
2	SUB	42		EXIN instruction				↓
3	(PRM)	○○○○		Control data address				↓
4	WRT	○○○○	.○	Transmission completion				W1

Control conditions

ACT=0: Do not process external data input/output.
ACT=1: Process external data input/output.
ACT is to be maintained '1' till the end of external data input/output. After external data input, reset ACT (W1=1).

Parameter

(a) Control data
The control data needs 4 continuous bytes from the specification address. The path is specified to the 1st byte. The addresses G0 to G2 of the interface from PMC to NC are specified by after 3 bytes. For 2nd path, the addresses G1000 to G1002 are specified. For 3rd path, the addresses G2000 to G2002 are specified.
In case of the extended specification (program number O8 digits etc.), a control data is extended. In this case, the control data address needs 6 continuous bytes from the specified address. The path is specified in the 1st byte. The addresses G0 to G2 and G210 to G211 of the interface from PMC to NC are specified in later 5 bytes. For 2nd path, the addresses G1000 to G1002 and G1210 to G1211 are specified. For 3rd path, the addresses G2000 to G2002 and G2210 to G2211 are specified.



[For single path control]

CTL+0	:	0
CTL+1 to CTL+3	:	Data to be specified for G0 to G2

In case of the extended specification (program number O8 digits etc.), it sets CTL+1 to CTL+5 as follows.

CTL+1 to CTL+2	:	Data to be specified for G0 to G1
CTL+3 to CTL+4	:	Data to be specified for G210 to G211
CTL+5	:	Data to be specified for G2

[For multi path control]

(1) 1st path

CTL+0	:	0 or 1
CTL+1 to CTL+3	:	Data to be specified for G0 to G2

In case of the extended specification (program number O8 digits etc.), it sets CTL+1 to CTL+5 as follows.

CTL+1 to CTL+2	:	Data to be specified for G0 to G1
CTL+3 to CTL+4	:	Data to be specified for G210 to G211
CTL+5	:	Data to be specified for G2

(2) 2nd path

CTL+0	:	2
CTL+1 to CTL+3	:	Data to be specified for G1000 to G1002

In case of the extended specification (program number O8 digits etc.), it sets CTL+1 to CTL+5 as follows.

CTL+1 to CTL+2	:	Data to be specified for G1000 to G1001
CTL+3 to CTL+4	:	Data to be specified for G1210 to G1211
CTL+5	:	Data to be specified for G1002

(3) 3rd path

CTL+0	:	3
CTL+1 to CTL+3	:	Data to be specified for G2000 to G2002

In case of the extended specification (program number O8 digits etc.), it sets CTL+1 to CTL+5 as follows.

CTL+1 to CTL+2	:	Data to be specified for G2000 to G2001
CTL+3 to CTL+4	:	Data to be specified for G2210 to G2211
CTL+5	:	Data to be specified for G2002

(4) 4th path

CTL+0	:	4
CTL+1 to CTL+3	:	Data to be specified for G3000 to G3002

In case of the extended specification (program number O8 digits etc.), it sets CTL+1 to CTL+5 as follows.

CTL+1 to CTL+2	:	Data to be specified for G3000 to G3001
CTL+3 to CTL+4	:	Data to be specified for G3210 to G3211
CTL+5	:	Data to be specified for G3002

(5) 5th path
CTL+0 : 5
CTL+1 to CTL+3 : Data to be specified for G4000 to G4002

In case of the extended specification (program number O8 digits etc.), it sets CTL+1 to CTL+5 as follows.
CTL+1 to CTL+2 : Data to be specified for G4000 to G4001
CTL+3 to CTL+4 : Data to be specified for G4210 to G4211
CTL+5 : Data to be specified for G4002

(6) 6th path
CTL+0 : 6
CTL+1 to CTL+3 : Data to be specified for G5000 to G5002

In case of the extended specification (program number O8 digits etc.), it sets CTL+1 to CTL+5 as follows.
CTL+1 to CTL+2 : Data to be specified for G5000 to G5001
CTL+3 to CTL+4 : Data to be specified for G5210 to G5211
CTL+5 : Data to be specified for G5002

(7) 7th path
CTL+0 : 7
CTL+1 to CTL+3 : Data to be specified for G6000 to G6002

In case of the extended specification (program number O8 digits etc.), it sets CTL+1 to CTL+5 as follows.
CTL+1 to CTL+2 : Data to be specified for G6000 to G6001
CTL+3 to CTL+4 : Data to be specified for G6210 to G6211
CTL+5 : Data to be specified for G6002

(8) 8th path
CTL+0 : 8
CTL+1 to CTL+3 : Data to be specified for G7000 to G7002

In case of the extended specification (program number O8 digits etc.), it sets CTL+1 to CTL+5 as follows.
CTL+1 to CTL+2 : Data to be specified for G7000 to G7001
CTL+3 to CTL+4 : Data to be specified for G7210 to G7211
CTL+5 : Data to be specified for G7002

(9) 9th path
CTL+0 : 9
CTL+1 to CTL+3 : Data to be specified for G8000 to G8002

In case of the extended specification (program number O8 digits etc.), it sets CTL+1 to CTL+5 as follows.
CTL+1 to CTL+2 : Data to be specified for G8000 to G8001
CTL+3 to CTL+4 : Data to be specified for G8210 to G8211
CTL+5 : Data to be specified for G8002

(10) 10th path

CTL+0	:	10
CTL+1 to CTL+3	:	Data to be specified for G9000 to G9002

In case of the extended specification (program number O8 digits etc.), it sets CTL+1 to CTL+5 as follows.

CTL+1 to CTL+2	:	Data to be specified for G9000 to G9001
CTL+3 to CTL+4	:	Data to be specified for G9210 to G9211
CTL+5	:	Data to be specified for G9002

NOTE
Refer to the "CONNECTION MANUAL (FUNCTION)" for detailed data to be specified concerning external data input.

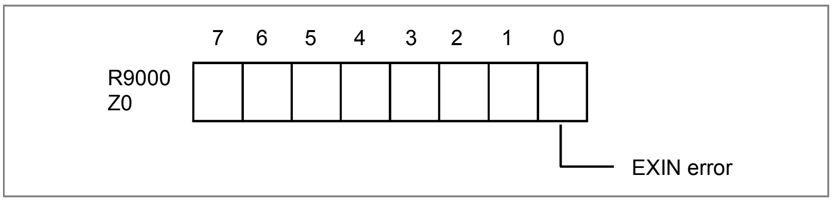
Completion of transfer (W1)

This indicates end of transfer of external data. This transfer end condition shows the completion of a series of external data input sequence. This functional instruction executes a series of transfer sequence, and finally sets ESTB = 0 in the PMC → NC interface. As a result, W1 is set to 1 (W1 = 1) after confirming that EREND = 0.
When W1 = 1, transfer of data is over. Reset ACT now.

⚠ CAUTION
1 The EXIN command cannot input multiple external data items at the same time. Be sure to issue the next EXIN command (ACT = 1) after external data transfer completion (W1 = 1).
2 Be sure to specify an interlock when the external data input function is used by commands other than the function command EXIN.
3 When an external program number search, one of the external data input functions, is executed, the end of data transfer (W1 = 1) means that the search command has been accepted. Note that this does not mean the completion of the program search. To confirm the completion of the program search, check the search completion signal (ESEND = 1) after the data transfer completion (W1 = 1).

Operation output register (R9000, Z0)

If any of the following errors occurs during external data input, the bit in the operation output register is set. In this case, external data transfer ends (W1 = 1).



(Description of errors)

- When the EXIN command (ACT = 1) is started, the strobe signal (ESTB) or EREND signal is already on. The external data may be input by commands other than the function command EXIN.

Notes when this functional instruction is used in subroutine

See Subsection 1.4.4.3 for details.

4.11.3 WINDR (Reading CNC Window Data: SUB 51)

This function reads various data items via the window between the PMC and the CNC.
The "WINDR" is classified into two types. One type completes reading a data during one scan time. Another type completes reading a data during a few scan times. The former is called the function of a high-speed response and the latter is called the function of a low-speed response.

> **NOTE**
> This instruction cannot be used in the 1st level whose execution cycle is 1ms or 2ms. It is processed as an NOP instruction.

Format

Fig. 4.11.3 shows the ladder format and Table 4.11.3 shows the mnemonic format.

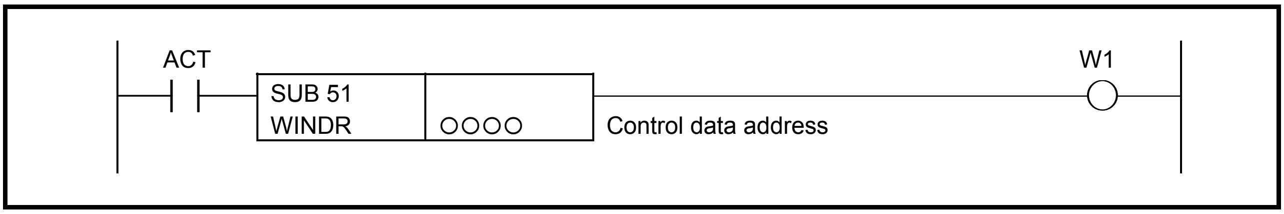


Fig. 4.11.3 Format of WINDR instruction

Table 4.11.3 Mnemonic of WINDR instruction

Mnemonic format

Step number	Instruction	Address No.	Bit No.	Remarks
1	RD	○○○○	.○	ACT
2	SUB	51		WINDR instruction
3	(PRM)	○○○○		Control data address
4	WRT	○○○○	.○	Read completion

Memory status of control condition

ST3	ST2	ST1	ST0
			ACT
			W1

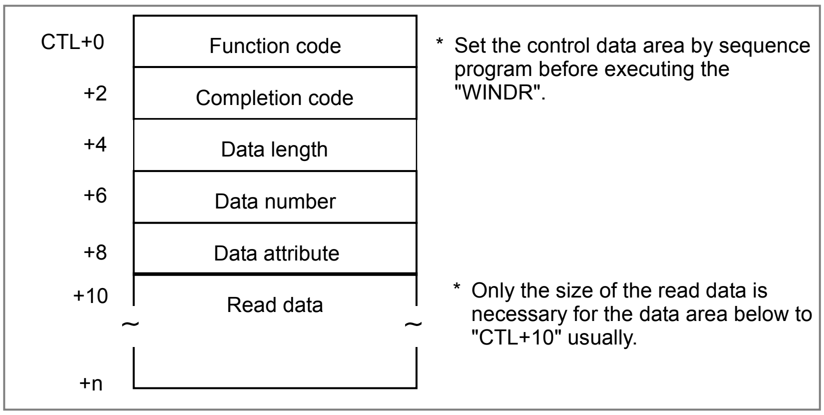
Control condition

ACT=0: The WINDR function is not executed.
ACT=1: The WINDR function is executed. Using the function of a high-speed response, it is possible to read the data continuously by always keeping ACT on. However, using the function of a low-speed response, as soon as reading a data is completed (W1=1), reset "ACT" once (ACT=0).

Parameter

(a) Control data address
The PMC byte address is used to specify the area where control data is stored.

Control data



See Chapter 5 for details.

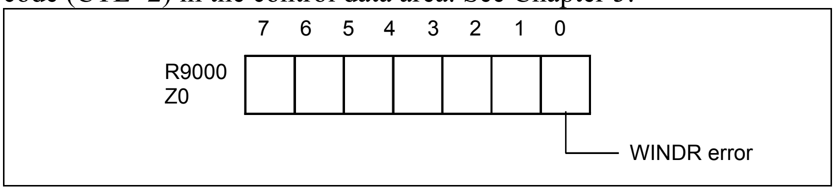
Reading completion (W1)

W1=0: "W1" is usually reset. The "W1=0" indicates that the "WINDR" is not executed or the "WINDR" being executed now.

W1=1: "W1" is set when the reading a data is completed by the reading command (ACT=1). If the function of a low-speed response is used, as soon as reading a data is completed (W1=1), reset "ACT" (ACT=0).

Operation output register (R9000, Z0)

If an error occurs during execution of the "WINDR" or "WINDW", the bit in the operation output register is set. At the same time, the reading completion is set (W1=1). Details of the error are output to the completion code (CTL+2) in the control data area. See Chapter 5.



Notes when this functional instruction is used in subroutine

When you use the function of a low-speed response, there are a few limitations. See Subsection 1.4.4.3. When you use the function of a high-speed response, there is no limitation.

4.11.4 WINDW (Writing CNC Window Data: SUB 52)

This function writes various data items via the window between the PMC and the CNC.

> ⚠ **WARNING**
> When you write some NC data using both this instruction in ladder program and other applications, take care that you do not write to the same data area.
> If some values are written to the same data area by two or more applications including ladder program, unexpected value may be written. In this case, it may cause an unexpected machine behavior and also tools, work pieces, and machines may be damaged.
> As for details, refer to “SAFETY PRECAUTIONS”.

> **NOTE**
> This instruction cannot be used in the 1st level whose execution cycle is 1ms or 2ms. It is processed as an NOP instruction.

Format

Fig. 4.11.4 shows the ladder format and Table 4.11.4 shows the mnemonic format.

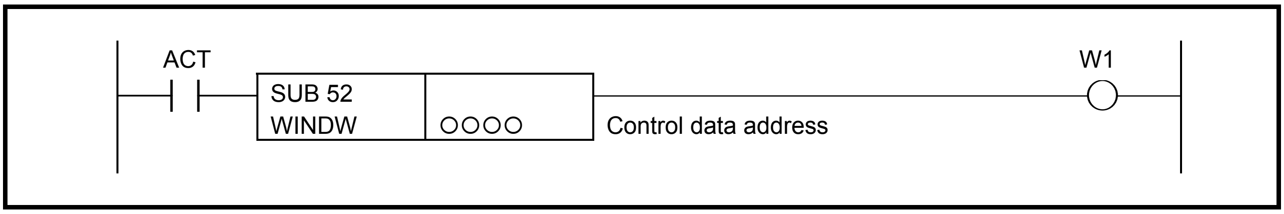


Fig. 4.11.4 Format of WINDW instruction

Table 4.11.4 Mnemonic of WINDW instruction

Mnemonic format

Step number	Instruction	Address No.	Bit No.	Remarks
1	RD	○○○○	.○	ACT
2	SUB	52		WINDW instruction
3	(PRM)	○○○○		Control data address
4	WRT	○○○○	.○	Read completion

Memory status of control condition

ST3	ST2	ST1	ST0
			ACT
			↓
			W1

Control condition

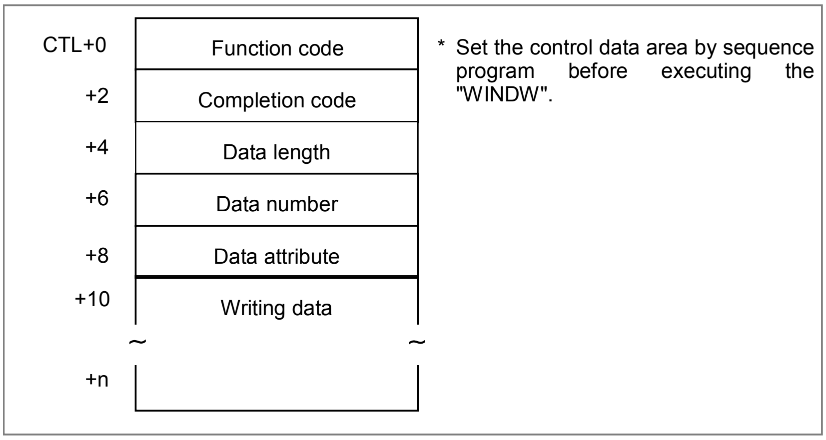
ACT=0: The WINDW function is not executed.

ACT=1: The WINDW function is executed. As soon as writing a data is completed (W1=1), reset "ACT" once (ACT=0).

Parameter

(a) Control data address
The PMC byte address is used to specify the area where control data is stored.

Control data



See Chapter 5 for details.

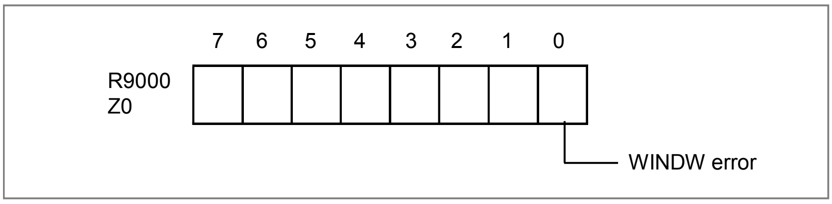
Writing completion (W1)

W1=0: "W1" is usually reset. The "W1=0" indicates that the "WINDW" is not executed or the "WINDW" being executed now.

W1=1: "W1" is set when the writing a data is completed by the writing command (ACT=1). As soon as writing a data is completed (W1=1), reset "ACT" (ACT=0).

Operation output register (R9000, Z0)

If an error occurs during execution of the "WINDR" or "WINDW", the bit in the operation output register is set. At the same time, the writing completion is set (W1=1). Details of the error are output to the completion code (CTL+2) in the control data area. See Chapter 5.

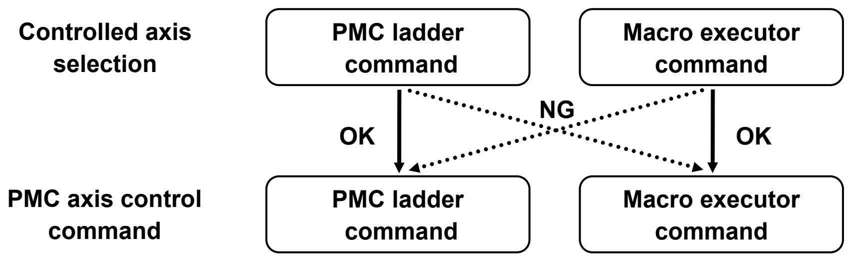


Notes when this functional instruction is used in subroutine

When you use the function of a low-speed response, there are a few limitations. See Subsection 1.4.4.3. When you use the function of a high-speed response, there is no limitation.

4.11.5 AXCTL (Axis Control by PMC: SUB 53)

This instruction simplifies the handshake of DI/DO signal for the axis control by PMC. For details of the PMC axis control, refer to section "PMC AXIS CONTROL" of "CONNECTION MANUAL (FUNCTION)".

> ⚠ **WARNING**
> PMC axis control is able to command by PMC ladder and macro executor. However, If you process the PMC signal set related to the PMC axis control by using two or more applications, the machine may behave in an unexpected manner and also tools, work pieces, and the machine may be damaged.
> When you use this instruction (PMC axis control) in ladder program, you should program the processing about this function only in same level of ladder program.
>
> For example, when "controlled axis selection" is commanded in macro executor and other "PMC axis controls" are commanded in ladder program, "PMC axis control command" may be ignored, or the command may cause incorrect axis motion.
>
> 
>

> **NOTE**
> 1 To use this function requires that the PMC axis control option be set on the CNC side.
> 2 This instruction cannot be used in the 1st level whose execution cycle is 1ms or 2ms. It is processed as a NOP instruction.

Format

Fig. 4.11.5 shows the ladder format and Table 4.11.5 shows the mnemonic format.

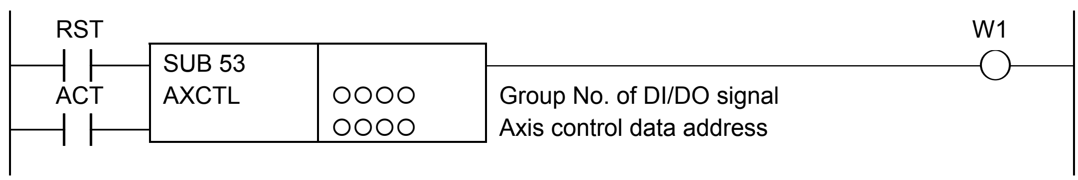


Fig. 4.11.5 Format of AXCTL instruction

Table 4.11.5 Mnemonic of AXCTL instruction

Mnemonic format					Memory status of control condition			
Step number	Instruction	Address No.	Bit No.	Remarks	ST3	ST2	ST1	ST0
1	RD	○○○○	.○	RST				RST
2	RD.STK	○○○○	.○	ACT			RST	ACT
3	SUB	53		AXCTL instruction				
4	(PRM)	○○○○		Group No. of DI/DO signal				
5	(PRM)	○○○○		Axis control data address				
6	WRT	○○○○	.○	Processing completion				W1

Control condition

(a) Input signal (ACT)
 ACT=0: The AXCTL function is not executed.
  If RST is 1, PMC axis control instruction reset processing is performed.
 ACT=1: The AXCTL function is executed.
  ACT is to be maintained '1' till the end of AXCTL processing.
  And reset ACT immediately after the processing is complete (W1 = 1) or when the CNC enters the alarm state.

(b) Reset (RST)
 RST=0: Release reset.
 RST=1: Set the reset signal (ECLRx) to 1 and W1 becomes 0. All the buffered commands are invalidated and the command being executed is stopped.
  If the CNC enters the alarm state, reset the PMC axis control instruction by setting ACT to 0.

> ⚠ **CAUTION**
> 1. Usually, set both ACT and RST to 0. Set ACT or RST to 1 only when executing the instruction. Note that, while ACT or RST is set to 1, you cannot update the ladder program after editing it.
> 2. If you make any change to the ladder program while RST is set to 1, you may be unable to continue to execute the AXCTL instruction when re-executing the ladder program. When changing the ladder program, set both ACT and RST to 0.
> 3. When RST and ACT become 1 at the same time, RST is prior to ACT.

Parameters

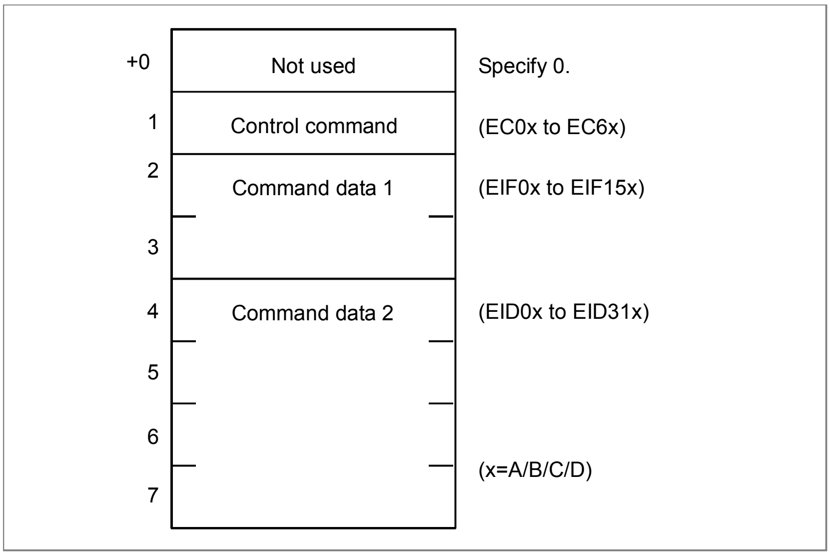
(a) Group number of DI/DO signal
 Specify the DI/DO signal group by the number.

Set value	Signal group number	DI address	DO address
1	1	G142 to G149, G150.5	F130 to F132, F142
2	2	G154 to G161, G162.5	F133 to F135, F145
3	3	G166 to G173, G174.5	F136 to F138, F148
4	4	G178 to G185, G186.5	F139 to F141, F151
1001	5	G1142 to G1149, G1150.5	F1130 to F1132, F1142
1002	6	G1154 to G1161, G1162.5	F1133 to F1135, F1145
1003	7	G1166 to G1173, G1174.5	F1136 to F1138, F1148
1004	8	G1178 to G1185, G1186.5	F1139 to F1141, F1151
2001	9	G2142 to G2149, G2150.5	F2130 to F2132, F2142
2002	10	G2154 to G2161, G2162.5	F2133 to F2135, F2145
2003	11	G2166 to G2173, G2174.5	F2136 to F2138, F2148
2004	12	G2178 to G2185, G2186.5	F2139 to F2141, F2151
3001	13	G3142 to G3149, G3150.5	F3130 to F3132, F3142

Set value	Signal group number	DI address	DO address
3002	14	G3154 to G3161, G3162.5	F3133 to F3135, F3145
3003	15	G3166 to G3173, G3174.5	F3136 to F3138, F3148
3004	16	G3178 to G3185, G3186.5	F3139 to F3141, F3151
4001	17	G4142 to G4149, G4150.5	F4130 to F4132, F4142
4002	18	G4154 to G4161, G4162.5	F4133 to F4135, F4145
4003	19	G4166 to G4173, G4174.5	F4136 to F4138, F4148
4004	20	G4178 to G4185, G4186.5	F4139 to F4141, F4151
5001	21	G5142 to G5149, G5150.5	F5130 to F5132, F5142
5002	22	G5154 to G5161, G5162.5	F5133 to F5135, F5145
5003	23	G5166 to G5173, G5174.5	F5136 to F5138, F5148
5004	24	G5178 to G5185, G5186.5	F5139 to F5141, F5151
6001	25	G6142 to G6149, G6150.5	F6130 to F6132, F6142
6002	26	G6154 to G6161, G6162.5	F6133 to F6135, F6145
6003	27	G6166 to G6173, G6174.5	F6136 to F6138, F6148
6004	28	G6178 to G6185, G6186.5	F6139 to F6141, F6151
7001	29	G7142 to G7149, G7150.5	F7130 to F7132, F7142
7002	30	G7154 to G7161, G7162.5	F7133 to F7135, F7145
7003	31	G7166 to G7173, G7174.5	F7136 to F7138, F7148
7004	32	G7178 to G7185, G7186.5	F7139 to F7141, F7151
8001	33	G8142 to G8149, G8150.5	F8130 to F8132, F8142
8002	34	G8154 to G8161, G8162.5	F8133 to F8135, F8145
8003	35	G8166 to G8173, G8174.5	F8136 to F8138, F8148
8004	36	G8178 to G8185, G8186.5	F8139 to F8141, F8151
9001	37	G9142 to G9149, G9150.5	F9130 to F9132, F9142
9002	38	G9154 to G9161, G9162.5	F9133 to F9135, F9145
9003	39	G9166 to G9173, G9174.5	F9136 to F9138, F9148
9004	40	G9178 to G9185, G9186.5	F9139 to F9141, F9151

(b) Axis control data address

Select the addresses of the locations that contain PMC axis control data.



The following functions are available.

Operation	Control	Command data 1	Command data 2
Rapid traverse	00H	Feedrate (Note 1)	Total travel amount
Cutting feed (feed per min.)	01H	Feedrate (Note 2)	Total travel amount
Cutting feed (feed per revolution)	02H	Feedrate per revolution	Total travel amount
Skip (feed per min.)	03H	Feedrate	Total travel amount
Dwell	04H	Not used	Dwell time
Reference pos. return	05H	Feedrate (Note 1)	Not used
Continuous feed (Note 3)	06H	Feedrate	Feed direction (Note 4)
1st ref. pos. return 2nd ref. pos. return 3rd ref. pos. return 4th ref. pos. return	07H 08H 09H 0AH	Feedrate (Note 1)	Not used Not used Not used Not used
External pulse synchronization (Position coder) (Note 3)	0BH	Pulse weighting	Not used
External pulse synchronization (1st manual pulse generator) (Note 3)	0DH	Pulse weighting	Not used
External pulse synchronization (2nd manual pulse generator) (Note 3)	0EH	Pulse weighting	Not used
External pulse synchronization (3rd manual pulse generator) (Note 3)	0FH	Pulse weighting	Not used
Speed command (Note 5)	10H	Feedrate	Not used
Torque control	11H	Maximum feedrate	Torque data
Auxiliary function 1	12H	Not used	Auxiliary function code
Auxiliary function 2	14H	Not used	Auxiliary function code
Auxiliary function 3	15H	Not used	Auxiliary function code
Machine coordinate system selection	20H	Rapid traverse rate (Note 1)	Machine coordinate position
Cutting feedrate (sec/block)	21H	Cutting feed time	Total travel amount

⚠ CAUTION

1 The rapid traverse rate is effective when parameter RPD (No. 8002#0) is set to 1.
2 When you specify 0 for feedrate, CNC does not work. Release this state by RST = 1.
3 When you end a continuous feed or external pulse synchronization, set RST to 1. And, continuous feed can't be used with buffering inhibits signal (EMBUFx) = 1. You must set the signal to 0.
4 Specify the direction by most significant bit of command data 2.
5 Command control axis must be specified to rotary axis by setting parameter ROTx (No. 1006#0) to 0.
6 For details such as the range of command data, refer to the NC connecting manual.
7 The above table is not up-to-date. For the latest information, refer to the descriptions about PMC axis control in the "CNC Connection Manual (Functions)".

Example 1) In case of cutting feed (feed per min.)

Offset	Content	Description
+0	0H	Not used (Specify 0).
1	01H	Command code for cutting feed. (feed per min.)
2	Feedrate	unit : mm/min.
3		
4	Total travel amount	
5		unit : 0.001mm
6		
7		

Example 2) In case of machine coordinate positioning.

Offset	Content	Description
+0	0H	Not used (Specify 0).
1	20H	Command code for machine coordinate selection.
2	0 or Feedrate	In case of CNC PRM8002#0 = 0 not used. = 1 Feedrate.
3		
4	Position in machine coordinate system	(Absolute)
5		
6		
7		

> ⚠ **CAUTION**
> It is necessary to set the CNC parameters relating to the axis movement.

End of command (W1)

W1=0: It is 0 usually.

W1=1: It will become 1 when the command of the axis control by PMC is buffered on CNC (when EMBUFx=0) or when axis movement is completed (when EMBUFx=1). Specify ACT=0 immediately after processing is completed. (W1=1).

Operation output register (R9000, Z0)

When error occurs by processing the axis control by PMC, the bit of the operation output register will be set. At the same time, processing is over (W1=1).

	7	6	5	4	3	2	1	0
R9000 Z0								

└ Group number of DI/DO signal specification error

> **NOTE**
> 1 W1 becomes 1 regardless of the state of ACT.
> 2 It is not related to the state of the alarm signal (EIALx).

Remarks

(1) The following signals are processed in this functional instruction.

• Axis control command signals	EC0g to EC6g (G143.0 to G143.6)
• Controlled axis feed signals	EIF0g to EIF15g (G144 to G145)
• Axis control data signals	EID0g to EID31g (G146 to G149)
• Axis control command read signal	EBUFg (G142.7)
• Axis control command read completion signal	EBSYg (F130.7)
• Reset signal	ECLRg (G142.6)

As for other than above signals (like the following signals), it is necessary to process G-addresses (X-addresses) from the ladder program directly.

• Axis control temporary stop signal	ESTPx (G142.5, G154.5, G166.5, G178.5)
• Servo-off signal	ESOFx (G142.4, G154.4, G166.4, G178.4)
• Block stop signal	ESBKx (G142.3, G154.3, G166.3, G178.3)
• Block stop disable signal	EMSBKx (G143.7, G155.7, G167.7, G179.7)
• Controlled axis selection signals	EAX1 to EAX8 (G136.0 to 7)
• Feedrate override signals	*EFOV0 to *EFOV7 (G151.0 to 7)
• Override cancellation signal	EOVC (G150.5)
• Rapid traverse override signals	EROV2, EROV1 (G150.1,0)
• Dry run signal	EDRN (G150.7)
• Manual rapid traverse selection signal	ERT (G150.6)
• Skip signal	SKIP/ESKIP (X4.7, X4.6)
• Buffering disable signal	EMBUFx (G142.2、G154.2, G166.2, G178.2)

(x=A/B/C/D)

> ⚠ **WARNING**
> 1 Above signals, which are processed in this functional instruction, cannot program in the ladder.
> 2 Movement cannot be sure when controlled axis selection signal (EAXx) is changed in the state of ACT=1.
> 3 PMC axis control must be executed while the PMC controlled-axis selection variable (#8700) or controlled axis selection signals EAX1 to EAX8 are "1". If PMC controlled-axis selection variable (#8700) and controlled axis selection signals EAX1 to EAX8 are "0", the command cannot be accepted. Therefore, the machine may behave in an unexpected manner.

(2) Buffering inhibit signal (EMBUFx)

0: The commands are buffered on the CNC.
Even if one command is being executed, the CNC accepts the next command as long as there is vacancy in the buffer on CNC.
W1 will become 1 when the command of the axis control by PMC is buffered on CNC.

1: Prohibits the buffering on CNC.
W1 will become 1 when the movement of the instructed axis control by PMC is completed.

4.11.6 PSGN2 (Position Signal: SUB 63)

This instruction is a position signal function. You can define the area of machine position for each PSGN2 instructions and you can know whether the current machine position is in the area or not.

> **NOTE**
> This instruction cannot be used in the 1st level whose execution cycle is 1ms or 2ms. It is processed as an NOP instruction.

Format

Fig. 4.11.6 shows the ladder format and Table 4.11.6 shows the mnemonic format.

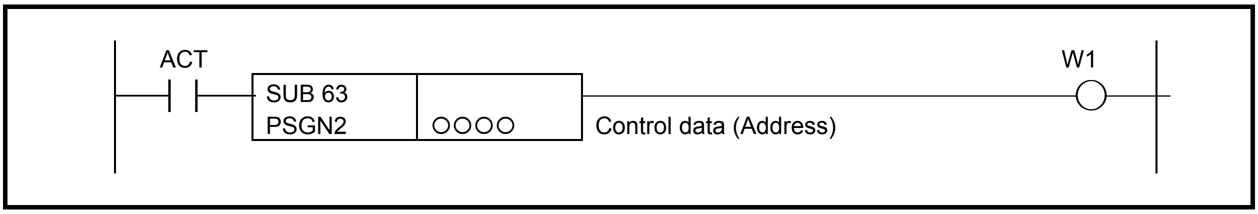


Fig. 4.11.6 Format of PSGN2 instruction

Table 4.11.6 Mnemonic of PSGN2 instruction

Mnemonic format

Step number	Instruction	Address No.	Bit No.	Remarks
1	RD	○○○○	.○	ACT
2	SUB	63		PSGN2 instruction
3	(PRM)	○○○○		Control data (Address)
4	WRT	○○○○	.○	Result

Memory status of control condition

ST3	ST2	ST1	ST0
			ACT
			↓
			↓
			W1

Control condition

(a) Command (ACT)
ACT=0: Do not execute the instruction. The W1 becomes 0.
ACT=1: Execute the instruction. The result is output to W1.

Parameters

(a) Control data
Set the top address of the control data. There are two format types for the control data. One is "Extended format" and other is "Basic format". The "Extended format" can be specified the CNC path or kind of machine position. The “Basic format” is for compatibility with conventional PMC system. We recommend you to use the "Extended format" if you use this instruction on single-path CNC system or you do not specify kind of machine position.

[Extended format]
- Set first byte of the control data area to 0.
- You can specify kind of machine position.
- In case of multi-path CNC system, choose this format.
- The continuous 12-bytes memory is necessary.

Control data (Extended format)	+0	0 (1byte)	Set zero.
	+1	Kind of machine position (1byte)	0: machine position 1: actual machine position
	+2	CNC path number (1byte)	1: path 1, 2: path 2...
	+3	Axis number (1byte)	1: 1st axis, 2: 2nd axis...
	+4	Position a (4byte)	Set to be a ≦ b.
	+8 +11	Position b (4byte)	

[Basic format]
- This format is only available on single-path CNC system.
- The continuous 9-bytes memory is necessary.

Control data (Basic format)	+0	Axis number (1byte)	1: 1st axis, 2: 2nd axis...
	+1	Position a (4byte)	Set to be a ≦ b.
	+5 +8	Position b (4byte)	

> ⚠ **CAUTION**
> Be careful that it is recognized as "Extended format" if you set “Axis number” to 0 in the case of “Basic format”.

(i) Kind of machine position

This parameter is only available on "Extended format". Set the Kind of machine position with 1-byte length binary data. If you set a value except for 0 or 1, this instruction terminates with error status and W1 is turned off.

= 0: machine position
= 1: actual machine position

The machine position means that the value read by the window function code 28 "Reading the Machine Position (Machine Coordinates) of Controlled Axes". The actual machine position means that the value read by the window function code 428 "Reading the Actual Machine Position of Controlled Axes".

NOTE

1. In case that CNC system software supports actual position reading function with absolute-position detector, to use the actual position setting "Kind of machine position" to 1, set the CNC parameter No.1806#5 and No.2224#1 to 1.
2. To use actual machine position that servo delay and acceleration/deceleration delay is applied setting "Kind of machine position" to 1, set the CNC parameter No.1806#5 to 0 and No.11313#7 to 1.
3. When "Kind of machine position" is 0, the update cycle of the machine position becomes faster by setting the CNC parameter No. 11300#5 (MPH) to 1. You should apply this setting only if necessary because this setting may lower the performance of CNC a little.

(ii) CNC path number

This parameter is only available on "Extended format". Set the CNC path number with 1-byte length binary data. If you set this parameter to zero, the path number is recognized as 1.

(Example)

= 1: 1st path CNC

= 2: 2nd path CNC

(iii) Axis number

Set the axis number with 1-byte length binary data. If you set this parameter to zero on "Extended format", this instruction terminates with error.

(Example)

= 1: 1st axis

= 2: 2nd axis

(iv) Position a, b

Set the machine position with 4-bytes length binary data with machine unit. You must set positions to be "Position a ≦ Position b". The position value "1" means the minimum unit of data with machine unit.

For example, when the setting of minimum unit of data is "IS-B" and the setting of machine unit is "mm", the position 10000 means "10.000mm".

Machine unit	Minimum unit of data				
	IS-A	IS-B	IS-C	IS-D	IS-E
mm / deg.	0.01	0.001	0.0001	0.00001	0.000001
inch / deg.	0.001	0.0001	0.00001	0.000001	0.0000001

⚠ **CAUTION**

You must set positions to be "Position a ≦ Position b". If not, this instruction does not work correctly.

NOTE

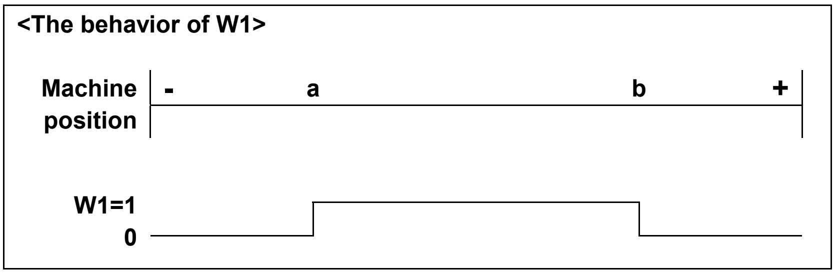
This instruction does not depend on the diameter or radius setting even using the Diameter and Radius Setting Switching function. Set the position which depends only on the setting of the CNC parameter No. 1006#3 (DIAx).

Output (W1)

When the machine position is "Position a ≦ Machine position ≦ Position b", W1 is turned on.

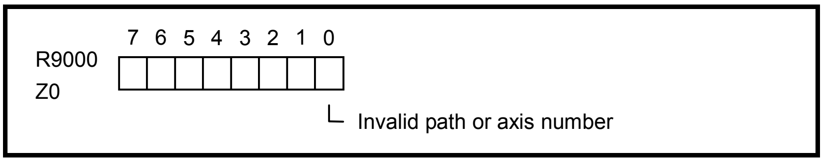
W1=1: - ACT=1 and "Position a ≦ Machine position ≦ Position b"

W1=0: - ACT=0
- ACT=1 and "Machine position < Position a" or "Position b < Machine position"
- ACT=1 and invalid path or axis number is specified.



Operation Output Register (R9000, Z0)

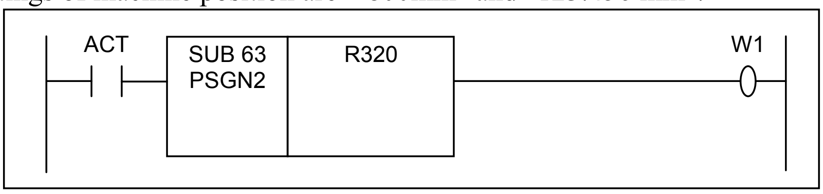
When ACT=1 and some error occurs in this instruction, the corresponding bit of the operation output register is set. In this case, W1 will be turned off. When ACT=0, the operation output register will not be updated.



Example

The example of using this instruction is shown bellow.

- The control data address is R320.
- The setting of machine unit is "mm".
- The setting of minimum unit of data is "IS-B".
- The kind of machine position is actual machine position.
- The axis is 3rd axis on 2nd CNC path.
- The settings of machine position are "-800mm" and "123.456 mm".



In this case, you should set the control data using "Extended format" as following.

Control data (Extended format)	R320	0 (2byte)	Set zero to this area.
	R321	1 (1byte)	1: actual machine position
	R322	2 (1byte)	2: path2
	R323	3 (1byte)	3: 3rd axis
	R324	-800000 (4byte)	a = -800.000 mm
	R328	123456 (4byte)	b = 123.456 mm
	R331		

When ACT=1 and the machine position is equal or grater than -800 mm and is equal or smaller than 123.456 mm, the W1 is turned on.

4.11.7 PSGNL (Position Signal: SUB 50)

This instruction is a position signal function. You can define eight areas of machine position for each PSGNL instructions and you can know the area where the machine position is currently located.

> **NOTE**
> This instruction cannot be used in the 1st level whose execution cycle is 1ms or 2ms. It is processed as an NOP instruction.

Format

Fig. 4.11.7 shows the ladder format and Table 4.11.7 shows the mnemonic format.

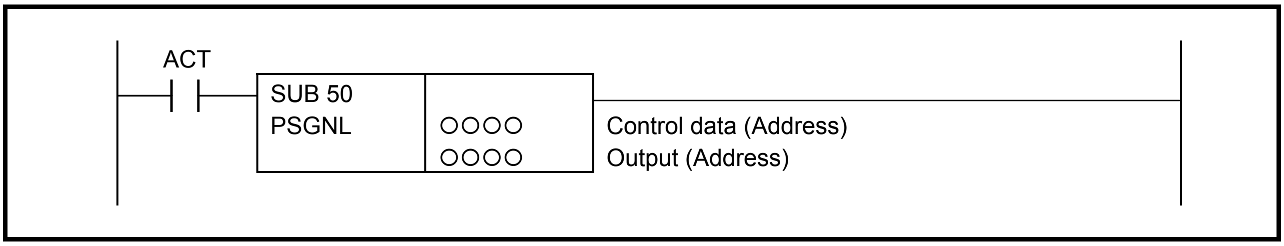


Fig. 4.11.7 Format of PSGNL instruction

Table 4.11.7 Mnemonic of PSGNL instruction

Mnemonic format					Memory status of control condition			
Step number	**Instruction**	**Address No.**	**Bit No.**	**Remarks**	**ST3**	**ST2**	**ST1**	**ST0**
1	RD	○○○○	.○	ACT				ACT
2	SUB	50		PSGNL instruction				
3	(PRM)	○○○○		Control data (Address)				
4	(PRM)	○○○○		Output (Address)				

Control condition

(a) Command (ACT)
ACT=0: Do not execute the instruction. The W1 becomes 0.
ACT=1: Execute the instruction. The result is output to "Output".

Parameters

(a) Control data
Set the top address of the control data. There are two format types for the control data. One is "Extended format" and other is "Basic format". The "Extended format" can be specified the CNC path or kind of machine position. The “Basic format” is for compatibility with conventional PMC system. We recommend you to use the "Extended format" if you use this instruction on single-path CNC system or you do not specify kind of machine position.

[Extended format]

- Set first byte of the control data area to 0.
- You can specify kind of machine position.
- In case of multi-path CNC system, choose this format.
- The continuous 32-bytes memory is necessary.

	Offset	Data	Description
Control data (Extended format)	+0	0 (1byte)	Set zero.
	+1	Kind of machine position (1byte)	0: machine position 1: actual machine position
	+2	CNC path number (1byte)	1: path 1, 2: path 2...
	+3	Axis number (1byte)	1: 1st axis, 2: 2nd axis...
	+4	Position a (4byte)	Set to be a < b < c < d < e < f < g
	+8	Position b (4byte)	
	+12	Position c (4byte)	
	+16	Position d (4byte)	
	+20	Position e (4byte)	
	+24	Position f (4byte)	
	+28 +31	Position g (4byte)	

[Basic format]

- This format is only available on single-path CNC.
- The continuous 29-bytes memory is necessary.

	Offset	Data	Description
Control data	+0	Axis number (1byte)	1: 1st axis, 2: 2nd axis...
	+1	Position a (4byte)	Set to be a < b < c < d < e < f < g
	+5	Position b (4byte)	
	+9	Position c (4byte)	
	+13	Position d (4byte)	
	+17	Position e (4byte)	
	+21	Position f (4byte)	
	+25 +28	Position g (4byte)	

> ⚠ **CAUTION**
> Be careful that it is recognized as "Extended format" if you set “Axis number” to 0 in the case of “Basic format”.

(i) Kind of machine position

This parameter is only available on "Extended format". Set the Kind of machine position with 1-byte length binary data. If you set a value except for 0 or 1, this instruction terminates with error status and W1 is turned off.

= 0: machine position
= 1: actual machine position

The machine position means that the value read by the window function code 28 "Reading the Machine Position (Machine Coordinates) of Controlled Axes". The actual machine position means that the value read by the window function code 428 "Reading the Actual Machine Position of Controlled Axes".

> **NOTE**
> 1 In case that CNC system software supports actual position reading function with absolute-position detector, to use the actual position setting "Kind of machine position" to 1, set the CNC parameter No.1806#5 and No.2224#1 to 1.
> 2 To use actual machine position that servo delay and acceleration/deceleration delay is applied setting "Kind of machine position" to 1, set the CNC parameter No.1806#5 to 0 and No.11313#7 to 1.
> 3 When "Kind of machine position" is 0, the update cycle of the machine position becomes faster by setting the CNC parameter No. 11300#5 (MPH) to 1. You should apply this setting only if necessary because this setting may lower the performance of CNC a little.

(ii) CNC path number

This parameter is only available on "Extended format". Set the CNC path number with 1-byte length binary data. If you set this parameter to zero, the path number is recognized as 1.
(Example)

= 1: 1st path CNC
= 2: 2nd path CNC

(iii) Axis number

Set the axis number with 1-byte length binary data. If you set this parameter to zero on "Extended format", this instruction terminates with error.
(Example)

= 1: 1st axis
= 2: 2nd axis

(iv) Position a, b, c, d, e, f and g

Set the machine position with 4-bytes length binary data with machine unit. You must set positions to be "Position a < b < c < d < e < f < g". The position value "1" means the minimum unit of data with machine unit.
For example, when the setting of minimum unit of data is "IS-B" and the setting of machine unit is "mm", the position 10000 means "10.000mm".

Machine unit	Minimum unit of data				
	IS-A	IS-B	IS-C	IS-D	IS-E
mm / deg.	0.01	0.001	0.0001	0.00001	0.000001
inch / deg.	0.001	0.0001	0.00001	0.000001	0.0000001

⚠ CAUTION

1 You must set all positions to be "Position a < b < c < d < e < f < g". If not, this instruction does not work correctly.

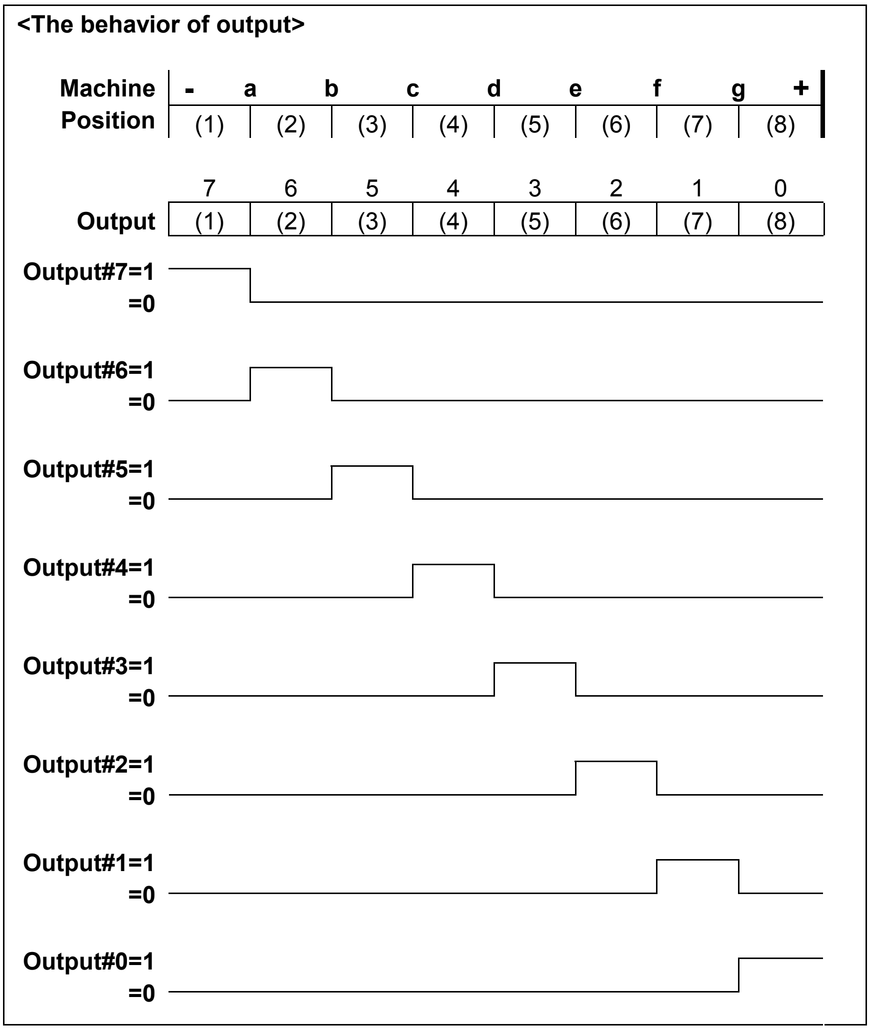
NOTE

This instruction does not depend on the diameter or radius setting even using the Diameter and Radius Setting Switching function. Set the position which depends only on the setting of the CNC parameter No. 1006#3 (DIAx).

(b) Output

Set the output address to this parameter. This output needs 1-byte length memory. When ACT=1, one of the bits corresponding to the current machine position is turned on by this instruction. When ACT=1 and any error occurs in this instruction, all bits of output will be turned off. When ACT=0, the output will not be updated.

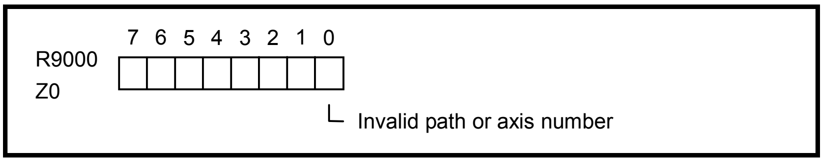
The correspondence between the setting of Position (a) to (g) and the bit signals of output are shown below.



When "Machine position ≦ a":	Output#7=1
When "a < Machine position ≦ b":	Output#6=1
When "b < Machine position ≦ c":	Output#5=1
When "c < Machine position ≦ d":	Output#4=1
When "d < Machine position ≦ e":	Output#3=1
When "e < Machine position ≦ f":	Output#2=1
When "f < Machine position ≦ g":	Output#1=1
When "g < Machine position":	Output#0=1

Operation Output Register (R9000, Z0)

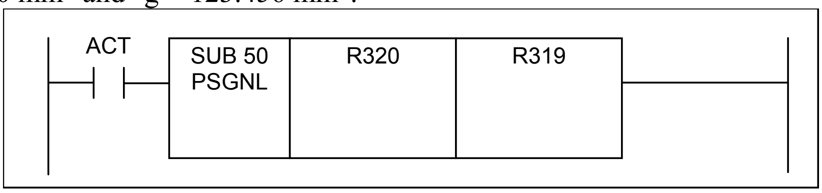
When ACT=1 and any error occurs in this instruction, the corresponding bit of the operation output register is set. In this case, all bits of output will be turned off. When ACT=0, the operation output register will not be updated.



Example

The example of using this instruction is shown bellow.

- The control data address is R320.
- The output address is R319.
- The setting of machine unit is "mm".
- The setting of minimum unit of data is "IS-B".
- The kind of machine position is actual machine position.
- The axis is 3rd axis on 2nd CNC path.
- The each positions are "a = -400 mm", "b = -200 mm", "c = -100 mm", "d = 0 mm", "e = 10 mm", "f = 100 mm" and "g = 123.456 mm".



In this case, you should set the control data as following.

Control data	R320	0 (1byte)	Set zero to this area.
	R321	1 (1byte)	1: actual machine position
	R322	2 (1byte)	2: path2
	R323	3 (1byte)	3: 3rd axis
	R324	-400000 (4byte)	a = -400 mm
	R328	-200000 (4byte)	b = -200 mm
	R332	-100000 (4byte)	c = -100 mm
	R336	0 (4byte)	d = 0 mm
	R340	10000 (4byte)	e = 10 mm
	R344	100000 (4byte)	f = 100 mm
	R348	123456 (4byte)	g = 123.456 mm
	R351		

When "Machine pos. ≦ -400 mm":	R319.7=1
When "-400 mm < Machine pos. ≦ -200 mm":	R319.6=1
When "-200 mm < Machine pos. ≦ -100 mm":	R319.5=1
When "-100 mm < Machine pos. ≦ 0 mm":	R319.4=1
When "0 mm < Machine pos. ≦ 10 mm":	R319.3=1
When "10 mm < Machine pos. ≦ 100 mm":	R319.2=1
When "100 mm < Machine pos. ≦ 123.456 mm":	R319.1=1
When "123.456 mm < Machine pos.":	R319.0=1

4.12 PROGRAM CONTROL

The following types of program control instruction are available. Use any of these instructions as appropriate for your purpose.

	Instruction name	Sub number	Processing
1	COM	9	Common line control
2	COME	29	Common line control end
3	JMP	10	Jump
4	JMPE	30	Jump end
5	JMPB	68	Label jump 1
6	JMPC	73	Label jump 2
7	LBL	69	Label
8	CALL	65	Conditional subprogram call
9	CALLU	66	Unconditional subprogram call
10	SP	71	Subprogram
11	SPE	72	End of a subprogram
12	END1	1	End of a first level program
13	END2	2	End of a second level program
14	END3	48	End of a third level program
15	END	64	End of a ladder program
16	NOP	70	No operation
17	CS	74	Case call
18	CM	75	Sub program call in case call
19	CE	76	End of case call

4.12.1 COM (Common Line Control: SUB 9)

The coils in a region up to the common line control end instruction (COME) are controlled.
This instruction can control whole coils in section of the common line control.
When COME instruction is not specified bottom of the section, the "COM FUNCTION MISSING" error results.

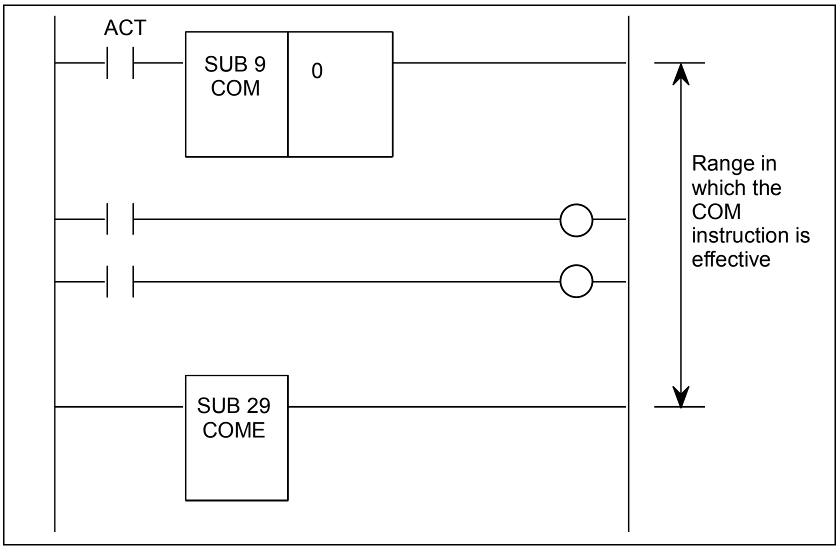


Fig. 4.12.1 (a) Function of COM instruction

Format

Fig. 4.12.1 (b) shows the ladder format and Table 4.12.1 shows the mnemonic format.

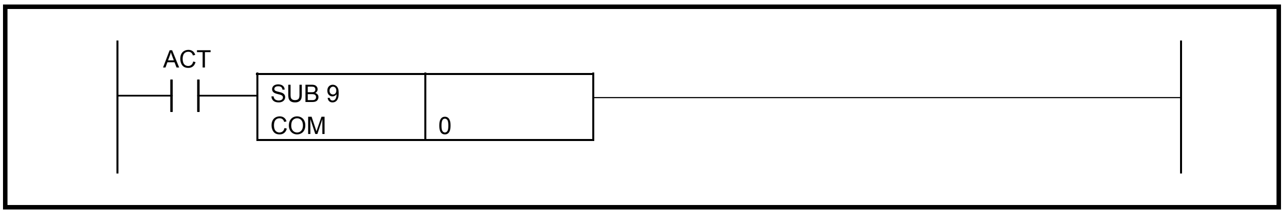


Fig. 4.12.1 (b) Format of COM instruction

Table 4.12.1 Mnemonic of COM instruction

Mnemonic format					Memory status of control condition			
Step number	Instruction	Address No.	Bit No.	Remarks	ST3	ST2	ST1	ST0
1	RD	○○○○	.○	ACT				ACT
2	SUB	9		COM instruction				↓
3	(PRM)	0		Specify 0.				

Control conditions

ACT=0: The coils within the region specified are unconditionally turned off (set to 0).
ACT=1: The program operates in the same way as when COM is not used.

Parameter

(a) Specify 0.

NOTE

1 The ladder diagram that includes the COM instruction as shown “Fig.1” is similar in logic to the ladder diagram as shown “Fig.2”.

Fig.1

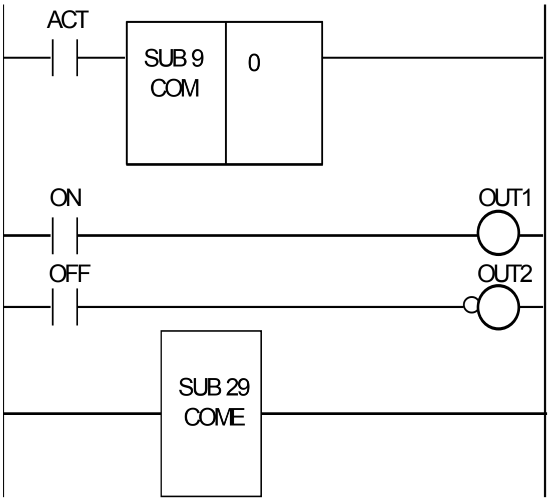
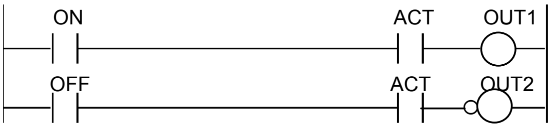


Fig.2



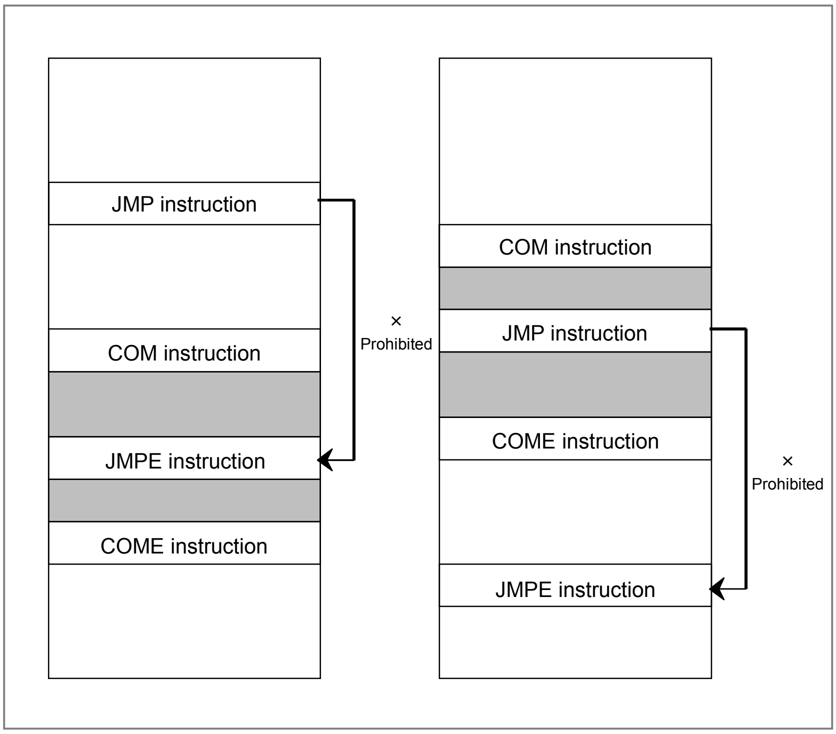
2 A functional instruction in a range specified by COM executes processing, regardless of ACT for COM. However, if ACT=0 for COM, the coil of the execution result becomes 0.

3 Another COM instruction cannot be specified in the range by the COM instruction.

4 When the ACT of COM instruction is set to 0, coils of WRT.NOT instruction in the range of common line becomes 1 unconditionally as described in NOTE 1.

⚠ **CAUTION**

Do not create a program in which a combination of JMP and JMPE instructions is used to cause a jump to and from a sequence between the COM and COME instructions. The ladder sequence may not be able to operate normally after the jump.



4.12.2 COME (Common Line Control End: SUB 29)

This instruction indicates the end of region of common line control instruction (COM).
This instruction cannot be used alone. It must he used together with the COM instruction.

Format

Fig. 4.12.2 shows the ladder format and Table 4.12.2 shows the mnemonic format.

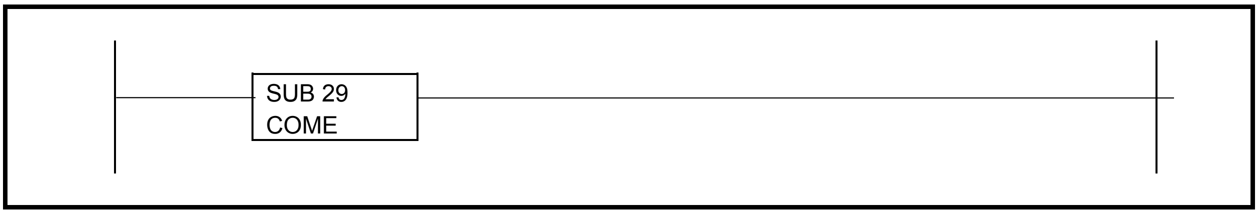


Fig. 4.12.2 Format of COME instruction

Table 4.12.2 Mnemonic of COME instruction

Mnemonic format

Step number	Instruction	Address No.	Bit No.	Remarks
1	SUB	29		COME instruction

Memory status of control condition

ST3	ST2	ST1	ST0

4.12.3 JMP (Jump: SUB 10)

The JMP instruction causes a departure from the normal sequence to executing instructions. When a JMP instruction is specified, processing jumps to a jump end instruction (JMPE) without executing the logical instructions (including functional instructions) in the range delimited by a jump end instruction (JMPE). (See Fig. 4.12.3 (a).) Specify a range to be skipped using the jump end instruction.
When the jump end instruction is not specified, the message JUMP FUNCTION MISSING is displayed.

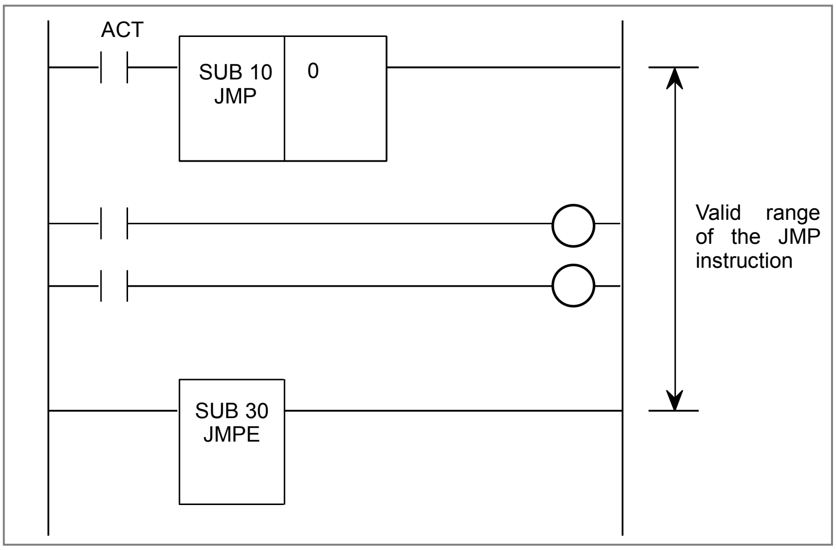


Fig. 4.12.3 (a) Function of JMP instruction

Format

Fig. 4.12.3 (b) shows the ladder format and Table 4.12.3 shows the mnemonic format.

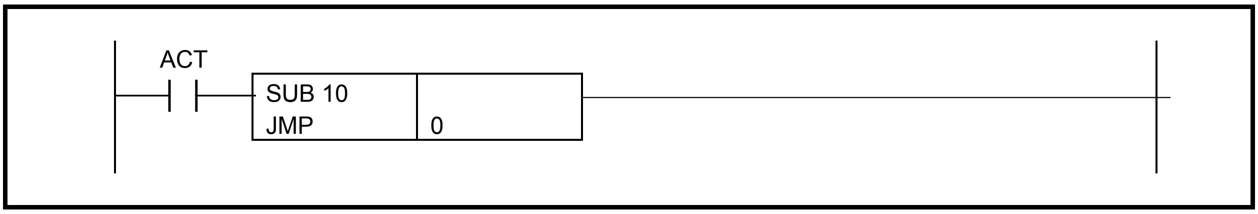


Fig. 4.12.3 (b) Format of JMP instruction

Table 4.12.3 Mnemonic of JMP instruction

Mnemonic format

Step number	Instruction	Address No.	Bit No.	Remarks
1	RD	○○○○	.○	ACT
2	SUB	10		JMP instruction
3	(PRM)	0		Specify 0.

Memory status of control condition

ST3	ST2	ST1	ST0
			ACT
			↓

Control conditions

ACT=1: The logical instructions (including functional instructions) to next JMPE instruction are skipped.
ACT=0: The JMP instruction is ignored. It is performed from next step.

Parameters

(a) Specify 0.

> ⚠ **CAUTION**
> When you use this instruction between COM and COME instructions, the ladder sequence may not be able to operate normally. For details, refer to "CAUTION" of the section of COM instruction.

4.12.4 JMPE (Jump End: SUB 30)

This instruction indicates the end of region of jump instruction (JMP).
This instruction cannot be used alone. It must be used together with the JMP instruction.

Format

Fig. 4.12.4 shows the ladder format and Table 4.12.4 shows the mnemonic format.

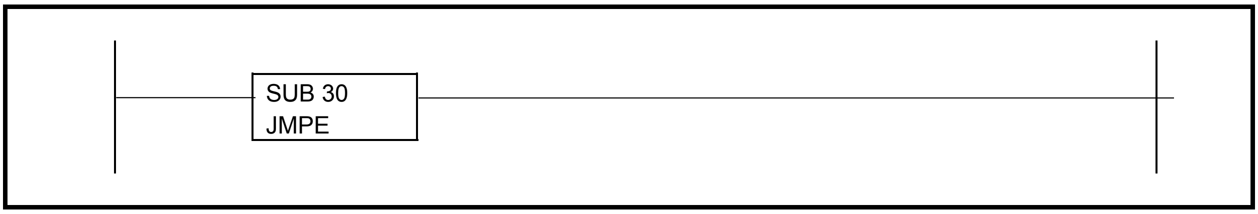


Fig. 4.12.4 Format of JMPE instruction

Table 4.12.4 Mnemonic of JMPE instruction

Mnemonic format

Step number	Instruction	Address No.	Bit No.	Remarks
1	SUB	30		JMPE instruction

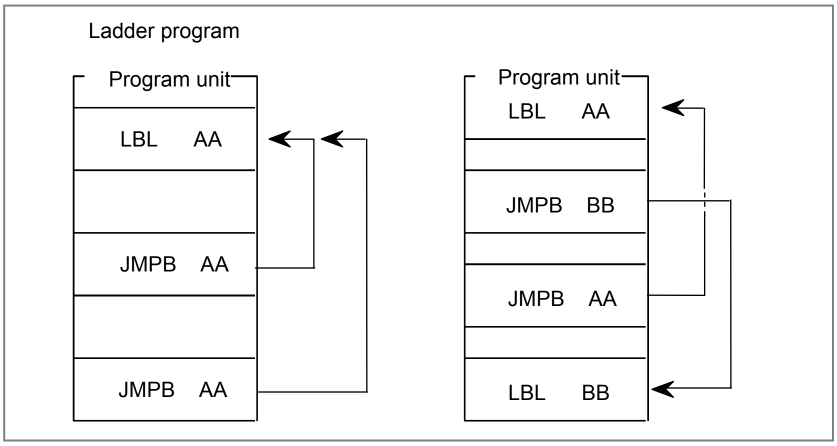
Memory status of control condition

ST3	ST2	ST1	ST0

4.12.5 JMPB (Label Jump 1: SUB 68)

This instruction transfers the control of ladder program to specified label.
It can jump freely before and after the instruction within main program or subprogram in which the instruction is coded.
JMPB instruction is effective in the following programming.

- More than one jump instruction can be coded for the same label.
- Jump instructions can be nested.



Format

Fig. 4.12.5 shows the ladder format and Table 4.12.5 shows the mnemonic format.

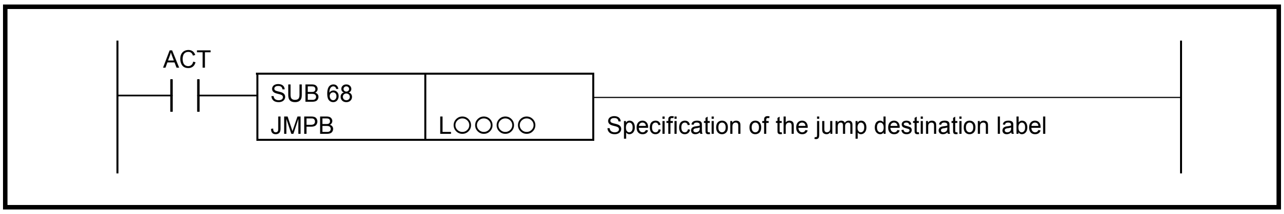


Fig. 4.12.5 Format of JMPB instruction

Table 4.12.5 Mnemonic of JMPB instruction

Mnemonic format

Step number	Instruction	Address No.	Bit No.	Remarks
1	RD	OOOO	.O	ACT
2	SUB	68		JMPB instruction
3	(PRM)	LOOOO		Specification of the jump destination label

Memory status of control condition

ST3	ST2	ST1	ST0
			ACT

Control conditions

ACT=0: The next instruction after the JMPB instruction is executed.
ACT=1: Control is transferred to the Ladder immediately after the specified label.

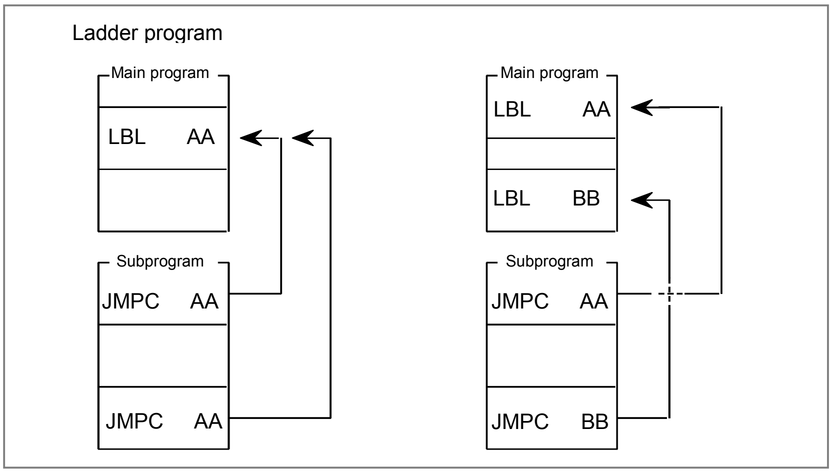
Parameters

(a) Label specification
Specify the label of the jump destination. The label number must be specified in the L address form. A value from L1 to L9999 can be specified.

⚠ **CAUTION**
1 For the specifications of this instruction, see the description of functional instruction JMP.
2 When this instruction is used for jump back to a previous instruction, take care not to cause an infinite loop.

4.12.6 JMPC (Label Jump 2: SUB 73)

This instruction returns the control from a subprogram to the main program of 2nd level. Be sure to code the destination label in the main program of 2nd level. More than one jump instruction can be coded for the same label.



Format

Fig. 4.12.6 shows the ladder format and Table 4.12.6 shows the mnemonic format.

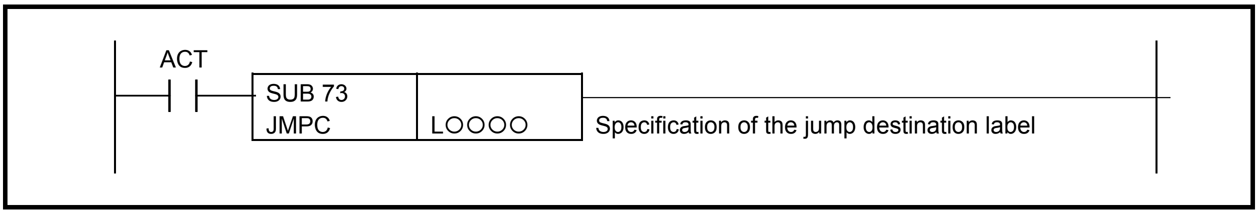


Fig. 4.12.6 Format of JMPC instruction

Table 4.12.6 Mnemonic of JMPC instruction

Mnemonic format

Step number	Instruction	Address No.	Bit No.	Remarks
1	RD	OOOO	.O	ACT
2	SUB	73		JMPC instruction
3	(PRM)	LOOOO		Specification of the jump destination label

Memory status of control condition

ST3	ST2	ST1	ST0
			ACT
			↓
			↓

Control conditions

ACT=0: The instruction after the JMPC instruction is executed.
ACT=1: Control is transferred to the Ladder after the specified label.

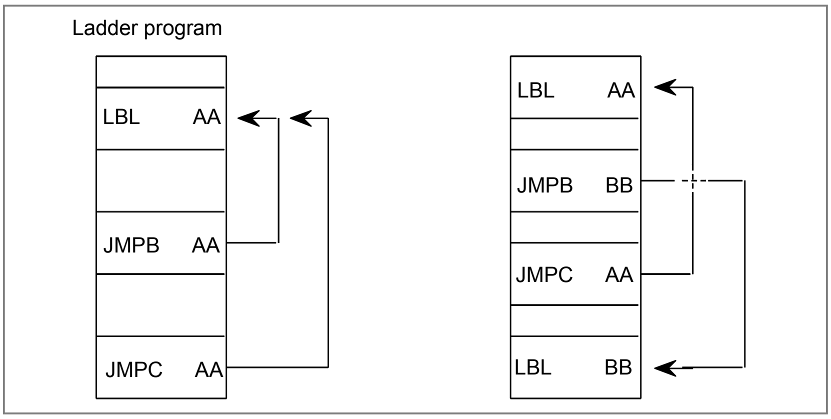
Parameters

(a) Label specification
Specify the label of the jump destination. The label number must be specified in the L address form. A number from L1 to L9999 can be specified.

> ⚠ **CAUTION**
> 1 For the specifications of this instruction, see the description of functional instruction JMP.
> 2 When this instruction is used for jump back to a previous instruction, take care not to cause an infinite loop.

4.12.7 LBL (Label: SUB 69)

It specifies the jump destination for the JMPB and JMPC instructions. (See the explanation of the JMPB and JMPC instructions.)



Format

Fig. 4.12.7 shows the ladder format and Table 4.12.7 shows the mnemonic format.

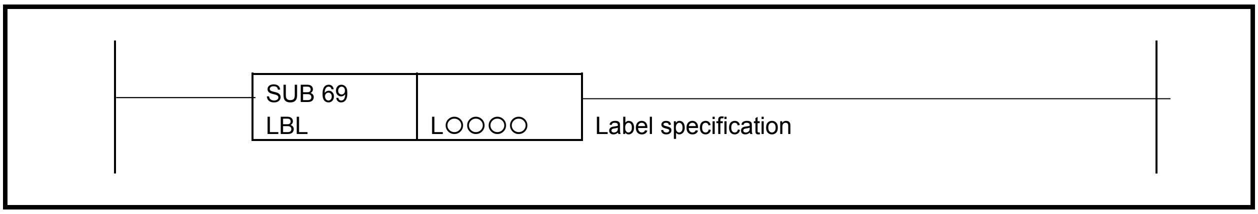


Fig. 4.12.7 Format of LBL instruction

Table 4.12.7 Mnemonic of LBL instruction

Mnemonic format

Step number	Instruction	Address No.	Bit No.	Remarks
1	SUB	69		LBL instruction
2	(PRM)	LOOOO		Label specification

Memory status of control condition

ST3	ST2	ST1	ST0

Parameters

(a) Label specification
Specify the jump destination for the JMPB and JMPC instructions. The label number must be specified in the L address form. A label number from L1 to L9999 can be specified. Up to 256 labels can be used in the main programs (level 1, level 2 and level3). Up to 256 labels can be used in a sub program. The label number may be used to overlap in between the main program and sub program, or in some sub programs.

> **NOTE**
> For the use of this instruction, see the description of functional instruction JMPB and JMPC.

4.12.8 CALL (Conditional Subprogram Call: SUB 65)

This instruction calls a subprogram. When a subprogram number is specified in CALL, a jump occurs to the subprogram if a condition is satisfied.

Format

Fig. 4.12.8 shows the ladder format and Table 4.12.8 shows the mnemonic format.

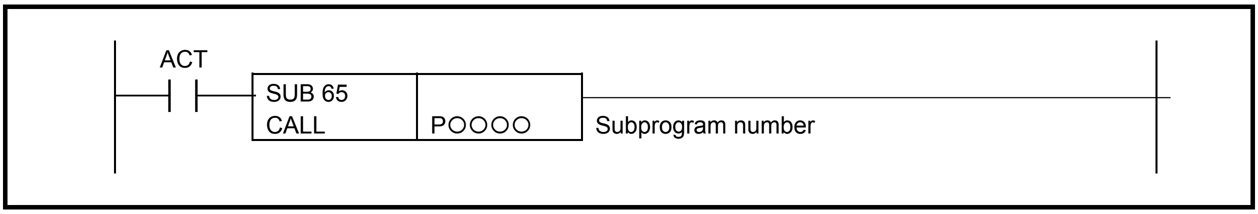


Fig. 4.12.8 Format of CALL instruction

Table 4.12.8 Mnemonic of CALL instruction

Mnemonic format

Step number	Instruction	Address No.	Bit No.	Remarks
1	RD	○○○○	.○	ACT
2	SUB	65		CALL instruction
3	(PRM)	P○○○○		Subprogram number

Memory status of control condition

ST3	ST2	ST1	ST0
			ACT

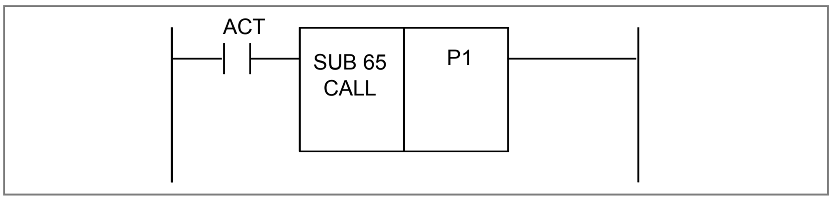
Control conditions

(a) Input signal
ACT=0: The CALL instruction is not executed.
ACT=1: The CALL instruction is executed.

Parameters

(a) Subprogram number
Specify the subprogram number of a subprogram to be called. The subprogram number must be specified in the P address form.

Example: Calling of subprogram 1



> ⚠ **CAUTION**
> Be careful when using the CALL instruction with the COM, COME, JMP, or JMPE functional instruction.
> For details, see Subsection 1.4.4.

4.12.9 CALLU (Unconditional Subprogram Call: SUB 66)

This instruction calls a subprogram. When a subprogram number is specified, a jump occurs to the subprogram.

Format

Fig. 4.12.9 shows the ladder format and Table 4.12.9 shows the mnemonic format.

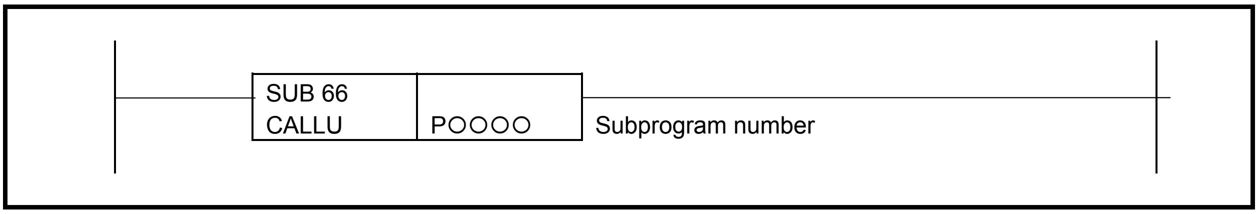


Fig. 4.12.9 Format of CALLU instruction

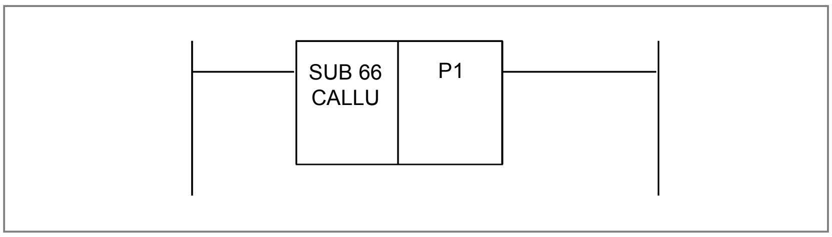
Table 4.12.9 Mnemonic of CALLU instruction

Mnemonic format					Memory status of control condition			
Step number	**Instruction**	**Address No.**	**Bit No.**	**Remarks**	**ST3**	**ST2**	**ST1**	**ST0**
1	SUB	66		CALLU instruction				
2	(PRM)	POOOO		Subprogram number				

Parameters

(a) Subprogram number
Specify the subprogram number of a subprogram to be called. The subprogram number must be specified in the P address form.

Example: Calling of subprogram 1



4.12.10 SP (Subprogram: SUB 71)

This instruction is used to create a subprogram. A subprogram number is specified as a subprogram name. SP is used with the SPE functional instruction (mentioned later) to specify the subprogram range.

Format

Fig. 4.12.10 shows the ladder format and Table 4.12.10 shows the mnemonic format.

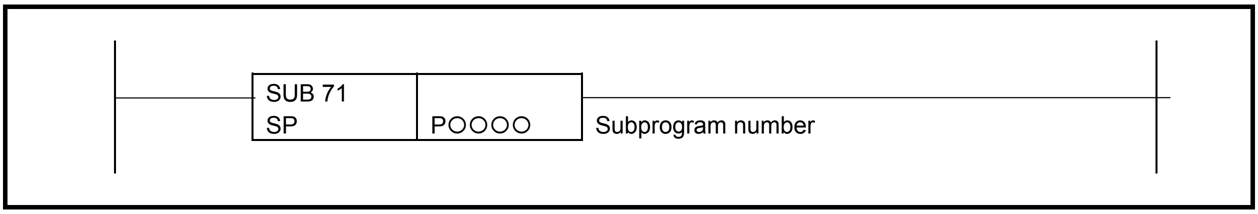


Fig. 4.12.10 Format of SP instruction

Table 4.12.10 Mnemonic of SP instruction

Mnemonic format

Step number	Instruction	Address No.	Bit No.	Remarks
1	SUB	71		SP instruction
2	(PRM)	POOOO		Subprogram number

Memory status of control condition

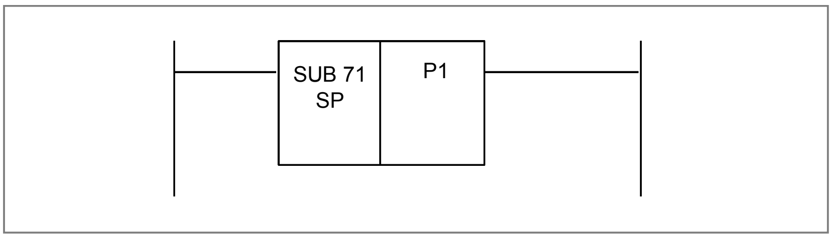
ST3	ST2	ST1	ST0

Parameters

(a) Subprogram number
Specify the subprogram number of a subprogram to be coded following this instruction. The subprogram number must be specified in the P address form.

1st to 5th path PMC				Dual check safety PMC
PMC Memory-A	PMC Memory-B	PMC Memory-C	PMC Memory-D	
P1 to P512	P1 to P5000	P1 to P5000	P1 to P5000	P1 to P512

The specified subprogram number must be unique within the sequence program.
Example: When the subprogram number is set to 1



4.12.11 SPE (End of a Subprogram: SUB 72)

This instruction indicates the end of a subprogram. SPE is used with the SP functional instruction. It specifies the range of a subprogram. When this functional instruction has been executed, control is returned to the functional instruction that called the subprogram.

Fig. 4.12.11 Format of SPE instruction

Table 4.12.11 Mnemonic of SPE instruction

Mnemonic format

Step number	Instruction	Address No.	Bit No.	Remarks
1	SUB	72		SPE instruction

Memory status of control condition

ST3	ST2	ST1	ST0

4.12.12 END1 (1st Level Sequence Program End: SUB 1)

This instruction indicates the end of 1st level sequence. When there is no 1st level sequence, this is specified at the beginning of the 2nd level sequence.

Fig. 4.12.12 Format of END1 instruction

Table 4.12.12 Mnemonic of END1 instruction

Mnemonic format

Step number	Instruction	Address No.	Bit No.	Remarks
1	SUB	1		END1 instruction

Memory status of control condition

ST3	ST2	ST1	ST0

4.12.13 END2 (2nd Level Sequence Program End: SUB 2)

This instruction indicates the end of 2nd level sequence.

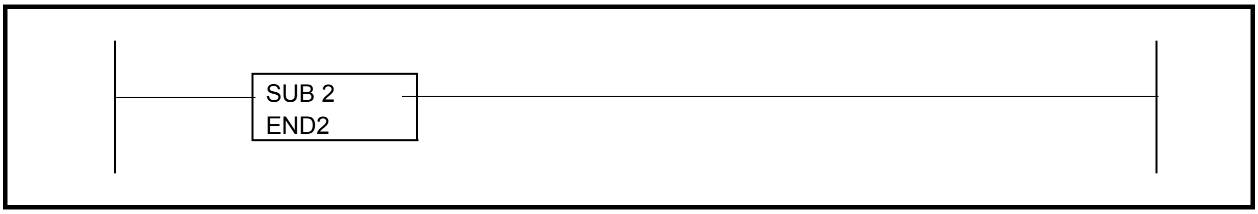


Fig. 4.12.13 Format of END2 instruction

Table 4.12.13 Mnemonic of END2 instruction

Mnemonic format

Step number	Instruction	Address No.	Bit No.	Remarks
1	SUB	2		END2 instruction

Memory status of control condition

ST3	ST2	ST1	ST0

4.12.14 END3 (3rd Level Sequence Program End: SUB 48)

This instruction indicates the end of 3rd level sequence program. If there is no 3rd level sequence program, this instruction need not be specified.

Fig. 4.12.14 Format of END3 instruction

Table 4.12.14 Mnemonic of END3 instruction

Mnemonic format

Step number	Instruction	Address No.	Bit No.	Remarks
1	SUB	48		END3 instruction

Memory status of control condition

ST3	ST2	ST1	ST0

4.12.15 END (End of a Ladder Program: SUB 64)

This instruction indicates the end of the end of a ladder program. END must be placed at the end of the ladder program.

Fig. 4.12.15 Format of END instruction

Table 4.12.15 Mnemonic of END instruction

Mnemonic format					Memory status of control condition			
Step number	Instruction	Address No.	Bit No.	Remarks	ST3	ST2	ST1	ST0
1	SUB	64		END instruction				

4.12.16 NOP (No Operation: SUB 70)

During creation of a ladder program using the programmer, if the program is compiled with specifying the setting with which a net comment or form feed code is used and the point of the net comment is output, position information of the net comment or form feed code is output as the NOP instruction. This instruction performs no operation during execution of the ladder.

4.12.17 CS (Case Call: SUB 74)

The combination of one CS, one or more CM and one CE is used to construct a case call block.

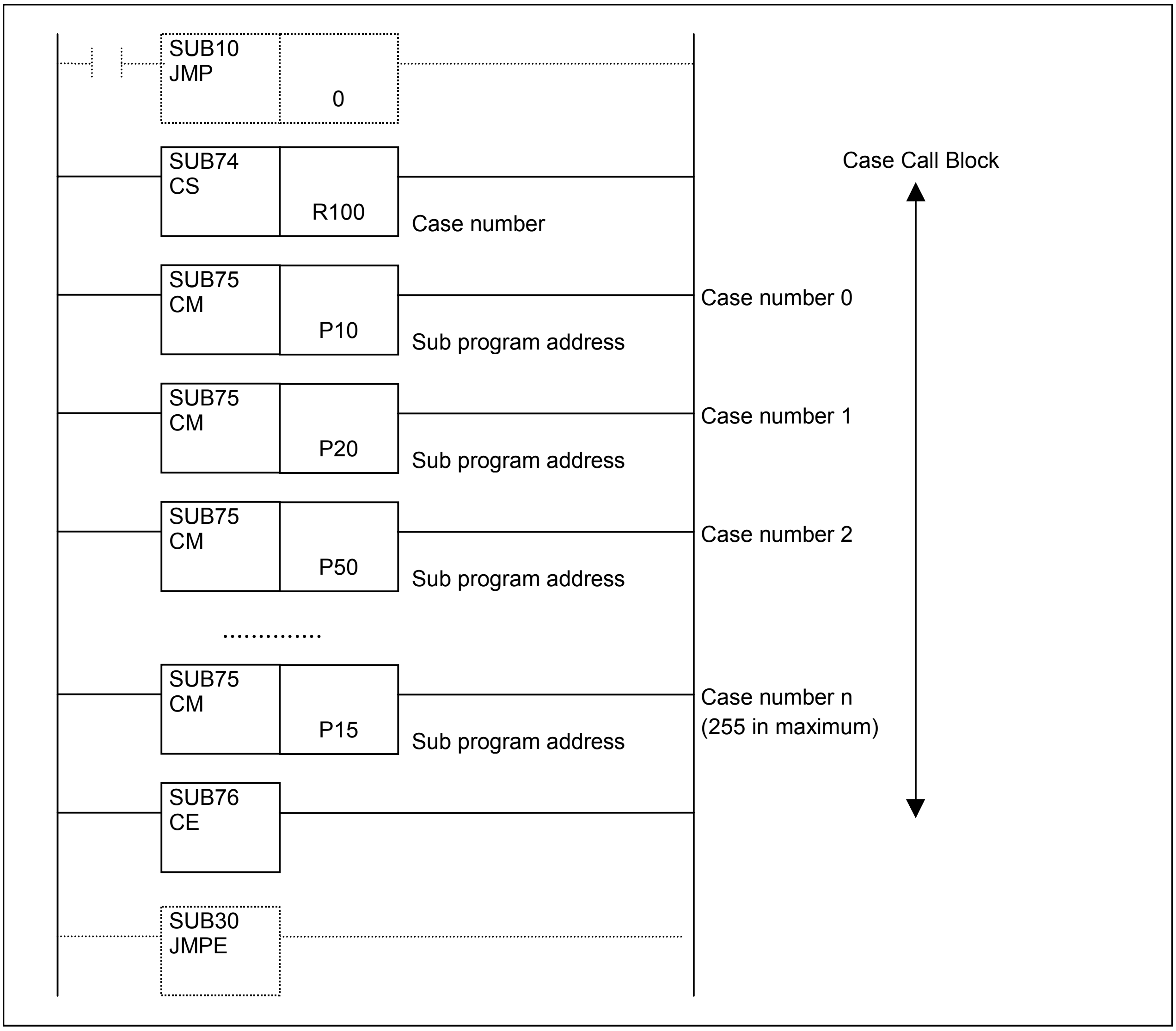
The CS starts the case call block and the CE ends the block. Each CM that should be located between the CS and CE specifies a sub program to be called in each case.

Executing case call block, the CS instruction evaluates the case number from its 1st parameter and only one of CMs that is selected by the case number is activated and calls its associated sub program. When the case number is 0, the 1st CM immediately after CS is executed and certain sub program is called. When the case number is 1, the 2nd CM after CS is executed. The number from 0 to 255 is allowed as the case number. When the case number except 0 through 255 is detected on CS, no sub program is called.

The CM instructions should be programmed immediately after the CS. Other functions except CM must not be programmed between CS and CE. If not so, an error will be detected in ending of edit.
The case call block is available only in LEVEL2 and outside of a COM and COME block where normal subprogram call instructions such as CALL and CALLU are allowed. The case call block can be programmed wherever normal subprogram call instructions can be programmed.

In the following example program, the sub program corresponding to the case number is called.

- R100 = 0: The sub program P10 is called.
- R100 = 1: The sub program P20 is called.
- R100 = 2: The sub program P50 is called.
- R100 = n: The sub program P15 is called.



Format

Fig. 4.12.17 shows the ladder format and Table 4.12.17 shows the mnemonic format.

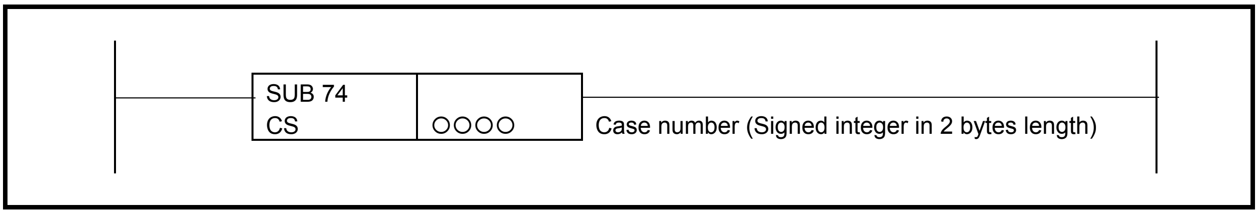


Fig. 4.12.17 Format of CS instruction

Table 4.12.17 Mnemonic of CS instruction

Mnemonic format

Step number	Instruction	Address No.	Bit No.	Remarks
1	SUB	74		CS instruction
2	(PRM)	○○○○		Case number (Address)

Memory status of control condition

ST3	ST2	ST1	ST0

Parameters

(a) Case number

Set the address or symbol of the variable in which the case number is stored and commanded. The data type is signed integer in 2 bytes length.

> **NOTE**
> Case number is evaluated by CS only once in every cycle. Even if you change the case number in the sub program which is called by the case call block, this change becomes effective in next cycle. This means that only one or no sub program is called in each case call block in each cycle.

4.12.18 CM (Sub Program Call in Case Call: SUB 75)

The combination of one CS, one or more CM and one CE is used to construct a case call block.
The CM that should be located between the CS and CE is used to specify a sub program to be called when the case number meets the condition.
See the section 4.12.17 CS (Case Call: SUB 74) in details.

Format

Fig. 4.12.18 shows the ladder format and Table 4.12.18 shows the mnemonic format.

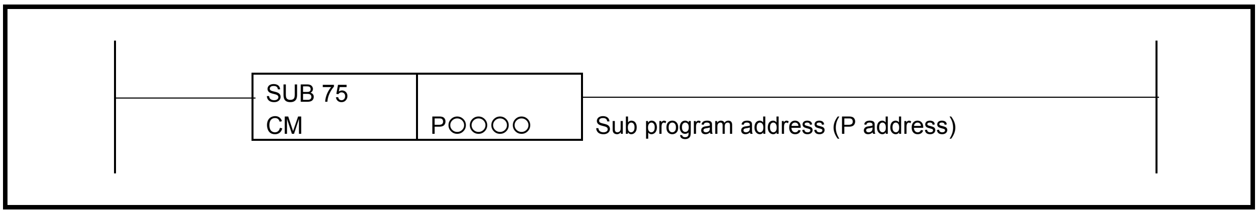


Fig. 4.12.18 Format of CM instruction

Table 4.12.18 Mnemonic of CM instruction

Mnemonic format

Step number	Instruction	Address No.	Bit No.	Remarks
1	SUB	75		CM instruction
2	(PRM)	POOOO		Sub program address (P address)

Memory status of control condition

ST3	ST2	ST1	ST0

Parameters

(a) Sub program address
Set a P address or symbol of a sub program that is call in the case.

4.12.19 CE (End of Case Call: SUB 76)

The combination of one CS, one or more CM and one CE is used to construct a case call block.

The CE ends the case call block.

See the section 4.12.17 CS (Case Call: SUB 74) in details.

Format

Fig.4.12.19 shows the ladder format and Table 4.12.19 shows the mnemonic format.

Fig. 4.12.19 Format of CE instruction

Table 4.12.19 Mnemonic of CE instruction

Mnemonic format

Step number	Instruction	Address No.	Bit No.	Remarks
1	SUB	76		CE instruction

Memory status of control condition

ST3	ST2	ST1	ST0

4.13 ROTATION CONTROL

The following types of rotation control instruction are available. Use any of these instructions as appropriate for your purpose.

	Instruction name	Sub number	Processing
1	ROT	6	Rotation control
2	ROTB	26	Binary rotation control

4.13.1 ROT (Rotation Control: SUB 6)

Controls rotors, such as the tool post, ATC, rotary table, etc., and is used for the following functions.

(a) Selection of the rotation direction via the shorter path.
(b) Calculation of the number of steps between the current position and the target position.
(c) Calculation of the position before the target or of the number of steps up to the position before the target.

Format

Fig. 4.13.1 (a) shows the ladder format and Table 4.13.1 shows the mnemonic format.

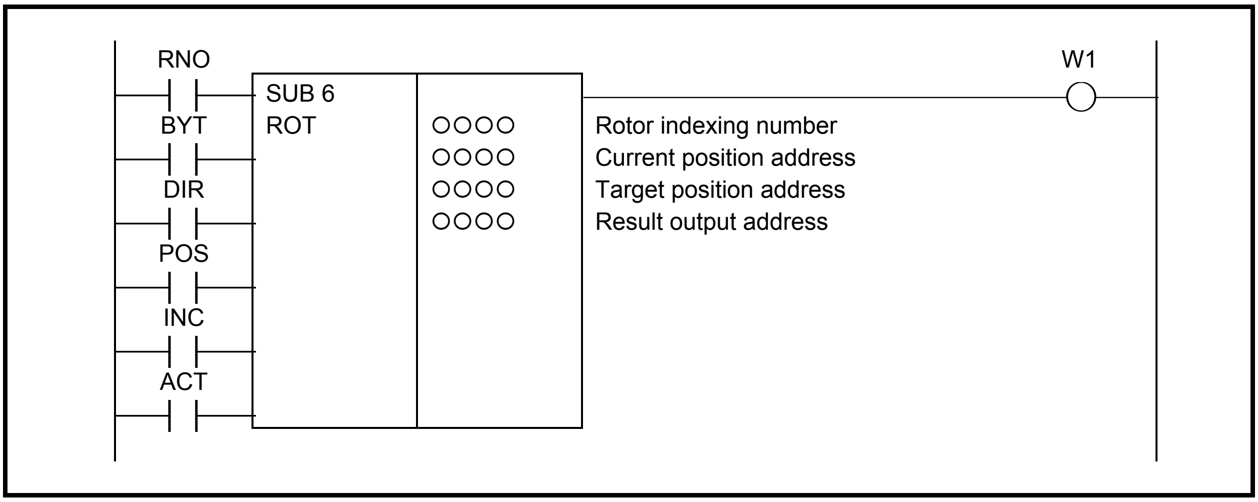


Fig. 4.13.1 (a) Format of ROT instruction

Table 4.13.1 Mnemonic of ROT instruction

Mnemonic format

Step number	Instruction	Address No.	Bit No.	Remarks
1	RD	○○○○	.○	RNO
2	RD.STK	○○○○	.○	BYT
3	RD.STK	○○○○	.○	DIR
4	RD.STK	○○○○	.○	POS
5	RD.STK	○○○○	.○	INC
6	RD.STK	○○○○	.○	ACT
7	SUB	6		ROT
8	(PRM)	○○○○		Rotor indexing number
9	(PRM)	○○○○		Current position address
10	(PRM)	○○○○		Target position address
11	(PRM)	○○○○		Result output address
12	WRT	○○○○	.○	Output of rotation direction

Memory status of control condition

ST5	ST4	ST3	ST2	ST1	ST0
					RNO
				RNO	BYT
			RNO	BYT	DIR
		RNO	BYT	DIR	POS
	RNO	BYT	DIR	POS	INC
RNO	BYT	DIR	POS	INC	ACT
					▼
▼	▼	▼	▼	▼	W1

Control conditions

(a) Specify the starting number of the rotor. (RNO)
RNO=0: Initial number of the position of the rotor is 0.
RNO=1: Initial number of the position of the rotor is 1.

(b) Specify the number of digits of the process data (position data). (BYT)
BYT=0: BCD two digits
BYT=1: BCD four digits

(c) Select the rotation direction via the shorter path or not. (DIR)
DIR=0: No rotation direction is selected. The rotation direction is only forward.
DIR=1: rotation direction is selected. See rotating direction output (W1) described below for details on the rotation direction.

(d) Specify the operating conditions. (POS)
POS=0: Calculate the target position.
POS=1: Calculate the position before the target position.

(e) Specify the position or the number of steps. (INC)
INC=0: Calculate the number of the position. If the position before the target position is to be calculated, specify INC=0 and POS=1
INC=1: Calculate the number of steps. If the difference between the current position and the target position is to be calculated, specify INC=1 and POS=0.

(f) Execution command (ACT)
ACT=0: The instruction is not executed. W1 does not change.
ACT=1: The instruction is executed. If the operation results are required, set ACT to 1.

Parameters

(a) Rotor indexing number
Specify the rotor indexing number.

(b) Current position address
Specify the address storing the current position.

(c) Target position address
Specify the address storing the target position (or command value), for example the address storing the NC output T code.

(d) Result output address
Specify the result output address.

NOTE

1 When POS is set to 1 and current position is same as target position, incorrect result is calculated.
2 When the value, which is exceeds the rotor index number, is set in the current poison and target position, incorrect result is calculated.

Rotating direction output (W1)

The direction of rotation for control of rotation via the shorter path is output to W1. When W1=0, the direction is forward (FOR). When W1=1, the direction is reverse (REV). The definition of FOR and REV is shown in Fig. 4.13.1 (b). If the number given to the rotor is increasing, the rotation is FOR; if decreasing, REV. The address of W1 can be determined arbitrarily. When, however, the result of W1 is to be used, always check that ACT=1.

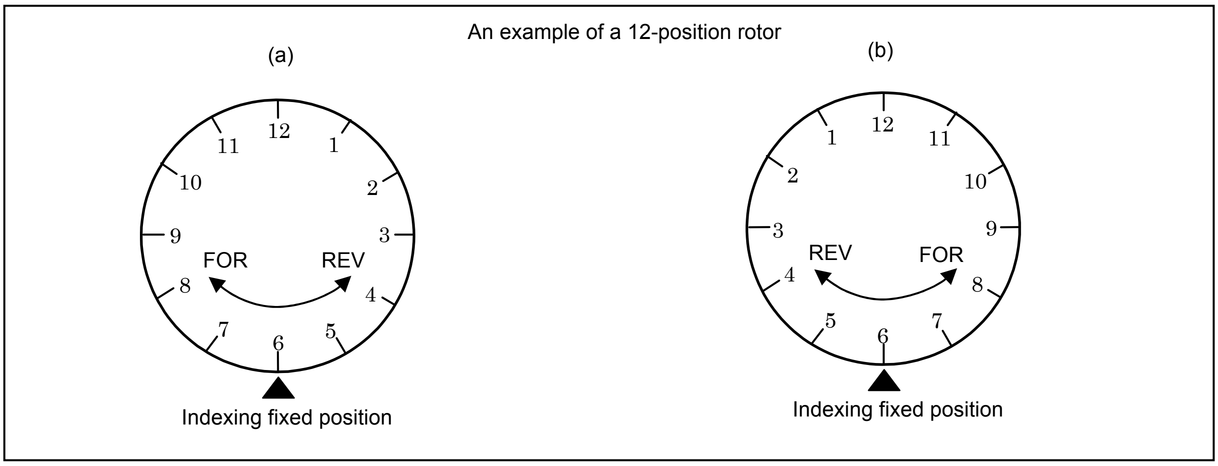


Fig. 4.13.1 (b) Rotation direction

4.13.2 ROTB (Binary Rotation Control: SUB 26)

This instruction is used to control rotating elements including the tool post, ATC (Automatic Tool Changer), rotary table, etc. In the ROT command a parameter indicating the number of rotating element indexing positions is a fixed data in programming. For ROTB, however, you can specify an address for the number of rotating element index positions, allowing change even after programming. The data handled are all in the binary format. Otherwise, ROTB instruction is coded in the same way as ROT instruction.

Format

Fig. 4.13.2 (a) shows the ladder format and Table 4.13.2 shows the mnemonic format.

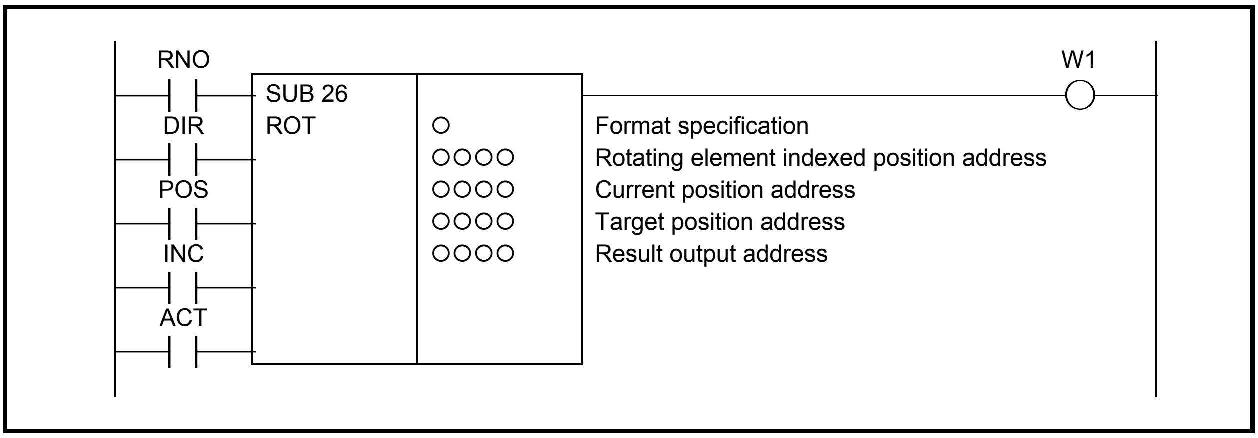


Fig. 4.13.2 (a) Format of ROTB instruction

Table 4.13.2 Mnemonic of ROTB instruction

Mnemonic format / **Memory status of control condition**

Step number	Instruction	Address No.	Bit No.	Remarks	ST4	ST3	ST2	ST1	ST0
1	RD	○○○○	.○	RNO					RNO
2	RD.STK	○○○○	.○	DIR				RNO	DIR
3	RD.STK	○○○○	.○	POS			RNO	DIR	POS
4	RD.STK	○○○○	.○	INC		RNO	DIR	POS	INC
5	RD.STK	○○○○	.○	ACT	RNO	DIR	POS	INC	ACT
6	SUB	26		ROTB					
7	(PRM)	○		Format specification					
8	(PRM)	○○○○		Rotating element indexed position address					
9	(PRM)	○○○○		Current position address					
10	(PRM)	○○○○		Target position address					
11	(PRM)	○○○○		Result output address					▼
12	WRT	○○○○	.○	Output of rotation direction	▼	▼	▼	▼	W1

Control conditions

(a) Specify the starting number of the rotor. (RNO)
RNO=0: Initial number of the position of the rotor is 0.
RNO=1: Initial number of the position of the rotor is 1.

(b) Specify the number of digits of the process data (position data). (BYT)
BYT=0: BCD two digits
BYT=1: BCD four digits

(c) Select the rotation direction via the shorter path or not. (DIR)
DIR=0: No rotation direction is selected. The rotation direction is only forward.
DIR=1: rotation direction is selected. See rotating direction output (W1) described below for details on the rotation direction.

(d) Specify the operating conditions. (POS)
POS=0: Calculate the target position.
POS=1: Calculate the position before the target position.

(e) Specify the position or the number of steps. (INC)
INC=0: Calculate the number of the position. If the position before the target position is to be calculated, specify INC=0 and POS=1
INC=1: Calculate the number of steps. If the difference between the current position and the target position is to be calculated, specify INC=1 and POS=0.

(f) Execution command (ACT)
ACT=0: The instruction is not executed. W1 does not change.
ACT=1: The instruction is executed. If the operation results are required, set ACT to 1.

Parameters

(a) Format specification
Specify data length (1, 2, or 4 bytes). Use the first digit of the parameter to specify the number of bytes.
1: 1 byte
2: 2 bytes
4: 4 bytes
All numerical data (number of indexed positions for the rotating elements, current address, etc.) are in the binary format. Therefore, they require the memory space specified by data length.

> ⚠ **CAUTION**
> Do not set an illegal value, that is not indicated above, into the "(a) Format specification".

(b) Rotating element indexed position address
Specify the address containing the number of rotary element positions to be indexed.

(c) Target position address
Specify the address storing the target position (or command value), for example the address storing the NC output T code.

(d) Result output address
Specify the result output address.

> **NOTE**
> 1 Do not set negative value in each parameter.
> 2 When POS is set to 1 and current position is same as target position, incorrect result is calculated.
> 3 When the value, which is exceeds the rotor index number, is set in the current poison and target position, incorrect result is calculated.

Output for rotational direction (W1)

See the ROT instruction.

Example of using the ROTB instruction

Fig. 4.13.2 (b) illustrates a ladder diagram for a 12-position rotor to be controlled for rotation via the shorter path and for deceleration at one position before the target.

- The target position is specified with the NC and 32 bits of binary code (address F26 to F29).
- The current position is entered with the binary code signal (address X41) from the machine tool.
- The result of calculating one position before the target is output to address R230 (work area).
- Operation starts with the output TF (address F7.3) from the NC.
- The binary compare instruction (COMPB) is used to detect the deceleration and stop positions.

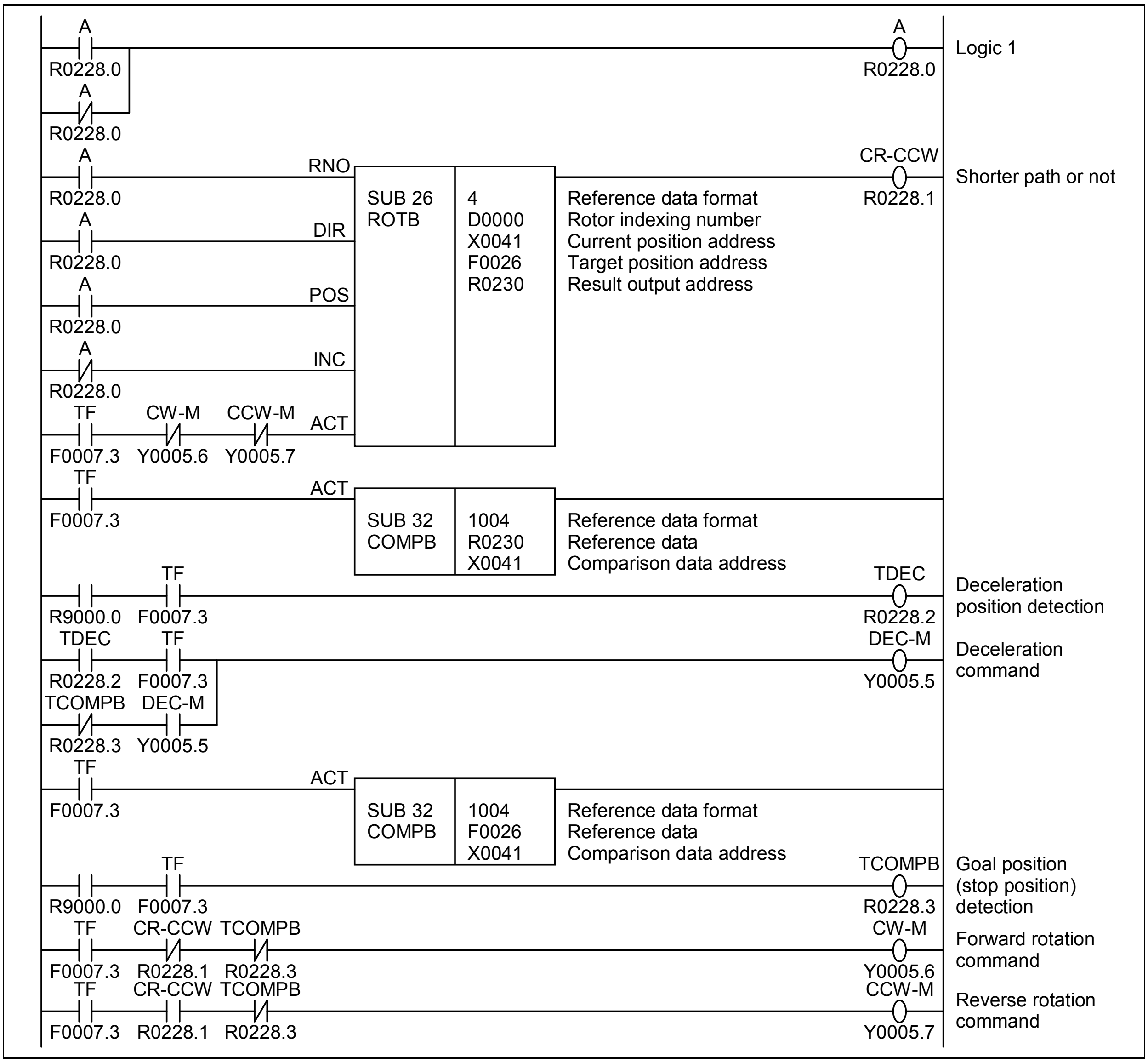


Fig. 4.13.2 (b) Example of a ladder diagram for the ROTB instruction

4.14 INVALID INSTRUCTIONS

The instructions listed below are invalid for 30*i*/31*i*/32*i*/35*i*-B, Power Motion *i*-A and 0*i*-F PMC.
If a ladder program used for another model is run on 30*i*/31*i*/32*i*/35*i*-B, Power Motion *i*-A or 0*i*-F PMC, these instructions are not executed. They cause no error but are treated as NOP instructions (which perform no operation when the ladder program is executed).

Instruction name	Sub number	Processing
SPCNT	46	Spindle control
DISP	49	Message display
MMCWR	98	Reading of MMC window data
MMCWW	99	Writing of MMC window data
FNC90	90	Auxiliary functional instruction 1
FNC91	91	Auxiliary functional instruction 2
FNC92	92	Auxiliary functional instruction 3
FNC93	93	Auxiliary functional instruction 4
FNC94	94	Auxiliary functional instruction 5
FNC95	95	Auxiliary functional instruction 6
FNC96	96	Auxiliary functional instruction 7
FNC97	97	Auxiliary functional instruction 8

4.15 NOTE ON PROGRAMMING

Some functional instructions may cause the ladder program to take a long time to update or stop, or the PMC alarm “WN03 ABORT NC-WINDOW/EXIN” may occur, or the ladder program is not able to update or stop, if their ACT or RST condition remains on for no apparent reason.
To avoid such problems, when you code a ladder program using those functional instructions, you need to design the ladder structure based on a thorough understanding of the control conditions of the individual instructions you use.
Listed below are typical cases in which the ladder program will not stop.

- A low-speed window function is used for a WINDR or WINDW functional instruction, and its ACT condition remains on after the end of command.
- In an EXIN instruction, its ACT condition remains on after the end of command.
- In an AXCTL instruction, its ACT condition or RST condition remains on after the end of command.
- The same processing is repeated by JMPB instruction and JMPC instruction.

It takes time for the following operations or the operation cannot be completed by the above-mentioned.

- Stopping the ladder program using a soft key on the screen
- Reading a new ladder program from a memory card or other medium, by using the data input and output screen
- Updating the ladder program with changes made using the ladder diagram edit screen

If any of the above phenomena occurs, the functional instruction causing the problem needs to be fixed. Check the functional instructions mentioned above to see whether there is any ACT or RST condition remaining on, and correct the ladder program according to the following procedure.

1. Put the machine in safe condition and turn off the power of the CNC.
2. Turn on the power of the CNC while holding down the "CAN" and "Z" keys simultaneously, to restart the NC with the ladder program halted.
3. In the ladder diagram edit screen, redesign the logic associated with the problematic functional instruction. When done, set the ACT or RST condition to off. If the same operation is repeating because of an inadequate JMPB or JMPC instruction, review the jump condition and, if necessary, change the ladder structure.
4. Write the resulting logic to flash ROM using the I/O screen.
5. Run the ladder program.

If the ladder program does not stop or cannot be changed even after you make the correction, there may be other functional instructions that have the same condition settings. Check for other functional instructions having the same condition settings, besides the one you have corrected, and repeat the above procedure to correct them all.

5 WINDOW FUNCTIONS

This chapter describes the functions that can be executed with the WINDR (SUB 51) and WINDW (SUB 52) functional instructions, as well as the formats and other details of the control data to be set for executing these functions.

As this function depends on the specification of CNC function, refer to the following CNC manuals with this manual.

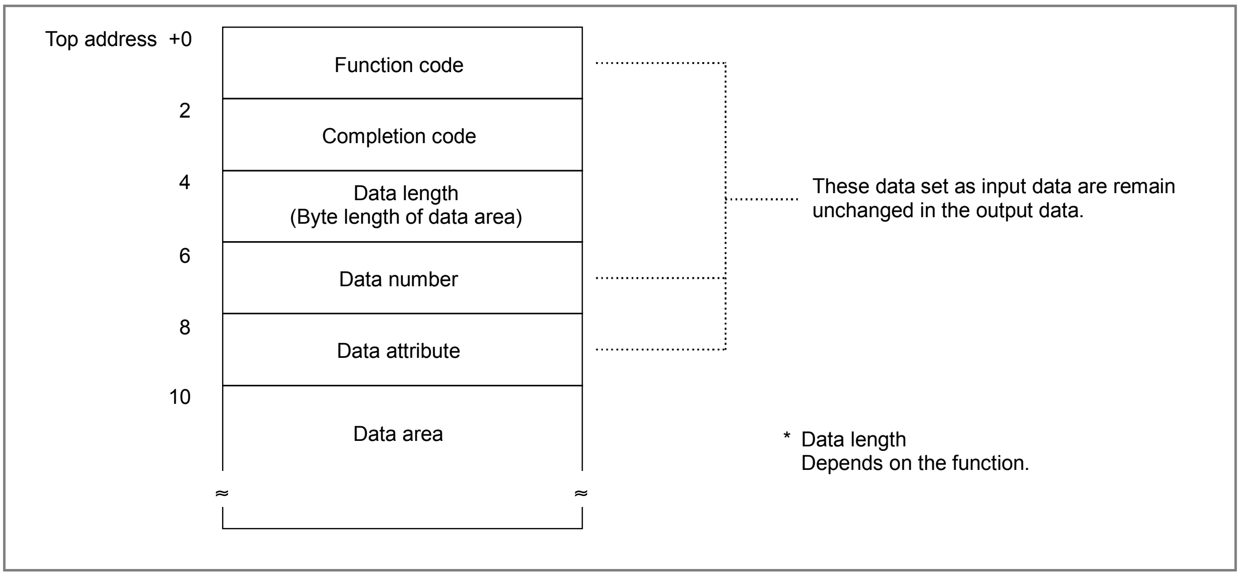
Manuals	Series	Drawings
CONNECTION MANUAL (HARDWARE)	Series 30*i* /31*i* /32*i*-B	B-64483EN
	Series 35*i*-B	B-64523EN
	Power Motion *i*-A	B-64573EN
	Series 0*i*-F	B-64603EN
CONNECTION MANUAL (FUNCTION)	Series 30*i* /31*i* /32*i*-B	B-64483EN-1
	Series 35*i*-B	B-64523EN-1
	Power Motion *i*-A	B-64573EN-1
	Series 0*i*-F	B-54603EN-1
OPERATOR’S MANUAL	Series 30*i* /31*i* /32*i*-B	B-64484EN/01 (Common to Lathe System / Machining Center System)
	Series 35*i*-B	B-64524EN
	Power Motion *i*-A	B-64574EN
	Series 0*i*-F	B-64604EN
PARAMETER MANUAL	Series 30*i* /31*i* /32*i*-B	B-64490EN
	Series 35*i*-B	B-64530EN
	Power Motion *i*-A	B-64580EN
	Series 0*i*-F	B-64610EN
MAINTENANCE MANUAL	Series 30*i* /31*i* /32*i* -B	B-64485EN
	Series 35*i*-B	B-64525EN
	Power Motion *i*-A	B-64575EN
	Series 0*i*-F	B-64605EN
Macro Executor PROGRAMMING MANUAL	Series 30*i* /31*i* /32*i*/35*i*-B	B-63943EN-2

⚠ **WARNING**

When you write some NC data using both this instruction in ladder program and other applications, take care that you do not write to the same data area.
If some values are written to the same data area by two or more applications including ladder program, unexpected value may be written. In this case, it may cause an unexpected machine behavior and also tools, work pieces, and machines may be damaged.
As for details, refer to “SAFETY PRECAUTIONS”.

5.1 FORMATS OF CONTROL DATA

Input and output control data has the following structure.



(1) In the explanation of the window functions below, minuses (-) in the data structure fields indicate that input data need not be set in these fields or that output data in these fields is not significant.
(2) All data is in binary unless otherwise specified.
(3) All data block lengths and data lengths are indicated in bytes.
(4) Output data is valid only when window processing terminates normally.
(5) Output data always includes one of the following completion codes. Note, however, that all of the completion codes listed are not always provided for each function.

Completion code	Meaning
0	Normal termination
1	Error (invalid function code)
2	Error (invalid data block length)
3	Error (invalid data number)
4	Error (invalid data attribute)
5	Error (invalid data)
6	Error (necessary option missing)
7	Error (write-protected)
113	Error (The CNC status is that the writing data cannot be allowed.)
-10	Processing (The CNC is processing now.)

5.2 LOW-SPEED RESPONSE AND HIGH-SPEED RESPONSE

There are two types of window function - one executed at high speed and the other executed at low speed.

TYPE	Number of scans to be executed until the window instruction is completed
LOW	TWO SCAN TIMES OR MORE (Depends on the CNC processing priority and operation status.)
HIGH	1 SCAN TIME

When using the low-speed response window function, set ACT to 0 immediately after the data transfer end data (W1) is set to 1 for the window instruction. For details, see "CAUTION" below.

⚠CAUTION

1 The window instruction of a low-speed response is controlled exclusively with the other window instructions of low-speed response.
Therefore, when the data is read or written continuously, it is necessary to clear ACT of the functional instruction to 0 once when the completion information (W1) become 1.
If you leave a window instruction of a low-speed response with W1=1 and ACT=1, other window instructions of low-speed response do not work.
The window instruction of a high-speed response is not exclusively controlled like a low-speed response. Therefore, when the data is read or written continuously, you need not make ACT=0.

2 The completion of the other window instruction of low-speed response may be delayed by the execution of application using FOCAS2 functions and C language executor application. If some window instruction of a low speed response is executed continuously with a high frequency, the completion of the other window instruction of low-speed response will be delayed, or may not be done. You should take care that the execution of application using FOCAS2 functions and C language executor application may be delayed. The window instruction of a low-speed response should be executed with the lowest required frequency.

5.2.1 Note on the Programming of a Low-speed Response Window Instruction

You need to design the ladder program to set ACT condition to off in a low-speed response window instruction after the completion information (W1) became 1. If the ACT condition is kept to on after the data transfer was completed, the PMC alarm “WN03 ABORT NC-WINDOW/EXIN” may occur or the stop of the ladder program takes a long time in the following cases.

1. Stopping the ladder program using a soft key on the screen
2. Reading a new ladder program from a memory card or other medium, by using the DATA I/O screen
3. Updating the ladder program with changes made using the LADDER DIAGRAM EDITOR screen

If the PMC alarm “WN03” occurs, the functional instruction causing the problem needs to be fixed. For information about how to fix the problem, see Section 4.15.

When the PMC alarm “WN03” occurs, the low-speed response window does not be executed. Therefore, the execution of the ladder program becomes unstable. To re-set the alarm, turn off and on the power of CNC.

5.3 LIST OF WINDOW FUNCTIONS

5.3.1 List of Window Functions (Function Group Order)

Group	No.	Description	Function code	Response	R/W
CNC information (Section 5.4)	1	Reading CNC system information	0	High-speed	R
	2	Reading a tool offset	13	High-speed	R
	3	Write a tool offset	14	Low-speed	W
	4	Reading a work piece origin offset value	15	High-speed	R
	5	Writing a work piece origin offset value	16	Low-speed	W
	6	Reading a parameter	17, 154	High-speed	R
	7	Writing a parameter	18	Low-speed	W
	8	Reading a real type parameter	321	High-speed	R
	9	Writing a real type parameter	323	Low-speed	W
	10	Reading setting data	19, 155	High-speed	R
	11	Writing setting data	20	Low-speed	W
	12	Reading a custom macro variable	21	High-speed	R
	13	Writing a custom macro variable	22	Low-speed	W
	14	Reading a custom macro variable (variable number extension)	437	Low-speed	R
	15	Writing a custom macro variable (variable number extension)	438	Low-speed	W
	16	Reading the CNC alarm status	23	High-speed	R
	17	Reading the current program number	24	High-speed	R
	18	Reading the current sequence number	25	High-speed	R
	19	Reading modal data	32	High-speed	R
	20	Reading diagnosis data	33	Low-speed	R
	21	Reading diagnosis data (specific number only)	156	High-speed	R
	22	Reading the P-code macro variable	59	High-speed	R
	23	Writing the P-code macro variable	60	Low-speed	W
	24	Reading CNC status information	76	High-speed	R
	25	Reading the current program number (8-digit program numbers)	90	High-speed	R
	26	Entering data on the program check screen	150	Low-speed	W
	27	Reading clock data (date and time)	151	High-speed	R
	28	Writing clock data (date and time)	139	Low-speed	W
	29	Reading the pitch error compensation data	395	High-speed	R
	30	Writing the pitch error compensation data	396	Low-speed	W
	31	Tool figure making instruction for 3D interference check function	431	Low-speed	W
	32	Reading detailed information of CNC alarm	433	Low-speed	R
	33	Command for changing the interference object for 3D interference check function	436	Low-speed	W
	34	Reading the CNC ID number	447	Low-speed	R
	35	Reading the number of repeats for subprogram calls / canned cycle	449	High-speed	R
Axis information (Section 5.5)	1	Reading the actual velocity of controlled axes	26	High-speed	R
	2	Reading the absolute position (absolute coordinates) of controlled axes	27	High-speed	R
	3	Reading the machine position (machine coordinates) of controlled axes	28	High-speed	R
	4	Reading a skip position (stop coordinates of skip operation (G31)) of controlled axes	29	High-speed	R

Group	No.	Description	Function code	Response	R/W
Axis information (Section 5.5)	5	Reading the servo delay for controlled axes	30	High-speed	R
	6	Reading the acceleration/deceleration delay on controlled axes	31	High-speed	R
	7	Reading the feed motor load current value (A/D conversion data)	34	High-speed	R
	8	Reading the actual spindle speed	50	High-speed	R
	9	Reading the relative position on a controlled axis	74	High-speed	R
	10	Reading the remaining travel	75	High-speed	R
	11	Reading the actual velocity of each controlled axes	91	High-speed	R
	12	Reading actual spindle speeds	138	High-speed	R
	13	Entering torque limit data for the digital servo motor	152	Low-speed	W
	14	Reading load information of the spindle motor (serial interface)	153	High-speed	R
	15	Reading a chopping data	206	Low-speed	R
	16	Reading the actual speed of servo motor	207	High-speed	R
	17	Reading the estimate disturbance torque data	211	High-speed	R
	18	Reading a fine torque sensing data (statistical calculation results)	226	High-speed	R
	19	Reading a fine torque sensing data (store data)	232	High-speed	R
	20	Presetting the relative coordinate	249	Low-speed	W
	21	Reading the three-dimensional error compensation data	413	Low-speed	R
	22	Writing the three-dimensional error compensation data	414	Low-speed	W
	23	Reading the position of controlled axes	428	High-speed	R
	24	Reading slider position of the Control function for link type press	386	High-speed	R
	25	Reading position of lower dead point of the Control function for link type press	387	High-speed	R
	26	Reading main gear angle of the Control function for link type press	388	High-speed	R
	27	Reading analog monitor unit data	435	High-speed	R
	28	Reading axes command value	446	High-speed	R
Tool life management functions (Section 5.6)	1	Reading the tool life management data (tool group number)	38	High-speed	R
	2	Reading tool life management data (number of tool groups)	39	High-speed	R
	3	Reading tool life management data (number of tools)	40	High-speed	R
	4	Reading tool life management data (tool life)	41	High-speed	R
	5	Reading tool life management data (tool life counter)	42	High-speed	R
	6	Reading tool life management data (tool length compensation number (1): Tool number)	43	High-speed	R
	7	Reading tool life management data (tool length compensation number (2): Tool order number)	44	High-speed	R
	8	Reading tool life management data (cutter radius compensation number (1): Tool number)	45	High-speed	R
	9	Reading tool life management data (cutter radius compensation number (2): Tool order number)	46	High-speed	R
	10	Reading tool life management data (tool information (1): Tool number)	47	High-speed	R
	11	Reading tool life management data (tool information (2): Tool order number)	48	High-speed	R
	12	Reading tool life management data (tool number)	49	High-speed	R

Group	No.	Description	Function code	Response	R/W
Tool life management functions (Section 5.6)	13	Reading the tool life management data (tool life counter type)	160	High-speed	R
	14	Registering tool life management data (tool group)	163	Low-speed	W
	15	Writing tool life management data (tool life)	164	Low-speed	W
	16	Writing tool life management data (tool life counter)	165	Low-speed	W
	17	Writing tool life management data (tool life counter type)	166	Low-speed	W
	18	Writing tool life management data (tool length compensation number (1): Tool number)	167	Low-speed	W
	19	Writing tool life management data (tool length compensation number (2): Tool order number)	168	Low-speed	W
	20	Writing tool life management data (cutter radius compensation number (1): Tool number)	169	Low-speed	W
	21	Writing tool life management data (cutter radius compensation number (2): Tool order number)	170	Low-speed	W
	22	Writing tool life management data (tool information (1): Tool number)	171	Low-speed	W
	23	Writing the tool management data (tool information (2): Tool order number)	172	Low-speed	W
	24	Writing tool life management data (tool number)	173	Low-speed	W
	25	Reading the tool life management data (tool group No.) (8-digit tool number)	200	High-speed	R
	26	Reading tool life management data (tool information (1): Tool number) (8-digit tool number)	201	High-speed	R
	27	Registering tool life management data (tool group number) (8-digit tool number)	202	Low-speed	W
	28	Reading tool life management data (tool length compensation number (1): Tool number) (8-digit tool number)	227	High-speed	R
	29	Reading tool life management data (cutter radius compensation number (1): Tool number) (8-digit tool number)	228	High-speed	R
	30	Writing tool life management data (tool length compensation number (1): Tool number) (8-digit tool number)	229	Low-speed	W
	31	Writing tool life management data (cutter radius compensation number (1): Tool number) (8-digit tool number)	230	Low-speed	W
	32	Writing the tool life management data (tool information (1): Tool number) (8-digit tool number)	231	Low-speed	W
	33	Deleting tool life management data (tool group)	324	Low-speed	W
	34	Deleting tool life management data (tool data)	325	Low-speed	W
	35	Clearing tool life management data (tool life counter and tool information)	326	Low-speed	W
	36	Writing tool life management data (arbitrary group number)	327	Low-speed	W
	37	Writing tool life management data (remaining tool life)	328	Low-speed	W
Tool management functions (Section 5.7)	1	Exchanging tool management data numbers in a magazine management table	329	Low-speed	W
	2	Searching for a free pot	330	Low-speed	R
	3	Registering new tool management data	331	Low-speed	W
	4	Writing tool management data	332	Low-speed	W
	5	Deleting tool management data	333	Low-speed	W

Group	No.	Description	Function code	Response	R/W
Tool management functions (Section 5.7)	6	Reading tool management data	334	Low-speed	R
	7	Writing a specified type of tool management data	335	Low-speed	W
	8	Searching for tool management data	366	Low-speed	R
	9	Shifting tool management data	367	Low-speed	W
	10	Searching for a free pot (oversize tools supported)	397	Low-speed	R
	11	Reading the total tool life data	409	Low-speed	R
	12	Writing tool management data by specified data	419	Low-speed	W
	13	Deleting tool management data by specified data	420	Low-speed	W
	14	Reading tool management data by specified data	421	Low-speed	R
	15	Writing each tool management data by specified data	422	Low-speed	W
	16	Writing magazine property data	423	Low-speed	W
	17	Reading magazine property data	424	Low-speed	R
	18	Writing pot property data	425	Low-speed	W
	19	Reading pot property data	426	Low-speed	R
	20	Searching for a free pot by specified data	427	Low-speed	R
	21	Reading a tool geometry data	429	Low-speed	R
	22	Writing a tool geometry data	430	Low-speed	W
	23	Moving tool management data numbers in a magazine management table	432	Low-speed	W
	24	Reading free number of Multi edge group / Tool offset	434	High-speed	R
	25	Writing edge data	439	Low-speed	W
	26	Reading edge data	440	Low-speed	R
	27	Writing each edge data	441	Low-speed	W
	28	Reading the total tool life data of an edge	442	Low-speed	R

*1 Function codes that have R in the R/W column are window read functions specifiable with the WINDR function command. Function codes that have W in the R/W column are window write functions specifiable with the WINDW function command.

*2 Functions of "High-speed" in their Response field can read or write data immediately upon request. On the other hand, functions of "Low-speed" in their Response field need to request the CNC to read or write data and receiving response from CNC completes the request.

NOTE

To read or write data for the second path in two-path control CNC, add 1000 to the function code number.
To read or write data for the third path in three-path control CNC, add 2000 to the function code number.
Similarly, to read or write data for the fourth to 10th paths, add 3000 to 9000 accordingly to the function code number.

5.3.2 List of Window Functions (Function Code Order)

Function code	Description	Response	R/W
0	Reading CNC system information	High-speed	R
13	Reading a tool offset	High-speed	R
14	Writing a tool offset	Low-speed	W
15	Reading a work piece origin offset value	High-speed	R
16	Writing a work piece origin offset value	Low-speed	W
17	Reading a parameter	High-speed	R
18	Writing a parameter	Low-speed	W
19	Reading setting data	High-speed	R
20	Writing setting data	Low-speed	W
21	Reading a custom macro variable	High-speed	R
22	Writing a custom macro variable	Low-speed	W
23	Reading the CNC alarm status	High-speed	R
24	Reading the current program number	High-speed	R
25	Reading the current sequence number	High-speed	R
26	Reading the actual velocity of controlled axes	High-speed	R
27	Reading the absolute position (absolute coordinates) of controlled axes	High-speed	R
28	Reading the machine position (machine coordinates) of controlled axes	High-speed	R
29	Reading a skip position (stop coordinates of skip operation (G31)) of controlled axes	High-speed	R
30	Reading the servo delay for controlled axes	High-speed	R
31	Reading the acceleration/deceleration delay on controlled axes	High-speed	R
32	Reading modal data	High-speed	R
33	Reading diagnosis data	Low-speed	R
34	Reading the feed motor load current value (A/D conversion data)	High-speed	R
38	Reading the tool life management data (tool group number)	High-speed	R
39	Reading tool life management data (number of tool groups)	High-speed	R
40	Reading tool life management data (number of tools)	High-speed	R
41	Reading tool life management data (tool life)	High-speed	R
42	Reading tool life management data (tool life counter)	High-speed	R
43	Reading tool life management data (tool length compensation number (1): Tool number)	High-speed	R
44	Reading tool life management data (tool length compensation number (2): Tool order number)	High-speed	R
45	Reading tool life management data (cutter radius compensation number (1): Tool number)	High-speed	R
46	Reading tool life management data (cutter radius compensation number (2): Tool order number)	High-speed	R
47	Reading tool life management data (tool information (1): Tool number)	High-speed	R
48	Reading tool life management data (tool information (2): Tool order number)	High-speed	R
49	Reading tool life management data (tool number)	High-speed	R
50	Reading the actual spindle speed	High-speed	R
59	Reading the P-code macro variable	High-speed	R
60	Writing the P-code macro variable	Low-speed	W
74	Reading the relative position on a controlled axis	High-speed	R
75	Reading the remaining travel	High-speed	R
76	Reading CNC status information	High-speed	R
90	Reading the current program number (8-digit program numbers)	High-speed	R
91	Reading the actual velocity of each controlled axes	High-speed	R
138	Reading actual spindle speeds	High-speed	R
139	Writing clock data (date and time)	Low-speed	W

Function code	Description	Response	R/W
150	Entering data on the program check screen	Low-speed	W
151	Reading clock data (date and time)	High-speed	R
152	Entering torque limit data for the digital servo motor	Low-speed	W
153	Reading load information of the spindle motor (serial interface)	High-speed	R
154	Reading a parameter	High-speed	R
155	Reading setting data	High-speed	R
156	Reading diagnosis data (specific number only)	High-speed	R
160	Reading the tool life management data (tool life counter type)	High-speed	R
163	Registering the tool life management data (tool group)	Low-speed	W
164	Writing the tool life management data (tool life)	Low-speed	W
165	Writing the tool life management data (tool life counter)	Low-speed	W
166	Writing the tool life management data (tool life counter type)	Low-speed	W
167	Writing the tool life management data (tool length compensation number (1): Tool number)	Low-speed	W
168	Writing the tool life management data (tool length compensation number (2): Tool order number)	Low-speed	W
169	Writing the tool life management data (cutter radius compensation number (1): Tool number)	Low-speed	W
170	Writing the tool life management data (cutter radius compensation number (2): Tool order number)	Low-speed	W
171	Writing the tool life management data (tool information (1): Tool number)	Low-speed	W
172	Writing the tool management data (tool condition (2): Tool order number)	Low-speed	W
173	Writing the tool life management data (tool number)	Low-speed	W
200	Reading the tool life management data (tool group number) (8-digit tool number)	High-speed	R
201	Reading tool life management data (tool information (1): Tool number) (8-digit tool number)	High-speed	R
202	Registering tool life management data (tool group number) (8-digit tool number)	Low-speed	W
206	Reading a chopping data	Low-speed	R
207	Reading the actual speed of servo motor	High-speed	R
211	Reading the estimate disturbance torque data	High-speed	R
226	Reading a fine torque sensing data (statistical calculation results)	High-speed	R
227	Reading tool life management data (tool length compensation number (1): Tool number) (8-digit tool number)	High-speed	R
228	Reading tool life management data (cutter radius compensation number (1): Tool number) (8-digit tool number)	High-speed	R
229	Writing tool life management data (tool length compensation number (1): Tool number) (8-digit tool number)	Low-speed	W
230	Writing tool life management data (cutter radius compensation number (1): Tool number) (8-digit tool number)	Low-speed	W
231	Writing the tool life management data (tool information (1): Tool number) (8-digit tool number)	Low-speed	W
232	Reading a fine torque sensing data (store data)	High-speed	R
249	Presetting the relative coordinate	Low-speed	W
321	Reading a real type parameter	High-speed	R
323	Writing a real type parameter	Low-speed	W
324	Deleting the tool life management data (tool group)	Low-speed	W
325	Deleting the tool life management data (tool data)	Low-speed	W
326	Deleting the tool life management data (tool life counter and tool information)	Low-speed	W
327	Writing the tool life management data (arbitrary group number)	Low-speed	W
328	Writing the tool life management data (remaining tool life)	Low-speed	W
329	Exchanging tool management data numbers in a magazine management table	Low-speed	W

Function code	Description	Response	R/W
330	Searching for a free pot	Low-speed	R
331	Registering new tool management data	Low-speed	W
332	Writing tool management data	Low-speed	W
333	Deleting tool management data	Low-speed	W
334	Reading tool management data	Low-speed	R
335	Writing a specified type of tool management data	Low-speed	W
366	Searching for tool management data	Low-speed	R
367	Shifting tool management data	Low-speed	W
386	Reading slider position of the Control function for link type press	High-speed	R
387	Reading position of lower dead point of the Control function for link type press	High-speed	R
388	Reading main gear angle of the Control function for link type press	High-speed	R
395	Reading the pitch error compensation data	High-speed	R
396	Writing the pitch error compensation data	Low-speed	W
397	Searching for a free pot (oversize tools supported)	Low-speed	R
409	Reading the total tool life data	Low-speed	R
413	Reading the three-dimensional error compensation data	Low-speed	R
414	Writing the three-dimensional error compensation data	Low-speed	W
419	Writing tool management data by specified data	Low-speed	W
420	Deleting tool management data by specified data	Low-speed	W
421	Reading tool management data by specified data	Low-speed	R
422	Writing each tool management data by specified data	Low-speed	W
423	Writing magazine property data	Low-speed	W
424	Reading magazine property data	Low-speed	R
425	Writing pot property data	Low-speed	W
426	Reading pot property data	Low-speed	R
427	Searching for a free pot by specified data	Low-speed	R
428	Reading the position controlled axes	High-speed	R
429	Reading a tool geometry data	Low-speed	R
430	Writing a tool geometry data	Low-speed	W
431	Tool figure making instruction for 3D interference check function	Low-speed	W
432	Moving tool management data numbers in a magazine management table	Low-speed	W
433	Reading detailed information of CNC alarm	Low-speed	R
434	Reading free number of Multi edge group / Tool offset	High-speed	R
435	Reading analog monitor unit data	High-speed	R
436	Command for Changing the Interference Object for 3D interference check function	Low-speed	W
437	Reading a custom macro variable (variable number extension)	Low-speed	R
438	Writing a custom macro variable (variable number extension)	Low-speed	W
439	Writing edge data	Low-speed	W
440	Reading edge data	Low-speed	R
441	Writing each edge data	Low-speed	W
442	Reading the total tool life data of an edge	Low-speed	R
446	Reading axes commanded value	Low-speed	R
447	Reading the CNC ID number	Low-speed	R
449	Reading the number of repeats for subprogram calls / canned cycle	High-speed	R

*1 Function codes that have R in the R/W column are window read functions specifiable with the WINDR function command. Function codes that have W in the R/W column are window write functions specifiable with the WINDW function command.

*2 Functions of "High-speed" in their Response field can read or write data immediately upon request. On the other hand, functions of "Low-speed" in their Response field need to request the CNC to read or write data and receiving response from CNC completes the request.

NOTE

1 To read or write data for the second path in two-path control CNC, add 1000 to the function code number.
To read or write data for the third path in three-path control CNC, add 2000 to the function code number.
Similarly, to read or write data for the fourth to 10th paths, add 3000 to 9000 accordingly to the function code number.

2 When using this function with multi-path PMC system, you should confirm the CNC-PMC interface assigned by NC parameter No. 11920-11929. According to the assignment of the interface, ladder program of each PMC path can read or write data for assigned CNC path. As for detail of these parameters, refer to section “2.4.3”.

5.3.3 Compatibility with Conventional Models

1. Compatibility with Series 30*i*/31*i*/32*i*-A
   The window function of Series 30*i*/31*i*/32*i*/35*i*-B, 0*i*-F PMC is highly compatible with the window function of series 30*i*/31*i*/32*i*-A PMC.

2. Compatibility with Series 0*i*-D
   The window function of Series 30*i*/31*i*/32*i*/35*i*-B PMC is highly compatible with the window function of series 0*i*-D PMC.

3. Compatibility with Series 16*i*/18*i*/21*i*-B
   The specifications of following WINDOW functions on Series 30*i*/31*i*/32*i*/35*i*-B PMC are different from ones on PMC-SB7 of Series 16*i*/18*i*/21*i*-B.
   - The new function “No.321 Reading a real type parameter” has been added. To read a real type CNC parameter, use this function.
   - The new function “No.323 Writing a real type parameter” has been added. To write a real type CNC parameter, use this function.
   - In the function “No.23 Reading the alarm status”, the output value has been extended into 4 bytes and some contents have been changed.
   - The function “No.33 Reading diagnosis data” has been equipped as low-speed response type.
   - The new function “No.395 Reading the pitch error compensation data” has been added. The function “No.17, 154 Reading the parameter” cannot read a pitch error compensation data. Use this new function to read it.
   - The new function “No.396 Writing the pitch error compensation data” has been added. The function “No.18 Writing the parameter” cannot write a pitch error compensation data. Use this new function to write it.
   - There is no analog input function on Series 30*i*/31*i*/32*i*/35*i*-B, 0*i*-F. Therefore, the function “No.34 Reading the feed motor load current value (A/D conversion data)” cannot read A/D conversion data using the function. This function can only read the feed motor load current value.
   - To use the function “No.152 Entering torque limit data for the digital servo motor”, you should set the CNC parameter No.6286#0 to 1.
   - When you read a speed of a linear motor using the function "No.207 Reading the actual speed of servo motor" with the data number 11, the unit of the read data is "cm / min".
   - When using the function "No.30 Reading the servo delay for controlled axes" with the data number N=0, the data is read with input unit. When using the function with the data number N=1, the data is read with detection unit. On PMC-SB7, the data is always read with detection unit.

- When using the function "No.31 Reading the acceleration / deceleration delay on controlled axes" with the data number N=0, the data is read with input unit. When using the function with the data number N=1, the data is read with detection unit. On PMC-SB7, the data is always read with machine unit.
- The function "No.21 Reading a custom macro variable" or "No.59 Reading a P-CODE macro variable" returns "mantissa"=0 and "number of decimal places"= -1 when the floating-point type variable is "null".
- The function "No.22 Writing a custom macro variable" or "No.60 Writing a P-CODE macro variable" can write "null" to the floating-point type variable by setting "mantissa"=0 and "number of decimal places"= -1.
- The function "No.32 Reading modal data" cannot read modal information for a block after the next block.

4. Compatibility with Power Mate *i*-D/H
   The specifications of following WINDOW functions on Series 30*i*/31*i*/32*i*/35*i*-B, 0*i*-F or Power Motion *i*-A PMC are different from ones on PMC-SB5/SB6 of Power Mate *i*-D/H.
   - The new function "No.321 Reading a real type parameter" has been added. To read a real type CNC parameter, use this function.
   - The new function "No.323 Writing a real type parameter" has been added. To write a real type CNC parameter, use this function.
   - In the function "No.23 Reading the alarm status", the output value has been extended into 4 bytes and some contents have been changed.
   - The function "No.433 Reading detailed information of CNC alarm" has been added. Note that this function is different from the function "No.186 Reading detailed information of CNC alarm"of PMC-SB5/SB6.
   - The function "No.33 Reading diagnosis data" has been equipped as low-speed response type.
   - The new function "No.395 Reading the pitch error compensation data" has been added. The function "No.17, 154 Reading the parameter" cannot read a pitch error compensation data. Use this new function to read it.
   - The new function "No.396 Writing the pitch error compensation data" has been added. The function "No.18 Writing the parameter" cannot write a pitch error compensation data. Use this new function to write it.
   - There is no analog input function on Series 30*i*/31*i*/32*i*/35*i*-B or Power Motion *i*-A. Therefore, the function "No.34 Reading the feed motor load current value (A/D conversion data)" cannot read A/D conversion data using the function. This function can only read the feed motor load current value.
   - To use the function "No.152 Entering torque limit data for the digital servo motor", you should set the CNC parameter No.6286#0 to 1.
   - When you read a speed of a linear motor using the function "No.207 Reading the actual speed of servo motor" with the data number 11, the unit of the read data is "cm / min".
   - When using the function "No.30 Reading the servo delay for controlled axes" with the data number N=0, the data is read with input unit. When using the function with the data number N=1, the data is read with detection unit. On PMC-SB5/SB6, the data is always read with detection unit.
   - When using the function "No.31 Reading the acceleration / deceleration delay on controlled axes" with the data number N=0, the data is read with input unit. When using the function with the data number N=1, the data is read with detection unit. On PMC-SB5/SB6, the data is always read with machine unit.
   - The function "No.21 Reading a custom macro variable" or "No.59 Reading a P-CODE macro variable" returns "mantissa"=0 and "number of decimal places"= -1 when the floating-point type variable is "null".
   - The function "No.22 Writing a custom macro variable" or "No.60 Writing a P-CODE macro variable" can write "null" to the floating-point type variable by setting "mantissa"=0 and "number of decimal places"= -1.

- The function "No.32 Reading modal data" cannot read modal information for a block after the next block.
- The function "No.120 Reading the current screen number" is not supported.

5.4 CNC INFORMATION

5.4.1 Reading CNC System Information (High-speed Response)

The system information specific to the CNC can be read including the CNC type (e.g., series name like 30), the distinction between the machining center system (M) and the lathe system (T) for each CNC path, the ROM series and edition of the CNC system software, and the number of axes to be controlled for each CNC path.

Input data structure

Address	Field	Remarks
Top Address +0	(Function code) 0	
+2	(Completion code) - (Need not to be set)	
+4	(Data length L) - (Need not to be set)	
+6	(Data number N) 0	Set 0 to this field.
+8	(Data attribute M) 0	Set 0 to this field.
+10 +41	(Data area) - (Need not to be set)	

Completion codes

0: CNC system information has been read normally.

Output data structure

Address	Content	Remarks
Top Address +0	(Function code) 0	
+2	(Completion code) 0 (Always terminates normally)	
+4	(Data length L) 14	
+6	(Data number N) 0 (Same as input data)	
+8	(Data attribute M) 0 (Same as input data)	
+10	CNC series name (2 bytes)	ASCII characters (30, 31, 32, 35)
+12	Machine type M/T (2 bytes)	ASCII characters (M, T)
+14	ROM series of CNC system software (4 bytes)	ASCII characters (EX. G001, ...)
+18	ROM version of CNC system software (4 bytes)	ASCII characters (0001, 0002, ...)
+22 +23	Number of axes to be controlled for the specified CNC path (2 bytes)	ASCII characters (2, 3, 4, ...)

NOTE

Data is stored from the upper digit in each lower byte.

5.4.2 Reading a Tool Offset (High-speed Response)

A tool offset value recorded in the CNC can be read.
Wear offset data, geometric offset data, cutter compensation data, and tool length offset data can be read as a tool offset.

Input data structure

Top Address +0	(Function code) 13
+2	(Completion code) - (Need not to be set)
+4	(Data length L) - (Need not to be set)
+6	(Data number N) Offset number
+8	(Data attribute M) Offset type
+10 +41	(Data area) - (Need not to be set)

(a) Offset types (for machining centers)

	Cutter	Tool length
Wear	0	2
Geometric	1	3

If the type of tool offset need not be specified, enter 0.

(b) Offset types (for lathes)

	X axis	Z axis	Tool tip R	Virtual tool tip	Y axis	B axis (Reserved)
Wear	0	2	4	6	8	10
Geometric	1	3	5	7	9	11
2nd Geometric	12	13			14	

(c) Offset types (for machining centers with the Tool offset for Milling and Turning function)

	X axis	Z axis	Tool tip R	Virtual tool tip	Y axis	Corner R
Wear	1010	1012	1015	1019	1018	1024
Geometric	1009	1011	1014		1017	1023

Completion codes

0 The tool offset has been read normally.

3 The offset number specified for reading is invalid. (This completion code is returned when the specified offset number data is not from 1 to the maximum number of offsets.)

4 There are mistakes in the data attribute that specifies the type of the offset to be read. (Some wrong offset types do not result this completion code.)

Output data structure

Top Address +0	(Function code) 13	
+2	(Completion code) ? (See above description)	
+4	(Data length L) 4	
+6	(Data number N) Offset number (Same as input data)	
+8	(Data attribute M) Offset type (Same as input data)	
+10 +13	Tool offset value (4bytes)	Signed binary (A negative value is represented in 2's complement.) Upper 3 bytes are always "0" for virtual tool tip.

Output data unit

		Input system	Increment system				
			IS-A	IS-B	IS-C	IS-D	IS-E
Machining center system		mm, deg	0.01	0.001	0.0001	0.00001	0.000001
		inch	0.001	0.0001	0.00001	0.000001	0.0000001
Lathe system	Radius specification	mm, deg	0.01	0.001	0.0001	0.00001	0.000001
	Diameter specification		0.01	0.001	0.0001	0.00001	0.000001
	Radius specification	inch	0.001	0.0001	0.00001	0.000001	0.0000001
	Diameter specification		0.001	0.0001	0.00001	0.000001	0.0000001

5.4.3 Writing a Tool Offset (Low-speed Response)

The tool offset value can be directly written into the CNC.
Wear offset data, geometric offset data, cutter compensation data, and tool length offset data can be written as a tool offset.

> ⚠ **WARNING**
> When you write some NC data using both this instruction in ladder program and other applications, take care that you do not write to the same data area.
> If some values are written to the same data area by two or more applications including ladder program, unexpected value may be written. In this case, it may cause an unexpected machine behavior and also tools, work pieces, and machines may be damaged. As for details, refer to “SAFETY PRECAUTIONS”.

Input data structure

Address	Content	Remarks
Top Address +0	(Function code) 14	
+2	(Completion code) - (Need not to be set)	
+4	(Data length L) 4	
+6	(Data number N) Offset number	
+8	(Data attribute M) Offset type	
+10 +13	Tool offset value	Signed binary (A negative value is represented in 2's complement.) Upper 3 bytes are always "0" for virtual tool tip.

(a) Offset types (for machining centers)

	Cutter	**Tool length**
Wear	0	2
Geometric	1	3

If the type of tool offset need not be specified, enter 0.

(b) Offset types (for lathes)

	X axis	**Z axis**	**Tool tip R**	**Virtual tool tip**	**Y axis**	**B axis (Reserved)**
Wear	0	2	4	6	8	10
Geometric	1	3	5	7	9	11
2nd Geometric	12	13			14	

(c) Offset types (for machining centers with the Tool offset for Milling and Turning function)

<table>
<tr><th></th><th>X axis</th><th>Z axis</th><th>Tool tip R</th><th>Virtual tool tip</th><th>Y axis</th><th>Corner R</th></tr>
<tr><td>Wear</td><td>1010</td><td>1012</td><td>1015</td><td rowspan="2">1019</td><td>1018</td><td>1024</td></tr>
<tr><td>Geometric</td><td>1009</td><td>1011</td><td>1014</td><td>1017</td><td>1023</td></tr>
</table>

Input data unit

<table>
<tr><th colspan="2" rowspan="2"></th><th rowspan="2">Input system</th><th colspan="5">Increment system</th></tr>
<tr><th>IS-A</th><th>IS-B</th><th>IS-C</th><th>IS-D</th><th>IS-E</th></tr>
<tr><td colspan="2" rowspan="2">Machining center system</td><td>mm, deg</td><td>0.01</td><td>0.001</td><td>0.0001</td><td>0.00001</td><td>0.000001</td></tr>
<tr><td>inch</td><td>0.001</td><td>0.0001</td><td>0.00001</td><td>0.000001</td><td>0.0000001</td></tr>
<tr><td rowspan="4">Lathe system</td><td>Radius specification</td><td rowspan="2">mm, deg</td><td>0.01</td><td>0.001</td><td>0.0001</td><td>0.00001</td><td>0.000001</td></tr>
<tr><td>Diameter specification</td><td>0.01</td><td>0.001</td><td>0.0001</td><td>0.00001</td><td>0.000001</td></tr>
<tr><td>Radius specification</td><td rowspan="2">inch</td><td>0.001</td><td>0.0001</td><td>0.00001</td><td>0.000001</td><td>0.0000001</td></tr>
<tr><td>Diameter specification</td><td>0.001</td><td>0.0001</td><td>0.00001</td><td>0.000001</td><td>0.0000001</td></tr>
</table>

Completion codes

0 The tool offset has been written normally.

2 The data byte length for the tool offset specified for writing is invalid.

3 The offset number specified for writing is invalid. (This completion code is returned when the specified offset number data is not from 1 to the maximum number of offsets.)

4 There are mistakes in the data attribute that specifies the type of the offset to be written. (Some wrong offset types do not result this completion code.)

5 The tool offset value is out of the effective range.

6 For the offset number specified for writing, the additional tool offset number option is required, but it is missing.
Also, the tool function option is not added that is necessary for the type of the offset specified for writing.

116 The tool offset value is out of the effective range set by the wrong operation prevention function.

Output data structure

Top Address +0	(Function code) 14	
+2	(Completion code) ? (See above description)	
+4	(Data length L) 4 (Same as input data)	
+6	(Data number N) Offset number (Same as input data)	
+8	(Data attribute M) Offset type (Same as input data)	
+10 +13	Tool offset value (Same as input data)	Signed binary (A negative value is represented in 2's complement.)

5.4.4 Reading a Workpiece Origin Offset Value (High-speed Response)

The workpiece origin offset recorded in the CNC can be read.
A workpiece origin offset is provided for each controlled axis (the 1st axis to the 32nd axis) in the CNC. Either the workpiece origin offset for a specific axis can be read, or the workpiece origin offsets for all axes can be read at one time. If the additional axis option is not provided, however, the workpiece origin offset for the additional axis cannot be read.

Input data structure

Top Address +0	(Function code) 15	
+2	(Completion code) - (Need not to be set)	
+4	(Data length L) - (Need not to be set)	
+6	(Data number N) Offset group number	N=0: External workpiece origin offset N=1: G54 : : N=6: G59 With "addition of workpiece coordinate system pair" N=7: G54.1 P1 : : N=306: G54.1 P300
+8	(Data attribute M) Axis number	M=1 to n: Workpiece origin offset number of a specific axis. n is the axis number. M=-1: Read for all axes.
+10 +41	(Data area) - (Need not to be set)	

Completion codes

0 The workpiece origin offset has been read normally.
3 The specified offset number is invalid.
4 The specified axis number is invalid.

Output data structure

Top Address +0	(Function code) 15	
+2	(Completion code) ? (See above description)	
+4	(Data length L) Byte length of the workpiece origin offset value	L=4: The workpiece origin offset value for a specific axis is read. L=4 × n: Workpiece origin offsets for all axes are read.
+6	(Data number N) Offset group number (Same as input data)	
+8	(Data attribute M) Axis number (Same as input data)	
+10	Workpiece origin offset value	Signed binary number (A negative value is represented in 2's complement.)

Output data unit

		Input system	Increment system				
			IS-A	IS-B	IS-C	IS-D	IS-E
Machining center system		mm, deg	0.01	0.001	0.0001	0.00001	0.000001
		inch	0.001	0.0001	0.00001	0.000001	0.0000001
Lathe system	Radius specification	mm, deg	0.01	0.001	0.0001	0.00001	0.000001
	Diameter specification		0.01	0.001	0.0001	0.00001	0.000001
	Radius specification	inch	0.001	0.0001	0.00001	0.000001	0.0000001
	Diameter specification		0.001	0.0001	0.00001	0.000001	0.0000001

5.4.5 Writing a Workpiece Origin Offset Value (Low-speed Response)

Data can be written directly as a workpiece origin offset value in the CNC.
A workpiece origin offset is provided for each controlled axis (the 1st axis to the 32nd axis) in the CNC. Either the workpiece origin offset value for a specific axis can be written, or the workpiece origin offset values for all axes can be written at one time. If the additional axis option is not provided, however, the workpiece origin offset value for the additional axis cannot be written.

> ⚠ **WARNING**
> When you write some NC data using both this instruction in ladder program and other applications, take care that you do not write to the same data area.
> If some values are written to the same data area by two or more applications including ladder program, unexpected value may be written. In this case, it may cause an unexpected machine behavior and also tools, work pieces, and machines may be damaged. As for details, refer to “SAFETY PRECAUTIONS”.

Input data structure

Top Address +0	(Function code) 16	
+2	(Completion code) - (Need not to be set)	
+4	(Data length L) Byte length of the workpiece origin offset value	L=4: Workpiece origin offset value for a specific axis is written. L=4 × n: Workpiece origin offset values for all axes are written.
+6	(Data number N) Offset group number	N=0: External workpiece origin offset N=1: G54 : : N=6: G59 With the option of adding Workpiece coordinate systems. N=7: G54.1 P1 : : N=306: G54.1 P300
+8	(Data attribute M) Axis number	M=1 to n: Workpiece origin offset number of a specific axis. n is the axis number. M=-1: Write for all.
+10	Workpiece origin offset value	Signed binary number (A negative value is represented in 2's complement.)

Input data unit

		Input system	Increment system				
			IS-A	**IS-B**	**IS-C**	**IS-D**	**IS-E**
Machining center system		mm, deg	0.01	0.001	0.0001	0.00001	0.000001
		inch	0.001	0.0001	0.00001	0.000001	0.0000001
Lathe system	Radius specification	mm, deg	0.01	0.001	0.0001	0.00001	0.000001
	Diameter specification		0.01	0.001	0.0001	0.00001	0.000001
	Radius specification	inch	0.001	0.0001	0.00001	0.000001	0.0000001
	Diameter specification		0.001	0.0001	0.00001	0.000001	0.0000001

Completion codes

0 The workpiece origin offset has been written normally.
2 The specified data length is invalid.
3 The offset number is invalid.
4 The specified axis number is invalid.
5 The workpiece origin offset value is out of the effective range.
6 There is no workpiece coordinate shift option added.

Output data structure

Top Address +0	(Function code) 16	
+2	(Completion code) ? (See above description)	
+4	(Data length L) (Same as input data)	
+6	(Data number N) Offset group number (Same as input data)	
+8	(Data attribute M) Axis number (Same as input data)	
+10	Workpiece origin offset value (Same as input data)	Signed binary number (A negative value is represented in 2's complement.)

5.4.6 Reading a Parameter (High-speed Response)

The integer type parameter data of the CNC is read by directly accessing the CNC.
There are four types of the integer parameters in the CNC: Bit parameters having a definite meaning for each bit, byte parameters holding 1-byte data, word parameters holding 2-byte data, and double word parameters holding 4-byte data. Therefore, the length of the read data varies according to the parameter number specified.
Note that bit parameters cannot be read in bit units. The eight bits (one byte) for a parameter number must be read at a time.
For axis parameters, data for a specific axis can be read, or data for all axes can be read at a time.
For details of parameter data, refer to the “PARAMETER MANUAL”.

Input data structure

Top Address +0	(Function code) 17 or 154	
+2	(Completion code) - (Need not to be set)	
+4	(Data length L) - (Need not to be set)	
+6	(Data number N) Parameter number	
+8	(Data attribute M) Axis number	M=0: No axis M=1 to n: A specific axis M=-1: All axes
+10 +41	(Data area) - (Need not to be set)	

Completion codes

0 Parameter data has been read normally.
3 The parameter number specified for reading is invalid.
4 The specified data attribute is invalid because it is neither 0, -1, nor a value 1 to n (n is the number of axes).

Output data structure

Address	Content	Remarks
Top Address +0	(Function code) 17 or 154	
+2	(Completion code) ? (See above description)	
+4	(Data length L) (L = 1, 2, 4, 1×n, 2×n, 4×n)	When no axis or one axis is specified L=1: Bit or byte parameter L=2: Word parameter L=4: Double word parameter When all axes are specified L=1×n: Bit or byte parameter L=2×n: Word parameter L=4×n: Double word parameter
+6	(Data number N) Parameter number (Same as input data)	
+8	(Data attribute M) Axis number (Same as input data)	
+10	Parameter data	Parameter - dependent form

⚠CAUTION

Macro executor parameters 9000 to 9011 cannot be read.

5.4.7 Writing a Parameter (Low-speed Response)

Data can be written in an integer parameter in the CNC.
There are four types of the integer parameters in the CNC: Bit parameters having a definite meaning for each bit, byte parameters holding 1-byte data, word parameters holding 2-byte data, and double word parameters holding 4-byte data. Therefore, the length of the written data varies according to the parameter specified.
Note that bit parameters cannot be written in bit units. The eight bits (one byte) for the parameter number must be written at a time. This means that when a bit needs to be written, the whole data for the corresponding parameter number shall be read first, modify the target bit in the read data, then the data shall be rewritten.
For axis parameters, data for a specific axis can be read, or data for all axes can be read at a time.
For details of parameter data, refer to the “PARAMETER MANUAL”.
Some parameters cause a P/S alarm 000 when data is written. (The power must be turned off before continuing operation.)

> ⚠ **WARNING**
> When you write some NC data using both this instruction in ladder program and other applications, take care that you do not write to the same data area.
> If some values are written to the same data area by two or more applications including ladder program, unexpected value may be written. In this case, it may cause an unexpected machine behavior and also tools, work pieces, and machines may be damaged. As for details, refer to “SAFETY PRECAUTIONS”.

Input data structure

Top Address +0	(Function code) 18	
+2	(Completion code) - (Need not to be set)	
+4	(Data length L) (L = 1, 2, 4, 1 × n, 2 × n, 4 × n)	When no axis or one axis is specified L=1: Bit or byte parameter L=2: Word parameter L=4: Double word parameter When all axes are specified L=1 × n: Bit or byte parameter L=2 × n: Word parameter L=4 × n: Double word parameter
+6	(Data number N) Parameter number	
+8	(Data attribute M) Axis number	M=0: No axis M=1 to n: A specific axis M=-1: All axes
+10	Parameter data	Parameter - dependent form

Completion codes

0 Parameter data has been written normally.
2 The data byte length of the parameter specified for writing is invalid.
3 The parameter number specified for writing is invalid.
4 The specified data attribute is invalid because it is neither 0, -1, nor a value from 1 to n (n is the number of axes).
6 The necessary option is not added.
113 The CNC status is that the writing the parameter cannot be allowed.

Output data structure

Top Address +0	(Function code) 18	
+2	(Completion code) ? (See above description)	
+4	(Data length L) (Same as input data)	
+6	(Data number N) Parameter number (Same as input data)	
+8	(Data attribute M) Axis number (Same as input data)	
+10	Parameter data (Same as input data)	Parameter - dependent form

⚠CAUTION

1 Parameters may not become effective immediately depending on the parameter numbers.
2 There is timing when it can't be written in some parameters. In this case '113' is set to the completion code.

5.4.8 Reading a Real Type Parameter (High-speed Response)

This function can read a real type CNC parameter.
For details of parameter data, refer to the “PARAMETER MANUAL”.

> **NOTE**
> This function cannot read integer type or bit type parameters. To read an integer type or bit type parameter, use the function having function code 17 or 154.

Input data structure

(1) Reading the non-axis type parameter or the axis type parameter for one axis (M=n)

Top Address +0	(Function Code) 321	
+2	(Completion code) - (Need not to be set)	
+4	(Data length L) - (Need not to be set)	
+6	(Data number N) Parameter number	Set the parameter number with singed binary format in four bytes length.
+10	(Data attribute M) Axis number	M=0: Non-axis type parameter M=1 to n: Axis number
+12	Decimal point position (2 bytes)	Set the decimal point position of the parameter value.
+14 +17	(Data area) - (Need not to be set)	

(2) Reading axis type parameters for all axes (M=-1, Example for 3 controlled-axes)

Offset	Content	Description
Top Address +0	(Function Code) 321	
+2	(Completion code) - (Need not to be set)	
+4	(Data length L) - (Need not to be set)	
+6	(Data number N) Parameter number	Set the parameter number with singed binary format in four bytes length.
+10	(Data attribute M) -1	All axes
+12	Decimal point position (2 bytes)	Set the decimal point position of the parameter value for the 1st axis.
+14	(Data area) - (Need not to be set)	
+18	Decimal point position (2 bytes)	Set the decimal point position of the parameter value for the 2nd axis.
+20	(Data area) - (Need not to be set)	
+24	Decimal point position (2 bytes)	Set the decimal point position of the parameter value for the 3rd axis.
+26 +29	(Data area) - (Need not to be set)	

Completion codes

0 Normal completion
3 The data number is invalid.
4 The data attribute is invalid.
5 The decimal point position is invalid.

Output data structure

(1) Reading the non-axis type parameter or the axis type parameter for one axis (M=n)

Address	Contents	Remarks
Top Address +0	(Function Code) 321	
+2	(Completion code) ? (See above description)	
+4	(Data length L) 6	
+6	(Data number N) Parameter number (Same as input data)	
+10	(Data attribute M) Axis number (Same as input data)	
+12	Decimal point position (Same as input data)	
+14 +17	Parameter value (4 bytes)	The read parameter value is set with signed binary format in four bytes length.

(2) Reading axis type parameters for all axes (M=-1, Example for 3 controlled-axes)

Top Address +0	(Function Code) 321	
+2	(Completion code) ? (See above description)	
+4	(Data length L) 18 (6 bytes * 3 axes)	
+6	(Data number N) Parameter number (Same as input data)	
+10	(Data attribute M) -1 (Same as input data)	
+12	Decimal point position (Same as input data)	
+14	Parameter value (4 bytes)	The read parameter value for the 1st axis is set with signed binary format in four bytes length.
+18	Decimal point position (Same as input data)	
+20	Parameter value (4 bytes)	The read parameter value for the 2nd axis is set with signed binary format in four bytes length.
+24	Decimal point position (Same as input data)	
+26 +29	Parameter value (4 bytes)	The read parameter value for the 3rd axis is set with signed binary format in four bytes length.

The read parameter value for each specified decimal point position is shown below.

$$\text{(The read value)} = \text{(Parameter value)} \times 10^{\text{(Decimal point position)}}$$

Parameter value	Decimal point position	Read value
1.234	0	1
	1	12
	2	123
	3	1234
	4	12340

5.4.9 Writing a Real Type Parameter (Low-speed Response)

This function can write a real type CNC parameter.
For details of parameter data, refer to the “PARAMETER MANUAL”.

> ⚠ **WARNING**
> When you write some NC data using both this instruction in ladder program and other applications, take care that you do not write to the same data area.
> If some values are written to the same data area by two or more applications including ladder program, unexpected value may be written. In this case, it may cause an unexpected machine behavior and also tools, work pieces, and machines may be damaged. As for details, refer to “SAFETY PRECAUTIONS”.

> **NOTE**
> This function cannot write integer type or bit type parameters. To write an integer type or bit type parameter, use the function having function code 18.

Input data structure

(1) Writing the non-axis type parameter or the axis type parameter for one axis (M=n)

Top Address +0	(Function Code) 323	
+2	(Completion code) - (Need not to be set)	
+4	(Data length L) 6	Set the data length.
+6	(Data number N) Parameter number	Set the parameter number with singed binary format in four bytes length.
+10	(Data attribute M) Axis number	M=0: Non-axis type parameter M=1 to n: Axis number
+12	Decimal point position (2 bytes)	Set the decimal point position of the parameter value.
+14 +17	Parameter value (4 bytes)	Set the parameter value with singed binary format in four bytes length

(2) Writing axis type parameters for all axes (M=-1, Example for 3 controlled-axes)

Offset	Field	Description
Top Address +0	(Function Code) 323	
+2	(Completion code) - (Need not to be set)	
+4	(Data length L) 18 (6bytes * 3axes)	Set the data length.
+6	(Data number N) Parameter number	Set the parameter number with singed binary format in four bytes length.
+10	(Data attribute M) -1	All axes
+12	Decimal point position (2 bytes)	Set the decimal point position of the parameter value for the 1st axis.
+14	Parameter value (4 bytes)	Set the parameter value for the 1st axis with singed binary format in four bytes length
+18	Decimal point position (2 bytes)	Set the decimal point position of the parameter value for the 2nd axis.
+20	Parameter value (4 bytes)	Set the parameter value for the 2nd axis with singed binary format in four bytes length
+24	Decimal point position (2 bytes)	Set the decimal point position of the parameter value for the 3rd axis.
+26 +29	Parameter value (4 bytes)	Set the parameter value for the 3rd axis with singed binary format in four bytes length

Completion codes

0 Normal completion
2 The data length is invalid.
3 The data number is invalid.
4 The data attribute is invalid.
5 The decimal point position is invalid.
113 The CNC status is that the writing the parameter cannot be allowed.

Output data structure

(1) Writing the non-axis type parameter or the axis type parameter for one controlled axis (M=n)

Top Address +0	(Function Code) 323
+2	(Completion code) ? (See above description)
+4	(Data length L) 6 (Same as input data)
+6	(Data number N) Parameter number (Same as input data)
+10	(Data attribute M) Axis number (Same as input data)
+12	Decimal point position (Same as input data)
+14 +17	Parameter value (Same as input data)

(2) Reading axis type parameters for all axes (M=-1, Example for 3 controlled-axes)

Address	Content
Top Address +0	(Function Code) 323
+2	(Completion code) ? (See above description)
+4	(Data length L) 18 (Same as input data)
+6	(Data number N) Parameter number (Same as input data)
+10	(Data attribute M) -1 (Same as input data)
+12	Decimal point position (Same as input data)
+14	Parameter value (Same as input data)
+18	Decimal point position (Same as input data)
+20	Parameter value (Same as input data)
+24	Decimal point position (Same as input data)
+26 +29	Parameter value (Same as input data)

The parameter value for each specified decimal point position is shown below.

(Writing value) = (Parameter value) × $10^{\text{(Decimal point position)}}$

Writing value	Decimal point position	Parameter value
1234	0	1234.000
	1	123.400
	2	12.240
	3	1.234
	4	0.123

⚠CAUTION

1 Parameters may not become effective immediately depending on the parameter numbers.
2 There is timing when it can't be written in some parameters. In this case '113' is set to the completion code.

5.4.10 Reading Setting Data (High-speed Response)

The data set in the CNC is read by directly accessing the CNC.
There are four types of setting data in the CNC: Bit setting data having a definite meaning for each bit, byte setting data stored in bytes, word setting data stored in 2-byte units, and double-word setting data stored in 4-byte units. Therefore, the length of the read data varies according to the setting data specified. Note that bit setting data cannot be read in bit units. The eight bits (one byte) for the setting data number must be read at a time.
For axis setting data, data for a specific axis can be read, or data for all axes can be read at a time.
For details of setting data, refer to the "OPERATOR'S MANUAL".

Input data structure

Top Address +0	(Function code) 19 or 155	
+2	(Completion code) - (Need not to be set)	
+4	(Data length L) - (Need not to be set)	
+6	(Data number N) Setting data number	
+8	(Data attribute M) Axis number	M=0: No axis M=1 to n: A specific axis M=-1: All axes
+10 +41	(Data area) - (Need not to be set)	

Completion codes

0 Setting data has been read normally.
3 The setting number specified for reading is invalid.
4 The specified data attribute is invalid because it is neither 0, -1, nor a value from 1 to n (n is the number of axes).

Output data structure

Address	Content	Description
Top Address +0	(Function code) 19 or 155	
+2	(Completion code) ? (See above description)	
+4	(Data length L) (L = 1, 2, 4, 1×n, 2×n, 4×n)	When no axis or one axis is specified L=1: Bit or byte setting data L=2: Word setting data L=4: Double word setting data When all axes are specified L=1×n: Bit or byte setting data L=2×n: Word setting data L=4×n: Double word parameter
+6	(Data number N) Parameter number (Same as input data)	
+8	(Data attribute M) Axis number (Same as input data)	
+10	Setting data	Parameter - dependent form

5.4.11 Writing Setting Data (Low-speed Response)

Data can be written as setting data in the CNC.
For details of setting data, refer to the "OPERATOR'S MANUAL".

> ⚠ **WARNING**
> When you write some NC data using both this instruction in ladder program and other applications, take care that you do not write to the same data area.
> If some values are written to the same data area by two or more applications including ladder program, unexpected value may be written. In this case, it may cause an unexpected machine behavior and also tools, work pieces, and machines may be damaged. As for details, refer to "SAFETY PRECAUTIONS".

Input data structure

Address	Content	Remarks
Top Address +0	(Function code) 20	
+2	(Completion code) - (Need not to be set)	
+4	(Data length L) (L = 1, 2, 4, 1×n, 2×n, 4×n)	When no axis or one axis is specified L=1: Bit or byte setting data L=2: Word setting data L=4: Double word setting data When all axes are specified L=1×n: Bit or byte setting data L=2×n: Word setting data L=4×n: Double word setting data
+6	(Data number N) Setting data number	
+8	(Data attribute M) Axis number	M=0: No axis M=1 to n: A specific axis M=-1: All axes
+10	Setting data	Setting data - dependent form

Completion codes

0 Setting data has been written normally.
2 The byte length of the setting data specified for writing is invalid.
3 The setting data number specified for writing is invalid.
4 The specified data attribute is invalid because it is neither 0, -1, nor a value from 1 to n (n is the number of axes).

Output data structure

Top Address +0	(Function code) 20	
+2	(Completion code) ? (See above description)	
+4	(Data length L) (Same as input data)	
+6	(Data number N) Setting data number (Same as input data)	
+8	(Data attribute M) Axis number (Same as input data)	
+10	Setting data (Same as input data)	Setting data - dependent form

5.4.12 Reading a Custom Macro Variable (High-speed Response)

Using this function, you can read a common variable of custom macro variables. You cannot read a local variable and a system variable.

Table 5.4.12 (a) Common variables of custom macro

Custom macro common variable addition option	Common variables
Not equipped	#100~#149, #500~#549
Equipped	#100~#199, #500~#999

> **NOTE**
> For details of the custom macro variables, refer to the "OPERATOR'S MANUAL ".

Input data structure

Top Address +0	(Function code) 21	
+2	(Completion code) - (Need not to be set)	
+4	(Data length L) - (Need not to be set)	
+6	(Data number N) Custom macro variable number	
+8	(Data attribute M) Number of decimal places	M=0: No specifying number of decimal places M=1 to 8: Specifying number of decimal places
+10 +15	(Data area) - (Need not to be set)	

Completion codes

0 Completed successfully
1 No option for custom macro variables
3 The data number is invalid.
4 The mantissa is out of range.

Output data structure

Offset	Content	Remarks
Top Address +0	(Function code) 21	
+2	(Completion code) ? (See above description)	
+4	(Data length L) 6	
+6	(Data number N) Custom macro variable number (Same as input data)	
+8	(Data attribute M) Number of decimal places (Same as input data)	
+10	Mantissa(D1) (4 bytes)	Signed binary format in 4 bytes length
+14 +15	Number of decimal places(D2) (2 bytes)	Signed binary format in 2 bytes length D2 = -1, 0 to 8

You can read D1 and D2 when the custom macro variable is expressed by the following formula.

[Custom macro variable] = $D1 \times 10^{-D2}$

There is a "null" state on custom macro variables that means the value is not defined. When the custom macro variable is "null", the D1=0 and the D2 = -1 are read in spite of the specified value of M.

Value of the custom macro variable	Specified number of decimal places (M)	Result data	
		Mantissa (D1)	Number of decimal places (D2)
1.234	0	1234	3
	1	12	1
	2	123	2
	3	1234	3
	4	12340	4
0	1	0	1
Null	-	0	-1

NOTE

When you set 0 to number of decimal places M, the read value of D2 may changes by the value of the macro variable and the setting of CNC system. So, we recommend to set 1 to 8 to number of decimal places M.

5.4.13 Writing a Custom Macro Variable (Low-speed Response)

Using this function, you can write value to a common variable of custom macro variables. You cannot write to local variables or system variables.

> ⚠ **WARNING**
> When you write some NC data using both this instruction in ladder program and other applications, take care that you do not write to the same data area.
> If some values are written to the same data area by two or more applications including ladder program, unexpected value may be written. In this case, it may cause an unexpected machine behavior and also tools, work pieces, and machines may be damaged. As for details, refer to “SAFETY PRECAUTIONS”.

Table5.4.13 (a) Common variables of custom macro

Custom macro common variable addition option	Common variables
Not equipped	#100~#149, #500~#549
Equipped	#100~#199, #500~#999

> **NOTE**
> For details of the custom macro variables, refer to the "OPERATOR’S MANUAL ".

Input data structure

Top Address +0	(Function code) 22	
+2	(Completion code) - (Need not to be set)	
+4	(Data length L) 6	
+6	(Data number N) Custom macro variable number	
+8	(Data attribute M) 0	Set 0 to this field.
+10	Mantissa (D1) (4 bytes)	Signed binary format in 4 bytes length
+14 +15	Number of decimal places (D2) (2 bytes)	Signed binary format in 2 bytes length D2 = -1, 0 to 8

You should set values to D1 and D2 when the custom macro variable is expressed by the following formula.

[Custom macro variable] = D1 × 10 $^{-D2}$

There is a "null" state on custom macro variables that means the value is not defined. When you set D1=0 and D2= -1, the custom macro variable becomes "null" state.

Setting data		Value of the custom macro variable (Result)
Mantissa (D1)	Number of decimal places (D2)	
1234	0	1234
1234	1	123.4
1234	2	12.34
1234	3	1.234
1234	4	0.1234
0	Except -1	0
0	-1	Null

Completion codes

0 Completed successfully
2 The data length is invalid.
3 The data number is invalid.
6 No option for custom macro variables
7 The variable is write-protected.

Output data structure

Top Address +0	(Function code) 22
+2	(Completion code) ? (See above description)
+4	(Data length L) 6 (Same as input data)
+6	(Data number N) Custom macro variable number (Same as input data)
+8	(Data attribute M) 0 (Same as input data)
+10	Mantissa (D1) (Same as input data)
+14 +15	Number of decimal places (D2) (Same as input data)

5.4.14 Reading a Custom Macro Variable (Variable Number Extension) (Low-speed Response)

Using this function, you can read a system variable and a common variable of custom macro variables. You cannot read a local variable.
The readable common variable range is changed by some software option. About details, refer to the following table.

Table5.4.14 (a) Range of common variables

		Custom macro common variables addition option	
		Not equipped	Equipped
Embedded macro option	Not equipped	#100~#149, #500~#549	#100~#199, #500~#999
	Equipped	#100~#149, #200~#499, #500~#549	#100~#199, #200~#499, #500~#999

NOTE
For details of the system variables and the common variables of the custom macro, refer to the "OPERATOR'S MANUAL".

Input data structure

Offset	Field	Remarks
Top Address +0	(Function code) 437	
+2	(Completion code) - (Need not to be set)	
+4	(Data length L) - (Need not to be set)	
+6	(Data number N) Custom macro variable number (4 bytes)	
+10	(Data attribute M) Number of decimal places (2 bytes)	M=0 to 8: Specifying number of decimal places
+12 to +17	(Data area) - (Need not to be set)	

Completion codes

0 Completed successfully.
3 The data number is invalid.
5 The mantissa is out of range.
6 No option for custom macro variables.

Output data structure

Offset	Field	Remarks
Top Address +0	(Function code) 437	
+2	(Completion code) ? (See above description)	
+4	(Data length L) 6	
+6	(Data number N) Custom macro variable number (Same as input data)	
+10	(Data attribute M) Number of decimal places (Same as input data)	
+12	Mantissa(D1) (4 bytes)	Signed binary format in 4 bytes length
+16 +17	Number of decimal places(D2) (2 bytes)	Signed binary format in 2 bytes length D2 = -1, 0 to 8

You can read D1 and D2 when the custom macro variable is expressed by the following formula.

$$[\text{Custom macro variable}] = D1 \times 10^{-D2}$$

There is a "null" state on custom macro variables that means the value is not defined. When the custom macro variable is "null", the D1=0 and the D2 = -1 are read in spite of the specified value of M.

Value of the custom macro variable	**Specified number of decimal places (M)**	**Result data**	
		Mantissa (D1)	**Number of decimal places (D2)**
1.234	0	1	0
	1	12	1
	2	123	2
	3	1234	3
	4	12340	4
0	-	0	0
Null	-	0	-1

5.4.15 Writing a Custom Macro Variable (Variable Number Extension) (Low-speed Response)

Using this function, you can write a system variable and a common variable of custom macro variables. You cannot write a local variable.
The writable common variable range is changed by some software option. About details, refer to the following table.

> ⚠ **WARNING**
> When you write some NC data using both this instruction in ladder program and other applications, take care that you do not write to the same data area.
> If some values are written to the same data area by two or more applications including ladder program, unexpected value may be written. In this case, it may cause an unexpected machine behavior and also tools, work pieces, and machines may be damaged. As for details, refer to “SAFETY PRECAUTIONS”.

Table5.4.15 (a) Range of common variables

		Custom macro common variables addition option	
		Not equipped	Equipped
Embedded macro option	Not equipped	#100~#149, #500~#549	#100~#199, #500~#999
	Equipped	#100~#149, #200~#499, #500~#549	#100~#199, #200~#499, #500~#999

> **NOTE**
> For details of the system variables and the common variables of the custom macro, refer to the "OPERATOR’S MANUAL".

Input data structure

Top Address +0	(Function code) 438	
+2	(Completion code) - (Need not to be set)	
+4	(Data length L) 6	
+6	(Data number N) Custom macro variable number (4 bytes)	
+10	(Data attribute M) 0 (2 bytes)	Set 0 to this field.
+12	Mantissa(D1) (4 bytes)	Signed binary format in 4 bytes length
+16 +17	Number of decimal places(D2) (2 bytes)	Signed binary format in 2 bytes length D2 = -1, 0 to 8

You should set values to D1 and D2 when the custom macro variable is expressed by the following formula.

[Custom macro variable] = D1 × 10 $^{-D2}$

There is a "null" state on custom macro variables that means the value is not defined. When you set D1=0 and D2= -1, the custom macro variable becomes "null" state.

Setting data		**Value of the custom macro variable (Result)**
Mantissa (D1)	**Number of decimal places (D2)**	
1234	0	1234
1234	1	123.4
1234	2	12.34
1234	3	1.234
1234	4	0.1234
0	Except -1	0
0	-1	Null

Completion codes

0 Completed successfully.
2 The Data length is invalid.
3 The Data number is invalid.
6 No option for custom macro variables.

Output data structure

Top Address +0	(Function code) 438
+2	(Completion code) ? (See above description)
+4	(Data length L) 6 (Same as input data)
+6	(Data number N) Custom macro variable number (Same as input data)
+10	(Data attribute M) 0 (Same as input data)
+12	Mantissa(D1) (Same as input data)
+16 +17	Number of decimal places(D2) (Same as input data)

5.4.16 Reading the CNC Alarm Status (High-speed Response)

When the CNC is in the alarm status, the alarm status data can be read. The following alarm status data can be read:

(a) First byte of alarm status data

7	6	5	4	3	2	1	0
SR	SV	OH	OT	PS	IO	PW	SW

SW : SW alarm (parameter writing alarm)
PW : PW alarm (alarm requiring power to be turned off)
IO : IO alarm (memory file alarm)
PS : PS alarm (program and operation alarm)
OT : OT alarm (overtravel alarm)
OH : OH alarm (overheat alarm)
SV : SV alarm (servo alarm)
SR : SR alarm (communication alarm)

(b) Second byte of alarm status data

7	6	5	4	3	2	1	0
EX	(Reserved)		BG	IE	DS	SP	MC

MC : MC alarm (macro alarm)
SP : SP alarm (spindle alarm)
DS : DS alarm (other alarm)
IE : IE alarm (malfunction prevention function alarm)
BG : BG alarm (background edit alarm)
EX : EX alarm (External alarm)

(c) Third byte of alarm status data

7	6	5	4	3	2	1	0
(Reserved)							

(d) Fourth byte of alarm status data

7	6	5	4	3	2	1	0
(Reserved)							

Input data structure

Address	Content	Remarks
Top Address +0	(Function code) 23	
+2	(Completion code) - (Need not to be set)	
+4	(Data length L) - (Need not to be set)	
+6	(Data number N) 0	Set 0 to this field.
+8	(Data attribute M) 0	Set 0 to this field.
+10 +41	(Data area) - (Need not to be set)	

Completion codes

0 Completed successfully.

Output data structure

Address	Content	Remarks
Top Address +0	(Function code) 23	
+2	(Completion code) ? (See above description)	
+4	(Data length L) 4	
+6	(Data number N) 0 (Same as input data)	
+8	(Data attribute M) 0 (Same as input data)	
+10 +13	Alarm status	4 bytes bit type

⚠CAUTION

In the previous CNC model (Series 16, 18, 21 etc.), the size of output data are 2 bytes. On this model, note that the size of output data is expanded to 4 bytes.

5.4.17 Reading the Current Program Number (High-speed Response)

The program number of a machining program being executed or selected on the CNC can be read.
When a subprogram is executed on the CNC, the program number of the main program can also be read.
Note that the program number that can be read is the first program number (first loop main program).
This function accepts only 4-digits program numbers. When the specification supports 8-digits program numbers, specify function code 90 to read 8-digits program numbers.

Input data structure

Top Address +0	(Function code) 24	
+2	(Completion code) - (Need not to be set)	
+4	(Data length L) - (Need not to be set)	
+6	(Data number N) 0	Set 0 to this field.
+8	(Data attribute M) 0	Set 0 to this field.
+10 +41	(Data area) - (Need not to be set)	

Completion codes

0 The program number of the currently executing program was read successfully.
5 The program number exceeds 4-digits. (Use function code 90.)

Output data structure

Top Address +0	(Function code) 24	
+2	(Completion code) ? (See above description)	
+4	(Data length L) 4	
+6	(Data number N) 0 (Same as input data)	
+8	(Data attribute M) 0 (Same as input data)	
+10	Current program number (ON)	Unsigned binary, 2 bytes long
+12 +13	Program number of main program (OMN)	Unsigned binary, 2 bytes long

(a) Current program number (ON)
The program number of the program being executed is set.

(b) Program number of main program (OMN)
When the currently executing program is a subprogram, the program number of its main program (first loop main program) is set. When the currently executing program is not a subprogram, 0 is set.

5.4.18 Reading the Current Sequence Number (High-speed Response)

The sequence number of a machining program being executed on the CNC can be read. If sequence numbers are not assigned to all blocks of the machining program, the sequence number of the most recently executed block is read.

Input data structure

Top Address +0	(Function code) 25	
+2	(Completion code) - (Need not to be set)	
+4	(Data length L) - (Need not to be set)	
+6	(Data number N) 0	Set 0 to this field.
+8	(Data attribute M) 0	Set 0 to this field.
+10 +41	(Data area) - (Need not to be set)	

Completion codes

0 The current sequence number has been read normally.

Output data structure

Top Address +0	(Function code) 25	
+2	(Completion code) ? (See above description)	
+4	(Data length L) 4	Note that the data length must be set to 4 bytes even though the current program number is 2 bytes long (the sequence number is indicated by 5 digits).
+6	(Data number N) 0 (Same as input data)	
+8	(Data attribute M) 0 (Same as input data)	
+10 +13	Current sequence number	Unsigned binary

5.4.19 Reading Modal Data (High-speed Response)

Using this function, you can read modal information of CNC.

(1) Reading modal information of G-function (Data number=0 to 33, -1)

Using this function, you can read modal information of G-function.

Input data structure

Top Address +0	(Function code) 32	
+2	(Completion code) - (Need not to be set)	
+4	(Data length L) - (Need not to be set)	
+6	(Data number N) Data type	N=0 to 33: Each data reading (See. Table 5.4.19 (a) to (c)) N=-1: Collective reading (Group No.0 to 31)
+8	(Data attribute M) Specified block	M=0: Current block M=1: Next block M=2: (reserved)
+10	(Data area) - (Need not to be set)	

NOTE
1 The modal information for a block after the next block cannot be read.
2 When a collective reading, the read modal information of groups are from No. 0 to No.31. To read modal information of over No. 31 group, use the each data reading by setting over 31 to the data number N.

Table5.4.19 (a) Modal information of G-function (part 1)

Group number (Data type)	Machining center system		Lathe system			
	G code	Code in a group	G code			Code in a group
			A series	B series	C series	
0	G00	0	G00	G00	G00	0
	G01	1	G01	G01	G01	1
	G02	2	G02	G02	G02	2
	G02.1	27				
	G02.2	10	G02.2	G02.2	G02.2	20
	G02.3	12	G02.3	G02.3	G02.3	22
	G02.4	15	G02.4	G02.4	G02.4	18
	G03	3	G03	G03	G03	3
	G03.2	11	G03.2	G03.2	G03.2	21
	G03.3	13	G03.3	G03.3	G03.3	23
	G03.4	16	G03.4	G03.4	G03.4	19
	G06.2	14	G06.2	G06.2	G06.2	17
	G33	4	G32	G33	G33	4
	G34	24	G34	G34	G34	9
	G35	22	G35	G35	G35	14
	G36	23	G36	G36	G36	15
			G71.3	G71.3	G71.3	10
			G72.3	G72.3	G72.3	11
			G73.3	G73.3	G73.3	12
			G74.3	G74.3	G74.3	13
	G77	6	G90	G77	G20	5
	G78	7	G92	G78	G21	6
	G79	8	G94	G79	G24	7
1	G17	0	G96	G96	G96	1
	G17.1P1	0	G97	G97	G97	0
	G17.1P2	14				
	G17.1P3	18				
	G17.1P4	22				
	G17.1P5	26				
	G18	8				
	G19	4				
2	G90	0		G90	G90	0
	G91	1		G91	G91	1
3	G22	1	G68	G68	G68	1
	G23	0	G69	G69	G69	0
4	G93	2	G93	G93	G93	2
	G94	0	G98	G94	G94	0
	G95	1	G99	G95	G95	1
5	G20(G70)	0	G20	G20	G70	0
	G21(G71)	1	G21	G21	G71	1
6	G40	0	G40	G40	G40	0
	G41	1	G41	G41	G41	1
	G41.2	3	G41.2	G41.2	G41.2	3
	G41.3	5	G41.3	G41.3	G41.3	5
	G41.4	6	G41.4	G41.4	G41.4	6
	G41.5	8	G41.5	G41.5	G41.5	8

Table5.4.19 (b) Modal information of G-function (part 2)

Group number (Data type)	Machining center system		Lathe system			
	G code	Code in a group	G code			Code in a group
			A series	B series	C series	
6	G41.6	10	G41.6	G41.6	G41.6	11
	G42	2	G42	G42	G42	2
	G42.2	4	G42.2	G42.2	G42.2	4
	G42.4	7	G42.4	G42.4	G42.4	7
	G42.5	9	G42.5	G42.5	G42.5	9
	G42.6	11	G42.6	G42.6	G42.6	12
7	G43	1	G25	G25	G25	0
	G43.1	3	G26	G26	G26	1
	G43.3	7				
	G43.4	4				
	G43.5	5				
	G43.7	11				
	G43.8	9				
	G43.9	10				
	G44	2				
	G44.1	12				
	G49(G49.1)	0				
8	G73	10	G22	G22	G22	1
	G74	11	G23	G23	G23	0
	G76	12				
	G80	0				
	G81	1				
	G82	2				
	G83	3				
	G84	4				
	G84.2	13				
	G84.3	14				
	G85	5				
	G86	6				
	G87	7				
	G88	8				
	G89	9				
9	G98	0	G80	G80	G80	0
	G99	1	G81	G81	G81	8
			G82	G82	G82	9
			G83	G83	G83	1
			G83.1	G83.1	G83.1	10
			G83.5	G83.5	G83.5	12
			G83.6	G83.6	G83.6	14
			G84	G84	G84	2
			G84.2	G84.2	G84.2	11
			G85	G85	G85	3
			G87	G87	G87	5
			G87.5	G87.5	G87.5	13
			G87.6	G87.6	G87.6	15
			G88	G88	G88	6
			G89	G89	G89	7

Table5.4.19 (c) Modal information of G-function (part 3)

Group number (Data type)	Machining center system		Lathe system			
	G code	Code in a group	G code			Code in a group
			A series	B series	C series	
10	G50 G51	0 1		G98 G99	G98 G99	0 1
11	G66 G66.1 G67	1 2 0	G66 G66.1 G67	G66 G66.1 G67	G66 G66.1 G67	1 2 0
12	G96 G97	1 0				
13	G54(G54.1) G55 G56 G57 G58 G59	0 1 2 3 4 5	G54(G54.1) G55 G56 G57 G58 G59	G54(G54.1) G55 G56 G57 G58 G59	G54(G54.1) G55 G56 G57 G58 G59	0 1 2 3 4 5
14	G61 G62 G63 G64	1 2 3 0	G61 G62 G63 G64	G61 G62 G63 G64	G61 G62 G63 G64	1 2 3 0
15	G68 G68.2 G68.3 G68.4 G69	1 2 3 4 0	G17 G17.1 G18 G19	G17 G17.1 G18 G19	G17 G17.1 G18 G19	0 10 to 29 4 8
16	G15 G16	0 1	G68.1 G68.2 G68.3 G68.4 G69.1	G68.1 G68.2 G68.3 G68.4 G69.1	G68.1 G68.2 G68.3 G68.4 G69.1	1 2 3 4 0
17	G40.1 G41.1 G42.1	0 1 2		G50 G51	G50 G51	0 1
18	G25 G26	0 1	G40.1 G41.1 G42.1	G40.1 G41.1 G42.1	G40.1 G41.1 G42.1	0 1 2
19			G50.2(G250) G51.2(G251)	G50.2(G250) G51.2(G251)	G50.2(G250) G51.2(G251)	0 1
20	G12.1(G112) G13.1(G113)	1 0	G12.1(G112) G13.1(G113)	G12.1(G112) G13.1(G113)	G12.1(G112) G13.1(G113)	1 0
21	G50.1 G51.1	0 1	G50.1 G51.1	G50.1 G51.1	G50.1 G51.1	0 1
22	G54.2	0 to 8	G43 G43.1 G43.4 G43.5 G43.7(G44.7) G44 G44.1 G49(G49.1)	G43 G43.1 G43.4 G43.5 G43.7(G44.7) G44 G44.1 G49(G49.1)	G43 G43.1 G43.4 G43.5 G43.7(G44.7) G44 G44.1 G49(G49.1)	1 3 4 5 6 2 12 0

Table5.4.19 (d) Modal information of G-function (part 4)

Group number (Data type)	Machining center system		Lathe system			
	G code	Code in a group	G code			Code in a group
			A series	B series	C series	
23	G80.5	0	G15	G15	G15	0
	G81.5	1	G16	G16	G16	1
25			G54.4	G54.4	G54.4	0
26	G44.9	1	G80.5	G80.5	G80.5	0
	G49.9	0	G81.5	G81.5	G81.5	1
27			G80.4	G80.4	G80.4	0
			G81.4	G81.4	G81.4	1
30	G50.2	0				
	G51.2	1				
32	G54.4	0				
33	G80.4	0				
	G81.4	1				

Completion codes

0 Completed successfully
3 The data number is invalid
4 The data attribute is invalid

Output data structure

(1) Each data reading (Data number N=G code group number)

Top Address +0	(Function code) 32	
+2	(Completion code) ? (See above description)	
+4	(Data length L) 2	
+6	(Data number N) Data type (Same as input data)	
+8	(Data attribute M) Specified block (Same as input data)	
+10 +11	Modal information of G-function (2 bytes)	See "Fig. 5.4.19 (a) Modal information of G-function".

(2) Corrective reading (Data number N=-1)

Top Address +0	(Function code) 32	
+2	(Completion code) ? (See above description)	
+4	(Data length L) 2 * n	n=1 to 32: Effective number of G-function group.
+6	(Data number N) -1 (Same as input data)	N=-1: Corrective reading
+8	(Data attribute M) Specified block (Same as input data)	
+10	Modal information of G-function group No.0 (2 bytes)	See "Fig. 5.4.19 (a) Modal information of G-function".
+12	Modal information of G-function group No.1 (2 bytes)	See "Fig. 5.4.19 (a) Modal information of G-function".
~		~
+72 +73	Modal information of G-function group No.31 (2 bytes)	See "Fig. 5.4.19 (a) Modal information of G-function".

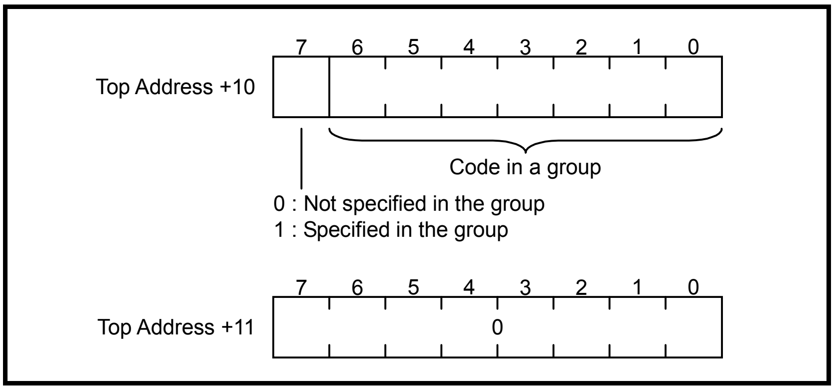


Fig. 5.4.19 (a) Modal information of g-function

(2) Reading modal information of other than G-function (Data number=100 to 126, -2)

Using this function, you can read modal information of other than G-function.

Input data structure

Top Address +0	(Function code) 32	
+2	(Completion code) - (Need not to be set)	
+4	(Data length L) - (Need not to be set)	
+6	(Data number N) Data type	N=100 to 126: Each data reading (See Table 5.4.19(d)) N=-2: Collective read (No.100 to 126)
+8	(Data attribute M) Specified block	M=0: Current block M=1: Next block M=2: (reserved)
+10	(Data area) - (Need not to be set)	

NOTE

A modal information for a block after the next block cannot be read.

Table5.4.19 (e) Modal information of other than G-function

Data type	Specified Address	Description
100	B	Second auxiliary function
101	D	
102	E	(Reserved)
103	F	
104	H	
105	L	
106	M	
107	S	
108	T	
109	R	
110	P	
111	Q	
112	A	
113	C	
114	I	
115	J	
116	K	
117	N	
118	O	
119	U	
120	V	
121	W	
122	X	
123	Y	
124	Z	
125	M2	
126	M3	

Completion codes

0 Completed successfully
3 The data number is invalid
4 The data attribute is invalid

Output data structure

(1) Each data reading (Data number N=See Table 5.4.19 (d))

Top Address +0	(Function code) 32	
+2	(Completion code) ? (See above description)	
+4	(Data length L) 6	
+6	(Data number N) Data type (Same as input data)	
+8	(Data attribute M) Specified block (Same as input data)	
+10 +15	Modal information (6 bytes)	See "Fig. 5.4.19 (b) Modal information of other than G-function".

(2) Corrective reading (Data number N=-2)

Top Address +0	(Function code) 32	
+2	(Completion code) ? (See above description)	
+4	(Data length L) 174	
+6	(Data number N) Data type (Same as input data)	
+8	(Data attribute M) Specified block (Same as input data)	
+10	Modal information of Data type No.100 (6 bytes)	See "Fig. 5.4.19 (b) Modal information of other than G-function".
+16	Modal information of Data type No.101 (6 bytes)	See "Fig. 5.4.19 (b) Modal information of other than G-function".
~		~
+166	Modal information of Data type No.126 (6 bytes)	See "Fig. 5.4.19 (b) Modal information of other than G-function".
+172 +183	Reserved (12 bytes)	

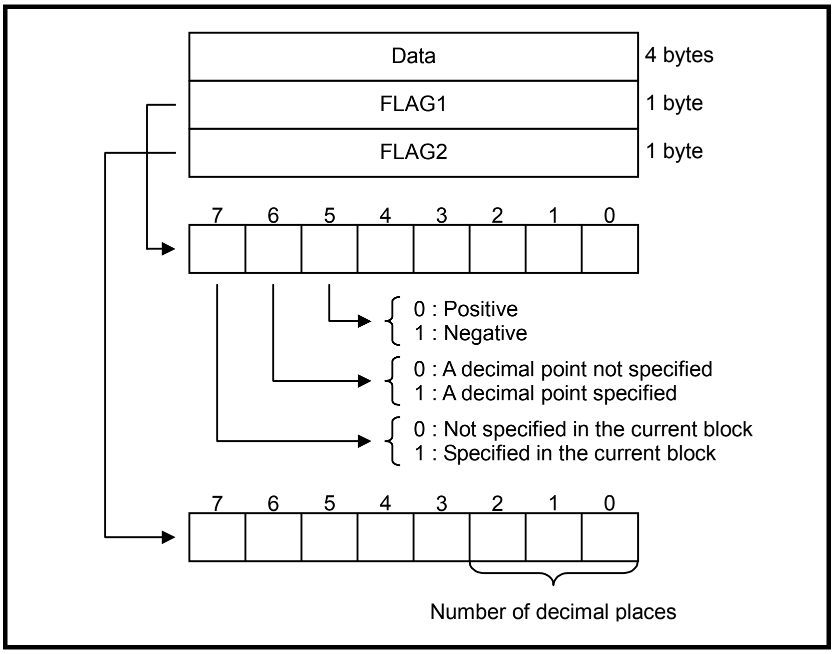


Fig. 5.4.19 (b) Modal information of other than G-function

NOTE

1 The specification of whether a decimal point is specified or not in FLAG1, and the specification of the number of decimal places in FLAG2, are valid only for F code. Even if a decimal point is not specified, the number of decimal places may not be 0.

2 PMC-SB7 outputs the number of input digits to bits 0 to 3 of FLAG1, however 30*i*/31*i*/32*i*/35*i*-B, Power Motion *i*-A, 0*i*-F PMC does not. If you need to have the number of input digits output as with the former specification, read the CNC parameters of the following numbers, by using the window function for reading a parameter (function code 17 or 154).

- For the M function:
  No.3030(allowable number of digits of the M code)
- For the S function:
  No.3031(allowable number of digits of the S code)
- For the T function:
  No.3032(allowable number of digits of the T code)
- For the B function:
  No.3033(allowable number of digits of the B code)

5.4.20 Reading Diagnosis Data (Low-speed Response)

The information displayed on the diagnosis data screen is read by directly accessing the CNC.

Input data structure

Top Address +0	(Function code) 33	
+2	(Completion code) - (Need not to be set)	
+4	(Data length L) - (Need not to be set)	
+6	(Data number N) Diagnosis No.	
+8	(Data attribute M) Axis number	M=0: No axis M=1 to n: axis number M=-1: All axes
+10	(Data area) - (Need not to be set)	

Completion codes

0 Diagnosis data has been read from the CNC normally.
3 The specified diagnosis data number is invalid.
4 The data specified as the data attribute is invalid because it is neither 0, -1, nor a value from 1 to n (n is the number of axes).

Output data structure

(1) In the case of bit, byte, word or double word type data

Top Address +0	(Function code) 33	
+2	(Completion code) ? (See above description)	
+4	(Data length L) L (L = 1, 2, 4, 1×n, 2×n, 4×n)	When no axis or one axis is specified L=1: Bit or byte data L=2: Word data L=4: Double word data When all axes are specified L=1×n: Bit or byte data L=2×n: Word data L=4×n: Double word data
+6	(Data number N) Diagnosis No. (Same as input data)	
+8	(Data attribute M) Axis number (Same as input data)	
+10	Diagnosis data (1, 2, 4 bytes)	Data - dependent form

(2) In the case of Floating point type data

Top Address +0	(Function code) 33	
+2	(Completion code) ? (See above description)	
+4	(Data length L) L (L = 6, 6×n)	When no axis or one axis is specified L=6: Floating point type data When all axes are specified L=6×n: Floating point type data
+6	(Data number N) Diagnosis No. (Same as input data)	
+8	(Data attribute M) Axis number (Same as input data)	
+10	decimal point (2 bytes)	
+12 +15	Diagnosis data (4 bytes)	

5.4.21 Reading Diagnosis Data (High-speed Response)

The specific data displayed on the diagnosis data screen can be read with high-speed response.
Supported numbers of diagnosis data are as follows.

Number	Data
0	CNC internal state 1
308	Servo motor temperature
309	Pulsecoder temperature
403	Temperature of spindle motor
445	Spindle position data
712	Spindle warning state
720	Spindle diagnosis data 1 *Note2
722	Spindle diagnosis data 2 *Note2
750	OVC level
752	DC link voltage information
1580	Spindle duration time
1581	Spindle load max (Current)
4900	Total of current actual power consumption of all axes

NOTE

1 As for a type, a unit and a range of each data, refer to “1.3 DIAGNOSIS FUNCTION” of the MAINTENANCE MANUAL and “13.1 DIAGNOSIS FUNCTION” of the OPERATION AND MAINTENANCE HANDBOOK.

2 The contents of the diagnosis numbers 720 and 722 depend on the setting of CNC parameter No.4532. For details, refer to the MAINTENANCE MANUAL and the PARAMETER MANUAL of AC spindle motor.

Input data structure

Top Address +0	(Function code) 156	
+2	(Completion code) - (Need not to be set)	
+4	(Data length L) - (Need not to be set)	
+6	(Data number N) Diagnosis number	
+8	(Data attribute M) Axis number	M=0: No axis M=1 to n: axis number M=-1: All axes
+10	(Data area) - (Need not to be set)	

Completion codes

0 Diagnosis data has been read from the CNC normally.
3 The specified diagnosis data number is invalid.
4 The data specified as the data attribute is invalid because it is neither 0, -1, nor a value from 1 to n (n is the number of axes).

Output data structure

(1) In the case of bit, byte, word or double word type data

Top Address +0	(Function code) 156	
+2	(Completion code) ? (See above description)	
+4	(Data length L) L (L = 1, 2, 4, 1×n, 2×n, 4×n)	When no axis or one axis is specified L=1: Bit or byte data L=2: Word data L=4: Double word data When all axes are specified L=1×n: Bit or byte data L=2×n: Word data L=4×n: Double word data
+6	(Data number N) Diagnosis number (Same as input data)	
+8	(Data attribute M) Axis number (Same as input data)	
+10	Diagnosis data (1, 2, 4 bytes)	Data - dependent form

(2) In the case of Floating point type data

Top Address +0	(Function code) 156	
+2	(Completion code) ? (See above description)	
+4	(Data length L) L (L = 6, 6×n)	When no axis or one axis is specified L=6: Floating point type data When all axes are specified L=6×n: Floating point type data
+6	(Data number N) Diagnosis number (Same as input data)	
+8	(Data attribute M) Axis number (Same as input data)	
+10	Decimal point (2 bytes)	
+12 +15	Diagnosis data (4 bytes)	

5.4.22 Reading a P-CODE Macro Variable (High-speed Response)

Using this function, you can read a P-CODE variable or an extended P-CODE variable for macro executor.

Data type	Number
P-CODE variables	#10000 to #19999
Extended P-CODE variables	#20000 to #89999

NOTE
For details of the P-CODE variables and extended P-CODE variables, refer to the "Macro Executor PROGRAMMING MANUAL".

Input data structure

Offset	Field	Remarks
Top Address +0	(Function code) 59	
+2	(Completion code) - (Need not to be set)	
+4	(Data length L) - (Need not to be set)	
+6	(Data number N) P-CODE variable number	Signed binary format in 4 bytes length (note)
+10	(Data attribute M) Number of decimal places	M=0: No specifying number of decimal places M=1 to 8: Specifying number of decimal places
+12 +17	(Data area) - (Need not to be set)	

NOTE
The data length is 4 bytes instead of 2 bytes.

Completion codes

0 Completed successfully
3 The data number is invalid.
4 The mantissa is out of range.

Output data structure

Offset	Field	Description
Top Address +0	(Function code) 59	
+2	(Completion code) ? (See above description)	
+4	(Data length L) 6	
+6	(Data number N) P-CODE variable number (Same as input data)	
+10	(Data attribute M) Number of decimal places (Same as input data)	
+12	Mantissa (D1) (4 bytes)	Signed binary format in 4 bytes length
+16 +17	Number of decimal places (D2) (2 bytes)	Signed binary format in 2 bytes length D2 = -1, 0 to 8 (Floating-point type) D2 = 0 to 8 (Integer type)

You can read D1 and D2 when the P-CODE variable is expressed by the following formula.

$$[\text{P-CODE variable}] = D1 \times 10^{-D2}$$

You can define the type of P-CODE variables as a floating-point type or an integer type by the setting of CNC parameter No. 9033#3 and 9033#4.

(a) Floating-point type)
When P-CODE variables are floating-point type, there is a "null" state on P-CODE variables that means the value is not defined. When the P-CODE variable is "null", the D1=0 and the D2 = -1 are read in spite of the specified value of M.

Value of the P-CODE variable	Specified number of decimal places (M)	Result data	
		Mantissa (D1)	Number of decimal places (D2)
1.234	0 (Note)	1234	3
	1	12	1
	2	123	2
	3	1234	3
	4	12340	4
0	1	0	1
Null	-	0	-1

(b) Integer type)
When P-CODE variables are integer type, there is no "null" state.

Value of the P-CODE variable	Specified number of decimal places (M)	Result data	
		Mantissa (D1)	Number of decimal places (D2)
1234	0 (Note)	1234000	3
	1	12340	1
	2	123400	2
	3	1234000	3
	4	12340000	4
0	1	0	1

NOTE

When you set 0 to number of decimal places M, the read value of D2 may changes by the value of the macro variable and the setting of CNC system. So, we recommend to set 1 to 8 to number of decimal places M.

5.4.23 Writing a P-CODE Macro Variable (Low-speed Response)

Using this function, you can write value to a P-CODE variable or an extended P-CODE variable for macro executor.

> ⚠ **WARNING**
> When you write some NC data using both this instruction in ladder program and other applications, take care that you do not write to the same data area.
> If some values are written to the same data area by two or more applications including ladder program, unexpected value may be written. In this case, it may cause an unexpected machine behavior and also tools, work pieces, and machines may be damaged. As for details, refer to “SAFETY PRECAUTIONS”.

Data type	Number
P-CODE variables	#10000 to #19999
Extended P-CODE variables	#20000 to #89999

> **NOTE**
> For details of the P-CODE variables and extended P-CODE variables, refer to the "Macro Executor PROGRAMMING MANUAL".

Input data structure

Top Address +0	(Function code) 60	
+2	(Completion code) - (Need not to be set)	
+4	(Data length L) 6	
+6	(Data number N) P-CODE variable number	Signed binary format in 4 bytes length (note)
+10	(Data attribute M) 0	Reserved You should set 0 to this field.
+12	Mantissa (D1) (4 bytes)	Signed binary format in 4 bytes length
+16 +17	Number of decimal places (D2) (2 bytes)	Signed binary format in 2 bytes length D2 = -1, 0 to 8 (Floating-point type) D2 = 0 to 8 (Integer type)

> **NOTE**
> The data length is 4 bytes instead of 2 bytes.

You should set values to D1 and D2 when the custom macro variable is expressed by the following formula.

[P-CODE variable] = D1 $\times$ 10 $^{-D2}$

You can define the type of P-CODE variables as a floating-point type or an integer type by the setting of CNC parameter No. 9033#3 and 9033#4.

(a) Floating-point type)
When P-CODE variables are floating-point type, there is a "null" state on P-CODE variables that means the value is not defined. When you set D1=0 and D2= -1, the P-CODE variable becomes "null" state.

Setting data		Value of the P-CODE variable (Floating-point)
Mantissa (D1)	**Number of decimal places (D2)**	
1234	0	1234
1234	1	123.4
1234	2	12.34
1234	3	1.234
1234	4	0.1234
0	Except -1	0
0	-1	Null

(b) Integer type)
When P-CODE variables are integer type, there is no "null" state. We recommend setting 0 to number of decimal places D2 for writing to an integer type variable. When a negative value is set to D2, the D2 is regarded as 0.

Setting data		Value of the P-CODE variable (Integer)
Mantissa (D1)	**Number of decimal places (D2)**	
1234	0	1234
1234	1	123
1234	2	12
1234	3	1
1234	4	0
0	Any	0

Completion codes

0 Completed successfully
2 The data length is invalid.
3 The data number is invalid.
6 No option for macro executor

Output data structure

Top Address +0	(Function code) 60
+2	(Completion code) ? (See above description)
+4	(Data length L) 6 (Same as input data)
+6	(Data number N) P-CODE variable number (Same as input data)
+10	(Data attribute M) 0 (Same as input data)
+12	Mantissa (D1) (Same as input data)
+16 +17	Number of decimal places (D2) (Same as input data)

5.4.24 Reading CNC Status Information (High-speed Response)

Status information (status indication on the screen) can be read from the CNC.
The types of status information that can be read are as follows.

(1) Indication of which mode is selected, automatic or manual
(2) Status of automatic operation
(3) Status of movement along the axis and dwelling
(4) Status of M, S, T, and B functions
(5) Statuses of emergency stop and the reset signal
(6) Alarm status
(7) Status of program edits

Input data structure

Top Address +0	(Function code) 76	
+2	(Completion code) - (Need not to be set)	
+4	(Data length L) - (Need not to be set)	
+6	(Data number N) 0	Set 0 to this field.
+8	(Data attribute M) 0	Set 0 to this field.
+10 +41	(Data area) - (Need not to be set)	

Completion codes

0 CNC status information has been read normally.

Output data structure

Top Address +0	(Function code) 76	
+2	(Completion code) ? (See above description)	
+4	(Data length L) 14	
+6	(Data number N) 0 (Same as input data)	
+8	(Data attribute M) 0 (Same as input data)	
+10	Indication of which mode is currently selected, automatic or manual (2 bytes)	0: MDI 1: MEMory 2: **** (Other state) 3: EDIT 4: HaNDle 5: JOG 6: Teach in JOG 7: Teach in HND 8: INC. feed 9: REFerence 10: ReMoTe
+12	Status of automatic operation (2 bytes)	0: **** (Reset state) 1: STOP 2: HOLD 3: STaRT
+14	Status of movement along the axis of dwelling (2 bytes)	0: *** (Other state) 1: MoTioN 2: DWell
+16	Status of M, S, T, and B functions (2 bytes)	0: *** (Other state) 1: FIN
+18	Status of emergency stop (2 bytes)	0: (Releases the emergency stop state) 1: --EMerGency-- 2: -RESET- (The reset signal is on)
+20	Alarm status (2 bytes)	0: *** (Other state) 1: ALarM 2: BATtery low
+22 +23	Status of program edit (2 bytes)	0: ******* (Non editing) 1: EDIT 2: SeaRCH 3: OUTPUT 4: INPUT 5: COMPARE 6: LabelSKip 7: OFST 8: WSFT 9: ReSTaRt

5.4.25 Reading the Current Program Number (8-digits Program Numbers) (High-speed Response)

This function reads CNC program numbers extended to 8 digits from the usual 4 digits.
Basically, this function is the same as function code 24 excluding the different data length of function code 90.

Input data structure

Top Address +0	(Function code) 90	
+2	(Completion code) - (Need not to be set)	
+4	(Data length L) - (Need not to be set)	
+6	(Data number N) 0	Set 0 to this field.
+8	(Data attribute M) 0	Set 0 to this field.
+10 +17	(Data area) - (Need not to be set)	

Completion codes

0 The program number of the currently executing program has been read normally.

Output data structure

Top Address +0	(Function code) 90	
+2	(Completion code) ? (See above description)	
+4	(Data length L) 8	
+6	(Data number N) 0 (Same as input data)	
+8	(Data attribute M) 0 (Same as input data)	
+10	Number of the program currently being executed (ON) (4bytes)	Unsigned binary format, 4-bytes length
+14 +17	Program number of the main program (OMN) (4bytes)	Unsigned binary format, 4-bytes length

(a) Number of the program currently being executed (ON)
The program number of the program currently being executed is set.

(b) Program number of the main program (OMN)
If the program currently being executed is a subprogram, the program number of its main program is set.
If the program currently being executed is not a subprogram, 0 is set.

5.4.26 Entering Data on the Program Check Screen (Low-speed Response)

On the program check screen of the CNC, data can be entered for the spindle tool No. (HD.T) and the next tool No. (NX.T).
This function is effective only when bit 2 of parameter 3108 is 1, and bit 1 of parameter 13200 is 1.

Input data structure

Address	Field	Remarks
Top Address +0	(Function code) 150	
+2	(Completion code) - (Need not to be set)	
+4	(Data length L) 4	
+6	(Data number N) 0, 1	N=0: Spindle tool No. (8 digits) N=1: Next tool No. (8 digits)
+8	(Data attribute M) 0	Set 0 to this field.
+10 +13	Data for the spindle tool No. or data for the next tool No. (4 bytes)	Unsigned binary

Completion codes

0 Data has been entered on the program check screen normally.
2 The data length in bytes is invalid.
3 The data No. is invalid.

Output data structure

Address	Field	Remarks
Top Address +0	(Function code) 150	
+2	(Completion code) ? (See above description)	
+4	(Data length L) 4 (Same as input data)	
+6	(Data number N) (Same as input data)	N=0: Spindle tool No. N=1: Next tool No.
+8	(Data attribute M) 0 (Same as input data)	
+10 +13	Data for the spindle tool No. or data for the next tool No. (4 bytes)	Unsigned binary

5.4.27 Reading Clock Data (Date and Time) (High-speed Response)

The current date (year, month, day) and time (hours, minutes, seconds) can be read from the clock built into the CNC.

Input data structure

Top Address +0	(Function code) 151	
+2	(Completion code) - (Need not to be set)	
+4	(Data length L) - (Need not to be set)	
+6	(Data number N) -1, 0, 1	N=-1: Reads current date and time N=0: Reads current date N=1: Reads current time
+8	(Data attribute M) 0	Set 0 to this field.
+10	(Data area) - (Need not to be set)	

Completion codes

0 Data of the clock built into the CNC has been read normally.
3 A value other than 0, 1, and -1 was specified for the data No.

Output data structure

(1) When reading the current date or the current time.

Top Address +0	(Function code) 151	
+2	(Completion code) ? (See above description)	
+4	(Data length L) 6	
+6	(Data number N) (Same as input data)	
+8	(Data attribute M) 0 (Same as input data)	
+10	Current date (year) or Current time (hours)	Unsigned binary
+12	Current date (month) or Current time (minutes)	Unsigned binary
+14 +15	Current date (day) or Current time (seconds)	Unsigned binary

(2) When both the current date and current time are specified to be read by entering [-1] for the data No.

Top Address +0	(Function code) 151	
+2	(Completion code) ? (See above description)	
+4	(Data length L) 12	
+6	(Data number N) (Same as input data)	
+8	(Data attribute M) 0 (Same as input data)	
+10	Current date (year)	Unsigned binary
+12	Current date (month)	Unsigned binary
+14	Current date (day)	Unsigned binary
+16	Current time (hours)	Unsigned binary
+18	Current time (minutes)	Unsigned binary
+20 +21	Current time (seconds)	Unsigned binary

[Example] Sep. 10th, 1990

Data area	1990
+2	9
+4	10

[Example] 23:59:59
(hours:minutes:seconds)

Data area	23
+2	59
+4	59

5.4.28 Writing Clock Data (Date and Time) (Low-speed Response)

The date (year, month, day) and the time (hours, minutes, seconds) can be written to the clock built into the CNC.

Input data structure

(1) When writing the date or the time.

Top Address +0	(Function code) 139	
+2	(Completion code) - (Need not to be set)	
+4	(Data length L) 6	
+6	(Data number N) 0 , 1	N=0: Writes date N=1: Writes time
+8	(Data attribute M) 0	Set 0 to this field.
+10	Current date (year) or Current time (hours)	Signed binary in 2 bytes length. Year: 2000 to 2096 Hours: 0 to 23
+12	Current date (month) or Current time (minutes)	Signed binary in 2 bytes length. Month: 1 to 12 Minutes: 0 to 59
+14	Current date (day) or Current time (seconds)	Signed binary in 2 bytes length. day: 1 to 31 seconds: 0 to 59

(2) When writing the date and the time.

Address	Content	Description
Top Address +0	(Function code) 139	
+2	(Completion code) - (Need not to be set)	
+4	(Data length L) 12	
+6	(Data number N) -1	N=-1: Writes date and time
+8	(Data attribute M) 0	Set 0 to this field.
+10	Current date (year)	Signed binary in 2 bytes length. Year: 2000 to 2096
+12	Current date (month)	Signed binary in 2 bytes length. Month: 1 to 12
+14	Current date (day)	Signed binary in 2 bytes length. day: 1 to 31
+16	Current time (hours)	Signed binary in 2 bytes length. Hours: 0 to 23
+18	Current time (minutes)	Signed binary in 2 bytes length. Minutes: 0 to 59
+20	Current time (seconds)	Signed binary in 2 bytes length. seconds: 0 to 59

Completion codes

0 Completed successfully.
2 The data length is invalid.
3 The data number is invalid.
5 The specified year, month, day, hours, minutes or seconds are incorrect.

Example Date
"Nov. 8th, 2007"

+0	139
+2	0
+4	6
+6	0
+8	0
+10	2007
+12	11
+14	8

Example Time
"23 hours 59 minutes 59 Seconds"

+0	139
+2	0
+4	6
+6	1
+8	0
+10	23
+12	59
+14	59

Output data structure

(1) When writing the date or the time.

Top Address +0	(Function code) 139
+2	(Completion code) ? (See above description)
+4	(Data length L) 6
+6	(Data number N) (Same as input data)
+8	(Data attribute M) 0 (Same as input data)
+10	Current date (year) or Current time (hours)
+12	Current date (month) or Current time (minutes)
+14 +15	Current date (day) or Current time (seconds)

(2) When writing both the date and time.

Top Address +0	(Function code) 139
+2	(Completion code) ? (See above description)
+4	(Data length L) 12
+6	(Data number N) (Same as input data)
+8	(Data attribute M) 0 (Same as input data)
+10	Current date (year)
+12	Current date (month)
+14	Current date (day)
+16	Current time (hours)
+18	Current time (minutes)
+20 +21	Current time (seconds)

5.4.29 Reading the Pitch Error Compensation Value (High-speed Response)

The pitch error compensation value in the CNC can be read.

Input data structure

Address	Content	Remarks
Top Address +0	(Function code) 395	
+2	(Completion code) - (Need not to be set)	
+4	(Data length L) - (Need not to be set)	
+6	(Data number N) Pitch error compensation No.	
+8	(Data attribute M) 0	Set 0 to this field.
+10 +41	(Data area) - (Need not to be set)	

Completion codes

0 The pitch error compensation value has been read normally.
3 Illegal pitch error compensation number.

Output data structure

Address	Content
Top Address +0	(Function code) 395
+2	(Completion code) ? (See above description)
+4	(Data length L) 1
+6	(Data number N) Pitch error compensation No. (Same as input data)
+8	(Data attribute M) 0 (Same as input data)
+10	Pitch error compensation value (1 byte)

5.4.30 Writing the Pitch Error Compensation Value (Low-speed Response)

The pitch error compensation value can be written in the CNC.

> ⚠ **WARNING**
> When you write some NC data using both this instruction in ladder program and other applications, take care that you do not write to the same data area.
> If some values are written to the same data area by two or more applications including ladder program, unexpected value may be written. In this case, it may cause an unexpected machine behavior and also tools, work pieces, and machines may be damaged. As for details, refer to "SAFETY PRECAUTIONS".

Input data structure

Top Address +0	(Function code) 396	
+2	(Completion code) - (Need not to be set)	
+4	(Data length L) 1	
+6	(Data number N) Pitch error compensation No.	
+8	(Data attribute M) 0	Set 0 to this field.
+10	Pitch error compensation value (1 byte)	

Completion codes

0 The pitch error compensation value has been read normally.
2 Illegal data length.
3 Illegal pitch error compensation number.

Output data structure

Top Address +0	(Function code) 396
+2	(Completion code) ? (See above description)
+4	(Data length L) 1 (Same as input data)
+6	(Data number N) Pitch error compensation No. (Same as input data)
+8	(Data attribute M) 0 (Same as input data)
+10	Pitch error compensation value (Same as input data)

5.4.31 Tool Figure Making Instruction for 3D Interference Check Function (Low-speed Response)

The tool compensation number is notified to make the tool figure to do the interference check by the built-in 3D interference check function automatically. When this PMC window ends normally, the made automatically tool figure becomes the object of the interference check.

Input data structure

Top Address +0	(Function code) 431	
+2	(Completion code) - (Need not to be set)	
+4	(Data length L) 2	
+6	(Data number N) 0	Set 0 to this field.
+8	(Data attribute M) 0	Set 0 to this field.
+10 +11	Tool compensation number (2 bytes)	Signed binary number(1 to) M system: tool radius correction number T system: tool figure correction number

Completion code

0 Normal end
1 This function is not supported.
2 invalid data block length(except 2)
5 When the mistake of the compensation number (smaller than one) or the compensation number is correct, it is a failure of the tool figure making due to the mistake of undefined or the setting data of the offset data of the correction number and the tool figure data.
6 Missing necessary option or parameter TDITL is set to one (No.10930#2).

Output data structure

Top Address +0	(Function code) 431
+2	(Completion code) ? (See above description)
+4	(Data length L) 2 (Same as input data)
+6	(Data number N) 0 (Same as input data)
+8	(Data attribute M) 0 (Same as input data)
+10 +11	(correction number) 2 bytes (Same as input data)

⚠ **CAUTION**

The 3D interference check function is not effective while executing this PMC window.

5.4.32 Reading Detailed Information of CNC Alarm

You can read detailed information of 30 CNC alarms in the maximum. Moreover, you can read detailed information of CNC alarms selected by an alarm type of input data.
The detailed information of CNC alarm is as follows.
- Axis number
- Alarm type
- Alarm number

Input data structure

	Offset	Content	Remarks
Top Address	+0	(Function code) 433	
	+2	(Completion code) - (Need not to be set)	
	+4	(Data length L) - (Need not to be set)	
	+6	(Data number N) Maximum number of alarms	N = 1 to 30
	+8	(Data attribute M) Alarm type number	-1: All alarm types 0- n: Alarm type
	+10 +(12+8*(N-1)+7)	(Data) - (Need not to be set)	

(1) Maximum number of alarms
You can set the number of alarms to read.
The maximum value is 30.

NOTE
The appropriate size of the data area corresponding to the maximum number of alarms is necessary.

(2) Alarm type number
A correspondence table of the alarm type and the alarm type number is as follows.

Alarm type number	Alarm type	Alarm type number	Alarm type
-1	All alarm	10	DS alarm
0	SW alarm	11	IE alarm
1	PW alarm	12	BG alarm
2	IO alarm	13	(Reserve)
3	PS alarm	14	(Reserve)
4	OT alarm	15	EX alarm
5	OH alarm	16	(Reserve)
6	SV alarm	17	(Reserve)
7	SR alarm	18	(Reserve)
8	MC alarm	19	(Reserve)
9	SP alarm	20	(Reserve)

Completion codes

0: Completed successfully
1: Not supported
3: The maximum number of alarms is invalid.
   You should set the number 1 to 30.
4: Alarm type number is invalid.

Output data structure

Address	Data	Description	
Top Address +0	(Function code) 433		
+2	(Completion code) ? (See above description)		
+4	(Data length L) (L = 2 + 8 × N)		
+6	(Data number N) (Same as input data)		
+8	(Data attribute M) (Same as input data)		
+10	Number of alarms (2 bytes)	0 to 30	
+12	Axis information (4bytes)	Bit format in 4 bytes length Refer to the "[Output data structure] (1) Structure of detailed alarm information" for details.	1st
+16	Alarm type number (2bytes)	Signed binary format in 2 bytes length Refer to the "[Input data structure] (2) Alarm type number" for details.	1st
+18	Alarm number (2bytes)	Signed binary format in 2 bytes length 0 to 32767	1st
~		~	
+(12+8×(N-1))	Axis information (4bytes)		N th
+(12+8×(N-1)+4)	Alarm type number (2bytes)		N th
+(12+8×(N-1)+6) +(12+8×(N-1)+7)	Alarm number (2bytes)		N th

NOTE
1 When the "number of alarms" is less than "maximum number of alarms" that you specify, the data at the position of "number of alarms" or after are set with 0 in "axis information" and -1 in "alarm type number" and "alarm number".
2 You ought not to program as depended on output order of the alarm information because this order may be changed.

(1) Structure of detailed alarm information
When the occurrence alarm is axis type, the bit corresponding to the axis number is set to 1.
When the occurrence alarm is not axis type, all bits are set to 0.

Axis information (4bytes)

	7	6	5	4	3	2	1	bit0
+12+8×(N-1)+0	8	7	6	5	4	3	2	1
+1	16	15	14	13	12	11	10	9
+2	24	23	22	21	20	19	18	17
+3	32	31	30	29	28	27	26	25

[Example]

NC alarm : EX0005(Not axis type)
: SV0302(An alarm for the 1st axis.)
: OT0500(An alarm for the 3rd axis.)

When these alarms occur, the read data is as follows.

1. In case that all alarm types are read and the maximum number of alarms is set to 4.

Top Address	+0	(Function code) 433	
	+2	(Completion code) 0	
	+4	(Data length) 34	
	+6	(Data number) Maximum number of alarms 4	
	+8	(Data attribute) Alarm type number -1	
	+10	Number of alarms 3	
	+12	Axis information 0	
	+16	Alarm type number 15	1 st
	+18	Alarm number 5	
	+20	Axis information 1	
	+24	Alarm type number 6	2 nd
	+26	Alarm number 302	
	+28	Axis information 4	
	+32	Alarm type number 4	3 rd
	+34	Alarm number 500	
	+36	Axis information 0	
	+40	Alarm type number -1	4 th
	+42 +43	Alarm number -1	

2. In case that OT alarm type is read and the maximum number of alarms is set to 4.

Top Address	+0	(Function code) 433	
	+2	(Completion code) 0	
	+4	(Data length) 34	
	+6	(Data number) Maximum number of alarms 4	
	+8	(Data attribute) Alarm type number 4	
	+10	Number of alarms 1	
	+12	Axis information 4	1 st
	+16	Alarm type number 4	1 st
	+18	Alarm number 500	1 st
	+20	Axis information 0	2 nd
	+24	Alarm type number -1	2 nd
	+26	Alarm number -1	2 nd
	+28	Axis information 0	3 rd
	+32	Alarm type number -1	3 rd
	+34	Alarm number -1	3 rd
	+36	Axis information 0	4 th
	+40	Alarm type number -1	4 th
	+42 +43	Alarm number -1	4 th

5.4.33 Command for Changing the Interference Object for 3D Interference Check Function (Low-speed Response)

In built-in 3D interference check function, the interference object number and the valid figure number are notified in order to change the interference object.

> **NOTE**
> The option for Built-in 3D interference is necessary to use this function.

Input data structure

Top Address	+0	(Function code) 436	
	+2	(Completion code) - (Need not to be set)	
	+4	(Data length L) 2	
	+6	(Data number N) Interference object number	Signed binary number. (1 to 6)
	+8	(Data attribute M) 0	Set 0 to this field.
	+10	Valid figure number (2byte)	Signed binary number. (0 to 10)

Completion codes

0 Completed successfully.
1 The Function code is invalid.
2 The Data length is invalid.
3 The Interference object number is invalid.
5 The Valid figure number is invalid.
6 Necessary option missing.

Output data structure

Top Address	+0	(Function code) 436
	+2	(Completion code) ? (See above description)
	+4	(Data length L) 2 (Same as input data)
	+6	(Data number N) Interference object number (Same as input data)
	+8	(Data attribute M) 0 (Same as input data)
	+10	Valid figure number (Same as input data)

5.4.34 Reading CNC ID Number (Low-speed Response)

CNC identification number 1 to 4 displayed on an ID-INF screen of CNC are read.

Input data structure

Top Address +0	(Function code) 447	
+2	(Completion code) - (Need not to be set)	
+4	(Data length L) - (Need not to be set)	
+6	(Data number N) 0	Set 0 to this field.
+8	(Data attribute M) 0	Set 0 to this field.
+10 +25	(Data area) - (Need not to be set)	

Completion codes

0 Completed successfully.
1 Not supported.
3 The data number is invalid.
4 The data attribute is invalid.

Output data structure

Top Address +0	(Function code) 447	
+2	(Completion code) ? (See above description)	
+4	(Data length L) 16 (L = 4 bytes * 4)	
+6	(Data number N) 0 (Same as input data)	
+8	(Data attribute M) 0 (Same as input data)	
+10	CNC ID number 1 (4 bytes)	Binary
+14	CNC ID number 2 (4 bytes)	Binary
+18	CNC ID number 3 (4 bytes)	Binary
+22 +25	CNC ID number 4 (4 bytes)	Binary

5.4.35 Reading repetition count for subprogram calls / canned cycle (High-speed Response)

When a subprogram is executed by specifying repetition count or a canned cycle is executed by specifying repetition count in a NC program operation, specified repetition count and remaining repetition count can be read.

Example of reading the repetition count:

The case that specified repetition count of subprogram call is 3.

Calling block of main program	Calling order of executing subprogram “P1000”	Remaining repetition count	Specified repetition count
M98P1000L3	First	3	3
	Second	2	3
	Third	1	3

Input data structure

Address	Field	Remark
Top Address +0	(Function code) 449	
+2	(Completion code) - (Need not to be set)	
+4	(Data length L) - (Need not to be set)	
+6	(Data number N) 0	Set 0 to this field.
+8	(Data attribute M) 0	Set 0 to this field.
+10 +17	(Data area) - (Need not to be set)	

Completion codes

0 Completed successfully.
1 This function is unsupported.
3 The data number is invalid.
4 The data attribute is invalid.

Output data structure

Address	Content
Top Address +0	(Function code) 449
+2	(Completion code) ? (See above description)
+4	(Data length L) 8
+6	(Data number N) 0 (Same as input data)
+8	(Data attribute M) 0 (Same as input data)
+10	Remaining repetition count (4 bytes)
+14 +17	Specified repetition count (4 bytes)

NOTE

1 When a subprogram is executed by specifying no repetition count or a canned cycle is executed by specifying no repetition count, this window function can read “0” as the remaining repetition count and the specified repetition count.

2 When a subprogram is not executed or a canned cycle is not executed, this window function can read “-1” as the remaining repetition count and the specified repetition count.

5.5 AXIS INFORMATION

5.5.1 Reading the Actual Velocity of Controlled Axes (High-speed Response)

The actual velocity of a movement on CNC-controlled axes can be read. Note that the read speed is the composite velocity for the controlled axes. When movement involves only the basic three axes, the X, Y, and Z axes, the composite velocity equals the actual velocity. When movement, however, involves the fourth axis, such as a rotation axis or a parallel axis, as well as some of the basic three axes, the composite velocity for all the relevant axes does not equal the actual velocity.

Input data structure

Address	Field	Remarks
Top Address +0	(Function code) 26	
+2	(Completion code) - (Need not to be set)	
+4	(Data length L) - (Need not to be set)	
+6	(Data number N) 0	Set 0 to this field.
+8	(Data attribute M) 0	Set 0 to this field.
+10 +41	(Data area) - (Need not to be set)	

Completion codes

0 The actual velocity for the controlled axes has been read normally.

Output data structure

Address	Field	Remarks
Top Address +0	(Function code) 26	
+2	(Completion code) ? (See above description)	
+4	(Data length L) 4	
+6	(Data number N) 0 (Same as input data)	
+8	(Data attribute M) 0 (Same as input data)	
+10 +13	Actual velocity for controlled axes (4 bytes)	Unsigned binary <Data increments> • Input in mm : 1mm/min. • Input in inches : 0.01 inch/min

5.5.2 Reading the Absolute Position (Absolute Coordinates) of Controlled Axes (High-speed Response)

The absolute coordinates of the CNC-controlled axes for movement can be read. According to the setting of NC parameter No.3104#6 (DAL) and No.3104#7(DAC), the absolute coordinates can be read. The values are the same as values displayed in the screen

Input data structure

Address	Field	Remarks
Top Address +0	(Function code) 27	
+2	(Completion code) - (Need not to be set)	
+4	(Data length L) - (Need not to be set)	
+6	(Data number N) 0	Set 0 to this field.
+8	(Data attribute M) Axis number	M=1 to n: Absolute coordinate of a specific axis. (n is the axis number.) M=-1: Coordinates of all axes
+10 +41	(Data area) - (Need not to be set)	

Completion codes

0 The absolute coordinates of the controlled axes have been read normally.

4 Data specified as the data attribute is invalid because it is neither -1 nor a value from 1 to n (n is the number of axes). Alternatively, the specified axis number is greater than the number of controlled axes.

Output data structure

(1) When reading a specified axis.

Address	Field	Remarks
Top Address +0	(Function code) 27	
+2	(Completion code) ? (See above description)	
+4	(Data length L) 4	
+6	(Data number N) 0 (Same as input data)	
+8	(Data attribute M) Axis number (Same as input data)	
+10 +13	Absolute coordinate of the controlled axis specified (4 bytes)	Signed binary (A negative value is represented in 2's complement)

(2) When reading all axes. (ex. number of controlled axes is 3)

Top Address +0	(Function code) 27	
+2	(Completion code) ? (See above description)	
+4	(Data length L) 12 (4bytes * 3axes)	
+6	(Data number N) 0 (Same as input data)	
+8	(Data attribute M) -1 (Same as input data)	M=-1: All axes.
+10	Absolute coordinate of the first axis (4 bytes)	Signed binary (A negative value is represented in 2's complement)
+14	Absolute coordinate of the second axis (4 bytes)	Signed binary (A negative value is represented in 2's complement)
+18 +21	Absolute coordinate of the third axis (4 bytes)	Signed binary (A negative value is represented in 2's complement)

Output data unit

Input system	Increment system				
	IS-A	IS-B	IS-C	IS-D	IS-E
mm, deg	0.01	0.001	0.0001	0.00001	0.000001
inch	0.001	0.0001	0.00001	0.000001	0.0000001

NOTE

The reading position does not depend on the diameter or radius setting even using the Diameter and Radius Setting Switching function but depends only on the setting of the CNC parameter No. 1006#3 (DIAx).

5.5.3 Reading the Machine Position (Machine Coordinates) of Controlled Axes (High-speed Response)

The machine coordinates of CNC-controlled axes for movement can be read. The machine position is read with the machine unit.

Input data structure

Address	Field	Description
Top Address +0	(Function code) 28	
+2	(Completion code) - (Need not to be set)	
+4	(Data length L) - (Need not to be set)	
+6	(Data number N) 0	Set 0 to this field.
+8	(Data attribute M) Axis number	M=1 to n: Machine coordinate of a specific axis. (n is the axis number.) M=-1: Coordinates of all axes
+10 +41	(Data area) - (Need not to be set)	

Completion codes

0 The machine coordinates of the controlled axes have been read normally.

4 Data specified as the data attribute is invalid because it is neither -1 nor a value from 1 to n (n is the number of axes). Alternatively, the specified axis number is greater than the number of the controlled axes.

Output data structure

(1) When reading a specified axis.

Address	Field	Description
Top Address +0	(Function code) 28	
+2	(Completion code) ? (See above description)	
+4	(Data length L) 4	
+6	(Data number N) 0 (Same as input data)	
+8	(Data attribute M) Axis number (Same as input data)	
+10 +13	Machine coordinate of the controlled axis specified (4 bytes)	Signed binary (A negative value is represented in 2's complement)

(2) When reading all axes. (Ex. number of controlled axes is 3)

Top Address +0	(Function code) 28	
+2	(Completion code) ? (See above description)	
+4	(Data length L) 12 (4bytes × 3axes)	
+6	(Data number N) 0 (Same as input data)	
+8	(Data attribute M) -1 (Same as input data)	M=-1: All axes.
+10	Machine coordinate of the first axis (4 bytes)	Signed binary (A negative value is represented in 2's complement)
+14	Machine coordinate of the second axis (4 bytes)	Signed binary (A negative value is represented in 2's complement)
+18 +21	Machine coordinate of the third axis (4 bytes)	Signed binary (A negative value is represented in 2's complement)

Output data unit

Machine system	Increment system				
	IS-A	**IS-B**	**IS-C**	**IS-D**	**IS-E**
mm, deg	0.01	0.001	0.0001	0.00001	0.000001
inch	0.001	0.0001	0.00001	0.000001	0.0000001

⚠CAUTION

When an inch machine is used in metric input, or when a millimeter machine is used in inch input, the machine position that is read with bit 0 of parameter No. 3104 set to 1 differs from the value indicated by the CNC. In this case, therefore, the value read through the ladder must be calculated (converted).

NOTE

1 The reading position does not depend on the diameter or radius setting even using the Diameter and Radius Setting Switching function but depends only on the setting of the CNC parameter No. 1006#3 (DIAx).
2 Update cycle of the machine position becomes faster by setting 1 to the CNC parameter No. 11300#5 (MPH). You should apply this setting only if necessary because this setting may lower the performance of CNC a little.

5.5.4 Reading a Skip Position (Stop Coordinates of Skip Operation (G31)) of Controlled Axes (High-speed Response)

When a block of the skip operation (G31) is executed by the CNC and the skip signal goes on to stop the machine, the absolute coordinates of the stop position on the axes of movement can be read.

Input data structure

Address	Field	Description
Top Address +0	(Function code) 29	
+2	(Completion code) - (Need not to be set)	
+4	(Data length L) - (Need not to be set)	
+6	(Data number N) 0	Set 0 to this field.
+8	(Data attribute M) Axis number	M=1 to n: Skip coordinate on a specific axis. (n is the axis number.) M=-1: Coordinates on all axes
+10 +41	(Data area) - (Need not to be set)	

Completion codes

0 The coordinates of the skip stop position for the controlled axes have been read normally.

4 Data specified for the data attribute is invalid because it is neither -1 nor a value from 1 to n (n is the number of axes). Alternatively, the specified axis number is greater than the number of controlled axes.

Output data structure

(1) When reading a specified axis.

Address	Field	Description
Top Address +0	(Function code) 29	
+2	(Completion code) ? (See above description)	
+4	(Data length L) 4	
+6	(Data number N) 0 (Same as input data)	
+8	(Data attribute M) Axis number (Same as input data)	
+10 +13	Skip coordinate of the controlled axis specified (4 bytes)	Signed binary (A negative value is represented in 2's complement)

(2) When reading all axes. (ex. number of controlled axes is 3)

Top Address +0	(Function code) 29	
+2	(Completion code) ? (See above description)	
+4	(Data length L) 12 (4bytes × 3axes)	
+6	(Data number N) 0 (Same as input data)	
+8	(Data attribute M) -1 (Same as input data)	M=-1: All axes.
+10	Skip coordinate of the first axis (4 bytes)	Signed binary (A negative value is represented in 2's complement)
+14	Skip coordinate of the second axis (4 bytes)	Signed binary (A negative value is represented in 2's complement)
+18 +21	Skip coordinate of the third axis (4 bytes)	Signed binary (A negative value is represented in 2's complement)

Output data unit

Input system	Increment system				
	IS-A	**IS-B**	**IS-C**	**IS-D**	**IS-E**
mm, deg	0.01	0.001	0.0001	0.00001	0.000001
inch	0.001	0.0001	0.00001	0.000001	0.0000001

NOTE

The reading position does not depend on the diameter or radius setting even using the Diameter and Radius Setting Switching function but depends only on the setting of the CNC parameter No. 1006#3 (DIAx).

5.5.5 Reading the Servo Delay for Controlled Axes (High-speed Response)

The servo delay, which is the difference between the specified coordinates of CNC-controlled axes and the actual servo position, can be read.

Input data structure

Top Address +0	(Function code) 30	
+2	(Completion code) - (Need not to be set)	
+4	(Data length L) - (Need not to be set)	
+6	(Data number N) Unit	N=0: Read with Input unit N=1: Read with Detection unit
+8	(Data attribute M) Axis number	M=1 to n: Axis number M=-1: All axes
+10 +n	(Data area) - (Need not to be set)	

Completion codes

0 The servo delay for the controlled axes have been read normally.
3 The data number is invalid.
4 The data specified as the data attribute is invalid because it is neither -1 nor a value from 1 to n (n is the number of axes). Alternatively, the specified axis number is greater than the number of controlled axes.

Output data structure

(1) When reading a specified axis.

Top Address +0	(Function code) 30	
+2	(Completion code) ? (See above description)	
+4	(Data length L) 4	
+6	(Data number N) Unit (Same as input data)	
+8	(Data attribute M) Axis number (Same as input data)	
+10 +13	Servo delay (4 bytes)	Signed binary format in 4 bytes length.

(2) When reading all axes. (ex. number of controlled axes is 3)

Top Address +0	(Function code) 30	
+2	(Completion code) ? (See above description)	
+4	(Data length L) 12 (4bytes × 3axes)	
+6	(Data number N) Unit (Same as input data)	
+8	(Data attribute M) -1 (Same as input data)	M=-1: All axes.
+10	Servo delay of 1st axis (4 bytes)	Signed binary format in 4 bytes length
+14	Servo delay of 2nd axis (4 bytes)	Signed binary format in 4 bytes length
+18 +21	Servo delay of 3rd axis (4 bytes)	Signed binary format in 4 bytes length

Output data unit

(1) In case of the data number N=0

Input system	Increment system				
	IS-A	IS-B	IS-C	IS-D	IS-E
mm, deg	0.01	0.001	0.0001	0.00001	0.000001
inch	0.001	0.0001	0.00001	0.000001	0.0000001

(2) In case of the data number N=1
Detection unit

NOTE
The reading position does not depend on the diameter or radius setting even using the Diameter and Radius Setting Switching function but depends only on the setting of the CNC parameter No. 1006#3 (DIAx).

5.5.6 Reading the Acceleration/Deceleration Delay on Controlled Axes (High-speed Response)

The acceleration/deceleration delay, which is the difference between the coordinates of controlled axes programmed in the CNC and the position after acceleration/deceleration is performed, can be read.

Input data structure

Top Address +0	(Function code) 31	
+2	(Completion code) - (Need not to be set)	
+4	(Data length L) - (Need not to be set)	
+6	(Data number N) Unit	N=0: Read with Input unit N=1: Read with Detection unit
+8	(Data attribute M) Axis number	M=1 to n: Axis number M=-1: All axes
+10 +n	(Data area) - (Need not to be set)	

Completion codes

0 The acceleration/deceleration delay for the control axis has been read normally.
3 The data number is invalid.
4 The data specified as the data attribute is invalid because it is neither -1 nor a value from 1 to n (n is the number of axes). Alternatively, the specified axis number is greater than the number of controlled axes.

Output data structure

(1) When reading a specified axis.

Top Address +0	(Function code) 31	
+2	(Completion code) ? (See above description)	
+4	(Data length L) 4	
+6	(Data number N) Unit (Same as input data)	
+8	(Data attribute M) Axis number (Same as input data)	
+10 +13	Acc./Dec. delay (4 bytes)	Signed binary format in 4 bytes length.

(2) When reading all axes. (ex. number of controlled axes is 3)

Address	Content	Remarks
Top Address +0	(Function code) 31	
+2	(Completion code) ? (See above description)	
+4	(Data length L) 12 (4bytes × 3axes)	
+6	(Data number N) Unit (Same as input data)	
+8	(Data attribute M) -1 (Same as input data)	M=-1: All axes.
+10	ACC./Dec. delay of 1st axis (4 bytes)	Signed binary format in 4 bytes length
+14	ACC./Dec. delay of 2nd axis (4 bytes)	Signed binary format in 4 bytes length
+18 +21	ACC./Dec. delay of 3rd axis (4 bytes)	Signed binary format in 4 bytes length

Output data unit

(1) In case of the data number N=0

Input system	Increment system				
	IS-A	**IS-B**	**IS-C**	**IS-D**	**IS-E**
mm, deg	0.01	0.001	0.0001	0.00001	0.000001
inch	0.001	0.0001	0.00001	0.000001	0.0000001

(2) In case of the data number N=1
Detection unit

NOTE
The reading position does not depend on the diameter or radius setting even using the Diameter and Radius Setting Switching function but depends only on the setting of the CNC parameter No. 1006#3 (DIAx).

5.5.7 Reading the Feed Motor Load Current Value (A/D Conversion Data) (High-speed Response)

The digital value converted from the load current of the CNC-controlled axis can be read.

NOTE
The load current value of Cs-axis can not be read.
If you want to know the load information of Cs-axis, use the function code No.153 (Reading load information of the spindle motor).

Input data structure

Offset	Field	Description
Top Address +0	(Function code) 34	
+2	(Completion code) - (Need not to be set)	
+4	(Data length L) - (Need not to be set)	
+6	(Data number N) 2	Type of analog voltage N=2: Load information for the CNC-controlled axes.
+8	(Data attribute M) Axis number	M=1 to n ('n' is maximum axis number)
+10	(Data area) - (Need not to be set)	

(a) Type of analog voltage (data number)

N	Type of analog voltage
0	(reserved)
2	Load information for the CNC-controlled axes

NOTE
There is no analog input function on 30*i*/31*i*/32*i*/35*i*-B, Power Motion *i*-A, 0*i*-F. If you need such a function, read A/D conversion data directly using the I/O Link analog input module. For details, see “CONNECTION MANUAL (HARDWARE)”.

(b) Specifying a CNC-controlled axis (data attribute)
Specify a CNC-controlled axis number for which the voltage conversion data for the load current is to be read.

Completion codes

0 A/D conversion data has been read normally.
3 The data specified for the data number is invalid.
4 The data specified for the data attribute is invalid, or the specified axis number is greater than the number of controlled axes.

Output data structure

Top Address +0	(Function code) 34	
+2	(Completion code) ? (See above description)	
+4	(Data length L) 2	
+6	(Data number N) 2 (Same as input data)	
+8	(Data attribute M) Axis number (Same as input data)	
+10	A/D conversion data	Binary number from 0 to +/-6554
+11	(2 bytes)	

(a) A/D conversion data (AD) of CNC controlled axis load information
The load current for the specified CNC controlled axis is converted into analog voltage, the input to the A/D converter to output a digital data.
The value actually set in the AD field is obtained from the following formula:

$$\mathbf{(AD)} \times \frac{\mathbf{N}}{\mathbf{6554}} = \textbf{Load current } [\mathbf{A_{peak}}]$$

AD = A/D conversion data [Value read by the window function (±)]
N = Nominal current limit (Maximum current (Imax)) for the amplifier corresponding to the motor

NOTE
For the nominal current limits (Maximum current (Imax)) of servo amplifier, see the descriptions manual of the servo amplifier.

5.5.8 Reading the Actual Spindle Speed (High-speed Response)

The actual speed of the spindle can be read from the CNC.

Input data structure

Address	Field	Remarks
Top Address +0	(Function code) 50	
+2	(Completion code) - (Need not to be set)	
+4	(Data length L) - (Need not to be set)	
+6	(Data number N) 0	Set 0 to this field.
+8	(Data attribute M) 0	Set 0 to this field.
+10 +41	(Data area) - (Need not to be set)	

Completion codes

0 The actual speed of the spindle has been read normally.

Output data structure

Address	Field	Remarks
Top Address +0	(Function code) 50	
+2	(Completion code) ? (See above description)	
+4	(Data length L) 4	
+6	(Data number N) 0 (Same as input data)	
+8	(Data attribute M) 0 (Same as input data)	
+10 +13	Actual spindle speed	Unsigned binary <Data unit> 1/min

5.5.9 Reading the Relative Position on a Controlled Axis (High-speed Response)

The relative coordinates of the machine moving along an axis controlled by the CNC can be read. According to the setting of NC parameter No.3104#4 (DRL) and No.3104#5 (DRC), the relative coordinates can be read. The values are the same as values displayed in the screen

Input data structure

Address	Field	Remarks
Top Address +0	(Function code) 74	
+2	(Completion code) - (Need not to be set)	
+4	(Data length L) - (Need not to be set)	
+6	(Data number N) 0	Set 0 to this field.
+8	(Data attribute M) Axis number	M=1 to n: Reads the relative coordinates of each axis. (n is an axis No.) M=-1: Reads the relative coordinates of all axes
+10 +41	(Data area) - (Need not to be set)	

Completion codes

0 The relative coordinates on the controlled axis have been read normally.

4 The specified data attribute is invalid. That is, a value other than -1 and 1 to n (number of axes) was specified, or the specified axis No. was greater than the number of controlled axes.

Output data structure

(1) When reading a specified axis.

Address	Field	Remarks
Top Address +0	(Function code) 74	
+2	(Completion code) ? (See above description)	
+4	(Data length L) 4	
+6	(Data number N) 0 (Same as input data)	
+8	(Data attribute M) Axis number (Same as input data)	
+10 +13	Relative coordinates on the specified controlled axis (4 bytes)	Signed binary (A negative value is represented in 2's complement)

(2) When reading all axes. (ex. number of controlled axes is 3)

Address	Data	Remarks
Top Address +0	(Function code) 74	
+2	(Completion code) ? (See above description)	
+4	(Data length L) 12 (4bytes * 3axes)	
+6	(Data number N) 0 (Same as input data)	
+8	(Data attribute M) -1 (Same as input data)	M=-1: All axes.
+10	Relative coordinates on the first axis (4 bytes)	Signed binary (A negative value is represented in 2's complement)
+14	Relative coordinates on the second axis (4 bytes)	Signed binary (A negative value is represented in 2's complement)
+18 +21	Relative coordinates on the third axis (4 bytes)	Signed binary (A negative value is represented in 2's complement)

Output data unit

Input system	Increment system				
	IS-A	**IS-B**	**IS-C**	**IS-D**	**IS-E**
mm, deg	0.01	0.001	0.0001	0.00001	0.000001
inch	0.001	0.0001	0.00001	0.000001	0.0000001

NOTE

The reading position does not depend on the diameter or radius setting even using the Diameter and Radius Setting Switching function but depends only on the setting of the CNC parameter No. 1006#3 (DIAx).

5.5.10 Reading the Remaining Travel (High-speed Response)

The remaining travel of the machine along an axis controlled by the CNC can be read. The unit of the read data is different whether the move command setting of the axis is radius specification or diameter specification. When the move command setting of the axis is radius specification, the CNC parameter No.1006#3 is “0”, the read data is double of the data that is displayed on a CNC position screen. When the move command setting of the axis is diameter specification, the CNC parameter No.1006#3 is “1”, the read data is the same as the data that is displayed on a CNC position screen.

Input data structure

Top Address +0	(Function code) 75	
+2	(Completion code) - (Need not to be set)	
+4	(Data length L) - (Need not to be set)	
+6	(Data number N) 0	Set 0 to this field.
+8	(Data attribute M) Axis number	M=1 to n: Reads the remaining travel along each axis. (n is an axis No.) M=-1: Reads the remaining travel along all axes
+10 +41	(Data area) - (Need not to be set)	

Completion codes

0 The remaining travel along the controlled axis has been read normally.

4 The specified data attribute is invalid. That is, a value other than -1 and 1 to n (number of axes) was specified, or the specified axis No. was greater than the number of controlled axes.

Output data structure

(1) When reading a specified axis.

Top Address +0	(Function code) 75	
+2	(Completion code) ? (See above description)	
+4	(Data length L) 4	
+6	(Data number N) 0 (Same as input data)	
+8	(Data attribute M) Axis number (Same as input data)	
+10 +13	Remaining travel along the specified controlled axis (4 bytes)	Signed binary (A negative value is represented in 2's complement)

(2) When reading all axes. (ex. number of controlled axes is 3)

Offset	Content	Remarks
Top Address +0	(Function code) 75	
+2	(Completion code) ? (See above description)	
+4	(Data length L) 12 (4bytes × 3axes)	
+6	(Data number N) 0 (Same as input data)	
+8	(Data attribute M) -1 (Same as input data)	M=-1: All axes.
+10	Remaining travel along the first axis (4 bytes)	Signed binary (A negative value is represented in 2's complement)
+14	Remaining travel along the second axis (4 bytes)	Signed binary (A negative value is represented in 2's complement)
+18 +21	Remaining travel along the third axis (4 bytes)	Signed binary (A negative value is represented in 2's complement)

Output data unit

Setting of move command (CNC parameter 1006#3)	**Input system**	**Increment system**				
		IS-A	**IS-B**	**IS-C**	**IS-D**	**ID-E**
Radius specification (1006#3=0)	mm deg	0.005	0.0005	0.00005	0.000005	0.0000005
	inch	0.0005	0.00005	0.000005	0.0000005	0.00000005
Diameter specification (1006#3=1)	mm deg	0.01	0.001	0.0001	0.00001	0.000001
	inch	0.001	0.0001	0.00001	0.000001	0.0000001

NOTE

The reading position does not depend on the diameter or radius setting even using the Diameter and Radius Setting Switching function but depends only on the setting of the CNC parameter No. 1006#3 (DIAx).

5.5.11 Reading the Actual Velocity of each Controlled Axis (High-speed Response)

The actual velocity of each controlled axis can be read.

Input data structure

Address	Field	Description
Top Address +0	(Function code) 91	
+2	(Completion code) - (Need not to be set)	
+4	(Data length L) - (Need not to be set)	
+6	(Data number N) 0	Set 0 to this field.
+8	(Data attribute M) Axis number	M=1 to n: Reads the actual velocity of each controlled axis. (n is an axis No.) M=-1: Reads the actual velocity of all controlled axes.
+10 +41	(Data area) - (Need not to be set)	

Completion codes

0 The actual velocity of the each controlled axis has been read normally.

4 The specified data attribute is invalid. That is, a value other than −1 and 1 to n (number of axes) was specified, or the specified axis No. was greater than the number of controlled axes.

Output data structure

(1) When reading a specified axis.

Address	Field	Description
Top Address +0	(Function code) 91	
+2	(Completion code) ? (See above description)	
+4	(Data length L) 4	
+6	(Data number N) 0 (Same as input data)	
+8	(Data attribute M) Axis number (Same as input data)	
+10 +13	Actual velocity of each controlled axes (4 bytes)	Signed binary(A negative value is represented in 2's complement)

(2) When reading all axes. (ex. number of controlled axes is 3)

Top Address +0	(Function code) 91	
+2	(Completion code) ? (See above description)	
+4	(Data length L) 12 (4bytes * 3axes)	
+6	(Data number N) 0 (Same as input data)	
+8	(Data attribute M) -1 (Same as input data)	M=-1: All axes.
+10	Actual velocity of first axis (4 bytes)	Signed binary (A negative value is represented in 2's complement)
+14	Actual velocity of second axis (4 bytes)	Signed binary (A negative value is represented in 2's complement)
+18 +21	Actual velocity of third axis (4 bytes)	Signed binary (A negative value is represented in 2's complement)

Output data unit

Increment system	Data Increment
mm	1mm/min, 1deg/min
inch	0.01inch/min, 0.01deg/min

5.5.12 Reading Actual Spindle Speeds (High-speed Response)

(1) Actual spindle speed

This function reads the actual speed of the serial spindles.

Input data structure

Top Address +0	(Function code) 138	
+2	(Completion code) - (Need not to be set)	
+4	(Data length L) - (Need not to be set)	
+6	(Data number N) 0	Set 0 to this field.
+8	(Data attribute M) Spindle number	M=1 to n: Read spindles on each axis. (n is the spindle number) M=-1: Read spindles on No.1 and No.2 axes M=-2: Read spindles on No.1 to No.3 axes M=-3: Read spindles on No.1 to No.4 axes
+10	(Data area) - (Need not to be set)	

Completion codes

0 The actual spindle speed was read successfully.

4 The spindle speed in 'Data Attribute' has wrong values, that is, a value outside of the range -1 to -(n - 1) or 1 to n (n: number of spindles).

Output data structure

(1) When reading a specified spindle.

Top Address +0	(Function code) 138	
+2	(Completion code) ? (See above description)	
+4	(Data length L) 4	
+6	(Data number N) 0 (Same as input data)	
+8	(Data attribute M) Spindle number (Same as input data)	
+10 +13	Actual speed of specified spindle (4bytes)	Signed binary <Data unit> 1/min

(2) When reading multiple spindles. (ex. 3 spindles)

Top Address +0	(Function code) 138	
+2	(Completion code) ? (See above description)	
+4	(Data length L) 12 (4bytes × 3spindles)	
+6	(Data number N) 0 (Same as input data)	
+8	(Data attribute M) -2 (Same as input data)	M=-2: Read spindles on No.1 to No.3 axes.
+10	Actual speed of No.1 spindle (4 bytes)	Signed binary <Data unit> 1/min
+14	Actual speed of No.2 spindle (4 bytes)	Signed binary <Data unit> 1/min
+18 +21	Actual speed of No.3 spindle (4 bytes)	Signed binary <Data unit> 1/min

(2) Position coder-less actual spindle speed

This function reads the actual spindle speed (position coder-less actual spindle speed) obtained by calculating the spindle motor speed of the serial spindles.

Input data structure

Top Address +0	(Function code) 138	
+2	(Completion code) - (Need not to be set)	
+4	(Data length L) - (Need not to be set)	
+6	(Data number N) 0	Set 0 to this field.
+8	(Data attribute M) Spindle number(+10)	M=11 to (10 + n): Read spindles on each axis. (n is the spindle number) M=-11: Read spindles on No.1 and No.2 axes M=-12: Read spindles on No.1 to No.3 axes M=-13: Read spindles on No.1 to No.4 axes
+10	(Data area) - (Need not to be set)	

Completion codes

0 The actual spindle speed was read successfully.

4 The spindle speed in 'Data Attribute' has wrong values, that is, a value outside of the range -11 to -(9 + 1) or 11 to (10 + n) (n: number of spindles).

Output data structure

(1) When reading a specified spindle.

Offset	Field	Remarks
Top Address +0	(Function code) 138	
+2	(Completion code) ? (See above description)	
+4	(Data length L) 4	
+6	(Data number N) 0 (Same as input data)	
+8	(Data attribute M) Spindle number(+10) (Same as input data)	
+10 +13	Position coder-less actual spindle speed (4bytes)	Signed binary <Data unit> 1/min

(2) When reading multiple spindles. (Ex. 3 spindles)

Offset	Field	Remarks
Top Address +0	(Function code) 138	
+2	(Completion code) ? (See above description)	
+4	(Data length L) 12 (4bytes × 3spindles)	
+6	(Data number N) 0 (Same as input data)	
+8	(Data attribute M) -12 (Same as input data)	M=-12: Read spindles on No.1 to No.3 axes.
+10	Position coder-less actual No.1 spindle speed (4bytes)	Signed binary <Data unit> 1/min
+14	Position coder-less actual No.2 spindle speed (4bytes)	Signed binary <Data unit> 1/min
+18 +21	Position coder-less actual No.3 spindle speed (4bytes)	Signed binary <Data unit> 1/min

5.5.13 Entering Torque Limit Data for the Digital Servo Motor (Low-speed Response)

Torque limit values for the digital servo motor can be entered.

> ⚠ **WARNING**
> When you write some NC data using both this instruction in ladder program and other applications, take care that you do not write to the same data area.
> If some values are written to the same data area by two or more applications including ladder program, unexpected value may be written. In this case, it may cause an unexpected machine behavior and also tools, work pieces, and machines may be damaged. As for details, refer to “SAFETY PRECAUTIONS”.

Input data structure

Top Address +0	(Function code) 152	
+2	(Completion code) - (Need not to be set)	
+4	(Data length L) 2	
+6	(Data number N) 0	Set 0 to this field.
+8	(Data attribute M) Axis number	M=1 to n: Axis No.
+10 +11	Torque limit data (2 byte) The high-order byte is always set to 0	Unsigned binary <Unit : %> Values from 0 to 255 correspond to 0% to 100%

> ⚠ **CAUTION**
> 1 To use this function, you should set the CNC parameter No. 6286#0 to 1.
> 2 Calculate the torque limit data assuming that the value of CNC parameter No.2060 is 100%.And, when using the standard parameter of servo motor, the value of 100% means the maximum torque of it.

Completion codes

0: Torque limit data has been entered normally.

4: The specified data attribute is invalid. That is, a value other than 1 to n (number of axes) was specified, or the specified axis No. was greater than the number of controlled axes.

113: The CNC status is that the writing data cannot be allowed. You should confirm that the CNC parameter No. 6286#0 is set to 1.

Output data structure

Address	Content	Remarks
Top Address +0	(Function code) 152	
+2	(Completion code) ? (See above description)	
+4	(Data length L) 2 (Same as input data)	
+6	(Data number N) 0 (Same as input data)	
+8	(Data attribute M) Axis number (Same as input data)	
+10 +11	Torque limit data (2 byte) (Input data) The high-order byte is always set to 0	Unsigned binary <Unit : %> Values from 0 to 255 correspond to 0% to 100%

5.5.14 Reading Load Information of the Spindle Motor (Serial Interface) (High-speed Response)

Load information of the serial spindle can be read.
The equation to normalize the load information is shown below

$$\text{Load (\%)} = \frac{L}{32767} \times \lambda$$

L: Data read from the window
λ: The percentage of the maximum output of the motor to the continuous rated output of the motor (When the maximum output is 180% and the continuous rated output is 100%, the percentage is 180.)

> **NOTE**
> The "λ" is equal to the value of parameter No. 4127.

Input data structure

Address	Field	Description
Top Address +0	(Function code) 153	
+2	(Completion code) - (Need not to be set)	
+4	(Data length L) - (Need not to be set)	
+6	(Data number N) Spindle number	N=0: Read the load of the No.1 spindle N=1: Read the load of the No.2 spindle N=2: Read the load of the No.3 spindle N=3: Read the load of the No.4 spindle N=-1: Read the loads of the No.1 and No.2 spindle N=-2: Read the loads of the No.1 to No.3 spindles N=-3: Read the loads of the No.1 to No.4 spindles
+8	(Data attribute M) 0	Set 0 to this field.
+10 +41	(Data area) - (Need not to be set)	

Completion codes

0 Load information of the serial spindle has been read normally.

Output data structure

(1) When reading a specified spindle.

Top Address +0	(Function code) 153	
+2	(Completion code) ? (See above description)	
+4	(Data length L) 2	
+6	(Data number N) Spindle number (Same as input data)	
+8	(Data attribute M) 0 (Same as input data)	
+10 +11	Load information of the serial spindle	Unsigned binary, 2 bytes long

(2) When reading multiple spindles. (Ex. 3 spindles)

Top Address +0	(Function code) 153	
+2	(Completion code) ? (See above description)	
+4	(Data length L) 6 (2bytes × 3spindles)	
+6	(Data number N) -2 (Same as input data)	N=-2: Read the loads of the No.1 to No.3 spindles
+8	(Data attribute M) 0 (Same as input data)	
+10	Load information of the 1st serial spindle	Unsigned binary, 2 bytes long
+12	Load information of the 2nd serial spindle	Unsigned binary, 2 bytes long
+14 +15	Load information of the 3rd serial spindle	Unsigned binary, 2 bytes long

5.5.15 Reading a Chopping Data (Low-speed Response)

Using this function, you can read the data (stroke count, real upper dead point, real lower dead point, and current position) about a chopping function. And, stroke count data can be reset.

Input data structure

Top Address	+0	(Function code) 206	
	+2	(Completion code) - (Need not be set)	
	+4	(Data length L) - (Need not be set)	
	+6	(Data number N) 0, 1, 2, 3, 4 Data type	N = 0 : Stroke count reset N = 1 : Stroke count read N = 2 : Real upper dead point read N = 3 : Real lower dead point read N = 4 : Current position read
	+8	(Data attribute M) - (Need not be set)	
	+10	(Data area) - (Need not be set)	

Completion codes

0: Completed successfully.
1: Not supported.
3: The data number is invalid.
6: No option for chopping function.

Output data structure

(1) Reset a stroke count (Data type N=0)

Top Address	+0	(Function code) 206	
	+2	(Completion code) ? (See above description)	
	+4	(Data length L) 0	
	+6	(Data number N) Data type (Same as input data)	
	+8	(Data attribute M) -	

(2) Reading a stroke count (Data type N=1)

Top Address	+0	(Function code) 206	
	+2	(Completion code) ? (See above description)	
	+4	(Data length L) 2	
	+6	(Data number N) Data type (Same as input data)	
	+8	(Data attribute M) -	
	+10	Stroke count (2 Bytes)	Signed binary format in 2 bytes length. Data = 0 to 32767

(3) Reading a real upper dead point or real lower dead point (Data type N=2 or 3)

Top Address	Offset	Content	Remarks
Top Address	+0	(Function code) 206	
	+2	(Completion code) ? (See above description)	
	+4	(Data length L) 4	
	+6	(Data number N) Data type (Same as input data)	
	+8	(Data attribute M) -	
	+10	Real upper dead point or real lower dead point (4 Bytes)	Signed binary format in 4 bytes length. (A negative value is represented in 2's complement)

(4) Reading a current position (Data type N=4)

Top Address	Offset	Content	Remarks
Top Address	+0	(Function code) 206	
	+2	(Completion code) ? (See above description)	
	+4	(Data length L) 4	
	+6	(Data number N) Data type (Same as input data)	
	+8	(Data attribute M) -	
	+10	Current position (4 Bytes)	Signed binary format in 4 bytes length. (A negative value is represented in 2's complement)

5.5.16 Reading the Actual Speed of Servo Motor (High-speed Response)

This function can read the following information of servo motor.

- Actual speed (rev / min)
- Thermal simulation data (OVC data)
- Torque command

(1) Reading the actual speed (Data number N = 11)

You can read the actual speed of servo motor.
The unit of the "Actual speed" are the "rev / min" for a rotary motor and the "cm / min" for a linear motor.

Input data structure

Top Address +0	(Function code) 207	
+2	(Completion code) - (Need not to be set)	
+4	(Data length L) - (Need not to be set)	
+6	(Data number N) 11	N=11: Actual speed (rev / min)
+8	(Data attribute M) Axis number	M=1 to n: Axis number M=-1: All axes
+10	(Data area) - (Need not to be set)	

Completion codes

0 Normal completion
3 The data number is invalid.
4 The data attribute is invalid.

Output data structure

(1) When reading a specified axis.

Top Address +0	(Function code) 207	
+2	(Completion code) ? (See above description)	
+4	(Data length L) 4	
+6	(Data number N) 11 (Same as input data)	
+8	(Data attribute M) Axis number (Same as input data)	
+10 +13	Actual speed (4 bytes)	Signed binary format in 4 bytes length Data unit: "rev / min" for a rotary motor, "cm / min" for a linear motor

(2) When reading all axes. (Ex. number of controlled axes is 3)

Top Address +0	(Function code) 207	
+2	(Completion code) ? (See above description)	
+4	(Data length L) 12 (4bytes × 3axes)	
+6	(Data number N) 11 (Same as input data)	
+8	(Data attribute M) -1 (Same as input data)	M=-1: All axes.
+10	Actual speed for 1st axis (4 bytes)	Signed binary format in 4 bytes length Data unit: "rev / min" for a rotary motor, "cm / min" for a linear motor
+14	Actual speed for 2nd axis (4 bytes)	Signed binary format in 4 bytes length Data unit: "rev / min" for a rotary motor, "cm / min" for a linear motor
+18 +21	Actual speed for 3rd axis (4 bytes)	Signed binary format in 4 bytes length Data unit: "rev / min" for a rotary motor, "cm / min" for a linear motor

(2) Reading the thermal simulation data (OVC data) (Data number N = 14)

You can read the thermal simulation data (OVC data) of servo motor.

Input data structure

Offset	Content	Description
Top Address +0	(Function code) 207	
+2	(Completion code) - (Need not to be set)	
+4	(Data length L) - (Need not to be set)	
+6	(Data number N) 14	N=14: Thermal simulation data (OVC data).
+8	(Data attribute M) Axis number	M=1 to n: Axis number M=-1: All axes
+10	(Data area) - (Need not to be set)	

Completion codes

0 Normal completion
3 The data number is invalid.
4 The data attribute is invalid.

Output data structure

(1) When reading a specified axis.

Offset	Content	Description
Top Address +0	(Function code) 207	
+2	(Completion code) ? (See above description)	
+4	(Data length L) 2	
+6	(Data number N) 14 (Same as input data)	
+8	(Data attribute M) Axis number (Same as input data)	
+10 +11	Thermal simulation data (2 bytes)	Signed binary format in 2 bytes length Data unit: % The OVC alarm will happen when this value is 100 %.

(2) When reading all axes. (ex. number of controlled axes is 3)

Top Address +0	(Function code) 207	
+2	(Completion code) ? (See above description)	
+4	(Data length L) 6 (2bytes * 3axes)	
+6	(Data number N) 14 (Same as input data)	
+8	(Data attribute M) -1 (Same as input data)	M=-1: All axes.
+10	Thermal simulation data for 1st axis (2 bytes)	Signed binary format in 2 bytes length Data unit: % The OVC alarm will happen when this value is 100 %.
+12	Thermal simulation data for 2nd axis (2 bytes)	Signed binary format in 2 bytes length Data unit: % The OVC alarm will happen when this value is 100 %.
+14 +15	Thermal simulation data for 3rd axis (2 bytes)	Signed binary format in 2 bytes length Data unit: % The OVC alarm will happen when this value is 100 %.

(3) Reading the torque command (Data number N = 15)

You can read the torque command of servo motor.
The read "Torque command" is normalized from -6554 to 6554. The value 6554 corresponds to the maximum current of servo amplifier.
Applying the following formula to this value, you can determine the ratio of the torque command to the maximum current of amplifier.

Ratio (%) = [data] × 100 / 6554

Applying the following formula, you can also determine the torque command (Apeak).

Torque command (Apeak) = [data] × [maximum current of amplifier] / 6554

Input data structure

Top Address +0	(Function code) 207	
+2	(Completion code) - (Need not to be set)	
+4	(Data length L) - (Need not to be set)	
+6	(Data number N) 15	N=15: Torque command.
+8	(Data attribute M) Axis number	M=1 to n: Axis number M=-1: All axes
+10	(Data area) - (Need not to be set)	

Completion codes

0 Normal completion
3 The data number is invalid.
4 The data attribute is invalid.

Output data structure

(1) When reading a specified axis.

Top Address +0	(Function code) 207	
+2	(Completion code) ? (See above description)	
+4	(Data length L) 2	
+6	(Data number N) 15 (Same as input data)	
+8	(Data attribute M) Axis number (Same as input data)	
+10 +11	Torque command (2 bytes)	Signed binary format in 2 bytes length Data: This data is normalized from -6554 to 6554.

(2) When reading all axes. (Ex. number of controlled axes is 3)

Top Address +0	(Function code) 207	
+2	(Completion code) ? (See above description)	
+4	(Data length L) 6 (2bytes * 3axes)	
+6	(Data number N) 15 (Same as input data)	
+8	(Data attribute M) -1	M=-1: All axes.
+10	Torque command for 1st axis (2 bytes)	Signed binary format in 2 bytes length Data: This data is normalized from -6554 to 6554.
+12	Torque command for 2nd axis (2 bytes)	Signed binary format in 2 bytes length Data: This data is normalized from -6554 to 6554.
+14 +15	Torque command for 3rd axis (2 bytes)	Signed binary format in 2 bytes length Data: This data is normalized from -6554 to 6554.

5.5.17 Reading the Estimate Disturbance Torque Data (High-speed Response)

Using the abnormal load detection function, the CNC constantly calculates an estimated load torque. Enabling the estimated load torque output function makes you able to read the data by using this function.

> **NOTE**
> The abnormal load detection function option is required. For detailed settings of parameters and so forth, refer to the description of abnormal load detection in the “CONNECTION MANUAL (FUNCTION)”.

(1) Servo axis (Data number N = 0)

This function can read the estimate disturbance torque data. The estimate disturbance torque data is the load current data except a necessary current data for acceleration / deceleration of the servo motor. This read value is normalized from –7282 to 7282. The value 7282 corresponds to the maximum current of servo amplifier.
Applying the following formula to this value, you can determine the ratio of the estimate disturbance current to the maximum current of amplifier.

Ratio (%) = [data] × 100 / 7282

Applying the following formula, you can also determine the estimate disturbance current (Apeak).

Estimate disturbance current (Apeak) = [data] × N / 7282

The value of N is following.

Parameter No.2165	N
less than 20	The value of No.2165
20 or more	The value that is rounded down below the one's digit of the value of No.2165

Input data structure

Top Address +0	(Function code) 211	
+2	(Completion code) - (Need not to be set)	
+4	(Data length L) - (Need not to be set)	
+6	(Data number N) 0	Set 0 to this field.
+8	(Data attribute M) Axis number	M=1 to n: Estimate disturbance torque data for specific axis. ("n" is the axis number) M=-1: Estimate disturbance torque data for all axes.
+10	(Data area) - (Need not to be set)	

Completion codes

0 The estimate disturbance torque data have been read normally.

4 The data specified as the data attribute is invalid because it is neither -1 nor a value from 1 to n (n is the number of axes). Alternatively, the specified axis number is greater than the number of controlled axes.

Output data structure

(1) When reading a specified axis.

Top Address +0	(Function code) 211	
+2	(Completion code) ? (See above description)	
+4	(Data length L) 2	
+6	(Data number N) 0 (Same as input data)	
+8	(Data attribute M) Axis number (Same as input data)	
+10 +11	Estimate disturbance torque data for the controlled axis specified (2 bytes)	(A negative value is represented in 2's complement)

(2) When reading all axes. (Ex. number of controlled axes is 3)

Top Address +0	(Function code) 211	
+2	(Completion code) ? (See above description)	
+4	(Data length L) 6 (2bytes * 3axes)	
+6	(Data number N) 0 (Same as input data)	
+8	(Data attribute M) -1 (Same as input data)	M=-1: All axes.
+10	Estimate disturbance torque data for first axis (2 bytes)	Signed binary(A negative value is represented in 2's complement)
+12	Estimate disturbance torque data for second axis (2 bytes)	Signed binary(A negative value is represented in 2's complement)
+14 +15	Estimate disturbance torque data for third axis (2 bytes)	Signed binary(A negative value is represented in 2's complement)

(2) Spindle axis (Data number N = 1)

This function can read the estimate disturbance torque data. The estimate disturbance torque data is the load torque data except a necessary torque data for acceleration / deceleration of the spindle motor. This read value is normalized from –16384 to 16384. The value 16384 corresponds to the maximum torque of spindle motor.
Applying the following formula to this value, you can determine the ratio of the estimate disturbance torque to the maximum torque of the spindle motor.

Ratio (%) = [data] ×100 / 16384

Applying the following formula, you can also determine the estimate disturbance torque (Nm). About the 30-min rated torque, refer to the specification document of the motor.

Estimate disturbance torque (Nm) = [data] ×N / 16384

N = [The 30-min rated torque of the motor] ×1.2 (In case of a SPINDLE MOTOR αi series.)

Input data structure

Top Address +0	(Function code) 211	
+2	(Completion code) - (Need not to be set)	
+4	(Data length L) - (Need not to be set)	
+6	(Data number N) 1	
+8	(Data attribute M) Spindle number	M=1 to n: Read the load of each spindle (n is the spindle number) M=-1: Read the loads of the No.1 and No.2 spindles M=-2: Read the loads of the No.1 to No.3 spindles M=-3: Read the loads of the No.1 to No.4 spindles
+10	(Data area) - (Need not to be set)	

Completion codes

0 The estimate disturbance torque data have been read normally.

4 The data specified as the data attribute is invalid because it is neither a value from -1 to -(n-1) nor a value from 1 to n (n is the number of axes). Alternatively, the specified axis number is greater than the number of controlled axes.

Output data structure

(1) When reading a specified spindle.

Top Address +0	(Function code) 211	
+2	(Completion code) ? (See above description)	
+4	(Data length L) 2	
+6	(Data number N) 1 (Same as input data)	
+8	(Data attribute M) Spindle number (Same as input data)	
+10 +11	Estimate disturbance torque data for the controlled axis specified (2 bytes)	Signed binary (A negative value is represented in 2's complement)

(2) When reading multiple spindles. (Ex. 3 spindles)

Top Address +0	(Function code) 211	
+2	(Completion code) ? (See above description)	
+4	(Data length L) 6 (2bytes × 3spindles)	
+6	(Data number N) 1 (Same as input data)	
+8	(Data attribute M) -2 (Same as input data)	-2: Read the loads of the No.1 to No.3 spindles
+10	Estimate disturbance torque data for first axis (2 bytes)	Signed binary (A negative value is represented in 2's complement)
+12	Estimate disturbance torque data for second axis (2 bytes)	Signed binary (A negative value is represented in 2's complement)
+14 +15	Estimate disturbance torque data for third axis (2 bytes)	Signed binary (A negative value is represented in 2's complement)

5.5.18 Reading a Fine Torque Sensing Data (Statistical Calculation Results) (High-speed Response)

You can read the statistical calculation results of the disturbance load torque, average value, maximum value and distribution, for the fine torque sensing function.
The disturbance load torque is represented as a percentage against the rated torque of servo motor.

NOTE
1 The option of "Fine torque sensing" is necessary.
2 You should set the axis number to the CNC parameter No. 6360 to 6363 as target axes for the fine torque sensing function.
- No. 6360 ... target axis No. 1
- No. 6361 ... target axis No. 2
- No. 6362 ... target axis No. 3
- No. 6363 ... target axis No. 4
In this window function, you should set above target axis number to the "Data number" field.

Input data structure

Address	Field	Remarks
Top Address +0	(Function code) 226	
+2	(Completion code) - (Need not to be set)	
+4	(Data length L) - (Need not to be set)	
+6	(Data number N) Target axis number	N=1 to n: Target axis number. (n is the maximum target axis number) N=-1: All axes
+8	(Data attribute M) 0 (2bytes)	Set 0 to this field.
+10	(Data area) - (Need not to be set)	

Completion codes
0 Completed successfully.
1 Not supported.
3 The data number is invalid.
6 No option for fine torque sensing function. The CNC system software does not support this function.

Output data structure

(1) When reading a specified axis.

Top Address +0	(Function code) 226	
+2	(Completion code) ? (See above description)	
+4	(Data length L) 6	
+6	(Data number N) Target axis number (Same as input data)	
+8	(Data attribute M) 0 (Same as input data)	
+10	Average value	Signed binary format in 2 bytes length -32768 to 32767 (%)
+12	Maximum value	Signed binary format in 2 bytes length -32768 to 32767 (%)
+14 +15	Distribution	Signed binary format in 2 bytes length 0 to 32767 (%)

(2) When reading all axes. (Ex. number of target axes is 4)

Top Address +0	(Function code) 226	
+2	(Completion code) ? (See above description)	
+4	(Data length L) 24 (6bytes × 4axes)	
+6	(Data number N) -1 (Same as input data)	-1: All axes.
+8	(Data attribute M) 0 (Same as input data)	
+10	Average value of target axis 1	Signed binary format in 2 bytes length -32768 to 32767 (%)
+12	Maximum value of target axis 1	Signed binary format in 2 bytes length -32768 to 32767 (%)
+14	Distribution value of target axis 1	Signed binary format in 2 bytes length 0 to 32767 (%)
+16	Average value of target axis 2	Signed binary format in 2 bytes length -32768 to 32767 (%)
+18	Maximum value of target axis 2	Signed binary format in 2 bytes length -32768 to 32767 (%)
+20	Distribution value of target axis 2	Signed binary format in 2 bytes length 0 to 32767 (%)
+22	Average value of target axis 3	Signed binary format in 2 bytes length -32768 to 32767 (%)
+24	Maximum value of target axis 3	Signed binary format in 2 bytes length -32768 to 32767 (%)
+26	Distribution value of target axis 3	Signed binary format in 2 bytes length 0 to 32767 (%)
+28	Average value of target axis 4	Signed binary format in 2 bytes length -32768 to 32767 (%)
+30	Maximum value of target axis 4	Signed binary format in 2 bytes length -32768 to 32767 (%)
+32 +33	Distribution value of target axis 4	Signed binary format in 2 bytes length 0 to 32767 (%)

5.5.19 Reading a Fine Torque Sensing Data (Store Data) (High-speed Response)

According to the specifying of “Data number N”, you can read three types of data for the fine torque sensing function.

> **NOTE**
> 1 The option of "Fine torque sensing" is necessary.
> 2 You should set the axis number to the CNC parameter No. 6360 to 6363 as target axes for the fine torque sensing function.
> - No. 6360 ... target axis No. 1
> - No. 6361 ... target axis No. 2
> - No. 6362 ... target axis No. 3
> - No. 6363 ... target axis No. 4
> In this window function, you should set above target axis number to the "Data number" field.

Reading a store counter (Data number N = 0)

You can read a store counter of stored data or sample data. The store counter indicates the number of data.

Input data structure

Address	Content	Remarks
Top Address +0	(Function code) 232	
+2	(Completion code) - (Need not to be set)	
+4	(Data length L) - (Need not to be set)	
+6	(Data number N) 0	N=0: Store counter
+8	(Data attribute M) Data type	M=0: Stored data M=1: Sample data
+10 +13	(Data area) - (Need not to be set)	

Completion codes

0 Completed successfully.
1 Not supported.
3 The data number is invalid.
4 The data attribute is invalid.
6 No option for fine torque sensing function. The CNC system software does not support this function.

Output data structure

Top Address +0	(Function code) 232	
+2	(Completion code) ? (See above description)	
+4	(Data length L) 4	
+6	(Data number N) 0 (Same as input data)	
+8	(Data attribute M) Data type (Same as input data)	
+10 +13	Store counter	Signed binary format in 4 bytes length. (0 to 524288)

Reading the latest data (Data number N = 101 to 104)

You can read the latest disturbance load torque.
The disturbance load torque is represented as a percentage against the rated torque of servo motor.
When you set 1 to the data attribute M, you can read a disturbance load torque in sample data that corresponds to the store counter of stored data.

Input data structure

Top Address +0	(Function code) 232	
+2	(Completion code) - (Need not to be set)	
+4	(Data length L) - (Need not to be set)	
+6	(Data number N) Target axis number(+100)	N=101 to (100+n): Target axis number + 100. (n is the maximum target axis number)
+8	(Data attribute M) Data type	M=0: Stored data. M=1: Sample data.
+10 +11	(Data area) - (Need not to be set)	

Completion codes

0 Completed successfully.
1 Not supported.
3 The data number is invalid.
4 The data attribute is invalid.
6 No option for fine torque sensing function. The CNC system software does not support this function.

Output data structure

Top Address +0	(Function code) 232	
+2	(Completion code) ? (See above description)	
+4	(Data length L) 2 or 0	
+6	(Data number N) Target axis number(+100) (Same as input data)	
+8	(Data attribute M) Data type (Same as input data)	
+10 +11	Latest data	Signed binary format in 2 bytes length (-32768 to 32767(%))

NOTE

When you set 1 to the "Data attribute M" and in the following condition, the data is not output, but completion code 0 and data length 0 are output.

- The number of sampling data is less than the number of stored data.
- There is no stored data.

Reading stored torque data (any data) (Data number N = 1 to 4)

You can read any disturbance load torque in a stored data or in a sample data.
The disturbance load torque is represented as a percentage against the rated torque of servo motor.
The read data is selected by the "Start data number n" and the "Number of data items l". The valid "Start data number n" and "Number of data items l" are follows.

(1) The valid "Start data number n"

Number of target axes	Sample data preservation function	
	Disabled	**Enabled**
1	0 to 524287	0 to 262143
2	0 to 262143	0 to 131071
3, 4	0 to 131071	0 to 65535

(2) The valid "Number of data items l"

Number of data items
1 to 120

Input data structure

Offset	Field	Description
Top Address +0	(Function code) 232	
+2	(Completion code) - (Need not to be set)	
+4	(Data length L) 6	You should set 6 to this field.
+6	(Data number N) Target axis number	N: 1 to n: Target axis number (n is the maximum target axis number)
+8	(Data attribute M) Data type	M=0: Stored data M=1: Sample data
+10	(Start data number) n	Signed binary format in 4 bytes length. (n = 0 to 524287)
+14	(Number of data items) l	Signed binary format in 2 bytes length. (l = 1 to 120)
+16 +(17+((l-1)×2))	(Data area) - (Need not to be set)	

Completion codes

0 Completed successfully.
1 Not supported.
2 The data length is invalid.
3 The data number is invalid.
4 The data attribute is invalid.
5 The "Start data number n" or the "Number of data items l" is invalid.
6 No option for fine torque sensing function. The CNC system software does not support this function.

Output data structure

Address	Content	Remarks
Top Address +0	(Function code) 232	
+2	(Completion code) ? (See above description)	
+4	(Data length L) (L=6+l×2)	
+6	(Data number N) Target axis number (Same as input data)	
+8	(Data attribute M) Data type (Same as input data)	
+10	(Start data number) n (Same as input data)	
+14	(Number of data items) l (Same as input data)	
+16	Data of number n	Signed binary format in 2 bytes length (-32768 to 32767(%))
+18	Data of number n+1	Signed binary format in 2 bytes length (-32768 to 32767(%))
	:	
+(16+((l-1)×2)) +(17+((l-1)×2))	Data of number (n+l-1)	Signed binary format in 2 bytes length (-32768 to 32767(%))

NOTE

1. When specified data range is larger than the data count of stored data, the valid data is read and its size is returned as the "Data length L"
2. When specified data number is greater than the data count of stored data, the data cannot be read, 6 is returned as the "Data length L" and 0 is returned as "Completion code".

5.5.20 Presetting the Relative Coordinate (Low-speed Response)

The preset data is set to the relative coordinate controlled by CNC. If 0 is set as preset data it becomes to origin.
But it is impossible to write the value of preset data to the transferring axis. In the case of the preset of relative coordinate of all axes is executed by using this function, if only one axis is transferring, the preset of relative coordinate cannot be executed, neither.

> ⚠ **WARNING**
> When you write some NC data using both this instruction in ladder program and other applications, take care that you do not write to the same data area.
> If some values are written to the same data area by two or more applications including ladder program, unexpected value may be written. In this case, it may cause an unexpected machine behavior and also tools, work pieces, and machines may be damaged. As for details, refer to "SAFETY PRECAUTIONS".

Input data structure

(1) When writing a specified axis.

Address	Content	Description
Top Address +0	(Function code) 249	
+2	(Completion code) - (Need not to be set)	
+4	(Data length L) 4	
+6	(Data number N) 0	Set 0 to this field.
+8	(Data attribute M) Axis number	M=1 to n: Write data on each (n is the axis number)
+10 +13	Value of relative coordinate for the controlled axis specified (4 bytes)	Signed binary (A negative value is represented in 2's complement)

(2) When writing all axes. (Ex. number of controlled axes is 3)

Address	Content	Description
Top Address +0	(Function code) 249	
+2	(Completion code) - (Need not to be set)	
+4	(Data length L) 12 (4bytes × 3axes)	
+6	(Data number N) 0	Set 0 to this field.
+8	(Data attribute M) -1	M=-1: All axes.

+10	Value of relative coordinate for the first axis (4 bytes)	Signed binary (A negative value is represented in 2's complement)
+14	Value of relative coordinate for the second axis (4 bytes)	Signed binary (A negative value is represented in 2's complement)
+18 +21	Value of relative coordinate for the third axis (4 bytes)	Signed binary (A negative value is represented in 2's complement)

Input data unit

		Input system	Increment system				
			IS-A	IS-B	IS-C	IS-D	IS-E
Machining center system		mm, deg	0.01	0.001	0.0001	0.00001	0.000001
		inch	0.001	0.0001	0.00001	0.000001	0.0000001
Lathe system	Radius specification	mm, deg	0.01	0.001	0.0001	0.00001	0.000001
	Diameter specification		0.01	0.001	0.0001	0.00001	0.000001
	Radius specification	inch	0.001	0.0001	0.00001	0.000001	0.0000001
	Diameter specification		0.001	0.0001	0.00001	0.000001	0.0000001

Completion codes

0 Success to set the value of relative coordinate.
4 Data specified for the data attribute is invalid because it is neither -1 nor a value from 1 to n (n is the number of axes). Alternatively, the specified axis number is greater than the number of controlled axes.
5 Relative coordinate is out of range.

Output data structure

Top Address +0	(Function code) 249
+2	(Completion code) ? (See above description)
+4	(Data length L) (Same as input data)
+6	(Data number N) 0 (Same as input data)
+8	(Data attribute M) Axis number (Same as input data)
+10	Value of relative coordinate (4×n bytes)

5.5.21 Reading the Three-Dimensional Error Compensation Data (Low-Speed Response)

This function can read the three-dimensional error compensation data corresponding to the specified compensation point number and compensation axis number.

NOTE
About the details of the three-dimensional error compensation function and the related CNC parameter, refer to the “CONNECTION MANUAL (FUNCTION) ”.

Input data structure

Offset	Field	Description
Top Address +0	(Function code) 413	
+2	(Completion code) - (Need not to be set)	
+4	(Data length L) - (Need not to be set)	
+6	(Data number N) Compensation point number	Set the compensation point number with signed binary format in 2-bytes length.(From 1 to maximum compensation point number)
+8	(Data attribute M) Compensation axis number	Set the compensation axis number with signed binary format in 2-bytes length.1 to 3: compensation axis number-1: all compensation axes
+10	(Data area) - (Need not to be set)	

Completion codes

0 The processing has been executed normally.
1 This function is not available.
3 The specified compensation point number is invalid.
4 The specified compensation axis number is invalid.
6 The necessary option is not found.

Output data structure

(1) When reading a specified axis.

Offset	Content	Remarks
Top Address +0	(Function code) 413	
+2	(Completion code) ? (See above description)	
+4	(Data length L) 2	
+6	(Data number N) Compensation point number (Same as input data)	
+8	(Data attribute M) Compensation axis number (Same as input data)	
+10 +11	Three-dimensional error compensation data (2bytes)	Signed binary format in 2-bytes length (from -128 to 127)

(2) When reading all axes. (Ex. number of controlled axes is 3)

Offset	Content	Remarks
Top Address +0	(Function code) 413	
+2	(Completion code) ? (See above description)	
+4	(Data length L) 6 (2bytes × 3axes)	
+6	(Data number N) Compensation point number (Same as input data)	
+8	(Data attribute M) -1 (Same as input data)	M=-1: All axes.
+10	Three-dimensional error compensation data for the 1st compensation axis (2bytes)	Signed binary format in 2-bytes length (from -128 to 127)
+12	Three-dimensional error compensation data for the 2nd compensation axis (2bytes)	Signed binary format in 2-bytes length (from -128 to 127)
+14 +15	Three-dimensional error compensation data for the 3rd compensation axis (2bytes)	Signed binary format in 2-bytes length (from -128 to 127)

5.5.22 Writing the Three-Dimensional Error Compensation Data (Low-Speed Response)

This function can write the three-dimensional error compensation data corresponding to the specified compensation point number and compensation axis number.

> ⚠ **WARNING**
> When you write some NC data using both this instruction in ladder program and other applications, take care that you do not write to the same data area.
> If some values are written to the same data area by two or more applications including ladder program, unexpected value may be written. In this case, it may cause an unexpected machine behavior and also tools, work pieces, and machines may be damaged. As for details, refer to “SAFETY PRECAUTIONS”.

> **NOTE**
> About the details of the three-dimensional error compensation function and the related CNC parameter, refer to the “CONNECTION MANUAL (FUNCTION)”.

Input data structure

(1) When writing a specified axis.

Top Address +0	(Function code) 414	
+2	(Completion) - (Need not to be set)	
+4	(Data length L) 2	
+6	(Data number N) Compensation point number	Set the compensation point number with signed binary format in 2-bytes length. (from 1 to maximum compensation point number)
+8	(Data attribute M) Compensation axis number	Set the compensation axis number with signed binary format in 2-bytes length. (1 to 3) M=-1: All axes
+10 +11	Three-dimensional error compensation data (2bytes)	Set the three-dimensional error compensation data with signed binary format in 2-bytes length. (from -128 to 127)

(2) When writing all axes. (Ex. number of controlled axes is 3)

Offset	Field	Description
Top Address +0	(Function code) 414	
+2	(Completion code) - (Need not to be set)	
+4	(Data length L) 6 (2bytes × 3axes)	
+6	(Data number N) Compensation point number	Set the compensation point number with signed binary format in 2-bytes length. (from 1 to maximum compensation point number)
+8	(Data attribute M) -1	M=-1: All axes.
+10	Three-dimensional error compensation data for the 1st compensation axis(2bytes)	Set the three-dimensional error compensation data for the 1st compensation axis with signed binary format in 2-bytes length. (from -128 to 127)
+12	Three-dimensional error compensation data for the 2nd compensation axis(2bytes)	Set the three-dimensional error compensation data for the 2nd compensation axis with signed binary format in 2-bytes length. (from -128 to 127)
+14 +15	Three-dimensional error compensation data for the 3rd compensation axis(2bytes)	Set the three-dimensional error compensation data for the 3rd compensation axis with signed binary format in 2-bytes length. (from -128 to 127)

Completion codes

0 The processing has been executed normally.
1 This function is not available.
2 The specified data length is invalid.
3 The specified compensation point number is invalid.
4 The specified compensation axis number is invalid.
5 The specified three-dimensional error compensation data is invalid.
6 The necessary option is not found.

Output data structure

(1) When writing a specified axis.

Top Address +0	(Function code) 414
+2	(Completion code) ? (See above description)
+4	(Data length L) 2 (Same as input data)
+6	(Data number N) Compensation point number (Same as input data)
+8	(Data attribute M) Compensation axis number (Same as input data)
+10 +11	Three-dimensional error compensation data (Same as input data)

(2) When writing all axes. (Ex. number of controlled axes is 3)

Top Address +0	(Function code) 414
+2	(Completion code) ? (See above description)
+4	(Data length L) 6 (Same as input data
+6	(Data number N) Compensation point number (Same as input data)
+8	(Data attribute M) -1 (Same as input data)
+10	Three-dimensional error compensation data for the 1st axis (Same as input data)
+12	Three-dimensional error compensation data for the 2nd axis (Same as input data)
+14 +15	Three-dimensional error compensation data for the 3rd axis (Same as input data)

5.5.23 Reading the Position of Controlled Axes

If you set following value to the data number N, following position or remaining travel can be read.

Data number N	Read value
0	Machine position that servo delay and acceleration / deceleration delay is not applied
1	Machine position that servo delay and acceleration / deceleration delay is applied
2	Machine position that displayed on the current position display screen of the CNC.
3	Absolute position in workpiece coordinate system
4	Absolute position in feature coordinate system
5	Remaining travel in workpiece coordinate system
6	Remaining travel in feature coordinate system

5.5.23.1 Reading the machine position of controlled axes

You can read the machine position.

- If you set 0 to the data number N, you can read the machine position that servo delay and acceleration / deceleration delay is not applied.
- If you set 1 to the data number N, you can read the machine position that servo delay and acceleration / deceleration delay is applied.
- If you set 2 to the data number N, you can read the machine position that displayed on the current position display screen of the CNC.

Input data structure

Top Address +0	(Function code) 428	
+2	(Completion code) - (Need not to be set)	
+4	(Data length L) - (Need not to be set)	
+6	(Data number N) Data type	0 : Machine position that servo delay and acceleration/deceleration delay is not applied. 1 : Machine position that servo delay and acceleration/deceleration delay is applied. 2 : Machine position that displayed on the current position display screen of the CNC.
+8	(Data attribute M) Axis number	1 to n (n is the number of axes in the CNC-path) : Reads the value of a specified axis. -1 : Reads the value of all axes in the CNC-path.
+10	(Data area) - (Need not to be set)	

NOTE

1 To read a machine poison that servo delay and acceleration/deceleration delay is applied, the following setting is required.
CNC parameter No.11313#7=1

2 When you set 1 to the data number N and "Actual position reading function with absolute position detector" is available on a CNC series, you can read the machine position by the function. Required setting is as follows.
CNC parameter No.1806#5=1, No.2224#4=1
For details of "Actual position reading function with absolute position detector", refer to the CONNECTION MANUAL (FUNCTION) of the CNC series.

Completion codes

0 Reading is successful.
3 The data specified as the data number is invalid.
4 The data specified as the data attribute is invalid because it is neither -1 nor a value from 1 to n (n is the number of axes). Alternatively, the specified axis number is greater than the number of controlled axes.
13 CNC is busy.

Output data structure

(1) When read a specified axis.

Top Address +0	(Function code) 428	
+2	(Completion code) ? (See above description)	
+4	(Data length L) 4	
+6	(Data number N) Data type (Same as input data)	
+8	(Data attribute M) Axis number (Same as input data)	
+10 ~ +13	Machine position (4 bytes)	Signed binary format in 4 bytes length.

(2) When read all axes. (Ex. number of controlled axes is 3)

Top Address +0	(Function code) 428	
+2	(Completion code) ? (See above description)	
+4	(Data length L) 12 (4bytes * 3axes)	
+6	(Data number N) Data type (Same as input data)	
+8	(Data attribute M) -1 (Same as input data)	M=-1: All axes.
+10	Machine position of 1st axis (4 bytes)	Signed binary format in 4 bytes length
+14	Machine position of 2nd axis (4 bytes)	Signed binary format in 4 bytes length
+18 ~ +21	Machine position of 3rd axis (4 bytes)	Signed binary format in 4 bytes length

Output data unit

Machine system	Increment system				
	IS-A	IS-B	IS-C	IS-D	IS-E
mm, deg	0.01	0.001	0.0001	0.00001	0.000001
inch	0.001	0.0001	0.00001	0.000001	0.0000001

NOTE

1 The read position does not depend on a status of "Diameter and Radius Setting Switching function". The read position depends only on following setting.
CNC parameter No. 1006#3 (DIAx)

2 When you set 0 or 1 to the data number N, machine position in the machine unit can be read.

3 When you set 0 to the data number N and following setting is applied, update cycle of the machine position becomes faster.
CNC parameter No.11300#5 (MPH) = 1
You should apply this setting only if necessary because this setting may lower the performance of CNC a little.

4 When you set 2 to the data number N, machine position in the input unit can be read. Read position depends on following parameters setting.
CNC parameter No. 0#2, No.3104#0

5.5.23.2 Reading the absolute position of controlled axes

You can read the absolute position.

- If you set 3 to the data number N, you can read the absolute position in the work coordinate system.
- If you set 4 to the data number N, you can read the absolute position in the feature coordinate system.

NOTE

1 "3-dimensional coordinate system conversion", "Tilted working plane command" or "Workpiece setting error compensation" option is necessary.

2 When a feature coordinate system is not defined, the absolute position in the work coordinate system can be read even if you set 4 to the data number N.

Input data structure

Top Address +0	(Function code) 428	
+2	(Completion code) - (Need not to be set)	
+4	(Data length L) - (Need not to be set)	
+6	(Data number N) Data type	3 : Absolute position in the work coordinate system. 4 : Absolute position in the feature coordinate system.
+8	(Data attribute M) Axis number	1 to n (n is the number of axes in the CNC-path) : Reads the value of a specified axis. -1 : Reads the value of all axes in the CNC-path.
+10	(Data area) - (Need not to be set)	

Completion codes

0 Reading is successful.
1 PMC system software does not support this function or necessary option missing.
3 The data specified as the data number is invalid.
4 The data specified as the data attribute is invalid because it is neither -1 nor a value from 1 to n (n is the number of axes). Alternatively, the specified axis number is greater than the number of controlled axes.
13 CNC is busy.

Output data structure

(1) When read a specified axis.

Top Address +0	(Function code) 428	
+2	(Completion code) ? (See above description)	
+4	(Data length L) 4	
+6	(Data number N) Data type (Same as input data)	
+8	(Data attribute M) Axis number (Same as input data)	
+10 +13	Absolute position (4 bytes)	Signed binary format in 4 bytes length.

(2) When read all axes. (Ex. number of controlled axes is 3)

Top Address +0	(Function code) 428	
+2	(Completion code) ? (See above description)	
+4	(Data length L) 12 (4bytes * 3axes)	
+6	(Data number N) Data type (Same as input data)	
+8	(Data attribute M) -1 (Same as input data)	M=-1: All axes.
+10	Absolute position of 1st axis (4 bytes)	Signed binary format in 4 bytes length
+14	Absolute position of 2nd axis (4 bytes)	Signed binary format in 4 bytes length
+18 +21	Absolute position of 3rd axis (4 bytes)	Signed binary format in 4 bytes length

Output data unit

Machine system	Increment system				
	IS-A	IS-B	IS-C	IS-D	IS-E
mm, deg	0.01	0.001	0.0001	0.00001	0.000001
inch	0.001	0.0001	0.00001	0.000001	0.0000001

NOTE
The read position does not depend on a status of "Diameter and Radius Setting Switching function". The read position depends only on following setting.
CNC parameter No. 1006#3 (DIAx)

5.5.23.3 Reading the remaining travel

You can read the remaining travel.

- If you set 5 to the data number N, you can read the remaining travel in the work coordinate system.
- If you set 6 to the data number N, you can read the remaining travel in the feature coordinate system.

NOTE
1 "3-dimensional coordinate system conversion", "Tilted working plane command" or "Workpiece setting error compensation" option is necessary.
2 When a feature coordinate system is not defined, the remaining travel in the work coordinate system can be read even if you set 6 to the data number N.

Input data structure

Address	Field	Description
Top Address +0	(Function code) 428	
+2	(Completion code) - (Need not to be set)	
+4	(Data length L) - (Need not to be set)	
+6	(Data number N) Data type	5 : Remaining travel in the work coordinate system. 6 : Remaining travel in the feature coordinate system.
+8	(Data attribute M) Axis number	1 to n (n is the number of axes in the CNC-path) : Reads the value of a specified axis. -1 : Reads the value of all axes in the CNC-path.
+10	(Data area) - (Need not to be set)	

Completion codes

0 Reading is successful.
1 PMC system software does not support this function or necessary option missing.
3 The data specified as the data number is invalid.
4 The data specified as the data attribute is invalid because it is neither -1 nor a value from 1 to n (n is the number of axes). Alternatively, the specified axis number is greater than the number of controlled axes.
13 CNC is busy.

Output data structure

(1) When read a specified axis.

Top Address +0	(Function code) 428	
+2	(Completion code) ? (See above description)	
+4	(Data length L) 4	
+6	(Data number N) Data type (Same as input data)	
+8	(Data attribute M) Axis number (Same as input data)	
+10 +13	Remaining travel (4 bytes)	Signed binary format in 4 bytes length.

(2) When read all axes. (Ex. number of controlled axes is 3)

Top Address +0	(Function code) 428	
+2	(Completion code) ? (See above description)	
+4	(Data length L) 12 (4bytes * 3axes)	
+6	(Data number N) Data type (Same as input data)	
+8	(Data attribute M) -1 (Same as input data)	M=-1: All axes.
+10	Remaining travel of 1st axis (4 bytes)	Signed binary format in 4 bytes length
+14	Remaining travel of 2nd axis (4 bytes)	Signed binary format in 4 bytes length
+18 +21	Remaining travel of 3rd axis (4 bytes)	Signed binary format in 4 bytes length

Output data unit

Machine system	Increment system				
	IS-A	IS-B	IS-C	IS-D	IS-E
mm, deg	0.01	0.001	0.0001	0.00001	0.000001
inch	0.001	0.0001	0.00001	0.000001	0.0000001

NOTE

The read position does not depend on a status of "Diameter and Radius Setting Switching function". The read position depends only on following setting.

CNC parameter No. 1006#3 (DIAx)

The read value is the same as remaining travel displayed on an actual position display screen on CNC.

5.5.24 Reading slider position of the Control function for link type press (High-speed Response)

You can read the slider position of control function for link type press.
If all axes are specified, this window allows the concurrent data to be read.

Input data structure

Address	Field	Remarks
Top Address +0	(Function code) 386	
+2	(Completion code) - (Need not to be set)	
+4	(Data length L) - (Need not to be set)	
+6	(Data number N) 0	Set 0 to this field.
+8	(Data attribute M) Axis number	M=1 to n: Target axis number. (n is maximum axis number.) M=-1: All axes
+10	(Data area) - (Need not to be set)	

Completion codes

0 The slider position for the specified axis has been read normally.
1 No option for "Control function for link type press".
4 Data specified for the data attribute is invalid because it is neither -1 nor a value from 1 to n (n is the number of axes). Specifically, the specified axis number is greater than the number of controlled axes.

Note
The option for "Control function for link type press" is necessary to use this function.

Output data structure

(1) When reading a specified axis.

Address	Content	Remarks
Top Address +0	(Function code) 386	
+2	(Completion code) ? (See above description)	
+4	(Data length L) 4	
+6	(Data number N) 0 (Same as input data)	
+8	(Data attribute M) Axis number (Same as input data)	
+10 +13	Slider position of the controlled axis specified (4 bytes)	Signed binary (A negative value is represented in 2's complement)

(2) When reading all axes. (Ex. number of controlled axes is 3)

Address	Content	Remarks
Top Address +0	(Function code) 386	
+2	(Completion code) ? (See above description)	
+4	(Data length L) 12 (4bytes * 3axes)	
+6	(Data number N) 0 (Same as input data)	
+8	(Data attribute M) -1 (Same as input data)	M=-1: All axes.
+10	Slider position of the first axis (4 bytes)	Signed binary (A negative value is represented in 2's complement)
+14	Slider position of the second axis (4 bytes)	Signed binary (A negative value is represented in 2's complement)
+18 +21	Slider position of the third axis (4 bytes)	Signed binary (A negative value is represented in 2's complement)

Output data unit

Input system	Increment system				
	IS-A	IS-B	IS-C	IS-D	IS-E
mm, deg	0.01	0.001	0.0001	0.00001	0.000001
inch	0.001	0.0001	0.00001	0.000001	0.0000001

5.5.25 Reading position of lower dead point of the Control function for link type press (High-speed Response)

You can read the lower dead point of the slider position of Control function for link type press.
If all axes are specified, this window allows the concurrent data to be read.

Input data structure

Top Address +0	(Function code) 387	
+2	(Completion code) - (Need not to be set)	
+4	(Data length L) - (Need not to be set)	
+6	(Data number N) 0	Set 0 to this field.
+8	(Data attribute M) Axis number	M=1 to n: Target axis number. (n is maximum axis number.) M=-1: All axes
+10	(Data area) - (Need not to be set)	

Completion codes

0 The position of the lower dead point for the specified axis has been read normally.
1 No option for "Control function for link type press".
4 Data specified for the data attribute is invalid because it is neither -1 nor a value from 1 to n (n is the number of axes). Specifically, the specified axis number is greater than the number of controlled axes.

> **Note**
> The option for "Control function for link type press" is necessary to use this function.

Output data structure

(1) When reading a specified axis.

Address	Data	Remarks
Top Address +0	(Function code) 387	
+2	(Completion code) ? (See above description)	
+4	(Data length L) 4	
+6	(Data number N) 0 (Same as input data)	
+8	(Data attribute M) Axis number (Same as input data)	
+10 +13	Position of the lower dead point of the controlled axis specified (4 bytes)	Signed binary (A negative value is represented in 2's complement)

(2) When reading all axes. (Ex. number of controlled axes is 3)

Address	Data	Remarks
Top Address +0	(Function code) 387	
+2	(Completion code) ? (See above description)	
+4	(Data length L) 12 (4bytes * 3axes)	
+6	(Data number N) 0 (Same as input data)	
+8	(Data attribute M) -1 (Same as input data)	M=-1: All axes.
+10	Position of the lower dead point of the first axis (4 bytes)	Signed binary (A negative value is represented in 2's complement)
+14	Position of the lower dead point of the second axis (4 bytes)	Signed binary (A negative value is represented in 2's complement)
+18 +21	Position of the lower dead point of the third axis (4 bytes)	Signed binary (A negative value is represented in 2's complement)

Output data unit

Input system	Increment system				
	IS-A	IS-B	IS-C	IS-D	IS-E
mm, deg	0.01	0.001	0.0001	0.00001	0.000001
inch	0.001	0.0001	0.00001	0.000001	0.0000001

5.5.26 Reading main gear angle of the Control function for link type press (High-speed Response)

You can read the main gear angle of the Control function for link type press.
If all axes are specified, this window allows the concurrent data to be read.

Input data structure

Top Address +0	(Function code) 388	
+2	(Completion code) - (Need not to be set)	
+4	(Data length L) - (Need not to be set)	
+6	(Data number N) 0	Set 0 to this field.
+8	(Data attribute M) Axis number	M=1 to n: Target axis number. (n is maximum axis number.) M=-1: All axes
+10	(Data area) - (Need not to be set)	

Completion codes

0 The main gear angle for the specified axis has been read normally.
1 No option for "Control function for link type press".
4 Data specified for the data attribute is invalid because it is neither -1 nor a value from 1 to n (n is the number of axes). Specifically, the specified axis number is greater than the number of controlled axes.

Note
The option for "Control function for link type press" is necessary to use this function.

Output data structure

(1) When reading a specified axis.

Address	Content	Remarks
Top Address +0	(Function code) 388	
+2	(Completion code) ? (See above description)	
+4	(Data length L) 4	
+6	(Data number N) 0 (Same as input data)	
+8	(Data attribute M) Axis number (Same as input data)	
+10 +13	Main gear angle of the controlled axis specified (4 bytes)	Signed binary (A negative value is represented in 2's complement)

(2) When reading all axes. (Ex. number of controlled axes is 3)

Address	Content	Remarks
Top Address +0	(Function code) 388	
+2	(Completion code) ? (See above description)	
+4	(Data length L) 12 (4bytes * 3axes)	
+6	(Data number N) 0 (Same as input data)	
+8	(Data attribute M) -1 (Same as input data)	M=-1: All axes.
+10	Main gear angle of the first axis (4 bytes)	Signed binary (A negative value is represented in 2's complement)
+14	Main gear angle of the second axis (4 bytes)	Signed binary (A negative value is represented in 2's complement)
+18 +21	Main gear angle of the third axis (4 bytes)	Signed binary (A negative value is represented in 2's complement)

Output data unit

Input system	Increment system				
	IS-A	IS-B	IS-C	IS-D	IS-E
Rotation axis	0.01	0.01	0.01	0.01	0.01

5.5.27 Reading analog monitor unit data (High-speed Response)

The analog current value from 0 to 25[mA] inputted into the analog monitor unit connected with CNC by FSSB is read as digital data from 0 to 32767.
If all axes are specified, this window allows the concurrent data to be read.

Input data structure

Top Address +0	(Function code) 435	
+2	(Completion code) - (Need not to be set)	
+4	(Data length L) - (Need not to be set)	
+6	(Data number N) 0	Set 0 to this field.
+8	(Data attribute M) Axis number	M=1 to n: Target axis number. (n is maximum axis number.) M=-1: All axes
+10	(Data area) - (Need not to be set)	

Completion codes

0 The analog monitor unit data has been read normally.
1 No option for "Control function for link type press" or "Pressure and position control function".
4 Data specified for the data attribute is invalid because it is neither -1 nor a value from 1 to n (n is the number of axes). Specifically, the specified axis number is greater than the number of controlled axes.

Note
The option for "Control function for link type press" and "Pressure and position control function" are necessary to use this function.

Output data structure

(1) When reading a specified axis.

Top Address +0	(Function code) 435	
+2	(Completion code) ? (See above description)	
+4	(Data length L) 4	
+6	(Data number N) 0 (Same as input data)	
+8	(Data attribute M) Axis number (Same as input data)	
+10 +13	Data of the controlled axis specified (4 bytes)	Signed binary 0 to 32767

(2) When reading all axes. (ex. number of controlled axes is 3)

Top Address +0	(Function code) 435	
+2	(Completion code) ? (See above description)	
+4	(Data length L) 12 (4bytes * 3axes)	
+6	(Data number N) 0 (Same as input data)	
+8	(Data attribute M) -1 (Same as input data)	M=-1: All axes.
+10	Data of the first axis (4 bytes)	Signed binary 0 to 32767
+14	Data of the second axis (4 bytes)	Signed binary 0 to 32767
+18 +21	Data of the third axis (4 bytes)	Signed binary 0 to 32767

5.5.28 Reading the Axes Command Value (High-speed Response)

You can read the axis command value.

Input data structure

Top Address +0	(Function code) 446	
+2	(Completion code) - (Need not to be set)	
+4	(Data length L) - (Need not to be set)	
+6	(Data number N) Axis number	1 to n (n is the number of axes in the CNC-path) : Reads the value of a specified axis. -1 : Reads the value of all axes in the CNC-path.
+8	(Data attribute M) Specified block	M=0: Previous block M=1: Active block M=2: Next block
+10	(Data area) - (Need not to be set)	

Completion codes

0 Normal completion.
3 The data number is invalid.
4 The data attribute is invalid.

Output data structure

(1) When read a specified axis.

Offset	Data	
Top Address +0	(Function code) 446	
+2	(Completion code) ? (See above description)	
+4	(Data length L) 12	
+6	(Data number N) Axis number (Same as input data)	
+8	(Data attribute M) Specified block (Same as input data)	
+10 +21	Axis command value (12 bytes)	See "Fig. 4.3 (a)".

(2) When read all axes. (Ex. number of controlled axes is 3)

Offset	Data	
Top Address +0	(Function code) 446	
+2	(Completion code) ? (See above description)	
+4	(Data length L) 36 (12bytes * 3axes)	
+6	(Data number N) Axis number (Same as input data)	
+8	(Data attribute M) Specified block (Same as input data)	
+10	Axis command value of the first axis (12 bytes)	See "Fig. 4.3 (a)".
+22	Axis command value of the second axis (12 bytes)	See "Fig. 4.3 (a)".
+34 +45	Axis command value of the third axis (12 bytes)	See "Fig. 4.3 (a)".

Data structure of the axis command value is as follows.

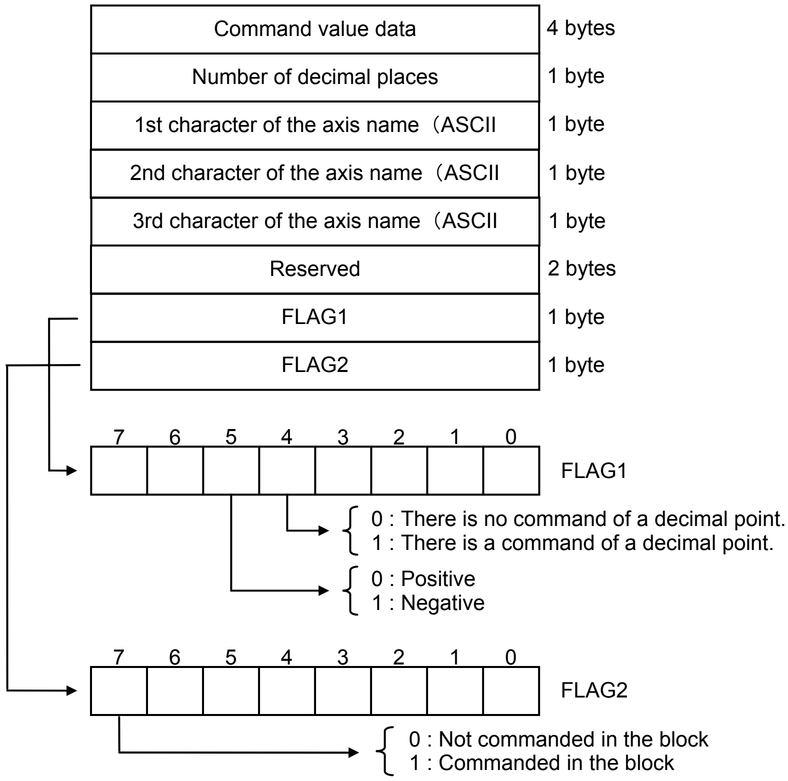


Fig 4.3 (c) data structure of axis command value

> **NOTE**
> 1 When 2nd or 3rd character of axis name is not defined, 0 can be read as 2nd or 3rd character.
> 2 Do not refer to undescribed bits of FLAG1 or FLAG2 because these statuses are indefinite.

Example: When second axis is Y and Y50.0 is commanded, the following data are read.

Command value data	=	500
Number of decimal places	=	1
1st character of the axis name	=	89 (ASCII code indicating the Y)
2nd character of the axis name	=	0
3rd character of the axis name	=	0

Calculation formula for the command value from the read value is as follows.

Command value = Command value data * $10^{-\text{Number of decimal places}}$

It is as follows when applying the read value of the example in the above calculation formula.

50.0 = $500 * 10^{-1}$

5.6 TOOL LIFE MANAGEMENT FUNCTION

5.6.1 Reading The Tool Life Management Data (Tool Group Number) (High-speed Response)

This function reads the tool group number in which the specified tool number is registered.

Input data structure

Address	Field	Remark
Top Address +0	(Function code) 38	
+2	(Completion code) - (Need not to be set)	
+4	(Data length L) - (Need not to be set)	
+6	(Data number N) 0	Set 0 to this field.
+8	(Data attribute M) Tool No.	
+10 +137 (MAX)	(Data area) - (Need not to be set)	

⚠CAUTION

1 When the tool number is set to "0", the tool group number of the currently used tool is read. If a tool group number is not specified after the power is turned ON, tool group number "0" is read.

2 If the same tool belongs to two or more tool groups, 32 tool groups can be read in the maximum. In this case, 128 bytes are required as the data area in the maximum.

Completion codes

0 The tool group number is read successfully.
4 The tool number in 'Data Attribute' has a wrong value.
5 The tool number is not registered.
6 The tool life management option has not been added on.

Output data structure

(1) When the specified tool is registered in only one group.

Top Address +0	(Function code) 38	
+2	(Completion code) ? (See above description)	
+4	(Data length L) 4	
+6	(Data number N) 0 (Same as input data)	
+8	(Data attribute M) Tool No. (Same as input data)	
+10 +13	Tool group No. (4 bytes)	Unsigned binary

(2) When the specified tool is registered in multiple groups.
(ex. number of registered group is 3)

Top Address +0	(Function code) 38	
+2	(Completion code) ? (See above description)	
+4	(Data length L) 12 (4bytes × n)	'n' is the number of tool groups to which the specified tool belongs
+6	(Data number N) 0 (Same as input data)	
+8	(Data attribute M) Tool No. (Same as input data)	
+10	Tool group No. (4 bytes)	Unsigned binary
+14	Tool group No. (4 bytes)	Unsigned binary
+18 +21	Tool group No. (4 bytes)	Unsigned binary

5.6.2 Reading Tool Life Management Data (Number of Tool Groups) (High-speed Response)

This function reads the number of tool groups in the tool life management data.
The maximum number of pairs of tool life management data in whole CNC system is 256 pairs (or 1024 pairs when extended).
The number of pairs assigned to the path is set to CNC parameter No.6813. The number of tool groups that can be registered varies depending on the setting of parameter No.6800#0(GS1) and No.6800#1(GS2) of the CNC, as indicated in the following table.

Parameter 6800

GS2	GS1	Number of tool groups	Tools per group
0	0	1/8 of Max. pairs (No.6813)	32
0	1	1/4 of Max. pairs (No.6813)	16
1	0	1/2 of Max. pairs (No.6813)	8
1	1	Max. pairs (No.6813)	4

Input data structure

Top Address +0	(Function code) 39	
+2	(Completion code) - (Need not to be set)	
+4	(Data length L) - (Need not to be set)	
+6	(Data number N) 0	Set 0 to this field.
+8	(Data attribute M) 0	Set 0 to this field.
+10 +41	(Data area) - (Need not to be set)	

Completion codes

0 The number of tool group numbers has been read successfully.
6 No option for the tool life management.

Output data structure

Top Address +0	(Function code) 39	
+2	(Completion code) ? (See above description)	
+4	(Data length L) 4	
+6	(Data number N) 0 (Same as input data)	
+8	(Data attribute M) 0 (Same as input data)	
+10 +13	Number of tool groups (4 bytes)	Unsigned binary

5.6.3 Reading Tool Life Management Data (Number of Tools) (High-speed Response)

This function reads the number of tools that belong to the tool group specified by tool group number, from the tool life management data.
The number of tools that can be registered in each tool group varies depending on the setting of parameter 6800#0(GS1) and 6800#1(GS2) of the CNC, as indicated in the following table.

Parameter 6800

GS2	GS1	Number of tools in a tool group
0	0	1 to 32
0	1	1 to 16
1	0	1 to 8
1	1	1 to 4

Input data structure

Top Address +0	(Function code) 40	
+2	(Completion code) - (Need not to be set)	
+4	(Data length L) - (Need not to be set)	
+6	(Data number N) Tool group number	
+8	(Data attribute M) 0	Set 0 to this field.
+10 +41	(Data area) - (Need not to be set)	

⚠**CAUTION**
Specifying "0" to the tool group number means the tool group that is currently selected.
While no tool group is selected yet after power-on of CNC, "0" of the tool group number results "0" of number of tools.

Completion codes

0 The number of tools has been read successfully.
3 The specified tool group number is incorrect.
6 No option for the tool life management.

Output data structure

Top Address +0	(Function code) 40	
+2	(Completion code) ? (See above description)	
+4	(Data length L) 4	
+6	(Data number N) Tool group number (Same as input data)	
+8	(Data attribute M) 0 (Same as input data)	
+10 +13	Number of tools (4 bytes)	Unsigned binary

5.6.4 Reading Tool Life Management Data (Tool Life) (High-speed Response)

This function reads the tool life value of the tool group specified by tool group number, from the tool life management data.
You can choose the method to manage tool lives by period of machining time or by the count of machining cycles for each tool group.

Input data structure

Address	Content	Remark
Top Address +0	(Function code) 41	
+2	(Completion code) - (Need not to be set)	
+4	(Data length L) - (Need not to be set)	
+6	(Data number N) Tool group number	
+8	(Data attribute M) 0	Set 0 to this field.
+10 +41	(Data area) - (Need not to be set)	

⚠CAUTION

Specifying "0" to the tool group number means the tool group that is currently selected.
While no tool group is selected yet after power-on of CNC, "0" of the tool group number results "0" of tool life value.

Completion codes

0 The tool life has been read successfully.
3 The specified tool group number is incorrect.
6 No option for the tool life management.

Output data structure

Top Address +0	(Function code) 41	
+2	(Completion code) ? (See above description)	
+4	(Data length L) 4	
+6	(Data number N) Tool group number (Same as input data)	
+8	(Data attribute M) 0 (Same as input data)	
+10 +13	Tool life (4 bytes)	Unsigned binary Time or number or cycles

In case the tool group chooses machining time to manage the lives of the tools, CNC parameter No.6805#0(FCO) determines the unit of the return value as below.

FCO	Unit
0	1 minute
1	0.1 minute

5.6.5 Reading Tool Life Management Data (Tool Life Counter) (High-speed Response)

This function reads the tool life counter of the tool group specified by tool group number, from the tool life management data.

Input data structure

Address	Field	Remarks
Top Address +0	(Function code) 42	
+2	(Completion code) - (Need not to be set)	
+4	(Data length L) - (Need not to be set)	
+6	(Data number N) Tool group number	
+8	(Data attribute M) 0	Set 0 to this field.
+10 +41	(Data area) - (Need not to be set)	

⚠CAUTION

Specifying "0" to the tool group number means the tool group that is currently selected.

While no tool group is selected yet after power-on of CNC, "0" of the tool group number results "0" of tool life counter.

Completion codes

0 The tool life has been read successfully.
3 The specified tool group number is incorrect.
6 No option for the tool life management.

Output data structure

Address	Content	Remarks
Top Address +0	(Function code) 42	
+2	(Completion code) ? (See above description)	
+4	(Data length L) 4	
+6	(Data number N) Tool group number (Same as input data)	
+8	(Data attribute M) 0 (Same as input data)	
+10 +13	Tool life counter (4 bytes)	Unsigned binary Time or number or cycles

In case the tool group chooses machining time to manage the lives of the tools, CNC parameter No.6805#0(FCO) determines the unit of the return value as below.

FCO	Unit
0	1 minute
1	0.1 minute

5.6.6 Reading Tool Life Management Data (Tool Length Compensation Number (1): Tool Number) (High-speed Response)

This function reads the tool length compensation number of the tool specified by tool group number and tool number, from the tool life management data.

Input data structure

Top Address +0	(Function code) 43
+2	(Completion code) - (Need not to be set)
+4	(Data length L) - (Need not to be set)
+6	(Data number N) Tool group number
+8	(Data attribute M) Tool number
+10 +41	(Data area) - (Need not to be set)

⚠CAUTION

Specifying "0" to the tool group number means the tool group that is currently selected, and "0" to the tool number means the tool that is currently used in the group.
While no tool group is selected yet after power-on of CNC, specifying the current tool of the current group results "0" of tool length compensation number.

Completion codes

0 The tool length compensation number has been read successfully.
3 The specified tool group number is incorrect.
4 The specified tool number is incorrect.
5 The specified tool number is not found in the specified tool group.
6 No option for the tool life management.

Output data structure

Top Address +0	(Function code) 43	
+2	(Completion code) ? (See above description)	
+4	(Data length L) 4	
+6	(Data number N) Tool group number (Same as input data)	
+8	(Data attribute M) Tool number (Same as input data)	
+10 +13	Tool length compensation number (4 bytes)	Unsigned binary

5.6.7 Reading Tool Life Management Data (Tool Length Compensation Number (2): Tool Order Number) (High-speed Response)

This function reads the tool length compensation number of the tool specified by tool group number and tool order number, from the tool life management data.

Input data structure

Top Address +0	(Function code) 44
+2	(Completion code) - (Need not to be set)
+4	(Data length L) - (Need not to be set)
+6	(Data number N) Tool group number
+8	(Data attribute M) Tool order number
+10 +41	(Data area) - (Need not to be set)

⚠CAUTION

Specifying "0" to the tool group number means the tool group that is currently selected. While no tool group is selected yet after power-on of CNC, specifying the current group results "0" of tool length compensation number.
Specifying "0" to the tool order number means the tool that is currently used. If the tool group has not ever been selected, tool order number "0" means the first tool in the group instead.

Completion codes

0 The tool length compensation number has been read successfully.
3 The specified tool group number is incorrect.
4 The specified tool order number is incorrect.
5 The specified tool group has no tool in the specified tool order position.
6 No option for the tool life management.

Output data structure

Top Address +0	(Function code) 44	
+2	(Completion code) ? (See above description)	
+4	(Data length L) 4	
+6	(Data number N) Tool group number (Same as input data)	
+8	(Data attribute M) Tool order number (Same as input data)	
+10 +13	Tool length compensation number (4 bytes)	Unsigned binary

5.6.8 Reading Tool Life Management Data (Cutter Radius Compensation Number (1): Tool Number) (High-speed Response)

This function reads the cutter radius compensation number of the tool specified by tool group number and tool number, from the tool life management data.

Input data structure

Top Address +0	(Function code) 45
+2	(Completion code) - (Need not to be set)
+4	(Data length L) - (Need not to be set)
+6	(Data number N) Tool group number
+8	(Data attribute M) Tool number
+10 +41	(Data area) - (Need not to be set)

⚠CAUTION

Specifying "0" to the tool group number means the tool group that is currently selected, and "0" to the tool number means the tool that is currently used in the group.
While no tool group is selected yet after power-on of CNC, specifying the current tool of the current group results "0" of cutter radius compensation number.

Completion codes

0 The cutter radius compensation number has been read successfully.
3 The specified tool group number is incorrect.
4 The specified tool number is incorrect.
5 The specified tool number was not found in the specified tool group.
6 No option for the tool life management.

Output data structure

Top Address +0	(Function code) 45	
+2	(Completion code) ? (See above description)	
+4	(Data length L) 4	
+6	(Data number N) Tool group number (Same as input data)	
+8	(Data attribute M) Tool number (Same as input data)	
+10 +13	Cutter compensation number (4 bytes)	Unsigned binary

5.6.9 Reading Tool Life Management Data (Cutter Radius Compensation Number (2): Tool Order Number) (High-speed Response)

This function reads the cutter radius compensation number of the tool specified by tool group number and tool order number, from the tool life management data.

Input data structure

Top Address +0	(Function code) 46
+2	(Completion code) - (Need not to be set)
+4	(Data length L) - (Need not to be set)
+6	(Data number N) Tool group number
+8	(Data attribute M) Tool order number
+10 +41	(Data area) - (Need not to be set)

⚠CAUTION

If 0 is specified for the tool group number, the tool group currently used is referred. In this case, if any tool group has not been used since the power to the CNC was turned on, 0 is read.
When 0 is specified for the tool order number, the data of the current tool in the tool group is read if the group has already been used, or the data of the first tool in the group is read if the group has not ever used.

Completion codes

0 The cutter radius compensation number has been read successfully.
3 The specified tool group number is incorrect.
4 The specified tool order number is incorrect.
5 The specified tool group has no tool in the specified tool order position.
6 No option for the tool life management.

Output data structure

Address	Contents	
Top Address +0	(Function code) 46	
+2	(Completion code) ? (See above description)	
+4	(Data length L) 4	
+6	(Data number N) Tool group number (Same as input data)	
+8	(Data attribute M) Tool order number (Same as input data)	
+10 +13	Cutter compensation number (4 bytes)	Unsigned binary

5.6.10 Reading Tool Life Management Data (Tool Information (1): Tool Number) (High-speed Response)

This function reads the status information of the tool specified by tool group number and tool number, from the tool life management data.

Input data structure

Address	Content
Top Address +0	(Function code) 47
+2	(Completion code) - (Need not to be set)
+4	(Data length L) - (Need not to be set)
+6	(Data number N) Tool group number
+8	(Data attribute M) Tool number
+10 +41	(Data area) - (Need not to be set)

⚠CAUTION

Specifying "0" to the tool group number means the tool group that is currently selected, and "0" to the tool number means the tool that is currently used in the group.

While no tool group is selected yet after power-on of CNC, specifying the current tool of the current group results "0" of tool status information.

Completion codes

0 The tool status information has been read successfully.
3 The specified tool group number is incorrect.
4 The specified tool number is incorrect.
5 The specified tool number was not found in the specified tool group.
6 No option for the tool life management.

Output data structure

Top Address +0	(Function code) 47	
+2	(Completion code) ? (See above description)	
+4	(Data length L) 4	
+6	(Data number N) Tool group number (Same as input data)	
+8	(Data attribute M) Tool number (Same as input data)	
+10 +13	Tool status information (4 bytes)	0: See "CAUTION" on the previous page. 1: The tool is registered. 2: The tool has reached the end of its life. 3: The tool was skipped. The three high-order bytes are fixed to 0.

5.6.11 Reading Tool Life Management Data (Tool Information (2): Tool Order Number) (High-speed Response)

This function reads the status information of the tool specified by tool group number and tool order number, from the tool life management data.

Input data structure

Top Address +0	(Function code) 48
+2	(Completion code) - (Need not to be set)
+4	(Data length L) - (Need not to be set)
+6	(Data number N) Tool group number
+8	(Data attribute M) Tool order number
+10 +41	(Data area) - (Need not to be set)

> ⚠CAUTION
> Specifying "0" to the tool group number means the tool group that is currently selected. While no tool group is selected yet after power-on of CNC, specifying the current group results "0" of tool status information.
> Specifying "0" to the tool order number means the tool that is currently used. If the tool group has not ever been selected, tool order number "0" means the first tool in the group instead.

Completion codes

0 The tool status information has been read successfully.
3 The specified tool group number is incorrect.
4 The specified tool order number is incorrect.
5 The specified tool group has no tool in the specified tool order position.
6 No option for the tool life management.

Output data structure

Top Address +0	(Function code) 48	
+2	(Completion code) ? (See above description)	
+4	(Data length L) 4	
+6	(Data number N) Tool group number (Same as input data)	
+8	(Data attribute M) Tool order number (Same as input data)	
+10 +13	Tool status information (4 bytes)	0: See "CAUTION" on the previous page. 1: The tool is registered. 2: The tool has reached the end of its life. 3: The tool was skipped. The three high-order bytes are fixed to 0.

5.6.12 Reading Tool Life Management Data (Tool Number) (High-speed Response)

This function reads the tool number of the tool specified by tool group number and tool order number, from the tool life management data.

Input data structure

Offset	Content
Top Address +0	(Function code) 49
+2	(Completion code) - (Need not to be set)
+4	(Data length L) - (Need not to be set)
+6	(Data number N) Tool group number
+8	(Data attribute M) Tool order number
+10 to +41	(Data area) - (Need not to be set)

⚠CAUTION

Specifying "0" to the tool group number means the tool group that is currently selected. While no tool group is selected yet after power-on of CNC, specifying the current group results "0" of tool number.
Specifying "0" to the tool order number means the tool that is currently used. If the tool group has not ever been selected, tool order number "0" means the first tool in the group instead.

Completion codes

0 The tool number has been read successfully.
3 The specified tool group number is incorrect.
4 The specified tool order number is incorrect.
5 The specified tool group has no tool in the specified tool order position.
6 No option for the tool life management.

Output data structure

Top Address +0	(Function code) 49	
+2	(Completion code) ? (See above description)	
+4	(Data length L) 4	
+6	(Data number N) Tool group number (Same as input data)	
+8	(Data attribute M) Tool order number (Same as input data)	
+10 +13	Tool number (4 bytes)	Unsigned binary

5.6.13 Reading the Tool Life Management Data (Tool Life Counter Type) (High-speed Response)

This function reads the tool life counter type of the tool group specified by tool group number, from the tool life management data.

Input data structure

Address	Field	Remark
Top Address +0	(Function code) 160	
+2	(Completion code) - (Need not to be set)	
+4	(Data length L) - (Need not to be set)	
+6	(Data number N) Tool group number	
+8	(Data attribute M) 0	Set 0 to this field.
+10 +11	(Data area) - (Need not to be set)	

⚠CAUTION

Specifying "0" to the tool group number means the tool group that is currently selected.
While no tool group is selected yet after power-on of CNC, "0" of the tool group number results "0" of tool life counter type.

Completion codes

0 The tool life counter type has been read successfully.
3 The specified tool group number is incorrect.
6 No option for Tool life management.

Output data structure

Top Address +0	(Function code) 160	
+2	(Completion code) ? (See above description)	
+4	(Data length L) 2	
+6	(Data number N) Tool group number (Same as input data)	
+8	(Data attribute M) 0 (Same as input data)	
+10 +11	Tool life counter type (2 bytes)	0: No counter type 1: Frequency 2: Real time

5.6.14 Registering Tool Life Management Data (Tool Group) (Low-speed Response)

This function registers a tool group in the tool life management data, with tool number, length of life and tool life counter type.

> ⚠ **WARNING**
> When you write some NC data using both this instruction in ladder program and other applications, take care that you do not write to the same data area.
> If some values are written to the same data area by two or more applications including ladder program, unexpected value may be written. In this case, it may cause an unexpected machine behavior and also tools, work pieces, and machines may be damaged. As for details, refer to “SAFETY PRECAUTIONS”.

Input data structure

Address	Field	Description
Top Address +0	(Function code) 163	
+2	(Completion code) - (Need not to be set)	
+4	(Data length L) 8	
+6	(Data number N) 0	Set 0 to this field.
+8	(Data attribute M) Tool number	
+10	Tool group number (2 bytes)	Unsigned binary 1-1024
+12	Tool life counter type (2 bytes)	1: Number of uses 2: Real time in minutes
+14 +17	Tool life (4 bytes)	Unsigned binary 1-65535 times (Number of uses) 1-4300 minutes (Read time) Note With the tool life management B function 1-99999999 times (Number of uses) 1-100000/60000 minutes (Real time) Note

> **NOTE**
> CNC parameter FCO(6805#0) decides the unit of tool life value of real time counter type as follows:
> 6805#0 = 0 : 1 minute (1–4300)
> 6805#0 = 1 : 0.1 minute (1–43000)
> With the tool life management B function, this parameter also decides the effective region of life value as follows:
> 6805#0 = 0 : 100000 minutes (1–100000)
> 6805#0 = 1 : 60000 minutes (1–600000)

Completion codes

0 Succeeded to register the tool group.
3 The specified tool group number is incorrect.
4 The tool number in 'Data attribute' has wrong value.
5 The length of tool life in 'Data area' is out of range.
6 No option for the tool life management.

Output data structure

Top Address +0	(Function code) 163
+2	(Completion code) ? (See above description)
+4	(Data length L) 8 (Same as input data)
+6	(Data number N) 0 (Same as input data)
+8	(Data attribute M) Tool number (Same as input data)
+10	Tool group number (2 bytes) (Same as input data)
+12	Tool life counter type (2 bytes) (Same as input data)
+14 +17	Length of Tool life (4 bytes) (Same as input data)

5.6.15 Writing Tool Life Management Data (Tool Life) (Low-speed Response)

This function sets the length of tool life of the specified tool group in the tool life management data.

> ⚠ **WARNING**
> When you write some NC data using both this instruction in ladder program and other applications, take care that you do not write to the same data area.
> If some values are written to the same data area by two or more applications including ladder program, unexpected value may be written. In this case, it may cause an unexpected machine behavior and also tools, work pieces, and machines may be damaged. As for details, refer to "SAFETY PRECAUTIONS".

Input data structure

Address	Field	Remarks
Top Address +0	(Function code) 164	
+2	(Completion code) - (Need not to be set)	
+4	(Data length L) 4	
+6	(Data number N) Tool group number	
+8	(Data attribute M) 0	Set 0 to this field.
+10 to +13	Tool life (4 bytes)	Unsigned binary 1-65535 times (Number of uses) 1-4300 minutes (Read time) Note With the tool life management B function 1-99999999 times (Number of uses) 1-100000/60000 minutes (Real time) Note

> **NOTE**
> CNC parameter FCO(6805#0) decides the unit of tool life value of real time counter type as follows:
> 6805#0 = 0 : 1 minute (1–4300)
> 6805#0 = 1 : 0.1 minute (1–43000)
> With the tool life management B function, this parameter also decides the effective region of life value as follows:
> 6805#0 = 0 : 100000 minutes (1–100000)
> 6805#0 = 1 : 60000 minutes (1–600000)

Completion codes

0 Succeeded to set the length of tool life.
3 The specified tool group number is incorrect.
5 The length of tool life is out of range.
6 No option for the tool life management.
13 The data of the currently selected tool group or the next tool group cannot be rewritten. An attempt was made to rewrite the data of the currently selected tool group or the next group.

Output data structure

Top Address +0	(Function code) 164
+2	(Completion code) ? (See above description)
+4	(Data length L) 4 (Same as input data)
+6	(Data number N) Tool group number (Same as input data)
+8	(Data attribute M) 0 (Same as input data)
+10 +13	Length of Tool life (4 bytes) (Same as input data)

5.6.16 Writing Tool Life Management Data (Tool Life Counter) (Low-speed Response)

This function sets the tool life counter in the specified tool group in the tool life management data.

> ⚠ **WARNING**
> When you write some NC data using both this instruction in ladder program and other applications, take care that you do not write to the same data area.
> If some values are written to the same data area by two or more applications including ladder program, unexpected value may be written. In this case, it may cause an unexpected machine behavior and also tools, work pieces, and machines may be damaged. As for details, refer to "SAFETY PRECAUTIONS".

Input data structure

Address	Data	Remarks
Top Address +0	(Function code) 165	
+2	(Completion code) - (Need not to be set)	
+4	(Data length L) 4	
+6	(Data number N) Tool group number	
+8	(Data attribute M) 0	Set 0 to this field.
+10 +13	Tool life counter (4 bytes)	Unsigned binary 1-65535 times (Number of uses) 1-4300 minutes (Read time) Note With the tool life management B function 1-99999999 times (Number of uses) 1-100000/60000 minutes (Real time) Note

> **NOTE**
> CNC parameter FCO(6805#0) decides the unit of tool life value of real time counter type as follows:
> 6805#0 = 0 : 1 minute (1–4300)
> 6805#0 = 1 : 0.1 minute (1–43000)
> With the tool life management B function, this parameter also decides the effective region of life value as follows:
> 6805#0 = 0 : 100000 minutes (1–100000)
> 6805#0 = 1 : 60000 minutes (1–600000)

Completion codes

0 Succeeded to set the tool life counter.
3 The specified tool group number is incorrect.
5 The value for tool life counter is out of range.
6 No option for the tool life management.

Output data structure

Top Address +0	(Function code) 165
+2	(Completion code) ? (See above description)
+4	(Data length L) 4 (Same as input data)
+6	(Data number N) Tool group number (Same as input data)
+8	(Data attribute M) 0 (Same as input data)
+10 +13	Length of Tool life (4 bytes) (Same as input data)

5.6.17 Writing Tool Life Management Data (Tool Life Counter Type) (Low-speed Response)

This function sets the tool life counter type of specified tool group in the tool life management data.

> ⚠ **WARNING**
> When you write some NC data using both this instruction in ladder program and other applications, take care that you do not write to the same data area.
> If some values are written to the same data area by two or more applications including ladder program, unexpected value may be written. In this case, it may cause an unexpected machine behavior and also tools, work pieces, and machines may be damaged. As for details, refer to "SAFETY PRECAUTIONS".

Input data structure

Address	Content	Remarks
Top Address +0	(Function code) 166	
+2	(Completion code) - (Need not to be set)	
+4	(Data length L) 2	
+6	(Data number N) Tool group number	
+8	(Data attribute M) 0	Set 0 to this field.
+10 +11	Tool life counter type (2 bytes)	1: Number of uses 2: Real time in minutes

Completion codes

0 Succeeded to set the tool life counter type.
3 The specified tool group number is incorrect.
5 The value for tool life counter type is wrong.
6 No option for the tool life management.

Output data structure

Top Address +0	(Function code) 166
+2	(Completion code) ? (See above description)
+4	(Data length L) 2 (Same as input data)
+6	(Data number N) Tool group number (Same as input data)
+8	(Data attribute M) 0 (Same as input data)
+10 +11	Tool life counter type (2 bytes) (Same as input data)

5.6.18 Writing Tool Life Management Data (Tool Length Compensation Number (1): Tool Number) (Low-speed Response)

This function sets the tool length compensation number of the specified tool group in the tool life management data.

> ⚠ **WARNING**
> When you write some NC data using both this instruction in ladder program and other applications, take care that you do not write to the same data area.
> If some values are written to the same data area by two or more applications including ladder program, unexpected value may be written. In this case, it may cause an unexpected machine behavior and also tools, work pieces, and machines may be damaged. As for details, refer to "SAFETY PRECAUTIONS".

Input data structure

Top Address +0	(Function code) 167	
+2	(Completion code) - (Need not to be set)	
+4	(Data length L) 4	
+6	(Data number N) Tool group number	
+8	(Data attribute M) Tool number	
+10 +13	Tool length compensation number (4 bytes)	Unsigned binary 1-255

Completion codes

0 Succeeded to set the tool length compensation number.
3 The specified tool group number is incorrect.
4 The tool number in 'Data attribute' has wrong value.
5 The tool number is not found in the tool group.
6 No option for the tool life management.

Output data structure

Top Address +0	(Function code) 167
+2	(Completion code) ? (See above description)
+4	(Data length L) 4 (Same as input data)
+6	(Data number N) Tool group number (Same as input data)
+8	(Data attribute M) Tool number (Same as input data)
+10 +13	Tool length compensation number (4 bytes) (Same as input data)

⚠CAUTION

The effective value for tool length compensation number depends on tool compensation number available on CNC.

5.6.19 Writing Tool Life Management Data (Tool Length Compensation Number (2): Tool Order Number) (Low-speed Response)

This function sets the tool length compensation number of the tool of the specified tool order number in the tool life management data.

> ⚠ **WARNING**
> When you write some NC data using both this instruction in ladder program and other applications, take care that you do not write to the same data area.
> If some values are written to the same data area by two or more applications including ladder program, unexpected value may be written. In this case, it may cause an unexpected machine behavior and also tools, work pieces, and machines may be damaged. As for details, refer to "SAFETY PRECAUTIONS".

Input data structure

Top Address +0	(Function code) 168	
+2	(Completion code) - (Need not to be set)	
+4	(Data length L) 4	
+6	(Data number N) Tool group number	
+8	(Data attribute M) Tool order number	
+10 +13	Tool length compensation number (4 bytes)	Unsigned binary 1-255

Completion codes

0 Succeeded to set the tool length compensation number.
3 The specified tool group number is incorrect.
4 The tool order number is wrong.
6 No option for the tool life management.

Output data structure

Top Address +0	(Function code) 168
+2	(Completion code) ? (See above description)
+4	(Data length L) 4 (Same as input data)
+6	(Data number N) Tool group number (Same as input data)
+8	(Data attribute M) Tool order number (Same as input data)
+10 +13	Tool length compensation number (4 bytes) (Same as input data)

⚠CAUTION

The effective value for tool length compensation number depends on tool compensation number available on CNC.

5.6.20 Writing Tool Life Management Data (Cutter Radius Compensation Number (1): Tool Number) (Low-speed Response)

This function sets the cutter radius compensation number of the specified tool group in the tool life management data.

> ⚠ **WARNING**
> When you write some NC data using both this instruction in ladder program and other applications, take care that you do not write to the same data area.
> If some values are written to the same data area by two or more applications including ladder program, unexpected value may be written. In this case, it may cause an unexpected machine behavior and also tools, work pieces, and machines may be damaged. As for details, refer to "SAFETY PRECAUTIONS".

Input data structure

Address	Content	Remarks
Top Address +0	(Function code) 169	
+2	(Completion code) - (Need not to be set)	
+4	(Data length L) 4	
+6	(Data number N) Tool group number	
+8	(Data attribute M) Tool number	
+10 +13	Cutter radius compensation number (4 bytes)	Unsigned binary 1-255

Completion codes

0 Succeeded to set the cutter radius compensation number.
3 The specified tool group number is incorrect.
4 The tool number in 'Data attribute' has wrong value.
5 The tool number is not found in the tool group.
6 No option for the tool life management.

Output data structure

Top Address +0	(Function code) 169
+2	(Completion code) ? (See above description)
+4	(Data length L) 4 (Same as input data)
+6	(Data number N) Tool group number (Same as input data)
+8	(Data attribute M) Tool number (Same as input data)
+10 +13	Cutter radius compensation number (4 bytes) (Same as input data)

⚠**CAUTION**

The effective value for Cutter radius compensation number depends on tool compensation number available on CNC.

5.6.21 Writing Tool Life Management Data (Cutter Radius Compensation Number (2): Tool Order Number) (Low-speed Response)

This function sets the cutter radius compensation number of the tool of the specified tool order number in the tool life management data.

> ⚠ **WARNING**
> When you write some NC data using both this instruction in ladder program and other applications, take care that you do not write to the same data area.
> If some values are written to the same data area by two or more applications including ladder program, unexpected value may be written. In this case, it may cause an unexpected machine behavior and also tools, work pieces, and machines may be damaged. As for details, refer to "SAFETY PRECAUTIONS".

Input data structure

Top Address +0	(Function code) 170	
+2	(Completion code) - (Need not to be set)	
+4	(Data length L) 4	
+6	(Data number N) Tool group number	
+8	(Data attribute M) Tool order number	
+10 +13	Cutter radius compensation number (4 bytes)	Unsigned binary 1-255

Completion codes

0 Succeeded to set the cutter radius compensation number.
3 The specified tool group number is incorrect.
4 The tool order number is wrong.
6 No option for the tool life management.

Output data structure

Top Address +0	(Function code) 170
+2	(Completion code) ? (See above description)
+4	(Data length L) 4 (Same as input data)
+6	(Data number N) Tool group number (Same as input data)
+8	(Data attribute M) Tool order number (Same as input data)
+10 +13	Cutter radius compensation number (4 bytes) (Same as input data)

⚠CAUTION

The effective value for cutter radius compensation number depends on tool compensation number available on CNC.

5.6.22 Writing the Tool Life Management Data (Tool Information (1): Tool Number) (Low-speed Response)

This function sets the Tool condition of the specified Tool group in the Tool life management data.

> ⚠ **WARNING**
> When you write some NC data using both this instruction in ladder program and other applications, take care that you do not write to the same data area.
> If some values are written to the same data area by two or more applications including ladder program, unexpected value may be written. In this case, it may cause an unexpected machine behavior and also tools, work pieces, and machines may be damaged. As for details, refer to "SAFETY PRECAUTIONS".

Input data structure

Top Address +0	(Function code) 171	
+2	(Completion code) - (Need not to be set)	
+4	(Data length L) 2	
+6	(Data number N) Tool group number	
+8	(Data attribute M) Tool number	
+10 +11	Tool information (2 bytes)	1: Tool state clear 2: Tool state skip

Completion codes

0 The tool information is written successfully.
3 The tool group number exceeds maximum number of registered groups.
4 The specified tool number is incorrect.
5 The specified tool number is not registered to the specified tool group.
6 The tool life management option has not been added on.

Output data structure

Top Address +0	(Function code) 171
+2	(Completion code) ? (See above description)
+4	(Data length L) 2 (Same as input data)
+6	(Data number N) Tool group number (Same as input data)
+8	(Data attribute M) Tool number (Same as input data)
+10 +11	Tool information (2 bytes) (Same as input data)

This function changes tool condition as shown below.

Command	Before call	After call
clear	Skip (#) Skip (#) Expired (*)	Unused ( ) In use (@) Unused ( )
skip	Unused ( ) In use (@) Expired (*)	Skip (#) Skip (#) Skip (#)

5.6.23 Writing the Tool Management Data (Tool Information (2): Tool Order Number) (Low-speed Response)

This function changes the status of the tool specified by tool group number and tool order number, in the tool life management data.

> ⚠ **WARNING**
> When you write some NC data using both this instruction in ladder program and other applications, take care that you do not write to the same data area.
> If some values are written to the same data area by two or more applications including ladder program, unexpected value may be written. In this case, it may cause an unexpected machine behavior and also tools, work pieces, and machines may be damaged. As for details, refer to "SAFETY PRECAUTIONS".

Input data structure

Top Address +0	(Function code) 172	
+2	(Completion code) - (Need not to be set)	
+4	(Data length L) 2	
+6	(Data number N) Tool group number	
+8	(Data attribute M) Tool order number	
+10 +11	Tool information (2 bytes)	1: Tool state clear 2: Tool state skip

Completion codes

0 The tool information has been set successfully.
3 The specified tool group number is incorrect.
4 The tool order number is incorrect.
6 No option for Tool life management.

Output data structure

Top Address +0	(Function code) 172
+2	(Completion code) ? (See above description)
+4	(Data length L) 2 (Same as input data)
+6	(Data number N) Tool group number (Same as input data)
+8	(Data attribute M) Tool order number (Same as input data)
+10 +11	Tool information (2 bytes) (Same as input data)

This function changes tool condition as shown below.

Command	Before call	After call
clear	Skip (#) Skip (#) Expired (*)	Unused ( ) In use (@) Unused ( )
skip	Unused ( ) In use (@) Expired (*)	Skip (#) Skip (#) Skip (#)

5.6.24 Writing Tool Life Management Data (Tool Number) (Low-speed Response)

This function registers a tool to the specified tool group in the tool life management data.

> ⚠ **WARNING**
> When you write some NC data using both this instruction in ladder program and other applications, take care that you do not write to the same data area.
> If some values are written to the same data area by two or more applications including ladder program, unexpected value may be written. In this case, it may cause an unexpected machine behavior and also tools, work pieces, and machines may be damaged. As for details, refer to "SAFETY PRECAUTIONS".

Input data structure

Top Address +0	(Function code) 173	
+2	(Completion code) - (Need not to be set)	
+4	(Data length L) 4	
+6	(Data number N) Tool group number	
+8	(Data attribute M) Tool order number	
+10 +13	Tool number (4 bytes)	Unsigned binary 1-99999999

Completion codes

0 Succeeded to register the tool number.
3 The specified tool group number is incorrect.
4 The tool order number is wrong.
6 No option for the tool life management.

Output data structure

Address	Contents
Top Address +0	(Function code) 173
+2	(Completion code) ? (See above description)
+4	(Data length L) 4 (Same as input data)
+6	(Data number N) Tool group number (Same as input data)
+8	(Data attribute M) Tool order number (Same as input data)
+10 +13	Tool number (4 bytes) (Same as input data)

5.6.25 Reading The Tool Life Management Data (Tool Group Number) (High-speed Response) (8-digits Tool Number)

This function reads the tool group number in which the specified tool number is registered. This function supports 8 digits tool number.

Input data structure

Offset	Content	Remark
Top Address +0	(Function code) 200	
+2	(Completion code) - (Need not to be set)	
+4	(Data length L) - (Need not to be set)	
+6	(Data number N) 0	Set 0 to this field.
+8	(Data attribute M) Tool number	
+12 +139 (MAX)	(Data area) - (Need not to be set)	

NOTE

1 When the tool number is set to "0", the tool group number of the currently used tool is read. If a tool group number is not specified after the power is turned ON, tool group number "0" is read.

2 If the same tool belongs to two or more tool groups, 32 tool groups can be read in the maximum. In this case, 128 bytes are required as the data area in the maximum.

Completion codes

0 The tool group number is read successfully.
4 The tool number in 'Data Attribute' has a wrong value.
5 The tool number is not registered.
6 The tool life management option has not been added on.

Output data structure

(1) When the specified tool is registered in only one group.

Top Address +0	(Function code) 200	
+2	(Completion code) ? (See above description)	
+4	(Data length L) 4	
+6	(Data number N) 0 (Same as input data)	
+8	(Data attribute M) Tool number (Same as input data)	
+12 +15	Tool group number (4 bytes)	Unsigned binary

(2) When the specified tool is registered in multiple groups.
(Ex. The number of registered group is 3.)

Top Address +0	(Function code) 200	
+2	(Completion code) ? (See above description)	
+4	(Data length L) 12 (4bytes × n)	'n' is the number of tool groups to which the specified tool belongs
+6	(Data number N) 0 (Same as input data)	
+8	(Data attribute M) Tool number (Same as input data)	
+12	Tool group number (4 bytes)	Unsigned binary
+16	Tool group number (4 bytes)	Unsigned binary
+20 +23	Tool group number (4 bytes)	Unsigned binary

5.6.26 Reading Tool Life Management Data (Tool Information (1): Tool Number) (High-speed Response) (8-digits Tool Number)

This function reads the status information of the tool specified by tool group number and tool number, from the tool life management data.

Input data structure

Address	Content
Top Address +0	(Function code) 201
+2	(Completion code) - (Need not to be set)
+4	(Data length L) - (Need not to be set)
+6	(Data number N) Tool group number
+8	(Data attribute M) Tool number
+12 +15	(Data area) - (Need not to be set)

> ⚠**CAUTION**
> Specifying "0" to the tool group number means the tool group that is currently selected, and "0" to the tool number means the tool that is currently used in the group.
> While no tool group is selected yet after power-on of CNC, specifying the current tool of the current group results "0" of tool status information.

Completion codes

0 The tool information was read successfully.
3 The specified tool group number is incorrect.
4 The specified tool number is incorrect.
5 The specified tool number is not registered to the specified tool group.
6 No option for the tool life management.

Output data structure

Top Address +0	(Function code) 201	
+2	(Completion code) ? (See above description)	
+4	(Data length L) 4	
+6	(Data number N) Tool group number (Same as input data)	
+8	(Data attribute M) Tool number (Same as input data)	
+12 +15	Tool status information (4 bytes)	0: See "CAUTION" on the previous page. 1: The tool is registered. 2: The tool has reached the end of its life. 3: The tool was skipped The three high-order bytes are fixed to 0.

5.6.27 Registering Tool Life Management Data (Tool Group Number) (Low-speed Response) (8-digits Tool Number)

This function registers the tool group number to tool life management data. Set the tool number, life value and life counter type to the specified tool group.

> ⚠ **WARNING**
> When you write some data using both this instruction in ladder program and other applications, take care of duplication writing into the same data area. If some values are written in the same data area by several applications, unexpected value may be set and the machine may behave in an unexpected working and tool, work piece, and the machine may also be damaged.
> As for details, refer to "SAFETY PRECAUTIONS".

Input data structure

Top Address +0	(Function code) 202	
+2	(Completion code) - (Need not to be set)	
+4	(Data length L) 8	
+6	(Data number N) 0	Set 0 to this field.
+8	(Data attribute M) Tool number	
+12	Tool group number (2 bytes)	Unsigned binary 1-1024
+14	Tool life counter type (2 bytes)	1: Number of uses 2: Real time in minutes
+16 +19	Tool life (4 bytes)	Unsigned binary 1-65535 times (Number or uses) 1-4300 minutes (Real time) Note With the tool life management B function 1-99999999 times (Number or uses) 1-100000/60000 minutes (Real time) Note

> **NOTE**
> CNC parameter FCO(6805#0) decides the unit of tool life value of real time counter type as follows:
> 6805#0 = 0 : 1 minute (1–4300)
> 6805#0 = 1 : 0.1 minute (1–43000)
> With the tool life management B function, this parameter also decides the effective region of life value as follows:
> 6805#0 = 0 : 100000 minutes (1–100000)
> 6805#0 = 1 : 60000 minutes (1–600000)

Completion codes

0 The tool length was registered successfully.
3 The specified tool group number is incorrect.
4 The tool number in 'Data Attribute' has a wrong value.
5 The tool life value is out-of-range.
6 No option for the tool life management.

Output data structure

Top Address +0	(Function code) 202
+2	(Completion code) ? (See above description)
+4	(Data length L) 8 (Same as input data)
+6	(Data number N) 0 (Same as input data)
+8	(Data attribute M) Tool number (Same as input data)
+12	Tool group number (2 bytes) (Same as input data)
+14	Tool life counter type (2 bytes) (Same as input data)
+16 +19	Tool life value (4 bytes) (Same as input data)

5.6.28 Reading Tool Life Management Data (Tool Length Compensation Number (1): Tool Number) (High-speed Response) (8-digits Tool Number)

This function reads the tool length compensation number of the tool specified by tool group number and tool number, from the tool life management data.

Input data structure

Top Address +0	(Function code) 227
+2	(Completion code) - (Need not to be set)
+4	(Data length L) - (Need not to be set)
+6	(Data number N) Tool group number
+8	(Data attribute M) Tool number
+12 +15	(Date area) - (Need not to be set)

> ⚠**CAUTION**
> Specifying "0" to the tool group number means the tool group that is currently selected, and "0" to the tool number means the tool that is currently used in the group.
> While no tool group is selected yet after power-on of CNC, specifying the current tool of the current group results "0" of tool length compensation number.

Completion codes

0 The tool length compensation number was read successfully.
3 The specified tool group number is incorrect.
4 The specified tool number is incorrect.
5 The specified tool number is not registered to the specified tool group.
6 No option for the tool life management.

Output data structure

Top Address +0	(Function code) 227	
+2	(Completion code) ? (See above description)	
+4	(Data length L) 4	
+6	(Data number N) Tool group number (Same as input data)	
+8	(Data attribute M) Tool number (Same as input data)	
+12 +15	Tool length compensation number (4 bytes)	Unsigned binary

5.6.29 Reading Tool Life Management Data (Cutter Radius Compensation Number (1): Tool Number) (High-speed Response) (8-digits Tool Number)

This function reads the cutter radius compensation number of the tool specified by tool group number and tool number, from the tool life management data.

Input data structure

Top Address +0	(Function code) 228
+2	(Completion code) - (Need not to be set)
+4	(Data length L) - (Need not to be set)
+6	(Data number N) Tool group number
+8	(Data attribute M) Tool number
+12 +15	(Date area) - (Need not to be set)

⚠CAUTION

Specifying "0" to the tool group number means the tool group that is currently selected, and "0" to the tool number means the tool that is currently used in the group.
While no tool group is selected yet after power-on of CNC, specifying the current tool of the current group results "0" of cutter radius compensation number.

Completion codes

0 The cutter radius compensation number was read successfully.
3 The specified tool group number is incorrect.
4 The specified tool number is incorrect.
5 The specified tool number is not registered to the specified tool group.
6 No option for the tool life management.

Output data structure

Top Address +0	(Function code) 228	
+2	(Completion code) ? (See above description)	
+4	(Data length L) 4	
+6	(Data number N) Tool group number (Same as input data)	
+8	(Data attribute M) Tool number (Same as input data)	
+12 +15	Cutter radius compensation number (4 bytes)	Unsigned binary

5.6.30 Writing Tool Life Management Data (Tool Length Compensation Number (1): Tool Number) (Low-speed Response) (8-digits Tool Number)

This function sets the tool length compensation number of a specified tool group in the tool life management data.

> ⚠ **WARNING**
> When you write some NC data using both this instruction in ladder program and other applications, take care that you do not write to the same data area.
> If some values are written to the same data area by two or more applications including ladder program, unexpected value may be written. In this case, it may cause an unexpected machine behavior and also tools, work pieces, and machines may be damaged. As for details, refer to "SAFETY PRECAUTIONS".

Input data structure

Address	Content	Remarks
Top Address +0	(Function code) 229	
+2	(Completion code) - (Need not to be set)	
+4	(Data length L) 4	
+6	(Data number N) Tool group number	
+8	(Data attribute M) Tool number	
+12 +15	Tool length compensation number (4 bytes)	Unsigned binary 1-255

Completion codes

0 The tool length compensation number was written successfully.
3 The specified tool group number is incorrect.
4 The specified tool number is incorrect.
5 The specified tool number is not registered to the specified tool group.
6 No option for the tool life management.

Output data structure

Address	Content
Top Address +0	(Function code) 229
+2	(Completion code) ? (See above description)
+4	(Data length L) 4 (Same as input data)
+6	(Data number N) Tool group number (Same as input data)
+8	(Data attribute M) Tool number (Same as input data)
+12 +15	Tool length compensation number (4 bytes) (Same as input data)

⚠CAUTION

The effective value for tool length compensation number depends on tool compensation number available on CNC.

5.6.31 Writing Tool Life Management Data (Cutter Radius Compensation Number (1): Tool Number) (Low-speed Response) (8-digits Tool Number)

This function sets the cutter radius compensation number of a tool belonging to a specified tool group in the tool life management data.

> ⚠ **WARNING**
> When you write some NC data using both this instruction in ladder program and other applications, take care that you do not write to the same data area.
> If some values are written to the same data area by two or more applications including ladder program, unexpected value may be written. In this case, it may cause an unexpected machine behavior and also tools, work pieces, and machines may be damaged. As for details, refer to "SAFETY PRECAUTIONS".

Input data structure

Address	Content	Remarks
Top Address +0	(Function code) 230	
+2	(Completion code) - (Need not to be set)	
+4	(Data length L) 4	
+6	(Data number N) Tool group number	
+8	(Data attribute M) Tool number	
+12 +15	cutter radius compensation number (4 bytes)	Unsigned binary 1-255

Completion codes

0 The cutter radius compensation number was written successfully.
3 The specified tool group number is incorrect.
4 The specified tool number is incorrect.
5 The specified tool number is not registered to the specified tool group.
6 No option for the tool life management.

Output data structure

Top Address +0	(Function code) 230
+2	(Completion code) ? (See above description)
+4	(Data length L) 4 (Same as input data)
+6	(Data number N) Tool group number (Same as input data)
+8	(Data attribute M) Tool number (Same as input data)
+12 +15	Cutter radius compensation number (4 bytes) (Same as input data)

⚠CAUTION

The effective value for Cutter radius compensation number depends on tool compensation number available on CNC.

5.6.32 Writing the Tool Life Management Data (Tool Information (1): Tool Number) (Low-speed Response) (8-digits Tool Number)

This function sets the tool information of a tool belonging to a specified tool group in the tool life management data. This function supports 8 digits tool number.

> ⚠ **WARNING**
> When you write some NC data using both this instruction in ladder program and other applications, take care that you do not write to the same data area.
> If some values are written to the same data area by two or more applications including ladder program, unexpected value may be written. In this case, it may cause an unexpected machine behavior and also tools, work pieces, and machines may be damaged. As for details, refer to “SAFETY PRECAUTIONS”.

Input data structure

Offset	Field	Remarks
Top Address +0	(Function code) 231	
+2	(Completion code) - (Need not to be set)	
+4	(Data length L) 2	
+6	(Data number N) Tool group number	
+8	(Data attribute M) Tool number	
+12 +13	Tool information (2 bytes)	1 : Clears tool status 2 : Skips tool status

Completion codes

0 The tool information is written successfully.
3 The tool group number exceeds maximum number of registered groups.
4 The specified tool number is incorrect.
5 The specified tool number is not registered to the specified tool group.
6 The tool life management option has not been added on.

Output data structure

Top Address +0	(Function code) 231
+2	(Completion code) ? (See above description)
+4	(Data length L) 2 (Same as input data)
+6	(Data number N) Tool group number (Same as input data)
+8	(Data attribute M) Tool number (Same as input data)
+12 +13	Tool information (2 bytes) (Same as input data)

This function changes tool condition as shown below.

Command	Before call	After call
clear	Skip (#) Skip (#) Expired (*)	Unused ( ) In use (@) Unused ( )
skip	Unused ( ) In use (@) Expired (*)	Skip (#) Skip (#) Skip (#)

5.6.33 Deleting Tool life Management Data (Tool Group) (Low-speed Response)

This function deletes the specified tool group in the tool life management data. In other words, it makes the tool group to be unregistered.

Input data structure

Address	Field	Remarks
Top Address +0	(Function code) 324	
+2	(Completion code) - (Need not to be set)	
+4	(Data length L) 0	Set 0 to this field.
+6	(Data number N) Tool group number	
+8 +9	(Data attribute M) 0	Set 0 to this field.

Completion codes

0 Succeeded to delete the tool group number.
3 The specified tool group number is incorrect.
6 No option for the tool life management.

Output data structure

Address	Field
Top Address +0	(Function code) 324
+2	(Completion code) ? (See above description)
+4	(Data length L) 0 (Same as input data)
+6	(Data number N) Tool group number (Same as input data)
+8 +9	(Data attribute M) 0 (Same as input data)

5.6.34 Deleting Tool life Management Data (Tool Data) (Low-speed Response)

This function deletes the tool data at the specified tool order number in the tool life management data.

Input data structure

Address	Content	Remarks
Top Address +0	(Function code) 325	
+2	(Completion code) - (Need not to be set)	
+4	(Data length L) 0	Set 0 to this field.
+6	(Data number N) Tool group number	
+8 +9	(Data attribute M) Tool order number	

Completion codes

0 Succeeded to delete the tool group number.
3 The specified tool group number is incorrect.
4 The tool order number is wrong.
6 No option for the tool life management.

Output data structure

Address	Content
Top Address +0	(Function code) 325
+2	(Completion code) ? (See above description)
+4	(Data length L) 0 (Same as input data)
+6	(Data number N) Tool group number (Same as input data)
+8 +9	(Data attribute M) Tool order number (Same as input data)

5.6.35 Clearing Tool Life Management Data (Tool Life Counter and Tool Information) (Low-speed Response)

This function clears the tool life counter and all tool information of the specified tool group in the tool life management data.

Input data structure

Top Address +0	(Function code) 326	
+2	(Completion code) - (Need not to be set)	
+4	(Data length L) 0	Set 0 to this field.
+6	(Data number N) Tool group number	
+8 +9	(Data attribute M) 0	Set 0 to this field.

Completion codes

0 Succeeded to clear the tool life counter and the tool information.
3 The specified tool group number is incorrect.
6 No option for the tool life management.

Output data structure

Top Address +0	(Function code) 326
+2	(Completion code) ? (See above description)
+4	(Data length L) 0 (Same as input data)
+6	(Data number N) Tool group number (Same as input data)
+8 +9	(Data attribute M) 0 (Same as input data)

5.6.36 Writing Tool Life Management Data (Arbitrary Group Number) (Low-speed Response)

This function sets arbitrary group number of the specified tool group in the tool life management data.

> ⚠ **WARNING**
> When you write some NC data using both this instruction in ladder program and other applications, take care that you do not write to the same data area.
> If some values are written to the same data area by two or more applications including ladder program, unexpected value may be written. In this case, it may cause an unexpected machine behavior and also tools, work pieces, and machines may be damaged. As for details, refer to "SAFETY PRECAUTIONS".

Input data structure

Top Address +0	(Function code) 327	
+2	(Completion code) - (Need not to be set)	
+4	(Data length L) 4	
+6	(Data number N) Tool group number	
+8	(Data attribute M) 0	Set 0 to this field.
+10 +13	Arbitrary group number (4 bytes)	

> **NOTE**
> Writing the tool life Management Data (Arbitrary group number) is available for tool life management B function.

Completion codes

0 Succeeded to set the arbitrary group number.
3 The specified tool group number is incorrect.
5 Arbitrary group number is out of range.
6 No option for the tool life management.

Output data structure

Top Address +0	(Function code) 327
+2	(Completion code) ? (See above description)
+4	(Data length L) 4 (Same as input data)
+6	(Data number N) Tool group number (Same as input data)
+8	(Data attribute M) 0 (Same as input data)
+10 +13	Arbitrary group number (4 bytes) (Same as input data)

5.6.37 Writing Tool Life Management Data (Remaining Tool Life) (Low-speed Response)

This function sets the length of remaining tool life of the specified tool group in the tool life management data.

> ⚠ **WARNING**
> When you write some NC data using both this instruction in ladder program and other applications, take care that you do not write to the same data area.
> If some values are written to the same data area by two or more applications including ladder program, unexpected value may be written. In this case, it may cause an unexpected machine behavior and also tools, work pieces, and machines may be damaged. As for details, refer to "SAFETY PRECAUTIONS".

Input data structure

Address	Field	Remark
Top Address +0	(Function code) 328	
+2	(Completion code) - (Need not to be set)	
+4	(Data length L) 4	
+6	(Data number N) Tool group number	
+8	(Data attribute M) 0	Set 0 to this field.
+10 +13	Remaining tool life (4 bytes)	

> **NOTE**
> Writing the tool life Management Data (Remaining tool life) is available for tool life management B function.

Completion codes

0 Succeeded to set the length of remaining tool life.
3 The specified tool group number is incorrect.
5 Remaining tool life is out of range.
6 No option for the tool life management.

Output data structure

Top Address +0	(Function code) 328
+2	(Completion code) ? (See above description)
+4	(Data length L) 4 (Same as input data)
+6	(Data number N) Tool group number (Same as input data)
+8	(Data attribute M) 0 (Same as input data)
+10 +13	Remaining tool life (4 bytes) (Same as input data)

5.7 TOOL MANAGEMENT FUNCTIONS

Commands regarding the main axis position and standby position of a multi-path system

In a multi-path system, the tool management data and the magazine data are shared by the paths. Regarding the main axis position and standby position, by contrast, the system has separate data for each individual path.
Therefore, when the PMC system issues a command regarding the main axis position or standby position, the path number needs to be included in that command as well.
The specifiable command values are listed below.

	Spindle position			
	1st	**2nd**	**3rd**	**4th**
Path 1	111 (11)	112 (12)	113 (13)	114 (14)
Path 2	211	212	213	214
Path 3	311	312	313	314
Path 4	411	412	413	414
Path 5	511	512	513	514
Path 6	611	612	613	614
Path 7	711	712	713	714
Path 8	811	812	813	814
Path 9	911	912	913	914
Path 10	1011	1012	1013	1014

	Standby position			
	1st	**2nd**	**3rd**	**4th**
Path 1	121 (21)	122 (22)	123 (23)	124 (24)
Path 2	221	222	223	224
Path 3	321	322	323	324
Path 4	421	422	423	424
Path 5	521	522	523	524
Path 6	621	622	623	624
Path 7	721	722	723	724
Path 8	821	822	823	824
Path 9	921	922	923	924
Path 10	1021	1022	1023	1024

NOTE
1 The CNC can control a maximum of four axes per path.
2 When the maximum number of axes that can be controlled per path is four, the CNC can control a maximum of eight axes for all the paths from path 1 to path 10.

5.7.1 Exchanging Tool Management Data Numbers in a Magazine Management Table (Low-speed Response)

The tool management data numbers of the two pot numbers of the specified magazine numbers are exchanged.
When you specify the spindle position or the waiting position as the magazine number of the source and the destination, specify 0 as the pot number.
When specifying the main axis position or standby position of the second or succeeding path of the CNC, enter the path number in the position of the number of hundreds in the magazine number. For example, when specifying the third main axis of path 2, enter 213 as the magazine number. When specifying path 1, the number of hundreds can be omitted. For example, magazine number 122 may be entered as 22.
When using the function "Tool Management Function Tool storage position reservation", you can also specify the "1" to the exchange type. If "1" is specified as an exchange type, you can exchange at once the tool management data numbers in a magazine management table and origin position. Therefore, when exchanging the tool by which the origin position is registered, the data of an origin position is also exchanged.

NOTE
1. To use this window function, the option of “Tool pair for tool management function: 64, 240 or 1000 pairs” is necessary.
2. To use the Tool Management Function Tool storage position reservation, the option of "Tool management expansion B" is necessary. Moreover, set CNC parameter TMP(No.13210#1) to 1 and TRF(No.13201#5) to 1.
3. To specify except zero as an exchange type, set CNC parameter TEA(No.13208#4) to 1.

Input data structure

Top Address +0	(Function code) 329	
+2	(Completion code) - (Need not to be set)	
+4	(Data length L) 8	
+6	(Data number N) 0	Set 0 to this field.
+8	(Data attribute M) Exchange type	0 : Only the tool management data numbers in a magazine management table is exchanged. 1 : Tool management data numbers in a magazine management table and origin position are exchanged at once.
+10	(Data number N2) 0	Set 0 to this field.
+12	(Detailed Completion code) - (Need not to be set)	
+14	Magazine number 1 (2 bytes)	
+16	Pot number 1 (2 bytes)	

+18	Magazine number 2 (2 bytes)
+20 +21	Pot number 2 (2 bytes)

Completion codes

0 The processing has been executed normally.
2 The data length is invalid.
3 The data number is invalid.
4 The exchange type is invalid.
5 (See the following detailed completion codes.)
6 The necessary option is not found.

Detailed completion codes

The detailed completion code is always 0 when the completion code is other than 5.
When the completion code is 5, the detailed completion code is one of the following values:
21 Cartridge number 1 is invalid.
22 Pot number 1 is invalid.
24 Cartridge number 2 is invalid.
25 Pot number 2 is invalid.
27 Interference with another tool or magazine frame

Output data structure

Top Address +0	(Function code) 329
+2	(Completion code) ? (See above description)
+4	(Data length L) 8 (Same as input data)
+6	(Data number N) 0 (Same as input data)
+8	(Data attribute M) 0 (Same as input data)
+10	(Data number N2) 0 (Same as input data)
+12	(Detailed completion code) ? (See above description)
+14	Magazine number 1 (2 bytes) (Same as input data)
+16	Pot number 1 (2 bytes) (Same as input data)
+18	Magazine number 2 (2 bytes) (Same as input data)
+20 +21	Pot number 2 (2 bytes) (Same as input data)

5.7.2 Searching for a Free Pot (Low-speed Response)

Based on the pot position that is specified, the nearest free pot (Tool management number is 0) is searched in the specified magazine or all the magazines. The position of spindle and standby are not included into the free pot.

> **NOTE**
> To use this window function, the option of “Tool pair for tool management function: 64, 240 or 1000 pairs” is necessary.

(a) Search direction

Search direction	Direction designation	Magazine that is searched for	The search direction with matrix type
0	Not specified	Specified magazine	Row
10	Not specified	All magazine	Row
20	Not specified	Specified magazine	Column
30	Not specified	All magazine	Column
1	Forward	Specified magazine	Row
11	Forward	All magazine	Row
-1	Backward	Specified magazine	Row
-11	Backward	All magazine	Row
2	Forward	Specified magazine	Column
12	Forward	All magazine	Column
-2	Backward	Specified magazine	Column
-12	Backward	All magazine	Column

In case that all magazine is specified to searching object, the search of free pot is performed in the specified magazine. If free pot cannot be searched in the specified magazine, the search object is sifted to the next magazine

Input data structure

Top Address +0	(Function code) 330
+2	(Completion code) - (Need not to be set)
+4	(Data length L) - (Need not to be set)
+6	(Data number N) Magazine number
+8	(Data attribute M) Search direction
+10	(Data number N2) Pot number
+12	(Detailed Completion code) - (Need not to be set)
+14 +17	(Data area) (4 bytes) (Need not to be set)

Completion codes

0 The processing has been executed normally.
3 (See the following detailed completion codes.)
4 The specified search direction is invalid.
6 The necessary option is not found.
8, 13 There is no free pot.

Detailed completion codes

The detailed completion code is always 0 when the completion code is other than 3.
When the completion code is 3, the detailed completion code is one of the following values:
21 The magazine number is invalid.
22 The pot number is invalid.

Output data structure

Offset	Contents
Top Address +0	(Function code) 330
+2	(Completion code) ? (See above description)
+4	(Data length L) 4
+6	(Data number N) Magazine number (Same as input data)
+8	(Data attribute M) Search direction (Same as input data)
+10	(Data number N2) Pot number (Same as input data)
+12	(Detailed completion code) ? (See above description)
+14	Cartridge number (2 bytes)
+16 ... +17	Pot number (2 bytes)

When the search direction is not specified and free pots are found to the same distance in both forward and backward directions, the pot found in the forward directions can be selected.

5.7.3 Registering New Tool Management Data (Low-speed Response)

A new tool is registered, based on the specified magazine number and pot number, or tool management data number. The system searches for a free area, starting from the top of the memory space, and registers the specified tool management data in the free area found. A free area refers to a location in the memory space where the tool management data is disabled (bit 0 of the tool management data is set to 0). Completion code 8 is returned if there is no free area.
If the specified magazine number or pot number does not correspond to a free pot (a tool management data number is already assigned to it), completion code 13 is returned.

When using the function "Tool management function for oversize tools", you can also register the item "Tool geometry number" to the tool management data. If you will register the tool management data that causes an interference with another tool or magazine frame, completion code 5 and detailed completion code 27 is returned.

When using the function "Tool management function tool storage position reservation", you can also register the items "Origin magazine number" and "Origin pot number" to the tool management data. If specified invalid magazine number and pot number as an origin position, completion code 5 and detailed completion code 17 or 18 is returned and data aren’t registered. And registered origin position was specified, completion code 5 and detailed completion code 104 is returned and data isn’t registered.

When using the function “Tool management function for multi-edge tools”, you can register the multi-edge tools by setting 1-5 to the item “Number of edge positions”. If value specified to the number of edge positions is other than 0-5, completion code 5 and detailed completion code 19 is returned. The multi-edge tools can be registered up to 100. If 100 multi-edge tools have already been registered, completion code 5 and detailed completion code 94 is returned.
When using the function "Tool management function multi-edge tools support", you can also register the items "Edge group number" and "Edge number" to the tool management data using this Window function. If you will register the tool management data that causes inconsistency such as duplication of an edge number on an edge group, completion code 5 and detailed completion code 29 is returned.

NOTE

1 To use this window function, the option of “Tool pair for tool management function: 64, 240 or 1000 pairs” is necessary.
2 The data length differs depending on whether the "Tool management function customized data extension (5 to 20)" or "Tool management function customized data extension (5 to 40)" option is equipped or not.
3 To use the Tool management function tool storage position reservation, the option of "Tool management expansion B" is necessary. Moreover, set CNC parameter TMP(No.13210#1) to 1 and TRF(No.13201#5) to 1.
4 To use the Tool management function for oversize tools, the option of "Tool management expansion B" is necessary. Moreover, set CNC parameter TOT(No.13210#0) to 1.
5 Tool management function has two functions concerning the multi-edge tool, which are “Tool management function for multi-edge tools” and “Tool management function multi-edge tools support”. And, the usable items are different respectively.
   1) Tool management function for multi-edge tools
      When “Tool management function for multi-edge tools” is used, the following item is enabled.
      - Number of edge positions
      To use the “Tool management function for multi-edge tools”, the option of "Tool management function for multi-edge tools" is necessary.
      Moreover, set the parameter MEB (No.13210#3) to 1.
   2) Tool management function multi-edge tools support
      When “Tool management function multi-edge tools support” is used, the following items are enabled.
      - Edge group number
      - Edge number
      To use the Tool management function multi-edge tools support, set the parameter TME (No.13201#3) to 1.

(a) Data length
76: When the option "Tool management function customized data extension" is not equipped.
140: When the option "Tool management function customized data extension (5 to 20)" is equipped.
220: When the option "Tool management function customized data extension (5 to 40)" is equipped.

Input data structure

Top Address +0	(Function code) 331	
+2	(Completion code) - (Need not to be set)	
+4	(Data length L) 76, 140, 220	
+6	(Data number N) Magazine number	If you want to specify the tool management data number, set zero to this field.
+8	(Data attribute M) 0	Set 0 to this field.

+10	(Data number N2) Pot number or tool management data number	
+12	(Detailed Completion code) - (Need not to be set)	
+14	Tool type number (4 bytes)	
+18	Tool life counter (4 bytes)	
+22	Maximum tool life (4 bytes)	
+26	Notice tool life (4 bytes)	
+30	Tool life status (1 byte)	
+31	Customized data 0 (1 byte)	
+32	Tool information (2 bytes)	
+34	Tool length compensation number H (2 bytes)	* for milling or compound system
+36	Cutter compensation number D (2 bytes)	* for milling or compound system
+38	Spindle speed S (4 bytes)	
+42	Cutting feedrate F (4 bytes)	
+46	(unused) 0 (2 bytes)	Set 0 to this field.
+48	(unused) 0 (2 bytes)	Set 0 to this field.
+50	Tool geometric compensation number G (2 bytes)	* for lathe or compound system
+52	Tool wear compensation number W (2 bytes)	* for lathe or compound system
+54	Tool geometry number GNO (2 bytes)	* When the function "Tool management function for oversize tools" is enabled.
+56	Edge group number (2 bytes)	* When the function "Tool management function multi-edge tools support" is enabled.
+58	Edge number (2 bytes)	* When the function "Tool management function multi-edge tools support" is enabled.
+60	Origin magazine number (2 bytes)	* When the function "Tool management function tool storage position reservation" is enabled.
+62	Origin pot number (2 bytes)	* When the function "Tool management function tool storage position reservation" is enabled.

+64	Number of edge positions (1 byte)	* When the function "Tool management function multi-edge tools support" is enabled.
+65	(reserved) 0 (9 bytes)	Set 0 to this field.
+74	Customized data 1 (4 bytes)	
~		~
+86 +89	Customized data 4 (4 bytes)	This item is end of data when the data length is 76.
~		~
+150 +153	Customized data 20 (4 bytes)	This item is end of data when the data length is 140.
~		~
+230 +233	Customized data 40 (4 bytes)	This item is end of data when the data length is 220.

Completion codes

0 The processing has been executed normally.
2 The data length is invalid.
3 (See the following detailed completion codes.)
5 (See the following detailed completion codes.)
6 The necessary option is not found.
7 The area is protected.
8 There is no free area.
13 There is no free pot.

Detailed completion codes

The detailed completion code is always 0 when the completion code is other than 3 or 5.

When the completion code is 3, the detailed completion code is one of the following values:
21 The magazine number is invalid.
22 The pot number is invalid.
23 The tool management data number is invalid.

When the completion code is 5, the detailed completion code is one of the following values:
1 The specified tool type number is invalid.
2 The specified tool life counter is invalid.
3 The specified maximum tool life is invalid.
4 The specified notice tool life is invalid.
5 The specified tool life status is invalid.
7 The specified tool information is invalid.
8 The specified tool length compensation number (H) is invalid.
9 The specified cutter compensation number (D) is invalid.
10 The specified spindle speed (S) is invalid.
11 The specified cutting feedrate (F) is invalid.
12 The specified tool geometric compensation number (G) is invalid.
13 The specified tool wear compensation number (W) is invalid.
14 The specified tool geometry number (GNO) is invalid
15 The specified edge group number is invalid.
16 The specified edge number is invalid.
17 Origin magazine number is invalid.

18 Origin pot number is invalid.
19 Number of edge positions is invalid.
27 Interference with another tool or magazine frame
29 Illegal multi edge tool data.
31 to 70 The specified customized data (1 to 40) is invalid.
94 Multi-edge tools have been full already.
104 Origin overlaps

Output data structure

Top Address +0	(Function code) 331	
+2	(Completion code) ? (See above description)	
+4	(Data length L) (Same as input data)	
+6	(Data number N) Magazine number (Same as input data)	
+8	(Data attribute M) 0 (Same as input data)	
+10	(Data number N2) Pot number or tool management data number (Same as input data)	
+12	(Detailed completion code) ? (See above description)	
+14	Tool type number (4 bytes) (Same as input data)	
+18	Tool life counter (4 bytes) (Same as input data)	
~		~
+86 +89	Customized data 4 (4 bytes) (Same as input data)	This item is end of data when the data length is 76.
~		~
+150 +153	Customized data 20 (4 bytes) (Same as input data)	This item is end of data when the data length is 140.
~		~
+230 +233	Customized data 40 (4 bytes) (Same as input data)	This item is end of data when the data length is 220.

5.7.4 Writing Tool Management Data (Low-speed Response)

The tool management data is changed based on the specified magazine number and pot number, or tool management data number. In the case of a free pot (a tool management data number is not assigned), completion code 9 is returned.

When using the function "Tool management function for oversize tools", you can also register the item "Tool geometry number" to the tool management data. If you will register the tool management data that causes an interference with another tool or magazine frame, completion code 5 and detailed completion code 27 is returned.

When using the function "Tool management function tool storage position reservation", you can also register the items "Origin magazine number" and "Origin pot number" to the tool management data. If specified invalid magazine number and pot number as an origin position, completion code 5 and detailed completion code 17 or 18 is returned and data aren't registered. And registered origin position was specified, completion code 5 and detailed completion code 104 is returned and data isn't registered.

When using the function “Tool management function for multi-edge tools”, you can register the multi-edge tools by setting 1-5 to the item “Number of edge positions”. If value specified to the number of edge positions is other than 0-5, completion code 5 and detailed completion code 19 is returned. . The multi-edge tools can be registered up to 100. If 100 multi-edge tools have already been registered, completion code 5 and detailed completion code 94 is returned.
When using the function "Tool management function multi-edge tools support", you can also register the items "Edge group number" and "Edge number" to the tool management data using this Window function. If you will register the tool management data that causes inconsistency such as duplication of an edge number on an edge group, completion code 5 and detailed completion code 29 is returned.

> ⚠ **WARNING**
> When you write some NC data using both this instruction in ladder program and other applications, take care that you do not write to the same data area.
> If some values are written to the same data area by two or more applications including ladder program, unexpected value may be written. In this case, it may cause an unexpected machine behavior and also tools, work pieces, and machines may be damaged. As for details, refer to “SAFETY PRECAUTIONS”.

NOTE

1 To use this window function, the option of “Tool pair for tool management function: 64, 240 or 1000 pairs” is necessary.
2 The data length differs depending on whether the "Tool management function customized data extension (5 to 20)" or "Tool management function customized data extension (5 to 40)" option is equipped or not.
3 To use the Tool management function tool storage position reservation, the option of "Tool management expansion B" is necessary. Moreover, set CNC parameter TMP(No.13210#1) to 1 and TRF(No.13201#5) to 1.
4 To use the Tool management function for oversize tools, the option of "Tool management expansion B" is necessary. Moreover, set CNC parameter TOT(No.13210#0) to 1.
5 Tool management function has two functions concerning the multi-edge tool, which are “Tool management function for multi-edge tools” and “Tool management function multi-edge tools support”. And, the usable items are different respectively.
   1) Tool management function for multi-edge tools
      When “Tool management function for multi-edge tools” is used, the following item is enabled.
      - Number of edge positions
      To use the “Tool management function for multi-edge tools”, the option of "Tool management function for multi-edge tools" is necessary.
      Moreover, set the parameter MEB (No.13210#3) to 1.
   2) Tool management function multi-edge tools support
      When “Tool management function multi-edge tools support” is used, the following items are enabled.
      - Edge group number
      - Edge number
      To use the Tool management function multi-edge tools support, set the parameter TME (No.13201#3) to 1.

(a) Data length
76: When the option "Tool management function customized data extension" is not equipped.
140: When the option "Tool management function customized data extension (5 to 20)" is equipped.
220: When the option "Tool management function customized data extension (5 to 40)" is equipped.

Input data structure

Top Address +0	(Function code) 332	
+2	(Completion code) - (Need not to be set)	
+4	(Data length L) 76, 140, 220	
+6	(Data number N) Magazine number	If you want to specify the tool management data number, set zero to this field.
+8	(Data attribute M) 0	Set 0 to this field.

+10	(Data number N2) Pot number or tool management data number	
+12	(Detailed Completion code) - (Need not to be set)	
+14	Tool type number (4 bytes)	
+18	Tool life counter (4 bytes)	
+22	Maximum tool life (4 bytes)	
+26	Notice tool life (4 bytes)	
+30	Tool life status (1 byte)	
+31	Customized data 0 (1 byte)	
+32	Tool information (2 bytes)	
+34	Tool length compensation number H (2 bytes)	* for milling or compound system
+36	Cutter compensation number D (2 bytes)	* for milling or compound system
+38	Spindle speed S (4 bytes)	
+42	Cutting feedrate F (4 bytes)	
+46	(unused) 0 (2 bytes)	Set 0 to this field.
+48	(unused) 0 (2 bytes)	Set 0 to this field.
+50	Tool geometric compensation number G (2 bytes)	* for lathe or compound system
+52	Tool wear compensation number W (2 bytes)	* for lathe or compound system
+54	Tool geometry number GNO (2 bytes)	* When the function "Tool management function for oversize tools" is enabled
+56	Edge group number (2 bytes)	* When the function "Tool management function multi-edge tools support" is enabled.
+58	Edge number (2 bytes)	* When the function "Tool management function multi-edge tools support" is enabled.
+60	Origin magazine number (2 bytes)	* When the function "Tool management function tool storage position reservation " is enabled.
+62	Origin pot number (2 bytes)	* When the function "Tool management function tool storage position reservation " is enabled.

+64	Number of edge positions (1 byte)	* When the function " Tool management function for multi-edge tools" is enabled.
+65	(reserved) 0 (9 bytes)	Set 0 to this field.
+74	Customized data 1 (4 bytes)	
~		~
+86 +89	Customized data 4 (4 bytes)	This item is end of data when the data length is 76.
~		~
+150 +153	Customized data 20 (4 bytes)	This item is end of data when the data length is 140.
~		~
+230 +233	Customized data 40 (4 bytes)	This item is end of data when the data length is 220.

Completion codes

0 The processing has been executed normally.
2 The data length is invalid.
3 (See the following detailed completion codes.)
5 (See the following detailed completion codes.)
6 The necessary option is not found.
7 The area is protected.
9 Free pot.

Detailed completion codes

The detailed completion code is always 0 when the completion code is other than 3 or 5.

When the completion code is 3, the detailed completion code is one of the following values:
21 The magazine number is invalid.
22 The pot number is invalid.
23 The tool management data number is invalid.

When the completion code is 5, the detailed completion code is one of the following values:
1 The specified tool type number is invalid.
2 The specified tool life counter is invalid.
3 The specified maximum tool life is invalid.
4 The specified notice tool life is invalid.
5 The specified tool life status is invalid.
7 The specified tool information is invalid.
8 The specified tool length compensation number (H) is invalid.
9 The specified cutter compensation number (D) is invalid.
10 The specified spindle speed (S) is invalid.
11 The specified cutting feedrate (F) is invalid.
12 The specified tool geometric compensation number (G) is invalid.
13 The specified tool wear compensation number (W) is invalid.
14 The specified tool geometry number (GNO) is invalid
15 The specified edge group number is invalid.
16 The specified edge number is invalid.
17 Origin magazine number is invalid.
18 Origin pot number is invalid.

19 Number of edge positions is invalid.
27 Interference with another tool or magazine frame
29 Illegal multi edge tool data.
31 to 70 The specified customized data (1 to 40) is invalid.
94 Multi-edge tools have been full already.
104 Origin overlaps

Output data structure

Top Address +0	(Function code) 332	
+2	(Completion code) ? (See above description)	
+4	(Data length L) (Same as input data)	
+6	(Data number N) Magazine number (Same as input data)	
+8	(Data attribute M) 0 (Same as input data)	
+10	(Data number N2) Pot number or tool management data number (Same as input data)	
+12	(Detailed completion code) ? (See above description)	
+14	Tool type number (4 bytes) (Same as input data)	
+18	Tool life counter (4 bytes) (Same as input data)	
~		
+86 +89	Customized data 4 (4 bytes) (Same as input data)	This item is end of data when the data length is 76.
~		~
+150 +153	Customized data 20 (4 bytes) (Same as input data)	This item is end of data when the data length is 140.
~		~
+230 +233	Customized data 40 (4 bytes) (Same as input data)	This item is end of data when the data length is 220.

5.7.5 Deleting Tool Management Data (Low-speed Response)

The tool management data is deleted based on the specified magazine number and pot number, or tool management data number.
In the case of a free pot (a tool management data number is not assigned), error code 9 is returned.

NOTE
1 To use this window function, the option of “Tool pair for tool management function: 64, 240 or 1000 pairs” is necessary.
2 When the “Tool management function for multi-edge tools” is used, the tool management data of the multi-edge tool can be deleted. In this time, the edge data is deleted with the tool management data.

Input data structure

Top Address +0	(Function code) 333	
+2	(Completion code) - (Need not to be set)	
+4	(Data length L) 0	
+6	(Data number N) Magazine number	If you want to specify the tool management data number, set zero to this field.
+8	(Data attribute M) 0	Set 0 to this field.
+10	(Data number N2) Pot number or tool management data number	
+12 +13	(Detailed Completion code) - (Need not to be set)	

Completion codes

0 The processing has been executed normally.
3 (See the following detailed completion codes.)
6 The necessary option is not found.
7 The area is protected.
9 Free pot.

Detailed completion codes

The detailed completion code is always 0 when the completion code is other than 3.
When the completion code is 3, the detailed completion code is one of the following values:
21 The magazine number is invalid.
22 The pot number is invalid.
23 The tool management data number is invalid.

Output data structure

Top Address +0	(Function code) 333
+2	(Completion code) ? (See above description)
+4	(Data length L) 0 (Same as input data)
+6	(Data number N) Magazine number (Same as input data)
+8	(Data attribute M) 0 (Same as input data)
+10	(Data number N2) Pot number or tool management data number (Same as input data)
+12 +13	(Detailed completion code) ? (See above description)

5.7.6 Reading Tool Management Data (Low-speed Response)

The tool management data is read based on the specified magazine number and pot number, or tool management data number. In the case of a free pot (a tool management data number is not assigned), completion code 9 is returned.

When using the function "Tool management function for oversize tools", you can also read the item "Tool geometry number" from the tool management data.

When using the function "Tool management function tool storage position reservation", you can also read the items "Origin magazine number" and "Origin pot number" from the tool management data.

When using the function “Tool management function for multi-edge tools”, you can also read the item “Number of edge positions” from the tool management data.
When using the function "Tool management function multi-edge tools support", you can also read the items "Edge group number" and "Edge number" from the tool management data using this Window function.

NOTE

1. To use this window function, the option of “Tool pair for tool management function: 64, 240 or 1000 pairs” is necessary.
2. Customized data 5 to 20 can be read when the "Tool management function customized data extension (5 to 20)" option is equipped. Customized data 5 to 40 can be read when the "Tool management function customized data extension (5 to 40)" option is equipped.
3. To use the Tool management function tool storage position reservation, the option of "Tool management expansion B" is necessary. Moreover, set CNC parameter TMP(No.13210#1) to 1 and TRF(No.13201#5) to 1.
4. To use the Tool management function for oversize tools, the option of "Tool management expansion B" is necessary. Moreover, set CNC parameter TOT(No.13210#0) to 1.
5. Tool management function has two functions concerning the multi-edge tool, which are “Tool management function for multi-edge tools” and “Tool management function multi-edge tools support”. And, the usable items are different respectively.
   1) Tool management function for multi-edge tools
      When “Tool management function for multi-edge tools” is used, the following item is enabled.
      - Number of edge positions
      To use the “Tool management function for multi-edge tools”, the option of "Tool management function for multi-edge tools" is necessary.
      Moreover, set the parameter MEB (No.13210#3) to 1.
   2) Tool management function multi-edge tools support
      When “Tool management function multi-edge tools support” is used, the following items are enabled.
      - Edge group number
      - Edge number
      To use the Tool management function multi-edge tools support, set the parameter TME (No.13201#3) to 1.

Input data structure

Top Address +0	(Function code) 334	
+2	(Completion code) - (Need not to be set)	
+4	(Data length L) - (Need not to be set)	
+6	(Data number N) Magazine number	If you want to specify the tool management data number, set zero to this field.
+8	(Data attribute M) 0	Set 0 to this field.
+10	(Data number N2) Pot number or tool management data number	
+12	(Detailed Completion code) - (Need not to be set)	
+14 +89	(Data area 1) (76 bytes) (Need not to be set)	
+90 +153	(Data area 2) (64 bytes) (Need not to be set)	Total 140 bytes data area is necessary when the option "Tool management function customized data extension (5 to 20)" is equipped.
+154 +233	(Data area 3) (80 bytes) (Need not to be set)	Total 220 bytes data area is necessary when the option "Tool management function customized data extension (5 to 40)" is equipped.

Completion codes

0 The processing has been executed normally.
3 (See the following detailed completion codes.)
6 The necessary option is not found.
7 The area is protected.
9 Free pot.

Detailed completion codes

The detailed completion code is always 0 when the completion code is other than 3.

When the completion code is 3, the detailed completion code is one of the following values:
21 The magazine number is invalid.
22 The pot number is invalid.
23 The tool management data number is invalid.

Output data structure

Offset	Data	Remarks
Top Address +0	(Function code) 334	
+2	(Completion code) ? (See above description)	
+4	(Data length L) 76, 140, 220	
+6	(Data number N) Magazine number (Same as input data)	
+8	(Data attribute M) 0 (Same as input data)	
+10	(Data number N2) Pot number or tool management data number (Same as input data)	
+12	(Detailed completion code) ? (See above description)	
+14	Tool type number (4 bytes)	
+18	Tool life counter (4 bytes)	
+22	Maximum tool life (4 bytes)	
+26	Notice tool life (4 bytes)	
+30	Tool life status (1 byte)	
+31	Customized data 0 (1 byte)	
+32	Tool information (2 bytes)	
+34	Tool length compensation number H (2 bytes)	* for milling or compound system
+36	Cutter compensation number D (2 bytes)	* for milling or compound system
+38	Spindle speed S (4 bytes)	
+42	Cutting feedrate F (4 bytes)	
+46	0 or Magazine number (2 bytes)	
+48	Tool management data number or pot number (2 bytes)	

+50	Tool geometric compensation number G (2 bytes)	* for lathe or compound system
+52	Tool wear compensation number W (2 bytes)	* for lathe or compound system
+54	Tool geometry number GNO (2 bytes)	* When the function "Tool management function for oversize tools" is enabled
+56	Edge group number (2 bytes)	* When the function "Tool management function multi-edge tools support" is enabled.
+58	Edge number (2 bytes)	* When the function "Tool management function multi-edge tools support" is enabled.
+60	Origin magazine number (2 bytes)	* When the function "Tool management function tool storage position reservation" is enabled.
+62	Origin pot number (2 bytes)	* When the function "Tool management function tool storage position reservation " is enabled.
+64	Number of edge positions (1 byte)	* When the function "Tool management function for multi-edge tools" is enabled.
+65	(reserved) 0 (9 bytes)	Set 0 to this field.
+74	Customized data 1 (4 bytes)	
~		~
+86 +89	Customized data 4 (4 bytes)	This item is end of data when the data length is 76.
~		~
+150 +153	Customized data 20 (4 bytes)	This item is end of data when the data length is 140.
~		~
+230 +233	Customized data 40 (4 bytes)	This item is end of data when the data length is 220.

5.7.7 Writing a Specified Type of Tool Management Data (Low-speed Response)

This function changes a part of tool management data.
Enter the data type number to be change, as the data attribute.
The size of the required data area differs depending on the data type.
The following table shows the relationship between each data type number and its corresponding data and required data area size.

> ⚠ **WARNING**
> When you write some NC data using both this instruction in ladder program and other applications, take care that you do not write to the same data area.
> If some values are written to the same data area by two or more applications including ladder program, unexpected value may be written. In this case, it may cause an unexpected machine behavior and also tools, work pieces, and machines may be damaged. As for details, refer to “SAFETY PRECAUTIONS”.

Table 5.7.7 (a) Data, data type number and data area size

Data type number	Data	Data area size	Remarks
1	Tool type number	4 bytes	
2	Tool life counter	4 bytes	
3	Maximum tool life	4 bytes	
4	Notice tool life	4 bytes	
5	Tool life status	1 byte	
6	Customized data 0	1 byte	
7	Tool information	2 bytes	
8	Tool length compensation number (H)	2 bytes	* for milling or compound system
9	Cutter compensation number (D)	2 bytes	* for milling or compound system
10	Spindle speed (S)	4 bytes	
11	Cutting feedrate (F)	4 bytes	
12	Tool geometric compensation number (G)	2 bytes	* for lathe or compound system
13	Tool wear compensation number (W)	2 bytes	* for lathe or compound system
14	Tool geometry number (GNO)	2 bytes	When the function "Tool management function for oversize tools" is enabled.
15	Edge group number	2 bytes	When the function "Tool management function multi-edge tools support" is enabled.
16	Edge number	2 bytes	When the function "Tool management function multi-edge tools support" is enabled.
17	Origin magazine number	2 bytes	When the function "Tool management function tool storage position reservation" is enabled.
18	Origin pot number	2 bytes	When the function "Tool management function tool storage position reservation" is enabled.
19	Number of edge positions	1 byte	When the function "Tool management function for multi-edge tools" is enabled.
31	Customized data 1	4 bytes	
~	~	~	
34	Customized data 4	4 bytes	
35	Customized data 5	4 bytes	These data are available when the option "Tool management function customized data extension (5 to 20)" or "Tool management function customized data extension (5 to 40)" is equipped.
~	~	~	
50	Customized data 20	4 bytes	

Table 5.7.7 (a) Data, data type number and data area size

Data type number	Data	Data area size	Remarks
51	Customized data 21	4 bytes	These data are available when the option "Tool management function customized data extension (5 to 40)" is equipped.
~	~	~	
70	Customized data 40	4 bytes	
100	Registering of origin magazine number and origin pot number	0 byte	- When the function " Tool Management Function Tool Return Function " is enabled. - Data area is not used.
101	Deleting of origin magazine number and origin pot number	0 byte	

When using the function "Tool management function for oversize tools", you can also register the item "Tool geometry number" to the tool management data. If you register the tool management data that causes an interference with another tool or magazine frame, completion code 5 and detailed completion code 27 is returned.

Using the function “Tool management function tool storage position reservation”, you can also register the item “Origin magazine number” to the tool management data by specifying 17 as data type number, and you can also register the item “Origin pot number” to the tool management data by specifying 18 as data type number. If specified invalid magazine number and pot number as an origin position, completion code 5 and detailed completion code 17 or 18 is returned and data aren’t registered. And registered origin position was specified, completion code 5 and detailed completion code 104 is returned and data isn’t registered.
By specifying 100 as data type number, specified magazine number and pot number are registered to “Origin magazine number” and “Origin pot number" of tool management data assigned there.
By specifying 101 as data type number, “Origin magazine number” and “Origin pot number" of tool management data assigned to the pot specified magazine number and pot number are deleted.
When you specified 100 or 101 as data type number, you should specify the tool management data by magazine number and pot number. When you specify 100 or 101 as data type number and specify -1 as pot number, ”Origin magazine number” and “Origin pot number" of all tool management data in specified magazine will be updated with current magazine and pot number, or deleted.
When you specify 100 or 101 as data type number and specify -1 as magazine number, “Origin magazine number” and “Origin pot number" of tool management data registered on all magazine except one in the main axis position or in the standby position are registered or deleted.
If you specify invalid magazine number and pot number as an origin position, or if the target is specified by tool management data number, completion code 3 and detailed completion code 21 or 22 is returned and no data is updated. And origin position to be registered is already occupied by other tool, completion code 5 and detailed completion code 104 is returned and no data is updated.
When you specify -1 as magazine number or pot number if no tool management data is registered, the completion code 9 "Free pot" is returned. If an error occurs while registering or deleting multiple origin positions at once, origin positions of tool management data after the pot with the error will not be updated.

When using the function “Tool management function for multi-edge tools”, you can register the multi-edge tools by specifying 19 as data type number and setting 1-5 to the item “Number of edge positions”. If value specified to the number of edge positions is other than 0-5, completion code 5 and detailed completion code 19 is returned. . The multi-edge tools can be registered up to 100. If 100 multi-edge tools have already been registered, completion code 5 and detailed completion code 94 is returned.
When using the function "Tool management function multi-edge tools support", you can also register the items "Edge group number" and "Edge number" to the tool management data using this Window function. If you register the tool management data that causes inconsistency such as duplication of an edge number on an edge group, completion code 5 and detailed completion code 29 is returned.

NOTE

1 To use this window function, the option of “Tool pair for tool management function: 64, 240 or 1000 pairs” is necessary.

2 Customized data 5 to 20 can be read when the "Tool management function customized data extension (5 to 20)" option is equipped. Customized data 5 to 40 can be read when the "Tool management function customized data extension (5 to 40)" option is equipped.

3 To use the Tool management function tool storage position reservation, the option of "Tool management expansion B" is necessary. Moreover, set CNC parameter TMP(No.13210#1) to 1 and TRF(No.13201#5) to 1.

4 To use the Tool management function for oversize tools, the option of "Tool management expansion B" is necessary. Moreover, set CNC parameter TOT(No.13210#0) to 1.

5 Tool management function has two functions concerning the multi-edge tool, which are “Tool management function for multi-edge tools” and “Tool management function multi-edge tools support”. And, the usable items are different respectively.

1) Tool management function for multi-edge tools
When “Tool management function for multi-edge tools” is used, the following item is enabled.
- Number of edge positions
To use the “Tool management function for multi-edge tools”, the option of "Tool management function for multi-edge tools" is necessary.
Moreover, set the parameter MEB (No.13210#3) to 1.

2) Tool management function multi-edge tools support
When “Tool management function multi-edge tools support” is used, the following items are enabled.
- Edge group number
- Edge number
To use the Tool management function multi-edge tools support, set the parameter TME (No.13201#3) to 1.

⚠ **CAUTION**

When you specify 100 or 101 as data type number and specified -1 as magazine number or pot number and too many tool management data will be registered or deleted, the completion of the window instruction will take some time, a few seconds in the worst case. In the meantime, other window instruction of low-speed response does not work. And then, the execution of application using FOCAS2 functions and C language executor application may be delayed. Therefore, when updating or deleting many origin positions at once, you should take special care for the delay of the other window instruction of low-speed response, application using FOCAS2 and C language executor application.

Input data structure

Offset	Field	Description
Top Address +0	(Function code) 335	
+2	(Completion code) - (Need not to be set)	
+4	(Data length L) 0, 1, 2, 4	Set the length of data that you want to write.
+6	(Data number N) Magazine number	If you want to specify the tool management data number, set zero to this field.
+8	(Data attribute M) Data type number	
+10	(Data number N2) Pot number or tool management data number	
+12	(Detailed Completion code) - (Need not to be set)	
+14 +n	(Data area) (0, 1, 2, 4 bytes)	Set the data that you want to write. The size of the required data area differs depending on the data type.

Completion codes

0 The processing has been executed normally.
2 The data length is invalid.
3 (See the following detailed completion codes.)
4 The specified data type is invalid.
5 (See the following detailed completion codes.)
6 The necessary option is not found.
7 The area is protected.
9 Free pot.

Detailed completion codes

The detailed completion code is always 0 when the completion code is other than 3 or 5.
When the completion code is 3, the detailed completion code is one of the following values:
21 The magazine number is invalid.
22 The pot number is invalid.
23 The tool management data number is invalid.

When the completion code is 5, the detailed completion code is one of the following values:
1 The specified tool type number is invalid.
2 The specified tool life counter is invalid.
3 The specified maximum tool life is invalid.
4 The specified notice tool life is invalid.
5 The specified tool life status is invalid.
6 The specified customized data 0 is invalid.
7 The specified tool information is invalid.
8 The specified tool length compensation number (H) is invalid.
9 The specified cutter compensation number (D) is invalid.
10 The specified spindle speed (S) is invalid.
11 The specified cutting feedrate (F) is invalid.
12 The specified tool geometric compensation number (G) is invalid.

13 The specified tool wear compensation number (W) is invalid.
14 The specified tool geometry number (GNO) is invalid
15 The specified edge group number is invalid.
16 The specified edge number is invalid.
17 Origin magazine number is invalid.
18 Origin pot number is invalid.
19 Number of edge positions is invalid.
27 Interference with another tool or magazine frame
29 Illegal multi edge tool data.
31 to 70 The specified customized data (1 to 40) is invalid.
94 Multi-edge tools have been full already.
104 Origin overlaps

Output data structure

Top Address +0	(Function code) 335
+2	(Completion code) ? (See above description)
+4	(Data length L) (Same as input data)
+6	(Data number N) Magazine number (Same as input data)
+8	(Data attribute M) Data type number (Same as input data)
+10	(Data number N2) Pot number or tool management data number (Same as input data)
+12	(Detailed completion code) ? (See above description)
+14 +n	(Data area) (0, 1, 2, 4 bytes) (Same as input data)

5.7.8 Searching for Tool Management Data (Low-speed Response)

Tool data is searched based on the customized data.
A search is conducted to see whether any tool data that matches the specified customized data is registered in the magazine management table. The magazine number and pot number of the first tool data found to match the customized data are returned.

> **NOTE**
> 1 To use this window function, the option of “Tool pair for tool management function: 64, 240 or 1000 pairs” is necessary.
> 2 When the “Tool management function for multi-edge tools” is used, the customize data registered in the first edge is searched.

Input data structure

Top Address +0	(Function code) 366	
+2	(Completion code) - (Need not to be set)	
+4	(Data length L) - (Need not to be set)	
+6	(Data number N) Customized data number	
+8	(Data attribute M) Lower 2 bytes of the customized data	Set lower 2 bytes of the customized data that you want to search.
+10	(Data number N2) Higher 2 bytes of the customized data	Set higher 2 bytes of the customized data that you want to search.
+12	(Detailed Completion code) - (Need not to be set)	
+14 +17	(Data area) (4 bytes) (Need not to be set)	

Completion codes

0 The processing has been executed normally.
3 (See the following detailed completion codes.)
6 The necessary option is not found.

Detailed completion codes

The detailed completion code is always 0 when the completion code is other than 3.
When the completion code is 3, the detailed completion code is one of the following values:
1 The specified customized data number is too small (a negative value is specified).
2 The specified customized data number is too large (the value is larger than 4, 20, or 40).
3 The specified customized data is not found.

Output data structure

Top Address +0	(Function code) 366
+2	(Completion code) ? (See above description)
+4	(Data length L) 4 or 0
+6	(Data number N) Customized data number (Same as input data)
+8	(Data attribute M) Lower 2 bytes of the customized data (Same as input data)
+10	(Data number N2) Higher 2 bytes of the customized data (Same as input data)
+12	(Detailed completion code) ? (See above description)
+14	Magazine number (2 bytes)
+16 +17	Pot number (2 bytes)

5.7.9 Shifting Tool Management Data (Low-speed Response)

The pot numbers in the magazine management table are shifted.
In the case of a magazine with fixed pot numbers, the tool management data numbers registered for the specified magazine are shifted by the specified shift count.

> **NOTE**
> To use this window function, the option of “Tool pair for tool management function: 64, 240 or 1000 pairs” is necessary.

(a) Shift direction
1: Forward shift
-1: Backward shift
The example of shift operation is shown below.
Before shift)

Pot number	1	2	3	4	5
Tool management data number	3	4	5	6	7

After one forward shift)

Tool management data number	7	3	4	5	6

After one backward shift)

Tool management data number	4	5	6	7	3

Input data structure

Top Address +0	(Function code) 367	
+2	(Completion code) - (Need not to be set)	
+4	(Data length L) 0	Set 0 to this field.
+6	(Data number N) Magazine number	
+8	(Data attribute M) Shift direction	1: Forward, -1: Backward
+10	(Data number N2) Shift count	
+12 +13	(Detailed Completion code) - (Need not to be set)	

Completion codes

0 The processing has been executed normally.
3 (See the following Detailed completion codes.)
4 The specified shift direction is invalid.
6 The necessary option is not found.

Detailed completion codes

The detailed completion code is always 0 when the completion code is other than 3.
When the completion code is 3, the detailed completion code is one of the following values:
1 The specified magazine number is invalid.
2 The specified shift count is invalid.
As the shift count, a value not greater than 0 or larger than the number of magazine data items is specified.

Output data structure

Top Address +0	(Function code) 367
+2	(Completion code) ? (See above description)
+4	(Data length L) 0 (Same as input data)
+6	(Data number N) Magazine number (Same as input data)
+8	(Data attribute M) Shift direction (Same as input data)
+10	(Data number N2) Shift count (Same as input data)
+12 +13	(Detailed completion code) ? (See above description)

5.7.10 Searching for a Free Pot (Oversize Tools Supported) (Low-speed Response)

Based on the pot position that is specified, the free pot (Tool management number is 0) nearest and oversize tool can be stored is searched in the specified magazine or all the magazines. The position of spindle and standby isn't included into the free pot.

NOTE
To use this window function, the option of "Tool pair for tool management function: 64, 240 or 1000 pairs" and the option of "Tool management expansion B" are necessary. Moreover, set CNC parameter TOT(No.13210#0) to 1.

(a) Search direction

Search direction	Direction designation	Magazine that is searched for	The search direction with matrix type
0	Not specified	Specified magazine	Row
10	Not specified	All magazine	Row
20	Not specified	Specified magazine	Column
30	Not specified	All magazine	Column
1	Forward	Specified magazine	Row
11	Forward	All magazine	Row
-1	Backward	Specified magazine	Row
-11	Backward	All magazine	Row
2	Forward	Specified magazine	Column
12	Forward	All magazine	Column
-2	Backward	Specified magazine	Column
-12	Backward	All magazine	Column

In case that all magazine is specified to searching object, the search of free pot is performed in the specified magazine. If free pot cannot be searched in the specified magazine, the search object is sifted to the next magazine

Input data structure

Offset	Content
Top Address +0	(Function code) 397
+2	(Completion code) - (Need not to be set)
+4	(Data length L) - (Need not to be set)
+6	(Data number N) Magazine number
+8	(Data attribute M) Search direction
+10	(Data number N2) Pot number
+12	(Detailed Completion code) - (Need not to be set)
+14	(Data number N3) Tool geometry number
+16 +19	(Data area) (4 bytes) (Need not to be set)

Completion codes

0 The processing has been executed normally.
3 (See the following Detailed completion codes.)
4 The specified search direction is invalid.
6 The necessary option is not found.
8, 13 There is no free pot.

Detailed completion codes

The detailed completion code is always 0 when the completion code is other than 3.
When the completion code is 3, the detailed completion code is one of the following values:
21 The magazine number is invalid.
22 The pot number is invalid.
26 The tool geometry number is invalid.

Output data structure

Top Address +0	(Function code) 397
+2	(Completion code) ? (See above description)
+4	(Data length L) 4
+6	(Data number N) Magazine number (Same as input data)
+8	(Data attribute M) Search direction (Same as input data)
+10	(Data number N2) Pot number (Same as input data)
+12	(Detailed completion code) ? (See above description)
+14	(Data number N3) Tool geometry number (Same as input data)
+16	Cartridge number (2 bytes)
+18 +19	Pot number (2 bytes)

When the search direction is not specified and free pots are found to the same distance in both forward and backward directions, the pot found in the forward directions can be selected.

5.7.11 Reading the Total Tool Life Data (Low-speed Response)

This function reads a total tool life data corresponding to the specified tool type number and the life count type.

NOTE
1. To use this window function, the option of “Tool pair for tool management function: 64, 240 or 1000 pairs” is necessary. Moreover, the option of "Tool management expansion" or the option of "Tool management expansion" is necessary.
2. When the “Tool management function for multi-edge tools” is used, the total tool life data of the first edge is read. To read the total tool life data of second or more, use the function code 442 “Reading total tool life data of edge”.

Input data structure

Top Address +0	(Function code) 409	
+2	(Completion code) - (Need not to be set)	
+4	(Data length L) - (Need not to be set)	
+6	(Data number N) Tool type number	Set the tool type number with signed binary format in 4bytes length.
+10	(Data attribute M) Life count type	Set the life count type with signed binary format in 2bytes length. M=0: Count, 1: Time
+12	(Detailed Completion code) - (Need not to be set)	
+14 +37	(Data area) (24 bytes) (Need not to be set)	

Completion codes

0 The processing has been executed normally.
3 (See the following detailed completion codes.)
4 The specified tool count type is invalid.
6 The necessary option is not found.

Detailed completion codes

The detailed completion code is always 0 when the completion code is other than 3.
When the completion code is 3, the detailed completion code is one of the following values:
1 The tool type number is invalid. (Except for 1 through 99999999)
28 No specified tool type number

Output data structure

Offset	Field	Description
Top Address +0	(Function code) 409	
+2	(Completion code) ? (See above description)	
+4	(Data length L) 24	
+6	(Data number N) Tool type number (Same as input data)	
+10	(Data attribute M) Life count type (Same as input data)	
+12	(Detailed completion code) ? (See above description)	
+14	Tool type number (4bytes)	This is the same as "N: Data number" which you specify.
+18	Total life counter (4bytes)	The unit of this data is indicated by "+37: Life count type".
+22	Total remaining life (4bytes)	The unit of this data is indicated by "+37: Life count type".
+26	Total maximum life (4bytes)	The unit of this data is indicated by "+37: Life count type".
+30	Total notice life (4bytes)	The unit of this data is indicated by "+37: Life count type".
+34	Tool count (2bytes)	The tools, which have the specified tool type number and tool life type, are counted.
+36	Total life status (1byte)	0: Not noticed, 1: Noticed
+37	Life count type (1byte)	0: Count, 1: Time (second), 2: Time (millisecond)

5.7.12 Writing Tool Management Data by Specified Data (Low-speed Response)

This function searches a tool management data for the specified search data and writes data to the searched tool management data. If two or more tool management data match, the tool management data that has smaller tool management data number is selected. If no tool management data matches, completion code 3 and detailed completion code 103 is returned.

When using the function "Tool management function for oversize tools", you can also register the item "Tool geometry number" to the tool management data. If you will register the tool management data that causes an interference with another tool or magazine frame, completion code 5 and detailed completion code 27 is returned.

When using the function "Tool management function tool storage position reservation", you can also register the items "Origin magazine number" and "Origin pot number" to the tool management data. If specified invalid magazine number and pot number as an origin position, completion code 5 and detailed completion code 17 or 18 is returned and data aren't registered. And registered origin position was specified, completion code 5 and detailed completion code 104 is returned and data isn't registered.

When using the function “Tool management function for multi-edge tools”, you can register the multi-edge tools by setting 1-5 to the item “Number of edge positions”. If value specified to the number of edge positions is other than 0-5, completion code 5 and detailed completion code 19 is returned. The multi-edge tools can be registered up to 100. If 100 multi-edge tools have already been registered, completion code 5 and detailed completion code 94 is returned.
When using the function "Tool management function multi-edge tools support ", you can also register the items "Edge group number" and "Edge number" to the tool management data using this Window function. If you will register the tool management data that causes inconsistency such as duplication of an edge number on an edge group, completion code 5 and detailed completion code 29 is returned.

⚠ **WARNING**

When you write some NC data using both this instruction in ladder program and other applications, take care that you do not write to the same data area.
If some values are written to the same data area by two or more applications including ladder program, unexpected value may be written. In this case, it may cause an unexpected machine behavior and also tools, work pieces, and machines may be damaged. As for details, refer to “SAFETY PRECAUTIONS”.

NOTE
1 To use this window function, the option of “Tool pair for tool management function: 64, 240 or 1000 pairs” is necessary.
2 The data length differs depending on whether the "Tool management function customized data extension (5 to 20)" or "Tool management function customized data extension (5 to 40)" option is equipped or not.
3 To use the Tool management function tool storage position reservation, the option of "Tool management expansion B" is necessary. Moreover, set CNC parameter TMP(No.13210#1) to 1 and TRF(No.13201#5) to 1.
4 To use the Tool management function for oversize tools, the option of "Tool management expansion B" is necessary. Moreover, set CNC parameter TOT(No.13210#0) to 1.
5 Tool management function has two functions concerning the multi-edge tool, which are “Tool management function for multi-edge tools”” and “Tool management function multi-edge tools support”. And, the usable items are different respectively.
   1) Tool management function for multi-edge tools”
      When “Tool management function for multi-edge tools”” is used, the following item is enabled.
      - Number of edge positions
      To use the “Tool management function for multi-edge tools”, the option of "Tool management function for multi-edge tools” is necessary.
      Moreover, set the parameter MEB (No.13210#3) to 1.
   2) Tool management function multi-edge tools support
      When “Tool management function multi-edge tools support” is used, the following items are enabled.
      - Edge group number
      - Edge number
      To use the Tool management function multi-edge tools support, set the parameter TME (No.13201#3) to 1.

(a) Data length
84: When the option "Tool management function customized data extension" is not equipped.
148: When the option "Tool management function customized data extension (5 to 20)" is equipped.
228: When the option "Tool management function customized data extension (5 to 40)" is equipped.

(b) Search kind number
You should set the search kind number that determines the kind of data to search.

Search kind number	Search data 1	Search data 2
0	Magazine number	Pot number
1	Tool management data number	-
2	Tool type number	Identifier

NOTE
When specifying '2' to the search kind number, the option of "Tool management expansion B" is necessary and it is necessary to set a customize data number that is used for the identifier to the CNC parameter No.13267.

Input data structure

Top Address +0	(Function code) 419	
+2	(Completion code) - (Need not to be set)	
+4	(Data length L) 84, 148, 228	
+6	(Data number N) Search kind number	
+8	(Data attribute M) 0	Set 0 to this field.
+10	(Data number N2) 0	Set 0 to this field.
+12	(Detailed Completion code) - (Need not to be set)	
+14	Search data 1 (4 bytes)	
+18	Search data 2 (4 bytes)	
+22	Tool type number (4 bytes)	
+26	Tool life counter (4 bytes)	
+30	Maximum tool life (4 bytes)	
+34	Notice tool life (4 bytes)	
+38	Tool life status (1 byte)	
+39	Customized data 0 (1 byte)	
+40	Tool information (2 bytes)	
+42	Tool length compensation number H (2 bytes)	* for milling or compound system
+44	Cutter compensation number D (2 bytes)	* for milling or compound system
+46	Spindle speed S (4 bytes)	
+50	Cutting feedrate F (4 bytes)	
+54	(unused) 0 (2 bytes)	Set 0 to this field.

+56	(unused) 0 (2 bytes)	Set 0 to this field.
+58	Tool geometric compensation number G (2 bytes)	* for lathe or compound system
+60	Tool wear compensation number W (2 bytes)	* for lathe or compound system
+62	Tool geometry number GNO (2 bytes)	* When the function "Tool management function for oversize tools" is enabled.
+64	Edge group number (2 bytes)	* When "Tool management function multi-edge tools support" is enabled.
+66	Edge number (2 bytes)	* When "Tool management function multi-edge tools support" is enabled.
+68	Origin magazine number (2 bytes)	* When the function "Tool management function tool storage position reservation" is enabled.
+70	Origin pot number (2 bytes)	* When the function "Tool management function tool storage position reservation" is enabled.
+72	Number of edge positions (1 byte)	* When the function "Tool management function for multi-edge tools" is enabled.
+73	(reserved) 0 (9 bytes)	Set 0 to this field.
+82	Customized data 1 (4 bytes)	
~		~
+94 +97	Customized data 4 (4 bytes)	This item is end of data when the data length is 84.
~		~
+158 +161	Customized data 20 (4 bytes)	This item is end of data when the data length is 148.
~		~
+238 +241	Customized data 40 (4 bytes)	This item is end of data when the data length is 228.

Completion codes

0 The processing has been executed normally.
2 The data length is invalid.
3 (See the following detailed completion codes.)
5 (See the following detailed completion codes.)
6 The necessary option is not found.
7 The area is protected.
9 Free pot.

Detailed completion codes

The detailed completion code is always 0 when the completion code is other than 3 or 5.

When the completion code is 3, the detailed completion code is one of the following values:
100 The specified Search kind number is invalid.
101 The specified Search data 1 is invalid.
102 The specified Search data 2 is invalid.
103 The specified tool is not found.

When the completion code is 5, the detailed completion code is one of the following values:
1 The specified tool type number is invalid.
2 The specified tool life counter is invalid.
3 The specified maximum tool life is invalid.
4 The specified notice tool life is invalid.
5 The specified tool life status is invalid.
7 The specified tool information is invalid.
8 The specified tool length compensation number (H) is invalid.
9 The specified cutter compensation number (D) is invalid.
10 The specified spindle speed (S) is invalid.
11 The specified cutting feedrate (F) is invalid.
12 The specified tool geometric compensation number (G) is invalid.
13 The specified tool wear compensation number (W) is invalid.
14 The specified tool geometry number (GNO) is invalid
15 The specified edge group number is invalid.
16 The specified edge number is invalid.
17 Origin magazine number is invalid.
18 Origin pot number is invalid.
19 Number of edge positions is invalid.
27 Interference with another tool or magazine frame
29 Illegal multi edge tool data.
31 to 70 The specified customized data (1 to 40) is invalid.
94 Multi-edge tools have been full already.
104 Origin overlaps

Output data structure

Top Address +0	(Function code) 419	
+2	(Completion code) ? (See above description)	
+4	(Data length L) (Same as input data)	
+6	(Data number N) Search kind number (Same as input data)	
+8	(Data attribute M) 0 (Same as input data)	
+10	(Data number N2) 0 (Same as input data)	
+12	(Detailed completion code) ? (See above description)	
+14	Search data 1 (4 bytes) (Same as input data)	
+18	Search data 2 (4 bytes) (Same as input data)	
~		
+94 +97	Customized data 4 (4 bytes) (Same as input data)	This item is end of data when the data length is 84.
~		
+158 +161	Customized data 20 (4 bytes) (Same as input data)	This item is end of data when the data length is 148.
~		
+238 +241	Customized data 40 (4 bytes) (Same as input data)	This item is end of data when the data length is 228.

5.7.13 Deleting Tool Management Data by Specified Data (Low-speed Response)

This function searches a tool management data for the specified search data and deletes the searched tool management data. If two or more tool management data match, the tool management data that has smaller tool management data number is selected. If no tool management data matches, completion code 3 and detailed completion code 103 is returned.

(a) Search kind number and Search data
You should set the search kind number that determines the kind of data to search.

Search kind number	Search data 1	Search data 2
0	Magazine number	Pot number
1	Tool management data number	
2	Tool type number	Identifier

NOTE
1 To use this window function, the option of “Tool pair for tool management function: 64, 240 or 1000 pairs” is necessary.
2 When specifying '2' to the search kind number, the option of "Tool management expansion B" is necessary and it is necessary to set a customize data number that is used for the identifier to the CNC parameter No.13267.
3 When the “Tool management function for multi-edge tools” is used, the tool management data of the multi-edge tool can be deleted. In this time, the edge data is deleted with the tool management data.

Input data structure

Top Address +0	(Function code) 420	
+2	(Completion code) - (Need not to be set)	
+4	(Data length L) 0	Set 0 to this field.
+6	(Data number N) Search kind number	
+8	(Data attribute M) 0	Set 0 to this field.
+10	(Data number N2) 0	Set 0 to this field.
+12	(Detailed Completion code) - (Need not to be set)	
+14	Search data 1 (4 bytes)	
+18 +21	Search data 2 (4 bytes)	

Completion codes

0 The processing has been executed normally.
3 (See the following detailed completion codes.)
6 The necessary option is not found.
7 The area is protected.
9 Free pot.

Detailed completion codes

The detailed completion code is always 0 when the completion code is other than 3.
When the completion code is 3, the detailed completion code is one of the following values:
100 The specified Search kind number is invalid.
101 The specified Search data 1 is invalid.
102 The specified Search data 2 is invalid.
103 The specified tool is not found.

Output data structure

Top Address +0	(Function code) 420
+2	(Completion code) ? (See above description)
+4	(Data length L) 0 (Same as input data)
+6	(Data number N) Search kind number (Same as input data)
+8	(Data attribute M) 0 (Same as input data)
+10	(Data number N2) 0 (Same as input data)
+12	(Detailed completion code) ? (See above description)
+14	Search data 1 (4 bytes) (Same as input data)
+18 +21	Search data 2 (4 bytes) (Same as input data)

5.7.14 Reading Tool Management Data by Specified Data (Low-speed Response)

This function searches a tool management data for the specified search data and reads data to the searched tool management data. If two or more tool management data match, the tool management data that has smaller tool management data number is selected. If no tool management data matches, completion code 3 and detailed completion code 103 is returned.

When using the function "Tool management function for oversize tools", you can also read the item "Tool geometry number" from the tool management data.

When using the function "Tool management function tool storage position reservation", you can also read the items "Origin magazine number" and "Origin pot number" from the tool management data.

When using the function “Tool management function for multi-edge tools”, you can also read the item “Number of edge positions” from the tool management data.
When using the function " Tool management function multi-edge tools support ", you can also read the item "Edge group number" and "Edge number" from the tool management data using this Window function.

NOTE

1 To use this window function, the option of “Tool pair for tool management function: 64, 240 or 1000 pairs” is necessary.
2 Customized data 5 to 20 can be read when the "Tool management function customized data extension (5 to 20)" option is equipped. Customized data 5 to 40 can be read when the "Tool management function customized data extension (5 to 40)" option is equipped.
3 To use the Tool management function tool storage position reservation, the option of "Tool management expansion B" is necessary. Moreover, set CNC parameter TMP(No.13210#1) to 1 and TRF(No.13201#5) to 1.
4 To use the Tool management function for oversize tools, the option of "Tool management expansion B" is necessary. Moreover, set CNC parameter TOT(No.13210#0) to 1.
5 Tool management function has two functions concerning the multi-edge tool, which are “Tool management function for multi-edge tools” and “Tool management function multi-edge tools support”. And, the usable items are different respectively.
   1) Tool management function for multi-edge tools
   When “Tool management function for multi-edge tools” is used, the following item is enabled.
   - Number of edge positions
   To use the “Tool management function for multi-edge tools”, the option of "Tool management function for multi-edge tools" is necessary.
   Moreover, set the parameter MEB (No.13210#3) to 1.
   2) Tool management function multi-edge tools support
   When “Tool management function multi-edge tools support” is used, the following items are enabled.
   - Edge group number
   - Edge number
   To use the Tool management function multi-edge tools support, set the parameter TME (No.13201#3) to 1.

(a) Search kind number and Search data
You should set the search kind number that determines the kind of data to search.

Search kind number	Search data 1	Search data 2
0	Magazine number	Pot number
1	Tool management data number	
2	Tool type number	Identifier

NOTE

When specifying '2' to the search kind number, the option of "Tool management expansion B" is necessary and it is necessary to set a customize data number that is used for the identifier to the CNC parameter No.13267.

Input data structure

Top Address +0	(Function code) 421	
+2	(Completion code) - (Need not to be set)	
+4	(Data length L) - (Need not to be set)	
+6	(Data number N) Search kind number	
+8	(Data attribute M) 0	Set 0 to this field.
+10	(Data number N2) 0	Set 0 to this field.
+12	(Detailed Completion code) - (Need not to be set)	
+14	Search data 1 (4 bytes)	
+18	Search data 2 (4 bytes)	
+22 +97	(Data area 1) (76 bytes) (Need not to be set)	
+98 +161	(Data area 2) (64 bytes) (Need not to be set)	Total 140 bytes data area is necessary when the option "Tool management function customized data extension (5 to 20)" is equipped.
+162 +241	(Data area 3) (80 bytes) (Need not to be set)	Total 220 bytes data area is necessary when the option "Tool management function customized data extension (5 to 40)" is equipped.

Completion codes

0 The processing has been executed normally.
3 (See the following detailed completion codes.)
6 The necessary option is not found.
7 The area is protected.
9 Free pot.

Detailed completion codes

The detailed completion code is always 0 when the completion code is other than 3.

When the completion code is 3, the detailed completion code is one of the following values:
100 The specified Search kind number is invalid.
101 The specified Search data 1 is invalid.
102 The specified Search data 2 is invalid.
103 The specified tool is not found.

Output data structure

Address	Content	Remark
Top Address +0	(Function code) 421	
+2	(Completion code) ? (See above description)	
+4	(Data length L) 84, 148, 228	
+6	(Data number N) Search kind number (Same as input data)	
+8	(Data attribute M) 0 (Same as input data)	
+10	(Data number N2) 0 (Same as input data)	
+12	(Detailed completion code) ? (See above description)	
+14	Search data 1 (4 bytes) (Same as input data)	
+18	Search data 2 (4 bytes) (Same as input data)	
+22	Tool type number (4 bytes)	
+26	Tool life counter (4 bytes)	
+30	Maximum tool life (4 bytes)	
+34	Notice tool life (4 bytes)	
+38	Tool life status (1 byte)	
+39	Customized data 0 (1 byte)	
+41	Tool information (2 bytes)	
+42	Tool length compensation number H (2 bytes)	* for milling or compound system
+44	Cutter compensation number D (2 bytes)	* for milling or compound system
+46	Spindle speed S (4 bytes)	
+50	Cutting feedrate F (4 bytes)	
+54	0 or Magazine number (2 bytes)	

Offset	Item	Remarks
+56	Tool management data number or Pot number (2 bytes)	
+58	Tool geometric compensation number G (2 bytes)	* for lathe or compound system
+60	Tool wear compensation number W (2 bytes)	* for lathe or compound system
+62	Tool geometry number GNO (2 bytes)	* When the function "Tool management function for oversize tools" is enabled.
+64	Edge group number (2 bytes)	* When "Tool management function multi-edge tools support" is enabled.
+66	Edge number (2 bytes)	* When "Tool management function multi-edge tools support" is enabled.
+68	Origin magazine number (2 bytes)	* When the function "Tool management function tool storage position reservation" is enabled.
+70	Origin pot number (2 bytes)	* When the function "Tool management function tool storage position reservation" is enabled.
+72	Number of edge positions (1 byte)	* When the function " Tool management function for multi-edge tools" is enabled.
+73	(reserved) 0 (9 bytes)	Set 0 to this field.
+82	Customized data 1 (4 bytes)	
~		~
+94 +97	Customized data 4 (4 bytes)	This item is end of data when the data length is 84.
~		~
+158 +161	Customized data 20 (4 bytes)	This item is end of data when the data length is 148.
~		~
+238 +241	Customized data 40 (4 bytes)	This item is end of data when the data length is 228.

5.7.15 Writing Each Tool Management Data by Specified Data (Low-speed Response)

This function searches a tool management data for the specified search data and writes data to the searched tool management data. If two or more tool management data match, the tool management data that has smaller tool management data number is selected. If no tool management data matches, completion code 3 and detailed completion code 103 is returned.
Enter the data type number to be changed, as the data attribute.
The required size of the data area differs depending on the data type.
The following table shows the relationship between each data type number and its corresponding data and required data area size.

> ⚠ **WARNING**
> When you write some NC data using both this instruction in ladder program and other applications, take care that you do not write to the same data area.
> If some values are written to the same data area by two or more applications including ladder program, unexpected value may be written. In this case, it may cause an unexpected machine behavior and also tools, work pieces, and machines may be damaged. As for details, refer to “SAFETY PRECAUTIONS”.

Table 5.7.15 (a) Data, data type number and data area size

Data type number	Data	Data area size	Remarks
1	Tool type number	4 bytes	
2	Tool life counter	4 bytes	
3	Maximum tool life	4 bytes	
4	Notice tool life	4 bytes	
5	Tool life status	1 byte	
6	Customized data 0	1 byte	
7	Tool information	2 bytes	
8	Tool length compensation number (H)	2 bytes	* for milling or compound system
9	Cutter compensation number (D)	2 bytes	* for milling or compound system
10	Spindle speed (S)	4 bytes	
11	Cutting feedrate (F)	4 bytes	
12	Tool geometric compensation number (G)	2 bytes	* for lathe or compound system
13	Tool wear compensation number (W)	2 bytes	* for lathe or compound system
14	Tool geometry number (GNO)	2 bytes	When the function "Tool management function for oversize tools" is enabled.
15	Edge group number	2 bytes	When "Tool management function multi-edge tools support" is enabled.
16	Edge number	2 bytes	When "Tool management function multi-edge tools support" is enabled.
17	Origin magazine number	2 bytes	When the function "Tool management function tool storage position reservation" is enabled.
18	Origin pot number	2 bytes	When the function "Tool management function tool storage position reservation" is enabled.
19	Number of edge positions	1 byte	When "Tool management function for multi-edge tools “is enabled.
31	Customized data 1	4 bytes	
~	~	~	
34	Customized data 4	4 bytes	

Data type number	Data	Data area size	Remarks
35	Customized data 5	4 bytes	These data are available when the option "Tool management function customized data extension (5 to 20)" or "Tool management function customized data extension (5 to 40)" is equipped.
~	~	~	
50	Customized data 20	4 bytes	
51	Customized data 21	4 bytes	These data are available when the option "Tool management function customized data extension (5 to 40)" is equipped.
~	~	~	
70	Customized data 40	4 bytes	
100	Registering of origin magazine number and origin pot number	0 byte	- When the function "Tool management function tool storage position reservation" is enabled. - Search kind number (described later) must be 0. - Data area is not used.
101	Deleting of origin magazine number and origin pot number	0 byte	

When using the function "Tool management function for oversize tools", you can also register the item "Tool geometry number" to the tool management data. If you register the tool management data that causes an interference with another tool or magazine frame, completion code 5 and detailed completion code 27 is returned.

Using the function “Tool management function tool storage position reservation”, you can also register the item “Origin magazine number” to the tool management data by specifying 17 as data type number, and you can also register the item “Origin pot number” to the tool management data by specifying 18 as data type number. If specified invalid magazine number and pot number as an origin position, completion code 5 and detailed completion code 17 or 18 is returned and data aren’t registered. And registered origin position was specified, completion code 5 and detailed completion code 104 is returned and data isn’t registered.
When you specify 100 or 101 as data type number, search kind number (described later) must be 0.
By specifying 100 as data type number, specified magazine number and pot number are registered to “Origin magazine number” and “Origin pot number" of tool management data assigned there.
By specifying 101 as data type number, “Origin magazine number” and “Origin pot number" of tool management data assigned to the pot specified magazine number and pot number are deleted.

When you specify 100 or 101 as data type number and specify -1 as pot number, ”Origin magazine number” and “Origin pot number" of all tool management data in specified magazine will be updated with current magazine and pot number, or deleted. When you specify 100 or 101 as data type number and specify -1 as magazine number, “Origin magazine number” and “Origin pot number" of tool management data registered on all magazine except one in the main axis position or in the standby position are registered or deleted.
If you specify invalid magazine number and pot number as an origin position, completion code 3 and detailed completion code 101 or 102 is returned and no data is updated. And origin position to be registered is already occupied by other tool, completion code 5 and detailed completion code 104 is returned and no data is updated.
When you specify -1 as magazine number or pot number if no tool management data is registered, the completion code 9 "Free pot" is returned. If an error occurs while registering or deleting multiple origin positions at once, origin positions of tool management data after the pot with the error will not be updated.
When you specify 100 or 101 as data type number and specify any number except 0 as search kind number, completion code 3 and detailed completion code 100 is returned and no data is registered.

When using the function “Tool management function for multi-edge tools”, you can register the multi-edge tools by specifying 19 as data type number and setting 1-5 to the item “Number of edge positions”. If value specified to the number of edge positions is other than 0-5, completion code 5 and detailed completion code 19 is returned. The multi-edge tools can be registered up to 100. If 100 multi-edge tools have already been registered, completion code 5 and detailed completion code 94 is returned.
When using the function "Tool management function multi-edge tools support ", you can also register the item "Edge group number" and "Edge number" to the tool management data using this Window function.

If you register the tool management data that causes inconsistency such as duplication of an edge number on an edge group, completion code 5 and detailed completion code 29 is returned.

NOTE

1 To use this window function, the option of “Tool pair for tool management function: 64, 240 or 1000 pairs” is necessary.

2 Customized data 5 to 20 can be read when the "Tool management function customized data extension (5 to 20)" option is equipped. Customized data 5 to 40 can be read when the "Tool management function customized data extension (5 to 40)" option is equipped.

3 To use the Tool management function tool storage position reservation, the option of "Tool management expansion B" is necessary. Moreover, set CNC parameter TMP(No.13210#1) to 1 and TRF(No.13201#5) to 1.

4 To use the Tool management function for oversize tools, the option of "Tool management expansion B" is necessary. Moreover, set CNC parameter TOT(No.13210#0) to 1.

5 Tool management function has two functions concerning the multi-edge tool, which are “Tool management function for multi-edge tools” and “Tool management function multi-edge tools support”. And, the usable items are different respectively.

1) Tool management function for multi-edge tools
When “Tool management function multi-edge tools support” is used, the following item is enabled.
- Number of edge positions
To use the “Tool management function for multi-edge tools”, the option of "Tool management function for multi-edge tools" is necessary.
Moreover, set the parameter MEB (No.13210#3) to 1.

2) Tool management function multi-edge tools support
When “Tool management function multi-edge tools support” is used, the following items are enabled.
- Edge group number
- Edge number
To use the Tool management function multi-edge tools support, set the parameter TME (No.13201#3) to 1.

⚠ **CAUTION**

When you specify 100 or 101 as data type number and specified -1 as magazine number or pot number and too many tool management data will be registered or deleted, the completion of the window instruction will take some time, a few seconds in the worst case. On the all times, other window instruction of low-speed response does not work. And then, the execution of application using FOCAS2 functions and C language executor application may be delayed. Therefore, when updating or deleting a lot of data at once, you should take special care for the delay of the other window instruction of low-speed response, application using FOCAS2 and C language executor application.

(a) Search kind number and Search data
You should set the search kind number that determines the kind of data to search.

Search kind number	Search data 1	Search data 2
0	Magazine number	Pot number
1	Tool management data number	—
2	Tool kind number	Identifier

> **NOTE**
> When specifying '2' to the search kind number, the option of "Tool management expansion B" is necessary and it is necessary to set a customize data number that is used for the identifier to the CNC parameter No.13267.

Input data structure

Top Address +0	(Function code) 422	
+2	(Completion code) - (Need not to be set)	
+4	(Data length L) 0, 1, 2, 4	Set the length of data that you want to write.
+6	(Data number N) Search kind number	
+8	(Data attribute M) Data type number	
+10	(Data number N2) 0	Set 0 to this field.
+12	(Detailed Completion code) - (Need not to be set)	
+14	Search data 1 (4 bytes)	
+18	Search data 2 (4 bytes)	
+22 +n	(Data area) (0, 1, 2, 4 bytes)	Set the data that you want to write. The size of the required data area differs depending on the data type.

Completion codes

0 The processing has been executed normally.
2 The data length is invalid.
3 (See the following detailed completion codes.)
4 The specified data type is invalid.
5 (See the following detailed completion codes.)
6 The necessary option is not found.
7 The area is protected.
9 Free pot.

Detailed completion codes

The detailed completion code is always 0 when the completion code is other than 3 or 5.

When the completion code is 3, the detailed completion code is one of the following values:

100 The specified Search kind number is invalid.
101 The specified Search data 1 is invalid.
102 The specified Search data 2 is invalid.
103 The specified tool is not found.

When the completion code is 5, the detailed completion code is one of the following values:

1 The specified tool type number is invalid.
2 The specified tool life counter is invalid.
3 The specified maximum tool life is invalid.
4 The specified notice tool life is invalid.
5 The specified tool life status is invalid.
6 The specified customized data 0 is invalid.
7 The specified tool information is invalid.
8 The specified tool length compensation number (H) is invalid.
9 The specified cutter compensation number (D) is invalid.
10 The specified spindle speed (S) is invalid.
11 The specified cutting feedrate (F) is invalid.
12 The specified tool geometric compensation number (G) is invalid.
13 The specified tool wear compensation number (W) is invalid.
14 The specified tool geometry number (GNO) is invalid
15 The specified edge group number is invalid.
16 The specified edge number is invalid.
17 Origin magazine number is invalid.
18 Origin pot number is invalid.
19 Number of edge positions is invalid.
27 Interference with another tool or magazine frame
29 Illegal multi edge tool data.
31 to 70 The specified customized data (1 to 40) is invalid.
94 Multi-edge tools have been full already.
104 Origin overlaps

Output data structure

Address	Content
Top Address +0	(Function code) 422
+2	(Completion code) ? (See above description)
+4	(Data length L) (Same as input data)
+6	(Data number N) Search kind number (Same as input data)
+8	(Data attribute M) Data type number (Same as input data)
+10	(Data number N2) 0 (Same as input data)
+12	(Detailed completion code) ? (See above description)
+14	Search data 1 (4 bytes) (Same as input data)
+18	Search data 2 (4 bytes) (Same as input data)
+22 +n	(Data area) (0, 1, 2, 4 bytes) (Same as input data)

5.7.16 Writing Magazine Property Data (Low-speed Response)

This function writes magazine property data with specified magazine number.

> ⚠ **WARNING**
> When you write some NC data using both this instruction in ladder program and other applications, take care that you do not write to the same data area.
> If some values are written to the same data area by two or more applications including ladder program, unexpected value may be written. In this case, it may cause an unexpected machine behavior and also tools, work pieces, and machines may be damaged. As for details, refer to “SAFETY PRECAUTIONS”.

> **NOTE**
> To use this window function, the option of “Tool pair for tool management function: 64, 240 or 1000 pairs” and the option of "Tool management expansion B" are necessary. Moreover, set CNC parameter TMP(No.13210#1) to 1.

Input data structure

Top Address +0	(Function code) 423	
+2	(Completion code) - (Need not to be set)	
+4	(Data length L) 24	
+6	(Data number N) Magazine number	
+8	(Data attribute M) 0	Set 0 to this field.
+10	(Data number N2) 0	Set 0 to this field.
+12	(Detailed completion code) - (Need not to be set)	
+14	Magazine information (1 byte)	
+15	(Reserved) 0 (3 bytes)	Set 0 to this field.
+18	(unused) 0 (4 bytes)	Set 0 to this field.
+22	Customize data 1 (4 bytes)	
+26	Customize data 2 (4 bytes)	
+30	Customize data 3 (4 bytes)	

+34 +37	Customize data 4 (4 bytes)

Completion codes

0 The processing has been executed normally.
2 The data length is invalid.
3 (See the following detailed completion codes.)
5 (See the following detailed completion codes.)
6 The necessary option is not found.

Detailed completion codes

The detailed completion code is always 0 when the completion code is other than 3 or 5.
When the completion code is 3, the detailed completion code is one of the following values:
21 The specified magazine number is invalid.

When the completion code is 5, the detailed completion code is one of the following values:
1 The specified magazine number is invalid.
11 to 14 The specified customized data (1 to 4) is invalid.

Output data structure

Top Address +0	(Function code) 423
+2	(Completion code) ? (See above description)
+4	(Data length L) 24 (Same as input data)
+6	(Data number N) Magazine number (Same as input data)
+8	(Data attribute M) 0 (Same as input data)
+10	(Data number N2) 0 (Same as input data)
+12	(Detailed completion code) ? (See above description)
~	~
+34 +37	Customized data 4 (4 bytes) (Same as input data)

5.7.17 Reading Magazine Property Data (Low-speed Response)

This function reads magazine property data with specified magazine number.

> **NOTE**
> To use this window function, the option of “Tool pair for tool management function: 64, 240 or 1000 pairs” and the option of "Tool management expansion B" are necessary. Moreover, set CNC parameter TMP(No.13210#1) to 1.

Input data structure

Top Address +0	(Function code) 424	
+2	(Completion code) - (Need not to be set)	
+4	(Data length L) - (Need not to be set)	
+6	(Data number N) Magazine number	
+8	(Data attribute M) 0	Set 0 to this field.
+10	(Data number N2) 0	Set 0 to this field.
+12	(Detailed completion code) - (Need not to be set)	
+14 +37	(Data area) (24 bytes) (Need not to be set)	

Completion codes

0 The processing has been executed normally.
3 (See the following detailed completion codes.)
6 The necessary option is not found.

Detailed completion codes

The detailed completion code is always 0 when the completion code is other than 3.
When the completion code is 3, the detailed completion code is one of the following values:
21 The specified magazine number is invalid.

Output data structure

Address	Content
Top Address +0	(Function code) 424
+2	(Completion code) ? (See above description)
+4	(Data length L) 24
+6	(Data number N) Magazine number (Same as input data)
+8	(Data attribute M) 0 (Same as input data)
+10	(Data number N2) 0 (Same as input data)
+12	(Detailed completion code) ? (See above description)
+14	Magazine information (1 byte)
+15	(Reserved) (3 bytes)
+18	Line of magazine (2 bytes)
+20	Row of magazine (2 bytes)
+22	Customize data 1 (4 bytes)
+26	Customize data 2 (4 bytes)
+30	Customize data 3 (4 bytes)
+34 +37	Customize data 4 (4 bytes)

5.7.18 Writing Pot Property Data (Low-speed Response)

This function writes pot property data with specified magazine and pot number.

> ⚠ **WARNING**
> When you write some NC data using both this instruction in ladder program and other applications, take care that you do not write to the same data area.
> If some values are written to the same data area by two or more applications including ladder program, unexpected value may be written. In this case, it may cause an unexpected machine behavior and also tools, work pieces, and machines may be damaged. As for details, refer to “SAFETY PRECAUTIONS”.

> **NOTE**
> To use this window function, the option of “Tool pair for tool management function: 64, 240 or 1000 pairs” and the option of "Tool management expansion B" are necessary. Moreover, set CNC parameter TMP(No.13210#1) to 1.

Input data structure

Top Address +0	(Function code) 425	
+2	(Completion code) - (Need not to be set)	
+4	(Data length L) 48	
+6	(Data number N) Magazine number	
+8	(Data attribute M) Data type	0: Not change the tool management data number. 1: Change the tool management data number.
+10	(Data number N2) Pot number	
+12	(Detailed completion code) - (Need not to be set)	
+14	Tool management data number (2 bytes)	When you want to change the tool management data number, set "1" to the "Data type".
+16	Pot type (2 bytes)	
+18	Pot information 1 (1 byte)	
+19	Pot information 2 (1 byte)	
+20	(Reserved) 0 (2 bytes)	Set 0 to this field.
+22	Customize data 1 (4 bytes)	
~		

+58	Customize data 10
+61	(4 bytes)

Completion codes

0 The processing has been executed normally.
2 The data length is invalid.
3 (See the following detailed completion codes.)
4 The specified data type is invalid.
5 (See the following detailed completion codes.)
6 The necessary option is not found.

Detailed completion codes

The detailed completion code is always 0 when the completion code is other than 3 or 5.
When the completion code is 3, the detailed completion code is one of the following values:
21 The magazine number is invalid.
22 The pot number is invalid.

When the completion code is 5, the detailed completion code is one of the following values:
1 The specified tool management data number is invalid.
2 The specified pot type is invalid.
3 The specified pot information 1 is invalid.
4 The specified pot information 2 is invalid.
11 to 20 The specified customized data (1 to 10) is invalid.

Output data structure

Top Address +0	(Function code) 425
+2	(Completion code) ? (See above description)
+4	(Data length L) 48 (Same as input data)
+6	(Data number N) Magazine number (Same as input data)
+8	(Data attribute M) Data type (Same as input data)
+10	(Data number N2) Pot number (Same as input data)
+12	(Detailed completion code) ? (See above description)
~	~
+58 +61	Customized data 10 (4 bytes) (Same as input data)

5.7.19 Reading Pot Property Data (Low-speed Response)

This function reads pot property data with specified magazine and pot number.

> **NOTE**
> To use this window function, the option of "Tool pair for tool management function: 64, 240 or 1000 pairs" and the option of "Tool management expansion B" are necessary. Moreover, set CNC parameter TMP(No.13210#1) to 1.

Input data structure

Top Address +0	(Function code) 426	
+2	(Completion code) - (Need not to be set)	
+4	(Data length L) - (Need not to be set)	
+6	(Data number N) Magazine number	
+8	(Data attribute M) 0	Set 0 to this field.
+10	(Data number N2) Pot number	
+12	(Detailed completion code) - (Need not to be set)	
+14 +61	(Data area) (48 bytes) (Need not to be set)	

Completion codes

0 The processing has been executed normally.
3 (See the following detailed completion codes.)
6 The necessary option is not found.

Detailed completion codes

The detailed completion code is always 0 when the completion code is other than 3.
When the completion code is 3, the detailed completion code is one of the following values:
21 The magazine number is invalid.
22 The pot number is invalid.

Output data structure

Address	Content
Top Address +0	(Function code) 426
+2	(Completion code) ? (See above description)
+4	(Data length L) 48
+6	(Data number N) Magazine number (Same as input data)
+8	(Data attribute M) 0 (Same as input data)
+10	(Data number N2) Pot number (Same as input data)
+12	(Detailed completion code) ? (See above description)
+14	Tool management data number (2 bytes)
+16	Pot type (2 bytes)
+18	Pot information 1 (1 byte)
+19	Pot information 2 (1 byte)
+20	(Reserved) (2 bytes)
+22	Customize data 1 (4 bytes)
~	~
+58 +61	Customize data 10 (4 bytes)

5.7.20 Searching for a Free Pot by Specified Data (Low-speed Response)

Based on the pot position that is specified, the nearest free pot(Tool management number is 0) that is adopted to search kind number and searched data and that can be stored in the specified magazine or all the magazines The position of spindle and standby aren't included into the free pot.

NOTE

To use this window function, the option of “Tool pair for tool management function: 64, 240 or 1000 pairs” is necessary.

(a) Search kind number

The search kind number relates the search data to the data of following table.

Search kind number	Search data	Description
0	-	Search for empty pot independent of search data
1	Tool geometry number	Search for empty pot in which specified tool geometry can be stored.
2	Pot type	Search for empty pot which has the specified pot type.
3 ~ 6	Magazine property Customize data 1 ~ 4	Searching the free pot that has same data of specified customize data of magazine property in the magazine
7 ~ 16	Pot property Customize data 1 ~ 10	Searching the free pot that has same customize data of pot property in the magazine

NOTE

1 When specifying '1' to the search kind number, the option of "Tool management expansion B" is necessary. Moreover, set CNC parameter TOT(No.13210#0) to 1.

2 When specifying '2' to ‘16' to the search kind number, the option of "Tool management expansion B" is necessary. Moreover, set CNC parameter TMP(No.13210#1) to 1.

(b) Search direction

Search direction	Direction designation	Magazine that is searched for	The search direction with matrix type
0	Not specified	Specified magazine	Row
10	Not specified	All magazine	Row
20	Not specified	Specified magazine	Column
30	Not specified	All magazine	Column
1	Forward	Specified magazine	Row
11	Forward	All magazine	Row
-1	Backward	Specified magazine	Row
-11	Backward	All magazine	Row
2	Forward	Specified magazine	Column
12	Forward	All magazine	Column
-2	Backward	Specified magazine	Column
-12	Backward	All magazine	Column

In case that “Direction designation” is “Not specified”, nearest free pot from the specified pot is selected.

In case that all magazine is specified to searching object, the search of free pot is performed in the specified magazine. If free pot cannot be searched in the specified magazine, the search object is sifted to the next magazine

Input data structure

Top Address +0	(Function code) 427	
+2	(Completion code) - (Need not to be set)	
+4	(Data length L) - (Need not to be set)	
+6	(Data number N) Magazine number	
+8	(Data attribute M) Search direction	
+10	(Data number N2) Pot number	
+12	(Detailed Completion code) - (Need not to be set)	
+14	Search kind number (2 bytes)	
+16	(Reserved) 0 (2 bytes)	Set 0 to this field.
+18	Search data (4 bytes)	
+22	(Reserved) 0 (12 bytes)	Set 0 to this field.
+34 +37	(Data area) (4 bytes) (Need not to be set)	

Completion codes

0 The processing has been executed normally.
3 (See the following detailed completion codes.)
4 The specified search direction is invalid.
6 The necessary option is not found.
13 There is no free pot.

Detailed completion codes

The detailed completion code is always 0 when the completion code is other than 3.
When the completion code is 3, the detailed completion code is one of the following values:
21 The magazine number is invalid.
22 The pot number is invalid.
100 The search kind number is invalid.
101 The search data is invalid.

Output data structure

Top Address +0	(Function code) 427
+2	(Completion code) ? (See above description)
+4	(Data length L) 4
+6	(Data number N) Magazine number (Same as input data)
+8	(Data attribute M) Search direction (Same as input data)
+10	(Data number N2) Pot number (Same as input data)
+12	(Detailed completion code) ? (See above description)
+14	Search kind number (2 bytes) (Same as input data)
+16	(Reserved) 0 (Same as input data)
+18	Search data (4 bytes) (Same as input data)
+22	(Reserved) 0 (Same as input data)
+34	Magazine number (2 bytes)
+36 +37	Pot number (2 bytes)

The search direction is not specified and the free pot is found to the same distance of forward and backward, the pot that is found in forward direction is priority.

5.7.21 Reading a Tool Geometry Data (Low-speed Response)

This function reads a tool geometry data.

> **NOTE**
> To use this window function, the option of “Tool pair for tool management function: 64, 240 or 1000 pairs” and the option of “Tool management expansion B” are necessary. Moreover, set CNC parameter TOT(No.13210#0) to 1.

Input data structure

Offset	Field	Description
Top Address +0	(Function code) 429	
+2	(Completion code) - (Need not to be set)	
+4	(Data length L) - (Need not to be set)	
+6	(Data number N) Tool geometry data number	You should specify the tool geometry data number. N = 1 to 20
+8	(Data attribute M) 0 (2bytes)	Set 0 to this field.
+10	(Data number N2) 0 (2bytes)	Set 0 to this field.
+12	(Detailed Completion code) - (Need not to be set)	
+14 +18	(Data area) (5bytes) (Need not to be set)	

Completion codes

0 Completed successfully
1 Not supported
3 The tool geometry data number is invalid.
6 No option

Output data structure

Address	Content	Description
Top Address +0	(Function code) 429	
+2	(Completion code) ? (See above description)	
+4	(Data length L) 5 (2bytes)	
+6	(Data number N) Tool geometry data number (Same as input data)	
+8	(Data attribute M) 0 (Same as input data)	
+10	(Data number N2) 0 (Same as input data)	
+12	(Detailed completion code) ? (See above description)	
+14	The number of occupation pot (left side) (1byte)	Signed binary format in 1 byte length 0 to 4
+15	The number of occupation pot (right side) (1byte)	Signed binary format in 1 byte length 0 to 4
+16	The number of occupation pot (upper side) (1byte)	Signed binary format in 1 byte length 0 to 4
+17	The number of occupation pot (lower side) (1byte)	Signed binary format in 1 byte length 0 to 4
+18	Geometry (1byte)	0: Geometry A 1: Geometry B

5.7.22 Writing a Tool Geometry Data (Low-speed Response)

This function writes a tool geometry data.
But, the tool geometry data of the tool, that is stored in pot, cannot be written.

> ⚠ **WARNING**
> When you write some NC data using both this instruction in ladder program and other applications, take care that you do not write to the same data area.
> If some values are written to the same data area by two or more applications including ladder program, unexpected value may be written. In this case, it may cause an unexpected machine behavior and also tools, work pieces, and machines may be damaged. As for details, refer to "SAFETY PRECAUTIONS".

> **NOTE**
> To use this function, the option of "Tool pair for tool management function: 64, 240 or 1000 pairs" and the option of "Tool management expansion B" are necessary. Moreover, set CNC parameter TOT(No.13210#0) to 1.

Input data structure

Top Address +0	(Function code) 430	
+2	(Completion code) - (Need not to be set)	
+4	(Data length L) 5 (2bytes)	
+6	(Data number N) Tool geometry data number	You should specify the tool geometry data number. N = 1 to 20
+8	(Data attribute M) 0 (2bytes)	Set 0 to this field.
+10	(Data number N2) 0 (2bytes)	Set 0 to this field.
+12	(Detailed Completion code) - (Need not to be set)	
+14	The number of occupation pot (left side) (1byte)	Signed binary format in 1 byte length 0 to 4
+15	The number of occupation pot (right side) (1byte)	Signed binary format in 1 byte length 0 to 4
+16	The number of occupation pot (upper side) (1byte)	Signed binary format in 1 byte length 0 to 4
+17	The number of occupation pot (lower side) (1byte)	Signed binary format in 1 byte length 0 to 4
+18	Geometry (1byte)	0 : Geometry A 1 : Geometry B

Completion codes

0 Completed successfully
1 Not supported
3 The tool geometry data number is invalid.
5 (See the following detailed completion codes.)
6 No option
7 The tool is stored in a pot.

Detail Completion codes

This code is 0 except completion code is 5.

When completion code is 5
1 The left side occupation pot number is invalid.
You should set the number 0 to 4.
2 The right side occupation pot number is invalid.
You should set the number 0 to 4.
3 The upper side occupation pot number is invalid.
You should set the number 0 to 4.
4 The lower side occupation pot number is invalid.
You should set the number 0 to 4.
5 The geometry data is invalid.
You should set the number 0(Geometry A) or 1(Geometry B).

Output data structure

Top Address +0	(Function code) 430	
+2	(Completion code) ? (See above description)	
+4	(Data length L) 5 (Same as input data)	
+6	(Data number N) Tool geometry data number (Same as input data)	
+8	(Data attribute M) 0 (Same as input data)	
+10	(Data number N2) 0 (Same as input data)	
+12	(Detailed completion code) ? (See above description)	
+14	The number of occupation pot (left side) (Same as input data)	Signed binary format in 1 byte length 0 to 4
+15	The number of occupation pot (right side) (Same as input data)	Signed binary format in 1 byte length 0 to 4
+16	The number of occupation pot (upper side) (Same as input data)	Signed binary format in 1 byte length 0 to 4
+17	The number of occupation pot (lower side) (Same as input data)	Signed binary format in 1 byte length 0 to 4
+18	Geometry (Same as input data)	0: Geometry A 1: Geometry B

5.7.23 Moving Tool Management Data Numbers in a Magazine Management Table (Low-speed Response)

The tool management data number is moved specifying the magazine number and the pot number of the source and the destination.
An empty pot is specified for the moving destination.
When you specify the spindle position or the waiting position as the magazine number of the source and the destination, specify 0 as the pot number.

When Tool management function tool storage position reservation is valid, an empty pot or the origin position registered into the tool which moves can be specified for the moving destination.
Moreover, when moving the tool by which the origin position is registered, the following data is changed according to the specification of the source and the destination.

- When the tool is moved to other magazine or pot from the pot of the origin position registered into the tool, the 2nd bit of the pot information 1 on the pot property of the origin position is set to 1.
- When the tool is returned to the origin position from magazine or pot other than the origin position registered into the tool, the 2nd bit of the pot information 1 on the pot property of the origin position is set to 0.

NOTE
1 To use this window function, the option of “Tool pair for tool management function: 64, 240 or 1000 pairs” is necessary.
2 To use the tool management function tool storage position reservation, the option of "Tool management expansion B" is necessary. Moreover, set CNC parameter TMP(No.13210#1) to 1 and TRF(No.13201#5) to 1.

Input data structure

Offset	Field	Remarks
Top Address +0	(Function code) 432	
+2	(Completion code) - (Need not to be set)	
+4	(Data length L) 8 (2bytes)	
+6	(Data number N) 0 (2bytes)	Set 0 to this field.
+8	(Data attribute M) 0 (2bytes)	Set 0 to this field.
+10	(Data number N2) 0 (2bytes)	Set 0 to this field.
+12	(Detailed Completion code) - (Need not to be set)	
+14	Magazine number of source (2bytes)	
+16	Pot number of source (2bytes)	When you specify the spindle position or the waiting position as the magazine number of the source, set 0 to this field.
+18	Magazine number of destination (2bytes)	
+20 +21	Pot number of destination (2bytes)	When you specify the spindle position or the waiting position as the magazine number of the destination, set 0 to this field.

Completion codes

0 The processing has been executed normally.
1 Not supported
5 (See the following detailed completion codes.)
6 The necessary option is not found.
7 The area is protected.
13 There is no free pot.

Detail Completion codes

The detailed completion code is always 0 when the completion code is other than 5.

When the completion code is 5, the detailed completion code is one of the following values:
1 Magazine number of source is invalid.
2 Pot number of source is invalid.
3 Tool is not found in the source magazine or pot.
4 Magazine number of destination is invalid.
5 Pot number of destination is invalid.
6 Tool is not found in the destination magazine or pot.

Output data structure

Top Address +0	(Function code) 432
+2	(Completion code) ? (See above description)
+4	(Data length L) 8 (Same as input data)
+6	(Data number N) 0 (Same as input data)
+8	(Data attribute M) 0 (Same as input data)
+10	(Data number N2) 0 (Same as input data)
+12	(Detailed Completion code) ? (See above description)
+14	Magazine number of source (2bytes) (Same as input data)
+16	Pot number of source (2bytes) (Same as input data)
+18	Magazine number of destination (2bytes) (Same as input data)
+20 +21	Pot number of destination (2bytes) (Same as input data)

5.7.24 Reading free number of Multi edge group / Tool offset (High-speed Response)

This function reads the free number of Multi edge group / Tool offset.

> **NOTE**
> 1 To use this window function, the option of "Tool pair for tool management function: 64, 240 or 1000 pairs" is necessary. Moreover set CNC parameter FNS(No.13210#7) to 1.
> 2 To use the edge group number, set the parameter TME (No.13201#3) to 1.

Input data structure

Top Address	Offset	Field	Remark
Top Address	+0	(Function code) 434	
	+2	(Completion code) - (Need not be set)	
	+4	(Data length L) - (Need not be set)	
	+6	(Data number N) 0	Set 0 to this field.
	+8	(Data attribute M) 0	Set 0 to this field.
	+10	(Data number N2) 0	Set 0 to this field.
	+12	(Detailed completion code) - (Need not be set)	
	+14 +29	(Data area) (16byte) (Need not be set)	

Completion code

0 The processing has been executed normally.
6 The necessary option is not found.

> **NOTE**
> Completion code is 0 when the option of "Tool management function" (64, 240 or 1000 pairs) is set and CNC parameter FNS(No.13210 #7) is 0.

Output data structure

Top Address			
Top Address	+0	(Function code) 434	
	+2	(Completion code) ? (See above description)	
	+4	(Data length L) 16	
	+6	(Data number N) 0	
	+8	(Data attribute M) 0	
	+10	(Data number N2) 0	
	+12	(Detailed completion code) 0	This field is 0 at all times.
	+14	Free Multi edge group number (GRP) (2byte)	Signed binary format in 2 bytes length. 1 to 99
	+16	Free Tool length compensation number (H) (2byte)	Signed binary format in 2 bytes length. 1 to n（n is the maximum compensation number）
	+18	Free Cutter compensation number (D) (2byte)	Signed binary format in 2 bytes length. 1 to n（n is the maximum compensation number）
	+20	Free Tool geometric compensation number (TG) (2byte)	Signed binary format in 2 bytes length. 1 to n（n is the maximum compensation number）
	+22	Free Tool wear compensation number (TW) (2byte)	Signed binary format in 2 bytes length. 1 to n（n is the maximum compensation number）
	+24	Reserved 1 -2 (2byte)	
	+26	Reserved 2 -2 (2byte)	
	+28 +29	Reserved 3 -2 (2byte)	

NOTE

1 When free numbers is not effective, free numbers "-1" is acquired.
2 When correspondence data is not effective, "-2" is acquired.
3 When CNC parameter No.13210#7 is 0, "-2" is acquired at all data area.
4 When the “Tool management function for multi-edge tools” is enabled, an edge group number is not used. Therefore, the free multi-edge group number is “-2”.

5.7.25 Writing Edge Data (Low-speed Response)

An edge data of multi-edge tools can be changed based on the specified magazine number, pot number, and edge position. The tool management data number can be specified instead of magazine number and pot number. If the tool except a multi-edge tool is specified, completion code 5 and detailed completion code 95 is returned. In the case of a free pot (a tool management data number is not assigned), completion code 9 is returned.
If zero is specified to edge position, the edge position stored in multi-edge tool is automatically selected. If invalid edge position is specified, completion code 3 and detailed completion code 96 is returned.

> ⚠ **WARNING**
> When you write some NC data using both this instruction in ladder program and other applications, take care that you do not write to the same data area.
> If some values are written to the same data area by two or more applications including ladder program, unexpected value may be written. In this case, it may cause an unexpected machine behavior and also tools, work pieces, and machines may be damaged. As for details, refer to "SAFETY PRECAUTIONS".

> **NOTE**
> To use this window function, the option of "Tool pair for tool management function: 64, 240 or 1000 pairs" and the option of "Tool management function for multi-edge tools" are necessary. Moreover, set the parameter MEB (No.13210#3) to 1.

Input data structure

Top Address +0	(Function code) 439	
+2	(Completion code) - (Need not to be set)	
+4	(Data length L) 48	
+6	(Data number N) Magazine number	If you want to specify the tool management data number, set zero to this field.
+8	(Data attribute M) 0	Set 0 to this field.
+10	(Data number N2) Pot number or tool management data number	
+12	(Detailed Completion code) - (Need not to be set)	
+14	Edge position (4 bytes)	If you want to specify the edge position stored in a multi-edge tool, set zero to this field.
+18	(Data area) (4 bytes) (Need not to be set)	
+22	Tool life counter (4 bytes)	

Offset	Field	Remarks
+26	Maximum tool life (4 bytes)	
+30	Notice tool life (4 bytes)	
+34	Tool life status (1 byte)	
+35	Customized data 0 (1 byte)	
+36	(unused) 0 (2 bytes)	Set 0 to this field.
+38	Tool length compensation number H (2 bytes)	* for milling or compound system
+40	Cutter compensation number D (2 bytes)	* for milling or compound system
+42	Spindle speed S (4 bytes)	
+46	Cutting feedrate F (4 bytes)	
+50	Tool geometric compensation number G (2 bytes)	* for lathe or compound system
+52	Tool wear compensation number W (2 bytes)	* for lathe or compound system
+54	Customized data 1 (4 bytes)	
~		~
+66	Customized data 4 (4 bytes)	
+69		

Completion codes

0 The processing has been executed normally.
2 The data length is invalid.
3 (See the following detailed completion codes.)
5 (See the following detailed completion codes.)
6 The necessary option or parameter is not found.
7 The area is protected.
9 Free pot.

Detailed completion codes

The detailed completion code is always 0 when the completion code is other than 3 or 5.

When the completion code is 3, the detailed completion code is one of the following values:

21 The magazine number is invalid.
22 The pot number is invalid.
23 The tool management data number is invalid.
96 The edge position is invalid.

When the completion code is 5, the detailed completion code is one of the following values:
2 The specified tool life counter is invalid.
3 The specified maximum tool life is invalid.
4 The specified notice tool life is invalid.
5 The specified tool life status is invalid.
8 The specified tool length compensation number (H) is invalid.
9 The specified cutter compensation number (D) is invalid.
10 The specified spindle speed (S) is invalid.
11 The specified cutting feedrate (F) is invalid.
12 The specified tool geometric compensation number (G) is invalid.
13 The specified tool wear compensation number (W) is invalid.
31 to 34 The specified customized data (1 to 4) is invalid.
95 The tool except a multi-edge tool is specified.

Output data structure

Top Address +0	(Function code) 439	
+2	(Completion code) ? (See above description)	
+4	(Data length L) 48 (Same as input data)	
+6	(Data number N) Magazine number (Same as input data)	
+8	(Data attribute M) 0 (Same as input data)	
+10	(Data number N2) Pot number or tool management data number (Same as input data)	
+12	(Detailed completion code) ? (See above description)	
+14	Edge position (4 bytes) (Same as input data)	
+18	Written edge position (4 bytes)	The same value as the edge position set to +14 is read. However, when 0 is specified, the edge position stored in the multi-edge tool is read.
+22	Tool life counter (4 bytes) (Same as input data)	
+26	Maximum tool life (4 bytes) (Same as input data)	
~		
+66 +69	Customized data 4 (4 bytes) (Same as input data)	

5.7.26 Reading Edge Data (Low-speed Response)

An edge data of multi-edge tools can be read based on the specified magazine number, pot number, and edge position. The tool management data number can be specified instead of magazine number and pot number. If the tool except a multi-edge tool is specified, completion code 5 and detailed completion code 95 is returned. In the case of a free pot (a tool management data number is not assigned), completion code 9 is returned.
If zero is specified to edge position, the edge position stored in multi-edge tool is automatically selected. If invalid edge position is specified, completion code 3 and detailed completion code 96 is returned.

NOTE
To use this window function, the option of “Tool pair for tool management function: 64, 240 or 1000 pairs” and the option of "Tool management function for multi-edge tools" are necessary. Moreover, set the parameter MEB (No.13210#3) to 1.

Input data structure

Top Address +0	(Function code) 440	
+2	(Completion code) - (Need not to be set)	
+4	(Data length L) (Need not to be set)	
+6	(Data number N) Magazine number	If you want to specify the tool management data number, set zero to this field.
+8	(Data attribute M) 0	Set 0 to this field.
+10	(Data number N2) Pot number or tool management data number	
+12	(Detailed Completion code) - (Need not to be set)	
+14	Edge position (4 bytes)	If you want to specify the edge position stored in a multi-edge tool, set zero to this field.
+18 +69	(Data area) (52 bytes) (Need not to be set)	

Completion codes

0 The processing has been executed normally.
3 (See the following detailed completion codes.)
5 (See the following detailed completion codes.)
6 The necessary option or parameter is not found.
7 The area is protected.
9 Free pot.

Detailed completion codes

The detailed completion code is always 0 when the completion code is other than 3 or 5.

When the completion code is 3, the detailed completion code is one of the following values:
21 The magazine number is invalid.
22 The pot number is invalid.
23 The tool management data number is invalid.
96 The edge position is invalid.

When the completion code is 5, the detailed completion code is one of the following values:
95 The tool except a multi-edge tool is specified.

Output data structure

Top Address +0	(Function code) 440	
+2	(Completion code) ? (See above description)	
+4	(Data length L) 48 (Same as input data)	
+6	(Data number N) Magazine number (Same as input data)	
+8	(Data attribute M) 0 (Same as input data)	
+10	(Data number N2) Pot number or tool management data number (Same as input data)	
+12	(Detailed completion code) ? (See above description)	
+14	Edge position (4 bytes) (Same as input data)	
+18	Read edge position (4 bytes)	The same value as the edge position set to +14 is read. However, when 0 is specified, the edge position stored in the multi-edge tool is read.
+22	Tool life counter (4 bytes)	
+26	Maximum tool life (4 bytes)	
+30	Notice tool life (4 bytes)	
+34	Tool life status (1 byte)	
+35	Customized data 0 (1 byte)	
+36	(unused) 0 (2 bytes)	
+38	Tool length compensation number H (2 bytes)	* for milling or compound system

Offset	Data	Remarks
+40	Cutter compensation number D (2 bytes)	* for milling or compound system
+42	Spindle speed S (4 bytes)	
+46	Cutting feedrate F (4 bytes)	
+50	Tool geometric compensation number G (2 bytes)	* for lathe or compound system
+52	Tool wear compensation number W (2 bytes)	* for lathe or compound system
+54	Customized data 1 (4 bytes)	
~		~
+66	Customized data 4 (4 bytes)	
+69		

5.7.27 Writing Each Edge Data (Low-speed Response)

A part of edge data can be changed based on the specified magazine number, pot number, and edge position. The tool management data number can be specified instead of magazine number and pot number. If the tool except a multi-edge tool is specified, completion code 5 and detailed completion code 95 is returned. In the case of a free pot (a tool management data number is not assigned), completion code 9 is returned.
If zero is specified to edge position, the edge position stored in multi-edge tool is automatically selected.
If invalid edge position is specified, completion code 3 and detailed completion code 96 is returned.
Enter the data type number to be change, as the data attribute.
The size of the required data area differs depending on the data type.
The following table shows the relationship between each data type number and its corresponding data and required data area size.

> ⚠ **WARNING**
> When you write some NC data using both this instruction in ladder program and other applications, take care that you do not write to the same data area.
> If some values are written to the same data area by two or more applications including ladder program, unexpected value may be written. In this case, it may cause an unexpected machine behavior and also tools, work pieces, and machines may be damaged. As for details, refer to "SAFETY PRECAUTIONS".

Table 5.7.27 (a) Data, data type number and data area size

Data type number	Data	Data area size	Remarks
2	Tool life counter	4 bytes	
3	Maximum tool life	4 bytes	
4	Notice tool life	4 bytes	
5	Tool life status	1 byte	
6	Customized data 0	1 byte	
8	Tool length compensation number (H)	2 bytes	* for milling or compound system
9	Cutter compensation number (D)	2 bytes	* for milling or compound system
10	Spindle speed (S)	4 bytes	
11	Cutting feedrate (F)	4 bytes	
12	Tool geometric compensation number (G)	2 bytes	* for lathe or compound system
13	Tool wear compensation number (W)	2 bytes	* for lathe or compound system
31	Customized data 1	4 bytes	
~	~	~	
34	Customized data 4	4 bytes	

> **NOTE**
> To use this window function, the option of "Tool pair for tool management function: 64, 240 or 1000 pairs" and the option of "Tool management function for multi-edge tools" are necessary. Moreover, set the parameter MEB (No.13210#3) to 1.

Input data structure

Address	Field	Description
Top Address +0	(Function code) 441	
+2	(Completion code) - (Need not to be set)	
+4	(Data length L) 1, 2, 4	Set the length of data that you want to write.
+6	(Data number N) Magazine number	If you want to specify the tool management data number, set zero to this field.
+8	(Data attribute M) Data type number	
+10	(Data number N2) Pot number or tool management data number	
+12	(Detailed Completion code) - (Need not to be set)	
+14	Edge position (4 bytes)	If you want to specify the edge position stored in a multi-edge tool, set zero to this field.
+18	(Data area 1) (4 bytes) (Need not to be set)	
+22 +n	(Data area 2) (1, 2, 4 bytes)	Set the data that you want to write. The size of the required data area differs depending on the data type.

Completion codes

0 The processing has been executed normally.
2 The data length is invalid.
3 (See the following detailed completion codes.)
4 The specified data type is invalid.
5 (See the following detailed completion codes.)
6 The necessary option or parameter is not found.
7 The area is protected.
9 Free pot.

Detailed completion codes

The detailed completion code is always 0 when the completion code is other than 3 or 5.

When the completion code is 3, the detailed completion code is one of the following values:
21 The magazine number is invalid.
22 The pot number is invalid.
23 The tool management data number is invalid.
96 The edge position is invalid.

When the completion code is 5, the detailed completion code is one of the following values:
2 The specified tool life counter is invalid.
3 The specified maximum tool life is invalid.
4 The specified notice tool life is invalid.
5 The specified tool life status is invalid.
6 The specified customized data 0 is invalid.

8 The specified tool length compensation number (H) is invalid.
9 The specified cutter compensation number (D) is invalid.
10 The specified spindle speed (S) is invalid.
11 The specified cutting feedrate (F) is invalid.
12 The specified tool geometric compensation number (G) is invalid.
13 The specified tool wear compensation number (W) is invalid.
31 to 34 The specified customized data (1 to 4) is invalid.
95 The tool except a multi-edge tool is specified.

Output data structure

Address	Contents	Remarks
Top Address +0	(Function code) 441	
+2	(Completion code) ? (See above description)	
+4	(Data length L) (Same as input data)	
+6	(Data number N) Magazine number (Same as input data)	
+8	(Data attribute M) Data type number (Same as input data)	
+10	(Data number N2) Pot number or tool management data number (Same as input data)	
+12	(Detailed completion code) ? (See above description)	
+14	Edge position (4 bytes) (Same as input data)	
+18	Written edge position (4 bytes)	The same value as the edge position set to +14 is read. However, when 0 is specified, the edge position stored in the multi-edge tool is read.
+22	(Data area) (1, 2, 4 bytes) (Same as input data)	

5.7.28 Reading the Total Tool Life Data of an Edge (Low-speed Response)

This function can read a total tool life data of multi-edge tools corresponding to the specified tool type number, the life count type, and edge position.
If the tool except a multi-edge tool is specified, completion code 5 and detailed completion code 95 is returned. And, if zero or invalid edge position is specified, completion code 3 and detailed completion code 96 is returned.

> **NOTE**
> To use this window function, the option of “Tool pair for tool management function: 64, 240 or 1000 pairs” and the option of "Tool management function for multi-edge tools" are necessary. Moreover, set the parameter MEB (No.13210#3) to 1.

Input data structure

Address	Field	Description
Top Address +0	(Function code) 442	
+2	(Completion code) - (Need not to be set)	
+4	(Data length L) - (Need not to be set)	
+6	(Data number N) Tool type number	Set the tool type number with signed binary format in 4bytes length.
+10	(Data attribute M) Life count type	Set the life count type with signed binary format in 2bytes length. M=0: Count, 1: Time
+12	(Detailed Completion code) - (Need not to be set)	
+14	Edge position (4 bytes)	
+18	(Reserved) (4 bytes)	Set zero to this field.
+22 +45	(Data area) (24 bytes) (Need not to be set)	

Completion codes

0 The processing has been executed normally.
3 (See the following detailed completion codes.)
4 The specified tool count type is invalid.
3 (See the following detailed completion codes.)
6 The necessary option or parameter is not found.

Detailed completion codes

The detailed completion code is always 0 when the completion code is other than 3 or 5.

When the completion code is 3, the detailed completion code is one of the following values:
1 The tool type number is invalid. (Except for 1 through 99999999)
28 No specified tool type number
96 The edge position is invalid.

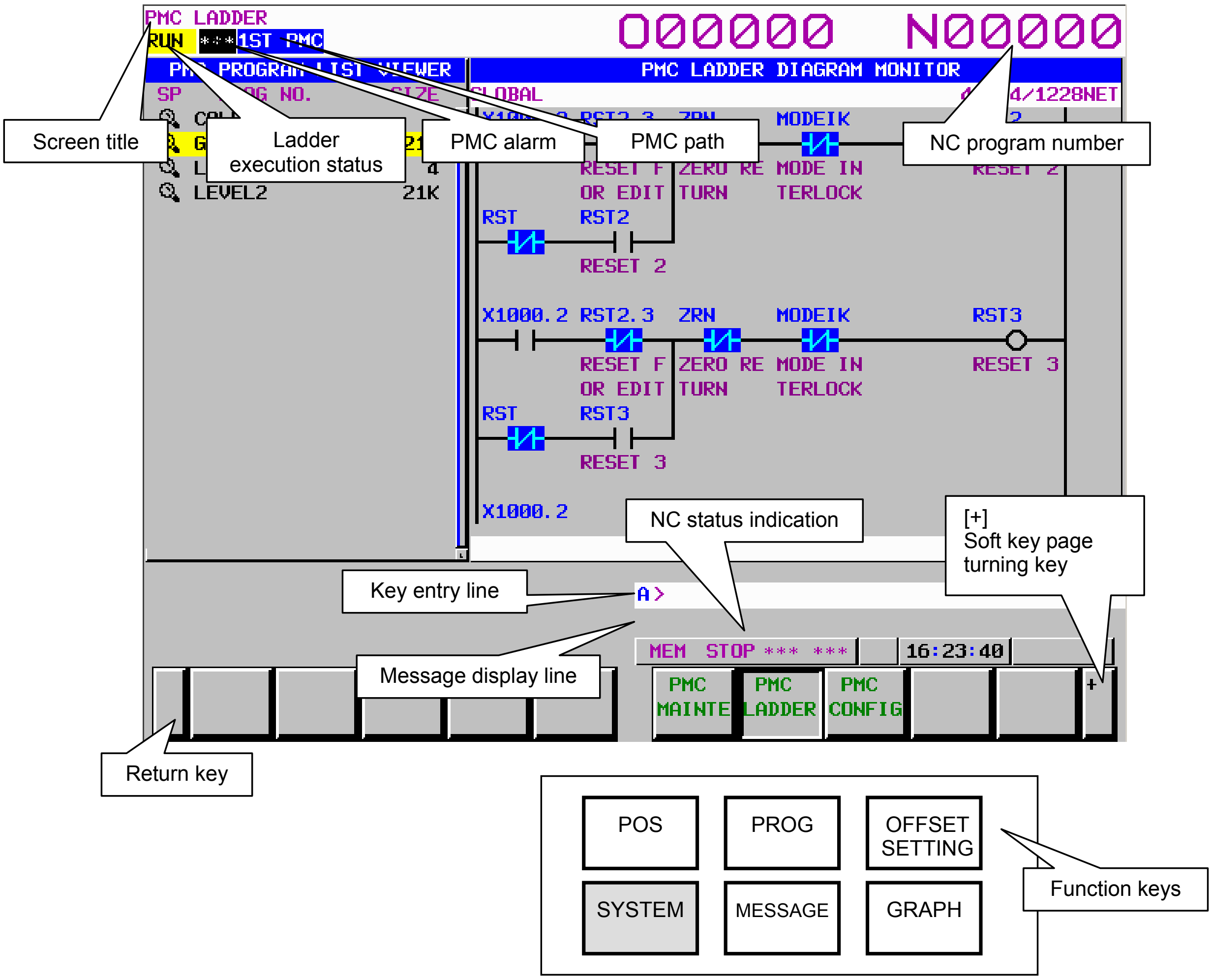
When the completion code is 5, the detailed completion code is one of the following values:
95 The tool except a multi-edge tool is specified.

Output data structure

Top Address +0	(Function code) 442	
+2	(Completion code) ? (See above description)	
+4	(Data length L) 24	
+6	(Data number N) Tool type number (Same as input data)	
+10	(Data attribute M) Life count type (Same as input data)	
+12	(Detailed completion code) ? (See above description)	
+14	Edge position (4 bytes) (Same as input data)	
+18	(Reserved) 0 (Same as input data)	
+22	Tool type number (4bytes)	This is the same as "N: Data number" which you specify.
+26	Total life counter (4bytes)	The unit of this data is indicated by "+45: Life count type".
+30	Total remaining life (4bytes)	The unit of this data is indicated by "+45: Life count type".
+34	Total maximum life (4bytes)	The unit of this data is indicated by "+45: Life count type".
+38	Total notice life (4bytes)	The unit of this data is indicated by "+45: Life count type".
+42	Tool count (2bytes)	The tools, which have the specified tool type number and tool life type, are counted.
+44	Total life status (1byte)	0: Not noticed, 1: Noticed
+45	Life count type (1byte)	0: Count, 1: Time (second), 2: Time (millisecond)

6 OPERATING THE PMC SCREEN

The basic configuration of the PMC screen is described below.



- Screen title:
  Displays the name of a specific submenu of the PMC.
- Ladder execution status:
  Displays the execution status of the ladder program.
- PMC alarm:
  Indicates whether any PMC alarm is occurring.
- PMC path:
  Displays the currently selected PMC.
- NC program number:
  Displays the currently selected NC program number.
- Key entry line:
  Line for entering a numerical value or character key string.
- Message display line:
  Displays an error or warning message.
- NC status indication:
  Displays the NC mode, the execution status of the NC program, the currently selected NC path number.

- Return key:
  Used to switch from the PMC operation menu to a specific PMC submenu or from a specific PMC submenu to the main menu of the PMC.
- Soft key page turning key:
  Used to turn soft key pages.

About the PMC screen

When you click the "SYSTEM" function key and then turn the soft key page by clicking the [+] soft key, the main menu of the PMC is displayed.
The PMC main menu offers the following three types of submenus, which are respectively used for specific purposes.

- PMC maintenance
- PMC ladder
- PMC configuration

Each of these PMC submenus is explained below.

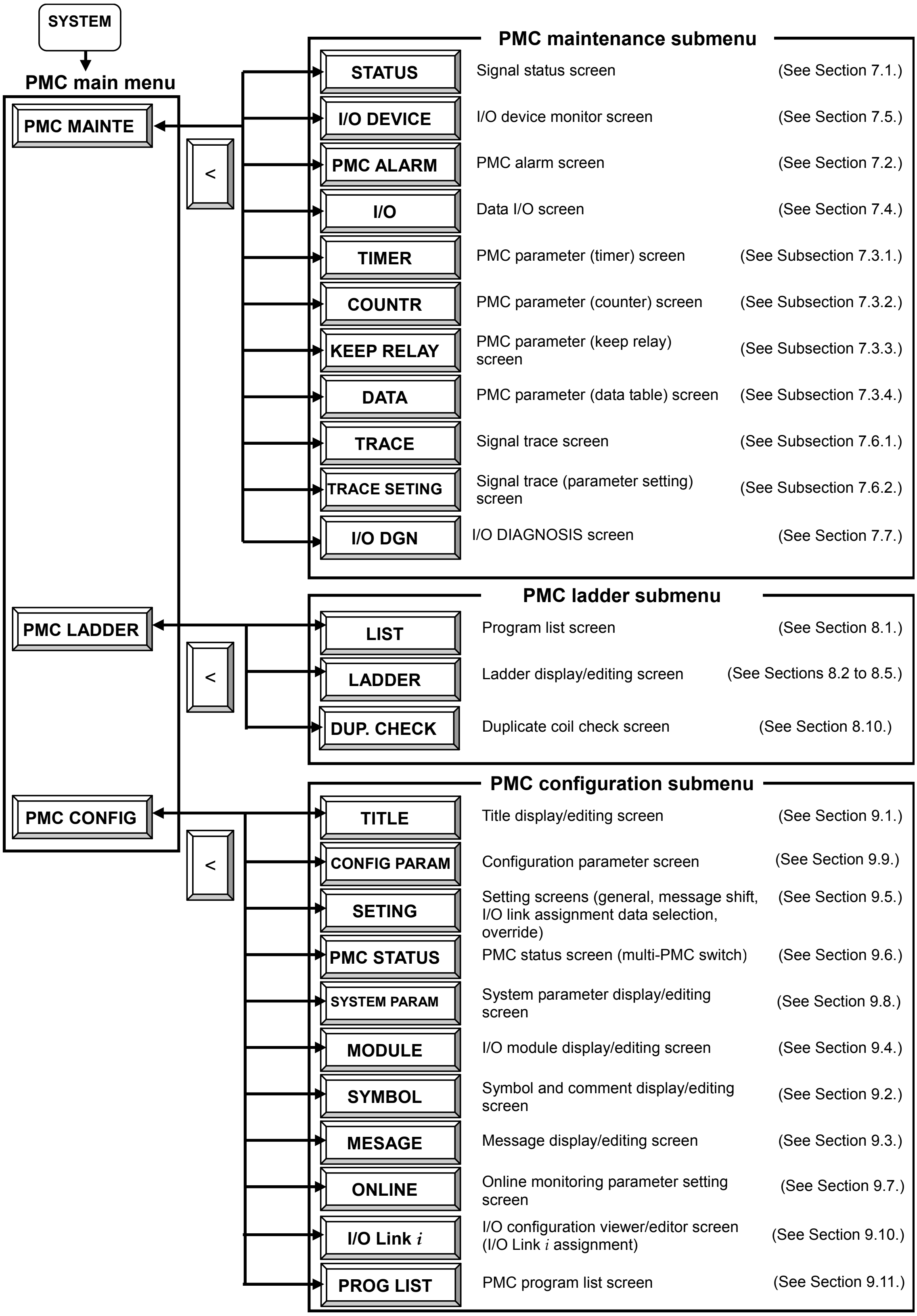
(1) PMC maintenance menu
This menu displays the screens related to the maintenance of the PMC, such as those for PMC signal status monitoring and traces and for PMC data display and editing.

(2) PMC ladder menu
This menu displays the screens related to the display and editing of the ladder program.

(3) PMC configuration menu
This menu displays the screens related to the display and editing of the data other than the ladder constituting the sequence program, as well as the screen for setting the PMC functions.

6.1 OPERATION SCREENS OF THE PMC AND SOFT KEY ORGANIZATION

6.1.1 Transition of the PMC Screens



6.1.2 Basic Screen Operations

Use the operation soft keys to operate the individual screens.
To switch to the operation soft keys, do the following:

- Click the [(OPRT)] soft key, which is one of the PMC submenu soft key.
- Enter a numerical value or character string.

To switch from the operation soft keys to a specific PMC submenu or to the PMC main menu, click the [<] soft key.

No operation soft keys are displayed when the screen requires no operation. In that case, the [(OPRT)] soft key is not displayed, either.
On the other hand, a screen that involves multiple different functions consists of two or more layers of operation soft keys.
In that case, to return from the operation soft keys of one layer to those of the previous layer, click the [EXIT] soft key.

A transition diagram for the PMC main menu soft keys, PMC submenu soft keys, and operation soft keys is shown below.

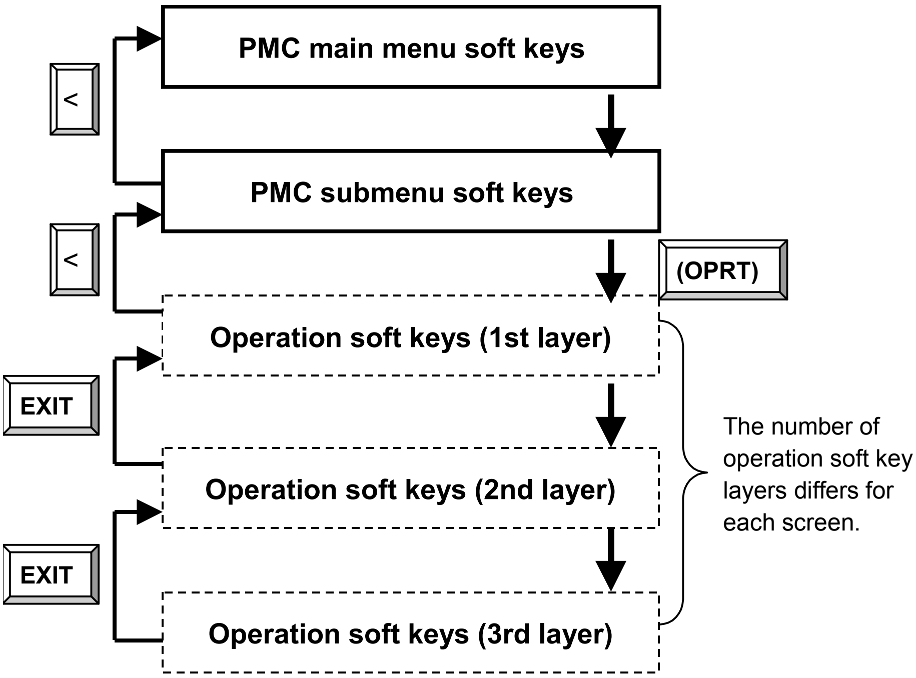
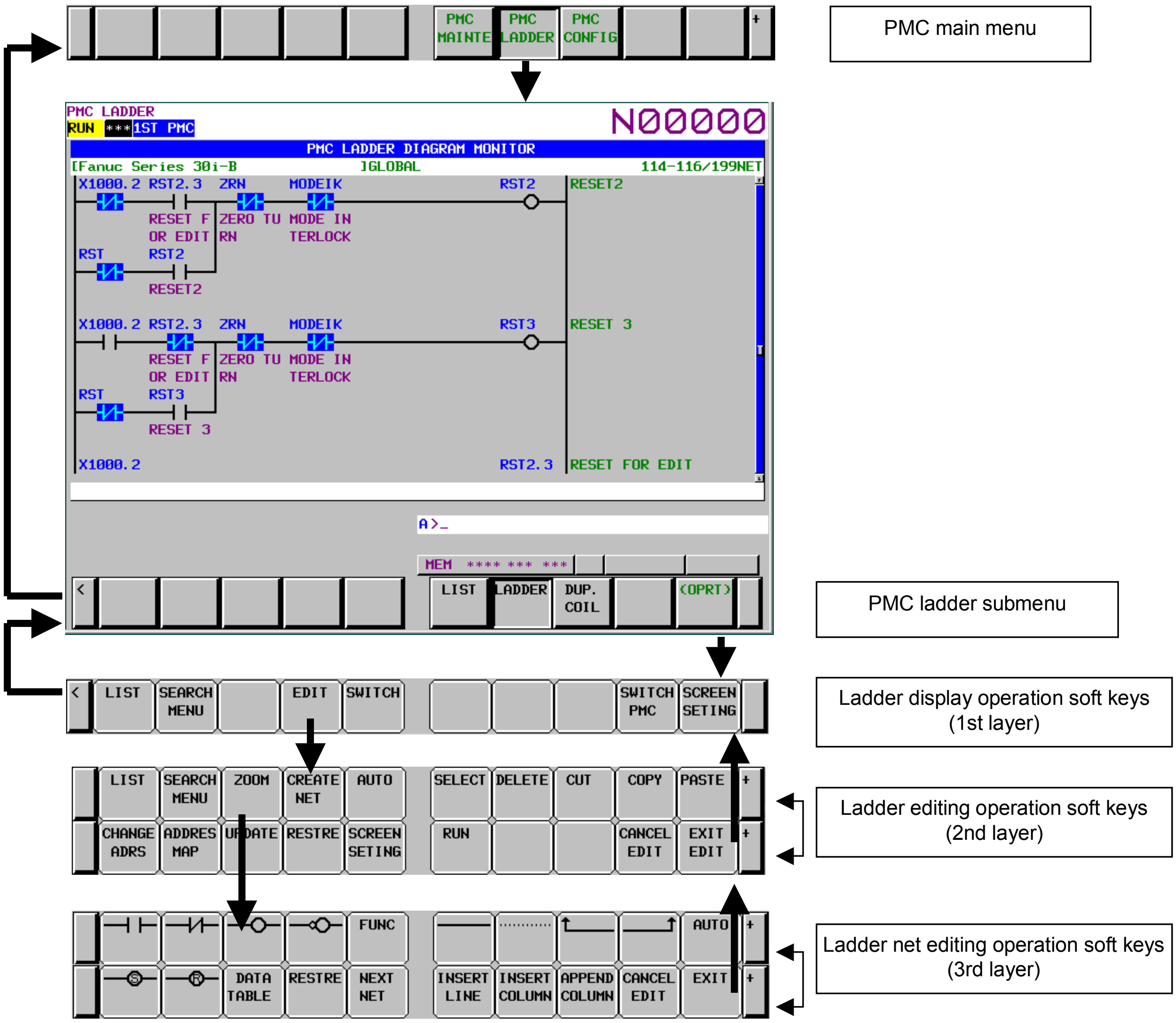


Fig. 6.1.2 Transition diagram for the PMC soft keys

Example) Ladder display/editing screen
Operate the ladder display/editing screen by switching three layers of operation soft keys - ladder display operation soft keys (1st layer), ladder editing operation soft keys (2nd layer), and ladder net editing operation soft keys (3rd layer).


PMC main menu
PMC MAINTE
PMC LADDER
PMC CONFIG
PMC LADDER
RUN ***1ST PMC
N00000
PMC LADDER DIAGRAM MONITOR
[Fanuc Series 30i-B]GLOBAL 114-116/199NET
X1000.2 RST2.3 ZRN MODEIK RST2 RESET2
RESET FOR EDIT ZERO TURN MODE INTERLOCK
RST RST2
RESET2
X1000.2 RST2.3 ZRN MODEIK RST3 RESET 3
RESET FOR EDIT ZERO TURN MODE INTERLOCK
RST RST3
RESET 3
X1000.2 RST2.3 RESET FOR EDIT
A>_
MEM **** *** ***
LIST
LADDER
DUP. COIL
(OPRT)
PMC ladder submenu
LIST
SEARCH MENU
EDIT
SWITCH
SWITCH PMC
SCREEN SETING
Ladder display operation soft keys (1st layer)
LIST
SEARCH MENU
ZOOM
CREATE NET
AUTO
SELECT
DELETE
CUT
COPY
PASTE
CHANGE ADRS
ADDRES MAP
UPDATE
RESTRE
SCREEN SETING
RUN
CANCEL EDIT
EXIT EDIT
Ladder editing operation soft keys (2nd layer)
FUNC
AUTO
DATA TABLE
RESTRE
NEXT NET
INSERT LINE
INSERT COLUMN
APPEND COLUMN
CANCEL EDIT
EXIT
Ladder net editing operation soft keys (3rd layer)

6.2 DISPLAY AND OPERATION CONDITIONS FOR SCREENS

Several PMC screens can be protected from unauthorized attempts to display data or operate the screen, based on preset conditions. This section describes such display and operation conditions.

There are two kinds of data protection for PMC. One is the Programmer Protection Function and another is Protection of Data at 8 Levels.
The Programmer Protection Function is effective in standard. When the Protection of Data at 8 Levels is added, the Programmer Protection Function becomes ineffective and the Protection of Data at 8 Levels becomes effective.

6.2.1 Programmer Protection Function

> ⚠**CAUTION**
> This section contains important information for developers of application system controlled by PMC. Improperly implemented application system may increase possibility of defects in its safety. Careful examinations and considerations on using and implementing with the functions explained especially in this section are strongly required.

PMC system provides various embedded programmer functions such as edit, diagnosis and debugging which help the programming and debugging of sequence program. To use these functions which may even disable safety mechanism realized by sequence program, it is required that the operator of these functions should be an expert who fully understands the sequence program and the operation of PMC. It is also strongly recommended to the developer of machine that these functions should be protected from careless use by ordinary operators after the machine is shipped into the field. Furthermore, if these functions partly need to be used in the field for any purpose such as the maintenance or adjustment, the developer of the machine should implement any means to enable these functions after forcing the machine in safe mode or should let the operator know and strictly follow proper procedure to ensure the safety.
The setting parameters described in this section are provided for the developer of machine to be able to properly program the sequence or control the parameters for necessary conditions on which the operator is allowed to use PMC programmer functions safely by eliminating careless operation which may cause "stopping the ladder", "changing sequence program" or "changing important setting data".
These parameters can be set on the setting screen or in some system keep relays (K900 to 999).

> **NOTE**
> 1 When using the ladder dividing management function, divided ladder programs are protected in the same condition as main ladder program.
> 2 When using PMC memory shared mode in multi-path PMC function, the ladder program in the path is protected in same condition as 1st path PMC.

PROGRAMMER ENABLE (K900.1)

If you set "PROGRAMMER ENABLE" to "YES", it enables the following functions as a supervisor mode.

- Ladder editing screen
- Title data editing screen
- Symbol/comment data editing screen
- Message data editing screen
- I/O unit address setting screen
- Start/stop of ladder
- Forcing function

- Override function (Note1)
- Setting of multi-language message display function
- Data I/O screen
- System parameter screen
- Parameter setting screen for online monitor
- Setting screen for the I/O Link assignment data selection function
- Setting screen for keep relay K900 or after
- Configuration parameter screen
- Sequence program input and output
- Data setting in the timer, counter, keep relay and data screen (Note2)
- PMC parameter input and output (Note3)
- Input and output of message data for multi-language display
- Saving of a sequence program to flash ROM
- Saving of message data for multi-language display to flash ROM
- I/O configuration viewer screen (I/O Link *i* assignment)
- I/O configuration editor screen (I/O Link *i* assignment)
- Input and Output of I/O configuration data
- Saving of I/O configuration data to flash ROM
- I/O configuration viewer screen (I/O Link *i* selectable I/O)
- Registration and deletion of I/O devices in I/O device monitor screen

NOTE

1 The override function also requires the setting of "OVERRIDE ENABLE" in the setting parameters.
2 In order to change the data in each PMC parameter screen, particular operations are necessity. For details, refer to subsection “6.2.2”.
3 In order to input/output the PMC parameters in the date I/O screen, particular operations are necessity. For details, refer to subsection “6.2.2”.

⚠ WARNING

If the sequence program is stopped while the machine is operating, the machine may cause unexpected operation. Before stopping the sequence program, make sure that there is no one near the machine and that the tool will not collide with the workpiece or machine. Operating the machine in any inappropriate fashion can result in the death of or serious injury to the user. The tool, workpiece, and/or machine can also be damaged.

⚠ CAUTION

Set this setting to "NO"(0) before shipment of the machine. If this setting is left as "YES"(1), the operator may stop execution of the ladder program by mistake. If you want to protect this setting, make a sequence that always writes 0 in this bit by your ladder. Or control the machine to force to translate into safety state by sequence program using the way described in Section 2.2.4 when the ladder stops.

HIDE PMC PROGRAM (K900.0)

If you set "HIDE PMC PROGRAM" to "YES", it disables the following functions which have the sequence program display.

- Ladder monitor screen
- Ladder editing screen
- Title data screen
- Title data editor screen
- Symbol/comment data viewer screen
- Symbol/comment data editor screen
- Message data viewer screen
- Message data editor screen
- I/O module viewer screen
- I/O module editor screen
- Clear of PMC parameter
- System parameter viewer screen
- System parameter editor screen
- Output of sequence program
- Output of message data for multi-language display
- I/O configuration viewer screen (I/O Link *i* assignment)
- I/O configuration editor screen (I/O Link *i* assignment)
- Output of I/O configuration data

NOTE

Even if this parameter is set to "YES", these functions will not be hidden except for Ladder monitor/editing screen if "PROGRAMMER ENABLE" is set to "YES".

EDIT ENABLE (K901.6)

If you set "EDIT ENABLE" to "YES", it enables the following functions which can edit the program.

- Ladder editing screen (Note1)
- Title data editing screen (Note1)
- Symbol/comment data editing screen (Note1) (Note2)
- Message data editing screen (Note1) (Note2)
- I/O unit address setting screen (Note1) (Note2)
- Clear of PMC parameter (Note1) (Note2)
- Setting of multi-language message display function
- System parameter screen (Note1)
- Setting screen for keep relay K900 or after
- Configuration parameter screen
- Sequence program input (Note2)
- Saving of a sequence program to flash ROM
- Input of message data for multi-language display (Note2)
- Saving of message data for multi-language display to flash ROM

NOTE

1 Even if this parameter is set to "YES", these functions, which display a part of program, are not available if "HIDE PMC PROGRAM" is set to "YES".

2 These screens, which stop ladder program, also require the below setting "ALLOW PMC STOP".

> ⚠ **CAUTION**
> Set this setting to "NO"(0) before shipment of the machine if you want to prohibit operator form editing the program. If you want to protect this setting, make a sequence that always writes 0 in this bit by your ladder.

ALLOW PMC STOP (K902.2)

If you set "ALLOW PMC STOP" to "YES", it enables the following functions which require stop/start of ladder program. (Note1)

- Symbol/comment data editing screen (Note2)
- Message data editing screen (Note2)
- I/O unit address setting screen (Note2)
- Clear of PMC parameter (Note2)
- Start/stop of ladder
- System parameter screen (Note2)
- Input of sequence program (Note2)
- Input of message data for multi-language display (Note2)

> **NOTE**
> 1 Even if this parameter is set to "YES", these functions, which display a part of program, are not available if "HIDE PMC PROGRAM" is set to "YES".
> 2 These editing screens also require the above setting "EDIT ENABLE".

> ⚠ **WARNING**
> If the sequence program is stopped while the machine is operating, the machine may cause unexpected operation. Before stopping the sequence program, make sure that there is no one near the machine and that the tool will not collide with the workpiece or machine. Operating the machine in any inappropriate fashion can result in the death of or serious injury to the user. The tool, workpiece, and/or machine can also be damaged.

> ⚠ **CAUTION**
> Set this setting to "NO"(0) before shipment of the machine. If this setting is left as "YES"(1), the operator may stop execution of the ladder program by mistake. If you want to protect this setting, make a sequence that always writes 0 in this bit by your ladder. Or control the machine to force to translate into safety state by sequence program using the way described in Section 2.2.4 when the ladder stops.

RAM WRITE ENABLE (K900.4)

If you set "RAM WRITE ENABLE" to "YES", it enables the following functions, regardless of the other protection.

- Forcing function
- Override function (Note)
- The change of the PMC parameters from the timer, counter, keep relay, and data screens is disabled.
- The input of the PMC parameters from the PMC I/O screen is disabled.

NOTE
The override function also requires the setting of "OVERRIDE ENABLE" in the setting parameters.

⚠ **CAUTION**
Set this setting to "NO"(0) before shipment of the machine. If this setting is left as "YES"(1), the operator may modify PMC parameters or PMC signals by mistake. If you want to protect this setting, make a sequence that always writes 0 in this bit by your ladder.

DATA TBL CNTL SCREEN (K900.7)

If you set "DATA TBL CNTL SCREEN" to "NO", the data table control screen is not displayed.

IO GROUP SELECTION (K906.1)

If you set "IO GROUP SELECTION " to "SHOW", it enables to use the following functions.

- Setting screen for the selectable I/O link assignment function
- I/O configuration viewer screen (I/O link *i* selectable assignment)

HIDE PMC PARAM (K902.6)

If you set "HIDE PMC PARAM" to "YES", functions that are related to the PMC parameters are protected, as follows:

- The timer, counter, keep relay, and data screens cannot be displayed.
- The PMC I/O screen cannot output the PMC parameters.

⚠ **CAUTION**
1 To output the PMC parameters from the data I/O screen requires a special operation. For information about how to enable the output of the PMC parameters, see "Output from the data I/O screen" in Subsection 6.2.2.
2 Even if the parameter is set to “YES”, above function is not protected if the "PROGRAMMER ENABLE" is set to "YES"

PROTECT PMC PARAM (K902.7)

If you set "PROTECT PMC PARAM" to "YES", functions that are related to the PMC parameters are protected, as follows:

- The change of the PMC parameters from the timer, counter, keep relay, and data screens is disabled.
- The input of the PMC parameters from the PMC I/O screen is disabled.

⚠ **CAUTION**
1 To change the PMC parameters on an individual screen requires a special operation. For information about how to enable the input of the PMC parameters, see "Input from the PMC parameter screen" in Subsection 6.2.2.
2 To enter the PMC parameters from the data I/O screen requires a special operation. For information about how to enable the input of the PMC parameters, see "Input from the data I/O screen" in Subsection 6.2.2.
3 Even if the parameter is set to “YES”, above function is not protected if the "PROGRAMMER ENABLE" is set to "YES"

KEEP RELAY (SYSTEM) (K906.6)

If you set " KEEP RELAY (SYSTEM)" to "SHOW", The KEEP RELAY for PMC system (after K900) screen is enabled.

I/O CONF EDIT ENABLE (K907.0)

If you set “I/O CONF EDIT ENABLE” to “YES”, it enables to use the following functions for editing of I/O configuration data. In the multi-path PMC system, the setting of first path PMC is effective.

- I/O configuration editor screen (I/O Link *i* assignment)
- Input of I/O configuration data
- Saving of I/O configuration data to flash ROM

REGISTER I/O DEVICES (K935.1)

If you set “REGISTER I/O DEVICES” to “YES”, it enables to use the following function. In the multi-path PMC system, the setting of first path PMC is effective.

- Registration / deletion of I/O devices configuration in the I/O device monitor screen

Example for setting parameters

(1) If you want to prohibit completely operator from accessing the sequence program;
- PROGRAMMER ENABLE (K900.1) "NO"
- HIDE PMC PROGRAM (K900.0) "YES"
- EDIT ENABLE (K901.6) "NO"
- ALLOW PMC STOP (K902.2) "NO"

(2) If you want to allow operator only monitoring the sequence program;
- PROGRAMMER ENABLE (K900.1) "NO"
- HIDE PMC PROGRAM (K900.0) "NO"
- EDIT ENABLE (K901.6) "NO"
- ALLOW PMC STOP (K902.2) "NO"

NOTE

Use the password function of sequence program to restrict the function to particular operator. Refer to FANUC LADDER-III operator's manual B-66234EN "5.4".

(3) If you want to allow operator monitoring and editing the sequence program;
- PROGRAMMER ENABLE (K900.1) "NO"
- HIDE PMC PROGRAM (K900.0) "NO"
- EDIT ENABLE (K901.6) "YES"
- ALLOW PMC STOP (K902.2) "NO"

NOTE

Use the password function of sequence program to restrict the function to particular operator. Refer to FANUC LADDER-III operator's manual B-66234EN "5.4".

(4) If you want to allow operator monitoring and editing the sequence program which requires stop of ladder;
- PROGRAMMER ENABLE (K900.1) "NO"
- HIDE PMC PROGRAM (K900.0) "NO"
- EDIT ENABLE (K901.6) "YES"
- ALLOW PMC STOP (K902.2) "YES"

NOTE

Use the password function of sequence program to restrict the function to particular operator. Refer to FANUC LADDER-III operator's manual B-66234EN "5.4".

> ⚠ **WARNING**
> If a sequence program is stopped while the machine is operating, the machine may behave unexpectedly. Before stopping the sequence program, make sure that nobody is near the machine and that the tool cannot interfere with the work-piece or machine. Incorrect operation of the machine presents an extreme risk of death or serious injury to the user. Damage the tool, work-piece, and/or the machine is also likely.

(5) The case that operator who familiar with the machine and the ladder sequence operate all the PMC programmer functions;
- PROGRAMMER ENABLE (K900.1) "YES"
- HIDE PMC PROGRAM (K900.0) "NO"

> ⚠ **WARNING**
> If a sequence program is stopped while the machine is operating, the machine may behave unexpectedly. Before stopping the sequence program, make sure that nobody is near the machine and that the tool cannot interfere with the work-piece or machine. Incorrect operation of the machine presents an extreme risk of death or serious injury to the user. Damage the tool, work-piece, and/or the machine is also likely.

(6) If you want to prohibit the editing and input/output of the ladder and allow the input/output of the PMC parameters:
- PROGRAMMER ENABLE (K900.1) "NO"
- RAM WRITE ENABLE (K900.4) "NO"
- HIDE PMC PROGRAM (K900.0) "YES"
- EDIT ENABLE (K901.6) "NO"
- ALLOW PMC STOP (K902.2) "NO"
- HIDE PMC PARAM (K902.6) "NO"
- PROTECT PMC PARAM (K902.7) "NO"

> **NOTE**
> 1 To input the PMC parameters, place the NC in the emergency stop state and set the PWE parameter, which is one of the NC parameters, to 1.
> 2 To output the PMC parameters, set the EDIT mode.

6.2.2 PMC Parameter Input/Output Conditions

Input from the PMC parameter screen

Usually, no data can be entered for PMC parameters because they are protected. The following methods can be used to make it possible to enter data for them.

(1) If the sequence program is running (RUN state) (usually, this method should be used when the machine is operating.)
   (a) Place the NC in MDI mode or bring it to an emergency stop. (Note1)
   (b) Set "PWE" on the NC setting screen to 1 (see the following table).
   (c) Alternatively, set the program protect signal (KEY4) to 1 (only if counters or data tables are involved).
   (d) The parameters are released from protection; so data can be entered for them (see the following table).

	PWE	KEY4
Timer	○	
Counter	○	○
Keep relay	○	
Data table	○	○

   (e) After entering data for the parameters, return "PWE" or the KEY4 signal to the previous state.

NOTE
1 Referenced NC mode is the mode of NC path to which is assigned the interface between CNC and PMC “F/G0 to F/G767” of PMC path of present operating screen. For details of the interface between CNC and PMC, see “1.6.2”.

(2) If the sequence program can be stopped (STOP state), for example, while it is being debugged
   (a) Stop the sequence program.
   (b) The parameter protection is released; so data can be entered for them.

⚠WARNING
If a sequence program is stopped while the machine is operating, the machine may behave unexpectedly. Before stopping the sequence program, make sure that nobody is near the machine and that the tool cannot interfere with the workpiece or machine. Incorrect operation of the machine presents an extreme risk of death or serious injury to the user. Damage the tool, workpiece, and/or the machine is also likely.

NOTE
1 These operations may be protected by the programmer protection function. For details of the programmer protection function, see "PROTECT PMC PARAM" in Subsection 6.2.1.
2 If you set "RAM WRITE ENABLE" to "YES", the change of the PMC parameters is enabled, regardless of the above operations and the other protection. For the details of "RAM WRITE ENABLE", see "RAM WRITE ENABLE" in “6.2.1”.

The guidance message displayed when protected PMC parameters are inputted on the PMC parameters screen.

Guidance message	Contents
MUST BE IN EMERGENCY STOP OR IN MDI MODE	NC is not in edit mode and not in emergency stop mode.
PWE MUST BE ON	PWE is 0.
EITHER PWE OR KEY4 MUST BE ON	PWE is 0 and KEY4 signal is 0.
THIS FUNCTION IS PROTECTED	This function is protected by the programmer protection function or protection of data at 8 levels.

Input from the data I/O screen

To enter the PMC parameters from the data I/O screen requires the operation described below. The following methods can be used to enable the input of the PMC parameters.

(1) If the sequence program is running (RUN state) (Under normal circumstances, this method should be used when the machine is operating.)
   (a) Place the NC in the emergency stop state or the EDIT mode.
   (b) Set "PWE" on the NC setting screen to "1".
   (c) The protection of the parameters is canceled, making it possible to enter them.
   (d) After entering the PMC parameters, reset "PWE" to its original state.

(2) If the sequence program is being debugged and can be stopped (STOP state)
   (a) Place the sequence program in the stop state.
   (b) The protection of the parameters is canceled, making it possible to enter them.

> **NOTE**
> 1 These operations may be protected by the programmer protection function. For details of the programmer protection function, see "PROTECT PMC PARAM" in Subsection 6.2.1.
> 2 If you set "RAM WRITE ENABLE" to "YES", the input of the PMC parameters from the PMC I/O screen is enabled, regardless of the above operations and the other protection. For details "RAM WRITE ENABLE", see "RAM WRITE ENABLE" in Subsection 6.2.1.

The guidance message displayed when protected PMC parameters are inputted on the I/O screen.

Guidance message	Contents
MUST BE IN EMERGENCY STOP OR IN EDIT MODE	CNC is not in emergency stop or EDIT mode.
PWE MUST BE ON	PWE is 0.
THIS FUNCTION IS NOT ALLOWED	This function is protected by the programmer protection function or protection of data at 8 levels.

Output from the data I/O screen

To output the PMC parameters from the data I/O screen requires the operation described below. The following methods can be used to enable the output of the PMC parameters.

(1) If the sequence program is running (RUN state) (Under normal circumstances, this method should be used when the machine is operating.)
  (a) Place the CNC in the emergency stop state or the EDIT mode.
  (b) The protection of the parameters is canceled, making it possible to enter them.

(2) If the sequence program is being debugged and can be stopped (STOP state)
  (a) Place the sequence program in the stop state.
  (b) The protection of the parameters is canceled, making it possible to enter them.

> **NOTE**
> These operations may be protected by the programmer protection function. For details of the programmer protection function, see "PROTECT PMC PARAM" in Subsection 6.2.1.

The guidance message displayed when protected PMC parameters is outputted on the I/O screen.

Guidance message	Contents
MUST BE IN EMERGENCY STOP OR IN EDIT MODE	CNC is not in emergency stop or EDIT mode.
THIS FUNCTION IS NOT ALLOWED	This function is protected by the programmer protection function or protection of data at 8 levels.

6.2.3 Password Function for Ladder Program

The password function provides protection against unauthorized attempts to display or edit the content of the ladder program. When the password function is in use, the ladder program cannot be displayed or edited without entering the "password" that is preset with an offline programmer such as FANUC LADDER-III.

(1) Types of password
There are two types of password.
- Display permission password
- Edit permission password

(2) Specifiable characters for password
For a character string to be specified as a password, it needs to meet the following conditions:
- 16 characters or less in length
- Alphabetic letters (uppercase only) and/or numbers

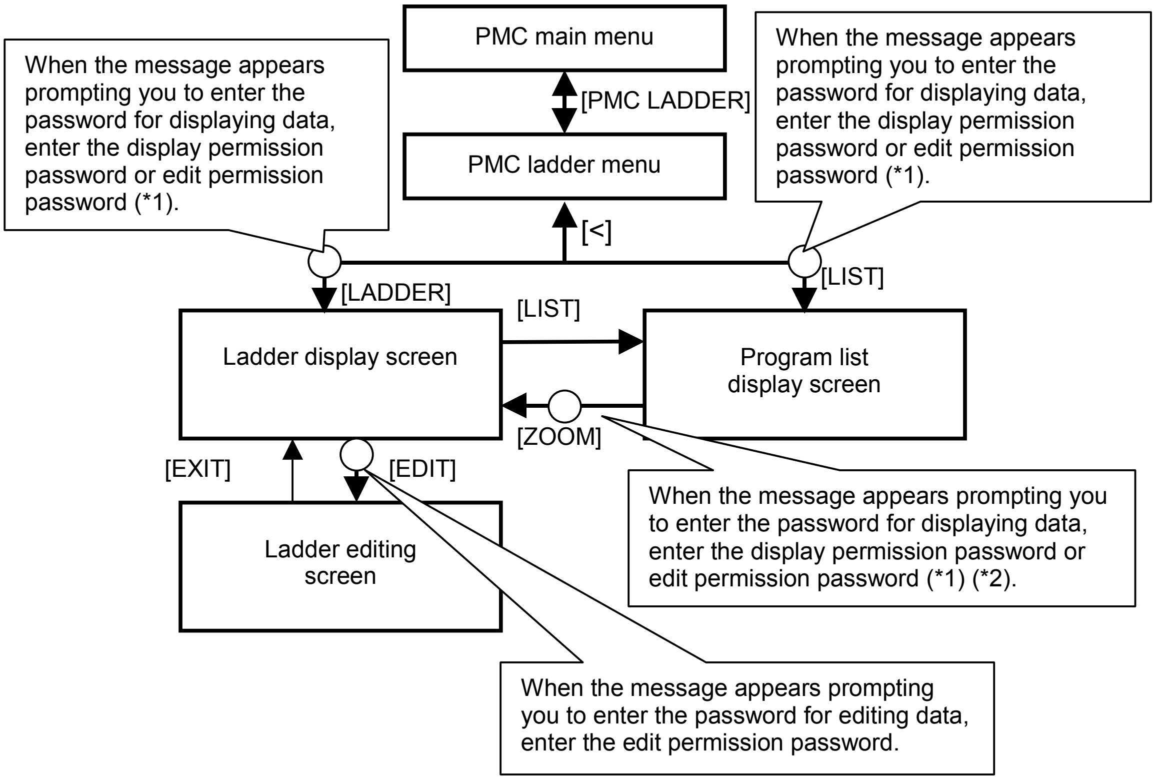
(3) Screens to be protected
The following screens are protected by the password:
- Ladder display screen
- Ladder editing screen
- Program list display screen
- Program list editing screen

(4) Display of the protection status
The protection status of the program can be checked using the program list display screen or program list editing screen. For details, see (2) in Section 8.1.

(5) Release from password protection
When you attempt to switch to a password-protected screen, you are asked to enter the password. In this process, you can release the protection by entering the "password strings" and then pressing the input key.

NOTE
1 Once the password protection is released, you will not be asked to enter the password until you either shut down the system and turn on its power again or replace the ladder program using the I/O function or other.
2 When you turn on the power of CNC with "X" and "O" pressed simultaneously, the sequence program can be cleared regardless of whether the password is set or not.
3 When K903.2=1, you will not be asked to enter the password.

Switching of the password-protected screens



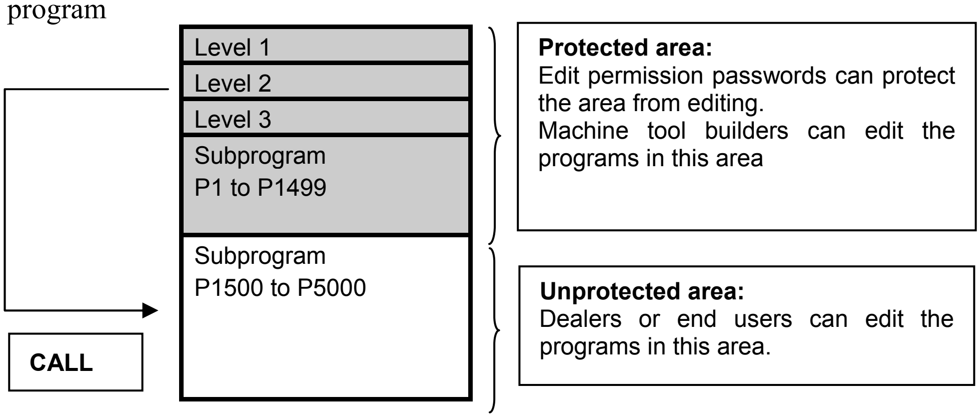
NOTE

1. When only the display permission password is set, both the display and editing functions are protected.
   When only the edit permission password is set, the editing function is protected.
   When both the display permission password and edit permission password are set, both the display and editing functions are protected. In that case, you can release the protection of the display and editing functions by using the edit permission password.
2. Enter the password when you want to display the content of a program protected by the partial protection function by using the [ZOOM] soft key. As for the partial protection function, refer to "6.2.4".

6.2.4 Partial Protection Function for Ladder Program

This function classifies subprograms into two areas, edit protected area and unprotected area, and the password protection affects only the edit protected area. As a result, it enables the partial edit protection for ladder program.
Therefore, it enables for dealers or end users to customize the ladder program and protects the program of machine tool builders.

Ladder program



Setting method

On FANUC LADDER-III, you should set the edit permission password which has "#" character at the beginning of string (Up to 16 characters including "#")

(Ex.) The edit permission password #1425

The subprograms from P1500 to P5000 can be edited regardless of the password protection. Even if you set the display permission password, the display of subprograms from P1500 to P5000 is not protected owing to this function.

Table 6.2.4 The protection status of each program for partial protection function

Program type		Protected/not protected
Main programs	Level 1	The editing functions are protected by each password.
	Level 2	
	Level 3	
Sub programs	P1 to P1499	
	P1500 to P5000	You can edit the subprograms without password.

> **NOTE**
> This function cannot be used for PMC memory A and DCSPMC.

6.2.5 Password Function for I/O Configuration Data

The password function provides protection against unauthorized attempts to display or edit of the I/O configuration data. When using this password function, the I/O configuration data cannot be displayed or edited without entering the "password" that is preset with an offline programmer such as FANUC LADDER-III.

(1) Type of passwords
There are two types of password.
- Display permission password
- Edit permission password

(2) Specifiable characters for password
For a character string to be specified as a password, it needs to meet the following conditions:
- 16 characters or less in length
- Alphabetic letters (uppercase only) and/or numbers

(3) Screens to be protected
The following screens are protected by the password:
- I/O configuration viewer screen (I/O Link *i* assignment)
- I/O configuration editor screen (I/O Link *i* assignment)

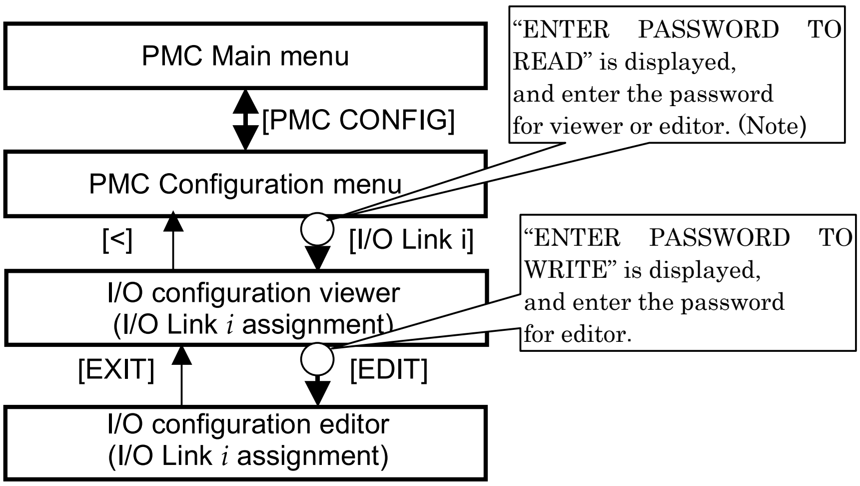
(4) Display of the protection status
The protection status of I/O configuration data can be checked using the I/O configuration viewer screen (I/O Link *i* assignment) or the I/O configuration editor screen (I/O Link *i* assignment).

(5) Release from password protection
When you attempt to switch to a password-protected screen, you are asked to enter the password. In this process, you can release the protection by entering the "password strings" and then pressing the input key.

It is unnecessary to turn the power off and on again

NOTE
1 Once the password protection is released, you will not be asked to enter the password until you either shut down the system and turn on its power again or replace the I/O Link *i* assignment data using the I/O function or other.
2 When K903.2=1, you will not be asked to enter the password.

Switching of the password-protecting screen



NOTE

When only the display permission password is set, both the viewer and the editor are protected.
When only the edit permission password is set, the editor is protected.
When both the display permission password and edit permission password are set, both the viewer and editor are protected. In that case, you can release the protection of the viewer and the editor by using the edit permission password.

6.2.6 Protection of Data at 8 Levels

The protection of data at 8 levels is a common function of CNC and PMC.
8 operation levels can be set for CNC and PMC operation, and 8 protection levels can be set for various types of CNC and PMC data.
When various types of CNC and PMC data are changed or output externally, the system compares the operation level with the protection level to determine whether change or external output is allowed.

NOTE

For the details of the protection of data at 8 levels on CNC, refer to the Connection Manual (Function) of CNC. And, refer to the OPERATOR'S Manual of CNC for the details of operation of setting the protection levels.

⚠ **CAUTION**

When the protection of data at 8 levels is added, programmer protection function of section 6.2.1 and PMC parameter input/output conditions of section 6.2.2 become ineffective. But, the password function of PMC is available with the protection of data at 8 levels at the same time.

⚠ **WARNING**

All protection levels of PMC item are level 0 in the initial condition. Namely, all PMC data are not protected. Therefore, set the opportune level (value) to prevent a miss operation.

Operation level

8 operation levels can be set for CNC and PMC operation.
Operation levels 0 to 3 are selected by the memory protection key signal. Operation levels 4 to 7 are selected by password.

Operation level	Setting method	Sample classification
7 (High)	Password	--
6	Password	MTB
5	Password	Dealer, Integrator
4	Password	End user
3	Memory protection key signal	User level (Level1)
2	Memory protection key signal	User level (Level2)
1	Memory protection key signal	User level (Level3)
0 (Low)	Memory protection key signal	User level (Level4)

When operation level 4 to 7 is set, the operation level remains unchanged until the password is cleared.
(The operation level also remains unchanged if the power is turned off.)
Operation level 7 is reserved for CNC and PMC maintenance.

Data protection level

A data protection level can be set for each of the following types of data.
There are two data protection levels as shown below.

- Change protection level
  Protection level used for changing data.
- Output protection level
  Protection level used for externally outputting data.

Protection levels 0 (low) to 7 (high) can be set.

There are common items and items of each path when using the multi-path PMC. The setting items of each path can be set to different level for each PMC path.

Table 6.2.6 (a) Setting items and protected action

Setting item		Protected action	
Data type	**Function**	**Screen**	**Operation**
CONFIGURATION PARAMETER (Note1)	CHANGE	Configuration parameter screen	Change
SETTING (ONLINE) (Note1)	CHANGE	Parameters for online monitor screen	Change
SETTING (EACH PATH)	CHANGE	Setting screen	Change
SEQUENCE PROGRAM (Note2)	CHANGE	Ladder diagram screen	Edit
		Title screen	Edit
		System parameter screen	Edit
		I/O module screen	Edit
		Symbol and Comment screen	Edit
		Message screen	Edit
		PMC status screen	Activate/Stop program
		Data I/O screen	Read program
			Write program to Flash ROM
	OUTPUT	Data I/O screen	Write program to external device
PMC PARAMETER	CHANGE	Data I/O screen	Read PMC parameter
	OUTPUT	Data I/O screen	Write PMC parameter
TIMER	CHANGE	Timer screen	Change
COUNTER	CHANGE	Counter screen	Change
KEEP RELAY	CHANGE	Keep relay screen (user area)	Change
KEEP RELAY (SYSTEM)	CHANGE	Keep relay screen (system area)	Change
DATA TABLE	CHANGE	Data table screen	Change
DATA TABLE CONTROL	CHANGE	Data table control screen	Change
PMC MEMORY	CHANGE	Signal status screen	Forced I/O function
I/O CONFIGURATION DATA (Note1)	CHANGE	I/O configuration editor screen (I/O Link *i* assignment)	Edit
		Data I/O screen	Read I/O configuration data
			Write I/O configuration data to flash ROM
	OUTPUT	Data I/O screen	Write I/O configuration data to external device
I/O LINK GROUP SELECTION (Note1)	CHANGE	I/O assignment data selection function setting screen	Change
		I/O configuration viewer screen (I/O Link *i* assignment)	Change
REGISTRATION OF I/O DEVICE	CHANGE	I/O device monitor screen	Change

NOTE
1 These items are common setting of all PMC paths when using multi-path PMC function.
2 When using the ladder dividing management function, divided ladder programs are protected in the same condition as main ladder program. However there are invalid screens for divided ladder programs.
3 Some data types do not have an output function.
4 For data whose protection level is higher than the operation level, the protection level cannot be changed.
5 The current data protection level cannot be changed to a protection level that is higher than the current operation level.
6 The I/O protection level of message data for multi-language display is the same as the I/O protection level of sequence programs.

Setting of PMC protection level

1 Press function key OFFSET SETTING .
2 Press the continuous menu key several times until [PROTECT] is displayed.
3 Press soft key [PROTECT].
4 Press soft key [PMC LEVEL].
The PROTECT LEVEL (PMC) screen shown below is displayed.

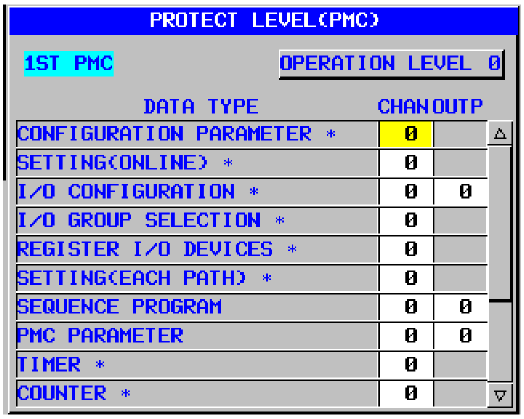


Fig. 6.2.6 (a) PMC protection level setting screen

5 When using multi-path PMC function, press soft key [SWITCH PMC] to select the PMC path.
6 Move the cursor to “CHANGE” level or “OUTPUT” level of a desired data item.
7 Key in a new desired level, then press soft key [INPUT].

NOTE
Some setting items with which an asterisk is displayed after the data name are the common data of all PMC paths when using multi-path PMC function.

6.3 DISPLAY OF DIVIDED LADDER PROGRAM

When using the ladder dividing management function, the following PMC screens display specified divided ladder program by pressing the [SWITCH PMC] soft key in each screen.

- Signal status screen (Note1)
- PMC parameter screen (Note1)
- I/O diagnosis screen (Note1)
- Program list screen
- Ladder display/editing screen
- Title display/editing screen
- Setting screens (Note1)
- System parameter display/editing screen
- I/O module display/editing screen (Note2)
- Symbol and comment display/editing screen
- Message display/editing screen (Note2)
- Duplicate coil check screen (Note1)

NOTE

1 To display symbol for signal address, the symbols, which are defined in specified divided ladder program, are used.
2 These screens are displayed only in main ladder program.

The [SWITCH PMC] soft key works as follows.

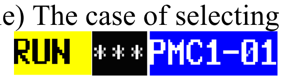
Operation	Behavior
Pressing the [SWITCH PMC] soft key only	Switching to the next sequence program in order.
“PMC path number”+ the [SWITCH PMC] soft key	Switching to the main ladder program in specified PMC path. For example, inputting “3” and pressing this soft key selects the main ladder program in the 3rd path
“PMC path number” - “Divided ladder program number” + the [SWITCH PMC] soft key	Switching to the specified divided ladder program. For example, inputting “3-2” and pressing this soft key selects the ladder program of divided number 2 in the 3rd path.

NOTE

1 The [SWITCH PMC] soft key is displayed when using the ladder dividing management function or the multi-path PMC function is effective.
2 There are some screens which do not have the [SWITCH PMC] soft key.
3 In 8 level data protection screen, only the PMC path is switched even if pressing the [SWITCH PMC] soft key when using the ladder dividing management function.

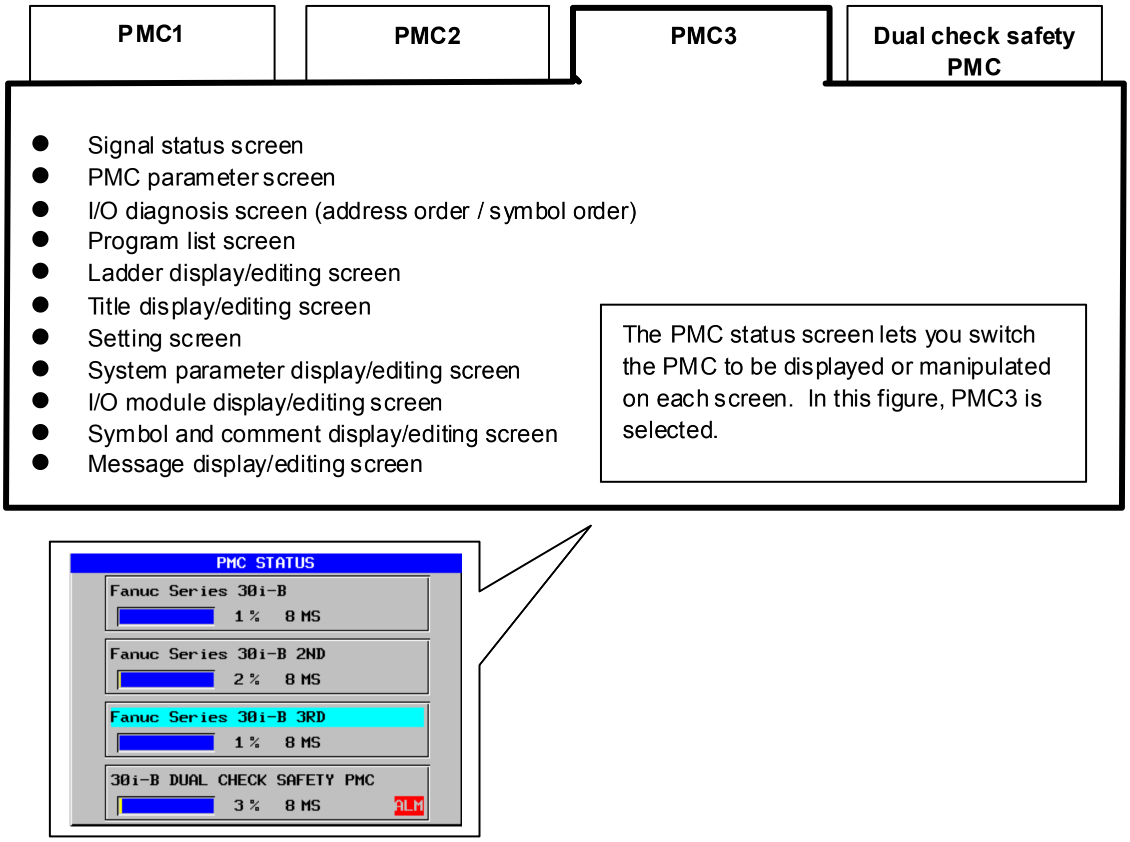
The number of the divided ladder program, which is selected, is displayed at the upper left of each PMC screen.

(Example) The case of selecting the program of divided number 1 of 1st path PMC.

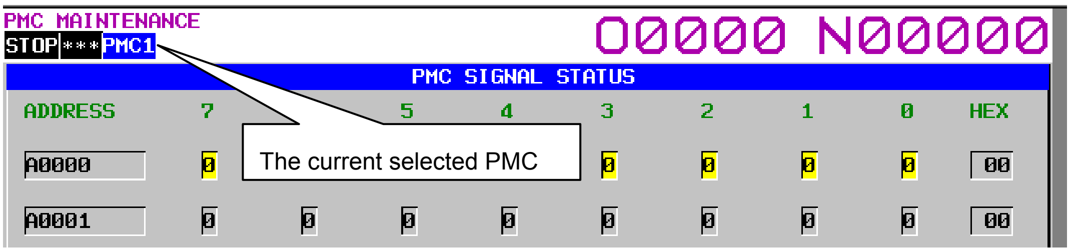


6.4 MULTI-PMC DISPLAY

In the case of a multi-PMC system (maximum five paths), when you select a specific PMC on the PMC status screen, each of the PMC screens listed below displays the information regarding that selected PMC. The following figure is a case of the system of three paths PMC and dual check safety PMC.
By default, the PMC screens display the information regarding PMC1. For details of the PMC status screen, see Section 9.6.



An indication of the currently selected PMC is displayed at the upper left corner of each PMC screen.



The screens listed below display the information regarding all the PMC on the same screen space, regardless of the switching of the PMC.

Screens intended to display or manipulate all the PMCs

- PMC alarm screen
- I/O Link connection status screen
- Data I/O screen
- Signal trace screen
- I/O diagnosis screen (network order)
- Parameter setting screen for online monitoring
- I/O Configuration viewer/editor screen
- PMC Program list screen

For details, see the sections describing the operation of the individual screens.

6.5 DISPLAYING EXTENDED SYMBOL AND COMMENT

Extended symbol and comment is displayed on the PMC screen.
For details of Extended symbol and comment, see " SPECIFICATION OF EXTENDED SYMBOL AND COMMENT " in Subsection 1.2.7.

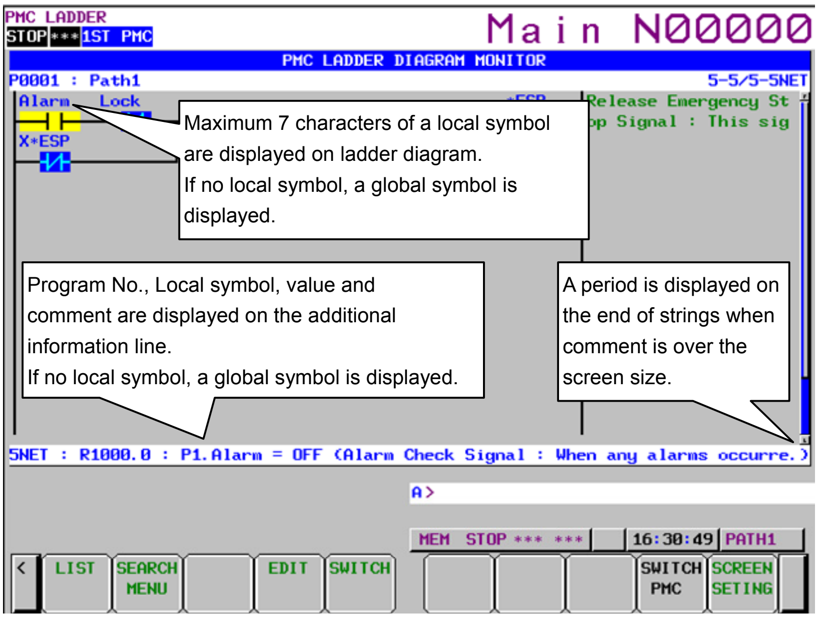


Fig. 6.5 (a) Ladder diagram screen (extended symbol and comment)

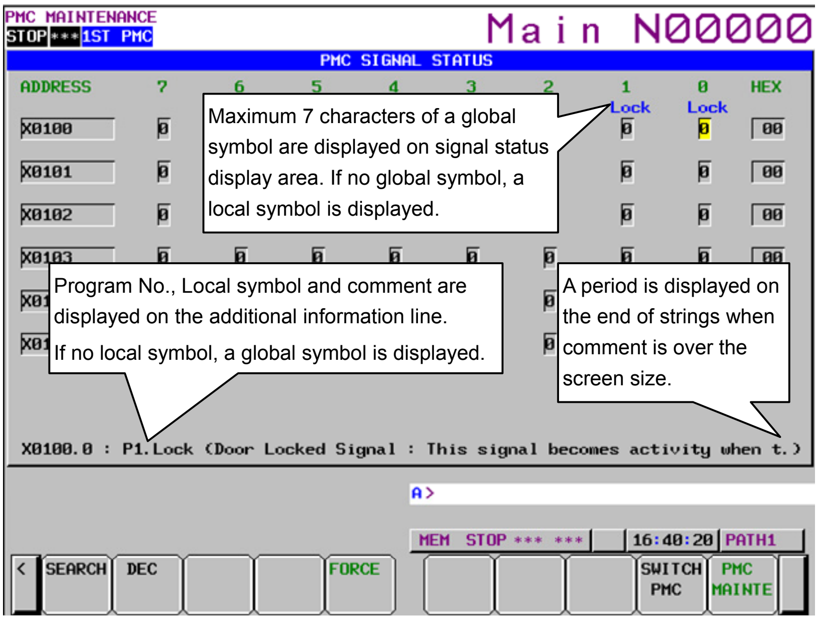


Fig. 6.5 (b) Signal status screen (extended symbol and comment)

When using extended symbol and comment, you can define local symbols in each sub-program. Moreover, you can define multiple symbol and comment to one signal.

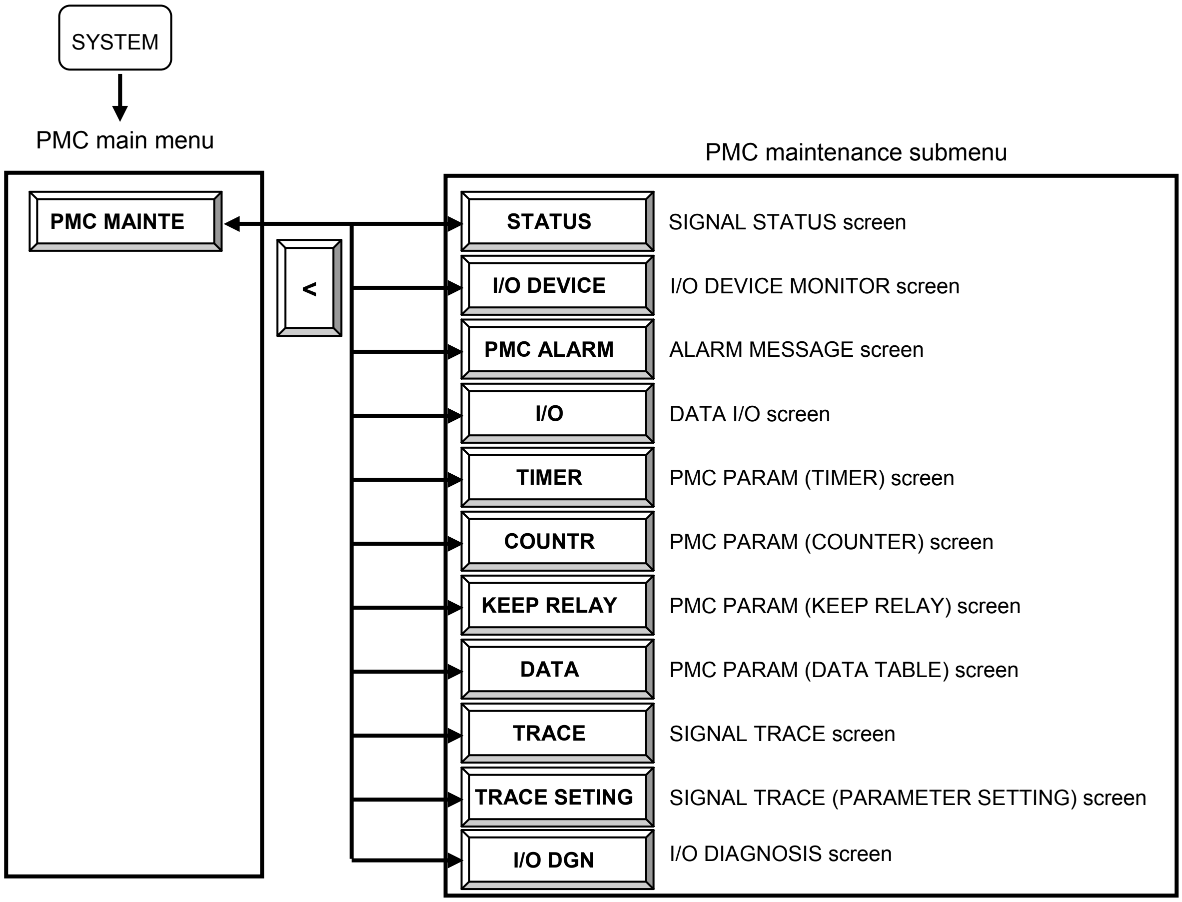
However, only one symbol and comment can to be displayed on PMC screen except I/O diagnosis screen and symbol and comment screen, for a PMC address.
The priority of displaying symbol and comment, and range of search function is defined as follows.

Screen	Displaying symbol and comment	Searching symbol and comment
Ladder screen (except address map) Program list screen	A symbol and comment is displayed by following priority. 1 Local symbol and comment that is defined in the displayed sub-program. 2 Global symbol and comment. 3 Symbol undefined comment.	The following symbol and comment can be searched. - Local symbol that is defined in the displayed sub-program. - Global symbol.
Signal status screen PMC parameter (timer) screen PMC parameter (counter) screen PMC parameter (keep relay) screen PMC parameter (data table) screen Signal trace screen Signal trace (parameter setting) screen Ladder (address map) screen	A symbol and comment is displayed by following priority. 1 Global symbol and comment. 2 Local symbol and comment of LEVEL1 to 3. 3 Local symbol and comment of sub-program P1 to P5000. 4 Symbol undefined comment.	All symbols and comments can be searched. You can search a local symbol by following format. - (program name).(symbol) The program name is able to be specified by sub-program number or a symbol of P-address.
I/O diagnosis screen Symbol and comment screen	All symbols and comments are displayed.	All symbols and comments can be searched. A symbol or comment can be searched by partial string.

NOTE
When multiple symbols and comments are defined in one signal, you can search each symbol name. On the other hand, the symbol displayed on PMC screen is one of these symbol names. Therefore, if you search a symbol, displayed symbol name on searched position may be different from searched word.

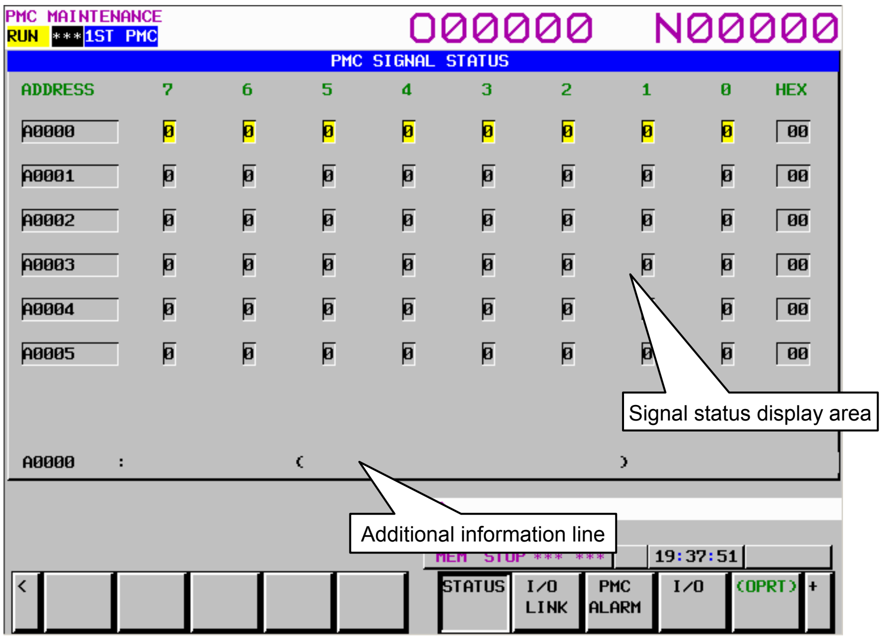
7 PMC DIAGNOSIS AND MAINTENANCE SCREENS ([PMC MAINTE])

The PMC maintenance menu displays the screens related to PMC maintenance including PMC signal status monitoring, trace, and PMC data display/editing.
In order to move to the PMC maintenance menu, press the SYSTEM key then select the [PMC MAINTE] soft key as shown below.



7.1 MONITORING PMC SIGNAL STATUS ([STATUS] SCREEN)

The SIGNAL STATUS screen displays the data at all addresses specified in the program. The data of each address consists of a bit pattern (0s and/or 1s) and a hexadecimal or decimal number at the rightmost position on a byte-by-byte basis.



The additional information line at the bottom of the screen displays the symbol and comment of the address on which the cursor is placed. When the cursor is placed on a byte, the byte symbol and comment are displayed.

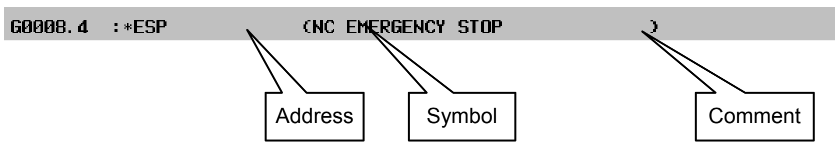


Table contents

- ADDRESS: Address referenced by a sequence program
- 0 to 7: Data at each bit position
- HEX: Display of each byte in hexadecimal
- DEC: Display of each byte in decimal

Operation procedure

(1) Press the [STATUS] soft key. The screen shown above appears.
(2) Key in an address whose data to be displayed, and then press the [SEARCH] soft key.
(3) The data starting at the input address is displayed as a bit pattern.
(4) To display the data at another address, press the cursor keys, page keys, or [SEARCH] soft key.
(5) To modify the status of a signal, switch to the forced I/O screen by pressing the [FORCE] soft key.

> **NOTE**
> The [FORCE] soft key is displayed and usable when the forced I/O function is enabled. For details, see Section 6.2.

(6) On the forced I/O screen, an overridden X signal or Y signal is prefixed by a greater-than sign (>) to indicate the setting of override.

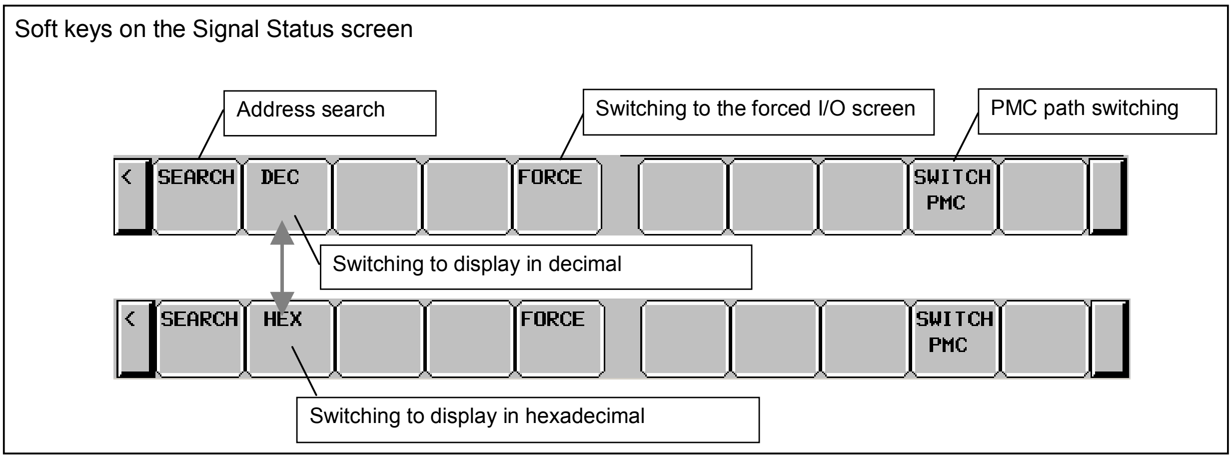


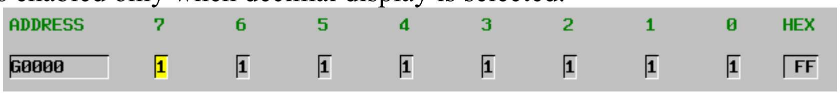
Fig. 7.1.1 (a) Soft keys on the SIGNAL STATUS screen

Operations using soft keys

(1) [SEARCH] Search for an address
Searches for a byte address or bit address.

(2) [DEC] Switching to display in decimal
Displays the data of each byte in decimal.
This soft key is enabled only when hexadecimal display is selected.

(3) [HEX] Switching to display in hexadecimal
Displays the data of each byte in hexadecimal.
This soft key is enabled only when decimal display is selected.



(4) [FORCE] Switching to the forced I/O screen
Switches the screen display to the forced I/O screen.

(5) [SWITCH PMC] Switching PMC path or divided ladder programs
Switches PMC path or divided ladder program. For details of the operation, refer to “6.3”.
By setting keep relay K935.0 to 1, you can display PMC program list screen. For details, refer to ”2.2.11”.

7.1.1 Forced I/O Function

The forced I/O function enables a value to be input forcibly for the signal at an arbitrary PMC address.
With this function, for example, a sequence program can be debugged without using an I/O device by forced input to X, and the signal routing on the I/O device can be checked efficiently without using a sequence program by forced output to Y.
Two input modes are available: the forced I/O mode and the override mode. Choose from the two modes for each application.

⚠ **WARNING**

Special care must be exercised when modifying a signal with the forced Input/output function. If the forced input/output function is used incorrectly, the operation of the machine may be unpredictable. Never use this function when people are near the machine.

⚠ **CAUTION**

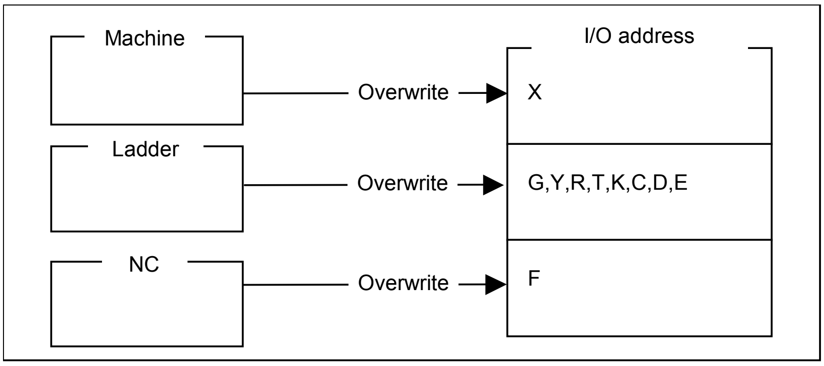
1 The Override function is a special function for debugging the ladder program. Therefore, when shipping the machine, disable the Override function invariably.
2 When using the Override function, the update cycle of input/output signals of I/O Link is as follows with the 1st level execution cycle of ladder program. Do not use the Override function when you debug the ladder program that is affected by the changing of update cycle of I/O signals.

	Update cycle of input/output signals
When the 1st level execution cycle is 4ms	4 ms
When the 1st level execution cycle is 1, 2 or 8ms	8 ms

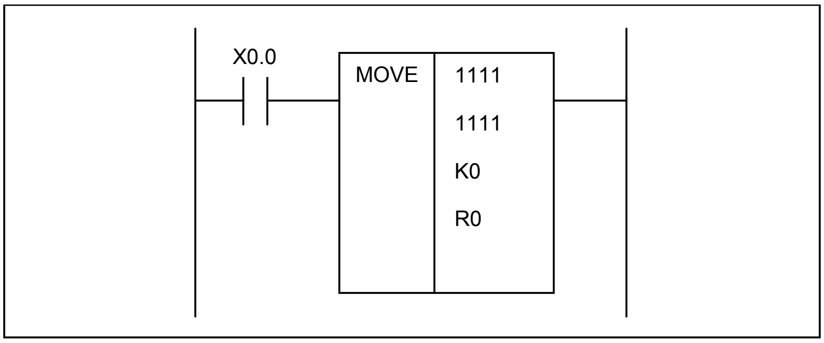
3 The I/O setting values of the Override function are cleared when the power is turned off. Therefore, Override settings for all signals are reset when cycling the power of CNC.
4 The override function can be used in three paths PMC simultaneously. However, the use in single-path is recommended because of the influence of scan time. If you use this function by the setting above the maximum path number, the PMC alarm “ER47 ILLEGAL OVERRIDE FUNCTION SETTING (TOO MANY PMC PATHS)” occurs and the override mode is invalid in all PMC paths.

	Number of the maximum path
When the 1st level execution cycle is 1 or 2ms	1
When the 1st level execution cycle is 4 or 8ms	3

(1) Forced I/O mode
This mode is applicable to all PMC addresses.
Note, however, that a signal modified by forced I/O is overwritten by a sequence program or input scanning, so that the result of modification by forced I/O is lost.



Example 1:
Forced I/O is performed for R0 in the following ladder program:



<1> The initial signal status is as follows:
X0.0 = off, K0 = 55H, R0 = 00H

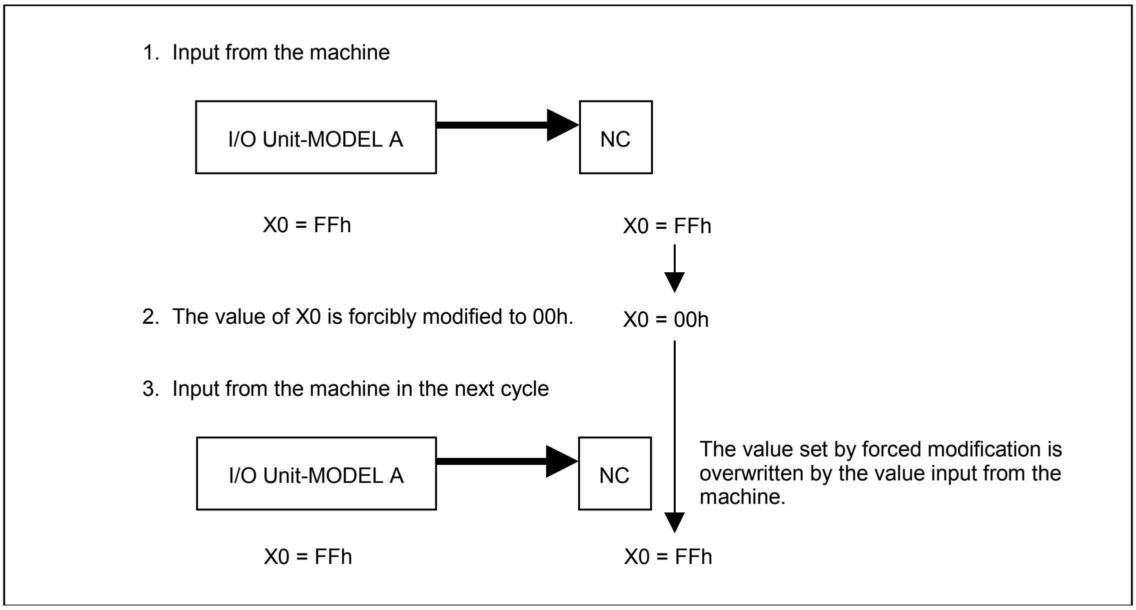
<2> The FFh is forcibly input to the R0.
X0.0 = off, K0 = 55H, R0 = FFH

<3> When the X0.0 is turned on, the R0 assumes the result of output by the sequence program.
X0.0 = on, K0 = 55H, R0 = 55H

Example 2:

Forced I/O is performed for X0 in a configuration where the I/O Unit-MODEL A is connected to the X0 via the I/O Link.

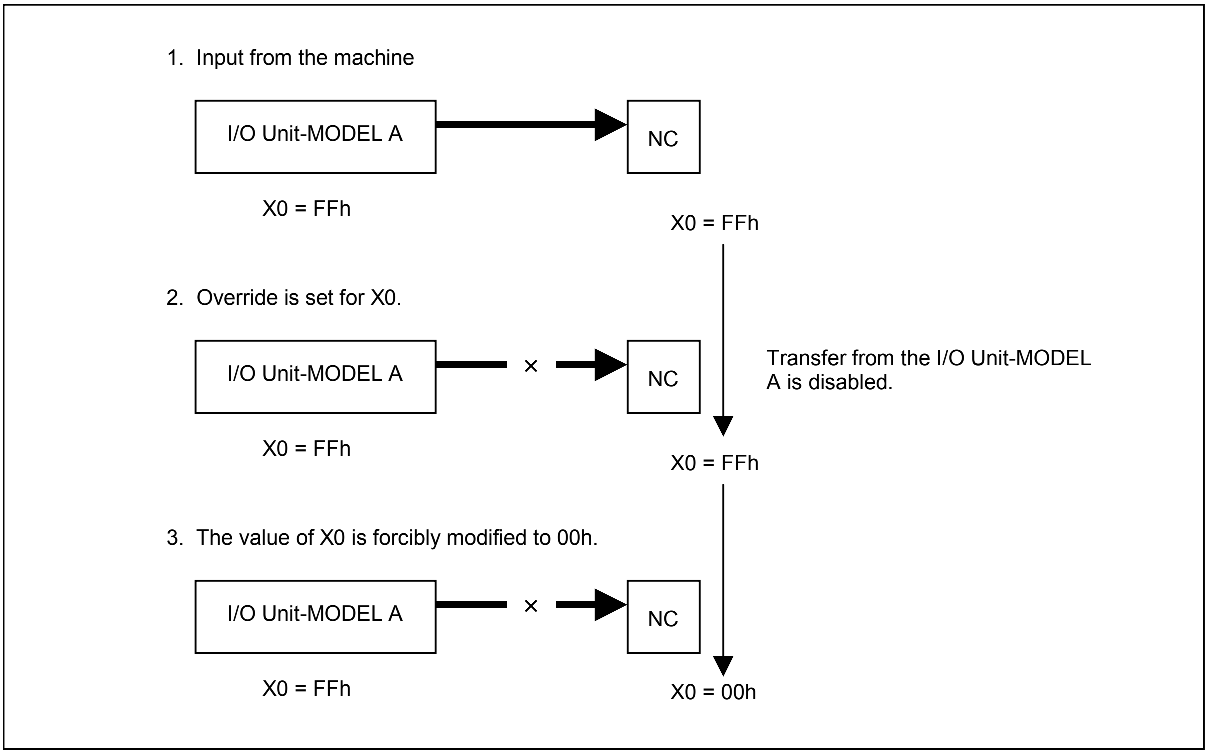
A value input from the I/O Unit-MODEL A is transferred to the X0 cyclically. Therefore, even if the value of X0 is modified forcibly during a period, the X0 is overwritten in the next cycle by the value input from the I/O Unit-MODEL A.



A value may be cyclically transferred even to an unallocated address. Therefore, the forced I/O function for the X in the forced I/O mode must be used when a sequence program is debugged with no I/O device connected or allocated.
When an I/O device is connected, use the override mode, described below, to debug a sequence program.

(2) Override mode
The state that disables a sequence program and machine signal from overwriting a value modified by forced I/O is referred to as override. In the override mode, override can be set for arbitrary X and Y signals. To the X and the Y addresses and other addresses for which override is not set, forced I/O is applied.

Example:
Forced I/O is performed for the X0 in a configuration where the I/O Unit-MODEL A is connected to the X0 via the I/O link.

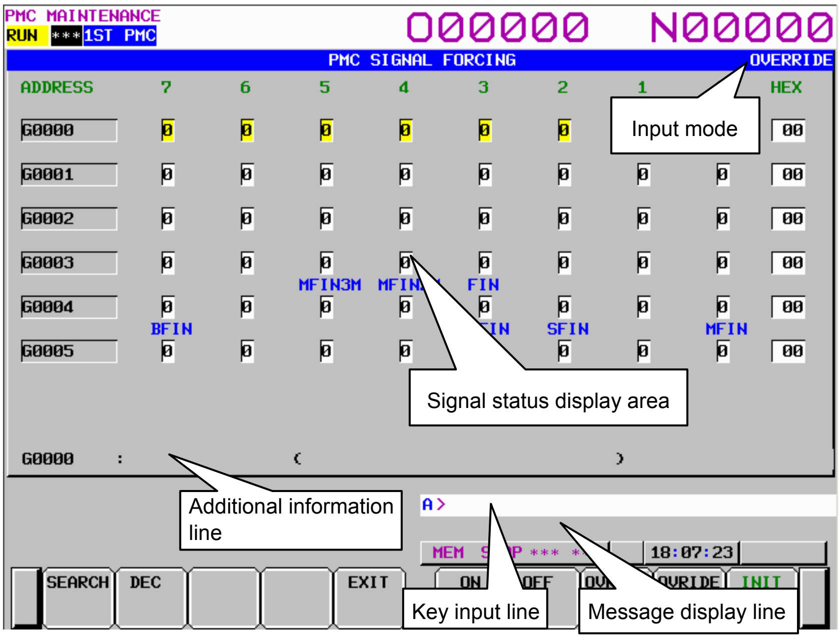


In this way, the forced I/O function for the X in the override mode can also be used to debug a sequence program when an I/O device is connected. If the override state is set for a Y address, a value after modification by forced I/O is output to the I/O device.

7.1.2 Forced I/O Screen

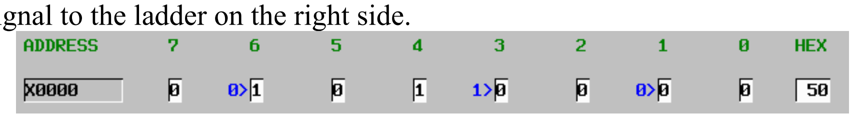
On the forced I/O screen, the value of an arbitrary signal can be modified forcibly.
The forced I/O screen can be used in one of two input modes: the forced I/O mode and the override mode.
To move to the forced I/O screen, press the [FORCE] soft key on the SIGNAL STATUS screen. On the forced I/O screen, the following operations can be performed:

• Signal search	[SEARCH]
• Switching to display/input in decimal	[DEC]
• Switching to display/input in hexadecimal	[HEX]
• Transition to the signal status screen	[EXIT]
• Signal on	[ON]
• Signal off	[OFF]
• Override setting	[OVRIDE SET]
• Override cancellation	[OVRIDE RESET]
• Complete override cancellation	[INIT]

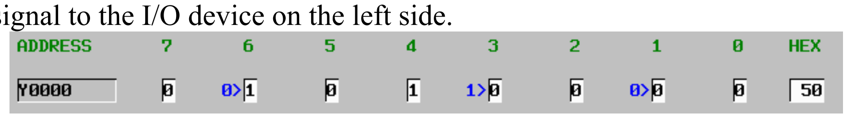


In the input mode display area to the right of the title, "OVERRIDE" is displayed only when the forced I/O mode is set to the override mode.
The signal status display area indicates the signal status of each address. The status shown below is indicated for X and Y signal bits for which override is set.

(1) X signal
(Input signal from the I/O device) > (Input signal to the ladder)
The hexadecimal or decimal display field on the rightmost position of the screen displays the value of the input signal to the ladder on the right side.



(2) Y signal
(Output signal from the ladder) > (Output signal to the I/O device)
The hexadecimal or decimal display field on the rightmost position of the screen displays the value of the output signal to the I/O device on the left side.



The message display line at the bottom of the screen displays an error message as required.

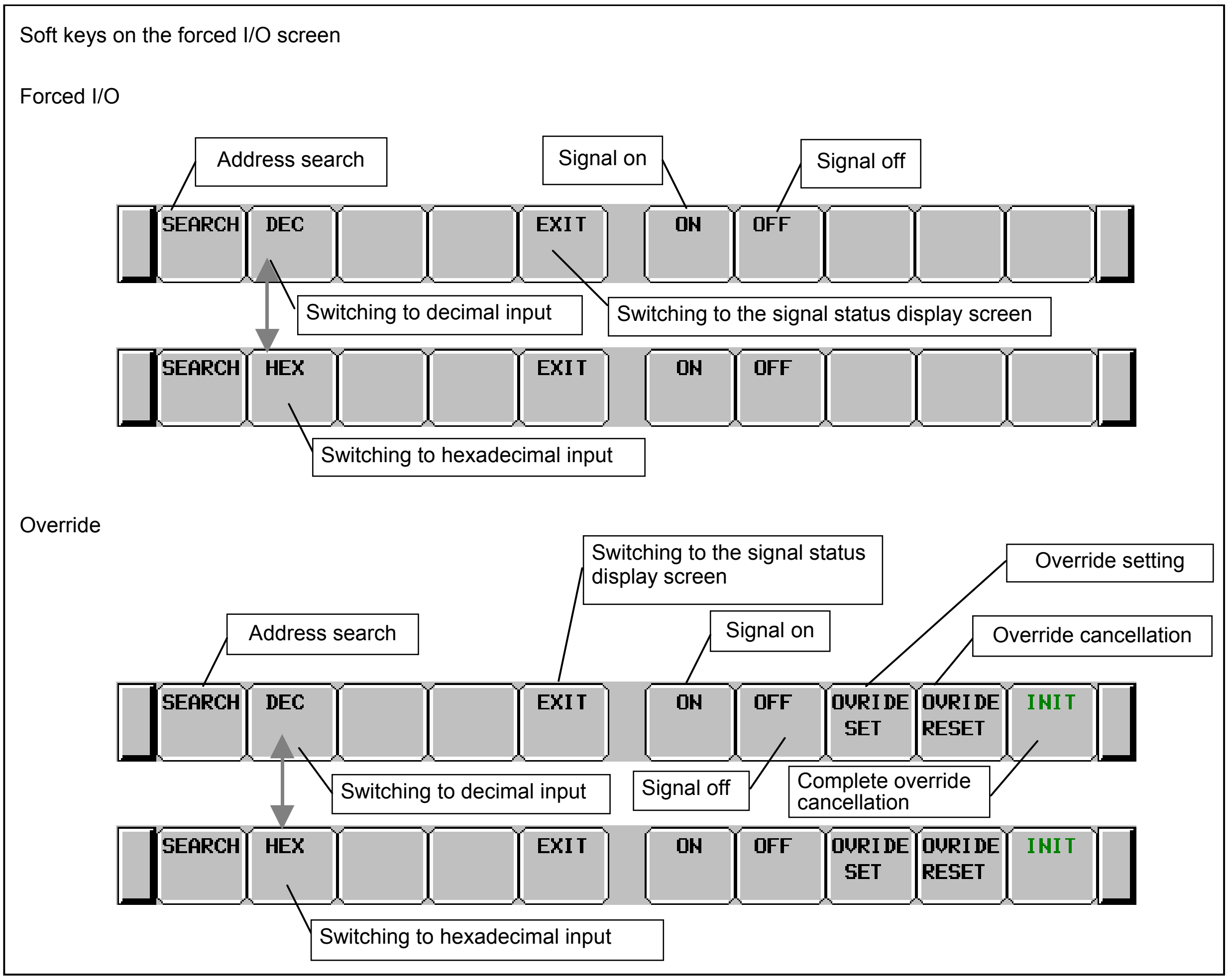


Fig. 7.1.2 (a) Soft keys on the forced I/O screen

Operations using the soft keys

(1) [SEARCH] Search for an address
Searches for a byte address or bit address.

(2) [DEC] Switching to decimal input
Displays and inputs the data of each byte in decimal.
This soft key is enabled only when display/input in hexadecimal is selected.

(3) [HEX] Switching to hexadecimal input
Displays and inputs the data of each byte in hexadecimal.
This soft key is enabled only when display/input in decimal is selected.

(4) [EXIT] Switching to the signal status display screen
Quits the forced I/O function.

(5) [ON] Signal on
Turns on the signal on which the cursor is placed. Depending on the cursor position, bit operation or byte operation can be performed.

(6) [OFF] Signal off
Turns off the signal on which the cursor is placed. Depending on the cursor position, bit operation or byte operation can be performed.

(7) [OVRIDE SET] Override setting
Sets the override state for the X or Y address on which the cursor is placed. Depending on the cursor position, bit operation or byte operation can be performed.
This soft key is valid only in the override mode.

(8) [OVRIDE RESET] Override cancellation
Cancels the override state set for the X or Y address on which the cursor is placed. Depending on the cursor position, bit operation or byte operation can be performed.
This soft key is valid only in the override mode.

(9) [INIT] Complete override cancellation
Cancels all override settings for X and Y addresses.
This soft key is valid only in the override mode.

Screen operations using other keys

(1) Input key
The input key is used to modify the signal status.
 (a) Bit-by-bit setting
 - Input 1 then press the input key to turn on the signal.
 - Input 0 then press the input key to turn off the signal.
 - Press the input key to toggle between the on and off statuses of the signal.

 (b) Byte-by-byte setting
 In the case of the byte cursor, input up to eight binary digits then press the input key. (When an input value is shorter than eight digits, the value is input from bit 0.)
 Example: When 100 is input, this value is input as follows:

Bit number	7	6	5	4	3	2	1	0
	0	0	0	0	0	1	0	0

 When the cursor is placed on the hexadecimal or decimal display field, hexadecimal input or decimal input is enabled on a byte-by-byte basis.

 (c) Successive data input
 Data items can be input successively in a column. The cursor moves to the last input data item.
 - As the data delimiter, ";" (EOB) is used.
 Example: "1;0;1;" + Input key
 - With ";=", the value of the immediately preceding data item is input.
 Example: "1;=;=;0;=" + Input key inputs 1,1,1,0,0.
 - With ";;", data items can be input, skipping an address.
 Example: "1;;1" + Input key inputs no data for the second item.
 - With "R;input-value;count", the same value can be input as many times as the specified count.
 Example: "R;1;200" + Input key inputs two hundred 1s in a column.

(2) Cursor keys
With the cursor keys, select a signal to be modified.
If you press the cursor key for moving left when the cursor is placed at bit 7 of an arbitrary address, the cursor changes to a byte cursor.
If you press the cursor key for moving right when the cursor is placed on the hexadecimal or decimal display field of an arbitrary address, the cursor changes to a byte cursor for the next one entire byte.
When the cursor is placed on the hexadecimal or decimal display field or the cursor is a byte cursor, the one-byte signal data of the address can be modified.

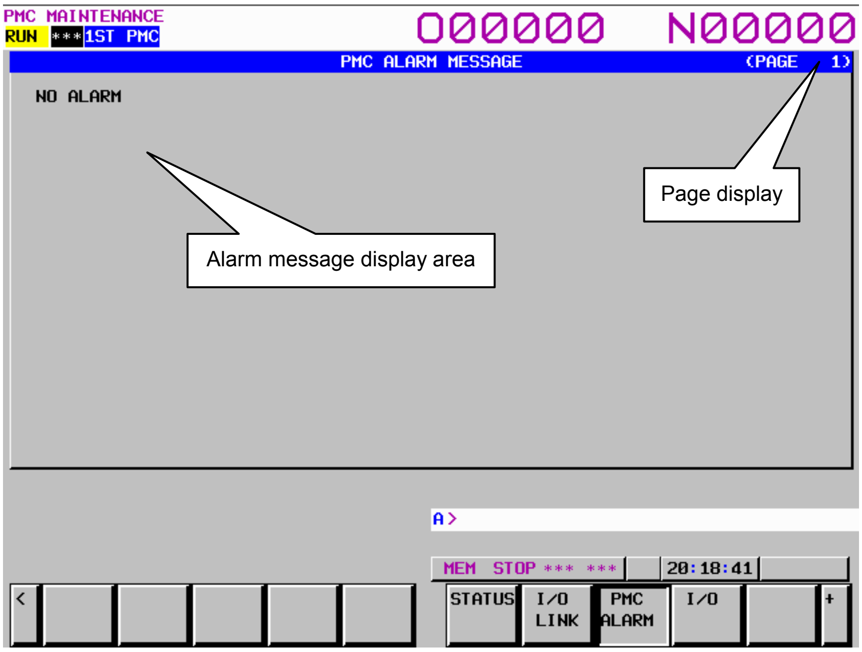
(3) Page keys
The page keys can be used to select a page to be displayed.

Operation of the return key

On the forced I/O screen, the operation of the return key is disabled.
Use the [EXIT] soft key to cancel the forced I/O mode and return to the Signal Status screen.

7.2 CHECKING PMC ALARMS ([PMC ALARM] SCREEN)

On this screen, an alarm message output from the PMC is displayed. To move to the PMC alarm screen, press the [PMC ALARM] soft key.



In the alarm message display area, an alarm message output from the PMC is displayed. When many alarm messages are output to two or more pages, the page keys can be used to switch from one page to another.
In the page display area to the right of the title, the number of the page currently displaying messages is indicated.

For information about messages displayed, see Section 12.1.

7.3 SETTING AND DISPLAYING PMC PARAMETERS

PMC parameters (timer, counter, keep relay, and data table) can be set and displayed on each screen. Moreover, data items can be input successively. The cursor moves to the last data item successively input.

Method of input

(1) As the data delimiter, ";" (EOB) is used.
Example: "100;200;300;" + Input key
(2) With ";=", the value of the immediately preceding data item is input.
Example: "100;=;=;200;=" + Input key inputs 100,100,100,200,200.
(3) With ";;", data items can be input, skipping an address.
Example: "100;;100" + Input key inputs no data for the second item.
(4) With "R;input-value;count", the same value can be input as many times as the specified count.
Example: "R;100;200" + Input key inputs two hundred 100s in a column.

7.3.1 Setting and Displaying Timers ([TIMER] Screen)

This screen is used to set and display timer values for functional instruction on-delay timer (TMR:SUB 3). This screen can be used in one of two modes: the simple display mode and the comment display mode. To move to the TIMER screen, press the [TIMER] soft key.

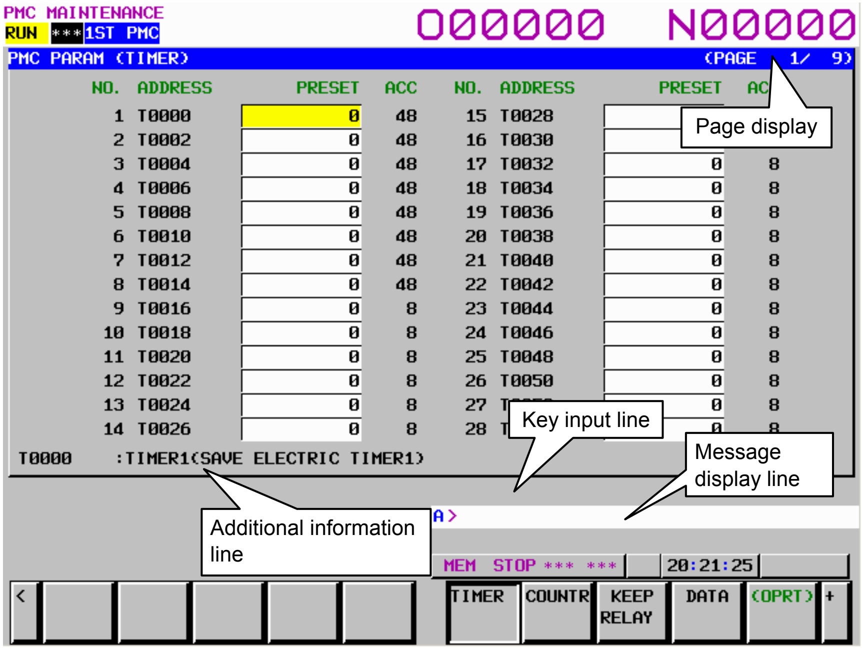


Fig. 7.3.1 (a) Simple display mode

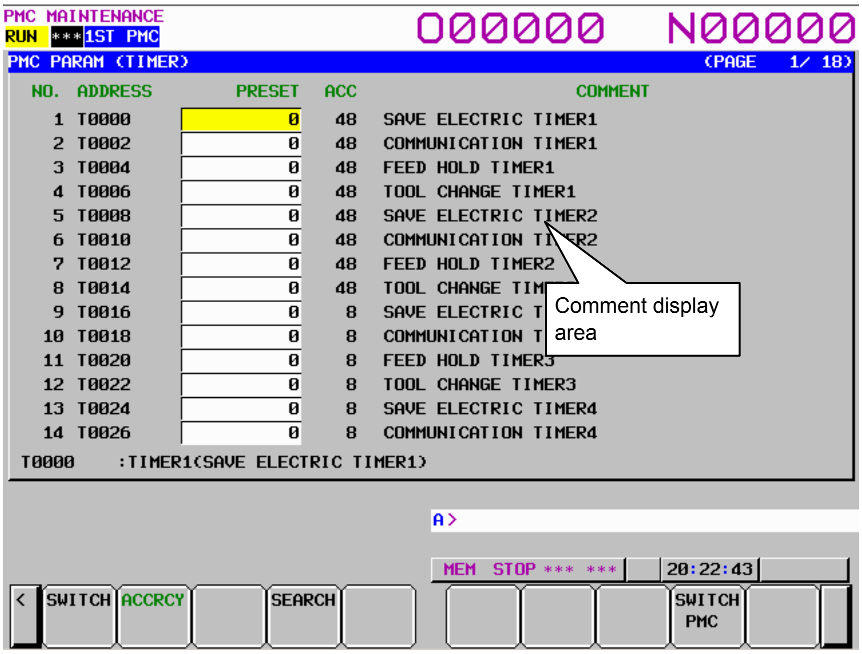


Fig. 7.3.1 (b) Comment display mode

> **NOTE**
> When using a display unit which has 7 soft keys, the comment display mode is not available.

Table contents

- NO.: Timer number specified for a functional instruction timer.
- ADDRESS: Address referenced by a sequence program
- PRESET: Timer setting value
- ACC: Timer accuracy
- COMMENT: T address comment

In the PRESET column, timer setting values are displayed. When the timer accuracy is 8, 48, 1, 10, or 100 msec, only a numeric value is displayed. When the timer accuracy is the second or minute, a time value is displayed using H, M, and S with the separator "_" used to delimit one unit from another as follows:

aaH_bbM_ccS

In the ACC column, timer accuracy values are displayed. The table below indicates the time setting values and notation of each accuracy value.

Timer No.	Accuracy notation	Minimum time setting	Maximum time setting
1 to 8	48 (initial value)	48 msec	1572.8 seconds
9 to 250	8 (initial value)	8 msec	262.1 seconds
1 to 250	1	1 msec	32.7 seconds
1 to 250	10	10 msec	327.7 seconds
1 to 250	100	100 msec	54.6 minutes
1 to 250	S	1 second	546 minutes
1 to 250	M	1 minute	546 hours

NOTE

Above table is for PMC Memory-B. the timer number is 1 to 40 in PMC Memory-A and DCSPMC, and 1 to 500 in PMC Memory-C/D.

The additional information line at the bottom of the screen displays the symbol and comment of the address on which the cursor is placed.

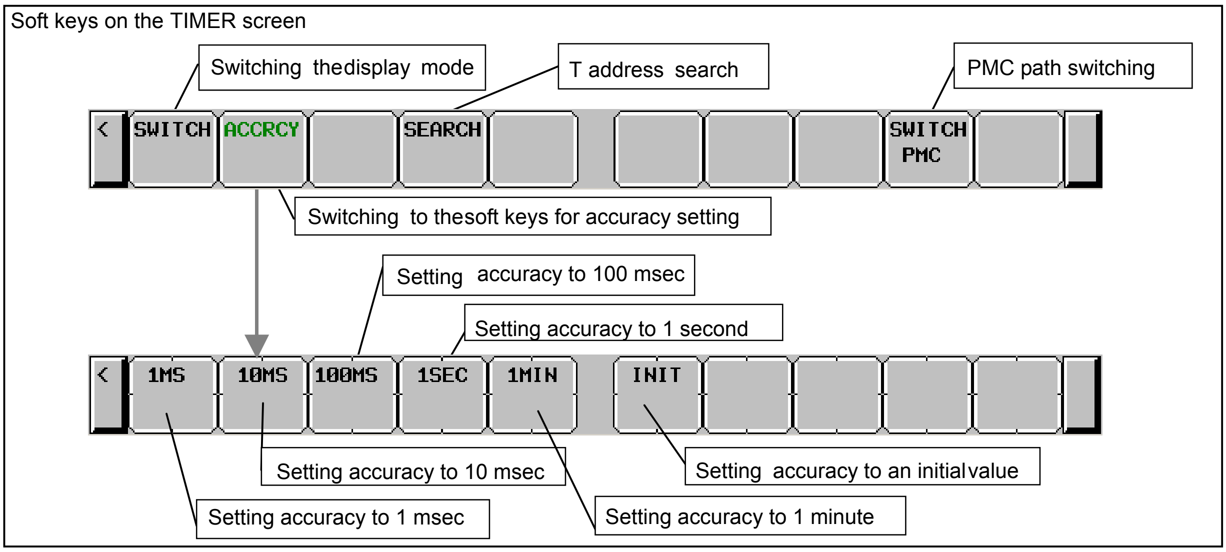


Fig. 7.3.1 (c) Soft keys on the TIMER screen

Operations using the soft keys

(1) [SWITCH] Switching the display mode
Switches the display mode.

> **NOTE**
> When using a display unit which has 7 soft keys, the soft key [SWITCH] is not displayed.

(2) [ACCRCY] Switching to the soft keys for accuracy setting
Switches to the soft keys for timer accuracy setting.
(3) [SEARCH] T address search
Searches for an input T address or timer number.
(4) [SWITCH PMC] Switching PMC path or divided ladder programs
Switches PMC path or divided ladder program. For details of the operation, refer to “6.3”.
By setting keep relay K935.0 to 1, you can display PMC program list screen. For details, refer to ”2.2.11”.
(5) [1MS] Setting accuracy to 1 msec
Sets timer accuracy to 1 msec.
(6) [10MS] Setting accuracy to 10 msec
Sets timer accuracy to 10 msec.
(7) [100MS] Setting accuracy to 100 msec
Sets timer accuracy to 100 msec.
(8) [1SEC] Setting accuracy to 1 second
Sets timer accuracy to 1 second.
(9) [1MIN] Setting accuracy to 1 minute
Sets timer accuracy to 1 minute.
(10) [INIT] Setting accuracy to an initial value
Sets the timer accuracy of the timer number on which the cursor is placed to an initial value (8 msec or 48 msec).

Data input using the input key

When timer accuracy is set to 1 second or 1 minute, the unit is the second if S is specified at the end of an input value; the unit is the minute if M is specified; the unit is the hour if H is specified.

Example:
When setting "2 hours, 46 minutes, 40 seconds" as the timer address for timer accuracy 1 second:
"2H46M40S"+ input key is inputted.

7.3.2 Setting and Displaying Counter Values ([COUNTR] Screen)

This screen is used to set and display the maximum and current counter values for functional instruction counters (SUB 5). This screen can be used in one of two modes: the simple display mode and the comment display mode. To move to the COUNTER screen, press the [COUNTR] soft key.

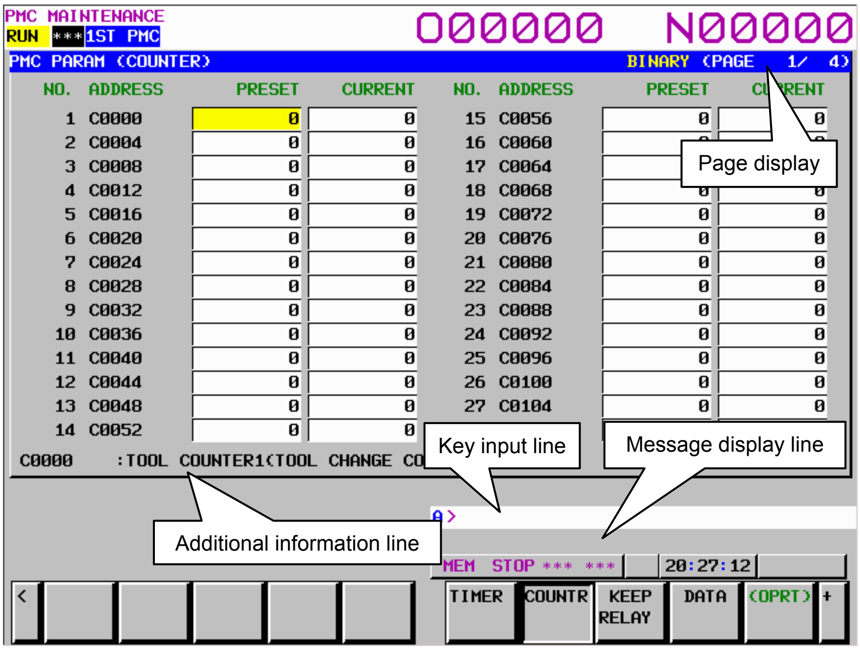


Fig. 7.3.2 (a) Simple display mode

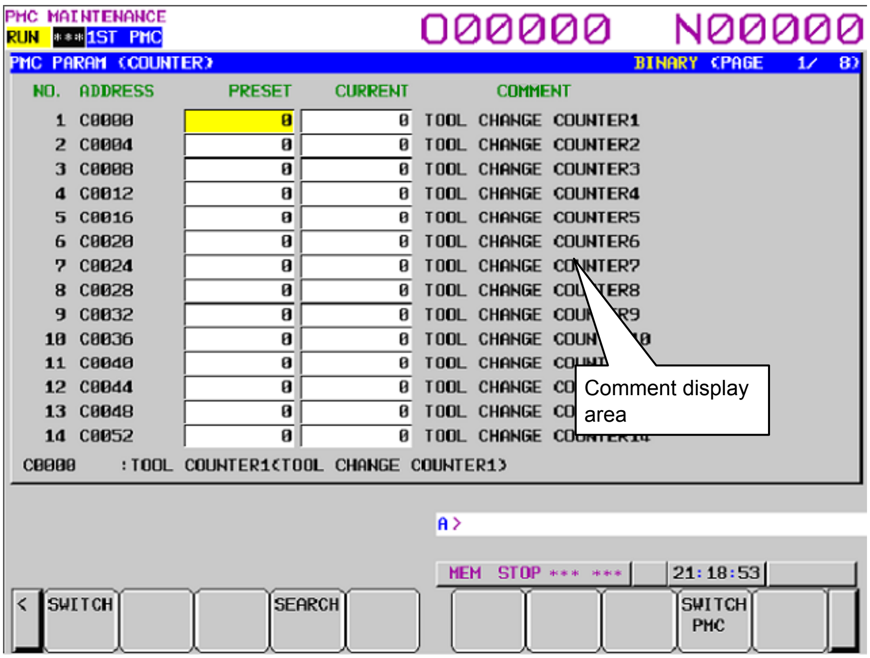


Fig. 7.3.2 (b) Comment display mode

NOTE
When using a display unit which has 7 soft keys, the comment display mode is not available.

Table contents

- NO.: Counter number specified for a functional instruction counter
- ADDRESS: Address referenced by a sequence program
- PRESET: Maximum counter value (a minimum counter value is specified by a counter instruction)
- CURRENT: Current counter value
- COMMENT: Comment on the C address of a setting value

The additional information line at the bottom of the screen displays the symbol and comment of the address on which the cursor is placed. If the cursor is placed on a PRESET value, the symbol and comment of the address of the PRESET value are displayed. If the cursor is placed on a CURRENT value, the symbol and comment of the address of the CURRENT value are displayed.

Counter types and maximum values

Counter type	PRESET maximum value	CURRENT maximum value
BINARY	32767	32767
BCD	9999	9999

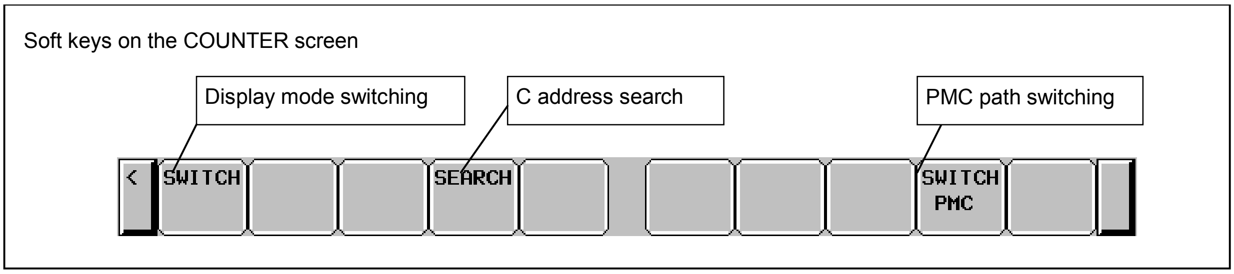


Fig. 7.3.2 (c) Soft keys on the COUNTER screen

Operations using the soft keys

(1) [SWITCH] Display mode switching
Switches the display mode.

> **NOTE**
> When using a display unit which has 7 soft keys, the soft key [SWITCH] is not displayed.

(2) [SEARCH] C address search
Searches for an input C address or counter number.

(3) [SWITCH PMC] Switching PMC path or divided ladder programs
Switches PMC path or divided ladder program. For details of the operation, refer to “6.3”.
By setting keep relay K935.0 to 1, you can display PMC program list screen. For details, refer to ”2.2.11”.

7.3.3 Setting and Displaying Keep Relays ([KEEP RELAY] Screen)

This screen is used for setting and displaying the Keep Relays. To move to the KEEP RELAY screen, press the [KEEP RELAY] soft key.

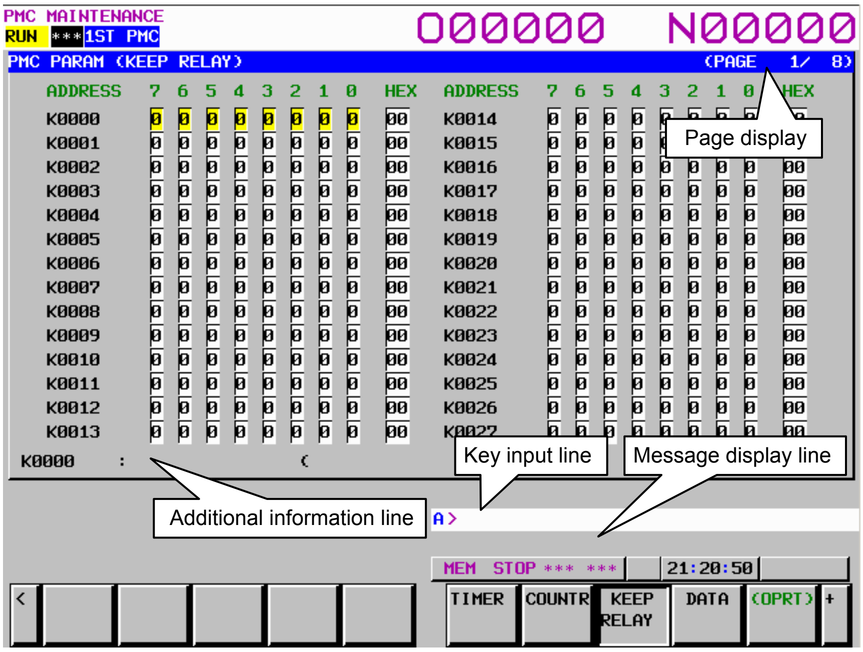


Table contents

- ADDRESS: Address referred by sequence Program
- 0 to 7: Contents of each bit
- HEX: Value of the byte data in hexadecimal notation

The additional information line at the bottom of the screen displays the symbol and comment of the address on which the cursor is placed. When the cursor is placed on a byte, the byte symbol and comment are displayed.
Since Keep Relay is nonvolatile memory, the contents are not lost even if you turn off the power.
The Keep Relay area consists of parts as follows.

	1st to 5th path PMC				Dual check safety PMC
	PMC Memory-A	PMC Memory-B	PMC Memory-C	PMC Memory-D	
User area	K0 to K19	K0 to K99	K0 to K199	K0 to K299	K0 to K19
Area for management software	K900 to K999	K900 to K999	K900 to K999	K900 to K999	K900 to K999

For details of the area for the PMC management software, see Subsection 2.2.11.

> ⚠ **CAUTION**
> If the area for the PMC management software is protected by the programmer protection function, the area is not displayed on the KEEP RELAY screen. For details, see Section 6.2.

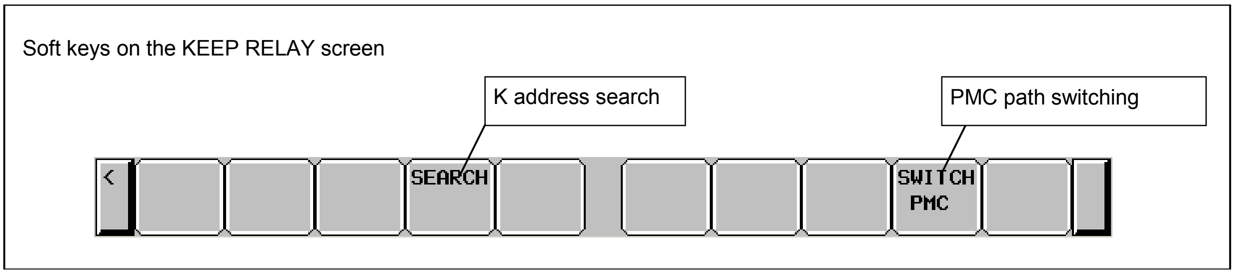


Fig. 7.3.3 Soft keys on the KEEP RELAY screen

Operations using the soft keys

(1) [SEARCH] K address search
Searches for an input K address.

(2) [SWITCH PMC] Switching PMC path or divided ladder programs
Switches PMC path or divided ladder program. For details of the operation, refer to “6.3”.
By setting keep relay K935.0 to 1, you can display PMC program list screen. For details, refer to ”2.2.11”.

Data input using the input key

The input key is used to modify the signal status.

(1) Bit-by-bit setting
- Input 1 then press the input key to turn on the signal.
- Input 0 then press the input key to turn off the signal.

(2) Byte-by-byte setting
In the case of the byte cursor, input up to eight binary digits then press the input key. (When an input value is shorter than eight digits, the value is input from bit 0.)
Example: When 100 is input, this value is input as follows:

Bit number	7	6	5	4	3	2	1	0
	0	0	0	0	0	1	0	0

When the cursor is placed on the hexadecimal display field, hexadecimal input is enabled on a byte-by-byte basis.

Cursor keys

With the cursor keys, select a signal to be modified.
If you press the cursor key for moving left when the cursor is placed at bit 7 of an arbitrary address, the cursor changes to a byte cursor.
If you press the cursor key for moving right when the cursor is placed on the hexadecimal display field of an arbitrary address, the cursor changes to a byte cursor for the next one entire byte.
When the cursor is on the hexadecimal display field or the cursor is a byte cursor, the one-byte signal data of the address can be modified.

⚠ CAUTION

1 Do not use the area for PMC management software. This area is not same as ordinary keep relays for ladder, because the relays in this area are reserved for PMC system software use, and they affect behavior of the PMC software. Set "0" to any relays that are not mentioned about their usage, to prevent unexpected behavior of PMC.

2 Be sure to set the reserved portion of the area for the PMC management software to 0.

7.3.4 Setting and Displaying Data Tables ([DATA] Screen)

Data table has two related screens; DATA TABLE CONTROL and DATA TABLE. And similarly, extra relay has two related screens; EXTRA RELAY CONTROL and EXTRA RELAY. These screens can be switched to each other. To move to the data screen, press the [DATA] soft key.

DATA TABLE CONTROL screen ([LIST] screen)

Pressing the [DATA] soft key displays the DATA TABLE CONTROL screen for data table management. This screen can be used in one of two modes: the simple display mode and the comment display mode.

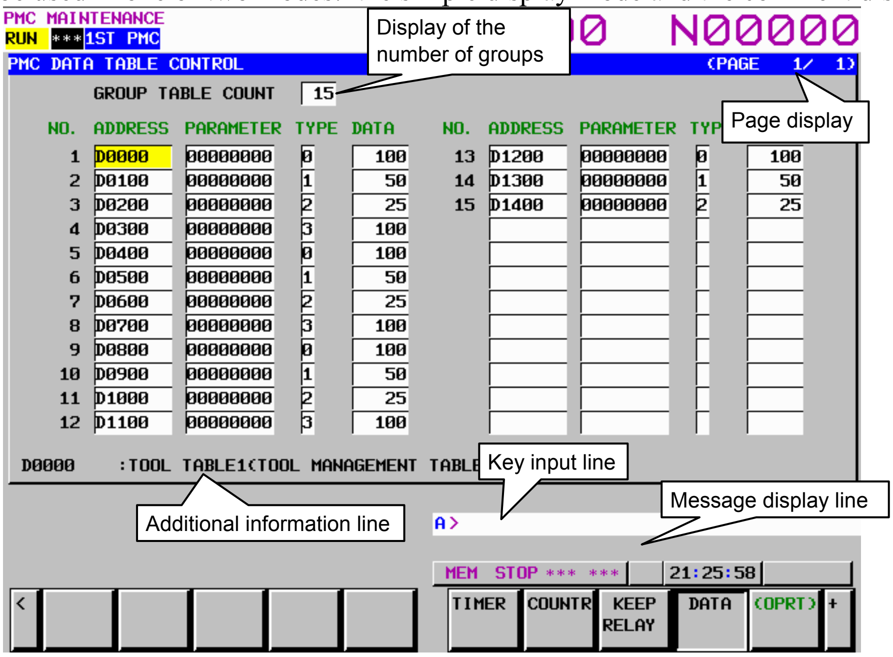


Fig. 7.3.4 (a) Simple display mode

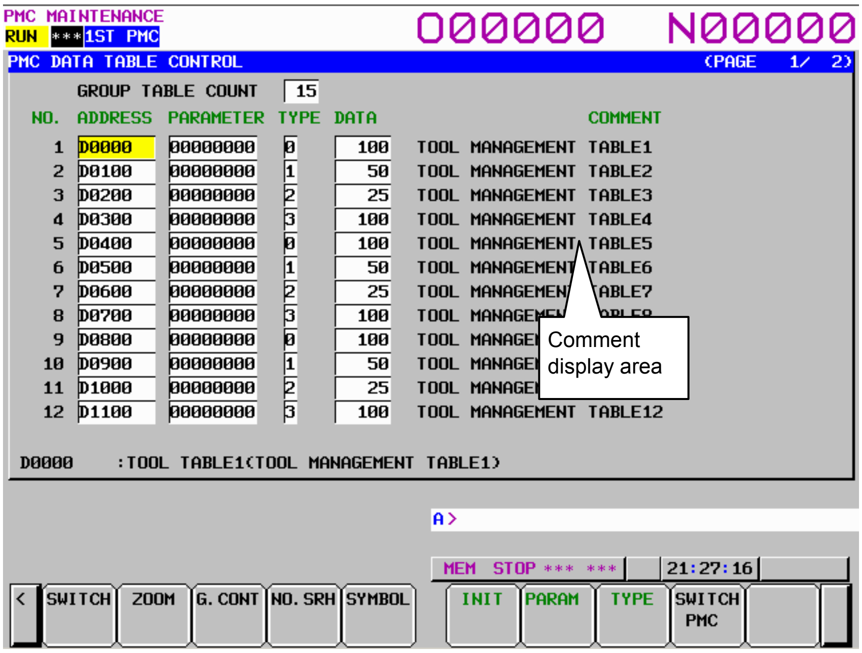


Fig. 7.3.4 (b) Comment display mode

> **NOTE**
> When using a display unit which has 7 soft keys, the comment display mode is not available.

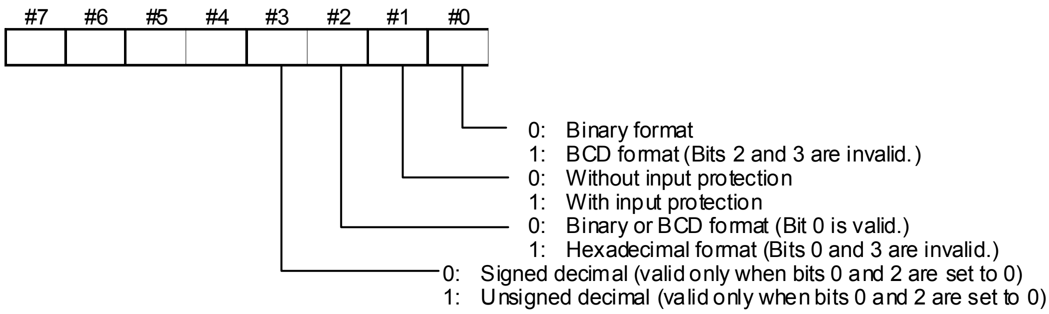
Table contents

- GROUP TABLE COUNT: Number of data items in the data table
- NO.: Group number
- ADDRESS: Data table start address
- PARAMETER: Data table control parameter
- TYPE: Data length (0 = 1 byte, 1 = 2 bytes, 2 = 4 bytes, 3 = bit)
- DATA: Number of data items in each data table
- COMMENT: Comment on the start D address of each group

The additional information line at the bottom of the screen displays the symbol and comment of the address on which the cursor is placed. When the cursor is placed on the PARAMETER, TYPE, or DATA column, the current setting is displayed.

The ADDRESS column displays the start address of a data table. Multiple groups may share an address. When the [SYMBOL] soft key is pressed, the symbol of the start address is displayed.

> **NOTE**
> The data table control parameters have the following meanings:



> **NOTE**
> 1 When data table control data is protected by the programmer protection function, the data table control data screen is not displayed. For details, see Section 6.2.
> 2 When PMC parameters are output using the I/O screen (see Section 7.4), only the data of an address D area set in the data table control data is output from the data table screen. The data of an address D area not set in the data table control data is not output.

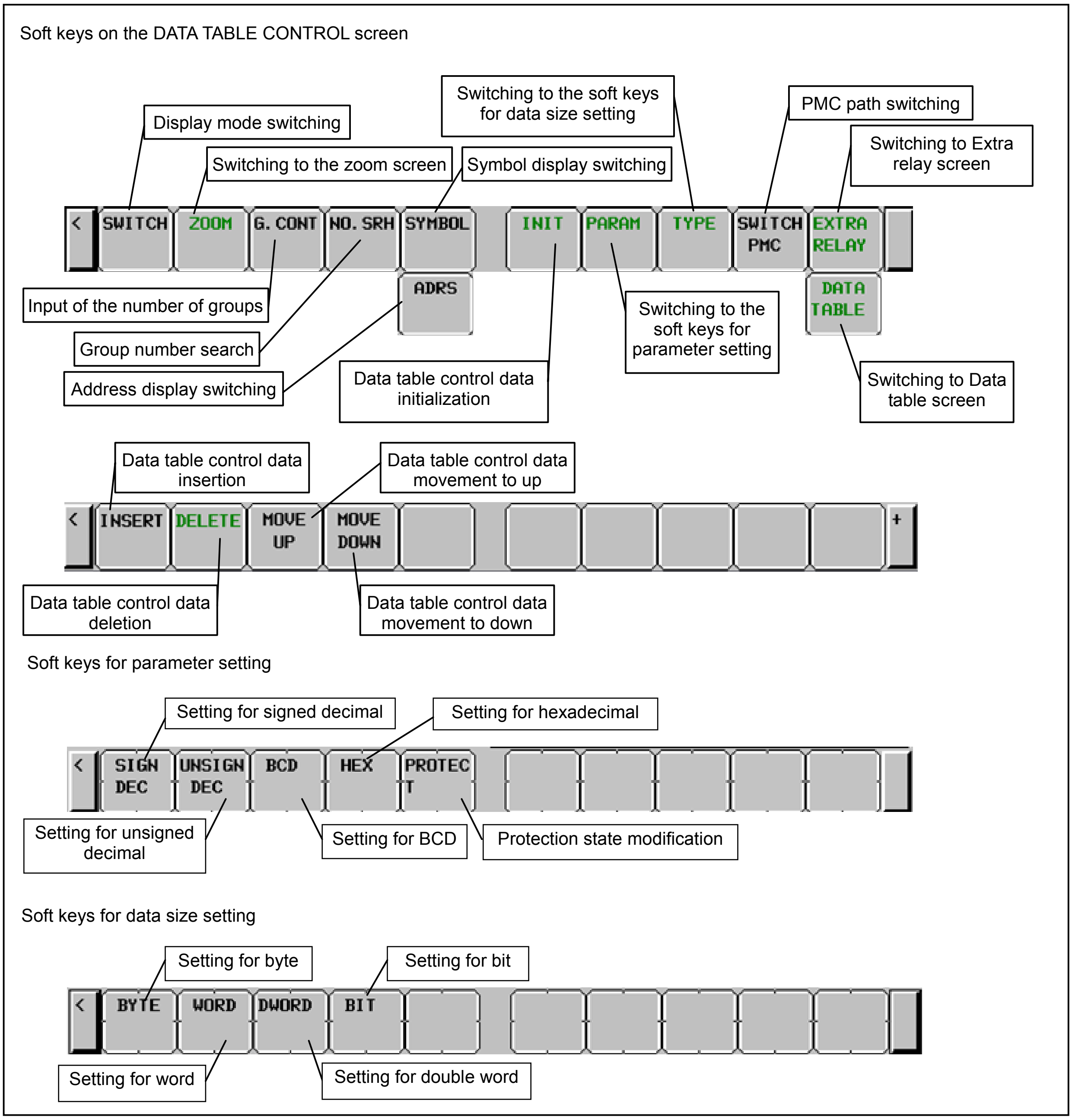


Fig. 7.3.4 (c) Soft keys on the DATA TABLE CONTROL screen

Operations using the soft keys

(1) [SWITCH] Display mode switching
Switches the display mode.

> **NOTE**
> When using a display unit which has 7 soft keys, the soft key [SWITCH] is not displayed.

(2) [ZOOM] Switching to the zoom screen
Switches the screen display to the DATA TABLE screen.

(3) [G.CONT] Input of the number of groups
By pressing this soft key after inputting the number of groups, the number of groups on the data table can be set. The maximum numbers of groups are 100.

(4) [NO.SRH] Group number search
By pressing this soft key after inputting a group number, the cursor can be moved to the specified group.

(5) [SYMBOL] Symbol display switching
Displays the symbol of the start address of a data table in the ADDRESS column.
This soft key is valid only for address display.

(6) [ADRESS] Address display switching
Displays the start address of a data table in the ADDRESS column.
This soft key is valid for symbol display.

(7) [INIT] Data table control data initialization
Initializes the setting of data table control data.

NO.	ADDRESS	PARAMETER	TYPE	DATA	
1	D0000	00000000	0	10000	(NOTE)

NOTE

1 When data table control data is initialized, the entire data area is set as a single table. The start address is the start address of the D addresses. The control parameters are set as follows: signed binary format, without input protection, one-byte data size, and the number of data items set to the total number of bytes in the entire D address area.

2 For the PMC Memory-A and DCSPMC, the initial number of data items is 3000. For the PMC Memory-B, it is 10000. For the PMC Memory-C, it is 20000. For the PMC Memory-D, it is 60000.

(8) [PARAM] Switching to the soft keys for parameter setting
Switches to the soft keys for setting the parameters of data table control data.

(9) [TYPE] Switching to the soft keys for data setting
Switches to the soft keys for data size setting.

(10) [EXTRA RELAY]/[DATA TABLE] Switching to Extra relay/Data Table control data
Switch the contents of the screen between the control data for Data table (D) and those for extra relays (E).
To switch to extra relay control data, the system keep relay K909.5 needs to be 1.

(11) [SWITCH PMC] Switching PMC path or divided ladder programs
Switches PMC path or divided ladder program. For details of the operation, refer to “6.3”.
By setting keep relay K935.0 to 1, you can display PMC program list screen. For details, refer to ”2.2.11”.

(12) [INSERT] Data table control data insertion
Inserts the new data table control data.

(13) [DELETE] Data table control data deletion
Delete the data table control data at the cursor position.

(14) [MOVE UP] Data table control data upward movement
Replaces the data table control data at the cursor position with upper line.

(15) [MOVE DOWN] Data table control data downward movement
Replaces the data table control data at the cursor position with lower line.

(16) [SIGN DEC] Setting for signed decimal
Sets signed decimal for the parameters of data table control data.

(17) [UNSIGN DEC] Setting for unsigned decimal
Sets unsigned decimal for the parameters of data table control data.

(18) [BCD] Setting for BCD
Sets BCD for the parameters of data table control data.

(19) [HEX] Setting for hexadecimal
Sets hexadecimal for the parameters of data table control data.

(20) [PROTECT] Protection state modification
Modifies the protection state of the parameters of data table control data.

(21) [BYTE] Setting for byte
Sets the data size to one byte.

(22) [WORD] Setting for word
Sets the data size to two bytes.
(23) [DWORD] Setting for double word
Sets the data size to four bytes.
(24) [BIT] Setting for bit
Sets the data size to one bit.
When the data size is one bit, the unit for the number of data items is one byte.

DATA TABLE screen ([ZOOM] screen)

If the data table control data is specified, pressing the [ZOOM] soft key on the data table control data screen displays the data table setting screen. This screen can be used in one of three modes: the simple display mode, the comment display mode, and the bit display mode.

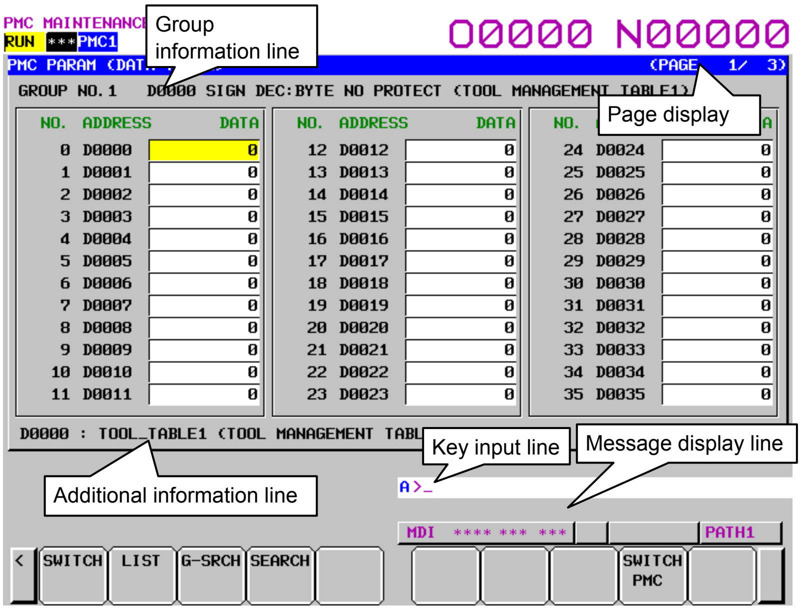


Fig. 7.3.4 (d) Simple display mode

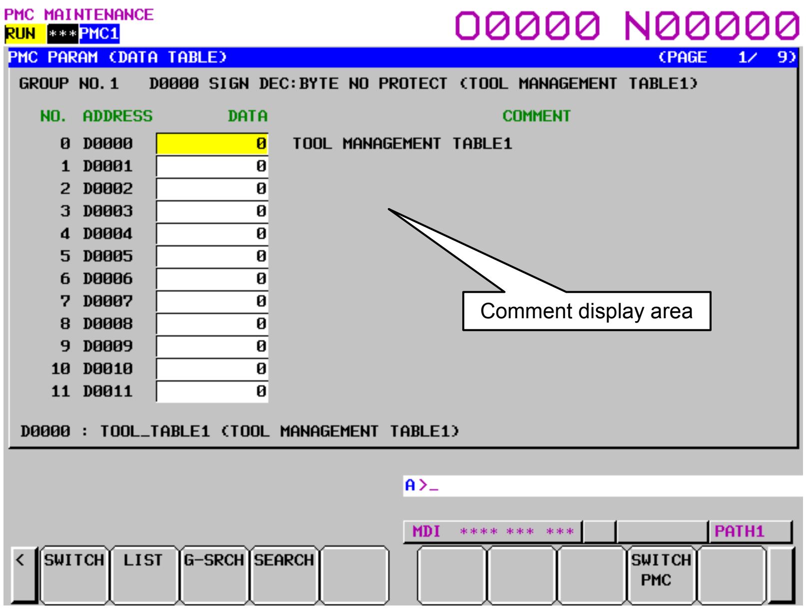


Fig. 7.3.4 (e) Comment display mode

> **NOTE**
> When using a display unit which has 7 soft keys, the comment display mode is not available.

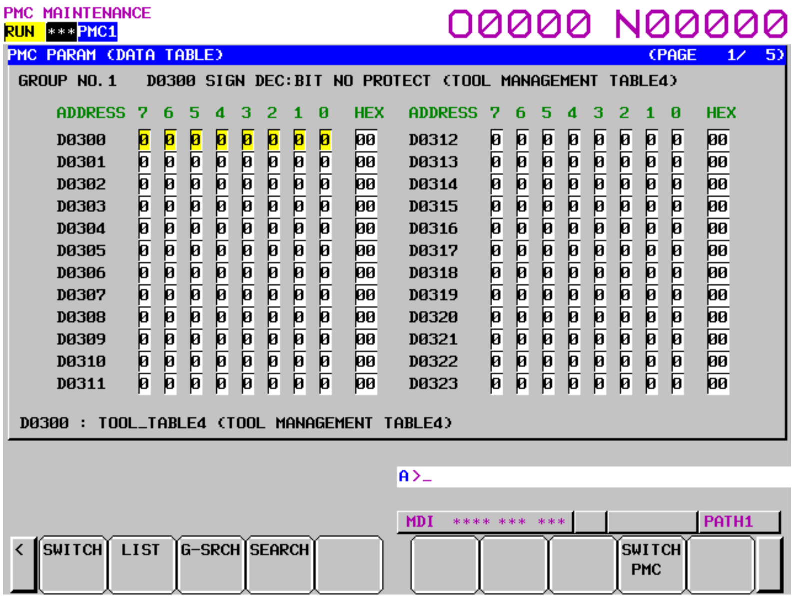


Fig. 7.3.4 (f) Bit display mode

Table contents

- NO.
- ADDRESS: Address used by the sequence program
- DATA: Data value of data table
- COMMENT: Comment on the D address
- 0 to 7: Data of each bit
- HEX: Display of each byte in hexadecimal

The group information line at the top of the screen displays a group number, group start address, settings, and comment on the start address.

The additional information line at the bottom of the screen displays the symbol and comment of the address on which the cursor is placed. In the bit display mode, a bit symbol and comment, or a byte symbol and comment are displayed, depending on the cursor position.

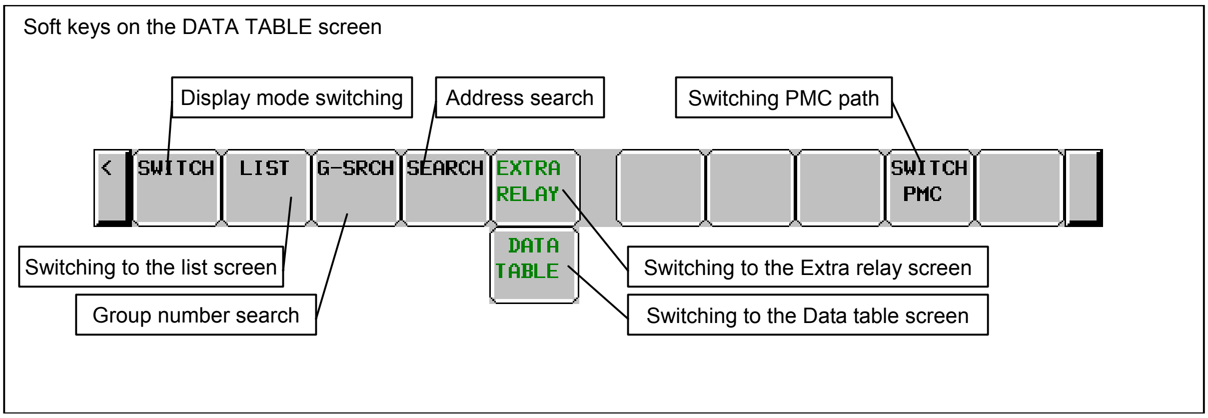


Fig. 7.3.4 (g) Soft keys on the DATA TABLE screen

Operations using the soft keys

(1) [SWITCH] Display mode switching
Switches the mode between the simple display mode and comment display mode when the data size is one byte, two bytes, or four bytes. When the data size is one bit, this soft key switches the mode between the simple display mode and bit display mode.

> **NOTE**
> When using a display unit which has 7 soft keys, the soft key [SWITCH] is not displayed.

(2) [LIST] Switching to the list screen
Pressing this soft key switches to the data table control data screen.
(3) [G-SRCH] Group number search
After the entry of a group number for a data table to be searched in another group, pressing this key moves the cursor to the beginning of that group.
(4) [SEARCH] Address search
After the entry of an address, pressing this key moves the cursor to the specified address within the currently selected group. In the bit display mode, this soft key searches for a byte address or bit address.
(5) [EXTRA RELAY]/[DATA TABLE] Switching to Extra relay/Data Table
Switch the contents of the screen between Data table (D) and extra relays (E).
To switch to extra relay, the system keep relay K909.5 needs to be 1.
(6) [SWITCH PMC] Switching PMC path or divided ladder programs
Switches PMC path or divided ladder program. For details of the operation, refer to “6.3”. This soft key is not shown in EXTRA RELAY screen.
By setting keep relay K935.0 to 1, you can display PMC program list screen. For details, refer to ”2.2.11”.

Screen operations in the bit display mode

In the bit display mode, the method of operation described below is used.

(1) Input key
The input key is used to modify the signal status.
(a) Bit-by-bit setting
- Input 1 then press the input key to turn on the signal.
- Input 0 then press the input key to turn off the signal.

(b) Byte-by-byte setting
In the case of the byte cursor, input up to eight binary digits then press the input key. (When an input value is shorter than eight digits, the value is input from bit 0.)
Example: When 100 is input, this value is input as follows:

Bit number	7	6	5	4	3	2	1	0
	0	0	0	0	0	1	0	0

When the cursor is placed on the hexadecimal display field, hexadecimal input is enabled on a byte-by-byte basis.

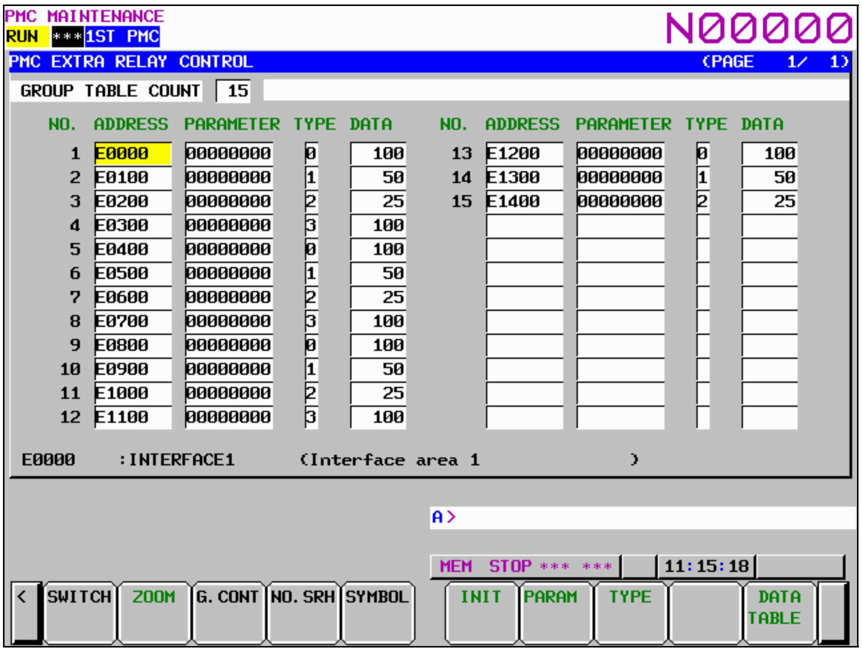
(2) Cursor keys
With the cursor keys, select a signal to be modified.
If you press the cursor key for moving left when the cursor is placed at bit 7 of an arbitrary address, the cursor changes to a byte cursor.
If you press the cursor key for moving right when the cursor is placed on the hexadecimal display field of an arbitrary address, the cursor changes to a byte cursor for the next one entire byte.
When the cursor is placed on the hexadecimal display field, or the cursor is a byte cursor, the one-byte signal data of the address can be modified.

EXTRA RELAY CONTROL screen ([LIST] screen)

To switch to the EXTRA RELAY CONTROL screen in which you can manage the extra relay tables, use [EXTRA RELAY] soft key in DATA TABLE CONTROL screen.

The operation of this screen is similar to the DATA TABLE CONTROL screen. See the "DATA TABLE CONTROL screen ([LIST] screen)" for the detail of the operations.

To make it easy to distinguish the EXTRA RELAY CONTROL screen from DATA TABLE CONTROL screen, the EXTRA RELAY CONTROL screen has white background at the line of "GROUP TABLE COUNT".

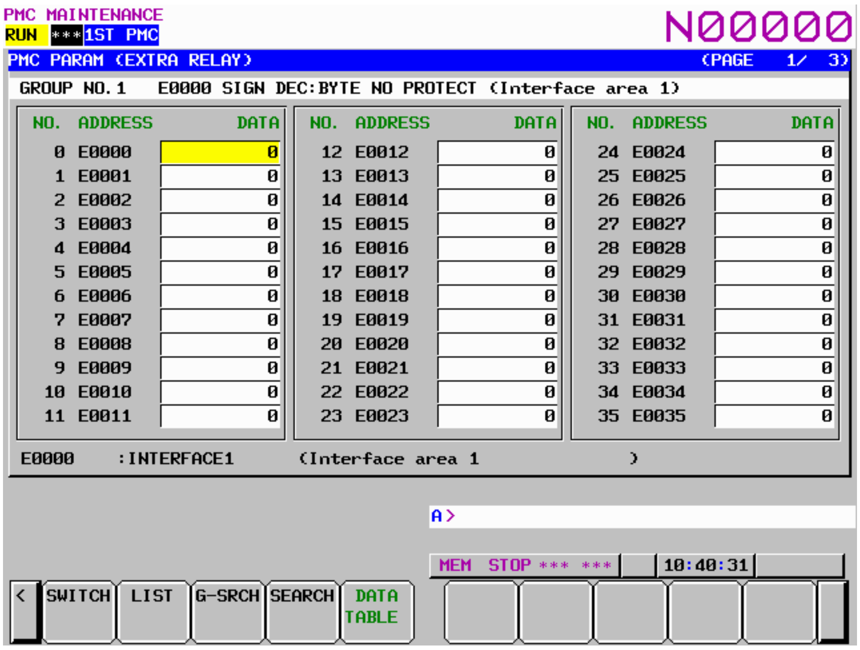


EXTRA RELAY screen ([ZOOM] screen)

When the extra relay control data are properly set, pressing [ZOOM] soft key at EXTRA RELAY CONTROL screen leads you to the EXTRA RELAY screen. Similarly to the DATA TABLE screen, this screen can show the contents of extra relays in three display modes; the simple display mode, the comment display mode, and the bit display mode.

The operation of this screen is similar to the DATA TABLE screen. See the "DATA TABLE screen ([ZOOM] screen)" for the detail of the operations.

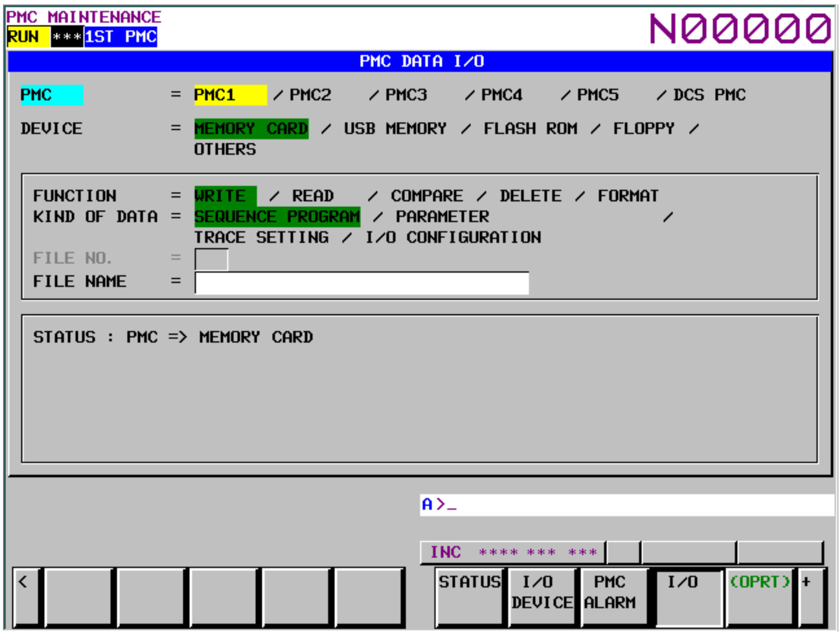
To make it easy to distinguish the EXTRA RELAY screen from the DATA TABLE screen, the EXTRARELAY screen has white background at the line of the group information.



> **NOTE**
>
> 1 Extra relays (E) can be included only in PMC parameter output from 1st PMC. If you set 1 to the system keep relay K906.3, no information of extra relays is included in PMC parameter output.
>
> 2 You have an option on the format of the extra relays when you include the extra relays in the PMC parameter output. See "2.3.2 PMC Parameter Format" for the detail of the format of the extra relays.
>
> 3 Even if the extra relays are not configured as non-volatile memory, their control data are non-volatile.

7.4 DATA INPUT/OUTPUT ([I/O] SCREEN)

To move to the I/O screen, press the [I/O] soft key.



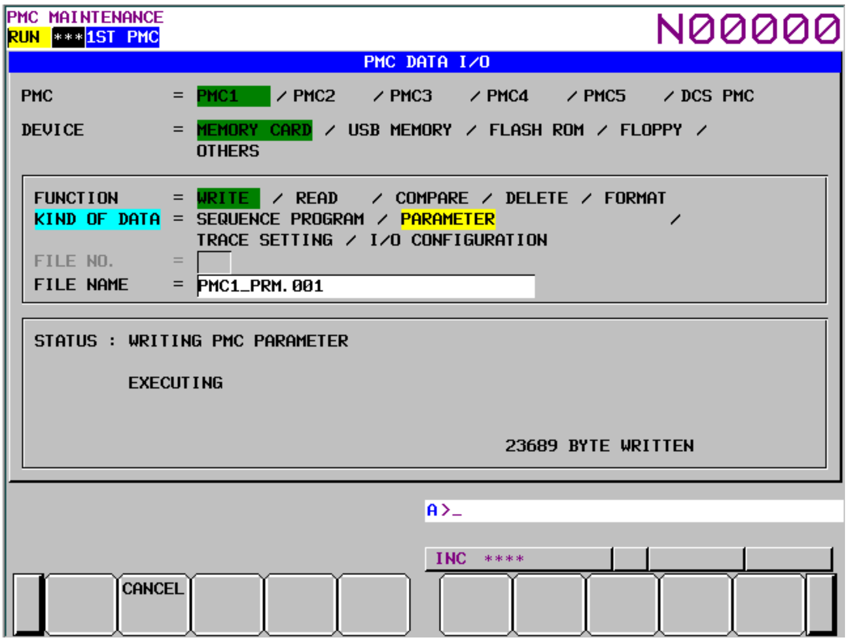
On this screen, sequence programs, PMC parameters, PMC message data for multi-language display, trace setting data and I/O configuration data can be written to the specified device, read from the device, and compared. The query selection cursor, which moves vertically from one question to another, is displayed, as is the option selection cursor, which moves horizontally from one option to another.

The following types of devices can be used for input/output. The desired device type can be selected by positioning the query selection cursor to "DEVICE" and moving the option selection cursor to that type.

- MEMORY CARD: Data can be output to and input from a memory card.
- USB MEMORY: Data can be output to and input from a USB memory.
- FLASH ROM: Data can be output to and input from flash ROM.
- FLOPPY: Data can be output to and input from Handy File or Floppy Cassette.
- OTHERS: Data can be output to and input from other general-purpose RS-232C input/output devices.

The multi-path PMC system enables an I/O target PMC to be selected. For details, see Section 7.4.4.

In STATUS in the lower part of the screen, a detailed explanation of execution and the execution status are displayed. During write, read, and comparison, the size of the data already transferred is indicated as the execution (intermediate) result.
The following gives a display example shown when PMC parameters are written to a memory card:



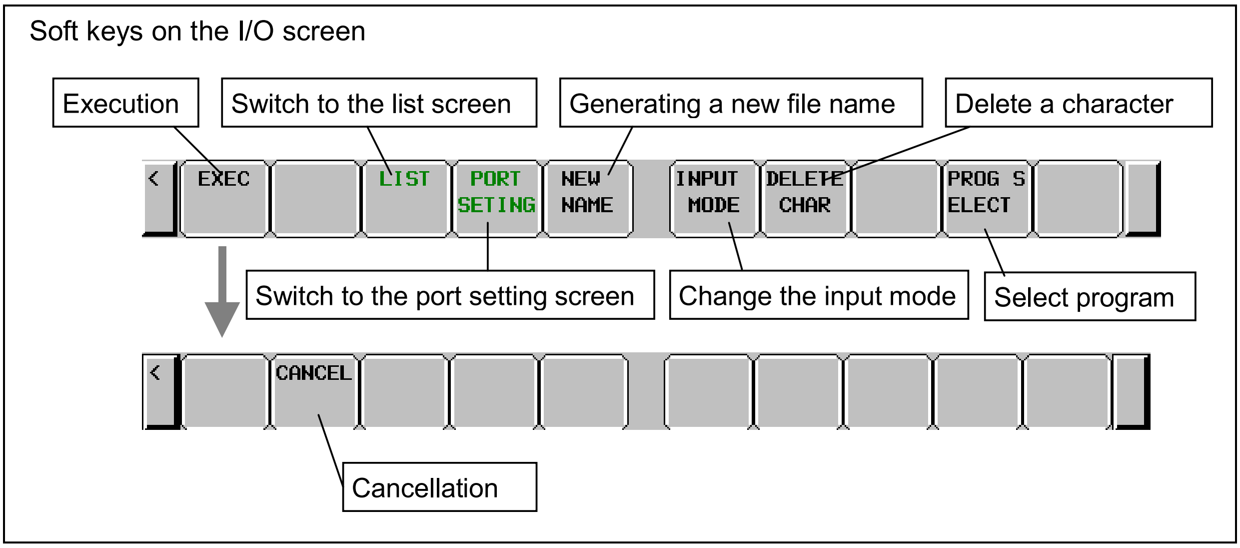


Fig. 7.4 Soft keys on the I/O screen

Operations using the soft keys

(1) [EXEC] Execution
Executes a processing item selected for FUNCTION.
During execution, the [CANCEL] soft key is displayed.

(2) [LIST] Switching to the list screen
Switches the screen display to the file list screen.
This soft key is valid only when MEMORY CARD, USB MEMORY or FLOPPY is selected for DEVICE.

(3) [PORT SETING] Switching to the port setting screen
Switches the screen display to the Port setting screen.
This soft key is valid only when FLOPPY or OTHERS is selected for DEVICE.

(4) [CANCEL] Cancellation
Cancels execution. Upon normal termination, the display of this soft key disappears.

(5) [NEW NAME] Generating a new file name
Unused new file name is generated by searching files on a memory card, a USB memory or a floppy disk. This soft key is displayed when a writing function to memory card, to USB memory or to floppy disk is selected.
New file name is generated with the following format.

$$\overbrace{\bigcirc\bigcirc\bigcirc\bigcirc\bigcirc\bigcirc\bigcirc\bigcirc}^{\text{Data Name}}\ \overbrace{.\mathbf{x\,x\,x}}^{\text{Data Number}}$$

- Data Name
  The following data name is specified for each kind of data.

Kind of Data		Data Name
Sequence program (Main ladder program) (Note)	1st path PMC	PMC1
	2nd path PMC	PMC2
	3rd path PMC	PMC3
	4th path PMC	PMC4
	5th path PMC	PMC5
	DCSPMC	PMCS
Sequence program (Divided ladder program) (Note)	Divided ladder program No.1 of 1st path PMC	L101PMC1
	Divided ladder program No.2 of 1st path PMC	L102PMC1
	Divided ladder program No.3 of 1st path PMC	L103PMC1
	:	:
	Divided ladder program No.98 of 1st path PMC	L198PMC1
	Divided ladder program No.99 of 1st path PMC	L199PMC1
	Divided ladder program No.1 of 2nd path PMC	L201PMC2
	:	:
	Divided ladder program No.99 of 2nd path PMC	L299PMC2
	Divided ladder program No.1 of 3rd path PMC	L301PMC3
	:	:
	Divided ladder program No.99 of 3rd path PMC	L399PMC3
	Divided ladder program No.1 of 4th path PMC	L401PMC4
	:	:
	Divided ladder program No.99 of 4th path PMC	L499PMC4
	Divided ladder program No.1 of 5th path PMC	L501PMC5
	:	:
	Divided ladder program No.99 of 5th path PMC	L599PMC5
PMC parameter	1st path PMC	PMC1_PRM
	2nd path PMC	PMC2_PRM
	3rd path PMC	PMC3_PRM
	4th path PMC	PMC4_PRM
	5th path PMC	PMC5_PRM
	DCSPMC	PMCS_PRM
Message data for multi-language display (Note)	1st path PMC	M1PMCMSG
	2nd path PMC	M2PMCMSG
	3rd path PMC	M3PMCMSG
	4th path PMC	M4PMCMSG
	5th path PMC	M5PMCMSG
Trace setting data		PMC_TRS
I/O configuration data (I/O Link *i* assignment data) (Note)		IOCONF

> **NOTE**
> The data name is the same as the file name of flash ROM.

- Data number
  The data number is the three digits number that begins at '000'. The next number of the maximum data number of a file that exists on a memory card or floppy disk is set to the data number. However, when a file that has a data number '999' exists on a memory card or floppy disk, the '999' is set to the data number.

> **NOTE**
> 1 When 128 or more files exist on a memory card or floppy disk, the "Generating new file name" does not work correctly. You should only use this function when 127 or less files exist on the device.
> 2 You cannot input/output divided ladder program from/into floppy disk.

(6) [INPUT MODE] Changing the input mode
By pressing the [INPUT MODE] soft key, the input mode is changed in the following order. The indicator "INSERT" that appears on the screen means insert mode. The indicator "ALTER" means replace mode. The soft key [INPUT MODE] appears only when the cursor is on the FILE NAME box.

→ Full-string input → Insert mode → Replace mode →

- Full-string input
  An entire file name is selected by the cursor and the entire file name is replaced by input.
- Insert mode
  Input characters are inserted at the cursor. If you press the INPUT key without no character, one space character will be inserted.
- Replace mode
  The characters on and after cursor are replaced by input characters. If you press the INPUT key without no character, the character on the cursor will be replaced by space character.

(7) [DELETE CHAR] Deleting a character
Delete a character on the cursor. This soft key [DELETE CHAR] appears only when the cursor is on the FILE NAME box and the input mode is "INSERT" or "ALTER".

> **NOTE**
> For the description of the error messages on the I/O screen, see Section 12.1.

(8) [PROG. SELECT] Selecting sequence program
You can select sequence program for inputting/outputting. This soft key is displayed when the ladder dividing management function is effective.

The [PROG. SELECT] soft key works as follows.

Operation	Behavior
Only [PROG. SELECT]	Select main ladder program or divided ladder program in selected PMC path in order.

Operation	Behavior
"Divided ladder program number" + [PROG. SELECT]	Select divided ladder program of specified number in selected PMC path. For example, inputting "12" and pressing this soft key in "PMC2" selects "PMC2-12". In case of selecting main ladder program, input "0".

Selected divided ladder program is displayed in the status column.

Example: Writing the ladder program of divided number 1 of 1st path PMC to Memory card.

```
STATUS : PMC => MEMORY CARD

CURRENT PROGRAM : PMC1-01
```

7.4.1 Memory Card and USB Memory

Memory card

The memory card, which is used for inputting/outputting the sequence program in the I/O screen, can also be used to access to the programmer (FANUC LADDER-III).

As for the memory card, you need use the compact flash adapter, which is attached a compact flash card (CF card) purchased from FANUC.

> **NOTE**
> If a CF card other than that purchased from FANUC is used, the operation is not guaranteed.

For the details, refer to “APPENDIX E” in the “CONNECTION MANUAL (HARDWARE)” of each CNC series.

USB memory

You can input/output some data to/from a USB memory with a USB port beside a display unit.

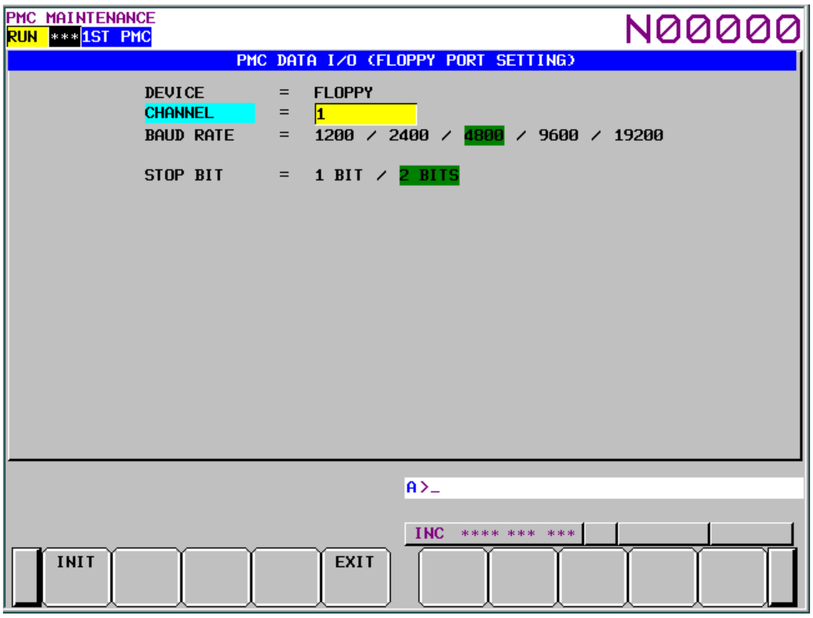
> **NOTE**
> It is not guaranteed that every commercially available USB memory can operate normally. A USB memory with a security function does not operate. Some commercially available USB memories may not be designed for the use in an FA environment.

> ⚠ **CAUTION**
> 1 While the control unit is accessing the USB memory, do not turn off the power to the control unit or do not remove the USB memory.
> 2 Close the cover of the USB port when no USB memory is inserted.

For the details, refer to section 5.6 in the “CONNECTION MANUAL (HARDWARE)” of each CNC series. .

7.4.2 Setting the Communication Port ([PORT SETING] Screen)

When FLOPPY or OTHERS is selected for DEVICE on the I/O screen, the [PORT SETING] soft key is displayed. When you press this soft key, the port setting screen appears. The screen below is a sample screen displayed when FLOPPY is selected for DEVICE.



This screen allows the setting of the communication data required for communication using the RS-232C. Communication data can be set for each of the two types of devices independently of the other.
Selected device type is displayed to "DEVICE" menu on screen.

Explanation of each question

- CHANNEL
  Check that an RS-232C cable is connected to the main board of the control unit. Directly enter the number corresponding to the connected connector.
  1.......... JD56A
  2.......... JD36A/JD54
- BAUD RATE
  1200: Sets the baud rate to "1200".
  2400: Sets the baud rate to "2400".
  4800: Sets the baud rate to "4800".
  9600: Sets the baud rate to "9600".
  19200: Sets the baud rate to "19200".
- STOP BIT
  1 BIT: Sets the number of stop bits to "1".
  2 BITS: Sets the number of stop bits to "2".
- WRITE CODE
  "WRITE CODE" is displayed when "OTHERS" is selected for "DEVICE".
  ASCII: Sets the output code to "ASCII".
  ISO: Sets the output code to "ISO".

NOTE
Parity is always "NONE".

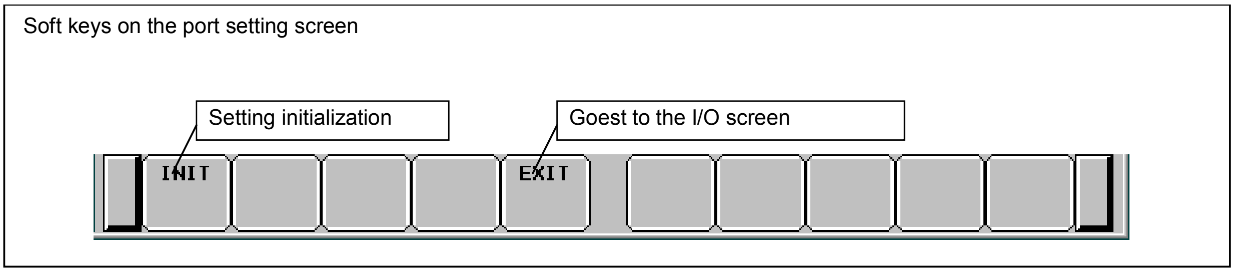


Fig. 7.4.2 Soft keys on the port setting screen

Operations using the soft keys

(1) [INIT] Setting initialization
Sets all the parameters to their initial values.
The table below indicates the initial value of each setting item.

Initial values

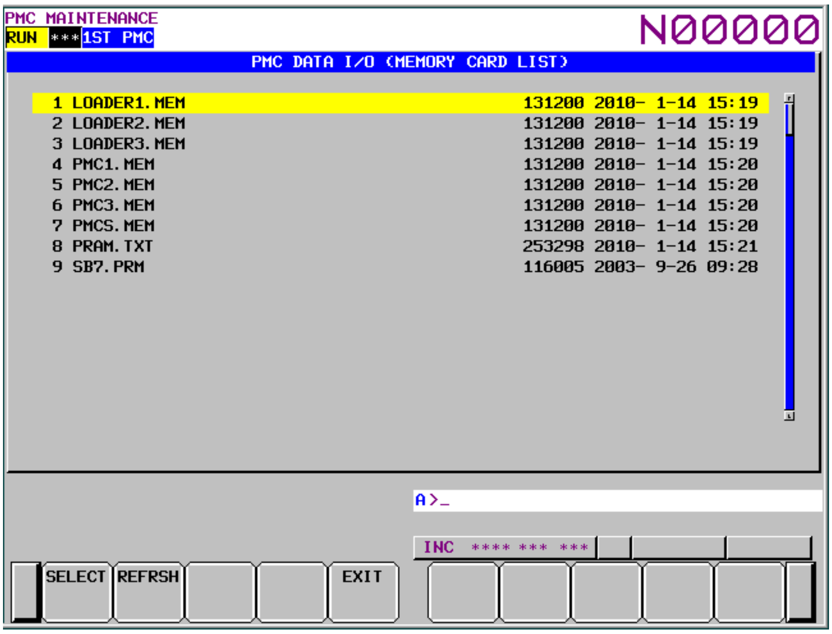
DEVICE	DEVICE = FLOPPY	DEVICE = OTHERS
CHANNEL	1	1
BAUD RATE	4800	4800
STOP BIT	2 BITS	2 BITS
WRITE CODE	(NONE)	ISO

(2) [EXIT] Switching to the I/O screen
Terminates the setting of the communication parameters and switches the screen display to the I/O screen.

Operation of the return key
On the port setting screen, the operation of the return key is disabled.
Use the [EXIT] soft key to terminate the setting of the communication parameters and return to the I/O screen.

7.4.3 Displaying a File List ([LIST] Screen)

When MEMORY CARD, USB MEMORY or FLOPPY is selected for DEVICE on the I/O screen, the [LIST] soft key is displayed. When you press this soft key, the file list screen appears. The contents of the root directory of the selected device are displayed. The screen below is a sample screen displayed when MEMORY CARD is selected for DEVICE.



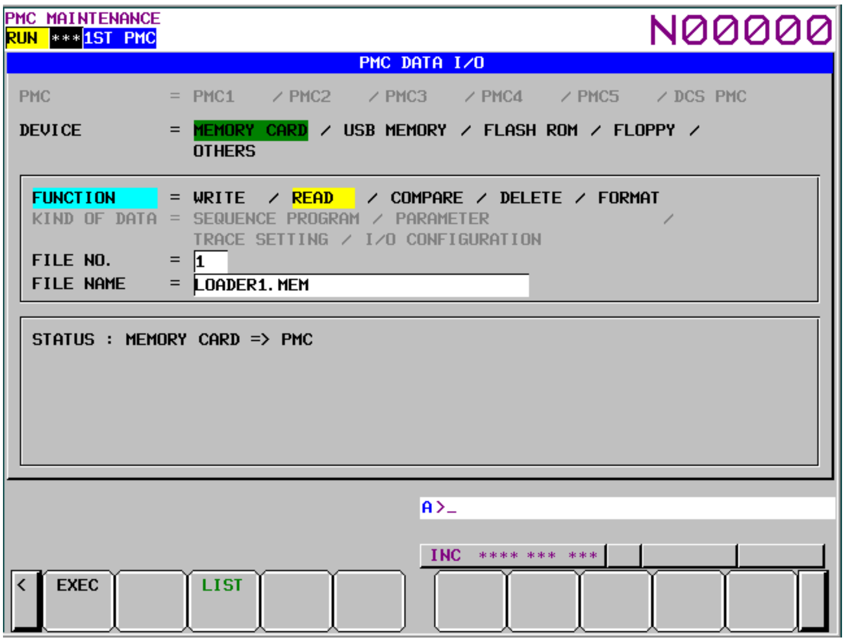
If MEMORY CARD is selected for DEVICE, and a memory card holding files is inserted into the slot, the contents of the memory card are displayed. If FLOPPY is selected for DEVICE, the contents of a Floppy Cassette or Handy File are displayed.

NOTE

1 Up to 128 files can be displayed on this screen. When 129 or more files are saved, the 129th and subsequent files are ignored.

2 In case of the USB memory, up to 32 characters of the file names can be displayed. If a file has a name over 32 characters, the first 32 characters are displayed. For a folder, the file size does not be displayed but “<FOLDER>” is displayed.

When a file is selected on this screen, the screen display can be returned to the I/O screen. To select a file, place the cursor at the name of the file, then press either the [SELECT] soft key or the INPUT key. After the key entry, the screen display switches to the I/O screen automatically. In this case, the cursor is positioned at READ on the FUNCTION menu, and the number and name of the file selected on the list screen are indicated in the FILE NO. and FILE NAME fields, respectively. A display example is shown below.



To return the screen display to the I/O screen without selecting a file, press the [EXIT] soft key. Even if the memory card, the USB memory or the floppy disk in the floppy cassette, or the handy file is exchanged while the file list screen is being displayed, the display data is not automatically updated. In this case, press the [REFRSH] soft key. The contents of the new memory card are then displayed.

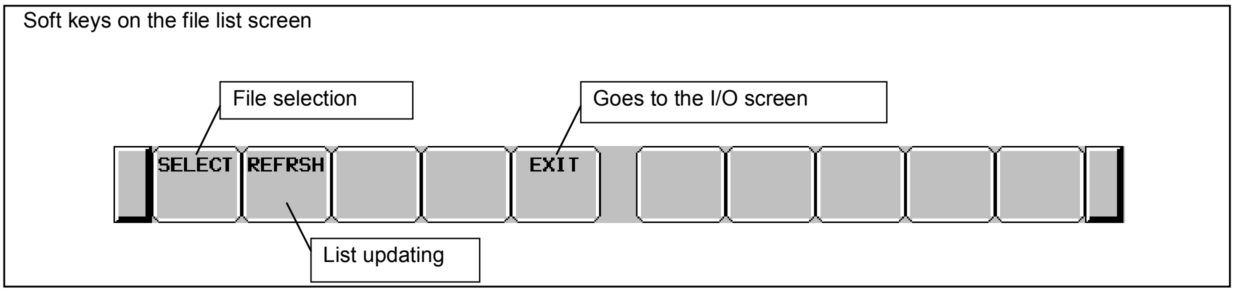


Fig. 7.4.3 Soft keys on the file list screen

Operations using the soft keys

(1) [SELECT] File selection
Selects a file, and returns the screen display to the I/O screen.

(2) [REFRSH] List updating
Redisplays the file list screen.

(3) [EXIT] Switching to the I/O screen
Switches the screen display to the I/O screen without selecting a file.

Operation of the return key

On the file list screen, the operation of the return key is disabled.
Use the [EXIT] soft key to return to the I/O screen without selecting a file.

7.4.4 Setting an I/O Target PMC

The multi-path PMC system enables an I/O target PMC to be selected on the I/O screen.

Specification of a PMC in the item of PMC

Select PMC with the query selection cursor then select an I/O target PMC by moving the option selection cursor.

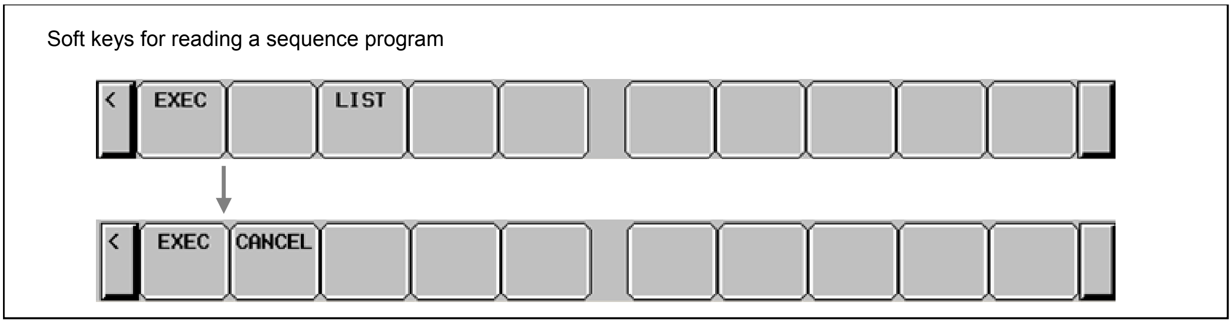
> **NOTE**
> The PMC query may not be displayed, depending on the setting of each query. For details, see the description of each operation procedure.

Nonexistent PMCs are not displayed as options.
Example: When PMC3, PMC4 and PMC5 do not exist
PMC = PMC1 / PMC2 / DCSPMC

When only PMC1 exists, the indication below is provided, so that no selection operation is required. In this case, the query selection cursor does not move to PMC.
PMC = PMC1

Specification of a PMC when a sequence program is read

When the data of the I/O screen is read, the type of data is automatically identified. The procedure for reading a sequence program is described below.

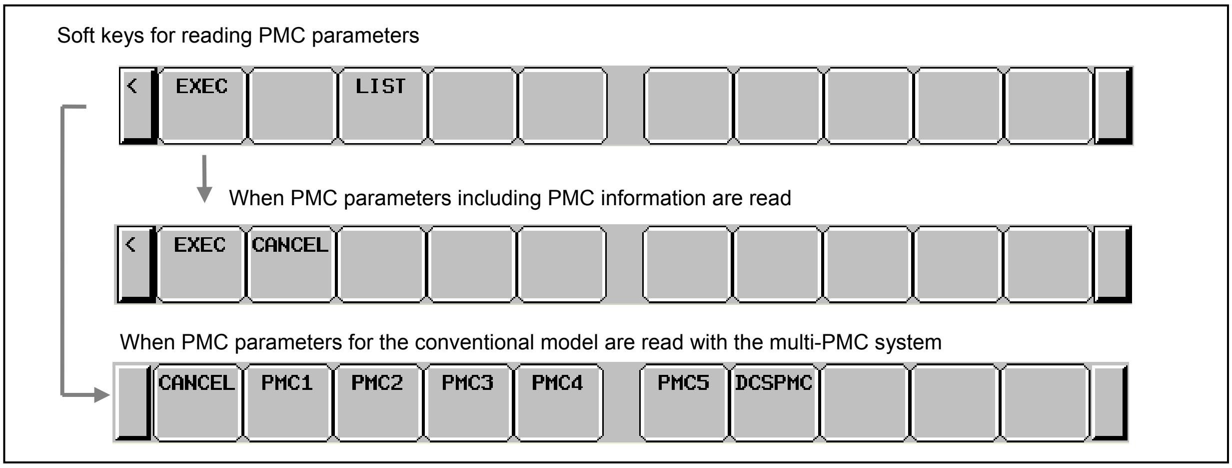


(1) Reading a sequence program including PMC information
  (a) After setting a device on the I/O screen, select READ for FUNCTION, then press the [EXEC] soft key.
  (b) The following message is displayed:
  "READING SEQUENCE PROGRAM (PMCx)"
  (As PMCx, the PMC number embedded in the data is displayed. "DCSPMC" is displayed for a program for dual check safety.)
  (c) Press the [EXEC] soft key to continue the operation.
  (d) Press the [CANCEL] soft key to stop the operation.

(2) Reading a sequence program for the conventional model
When the reading of the sequence program of the conventional model begins, the following message is displayed, and the read operation is terminated abnormally:
"UNKNOWN FILE FORMAT"

Specification of a PMC when PMC parameters are read

When the data of the I/O screen is read, the type of data is automatically identified. The procedure for reading PMC parameters is described below.



(1) Reading PMC parameters including PMC information
- (a) After setting a device, select READ for FUNCTION, then execute.
- (b) The following message is displayed:
  "READING PMC PARAMETER (PMCx)"
  (As PMCx, the PMC number embedded in the data is displayed. "DCSPMC" is displayed for parameters for dual check safety.)
- (c) Press the [EXEC] soft key to continue the operation.
- (d) Press the [CANCEL] soft key to stop the operation.

(2) Reading PMC parameters for the conventional model
- (a) After setting a device, select READ for FUNCTION, then execute.
- (b) The following message is displayed:
  "READING PMC PARAMETER"
- (c) Select a read source PMC with the corresponding soft key.
- (d) Press the [CANCEL] soft key to stop processing.

NOTE
1 When only PMC1 exists, only the step for reading PMC parameters including PMC information needs to be executed.
2 For a nonexistent PMC, no soft key is displayed.

7.4.5 Note on Inputting of Sequence Program

When reading a sequence program during execution of the ladder program, there are the following methods.

- The execution of the ladder program is stopped and new ladder program is read.
- The execution of the ladder program is not stopped. The ladder program is exchanged and running continuously after the completion of reading of the ladder program.

For the way to read a sequence program without stopping the ladder, set the CNC parameter No. 11933#5 to 1. See “2.4.3 CNC Parameters Related to the PMCs” for details.

After understanding the following warning well, read a sequence program.

> ⚠ **WARNING**
>
> 1 When reading a ladder program, executed ladder program is stopped. Even If the setting that a sequence program can be read without stopping the ladder is chosen, executed ladder would be stopped when improper file is read or you cancel the operation of reading during reading a sequence program. When the ladder program is stopped, controls, safety features and monitoring by the ladder program do not work. And it may cause an unexpected machine behavior. Before reading a ladder program, make it sure that the machine is proper status and nobody is near the machine.
>
> 2 If the setting that a sequence program can be read without stopping the ladder is chosen, the ladder program is exchanged after the completion of reading of the ladder program. When reading the ladder program that the assignment of signal addresses is changed, it may cause an unexpected machine behavior. Before reading a ladder program, make it sure that the machine is proper status and nobody is near the machine.
>
> 3 When stopping executed ladder program, the terminate procedure of the ladder program may not complete. In such a case, modify the ladder program referring to Section 4.15.

7.4.6 Outputting a Sequence Program to the Memory Card or the USB Memory

A sequence program can be output from a PMC to the memory card or the USB memory. To use this function, perform the operation described below on the I/O screen.

> **NOTE**
> This operation can be performed only when the operation condition allows sequence program output. For details, see Section 6.2.

(1) On the I/O screen, make the following settings with the query selection cursor and option selection cursor:

Query	Setting
PMC	(Output target PMC)
DEVICE	MEMORY CARD or USB MEMORY
FUNCTION	WRITE
KIND OF DATA	SEQUENCE PROGRAM

For the setting of an output target PMC, see Subsection 7.4.4.

(2) Move the query selection cursor to FILE NAME and enter a file name.
You should enter the file name with "8.3 format" that is constructed with base name, less than 8 characters, dot "." and extension, less than 3 characters. In case of the USB memory, a file name is up to 32 characters.
Or, press the [NEW NAME] soft key to set a new file name.

(3) Press the [EXEC] soft key to output the sequence program.
Press the [CANCEL] soft key to stop the operation.

(4) If the specified file name already exists on a memory card or a USB memory, the following message will be displayed. If you want to overwrite the file, press the [YES] soft key. And, if you want to cancel the output, press the [NO] key.

"THIS FILE NAME IS ALREADY USED. OVERWRITE IT?"

> **NOTE**
> 1 For the supported memory card/USB memory, see Subsection 7.4.1.
> 2 A folder cannot be specified for an output.
> 3 In case of the USB memory, “FORFANUC” cannot be used for the first 8 characters of the file name.

7.4.7 Inputting a Sequence Program from the Memory Card or the USB Memory

A sequence program can be input from the memory card or the USB memory to a PMC. To use this function, perform the operation described below on the I/O screen.

> ⚠ **WARNING**
> When the sequence program being executed is updated to the sequence program whose symbols are assigned to the different addresses, the signal state may be unsuitable. If you activate the sequence program in this state, the machine may behave in an unexpected way, and there is an extreme risk of death or serious injury, as well as the likelihood of tools, work pieces and the machine being damaged. Therefore, initialize the signals if needed before starting the updated sequence program.

> ⚠ **CAUTION**
> When editing FB definitions and FB instances by the offline editing function on FANUC LADDER-III, the addresses assigned to the parameters and variables of function block will be changed. Therefore, the parameters and variables of all function blocks will be initialized by 0 when the sequence program is inputted into CNC. (See “11.1.4 Assignment of FB variable” for details.)

> **NOTE**
> 1 This operation can be performed only when the operation condition allows sequence program input. For details, see Section 6.2.
> 2 In a sequence program which uses extended symbol and comment format, if you edit the symbol / comment data of the sequence program by FANUC LADDER-III and store it into CNC with K903.5=1, the address area for automatically assignment will be initialized to 0.

(1) On the I/O screen, make the following settings with the query selection cursor and option selection cursor:

Query	Setting
DEVICE	MEMORY CARD or USB MEMORY
FUNCTION	READ

(2) Specify an input target sequence program by performing the following operations:
- Move the query selection cursor to FILE NO., then key in an input target file number. At this time, the FILE NAME field displays the file name corresponding to the entered file number.
- Move the query selection cursor to FILE NAME, then key in the input target file name.
- Switch the screen display to the list screen, then select the input target file.
  For the list screen, see Subsection 7.4.3.

NOTE

1 If a value is set in the FILE NO. field, and a file name not corresponding to the file number is entered in the FILE NAME field when FILE NO. and FILE NAME are displayed at the same time, the value set in the FILE NO. field is erased, and the setting in the FILE NAME field becomes valid.

2 A folder cannot be specified for an input subject. When the specified FILE NO. is a folder, the following message is displayed.
"FOLDER CANNOT BE SPECIFIED".

(3) Press the [EXEC] soft key.
A warning message is displayed for the reading.
The reading starts when pressing the [EXEC] soft key again. The execution of the ladder program is stopped automatically.
The ladder program can be read without stopping the ladder program. See 7.4.5 for details.
When pressing the [CANCEL] soft key, the reading processing is canceled.

⚠ **WARNING**

1 When reading a ladder program, executed ladder program is stopped. Even If the setting that a sequence program can be read without stopping the ladder is chosen, executed ladder would be stopped when improper file is read or you cancel the operation of reading during reading a sequence program. When the ladder program is stopped, controls, safety features and monitoring by the ladder program do not work. And it may cause an unexpected machine behavior. Before reading a ladder program, make it sure that the machine is proper status and nobody is near the machine.

2 If the setting that a sequence program can be read without stopping the ladder is chosen, the ladder program is exchanged after the completion of reading of the ladder program. When reading the ladder program that the assignment of signal addresses is changed, it may cause an unexpected machine behavior. Before reading a ladder program, make it sure that the machine is proper status and nobody is near the machine.

3 When stopping executed ladder program, the terminate procedure of the ladder program may not complete. In such a case, modify the ladder program referring to Section 4.15.

NOTE

1 For the supported memory card/USB memory, see Subsection 7.4.1.

2 When the format of a specified file cannot be recognized, the read operation is terminated abnormally with the following message:
"UNKNOWN FILE FORMAT"

3 In case of the USB memory, "FORFANUC" cannot be used for the first 8 characters of the file name.

7.4.8 Comparing Sequence Programs with Memory Card Files or USB Memory Files

A sequence program comparison can be made between the PMC and memory card or USB memory. To use this function, perform the operation described below on the I/O screen.

> **NOTE**
> Compare operation can be performed only when the operation condition allows sequence program output. For details, see Section 6.2.

(1) On the I/O screen, make the following settings with the query selection cursor and option selection cursor:

Query	Setting
DEVICE	MEMORY CARD or USB MEMORY
FUNCTION	COMPARE

(2) Specify a sequence program to be compared, by performing the following operations:
- Move the query selection cursor to FILE NO., then key in a compare target file number. At this time, the FILE NAME field displays the file name corresponding to the entered file number.
- Move the query selection cursor to FILE NAME, then key in the compare target file name.
- Switch the screen display to the list screen, and then select the compare target file.
  For the list screen, see Subsection 7.4.3.

> **NOTE**
> 1 If a value is set in the FILE NO. field, and a file name not corresponding to the file number is entered in the FILE NAME field when FILE NO. and FILE NAME are displayed at the same time, the value set in the FILE NO. field is erased, and the setting in the FILE NAME field becomes valid.
> 2 A folder cannot be specified for a compare subject. When the specified FILE NO. is a folder, the following message is displayed.
> "FOLDER CANNOT BE SPECIFIED".

(3) Press the [EXEC] soft key to execute a sequence program comparison.
Press the [CANCEL] soft key to stop the operation.

> **NOTE**
> 1 For the supported memory card/USB memory, see Subsection 7.4.1.
> 2 When the format of a specified file cannot be recognized, the compare operation is terminated abnormally with the following message:
> "UNKNOWN FILE FORMAT"
> 3 In case of the USB memory, "FORFANUC" cannot be used for the first 8 characters of the file name.

7.4.9 Saving Sequence Programs to the Flash ROM

Sequence programs can be saved from a PMC to the flash ROM. To use this function, perform the operation described below on the I/O screen.

> **NOTE**
> This operation can be performed only when the operation condition allows sequence program output. For details, see Section 6.2.

(1) On the I/O screen, make the following settings with the query selection cursor and option selection cursor:

Query	Setting
PMC	(Output target PMC)
DEVICE	FLASH ROM
FUNCTION	WRITE
KIND OF DATA	SEQUENCE PROGRAM

For the setting of an output target PMC, see Subsection 7.4.4.

(2) Press the [EXEC] soft key to save sequence programs.
When writing to the flash ROM is performed, the processing cannot be stopped.

> **NOTE**
> When programs are written, flash ROM initialization may consume some time. During initialization, "INITIALIZING FLASH ROM." is displayed in the STATUS display field.

7.4.10 Inputting Sequence Programs from the Flash ROM

Sequence programs can be inputted from the flash ROM to a PMC. To use this function, perform the operation described below on the I/O screen.

> ⚠ **WARNING**
> When the sequence program being executed is updated to the sequence program whose symbols are assigned to the different addresses, the signal state may be unsuitable. If you activate the sequence program in this state, the machine may behave in an unexpected way, and there is an extreme risk of death or serious injury, as well as the likelihood of tools, work pieces and the machine being damaged. Therefore, initialize the signals if needed before starting the updated sequence program.

> ⚠ **CAUTION**
> When editing FB definitions and FB instances by the offline editing function on FANUC LADDER-III, the addresses assigned to the parameters and variables of function block will be changed. Therefore, the parameters and variables of all function blocks will be initialized by 0 when the sequence program is inputted into CNC. (See “11.1.4 Assignment of FB variable” for details.)

> **NOTE**
> 1 This operation can be performed only when the operation condition allows sequence program input. For details, see Section 6.2.
> 2 In a sequence program which uses extended symbol and comment format, if you edit the symbol / comment data of the sequence program by FANUC LADDER-III and store it into CNC with K903.5=1, the address area for automatically assignment will be initialized to 0.

(1) On the I/O screen, make the following settings with the query selection cursor and option selection cursor:

Query	Setting
PMC	(Input target PMC)
DEVICE	FLASH ROM
FUNCTION	READ

For the setting of an input target PMC, see Subsection 7.4.4.

(2) Press the [EXEC] soft key to input sequence programs.
A warning message is displayed for the reading.
The reading starts when pressing the [EXEC] soft key again. The execution of the ladder program is stopped automatically.
The ladder program can be read without stopping the ladder program. See 7.4.5 for details.
The reading processing cannot be stopped during reading from the flash ROM,

⚠ **WARNING**

1. When reading a ladder program, executed ladder program is stopped. Even If the setting that a sequence program can be read without stopping the ladder is chosen, executed ladder would be stopped when improper file is read or you cancel the operation of reading during reading a sequence program. When the ladder program is stopped, controls, safety features and monitoring by the ladder program do not work. And it may cause an unexpected machine behavior. Before reading a ladder program, make it sure that the machine is proper status and nobody is near the machine.
2. If the setting that a sequence program can be read without stopping the ladder is chosen, the ladder program is exchanged after the completion of reading of the ladder program. When reading the ladder program that the assignment of signal addresses is changed, it may cause an unexpected machine behavior. Before reading a ladder program, make it sure that the machine is proper status and nobody is near the machine.
3. When stopping executed ladder program, the terminate procedure of the ladder program may not complete. In such a case, modify the ladder program referring to Section 4.15.

7.4.11 Comparing Sequence Programs with Flash ROM Files

A sequence program comparison can be made between the PMC and flash ROM. To use this function, perform the operation described below on the I/O screen.

> **NOTE**
> Compare operation can be performed only when the operation condition allows sequence program output. For details, see Section 6.2.

(1) On the I/O screen, make the following settings with the query selection cursor and option selection cursor:

Query	Setting
PMC	(Compare target PMC)
DEVICE	FLASH ROM
FUNCTION	COMPARE

For the setting of a compare target PMC, see Subsection 7.4.4.

(2) Press the [EXEC] soft key to execute a sequence program comparison.
When a sequence program comparison with the flash ROM is performed, the processing cannot be stopped.

7.4.12 Outputting a Sequence Program to the FLOPPY

A sequence program can be output from a PMC to a Floppy Cassette or Handy File connected via RS-232C. To use this function, perform the operation described below on the I/O screen. To set the communication parameters, display the port setting screen by pressing the [PORT SETING] soft key. For the port setting screen, see Subsection 7.4.2.

> **NOTE**
> This operation can be performed only when the operation condition allows sequence program output. For details, see Section 6.2.

(1) On the I/O screen, make the following settings with the query selection cursor and option selection cursor:

Query	Setting
PMC	(Output target PMC)
DEVICE	FLOPPY
FUNCTION	WRITE
KIND OF DATA	SEQUENCE PROGRAM

For the setting of an output target PMC, see Subsection 7.4.4.

(2) Move the query selection cursor to FILE NAME and enter a file name.
When using a MS-DOS formatted floppy disk, you should enter the file name with "8.3 format" that is constructed with base name, less than 8 characters, dot "." and extension, less than 3 characters.
When using a FANUC formatted floppy disk, you should enter the file name with less than 17 characters.
Or, press the [NEW NAME] soft key to set a new file name.

(3) Press the [EXEC] soft key to output the sequence program.
Press the [CANCEL] soft key to stop the operation.

7.4.13 Inputting a Sequence Program from the FLOPPY

A sequence program can be input to a PMC from a Floppy Cassette or Handy File connected via RS-232C. To use this function, perform the operation described below on the I/O screen. To set the communication parameters, display the port setting screen by pressing the [PORT SETING] soft key. For the port setting screen, see Subsection 7.4.2.

> ⚠ **WARNING**
> When the sequence program being executed is updated to the sequence program whose symbols are assigned to the different addresses, the signal state may be unsuitable. If you activate the sequence program in this state, the machine may behave in an unexpected way, and there is an extreme risk of death or serious injury, as well as the likelihood of tools, work pieces and the machine being damaged. Therefore, initialize the signals if needed before starting the updated sequence program.

> ⚠ **CAUTION**
> When editing FB definitions and FB instances by the offline editing function on FANUC LADDER-III, the addresses assigned to the parameters and variables of function block will be changed. Therefore, the parameters and variables of all function blocks will be initialized by 0 when the sequence program is inputted into CNC. (See "11.1.4 Assignment of FB variable" for details.)

> **NOTE**
> 1 This operation can be performed only when the operation condition allows sequence program input. For details, see Section 6.2.
> 2 In a sequence program which uses extended symbol and comment format, if you edit the symbol / comment data of the sequence program by FANUC LADDER-III and store it into CNC with K903.5=1, the address area for automatically assignment will be initialized to 0.

(1) On the I/O screen, make the following settings with the query selection cursor and option selection cursor:

Query	Setting
DEVICE	FLOPPY
FUNCTION	READ

(2) Specify an input target sequence program by performing the following operations:

- Move the query selection cursor to FILE NO., then key in an input target file number. At this time, the FILE NAME field displays the file name corresponding to the entered file number.
- Move the query selection cursor to FILE NAME, then key in the input target file name.
- Switch the screen display to the list screen, and then select the input target file.
  For the list screen, see Subsection 7.4.3.

> **NOTE**
> If a value is set in the FILE NO. field, and a file name not corresponding to the file number is entered in the FILE NAME field when FILE NO. and FILE NAME are displayed at the same time, the value set in the FILE NO. field is erased, and the setting in the FILE NAME field becomes valid.

(3) Press the [EXEC] soft key.
A warning message is displayed for the reading.
The reading starts when pressing the [EXEC] soft key again. The execution of the ladder program is stopped automatically.
The ladder program can be read without stopping the ladder program. See 7.4.5 for details.
When pressing the [CANCEL] soft key, the reading processing is canceled.

> ⚠ **WARNING**
> 1 When reading a ladder program, executed ladder program is stopped. Even If the setting that a sequence program can be read without stopping the ladder is chosen, executed ladder would be stopped when improper file is read or you cancel the operation of reading during reading a sequence program. When the ladder program is stopped, controls, safety features and monitoring by the ladder program do not work. And it may cause an unexpected machine behavior. Before reading a ladder program, make it sure that the machine is proper status and nobody is near the machine.
> 2 If the setting that a sequence program can be read without stopping the ladder is chosen, the ladder program is exchanged after the completion of reading of the ladder program. When reading the ladder program that the assignment of signal addresses is changed, it may cause an unexpected machine behavior. Before reading a ladder program, make it sure that the machine is proper status and nobody is near the machine.
> 3 When stopping executed ladder program, the terminate procedure of the ladder program may not complete. In such a case, modify the ladder program referring to Section 4.15.

> **NOTE**
> 1 When the format of a specified file cannot be recognized, the read operation is terminated abnormally with the following message:
> "UNKNOWN FILE FORMAT"

7.4.14 Comparing Sequence Programs with FLOPPY Files

A sequence program comparison can be made between the PMC and Floppy Cassette or Handy File connected via RS-232C. To use this function, perform the operation described below on the I/O screen. To set the communication parameters, display the port setting screen by pressing the [PORT SETING] soft key. For the port setting screen, see Subsection 7.4.2.

> **NOTE**
> Compare operation can be performed only when the operation condition allows sequence program output. For details, see Section 6.2.

(1) On the I/O screen, make the following settings with the query selection cursor and option selection cursor:

Query	Setting
DEVICE	FLOPPY
FUNCTION	COMPARE

(2) Specify a sequence program to be compared, by performing the following operations:

- Move the query selection cursor to FILE NO., then key in a compare target file number. At this time, the FILE NAME field displays the file name corresponding to the entered file number.
- Move the query selection cursor to FILE NAME, then key in the compare target file name.
- Switch the screen display to the list screen, and then select the compare target file.
  For the list screen, see Subsection 7.4.3.

> **NOTE**
> If a value is set in the FILE NO. field, and a file name not corresponding to the file number is entered in the FILE NAME field when FILE NO. and FILE NAME are displayed at the same time, the value set in the FILE NO. field is erased, and the setting in the FILE NAME field becomes valid.

(3) Press the [EXEC] soft key to execute a sequence program comparison.
Press the [CANCEL] soft key to stop the operation.

> **NOTE**
> 1 When the format of a specified file cannot be recognized, the compare operation is terminated abnormally with the following message:
> "UNKNOWN FILE FORMAT"

7.4.15 Outputting Sequence Programs to Other Devices (via the RS-232C Port)

Sequence programs can be output from a PMC to another type of device connected via RS-232C. To use this function, perform the operation described below on the I/O screen. To set the communication parameters, display the port setting screen by pressing the [PORT SETING] soft key. For the port setting screen, see Subsection 7.4.2.

> **NOTE**
> This operation can be performed only when the operation condition allows sequence program output. For details, see Section 6.2.

(1) On the I/O screen, make the following settings with the query selection cursor and option selection cursor:

Query	Setting
PMC	(Output target PMC)
DEVICE	OTHERS
FUNCTION	WRITE
KIND OF DATA	SEQUENCE PROGRAM

For the setting of an output target PMC, see Subsection 7.4.4.

(2) Press the [EXEC] soft key to output sequence programs.
Press the [CANCEL] soft key to stop the operation.

7.4.16 Inputting Sequence Programs from Other Devices (via the RS-232C Port)

Sequence programs can be input to a PMC from another type of device connected via RS-232C. To use this function, perform the operation described below on the I/O screen. To set the communication parameters, display the port setting screen by pressing the [PORT SETING] soft key. For the port setting screen, see Subsection 7.4.2.

> ⚠ **WARNING**
> When the sequence program being executed is updated to the sequence program whose symbols are assigned to the different addresses, the signal state may be unsuitable. If you activate the sequence program in this state, the machine may behave in an unexpected way, and there is an extreme risk of death or serious injury, as well as the likelihood of tools, work pieces and the machine being damaged. Therefore, initialize the signals if needed before starting the updated sequence program.

> ⚠ **CAUTION**
> When editing FB definitions and FB instances by the offline editing function on FANUC LADDER-III, the addresses assigned to the parameters and variables of function block will be changed. Therefore, the parameters and variables of all function blocks will be initialized by 0 when the sequence program is inputted into CNC. (See “11.1.4 Assignment of FB variable” for details.)

> **NOTE**
> 1 This operation can be performed only when the operation condition allows sequence program input. For details, see Section 6.2.
> 2 In a sequence program which uses extended symbol and comment format, if you edit the symbol / comment data of the sequence program by FANUC LADDER-III and store it into CNC with K903.5=1, the address area for automatically assignment will be initialized to 0.

(1) On the I/O screen, make the following settings with the query selection cursor and option selection cursor:

Query	Setting
DEVICE	OTHERS
FUNCTION	READ

(2) Press the [EXEC] soft key.
A warning message is displayed for the reading.
The reading starts when pressing the [EXEC] soft key again. The execution of the ladder program is stopped automatically.
The ladder program can be read without stopping the ladder program. See 7.4.5 for details.
When pressing the [CANCEL] soft key, the reading processing is canceled.

⚠ **WARNING**

1 When reading a ladder program, executed ladder program is stopped. Even If the setting that a sequence program can be read without stopping the ladder is chosen, executed ladder would be stopped when improper file is read or you cancel the operation of reading during reading a sequence program. When the ladder program is stopped, controls, safety features and monitoring by the ladder program do not work. And it may cause an unexpected machine behavior. Before reading a ladder program, make it sure that the machine is proper status and nobody is near the machine.
2 If the setting that a sequence program can be read without stopping the ladder is chosen, the ladder program is exchanged after the completion of reading of the ladder program. When reading the ladder program that the assignment of signal addresses is changed, it may cause an unexpected machine behavior. Before reading a ladder program, make it sure that the machine is proper status and nobody is near the machine.
3 When stopping executed ladder program, the terminate procedure of the ladder program may not complete. In such a case, modify the ladder program referring to Section 4.15.

NOTE

1 When the format of a specified file cannot be recognized, the read operation is terminated abnormally with the following message:
"UNKNOWN FILE FORMAT"

7.4.17 Comparing Sequence Programs with Files of Other Devices (via the RS-232C Port)

A sequence program comparison can be made between the PMC and another type of device connected via RS-232C. To use this function, perform the operation described below on the I/O screen. To set the communication parameters, display the port setting screen by pressing the [PORT SETING] soft key. For the port setting screen, see Subsection 7.4.2.

NOTE

Compare operation can be performed only when the operation condition allows sequence program output. For details, see Section 6.2.

(1) On the I/O screen, make the following settings with the query selection cursor and option selection cursor:

Query	Setting
DEVICE	OTHERS
FUNCTION	COMPARE

(2) Press the [EXEC] soft key to execute a sequence program comparison.
Press the [CANCEL] soft key to stop the operation.

NOTE

1 When the format of a specified file cannot be recognized, the compare operation is terminated abnormally with the following message:
"UNKNOWN FILE FORMAT"

7.4.18 Outputting PMC Parameters to the Memory Card or the USB memory

PMC parameters can be output from a PMC to the memory card or the USB memory. To use this function, perform the operation described below on the I/O screen.

> **NOTE**
> This operation can be performed only when the operation condition allows PMC parameter output. For details, see Section 6.2.

(1) On the I/O screen, make the following settings with the query selection cursor and option selection cursor:

Query	Setting
PMC	(Output target PMC)
DEVICE	MEMORY CARD or USB MEMORY
FUNCTION	WRITE
KIND OF DATA	PARAMETER

For the setting of an output target PMC, see Subsection 7.4.4.

(2) Move the query selection cursor to FILE NAME and enter a file name.
You should enter the file name with "8.3 format" that is constructed with base name, less than 8 characters, dot "." and extension, less than 3 characters. In case of the USB memory, a file name is up to 32 characters.
Or, press the [NEW NAME] soft key to set a new file name.

(3) Press the [EXEC] soft key to output PMC parameters.
Press the [CANCEL] soft key to stop the operation.

(4) If the specified file name already exists on a memory card or a USB memory, the following message will be displayed.
If you want to overwrite the file, press the [YES] soft key. And, if you want to cancel the output, press the [NO] key.

"THIS FILE NAME IS ALREADY USED. OVERWRITE IT?"

> **NOTE**
> 1 For the supported memory card/USB memory, see Subsection 7.4.1.
> 2 A folder cannot be specified for an output subject.
> 3 In case of the USB memory, “FORFANUC” cannot be used for the first 8 characters of the file name.
> 4 When using the Common PMC Memory mode, the PMC Parameter is shared by those PMC paths, too. The PMC Parameter can be inputted or outputted on PMC1.

7.4.19 Inputting PMC Parameters from the Memory Card or the USB Memory

PMC parameters can be input from the memory card or the USB memory to a PMC. To use this function, perform the operation described below on the I/O screen.

> **NOTE**
> This operation can be performed only when the operation condition allows PMC parameter input. For details, see Section 6.2.

(1) On the I/O screen, make the following settings with the query selection cursor and option selection cursor:

Query	Setting
DEVICE	MEMORY CARD or USB MEMORY
FUNCTION	READ

(2) Specify input target PMC parameters by performing the following operations:
- Move the query selection cursor to FILE NO., then key in an input target file number. At this time, the FILE NAME field displays the file name corresponding to the entered file number.
- Move the query selection cursor to FILE NAME, then key in the input target file name.
- Switch the screen display to the list screen, and then select the input target file.
  For the list screen, see Subsection 7.4.3.

> **NOTE**
> 1 If a value is set in the FILE NO. field, and a file name not corresponding to the file number is entered in the FILE NAME field when FILE NO. and FILE NAME are displayed at the same time, the value set in the FILE NO. field is erased, and the setting in the FILE NAME field becomes valid.
> 2 A folder cannot be specified for an input subject. When the specified FILE NO. is a folder, the following message is displayed.
> “FOLDER CANNOT BE SPECIFIED”.

(3) Press the [EXEC] soft key.
Before the reading of the file is started, the following message is displayed to check if read processing may be executed:
"READING PMC PARAMETER (PMCx)"
(As PMCx, the PMC number embedded in the data is displayed. "DCSPMC" is displayed for parameters for dual check safety.)
Press the [EXEC] soft key to continue the operation. When PMC parameters for the conventional model are to be read with the multi-PMC system, select a read source PMC with soft key operation. For PMC selection, see Subsection 7.4.4. Press the [CANCEL] soft key to stop the operation.
If the reading of PMC parameters is continued, the PMC parameters are rewritten even when a ladder program is being executed.

> ⚠ **WARNING**
> When PMC parameters are read, a modified parameter can exercise an unexpected influence on ladder operation. Before reading PMC parameters, make sure that the parameters to be read do not affect ladder operation.

NOTE

1 For the supported memory card/USB memory, see Subsection 7.4.1.
2 When the format of a specified file cannot be recognized, the read operation is terminated abnormally with the following message:
"UNKNOWN FILE FORMAT"
3 In case of the USB memory, “FORFANUC” cannot be used for the first 8 characters of the file name.
4 When using the Common PMC Memory mode, the PMC Parameter is shared by those PMC paths, too. The PMC Parameter can be inputted or outputted on PMC1.

7.4.20 Comparing PMC Parameters with Memory Card Files or USB Memory Files

A PMC parameter comparison can be made between the PMC and memory card or USB memory. To use this function, perform the operation described below on the I/O screen.

> **NOTE**
> Compare operation can be performed only when the operation condition allows PMC parameter output. For details, see Section 6.2.

(1) On the I/O screen, make the following settings with the query selection cursor and option selection cursor:

Query	Setting
DEVICE	MEMORY CARD or USB MEMORY
FUNCTION	COMPARE

(2) Specify PMC parameters to be compared, by performing the following operations:
- Move the query selection cursor to FILE NO., then key in a compare target file number. At this time, the FILE NAME field displays the file name corresponding to the entered file number.
- Move the query selection cursor to FILE NAME, then key in the compare target file name.
- Switch the screen display to the list screen, and then select the compare target file.
  For the list screen, see Subsection 7.4.3.

> **NOTE**
> 1 If a value is set in the FILE NO. field, and a file name not corresponding to the file number is entered in the FILE NAME field when FILE NO. and FILE NAME are displayed at the same time, the value set in the FILE NO. field is erased, and the setting in the FILE NAME field becomes valid.
> 2 A folder cannot be specified for a compare subject. When the specified FILE NO. is a folder, the following message is displayed.
> "FOLDER CANNOT BE SPECIFIED".

(3) Press the [EXEC] soft key to execute a PMC parameter comparison.
When PMC parameters for the conventional model are to be read with the multi-PMC system, select a read source PMC with soft key operation. For PMC selection, see Subsection 7.4.4. Press the [CANCEL] soft key to stop the operation.

> **NOTE**
> 1 For the supported memory card/USB memory, see Subsection 7.4.1.
> 2 When the format of a specified file cannot be recognized, the compare operation is terminated abnormally with the following message:
> "UNKNOWN FILE FORMAT"
> 3 In case of the USB memory, "FORFANUC" cannot be used for the first 8 characters of the file name.
> 4 When using the Common PMC Memory mode, the PMC Parameter is shared by those PMC paths, too. The PMC Parameter can be inputted or outputted on PMC1.

7.4.21 Outputting PMC Parameters to the FLOPPY

PMC parameters can be output from a PMC to a Floppy Cassette or Handy File connected via RS-232C. To use this function, perform the operation described below on the I/O screen. To set the communication parameters, display the port setting screen by pressing the [PORT SETING] soft key. For the port setting screen, see Subsection 7.4.2.

> **NOTE**
> This operation can be performed only when the operation condition allows PMC parameter output. For details, see Section 6.2.

(1) On the I/O screen, make the following settings with the query selection cursor and option selection cursor:

Query	Setting
PMC	(Output target PMC)
DEVICE	FLOPPY
FUNCTION	WRITE
KIND OF DATA	PARAMETER

For the setting of an output target PMC, see Subsection 7.4.4.

(2) Move the query selection cursor to FILE NAME and enter a file name.
When using a MS-DOS formatted floppy disk, you should enter the file name with "8.3 format" that is constructed with base name, less than 8 characters, dot "." and extension, less than 3 characters.
When using a FANUC formatted floppy disk, you should enter the file name with less than 17 characters.
Or, press the [NEW NAME] soft key to set a new file name.

(3) Press the [EXEC] soft key to output the PMC parameters.
Press the [CANCEL] soft key to stop the operation.

> **NOTE**
> When using the Common PMC Memory mode, the PMC Parameter is shared by those PMC paths, too. The PMC Parameter can be inputted or outputted on the 1st-path PMC.

7.4.22 Inputting PMC Parameters from the FLOPPY

PMC parameters can be input to a PMC from a Floppy Cassette or Handy File connected via RS-232C. To use this function, perform the operation described below on the I/O screen. To set the communication parameters, display the port setting screen by pressing the [PORT SETING] soft key. For the port setting screen, see Subsection 7.4.2.

> **NOTE**
> This operation can be performed only when the operation condition allows PMC parameter input. For details, see Section 6.2.

(1) On the I/O screen, make the following settings with the query selection cursor and option selection cursor:

Query	Setting
DEVICE	FLOPPY
FUNCTION	READ

(2) Specify input target PMC parameters by performing the following operations:
- Move the query selection cursor to FILE NO., then key in an input target file number. At this time, the FILE NAME field displays the file name corresponding to the entered file number.
- Move the query selection cursor to FILE NAME, then key in the input target file name.
- Switch the screen display to the list screen, and then select the input target file. For the list screen, see Subsection 7.4.3.

> **NOTE**
> If a value is set in the FILE NO. field, and a file name not corresponding to the file number is entered in the FILE NAME field when FILE NO. and FILE NAME are displayed at the same time, the value set in the FILE NO. field is erased, and the setting in the FILE NAME field becomes valid.

(3) Press the [EXEC] soft key.
Before the reading of the file is started, the following message is displayed to check if read processing may be executed:
"READING PMC PARAMETER (PMCx)"
(As PMCx, the PMC number embedded in the data is displayed. "DCSPMC" is displayed for parameters for dual check safety.)
Press the [EXEC] soft key to continue the operation. When PMC parameters for the conventional model are to be read with the multi-PMC system, select a read source PMC with soft key operation. For PMC selection, see Subsection 7.4.4. Press the [CANCEL] soft key to stop the operation.
If the reading of PMC parameters is continued, the PMC parameters are rewritten even when a ladder program is being executed.

> **NOTE**
> 1 When the format of a specified file cannot be recognized, the read operation is terminated abnormally with the following message:
> "UNKNOWN FILE FORMAT"
> 2 When using the Common PMC Memory mode, the PMC Parameter is shared by those PMC paths, too. The PMC Parameter can be inputted or outputted on PMC1.

> ⚠ **WARNING**
> When PMC parameters are read, a modified parameter can exercise an unexpected influence on ladder operation. Before reading PMC parameters, make sure that the parameters to be read do not affect ladder operation.

7.4.23 Comparing PMC Parameters with FLOPPY Files

A PMC parameter comparison can be made between the PMC and Floppy Cassette or Handy File connected via RS-232C. To use this function, perform the operation described below on the I/O screen. To set the communication parameters, display the port setting screen by pressing the [PORT SETING] soft key. For the port setting screen, see Subsection 7.4.2.

> **NOTE**
> Compare operation can be performed only when the operation condition allows PMC parameter output. For details, see Section 6.2.

(1) On the I/O screen, make the following settings with the query selection cursor and option selection cursor:

Query	Setting
DEVICE	FLOPPY
FUNCTION	COMPARE

(2) Specify PMC parameters to be compared, by performing the following operations:

- Move the query selection cursor to FILE NO., then key in a compare target file number. At this time, the FILE NAME field displays the file name corresponding to the entered file number.
- Move the query selection cursor to FILE NAME, then key in the compare target file name.
- Switch the screen display to the list screen, and then select the compare target file.
  For the list screen, see Subsection 7.4.3.

> **NOTE**
> If a value is set in the FILE NO. field, and a file name not corresponding to the file number is entered in the FILE NAME field when FILE NO. and FILE NAME are displayed at the same time, the value set in the FILE NO. field is erased, and the setting in the FILE NAME field becomes valid.

(3) Press the [EXEC] soft key to execute a PMC parameter comparison.
When PMC parameters for the conventional model are to be read with the multi-PMC system, select a read source PMC with soft key operation. For PMC selection, see Subsection 7.4.4. Press the [CANCEL] soft key to stop the operation.

> **NOTE**
> 1 When the format of a specified file cannot be recognized, the compare operation is terminated abnormally with the following message:
> "UNKNOWN FILE FORMAT"
> 2 When using the Common PMC Memory mode, the PMC Parameter is shared by those PMC paths, too. The PMC Parameter can be inputted or outputted on PMC1.

7.4.24 Outputting PMC Parameters to Other Devices (via the RS-232C Port)

PMC parameters can be output from a PMC to another type of device connected via RS-232C. To use this function, perform the operation described below on the I/O screen. To set the communication parameters, display the port setting screen by pressing the [PORT SETING] soft key. For the port setting screen, see Subsection 7.4.2.

> **NOTE**
> This operation can be performed only when the operation condition allows PMC parameter output. For details, see Section 6.2.

(1) On the I/O screen, make the following settings with the query selection cursor and option selection cursor:

Query	Setting
PMC	(Output target PMC)
DEVICE	OTHERS
FUNCTION	WRITE
KIND OF DATA	PARAMETER

For the setting of an output target PMC, see Subsection 7.4.4.

(2) Press the [EXEC] soft key to output PMC parameters.
Press the [CANCEL] soft key to stop the operation.

> **NOTE**
> When using the Common PMC Memory mode, the PMC Parameter is shared by those PMC paths, too. The PMC Parameter can be inputted or outputted on the 1st-path PMC.

7.4.25 Inputting PMC Parameters from Other Devices (via the RS-232C Port)

PMC parameters can be input to a PMC from another type of device connected via RS-232C. To use this function, perform the operation described below on the I/O screen. To set the communication parameters, display the port setting screen by pressing the [PORT SETING] soft key. For the port setting screen, see Subsection 7.4.2.

> **NOTE**
> This operation can be performed only when the operation condition allows PMC parameter input. For details, see Section 6.2.

(1) On the I/O screen, make the following settings with the query selection cursor and option selection cursor:

Query	Setting
DEVICE	OTHERS
FUNCTION	READ

(2) Press the [EXEC] soft key.
Before the reading of a file is started, the following message is displayed to check if read processing may be executed:
"READING PMC PARAMETER (PMCx)"
(As PMCx, the PMC number embedded in the data is displayed. "DCSPMC" is displayed for parameters for dual check safety.)
Press the [EXEC] soft key to continue the operation. When PMC parameters for the conventional model are to be read with the multi-PMC system, select a read source PMC with soft key operation. For PMC selection, see Subsection 7.4.4. Press the [CANCEL] soft key to stop the operation.
If the reading of PMC parameters is continued, the PMC parameters are rewritten even when a ladder program is being executed.

> **NOTE**
> 1 When the format of a specified file cannot be recognized, the read operation is terminated abnormally with the following message:
> "UNKNOWN FILE FORMAT"
> 2 When using the Common PMC Memory mode, the PMC Parameter is shared by those PMC paths, too. The PMC Parameter can be inputted or outputted on PMC1.

> ⚠ **WARNING**
> When PMC parameters are read, a modified parameter can exercise an unexpected influence on ladder operation. Before reading PMC parameters, make sure that the parameters to be read do not affect ladder operation.

7.4.26 Comparing PMC Parameters with Files of Other Devices (via the RS-232C Port)

A PMC parameter comparison can be made between the PMC and another type of device connected via RS-232C. To use this function, perform the operation described below on the I/O screen. To set the communication parameters, display the port setting screen by pressing the [PORT SETING] soft key. For the port setting screen, see Subsection 7.4.2.

> **NOTE**
> Compare operation can be performed only when the operation condition allows PMC parameter output. For details, see Section 6.2.

(1) On the I/O screen, make the following settings with the query selection cursor and option selection cursor:

Query	Setting
DEVICE	OTHERS
FUNCTION	COMPARE

(2) Press the [EXEC] soft key to execute a PMC parameter comparison.
When PMC parameters for the conventional model are to be read with the multi-PMC system, select a read source PMC with soft key operation. For PMC selection, see Subsection 7.4.4. Press the [CANCEL] soft key to stop the operation.

> **NOTE**
> 1 When the format of a specified file cannot be recognized, the compare operation is terminated abnormally with the following message:
> "UNKNOWN FILE FORMAT"
> 2 When using the Common PMC Memory mode, the PMC Parameter is shared by those PMC paths, too. The PMC Parameter can be inputted or outputted on PMC1.

7.4.27 Outputting Message Data for Multi-Language Display to the Memory Card or the USB memory

A message data for multi-language display can be output from a PMC to the memory card or the USB memory. To use this function, perform the operation described below on the I/O screen.

> **NOTE**
> This operation can be performed only when the operation condition allows message data for multi-language display output. For details, see Section 6.2.

(1) On the I/O screen, make the following settings with the query selection cursor and option selection cursor:

Query	Setting
PMC	(Output target PMC)
DEVICE	MEMORY CARD or USB MEMORY
FUNCTION	WRITE
KIND OF DATA	MESSAGE

For the setting of an output target PMC, see Subsection 7.4.4.

(2) Move the query selection cursor to FILE NAME and enter a file name.
You should enter the file name with "8.3 format" that is constructed with base name, less than 8 characters, dot "." and extension, less than 3 characters. In case of the USB memory, a file name is up to 32 characters.
Or, press the [NEW NAME] soft key to set a new file name.

(3) Press the [EXEC] soft key to output the message data for multi-language display.
Press the [CANCEL] soft key to stop the operation.

(4) If the specified file name already exists on a memory card or a USB memory, the following message will be displayed.
If you want to overwrite the file, press the [YES] soft key. And, if you want to cancel the output, press the [NO] key.

"THIS FILE NAME IS ALREADY USED. OVERWRITE IT?"

> **NOTE**
> 1 For the supported memory card/USB memory, see Subsection 7.4.1.
> 2 A folder cannot be specified for an output subject.
> 3 In case of the USB memory, “FORFANUC” cannot be used for the first 8 characters of the file name.

7.4.28 Inputting Message Data for Multi-Language Display from the Memory Card or the USB memory

A message data for multi-language display can be input from the memory card or the USB memory to a PMC. To use this function, perform the operation described below on the I/O screen.

> **NOTE**
> This operation can be performed only when the operation condition allows message data for multi-language display input. For details, see Section 6.2.

(1) On the I/O screen, make the following settings with the query selection cursor and option selection cursor:

Query	Setting
DEVICE	MEMORY CARD or USB MEMORY
FUNCTION	READ

(2) Specify an input target message data for multi-language display by performing the following operations:

- Move the query selection cursor to FILE NO., then key in an input target file number. At this time, the FILE NAME field displays the file name corresponding to the entered file number.
- Move the query selection cursor to FILE NAME, then key in the input target file name.
- Switch the screen display to the list screen, and then select the input target file.
  For the list screen, see Subsection 7.4.3.

> **NOTE**
> 1 If a value is set in the FILE NO. field, and a file name not corresponding to the file number is entered in the FILE NAME field when FILE NO. and FILE NAME are displayed at the same time, the value set in the FILE NO. field is erased, and the setting in the FILE NAME field becomes valid.
> 2 A folder cannot be specified for an input subject. When the specified FILE NO. is a folder, the following message is displayed.
> "FOLDER CANNOT BE SPECIFIED".

(3) Press the [EXEC] soft key.
Before the reading of the file is started, the following message is displayed to check if read processing may be executed:

STATUS : READING MESSAGE DATA (PMC1)
<WARNING>
READING SEQUENCE PROGRAM OR PMC PARAMETER REQUIRES SPECIAL CARE.
* READING IMPROPER DATA MAY CAUSE UNEXPECTED MOVEMENT OF MACHINE.
* PROGRAM WILL BE STOPPED BY READING SEQUENCE PROGRAM.
ARE YOU SURE YOU WANT TO READ THIS FILE?

Press the [EXEC] soft key to continue the operation. Press the [CANCEL] soft key to stop the operation.
If the reading of the message data for multi-language display is continued, the ladder program being executed is automatically stopped.

⚠ **WARNING**

1. If a message data for multi-language display is read while ladder program is being executed, the ladder program being executed is automatically stopped. Take special care when stopping a ladder program. If a ladder program is stopped at an inadequate timing or in an inadequate machine state, the machine can make an unexpected movement. Moreover, when a ladder program is stopped, the safety feature and monitoring based on the ladder program do not function. Before stopping a ladder program, make sure that the machine state is normal and that there is no person near the machine.
2. When an attempt is made to stop the ladder program being executed, the stop processing may continue endlessly, depending on the ladder operation. In such a case, modify the ladder program according to Section 4.15.

NOTE

1. For the supported memory card/USB memory, see Subsection 7.4.1.
2. When the format of a specified file cannot be recognized, the read operation is terminated abnormally with the following message:
   "UNKNOWN FILE FORMAT"
3. In case of the USB memory, “FORFANUC” cannot be used for the first 8 characters of the file name.

7.4.29 Comparing Message Data for Multi-Language Display with Memory Card Files or USB Memory Files

A message data for multi-language display comparison can be made between the PMC and memory card or USB memory. To use this function, perform the operation described below on the I/O screen.

> **NOTE**
> Compare operation can be performed only when the operation condition allows message data for multi-language display output. For details, see Section 6.2.

(1) On the I/O screen, make the following settings with the query selection cursor and option selection cursor:

Query	Setting
DEVICE	MEMORY CARD or USB MEMORY
FUNCTION	COMPARE

(2) Specify a message data for multi-language display to be compared, by performing the following operations:
- Move the query selection cursor to FILE NO., then key in a compare target file number. At this time, the FILE NAME field displays the file name corresponding to the entered file number.
- Move the query selection cursor to FILE NAME, then key in the compare target file name.
- Switch the screen display to the list screen, and then select the compare target file.
  For the list screen, see Subsection 7.4.3.

> **NOTE**
> 1 If a value is set in the FILE NO. field, and a file name not corresponding to the file number is entered in the FILE NAME field when FILE NO. and FILE NAME are displayed at the same time, the value set in the FILE NO. field is erased, and the setting in the FILE NAME field becomes valid.
> 2 A folder cannot be specified for a compare subject. When the specified FILE NO. is a folder, the following message is displayed.
> “FOLDER CANNOT BE SPECIFIED”.

(3) Press the [EXEC] soft key to execute a message data for multi-language display comparison.
Press the [CANCEL] soft key to stop the operation.

> **NOTE**
> 1 For the supported memory card/USB memory, see Subsection 7.4.1.
> 2 When the format of a specified file cannot be recognized, the compare operation is terminated abnormally with the following message:
> "UNKNOWN FILE FORMAT"
> 3 In case of the USB memory, “FORFANUC” cannot be used for the first 8 characters of the file name.

7.4.30 Saving Message Data for Multi-Language Display to the Flash ROM

A message data for multi-language display can be saved from a PMC to the flash ROM. To use this function, perform the operation described below on the I/O screen.

> **NOTE**
> This operation can be performed only when the operation condition allows message data for multi-language display output. For details, see Section 6.2.

(1) On the I/O screen, make the following settings with the query selection cursor and option selection cursor:

Query	Setting
PMC	(Output target PMC)
DEVICE	FLASH ROM
FUNCTION	WRITE
KIND OF DATA	MESSAGE

For the setting of an output target PMC, see Subsection 7.4.4.

(2) Press the [EXEC] soft key to save a message data for multi-language display.
When writing to the flash ROM is performed, the processing cannot be stopped.

> **NOTE**
> When programs are written, flash ROM initialization may consume some time. During initialization, "INITIALIZING FLASH ROM." is displayed in the STATUS display field.

7.4.31 Inputting Message Data for Multi-Language Display from the Flash ROM

A message data for multi-language display can be inputted from the flash ROM to a PMC. To use this function, perform the operation described below on the I/O screen.

NOTE
This operation can be performed only when the operation condition allows message data for multi-language display input. For details, see Section 6.2.

(1) On the I/O screen, make the following settings with the query selection cursor and option selection cursor:

Query	Setting
PMC	(Input target PMC)
DEVICE	FLASH ROM
FUNCTION	READ

For the setting of an input target PMC, see Subsection 7.4.4.

(2) Press the [EXEC] soft key to input message data for multi-language display.
When reading from the flash ROM is performed, the processing cannot be stopped.
If the reading of message data for multi-language display is continued, the ladder program being executed is automatically stopped.

⚠ **WARNING**
1 If a message data for multi-language display is read while ladder program is being executed, the ladder program being executed is automatically stopped. Take special care when stopping a ladder program. If a ladder program is stopped at an inadequate timing or in an inadequate machine state, the machine can make an unexpected movement. Moreover, when a ladder program is stopped, the safety feature and monitoring based on the ladder program do not function. Before stopping a ladder program, make sure that the machine state is normal and that there is no person near the machine.
2 When an attempt is made to stop the ladder program being executed, the stop processing may continue endlessly, depending on the ladder operation. In such a case, modify the ladder program according to Section 4.15.

7.4.32 Comparing Message Data for Multi-Language Display with Flash ROM Files

A message data for multi-language display comparison can be made between the PMC and flash ROM. To use this function, perform the operation described below on the I/O screen.

> **NOTE**
> Compare operation can be performed only when the operation condition allows message data for multi-language display output. For details, see Section 6.2.

(1) On the I/O screen, make the following settings with the query selection cursor and option selection cursor:

Query	Setting
PMC	(Compare target PMC)
DEVICE	FLASH ROM
FUNCTION	COMPARE

For the setting of a compare target PMC, see Subsection 7.4.4.

(2) Press the [EXEC] soft key to execute a message data for multi-language display comparison.
When a message data for multi-language display comparison with the flash ROM is performed, the processing cannot be stopped.

7.4.33 Outputting Trace setting data to the Memory Card or the USB Memory

A trace setting data can be output from a PMC to the memory card or the USB memory. To use this function, perform the operation described below on the I/O screen.

NOTE
This operation can be performed only when the operation condition allows trace setting data output. For details, see Section 6.2.

(1) On the I/O screen, make the following settings with the query selection cursor and option selection cursor:

Query	Setting
DEVICE	MEMORY CARD or USB MEMORY
FUNCTION	WRITE
KIND OF DATA	TRACE SETTING

(2) Move the query selection cursor to FILE NAME and enter a file name.
You should enter the file name with "8.3 format" that is constructed with base name, less than 8 characters, dot "." and extension, less than 3 characters. In case of the USB memory, a file name is up to 32 characters.
Or, press the [NEW NAME] soft key to set a new file name.

(3) Press the [EXEC] soft key to output the trace setting data.
Press the [CANCEL] soft key to stop the operation.

(4) If the specified file name already exists on a memory card or a USB memory, the following message will be displayed.
If you want to overwrite the file, press the [YES] soft key. And, if you want to cancel the output, press the [NO] key.

"THIS FILE NAME IS ALREADY USED. OVERWRITE IT?"

NOTE
1 For the supported memory card/USB memory, see Subsection 7.4.1.
2 A folder cannot be specified for an output subject.
3 In case of the USB memory, “FORFANUC” cannot be used for the first 8 characters of the file name.

7.4.34 Inputting Trace Setting Data from the Memory Card or the USB Memory

A trace setting data can be input from the memory card or the USB memory to a PMC. To use this function, perform the operation described below on the I/O screen.

> **NOTE**
> This operation can be performed only when the operation condition allows trace setting data input. For details, see Section 6.2.

(1) On the I/O screen, make the following settings with the query selection cursor and option selection cursor:

Query	Setting
DEVICE	MEMORY CARD or USB MEMORY
FUNCTION	READ

(2) Specify an input trace setting data by performing the following operations:
- Move the query selection cursor to FILE NO., then key in an input target file number. At this time, the FILE NAME field displays the file name corresponding to the entered file number.
- Move the query selection cursor to FILE NAME, then key in the input target file name.
- Switch the screen display to the list screen, and then select the input target file.
  For the list screen, see Subsection 7.4.3.

> **NOTE**
> If a value is set in the FILE NO. field, and a file name not corresponding to the file number is entered in the FILE NAME field when FILE NO. and FILE NAME are displayed at the same time, the value set in the FILE NO. field is erased, and the setting in the FILE NAME field becomes valid.

(3) Press the [EXEC] soft key.
Before the reading of the file is started, the following message is displayed to check if read processing may be executed:
"READING TRACE SETTING"
*ARE YOU SURE YOU WANT TO READ THIS FILE?
Press the [EXEC] soft key to continue the operation. Press the [CANCEL] soft key to stop the operation.

> **NOTE**
> 1 For the supported memory card/USB memory, see Subsection 7.4.1.
> 2 When the format of a specified file cannot be recognized, the read operation is terminated abnormally with the following message:
> "UNKNOWN FILE FORMAT"
> 3 A folder cannot be specified for an input subject.
> 4 When the specified name is a folder name, the following message is display by pressing the [EXEC] soft key.
> “FOLDER NAME CANNOT BE SPECIFIED”
> 5 In case of the USB memory, “FORFANUC” cannot be used for the first 8 characters of the file name.

7.4.35 Outputting I/O Configuration data to the Memory Card or USB Memory

I/O configuration data (I/O Link *i* assignment data) can be output from a PMC to the memory card or the USB memory. To use this function, perform the operation described below on the I/O screen.

> **NOTE**
> This operation can be performed only when the operation condition allows I/O configuration data output. For details, see Section 6.2.

(1) On the I/O screen, make the following settings with the query selection cursor and option selection cursor:

Query	Setting
DEVICE	MEMORY CARD or USB MEMORY
FUNCTION	WRITE
KIND OF DATA	I/O CONFIGURATION DATA

(2) Move the query selection cursor to FILE NAME and enter a file name.
You should enter the file name with "8.3 format" that is constructed with base name, less than 8 characters, dot "." and extension, less than 3 characters. In case of the USB memory, a file name is up to 32 characters.
Or, press the [NEW NAME] soft key to set a new file name.

(3) Press the [EXEC] soft key to output the I/O configuration data.
Press the [CANCEL] soft key to stop the operation.

(4) If the specified file name already exists on a memory card or a USB memory, the following message will be displayed. If you want to overwrite the file, press the [YES] soft key. And, if you want to cancel the output, press the [NO] key.

"THIS FILE NAME IS ALREADY USED. OVERWRITE IT?"

> **NOTE**
> 1 For the supported memory card/USB memory, see Subsection 7.4.1.
> 2 A folder cannot be specified for an output subject.
> 3 In case of the USB memory, “FORFANUC” cannot be used for the first 8 characters of the file name.

7.4.36 Inputting I/O Configuration data from the Memory Card or USB Memory

I/O configuration data (I/O Link *i* assignment data) can be input from the memory card or the USB memory to a PMC. To use this function, perform the operation described below on the I/O screen.

> **NOTE**
> This operation can be performed only when the operation condition allows I/O configuration data input. For details, see Section 6.2.

(1) On the I/O screen, make the following settings with the query selection cursor and option selection cursor:

Query	Setting
DEVICE	MEMORY CARD or USB MEMORY
FUNCTION	READ

(2) Specify an input target I/O configuration data by performing the following operations:
- Move the query selection cursor to FILE NO., then key in an input target file number. At this time, the FILE NAME field displays the file name corresponding to the entered file number.
- Move the query selection cursor to FILE NAME, then key in the input target file name.
- Switch the screen display to the list screen, and then select the input target file.
  For the list screen, see Subsection 7.4.3.

> **NOTE**
> If a value is set in the FILE NO. field, and a file name not corresponding to the file number is entered in the FILE NAME field when FILE NO. and FILE NAME are displayed at the same time, the value set in the FILE NO. field is erased, and the setting in the FILE NAME field becomes valid.

(3) Press the [EXEC] soft key.
Before the reading of the file is started, the following message is displayed to check if read processing may be executed:
"READING I/O CONFIGURATION DATA"
*ARE YOU SURE YOU WANT TO READ THIS FILE?

Press the [EXEC] soft key to continue the operation. Press the [CANCEL] soft key to stop the operation.

> **NOTE**
> 1 For the supported memory card/USB memory, see Subsection 7.4.1.
> 2 A folder cannot be specified for an input subject.
> 3 In case of the USB memory, “FORFANUC” cannot be used for the first 8 characters of the file name.
> 4 When the format of a specified file cannot be recognized, the read operation is terminated abnormally with the following message:
> "UNKNOWN FILE FORMAT"

7.4.37 Comparing I/O Configuration data with Memory Card Files or USB Memory Files

I/O configuration data (I/O Link *i* assignment data) comparison can be made between the PMC and memory card or USB memory. To use this function, perform the operation described below on the I/O screen.

> **NOTE**
> The compare operation can be performed only when the operation condition allows the I/O configuration data output. For details, see Section 6.2.

(1) On the I/O screen, make the following settings with the query selection cursor and option selection cursor:

Query	Setting
DEVICE	MEMORY CARD or USB MEMORY
FUNCTION	COMPARE

(2) Specify I/O configuration data to be compared, by performing the following operations:
- Move the query selection cursor to FILE NO., then key in a compare target file number. At this time, the FILE NAME field displays the file name corresponding to the entered file number.
- Move the query selection cursor to FILE NAME, then key in the compare target file name.
- Switch the screen display to the list screen, and then select the compare target file.
  For the list screen, see Subsection 7.4.3.

> **NOTE**
> If a value is set in the FILE NO. field, and a file name not corresponding to the file number is entered in the FILE NAME field when FILE NO. and FILE NAME are displayed at the same time, the value set in the FILE NO. field is erased, and the setting in the FILE NAME field becomes valid.

(3) Press the [EXEC] soft key to execute I/O configuration data comparison.
Press the [CANCEL] soft key to stop the operation.

> **NOTE**
> 1 For the supported memory card/USB memory, see Subsection 7.4.1.
> 2 A folder cannot be specified for a compare subject.
> 3 In case of the USB memory, “FORFANUC” cannot be used for the first 8 characters of the file name.
> 4 When the format of a specified file cannot be recognized, the compare operation is terminated abnormally with the following message:
> "UNKNOWN FILE FORMAT"

7.4.38 Saving I/O Configuration data to the Flash ROM

I/O configuration data (I/O Link *i* assignment data) can be saved from a PMC to the flash ROM. To use this function, perform the operation described below on the I/O screen.

> **NOTE**
> This operation can be performed only when the operation condition allows I/O configuration data output. For details, see Section 6.2.

(1) On the I/O screen, make the following settings with the query selection cursor and option selection cursor:

Query	Setting
DEVICE	FLASH ROM
FUNCTION	WRITE
KIND OF DATA	I/O CONFIGURATION DATA

For the setting of an output target PMC, see Subsection 7.4.4.

(2) Press the [EXEC] soft key to save the I/O configuration data.
When writing to the flash ROM is performed, the processing cannot be stopped.

> **NOTE**
> When programs are written, flash ROM initialization may consume some time. During initialization, "INITIALIZING FLASH ROM." is displayed in the STATUS display field.

> ⚠ **WARNING**
> If unsuitable I/O configuration data is used, the machine can make an unexpected movement. Before saving an I/O configuration data, make sure that the I/O configuration data is suitable.

7.4.39 Inputting I/O Configuration data from the Flash ROM

I/O configuration data (I/O Link *i* assignment data) can be inputted from the flash ROM to a PMC. To use this function, perform the operation described below on the I/O screen.

> **NOTE**
> 1 This operation can be performed only when the operation condition allows I/O configuration data input. For details, see Section 6.2.

(1) On the I/O screen, make the following settings with the query selection cursor and option selection cursor:

Query	Setting
DEVICE	FLASH ROM
FUNCTION	READ

For the setting of an input target PMC, see Subsection 7.4.4.

(2) Press the [EXEC] soft key to input the I/O configuration data programs.
When reading from the flash ROM is performed, the processing cannot be stopped.

7.4.40 Comparing I/O Configuration data with Flash ROM Files

I/O configuration data (I/O Link *i* assignment data) comparison can be made between the PMC and flash ROM. To use this function, perform the operation described below on the I/O screen.

> **NOTE**
> Compare operation can be performed only when the operation condition allows I/O configuration data output. For details, see Section 6.2.

(1) On the I/O screen, make the following settings with the query selection cursor and option selection cursor:

Query	Setting
DEVICE	FLASH ROM
FUNCTION	COMPARE

For the setting of a compare target PMC, see Subsection 7.4.4.

(2) Press the [EXEC] soft key to execute the I/O configuration data comparison.
When a sequence program comparison with the flash ROM is performed, the processing cannot be stopped.

7.4.41 Deleting Memory Card/USB memory Files or Formatting a Memory Card

A file on a memory card or a USB memory can be deleted, or a memory card can be formatted. To use this function, perform the operation described below on the I/O screen.

Deleting memory card files

(1) On the I/O screen, make the following settings with the query selection cursor and option selection cursor:

Query	Setting
DEVICE	MEMORY CARD or USB MEMORY
FUNCTION	DELETE

(2) Specify a file to be deleted, by performing the following operations:

- Move the query selection cursor to FILE NO., then key in the number of a file to be deleted. At this time, the FILE NAME field displays the file name corresponding to the entered file number.
- Move the query selection cursor to FILE NAME, then key in the name of the file to be deleted.
- Switch the screen display to the list screen, and then select the file to be deleted.
  For the list screen, see Subsection 7.4.3.

> **NOTE**
> If a value is set in the FILE NO. field, and a file name not corresponding to the file number is entered in the FILE NAME field when FILE NO. and FILE NAME are displayed at the same time, the value set in the FILE NO. field is erased, and the setting in the FILE NAME field becomes valid.

(3) Press the [EXEC] soft key to delete the file.

> **NOTE**
> 1 No files can be deleted from a flash memory card.
> 2 A folder cannot be specified for a deletion subject.

Formatting a memory card

(1) On the I/O screen, make the following settings with the query selection cursor and option selection cursor:

Query	Setting
DEVICE	MEMORY CARD
FUNCTION	FORMAT

(2) Press the [EXEC] soft key to format the memory card.

> ⚠ **CAUTION**
> When the formatting of a memory card is executed with FORMAT selected, all data of the memory card is lost. Be careful when formatting a memory card.

> **NOTE**
> For the supported memory card/USB memory, see Subsection 7.4.1.

7.4.42 Deleting One or All FLOPPY Files

A specified file or all files on a Floppy Cassette or Handy File connected via RS-232C can be deleted. To use this function, perform the operation described below on the I/O screen. To set the communication parameters, display the port setting screen by pressing the [PORT SETING] soft key. For details of the port setting screen, see Subsection 7.4.2.

Deleting a specified file on the FLOPPY

(1) On the I/O screen, make the following settings with the query selection cursor and option selection cursor:

Query	Setting
DEVICE	FLOPPY
FUNCTION	DELETE

(2) Specify a file to be deleted, by performing the following operations:
- Move the query selection cursor to FILE NO., then key in the number of a file to be deleted. At this time, the FILE NAME field displays the file name corresponding to the entered file number.
- Move the query selection cursor to FILE NAME, then key in the name of the file to be deleted.
- Switch the screen display to the list screen, and then select the file to be deleted.
  For the list screen, see Subsection 7.4.3.

NOTE
If a value is set in the FILE NO. field, and a file name not corresponding to the file number is entered in the FILE NAME field when FILE NO. and FILE NAME are displayed at the same time, the value set in the FILE NO. field is erased, and the setting in the FILE NAME field becomes valid.

(3) Press the [EXEC] soft key to delete the file.

Deleting all files on the FLOPPY

(1) On the I/O screen, make the following settings with the query selection cursor and option selection cursor:

Query	Setting
DEVICE	FLOPPY
FUNCTION	DELETE ALL

(2) Press the [EXEC] soft key to delete all files.

NOTE
The following Floppy Cassette does not support the operation of FORMAT:
FLOPPY CASSETTE ADAPTER A13B-0131-B001

7.5 DISPLAYING I/O DEVICES CONNECTION STATUS ([I/O DEVICE] SCREEN)

I/O DEVICE MONITOR screen shows the types and the ID codes of I/O Units that are connected to I/O Link in order of Group number. The screen displayed the difference between the group number of I/O module allocation data and actually connected group number.

In case that you register configuration of I/O devices in this screen, the difference between the registered groups and actually connected groups can be detected during the power on sequence of the system and the groups are displayed in the screen. We recommend the registration of configuration of I/O devices when shipping of the machine system. If you do not register configuration of I/O devices, difference check of I/O devices is not performed.

The screen supports the following operations.

- Registration of configuration of I/O devices [REG.]
- Deletion of configuration of I/O devices [DELETE]

To switch the screen display to the I/O DEVICE MONITOR screen, press the [I/O DEVICE] soft key.

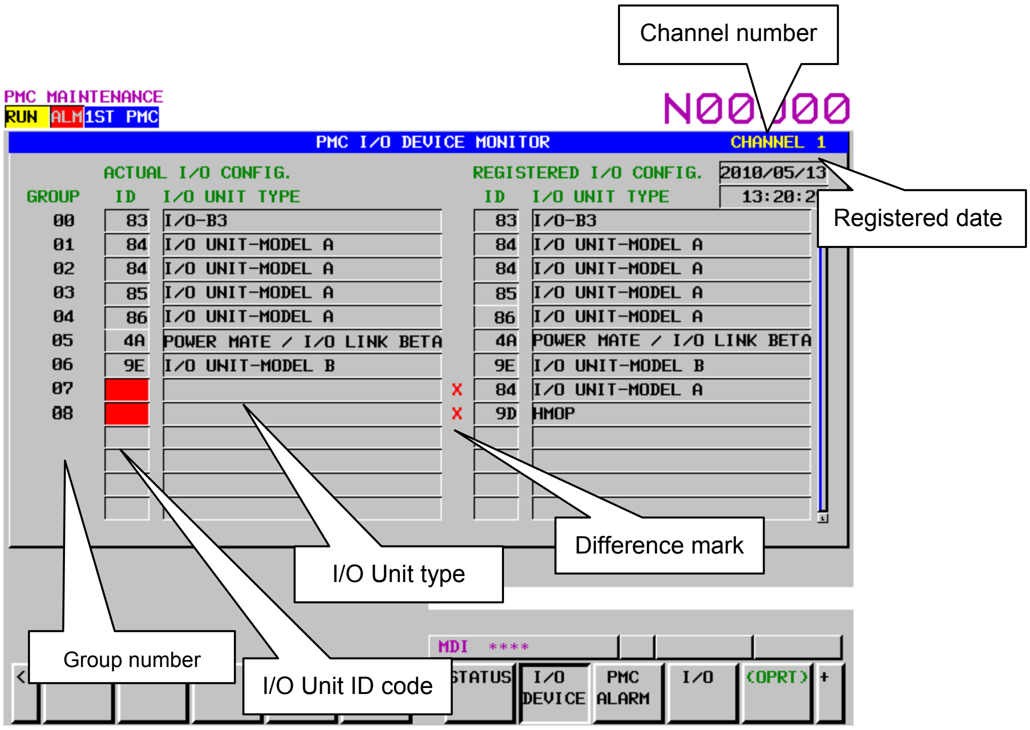


Table 7.5(a) Displayed type and actual type of I/O Units (for I/O Link)

Displayed I/O Unit	ID	Actual I/O Unit
CONNECTION UNIT	80	Connection Unit
OPERATOR PANEL	82	Connection Unit for Operators Panel
I/O-B3	83	I/O B3
IO UNIT-MODEL A	84 86 87	I/O Unit-MODEL A
POWER MATE / I/O LINK BETA	4A	Power Mate or I/O Link Beta
SERIES 0	50	Series 0
OPERATOR I/F BOARD (MPG1)	53	Machine Operators Panel Interface
LINK CONNECTION UNIT	96	I/O Link Connecting Unit
I/O UNIT-MODEL B	9E	I/O Unit-MODEL B

Displayed I/O Unit	ID	Actual I/O Unit
R-J MATE	61	R-J Mate
CONNECTOR PANEL MODULE	A9	I/O module for connector panel
OPERATOR PANEL A1	AA	I/O module for operator's panel
OPERATOR I/F BOARD (MPG3)	6B	Operator Interface (with MPG)
LOADER I/O	AF	I/O Board for Loader
FRC DIF	B0	DIF Board for ROBOCUT
FRC MIF	B1	MIF Board for ROBOCUT
I/O CARD	B2	I/O board
ROBOSHOT I/O CARD A	B3	I/O for ROBOSHOT
LOADER I/O (MATRIX)	B4	I/O Board for Loader (Matrix)
PROCESS I/O FA	B5	Process I/O for robot controller
PROCESS IO	89	Process I/O for robot controller
I/O LINK ADAPTER	8B	I/O Link adapter
OPERATOR PANEL	95	I/O for Series 0
LASER OSCILLATOR	97	Laser Oscillator
FIXED I/O TYPE A	98	I/O for Robot Type A
FIXED I/O TYPE B	99	I/O for Robot Type B
AS-I CONVERTER	77	AS-i Converter
OPERATOR PANEL B	A8	I/O Module (for Operator Panel 48/32)
MACHINE OPERATOR PANEL A	A8	I/O Module (for Machine Operator Panel of 0 Type)
CONNECTION UNIT C1 (MPG)	A8	Connection Unit C1 (with MPG)
MACHINE OPERATOR PANEL B	A8	I/O Module (for Machine Operator Panel)
I/O MODULE WITH LCD	A8	LCD display embedded I/O
I/O FOR CONNECTOR PANEL	A8	I/O for connector panel
MACHINE OPERATORS PANEL	A8	Machine operator’s panel
I/O FOR OPERATOR PANEL C1	A8	I/O module for operator's panel
SAFETY M.O.P.(PMC)	A8	Safety machine operator’s panel (PMC)
SAFETY M.O.P.(DCS)	A8	Safety machine operator’s panel (DCSPMC)
UNKNOWN UNIT	-	Unknown I/O Unit

NOTE

Some I/O units in above table may be displayed as “Unknown I/O unit” according to the version of the system software. However, these I/O units would work normally.

Table 7.5(b) Displayed type of I/O Units (for I/O Link *i*)

ID	Displayed I/O Unit
01	OP. PANEL (CABINET) I/O B
04	MACHINE OPERATORS PANEL
08	DISPLAY FOR AUTOMOTIVE
0A	I/O MODULE TYPE-2
0B	I/O FOR PWR MAGNETICS CAB
0C	FRC PIF
0D	FRC DIF
0E	FRC MIF
14	I/O BOARD SLAVE0
15	I/O BOARD SLAVE1
17	TERMINAL I/O MODULE
1E	OPERATORS PANEL
21	MACHINE OPERATORS PANEL
26	I/O FOR OPERATOR PANEL C1
2C	FRC PIF (DCS)
2D	SMALL MACHINE OP. PANEL B

ID	Displayed I/O Unit
30	HANDY MACHINE OP. PANEL
32	SAFETY M.O.P.
3F	Unit name same as name of previous group (I/O device composed of plural groups)
4A	I/O Link BETA
53	OPERATORS PANEL I/F BOARD
56	R-30iB
57	R-30iB Mate
6B	OPERATORS PANEL I/F BOARD
77	I/O Link AS-i CONVERTER
82	OP. PANEL CONNECTION UNIT
96	CONNECTION UNIT
A9	I/O FOR CONNECTOR PANEL
AA	I/O FOR OPERATOR PANEL A1
AB	MULTISENSOR UNIT
AE	I/O FOR OPERATOR PANEL A3
B2	I/O CARD
B8	LASER OSCILLATOR
C6	I/O FOR OP. PANEL (DCS)
C7	I/O FOR OP. PANEL (DCS)_S
C8	SAFETY IO UNIT
D0	I/O UNIT-MODEL A
D8	I/O UNIT-MODEL B

NOTE

Some I/O units in above table may be displayed as "Unknown I/O unit" according to the version of the system software. However, these I/O units would work normally.

(1) GROUP NUMBER

The group number, which is assigned in I/O module allocation data at the time of power on, is displayed from "00". Non-assigned group is not displayed.

NOTE

Even if I/O module allocation data is updated, the group number is never updated before the power is turn off/on.

(2) ID of I/O UNIT

The ID of "ACTUAL I/O CONFIG." shows the IDs of the actual connected I/O units. The ID of "REGISTERED I/O CONFIG." shows the IDs of registered I/O units.

When the PMC alarm "ER97" occurs, the ID of caused I/O unit is emphasized by red color.

NOTE

1 Even if I/O module allocation data is corrected during PMC alarm, emphasized display is never cleared before the power is turn off/on.

2 The ID of I/O Link i is displayed by 4 digits. The ID of I/O Link is displayed by 2 digits.

3 Several I/O devices have same ID.

(3) I/O UNIT TYPE

I/O UNIT TYPE of "ACTUAL I/O CONFIG." shows the I/O unit type of the actual connected I/O units. I/O UNIT TYPE of "REGISTERED I/O CONFIG." shows the IDs of registered I/O units.

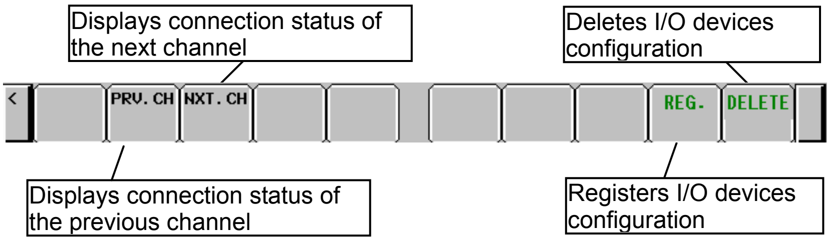
(4) Difference mark
When registered I/O devices configuration is differ from actual I/O devices at the power on, the difference mark is displayed.

> **NOTE**
> Even if registered configuration of I/O devices is updated by the operation of [REG.] or [DELETE], the difference mark will not be updated immediately.

(5) REGISTRATION DATE
The date, at which the configuration of I/O devices is registered, is displayed.

(6) REGISTRATION TIME
The time, at which the configuration of I/O devices is registered, is displayed.

Soft keys



(a) [PRV. CH] Displays connection status of the previous channel.
(b) [NXT. CH] Displays connection status of the next channel.
(c) [REG.] Registers actual I/O devices configuration.
When no I/O device is connected, the operation of this soft key is invalid.
Refer to 7.5.1 for details.
(d) [DELETE] Deletes registered I/O devices configuration.
When no I/O devices configuration is registered, this soft key is not displayed.

> ⚠ **CAUTION**
> When you clear the PMC parameter, like the power on operation with pressing “O” and “Z”, registered I/O devices configuration is cleared.
> Register again if necessary.

> **NOTE**
> 1 The operations of [REG.] and [DELETE] can be protected by the programmer protection function. In case of protecting, these soft-keys is not displayed.
> 2 The operations of [REG.] and [DELETE] can update the IDs, the unit types, and the date and time of registration.
> 3 The operations of [REG.] and [DELETE] are performed in each channel.

7.5.1 Registration of I/O Devices Configuration

After you check whether the I/O devices configuration is correctly connecting, register the I/O devices configuration by the soft key [REG.] in the I/O DEVICE MONITOR screen. As a result, the difference between the registered I/O devices configuration and actual connected I/O devices configuration can be checked during the power on sequence.
By deleting registered I/O devises configuration, the difference check between the registered I/O devices configuration and actual connected I/O devices configuration is canceled.

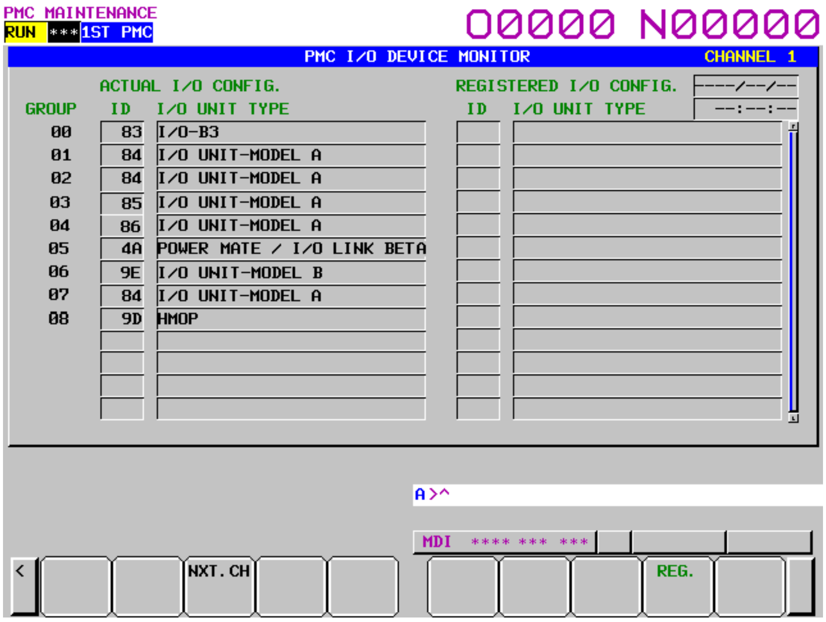


Fig. 7.5.1 (a) No registration of I/O devices configuration

The following is an example of registration.

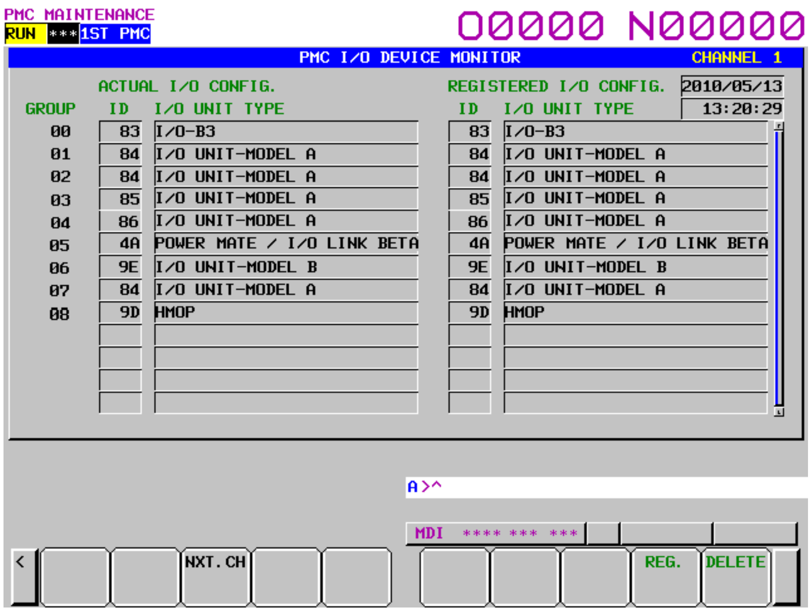


Fig. 7.5.1 (b) Registration of I/O devices configuration

7.5.2 Check of I/O Link Connection

When the I/O Link connection check function is effective (K906#2=0), the difference in the group number between the group of the I/O module allocation data and the group of actual connected I/O devices is checked.
For details of the I/O Link connection check function, refer to subsection “3.4”.
Moreover, when the configuration of I/O devices is registered in this screen, the difference between the registered configuration of I/O devices and actually connected configuration of I/O devices is checked at the time of power on.

In case of no alarm of I/O devices connection

The following is the case of no problem of I/O devices connection.

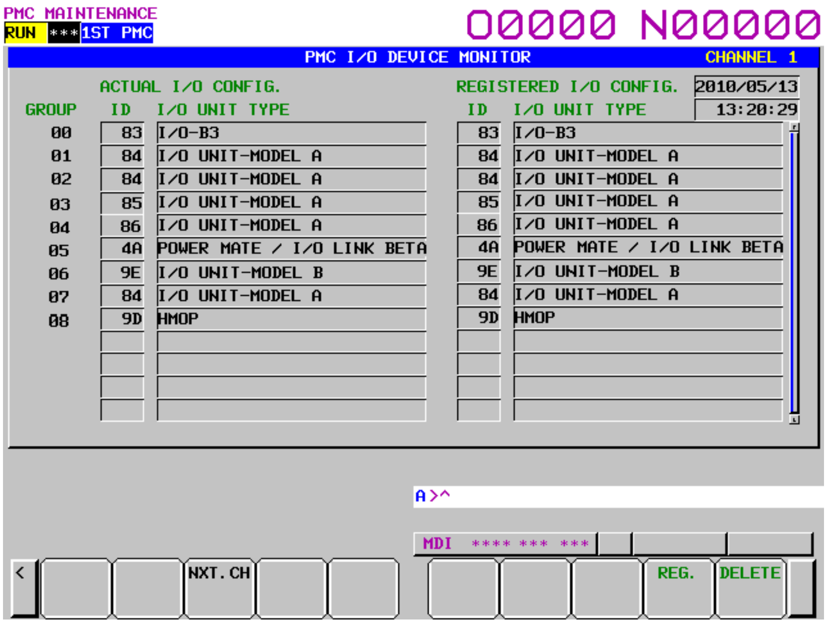


Fig. 7.5.2 (a) No alarm of I/O Link connection check

In case of PMC alarm ER97

When the PMC alarm "ER97" occurs, the ID part of I/O unit of the group leading to the alarm in the "ACTUAL I/O CONFIG." is emphasized by red color.

And the difference between the registered configuration of I/O devices and actually connected configuration of I/O devices is displayed with the difference mark.

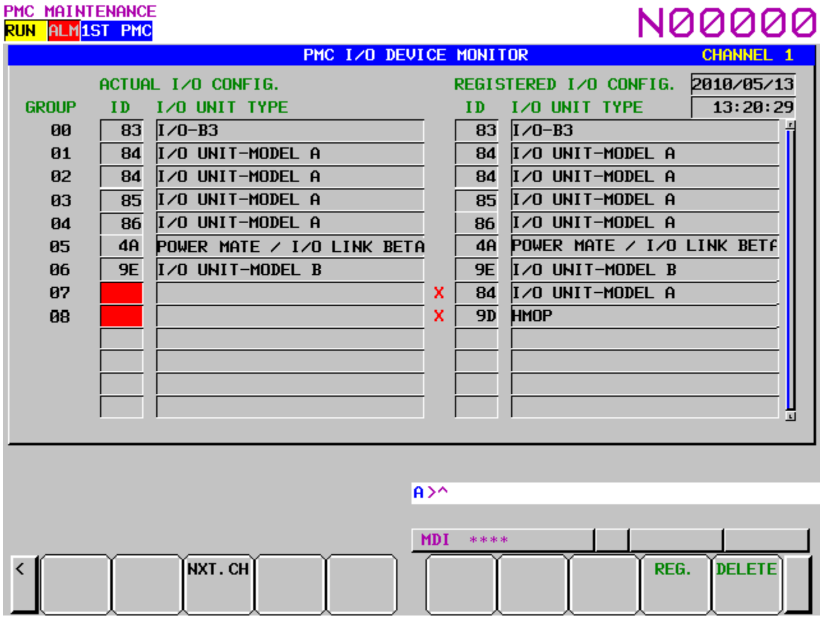


Fig. 7.5.2 (b) Example of I/O Link connection check alarm

In case of above example, the cause is that the group number 7 or later cannot be recognized.
The issue can be specified by investigating the I/O device connected to group 7.
Even if I/O devises configuration is not registered, ID part of I/O unit in the "ACTUAL I/O CONFIG." is emphasized by red color.

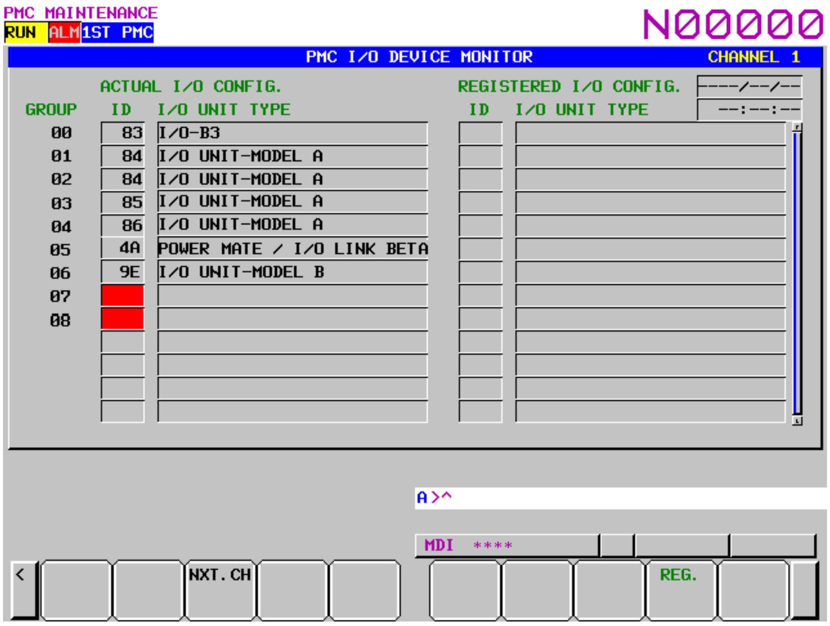


Fig. 7.5.2 (c) Example of no registration of configuration of I/O devices

In case of PMC alarm ER95

When the PMC alarm "ER95" occurs, the groups of I/O unit leading to the alarm are displayed with the difference mark.

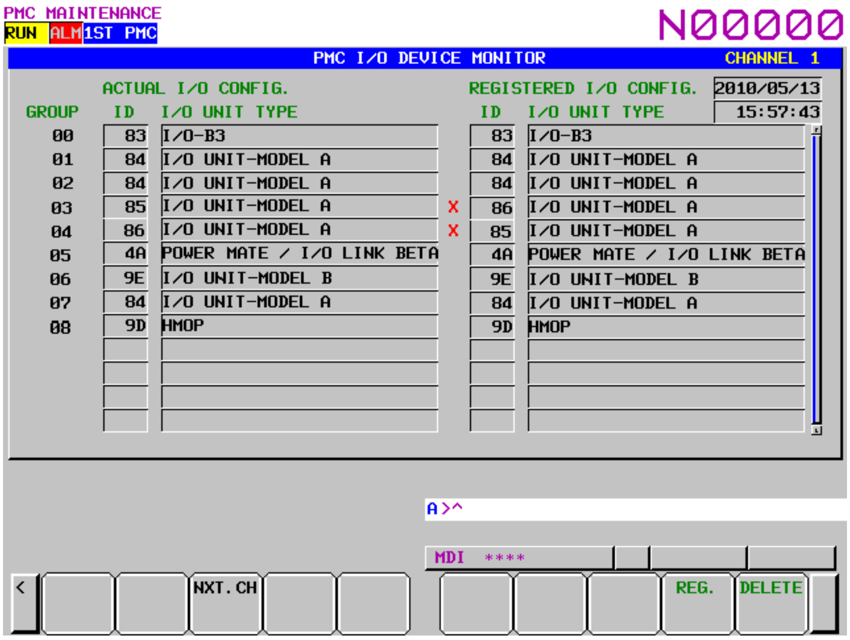


Fig. 7.5.2 (d) When configuration of I/O devices is different

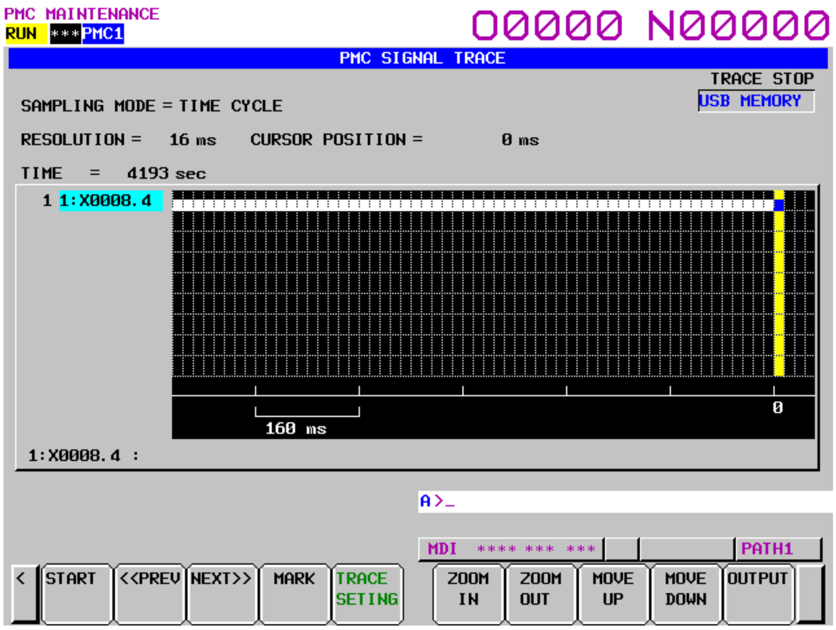
In case of above example, the cause is the order of group 3 and 4 of the I/O devices.

7.6 TRACING AND DISPLAYING PMC SIGNAL STATUS

After setting a signal sampling condition on the trace parameter setting screen, PMC signal transitions can be traced on the SIGNAL TRACE screen by executing the trace function.
To switch the screen display to the SIGNAL TRACE screen, press the [TRACE] soft key.
To switch the screen display to the trace parameter setting screen, press the [TRACE SETING] soft key.

With the multi-PMC system, the signals of all PMCs can be traced simultaneously.

7.6.1 Signal Trace Function ([TRACE] Screen)



SIGNAL TRACE screen

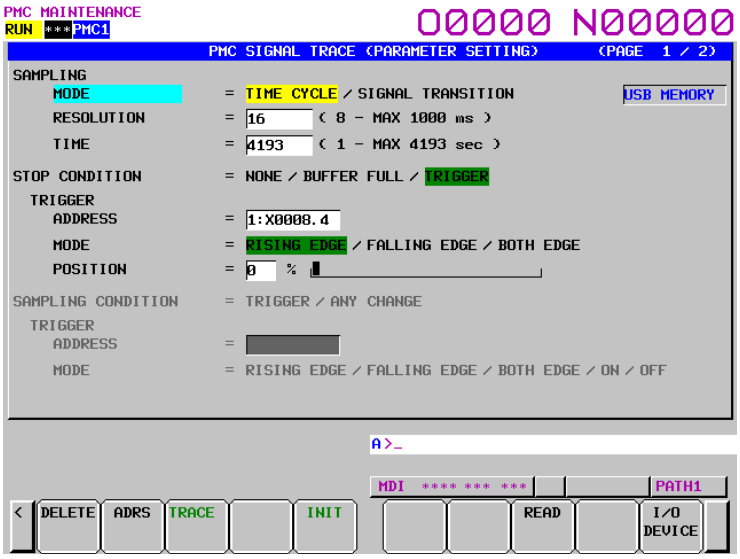
Before trace operation can be executed, the trace parameters must be set. Press the [TRACE SETING] soft key to switch the screen display to the trace parameter setting screen.
By setting the PMC setting screen, the trace function can be automatically started after the power is turned on. In this case as well, the trace parameters must be set beforehand.

NOTE
For the setting to automatically start the trace function after the power is turned on, see Subsection 7.6.5.

7.6.2 Setting of Trace Parameter ([TRACE SETING] Screen)

On the trace parameter setting screen, a sampling condition can be set. The screen consists of two pages. Use the page keys to switch between the pages.

> **NOTE**
> Even if you set a trace parameter during executing of trace, the modification of the parameter does not influence the trace execution.



Trace parameter setting screen (first page)

(1) SAMPLING/ MODE
Determines the sampling mode.
- TIME CYCLE: Samples at every specified cycle time.
- SIGNAL TRANSITION: Monitors the signal at a set cycle and samples when the signal makes a transition.

(2) SAMPLING/ RESOLUTION
The resolution of sampling is inputted. The default value is the minimum sampling resolution (msec), which varies depending on the CNC.
Setting range: Minimum sampling resolution to 1000 (msec)
An input value is rounded off to a multiple of the minimum sampling resolution (msec) which is closest to but not greater than the input value.

(3) SAMPLING/ TIME
This parameter is displayed when "TIME CYCLE" is set on "SAMPLING/ MODE". The execution time of trace is inputted. The value of "SAMPLING/ RESOLUTION" or the number of specified signal address changes the range of the value that is able to input. The range is displayed on the right side.

(4) SAMPLING/ FRAME
This parameter is displayed when "SIGNAL TRANSITION" is set on SAMPLING/ MODE". The number of sampling is inputted. The value of "SAMPLING/ RESOLUTION" or the number of specified signal addresses changes the range of the value that is able to input. The range is displayed on the right side.

(5) STOP CONDITION
Determines the condition to stop the trace.
- NONE: Does not stop the tracing automatically.
- BUFFER FULL: Stops the tracing when the buffer becomes full.
- TRIGGER: Stops the tracing by trigger.

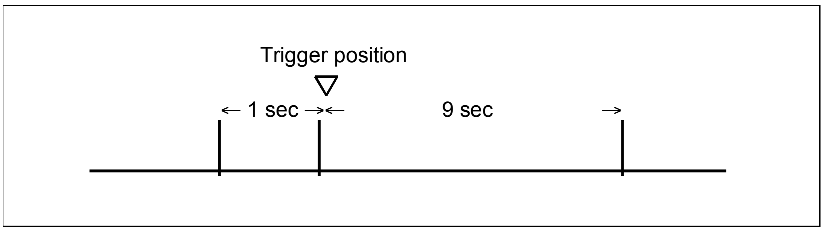
(6) STOP CONDITION/ TRIGGER/ ADDRESS
When "TRIGGER" is set on "STOP CONDITION", this parameter is enabled. Input signal address or symbol name as stop trigger.
A PMC number can be set for a trigger address by entering the PMC number at the time of address setting.
Example: "2:R9200.1" + Input key
A setting can be made by entering "PMC number" + ":" + "address" as indicated above.

NOTE
1 For the PMC numbers, see Section 1.6.
2 If there is not “:” key on your keyboard, use “;” or “/” instead.

(7) STOP CONDITION/ TRIGGER/ MODE
When "TRIGGER" is set on "STOP CONDITION", this parameter is enabled. Determine the trigger mode when the trace is stopped.

- RISING EDGE: Stops the tracing automatically by rising up of the trigger signal.
- FALLING EDGE: Stops the tracing automatically by falling down of the trigger signal.
- BOTH EDGE: Stops the tracing automatically by rising up or falling down of the trigger signal.

(8) STOP CONDITION/ TRIGGER/ POSITION
When "TRIGGER" is set on "STOP CONDITION", this parameter is enabled. Input the ratio (%) of the sampling time or number which specifies the position where specified trigger condition is on. If you would like to examine the transitions of the signal before the trigger condition, you should set a big value in this parameter. If you would like to examine the transitions of the signal after the trigger condition, you should set a small value in this parameter.
Example:
The case that sampling time is 10 seconds and trigger position is set as "10%".



(9) SAMPLING CONDITION
When "SIGNAL TRANSITION" is set on "TRACE MODE", this parameter is enabled.
Determine the sampling condition.

- TRIGGER: Samples the status of specified signals when the specified sampling condition is on.
- ANY CHANGE: Samples the status of specified signals when the signals change.

(10) SAMPLING CONDITION/ TRIGGER/ ADDRESS
When "SIGNAL TRANSITION" is set on "TRACE MODE", and "TRIGGER" is set on "SAMPLING CONDITION", this parameter is enabled. Input signal address or symbol name as sampling trigger.
A PMC number can be set for a trigger address by entering the PMC number at the time of address setting.
Example: "2:R9200.1" + Input key
A setting can be made by entering "PMC number" + ":" + "address" as indicated above.

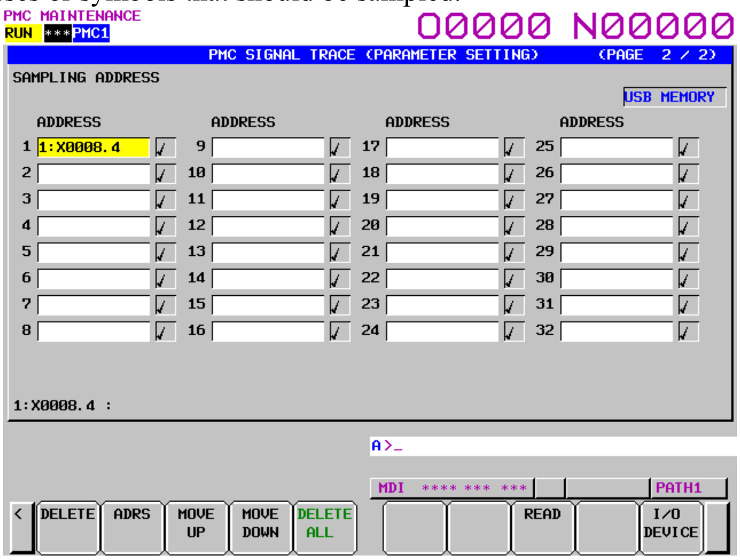
NOTE
1 For the PMC numbers, see Section 1.6.
2 If there is not “:” key on your keyboard, use “;” or “/” instead.

(11) SAMPLING CONDITION/ TRIGGER/ MODE
When "SIGNAL TRANSITION" is set on "TRACE MODE", and "TRIGGER" is set on "SAMPLING CONDITION", this parameter is enabled. Input trigger mode that determines the condition of specified trigger.

- RISING EDGE: Samples the status of specified signals by rising up of the trigger signal.
- FALLING EDGE: Samples the status of specified signals by falling down of the trigger signal.
- BOTH EDGE: Samples the status of specified signals by rising up or falling down of the trigger signal.
- ON: Samples the status of specified signals during the trigger signal is on.
- OFF: Samples the status of specified signals during the trigger signal is off.

Page 2 of the PARAMETER SETTING screen

You can set the addresses or symbols that should be sampled.



Trace parameter setting screen (second page)

(1) Setting addresses
In case of inputting discrete bit addresses, any bit address can be inputted.
Moreover, when you input byte address, all bits of the address (bits 0 to 7) are set automatically. Maximum 32 points of signal address can be inputted.
With the multi-PMC system, an address can be set for a desired PMC by specifying its PMC number.
Example: 2:R9200.1 + Input key
A setting can be made by entering "PMC number" + ":" + "address" as indicated above.
In case of the DCSPMC, enter "S:"+"address".
When no PMC number is specified, the specification of the currently selected PMC is assumed. In this case, "PMC number" + ":" is automatically prefixed to a specified address.
When only one PMC is used as in the standard PMC system, no PMC number needs to be specified.

NOTE
1 For the PMC numbers, see Section 1.6.
2 If there is not “:” key on your keyboard, use “;” or “/” instead.

NOTE

3 Increasing the number of the signal address changes the capacity of "SAMPLING/ TIME" or "SAMPLING/ FRAME" in page 1. If the capacity is changed, the following warning message is displayed. (The "n" on the message means the maximum value that is able to input.)
   a) In case of "TIME CYCLE" mode
      "SAMPLING TIME IS REDUCED TO n SEC."
   b) In case of "SIGNAL TRANSITION" mode
      "SAMPLING FRAME IS REDUCED TO n."

4 The signal trace for the DCSPMC is executed in the same timing as signals of 1st to 5th paths PMC.

⚠ **CAUTION**

The signal trace of the DCSPMC does not synchronize with the ladder execution period of the DCSPMC. Therefore, when plural signals are traced, the timing of tracing may not be accurate.

(2) Soft keys
Soft keys on the setting screen of sampling address are as follows
- (a) [DELETE]
  Clears the value of the edit box on the cursor.
- (b) [SYMBOL]/[ADDRESS]
  Changes the address display to the symbol display. However, display of the address that is not defined the symbol does not change. This soft key also changes to "ADDRESS".
- (c) [MOVE UP]
  Exchanges the signal indicated the cursor for the signal above one line.
- (d) [MOVE DOWN]
  Exchanges the signal indicated the cursor for the signal below one line.
- (e) [DELETE ALL]
  Clears all of the value of the edit box.
- (f) [READ]
  Reads the trace setting file from the device displayed in the indicator window. There are two kinds of the devices i.e. “memory card” and “USB memory”.

NOTE

When not specifying the file name, the file name of a trace setting data which can be read is “PMC_TRS.000”. When specifying the file name, a trace setting data of the file name can be read.

- (g) [I/O DEVICE]
  Selects input device of the trace setting file and output device of the trace result data. Pressing the soft-key switches “memory card” or “USB memory” alternately. Selected device name is displayed in the indicator window on the trace result screen and the trace setting screen.

NOTE

Selected device information is not initialized by the soft key [INIT] in the page 1 of the trace parameter setting screen. The clearing operation of PMC parameter (Power on with pressing “O” key and ”Z” key) initializes the information. The Initial setting is “memory card”.

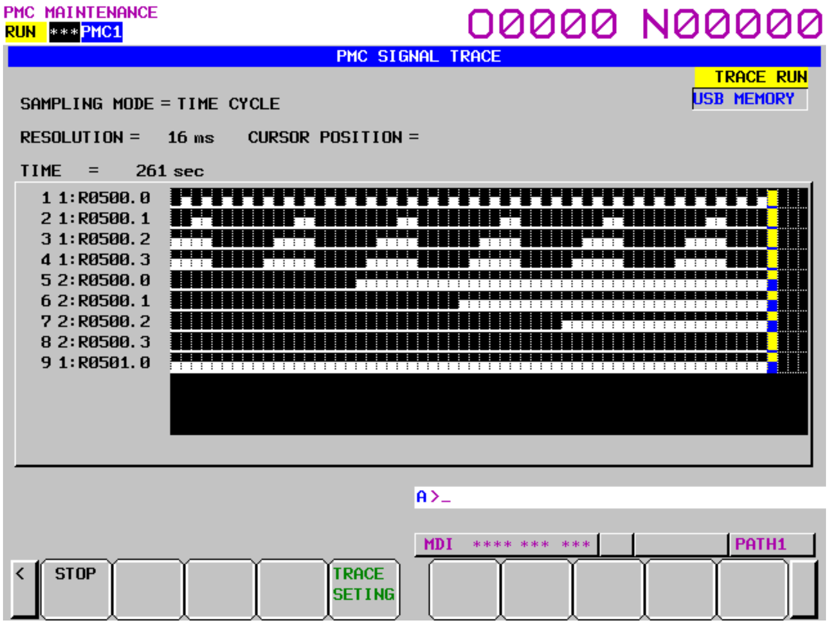
(3) Trigger setting
When "SIGNAL TRANSITION" is set on "TRACE MODE" and "ANY CHANGE" is set on "SAMPLING CONDITION", it can be set whether to use the setting address as the signals that should trigger the sampling in the setting signals. As for the signal address where the trigger was set, "✓" is displayed right. Soft keys on the Trigger setting screen are as follows:

- TRGON: Sets the Trigger on.
- TRGOFF:Sets the Trigger off.

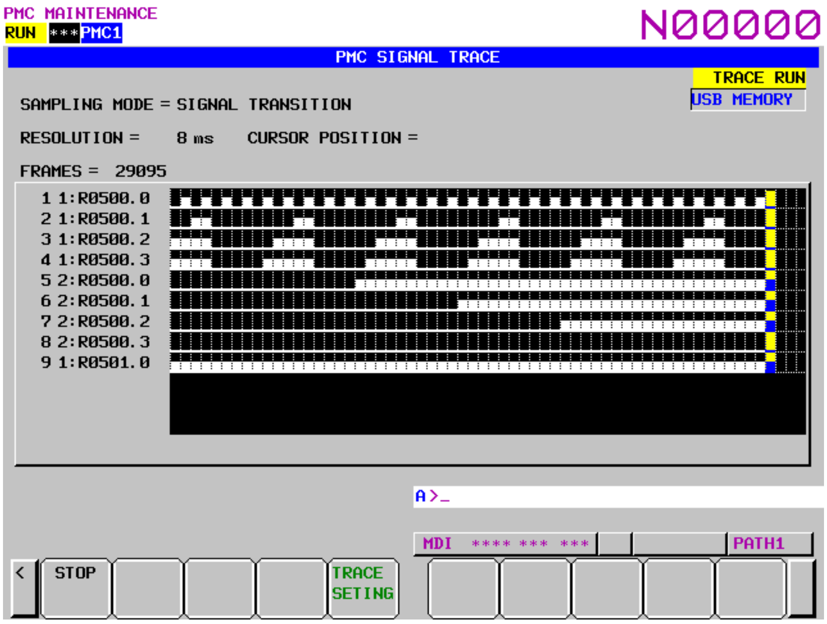
The default setting is trigger on for all signals.

7.6.3 Execution of Trace

After the trace parameters are set, a trace operation can be started by pressing the [(OPRT)] soft key and the [START] soft key on the SIGNAL TRACE screen. The following is the screen examples of the trace execution by "TIME CYCLE" mode and "SIGNAL TRANSITION" mode.



Trace execution screen (TIME CYCLE mode)

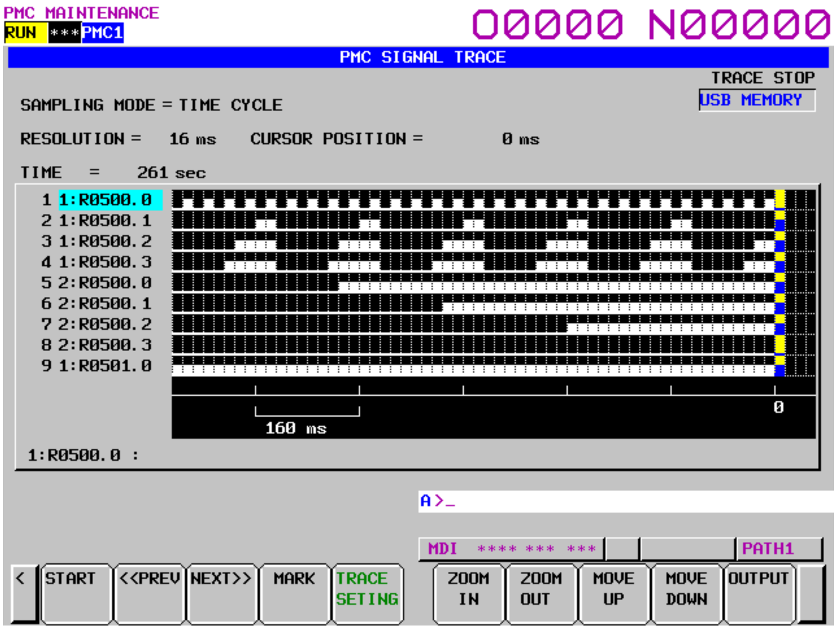


Trace execution screen (SIGNAL TRANSITION mode)

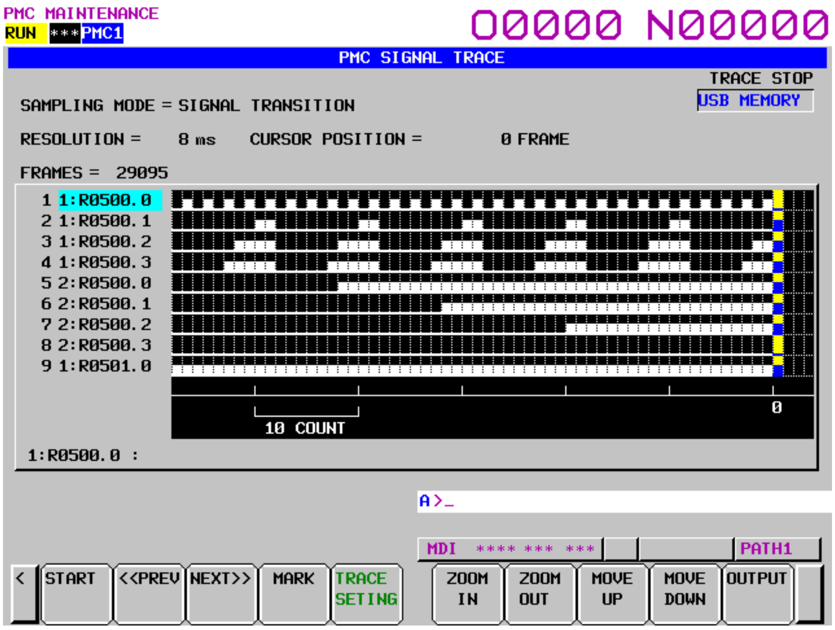
The result of trace is immediately displayed during execution of the trace.
When the stop conditions that is set in parameter setting screen is satisfied the execution is finished. Pressing the [STOP] soft key aborts the execution. In "SIGNAL TRANSITION" mode, graphic display is not refreshed until any signal for sampling trigger changes.

7.6.4 Operation after Execution of Trace

When the execution is finished, the result of trace is displayed. The followings are the screen examples of trace by "TIME CYCLE" and "SIGNAL TRANSITION" mode.



Trace result screen (TIME CYCLE mode)

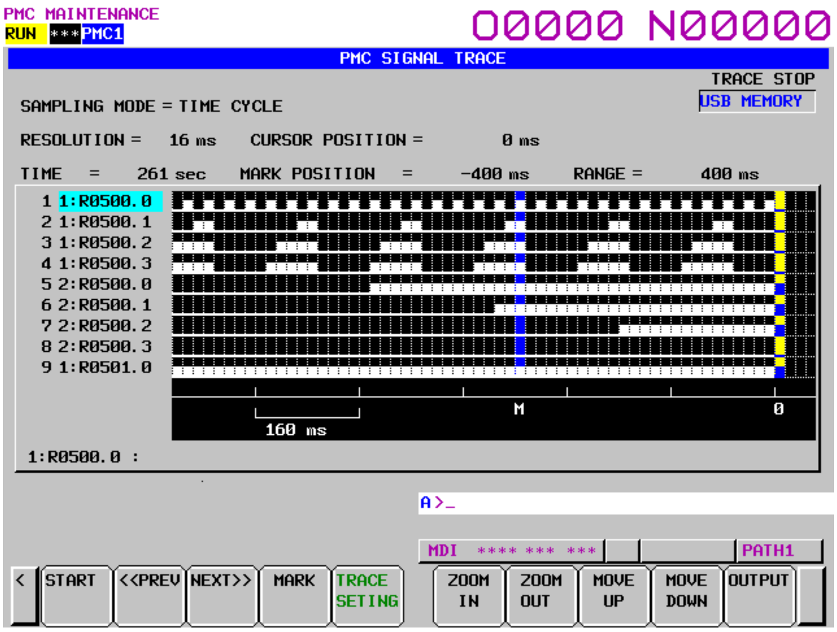


Trace result screen (SIGNAL TRANSITION mode)

The cursor indicating current position is initially displayed on the original point (0 point). The position of the cursor is displayed in "CURSOR POSITION" in the upper of the screen. The cursor can move horizontally with the <←> or <→> key. After the execution, following operation is enabled.

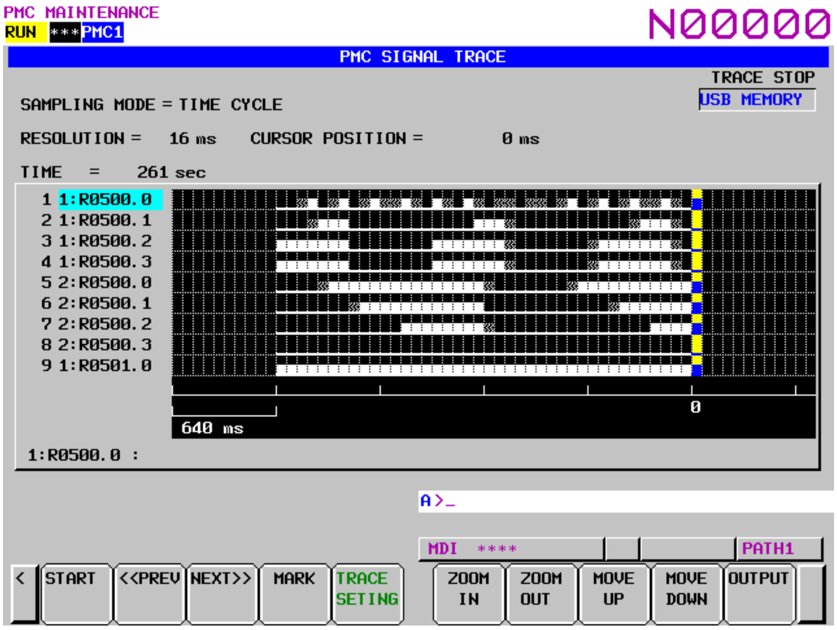
a) Scroll of screen
   - Cursor up/down key and Page up/down key
     Enables the vertical scroll for the specified signal
   - Cursor right/left key, [NEXT>>] soft key and [<< PREV] soft key
     Enables the horizontal scroll of the graph.

b) Automatic calculation of the selected range
   Pressing the [MARK] soft key marks the current position and displays the mark cursor.
   If the mark cursor duplicates with the current position cursor, the current position cursor has priority of display. The "MARK POSITION" that shows the position of the mark cursor and "RANGE" that shows the range between the mark cursor and the current position cursor are displayed in the upper of screen.
   Moving the current position cursor changes these values. Pressing the [MARK] soft key again releases the select range mode.



Trace result screen (Mark cursor display)

c) Zoom in/Zoom out of waveform
   Pressing the [ZOOM IN] soft key magnifies the display of chart. Pressing the [ZOOM OUT] soft key reduces the display of chart. Pressing these soft keys also change the scale value of the graduation on the graph. When trace is just finished, the default zooming level was the most magnified level. In “ZOOM OUT” mode, "▒ " is displayed as following screen example when the transitions of signal cannot be expressed accurately enough. The limitation of “ZOOM OUT” displays all of result of the trace in one page.



Trace result screen (Zoom out display)

d) Exchange of sampling signal
Pressing the [MOVE UP] soft key exchanges the signal indicated by the signal cursor for the signal one line above. Pressing the [MOVE DOWN] soft key exchanges the signal indicated by the signal cursor for the signal one line below. The result of the operation is cancelled by the execution of trace or putting the power off. If you want to maintain the order of displayed signals behind the re-execution or the power off, set the order on "SAMPLING ADDRESS" screen.

e) Output of the trace result data
Pressing the [OUTPUT] soft key writes the trace result data to “memory card” or “USB memory”.

7.6.5 Automatic Start of Trace Setting

Trace execution is automatically started after power-on by setting a PMC setting data.

- TRACE START = MANUAL/AUTO

> **NOTE**
> For details of the method of setting PMC setting data, see Section 9.5.

7.6.6 Trace Result Output

If trace result data is present when a trace operation has been executed, the data can be output to the memory card or the USB memory. Output trace result data can be input to application software such as spreadsheet software run on the personal computer. For the method of input, refer to the relevant manual of application software.

(1) Operation
Press the [OUTPUT] soft key. The soft key display changes to [EXEC] and [CANCEL]. Press the [EXEC] soft key to start output. Upon completion of output, the soft key display returns to the initial status on the signal trace result screen.

(2) File name
The name of an output file is PMCTRACE.000. If a file with the same name exists on the memory card, the extension is incremented to PMCTRACE.001, PMCTRACE.002, and so on (up to PMCTRACE.999).

(3) Output format
Trace result data is output in the text format. Character string data items such as item names and setting names are enclosed in quotation marks (').
Output data is divided into four major blocks: a header, data of the first parameter setting page, data of the second parameter setting page, and trace result data.

(a) Header
At the start of data, an identifier representing the type of data and edition information are output.
Identifier: ('PMC TRACE DATA')
Edition information: ('Edition', 1)

(b) Data of the first parameter setting page
identifier, , ,
setting-number, setting-item-name, setting, setting-character-string
setting-number, setting-item-name, setting, setting-character-string
setting-number, setting-item-name, setting, setting-character-string
setting-number, setting-item-name, setting, setting-character-string
:
:

- identifier Character string data
  The character string 'Setting' is output.

- setting-number Numeric data
  The numbers (starting with 1) assigned to setting items in ascending order are output.

- setting-item-name Character string data
  The character string of each setting item is output.

- setting Numeric data
  A value that is originally numeric, such as a resolution value, is directly output. Numbers (starting with 1) are assigned from left to right to options from which a choice is to be made, such as TIME CYCLE/SIGNAL TRANSITION, and the number assigned to a selected option is output.

- setting-character-string Character string data
  For a setting that is numeric data, its unit, if used, is output.
  For an option that is converted to a number in the item of "setting" mentioned above, the original character string data is output. In other cases, a blank is output in this column.

Table of data of the first parameter setting page

Item	Setting number	Setting item name	Setting	Setting character string
Sampling mode	1	'Sampling mode'	1	'TIME CYCLE'
			2	'SIGNAL TRANSITION'
Sampling resolution	2	'Sampling resolution'	Numeric value	'MSEC'
Sampling time Sampling frame	3	'Sampling time' 'Sampling frame'	Numeric value	'SEC'
Stop condition	4	'Stop condition'	1	'NONE'
			2	'BUFFER FULL'
			3	'TRIGGER'
Stop trigger address	5	'Stop trigger address'	Address	Symbol
Stop trigger mode	6	'Stop trigger mode'	1	'RISING EDGE'
			2	'FALLING EDGE'
			3	'BOTH EDGE'
Stop position	7	'Stop trigger position'	Numeric value	%
Sampling condition	8	'Sampling condition'	1	'TRIGGER'
			2	'ANY CHANGE'
Sampling trigger address	9	'Sampling trigger address'	Address	Symbol
Sampling trigger mode	10	'Sampling trigger mode'	1	'RISING EDGE'
			2	'FALLING EDGE'
			3	'BOTH EDGE'

NOTE

1 For a setting item that is invalidated in combination with another setting, only a setting number and setting item name are output, with a blank output in the setting column and the setting character string column. (However, commas are not omitted.)

2 For an item name that changes according to the setting of another item, the item name displayed according to the setting is displayed. (Example: Sampling time/Sampling frame dependent on the selection of a Sampling mode option)

3 For a sampling stop trigger address and sampling trigger address, an address is output in the setting column, and a symbol is output in the setting character string column. When no symbol is set, an address is output in the setting character string column as well.

4 For a sampling stop trigger position (successful trigger position/sampling frame count) is output after "%". (This is because a frame position is internally held, so that an error can occur at the time of conversion to a percentage value.)

(c) Data of the second parameter setting page
identifier-1, data-1, data-2, data-3, ...
identifier-2, data-1, data-2, data-3, ...
identifier-3, data-1, data-2, data-3, ...
identifier-4, data-1, data-2, data-3, ...

- identifier Character string data
  'Address': Sampling address
  'Symbol': Symbol defined for a sampling address
  'Comment': Comment defined for a sampling address
  'Check': Indicates whether a check is made to see if each signal is used to trigger sampling when SAMPLING CONDITION = ANY CHANGE.
- data
  'Address': Address character string
  'Symbol': Symbol character string
  'Comment': Comment character string
  'Check': With check = 1/without check = 0

NOTE
1 Data is not output beyond set sampling addresses. This means that no blank is output in the item of 'Address'.
2 For an address for which no symbol or no comment is set, no data is output, but a blank is output in the column. Commas are not omitted but are output for up to set sampling addresses.

(d) Trace result data
identifier, sampling-address-1, sampling-address-2, ...
frame-count, data-1, data-2, data-3. . . . .
:
:
:

- identifier Character string data
  The character string 'Data' is output.
- frame-count Numeric value
  The position where the frame count is 0 is a position where triggering is performed successfully. If triggering is unsuccessful, the frame count is 0 at the point where sampling stopped.
- data Numeric data
  The value 0 or 1 is output.
  It is assumed that data is output until an EOF (end of file) appears. Information such as data size is not set.

(4) Example of trace result output (The contents of the following example is rearranged for easy understanding. The actual may be different.)

Note1

Note2,3

```
'PMC TRACE DATA'
'Edition', 1

'Setting', , ,
1,'Sampling mode',              2,                'SIGNAL TRANSITION'
2,'Sampling resolution',        8,                'MSEC'
3,'Sampling time',              2000,
4,'Stop condition',             3,                'TRIGGER'
5,'Stop trigger address',       'X10.0',          'SYMBOL1'
6,'Stop trigger mode',          1,                'RISING EDGE'
7,'Stop trigger position',      50(1250/2500),    '%'
8,'Sampling condition',         1,                'TRIGGER'
9,'Sampling trigger address',   'X10.1',          'SYMBOL2'
10,'Sampling trigger mode',     3,                'BOTH EDGE'
'Address','R0000.0', 'R0000.1', 'R0000.2', 'R0000.3', 'R0000.4', 'R0000.5', 'R0000.6', 'R0000.7',
'R0001.0', 'R0002.0'
'Symbol', 'ZRN_M' , , , '*SPA1' , '*SPA2', 'MX-RD','RSTN', 'RSTMA', 'MO1X', 'MO2X'
'Comment', 'ZRN MODE', 'TIME CNT.AUX1(MEM)' , , , , 'READ STROBE', 'NORMAL RESET PB',
'INIT_M&RSTM (RST->MACRO)', 'OPTIONAL STOP1','OPTIONAL STOP2'
'Check', 0, 1, 1, 1, 1, 1, 0, 1, 1, 1

'Data','R0000.0', 'R0000.1', 'R0000.2', 'R0000.3', 'R0000.4', 'R0000.5',
'R0000.6', 'R0000.7', 'R0001.0', 'R0002.0'
-6, 1,0,0,0,0,0,0,0,0,0
-5, 0,0,0,0,0,1,1,1,1,1
-4, 1,1,1,1,1,0,0,0,0,0
-3, 0,1,0,1,0,1,0,1,0,1
-2, 0,0,1,1,0,0,1,1,0,0
```

NOTE

1 With the multi-PMC system, this data is output in the format: "PMC number" + ":" + "address".
   Example: '2:R0000.0'

2 In case of the extended symbol mode, a program name is added in front of the local symbol.
   Example: ‘1:P1.ZRN_M’ (PMC path=1, Local symbol in P1)

3 When using the ladder dividing management function, the symbols and comments defined in the main ladder program are output to trace result and setting data.

7.7 MONITORING I/O DIAGNOSIS ([I/O DGN] SCREEN)

The I/O diagnosis screen shows the status of I/O variables, which are extracted from symbol data, and configuration of network and the status of communication of I/O modules. The following items are listed in this screen:

- The symbol and comment of the variable
- The status of the variable
- The address of the variable
- The type of I/O network device
- The type of I/O module of the network device
- The network address information of the network device
- The communication status of the network device

NOTE
Supported types of I/O network device are PROFIBUS, I/O Link and I/O Link *i*.

There are two screens related to I/O diagnosis function.

(1) The I/O diagnosis screen
The I/O variables are listed in this screen. You can check the configuration of the I/O network devices and the status of the communication with them.
You can select three ways of ordering the list by soft keys:

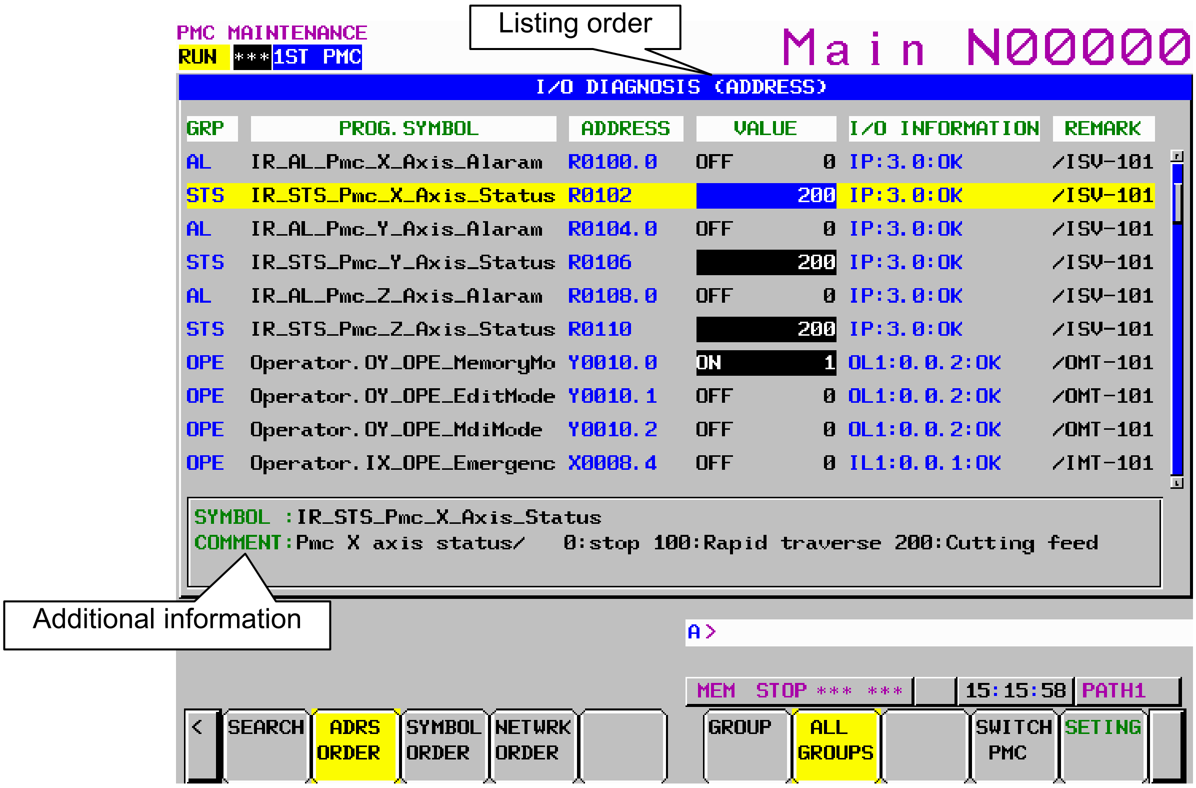
- Address order (Default)
  The variables are displayed in the order of their actual addresses.
- Symbol order
  The variables are displayed in the alphabetical order of their symbols.
- Network order
  The variables are displayed in the order of their network addresses. Only the variables actually associated with an I/O network appear in this mode.

NOTE
"Symbol order" is available only in case of the sequence program with extended symbol and comment.

(2) The setting screen
You can configure the I/O diagnosis screen at the setting screen

7.7.1 I/O DIAGNOSIS Screen

In I/O Diagnosis screen, you can check the status of each I/O variable. You can also check the configuration of I/O devices and the communication status with them.

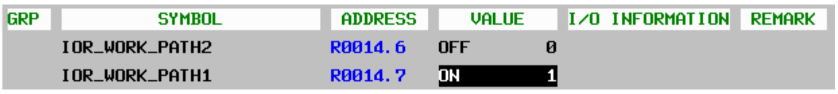


(1) GRP (GROUP)
To include a specific string, which means a kind of signals in a part of symbol string, these signals on I/O diagnosis screen are classified and you can easy to understand the status of signals.
The group names of the I/O variables are displayed, which are extracted (Max. 4 chars) out of their symbol names as configured in “GROUP FORMAT” in the setting screen.
The groups to be displayed can be specified by soft key.
[ALL GROUPS] All groups are displayed.
[GROUP] The group entered by key or the group under the cursor is selected to be displayed.

(2) PROG.SYMBOL (SYMBOL)
The symbol names of the I/O variables are displayed.
The symbol names are displayed in the following formats according to the setting of the “SHOW PROGRAM” on the Setting screen of I/O DIAGNOSIS.
<Program Symbol>.<Signal Symbol>
<Program Number>.<Signal Symbol>
<Signal Symbol>
For details of the setting of the “SHOW PROGRAM”, see to the description of “SHOW PROGRAM” in Section 7.7.2

(3) ADDRESS
The actual locations of I/O variables are displayed.

(4) VALUE
The current values of I/O variables are displayed as signed decimal, according to the data type of them (i.e. BOOL, BYTE, WORD, and DWORD). If the data type is BOOL, “ON” or “OFF” is also displayed as follows.



(5) I/O INFORMATION
The information related to I/O network is displayed in the display format below:

<I/O type><Network type> : <Network address> : <status>

I/O type:

Module type	Shown as
Input module	I
Output module	O
Other	*

Network type:

Network type	Shown as
PROFIBUS	P
I/O Link	L*n* (*n*: channel number)
I/O Link *i*	L*n* (*n*: channel number)

Network address:

Network type	Network address notation
PROFIBUS	*<Slave #>.<Slot #>*
I/O Link	*<Group #>.<Base #>.<Slot #>*
I/O Link *i*	*<Group #>.<Slot #>*

NOTE

This screen shows the I/O information according to the network setting that became effective at the time of the last power-on.
The notes for each network device are as follows:

PROFIBUS
1. If you have changed some of the PROFIBUS parameters, you have to cycle the power once to make the changes take effect.

I/O Link
1. Only the I/O Link assignments, which are made effective by the setting of "Machine Signal Interface" in Configuration Parameter menu and the setting of the "Communication method of I/O Link" in NC Parameter and the setting of "Selectable I/O Link Assignment Function", are displayed.
2. If you have changed the following parameters, you have to cycle the power once to make them take effect:
   - "I/O Link assignment data"
   - "Machine signal interface" in PMC configuration parameter
   - "Communication method of I/O Link" in NC Parameter
   - Parameter of "Selectable I/O Link assignment function"
3 If you have stored new sequence program to PMC, its I/O Link assignment data will not take effect until you write it into Flash-ROM and cycle the power once.

I/O Link *i*
1. Only the I/O Link *i* assignments, which are made effective by the setting of "Communication method of I/O Link" in NC Parameter and the setting of "Selectable I/O Link *i* Assignment Function", are displayed.
2. If you have changed the following parameters, you have to cycle the power once to make them take effect:
   - "I/O Link *i* assignment data"
   - "Communication method of I/O Link" in NC Parameter
   - Parameter of "Selectable I/O Link *i* assignment function"
3. If you have stored new I/O configuration data to PMC, its I/O Link *i* assignment data will not take effect until you write it into Flash-ROM and cycle the power once.

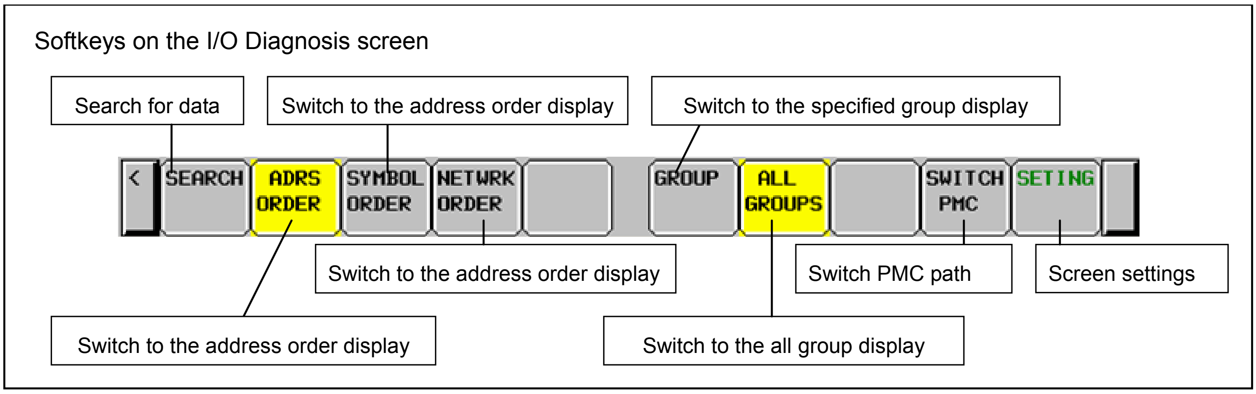
Status: the status of communication
"OK" or "NG" is displayed.

(6) REMARK
The remarks up to 8 characters extracted from comment data are displayed. To specify the remark at this field, set "100" to the attribute value of the comment, which you want to show in this field, on FANUC LADDER-III,

(7) Additional information window
In this window, symbol and comment of the I/O variable under the cursor are displayed.
To display comments depend on language, set a language attribute with FANUC LADDER-III.

NOTE

In case of the extended symbol and comment, the comments on the screen will be switched dynamically to new language when the language setting of CNC changes. For the language attribute, refer to "APPENDIX B. LANGUAGE ID TABLE".



Operations using soft keys

(1) [SEARCH] Search symbol or address

Pressing [SEARCH] soft key after a string searches the string in the symbols and addresses, and shows a symbol or an address that contains the string if found.

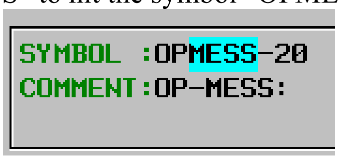
The search is performed toward bottom of the list. When it reaches the bottom of the list, it goes back to the top and continues.

Pressing [SEARCH] alone repeats the last search.

When the search hits, the part of the searched string is highlighted by light blue background in the Additional Information window.

Example:

The case of searching “MESS” to hit the symbol “OPMESS-20”



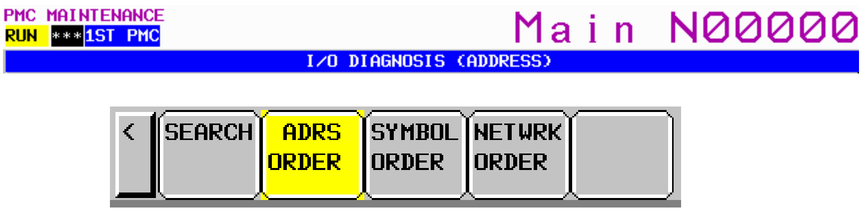
NOTE

1 When arrived back to the starting position where the first search operation hit by repeated search of the same entry, the message “REACHED TO THE END OF SYMBOL DATA.” appears.

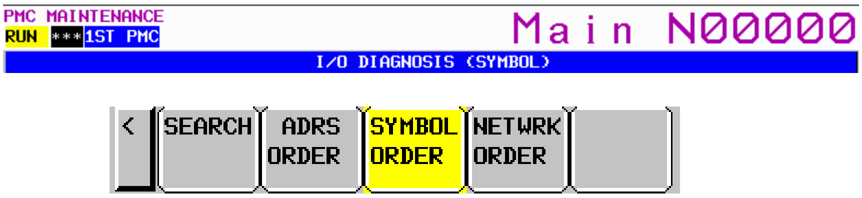
2 If the setting “SHOW PROGRAM” is set to “SYMBOL” or “PROGRAM NO.”, the symbol name is displayed in one of forms below:
<Program Symbol>.<Signal Symbol>
<Program Number>.<Signal Symbol>
In this case, search function will not hit in “Program Symbol” nor “Program Number”.

3 On a symbol screen in network order a searching word is performed in address order. When you search a part string and some word are hit, the searched position (cursor position) may move to unexpected direction.

(2) [ADRS ORDER] Sort by address order
Displays I/O variables in address order. (Default)
In this mode, the mark “(ADDRESS)” is appended in the title of this screen, and the [ADRS ORDER] soft key is highlighted with yellow background.

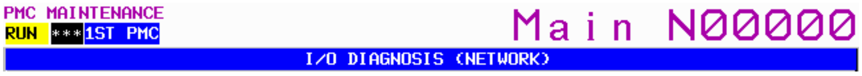


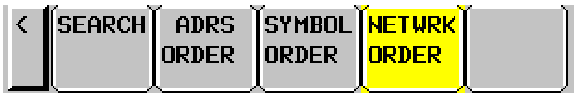
(3) [SYMBOL ORDER] Sort by symbol order
Displays I/O variables in symbol order.
In this mode, the mark “(SYMBOL)” is appended in the title of this screen, and the [SYMBOL ORDER] soft key is highlighted with yellow background.



NOTE
“Symbol order” is available only in case of the sequence program with extended symbol and comment.

(4) [NETWRK ORDER] Sort by network address order
Displays I/O variables in order of network address.
Only the I/O variables that is actually effective are displayed.
In this mode, the mark "(NETWORK)" is appended in the title of this screen, and the [NETWRK ORDER] soft key is highlighted with yellow background.





The I/O variables are sorted by its network address. The sorting order is not affected by the type of modules such as input or output. The order is determined according only to priority of network address portion as following. For I/O Link and I/O Link *i*, the I/O variables of them are displayed together by the channel order.

PROFIBUS: Slave Number, Slot Number
I/O Link: Channel, Group, Base, Slot
I/O Link *i*: Channel, Group, Slot

Example: In case that the channel 1 is I/O Link *i* and the channel 2 is I/O Link, I/O Link *i* is displayed earlier.
IP:3.0:OK
IL1:0.1:OK
IL2:0.0.1:OK

> **NOTE**
> If while sorting the I/O variables in "Network order" mode, the following messages may appear:
> SORTING DATA [PROFIBUS : *n* SLAVE]
> SORTING DATA [I/O LINK : *n* CH *m* GROUP]

(5) [GROUP] Filter by group
Choose a group to which the I/O variables to be displayed belong. Press this soft key following the group name, or press it alone with the cursor placed on the group you want to specify.
The way to order the I/O variables will not change.
If the setting "GROUP FORMAT" is not specified, the soft key [GROUP] and [ALL GROUPS] are not effective.

> **NOTE**
> If while extracting the I/O variables of specific group, the following messages may appear:
> SELECTING GROUP [PROFIBUS : *n* SLAVE]
> SELECTING GROUP [I/O LINK : *n* CH *m* GROUP]

(6) [ALL GROUPS] Cancel group filter
Displays I/O variables of any group. (Default)
If the setting "GROUP FORMAT" is not specified, the soft key [GROUP] and [ALL GROUPS] are not effective.

(7) [SWITCH PMC] Switching PMC path or divided ladder programs
Switches PMC path or divided ladder program of which the I/O variables are to be shown. For details of the operation, refer to "6.3".
By setting keep relay K935.0 to 1, you can display PMC program list screen. For details, refer to "2.2.11".

(8) [SETING] Configure the setting of this screen
Goes to the setting screen of I/O diagnosis.

Screen operation using other keys

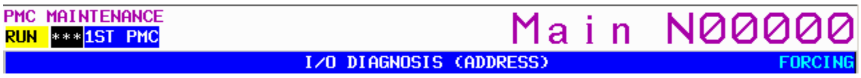
(1) Cursor keys
Move cursor to change the I/O variable, whose information is displayed in Additional information window, or to which the forcing function is performed. They scroll up and down the contents of the screen if necessary.

(2) Page keys
Scroll up or down the contents of the screen by page.

(3) Input key
If the forcing function is available, you can change the status of I/O variables by Input key.
(a) Changing a bit signal
- "1" + Input key to turn on the signal.
- "0" + Input key to turn off the signal.
- Press Input key alone to toggle the signal

(b) Changing a byte, word, dword variable
Press Input key following signed decimal

If the setting item "FORCING ENABLE" is set to "YES" in the setting screen, you can change the value of I/O variables as described above.
The mark "FORCING" at the right end of the screen title indicates the forcing function is enabled.



> ⚠ **WARNING**
> 1 You have to pay special attention to use Forced I/O function to change status of signals. Inappropriate use of Forced I/O function may cause unexpected reaction of machine. You have to make it sure that nobody is near the machine when you use this function.
> 2 As you use Forcing mode of Forced I/O function to change status of signal, however, the signal may look proof against Forced I/O function, because LADDER program or I/O device writes into the signal repeatedly. In this case, even if the signal looks unchanged, actual signal may be changed in very short moment. You should be careful for the reaction of machine to such signal changes.

7.7.2 SETTING Screen of I/O DIAGNOSIS

In “I/O DIAGNOSIS (SETTING)” screen, you can change the setting to configure the I/O diagnosis screen

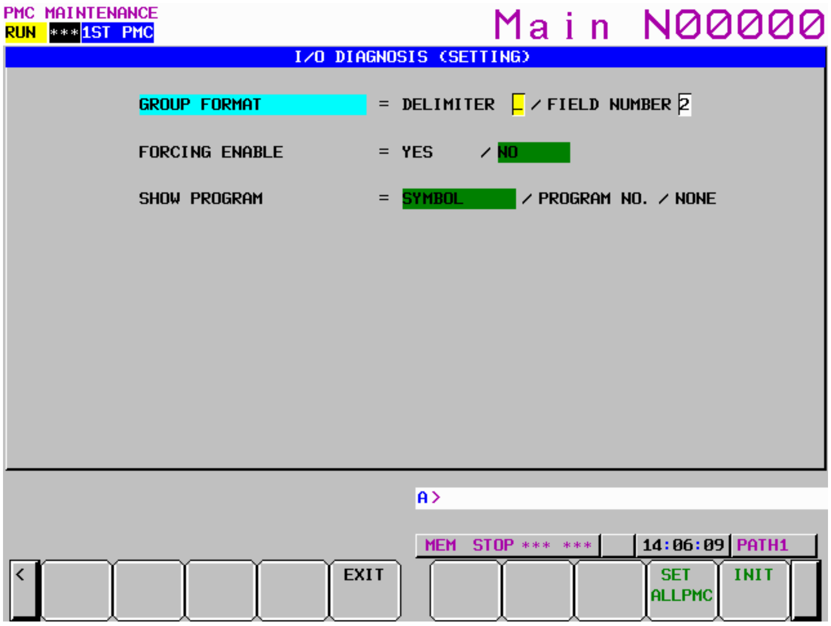


Fig. 7.7.2(a) Setting screen of the I/O diagnosis (for extended symbol and comment)

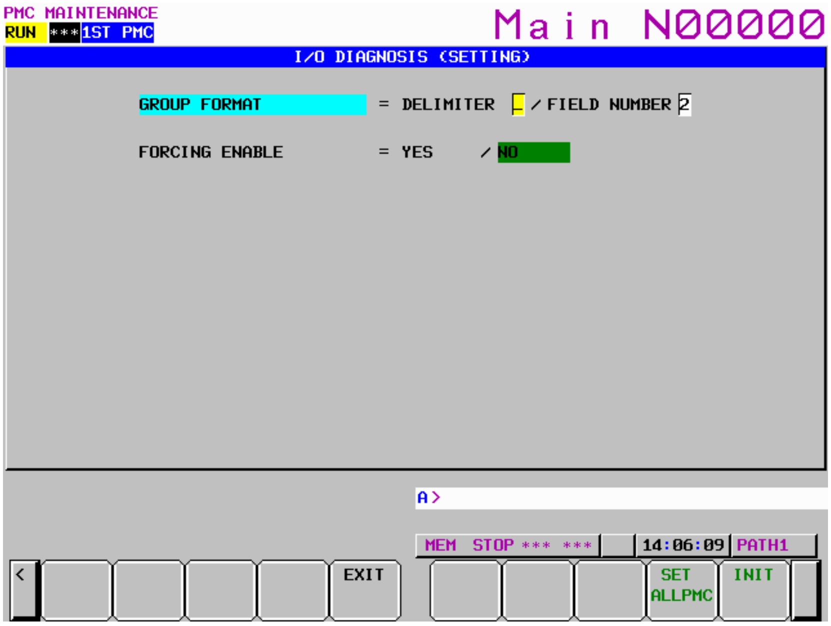


Fig. 7.7.2 (b) Setting screen of the I/O diagnosis (for former symbol and comment)

(1) GROUP FORMAT
The group names shown in I/O Diagnosis screen are strings extracted from their symbol names according to this parameter.

- DELIMITER
  Sets the character of delimiter for extraction. Every appearance of this character in a symbol string cut the symbol into “fields”.

> **NOTE**
> If no character is given, the group feature of I/O Diagnosis screen is disabled. In this case, the field number has no effect.

- FIELD NUMBER
  Sets the field number, which indicates the field to be a group name. If this number is 1, the first field, which means the portion of each symbol name from the first character to the character just before the first appearance of the delimiter character,

> **NOTE**
> If 0 is set, the group feature of I/O Diagnosis screen is disabled.
> In this case, the delimiter has no effect.

Example: Case of "_" as delimiter, and group name at 2nd field
The symbol = I_AL_NC_WATCH_DOG_SIGNAL
DELIMITER = '_'
FIELD NUMBER = 2
As a result, "AL" is extracted as its group name

(2) FORCING ENABLE
Enables or disables the forcing function.

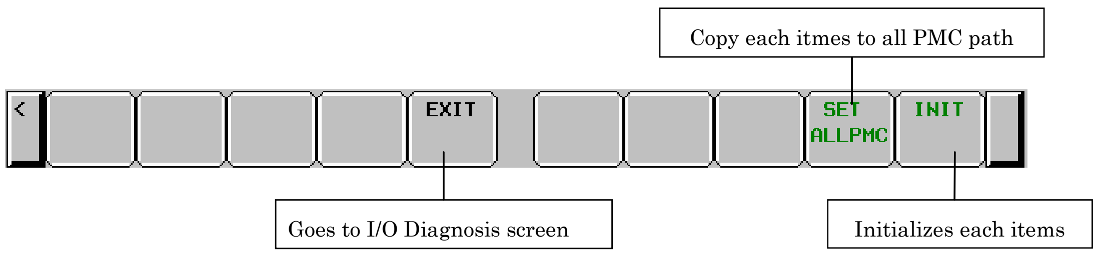
> ⚠ **WARNING**
> 1 You have to pay special attention to use Forced I/O function to change status of signals. Inappropriate use of Forced I/O function may cause unexpected reaction of machine. You have to make it sure that nobody is near the machine when you use this function.
> 2 As you use Forcing mode of Forced I/O function to change status of signal, however, the signal may look proof against Forced I/O function, because LADDER program or I/O device writes into the signal repeatedly. In this case, even if the signal looks unchanged, actual signal may be changed in very short moment. You should be careful for the reaction of machine to such signal changes.

> **NOTE**
> If the Forced I/O function is protected by the programmer protection function, this setting is not effective.
> The Forced I/O function will be protected in the condition as follows.
>
> In case of Programmer Protection Function
> - PROGRAMMER ENABLE (K900.1) "NO"
>   and
> - RAM WRITE ENABLE (K900.4) "NO"
>
> In case of Protection of Data at 8 Levels
> - Operation level is less than CHANGE level of "PMC MEMORY".

(3) SHOW PROGRAM
Determines the form of symbol name in the I/O Diagnosis screen.
SYMBOL:
Symbol names are displayed in the form below:
<Program Symbol>.<Signal Symbol>
If symbol name is too long for the symbol field of the I/O Diagnosis screen, the tail of signal symbol is cut to fit it.
PROGRAM NO.:
Symbol names are displayed in the form below:
<Program Number>.<Signal Symbol>
If symbol name is too long for the symbol field of the I/O Diagnosis screen, the tail of signal symbol is cut to fit it.
NONE:
Program symbol nor program number is not displayed.

NOTE
These setting data are kept in the nonvolatile memory not to be lost even if the power is turned off.

Softkeys on the I/O Diagnosis screen



Operations using the soft keys

(1) [EXIT]
Goes to the I/O Diagnosis screen.

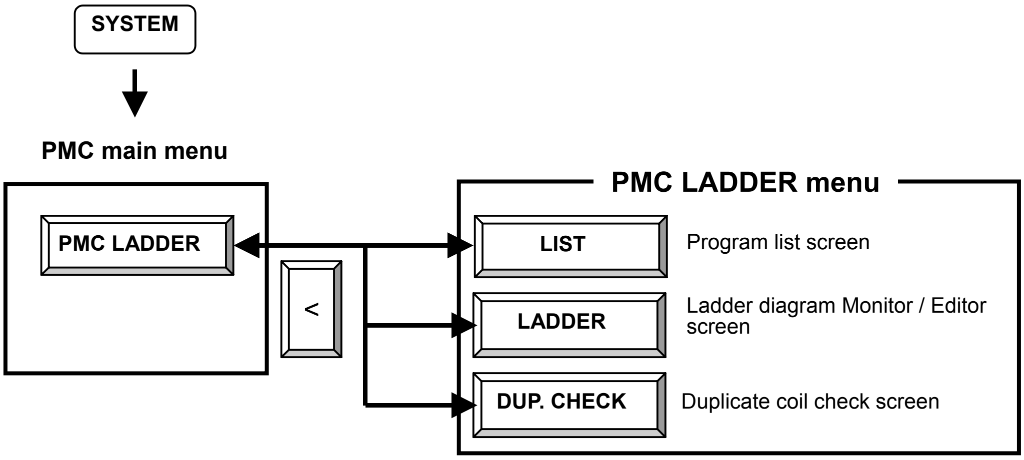
(2) [SET ALLPMC] Copies settings to all PMC paths
Copies current settings to all other PMC paths.

(3) [INIT] Initializes settings
All the settings are initialized to their initial values as follows:

GROUP FORMAT:	DELIMITER = *none*
	FIELD NUMBER = 0
FORCING ENABLE:	NO
SHOW PROGRAM:	SYMBOL

8 LADDER DIAGRAM MONITOR AND EDITOR SCREENS ([PMC LADDER])

The PMC LADDER menu contains the screens related to PMC Ladder diagrams, such as the PROGRAM LIST screen and the LADDER DIAGRAM MONITOR/EDITOR screens.
You can switch to the PMC LADDER menu by operating on the "SYSTEM" key and then the [PMC LADDER] soft key.



Pressing the [LADDER] soft key causes the sequence program to be dynamically displayed, allowing you to monitor operation. The editor screen allows you to make changes to relay and functional instructions in the sequence program to change the operation of the sequence program.
The ladder diagram display/editor functions consist of the following screens:

(1) LADDER DIAGRAM MONITOR screen
Displays ladder diagrams to monitor the current states of relays, coils, and so on.
(2) COLLECTIVE MONITOR screen
Displays selected ladder net to monitor the current states of relays, coils, and so on.
(3) LADDER DIAGRAM EDITOR screen
Allows you to edit ladder diagram in units of net.
(4) NET EDITOR screen
Allows you to edit single net in a ladder diagram.
(5) PROGRAM LIST VIEWER screen
Allows you to select the subprogram to be displayed on the LADDER DIAGRAM MONITOR screen.
(6) PROGRAM LIST EDITOR screen
Allows you to edit a ladder program in units of subprograms. Also allows you to select the subprogram to be edited on the LADDER DIAGRAM EDITOR screen.
(7) FUNCTIONAL INSTRUCTION DATA TABLE VIEWER screen
Allows you to view the contents of the data table for functional instruction with data table.
(8) FUNCTIONAL INSTRUCTION DATA TABLE EDITOR screen
Allows you to edit the contents of the data table for functional instruction with data table.
(9) SUBPROGRAM LIST VIEWER screen
Displays the list of the called subprogram and the subprogram switching history.

NOTE

You can protect these screens by using the programmer protection function. For details, see Section 6.2.

You can move among screens as shown in the figure below.

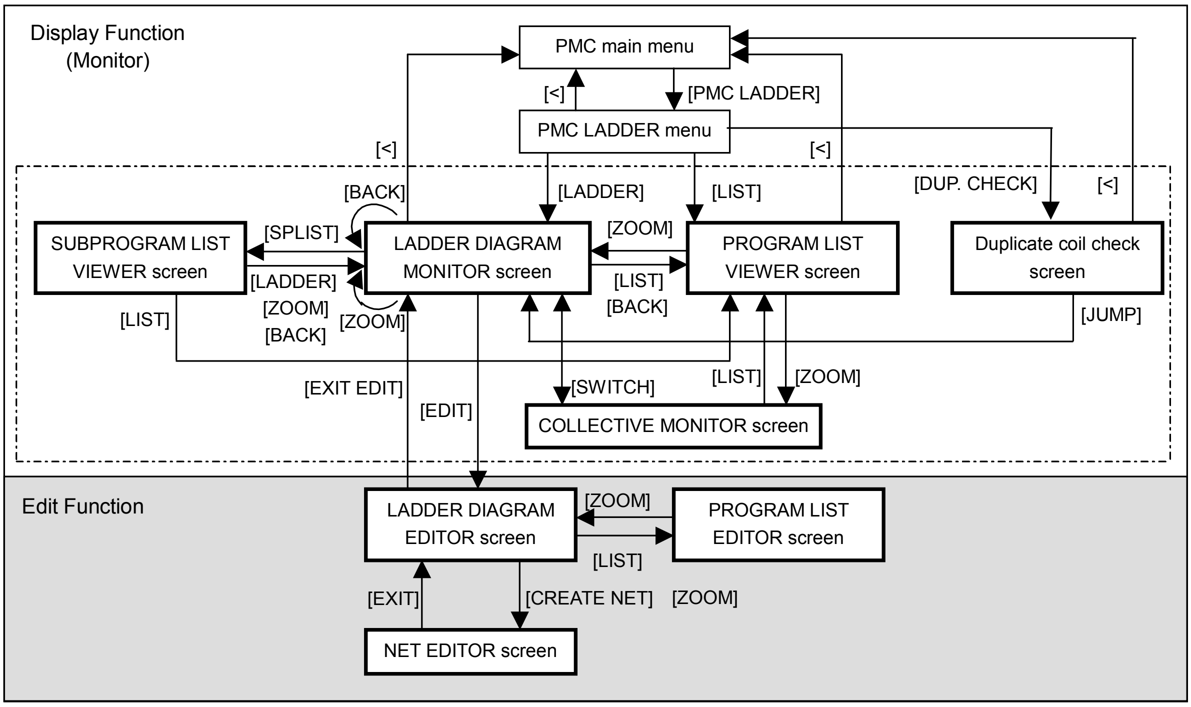


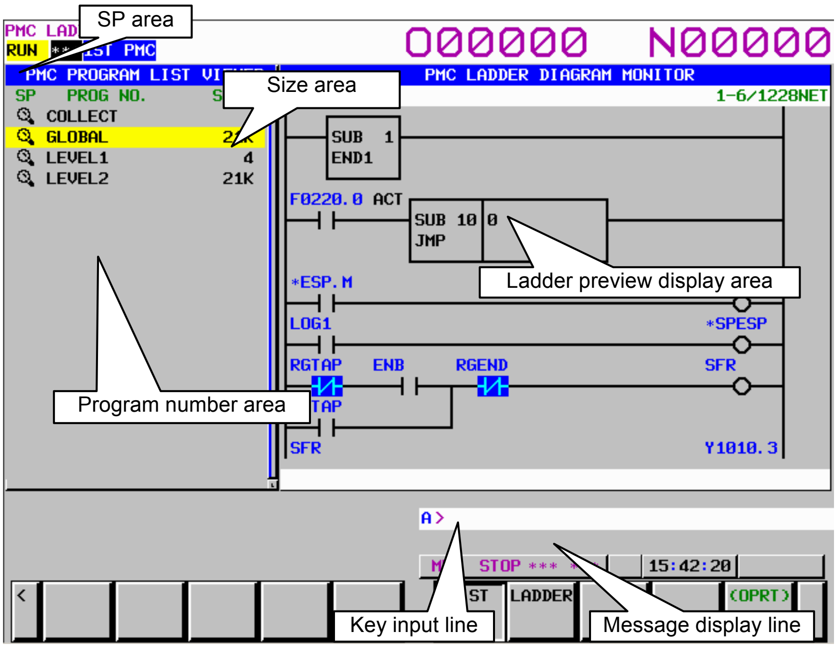
Fig. 8 Transition among screens

NOTE

The [EDIT] soft key on the LADDER DIAGRAM MONITOR screen is displayed and becomes available if the programmer protection function enables to edit ladder program. For details, see Section 6.2.

8.1 DISPLAYING A PROGRAM LIST ([LIST] SCREEN)

The PROGRAM LIST VIEWER screen shows program information such as the program size.



(1) Screen structures

(a) A program list is displayed on the left side of the screen; on the right side, the ladder diagram of the program currently indicated by the cursor on the program list is displayed.

(b) In the message line, error messages or inquiry messages will be displayed depending on the situation.

(c) The program list displays up to 18 programs at a time in the list display area.

(2) Area of program list

(a) In the "SP area", the protect information for subprograms is displayed, so are their program types.

(Lock): Unable to browse and edit (Global program)

(Magnifying glass): Ladder program which is able to browse but unable to edit

(Pencil): Ladder program which is able to browse and edit

(b) Program name is displayed in the "PROG NO." field for each program.
There are three kinds of program names.

COLLECT: means the collective monitor screen.
GLOBAL: means the whole program.
LEVELn (n = 1, 2, 3): means the Ladder level 1, 2 and 3.
Pm (m = subprogram number): means subprogram.

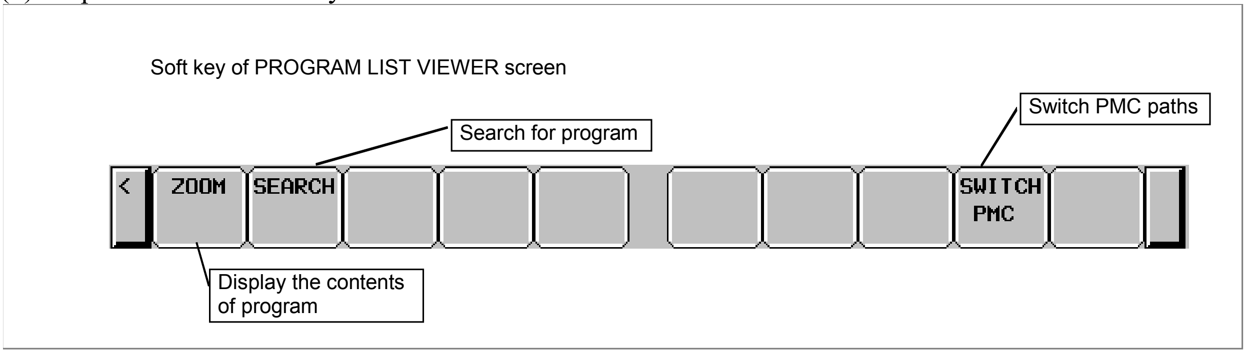
By changing the “ADDRESS NOTATION” item in the LADDER DIAGRAM MONITOR Setting screen to “SYMBOL”, you can display symbols.

(c) The program size is displayed in the “SIZE” field for each program.
If the program size is not over 1024 byte, the unit is shown in byte.
If it is over 1024 byte, the unit is shown in kilo (1024) byte with “K”.

Ex.) The case that program size is not over 1024 byte.
1023 bytes: “1023” is shown.

Ex.) The case that program size is over 1024 byte.
20000 bytes: “19K” is shown.
(Sizes are rounded off to whole numbers before being displayed.)

(3) Operation with Soft keys



(a) [ZOOM] Display the contents of program
Goes to LADDER DIAGRAM MONITOR screen. If you press [ZOOM] soft key without strings, the program under the cursor is displayed at LADDER DIAGRAM MONITOR screen.
If you entered program name (See (a) in (5) for detail) or symbol before pressing [ZOOM] soft key, the program according to the preceding string is searched and the program is displayed at LADDER DIAGRAM MONITOR screen.
But, when the selected program is protected to monitor, you have to unlock the protection.

(b) [SEARCH] Search for program
Searches the program. If you entered program name (See (a) in (5) for detail) or symbol and press [SEARCH] soft key, the program according to the preceding string is searched, the cursor points the program.

(c) [SWITCH PMC] Switching PMC path or divided ladder programs
Switches PMC path or divided ladder program. For details of the operation, refer to “6.3”.
By setting keep relay K935.0 to 1, you can display PMC program list screen. For details, refer to ”2.2.11”.

(4) Other operations

(a) Cursor move keys, Page change keys
You can move cursor by all cursor move keys and Page change keys.

(b) INPUT key
You can operate same as [ZOOM] soft key.

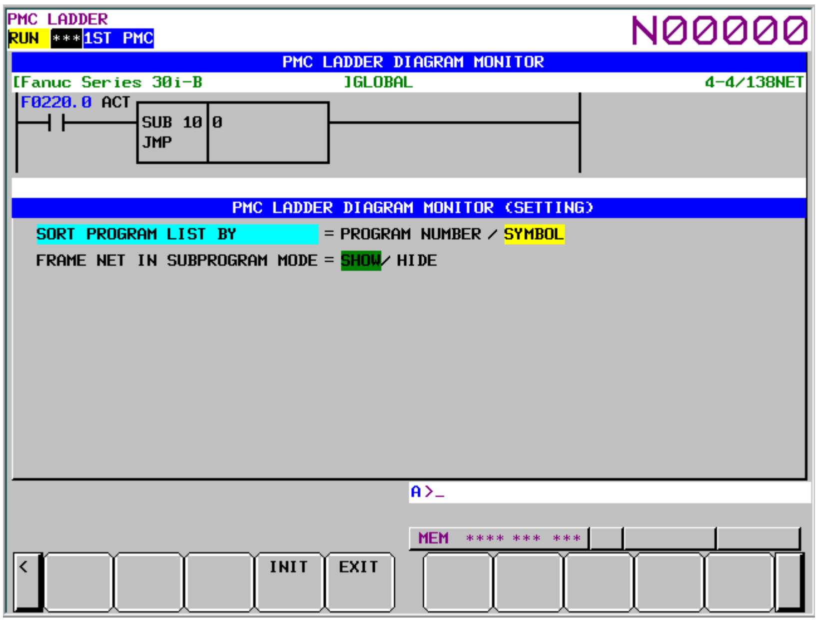
(5) Note of searching and zooming operations

(a) When you specify a subprogram to search for, or to zoom into, you can use following notation for each program part:
GLOBAL: “0”(Zero) or “G”
LEVEL1, 2, 3: “L” + Number Ex.) “L1”, “L01”, etc
Pn: Number or “P2 + Number
Ex.) “1”, “P1”, “P01”

(b) Search function by [SEARCH] soft key tries to suppose the given word as an item to be searched in following order.
(i) The string for GLOBAL or LEVEL: “0”(Zero), “G”,“L” + Number
The number for subprogram:Number
(ii) Symbol
(iii) The string for subprogram: “P” + Number

(6) Ladder preview
The subprogram indicated by the cursor in the program list is displayed in the ladder display area on the right of the screen.
If you wish to operate on the ladder diagram, you must switch to the LADDER DIAGRAM MONITOR screen by using the [ZOOM] soft key from the program list.

8.1.1 Setting the Program List Screen



(1) Program list screen setting
To make settings on the program list screen, use the [SCREEN SETING] soft key on the ladder screen.
Page 2 of the ladder setting screen contains the settings of the program list screen.

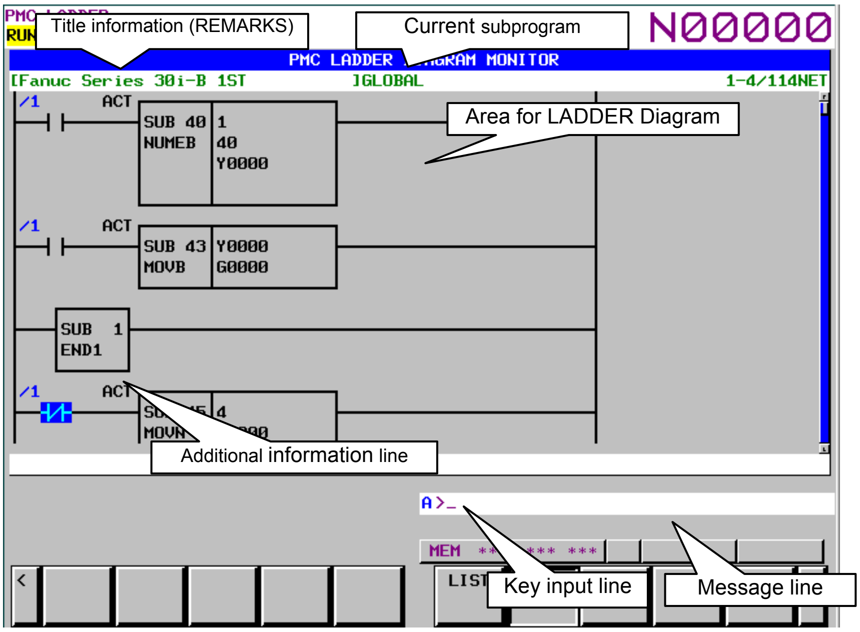
(2) Setting items
(a) SORT PROGRAM LIST BY
Specifies whether to display each subprograms on Program List display screen in order of program numbers or symbols. When ADDRESS NOTATION is SYMBOL, programs without symbols are displayed in order of program number after programs with the symbols. COLLECT,GLOBAL, LEVEL1, LEVEL2, LEVEL3 are out of target of sort.
PROGRAM NUMBER (default)
Program List display screen in order of program numbers.
SYMBOL
Program List display screen in order of symbols.

(b) FRAME NET IN SUBPROGRAM MODE
Frame net means functional instruction END1, 2 and 3 on LEVEL1, 2, 3, and functional instruction SP and SPE on subprogram.
It determines whether the frame net in the LADDER DIAGRAM MONITOR/EDITOR screen are displayed or not, when you selected the program and press [ZOOM] soft key in the PROGRAM LIST VIEWER/EDITOR screen.
SHOW (default)
The frame net is displayed in the LADDER DIAGRAM MONITOR/EDITOR screen.
HIDE
The frame net is not displayed in the LADDER DIAGRAM MONITOR/EDITOR screen.

8.2 MONITORING LADDER DIAGRAMS ([LADDER] SCREEN)

LADDER DIAGRAM MONITOR screen shows the on/off status of contacts and coils, and the contents of address specified for parameter of functional instructions.
From the PMC LADDER menu, you can switch to the LADDER DIAGRAM MONITOR screen by using the [LADDER] soft key. You can use following operation at this screen, including "Forced I/O function (Forcing mode)", by which you can force the relay or the address parameters of functional instructions to a new status or value.

- Switch subprogram to show [LIST]
- Search for address or others [SEARCH MENU]
- Show data table of functional instructions [DATA TABLE]
- Go to COLLECTIVE MONITOR Screen [SWITCH]
- Forced I/O function (Forcing mode) "number" + INPUT key



(1) Screen structures

(a) Title information (REMARKS) of the LADDER Program, the current subprogram, and the current position information of the Diagram displayed in this screen, are displayed above the LADDER Diagram.
When you select a subprogram to be displayed, range for search function is indicated at right of the top line as "LOCAL" or "GLOBAL". In case of "LOCAL", the range for search function is restricted within the current subprogram. In case of "GLOBAL", on the other hand, search function searches whole of LADDER program, and switch current subprogram automatically according to the result of searching.

NOTE
The range mark for search, “LOCAL” or “GLOBAL” does not be displayed in the displays of 8.4 inch or 10.4 inch.

(b) In the additional information line near the bottom of the screen, the following information of the address under the cursor is displayed when the cursor is shown.
- Net number of the net at the cursor
- Address and its symbol and comment information
- Current value

Symbol and Comment are displayed with fixed length when using Basic type Symbol and Comment data.

In case of the bit address under the cursor.

```
1NET:G0078.0:Spdl0rientation (Spindle orienta)=OFF
```

In case of the byte address under the cursor.(4 bytes parameter)

```
2NET:G0104  :StoredStrokeLmt1(Axis direction )=          0/00000000H
```

Left justified Symbol and Comment are displayed with flexible length when using Extended type Symbol and Comment data.

In case of the bit address under the cursor.

```
1NET : G0078.0 : Spdl0rientation = OFF (Spindle orientation external S)
```

In case of the byte address under the cursor.(4 bytes parameter)

```
2NET : G0104 : StoredStrokeLmt1 =          0/00000000H (Axis direction depen.)
```

NOTE

1 When you set K903.1 to 1 and using Basic type Symbol and Comment data, the symbol and comment are displayed with flexible length on additional information line, as same as when using Extended Symbol and Comment data.

2 Displayed comment characters on additional information line is shown below when the symbol and comment are displayed with fixed length.
8.4 inch, 10.4 inch : 15 characters
15 inch, 19 inch : 30 characters

3 When symbol and comment on an additional information line are displayed with flexible length and all the characters of comment cannot be displayed on the line, a period is displayed at the end of comment string.

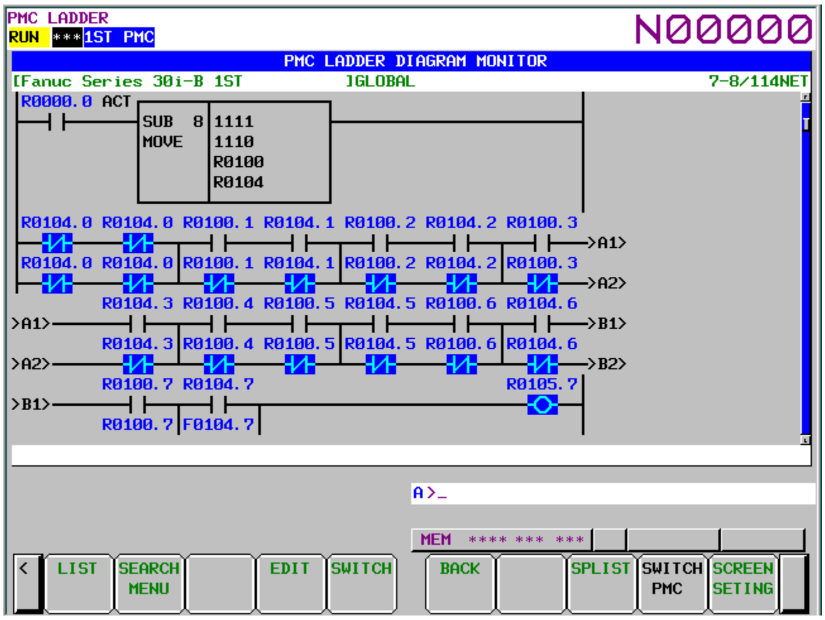
(c) In the message line, error messages or inquiry messages will be displayed depending on the situation.

(d) In the area for LADDER diagrams, 9 × 8, 9 × 6, 9 × 4, 7 × 8, 7 × 6, and 7 × 4 relays can be displayed (horizontally and vertically). For details, see Subsection 8.2.2.

(e) The gauge indicating the current display position in relation to the whole Ladder program is displayed at the right end of the screen.

(2) LADDER diagram

(a) Nets wider than the screen width are displayed as “Continuous Net” using continuous marks (“>A1>”). Same continuous marks mean they are connected with each other.



(3) Monitor

(a) Contacts and coils change their colors and/or shapes according to the status of the signals. The status of power flow is not displayed.

(b) Usually, the parameters of functional instructions are monitored and displayed. You can suppress the monitor and display by an appropriate setting. For details, see Subsection 8.2.2.

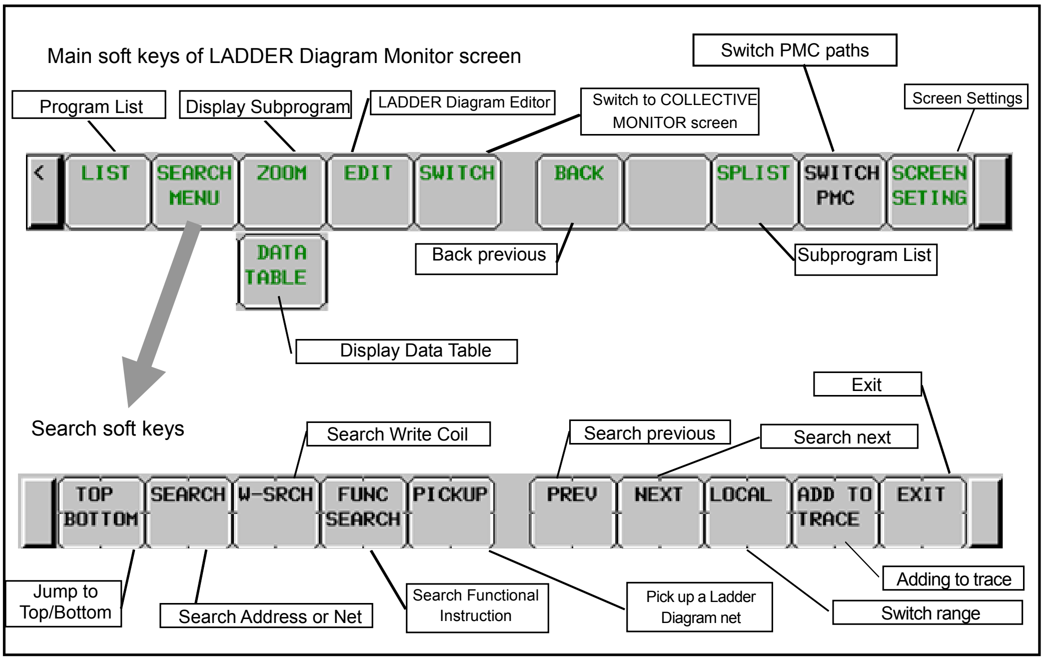
(4) Displaying Symbols and Comments

(a) Usually, addresses are displayed above contacts and coils. For an address with a symbol assigned, you can change the setting so that the symbol is displayed instead of the address. You can add colors to addresses. For details, see Subsection 8.2.2.

(b) If the address of a contact has a comment attached, the comment is displayed below the contact. You can change its display mode by changing the setting. You can add colors to comments. For details, see Subsection 8.2.2.

(c) If the address used with coil has a comment string assigned, the comment strings will be displayed at the right margin beside the coil. You can use this margin area to display an additional relay instead of the comment string by setting: at this setting, one more relay can be displayed in each diagram line. You can add colors to comments. For details, see Subsection 8.2.2.

8.2.1 Operating on the LADDER DIAGRAM MONITOR Screen



(1) Operation with Soft keys

(a) [LIST] Go to PROGRAM LIST VIEWER screen
Goes to PROGRAM LIST VIEWER screen to choose subprogram to be displayed at LADDER DIAGRAM MONITOR screen.

(b) [SEARCH MENU] Search & Jump
Change soft keys to “Search soft keys”. Use the [EXIT] soft key to return to the “Main soft keys”.
“Search soft keys” consists of followings:

- [TOP BOTTOM] Jump to Top/Bottom
  Jumps to the top of LADDER Program. If the top is displayed already, then jump to the bottom.
- [SEARCH] Search Address/Net
  Searches the PMC address or the net according to the preceding string. You can specify both of bit address and byte address.
  When digits are entered, the digits are supposed to be a net number and the screen will jump to the net of the net number.
  When a string other than digits is entered, the string is examined as a symbol for PMC address at first. If the string is found to match a symbol, then the address that the symbol means will be searched for.
  If no symbol matches the string, then the string is examined as PMC address at next. If the string indicates correct PMC address, then the address will be searched for.
  When cursor is hidden, the net that has the specified net number or contains the specified address will be shown at the top of the screen. When cursor is shown, the cursor moves to the relay or the parameter to show the found address directly.
  When target address is in a program protected by the partial protection function, it can be skipped and moved to the next by pressing [SKIP] key.
- [W-SRCH] Search Write Coil
  Searches for the write coils with the address that entered string means. Any contacts with the address are ignored.

- [FUNC SEARCH] Search Functional Instruction
  Searches for the functional instructions by its SUB number or its mnemonic name such as "TMR" or "END2".
- [PICKUP] Pick up a ladder net and load it into the COLLECTIVE MONITOR screen
  Picks up the ladder net to monitor and loads it into the COLLECTIVE MONITOR screen.
- [PREV] Search previous
  Repeats to search the same thing backward (upward).
- [NEXT] Search next
  Repeats to search the same thing forward (downward).
- [GLOBAL]/[LOCAL] Change range
  Changes the range for searching between GLOBAL and LOCAL; GLOBAL means whole of program, and LOCAL means within the displaying subprogram. Current range for searching is indicated at right of the information line at top of screen.
- [ADD TO TRACE] Adding to trace
  Adds the PMC address used for contact or coil into sampling address for signal trace.
- [EXIT] Exit from the search function
  Exits from a search process and returns you to the main soft key display.

(c) [DATA TABLE] Go to FUNCTIONAL INSTRUCTION DATA TABLE VIEWER screen
Goes to FUNCTIONAL INSTRUCTION DATA TABLE VIEWER screen to examine contents of Data Table of functional instructions such as COD (SUB 7) and CODB (SUB 27), which have Data Table in themselves. This soft key appears only when the cursor is on a functional instruction that has Data Table.

(d) [ZOOM] Display contents of subprogram
Placing the cursor on a CALL/CALLU/CM instruction, [ZOOM] soft key is displayed. Pressing [ZOOM] soft key switches the subprogram on the screen to the one which the instruction under the cursor calls. Each subprogram switching is recorded in the subprogram history (Max. 16 records), and you can trace back the history by [BACK] soft key. You can see the list of subprograms in the current history at the Subprogram List Display screen.

(e) [EDIT] Go to LADDER DIAGRAM EDITOR screen
Goes to LADDER DIAGRAM EDITOR screen. This soft key appears only when Programmer function is enabled. And activating Online Monitor function disables this soft key.
If the ladder program is password-protected, you are asked to enter a password. Enter the password required to edit the program.

(f) [SWITCH] Switch to COLLECTIVE MONITOR screen
Switches to COLLECTIVE MONITOR screen.

(g) [BACK] Show the preceding subprogram
Ladder Diagram Monitor screen manages the history of the subprograms which have been displayed. You can use [BACK] soft key to trace back the history to recall the previous subprogram. You can see the subprograms in the current history at the subprogram list screen.

(h) [SPLIST] Switch to the subprogram list screen
The subprogram list screen shows the list of the subprograms which are called by the current subprogram. You can choose a subprogram from the list, which will be displayed on the screen. On the other hand, the history of the displayed subprogram is displayed.

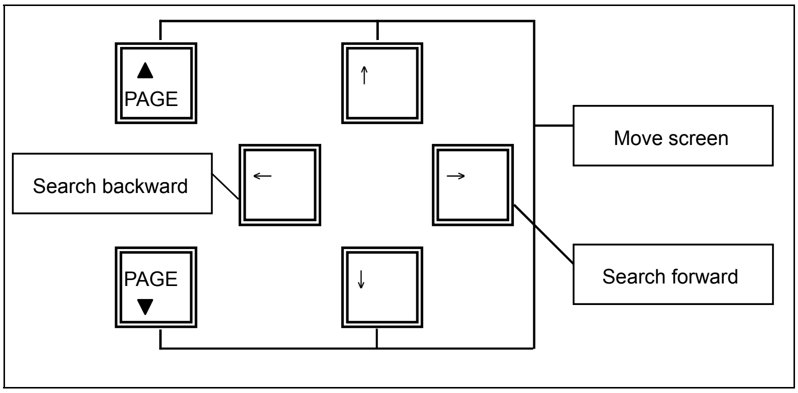
(i) [SWITCH PMC] Switching PMC path or divided ladder programs
Switches PMC path or divided ladder program. For details of the operation, refer to "6.3".
By setting keep relay K935.0 to 1, you can display PMC program list screen. For details, refer to "2.2.11".

(j) [SCREEN SETING] Screen settings
Goes to setting screen for LADDER DIAGRAM MONITOR screen. You can change various settings for LADDER DIAGRAM MONITOR screen at the screen. Use "EXIT" soft key to return to LADDER DIAGRAM MONITOR screen. See Subsection 8.2.2 for the detail.

(2) Other operations

(a) Cursor move keys, Page change keys

With cursor hidden, you can move diagram in the screen by up/down Cursor move keys and Page change keys.



Function of Cursor keys when cursor is hidden

With cursor displayed, you can move the cursor by all cursor move keys and Page change keys. When cursor is placed on some relay or some address parameter of a functional instruction, the information about the address under cursor is displayed at "Additional Information Line".

(b) "number" + INPUT key

When cursor is shown, you can force the value of the address under cursor by entering new value as "number" + INPUT key. In this screen, Forced I/O function is limited only to Forcing mode. This Forced I/O function asks you to confirm your intention before it takes effect. Once it is confirmed that you actually want to change value by this function, you can change the value of the same relay or parameter without further confirmation. However, after you move cursor or you operate other functions, you will be asked when you use the Forced I/O function again.

> ⚠ **WARNING**
> 1 You have to pay special attention to use Forced I/O function to change status of signals. Inappropriate use of Forced I/O function may cause unexpected reaction of machine. You have to make it sure that nobody is near the machine when you use this function.
> 2 As you use Forcing mode of Forced I/O function to change status of signal, however, the signal may look proof against Forced I/O function, because LADDER program or I/O device writes into the signal repeatedly. In this case, even if the signal looks unchanged, actual signal may be changed in very short moment. You should be careful for the reaction of machine to such signal changes.

> **NOTE**
> 1 If the forced I/O function is protected by the programmer protection function, pressing the INPUT key has no effect. For details of protection conditions, and the like, see Section 6.2.
> 2 Parameters of timer functional instructions, TMR and TMRB, which have special monitor formats, are not supported by Forced I/O function. For details, see the description of functional instructions of special monitor format in Subsection 8.2.3.

(3) Notes for Search function

(a) The string followed by [SEARCH] is treated as symbol first. In case that the symbol “D0” is assigned to the bit address “R0.0”, the operation “D0” + [SEARCH] will search the bit address “R0.0”, instead of byte address “D0”.

(b) To search the symbol that consists of only digit characters, which will usually be treated as net number, you can use leading space to specify explicitly the string is symbol. For example, while “123” + [SEARCH] will search the 123rd net from top of the LADDER, “_123” + [SEARCH] (“_” is space) will search address with symbol “123”.

(c) When the range for searching is GLOBAL, and the target is found in other than displaying subprogram, the screen will automatically switch to the subprogram to which the found target belongs. Searching GLOBAL net number that current subprogram does not contain, for example, the subprogram that contains the net of the net number will appear in the screen, displaying the net.

(4) Shortcuts

(a) When cursor is hidden, left/right cursor move keys without string act just like [PREV]/[NEXT] soft keys.

(b) String followed by [SEARCH MENU] soft key in “Main soft keys” starts searching directly.

(c) [SEARCH] soft key in the search soft keys without string searches the address or the functional instruction under cursor forward. If cursor is hidden, or cursor is placed neither on a relay nor on a functional instruction, this operation just repeats the last successful search forward, just like [NEXT] soft key.

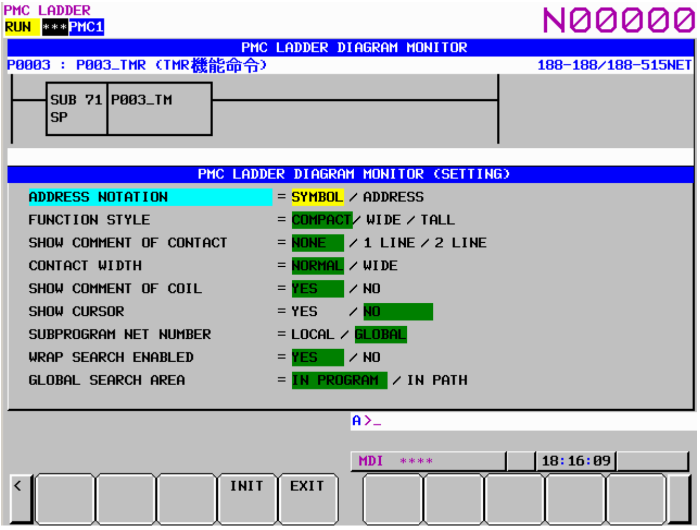
(d) [W-SRCH] soft key without string searches forward a write coil of the same address with relay under cursor. If cursor is hidden, or cursor is not placed on a relay, this operation will search a write coil of the bit address that is searched at last successful search. If the last search was not made with bit address, the last entered string for searching is used to determine what bit address is to be searched for a write coil.

(e) [FUNC SEARCH] soft key without string searches forward the same functional instruction with one under cursor. If cursor is hidden, or cursor is not placed on a functional instruction, this operation will search a functional instruction that is searched at last successful search. If the last search was not made for functional instruction, the last entered string for searching is used to determine what functional instruction is to be searched.

(f) [LIST] soft key following string that indicates subprogram, switches subprogram on LADDER DIAGRAM MONITOR screen. Examples for strings to specify subprogram are following:

“L1”	Level 1
“P10”, “10”	Subprogram “P10”
“0”(zero), “G”	Whole of LADDER program (Global)

8.2.2 Setting the Display Format of the LADDER DIAGRAM MONITOR Screen



(1) Display screen
The LADDER DIAGRAM MONITOR screen is partially displayed on the screen.
The relays displayed here will change real-time by changing the setting.

(2) Setting items
LADDER DIAGRAM MONITOR (SETTING) screen contains the setting items below:

(a) ADDRESS NOTATION
Determines whether the bit and byte addresses in the LADDER Diagram are displayed as corresponding symbols, or the addresses themselves.

SYMBOL (default)
Addresses that have a symbol are displayed by the symbols. Addresses without symbols are displayed by the addresses themselves.

ADDRESS
All addresses are displayed as the addresses themselves even if they have a symbol.

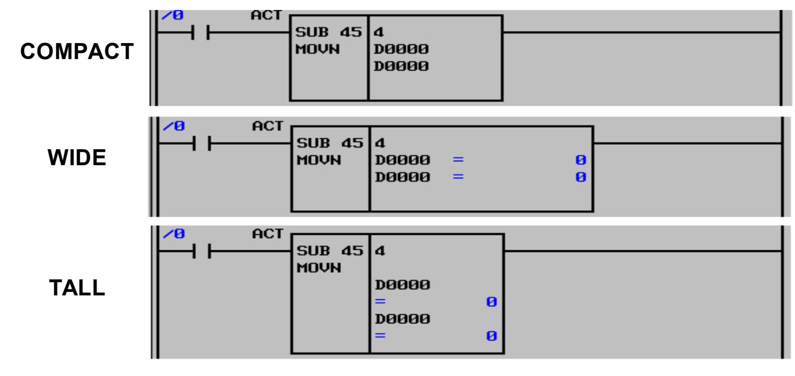
(b) FUNCTION STYLE
Change the shape of functional instructions. There are three options as below. You have to choose other than “COMPACT” to show the current values of address parameters of functional instructions.

COMPACT (default)
Occupies least space in diagram. Monitors of current values of address parameters are omitted.

WIDE
Extends the box horizontally to reserve spaces for the monitors of current values of address parameters. The box becomes wider than COMPACT.

TALL
Extends the box vertically to reserve spaces for the monitors of current values of address parameters. The box becomes taller than COMPACT.

Display styles of functional instructions



The displays of current values of address parameters change their format according to each parameter. See Subsection 8.2.3 for details.
When you place the cursor on an address parameter, its current value is displayed in the “Additional Information Line” in both formats of binary decimal, and BCD (or hexadecimal binary).

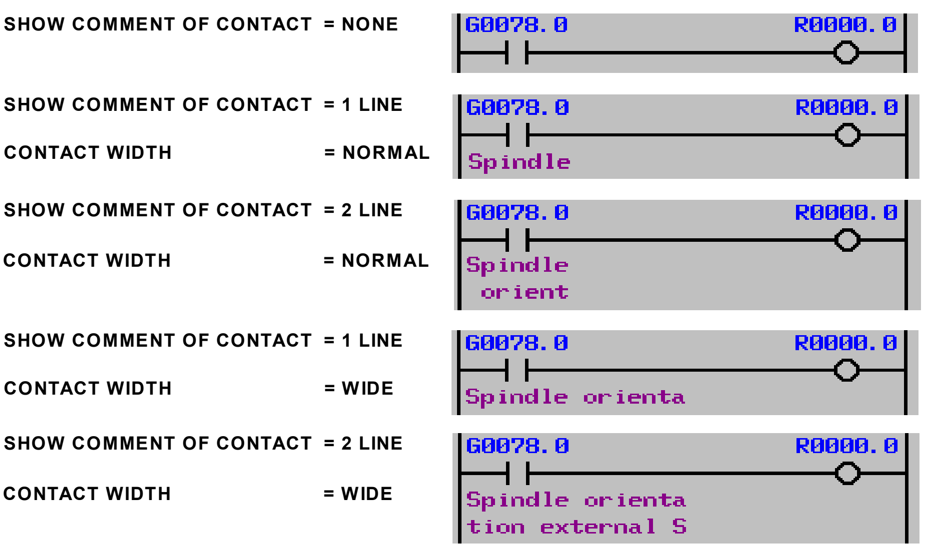
(c) SHOW COMMENT OF CONTACT
Set the style of relay comment. These are three options as below. When you display relay comment, less ladder diagram circuits are shown.

NONE (default)
    Relay comments are not displayed.

1 LINE
    Relay comments are displayed in one line. Up to 15 characters (7 characters in Japanese) of relay comment can be displayed when "WIDE" is selected for the "CONTACT WIDTH" setting that is described below. Characters after 15th character will not be displayed.

2 LINE
    Relay comments are displayed in two lines. Up to 30 characters (14 characters in Japanese) of relay comment can be displayed when "WIDE" is selected to the "CONTACT WIDTH" setting that is described below. Up to 14 characters can be displayed. Characters after 30th character will not be displayed.

Display styles of relay comment



(d) CONTACT WIDTH

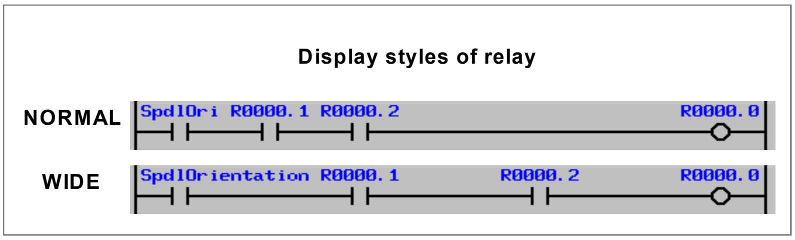
Set the style of relay width. When "WIDE" is selected for the "CONTACT WIDTH" setting, up to 15 characters of symbol on relay can be displayed. Moreover, when "1 LINE" is selected for the "SHOW COMMENT OF CONTACT" setting, up to 15 characters of relay comment can be displayed. When "2 LINE" is selected for the "SHOW COMMENT OF CONTACT" setting, up to 30 characters of relay comment can be displayed. However, in these cases, fewer contacts can be displayed.

NORMAL (default)

A relay is expressed with 8-character length.
Up to 7 characters of symbol can be displayed.

WIDE

A relay is expressed with 16-character length.
Up to 15 characters of symbol can be displayed.



(e) SHOW COMMENT OF COIL

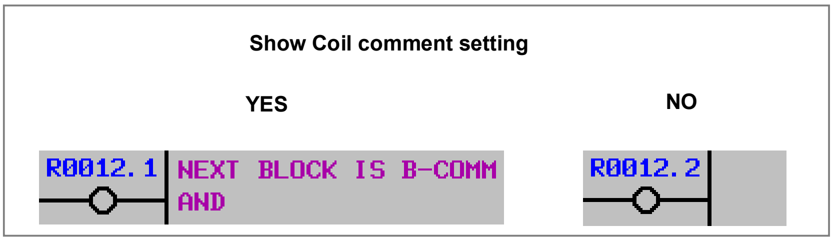
Determines whether to show coil comments.

YES (default)

Right margin of 2 lines of 15 characters is reserved for display of coil comments.

NO

Right margin is used to extend diagram by two more relays (15inch; one more relay), instead of showing coil comment. The screen position bar is also displayed at the right edge of the screen in this option.



(f) SHOW CURSOR

Determines whether to show cursor.

YES (default)

Cursor is displayed. Cursor move keys will move the cursor. When the cursor is placed on bit or byte addresses, the information of the address is displayed at "Additional Information Line". When you search something with the cursor displayed, the cursor goes directly where it is found. This option is recommended for search operation with LADDER program that contains many large nets.

NO

Cursor is not displayed. Up/down cursor move keys will scroll the contents of screen directly. When you search something with the cursor hidden, the net, which contains it, will appear at the top of the screen.

(g) SUBPROGRAM NET NUMBER

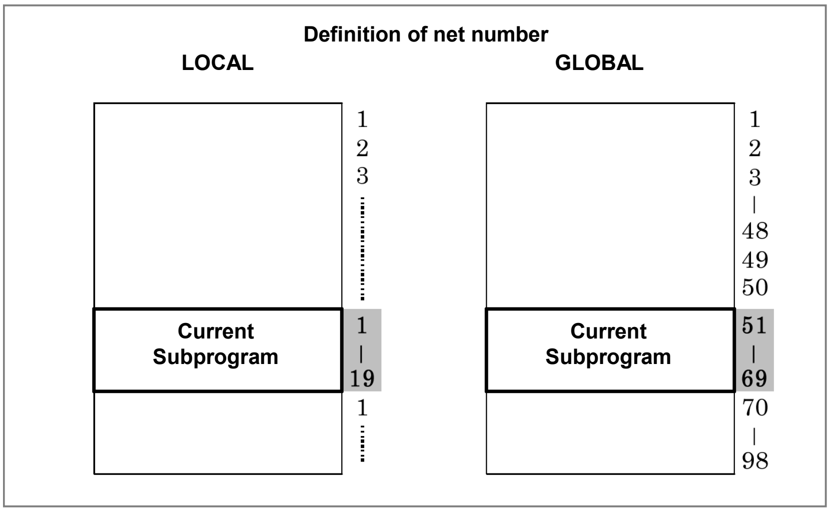
Determines whether a net number is counted as "LOCAL" starting from the top of current subprogram, or is counted as "GLOBAL" starting from the top of whole program. This setting also affects the expression of net number at searching nets by number.

LOCAL

Net number starts from 1 at top of current subprogram. Net number is defined only within current subprogram. The net number information at upper right of the screen is displayed in the format "displaying range/nets in subprogram NET".

GLOBAL (default)

Net number starts from 1 at top of Level 1 program. Net number is defined identically at whole of program. The net number information at upper right of the screen is displayed in the format "displaying range/subprogram range NET".



(h) WRAP SEARCH ENABLED

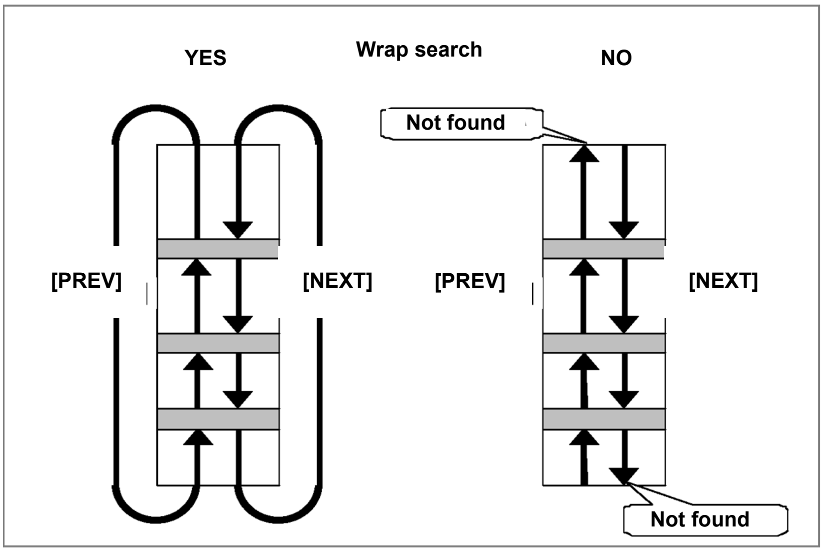
Allows search process to wrap from top/bottom to bottom/top to continue to search.

YES (default)

Downward search will continue to search from top of LADDER when reaches to bottom. Upward search will also continue to search from bottom when reaches to top.

NO

Search process will fail when reached top or bottom, and displays an error message at Message Line.



(i) GLOBAL SEARCH AREA

Determines whether searching range is the displaying program or all programs in the PMC path when using the ladder dividing management function.

IN PROGRAM (default)

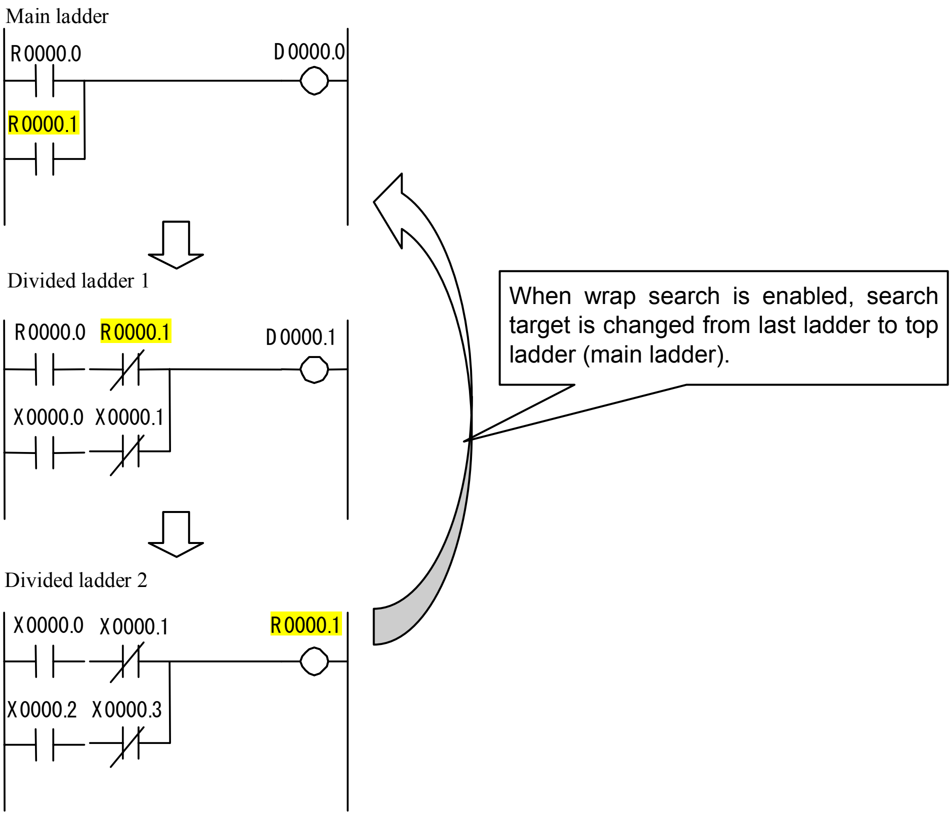
Current displaying program is searching target.

IN PATH

All programs in current selected PMC path are searching target.

Note
When not using the ladder dividing management function (PRM 11931#5 = 0), this item is not displayed.

Searching range and order

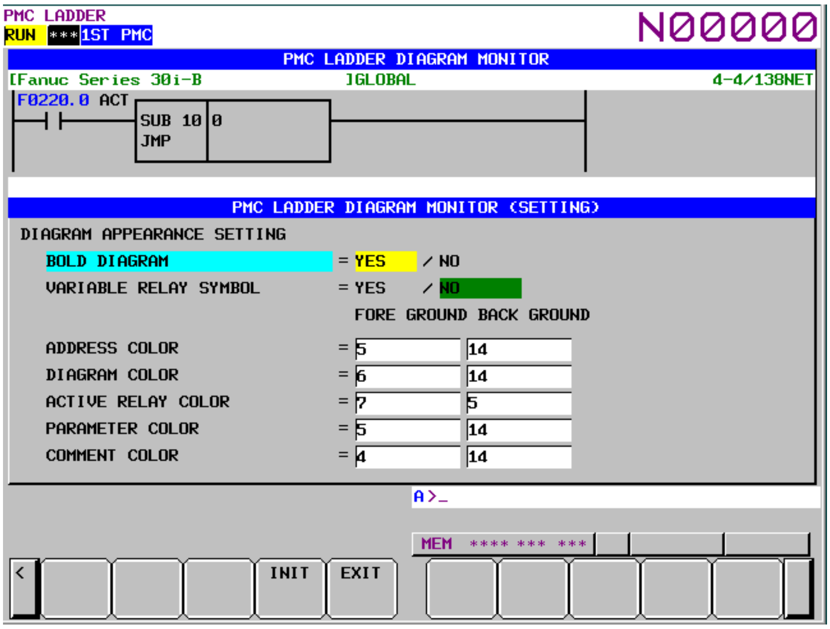


Example of searching action in PMC path (searching PMC address R0000.1)

NOTE
When a search target is found in protected program by password in PMC path, the action depends on keep relay K903.2. K903.2=0: Asking for password. K903.2=1: “PROGRAM IS PROTECTED.” is displayed.

(i) DIAGRAM APPEARANCE SETTING

Changes the appearance of LADDER diagram. Lines, relays, and functional instructions that constitute LADDER diagram can be changed in the colors and the shapes.



- BOLD DIAGRAM

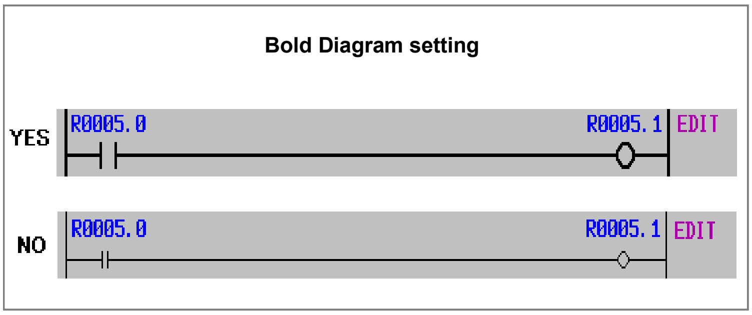
  Sets thickness of diagram lines. This setting also affects shapes of relays.

  YES (default)

  Diagram is drawn with thick lines. Relays are drawn in more distinct shapes. You have to choose this option to make following "VARIABLE RELAY SYMBOL" setting effective.

  NO

  Diagram is drawn with thin lines. Relays are drawn in smaller shapes.



- VARIABLE RELAY SYMBOL

  Determines whether to change the shapes of relays according to their on/off status, or to fix their shapes. This setting is effective only when the setting "BOLD DIAGRAM" is set to "YES".

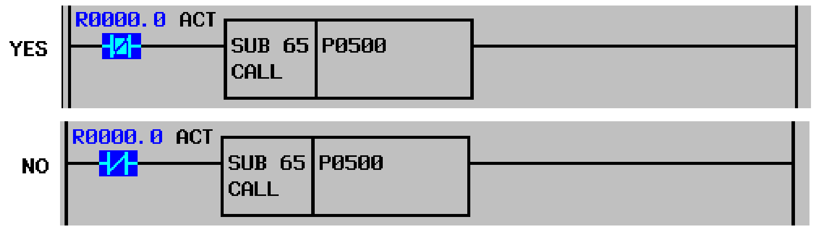
  YES

  Shapes of relays change according to their on/off status. This option is effective only when the setting "BOLD DIAGRAM" is set to "YES". If it is set to "NO", shapes of relays will not change regardless of this setting.

  NO (default)

  Shapes of relays will not change.

Change of relay shapes at on/off status



- ADDRESS COLOR
  Colors for the relay address are set. You can specify these colors by entering color number. 15 colors (from No. 0 to No. 14) are available. Foreground color should be different from background one.

- DIAGRAM COLOR
  General color and its background color for LADDER Diagram. You can specify these colors by entering color number, or by using right and left cursor move keys to change the color number. You can use 15 numbers from 0 to 14; however, some different number may correspond to the same color. You cannot specify the same number to the foreground and the background colors.
- ACTIVE RELAY COLOR
  Color setting for the active relay. When a contact allows power flow, and when a coil receives power, they are active and are displayed with this color setting. When contacts and coils are not active, they are displayed with "general color". You can specify these colors in the same manner as color setting of DIAGRAM COLOR, etc.
- PARAMETER COLOR
  Color setting for the monitor of functional instruction parameters. They are displayed when functional instructions are displayed in the shape other than "COMPACT". You can specify these colors in the same manner as color setting of DIAGRAM COLOR, etc.
- COMMENT COLOR
  Colors for the relay comment are set. You can specify these colors by entering color number, or by moving right and left cursor. 15 colors (from No. 0 to No. 14) are available. Foreground color should be different from background one.

(3) Soft keys
LADDER DIAGRAM MONITOR (SETTING) screen has the soft keys of options and following:
(a) [INIT] Initialize all settings
All settings will be initialized to the default values.
(b) [EXIT] Switch to LADDER DIAGRAM MONITOR screen
Ends the LADDER DIAGRAM MONITOR (SETTING) screen and switches to LADDER DIAGRAM MONIITOR screen.

(4) Settings on multi-path PMC system
On the multi-path PMC systems, the Ladder Diagram related configuration is common to all PMC paths at first. To make it independent for each PMC path, set system keep relay K909.4 to 1.
For example, different color settings may make it easier to recognize the PMC path which the Ladder Diagram on the screen belongs to.
When you set 1 to K909.4 at the first time, the first PMC path will inherit the old settings, and the rest path will start with the initial settings.

8.2.3 Display Format for Parameters

The following table shows all monitor formats for each parameter of each functional instruction.

> **NOTE**
> 1 "Variable" in "Monitor format" field means that this parameter changes its size according to the other parameter. See the descriptions for each functional instruction for detail.
> 2 Functional instruction with "*" mark has Data table.

No.	Name	Parameter	Monitor format
1	END1	–	–
2	END2	–	–
3	TMR	1	special
4	DEC	1	2-digit BCD
		2	constant
5	CTR	1	special
6	ROT	1	constant
		2	4-digit BCD
		3	4-digit BCD
		4	4-digit BCD
7	COD *	1	constant
		2	2-digit BCD
		3	4-digit BCD
8	MOVE	1	constant
		2	constant
		3	2-digit HEX
		4	2-digit HEX
9	COM	1	constant
10	JMP	1	constant
11	PARI	1	1-byte binary
14	DCNV	1	no monitor
		2	no monitor
15	COMP	1	constant
		2	4-digit BCD
		3	4-digit BCD
16	COIN	1	constant
		2	4-digit BCD
		3	4-digit BCD
17	DSCH	1	constant
		2	4-digit BCD
		3	4-digit BCD
		4	4-digit BCD
18	XMOV	1	constant
		2	4-digit BCD
		3	4-digit BCD
		4	4-digit BCD
19	ADD	1	constant
		2	4-digit BCD
		3	4-digit BCD
		4	4-digit BCD
20	SUB	1	constant
		2	4-digit BCD
		3	4-digit BCD
		4	4-digit BCD
21	MUL	1	constant
		2	4-digit BCD
		3	4-digit BCD
		4	4-digit BCD
22	DIV	1	constant
		2	4-digit BCD
		3	4-digit BCD
		4	4-digit BCD
23	NUME	1	constant
		2	4-digit BCD
24	TMRB	1	special
		2	constant
25	DECB	1	constant
		2	variable binary
		3	constant
		4	2-digit HEX
26	ROTB	1	constant
		2	variable binary
		3	variable binary
		4	variable binary
		5	variable binary

No.	Name	Parameter	Monitor format
27	CODB *	1	constant
		2	constant
		3	1-byte binary
		4	variable binary
28	MOVOR	1	2-digit HEX
		2	2-digit HEX
		3	2-digit HEX
29	COME	–	–
30	JMPE	–	–
31	DCNVB	1	constant
		2	no monitor
		3	no monitor
32	COMPB	1	constant
		2	constant or variable binary
		3	variable binary
33	SFT	1	4-digit HEX
34	DSCHB	1	constant
		2	variable binary
		3	variable binary
		4	variable binary
		5	variable binary
35	XMOVB	1	constant
		2	variable binary
		3	variable binary
		4	variable binary
		5	variable binary
36	ADDB	1	constant
		2	variable binary
		3	constant or variable binary
		4	variable binary
37	SUBB	1	constant
		2	variable binary
		3	constant or variable binary
		4	variable binary
38	MULB	1	constant
		2	variable binary
		3	constant or variable binary
		4	variable binary

No.	Name	Parameter	Monitor format
39	DIVB	1	constant
		2	variable binary
		3	constant or variable binary
		4	variable binary
40	NUMEB	1	constant
		2	constant
		3	variable binary
41	DISPB	1	constant
42	EXIN	1	8-digit HEX
43	MOVB	1	1-byte binary
		2	1-byte binary
44	MOVW	1	2-byte binary
		2	2-byte binary
45	MOVN	1	constant
		2	4-byte binary
		3	4-byte binary
47	MOVD	1	4-byte binary
		2	4-byte binary
48	END3	–	–
50	PSGNL	1	1-byte binary
		2	2-digit HEX
51	WINDR	1	2-byte binary
52	WINDW	1	2-byte binary
53	AXCTL	1	constant
		2	8-digit HEX
54	TMRC	1	constant
		2	special
		3	special
55	CTRC	1	2-byte binary
56	CTRB	1	constant
		2	special
57	DIFU	1	constant
58	DIFD	1	constant
59	EOR	1	constant
		2	variable HEX
		3	constant or variable HEX
		4	variable HEX

No.	Name	Parameter	Monitor format
60	AND	1	constant
		2	variable HEX
		3	constant or variable HEX
		4	variable HEX
61	OR	1	constant
		2	variable HEX
		3	constant or variable HEX
		4	variable HEX
62	NOT	1	constant
		2	variable HEX
		3	variable HEX
63	PSGN2	1	1-byte binary
64	END	–	–
65	CALL	1	no monitor
66	CALLU	1	no monitor
68	JMPB	1	no monitor
69	LBL	1	no monitor
70	NOP	1	constant
71	SP	1	no monitor
72	SPE	–	–
73	JMPC	1	no monitor
74	CS	1	2-byte binary
75	CM	1	no monitor
76	CE	-	–
77	TMRBF	1	special
		2	constant
200	EQB	1	constant or 1-byte binary
		2	constant or 1-byte binary
201	EQW	1	constant or 2-byte binary
		2	constant or 2-byte binary
202	EQD	1	constant or 4-byte binary
		2	constant or 4-byte binary

No.	Name	Parameter	Monitor format
203	NEB	1	constant or 1-byte binary
		2	constant or 1-byte binary
204	NEW	1	constant or 2-byte binary
		2	constant or 2-byte binary
205	NED	1	constant or 4-byte binary
		2	constant or 4-byte binary
206	GTB	1	constant or 1-byte binary
		2	constant or 1-byte binary
207	GTW	1	constant or 2-byte binary
		2	constant or 2-byte binary
208	GTD	1	constant or 4-byte binary
		2	constant or 4-byte binary
209	LTB	1	constant or 1-byte binary
		2	constant or 1-byte binary
210	LTW	1	constant or 2-byte binary
		2	constant or 2-byte binary
211	LTD	1	constant or 4-byte binary
		2	constant or 4-byte binary
212	GEB	1	constant or 1-byte binary
		2	constant or 1-byte binary

No.	Name	Parameter	Monitor format
213	GEW	1	constant or 2-byte binary
		2	constant or 2-byte binary
214	GED	1	constant or 4-byte binary
		2	constant or 4-byte binary
215	LEB	1	constant or 1-byte binary
		2	constant or 1-byte binary
216	LEW	1	constant or 2-byte binary
		2	constant or 2-byte binary
217	LED	1	constant or 4-byte binary
		2	constant or 4-byte binary
218	RNGB	1	constant or 1-byte binary
		2	constant or 1-byte binary
		3	constant or 1-byte binary
219	RNGW	1	constant or 2-byte binary
		2	constant or 2-byte binary
		3	constant or 2-byte binary
220	RNGD	1	constant or 4-byte binary
		2	constant or 4-byte binary
		3	constant or 4-byte binary

No.	Name	Parameter	Monitor format
221	TMRST	1	Constant or Special
		2	Special
		3	No monitor
222	TMRSS	1	Constant or Special
		2	Special
		3	No monitor
223	CTRD	1	4-byte binary
		2	4-byte binary
224	MOVBT	1	No monitor
		2	4-byte HEX
		3	Constant
		4	4-byte HEX
		5	Constant
225	SETNB	1	No monitor
		2	Constant or 1-byte binary
		3	1-byte binary
226	SETNW	1	No monitor
		2	Constant or 2-byte binary
		3	2-byte binary
227	SETND	1	No monitor
		2	Constant or 4-byte binary
		3	4-byte binary
228	XCHGB	1	1-byte binary
		2	1-byte binary
229	XCHGW	1	2-byte binary
		2	2-byte binary
230	XCHGD	1	4-byte binary
		2	4-byte binary
231	SWAPW	1	No monitor
		2	2-byte binary
		3	2-byte binary
232	SWAPD	1	No monitor
		2	4-byte binary
		3	4-byte binary

No.	Name	Parameter	Monitor format
233	TBLRB	1	No monitor
		2	1-byte binary
		3	Constant or 2-byte binary
		4	1-byte binary
234	TBLRW	1	No monitor
		2	2-byte binary
		3	Constant or 2-byte binary
		4	2-byte binary
235	TBLRD	1	No monitor
		2	4-byte binary
		3	Constant or 2-byte binary
		4	4-byte binary
236	TBLRN	1	No monitor
		2	No monitor
		3	4-byte binary
		4	Constant or 2-byte binary
		5	4-byte binary
237	TBLWB	1	No monitor
		2	1-byte binary
		3	Constant or 2-byte binary
		4	1-byte binary
238	TBLWW	1	No monitor
		2	2-byte binary
		3	Constant or 2-byte binary
		4	2-byte binary
239	TBLWD	1	No monitor
		2	4-byte binary
		3	Constant or 2-byte binary
		4	4-byte binary
240	TBLWN	1	No monitor
		2	No monitor
		3	4-byte binary
		4	Constant or 2-byte binary
		5	4-byte binary

No.	Name	Parameter	Monitor format
241	DSEQB	1	No monitor
		2	1-byte binary
		3	Constant or 2-byte binary
		4	Constant or 1-byte binary
		5	2-byte binary
242	DSEQW	1	No monitor
		2	2-byte binary
		3	Constant or 2-byte binary
		4	Constant or 2-byte binary
		5	2-byte binary
243	DSEQD	1	No monitor
		2	4-byte binary
		3	Constant or 2-byte binary
		4	Constant or 4-byte binary
		5	2-byte binary
244	DSNEB	1	No monitor
		2	1-byte binary
		3	Constant or 2-byte binary
		4	Constant or 1-byte binary
		5	2-byte binary
245	DSNEW	1	No monitor
		2	2-byte binary
		3	Constant or 2-byte binary
		4	Constant or 2-byte binary
		5	2-byte binary
246	DSNED	1	No monitor
		2	4-byte binary
		3	Constant or 2-byte binary
		4	Constant or 4-byte binary
		5	2-byte binary

No.	Name	Parameter	Monitor format
247	DSGTB	1	No monitor
		2	1-byte binary
		3	Constant or 2-byte binary
		4	Constant or 1-byte binary
		5	2-byte binary
248	DSGTW	1	No monitor
		2	2-byte binary
		3	Constant or 2-byte binary
		4	Constant or 2-byte binary
		5	2-byte binary
249	DSGTD	1	No monitor
		2	4-byte binary
		3	Constant or 2-byte binary
		4	Constant or 4-byte binary
		5	2-byte binary
250	DSLTB	1	No monitor
		2	1-byte binary
		3	Constant or 2-byte binary
		4	Constant or 1-byte binary
		5	2-byte binary
251	DSLTW	1	No monitor
		2	2-byte binary
		3	Constant or 2-byte binary
		4	Constant or 2-byte binary
		5	2-byte binary
252	DSLTD	1	No monitor
		2	4-byte binary
		3	Constant or 2-byte binary
		4	Constant or 4-byte binary
		5	2-byte binary

No.	Name	Parameter	Monitor format
253	DSGEB	1	No monitor
		2	1-byte binary
		3	Constant or 2-byte binary
		4	Constant or 1-byte binary
		5	2-byte binary
254	DSGEW	1	No monitor
		2	2-byte binary
		3	Constant or 2-byte binary
		4	Constant or 2-byte binary
		5	2-byte binary
255	DSGED	1	No monitor
		2	4-byte binary
		3	Constant or 2-byte binary
		4	Constant or 4-byte binary
		5	2-byte binary
256	DSLEB	1	No monitor
		2	1-byte binary
		3	Constant or 2-byte binary
		4	Constant or 1-byte binary
		5	2-byte binary
257	DSLEW	1	No monitor
		2	2-byte binary
		3	Constant or 2-byte binary
		4	Constant or 2-byte binary
		5	2-byte binary
258	DSLED	1	No monitor
		2	4-byte binary
		3	Constant or 2-byte binary
		4	Constant or 4-byte binary
		5	2-byte binary

No.	Name	Parameter	Monitor format
259	DMAXB	1	No monitor
		2	1-byte binary
		3	Constant or 2-byte binary
		4	1-byte binary
		5	2-byte binary
260	DMAXW	1	No monitor
		2	2-byte binary
		3	Constant or 2-byte binary
		4	2-byte binary
		5	2-byte binary
261	DMAXD	1	No monitor
		2	4-byte binary
		3	Constant or 2-byte binary
		4	4-byte binary
		5	2-byte binary
262	DMINB	1	No monitor
		2	1-byte binary
		3	Constant or 2-byte binary
		4	1-byte binary
		5	2-byte binary
263	DMINW	1	No monitor
		2	2-byte binary
		3	Constant or 2-byte binary
		4	2-byte binary
		5	2-byte binary
264	DMIND	1	No monitor
		2	4-byte binary
		3	Constant or 2-byte binary
		4	4-byte binary
		5	2-byte binary

No.	Name	Parameter	Monitor format
265	EORB	1	Constant or 1-byte HEX
		2	Constant or 1-byte HEX
		3	1-byte HEX
266	EORW	1	Constant or 2-byte HEX
		2	Constant or 2-byte HEX
		3	2-byte HEX
267	EORD	1	Constant or 4-byte HEX
		2	Constant or 4-byte HEX
		3	4-byte HEX
268	ANDB	1	Constant or 1-byte HEX
		2	Constant or 1-byte HEX
		3	1-byte HEX
269	ANDW	1	Constant or 2-byte HEX
		2	Constant or 2-byte HEX
		3	2-byte HEX
270	ANDD	1	Constant or 4-byte HEX
		2	Constant or 4-byte HEX
		3	4-byte HEX
271	ORB	1	Constant or 1-byte HEX
		2	Constant or 1-byte HEX
		3	1-byte HEX
272	ORW	1	Constant or 2-byte HEX
		2	Constant or 2-byte HEX
		3	2-byte HEX

No.	Name	Parameter	Monitor format
273	ORD	1	Constant or 4-byte HEX
		2	Constant or 4-byte HEX
		3	4-byte HEX
274	NOTB	1	Constant or 1-byte HEX
		2	1-byte HEX
275	NOTW	1	Constant or 2-byte HEX
		2	2-byte HEX
276	NOTD	1	Constant or 4-byte HEX
		2	4-byte HEX
277	SHLB	1	Constant or 1-byte HEX
		2	Constant or 1-byte binary
		3	1-byte HEX
278	SHLW	1	Constant or 2-byte HEX
		2	Constant or 2-byte binary
		3	2-byte HEX
279	SHLD	1	Constant or 4-byte HEX
		2	Constant or 4-byte binary
		3	4-byte HEX
280	SHLN	1	No monitor
		2	Constant or 4-byteS HEX
		3	Constant or 4-byte binary
		4	4-byte HEX
281	SHRB	1	Constant or 1-byte HEX
		2	Constant or 1-byte binary
		3	1-byte HEX

No.	Name	Parameter	Monitor format
282	SHRW	1	Constant or 2-byte HEX
		2	Constant or 2-byte binary
		3	2-byte HEX
283	SHRD	1	Constant or 4-byte HEX
		2	Constant or 4-byte binary
		3	4-byte HEX
284	SHRN	1	No monitor
		2	Constant or 4-byte HEX
		3	Constant or 4-byte binary
		4	4-byte HEX
285	ROLB	1	Constant or 1-byte HEX
		2	Constant or 1-byte binary
		3	1-byte HEX
286	ROLW	1	Constant or 2-byte HEX
		2	Constant or 2-byte binary
		3	2-byte HEX
287	ROLD	1	Constant or 4-byte HEX
		2	Constant or 4-byte binary
		3	4-byte HEX
288	ROLN	1	No monitor
		2	Constant or 4-byte HEX
		3	Constant or 4-byte binary
		4	4-byte HEX
289	RORB	1	Constant or 1-byte HEX
		2	Constant or 1-byte binary
		3	1-byte HEX

No.	Name	Parameter	Monitor format
290	RORW	1	Constant or 2-byte HEX
		2	Constant or 2-byte binary
		3	2-byte HEX
291	RORD	1	Constant or 4-byte HEX
		2	Constant or 4-byte binary
		3	4-byte HEX
292	RORN	1	No monitor
		2	Constant or 4-byte HEX
		3	Constant or 4-byte binary
		4	4-byte HEX
293	BSETB	1	1-byte HEX
		2	Constant or 1-byte binary
294	BSETW	1	2-byte HEX
		2	Constant or 2-byte binary
295	BSETD	1	4-byte HEX
		2	Constant or 4-byte binary
296	BSETN	1	No monitor
		2	4-byte HEX
		3	Constant or 4-byte binary
297	BRSTB	1	1-byte HEX
		2	Constant or 1-byte binary
298	BRSTW	1	2-byte HEX
		2	Constant or 2-byte binary
299	BRSTD	1	4-byte HEX
		2	Constant or 4-byte binary
300	BRSTN	1	No monitor
		2	4-byte HEX
		3	Constant or 4-byte binary

No.	Name	Parameter	Monitor format
301	BTSTB	1	1-byte HEX
		2	Constant or 1-byte binary
302	BTSTW	1	2-byte HEX
		2	Constant or 2-byte binary
303	BTSTD	1	4-byte HEX
		2	Constant or 4-byte binary
304	BTSTN	1	No monitor
		2	4-byte HEX
		3	Constant or 4-byte binary
305	BPOSB	1	1-byte HEX
		2	1-byte binary
306	BPOSW	1	2-byte HEX
		2	2-byte binary
307	BPOSD	1	4-byte HEX
		2	4-byte binary
308	BPOSN	1	No monitor
		2	4-byte HEX
		3	4-byte binary
309	BCNTB	1	1-byte HEX
		2	1-byte binary
310	BCNTW	1	2-byte HEX
		2	2-byte binary
311	BCNTD	1	4-byte HEX
		2	4-byte binary
312	BCNTN	1	No monitor
		2	4-byte HEX
		3	4-byte binary
313	TBCDB	1	Constant or 1-byte binary
		2	1-byte HEX
314	TBCDW	1	Constant or 2-byte binary
		2	2-byte HEX
315	TBCDD	1	Constant or 4-byte binary
		2	4-byte HEX

No.	Name	Parameter	Monitor format
316	FBCDB	1	Constant or 1-byte HEX
		2	1-byte binary
317	FBCDW	1	Constant or 2-byte HEX
		2	2-byte binary
318	FBCDD	1	Constant or 4-byte HEX
		2	4-byte binary
319	ADDSB	1	Constant or 1-byte binary
		2	Constant or 1-byte binary
		3	1-byte binary
320	ADDSW	1	Constant or 2-byte binary
		2	Constant or 2-byte binary
		3	2-byte binary
321	ADDSD	1	Constant or 4-byte binary
		2	Constant or 4-byte binary
		3	4-byte binary
322	SUBSB	1	Constant or 1-byte binary
		2	Constant or 1-byte binary
		3	1-byte binary
323	SUBSW	1	Constant or 2-byte binary
		2	Constant or 2-byte binary
		3	2-byte binary
324	SUBSD	1	Constant or 4-byte binary
		2	Constant or 4-byte binary
		3	4-byte binary

No.	Name	Parameter	Monitor format
325	MULSB	1	Constant or 1-byte binary
		2	Constant or 1-byte binary
		3	1-byte binary
326	MULSW	1	Constant or 2-byte binary
		2	Constant or 2-byte binary
		3	2-byte binary
327	MULSD	1	Constant or 4-byte binary
		2	Constant or 4-byte binary
		3	4-byte binary
328	DIVSB	1	Constant or 1-byte binary
		2	Constant or 1-byte binary
		3	1-byte binary
329	DIVSW	1	Constant or 2-byte binary
		2	Constant or 2-byte binary
		3	2-byte binary
330	DIVSD	1	Constant or 4-byte binary
		2	Constant or 4-byte binary
		3	4-byte binary
331	MODSB	1	Constant or 1-byte binary
		2	Constant or 1-byte binary
		3	1-byte binary
332	MODSW	1	Constant or 2-byte binary
		2	Constant or 2-byte binary
		3	2-byte binary

No.	Name	Parameter	Monitor format
333	MODSD	1	Constant or 4-byte binary
		2	Constant or 4-byte binary
		3	4-byte binary
334	INCSB	1	1-byte binary
335	INCSW	1	2-byte binary
336	INCSD	1	4-byte binary
337	DECSB	1	1-byte binary
338	DECSW	1	2-byte binary
339	DECSD	1	4-byte binary
340	ABSSB	1	Constant or 1-byte binary
		2	1-byte binary
341	ABSSW	1	Constant or 2-byte binary
		2	2-byte binary
342	ABSSD	1	Constant or 4-byte binary
		2	4-byte binary
343	NEGSB	1	Constant or 1-byte binary
		2	1-byte binary
344	NEGSW	1	Constant or 2-byte binary
		2	2-byte binary
345	NEGSD	1	Constant or 4-byte binary
		2	4-byte binary

• Functional instructions of special monitor format

TMR

Displays instructions in the following format:

Functional instructions Vertical display	Functional instruction horizontal display
Timer number = Current value	Timer number
Preset value	Current value
	Preset value

The monitor display format of the preset values and the current values varies depending on the timer precision, as given in the table below. For details of timer precision, see Subsection 7.3.1.

Precision	Resolution	Display format
0	8 msec/48 msec	by second
1	1 msec	by second
2	10 msec	by second
3	100 msec	by second
4	1 second	HH:MM:SS
5	1 minute	HH:MM:SS

<table>
<tr><td>TMRB</td><td>Displays current value by seconds (HH:MM:SS if 1 minute or more) (preset value is displayed by milliseconds)</td></tr>
<tr><td>TMRC</td><td>The 2nd parameter shows preset value, and the 3rd parameter shows current value as their monitor displays.
These two monitor displays changes their format according to the 1st parameter as below:
<table>
<tr><th>1st parameter</th><th>Resolution</th><th>Display format</th></tr>
<tr><td>0</td><td>8 msec</td><td>by second</td></tr>
<tr><td>1</td><td>48 msec</td><td>by second</td></tr>
<tr><td>2</td><td>1 second</td><td>HH:MM:SS</td></tr>
<tr><td>3</td><td>10 seconds</td><td>HH:MM:SS</td></tr>
<tr><td>4</td><td>1 minute</td><td>HH:MM:SS</td></tr>
<tr><td>5</td><td>1 msec</td><td>by second</td></tr>
<tr><td>6</td><td>10 msec</td><td>by second</td></tr>
<tr><td>7</td><td>100 msec</td><td>by second</td></tr>
</table></td></tr>
<tr><td>TMRBF</td><td>Displays current value by seconds (HH:MM:SS if 1 minute or more) (preset value is displayed by milliseconds)</td></tr>
<tr><td>TMRSS</td><td>By the setting time or the addition time, the monitor display format is changed as follows.
In the case of 59 minutes and less than 59 seconds:
MM:SS:xxx
When 1 hour is exceeded:
HHH: MM:SS</td></tr>
<tr><td>TMRST</td><td>By the setting time or the addition time, the monitor display format is changed as follows.
In the case of less than 10000 hours:
HHHH: MM:SS
When 10000 hours is exceeded:
It displays by 10 figures of signed decimal numbers.</td></tr>
<tr><td>CTR</td><td>Displays in "Current/Preset" format by binary or BCD according to the counter type setting in LADDER Program.</td></tr>
</table>

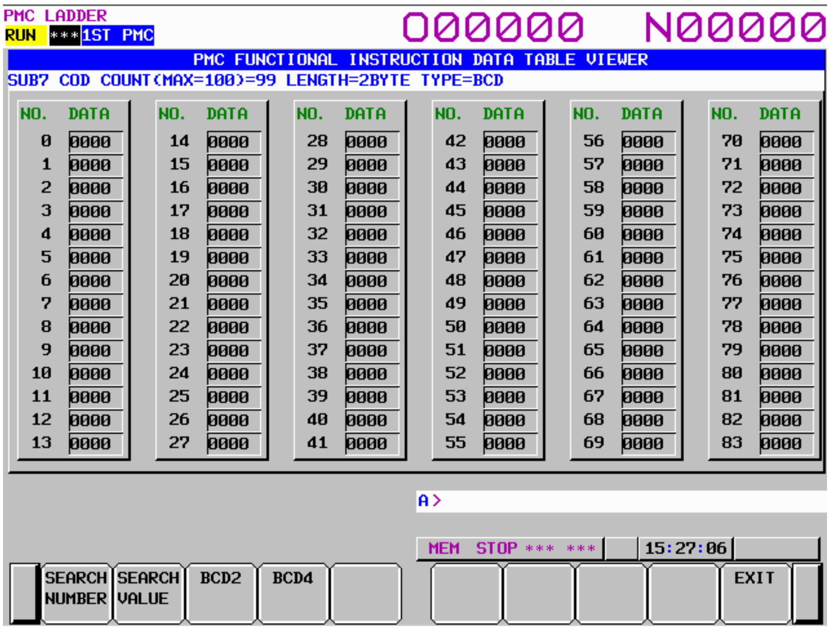
8.2.4 FUNCTIONAL INSTRUCTION DATA TABLE VIEWER Screen

FUNCTIONAL INSTRUCTION DATA TABLE VIEWER screen shows the contents of following data table that belongs to some functional instructions.

- Functional Instruction COD (SUB7)
- Functional Instruction CODB (SUB27)

To reach this screen, at LADDER DIAGRAM MONITOR screen, press [DATA TABLE] soft key that is displayed when the cursor is on the following functional instructions which have a data table.
Following operations are available at this screen.

- Search for data table number. [SEARCH NUMBER]
- Search for data value. [SEARCH VALUE]
- Change the displaying data digits. [BCD2], [BCD4]
  (These soft keys can be operated only at FUNCTIONAL INSTRUCTION DATA TABLE VIEWER screen of functional instruction COD.)
- Switch to LADDER DIAGRAM MONITOR screen. [EXIT]



FUNCTIONAL INSTRUCTION DATA TABLE VIEWER screen of functional instruction COD

(1) Screen structures

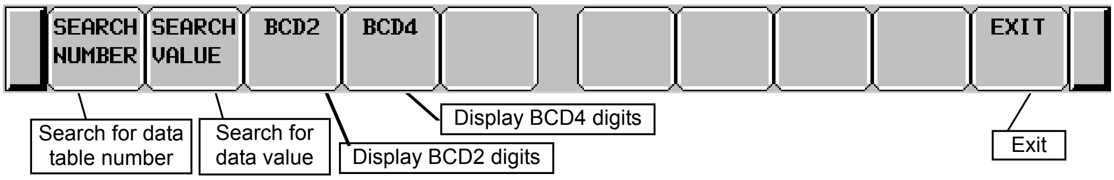
(a) The functional instruction name, the number of data table, data length and data types are displayed above the Data Table.

(b) In the message line, error messages or inquiry messages will be displayed depending on the situation.

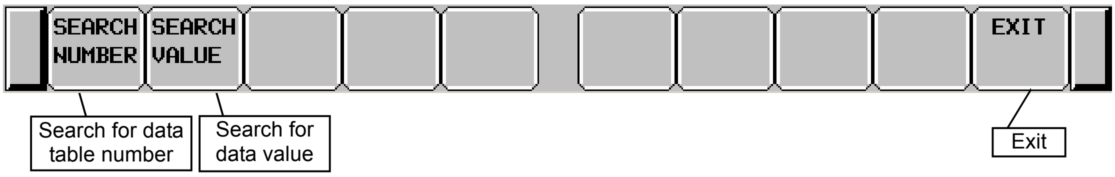
(c) In case of functional instruction COD, the data of 6 lines and 14 columns can be displayed in the area for Data table.
In case of functional instruction CODB, the data of 4 lines and 14 columns can be displayed in the area for Data table.

(2) Operations

Soft keys of Functional Instruction Data Table Viewer screen of functional instruction COD



Soft keys of Functional Instruction Data Table Viewer screen of functional instruction CODB



(a) [SEARCH NUMBER] Search for data table number
Searches the data table number which you specified.
Then the cursor is displayed on the data of the target number.
And the cursor is disappeared when you operate something.

(b) [SEARCH VALUE] Search for data value
Searches the data value which you specified.
Then the cursor is displayed on the target data.
And the cursor is disappeared when you operate something.

(c) [BCD2] Display BCD2 digits
Changes the display data type to 2 digits of BCD. This operation only switches the display data type. So it does never edit the data on memory.

(d) [BCD4] Display BCD4 digits
Changes the display data type to 4 digits of BCD. This operation only switches the display data type. So it does never edit the data on memory.

(e) [EXIT] Exit View
Ends the FUNCTIONAL INSTRUCTION DATA TABLE
VIEWER screen and switches to LADDER DIAGRAM MONITOR screen.

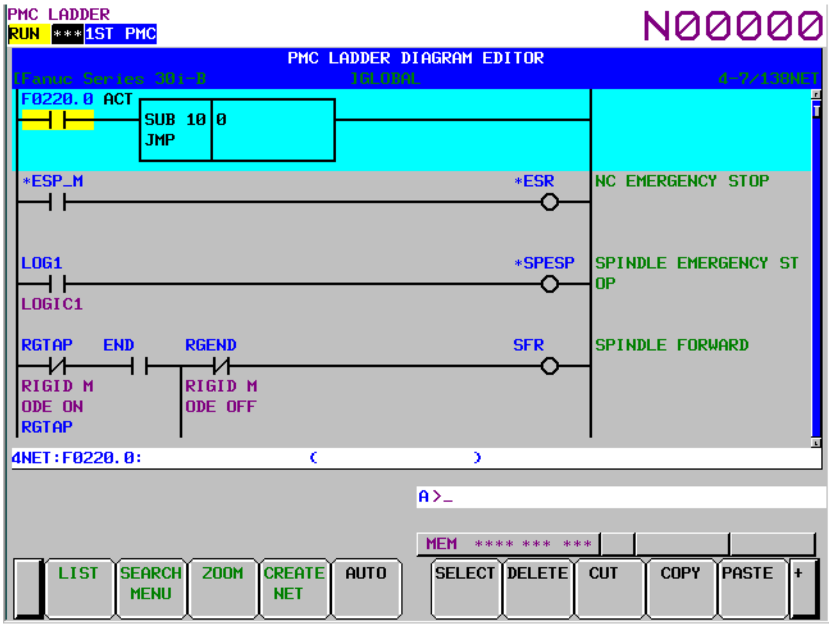
(f) Cursor move keys, Page change keys
You can scroll screen by right/left cursor move keys and Page change keys.

(g) Operation of the return key
On the FUNCTIONAL INSTRUCTION DATA TABLE VIEWER screen, the return key has no effect.
After you have finished editing data, and want to return to the LADDER DIAGRAM MONITOR screen, use the [EXIT] soft key.

8.3 EDITING LADDER PROGRAMS

At LADDER DIAGRAM EDITOR screen you can edit LADDER program to change its behavior.
To switch LADDER DIAGRAM EDITOR screen, press [EDIT] soft key at LADDER DIAGRAM MONITOR screen.
Following operations are available at LADDER DIAGRAM EDITOR screen.

• Delete by net	[DELETE]
• Move by net	[CUT] & [PASTE]
• Copy by net	[COPY] & [PASTE]
• Change address of contacts and coils	"bit address" + INPUT key
• Change parameters of functional instructions	"number" or "byte address" + INPUT key
• Add new net	[CREATE NET]
• Change construction of net	[ZOOM]
• Make changes effective	[UPDATE]
• Abandon changes	[RESTRE]
• Cancel edit	[CANCEL EDIT]



LADDER DIAGRAM EDITOR screen

⚠ **CAUTION**

1 You can edit ladder programs regardless of whether they are active or not. To execute a ladder program with the results of editing being reflected, you must update the ladder program. To do this, press the [UPDATE] soft key, or update the program when exiting from the LADDER DIAGRAM EDITOR screen. For details of the method of protecting editing, see Section 7.3.

2 After you have edited a sequence program, the results of editing will be lost if the power is turned off without first writing the edited sequence program to flash ROM. Write the sequence program to flash ROM on the I/O screen. If you set "WRITE TO F-ROM(EDIT)" to "YES" on the general functions' setting parameter screen, a confirmation message will be displayed, prompting you to ask whether to write a sequence program to flash ROM after the end of editing. For details of this setting, see Section 9.5.

(1) Screen structures
- (a) It is basically same with LADDER DIAGRAM MONITOR screen, except that no monitor displays of relays and parameters of functional instructions are displayed.
- (b) At right side of LADDER Diagram area, a position bar is always displayed, which indicates screen position within current subprogram: in LADDER DIAGRAM MONITOR screen, this position bar is exclusively displayed with comments of write coil. Sometimes, this position bar hides a part of write coil comments.

(2) LADDER Diagram
- (a) Style of LADDER Diagram is basically same with LADDER DIAGRAM MONITOR screen, except that functional instructions are drawn always in "COMPACT" format that has no monitor displays.
- (b) Cursor is shown always. And the net, which will be an object of following editing operations, is emphasized in screen.

8.3.1 Operating on the LADDER DIAGRAM EDITOR Screen

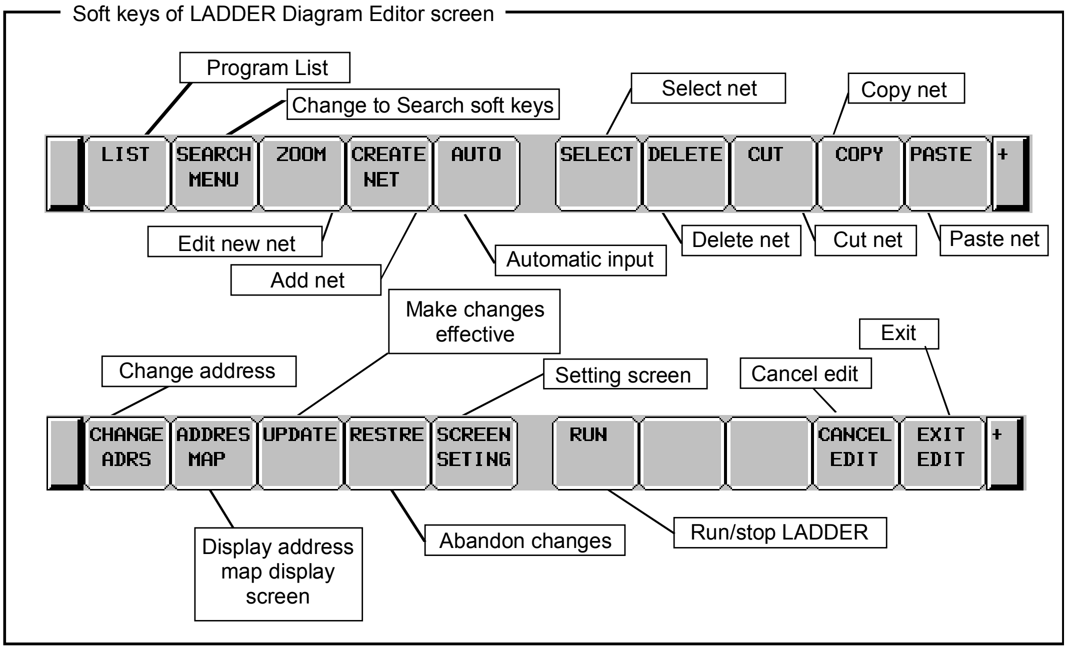


Fig. 8.3.1 Soft keys of LADDER DIAGRAM EDITOR screen

(1) Operation with Soft keys

(a) [LIST] Go to PROGRAM LIST EDITOR screen
Goes to PROGRAM LIST EDITOR screen to choose which subprogram to be edited at LADDER DIAGRAM EDITOR screen. The PROGRAM LIST EDITOR screen can also edit subprograms.

(b) [SEARCH MENU] Search & Jump
Change soft keys to "Search soft keys". Use "EXIT" soft key to return to the "Main soft keys".
"Search soft keys" are quite same with ones of LADDER DIAGRAM MONITOR screen.

(c) [ZOOM] Change construction of net
Goes to NET EDITOR screen to modify structure of the selected net.
You can select the net to be modified, either a net under the cursor or multiple nets near the cursor by setting of "ZOOM MODE" on ladder diagram editor setting screen.

(d) [CREATE NET] Add new net
Create and add new net to cursor position. Pressing this soft key reaches NET EDITOR screen, so that new net is constructed.

(e) [AUTO] Automatic input of unused address/parameter number
Executes the function for automatically inputting an unused address or parameter number. For details of these functions, see Sections 8.7 and 8.8.

(f) [SELECT] Select multiple nets
Used to specify multiple nets before performing an editing operation such as [DELETE], [CUT], and [COPY]. Press the [SELECT] soft key to select the start point of the range to be selected, then use the cursor movement keys or the search function to specify the end point of the selected range. After you have selected nets, edit them by pressing the appropriate editing soft key. While the multiple nets are being selected, the information on the selected range is displayed on the additional information line. And the [SELECT] soft key is highlighted with yellow background .

(g) [DELETE] Delete net
Deletes selected nets. The nets deleted by [DELETE] soft key are lost. If you delete wrong nets by the [DELETE] soft key, you have to abandon the all modifications you have made, and restore LADDER program to the original one before editing operation by using the [RESTRE] soft key.

(h) [CUT] Cut nets
Cuts selected nets. The cut nets are preserved in Paste Buffer, and disappear from diagram. The contents of Paste Buffer before [CUT] operation are lost.
[CUT] and [PASTE] soft keys are used to move nets.
The Paste Buffer can contain approx. 8000 steps maximum, and [CUT] may fail to cut nets of over 8000 steps.

(i) [COPY] Copy nets
Copy selected nets into Paste Buffer. No change on diagram will be made. The contents of Paste Buffer before [COPY] operation are lost.
[COPY] and [PASTE] soft keys are used to copy nets.

(j) [PASTE] Paste nets
Pastes nets at cursor position, which were stored into Paste Buffer by [CUT] or [COPY] soft key.
Pressing [PASTE] soft key while selecting nets using [SELECT] soft key, alters the selected nets with the nets in Paste Buffer.
The contents of Paste Buffer will remain until turning NC power off.

(k) [CHANGE ADRS] Change addresses
Switches to the mode in which the address alteration function is enabled.

(l) [ADDRES MAP] Display the address map display screen
Displays the address map display screen to view references of addresses in use.

(m) [UPDATE] Make changes effective
Reflects the results of the editing operations executed thus far in the ladder program under execution. If it succeeds to update running LADDER, edited LADDER starts to run.
When there are some errors on the net, an error message is showed and the ladder program is not updated.

> ⚠ **WARNING**
> You have to pay special attention to modify running LADDER program. If you modify LADDER program in wrong way, or update LADDER program with the machine in improper status, it may cause unexpected reaction of the machine. You have to make it sure that modifications you make on LADDER program is appropriate, machine is in proper status, and nobody is near the machine, when you update LADDER program.

(n) [RESTRE] Abandon changes
Abandons all changes, and restores LADDER program to the one at entering LADDER DIAGRAM EDITOR screen, or last updated one using [UPDATE] soft key. This soft key is useful when you make wrong modifications and hard to recover from them.

(o) [SCREEN SETING] Screen settings
Goes to setting screen for LADDER DIAGRAM EDITOR screen. You can change various settings for LADDER DIAGRAM EDITOR screen at the screen. Use "EXIT" soft key to return to LADDER DIAGRAM EDITOR screen.

(p) [RUN]/[STOP] Run and stop LADDER program
Controls LADDER program execution. [RUN] soft key makes LADDER run, and [STOP] soft key makes LADDER stop. If changes are reflected normally, the LADDER program as edited will be executed at that point.

> ⚠ **WARNING**
> You have to pay special attention to run/stop LADDER program. Running/stopping LADDER program in a wrong timing, or with machine in improper status, may cause unexpected reaction of machine. You have to make it sure that machine is in proper status, and nobody is near the machine when you run/stop LADDER program.

(q) [CANCEL EDIT] Abandon editing
Abandons all changes, and restores LADDER program to the one at entering LADDER DIAGRAM EDITOR screen, or last updated one using [UPDATE] soft key. Switches to LADDER DIAGRAM MONITOR screen.

(r) [EXIT EIDT] Exit Editor
Updates running LADDER program to edited LADDER program, so that the all modifications will take effects, and exits the editor screen. When there are some errors on the net, an error message is showed and the ladder program is not updated. The screen is not exited.

Even if you press function keys such as the SYSTEM key while editing a ladder diagram, screen does not move to another screen.

> ⚠ **WARNING**
> You have to pay special attention to modify running LADDER program. If you modify LADDER program in wrong way, or update LADDER program with the machine in improper status, may cause unexpected reaction of the machine.
> You have to make it sure that modifications you make on LADDER program is appropriate, machine is in proper status, and nobody is near the machine, when you update LADDER program.

(2) Other operations
  (a) Cursor move keys, Page change keys
  Cursor move keys and Page change keys move cursor on screen. When cursor is placed on some relay or some address parameter of a functional instruction, the information about the address under cursor is displayed at "Additional Information Line".
  (b) "bit address" + INPUT key
  Changes bit address of relay under cursor.
  (c) "number" or "byte address" + INPUT key
  Changes parameter of functional instructions under cursor.
  But, there are some parameters that can not change by this operation. If you see a message that means that this parameter can not be changed, use NET EDITOR screen to change the parameter.

(3) Shortcuts
  (a) Same shortcut search operations with LADDER DIAGRAM MONITOR screen are available. For their detail, see descriptions about shortcut operations of LADDER DIAGRAM MONITOR screen.
  (b) Same shortcut operations using [LIST] soft key with LADDER DIAGRAM MONITOR screen are available.

(4) Operation of the return key
On the LADDER DIAGRAM EDITOR screen, the return key has no effect.
After you have finished editing ladder data, and want to return to the LADDER DIAGRAM MONITOR screen, use the [EXIT] soft key.

8.3.2 Setting the LADDER DIAGRAM EDITOR Screen

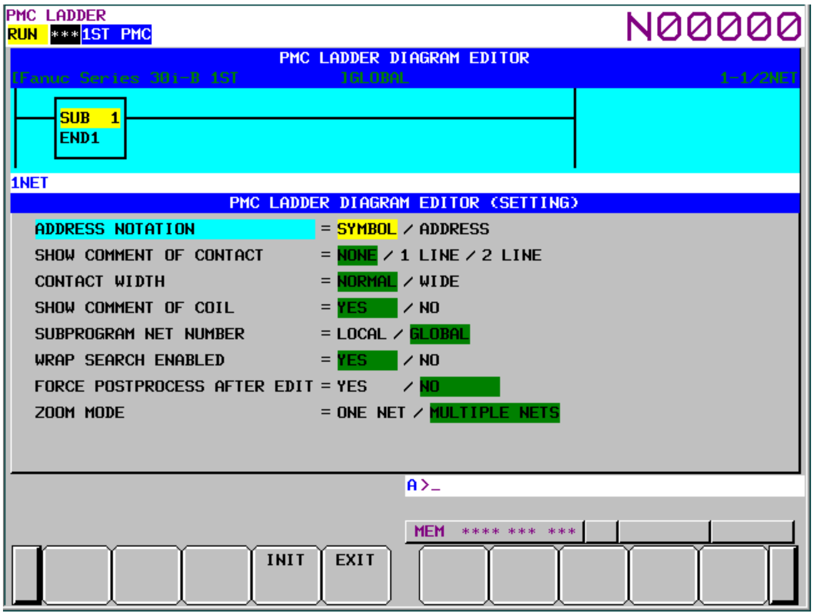


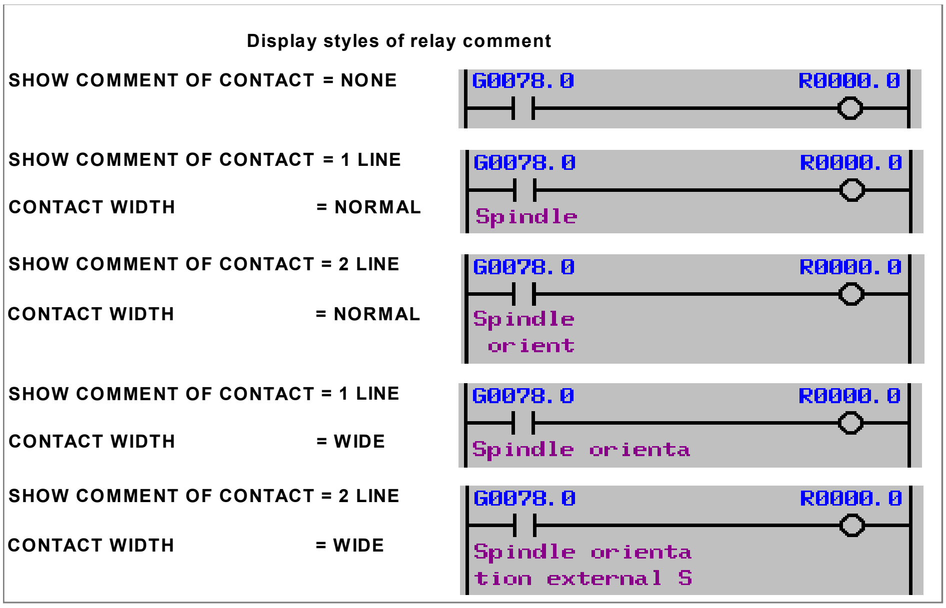
Fig. 8.3.2 LADDER DIAGRAM EDITOR (SETTING) screen

(1) Display screen
The LADDER DIAGRAM EDITOR screen is partially displayed on the screen.
The relays displayed here will change real-time by changing the setting.

(2) Setting items
LADDER DIAGRAM EDITOR (SETTING) screen contains the setting items below:

(a) ADDRESS NOTATION
Determines whether the bit and byte addresses in the LADDER Diagram are displayed as corresponding symbols, or the addresses themselves.
SYMBOL (default)
Addresses that have a symbol are displayed by the symbols. Addresses without symbols are displayed by the addresses themselves.
ADDRESS
All addresses are displayed as the addresses themselves even if they have a symbol.

(b) SHOW COMMENT OF CONTACT
Set the style of relay comment. These are three options as below. When you display relay comment, less ladder diagram circuits are shown.
NONE (default)
Relay comments are not displayed.
1 LINE
Relay comments are displayed in one line. Up to 15 characters (7 characters in Japanese) of relay comment can be displayed when "WIDE" is selected for the "CONTACT WIDTH" setting that is described below. Characters after 15th character will not be displayed.
2 LINE
Relay comments are displayed in two lines. Up to 30 characters (14 characters in Japanese) of relay comment can be displayed when "WIDE" is selected to the "CONTACT WIDTH" setting that is described below. Up to 14 characters can be displayed. Characters after 30th character will not be displayed.



(c) CONTACT WIDTH

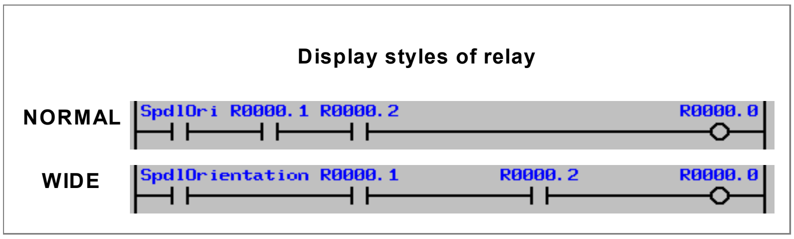
Set the style of relay width. When "WIDE" is selected for the "CONTACT WIDTH" setting, up to 15 characters of symbol on relay can be displayed. Moreover, when "1 LINE" is selected for the "SHOW COMMENT OF CONTACT" setting, up to 15 characters of relay comment can be displayed. When "2 LINE" is selected for the "SHOW COMMENT OF CONTACT" setting, up to 30 characters of relay comment can be displayed. However, in these cases, fewer contacts can be displayed.

NORMAL (default)

A relay is expressed with 8-character length.
Up to 7 characters of symbol can be displayed.

WIDE

A relay is expressed with 16-character length.
Up to 15 characters of symbol can be displayed.



(d) SHOW COMMENT OF COIL

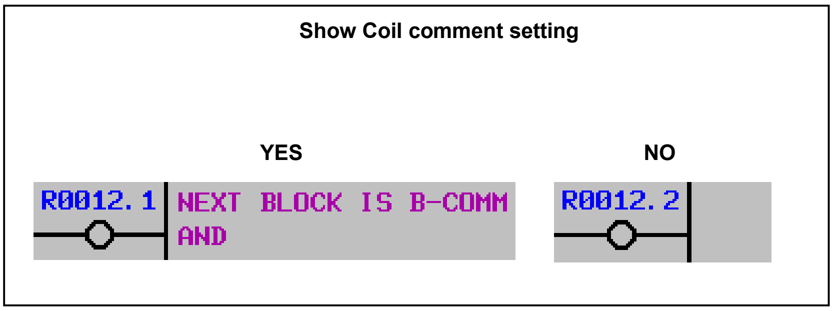
Determines whether to show coil comments. Unlike the LADDER DIAGRAM MONITOR screen, the gage indicating the current display position is displayed at the right end of the LADDER DIAGRAM EDITOR screen, regardless of this setting.

YES (default)

Right margin of 2 lines of 15 characters is reserved for display of coil comments.

NO

Right margin is used to extend diagram by one more relay, instead of showing coil comment.



(e) SUBPROGRAM NET NUMBER

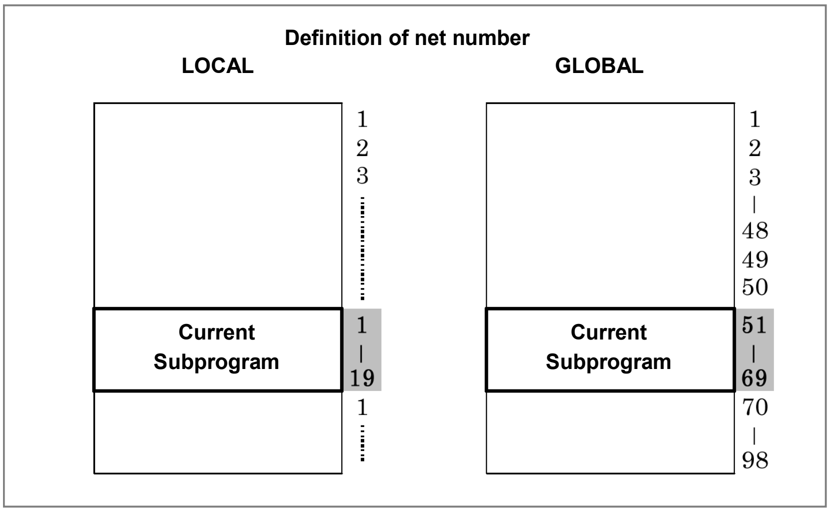
Determines whether a net number is counted as "LOCAL" starting from the top of current subprogram, or is counted as "GLOBAL" starting from the top of whole program. This setting also affects the expression of net number at searching nets by number.

LOCAL

Net number starts from 1 at top of current subprogram. Net number is defined only within current subprogram. The net number information at upper right of the screen is displayed in the format "displaying range / nets in subprogram NET".

GLOBAL (default)

Net number starts from 1 at top of Level 1 program. Net number is defined identically at whole of program. The net number information at upper right of the screen is displayed in the format "displaying range / subprogram range NET".



(f) WRAP SEARCH ENABLED

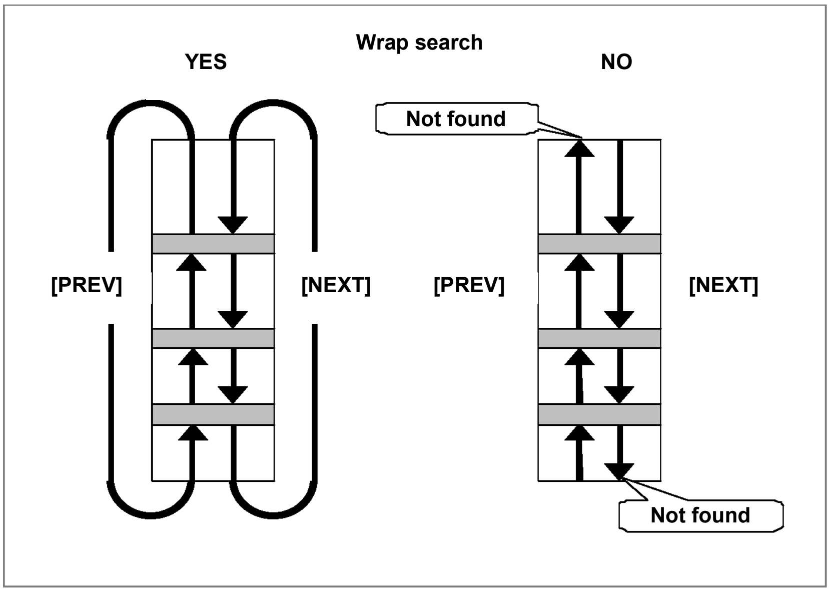
Allows search process to wrap from top/bottom to bottom/top to continue to search.

YES (default)

Downward search will continue to search from top of LADDER when reaches to bottom. Upward search will also continue to search from bottom when reaches to top.

NO

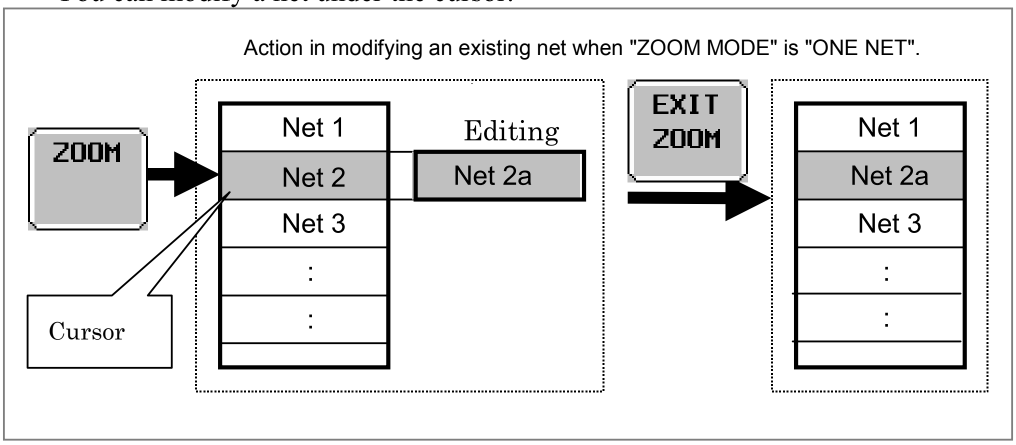
Search process will fail when reached top or bottom, and displays an error message at Message Line.



(g) FORCE POSTPROCESS AFTER EDIT
Allows you to specify whether to always perform the postprocessing necessary to operate a ladder program or perform it only if the ladder program has been changed.
YES (default)
Postprocessing is always performed when you exit from the LADDER DIAGRAM EDITOR screen. The postprocessing checks the contents of the ladder diagram. This means that merely by entering the LADDER DIAGRAM EDITOR screen and then exiting from it, the contents of the ladder diagram is checked again.
NO
Postprocessing is performed only if the ladder program has been changed. No postprocessing will be performed when you enter the LADDER DIAGRAM EDITOR screen and then exiting from it. This means that you can exit from the LADDER DIAGRAM EDITOR screen even if the ladder program contains an error.

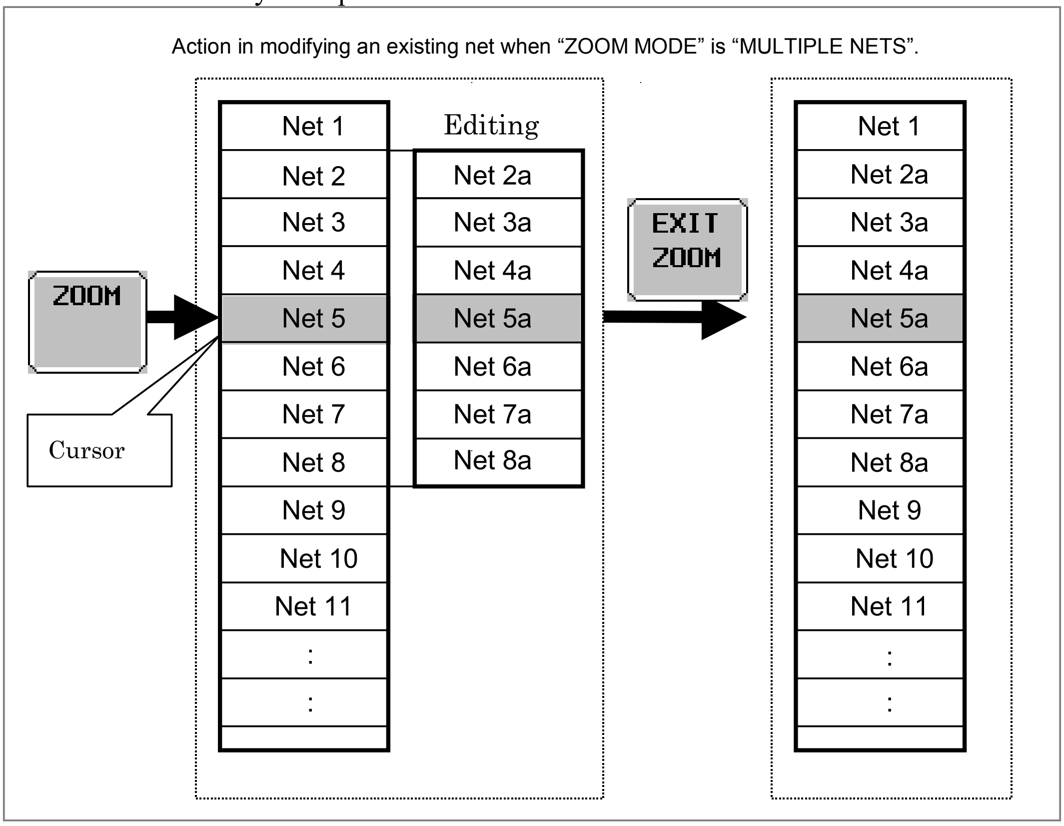
(h) ZOOM MODE
When going to NET EDITOR screen by [ZOOM] soft key on ladder editor screen, you can select the net to be modified, either a net under the cursor or multiple nets near the cursor.

ONE NET (default)
You can modify a net under the cursor.



MULTIPLE NETS

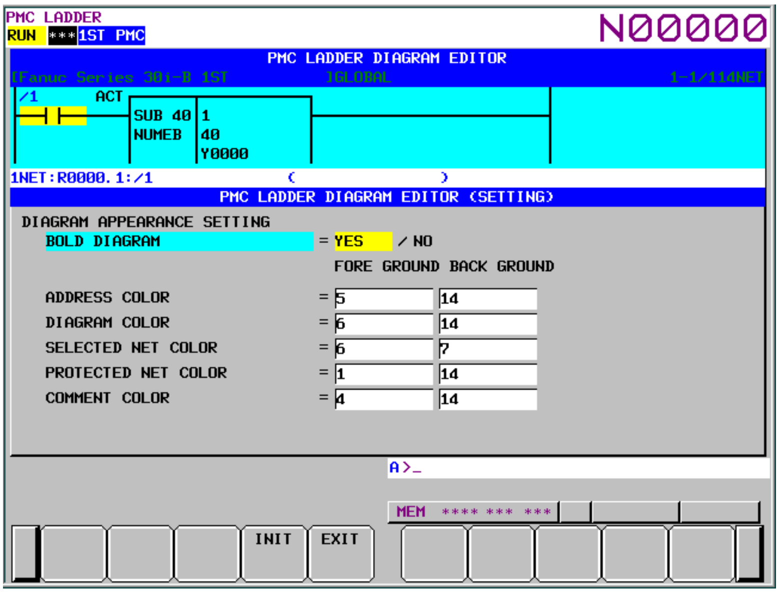
You can modify multiple nets near the cursor.



Page 3 of the setting screen

(i) DIAGRAM APPEARANCE SETTING

Changes the appearance of LADDER diagram. Lines, relays, and functional instructions that constitute LADDER diagram can be changed in the colors and the shapes. You can set colors by entering their numbers. You can set 16 colors from 0 to 15. (Different numbers may correspond to the same color.) You cannot set the same color number for the display and background colors of the same portion.



・BOLD DIAGRAM

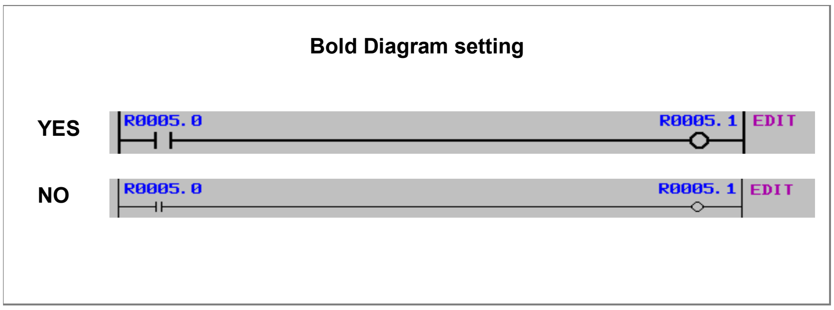
Sets thickness of diagram lines. This setting also affects shapes of relays.

YES (default)

Diagram is drawn with thick lines. Relays are drawn in more distinct shapes.

NO

Diagram is drawn with thin lines. Relays are drawn in smaller shapes.



・ADDRESS COLOR

Colors for the relay address are set. You can specify these colors by entering color number. 16 colors (from No. 0 to No. 15) are available. Foreground color should be different from background one.

・DIAGRAM COLOR

General color and its background color for LADDER Diagram.

・SELECTED NET COLOR

Color setting for a selected net. The net subject to the editing operation will be displayed in this color.

・PROTECTED NET COLOR
Color setting for a net protected from an editing operation. The protected net will not be selected as an object of editing. When a subprogram is displayed, those nets that contain the following functional instructions are protected so that they cannot be deleted or entered.
END1 END3 SP
END2 SPE

・COMMENT COLOR
Colors for the relay comment are set. You can specify these colors by entering color number. 16 colors (from No. 0 to No. 15) are available. Foreground color should be different from background one.

(3) Soft keys
LADDER DIAGRAM EDITOR (SETTING) screen has the soft keys of options and following:

- [INIT] Initialize all settings
  All settings will be initialized to the default values.
- [EXIT] Switch to the LADDER DIAGRAM EDITOR screen
  Ends the LADDER DIAGRAM EDITOR (SETTING) screen and switches to the LADDER DIAGRAM EDITOR screen.

(4) Settings on multi-path PMC system
On the multi-path PMC systems, the Ladder Diagram related configuration is common to all PMC paths at first. To make it independent for each PMC path, set system keep relay K909.4 to 1.
For example, different color settings may make it easier to recognize the PMC path which the Ladder Diagram on the screen belongs to.
When you set 1 to K909.4 at the first time, the first PMC path will inherit the old settings, and the rest path will start with the initial settings.

8.3.3 NET EDITOR Screen

At the NET EDITOR screen, you can create new net, and modify existing net.

- Changing existing nets
  If you move a net with the [ZOOM] soft key, you will enter a mode (Modify mode) in which you can change the net.
  You can select the net to be modified, either a net under the cursor or multiple nets near the cursor by setting of "ZOOM MODE" on ladder diagram editor setting screen.
- Adding a new net
  When [CREATE NET] soft key is used, this screen is in "New mode" to create new net from nothing.

Following operations are available at this screen:

• Place new contacts and coils	"bit address" + [—| |—], [—O—], etc.
• Change type of contacts and coils	[—| |—], [—O—], etc.
• Place new functional instructions	[FUNC]
• Change type of functional instructions	[FUNC]
• Erase contacts, coils, and functional instructions	[········]
• Draw/erase connecting lines	[———]/[·······], [↑——], [——↑]
• Edit data table of functional instructions	[DATA TABLE]
• Insert line/column	[INSERT LINE], [INSERT COLUMN], [APPEND COLUMN]
• Change address of contacts and coils	"bit address" + INPUT key
• Change parameters of functional instructions	"number" or "byte address" + INPUT key
• Abandon modifications	[CANCEL EDIT]
• Restore the net to the state it was before editing	[RESTRE]

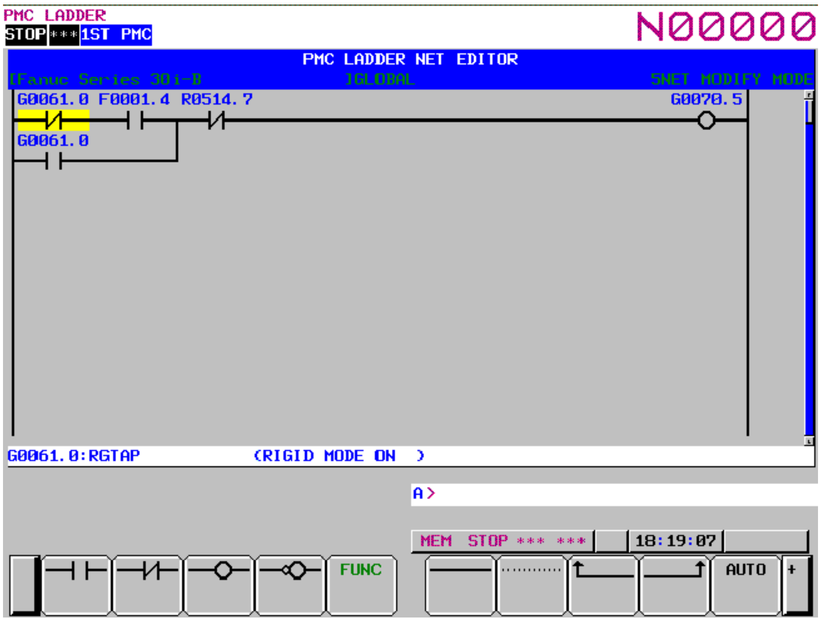


Fig. 8.3.3 (a) Structure of the NET EDITOR screen (ONE NET)

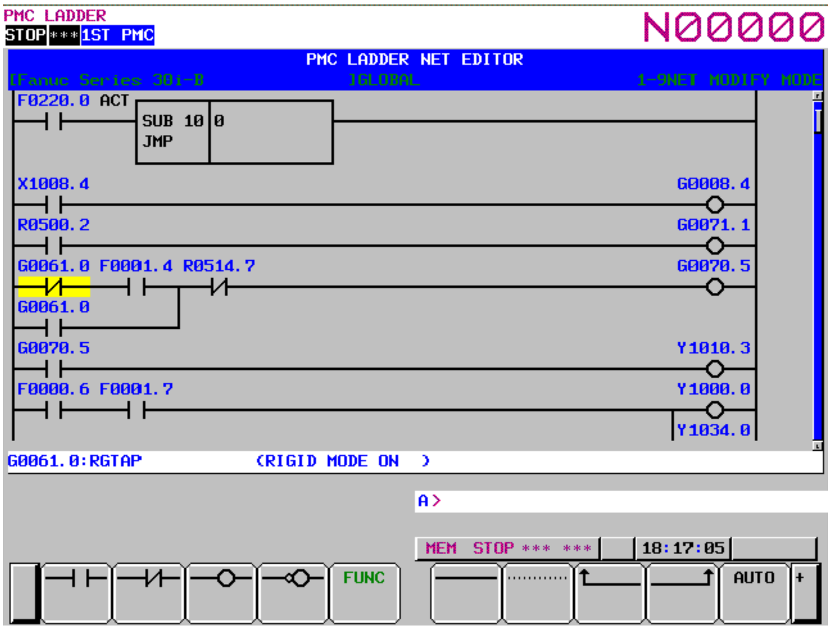


Fig. 8.3.3 (b) Structure of the NET EDITOR screen (MULTIPLE NETS)

(1) Screen structures
- (a) It is basically same with the LADDER DIAGRAM EDITOR screen.
- (b) The gage indicating the current display position in relation to the edit area is displayed at the right end of the screen.
- (c) Current edit mode is indicated at right of the top line as "NEW MODE" or "MODFY MODE". When [ZOOM] soft key at the LADDER DIAGRAM EDITOR screen is used to reach NET EDITOR screen, the screen is in Modify mode, and when [CREATE NET] soft key is used, it is in New mode.
- (d) Current net number is displayed at right of the top line. The net number is same with the net number in previous the LADDER DIAGRAM EDITOR screen.
- (e) NET EDITOR screen expands image of net horizontally for a wider net according to its width, while LADDER DIAGRAM MONITOR/EDITOR screen folds nets wider than screen width. When net width is expanded over screen width, attempt to move cursor out of screen will scroll net image to the direction.

The net of maximum size occupies area of 1024 elements, but actually available area may be little less for internal use according to the internal condition: "element" means the space that is occupied by single relay.

(f) The maximum size of edit area occupies the area for 1024 elements when you modify and add multiple nets.
If "ZOOM MODE" is "MULTIPLE NETS" on ladder diagram editor setting screen, the half of edit area is filled with modified net when going to the NET EDITOR screen by [ZOOM] soft key on the ladder editor screen.

(2) Operation with Soft keys

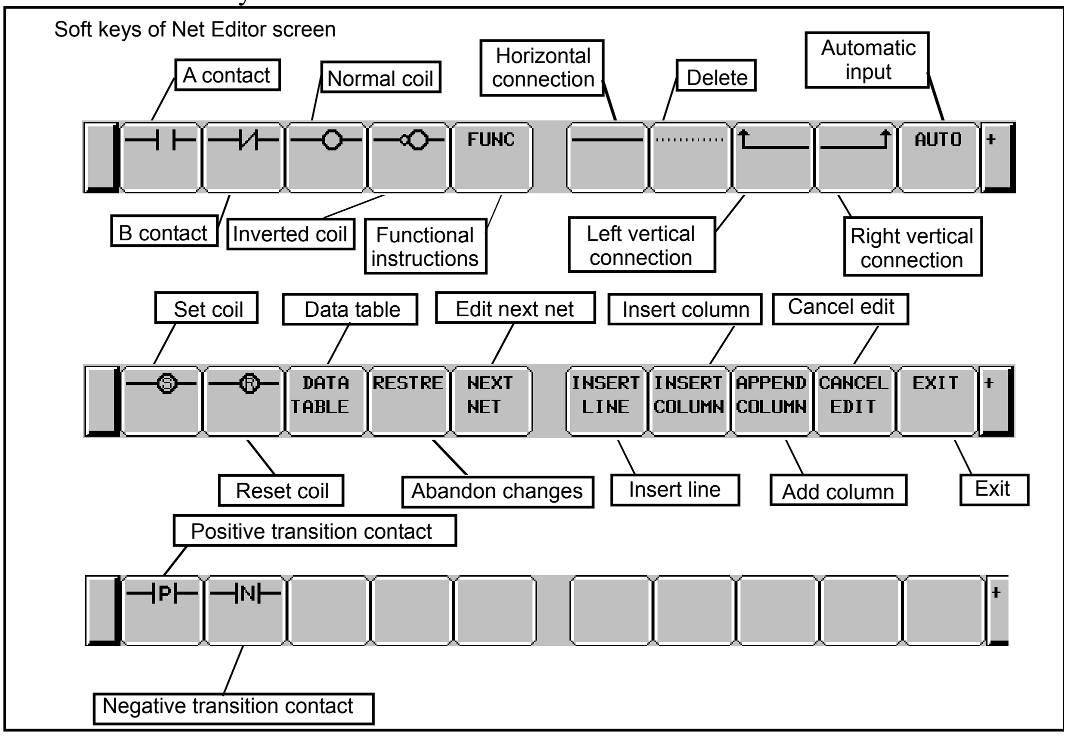


Fig. 8.3.3 (b) Soft keys of NET EDITOR screen

(a) [—| |—], [—|/|—], [—○—], [—⊘—], [—Ⓢ—], [—Ⓡ—], [—|P|—], [—|N|—]
Place relays (contacts and coils), or change type of existing relays.
When one of these relay soft keys is pressed at cursor on blank place, new relay of the soft key is placed under the
cursor. When the soft key follows a string that means a bit address, the bit address is assigned to the newly placed relay.
If no bit address is given, last entered bit address is automatically used for the new relay. If no bit address has been entered yet, the new relay will have no address assigned to it. Contacts can be placed at other than rightmost column, and coils can be placed at rightmost column only.
Moving cursor onto an existing relay, pressing a relay soft key of different type changes the type of relay under the cursor. But, changing coil to contact, and changing contact to coil are forbidden.

Sample of contacts and coils

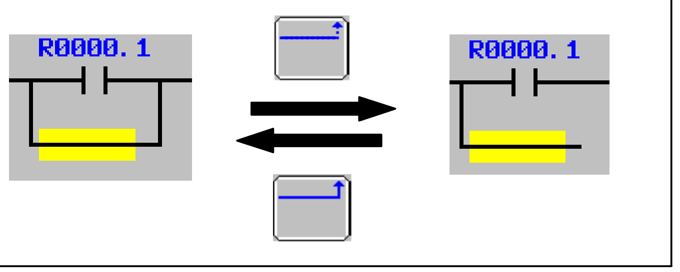
(b) [FUNC] Enter and change functional instruction
Places functional instruction, or changes type of existing functional instruction.
When [FUNC] soft key is pressed at cursor on blank place, new functional instruction will be placed under the cursor: list of available functional instructions is displayed, then choose type of functional instruction to be entered. When [FUNC] soft key follows a string that means number or name of a functional instruction, the specified functional instruction is entered directly, without the list screen.
Moving cursor onto an existing functional instruction, pressing [FUNC] soft key changes the type of functional instruction under the cursor.

(c) [———] Draw horizontal connection
Draws horizontal connection line. Or alters an existing relay to horizontal line.

(d) [·······] Erase relays and functional instructions
Erases relays and functional instructions under cursor.

(e) [↑———], [———↑] Draw and erase vertical connection
Draw vertical connection line upward from right or left edge of relay or horizontal line under cursor. Or erase existing vertical lines.
If the relay or line under the cursor has no vertical line upward, these soft keys have solid arrows, and indicate that pressing them means drawing lines. On the other hand, if a vertical line already exists under the cursor, arrows in these soft keys become pale ([↑———], [———↑]), and indicate that pressing them means erasing lines.

Drawing and erasing vertical connection line



(f) [AUTO] Automatic input of unused address/parameter number
Executes the function for automatically inputting an unused address or parameter number. For details of these functions, see Sections 8.7 and 8.8.

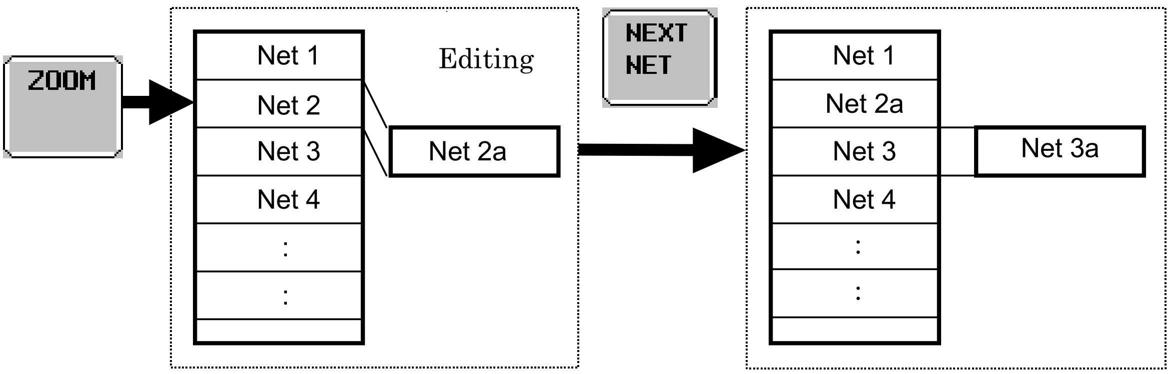
(g) [DATA TABLE] Edit data table
Reaches FUNCTIONAL INSTRUCTION DATA TABLE EDITOR screen to edit data table of functional instruction under cursor. This soft key appears only when cursor is on a functional instruction that has data table with it.
For detail of editing operation of data table, see descriptions of FUNCTIONAL INSTRUCTION DATA TABLE EDITOR screen.

(h) [RESTRE] Restore net
Restores the currently edited net to the state it was before the start of editing. If you called the NET EDITOR screen with the [CREATE NET] soft key from the LADDER DIAGRAM EDITOR screen, the net will be restored to the state in which it contains nothing; if you called the NET EDITOR screen with the [ZOOM] soft key, the net will be restored to the state it was before the changes.

(i) [NEXT NET] Go to next net
If [ZOOM] soft key at LADDER DIAGRAM EDITOR screen is used to reach NET EDITOR screen, the [NEXT NET] soft key acts on setting of "ZOOM MODE" on ladder diagram editor setting screen.

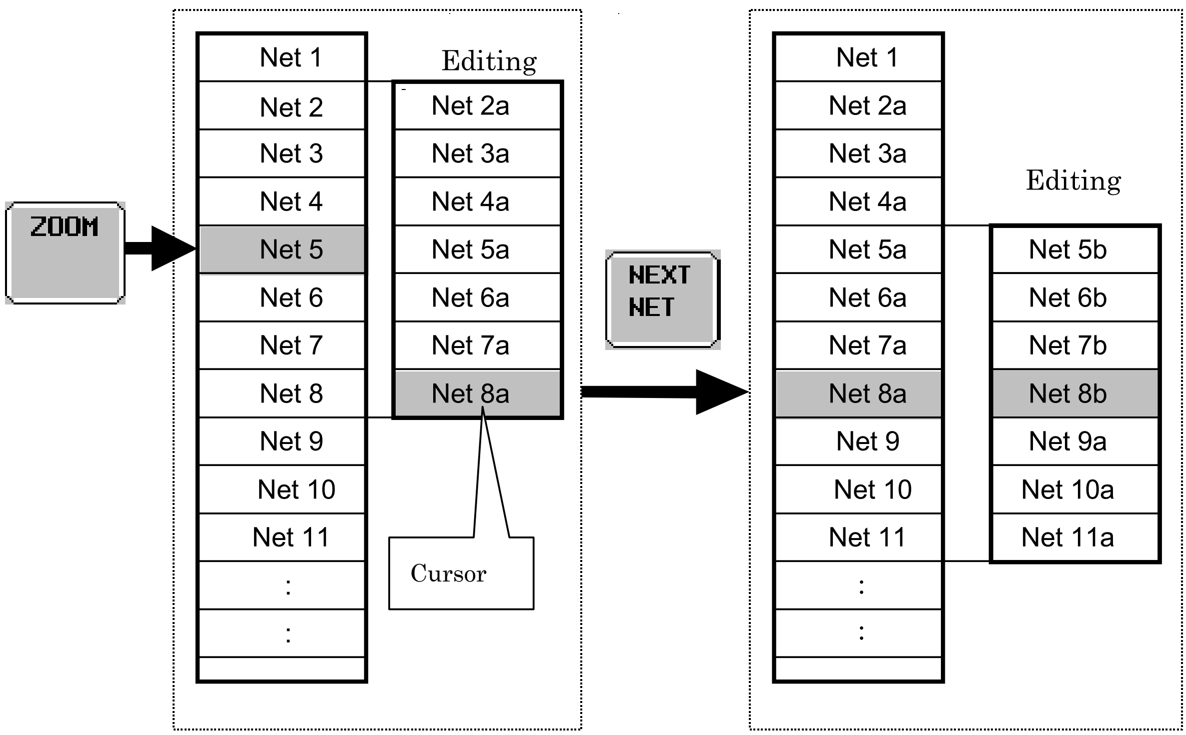
In case of "ZOOM MODE" is "ONE NET"
Finishes editing current net, and goes to next net.
If [ZOOM] soft key at LADDER DIAGRAM EDITOR screen is used to reach NET EDITOR screen, [NEXT NET] will finish modifying current net, and the next net will be an object of further editing operation.

Action of [NEXT NET] soft key in modifying an existing net when "ZOOM MODE" is "ONE NET".

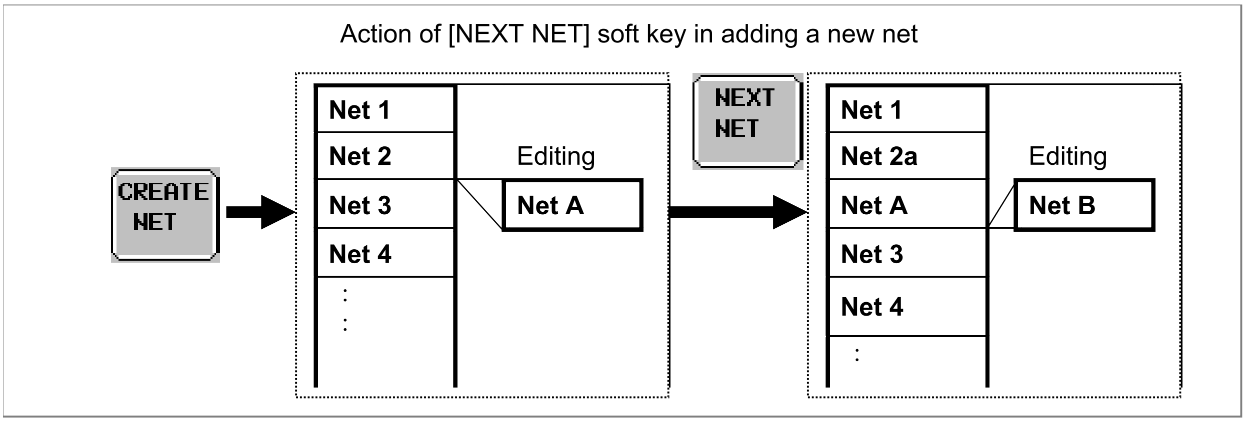


In case of "ZOOM MODE" is " MULTIPLE NETS"
Finishes editing current net, change multiple nets to be modified by centering the cursor, on the editing area.

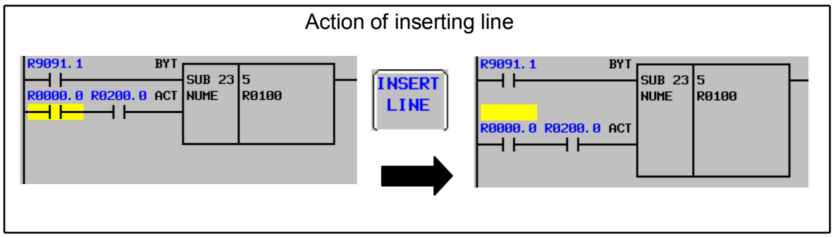
Action of [NEXT NET] soft key in modifying an existing net when "ZOOM MODE" is "MULTIPLE NETS".



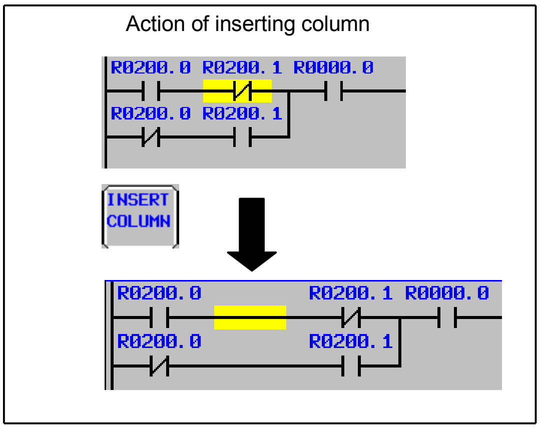
If [CREATE NET] soft key at LADDER DIAGRAM EDITOR screen is used to reach NET EDITOR screen, [NEXT NET] will finish creating current net, insert it into the LADDER program, and start with blank to create another new net to be inserted next to the current net.



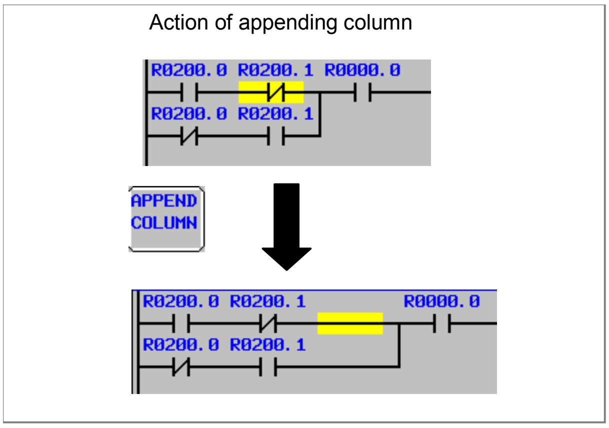
(j) [INSERT LINE] Insert line
Inserts one blank line at cursor position. Diagram elements at or below vertical cursor position will be shifted downward by one line. Inserting line at middle of functional instruction box will expand the box vertically to make a space between the input conditions.



(k) [INSERT COLUMN] Insert column before cursor
Inserts one blank column at cursor position. Diagram elements at or on right of horizontal cursor position will be shifted to right by one column. And if there is no room to shift the elements, a new column is added and the Diagram area will be expanded to right.



(l) [APPEND COLUMN] Insert column after cursor
Inserts one blank column at right of cursor position. Diagram elements on right of horizontal cursor position will be shifted to right by one column. And if necessary, net will be expanded to right.



(m) [CANCEL EDIT] Abandon changes
Restores the currently edited net to the state it was before the start of editing and moves you to the LADDER DIAGRAM MONITOR screen. If [CREATE NET] soft key at LADDER DIAGRAM EDITOR screen is used to reach NET EDITOR screen, it will be back to blank net, and if [ZOOM] soft key is used, it will be back to the old net before modifications in this screen.

(n) [EXIT] Exit editor screen
Analyzes current editing net, and store it into LADDER program.
If some error is found in the net, it still remains NET EDITOR screen, and an error message will be displayed. According to a kind of error, cursor may indicate where the error is detected.

(3) Other operations
(a) Cursor move keys, Page change keys
Cursor move keys and Page change keys move cursor on screen.
The NET EDITOR screen expands image of net horizontally for a wider net according to its width, while LADDER DIAGRAM MONITOR/EDITOR screen folds nets wider than screen width. When net width is expanded over screen width, attempt to move cursor out of screen will scroll net image to the direction. The net of maximum size occupies area of 1024 elements, but actually available area may be little less for internal use according to the internal condition: "element" means the space that is occupied by single relay.
(b) "bit address" + INPUT key
Changes bit address of relay under cursor.
(c) "number" / "byte address" + INPUT key
Changes parameter of functional instructions under cursor.

(4) Operation of the return key
On the LADDER NET EDITOR screen, the return key has no effect.
After you have finished editing ladder net data, and want to return to the LADDER DIAGRAM EDITOR screen, use the [EXIT] soft key.

(5) Displaying extended symbol and comment
When using extended symbol and comment, you can define local symbols in each sub-program.

On the NET EDITOR screen, the priority of displaying symbol and comment by setting of "ZOOM MODE" on ladder diagram editor setting screen and by selected program is defined as follows.

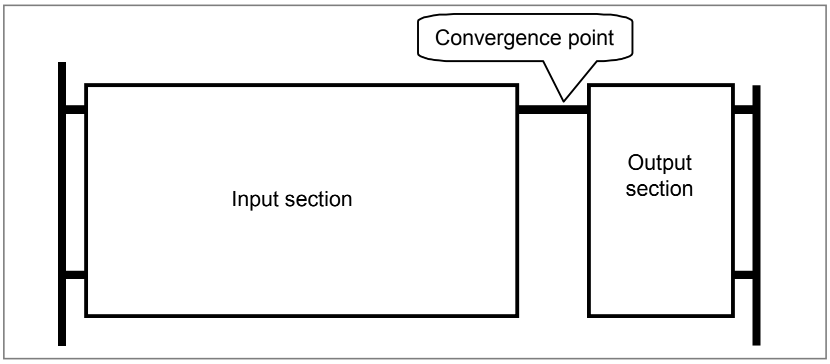
ZOOM MODE	Program	Displaying symbol and comment
ONE NET	The whole program, LEVEL 1 to 3, Sub-program P1 to P5000.	A symbol and comment is displayed by following priority. 1 Local symbol and comment that defined to displaying sub-program. 2 Global symbol and comment. 3 Symbol undefined comment.
MULTIPLE NETS	The whole program	Global symbol and comment.
	LEVEL 1 to 3, Sub-program P1 to P5000.	A symbol and comment is displayed by following priority. 1 Local symbol and comment that defined to displaying sub-program. 2 Global symbol and comment. 3 Symbol undefined comment.

8.3.4 Structure of Valid Net

There are the standard type and the extended type of the structures of ladder net. On the Extended PMC Ladder Instruction Function, structure of standard type net and structure of extended type net can be intermingled. Structure of extended type net includes structure of standard type net. And complicated logic can be expressed in one net.

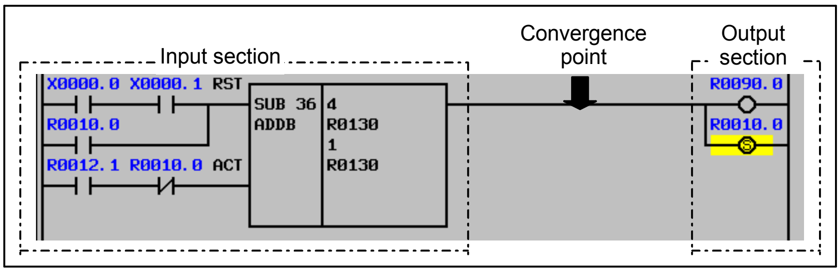
8.3.4.1 Structure of standard type net

Valid net must have following structure:



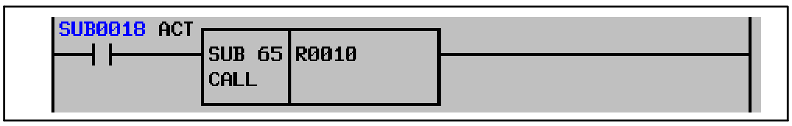
Structure of valid net

"Input section" consists of contacts and functional instruction, and the result of operations of input section is led to "Convergence point". After the convergence point, there is "Output section" that consists of coils only. The "Convergence point" is the nearest point to right power line, where all connections join with each other to gather into single connection.



Sample of valid net

Input section contains at least one relay or functional instruction, however, output section may contain nothing.



Example of net with no output section

Valid net is also restricted in following rules:

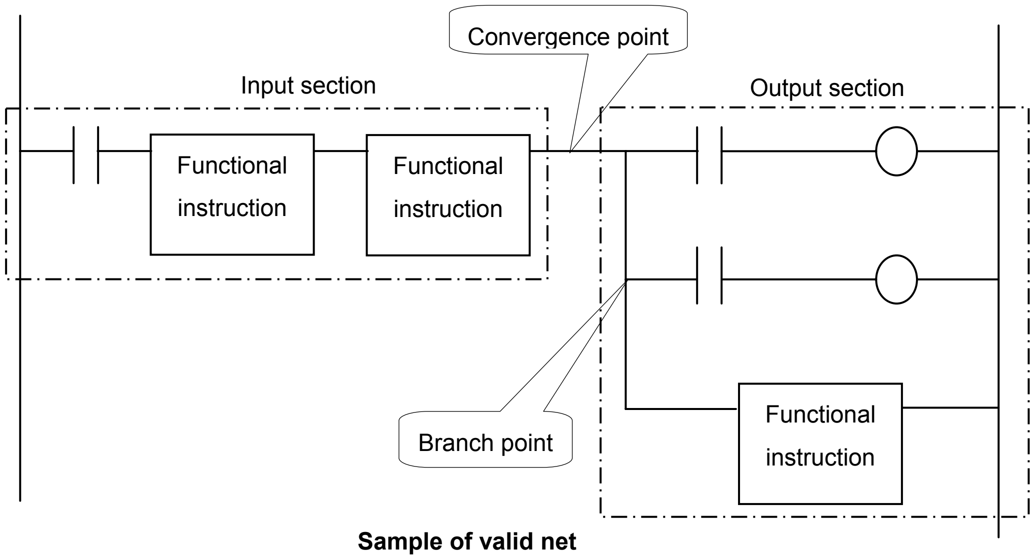
- Only one functional instruction is available for a net.
- Functional instruction can be placed only at last (rightmost) of input section.
- Only coils can be contained in output section.

8.3.4.2 Structure of extended type net

If the structure of extended type net is used, a more complicated circuit can be made compared with the structure of standard type net.

As for the structure of extended type net, the following points are extended to the structure of standard type net.

- Two or more functional instructions can be used for one net.
- A relay or other functional instructions are connectable with the output of a functional instruction.
- In the output section, not only a coil (coil, negative coil, set coil, reset coil) but also a relay and the functional instruction can be located.



Sample of valid net

> **NOTE**
> The functional instruction, which can be used with the structure of extended type net, has restriction. For details, refer to Table 8.3.4.2.

The functional instruction, which can be used in the structure of extended type net.

Table 8.3.4.2

Instruction Name	SUB Number	Usable in Extended type net
END1	1	No
END2	2	No
TMR	3	Yes
DEC	4	Yes
CTR	5	No
ROT	6	No
COD	7	No
MOVE	8	No
COM	9	No
JMP	10	No
PARI	11	No
DCNV	14	No
COMP	15	No
COIN	16	No
DSCH	17	No
XMOV	18	No
ADD	19	No
SUB	20	No
MUL	21	No
DIV	22	No
NUME	23	No
TMRB	24	Yes
DECB	25	No
ROTB	26	No
CODB	27	No
MOVOR	28	No
COME	29	No
JMPE	30	No
DCNVB	31	No
COMPB	32	No
SFT	33	No
DSCHB	34	No
XMOVB	35	No
ADDB	36	No
SUBB	37	No
MULB	38	No
DIVB	39	No
NUMEB	40	No
DISPB	41	No
EXIN	42	No
MOVB	43	Yes (Note)
MOVW	44	Yes (Note)
MOVN	45	Yes (Note)
MOVD	47	Yes (Note)
END3	48	No
PSGNL	50	No
WINDR	51	No
WINDW	52	No
AXCTL	53	No
TMRC	54	Yes
CTRC	55	No

Instruction Name	SUB Number	Usable in Extended type net
CTRB	56	No
DIFU	57	Yes
DIFD	58	Yes
EOR	59	No
AND	60	No
OR	61	No
NOT	62	No
PSGN2	63	No
END	64	No
CALL	65	No
CALLU	66	No
JMPB	68	No
LBL	69	No
NOP	70	No
SP	71	No
SPE	72	No
JMPC	73	No
CS	74	No
CM	75	No
CE	76	No
TMRBF	77	Yes
EQB	200	Yes
EQW	201	Yes
EQD	202	Yes
NEB	203	Yes
NEW	204	Yes
NED	205	Yes
GTB	206	Yes
GTW	207	Yes
GTD	208	Yes
LTB	209	Yes
LTW	210	Yes
LTD	211	Yes
GEB	212	Yes
GEW	213	Yes
GED	214	Yes
LEB	215	Yes
LEW	216	Yes
LED	217	Yes
RNGB	218	Yes
RNGW	219	Yes
RNGD	220	Yes
TMRST	221	No
TMRSS	222	No
CTRD	223	No
MOVBT	224	Yes
SETNB	225	Yes
SETNW	226	Yes
SETND	227	Yes
XCHGB	228	Yes
XCHGW	229	Yes
XCHGD	230	Yes
SWAPW	231	Yes
SWAPD	232	Yes

Instruction Name	SUB Number	Usable in Extended type net
TBLRB	233	Yes
TBLRW	234	Yes
TBLRD	235	Yes
TBLRN	236	Yes
TBLWB	237	Yes
TBLWW	238	Yes
TBLWD	239	Yes
TBLWN	240	Yes
DSEQB	241	Yes
DSEQW	242	Yes
DSEQD	243	Yes
DSNEB	244	Yes
DSNEW	245	Yes
DSNED	246	Yes
DSGTB	247	Yes
DSGTW	248	Yes
DSGTD	249	Yes
DSLTB	250	Yes
DSLTW	251	Yes
DSLTD	252	Yes
DSGEB	253	Yes
DSGEW	254	Yes
DSGED	255	Yes
DSLEB	256	Yes
DSLEW	257	Yes
DSLED	258	Yes
DMAXB	259	Yes
DMAXW	260	Yes
DMAXD	261	Yes
DMINB	262	Yes
DMINW	263	Yes
DMIND	264	Yes
EORB	265	Yes
EORW	266	Yes
EORD	267	Yes
ANDB	268	Yes
ANDW	269	Yes
ANDD	270	Yes
ORB	271	Yes
ORW	272	Yes
ORD	273	Yes
NOTB	274	Yes
NOTW	275	Yes
NOTD	276	Yes
SHLB	277	Yes
SHLW	278	Yes
SHLD	279	Yes
SHLN	280	Yes
SHRB	281	Yes
SHRW	282	Yes
SHRD	283	Yes
SHRN	284	Yes
ROLB	285	Yes
ROLW	286	Yes

Instruction Name	SUB Number	Usable in Extended type net
ROLD	287	Yes
ROLN	288	Yes
RORB	289	Yes
RORW	290	Yes
RORD	291	Yes
RORN	292	Yes
BSETB	293	Yes
BSETW	294	Yes
BSETD	295	Yes
BSETN	296	Yes
BRSTB	297	Yes
BRSTW	298	Yes
BRSTD	299	Yes
BRSTN	300	Yes
BTSTB	301	Yes
BTSTW	302	Yes
BTSTD	303	Yes
BTSTN	304	Yes
BPOSB	305	Yes
BPOSW	306	Yes
BPOSD	307	Yes
BPOSN	308	Yes
BCNTB	309	Yes
BCNTW	310	Yes
BCNTD	311	Yes
BCNTN	312	Yes
TBCDB	313	Yes
TBCDW	314	Yes
TBCDD	315	Yes
FBCDB	316	Yes
FBCDW	317	Yes
FBCDD	318	Yes
ADDSB	319	Yes
ADDSW	320	Yes
ADDSD	321	Yes
SUBSB	322	Yes
SUBSW	323	Yes
SUBSD	324	Yes
MULSB	325	Yes
MULSW	326	Yes
MULSD	327	Yes
DIVSB	328	Yes
DIVSW	329	Yes
DIVSD	330	Yes
MODSB	331	Yes
MODSW	332	Yes
MODSD	333	Yes
INCSB	334	Yes
INCSW	335	Yes
INCSD	336	Yes
DECSB	337	Yes
DECSW	338	Yes
DECSD	339	Yes
ABSSB	340	Yes

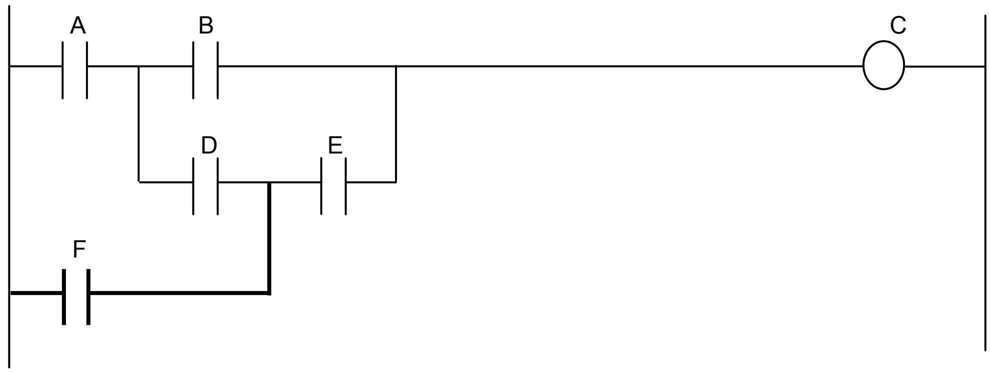
Instruction Name	SUB Number	Usable in Extended type net
ABSSW	341	Yes
ABSSD	342	Yes
NEGSB	343	Yes
NEGSW	344	Yes
NEGSD	345	Yes

NOTE
When using these instructions in the structure of extended type net, it is possible either to output a result of operation to a coil or to omit a coil.

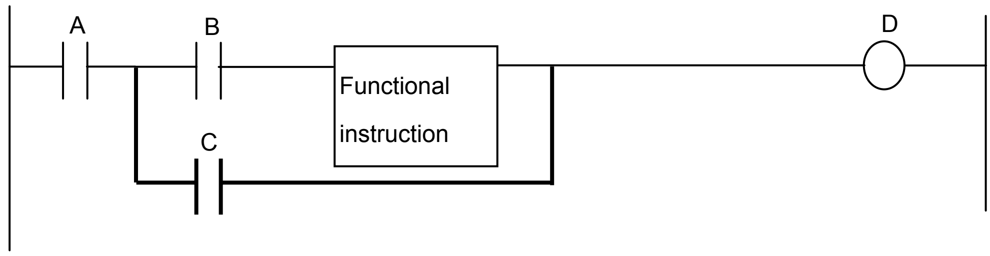
8.3.4.3 Ladder that is not programmable

The following ladder diagrams are not programmable.

(1) Perform an OR operation in the middle of operation.

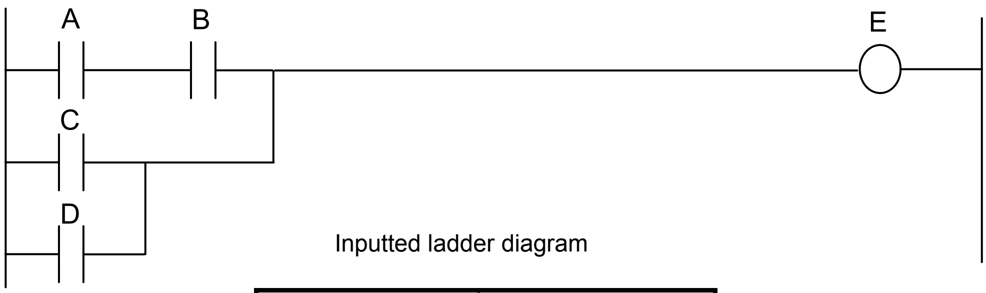


(2) A loop circuit is placed before and after of functional instruction.



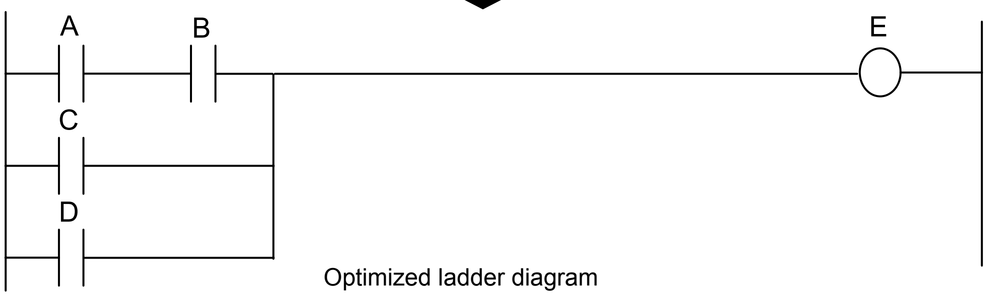
8.3.5 Optimization

In order to generate the always same object from the inputted ladder diagram, the optimization which deletes bit stack manipulation omissible by changing an operation order, makes smaller the object generated, and makes execution speed quick is performed. However, the optimization which changes an access order to each bit address is not performed.



Inputted ladder diagram

Mnemonic	Stack consumption
RD A	0
AND B	0
RD.STK C	1
OR D	1
OR.STK	0
WRT E	0

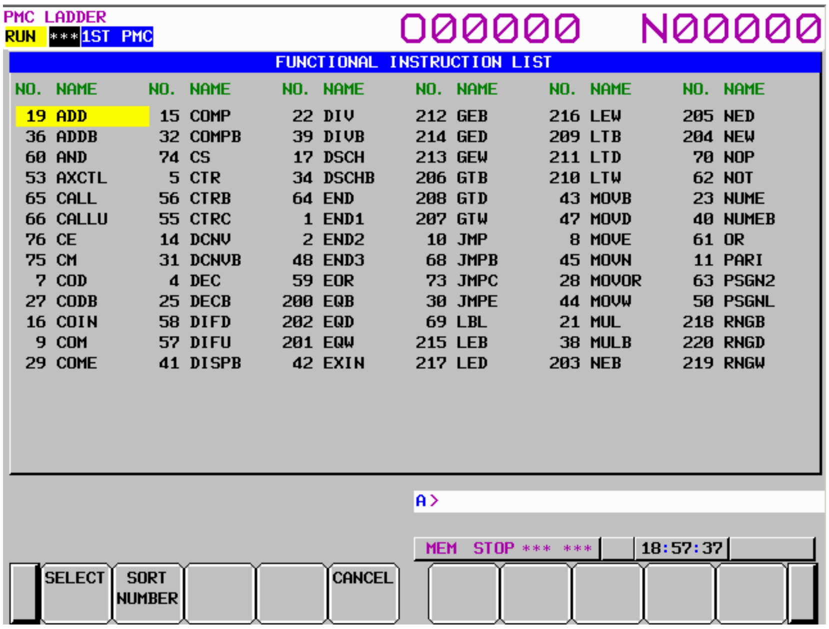


Optimized ladder diagram

Mnemonic	Stack consumption
RD A	0
AND B	0
OR C	0
OR D	0
WRT E	0

8.3.6 FUNCTIONAL INSTRUCTION LIST Screen

Pressing [FUNC] soft key at the NET EDITOR screen reaches FUNCTIONAL INSTRUCTION LIST screen at which you can choose a functional instruction to be entered from the list of all available functional instructions.



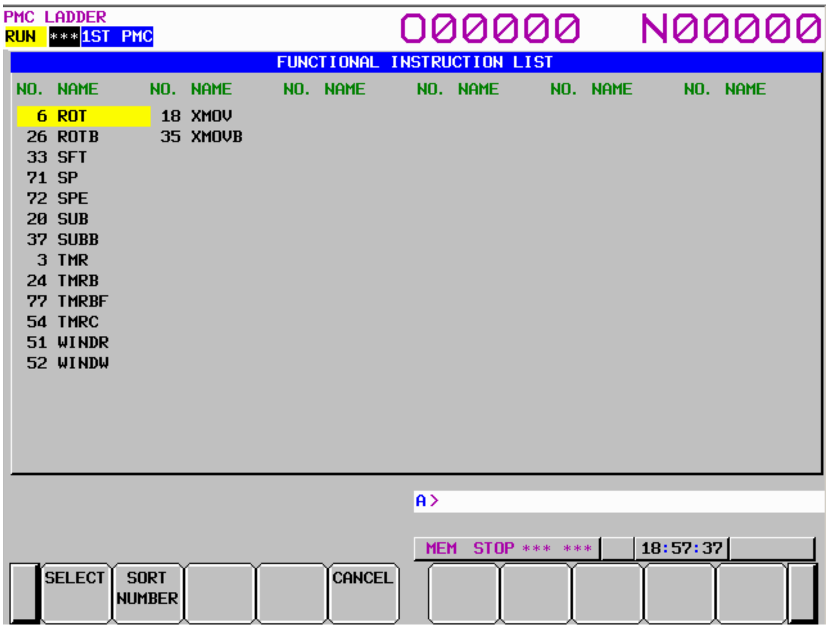


Fig. 8.3.6 FUNCTIONAL INSTRUCTION LIST screen

Operations at this screen are below:

(1) Operation with soft keys

(a) [SELECT] Select a functional instruction
Selects a functional instruction. The functional instruction is entered into the editing net.

(b) [SORT NUMBER], [SORT NAME] Rearrange functional instructions list
Rearrange functional instructions list in two ways. [SORT NUMBER] soft key arranges the list in numerical order with their identifying numbers, on the other hand, [SORT NAME] soft key arranges it in alphabetical order with their names.

(c) [CANCEL] Quit selecting
Quits selecting functional instruction, and return to the NET EDITOR screen.

(2) Other operations
   (a) Cursor move keys
       Cursor move keys move cursor on screen. According to the cursor position, the functional instruction to be selected changes.
   (b) INPUT key
       Act just like [SELECT] soft key.

(3) Shortcuts
   (a) [SELECT] soft key and INPUT key following number or name of a functional instruction will select the specified functional instruction directly, instead of the one under cursor.
   (b) When [FUNC] soft key in the NET EDITOR screen is pressed following a string that means number or name of a functional instruction, the specified functional instruction is entered directly, without displaying FUNCTIONAL INSTRUCTION LIST screen.

8.3.7 FUNCTIONAL INSTRUCTION DATA TABLE EDITOR Screen

At FUNCTIONAL INSTRUCTION DATA TABLE EDITOR screen, you can edit the contents of data table that belongs to some functional instructions.
To reach this screen, at NET EDITOR screen, press [DATA TABLE] soft key that is displayed when the cursor is on the following functional instructions which have a data table.

- Functional Instruction COD (SUB7)
- Functional Instruction CODB(SUB27)

The following edit operations are available at this screen.

- Change the data table value "number" + INPUT key
- Change the data length [BYTE], [WORD], [DWORD]
  (These soft keys can be operated only at FUNCTIONAL INSTRUCTION DATA TABLE EDITOR screen of Functional Instruction CODB.)
- Change the number of data [COUNT]
- Initialize all of data [INIT]
- Switch to LADDER DIAGRAM EDITOR screen [EXIT]

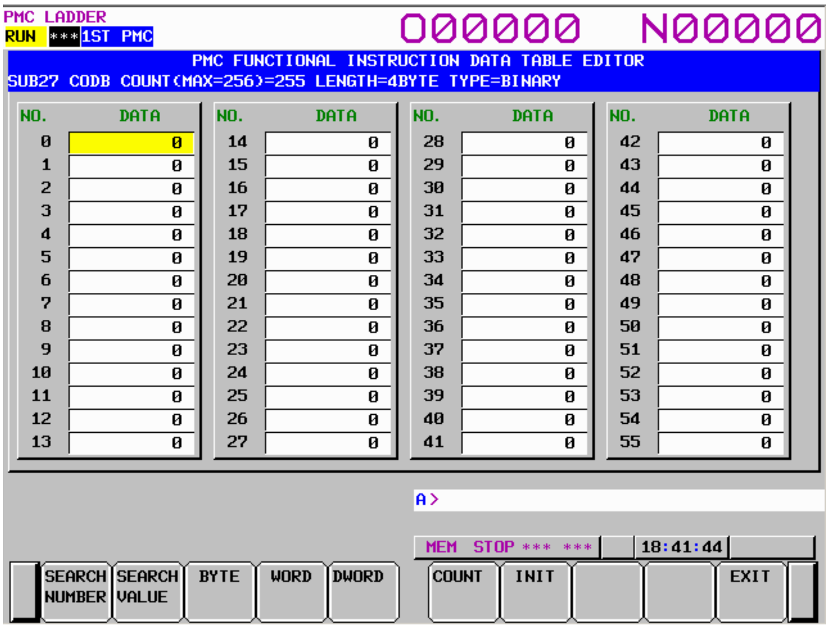
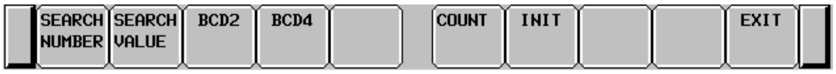


Fig. 8.3.7 FUNCTIONAL INSTRUCTION DATA TABLE EDITOR screen

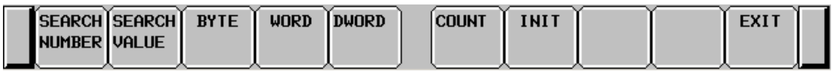
(1) Screen structures
It is same with the FUNCTIONAL INSTRUCTION DATA TABLE VIEWER screen.

(2) Display data
The cursor is shown always. You can edit the data that is pointed by the cursor.

8.3.8 Operating on the FUNCTIONAL INSTRUCTION DATA TABLE EDITOR Screen



Soft keys of FUNCTIONAL INSTRUCTION DATA TABLE EDITOR screen of functional instruction COD



Soft keys of FUNCTIONAL INSTRUCTION DATA TABLE EDITOR screen of functional instruction CODB

(1) [SEARCH NUMBER] Search for data table number
Searches the data table number which you specified.
(2) [SEARCH VALUE] Search for data value
Searches the data value which you specified.
(3) [BCD2] Display BCD2 digits
Changes the display data type to 2 digits of BCD. This operation only switches the display data type. So it does never edit the data on memory.
(4) [BCD4] Display BCD4 digits
Changes the display data type to 4 digits of BCD. This operation only switches the display data type. So it does never edit the data on memory.

NOTE

In the functional instruction COD (SUB7), the data type of the data table can dynamically be changed either BCD2 or BCD4 by "BYT" which is one of input condition. So the data type of the data table is decided when the functional instruction COD is executed. Decide the display data digit according to the status of "BYT" by pressing either [BCD2] soft key or [BCD4] soft key. After turning the power on, the default displaying data type is BCD4 digits. But if you change data type by pressing [BCD2] soft key or [BCD4] soft key, the data type is kept until you change again.
The data table of functional instruction COD is stored in the memory as BCD4 digits type. If you change the data type from BCD4 digits to BCD2 digits, the data is displayed without higher 2-digits. But the data of higher 2-digits is kept in the memory. So you return the data type from BCD2 digits to BCD4 digits, the former BCD4 digits is recovered. The input range of the data obeys the current data type.

(5) [BYTE] Change to the BYTE length
Changes data length to 1 byte. If overflowed data is found, the cursor points it, and this operation aborts. Then, correct it and press [BYTE] soft key again.
(6) [WORD] Change to the 2 BYTE length
Changes data length to 2 bytes. If overflowed data is found, the cursor points it, and this operation aborts. Then, correct it and press [WORD] soft key again.
(7) [DWORD] Change to the 4 BYTE length
Changes data length to 4 bytes.

> **NOTE**
> On functional instruction CODB, the data type is decided by the first parameter of it. So, if you change data type, the first parameter is changed too.
> When you added functional instruction CODB to ladder program, the default data type is BYTE.

(8) [COUNT] Change the number of data
Changes the number of data. If you expanded the number of data, "0" is set to expanded data as default.

> **NOTE**
> In case of functional instruction COD, the number of data is decided by the first parameter of it. In case of functional instruction CODB, the number of data is decided by the second parameter of it. If you change the number of data, these parameters are also changed.

(9) [INIT] Initialize all of data
Initializes all of data to "0". The number of data is not changed.

(10) [EXIT] Exit Editor
Ends the FUNCTIONAL INSTRUCTION DATA TABLE EDITOR screen and switches to NET EDITOR screen.

(11) Cursor move keys, page change keys
You can move the cursor by all cursor move keys and page change keys.

(12) Operation of the return key
On the FUNCTIONAL INSTRUCTION DATA TABLE EDITOR screen, the return key has no effect.
After you have finished editing ladder net data, and want to return to the LADDER DIAGRAM EDITOR screen, use the [EXIT] soft key.

(13) "number" + INPUT key
Changes the data that is pointed by the cursor.
The input range of the data obeys the data length and the display data type.
Ex.) The case of functional instruction COD and displaying BCD2 digits
The available data range: 0 to 99
Ex.) The case of functional instruction CODB and length of 2 BYTE
The available data range: -32768 to 32767
And you can input multiple numbers by the following methods.
(a) ";"(EOB) is used for separating data.
(Ex.)Press the INPUT key after typing "100;200;300;"
(b) ";=" is used for inputting the same value as preceding data.
(Ex.)Press the INPUT key after typing "100;=;=;200;=", and it becomes "100,100,100,200,200".
(c) ";;" is used for skipping an input address.
(Ex.)Press the INPUT key after typing "100;;100". The second data is not inputted.

8.3.9 PROGRAM LIST EDITOR Screen

At the PROGRAM LIST EDITOR screen you can create new program and delete a program in addition to the function of PROGRAM LIST VIEWER screen. To reach this screen, press [LIST] soft key at the LADDER DIAGRAM EDITOR screen. Following operations are available at the PROGRAM LIST EDITOR screen. For more detail of these operations, see the descriptions of each key to operate.

- Create new program [NEW]
- Delete a program [DELETE]

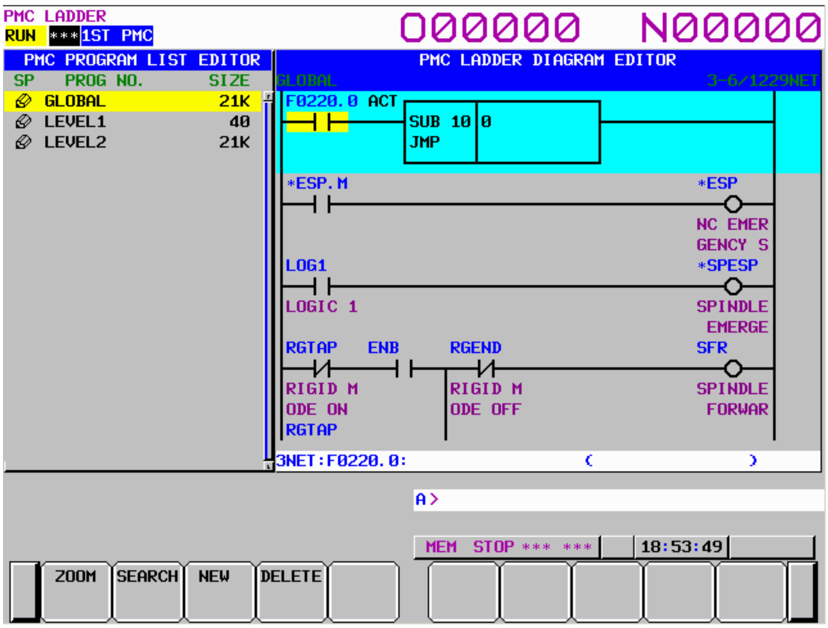
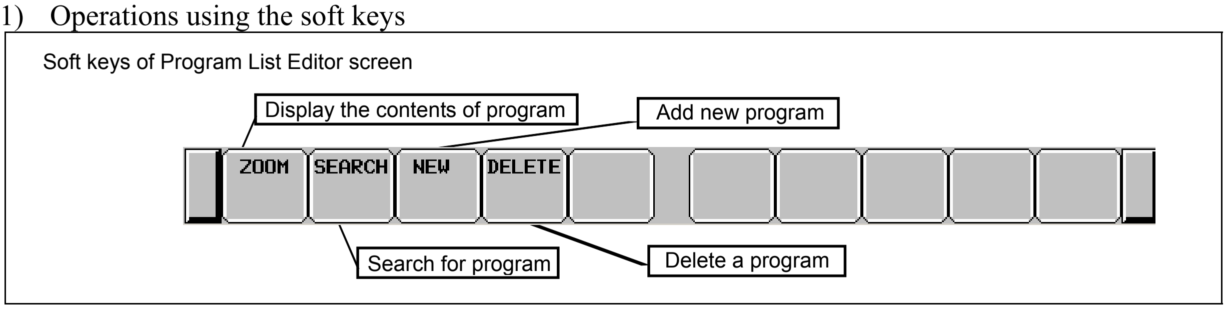


Fig. 8.3.9 PROGRAM LIST EDITOR screen

On the PROGRAM LIST EDITOR screen, a preview of the editor screen for the ladder program currently positioned by the cursor on the program list is displayed on the right of the screen.

(1) Operations using the soft keys



Soft keys of PROGRAM LIST EDITOR screen

(a) [ZOOM] Display the contents of program
Goes to LADDER DIAGRAM EDITOR screen.

(b) [SEARCH] Search for program
Searches for a program. Pressing the [SEARCH] soft key after entering a program name or symbol name searches for program corresponding to the input character string and moves the cursor to the program.

(c) [NEW] Create new program
If you entered program name or symbol and press the [NEW] soft key, the program will be checked its existence. If such program is not found, new program will be created. The created program is inserted automatically into the program list and the cursor points it. The following ladder nets are created automatically according to the type of created program by this operation.

LEVEL1:	Functional instruction END1
LEVEL2:	Functional instruction END2
LEVEL3:	Functional instruction END3
Subprogram:	Functional instruction SP, SPE

If the status of protection of the program is enabled to edit, this operation is available.

(d) [DELETE] Delete a program
Deletes a program. If you entered no strings and press the [DELETE] soft key, the program under the cursor is deleted. If you entered program name or symbol and press the [DELETE] soft key, the program will be checked its existence, and will be deleted if such program is found.
But, GLOBAL, LEVEL1 and LEVEL2 should always exist on program list. If you delete these programs, the contents of program are abandoned. But these programs do not disappear on program list.
If the status of protection of the program is enabled to edit, this operation is available.
But this operation is disabled in case of the step sequence program.

8.3.10 Setting the PROGRAM LIST EDITOR Screen

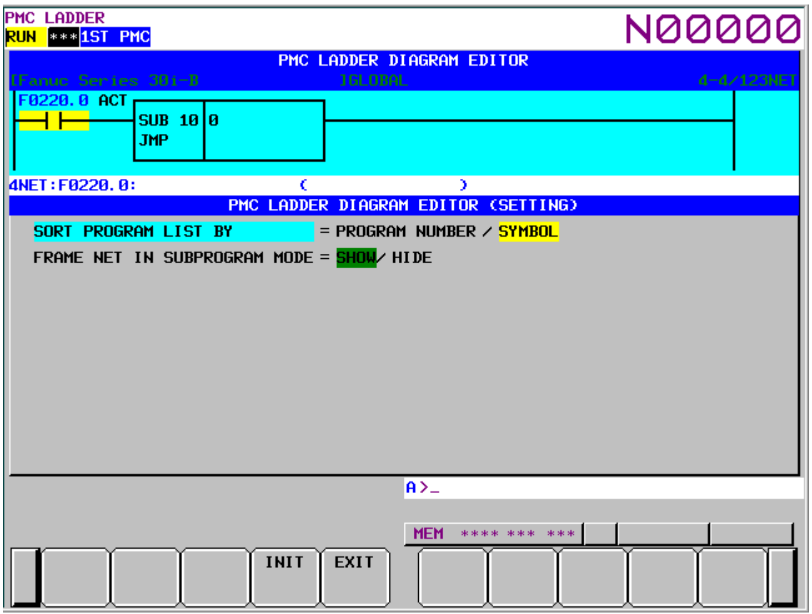


Fig. 8.3.10 PROGRAM LIST EDITOR (SETTING) screen

(1) Program list screen setting
To set the program list screen, use the [SCREEN SETING] soft key on the Ladder screen.
Page 2 of the ladder setting screen, contains the setting items for the program list screen.

(a) SORT PROGRAM LIST BY
Specifies whether to display each subprogram on Program List editor screen in order of program numbers or symbols. When ADDRESS NOTATION is SYMBOL, programs without symbols are displayed in order of program number after programs with the symbols. GLOBAL, LEVEL1, LEVEL2, LEVEL3 are out of target of sort.
PROGRAM NUMBER (default)
Program List display screen in order of program numbers.
SYMBOL
Program List display screen in order of symbols.

(b) FRAME NET IN SUBPROGRAM MODE
Frame nets refer to the functional instructions END1, END2, END3 at LEVEL1, LEVEL2, and LEVEL3 and function instructions SP and SPE in subprograms. When you display the contents of a program with the [ZOOM] soft key from the PROGRAM LIST VIEWER/EDITOR screens, specify whether or not to display these frame nets.
SHOW (default)
Displays frame nets on the LADDER DIAGRAM MONITOR/EDITOR screens.
HIDE
Hides frame nets from the LADDER DIAGRAM MONITOR/EDITOR screens.

8.4 SELECTING AND DISPLAYING THE NECESSARY LADDER NET ([SWITCH] SCREEN])

8.4.1 Collective Monitor Function

The COLLECTIVE MONITOR screen allows you to specify ladder nets to be monitored, so that you can monitor only the necessary ladder net.

The COLLECTIVE MONITOR screen can be called in either of the following ways:

(1) Calling from the PROGRAM LIST VIEWER screen
On the program list screen, move the cursor to the "COLLECT" program position, then press the [ZOOM] soft key.

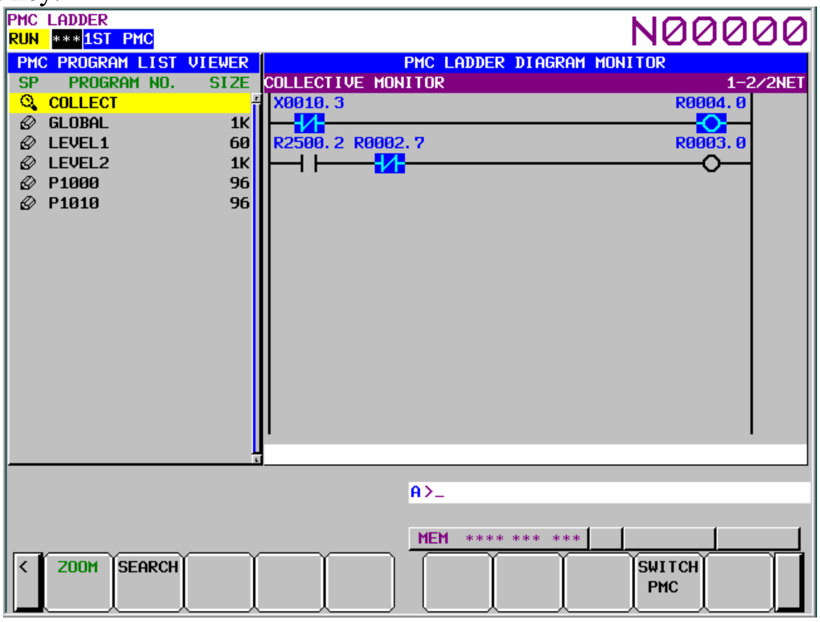


Fig. 8.4.1 (a) PROGRAM LIST VIEWER screen

(2) Calling from the LADDER DIAGRAM MONITOR screen
On the LADDER DIAGRAM MONITOR screen, press the [SWITCH] soft key.

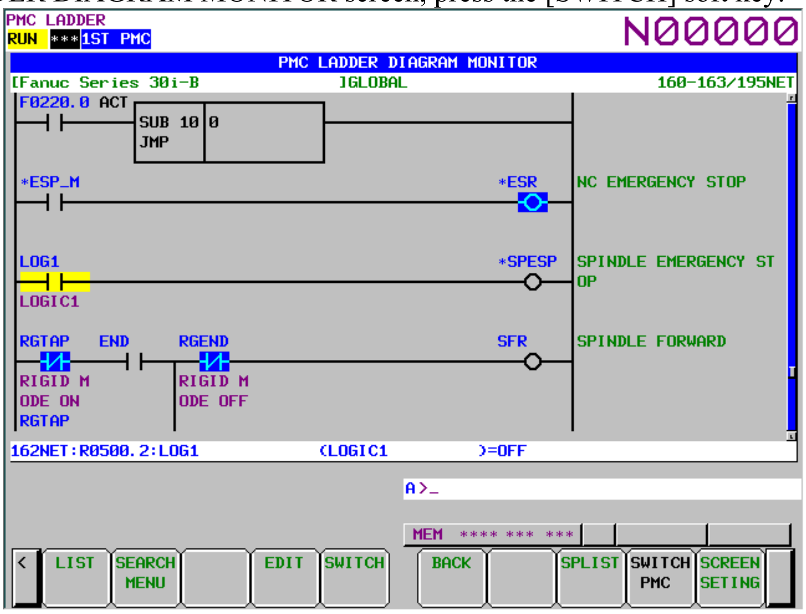


Fig. 8.4.1 (b) LADDER DIAGRAM MONITOR screen

8.4.2 Collective Monitor Screen

The COLLECTIVE MONITOR screen is such as that shown below. At first, it does not display any ladder diagram. Ladder nets will be added to this screen as they are selected with coil search and pickup operations. Up to 128 nets can be added to the COLLECTIVE MONITOR screen. If an attempt is made to add more, the most recently added 128 nets will be displayed.

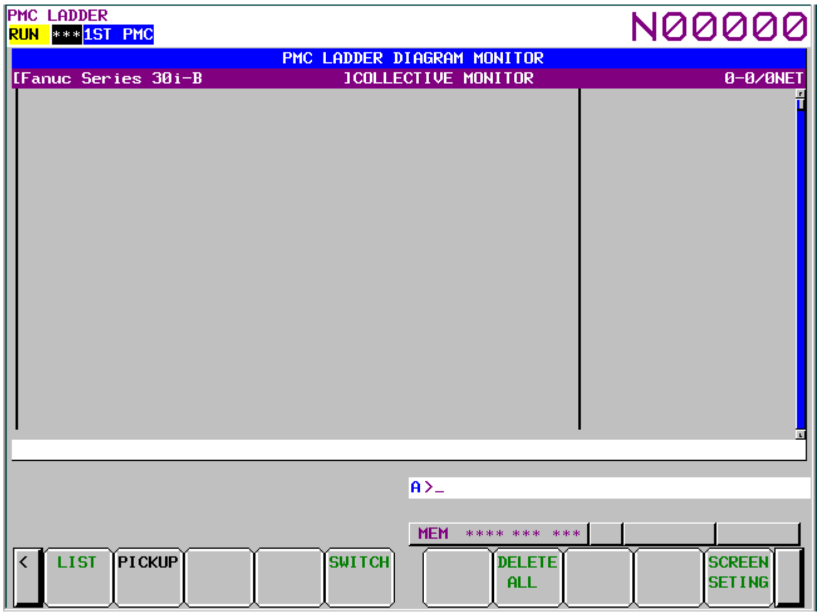


Fig. 8.4.2 (a) COLLECTIVE MONITOR screen (initial screen)

(1) Operations using the soft keys

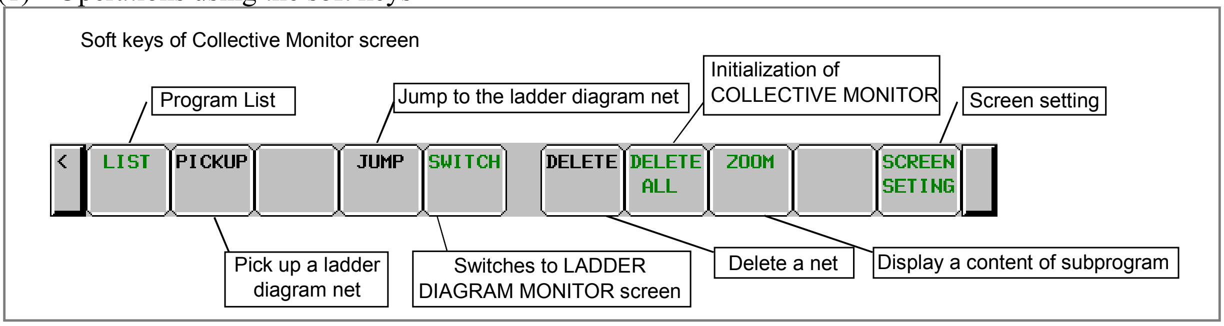


Fig. 8.4.2 (b) Soft keys of COLLECTIVE MONITOR screen

(a) [LIST] Calling PROGRAM LIST VIEWER screen.
Calls the PROGRAM LIST VIEWER screen. On PROGRAM LIST VIEWER screen, you can switch subprograms to be displayed on LADDER DIAGRAM MONITOR screen.

(b) [PICKUP] Picking up ladder nets.
Picks up ladder nets with coil which you want to monitor, on COLLECTIVE MONITOR screen.

(c) [JUMP] Jump to a ladder net.
On LADDER DIAGRAM MONITOR screen, search the ladder net at a cursor position on the COLLECTIVE MONITOR screen and jumps to the ladder net.

(d) [SWITCH] Switches to LADDER DIAGRAM MONITOR screen.
Switches to the LADDER DIAGRAM MONITOR screen.

(e) [DELETE] Quits to display a ladder diagram net on the screen. (1 net)
Quits to display a ladder diagram net (only 1 net) which is picked up on the COLLECTIVE MONITOR screen. This soft key appears by setting "SHOW CURSOR" to "YES" on the setting screen.

(f) [DELETE ALL] Erases to display a ladder diagram net on the screen. (all nets)
Erases to display ladder diagram nets (all net) which is picked up on the COLLECTIVE MONITOR screen.

(g) [ZOOM] Display contents of subprogram.
Placing the cursor on a CALL/CALLU/CM instruction and pressing [ZOOM] soft key displays the target subprogram.

(g) [SCREEN SETING] Screen settings.
Calling the setting screen for the COLLECTIVE MONITOR screen. You can change each settings of a ladder diagram display. Return to COLLECTIVE MONITOR screen by pressing the [EXIT] soft key.

(2) Specifying the ladder diagram to monitor
The operation for picking up ladder nets which you want to monitor on COLLECTIVE MONITOR screen is as follows.

(a) Specification of ladder nets on the COLLECTIVE MONITOR screen
- Specify the address by key input
  Pick up a ladder net by keying in the address used by a coil.
- Indication from a ladder net on the COLLECTIVE MONITOR screen
  Indicate a relay on an already picked up ladder net, with the cursor, to pick up the net that uses the relay address for the coil.

(b) Specifying a ladder net from the LADDER DIAGRAM MONITOR screen
Specify a net from the LADDER DIAGRAM MONITOR screen to pick it and load it into the COLLECTIVE MONITOR screen.

(3) Picking up a ladder net on the COLLECTIVE MONITOR screen
You can pick up a ladder net from the COLLECTIVE MONITOR screen. The procedure for picking up a ladder net is as described below.

(a) Address specification
(i) Enter the address to monitor (for example, R10.1).
(ii) Press the [PICKUP] soft key.
(iii) The net in which a coil uses the address specified in (i) will be picked up and loaded at the beginning of the screen.

(b) Specification of an address from a ladder net on the screen
(i) Move the cursor to a relay on the ladder net that uses the address you want to monitor.
(ii) Press the [PICKUP] soft key.
(iii) The net in which a coil uses the address specified in (i) will be picked up and loaded at the beginning of the screen, and the cursor moves to the specified coil position.

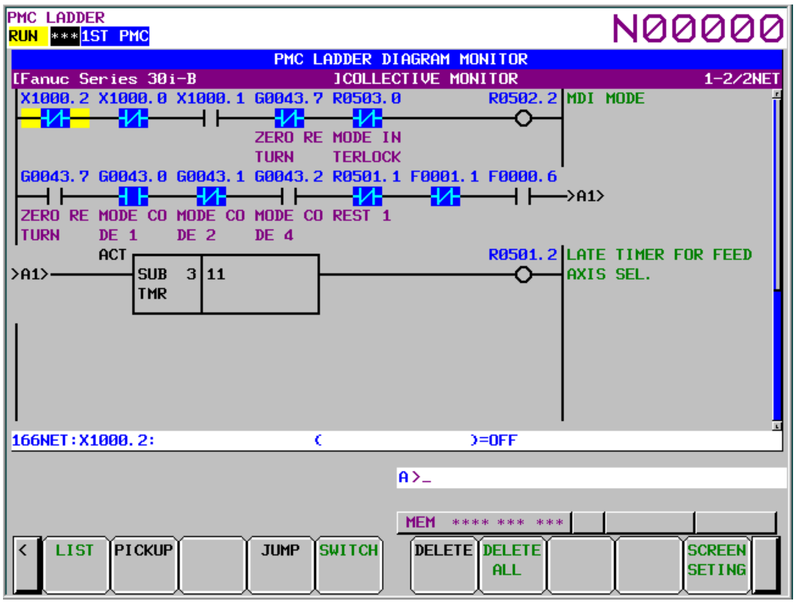


Fig. 8.4.2 (c) COLLECTIVE MONITOR screen

(4) Picking up a ladder net from the LADDER DIAGRAM MONITOR screen
You can pick up a ladder net from the LADDER DIAGRAM MONITOR screen. The procedure for picking up a ladder net is as described below.

(a) From the LADDER DIAGRAM MONITOR screen, press the [SEARCH] soft key to display the soft keys for search.
(b) Move the cursor to the ladder net to pick up.
(c) Press the [PICKUP] soft key to pick up and load the net specified in (b) at the beginning of the COLLECTIVE MONITOR screen.
(d) For the ladder net picked up and loaded into the COLLECTIVE MONITOR screen, the "?" mark is displayed at the left end of the net.

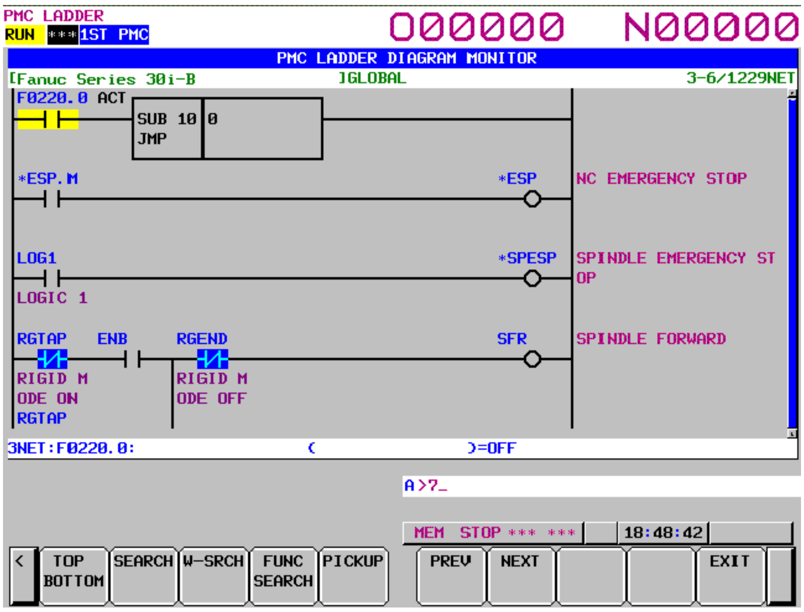
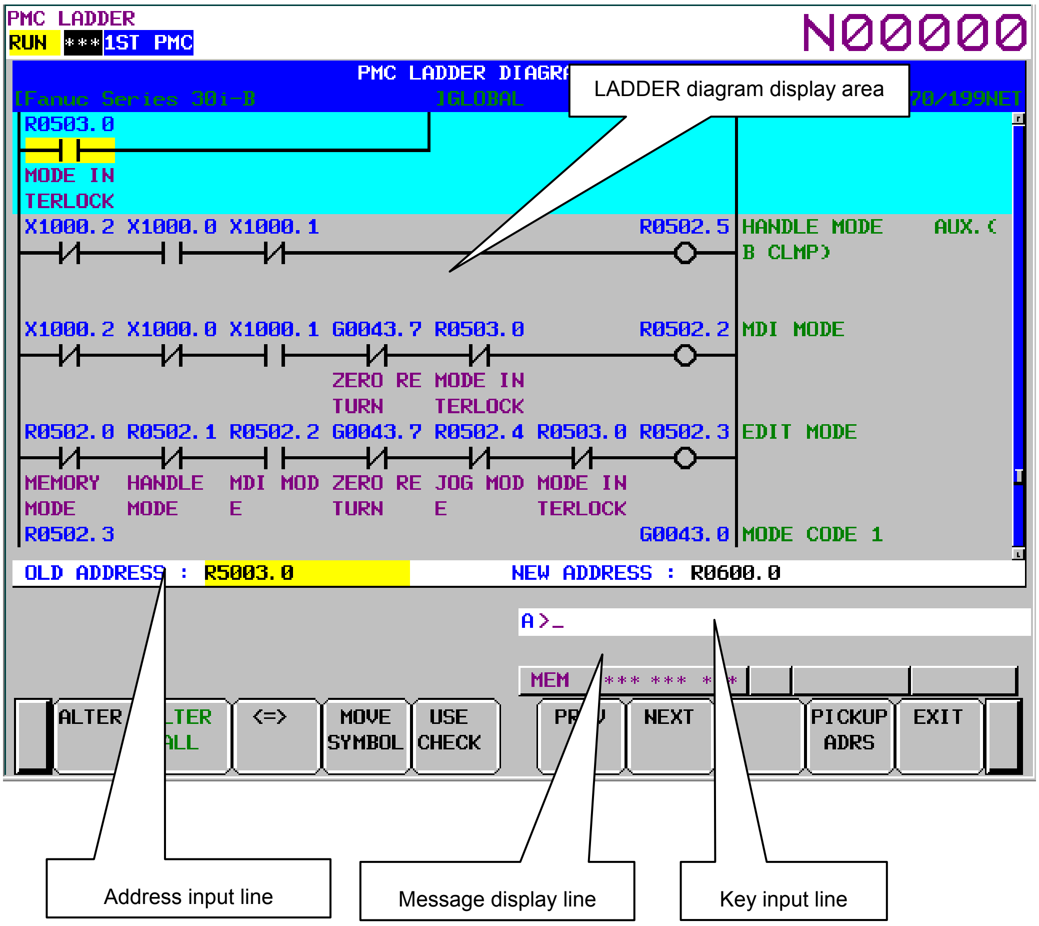


Fig. 8.4.2 (d) LADDER DIAGRAM MONITOR screen (search soft keys)

8.5 ADDRESS ALTERATION FUNCTION

You can alter the address used in a ladder program with another address.
To perform address change, press the [CHANGE ADRS] soft key to switch to address change mode.

8.5.1 Screen Structures



(1) Key input line
Area in which data is displayed as it is keyed in.
(2) Message display line
Area in which confirmation and error messages are displayed.
(3) Address input line
Enter the address used in the ladder program in the "OLD ADDRESS" field and a new address into the "NEW ADDRESS" field.
You can enter either PMC addresses or symbols as addresses.

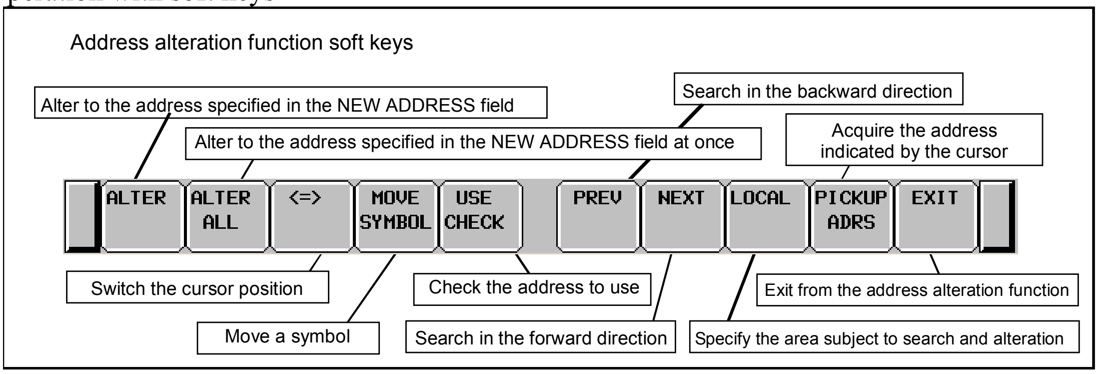
8.5.2 Operating on the Screen

(1) Entering an address
You can enter an address by entering a "character string" and pressing the [INPUT] key.

- Address specification using a wildcard
  You can use a wildcard (*) in the bit portion of a bit address.
  Example: X100.*, which represents X100.0 to X100.7

The following input examples result in errors (invalid input).
(a) Use of a wildcard in a symbol
Example: ALWYS*
(b) Use of a wildcard in a portion other than the bit portion of a bit address
Example: X10*.0, X10*.*
(c) Use of a wildcard in a byte address
Example: X10*

(2) Operation with soft keys



Address alteration function soft keys

(a) [ALTER] Alter to the address specified in the NEW ADDRESS field
Alters the address indicated by the cursor in the ladder diagram display area to the address specified in the "NEW ADDRESS" field.
This soft key is not displayed if the cursor in the ladder diagram does not indicate an address that can be altered.
(b) [ALTER ALL] Alter to the address specified in the NEW ADDRESS field at once
Alters all instances of the address specified in the "OLD ADDRESS" field to the address specified in the "NEW ADDRESS" field at once. If a whole program is selected, alteration will take place globally. If a local program is selected, alteration will take place locally.
The following messages are displayed at the start and end of alteration.
(Confirmation message before alteration)
DO YOU ALTER ALL OLD ADDRESS IN GLOBAL?
(At the end of alteration)
ADDRESSES WERE ALTERED INTO "XXXXX" IN THE GLOBAL.
(c) [<=>] Switch the cursor position
Switches the cursor position between "OLD ADDRESS" and "NEW ADDRESS" alternately.

(d) [MOVE SYMBOL] Move a symbol
Deletes the symbol of the address in the "OLD ADDRESS" field and redefines it for the address in the "NEW ADDRESS" field.
The following messages are displayed at the start and end of alteration.
(Confirmation message before alteration)
ARE YOU SURE YOU WANT TO MOVE THE SYMBOL?
(At the end of alteration)
THE SYMBOL WAS MOVED.

(e) [USE CHECK] Check the address to use
Checks to see if the address specified in the "NEW ADDRESS" field is in use by searching for the address through the ladder diagram.
When the address is used, the following messages are displayed.
・The case that selected program uses the address.
”xxxxx” IS USED.
・The case that selected program uses the address (extended symbol/comment format)
THE ADDRESS IS USED.
・The case that other divided program uses the address.
THE ADDRESS IS USED IN OTHER PROGRAM.

(f) [PREV] Search in the backward direction
Searches for the address specified in the "OLD ADDRESS" field through the ladder diagram in the backward direction.

(g) [NEXT] Search in the forward direction
Searches for the address specified in the "OLD ADDRESS" field through the ladder diagram in the forward direction.

(h) [GLOBAL/LOCAL] Specify the area subject to search and alteration
Used to specify either the entire program (global) or the subprogram (local) as the area subject to search and alteration in the ladder diagram.
This soft key is displayed when a local program is selected in the program list screen.

(i) [PICKUP ADRS] Acquire the address indicated by the cursor
Used to pick up and load the address indicated by the cursor in the ladder diagram into the "OLD ADDRESS" or "NEW ADDRESS" field.

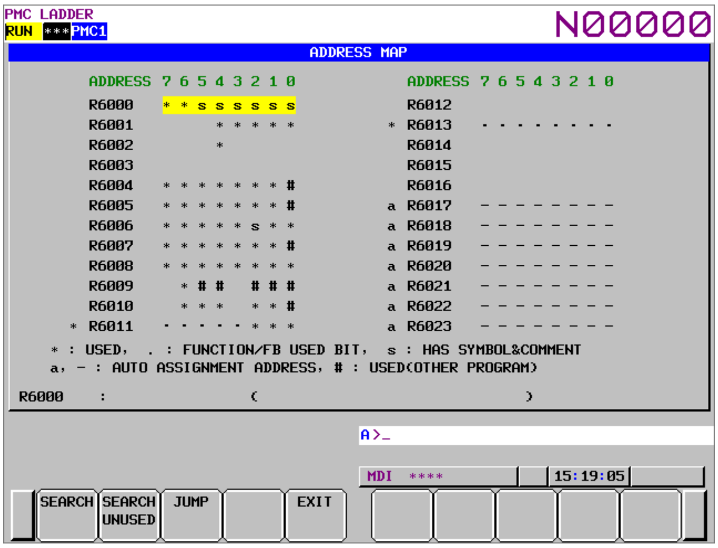
(j) [EXIT] Exits from the address alternation function
Exits from the address alteration function and returns you to the ladder edit functions.
To use the address alteration function again, press the [CHANGE ADRS] soft key while the ladder edit functions are displayed.

8.6 FUNCTION TO REFERENCE ADDRESSES IN USE

You can switch the LADDER DIAGRAM EDITOR screen to the address map display screen where you can view a list of addresses in use.
The address map display screen displays 24-byte bit map starting at any address.
Those "addresses not referenced in ladder diagrams that have symbols/comments defined" are also displayed.

8.6.1 Address Map Display Screen

When pressing the [ADDRESS MAP] soft key on the ladder editor screen, the address map display screen appears.



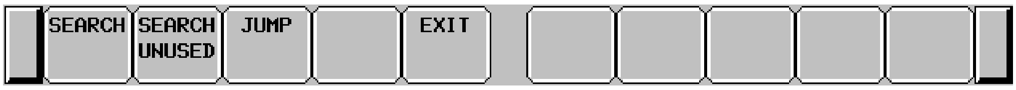
(1) Address representation
By representing each bit as described below, the status of PMC addresses in use are indicated.
Blank: Address bit not in use
*: Address bit in use (When a byte is used, an asterisk (*) is displayed to the left of the address representation.)
*R100 • • • • • • • •: R100 is byte reference.
R101 * * * * * * * *: R101.0 to R101.7 are bit reference, respectively.
*R102 * * * * * * * *: Both byte and bit reference
S: Bit not referenced in the ladder diagram but that has a symbol/comment defined.
a: Automatic assignment address (byte) (Note)
-: Automatic assignment address (bit) (Note)
#: Address which is used in other program of same PMC path (ladder divided management function)

NOTE
1 When same address is used in both selected program and another program, the status for selected program is displayed.
2 The mark of addresses used in other program is displayed in bit position.
3 When there are some addresses used in other program, the following statuses are showed as “#”
*(used as bit or byte), S(symbol/comment is defined), a,- (Automatic assignment address)

(2) Additional display line
Any symbol/comment of the address at the cursor position is displayed in the additional display line.

8.6.2 Operating on the Screen

(1) Operation with soft keys



(a) [SEARCH] Search for an address
Searches for the specified address and displays it as the start address of the address map display.

(b) [SEARCH UNUSED] Search for unused address
Displays an address map centering on the unused address with the smallest number found from the specified address (if not specified, the address at which the cursor is currently located) and containing the preceding and succeeding 12 bytes, 24 bytes in total.

NOTE

1 Parameters of functional instructions are handled as addresses in use with a length of one byte, regardless of the data length of the parameters.

2 The range of the addresses to be searched for is determined by the specified address.
Example: When R100.0 is specified, R100.0 to R7999.7 are searched for. (Memory-B)

3 The following addresses are not subject to unused address search: (Memory-B)
X/Y1000 to X/Y1127, R9000 to R9499, T0 to T499, T9000 to T9499, C0 to C399, C5000 to C5199, K900 to K999, A9000 to A9249, P1 to P5000, and L1 to L9999

(c) [JUMP]
Moves to the net in which the address at the cursor is in use. At this time, lap search is executed in whole ladder program, regardless of the ladder screen settings. Addresses, which are showed as “*” mark of bit or byte, can be jumped.

(d) [EXIT]
Switches the screen to the LADDER DIAGRAM EDITOR screen. At this time, the LADDER DIAGRAM EDITOR screen displays the ladder net that it displayed before the switch to this screen.

(2) Other operations with keys
You can use the page switch keys to switch between pages.
You cannot scroll with the cursor movement keys.

8.7 FUNCTION TO AUTOMATICALLY INPUT UNUSED ADDRESSES

This function automatically inputs unused R, D, and E addresses during ladder editing.

Specifying an unused start address

Enter any R, D, or E address and press the [AUTO] soft key.
The system searches for an unused bit through a list of addresses in the ascending order, starting at that address, inputs the unused address of the unused bit and places that address at the top of the list of unused addresses. If you repeat this operation, the unused start address will be updated. This address is not displayed on the screen. Upon the completion of editing, the stored unused start address is abandoned.

Automatic input of R, D, or E address

After you have specified an unused start address, entering a single address character "R", "D", or "E" and pressing the [AUTO] soft key causes an unused bit address subsequent to the specified unused address to be automatically input.
For the R address, a simpler operation is available: Merely pressing the [AUTO] soft key enables automatic input.
If you perform this operation without specifying an unused start address, the system searches for unused bit, starting at the first address of the specified address type.
If an address used by a functional instruction parameter before a search for an unused address is found, the following message will be displayed and the search for an unused bit will be stopped to avoid the simultaneous uses of the address.

NO FREE ADDRESS IS FOUND BEFORE Xxxxx.

NOTE
This operation is available to bit addresses only.
You cannot automatically input byte addresses.

8.8 AUTOMATICALLY INPUTTING UNUSED PARAMETER NUMBERS

This function automatically inputs the unused numbers for the parameters of functional instructions during ladder editing.

Operation

This function is applicable to the first parameters of the following functional instructions.

SUB3 (TMR)
SUB5 (CTR)
SUB24 (TMRB)
SUB56 (CTRB)
SUB57 (DIFU)
SUB58 (DIFD)
SUB77 (TMRBF)

Moving the cursor to one of these parameters and pressing the [AUTO] soft key causes an unused parameter number to be input.

> **NOTE**
> Special specifications apply to SUB3 (TMR) and SUB5 (CTR). For details, see "Automatic input of the TMR parameter of a functional instruction" and "Automatic input of the CTR parameter of a functional instruction", described later.

If you perform this operation with a parameter number already input, an unused parameter number subsequent to that number will be set.
If an attempt is made to perform this operation on a function instruction to which this operation is not applicable, the following error message will be displayed.

CANNOT PERFORM "AUTO" ON THE INSTRUCTION.

If no unused numbers for parameters are found, the following error message will be displayed.

NO UNUSED PARAMETER NUMBER.

Automatic input of the TMR parameter of a functional instruction

When inputting the TMR parameter, you must consider precision.

(1) Range of parameter numbers subject to this automatic input
Timer numbers with their precision default setting being 8 msec (timer number 9 and subsequent numbers) are assumed to be subject to this automatic input.
(2) Display of setting and precision of an input timer number
The setting and precision of an input timer number are displayed in the additional display line in the following format:

TMR-number xx: setting xxxxxxxxxx precision xxMS

Automatic input of the CTR parameter of a functional instruction

(1) Display of the setting and current value of an input counter number
The setting and current-value of an input counter number are displayed in the additional display line in the following format:

CTR-number xx: setting xxxxxxxxxx current-value xxxxxxx

8.9 DUPLICATION DETECTION IN LADDER EDITING

8.9.1 DETECTION OF DOUBLE COILS

This function automatically detects double coils when you edit WRT coils with ladder editing operations.

Time to check

When you edit coils, this function always detects double coils.
When the check makes a hit, the following message is displayed:

- The case of detecting double coil in selected program
  xxxxx.x IS USED IN NET xxxxx AS COIL.
- The case of detecting double coil in other program of same PMC path
  USED IN OTHER PROG. AS COIL(xxxxx.x).

Example)
R0100.0 IS USED IN NET 100 AS COIL.

The coil editing refers to the following:

- Creation of a new WRT coil and change of a coil to a WRT coil
- Creation of a new WRT.NOT coil and change of a coil to a WRT.NOT coil
- Creation of a new SET/RST coil and change of a coil to a SET/RST coil

Objects of the check

Only coils are the objects of this check.
Thus, the following are not the object of this check:

- Output parameters of functional instructions

8.9.2 DUPLICATION DETECTION OF PARAMETER NUMBER OF FUNCTIONAL INSTRUCTIONS

This function automatically detects duplication when you edit parameter number of functional instructions.

Timing to check

When you edit parameter number of functional instructions, this function always detects duplication.
When the check makes a hit, the following message is displayed:

- The case of detecting duplication of parameter number of functional instructions in selected program
  “INSTRUCTION” NUMBER IS USED(NET xxxx).
- The case of detecting duplication of parameter number of functional instructions in other program of same PMC path
  “Instruction name” NUMBER IS USED IN OTHER PROGRAM.

Example)
CTR NUMBER IS USED(NET 100).

The parameter number editing refers to the following:

- Creation of a new functional instruction (including the selection from functional instruction list screen)
- Change of a parameter number of functional instruction

Objects of the check

Only parameter number (first parameter) of the following functional instructions is the objects of this check.

SUB3 (TMR), SUB5 (CTR), SUB24 (TMRB), SUB77 (TMRBF), SUB56 (CTRB), SUB57 (DIFU), SUB58 (DIFD)

There are two area in which above functional instructions should check. One is that checking in whole program of the PMC path and another is that checking in selected program only.

Whole program of the PMC path: SUB3 (TMR), SUB5 (CTR), SUB56 (CTRB)
Selected program: SUB24 (TMRB), SUB77 (TMRBF), SUB57 (DIFU), SUB58 (DIFD)

8.10 CHECKING OF DUPLICATE COIL ([DUP. CHECK] SCREEN)

On the Duplicate Coil Check screen, you can check the overwriting of a PMC address from some coil instructions. And, you can check the multiple use of instruction number of the following numbered functional instructions.

Instruction name	SUB number	Function
TMR	3	Timer
TMRB	24	Fixed Timer
TMRBF	77	Off Delay Fixed Timer
CTR	5	Counter
CTRB	56	Fixed Counter
DIFU	57	Rising Edge Detection
DIFD	58	Falling Edge Detection

Moreover, you can check the overwriting for plural sequence programs.

- When using the ladder dividing management function, they are checked among main ladder program and divided ladder programs.
- Common memories (E address) for two or more PMC paths are checked when using a multiple PMC paths system.
- When using memory shared mode in the multi-path PMC, all of shared PMC memories and instruction numbers are checked.

The result of check is displayed with a list of net numbers of a program that is using duplicated data.
You can display a selected ladder net by moving the cursor and pressing the [JUMP] soft key.

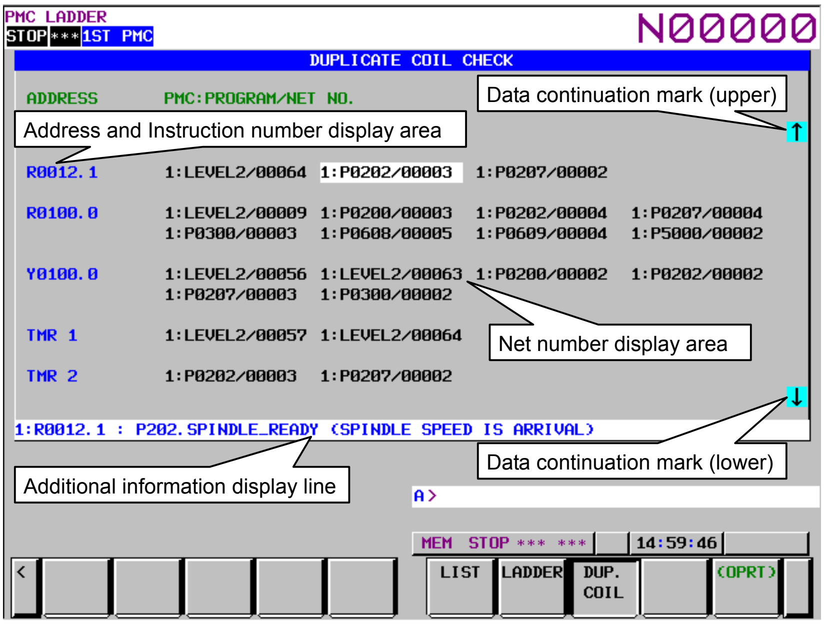


Fig. 8.10 (a) Duplicate coil check screen

Screen structures

(1) ADDRESS

Duplicated PMC address of coil and Functional instruction's name and number are displayed. You can also display it by symbol instead of PMC address by pressing the [SYMBOL] soft key.

(2) NET NO.
Some net numbers using the same coil or instruction number are displayed. The net number is displayed in the following format by the configuration of PMC and the setting of the Ladder diagram screen.

Setting of Ladder screen (SUBPROGRAM NET NUMBER)	Net number display format
Global	PMC:NET NO.
Local	PMC:PROGRAM/NET NO.

In the "PMC" field of the format above, PMC path number and divided ladder program number are displayed.
In case of main ladder program, the following PMC path numbers are displayed. In case of divided ladder program, the divided number is also displayed after PMC path number + "-".

PMC path	Display number
1st path PMC	1
2nd path PMC	2
3rd path PMC	3
4th path PMC	4
5th path PMC	5
DCSPMC	S

(3) Data continuation mark
This mark is displayed when the data continues to the pointed direction.

(4) Additional information display line
Symbol and comment of the cursor focused data are displayed

NOTE
In the address area and the additional information display line, symbols of current sequence program are displayed.

Operations using soft keys

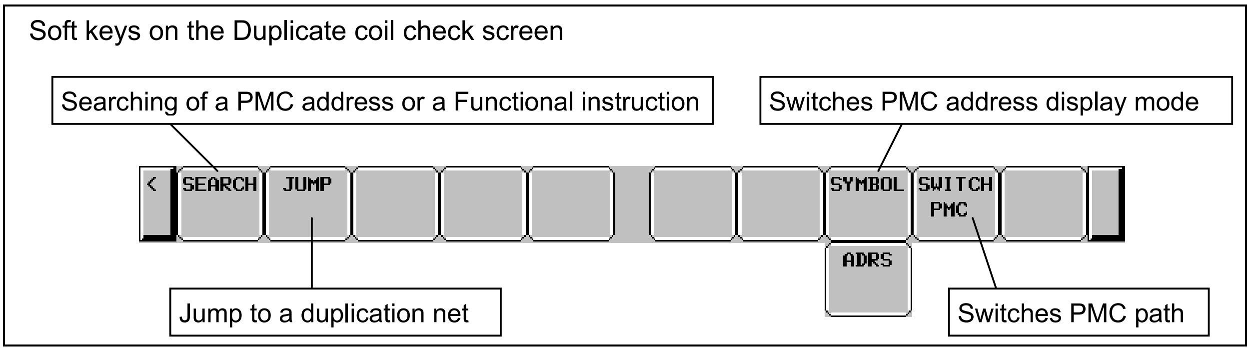


Fig. 8.10 (b) Soft keys on the Duplicate coil check screen

(1) [SEARCH] Searches a PMC address or a Functional instruction
This searches a PMC address or a Functional instruction. If specified PMC address or Functional instruction is not duplicated, the following message is displayed, and duplications that found after it are displayed.

When searching a PMC address :
"THE ADDRESS IS NOT FOUND"

When searching a Functional instruction:
"THE FUNCTIONAL INSTRUCTION IS NOT FOUND"

When you cancel the searching, the check result display area is cleared. Operate the search function again to re-display it.

The following letters can be used for searching PMC address.

- Bit address (ex. "R100.1" + [SEARCH])
- Byte address (ex. "R200" + [SEARCH])
- PMC memory type (ex. "R" + [SEARCH])

The following letters can be used for searching functional instruction.

Functional instruction	Operation
TMR (Timer : SUB 3)	"TMR" + [SEARCH]
	"3" + [SEARCH]
TMRB (Fixed Timer : SUB 24) and TMRBF (Off delay fixed Timer : SUB 77)	"TMRB" + [SEARCH]
	"24" + [SEARCH]
	"TMRBF" + [SEARCH]
	"77"
CTR (Counter : SUB 5)	"CTR" + [SEARCH]
	"5" + [SEARCH]
CTRB (Fixed Counter : SUB 56)	"CTRB" + [SEARCH]
	"56"
DIFU (Rising Edge Detection : SUB 57) and DIFD (Falling Edge Detection : SUB58)	"DIFU" + [SEARCH]
	"57" + [SEARCH]
	"DIFD" + [SEARCH]
	"58" + [SEARCH]

(2) [JUMP] Jump to a duplication net
Change to the Ladder diagram screen and display the selected net. This soft key is displayed when any duplication is detected.

(3) [SYMBOL] / [ADRS] Switches PMC address display mode
By pressing the [SYMBOL] soft key, you can change PMC addresses to symbol on the check result display area. And, you can change to the original PMC address by pressing the [ADRS] soft key.

(4) [SWITCH PMC] Switching PMC path or divided ladder programs
Switches PMC path or divided ladder program. For details of the operation, refer to “6.3”.
By setting keep relay K935.0 to 1, you can display PMC program list screen. For details, refer to ”2.2.11”.

Operations using other keys

(1) Cursor keys
Move the cursor displayed on a net number. You can display any Ladder net selected with the cursor, by pressing the [JUMP] soft key.
When the cursor is on the top or bottom line of the screen, pressing the cursor key of the same direction scrolls the contents of the screen.

(2) Page keys
Scroll up or down the contests of the screen by page.

8.11 DISPLAYING A SUBPROGRAM LIST ([SPLIST] SCREEN)

8.11.1 Display history of a Subprogram

To record the switching history of subprogram display in the LADDER DIAGRAM DISPLAY screen and STEP SEQUENCE DISPLAY screen, you can trace back the history by [BACK] soft key.

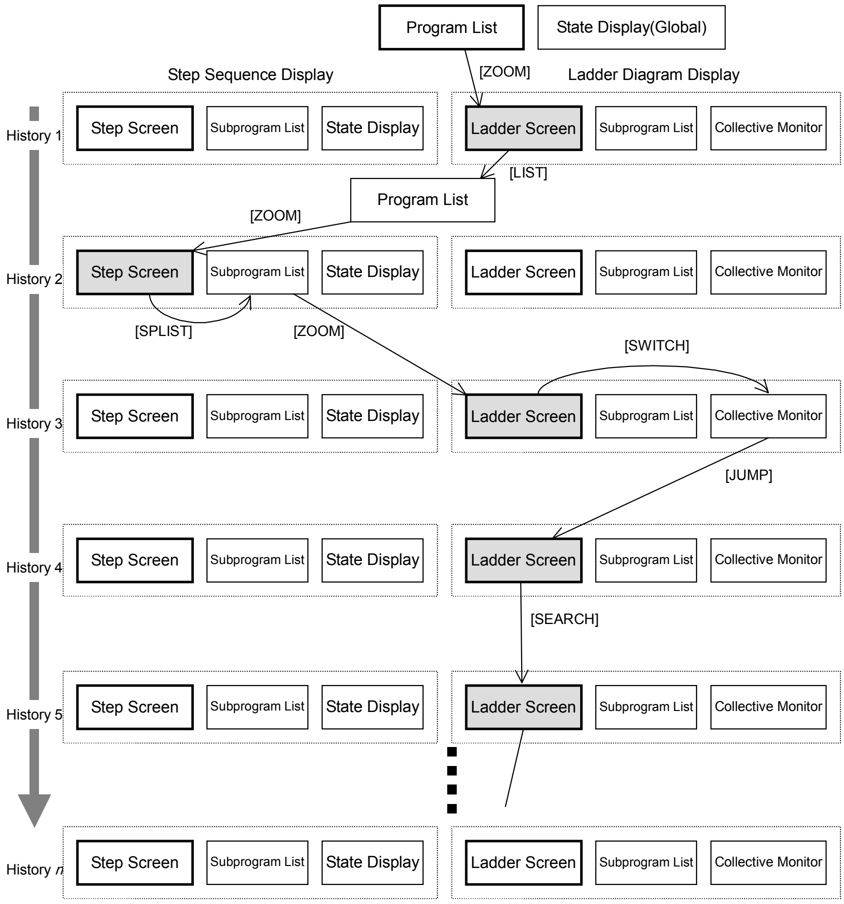


Fig. 8.11.1 (a) Display history of a Subprogram

> **NOTE**
> When current program is switched from main program to divided program with searching operation, the display history is recorded. However, switching from divided program to other divided program clears recorded display history.

Management of history information

Max.16 records are recorded in the history information. When subprogram is switched more than 16 times, the old history information is deleted in turn.
Jump within the same subprogram is not recorded.
When changing the sequence program by the PMC data I/O screen or FANUC LADDER-III, all the display history of the subprogram is deleted.
The display history is not deleted even if the program is changed by the LADDER DIAGRAM EDITOR screen. When deleting a subprogram, the deleted subprogram is removed from the history. And the history information is not recorded by switching the subprogram in the LADDER DIAGRAM EDITOR screen. When the subprogram A which is displayed just before starting the editing operation is different from the subprogram B which is displayed just after editing, it is switched from B to A by the [BACK] operation.

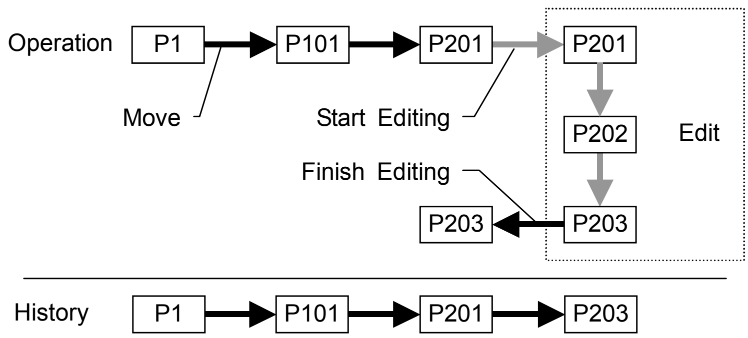


Fig. 8.11.1 (b) Management of historical information

Display of the history in the subprogram list screen

The display history of subprograms and the list of calling subprogram are displayed together.
The display history of subprograms is displayed as the history number in the program type section. The oldest history number is 1 and as it becomes newer, the number becomes larger.
You can move the cursor to the subprogram in the list of the history.
When the cursor is positioned on a subprogram in the history and it is zoomed, you can back to the older subprogram of history directly.

8.11.2 Subprogram List Display Screen

The Subprogram List Display screen shows the list of the subprograms which are called by the current subprogram. You can choose a subprogram from the list, which will be displayed on the screen. On the other hand, the history of the displayed subprogram is also displayed.

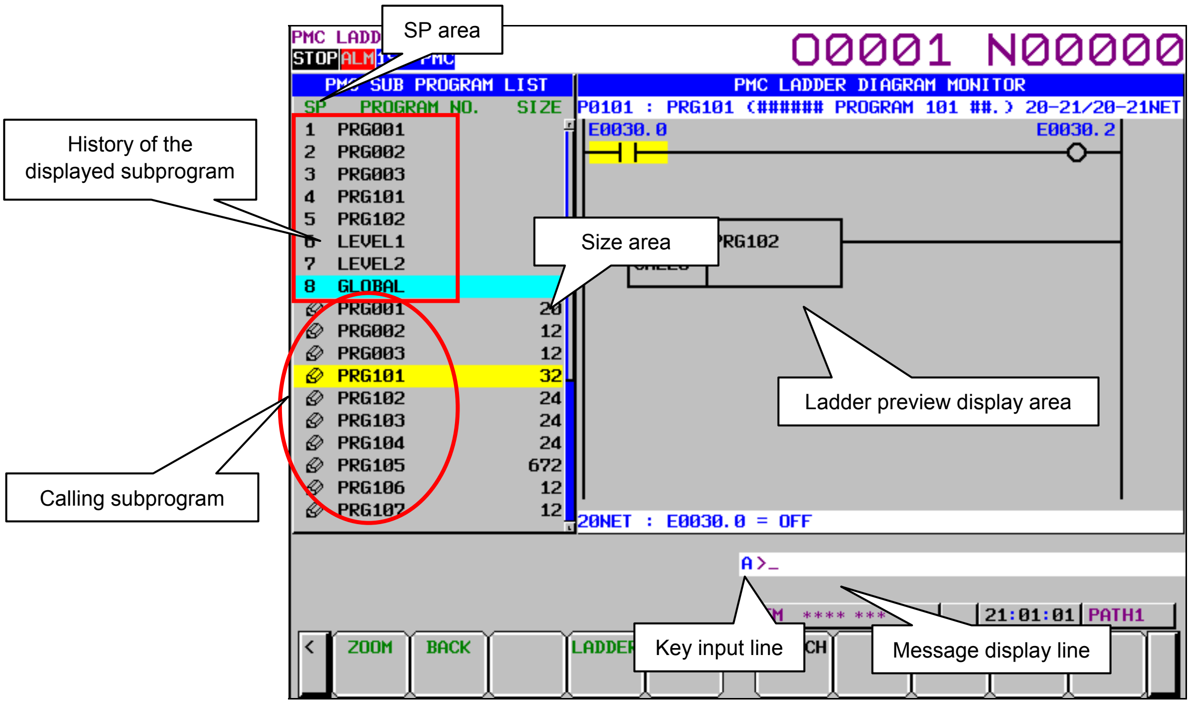
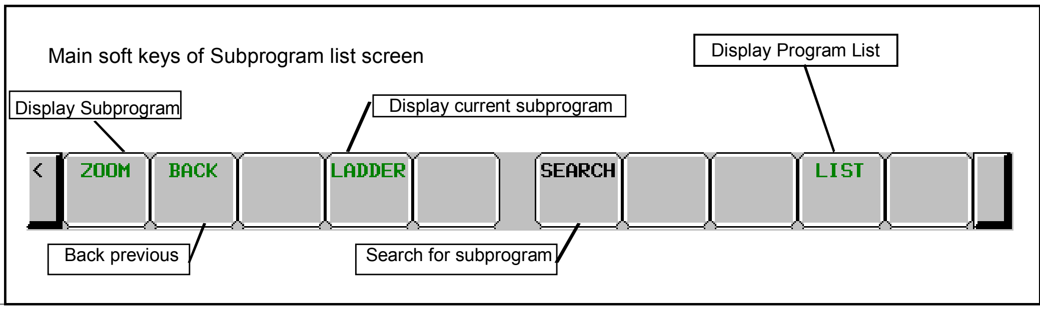


Fig. 8.11.2 (a) Subprogram List Display Screen

(1) Operation with Soft keys



(a) [ZOOM] Display specified subprogram
Switches the screen display to the ladder diagram display screen. When you press the [ZOOM] soft key without entering a character string, the ladder diagram display screen is displayed with subprogram under the cursor. When you press the [ZOOM] soft key after entering a program name or symbol name, the subprogram corresponding to the entered character string is displayed. If the subprogram is protected, the password needs to be released.

(b) [BACK] Switch to the program list screen or the previous history
When the display history is one, it returns to the program list display screen. When the display history is two or more, it returns to the previous history.

(c) [LADDER] Switch to the ladder diagram monitor screen
Switches the screen display to the ladder diagram monitor screen which displays the current subprogram.

(d) [SEARCH] Subprogram search
Searches for a subprogram. When you press the [SEARCH] soft key after entering a subprogram name or symbol name, the subprogram corresponding to the entered character string is searched for.

(e) [LIST] Go to PROGRAM LIST VIEWER screen
Displays the program list screen.

(2) Others
For details of screen structures and operation, see Section 8.1, "DISPLAYING A PROGRAM LIST ([LIST] SCREEN)".

8.11.3 Setting Subprogram List Screen

The setting the subprogram list display screen is shared with the program list display screen.
For details of the setting screen, see Subsection 8.1.1, "Setting Program List Screen".

8.12 OPERATION BY TOUCH PANEL

A CNC with a touch panel enables you to operate several functions of the following screens by touching the screen.

- Ladder diagram monitor screen
- Ladder diagram editor screen
- Net editor screen
- Program list viewer screen
- Program list editor screen
- Subprogram list display screen
- Collective monitor screen

You can operate with two ways of touching the screen.

-Touch
    "Touch" means to press a point on the screen momentarily.
- Long touch
    "Long touch" means that a point on the screen is kept pressed for a second or longer and then a pointer is released from same point on the screen.

Furthermore, you can operate a soft key using a touch panel on all screens.

> ⚠**CAUTION**
> When a point on the screen is kept pressed for a second or longer, "Long touch" comes into effect. If CNC parameter 3192#2 is set to 1 and CNC parameter 3197, which means detection time of continuous pressing on touch panel, is set to a short time, NC alarm " SR5303 TOUCH PANEL ERROR " might occur on "Long touch".
> When NC alarm occurred, operation of CNC is stopped.
> When NC alarm occurred, adjust CNC parameter 3192#2 and 3197.

> **NOTE**
> 1 To use a touch panel function, the "Touch panel control" or the "FANUC PICTURE function" option is necessary.
> 2 An operation of touch panel is not recorded to the operation history.
> 3 See "8.12.1 Operation list of the touch panel" for available operations of touch panel.
> 4 When display of the virtual MDI key overlaps with PMC screen, this function is disabled because of taking precedence the virtual MDI key.
> See "USER'S MANUAL of each CNC series for the virtual MDI key function details.
> 5 When the one-touch menu displays on 10.4" display unit, this function is disabled because of taking precedence the one-touch menu.
> 6 This function can be controlled using keep relay.
> K931.0.
> 0: Enables the touch panel operation of PMC screens. (Initial value)
> 1: Disables the touch panel operation of PMC screens.
> 7 On series 30*i*/31*i*/32*i*/35*i*-B or Power Motion *i*-A, 0*i*-F with Personal Computer, this function is not supported.

8.12.1 Operation List of the Touch Panel

Table8.12.1 (a) Operation list of the touch panel

Screen	Operation	Detail
Program list viewer	Cursor move	A Cursor moves to a touched point on the screen.
	Page change	When either end of a scroll bar is touched, the screen is scrolled up or down one page.
	Zoom	When a cursor is long touched, a program under the cursor is displayed.
Ladder diagram monitor (note)	Cursor move	A Cursor moves to a touched point on the screen.
	Page change	When either end of a scroll bar is touched, the screen is scrolled up or down one page.
	Search coil	When a cursor is long touched, a address under a cursor is searched for the coil.
	Zoom	When a cursor is long touched, a subprogram, which is specified at FB, CALL, CALLU and CM instruction's parameter under the cursor, is displayed.
Ladder diagram editor	Cursor move	A Cursor moves to a touched point on the screen.
	Page change	When either end of a scroll bar is touched, the screen is scrolled up or down one page.
Net editor	Cursor move	A Cursor moves to a touched point on the screen.
Program list editor	Cursor move	A Cursor moves to a touched point on the screen.
	Page change	When either end of a scroll bar is touched, the screen is scrolled up or down one page.
	Zoom	When a cursor is long touched, a program under the cursor is displayed.
Collective monitor (note)	Cursor move	A Cursor moves to a touched point on the screen.
	Page change	When either end of a scroll bar is touched, the screen is scrolled up or down one page.
	Pick up	When a cursor is long touched, a ladder net including a coil with a address under the cursor is picked up.
	Zoom	When a cursor is long touched, a subprogram, which is specified at FB, CALL, CALLU and CM instruction's parameter under the cursor, is displayed.
Subprogram list display	Cursor move	A Cursor moves to a touched point on the screen.
	Page change	When either end of a scroll bar is touched, the screen is scrolled up or down one page.
	Zoom	When a cursor is long touched, a program under the cursor is displayed.

NOTE

When you operate using touch panel on the ladder diagram screen and the collective monitor screen, set "SHOW CURSOR" to "YES" on the ladder diagram monitor screen (setting). If "SHOW CURSOR" is "NO", you can operate only the page change on these screens.

8.12.2 Operation of Program List Viewer Screen

You can operate the following operations using the touch panel on the Program list viewer screen.
- Cursor move
- Page change
- Display the contents of subprogram [ZOOM]

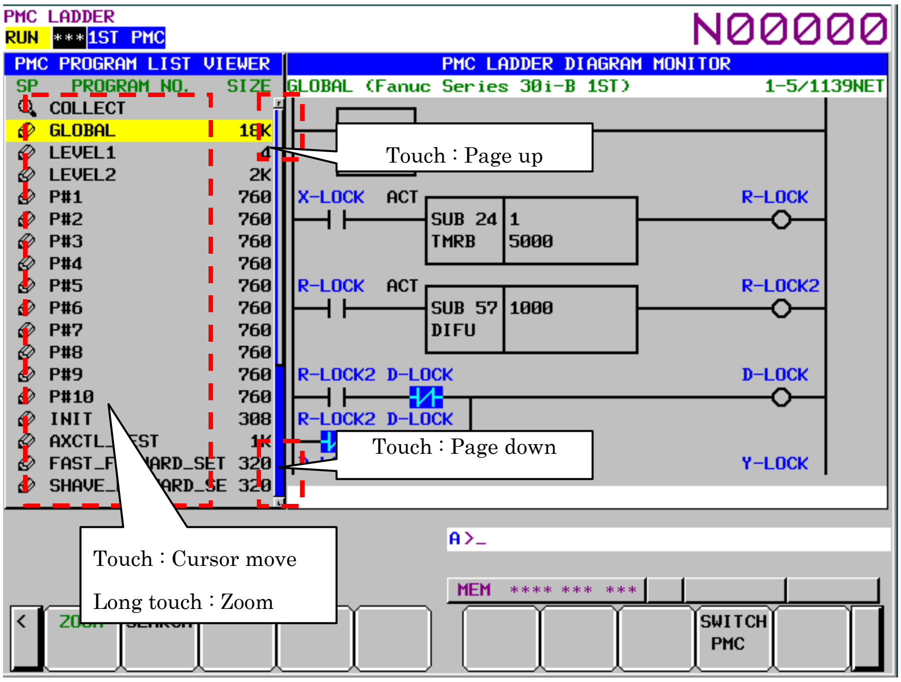


Fig.8.12.2 (a) Operation of Program list viewer screen

(1) Cursor move
When you touch SP area and program number area, the cursor moves to the touched point.

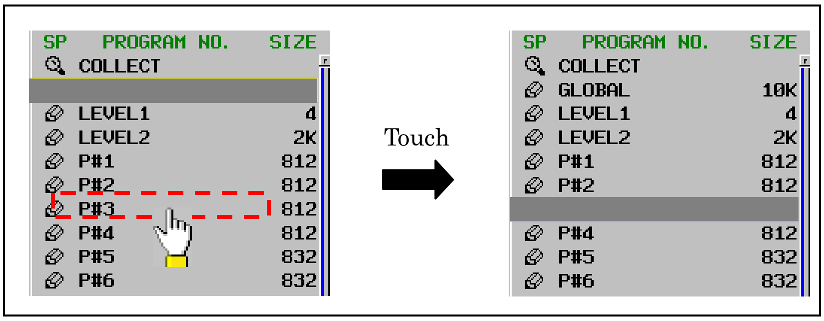


Fig.8.12.2 (b) Cursor move

(2) Page change
When upper end of the scroll bar is touched, the screen is scrolled up one page.
When lower end of a scroll bar is touched, the screen is scrolled down one page.
When the page up/down area is touched, the scroll bar is displayed with yellow color.

(3) Display the contents of subprogram [ZOOM]

When you long touch the program number, the cursor color becomes red and touched program is displayed on ladder diagram monitor screen. If you want to cancel "zoom" operation, move the touched point after the cursor color is red. By the way, when the selected program is protected to monitor, you have to unlock the protection.

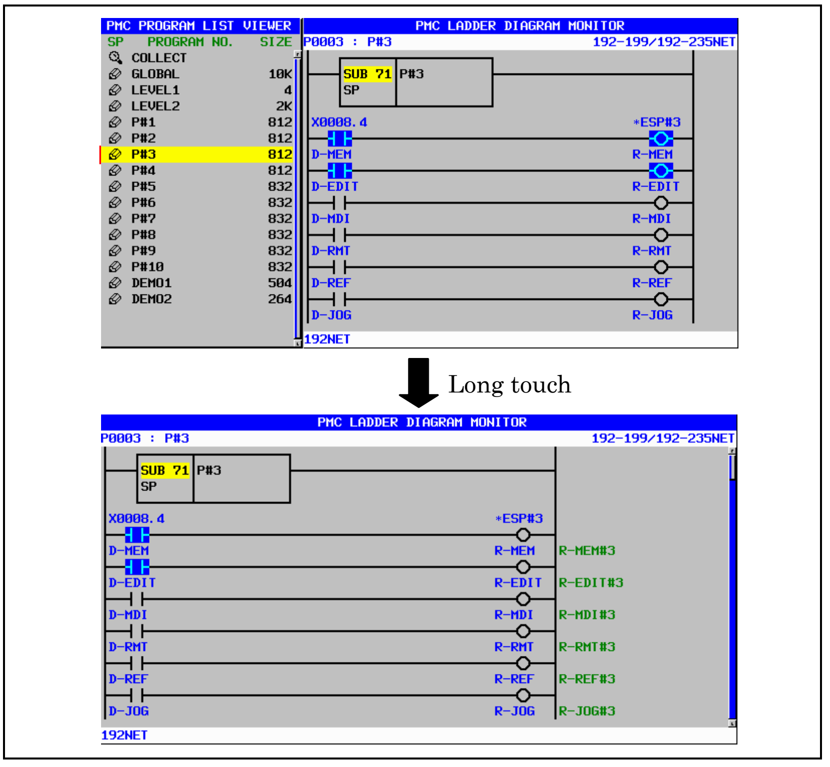


Fig.8.12.2 (c) Display the contents of subprogram

8.12.3 Operation of Ladder Diagram Monitor Screen

You can operate the following operations using the touch panel on the ladder diagram monitor screen.
- Cursor move
- Page change
- Search coil [W-SRCH]
- Display the contents of subprogram/function block [ZOOM]

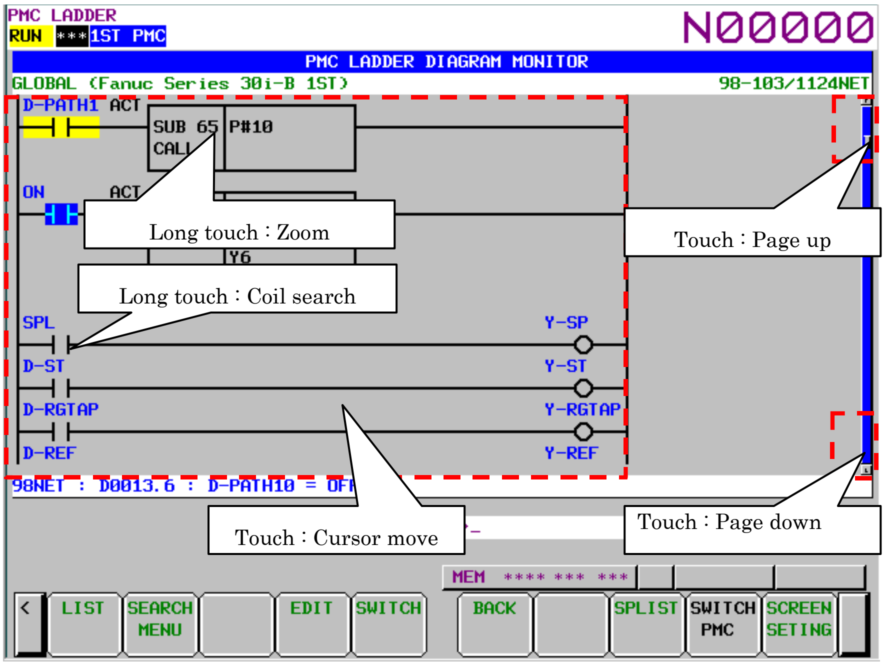


Fig.8.12.3 (a) Operation of ladder diagram monitor screen

(1) Cursor move
When you touch the ladder diagram area, the cursor goes to the touched point.

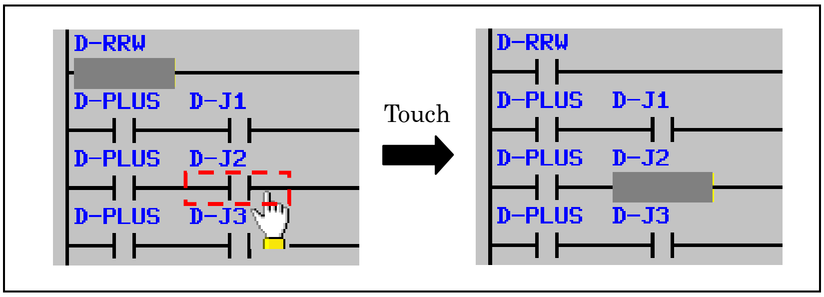


Fig.8.12.3 (b) Cursor move

(2) Page change
When upper end of the scroll bar is touched, the screen is scrolled up one page.
When lower end of the scroll bar is touched, the screen is scrolled down one page.
When the page up/down area is touched, the scroll bar is displayed with yellow color.

(3) Search coil [W-SRCH]
When you long touch the bit address, the cursor color becomes red and the coil with the touched bit address is searched. If you want to cancel "coil search" operation, move the touched point after the cursor color is red.

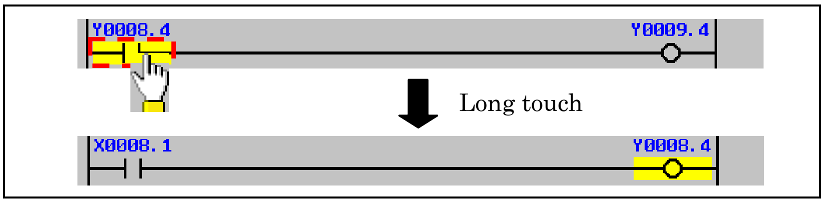


Fig.8.12.3 (c) Search coil

(4) Display the contents of subprogram/function block [ZOOM]
When you long touch CALL, CALLU and CM instruction and instance of the function block, the cursor color becomes red and the subprogram or the FB body program is displayed. If you want to cancel "zoom" operation, move the touched point after the cursor color is red. By the way, when the selected subprogram or the function block is protected to monitor, you have to unlock the protection.

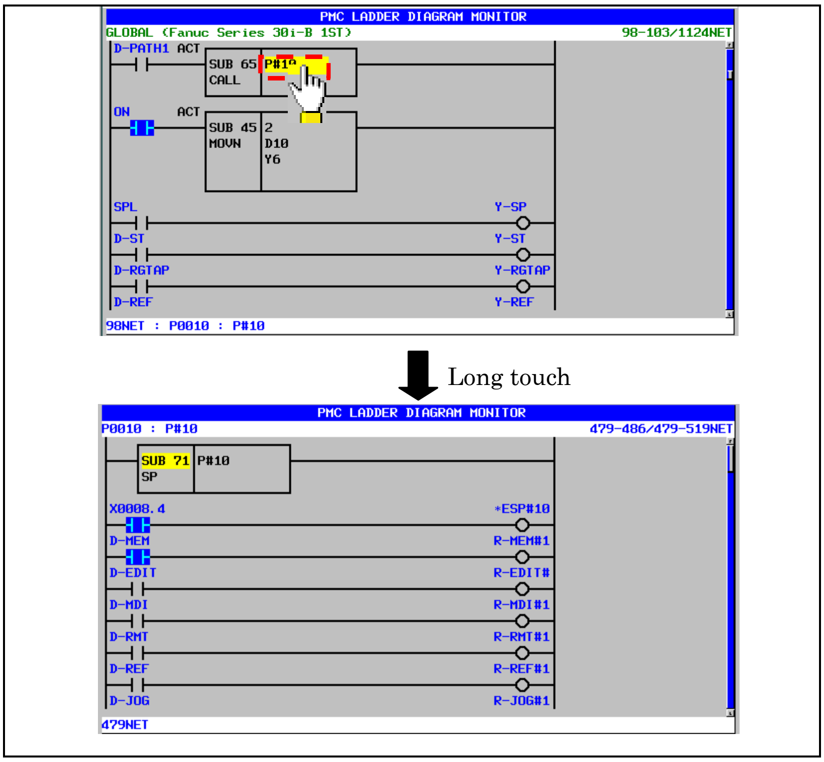


Fig.8.12.3 (d) Display the contents of subprogram/function block

On the instance of function block, long touch is available at "FB instance", "FB definition name"," Input parameter", "Output parameter", "Input/Output parameter" or "Instance monitor".

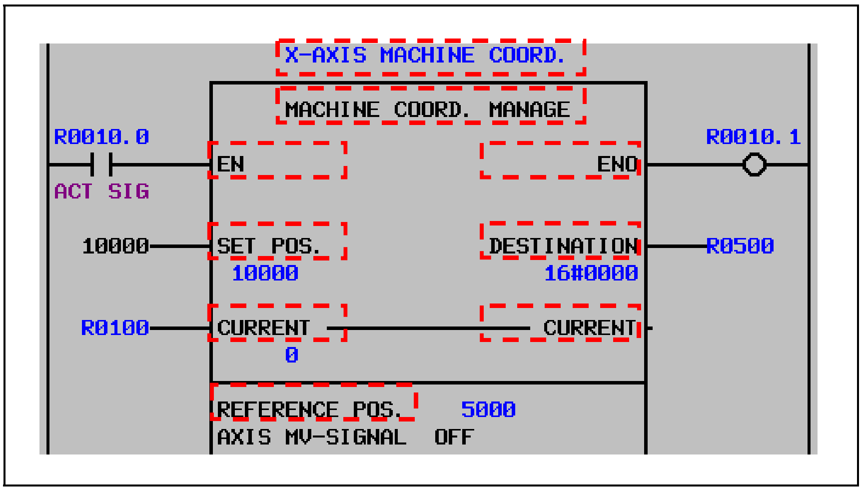


Fig.8.12.3 (e) Available cursor positions of zooming in a function block

8.12.4 Operation of Ladder Diagram Editor Screen

You can operate the following operations using the touch panel on the ladder diagram editor screen.
- Cursor move
- Page change

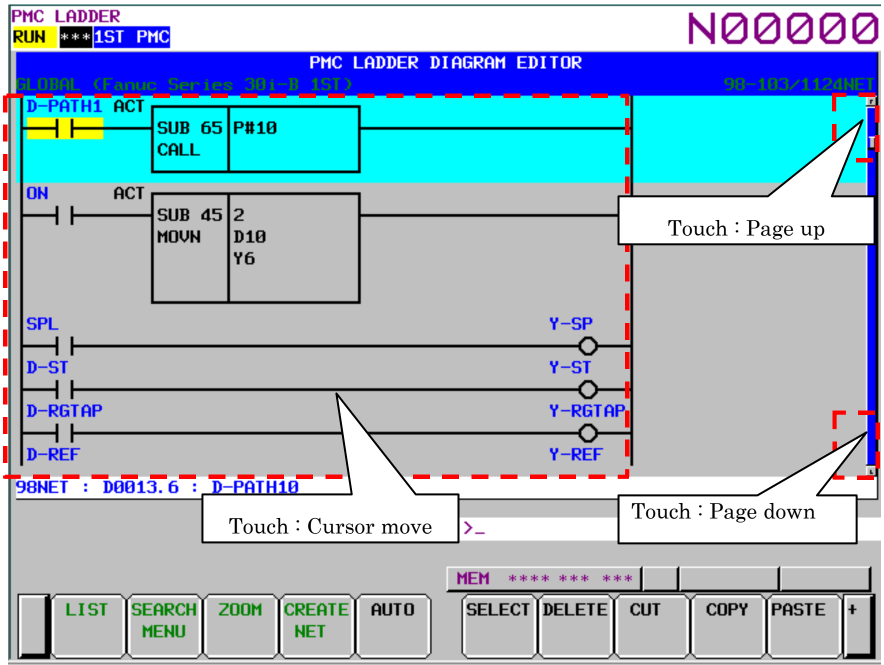


Fig.8.12.4 (a) Operation of ladder diagram editor screen

(1) Cursor move
When you touch the ladder diagram area, the cursor goes to the touched point.

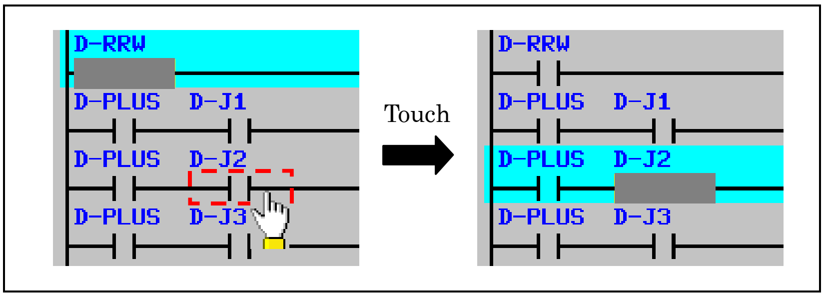


Fig.8.12.4 (b) Cursor move

(2) Page change
When upper end of the scroll bar is touched, the screen is scrolled up one page.
When lower end of the scroll bar is touched, the screen is scrolled down one page.
When the page up/down area is touched, the scroll bar is displayed with yellow color.

8.12.5 Operation of Net Editor Screen

You can operate the following operations using the touch panel on the net editor screen.
- Cursor move

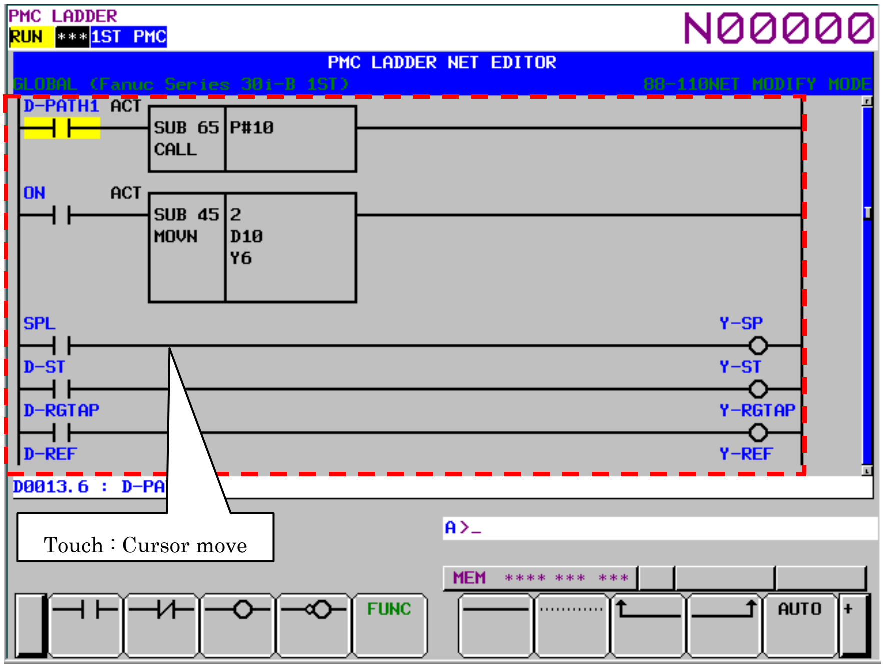


Fig.8.12.5 (a) Operation of Net editor screen

(1) Cursor move
When you touch the ladder diagram area, the cursor goes to the touched point.

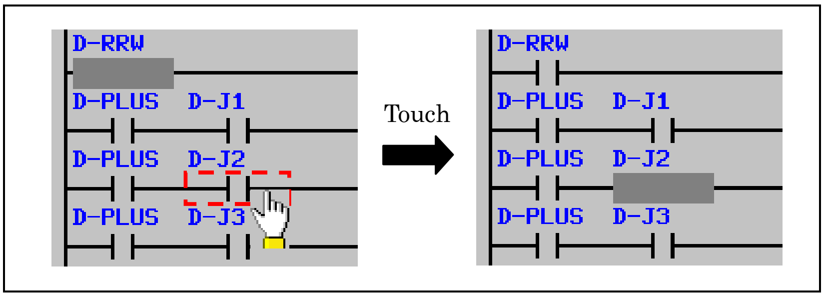


Fig.8.12.5 (b) Cursor move

8.12.6 Operation of Program List Editor Screen

You can operate the following operations using the touch panel on the program list editor screen.
- Cursor move
- Page change
- Display the contents of subprogram [ZOOM]

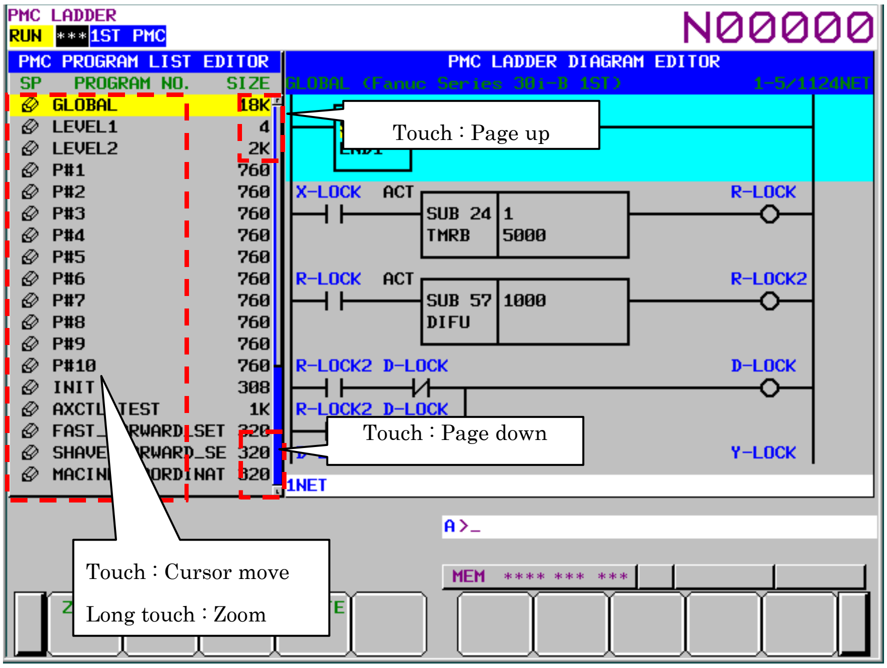


Fig.8.12.6 (a) Operation of program list editor screen

(1) Cursor move
When you touch the SP area and the program number area, the cursor goes to the touched point.

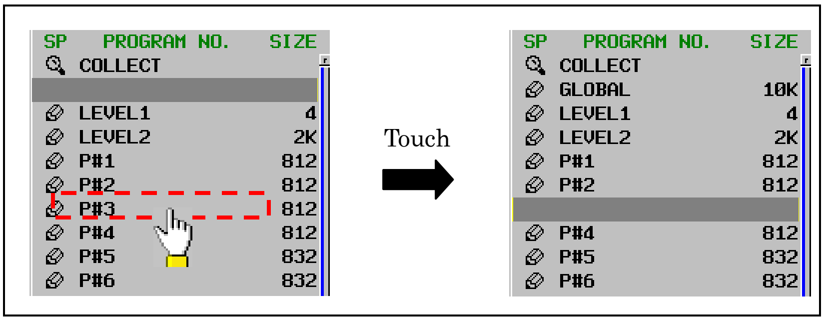


Fig.8.12.6 (b) Cursor move

(2) Page change
When upper end of the scroll bar is touched, the screen is scrolled up one page.
When lower end of the scroll bar is touched, the screen is scrolled down one page.
When the page up/down area is touched, the scroll bar is displayed with yellow color.

(3) Display the contents of subprogram [ZOOM]
When you long touch the program number, the cursor color becomes red and touched program is displayed on ladder diagram editor screen. If you want to cancel "zoom" operation, move the touched point after the cursor color is red. By the way, when the selected program is protected to edit, you have to unlock the protection.

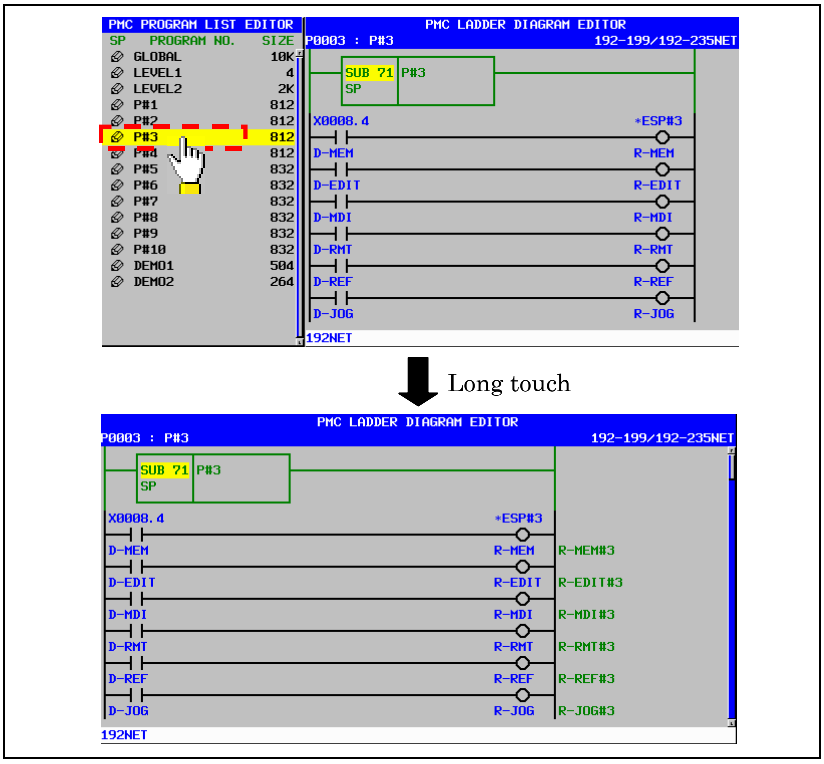


Fig.8.12.6 (c) Display the contents of subprogram

8.12.7 Operation of Collective Monitor Screen

You can operate the following operations using the touch panel on the collective monitor screen.
- Cursor move
- Page change
- Pick up ladder net [PICKUP]
- Display the contents of subprogram/function block [ZOOM]

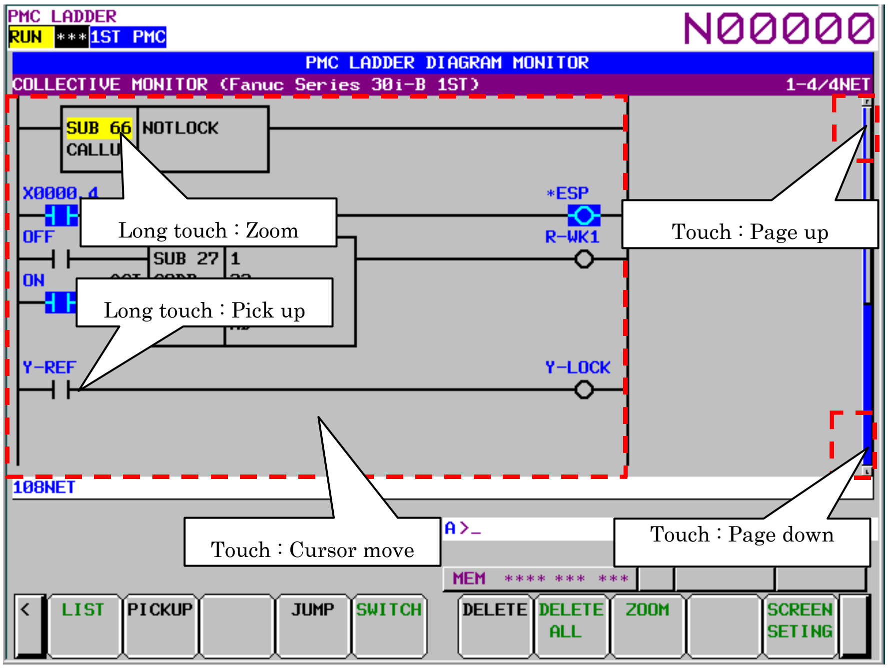


Fig.8.12.7 (a) Operation of collective monitor screen

(1) Cursor move
When you touch the ladder diagram area, the cursor goes to the touched point.

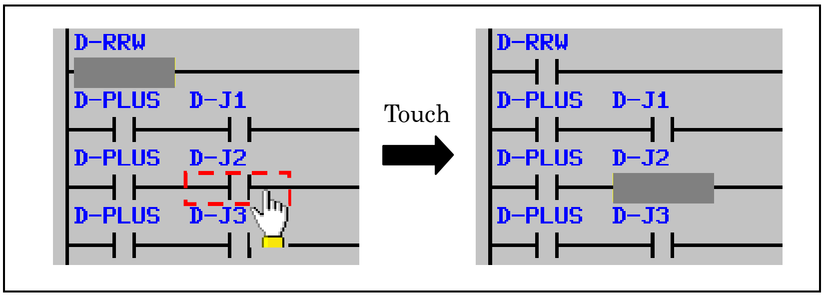


Fig.8.12.7 (b) Cursor move

(2) Page change
When upper end of the scroll bar is touched, the screen is scrolled up one page.
When lower end of the scroll bar is touched, the screen is scrolled down one page.
When the page up/down area is touched, the scroll bar is displayed with yellow color.

(3) Pick up ladder net [PICKUP]
When you long touch the bit address, the cursor color becomes red and the ladder net including the coil with the touched bit address is picked up. If you want to cancel "pick up" operation, move the touched point after the cursor color is red.

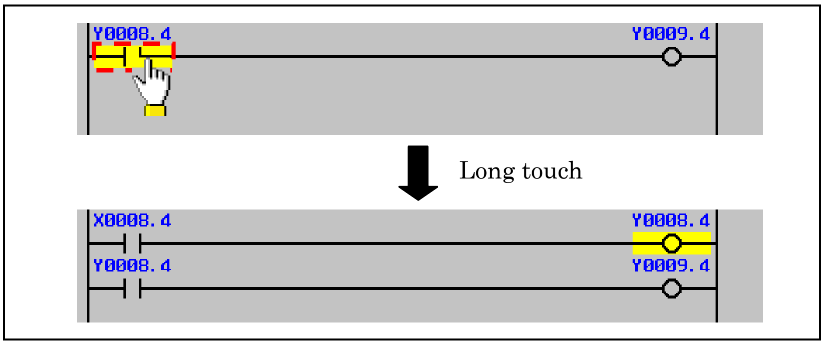


Fig.8.12.7 (c) Pick up ladder net

(4) Display the contents of subprogram/function block [ZOOM]
When you long touch CALL, CALLU and CM instruction and instance of the function block, the cursor color becomes red and the subprogram or the FB body program is displayed. If you want to cancel "zoom" operation, move the touched point after the cursor color is red. By the way, when the selected subprogram or the function block is protected to monitor, you have to unlock the protection.

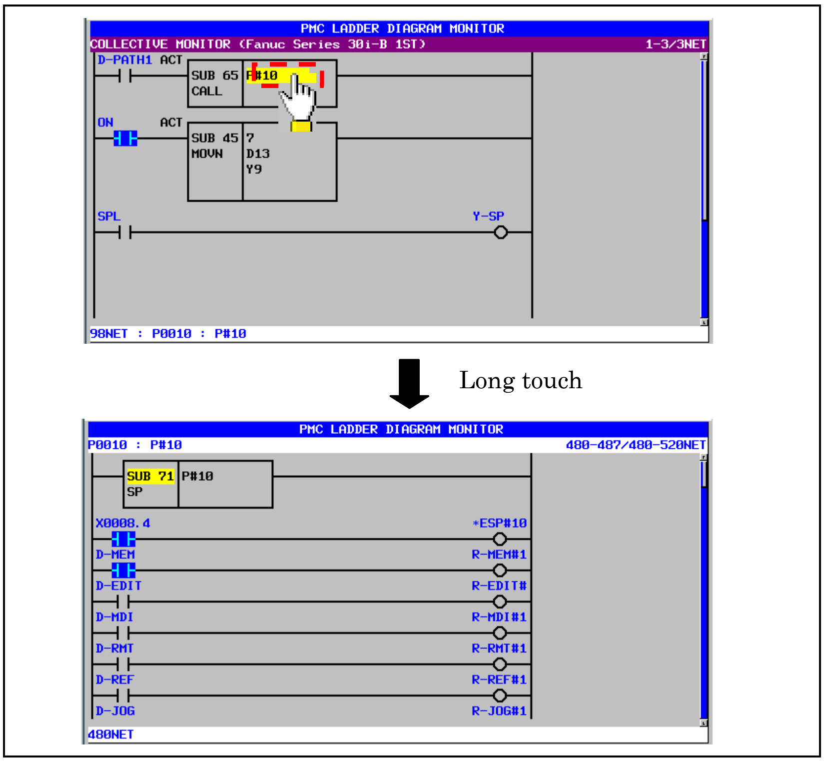


Fig.8.12.7 (d) Display the contents of subprogram/function block

On the instance of function block, long touch is available at "FB instance", "FB definition name", "Input parameter", "Output parameter", "Input/Output parameter" or "Instance monitor".

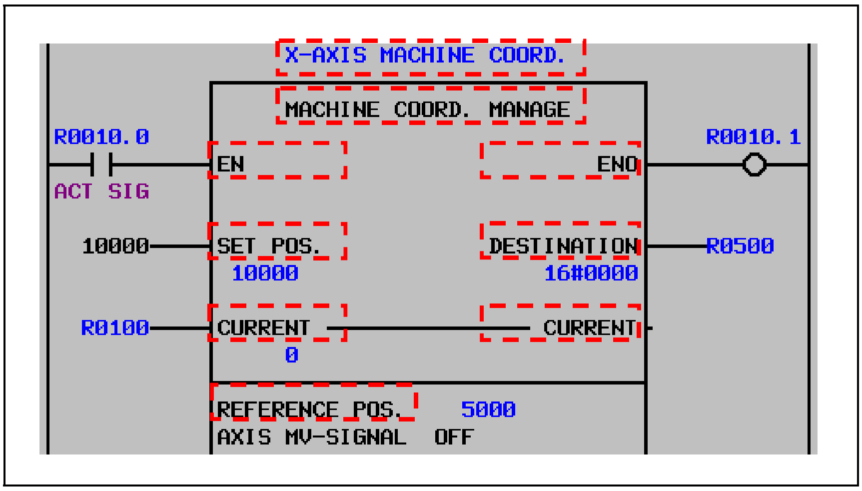


Fig.8.12.7 (e) Available cursor positions of zooming in a function block

8.12.8 Operation of Subprogram List Display Screen

You can operate the following operations using the touch panel on the subprogram list display screen.
- Cursor move
- Page change
- Display the contents of subprogram/function block [ZOOM]

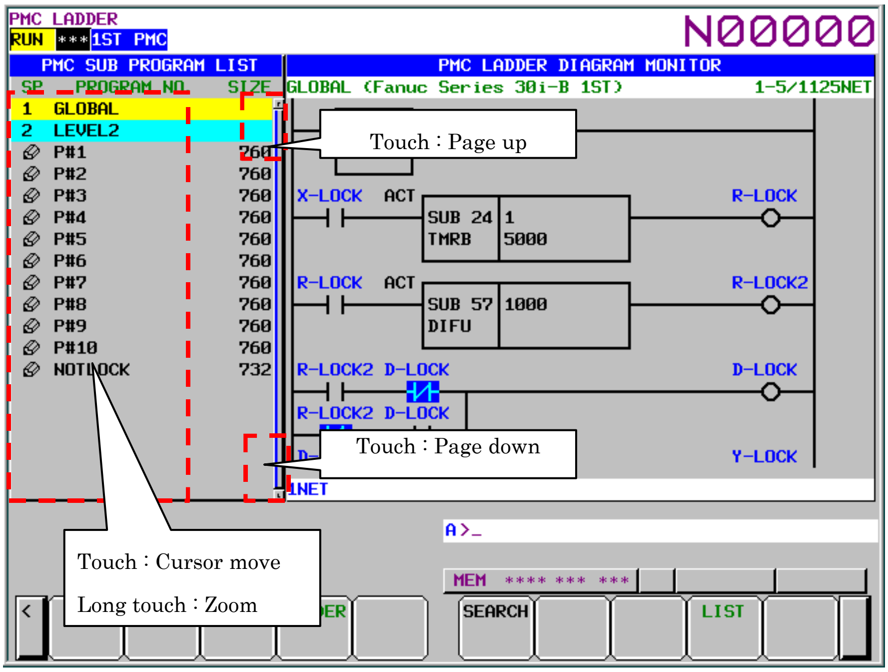


Fig.8.12.8 (a) Operation of subprogram list display screen

(1) Cursor move
When you touch the SP area and the program number area, the cursor goes to a touched point.

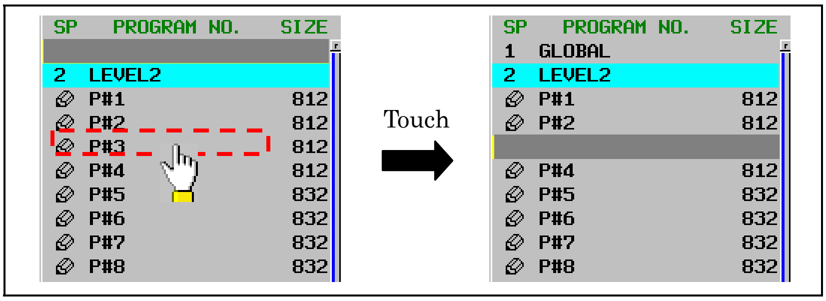


Fig.8.12.8 (b) Cursor move

(2) Page change
When upper end of the scroll bar is touched, the screen is scrolled up one page.
When lower end of the scroll bar is touched, the screen is scrolled down one page.
When the page up/down area is touched, the scroll bar is displayed with yellow color.

(3) Display the contents of subprogram/function block [ZOOM]
When you long touch CALL, CALLU and CM instruction and instance of the function block, the cursor color becomes red and the subprogram or the FB body program is displayed. If you want to cancel "zoom" operation, move the touched point after the cursor color is red. By the way, when the selected subprogram or the function block is protected to monitor, you have to unlock the protection.

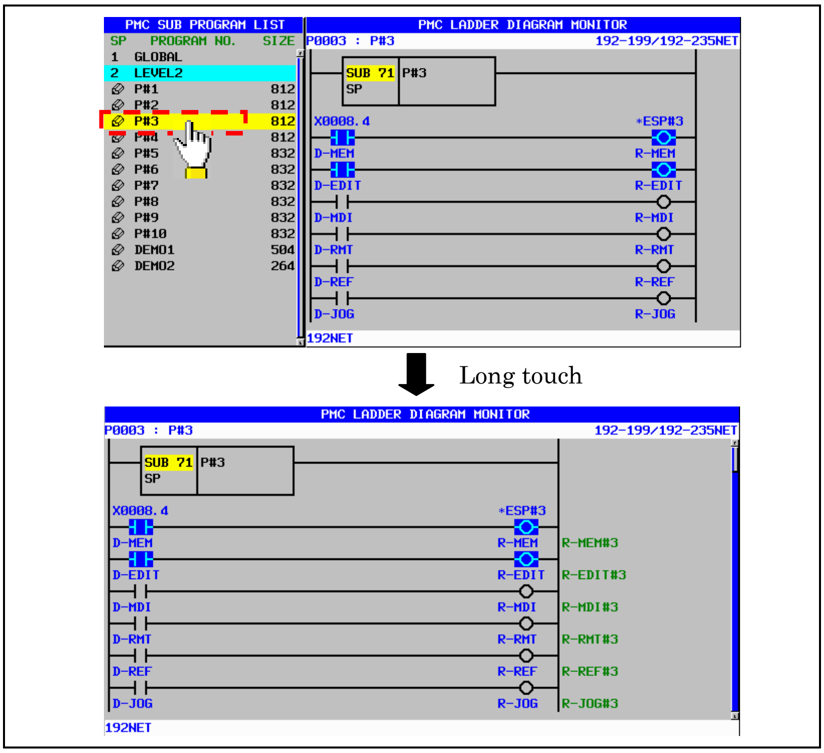


Fig.8.12.8 (c) Display the contents of subprogram/function block

On the instance of function block, long touch is available at "FB instance", "FB definition name", "Input parameter", "Output parameter", "Input/Output parameter" or "Instance monitor".

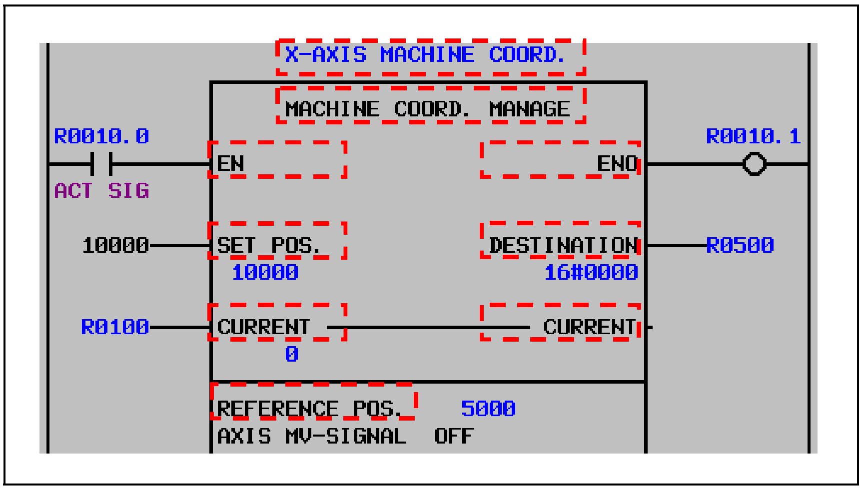


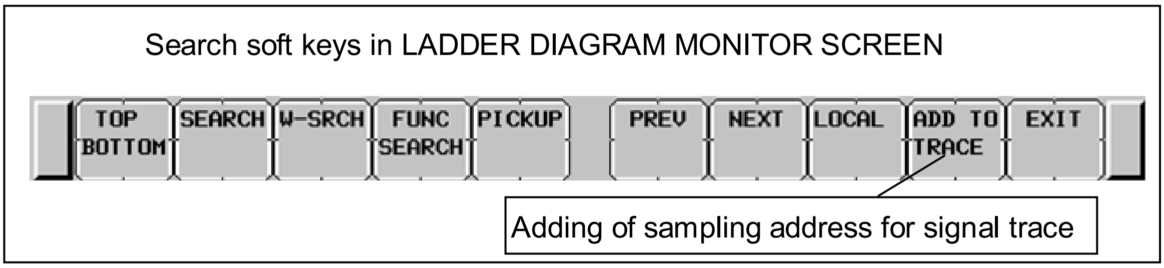
Fig.8.12.8 (d) Available cursor positions of zooming in a function block

8.13 Adding of Sampling Address of Signal Trace

You can add PMC addresses used in ladder program on the ladder monitoring screen into sampling addresses for signal trace.

Operation

Pressing the [ADD TO TRACE] soft key adds the PMC address used for contact or coil into sampling address for signal trace.
When adding, the message "ADDED TO TRACE SAMPLING ADDRESS." is displayed.

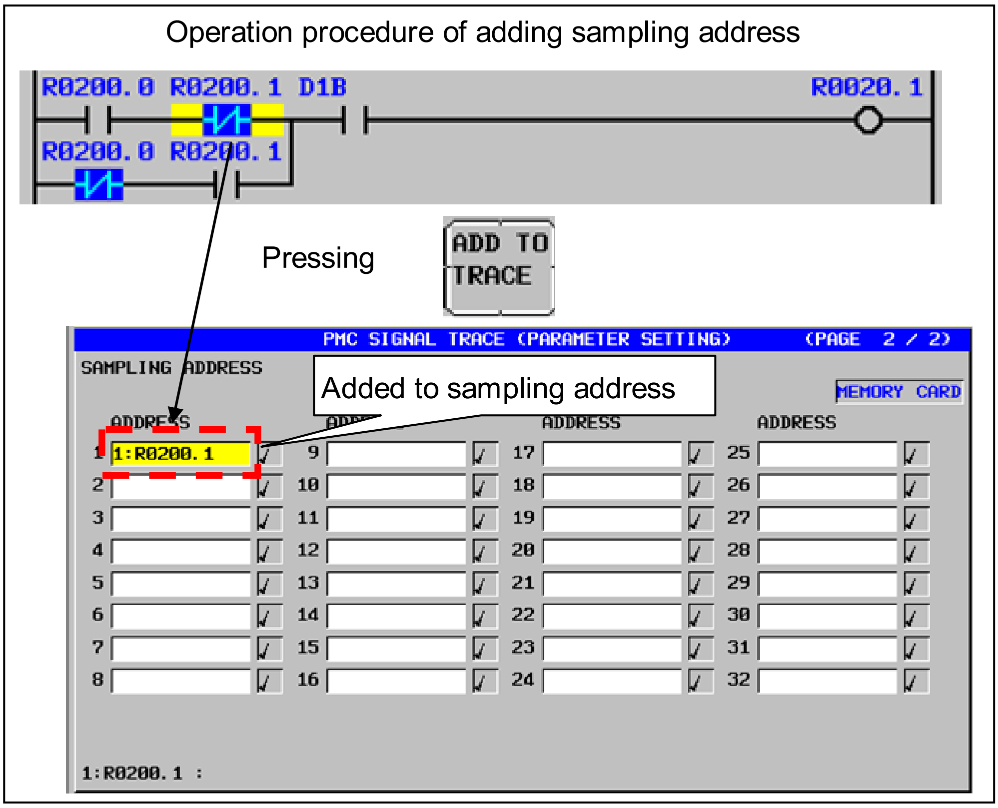


There are two operation ways for adding of sampling address.

(1) Adding of PMC address on cursor.
You select the following instructions or PMC address by the cursor and press the [ADD TO TRACE] soft key.

- Coils
- Contacts
- FB parameters
- FB instance monitor

Selected PMC address is added to sampling address.



(2) Adding of entered PMC address
Enter a symbol or PMC address and press the [ADD TO TRACE] soft key.

Example: "R200.1" + [ADD TO TRACE] soft key

Entered symbol or PMC address is added to sampling address.

NOTE

1. When there is a contact or a coil on cursor and pressing [ADD TO TRACE] after entering PMC address, the PMC address is added to sampling address. PMC address of the contact or the coil on the cursor is not added to sampling address.
2. PMC address to add to sampling address is only bit address. Byte address cannot be added.
3. When cursor is located on the position on which the PMC address cannot be added and press the [ADD TO TRACE], there is no reaction.
4. When entered strings are not correct symbol or PMC address, the error message "INPUT INVALID" is displayed.

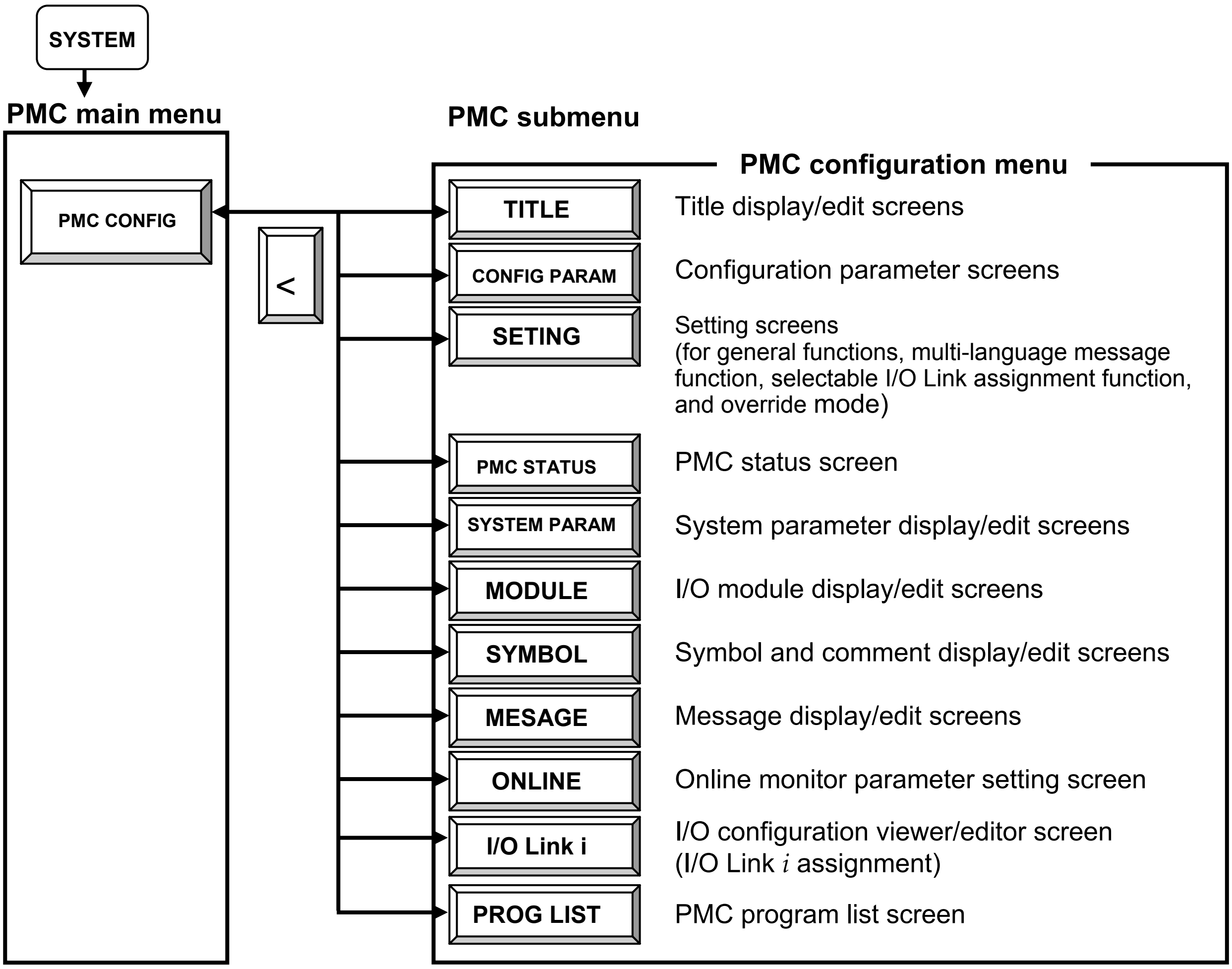
Result of adding

PMC address, which is added in ladder diagram monitor screen, is registered at the top of sampling addresses.
The sampling addresses, which have already set, are moved down one step. When sampling addresses exceeds the maximum number, last sampling address is deleted.

You can confirm the added address in the trace parameter setting screen.

9 PMC CONFIGURATION DATA SETTING SCREENS ([PMC CONFIG])

The PMC configuration menu is used to display screens related to PMC configuration data that change the target PMC, and display and edit PMC data.
You can move to the PMC configuration menu by pressing the [SYSTEM] key, then the [PMC CONFIG] soft key.

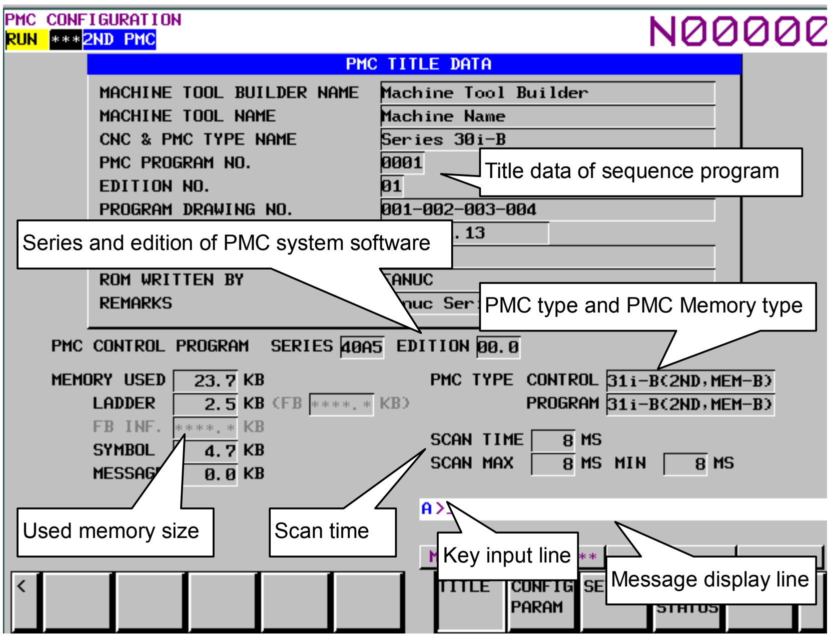


9.1 DISPLAYING AND EDITING TITLE DATA ([TITLE] SCREENS)

9.1.1 Displaying Title Data

On the TITLE DATA screen, you can check the title data items and some ladder information items. To switch to the TITLE DATA screen, press the [TITLE] soft key.
Besides, the following operation is available in the TITLE DATA screen.

- Moving to the TITLE DATA EDITOR screen [EDIT]
- Moving to the TITLE DATA (MESSAGE) screen [MESAGE TITLE]



(1) Title data
The following title data that is set in the sequence program is displayed.

Item	Max. characters
MACHINE TOOL BUILDER NAME	32
MACHINE TOOL NAME	32
CNC & PMC NAME	32
PMC PROGRAM NO.	4
EDITION NO.	2
PROGRAM DRAWING NO.	32
DATA OF PROGRAMMING	16
PROGRAM DESIGNED BY	32
ROM WRITTEN BY	32
REMARKS	32

(2) PMC control program
The series and edition of PMC system software is displayed.

(3) Used memory
Using memory size for each data are displayed. The following information is displayed.
- All program size
- Ladder program size
- Symbol & Comment data size
- Message data size

(4) PMC type
The PMC type and PMC Memory Type of PMC system software is displayed. And, the PMC type and PMC Memory Type of sequence program is displayed.

(5) Scan time
The scan time of sequence program is displayed. The following information is displayed.
- Current scan time
- Maximum scan time
- Minimum scan time

You can switch the display of scan time by operating a soft key.
The detailed display of scan time is an execution period of 2nd level ladder, which is represented by percentage (%). The 100% means the assigned time for execution of ladder for each PMC paths in every ladder execution cycle.
The relation between the scan time and the detailed display of scan time is as follows.

Table 9.1.1(a) Ladder execution cycle (4 ms)

Detailed display of scan time	Scan Time
100% or less	4
From 101 to 200%	8
From 201 to 300%	12

Table 9.1.1(b) Ladder execution cycle (8 ms)

Detailed display of scan time	Scan Time
100% or less	8
From 101 to 200%	16
From 201 to 300%	24

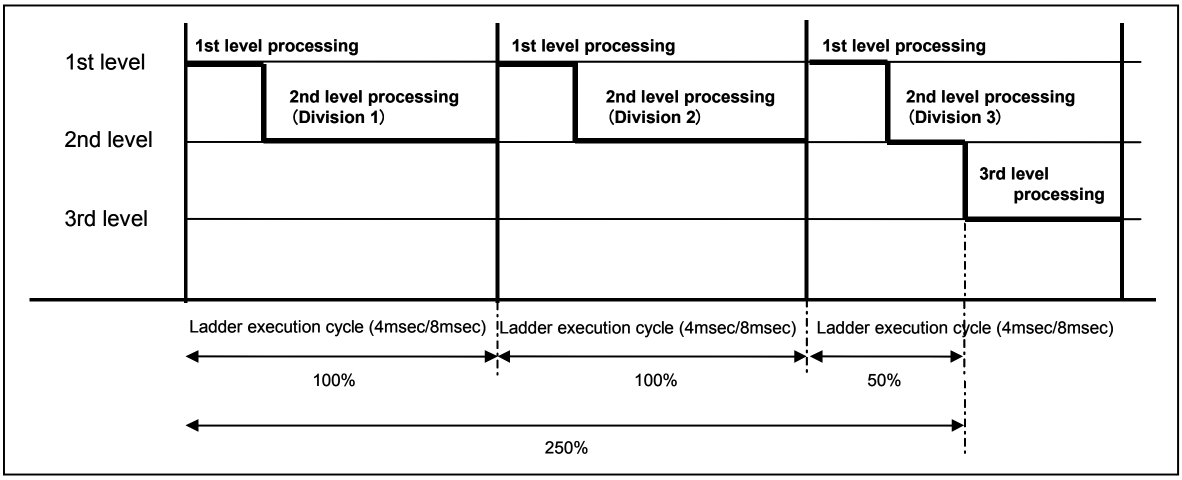


Fig. 9.1.1(a) Detailed display of scan time (the case of 250%)

NOTE
1 When the ladder is stopped, the maximum/minimum of scan time is cleared.
2 When the scan time exceeds 4-digit, "****" is displayed.
3 When the execution time at the 1st level of the ladder exceeds the time allocated in each PMC paths, a detailed display of scan time is not displayed correctly.
4 When using the 1st level execution cycle in 1ms, 2ms, the detailed scan time may be dramatically changed by the execution timing of the 1st level.

Screen operations

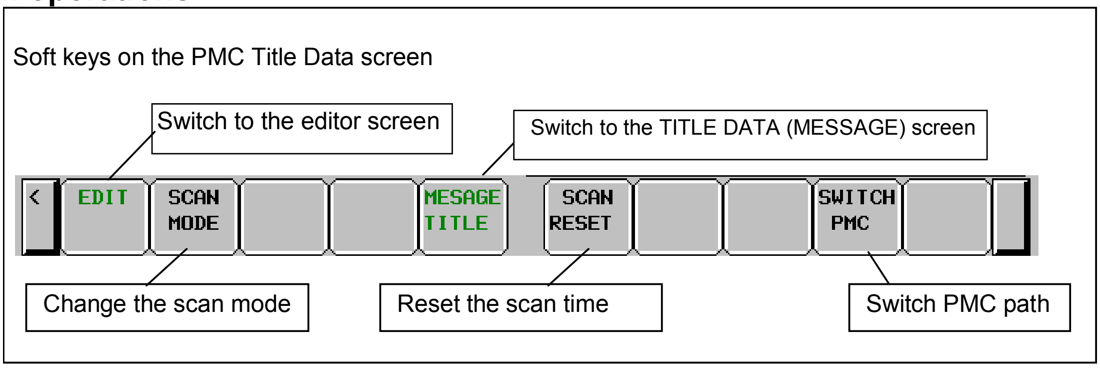


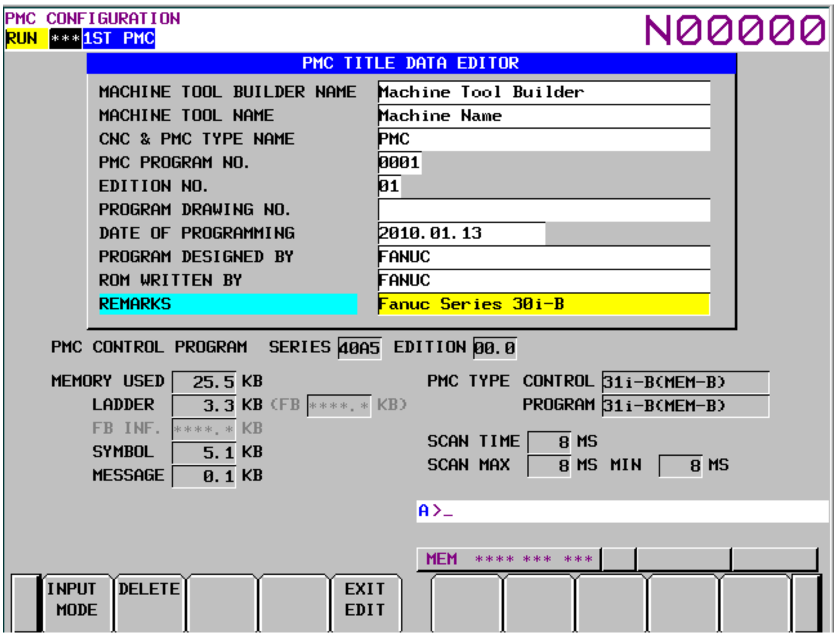
Fig. 9.1.1(b) Soft keys on the TITLE DATA screen

(1) Operations using the soft keys
- (a) [EDIT] Switch to the editor screen
  Switches to the TITLE DATA EDITOR screen.
- (b) [SCAN MODE] Change the display of scan time
  Switches the display of the scan time between the scan time by milliseconds and detailed displays of scan time.
- (c) [MESAGE TITLE] Switch to the TITLE DATA (MESSAGE) screen
  Switches to the TITLE DATA (MESSAGE) screen.
- (d) [SCAN RESET] Reset the maximum/minimum of scan time
  Resets the maximum/minimum of scan time.
- (e) [SWICTH PMC] Change the PMC
  Switches the PMC path.

NOTE
1 The [EDIT] soft key appears when the Programmer Protection is released, and it becomes effective.
2 The operation of changing scan time display by [SCAN MODE] is applied to all PMC paths.
3 The operation of resetting maximum / minimum scan time display by [SCAN RESET] is applied to each PMC path.

9.1.2 Editing Title Data

On the TITLE DATA EDITOR screen, you can edit title data items. To switch to the TITLE DATA EDITOR screen, press the [EDIT] soft key on the TITLE DATA screen.
On the TITLE DATA EDITOR screen, you can perform the following operations:
- Changing the input mode [INPUT MODE]
- Deleting title data [DELETE]
- Moving to the TITLE DATA screen [EXIT EDIT]



Screen operations

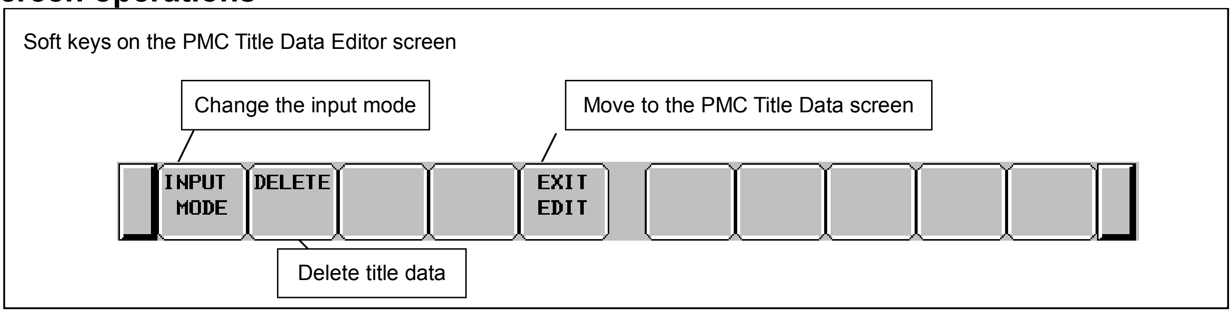
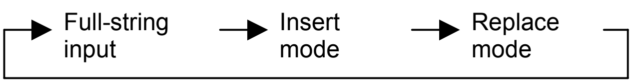


Fig. 9.1.2 Soft keys on the TITLE DATA EDITOR screen

(1) Operations using the soft keys

(a) [INPUT MODE] Change the input mode

Pressing the [INPUT MODE] soft key changes the input mode. The selection cycles in the following order. In the insert mode, "INSERT" appears on the screen; in the replace mode, "ALTER" appears.



- Full-string input
  The entire string at the cursor is selected and replaced with an input string.
- Insert mode
  Input characters are inserted at the cursor. Pressing the INPUT key with inputting no characters inserts one space.
- Replace mode
  Input characters replace characters at and after the cursor. Pressing the INPUT key with inputting no characters replaces the character at the cursor with a space.

(b) [DELETE] Delete characters

Deletes selected characters.

(c) [EXIT EDIT] Switch to the TITLE DATA screen

Terminates editing of title data and moves to the TITLE DATA screen.

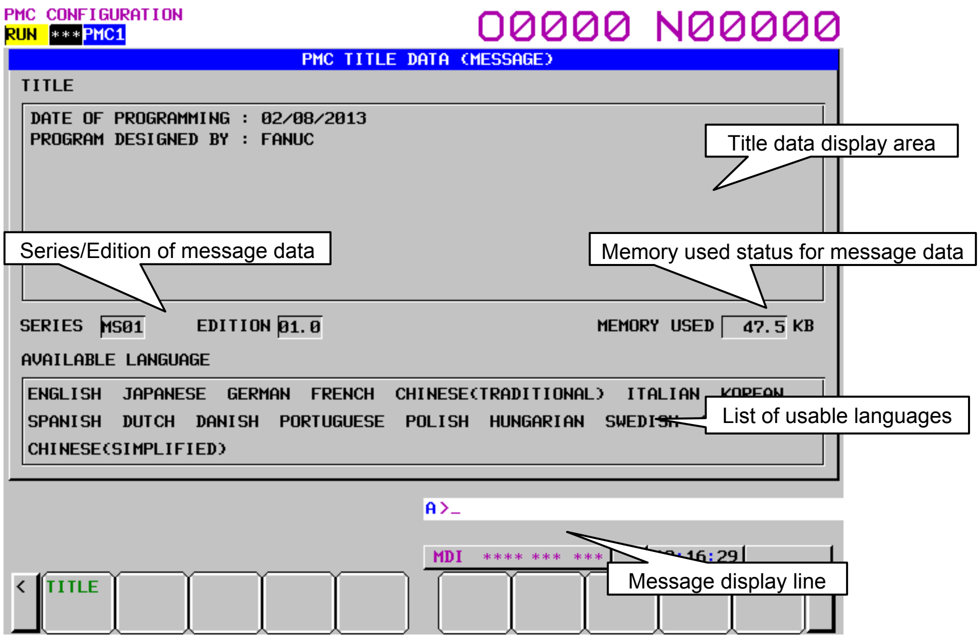
(2) Screen operation using other keys
Use cursor keys to select characters to be edited.

(3) RETURN key operation
On the TITLE DATA EDITOR screen, the return key operation is disabled.
To terminate title editing and return to the TITLE DATA screen, use the [EXIT EDIT] soft key.

9.1.3 Displaying Title Data (Message)

On the TITLE DATA (MESSAGE) screen, message data for multi-language display can be checked. To switch to the TITLE DATA (MESSAGE) screen, press the [MESAGE TITLE] soft key. On the TITLE DATA (MESSAGE) screen, the operation described below can be performed.

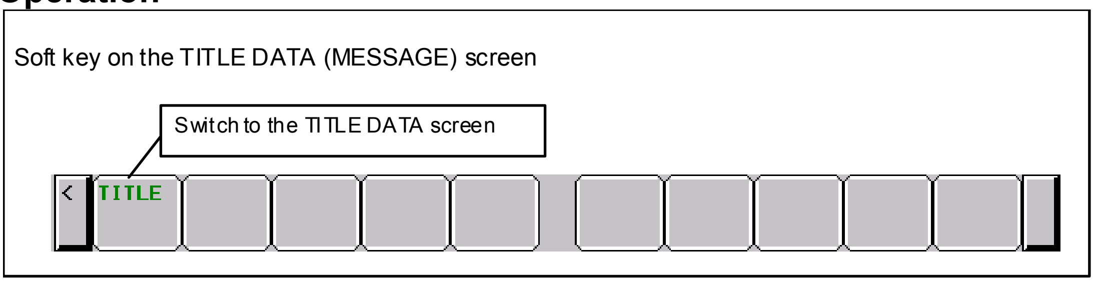
- Moving to the TITLE DATA screen [TITLE]



In this screen, the following items are displayed for message data for multi-language display.

- TITLE: Title information of the message data
- SERIES: Series of the title data
- EDITION: Edition of the title data
- MEMORY USED: Memory used status
- AVILABLE LANGUAGE: List of language IDs

Screen Operation



(1) Operation using the soft key
(a) [TITLE] Switch to the TITLE DATA screen
Switches to the TITLE DATA screen.

Setting and Displaying of Series/Edition

The message data for multi-language display can be created with FANUC LADDER-III.
You can specify series/edition directive line in the title information of the data. Therefore, the series/edition can be display in the TITLE DATA (MESSAGE) screen.

> **NOTE**
> This manual describes the procedure for displaying series/edition in the screen. As for details for creating of message data for multi-language display, refer to “FANUC LADDER-III OPERATOR’S MANUAL (B-66234EN)”.

Specification method of series/edition

- The followings are the format of series/edition directive line. These directives can be specified with both capital and small letters.

Series directive line	.SERIES=xxxx .series=xxxx
Edition directive line	.EDITION=xxxx .edition=xxxx

- Specify the series/edition directive line from the beginning of a line in title information enclosed in double quotation marks.

- To display the “xxxx” in the screen, specify a string within four characters.
  Usable characters are half-width capital alphabet, digit characters, space and dot.

Useable characters
A to Z, 0 to 9, Space, . (dot)

Example)

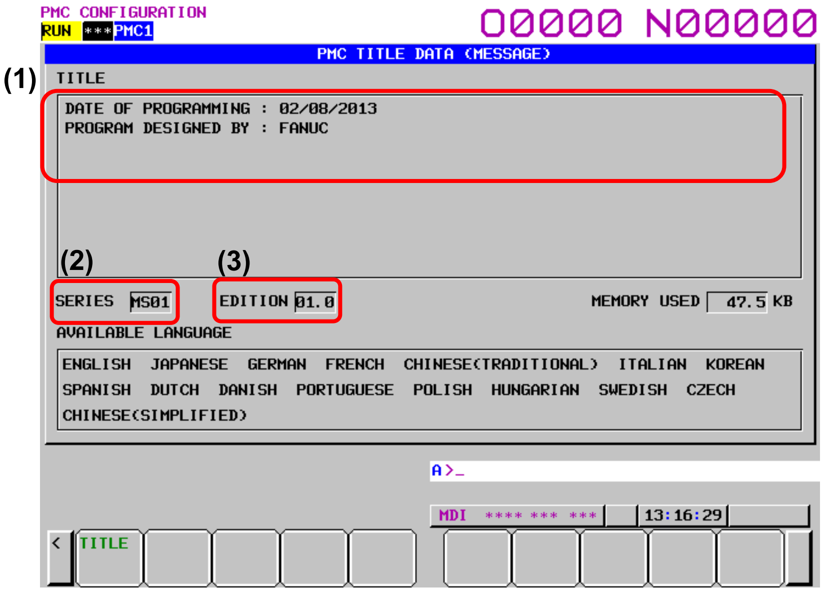
The case of displaying “SERIES MS01” and “EDITION 01.0” in the TITLE DATA (MESSAGE) screen

Specify “(2) Series directive line” and “(3) Edition directive line” in the title information of message source file for multi-language display.

```
%@4-D                                             } Identification code
” DATE OF PROGRAMMING : 02/08/2013                  Title information
PROGRAM DESIGNED BY : FANUC                          (1) Title data
.SERIES=MS01                                         (2) Series directive line
.EDITION=01.0”                                       (3) Edition directive line
$0 ALM1001 1001 FUSE IS BLOWN (SURGE KILLER)        Message data
$1 ALM1001 1001 ﾋｭｰｽﾞ切れ(ｻｰｼﾞｷﾗｰ)                     ・English
$2 ALM1001 1001 FUSE IS BLOWN (SURGE KILLER)         ・Japanese
                                                     ・German
%                                                 } Identification code
```

Message source file for multi-language display

Convert the message source file for multi-language display to memory card format file and load the file into CNC. Therefore, the series/edition directive line is not displayed in the title column and specified strings are displayed in the series/edition column.



TITLE DATA (MESSAGE) screen

NOTE

1 When no series/edition directive line is specified in the message source file of multi-language message data, the column of series/edition of the screen becomes blank.

2 When specifying characters which can not be used for string of series/edition, space characters are displayed in the column of series/edition of the screen.

3 When loading the message data for multi-language display with series/edition directive into CNC system which is not applied to this function, the series/edition directive line is displayed in the title column as the string typed in the message source file.

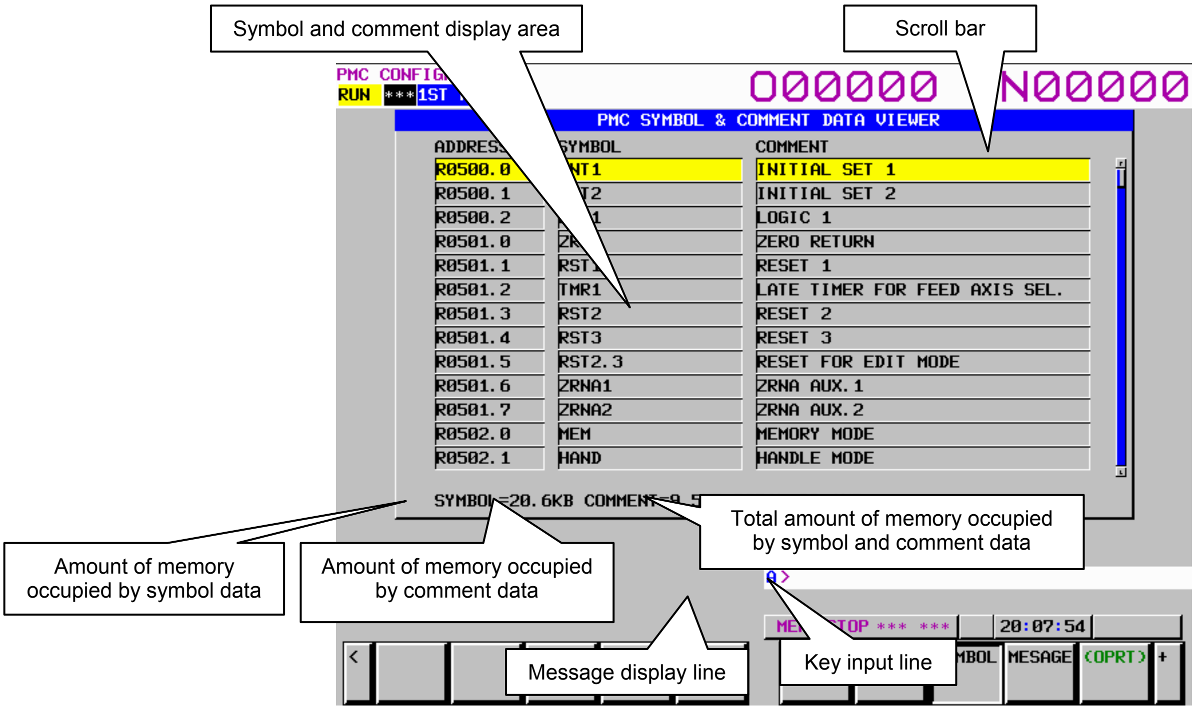
9.2 DISPLAYING AND EDITING SYMBOL AND COMMENT DATA ([SYMBOL] SCREENS)

The display and operation of symbol and comment screen differs in former type from extended type.

For details of former type symbol and comment screen, see Subsection 9.2.1 to 9.2.4.
For details of extended type symbol and comment screen, see Subsection 9.2.5 to 9.2.7.

9.2.1 Displaying Symbol and Comment Data

On the SYMBOL & COMMENT DATA VIEWER screen, you can check symbol and comment data items defined for each address byte or bit used by a ladder program.



ADDRESS: Displays the byte or bit addresses for which a symbol or comment is registered.
SYMBOL: Displays the symbol for each address (16 characters).
COMMENT: Displays the comment for the address (30 characters).
Scroll bar: Indicates the position of the current displayed data.
Amount of occupied memory:
The amounts of memory occupied by symbol data and of that occupied by comment data, and total amount of memory occupied by symbol and comment data are displayed under the symbol and comment display.

Screen operations

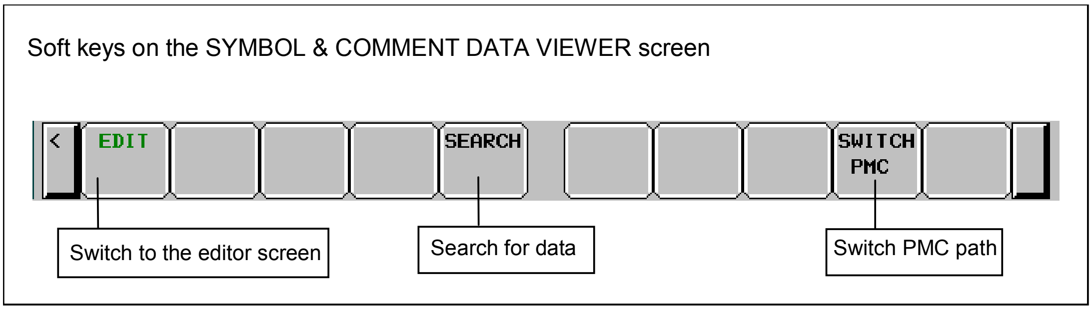


Fig. 9.2.1 Soft keys on the SYMBOL & COMMENT DATA VIEWER screen

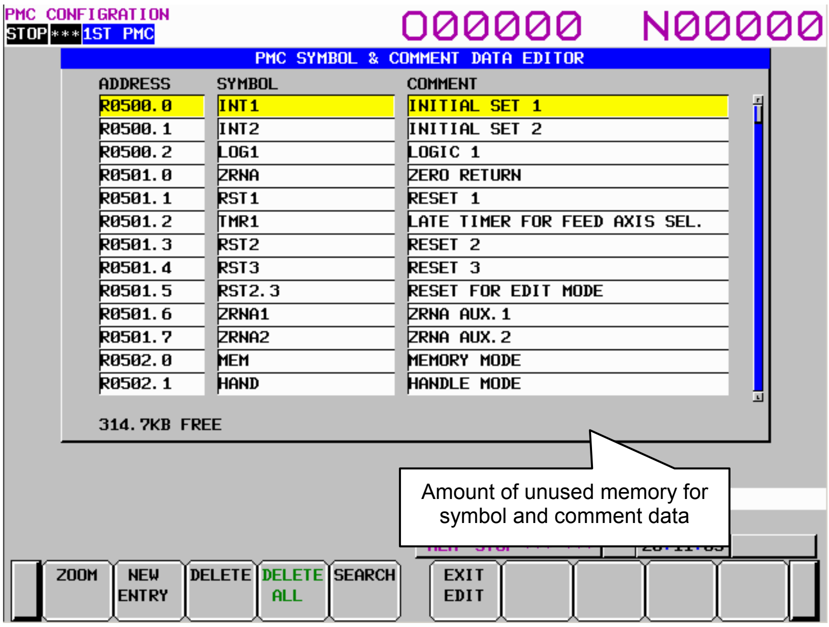
(1) Operations using the soft keys
- (a) [EDIT] Switch to the editor screen
  Moves to the SYMBOL & COMMENT DATA EDITOR screen.
- (b) [SEARCH] Search for data
  Searches for the address corresponding to the input string or an address for which symbol or comment data containing the input string is defined and displays it on the screen. Both bit and byte addresses can be searched for.
- (c) [SWITCH PMC] Switching PMC path or divided ladder programs
  Switches PMC path or divided ladder program. For details of the operation, refer to "6.3".
  By setting keep relay K935.0 to 1, you can display PMC program list screen. For details, refer to "2.2.11".

(2) Screen operations using other keys
Cursor keys: Move the cursor.
Page keys: Scroll the screen up or down one page.

> ⚠ **CAUTION**
> When the programmer protection function is enabled, the [EDIT] soft key appears and is available. When the online monitor function is enabled, you cannot move to the SYMBOL & COMMENT DATA EDITOR screen.
> For details, see Section 6.2.

9.2.2 Editing Symbol and Comment Data

On the SYMBOL & COMMENT DATA EDITOR screen, you can define a symbol for a desired address byte or bit and add a comment. You can also change already defined symbol and comment data.



Amount of unused memory

The amount of unused memory for editing symbol and comment data is displayed under the symbol and comment display.

Screen operations

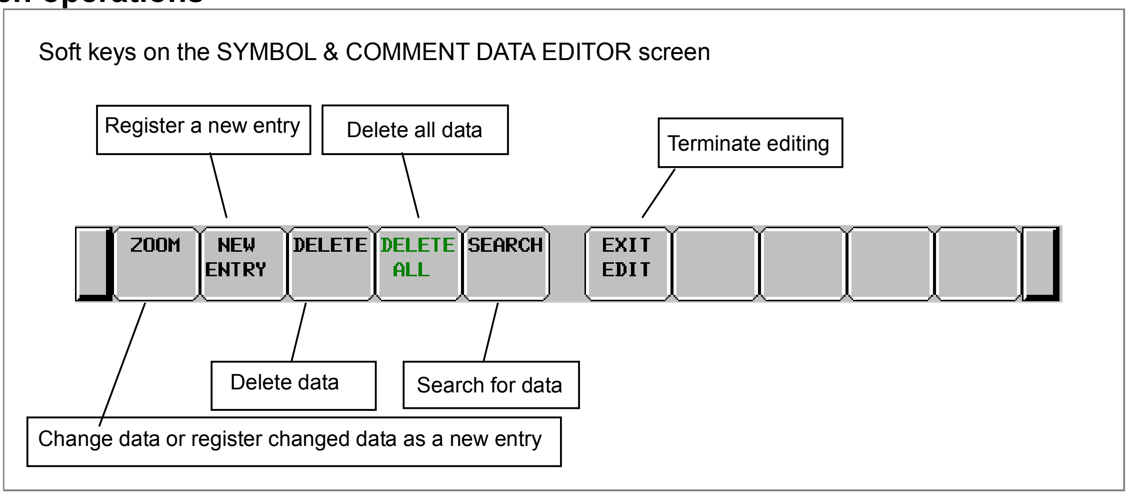


Fig. 9.2.2 Soft keys on the SYMBOL & COMMENT DATA EDITOR screen

(1) Operations using the soft keys
- (a) [ZOOM] Change data or register changed data as a new entry
  Switches to the screen for changing data of the entry at the cursor or registering the changed data as a new entry.
- (b) [NEW ENTRY] Register a new entry
  Switches to the screen for registering a new entry.
- (c) [DELETE] Delete data
  Deletes symbol and comment data at the cursor.

(d) [DELETE ALL] Delete all data
Deletes all symbol and comment data.

(e) [SEARCH] Search for data
Searches for the address corresponding to the input string or an address for which symbol or comment data containing the input string is defined and displays it on the screen. Both bit and byte addresses can be searched for.

(f) [EXIT EDIT] Terminate editing
Switches to the SYMBOL & COMMENT DATA VIEWER screen.

(2) Editing a set of symbol and comment data at a time
An address, symbol, and comment are input at a time.
Enter a symbol and comment following an address with delimiting them by non-alphanumeric characters as shown below and press the INPUT key. Symbol or comment data can be omitted.
address/symbol/comment/ INPUT key ("/" is a non-alphanumeric character.)

Example 1:
Inputs an address, symbol, and comment. A slash "/" is used as a delimiter.
G0.4/*EMG/EMERGENCYSW/INPUT key

Example 2:
Omits a comment. A slash "/" is used as a delimiter.
G0.4/*EMG//INPUT key
G0.4/*EMG/ INPUT key
G0.4/*EMG INPUT key

To update symbol or comment data for an existing address, move the cursor to the target address and enter symbol or comment data with omitting the address.

Example 3:
Omits an address and inputs symbol and comment data. A slash "/" is used as a delimiter.
/*EMG/EMERGENCYSW/INPUT key

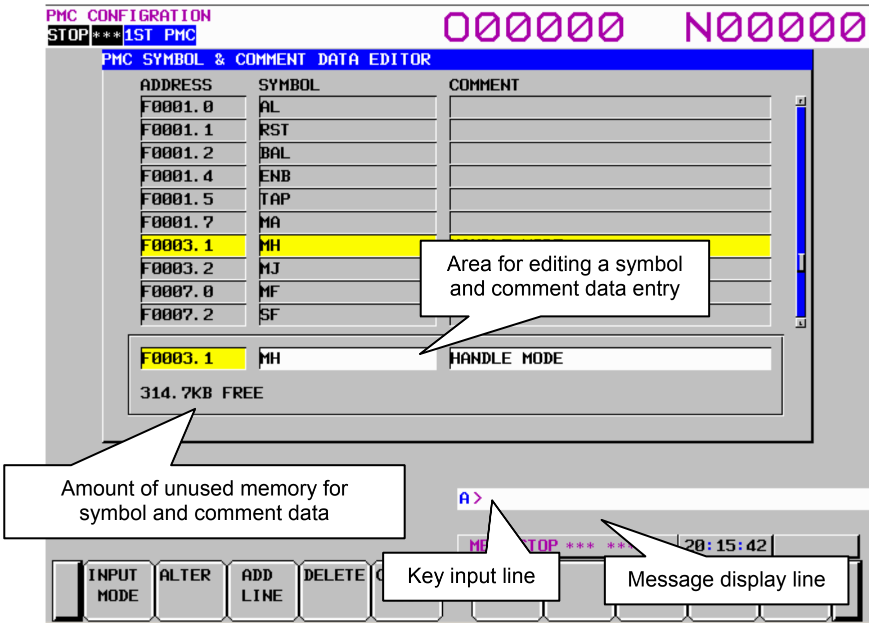
In this case, when symbol or comment data is omitted, the displayed data is not changed.

(3) Screen operations using other keys
Cursor keys: Move the cursor.
Page keys: Scroll the screen up or down one page.

(4) RETURN key operation
On the SYMBOL & COMMENT DATA EDITOR screen, the return key operation is disabled.
To terminate editing of symbol and comment data and return to the SYMBOL & COMMENT DATA VIEWER screen, use the [EXIT EDIT] soft key.

9.2.3 Partially Changing Symbol and Comment Data

On the SYMBOL & COMMENT DATA EDITOR screen, pressing the [ZOOM] soft key displays the following screen. At the bottom of the screen, the area for editing a symbol and comment data entry appears. You can define a symbol for a desired address byte or bit and add a comment. You can also change already defined symbol and comment data.
For a registered data entry, you can edit the address, symbol, and comment in character units.



Amount of unused memory:
The amount of unused memory for editing symbol and comment data is displayed.

Area for editing a symbol and comment data entry:
Enter an address, symbol data, and comment data.

Screen operations

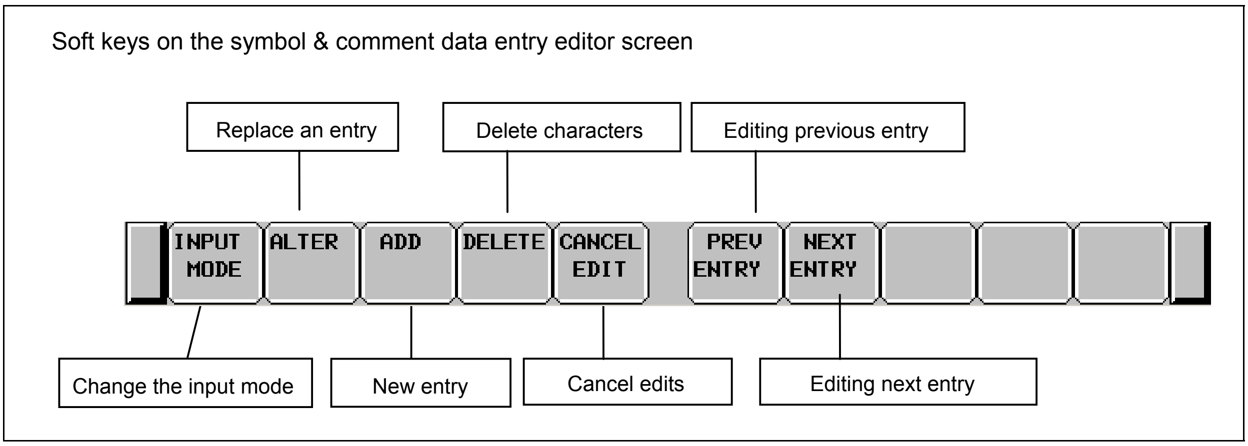


Fig. 9.2.3 Soft keys on the symbol & comment data entry editor screen

(1) Operations using the soft keys

(a) [INPUT MODE] Change the input mode

Pressing the [INPUT MODE] soft key changes the input mode. The selection cycles in the following order. In the insert mode, "INSERT" appears on the screen; in the replace mode, "ALTER" appears.

→ Full-string input → Insert mode → Replace mode →

- Full-string input
  The entire string at the cursor is selected and replaced with an input string.
- Insert mode
  Input characters are inserted at the cursor. Pressing the INPUT key with inputting no characters inserts one space.
- Replace mode
  Input characters replace characters at and after the cursor. Pressing the INPUT key with inputting no characters replaces the character at the cursor with a space.

(b) [ALTER] Replace an entry

Replaces the target entry with edit data. When the data in the address field is updated and the address is a new one, the original data corresponding to the old address is deleted and the edit data is registered as a new entry. If an address to be registered as a new one is already registered, a confirmation message appears, which asks you if you are sure to overwrite the old data.

(c) [ADD LINE] New entry

Registers input data as a new entry. If the address of the new entry is already registered, a confirmation message appears, which asks you if you are sure to overwrite the old data.

(d) [DELETE] Delete characters

Performs either of the following deletions:

- In the full-string input mode
  Deletes the string at the cursor.
- In the insert or replace mode
  Deletes one character at the cursor.

(e) [CANCEL EDIT] Cancel edits

Cancels edits and switches to the SYMBOL & COMMENT DATA EDITOR screen. The data is not updated.

(f) [PREV ENTRY] Editing previous entry

You can edit a symbol and comment on previous entry without leaving from editing mode.

(g) [NEXT ENTRY] Editing next entry

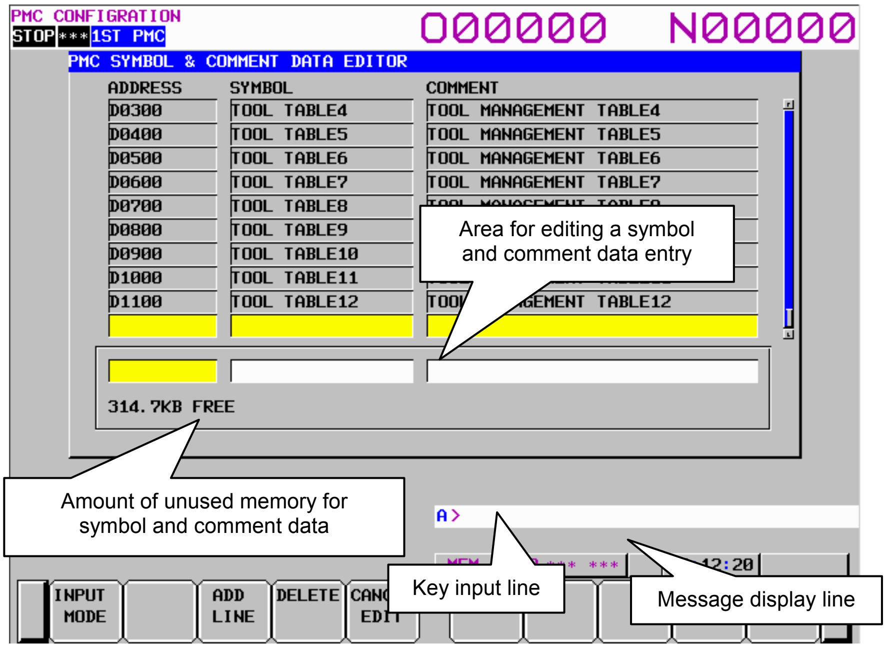
You can edit a symbol and comment on next entry without leaving from editing screen.

(2) RETURN key operation

On the symbol & comment data entry editor screen, the return key operation is disabled. To terminate editing of a symbol and comment data entry and return to the SYMBOL & COMMENT DATA EDITOR screen, use the [ALTER], [ADD LINE], or [CANCEL EDIT] soft key.

9.2.4 Registering New Symbol and Comment Data

On the SYMBOL & COMMENT DATA EDITOR screen, pressing the [NEW ENTRY] soft key displays the following screen. At the bottom of the screen, the area for editing a symbol and comment data entry appears. You can register new entry data.



Amount of unused memory:
The amount of unused memory for editing symbol and comment data is displayed.

Area for editing a symbol and comment data entry:
Enter an address, symbol data, and comment data.

Screen operations

Symbol & comment data entry editor screen

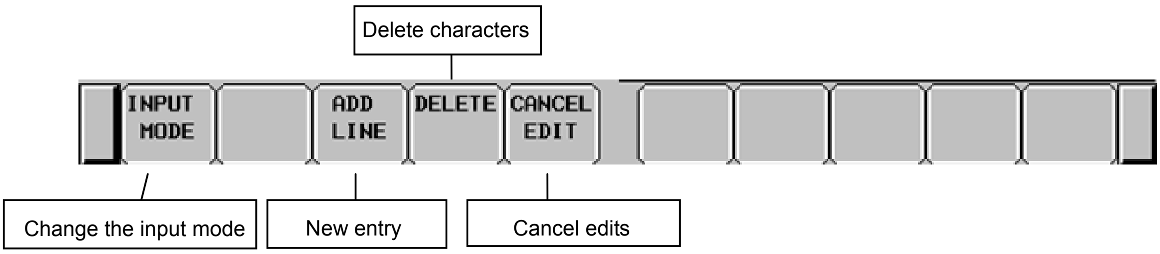
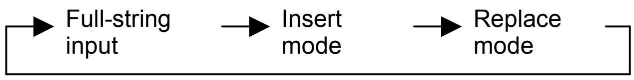


Fig. 9.2.4 Soft keys on the symbol & comment data entry editor screen

(1) Operations using the soft keys

(a) [INPUT MODE] Change the input mode

Pressing the [INPUT MODE] soft key changes the input mode. The selection cycles in the following order. In the insert mode, "INSERT" appears on the screen; in the replace mode, "ALTER" appears.



- Full-string input
  The entire string at the cursor is selected and replaced with an input string.
- Insert mode
  Input characters are inserted at the cursor. Pressing the INPUT key with inputting no characters inserts one space.
- Replace mode
  Input characters replace characters at and after the cursor. Pressing the INPUT key with inputting no characters replaces the character at the cursor with a space.

(b) [ADD LINE] Register new entry data

Registers input data as a new entry. If the address of the new entry is already registered, a confirmation message appears, which asks you if you are sure to overwrite the old data.

(c) [DELETE] Delete entry data

Performs either of the following deletions:

- In the full-string input mode
  It deletes the string at the cursor.
- In the insert or replace mode
  It deletes one character at the cursor.

(d) [CANCEL EDIT] Cancel edits

Cancels edits and switches to the SYMBOL & COMMENT DATA EDITOR screen. The data is not updated.

(2) Screen operation using other keys

Cursor keys: Move the cursor.

(3) RETURN key operation

On the symbol & comment data entry editor screen, the return key operation is disabled. To terminate editing of a symbol and comment data entry and return to the SYMBOL & COMMENT DATA EDITOR screen, use the [ADD LINE] or [CANCEL EDIT] soft key.

9.2.5 Displaying Extended Symbol and Comment

Pressing the [SYMBOL] soft key, screen changes to symbol and comment displaying screen. In this screen, you can see all defined symbols and comments.
There are two displaying modes. One is "Outline mode" and another is "Details mode". You can change this mode each other by pressing the [DISP MODE] soft key.

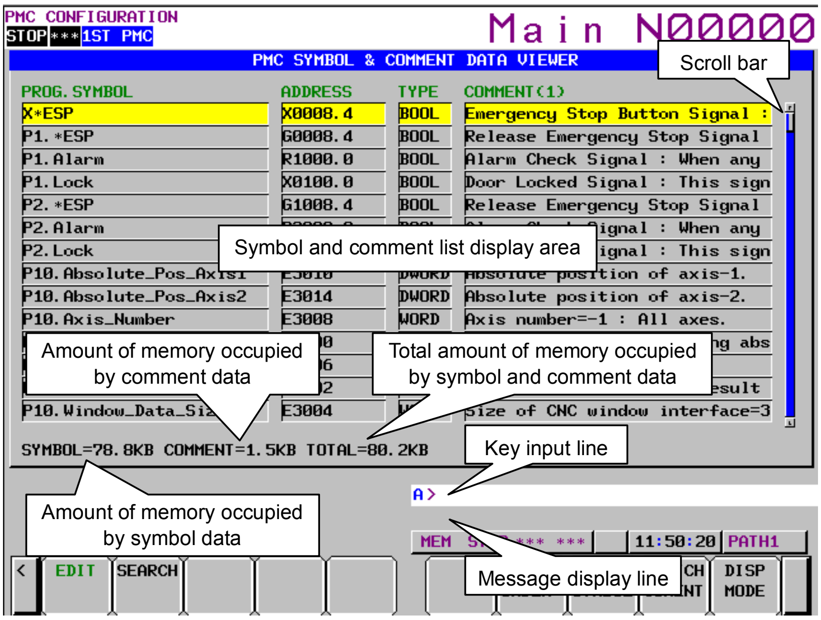


Fig. 9.2.5(a) Extended symbol and comment displaying screen (Outline mode, Symbol order)

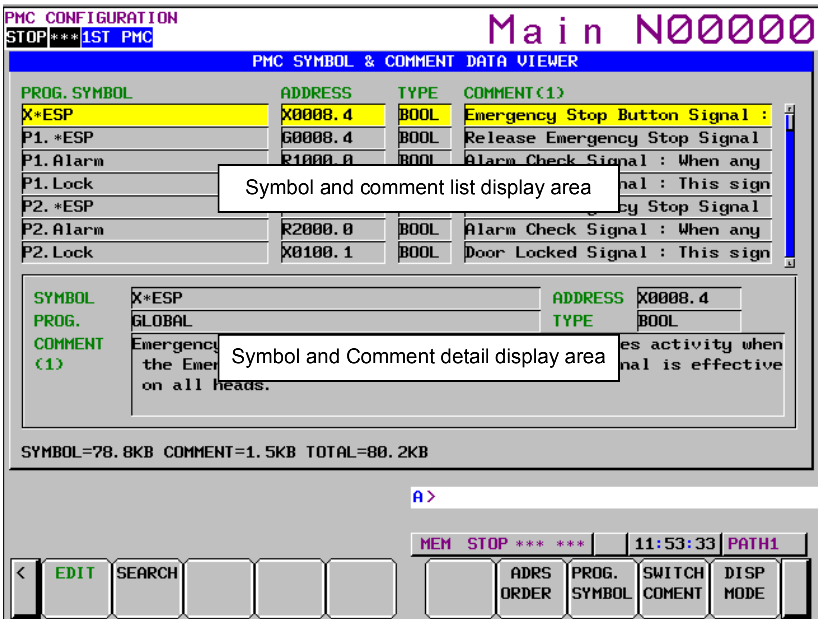


Fig. 9.2.5(b) Extended symbol and comment displaying screen (Details mode, Symbol order)

Pressing the [ADRS ORDER] or [SYMBOL ORDER] soft key, you can sort entries by address or characters of symbol.

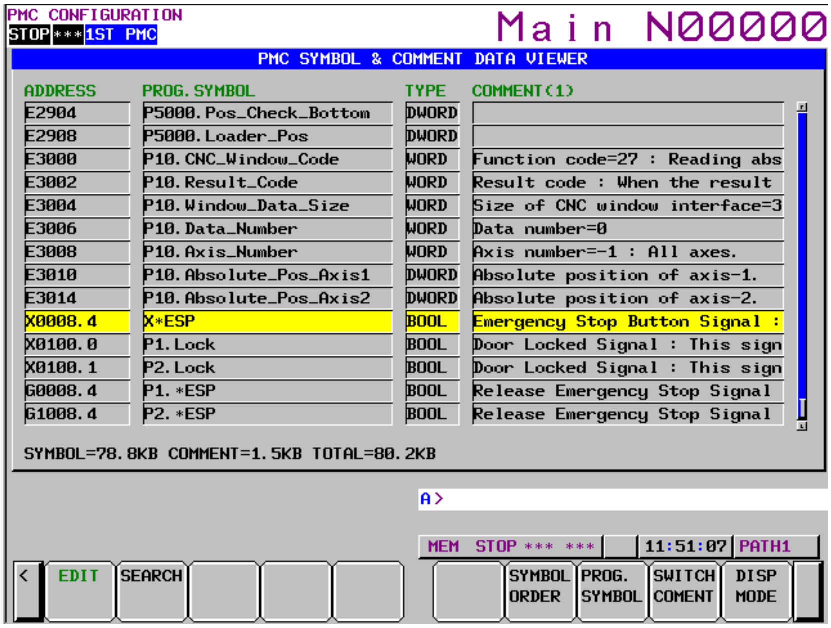


Fig. 9.2.5(c) Extended symbol and comment displaying screen (Outline mode, Address order)

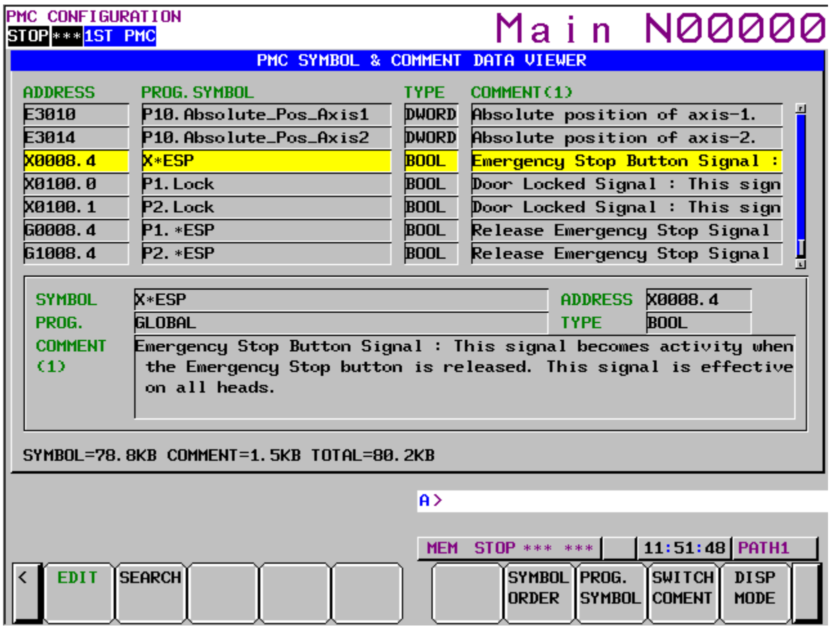


Fig. 9.2.5(d) Extended symbol and comment displaying screen (Details mode, Address order)

PROG.SYMBOL: Symbol is displayed. When a symbol is local symbol, this symbol is displayed as the form "[PROGRAM NAME].[SYMBOL]"

ADDRESS: Address is displayed.

TYPE: Data type is displayed.

COMMENT: Comment is displayed. When multi comments are defined, you can see each comment by pressing the soft key [SWITCH COMENT].

Operation

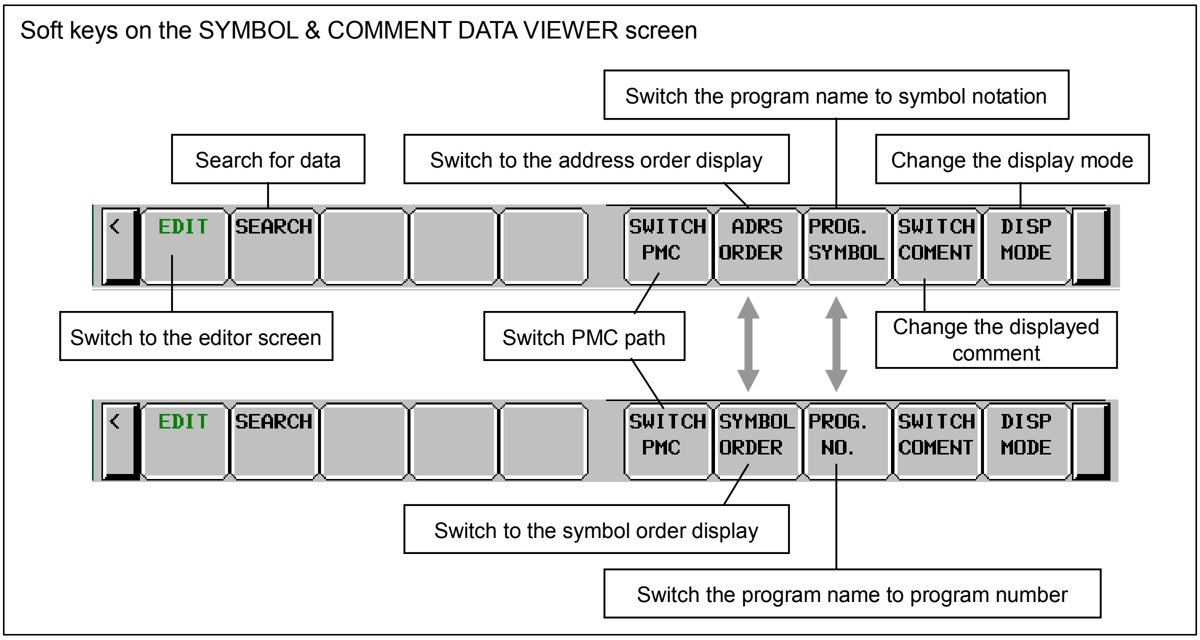


Fig. 9.2.5(e) Soft key layout in extended symbol and comment displaying screen

(1) Operation by soft key

(a) [EDIT] Changing to editing screen
Pressing the [EDIT] soft key, the screen is changed to “extended symbol and comment editing screen”

(b) [SEARCH] Searching word
You can search entry by address expression, part characters of symbol or part characters of comment.

(c) [ADRS ORDER] / [SYMBOL ORDER] Changing a displaying order
You can change the displaying order. Pressing the [ADRS ORDER] soft key, all entries are sorted by address. Pressing the [SYMBOL ORDER] soft key, entries are sorted by character of symbols in each sub programs.

(d) [PROG. SYMBOL] / [PROG. NO.] Changing a display of program name
Pressing the [PROG.SYMBOL] soft key, all symbols defined to addresses P are displayed as a name of sub program. When pressing the [PROG. ADRS] soft key, the addresses P are displayed as a name of subprogram.

(e) [SWITCH COMENT] Changing a display of comment set.
Pressing the [SWITCH COMENT] soft key, current displaying comment set is changed to next comment set.

(f) [DISP MODE] Changing the displaying mode
There are two displaying modes. One is “Outline mode” and another is “Details mode”. You can change this mode each other by pressing the [DISP MODE] soft key.

(g) [SWITCH PMC] Switching PMC path or divided ladder programs
Switches PMC path or divided ladder program. For details of the operation, refer to “6.3”.
By setting keep relay K935.0 to 1, you can display PMC program list screen. For details, refer to ”2.2.11”.

(2) Operation by other keys

CURSOR KEY:	Moving cursor
PAGE KEY:	Paging up or down.

9.2.6 Editing Extended Symbol and Comment

In symbol and comment editing screen, you can change, add or delete symbol and comment. To change screen to the symbol and comment editing screen, press the [EDIT] soft key in the symbol and comment display screen.

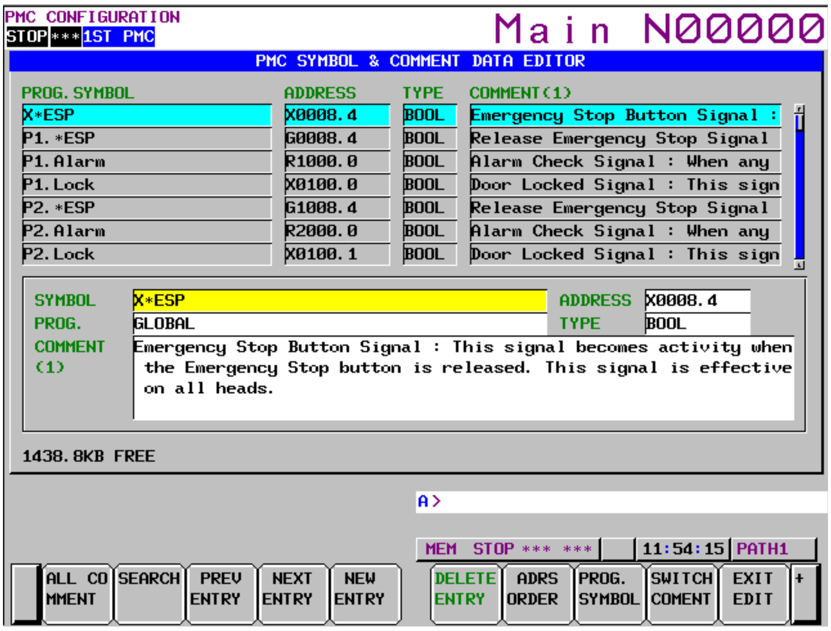


Fig. 9.2.6(a) Extended symbol and comment editing screen (One comment display)

Pressing the [ALL COMENT] soft key changes a screen to the “All comment display” screen. In the “All comment display” screen, you can refer to other comment sets in editing.

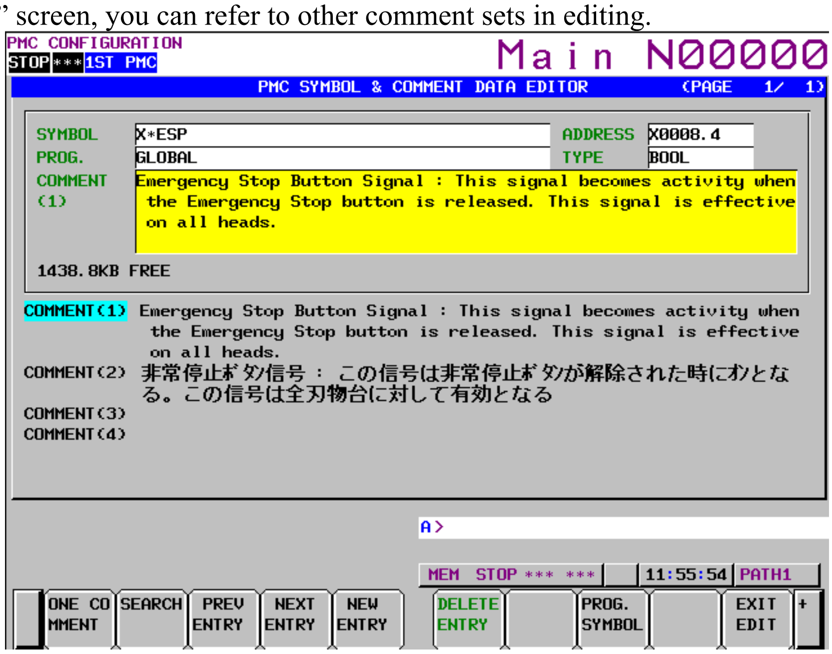


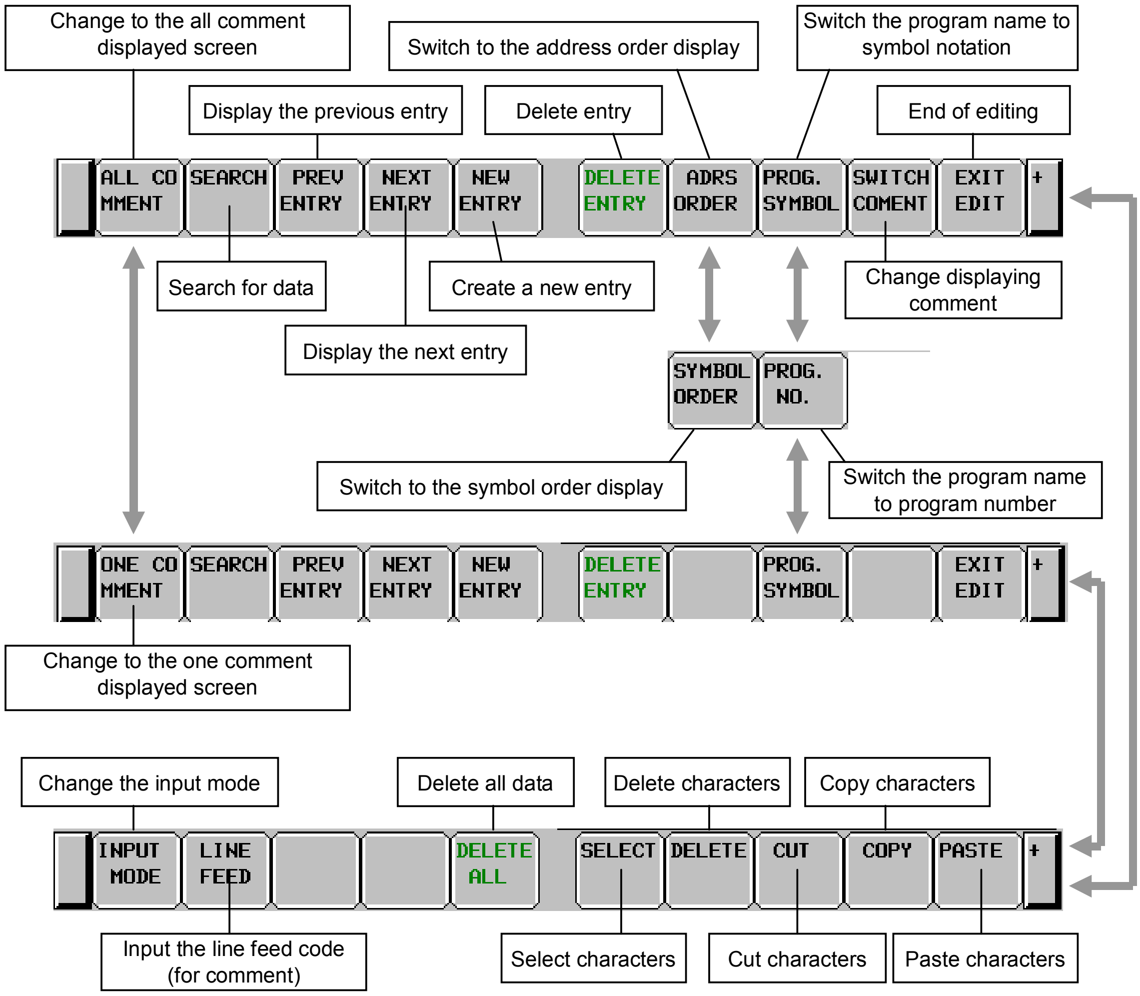
Fig. 9.2.6 (b) Extended symbol and comment editing screen (All comment display)

FREE:

Free memory size to store symbol and comment is shown. Editing various data such as sequence program and message will change this free size.

Operation

Soft keys on the SYMBOL & COMMENT DATA EDITOR screen



Soft keys for the data type inputting edit-box

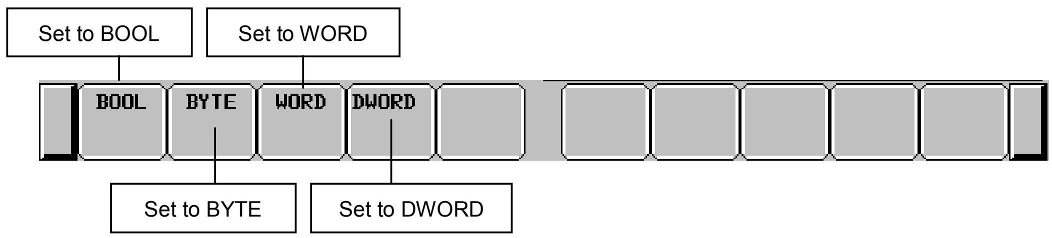


Fig. 9.2.6 (c) Soft key layout in extended symbol and comment editing screen

(1) Operation by soft key

(a) [ALL COMMENT] / [ONE COMMENT] Changing the comment display mode
This soft key allows you to change the comment display mode. One mode is "All comment display". Another is "One comment display". In the "All comment display" mode, you can edit all comments in the same screen. In the "One comment display" mode, you can refer to another symbol and comment.

(b) [SEARCH] Searching word
You can search entry by address expression, part characters of symbol or part characters of comment.

(c) [PREV ENTRY] Editing previous entry
You can edit a symbol and comment on previous entry without leaving from editing mode.

(d) [NEXT ENTRY] Editing next entry
You can edit a symbol and comment on next entry without leaving from editing screen.

(e) [NEW ENTRY] Adding a new entry
You can add a new symbol and comment entry.

(f) [DELETE ENTRY] Deleting entry
You can delete a symbol and comment entry.

(g) [ADRS ORDER] / [SYMBOL ORDER] Changing a displaying order
You can change the displaying order. Pressing the [ADRS ORDER] soft key, all entries are sorted by address. Pressing the [SYMBOL ORDER] soft key, entries are sorted by character of symbols in each sub programs.

(h) [PROG. SYMBOL] / [PROG. NO.] Changing a display of program name
Pressing the [PROG.SYMBOL] soft key, all symbols defined to addresses P are displayed as a name of sub program. When pressing the [PROG. NO.] soft key, addresses P are displayed as a name of subprogram.

(i) [SWITCH COMENT] Changing a display of comment set.
Pressing the [SWITCH COMENT] soft key, current displaying comment set is changed to next comment set.

(j) [EXIT EDIT] Terminating editing
Pressing the [EXIT EDIT] soft key, editing of symbol and comment is terminated. A screen is changed to symbol and comment display screen.

(k) [INPUT MODE] Changing an input mode
Pressing the [INPUT MODE] soft key, input mode is changed as following. Current input mode is displayed on right top of the screen.

→ WHOLE → INSERT → ALTER

- WHOLE
  This mode is whole editing mode. Whole characters on the cursor are replaced.
- INSERT
  The input characters are inserted before the cursor. On comment editing box, pressing the INPUT key with no character inserts one white space before the cursor.
- ALTER
  The characters on and after cursor are overwritten by input characters. On comment editing box, pressing the INPUT key with no character overwrites a character on the cursor by one white space.

(l) [LINE FEED] Inserting a new line code
On comment editing box, pressing the [LINE FEED] soft key inserts a new line code. When you print a sequence program on FANUC LADDER-III, comment string starts new line at the inserted new line code. New line code is only available in comment string.

(m) [DELETE ALL] Deleting all symbols and comments
Pressing the [DELETE ALL] soft key deletes all symbols and comments.

(n) [SELECT] Selecting
Pressing the [SELECT] soft key starts selecting and after that moving the cursor selects some characters for deleting, overwriting, copying or cutting. To input characters with selecting some characters can overwrites selecting characters by the input characters.

(o) [DELETE] Deleting characters
To press the [DELETE] soft key with selecting some characters deletes them.

(p) [CUT] Cutting characters
To press the [CUT] soft key with selecting some characters cuts them and sends them to pasting buffer. Previous contents of the pasting buffer are lost and new contents are stored. To move some characters, use the [SELECT], [CUT] and [PASTE] soft key.

(q) [COPY] Copying characters
To press the [COPY] soft key with selecting some characters send them to pasting buffer. Previous contents of the pasting buffer are lost and new contents are stored. To copy some characters, use the [SELECT], [COPY] and [PASTE] soft key.

(r) [PASTE] Pasting characters
To press the [PASTE] soft key pastes the contents of pasting buffer. In the "WHOLE" mode, pasted characters overwrite whole characters on the cursor. In the "INSERT" mode, pasted characters are inserted at before the cursor. In the "ALTER" mode, pasted characters overwrite characters on the cursor. Pasting operation does not delete the contents of pasting buffer. So you can paste repeatedly.

(2) Operation by other keys
CURSOR KEY: Moving cursor
PAGE KEY: Paging up or down.

(3) Operation by "RETURN" key
On the symbol and comment editing screen, the "RETURN" key is not available. To terminate symbol and comment editing, press the [EXIT EDIT] soft key.

NOTE
1 The character which can be inputted from CNC screen are the alphabetic character, number, and sign of ASCII. Refer to "1.2.7 (7) Available characters" for the character which can be used.
2 Create the data of Japanese comment and multi-language comment (simplified Chinese character, Korean, etc.) using FANUC LADDER-III.
3 The character which cannot be displayed on CNC screen is converted to a space character, when compiled by FANUC LADDER-III.

9.2.7 Adding an Extended Symbol and Comment

To add a new entry of symbol and comment, press the [NEW ENTRY] soft key. In this situation, you can also change the comment displaying mode. One is the “one comment displaying mode” and another is “all comments displaying mode”.

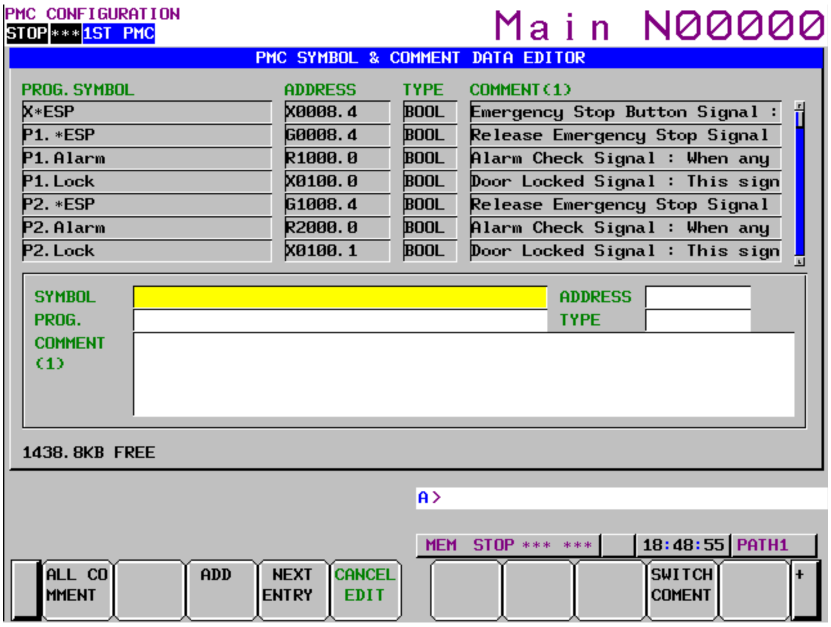


Fig. 9.2.7 (a) Adding new entry of symbol and comment screen (One comment display)

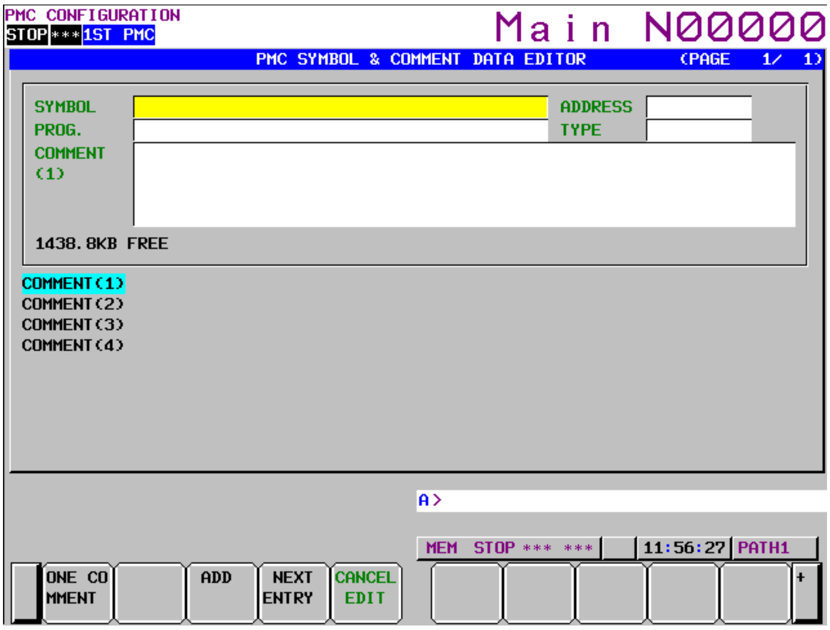


Fig. 9.2.7 (b) Adding new entry of symbol and comment screen (All comment display)

Operation

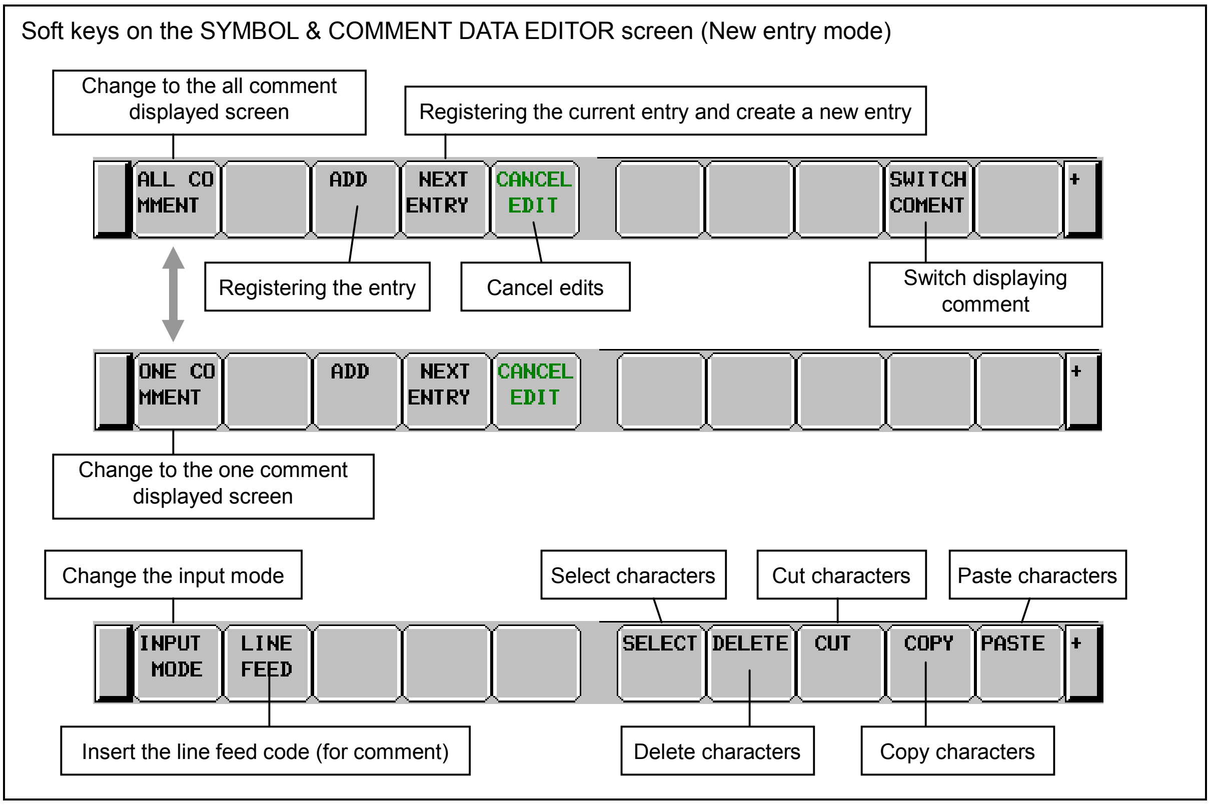


Fig. 9.2.7 (c) Soft key layout in adding new entry of symbol and comment screen

(1) Operation by soft key
- (a) [ADD] Registering new entry
  Pressing the [ADD] soft key registers new entry of symbol and comment.
- (b) [NEXT ENTRY] Creating new entry
  You can create a new symbol and comment entry without leaving from editing mode.
- (c) [CANCEL EDIT] Discarding the new entry
  Pressing the [CANCEL EDIT] soft key discards current new entry.

As for the explanation of other soft keys, refer to "9.2.6 Editing Extended Symbol and Comment".

(2) Operation by other keys

CURSOR KEY: Moving cursor
PAGE KEY: Paging up or down.

(3) Operation by "RETURN" key

On the symbol and comment editing screen, the "RETURN" key is not available. To terminate symbol and comment editing, press the [ADD] or [CANCEL EDIT] soft key.

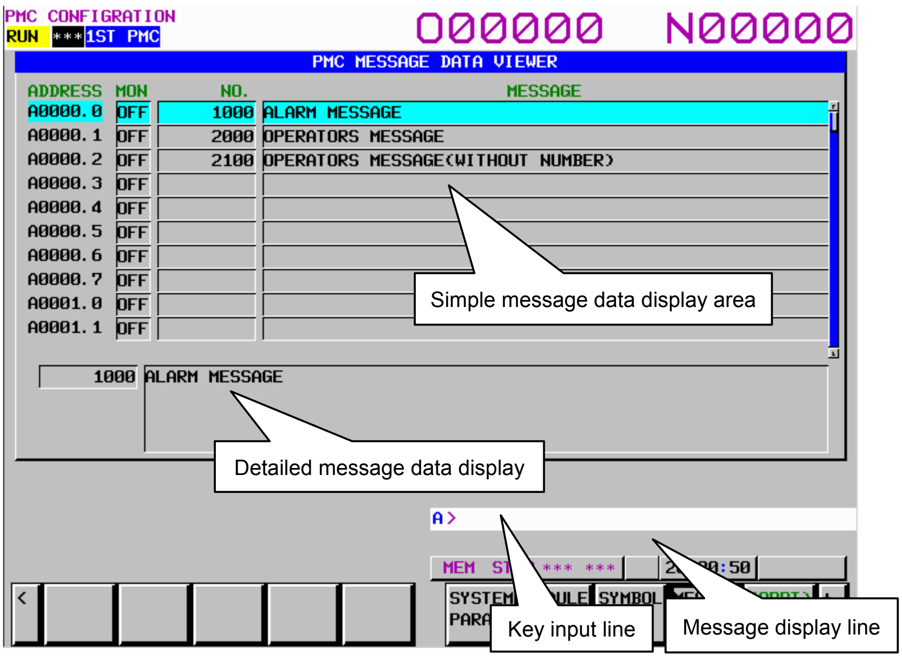
9.3 DISPLAYING AND EDITING MESSAGE DATA ([MESAGE] SCREENS)

9.3.1 Displaying Message Data

On the MESSAGE DATA VIEWER screen, you can check each external message data item output to the NC screen by functional instruction DISPB.
To display the MESSAGE DATA VIEWER screen, press the [MESAGE] soft key. On the MESSAGE DATA VIEWER screen, you can perform the following operations:

- Moving to the MESSAGE DATA EDITOR screen [EDIT]
- Searching for message data [SEARCH]
- Previewing message data [PREVIEW]

> **NOTE**
> Multi-language message data are not displayed on this screen. When you create or edit the data, use FANUC LADDER-III.



Description of items in the table

- ADDRESS: Message address
- MON: Current status of the message requests (A addresses)
- NO.: Message number
- MESSAGE: Message data

Screen configuration

(1) On the screen, message addresses, message requesting monitors, message numbers, and message data are displayed from left to right. A message requesting monitor indicates the status of the signal (A addresses) of the message address. In the simple message data display area, the first line of data is displayed.

(2) In the detailed message data display at the bottom of the screen, message data at the cursor is all displayed.

(3) On the message display line at the bottom of the screen, an error message appears when issued.

Screen operations

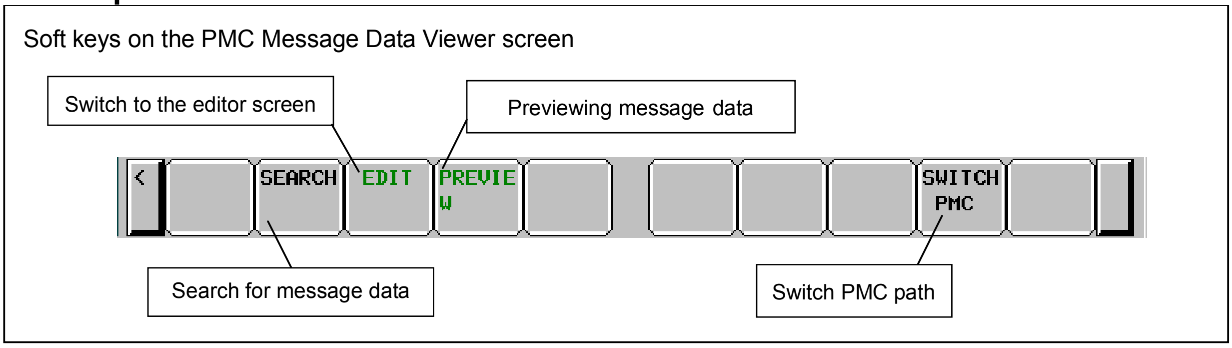


Fig. 9.3.1 Soft keys on the MESSAGE DATA VIEWER screen

(1) Operations using the soft keys

(a) [SEARCH] Search for message data

It searches for the address for which message data containing an address, message number, or string corresponding to the input string is set and displays the message data on the screen.
When a byte address is searched for, a bit 0 address is found.
Example)
When A2 is searched for, the cursor moves to A2.0.

(b) [EDIT] Switch to the editor screen

Moves to the MESSAGE DATA EDITOR screen.

> **NOTE**
> When the programmer protection function is enabled, the [EDIT] soft key appears and is available. When the online monitor function is enabled, you cannot move to the MESSAGE DATA EDITOR screen. For details, see Section 6.2.

(c) [PREVIEW] Previewing message data

Displays a character code enclosed by at signs (@) with the corresponding character actually displayed.
Example)
Japanese1: ”@B6C532@” →”カナ 2”
Japanese2:”@0248733E6F44643B5F01@100”→”非常停止 100”

European character type 1: UNZUL@0DC101@SSIGE → "UNZULÄSSIGE"
European character type 2: C@0EA501@MBO@0EA801@ → "СИМВОЛ"
European character type 3: @05ED01@123 → " § 123"

To terminate preview display, press the [EXIT] soft key.

(d) [SWITCH PMC] Switching PMC path or divided ladder programs

Switches PMC path or divided ladder program. For details of the operation, refer to “6.3”.
By setting keep relay K935.0 to 1, you can display PMC program list screen. For details, refer to ”2.2.11”.

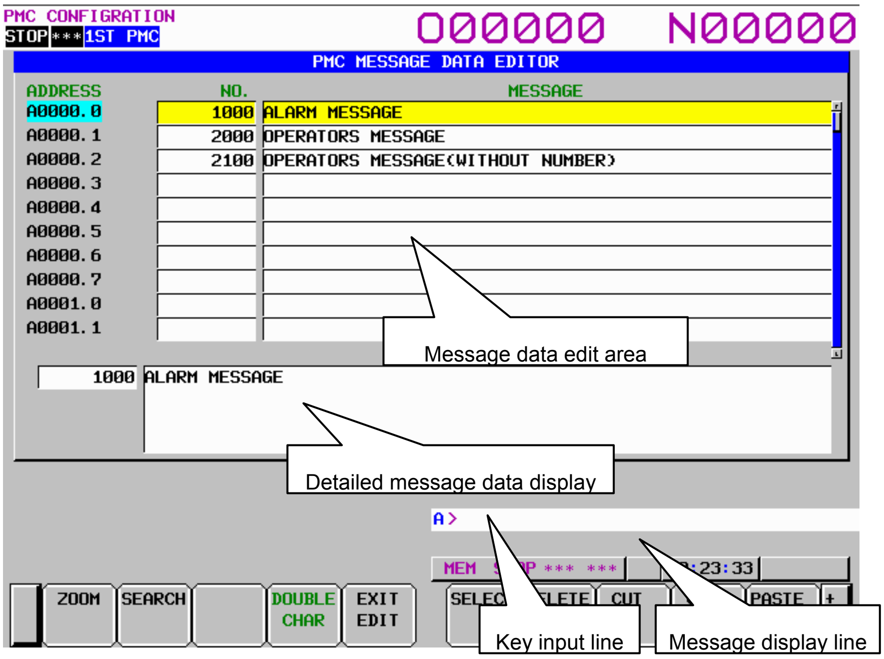
(2) Screen operation using other keys

Use cursor and page keys to change the message data in the detailed message data display.

9.3.2 Editing Message Data

On the MESSAGE DATA EDITOR screen, you can edit message data items.
To move to the MESSAGE DATA EDITOR screen, press the [EDIT] soft key on the MESSAGE DATA VIEWER screen. On the MESSAGE DATA EDITOR screen, you can perform the following operations:

- Moving to the message data entry editor screen [ZOOM]
- Searching for message data [SEARCH]
- Previewing message data [PREVIEW]
- Moving to the MESSAGE DATA VIEWER screen [EXIT EDIT]
- Selecting multiple entries [SELECT]
- Deleting an entry [DELETE]
- Moving an entry [CUT] and [PASTE]
- Copying an entry [COPY] and [PASTE]
- Deleting all entries [DELETE ALL]



Screen configuration

(1) On the screen, message addresses, message numbers, and message data are displayed from left to right. In the message data edit area, the first line of data is displayed.
(2) In the detailed message data display at the bottom of the screen, message data at the cursor is all displayed.
(3) On the message display line at the bottom of the screen, an error message appears when issued.

Screen operations

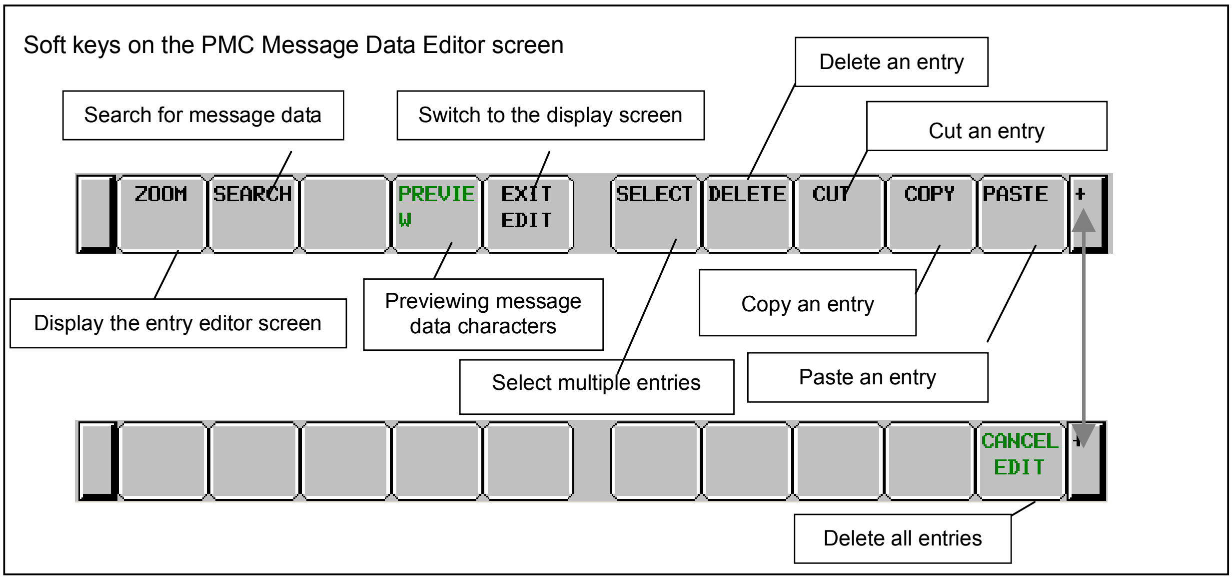


Fig. 9.3.2 Soft keys on the MESSAGE DATA EDITOR screen

(1) Operations using the soft keys
- (a) [ZOOM] Switch to the entry editor screen
  Moves to the entry editor screen for message data to edit entry data at the cursor.
- (b) [SEARCH] Search for message data
  Searches for an address, message number, or message data string. The operation method conforms to that for [SEARCH] on the MESSAGE DATA VIEWER screen. For details, see "Screen operations" for the MESSAGE DATA VIEWER screen.
- (c) [PREVIEW] Previewing message data
  Displays a character code enclosed by at signs (@) with the corresponding character actually displayed.
  The operation method conforms to that for [PREVIEW] on the MESSAGE DATA VIEWER screen. For details, see "Screen operations" for the MESSAGE DATA VIEWER screen.
- (d) [EXIT EDIT] Switch to the display screen
  Terminates editing of message data and moves to the MESSAGE DATA VIEWER screen.
- (e) [SELECT] Select multiple entries
  Use this key to specify multiple entries to be edited with a soft key such as [DELETE]. Pressing this soft key puts the screen into the mode for selecting multiple entries starting from the entry being edited at that time. Move the cursor and use the search function so that the entries to be edited are selected. After the entries to be edited are selected, edit them by pressing each edit soft key. When you want to delete, move, or copy multiple entries, use this soft key to select multiple entries.
- (f) [DELETE] Delete an entry
  Deletes a selected entry.
- (g) [CUT] Cut an entry
  Cuts a selected entry. The cut data is transferred to the pasting buffer and deleted from message data. The contents of the pasting buffer before the data is transferred are erased. When you want to move data from an entry to another, use this soft key together with the [PASTE] soft key.
- (h) [COPY] Copy an entry
  Transfers a selected entry to the pasting buffer. The message data is not changed. The contents of the pasting buffer before the data is transferred are erased. When you want to copy data in an entry to another, use this soft key together with the [PASTE] soft key.

(i) [PASTE] Paste an entry
Replaces data at the cursor with the entry transferred to the pasting buffer by the [CUT] or [COPY] soft key. When the contents of the pasting buffer are pasted by pressing the [PASTE] soft key, they are not erased. The contents of the pasting buffer are retained until the power to the NC is turned off.

(j) [DELETE ALL] Delete all entries
Deletes all message data.

(2) Editing message data for an entry at a time
Message data for an entry is input at a time.

(a) Standard specification
Enter a message string following a message number with delimiting them by a semicolon (;) as shown below and press the INPUT key.
message-number;message-string
Example: 2001; ABCDEFG INPUT key

(b) Extended specification
Enter a message string following a message number in the extended specification format as shown below and press the INPUT key.
message-number;message-string
Example: AL1+000= ABCDEFG INPUT key
OP1+999= ABCDEFG INPUT key

> **NOTE**
> For details of the extended specification of message number, see the description of Extended specification in Subsection 4.11.1.(iv)

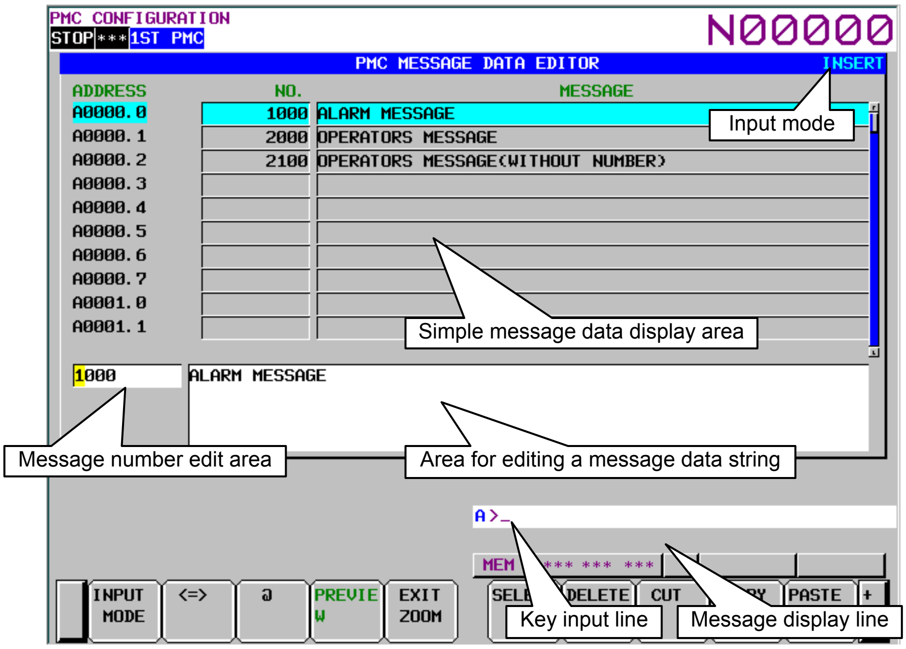
(3) Screen operation using other keys
Use cursor and page keys to change the message data in the detailed message data display.

(4) RETURN key operation
On the MESSAGE DATA EDITOR screen, the return key operation is disabled. To terminate editing of message data and return to the MESSAGE DATA VIEWER screen, use the [EXIT EDIT] soft key.

9.3.3 Editing Desired Message Data

On the message data entry editor screen, you can edit desired message data. To move to the message data entry editor screen, press the [ZOOM] soft key on the MESSAGE DATA EDITOR screen. On the message data entry editor screen, you can perform the following operations:

- Changing the input mode [INPUT MODE]
- Changing data to be edited [<=>]
- Inserting an at sign (@) [@]
- Previewing message data [PREVIEW]
- Moving to the MESSAGE DATA EDITOR screen [EXIT]
- Selecting a string [SELECT]
- Deleting a string [DELETE]
- Moving a string [CUT] and [PASTE]
- Copying a string [COPY] and [PASTE]
- Canceling edits [CANCEL EDIT]



Screen configuration

(1) On the screen, message addresses, message numbers, and message data are displayed from left to right. In the simple message data display area, the first line of data is displayed.

(2) The message number edit area and area for editing a message data string at the bottom of the screen are used to edit the message number and data.

(3) On the message display line at the bottom of the screen, an error message appears when issued.

Screen operations

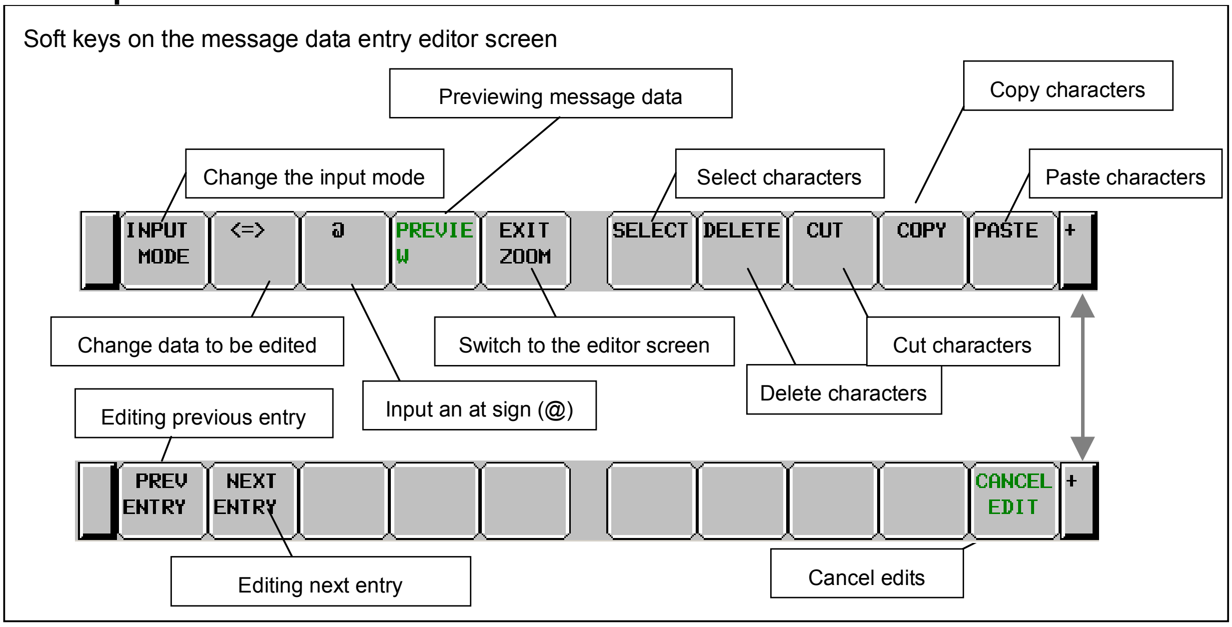
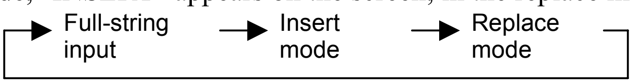


Fig. 9.3.3 Soft keys on the message data entry editor screen

(1) Operations using the soft keys

(a) [INPUT MODE] Change the input mode

Pressing [INPUT MODE] changes the input mode. The selection cycles in the following order. In the insert mode, "INSERT" appears on the screen; in the replace mode, "ALTER" appears.



- Full-string input
  The entire string at the cursor is selected and replaced with an input string.
- Insert mode
  Input characters are inserted at the cursor. Pressing the INPUT key with inputting no characters inserts one space.
- Replace mode
  Input characters replace characters at and after the cursor. Pressing the INPUT key with inputting no characters replaces the character at the cursor with a space.

(b) [<=>] Change data to be edited

Use this soft key to move the cursor between the message number edit area and area for editing a message string. You can check the cursor position to know which data is currently being edited.

(c) [@] Input of an at sign (@)

To display Japanese, or special character, the character code of the character is enclosed by at signs (@). To simplify the input of an at sign (@), this soft key adds an at sign (@) to the string in the key input line. This soft key is enabled when the input mode is insert or replace. In the full-string input mode, this soft key is not displayed.

(d) [PREVIEW] Previewing message data

Displays a character code enclosed by at signs (@) with the corresponding character actually displayed.

The operation method conforms to that for [PREVIEW] on the MESSAGE DATA VIEWER screen. For details, see "Screen operations" for the MESSAGE DATA VIEWER screen.

(e) [EXIT ZOOM] Switch to the editor screen

Terminates entry editing of message data and moves to the MESSAGE DATA EDITOR screen.

(f) [SELECT] Select characters

Use this key to specify multiple characters to be edited with a soft key such as [DELETE]. Pressing this soft key puts the screen into the mode for selecting multiple characters starting from the character being edited at that time. Move the cursor so that the characters to be edited are selected. After the characters to be edited are selected, operate each edit soft key or enter characters. This soft key is enabled when the input mode is insert or replace. In the full-string input mode, this soft key is not displayed.

(g) [DELETE] Delete characters
Deletes selected characters.

(h) [CUT] Cut characters
Cuts selected characters. The cut characters are transferred to the pasting buffer and deleted from message data. The contents of the pasting buffer before the characters are transferred are erased. When you want to move characters, use this soft key together with the [PASTE] soft key.

(i) [COPY] Copy characters
Transfers selected characters to the pasting buffer. The message data is not changed. The contents of the pasting buffer before the characters are transferred are erased. When you want to copy characters, use this soft key together with the [PASTE] soft key.

(j) [PASTE] Paste characters
Inserts the characters transferred to the pasting buffer by the [CUT] or [COPY] soft key at the cursor in the insert input mode or replaces the data at the cursor with the characters in other input modes. When the contents of the pasting buffer are pasted by pressing the [PASTE] soft key, they are not erased. The contents of the pasting buffer are retained until the power to the NC is turned off.

(k) [PREV ENTRY] Editing previous entry
You can edit a symbol and comment on previous entry without leaving from editing mode. And the up cursor move key acts just like [PREV ENTRY] soft key.

(l) [NEXT ENTRY] Editing next entry
You can edit a symbol and comment on next entry without leaving from editing mode. And the down cursor move key acts just like [NEXT ENTRY] soft key.

(m) [CANCEL EDIT] Cancel edits
Cancels edits made on this screen.

(2) Screen operation using other keys
Use cursor keys to change the character to be edited.

(3) RETURN key operation
On the message data entry editor screen, the return key operation is disabled. To terminate entry editing of message data and return to the MESSAGE DATA EDITOR screen, use the [EXIT] soft key.

NOTE

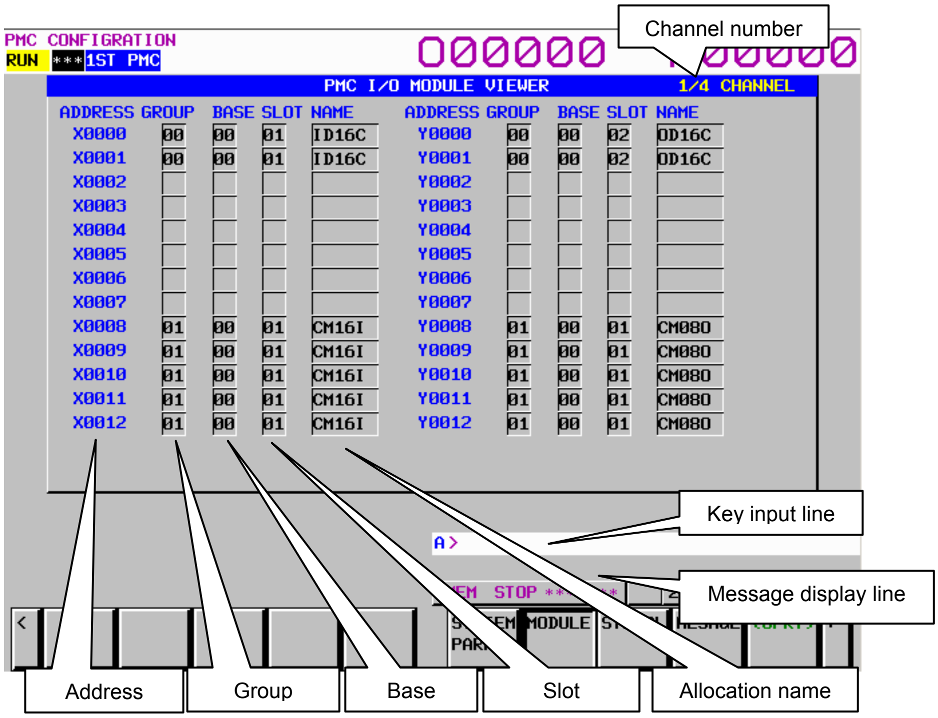
1 For details of the input format for kanji and other special character strings, see Subsection 4.11.1.

2 For details of the extended specification of message number, see the description of Extended specification in Subsection 4.11.1.(iv)

9.4 DISPLAYING AND EDITING I/O MODULE ALLOCATION DATA ([MODULE] SCREENS)

9.4.1 Displaying I/O Module Allocation Data

The I/O MODULE VIEWER screen displays data of allocation of I/O modules to X and Y addresses.
Check that I/O modules are allocated correctly.
To switch to the I/O MODULE VIEWER screen, press the [MODULE] soft key.



Screen operations

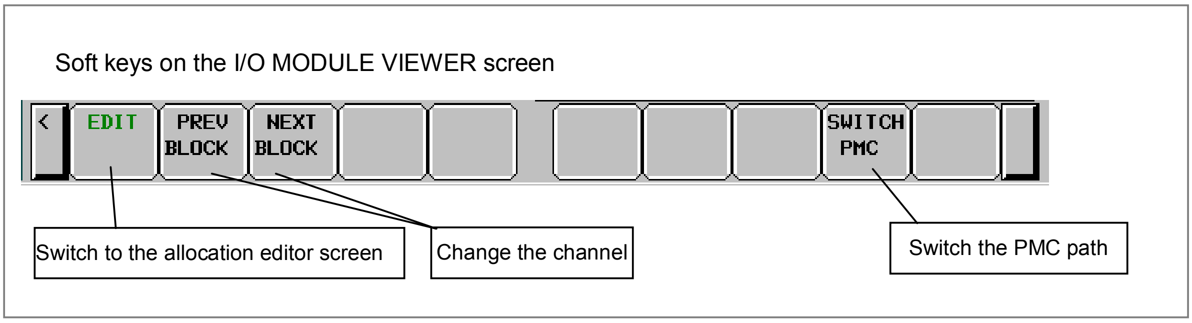
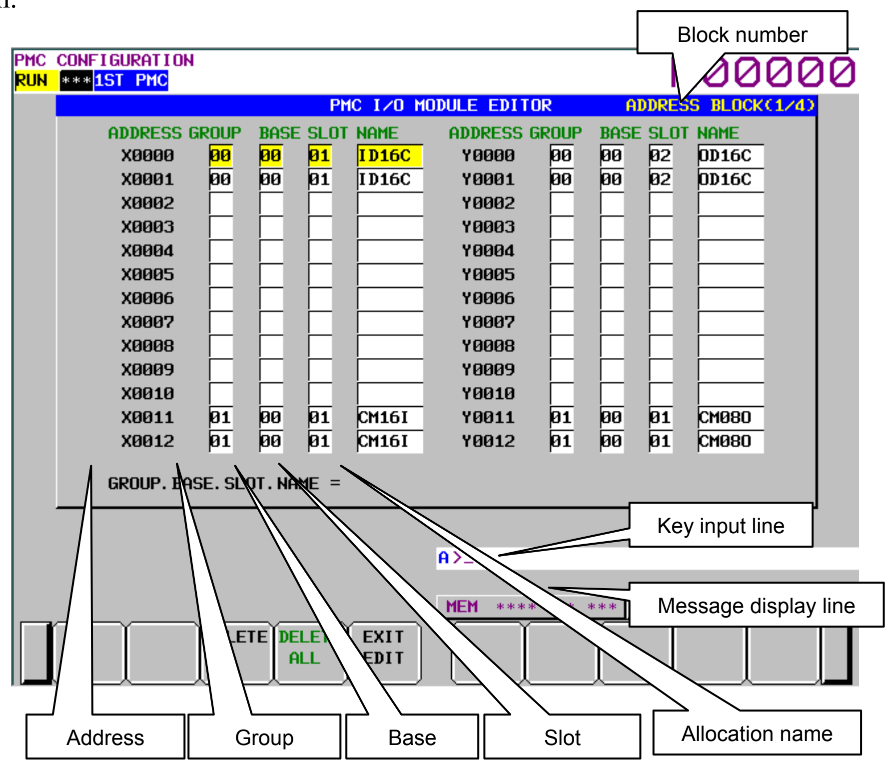


Fig. 9.4.1 Soft keys on the I/O MODULE VIEWER screen

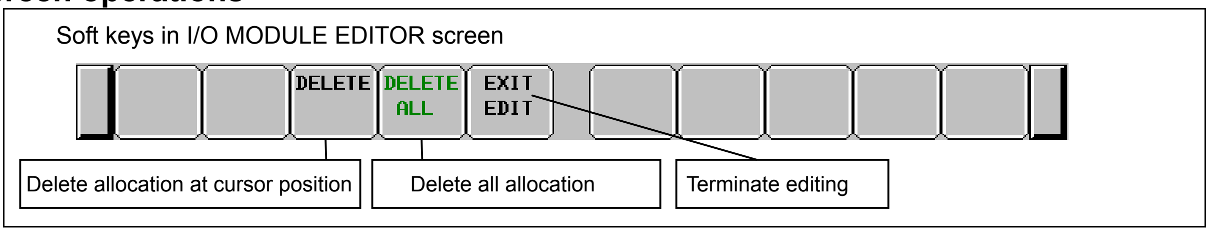
(1) Operations using the soft keys
- (a) [EDIT] Switch to the I/O MODULE EDITOR screen
- (b) [PRV.CH] Display I/O module allocation data for the previous channel
- (c) [NXT.CH] Display I/O module allocation data for the next channel
- (d) [SWITCH PMC] Switching PMC path or divided ladder programs
  Switches PMC path or divided ladder program. For details of the operation, refer to “6.3”.
  By setting keep relay K935.0 to 1, you can display PMC program list screen. For details, refer to ”2.2.11”.

9.4.2 Editing I/O Module Allocation Data

On the I/O MODULE EDITOR screen, you can edit data of allocation of I/O modules to X and Y addresses.
To switch to the I/O MODULE EDITOR screen, press the [EDIT] soft key on the I/O MODULE VIEWER screen.

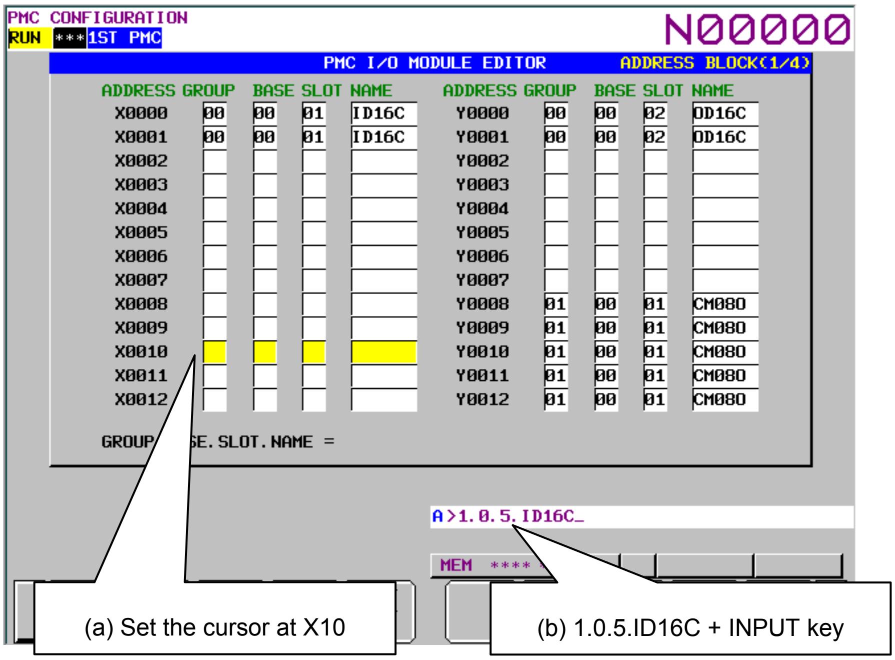


Screen operations



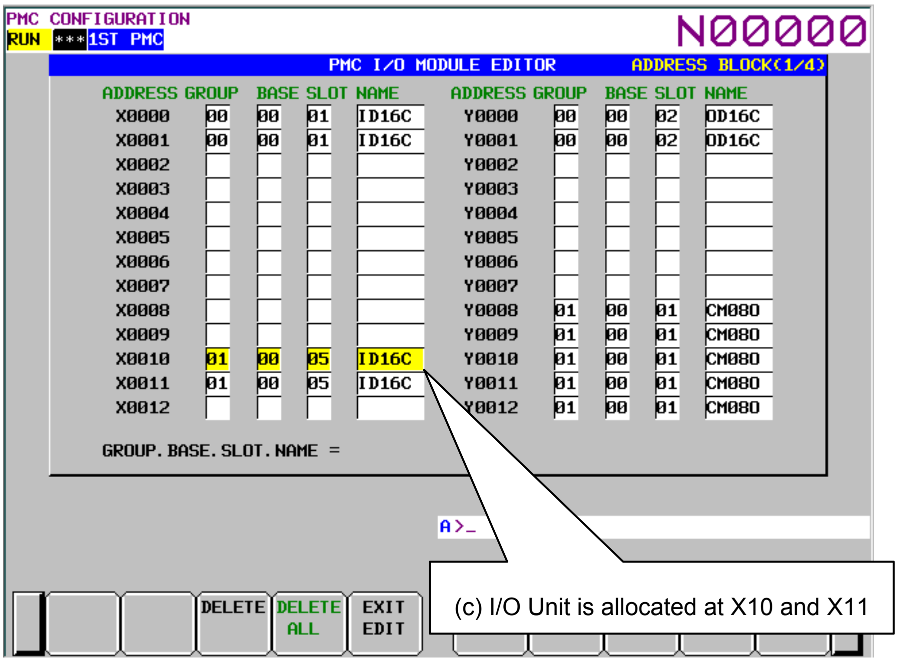
(1) Operations using the soft keys
 (a) [DELETE] Delete allocation data
 Deletes allocation data at the cursor.
 (b) [DELETE ALL] Delete all allocation data
 When this soft key is pressed, the following confirmation message appears:
 "DO YOU DELETE ALL ALLOCATION DATA?"
 The [YES] and [NO] soft keys appear. Press [NO] to cancel deletion or [YES] to execute deletion.
 (c) [EXIT EDIT] Switch to the I/O MODULE VIEWER screen

(2) Allocation of I/O Units to X and Y addresses
 (a) Set the cursor at address to which you will allocate new I/O Unit.
 (b) Type "Group. Base. Slot. I/O-module-name" and press INPUT key.
 Ex) In case you allocate "Group = 1, Base = 0, Slot = 5, Name = ID16C" to X10, set the cursor at X10 and enter "1.0.5.ID16C" + INPUT key



> **NOTE**
> As to the allocation name of I/O Unit, see Tables 3.2.3 (a) to 3.2.3 (c) in section "3.2.3".

(c) The I/O Unit is allocated to address of the cursor position for the I/O Unit size.
In case of above example (b), I/O Unit is allocated at X10 and X11 like as follows.



NOTE
1 To make the allocation effective, after storing the Ladder program in the flash ROM, turn the power to the CNC and all slave I/O devices off, then on again.
2 The Ladder program is not stopped automatically when you open I/O MODULE VIEWER screen or EDITOR screen.

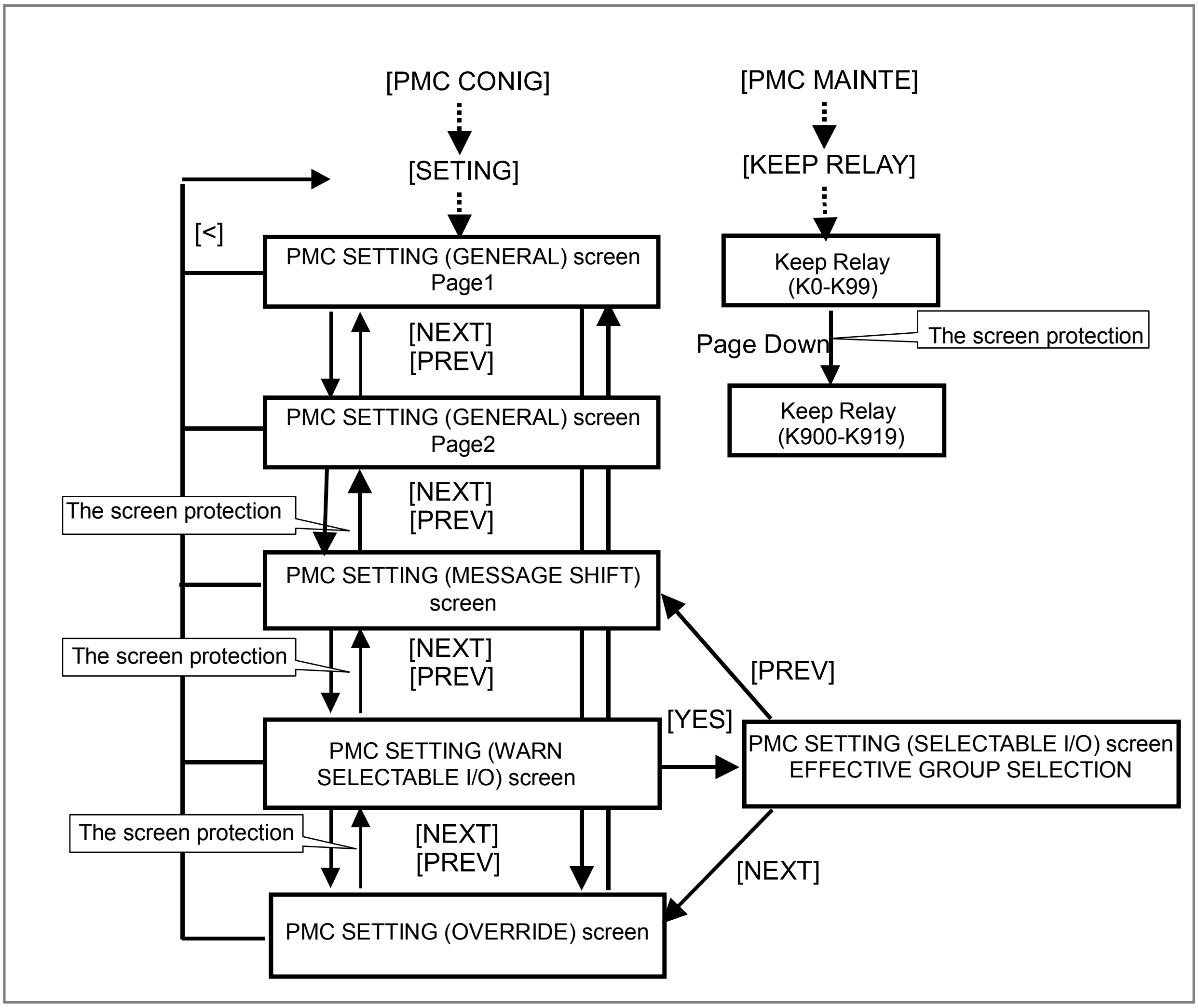
(3) Delete allocation
  (a) Set the cursor at allocation, which you will delete, and press ”the [DELETE] soft key”.
  (b) The allocation is deleted.
(4) Delete all allocation
  (a) Press the [DELETE ALL] soft key.
  (b) "DO YOU DELETE ALL ALLOCATION DATA?" is displayed.
  (c) Press the [YES] soft key.
  (d) Allocation data of X and Y are all deleted.
(5) RETURN key operation
  On the I/O MODULE EDITOR screen, the return key operation is disabled. To terminate editing of allocation data and return to the I/O MODULE VIEWER screen, use the [EXIT EDIT] soft key.

9.5 DISPLAYING AND CHANGING PMC SETTINGS ([SETING] SCREENS)

There are following setting parameter screens.

- PMC SETTING (GENERAL) screen
- PMC SETTING (MESSGE SHIFT) screen
- PMC SETTING (SELECTABLE I/O) screen
- PMC SETTING (OVERRIDE) screen

Use the [NEXT] and [PREV] soft keys to switch from a setting screen to another as shown in the figure below.

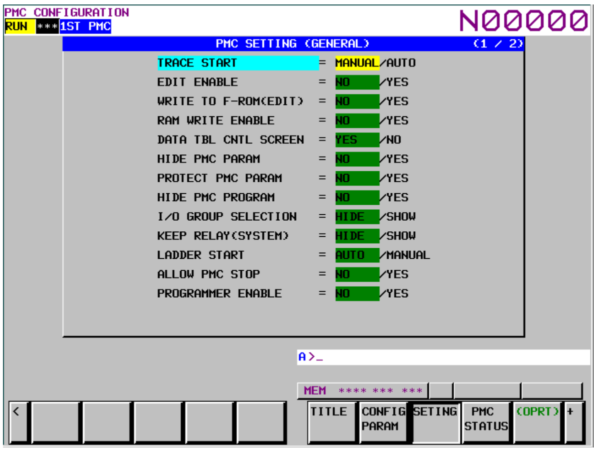


> **NOTE**
> You can also use the keep relay screen (for K900 and after) to set these setting parameters.

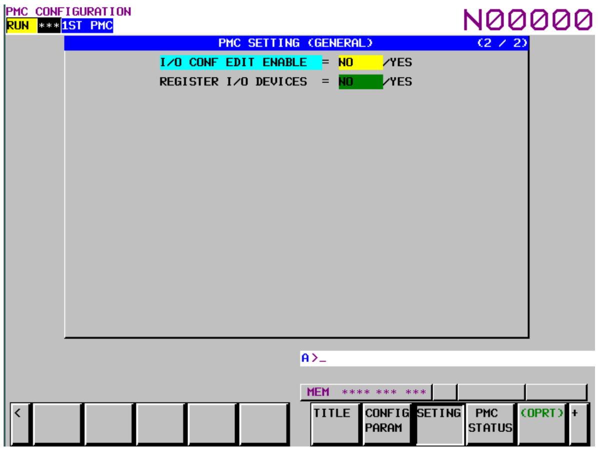
Setting screen of multi-language display function, selectable I/O link assignment function and OVERRIDE mode of the forced input/output function and System Keep Relay screen can be protected by programmer protection function.

(1) PMC SETTING GENERAL screen

On the PMC SETTING (GENERAL) screen, set parameters that specify the use condition of each PMC function.



Page1



Page2

Use the [↑] and [↓] keys to move the item cursor.
Use the [←] and [→] keys to move the setting cursor and set the parameter.
Use the page keys to switch to another page.

(a) TRACE START (K906.5) (only 1st PMC path)

MANUAL: Executes the trace function by operating the corresponding soft key on the trace screen.

AUTO: Automatically executes the trace function after power-on.

(b) EDIT ENABLE (K901.6)

NO: Prevents editing of the sequence program.

YES: Allows editing of the sequence program.

NOTE

This setting effects some PMC functions.
For details, see Section 6.2.

(c) WRITE TO F-ROM (EDIT) (K902.0)

NO: Does not write to flash ROM automatically after editing of sequence program.

YES: Writes to flash ROM automatically after editing of sequence program.

(d) RAM WRITE ENABLE (K900.4)

NO: Prevents forcing function.

YES: Allows forcing function.

NOTE

This setting effects some PMC functions.
For details, see Section 6.2.

(e) DATA TBL CNTL SCREEN (K900.7)

YES: Displays PMC parameter data table control screen.

NO: Does not display PMC parameter data table control screen.

(f) HIDE PMC PARAM (K902.6)
NO: Allows PMC parameter display.
YES: Prevents PMC parameter display.

> **NOTE**
> This setting effects some PMC functions.
> For details, see Section 6.2.

(g) PROTECT PMC PARAM (K902.7)
NO: Allows PMC parameter editing.
YES: Prevents PMC parameter editing.

(h) HIDE PMC PROGRAM (K900.0)
NO: Allows sequence program display.
YES: Prevents sequence program display.

> **NOTE**
> This setting effects some PMC functions.
> For details, see Section 6.2.

(i) I/O GROUP SELECTION (K906.1)
HIDE: The PMC SETTING (SELECTABLE I/O) screen is not displayed.
SHOW: The PMC SETTING (SELECTABLE I/O) screen is displayed.

(j) KEEP RELAY (SYSTEM) (K906.6)
HIDE: The KEEP RELAY (K900-K999) screen is not displayed.
SHOW: The KEEP RELAY (K900-K999) screen is displayed.

(k) LADDER START (K900.2)
AUTO: Executes the sequence program automatically after the power turns on.
MANUAL: Executes the sequence program by [RUN] soft-key.

(l) ALLOW PMC STOP (K902.2)
NO: Prevents run/stop operation of the sequence program.
YES: Allows run/stop operation of the sequence program.

> **NOTE**
> This setting effects some PMC functions.
> For details, see Section 6.2.

(m) PROGRAMMER ENABLE (K900.1)
NO: Disables embedded programmer.
YES: Enables embedded programmer.

> **NOTE**
> This setting effects some PMC functions.
> For details, see Section 6.2.

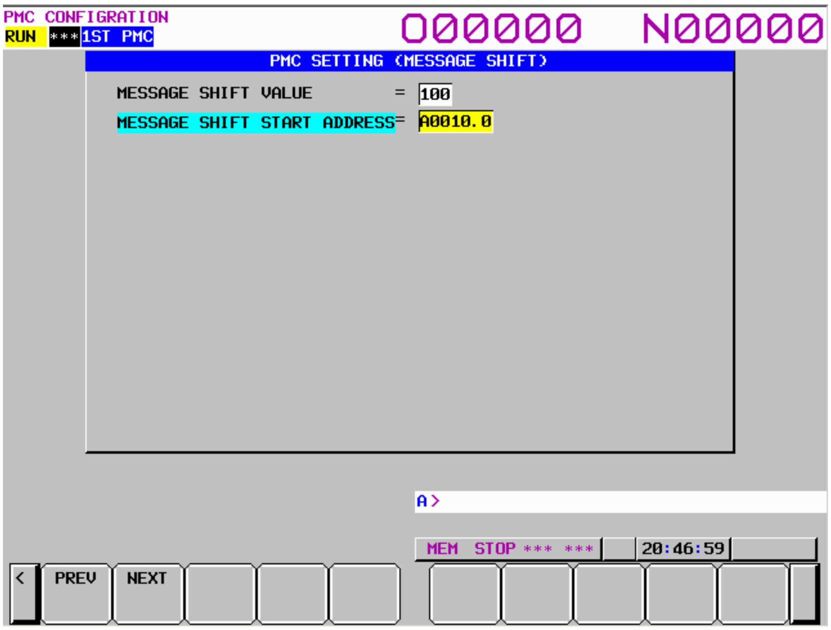
(n) I/O CONF EDIT ENABLE (K907.0) (only 1st PMC path)
NO: Disables editing of I/O configuration data (I/O Link *i* assignment data).
YES: Enables editing of I/O configuration data (I/O Link *i* assignment data).

> **NOTE**
> This setting effects some PMC functions.
> For details, see Section 6.2.

(o) REGISTER I/O DEVICES (K935.1) (only 1st PMC path)
NO: Disables register/delete of I/O device configuration.
YES: Enables register/delete of I/O device configuration.

NOTE
This setting effects some PMC functions.
For details, see Section 6.2.

(2) PMC SETTING (MESSAGE SHIFT) screen
On the PMC SETTING (MESSAGE SHIFT) screen, set the parameters for the message shift function by functional instruction DISPB.



NOTE
For details of the display condition for this screen, see Section 6.2.

(a) MESSAGE SHIFT VALUE (K918, K919)
Enter the amount by which the message display request bit is to be shifted.
The valid data range is between 0 and 1999. The initial value is 0.
After entering a value, press the INPUT key to set the value.
The input data is also retained after power-off.

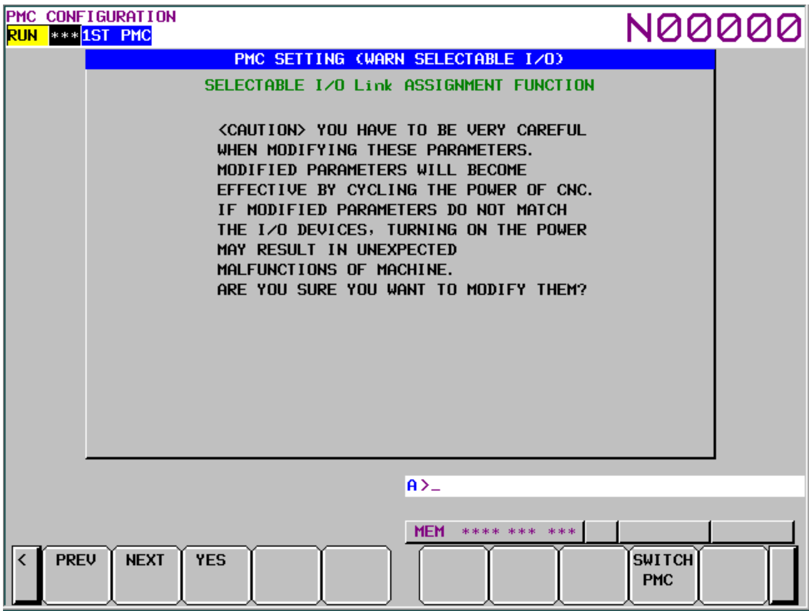
(b) MESSAGE SHIFT START ADDRESS (K916, K917)
Enter the start bit address of the area for the message display request bit to be shifted.
The specified address must be within the A address area. The initial value is A0.0.
The input data is also retained after power-off.

NOTE
Data set for "MESSAGE SHIFT START ADDRESS" is valid only when the value set for "MESSAGE SHIFT VALUE" is other than 0.

(3) Setting screens for the selectable I/O Link assignment function

(a) PMC SETTING (WARN SELECTABLE I/O) screen

This caution screen is displayed for the operator's attention when the operator is switching to the PMC SETTING (SELECTABLE I/O) screen.



Read the displayed caution carefully.
When you are sure to set parameters after reading the caution, press the [YES] soft key.
This soft key switches to the PMC SETTING (SELECTABLE I/O) screen.

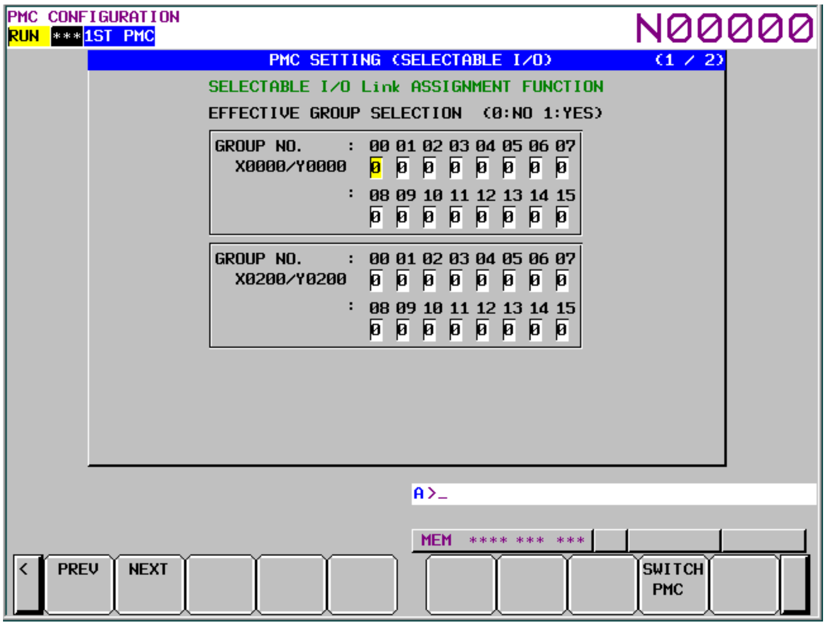
NOTE

For details of the display condition for this screen, see Section 6.2.

⚠WARNING

If you modify this setting parameter without care, the I/O assignment data may not match I/O devices and turning on the power may result in unexpected malfunctions of machine. Therefore, it is required that the operator of this function should be an expert who fully understands the sequence program and the operation of PMC. It is also strongly recommended to the developer of machine that this setting screen should be protected from careless use by ordinary operators after the machine is shipped into the field.

(b) PMC SETTING (SELECTABLE I/O) screen
You can set the group of optional I/O device that is connected with each machine.



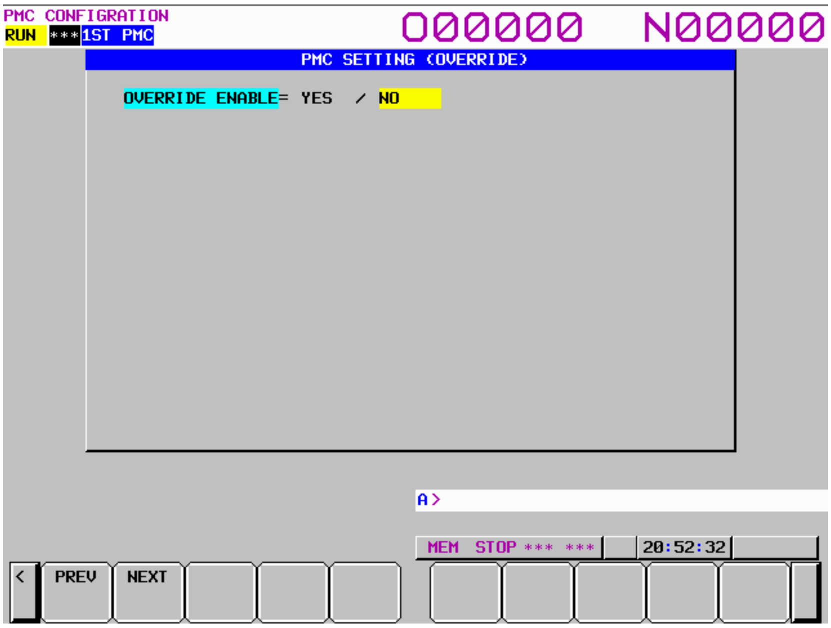
The maximum number of X/Y address blocks of I/O Link per PMC is 4.
You can set these parameters of available X/Y address blocks of I/O Link.
To switch to another page, use the page keys.

EFFECTIVE GROUP SELECTION
(X/Y0: K920 and K921, X/Y200: K922 and K923, X/Y400: K924 and K925, X/Y600: K926 and K927)
You can select effective I/O group in I/O link assignment data.

1: I/O group is effective.
0: I/O group is no effective.

The "*" mark means that the group is set as the basic part by the parameter "BASIC GROUP COUNT" on the SYSTEM PARAMETER screen. The value cannot be set into these parts.

(4) PMC SETTING (OVERRIDE) screen
On this screen, specify whether to enable the override function.



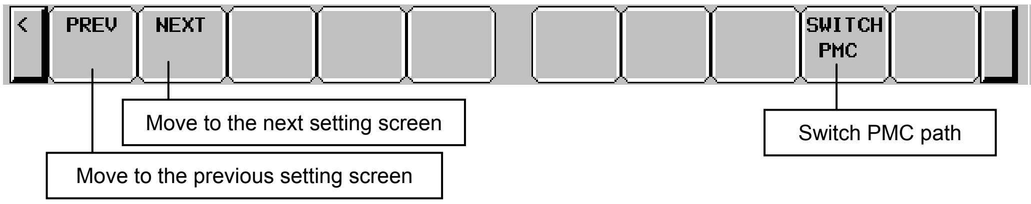
NOTE
For details of the display condition for this screen, see Section 6.2.

OVERRIDE ENABLE (K906.0)
- YES: Enables the override function.
- NO: Disables the override function.

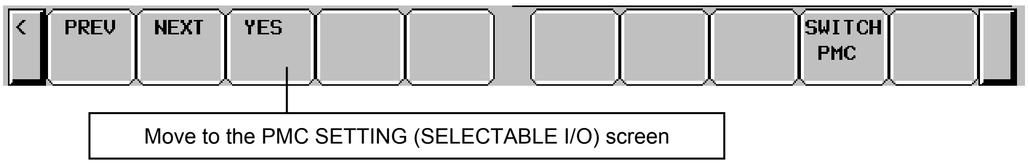
NOTE
The change to this parameter setting is made effective at the next power-on. After changing the setting of this parameter, be sure to turn the power off, then on again.

⚠ **WARNING**
Special care must be exercised when using the Override function. If the Override function is used incorrectly, the operation of the machine may be unpredictable. Therefore, use the Override function after understood "7.1.1 Forced I/O function" sufficiently. Moreover, When shipping the machine, disable the Override function invariably.

(5) Operations using the soft keys
Soft keys common to the setting parameter screens



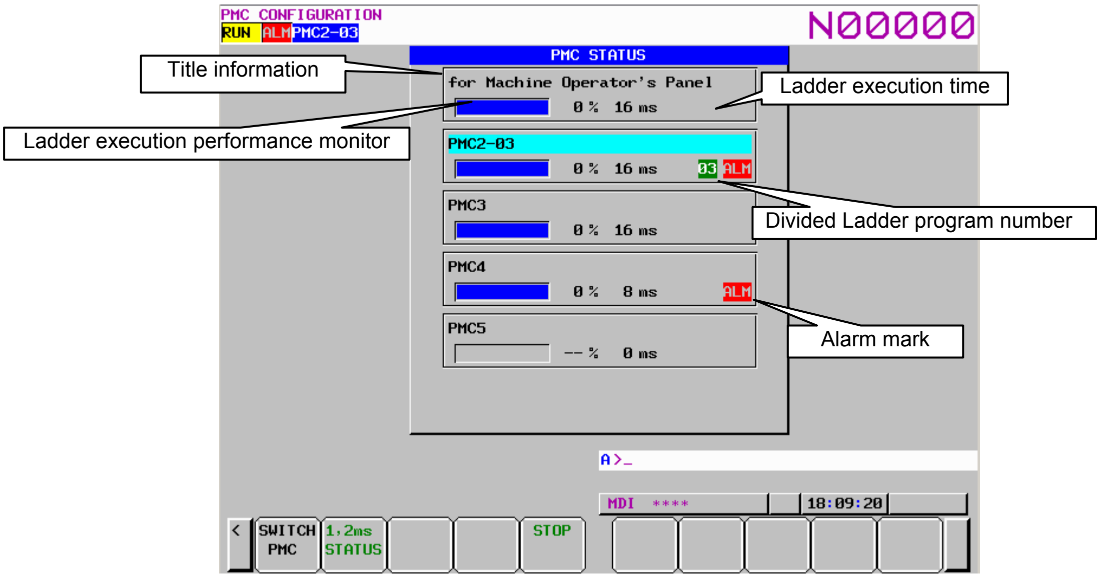
Soft keys on the PMC SETTING (WARN SELECTABLE I/O) screen



(a) [PREV] Switch to the previous page
(b) [NEXT] Switch to the next page
(c) [YES] Switch to the PMC SETTING (SELECTABLE I/O) screen
(d) [SWITCH PMC] Switching PMC path or divided ladder programs
Switches PMC path or divided ladder program. For details of the operation, refer to “6.3”.
By setting keep relay K935.0 to 1, you can display PMC program list screen. For details, refer to ”2.2.11”.

9.6 DISPLAYING THE STATUS OF PMCS AND CHANGING THE TARGET PMC ([PMC STATUS] SCREENS)

On the PMC STATUS screen, you can display the status of each existing PMC and change the target PMC for display and operation on each screen. To switch to the PMC STATUS screen, press the [PMC STATUS] soft key.



This screen displays the status of up to five PMCs and dual check safety.
The status display for each PMC shows title information (REMARKS), ladder execution performance monitor, current execution time of the ladder program, sequence program number, divided ladder program number and edition corresponding to the title data, and alarm mark.

The ladder execution performance monitor shows the ratio of the execution of the level-1 and level-2 sequence sections of the ladder program on the monitor bar. The ratio of the execution of the level-1 sequence section of the ladder program is displayed with a numeric value next to the monitor bar. When the ladder program is stopped, the monitor bar is not displayed.
When using the ladder dividing management function, the divided ladder program number is displayed. No number is displayed when main ladder program is selected.
The alarm mark is displayed only when an alarm is issued on the PMC. Nothing is displayed when no alarm is issued.

On this screen, you can start and stop a ladder program.

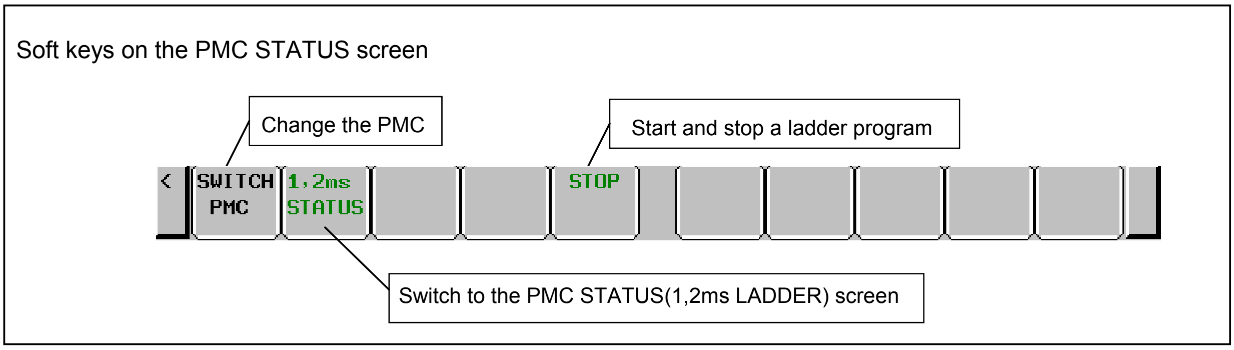


Fig. 9.6 Soft keys on the PMC STATUS screen

Operation using the soft key

(1) [SWITCH PMC] Switching PMC path or divided ladder programs
Switches PMC path or divided ladder program. For details of the operation, refer to "6.3".
You can check the position of the cursor displayed at the title information of each PMC to know the current target PMC.
By setting keep relay K935.0 to 1, you can display PMC program list screen. For details, refer to "2.2.11".

(2) [1, 2ms STATUS] Switch to the PMC STATUS(1,2ms LADDER) screen
This soft key switches to the PMC STATUS(1,2ms LADDER) screen. This soft key is displayed when using the 1st level execution cycle in 1ms, 2ms.
About a PMC STATUS(1, 2ms LADDER) screen, refer to "3.9.1 Displaying the status of the 1st level execution cycles in 1ms/2ms ([PMC status (1,2ms ladder)] screen)" of this document for details.

(3) [RUN]/[STOP] Start and stop a ladder program
For details of these operations, see Subsection 9.6.1.

> ⚠ **CAUTION**
> When the programmer protection function is enabled, the [RUN]/[STOP] soft key appears and is available. For details, see Section 6.2.

9.6.1 Starting and Stopping Sequence Programs

On this screen, you can start or stop a sequence program. NC parameter No.11931#0 determines whether multi-path PMC shall start/stop individually, or they shall synchronize.

(1) Starting a sequence program ([RUN])
When a program is stopped, pressing the [RUN] soft key causes the system to display the inquiry message "ARE YOU SURE YOU WANT TO RUN PROGRAM?". Pressing the [YES] soft key in response to this message causes the program to start. The status line display changes to "RUN". The sequence program starts from the beginning. The soft key changes to [STOP].

(2) Stopping a sequence program ([STOP])
When a program is running, pressing the [STOP] soft key causes the system to display the inquiry message "ARE YOU SURE YOU WANT TO STOP PROGRAM?". Pressing the [YES] soft key in response to this message causes the program to stop. The status line display changes to "STOP". The soft key changes to [RUN].

> ⚠**WARNING**
> If the sequence program is stopped while the machine is operating, the machine may behave in an unexpected way. Before stopping the sequence program, ensure that there are no people near the machine and that the tool cannot collide with the work piece or the machine.
> Otherwise, there is an extreme risk of death or serious injury, as well as the likelihood of the tool, the work piece, and the machine being damaged.

(3) Automatic operation of a sequence program
When LADDER START is set to AUTO (bit 2 of the keep relay K900 = 0) on the setting screen, a sequence program can be executed automatically when the power is turned on.
And the inquiry message "ARE YOU SURE YOU WANT TO RUN PROGRAM?" is displayed after editing the following data. Pressing the [YES] soft key in response to this message causes the program to start. The status line display changes to "RUN".

- Symbol comment data
- Message data
- System parameter

NOTE
In case of a fatal PMC alarm that prevents the program to start, even if you press "YES" soft key, the program will not start.

9.6.2 Displaying the status of the 1st level execution cycle in 1ms/2ms ([PMC STATUS(1,2ms LADDER)] screen)

The PMC STATUS(1,2ms LADDER) screen displays the execution status of the 1st level of ladder program which 1ms or 2ms is set to the execution cycle of the 1st level.
This screen is displayed by pressing the [1,2ms STATUS] soft key of PMC status screen. [1 or 2ms status] soft key is displayed when 1ms or 2ms are set to the execution cycle of the 1st level.

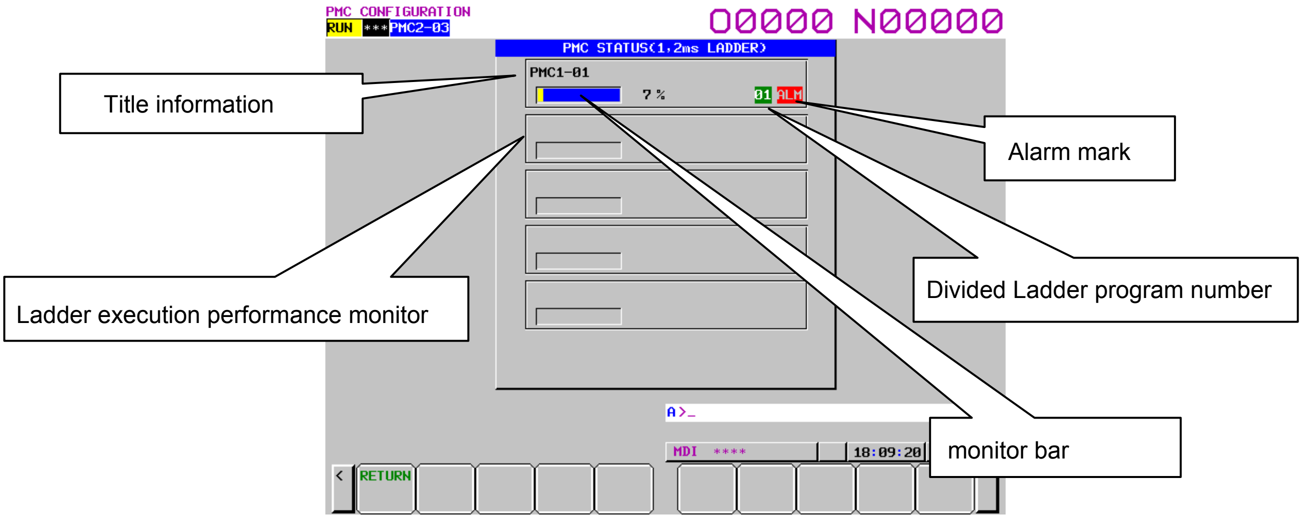


Fig.9.6.2 (a) PMC STATUS(1,2ms LADDER) screen

The ladder execution performance monitor shows the execution time ratio of the 1st level of execution cycle in 1ms or 2ms. The maximum execution time is 100%. In case of 1ms of the execution cycle, the maximum execution time is 0.5ms. In case of 2ms of the execution cycle, the maximum execution time is 1ms.

The information of the ladder program of the 1st level of ladder execution cycle in 1ms, 2ms is displayed on the title information and divided ladder program number. And the alarm status of the PMC path of the 1st level execution cycle in 1ms, 2ms is displayed at the alarm mark.
In the PMC path in which 1ms or 2ms is not set to execution cycle of the 1st level, this information is displayed as blank.

Operation using the soft key

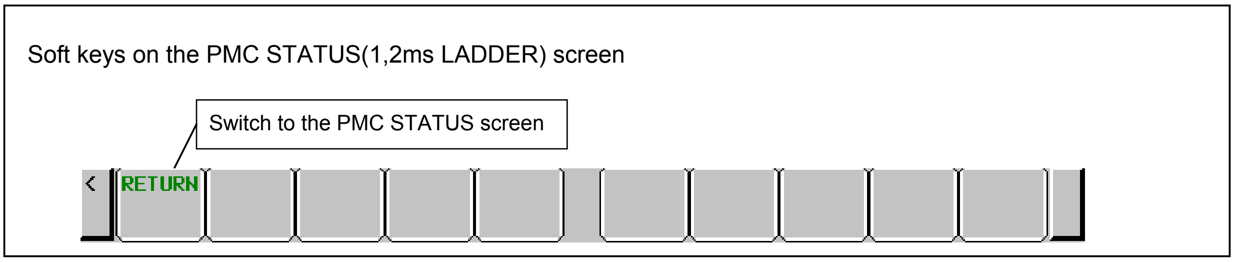


Fig. 9.6.2 (b) Soft keys on the PMC STATUS(1,2ms LADDER) screen

(1) [RETURN] Switch to the PMC STATUS screen
Switches to the PMC STATUS screen.

9.7 DISPLAYING AND SETTING PARAMETERS FOR THE ONLINE FUNCTION ([ONLINE] SCREEN)

The online function allows PMC data to be displayed and edited on a personal computer when the PMC is connected to FANUC LADDER-III or Ladder Editing Package.
Following functions are available in the online function.

- Ladder monitor display
- Online ladder editing
- PMC parameter display and editing
- Signal state monitor
- Input/output to and from the PMC (loading from the PMC, storing to the PMC)
- Writing to flash ROM

For detailed explanation of the online function, refer to the following manuals:

Manual name	Drawing number	Description
FANUC LADDER-III Operator's Manual	B-66234EN	Online function by FANUC LADDER-III
Ladder Editing Package (Windows) Operator's Manual	B-63484EN	Online function by Ladder Editing Package

> ⚠ **CAUTION**
> When the online function is used with RS-232C, the selected channel is occupied by the PMC system. To use other functions with RS-232C, specify other channel setting than the one used by online function.

Even while you are monitoring signals, ladder program and PMC parameters, and editing PMC parameters using the online function, you can monitor them also on following PMC screen.

- The LADDER DIAGRAM VIEWER screen
- The PROGRAM LIST VIEWER screen
- The TITLE DATA VIEWER screen
- The SYSTEM PARAMETER VIEWER screen
- The I/O MODULE VIEWER screen
- The SYMBOL & COMMENT DATA EDITOR screen
- The MESSAGE DATA EDITOR screen
- The I/O DIAGNOSIS screen

On these screens, if you start editing the sequence program by online edit or storing another sequence program from FANUC LADDER-III or Ladder Editing Package to PMC, PMC will stop monitoring the sequence program. When updating the sequence program is completed, PMC will start monitoring the new program again.

However, on the following PMC screens, even if you start storing another sequence program from FANUC LADDER-III or Ladder Editing Package to PMC, symbol and comment data displayed in the screen will not be updated automatically.
When symbol and comment data are displayed again by page up/down key, etc, the updated symbol and comment data will be displayed.

- The SIGNAL STATUS screen
- The PMC PARAMETER (TIMER) screen
- The PMC PARAMETER (COUNTER) screen
- The PMC PARAMETER (KEEP RELAY) screen
- The PMC PARAMETER (DATA TABLE CONTROL DATA) screen
- The PMC PARAMETER (DATA TABLE) screen
- The SIGNAL TRACE screen

⚠ **CAUTION**

1 While communicating with online function, you can not move to following PMC editor screens and an attempt will result in an error message "PROGRAM IS BEING MODIFIED".
On the other hand, while one of the following PMC screens is displayed, a demand to make connection with the online function of FANUC LADDER-III or Ladder Editing Package will be rejected, and will issue a communication error instead and you can not use online function.
Use the online function on the screen except following PMC screens.
- LADDER DIAGRAM EDITOR screen
- PROGRAM LIST EDITOR screen
- TITLE DATA EDITOR screen
- SYSTEM PARAMETER EDITOR screen
- I/O MODULE EDITOR screen
- SYMBOL & COMMENT DATA EDITOR screen
- MESSAGE DATA EDITOR screen
- PMC PARAMETER (DATA TABLE) screen (write enable)
(When data table control data is protected, the data table control data can not be modified on the screen. For details, see section 6.2.1 and 6.2.2)

2 If you start storing a PMC parameter from FANUC LADDER-III or Ladder Editing Package to PMC, while the PMC PARAMETER (DATA TABLE) screen is displayed, data table is displayed according to the old data table control data until you once exit and re-enter PMC PARAMETER (DATA TABLE) screen.

9.7.1 Setting Parameters for the Online Function

The online function can be connected using one of the following three methods.

Connection method	Applicable software
Ethernet	FANUC LADDER-III and Ladder Editing Package
RS-232C	FANUC LADDER-III
HSSB	Ladder Editing Package

Before using the online function, put the online function into the connection waiting state on the PMC.
To put the PMC into the connection waiting state, use the PARAMETERS FOR ONLINE MONITOR screen or relevant CNC parameter.
To use Ethernet for connecting the online function, set Ethernet communication parameters. For details of the Ethernet communication parameters, see Subsection 9.7.3.

(1) Setting of online connection using the PARAMETERS FOR ONLINE MONITOR screen
Press the [ONLINE] soft key to display the PARAMETERS FOR ONLINE MONITOR screen.

> **NOTE**
> When the programmer protection function is enabled, the online setting screen is available. For details, see Section 6.2.

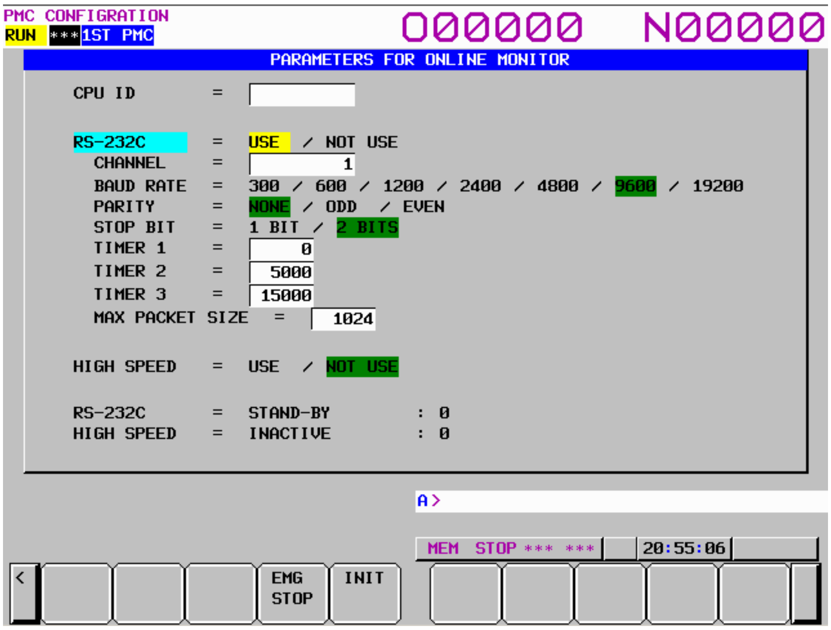


Fig. 9.7.1 PARAMETERS FOR ONLINE MONITOR screen

EMG STOP: Terminates communication forcibly. Use this key if communication becomes abnormal and the connection cannot be terminated normally.
INIT: Initializes the parameters to their default values.

> **⚠ CAUTION**
> In case of configuration of CNC with which neither Ethernet nor HSSB is available, the item of "HIGH SPEED " is not displayed.

(a) Case of connection by RS-232C (FANUC LADDER-III)
  (i) Check that "NOT USE" is selected at the "RS-232C" item.
  (ii) Set the parameter of "CHANNEL" and "BAUD RATE".
  (iii) Move the cursor to the "RS-232C" item with Up or Down Cursor key.
  (iv) Select "USE" with Left or Right Cursor key.
(b) Case of connection by Ethernet (FANUC LADDER-III, Ladder Editing Package)
  (i) Move the cursor to the "HIGH SPEED" item with Up or Down Cursor key.
  (ii) Select "USE" with Left or Right Cursor key.
(c) Case of connection by HSSB (Ladder Editing Package)
  (i) Move the cursor to the "HIGH SPEED" item with Up or Down Cursor key.
  (ii) Select "USE" with Left or Right Cursor key.

NOTE

1 When both "RS-232C = USE" and "HIGH SPEED = USE" are selected, the PMC system will communicate with the application which is connected first. If PMC system is already connecting with an application, it can not connect with other applications.

2 When you use the online function by Ethernet, setting Ethernet parameters of CNC is necessary in advance.

(2) Setting of online connection by NC parameter
You can enable and disable the online connection for Ethernet, HSSB and RS-232C by NC parameter No.24 without setting on the PMC online setting screen.
For details of the parameter, see Subsection 2.4.3.

9.7.2 Communication Status

The communication status of RS-232C and HIGH SPEED are displayed at the online monitor screen during the online communication.

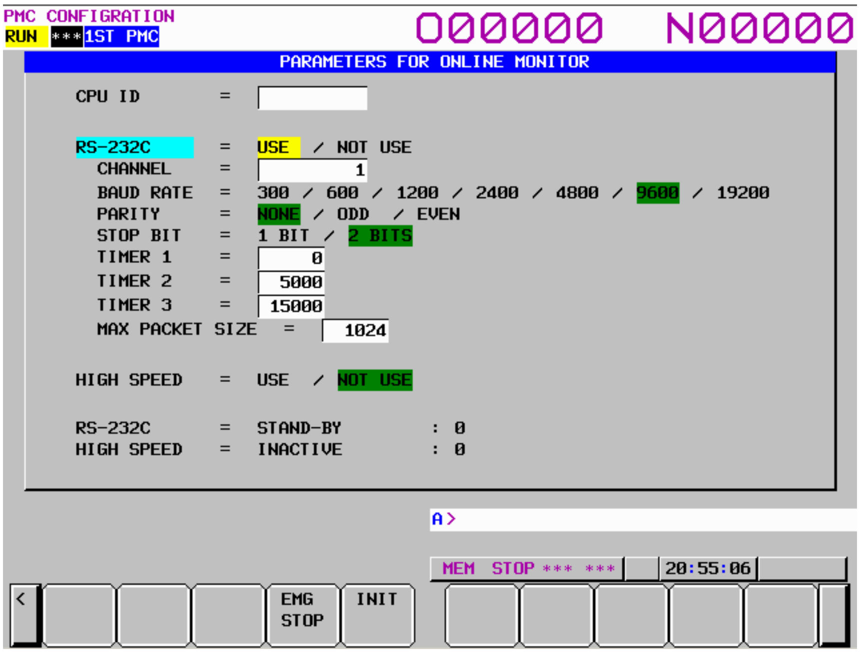


Fig. 9.7.2 Communication status of online setting screen

RS-232C	:	The communication condition of RS-232C is displayed.
HIGH SPEED	:	The communication condition of high-speed I/F (HSSB or Ethernet) is displayed.

The display messages and the meanings are shown in the table of below.

Displayed messages	Meanings
INACTIVE	The communication is inactive.
STOPPING	The communication is being stopped.(Wait for the termination of communication)
STARTING	The communication is being started.(Wait for the termination of communication over another communication path)
STAND-BY	The communication is in standby mode.
CONNECTED	The communication is being connected.
NO OPTION	The port can be not opened because there is not option of RS-232C.
BAD PARAMETER	Invalid RS-232C parameters are specified.
TIMEOUT ERROR	A time-out has occurred and communication is aborted.
TIMEOUT(K) ERROR	A time-out has occurred and communication is aborted.
BCC ERROR	Invalid Block Check Code (packet parity) is specified.
PARITY ERROR	A parity error has occurred.
OVER-RUN ERROR	A reception overrun has occurred.
SEQUENCE ERROR	Packets have been received in invalid sequence.
DATA ERROR	Incorrect packet has been received.
QUEUE OVERFLOW	The transmit/receive queue has overflowed.
DISCONNECTED	Communication has been terminated successfully.
NO CONNECTION	The cable is disconnected.

9.7.3 About Ethernet Communication Parameters

(1) Setting of Ethernet parameters

When you try to connect FANUC LADDER-III or Ladder Editing Package with CNC by Ethernet, it is necessary to set some Ethernet parameters. The setting of Ethernet parameters can be set in the following Ethernet parameter screen of CNC. Refer to the section "EMBEDDED ETHERNET FUNCTION" of CONNECTION MANUAL (FUNCTION) about the detail of the setting screen and setting parameters.

The setting item necessary for Ethernet connection for PMC online function is as follows.

- IP ADDRESS (Set the IP address of CNC. 192.168.0.1 etc.)
- SUBNET MASK (Set the mask address of the IP address. 255.255.255.0 etc.)
- ROUTER IP ADDRESS (If you use the router, set the Router IP Address.)
- PORT NUMBER (TCP) (8193 etc.)

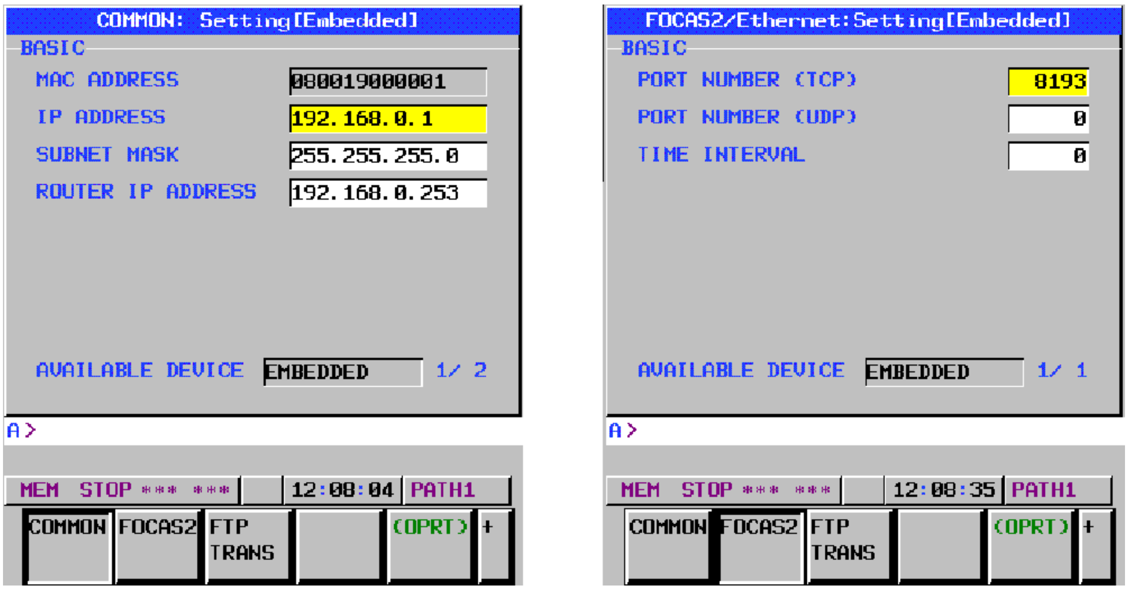
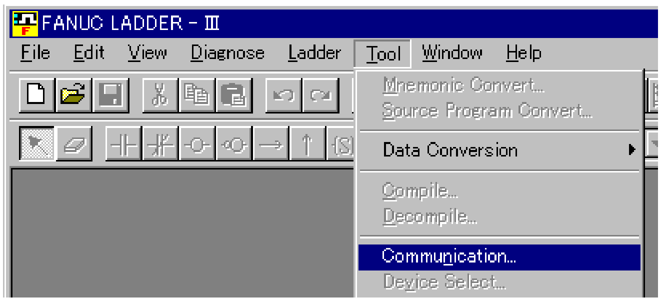


Fig. 9.7.3 Ethernet parameter setting screen

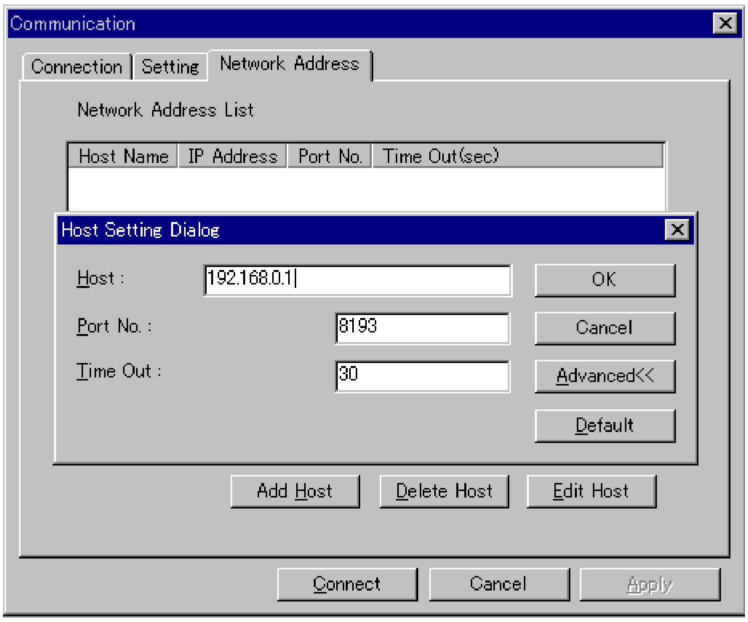
(2) Starting online communication by offline programmer (Ethernet connection)

The procedures for online connection with PMC and the offline programmer (FANUC LADDER-III, Ladder Editing Package) by Ethernet are as follows. (Example: FANUC LADDER-III)

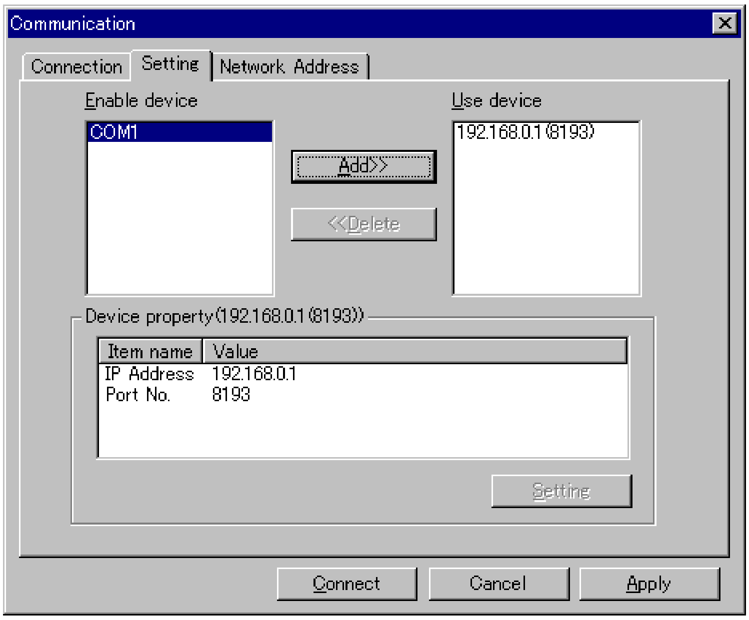
(a) Start up FANUC LADDER-III, and click the [Communication] on [Tool] menu.



(b) Select the [Network Address] tab and push the <Add Host> button. Input the "IP Address" and "Port No." inputted in (1) of this subsection.



(c) Select the [Setting] tab, and add the IP Address to "Use device".



(d) Press the <Connect> button for start of the communication.

9.7.4 About Connection Log of Ethernet

If any errors have occurred during Ethernet connection, the contents of the errors are displayed at "EMBEDDED LOG" screen of CNC.
Refer to this screen when the communication does not start.

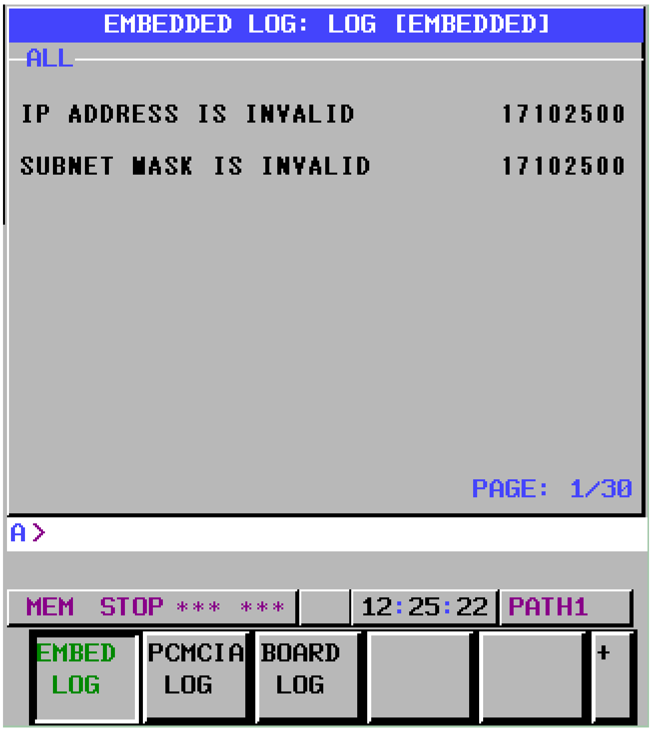


Fig. 9.7.4 The log screen of embedded Ethernet

Connection log	Meanings and countermeasures
Cat6Err: PDU = *m, n,* [*x*] *date time* Cat6Err: PDU = *n,* [*x*] *date time* Cat6Err: TaskTimeOut[*x*] *date time*	An error has occurred during the online communication. *m, n*: Online communication information that is internal information of a system. x: Error information 6001 PMC does not support the Ethernet. Confirm the Series/Edition of PMC software. 6003 Unsupported command data was received. Confirm the Series/Edition of Ethernet board software. 6004 There was an error in command data. Confirm the Series/Edition of Ethernet board software. 6005 PMC does not receive command data. Confirm the communication status at the online setting screen of PMC. 6010 PMC does not receive command data. Confirm if "HIGH SPEED = USE" is selected and other application is not connected at the online setting screen of PMC. 6011 Time-out error occurred at PMC. Increase the value of "Time Out" in [Network Address] of [Communication] menu for FANUC LADDER-III or Ladder Editing Package. 6012 PMC does not receive command data because it is busy for processing. Confirm the communication status at the online setting screen of PMC. 6013 Time-out error occurred at PMC. Increase the value of "Time Out" in [Network Address] of [Communication] menu for FANUC LADDER-III or Ladder Editing Package. 6101 PMC received an unsupported function code. Confirm the Series/Edition of PMC software. *date time* : The time when the error occurred. Ex.) "0323" means March 23rd. "1858" means 6:58 PM. "21161714" means 21st 4:17 PM 14 seconds.

9.8 DISPLAYING AND SETTING SYSTEM PARAMETERS ([SYSTEM PARAM] SCREENS)

On the SYSTEM PARAMETER screen, you can display and set the following data items:

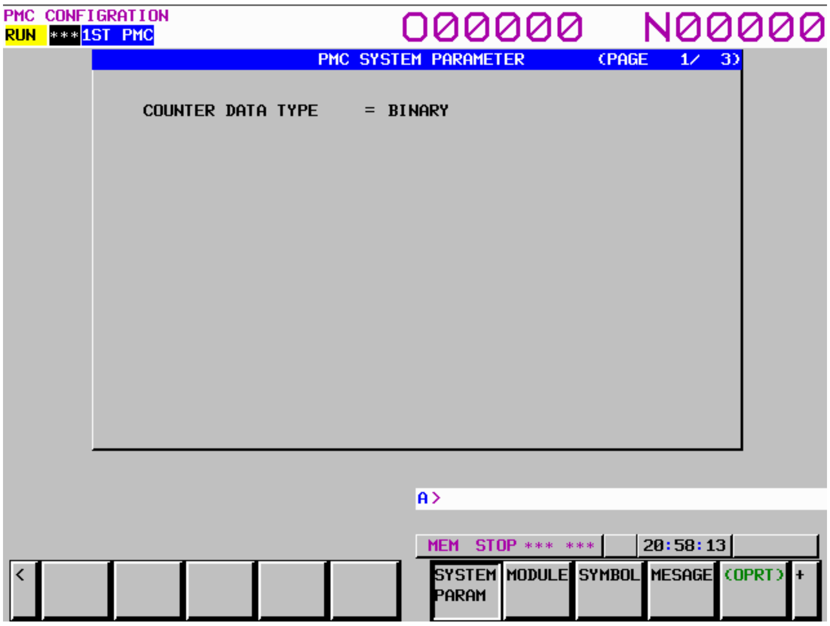
- Counter data type
- Parameters for an FS0 operator's panel
- Parameters for the selectable I/O Link assignment function

To switch to each data display/setting screen, use the page keys.

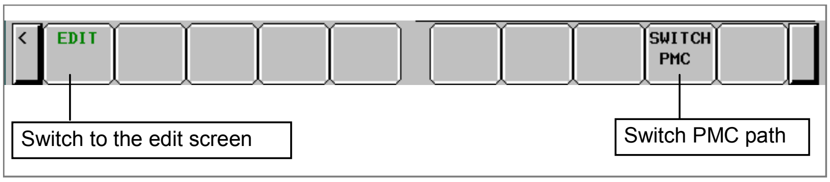
9.8.1 Displaying and Setting the Counter Data Type

Display and set the type of counter data used by the functional instruction counter.
Set the BINARY or the BCD.

Display screen



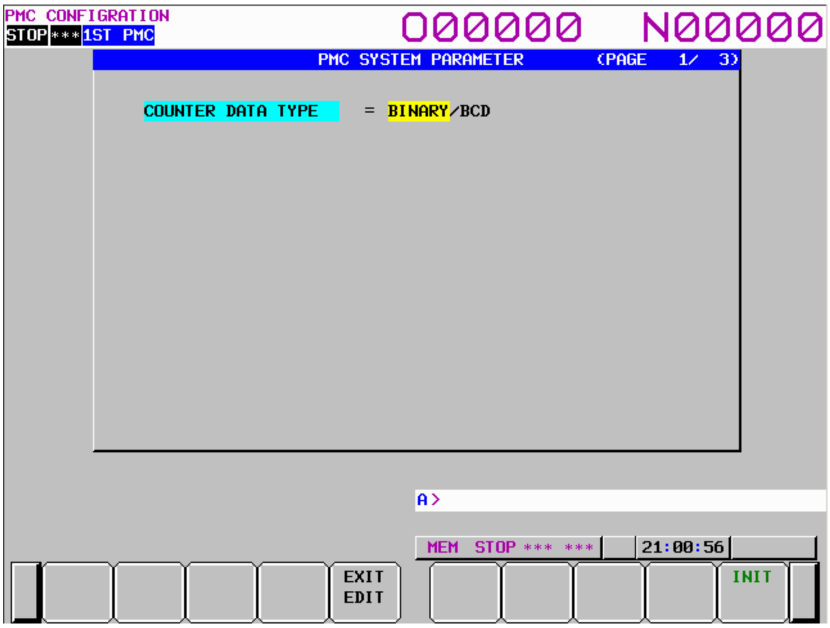
Screen operation



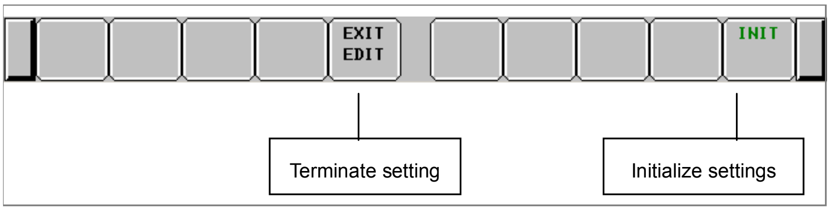
(1) Operation using the soft key
[EDIT] Switch to the edit screen
Switches to the system parameter edit screen.
[SWITCH PMC] Switching PMC path or divided ladder programs
Switches PMC path or divided ladder program. For details of the operation, refer to “6.3”.
By setting keep relay K935.0 to 1, you can display PMC program list screen. For details, refer to ”2.2.11”.

> ⚠ **CAUTION**
> When the programmer protection function is enabled, the [EDIT] soft key appears and is available. When the online monitor function is enabled, you cannot move to the system parameter edit screen. For details, see Section 6.2.

Setting screen



Screen operation



(1) Operation using the soft key
(a) [EXIT EDIT] Terminate setting
Switches to the system parameter display screen.

> ⚠ **CAUTION**
> After changing the data type, set the counter value again.
> See Subsection 7.3.2.

(b) [INIT] Initialize settings
Initializes all system parameters.

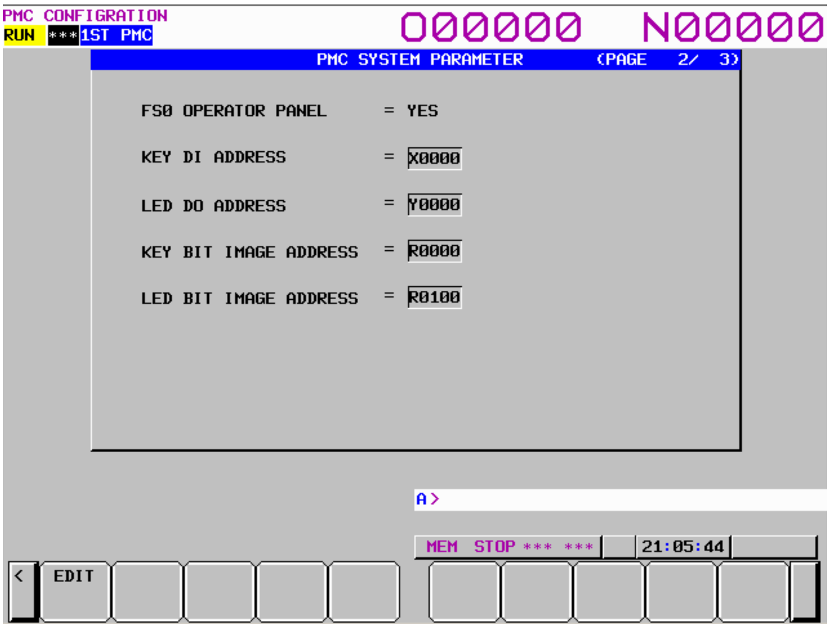
(2) Screen operation using other keys
Use cursor keys to switch between BINARY and BCD.

(3) RETURN key operation
On the system parameter edit screen, the return key operation is disabled. To terminate system parameter editing and return to the system parameter display screen, use the [EXIT EDIT] soft key.

9.8.2 Displaying and Setting Parameters for an FS0 Operator's Panel

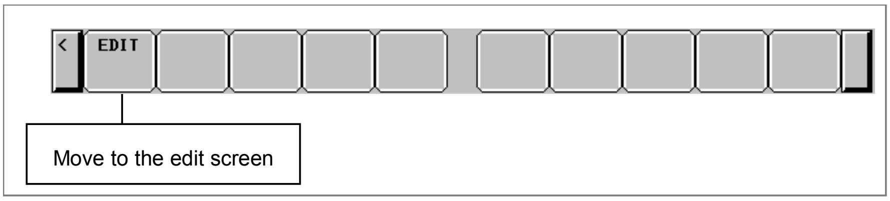
Display and set parameters for using an FS0 operator's panel.

Display screen



- FS0 OPERATOR PANEL Whether to use an FS0 operator's panel
- KEY DI ADDRESS Start address of actually connected external DI
- LED DO ADDRESS Start address of actually connected external DO
- KEY BIT IMAGE ADDRESS Start address of the key image referenced by user programs
- LED BIT IMAGE ADDRESS Start address of the LED image generated by user programs

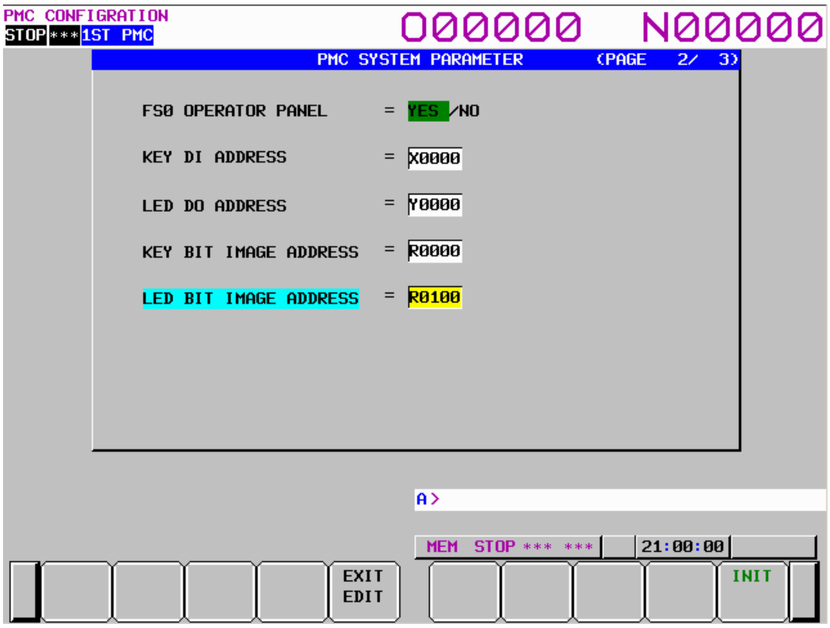
Screen operation



(1) Operation using the soft key
[EDIT] Switch to the edit screen
Switches to the system parameter edit screen.

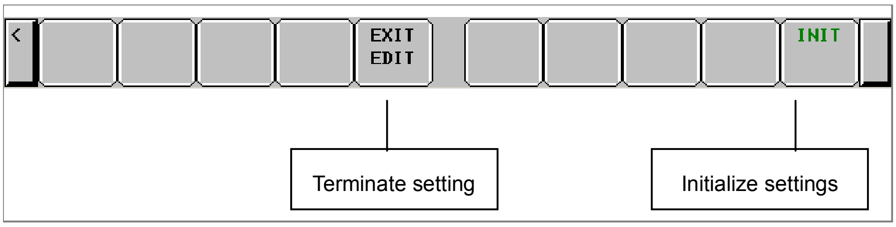
> ⚠ **CAUTION**
> When the programmer protection function is enabled, the [EDIT] soft key appears and is available. When the online monitor function is enabled, you cannot move to the system parameter edit screen. For details, see Section 6.2.

Setting screen



- FS0 OPERATOR PANEL
  Specify whether to connect an FS0 operator's panel. When setting this item to YES, set the addresses of the actual DI and DO connected to the operator's panel, address of the key image transferred from the operator's panel, and address of the LED image transferred to the operator's panel.
- KEY DI ADDRESS
  Set the start address of the actually connected external DI with a PMC address (X0 to X127, X200 to X327, X400 to X527, or X600 to X727).
- LED DO ADDRESS
  Set the start address of the actually connected external DO with a PMC address (Y0 to Y127, Y200 to Y327, Y400 to Y527, or Y600 to Y727).
- KEY BIT IMAGE ADDRESS
  Set the start address of the key image referenced by user programs with a PMC address. Normally, set an internal relay (R) area.
- LED BIT IMAGE ADDRESS
  Set the start address of the LED image generated by user programs with a PMC address. Normally, set an internal relay (R) area.

Screen operation



(1) Operation using the soft key
   (a) [EXIT EDIT] Terminate setting
      Switches to the system parameter display screen.
   (b) [INIT] Initialize settings
      Initializes all system parameters.

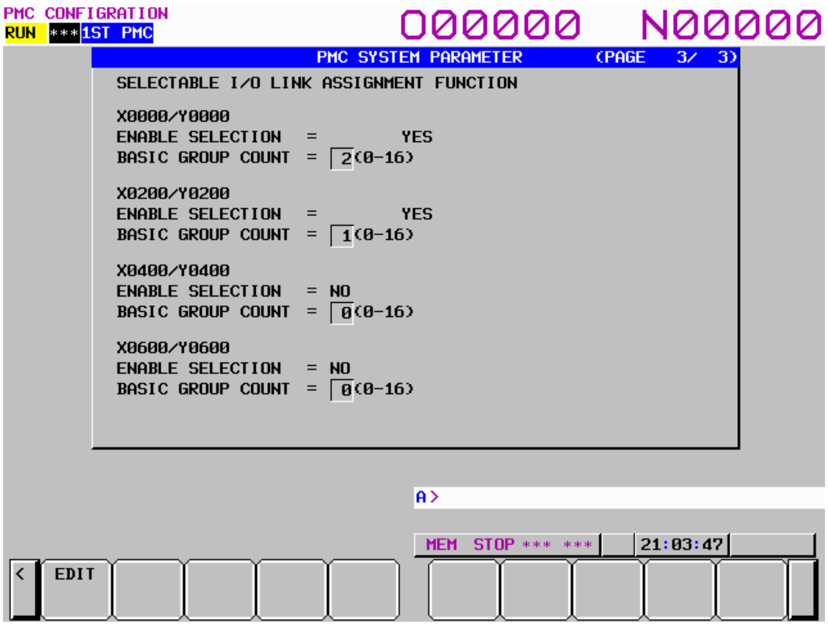
(2) Screen operations using other keys
Use the [↑] and [↓] cursor keys to change the item to be edited.
Use the [←] and [→] cursor keys to change the setting.

(3) RETURN key operation
On the system parameter edit screen, the return key operation is disabled. To terminate system parameter editing and return to the system parameter display screen, use the [EXIT EDIT] soft key.

9.8.3 Displaying and Setting Parameters for the Selectable I/O Link Assignment Function

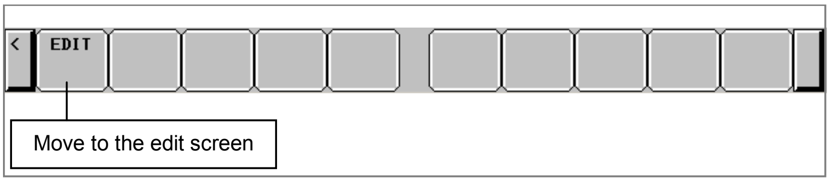
Display and set parameters for using the selectable I/O Link assignment function.

Display screen



- ENABLE SELECTION
  Whether to enable or disable the selectable I/O Link assignment function
- BASIC GROUP COUNT
  Number of groups always enabled for any machine configuration

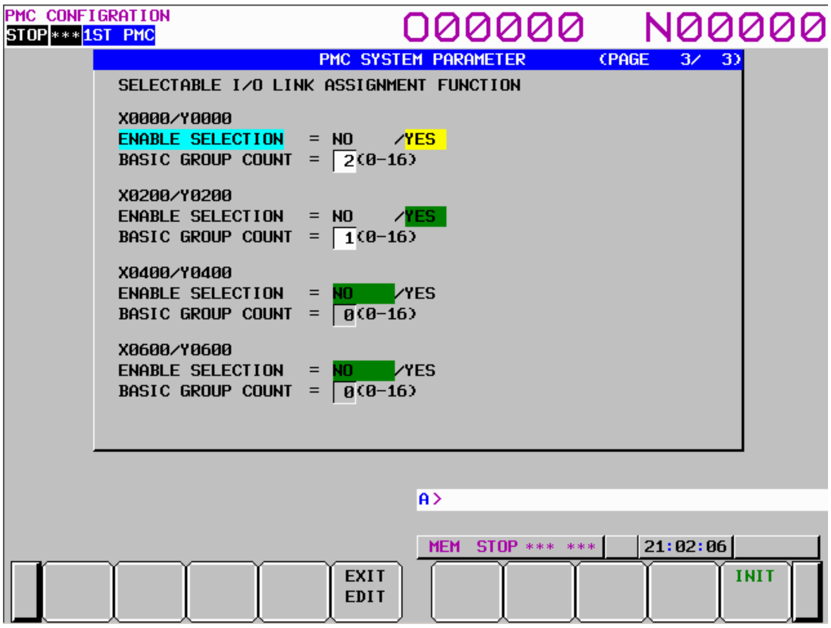
Screen operation



(1) Operation using the soft key
  (a) [EDIT] Switch to the edit screen
    Switches to the system parameter edit screen.

> ⚠ **CAUTION**
> When the programmer protection function is enabled, the [EDIT] soft key appears and is available. When the online monitor function is enabled, the system parameter edit screen cannot be displayed. For details, see Section 6.2.

Setting screen

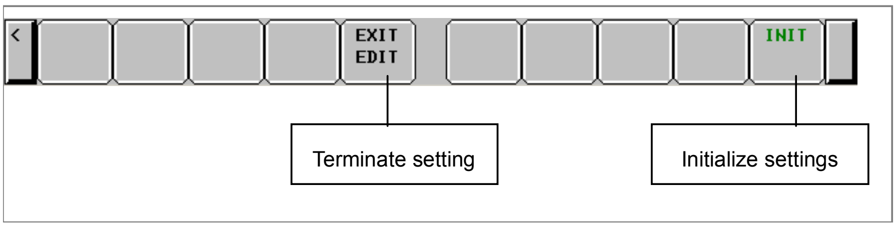


- ENABLE SELECTION
  Specify whether to enable or disable the selectable I/O Link assignment function with YES or NO. The initial setting is NO (disabled).
- BASIC GROUP COUNT
  Set the number of groups always enabled for any machine configuration.

> ⚠ **CAUTION**
> When enabling this function, set the setting parameters (K920 to K927 described below) properly according to the actually connected I/O devices. If this function is enabled, but the DI/DO area is not assigned to a hardware channel, the function does not operate.

> **NOTE**
> The parameters can be set only for available channels according to the I/O Link configuration. For a channel for which the parameters cannot be set, the BASIC GROUP COUNT field is left blank.

Screen operation



(1) Operation using the soft key
  (a) [EXIT EDIT] Terminate setting
    Switches to the system parameter display screen.
  (b) [INIT] Initialize settings
    Initializes all system parameters.

(2) Screen operations using other keys
Use the [↑] and [↓] cursor keys to change the item to be edited.
Use the [←] and [→] cursor keys to change the setting.

(3) RETURN key operation
On the system parameter edit screen, the return key operation is disabled. To terminate system parameter editing and return to the system parameter display screen, use the [EXIT EDIT] soft key.

9.9 DISPLAYING AND SETTING CONFIGURATION PARAMETERS ([CONFIG PARAM] SCREENS)

Configuration parameter setting screens display the following NC parameters related to PMCs in an easy-to-understand manner and facilitate setting.

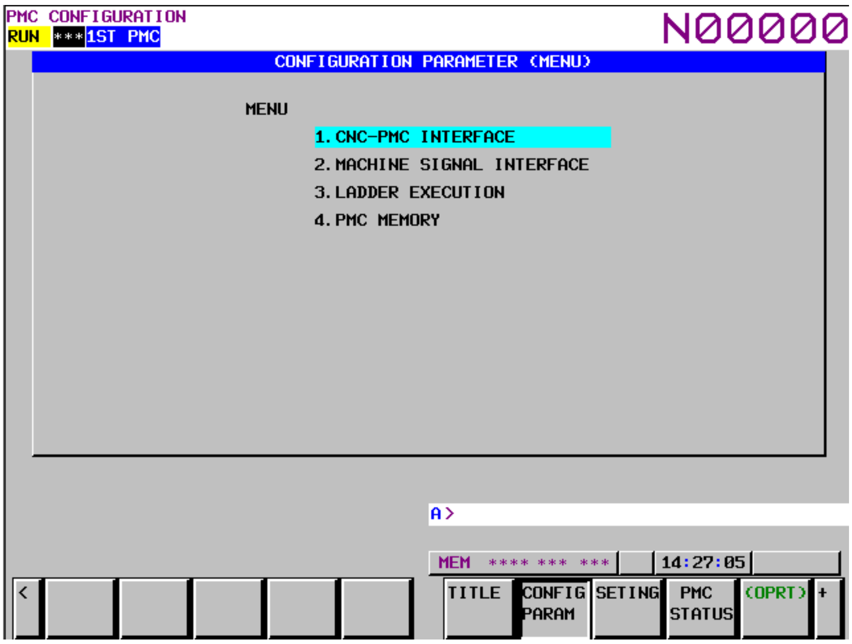
No.	Settings	Remarks
11900 to 11904	Execution priorities of multiple PMCs	LADDER EXEC screen
11905 to 11909	Execution ratios of multiple PMCs	LADDER EXEC screen
11910 to 11912	Input/output addresses of the I/O Link	MACHINE I/F screen
11915 to 11917	Input/output address of dual assignment of I/O Link channel	MACHINE I/F screen
11920 to 11929	G/F addresses of the CNC interface	CNC I/F screen
11930	Level-1 execution cycle	LADDER EXEC screen
11931	Start/stop mode of multiple PMCs	LADDER EXEC screen
11940 to 11944	PMC Memory type	PMC MEMORY screen

⚠ **CAUTION**
1 For details of each NC parameter, see Subsection 2.4.3.
2 After setting these NC parameters, turn the power off, then on again.

9.9.1 Menu for Setting Configuration Parameters

There are the following PMC configuration parameter setting screens.
- The MENU screen
- The CNC-PMC INTERFACE screen
- The MACHINE SIGNAL INTERFACE screen
- The LADDER EXECUTION screen
- The PMC MEMORY screen

Move to each setting screen from the MENU screen.



Soft key on the PMC CONFIGRATION PARAMETER (MENU) screen

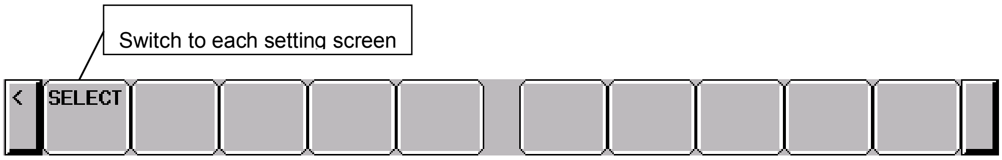


Fig. 9.9.1 Soft key on the PMC CONFIGRATION PARAMETER (MENU) screen

(1) Operation using the soft key
 (a) [SELECT] Switch to each setting screen

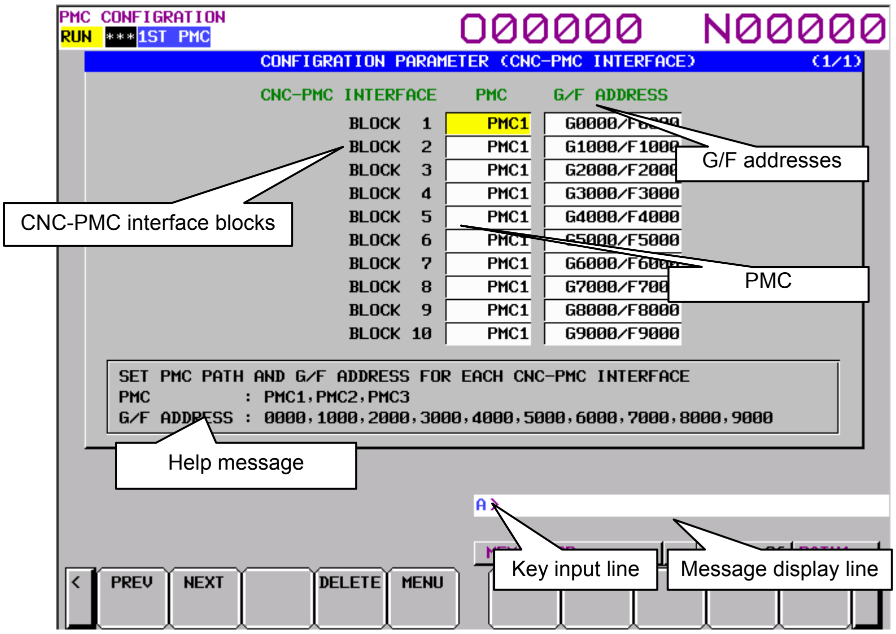
> **NOTE**
> Each setting screen can be protected using the programmer protection function. If a setting screen is protected, the [SELECT] soft key is not displayed.

(2) Screen operation using other keys
 Use cursor keys to switch to a desired setting item.

9.9.2 Setting the CNC-PMC Interface

On the PMC CONFIGRATION PARAMETER (CNC-PMC INTERFACE) screen, set a correspondence between the G/F addresses of each PMC and CNC-PMC interface.

> **NOTE**
> For details of the CNC-PMC interface, see the description of the CNC-PMC interface in Subsection 2.4.3.



PMC CONFIGRATION PARAMETER (CNC-PMC INTERFACE) screen

(1) CNC-PMC INTERFACE
Displays the number of each CNC-PMC interface block.

BLOCK 1:	G0000 to G0768/F0000 to F0768 viewed from the CNC
BLOCK 2:	G1000 to G1768/F1000 to F1768 viewed from the CNC
BLOCK 3:	G2000 to G2768/F2000 to F2768 viewed from the CNC
BLOCK 4:	G3000 to G3768/F3000 to F3768 viewed from the CNC
BLOCK 5:	G4000 to G4768/F4000 to F4768 viewed from the CNC
BLOCK 6:	G5000 to G5768/F5000 to F5768 viewed from the CNC
BLOCK 7:	G6000 to G6768/F6000 to F6768 viewed from the CNC
BLOCK 8:	G7000 to G7768/F7000 to F7768 viewed from the CNC
BLOCK 9:	G8000 to G8768/F8000 to F8768 viewed from the CNC
BLOCK 10:	G9000 to G9768/F9000 to F9768 viewed from the CNC

(2) PMC
Assign a PMC to each CNC-PMC interface block.
PMC1: First PMC
PMC2: Second PMC
PMC3: Third PMC
PMC4: Forth PMC
PMC5: Fifth PMC

(3) G/F ADDRESS
Set the start G/F addresses.

NOTE

If an invalid value is set for the NC parameter, "ILLEGAL" is displayed as shown below:

BLOCK 3	ILLEGAL	ILLEGAL

(4) Help message
A help message for operation is displayed.

(5) Example of screen setting and corresponding NC parameter settings

CNC-PMC INTERFACE	PMC	G/F ADDRESS
BLOCK 1	PMC1	G0000/F0000
BLOCK 2	PMC1	G1000/F1000
BLOCK 3	PMC1	G2000/F2000
BLOCK 4	PMC1	G3000/F3000
BLOCK 5	PMC1	G4000/F4000
BLOCK 6	PMC1	G5000/F5000
BLOCK 7	PMC2	G0000/F0000
BLOCK 8	PMC2	G1000/F1000
BLOCK 9	PMC3	G0000/F0000
BLOCK 10	PMC3	G1000/F1000

When values are set on the screen as shown in the figure above, the following settings are input for the corresponding NC parameters:

Block number	NC parameter number	Setting
1	11920	100
2	11921	101
3	11922	102
4	11923	103
5	11924	104
6	11925	105
7	11926	200
8	11927	201
9	11928	300
10	11929	301

NOTE

This screen can be protected from editing using the programmer protection function.

Screen operation

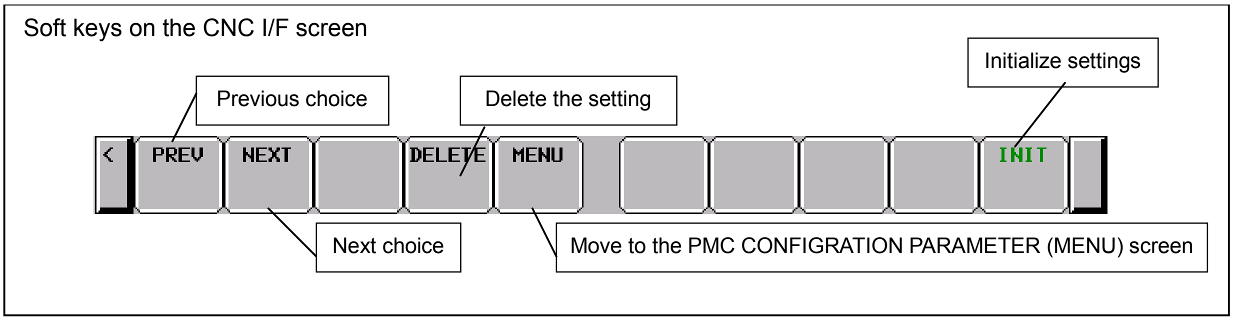


Fig. 9.9.2 Soft keys on the CNC-PMC INTERFACE screen

(1) Operations using the soft keys

(a) [PREV] Previous choice
[NEXT] Next choice
Inputs the value of the previous or next choice for the item at the cursor like a toggle switch.

To select a PMC

PREV NEXT

PMC1
PMC2
PMC3
PMC4
PMC5

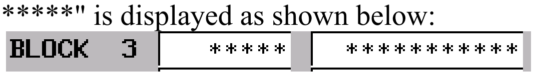
To select G/F addresses

PREV NEXT

G0000 to G0768/F0000 to F0768
G1000 to G1768/F1000 to F1768
G2000 to G2768/F2000 to F2768
G3000 to G3768/F3000 to F3768
G4000 to G4768/F4000 to F4768
G5000 to G5768/F5000 to F5768
G6000 to G6768/F6000 to F6768
G7000 to G7768/F7000 to F7768
G8000 to G8768/F8000 to F8768
G9000 to G9768/F9000 to F9768

This soft key is displayed and can be operated only when editing is allowed.

(b) [DELETE] Delete the setting
Deletes the setting of the item at the cursor.
After data is deleted, "*****" is displayed as shown below:



This soft key is displayed and can be operated only when editing is allowed.

> ⚠ **CAUTION**
> When the NC parameters are all set to 0, the initial status (for the initial status, see (d)) is set. Deleting all items with this operation is equivalent to setting the initial status. For this reason, if an attempt is made to delete the last item, the following message appears and the item cannot be deleted:
> "LAST SETTING DATA CAN NOT BE DELETED."

(c) [MENU] Switch to the MENU screen
Switches to the MENU screen.

(d) [INIT] Initialize settings
Initializes the interface settings.
This soft key is displayed and can be operated only when editing is allowed.
The initial settings are as follows:

CNC-PMC INTERFACE	PMC	G/F ADDRESS
BLOCK 1	PMC1	G0000/F0000
BLOCK 2	PMC1	G1000/F1000
BLOCK 3	PMC1	G2000/F2000
BLOCK 4	PMC1	G3000/F3000
BLOCK 5	PMC1	G4000/F4000
BLOCK 6	PMC1	G5000/F5000
BLOCK 7	PMC1	G6000/F6000
BLOCK 8	PMC1	G7000/F7000
BLOCK 9	PMC1	G8000/F8000
BLOCK 10	PMC1	G9000/F9000

(2) Screen operations using other keys
Cursor keys
Use them to change the CNC-PMC interface block to be set.

INPUT key
You can also set an item by entering a numeric value or string and pressing the INPUT key.
To set a PMC
- Enter PMC1, PMC2, PMC3, PMC4 or PMC5.
- Enter a numeric value 1, 2, 3, 4 or 5.

To set G/F addresses
- Enter a displayed string such as G0000/F0000.
- Enter a start address such as 0, 1000, or 2000.

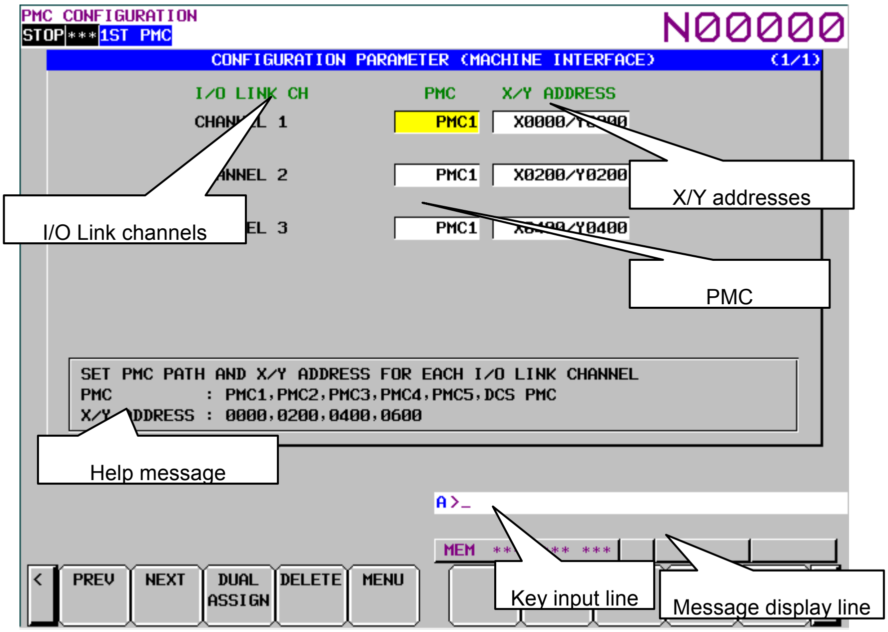
> ⚠ **CAUTION**
> 1 You can set an item on this screen regardless of the NC mode.
> 2 If data is duplicate, the data is displayed in red and the following message appears:
> "DUPLICATE G/F ADDRESS"

9.9.3 Setting the Machine Signal Interface

On the PMC CONFIGRATION PARAMETER (MACHINE INTERFACE) screen, set the input/output addresses of the I/O Link.

NOTE

1 For details of input/output addresses of the I/O Link, see the description of input/output addresses of the I/O Link in Subsection 2.4.3.
2 For details of input/output addresses for virtual channels of the I/O Link channel split function, see the description of Input/output addresses of dual assignment of I/O Link channel in Subsection 2.4.3.



PMC CONFIGRATION PARAMETER (MACHINE INTERFACE) screen

(1) I/O Link CH
Displays I/O Link channel numbers.

(2) PMC
Displays each PMC.

PMC1:	First PMC
PMC2:	Second PMC
PMC3:	Third PMC
PMC4:	Forth PMC
PMC5:	Fifth PMC
DCSPMC:	Dual check safety ladder

(3) X/Y ADDRESS
Set the start X/Y addresses.

NOTE

If an invalid value is set for the NC parameter, "ILLEGAL" is displayed as shown below:

CHANNEL 2 ILLEGAL ILLEGAL

(4) Help message
A help message for operation is displayed.

> **NOTE**
> This screen can be protected from editing using the programmer protection function.

Screen operation

Soft keys on the MACHINE SIGNAL INTERFACE screen

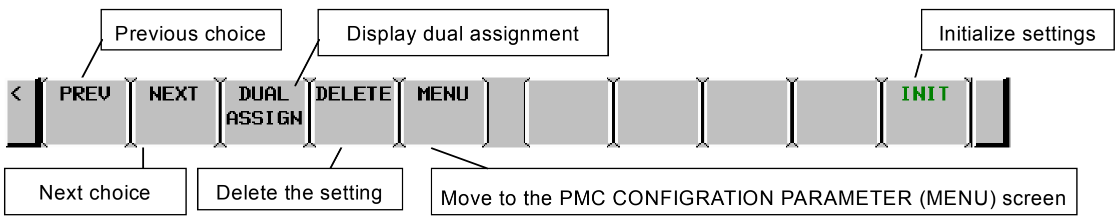
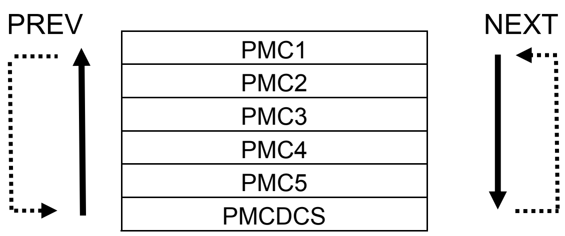


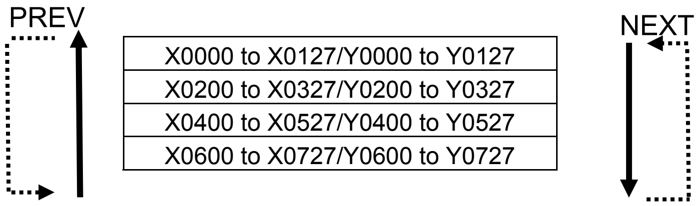
Fig. 9.9.3 Soft keys on the MACHINE SIGNAL INTERFACE screen

(1) Operations using the soft keys
(a) [PREV] Previous choice
[NEXT] Next choice
Inputs the value of the previous or next choice for the item at the cursor like a toggle switch.

To select a PMC



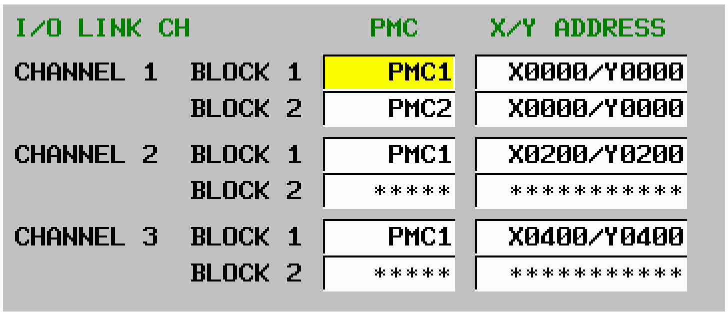
To select X/Y addresses



This soft key is displayed and can be operated only when editing is allowed.

(b) [DUAL ASSIGN] Display of dual assignment
Setting items (BLOCK 2) of dual assignment of I/O link channel are displayed. They are already displayed when they have been set. This soft key is displayed and can be operated only when editing is allowed.

Example : Set the second block of channel 1

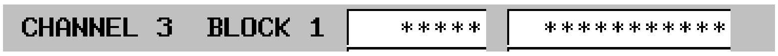


Setting of dual assignment of I/O link channel

These settings reflect NC parameters of "I/O link input/output address" and "input/output address of dual assignment of I/O link channel" as follows.

NC parameter number	Setting	Meaning
11910	100	Assign X/Y0 to X/Y127 of the first PMC to the first block of channel 1.
11915	200	Assign X/Y0 to X/Y127 of the second PMC to the second block of channel 1.
11911	101	Assign X/Y200 to X/Y327 of the first PMC to channel 2.
11916	0	Second block is not used in channel 2.
11912	102	Assign X/Y400 to X/Y527 of the first PMC to channel 3.
11917	0	Second block is not used in channel 3.

(c) [DELETE] Delete the setting
Deletes the setting of the item at the cursor.
After data is deleted, "*****" is displayed as shown below:

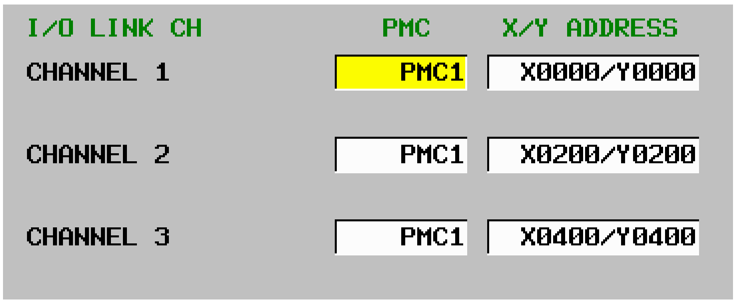


This soft key is displayed and can be operated only when editing is allowed.

> ⚠ **CAUTION**
> When the NC parameters are all set to 0, the initial status (for the initial status, see (e)) is set. Deleting all items with this operation is equivalent to setting the initial status. For this reason, if an attempt is made to delete the last item, the following message appears and the item cannot be deleted:
> "LAST SETTING DATA CAN NOT BE DELETED."

(d) [MENU] Switch to the MENU screen
Switches to the MENU screen.

(e) [INIT] Initialize settings
Initializes the interface settings.
This soft key is displayed and can be operated only when editing is allowed.
The initial settings are as follows:



(2) Screen operations using other keys

Cursor keys

Use them to change the I/O Link channel to be set.

INPUT key

You can also set an item by entering a numeric value or string and pressing the INPUT key.

To set a PMC

- Enter PMC1, PMC2, PMC3, PMC4, PMC5 or DCSPMC.
- Enter a numeric value 1, 2, 3, 4, 5 or S.

To set X/Y addresses

- Enter a displayed string such as X0000/Y0000.
- Enter a start address such as 0, 200,400 or 600.

NOTE

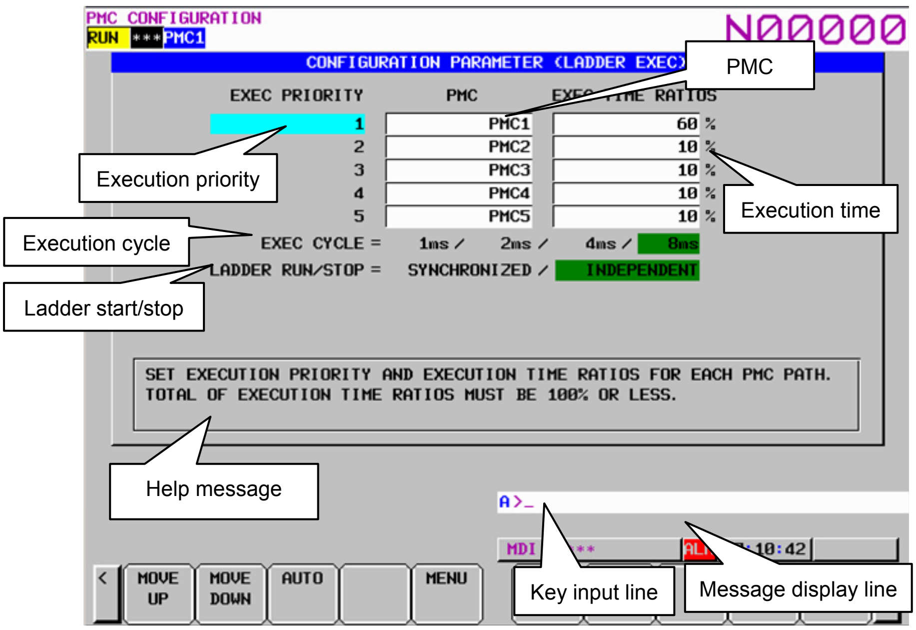
1 You can set an item on this screen regardless of the NC mode.

2 If data is duplicate, the data is displayed in red and the following message appears:
"DUPLICATE X/Y ADDRESS"

9.9.4 Setting the Parameters Related to Ladder Execution

On the PMC CONFIGRATION PARAMETER (LADDER EXEC) screen, set the execution priorities of multiple PMCs, execution ratios of multiple PMCs, level-1 execution cycle, and start/stop control of multiple PMCs.

NOTE
1 For details of execution priorities of multiple PMCs, see the description of execution priorities of multiple PMCs in Subsection 2.4.3.
2 For details of execution ratios of multiple PMCs, see the description of execution ratios of multiple PMCs in Subsection 2.4.3.
3 For details of the level-1 execution cycle, see the description of level-1 execution cycle in Subsection 2.4.3.
4 For details of the start/stop mode of multiple PMCs, see the description of start/stop control of multiple PMCs in Subsection 2.4.3.



(1) EXEC PRIORITY PMC EXEC TIME RATIOS
Displays and sets the execution priority of each PMC. Also displays and sets the execution time ratio of each PMC.

NOTE
If an invalid value is set for the NC parameter, "ILLEGAL" is displayed as shown below:

3	ILLEGAL	10 %

(2) EXEC CYCLE
Set the PMC execution cycle.
PMC execution cycle is different by PMC type.

⚠ **CAUTION**
If an invalid value is set for the NC parameter, the cursor is not displayed. Press the [INIT] soft key to release the invalid state.

(3) LADDER RUN/STOP
Specify whether to start/stop the ladder programs of multiple PMCs synchronously or control the start/stop of the ladder program of each PMC independently.

(4) Help message
A help message for operation is displayed.

> **NOTE**
> This screen can be protected from editing using the programmer protection function.

Screen operation

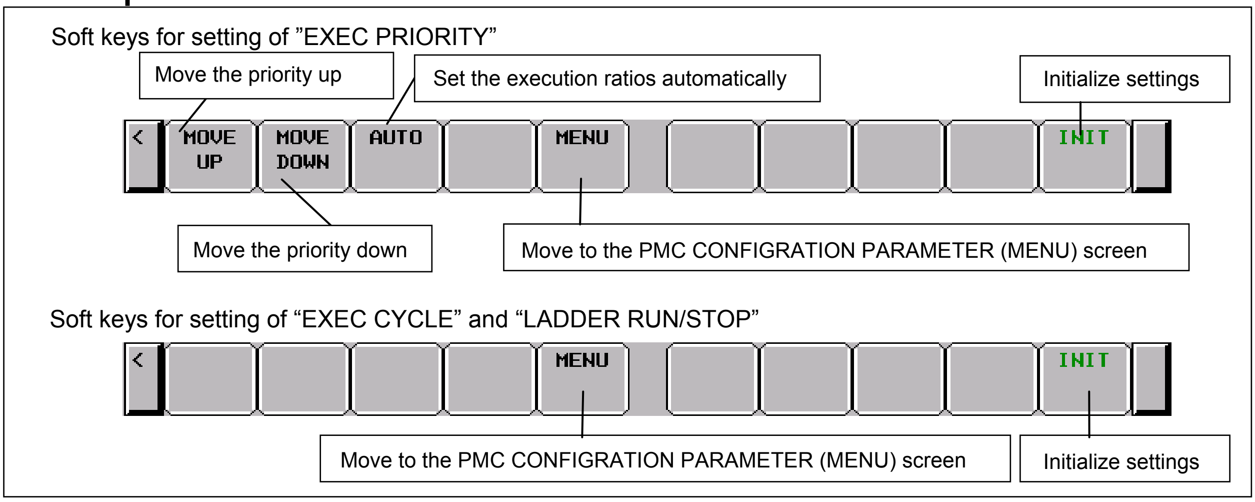


Fig. 9.9.4 Soft keys on the LADDER EXECUTION screen

(1) Operations using the soft keys
 (a) [MOVE UP] Move the execution priority up
 Moves a PMC set under EXEC PRIORITY and changes its execution priority.
 The execution time ratio is not changed with this operation because it is determined by the execution sequence.
 This soft key is displayed only when the execution priority is to be set.
 (b) [MOVE DOWN] Move the execution priority down
 Moves a PMC set under EXEC PRIORITY and changes its execution priority.
 The execution time ratio is not changed with this operation because it is determined by the execution sequence.
 This soft key is displayed only when the execution priority is to be set.

 (c) [AUTO] Set the execution time ratios automatically
 Automatically sets the execution time ratios according to the actual number of steps in the ladder programs.
 This soft key is displayed only when the execution priority is to be set.
 Example: When PMC1 = 15000 steps, PMC2 = 6000steps, PMC3 = 5000steps, PMC4 = 1500 steps, PMC5 = 1500steps

 PMC1 = 15000 / (15000 + 6000 + 6000 + 1500 + 1500) = 50%
 PMC2 = 6000 / (15000 + 6000 + 6000 + 1500 + 1500) = 20%
 PMC3 = 6000 / (15000 + 6000 + 6000 + 1500 + 1500) = 20%
 PMC4 = 1500 / (15000 + 6000 + 6000 + 1500 + 1500) = 5%
 PMC5 = 1500 / (15000 + 6000 + 6000 + 1500 + 1500) = 5%

(d) [MENU] Switch to the MENU screen
Switches to the MENU screen.

(e) [INIT] Initialize settings
It initializes the settings.
- EXEC PRIORITY: Set to the default setting.

When the values are all set to 0, the following default setting is used.
When only the first PMC is used

EXEC PRIORITY	PMC	EXEC RATIOS
1	PMC1	100%
2	–	0%
3	–	0%

When the first and second PMCs are used

EXEC PRIORITY	PMC	EXEC RATIOS
1	PMC1	85%
2	PMC2	15%
3	–	0%

When the first, second, and third PMCs are used

EXEC PRIORITY	PMC	EXEC RATIOS
1	PMC1	75%
2	PMC2	15%
3	PMC3	10%

When the first, second, third and forth PMCs are used

EXEC PRIORITY	PMC	EXEC RATIOS
1	PMC1	70%
2	PMC2	10%
3	PMC3	10%
4	PMC4	10%

When the first, second, third, forth and fifth PMCs are used

EXEC PRIORITY	PMC	EXEC RATIOS
1	PMC1	60%
2	PMC2	10%
3	PMC3	10%
4	PMC4	10%
5	PMC5	10%

- EXEC CYCLE : 8msec
- LADDER RUN/STOP : INDEPENDENT

NOTE
If an invalid value is set for the NC parameter, press the [INIT] soft key to release the invalid state.

(2) Screen operations using other keys
Cursor keys
Use them to set an item for EXEC CYCLE and LADDER RUN/STOP.

INPUT key

Use this key to input the execution time ratio in units of 1%.
If the total of values set for the PMCs exceeds 100%, the following error message appears:
"TOTAL OF EXEC RATIO IS OVER 100%."

> ⚠ **CAUTION**
> 1 You can set an item on this screen regardless of the NC mode.
> 2 When the NC parameters are all set to 0, the initial status (for the initial status, see (e) in (1)) is set. Setting all execution time ratios to 0 with this operation is equivalent to setting the initial status. For this reason, if an attempt is made to set the last item to 0, the following message appears and the item cannot be set to 0:
> "CANNOT SET 0% TO ALL EXECUTION TIME RATIOS."

9.9.5 Setting the PMC Memory Type

On the PMC CONFIGURATION PARAMETER(PMC MEMORY) screen, you can change the PMC Memory Type of each PMC path.
The setting is saved to the CNC parameter and becomes effective after rebooting CNC. See the "2.4.3 CNC Parameters Related to the PMCs" for the details of the CNC parameter.

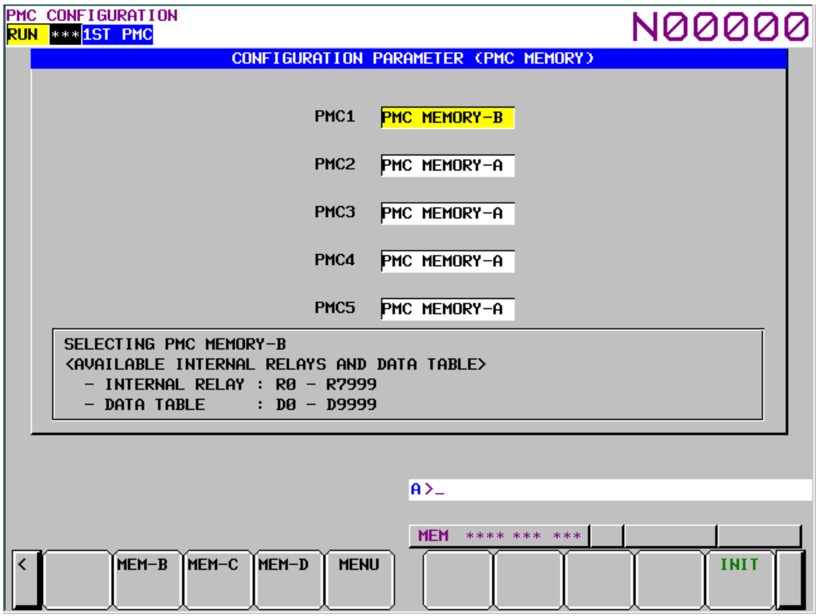


Fig. 9.9.5 (a) PMC CONFIGURATION PARAMETER (PMC MEMORY) screen

> ⚠ **CAUTION**
> PMC nonvolatile memory must be initialized after changing PMC Memory Type. Therefore, make a backup of PMC parameter before changing PMC Memory Type. See "2.8 BATTERY BACKUP DATA" about the operation of initializing PMC nonvolatile memory.

> **NOTE**
> 1 The item of the menu differs by the constitution of software options.
> 2 Selectable PMC Memory Type differs for each PMC path. See the "2.1.3 Determination of PMC Memory Type" for the details of selectable types.

Screen operations

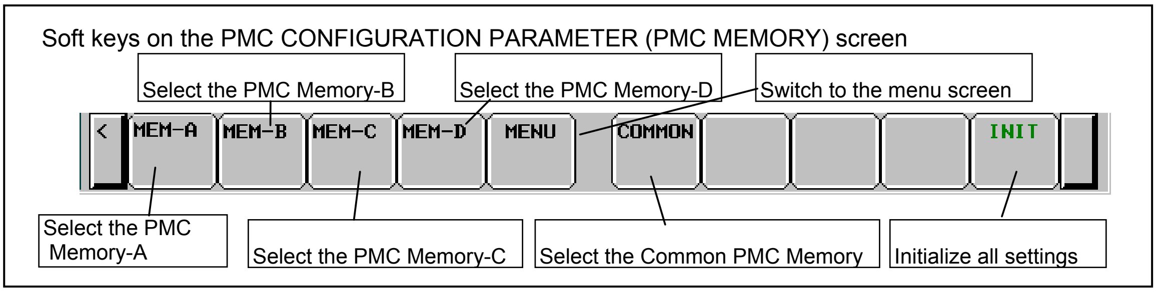


Fig. 9.9.5 (b) Soft keys on the PMC CONFIGURATION PARAMETER (PMC MEMORY) screen

(1) Operation with soft keys

(a) [MEM-A] Select the PMC Memory-A.
Selects the PMC Memory-A for the cursor focused PMC path. This soft key is displayed when the PMC Memory-A is selectable at focused PMC path.

(b) [MEM-B] Select the PMC Memory-B.
Selects the PMC Memory-B for the cursor focused PMC path. This soft key is displayed when the PMC Memory-B is selectable at focused PMC path.

(c) [MEM-C] Select the PMC Memory-C.
Selects the PMC Memory-C for the cursor focused PMC path. This soft key is displayed when the PMC Memory-C is selectable at focused PMC path.

(d) [MEM-D] Select the PMC Memory-D.
Selects the PMC Memory-D for the cursor focused PMC path. This soft key is displayed when the PMC Memory-D is selectable at focused PMC path.

(e) [COMMON] Select the Common PMC Memory mode.
Selects the Common PMC Memory mode to the cursor focused PMC path. This soft key is displayed when the Common PMC Memory mode is selectable at focused PMC path.

(f) [MENU] Switch to the menu screen.
Switches to the CONFIGURATION PARAMETER (MENU) screen.

(g) [INIT] Initialize all settings
Reset all PMC Memory Type of each PMC paths to the default setting.

9.10 DISPLAYING AND EDITING OF I/O Link *i* ASSIGNMENT ([I/O LINK I] SCREEN)

Pressing the [I/O Link i] soft key shows I/O Link *i* assignment data and you can confirm the contents of the I/O devices assignment. In the editing screen, you can edit the I/O Link *i* assignment data and change the assignment of I/O devices.
I/O Link *i* assignment data is stored in I/O configuration data.
The display/edit screens of the I/O Link *i* assignment data are as follows.

(1) I/O CONFIGURATION VIEWER (I/O Link *i* GROUP SETTING) Screen
It displays the group setting of I/O Link *i* assignment data.
(2) I/O CONFIGURATION VIEWER (I/O Link *i* SLOT SETTING) Screen
It displays the slot setting of I/O Link *i* assignment data.
(3) I/O CONFIGURATION VIEWER (I/O Link *i* TITLE) Screen
It displays the tile of I/O Link *i* assignment data.
(4) I/O CONFIGURATION VIEWER (SELECTABLE I/O Link *i* ASSIGNMENT) Screen
It selects the I/O devices groups which are required for each machine.
(5) I/O CONFIGURATION EDITOR (I/O Link *i* GROUP SETTING) Screen
It edits the group setting of I/O Link *i* assignment data.
(6) I/O CONFIGURATION EDITOR (I/O Link *i* SLOT SETTING) Screen
It edits the slot setting of I/O Link *i* assignment data.

NOTE
You are able to protect these screens by the programmer protection function.
For details, refer to subsection "6.2.1".

The flow chart of each screen is as follows:

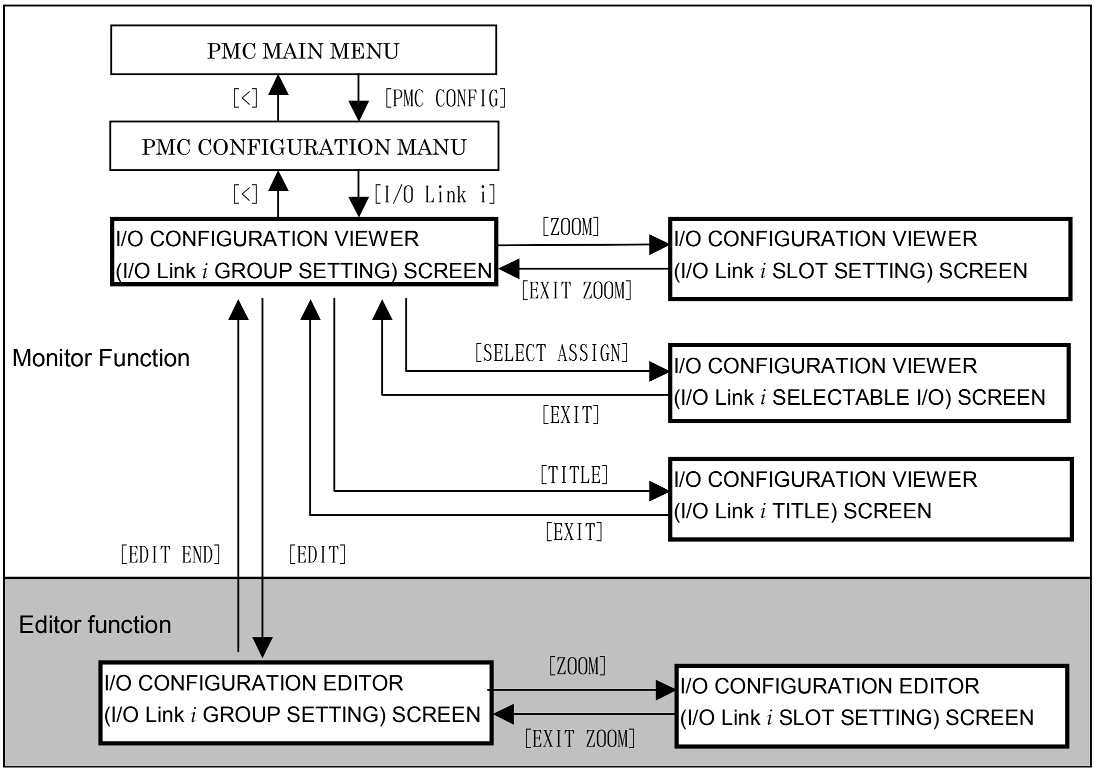


Fig. 9.10 Flow chart of the screens

NOTE

The [EDIT] soft key is available when the setting of "I/O CONF EDIT ENABLE" is "YES" in the programmer protection function. The [SELECT ASSIGN] soft key is available when the setting of "REGISTER I/O DEVICES" is "YES" in the programmer protection function and the selectable assignment function is enabled. For the details, refer to subsection "6.2.1" and "9.10.5".

9.10.1 Displaying of Group Information of I/O Link *i* Assignment Data

In the I/O CONFIGRATION VIEWER (I/O Link *i* GROUP SETTING) screen, you can confirm the contents of the group setting of the I/O Link *i* assignment data. Pressing the [I/O Link i] soft key shows this screen. The following operations can be performed in this screen.

- Go to the VIEWER (I/O Link *i* SLOT SETTING) screen [ZOOM]
- Switch display mode [COMENT],[ATTRIB]
- Switch the channel [SWITCH CHANEL]
- Search for an address [SEARCH]
- Go to the EDITOR (I/O Link *i* group setting) screen [EDIT]
- Go to the VIEWER (I/O Link *i* title) screen [TITLE]
- Go to the VIEWER (I/O Link *i* SELECT ASSIGN) screen [SELECT ASSIGN]

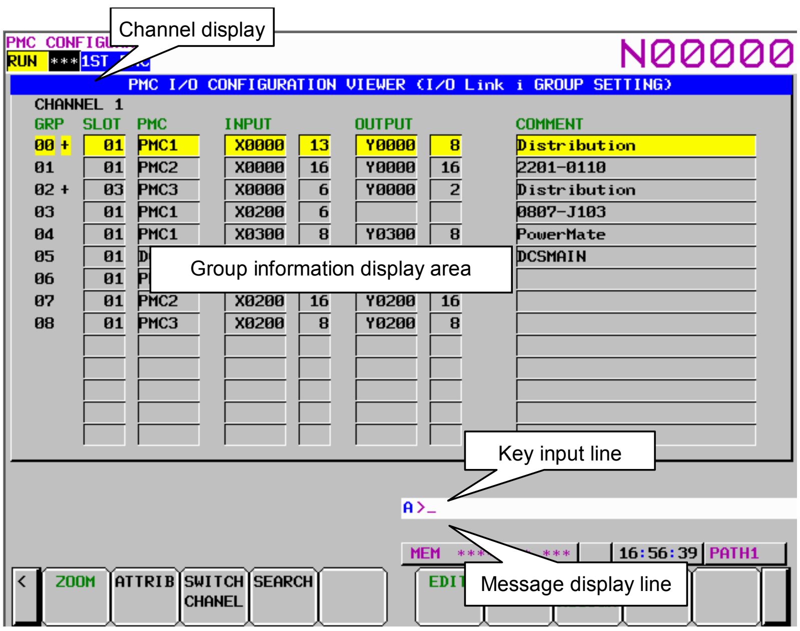


Fig. 9.10.1(a) I/O CONFIGRATION VIEWER (I/O Link *i* GROUP SETTING) screen (Comment display mode)

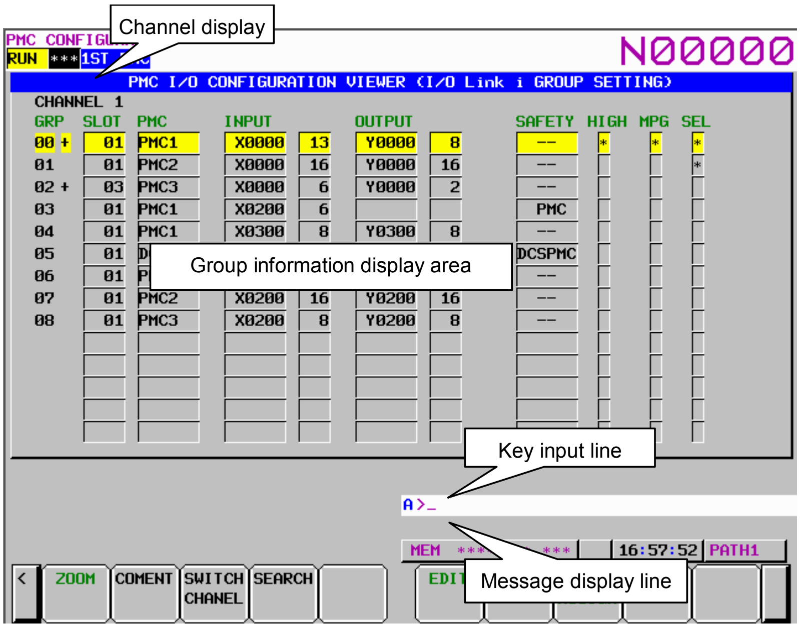


Fig. 9.10.1(b) I/O CONFIGRATION VIEWER (I/O Link *i* GROUP SETTING) screen (Attribute display mode)

Contents of the table

GRP: Displays the group number of assignment location. When plural slots are defined in the group, "+" is displayed at the right side of the group number.

SLOT: Displays the slot number of the top slot.

PMC: Displays the PMC path of the top slot.

INPUT: Displays the X address and data length (byte) of the top slot.

OUTPUT: Displays the Y address and data length (byte) of the top slot.

COMMENT: Displays the comment as for the top slot.

SAFETY: Displays the contents for the safety I/O mode.

Safety I/O mode	Remark
Normal I/O (Default)	--
Safety I/O for DCSPMC	DCSPMC
Safety I/O for PMC1～PMC5	PMC

HIGH: Displays the update cycle for each group.

Update cycle	Remark
Normal mode (2ms) (Default)	(space)
High-speed mode (0.5ms)	*

MPG: Displays existence/non-existence of the manual pulse module foe each ~~every~~ group.

Manual pulse module	Remark
Not use of the manual pulse module (Default)	(space)
Use of the manual pulse module	*

SEL: Displays effective groups.

Selectable status of groups	Remark
Invalid group (Default)	(space)
Effective group	レ
Basic group	*

> **NOTE**
> The data of "SEL" are displayed when the selectable assignment function is enabled in the I/O CONFIGURATION EDITOR (I/O Link *i* GROUP SETTING) screen.

Screen operations

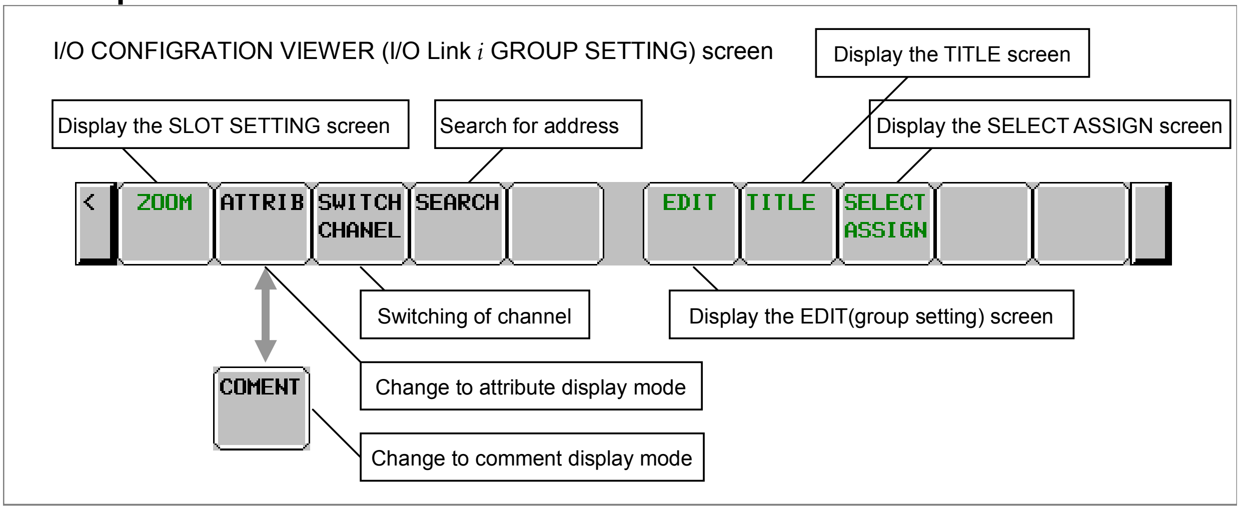


Fig. 9.10.1 (c) Soft keys on I/O CONFIGRATION VIEWER (I/O Link *i* GROUP SETTING) screen

(1) Operations using the soft keys
- (a) [ZOOM] Display the SLOT SETTING screen
  Moves to the I/O CONFIGRATION VIEWER (I/O Link *i* SLOT SETTING) screen.
- (b) [ATTRIB] Change to attribute display mode
  Changes the display mode to the attribute display mode. This soft key appears in the comment display mode.
- (c) [COMENT] Change to comment display mode
  Changes the display mode to the comment display mode. This soft key appears in the attribute display mode.
- (d) [SWITCH CHANEL] Switching of channel
  Switches the channel to display in order.
- (e) [SEARCH] Search for address
  Searches for address corresponding to the input character string and displays a group that includes the address. In the message line, the detail information of slot is displayed. The range for search is all of slots in whole channels.
- (f) [EDIT] Display the EDIT screen
  Moves to the I/O CONFIGRATION EDITOR (I/O Link *i* GROUP SETTING) screen. This soft key appears when the programmer function enables. The password is required when the I/O Link *i* assignment data is protected by password function. Enter the password required in order to edit.
- (g) [TITLE] Display the TITLE screen
  Moves to the I/O CONFIGRATION VIEWER (I/O Link *i* TITLE) screen.
- (h) [SELECT ASSIGN] Display the SELECTABLE ASSIGNMET screen
  Moves to the I/O CONFIGRATION VIEWER (I/O Link *i* SELECTABLE ASSIGNMET) screen.

(2) Operations using other keys

Cursor move key:	Moves the cursor.
Page change key:	Scrolls a page of display data.

9.10.2 Displaying of Slot Information of I/O Link *i* Assignment Data

In the I/O CONFIGURATION VIEWER (I/O Link *i* SLOT SETTING) screen, you can confirm the contents of each slot setting in specified group of the I/O Link *i* assignment data. Pressing the [ZOOM] soft key in the GROUP SETTING screen shows this screen. The following operations can be performed in this screen.

- Search for an address [SEARCH]
- Go to the VIEWER (I/O Link *i* GROUP SETTING) screen [EXIT ZOOM]

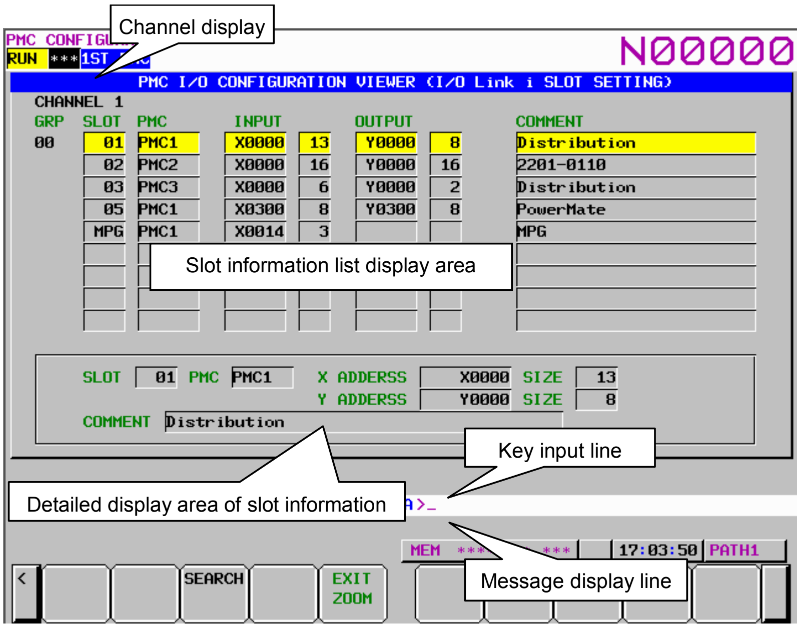


Fig. 9.10.2(a) I/O CONFIGRATION VIEWER (I/O Link *i* SLOT SETTING) screen

Contents of the table

GRP: Displays the group number.
SLOT: Displays the slot number. When the “manual pulse module” is set, the “MPG” is displayed
PMC: Displays the PMC path..
INPUT: Displays the X address and data length (byte) for each I/O device.
OUTPUT: Displays the Y address and data length (byte) for each I/O device.
COMMENT: Displays the comment as for the I/O device

Screen operations

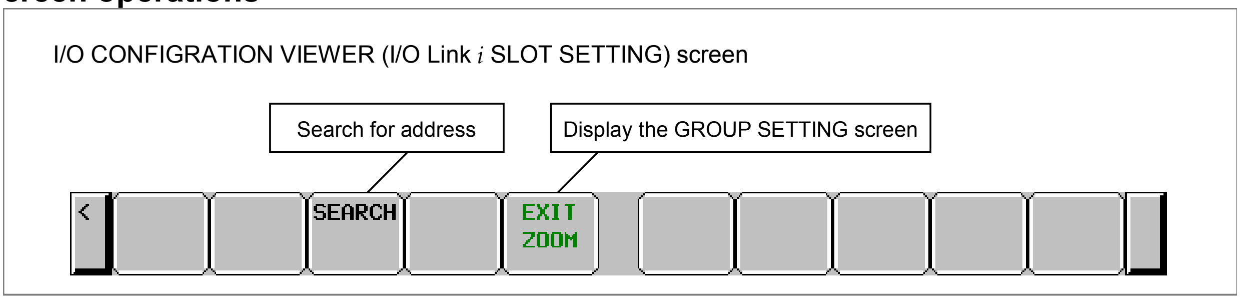


Fig. 9.10.2 (b) soft keys of I/O CONFIGRATION VIEWER (I/O Link *i* SLOT SETTING) screen

(1) Operations using the soft keys
  (a) [SEARCH] Search for address
  Searches for address corresponding to the input character string ~~input address~~ and displays on the screen. The range for search are all of slots in whole channels.

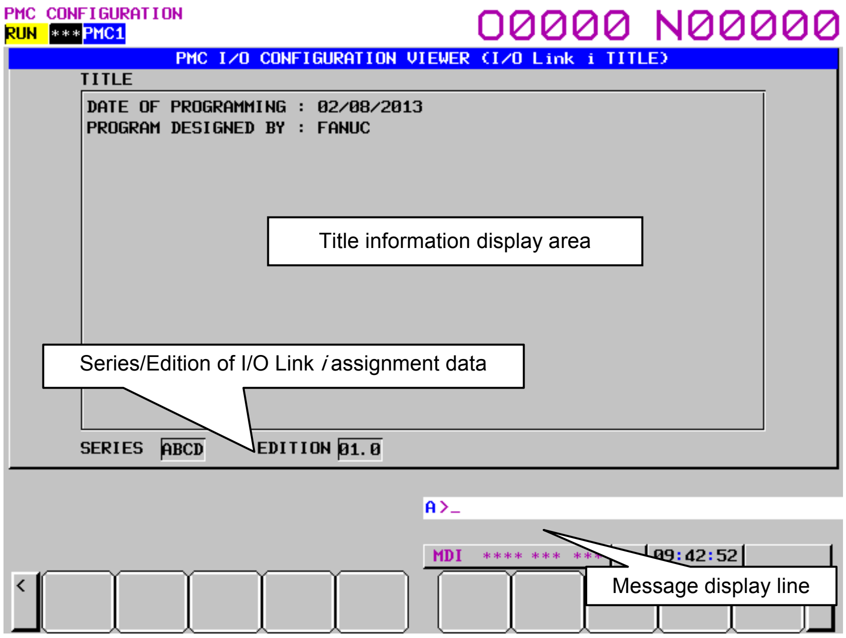
(b) [EXIT ZOOM] Display the I/O Link *i* GROUP SETTING screen
Moves to the I/O CONFIGRATION VIEWER (I/O Link *i* GROUP SETTING) screen.

(2) Operations using other keys
Cursor move key: Moves the cursor.
Page change key: Scrolls a page of display data.

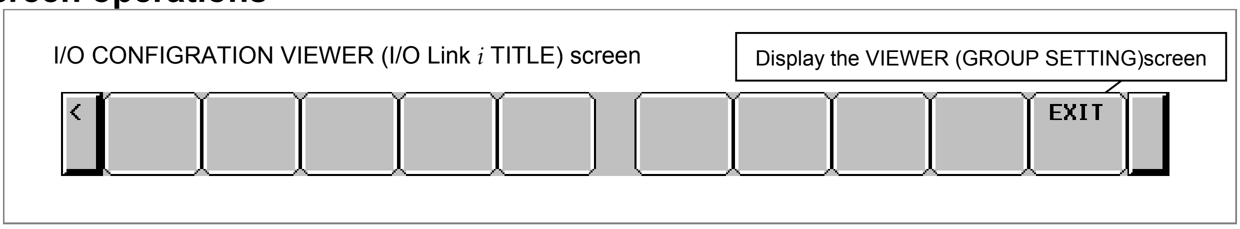
9.10.3 Displaying of Title Information of I/O Link *i* Assignment Data

In the I/O CONFIGURATION VIEWER (I/O Link *i* TITLE) screen, you can confirm the title information for the I/O Link *i* assignment data. Pressing the [TITLE] soft key in the GROUP SETTING screen shows this screen. The following operations can be performed in this screen.

- Go to the VIEWER (I/O Link *i* GROUP SETTING) screen [EXIT]



Screen operations



(1) Operations using the soft keys
[EXIT] Goes to the I/O CONFIGURATION VIEWER (I/O Link *i* GROUP SETTING) screen

Setting and Displaying of Series/Edition

I/O Link *i* assignment data can be created with FANUC LADDER-III.
You can specify series/edition directive line in the title information of the I/O Link *i* assignment data. Therefore, the series/edition can be display in the I/O CONFIGURATION VIEWER (I/O Link *i* TITLE) screen.

NOTE

This manual describes the procedure for displaying series/edition in the screen. As for details for creating of I/O Link *i* assignment data, refer to “FANUC LADDER-III OPERATOR’S MANUAL (B-66234EN)”.

Specification method of series/edition

- The followings are the format of series/edition directive line. These directives can be specified with both capital and small letters.

Series directive line	.SERIES=xxxx .series=xxxx
Edition directive line	.EDITION=xxxx .edition=xxxx

- Specify the series/edition directive line from the beginning of a line.

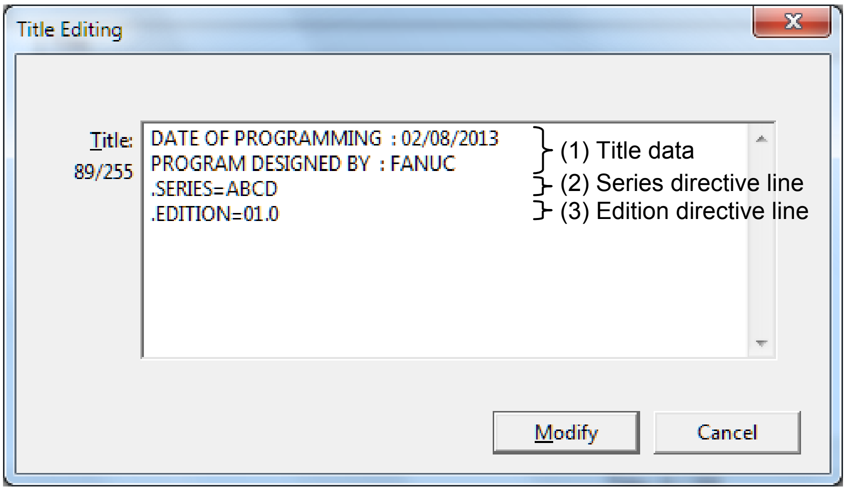
- To display the “xxxx” in the screen, specify a string within four characters.
  Usable characters are half-width capital alphabet, digit characters, space and dot.

Useable characters
A to Z, 0 to 9, Space, . (dot)

Example)

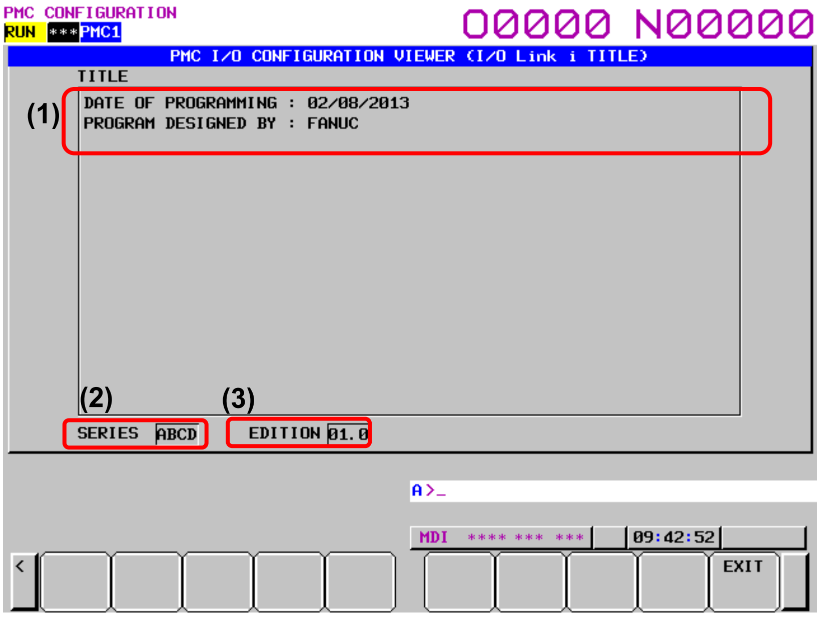
The case of displaying “SERIES ABCD” and “EDITION 01.0” in the I/O CONFIGURATION VIEWER (I/O Link *i* TITLE) screen

Specify “(2) Series directive line” and “(3) Edition directive line” in the title in I/O Link *i* editing screen of FANUC LADDER-III.



I/O Link *i* Editing screen (Title Editing) of FANUC LADDER-III

Compile the I/O Link *i* assignment data to memory card format file and load the file into CNC. Therefore, the series/edition directive line is not displayed in the title column and specified strings are displayed in the series/edition column.



I/O CONFIGURATION VIEWER (I/O Link *i* TITLE) screen

> **NOTE**
> 1 When no series/edition directive line is specified in the I/O Link i assignment data, the column of series/edition of the screen becomes blank.
> 2 When specifying characters which can not be used for string of series/edition, space characters are displayed in the column of series/edition of the screen.
> 3 When loading the I/O Link *i* assignment data with series/edition directive into CNC system which is not applied to this function, the series/edition directive line is displayed in the title column as the string typed in FANUC LADDER-III.

9.10.4 Setting of Effective Group of I/O Link *i* Assignment Data (Selectable Assignment Function)

In the I/O CONFIGRATION VIEWER (I/O Link *i* SELECTABLE I/O) screen, you can select the I/O Link *i* groups which are required for each machine. Pressing the [SELECT ASSIGN] soft key shows this screen. The following operations can be performed in this screen.

- Switch the channel [SWITCH CHANEL]
- Search for an address [SEARCH]
- Setting of the effective group [ENABLE],[DISABL]
- Go to the VIEWER (I/O Link *i* GROUP SETTING) screen [EXIT]

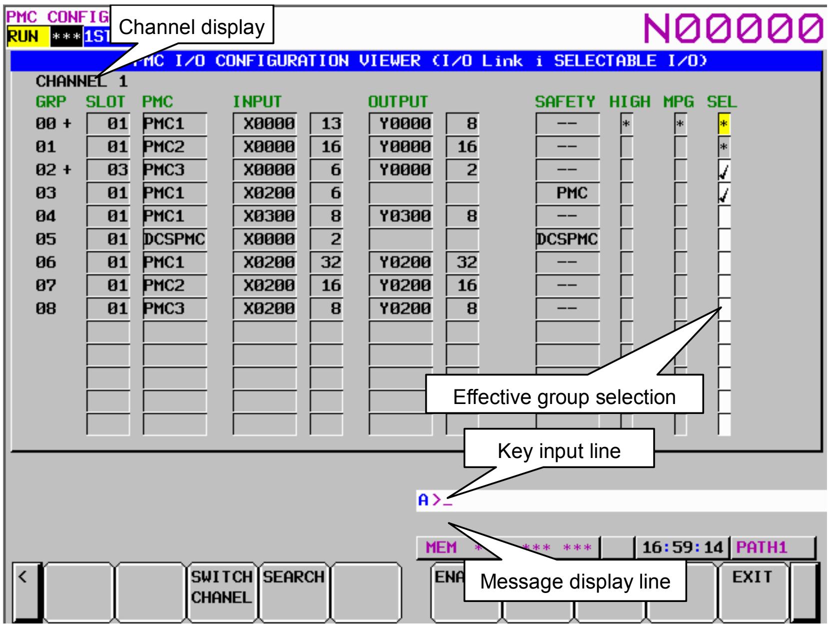


Fig. 9.10.4(a) I/O CONFIGRATION VIEWER (I/O Link *i* SELECTABLE I/O) screen

Setting of the effective group
(Channel 1: K928 to K930, Channel 2: K932 to K934)

You can select the effective group of I/O Link *i* assignment data.

"✓" : The assignment is enabled.
(space): The assignment is disabled

The "*" mark is displayed on the basic group which is set by pressing the [BASIC GROUP] soft key in the I/O CONFIGURAITON EDITOR (I/O Link *i* GROUP SETTING) screen. This operation cannot be performed on the basic group.

> ⚠ **WARNING**
> If you modify this setting without care, the I/O assignment data may not match I/O devices and turning on the power may result in unexpected malfunctions of machine. So, it is required that the operator of this function should be an expert who fully understands the sequence program and the operation of PMC. It is also strongly recommended to the developer of machine that this setting screen should be protected from careless use by ordinary operators after the machine is shipped into the field.

Screen operations

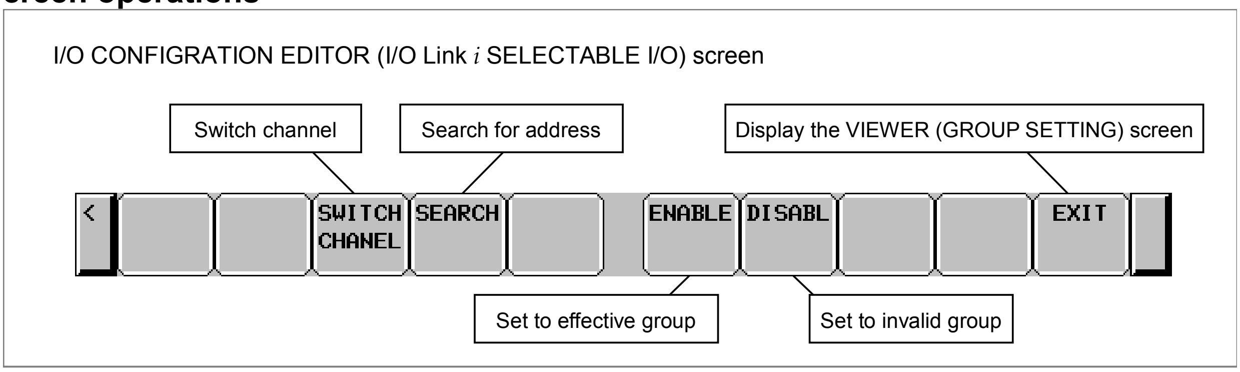


Fig. 9.10.4 (b) Soft keys of I/O CONFIGRATION VIEWER (I/O Link *i* SELECTABLE I/O) screen

(1) Operations using the soft keys
(d) [SWITCH CHANEL] Switching of channel
Switches the channels to display in order.
(e) [SEARCH] Search for address
Searches for address corresponding to the input character string ~~input address~~ and displays a group that includes the address. In the message line, the detail information of slot is displayed. The range for search are all of slots in whole channels.
(c) [ENABLE] Set to effective group
The assignment of the group is enabled.
(d) [DISABL] Set to invalid group
The assignment of the group is disabled.
(e) [EXIT] Display the GROUP SETTING screen
Moves to the I/O CONFIGRATION VIEWER (I/O Link *i* GROUP SETTING) screen.

(2) Operations using other keys

Cursor move key:	Moves the cursor.
Page change key:	Scrolls a page of display data.
Input key:	The “1” + input key enables the assignment data. The “0” + input key disables the assignment data. Only input key switches disable/enable of the assignment data.

9.10.5 Editing of Group Information of I/O Link *i* Assignment Data

In the I/O CONFIGRATION EDITOR (I/O Link *i* GROUP SETTING) screen, you can edit the contents of the group setting of the I/O Link *i* assignment data. Pressing the [EDIT] soft key in the I/O CONFIGRATION VIEWER (I/O Link *i* GROUP SETTING) screen shows this screen. The following operations can be performed in this screen.

- Go to the EDITOR (I/O Link *i* SLOT SETTING) screen [ZOOM]
- Switch display mode [COMENT],[ATTRIB]
- Switch the channel [SWITCH CHANEL]
- Search for an address [SEARCH]
- Change the assignment data [CHANGE]
- Delete the assignment data [DELETE]
- Add new group [NEW]
- Exchange group order [MOVE UP]、[MOVE DOWN]
- Delete the group [DELETE GROUP]
- Exit editor [EXIT EDIT]
- Enable selectable assignment function [ENABLE SELECT]
- Setting of basic group [BASIC GROUP]
- Delete all data [DELETE ALL]

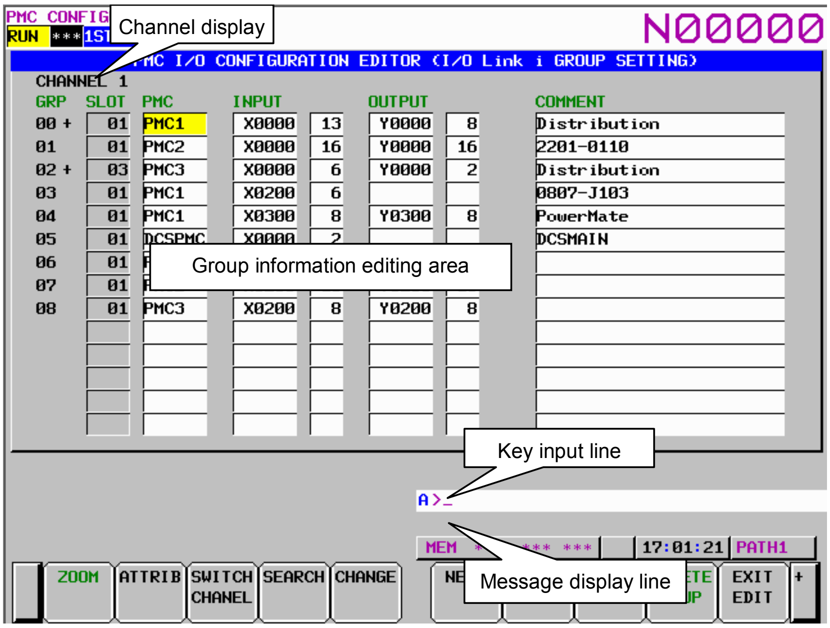


Fig. 9.10.5(a) I/O CONFIGRATION EDITOR (I/O Link *i* GROUP SETTING) screen (Comment display mode)

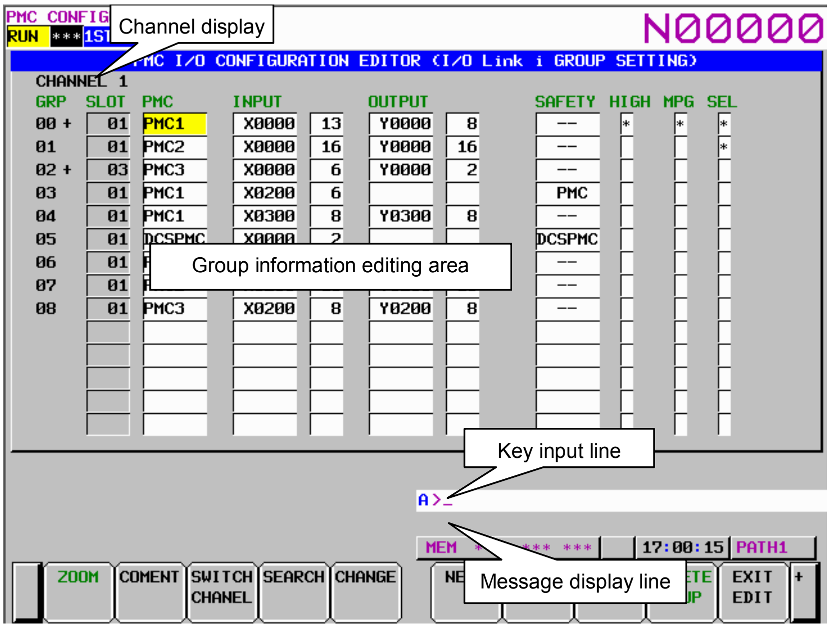


Fig. 9.10.5(b) I/O CONFIGRATION EDITOR (I/O Link *i* GROUP SETTING) screen (Attribute display mode)

Screen operations

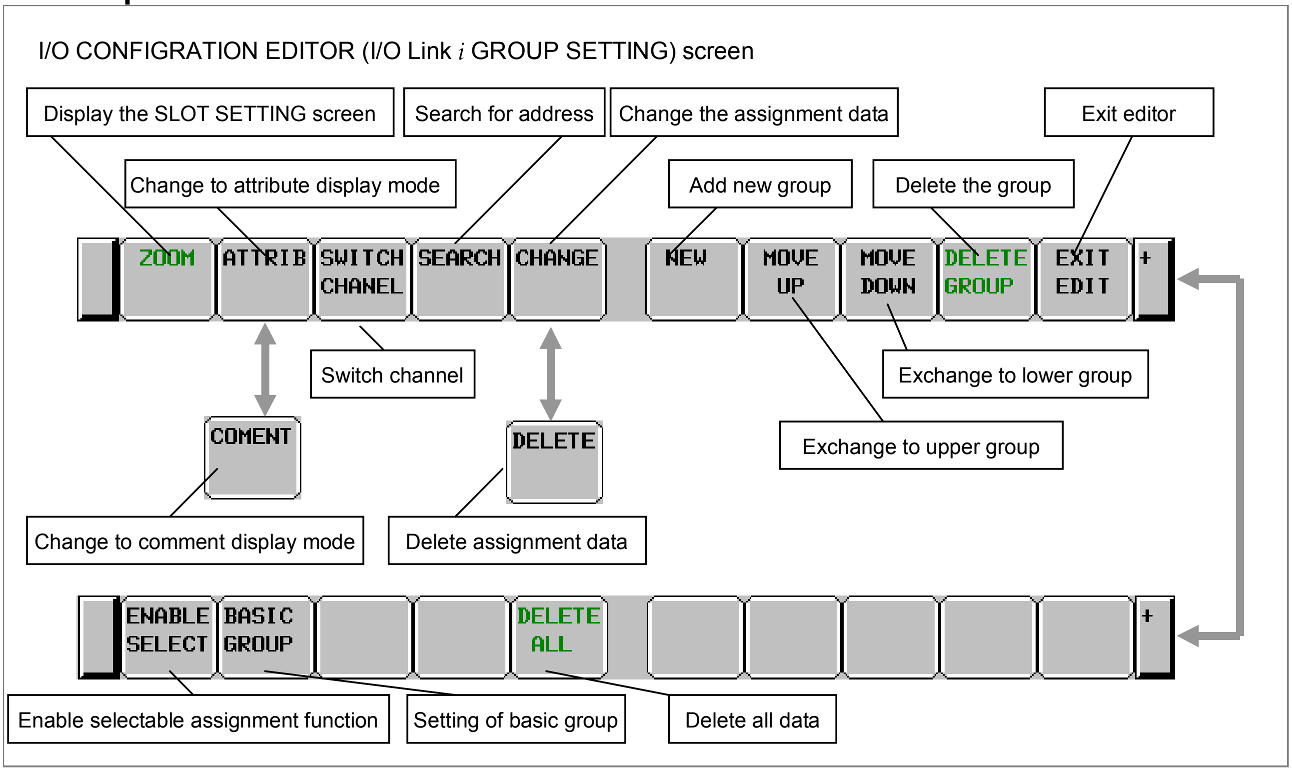
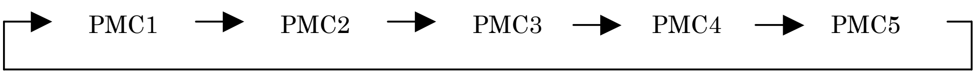


Fig. 9.10.5 (c) Soft keys of I/O CONFIGRATION EDITOR (I/O Link *i* GROUP SETTING) screen

(1) Operations using the soft keys
  (a) [ZOOM] Display the SLOT SETTING screen
  Moves to the I/O CONFIGRATION EDITOR (I/O Link *i* SLOT SETTING) screen.
  (b) [ATTRIB] Change to attribute display mode
  Changes the display mode to the attribute display mode. This soft key appears in the comment display mode.
  (c) [COMENT] Change to comment display mode
  Changes the display mode to the comment display mode. This soft key appears in the attribute display mode.
  (d) [SWITCH CHANEL] Switching of channel
  Switches the channel to display in order.
  (e) [SEARCH] Search for address
  Searches for address corresponding to the input character string ~~input address~~ and displays a group that includes the address. In the message line, the detail information of slot is displayed. The range for search are all of slots in whole channels.
  (f) [CHANGE] Change the assignment data
  This soft key appears when the cursor is on some items which are "PMC", "SAFETY", "HIGH" and "MPG". Changes the each item of the assignment data at the cursor as follows:
  - PMC
    Changes the PMC path in order.



> **NOTE**
> When the safety I/O mode is "DCSPMC", the PMC path is set to "DCSPMC" and pressing this key is invalid .

- SAFETY
  Changes the safety I/O mode in order.
  Normal I/O → PMC → DCSPMC

- HIGH
  Changes the update cycle in order.
  Normal (2ms) → High-speed (0.5ms)

- MPG
  Changes existence/non-existence of manual pulse module.
  Non-existence of MPG → Existence of MPG

NOTE
When changing to "Non-existence of MPG", the "MPG" in SLOT disappears.

(g) [DELETE] Delete the assignment data
This soft key appears when the cursor is on some items which are "INPUT", "OUTPUT" and "COMMENT". The assignment data on the cursor is deleted.

(h) [NEW] Add new group
New group is inserted on the cursor. The numbers of the groups after added group are shifted. The slot information is linked to shifted groups but the effect group information "SEL" is not linked.

Example:

Before the editing:

GRP	Group information	Slot information	SEL
01	GA	SA	✓
02	GB	SB	✓
03	GC	SC	(space)

Operation:
Pressing [NEW] when the cursor is on "GRP 02".

After the editing:

GRP	Group information	Slot information	SEL
01	GA	SA	✓
02	(space)	(space)	✓
03	GB	SB	(space)
04	GC	SC	(space)

(i) [MOVE UP] Exchange to upper group
The group on the cursor is exchanged to the upper group.

(j) [MOVE DOWN] Exchange to lower group
The group on the cursor is exchanged to the lower group.

(k) [DELETE GROUP] Delete the group
The group on the cursor is deleted. The numbers of the groups after deleted group are shifted. The slot information is linked to shifted groups but the effect group information "SEL" is not linked.

Example:

Before the editing:

GRP	Group information	Slot information	SEL
01	GA	SA	✓
$\boxed{02}$	GB	SB	✓
03	GC	SC	(space)

Operation:

Pressing [DELETE] when the cursor is on “GRP 02”.

After the editing:

GRP	Group information	Slot information	SEL
01	GA	SA	✓
$\boxed{02}$	GC	SC	✓

NOTE

The operation of the group deletion deletes all of slot information which belongs to the group.

(l) [EXIT EDIT] Exit editor

Exits the editor and moves to the I/O CONFIGURATION VIEWER (I/O Link *i* GROUP SETTING) screen.

(m) [ENABLE SELECT] Enable selectable assignment function

Enables or disables the selectable assignment function for this channel.

(n) [BASIC GROUP] Setting of basic group

Sets the basic group. You can input the number 0 to 24 and press this soft key. This key is displayed when the selectable assignment function for this channel is enabled.

(o) [DELETE ALL] Delete all data

All of information for this channel is deleted.

NOTE

The operation of [DELETE ALL] deletes all of group information and slot information. And the selectable assignment function is disabled.

(2) Operations using other keys

Cursor move key: Moves the cursor.

Page change key: Scrolls a page of display data.

Input key:

When the cursor is on the “PMC”:

“Numeric” + “Input key” means “PMC1”, “PMC2”, “PMC3”, “PMC4” and “PMC5”.

Only “Input key” changes PMC path by turns.

When the cursor is on the “SAFETY”:

Only “Input key” changes the safety I/O mode by turns.

When the cursor is on the “MPG”:

Only “Input key” changes the setting by turns.

NOTE

When changing to “Non-existence of MPG”, the “MPG” in SLOT disappears.

(3) Operations using return key
The return key is invalid in this screen. To return the I/O CONFIGURATION VIEWER (I/O Link *i* GROUP SETTING) screen, press the [EXIT EDIT] soft key.

9.10.6 Changing of Slot Information of I/O Link *i* Assignment Data

In the I/O CONFIGRATION EDITOR (I/O Link *i* SLOT SETTING) screen, you can edit the contents of the slot setting of specified group. Pressing the [ZOOM] soft key in the I/O CONFIGRATION EDITOR (I/O Link *i* GROUP SETTING) screen shows this screen. The following operations can be performed in this screen.

• Switch input mode	[INPUT MODE]
• Automatic setting of free address	[AUTO]
• Search for an address	[SEARCH]
• Delete the data	[DELETE]
• Exit the slot editor	[EXIT ZOOM]
• Change display slot	[PREV. SLOT], [NEXT SLOT]
• Add new slot	[NEW SLOT]
• Delete slot	[DELETE SLOT]

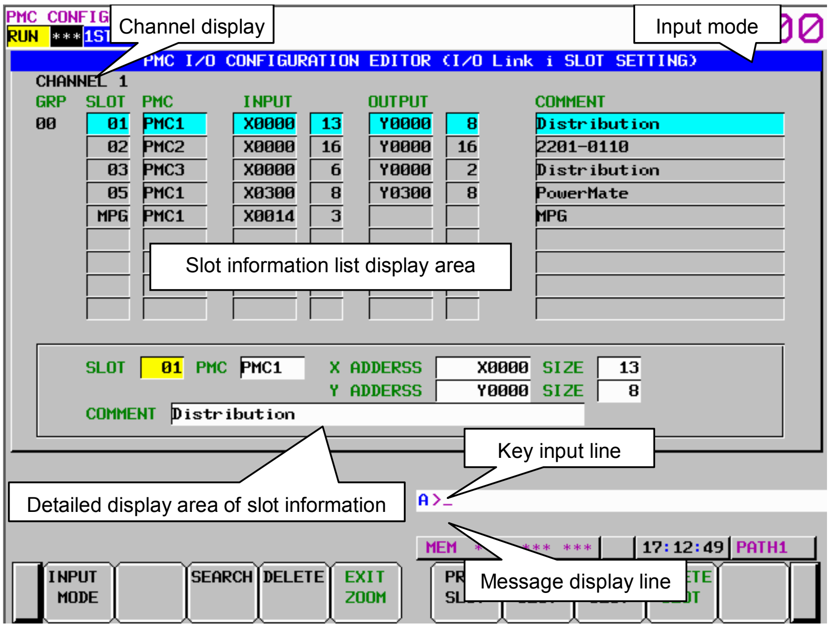


Fig. 9.10.6(a) I/O CONFIGRATION EDITOR (I/O Link *i* SLOT SETTING) screen

Screen operations

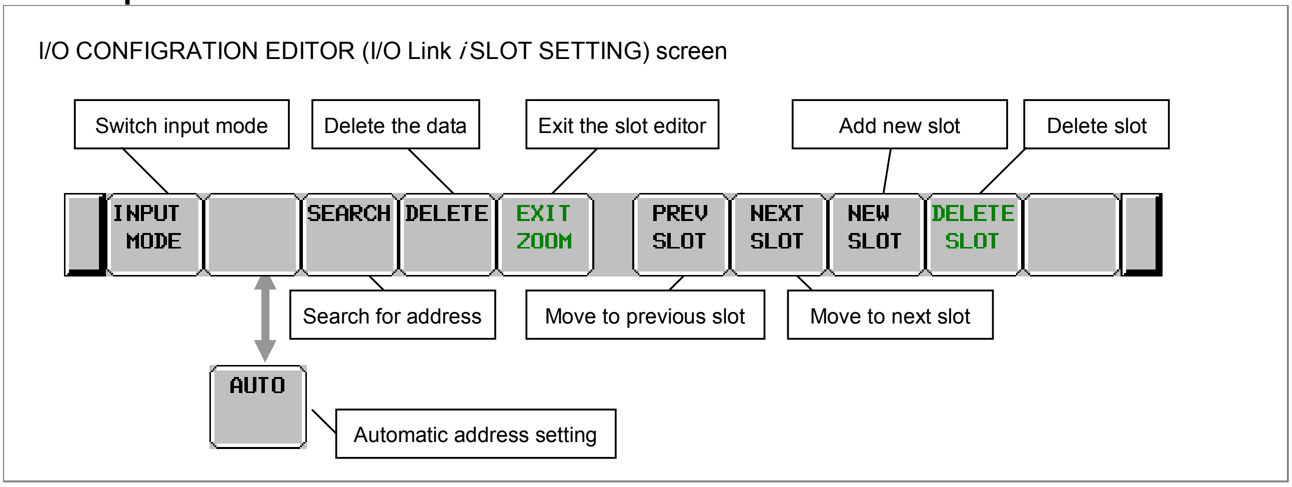
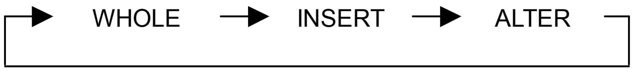


Fig. 9.10.6 (b) Soft keys of I/O CONFIGRATION EDITOR (I/O Link *i* SLOT SETTING) screen

(1) Operations using the soft keys

(a) [INPUT MODE] Switch input mode
Pressing the [INPU MODE] soft key, the input mode for the comment is changed as follows. Current input mode is displayed on the screen.



For the detail of the input mode, refer to subsection “9.2.6”.

> **NOTE**
> This key is valid for the comment data. For other data, this key is invalid and input mode becomes the “WHOLE” mode.

(b) [AUTO] Automatic address setting
This key is displayed when the cursor is on the “X ADDRESS” and “Y ADDRESS”. An address having the input “SIZE” is searched from each free area. For example, when “X0020” is set in the “INPUT”, pressing this key searched a free address within the range of X0020 to X0127.

> **NOTE**
> If once a free address is set by pressing this key, other address is never searched by pressing this key again.

(c) [SEARCH] Search for address
Searches input address and displayed a group that includes the address. The range for search is all of slots in whole channels.

(d) [DELETE] Delete the data
Deletes selected data.

(e) [EXIT ZOOM] Exit the slot editor
Moves to I/O CONFIGURATION EDITOR (I/O Link *i* GROUP SETTING) screen.

(f) [PREV. SLOT] Move to previous slot
Selects the slot displayed on upper line of the cursor in the slot list.

(g) [NEXT SLOT] Move to next slot
Selects the slot displayed on lower line of the cursor in the slot list.

(h) [NEW SLOT] Add new slot
Adds a new slot.

(i) [DELETE SLOT] Delete slot
Deletes a slot.

> **NOTE**
> The operation of the [DELETE SLOT] soft key never deletes the slot of the "MPG". When you want to delete the slot of the "MPG", set the "MPG" off in the I/O CONFIGURATION EDITOR (I/O Link *i* GROUP SETTING) screen.

(2) Operations using other keys
Cursor move key: Moves the cursor.
Page change key: Scrolls a page of display data.

> **NOTE**
> When you set the "SAFETY" I/O mode to the "DCSPMC" for a group in the I/O CONFIGURATION EDITOR (I/O Link *i* GROUP SETTING) screen, you cannot change to the PMC path in the "PMC" item of the group.

(3) Operations using return key
The return key is invalid in this screen. To return the I/O CONFIGURATION VIEWER (I/O Link *i* GROUP SETTING) screen, press the [EXIT EDIT] soft key.

9.10.7 Adding of Slot Information of I/O Link *i* Assignment Data

Pressing the [NEW SLOT] soft key creates a new slot in the I/O CONFIGURATION EDITOR (I/O Link *i* SLOT SETTING) screen.

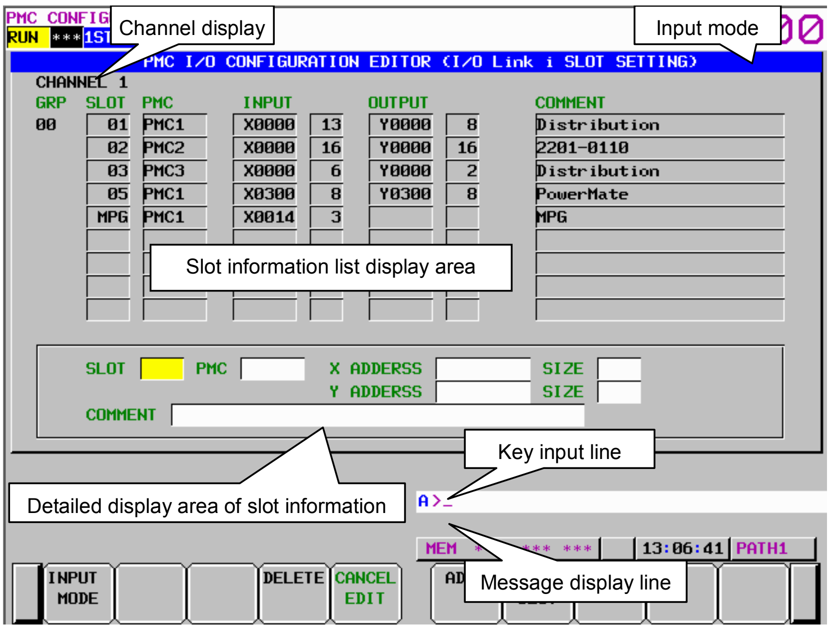


Fig. 9.10.7(a) I/O CONFIGRATION EDITOR (I/O Link *i* SLOT SETTING) screen (NEW SLOT)

Screen operations

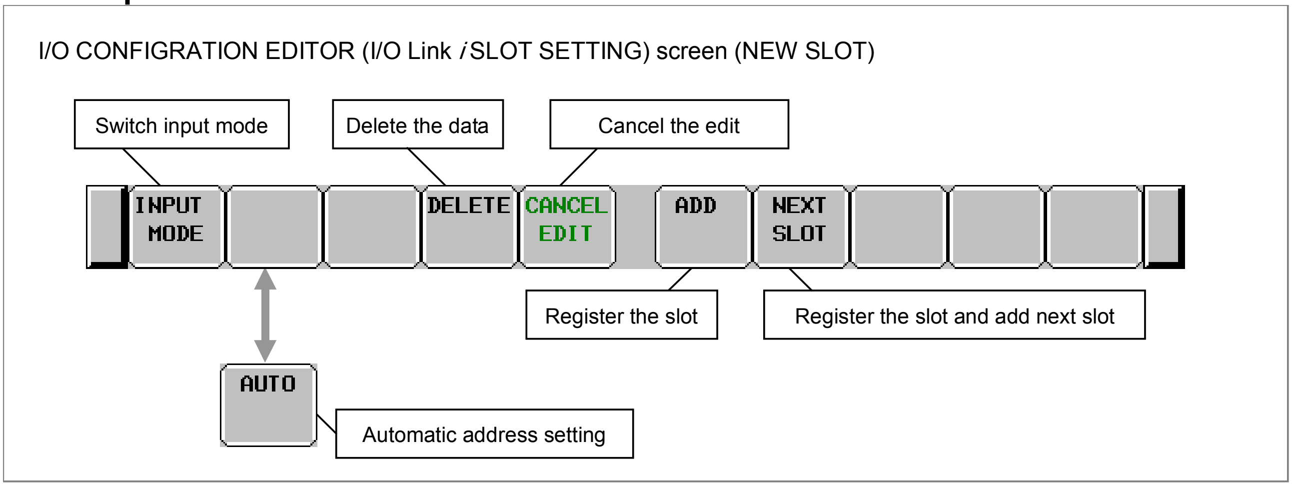


Fig. 9.10.7 (b) I/O CONFIGRATION EDITOR (I/O Link *i* SLOT SETTING) screen (NEW SLOT)

(1) Operations using the soft keys
  (a) [CANCEL EDIT] Cancel the edit
    New created slot is aborted.
  (b) [ADD] Register the slot
    Registers new created slot.
  (c) [NEXT SLOT] Register the slot and add next slot
    Registers current editing slot and creates new slot.

  For details of other soft keys, refer to subsection “9.10.6”.

(2) Operations using other keys
  Cursor move key: Moves the cursor.

(3) Operations using return key
  The return key is invalid in this screen. To return the I/O CONFIGURATION VIEWER (I/O Link *i* SLOT SETTING) screen, press the [ADD] or [CANCEL EDIT] soft key.

9.11 PMC Program List Screen

In case of using multi-path PMC or ladder dividing management function, you can confirm the information of main ladder programs or divided ladder programs for all PMC paths installed in CNC system.
In PMC program list screen, you can confirm all main programs and divided programs of all PMC paths. By selecting a program in the list, displayed program can be switched. PMC program list screen appears by pressing the [PROG LIST] soft key or pressing the [SWITCH PMC] soft key in each PMC screen.

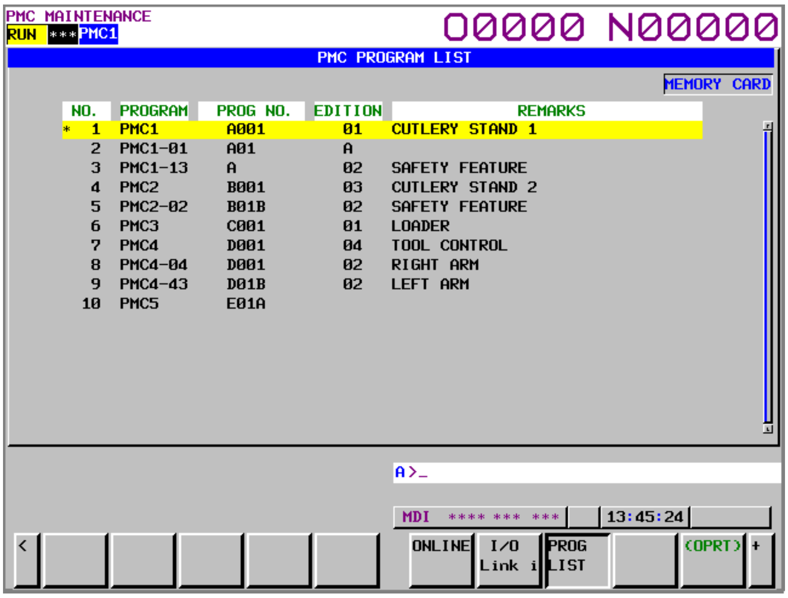


Fig.9.11 (a) PMC PROGRAM LIST screen

> **NOTE**
> Set keep relay K935.0 to 1 in order to display this screen by pressing [SWICH PMC] in each PMC screen.

Displayed program information

Program on selecting:	asterisk "*" is displayed on the left end of the program.
NO:	List number
PROGRAM:	In case of main ladder program, PMC path name is displayed. In case of divided ladder program, divided number with PMC path name and hyphen "-" is displayed.
PROGRAM NO.:	The program No., which is set in title data of the sequence program, is displayed.
EDITION:	The edition, which is set in title data of the sequence program, is displayed.
REMAERKS:	The remarks, which is set in title data of the sequence program, is displayed.

Operations using the soft keys

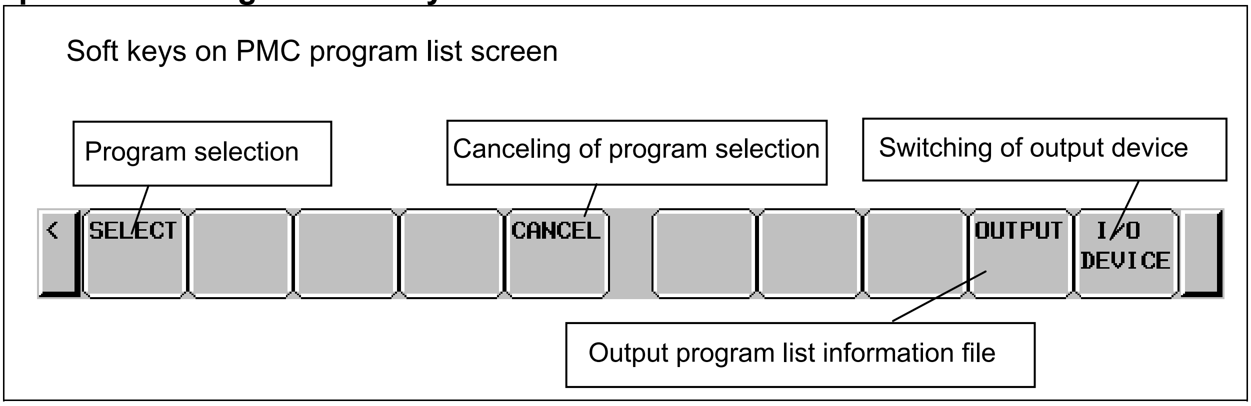


Fig.9.11 (b) Soft keys on PMC program list screen

(1) [SELECT] Program selection
This key switches selected program.
According to kind of soft key to display this screen, switching action is as follows.

・The case that the screen is displayed by the [PROG LIST] soft key
Selected program is switched.
・The case that the screen is displayed by the [SWITCH PMC] soft key
Selected program is switched and return to previous screen.

(2) [CANCEL] Canceling of program selection.
This key cancels program selection and return to previous screen.

> **NOTE**
> [CANCEL] soft key is displayed only when the screen is displayed by [SWITCH PMC] soft key.

(3) [OUTPUT] Output of program list information file
This key outputs program list information file. As for the contents of the output file, refer to "9.11.1".

(4) [IO DEVICE] Switching of output device
This key selects output device (USB memory or memory card) of program list information file. By pressing this key, "memory card" or "USB memory" switches alternately. Selected device name is displayed in the indicator window.

9.11.1 Output of program list information file

You can output program list information file by pressing the [OUTPUT] soft key.
For maintenance of machines, there are cases where you want to get the information of ladder programs installed in CNC system. In case of using multi-path PMC or ladder dividing management function, you can confirm the information on the PMC program list screen. You can get the information of the screen as a bitmap file. To use this function, however, you can output a text file of the screen information. The text file is output as “CSV” format. Therefore, you can manage it using application software such as EXCEL on PC.

When pressing this soft key, [EXEC] and [CANCEL] soft keys appear. To output the file, press the [EXEC] soft key.
You can select output device by the [IO DEVICE] soft key.

(1) File name
The output file name is “PMC_LIST.000”. If the same file name exists on the device, the extension is incremented to “001”, “002” and so on.（Maximum “999”）

(2) Output format
The file is output with the “CSV” format. Character string data such as program and remarks are enclosed in double quotation marks (“ ”).
Output contents are as follows.
(a) Header
At the top of data, an identifier representing the file information is output.
Identifier: (“PMC PROGRAM LIST”)
Edition information: (“Edition”, 1)

(b) Data
Program information, which are displayed on program list screen, are output.
Program information: Number, “Program”, “Program No.”, “Edition”, “Remarks”

Example of program list information
(For view comfort, tabs are inserted in several places. In actual data, however, no tab is inserted.)

```
“PMC PROGRAM LIST”        Header
“Edition”, 1

1, “PMC1”,    ”A001”, ”01”, ”CUTLERY STAND1”          Data
2, “PMC1-01”, ”A01B”, ”01”,
3, “PMC1-02”, ”A01C”, ”02”, ”SAFETY FEATURE”
4, “PMC2”,    ”B001”, ”03”, ”CUTLERY STAND2”
5, “PMC2-01”, ”B01B”, ”02”, ” SAFETY FEATURE”
6, “PMC3”,    ”C001”, ”01”, ”LOADER”
7, “PMC4”,         ,    ,
8, “PMC4-01”, ”D01A”, ”02”, ”RIGHIT ARM”
9, “PMC4-02”, ”D01B”, ”01”, ”LEFT ARM”
10, “PMC5”,   ”E01A”,    ,
```

10 STEP SEQUENCE FUNCTION

10.1 OVERVIEW

10.1.1 Step Sequence Method

The ladder method is most often used for programming the sequence control governed by a programmable controller. This method, shown in Fig.10.1.1(a), was derived from relay-panel control circuits. Since it has been in use for years, many sequence control engineers are already familiar with it. This method is also used in PMC sequence programming.

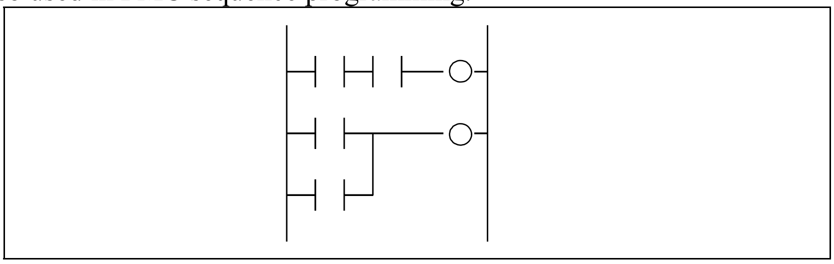


Fig. 10.1.1(a) Ladder method

The greater the number of functions implemented by the PMC for a CNC system, the larger and the more complicated the sequence program becomes. A large-scale system requires a larger program and a greater number of processes, making it hard for the ladder method to control the overall process. This is because the ladder method does not describe the order of control. While the ladder method is suitable for describing partial control, it is hard to apply it to the description of the flow of control overall.
To overcome this problem, structured programming has been introduced into sequence control. A PMC that supports the subprogram function enables the use of modular programs. As shown in Fig.10.1.1(b), a large-scale program is divided into subprograms for each function, simplifying the unit of processing. Since the programmer determines how to divide the main program into subprograms and the control flow used to call the subprograms, however, the programs are not necessarily easy-to-understand by other programmers.

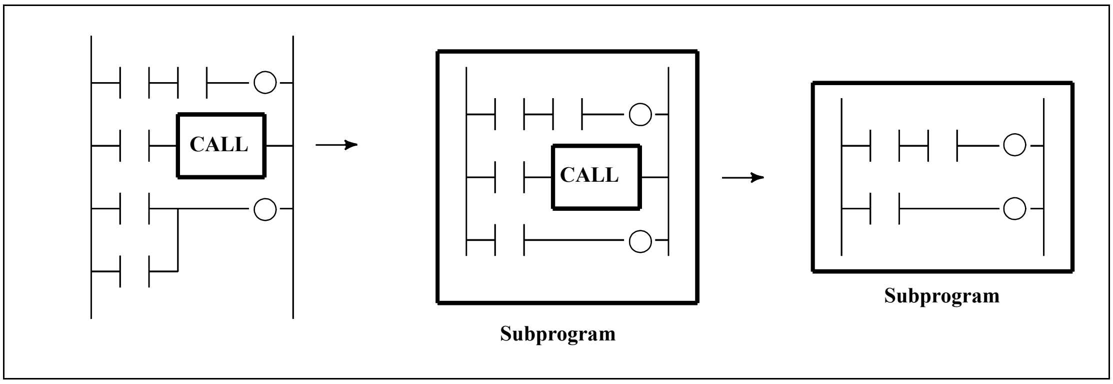


Fig. 10.1.1(b) Module method

Given these conditions, a step sequence method has been created to describe programs structurally. It is well-suited to the control of entire processes and provides an easy-to-understand visualized flow of the process. The step sequence programming features the direct representation of the control flow on a flow chart, as shown in Fig. 10.1.1(c).
Each block of processing is described as a subprogram, using the ladder method. The entire program is then created by combining these subprograms.

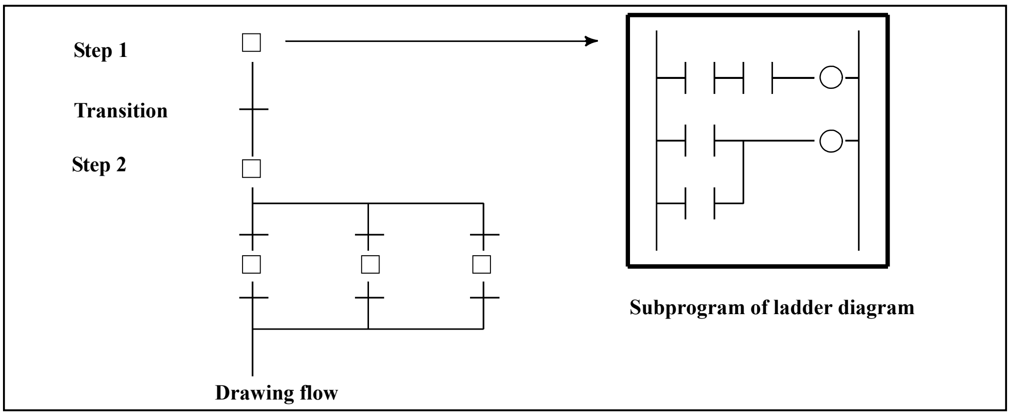


Fig. 10.1.1(c) Step sequence method

The step sequence method has the following features:

(1) Increased programming efficiency
- Since the flow of processes can be programmed directly, simple, correct programming is enabled, reducing the time required for programming.
- Even for complicated control, programming proceeds from the main flow to detailed flow in each process, creating a structured, top-down program, which is easy-to-understand by persons other than the original creator.
- Structured modules can be used again easily.

(2) Easy debugging and maintenance
- Graphical display enables the operator to easily understand the execution state of a program visually.
- Erroneous steps in a program can be found easily.
- A part of a program can be easily modified.

(3) High-speed program
- Since only the subprograms required for a certain process are executed, the cycle time is reduced.

(4) Transition from ladder programs
- Since steps and transitions consist of conventional ladder programs, conventional ladder programs can be converted to new step sequence programs, without discarding ladder-program resources.

In step sequence programming, a sequence control program is divided into two types of subprograms, steps and transitions. Steps describe processes. Transitions connect steps and determine whether the transition conditions from one step to another evaluate true. As shown in Fig. 10.1.1(d), a step sequence program is described using graphical symbols.

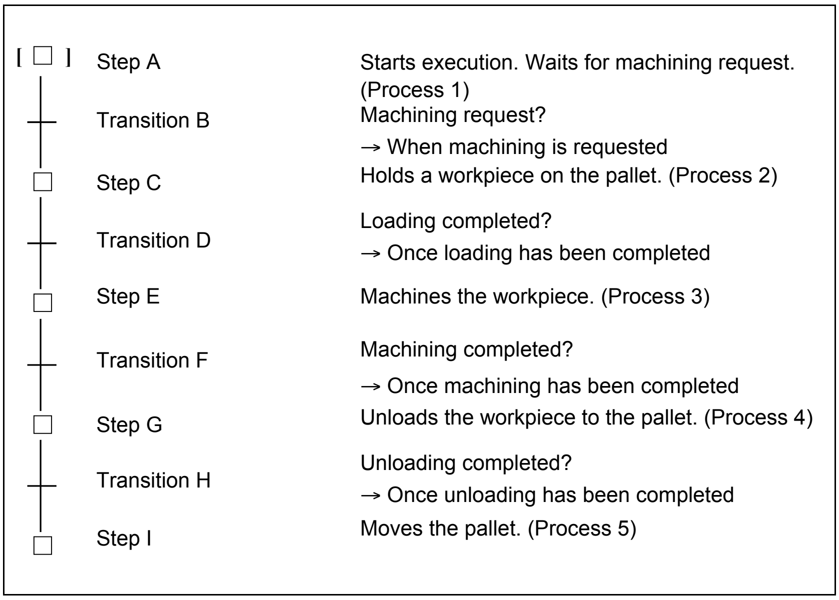


Fig. 10.1.1(d) Example of machining the workpiece

As shown in this example, the program flow from process 1 through process 5 is expressed visually. Detailed programs related to the movements performed as part of each process, and the signals used for determining whether transition conditions for proceeding to the next step are satisfied, are not described here. To program complicated control flows, many other functions are supported, such as divergence, jump, and nesting functions. The details of these functions are described later.
Step sequence programming is suitable for creating programs which control processes sequentially. Programs used for controlling a unit which operates according to a certain sequence, such as a loader, ATC, and other peripheral units, are best suited to step sequence programming. For programs which control units with no particular sequence, such as that of the operator’s panel which is always monitoring the emergency stop signal or mode signals, however, are not well-suited to step sequence programming. The PMC supports the advantages of both methods, ladder and step sequence programming, by calling subprograms written according to a step sequence and those written as a ladder, from the main program.

10.1.2 Graphical Symbols

This manual uses the graphical symbols listed in Table 10.1.2 to describe step sequence flowcharts. Depending on the character font being used, the actually displayed symbols may differ slightly from those listed here.
These graphical symbols are described in the subsequent chapters.

Table 10.1.2 List of graphical symbols

Contents	Display of programming manual	Display	
		CNC Device	Personal Computer FANUC LADDER-III
Step	□ Sn	□ Sn	□ Sn
Initial Step	[□] Sn	[□] Sn	[□] Sn
Transition	Pn	Pn	Pn
Divergence of Selective Sequence			
Convergence of Selective Sequence			
Divergence of Simultaneous Sequence			
Convergence of Simultaneous Sequence			
Jump	→ Ln	-> Ln	-> Ln
Label	← Ln	<- Ln	<- Ln
Block Step	□] Sn	□] Sn	□] Sn
Initial Block Step	[□] Sn	[□] Sn	[□] Sn
End of Block Step			

10.1.3 Editing and Debugging Step Sequence Programs

The personal computer programmer "FANUC LADDER-III" is used to edit a step sequence program.
For details of transferring and writing a step sequence program to the PMC, see Subsection 1.3.4, "Transferring and Writing a Step Sequence Program to the PMC".

A step sequence program is executed and debugged on the CNC.
For details of debugging a step sequence program, see Subsection 1.3.5, "Checking a Sequence Program".

Table 10.1.3 indicates the step sequence functions usable on FANUC LADDER-III and the CNC.

Table 10.1.3 Step sequence functions

	PMC	FANUC LADDER-III
Display and edit of a program		
• Display of subprogram list	○	○
• Create a new subprogram	○	○
• Delete a subprogram		○
• Edit a subprogram of Step Sequence form		○
• Edit a subprogram of ladder diagram	○	○
Input and output		
• Input and output with a memory card/USB memory	○	○
• Input and output with RS232C	○	○
• Write to a Flash ROM	○	○
Execution of program		
• Execution of a ladder diagram	○	○
Diagnosis and debugging		
• Diagnosis of Step Sequence program	○	
• Diagnosis of a ladder diagram	○	○
• Set and display a monitoring timer	○	

10.2 STEP SEQUENCE BASICS

10.2.1 Terminology

A step sequence program is created using a variety of graphical symbols, as shown in Fig. 10.2.1(a). The main terms used in the step sequence are described below.

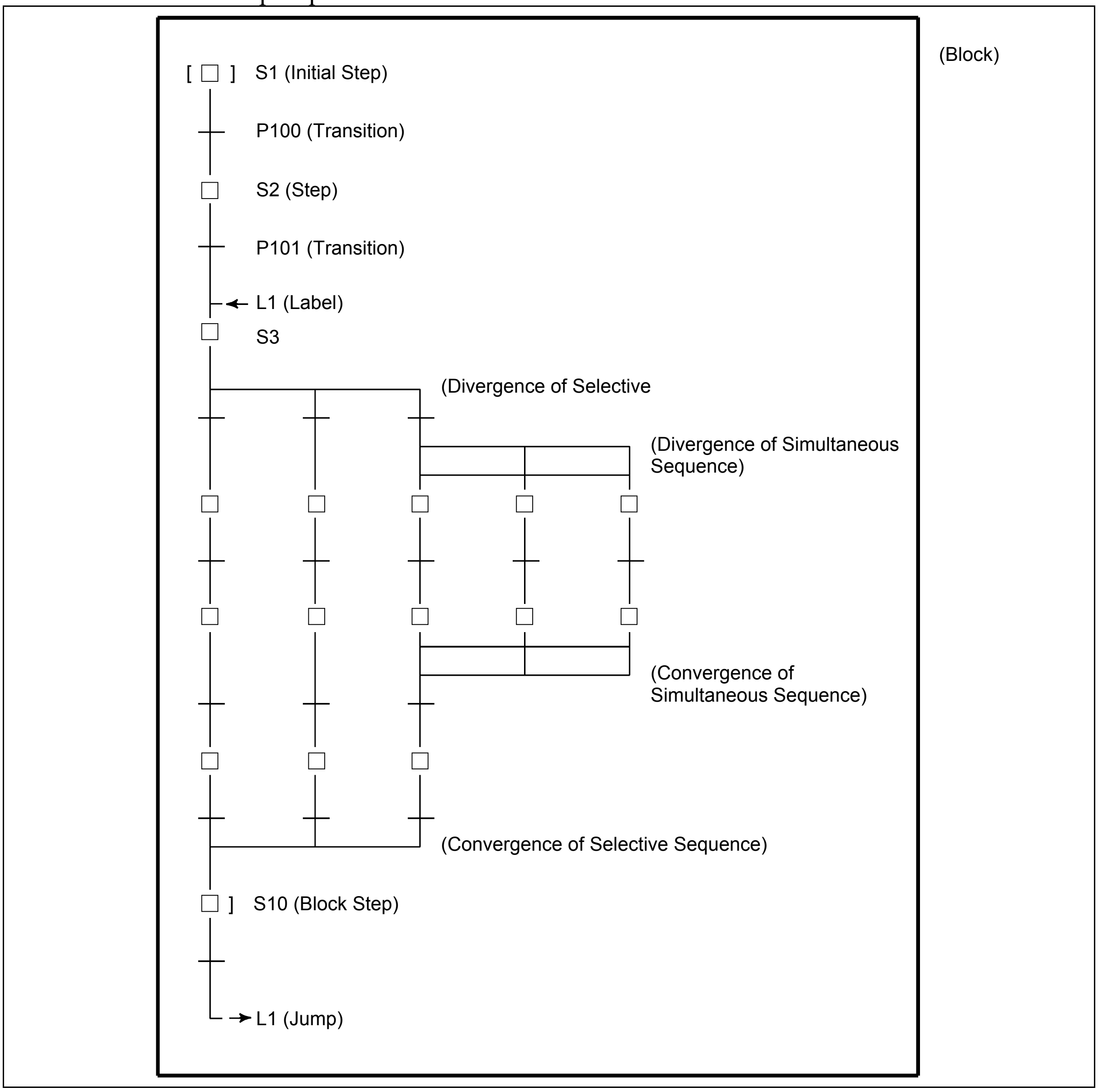
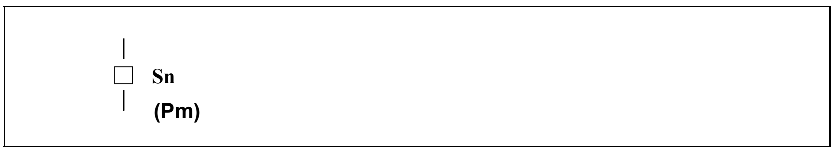


Fig. 10.2.1(a) Step sequence elements

(1) Step



A step indicates a process, which is the basic processing unit in a step sequence program. In a step, specify the S address (Sn), which is a step number, and P address (Pm), which indicates a subprogram (action program) specifying the details of processing in each step.

(2) Step state transition

When a step sequence program is executed, the process proceeds as program processing advances, the state of each step changes accordingly. Each step can assume any of the logical states listed in Table 10.2.1, its state changes as shown in Fig. 10.2.1(b). Activation refers to the changing of a step from the inactive state to the active state.

Inactivation refers to the changing of a step from the active state to the inactive state.

Table 10.2.1 Step state

State		Processing	Display
Active	Execution	Activated step. The action program (subprogram) is being executed.	■ Sn
Inactive	Transition to halt	Transition from execution to halt. The action program (subprogram) is executed once only, then the step automatically transits to halt.	□ Sn
	Halt	Not activated state. The action program (subprogram) has not yet been executed.	

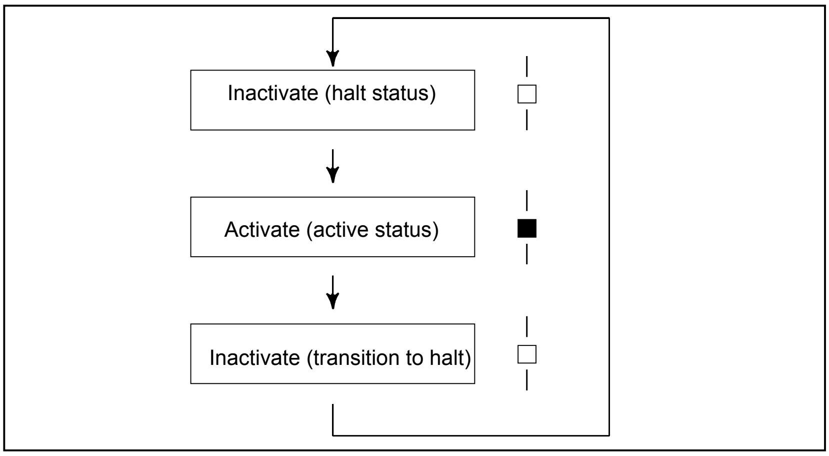


Fig. 10.2.1(b) Step state transition

(3) Transition

A transition denotes the transition conditions. When these evaluate true, the step of the corresponding state changes from the inactive to active state or vice the reverse. Specify the P address (Pn), which indicates a subprogram describing the transition conditions in detail.

As shown in Fig. 10.2.1(c), step S2 changes its state from inactive to active when the conditions described in transition P10 evaluate true, while step S2 changes its state from active to inactive when the conditions described in transition P20 evaluate true.

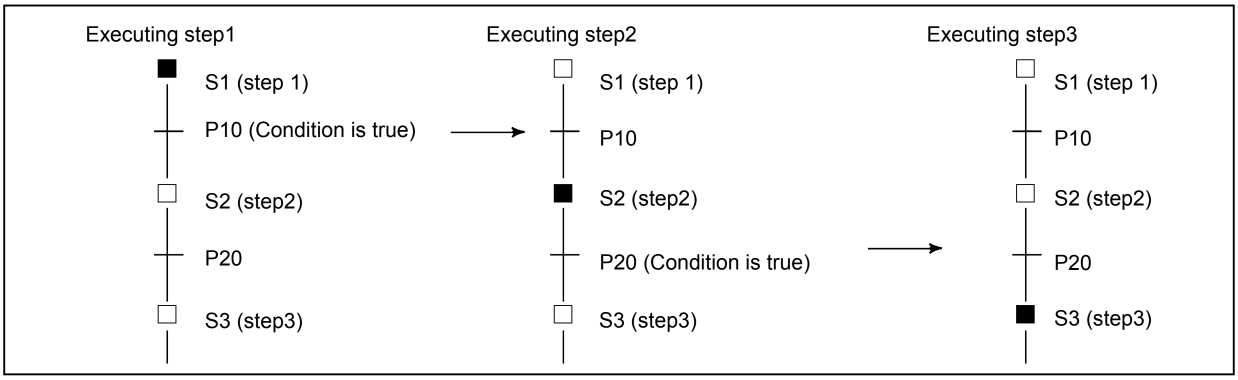


Fig. 10.2.1(c) Transition of step state by the transition

Note that the step immediately before a transition must be active in order to switch the next step from inactive to active when the conditions specified in the transition evaluate true. As shown in Fig. 10.2.1(d), step S3 does not change to the active state, even when transition P20 evaluates true, if step S1 is active and step S2 is inactive. An active state passes from a certain step to the next step when the corresponding transition conditions evaluate true, the execution of the step sequence program advancing one step.

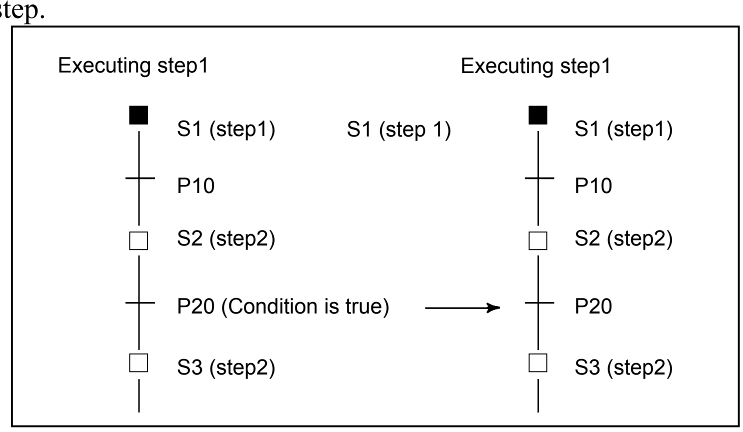


Fig. 10.2.1(d) Transition of step state by transition

(4) Initial Step

While a normal step can be activated by a transition, the initial step is activated automatically when execution of the program starts, as shown in Fig. 10.2.1(e).

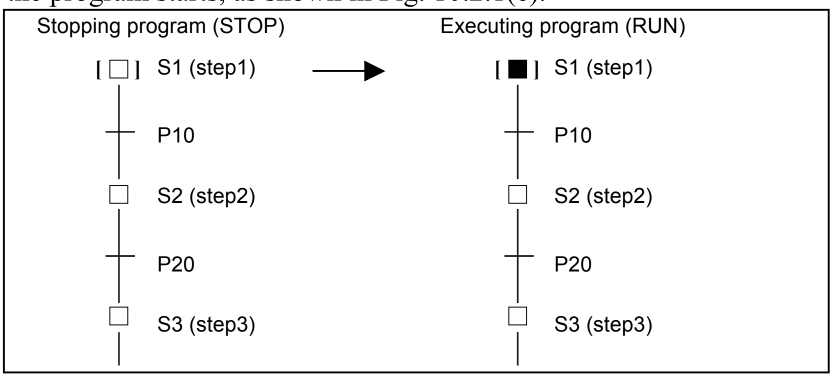


Fig. 10.2.1(e) Activate of initial step

Although the initial step, which is usually executed first, is often placed at the top of a program, it can also be specified at some point within a program. It is always activated first. After being deactivated once, it can be subsequently be activated again. In this case, it acts in the same way as a normal step.

(5) Divergence and Convergence of Selective Sequence
To describe a complicated sequence, selective sequences can be used.
A selective sequence offers multiple choices, from among which the condition becomes true first activates the corresponding step, as shown in Fig. 10.2.1(f). The divergent paths join to generate the main sequence.

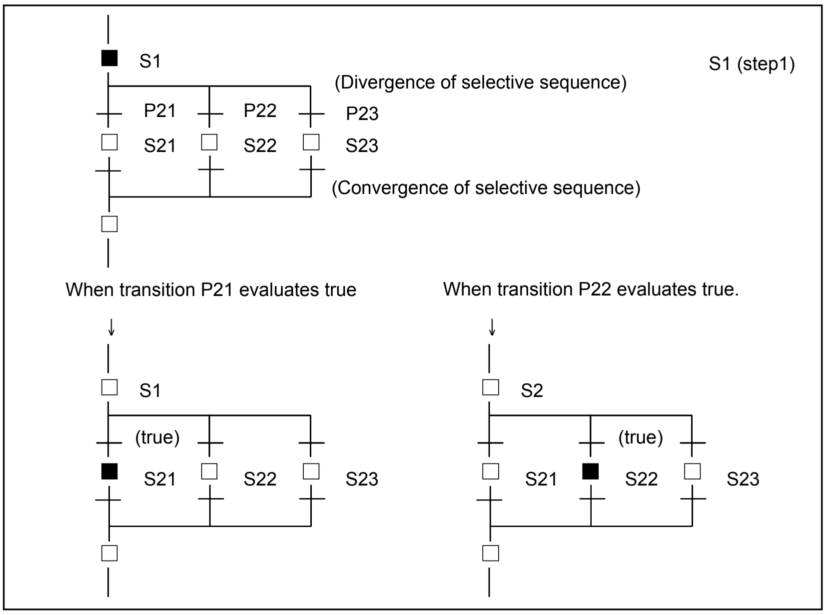


Fig. 10.2.1(f) Selective sequence

(6) Divergence and Convergence of Simultaneous Sequence
A Simultaneous sequence can be used to execute multiple processes simultaneously. In a Simultaneous sequence, as shown in Fig. 10.2.1(g), one transition activates multiple steps. The activated multiple steps are executed independently. Once all steps along the multiple paths have been completed, the divergent paths join to generate the main sequence.

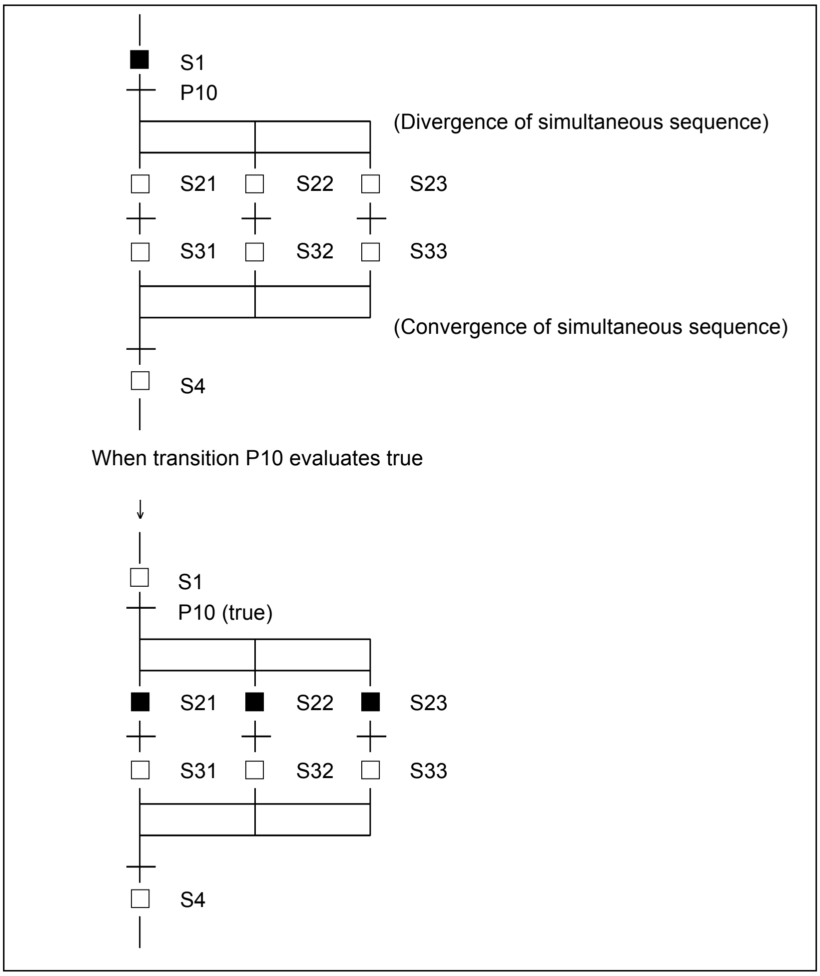


Fig. 10.2.1(g) Simultaneous sequence

(7) Jump and Label

The jump function is used to describe a non–serial sequence, such as a repeated loop. As shown in Fig. 10.2.1(h), when a jump designation is activated, the sequence jumps to the step having the corresponding jump destination label, after which that step is activated. To specify a label number, the L address is used in the same way as a jump instruction in ladder programming. A jump can be made to a previous or subsequent step.

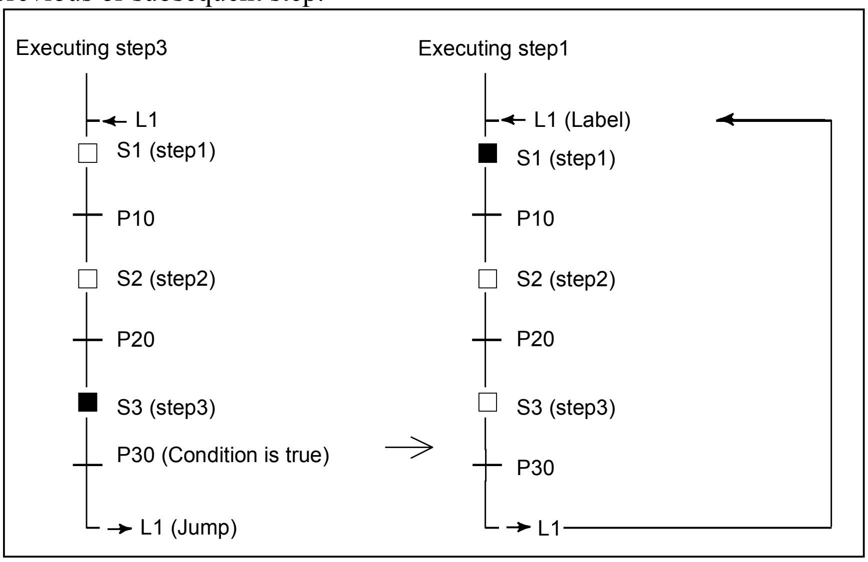


Fig. 10.2.1(h) Jump and Label

(8) Block
A block refers to a group of consecutive steps and transitions. A block can be a step sequence program. The more complicated the sequence becomes, the larger and more complex the block is. A program can be divided into multiple blocks in the same way as for subprograms in ladder programming, based on the concept of modular programming. Each block is identified by a P address, which corresponds to the subprogram number in ladder programming.
A block is executed as the main program in a step sequence, or called from another step sequence program as a subprogram.

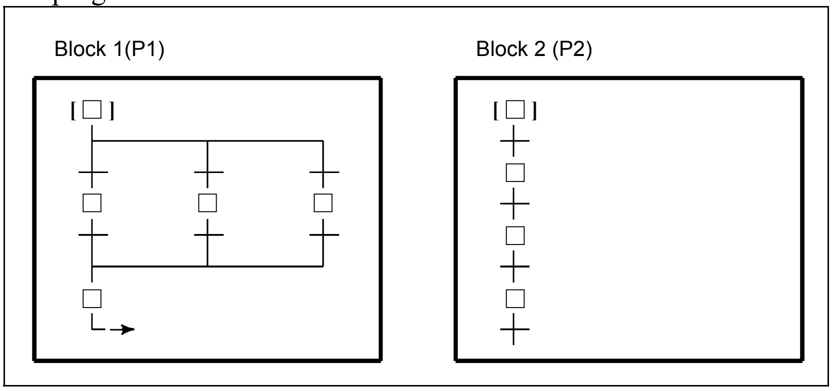


Fig. 10.2.1(i) Block

(9) Calling block
To execute a block as the main program in a step sequence, call the block with the CALLU (SUB 66) or CALL (SUB65) instruction in the same way as for ladder subprogram calling from the second level ladder program.

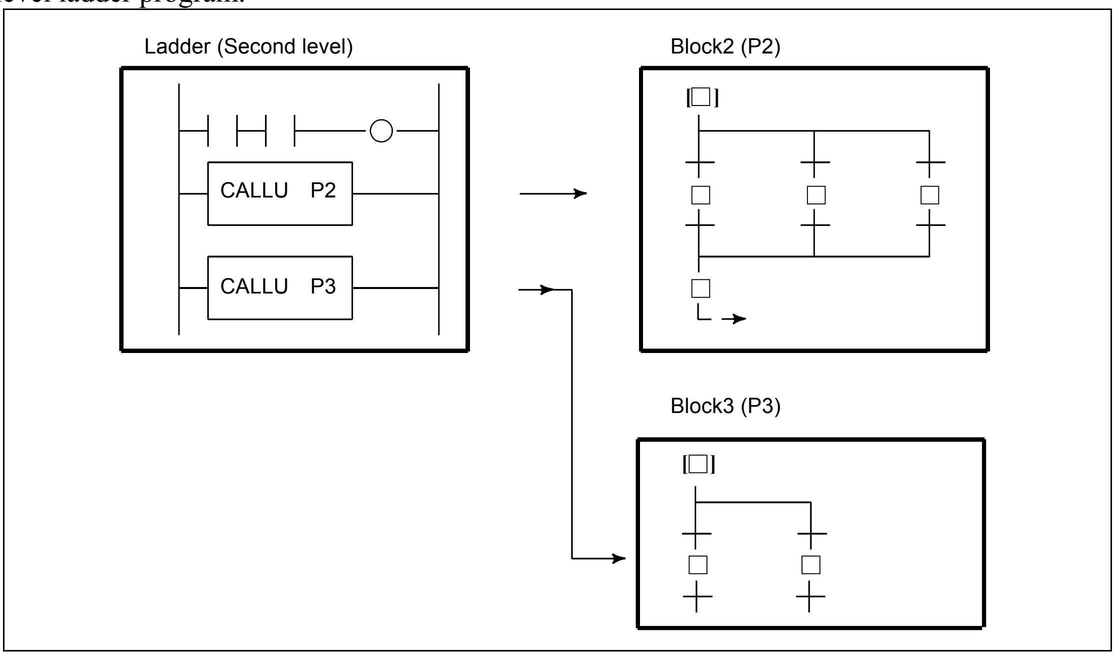


Fig. 10.2.1(j) Calling block

(10) Block step (calling step sequence program)

To call a block from the step sequence program as a subprogram, specify a block step in the step sequence program which calls the block, as shown in Fig. 10.2.1 (k). This is called bloc nesting.

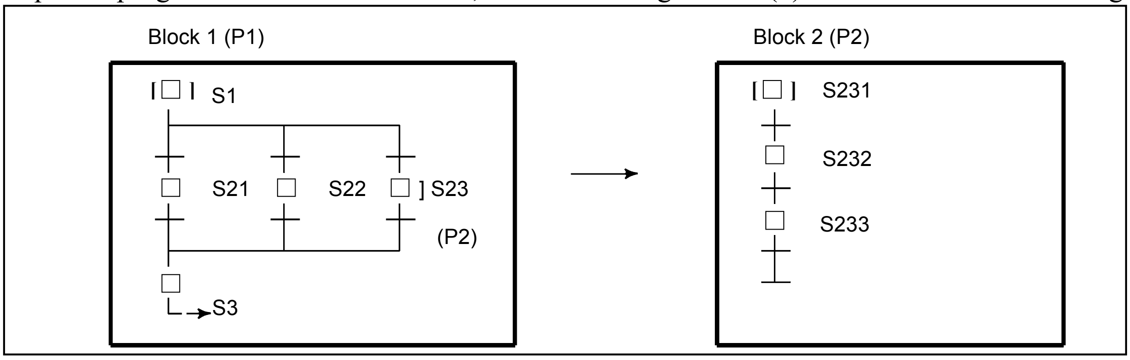


Fig. 10.2.1(k) Block nesting

The program shown in Fig. 10.2.1(k) is equivalent to in Fig. 10.2.1(l) which does not use a block step.

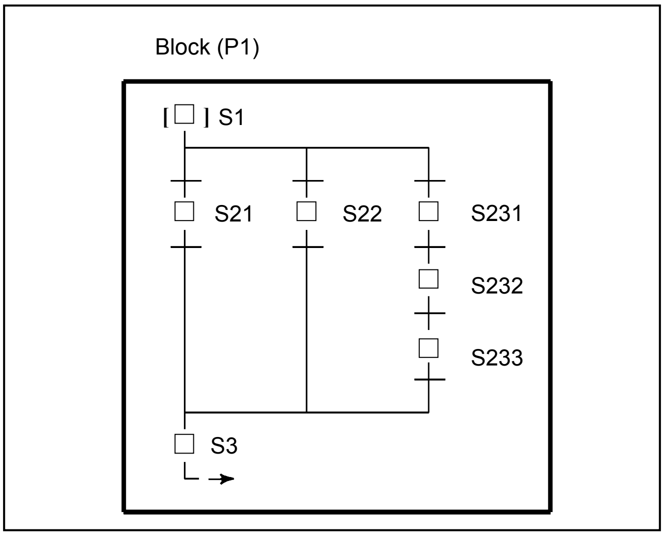
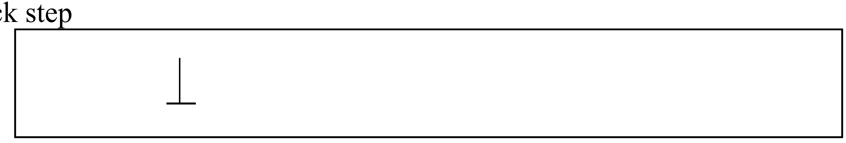


Fig. 10.2.1(l) Program without block step

(11) End of block step



Use an end block step to terminate nested–block–step calling and to return to the calling sequence.

10.2.2 Execution of Step Sequence

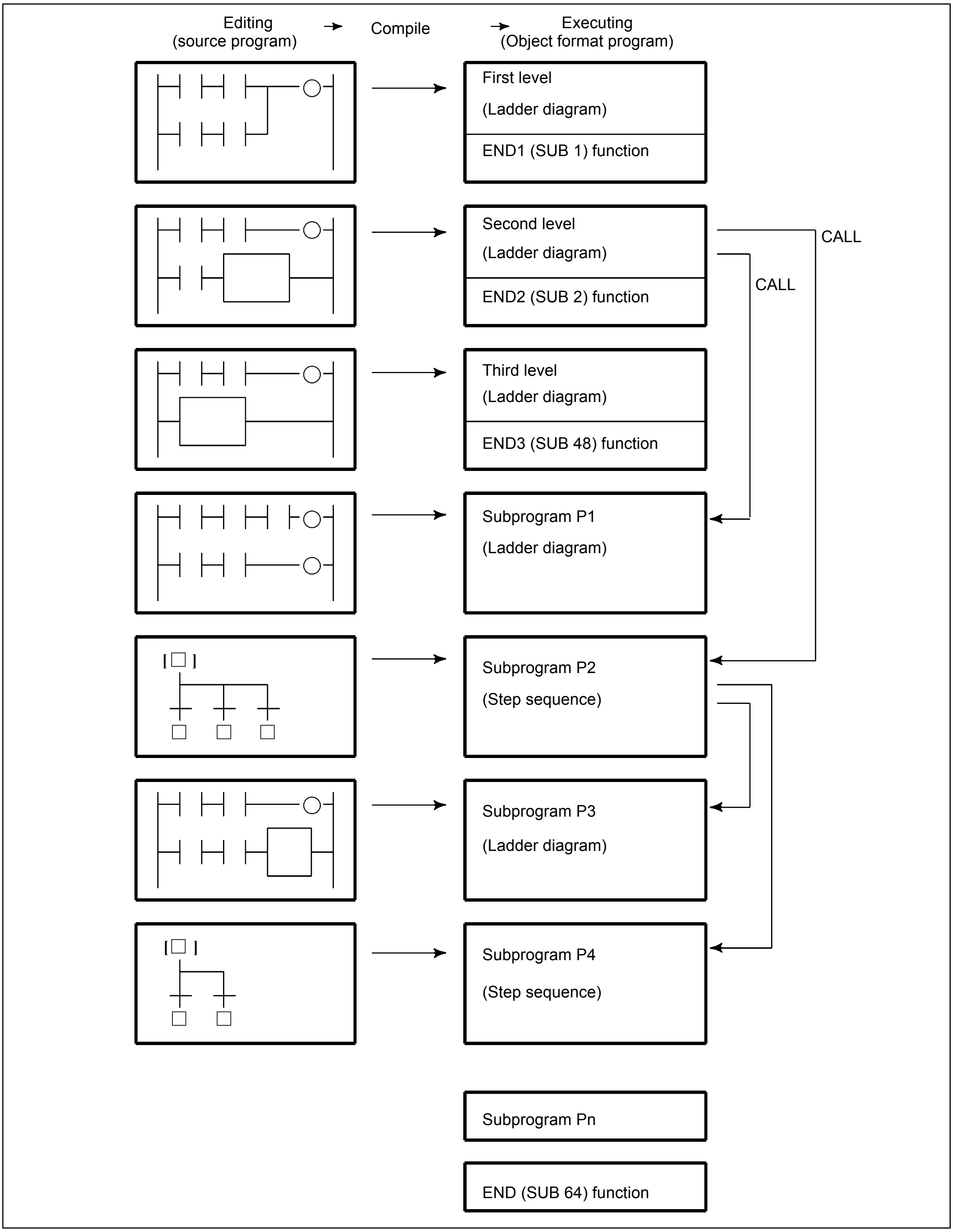


Fig. 10.2.2(a) Structure of program

In the step sequence method, a program is created (edited) in units of subprograms. The edited source program is compiled and converted to an executable ROM–format program, then linked, as shown in Fig. 10.2.2(a).

A ROM–format program is a kind of a modular program, created using conventional subprograms. A step sequence block is also a type of a subprogram. Step sequence blocks are linked to the end of the first level to third level ladder programs, together with other ladder subprograms.
In the same way as in the ladder method, a program is activated at certain intervals.
Refer to section 1.4.3 "Processing Priority (1st Level, 2nd Level, and 3rd Level) " for details

All subprograms, created using either the ladder or step sequence method, are called from the second level ladder. Hence, the execution time of the second level ladder includes those of ladder subprograms, step sequence programs (blocks), steps, and transitions. Since only the activated step and the transition which checks the transition condition from the step to the next step are executed in a step sequence program, the second level ladder is executed much more frequently than may be expected from the total number of steps.

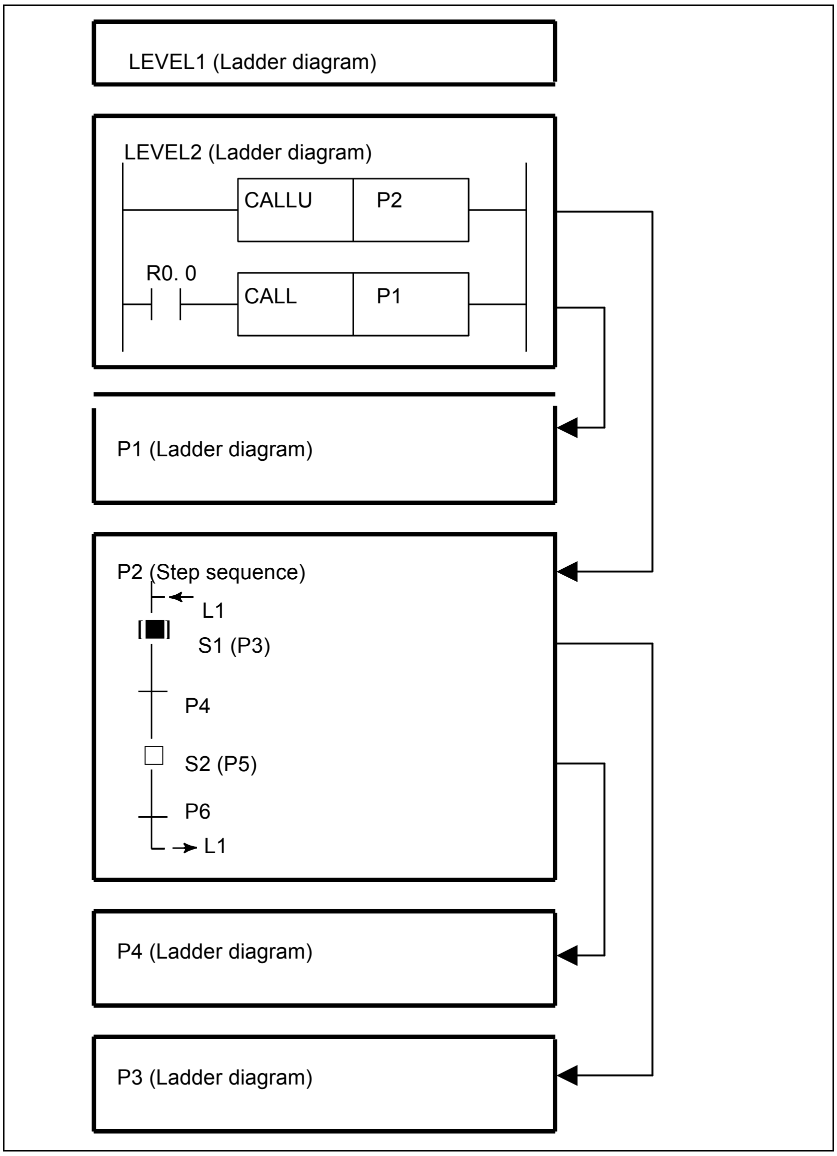


Fig. 10.2.2(b) Execution of step sequence

In the step sequence program shown in Fig. 10.2.2(b), when step S1 is activated, subprograms are executed according to the timing illustrated in Fig. 10.2.2(c).

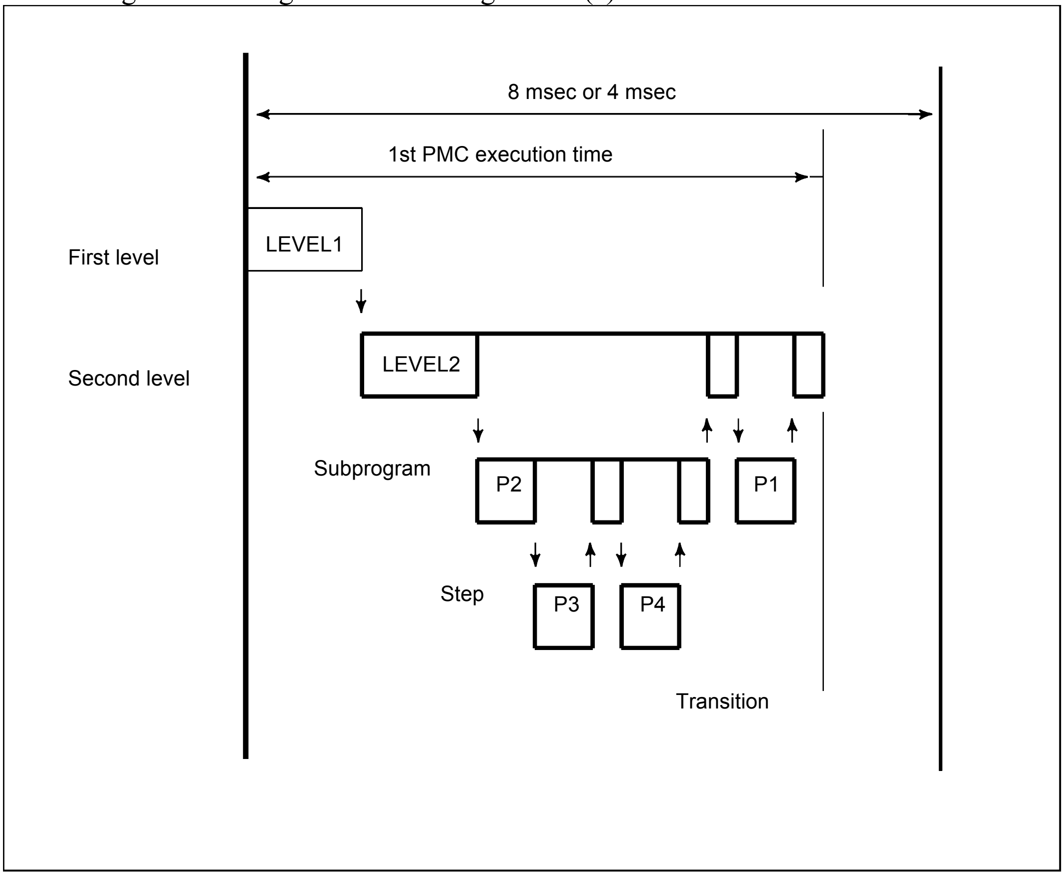


Fig. 10.2.2(c) Timing of execution of step sequence program

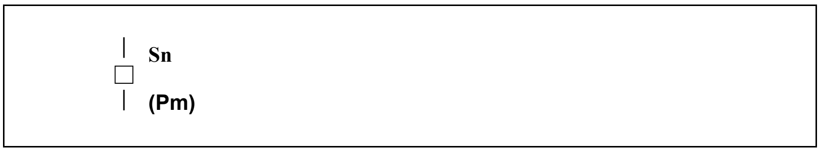
In this case, step sequence program P2, step P3, transition P4, and ladder subprogram P1 are executed. Step P5 and transition P6 are not executed.

10.3 CONFIGURATION AND OPERATION OF STEP–SEQUENCE PROGRAMS

10.3.1 Step

A step is a unit of processing in a program.

Display

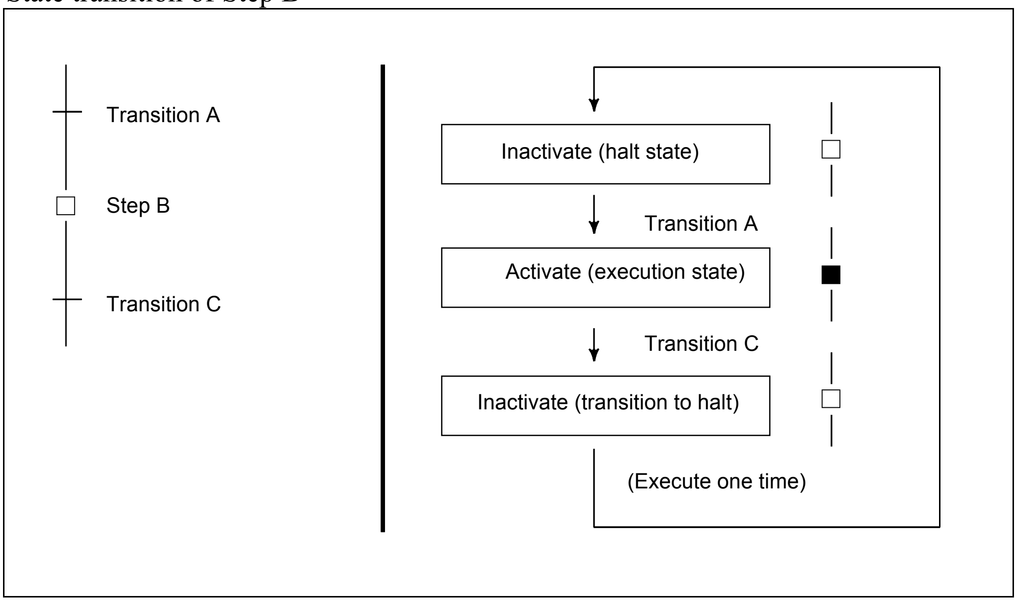


Contents

- Define a step number (Sn), necessary for controlling execution, and subprogram number (Pm) specifying actual processing, for a step.
- Assign a step number to a step.
- The same step number cannot be used twice in a program.
- A step has three logical states: the execution, transition to halt, and halt states. The execution state is also called the active state. The transition to halt and halt states are collectively called the inactive state.

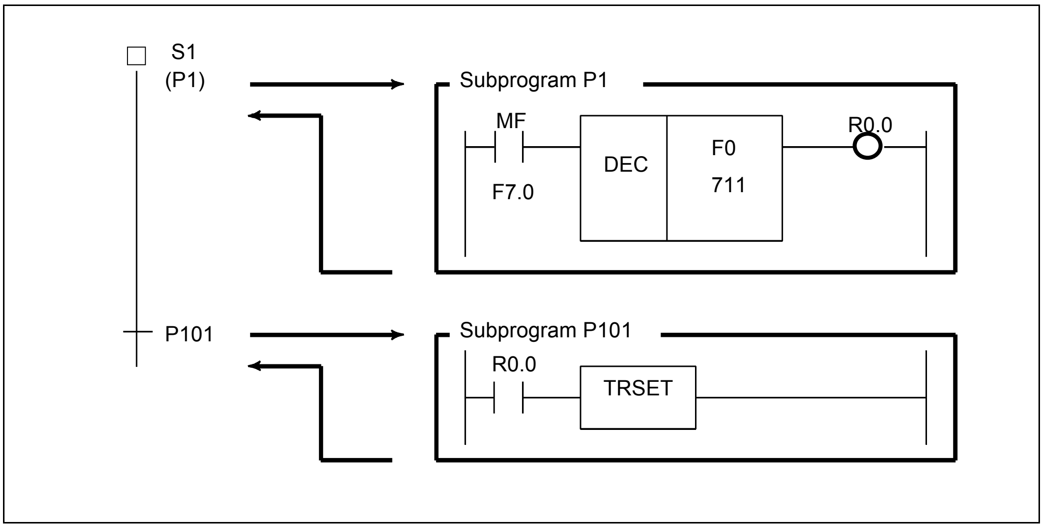
State		Contents of operation	Display	Sn.0
Activate	Execution	Activated step. The action program (subprogram) is being executed.	■ Sn	1
Inactivate	Transition to halt	Transition from execution to halt. The action program (subprogram) is executed once only, then the step automatically transits to halt.	□ Sn	0
	Stop	Not activated state. The action program (subprogram) has not yet been executed.	□ Sn	0

Example) State transition of Step B



Example

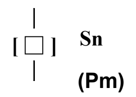
After the M7 code is decoded, control is transferred to the next step using a DEC functional instruction.



10.3.2 Initial Step

An initial step is automatically activated when execution of the program starts. Once it has been activated, it operates in the same way as a normal step. The program can be returned to this step through other steps.

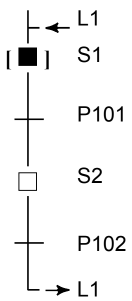
Display



Contents

- Define a step number (Sn), necessary for controlling execution, and subprogram number (Pm) specifying the actual processing, for an initial step.
- All initial steps are activated when the other steps are not activated.
- Each block must contain at least one initial step. No limit is applied to the number of initial steps contained in a block.
- A block having no initial step cannot be executed if called.
- Assign a step number to an initial step.
- The same step number cannot be used more than once in a program.
- In parallel branch, one initial step is required for each path. (See example 2.)

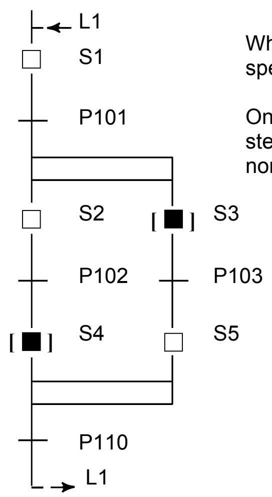
Example 1



When a program is executed, step P1, specified by an initial step, is activated first.

Initial step S1 is executed in the same way as normal step once S1 has been executed.

Example 2



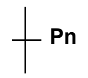
When a program is executed, steps S3 and S4, specified by an initial step, are activated first.

Once steps S3 and S4 have been executed, initial steps S3 and S4 are executed in the same way as normal step when the program starts from step S1.

10.3.3 Transition

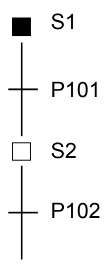
A transition specifies the conditions governing the transition from the step to the next step.

Display



Contents

- Only one transition is required between steps.
- Transition between steps is performed as described below.



While S1 is activate, only S1 and P101 are executed.
Other steps and transition are not executed.
When the transition P102 evaluates true unless S2 is not being executed, the state is ignored.

When the transition P101 evaluates true, control passes fro S1 to S2. In this case, when the condition is true, S1 is terminated regardless of the state of S1, and S2 is activated.

- When a signal is set to 1 in a transition, it remains the state even if the control is transferred to the subsequent step. To set the signal to 0, use another subprogram to do so.

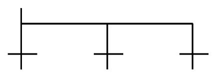
Example

Refer an example described on the Step function (Sub sec. 10.3.1).

10.3.4 Divergence of Selective Sequence

A selective sequence branches to two or more sequences. When the transition evaluates true, the corresponding step is activated.

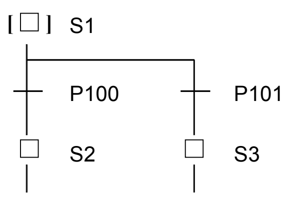
Display



Contents

- Transitions are placed after a divergence of selective sequence.
- The step connected to the transition for which the conditions are true is first activated.
- When the conditions for any transition are true simultaneously, the leftmost step is activated.
- A selective sequence can create up to 16 paths.

Example



When the conditions for P101 are satisfied earlier than those of P102, step S3 is activated.

10.3.5 Convergence of Selective Sequence

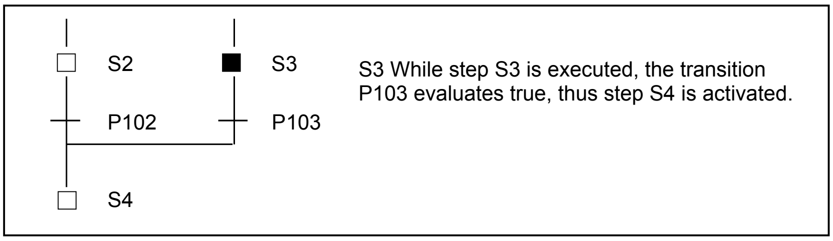
It combines two or more divergent paths to the main sequence.

Display

Contents

The number of divergent paths must match that of the convergent paths.

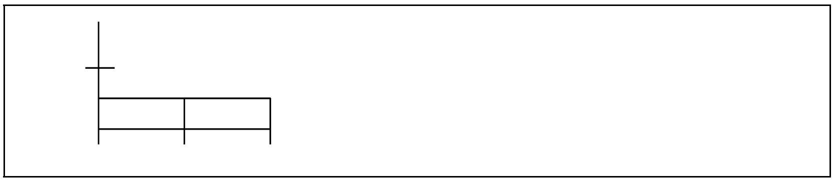
Example



10.3.6 Divergence of Simultaneous Sequence

A simultaneous sequence branches to two or more sequences, and all steps are activated simultaneously.

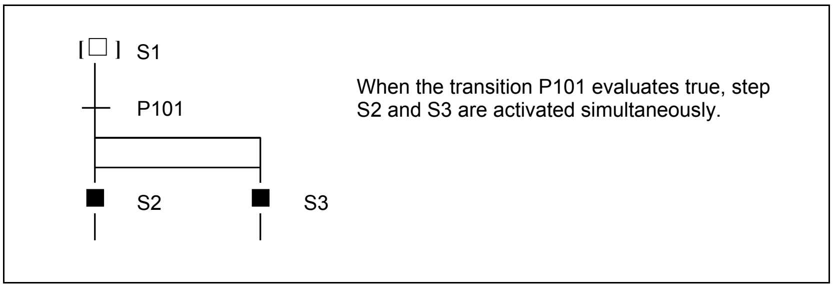
Display



Contents

- A transition must be placed before a divergence of simultaneous sequence.
- All branched steps are activated simultaneously, then executed.
- A simultaneous sequence can create up to 32 paths.

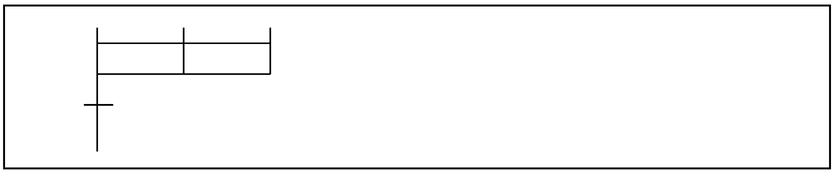
Example



10.3.7 Convergence of Simultaneous Sequence

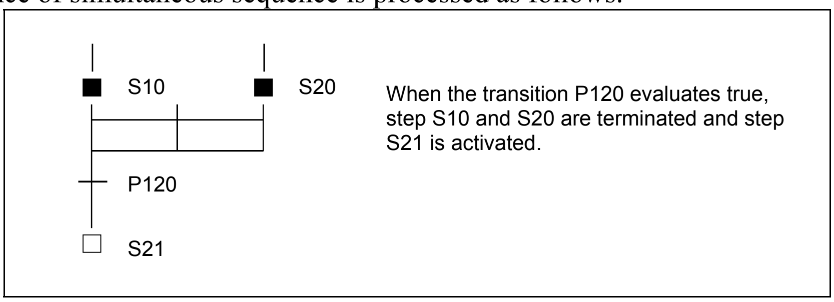
It combines two or more divergent paths to the main sequence.

Display



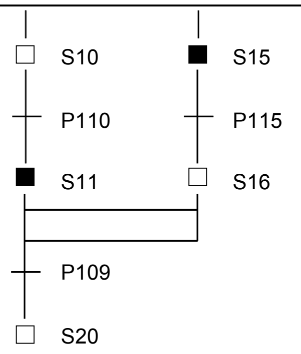
Contents

- A convergence of simultaneous sequence is processed as follows.



- Wait processing is processed as follows.

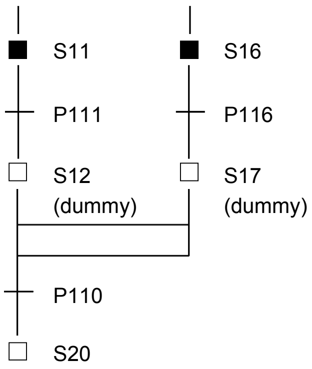
Case 1)



When the transition P109 evaluates true unless both of step S11 and S16 are active, control does not pass to step S20.

When the transition P109 evaluates true while both of S11 and S16 are active, S11 and S16 are terminated and S20 is activated. In the case, P109 provides the termination conditions for both S11 and S16.

Case 2)



To specify the termination conditions for S11 and S16 separately, place the conditions in P111 and P116 and specify two dummy steps, S12 and S17, as shown

A dummy step also requires a step number and subprogram number. Also specify a dummy transition condition, which becomes always true, in P110.

10.3.8 Jump

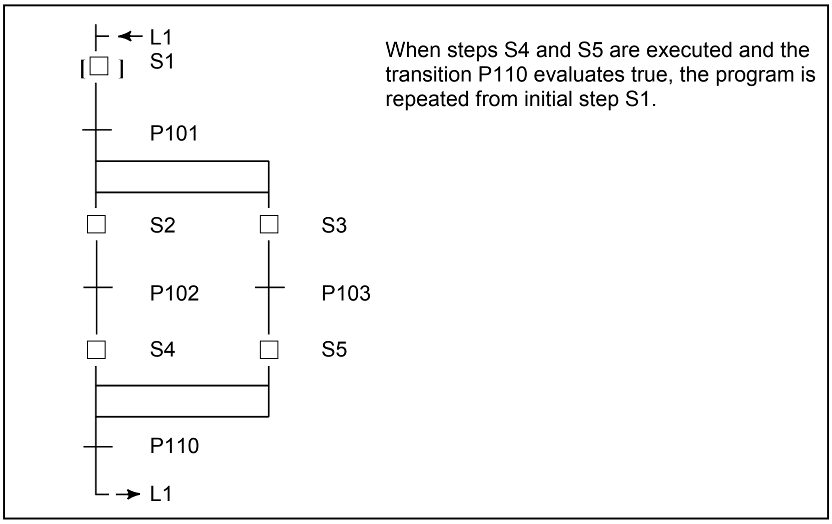
A jump controls the execution of steps non–sequentially, together with a transition.

Display

Contents

- Specify a jump destination label (Ln).
- The step to which control is transferred (jumped) is activated.
- The jump destination must be within the same program.
- A jump cannot be performed from outside a simultaneous sequence to within the simultaneous sequence, or from within a simultaneous sequence to outside.
- A jump cannot be performed between parallel–branched paths.

Example



10.3.9 Label

A label specifies the jump destination.

Display

Contents

Specify the jump destination label (Ln).

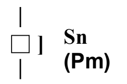
Example

Refer to an example described on the jump function (Subsec. 10.3.8).

10.3.10 Block Step

A block step specifies the step sequence subprogram to be executed.

Display

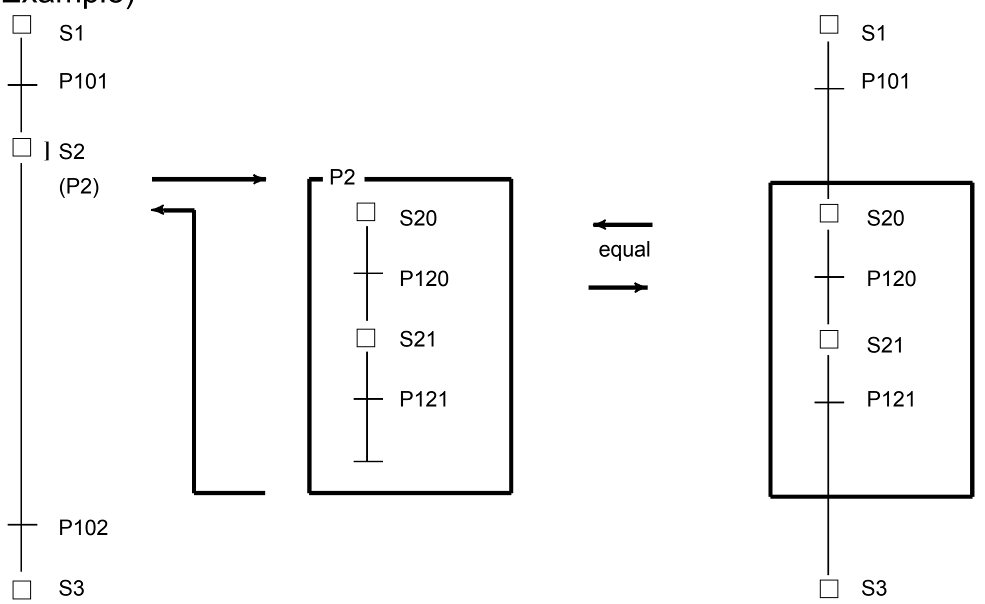


Contents

Define a step number (Sn), which controls the execution of a block step, and a subprogram (Pm) specifying the actual process, for a block step.

⚠ CAUTION

1 Assign a step number to a block step.
2 The same step number cannot be used twice in a program.
3 A transition must be placed after a block step.
Example)



4 Transition P102 cannot be omitted due to the syntax of the step sequence method. Specify a dummy transition, which becomes always true, for transition P102.
5 Transition P121 must specify the transition condition for the termination of the step S21.
6 When the conditions of transitions P102 and P121 are switched, step S21 will not be correctly executed.

10.3.11 Initial Block Step

This is an initial step on the block step.

Display

Contents

- Define a step number (Sn), necessary for controlling execution, and subprogram number (Pm) specifying the actual processing, for an initial step.
- This step has the same function and graphical symbol as an initial step.

10.3.12 End Of Block Step

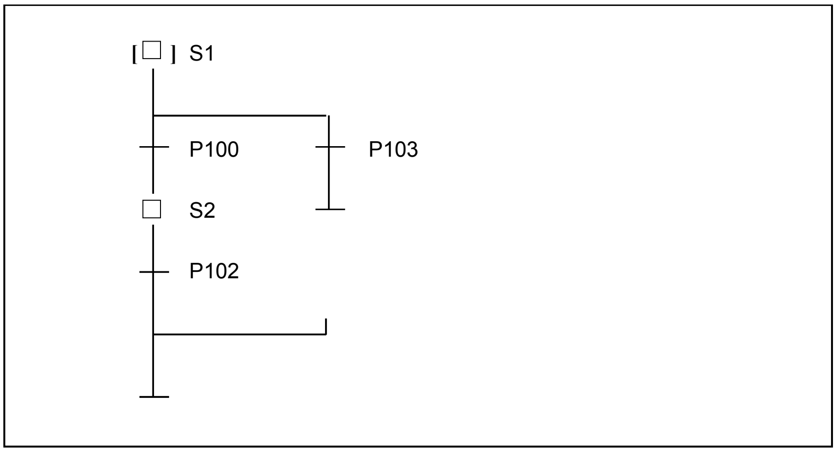
This terminates a block step.

Display

Contents

- Use this step to terminate a block step.
- Each block requires at least one end block step. No limit is applied to the number of end block steps.

Example



10.4 EXTENDED LADDER INSTRUCTIONS

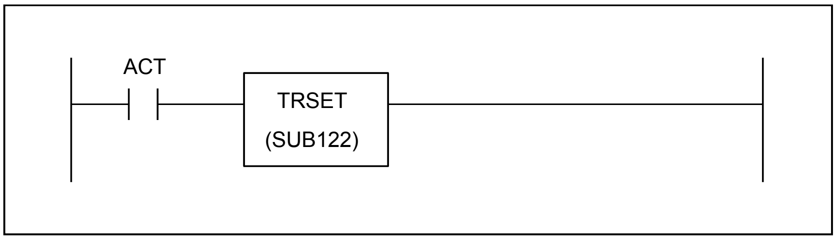
To enable the specification of steps and transitions, the components of a step sequence program, by means of the ladder method, the following signals and functional instructions are provided. These signals and instructions can only be used in subprograms in which step sequence step and transitions are specified.

10.4.1 Functional Instruction TRSET

Function

This instruction describes that the conditions for a transition have been true.
This instruction is used in a subprogram which is called from a transition.

Format



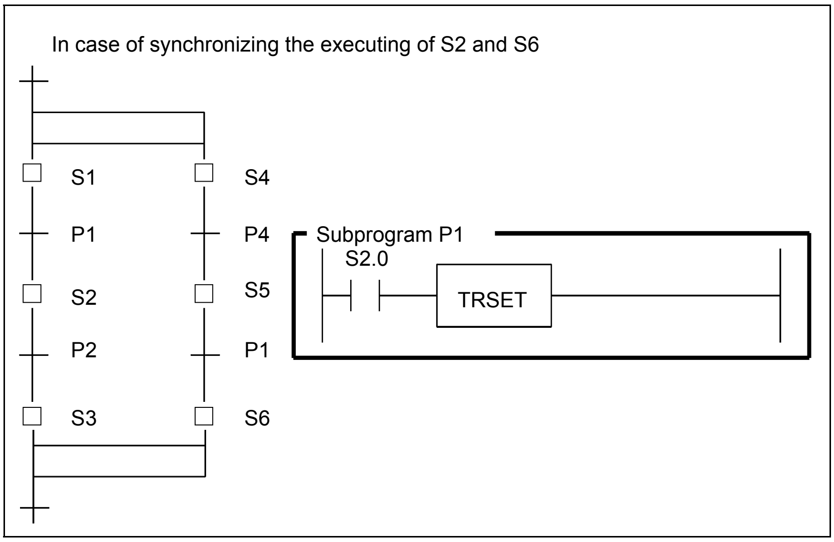
10.4.2 PMC Address (S Address)

Contents

- An S address is created to end block step processing.
- The meaning of each bit of the step number (S address) is shown in the following.
  S*n*.0 0: Transition to halt state, or halt state
  1: Execution state
  S*n*.4 0: Transition to halt state, or halt state, or the scanning execute for the first time.
  1: Execution state (Turns ON 1 scan delayed from Sn.0)
- This address allows any subprogram to reference the state of any step.
- When 0 is written in the S address with byte size, the Execution State of step that is specified can be initialized. When LADDER was stopped, or the step which is no longer being called while in the activated state, etc, the step sequence program can be execute from the beginning when it is activated next time. The initialization of Execution State of step should be carried out with state that step sequence program which contains this step isn't called (ACT=0). To initialize a step sequence program, writes 0 in all the S addresses included within the program.
- A ladder for the TRSET transition instruction can be programmed using each bits of S address. Referring to S address, however, adversely affects the portability and comprehensibility. Use this feature sparingly.

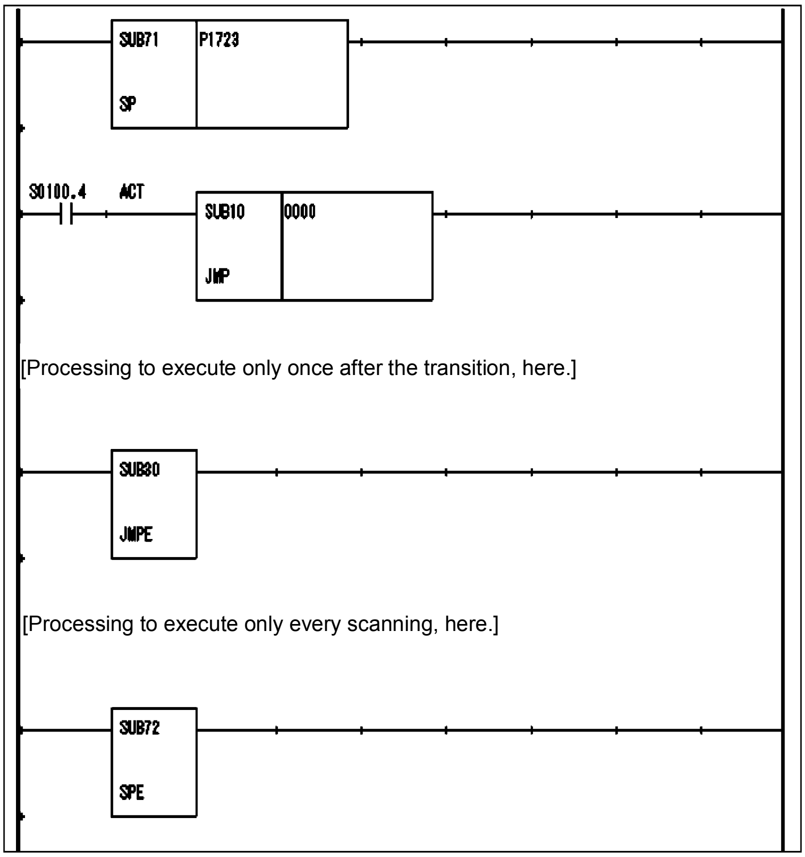
Example 1

This address is used to reference the activation states of steps in a step in which this address has been specified, and performs complicated wait processing in a program including a simultaneous sequence.



Example 2

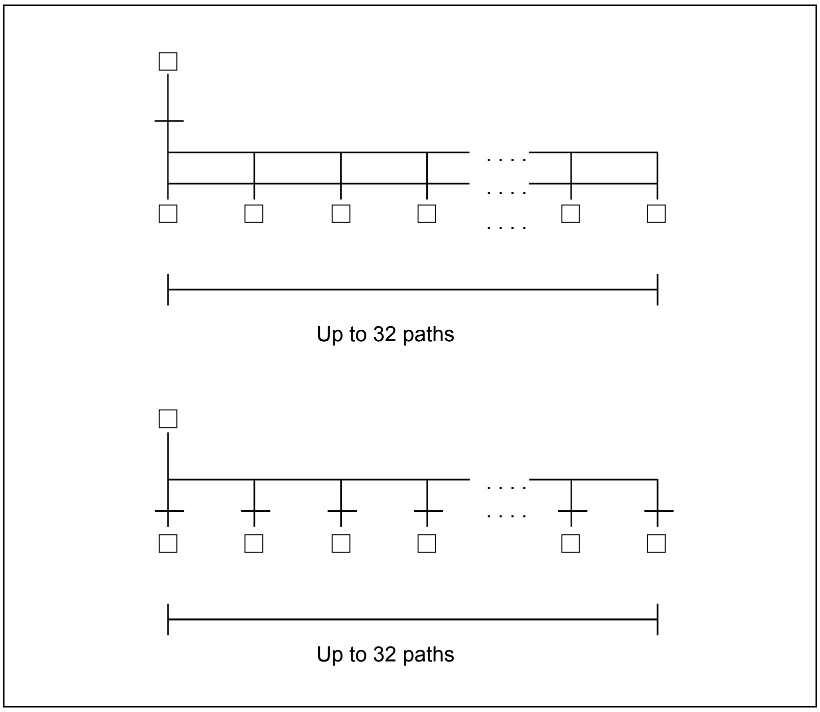
The section between JMP and JMPE in the following example is executed only once after the specific step (The following example is in the case of S100.) transits in the activated state from the inactivated state.



10.5 SPECIFICATION OF STEP SEQUENCE

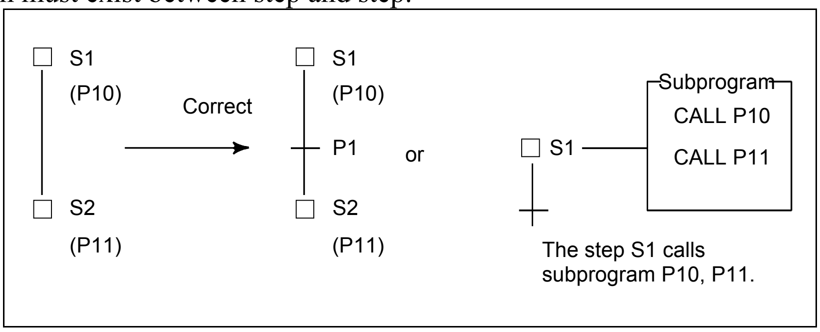
10.5.1 Specification

Item	Description
Number of subprogram	Up to 5000 (P1 to P5000)
Number of step	Up to 2000 (S1 to S2000)
Number of label	Up to 9999 (L1 to L9999)
Maximum number of jumps per block	Up to 256
Nesting depth of block step	Up to 8 levels
Size of block	192 lines × 48 columns
Number of paths	Up to 32 paths

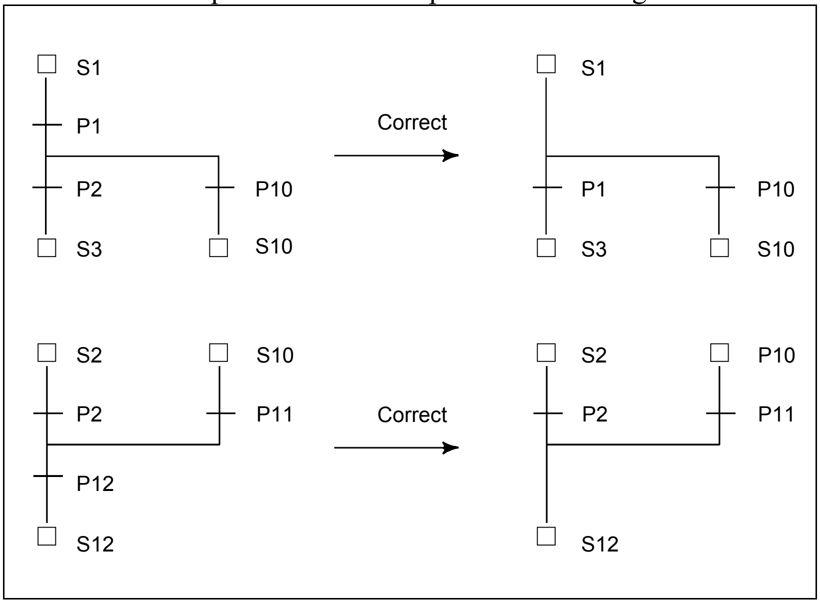


10.5.2 General Rules

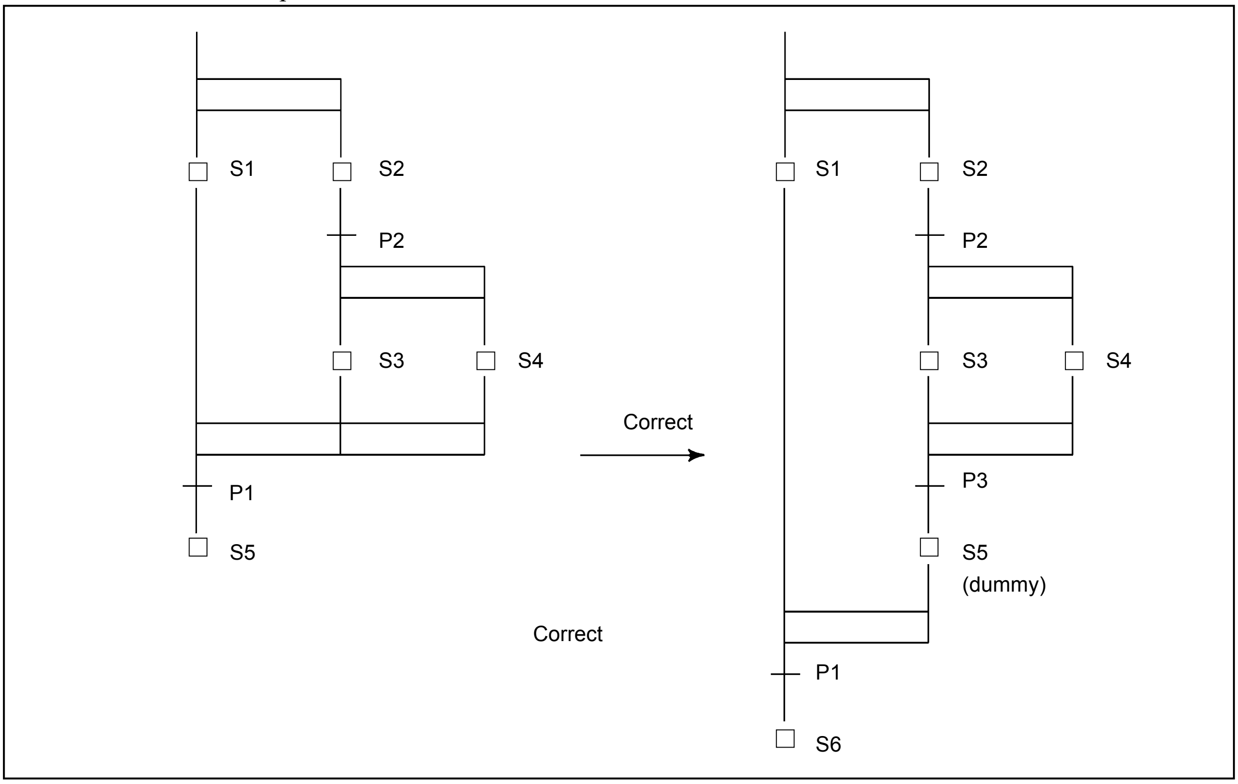
- One transition must exist between step and step.



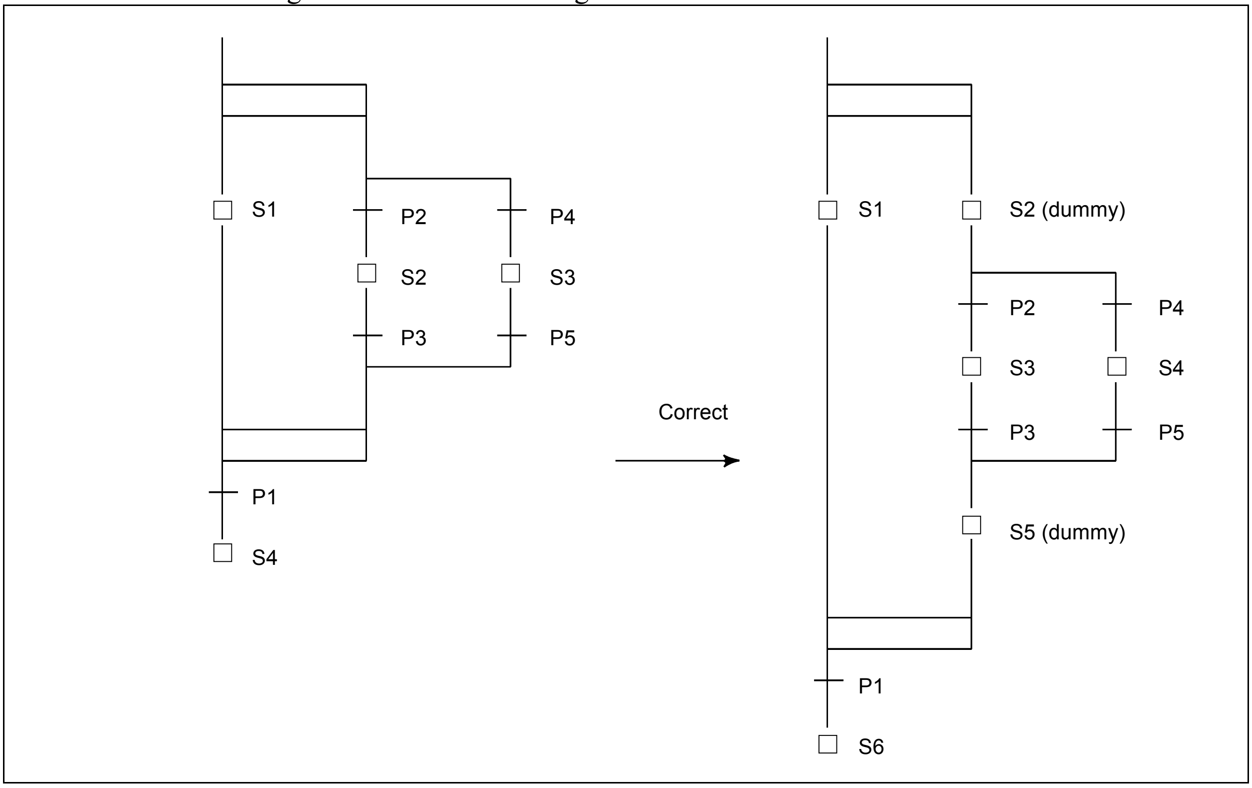
- The transition shall never be repeated even at the point of the divergence and the convergence.



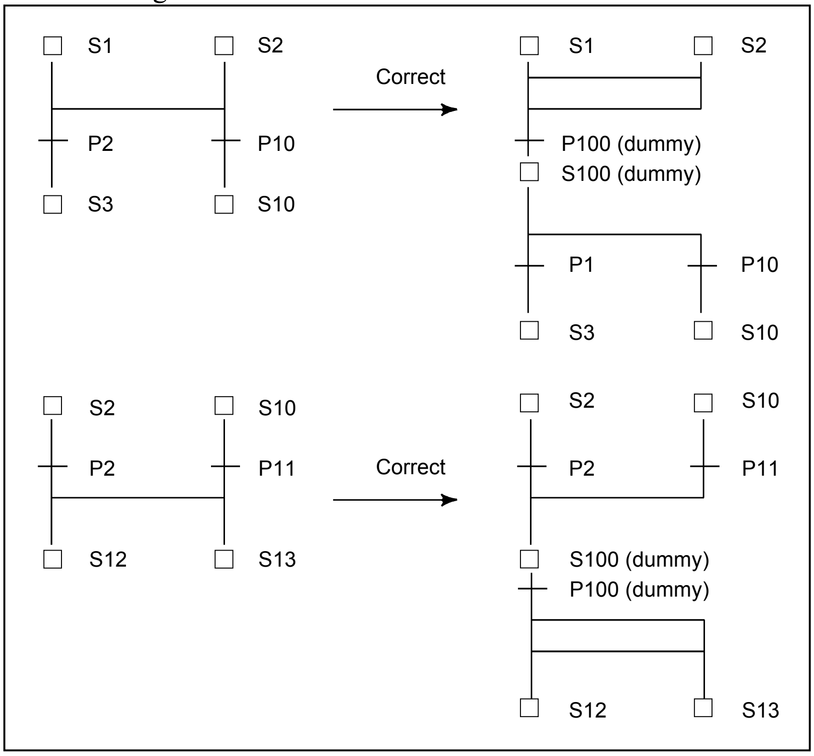
- When a simultaneous sequence is specified in another simultaneous sequence, one convergence must not be used for each sequence.



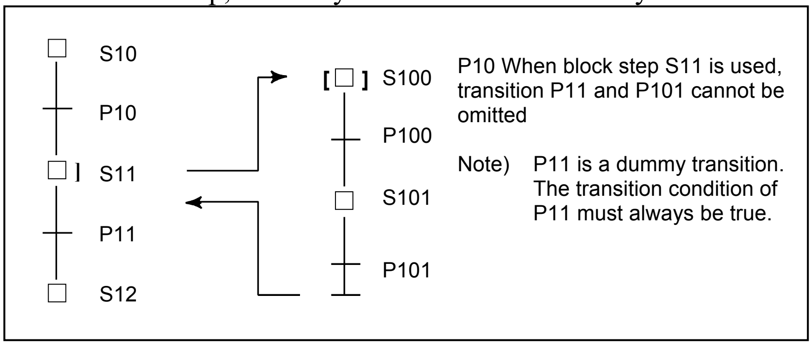
- When a selective sequence is specified in a simultaneous sequence, dummy steps must be required both after the divergence and before convergence.



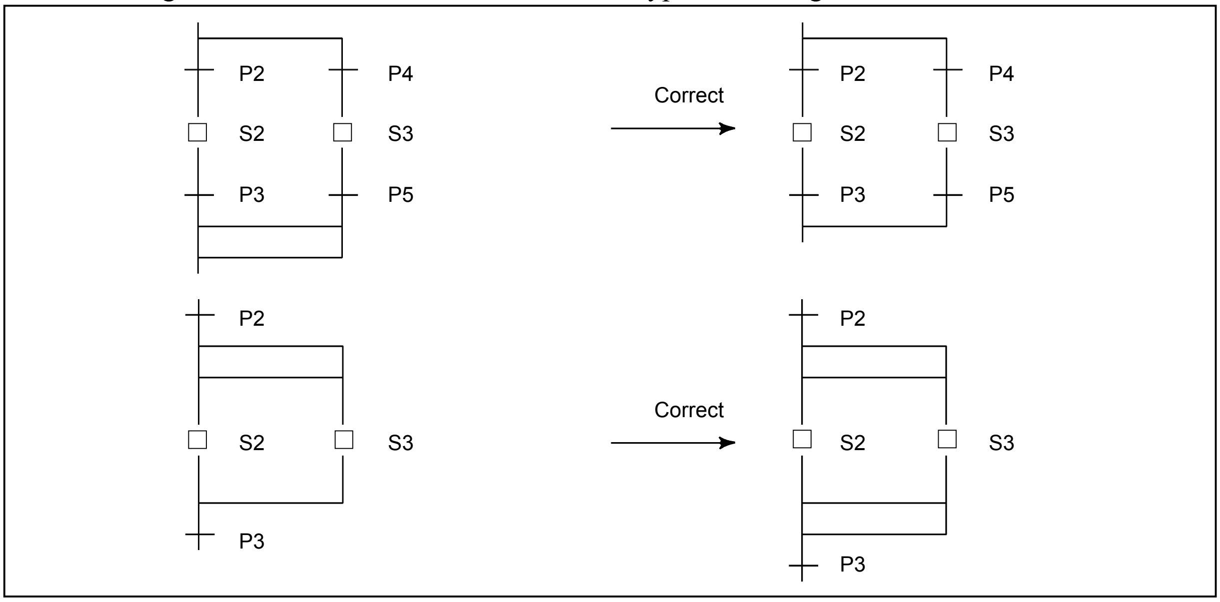
- In case of branching again immediately after the convergence, a step/transition is required between the divergence and convergence.



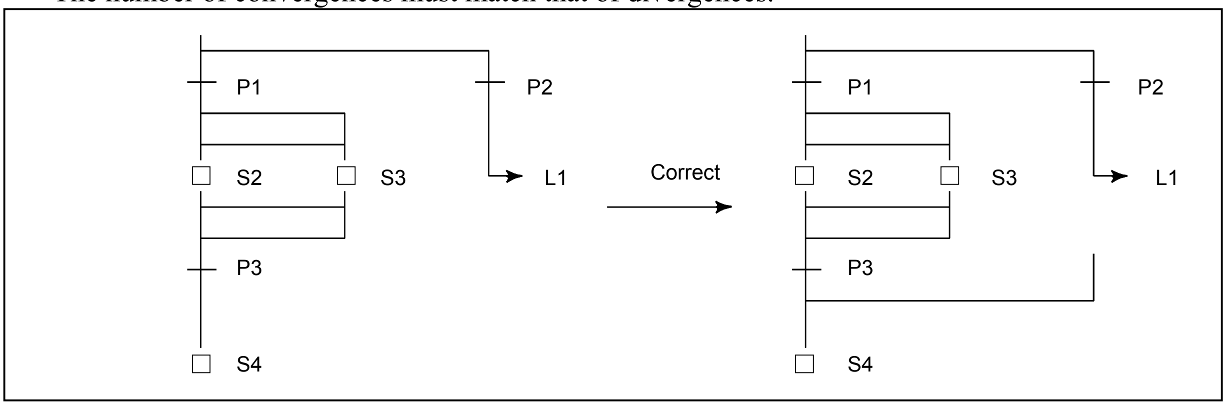
- Immediately after the block step, a dummy transition which is always true is needed.



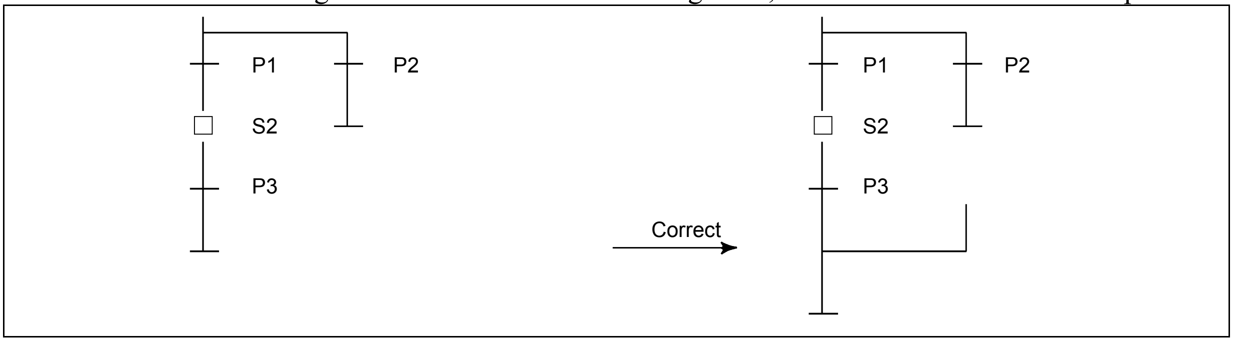
- The divergence must be terminated with the same type of convergence.



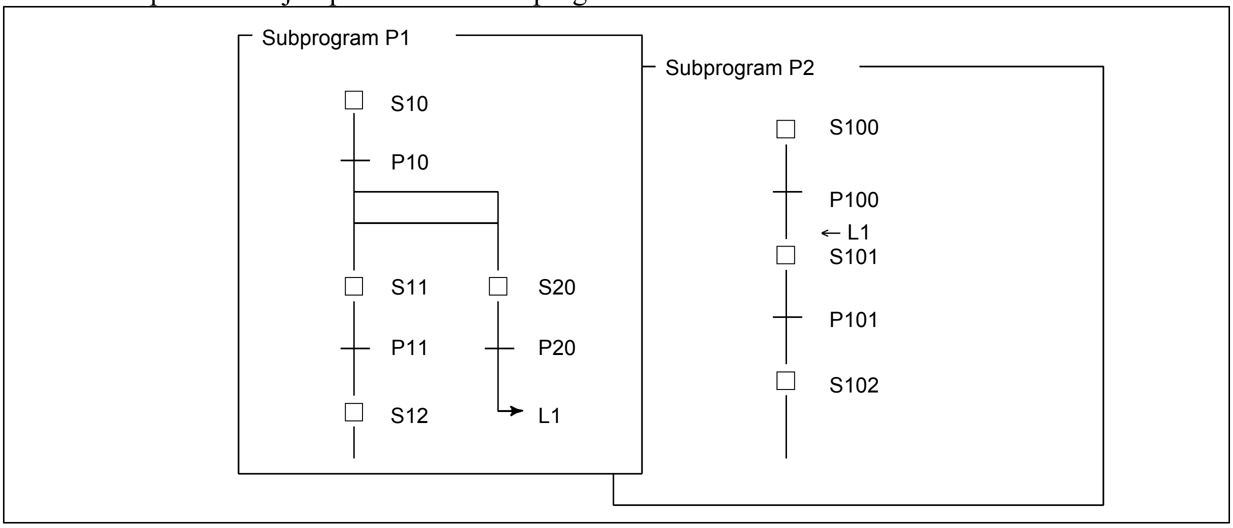
- The number of convergences must match that of divergences.



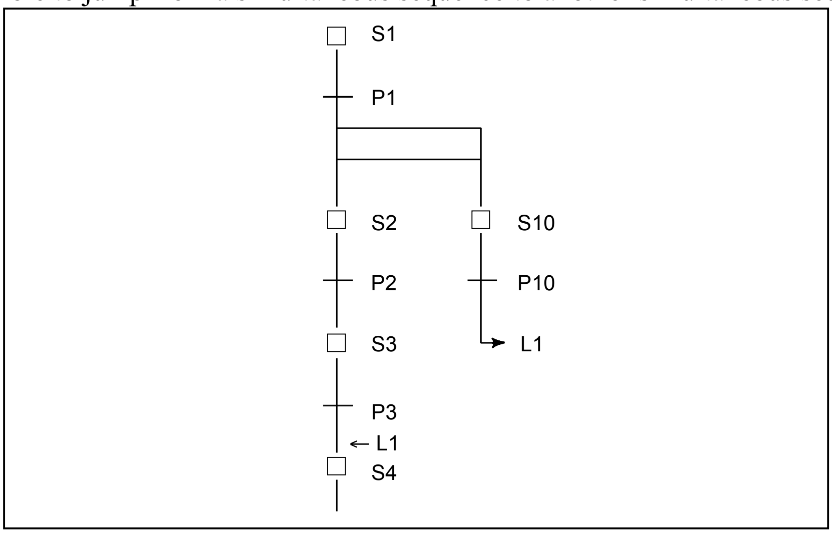
- The number of convergences must match that of divergences, even at the end of a block step.



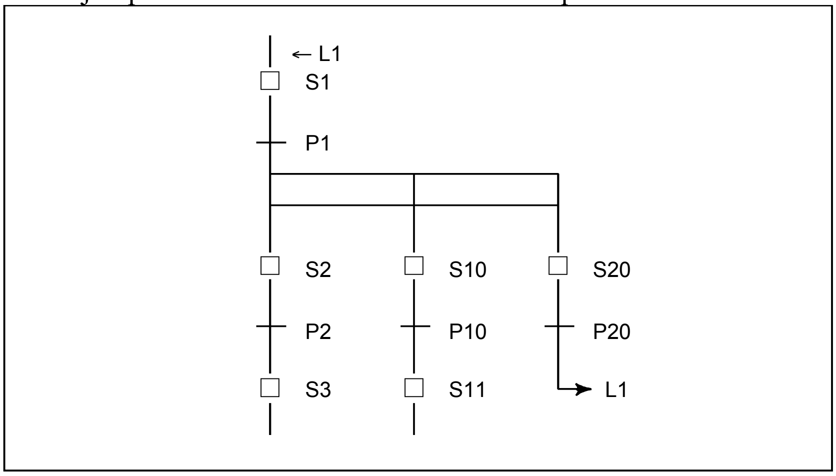
- It is not possible to jump to the other subprogram.



- It is not possible to jump from a simultaneous sequence to another simultaneous sequence.



- It is not allowed to jump from inside of the simultaneous sequence to outside.



10.5.3 Exclusive Control for Functional Instructions

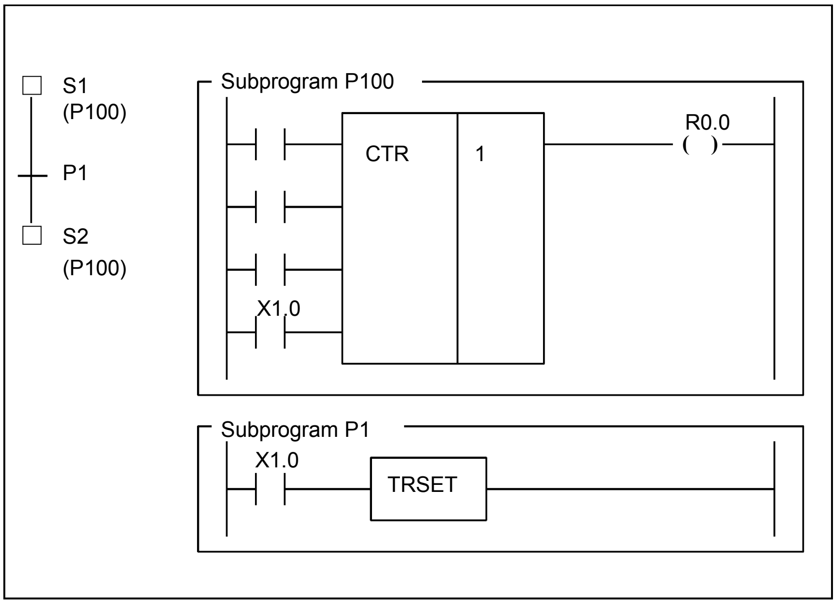
The use of the following basic/functional instructions is restricted in steps and transitions.

<table>
<tr><th>Group</th><th colspan="2">Description</th><th>Basic instructions</th><th>Functional instructions</th></tr>
<tr><td rowspan="3">A</td><td colspan="2">The instructions operate when a signal changes.</td><td rowspan="3">RDPT
ANDPT
ORPT
RDPT.STK
RDNT
ANDNT
ORNT
RDNT.STK</td><td rowspan="3">CTR (SUB5)
CTRC (SUB60)
TMR (SUB3)
TMRB (SUB24)
TMRC (SUB54)
DIFU (SUB57)
DIFD (SUB58)</td></tr>
<tr><td>Condition</td><td>Multiple functional instructions having the same number are used.</td></tr>
<tr><td>Problem</td><td>Not activated.
Correct operation cannot be guaranteed.</td></tr>
<tr><td rowspan="3">B</td><td colspan="2">Restriction due to the interface.</td><td rowspan="3">-</td><td rowspan="3">WINDR (SUB51)
WINDW (SUB52)
DISP (SUB49)
DISPB (SUB41)
EXIN (SUB40)
AXCTL (SUB53)</td></tr>
<tr><td>Condition</td><td>Data is input or output by using two subprograms.</td></tr>
<tr><td>Problem</td><td>Invalid return value.
Not terminated.</td></tr>
</table>

(1) Basic/functional instructions of group A
Since these functional instructions operate when the corresponding signals change, they may not operate correctly when called from multiple steps.

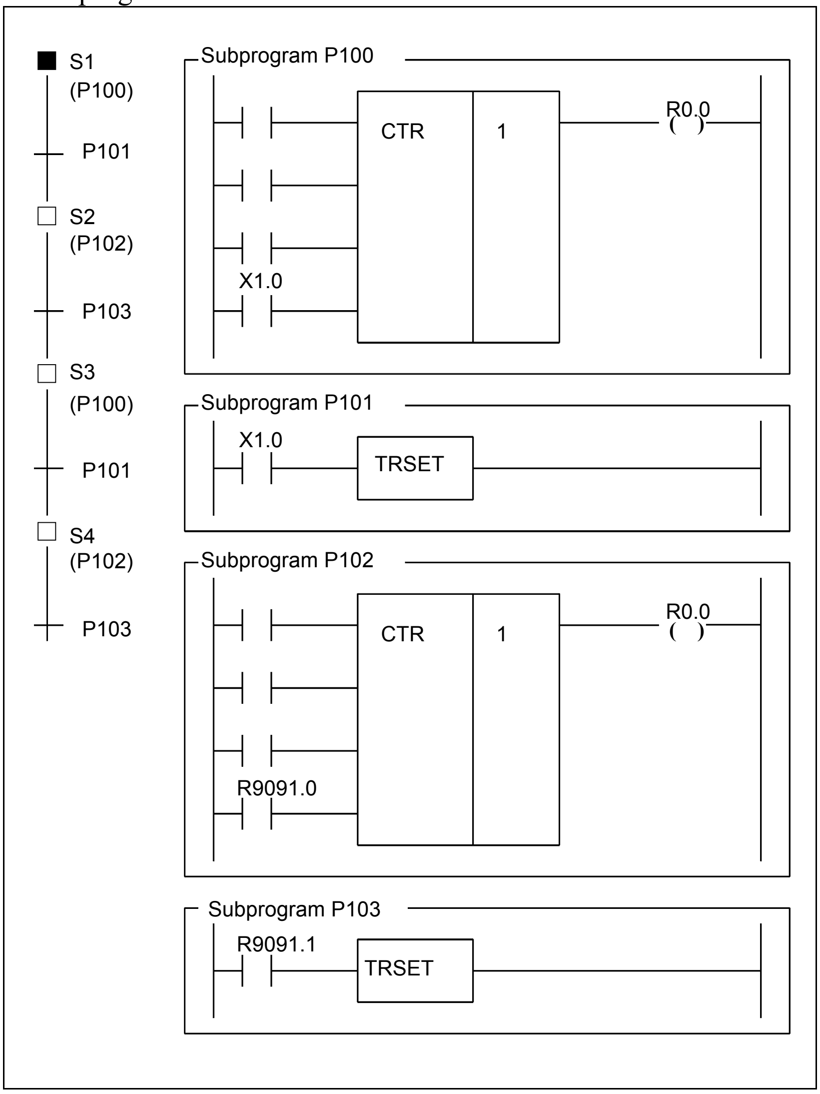
Example

While multiple CTR functional instructions are used, when control passes from S1 to S2 with ACT of CTR not set to off, CTR is not counted when called from step S2.



Correct program

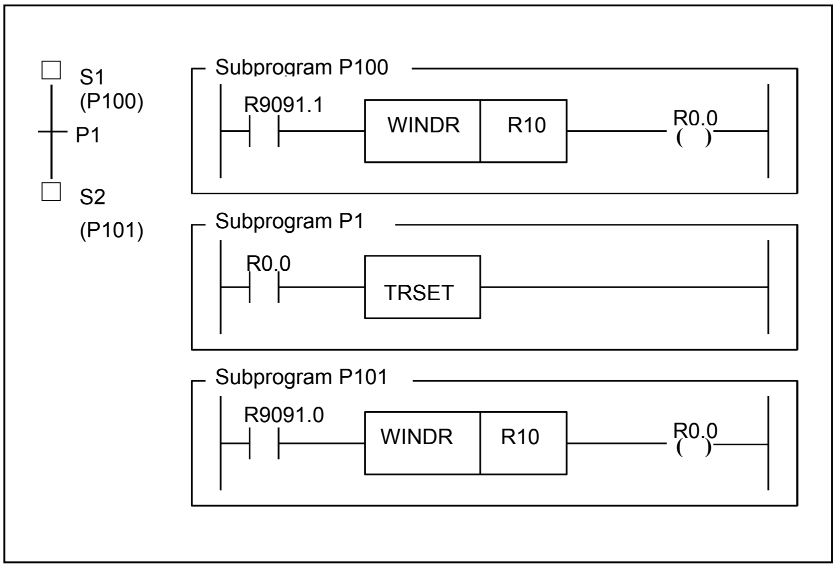
Divide the subprogram so that ACT of CTR is called after it is set to off.



(2) Functional instructions of group B
While an instruction is being executed through the interface with the NC, other same instructions cannot be executed. PMC control software does not receive the process when the instruction is not at a same position (net).
If ACT is set to on and off in different instructions (or subprograms), these processes are not terminated.

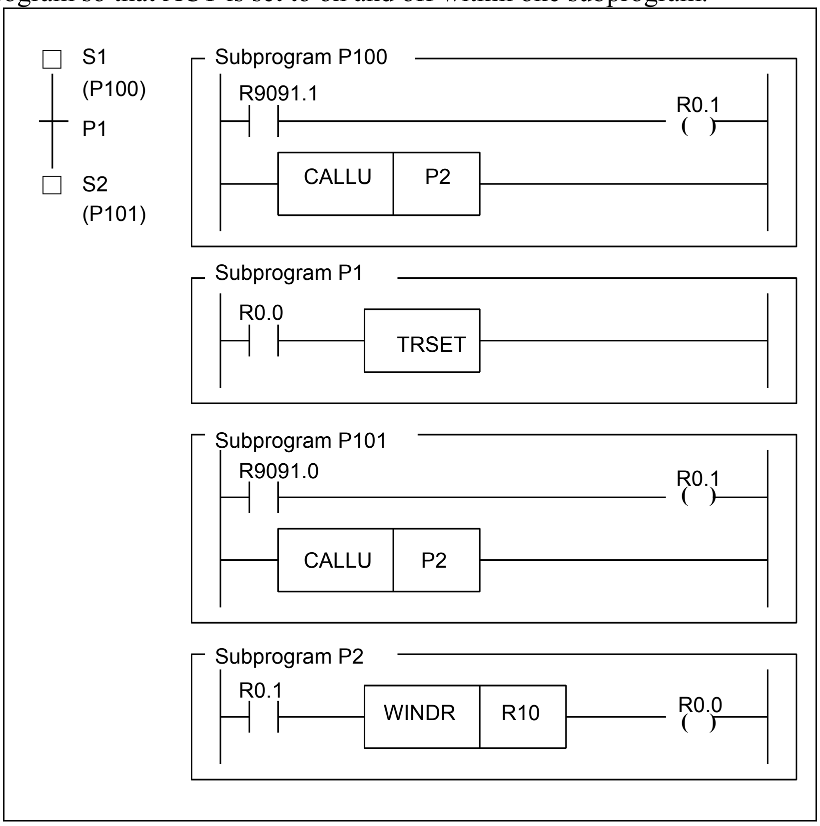
NOTE
Only the window instructions (WINDR and WINDW) which work as low–speed–type belong to the group B.

Example



Correct program

Correct the program so that ACT is set to on and off within one subprogram.



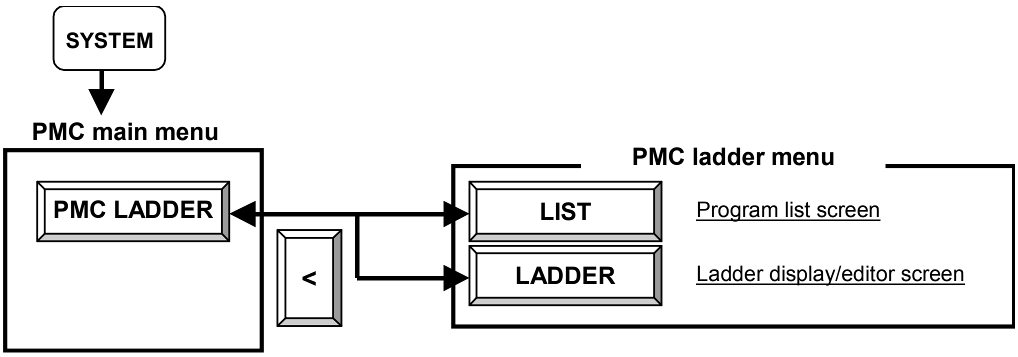
10.6 STEP SEQUENCE SCREEN OPERATION

10.6.1 Displaying a Step Sequence Diagram

The following operations are supported to enable the diagnosis and debugging of a step sequence program.

- Displaying a step sequence and editing a ladder
- Displaying the execution state of a step sequence
- Monitoring the run time of the step sequence program

A step sequence can be operated using the PMC ladder menu.
The PMC ladder menu is used to display PMC ladder related screens such as a program list screen and ladder diagram display/editor screen.
The screen display can be switched to the PMC ladder menu by operating the <SYSTEM> key then the [PMC LADDER] soft key as shown below.



Pressing the [LADDER] soft key displays a sequence program dynamically to enable operation monitoring. On the editor screen, modifications can be made to relays and function instructions of a sequence program to change the operation of the sequence program.
The ladder diagram display/edit function consists of the following screens:
(1) Ladder diagram display screen (ladder diagram monitor screen)
Displays a ladder diagram and monitors the current state of relays/coils.
(2) Selection monitor screen
Displays a selected ladder net only and monitors the current state of relays/coils.
(3) Ladder diagram editor screen
Used to edit a ladder on a net-by-net basis.
(4) Net editor screen
Used to edit the contents of a net in a ladder.
(5) Program list display screen
Used to select a subprogram to be displayed on the ladder diagram display screen.
(6) Program list editor screen
Used to edit a ladder program on a subprogram-by-subprogram basis and select a subprogram to be edited on the ladder diagram editor screen.
(7) Function instruction data table display screen
Enables the data table of a function instruction to be referenced.
(8) Function instruction data table editor screen
Enables the data table of a function instruction to be edited.
(9) Step sequence display screen
Displays a step sequence diagram and monitors the current step/transition state.
(10) Subprogram list display screen
Used to select a subprogram used with a step sequence.

(11) Step sequence state display screen
Displays the execution state of each step of a step sequence.

NOTE
These screens can be protected using the programmer protection function.

The screens make transactions as shown below.

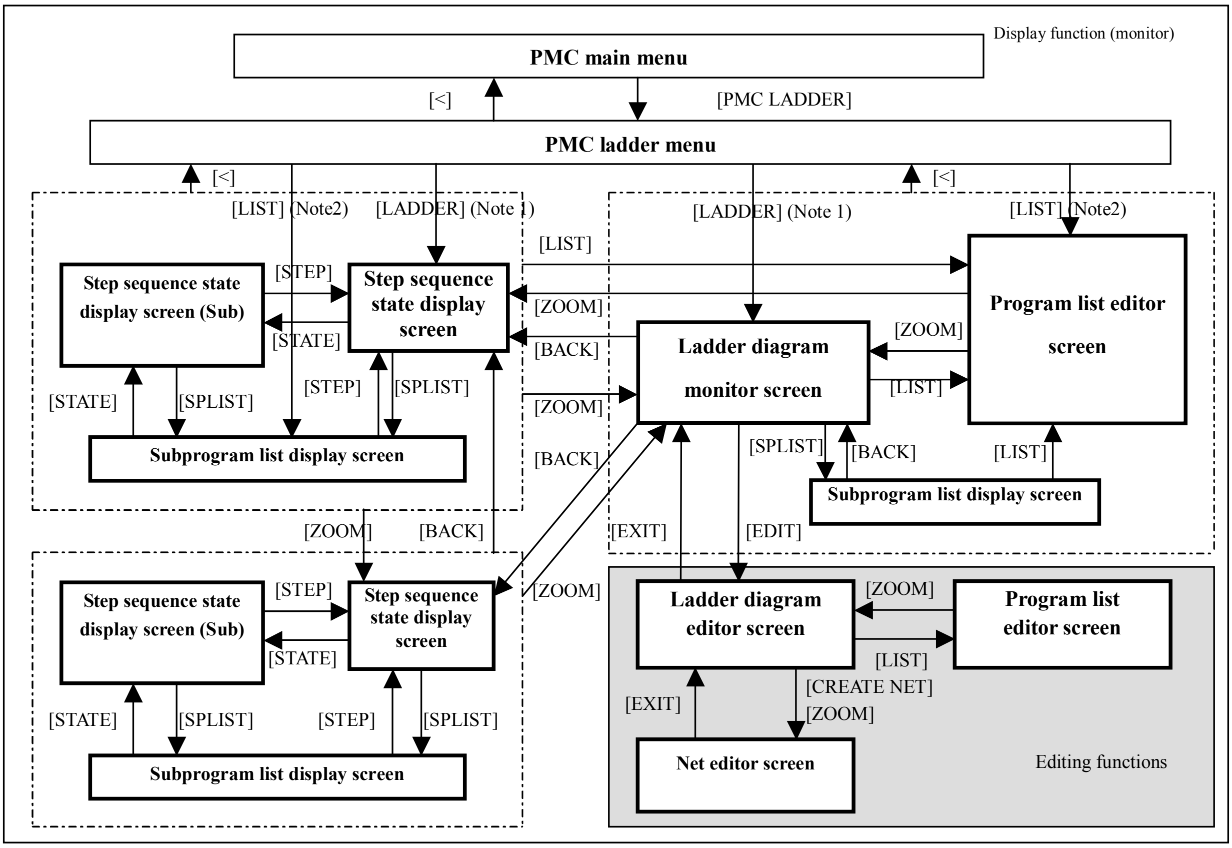


Fig. 10.6.1 Transition of step sequence display and ladder display/editing screen

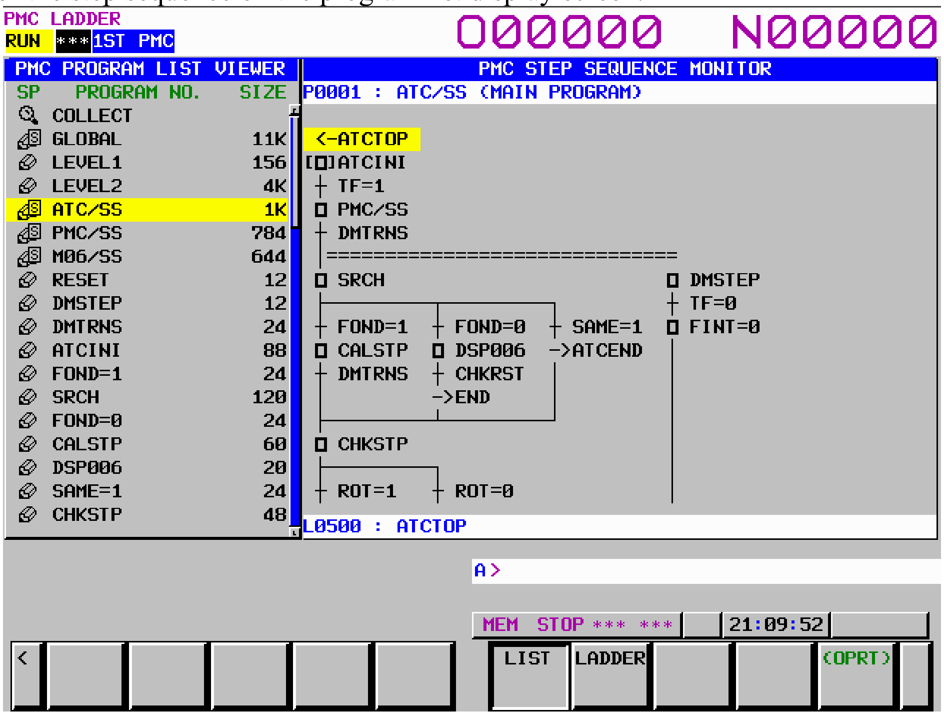
NOTE
1 Pressing the [PMC LADDER] soft key displays one of the ladder diagram display screen, selection monitor screen, step sequence display screen or the program list display screen which was displayed most recently.
2 The [EDIT] soft key on the ladder diagram display screen is displayed only when the programmer function is enabled. (To enable the programmer function, set the setting item "PROGRAMMER ENABLE" on the PMC parameter setting screen to "Yes" or set K900.1 to 1.) Alternatively, set "EDIT ENABLE" to "Yes" or set K901.6 to 1.

10.6.2 History of Display

The history of transition of subprogram display in the ladder program display screen or the step sequence program display screen is recorded. The history records are displayed in the subprogram list display screen. As for details, refer to 8.11.1.

10.6.3 Program List Display Screen

To display the step sequence diagram display screen first after the power is turned on, select a subprogram of the step sequence on the program list display screen.



Program list display screen (step sequence)

On the program list display screen, a subprogram of a step sequence is marked with  or  in the "SP" display area. Pressing the [ZOOM] soft key when the cursor is placed on a subprogram, the screen display switches to the step sequence display screen.
For details of the program list display screen, see Section 8.1, "DISPLAYING THE PROGRAM LIST ("LIST" SCREEN)".

10.6.4 Step Sequence Display Screen

Pressing the [ZOOM] soft key when the cursor is placed on a step sequence on the program list display screen, subprogram list display screen, or step sequence display screen displays the step sequence display screen.

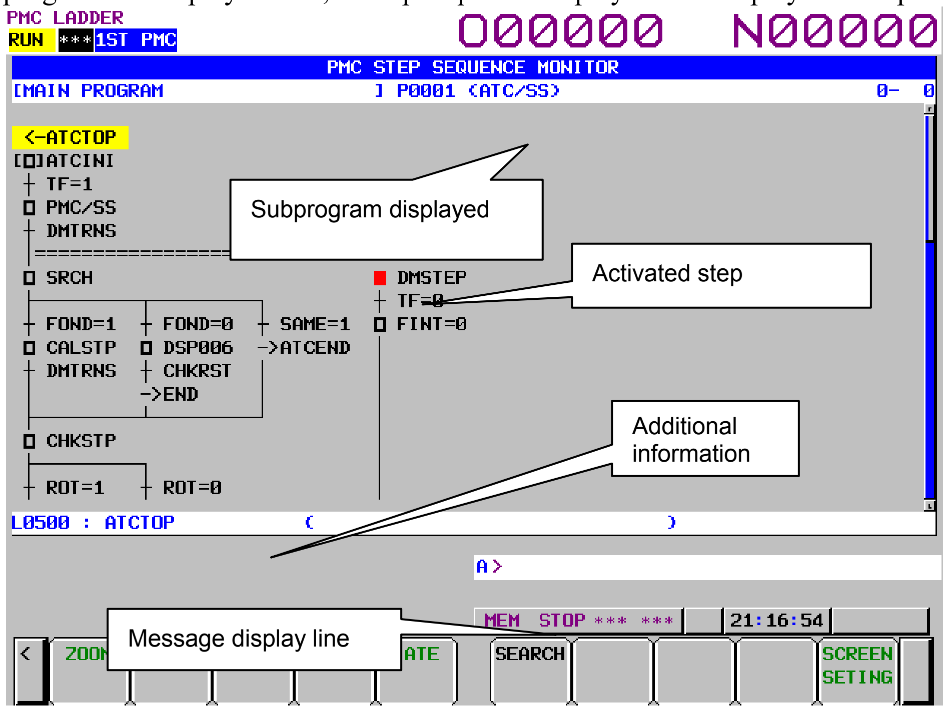


Fig. 10.6.4 Step sequence display screen

(1) Screen configuration
   (a) At the top of the screen, information ("[*comment*] *program number* (*symbol*)") on the subprogram for which a sequence diagram is currently displayed is displayed together with the coordinates of the cursor position.
   (b) The message display line displays a message such as an error message and inquiry, depending on the situation.
   (c) The additional information line displays detail information on the step sequence diagram element where the cursor is placed.

When the cursor is placed on a step, the information displayed changes according to the setting of "STEP NOTATION" described in Subsection 10.6.5, "Setting the Step Sequence Diagram Screen".

- When "S-ADDRESS" is set in "STEP NOTATION"
  [P-address] S-address: symbol information of the S-address (comment information of the S-address)
- When "P-ADDRESS" is set in "STEP NOTATION"
  [S-address] P-address: symbol information of the P-address (comment information of the P-address)

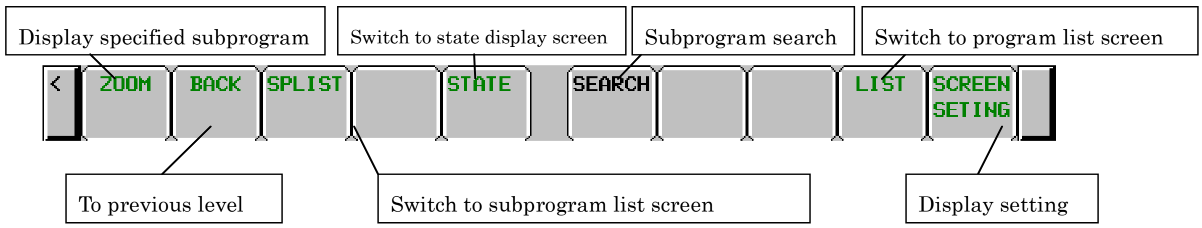
When the cursor is placed on a transition, jump, or label, detail information is displayed in the following format:

Address : *Symbol information* (*Comment information*)

When a step sequence diagram is displayed, the screen can display 16 elements vertically and 8 elements horizontally.

(2) Operations using soft keys

Soft keys for step sequence display screen



(a) [ZOOM] Display specified subprogram
Switches the screen display to the ladder diagram display screen or the step sequence display screen.
When you press the [ZOOM] soft key without entering a character string, the ladder diagram display screen is displayed if the cursor is placed on a ladder, or the step sequence display screen is displayed if the cursor is placed on a step sequence.
When you press the [ZOOM] soft key after entering a subprogram name or symbol name, the subprogram (ladder diagram display screen or step sequence display screen) corresponding to the entered character string is displayed. If the subprogram is protected, the password needs to be released.

(b) [BACK] Show the preceding subprogram
Traces back the history to recall the previous displayed subprogram.

(c) [SPLIST] Switch to the subprogram list screen
Switches the screen display to the subprogram list display screen.

(d) [STATE] Switch to the state display screen
Switches the screen display to the step sequence state display screen.

(e) [SEARCH] Search symbol/address
Searches the symbol or the PMC address according to the preceding string.

(f) [LIST] Go to PROGRAM LIST VIEWER screen
Displays the program list screen.

(g) [SCREEN SETTING] Display setting
Switches the screen display to the step sequence display setting screen.

(h) [<]
Switches the screen display to the PMC ladder menu.

(3) Screen operations using other keys

(a) Cursor keys, page keys
The cursor can be moved using the up/down/left/right cursor keys and the page keys.
By pressing the down cursor key after entering a program name or symbol name, you can search for the program.

(b) INPUT key
With the INPUT key, operations equivalent to those enabled by the [ZOOM] soft key can be performed.

10.6.5 Setting the Step Sequence Diagram Screen

Set the display format for the step sequence display screen.
To set each item, use the left/right cursor keys or soft keys.

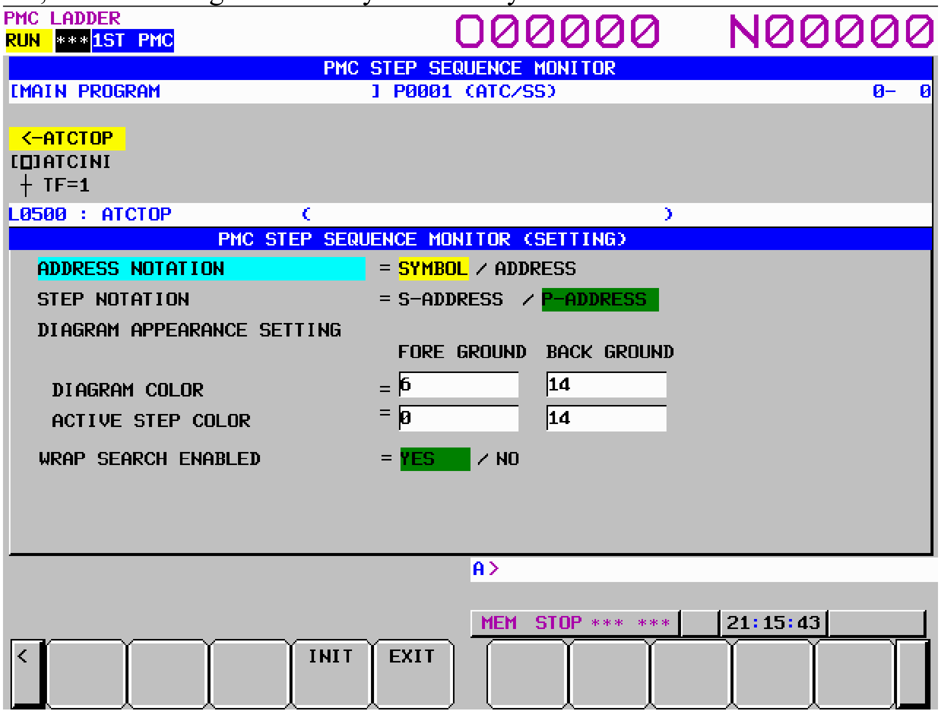


Fig. 10.6.5 Step sequence display screen

(1) Setting items

(a) ADDRESS NOTATION

Set whether to use an address or symbol when a subprogram is to be displayed on the step sequence display screen.

SYMBOL (default)

An address for which a symbol is defined is displayed using the symbol. An address for which no symbol is defined is displayed using the address.

ADDRESS

An address for which a symbol is defined is displayed using the address at all times.

(b) STEP NOTATION

Set whether to use an S-address or P-address when the subprogram of each step is to be displayed on the step sequence display screen. This setting is valid for steps only.

S-ADDRESS

When “ADDRESS NOTATION” is “ADDRESS”, each step is displayed using an S-address (step number). When “ADDRESS NOTATION” is “SYMBOL”, the symbol set for the S-address is displayed.

P-ADDRESS (default)

When “ADDRESS NOTATION” is “ADDRESS”, each step is displayed using a P-address (subprogram number). When “ADDRESS NOTATION” is “SYMBOL”, the symbol set for the P-address is displayed.

(c) DIAGRAM COLOR

Set the display color of an entire sequence diagram except the activation state mark of each step on the step sequence display screen.

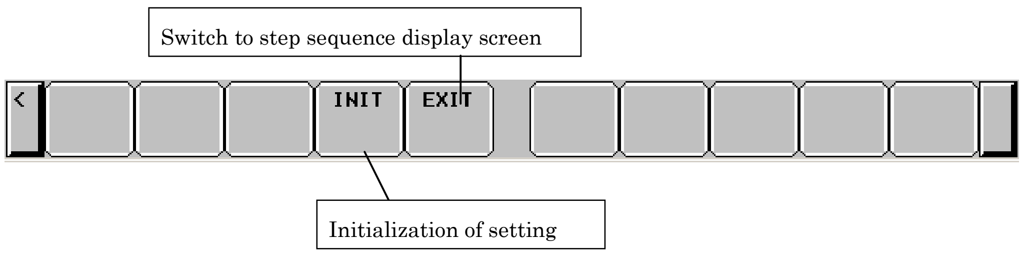
The display color can be changed by entering a numeric value or the left/right cursor keys. One of 15 color numbers, 0 to 14, can be set.

(d) ACTIVE STEP COLOR
Set the display color of the activation state mark of each step on the step sequence display screen.
The setting method and settable colors are the same as for the display color of a sequence diagram.

(e) WRAP SEARCH ENABLED
Set whether to perform continued search operation from the start when search processing has reached the end of the step sequence program.
YES (default)
When search processing has reached the end of the step sequence program, it goes to the top of the program to continue to perform the search operation.
NO
When search processing has reached the end of a step sequence program, it ends with failure.

(2) Operations using soft keys

Soft keys on step sequence display setting screen



(a) [INIT]
Initializes all settings.
(b) [EXIT]
Returns the screen display to the step sequence display screen.

10.6.6 Subprogram List Display Screen

When you press the [SPLIST] soft key on the step sequence display screen, a list of the subprograms that are being used with the step sequence currently displayed is displayed. On the other hand, the history of the displayed subprogram is also displayed.

There are the following operations related to step sequence.

- On the subprogram list display screen, the subprogram of the step sequence is marked with or in the "SP" display area. Pressing the [ZOOM] soft key when the cursor is placed on a subprogram, the screen display switches to the step sequence display screen.
- Pressing the [STEP] soft key, switches the screen display to the step sequence display screen.
- Pressing the [STATE] soft key, switches the screen display to the step sequence state display screen.

For details of the subprogram list display screen, see Section 8.11, " DISPLAYING A SUBPROGRAM LIST ([SPLIST] SCREEN)".

10.6.7 Setting Subprogram List Screen

The method of setting the subprogram list display screen is the same as for the program list display screen.
For details of the setting screen, see Subsection 8.1.1, "Setting Program List Screen".

10.6.8 Ladder Diagram Monitor Screen

The ladder diagram display screen is displayed by pressing the [ZOOM] soft key when the cursor is placed on a ladder subprogram on the program list screen, subprogram list screen, or step sequence display screen.
This screen is the same as the screen described in Section 8.2, "MONITORING LADDER DIAGRAMS ([LADDER] SCREEN) ". For details of the screen, see Section 8.2.

10.6.9 Collective Monitor Screen

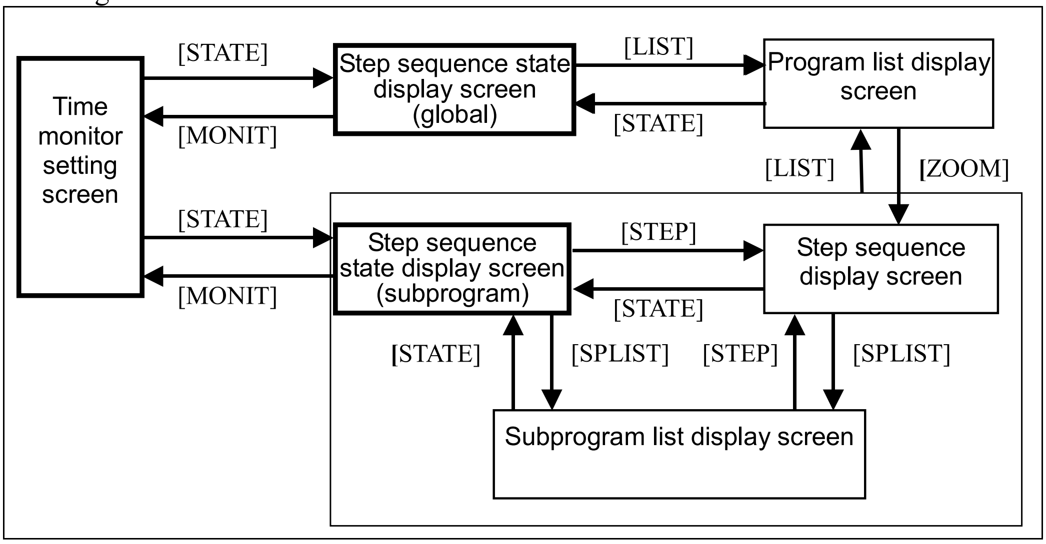
This screen is the same as the screen described in Subsection 8.4.2, "COLLECTIVE MONITOR Function". For details of the screen, see Subsection 8.4.2.
If you use the function for jumping to a ladder net with the [JUMP] soft key on the selection monitor screen, step sequence display hierarchy information is lost.

10.7 EXECUTION STATE DISPLAY

The execution state of each step of a step sequence is displayed.

- Step sequence state display screen (global)
- Step sequence state display screen (subprogram)
- Time monitor setting screen

The screen configuration is shown below.



10.7.1 Step Sequence State Display Screen (Global)

Pressing the [STATE] soft key on the program list screen displays the step sequence state display screen (global).
This screen displays the execution state and the elapsed time of operation of an entire step sequence.

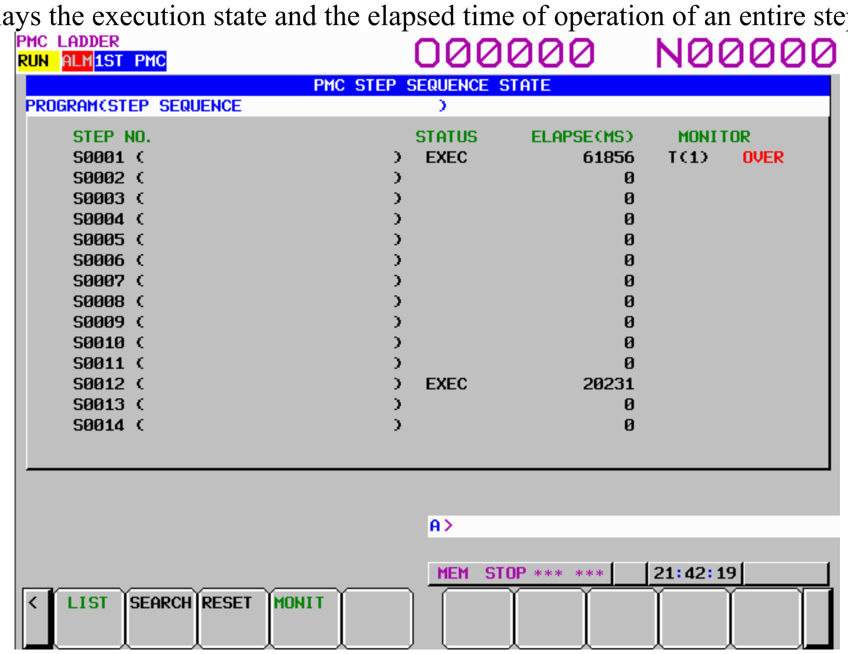


Fig. 10.7.1 Step sequence state display screen (global)

(1) Screen configuration

(a) STEP NO.
Displays a step number. In parentheses, the symbol of the address of a step number is displayed.

(b) STATUS
When "EXEC" is displayed, it means the active state. When "EXEC" is not displayed, it means the inactive state.

(c) ELAPSE(MS)
Indicates the period of time of the active state. In the active state, the time indication changes.

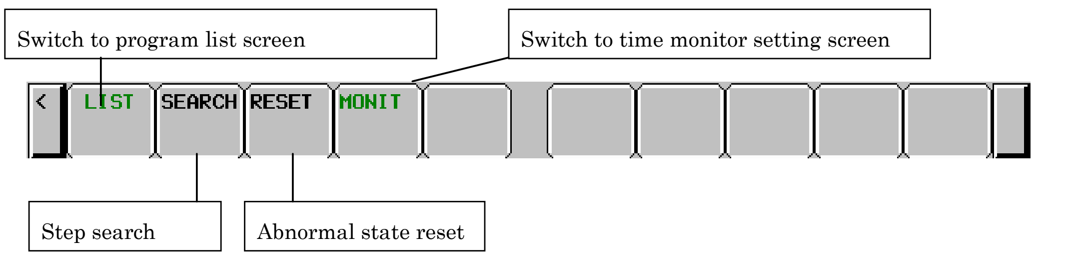
(d) MONITOR
Shows assigned time monitor information.

- T(x) : Timer number for monitoring
- OVER : Monitor time exceeded

The message display line displays a message such as an error message and inquiry, depending on the situation.

(2) Operations using soft keys

Soft keys for step sequence state display screen (global)



(a) [LIST] Switch to the program list display screen
Switches the screen display to the program list display screen.

(b) [SEARCH] Step search
Searches for a step. When you press the [SEARCH] soft key after entering a step number or symbol name, the step corresponding to the entered character string is found, and the display is updated so that the found step is placed at the start.

(c) [RESET] Abnormal state reset
Resets abnormal states that have occurred in all time monitoring operations.
For individual resetting, reset a desired monitoring operation on the time monitor setting screen.

(d) [MONIT] Switch to the time monitor setting screen
Switches the screen display to the time monitor setting screen.

(e) [<]
Switches the screen display to the PMC ladder menu.

(3) Screen operations using other keys

Page keys

The page keys can be used to switch from one display page to another. A program can be searched using the down cursor key following the step number or symbol name entered.

10.7.2 Step Sequence State Display Screen (Subprogram)

Pressing the [STATE] soft key on the subprogram list screen or the step sequence display screen displays the step sequence state display screen (subprogram).
This screen displays the execution state and the elapsed time of operation of each step used in the currently selected step sequence.

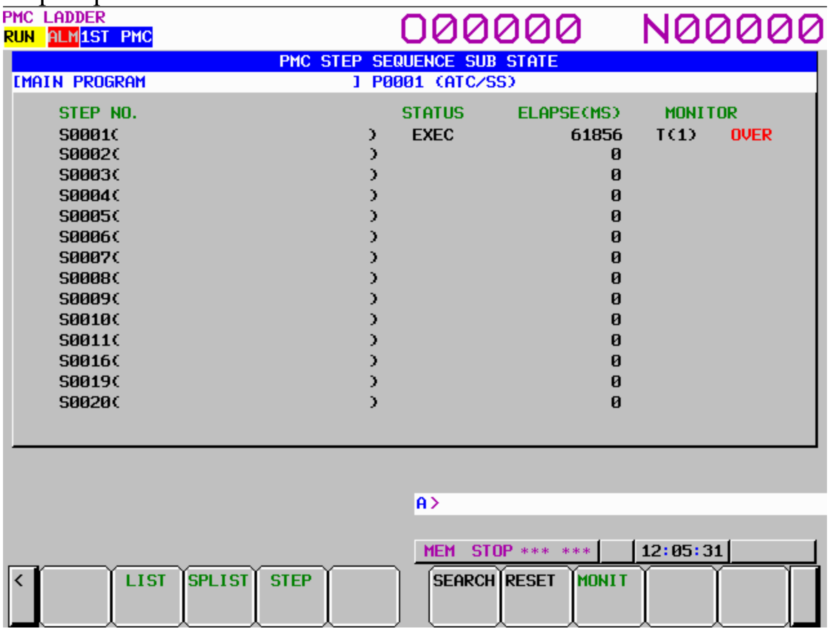
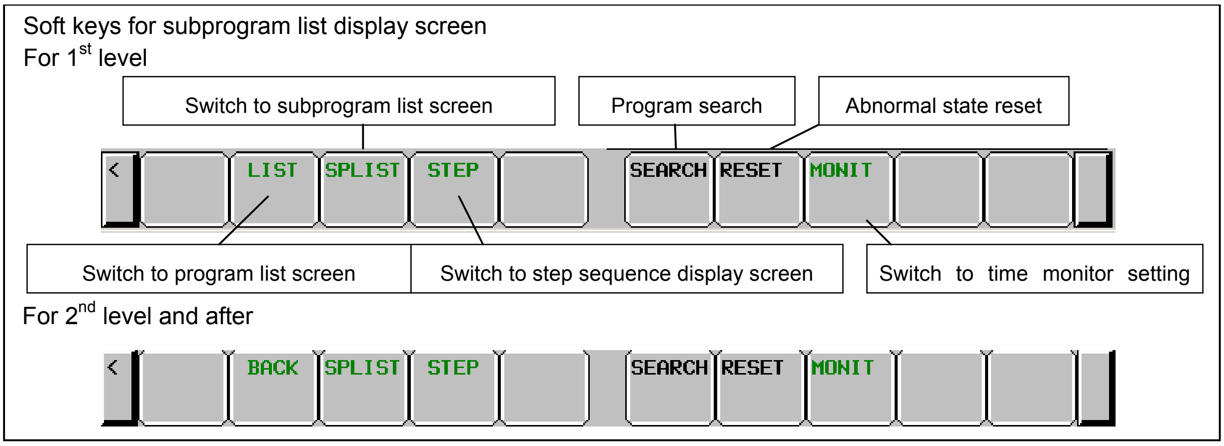


Fig. 10.7.2 Step sequence state display screen (subprogram)

(1) Screen configuration
 (a) STEP NO.
 Displays a step number. In parentheses, the symbol of the address of a step number is displayed.
 (b) STATUS
 When "EXEC" is displayed, it means the active state. When "EXEC" is not displayed, it means the inactive state.
 (c) ELAPSE(MS)
 Indicates the period of time of the active state. In the active state, the time indication changes.
 (d) MONITOR
 Shows assigned time monitor information.
 • T(x) : Timer number for monitoring
 • OVER : Monitor time exceeded

The message display line displays a message such as an error message and inquiry, depending on the situation.

(2) Operations using soft keys



Soft keys for step sequence state display screen

(a) [LIST] or [BACK] Switch to the program list screen or one level higher
Switches the screen display to the step sequence display screen one level higher. If one of these soft keys is pressed on the step sequence display screen on the first level, the screen display returns to the program list display screen.

(b) [SPLIST] Switch to the subprogram list screen
Switches the screen display to the subprogram list display screen.

(c) [STEP] Switch to the step sequence display screen
Switches the screen display to the step sequence display screen.

(d) [SEARCH] Step search
Searches for a step. When you press the [SEARCH] soft key after entering a step number or symbol name, the step corresponding to the entered character string is found, and the display is updated so that the found step is placed at the start.

(e) [RESET] Abnormal state reset
Resets abnormal states that have occurred in all time monitoring operations.
For individual resetting, reset a desired monitoring operation on the time monitor setting screen.

(f) [MONIT] Switch to the time monitor setting screen
Switches the screen display to the time monitor setting screen.

(g) [<]
Switches the screen display to the PMC main menu.

(3) Screen operations using other keys

(a) Page keys
The page keys can be used to switch from one display page to another. A program can be searched using the down cursor key following the step number or symbol name entered.

10.8 TIME MONITOR FUNCTION

The time monitor function reports an error if a step sequence continues to be active for more than a specified monitor time. For each of up to eight steps, a monitor time can be set.
If the active state of a step lasts for more than a specified time, the processing described below is performed.
On the step sequence execution state display screen, "OVER" is indicated for a step number whose monitor time has been exceeded.
The ladder just continues running.

(1) The bit of R9118 or Z118 corresponding to a monitor timer number is turned on. By monitoring R9118 or Z118 with the ladder program, error processing can be programmed.

Timer No.	Corresponding bit
1	R9118.0 or Z118.0
2	R9118.1 or Z118.1
3	R9118.2 or Z118.2
4	R9118.3 or Z118.3
5	R9118.4 or Z118.4
6	R9118.5 or Z118.5
7	R9118.6 or Z118.6
8	R9118.7 or Z118.7

(2) The PMC alarm screen displays the following message:
"ER48 STEP SEQUENCE TIME OVER(xxH)"
xx represents the value of R9118 or Z118 in hexadecimal.

10.8.1 Time Monitor Setting Screen

Pressing the [MONIT] soft key on the step sequence state display screen displays the time monitor setting screen. The time monitor setting screen is used to set the time monitor function. Enter a step number or monitor time after moving the cursor with the cursor up/down/left/right keys to the input field then press the INPUT key for setting.

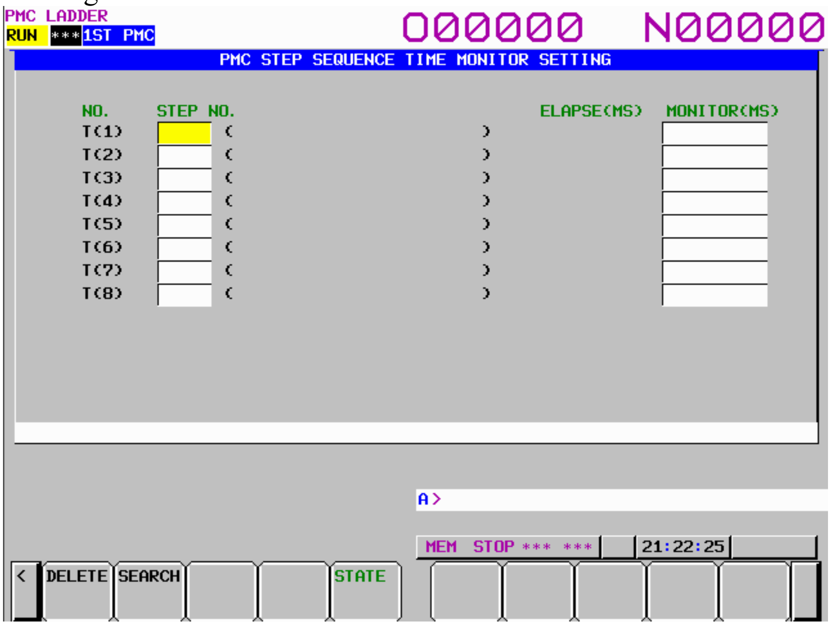
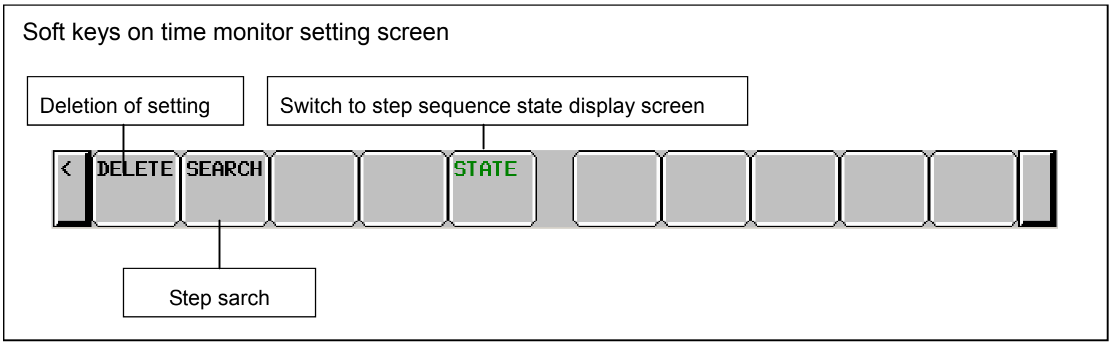


Fig. 10.8.1(a) Time monitor setting screen

(1) Screen configuration
  (a) NO.
    Monitor timer number. T(1): Uses Monitor timer 1.
  (b) STEP NO.
    Step number and symbol
    S0001: Step number
    The symbol of the step number is displayed in the parentheses at right.
  (c) ELAPSE(MS)
    Elapsed time (in msec). In the active state, the time indication changes.
  (d) MONITOR(MS)
    Time (in msec) set with the timer for monitoring

(2) Operations using soft keys



  (a) [DELETE] Deletion of setting
    Deletes the setting of a specified monitor number. Move the cursor to a number whose setting is to be deleted then press the [DELETE] soft key.

(b) [SEARCH] Step search
Searches for a step. When you press the [SEARCH] soft key after entering a step number or symbol name, the cursor will move onto the monitor item with the corresponding step assigned if found.

(c) [STATE] Switch to the step sequence state display screen
Switches to the step sequence state display screen.

(d) [<]
Returns the display screen to the step sequence state display screen.

(3) Setting of monitoring

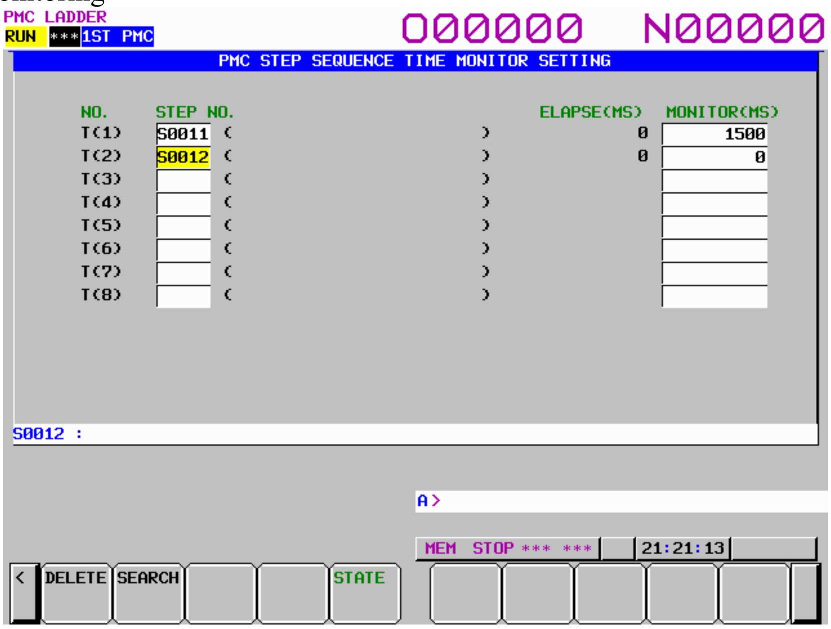


Fig. 10.8.1(b) Entering a step number

(a) Move the cursor to an input field then enter a step number (or symbol) to set.

Type "S12" then press the INPUT key.

(b) Move the cursor to the corresponding input field then set the monitor time.

- Up to eight monitor time values can be set.
- The cursor can be moved to a step number field and monitor time field.
- The maximum settable monitor time is 214748367 msec. If a greater value is entered, an error occurs.
- If a monitor time is entered when the corresponding step number is not entered, an error occurs.
- The same step number must not be set more than once.

(4) Canceling a setting of monitoring
Move the cursor to a field whose setting is to be deleted then press the [DELETE] soft key.
The setting of a monitor number is deleted, regardless of which field (step number or monitor time) the cursor is placed on.

(5) Modifying a setting of monitoring
Move the cursor to a field then enter a new value.

11 FUNCTION BLOCK FUNCTION

11.1 OVERVIEW

A “function block” is a block of a ladder program defined in advance that implements a particular process (function).
You can place a defined function block in other ladder program and set required input/output parameters to execute the function.
By defining a frequently used function as a function block, you can reuse the function easily, and can reduce the time required for programming and increase the development efficiency.
In addition, program diagnosis can be performed without displaying the detailed program in the function block, which is also effective to decreases the amount of the printed maintenance ladder diagram.

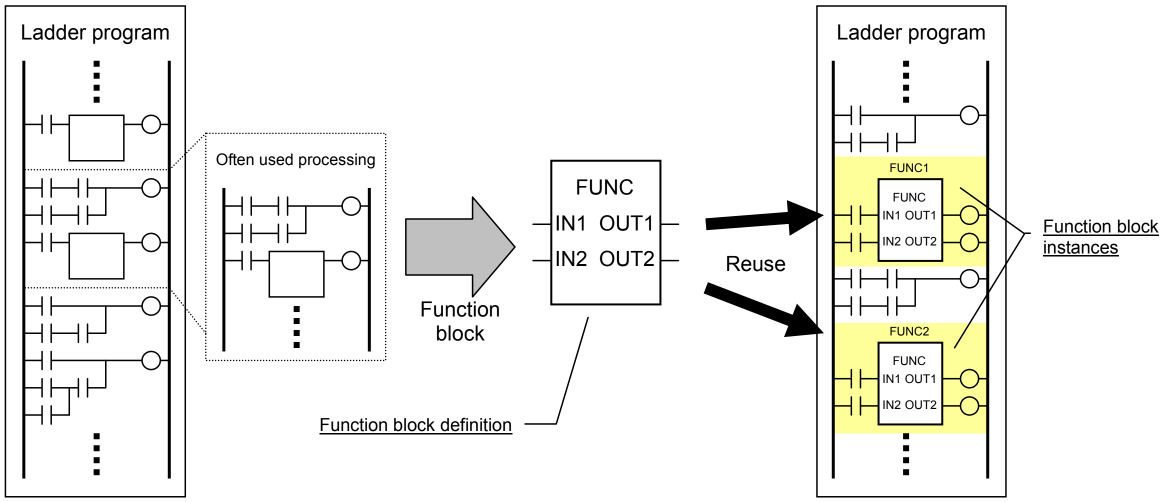


Fig. 11.1 (a) Reusing a program using a function block

> **NOTE**
> To use the Function Block function on the series 30*i*/31*i*/32*i*/35*i*-B or the Power Motion *i*-A, its option is necessary.

Definition and instance

To create a function block, you need ladder program to implement the function and the input and output signals for the program. These are called as “function block definition.” You can paste the defined function block into an actual program and specify the input and output signals to call and execute the function. Each function block pasted into a program is called a “function block instance.” You can create more than one instances of the same function block in a program.

> **NOTE**
> Programming using function blocks requires FANUC LADDER-III, a PMC programmer that runs on PC. You can also use PMC screens built into the CNC to display the function block monitor and to change addresses and other items that are set as parameters.

Assignment of addresses to parameters and variables

Program a ladder program in a function block definition using variables (symbols) to which specific addresses are not assigned (symbol programming). When a program containing a function block instance is compiled, specific addresses are assigned to the parameters and variables used in the program in the function block. Different addresses are assigned to different function block instances and individual instances operate independently.

11.1.1 Item Names

A function block is represented by a rectangle as shown below.

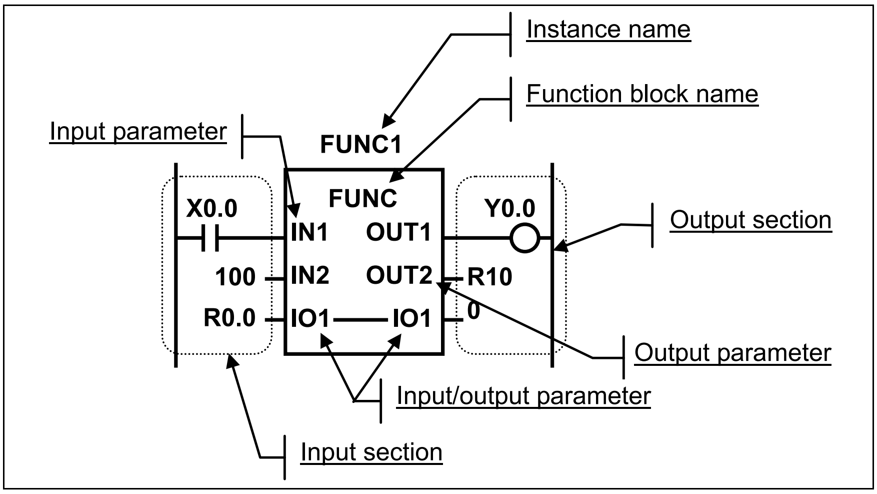


Fig. 11.1.1 (a) Function block

An “**instance name**” is a name that uniquely identifies each instance of a function block. Each instance has different name with each other.

A “**function block name**” is the name of the source function block definition of each instance. The instances that call the same function block have the same function block name.

“**Input parameters**” receive input signals to a function block. Specify the value passed to each input parameter with an address or constant in the “input section”. For a bit signal, specify its address on the relevant contact.

“**Output parameters**” are output signals from a function block. In the “output section”, specify the address for receiving each output parameter value to fetch the output of the function block. For a bit signal, specify its address on the relevant coil.

“**Input/output parameters**” functions as both input and output of a function block. It is represented as the two same parameter names in the input and output parameter positions connected by a line.

11.1.2 Overview of Specifications

(1) Function block definition

Item	Specification	Remarks
Function block name	Identifier consisting of up to 40 characters	Conforms to IEC61131-3.
Comment	Character string consisting of up to 255 characters x 4 (Japanese characters available)	Can be displayed on NC screens.
Parameter	Up to 64 parameters in total of input and output	
Data protection	For each function block, “editing protection” or “browsing and editing protection” using a password can be specified.	
Other information	Version information	

(2) Parameter specifications

Item	Specification	Remarks
Types of parameters	Input parameter Input/output parameter (NOTE 1) Output parameter	The EN input and ENO output are also supported.
Maximum number of parameters	64 parameters in total	
Name (symbol)	Identifier consisting of up to 40 characters	Conforms to IEC61131-3.
Comment	Character string consisting of up to 255 characters x 4 (Japanese characters available)	Can be displayed on NC screens.
Data types	BOOL SINT, USINT, INT, UINT, DINT, UDINT BYTE, WORD, DWORD	Conforms to IEC61131-3.
Count specification (NOTE 2)	1 to 32	Integer parameters other than BOOL only
Displaying Internal and External Variables in the Monitor (FB Instance Monitor Display)	BOOL SINT, USINT, INT, UINT, DINT, UDINT BYTE, WORD, DWORD 8-bit bit string, 16-bit bit string	Can be specified up to 16 parameters in each function block.

⚠ CAUTION

When editing FB definitions and FB instances by the offline editing function on FANUC LADDER-III, the addresses assigned to the parameters and variables of function block will be changed. Therefore, the parameters and variables of all function blocks will be initialized by 0 when the sequence program is inputted into CNC. (See “11.1.4 Assignment of FB variable” for details.)

NOTE

1 While the data of input/output parameters are passed by reference, the data of other parameters are passed by value.
2 A value of 2 or larger can be specified to pass multiple contiguous data items of the same data type.

(3) Variable specifications

Item	Specification	Remarks
Types of variables	Internal variable External variable	
Maximum number of variables	1024 in total	
Name (symbol)	Identifier consisting of up to 40 characters	Conforms to IEC61131-3.
Comment	Character string consisting of up to 255 characters x 4 (Japanese characters available)	Can be displayed on NC screens.
Data types	BOOL SINT, USINT, INT, UINT, DINT, UDINT BYTE, WORD, DWORD	Conforms to IEC61131-3.
Count specification (NOTE 1)	1 to 1000	Can be specified only for non-bool internal variables.
Nonvolatile memory type specification	Available	Can be specified only for internal variables.
Memory allocation of internal variables	Contiguously allocated in the order in which they are defined.	Divided into nonvolatile and volatile types and arranged in different areas.
Displaying Internal and External Variables in the Monitor (FB Instance Monitor Display)	BOOL SINT, USINT, INT, UINT, DINT, UDINT BYTE, WORD, DWORD 8-bit bit string, 16-bit bit string	Can be specified up to 16 variables in each function block.

⚠ CAUTION

When editing FB definitions and FB instances by the offline editing function on FANUC LADDER-III, the addresses assigned to the parameters and variables of function block will be changed. Therefore, the parameters and variables of all function blocks will be initialized by 0 when the sequence program is inputted into CNC. (See “11.1.4 Assignment of FB variable” for details.)

NOTE

1 A value of 2 or larger can be specified to allocate contiguous areas for multiple data items of the same data type.

(4) Program in a function block(FB body program)

Item	Specification	Remarks
Programming language	Ladder language can call another function block (up to 4 nested levels).	
Maximum number of steps	8000 steps per function block	
Available addresses	Defined parameters, and internal and external variables (NOTE 1) Fixed PMC addresses (NOTE 2)	
Available instructions	Basic and functional instructions available with the PMC for 30*i*/31*i*/32*i*/35*i*-B, Power Motion *i*-A or 0*i*-F. The following instructions cannot be used, however: END1, END2, END3, END SP, SPE, CALL, CALLU, JMPC CS, CM, CE The following instructions cannot be used in any function block for which more than one instance is to be created: TMR CTR, CTRB For the following instructions, the automatic number assignment function must be used: TMRB, TMRBF DIFU, DIFD	
Call of another function block	Other function block can be called up to 4 levels deep.	

NOTE

1 They are programmed not with actual addresses, but with symbols.

2 Any addresses (including X, Y, F, G, R, D, and so on) available in the ladder language of the PMC for 30*i*/31*i*/32*i*/35*i*-B, Power Motion *i*-A or 0*i*-F can be directly specified.

(5) Function block call

Item	Specification	Remarks
Instance name	Identifier consisting of up to 40 characters	Conforms to IEC61131-3.
Comment	Character string consisting of up to 255 characters x 4 (Japanese characters available)	Can be displayed on NC screens.
Parameter specification	For a BOOL parameter, connect basic instructions. For an integer parameter, specify an address or constant. For an integer input/output parameter, specify an address only.	
Program level to call function block	Can be called from level 1 to 3 or subprogram. Placed as a net in ladder program.	
Number of function block calls	Up to 1024 types of function blocks Up to 5000 calls (instances) (NOTE)	Function block instance called from a function block also included

> **NOTE**
> In PMC Memory-B/C/D up to 5000 instances can be used. In PMC Memory-A, and DCS PMC up to 512 instances can be used.

(6) PMC screen display and operations

Item	Specification	Remarks
Monitor display	The signal status and values of parameters can be monitored.	
Internal and external variable monitor (FB instance monitor display)	Up to 16 internal and external variables can be monitored. Setting to show/hide the monitor is available.	To add and change the Internal and external variable monitor, FANUC LADDER-III is required. Variable monitor by bit-string form is available only in the FB instance monitor display.
Function block zoom	The program in a function block can be zoomed.	You can also go back to the previous function block screen after zooming.
Operation available during monitor display	Forcibly turning the signal on or off	
Diagnosis functions	Trace function which displays signal changes in graph form Collective Monitor function which calls up the coil from a contact	
Function block editing (editing function built into the PMC)	Only input and output sections for parameters can be changed. The ladder circuit of the FB body program cannot be changed.	To change the FB body program, FANUC LADDER-III is required.

11.1.3 Memory Usage Related to Function Blocks

The following table lists memory usage related to programming using function blocks.

Table11.1.3 (a) Memory usage related to function blocks

Category	Item	Memory usage (NOTE 1)
Function block definition information (NOTE 2)	One function block (including name and comment character string)	55 to 148 bytes
	One parameter information item (including symbol and comment character string)	14 to 91 bytes
	Program section	Varies depending on the program (NOTE 3)
Function block call (instance)	One call	76 bytes
	BOOL type parameter	12 bytes + Input/Output circuit(NOTE 5)
	Parameter other than BOOL type	24 bytes (NOTE 5)
	FB body program section (NOTE 4)	Equivalent to a conventional ladder program(NOTE 6)
Symbol and comment (Extended function format)	One definition	16 to 23 bytes (NOTE 8)
	One symbol character	1 byte
	One comment character (single-byte character)	1 byte (NOTE 7)
	One function block (NOTE 9)	8 bytes

NOTES

1 In addition to the memory usage listed in the table, some amount of memory may be used to adjust the memory allocation.
2 These items are required for each type of function block used in the program.
3 To enable function block definitions to be restored at decompilation, include the function block definition data in the object. In this case, the memory usage varies depending on the contents of the function block definition. Generally the memory usage of a function block consisting of 8000 steps may be about 7K to 10K bytes.
4 The size of FB body program is added for each instance.
5 The memory usage in following cases is 8 bytes.
- Case of input side of input/output parameter
- Case of omitted output side of output parameter and input/output parameter.
6 The size of FB body program is calculated in the same way as for conventional ladder programs as the memory usage listed in the table below.

Type of instruction	Memory usage
Basic instruction	4 bytes
Functional instruction	4 bytes
Functional instruction parameter	4 bytes

See “2.1.4” for details.
7 One double-byte character uses 2 bytes.
8 One definition of symbol and comment data uses 16 to 23 bytes of memory. In addition, memory is used based on the lengths of the symbol and comment character strings.
9 This memory is required for each function block call.

11.1.4 Assignment of FB Variable

An address of FB variable is assigned at compiling on FANUC LADDER-III and the assigned address depends on the arrangement of FB instance in the ladder program. Therefore, when FB definition and FB instance are edited, the assignment of address may be changed.
When the sequence program being executed is updated to the sequence program whose FB variables are assigned to the different addresses, value of the variables may be unsuitable. For this reason, when updating sequence program to the one whose FB variables are assigned to the different addresses, the PMC system software will initialize FB variable area by 0. Therefore, you should design your function block to operate safety when updating sequence program to the one whose FB variables are assigned to the different addresses. The initialization range of FB variable area is not only actually assigned address for variables but all addresses specified by setting of “Assignment Address of FB” on FANUC LADDER-III

When updating sequence program to the one by the following operations, FB variable area will be initialized.
(a) When changing a FB definition (except for editing FB body program only)
(b) When adding / deleting / moving a FB instance
(c) When changing an address of input / output parameter
(d) When changing a symbol / comment data referred as an external variable
(e) When changing the setting of “Assignment Address of FB” in the system parameter

NOTE
1 Depending on how you modify the sequence program, the updated sequence program may run safety without initializing FB variable area.
2 By setting 1 to K903.4 of system keep relay, you can choose not initialize FB variable area when changing the address of FB variable. (See “2.2.11 System Keep Relay Addresses (K)” for details)

11.2 FUNCTION BLOCK DEFINITION

The definition section of a function block consists of the following information:

- Function block name
- Information of variables (including parameters and internal variables)
- FB body program
- Other information

The following sections explain the above items.

11.2.1 Function Block Name

A function block name is a character string used to identify a function block.
A character string consisting of the following characters (identifier conforming to IEC61131-3) can be used as the name of a function block:

- Alphabetic characters (A to Z)
- Numeric characters (0 to 9)
- Underscore (_)

NOTE

1 A function block name must not begin with a numeric character. When an underscore is specified as the first character, it must be followed by an alphanumeric character.

2 A name character string can consist of up to 40 characters.

In addition to the name, you can define an arbitrary character string as a comment for a function block.

11.2.2 Variable Information

Variables used in the FB body program must be declared in advance.
The following types of variables are available in the program:

- Parameter
- Internal variable
- External variable

> ⚠ **CAUTION**
> When editing FB definitions and FB instances by the offline editing function on FANUC LADDER-III, the addresses assigned to the parameters and variables of function block will be changed. Therefore, the parameters and variables of all function blocks will be initialized by 0 when the sequence program is inputted into CNC. (See “11.1.4 Assignment of FB variable” for details.)

The following table lists the maximum number of variables of each type that can be used in a function block.

Type	Maximum number
Parameter	64 in total
Internal and external variables	1024 in total

> **NOTE**
> 1 Different addresses are assigned for parameters and internal variables in different function block instances.
> 2 You can directly specify an actual address in the FB body program. In this case, the address has an effect equivalent to an external variable. The address is not included in the above number because it is not assumed to be an external variable.

Each type of variable definition consists of the following information. Each variable type has its features and restrictions. For details, see the explanation of each type of variable.

(a) Symbol
Each variable is identified by a symbol represented by a character string consisting of the following characters (identifier conforming to IEC61131-3):

- Alphabetic characters (A to Z)
- Numeric characters (0 to 9)
- Underscore (_)

> **NOTE**
> 1 A symbol must not begin with a numeric character. When an underscore is specified as the first character, it must be followed by an alphanumeric character.
> 2 A symbol character string can consist of up to 40 characters.
> 3 The following symbols are reserved and not available for other purpose:
> • EN
> • ENO
> For details of these symbols, see “(1) EN input and ENO output”.

In addition to the symbol, you can define an arbitrary character string as a comment for each variable.
You cannot use the same symbol for more than one variable in a function block definition.

(b) Basic data type
A defined variable must have one of the following data types conforming to IEC61131-3.

Type name	Data type	Monitor format
BOOL	1-bit bool value	ON/OFF
SINT	8-bit signed integer value	Signed decimal number
USINT	8-bit unsigned integer value	Unsigned decimal number
INT	16-bit signed integer value	Signed decimal number
UINT	16-bit unsigned integer value	Unsigned decimal number
DINT	32-bit signed integer value	Signed decimal number
UDINT	32-bit unsigned integer value	Unsigned decimal number
BYTE	8-bit bit string	Hexadecimal number
WORD	16-bit bit string	Hexadecimal number
DWORD	32-bit bit string	Hexadecimal number

NOTE
1 A constant is also displayed in the monitor format listed above if given to an input parameter.
2 BCD data is correctly displayed in hexadecimal notation.

(c) Count specification
For input and output parameters and internal variables of the data types that occupy 1 byte or more such as INT, you can specify the number of data items to allocate their area. For example, when you specify 3 for the number of an INT internal variable, 6-byte area is allocated as the area for the variable.

Type of variable	Count specification range
Input or output parameter	1 to 32
Internal variable	1 to 1000

NOTE
The larger value is specified as the number of input or output parameters, the larger amount of data must be copied during the execution of each relevant function block instance, resulting in worse performance. In this case, memory allocated for each instance is also increased. If you require input or output parameters that use a large amount of PMC memory (R, D), you can use input/output parameters to efficiently pass the large data.

Parameter

Parameters are variables used to exchange values between a function block and the circuit outside the function block.

Parameters are divided into the following types:
- Input parameter
- Output parameter
- Input/output parameter

In addition, there are the following two special parameters:

- EN input
- ENO output

The EN input and ENO output are special input and output parameters that control the execution of the function block. For details, see “(1) EN input and ENO output” below.

For each parameter, specify an address for exchanging a value or a constant. While a constant or address can be specified for an input parameter, only an address can be specified for an input/output parameter or output parameter.

Each type of parameter is explained below.

(1) EN input and ENO output
The EN input is an input parameter which controls execution of the function block itself. The ENO output is an output parameter which indicates whether the function block terminates normally when the execution of the function block itself is completed.
The EN input and ENO output may or may not be specified. When defining a function block, specify whether to use each of the EN input and ENO output.

NOTE
A parameter having the name of EN or ENO is always treated as the EN input or ENO output. You cannot define a parameter or variable other than the EN input or ENO output with the name of EN or ENO.

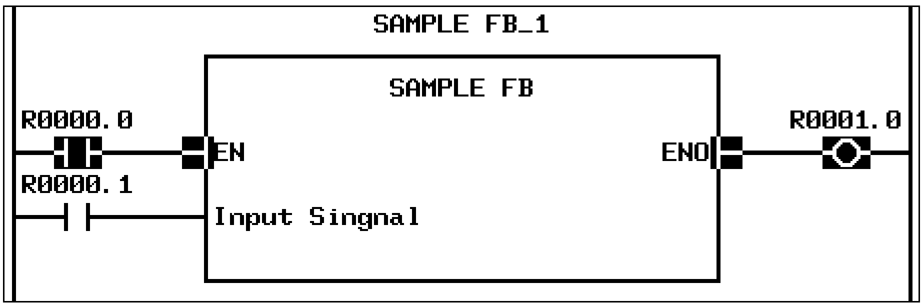


Fig.11.2.2 (a) EN input and ENO output

(a) EN input
The EN input controls whether to execute the function block. It functions as follows:

- When the EN input is ON, the FB body program is executed. When the FB has ENO output, the ENO is set to ON before the program is executed.
- When the EN input is OFF, the FB body program is not executed and control is passed to the execution of the subsequent program with the status at that point kept. When the FB has ENO output, the ENO is set to OFF.

When the FB has no EN input, the FB body program is executed in the same way as when it is ON.

NOTE
You can also use common line control (COM instruction) to control execution, which is similar to using the EN input. Common line control is also valid for a function block for without EN input.

(b) ENO output
The ENO output indicates whether operation of a function block terminates normally. The value of the ENO output is set to ON before the FB body program is executed. If an error occurs in the FB body program and the output is invalid, the ENO output should be set to OFF. When the EN input is OFF or when ACT of common line control (COM instruction) is OFF, the ENO output is automatically set to OFF.

(2) Input parameter
An input parameter is a variable which receives the input to the FB body program. It is read only in the FB body program. The EN input is a kind of input parameter.
Input parameters are displayed at the left side of a function block instance.

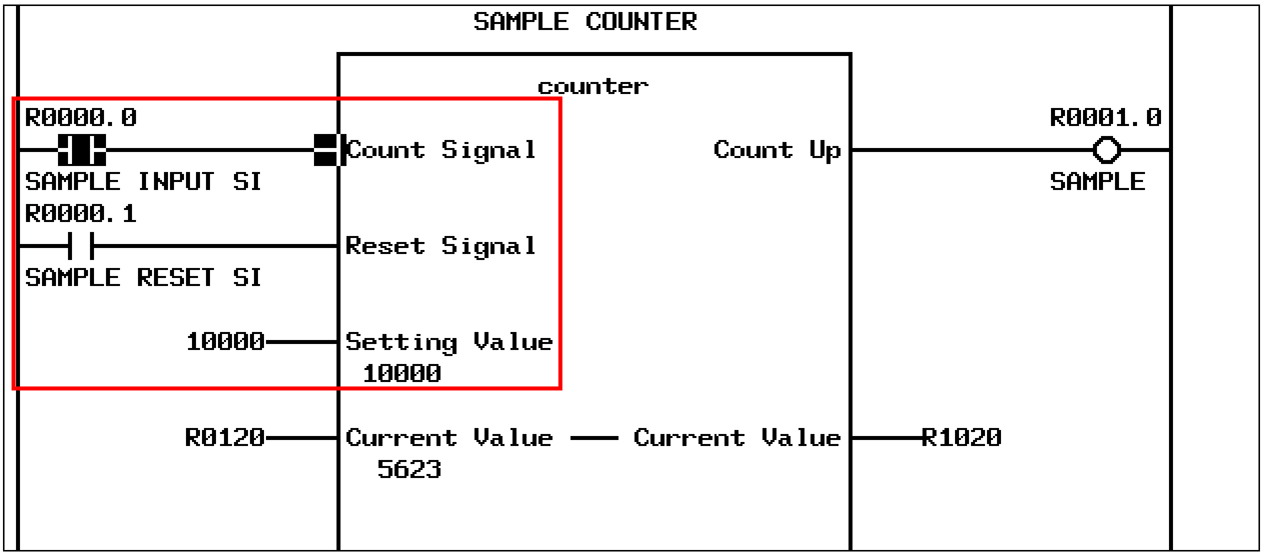


Fig.11.2.2 (b) Input parameters and input section

> **NOTE**
> You cannot write to an input parameter in the FB body program.

(3) Output parameter
An output parameter is a variable to pass the output from the FB body program. A value should be set to it by the FB body program. The ENO output is a kind of output parameter.
If you do not have to fetch any output value, you can leave an output section without specifying an address.
Output parameters are displayed at the right side of a function block instance in the output section.

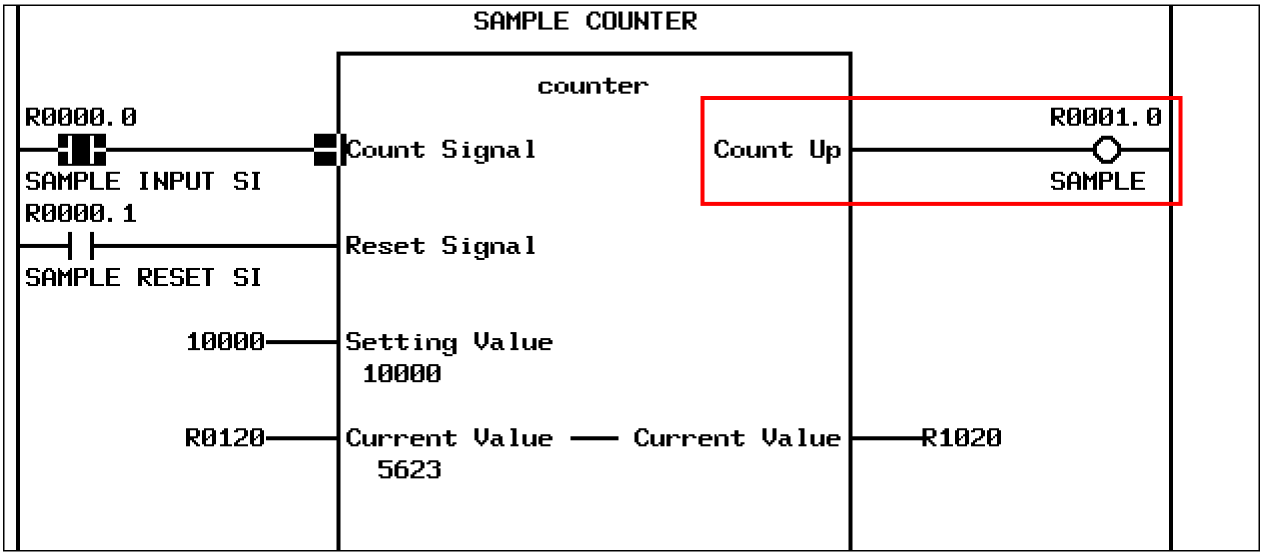


Fig.11.2.2 (c) Output parameters and output section

> **NOTE**
> If a value is not set for an output parameter in the FB body program, the previous value is remained.

(4) Input/output parameter

An input/output parameter is handled as a variable which receives the input to the FB body program and of which value can be changed by the FB body program.

It can be read and written by the FB body program without restrictions.

An input/output parameter is displayed at both sides of a function block connected by a line.

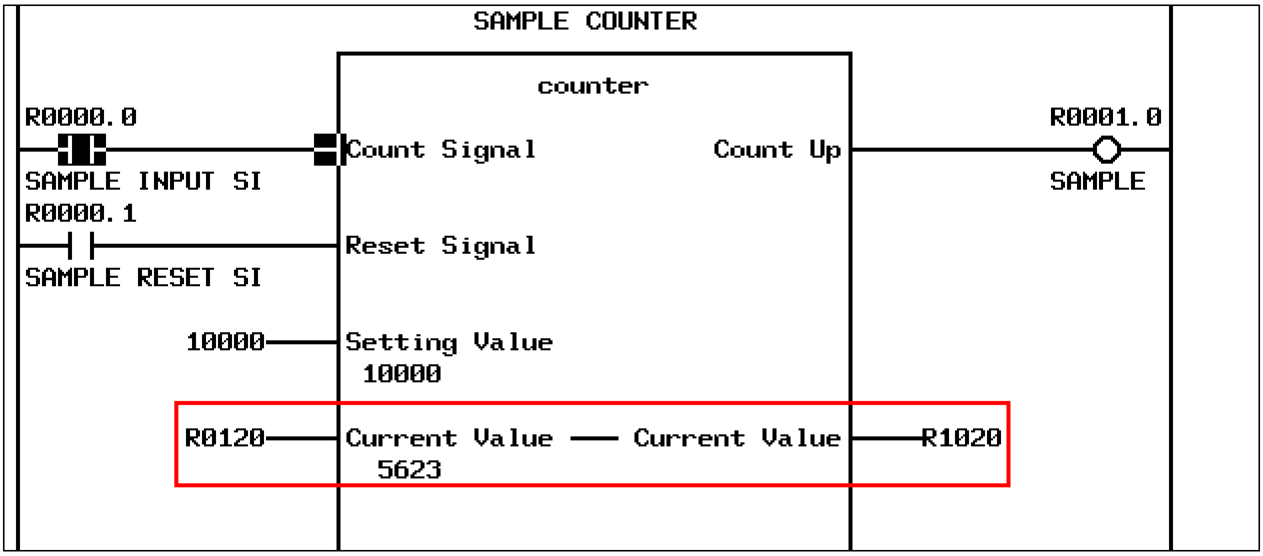


Fig.11.2.2 (d) Input/output parameter display

For an input/output parameter, you can specify an address in each of the left input and right output sections. You can omit an address in the output section, but cannot omit one in the input section. When an input/output parameter is accessed in the FB body program, the address specified in the input section is referenced directly. The value of the input/output parameter is copied to the address specified in the output section after function block processing terminates.

For input/output parameter “Current Value” in the figure above, the address specified in the input section is “R0120” and that specified in the output section is “R1020.”

(a) Feature of input/output parameters
For an input parameter, the given constant or the value at the specified address is stored in the variable assigned as the input parameter before the start of FB body program processing. For an output parameter, the value of the output parameter is written at the specified address after the termination of function block processing.
In contrast, for an input/output parameter, the program in the function block directly accesses the address specified in the input section. Therefore, writing an input/output parameter by the FB body program means directly writing a value at the address specified in the input section for that input/output parameter.
You can use this feature of input/output parameters when the order to access signals must strictly be controlled in a function block or when a large amount of data such as table data needs to be passed.

(b) Notes on input/output parameters
Note the following points when using input/output parameters:

- No constant can be specified for an input/output parameter.
- The value of an input/output parameter may change during the execution of the FB body program.
- The address assigned in the input section for an input/output parameter cannot be changed by the online editing function or on the PMC ladder diagram editor screen.
- When the same address is set to different input/output parameters of a function block, or when an address used as an external variable in the function block is set for an input/output parameter of the function block, a correct symbol may not be displayed for the address in the FB body program when displayed.

Internal variables

An internal variable is used only in the function block.

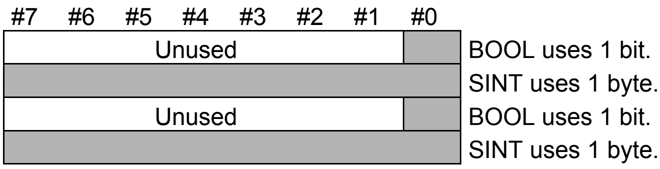
(1) Nonvolatile memory type
The nonvolatile memory type can be specified for an internal variable. In this case, the variable is allocated in the nonvolatile memory type area (D address).

(2) Arrangement
Internal variables are arranged in contiguous memory areas in the order in which they are defined. Nonvolatile and volatile variables are arranged in different areas.

NOTE

1 When internal variables of different data types are arranged, any variable of a data type such as INT or DWORD that occupies at least 2 bytes is not aligned based on the data type, but is arranged on a byte boundary. To avoid affect performance, try to adjust the order of variable definitions so that variables of these data types are arranged at even addresses. (The start of an internal variable is always arranged at an even address.)

2 When a non-BOOL variable is arranged following a BOOL variable, any unused bit address is not assigned to other BOOL variable after that. For example, BOOL, SINT, BOOL, and SINT variables defined in this order use 4 byte area. A used memory can be reduced to define the BOOL variables contiguously.



(3) Input parameter

When a function block is displayed on the screen, any internal variable is not displayed on that screen. If you want to display and monitor the value of an internal variable in the function block, you can specify the “monitor display” attribute with FANUC LADDER-III to display and monitor the value of the variable in the function block. For details of monitor display of internal variables, Subsection 11.5.3, " DISPLAYING INTERNAL AND EXTERNAL VARIABLES IN THE MONITOR (FB INSTANCE MONITOR DISPLAY)".

External variables

An external variable is used in a function block to refer a symbol defined in advance in ladder program outside the function block. The entity (address) to be accessed is the same even from different function block instances.
If a symbol definition of the same name as an external variable is not found during compilation, an error occurs.

> **NOTE**
> 1 Details (including the real address) of an external variable are defined not by an external variable declaration in the function block definition, but by symbol data of the used ladder program. An external variable declaration in a function block definition is used for referencing a variable defined in the ladder program.
> 2 The name of an external variable is an identifier conforming to IEC61131-3, so only a symbol defined as an identifier conforming to IEC61131-3 can be referenced. For details of a variable name, see Section 11.2.2, "Variable Information"
> 3 The symbol and data type of a declared external variable must be consistent within the whole program. For example, if a program registers symbol "ABC" of the bit type, and a function block declares "ABC" as a byte external variable, a compilation error occurs because the data type of the variable indicated by symbol "ABC" is inconsistent.
> 4 A fixed address can be referenced by writing not a symbol, but a specific address directly in the FB body program. In this case, the address does not need to be counted as an external variable.

(1) Monitor display
The "monitor display" attribute can be specified for an external variable like an internal variable.
Specifying this attribute with FANUC LADDER-III will display and monitor an external variable, which is normally not displayed in the function block.
For details of monitor display of internal variables, see Subsection 11.5.3, "Displaying Internal and External Variables in the Monitor (FB Instance Monitor Display)".

11.2.3 FB Body Program

The function of each function block is defined by ladder program programmed using symbols. All symbols that appear in the program must be declared as variables in advance. You can also specify an address directly in a program to always access a fixed address.

> **NOTE**
> Creating more than one instance of a function block which writes data at a fixed address causes duplicate writing.

(1) Levels of nested function block calls
From the FB body program, other function block can be called. Calling function block can be nested up to 4 levels deep. If calling function block is nested more than 4 levels deep, a compilation error occurs on FANUC LADDER-III.

> **NOTE**
> 1 An ordinary subprogram cannot be called from a function block.
> 2 A function block call is independent of the nesting of subprogram call using the CALL or CALLU instruction in the ladder language. Therefore, you do not have to count a function block call in the number of nested subprogram call levels, or a subprogram call in the number of nested function block call levels.
> 3 The depth of nested function block calls is not determined based on not the number of nested function blocks actually called during execution, but the number of nested function block calls defined in the program. That is, a function block call that is programmed not to call actually is also counted. Therefore, any function block cannot be called recursively.
> 4 For each of function block calls (instances) in a function block, a number is automatically added to its instance name during compilation on FANUC LADDER-III so that they have different names.

(2) Restrictions
There are some restrictions at creating the FB body program comparing with an ordinary ladder program.

(a) Functional instructions
There are restrictions and notes on some functional instructions.
The following functional instructions cannot be used in the FB body program:
- END1, END2, END3, END
- SP, SPE
- CALL, CALLU
- JMPC
- CS, CM, CE

Do not use the following functional instructions in a function block of which more than one instance is to be created because they cannot perform independent operations for different function block instances:
- TMR
- CTR, CTRB

When the following functional instructions are used in a function block, set 0 to the timer number, and rising and falling numbers with FANUC LADDER-III so that the automatic number assignment function assigns different numbers for different function block instances:

- TMRB, TMRBF
- DIFU, DIFD

NOTE
If these functional instructions are used in a program without using the automatic number assignment function, these instructions may not work correctly because more than one functional instruction having the same number may operate simultaneously.

When the following functional instructions are used in a FB body program, time is integrated only while the FB body program is called:

- TMRST, TMRSS

The following functional instructions are executed in plural ladder scans. Do not cancel calling a FB body program when the status of instruction is not completed (executing). Executing of instruction means that from the execution start (ACT) is set to 1 and transfer completion (coil) becomes 1 until the ACT is set to 0 and the coil becomes 0:

- DISPB
- EXIN
- WINDR (low-speed type only)
- WINDW (low-speed type only)
- AXCTL

NOTE
1 When the FB body program call is canceled in executing one of the above functional instructions, other EXIN, WINDR, WINDW and AXCTL may not work correctly. Operation of instruction is not also guaranteed.
2 As for AXCTL instruction, use the reset request(RST) = 0 normally. Do not cancel the FB body program call when the reset request(RST) = 1. When canceled, other AXCTL may not work correctly and operation of instruction is not guaranteed.

For the example, see Subsection 1.4.4.3, " Notes on using subroutines".

(b) Other restrictions
In addition, the following restrictions apply on the FB body program:

- A value cannot be written to an input parameter.
- The JMP and JMPE instructions and the COM and COME instructions must be paired within a function block.
- The JMPB instruction can jump only to the LBL instruction within the function block.
- A program consisting of up to 8000 steps can be created in a function block.
- Because a FB body program is not executed when the EN input is OFF, it is referred as always ON in the case of it is used in the FB body program. So, the EN input can not be used as the input signal of DIFU/DIFD, -|P|-, -|N|- and counter instructions to catch rising and falling edge.

11.2.4 Other Information

A function block definition also contains the following information:

- Version information
- Protection information

The following explains the above information.

(1) Version information
The following information is included as version information in a function block definition:

- Character string indicating the user definition version (character string consisting of up to 16 desired characters)
- Last update time stamp

These information items are used for managing the function block in a library. They are also used as criteria at an identity check function for function blocks during recompilation on FANUC LADDER-III.

NOTE
FANUC LADDER-III automatically records the last update time stamp. You do not need specific setting or operation.

(2) Protection information
Protection information is used to protect a function block definition from editing or browsing with a password.
After a password for protection is set, the password is required when the function block definition is to be edited or the FB body program is to be browsed (displayed in the monitor).
Protection information set in a function block definition is inherited to each function block instance generated from the function block definition.

There are the following two types of password protection:

- Editing protection
- Browsing and editing protection

Select editing or browsing and editing protection and set a password to protect the function block definition. You can use a character string consisting of up to any 16 desired characters for the password.
According to the selected type of protection, the relevant operations are prohibited as listed in the table below.

Type of protection	Browsing	Editing
No protection	○ Enabled	○ Enabled
Editing protection	○ Enabled	× Disabled
Browsing and editing protection	× Disabled	× Disabled

Each protection setting prohibits the following operations.

Type of protection	Example of prohibited operation
Editing protection	Editing of the function block definition (Deletion of the function block definition itself is possible.)
Browsing and editing protection	Display and monitor display of the FB body program

NOTE

The FB body program can be displayed and monitored on both the PMC screens and FANUC LADDER-III, but can be edited only on FANUC LADDER-III in the offline mode.

Protection with a password can be released by entering the password to enable the relevant operation temporarily.

11.3 FUNCTION BLOCK CALL

To use a defined function block actually, insert an instruction (instance) which calls the function block in a program and set signals and other items in the input and output section to complete the calling section. An object code which calls the specified function block processing is generated based on the information at compilation on FANUC LADDER-III.

> ⚠ **CAUTION**
> When editing FB definitions and FB instances by the offline editing function on FANUC LADDER-III, the addresses assigned to the parameters and variables of function block will be changed. Therefore, the parameters and variables of all function blocks will be initialized by 0 when the sequence program is inputted into CNC. (See “11.1.4 Assignment of FB variable” for details.)

11.3.1 Function Block Call Positions

This section explains about difference by the positions of function block call.

(1) Program levels
A function block can be called from any position in level 1 to 3 ladder programs and subprograms.

(2) Common line control
When the ACT condition of the COM instruction is OFF, a function block call between COM and COME is not called and the processing in the function block is not executed.
This is the same effect as when the EN input is set to OFF. For a function block without EN input, you can use common line control to control a conditional function block call, which is similar to using the EN input.

11.3.2 Creating a Function Block Call Section

Follow the procedure below to create a function block call section:

1. Enable the reference to the definition of a function block to be called.
2. Choose the function block definition and create a function block call section in the program.
3. Assign a name (instance name) to the function block call section.
4. Set a value, address, or symbol for each parameter.

> **NOTE**
> A total of function block instance which can be created in a program is as follows.
> - Up to 5000, in the case of PMC Memory-B,C and D
> - Up to 512, in the case of PMC Memory-A, DCS PMC
>
> This number includes function blocks called from other function blocks.

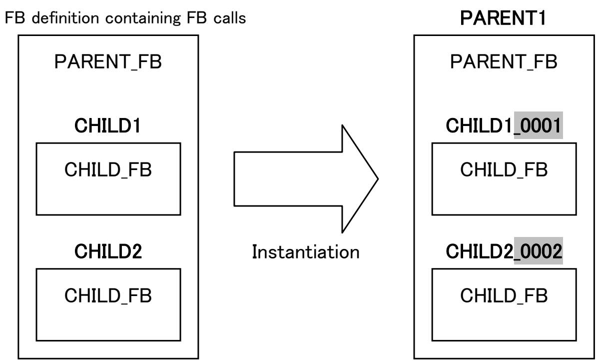
The following explains the above procedure in detail.

(1) Name of a function block instance
To insert an instruction which calls a function block in a ladder program, a name must be assigned to the instance to be created at that time. Instance names are assigned to distinguish individual instances when the same function block is called plurally in a program. The same name cannot be assigned to more than one instance.
For the name of a function block instance, specify a character string consisting of the following characters (identifier conforming to IEC61131-3):

- Alphabetic characters (A to Z)
- Numeric characters (0 to 9)
- Underscore (_)

NOTE

1 A function block instance name must not begin with a numeric character. When an underscore is specified as the first character, it must be followed by an alphanumeric character.
2 A name character string can consists of up to 40 characters.
3 When a function block contains a function block call instance, underscore (_) + 4-digit number is automatically added to the instance name in the function block definition during compilation on FANUC LADDER-III so that the name uniquely identifies the instance. For this reason, 5 characters ("_*nnnn*") are added to a function block instance name in a function block definition and the maximum number of characters of the instance name becomes 35. If a name to which a number is added is the name of another symbol, a compilation error occurs. Do not use any similar symbols.



(2) Setting data in the input and output section
After inputting a function block instance, set a numeric value or address to each parameter of the function block in the input or output section.
The available range differs depending on the type of parameter. For details, see “Parameter” in Subsection 11.2.2.

For a non-BOOL parameter, specify an address to the right or left side of the parameter name. For an input parameter, you can also specify a constant.

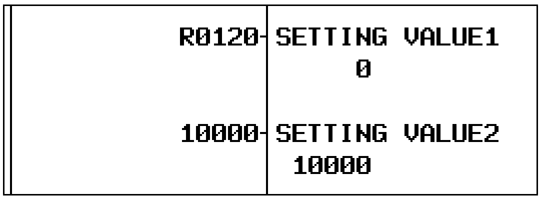


Fig.11.3.2 (a) Specifying an address (upper) and a constant (lower) for parameters

For a BOOL parameter, a contact is displayed in the input section. Specify an address on the contact. And, you can add coils, contacts and connection lines if needed.

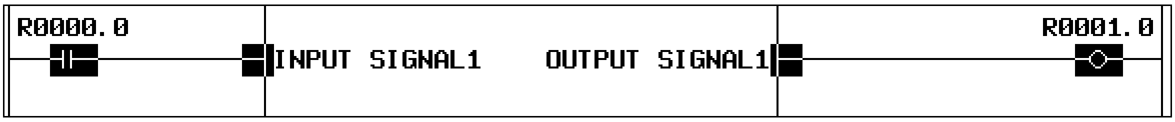


Fig.11.3.2 (b) Specifying a contact and a coil for BOOL parameters

For an input/output parameter, no contact is displayed in the input section even when the data type is BOOL. Directly specify an address in the same way as for other data types of parameters.

For the output section for an output parameter or input/output parameter, you can omit the address specification if the output value does not need to be saved.

NOTE

The consistency of the data type between the symbol set to the parameter and the parameter itself is basically not checked. Combination of the BOOL and non-BOOL types causes an error. Any combination of a numeric type (such as INT or DINT) and a bit set type (such as BYTE) is available.
When a symbol of a different type is set for an input or output parameter, data of the size which suites to the type of parameter is actually input or output. Note that if data is input and output in different sizes, the program may not work as expected.

11.4 EXECUTING A FUNCTION BLOCK

A function block call section is executed in the following three steps:

1. Input process
2. Execution of the FB body program
3. Output process

The following explains the processing performed in each step in detail.

(1) Input process
In input process, given signals and numeric values are set to input parameters. The values are sequentially set for the input parameters from the top to the bottom.

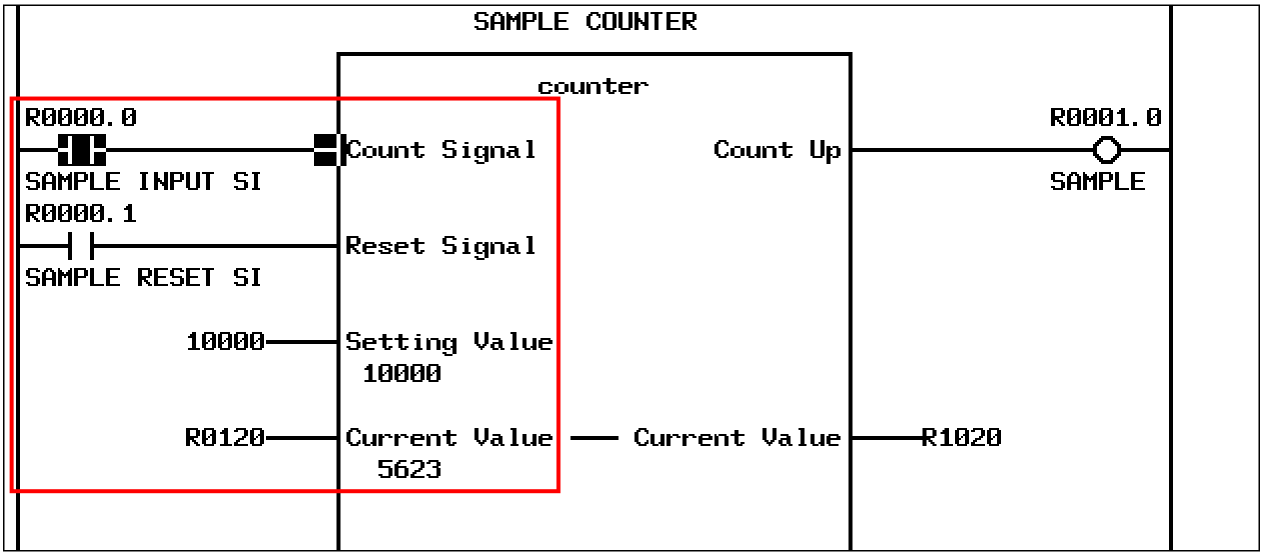


Fig.11.4 (a) Input process

In the example in this figure, input process will be performed as follows:

1. The signal status of R0000.0 is copied into input parameter “count signal”.
2. The signal status of R0000.1 is copied into input parameter “reset signal”.
3. The value 10000 is copied into input parameter “setting value”.

The address of input/output parameter “current value” itself will be R0120 and the value is not copied.

> **NOTE**
> When a function block to be executed has the EN input and the EN input is OFF, value is set for the subsequent input parameters but the subsequent execution step of the FB body program is skipped. For details of the EN input, see Section 11.2.2, “Variable Information”.

(2) Execution of the FB body program
After values are set to all input parameters by input process, the FB body program is executed.

NOTE
When a function block to be executed has the EN input and the EN input is OFF, the FB body program is not executed. For details of the EN input, see Section 11.2.2, "Variable Information".

(3) Output process
After the FB body program has been executed, output process is performed.
In output processing, the values of the output parameters are set to the addresses connected to these output parameters. The values of the output parameters are sequentially set from the top to the bottom.

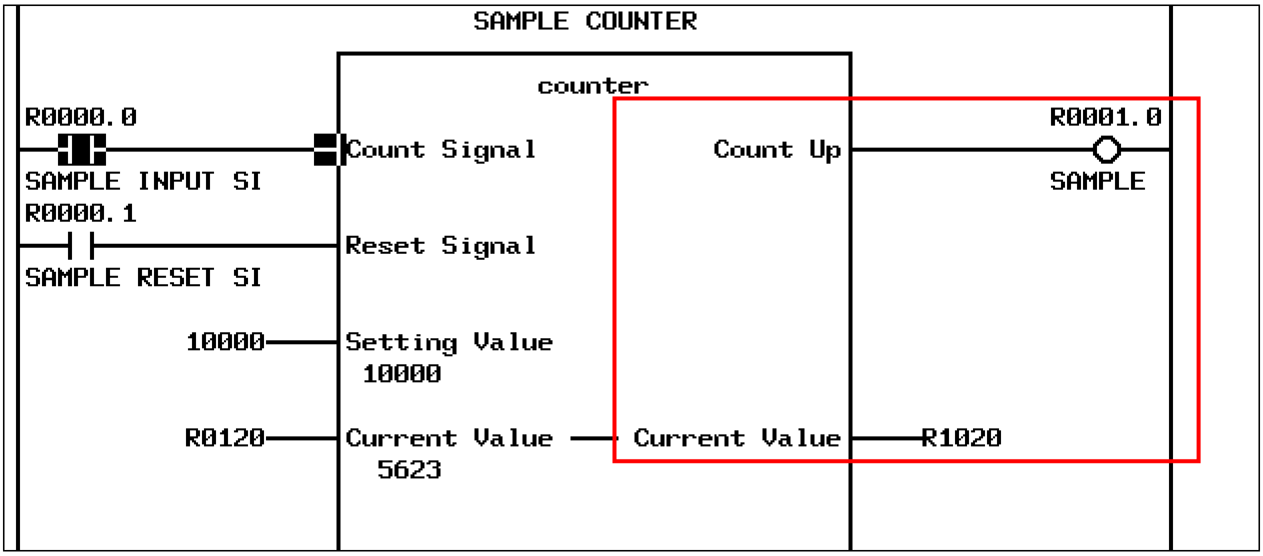


Fig.11.4 (b) Output process

In the example in this figure, output process will be performed as follows:

1. The signal status of output parameter "count up" is copied into R0001.0.
2. The value of input/output parameter "current value" is copied into R1020.

NOTE
1 Output process is performed in the order in which parameters are arranged. When the order in which values are set is important, change the order of parameters or use input/output parameters to adjust the timing to set values.
2 When a value is set to an input/output parameter in the FB body program, the value is set directly to the address specified in the input section of the input/output parameter. Then the value of output and input/output parameter is set to an address in the output section at output process.

11.5 DISPLAYING AND EDITING A FUNCTION BLOCK

A function block in a ladder program is displayed on the ladder diagram monitor screen. The displayed items include the function block definition name, instance name, and defined input, output, and input/output signals. You can also monitor the active/inactive state of the function block, the value of each parameter, and input and output values during the execution of the ladder.
In addition, you can use the editing function to change addresses and values set in the input and output sections of the function block.

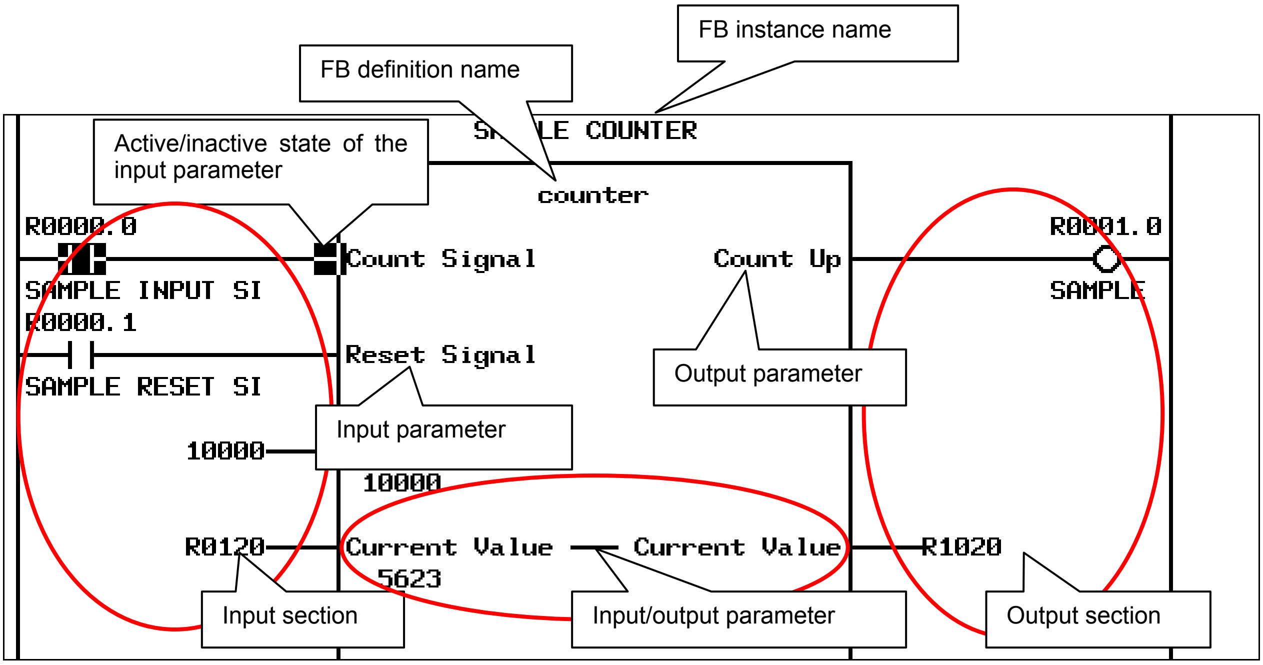


Fig.11.5 (a) Display of the function block

The following table lists whether each PMC function related to function blocks is available.

Table11.5 (a) List of functions

PMC functions related to function block		PMC screen
Displaying and editing a function block	・Displaying a list of function blocks	×
	・Creating and editing a new function block	×
Displaying and editing the function block instance	・Displaying the function block instance	○
	・Creating and copying the function block instance	×
	・Deleting the function block instance	○
	・Changing data in the input and output sections of the function block instance	○(NOTE)
	・Displaying the ladder program in the function block instance	○
	・Modifying the ladder program in the function block instance	×

NOTE
Any address in the input section assigned to an input/output parameter cannot be changed.

11.5.1 Program List Display Screen

The PROGRAM LIST VIEWER screen shows program information such as the program size.

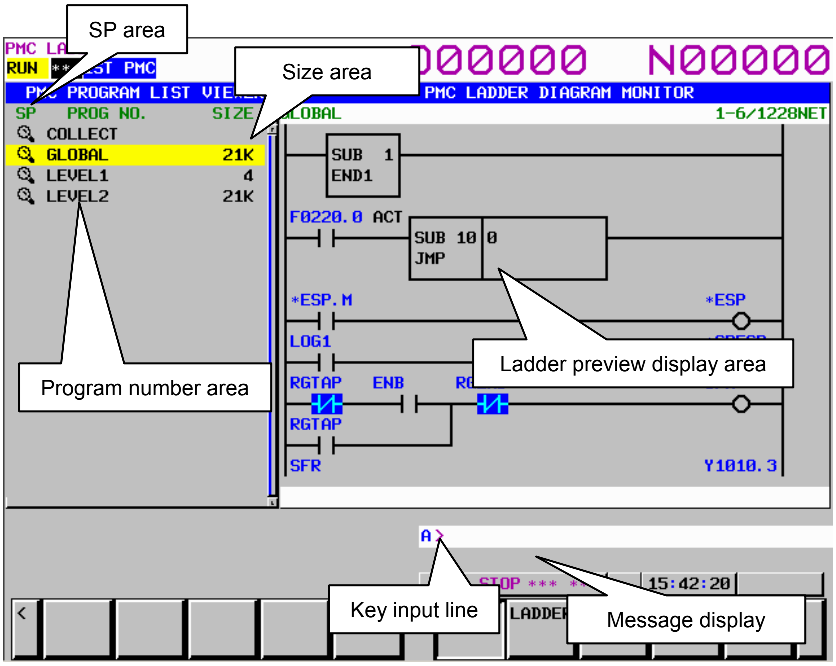


Fig.11.5.1 (a) Program List Display Screen

Any function block is not displayed in the program list of this screen.
When pressing the [ZOOM] soft key after inputting the function block instance name, the screen display switches to the FB body program of the specified function block instance.

For details of the screen, see Section 8.1, "DISPLAYING A PROGRAM LIST ([LIST] SCREEN)".

NOTE

The size of FB body program is not included in the program size of GLOBAL and each subprogram displayed in the list.

11.5.2 LADDER DIAGRAM MONITOR Screen

A function block in a ladder program is displayed on the ladder diagram monitor screen. You can also monitor the active/inactive state of the function block, the value of each parameter, and input and output values during the execution of the ladder.

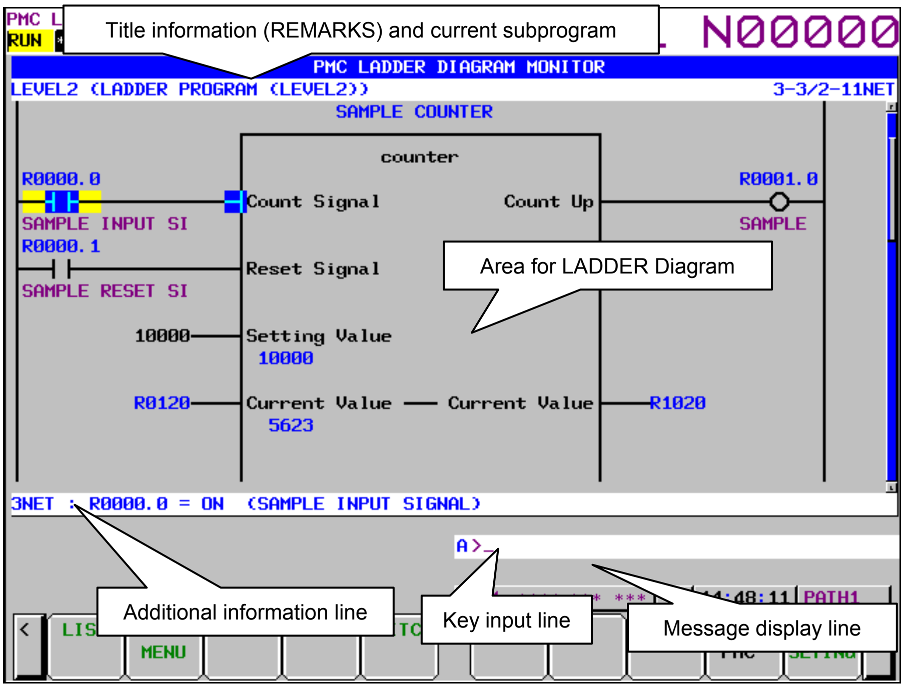


Fig.11.5.2 (a) Function block displayed on the ladder diagram monitor screen

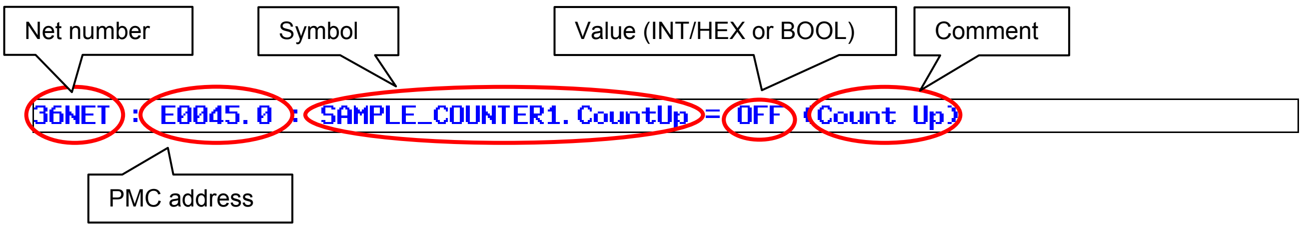
(1) Screen structures

(a) At the top of the screen, the title information (REMARKS) and current subprogram information (“[comment] program number (symbol)”) are displayed together with the ladder position which is displayed on the screen.

(b) The message display line displays a message such as an error message and inquiry, depending on the situation.

(c) The additional information line displays the information of the function block when the cursor is placed on the function block instance.

When the cursor position is on the function block parameter.



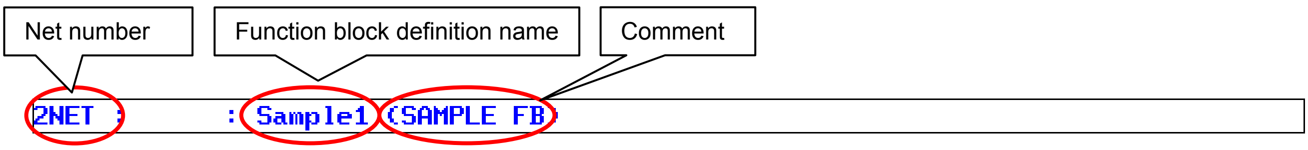
- Net number
  Number of the net at the cursor position
- PMC address
  4-digit byte address + bit address
- Symbol
  Symbol set for the function block parameter
- Comment
  Comment set for the function block parameter
- Value
  Value of the parameter at the cursor position according to its data type
- When the type is BOOL: "ON" or "OFF"
- When the type is not BOOL: Decimal or hexadecimal number

NOTE

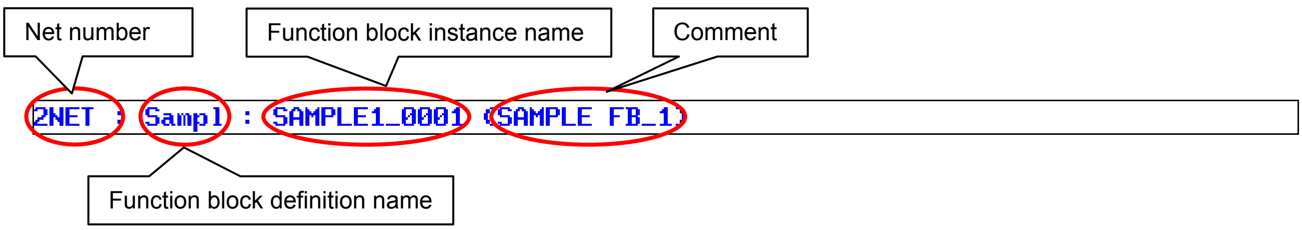
When the cursor is positioned on a constant or an omitted parameter in the output section, only the net number is displayed.

When the cursor position is on the function block definition name or instance name.

- Function block definition name



- Function block instance name



(2) Function block display
On the ladder diagram monitor screen, you can monitor the signal status and current value of each parameter of a function block in the ladder program being executed. The parameter is displayed in the format corresponding to its data type.

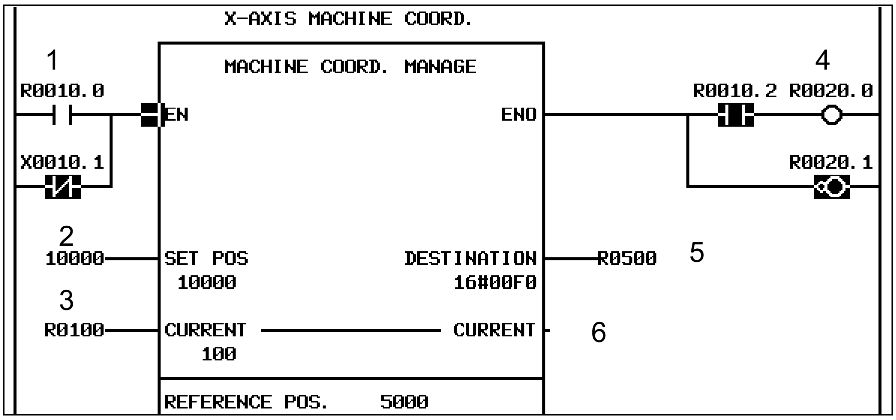


Fig.11.5.2 (b) Sample of a function block monitor

Each item in Fig. 11.5.2 (b) is explained below.

1. For a BOOL parameter in the input section, contact instructions are connected.

> **NOTE**
> No constant can be set for a BOOL parameter.

2. Displays the numeric value set to the input parameter as a constant.
3. Displays the PMC address set of the input/output parameter.

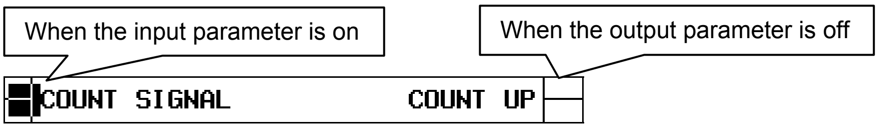
> **NOTE**
> For an input/output parameter, no constant can be set in the input section. Set a PMC address.

4. For a BOOL parameter in the output section, coil instructions are connected. And, you can connect a contact instruction before the coil instruction.
5. Displays the PMC address defined as the copy destination of the output parameter.
6. Displays a blank when output section for a parameter is omitted.

(3) Monitor display screen

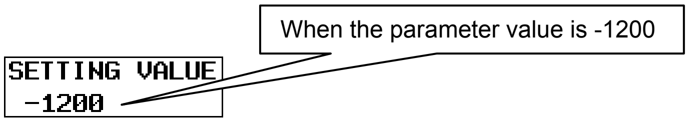
- BOOL

  The status is displayed at border between the input section and input parameter, and between the output parameter and output section which indicates the active/inactive state of the parameter.



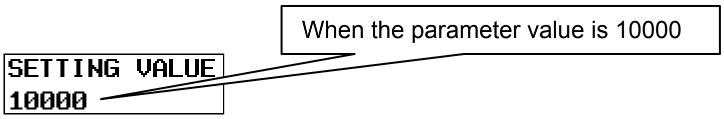
- SINT, INT, DINT

  The value of the input parameter, output parameter and input/output parameter is displayed with a signed decimal number.



- USINT, UINT, UDINT

  The value of the input parameter, output parameter and input/output parameter is displayed with an unsigned decimal number.

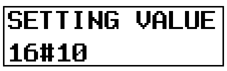


- BYTE, WORD, DWORD

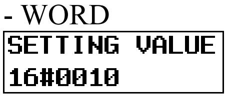
  The value of the input parameter, output parameter and input/output parameter is displayed with a hexadecimal number.

  The number of displayed digits differs depending on the data type.

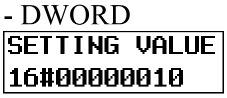
  - BYTE



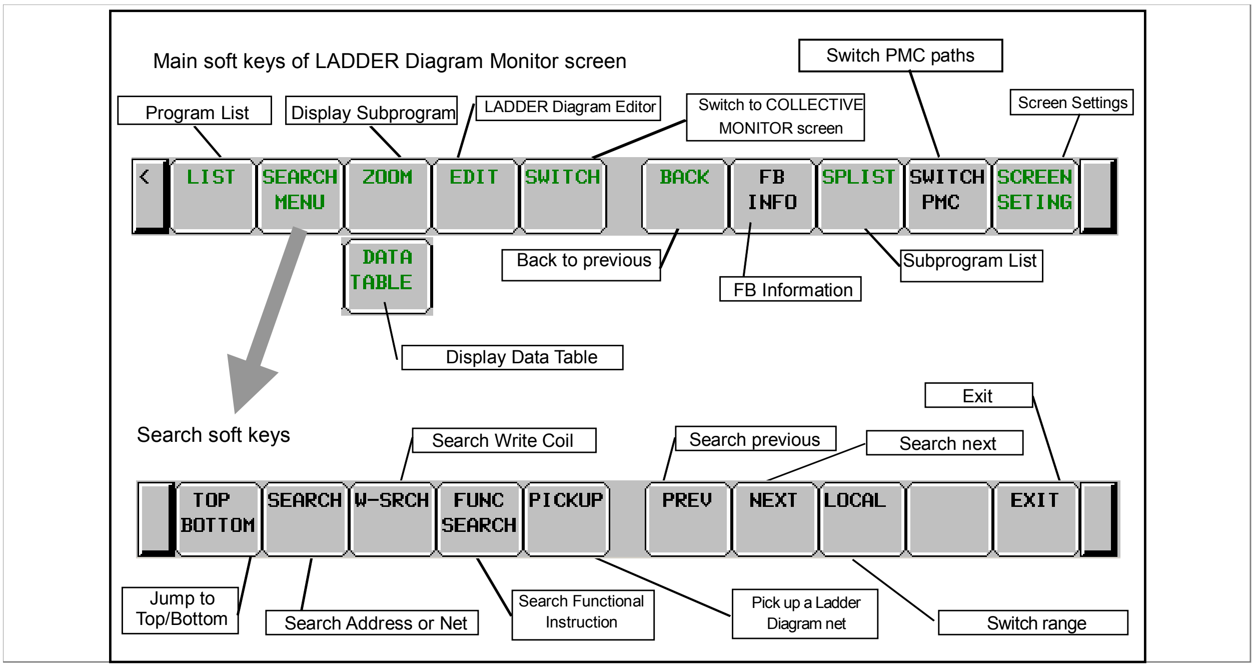
  - WORD



  - DWORD



(4) Operation with Soft keys
The soft key operations to function block are described below. About the other operation with soft keys, see Subsection 8.2.1, "Operating on the LADDER DIAGRAM MONITOR Screen".



(a) [LIST] Go to PROGRAM LIST VIEWER screen
Displays the program list screen. Specifying a function block instance name and pressing the [LIST] soft key can zoom in the FB body program.

(b) [SEARCH MENU] Search & Jump
Change soft keys to “Search soft keys”. There are the following search functions related to function blocks.

Table11.5.2 (a) Search functions

Function name	Searched item related to function blocks
Search	PMC address used in the input or output section of a function block
	PMC address used for a function block parameter
	An internal or external variable (PMC address) which the FB instance monitor is set
	Function block instance name
Coil search	BOOL parameter in the output section of a function block
Functional instruction search	Function block definition name
Pick up	Pick up the function block net and net in the FB body program
Previous	Search target
Next	Search target

NOTE

1 When search function find the target and attempt to zoom in a function block for which browsing and editing protection is set, you are asked to enter the password. When pressing the [SKIP] key in this case, the target address is skipped and the next target is searched.
2 When a GLOBAL program is displayed and you search for an internal variable of a function block, the FB body program is displayed and the cursor moves to the target address.
3 When a subprogram is displayed and you search for an internal variable of a function block in the global search mode, the cursor also moves to the target address in the FB body program.

(c) [DATA TABLE] Go to FUNCTIONAL INSTRUCTION DATA TABLE VIEWER screen
Goes to FUNCTIONAL INSTRUCTION DATA TABLE VIEWER screen to examine contents of Data Table of functional instructions such as COD (SUB 7) and CODB (SUB 27), which have Data Table in themselves. This soft key appears only when the cursor is on a functional instruction that has Data Table.

(d) [ZOOM] Display contents of subprogram/function block
When positioning the cursor on a CALL/CALLU/CM instruction or a function block instance, the [ZOOM] soft key is displayed. Pressing the [ZOOM] soft key displays the subprogram and FB body program. When you attempt to zoom in a password-protected subprogram or function block, you are asked to enter the password.

NOTE

1 The FB body program is not included in the GLOBAL program. To display an FB body program, zoom in the function block from the section in which the relevant function block instance is used.
2 When K903.2=1, you will not be asked to enter the password.

(e) [EDIT] Go to LADDER DIAGRAM EDITOR screen
Goes to LADDER DIAGRAM EDITOR screen. Even if the [EDIT] soft key is pressed, an error message is displayed and edit operation is disabled when an FB body program is displayed.

(f) [SWITCH] Switch to COLLECTIVE MONITOR screen
Switches to COLLECTIVE MONITOR screen.

(g) [BACK] Show the preceding subprogram/function block
Traces back the history to recall the previous displayed subprogram and function block.

(h) [FB INFO] Function block information display
Displays information (version, date, and protection status) on the function block at the cursor position at the message display line. This soft key is displayed only when the cursor is positioned on a function block.

Example)

Version	Date	Protection status
01	2007/09/03	PROT = P

Protection status
P : browsing and editing protection
R : editing protection

(i) [SPLIST] Switch to the subprogram list screen
Switches the screen display to the subprogram list display screen.

(j) [SWITCH PMC] Switching PMC path or divided ladder programs
Switches PMC path or divided ladder program. For details of the operation, refer to “6.3”.
By setting keep relay K935.0 to 1, you can display PMC program list screen. For details, refer to ”2.2.11”.

(k) [SCREEN SETING] Screen settings
Goes to setting screen for LADDER DIAGRAM MONITOR screen.

11.5.3 Displaying Internal and External Variables in the Monitor (FB Instance Monitor Display)

Normally, when a function block is displayed on the ladder diagram monitor screen, the signal status and current value of each parameter is displayed in the monitor, but the internal and external variables used in the function block are not displayed.
However, you can specify the “monitor display” attribute for specific internal or external variables that you can monitor their values in the same way as for parameters, which provide a clue for the internal status of the function block. This monitor display is called “FB instance monitor”.
The monitor display attribute can be specified for up to 16 internal and external variables in one function block.
For FB instance monitor display, you can specify the following monitor formats in addition to the ordinary monitor formats.

Type name	Data type	Monitor format
BYTE (bit)	8-bit bit string	Bit string display
WORD (bit)	16-bit bit string	Bit string display

Internal and external variables with the monitor display attribute are listed under the monitor display of parameters. You can also change the value of each variable displayed in the monitor.

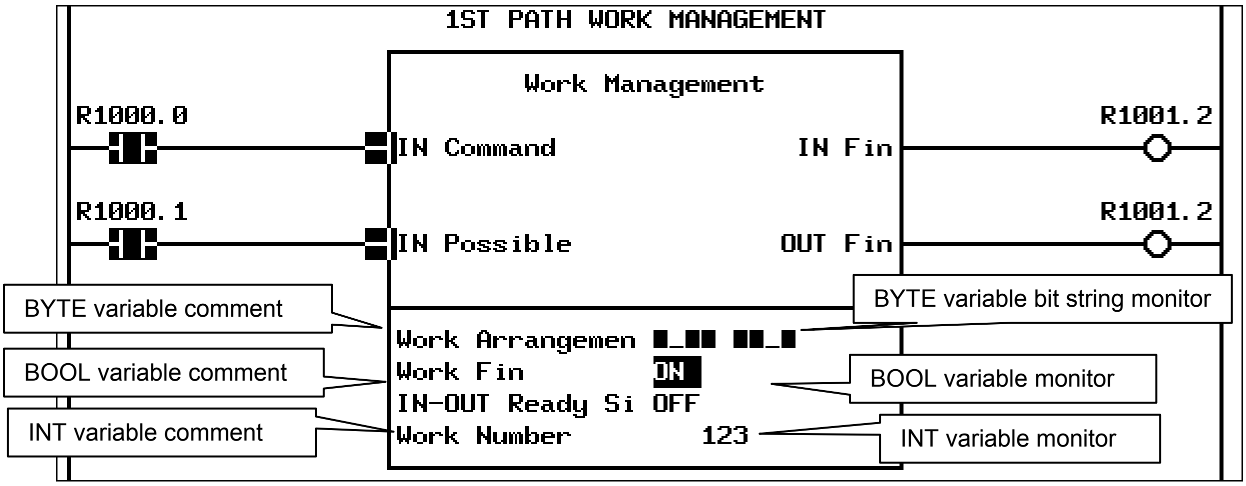


Fig.11.5.3 (a) FB instance monitor display

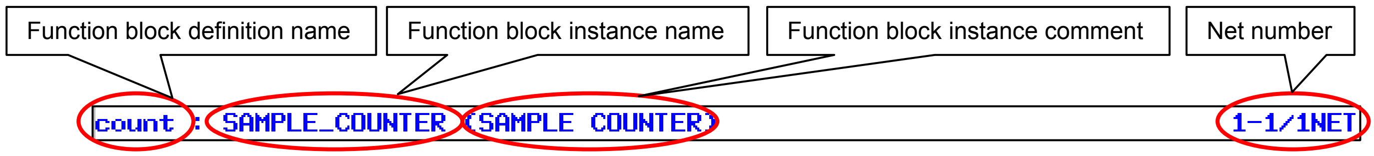
You can display or hide the FB instance monitor by the screen setting. See Subsection 11.5.5 " Setting the Display Format of the LADDER DIAGRAM MONITOR Screen".
The variables to be displayed in the FB instance monitor can be defined in the function block definition on FANUC LADDER-III.

NOTE
1 You can monitor variables in the bit string display of BYTE and WORD only in the FB instance monitor.
2 The 32-bit bit string monitor format is not available.

11.5.4 Displaying the FB Body Program

To move the cursor to the function block on the ladder diagram monitor screen and press the [ZOOM] soft key, you can display the ladder circuit in the function block in the monitor.
You can also press the [BACK] soft key to return the screen to the display the function block monitor display mode.

(1) Items displayed at the top of the screen
The following function block information is displayed at the top of the screen when a FB body program is displayed.



- Function block definition name
  Name of the function block definition
- Function block instance name
  Symbol registered as the function block instance name
- Function block instance comment
  The comment set for the function block instance
- Net number
  Local net number in the function block

11.5.5 Setting the Display Format of the LADDER DIAGRAM MONITOR Screen

You can set the display format of the LADDER DIAGRAM MONITOR screen. The settings mainly related to the display format of function block instance are as follows.

- SHOW COMMENT OF CONTACT
- ADDRESS NOTATION IN FB
- SHOW FB INSTANCE MONITOR
- FB PARAMETER NAME
- DIAGRAM APPEARANCE SETTING (COLOR)

About other settings, see Subsection 8.2.2 "Setting the Display Format of the LADDER DIAGRAM MONITOR Screen".

(1) SHOW COMMENT OF CONTACT
The display line of comment of contact, the display line of parameter name, and the presence of monitor display on the function block instance vary according to the setting of “SHOW COMMENT OF CONTACT”.

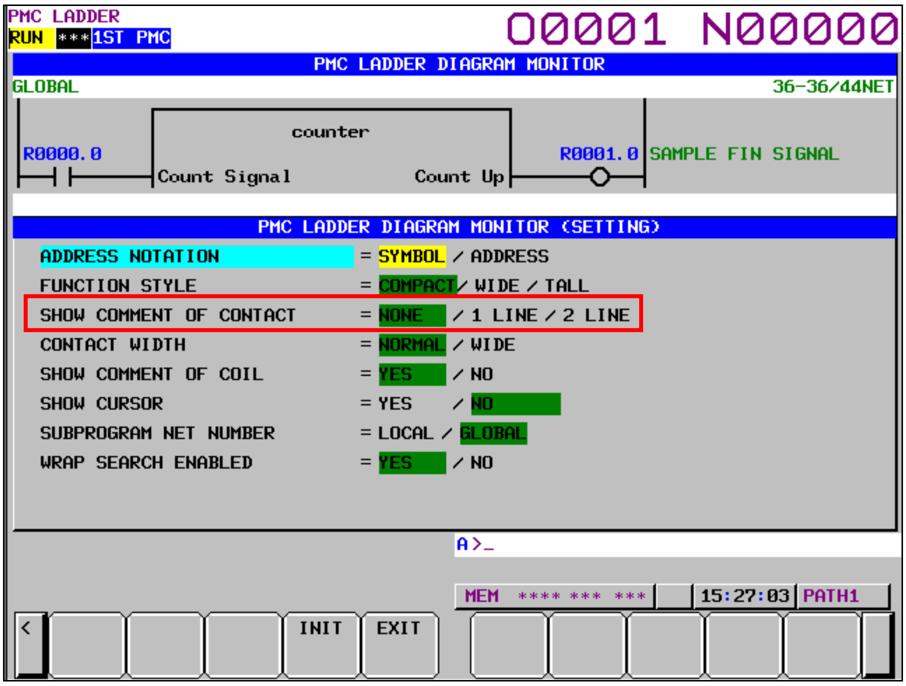


Fig.11.5.5 (a) Setting of “SHOW COMMENT OF CONTACT”

Setting of “SHOW COMMENT OF CONTACT”	Parameter		Comment in the input and output sections	
	Name	Non-BOOL monitor	BOOL (relay)	Non-BOOL (byte address)
2 line	2 lines	Displayed	2 lines	2 lines
1 line	2 lines	Displayed	1 line	1 line
None (default)	2 lines	Not displayed	Not displayed	Not displayed

The display format in each setting value is shown below.

(a) "2 LINE" for "SHOW COMMENT OF CONTACT"
The display format when setting "2 LINE" for "SHOW COMMENT OF CONTACT" is as follows.

Display item		Description
Parameter	Name	Comment or symbol (15 single-byte characters x 2 lines)
	Non-BOOL monitor	Displayed
Input/output sections	BOOL	Address or symbol (15 single-byte characters x 1 line) Comment (15 single-byte characters x 2 lines)
	Non-BOOL	Address or symbol (15 single-byte characters x 2 lines) Comment (15 single-byte characters x 2 lines)

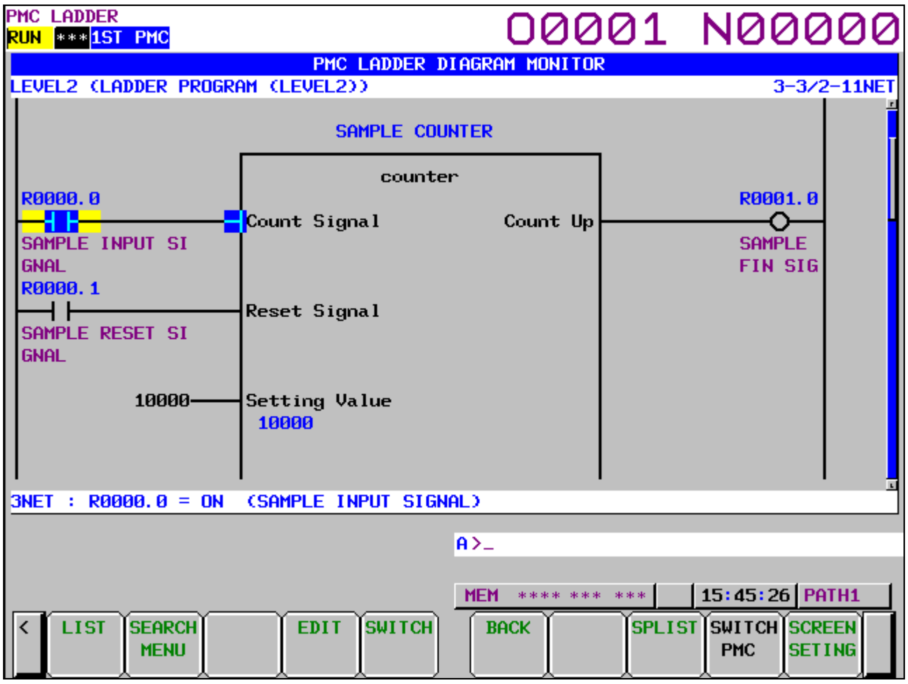


Fig.11.5.5 (b) Display screen of "SHOW COMMENT OF CONTACT = 2 LINE"

(b) "1 LINE" for "SHOW COMMENT OF CONTACT"
The display format when setting "1 LINE" for "SHOW COMMENT OF CONTACT" is as follows.

Display item		Description
Parameter	Parameter name	Comment or symbol (15 single-byte characters x 2 lines)
	Non-BOOL monitor	Displayed
Input/output sections	BOOL	Address or symbol (15 single-byte characters x 1 line) Comment (15 single-byte characters x 1 lines)
	Non-BOOL	Address or symbol (15 single-byte characters x 2 lines) Comment (15 single-byte characters x 1 lines)

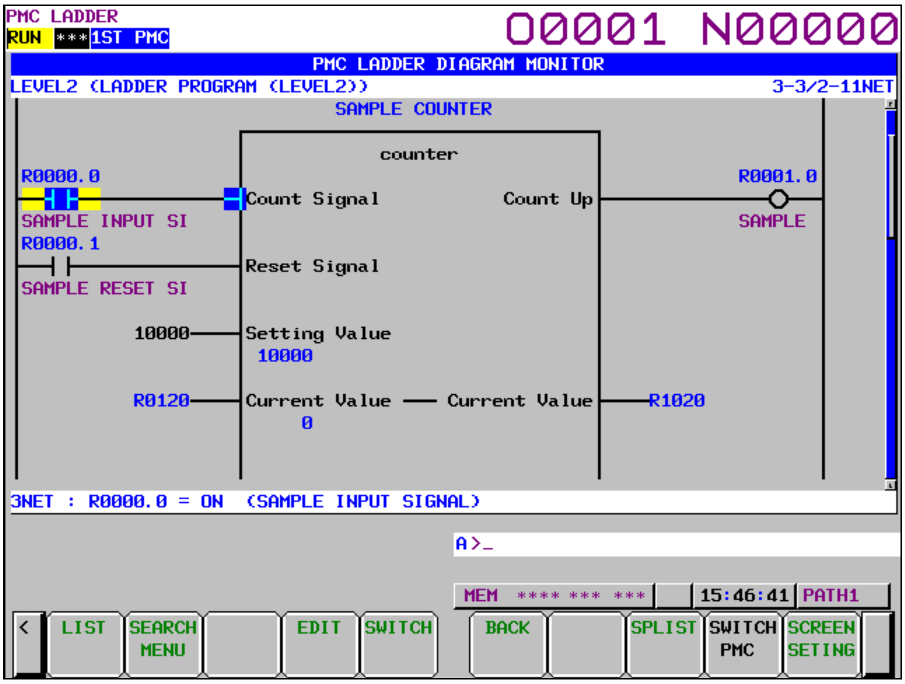


Fig.11.5.5 (c) Display screen of “SHOW COMMENT OF CONTACT = 1 LINE”

(c) “NONE” for “SHOW COMMENT OF CONTACT”

The display format when setting “NONE” for “SHOW COMMENT OF CONTACT” is as follows.

Display item		Description
Parameter	Parameter name	Comment or symbol (15 single-byte characters x 2 lines)
	Non-BOOL monitor	Not displayed
Input/output sections	BOOL	Address or symbol (15 single-byte characters x 1 line)
	Non-BOOL	Address or symbol (15 single-byte characters x 2 lines)

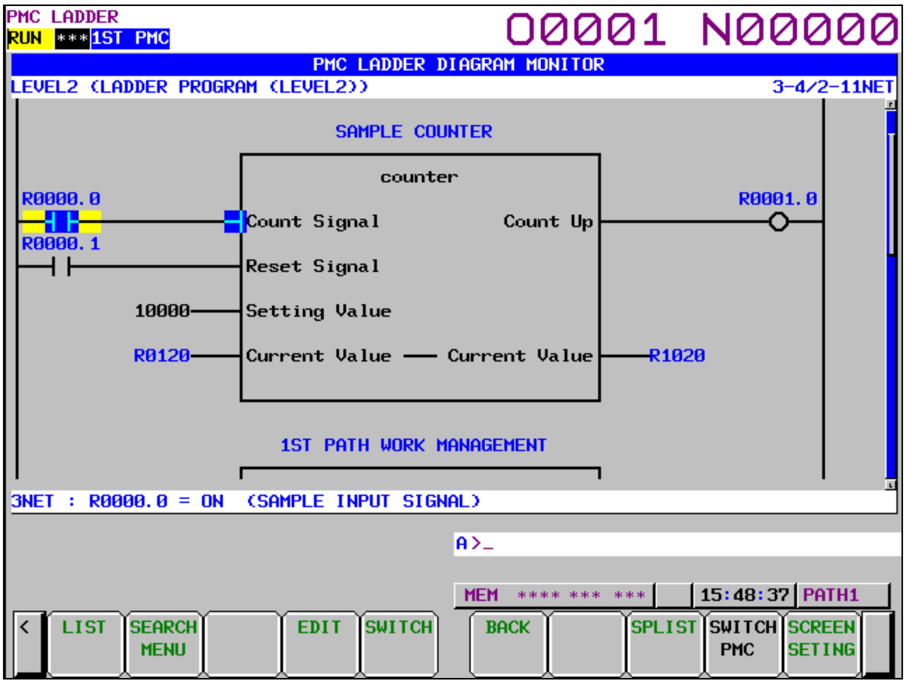


Fig.11.5.5 (d) Display screen of “SHOW COMMENT OF CONTACT = NONE”

(2) ADDRESS NOTATION IN FB

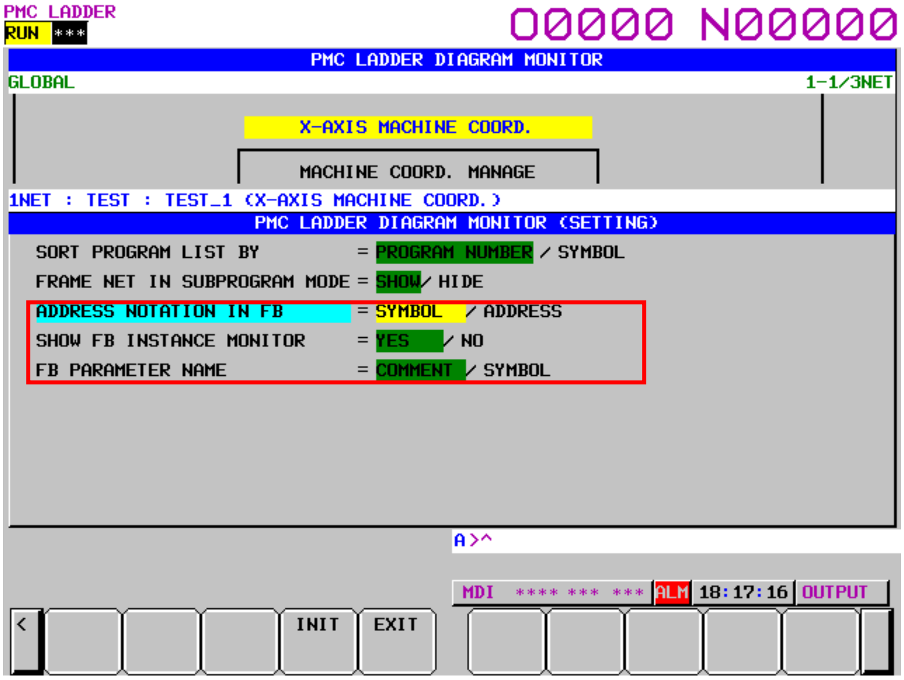


Fig.11.5.5 (e) Display settings of the function block

Determines whether the bit / byte address in FB body program is displayed in a corresponding symbol or it is always displayed in an address.

SYMBOL (default)

The address with a symbol is displayed by the symbol. The address with no symbol is displayed by the address.

ADDRESS

The address with a symbol is also displayed by the address.

(3) SHOW FB INSTANCE MONITOR

Determines whether to show FB instance monitor display.

YES (default)

FB instance monitor is displayed.

NO

FB instance monitor is not displayed.

(4) FB PARAMETER NAME

Determines whether the parameter name of function block instance is displayed as corresponding symbol or comment.

COMMENT (default)

Parameter name of function block is displayed by its comment.

SYMBOL

Parameter name of function block is displayed by its symbol.

(5) DIAGRAM APPEARANCE SETTING (COLOR)
The display color of each element of function block instance is determined by a color setting on the ladder diagram monitor setting screen. The correspondence of the display color in each element and the setting item is as follows.

Table11.5.5 (a) Display color settings related to function block

Element	Setting item
Function block instance name	ADDRESS COLOR
Function block definition name	DIAGRAM COLOR
Function block instance frame	DIAGRAM COLOR
PMC address (in the input or output section)	ADDRESS COLOR
Constant (in the input section)	DIAGRAM COLOR
Parameter name (parameter)	DIAGRAM COLOR
Monitor value (parameter)	PARAMETER COLOR
Active/inactive state (parameter)	ACTIVE RELAY COLOR
Variable name (in the FB instance monitor)	DIAGRAM COLOR
Variable monitor value: Numeric (in the FB instance monitor)	PARAMETER COLOR
Variable monitor value: BOOL (in the FB instance monitor)	ON：ACTIVE RELAY COLOR OFF：DIAGRAM COLOR
Variable monitor value: Bit string (in the FB instance monitor)	ACTIVE RELAY COLOR (BACK GROUND)

11.5.6 LADDER DIAGRAM EDITOR Screen

You can edit PMC addresses and constants set in the input and output sections of a function block. You cannot change any parameter defined in the function block. The input section for an input/output parameter can not be changed, however.

Table11.5.6 (a) Whether the input and output sections can be edited

	Input section	Output section
Input parameter	Can be edited. (NOTE)	
Input/output parameter	Cannot be edited.	Can be edited. (NOTE)
Output parameter		Can be edited. (NOTE)

NOTE

The following operations are not possible in the LADDER DIAGRAM EDITOR Screen. Use the NET EDITOR Screen instead.

- Adding or deleting a contact or a coil in the input section or the output section of BOOL type parameter.
- Omitting the address set in the output section.
- Setting the address in the output section which is omitted.

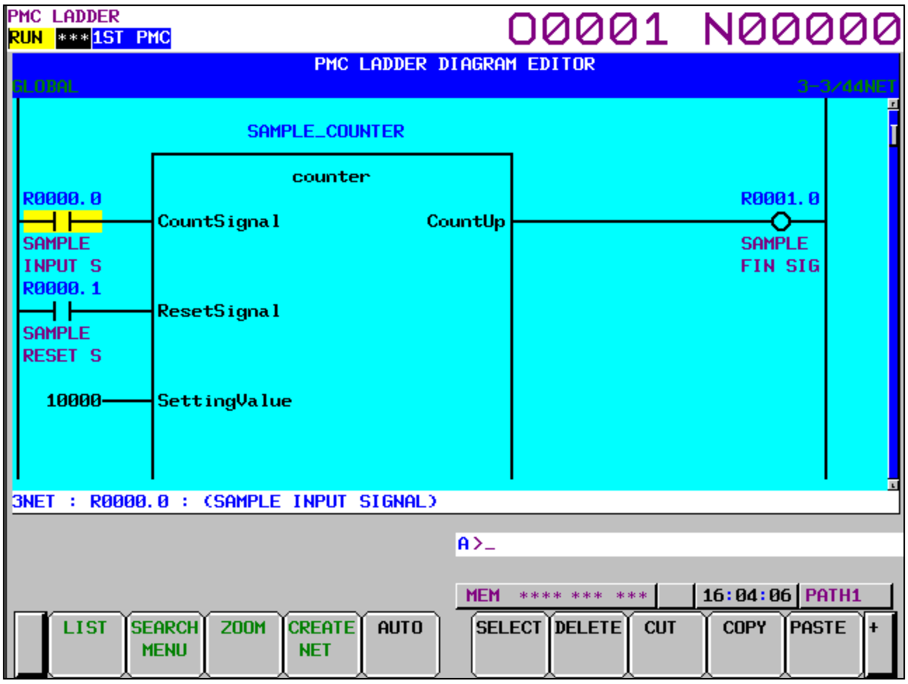
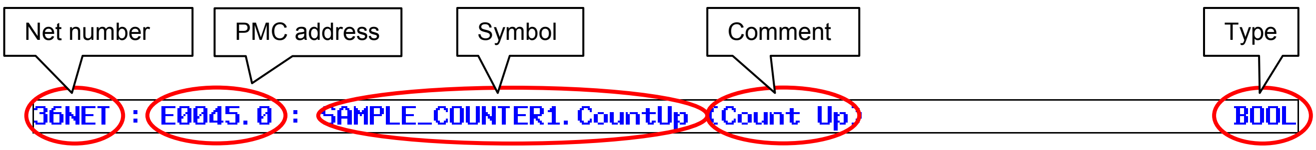


Fig.11.5.6 (a) Function block displayed on the ladder diagram editor screen

(1) Screen structures

(a) It is basically same with LADDER DIAGRAM MONITOR screen. It displays a function block like the ladder diagram monitor screen. The parameter or FB instance monitor is not displayed, however.

(b) Items displayed in the additional information display line on the ladder diagram editor screen are almost the same as in the line on the ladder diagram monitor screen. When the cursor is positioned on the input or output parameter or input/output parameter of the function block, however, the type of that parameter is displayed at the rightmost position in the additional information display line.



(2) Operation with Soft keys

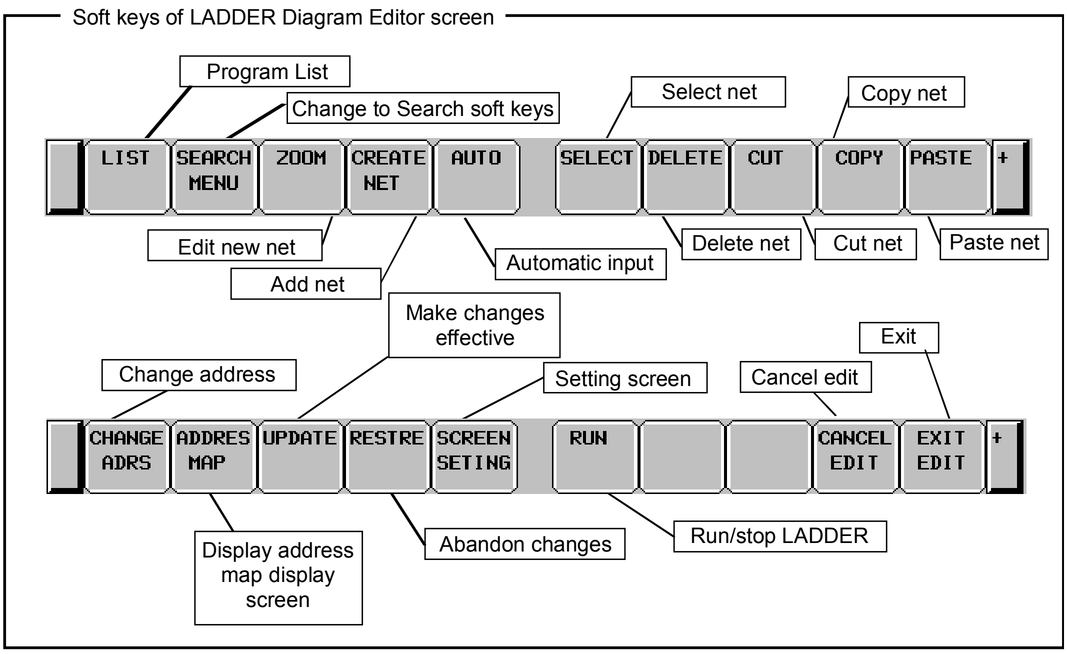


Fig.11.5.6 (b) Soft keys of LADDER DIAGRAM EDITOR screen

(a) [LIST] Go to PROGRAM LIST EDITOR screen
Goes to PROGRAM LIST EDITOR screen to choose which subprogram to be edited at LADDER DIAGRAM EDITOR screen. The PROGRAM LIST EDITOR screen can also edit subprograms. Inputting a function block instance name and pressing the [LIST] soft key appears the message “CANNOT EDIT FUNCTION BLOCK” in the message line.

(b) [SEARCH MENU] Search & Jump
The way of using the search soft keys is the same as in the ladder diagram monitor screen. If a PMC address etc. in the FB body program is searched for in the global search mode, the message “CANNOT EDIT FUNCTION BLOCK” appears in the message line.

(c) [ZOOM] Change construction of net
Calls the net editor screen to modify the net structure. You can position the cursor on a function block instance and press the [ZOOM] soft key to edit the net of the function block instance.

(d) [CREATE NET] Add new net
Create and add new net to cursor position. Pressing this soft key reaches NET EDITOR screen, so that new net is constructed.

(e) [AUTO] Automatic input of unused address/parameter number

Executes the function to automatically input an unused address or parameter number. The range of specified PMC addresses of the "Assignment Address of FB" and "Automatic Assignment Address" in the FANUC LADDER-III are excluded from the target of the automatic input.

(f) [SELECT] Select multiple nets
Used to specify multiple nets before performing an editing operation such as [DELETE], [CUT], and [COPY] soft key.

(g) [DELETE] Delete net
Deletes the selected net. You can delete a net containing a function block.

NOTE
Even if a net of function block instance is deleted, the FB body program remains. To delete unused FB body program, you have to delete a net of FB instance by the offline editing function on FANUC LADDER-III.

(h) [CUT] Cut nets
Cuts selected nets. If a net containing a function block is selected, an error message appears and the net cannot be removed.

(i) [COPY] Copy nets
Copies the selected net. If a net containing a function block is selected, an error message appears and the net cannot be copied.

(j) [PASTE] Paste nets
Pastes nets at cursor position, which were stored into Paste Buffer by [CUT] or [COPY] soft key.

(k) [CHANGE ADRS] Change addresses
Displays the address conversion soft keys to use the address conversion function. You can change a PMC address set in the input or output section of a function block.

(l) [ADDRES MAP] Display the address map display screen
Displays the address map display screen to view references of addresses in use.

(m) [UPDATE] Make changes effective
Updates the ladder program with the results of the editing operations and make it ready to be actually executed. If it succeeds to update running LADDER, edited LADDER starts to run.

(n) [RESTRE] Abandon changes
Abandons all changes, and restores LADDER program to the one at entering LADDER DIAGRAM EDITOR screen, or last updated one using [UPDATE] soft key.

(o) [SCREEN SETING] Screen settings
Goes to setting screen for LADDER DIAGRAM EDITOR screen.

(p) [RUN]/[STOP] Run and stop LADDER program
Controls LADDER program execution. [RUN] soft key makes LADDER run, and [STOP] soft key makes LADDER stop. If changes are applied normally, the LADDER program as edited will be executed at that point.

(q) [CANCEL EDIT] Abandon editing
Abandons all changes, and restores LADDER program to the one at entering LADDER DIAGRAM EDITOR screen, or last updated one using [UPDATE] soft key. Switches to LADDER DIAGRAM MONITOR screen.

(r) [EXIT EIDT] Exit Editor
Updates running LADDER program to edited LADDER program, so that the all modifications will take effects, and exits the editor screen.

11.5.7 NET EDITOR Screen

At NET EDITOR screen, you can create new net, and modify existing net. You can edit the net of input and output sections of a function block instance which is selected in the LADDER DIAGRAM EDITOR screen. You can also set an address in the omitted output section or delete and omit it in the output section. This screen is the same as the screen described in Subsection 8.3.3, "NET EDITOR Screen". For details of the screen, see Subsection 8.3.3.

11.5.8 Address Alteration Function

To perform address change, press the [CHANGE ADRS] soft key from the LADDER DIAGRAM EDITOR screen to switch to the address change mode.

> **NOTE**
> The input and output parameters of a function block instance and the PMC address used in the FB body program cannot be changed by this function. To change these addresses, use FANUC LADDER-III.

(1) Operation with soft keys

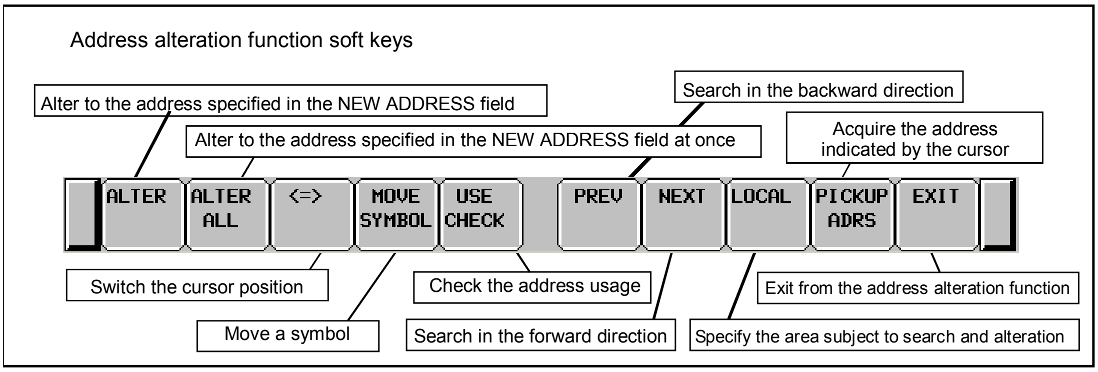


Fig.11.5.8 (a) Address alteration function soft keys

PMC addresses used in the input and output section of the function block can be changed. The following explains address conversion function operations related to function blocks. For details, see Section 8.5, "ADDRESS ALTERATION FUNCTION".

- [ALTER]
  You can position the cursor on an address in the input or output section of a function block, enter a desired PMC address for “Alter address”, and press the [ALTER] soft key to replace a PMC address.
- [ALTER ALL]
  You can set a PMC address set in the input or output section of a function block for “OLD ADDRESS” and a PMC address after conversion for “NEW ADDRESS”, and press the [ALTER ALL] soft key to convert the address in the input and output sections of the function block that is set for “OLD ADDRESS”.
- [USE CHECK]
  Checks to see if the address specified in the "NEW ADDRESS" field is in use by searching for the address through the ladder diagram. The address used in the function block instance and FB body program is the subject of the use check, too.

- [PICKUP ADRS]
  You can fetch a PMC address set in the input or output or input/output section of a function block for “OLD ADDRESS” or “NEW ADDRESS”.

NOTE

When trying to alter an address assigned in the input section for an input/output parameter, the following error message is displayed.
"CANNOT EDIT INPUT/OUTPUT PARAM ADDRESS"

11.5.9 Address Map Display Screen

Pressing the [ADDRESS MAP] soft key on the ladder editor screen causes that screen to switch to the address map display screen.

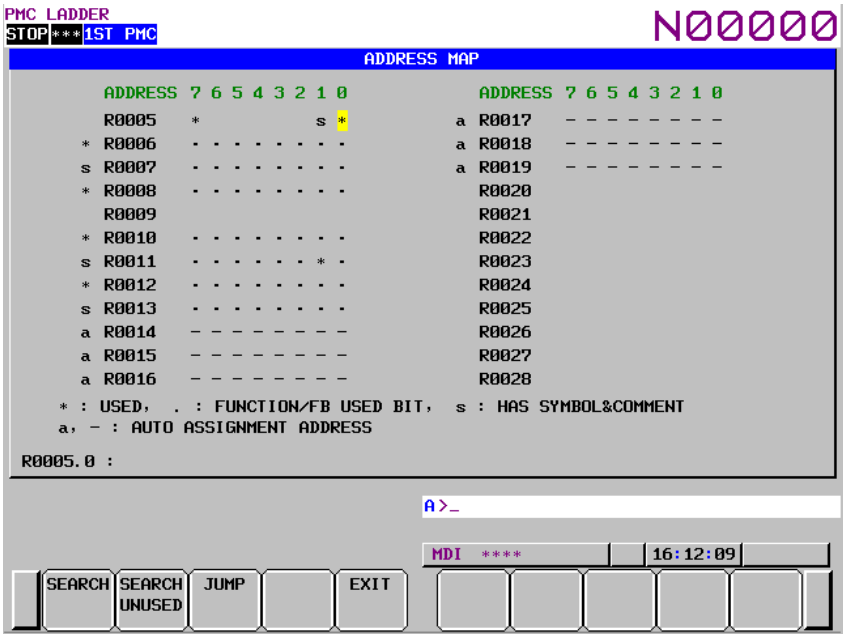


Fig.11.5.9 (a) Address Map Display Screen

An asterisk (*) is marked also to the address which is used in the FB body program and function block instance when using a function block function.

Symbol and comment (s) is marked to the address of internal and external variables that are not used actually in the FB body program and function block instance but defined in function block.
The “a” mark (for byte) and the “-“ mark (for bit) is marked for the automatic assignment address.

> **NOTE**
> 1 Non-BOOL parameters of function block are handled as addresses in use with a length of one byte, regardless of the data length of the parameters.
> 2 It does not jump to the address used in the FB body program because it cannot be edited.

For details of the Address Map Display Screen, see Subsection 8.6.1, "Address Map Display Screen".

11.5.10 Duplicate Coil Check Screen

On the Duplicate Coil Check screen, you can check the overwriting of a PMC address by multiple coil instructions. And, you can also check the multiple use of instruction number of the following functional instructions.

Instruction name	SUB number	Function
TMR	3	Timer
TMRB	24	Fixed Timer
TMRBF	77	Off Delay Fixed Timer
CTR	5	Counter
CTRB	56	Fixed Counter
DIFU	57	Rising Edge Detection
DIFD	58	Falling Edge Detection

The target of multiple use check related to function block is as follows.
- A coil in the FB body program
- The instruction number of the above functional instructions in the FB body program
- A coil in the output section of a function block instance
- A BOOL input parameter of a function block instance

For details of the Duplicate Coil Check, see Section 8.10, "CHECKING OF DUPLICATE COIL ([DUP. CHECK] SCREEN)".

NOTE
Do not delete the symbol for the function block instance name on the symbol and comment editor screen. When it is deleted, jump function for FB body program become unavailable.

11.5.11 Subprogram List Display Screen

The Sub Program List Viewer screen shows the list of the subprograms and function blocks called by the current subprogram. On the other hand, the history of the displayed subprogram and function block is displayed.

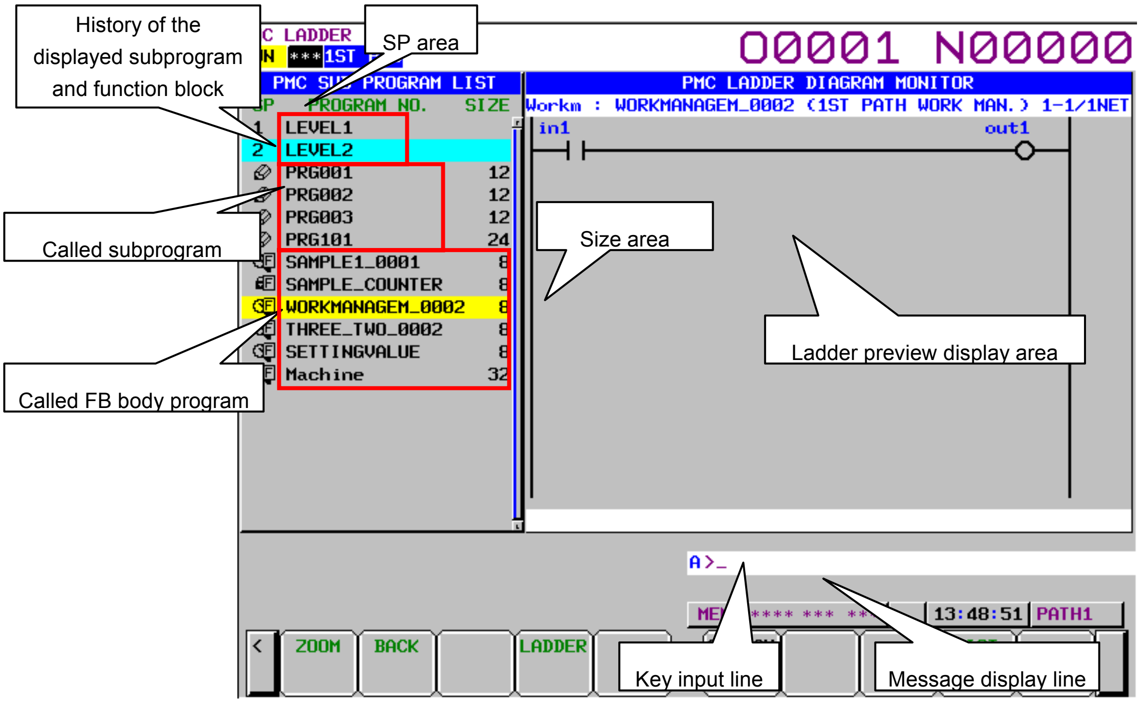


Fig.11.5.11 (a) Subprogram List Display Screen

There are the following operations related to function blocks.

(1) Area of subprogram list

In the "SP area", the program types of function block are displayed.

 (Lock): Unable to browse and edit

 (Magnifying glass): Able to browse but unable to edit

(2) Function block display of browsing and editing protection
When you preview a FB body program for which browsing and editing protection is set, the following contents are displayed.
FB PROGRAM IS PROTECTED BY PASSWORD.
Comment of function block
Version
Date

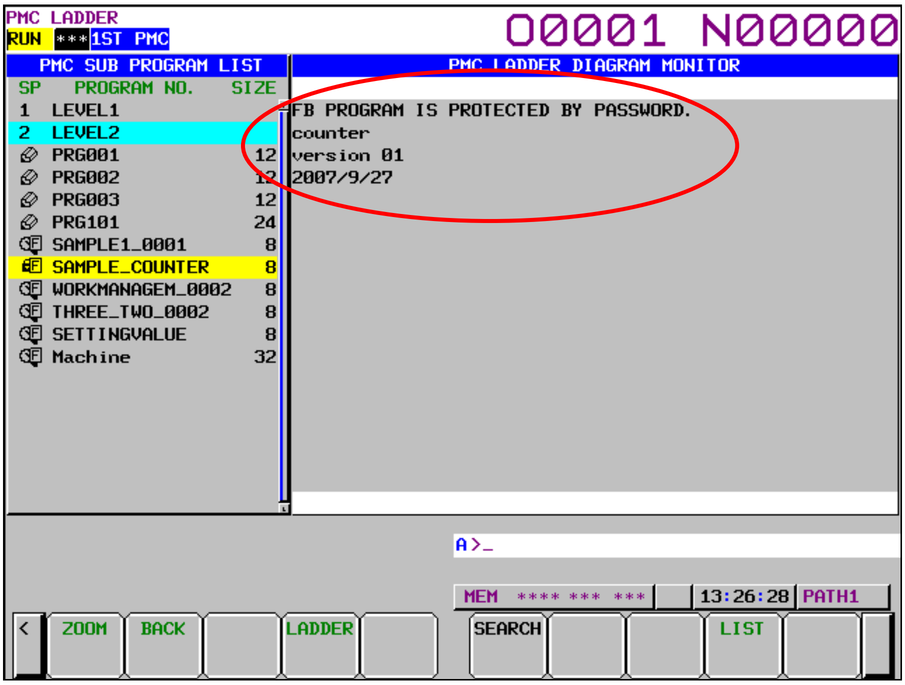


Fig.11.5.11 (b) Preview display when FB program is protected

> **NOTE**
> Do not delete the symbol for the function block instance name on the symbol and comment editor screen. When it is deleted, displaying the screen in order of symbols may not work correctly.

For details of the Subprogram List Display Screen, see Section 8.11, "DISPLAYING A SUBPROGRAM LIST ([SPLIST] SCREEN)".

11.5.12 Title Screen

On the TITLE DATA screen, you can check the title data items and some ladder information items. The following items are displayed when using the function block function.

- The size of function block
  Memory size used for the part of FB body program of function block. And, memory size used for ladder also includes FB body program size.

- The size of function block information
  Data size for the function block information as for the function block definition etc.

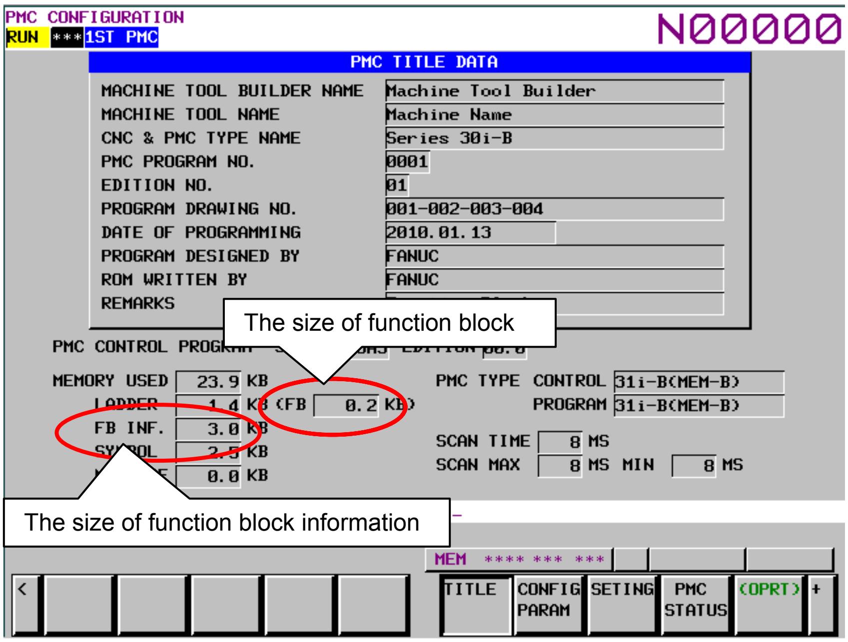


Fig.11.5.12 (a) Title Screen

For details of the Title Screen, see Section 9.1, "DISPLAYING AND EDITING TITLE DATA ([TITLE] SCREENS)".

11.6 DISPLAYING AND EDITING SYMBOL AND COMMENT

11.6.1 Extended Symbol and Comment Screen

This screen is the same as the screen described in Subsection 9.2.5, "Displaying Extended Symbol and Comment". For details of the screen, see Subsection 9.2.5.

There are the following symbol and comment data definitions related to function block.

(1) Symbol and comment definition of function block instance name
PROG.SYMBOL: Displayed as the form “[PROGRAM NAME].[SYMBOL]”
ADDRESS: This column is blank.
TYPE: “FB_I” is displayed.

(2) Symbol and comment definition of internal and external variables in the function block
PROG.SYMBOL: Local symbol to the function block
- When a symbol is defined for the function block instance:
  “function-block-instance-name.symbol”
- When a symbol is not defined for the function block instance:
  “function-block-definition-name.symbol”

> **NOTE**
> The symbol for a function block cannot be changed or added. Available operations are line deletion in entry units and all deletion only.

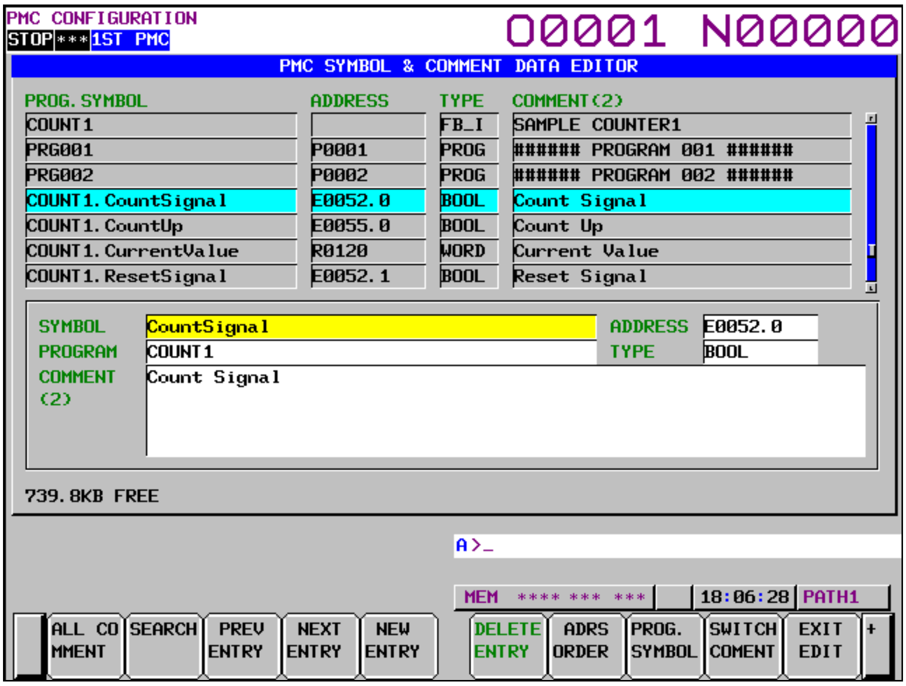


Fig.11.6.1 (a) Extended Symbol and Comment Screen

11.6.2 Displaying Extended Symbol and Comment

The following table lists how symbols and comments are displayed and searched for on each screen.

Screen	Displaying symbol and comment	Searching symbol and comment
Ladder screen (except address map) Program list screen Subprogram list screen	A symbol and comment is displayed by following priority. 1 Local symbol and comment that defined to displayed subprogram or function block. 2 Global symbol and comment. 3 Comment without symbol.	The following symbol and comment can be searched. - Local symbol that defined to displayed subprogram or function block. - Global symbol.
Signal status screen PMC parameter (timer) screen PMC parameter (counter) screen PMC parameter (keep relay) screen PMC parameter (data table) screen Signal trace screen Signal trace (parameter setting) screen Ladder (address map) screen	A symbol and comment is displayed by following priority. 1 Global symbol and comment. 2 Local symbol and comment of LEVEL1 to 3. 3 Local symbol and comment of sub-program P1 to P5000. 4 Local symbol and comment for the function block 5 Comment without symbol.	All symbols and comments can be searched. You can search a local symbol by following format. - (program name).(symbol) The program name is able to be specified by sub-program number or a symbol of P-address. For a function block, specify it with a function block instance name.
I/O diagnosis screen Symbol and comment screen	All symbols and comments are displayed.	All symbols and comments can be searched. A symbol or comment can be searched by partial string.

NOTE

When multiple symbol and comment are defined to the same address, you can search it by each symbol name. On the other hand the symbol displayed for the address on PMC screen is one of these symbol names. So if you search such a symbol, displayed symbol name on searched position may be different from the symbol searched.

12 PMC ALARM MESSAGES AND ACTIONS TO TAKE

12.1 ALARM MESSAGE LIST

12.1.1 Messages That May Be Displayed on the PMC Alarm Screen

The following table lists the PMC alarm messages that may be displayed on the PMC alarm screen.

Alarm number	Faulty location/corrective action	Contents
ER01 PROGRAM DATA ERROR	<1> Enter the sequence program again. <2> If this error recurs even after you have entered the sequence program again, the error may be due to a hardware fault. In that case, contact us.	The sequence program is invalid.
ER02 PROGRAM SIZE OVER	<1> Reduce the size of the sequence program. <2> Contact us, and specify a ladder step count option that allows you to set a larger program size.	The sequence program is too large to load into the save area. The sequence program is invalid.
ER03 PROGRAM SIZE ERROR(OPTION)	<1> Reduce the size of the sequence program. <2> Contact us, and specify a ladder step count option that allows you to set a larger program size.	The sequence program exceeds the size specified by the ladder step count option.
ER04 PMC TYPE UNMATCH	Change the sequence program so that it specifies the adequate PMC type, by using the programmer.	The PMC type specified in the sequence program does not match the type of the PMC actually in use.
ER08 OBJECT UNMATCH	Contact us.	An unsupported function is used in the sequence program.
ER09 PMC LABEL CHECK ERROR. PLEASE TURN ON POWER AGAIN WITH PRESSING 'O'&'Z'. (CLEAR PMC SRAM)	<1> Turn on the power of the CNC again, by holding down the 'O' and 'Z' keys at the same time. <2> Replace the backup batteries.	The nonvolatile memory of the PMC system needs to be initialized in such cases as when you have changed the PMC model.
ER17 PROGRAM PARITY	<1> Enter the sequence program again. <2> If this error recurs even after you have entered the sequence program again, the error may be due to a hardware fault. In that case, contact us.	The parity of the sequence program is invalid.
ER18 PROGRAM DATA ERROR BY I/O	Enter the sequence program again.	Reading sequence program was interrupted.
ER19 LADDER DATA ERROR	Display the LADDER DIAGRAM EDITOR screen again, and terminate the editing operation by pressing the [EXIT] soft key.	During editing the ladder, the screen display is switched to a CNC screen by the operation of a function key.
ER22 NO PROGRAM	Enter the sequence program again.	The sequence program is empty.
ER27 LADDER FUNC. PRM IS OUT OF RANGE	Correct the sequence program; change the parameter number specified in a functional instruction to a value that is within the allowable range.	An out-of-range parameter number is specified in the TMR, TMRB, TMRBF, CTR, CTRB, DIFU, or DIFD functional instruction.

Alarm number	Faulty location/corrective action	Contents
ER33 I/O Link ERROR(CHn) (Note3)	Contact us; replace the faulty hardware.	The LSI for the I/O Link is faulty.
ER34 I/O Link ERROR (CHn Gxx) (Note1)(Note3)	<1> Check the cable connections to the devices of group xx. <2> Check whether the power of each I/O device has been turned on before the CNC. <3> Replace any device of group xx in which the PMC control module is embedded.	An I/O device communication error occurred on the slave side of group xx.
ER35 TOO MUCH OUTPUT DATA IN GROUP(CHn Gxx) (Note1)(Note3)	Reduce the output data count of group xx.	The output data count of I/O Link group xx exceeds the upper limit (33 bytes). Or the output data count of I/O Link *i* group “xx” exceeds the upper limit (65 bytes for the normal I/O, 29 bytes for the safety I/O). The superfluous data is regarded as invalid.
ER36 TOO MUCH INPUT DATA IN GROUP(CHn Gxx) (Note1)(Note3)	Reduce the input data count of group xx.	The input data count of I/O Link group xx exceeds the upper limit (33 bytes). Or the input data count of I/O Link *i* group “xx” exceeds the upper limit (65 bytes for the normal I/O, 29 bytes for the safety I/O). The superfluous data is regarded as invalid.
ER37 TOO MUCH SLOT IN BASE(CHn) (Note3)	Correct the slot number to a value of 10 or less.	The slot number for the I/O Link exceed the upper limit (10). The slot number larger than 11 is regarded as invalid.
ER38 MAX SETTING OUTPUT DATA OVER(CHn Gxx) (Note1)(Note3)	<1> In case of I/O Link, reduce the total amount of output data of all groups to 128 bytes or less. <2> In case of I/O Link *i*, reduce the total amount of output data of all groups to 256 bytes or less.	The I/O area for the I/O Link is insufficient. (The area allocated to the group “xx” and later on the output side is regarded as invalid.) In case of I/O Link *i*, The I/O area is insufficient in the normal update cycle mode.
ER39 MAX SETTING INPUT DATA OVER(CHn xx) (Note1)(Note3)	<1> In case of I/O Link, reduce the total amount of input data of all groups to 128 bytes or less. <2> In case of I/O Link *i*, reduce the total amount of input data of all groups to 256 bytes or less.	The I/O area for the I/O Link is insufficient. (The area allocated to the group “xx” and later on the input side is regarded as invalid.) In case of I/O Link *i*, The I/O area is insufficient in the normal update cycle mode.
ER43 PROGRAM DATA ERROR(PT/NT)	<1> Store sequence program which is compiled again after recompilations using FANUC LADDER-III. <2> If you see the same alarm again after <1>, contact us.	The sequence program is invalid.
ER45 NO OPTION (FUNCTION BLOCK)	Add a required function block option.	No function block option is specified.

Alarm number	Faulty location/corrective action	Contents
ER46 MESSAGE DATA UPDATE ERROR. PLEASE TRUN OFF POWER AFTER SAVING DATA.	Save the corrected sequence program or message data for multi-language display to F-ROM. Moreover, turn the power off/on.	The message data in the sequence program or the message data for multi-language display cannot be updated. It is necessary to turn off/on the power. The ladder program cannot be executed when this alarm occurs.
ER47 ILLEGAL OVERRIDE FUNCTION SETTING (TOO MANY PMC PATHS)	The override mode of the force I/O function is available in 3 or less PMC paths in same time. In some PMC paths, make the function invalid. Moreover, turn the power off/on.	The override function is enabled in four or more PMC paths.
ER48 STEP SEQUENCE TIME OVER(xxH)	Remove the setting of exceeding setting time on the STEP SEQUENCE TIME MONITOR SETTING screen.	The activated condition of step sequence exceeds the time limit, which is set on the STEP SEQUENCE TIME MONITOR SETTING screen.
ER49 POSITIVE/NEGATIVE TRANSITION (PT/NT) INSTRUCTION INITIALIZE ERROR. PLEASE TRUN OFF POWER AFTER SAVING PROGRAM.	Modify the sequence program and save the program to flash ROM. Then, reboot the CNC.	The work memory of positive / negative transition (PT/NT) instruction cannot be initialized. It is necessary to reboot the CNC. The ladder program stops when this alarm occurs.
ER50 PMC EXECUTION ORDER ERROR	Check CNC parameter Nos. 11900 to 11904.	The execution order setting of the multi-PMC function is invalid.
ER51 PMC EXECUTION PERCENTAGE ERROR	Check CNC parameter Nos. 11905 to 11909.	The execution percentage setting of the multi-PMC function is invalid.
ER52 I/O Link CHANNEL ASSIGNMENT ERROR (Note3)	Check CNC parameter Nos. 11910 to 11912.	The I/O Link channel assignment to the PMC system is invalid.
ER54 NC-PMC I/F ASSIGNMENT ERROR	Check CNC parameter Nos. 11920 to 11929.	The interface assignment between NC and PMC is invalid.
ER55 LADDER EXECUTION CYCLE SETTING ERROR	Check the CNC parameter, No.11930, 11945, and 11946.	Setting of the execution cycle of the ladder 1st level (CNC parameter No.11930) is incorrect. Or, a setting of the ladder 1st level execution cycle in 1ms or 2ms (CNC parameter No.11945, 11946) is incorrect.
ER57 MULTI-PATH PMC I/F ASSIGNMENT ERROR	Check CNC parameter No. 11932.	The assignment of multi-path PMC interface is invalid.
ER58 PMC MEMORY TYPE SETTING ERROR	Check CNC parameter No.11940 to No.11944.	The setting of PMC Memory Type is invalid.
ER60 I/O Link i ERROR(CHn) (Note3)	Contact us. Exchange of the hardware.	The LSI for I/O Link *i* is faulty.
ER61 I/O Link i ERROR(CHn Gxx) (Note1) (Note3)	<1> Check the cable connected to the device of group “xx”. <2> Check the power supply of the I/O device if the power is turned on earlier than the power of CNC. <3> Exchange the I/O device in group “xx” in which PMC control module is built. <4> Check the assignment data of handy machine operator’s panel if it is used in group “xx”.	The connection error occurred in the slave of group “xx”.

Alarm number	Faulty location/corrective action	Contents
ER62 I/O Link i DCS ERROR (Note3)	Contact us. Exchange of the hardware.	The LSI for I/O Link *i* DCS is faulty.
ER63 I/O Link CHANNEL SETTING ERROR (Note3)	<1> Change the channel configuration in order to reduce the I/O points. As for the communication method for each channel, specify the CNC parameter No. 11933#0 and 1.	Total I/O points are over 4096/4096 points in system. For the I/O Link, the I/O points are 1024/1024 points for one channel. For the I/O Link *i*, 2048/2048 points for one channel.
ER64 I/O Link i TOO MANY CONNECTED GROUPS(CHn) (Note3)	Reduce the number of connected I/O modules in channel “n”.	257 or more I/O modules are connected with channel “n”. (Note 4)
ER65 I/O Link i TOO MANY SLOTS(CHn) (Note3)	Reduce the number of connected I/O modules to 256 or less.	257 or more of I/O modules are connected in channel “n”.
ER66 I/O Link i PMC ADDRESS OVERLAPPED (PMCm X(Y)nnnn) (Note3)	Enter the PMC address or size again so that any address is not used by multiple PMCs that share PMC memory.	The address X(Y)”nnnn” assigned in PMC path “m” is assigned to another PMC path that is shared the common memory with PMC path “m”.
ER67 I/O Link i TOO MANY SAFETY I/O GROUPS (Note3)	Reduce the group number of safety I/O.	The total group number of safety I/O in PMC paths exceed 4 or the total group number of safety I/O in DSCPMC exceed 4 for I /O Link *i*.
ER68 I/O Link i TOO MANY ASSIGNMENTS IN HIGH SPEED MODE (CHn,Gyy) (Note1) (Note3)	When there are some groups which is set to high-speed update cycle mode in I/O Link *i*, Correct the transmission timing. Refer to subsection “3.3.3”.	In the channel n, the transmission size exceeds the limit of high-speed mode for I/O Link *i*. The assignment of group “yy” or later cannot be performed.
ER69 I/O Link i ASSIGNMENT ADDRESS INVALID(CHn Gyy) (Note2)(Note3)	Correct the assignment data of I/O Link *i*.	The address of false PMC path is assigned in group “yy” of channel “n” of I/O Link *i* assignment data.
ER70 PMC ADDRESS BLOCK OVERLAPPED BETWEEN I/O Link AND I/O Link i(PMCm X(Y)nnnn) (Note3)	<1> Delete the assignment data for I/O Link *i* or correct the assignment address. <2> Correct the X/Y address block of the I/O Link channel. (The setting of Machine signal interface of PMC configuration parameter) <3> Check the communication method of I/O Link. (NC parameter 11933#0,#1) <4> Check the setting of the selectable assignment data function for I/O Link *i*.	There is a PMC address block which is assigned in both I/O Link and I/O Link *i*.
ER71 I/O Link i STATUS ALARM LENGTH OVER IN GROUP(CHn Gxx) (Note1)(Note3)	Correct the configuration of I/O devices and reduce the total of the status alarms to 64bytes or less.	The total of the status alarms for I/O devices connected with group “xx” of channel “n” exceeds 64 bytes
ER89 EDITING I/O CONFIGURATION DATA IS NOT COMPLETED	Finish the edit of I/O configuration data.	I/O configuration data is invalid because that the editing of the I/O configuration data is in the midst.
ER90 TOO LARGE I/O CONFIGURATION DATA (Note3)	Reduce the I/O configuration data file.	I/O configuration data is larger than the save area or invalid.
ER91 I/O CONFIGURATION DATA PARITY (Note3)	<1> Input I/O configuration data file again. <2> When re-input cannot solve this error, the hardware may be failure. Contact us.	The parity of I/O configuration data is invalid.

Alarm number	Faulty location/corrective action	Contents
ER92 I/O CONFIGURATION DATA ERROR BY I/O	Input I/O configuration data file again.	Reading of I/O configuration file is interrupted.
ER93 UNSUPPORTED I/O CONFIGURATION DATA (Note3)	Correct the type of I/O configuration data and input again.	The type of I/O configuration data is invalid.
ER94 I/O CONFIGURATION DATA ERROR (Note3)	Re-compile the I/O configuration data by FL-III. Moreover, input again.	Data configuration of I/O configuration data is abnormal.
ER95 I/O DEVICE MISMATCH(CHn) (Note3)	When this alarm occurs on a well-worked machine, the causes may be following: <1> Disconnection of communication cable or contact fault. <2> The power of an I/O device is turned off. Or the power on is delayed. <3> The failure of an I/O device. <4> The power of some I/O devices remain when the power of CNC is turned off/on. Turn the power all of I/O devices off/on when the power of CNC is turned off/on. When this alarm occurs during a debugging of sequence program, the following causes also come up. <5> The configuration (type, order or number) of the I/O devices is wrong. <6> Invalid I/O configuration data is registered. You can confirm the error I/O device in the “I/O Device Monitor” screen.	This alarm occurs when actual I/O devices connected to CNC differ from the I/O configuration data registered in the “I/O Device Monitor” screen. The ladder program runs regardless of the occurrence of this alarm.
ER96 I/O Link MAX GROUP OVER(CHn) (Note3)	<1> Check the PMC paths and addresses of first and second blocks of n channel on configuration parameter setting screen. <2> Check the total groups of first and second block on I/O module assignment. <3> Check the parameter setting of "Selectable I/O Link assignment function".	When dual assignment of I/O Link channel is used, total groups of first and second block exceeds 16 groups. The ladder program runs regardless of the occurrence of this alarm.

Alarm number	Faulty location/corrective action	Contents
ER97 I/O Link FAILURE(CHn Gxx) (Note1) (Note3)	When this alarm occurs on a well-worked machine, the cause may be following. <1> The failure of the cable or contact from group (“xx” – 1) to “xx”. <2> The power of an I/O device of group “xx” or later is turned off. Or the power on is delayed. <3> The failure of an I/O device of group “xx” or (“xx” – 1). <4> The power of some I/O devices remain when the power of CNC is turned off/on. Turn the power all of I/O devices off/on when the power of CNC is turned off/on. If this alarm occurs during a debugging of sequence program, the following causes also come up. <5> The group number of I/O device is invalid. <6> The mistake of the assignment setting of I/O modules. <7> The mistake of the parameter setting of "Selectable I/O Link assignment function" <8> The mistake of the machine signal interface setting. You can confirm the details of the error in the “I/O Device Monitor” screen.	This alarm occurs when less I/O devices are connected. This alarm occurs when a total group count of the I/O module assignment are different with one of connected device count. The ladder program runs regardless of the occurrence of this alarm.
WN02 OPERATE PANEL ADDRESS ERROR	Correct the Series 0 operator's panel address that is set in the PMC system parameter.	The Series 0 operator's panel address that is set in the PMC system parameter is invalid.
WN03 ABORT WINDOW/EXIN	Modify the ladder program and turn on the power of the CNC again. Refer to subsection “4.15” for details.	The ladder program was stopped while communication was in progress between CNC and PMC. This alarm may cause the WINDR, WINDW, EXIN, and DISPB functional instructions to malfunction.
WN07 LADDER SP ERROR(STACK)	Correct the sequence program so that the subprogram has eight or fewer levels of nesting.	There are too many levels of nesting (levels more than 8) for the CALL or CALLU functional instruction to call the subprogram.
WN09 SEQUENCE PROGRAM IS NOT WRITTEN TO FLASH ROM	If you want to use the current sequence program next time you power on the system, write the sequence program to flash ROM. If you have made any unwanted change to the sequence program by mistake, read the original sequence program from flash ROM.	You have changed the sequence program using the LADDER DIAGRAM EDITOR screen or DATA I/O screen, but you have not yet written the changed sequence program to flash ROM. If you shut down the system without writing the changed sequence program to flash ROM, the changes you have made will be lost next time you turn on the power.
WN10 NO OPTION(STEP SEQUENCE)	<1> Add the step sequence option. <2> Arrange so that the step sequence subprogram will not be called.	No step sequence option was found when the system attempted to execute a step sequence.

Alarm number	Faulty location/corrective action	Contents
WN57 OVERRIDE FUNCTION IS ACTIVE	The Override function is for debugging only. So, disable the function when shipping the machine.	The Override function is activated.
WN58 UNSUPPORTED FUNCTION	Correct the sequence program with Ladder editing function on PMC screen.	An unsupported functional instruction is used in the sequence program. The functional instruction was skipped.
WN59 MESSAGE FILE SYMBOL UNDEFINED	Correct the error in the message file for multi-language display.	In the message file for multi-language display, a symbol that does not exist in the ladder is defined.
WN60 MESSAGE FILE SYMBOL INVALID	Correct the error in the message file for multi-language display.	In the message file for multi-language display, a symbol other than an A address is defined.
WN61 MESSAGE FILE ADDRESS DUPLICATE	Correct the error in the message file for multi-language display.	The A address area has a duplicate definition between a symbol and address or between symbols.
WN62 MESSAGE FILE NUMBER ERROR	Correct the error in the message file for multi-language display.	A message number differs between the ladder and message file for multi-language display at the same A address.
WN63 MESSAGE FILE IS NOT WRITTEN TO FLASH ROM	If you want to use the current message file for multi-language display next time you power on the system, write the message file to flash ROM.	You have changed the message data for multi-language display using DATA I/O screen, but you have not yet written the changed message data to flash ROM. If you shut down the system without writing the changed message data to flash ROM, the changes you have made will be nowhere next time you turn on the power.
WN64 MESSAGE FILE SIZE OVER	<1> Reduce the size of the message file for multi-language display. <2> Contact us and specify an option for a larger size.	The message file for multi-language display is too large to load into the save area. The message file for multi-language display is invalid.
WN65 MESSAGE FILE MISMATCH	Contact us.	An unsupported function is used in the message file for multi-language display.
WN66 MESSAGE FILE PARITY	<1> Enter the message file for multi-language display again. <2> If this error recurs even after you have entered the message file for multi-language display again, the error may be due to a hardware fault. In that case, contact us.	The parity of the message file for multi-language display is invalid.
WN67 MESSAGE FILE ERROR BY I/O	Enter the message file for multi-language display again.	Reading the message file for multi-language display was interrupted.

Alarm number	Faulty location/corrective action	Contents
WN68 I/O CONFIGURATION DATA IS NOT WRITTEN TO FLASH ROM	If you want to make updated I/O configuration data effective, write the data to Flash ROM.	The I/O configuration data was updated in the I/O configuration editor screen or data I/O screen but the data has not been written to Flash ROM yet. The data will be lost if the save operation is not performed.
WN69 I/O Link i DO ALARM (CHn Gxx Syy zz : PMCm Ybbb = **H) (Note1)	Check DO of the relevant device. For the details of the alarm of I/O devices, refer to the “CONNECTION MANUAL (HARDWARE)” of each CNC series.	The DO alarm (ex. a short circuit with the ground) occurs at byte “zz” of slot “yy” of group “xx” in channel “n”. Y “bbbb” of PMC path ”m” is the address at which the alarm occurred. DCSPMC Y”bbbb” is the address for DCSPMC. Display of “PMC*Y****” is the case of occurrence of unassigned address. The “**H” shows some bits at which the alarm occurs by hexadecimal. (Ex. “PMC1Y115=28H” shows the alarm occurs at Y115.3 and Y115.5 in PMC1. “28H” means “00101000” in binary.)
WN70 I/O Link i STATUS ALARM (CHn Gxx Syy zz = **H) (Note1)	Check the alarm information of applied I/O device. For the details of the alarm of I/O devices, refer to the “CONNECTION MANUAL (HARDWARE)” of each CNC series	The status alarm except for the DO alarm occurs at byte “zz” of slot “yy” of group “xx” in channel “n”. The “**H” shows some bits at which the alarm occurs by hexadecimal.

NOTE

1 The displayed group number in ER34, ER35, ER36, ER38, ER39, ER61, ER68, ER71, ER97, WN69 and WN70 is wiring number of I/O device.
2 The group number displayed in ER69 is the number of I/O Link *i* assignment data.
3 When some PMC alarms related to I/O Link and I/O Link *i* occur, all of I/O devices in all of channels do not be liked with the CNC.
4 This alarm may occur even if 256 or less I/O modules are connected with the channel. It depends on situation of composition of I/O devices.

12.1.2 PMC System Alarm Messages

Error Messages when SYS_ALM199 (PMC General)

Alarm number	Faulty location/corrective action	Contents
PC004 CPU INVALID INSTRUCTION -----< ERROR POSITION >----- MAIN BOARD ---	This alarm may be due to a main board fault.	A CPU error occurred in the PMC system.
PC006 CPU INVALID SLOT INSTRUCTION -----< ERROR POSITION >----- MAIN BOARD ---		
PC009 CPU ADDRESS ERROR -----< ERROR POSITION >----- MAIN BOARD ---		
PC010 DMA ADDRESS ERROR -----< ERROR POSITION >----- MAIN BOARD ---		
PC012 CPU USER BREAK EXCEPTION -----< ERROR POSITION >----- MAIN BOARD ---		
PC030 RAM PARITY PC030 S-RAM PARITY -----< ERROR POSITION >----- MAIN BOARD ---		A RAM parity error occurred in the PMC system.
PC060 BUS ERROR -----< ERROR POSITION >----- MAIN BOARD ---		A bus error occurred in the PMC system.
PC070 ILLEGAL LADDER SPE (PMCn) PC070 LADDER SPE(PMCm) -----< ERROR POSITION >----- MAIN BOARD ---		A stack error occurred with the SPE functional instruction of the ladder program of n path.
PC071 ILLEGAL LADDER FBE (PMCn) -----< ERROR POSITION >----- MAIN BOARD ---		A stack error occurred with the FBE functional instruction of the ladder program of path n.
PC072 STACK OVERFLOW (TASK:xx) PC072 STACK OVERFLOW (INT:xx) -----< ERROR POSITION >----- MAIN BOARD ---		A stack error occurred. (detected by the software).
PC080 SYSTEM EMERGENCY -----< ERROR POSITION >----- MAIN BOARD ---		System emergency state of the PMC LSI.

Alarm number	Faulty location/corrective action	Contents
PC090 SYSTEM EMERGENCY (SOFTWARE) PC090 NON MASKABLE INTERRUPT (SOFTWARE) PC090 NON MASKABLE INTERRUPT (UNKNOWN) -----< ERROR POSITION >----- MAIN BOARD ---		CPU error (unexpected NMI) occurs in PMC control software.
PC093 UNEXPECTED INTERRUPT (xx) -----< ERROR POSITION >----- MAIN BOARD ---		
PC094 UNEXPECTED TRAP EXCEPTION (xx) -----< ERROR POSITION >----- MAIN BOARD ---		A trap exception of unknown cause occurred with the PMC control software.
PC095 MESSAGE CRC ERROR (PMCn) -----< ERROR POSITION >----- MAIN BOARD ---		RAM check error occurred.
PC096 LADDER CODE ERROR (___) -----< ERROR POSITION >----- MAIN BOARD ---		
PC097 LADDER CRC ERROR (PMCm) -----< ERROR POSITION >----- MAIN BOARD ---		
PC098 PMC SOFTWARE CRC ERROR PC098 PMC SOFTWARE ECC ERROR (______:_) -----< ERROR POSITION >----- MAIN BOARD ---		
PC501 CNC/PMC INTERFACE ERROR (PATHn) -----< ERROR POSITION >----- MAIN BOARD ---		The read or write operation between CNC and PMC failed

Error Messages when SYS_ALM197 (PMC General)

Alarm number	Faulty location/corrective action	Contents
PC070 ILLEGAL LADDER SPE (DCSPMC) -----< ERROR POSITION >----- CPU CARD --	This alarm may be due to a CPU card fault.	A stack error occurred with the SPE functional instruction of the ladder program of DCSPMC.
PC071 ILLEGAL LADDER FBE (DCSPMC) -----< ERROR POSITION >----- CPU CARD --		A stack error occurred with the FBE functional instruction of the ladder program of DCSPMC.
PC095 MESSAGE CRC ERROR (DCSPMC) -----< ERROR POSITION >----- CPU CARD --		RAM check error occurred.
PC097 LADDER PARITY ERR (DCSPMC) -----< ERROR POSITION >----- CPU CARD --		

Error Messages when SYS_ALM196 (PMC Watch Dog)

Alarm number	Faulty location/corrective action	Contents
PC073 WATCH-DOG ALARM(CNC<->PMC) -----< ERROR POSITION >----- MAIN BOARD --	This alarm may be due to a main board fault.	The PMC CPU is not running.

Error Messages when SYS_ALM195 (I/O Link)

Alarm number	Faulty location/corrective action	Contents
PC050 I/O Link ER1 CHn:GRxx:yy COMMUNICATION ALARM AT CHn : GROUP xx -----< ERROR POSITION>----- CHn / GROUPxx --	<1> Check the I/O device of group “xx” in channel “n” – Instantaneous power failure – Unstable power line <2> Check the I/O Link cable between JD1B of group “xx” and JD1A of group “xx-1” – faulty wiring – incomplete contact <3> The I/O Link device of group “xx” in channel “n” is faulty.	An I/O Link communication error occurred. “n” is a channel number (1 to 3). “xx” is a group number (0 to 15). “yy” is a internal error code. This error occurs when the communication with the device of group “xx” in channel “n” is stopped. The causes are as follows: – Instantaneous power failure, unstable voltage or unstable power line of the device – Faulty wiring or incomplete contact of communication cable – Faulty device Please note that It may not show an accurate group number with some conditions of the problem.

Alarm number	Faulty location/corrective action	Contents
PC051 I/O Link ER2 CHn:yy:xx:ww:vv COMMUNICATION ALARM AT CHn -----< ERROR POSITION>----- CHn --	<1> When you use an I/O Unit-Model A, no base extension unit is connected corresponding to an I/O assignment data. Check connection of I/O devices and I/O assignment data. <2> When you use Power Mate as I/O Link slave device and/or Servo Motor Beta series I/O Link option, some system alarm occurs in such devices. <3> A Communication may be influenced by noise. Check the ground wire and the shield of the communication cables. <4> The output of the I/O Link devices is short-circuited. <5> The power of the I/O Link master and/or slave devices is faulty. – Instantaneous power failure – Unstable power line <6> Incomplete contact of the communication cable <7> Faulty wiring of the communication cable <8> Check the grounding of the shield wire of the earth terminal or the communication cable of I/O devices. <9> I/O Link devices are faulty. <10>I/O Link master is faulty. n=1,2: main board n=3: CPU card	An I/O Link communication error occurred. “n” is a channel number (1 to 3). “yy”, “xx”, “ww” and “vv” are internal error code. There are various causes as for this error.

Error Messages when SYS_ALM194 (I/O Link *i*)

Alarm number	Faulty location/corrective action	Contents
PC049 HMOP DISTRIBUTED LINK HMOP DISTRIBUTED LINK ERROR -----< ERROR POSITION >--------------- CHn / UNITy(GROUPx) : HANDY MACHINE OP. PANEL HANDY MACHINE OP. PANEL I/F UNIT --	Check whether any noise is inserted and check the ground status of the unit. Check whether there is disconnection or incomplete contact for the cable between the interface unit and the DI/DO unit. Check the power supply of the unit. Change the unit.	A communication error occurred between interface unit of handy machine operation panel and handy machine operation panel of “y”th unit (group x) of channel “n”.
PC052 I/O Link I PMC LSI RAM PARITY ERROR -----< ERROR POSITION>---------------- MAIN BOARD ---	Change the main board.	A RAM parity error occurred in PMC LSI on the main board.

Alarm number	Faulty location/corrective action	Contents
PC053 I/O Link I SLAVE LSI RAM PARITY ERROR -----< ERROR POSITION>---------------- CHn / UNITy(GROUPx) : "Unit name" (Note1) ---	Change the I/O device of the unit.	A RAM parity error occurred in "y"th unit (group "x") of channel "n".
PC054 I/O Link I ABNORMAL POWER SUPPLY -----< ERROR POSITION>---------------- CHn / UNITy(GROUPx) : "Unit name" (Note) ---	Check the power supply of the I/O unit.	A power disconnection alarm occurred in the "y"th unit (group "x") of channel "n".
PC055 I/O Link I I/O Link I SENDING DATA FAILURE -----< ERROR POSITION>---------------- CHn / CNC <-> UNIT1(GROUP0) CNC : MAIN BOARD UNIT1 : "Unit name" (Note1) ---	Check whether any noise is inserted between the CNC and 1st unit. Check the ground status of the slave device and the contact of the connection cable.	A communication error occurred between the CNC and 1st unit (group 0) of channel "n".
PC055 I/O Link I I/O Link I SENDING DATA FAILURE -----< ERROR POSITION>---------------- CHn / UNITy-1(GROUPx-1) <-> UNITy(GROUPx) UNITy –1 : "Unit name" (Note1) UNITy : "Unit name" (Note1) ---	Check whether there any noise is inserted between the "y-1"th unit (group "x-1") and "y"th unit (group "x"). Check the ground status of the slave device and the contact of the connection cable.	A communication error occurred between the "y-1"th unit (group "x-1") and the "y"th unit (group "x") of channel "n".
PC056 I/O Link I I/O Link I DISCONNECTION -----< ERROR POSITION>---------------- CHn / CNC <-> UNIT1(GROUP0) CNC : MAIN BOARD UNITy : "Unit name" (Note1) ---	Check whether there is disconnection or incomplete contact for the cable between the CNC and 1st unit (group 0).	Connection error occurred between the CNC and 1st unit (group 0) of channel "n".
PC056 I/O Link I I/O Link I DISCONNECTION -----< ERROR POSITION>---------------- CHn / UNITy-1(GROUPx-1)<-> UNITy(GROUPx) UNITy –1 : "Unit name" (Note1) UNITy : "Unit name" (Note1) ---	Check whether there is disconnection or incomplete contact of the cable between the "y-1"th unit (group "x-1") and "y"th unit (group "x").	Connection error occurred between the "y-1"th unit (group "x-1") and "y"th unit (group "x") of channel "n".
PC057 I/O Link I SAFETY I/O ALARM -----< ERROR POSITION >----- UNITy : "unit name" (Note 1) --	Change the I/O device of the unit. If the error still occurs, change the main board.	A hardware failure of the safety I/O occurred between the CNC and the "y"th unit.
PC058 I/O Link I SLAVE LSI EXTERNAL ALARM -----< ERROR POSITION>---------------- CHn / UNITy(GROUPx) : "Unit name" (Note1) ---	Change the I/O device of the unit.	A hardware failure occurred on the "y"th unit (group "x") of channel "n".

Alarm number	Faulty location/corrective action	Contents
PC059 I/O UNIT-MODEL B DISTRIBUTED LINK I/O UNIT-MODEL B DISTRIBUTED LINK ERROR -----< ERROR POSITION >--------------- CHn / UNITy(GROUPx) : I/O UNIT-MODEL B DI/DO UNIT I/O UNIT-MODEL B I/F UNIT --	Check whether any noise is inserted and check the ground status of the unit. Check whether there is disconnection or incomplete contact for the cable between the interface unit and the DI/DO unit. Check the power supply of the unit. Change the unit.	A communication error occurred between interface unit of I/O Unit-MODEL B and DI/DO unit of “y”th unit (group x) of channel “n”.

NOTE

1 When an unknown unit is connected, the hardware ID is displayed.
2 For some I/O devices, one unit such as a safety I/O unit may consist of two groups. If a connection failure occurs between groups containing units of the same type, PC058 instead of PC056 indicating a connection failure occurs as a unit failure.

12.1.3 Operation Errors

Error messages that may be displayed on the PMC LADDER DIAGRAM VIEWER screen

Message	Faulty location/corrective action	Contents
INPUT INVALID	Input a valid address or numeric value.	The input address or numeric value is invalid.
LADDER PROGRAM IS PROTECTED BY PASSWORD	Enter the password.	The screen cannot be displayed because the program is protected by the password.
ILLEGAL SUBPROGRAM NAME	Input a existent subprogram number or symbol.	A nonexistent subprogram number or symbol is specified.
SYMBOL UNDEFINED	Input a defined symbol or bit address.	An undefined symbol character string is specified.
THE NET IS NOT FOUND		The specified net is not found.
THE ADDRESS IS NOT FOUND		The specified address is not found.
THE FUNCTIONAL INSTRUCTION IS NOT FOUND		The specified functional instruction is not found.
WRITE COIL NEEDS BIT ADDRESS	Specify a bit address for the write coil search.	You entered a byte address when specifying an address used for the write coil search.
SOME NETS ARE DISCARDED	The system cannot pick up all the nets. Choose the nets to pick up, by using the LADDER DIAGRAM VIEWER display screen, and then perform the net pickup operation manually.	The system failed to pick up all the nets because there were 128 nets or more to be picked up.
PROGRAM IS BEING MODIFIED	Disconnect the online communication with FANUC LADDER-III. Stop other applications from accessing the ladder data.	The ladder data cannot be displayed because online communication with FANUC LADDER-III is in progress or another application is accessing the ladder data.
THIS FUNCTION IS PROTECTED	Cancel the protection by the programmer protection function or 8-level protection function.	This function is protected by the programmer protection function or 8-level protection function.
CANNOT EDIT FUNCTION BLOCK	Use FANUC LADDER-III to edit function block.	You tried to edit the FB body program.

Error messages that may be displayed on the PMC LADDER DIAGRAM EDITOR screen

Message	Faulty location/corrective action	Contents
THIS NET IS PROTECTED		When you are editing data on a per-subprogram basis, you cannot edit the subprogram frame nets (END1, END2, END3, SP, and SPE).
TOO LARGE DATA TO COPY	Reduce the range of data to copy. Perform the copy operation several times, copying a smaller range of data at a time.	The selected range of data exceeds the size of the copy buffer.
TOO LARGE DATA TO PASTE	Reduce the size of data to paste.	An attempt was made to paste data whose size exceeded the free space of the sequence program.
BIT ADDRESS IS REQUIRED	Make sure that the address types match for the alteration operation.	An attempt was made to alter a bit address to a byte address.
BYTE ADDRESS IS REQUIRED	Make sure that the address types match for the alteration operation.	An attempt was made to alter a byte address to a bit address.

Message	Faulty location/corrective action	Contents
ILLEGAL PMC ADDRESS	Check the address to be input, and then enter it correctly.	• A character string was entered that was unacceptable as a PMC address. • A wildcard (*) was specified in an inappropriate manner. • Either "OLD ADDRESS" or "NEW ADDRESS" was not entered.
THIS ADDRESS IS READ-ONLY	Enter a write-permitted address.	• An attempt was made to alter a write coil address to a write-prohibited bit address. • An attempt was made to alter an address set in an output parameter of a functional instruction to a write-prohibited bit address.
THE ADDRESS TYPES ARE MISMATCHED	Check the types of the address in "OLD ADDRESS" and "NEW ADDRESS" and, if necessary, enter the correct address or addresses.	The type of the addresses in "OLD ADDRESS" does not match that in "NEW ADDRESS".
***** DOSE NOT HAVE SYMBOL	Define symbol data in "OLD ADDRESS".	No symbol data is defined for "OLD ADDRESS".
***** ALREADY HAS SYMBOL	Make sure that the address types match for the alteration operation.	Symbol data is already defined for "NEW ADDRESS".
CANNOT CUT FUNCTION BLOCK	Use FANUC LADDER-III to edit function block. Cut nets which do not include any function block.	You tried to cut the net including the function block.
CANNOT COPY FUNCTION BLOCK	Use FANUC LADDER-III to edit function block. Copy nets which do not include any function block.	You tried to copy the net including the function block.
CANNOT EDIT FUNCTION BLOCK	Use FANUC LADDER-III to edit function block.	You tried to edit the FB body program.
CANNOT INPUT AT THIS SCREEN	Use NET EDITOR screen.	You tried to set an address in the output section that is omitted in the function block.
CANNOT EDIT INPUT/OUTPUT PARAM ADDRESS		An address in the input section of an input/output parameter in the function block cannot be changed.
NO CONSTANT TO PARAMETER OF PLURAL TYPE		When the input parameter of the function block is plural data type, any constant cannot be set.

Error messages that may be displayed on the PMC LADDER DIAGRAM EDITOR screen (when updating)

Message	Faulty location/corrective action	Contents
OVERLAPPED COM	If COME is missing, add it in proper position. If the COM is unnecessary, remove it.	There is no COME that corresponds to this COM.
END IN COM END1 IN COM END2 IN COM END3 IN COM	If COME is missing, add it in proper position. If COM is unnecessary, remove it.	END,END1,END2, or END3 is found between COM and COME.

Message	Faulty location/corrective action	Contents
JMPE IN COM	JMPE and corresponding JMP must have same COM/COME status. Review JMP range and COM range, to adjust not to overlap with each other: it is possible that one range includes the other completely.	JMPE is found between COM and COME, and JMP and corresponding JMPE have different COM/COME status.
SP/SPE IN COM	If COME is missing, add it in proper position. If the COM is unnecessary, remove it.	SP or SPE is found between COM and COME.
COME WITHOUT COM	If COM is missing, add it in proper position. If the COME is unnecessary, remove it.	There is no COM that corresponds to this COME.
COME NOT FOUND AFTER COM	If COME is missing, add it in proper position. If the COM is unnecessary, remove it.	There is no COME that corresponds to this COM.
DUPLICATE CTR NUMBER (WARN)	If some of them are unnecessary, remove them. If all of them are necessary, assign other number to parameter of them to make them unique. (If two or more instructions with same parameter number will never be active simultaneously at one time, the Ladder program has a possibility to work correctly, however, it is recommended from safety and maintenance points of view, that all these instructions should have different parameter number with each other.)	Plural CTRs have the same number as their parameter. (This is warning.)
ILLEGAL CTR NUMBER	If unnecessary, remove it. Assign correct number not to exceed the maximum number defined by each PMC model.	CTR has parameter number that is out of range.
DUPLICATE DIFU/DIFD NUMBER (WARN)	If some of them are unnecessary, remove them. If all of them are necessary, assign other number to parameter of them to make them unique. (If two or more instructions with same parameter number will never be active simultaneously at one time, the Ladder program has a possibility to work correctly, however, it is recommended from safety and maintenance points of view, that all these instructions should have different parameter number with each other.)	Plural DIFUs or DIFDs have the same number as their parameter. (This is warning.)
ILLEGAL DIFU/DIFD NUMBER	If unnecessary, remove it. Assign correct number not to exceed the maximum number defined by each PMC model.	DIFU or DIFD has parameter number that is out of range.
NO END1 NO END2 NO END3	Add END1, END2 or END3 in proper position.	END1, END2 or END3 is not found.
DUPLICATE END1 DUPLICATE END2 DUPLICATE END3	Remove extra END1, END2 or END3.	Multiple END1, END2 or END3 are found.
GARBAGE AFTER END GARBAGE AFTER END2 GARBAGE AFTER END3	Remove unnecessary nets, and move necessary nets to proper position so that they will be executed.	There are some nets after END, END2 or END3, which will not be executed.

Message	Faulty location/corrective action	Contents
OVERLAPPED JMP	If JMPE is missing, add it in proper position. If the JMP is unnecessary, remove it.	There is no JMPE that corresponds to this JMP.
JMP/JMPE TO BAD COM LEVEL	JMP and corresponding JMPE must have same COM/COME status. Review JMP range and COM range, to adjust not to overlap with each other: it is possible that one range includes the other completely.	JMP and corresponding JMPE have different COM/COME status.
COME IN JMP	COME and corresponding COM must have same JMP/JMPE status. Review COM range and JMP range, to adjust not to overlap with each other: it is possible that one range includes the other completely.	COME is found between JMP and JMPE, and COM and corresponding COME have different JMP/JMPE status.
END IN JMP END1 IN JMP END2 IN JMP END3 IN JMP	If JMPE is missing, add it in proper position. If JMP is unnecessary, remove it.	END,END1,END2, or END3 is found between JMP and JMPE.
SP/SPE IN JMP	If JMPE is missing, add it in proper position. If the JMP is unnecessary, remove it.	SP or SPE is found between JMP and JMPE.
JMPB OVER COM BORDER	JMPB and its destination must have same COM/COME status. Review range of JMPB and COM range, to adjust not to overlap with each other: it is possible that one range includes the other completely.	JMPB and its destination differ in COM/COME status.
JMPB OVER LEVEL	JMPB can only jump to the same program level, or within a subprogram. If the JMPB is unnecessary, remove it. If LBL for the JMPB is missing, add it in proper position. If it should be JMPC, correct it.	JMPB jumps to different program level.
LBL FOR JMPB NOT FOUND	If JMPB is unnecessary, remove it. If LBL is missing, add it in proper position.	Can not find proper LBL for JMPB.
JMPC IN BAD LEVEL	JMPC is used to jump from a subprogram to level 2. If the JMPC is unnecessary, remove it. If it should be JMPB or JMP, correct it.	JMPC is used in other than subprogram.
LBL FOR JMPC NOT FOUND	If JMPC is unnecessary, remove it. If LBL is missing, add it in proper position: JMPC jumps into level 2.	Can not find proper LBL for JMPC.
LBL FOR JMPC IN BAD LEVEL	JMPC is used to jump from a subprogram to level 2. If the JMPC is unnecessary, remove it. If another LBL of same L-address that the JMPC is intended to jump exists in the subprogram, assign different L-address to these two LBLs. If it should be JMPB or JMP, correct it.	Destination of JMPC is not level 2.
JMPC INTO COM	LBL for JMPC must be located out of any COM and COME pair. If the JMPC is unnecessary, remove it. If the LBL is located wrong, move it to correct position. If the L-address of JMPC is wrong, correct it.	JMPC jumps to LBL between COM and COME.

Message	Faulty location/corrective action	Contents
JMPE WITHOUT JMP	If JMP is missing, add it in proper position. If the JMPE is unnecessary, remove it.	There is no JMP that corresponds to this JMPE.
JMPE NOT FOUND AFTER JMP	If JMPE is missing, add it in proper position. If the JMP is unnecessary, remove it.	There is no JMPE that corresponds to this JMP.
TOO MANY LBL	Remove unnecessary LBLs. If this error still occurs, adjust the construction of program to use less LBLs.	There are too many LBLs.
DUPLICATE LBL	If some of these LBLs are unnecessary, remove them. If all of these LBLs is necessary, assign other L-addresses to them to make all LBLs unique.	Same L-address is used in plural LBLs.
OVERLAPPED SP	If SPE is missing, add it in proper position. If the SP is unnecessary, remove it.	There is no SPE that corresponds to this SP.
SPE WITHOUT SP	If SP is missing, add it in proper position. If the SPE is unnecessary, remove it.	There is no SP that corresponds to this SPE.
SPE NOT FOUND AFTER SP	If SPE is missing, add it in proper position. If the SP is unnecessary, remove it.	There is no SPE that corresponds to this SP.
END IN SP	If SPE is missing, add it in proper position. If END is in wrong place, move it to proper position.	END is found between SP and SPE.
DUPLICATE P ADDRESS	If some of these SPs are unnecessary, remove them. If all of these SPs is necessary, assign other P-addresses to them to make all SPs unique.	Same P-address is used in plural SPs.
DUPLICATE TMRB/TMRBF NUMBER (WARN)	If some of them are unnecessary, remove them. If all of them are necessary, assign other number to parameter of them to make them unique. (If two or more instructions with same parameter number will never be active simultaneously at one time, the Ladder program has a possibility to work correctly, however, it is recommended from safety and maintenance points of view, that all these instructions should have different parameter number with each other.)	Plural TMRBs/TMRBFs have the same number as their parameter. (This is warning.)
ILLEGAL TMRB/TMRBF NUMBER	If unnecessary, remove it. Assign correct number not to exceed the maximum number defined by each PMC model.	TMRB/TMRBF has parameter number that is out of range.

Message	Faulty location/corrective action	Contents
DUPLICATE TMR NUMBER (WARN)	If some of them are unnecessary, remove them. If all of them are necessary, assign other number to parameter of them to make them unique. (If two or more instructions with same parameter number will never be active simultaneously at one time, the Ladder program has a possibility to work correctly, however, it is recommended from safety and maintenance points of view, that all these instructions should have different parameter number with each other.)	Plural TMRs have the same number as their parameter. (This is warning.)
ILLEGAL TMR NUMBER	If unnecessary, remove it. Assign correct number not to exceed the maximum number defined by each PMC model.	TMR has parameter number that is out of range.
NO SUCH SUBPROGRAM	If it calls wrong subprogram, correct it. If the subprogram is missing, create it.	Subprogram that is called by CALL/CALLU is not found.
UNAVAILABLE INSTRUCTION	Confirm that this ladder program is correct one. If this program is correct one, all these unsupported instructions have to be removed.	Unsupported instruction for this PMC model is found.
SP IN BAD LEVEL	SP can be used at top of a subprogram. Correct it so that no SP exists in other place.	SP is found in wrong place.
LADDER PROGRAM IS BROKEN	This ladder program must be all cleared once, and remake ladder program.	Ladder program may be broken by some reason.
NO WRITE COIL	Add proper write coil.	Write coil is necessary, but is not found.
CALL/CALLU IN BAD LEVEL	CALL/CALLU must be used in Level 2 or in subprograms. Do not use any other places.	CALL/CALLU is used in wrong place.
SP IN LEVEL3	If END3 is located wrong, move it to correct position. If the SP is unnecessary, remove it.	SP is found in level 3.
CS/CM/CE IN COM	If COME is missing, add it in proper position. If the COM is unnecessary, remove it.	CS,CM or CE is found between COM and COME.
CS/CM/CE IN BAD LEVEL	CS, CM or CE must be used in Level 2 or in subprograms. Do not use any other places.	CS,CM, or CE is used in wrong place.
CM/CE WITHOUT CS	If CS is missing, add it in proper position. If the CM or CE is unnecessary, remove it.	There is no CS that corresponds to this CM or CE.
INSTRUCTION EXCEPT CM IN CS	If CE is missing, add it in proper position. If the instruction other than CM is unnecessary, remove it.	Instruction except CM is found between CS and CE.
OVERLAPPED CS	If CE is missing, add it in proper position. If the CS is unnecessary, remove it.	There is no CE that corresponds to this CS.
New ladder needs reboot to run (PT/NT)	To execute the program, once stop it and save it to flash ROM. Then, reboot the CNC.	If you want to enable the added positive / negative transition (PT/NT) instruction, it is necessary to reboot the CNC.
FB BODY PROGRAM IS BLOKEN	The ladder program must be deleted and remake it.	FB body program is broken.

Error messages that may be displayed on the PMC NET EDITOR screen

Message	Faulty location/corrective action	Contents
ILLEGAL FUNCTIONAL INSTRUCTION NAME	Specify the name of an available functional instruction.	The entered name of functional instruction is invalid.
TOO MANY FUNCTION IN ONE NET	Only one functional instruction is allowed to constitute a net. If necessary, divide the net into plural nets.	Too many functional instructions are in one net.
TOO LARGE NET	Divide the net into plural nets so that step number in a net may become small.	Net is too large. When a net is converted into the object, the net exceeds 256 steps.
NO INPUT FOR OPERATION	Coil without input, or coil connected to output of functional instruction that has no output, causes this error. If coil is not necessary, remove it. If necessary, connect it to meaningful input.	No signal is provided for logical operation.
OPERATION AFTER FUNCTION IS FORBIDDEN	Output of functional instruction can not be connected to a contact, nor to conjunction with other signal that will be implemented by logical-or operation.	No logical operation with functional instruction output is permitted, except write coils.
WRITE COIL IS EXPECTED	Write coil is not found even if it is expected. Add proper write coil to the net.	Write coil is expected, but not found.
BAD COIL LOCATION	Coil can be located only at rightmost column. Any coil located at other place must be erased once, and place necessary coils in correct place.	Coil is located in bad position.
SHORT CIRCUIT	Find contact with terminals connected by short circuit, and correct connections.	Some contacts are connected with short circuit. CTR has a parameter number that is out of the range.
FUNCTION AFTER DIVERGENCE IS FORBIDDEN	Functional instruction can not be used in output section of net. If necessary, divide the net into plural nets.	Functional instruction is used in output section of net.
ALL COIL MUST HAVE SAME INPUT	Left terminals of all coils in a net must be connected to same input point.	When a net contains more than one coil, the coils should not have any contact beside them affects only of the coils.
BAD CONDITION INPUT	Check the connection of all condition inputs of the functional instruction. Especially for functional instruction that has more than one condition input, check if connections to condition inputs interfere with each other.	Some condition input of functional instruction is not connected correctly.
NET IS TOO COMPLICATED	Examine every connection, and find unnecessarily bending connection, or coils that are connected to different point.	Net is too complicated to analyze.
PARAMETER IS NOT SUPPLIED	Enter all of the relay addresses, and parameters of functional instructions.	Relay with blank address, or blank parameter of functional instruction, is found.
TOO LARGE DATA FOR NET-EDITOR	Change for being to modify net by [NEXT NET] soft key.	The net data in net editor screen is too large.
TOO MANY FUNCTIONS FOR NET-EDITOR	Change for being to modify net by [NEXT NET] soft key.	There are too many functional instructions in net editor screen.

Message	Faulty location/corrective action	Contents
BAD DIAGRAM STRUCTURE	Examine every connection, and find the error of connection of relay or functional instruction.	Circuit is too complicated to analyze.
NOT SUPPORT ENHANCED LADDER DIAGRAM	Replace other functional instruction which supports Structure of extended type net. Or, change the ladder net construction not to be Structure of extended type net.	The ladder net Structure of extended type net contains a functional instruction which does not support Structure of extended type net.
TOO COMPLICATED CIRCUIT AROUND FUNCTION	The circuit lines branched from a conditional input for some functional instruction must reach the right power line without joining the output line from the functional instruction. Refer to 8.3.4.3.	The circuit construction around functional instruction is too complicated.
CONNECT OUTPUT TO COIL DIRECTLY	Connect the output of the functional instruction directly to a coil.	The output of the functional instruction is not connected directly to a coil.
SINGLE COIL IS EXPECTED	This functional instruction must have single coil directly connected to the output.	A functional instruction has multiple coils connected to its output which are prohibited.
INVALID CIRCUIT FOR FB PARAMETER	Specify the name of contact and coil for the parameter of function block.	The functional instruction is connected to the parameter of function block.
NO CONNECTION	Connect the broken connection.	The connection is broken.
PARAMETER IS NOT SUPPLIED	Specify an address.	The address is not assigned to the input section and the coil of output section of a function block.
CAN NOT PLACE FB AND FUNCTION IN ONE NET	Delete the functional instruction placed on the same net as the function block.	A functional instruction is placed on the same net as the function block.
NO ASSIGNMENT TO FB CONTACT	Specify a contact.	The contact is not assigned in the input section for a BOOL type of the function block.

Error messages that may be displayed on the TITLE DATA EDITOR screen

Message	Faulty location/corrective action	Contents
TOO MANY CHARACTERS	Make sure that the entered character string is within the allowable input length.	The number of characters in the entered character string exceeds the allowable input length. Some of the characters are discarded.
PROGRAM IS BEING MODIFIED	Disconnect the online communication with FANUC LADDER-III. Stop other applications from accessing the title data.	The title data cannot be displayed because online communication with FANUC LADDER-III is in progress or another application is accessing the title data.
THIS FUNCTION IS PROTECTED	Cancel the protection by the programmer protection function or 8-level protection function.	This function is protected by the programmer protection function or 8-level protection function.

Error messages that may be displayed on the SYMBOL & COMMENT DATA EDITOR screen

Message	Faulty location/corrective action	Contents
TOO MANY CHARACTERS	Make sure that the entered address is within the allowable input length.	The number of characters in the entered address exceeds the allowable address input length.
ADDRESS IS REQUIRED	Enter data in a batch correctly, as instructed in "Editing a set of symbol and comment data" in Subsection 9.2.2.	No address was entered during the batch input of address, symbol, and comment data using the SYMBOL & COMMENT EDITOR screen.
ILLEGAL PMC ADDRESS	Enter an address correctly.	The specified address is invalid, or the entered address character string contains a space or spaces.
THE ADDRESS ALREADY HAS AN ENTRY	Specify another address.	An already registered address was entered.
THE SYMBOL NAME IS ALREADY USED	Specify another symbol.	An already registered symbol was entered.
PMC ADDRESS MUST BE ENTERED	Enter a PMC address in the ADDRESS field.	No PMC address was entered when new symbol/comment data is registered.
TOO LONG COMMENT STRING	Make sure that the comment consists of 30 characters or less.	The entered comment exceeds the specified number of characters.
THE STRING IS NOT FOUND	Specify another character string for the search.	The search was done for the specified character string but did not find it.
OUT OF SPACE	Create free space for the sequence program, by deleting unnecessary ladder or message data.	The symbol/comment editing area has no free space.
PROGRAM IS BEING MODIFIED	Disconnect the online communication with FANUC LADDER-III. Stop other applications from accessing the symbol/comment data.	The symbol/comment data cannot be displayed because online communication with FANUC LADDER-III is in progress or another application is accessing the symbol/comment data.
THIS FUNCTION IS PROTECTED	Cancel the protection by the programmer protection function or 8-level protection function.	This function is protected by the programmer protection function or 8-level protection function.
BAD SYMBOL NAME	Change the symbol name.	The symbol name is invalid.
CANNOT EDIT ADDRESS AUTO ASSIGNED SYMBOL	Use FANUC LADDER-III to change the symbol.	The symbol whose PMC address is assigned automatically by compiling FANUC LADDER-III, can not edit.
ILLEGAL DATA TYPE	Enter a correct data type.	The specified data type is invalid.
ILLEGAL PROGRAM NAME	Enter a correct program name.	The specified program is invalid.
LINE FEED IS NOT AVAILABLE IN THIS DATA	Line feed code can be entered in comment data only. Do not enter it in other data.	Line feed code cannot be entered in this data.
LINE FEED IS NOT AVAILABLE IN THIS MODE	Enter Line feed code in the insert or overwrite mode.	Line feed code cannot be entered in this mode.
NO SYMBOL. PROGRAM SETTING IS IGNORED	Symbol name is required for local symbol.	The specified program is ignored because no symbol is specified.
NOTHING TO PASTE	You need to copy or cut character strings before you paste them.	You try to paste character strings without copying or cutting ones.
TOO LARGE DATA TO PASTE	Shorten the character string to copy or cut.	The character strings is too long to copy or cut.
UNAVAILABLE CHARACTERS WAS OMITTED.	Do not copy or cut characters which cannot be used at pasted position.	The characters which can not be used at pasted position, were omitted.

Error messages that may be displayed on the MESSAGE DATA EDITOR screen

Message	Faulty location/corrective action	Contents
INPUT INVALID	Correct the message number. Enter ";" in the 5th digit position in the batch message input process.	The format of the message number is invalid, or the delimiter code - semicolon (;) - was not entered in the batch message input process.
ILLEGAL NUMBER	Enter a four-digit number as the message number.	The entered message number contains any nonnumeric character, or a number shorter than four digits was entered.
THE NUMBER IS OUT OF RANGE	Enter the number in the range from 0 to 4095 for the message number of the format with path number, and 1000 to 9999 for the message number of other format.	The entered message number is out of range.
CLOSING "@" IS NOT FOUND	When entering kana or other Japanese characters, make sure that they are enclosed within a pair of @ signs.	One of the @ sign pair is missing.
BAD NUMBER OF CHARACTERS IN "@-@"	Enter a character string correctly between a pair of @ signs.	The number of characters entered between the pair of @ signs is not even.
ILLEGAL CHARACTER IN "@-@"	Enter a character string correctly between a pair of @ signs.	One or more invalid character codes exist between the pair of @ signs.
BAD NUMBER OF CHARACTERS FOR 2-BYTE CODE	Enter a two-byte code correctly between @02 and 01@.	The number of characters in the two-byte code (characters entered between @02 and 01@) is not a multiple of four.
ILLEGAL 2-BYTE CODE	Enter a two-byte code correctly between @02 and 01@.	The two-byte code (characters entered between @02 and 01@) contains one or more characters other than the JIS codes.
CLOSING CONTROL CODE "01" IS NOT FOUND	Enter the closing control code.	The two-byte code (characters entered between @02 and 01@) lacks the closing control code (01).
CONTROL CODE "XX" IS REPEATED	Remove any repeated control code.	The starting control code (02), closing control code (01), and/or umlaut code (0D) is repeated.
CLOSING "]" IS NOT FOUND	Make sure that the "[" and "]" codes are entered in pairs.	The delimiter codes for numerical data are not entered in pairs.
BAD NUMERICAL DATA FORMAT	Specify the numerical data correctly.	The format of the numerical data is invalid.
BAD PMC ADDRESS FOR NUMERIAL DATA	Enter an available address.	The address section of the numerical data is invalid.
PROGRAM IS BEING MODIFIED	Disconnect the online communication with FANUC LADDER-III. Stop other applications from accessing the message data.	The message data cannot be displayed because online communication with FANUC LADDER-III is in progress or another application is accessing the message data.
THIS FUNCTION IS PROTECTED	Cancel the protection by the programmer protection function or 8-level protection function.	This function is protected by the programmer protection function or 8-level protection function.

Error messages that may be displayed on the I/O MODULE EDITOR screen

Message	Faulty location/corrective action	Contents
GROUP NUMBER IS TOO LARGE	Specify 15 or a smaller value as the group number.	The entered group number is too large.
BASE NUMBER IS TOO LARGE	Specify base number 0 for I/O Unit-B (##, #1 - #10).	The entered base number is too large.
SLOT NUMBER IS TOO LARGE	Specify 30 or a smaller value as the slot number for I/O Unit-B (##, #1 - #10). For other I/O units, specify 10 or a smaller value.	The entered slot number is too large.
SLOT NUMBER IS TOO SMALL	Specify 0 or a large value as the slot number for I/O Unit-B (##, #1 - #10). For other I/O units, specify 1 or a larger value.	The entered slot number is too small.
I/O UNIT NAME MISMATCH	Check the I/O unit name or address.	The input I/O unit is assigned to the Y address, or the output I/O unit is assigned to the X address.
ILLEGAL I/O UNIT NAME	Enter an I/O unit that is listed in Tables 3.2 (a) to 3.2 (c) in Chapter 3.	The entered I/O unit name is invalid.
NOT ENOUGH SPACE	Enter the data again after creating free space by deleting the data allocated behind the current cursor position or by other adequate means.	There is not enough free address space for the size of the I/O unit you are going to assign. This error also occurs if you attempt to assign the I/O unit to an already allocated address space.
PROGRAM IS BEING MODIFIED	Disconnect the online communication with FANUC LADDER-III. Stop other applications from accessing the I/O module data.	The I/O module data cannot be displayed because online communication with FANUC LADDER-III is in progress or another application is accessing the I/O module data.
THIS FUNCTION IS PROTECTED	Cancel the protection by the programmer protection function or 8-level protection function.	This function is protected by the programmer protection function or 8-level protection function.

Error messages that may be displayed on the I/O CONFIGURATION EDITOR screen

Message	Faulty location/corrective action	Contents
TOO MANY GROUPS (CHx)	Delete any unnecessary group, then create a new group.	A new group cannot be created because the maximum number of groups per channel is exceeded.
TOO MANY SLOTS (CHx)	Delete any unnecessary slot, then create a new slot.	A new slot cannot be created because the maximum number of slots per channel (256 slots) is exceeded.
TOO MANY SLOTS IN A GROUP (CHx, Gyy)	Delete any unnecessary slot, then create a new slot.	A new slot cannot be created because the maximum number of slots per channel (32 slots) is exceeded.
NO SLOT(Gxx)	Add a slot.	There is no slot in group Gxx.
SLOT NUMBER IS REQUIRED	Enter a slot number.	No slot number is entered for a slot.
SLOT NUMBER DUPLICATE	Change the slot number used more than once.	More than one slot data item having the same slot number is found in the same group.
CAN NOT DELETE MPG SLOT	Turn the MPG flag off in the group setting screen.	No MPG slot can be deleted in the slot setting screen.

Message	Faulty location/corrective action	Contents
ILLEGAL SLOT NUMBER	Enter a slot number not greater than 32.	The entered slot number is greater than 32.
ILLEGAL PMC ADDRESS	Enter a correct PMC address again.	The entered PMC address is invalid. Alternatively, no PMC address is entered.
ILLEGAL SIZE	Enter a correct size again.	The entered size is outside the PMC address range. Alternatively, a value of 0 is entered as the size.
SLOT HAS NO ASSIGNMENT	Enter a PMC address and size.	For a slot, a PMC address or size is not entered for both DI and DO.
ILLEGAL COMMENT	Enter a correct comment again.	An entered comment does not conform to the extended symbol and comment format.
PMC ADDRESS OVERLAPPED (PMCm X(Y)nnnn)	Enter the PMC address or size so that it is set only once.	Address PMCm X(Y)nnnn is also assigned to another slot in I/O Link *i* assignment data.
TOO MANY OUTPUT POINTS (CHx, Gyy)	Reduce the number of output points of the group.	The number of output points of the I/O Link *i* group set for Gyy of CHx exceeds the upper limit (65 bytes by default or 29 bytes for the safety I/O device).
TOO MANY INPUT POINTS (CHx, Gyy)	Reduce the number of input points of the group.	The number of input points of the I/O Link *i* group set for Gyy of CHx exceeds the upper limit (65 bytes by default or 29 bytes for the safety I/O device).
TOO MANY OUTPUT POINTS (CHx)	Reduce the number of output points in the channel.	Warning message. The number of I/O Link *i* output points set in CHx exceeds the upper limit.
TOO MANY INPUT POINTS (CHx)	Reduce the number of input points in the channel.	Warning message. The number of I/O Link *i* input points set in CHx exceeds the upper limit.
TOO MANY CHARACTERS	Enter a comment within the input field.	The number of characters in an entered comment exceeds the input width.
THE ADDRESS IS NOT FOUND		The specified address is not found.
INPUT INVALID	Enter a correct numeric value.	A numeric value is invalid.
I/O CONFIG DATA IS BROKEN	Enter an I/O configuration file again.	I/O Link *i* assignment data is invalid.
TOO MANY SAFETY I/O GROUPS	Reduce the number of I/O Link *i* safety I/O groups.	Warning message. More than four I/O Link *i* safety I/O groups are specified either on the PMC or DCS side in the entire system.
TOO MANY ASSIGNMENTS (H.SPEED)(CHn,Gyy)	When a group in the high-speed transfer cycle mode is connected to I/O Link *i*, correct assignment so that the assignment for each group is performed within the quartered transfer timing with referencing Subsection 3.6.4 “Transfer Cycle”.	Warning message. In CHn, group yy and following exceed the transfer capacity limit in transfer timing assignment processing when the high-speed mode of I/O Link *i* is used.
BASIC GROUP INVALID	Correct the number of basic groups for the I/O assignment selection function of I/O Link *i*.(0 to 24)	The number of basic groups for the I/O assignment selection function of I/O Link *i* is invalid.

Message	Faulty location/corrective action	Contents
UNAVAILABLE ADDRESS FOR DCSPMC	Use addresses X0/Y0 and following.	Addresses X200/Y200, X400/Y400, or X600/Y600 and following are assigned to a group for which DCSPMC is specified for the PMC path.
THIS DATA IS BEING MODIFIED	Disconnect the online communication with FANUC LADDER-III. Stop other applications from accessing the I/O configuration data.	I/O configuration data cannot be displayed because online communication with FANUC LADDER-III is in progress or another application is accessing the I/O configuration data.
INTERNAL ERROR(0xCxxxxxxx)	Contact us, and report the displayed message correctly.	This error occurs due to an internal factor. An error code is indicated in parentheses.

Error messages that may be displayed on the SYSTEM PARAMETER screen

Message	Faulty location/corrective action	Contents
INPUT INVALID	Enter a numerical value correctly, as instructed in Section 9.8.	The entered numerical value or its input format is invalid.
SYMBOL UNDEFINED	Enter a defined symbol or bit address.	An undefined symbol character string was entered.
PROGRAM IS BEING MODIFIED	Disconnect the online communication with FANUC LADDER-III. Stop other applications from accessing the system parameter data.	The system parameter data cannot be displayed because online communication with FANUC LADDER-III is in progress or another application is accessing the system parameter data.
THIS FUNCTION IS PROTECTED	Cancel the protection by the programmer protection function or 8-level protection function.	This function is protected by the programmer protection function or 8-level protection function.

Error messages that may be displayed on the SIGNAL STATUS screen

Message	Faulty location/corrective action	Contents
INPUT INVALID	Enter a numerical value correctly, as instructed in "Screen operations using other keys" in Subsection 7.1.2.	The entered numerical value or its input format is invalid.
SYMBOL UNDEFINED	Enter a defined symbol or bit address.	An undefined symbol character string was entered.
THIS FUNCTION IS PROTECTED	Cancel the protection by the programmer protection function or 8-level protection function.	This function is protected by the programmer protection function or 8-level protection function.

Error messages that may be displayed on the PMC PARAM screen

Message	Faulty location/corrective action	Contents
INPUT INVALID	Enter a numerical value correctly, as instructed in Section 7.3.	The entered numerical value or its input format is invalid.
MUST BE IN EMERGENCY STOP OR IN MDI MODE	Set a mode to MDI or emergency stop.	The status of NC is not MDI mode or emergency stop.
PWE MUST BE ON	Set the “PWE” to ”1” in NC setting screen.	The “PWE” in NC setting screen is ”0”.
EITHER PWE OR KEY4 MUST BE ON	Set the “PWE” to ”1” in NC setting screen or set the key “KEY4” to “1”.	The “PWE” in NC setting screen is ”0” or the program protect key “KEY4” is ”0”.

Message	Faulty location/corrective action	Contents
THIS FUNCTION IS PROTECTED	Cancel the protection by the programmer protection function or 8-level protection function.	This function is protected by the programmer protection function or 8-level protection function.

Error messages that may be displayed on the SIGNAL TRACE screen

Message	Faulty location/corrective action	Contents
TRACE FUNCTION IS ALREADY IN USE	Wait until FANUC LADDER-III or some other application finishes using the trace function before executing it.	FANUC LADDER-III or some other application is currently using the trace function.
NO SAMPLING ADDRESS	Specify a bit address as a sampling address in the trace parameter.	No sampling address is specified in the trace parameter.
NO STOP TRIGGER ADDRESS	Specify a bit address as the stop trigger address in the trace parameter.	The stop trigger address is not specified in the trace parameter.
NO SAMPLING TRIGGER ADDRESS	Specify a bit address as the sampling trigger address in the trace parameter.	The sampling trigger address is not specified in the trace parameter.
USB MEMORY IS USED BY OTHER FUNCTION.	Terminate another function that is using the USB memory, then perform operation again.	The USB memory is being used by another function.
USB MEMORY IS NOT READY.	Check whether a USB memory is inserted.	No USB memory is inserted.
USB MEMORY IS FULL.	Delete any unnecessary files and allocate a required capacity.	The USB memory is full.
USB MEMORY HAS BEEN REMOVED	Insert the USB memory, then execute input/output operation again.	A USB memory is removed while it is being accessed.
USB MEMORY IS NOT FORMATTED	Replace the USB memory with another one.	The inserted USB memory cannot be recognized.
USB HARDWARE ERROR (xxxxxxxxxx)	Replace the USB memory with another one. If this error still occurs after replacement, contact us, and report the displayed message correctly.	This error occurs due to a USB hardware failure. An error code is indicated in parentheses.
INTERNAL ERROR (xxxxxxxxxx)	Contact us, and report the displayed message correctly.	This error occurs due to an internal factor. An error code is indicated in parentheses.

Error messages that may be displayed on the trace setting screen

Message	Faulty location/corrective action	Contents
INPUT INVALID	Enter a numerical value that is within the specified data range of the relevant trace parameter.	A nonnumeric value or an out-of-range parameter value was entered.
SYMBOL UNDEFINED	Enter a defined symbol or bit address.	An undefined symbol character string was entered.
BIT ADDRESS IS REQUIRED	Specify a bit address as the stop or sampling trigger address.	A byte address was specified as the stop or sampling trigger address.
INVALID STOP TRIGGER ADDRESS	Enter a PMC signal address that can be used as the stop trigger address.	The bit address entered as the stop trigger address is invalid.
INVALID SAMPLING TRIGGER ADDRESS	Enter a PMC signal address that can be used as the sampling trigger address.	The bit address entered as the sampling trigger address is invalid.
UNSUPPORTED TRACE SETTING FILE	This file cannot be handled. Set data in the TRACE SETING screen.	Unsupported trace setting file was read.
INVALID SETTING VALUE (LINE n)	Output the trance setting file again. Alternatively, set data in the TRACE SETING screen.	An invalid setting was found. The file may be broken.

Message	Faulty location/corrective action	Contents
SAMPLING TIME/FRAME WAS ADJUSTED	Check the data on the TRACE SETING screen.	The values were adjusted according to the read data. (This is warning.)
UNKNOWN SETTING WAS SKIPPED(LINE n)	Check the read trace data.	An unknown trace setting item was found and ignored. (This is warning.)
INVALID SAMPLING ADDRESS WAS FOUND	Check the read trace data.	An invalid sampling address was found. (This is warning.)
TOO MANY SAMPLING ADDRESSES	Check the read trace data.	The number of sampling addresses exceeds the upper limit. (This is warning.)
THE FILE IS NOT TRACE SETTING FILE	This file cannot be read. Specify a correct file.	An attempt was made to read a file which was not a trace setting file.
FILE NAME CONTAINS RESERVED WORD.	Correct file name.	"FORFANUC" cannot be used in the top of the file name.
USB MEMORY IS USED BY OTHER FUNCTION.	Terminate another function that is using the USB memory, then perform operation again.	The USB memory is being used by another function. Another function is formatting the USB memory.
USB MEMORY IS NOT READY.	Check whether a USB memory is inserted.	No USB memory is inserted.
USB MEMORY HAS BEEN REMOVED	Insert the USB memory, then execute input/output operation again.	A USB memory is removed while it is being accessed.
USB MEMORY IS NOT FORMATTED	Replace the USB memory with another one.	The inserted USB memory cannot be recognized.
FILE NAME IS INVALID.	Correct the file name.	An invalid character was found in a file name.
FOLDER NAME CANNOT BE SPECIFIED.	A folder name is specified. Specify an appropriate file name.	An attempt was made to read or write a folder.
USB HARDWARE ERROR (xxxxxxxxxx)	Replace the USB memory with another one. If this error still occurs after replacement, contact the FANUC service center, and report the displayed message correctly.	This error occurs due to a USB hardware failure. An error code is indicated in parentheses.
INTERNAL ERROR (xxxxxxxxxx)	Contact us, and report the displayed message correctly.	This error occurs due to an internal factor. An error code is indicated in parentheses.

Error messages that may be displayed on the I/O Diagnosis screen

Message	Faulty location/corrective action	Contents
ENTER STRING TO SEARCH.	Enter a string before starting a search.	No search string is specified.
I/O DIAGNOSIS FUNCTION IS NOT SUPPORTED	To use the I/O diagnosis function, update the PMC system software.	The I/O diagnosis function cannot be used because the PMC system software is an older version.
INPUT INVALID	Check the entered string.	The entered string is invalid.
LADDER PROGRAM IS BROKEN	Check the information displayed on the PMC alarm screen and reload the program.	The program is broken.
NO GROUP FORMAT.	Use [GROUP] on the I/O diagnosis (setting) screen.	No group display is set.
PROGRAM IS BEING MODIFIED.	Retry after completing the function that is using the program.	The program cannot be referenced because it is being used by another function.

Message	Faulty location/corrective action	Contents
REACHED TO THE END OF SYMBOL DATA.	To make another search, specify a string again.	The search has been completed until the end of the data has been reached.
SYMBOL ORDER IS NOT AVAILABLE.	Use the FANUC LADDER-III to convert the program to one with the extended symbol & comment function.	The format of this program does not allow sorting and display in symbol order.
THE GROUP IS NOT FOUND	Check the specified group.	The specified group is not found.
FORCING IS PROTECTED ON THIS PATH.	Disable the programmer protection function.	The forced input/output function is currently protected on the selected PMC path.
THE STRING IS NOT FOUND	Check the specified string.	The specified string is not found.

12.1.4 I/O Communication Error Messages

The error messages that may appear on the I/O screen and their meanings and actions are listed below.

Error messages displayed during memory card I/O operation

Message	Faulty location/corrective action	Contents
MEMORY CARD IS NOT READY	Check whether a memory card is installed.	No memory card is installed.
MEMORYCARD IS FULL	Delete files to create available space.	There is no available space in the memory card.
MEMORYCARD IS WRITE PROTECTED	Release the write protection of the memory card.	The memory card is write-protected.
MEMORYCARD IS NOT FORMATTED	Format the memory card.	The memory card cannot be recognized.
TOO MANY FILES IN MEMORYCARD	Delete unnecessary files to reduce the number of files.	There are too many files.
FILE NOT FOUND	On the list screen, check the file name or file number.	The specified file cannot be found.
FILE IS READ-ONLY	Check the attributes of the file.	Write to the specified file is not permitted.
FILE NAME IS INVALID	Specify the file name in MS-DOS form.	The file name is illegal.
CAN NOT FORMAT MEMORY CARD	The NC cannot format this memory card. Use another unit such as a personal computer to format the memory card.	The memory card cannot be formatted.
UNSUPPORTED MEMORYCARD	Replace the memory card with another one.	This memory card is not supported.
CAN NOT DELETE FILE	Check the attributes of the file.	An error occurred when a file was deleted from the memory card.
MEMORYCARD BATTERY ALARM	Replace the battery of the memory card.	The battery of the memory card has become weak.
THIS FILE NAME IS ALREADY USED	Change the file name to another one.	The file name is already used.
MEMORYCARD ACCESS ERROR	Replace the memory card with another one.	The memory card cannot be accessed.
DIFFERENCE FOUND		File comparison detected a mismatch.
MEMORY CARD HEADER ROM DATA ID IS ILLEGAL	This file cannot be read. Check the type of the file.	An attempt was made to read a file, but its ROM data ID was illegal.

Message	Faulty location/corrective action	Contents
FILE NUMBER CAN NOT SELECTED	If the file does not exist, the key entry is invalid. If this error occurs even when the cursor is placed at a file name, contact the FANUC service center.	The file number cannot be selected.
THE FILE NUMBER DOES NOT EXIST	Check the total number of files on the list screen.	The entered file number is not present. The entered number exceeds the total number of files.
FILE NUMBER IS RESTRICTED TO "128"	Enter a numeric value not exceeding 128.	A value up to 128 can be entered as the file number.
MEMORY CARD IS USED BY OTHER FUNCTION	Retry after terminating the other function that is currently using the memory card.	Some other function is currently using the memory card.
MEMORY CARD IS WRITE PROTECTED	Cancel the write protection of the memory card, or use another memory card that is not write protected.	The memory card is write protected.
UNSUPPORTED MEMORY CARD	Use another memory card.	This is an unsupported type of memory card.
COULD NOT DELETE FILE	Check the read/write permission attribute of the file.	The file cannot be deleted.
UNSUPPORTED TRACE SETTING FILE	This file is Invalid. Set data in the TRACE SETING screen.	Unsupported trace setting file was read.
INVALID SETTING VALUE (LINE n)	Output the trance setting file again. Alternatively, set data in the TRACE SETING screen.	Invalid setting value was found. The file may be broken.
SAMPLING TIME/FRAME WAS ADJUSTED	Check the data on trace setting screen.	It was adjusted according to the contents. (This is warning.)
UNKNOWN SETTING WAS SKIPPED(LINE n)	Check the read trace data.	An unknown trace setting item was found and ignored. (This is warning.)
INVALID SAMPLING ADDRESS WAS FOUND	Check the read trace data.	An invalid sampling address was found. (This is warning.)
TOO MANY SAMPLING ADDRESSES	Check the read trace data.	The number of sampling addresses exceeds the upper limit. (This is warning.)
INTERNAL ERROR (xxxxxxxxxx)	Contact us, and report the displayed message correctly.	An error due to an internal factor occurred. Details on the error are displayed in parentheses.

Error messages displayed during USB memory I/O operation

Message	Faulty location/corrective action	Contents
FILE NAME CONTAINS RESERVED WORD.	Correct file name.	The string “FORFANUC” cannot be used in the top of the file name.
USB MEMORY HAS BEEN REMOVED	Insert the USB memory, then execute input/output operation again.	A USB memory is removed while it is being accessed.
USB MEMORY IS NOT READY.	Check whether a USB memory is inserted.	No USB memory is inserted.
USB MEMORY IS USED BY OTHER FUNCTION.	Terminate another function that is using the USB memory, then perform operation again.	The USB memory is being used by another function.
THIS FILE NAME IS ALREADY USED. OVERWRITE IT?	Follow the message, and overwrite the file or specify another file name to write data.	An existing file name is specified as the write destination.
FILE NOT FOUND	Check the file name or number on the file list screen.	The specified file was not found.

Message	Faulty location/corrective action	Contents
USB MEMORY IS FULL.	Delete any unnecessary files and allocate a required capacity.	The USB memory is full.
FILE IS READ-ONLY.	Specify another file or check the file attribute and delete the read-only attribute.	The specified file is read-only.
USB MEMORY IS NOT FORMATTED	Replace the USB memory with another one.	The inserted USB memory cannot be recognized.
FILE NAME IS INVALID.	Correct the file name.	An invalid character was found in a file name.
DIFFERENCE FOUND		File comparison detected a mismatch.
THE FILE NUMBER DOES NOT EXIST	Check the total number of files on the list screen.	The entered file number is not found. The entered number is greater than the total number of files.
FILE NUMBER IS RESTRICTED TO "128"	Enter a numeric value not greater than 128.	A value up to 128 can be entered as the file number.
FOLDER CANNOT BE SPECIFIED.	<1> The specified number indicates a folder. Enter an appropriate number. <2> No folder can be selected in the file list screen.	<1> The specified number indicates a folder. <2> An attempt was made to select a folder in the file list screen.
THIS FILE CANNOT BE SPECIFIED.	<1> The file name corresponding to the specified file number consists of more than 32 characters. Enter an appropriate number. <2> No file having a file name consisting of more than 32 characters can be selected in the file list screen.	<1> The file name corresponding to the specified file number consists of more than 32 characters. <2> An attempt was made to select a file having a file name consisting of more than 32 characters.
USB HARDWARE ERROR (xxxxxxxxxx)	Replace the USB memory with another one. If this error still occurs after replacement, contact us, and report the displayed message correctly.	This error occurs due to a USB hardware failure. An error code is indicated in parentheses.
INTERNAL ERROR (xxxxxxxxxx)	Contact us, and report the displayed message correctly.	This error occurs due to an internal factor. An error code is indicated in parentheses.

Error messages displayed during flash ROM I/O operation

Message	Faulty location/corrective action	Contents
NOT IN EMG STOP MODE	Place the system in the emergency stop state.	The system is not in the emergency stop state.
DIFFERENCE FOUND		A file comparison detected a mismatch.
FLASH ROM IS USED BY OTHER FUNCTION	Retry after ending another function that uses flash ROM.	Flash ROM is in use by another function.
INTERNAL ERROR (xxxxxxxxxx)	Contact us, and report the displayed message correctly.	An error due to an internal factor occurred. Details on the error are displayed in parentheses.

Error messages displayed during FLOPPY or other input/output device I/O operation.

Message	Faulty location/corrective action	Contents
ILLEGAL PMC PARAMETER FORMAT	Specify a file of the PMC parameter format. Also, check the specified file to see whether its content is not disrupted.	The specified file is not of the PMC parameter format.
ILLEGAL HANDY FILE FORMAT	Specify a file of the handy file format. Also, check the specified file to see whether its content is not disrupted.	The specified file is not of the handy file format.
UNKNOWN FILE FORMAT	Specify file of recognizable format such as PMC parameter format, or check the contents of the file.	Cannot recognize the format of specified file.
FILE NAME OR FILE NUMBER IS REQUIRED	Specify file name or file number for the operation.	Need file name or file number to identify file to read, compare, or delete.
I/O DEVICE IS NOT ATTACHED OR IN ERROR STATUS	Check the power of I/O device is ON. Check the I/O device is connected. Check the cable that connects I/O device with PMC is correct one. If some error has occurred in I/O device, solve it.	Any I/O device is not connected, or some error has occurred in it.
RECEIVED BAD DATA: CHECK THE COMMUNICATION PARAMETERS	Check the PMC's communication parameters such as baud rate match the ones of I/O device.	Invalid data has been received.
RECEIVED DATA HAS OVERRUN	Check the communication parameters about flow control.	Too many data have received at once.
OTHER FUNCTION IS USING THIS CHANNEL	Use the other channel, or stop the function.	Others function is using this channel.
BAD COMMUNICATION PARAMETER	Check the communication parameters such as baud rate.	Setting parameters of communication are not correct.
I/O FUNCTION IS USED BY OTHER FUNCTION	Wait until function that using I/O function do finish, or stop the function.	Another function such as FANUC LADDER-III is using I/O function.
UNKNOWN HANDY FILE FORMAT DATA	Check the file.	The received data is not a program of the PMC system or is a program of some other incompatible type.
ILLEGAL BAUD RATE SETTING	Set a valid baud rate.	The set baud rate is invalid.
ILLEGAL CHANNEL NUMBER	Set a valid channel number.	The set channel number is invalid.
ILLEGAL PARITY BIT SETTING	Set a valid parity bit.	The set parity bit is invalid.
ILLEGAL STOP BIT SETTING	Set a valid stop bit.	The set stop bit is invalid.
ILLEGAL WRITE CODE SETTING	Set a valid output code.	The set output code is invalid.
SEQUENCE PROGRAM IS IN USE BY ONLINE FUNCTION	Wait until On-line function, do finish the using I/O function. In general, both of I/O function and On-line function should not be used at the same time.	Can not input/output of sequence program, because On-line function is using sequence program.

Common error messages that may be displayed on individual devices during the I/O operations

Message	Faulty location/corrective action	Contents
ERROR OCCURS IN SEQUENCE PROGRAM	Check the PMC alarm screen and correct the indicated program error accordingly.	Data cannot be output because there is an error in the ladder program.
MUST BE IN EMERGENCY STOP	Set to emergency stop.	The status of NC is not emergency stop when reading PMC parameter.

Message	Faulty location/corrective action	Contents
PWE MUST BE ON	Set the “PWE” to ”1” in NC setting screen.	The “PWE” in NC setting screen is ”0” when reading PMC parameter.
MUST BE IN EDIT MODE	Set to the EDIT mode.	The mode is not EDIT when reading PMC parameter.
THIS FUNCTION IS NOT ALLOWED	Check the related settings.	There are not all the settings that are needed to use this function.
PMC PARAMETER IS USED BY OTHER FUNCTION	Retry after terminating the other function that is currently using the PMC parameter.	The PMC parameter is currently used by some other function and cannot be referenced by this function.
TOO LARGE SEQUENCE PROGRAM	Check the file. Or, change to a step number option that allows you to set a larger program size.	The ladder program is too large to read.
SEQUENCE PROGRAM IS USED BY OTHER FUNCTION	Retry after terminating the other function that is currently displaying the ladder program.	The ladder program is currently used by some other function and cannot be referenced by this function.
INVALID I/O CONFIGURATION DATA	Read correct I/O configuration file.	Invalid I/O configuration data was read and any of the following operations was performed: - Writing it to the memory card - Comparing it with a memory card file USB - Writing it to flash ROM -Comparing it with flash ROM
TOO LARGE I/O CONFIGURATION DATA	Check the I/O configuration file.	The I/O configuration file is too large to read.
I/O CONFIGURATION DATA IS USED BY OTHER FUNCTION	Terminate another function that is using the I/O configuration data, then execute operation again.	I/O configuration data is being used by another function (such as FANUC LADDER-III).

12.2 I/O Link COMMUNICATION ERRORS AND ACTIONS TO TAKE

If an I/O Link communication error occurs, the system generates a system alarm, displaying an error message of the following format.

```
PC050 I/O Link CHn GRa:bb
```

In this message format, CHn (where n is 1 or a higher number) represents the number of the channel that has caused the communication error. “GRa” represents a group number in which a problem may occur. “bb” means internal code.
However, correct group number may not be shown depend on cause or condition of the communication error. Please note that it is difficult to identify the cause of the error or the location of the fault with these values alone, for the following reasons.

(1) If the communication error has resulted from a hardware fault or noise, these register values themselves may not be correct.
(2) Different register values may be presented for the same cause depending on the timing of the error occurrence.

Therefore, it is important to consider other circumstantial factors in addition to this displaying.

12.2.1 Causes of Communication Errors

An I/O Link communication error can stem from various types of causes such as those described below.

(1) Improper cable type, disconnection, or inadequate connection
Several different types of I/O Link electrical cables are used, as listed below. Check that the cable of the proper type is connected to each device. Also, check the connection of each cable, based on "Connection Manual (Hardware)". Pay particular attention to those signals to be carried over a twisted-pair cable. Make sure that the SIN signal is paired with the *SIN signal and that the SOUT signal is paired with the *SOUT signal. If any of these signals is paired with the wrong signal, the cable will become more susceptible to noise. Do not connect any unnecessary cable. Since the system has the +24V and +5V power cables, connecting an unnecessary cable can lead to a failure or malfunction.

- K1X: Used to connect groups.
- K2X: Used for base extension.
- K3X: Used to connect an optical I/O Link adapter or I/O Link dummy unit.

(2) Connection to the wrong connector
The output end of a cable between I/O Link groups is connected to "JD1A" and its input end is connected to "JD1B". Check each cable to see whether it is not connected to the wrong connector.

(3) Loose connector connection
Check each cable to see whether it is firmly connected to the relevant connector. The cable may be connected loosely.

(4) Assignment data mismatch
If the actual link configuration does not match the assignment data, a communication error may result. For example, if base extensions (bases 1 to 3) are assigned but if those bases are not connected, a system alarm is generated when the CNC is started.

(5) Noise
Take necessary counter-noise measures, as instructed in "Connection Manual (Hardware)". If the communication cables are bundled together with the power cables, noise may be introduced to the communication cables. To avoid such noise, install the communication cables and the power cables in separate bundles. Also, connect the shield of the communication cable to the ground plate using a cable clamp. (Refer to "Connection Manual (Hardware)".)

(6) DO connection to ground
With some types of operator's panel, a communication alarm occurs if the DO terminal is connected to ground or to another DO terminal due to inadequate cable connection, module malfunction or failure, or other cause.

(7) Insufficient power capacity or drop in voltage
Check whether the power capacity is insufficient. While the machine had a sufficient power capacity when originally designed, it may be suffering a power shortage due to such factors as subsequent modifications to the machine design and/or the factory facilities. Also, even if there is no problem under normal operating conditions, certain operations may result in a drop in voltage.

(8) Loose power connection
Check that the power cable is connected firmly. Several cases have been identified in which intermittent errors occur at an extremely low incidence because the power cable is loosely connected to the power unit precluding the stable supply of power to the slave.

(9) Power unit malfunction or failure
A communication error may result from an instantaneous interruption of power supply due to a malfunction or failure of the power unit.

(10) Restart of the slave at the time of the CNC restart
When the master I/O Link device is restarted, the slave needs to be restarted as well. Particular care must be exercised about intelligent-type slaves (those that exert standalone control independently, such as FS0-C, Power Mate, β amplifier, and spindle monitor unit) because, when the power of the master is turned off, a system alarm is generated in the slave. If the CNC alone is restarted in this situation, the system alarm in the slave causes another system alarm to be generated in the master.

(11) System alarm in the slave
In cases where intelligent-type slaves are used, if a system alarm occurs in any of the slaves, the master also generates a system alarm. Similarly, if a system alarm occurs in the master, the slave generates a system alarm as well. Therefore, when such slaves are used, it is important to know which device (master or slave) has generated a system alarm first.
If only the master is experiencing a system alarm while no such alarm is occurring in the slave, the likely cause is that the power of the slave was turned off instantaneously, causing a system alarm in the master, and then the slave was restarted.

(12) Failure to connect the optical I/O Link adapter to ground
The optical I/O Link adapter, which accomplishes conversion between electrical cable and optical cable, uses its own case as a grounding body. Therefore, the case of the adapter must be connected to ground.

(13) CNC or I/O device malfunction or failure
A communication error may stem from a hardware malfunction or failure. Try replacing boards having an I/O Link connector (master PCB and PMC boards), the PMC control module (which may be attached directly to the master PCB in some PMC types), back panel, individual slaves, or other adequate components.

(14) Operation mistake
If the error has occurred only once, it may be due to an operation mistake, such as turning off the power of the slave inadvertently.

12.2.2 Check Items

Check the following items individually to make a judgment as to whether any of the causes described in the preceding subsection is present.

(1) Operation records

"Had the machine been operating normally before the error occurred?"

If the machine suddenly starts to experience problems while it has been operating normally all along, one potential cause of those problems is noise, loose connector connection, or insufficient power capacity due to such factors as modifications to machine design and/or the factory facilities. Another highly likely cause is a hardware failure.
If the machine is still in the startup phase and has no operation records, you need to begin your investigation by checking the assignment data and hardware connections.

(2) Configuration and assignment data

"How are the I/O Link devices configured?"

Examine the actual I/O Link configuration (types of the master and slaves and their connections) and the assignment data.
Based on "Connection Manual (Hardware)", check whether the assignment data matches the actual I/O Link configuration, whether the I/O Link point count is within the limit, whether terminal resistors and other connectors are properly connected, whether a power cable is properly connected to each master and slave, whether the power-on or power-off procedure has been performed normally, and so on.

(3) Timing

"What did you do when the error occurred?"

If the error occurs when you turn on the power, first check whether each cable connector is connected to the appropriate device, as well as the assignment data. A system alarm occurs when the power is turned on, if bases 1 to 3 are assigned while bases 1 to 3 are actually not connected.
Also, when the master is restarted, the slave needs to be restarted as well. Check that the power of the slave is off before turning off the power of the master.
If the error repeats every time you carry out a certain operation, the likely cause is that an inadequate voltage is applied to the machine because of loose connector connection, noise, insufficient power capacity, or DO connection to ground that is caused by that particular operation.

(4) Operation

"Does the error occur every time you carry out the same operation?"

If the error occurs every time you carry out the same operation, you can locate the faulty part by removing the slaves sequentially starting with the one having the largest group number. Note that removing certain types of slaves (e.g., operator's panel) leaves you unable to manipulate the machine. Take necessary precautions for safety before removing such slaves.
If an error is unrepeatable and occurs with low frequency, its cause is difficult to identify. In that case, there is no option but to take every possible measure and see if the error will be corrected.
Such measures include replacing hardware components (masters, slaves, cables, etc.), strengthening the power supply (using an independent power source not shared with other devices), enhancing the earth grounding system, shielding the cables, and installing the PMC cables and other cables in separate bundles.

(5) Phenomenon

"Does the error cause the same phenomenon every time?"

Each time the same error occurs, check the system alarm message (register values), the LEDs on the slave, and the system alarm message displayed by the slave. As described earlier, these indications may vary depending on certain conditions. If the status denoted by these indications changes every time, the information given by the register values and LEDs is not reliable.

(6) Alarm history/system alarm history

"Is there any other alarm?"

The communication error may be due to another alarm event that occurred before the I/O Link system alarm. Check the alarm history and system alarm history records for any such alarm.
If the slave also has alarm history and system alarm history data, check those history records as well.

(7) Register values

"What kind of alarm is occurring?"

If the same register values are displayed every time the system alarm occurs, those register values may help you identify the location or cause of the error. However, as described earlier, these register values are not always valid.

(8) Retry counters

"Isn't the communication unstable?"

In response to an error that has occurred singly, the I/O Link attempts to retransmit data. If the error cannot be avoided by this retransmission attempt, then a system alarm is generated.
Every time such a retransmission takes place, one of the register values is incremented by 1. The addresses of these registers are the same regardless of the type of the PMC system.

Meaning of the register	PMC address	Size
Retry counter of channel 1	R9051	1 byte
Retry counter of channel 2	R9057	1 byte
Retry counter of channel 3	R9165	1 byte

By checking these register values, you can know whether the communication had been unstable all along or a communication error occurred suddenly after a reasonable period of stable operation.
In cases where a communication error repeats intermittently and the values of these registers are frequently updated, try replacing adequate hardware components. If the register values come to stay unchanged after you replace a certain hardware component, then you can tell that particular hardware component is the cause of the error.
These registers are volatile memory, and their values are cleared to 0 at the time of powering on.

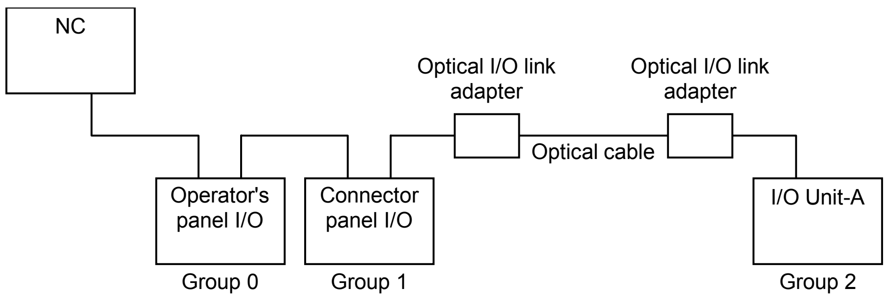
12.2.3 Sample Cases

A system alarm occurs once a day.

<Category>

Improper cable type, cable cut, or inadequate connection

<Configuration>



<Cause>

Groups 0 and 1 were connected using a cable to which a +5 V power wire was attached.

<Explanation>

The cable to which a +5V power wire is attached is intended to connect optical I/O Link adapters. When not using optical I/O Link adapters, use a cable to which a +5V power wire is not attached.

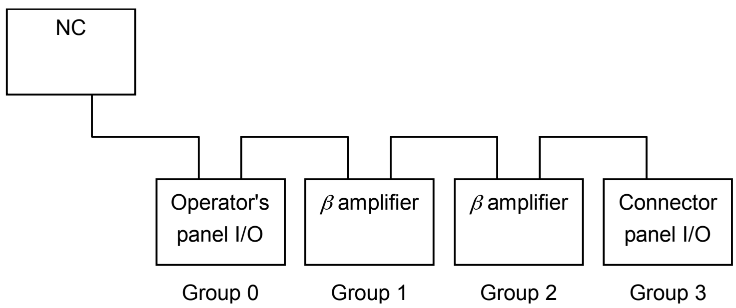
Note that, when this troubleshooting work (replacing the cable) was done, the operator's panel I/O module was replaced as well. Therefore, the direct cause of the error might have been the operator's panel I/O module.

A system alarm occurs two or three times a day.

<Category>

Improper cable type, cable cut, or inadequate connection

<Configuration>



<Cause>

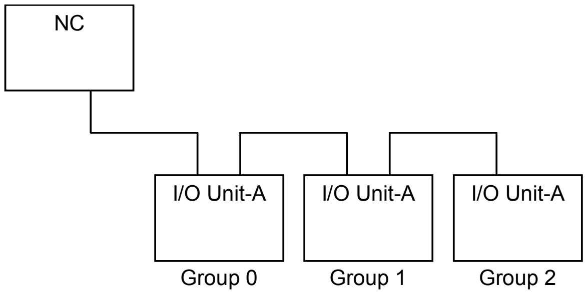
The cable between groups 2 and 3 had a short circuit inside it.

<Explanation>

Because the alarm had been occurring with relatively high frequency (two or three times a day), the cause of the error was located by removing the salve devices sequentially starting with the one having the largest group number.

A system alarm occurs if you execute "I/O Link startup" after storing the ladder program using the online monitor.

<Category>
Assignment data mismatch
<Register>
83:41
<Configuration>



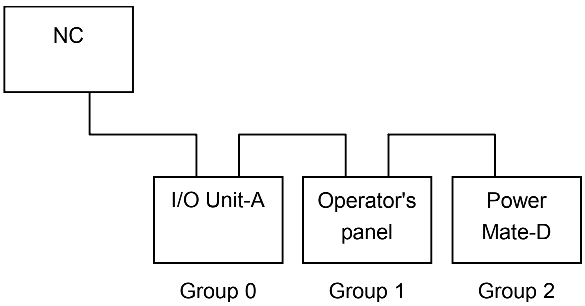
<Cause>
The groups and bases had been set mistakenly.

(Correct)				(Wrong)			
Group	Base	Slot	Module name	Group	Base	Slot	Module name
0	0	*n*	*Module 1*	0	0	*n*	*Module 1*
1	0	*n*	*Module 2*	0	1	*n*	*Module 2*
2	0	*n*	*Module 3*	0	2	*n*	*Module 3*

<Explanation>
If the base numbers are mistakenly assigned, the error almost always occurs when the power of the CNC is turned on.

A system alarm is prone to occur when the feeder starts to operate after the machining process.

<Category>
Noise
<Configuration>



<Cause>

None of the masters, slaves, or communication cables were properly grounded to earth.

<Explanation>

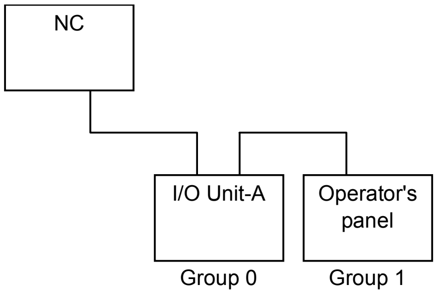
If a system alarm is prone to occur in response to a specific operation, it is highly likely that a drop in voltage, noise interference, loose cable connection, or short circuit results from that operation.

A system alarm occurs almost every time the automatic operation begins.

<Category>

Noise

<Configuration>



<Cause>

The communication cables and power cables were installed in the same bundle.

<Explanation>

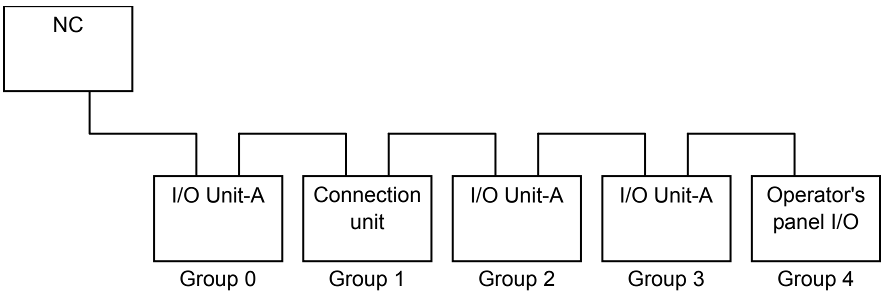
The error no longer occurred after the communication cables and power cables were installed in separate bundles. In this case, too, noise is considered to be the cause of the error. Note, however, that such noise-caused errors do not necessarily occur in response to one specific operation. In many cases, they emerge as intermittent errors that occur with extremely low frequency and it is difficult to identify any particular condition for them to arise. Therefore, if an error is occurring intermittently and if you have potential error factors, such as any hardware component not connected to ground, poor grounding, and cables installed near a noise source, you need to take necessary measures for each of those error factors and see if the error will be corrected.

A system alarm occurs at a cycle start.

<Category>

DO connection to ground

<Configuration>



<Cause>

DO was short-circuited due to a wiring mistake on the operator's panel.

<Explanation>

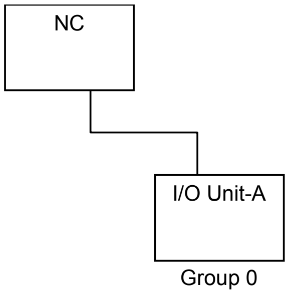
Some operator's panel I/O modules cause a system alarm if the DO output is connected to ground. In this case, we were able to identify the faulty component by checking the signal which is turned on at a cycle start on the operator's panel.

A system alarm occurs once every five times the feeder is moved.

<Category>

Insufficient power capacity or drop in voltage

<Configuration>



<Cause>

The power voltage of the slave dropped from 24 volts to 17 volts when the feeder was moved.

<Explanation>

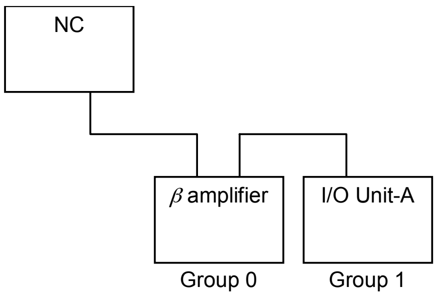
If a system alarm is prone to occur in response to a specific operation, it is highly likely that a drop in voltage, noise interference, or loose cable connection results from that operation.

A system alarm occurs every time an external alarm is displayed.

<Category>

Insufficient power capacity or drop in voltage

<Configuration>



<Cause>

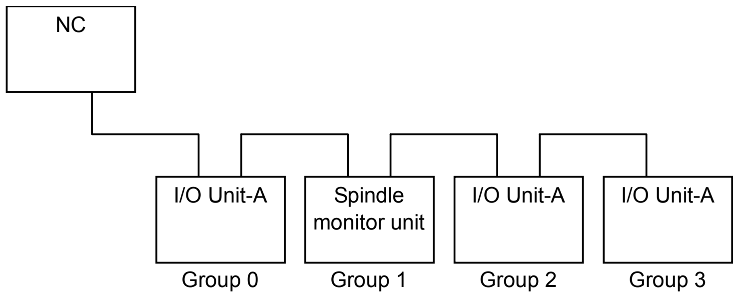
A flashing lamp was lit when an alarm occurred, which caused the power voltage of the slave to drop from 24 volts to 10 volts.

<Explanation>

We checked the LED of group 0 (β amplifier) and found that an NMI had occurred. As a result of examining the power supply of the β amplifier, we were able to confirm that its voltage would drop when its flashing lamp was lit.

A system alarm occurs intermittently.

<Category>
Loose power connection
<Configuration>



<Cause>
The cable was loosely connected to the terminal block of the slave power unit; it was merely in touch of the block. We conducted a voltage measurement and found that the voltage of the slave sometimes dropped from the 24-volt level.
<Explanation>
At the time when this measurement was conducted, the voltage of the slave dropped only by 2 volts or so and no system alarm occurred. However, when the voltage level is unstable, any instantaneous yet substantial change in voltage can lead to an error. To prevent this, check that each cable is connected firmly, replace the power supply unit, or use a stable power supply.

A system alarm sometimes occurs at powering on.

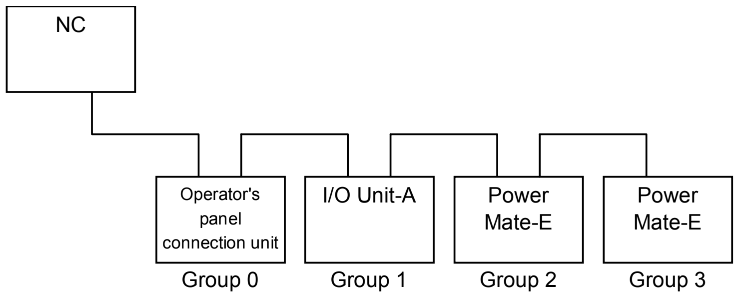
<Category>
Restart of the slave at the time of the CNC restart
<Configuration>
(Unknown)
<Cause>
Due to a wiring mistake, some slaves did not turn off their power even when the power of the CNC was turned off.
<Explanation>
When the master I/O Link device is restarted, all the slaves need to be restarted as well. The error occurred intermittently because only the CNC power was turned on or off rather than turning on or off the main power.

A system alarm occurs when data is written using the BOOT screen.

<Category>
Restart of the slave at the time of the CNC restart
<Configuration>
(Unknown)
<Cause>
When a macro was to be written using the BOOT screen, only the power of the CNC was turned off and then on while the power of the slaves remained on.
<Explanation>
When the master I/O Link device is restarted, all the slaves need to be restarted as well.

A system alarm occurs every time the power is turned on.

<Category>
System down of in the slave
<Configuration>



<Cause>
A RAM parity error had occurred in Power Mate-E of group 2.
<Explanation>
Since group 2 was Power Mate-E, we checked the alarm using the DPL and MDI and confirmed that a RAM parity error had occurred in the device.

System alarms began to occur after the machine had been in operation for about one year.

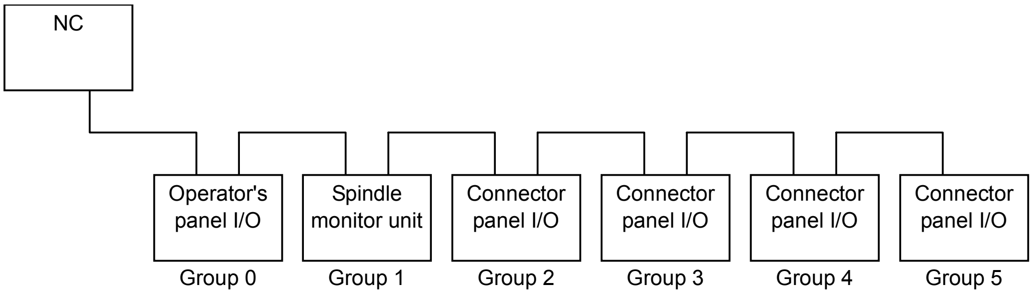
<Category>
Failure to connect the optical I/O Link adapter to ground
<Configuration>
(Unknown)
<Cause>
The connection between the optical I/O Link adapter case and the inside of the optical I/O Link adapter was loose.
<Explanation>
The case of the optical I/O Link adapter is not painted and serves as a grounding body as well. Therefore, the optical I/O Link adapter must be connected to ground. In this case, the adapter was properly grounded but, because it was installed in a position subject to vibration, the connection between the adapter case and the inside of the adapter had been lost.

A system alarm occurs every time the power is turned on.

<Category>

CNC or I/O device malfunction or failure

<Configuration>



<Cause>

The basic connector panel I/O module of group 5 was faulty.

<Explanation>

Since the alarm had occurred every time the power was turned on, we removed the devices sequentially, starting with the one having the largest group number, and checked whether an alarm would arise. As a result, we found out that the system would start normally when group 5 was removed. We then conducted a test with the basic module of group 5 attached to another CNC and discovered that the error was due to the malfunction of that individual module.

APPENDIX

A CHARACTER CODE TABLE

A.1 Simplified chinese character code table (GB2312 code)

	+0	+1	+2	+3	+4	+5	+6	+7	+8	+9	+A	+B	+C	+D	+E	+F
A1A0			、	。	·	ˉ	ˇ	¨	〃	々	—	～	‖	…	‘	’
A1B0	“	”	〔	〕	〈	〉	《	》	「	」	『	』	〖	〗	【	】
A1C0	±	×	÷	∶	∧	∨	∑	∏	∪	∩	∈	∷	√	⊥	∥	∠
A1D0	⌒	⊙	∫	∮	≡	≌	≈	∽	∝	≠	≮	≯	≤	≥	∞	∵
A1E0	∴	♂	♀	°	′	″	℃	＄	¤	￠	￡	‰	§	№	☆	★
A1F0	○	●	◎	◇	◆	□	■	△	▲	※	→	←	↑	↓	〓	
A2A0																
A2B0		⒈	⒉	⒊	⒋	⒌	⒍	⒎	⒏	⒐	⒑	⒒	⒓	⒔	⒕	⒖
A2C0	⒗	⒘	⒙	⒚	⒛	⑴	⑵	⑶	⑷	⑸	⑹	⑺	⑻	⑼	⑽	⑾
A2D0	⑿	⒀	⒁	⒂	⒃	⒄	⒅	⒆	⒇	①	②	③	④	⑤	⑥	⑦
A2E0	⑧	⑨	⑩			㈠	㈡	㈢	㈣	㈤	㈥	㈦	㈧	㈨	㈩	
A2F0		Ⅰ	Ⅱ	Ⅲ	Ⅳ	Ⅴ	Ⅵ	Ⅶ	Ⅷ	Ⅸ	Ⅹ	Ⅺ	Ⅻ			
A3A0		！	＂	＃	￥	％	＆	＇	（	）	＊	＋	，	－	．	／
A3B0	０	１	２	３	４	５	６	７	８	９	：	；	＜	＝	＞	？
A3C0	＠	Ａ	Ｂ	Ｃ	Ｄ	Ｅ	Ｆ	Ｇ	Ｈ	Ｉ	Ｊ	Ｋ	Ｌ	Ｍ	Ｎ	Ｏ
A3D0	Ｐ	Ｑ	Ｒ	Ｓ	Ｔ	Ｕ	Ｖ	Ｗ	Ｘ	Ｙ	Ｚ	［	＼	］	＾	＿
A3E0	｀	ａ	ｂ	ｃ	ｄ	ｅ	ｆ	ｇ	ｈ	ｉ	ｊ	ｋ	ｌ	ｍ	ｎ	ｏ
A3F0	ｐ	ｑ	ｒ	ｓ	ｔ	ｕ	ｖ	ｗ	ｘ	ｙ	ｚ	｛	｜	｝	￣	
A4A0		ぁ	あ	ぃ	い	ぅ	う	ぇ	え	ぉ	お	か	が	き	ぎ	く
A4B0	ぐ	け	げ	こ	ご	さ	ざ	し	じ	す	ず	せ	ぜ	そ	ぞ	た
A4C0	だ	ち	ぢ	っ	つ	づ	て	で	と	ど	な	に	ぬ	ね	の	は
A4D0	ば	ぱ	ひ	び	ぴ	ふ	ぶ	ぷ	へ	べ	ぺ	ほ	ぼ	ぽ	ま	み
A4E0	む	め	も	ゃ	や	ゅ	ゆ	ょ	よ	ら	り	る	れ	ろ	ゎ	わ
A4F0	ゐ	ゑ	を	ん												
A5A0		ァ	ア	ィ	イ	ゥ	ウ	ェ	エ	ォ	オ	カ	ガ	キ	ギ	ク
A5B0	グ	ケ	ゲ	コ	ゴ	サ	ザ	シ	ジ	ス	ズ	セ	ゼ	ソ	ゾ	タ
A5C0	ダ	チ	ヂ	ッ	ツ	ヅ	テ	デ	ト	ド	ナ	ニ	ヌ	ネ	ノ	ハ
A5D0	バ	パ	ヒ	ビ	ピ	フ	ブ	プ	ヘ	ベ	ペ	ホ	ボ	ポ	マ	ミ
A5E0	ム	メ	モ	ャ	ヤ	ュ	ユ	ョ	ヨ	ラ	リ	ル	レ	ロ	ヮ	ワ
A5F0	ヰ	ヱ	ヲ	ン	ヴ	ヵ	ヶ									

	+0	+1	+2	+3	+4	+5	+6	+7	+8	+9	+A	+B	+C	+D	+E	+F
A6A0		Α	Β	Γ	Δ	Ε	Ζ	Η	Θ	Ι	Κ	Λ	Μ	Ν	Ξ	Ο
A6B0	Π	Ρ	Σ	Τ	Υ	Φ	Χ	Ψ	Ω							
A6C0		α	β	γ	δ	ε	ζ	η	θ	ι	κ	λ	μ	ν	ξ	ο
A6D0	π	ρ	σ	τ	υ	φ	χ	ψ	ω							
A6E0																
A6F0																
A7A0		А	Б	В	Г	Д	Е	Ё	Ж	З	И	Й	К	Л	М	Н
A7B0	О	П	Р	С	Т	У	Ф	Х	Ц	Ч	Ш	Щ	Ъ	Ы	Ь	Э
A7C0	Ю	Я														
A7D0		а	б	в	г	д	е	ё	ж	з	и	й	к	л	м	н
A7E0	о	п	р	с	т	у	ф	х	ц	ч	ш	щ	ъ	ы	ь	э
A7F0	ю	я														
A8A0		ā	á	ǎ	à	ē	é	ě	è	ī	í	ǐ	ì	ō	ó	ǒ
A8B0	ò	ū	ú	ǔ	ù	ǖ	ǘ	ǚ	ǜ	ü	ê					
A8C0						ㄅ	ㄆ	ㄇ	ㄈ	ㄉ	ㄊ	ㄋ	ㄌ	ㄍ	ㄎ	ㄏ
A8D0	ㄐ	ㄑ	ㄒ	ㄓ	ㄔ	ㄕ	ㄖ	ㄗ	ㄘ	ㄙ	ㄚ	ㄛ	ㄜ	ㄝ	ㄞ	ㄟ
A8E0	ㄠ	ㄡ	ㄢ	ㄣ	ㄤ	ㄥ	ㄦ	ㄧ	ㄨ	ㄩ						
A8F0																
A9A0					─	━	│	┃	┄	┅	┆	┇	┈	┉	┊	┋
A9B0	┌	┍	┎	┏	┐	┑	┒	┓	└	┕	┖	┗	┘	┙	┚	┛
A9C0	├	┝	┞	┟	┠	┡	┢	┣	┤	┥	┦	┧	┨	┩	┪	┫
A9D0	┬	┭	┮	┯	┰	┱	┲	┳	┴	┵	┶	┷	┸	┹	┺	┻
A9E0	┼	┽	┾	┿	╀	╁	╂	╃	╄	╅	╆	╇	╈	╉	╊	╋
A9F0																
B0A0		啊	阿	埃	挨	哎	唉	哀	皑	癌	蔼	矮	艾	碍	爱	隘
B0B0	鞍	氨	安	俺	按	暗	岸	胺	案	肮	昂	盎	凹	敖	熬	翱
B0C0	袄	傲	奥	懊	澳	芭	捌	扒	叭	吧	笆	八	疤	巴	拔	跋
B0D0	靶	把	耙	坝	霸	罢	爸	白	柏	百	摆	佰	败	拜	稗	斑
B0E0	班	搬	扳	般	颁	板	版	扮	拌	伴	瓣	半	办	绊	邦	帮
B0F0	梆	榜	膀	绑	棒	磅	蚌	镑	傍	谤	苞	胞	包	褒	剥	
B1A0		薄	雹	保	堡	饱	宝	抱	报	暴	豹	鲍	爆	杯	碑	悲
B1B0	卑	北	辈	背	贝	钡	倍	狈	备	惫	焙	被	奔	苯	本	笨
B1C0	崩	绷	甭	泵	蹦	迸	逼	鼻	比	鄙	笔	彼	碧	蓖	蔽	毕
B1D0	毙	毖	币	庇	痹	闭	敝	弊	必	辟	壁	臂	避	陛	鞭	边
B1E0	编	贬	扁	便	变	卞	辨	辩	辫	遍	标	彪	膘	表	鳖	憋

	+0	+1	+2	+3	+4	+5	+6	+7	+8	+9	+A	+B	+C	+D	+E	+F
B1F0	别	瘪	彬	斌	濒	滨	宾	摈	兵	冰	柄	丙	秉	饼	炳	
B2A0		病	并	玻	菠	播	拨	钵	波	博	勃	搏	铂	箔	伯	帛
B2B0	舶	脖	膊	渤	泊	驳	捕	卜	哺	补	埠	不	布	步	簿	部
B2C0	怖	擦	猜	裁	材	才	财	睬	踩	采	彩	菜	蔡	餐	参	蚕
B2D0	残	惭	惨	灿	苍	舱	仓	沧	藏	操	糙	槽	曹	草	厕	策
B2E0	侧	册	测	层	蹭	插	叉	茬	茶	查	碴	搽	察	岔	差	诧
B2F0	拆	柴	豺	搀	掺	蝉	馋	谗	缠	铲	产	阐	颤	昌	猖	
B3A0		场	尝	常	长	偿	肠	厂	敞	畅	唱	倡	超	抄	钞	朝
B3B0	嘲	潮	巢	吵	炒	车	扯	撤	掣	彻	澈	郴	臣	辰	尘	晨
B3C0	忱	沉	陈	趁	衬	撑	称	城	橙	成	呈	乘	程	惩	澄	诚
B3D0	承	逞	骋	秤	吃	痴	持	匙	池	迟	弛	驰	耻	齿	侈	尺
B3E0	赤	翅	斥	炽	充	冲	虫	崇	宠	抽	酬	畴	踌	稠	愁	筹
B3F0	仇	绸	瞅	丑	臭	初	出	橱	厨	躇	锄	雏	滁	除	楚	
B4A0		础	储	矗	搐	触	处	揣	川	穿	椽	传	船	喘	串	疮
B4B0	窗	幢	床	闯	创	吹	炊	捶	锤	垂	春	椿	醇	唇	淳	纯
B4C0	蠢	戳	绰	疵	茨	磁	雌	辞	慈	瓷	词	此	刺	赐	次	聪
B4D0	葱	囱	匆	从	丛	凑	粗	醋	簇	促	蹿	篡	窜	摧	崔	催
B4E0	脆	瘁	粹	淬	翠	村	存	寸	磋	撮	搓	措	挫	错	搭	达
B4F0	答	瘩	打	大	呆	歹	傣	戴	带	殆	代	贷	袋	待	逮	
B5A0		怠	耽	担	丹	单	郸	掸	胆	旦	氮	但	惮	淡	诞	弹
B5B0	蛋	当	挡	党	荡	档	刀	捣	蹈	倒	岛	祷	导	到	稻	悼
B5C0	道	盗	德	得	的	蹬	灯	登	等	瞪	凳	邓	堤	低	滴	迪
B5D0	敌	笛	狄	涤	翟	嫡	抵	底	地	蒂	第	帝	弟	递	缔	颠
B5E0	掂	滇	碘	点	典	靛	垫	电	佃	甸	店	惦	奠	淀	殿	碉
B5F0	叼	雕	凋	刁	掉	吊	钓	调	跌	爹	碟	蝶	迭	谍	叠	
B6A0		丁	盯	叮	钉	顶	鼎	锭	定	订	丢	东	冬	董	懂	动
B6B0	栋	侗	恫	冻	洞	兜	抖	斗	陡	豆	逗	痘	都	督	毒	犊
B6C0	独	读	堵	睹	赌	杜	镀	肚	度	渡	妒	端	短	锻	段	断
B6D0	缎	堆	兑	队	对	墩	吨	蹲	敦	顿	囤	钝	盾	遁	掇	哆
B6E0	多	夺	垛	躲	朵	跺	舵	剁	惰	堕	蛾	峨	鹅	俄	额	讹
B6F0	娥	恶	厄	扼	遏	鄂	饿	恩	而	儿	耳	尔	饵	洱	二	
B7A0		贰	发	罚	筏	伐	乏	阀	法	珐	藩	帆	番	翻	樊	矾
B7B0	钒	繁	凡	烦	反	返	范	贩	犯	饭	泛	坊	芳	方	肪	房
B7C0	防	妨	仿	访	纺	放	菲	非	啡	飞	肥	匪	诽	吠	肺	废
B7D0	沸	费	芬	酚	吩	氛	分	纷	坟	焚	汾	粉	奋	份	忿	愤

	+0	+1	+2	+3	+4	+5	+6	+7	+8	+9	+A	+B	+C	+D	+E	+F
B7E0	粪	丰	封	枫	蜂	峰	锋	风	疯	烽	逢	冯	缝	讽	奉	凤
B7F0	佛	否	夫	敷	肤	孵	扶	拂	辐	幅	氟	符	伏	俘	服	
B8A0		浮	涪	福	袱	弗	甫	抚	辅	俯	釜	斧	脯	腑	府	腐
B8B0	赴	副	覆	赋	复	傅	付	阜	父	腹	负	富	讣	附	妇	缚
B8C0	咐	噶	嘎	该	改	概	钙	盖	溉	干	甘	杆	柑	竿	肝	赶
B8D0	感	秆	敢	赣	冈	刚	钢	缸	肛	纲	岗	港	杠	篙	皋	高
B8E0	膏	羔	糕	搞	镐	稿	告	哥	歌	搁	戈	鸽	胳	疙	割	革
B8F0	葛	格	蛤	阁	隔	铬	个	各	给	根	跟	耕	更	庚	羹	
B9A0		埂	耿	梗	工	攻	功	恭	龚	供	躬	公	宫	弓	巩	汞
B9B0	拱	贡	共	钩	勾	沟	苟	狗	垢	构	购	够	辜	菇	咕	箍
B9C0	估	沽	孤	姑	鼓	古	蛊	骨	谷	股	故	顾	固	雇	刮	瓜
B9D0	剐	寡	挂	褂	乖	拐	怪	棺	关	官	冠	观	管	馆	罐	惯
B9E0	灌	贯	光	广	逛	瑰	规	圭	硅	归	龟	闺	轨	鬼	诡	癸
B9F0	桂	柜	跪	贵	刽	辊	滚	棍	锅	郭	国	果	裹	过	哈	
BAA0		骸	孩	海	氦	亥	害	骇	酣	憨	邯	韩	含	涵	寒	函
BAB0	喊	罕	翰	撼	捍	旱	憾	悍	焊	汗	汉	夯	杭	航	壕	嚎
BAC0	豪	毫	郝	好	耗	号	浩	呵	喝	荷	菏	核	禾	和	何	合
BAD0	盒	貉	阂	河	涸	赫	褐	鹤	贺	嘿	黑	痕	很	狠	恨	哼
BAE0	亨	横	衡	恒	轰	哄	烘	虹	鸿	洪	宏	弘	红	喉	侯	猴
BAF0	吼	厚	候	后	呼	乎	忽	瑚	壶	葫	胡	蝴	狐	糊	湖	
BBA0		弧	虎	唬	护	互	沪	户	花	哗	华	猾	滑	画	划	化
BBB0	话	槐	徊	怀	淮	坏	欢	环	桓	还	缓	换	患	唤	痪	豢
BBC0	焕	涣	宦	幻	荒	慌	黄	磺	蝗	簧	皇	凰	惶	煌	晃	幌
BBD0	恍	谎	灰	挥	辉	徽	恢	蛔	回	毁	悔	慧	卉	惠	晦	贿
BBE0	秽	会	烩	汇	讳	诲	绘	荤	昏	婚	魂	浑	混	豁	活	伙
BBF0	火	获	或	惑	霍	货	祸	击	圾	基	机	畸	稽	积	箕	
BCA0		肌	饥	迹	激	讥	鸡	姬	绩	缉	吉	极	棘	辑	籍	集
BCB0	及	急	疾	汲	即	嫉	级	挤	几	脊	己	蓟	技	冀	季	伎
BCC0	祭	剂	悸	济	寄	寂	计	记	既	忌	际	妓	继	纪	嘉	枷
BCD0	夹	佳	家	加	荚	颊	贾	甲	钾	假	稼	价	架	驾	嫁	歼
BCE0	监	坚	尖	笺	间	煎	兼	肩	艰	奸	缄	茧	检	柬	碱	硷
BCF0	拣	捡	简	俭	剪	减	荐	槛	鉴	践	贱	见	键	箭	件	
BDA0		健	舰	剑	饯	渐	溅	涧	建	僵	姜	将	浆	江	疆	蒋
BDB0	桨	奖	讲	匠	酱	降	蕉	椒	礁	焦	胶	交	郊	浇	骄	娇
BDC0	嚼	搅	铰	矫	侥	脚	狡	角	饺	缴	绞	剿	教	酵	轿	较

	+0	+1	+2	+3	+4	+5	+6	+7	+8	+9	+A	+B	+C	+D	+E	+F
BDD0	叫	窖	揭	接	皆	秸	街	阶	截	劫	节	桔	杰	捷	睫	竭
BDE0	洁	结	解	姐	戒	藉	芥	界	借	介	疥	诫	届	巾	筋	斤
BDF0	金	今	津	襟	紧	锦	仅	谨	进	靳	晋	禁	近	烬	浸	
BEA0		尽	劲	荆	兢	茎	睛	晶	鲸	京	惊	精	粳	经	井	警
BEB0	景	颈	静	境	敬	镜	径	痉	靖	竟	竞	净	炯	窘	揪	究
BEC0	纠	玖	韭	久	灸	九	酒	厩	救	旧	臼	舅	咎	就	疚	鞠
BED0	拘	狙	疽	居	驹	菊	局	咀	矩	举	沮	聚	拒	据	巨	具
BEE0	距	踞	锯	俱	句	惧	炬	剧	捐	鹃	娟	倦	眷	卷	绢	撅
BEF0	攫	抉	掘	倔	爵	觉	决	诀	绝	均	菌	钧	军	君	峻	
BFA0		俊	竣	浚	郡	骏	喀	咖	卡	咯	开	揩	楷	凯	慨	刊
BFB0	堪	勘	坎	砍	看	康	慷	糠	扛	抗	亢	炕	考	拷	烤	靠
BFC0	坷	苛	柯	棵	磕	颗	科	壳	咳	可	渴	克	刻	客	课	肯
BFD0	啃	垦	恳	坑	吭	空	恐	孔	控	抠	口	扣	寇	枯	哭	窟
BFE0	苦	酷	库	裤	夸	垮	挎	跨	胯	块	筷	侩	快	宽	款	匡
BFF0	筐	狂	框	矿	眶	旷	况	亏	盔	岿	窥	葵	奎	魁	傀	
C0A0		馈	愧	溃	坤	昆	捆	困	括	扩	廓	阔	垃	拉	喇	蜡
C0B0	腊	辣	啦	莱	来	赖	蓝	婪	栏	拦	篮	阑	兰	澜	谰	揽
C0C0	览	懒	缆	烂	滥	琅	榔	狼	廊	郎	朗	浪	捞	劳	牢	老
C0D0	佬	姥	酪	烙	涝	勒	乐	雷	镭	蕾	磊	累	儡	垒	擂	肋
C0E0	类	泪	棱	楞	冷	厘	梨	犁	黎	篱	狸	离	漓	理	李	里
C0F0	鲤	礼	莉	荔	吏	栗	丽	厉	励	砾	历	利	傈	例	俐	
C1A0		痢	立	粒	沥	隶	力	璃	哩	俩	联	莲	连	镰	廉	怜
C1B0	涟	帘	敛	脸	链	恋	炼	练	粮	凉	梁	粱	良	两	辆	量
C1C0	晾	亮	谅	撩	聊	僚	疗	燎	寥	辽	潦	了	撂	镣	廖	料
C1D0	列	裂	烈	劣	猎	琳	林	磷	霖	临	邻	鳞	淋	凛	赁	吝
C1E0	拎	玲	菱	零	龄	铃	伶	羚	凌	灵	陵	岭	领	另	令	溜
C1F0	琉	榴	硫	馏	留	刘	瘤	流	柳	六	龙	聋	咙	笼	窿	
C2A0		隆	垄	拢	陇	楼	娄	搂	篓	漏	陋	芦	卢	颅	庐	炉
C2B0	掳	卤	虏	鲁	麓	碌	露	路	赂	鹿	潞	禄	录	陆	戮	驴
C2C0	吕	铝	侣	旅	履	屡	缕	虑	氯	律	率	滤	绿	峦	挛	孪
C2D0	滦	卵	乱	掠	略	抡	轮	伦	仑	沦	纶	论	萝	螺	罗	逻
C2E0	锣	箩	骡	裸	落	洛	骆	络	妈	麻	玛	码	蚂	马	骂	嘛
C2F0	吗	埋	买	麦	卖	迈	脉	瞒	馒	蛮	满	蔓	曼	慢	漫	
C3A0		谩	芒	茫	盲	氓	忙	莽	猫	茅	锚	毛	矛	铆	卯	茂
C3B0	冒	帽	貌	贸	么	玫	枚	梅	酶	霉	煤	没	眉	媒	镁	每

	+0	+1	+2	+3	+4	+5	+6	+7	+8	+9	+A	+B	+C	+D	+E	+F
C3C0	美	昧	寐	妹	媚	门	闷	们	萌	蒙	檬	盟	锰	猛	梦	孟
C3D0	眯	醚	靡	糜	迷	谜	弥	米	秘	觅	泌	蜜	密	幂	棉	眠
C3E0	绵	冕	免	勉	娩	缅	面	苗	描	瞄	藐	秒	渺	庙	妙	蔑
C3F0	灭	民	抿	皿	敏	悯	闽	明	螟	鸣	铭	名	命	谬	摸	
C4A0		摹	蘑	模	膜	磨	摩	魔	抹	末	莫	墨	默	沫	漠	寞
C4B0	陌	谋	牟	某	拇	牡	亩	姆	母	墓	暮	幕	募	慕	木	目
C4C0	睦	牧	穆	拿	哪	呐	钠	那	娜	纳	氖	乃	奶	耐	奈	南
C4D0	男	难	囊	挠	脑	恼	闹	淖	呢	馁	内	嫩	能	妮	霓	倪
C4E0	泥	尼	拟	你	匿	腻	逆	溺	蔫	拈	年	碾	撵	捻	念	娘
C4F0	酿	鸟	尿	捏	聂	孽	啮	镊	镍	涅	您	柠	狞	凝	宁	
C5A0		拧	泞	牛	扭	钮	纽	脓	浓	农	弄	奴	努	怒	女	暖
C5B0	虐	疟	挪	懦	糯	诺	哦	欧	鸥	殴	藕	呕	偶	沤	啪	趴
C5C0	爬	帕	怕	琶	拍	排	牌	徘	湃	派	攀	潘	盘	磐	盼	畔
C5D0	判	叛	乓	庞	旁	耪	胖	抛	咆	刨	炮	袍	跑	泡	呸	胚
C5E0	培	裴	赔	陪	配	佩	沛	喷	盆	砰	抨	烹	澎	彭	蓬	棚
C5F0	硼	篷	膨	朋	鹏	捧	碰	坯	砒	霹	批	披	劈	琵	毗	
C6A0		啤	脾	疲	皮	匹	痞	僻	屁	譬	篇	偏	片	骗	飘	漂
C6B0	瓢	票	撇	瞥	拼	频	贫	品	聘	乒	坪	苹	萍	平	凭	瓶
C6C0	评	屏	坡	泼	颇	婆	破	魄	迫	粕	剖	扑	铺	仆	莆	葡
C6D0	菩	蒲	埔	朴	圃	普	浦	谱	曝	瀑	期	欺	栖	戚	妻	七
C6E0	凄	漆	柒	沏	其	棋	奇	歧	畦	崎	脐	齐	旗	祈	祁	骑
C6F0	起	岂	乞	企	启	契	砌	器	气	迄	弃	汽	泣	讫	掐	
C7A0		恰	洽	牵	扦	钎	铅	千	迁	签	仟	谦	乾	黔	钱	钳
C7B0	前	潜	遣	浅	谴	堑	嵌	欠	歉	枪	呛	腔	羌	墙	蔷	强
C7C0	抢	橇	锹	敲	悄	桥	瞧	乔	侨	巧	鞘	撬	翘	峭	俏	窍
C7D0	切	茄	且	怯	窃	钦	侵	亲	秦	琴	勤	芹	擒	禽	寝	沁
C7E0	青	轻	氢	倾	卿	清	擎	晴	氰	情	顷	请	庆	琼	穷	秋
C7F0	丘	邱	球	求	囚	酋	泅	趋	区	蛆	曲	躯	屈	驱	渠	
C8A0		取	娶	龋	趣	去	圈	颧	权	醛	泉	全	痊	拳	犬	券
C8B0	劝	缺	炔	瘸	却	鹊	榷	确	雀	裙	群	然	燃	冉	染	瓤
C8C0	壤	攘	嚷	让	饶	扰	绕	惹	热	壬	仁	人	忍	韧	任	认
C8D0	刃	妊	纫	扔	仍	日	戎	茸	蓉	荣	融	熔	溶	容	绒	冗
C8E0	揉	柔	肉	茹	蠕	儒	孺	如	辱	乳	汝	入	褥	软	阮	蕊
C8F0	瑞	锐	闰	润	若	弱	撒	洒	萨	腮	鳃	塞	赛	三	叁	
C9A0		伞	散	桑	嗓	丧	搔	骚	扫	嫂	瑟	色	涩	森	僧	莎

	+0	+1	+2	+3	+4	+5	+6	+7	+8	+9	+A	+B	+C	+D	+E	+F
C9B0	砂	杀	刹	沙	纱	傻	啥	煞	筛	晒	珊	苫	杉	山	删	煽
C9C0	衫	闪	陕	擅	赡	膳	善	汕	扇	缮	墒	伤	商	赏	晌	上
C9D0	尚	裳	梢	捎	稍	烧	芍	勺	韶	少	哨	邵	绍	奢	赊	蛇
C9E0	舌	舍	赦	摄	射	慑	涉	社	设	砷	申	呻	伸	身	深	娠
C9F0	绅	神	沈	审	婶	甚	肾	慎	渗	声	生	甥	牲	升	绳	
CAA0		省	盛	剩	胜	圣	师	失	狮	施	湿	诗	尸	虱	十	石
CAB0	拾	时	什	食	蚀	实	识	史	矢	使	屎	驶	始	式	示	士
CAC0	世	柿	事	拭	誓	逝	势	是	嗜	噬	适	仕	侍	释	饰	氏
CAD0	市	恃	室	视	试	收	手	首	守	寿	授	售	受	瘦	兽	蔬
CAE0	枢	梳	殊	抒	输	叔	舒	淑	疏	书	赎	孰	熟	薯	暑	曙
CAF0	署	蜀	黍	鼠	属	术	述	树	束	戍	竖	墅	庶	数	漱	
CBA0		恕	刷	耍	摔	衰	甩	帅	栓	拴	霜	双	爽	谁	水	睡
CBB0	税	吮	瞬	顺	舜	说	硕	朔	烁	斯	撕	嘶	思	私	司	丝
CBC0	死	肆	寺	嗣	四	伺	似	饲	巳	松	耸	怂	颂	送	宋	讼
CBD0	诵	搜	艘	擞	嗽	苏	酥	俗	素	速	粟	僳	塑	溯	宿	诉
CBE0	肃	酸	蒜	算	虽	隋	随	绥	髓	碎	岁	穗	遂	隧	祟	孙
CBF0	损	笋	蓑	梭	唆	缩	琐	索	锁	所	塌	他	它	她	塔	
CCA0		獭	挞	蹋	踏	胎	苔	抬	台	泰	酞	太	态	汰	坍	摊
CCB0	贪	瘫	滩	坛	檀	痰	潭	谭	谈	坦	毯	袒	碳	探	叹	炭
CCC0	汤	塘	搪	堂	棠	膛	唐	糖	倘	躺	淌	趟	烫	掏	涛	滔
CCD0	绦	萄	桃	逃	淘	陶	讨	套	特	藤	腾	疼	誊	梯	剔	踢
CCE0	锑	提	题	蹄	啼	体	替	嚏	惕	涕	剃	屉	天	添	填	田
CCF0	甜	恬	舔	腆	挑	条	迢	眺	跳	贴	铁	帖	厅	听	烃	
CDA0		汀	廷	停	亭	庭	挺	艇	通	桐	酮	瞳	同	铜	彤	童
CDB0	桶	捅	筒	统	痛	偷	投	头	透	凸	秃	突	图	徒	途	涂
CDC0	屠	土	吐	兔	湍	团	推	颓	腿	蜕	褪	退	吞	屯	臀	拖
CDD0	托	脱	鸵	陀	驮	驼	椭	妥	拓	唾	挖	哇	蛙	洼	娃	瓦
CDE0	袜	歪	外	豌	弯	湾	玩	顽	丸	烷	完	碗	挽	晚	皖	惋
CDF0	宛	婉	万	腕	汪	王	亡	枉	网	往	旺	望	忘	妄	威	
CEA0		巍	微	危	韦	违	桅	围	唯	惟	为	潍	维	苇	萎	委
CEB0	伟	伪	尾	纬	未	蔚	味	畏	胃	喂	魏	位	渭	谓	尉	慰
CEC0	卫	瘟	温	蚊	文	闻	纹	吻	稳	紊	问	嗡	翁	瓮	挝	蜗
CED0	涡	窝	我	斡	卧	握	沃	巫	呜	钨	乌	污	诬	屋	无	芜
CEE0	梧	吾	吴	毋	武	五	捂	午	舞	伍	侮	坞	戊	雾	晤	物
CEF0	勿	务	悟	误	昔	熙	析	西	硒	矽	晰	嘻	吸	锡	牺	

	+0	+1	+2	+3	+4	+5	+6	+7	+8	+9	+A	+B	+C	+D	+E	+F
CFA0		稀	息	希	悉	膝	夕	惜	熄	烯	溪	汐	犀	檄	袭	席
CFB0	习	媳	喜	铣	洗	系	隙	戏	细	瞎	虾	匣	霞	辖	暇	峡
CFC0	侠	狭	下	厦	夏	吓	掀	锨	先	仙	鲜	纤	咸	贤	衔	舷
CFD0	闲	涎	弦	嫌	显	险	现	献	县	腺	馅	羡	宪	陷	限	线
CFE0	相	厢	镶	香	箱	襄	湘	乡	翔	祥	详	想	响	享	项	巷
CFF0	橡	像	向	象	萧	硝	霄	削	哮	嚣	销	消	宵	淆	晓	
D0A0		小	孝	校	肖	啸	笑	效	楔	些	歇	蝎	鞋	协	挟	携
D0B0	邪	斜	胁	谐	写	械	卸	蟹	懈	泄	泻	谢	屑	薪	芯	锌
D0C0	欣	辛	新	忻	心	信	衅	星	腥	猩	惺	兴	刑	型	形	邢
D0D0	行	醒	幸	杏	性	姓	兄	凶	胸	匈	汹	雄	熊	休	修	羞
D0E0	朽	嗅	锈	秀	袖	绣	墟	戌	需	虚	嘘	须	徐	许	蓄	酗
D0F0	叙	旭	序	畜	恤	絮	婿	绪	续	轩	喧	宣	悬	旋	玄	
D1A0		选	癣	眩	绚	靴	薛	学	穴	雪	血	勋	熏	循	旬	询
D1B0	寻	驯	巡	殉	汛	训	讯	逊	迅	压	押	鸦	鸭	呀	丫	芽
D1C0	牙	蚜	崖	衙	涯	雅	哑	亚	讶	焉	咽	阉	烟	淹	盐	严
D1D0	研	蜒	岩	延	言	颜	阎	炎	沿	奄	掩	眼	衍	演	艳	堰
D1E0	燕	厌	砚	雁	唁	彦	焰	宴	谚	验	殃	央	鸯	秧	杨	扬
D1F0	佯	疡	羊	洋	阳	氧	仰	痒	养	样	漾	邀	腰	妖	瑶	
D2A0		摇	尧	遥	窑	谣	姚	咬	舀	药	要	耀	椰	噎	耶	爷
D2B0	野	冶	也	页	掖	业	叶	曳	腋	夜	液	一	壹	医	揖	铱
D2C0	依	伊	衣	颐	夷	遗	移	仪	胰	疑	沂	宜	姨	彝	椅	蚁
D2D0	倚	已	乙	矣	以	艺	抑	易	邑	屹	亿	役	臆	逸	肄	疫
D2E0	亦	裔	意	毅	忆	义	益	溢	诣	议	谊	译	异	翼	翌	绎
D2F0	茵	荫	因	殷	音	阴	姻	吟	银	淫	寅	饮	尹	引	隐	
D3A0		印	英	樱	婴	鹰	应	缨	莹	萤	营	荧	蝇	迎	赢	盈
D3B0	影	颖	硬	映	哟	拥	佣	臃	痈	庸	雍	踊	蛹	咏	泳	涌
D3C0	永	恿	勇	用	幽	优	悠	忧	尤	由	邮	铀	犹	油	游	酉
D3D0	有	友	右	佑	釉	诱	又	幼	迂	淤	于	盂	榆	虞	愚	舆
D3E0	余	俞	逾	鱼	愉	渝	渔	隅	予	娱	雨	与	屿	禹	宇	语
D3F0	羽	玉	域	芋	郁	吁	遇	喻	峪	御	愈	欲	狱	育	誉	
D4A0		浴	寓	裕	预	豫	驭	鸳	渊	冤	元	垣	袁	原	援	辕
D4B0	园	员	圆	猿	源	缘	远	苑	愿	怨	院	曰	约	越	跃	钥
D4C0	岳	粤	月	悦	阅	耘	云	郧	匀	陨	允	运	蕴	酝	晕	韵
D4D0	孕	匝	砸	杂	栽	哉	灾	宰	载	再	在	咱	攒	暂	赞	赃
D4E0	脏	葬	遭	糟	凿	藻	枣	早	澡	蚤	躁	噪	造	皂	灶	燥

	+0	+1	+2	+3	+4	+5	+6	+7	+8	+9	+A	+B	+C	+D	+E	+F
D4F0	责	择	则	泽	贼	怎	增	憎	曾	赠	扎	喳	渣	札	轧	
D5A0		铡	闸	眨	栅	榨	咋	乍	炸	诈	摘	斋	宅	窄	债	寨
D5B0	瞻	毡	詹	粘	沾	盏	斩	辗	崭	展	蘸	栈	占	战	站	湛
D5C0	绽	樟	章	彰	漳	张	掌	涨	杖	丈	帐	账	仗	胀	瘴	障
D5D0	招	昭	找	沼	赵	照	罩	兆	肇	召	遮	折	哲	蛰	辙	者
D5E0	锗	蔗	这	浙	珍	斟	真	甄	砧	臻	贞	针	侦	枕	疹	诊
D5F0	震	振	镇	阵	蒸	挣	睁	征	狰	争	怔	整	拯	正	政	
D6A0		帧	症	郑	证	芝	枝	支	吱	蜘	知	肢	脂	汁	之	织
D6B0	职	直	植	殖	执	值	侄	址	指	止	趾	只	旨	纸	志	挚
D6C0	掷	至	致	置	帜	峙	制	智	秩	稚	质	炙	痔	滞	治	窒
D6D0	中	盅	忠	钟	衷	终	种	肿	重	仲	众	舟	周	州	洲	诌
D6E0	粥	轴	肘	帚	咒	皱	宙	昼	骤	珠	株	蛛	朱	猪	诸	诛
D6F0	逐	竹	烛	煮	拄	瞩	嘱	主	著	柱	助	蛀	贮	铸	筑	
D7A0		住	注	祝	驻	抓	爪	拽	专	砖	转	撰	赚	篆	桩	庄
D7B0	装	妆	撞	壮	状	椎	锥	追	赘	坠	缀	谆	准	捉	拙	卓
D7C0	桌	琢	茁	酌	啄	着	灼	浊	兹	咨	资	姿	滋	淄	孜	紫
D7D0	仔	籽	滓	子	自	渍	字	鬃	棕	踪	宗	综	总	纵	邹	走
D7E0	奏	揍	租	足	卒	族	祖	诅	阻	组	钻	纂	嘴	醉	最	罪
D7F0	尊	遵	昨	左	佐	柞	做	作	坐	座						
D8A0		亍	丌	兀	丐	廿	卅	丕	亘	丞	鬲	孬	噩	丨	禺	丿
D8B0	匕	乇	夭	爻	卮	氐	囟	胤	馗	毓	睾	鼗	丶	亟	鼐	乜
D8C0	乩	亓	芈	孛	啬	嘏	仄	厍	厝	厣	厥	厮	靥	赝	匚	叵
D8D0	匦	匮	匾	赜	卦	卣	刂	刈	刎	刭	刳	刿	剀	剌	剞	剡
D8E0	剜	蒯	剽	劂	劁	劐	劓	冂	罔	亻	仃	仉	仂	仨	仡	仫
D8F0	仞	伛	仳	伢	佤	仵	伥	伧	伉	伫	佞	佧	攸	佚	佝	
D9A0		佟	佗	伲	伽	佶	佴	侑	侉	侃	侏	佾	佻	侪	佼	侬
D9B0	侔	俦	俨	俪	俅	俚	俣	俜	俑	俟	俸	倩	偌	俳	倬	倏
D9C0	倮	倭	俾	倜	倌	倥	倨	偾	偃	偕	偈	偎	偬	偻	傥	傧
D9D0	傩	傺	僖	儆	僭	僬	僦	僮	儇	儋	仝	氽	佘	佥	俎	龠
D9E0	汆	籴	兮	巽	黉	馘	冁	夔	勹	匍	訇	匐	凫	夙	兕	亠
D9F0	兖	亳	衮	袤	亵	脔	裒	禀	嬴	蠃	羸	冫	冱	冽	冼	
DAA0		凇	冖	冢	冥	讠	讦	讧	讪	讴	讵	讷	诂	诃	诋	诏
DAB0	诎	诒	诓	诔	诖	诘	诙	诜	诟	诠	诤	诨	诩	诮	诰	诳
DAC0	诶	诹	诼	诿	谀	谂	谄	谇	谌	谏	谑	谒	谔	谕	谖	谙
DAD0	谛	谘	谝	谟	谠	谡	谥	谧	谪	谫	谮	谯	谲	谳	谵	谶

	+0	+1	+2	+3	+4	+5	+6	+7	+8	+9	+A	+B	+C	+D	+E	+F
DAE0	卩	卺	阝	阢	阡	阱	阪	阽	阼	陂	陉	陔	陟	陧	陬	陲
DAF0	陴	隈	隍	隗	隰	邗	邛	邝	邙	邬	邡	邴	邳	邶	邺	
DBA0		邸	邰	郏	郅	邾	郐	郄	郇	郓	郦	郢	郜	郗	郛	郫
DBB0	郯	郾	鄄	鄢	鄞	鄣	鄱	鄯	鄹	酃	酆	刍	奂	劢	劬	劭
DBC0	劾	哿	勐	勖	勰	叟	燮	矍	廴	凵	凼	鬯	厶	弁	畚	巯
DBD0	坌	垩	垡	塾	墼	壅	壑	圩	圬	圪	圳	圹	圮	圯	坜	圻
DBE0	坂	坩	垅	坫	垆	坼	坻	坨	坭	坶	坳	垭	垤	垌	垲	埏
DBF0	垧	垴	垓	垠	埕	埘	埚	埙	埒	垸	埴	埯	埸	埤	埝	
DCA0		堋	堍	埽	埭	堀	堞	堙	塄	堠	塥	塬	墁	墉	墚	墀
DCB0	馨	鼙	懿	艹	艽	艿	芏	芊	芨	芄	芎	芑	芗	芙	芫	芸
DCC0	芾	芰	苈	苊	苣	芘	芷	芮	苋	苌	苁	芩	芴	芡	芪	芟
DCD0	苄	苎	芤	苡	茉	苷	苤	茏	茇	苜	苴	苒	苘	茌	苻	苓
DCE0	茑	茚	茆	茔	茕	苠	苕	茜	荑	荛	荜	茈	莒	茼	茴	茱
DCF0	莛	荞	茯	荏	荇	荃	荟	荀	茗	荠	茭	茺	茳	荦	荥	
DDA0		荨	茛	荩	荬	荪	荭	荮	莰	荸	莳	莴	莠	莪	莓	莜
DDB0	莅	荼	莶	莩	荽	莸	荻	莘	莞	莨	莺	莼	菁	萁	菥	菘
DDC0	堇	萘	萋	菝	菽	菖	萜	萸	萑	萆	菔	菟	萏	萃	菸	菹
DDD0	菪	菅	菀	萦	菰	菡	葜	葑	葚	葙	葳	蒇	蒈	葺	蒉	葸
DDE0	萼	葆	葩	葶	蒌	蒎	萱	葭	蓁	蓍	蓐	蓦	蒽	蓓	蓊	蒿
DDF0	蒺	蓠	蒡	蒹	蒴	蒗	蓥	蓣	蔌	甍	蔸	蓰	蔹	蔟	蔺	
DEA0		蕖	蔻	蓿	蓼	蕙	蕈	蕨	蕤	蕞	蕺	瞢	蕃	蕲	蕻	薤
DEB0	薨	薇	薏	蕹	薮	薜	薅	薹	薷	薰	藓	藁	藜	藿	蘧	蘅
DEC0	蘩	蘖	蘼	廾	弈	夼	奁	耷	奕	奚	奘	匏	尢	尥	尬	尴
DED0	扌	扪	抟	抻	拊	拚	拗	拮	挢	拶	挹	捋	捃	掭	揶	捱
DEE0	捺	掎	掴	捭	掬	掊	捩	掮	掼	揲	揸	揠	揿	揄	揞	揎
DEF0	摒	揆	掾	摅	摁	搋	搛	搠	搌	搦	搡	摞	撄	摭	撖	
DFA0		摺	撷	撸	撙	撺	擀	擐	擗	擤	擢	攉	攥	攮	弋	忒
DFB0	甙	弑	卟	叱	叽	叩	叨	叻	吒	吖	吆	呋	呒	呓	呔	呖
DFC0	呃	吡	呗	呙	吣	吲	咂	咔	呷	呱	呤	咚	咛	咄	呶	呦
DFD0	咝	哐	咭	哂	咴	哒	咧	咦	哓	哔	呲	咣	哕	咻	咿	哌
DFE0	哙	哚	哜	咩	咪	咤	哝	哏	哞	唛	哧	唠	哽	唔	哳	唢
DFF0	唣	唏	唑	唧	唪	啧	喏	喵	啉	啭	啁	啕	唿	啐	唼	
E0A0		唷	啖	啵	啶	啷	唳	唰	啜	喋	嗒	喃	喱	喹	喈	喁
E0B0	喟	啾	嗖	喑	啻	嗟	喽	喾	喔	喙	嗪	嗷	嗉	嘟	嗑	嗫
E0C0	嗬	嗔	嗦	嗝	嗄	嗯	嗥	嗲	嗳	嗌	嗍	嗨	嗵	嗤	辔	嘞

	+0	+1	+2	+3	+4	+5	+6	+7	+8	+9	+A	+B	+C	+D	+E	+F
E0D0	嘈	嘌	嘁	嘤	嘣	嗾	嘀	嘧	嘭	噘	嘹	噗	嘬	噍	噢	噙
E0E0	噜	噌	噔	嚆	噤	噱	噫	噻	噼	嚅	嚓	嚯	囔	囗	囝	囡
E0F0	囵	囫	囹	囿	圄	圊	圉	圜	帏	帙	帔	帑	帱	帻	帼	
E1A0		帷	幄	幔	幛	幞	幡	岌	屺	岍	岐	岖	岈	岘	岙	岑
E1B0	岚	岜	岵	岢	岽	岬	岫	岱	岣	峁	岷	峄	峒	峤	峋	峥
E1C0	崂	崃	崧	崦	崮	崤	崞	崆	崛	嵘	崾	崴	崽	嵬	嵛	嵯
E1D0	嵝	嵫	嵋	嵊	嵩	嵴	嶂	嶙	嶝	豳	嶷	巅	彳	彷	徂	徇
E1E0	徉	後	徕	徙	徜	徨	徭	徵	徼	衢	彡	犭	犰	犴	犷	犸
E1F0	狃	狁	狎	狍	狒	狨	狯	狩	狲	狴	狷	猁	狳	猃	狺	
E2A0		狻	猗	猓	猡	猊	猞	猝	猕	猢	猹	猥	猬	猸	猱	獐
E2B0	獍	獗	獠	獬	獯	獾	舛	夥	飧	夤	夂	饣	饧	饨	饩	饪
E2C0	饫	饬	饴	饷	饽	馀	馄	馇	馊	馍	馐	馑	馓	馔	馕	庀
E2D0	庑	庋	庖	庥	庠	庹	庵	庾	庳	赓	廒	廑	廛	廨	廪	膺
E2E0	忄	忉	忖	忏	怃	忮	怄	忡	忤	忾	怅	怆	忪	忭	忸	怙
E2F0	怵	怦	怛	怏	怍	怩	怫	怊	怿	怡	恸	恹	恻	恺	恂	
E3A0		恪	恽	悖	悚	悭	悝	悃	悒	悌	悛	惬	悻	悱	惝	惘
E3B0	惆	惚	悴	愠	愦	愕	愣	惴	愀	愎	愫	慊	慵	憬	憔	憧
E3C0	憷	懔	懵	忝	隳	闩	闫	闱	闳	闵	闶	闼	闾	阃	阄	阆
E3D0	阈	阊	阋	阌	阍	阏	阒	阕	阖	阗	阙	阚	丬	爿	戕	氵
E3E0	汔	汜	汊	沣	沅	沐	沔	沌	汨	汩	汴	汶	沆	沩	泐	泔
E3F0	沭	泷	泸	泱	泗	沲	泠	泖	泺	泫	泮	沱	泓	泯	泾	
E4A0		洹	洧	洌	浃	浈	洇	洄	洙	洎	洫	浍	洮	洵	洚	浏
E4B0	浒	浔	洳	涑	浯	涞	涠	浞	涓	涔	浜	浠	浼	浣	渚	淇
E4C0	淅	淞	渎	涿	淠	渑	淦	淝	淙	渖	涫	渌	涮	渫	湮	湎
E4D0	湫	溲	湟	溆	湓	湔	渲	渥	湄	滟	溱	溘	滠	漭	滢	溥
E4E0	溧	溽	溻	溷	滗	溴	滏	溏	滂	溟	潢	潆	潇	漤	漕	滹
E4F0	漯	漶	潋	潴	漪	漉	漩	澉	澍	澌	潸	潲	潼	潺	濑	
E5A0		濉	澧	澹	澶	濂	濡	濮	濞	濠	濯	瀚	瀣	瀛	瀹	瀵
E5B0	灏	灞	宀	宄	宕	宓	宥	宸	甯	骞	搴	寤	寮	褰	寰	蹇
E5C0	謇	辶	迓	迕	迥	迮	迤	迩	迦	迳	迨	逅	逄	逋	逦	逑
E5D0	逍	逖	逡	逵	逶	逭	逯	遄	遑	遒	遐	遨	遘	遢	遛	暹
E5E0	遴	遽	邂	邈	邃	邋	彐	彗	彖	彘	尻	咫	屐	屙	孱	屣
E5F0	屦	羼	弪	弩	弭	艴	弼	鬻	屮	妁	妃	妍	妩	妪	妣	
E6A0		妗	姊	妫	妞	妤	姒	妲	妯	姗	妾	娅	娆	姝	娈	姣
E6B0	姘	姹	娌	娉	娲	娴	娑	娣	娓	婀	婧	婊	婕	娼	婢	婵

	+0	+1	+2	+3	+4	+5	+6	+7	+8	+9	+A	+B	+C	+D	+E	+F
E6C0	胬	媪	媛	婷	婺	媾	嫫	媲	嫒	嫔	媸	嫠	嫣	嫱	嫖	嫦
E6D0	嫘	嫜	嬉	嬗	嬖	嬲	嬷	孀	尕	尜	孚	孥	孳	孑	孓	孢
E6E0	驵	驷	驸	驺	驿	驽	骀	骁	骅	骈	骊	骐	骒	骓	骖	骘
E6F0	骛	骜	骝	骟	骠	骢	骣	骥	骧	纟	纡	纣	纥	纨	纩	
E7A0		纭	纰	纾	绀	绁	绂	绉	绋	绌	绐	绔	绗	绛	绠	绡
E7B0	绨	绫	绮	绯	绱	绲	缍	绶	绺	绻	绾	缁	缂	缃	缇	缈
E7C0	缋	缌	缏	缑	缒	缗	缙	缜	缛	缟	缡	缢	缣	缤	缥	缦
E7D0	缧	缪	缫	缬	缭	缯	缰	缱	缲	缳	缵	幺	畿	巛	甾	邕
E7E0	玎	玑	玮	玢	玟	珏	珂	珑	玷	玳	珀	珉	珈	珥	珙	顼
E7F0	琊	珩	珧	珞	玺	珲	琏	琪	瑛	琦	琥	琨	琰	琮	琬	
E8A0		琛	琚	瑁	瑜	瑗	瑕	瑙	瑷	瑭	瑾	璜	璎	璀	璁	璇
E8B0	璋	璞	璨	璩	璐	璧	瓒	璺	韪	韫	韬	杌	杓	杞	杈	杩
E8C0	枥	枇	杪	杳	枘	枧	杵	枨	枞	枭	枋	杷	杼	柰	栉	柘
E8D0	栊	柩	枰	栌	柙	枵	柚	枳	柝	栀	柃	枸	柢	栎	柁	柽
E8E0	栲	栳	桠	桡	桎	桢	桄	桤	梃	栝	桕	桦	桁	桧	桀	栾
E8F0	桊	桉	栩	梵	梏	桴	桷	梓	桫	棂	楮	棼	椟	椠	棹	
E9A0		椤	棰	椋	椁	楗	棣	椐	楱	椹	楠	楂	楝	榄	楫	榀
E9B0	榘	楸	椴	槌	榇	榈	槎	榉	楦	楣	楹	榛	榧	榻	榫	榭
E9C0	槔	榱	槁	槊	槟	榕	槠	榍	槿	樯	槭	樗	樘	橥	槲	橄
E9D0	樾	檠	橐	橛	樵	檎	橹	樽	樨	橘	橼	檑	檐	檩	檗	檫
E9E0	猷	獒	殁	殂	殇	殄	殒	殓	殍	殚	殛	殡	殪	轫	轭	轱
E9F0	轲	轳	轵	轶	轸	轷	轹	轺	轼	轾	辁	辂	辄	辇	辋	
EAA0		辍	辎	辏	辘	辚	軎	戋	戗	戛	戟	戢	戡	戥	戤	戬
EAB0	臧	瓯	瓴	瓿	甏	甑	甓	攴	旮	旯	旰	昊	昙	杲	昃	昕
EAC0	昀	炅	曷	昝	昴	昱	昶	昵	耆	晟	晔	晁	晏	晖	晡	晗
EAD0	晷	暄	暌	暧	暝	暾	曛	曜	曦	曩	贲	贳	贶	贻	贽	赀
EAE0	赅	赆	赈	赉	赇	赍	赕	赙	觇	觊	觋	觌	觎	觏	觐	觑
EAF0	牮	犟	牝	牦	牯	牾	牿	犄	犋	犍	犏	犒	挈	挲	掰	
EBA0		搿	擘	耄	毪	毳	毽	毵	毹	氅	氇	氆	氍	氕	氘	氙
EBB0	氚	氡	氩	氤	氪	氲	攵	敕	敫	牍	牒	牖	爰	虢	刖	肟
EBC0	肜	肓	肼	朊	肽	肱	肫	肭	肴	肷	胧	胨	胩	胪	胛	胂
EBD0	胄	胙	胍	胗	朐	胝	胫	胱	胴	胭	脍	脎	胲	胼	朕	脒
EBE0	豚	脶	脞	脬	脘	脲	腈	腌	腓	腴	腙	腚	腱	腠	腩	腼
EBF0	腽	腭	腧	塍	媵	膈	膂	膑	滕	膣	膪	臌	朦	臊	膻	
ECA0		臁	膦	欤	欷	欹	歃	歆	歙	飑	飒	飓	飕	飙	飚	殳

	+0	+1	+2	+3	+4	+5	+6	+7	+8	+9	+A	+B	+C	+D	+E	+F
ECB0	彀	毂	觳	斐	齑	斓	於	旆	旄	旃	旌	旎	旒	旖	炀	炜
ECC0	炖	炝	炻	烀	炷	炫	炱	烨	烊	焐	焓	焖	焯	焱	煳	煜
ECD0	煨	煅	煲	煊	煸	煺	熘	熳	熵	熨	熠	燠	燔	燧	燹	爝
ECE0	爨	灬	焘	煦	熹	戾	戽	扃	扈	扉	礻	祀	祆	祉	祛	祜
ECF0	祓	祚	祢	祗	祠	祯	祧	祺	禅	禊	禚	禧	禳	忑	忐	
EDA0		怼	恝	恚	恧	恁	恙	恣	悫	愆	愍	慝	憩	憝	懋	懑
EDB0	戆	肀	聿	沓	泶	淼	矶	矸	砀	砉	砗	砘	砑	斫	砭	砜
EDC0	砝	砹	砺	砻	砟	砼	砥	砬	砣	砩	硎	硭	硖	硗	砦	硐
EDD0	硇	硌	硪	碛	碓	碚	碇	碜	碡	碣	碲	碹	碥	磔	磙	磉
EDE0	磬	磲	礅	磴	礓	礤	礞	礴	龛	黹	黻	黼	盱	眄	眍	盹
EDF0	眇	眈	眚	眢	眙	眭	眦	眵	眸	睐	睑	睇	睃	睚	睨	
EEA0		睢	睥	睿	瞍	睽	瞀	瞌	瞑	瞟	瞠	瞰	瞵	瞽	町	畀
EEB0	畎	畋	畈	畛	畲	畹	疃	罘	罡	罟	詈	罨	罴	罱	罹	羁
EEC0	罾	盍	盥	蠲	钅	钆	钇	钋	钊	钌	钍	钏	钐	钔	钗	钕
EED0	钚	钛	钜	钣	钤	钫	钪	钭	钬	钯	钰	钲	钴	钶	钷	钸
EEE0	钹	钺	钼	钽	钿	铄	铈	铉	铊	铋	铌	铍	铎	铐	铑	铒
EEF0	铕	铖	铗	铙	铘	铛	铞	铟	铠	铢	铤	铥	铧	铨	铪	
EFA0		铩	铫	铮	铯	铳	铴	铵	铷	铹	铼	铽	铿	锃	锂	锆
EFB0	锇	锉	锊	锍	锎	锏	锒	锓	锔	锕	锖	锘	锛	锝	锞	锟
EFC0	锢	锪	锫	锩	锬	锱	锲	锴	锶	锷	锸	锼	锾	锿	镂	锵
EFD0	镄	镅	镆	镉	镌	镎	镏	镒	镓	镔	镖	镗	镘	镙	镛	镞
EFE0	镟	镝	镡	镢	镤	镥	镦	镧	镨	镩	镪	镫	镬	镯	镱	镲
EFF0	镳	锺	矧	矬	雉	秕	秭	秣	秫	稆	嵇	稃	稂	稞	稔	
F0A0		稹	稷	穑	黏	馥	穰	皈	皎	皓	皙	皤	瓞	瓠	甬	鸠
F0B0	鸢	鸨	鸩	鸪	鸫	鸬	鸲	鸱	鸶	鸸	鸷	鸹	鸺	鸾	鹁	鹂
F0C0	鹄	鹆	鹇	鹈	鹉	鹋	鹌	鹎	鹑	鹕	鹗	鹚	鹛	鹜	鹞	鹣
F0D0	鹦	鹧	鹨	鹩	鹪	鹫	鹬	鹱	鹭	鹳	疒	疔	疖	疠	疝	疬
F0E0	疣	疳	疴	疸	痄	疱	疰	痃	痂	痖	痍	痣	痨	痦	痤	痫
F0F0	痧	瘃	痱	痼	痿	瘐	瘀	瘅	瘌	瘗	瘊	瘥	瘘	瘕	瘙	
F1A0		瘛	瘼	瘢	瘠	癀	瘭	瘰	瘿	瘵	癃	瘾	瘳	癍	癞	癔
F1B0	癜	癖	癫	癯	翊	竦	穸	穹	窀	窆	窈	窕	窦	窠	窬	窨
F1C0	窭	窳	衤	衩	衲	衽	衿	袂	袢	裆	袷	袼	裉	裢	裎	裣
F1D0	裥	裱	褚	裼	裨	裾	裰	褡	褙	褓	褛	褊	褴	褫	褶	襁
F1E0	襦	襻	疋	胥	皲	皴	矜	耒	耔	耖	耜	耠	耢	耥	耦	耧
F1F0	耩	耨	耱	耋	耵	聃	聆	聍	聒	聩	聱	覃	顸	颀	颃	

	+0	+1	+2	+3	+4	+5	+6	+7	+8	+9	+A	+B	+C	+D	+E	+F
F2A0		颉	颌	颍	颏	颔	颚	颛	颞	颟	颡	颢	颥	颦	虍	虔
F2B0	虬	虮	虿	虺	虼	虻	蚨	蚍	蚋	蚬	蚝	蚧	蚣	蚪	蚓	蚩
F2C0	蚶	蛄	蚵	蛎	蚰	蚺	蚱	蚯	蛉	蛏	蚴	蛩	蛱	蛲	蛭	蛳
F2D0	蛐	蜓	蛞	蛴	蛟	蛘	蛑	蜃	蜇	蛸	蜈	蜊	蜍	蜉	蜣	蜻
F2E0	蜞	蜥	蜮	蜚	蜾	蝈	蜴	蜱	蜩	蜷	蜿	螂	蜢	蝽	蝾	蝻
F2F0	蝠	蝰	蝌	蝮	螋	蝓	蝣	蝼	蝤	蝙	蝥	螓	螯	螨	蟒	
F3A0		蟆	螈	螅	螭	螗	螃	螫	蟥	螬	螵	螳	蟋	蟓	螽	蟑
F3B0	蟀	蟊	蟛	蟪	蟠	蟮	蠖	蠓	蟾	蠊	蠛	蠡	蠹	蠼	缶	罂
F3C0	罄	罅	舐	竺	竽	笈	笃	笄	笕	笊	笫	笏	筇	笸	笪	笙
F3D0	笮	笱	笠	笥	笤	笳	笾	笞	筘	筚	筅	筵	筌	筝	筠	筮
F3E0	筻	筢	筲	筱	箐	箦	箧	箸	箬	箝	箨	箅	箪	箜	箢	箫
F3F0	箴	篑	篁	篌	篝	篚	篥	篦	篪	簌	篾	篼	簏	簖	簋	
F4A0		簟	簪	簦	簸	籁	籀	臾	舁	舂	舄	臬	衄	舡	舢	舣
F4B0	舭	舯	舨	舫	舸	舻	舳	舴	舾	艄	艉	艋	艏	艚	艟	艨
F4C0	衾	袅	袈	裘	裟	襞	羝	羟	羧	羯	羰	羲	籼	敉	粑	粝
F4D0	粜	粞	粢	粲	粼	粽	糁	糇	糌	糍	糈	糅	糗	糨	艮	暨
F4E0	羿	翎	翕	翥	翡	翦	翩	翮	翳	糸	絷	綦	綮	繇	纛	麸
F4F0	麴	赳	趄	趔	趑	趱	赧	赭	豇	豉	酊	酐	酎	酏	酤	
F5A0		酢	酡	酰	酩	酯	酽	酾	酲	酴	酹	醌	醅	醐	醍	醑
F5B0	醢	醣	醪	醭	醮	醯	醵	醴	醺	豕	鹾	趸	跫	踅	蹙	蹩
F5C0	趵	趿	趼	趺	跄	跖	跗	跚	跞	跎	跏	跛	跆	跬	跷	跸
F5D0	跣	跹	跻	跤	踉	跽	踔	踝	踟	踬	踮	踣	踯	踺	蹀	踹
F5E0	踵	踽	踱	蹉	蹁	蹂	蹑	蹒	蹊	蹰	蹶	蹼	蹯	蹴	躅	躏
F5F0	躔	躐	躜	躞	豸	貂	貊	貅	貘	貔	斛	觖	觞	觚	觜	
F6A0		觥	觫	觯	訾	謦	靓	雩	雳	雯	霆	霁	霈	霏	霎	霪
F6B0	霭	霰	霾	龀	龃	龅	龆	龇	龈	龉	龊	龌	黾	鼋	鼍	隹
F6C0	隼	隽	雎	雒	瞿	雠	銎	銮	鋈	錾	鍪	鏊	鎏	鐾	鑫	鱿
F6D0	鲂	鲅	鲆	鲇	鲈	稣	鲋	鲎	鲐	鲑	鲒	鲔	鲕	鲚	鲛	鲞
F6E0	鲟	鲠	鲡	鲢	鲣	鲥	鲦	鲧	鲨	鲩	鲫	鲭	鲮	鲰	鲱	鲲
F6F0	鲳	鲴	鲵	鲶	鲷	鲺	鲻	鲼	鲽	鳄	鳅	鳆	鳇	鳊	鳋	
F7A0		鳌	鳍	鳎	鳏	鳐	鳓	鳔	鳕	鳗	鳘	鳙	鳜	鳝	鳟	鳢
F7B0	靼	鞅	鞑	鞒	鞔	鞯	鞫	鞣	鞲	鞴	骱	骰	骷	鹘	骶	骺
F7C0	骼	髁	髀	髅	髂	髋	髌	髑	魅	魃	魇	魉	魈	魍	魑	飨
F7D0	餍	餮	饕	饔	髟	髡	髦	髯	髫	髻	髭	髹	鬈	鬏	鬓	鬟
F7E0	鬣	麽	麾	縻	麂	麇	麈	麋	麒	鏖	麝	麟	黛	黜	黝	黠

	+0	+1	+2	+3	+4	+5	+6	+7	+8	+9	+A	+B	+C	+D	+E	+F
F7F0	黟	黢	黩	黧	黥	黪	黯	鼢	鼬	鼯	鼹	鼷	鼽	鼾	齄	

A.2 Korean character code table

Unicode	Character
AC00	가
AC01	각
AC04	간
AC08	갈
AC10	감
AC11	갑
AC12	값
AC15	강
AC16	갖
AC19	같
AC1C	개
AC1D	객
AC2D	갭
AC31	갱
AC70	거
AC74	건
AC78	걸
AC80	검
AC81	겁
AC83	것
AC8C	게
ACA8	겨
ACA9	격
ACAC	견
ACB0	결
ACB8	겸
ACB9	겹
ACBD	경
ACC4	계

Unicode	Character
ACE0	고
ACE1	곡
ACE4	곤
ACE8	골
ACF0	곰
ACF3	곳
ACF5	공
ACFC	과
ACFD	곽
AD00	관
AD04	괄
AD11	광
AD18	괘
AD38	괸
AD50	교
AD6C	구
AD6D	국
AD70	군
AD74	굴
AD75	굵
AD7C	굼
AD7D	굽
AD82	굿
AD88	궈
AD8C	권
ADA4	궤
ADC0	귀
ADDC	규
ADE0	균

Unicode	Character
ADF8	그
ADF9	극
ADFC	근
AE00	글
AE08	금
AE09	급
AE30	기
AE38	길
AE4A	깊
AE4C	까
AE4D	깍
AE4E	깎
AE5D	깝
AE65	깥
AE68	깨
AED8	께
AF3C	꼼
AF3F	꼿
AFB8	꾸
B048	끈
B04A	끊
B05D	끝
B098	나
B099	낙
B09C	난
B0A0	날
B0A8	남
B0A9	납
B0AD	낭

Unicode	Character
B0AE	낮
B0B4	내
B0B5	낵
B0C4	냄
B0C9	냉
B0CE	냎
B108	너
B10C	넌
B113	넓
B118	넘
B123	넣
B124	네
B125	넥
B137	넷
B140	녀
B144	년
B150	념
B178	노
B179	녹
B17C	논
B180	놀
B189	놉
B18B	놋
B18D	농
B192	높
B193	놓
B204	누
B205	눅
B208	눈

Unicode	Character
B214	눔
B217	눗
B274	뉴
B284	늄
B290	느
B294	는
B298	늘
B2A0	늠
B2A5	능
B2A6	늦
B2C8	니
B2D8	님
B2D9	닙
B2E4	다
B2E6	닦
B2E8	단
B2EB	닫
B2EC	달
B2EE	닮
B2F4	담
B2F5	답
B2F9	당
B2FF	닿
B300	대
B308	댈
B310	댐
B311	댑
B315	댕
B354	더
B35F	덟
B365	덥

Unicode	Character
B36E	덮
B370	데
B371	덱
B3C4	도
B3C5	독
B3C8	돈
B3CC	돌
B3D7	돗
B3D9	동
B418	되
B41C	된
B420	될
B428	됨
B429	됩
B450	두
B451	둑
B454	둔
B458	둘
B461	둡
B465	둥
B4A4	뒤
B4B7	뒷
B4DC	드
B4DD	득
B4E0	든
B4E3	듣
B4E4	들
B4F1	등
B4F8	듸
B514	디
B518	딘

Unicode	Character
B51C	딜
B524	딤
B525	딥
B530	따
B531	딱
B534	딴
B54C	때
B5A0	떠
B5A4	떤
B5B0	떰
B5BB	떻
B5C0	뗀
B5C4	뗄
B610	또
B69C	뚜
B6AB	뚫
B6F0	뛰
B700	뜀
B728	뜨
B738	뜸
B744	띄
B77C	라
B77D	락
B780	란
B78C	람
B791	랑
B798	래
B7A8	램
B7B5	략
B7C9	량
B7EC	러

Unicode	Character
B7F0	런
B7FD	럽
B807	렇
B808	레
B824	려
B825	력
B828	련
B834	렴
B839	령
B85C	로
B85D	록
B860	론
B871	롱
B8B0	뢰
B8CC	료
B8E8	루
B8F9	룹
B958	류
B960	률
B974	르
B978	른
B97C	를
B984	름
B9AC	리
B9AD	릭
B9B0	린
B9BC	림
B9BD	립
B9C1	링
B9C6	릿
B9C8	마

Unicode	Character
B9C9	막
B9CC	만
B9CE	많
B9D0	말
B9DD	망
B9DE	맞
B9E1	맡
B9E4	매
B9EC	맬
B9F9	맹
BA38	머
BA39	먹
BA3C	먼
BA48	멈
BA4D	멍
BA4E	멋
BA54	메
BA70	며
BA74	면
BA78	멸
BA85	명
BA87	몇
BAA8	모
BAA9	목
BAAB	몫
BAB0	몰
BAB9	몹
BABB	못
BABD	몽
BAFC	뫼
BB18	묘

Unicode	Character
BB34	무
BB35	묵
BB38	문
BB3C	물
BB3D	묽
BB44	뭄
BB49	뭉
BBC0	므
BBC4	믄
BBD0	믐
BBF8	미
BBF9	믹
BBFC	민
BBFF	믿
BC00	밀
BC0D	밍
BC0F	및
BC11	밑
BC14	바
BC15	박
BC16	밖
BC18	반
BC1B	받
BC1C	발
BC1D	밝
BC24	밤
BC29	방
BC30	배
BC31	백
BC84	버
BC88	번

Unicode	Character
BC8C	벌
BC94	범
BC95	법
BC97	벗
BCA0	베
BCA8	벨
BCBC	벼
BCBD	벽
BCC0	변
BCC4	별
BCD1	병
BCF4	보
BCF5	복
BCF8	본
BCFC	볼
BD09	봉
BD80	부
BD81	북
BD84	분
BD88	불
BD93	붓
BD99	붙
BE0C	브
BE14	블
BE44	비
BE54	빔
BE57	빗
BE60	빠
BE68	빨
BE7C	빼
BFCC	뿌

Unicode	Character
BFD0	뿐
C0AC	사
C0AD	삭
C0B0	산
C0B4	살
C0BC	삼
C0BD	삽
C0C1	상
C0C8	새
C0C9	색
C0D8	샘
C0DD	생
C11C	서
C11D	석
C11E	섞
C120	선
C124	설
C12C	섬
C12D	섭
C131	성
C138	세
C13C	센
C140	셀
C148	셈
C14B	셋
C154	셔
C15B	셛
C18C	소
C18D	속
C190	손
C194	솔

Unicode	Character
C19C	솜
C19F	솟
C1A1	송
C1E0	쇠
C218	수
C219	숙
C21C	순
C220	술
C22B	숫
C26C	쉬
C270	쉰
C2A4	스
C2A8	슨
C2B5	습
C2B7	슷
C2B9	승
C2DC	시
C2DD	식
C2E0	신
C2E4	실
C2EB	싫
C2EC	심
C2ED	십
C2F8	싸
C308	쌈
C30D	쌍
C368	써
C36C	썬
C37C	썼
C3D8	쏘
C410	쐐

Unicode	Character
C42C	쐬
C464	쑤
C4F0	쓰
C4F4	쓴
C500	씀
C50C	씌
C528	씨
C529	씩
C53B	씻
C544	아
C545	악
C548	안
C549	앉
C54A	않
C54C	알
C554	암
C555	압
C558	았
C559	앙
C55E	앞
C560	애
C561	액
C57C	야
C57D	약
C580	얀
C587	얇
C591	양
C595	얕
C5B4	어
C5B5	억
C5B8	언

Unicode	Character
C5B9	얹
C5BB	얻
C5BC	얼
C5C4	엄
C5C5	업
C5C6	없
C5C8	었
C5CA	엊
C5D0	에
C5D4	엔
C5EC	여
C5ED	역
C5F0	연
C5F4	열
C5FC	염
C5FD	엽
C600	였
C601	영
C605	옅
C606	옆
C624	오
C625	옥
C628	온
C62C	올
C633	옳
C634	옴
C635	옵
C637	옷
C640	와
C644	완
C654	왔

Unicode	Character
C655	왕
C65C	왜
C678	외
C67C	왼
C694	요
C6A9	용
C6B0	우
C6B1	욱
C6B4	운
C6B8	울
C6C5	웅
C6CC	워
C6D0	원
C6D4	월
C6DC	웜
C704	위
C717	윗
C720	유
C721	육
C724	윤
C728	율
C735	융
C73C	으
C740	은
C744	을
C74C	음
C751	응
C758	의
C774	이
C775	익
C778	인

Unicode	Character
C77C	일
C77D	읽
C783	잃
C784	임
C785	입
C788	있
C78A	잇
C78E	잎
C790	자
C791	작
C794	잔
C798	잘
C7A0	잠
C7A1	잡
C7A5	장
C7AC	재
C7AD	잭
C7C1	쟁
C800	저
C801	적
C804	전
C808	절
C810	점
C811	접
C814	젔
C815	정
C81C	제
C838	져
C870	조
C871	족
C874	존

Unicode	Character
C878	졸
C880	좀
C881	좁
C885	종
C88B	좋
C88C	좌
C8FC	주
C900	준
C904	줄
C911	중
C99D	증
C9C0	지
C9C1	직
C9C4	진
C9C8	질
C9D0	짐
C9D1	집
C9D3	짓
C9D9	짙
C9DC	짜
C9DD	짝
C9E7	짧
C9F8	째
CABD	쪽
CB10	쬐
CBE4	찜
CC28	차
CC29	착
CC2C	찬
CC30	찰
CC38	참

Unicode	Character
CC3B	찻
CC3D	창
CC3F	찾
CC44	채
CC45	책
CC54	챔
CC98	처
CC99	척
CC9C	천
CCA0	철
CCAB	첫
CCAD	청
CCB4	체
CCD0	쳐
CD08	초
CD09	촉
CD0C	촌
CD1D	총
CD5C	최
CD94	추
CD95	축
CD9C	출
CDA5	춤
CDA9	충
CDE8	취
CE21	측
CE35	층
CE58	치
CE59	칙
CE5C	친
CE68	침

Unicode	Character
CE69	칩
CE6D	칭
CE74	카
CE78	칸
CE90	캐
CE94	캔
CEA0	캠
CEE4	커
CEF4	컴
CEF5	컵
CF00	케
CF1C	켜
CF54	코
CFE0	쿠
CFE1	쿡
D034	퀴
D06C	크
D070	큰
D074	클
D07C	큼
D07D	큽
D0A4	키
D0A5	킥
D0B5	킵
D0C0	타
D0C1	탁
D0C4	탄
D0C8	탈
D0D5	탕
D0DC	태
D0DD	택

Unicode	Character
D0ED	탭
D0F6	탤
D130	터
D131	턱
D134	턴
D14C	테
D1A0	토
D1A4	톤
D1B1	톱
D1B5	통
D1F4	퇴
D22C	투
D2B8	트
D2B9	특
D2BC	튼
D2C0	틀
D2C8	틈
D2F0	티
D300	팀
D301	팁
D305	팅
D30C	파
D310	판
D314	팔
D328	패
D380	펀
D384	펄
D38C	펌
D398	페
D39C	펜
D3B4	펴

Unicode	Character
D3B8	편
D3C9	평
D3D0	폐
D3EC	포
D3ED	폭
D3FC	폼
D45C	표
D478	푸
D480	풀
D488	품
D48D	풍
D4E8	퓨
D504	프
D53C	피
D544	필
D54D	핍
D558	하
D559	학
D55C	한
D560	할
D568	함
D569	합
D56D	항
D574	해
D575	핵
D588	했
D589	행
D5A5	향
D5C8	허
D5C9	헉
D5CC	헌

Unicode	Character
D5D8	험
D5DD	헝
D5E4	헤
D601	혁
D604	현
D611	협
D615	형
D638	호
D639	혹
D63C	혼
D648	홈
D64D	홍
D654	화
D655	확
D658	환
D65C	활
D669	황
D68C	회
D69F	횟
D6A1	횡
D6A8	효
D6C4	후
D6C5	훅
D6C8	훈
D718	휘
D734	휴
D751	흑
D754	흔
D758	흘
D760	흠
D765	흥

Unicode	Character
D76C	희
D770	흰
D788	히
D798	힘

A.3 Russian (Cyrillic) character code table

Code	Character
0xC0	А
0xC1	Б
0xC2	В
0xC3	Г
0xC4	Д
0xC5	Е
0xA8	Ё
0xC6	Ж
0xC7	З

Code	Character
0xC8	И
0xC9	Й
0xCA	К
0xCB	Л
0xCC	М
0xCD	Н
0xCE	О
0xCF	П
0xD0	Р

Code	Character
0xD1	С
0xD2	Т
0xD3	У
0xD4	Ф
0xD5	Х
0xD6	Ц
0xD7	Ч
0xD8	Ш
0xD9	Щ

Code	Character
0xDA	Ъ
0xDB	Ы
0xDC	Ь
0xDD	Э
0xDE	Ю
0xDF	Я

A.4 Turkish character code table

Unicode	Character	Unicode	Character	Unicode	Character	Unicode	Character
0x60	`	0x7A	z	0xCA	Ê	0xE5	å
0x61	a	0x7B	{	0xCB	Ë	0xE6	æ
0x62	b	0x7C	¦	0xCC	Ì	0xE7	ç
0x63	c	0x7D	}	0xCD	Í	0xE8	è
0x64	d	0x8A	Š	0xCE	Î	0xE9	é
0x65	e	0x8B	‹	0xCF	Ï	0xEA	ê
0x66	f	0x8C	Œ	0xD0	Ğ	0xEB	ë
0x67	g	0x98	˜	0xD1	Ñ	0xEC	ì
0x68	h	0x9A	š	0xD2	Ò	0xED	í
0x69	i	0x9B	›	0xD3	Ó	0xEE	î
0x6A	j	0x9C	œ	0xD4	Ô	0xEF	ï
0x6B	k	0x9F	Ÿ	0xD5	Õ	0xF0	ğ
0x6C	l	0xA1	¡	0xD6	Ö	0xF1	ñ
0x6D	m	0xA5	¥	0xD8	Ø	0xF2	ò
0x6E	n	0xB5	µ	0xD9	Ù	0xF3	ó
0x6F	o	0xBF	¿	0xDA	Ú	0xF4	ô
0x70	p	0xC0	À	0xDB	Û	0xF5	õ
0x71	q	0xC1	Á	0xDC	Ü	0xF6	ö
0x72	r	0xC2	Â	0xDD	İ	0xF8	ø
0x73	s	0xC3	Ã	0xDE	Ş	0xF9	ù
0x74	t	0xC4	Ä	0xDF	ß	0xFA	ú
0x75	u	0xC5	Å	0xE0	à	0xFB	û
0x76	v	0xC6	Æ	0xE1	á	0xFC	ü
0x77	w	0xC7	Ç	0xE2	â	0xFD	ı
0x78	x	0xC8	È	0xE3	ã	0xFE	ş
0x79	y	0xC9	É	0xE4	ä	0xFF	ÿ

B LANGUAGE ID TABLE

Language ID used for Extended symbol and comment function and PMC message multi-language display function is as follows.

Language ID	Language
0	English
1	Japanese
2	German
3	French
4	Chinese (Traditional)
5	Italian
6	Korean
7	Spanish
8	Dutch
9	Danish
10	Portuguese
11	Polish
12	Hungarian
13	Swedish
14	Czech
15	Chinese (Simplified)
16	Russian
17	Turkish
18	Bulgarian
19	Rumanian
20	Slovak
21	Finnish
22	Hindi
23	Vietnamese

C LIST OF CNC FUNCTIONS USING PMC SIGNALS OTHER THAN G/F ADDRESS

CNC Functions using PMC signals other than G/F address in addition to the function to create applications and the communication function that are listed in "SAFETY PRECAUTIONS" are as follows. For details, refer to "CONNECTION MANUAL (FUNCTION)" of each CNC series.

CNC function name	Signal types	Access types to signal	Related CNC parameter numbers	CONNECTION MANUAL (FUNCTION) Reference item
High-Speed Position Switch	Y	Write	HPF(No.8501#0) No.8565	High-Speed Position Switch
Direction-Sensitive High-Speed Position Switch	Y	Write	HPF(No.8501#0) No.8565	Direction-Sensitive High-Speed Position Switch
Flexible Path Axis Assignment	R	Write	No.11554	Outputting States of Individual Axes
Flexible Path Axis Assignment	R	Read	CSG(No.11563#0) No.11553	Signal Type of Flexible Path Axis Assignment
Stored Stroke Limit Range Switching Function by Signal	D	Read	No.1313	Stored Stroke Limit Range Switching Function by Signal
Manual Linear/Circular Interpolation	R	Read Write	MRI(No.7106#3) MRO(No.7106#4) No.13541 No.13542	Manual Linear/Circular Interpolation
Manual Reference Position Return	X	Read	GDC(No.3006#0) XSG(No.3008#2) No.3013 No.3014	Manual Reference Position Return
Spindle Speed Command Clamp	R	Read	No.3773	Spindle Speed Command Clamp
Custom Macro	R	Write	IFR(No.6020#2) No.6094	Custom Macro
High-Speed Cycle Machining Operation Information Output Function	R	Write	HIF(No.7504#1) No.7526	High-Speed Cycle Machining Operation Information Output Function
Energy Saving Level Selecting Function	X,Y,A,R, T,K,C,D	Read	Set signals on the display	Energy Saving Level Selecting Function
Machine operation menu function	R	Read Write	Set signals on the tool	Machine operation menu function Machine operation menu making tool
Automatic Tool Length Measurement (M Series) /Automatic Tool Offset (T Series)	X	Read	XSG(No.3008#2) No.3019	Automatic Tool Length Measurement (M Series) /Automatic Tool Offset (T Series)
Skip Function	X	Read	XSG(No.3008#2) No.3012	Skip Function
Multi-Step Skip	X	Read	XSG(No.3008#2) No.3012	Multi-Step Skip
Direct Input of Offset Value Measured B (for Lathe System)	X	Read	XSG(No.3008#2) No.3019	Direct Input of Offset Value Measured B (for Lathe System)

CNC function name	Signal types	Access types to signal	Related CNC parameter numbers	CONNECTION MANUAL (FUNCTION) Reference item
PMC Axis Control	X	Read	XSG(No.3008#2) No.3019 SKE(No.8001#7)	PMC Axis Control
Extended External Machine Zero Point Shift	R	Read	EMS(No.1203#0) No.1280	Extended External Machine Zero Point Shift
Communication Retry Monitoring Function	R9051 (Z51) R9057 (Z57) R9165 (Z165)	Read	Fixed signals	Communication Retry Monitoring Function

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REVISION RECORD

Edition	Date	Contents
03	Nov., 2014	• PMC function for 0*i* -MODEL F • Improvement of Window function • Displaying series/edition of I/O link *i* assignment data and Multi-language PMC message • Correction of errors
02	Jul., 2013	• Ladder Dividing Management Function • Modification of file names in PMC [I/O] screen • PMC function for Power Motion *i* -MODEL A • PSGN2/PSGNL functional instruction using actual machine position • The 1st level execution cycle 1ms/2ms of ladder • Improvement of Data Table Control Data Screen • Assignment of network devices to X/Y address • Multi-language display of signal comment • Setting of sampling address for PMC signal trace on the PMC Ladder monitor screen • Improvement of Window function • Correction of errors
01	Jul., 2010	

FANUC Series 30*i*/31*i*/32*i*/35*i*-MODEL B
FANUC Power Motion *i*-MODEL A
FANUC Series 0*i*-MODEL F
PMC Supplemental Programming Manual

Type of applied technical documents

Name	FANUC Series 30*i*/31*i*/32*i*/35*i*-MODEL B FANUC Power Motion *i*-MODEL A FANUC Series 0*i*-MODEL F PMC Programming Manual
Spec. No. /Ed.	B-64513EN/03

Summary of Change

Group	Name/Outline	New, Add, Correct, Delete	Applied Date
Basic Function	・ PMC window functions has been improved.	Add	Dec. 2014
Optional Function			
Unit			
Maintenance Parts			
Notice			
Correction			
Another			

FANUC Series 30*i*/31*i*/32*i*/35*i* -MODEL B
Power Motion *i* -MODEL A
FANUC Series 0*i* -MODEL F
PMC Supplemental Programming Manual

Contents

1 SUMMARY

The following function has been improved.

● The following window function has been improved.
- No.32 Reading modal data

This document is a supplemental manual for above.
Specifications and operations about PMC for FANUC Series 30*i*/31*i*/32*i*/35*i*-MODEL B, FANUC Power Motion *i*-MODEL A, FANUC Series 0*i*-MODEL F are described in the following manual.

Manual	Spec.
FANUC Series 30*i*/31*i*/32*i*/35*i*-MODEL B FANUC Power Motion *i*-MODEL A FANUC Series 0*i*-MODEL F PMC Programming Manual	B-64513EN / 03

In this document, the following abbreviations are used.

Name	Abbreviation
FANUC Series 30*i*/31*i*/32*i*/35*i*-MODEL B	30*i*/31*i*/32*i*/35*i* -B
FANUC Power Motion *i*-MODEL A	Power Motion *i*-A
FANUC Series 0*i*-MODEL F	0*i* -F

2 APPLIED SOFTWARE

The new features will be applied to the following software.

● Improvement of 'No.32 Reading modal data'

PMC System software

PMC	Drawing number	Series	Edition
Series 30*i*/31*i*/32*i*-B Series 35*i*-B Power Motion *i*-A	A02B-0323-H580#40A5 A02B-0333-H580#40A5 A02B-0334-H580#40A5	40A5	19 or later

3 WINDOW FUNCTIONS

The following window function has been improved.

Function code	Description
32	Reading modal data

3.1 Reading Modal Data (High-speed Response)

Change "5.4.19 Reading modal data(High-speed Response)" as follows.

Using this function, you can read modal information of CNC.

(1) Reading modal information of G-function (Data number=0 to 33, -1, -3)

Using this function, you can read modal information of G-function.

Input data structure

Top Address +0	(Function code) 32	
+2	(Completion code) - (Need not to be set)	
+4	(Data length L) - (Need not to be set)	
+6	(Data number N) Data type	N=0 to 33: Reading each data (See. Table 3.1 (a) to (d)) N=-1: Reading 32 groups (Group No.0 to 31) N=-3: Reading all groups
+8	(Data attribute M) Specified block	M=0: Current block M=1: Next block M=2: (reserved)
+10	(Data area) - (Need not to be set)	

NOTE
1. The modal information for a block after the next block cannot be read.
2. When reading 32 groups, the read modal information of groups are from No. 0 to No.31. To read modal information of over No. 31 group, set over 31 to the data number N or set “-3 (reading 32 all groups)” to the data number N.
3. When reading all groups, the modal information of 50 groups can be read including some reserve groups. In the reserve group, the value “0” is set.

⚠CAUTION
When using “N=-3” (reading all groups), ensure 100 byte area for the data area, that is 110 bytes area for the input data area. If the data area is insufficient, a new group data would be written to non-secured area when CNC new features will be added in the future. As a result, the sequence program is not executed correctly and the machine may behave an unexpected working.

Table3.1 (a) Modal information of G-function (part 1)

Group number (Data type)	Machining center system		Lathe system			
	G code	Code in a group	G code			Code in a group
			A series	B series	C series	
0	G00	0	G00	G00	G00	0
	G01	1	G01	G01	G01	1
	G02	2	G02	G02	G02	2
	G02.1	27				
	G02.2	10	G02.2	G02.2	G02.2	20
	G02.3	12	G02.3	G02.3	G02.3	22
	G02.4	15	G02.4	G02.4	G02.4	18
	G03	3	G03	G03	G03	3
	G03.2	11	G03.2	G03.2	G03.2	21
	G03.3	13	G03.3	G03.3	G03.3	23
	G03.4	16	G03.4	G03.4	G03.4	19
	G06.2	14	G06.2	G06.2	G06.2	17
	G33	4	G32	G33	G33	4
	G34	24	G34	G34	G34	9
	G35	22	G35	G35	G35	14
	G36	23	G36	G36	G36	15
			G71.3	G71.3	G71.3	10
			G72.3	G72.3	G72.3	11
			G73.3	G73.3	G73.3	12
			G74.3	G74.3	G74.3	13
	G77	6	G90	G77	G20	5
	G78	7	G92	G78	G21	6
	G79	8	G94	G79	G24	7
1	G17	0	G96	G96	G96	1
	G17.1P1	0	G97	G97	G97	0
	G17.1P2	14				
	G17.1P3	18				
	G17.1P4	22				
	G17.1P5	26				
	G18	8				
	G19	4				
2	G90	0		G90	G90	0
	G91	1		G91	G91	1
3	G22	1	G68	G68	G68	1
	G23	0	G69	G69	G69	0
4	G93	2	G93	G93	G93	2
	G94	0	G98	G94	G94	0
	G95	1	G99	G95	G95	1
5	G20(G70)	0	G20	G20	G70	0
	G21(G71)	1	G21	G21	G71	1
6	G40	0	G40	G40	G40	0
	G41	1	G41	G41	G41	1
	G41.2	3	G41.2	G41.2	G41.2	3
	G41.3	5	G41.3	G41.3	G41.3	5
	G41.4	6	G41.4	G41.4	G41.4	6
	G41.5	8	G41.5	G41.5	G41.5	8

Table3.1 (b) Modal information of G-function (part 2)

Group number (Data type)	Machining center system		Lathe system			
	G code	Code in a group	G code			Code in a group
			A series	B series	C series	
6	G41.6 G42 G42.2 G42.4 G42.5 G42.6	10 2 4 7 9 11	G41.6 G42 G42.2 G42.4 G42.5 G42.6	G41.6 G42 G42.2 G42.4 G42.5 G42.6	G41.6 G42 G42.2 G42.4 G42.5 G42.6	11 2 4 7 9 12
7	G43 G43.1 G43.3 G43.4 G43.5 G43.7 G43.8 G43.9 G44 G44.1 G49(G49.1)	1 3 7 4 5 11 9 10 2 12 0	G25 G26	G25 G26	G25 G26	0 1
8	G73 G74 G76 G80 G81 G82 G83 G84 G84.2 G84.3 G85 G86 G87 G88 G89	10 11 12 0 1 2 3 4 13 14 5 6 7 8 9	G22 G23	G22 G23	G22 G23	1 0
9	G98 G99	0 1	G80 G81 G82 G83 G83.1 G83.5 G83.6 G84 G84.2 G85 G87 G87.5 G87.6 G88 G89	G80 G81 G82 G83 G83.1 G83.5 G83.6 G84 G84.2 G85 G87 G87.5 G87.6 G88 G89	G80 G81 G82 G83 G83.1 G83.5 G83.6 G84 G84.2 G85 G87 G87.5 G87.6 G88 G89	0 8 9 1 10 12 14 2 11 3 5 13 15 6 7

Table3.1 (c) Modal information of G-function (part 3)

Group number (Data type)	Machining center system		Lathe system			
	G code	Code in a group	G code			Code in a group
			A series	B series	C series	
10	G50 G51	0 1		G98 G99	G98 G99	0 1
11	G66 G66.1 G67	1 2 0	G66 G66.1 G67	G66 G66.1 G67	G66 G66.1 G67	1 2 0
12	G96 G97	1 0				
13	G54(G54.1) G55 G56 G57 G58 G59	0 1 2 3 4 5	G54(G54.1) G55 G56 G57 G58 G59	G54(G54.1) G55 G56 G57 G58 G59	G54(G54.1) G55 G56 G57 G58 G59	0 1 2 3 4 5
14	G61 G62 G63 G64	1 2 3 0	G61 G62 G63 G64	G61 G62 G63 G64	G61 G62 G63 G64	1 2 3 0
15	G68 G68.2 G68.3 G68.4 G69	1 2 3 4 0	G17 G17.1 G18 G19	G17 G17.1 G18 G19	G17 G17.1 G18 G19	0 10 to 29 4 8
16	G15 G16	0 1	G68.1 G68.2 G68.3 G68.4 G69.1	G68.1 G68.2 G68.3 G68.4 G69.1	G68.1 G68.2 G68.3 G68.4 G69.1	1 2 3 4 0
17	G40.1 G41.1 G42.1	0 1 2		G50 G51	G50 G51	0 1
18	G25 G26	0 1	G40.1 G41.1 G42.1	G40.1 G41.1 G42.1	G40.1 G41.1 G42.1	0 1 2
19			G50.2(G250) G51.2(G251)	G50.2(G250) G51.2(G251)	G50.2(G250) G51.2(G251)	0 1
20	G12.1(G112) G13.1(G113)	1 0	G12.1(G112) G13.1(G113)	G12.1(G112) G13.1(G113)	G12.1(G112) G13.1(G113)	1 0
21	G50.1 G51.1	0 1	G50.1 G51.1	G50.1 G51.1	G50.1 G51.1	0 1
22	G54.2	0 to 8	G43 G43.1 G43.4 G43.5 G43.7(G44.7) G44 G44.1 G49(G49.1)	G43 G43.1 G43.4 G43.5 G43.7(G44.7) G44 G44.1 G49(G49.1)	G43 G43.1 G43.4 G43.5 G43.7(G44.7) G44 G44.1 G49(G49.1)	1 3 4 5 6 2 12 0

Table3.1 (d) Modal information of G-function (part 4)

Group number (Data type)	Machining center system		Lathe system			
	G code	Code in a group	G code			Code in a group
			A series	B series	C series	
23	G80.5 G81.5	0 1	G15 G16	G15 G16	G15 G16	0 1
25			G54.4	G54.4	G54.4	0
26	G44.9 G49.9	1 0	G80.5 G81.5	G80.5 G81.5	G80.5 G81.5	0 1
27			G80.4 G81.4	G80.4 G81.4	G80.4 G81.4	0 1
30	G50.2 G51.2	0 1				
32	G54.4	0				
33	G80.4 G81.4	0 1				

Completion codes

0 Completed successfully
3 The data number is invalid
4 The data attribute is invalid

Output data structure

(1) Reading each data (Data number N=G code group number)

Address	Content	
Top Address +0	(Function code) 32	
+2	(Completion code) ? (See above description)	
+4	(Data length L) 2	
+6	(Data number N) Data type (Same as input data)	
+8	(Data attribute M) Specified block (Same as input data)	
+10 +11	Modal information of G-function (2 bytes)	See "Fig. 3.1 (a) Modal information of G-function".

	7	6	5	4	3	2	1	0
Top Address +10								

Bit 7: 0 : Not specified in the group
1 : Specified in the group

Bits 6–0: Code in a group

	7	6	5	4	3	2	1	0
Top Address +11	0							

Fig. 3.1 (a) Modal information of g-function

(2) Reading 32 groups (Data number N=-1)

Top Address +0	(Function code) 32	
+2	(Completion code) ? (See above description)	
+4	(Data length L) 64	
+6	(Data number N) -1 (Same as input data)	
+8	(Data attribute M) Specified block (Same as input data)	
+10	Modal information of G-function group No.0 (2 bytes)	See "Fig. 3.1 (a) Modal information of G-function".
+12	Modal information of G-function group No.1 (2 bytes)	See "Fig. 3.1 (a) Modal information of G-function".
~		~
+72 +73	Modal information of G-function group No.31 (2 bytes)	See "Fig. 3.1 (a) Modal information of G-function".

(3) Reading all groups (Data number N=-3)

Address	Content	Remark
Top Address +0	(Function code) 32	
+2	(Completion code) ? (See above description)	
+4	(Data length L) 100	
+6	(Data number N) -3 (Same as input data)	
+8	(Data attribute M) Specified block (Same as input data)	
+10	Modal information of G-function group No.0 (2 bytes)	See "Fig. 3.1 (a) Modal information of G-function".
+12	Modal information of G-function group No.1 (2 bytes)	See "Fig. 3.1 (a) Modal information of G-function".
~		~
+108 +109	Modal information of G-function group No.49 (2 bytes)	

NOTE

The modal information of 50 groups can be read including some reserve groups.
In the reserve group, the value “0” is set.

(2) Reading modal information of other than G-function (Data number=100 to 126, -2)

Using this function, you can read modal information of other than G-function.

Input data structure

Address	Content	Remarks
Top Address +0	(Function code) 32	
+2	(Completion code) - (Need not to be set)	
+4	(Data length L) - (Need not to be set)	
+6	(Data number N) Data type	N=100 to 126: Each data reading (See Table 3.1(e)) N=-2: Collective read (No.100 to 126)
+8	(Data attribute M) Specified block	M=0: Current block M=1: Next block M=2: (reserved)
+10	(Data area) - (Need not to be set)	

NOTE
A modal information for a block after the next block cannot be read.

Table3.1 (e) Modal information of other than G-function

Data type	Specified Address	Description
100	B	Second auxiliary function
101	D	
102	E	(Reserved)
103	F	
104	H	
105	L	
106	M	
107	S	
108	T	
109	R	
110	P	
111	Q	
112	A	
113	C	
114	I	
115	J	
116	K	
117	N	
118	O	
119	U	
120	V	
121	W	
122	X	
123	Y	
124	Z	
125	M2	
126	M3	

Completion codes

0 Completed successfully
3 The data number is invalid
4 The data attribute is invalid

Output data structure

(1) Each data reading (Data number N=See Table 3.1 (e))

Address	Content	Remarks
Top Address +0	(Function code) 32	
+2	(Completion code) ? (See above description)	
+4	(Data length L) 6	
+6	(Data number N) Data type (Same as input data)	
+8	(Data attribute M) Specified block (Same as input data)	
+10 +15	Modal information (6 bytes)	See "Fig. 3.1 (b) Modal information of other than G-function".

(2) Corrective reading (Data number N=-2)

Address	Content	Remarks
Top Address +0	(Function code) 32	
+2	(Completion code) ? (See above description)	
+4	(Data length L) 174	
+6	(Data number N) Data type (Same as input data)	
+8	(Data attribute M) Specified block (Same as input data)	
+10	Modal information of Data type No.100 (6 bytes)	See "Fig. 3.1 (b) Modal information of other than G-function".
+16	Modal information of Data type No.101 (6 bytes)	See "Fig. 3.1 (b) Modal information of other than G-function".
~		~
+166	Modal information of Data type No.126 (6 bytes)	See "Fig. 3.1 (b) Modal information of other than G-function".
+172 +183	Reserved (12 bytes)	

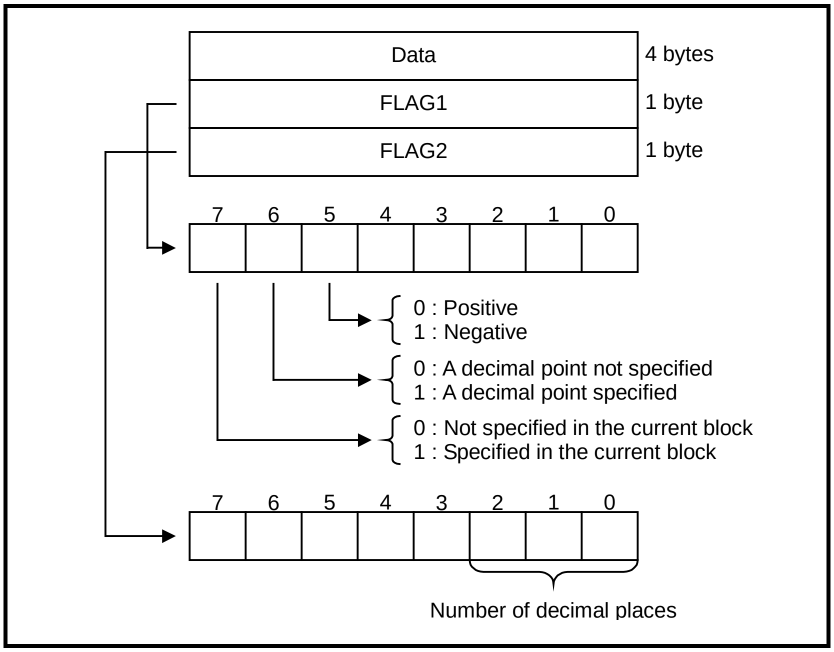


Fig. 3.1 (b) Modal information of other than G-function

NOTE

1 The specification of whether a decimal point is specified or not in FLAG1, and the specification of the number of decimal places in FLAG2, are valid only for F code. Even if a decimal point is not specified, the number of decimal places may not be 0.

2 PMC-SB7 outputs the number of input digits to bits 0 to 3 of FLAG1, however 30*i*/31*i*/32*i*/35*i*-B, Power Motion *i*-A, 0*i*-F PMC does not. If you need to have the number of input digits output as with the former specification, read the CNC parameters of the following numbers, by using the window function for reading a parameter (function code 17 or 154).

- For the M function:
  No.3030(allowable number of digits of the M code)
- For the S function:
  No.3031(allowable number of digits of the S code)
- For the T function:
  No.3032(allowable number of digits of the T code)
- For the B function:
  No.3033(allowable number of digits of the B code)

4 APPENDIX B LANGUAGE ID TABLE

Change "APPENDIX-B LANGUAGE ID TABLE " as follows.

Language ID used for Extended symbol and comment function and PMC message multi-language display function is as follows.

Language ID	Language
0	English
1	Japanese
2	German
3	French
4	Chinese (Traditional)
5	Italian
6	Korean
7	Spanish
8	Dutch
9	Danish
10	Portuguese
11	Polish
12	Hungarian
13	Swedish
14	Czech
15	Chinese (Simplified)
16	Russian
17	Turkish
18	Bulgarian
19	Rumanian
20	Slovak
21	Finnish
22	(reserved)
23	Vietnamese
24	Indonesian

FANUC Series 30*i*/31*i*/32*i*/35*i*-MODEL B
FANUC Power Motion *i*-MODEL A
FANUC Series 0*i*-MODEL F
PMC Supplemental Programming Manual

Type of applied technical documents

Name	FANUC Series 30*i*/31*i*/32*i*/35*i*-MODEL B FANUC Power Motion *i*-MODEL A FANUC Series 0*i*-MODEL F PMC Programming Manual
Spec. No. /Ed.	B-64513EN/03

Summary of Change

Group	Name/Outline	New, Add, Correct, Delete	Applied Date
Basic Function	・ Addition of 0*i*-F PMC/L. ・ Addition of PMC Memory Type-E. ・ Addition of PID control instruction. ・ Expansion of PMC PROGRAM NO. and EDITION NO. of title data.	Add	Apr. 2015
Optional Function			
Unit			
Maintenance Parts			
Notice			
Correction			
Another	Addition of notes.		

FANUC Series 30*i*/31*i*/32*i*/35*i*-MODEL B
FANUC Power Motion *i*-MODEL A
FANUC Series 0*i*-MODEL F
PMC Supplemental Programming Manual

Contents

1 SUMMARY

The following function has been added or been improved.

(1) Addition of 0*i*-F PMC/L.
PMC/L function for Type 3 or Type 5 of FANUC Series 0*i*-MODEL F has been added.
About this function, refer to the following chapters.
- 4. PMC SPECIFICATIONS
- 5. COMMUNICATION WITH I/O DEVICE
- 10. PMC ALARM MESSAGE AND ACTIONS TO TAKE

(2) Addition of PMC Memory Type-E.
PMC Memory Type-E which is used for multi path or multi axes CNC has been added.
About this function, refer to the following chapters.
- 3. OVERVIEW OF PMC
- 4. PMC SPECIFICATIONS
- 9. PMC CONFIGURATION DATA SETTING SCREEN ([PMC CONFIG])

NOTE
PMC Memory Type-E is enabled only on a special series of CNC software.

(3) Addition of PID control instruction.
Functional instruction for PID control that is used at temperature control etc has been added.
About this function, refer to the following chapters.
- 4. PMC SPECIFICATIONS
- 6. LADDER LANGUAGE
- 8. LADDER DIAGRAM MONITOR AND EDITOR SCREEN ([PMC LADDER])

(4) Expansion of PMC PROGRAM NO. and EDITION NO. of title data.
At title data, PMC PROGRAM NO. has been expanded to 8 characters from 4 characters, and EDITION NO. has been expanded to 8 characters from 2 characters.
About this function, refer to the following chapter.
- 9. PMC CONFIGURATION DATA SETTING SCREEN ([PMC CONFIG])

This document is a supplemental manual for above.
Please refer to the following manual about existing functions and operations.

Manual	Spec.
FANUC Series 30*i*/31*i*/32*i*/35*i*-MODEL B FANUC Power Motion *i*-MODEL A FANUC Series 0*i*-MODEL F PMC Programming Manual	B-64513EN / 03

In this document, the following abbreviations are used.

Name	Abbreviation
FANUC Series 30*i*/31*i*/32*i*/35*i*-MODEL B	30*i*/31*i*/32*i*/35*i*-B
FANUC Power Motion *i*-MODEL A	Power Motion *i*-A
FANUC Series 0*i*-MODEL F	0*i*-F

2 APPLIED SOFTWARE

The new features will be applied to the following software.

(1) Addition of PMC/L

● PMC System software

PMC	Drawing number	Series	Edition
Series 0*i*-MODEL F PMC/L	A02B-0339-H580#40B2	40B2	03 or later

● CNC System software

PMC	Drawing number	Series	Edition
Series 0*i*-MODEL TF Series 0*i*-MODEL MF	A02B-0339-H501#D6G1 A02B-0340-H501#D4G1	D6G1 D4G1	07 or later

(2) Addition of PMC Memory Type-E

● PMC System software

PMC	Drawing number	Series	Edition
Series 30*i*-MODEL B PMC	A02B-0323-H580#40A5	40A5	20 or later

● CNC System software

PMC	Drawing number	Series	Edition
Series 30*i*-MODEL B	(Now developing)		

(3) Addition of PID control instruction

- PMC System software

PMC	Drawing number	Series	Edition
Series 30*i*/31*i*/32*i*/35*i*-MODEL B PMC Power Motion *i*-MODEL A PMC	A02B-0323-H580#40A5	40A5	20 or later
Series 0*i*-MODEL F PMC	A02B-0339-H580#40B2	40B2	03 or later

- CNC System software

PMC	Drawing number	Series	Edition
Series 30*i*-MODEL B	A02B-0323-H501#G301 G311 G321	G301 G311 G321	69 or later
Series 31*i*-MODEL B5	A02B-0326-H501#G421 G431	G421 G431	69 or later
Series 31*i*-MODEL B	A02B-0327-H501#G401 G411	G401 G411	69 or later
Series 32*i*-MODEL B	A02B-0328-H501#G501	G501	69 or later
Series 35*i*-MODEL B	A02B-0333-H501#G601 G611	G601 G611	23 or later (Scheduled)
Power Motion *i*-MODEL A	A02B-0334-H501#88H0	88H0	20 or later
Series 0*i*-MODEL TF Series 0*i*-MODEL MF	A02B-0339-H501#D6G1 A02B-0340-H501#D4G1	D6G1 D4G1	07 or later

(4) Expansion of “PMC PROGRAM NO.” and “EDITION NO.” of title data.
Same as ‘(3) Addition of PID control instruction’.

3 OVERVIEW OF PMC

3.1 LADDER DIVIDING MANAGEMENT FUNCTION

Add the following note into "1.5 LADDER DIVIDING MANAGEMENT FUNCTION".

NOTE
To enable the ladder dividing management function, set 1 to the NC parameter 11931#5. For details, refer to "2.4.3"

3.2 MULTI-PATH PMC FUNCTION

3.2.1 Interface between CNC and PMC

Change "1.6.2 Interface between CNC and PMC" as follows.

When using PMC Memory Type-A, B, C, or D

The PMC path that controls the CNC-PMC interfaces, and the PMC addresses (F/G addresses) of the interfaces, can be configured by CNC parameters.
These parameter settings enable you to configure the interface control system; configuration that all CNC-PMC interfaces of the CNC are controlled by single PMC, or configuration that the CNC-PMC interfaces are controlled by multiple PMCs.
The CNC-PMC interface is a memory block consisting of DI/DO areas of 768-byte each. There are 10 CNC-PMC interfaces at CNC side, and also 10 interfaces for each PMC path at PMC side, and you can configure their connections as you like.
If all of these parameters are not set (0 is set to all), it is treated as the initial settings; all the F/G addresses of the CNC side are assigned to the F/G addresses of the first PMC as described below.

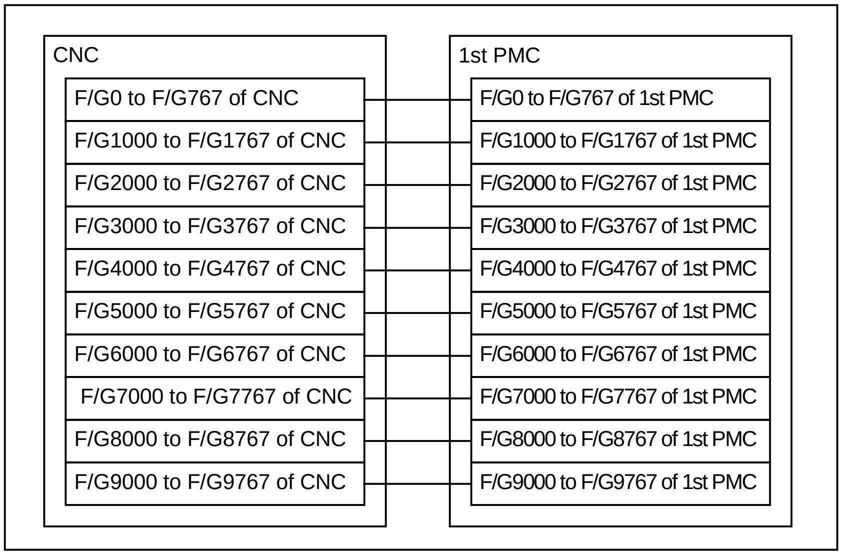


Fig. 3.2.1 (a) Initial settings for CNC-PMC interface

In the following example, F/G0 to F/G767 and F/G1000 to F/G1767 of the CNC are assigned to F/G0 to F/G767 and F/G1000 to F/G1767 of the first PMC, and F/G2000 to F/G2767 of the CNC are assigned to F/G0 to F/G767 of the second PMC:

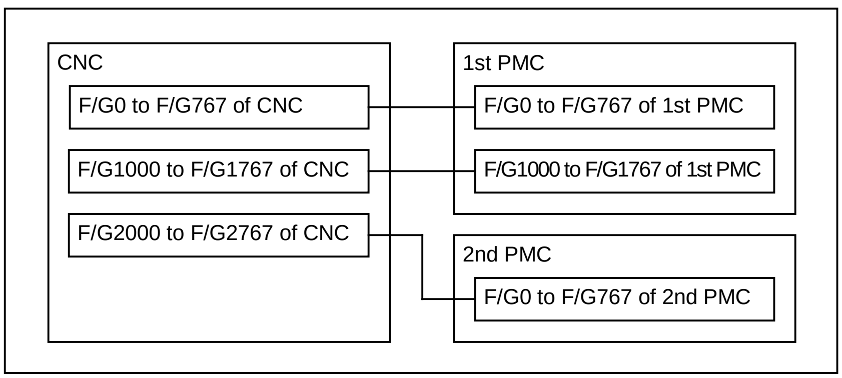


Fig. 3.2.1 (b) Setting example for CNC-PMC interface

For details of parameter setting, see Subsection 2.4.3.

When using PMC Memory Type-E

When using PMC Memory Type-E, the CNC-PMC interfaces are assigned as follows.
(F/G address of CNC = F/G address of 1st PMC)
This configuration of the interfaces is fixed and cannot be changed.

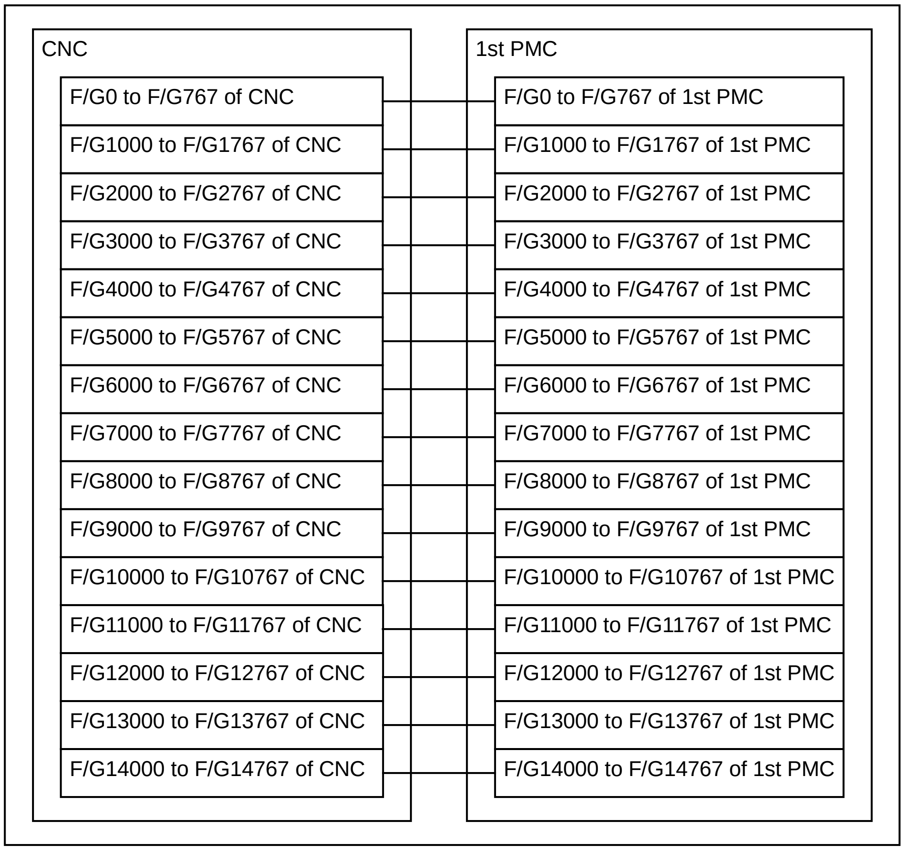


Fig. 3.2.1 (c) CNC-PMC interface of PMC memory type-E

4 PMC SPECIFICATIONS

4.1 SPECIFICATIONS

4.1.1 Basic Specifications

Change “2.1.1 Basic Specifications” as follows.

Table 4.1.1 (a) Basic specifications of each PMC path

Function	1st to 5th path PMC	0*i*-F PMC/L	DCSPMC (Note1)	Reference
Multi-Path PMC function	Maximum 5 paths (0*i*-F:Maximum 3 paths)	-	-	1.6
PMC Memory Type	1st PMC PMC Memory-B, C, D, E(Note2) 2nd to 5th PMC PMC Memory-A, B, C Common PMC Memory with 1st PMC	-	-	2.1.3
Programming language	Ladder Step sequence(Note3) Function block	Ladder Function block	Ladder Function block	4 10 11
Divided ladder program - Number of programs - File number	 40(0*i*-F:16) 1 to 99	 6 1 to 99	None	2.1.4
Number of ladder levels	3	2 (Note4)	2 (Note4)	1.4.3
Level 1 execution period	1ms, 2ms, 4ms or 8ms (0*i*-F:4ms or 8ms)	8ms	8ms	1.8, 2.4.3
Processing power - Basic instruction processing speed (transition contact)	 9.1ns/step (0*i*-F:18.2ns/step)	 1μs/step	 1μs/step	-
Program capacity - Ladder - Symbol & Comment - Message	 Up to about 300,000 steps (0*i*-F:100,000steps) At least 1KB At least 8KB	 Up to about 24,000 steps At least 1KB At least 8KB	 Up to about 5,000 steps At least 1KB At least 8KB	2.1.2, 2.1.4
Instructions - Basic instructions - Functional instructions	 24 219	 24 217	 24 210	 2.1.7 2.1.8, 2.1.9
CNC interface - Inputs (F) - Outputs (G)	 768 bytes * 15 768 bytes * 15	 768 bytes * 2 768 bytes * 2	 768 bytes 768 bytes	2.2.1

Function	1st to 5th path PMC	0i-F PMC/L	DCSPMC (Note1)	Reference
DI/DO - Inputs (X) - Outputs(Y)	 Up to 4,096 points (0*i*-F:2,048 points) Up to 4,096 points (0*i*-F:2,048 points)	 Up to 1,024 points Up to 1,024 points	 Up to 896 points Up to 896 points	2.2.2, 3
Symbol & Comment				1.2.7, 2.1.5
- Number of symbol characters	40	40	40	
- Number of comment characters	255 * 4	255 * 4	255 * 4	
Program storage area (Flash ROM)	Max. 5MB (0*i*-F:Max. 2MB)	Max. 768KB	128 KB	2.1.4

NOTE

1. This PMC is used for Dual Check Safety function (option) and handles the safety related signals.
2. PMC Memory Type-E is enabled only on a special series of CNC software.
3. The Step Sequence is available in the main ladder of 1st PMC.
4. A program can be created on level 3 to maintain source-level compatibility with programs for other models, but it is not executed.

Table 4.1.1 (b) Basic specifications of each PMC Memory Type

Function	1st to 5th PMC				0*i*-F PMC/L	DCSPMC (Note 1)
	PMC Memory-A	PMC Memory-B	PMC Memory-C	PMC Memory-D PMC Memory-E (Note2)		
PMC Memory						
• Internal relay (R)	1,500 bytes	8,000 bytes	16,000 bytes	60,000 bytes	1,500 bytes	1,500 bytes
• System Relay (R9000 or Z0)	500 bytes	500 bytes	500 bytes	500 bytes	500 bytes	500 bytes
• Extra relay (E) (Note3)	10,000 bytes	10,000 bytes	10,000 bytes	10,000 bytes	10,000 bytes	(Note 4)
• Message display (A) · Display requests · Status displays	 2,000 points 2,000 points	 2,000 points 2,000 points	 4,000 points 4,000 points	 6,000 points 6,000 points	 2,000 points 2,000 points	 (Note 5) (Note 5)
• Nonvolatile memory						
• Timer (T) · Variable timer · Variable timer precision	 80 bytes (40 pieces) 80 bytes (40 pieces)	 500 bytes (250 pieces) 500 bytes (250 pieces)	 1,000 bytes (500 pieces) 1,000 bytes (500 pieces)	 1,000 bytes (500 pieces) 1,000 bytes (500 pieces)	 80 bytes (40 pieces) 80 bytes (40 pieces)	 80 bytes (40 pieces) 80 bytes (40 pieces)
• Counter (C) · Variable counter · Fixed counter	 80 bytes (20 pieces) 40 bytes (20 pieces)	 400 bytes (100 pieces) 200 bytes (100 pieces)	 800 bytes (200 pieces) 400 bytes (200 pieces)	 1200 bytes (300 pieces) 600 bytes (300 pieces)	 80 bytes (20 pieces) 40 bytes (20 pieces)	 80 bytes (20 pieces) 40 bytes (20 pieces)
• Keep relay (K) · User area · System area	 20 bytes 100 bytes	 100 bytes 100 bytes	 200 bytes 100 bytes	 300 bytes 100 bytes	 100 bytes 100 bytes	 20 bytes 100 bytes
• Data table (D)	3,000 bytes	10,000 bytes	20,000 bytes (Note 6)	60,000 bytes (Note 6)	3,000 bytes	3,000 bytes
• Step sequence · Step number (S)	 (None)	 2,000 bytes	 2,000 bytes	 2,000 bytes	 (None)	 (None)
Functional instructions						
• Variable timers (TMR)	40 pieces	250 pieces	500 pieces	500 pieces	40 pieces	40 pieces
• Fixed timers (TMRB/TMRBF)	100 pieces	500 pieces	1,000 pieces	1,500 pieces	100 pieces	100 pieces
• Variable counters (CTR)	20 pieces	100 pieces	200 pieces	300 pieces	20 pieces	20 pieces
• Fixed counters (CTRB)	20 pieces	100 pieces	200 pieces	300 pieces	20 pieces	20 pieces
• Rising/Falling edge detection (DIFU/DIFD)	256 pieces	1,000 pieces	2,000 pieces	3,000 pieces	256 pieces	256 pieces
• Labels (LBL)	9,999 pieces	9,999 pieces	9,999 pieces	9,999 pieces	9,999 pieces	9,999 pieces
• Subprograms (SP)	512 pieces	5,000 pieces	5,000 pieces	5,000 pieces	512 pieces	512 pieces

NOTE
1 This PMC is used for Dual Check Safety function (option).
2 PMC Memory Type-E is enabled only on a special series of CNC software.
3 The extra relay is common memory for the multi-PMC function. This means that its size covers all of PMCs. Moreover, It is possible to use the extra relay as nonvolatile memory by the option. (Exclude 0*i*-F PMC/L)
4 No extra relay is available for DCSPMC.
5 The message display relay is ineffective in DCSPMC because the message display function is unavailable in it.
6 Under the configuration having two or more paths of PMC Memory-C or one path of PMC Memory-D or E, specify the “Nonvolatile PMC data table area expansion 40KB” option. If this option is not added, the expanded data table area (D10000~) is not kept after rebooting CNC. Refer to subsection 2.1.3 for details.

4.1.2 Total Ladder Steps of Multi-path PMC

Change part of "2.1.2 Total Ladder Steps of Multi-path PMC" as follows.

For the multi-path PMC system, you can specify a ladder step option by the total step of all of PMCs.

Table 4.1.2 (a) Ladder step options of 30*i*/31*i*/32*i*/35*i*-B, Power Motion *i*-A, 0*i*-F PMC

Option name	Specification	Maximum ladder size
PMC Ladder Function 24,000 Steps	Basic	102 KB
PMC Ladder Function 32,000 Steps	H990#32K	136 KB
PMC Ladder Function 64,000 Steps	H990#64K	272 KB
PMC Ladder Function 100,000 Steps	H990#100K	425 KB
PMC Ladder Function 300,000 Steps (Note)	H990#300K	1,275 KB

NOTE
The option is not supported for the Series 0*i*-F.

Table 4.1.2 (b) Ladder step options of 0*i*-F PMC/L

Option name	Specification	Maximum ladder size
PMC Ladder Function 5,000 Steps	Basic	21.25 KB
PMC Ladder Function 8,000 Steps	H990#8K	34 KB
PMC Ladder Function 24,000 Steps	H990#24K	102 KB

**** omitted below ****

4.1.3 Determination of PMC Memory Type

Change "2.1.3 Determination of PMC Memory Type" as follows.

PMC memory type

There are five PMC memory types i.e. memory-A, memory-B, memory-C, memory-D and memory-E. These memory types differ in the size of PMC address. For the 2nd to 5th path PMC, the PMC memory can be also shared with the 1st path PMC. The 0*i*-F PMC/L and the DCSPMC do not have plural PMC memory types.

For the details of the PMC memory type, refer to subsection "2.1.1". As for the CNC parameter for the PMC memory type, refer to subsection "2.4.3".

The following is the selectable PMC memory types in each PMC path.

1st path PMC	2nd to 5th path PMC	Remark
PMC-memory B (default) PMC-memory C	PMC-memory A (default) PMC-memory B PMC-memory C Shared with 1st path PMC	You can specify up to three paths both of PMC-memory B and C in total.
PMC-memory D PMC-memory E (NOTE)	Shared with 1st path PMC	

NOTE
PMC Memory Type-E is enabled only on a special series of CNC software.

Nonvolatile area of the data table in each PMC memory type

The following table is the data table number and basic nonvolatile area of each PMC memory type.

Table 4.1.3 (a) Data table number of each PMC memory type

PMC memory type	Data Table	Basic nonvolatile area
PMC memory-A	3,000 bytes	3,000 bytes
PMC memory-B	10,000 bytes	10,000 bytes
PMC memory-C	20,000 bytes	20,000 bytes (In case of using one path of PMC-memory C) 10,000 bytes (In case of using two or more paths of PMC-memory C)
PMC memory-D PMC memory-E	60,000 bytes	10,000 bytes

NOTE
To use two or more paths of PMC memory-C or one path of PMC memory-D or E, specify the option "Nonvolatile PMC data table area expansion (40KB)". If this option is not specified, the data at D10000 and subsequent addresses is not saved.

4.1.4 Program Capacity

Change part of "2.1.4 Program Capacity" as follows.

All of the memory size, to which save the sequence program and multi-language PMC message data for all PMC paths, is specified as the combination of the following two options. The size of each data is calculated per 128KB.
Minimum unit of the size of divided ladder program is also 128KB. You can make up to 40(Note1) programs of main ladder and divided ladder within specified total memory size.

(1) PMC Ladder step option (30*i*/31*i*/32*i*/35*i*-B, Power Motion *i*-A, 0*i*-F PMC)

Option name	Memory size
PMC Ladder Function 24,000 Steps (Basic)	256 KB
PMC Ladder Function 32,000 Steps	384 KB
PMC Ladder Function 64,000 Steps	768 KB
PMC Ladder Function 100,000 Steps	1 MB (1,024 KB)
PMC Ladder Function 300,000 Steps (Note2)	3 MB (3,072 KB)

(2) PMC Ladder step option (0*i*-F PMC/L)

Option name	Memory size
PMC Ladder Function 5,000 Steps (Basic)	128 KB
PMC Ladder Function 8,000 Steps	128 KB
PMC Ladder Function 24,000 Steps	256 KB

(3) PMC Symbol, Comment and Message capacity expansion option (30*i*/31*i*/32*i*/35*i*-B, Power Motion *i*-A, 0*i*-F PMC)

Option name	Memory size
PMC Symbol, Comment and Message capacity expansion (512KB)	512 KB
PMC Symbol, Comment and Message capacity expansion (1MB)	1MB (1,024 KB)
PMC Symbol, Comment and Message capacity expansion (2MB) (Note2)	2MB (2,048 KB)

(4) PMC Symbol, Comment and Message capacity expansion option (0*i*-F PMC/L)

Option name	Memory size
PMC Symbol, Comment and Message capacity expansion (512KB)	512 KB

⚠ **CAUTION**
When using 0*i*-F PMC/L, create message data in sequence program and message data for multi-language display, so that total size of those data becomes less than 128KB. If total size exceeds 128KB, PMC alarm "ER59 MESSAGE DATA SIZE OVER" occurs, and the sequence program does not start.

NOTE
1 Up to 16 programs are available for 0*i*-F PMC. And, up to 6 programs are available for 0*i*-F PMC/L.
2 These options are not supported by the Series 0*i*-F.

***** omitted below *****

4.1.5 Used Memory Size of Sequence Program

Change “2.1.5 Used Memory Size of Sequence Program” as follows.

The following table lists the memory capacity used by sequence programs. When creating the sequence programs, keep their total size within this memory capacity.

Table 4.1.5 (a) Used memory size for each data

Category	Item	Required memory size (Note 1)
Ladder (Note 2)	Basic instruction	Refer to table 2.1.8.
	Functional instruction	Refer to table 2.1.9 and table2.1.10.
	Functional instruction parameter	4 bytes
Symbol/comment conventional type (Note 2)	One definition of symbol/comment (Including symbol string)	24 bytes
	One comment character	1 byte (Note 3)
Symbol/comment extended type (Note 2)	One definition of symbol/comment	16 - 23 bytes (Note 5)
	One symbol character	1 byte
	One comment character	1 byte (Note 3)
	One sub-program	8 bytes (Note 6)
Message (Note 2)	One message character (alphanumeric characters)	1 byte (Note 4)
Others	Area used by the system	About 16K bytes (PMC Memory-A, B, DCS PMC)
		About 24K bytes (Note 7) (PMC Memory-C)
		About 32K bytes (Note 7) (PMC Memory-D, E)

NOTE

1 The total sequence program size (including all items such as ladders, symbols/comments, and messages) cannot exceed the sequence program memory storage capacity. If a ladder, symbol/ comment, or message is large, the size of other categories may be limited.
2 The PMC programmer may adjust arrangement of these items in the sequence program memory to improve processing efficiency. As a result, up to 1K byte (1024 bytes) may be added to the sum of the sizes of individual items.
3 Each full-size character takes a memory capacity of 2 bytes.
4 For Japanese and special characters, each character in a character code notation (including leading and trailing "@" characters) takes a memory capacity of one byte. See descriptions about the DISPB function instructions for the character input code notation.
5 One definition of extended symbol and comment takes 16-23 bytes plus the memory according to the length of symbol and comment.
6 8 bytes are taken for a sub-program when local symbols are defined in the sub-program.
7 In the PMC Memory-C, the system area is expanded by about 8KB from PMC Memory-A or B. In the PMC Memory-D or E, the area is expanded by about 16KB from PMC Memory-A or B. Therefore, available memory size for Symbol, Comment and Message data is smaller than PMC Memory-A and B. If the program overflowed by converting PMC Memory Type, decrease the Symbol, Comment or Message data, or upgrade the Ladder step option to larger size.

4.1.6 PMC Addresses

Change “2.1.6 PMC Address” as follows.

Table 4.1.6 (a) PMC Address list(30*i*/31*i*/32*i*/35*i*-B, Power Motion *i*-A, 0*i*-F PMC) (1)

Signals	Symbol	1st to 5th path PMC			
		PMC Memory-A	PMC Memory-B	PMC Memory-C	PMC Memory-D PMC Memory-E (Note 2)
Input signal to the PMC from the machine	X	X0 ~ X127 X200 ~ X327 X400 ~ X527 X600 ~ X727 X1000 ~ X1127 (Note 3)	X0 ~ X127 X200 ~ X327 X400 ~ X527 X600 ~ X727 X1000 ~ X1127 (Note 3)	X0 ~ X127 X200 ~ X327 X400 ~ X527 X600 ~ X727 X1000 ~ X1127 (Note 3)	X0 ~ X127 X200 ~ X327 X400 ~ X527 X600 ~ X727 X1000 ~ X1127 (Note 3)
Output signal from the PMC to the machine	Y	Y0 ~ Y127 Y200 ~ Y327 Y400 ~ Y527 Y600 ~ Y727 Y1000 ~ Y1127 (Note 3)	Y0 ~ Y127 Y200 ~ Y327 Y400 ~ Y527 Y600 ~ Y727 Y1000 ~ Y1127 (Note 3)	Y0 ~ Y127 Y200 ~ Y327 Y400 ~ Y527 Y600 ~ Y727 Y1000 ~ Y1127 (Note 3)	Y0 ~ Y127 Y200 ~ Y327 Y400 ~ Y527 Y600 ~ Y727 Y1000 ~ Y1127 (Note 3)
Input signal to the PMC from the CNC	F	F0 ~ F767 F1000 ~ F1767 F2000 ~ F2767 F3000 ~ F3767 F4000 ~ F4767 F5000 ~ F5767 F6000 ~ F6767 F7000 ~ F7767 F8000 ~ F8767 F9000 ~ F9767	F0 ~ F767 F1000 ~ F1767 F2000 ~ F2767 F3000 ~ F3767 F4000 ~ F4767 F5000 ~ F5767 F6000 ~ F6767 F7000 ~ F7767 F8000 ~ F8767 F9000 ~ F9767	F0 ~ F767 F1000 ~ F1767 F2000 ~ F2767 F3000 ~ F3767 F4000 ~ F4767 F5000 ~ F5767 F6000 ~ F6767 F7000 ~ F7767 F8000 ~ F8767 F9000 ~ F9767	F0 ~ F767 F1000 ~ F1767 F2000 ~ F2767 F3000 ~ F3767 F4000 ~ F4767 F5000 ~ F5767 F6000 ~ F6767 F7000 ~ F7767 F8000 ~ F8767 F9000 ~ F9767 Below is only for PMC Memory-E F10000 ~ F10767 F11000 ~ F11767 F12000 ~ F12767 F13000 ~ F13767 F14000 ~ F14767

Table 4.1.6 (b) PMC Address list(30*i*/31*i*/32*i*/35*i*-B, Power Motion *i*-A, 0*i*-F PMC) (2)

Signals	Symbol	1st to 5th path PMC			
		PMC Memory-A	PMC Memory-B	PMC Memory-C	PMC Memory-D PMC Memory-E (Note 2)
Output signal from the PMC to the CNC	G	G0 ~ G767 G1000 ~ G1767 G2000 ~ G2767 G3000 ~ G3767 G4000 ~ G4767 G5000 ~ G5767 G6000 ~ G6767 G7000 ~ G7767 G8000 ~ G8767 G9000 ~ G9767	G0 ~ G767 G1000 ~ G1767 G2000 ~ G2767 G3000 ~ G3767 G4000 ~ G4767 G5000 ~ G5767 G6000 ~ G6767 G7000 ~ G7767 G8000 ~ G8767 G9000 ~ G9767	G0 ~ G767 G1000 ~ G1767 G2000 ~ G2767 G3000 ~ G3767 G4000 ~ G4767 G5000 ~ G5767 G6000 ~ G6767 G7000 ~ G7767 G8000 ~ G8767 G9000 ~ G9767	G0 ~ G767 G1000 ~ G1767 G2000 ~ G2767 G3000 ~ G3767 G4000 ~ G4767 G5000 ~ G5767 G6000 ~ G6767 G7000 ~ G7767 G8000 ~ G8767 G9000 ~ G9767 Below is only for PMC Memory-E G10000 ~ G10767 G11000 ~ G11767 G12000 ~ G12767 G13000 ~ G13767 G14000 ~ G14767
Input signal from other PMC path	M	M0 ~ M767 (Note 4)	M0 ~ M767 (Note 4)	M0 ~ M767 (Note 4)	M0 ~ M767 (Note 4)
Output signal to other PMC path	N	N0 ~ N767 (Note 4)	N0 ~ N767 (Note 4)	N0 ~ N767 (Note 4)	N0 ~ N767 (Note 4)
Internal relay	R	R0 ~ R1499	R0 ~ R7999	R0 ~ R15999	R0 ~ R59999
System relay	R / Z	R9000 ~ R9499	R9000 ~ R9499	Z0 ~ Z499	Z0 ~ Z499
Extra relay	E	E0 ~ E9999 (Note 5)	E0 ~ E9999 (Note 5)	E0 ~ E9999 (Note 5)	E0 ~ E9999 (Note 5)
Message display ・Display request ・Display status	A	A0 ~ A249 A9000 ~ A9249	A0 ~ A249 A9000 ~ A9249	A0 ~ A499 A9000 ~ A9499	A0 ~ A749 A9000 ~ A9749
Timer ・Variable timer ・Variable timer precision (Note 7)	T	T0 ~ T79 T9000 ~ T9076	T0 ~ T499 T9000 ~ T9499	T0 ~ T999 T9000 ~ T9999	T0 ~ T999 T9000 ~ T9999
Counter ・Variable counter ・Fixed counter	C	C0 ~ C79 C5000 ~ C5039	C0 ~ C399 C5000 ~ C5199	C0 ~ C799 C5000 ~ C5399	C0～C1199 C5000～C5599
Keep relay ・User area ・System area	K	K0 ~ K19 K900 ~ K999	K0 ~ K99 K900 ~ K999	K0 ~ K199 K900 ~ K999	K0 ~ K299 K900 ~ K999
Data table	D	D0 ~ D2999	D0 ~ D9999	D0 ~ D19999 (Note 8)	D0 ~ D59999 (Note 8)
Label	L	L1 ~ L9999	L1 ~ L9999	L1 ~ L9999	L1 ~ L9999
Subprogram	P	P1 ~ P512	P1 ~ P5000	P1 ~ P5000	P1 ~ P5000
Step number (Step sequence)	S	(none)	S1 ~ S2000	S1 ~ S2000	S1 ~ S2000

Table 4.1.6 (c) PMC Address list(0*i*-F PMC/L, DCSPMC)

Signals	Symbol	0*i*-F PMC/L	DCSPMC (Note 1)
Input signal to the PMC from the machine	X	X0 ~ X127	X0 ~ X127
Output signal from the PMC to the machine	Y	Y0 ~ Y127	Y0 ~ Y127
Input signal to the PMC from the CNC	F	F0 ~ F767 F1000 ~ F1767	F0 ~ F767
Output signal from the PMC to the CNC	G	G0 ~ G767 G1000 ~ G1767	G0 ~ G767
Input signal from other PMC path	M	-	-
Output signal to other PMC path	N	-	-
Internal relay	R	R0 ~ R1499	R0 ~ R1499
System relay	R / Z	R9000 ~ R9499	R9000 ~ R9499
Extra relay	E	E0 ~ E9999	(Note 6)
Message display ・Display request ・Display status	A	 A0 ~ A249 A9000 ~ A9249	-
Timer ・Variable timer ・Variable timer precision (Note 7)	T	 T0 ~ T79 T9000 ~ T9079	 T0 ~ T79 T9000 ~ T9079
Counter ・Variable counter ・Fixed counter	C	 C0 ~ C79 C5000 ~ C5039	 C0 ~ C79 C5000 ~ C5039
Keep relay ・User area ・System area	K	 K0 ~ K99 K900 ~ K999	 K0 ~ K19 K900 ~ K999
Data table	D	D0 ~ D2999	D0 ~ D2999
Label	L	L1 ~ L9999	L1 ~ L9999
Subprogram	P	P1 ~ P512	P1 ~ P512
Step number (Step sequence)	S	(none)	(none)

NOTE

1 This PMC is used for Dual Check Safety function (option).
2 PMC Memory Type-E is enabled only on a special series of CNC software.
3 This area is reserved for PMC management software. Do not use it in user programs.
4 The M/N addresses cannot be used in 4th and 5th path PMC.
5 This area is common memory for the multi-path PMC function. Each program can write and read the same value in the area.
6 No extra relay is available for the Dual Check Safety PMC.
7 This area is used to specify the precision of a variable timer.
- Don't modify the value of active timer and its precision except for writing same value.
- Don't set the value other than the following range.
- If above rules are violated, the behavior of the timer is not guaranteed.

The value of precision
0: Default (8 msec or 48 msec)
1: 1 msec
2: 10 msec
3: 100 msec
4: 1 sec
5: 1 min

8 To save all area of the data table, the “Nonvolatile PMC data table area expansion (40KB)” option may be necessary. See “2.1.3 Determination of PMC Memory Type” for details.

4.1.7 Basic Instructions

Change “2.1.7 Basic Instructions” as follows.

Instruction name	Required memory size	1st to 5th path PMC	0*i*-F PMC/L	DCSPMC (Note)
RD	4 bytes	○	○	○
RD.NOT	4 bytes	○	○	○
WRT	4 bytes	○	○	○
WRT.NOT	4 bytes	○	○	○
AND	4 bytes	○	○	○
AND.NOT	4 bytes	○	○	○
OR	4 bytes	○	○	○
OR.NOT	4 bytes	○	○	○
RD.STK	4 bytes	○	○	○
RD.NOT.STK	4 bytes	○	○	○
AND.STK	4 bytes	○	○	○
OR.STK	4 bytes	○	○	○
SET	4 bytes	○	○	○
RST	4 bytes	○	○	○
RDPT	12 bytes	●	●	●
ANDPT	12 bytes	●	●	●
ORPT	12 bytes	●	●	●
RDPT.STK	12 bytes	●	●	●
RDNT	12 bytes	●	●	●
ANDNT	12 bytes	●	●	●
ORNT	12 bytes	●	●	●
RDNT.STK	12 bytes	●	●	●
PUSH	4 bytes	●	●	●
POP	4 bytes	●	●	●

(○: Usable. ●: The Extended PMC Ladder Instruction Function. ×: Unusable.)

NOTE
This PMC is used for Dual Check Safety function (option). See “Dual Check Safety Connection Manual” of each CNC series for details.

4.1.8 Functional Instructions (Arranged in Sequence of Instruction Group)

Change "2.1.8 Functional Instructions (Arranged in Sequence of Instruction Group)" as follows.

Table 4.1.8 (a) Functional instruction list (arranged in sequence of instruction group) (1)

Instruction group		Instruction name	SUB No.	Processing	Required memory size (byte)	1st to 5th PMC	0*i*-F PMC/L	DCS PMC (Note1)
Timer	1	TMR	3	On-delay timer	8	○	○	○
	2	TMRB	24	Fixed on-delay timer	12	○	○	○
	3	TMRBF	77	Fixed off-delay timer	12	○	○	○
	4	TMRC	54	On-delay timer	16	○	○	○
	5	TMRST	221	Stop watch timer (1 ms accuracy)	20	●	●	●
	6	TMRSS	222	Stop watch timer (1 sec accuracy)	20	●	●	●
Counter	1	CTR	5	Counter processing	8	○	○	○
	2	CTRB	56	Counter processing	12	○	○	○
	3	CTRC	55	Counter processing	12	○	○	○
	4	CTRD	223	Counter processing (4 byte length)	12	●	●	●
Data transfer	1	MOVB	43	1-byte transfer	12	○	○	○
	2	MOVW	44	2-byte transfer	12	○	○	○
	3	MOVD	47	4-byte transfer	12	○	○	○
	4	MOVN	45	Transfer of arbitrary number of bytes	16	○	○	○
	5	MOVE	8	Data transfer after logical product	20	○	○	○
	6	MOVOR	28	Data transfer after logical sum	16	○	○	○
	7	XMOVB	35	Index modification binary data transfer	24	○	○	○
	8	XMOV	18	Index modification data transfer	20	○	○	○
	9	MOVBT	224	Bit transfer	24	●	●	●
	10	SETNB	225	Data setting (1 byte length)	20	●	●	●
	11	SETNW	226	Data setting (2 byte length)	20	●	●	●
	12	SETND	227	Data setting (4 byte length)	20	●	●	●
	13	XCHGB	228	Data exchange (1 byte length)	12	●	●	●
	14	XCHGW	229	Data exchange (2 byte length)	12	●	●	●
	15	XCHGD	230	Data exchange (4 byte length)	12	●	●	●
	16	SWAPW	231	Data swap (2 byte length)	16	●	●	●
	17	SWAPD	232	Data swap (4 byte length)	16	●	●	●
	18	DSCHB	34	Binary data search	24	○	○	○
	19	DSCH	17	Data search	20	○	○	○

(○: Usable, ●: The Extended PMC Ladder Instruction Function, Δ: Executed as NOP instruction (Note 2), ×: Unusable.)

Table 4.1.8 (b) Functional instruction list (arranged in sequence of instruction group) (2)

Instruction group		Instruction name	SUB No.	Processing	Required memory size (byte)	1st to 5th PMC	0*i*-F PMC/L	DCS PMC (Note1)
Table Data	1	TBLRB	233	Reading data from table (1 byte length)	24	●	●	●
	2	TBLRW	234	Reading data from table (2 byte length)	24	●	●	●
	3	TBLRD	235	Reading data from table (4 byte length)	24	●	●	●
	4	TBLRN	236	Reading data from table (Arbitrary byte length)	28	●	●	●
	5	TBLWB	237	Writing data to table (1 byte length)	24	●	●	●
	6	TBLWW	238	Writing data to table (2 byte length)	24	●	●	●
	7	TBLWD	239	Writing data to table (4 byte length)	24	●	●	●
	8	TBLWN	240	Writing data to table (Arbitrary byte length)	28	●	●	●
	9	DSEQB	241	Searching data from table (=) (1 byte length)	28	●	●	●
	10	DSEQW	242	Searching data from table (=) (2 byte length)	28	●	●	●
	11	DSEQD	243	Searching data from table (=) (4 byte length)	28	●	●	●
	12	DSNEB	244	Searching data from table (≠) (1 byte length)	28	●	●	●
	13	DSNEW	245	Searching data from table (≠) (2 byte length)	28	●	●	●
	14	DSNED	246	Searching data from table (≠) (4 byte length)	28	●	●	●
	15	DSGTB	247	Searching data from table (>) (1 byte length)	28	●	●	●
	16	DSGTW	248	Searching data from table (>) (2 byte length)	28	●	●	●
	17	DSGTD	249	Searching data from table (>) (4 byte length)	28	●	●	●
	18	DSLTB	250	Searching data from table (<) (1 byte length)	28	●	●	●
	19	DSLTW	251	Searching data from table (<) (2 byte length)	28	●	●	●
	20	DSLTD	252	Searching data from table (<) (4 byte length)	28	●	●	●
	21	DSGEB	253	Searching data from table (≧) (1 byte length)	28	●	●	●
	22	DSGEW	254	Searching data from table (≧) (2 byte length)	28	●	●	●
	23	DSGED	255	Searching data from table (≧) (4 byte length)	28	●	●	●
	24	DSLEB	256	Searching data from table (≦) (1 byte length)	28	●	●	●
	25	DSLEW	257	Searching data from table (≦) (2 byte length)	28	●	●	●
	26	DSLED	258	Searching data from table (≦) (4 byte length)	28	●	●	●
	27	DMAXB	259	Maximum data (1 byte length)	28	●	●	●
	28	DMAXW	260	Maximum data (2 byte length)	28	●	●	●
	29	DMAXD	261	Maximum data (4 byte length)	28	●	●	●
	30	DMINB	262	Minimum data (1 byte length)	28	●	●	●
	31	DMINW	263	Minimum data (2 byte length)	28	●	●	●
	32	DMIND	264	Minimum data (4 byte length)	28	●	●	●

(○: Usable, ●: The Extended PMC Ladder Instruction Function, ∆: Executed as NOP instruction (Note 2), ×: Unusable.)

Table 4.1.8 (c) Functional instruction list (arranged in sequence of instruction group) (3)

Instruction group		Instruction name	SUB No.	Processing	Required memory size (byte)	1st to 5th PMC	0*i*-F PMC/L	DCS PMC (Note1)
Comparison	1	EQB	200	Signed Binary Comparison (=) (1 byte length)	16	○	○	○
	2	EQW	201	Signed Binary Comparison (=) (2 byte length)	16	○	○	○
	3	EQD	202	Signed Binary Comparison (=) (4 byte length)	16	○	○	○
	4	NEB	203	Signed Binary Comparison (≠) (1 byte length)	16	○	○	○
	5	NEW	204	Signed Binary Comparison (≠) (2 byte length)	16	○	○	○
	6	NED	205	Signed Binary Comparison (≠) (4 byte length)	16	○	○	○
	7	GTB	206	Signed Binary Comparison (>) (1 byte length)	16	○	○	○
	8	GTW	207	Signed Binary Comparison (>) (2 byte length)	16	○	○	○
	9	GTD	208	Signed Binary Comparison (>) (4 byte length)	16	○	○	○
	10	LTB	209	Signed Binary Comparison (<) (1 byte length)	16	○	○	○
	11	LTW	210	Signed Binary Comparison (<) (2 byte length)	16	○	○	○
	12	LTD	211	Signed Binary Comparison (<) (4 byte length)	16	○	○	○
	13	GEB	212	Signed Binary Comparison (≧) (1 byte length)	16	○	○	○
	14	GEW	213	Signed Binary Comparison (≧) (2 byte length)	16	○	○	○
	15	GED	214	Signed Binary Comparison (≧) (4 byte length)	16	○	○	○
	16	LEB	215	Signed Binary Comparison (≦) (1 byte length)	16	○	○	○
	17	LEW	216	Signed Binary Comparison (≦) (2 byte length)	16	○	○	○
	18	LED	217	Signed Binary Comparison (≦) (4 byte length)	16	○	○	○
	19	RNGB	218	Signed Binary Comparison (range) (1 byte length)	20	○	○	○
	20	RNGW	219	Signed Binary Comparison (range) (2 byte length)	20	○	○	○
	21	RNGD	220	Signed Binary Comparison (range) (4 byte length)	20	○	○	○
	22	COMPB	32	Comparison between binary data	20	○	○	○
	23	COMP	15	Comparison	16	○	○	○
	24	COIN	16	Coincidence check	16	○	○	○

(○: Usable, ●: The Extended PMC Ladder Instruction Function, △: Executed as NOP instruction (Note 2), ×: Unusable.)

Table 4.1.8 (d) Functional instruction list (arranged in sequence of instruction group) (4)

Instruction group		Instruction name	SUB No.	Processing	Required memory size (byte)	1st to 5th PMC	0*i*-F PMC/L	DCS PMC (Note1)
Bit operation	1	DIFU	57	Rising-edge detection	8	○	○	○
	2	DIFD	58	Falling-edge detection	8	○	○	○
	3	EOR	59	Exclusive OR	20	○	○	○
	4	AND	60	Logical AND	20	○	○	○
	5	OR	61	Logical OR	20	○	○	○
	6	NOT	62	Logical NOT	16	○	○	○
	7	PARI	11	Parity check	8	○	○	○
	8	SFT	33	Shift register	8	○	○	○
	9	EORB	265	Exclusive OR (1 byte length)	20	●	●	●
	10	EORW	266	Exclusive OR (2 byte length)	20	●	●	●
	11	EORD	267	Exclusive OR (4 byte length)	20	●	●	●
	12	ANDB	268	Logical AND (1 byte length)	20	●	●	●
	13	ANDW	269	Logical AND (2 byte length)	20	●	●	●
	14	ANDD	270	Logical AND (4 byte length)	20	●	●	●
	15	ORB	271	Logical OR (1 byte length)	20	●	●	●
	16	ORW	272	Logical OR (2 byte length)	20	●	●	●
	17	ORD	273	Logical OR (4 byte length)	20	●	●	●
	18	NOTB	274	Logical NOT (1 byte length)	16	●	●	●
	19	NOTW	275	Logical NOT (2 byte length)	16	●	●	●
	20	NOTD	276	Logical NOT (4 byte length)	16	●	●	●
	21	SHLB	277	Bit shift left (1 byte length)	20	●	●	●
	22	SHLW	278	Bit shift left (2 byte length)	20	●	●	●
	23	SHLD	279	Bit shift left (4 byte length)	20	●	●	●
	24	SHLN	280	Bit shift left (Arbitrary byte length)	24	●	●	●
	25	SHRB	281	Bit shift right (1 byte length)	20	●	●	●
	26	SHRW	282	Bit shift right (2 byte length)	20	●	●	●
	27	SHRD	283	Bit shift right (4 byte length)	20	●	●	●
	28	SHRN	284	Bit shift right (Arbitrary byte length)	24	●	●	●
	29	ROLB	285	Bit rotation left (1 byte length)	20	●	●	●
	30	ROLW	286	Bit rotation left (2 byte length)	20	●	●	●
	31	ROLD	287	Bit rotation left (4 byte length)	20	●	●	●
	32	ROLN	288	Bit rotation left (Arbitrary byte length)	24	●	●	●
	33	RORB	289	Bit rotation right (1 byte length)	20	●	●	●
	34	RORW	290	Bit rotation right (2 byte length)	20	●	●	●
	35	RORD	291	Bit rotation right (4 byte length)	20	●	●	●
	36	RORN	292	Bit rotation right (Arbitrary byte length)	24	●	●	●
	37	BSETB	293	Bit set (1 byte length)	16	●	●	●
	38	BSETW	294	Bit set (2 byte length)	16	●	●	●
	39	BSETD	295	Bit set (4 byte length)	16	●	●	●
	40	BSETN	296	Bit set (Arbitrary byte length)	20	●	●	●

(○: Usable, ●: The Extended PMC Ladder Instruction Function, ∆: Executed as NOP instruction (Note 2), ×: Unusable.)

Table 4.1.8 (e) Functional instruction list (arranged in sequence of instruction group) (5)

Instruction group		Instruction name	SUB No.	Processing	Required memory size (byte)	1st to 5th PMC	0*i*-F PMC/L	DCS PMC (Note1)
Bit operation	41	BRSTB	297	Bit reset (1 byte length)	16	●	●	●
	42	BRSTW	298	Bit reset (2 byte length)	16	●	●	●
	43	BRSTD	299	Bit reset (4 byte length)	16	●	●	●
	44	BRSTN	300	Bit reset (Arbitrary byte length)	20	●	●	●
	45	BTSTB	301	Bit test (1 byte length)	16	●	●	●
	46	BTSTW	302	Bit test (2 byte length)	16	●	●	●
	47	BTSTD	303	Bit test (4 byte length)	16	●	●	●
	48	BTSTN	304	Bit test (Arbitrary byte length)	20	●	●	●
	49	BPOSB	305	Bit search (1 byte length)	12	●	●	●
	50	BPOSW	306	Bit search (2 byte length)	12	●	●	●
	51	BPOSD	307	Bit search (4 byte length)	12	●	●	●
	52	BPOSN	308	Bit search (Arbitrary byte length)	16	●	●	●
	53	BCNTB	309	Bit count (1 byte length)	12	●	●	●
	54	BCNTW	310	Bit count (2 byte length)	12	●	●	●
	55	BCNTD	311	Bit count (4 byte length)	12	●	●	●
	56	BCNTN	312	Bit count (Arbitrary byte length)	16	●	●	●
Code conversion	1	COD	7	Code conversion	16+n (Note5)	○	○	○
	2	CODB	27	Binary code conversion	20+n (Note5)	○	○	○
	3	DCNV	14	Data conversion	12	○	○	○
	4	DCNVB	31	Extended data conversion	16	○	○	○
	5	DEC	4	Decoding	12	○	○	○
	6	DECB	25	Binary decoding	20	○	○	○
	7	TBCDB	313	Binary to BCD conversion (1 byte length)	16	●	●	●
	8	TBCDW	314	Binary to BCD conversion (2 byte length)	16	●	●	●
	9	TBCDD	315	Binary to BCD conversion (4 byte length)	16	●	●	●
	10	FBCDB	316	BCD to Binary conversion (1 byte length)	16	●	●	●
	11	FBCDW	317	BCD to Binary conversion (2 byte length)	16	●	●	●
	12	FBCDD	318	BCD to Binary conversion (4 byte length)	16	●	●	●

(○: Usable, ●: The Extended PMC Ladder Instruction Function, Δ: Executed as NOP instruction (Note 2), ×: Unusable.)

Table 4.1.8 (f) Functional instruction list (arranged in sequence of instruction group) (6)

Instruction group		Instruction name	SUB No.	Processing	Required memory size (byte)	1st to 5th PMC	0*i*-F PMC/L	DCS PMC (Note1)
Operation	1	ADDB	36	Binary addition	20	○	○	○
	2	SUBB	37	Binary subtraction	20	○	○	○
	3	MULB	38	Binary multiplication	20	○	○	○
	4	DIVB	39	Binary division	20	○	○	○
	5	ADD	19	BCD addition	20	○	○	○
	6	SUB	20	BCD subtraction	20	○	○	○
	7	MUL	21	BCD multiplication	20	○	○	○
	8	DIV	22	BCD division	20	○	○	○
	9	NUMEB	40	Binary constant definition	16	○	○	○
	10	NUME	23	BCD-constant definition	12	○	○	○
	11	ADDSB	319	Addition (1 byte length)	20	●	●	●
	12	ADDSW	320	Addition (2 byte length)	20	●	●	●
	13	ADDSD	321	Addition (4 byte length)	20	●	●	●
	14	SUBSB	322	Subtraction (1 byte length)	20	●	●	●
	15	SUBSW	323	Subtraction (2 byte length)	20	●	●	●
	16	SUBSD	324	Subtraction (3 byte length)	20	●	●	●
	17	MULSB	325	Multiplication (1 byte length)	20	●	●	●
	18	MULSW	326	Multiplication (2 byte length)	20	●	●	●
	19	MULSD	327	Multiplication (4 byte length)	20	●	●	●
	20	DIVSB	328	Division (1 byte length)	20	●	●	●
	21	DIVSW	329	Division (2 byte length)	20	●	●	●
	22	DIVSD	330	Division (4 byte length)	20	●	●	●
	23	MODSB	331	Remainder (1 byte length)	20	●	●	●
	24	MODSW	332	Remainder (2 byte length)	20	●	●	●
	25	MODSD	333	Remainder (4 byte length)	20	●	●	●
	26	INCSB	334	Increment (1 byte length)	8	●	●	●
	27	INCSW	335	Increment (2 byte length)	8	●	●	●
	28	INCSD	336	Increment (4 byte length)	8	●	●	●
	29	DECSB	337	Decrement (1 byte length)	8	●	●	●
	30	DECSW	338	Decrement (2 byte length)	8	●	●	●
	31	DECSD	339	Decrement (4 byte length)	8	●	●	●
	32	ABSSB	340	Absolute value (1 byte length)	16	●	●	●
	33	ABSSW	341	Absolute value (2 byte length)	16	●	●	●
	34	ABSSD	342	Absolute value (4 byte length)	16	●	●	●
	35	NEGSB	343	Sign inversion (1 byte length)	16	●	●	●
	36	NEGSW	344	Sign inversion (2 byte length)	16	●	●	●
	37	NEGSD	345	Sign inversion (4 byte length)	16	●	●	●
	38	PID	460	PID control (Note6)	28	●	×	×

(○: Usable, ●: The Extended PMC Ladder Instruction Function, Δ: Executed as NOP instruction (Note 2), ×: Unusable.)

Table 4.1.8 (g) Functional instruction list (arranged in sequence of instruction group) (7)

Instruction group		Instruction name	SUB No.	Processing	Required memory size (byte)	1st to 5th PMC	0*i*-F PMC/L	DCS PMC (Note1)
CNC Function	1	DISPB	41	Message display	8	○	○	Δ
	2	EXIN	42	External data input	8	○	○	Δ
	3	WINDR	51	CNC window data read	8	○	○	Δ
	4	WINDW	52	CNC window data write	8	○	○	Δ
	5	AXCTL	53	PMC axis control	12	○	○	Δ
	6	PSGN2	63	Position signal	8	○	○	Δ
	7	PSGNL	50	Position signal	12	○	○	Δ
Program control	1	COM	9	Common line control	8	○	○	○
	2	COME	29	End of common line control	4	○	○	○
	3	JMP	10	Jump	12	○	○	○
	4	JMPE	30	End of jump	4	○	○	○
	5	JMPB	68	Label jump 1	16	○	○	○
	6	JMPC	73	Label jump 2	16	○	○	○
	7	LBL	69	Label	12	○	○	○
	8	CALL	65	Conditional subprogram call	12	○	○	○
	9	CALLU	66	Unconditional subprogram call	12	○	○	○
	10	SP	71	Subprogram	8	○	○	○
	11	SPE	72	End of subprogram	4	○	○	○
	12	END1	1	End of first-level program	4	○	○	○
	13	END2	2	End of second-level program	4	○	○	○
	14	END3	48	End of third-level program	4	○ (Note3)	Δ (Note4)	Δ (Note4)
	15	END	64	End of ladder program	4	○	○	○
	16	NOP	70	No operation	8	○	○	○
	17	CS	74	Case call	8	○	○	○
	18	CM	75	Sub program call in case call	12	○	○	○
	19	CE	76	End of case call	4	○	○	○
Rotation control	1	ROT	6	Rotation control	20	○	○	○
	2	ROTB	26	Binary rotation control	24	○	○	○
Invalid instruction	1	SPCNT	46	Spindle control	16	Δ	Δ	Δ
	2	DISP	49	Message display	16+n (Note5)	Δ	Δ	Δ
	3	MMCWR	98	MMC window data read	12	Δ	Δ	Δ
	4	MMCWW	99	MMC window data write	12	Δ	Δ	Δ
	5	FNC90	90	Arbitrary-function instruction 1	8	Δ	Δ	Δ
	6	FNC91	91	Arbitrary-function instruction 2	8	Δ	Δ	Δ
	7	FNC92	92	Arbitrary-function instruction 3	8	Δ	Δ	Δ
	8	FNC93	93	Arbitrary-function instruction 4	8	Δ	Δ	Δ
	9	FNC94	94	Arbitrary-function instruction 5	8	Δ	Δ	Δ
	10	FNC95	95	Arbitrary-function instruction 6	8	Δ	Δ	Δ
	11	FNC96	96	Arbitrary-function instruction 7	8	Δ	Δ	Δ
	12	FNC97	97	Arbitrary-function instruction 8	8	Δ	Δ	Δ

(○: Usable, ●: The Extended PMC Ladder Instruction Function, Δ: Executed as NOP instruction (Note 2), ×: Unusable.)

NOTE

1 This term stands for the Dual Check Safety PMC (option).
2 These instructions are intended to maintain source-level compatibility with programs for conventional models. They are treated as a NOP instruction (instruction that performs no operation).
3 The 3rd level sequence part is available for the compatibility with programs for conventional models. However, the execution cycle period for processing the 3rd level sequence part is not guaranteed. See Section 1.4.3 “Processing priority”.
4 This instruction is available only for source-level compatibility with programs for other models. A program can be created on level 3, but it is not executed.
5 Memory size increases according to the number of data tables to be used. In the COD instruction, CODB instruction (1 byte length), CODB instruction (2 byte length), or DISP instruction, 2 bytes are added for each data. And, when the number of data is odd, extra 2 bytes are added. In the CODB instruction, 4 bytes are added for each data.
6 This instruction cannot be used in some version of PMC software. Executing this instruction on the unsupported version of PMC software will raise the warning “WN58 UNSUPPORTED FUNCTION” on PMC alarm screen, and the ladder program is executed excluding this instruction.

4.1.9 Functional Instructions (Arranged in Sequence of SUB No.)

Change "2.1.9 Functional Instructions (Arranged in Sequence of SUB No.)" as follows.

Table 4.1.9 (a) Functional instruction list (arranged in sequence of SUB No.) (1)

Instruction name	SUB No.	Processing	Required memory size (byte)	1st to 5th PMC	0*i*-F PMC/L	DCS PMC (Note1)
END1	1	End of first-level program	4	○	○	○
END2	2	End of second-level program	4	○	○	○
TMR	3	Timer processing	8	○	○	○
DEC	4	Decoding	12	○	○	○
CTR	5	Counter processing	8	○	○	○
ROT	6	Rotation control	20	○	○	○
COD	7	Code conversion	16+n (Note5)	○	○	○
MOVE	8	Data transfer after logical product	20	○	○	○
COM	9	Common line control	8	○	○	○
JMP	10	Jump	12	○	○	○
PARI	11	Parity check	8	○	○	○
DCNV	14	Data conversion	12	○	○	○
COMP	15	Comparison	16	○	○	○
COIN	16	Coincidence check	16	○	○	○
DSCH	17	Data search	20	○	○	○
XMOV	18	Index modification data transfer	20	○	○	○
ADD	19	Addition	20	○	○	○
SUB	20	Subtraction	20	○	○	○
MUL	21	Multiplication	20	○	○	○
DIV	22	Division	20	○	○	○
NUME	23	Constant definition	12	○	○	○
TMRB	24	Fixed-timer processing	12	○	○	○
DECB	25	Binary decoding	20	○	○	○
ROTB	26	Binary rotation control	24	○	○	○
CODB	27	Binary code conversion	20+n (Note5)	○	○	○
MOVOR	28	Data transfer after logical sum	16	○	○	○
COME	29	End of common line control	4	○	○	○
JMPE	30	End of jump	4	○	○	○
DCNVB	31	Extended data conversion	16	○	○	○
COMPB	32	Binary comparison	20	○	○	○
SFT	33	Shift register	8	○	○	○
DSCHB	34	Binary data search	24	○	○	○
XMOVB	35	Index modification binary data transfer	24	○	○	○
ADDB	36	Binary addition	20	○	○	○
SUBB	37	Binary subtraction	20	○	○	○
MULB	38	Binary multiplication	20	○	○	○
DIVB	39	Binary division	20	○	○	○

(○: Usable, ●: The Extended PMC Ladder Instruction Function, ∆: Executed as NOP instruction (Note 2), ×: Unusable.)

Table 4.1.9 (b) Functional instruction list (arranged in sequence of SUB No.) (2)

Instruction name	SUB No.	Processing	Required memory size (byte)	1st to 5th PMC	0*i*-F PMC/L	DCS PMC (Note1)
NUMEB	40	Binary constant definition	16	○	○	○
DISPB	41	Message display	8	○	○	Δ
EXIN	42	External data input	8	○	○	Δ
MOVB	43	1-byte transfer	12	○	○	○
MOVW	44	2-byte transfer	12	○	○	○
MOVN	45	Transfer of arbitrary number of bytes	16	○	○	○
SPCNT	46	Spindle control	16	Δ	Δ	Δ
MOVD	47	4-byte transfer	12	○	○	○
END3	48	End of third-level program	4	○ (Note3)	Δ (Note4)	Δ (Note4)
DISP	49	Message display	16+n (Note5)	Δ	Δ	Δ
PSGNL	50	Position signal	12	○	○	Δ
WINDR	51	CNC window data read	8	○	○	Δ
WINDW	52	CNC window data write	8	○	○	Δ
AXCTL	53	PMC axis control	12	○	○	Δ
TMRC	54	Timer processing	16	○	○	○
CTRC	55	Counter processing	12	○	○	○
CTRB	56	Counter processing	12	○	○	○
DIFU	57	Rising-edge detection	8	○	○	○
DIFD	58	Falling-edge detection	8	○	○	○
EOR	59	Exclusive OR	20	○	○	○
AND	60	Logical AND	20	○	○	○
OR	61	Logical OR	20	○	○	○
NOT	62	Logical NOT	16	○	○	○
PSGN2	63	Position signal	8	○	○	Δ
END	64	End of ladder program	4	○	○	○
CALL	65	Conditional subprogram call	12	○	○	○
CALLU	66	Unconditional subprogram call	12	○	○	○
JMPB	68	Label jump 1	16	○	○	○
LBL	69	Label	12	○	○	○
NOP	70	No operation	8	○	○	○
SP	71	Subprogram	8	○	○	○
SPE	72	End of subprogram	4	○	○	○
JMPC	73	Label jump 2	16	○	○	○
CS	74	Case call	8	○	○	○
CM	75	Sub program call in case call	12	○	○	○
CE	76	End of case call	4	○	○	○
TMRBF	77	Fixed off-delay timer	12	○	○	○
FNC90	90	Arbitrary-function instruction 1	8	Δ	Δ	Δ
FNC91	91	Arbitrary-function instruction 2	8	Δ	Δ	Δ
FNC92	92	Arbitrary-function instruction 3	8	Δ	Δ	Δ
FNC93	93	Arbitrary-function instruction 4	8	Δ	Δ	Δ

(○: Usable, ●: The Extended PMC Ladder Instruction Function, Δ: Executed as NOP instruction (Note 2), ×: Unusable.)

Table 4.1.9 (c) Functional instruction list (arranged in sequence of SUB No.) (3)

Instruction name	SUB No.	Processing	Required memory size (byte)	1st to 5th PMC	0*i*-F PMC/L	DCS PMC (Note1)
FNC94	94	Arbitrary-function instruction 5	8	Δ	Δ	Δ
FNC95	95	Arbitrary-function instruction 6	8	Δ	Δ	Δ
FNC96	96	Arbitrary-function instruction 7	8	Δ	Δ	Δ
FNC97	97	Arbitrary-function instruction 8	8	Δ	Δ	Δ
MMCWR	98	MMC window data read	12	Δ	Δ	Δ
MMCWW	99	MMC window data write	12	Δ	Δ	Δ
GTB	206	Signed Binary Comparison (>)(1 byte length)	16	○	○	○
GTW	207	Signed Binary Comparison (>)(2 byte length)	16	○	○	○
GTD	208	Signed Binary Comparison (>)(4 byte length)	16	○	○	○
LTB	209	Signed Binary Comparison (<)(1 byte length)	16	○	○	○
LTW	210	Signed Binary Comparison (<)(2 byte length)	16	○	○	○
LTD	211	Signed Binary Comparison (<)(4 byte length)	16	○	○	○
GEB	212	Signed Binary Comparison (≧)(1 byte length)	16	○	○	○
GEW	213	Signed Binary Comparison (≧)(2 byte length)	16	○	○	○
GED	214	Signed Binary Comparison (≧)(4 byte length)	16	○	○	○
LEB	215	Signed Binary Comparison (≦)(1 byte length)	16	○	○	○
LEW	216	Signed Binary Comparison (≦)(2 byte length)	16	○	○	○
LED	217	Signed Binary Comparison (≦)(4 byte length)	16	○	○	○
RNGB	218	Signed Binary Comparison (range)(1 byte length)	20	○	○	○
RNGW	219	Signed Binary Comparison (range)(2 byte length)	20	○	○	○
RNGB	220	Signed Binary Comparison (range)(4 byte length)	20	○	○	○
TMRST	221	Stop watch timer (1 ms accuracy)	20	●	●	●
TMRSS	222	Stop watch timer (1 sec accuracy)	20	●	●	●
CTRD	223	Counter processing (4 byte length)	12	●	●	●
MOVBT	224	Bit transfer	24	●	●	●
SETNB	225	Data setting (1 byte length)	20	●	●	●
SETNW	226	Data setting (2 byte length)	20	●	●	●
SETND	227	Data setting (4 byte length)	20	●	●	●
XCHGB	228	Data exchange (1 byte length)	12	●	●	●
XCHGW	229	Data exchange (2 byte length)	12	●	●	●
XCHGD	230	Data exchange (4 byte length)	12	●	●	●
SWAPW	231	Data swap (2 byte length)	16	●	●	●
SWAPD	232	Data swap (4 byte length)	16	●	●	●
TBLRB	233	Reading data from table (1 byte length)	24	●	●	●
TBLRW	234	Reading data from table (2 byte length)	24	●	●	●
TBLRD	235	Reading data from table (4 byte length)	24	●	●	●
TBLRN	236	Reading data from table (Arbitrary byte length)	28	●	●	●
TBLWB	237	Writing data to table (1 byte length)	24	●	●	●
TBLWW	238	Writing data to table (2 byte length)	24	●	●	●
TBLWD	239	Writing data to table (4 byte length)	24	●	●	●
TBLWN	240	Writing data to table (Arbitrary byte length)	28	●	●	●

(○: Usable, ●: The Extended PMC Ladder Instruction Function, Δ: Executed as NOP instruction (Note 2), ×: Unusable.)

Table 4.1.9 (d) Functional instruction list (arranged in sequence of SUB No.) (4)

Instruction name	SUB No.	Processing	Required memory size (byte)	1st to 5th PMC	0*i*-F PMC/L	DCS PMC (Note1)
DSEQB	241	Searching data from table (=)(1 byte length)	28	●	●	●
DSEQW	242	Searching data from table (=)(2 byte length)	28	●	●	●
DSEQD	243	Searching data from table (=)(4 byte length)	28	●	●	●
DSNEB	244	Searching data from table (≠)(1 byte length)	28	●	●	●
DSNEW	245	Searching data from table (≠)(2 byte length)	28	●	●	●
DSNED	246	Searching data from table (≠)(4 byte length)	28	●	●	●
DSGTB	247	Searching data from table (>)(1 byte length)	28	●	●	●
DSGTW	248	Searching data from table (>)(2 byte length)	28	●	●	●
DSGTD	249	Searching data from table (>)(4 byte length)	28	●	●	●
DSLTB	250	Searching data from table (<)(1 byte length)	28	●	●	●
DSLTW	251	Searching data from table (<)(2 byte length)	28	●	●	●
DSLTD	252	Searching data from table (<)(4 byte length)	28	●	●	●
DSGEB	253	Searching data from table (≧)(1 byte length)	28	●	●	●
DSGEW	254	Searching data from table (≧)(2 byte length)	28	●	●	●
DSGED	255	Searching data from table (≧)(4 byte length)	28	●	●	●
DSLEB	256	Searching data from table (≦)(1 byte length)	28	●	●	●
DSLEW	257	Searching data from table (≦)(2 byte length)	28	●	●	●
DSLED	258	Searching data from table (≦)(4 byte length)	28	●	●	●
DMAXB	259	Maximum data (1 byte length)	28	●	●	●
DMAXW	260	Maximum data (2 byte length)	28	●	●	●
DMAXD	261	Maximum data (4 byte length)	28	●	●	●
DMINB	262	Minimum data (1 byte length)	28	●	●	●
DMINW	263	Minimum data (2 byte length)	28	●	●	●
DMIND	264	Minimum data (4 byte length)	28	●	●	●
EORB	265	Exclusive OR (1 byte length)	20	●	●	●
EORW	266	Exclusive OR (2 byte length)	20	●	●	●
EORD	267	Exclusive OR (4 byte length)	20	●	●	●
ANDB	268	Logical AND (1 byte length)	20	●	●	●
ANDW	269	Logical AND (2 byte length)	20	●	●	●
ANDD	270	Logical AND (4 byte length)	20	●	●	●
ORB	271	Logical OR (1 byte length)	20	●	●	●
ORW	272	Logical OR (2 byte length)	20	●	●	●
ORD	273	Logical OR (4 byte length)	20	●	●	●
NOTB	274	Logical NOT (1 byte length)	16	●	●	●
NOTW	275	Logical NOT (2 byte length)	16	●	●	●
NOTD	276	Logical NOT (4 byte length)	16	●	●	●
SHLB	277	Bit shift left (1 byte length)	20	●	●	●
SHLW	278	Bit shift left (2 byte length)	20	●	●	●
SHLD	279	Bit shift left (4 byte length)	20	●	●	●
SHLN	280	Bit shift left (Arbitrary byte length)	24	●	●	●

(○: Usable, ●: The Extended PMC Ladder Instruction Function, △: Executed as NOP instruction (Note 2), ×: Unusable.)

Table 4.1.9 (e) Functional instruction list (arranged in sequence of SUB No.) (5)

Instruction name	SUB No.	Processing	Required memory size (byte)	1st to 5th PMC	0*i*-F PMC/L	DCS PMC (Note1)
SHRB	281	Bit shift right (1 byte length)	20	●	●	●
SHRW	282	Bit shift right (2 byte length)	20	●	●	●
SHRD	283	Bit shift right (4 byte length)	20	●	●	●
SHRN	284	Bit shift right (Arbitrary byte length)	24	●	●	●
ROLB	285	Bit rotation left (1 byte length)	20	●	●	●
ROLW	286	Bit rotation left (2 byte length)	20	●	●	●
ROLD	287	Bit rotation left (4 byte length)	20	●	●	●
ROLN	288	Bit rotation left (Arbitrary byte length)	24	●	●	●
RORB	289	Bit rotation right (1 byte length)	20	●	●	●
RORW	290	Bit rotation right (2 byte length)	20	●	●	●
RORD	291	Bit rotation right (4 byte length)	20	●	●	●
RORN	292	Bit rotation right (Arbitrary byte length)	24	●	●	●
BSETB	293	Bit set (1 byte length)	16	●	●	●
BSETW	294	Bit set (2 byte length)	16	●	●	●
BSETD	295	Bit set (4 byte length)	16	●	●	●
BSETN	296	Bit set (Arbitrary byte length)	20	●	●	●
BRSTB	297	Bit reset (1 byte length)	16	●	●	●
BRSTW	298	Bit reset (2 byte length)	16	●	●	●
BRSTD	299	Bit reset (4 byte length)	16	●	●	●
BRSTN	300	Bit reset (Arbitrary byte length)	20	●	●	●
BTSTB	301	Bit test (1 byte length)	16	●	●	●
BTSTW	302	Bit test (2 byte length)	16	●	●	●
BTSTD	303	Bit test (4 byte length)	16	●	●	●
BTSTN	304	Bit test (Arbitrary byte length)	20	●	●	●
BPOSB	305	Bit search (1 byte length)	12	●	●	●
BPOSW	306	Bit search (2 byte length)	12	●	●	●
BPOSD	307	Bit search (4 byte length)	12	●	●	●
BPOSN	308	Bit search (Arbitrary byte length)	16	●	●	●
BCNTB	309	Bit count (1 byte length)	12	●	●	●
BCNTW	310	Bit count (2 byte length)	12	●	●	●
BCNTD	311	Bit count (4 byte length)	12	●	●	●
BCNTN	312	Bit count (Arbitrary byte length)	16	●	●	●
TBCDB	313	Binary to BCD conversion (1 byte length)	16	●	●	●
TBCDW	314	Binary to BCD conversion (2 byte length)	16	●	●	●
TBCDD	315	Binary to BCD conversion (4 byte length)	16	●	●	●
FBCDB	316	BCD to Binary conversion (1 byte length)	16	●	●	●
FBCDW	317	BCD to Binary conversion (2 byte length)	16	●	●	●
FBCDD	318	BCD to Binary conversion (4 byte length)	16	●	●	●
ADDSB	319	Addition (1 byte length)	20	●	●	●
ADDSW	320	Addition (2 byte length)	20	●	●	●
ADDSD	321	Addition (4 byte length)	20	●	●	●

(○: Usable, ●: The Extended PMC Ladder Instruction Function, ∆: Executed as NOP instruction (Note 2), ×: Unusable.)

Table 4.1.9 (f) Functional instruction list (arranged in sequence of SUB No.) (6)

Instruction name	SUB No.	Processing	Required memory size (byte)	1st to 5th PMC	0*i*-F PMC/L	DCS PMC (Note1)
SUBSB	322	Subtraction (1 byte length)	20	●	●	●
SUBSW	323	Subtraction (2 byte length)	20	●	●	●
SUBSD	324	Subtraction (3 byte length)	20	●	●	●
MULSB	325	Multiplication (1 byte length)	20	●	●	●
MULSW	326	Multiplication (2 byte length)	20	●	●	●
MULSD	327	Multiplication (4 byte length)	20	●	●	●
DIVSB	328	Division (1 byte length)	20	●	●	●
DIVSW	329	Division (2 byte length)	20	●	●	●
DIVSD	330	Division (4 byte length)	20	●	●	●
MODSB	331	Remainder (1 byte length)	20	●	●	●
MODSW	332	Remainder (2 byte length)	20	●	●	●
MODSD	333	Remainder (4 byte length)	20	●	●	●
INCSB	334	Increment (1 byte length)	8	●	●	●
INCSW	335	Increment (2 byte length)	8	●	●	●
INCSD	336	Increment (4 byte length)	8	●	●	●
DECSB	337	Decrement (1 byte length)	8	●	●	●
DECSW	338	Decrement (2 byte length)	8	●	●	●
DECSD	339	Decrement (4 byte length)	8	●	●	●
ABSSB	340	Absolute value (1 byte length)	16	●	●	●
ABSSW	341	Absolute value (2 byte length)	16	●	●	●
ABSSD	342	Absolute value (4 byte length)	16	●	●	●
NEGSB	343	Sign inversion (1 byte length)	16	●	●	●
NEGSW	344	Sign inversion (2 byte length)	16	●	●	●
NEGSD	345	Sign inversion (4 byte length)	16	●	●	●
PID	460	PID control (Note6)	28	●	×	×

(○: Usable, ●: The Extended PMC Ladder Instruction Function, △: Executed as NOP instruction (Note 2), ×: Unusable.)

NOTE

1. This term stands for the Dual Check Safety PMC (option).
2. These instructions are intended to maintain source-level compatibility with programs for conventional models. They are treated as a NOP instruction (instruction that performs no operation).
3. The 3rd level sequence part is available for the compatibility with programs for conventional models. However, the execution cycle period for processing the 3rd level sequence part is not guaranteed. See Section 1.4.3 “Processing priority”.
4. This instruction is intended to maintain source-level compatibility with programs for other models. A program can be created on level 3, but it is not executed.
5. Memory size increases by the number of data tables to be used. In the COD instruction, CODB instruction (1byte length), CODB instruction (2byte length), or DISP instruction, 2 bytes are added for each data. And, when the number of data is odd, 2 bytes are added moreover. In the CODB instruction, 4 bytes are added for each data.
6. This instruction cannot be used in some version of PMC software. Executing this instruction on the unsupported version of PMC software will raise the warning “WN58 UNSUPPORTED FUNCTION” on PMC alarm screen, and the ladder program is executed excluding this instruction.

4.2 PMC SIGNAL ADDRESSES

4.2.1 Addresses for Signals Between the PMC and CNC (F, G)

Change "2.2.1 Addresses for Signals Between the PMC and CNC (F, G)" as follows.

These addresses are interface areas between PMC and CNC. Refer to the applicable CNC connection manual for details.

(1) Signals from the CNC to the PMC

1st to 5th path PMC		0*i*-F PMC/L	DCSPMC
PMC Memory-A, B, C, D	PMC Memory-E		
F0 ~ F767 F1000 ~ F1767 F2000 ~ F2767 F3000 ~ F3767 F4000 ~ F4767 F5000 ~ F5767 F6000 ~ F6767 F7000 ~ F7767 F8000 ~ F8767 F9000 ~ F9767	F0 ~ F767 F1000 ~ F1767 F2000 ~ F2767 F3000 ~ F3767 F4000 ~ F4767 F5000 ~ F5767 F6000 ~ F6767 F7000 ~ F7767 F8000 ~ F8767 F9000 ~ F9767 F10000 ~ F10767 F11000 ~ F11767 F12000 ~ F12767 F13000 ~ F13767 F14000 ~ F14767	F0 ~ F767 F1000 ~ F1767	F0 ~ F767

(2) Signals from the PMC to the CNC

1st to 5th path PMC		0*i*-F PMC/L	DCSPMC
PMC Memory-A, B, C, D	PMC Memory-E		
G0 ~ G767 G1000 ~ G1767 G2000 ~ G2767 G3000 ~ G3767 G4000 ~ G4767 G5000 ~ G5767 G6000 ~ G6767 G7000 ~ G7767 G8000 ~ G8767 G9000 ~ G9767	G0 ~ G767 G1000 ~ G1767 G2000 ~ G2767 G3000 ~ G3767 G4000 ~ G4767 G5000 ~ G5767 G6000 ~ G6767 G7000 ~ G7767 G8000 ~ G8767 G9000 ~ G9767 G10000 ~ G10767 G11000 ~ G11767 G12000 ~ G12767 G13000 ~ G13767 G14000 ~ G14767	G0 ~ G767 G1000 ~ G1767	G0 ~ G767

NOTE
The PMC paths corresponding to each CNC path to be controlled can be set. As for details, refer to “CNC Parameters Related to the PMCs” in subsection “2.4.3”.

4.2.2 Addresses of Signals Between the PMC and Machine (X, Y)

Change part of “2.2.2 Addresses of Signals Between the PMC and Machine (X, Y)” as follows.

These addresses are interface areas between PMC and machines.

(1) Assignment of the FANUC I/O Link / I/O Link *i*
(a) Signals input from the machine to the PMC

PMC	PMC address	I/O Link	I/O Link *i*
1st to 5th PMC	X0～X127 X200～X327 X400～X527 X600～X727	Assign an address area to each channel. (Note1)	Assign PMC address to each I/O device. (Note2)
0*i*-F PMC/L	X0～X127	Channel 1.	
DCSPMC	X0～X127	Assign to Channel 3. (Note1)	

(b) Signals output from the PMC to the machine

PMC	PMC address	I/O Link	I/O Link *i*
1st to 5th PMC	Y0～Y127 Y200～Y327 Y400～Y527 Y600～Y727	Assign an address area to each channel. (Note1)	Assign PMC address to each I/O device. (Note2)
0*i*-F PMC/L	Y0～Y127	Channel 1.	
DCSPMC	Y0～Y127	Assign to Channel 3. (Note1)	

NOTE
1 See "I/O Link input/output addresses" in subsection "2.4.3" for details.
2 See subsection "3.3.6" for details.
3 X/Y addresses can be also used for network devices. As for details, refer to “The input/output address used by network device” in subsection "2.4.3".

**** omitted below ****

4.2.3 Internal Relay Addresses (R)

Change "2.2.3 Internal Relay Address (R)" as follows.

These addresses are a work area used in sequence programs.
Signals that interface with other control units can be assigned to these bytes over the FA network. It can also be used as the interface with the C language executor and FOCAS2 functions.
Turning on the power clears these areas to 0.

NOTE
This address is not synchronized in the 2nd level ladder. A value of a signal in this address may change during the execution of 2nd level ladder same as 1st and 3rd level ladder when it is written by other program (Ex. Network function, C language executor).

Table 4.2.3 Address of Internal Relay

Data kind	1st to 5th path PMC				0*i*-F PMC/L	DCSPMC
	PMC Memory-A	PMC Memory-B	PMC Memory-C	PMC Memory-D, E		
User area	R0 to R1499	R0 to R7999	R0 to R15999	R0 to R59999	R0 to R1499	R0 to R1499

4.2.4 System Relay Addresses (R9000, Z0)

Change part of "2.2.4 System Relay Address (R9000, Z0)" as follows.

These addresses are a system information area. The area cannot be written from sequence programs.

Table 4.2.4 Address of System Relay

Data kind	1st to 5th path PMC				0*i*-F PMC/L	DCSPMC
	PMC Memory-A	PMC Memory-B	PMC Memory-C	PMC Memory-D, E		
System relays	R9000 to R9499	R9000 to R9499	Z0 to Z499	Z0 to Z499	R9000 to R9499	R9000 to R9499

NOTE
1 The address conversion of the System Relays is necessary when a Sequence Program is changed between PMC Memory-A/B and PMC Memory-C/D/E.

**** Omitted below ****

4.2.5 Extra Relay Addresses (E)

Change part of “2.2.5 Extra Relay Address (E)” as follows.

These addresses are a work area used in sequence programs. When using the multi-path PMC function, the area becomes a common memory. The same value can be read and written in sequence programs of each PMC path.
Extra relays can be used in the same manner as for internal relays.
Signals that interface with other control units can be assigned to these bytes over the FA network. It can also be used as the interface with the C language executor and FOCAS2 functions.
Turning on the power clears this area to 0. (Note2)

NOTE

1. These addresses are not synchronized in the 2nd level ladder. A value of a signal in these addresses may change during the execution of 2nd level ladder same as 1st and 3rd level ladder when it is written in other program (Ex. Network function, C language executor).
2. The extra relay addresses (E) can be optionally configured as nonvolatile. When they are nonvolatile, turning off the power does not erase the memory contents. (exclude 0*i*-F PMC/L)

Table 4.2.5 Address of Extra Relay

Data kind	1st to 5th path PMC				0*i*-F PMC/L	DCSPMC
	PMC Memory-A	PMC Memory-B	PMC Memory-C	PMC Memory-D, E		
Extra relays	E0 to E9999	E0 to E9999	E0 to E9999	E0 to E9999	E0 to E9999	-

**** Omitted below ****

4.2.6 Message Display Addresses (A)

Change “2.2.6 Message Display Address (A)” as follows.

These addresses are areas used for requesting a message display and outputting a message status.
See descriptions about the DISPB functional instruction in Chapter 4 for explanations about how to use this area.
Turning on the power clears this area to 0.

Table 4.2.6 Address of Message display

Data kind	1st to 5th path PMC				0*i*-F PMC/L	DCSPMC
	PMC Memory-A	PMC Memory-B	PMC Memory-C	PMC Memory-D, E		
Message display request (points)	A0 to A249 (2,000 points)	A0 to A249 (2,000 points)	A0 to A499 (4,000 points)	A0 to A749 (6,000 points)	A0 to A249 (2,000 points)	-
Message display status	A9000 to A9249	A9000 to A9249	A9000 to A9499	A9000 to A9749	A9000 to A9249	-

4.2.7 Timer Addresses (T)

Change "2.2.7 Timer Addresses (T)" as follows.

These addresses are areas for setting values and the precision of variable timers (the TMR instruction).
The memory contents are kept even if turning off the power.

Table 4.2.7 Address of variable timer

Data kind	1st to 5th path PMC				0*i*-F PMC/L	DCSPMC
	PMC Memory-A	PMC Memory-B	PMC Memory-C	PMC Memory-D, E		
Variable timer (Number of timers)	T0 to T79 (40 pieces)	T0 to 499 (250 pieces)	T0 to T999 (500 pieces)	T0 to T999 (500 pieces)	T0 to T79 (40 pieces)	T0 to T79 (40 pieces)
precision	T9000 to T9079	T9000 to 9499	T0 to T9999	T0 to T9999	T9000 to T9079	T9000 to T9079

4.2.8 Counter Addresses (C)

Change "2.2.8 Counter Addresses (C)" as follows.

These addresses are areas used for variable counters (the CTR instruction) and fixed counters (the CTRB instruction).
The memory contents are kept even if turning off the power.

Table 4.2.8 Address of counters

Data kind	1st to 5th path PMC				0*i*-F PMC/L	DCSPMC
	PMC Memory-A	PMC Memory-B	PMC Memory-C	PMC Memory-D, E		
Variable counter (Number of counters)	C0 to C79 (20 pieces)	C0 to C399 (100 pieces)	C0 to C799 (200 pieces)	C0 to C1199 (300 pieces)	C0 to C79 (20 pieces)	C0 to C79 (20 pieces)
Fixed counter (Number of counters)	C5000 to C5039 (20 pieces)	C5000 to C5199 (100 pieces)	C5000 to C5399 (200 pieces)	C5000 to C5599 (300 pieces)	C5000 to C5039 (20 pieces)	C5000 to C5039 (20 pieces)

4.2.9 Keep Relay Addresses (K)

Change "2.2.9 Keep Relay Addresses (K)" as follows.

These addresses are a work area in which data are kept even if turning the power off.

Table 4.2.9 Address of keep relays

Data kind	1st to 5th path PMC				0*i*-F PMC/L	DCSPMC
	PMC Memory-A	PMC Memory-B	PMC Memory-C	PMC Memory-D, E		
Keep relays	K0 to K19	K0 to K99	K0 to K199	K0 to K299	K0 to K99	K0 to K19

4.2.10 System Keep Relay Addresses (K)

Change part of "2.2.11 System Keep Relay Addresses (K)" as follows.

These addresses are an area for the setting of PMC system.
The memory contents are kept even if turning off the power.

Table 4.2.10 Address of System keep relay

Data kind	1st to 5th path PMC				0*i*-F PMC/L	DCSPMC
	PMC Memory-A	PMC Memory-B	PMC Memory-C	PMC Memory-D, E		
System keep relays	K900 to K999	K900 to K999	K900 to K999	K900 to K999	K900 to K999	K900 to K999

**** Omitted below ****

4.2.11 Data Table Addresses (D)

Change part of "2.2.12 Data Table Addresses (D)" as follows.

These addresses are work areas in which data are kept even if turning the power off.
PMC sequence control sometimes requires a sizable amount of numeric data (hereinafter referred to as data table). If the contents of a data table can be set or read freely, they can be used as various PMC sequence control data, such as tool numbers of tools on the ATC magazine.
Each table can have an arbitrary size as long as it fits the data table memory, and 1-, 2-, and 4-byte binary and BCD data can be used for each table separately; so it is possible to configure efficient, easy-to-use tables.
Data in a data table can be set or displayed on the DATA TABLE screen.
Data set in data tables can also be easily read and written with the sequence program using functional instructions such as data search (DSCHB) and index modification data transfer (XMOVB).
The following table lists the number of bytes that can be used.
Signals that interface with other control units can be assigned to these bytes over the FA network. It can also be used as the interface with the C language executor and FOCAS2 functions.

NOTE
These addresses are not synchronized in the 2nd level ladder. A value of a signal in these addresses may change during the execution of 2nd level ladder same as 1st and 3rd level ladder when it is written in other program (Ex. Network function, C language executor).

Table 4.2.11 Address of Data table

Data kind	1st to 5th path PMC				0*i*-F PMC/L	DCSPMC
	PMC Memory-A	PMC Memory-B	PMC Memory-C	PMC Memory-D, E		
Data table	D0 to D2999	D0 to D9999	D0 to D19999	D0 to D59999	D0 to D2999	D0 to D2999

NOTE
The basic nonvolatile area is 10,000bytes. To make a nonvolatile area of D10000 or more, you should specify the option "Nonvolatile PMC Data Table Area Expansion (40KB)". Refer to subsection "2.1.3" for details.

**** Omitted below ****

4.2.12 Addresses for Multi-path PMC Interface (M, N)

Change “2.2.13 Addresses for Multi-path PMC Interface (M, N)” as follows.

These addresses are used to the Multi-path PMC interface area.

(1) Input signals from another PMC path

Table 4.2.12 Input signals from another PMC path

Data kind	1st to 3rd path PMC				0*i*-F PMC/L	DCSPMC
	PMC Memory-A	PMC Memory-B	PMC Memory-C	PMC Memory-D, E		
Input signals	M0 to M767	M0 to M767	M0 to M767	M0 to M767	(unavailable)	(unavailable)

(2) Output signals to another PMC path

Table 4.2.12 Input signals from another PMC path

Data kind	1st to 3rd path PMC				0*i*-F PMC/L	DCSPMC
	PMC Memory-A	PMC Memory-B	PMC Memory-C	PMC Memory-D, E		
Output signals	N0 to N767	N0 to N767	N0 to N767	N0 to N767	(unavailable)	(unavailable)

NOTE
These interfaces cannot be used in 4th and 5th path PMC.

4.2.13 Subprogram Number Addresses (P)

Change “2.2.14 Subprogram Number Addresses (P)” as follows.

These addresses are subprogram number for specifying the subprogram.
The subprogram number is used in the CALL, CALLU and CM instructions and applied subprogram is called.

Table 4.2.13 Address of Subprogram number

Data kind	1st to 5th path PMC				0*i*-F PMC/L	DCSPMC
	PMC Memory-A	PMC Memory-B	PMC Memory-C	PMC Memory-D, E		
Subprogram number	P1 to P512	P1 to P5000	P1 to P5000	P1 to P5000	P1 to P512	P1 to P512

4.2.14 Label Number Addresses (L)

Change "2.2.15 Label Number Addresses (L)" as follows.

These addresses are label number for specifying the label (LBL instruction).
The label number is used in the JMPB and JMPC instructions and jumps to applied LBL instruction.
The same label number can be specified for different instructions as long as the instructions are not within the same program unit (main program or subprogram).

Table 4.2.14 Address of Label number

Data kind	1st to 5th path PMC				0*i*-F PMC/L	DCSPMC
	PMC Memory-A	PMC Memory-B	PMC Memory-C	PMC Memory-D, E		
Label number	L1 to L9999	L1 to L9999	L1 to L9999	L1 to L9999	L1 to L9999	L1 to L9999

4.3 PMC PARAMETERS

4.3.1 PMC Parameter Format

Change part of "2.3.2 PMC Parameter Format" as follows.

This subsection describes the format used in outputting the contents of the PMC parameter to an external device. As for the operation of output, refer to section 7 "sequence program and PMC parameter I/O".

(1) Header information
The data begins with header information. Its format is as follows:

[Format]
%
(PMC = xxx, MSID = n)

PMC = xxx "xxx" is the model name of the PMC.
MSID = n "n" is ID information.
The following table lists values that can be set as "xxx" or "n".

PMC Series	"xxx"
30*i*-B PMC	30I-B
31*i*-B PMC	31I-B
32*i*-B PMC	32I-B
35*i*-B PMC	35I-B
Power Motion *i*-A PMC	PMI-A
0*i*-F PMC	0I-F
0*i*-F PMC/L	0I-F-L

PMC Path	"n"
1st path PMC(include 0*i*-F PMC/L)	1
2nd path PMC	2
3rd path PMC	3
4th path PMC	4
5th path PMC	5
DCSPMC	9

(2) Timer (T)

[Format]

N60xxxx Pnnnnn;

N600xxxx Pnnnnn;

[Data Contents]

N60xxxx or N600xxxx : parameter number

Specify the sum of the timer address (T) offset and 600000 or 6000000. The number in the following table can be used.

	1st to 5th path PMC				0*i*-F PMC/L	DCSPMC
	PMC Memory-A	PMC Memory-B	PMC Memory-C	PMC Memory-D, E		
Timer setting value	N600000 to N600078	N600000 to N600498	N600000 to N600998	N6000000 to N6000998	N600000 to N600078	N600000 to N600078
Timer accuracy	N609000 to N609078	N609000 to N609498	N609000 to N609998	N6009000 to N6009998	N609000 to N609078	N609000 to N609078

**** Omitted below ****

(3) Counter (C)

[Format]

N61xxxx Pnnnnn;

N610xxxx Pnnnnn;

[Data Contents]

N61xxxx or N610xxxx; parameter number

Specify the sum of the counter address (C) offset and 610000 or 6100000. The number in the following table can be used.

	1st to 5th path PMC				0*i*-F PMC/L	DCSPMC
	PMC Memory-A	PMC Memory-B	PMC Memory-C	PMC Memory-D, E		
Variable counter (CTR)	N610000 to N610078	N610000 to N610398	N610000 to N610798	N6100000 to N6101198	N610000 to N610078	N610000 to N610078
Fixed counter (CTRB)	N615000 to N615038	N615000 to N615198	N615000 to N615398	N6105000 to N6105598	N615000 to N615038	N615000 to N615038

**** Omitted below ****

(4) Keep relay (K)

[Format]

N62xxxx Pnnnnnnnn;

N620xxxx Pnnnnnnnn;

[Data Contents]

N62xxxx or N620xxxx Parameter number

Specify the sum of the keep relay address (K) offset and 620000 or 6200000. The number in the following table can be used.

	1st to 5th path PMC				0*i*-F PMC/L	DCSPMC
	PMC Memory-A	PMC Memory-B	PMC Memory-C	PMC Memory-D, E		
User area	N620000 to N620019	N620000 to N620099	N620000 to N620199	N6200000 to N6200299	N620000 to N620099	N620000 to N620019
System area	N620900 to N620999	N620900 to N620999	N620900 to N620999	N6200900 to N6200999	N620900 to N620999	N620900 to N620999

**** Omitted below ****

(5) Data (D)

(a) Data table control

[Format]

N630xxx Pnnnnn;

N6300xxx Pnnnnn;

[Data Contents]

**** Omission ****

The range of “Data size” and “Start address” is as follows.

	1st to 5th path PMC				0*i*-F PMC/L	DCSPMC
	PMC Memory-A	PMC Memory-B	PMC Memory-C	PMC Memory-D, E		
Data Size	1 to 3000	1 to 10000	1 to 20000	1 to 60000	1 to 3000	1 to 3000
Start address	0 to 2999	0 to 9999	0 to 19999	0 to 59999	0 to 2999	0 to 2999

**** Omission ****

(b) Data table

[Format]

N64xxxx Pnnnnn;

N64xxxxx Pnnnnn;

[Data Contents]

N64xxxx or N64xxxxx Parameter number

Specify the sum of the data table address (D) offset and 640000 or 6400000. The number in the following table can be used.

	1st to 5th path PMC				0*i*-F PMC/L	DCSPMC
	PMC Memory-A	PMC Memory-B	PMC Memory-C	PMC Memory-D, E		
Data table	N640000 to N642999	N640000 to N649999	N640000 to N659999	N6400000 to N6459999	N640000 to N642999	N640000 to N642999

**** Omitted below ****

(6) Extra memory (E)

**** Omission ****

(a) Byte format
[Format]
N69xxxx Pnnnnn;
N690xxxx Pnnnnn;

[Data Contents]
N69xxxx or N690xxxx Parameter number
Specify the sum of the offset number of the extra relay and 690000 or 6900000. The number in the following table can be used.

	1st to 5th path PMC				0*i*-F PMC/L	DCSPMC
	PMC Memory-A	PMC Memory-B	PMC Memory-C	PMC Memory-D, E		
Extra relay	N690000 to N699999	N690000 to N699999	N690000 to N699999	N6900000 to N6909999	N690000 to N699999	N690000 to N699999

**** Omission ****

(c) Table format (Extra relay part)
[Format]
N69xxxx Pnnnnn;
N690xxxx Pnnnnn;

[Data Contents]
N69xxxx or N690xxxx Parameter Number
Specify the sum of the offset number of the extra relay and 690000 or 6900000. The number in the following table can be used.

	1st to 5th path PMC				0*i*-F PMC/L	DCSPMC
	PMC Memory-A	PMC Memory-B	PMC Memory-C	PMC Memory-D, E		
Data table	N690000 to N699999	N690000 to N699999	N690000 to N699999	N6900000 to N6909999	N690000 to N699999	N690000 to N699999

**** Omitted below ****

4.4 PARAMETERS FOR THE PMC SYSTEM

4.4.1 CNC Parameters Related to the PMCs

Change part of "2.4.3 CNC Parameters Related to the PMCs" as follows.

The CNC parameters related to the PMCs can be divided into those for controlling communication with FANUC LADDER-III and ladder editing package and those for setting up the PMCs.

The following table summaries the CNC parameters related to the PMCs.

Table 4.4.1 (a) Summary of the CNC parameters related to the PMC

No.	Use	Remarks
24	Setting up communication with ladder development tools	PMC online connection function
11900 to 11904	Execution sequence for multiple PMCs	1st to 5th path PMC (Note2)
11905 to 11909	Percent execution time for multiple PMCs	1st to 5th path PMC (Note2)
11910 to 11912	I/O Link input/output address	Channels 1 to 3 (Note2)
11914	2nd, 3rd level execution cycle of ladder	Common to 1st to 5th path PMC (Note1, Note2)
11915 to 11917	Input/output address of dual assignment of I/O Link channel	Second Block of Channels 1 to 3 (Note2)
11920 to 11929	CNC interface control address	CNC 10 paths (Note2)
11930	Ladder 1st level execution period	Common to 1st to 5th path PMC (Note2)
11931#0	Run/stop of Ladder	1st to 5th path PMC (Note2)
11931#1	The display number of external alarms/operator messages	External data input, External message
11931#5	Ladder dividing management function	Common to 1st to 5th path PMC
11931#7	Clearing of PMC nonvolatile memory	
11932	Multi path PMC interface	(Note2)
11933#0,#1	I/O Link communication method	Channel 1, 2
11933#5	Running/stopping of ladder program when updating	
11936	The number of PMC paths	(Note2)
11937 to 11939	The input / output address used by network devices	1st to 5th path PMC, X/Y0 to 727
11940 to 11944	PMC Memory Type	1st to 5th path PMC (Note2)
11945	The PMC path that the 1st level execution cycle in 1ms or 2ms is applied when using multi-path PMC function.	1st to 5th path PMC (Note1, Note2)
11946	The divided ladder that the 1st level execution cycle in 1ms or 2ms is applied when using ladder dividing management function.	Divided ladder program 1 to 99 (Note1, Note2)

NOTE

1. These parameters are unavailable for 0*i*-F PMC.
2. These parameters are unavailable for 0*i*-F PMC/L.

**** Omitted below ****

PMC setup parameters

Execution sequence for multiple PMCs

11900	PMC having the first priority in execution sequence
11901	PMC having the second priority in execution sequence
11902	PMC having the third priority in execution sequence
11903	PMC having the fourth priority in execution sequence
11904	PMC having the fifth priority in execution sequence

NOTE
1. Once any of these parameters is re-set, it is necessary to turn the power off and on again.
2. This parameter is unavailable for 0*i*-F PMC/L.

**** Omitted below ****

Percent execution time for multiple PMCs

11905	Percent execution time for the PMC having the first priority in execution sequence
11906	Percent execution time for the PMC having the second priority in execution sequence
11907	Percent execution time for the PMC having the third priority in execution sequence
11908	Percent execution time for the PMC having the fourth priority in execution sequence
11909	Percent execution time for the PMC having the fifth priority in execution sequence

NOTE
1. Once any of these parameters is re-set, it is necessary to turn the power off and on again.
2. This parameter is unavailable for 0*i*-F PMC/L.

**** Omitted below ****

I/O Link input/output addresses

11910	I/O Link channel 1 input/output addresses
11911	I/O Link channel 2 input/output addresses
11912	I/O Link channel 3 input/output addresses

NOTE
1 Once any of these parameters is re-set, it is necessary to turn the power off and on again.
2 This parameter is unavailable for 0*i*-F PMC/L.

**** Omitted below ****

2nd, 3rd level execution cycle

11914	2nd / 3rd level execution cycle of ladder

NOTE
1 Once this parameter is set, it is necessary to turn off and on the power.
2 This parameter is unavailable for 0*i*-F PMC and 0*i*-F PMC/L.

**** Omitted below ****

Input/output addresses of dual assignment of I/O Link channel

11915	Input/output addresses of the second block of I/O Link channel 1
11916	Input/output addresses of the second block of I/O Link channel 2
11917	Input/output addresses of the second block of I/O Link channel 3

NOTE
1 Once any of these parameters is re-set, it is necessary to turn the power off and on again.
2 This parameter is unavailable for 0*i*-F PMC/L.

**** Omitted below ****

CNC-PMC interface

11920	CNC-PMC interface 1 input/output address
11921	CNC-PMC interface 2 input/output address
11922	CNC-PMC interface 3 input/output address
11923	CNC-PMC interface 4 input/output address
11924	CNC-PMC interface 5 input/output address
11925	CNC-PMC interface 6 input/output address
11926	CNC-PMC interface 7 input/output address
11927	CNC-PMC interface 8 input/output address
11928	CNC-PMC interface 9 input/output address
11929	CNC-PMC interface 10 input/output address

NOTE

1. Once any of these parameters is re-set, it is necessary to turn the power off and on again.
2. This parameter is unavailable on the following composition. In this case, F/G address of PMC is the same as F/G address of CNC.
   - 0i-F PMC/L
   - PMC Memory Type-E

[Input type] Parameter input
[Data type] Word
[Valid data range] 0, 100 to 109, 200 to 209, 300 to 309, 400 to 409, 500 to 509

This item assigns a PMC F/G address to a CNC F/G address.

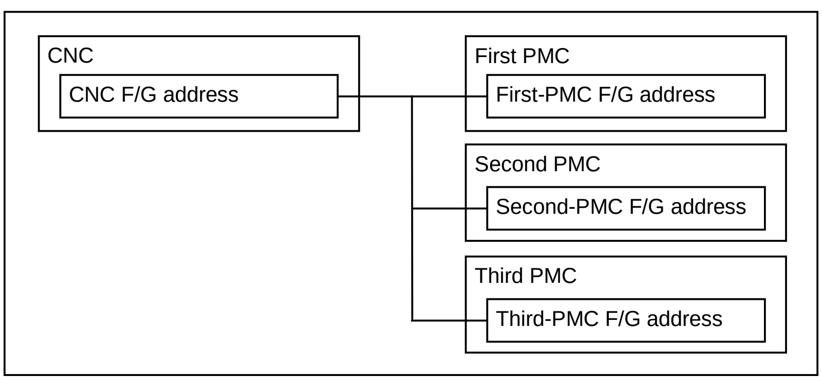


Fig. 4.4.1 (d) CNC-PMC interface assignment concept

Table 4.4.1 (b) CNC-PMC interface input/output address

Setting	Input/output address
0	Standard setting (see below)
100	F0 to 767/G0 to G767 for the 1st PMC
101	F1000 to F1767/G1000 to G1767 for the 1st PMC
102	F2000 to F2767/G2000 to G2767 for the 1st PMC
103	F3000 to F3767/G3000 to G3767 for the 1st PMC
104	F4000 to F4767/G4000 to G4767 for the 1st PMC
105	F5000 to F5767/G5000 to G5767 for the 1st PMC
106	F6000 to F6767/G6000 to G6767 for the 1st PMC
107	F7000 to F7767/G7000 to G7767 for the 1st PMC
108	F8000 to F8767/G8000 to G8767 for the 1st PMC
109	F9000 to F9767/G9000 to G9767 for the 1st PMC
200	F0 to F767/G0 to G767 for the 2nd PMC
201	F1000 to F1767/G1000 to G1767 for the 2nd PMC
202	F2000 to F2767/G2000 to G2767 for the 2nd PMC
203	F3000 to F3767/G3000 to G3767 for the 2nd PMC
204	F4000 to F4767/G4000 to G4767 for the 2nd PMC
205	F5000 to F5767/G5000 to G5767 for the 2nd PMC
206	F6000 to F6767/G6000 to G6767 for the 2nd PMC
207	F7000 to F7767/G7000 to G7767 for the 2nd PMC
208	F8000 to F8767/G8000 to G8767 for the 2nd PMC
209	F9000 to F9767/G9000 to G9767 for the 2nd PMC
300	F0 to F767/G0 to G767 for the 3rd PMC
301	F1000 to F1767/G1000 to G1767 for the 3rd PMC
302	F2000 to F2767/G2000 to G2767 for the 3rd PMC
303	F3000 to F3767/G3000 to G3767 for the 3rd PMC
304	F4000 to F4767/G4000 to G4767 for the 3rd PMC
305	F5000 to F5767/G5000 to G5767 for the 3rd PMC
306	F6000 to F6767/G6000 to G6767 for the 3rd PMC
307	F7000 to F7767/G7000 to G7767 for the 3rd PMC
308	F8000 to F8767/G8000 to G8767 for the 3rd PMC
309	F9000 to F9767/G9000 to G9767 for the 3rd PMC
400	F0 to F767/G0 to G767 for the 4th PMC
401	F1000 to F1767/G1000 to G1767 for the 4th PMC
402	F2000 to F2767/G2000 to G2767 for the 4th PMC
403	F3000 to F3767/G3000 to G3767 for the 4th PMC
404	F4000 to F4767/G4000 to G4767 for the 4th PMC
405	F5000 to F5767/G5000 to G5767 for the 4th PMC
406	F6000 to F6767/G6000 to G6767 for the 4th PMC
407	F7000 to F7767/G7000 to G7767 for the 4th PMC
408	F8000 to F8767/G8000 to G8767 for the 4th PMC
409	F9000 to F9767/G9000 to G9767 for the 4th PMC
500	F0 to F767/G0 to G767 for the 5th PMC
501	F1000 to F1767/G1000 to G1767 for the 5th PMC
502	F2000 to F2767/G2000 to G2767 for the 5th PMC
503	F3000 to F3767/G3000 to G3767 for the 5th PMC
504	F4000 to F4767/G4000 to G4767 for the 5th PMC
505	F5000 to F5767/G5000 to G5767 for the 5th PMC

Setting	Input/output address
506	F6000 to F6767/G6000 to G6767 for the 5th PMC
507	F7000 to F7767/G7000 to G7767 for the 5th PMC
508	F8000 to F8767/G8000 to G8767 for the 5th PMC
509	F9000 to F9767/G9000 to G9767 for the 5th PMC

If all these parameters are 0, the standard setting is used, that is, “CNC F/G address = 1st PMC F/G address” is satisfied.

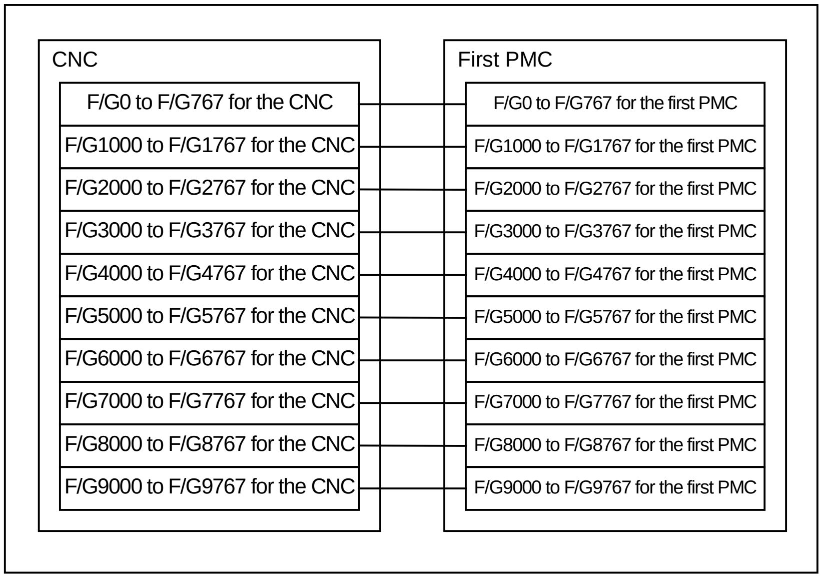


Fig. 4.4.1 (e) CNC-PMC interface initial settings

⚠ CAUTION

1 If any of these parameters is nonzero, a duplicate number results in the PMC alarm “ER54 NC-PMC I/F ASSIGNMENT ERROR”, thus disabling all the PMCs from starting.

2 If these parameters are not set up in part, it is impossible to assign a PMC address to the related CNC F/G address.

Level 1 execution period

11930	Ladder level execution period

> **NOTE**
> 1 Once this parameter is re-set, it is necessary to turn the power off and on again.
> 2 This parameter is unavailable for 0*i*-F PMC/L.

[Input type] Byte input
[Data type] Byte
[Valid data range] 0, 1, 2, 4, 8

This item specifies an execution period for ladder level 1.

Setting	Meaning
1 (Note2,3)	Executed at a 1ms cycle.
2 (Note2,3)	Executed at a 2ms cycle.
4	Executed at a 4-msec interval.
0, 8	Executed at an 8-msec interval.

> **NOTE**
> 1 The level 1 execution period cannot be set for each PMC path independently.
> 2 Refer to “1.8” when this parameter is set to a value “1” or “2”.
> 3 These values are unavailable for 0*i*-F PMC.

> ⚠ **CAUTION**
> 1 Setting this parameter to an unsupported value results in the PMC alarm “ER55 LEVEL1 EXECUTION CYCLE ERROR”, and all PMCs are not executed.

**** Omitted below ****

Start or stop of the ladder

	#7	#6	#5	#4	#3	#2	#1	#0
11931	NMC		LDV				M16	PCC

[Data type] Bit

#0 PCC This item specifies start or stop of the ladder as follows:
0 : The ladder is started or stopped independently for each PMC.
1 : The ladders in all PMCs are started or stopped together.

> **NOTE**
> 1 Once this parameter is re-set, it is necessary to turn the power off and on again.
> 2 When using the Common PMC Memory mode, those programs are started or stopped together regardless of this parameter.
> 3 This parameter is unavailable for 0*i*-F PMC/L.

***** Omitted below *****

Multi-path PMC interface

11932	Multi-path PMC interface

> **NOTE**
> 1 Once this parameter is re-set, it is necessary to turn the power off and on again.
> 2 This parameter is unavailable for 0*i*-F PMC/L.

**** Omitted below ****

Communication method with I/O device
Running/stopping of ladder program when updating

	#7	#6	#5	#4	#3	#2	#1	#0
11933			SRL				C2T	C1T

[Input type] Parameter input
[Data type] Bit

> **NOTE**
> Once these parameters are re-set, it is necessary to turn the power off and on again.

#0 C1T Specifies the communication method of channel 1.
0 : I/O Link is used.
1 : I/O Link *i* is used.

#1 C2T Specifies the communication method of channel 2.
0 : I/O Link is used.
1 : I/O Link *i* is used.

> **NOTE**
> 1 When you set the channel to “use I/O Link”, set the parameter no.11910 to 11912, also.
> 2 On 0*i*-F PMC and 0*i*-F PMC/L, the default value of these parameters is “1”.
> 3 The parameter C2T(No.11933#1) is unavailable for 0*i*-F PMC/L.

***** *Omitted below* ***

The number of PMC paths

11936	The number of PMC paths

> **NOTE**
> 1 Once this parameter is re-set, it is necessary to turn the power off and on again.
> 2 This parameter is unavailable for 0*i*-F PMC/L.

*** *Omitted below* ***

The input / output address used by network device

	#7	#6	#5	#4	#3	#2	#1	#0
11937	P24	P23	P22	P21	P14	P13	P12	P11

**** Omitted below ****

NOTE

1 Once these parameters are set, it is necessary to turn off and on the power.
2 For 0*i*-F PMC, P11 and P12 and P21 and P22 and P31 and P32(No.11937#0, #1, #4, #5, No.11938#0, #1) are available only.
3 For 0*i*-F PMC/L, P11(No.11937#0) is available only.
4 This parameter should be set only for the X /Y address area to which the network device is assigned, because this parameter may affect the ladder execution performance.
5 Network devices cannot be assigned to the X/Y address area to which any I/O Link and I/O Link *i* are assigned.
6 In case of using I/O Link *i*, assign network devices to the X/Y address area to which any I/O Link *i* devices are not assigned, then set this parameter for corresponding area.
7 In case of using I/O Link and the parameter No.11910-11912 are set to 0 (default setting), I/O Link devices are assigned to X0-X127/Y0-Y127, X200-X327/Y200-Y327 and X400-X527/Y400-Y527 area of 1st PMC path. In this case for 1st PMC path, network devices can only be assigned to X600-X727/Y600-Y727 area.
If all parameters are not set to 0, network devices can be assigned to the X/Y address area to which any I/O Link channels are not assigned, and set this parameter for corresponding area accordingly.
Example) When I/O Link channel 1 is assigned to X0-X127/Y0-Y127 of 1st PMC path, and network device can be assigned to X200-327/Y200-327,
set the parameter No.11910=100, No.11911=0, No.11912=0, No.11937#1=1.

PMC Memory Type

11940	PMC Memory Type of 1st PMC
11941	PMC Memory Type of 2nd PMC
11942	PMC Memory Type of 3rd PMC
11943	PMC Memory Type of 4th PMC
11944	PMC Memory Type of 5th PMC

NOTE
1. Once this parameters is re-set, it is necessary to turn the power off and on again.
2. This parameter is unavailable for 0*i*-F PMC/L.

[Input type] Parameter input
[Data type] Integer
[Valid data range] -1, 0, 1, 2, 3, 4, 5

Select a PMC Memory Type of each PMC path. Refer to "Table 2.1.1 Basic specification of each PMC Memory Type" for details of each PMC Memory Type.

Setting	Meaning
0	Use standard setting of PMC Memory Type.
1	Use PMC Memory-A.
2	Use PMC Memory-B.
3	Use PMC Memory-C.
4	Use PMC Memory-D.
5	Use PMC Memory-E.(Note1)
-1	The 2nd to 5th paths PMC share the PMC Memory with 1st path PMC.

The following is the selectable PMC memory types in each PMC path.

1st path PMC	2nd to 5th path PMC	Remark
PMC-memory B (default) PMC-memory C (note2)	PMC-memory A (default) PMC-memory B PMC-memory C (note2) Shared with 1st path PMC	You can specify up to three paths both of PMC-memory B and C in total.
PMC-memory D (note2) PMC-memory E (note2)	Shared with 1st path PMC	

⚠ **CAUTION**

1 Setting an invalid value to this parameter results in the PMC alarm "ER58 PMC MEMORY TYPE SETTING ERROR" and all sequence programs for each PMC will not be started.
2 PMC nonvolatile memory must be initialized after changing PMC Memory Type. Therefore, make a backup of PMC parameter before changing PMC Memory Type. Refer to the "2.7 DATA BACKED UP BY THE BATTERY" of PMC Programming Manual about the operation of initializing PMC nonvolatile memory.

NOTE

1 PMC Memory Type-E is enabled only on a special series of CNC software.
2 To use all data table area as nonvolatile memory with PMC Memory-C/D/E, specify the option "Nonvolatile PMC data table area expansion (40KB)". If this option does not be specified, the expanded data table area (D10000 or more) does not keep the memory after rebooting CNC.

The PMC path that the 1st level execution cycle in 1ms or 2ms is applied when using multi-path PMC function

11945	The PMC path that the 1st level execution cycle in 1ms or 2ms is applied when using multi-path PMC function

NOTE

1. Once this parameter is set, it is necessary to turn off and on the power.
2. This parameter is unavailable for 0*i*-F PMC and 0*i*-F PMC/L..

**** Omitted below ****

The divided ladder that the 1st level execution cycle in 1ms or 2ms is applied when using ladder dividing management function

11946	The divided ladder that the 1st level execution cycle in 1ms or 2ms is applied when using ladder dividing management function

NOTE

1. Once this parameter is set, it is necessary to turn off and on the power.
2. This parameter is unavailable for 0*i*-F PMC and 0*i*-F PMC/L..

**** Omitted below ****

4.5 COMPATIBILITY BETWEEN PMC MEMORY TYPE

4.5.1 Compatibility between PMC Memory-D and PMC Memory-E

Add the following after "2.5.3 Compatibility between PMC Memory-C and PMC Memory-D".

The sequence program for the PMC Memory-E has highly compatibility of the source program with the one for the PMC Memory-D.
You can convert a sequence program for the PMC Memory-D to one for the PMC Memory-E by using the conversion function of FANUC LADDER-III.

> ⚠ **WARNING**
> A little difference of execution timing may exist between PMC Memory Types. Therefore, you should check again whether the program works correctly after changing the PMC Memory Types even if the program worked fine before changing the PMC Memory Type.

PMC parameter compatibility

PMC parameters outputted from on the PMC Memory-D can be loaded into the PMC Memory-E without any modification.
When loading PMC parameters outputted on the PMC Memory-E to the PMC Memory-D without any modification.

4.6 COMPATIBILITY WITH CONVENTIONAL MODELS

4.6.1 Compatibility between 0*i*/0*i* Mate-D PMC/L and 0*i*-F PMC/L

Add the following after “2.6.5 Compatibility with series 0i-D PMC”.

Ladder program compatibility

The series 0*i*-F PMC/L is highly compatible with the series 0*i*/0*i* Mate *i*-D PMC on the source level.
You can use the sequence program of the series 0*i*/0*i* Mate-D PMC/L on the series 0*i*-F PMC/L by changing the PMC model using FANUC LADDER-III.
Transporting programs require modification because the specifications of the following functions have been changed.

(1) The following items about execution timing may be changed.
- The execution cycle of both first and second level of ladder
- The timing of the execution cycle of first level of ladder according to the partition of second level ladder
- The timing between ladder execution and I/O transfer or F,G signals

(2) The execution timing between the CNC processing and the ladder execution may be changed.

(3) When setting an illegal value, that is not written in the programming manual, into parameters of functional instructions, the result may be different from the series 0*i*/0*i* Mate-D PMC/L.

PMC parameter compatibility

PMC parameters outputted from the series 0*i*/0*i* Mate-D PMC/L can be loaded into the series 0*i*-F PMC/L without any modification.

File names in PMC [I/O] screen

In 0*i*-F PMC/L, PMC file names, which are created in PMC [I/O] screen, are different from the names in 0*i*/0*i* Mate-D PMC/L.

Kind of data	File name of 0*i*/0*i* Mate-D PMC/L	File name of 0*i*-F PMC/L
Sequence program	PMC1_LAD.xxx	PMC1.xxx
Message data for multi-language display	PMC1_MSG.xxx	M1PMCMSG.xxx

（xxx：Data number in three-digit）

5 COMMUNICATION WITH I/O DEVICE

5.1 I/O Link *i* and I/O Link

Change "3.1 I/O Link i and I/O Link" as follows.

There are two communication methods for the high-speed serial interface which transmits input/output signals between the PMC and I/O devices. They are the FANUC I/O Link *i* and the FANUC I/O Link.
You can use up to three channels for the serial interface. The communication method for channel 1 and channel 2 can be specified by the CNC parameter. The channel 3 can be used only for the I/O Link.
For the details of the setting of the CNC parameter, see subsection "2.4.3".

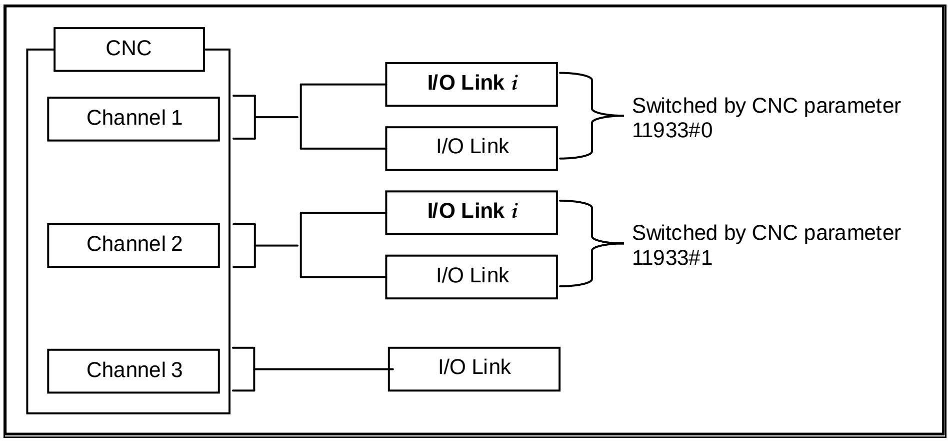


Fig. 5.1 Setting of communication method for each channel

The maximum I/O points of the I/O Link *i* are 2048 poins/2048 points for each channel. The maximum I/O points of the I/O Link are 1024 points/1024 points for each channel. The maximum I/O points for a PMC system are 4096 points/4096 points (0*i*-F: 2048 points/2048 points, 0*i*-F PMC/L: 1024 points/1024 points). You can use one or more channels of the I/O Link *i* and the I/O Link however the total points cannot exceed the maximum points of the PMC system.

[Example of the selectable case of the I/O Link *i* and the I/O Link]

Channel 1	Channel 2	Channel 3	Total points (DI / DO)
I/O Link *i*	I/O Link *i*	—	4096 / 4096 (Note1, Note2)
I/O Link *i*	I/O Link	I/O Link	4096 / 4096 (Note1, Note2)
I/O Link *i*	I/O Link	—	3072 / 3072 (Note1, Note2)
I/O Link	I/O Link	I/O Link	3072 / 3072 (Note1, Note2)
I/O Link *i*	—	—	2048 / 2048 (Note2)
I/O Link	I/O Link	—	2048 / 2048 (Note2)
I/O Link	—	I/O Link	2048 / 2048 (Note2)
I/O Link	—	—	1024 / 1024

NOTE

1 For 0*i*-F PMC, the total points (DI/DO) are 2048/2048 points.
2 For 0*i*-F PMC/L, the total points (DI/DO) are 1024/1024 points.

For the multi-path PMC, the DI/DO of one channel can be assigned to plural PMC paths efficiently using the I/O Link *i*. The connect position of I/O devices can be defined as group/slot number.
As for the transmission cycle of the signals from the I/O Link *i*, there are two modes of the normal mode (2msec) and the high-speed mode (0.5msec). You can specify the mode for each group of I/O devices.
For details, refer to subsection "3.3.3".

⚠ **CAUTION**

1 For an I/O Link *i* channel, You should use I/O devices applied to the I/O Link *i*. Or for an I/O Link channel, you should use I/O devices applied to the I/O Link. If you use an inadaptable I/O device, all of I/O devices after the device cannot be connected.
2 In case of using the dual check safety function, you can build the system by using only devices of the I/O Link *i* or only devices of the I/O Link. You cannot build the system by using both the I/O Link *i* and the I/O Link. If you use I/O Link, I/O devices for DCSPMC must be connected to channel 3.

5.2 WHAT IS I/O Link *i* ?

Change "3.3 WHAT IS I/O LINK i ?" as follows.

The FANUC I/O Link *i* is one of the serial interfaces which transmits input/output signals at a high speed between the PMC and I/O devices.
Available channels are two channels and for each channel, up to 2048 DI points and up to 2048 DO points can be connected and controlled from the PMC.

As for the transmission cycle of the signals from I/O Link *i*, there are two modes of the normal mode (2msec) and the high-speed mode (0.5msec). You can specify the mode for each group of I/O devices.

Fig. 5.2 Outline of specification of I/O Link *i*

Item	I/O Link *i*		I/O Link
	Normal mode	High-speed mode	
Transmit speed	12Mbps		1.5Mbps
Update cycle(Note 2)	2ms	0.5ms	2ms
I/O points for one channel (Note 3)	2048 / 2048	512 / 512	1024 / 1024 (64 / 64)
I/O points for one group (Note 3)	512 / 512 (224 / 224)		256 / 256
Maximum groups for one channel (Note 3, Note4)	24 (4)	5 (4)	16
PMC control address	1st path PMC to 5th path PMC DI: X0～X127, X200～X327, X400～X527, X600～X727 DO: Y0～Y127, Y200～Y327, Y400～Y527, Y600～Y727		
Selection of effective group	I/O link selectable assignment data function		

NOTE

1 You can select a communication method from either the I/O Link *i* or the I/O Link for each channel by setting the CNC parameter "Communication method of I/O Device". The default setting is the I/O Link mode (0*i*-F: I/O Link *i* mode). For details of the parameter, refer to subsection "2.4.3". For example, you can use the channel 1 as the I/O Link *i*, and the channel 2 as the I/O Link. In this case, the total I/O points are 3072 points / 3072 points (0*i*-F: 2048 points / 2048 points, 0*i*-F PMC/L: 1024 points /1024 points).
2 You can select an update cycle mode from either the normal mode or the high-speed mode for each group. You can make use of two modes in one channel. For details, refer to subsection "3.3.3".
3 The Inside of "( )" is the specification of dual check safety.
4 If you build the dual check safety system using the I/O Link *i*, you can make use of up to 4 groups for DCSPMC. If you use two channels of the I/O Link *i*, the maximum number of available groups is 4 groups. For details of the directions for the dual check safety of I/O Link *i*, refer to subsection "3.3.7".

6 LADDER LANGUAGE

6.1 OPERATION INSTRUCTION

Change "4.10 OPERATION INSTRUCTION" as follows.

The following types of operation instruction are available. Use any of these instructions as appropriate for your purpose.

	Instruction name	Sub number	Processing
1	ADDB	36	Binary addition
2	SUBB	37	Binary subtraction
3	MULB	38	Binary multiplication
4	DIVB	39	Binary division
5	ADD	19	BCD addition
6	SUB	20	BCD subtraction
7	MUL	21	BCD multiplication
8	DIV	22	BCD division
9	NUMEB	40	Definition of binary constants
10	NUME	23	Definition of BCD constants
11	ADDSB	319	Addition (1 byte length)
12	ADDSW	320	Addition (2 bytes length)
13	ADDSD	321	Addition (4 bytes length)
14	SUBSB	322	Subtraction (1 byte length)
15	SUBSW	323	Subtraction (2 bytes length)
16	SUBSD	324	Subtraction (3 byte length)
17	MULSB	325	Multiplication (1 byte length)
18	MULSW	326	Multiplication (2 bytes length)
19	MULSD	327	Multiplication (4 bytes length)
20	DIVSB	328	Division (1 byte length)
21	DIVSW	329	Division (2 bytes length)
22	DIVSD	330	Division (4 bytes length)
23	MODSB	331	Remainder (1 byte length)
24	MODSW	332	Remainder (2 bytes length)
25	MODSD	333	Remainder (4 bytes length)
26	INCSB	334	Increment (1 byte length)
27	INCSW	335	Increment (2 bytes length)
28	INCSD	336	Increment (4 bytes length)
29	DECSB	337	Decrement (1 byte length)
30	DECSW	338	Decrement (2 bytes length)
31	DECSD	339	Decrement (4 bytes length)
32	ABSSB	340	Absolute value (1 byte length)
33	ABSSW	341	Absolute value (2 bytes length)
34	ABSSD	342	Absolute value (4 bytes length)
35	NEGSB	343	Sign inversion (1 byte length)
36	NEGSW	344	Sign inversion (2 bytes length)
37	NEGSD	345	Sign inversion (4 bytes length)
38	PID	460	PID control

6.1.1 PID (PID Control : SUB 460)

Add the following after "4.10.19 NEGSB (Sign Inversion (1 Byte Length) : SUB 343), NEGSW (Sign Inversion (2 Bytes Length) : SUB 344), NEGSD (Sign Inversion (4 Bytes Length) : SUB 345)".

This instruction executes PID operation.

> ⚠ **WARNING**
> This instruction cannot be used in some version of PMC software. Executing this instruction on the unsupported version of PMC software will raise the warning "WN58 UNSUPPORTED FUNCTION" on PMC alarm screen, and the ladder program is executed excluding this instruction.

PID control

The PID control calculates the manipulated value to operate the controlled object from the preset setting value and the process variable which are measured by sensors and so on. This control method is used for controlling temperature, pressure, flow rate, and so on. By combining a proportional action (P), an integral action (I), and a derivative action (D), it calculates the manipulated value to make the process variable agree with the preset setting value soon and precisely.

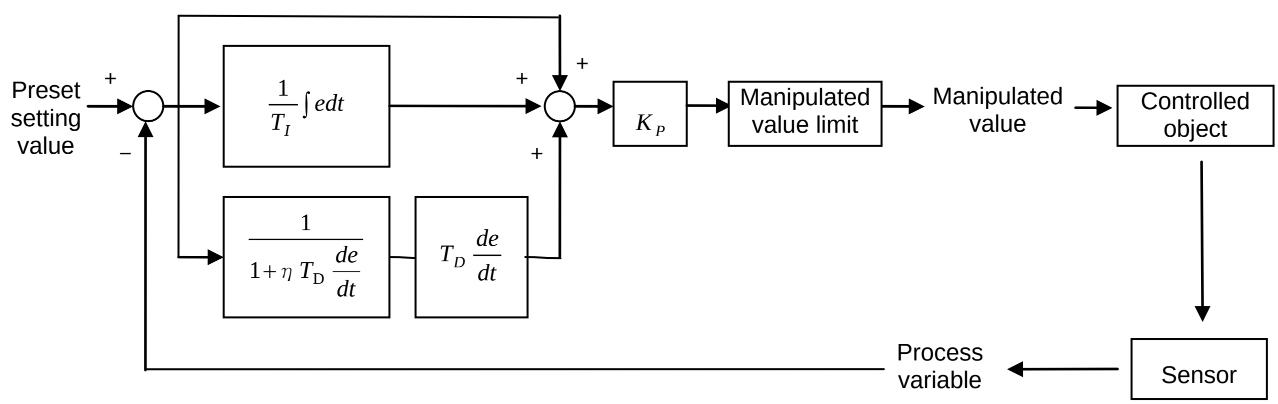


Fig.6.1.1 (a) Block diagram of PID control

Operation formula of PID control

The operation formula of the PID control is an additive synthesis of a proportional action (P), an integral action (I), and a derivative action (D).

$$MV = K_P(\underbrace{e}_{\text{Proportional action}} + \underbrace{\frac{1}{T_I}\int edt}_{\text{Integral action}} + \underbrace{\frac{1}{1+\frac{T_D}{K_D}\frac{de}{dt}}T_D\frac{de}{dt}}_{\text{Derivative action}})$$

MV :	Manipulated value	
e :	Deviation	
	- Positive action	Process variable (PV) - Preset setting value (SV)
	- Reverse action	Preset setting value (SV) - Process variable (PV)
K_p :	Proportional gain	
T_I :	Integral time	
t :	Sampling period	
T_D :	Derivative time	
K_D :	Derivative gain	

Format

Fig. 6.1.1 (b) shows the ladder format and Table 6.1.1 (a) shows the mnemonic format.

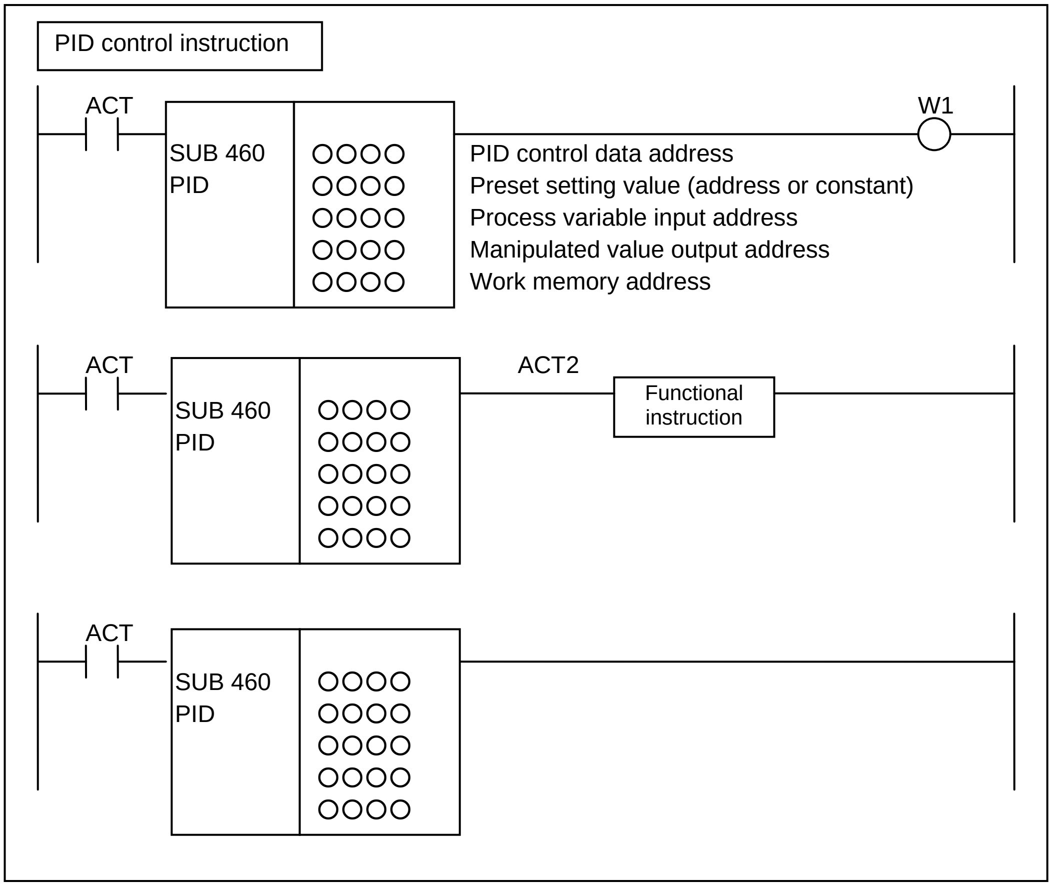


Fig. 6.1.1 (b) Format of PID control instruction

Table 6.1.1 (a) Mnemonic of PID control instruction

Mnemonic format

Step number	Instruction	Address No.	Bit No.	Remarks
1	RD	○○○○	.○	ACT
2	SUB	460		SUB No. (PID control instruction)
3	(PRM)	○○○○		PID control data address
4	(PRM)	○○○○		Preset setting value (address or constant)
5	(PRM)	○○○○		Process variable input address
6	(PRM)	○○○○		Manipulated value output address
7	(PRM)	○○○○		Work memory address
8	WRT	○○○○	.○	W1 Output

Memory status of control condition

ST3	ST2	ST1	ST0
			ACT
			W1

Control condition

(a) Input signal (ACT)
ACT = 0 : Do not execute the PID control instruction.
ACT = 1 : Execute the PID control instruction.

Parameters

(a) PID control data address
You set the following PID control data in the area of 18 bytes length and specify the top address to this parameter.
You can set and modify the values in the area under the condition of ACT = 0.

	Contents	Setting range	Remarks
CTL+0	Proportional gain (K_P)	1 to 32767	Unit：0.01
+2	Integral time (T_I)	0 to 32767	Unit：100 ms If this value is 0, Integral action (I) does not work.
+4	Derivative time (T_D)	0 to 32767	Unit：10 ms If this value is 0 or integral time (T_I) is 0 (Integral action does not work), and Derivative action (D) does not work.
+6	Derivative gain (K_D)	0 to 32767	Unit：0.01 Set value between 8.00 and 10.00 normally; the actual value between 800 and 1000. If the setting is 0, the Derivative action (D) becomes exact differential.
+8	Sampling period (t)	1 to 32767	Unit：10 ms If this value is shorter than ladder execution period, the sampling period will be same as the ladder execution period. For details, refer to “Sampling period” below.
+10	Positive action / Reverse action	0：Positive 1：Reverse	Specify the direction of PID control. For details, refer to “Positive action / reverse action”.
+12	Manipulated value limit	0：No limit 1：Limit	When you want to restrict the range of the manipulated value, specify “1”.
+14	Maximum manipulated value	-32768 to 32767	Specify the maximum value of the manipulated value when the manipulated value limit is set to 1. If the operation result of the manipulated value exceeds this value, the manipulated value will be this value.
+16	Minimum manipulated value	-32768 to 32767	Specify the minimum value of the manipulated value when the manipulated value limit is set to 1. If the operation result of the manipulated value is less than this value, the manipulated value will be this value.
+18			

⚠ **CAUTION**
If you change the PID control data while ACT = 1, the operation result may be incorrect.

> **NOTE**
> When the manipulated value limit is set to 1(enable limit), set the maximum and the minimum manipulated values defined as “minimum < maximum”. If these values do not satisfy the relation, the operation will not be executed and W1 will be 0.

(b) Preset setting value
Specify the Preset setting value (SV), either by a constant or a PMC memory address for storing the data.

(c) Process variable input address
Specify PMC memory address where the 2 byte data of the process variable is stored.

(d) Manipulated value output address
Specify PMC memory address where the 2 byte data of the manipulated value is stored.

> **NOTE**
> When the result of PID operation is out of the range of the manipulated value output address, output the maximum value or the minimum value which can be stored in the address.

(e) Work memory address
Specify a work memory address of 14 bytes length which is used for PID operation. R address will be used typically.
The work memory is used for preserving the progress data of the PID operation. If you specify a nonvolatile memory for the work memory, you have to initialize the area to 0 before the initial execution of the instruction.

> ⚠ **CAUTION**
> 1 If the instruction starts working with the work memory that is not initialized to “0”, the result of the PID operation will be incorrect.
> 2 Do not modify the contents of the work memory while the instruction is active.
> 3 If you change the work memory address by ladder editor, the new work memory has to be initialized before starting the PID operation. In this case, the PID operation starts from the initial state.

OUTPUT (W1)

W1=1 : The operation works normally.

W1=0 : The operation is not executed (ACT=0).
Some of the PID control data is out of range.
Or, the relation of “minimum manipulated value ≥ maximum manipulated value” is not satisfied when the manipulated value limit is “1”.
Or, invalid data is found in the work memory.

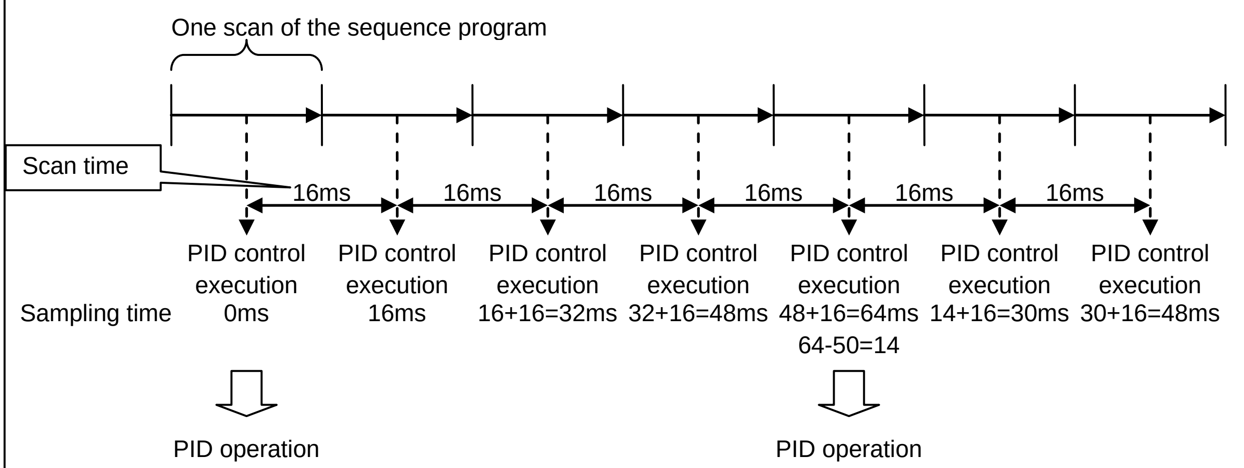
NOTE

1. When W1=0, the value in the manipulated value output address is preserved.
2. W1 can be omitted. Or it can be also connected to another functional instruction instead of a coil.
3. This instruction does not use the operation output registers (R9000, Z0).

Sampling period

Specify the execution period of the PID operation by 10 ms unit.

Example) The scan time of the ladder program = 16 ms; the sampling period = 50 ms;



Every time the PID control instruction is executed, it adds up each scan time. The PID operation is processed when the total of scan time reaches the sampling period. The excess of scan time total over the sampling period will be carried over into the next scan time total.

NOTE

1. The PID operation is processed at the timing of execution of PID control instruction. Therefore, the processing timing of the operation may have a time lag up to one scan time of the ladder program.
2. If the scan time of the ladder program is longer than the sampling period, the PID operation is processed every scan of the ladder.

Positive action / Reverse action

The following control direction can be selected in the PID control instruction.

(1) Positive action

This action makes the Manipulated value increase when the Process variable is larger than the Preset setting value. The following figure is an example of relationship diagram of manipulated value, Process variable, and Preset setting value, and an example of temperature control in case of the positive action.

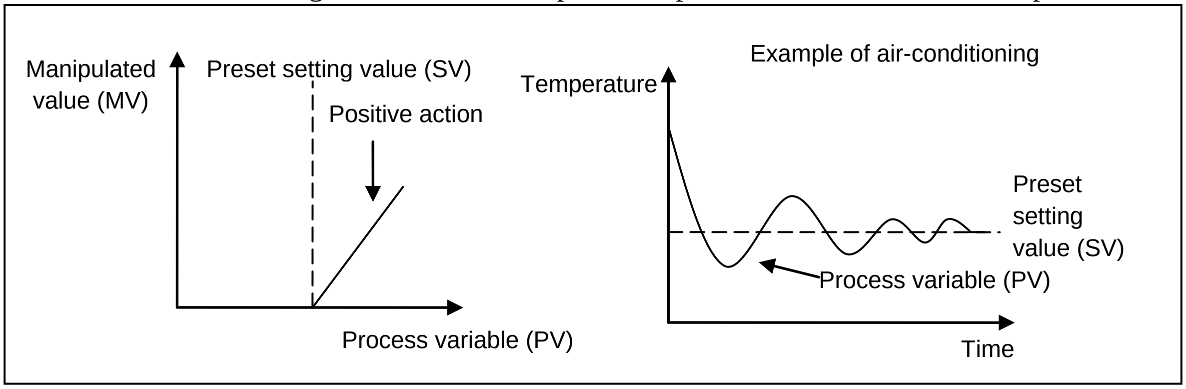


Fig.6.1.1 (c) Example of relationship diagram of MV, PV, and SV, and temperature control

(2) Reverse action

This action makes the Manipulated value increase when the Process variable is smaller than the Preset setting value. The following figure is an example of relationship diagram of Manipulated value, Process variable, and Preset setting value, and an example of temperature control in case of the reverse action.

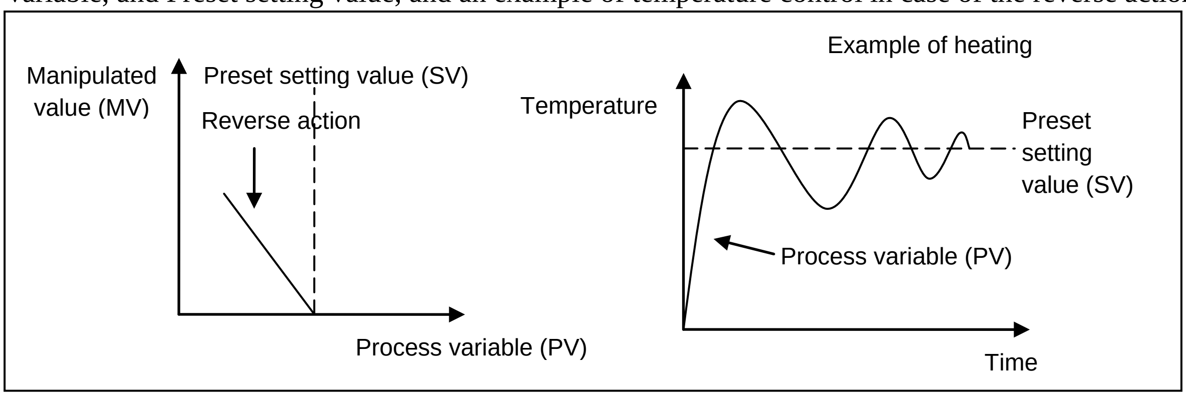


Fig.6.1.1 (d) Example of relationship diagram of MV, PV and SV and temperature control

7 PMC DIAGNOSIS AND MAINTENANCE SCREENS ([PMC MAINTE])

7.1 DATA INPUT/OUTPUT ([I/O] SCREEN)

7.1.1 7.4.1 Memory Card and USB Memory

Add the following to "7.4.1 Memory Card and USB Memory".

Memory card

The memory card, which is used for inputting/outputting the sequence program in the I/O screen, can also be used to access to the programmer (FANUC LADDER-III).
As for the memory card, you need use the compact flash adapter, which is attached a compact flash card (CF card) purchased from FANUC.

> **NOTE**
> If a CF card other than that purchased from FANUC is used, the operation is not guaranteed.

For the details, refer to "APPENDIX E" in the "CONNECTION MANUAL (HARDWARE)" of each CNC series.

USB memory

You can input/output some data to/from a USB memory with a USB port beside a display unit.

> ⚠ **CAUTION**
> 1 While the control unit is accessing the USB memory, do not turn off the power to the control unit or do not remove the USB memory.
> 2 Close the cover of the USB port when no USB memory is inserted.

> **NOTE**
> 1 It is not guaranteed that every commercially available USB memory can operate normally. A USB memory with a security function does not operate. Some commercially available USB memories may not be designed for the use in an FA environment.
> 2 To use the USB slot of *i*Pendant with a PMC screen, set bit 0 (PCM) of parameter No. 300 to 1 and select MEMORY card to the device.

For the details, refer to section 5.6 in the "CONNECTION MANUAL (HARDWARE)" of each CNC series.

8 LADDER DIAGRAM MONITOR AND EDITOR SCREEN ([PMC LADDER])

8.1 MONITORING LADDER DIAGRAMS ([LADDER] SCREEN)

8.1.1 Display Format for Parameters

Add the following to "8.2.3 Display Format for Parameters".

No.	Name	Parameter	Monitor format
460	PID	1	2-byte binary
		2	Constant or 2-byte binary
		3	2-byte binary
		4	2-byte binary
		5	No monitor

8.2 EDITING LADDER PROGRAMS

8.2.1 Structure of Valid Net

8.2.1.1 Structure of extended type net

The functional instruction, which can be used in the structure of extended type net

Add the following to the table 8.3.4.2 of "8.3.4.2 Structure of extended type net".

Instruction name	SUB Number	Usable in Extended type net
PID	460	Yes

9 PMC CONFIGURATION DATA SETTING SCREEN ([PMC CONFIG])

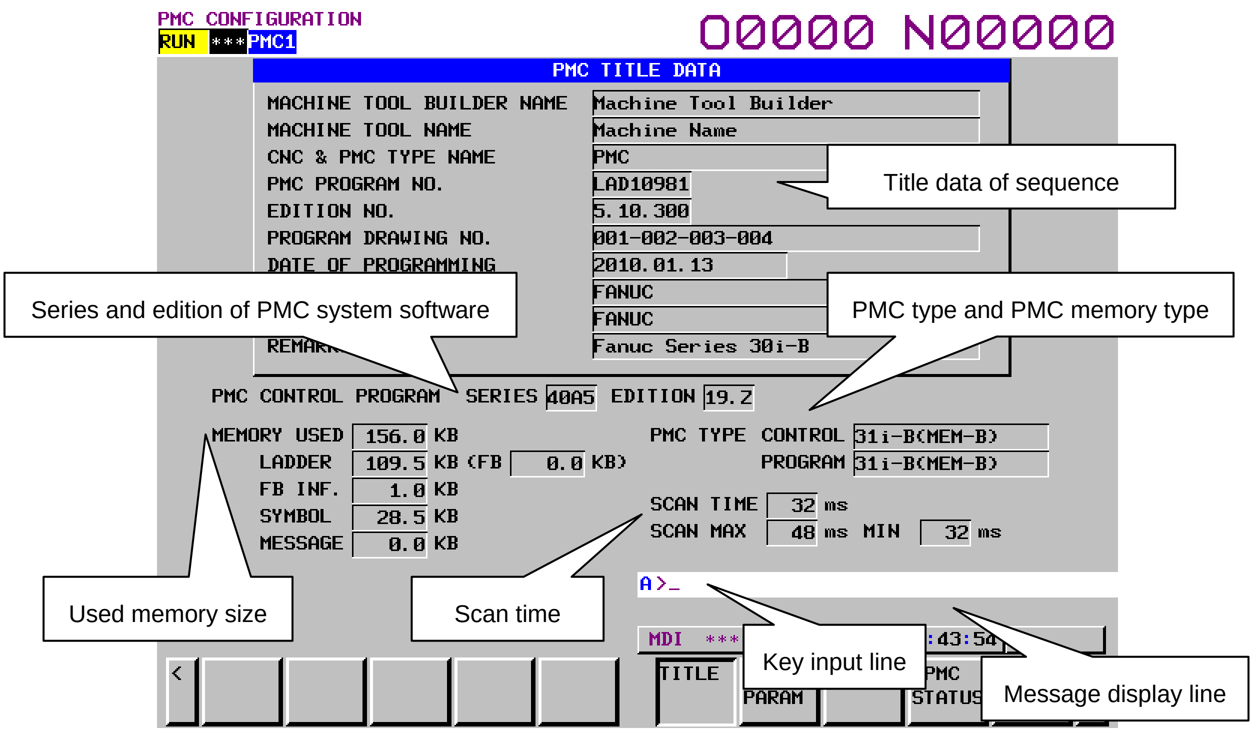
9.1 DISPLAYING AND EDITING TITLE DATA ([TITLE] SCREENS)

9.1.1 Displaying Title Data

Change a part of “9.1.1 Displaying Title Data” as follows.

On the TITLE DATA screen, you can check the title data items and some ladder information items.
To switch to the TITLE DATA screen, press the [TITLE] soft key.
Besides, the following operation is available in the TITLE DATA screen.

- Moving to the TITLE DATA EDITOR screen [EDIT]
- Moving to the TITLE DATA (MESSAGE) screen [MESAGE TITLE]



(1) Title data

The following title data that is set in the sequence program is displayed.

Item	Max. characters
MACHINE TOOL BUILDER NAME	32
MACHINE TOOL NAME	32
CNC & PMC NAME	32
PMC PROGRAM NO.	8
EDITION NO.	8
PROGRAM DRAWING NO.	32
DATA OF PROGRAMMING	16
PROGRAM DESIGNED BY	32
ROM WRITTEN BY	32
REMARKS	32

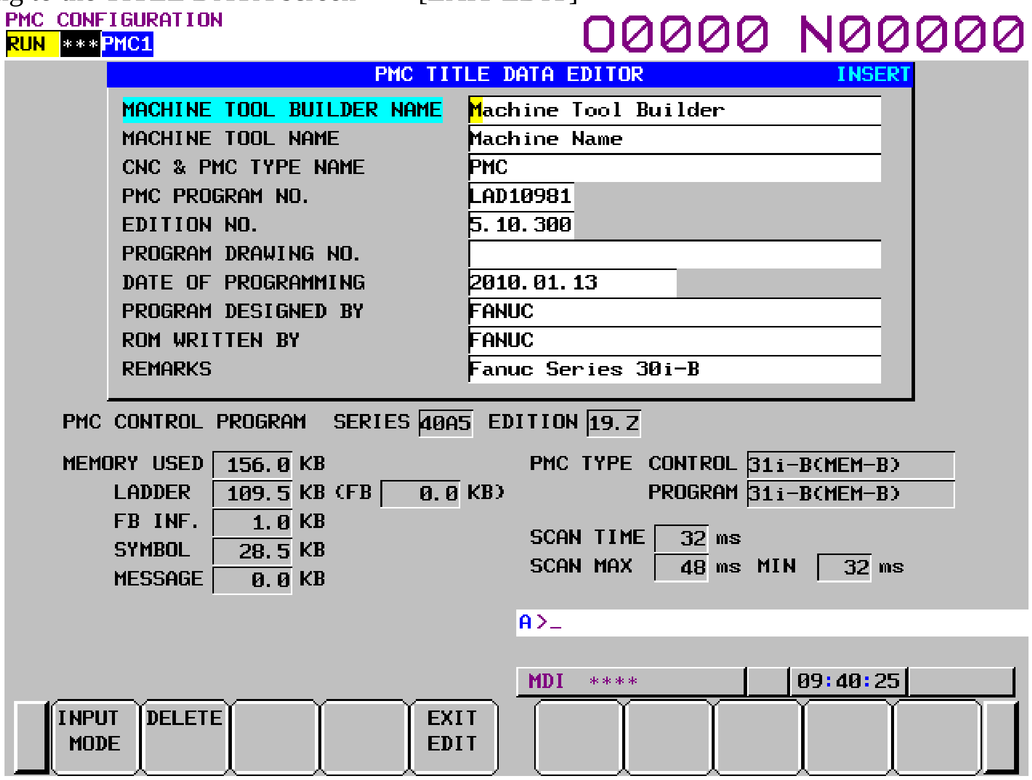
**** Omitted below ****

9.1.2 Editing Title Data

Change a part of a part of "9.1.2 Editing Tile Data" as follows.

On the TITLE DATA EDITOR screen, you can edit title data items. To switch to the TITLE DATA EDITOR screen, press the [EDIT] soft key on the TITLE DATA screen.
On the TITLE DATA EDITOR screen, you can perform the following operations:

- Changing the input mode [INPUT MODE]
- Deleting title data [DELETE]
- Moving to the TITLE DATA screen [EXIT EDIT]



**** Omitted below ****

9.2 DISPLAYING AND SETTING CONFIGURATION PARAMETERS ([CONFIG PARAM] SCREEN)

9.2.1 Setting the PMC memory type

Change "9.9.5 Setting the PMC Memory Type" as follows.

On the PMC CONFIGURATION PARAMETER (PMC MEMORY) screen, you can change the PMC Memory Type of each PMC path.
The setting is saved to the CNC parameter and becomes effective after rebooting CNC. See the "2.4.3 CNC Parameters Related to the PMCs" for the details of the CNC parameter.

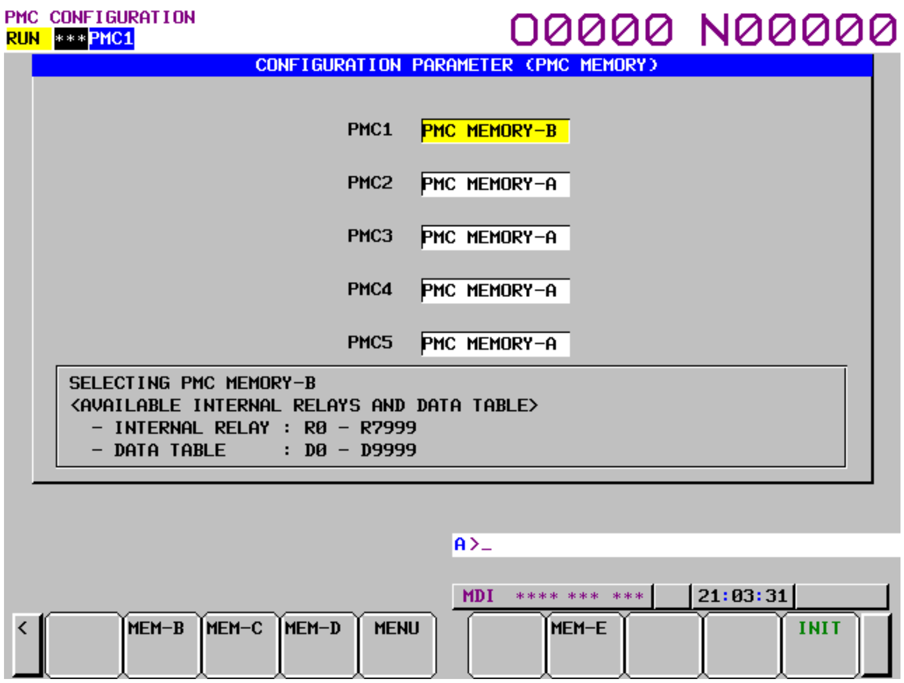


Fig. 9.2.1 (a) PMC CONFIGURATION PARAMETER (PMC MEMORY) screen

> ⚠ **CAUTION**
> PMC nonvolatile memory must be initialized after changing PMC Memory Type. Therefore, make a backup of PMC parameter before changing PMC Memory Type. See "2.8 BATTERY BACKUP DATA" about the operation of initializing PMC nonvolatile memory.

> **NOTE**
> 1 Selectable PMC Memory Type differs for each PMC path. See the "2.1.3 Determination of PMC Memory Type" for the details of selectable types.
> 2 The soft-key [MEM-E] is displayed only on a special series of CNC software.

Screen operations

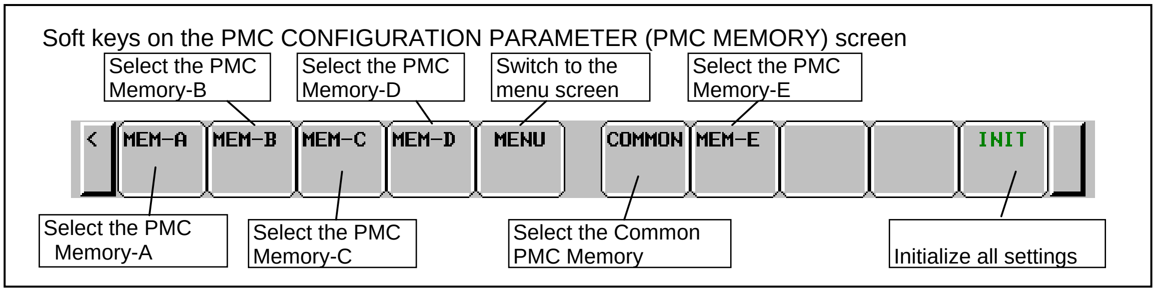


Fig. 9.2.1 (b) Soft keys on the PMC CONFIGURATION PARAMETER (PMC MEMORY) screen

(1) Operation with soft keys

(a) [MEM-A] Select the PMC Memory-A.
Selects the PMC Memory-A for the cursor focused PMC path. This soft key is displayed when the PMC Memory-A is selectable at focused PMC path.

(b) [MEM-B] Select the PMC Memory-B.
Selects the PMC Memory-B for the cursor focused PMC path. This soft key is displayed when the PMC Memory-B is selectable at focused PMC path.

(c) [MEM-C] Select the PMC Memory-C.
Selects the PMC Memory-C for the cursor focused PMC path. This soft key is displayed when the PMC Memory-C is selectable at focused PMC path.

(d) [MEM-D] Select the PMC Memory-D.
Selects the PMC Memory-D for the cursor focused PMC path. This soft key is displayed when the PMC Memory-D is selectable at focused PMC path.

(e) [MEM-E] Select the PMC Memory-E.
Selects the PMC Memory-E for the cursor focused PMC path. This soft key is displayed when the PMC Memory-E is selectable CNC series and PMC path.

(f) [COMMON] Select the Common PMC Memory mode.
Selects the Common PMC Memory mode to the cursor focused PMC path. This soft key is displayed when the Common PMC Memory mode is selectable at focused PMC path.

(g) [MENU] Switch to the menu screen.
Switches to the CONFIGURATION PARAMETER (MENU) screen.

(h) [INIT] Initialize all settings
Reset all PMC Memory Type of each PMC paths to the default setting.

9.3 PMC Program List Screen

Change "9.11 PMC Program List Screen" as follows.

In case of using multi-path PMC or ladder dividing management function, you can confirm the information of main ladder programs or divided ladder programs for all PMC paths installed in CNC system.
In PMC program list screen, you can confirm all main programs and divided programs of all PMC paths.
By selecting a program in the list, displayed program can be switched. PMC program list screen appears by pressing the [PROG LIST] soft key or pressing the [SWITCH PMC] soft key in each PMC screen.

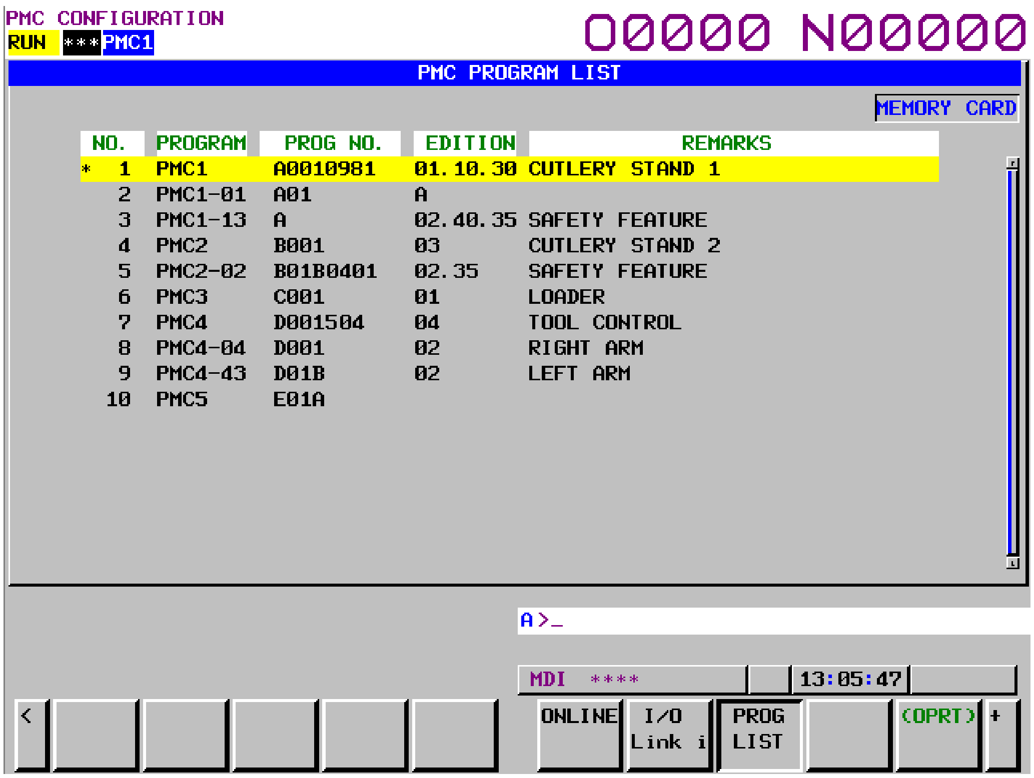


Fig.9.3 (a) PMCPROGRAM LIST screen

**** Omitted below ****

				FANUC Series 30*i*/31*i*/32*i*/35*i*-MODEL B FANUC Power Motion *i*-MODEL A FANUC Series 0*i*-MODEL F PMC Supplemental Programming Manual
01	2015.4.16	H.Yonekura	New registration	DRAW. NO. : B-64513EN/03-2
EDIT.	DATE	DESIG.	DESCRIPTION	FANUC CORPORATION 86 / 88

9.3.1 Output of program list information file

Change "9.11.1 Output of program list information file" as follows.

For maintenance of machines, there are cases where you want to get the information of ladder programs installed in CNC system. In case of using multi-path PMC or ladder dividing management function, you can confirm the information on the PMC program list screen. You can get the information of the screen as a bitmap file. To use this function, however, you can output a text file of the screen information. The text file is output as "CSV" format. Therefore, you can manage it using application software such as EXCEL on PC.

When pressing this soft key, [EXEC] and [CANCEL] soft keys appear. To output the file, press the [EXEC] soft key.
You can select output device by the [IO DEVICE] soft key.

(1) File name
The output file name is "PMC_LIST.000". If the same file name exists on the device, the extension is incremented to "001", "002" and so on. (Maximum "999")

(2) Output format
The file is output with the "CSV" format. Character string data such as program and remarks are enclosed in double quotation marks ("   ").
Output contents are as follows.
  (a) Header
  At the top of data, an identifier representing the file information is output.
  Identifier: ("PMC PROGRAM LIST")
  Edition information: ("Edition", 1)
  (b) Data
  Program information, which is displayed on program list screen, is output.
  Program information: Number, "Program", "Program No.", "Edition", "Remarks"

Example of program list information

```
"PMC PROGRAM LIST"
"Edition",    1                                   Header

1,     "PMC1",      "A0010981",  "01.10.30",  "CUTLERY STAND1"
2,     "PMC1-01",   "A01B",      "01",
3,     "PMC1-02",   "A01C",      "02.40.35",  "SAFETY FEATURE"
4,     "PMC2",      "B001",      "03",        "CUTLERY STAND2"    Data
5,     "PMC2-01",   "B01B0401",  "02.35",     "SAFETY FEATURE"
6,     "PMC3",      "C001",      "01",        "LOADER"
7,     "PMC4",      ,            ,
8,     "PMC4-01",   "D01A",      "02",        "RIGHIT ARM"
9,     "PMC4-02",   "D01B",      "01",        "LEFT ARM"
10,    "PMC5",      "E01A",      ,
```

> **NOTE**
> For view comfort, tabs are inserted in several places. In actual data, however, no tab is inserted.

10 PMC ALARM MESSAGE AND ACTIONS TO TAKE

10.1 ALARM MESSAGE LIST

10.1.1 Message that May Be Displayed on the PMC Alarm Screen

Add the following to "12.1.1 Messages That May Be Displayed on the PMC Alarm Screen".

Alarm number	Faulty location/corrective action	Contents
ER59 MESSAGE DATA SIZE OVER	Reduce the size of message data in sequence program or message file for multi-language display.	The message data exceeds the maximum message data size. (Only 0*i*-F PMC/L)

10.1.2 Operation Errors

Add the following to "12.1.3 Operation Errors".

Error messages that may be displayed on the PMC LADDER DIAGRAM VIEWER screen

Message	Faulty location/corrective action	Contents
NET IS TOO COMPLICATED	Divide the net that is not displayed into some smaller nets with FANUC LADDER-III.	There is a net exceeding the limit size for displaying on ladder diagram monitor screen.