Technical Information

FA-M3 Training Text
FA-M3 Programming Tool
WideField2 for Ladder

TI 34M6A82-01E

YOKOGAWA
Yokogawa Electric Corporation

TI34M6A82-01E
2002.11 2nd Edition

Precautions

The operating information described in this training guide is written for use with the training system and training kit recommended by Yokogawa. When operating measurement and control devices for actual plant equipment, be sure to read the warning labels pasted on the devices and cautionary notes provided in the instruction manuals, specifications, design guides, operating manuals, etc.

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Preface

This book provides an overview of the “Range-Free Multi-Controller FA-M3” and helps the reader to understand the installation and basic operation of the FA-M3 Programming Tool WideField2 by operating the training kit.

It is targeted at first time users of FA-M3 with basic understanding of sequence circuits and Windows concepts. The book should be read together with the other FA-M3 instruction manuals for a deeper understanding of the topics introduced herein.

Please note that the contents of the book are subject to change without prior notice.

■ Safety Precautions

Operate the training kit carefully during the training.
Please read the other related manuals when designing your system.

■ Trademarks

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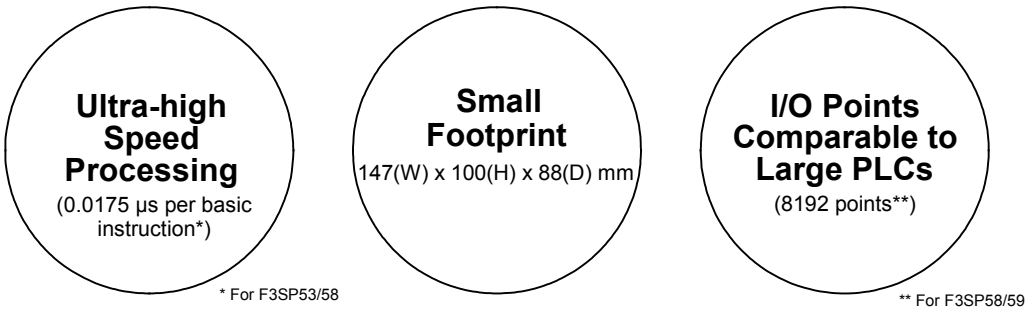
1. Features and System Configuration

1.1 Features

■ Compact yet powerful...

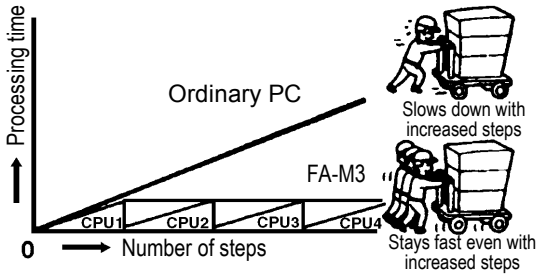
The FA-M3 is a compact PLC that can quickly process, respond and control processes of varying scales, providing for significantly increased performance and reduced cost of control panels and machines.



■ No more worries about memory capacity or performance...

The use of add-on sequence CPUs (with memory) dedicated to sequence control allows you to write programs without worrying about the number of sequence control steps, memory capacity, or processing speed. Structured programs to be run on add-on sequence CPUs are not only easy to read but also yields high performance.

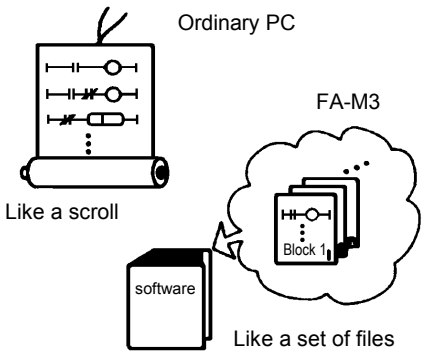
High-speed processing with add-on CPUs



■ Control programs that are easy to create and maintain...

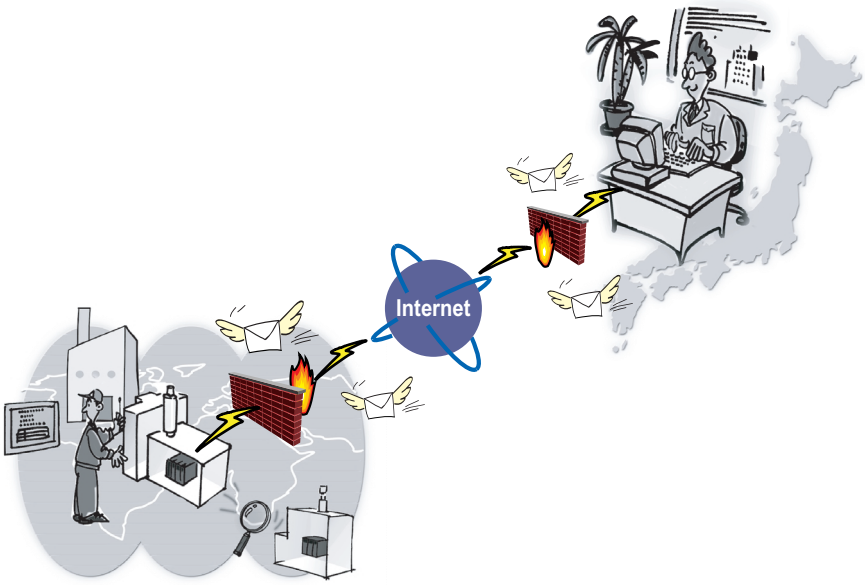
The FA-M3 adopts a structured ladder programming approach; ladder programs are created, edited and maintained as independent blocks, which can be combined as required. Furthermore, with the use of tag names and other logical signal names, you can start programming even before determining terminal allocations.

Structured ladder programming



■ Easy remote system maintenance by e-mail...

The FA-M3 supports remote system maintenance and engineering by e-mails. You may report errors, read from or write to devices, read system and user logs, and monitor a system using trace functions, all remotely.



1.2 System Configuration

1.2.1 Unit

A unit is the smallest system consisting of the following modules. Install the modules below on a base module to compose a unit.

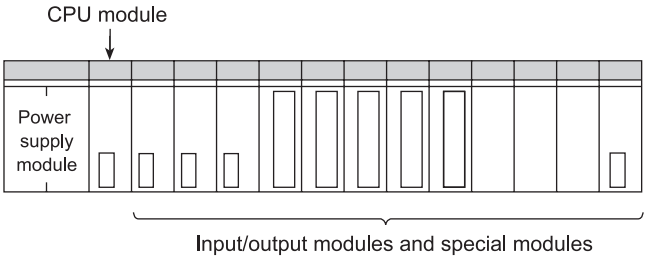
Name	Description
Base module	Five types are available depending on the number of modules to be installed.
Power supply module	One power supply module is required to be installed on a base module.
CPU module(s)	At least one CPU module is required. Several types are available depending on the functions to be used.
Input/output module	Several types are available depending on the type and the number of input/output points.
Special module(s)	Many types are available such as analog input/output and communication.

A location where you install a module is called a slot.

■ Main Unit

A unit with a CPU module is called a main unit.

Install the power supply module in the slot on the left end of the base module and install the CPU module(s) in the slot(s) immediately to the right of the power supply module.



■ Subunit

A subunit is an extension unit for accommodating additional I/O modules, and is connected to a main unit using an optical FA bus module. Thus, a subunit has no CPU module installed. Up to seven subunits may be connected to a main unit.

■ Slot Number

Slot numbers represent the slot positions where modules are installed.

A slot number is defined as a 3-digit positive number as follows.

Slot number □□□

01-16: Slot locations from the right of the power supply module to the right end of the base module.

Unit number
0 : Main unit
1-7 : Subunits

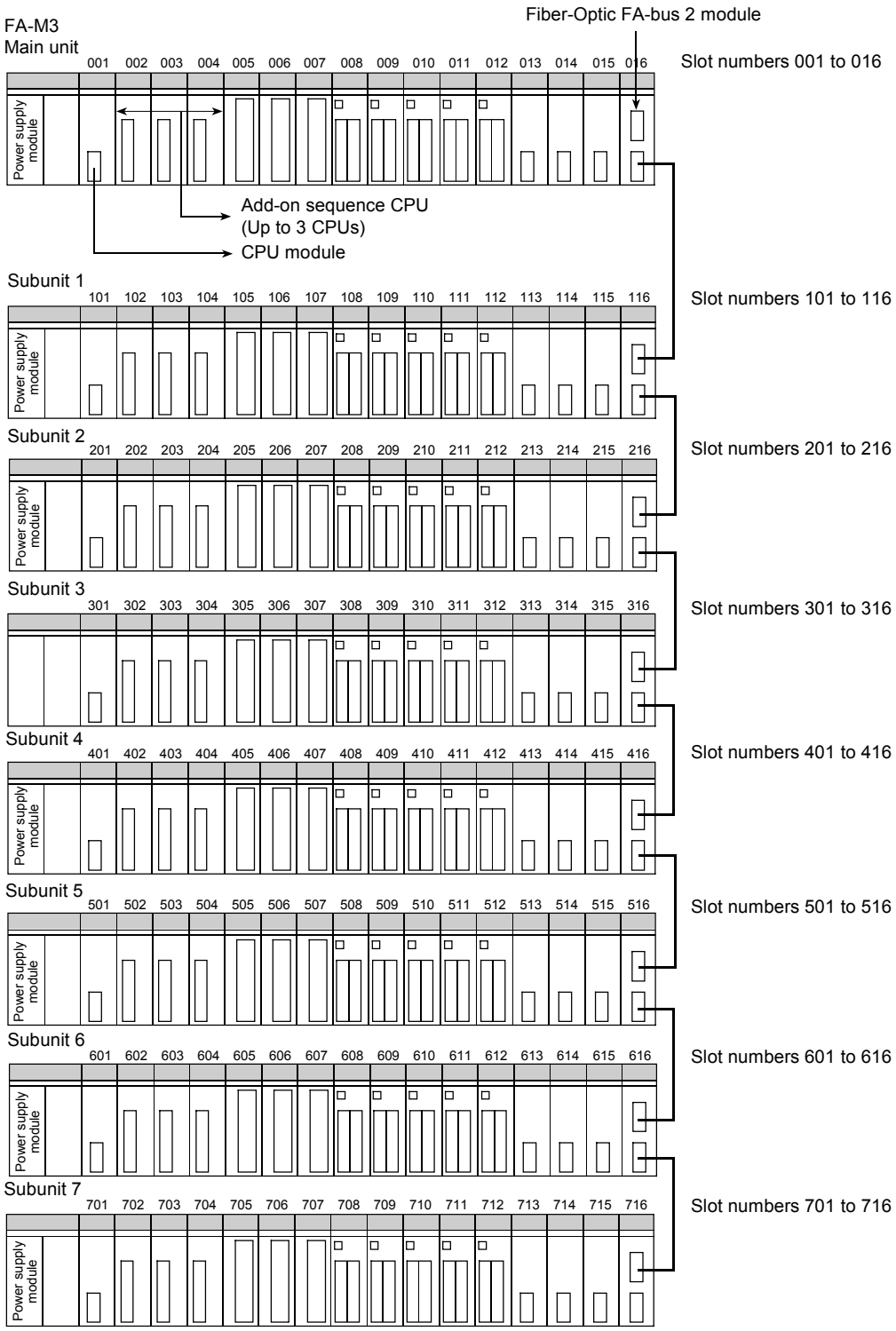


Figure Slot Numbers

A main unit and a subunit are each provided with an optical FA bus 2 module, and are connected to each other via the modules with an interconnecting fiber-optic cable. Up to seven subunits may be connected to a main unit. Each subunit is identified with a subunit number defined using a rotary switch on the front face of the optical FA bus 2 module.

■ Restrictions on CPU Module Locations

1. The sequence CPU module that is to be used as the main CPU must be installed in slot 001 of the main unit.
2. In addition to the main CPU, sequence CPUs may also be installed in slots 002 to 004 of the main unit, acting as add-on sequence CPU modules.
3. Input/Output modules may also be installed in slots 2 to 4. Add-on CPU modules can only be installed in slots to the left of input/output modules.

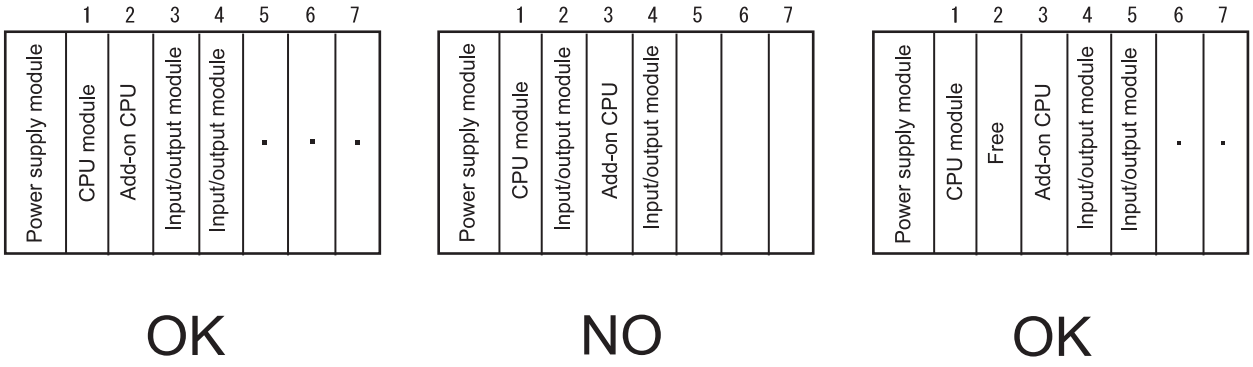


Figure Restrictions on Module Locations

1.3 FA-M3 Configuration

1.3.1 Main Unit

■ Module Names

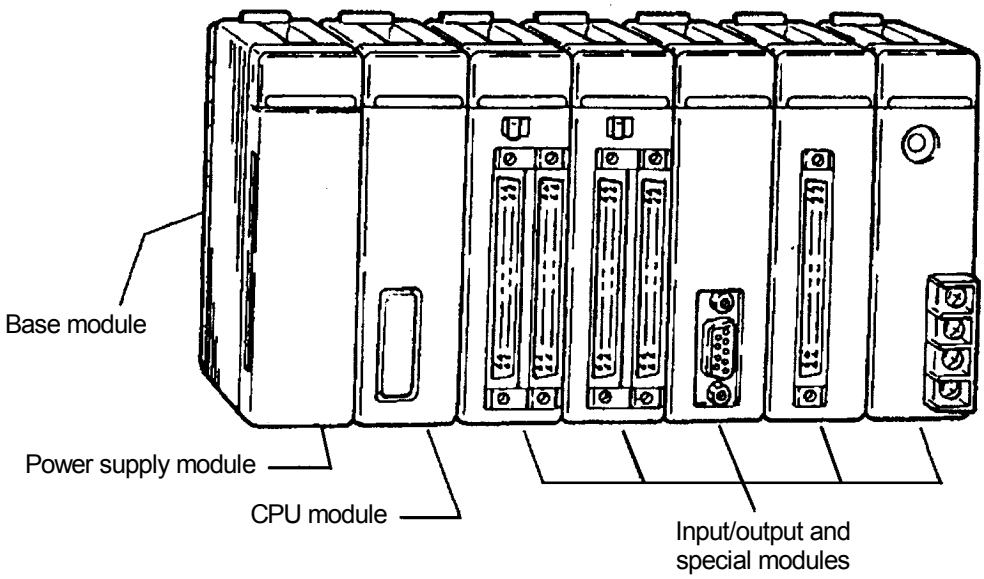


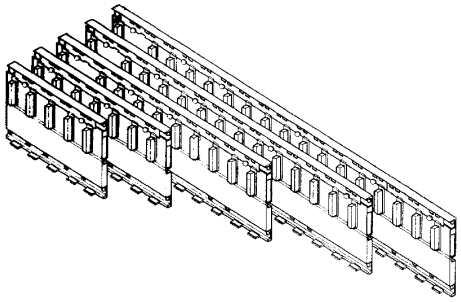
Figure External view of FA-M3

1.3.2 Base Module

■ Overview

The base module is used for holding the different modules. There are five types of base module: 4 slots, 6 slots, 9 slots, 13 slots and 16 slots modules. Select an appropriate module type according to your application.

There is no difference between main unit and subunits.



■ Specifications

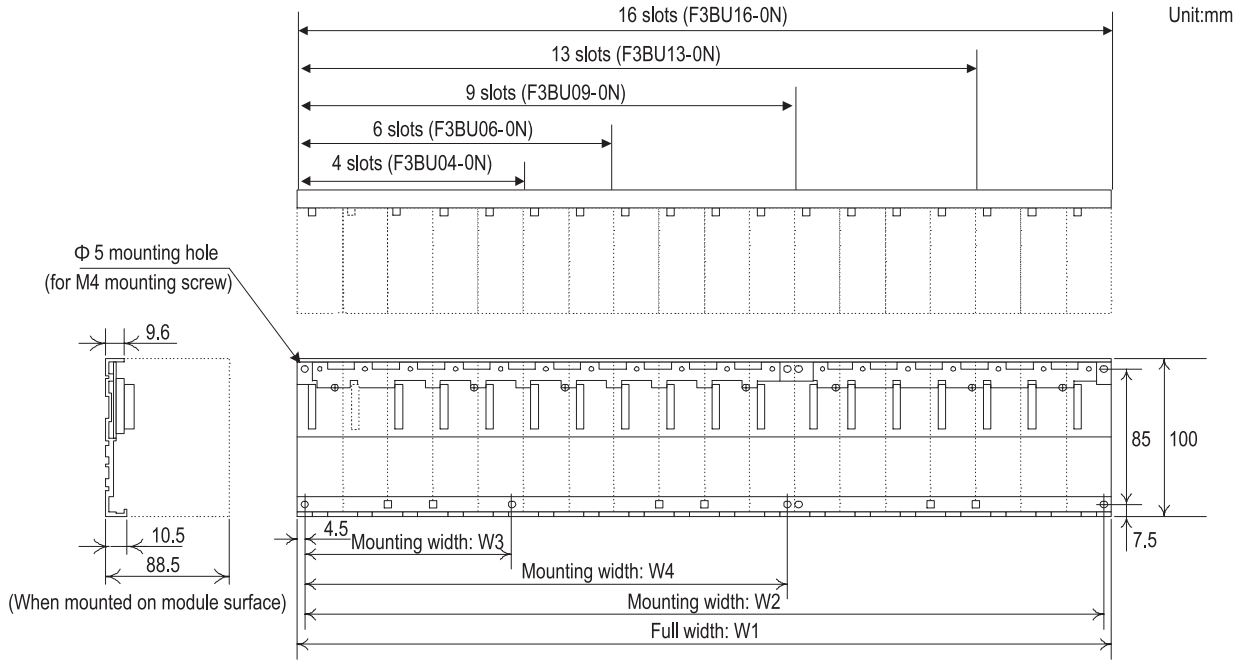
	F3BU04-0N	F3BU06-0N	F3BU09-0N	F3BU13-0N	F3BU16-0N
Number of slots	4	6	9	13	16
Number of I/O slots*	3	5	8	12	15
Power consumption	50mA (5V DC)				
Weight	140g	200g	310g	420g	550g

*: The number of I/O slots that can be used when 1 CPU module is installed.

■ Model and Specification Code

Model	Suffix Code	Style Code	Option Code	Description
F3BU04	-0N	.....	.....	4 slots (Number of slots, excluding the slot for power supply module)
F3BU06	-0N	.....	.....	6 slots (Number of slots, excluding the slot for power supply module)
F3BU09	-0N	.....	.....	9 slots (Number of slots, excluding the slot for power supply module)
F3BU13	-0N	.....	.....	13 slots (Number of slots, excluding the slot for power supply module)
F3BU16	-0N	.....	.....	16 slots (Number of slots, excluding the slot for power supply module)

■ External Dimensions



Model of Base Module	Full Width W1	Mounting Width		
		W2	W3	W4
F3BU04-0N	147	138	.....	.....
F3BU06-0N	205	196	.....	.....
F3BU09-0N	322	313	138	.....
F3BU13-0N	439	430	196	.....
F3BU16-0N	527	517	138	313

CAUTION

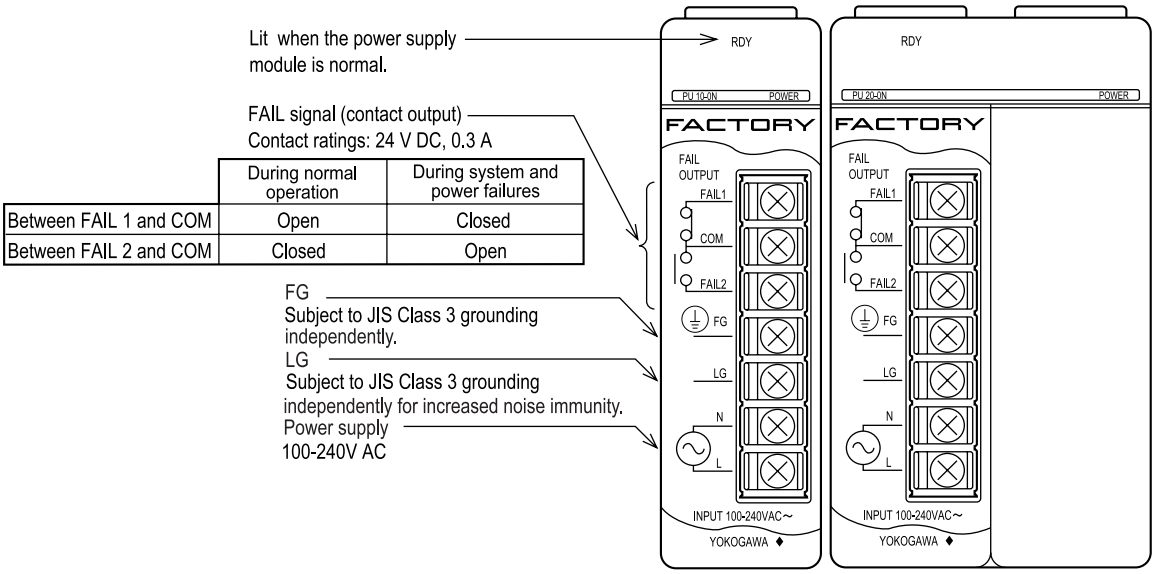
- Make sure that the total power consumption of all the installed modules does not exceed the capacity of the power supply module.
- Do not install the F3BU16-0N on the DIN rail.
- The metallic chassis of the base module is connected to the signal ground of the FA-M3 system.

1.3.3 Power Supply Module

■ Components and their Functions

F3PU10/F3PU20/F3PU30 Power Supply Modules

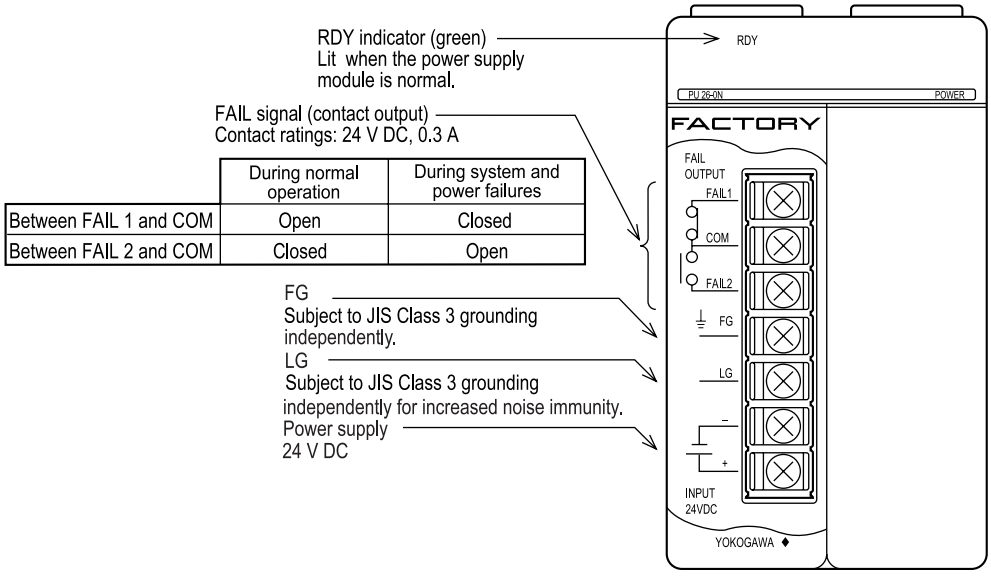
The following figure shows the power supply modules with their covers removed.



F3PU10 F3PU20/F3PU30

F3PU26 Power Supply Module

The following figure shows the power supply module with its cover removed.



F3PU26

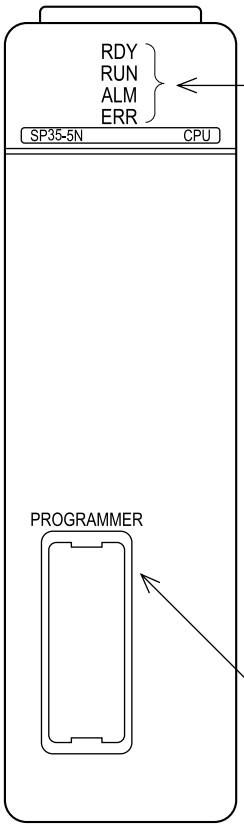
F3PU16 Power Supply Module

The power supply module supplies 24 VDC to a base module with 4 or 6 slots (it occupies one slot space).

1.3.4 CPU Modules

■ Components and their Functions

F3SP21/F3SP25/F3SP28/F3SP35/F3SP38 CPU Modules



CPU module maintenance LED

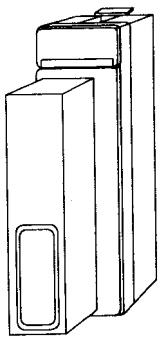
LED	Meaning
RDY(READY) Green	★ Fatal (when off): The hardware cannot run. Examples: CPU error Memory error, Power failure
RUN(RUN) Green	When lit: The user program is running.
ALM(ALARM) Yellow	★ Non-fatal (when lit): The user program can run but an error occurs. Examples: Power failure Communication error
ERR(ERROR) Red	★ Error (when lit): The user program cannot start or continue execution. Examples: Program error* I/O comparison error* I/O module error* Memory error Sequence processor error Instruction processing error* Scan timeout*

* : Error or non-fatal error can be selected in the configuration settings.

Programming tool interface

Connects to a programming tool cable.

The external view of a F3SP53/F3SP58/F3SP59 CPU is shown below.



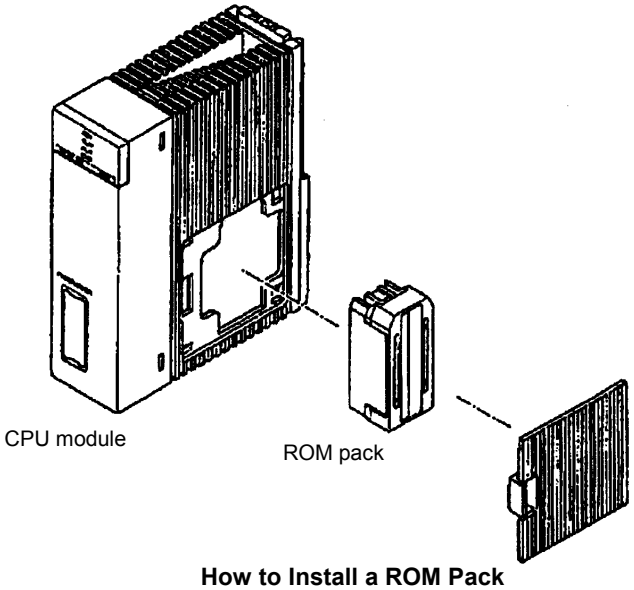
1.3.5 ROM Packs

A CPU module can be installed with a ROM pack to store programs and device data. If programs and partial device data are made resident in the ROM, the CPU module automatically reads the program and device data from the ROM pack at powering up and executes the program. For the types of available ROM packs and their specifications, see the General Specifications (GS 34M6C01-01E).

The major functions of ROM packs are listed below.

- Can store both programs and data.
- Programs and data are written using a programming tool (WideField2).
- Can store the following types of information:
  Program management information, programs, configuration data, control tables, timer/counter setting tables and comment management information
- The ROM packs can store 1024 words of data register data.

Figure ROM Pack (RK10-0N)



How to Install a ROM Pack

1.4 Functional Specifications

1.4.1 CPU Module Types and Performance Specifications

Table List of performance specifications (F3SP□□-□S) (1/2)

Item		Specifications				
		F3SP28-3S	F3SP53-4S	F3SP38-6S	F3SP58-6S	F3SP59-7S
Control Mode		Repeating operations (by stored program)				
Input/output control mode		Refresh method (direct refresh instruction)				
Programming language		Structured ladder language and mnemonic language				
Number of input/output points		4096 max.		8192 max. (including remote I/Os)		
Number of internal relays (I)		16384		32768		65535
Number of shared relays (E)		2048				
Number of extended shared relays (E)		2048				
Number of link relays (L)		8192		16384		
Number of special relays (M)		9984				
Number of timers (T)		1024		2048		
Number of counters (C)		1024				
Number of data registers (D)		16384		32768		65535
Number of shared registers (R)		1024				
Number of extended shared registers (R)		3072				
Number of file registers (B)		32768		262144		
Number of link registers (W)		8192		16384		
Number of special registers (Z)		1024				
Number of labels		1024				
Number of input interrupt processing routines		4				
Constants	Decimal constants	-32768 to 32767 for 16-bit instructions -2147483648 to 2147483647 for 32-bit instructions				
	Hexadecimal constants	$0 to $FFFF (hexadecimal) for 16-bit instructions $0 to $FFFFFFFF (hexadecimal) for 32-bit instructions				
	Character string constants	"AB", etc. for 16-bit instructions "ABCD", etc. for 32-bit instructions				
	IEEE single-precision floating-point constants	1.23, -3.21, etc. for 32-bit instructions Approx. -3.4×10^{38} to +3.4×10^{38}				
	Index constants	0 to 2047				
Program capacity (maximum program size that can be stored in ROM)		30K steps max.	56K steps max.	120K steps max.		254K steps max.
Total capacity (for program and tag name combined)						360K steps max.
ROM capacity (for program and tag name combined)		120K steps max.		360K steps max.		
Number of blocks		1024 max.				
Instructions	Basic instructions	37 types				
	Application instructions	329 types				
Number of macro instructions		256 max.				

Table List of performance specifications (F3SP□□-□S) (2/2)

Item		Specifications				
		F3SP28-3S	F3SP53-4S	F3SP38-6S	F3SP58-6S	F3SP59-7S
Instruction execution time	Basic instructions	0.045 to 0.18 μs per instruction	0.0175 to 0.07μs per instruction	0.045 to 0.18μs per instruction	0.0175 to 0.07μs per instruction	
	Application instructions	0.18 μs min. per instruction	0.07 μs min. per instruction	0.18 μs min. per instruction	0.07 μs min. per instruction	
Special module high-speed read (HRD)/high-speed write (HWR) instructions		64 instructions each				
Sampling trace		Available. Collects and displays statuses of multiple devices for up to 1024 scans.				
PC link function support at the programming tool connection port		Available. The programming tool connection port allows the connection of a PC or monitor to perform communications equivalent to a PC link module.				
User log function		Available. A user log instruction is provided to log errors and operation statuses of a user system.				
Number of PC link modules to be installed		6 max.				
Macro instructions		Available. Users can create and register user-defined macro instructions.				
Scan time monitoring period		10 to 200 ms (user-definable)				
Operation at powering up (including recovery from power failure)		Automatic start, automatic restart (power on/off time and instantaneous power failure time are automatically recorded)				
Sensor control function		Available. One specific block is executed at higher speed, independent of the normal scanning period.				
Constant scanning		1 to 190 ms (user-definable in 0.1 ms increments)				
Self-diagnosis		Memory error, CPU module error, I/O module error, syntax check, etc.				
Link function		FA link, PC link, and remote I/O (optical FA bus and μ bus)				
Comment storage function		Available for circuit comments, subcomments, and tag name definitions (including I/O comments)				
Other functions		- Online editing - Forced set/reset - Clock (year, month, day of the month, hour, minute, second, day of the week) - Configuration (device capacity, power failure lockup range, latched external outputs at sequence stop) - Program protection - Refresh suspension				

1.4.2 Ladder Sequence Device Performance Specifications

Table List of devices

Device		Name	F3SP28-3N/-3S F3SP53-4H/-4S		F3SP38-6N/-6S F3SP58-6H/-6S		F3SP59-7S		Remarks
			Range	No. of points	Range	No. of points	Range	No. of points	
Input relay		X	X00201 to X71664 (not continuous)	4096	X00201 to X71664 (not continuous)	8192	X00201 to X71664 (not continuous)	8192	Available ranges depend on specific modules
Output relay		Y	Y00201 to Y71664 (not continuous)		Y00201 to Y71664 (not continuous)		Y00201 to Y71664 (not continuous)		
Internal relay		I	I00001 to I16384	16384	I00001 to I32768	32768	I00001 to I65535	65535	
Shared relay	Non-lock-up type	E	E0001 to E2048	2048	E0001 to E2048	2048	E0001 to E2048	2048	The default is 0. Configuration is required when using multiple CPU modules.
Extended shared relay			E2049 to E4096	2048	E2049 to E4096	2048	E2049 to E4096	2048	
Link relay	Non-lock-up type	L	L0001 to L72048 (not continuous)	8192	L0001 to L72048 (not continuous)	16384	L0001 to L72048 (not continuous)	16384	Used for FA link communications
Special relay		M	M0001 to M9984	9984	M0001 to M9984	9984	M0001 to M9984	9984	
Timer	100 µs timer	T	T0001 to T0016	Total 2048	T0001 to T0016	Total 3072	T0001 to T0016	Total 3072	Up to 16 timers can be set up
	1 ms timer		T0001 to T2048		T0001 to T3072		T0001 to T3072		The number of timers available depends on the number of counters used (C) (see note)
	10 ms timer								
	100 ms timer								
Continuous timer	100 ms timer								
Counter	Lock-up type	C	C0001 to C2048		C0001 to C3072		C0001 to C3072		The number of counters available depends on the number of timers used (T) (see note)
Data register	Lock-up type	D	D00001 to D16384	16384	D00001 to D32768	32768	D00001 to D65535	65535	
File register	Lock-up type	B	B000001 to B32768	32768	B000001 to B262144	262144	B000001 to B262144	262144	
Link register	Non-lock-up type	W	W00001 to W72048 (not continuous)	8192	W00001 to W72048 (not continuous)	16384	W00001 to W72048 (not continuous)	16384	Used for FA link communications
Special register		Z	Z0001 to Z1024	1024	Z0001 to Z1024	1024	Z0001 to Z1024	1024	
Index register		V	V001 to V256	256	V001 to V256	256	V001 to V256	256	
Shared register	Non-lock-up type	R	R0001 to R1024	1024	R0001 to R1024	1024	R0001 to R1024	1024	The default is 0. Configuration is required when using multiple CPU modules.
Extended shared register			R1025 to R4096	3072	R1025 to R4096	3072	R1025 to R4096	3072	

Note: See “Device Capacities and Configuration Limits” on page 1-15.

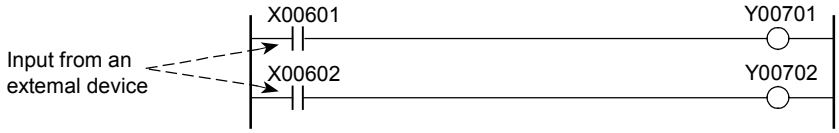
Table Device Capacities and Configuration Limits

Device	Name	F3SP28-3N/-3S F3SP53-4H/-4S		F3SP38-6N/-6S F3SP58-6H/-6S		F3SP59-7S	
		Initial value	Limits	Initial value	Limits	Initial value	Limits
Timer	T	1024	Number of timers and counters combined: 3072 max. The number of 100-µs or 1-ms timers is set to 0 by default.	2048	Number of timers and counters combined: 3072 max. The number of 100-µs or 1-ms timers is set to 0 by default.	2048	Number of timers and counters combined: 3072 max. The number of 100-µs or 1-ms timers is set to 0 by default.
Counter	C	1024		1024		1024	
Shared relay	E	0	2048 max.	0	2048 max.	0	2048 max.
Extended shared relay	E	0	2048 max.	0	2048 max.	0	2048 max.
Shared register	R	0	1024 max.	0	1024 max.	0	1024 max.
Extended shared register	R	0	3072 max.	0	3072 max.	0	3072 max.

1.4.3 Devices

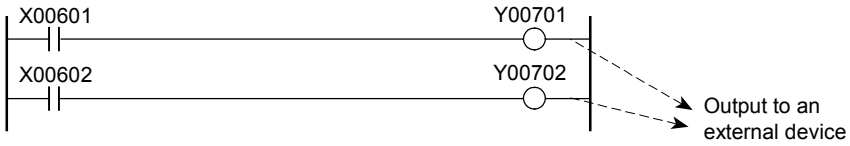
■ Input Relay (X)

Input relays are used for entering an ON/OFF state of an external device such as a push button or a limit switch.



■ Output Relay (Y)

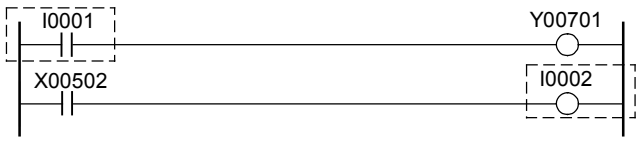
Output relays are used for outputting the control results of the program to external devices such as an actuator.



■ Internal Relay (I)

Internal relays are auxiliary relays.

Unlike input/output relays, the internal relays cannot directly input signals from and output signals to external devices.

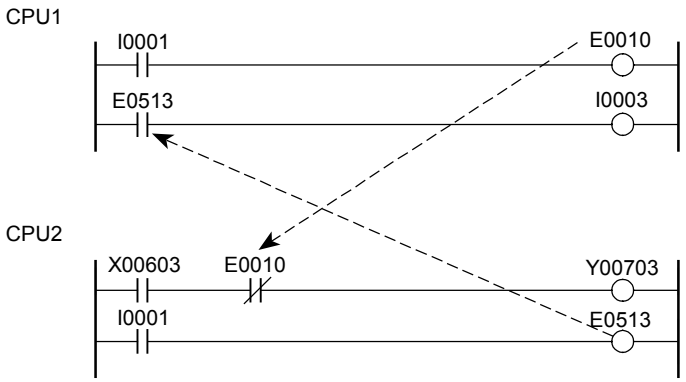


■ Shared Relay, Extended Shared Relay (E), Shared Register, Extended Shared Register (R)

When multiple CPU modules are installed, these relays and registers are used for exchanging data between the CPUs.

Shared relays and registers can be used regardless of how multiple CPUs are combined.

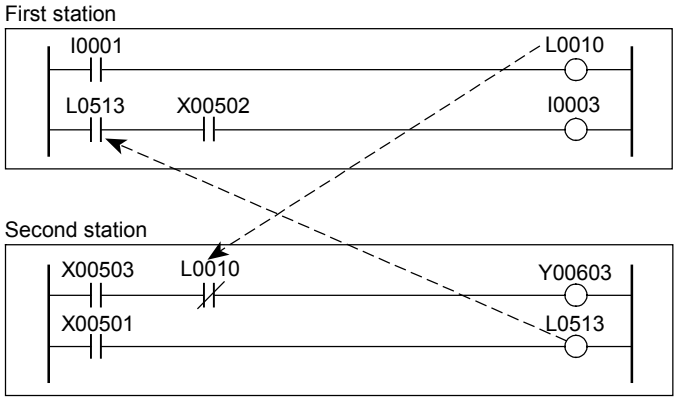
Extended shared relays and extended shared registers can only be used when a sequence CPU is combined with a CPU provided with extended shared relays/registers, acting as an add-on CPU.



Note: ON/OFF information can be exchanged between the CPUs by using the shared relays as coils in the local CPU and as contacts in the remote CPU.

■ Link Relay (L), Link Register (W)

Link relays and registers are used for exchanging data with other programmable controllers through FA link modules.



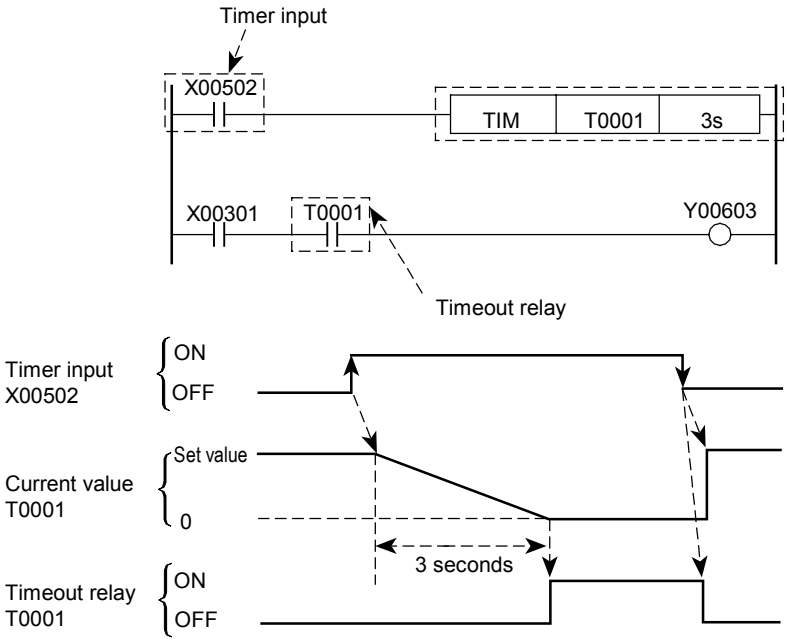
■ Special Relay (M), Special Register (Z)

A special relay or register has a specific function such as indicating an internal state of the CPU or error information. For more information, refer to 8 ”Appendix”.

■ Timer (1 ms, 10 ms, 100 ms timers)

Each timer is a countdown type which starts counting at the rising edge of a timer input and times out when the current value reaches 0. When the timer times out, its timeout relay is set to ON.

The timer is reset at the falling edge of the timer input and the current value returns to the set value.

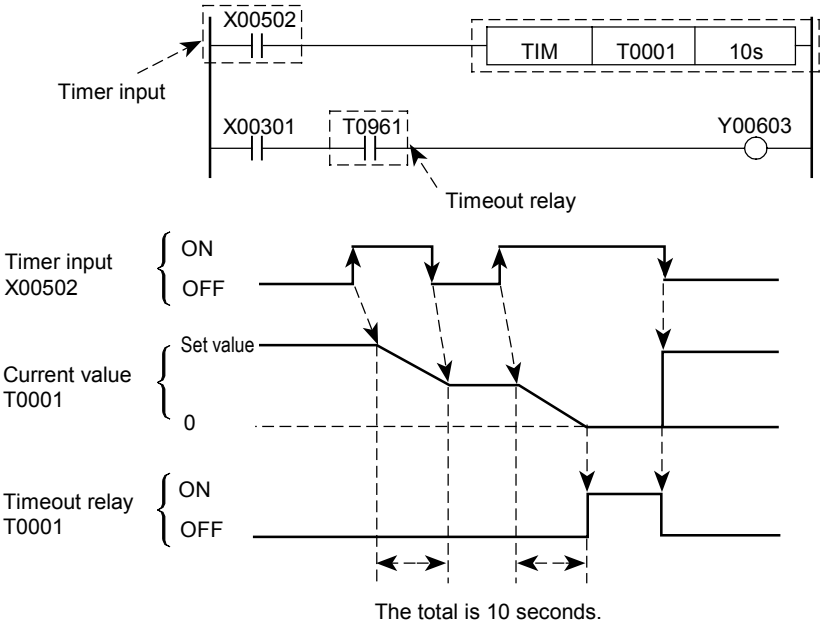


■ 100 μs Timer (T)

100 μs timers can be used in F3SP28, F3SP38, F3SP53, F3SP58 and F3SP59 sequence CPUs (Up to 16 points can be defined)

■ Continuous Timer (100 ms timer)

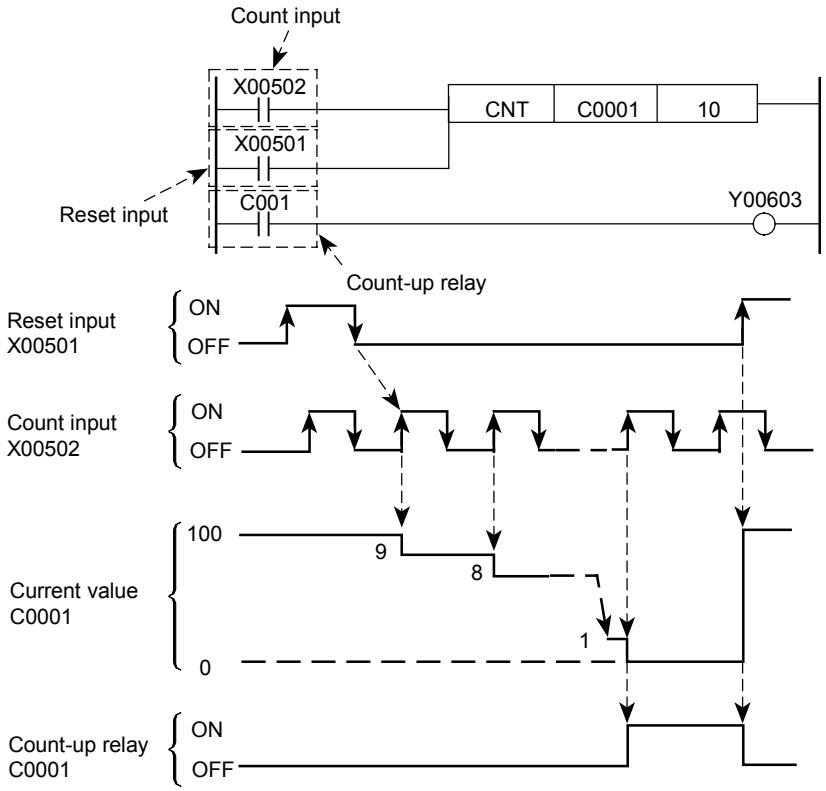
A 100-ms continuous type is a countdown type, which maintains its current value and timeout relay state even when the input condition is set to OFF. When the input condition is set to ON again, the timer starts counting from the maintained values. When the input condition is set to OFF after the continuous timer times out, the timer is reset, the current value returns to the set value, and the timeout relay is set to OFF.



■ Counter (C)

A decrement counter detects the rising edge of the counter input when the Counter instruction is executed and updates the current value. When the current value reaches 0, count up is said to occur. At this time, the Count-Up relay of the counter turns on.

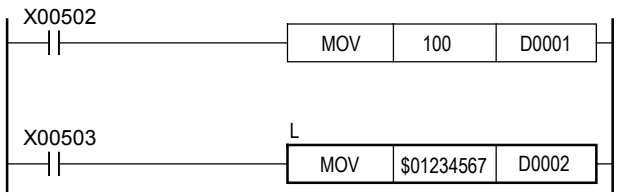
When the reset input is on, the counter does not accept count input.



■ Data Register (D)

Data registers are memory which store computation results of the program, and one point consists of 16-bits. Data can be read/written on 16-bit on 32-bit basis using application instructions.

When you use the data registers on a 32-bit basis, lower 16-bit data is stored in a data register having a data register number you specified, and upper 16-bit data is stored in a data register having the data register number you specified plus 1.

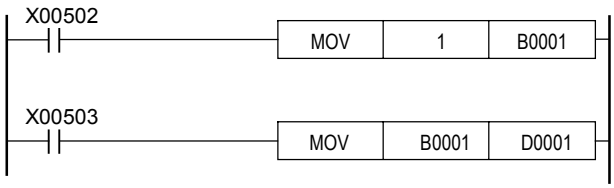


Note: When upper data of BCD code is $0123 and lower data is $4567, the lower data is stored in D0002 and the upper data in D0003.

■ File Register (B)

One point of file registers consists of 16 bits.

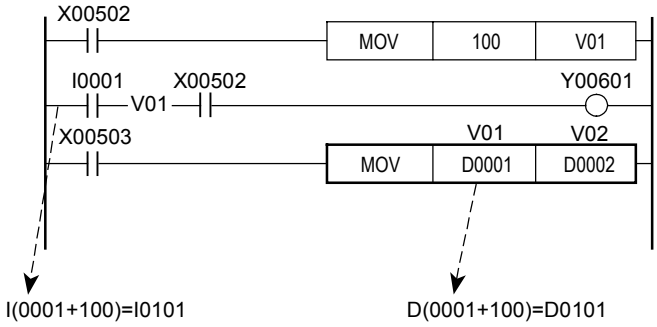
As in data registers, data can be read/written on a 16-bit or 32-bit basis using application instructions.



■ Index Register (V)

Index registers are used for performing index modification for devices.

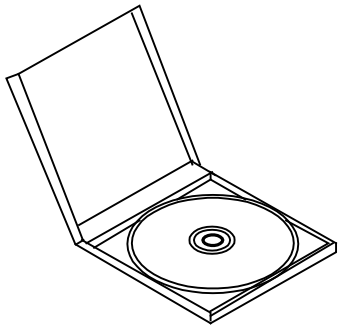
The value of an index register is added to the device number specified by the instruction.



2. Installing FA-M3 Programming Tool WideField2 (SF620-ECW)

2.1 Overview of WideField2

The SF620-ECW FA-M3 Programming Tool WideField2 for the FA-M3 sequence CPU modules allows a user to create and debug programs, as well as manage applications. Its enhanced program reuse feature, coupled with functions for debugging various advanced function modules of FA-M3 dramatically increases efficiency of program and application development.



Features

Operation

- Screen display and other settings can be restored, removing the need to re-configure after startup.
- All tag name definition data can be edited in a single window.
- Menus support shortcut keys.
- All instructions and line connections can be entered using the keyboard or function keys.
- A user can search an entire project and then jump from the search results window directly to the appropriate location in a program edit or monitor window.
- Circuits can be copied and pasted between programs.
- Address and I/O comments can be entered concurrently with instruction parameters.
- I/O comments can be searched when editing tag name definitions. Search and replacement functions permit the use of the wildcard character.

Program Reuse

- Supports modular programming using function blocks.
- Frequently used circuits can be registered as macros and shared with other developers in a library.
- Macros can be used as input conditions.
- Local devices can be used in blocks and component macros. Blocks coded using local devices can be reused in other projects without modifications.
- Structure data format is supported. Structure data can also be used to interface with macros and be used in arrays.
- Both index modification by constant or indirect designation are supported.
- Supports program design by tag names. Programs can be created before terminals are allocated. Up to 70,000 tag names and I/O comments in multiple blocks and component macros can be collectively managed.
- Individual blocks can be configured to refer to block tag name definitions, instead of common tag name definitions.
- All tag names used in circuits can be collectively read; all tag names not used in circuits can be collectively deleted.
- Changes in installed positions of I/O modules can be implemented over all blocks of a project with a single operation.
- Projects can be saved with a new name.
- WideField2 is downward compatible with WideField (SF610).
- Programs in CADM3 (SF510) format can be opened.

Data Exchange with Other Applications

- Circuits can be pasted to other applications.
- Tag names and I/O comments can be copied and pasted between Microsoft Excel and WideField2.
- Results of sampling trace can be generated in Microsoft Excel format for conversion to graphs.
- Device data edited in WideField2 can be exported in Microsoft Excel format.

Operating Environment

Item	Specification
PC	PC/AT Compatible
OS	Microsoft Windows 2000 Microsoft Windows NT Workstation 4.0, Service Pack 3 and above Microsoft Windows Me Microsoft Windows 98 Microsoft Windows 95 OSR2 Microsoft Windows XP
Required Software	Internet Explorer 4, SP2 and above
Media	CD-ROM
CPU	Pentium133MHz min. (when using RS-232-C communications with Ethernet)
Memory	32 MB min. (when using RS-232-C communications with Ethernet)
Hard Disk Capacity	200MB min.
Display	800×600 dots or higher resolution
Communications	RS-232-C, Ethernet
Printer	A printer that supports A4 size paper and the above operating systems.
Japanese FEP	MS-IME and others
CPU Module	F3SP05-0P, F3SP08-0P, F3SP21-0N, F3SP25-2N, F3SP35-5N, F3SP28-3N, F3SP38-6N, F3SP53-4H, F3SP58-6H, F3SP28-3S, F3SP38-6S, F3SP53-4S, F3SP58-6S, F3SP59-7S, F3SPV3-4H, F3SPV8-6H, F3FP36-3N

Model and Suffix Codes

Model	Suffix Code	Style Code	Option Code	Description
SF620	.....	.....	.....	FA-M3 Programming Tool WideField2
	-ECW			English version

Visibility

- The project window gives a clear view of the program structure and allows any block to be directly opened from the window.
- The Index View can be configured to display only the required circuits. Displaying only circuit comments provides an overall view of the program flow. Circuits can also be printed in index view.
- Up to 16 characters are allowed for tag names. Supports switching between tag name and address display.
- Circuits can be enlarged or reduced in the display.
- Font sizes and colors of circuits, window background, devices and comments are user-definable.
- Global devices and local devices can be identified with different colors.
- Undefined tag name definitions and local devices can be distinguished using colored parameters.
- Errors in tag name definitions are highlighted in the display.
- The TIP help function can be used to view the I/O comment and address allocated to a tag name in a circuit.
- Syntax checking performs checking of detailed program data.

Debugging and Maintenance

- Supports CPU access via Ethernet.
  Operation status of the system can be managed in user logs.
- Various types of comments and tag name definitions can be stored in the CPU. *1
- Supports downloading and uploading of selected blocks and macros. *1
- Register values of advanced function modules can be monitored and modified.
- Devices can be registered for monitoring, up to 256 devices for each project.
- Multiple users can concurrently online-edit and debug programs on the same CPU from different personal computers.
- A user can connect to a sequence CPU using electronic mails and perform remote OME (Operation, Maintenance & Engineering) via the Internet. *2

*1: Only supported on the F3SP□□-□S CPU module.

*2: Remote OME (Remote Operation Maintenance & Engineering) is the generic name of a mechanism for remote maintenance of equipment proposed by Yokogawa and is a registered trademark of Yokogawa Electric Corporation.

Program Management

- Project edit history displays recently used files and allow a project to be started.
- A rich set of program management functions are provided to compress and save a project, split and save a project in multiple files, and restore a compressed project.
- An edited project can be saved with a different name.

Help

- Context-sensitive help can be easily retrieved.
- Provides information on the use and operation of instructions.
- Provides function overviews, with usage information.
- Provides possible causes of errors and troubleshooting tips.
- Keywords facilitate high-speed searches.
- Instructions are selectable from an instruction list.

Cable for PC Connection

A cable is required to connect a personal computer to the programming tool connector (labeled “PROGRAMMER”) on the FA-M3 CPU module.

Model and Name:
KM-11-2T, -3T, -4T Programming Tool Cable
(for PC/AT-compatible computer)

*: For details on cables used for connecting personal computers, see GS34M6C91-01E.

Menu Configuration

FA-M3 Programming Tool
WideField2

- File
  - New Project
  - Open Project
  - Close Project
  - Save Project
  - Save Project As
  - Downgrade and Save Project
  - Compress and Save Project
  - Restore Compressed Segmented Project
  - New
  - Open
  - Close
  - Save
  - Save As
  - Print Setup
  - Print
  - Open CADM3 Executable Program
  - Open CADM3 File
  - Recent Opened Projects
  - Exit
- Edit
  - Undo
  - Convert
  - Cut
  - Copy
  - Paste
  - Delete
  - Image Copy
  - Insert Line
  - Delete Lines
  - Temporary Delete
  - Undo Temporary Delete
  - Ladder Symbol
  - Page Break
  - Hide Circuits
  - Show Circuits
  - Block Tag Name Definitions
  - Local Device/Properties
- Search
  - Search
  - Search Instruction
  - Find Next
  - Jump
  - Replace
  - Device Usage Status
- View
  - Toolbars
  - Instruction Palette
  - Status Bar
  - Function Keys
  - Project Window
  - Action Monitor
  - Display I/O Comment
  - Display Instruction Number
  - Display Address
  - Redraw
  - Zoom
  - Detail
  - Display Format
  - Suspend Monitor
- Project
  - Define Program Components
  - Change CPU Type/Properties
  - Configuration
  - User Log Message
  - Common Tag Name Definition
  - Check Program
  - Find Project
  - Find Instruction in Project
  - Replace in Project
  - Change I/O Installation Position
  - Project Device Usage Status
  - Insert File
  - Rename File
  - Delete File
  - Register Macros
  - Get Macros
  - Convert Data
- Online
  - Connect
  - Disconnect
  - Program Monitor
  - Macro Monitor
  - Device Monitor
  - Registry Monitor
  - Configuration
  - CPU Program Information
  - Common Tag Name Definition
  - Operating Mode
  - Download
  - Upload
  - Compare File and CPU
  - ROM Management
  - Extended Functions
- Debug/Maintenance
  - Forced Set
  - Forced Reset
  - Cancel Forced Set/Reset
  - Cancel All Forced Set/Reset
  - Change Word Data
  - Change Long Word Data
  - Change Current Value of Timer/
  - Change Preset Value of Timer/C
  - Start Online Editing
  - Start Block
  - Stop Block
  - Stop refreshing
  - Restart refreshing
  - Display alarm
  - Cancel alarm
  - Display System Log
  - Display User Log
  - Clear Log
- Tools
  - Setup Environment
  - Mail
  - Setup I/O Module
  - Device Manager
  - Sampling Trace
- Window
  - Cascade
  - Tile
  - Arrange Icons
- Help
  - WideField2 help
  - Contents and Index
  - About WideField2

*: Underlined functions are new functions added in WideField2.

2.2 Installing and Starting WideField2

This section describes how to install the WideField2 software, how to remove it from the PC when it is no longer required, as well as how to start the WideField2 software.

CAUTION

In the Windows NT and Windows 2000 environment, always log in as the system administrator before installing, maintaining or removing the WideField2 software. Users without administrator access rights are not allowed to install, maintain or remove the WideField2 software.

CAUTION

When setting up WideField2 in the Windows 2000 environment, we recommend that you install WideField2 into a folder which restricted users have the right to access. If WideField2 is installed in a folder which restricted users do not have the right to access, restricted users will not be able to use the WideField2 software.

2.2.1 Setting up WideField2

This section describes how to install and set up the WideField2 software on a personal computer.

TIP

We describe here WideField2 setup on the Windows NT environment. Take note that there may be some differences in the procedure on different operating systems.

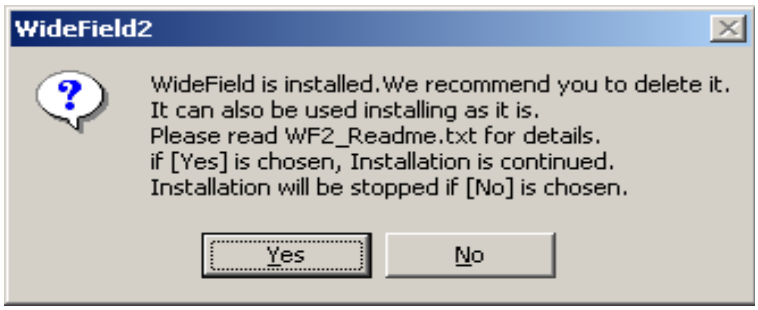
CAUTION

Exit from all other applications such as a virus checking program and IME before installing the software.

■ Procedure

1. Insert the product CD-ROM into the CD-ROM drive.
2. Move to the root folder on the CD-ROM using the Explorer or other means.
3. Select SETUP.EXE from the listed files.

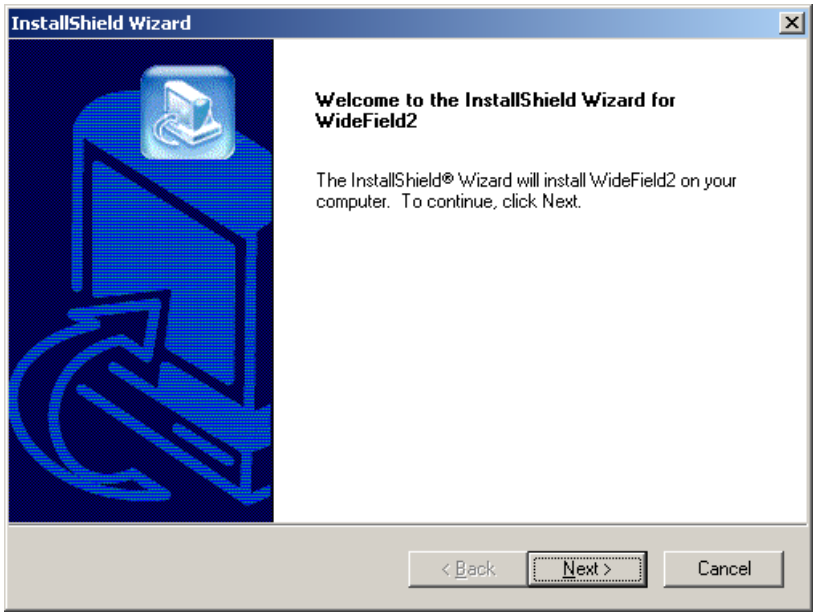
   The WideField2 InstallShield Wizard runs and opens the “Welcome to the InstallShield Wizard for WideField2” dialog box.



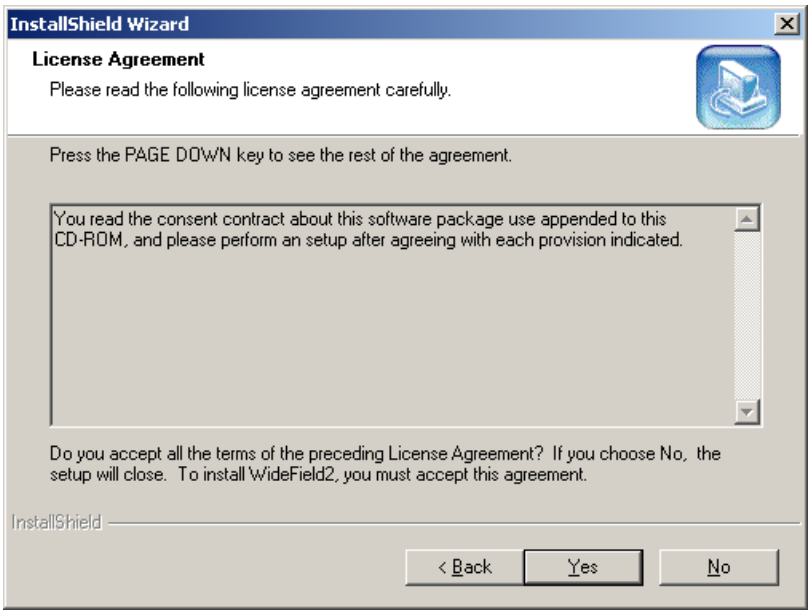
TIP

If the older version WideField (SF610) is already installed on the system, a confirmation dialog is displayed on the screen. Click the Yes button to continue with installation.

4. Click [Next].
   The License Agreement dialog box opens.



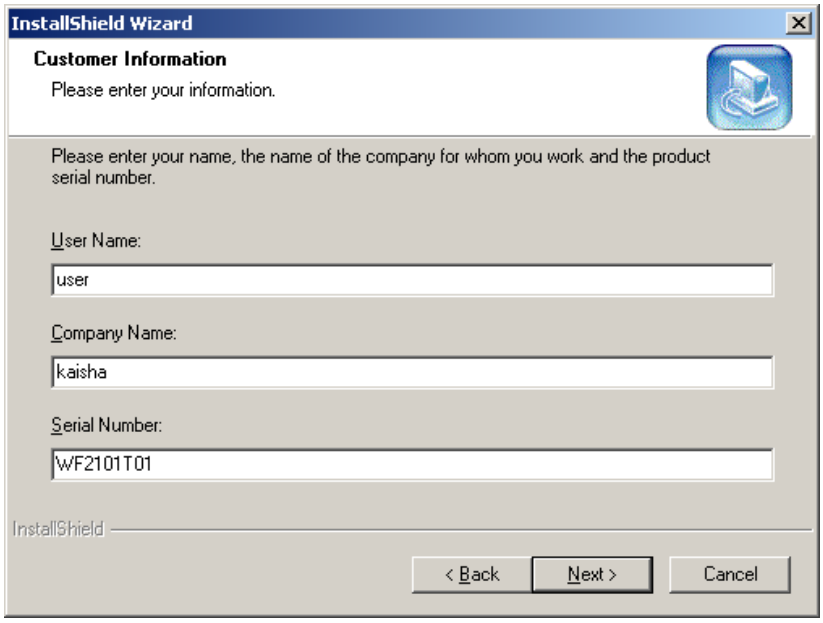
5. Click [Yes].
   The Customer Information dialog box will be displayed.



TIP

The license agreement document is also provided with the product. Click [Yes] only if you have completely read the license agreement and agree with the terms therein. Clicking [No] exits the installation.

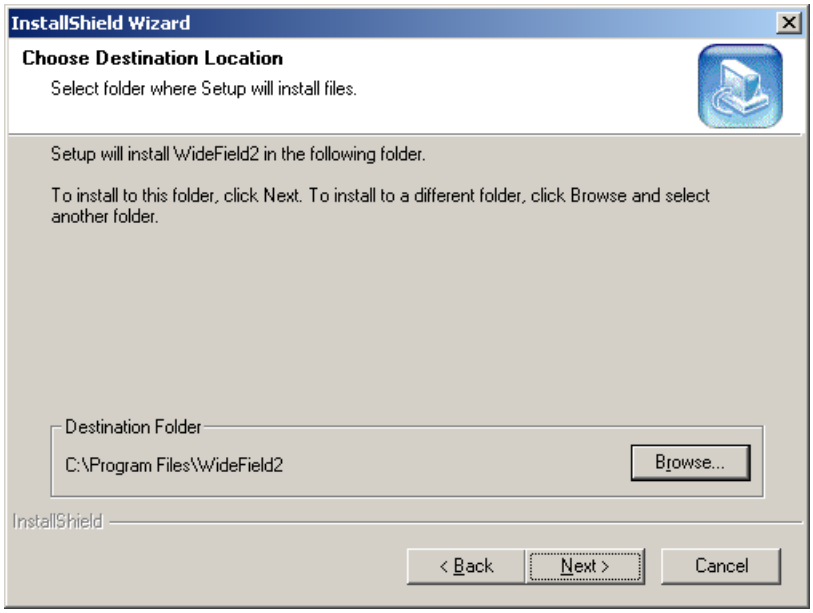
6. Enter the Serial Number and click [Next].
   The Choose Destination Location dialog box is displayed.



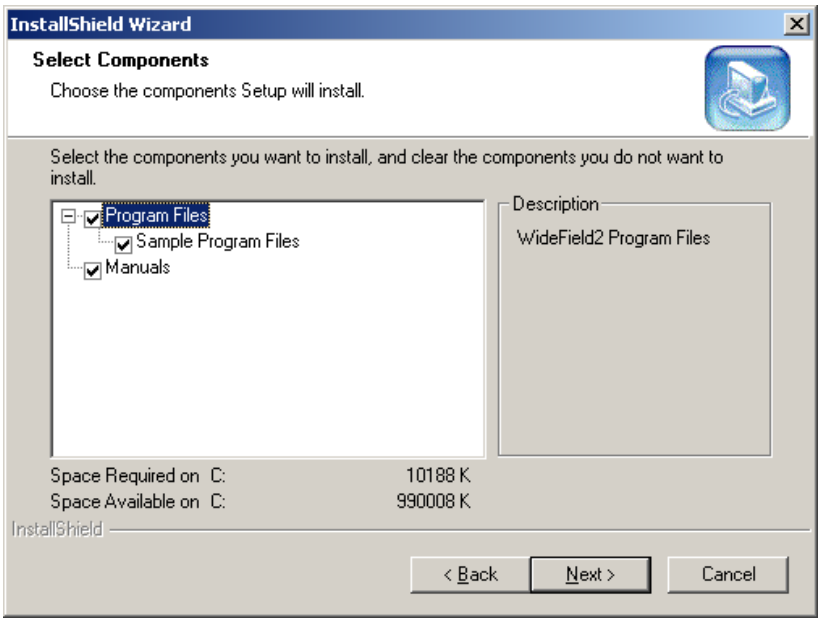
TIP

The Serial Number is given on the registration card provided with the product.

7. Select the installation destination and click [Next].
   The Select Components dialog box is displayed.



8. Select the components you wish to install and click [Next].
   Installation begins.



TIP

- The components available for installation include the WideField2 program files, the sample program files and the instruction manuals. Turn on the checkboxes for the components you wish to install.
- Restart the computer after installation ends.

■ Changing Folder Security

Windows 2000 allows access rights to be defined for folders. WideField2 can be installed only in a folder which restricted users have the right to access.

You can also change the access right for an installation folder during the installation.

If you specify a folder for which restricted users do not have access right as the installation destination folder, the following message will be displayed.

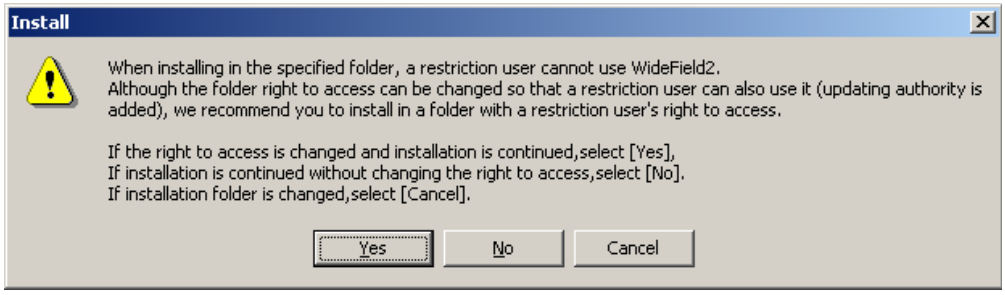


Figure Changing Access Rights

- Yes button

  Adds to folder security the right for restricted users to access the folder, and allows restricted users to continue with installation.

- No button

  Continues installation without changing folder security.

  In this case, restricted users will not be able to run the WideField2 software.

- Cancel button

  Returns to an earlier screen to specify the installation destination folder.

CAUTION

WideField2 frequently accesses system files of the folder where it is installed. Therefore, if restricted users are not granted the change permission for the installation folder, they cannot use the WideField2 software.

We do not guarantee that the operating system or other applications will operate correctly if folder security is changed.

2.2.2 Removing WideField2

This section describes how to remove the WideField2 software

TIP

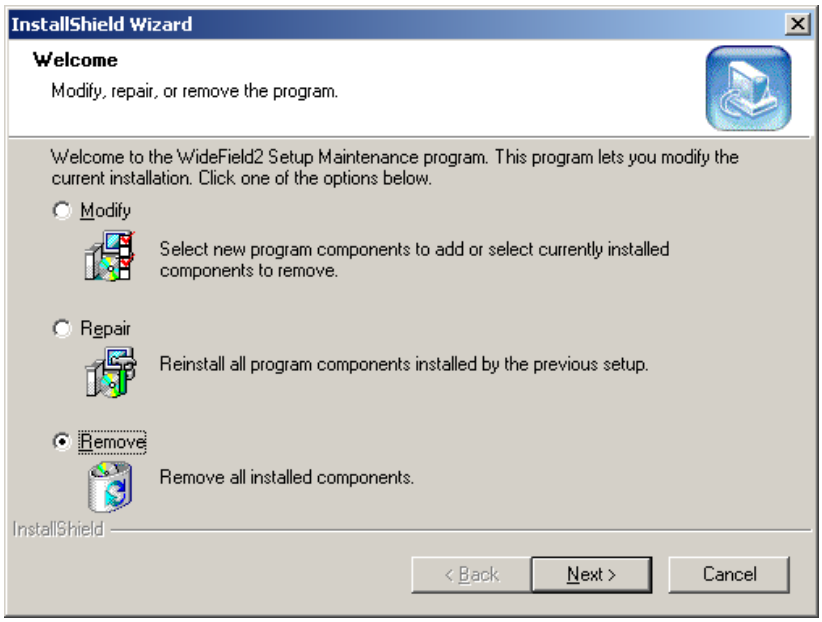
Removing the WideField2 software does not automatically delete project files or other application files created by the user.

■ Procedure

1. Insert the product CD-ROM into the CD-ROM drive.
2. Move to the root folder on the CD-ROM using the Explorer or other means.
3. Select SETUP.EXE from the files listed.

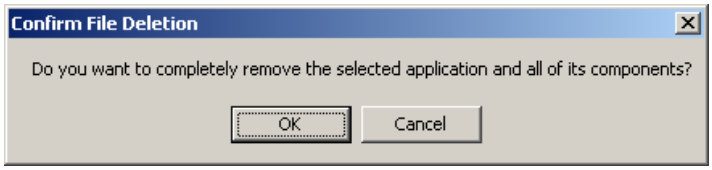
   The InstallShield wizard runs and displays the “Welcome to the InstallShield Wizard for WideField2” dialog box.
4. Turn on the [Remove] option button and click [Next].

   The Confirm File Deletion dialog box will be displayed.

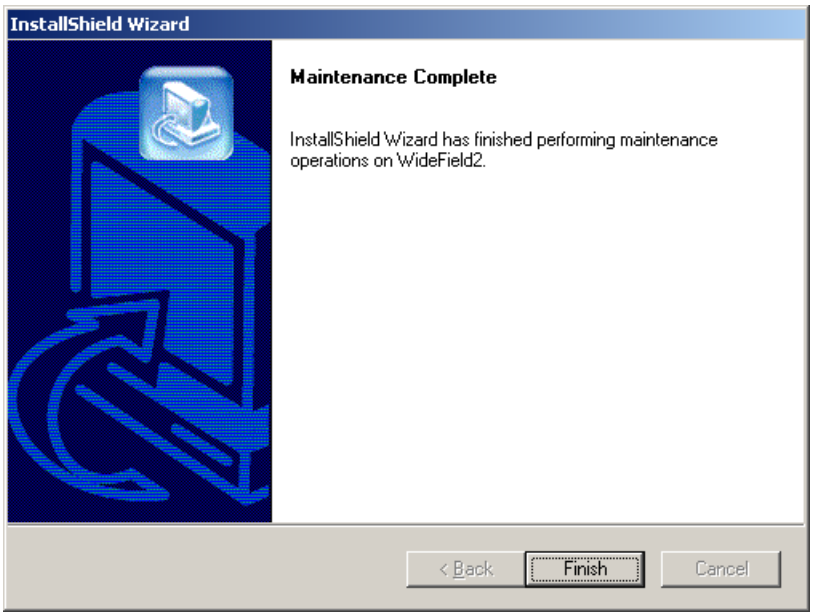


5. Click [OK].

   File deletion begins. The Maintenance Complete dialog box will be displayed when the program has been removed.



6. Click [Finish].

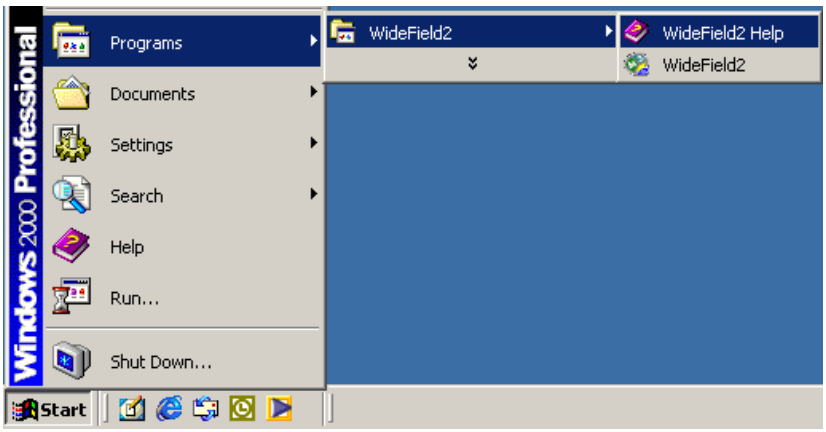


2.2.3 Starting WideField2

This section describes how to start the WideField2 software.

■ Procedure

1. Select [Programs]—[WideField2]— [WideField2] from the Start menu.
   WideField2 runs.



CAUTION

Do not run the WideField2 software and the WideField (SF610) software concurrently.

3. Basic Operation of FA-M3 Programming Tool WideField2

3.1 Screen Layout

This section describes the layout of a WideField2 screen.

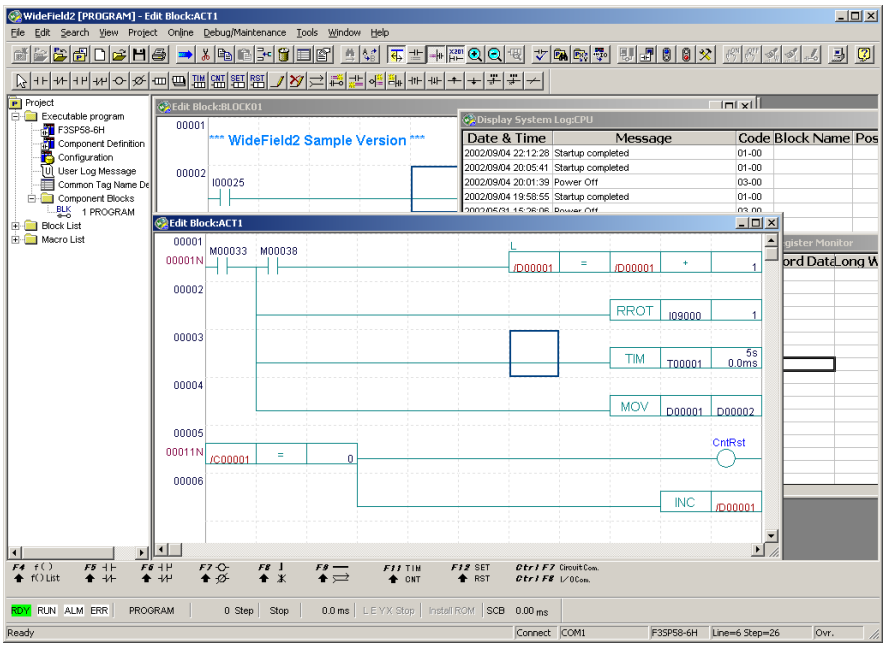


Figure Screen Layout

■ Title Bar

The title bar displays the name of the open project, the name of the active window and the name of the file being edited.

Figure Layout of Title Bar

■ Menu Bar

The menu bar displays names of menus which are available in WideField2. You can select a menu from the menu bar. The menus displayed in the menu bar are dependant on the function that is currently active e.g. online or tag name definition function.

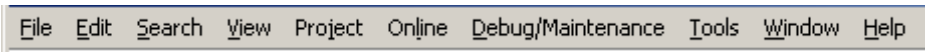


Figure Layout of Menu Bar

■ Toolbar

The toolbar displays icons of the most frequently used menus from the menu bar. You can select a menu from the menu bar or the toolbar.

To register a menu to the toolbar, use the Setup Environment dialog box.

To switch between showing and hiding the tool bar, use [View]-[Tool Bar].

Figure Layout of Toolbar

■ Instruction Palette

The instruction palette displays icons for instructions and comments. You can create a circuit by selecting instructions from the instruction palette.

To switch between showing and hiding the instruction palette, use [View]–[Instruction Palette].

Figure Layout of Instruction Palette

■ Function Keys

The function key area displays instruction and comment icons on a ladder program edit window. The same area displays debug functions on a monitor window. In addition to the menu bar and instruction menu, function keys provide another way to select instructions and menus.

To switch between showing and hiding the function keys, use [View]-[Function Keys].

Figure Layout of Function Keys

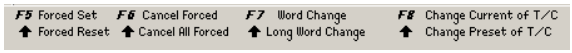


Figure Layout of Debug Function Keys

■ Status Bar

The status bar displays various status information of the WideField2 software.

To switch between showing or hiding the status bar, use [View]-[Status Bar].

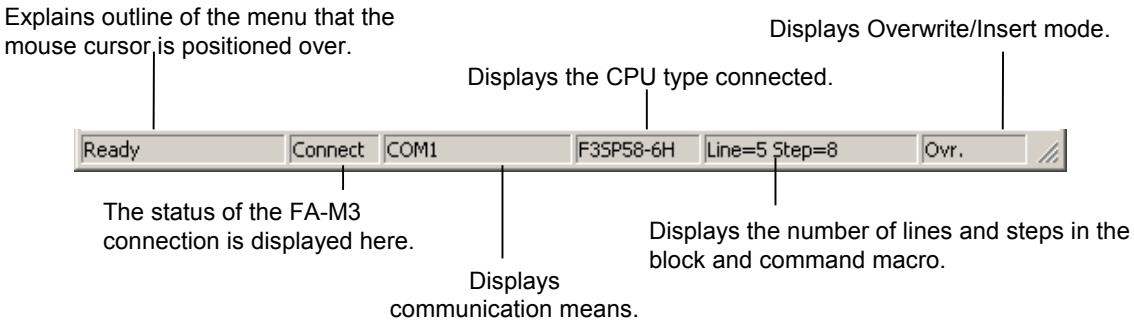


Figure Layout of Status Bar

■ Project Window

The Project window displays the components of an open project.

It displays the components of the executable program and lists blocks and instruction macros within a project.

To switch between showing or hiding the Project window, use [View]-[Project Window].

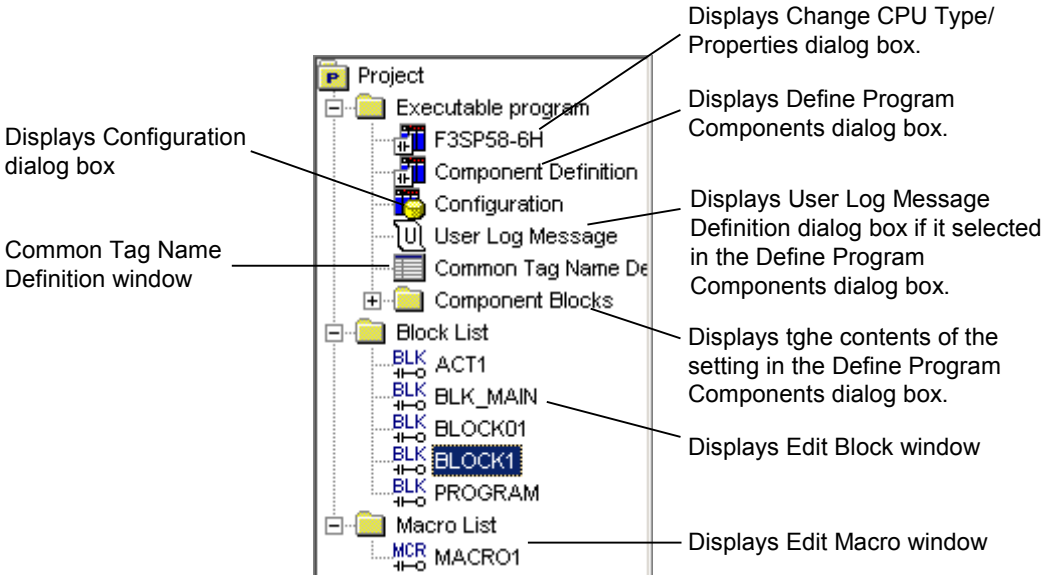


Figure Layout of Project Window

You can call up various windows directly from the project window.

● Change CPU Type/Properties dialog box

To invoke this window, double-click the icon for a CPU Type (e.g. F3SP58-6H) in the project window.

● Define Program Components dialog box

To invoke this window, double-click [Component Definition] in the project window.

● Configuration dialog box

If [Configuration] on the Define Program Components dialog box has been previously set to [Setup], [Configuration] will be displayed in the project window.

Double-clicking [Configuration] invokes the Configuration dialog box.

● User Log Message Definition dialog box

If [User Log Message] on the Define Program Components dialog box has been previously set to [Yes], [User Log Message] will be displayed in the project window.

Double-clicking [User Log Message] invokes the User Log Message Definition dialog box.

● Common Tag Name Definition window

To invoke this window, double-click [Common Tag Name Definition] in the project window.

● Edit Block window

To invoke this window, double-click the name of a block under [Block Components] or [Block List] in the project window.

● Edit Macro window

To invoke this window, double-click the name of a macro under [Macro List] in the project window.

3.2 List of Files

This section describes the various generated files.

■ Generated Files

CAUTION

User program files in WideField2 are managed as version 4 files in WideField series.

Table Specifications of Generated Files

Generated File	Icon	Extension	Item	Specifications
Project file		.YPJT	File name	Up to 8 alphanumeric characters, beginning with a letter. May also contain special characters '-' (hyphen) and '_' (underscore).
			Project title	Up to 32 alphanumeric characters and special characters
Executable program file		.YPRG	File name	Only one program file having the same name as the project can be created within a project.
			Number of component blocks	Up to 1024 blocks (Limit depends on CPU type)
			Configuration Settings	0 or 1 (setup is optional)
			User log message settings	0 or 1 (setup is optional)
		.YMPR	File name	Up to 254 alphanumeric characters and special characters. The characters must be within Windows specifications range. (file for electronic mail)
Configuration file		.YC□□	File name	Only one file having the same name as the project can be created within a project.
User log message file		.YUMS	File name	Only one file having the same name as the project can be created within a project.
			Number of message characters	Up to 32 alphanumeric characters and special characters
			Number of messages	Up to 64 messages
Common tag name definition file		.YCMN	File name	Only one file with the same name as the project can be created within a project.
			Number of registered items	Up to 70,000
Block file	BLK	.YBLK	File name	Up to 8 alphanumeric characters beginning with two letters May also contain special characters '-' (hyphen) and '_' (underscore).
			Number of steps	Up to 56K steps for models SP28-3S/38-6S/53-4S/58-6S/59-7S Up to 10K steps for models other than the above
			Number of lines	Up to 20,000 lines
Block tag name definition file		.YSIG	File name	Can be created with the same name as the block.
			Number of registered items	Up to 5,120
Instruction macro file	MCR	.YMCR	File name	Up to 8 alphanumeric characters beginning with 2 letters. May also contain special characters '-' (hyphen) and '_' (underscore).
			Number of steps	Up to 10K steps
			Number of lines	Up to 20,000 lines
Macro tag name definition file		.YMCS	File name	Can be created with the same name as the macro.
			Number of registered items	Up to 5,120
Group template file		.YGRP	File name	Up to 8 alphanumeric characters beginning with a letter. May also contain special characters '-' (hyphen) and '_' (underscore).
			Number of registered items	Up to 64

Generated File	Icon	Extension	Item	Specifications
Structure Type Definition File		.YGRS	File Name	Up to 8 alphanumeric characters beginning with a letter. String may also include special characters '-' (hyphen) and '_' (underscore).
System Log File		.YSLG	File Name e	Up to 8 alphanumeric characters beginning with a letter. String may also include special characters '-' (hyphen) and '_' (underscore).
User Log File		.YULG	File Name	Up to 8 alphanumeric characters beginning with a letter. String may also include special characters '-' (hyphen) and '_' (underscore).
Sampling Trace Setup File		.YTST	File Name	Up to 254 characters (The characters must be within Windows specifications range.)
Sampling Trace Results File		.YTRC	File Name	Up to 254 characters (The characters must be within Windows specifications range.)
Device Management File		.YDVF	File Name	Up to 254 characters (The characters must be within Windows specifications range.)
		.YMDV	File Name	Up to 254 characters (The characters must be within Windows specifications range.) (File for electronic mails)
FA Link Setup File		.FAI	File Name	Up to 8 alphanumeric characters, beginning with a letter

3.3 Elements of Edit Circuits

This section describes the elements of an edit circuit.

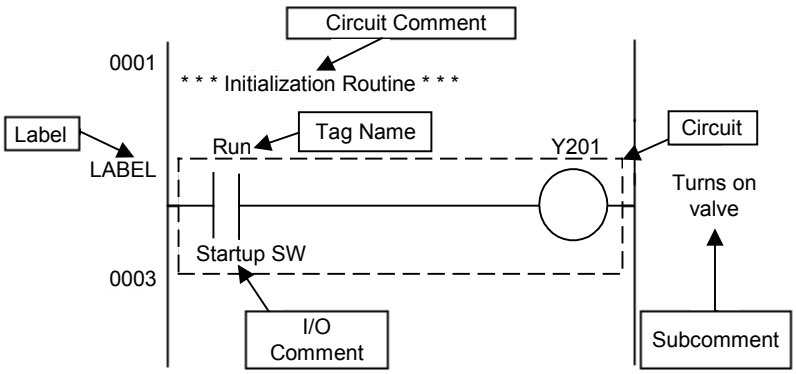


Figure Elements of Edit Circuit

Table Specifications of Circuit Elements

Element	Item	Specifications
Tag Name	Number of Characters	Up to 16 alphanumeric characters, beginning with two letters. String may also contain special characters '-' (hyphen), '_' (underscore) and '.' (period). A period character can be used as a separator between a structure name and a structure member name. However, strings that are not distinguishable from device names are not allowed.
	Number of registered items	For block tag name reference, 5120 max. For common tag name reference, 70,000 max.
Structure	Structure name	2 to 7 alphanumeric characters, beginning with a letter. String may also contain special characters '-' (hyphens) and '_' (underscore). However, strings that are not distinguishable from device names are not allowed.
	Structure member name	1 to 8 alphanumeric characters.
	Separator	Period
Circuit	Number of lines in 1 Circuit	Up to 25 lines.
	Number of Instructions in 1 Circuit	Up to 128 instructions.
	Continuation lines	Up to 3 continuation lines per line.
	Number of columns	11 columns fixed
Circuit Comment	Number of characters	Up to 72 characters.
	Number of registered items	For model, F3SP□□-□S, no restriction. For other CPU types, 3000 max. (including subcomments).
Subcomment	Number of characters	Up to 24 characters.
	Number of registered items	For model, F3SP□□-□S, no restriction. For other CPU types, 3000 max. (including subcomments).
I/O Comment	Number of characters	Up to 32 characters.
	Number of registered items	For block tag name definition reference, 5,120 max. For common tag name definition reference, 70,000 max.
Title	Number of characters	Up to 24 characters, including letters, numbers and special characters
Label	Number of characters	Alphanumeric string beginning with a letter. Special characters '-' (hyphen) and '_' (underscore).
	Number of registered items	There is a maximum limit over the entire executable program, which is dependant on the CPU type.

4. Creating a Ladder Program

In this chapter, you will practice how to operate the WideField programming tool and how to create a ladder program.

4.1 Creating a New Project

When you create a new project, a folder with the same name as the project is automatically created and the following files are generated in the folder.

The generated files have the same name as the project with different extensions as follows:

- Project file (.YPJT)
- Executable program file (.YPRG)
- Configuration file (.YC□□ where □□ is the numeric digit portions of the CPU model)
- User log message file (.YUMS)
- Common tag name definition file (.YCMN)

1. Select [File]–[New Project] from the menu bar.
2. In the screen displayed, enter the following:
   - Project name : TEST1
   - CPU type : Select the type of the CPU module actually installed.
   - Project Title : TEST
3. Click the [New] button.

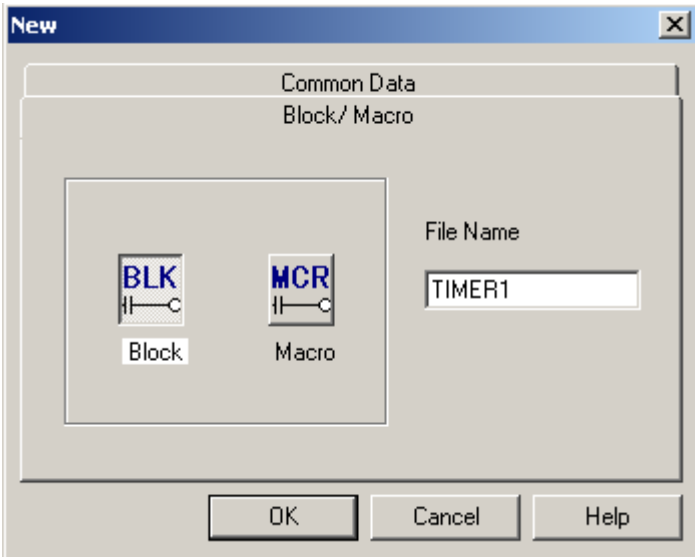
TIP

The CPU type and the project title can be changed by selecting [Project]–[Change CPU Type/Properties], or by double-clicking [CPU Type] displayed in the project window.

4.2 Creating a New Block File

Block files store blocks of a ladder diagram. An FA-M3 executable program consists of multiple block files.

1. First, select [File]–[Open Project].
2. Double-click the TEST1 folder on the display screen.
3. Click the “TEST1.YPJT” project file and select the Open button.
4. Select [File]–[New].
5. On the New screen, select block, enter “TIMER1” in the file name field and click the [OK] button.



TIP

A macro is a sequence of instructions that are defined as one user-defined single instruction.
By assigning a name to a macro, the set of instructions can be executed just like other instructions.
Macros are not included in this training session.

6. The Local Device/Properties screen will be displayed. Click the [x] button to close the screen.

   For details on local devices, see Chapter 5.

4.3 Setting up Communication

You can set the method of communication with the FA-M3.
The settings are reflected as soon as you connect to the FA-M3.

■ Procedure for Setting Up Communication

1. Select [Tool]–[Setup Environment], and click the [Setup Communication] tab.
   The following screen will be displayed.
   Select the communication media from [RS-232C], [RS-232C via modem], and [Ethernet]. The initial setting is RS-232C.

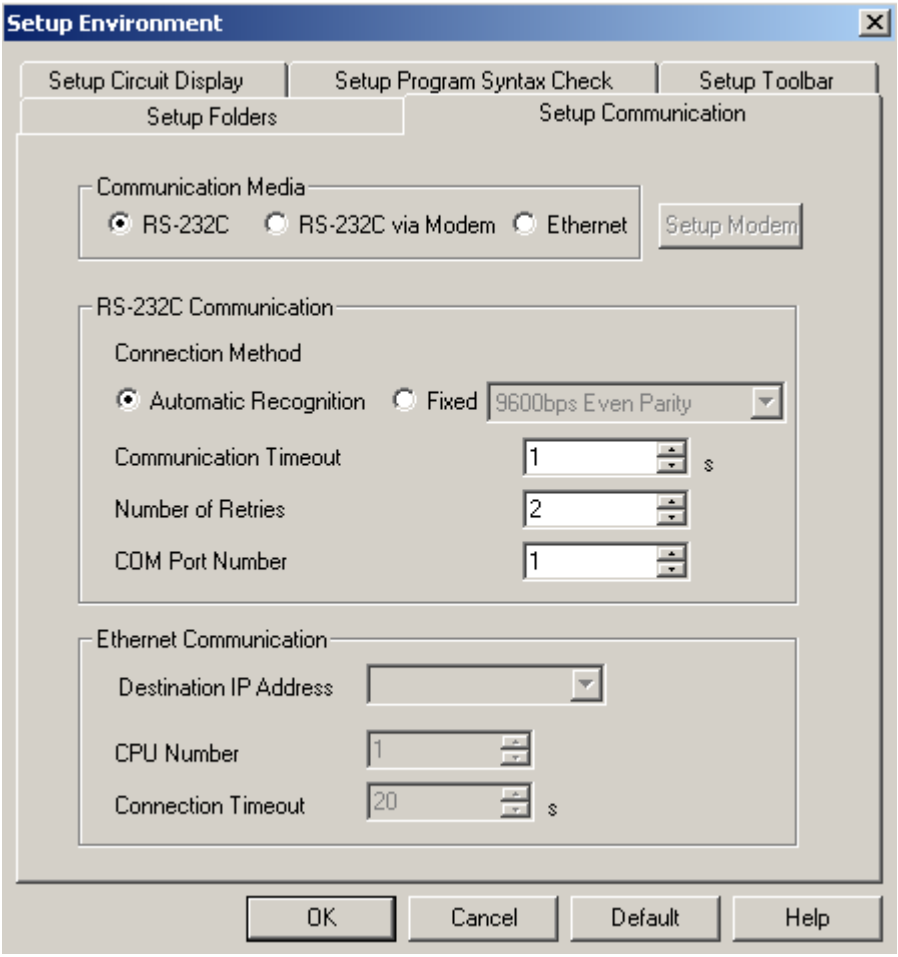


Figure Setting up Communication

2. Make the following settings for an RS-232C communication.
   - Setting the Connection Method
     Select either auto-detect (adjusting to the CPU communication mode), or fixed mode for your PC's communication setting.
     If fixed mode is selected, select the communication mode from the list box. (Use this when you know your CPU's communication mode.)
     If auto-detect is selected, it will take some time to connect to the FA-M3. The initial setting is for auto-detect. (You will not need to change any settings if RS-232C via modem is used.)
   - Setting the Communication Timeout, etc.
     Set the timeout for ENQ-ACK communication, the number of retries, and the COM port number.
     The initial settings are 1 second timeout, 2 retries, and COM port number 1. Normally, you will not have to make any changes. (When an RS-232C via modem is used, set only the timeout for ENQ-ACK communication and the number of retries.)
3. Perform the following setting for an Ethernet connection.
   - Setting for the remote computer
     Set the computer you will be communicating with. You can set either the host name or IP address. Up to 16 IP addresses are saved in the memory, so you can choose an IP address that you have set in the past from the list box. The CPU number is set with the spin button. (1-4)
   - Connection Timeout
     Set the timeout when connecting to another computer.
     The initial setting is 20 seconds.
4. When connecting with an RS-232C via modem, click on [Setup Modem] and set the telephone number of the connection. (Enter only numbers.)

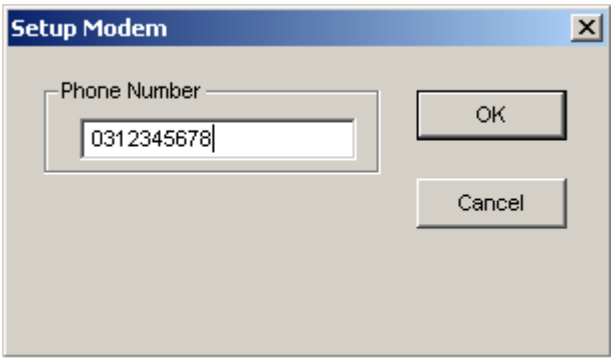


Figure Setting the Telephone Number for the Modem (This example is for the number 03-1234-5678)

CAUTION

Adjust the modem setting for communication speed, etc., from Windows control panel.

To perform setting, select [Control Panel]–[Modem]. See your Windows manual, Windows Help, your modem's instruction manual, etc. for details.

4.4 Entering and Editing Instructions

Display the Edit Block screen and select to show the following 6 items using the View pull-down menu.

- Toolbar
- Instruction Palette
- Status Bar
- Function Keys
- Action Monitor
- Project Window

4.4.1 Entering Instructions

There are 3 ways to enter instructions:

1. Using the mouse
   Select the instruction from the instruction palette using the mouse, click on the desired input location and then enter the parameter(s) in the parameter field(s).
2. Using function keys
   Move the cursor to the desired input location, select the function key for the required instruction and enter the parameters.
3. Using the alphabet keys
   Move the cursor to the desired input location, enter the instruction mnemonic and then enter the parameters, separated with a space.

TIP

To display the Instruction List screen, you can click the Instruction List icon or press the [Shift]+[F4] keys. You can then select the instruction word from the instruction list displayed.

4.4.2 Entering and Deleting Connection Lines

1. Using the mouse
   - Drawing a connection line
     Click the connection line icon and drag the connection line cursor (cross cursor) from the starting position of the connection line to the ending position. To return the cross cursor to the normal cursor, right-click the mouse or press [ESC].
   - Deleting a connection line
     Click the delete connection line icon and drag the delete connection line cursor from the starting position of the connection line you wish to delete to the ending position.
2. Using function keys
   - Entering a vertical connection line
     Press the vertical connection line function key [F8], move the vertical line cursor to the input position using the arrow keys and press [ENTER].
     To release the vertical line cursor, press [ESC].
   - Deleting a vertical connection line
     Press the delete vertical connection line function keys [Shift]+[F8], specify the deletion position using the delete vertical line cursor and press [ENTER].
   - Entering a horizontal connection line
     Press the horizontal connection line function key [F9] and enter a horizontal connection line at the cursor.
   - Deleting a horizontal connection line
     Move the position cursor to the horizontal line you wish to delete and press the [Delete] key.

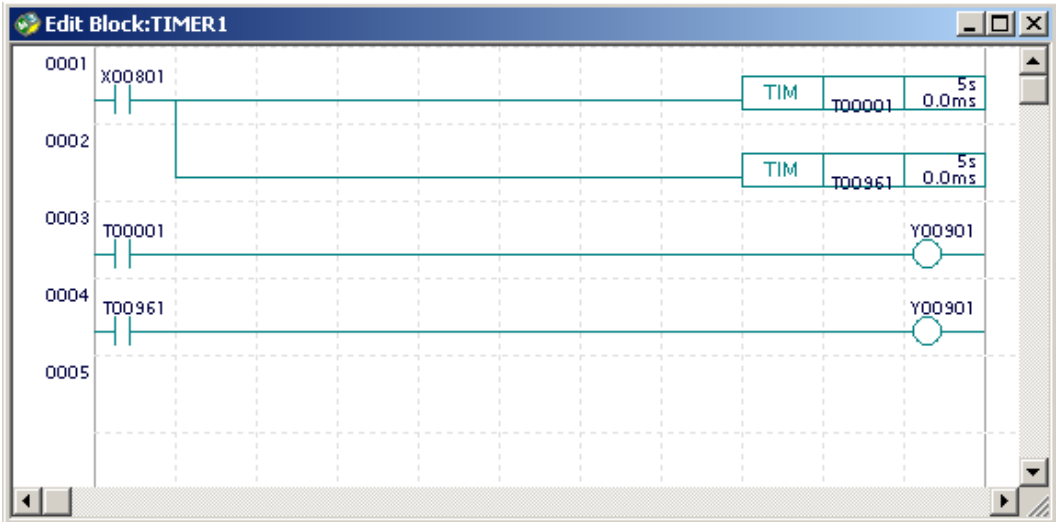
4.5 Creating a Ladder Program

4.5.1 Editing a Block

1. In the [Edit Block: TIMER1] screen, create the following ladder circuit.
   Note that, for the 3FSP58, T1921 must be substituted for T961.

CAUTION

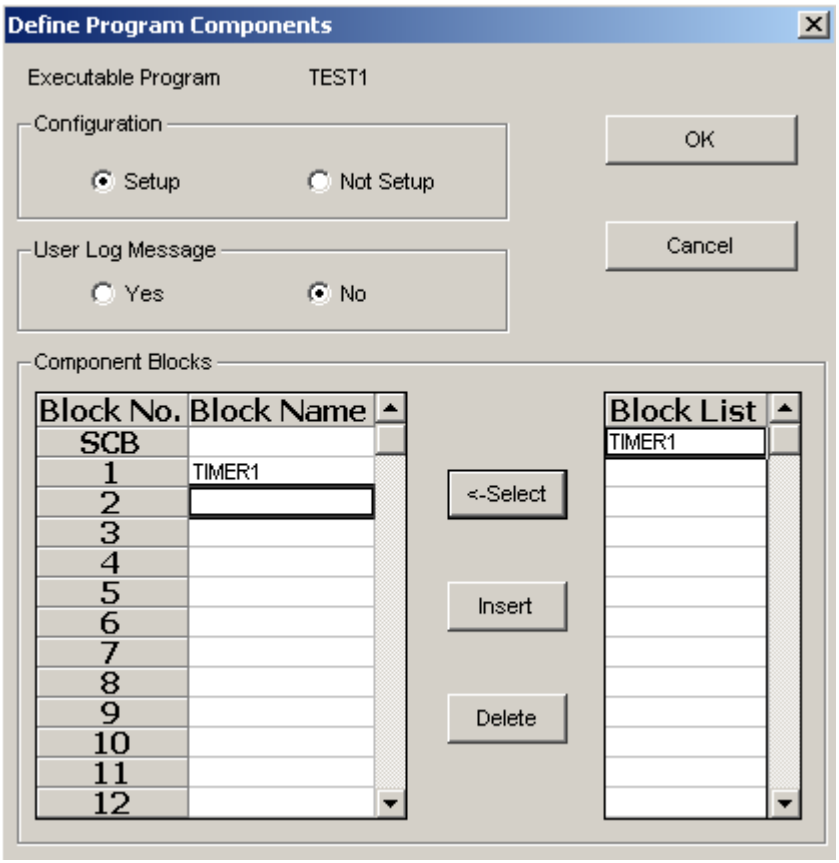
For the 3FSP25 CPU module, T961 is the start address for the continuous timers.
For the 3FSP58 CPU module, T1921 is the start address for the continuous timers.
To confirm this, Select [Project]–[Configuration], click the [Device Capacities] tab, and check the 100 ms continuous timer fields for the maximum number and the range of available timers.



2. Select [File]–[Save]. The block is saved with block name “TIMER1”.

4.5.2 Defining Program Components

1. Select [Project]–[Define Program Components]. The Define Program Components screen for project name "**TEST1**" is displayed.
2. Click on [**TIMER1**] displayed in the [Block List] as shown below to activate it (enclose it in a box).



3. Check that the block name field for [Block Number] 1 is active (boxed).
4. Clicking the [Select] button automatically enters TIMER1 into the block name column of [Block Number] 1.
5. Click [OK] on the upper right of the screen.

4.5.3 Downloading a Program

1. Select [Online]–[Download].
   From the available [Project] and [Block/Macro] options, select [Project].

TIP

With the F3SP28-3S and other newer CPU modules, partial downloading of Block/Macro is available.

With the F3SP25-2N and other older CPU modules, partial downloading is not available.

1. The following messages are displayed. Select [Yes] for each question.
   - "Download?"
   - "Some macro/block is being edited. Save first?"
   - "You are in Run or Debug Mode. Terminate?"
   - "Download is completed. Enter Run mode?"
2. The TEST1 program is downloaded to the CPU and enters run mode.

4.5.4 Monitoring a Program

1. Select [Online]–[Program Monitor]
2. Double-click the program name "Timer1".
3. Turn on the contact input switch X801 and check the operation of the timer (T00961 is a continuous timer).
4. Select [Tool]–[Setup Environment].
5. Select the [Setup Circuit Display/Input] tab.
6. In the [Set Background Colors] field, select [Online Screen] and use the [Set Color] button to select [Light Yellow].
7. Click the [OK] button to close the [Setup Environment] window.

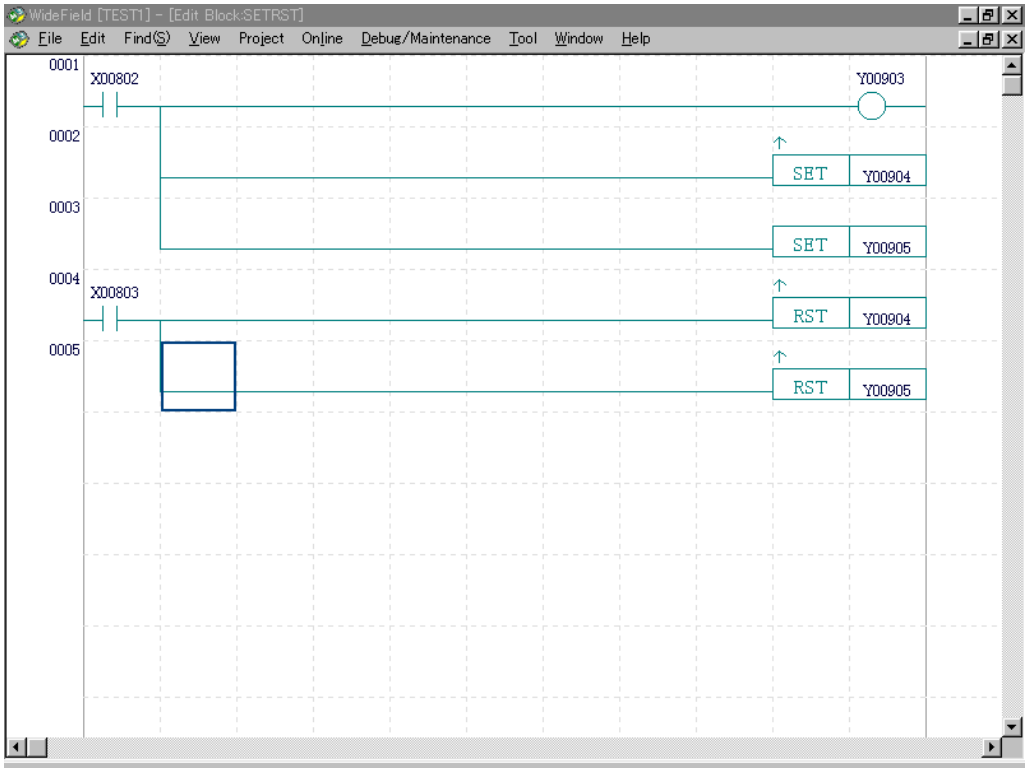
4.5.5 Adding a Block

Now, we will add the block named SETRST to the TEST1 program, download the program, and check its operation.

CAUTION

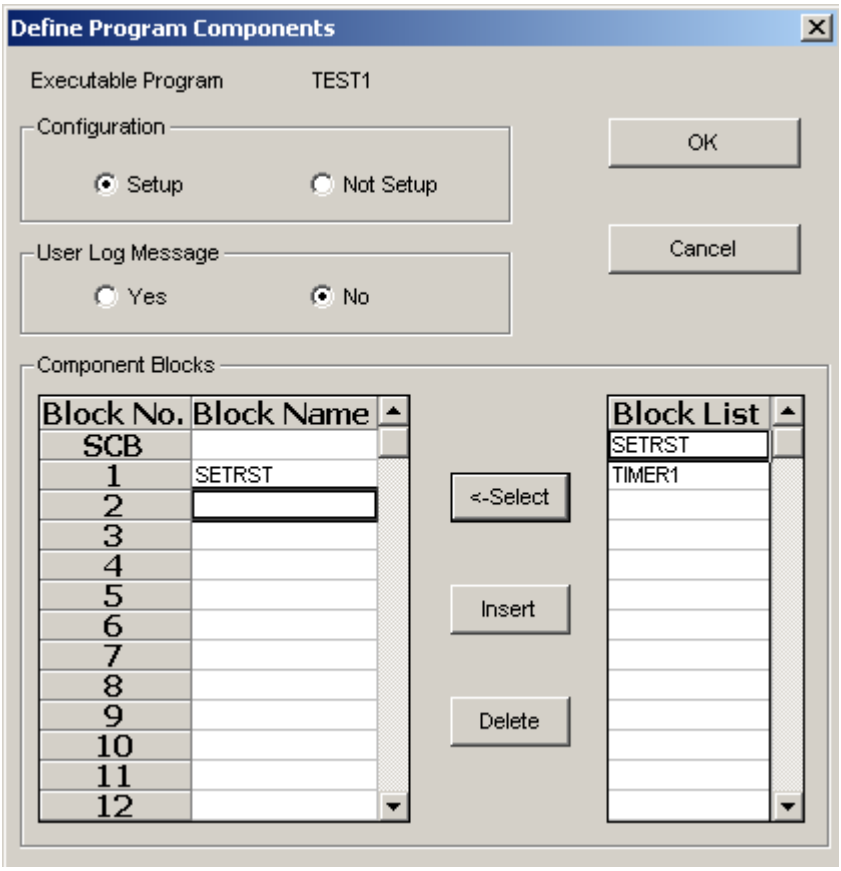
The following sample program checks for successful execution of the Out, Set, and Reset instructions. It serves no other useful purpose.

1. Close the Edit Block window or block monitor window currently displayed.
2. Select [File]–[New].
3. Enter the file name of the block as “SETRST” and click [OK].
4. Create the program shown below.
   For pulse input, enter P as SET P Y904



5. Select [File]–[Save].
6. Select [Project]–[Define Program Components].
7. Activate (Enclose in a box) the TIMER1 block, which is registered in the block name column, and delete it using the [Delete] button.

8. Activate (Enclose in a box) the SETRST block in the block list column and press the [Select] button. (See figure below)

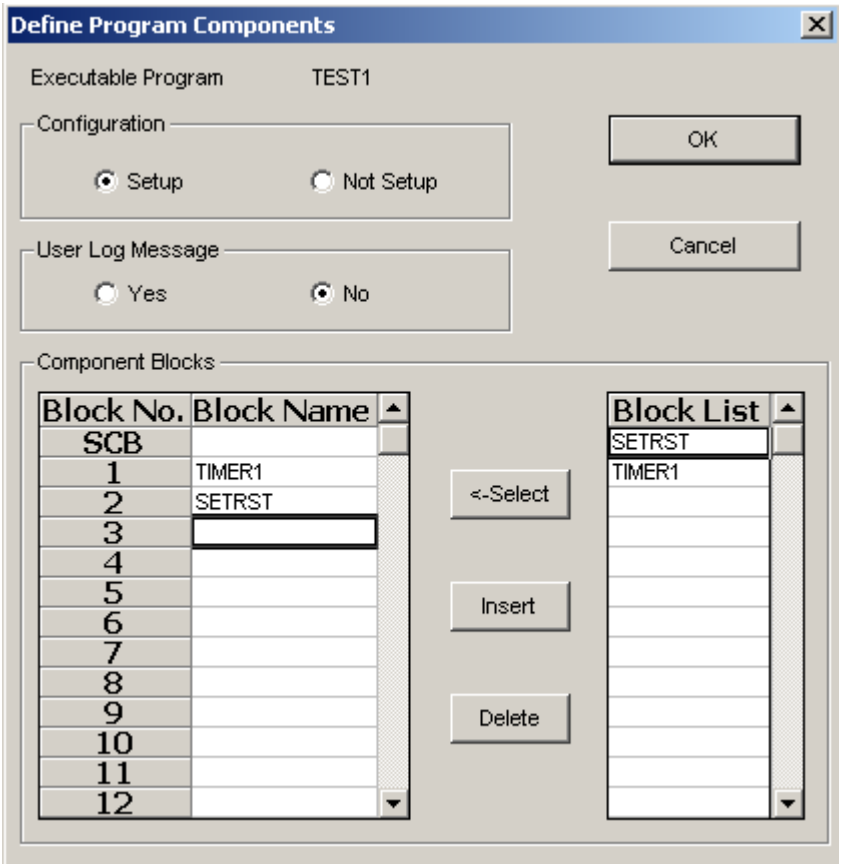


9. Click [OK].
10. Select [Online]–[Download] and download the project.
11. Select [Online]–[Program Monitor] and display the SETRST block monitor.
12. Turn on/off X00802 and X00803 and check the operations of the SET instruction, RST instruction and the pulse type instruction.

4.5.6 Downloading 2 Blocks

We will now register the TIMER1 and SETRST blocks to an excutable program and download them.

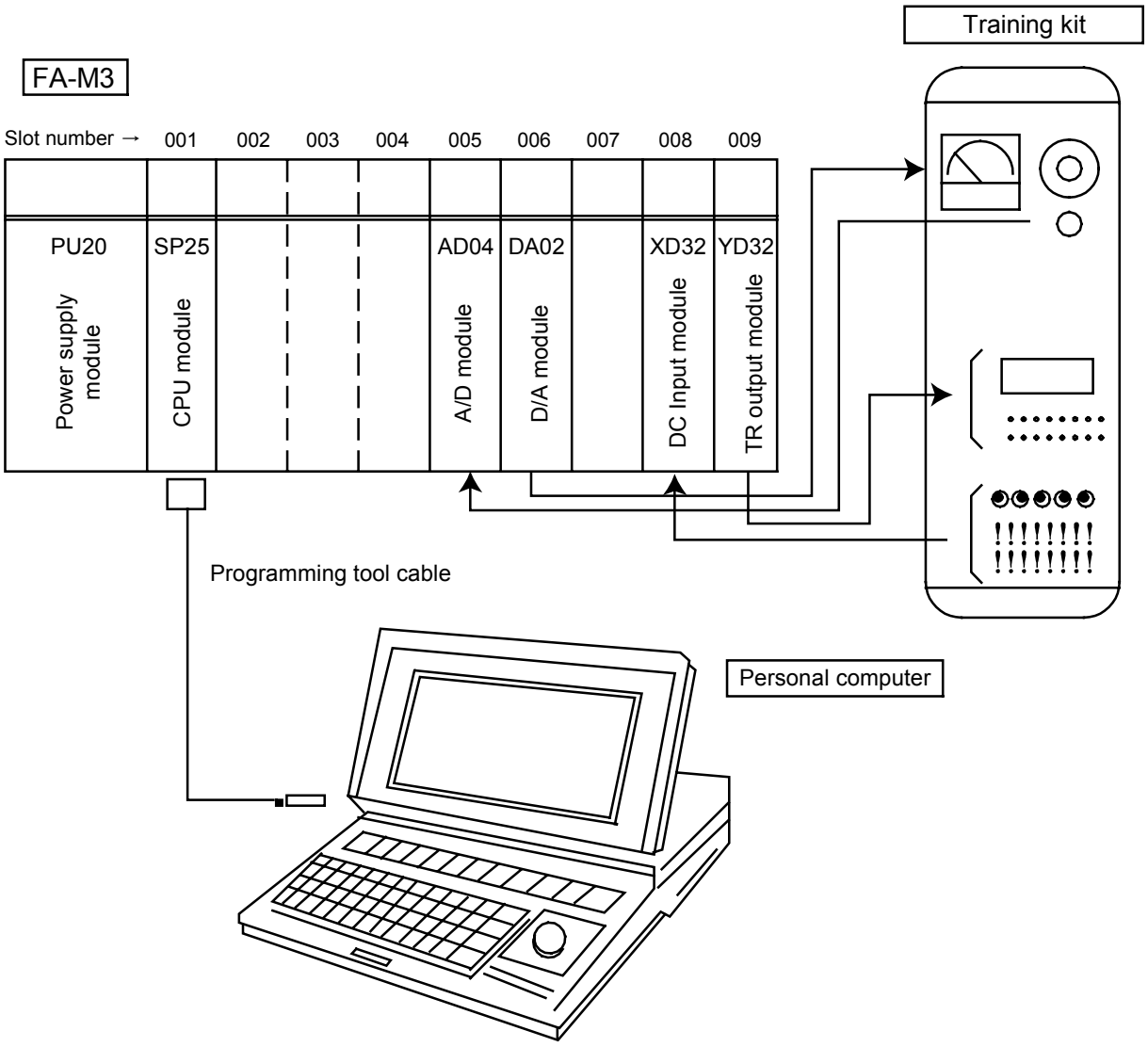
1. Close the Edit Block and Block Monitor window currently displayed.
2. Select [Project]–[Define Program Components].
3. Register the TIMER1 and SETRST blocks as shown below and click [OK].



4. Select [Online]–[Download] and download the project.
5. Select [Online]–[Program Monitor].
6. Double-click TIMER1 and SETRST to display the block monitor windows.
7. Check the operation.

5. Ladder Program Training

5.1 Training Kit System Configuration



Training kit specifications:

- 12VDC data input

  16 toggle switches for ON-OFF (ON) operation,
  where 4 switches are for negative logic inputs

  A 5-digit binary data switch for hexadecimal data input
- 12VDC data outputs

  16 LEDs

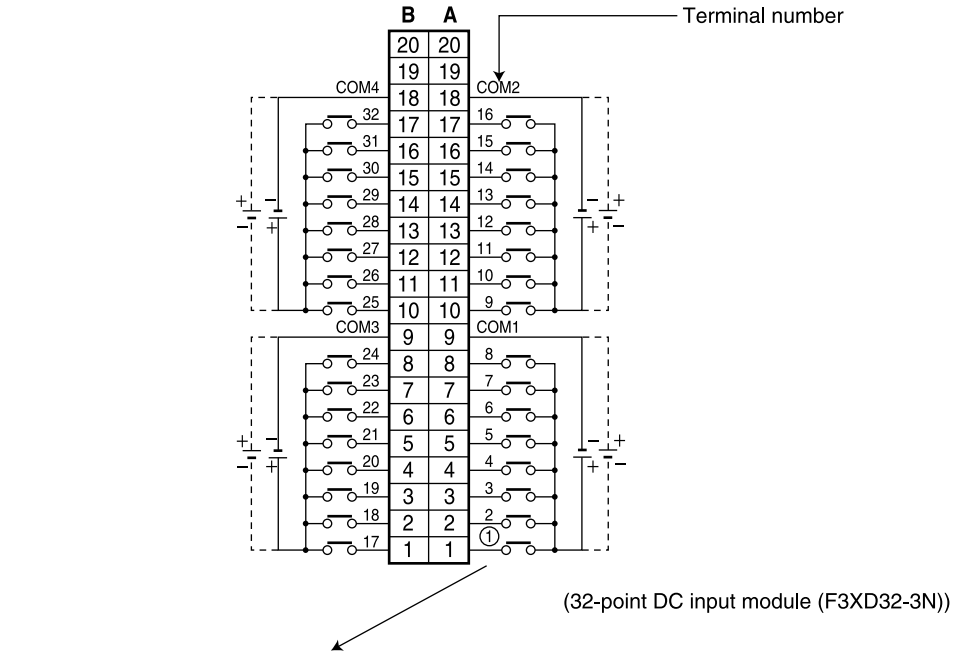
  A 5-digit 7-segment indicator for hexadecimal data display

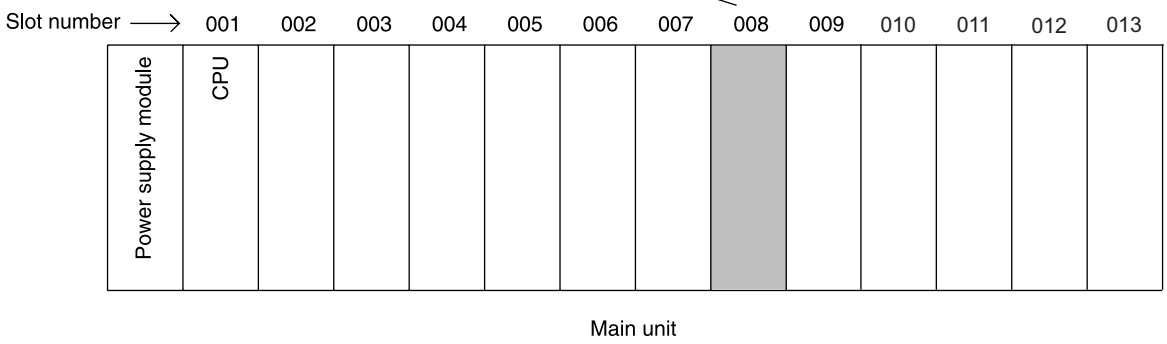
■ Terminal Number and Physical Address

The following shows an example for accessing terminal number 1 of a 32-point DC input module.

The physical address of an input/output relay is represented by one alphabetic character and five numeric digits.

The relay type (X or Y) is on the left, followed by the unit number (0-7), slot position (01-13) and terminal number (01-32).





■ I/O list (1)

DC input module: F3XD32-3N

XD32		Tag name	Training kit SW No.	
Terminal No.	Physical address			
1	X00801	START	00	Exercises 1, 2, and 3
2	X00802	STOP	01	
3	X00803		02	Exercise 3
4	X00804		03	
5	X00805		04	
6	X00806		05	
7	X00807		06	
8	X00808		07	
9	X00809		08	
10	X00810		09	
11	X00811		10	
12	X00812		11	
13	X00813		12*	Negative logic
14	X00814		13*	
15	X00815		14*	
16	X00816		15*	
17	X00817		Rotary	
18	X00818		binary switch	
19	X00819		for 1st digit	
20	X00820			
21	X00821		Rotary	
22	X00822		binary switch	
23	X00823		for 2nd digit	
24	X00824			
25	X00825		Rotary	
26	X00826		binary switch	
27	X00827		for 3rdst digit	
28	X00828			
29	X00829		Rotary	
30	X00830		binary switch	
31	X00831		for 4th digit	
32	X00832			

■ I/O list (2)

TR output module: F3YD32-1A

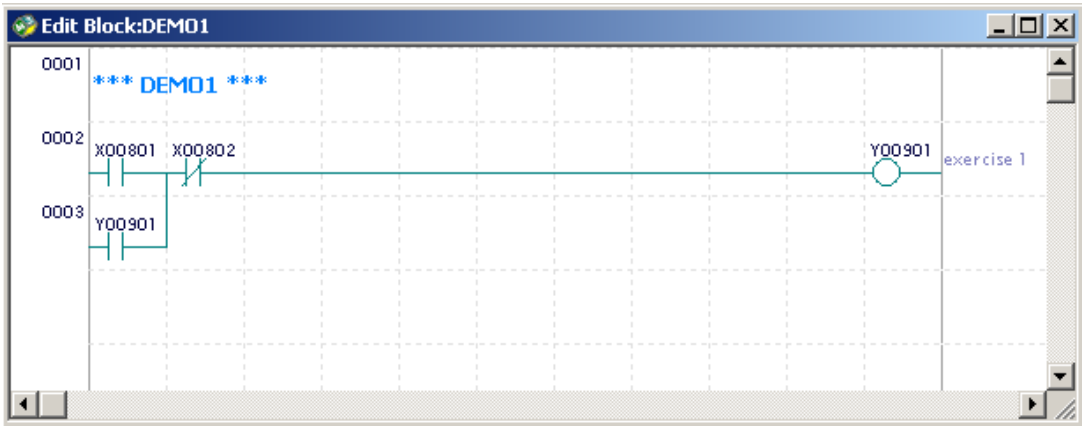
YD32		Tag name	Training kit SW No.
Terminal No.	Physical address		
1	Y00901	HOLD	00
2	Y00902	LAMP1	01
3	Y00903	LAMP2	02
4	Y00904	SHOT	03
5	Y00905		04
6	Y00906		05
7	Y00907		06
8	Y00908		07
9	Y00909		08
10	Y00910		09
11	Y00911		10
12	Y00912		11
13	Y00913		12
14	Y00914		13
15	Y00915		14
16	Y00916		15
17	Y00917		7-segment
18	Y00918		indicator
19	Y00919		for 1st digit
20	Y00920		
21	Y00921		7-segment
22	Y00922		indicator
23	Y00923		for 2nd digit
24	Y00924		
25	Y00925		7-segment
26	Y00926		indicator
27	Y00927		for 3rd digit
28	Y00928		
29	Y00929		7-segment
30	Y00930		indicator
31	Y00931		for 4th digit
32	Y00932		

5.2 Exercise 1 (Circuit Design Using Physical Addresses)

5.2.1 Edit Ladder Diagram

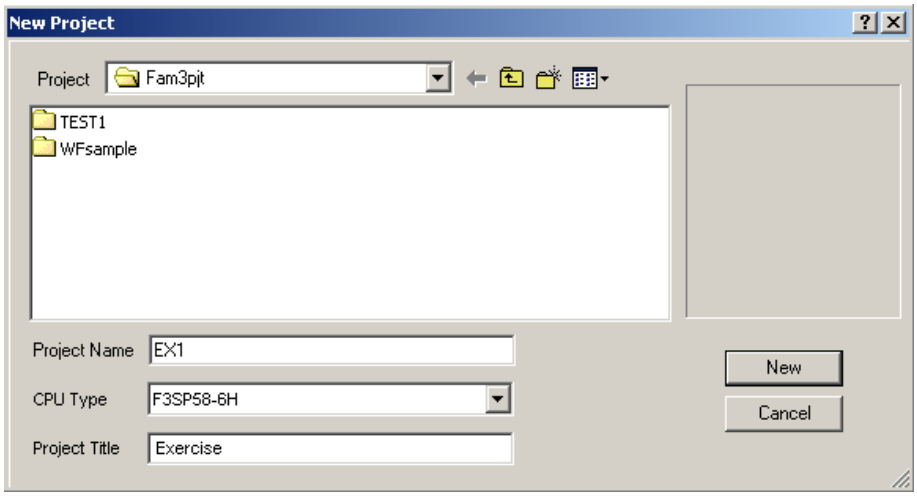
■ Outline of Exercise 1

In Exercise 1, you will use physical addresses to design a self-hold circuit. When you set an input switch (X00801) to ON, an output indicator (Y00901) is turned on. Even when you set this input switch (X00801) to OFF, the output indicator remains on. When you set another input switch (X00802) to ON, the output indicator (Y00901) is turned off.



■ Creating a New Project

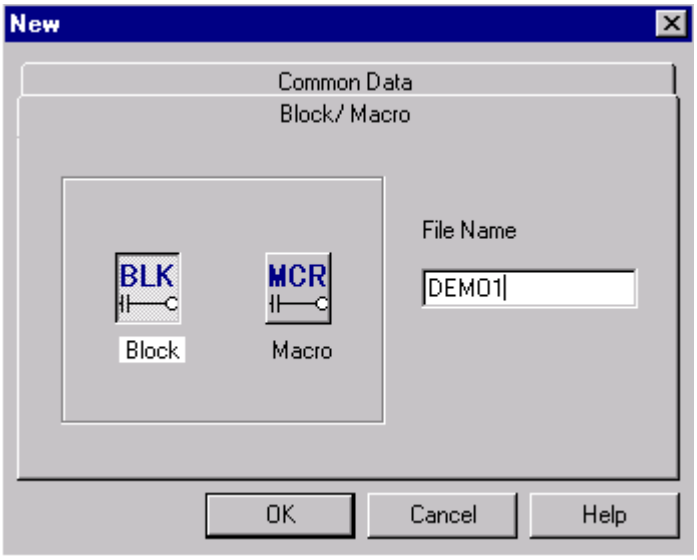
1. Close the window currently displayed.
   Select [File]–[Close Project].
2. [File]–[New Project].
3. Enter the input as shown below.
   - Project name : EX1
   - CPU Type : Select the type of the CPU module actually installed.
   - Project Title : Exercise



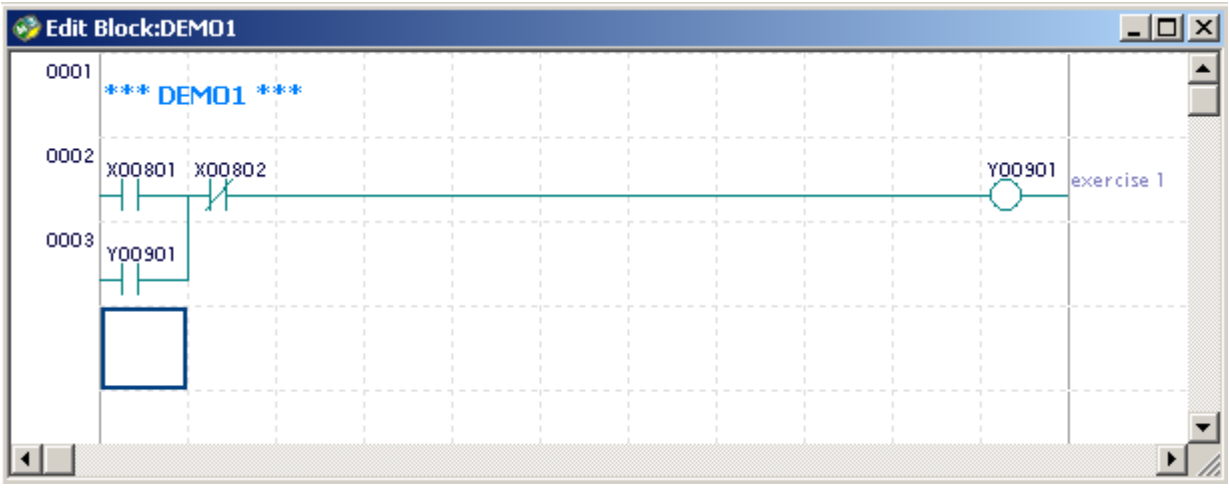
4. Click the [New] button.

■ Creating a New Block DEMO1

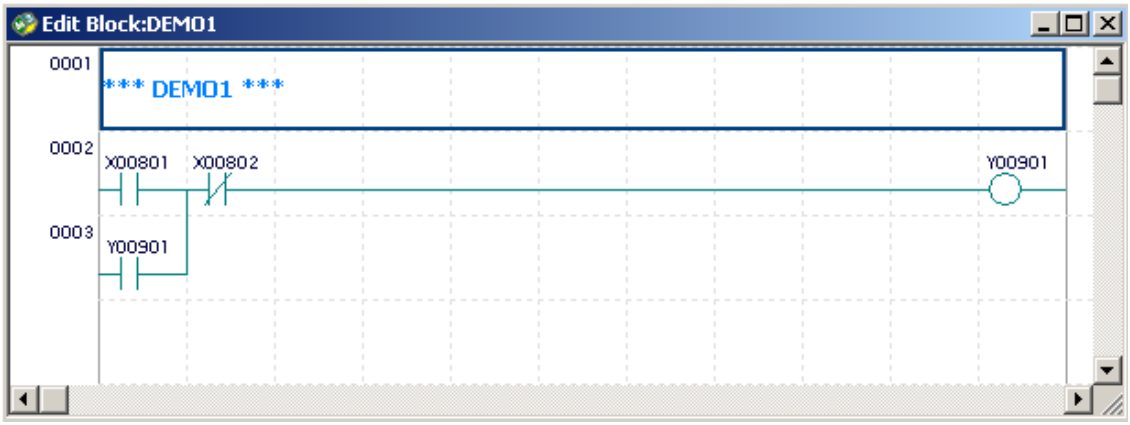
1. Select [File]–[New] and enter “DEMO1” as the file name of the block.



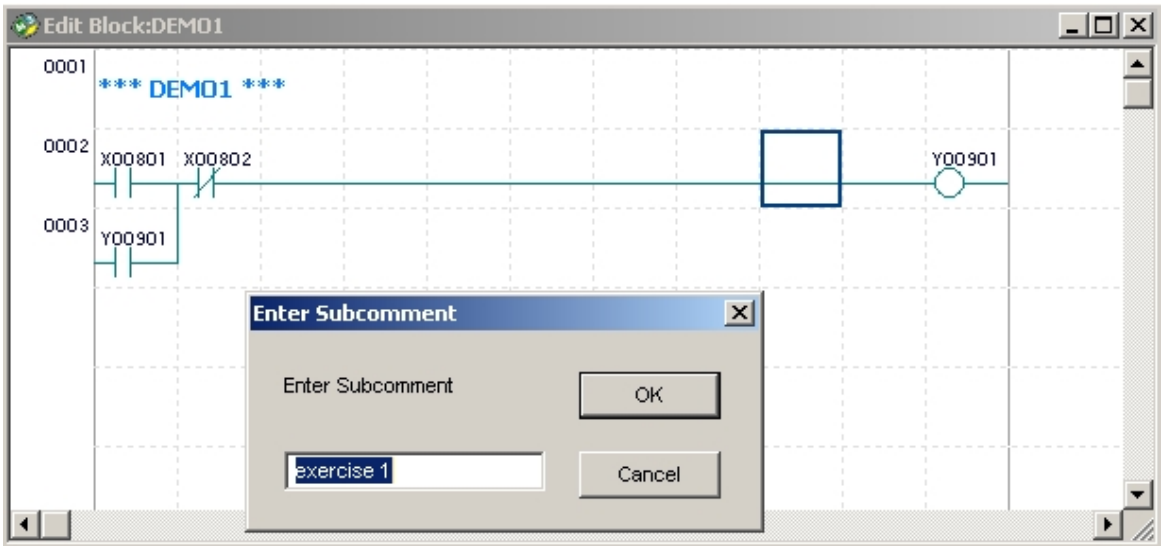
2. Close the [Local Device/Properties] screen.
3. Create the circuit shown in the following diagram.
   Then insert comments according to the steps given below.



4. Enter a circuit comment
   There are 2 ways to enter the circuit comment.
   - Click the Circuit Comment icon on the instruction tool palette and click the position where you wish to enter the comment (Alternatively, you can also select [Edit]–[Ladder Symbol]–[Circuit Comment])
   - Move the position cursor to the position where you wish to enter the circuit comment and press the [Ctrl]+[F7] keys. Enter the circuit comment as "*** DEMO1 ***" followed by the circuit shown in the figure below.

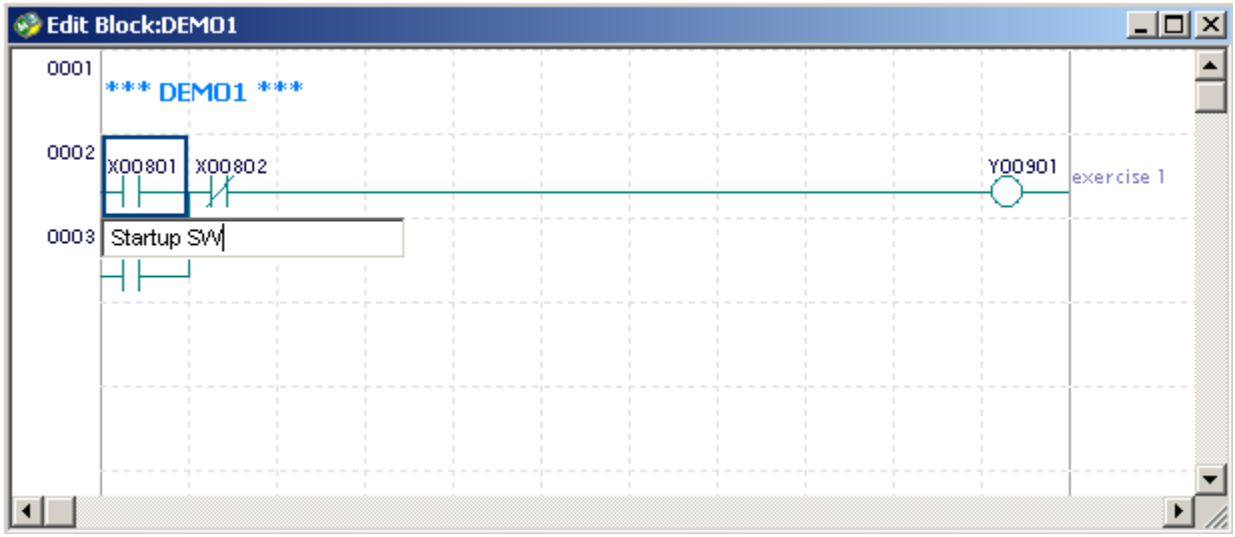


5. Edit/Delete a circuit comment
   - Move the position cursor to the circuit comment and press the [ENTER] key. Modify the comment and press the [ENTER] key.
   - Double-click the circuit comment. Modify the comment and press the [ENTER] key.
   - To delete a circuit comment, move the position cursor to the circuit comment and press the [Delete] key or select [Edit]–[Delete].
6. Enter a subcomment
   There are 2 ways to enter a subcomment
   - Select the Subcomment icon, click the line where you wish to enter the subcomment, enter the subcomment and press the [ENTER] key.
   - press the [Ctrl]+[F9] keys (or select [Edit]–[Ladder Symbol]–[Subcomment]). Enter the comment and press the [ENTER] key. Enter the subcomment as "exercise 1" as shown below.



7. Edit/Delete a subcomment
   - As with entering a subcomment, open the subcomment input window, modify the comment and press the [ENTER] key.
   - As with entering a subcomment, open the subcomment input window, delete the comment, press the [ENTER] key or click the [OK] button.
8. Enter an I/O comment
   There are 2 ways to enter an I/O comment.
   - Using the I/O Comment icon, click the element (device) assigned to the address, enter the I/O comment and press the [ENTER] key.
   - Move the position cursor to the element (device) to which you wish to enter an I/O comment, press the [Ctrl]+[F8] keys and enter the comment. (Alternatively, you can also select [Edit]–[Ladder Symbol]–[I/O Comment]).

     Enter “Startup SW” as I/O comment to X00801 as shown below.



9. Edit/Delete an I/O comment
   - As with entering an I/O comment, open the I/O Comment window, modify the comment and press the [ENTER] key or click the [OK] button.
   - As with entering an I/O comment, open the I/O Comment window, delete the comment, press the [ENTER] key or click the [OK] button.
10. Display an I/O Comment
    - Click the Display I/O Comment icon to display the I/O comment. Clicking the icon again reverts to the original state.
    - Alternatively, you can select [View]–[Display I/O Comments] to achieve the same effect.
11. Save a file.
    Select [File]–[Save] to save the file for the created block.

5.2.2 Useful Functions of Edit Ladder Diagram

■ Inserting an Empty Line

To insert an empty line into the ladder diagram, select [Edit]–[Insert Line] from the menu. An empty line will be inserted at the position cursor line.

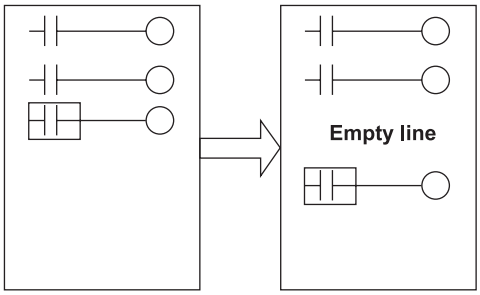


Figure Inserting an Empty Line

■ Selecting Lines

Lines must be selected for line operations (copy, move, delete). They can be selected using the mouse or the keyboard.

To select lines using the mouse, change the mouse cursor into the selector cursor (usual cursor), and drag it over the line number area. Up to 100 lines can be selected at one time.

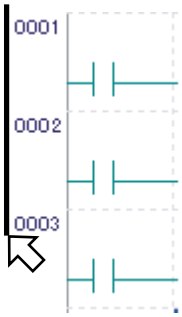


Figure Selecting Lines Using a Mouse (dragging over the line number area)

To select lines using a keyboard, press the [Shift] key plus the up/down arrow keys.

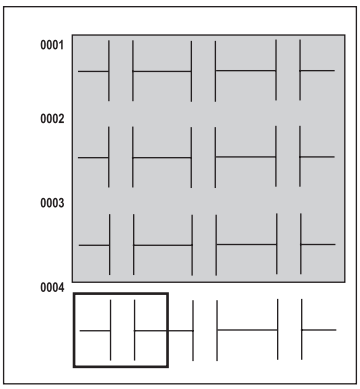


Figure Selecting Lines Using a Keyboard

■ Deleting Lines

Lines within a specified range can be deleted in line units.

The circuit comments and subcomments are also deleted.

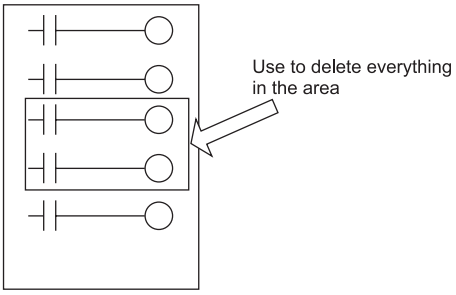


Figure Deleting Lines

■ Procedure for Deleting Lines

1. Select the line(s).
2. Select [Edit]–[Delete Line], or press the [Delete] key. The following dialog box appears.

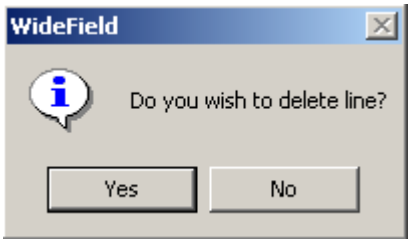


Figure Delete Line Confirmation Dialog Box

3. Select [Yes] to delete the line(s).
   Deleted lines cannot be recovered.

■ Temporarily Deleting Lines/ Recovering Temporarily Deleted Lines

1. Temporarily Deleting Lines
   Lines in specified areas can be temporarily deleted in line units. Temporarily deleted lines are displayed with their background color changed.
   This function is handy for temporarily deleting lines of circuits while editing programs, when you are uncertain whether the lines should be deleted or not.
   Circuit comments and sub-comments are also deleted temporarily.

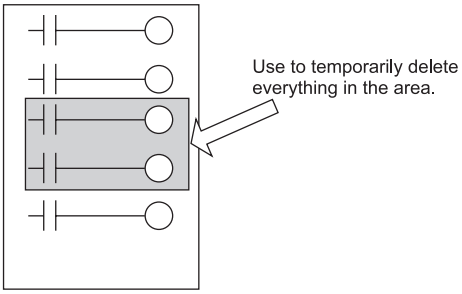


Figure Deleting Temporarily

   1) Select the line(s).
   2) Select [Edit]–[Temporary Delete], or press the [Delete] key. The following dialog box appears.

TIP

When the block is converted, temporarily deleted lines are deleted from the program.

2. Recovering Temporarily Deleted Lines
   Temporarily deleted lines in a specified area can be recovered so that they can be edited as usual.
   1) Select the temporarily deleted lines.
   2) Select [Edit]–[Undo Temporary Delete].
      The selected lines revert to normal edit status.

■ Copying and Pasting Lines

Lines in specified areas can be copied and moved to specified positions in line units. Lines can be copied and pasted to the same or a different window.

Circuit comments and sub-comments are also copied and pasted.

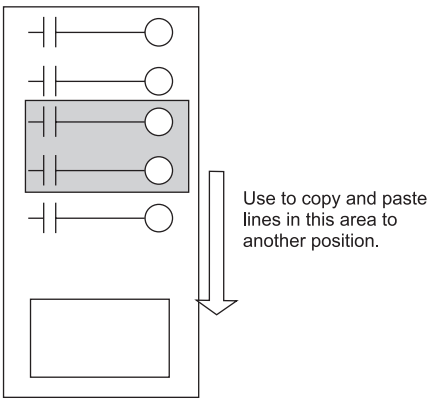


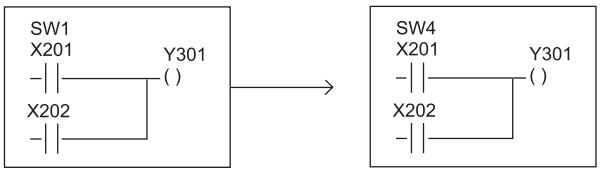
Figure Copying and Pasting

1. Select the line(s) to copy and paste.
2. Select [Edit]–[Copy] or [Edit]–[Cut].
   When [Cut] is selected, selected lines are cleared from the screen. (The move function is activated.)
3. Bring the position cursor to the place for inserting the lines.
   To copy and paste to another screen, bring the position cursor to the paste position on the other screen.
4. Select [Paste] from the Edit menu.
   The lines are inserted where the position cursor is.

CAUTION

Copying to another screen operates as follows:

- The actual addresses of the circuit elements assigned in the source circuit are copied. If different tag names are assigned in the destination block, the lines will be displayed with the tag names of the destination block.



Source circuit Destination circuit

Circuit is copied to a different block where tag name SW4 is assigned to X201.

■ Copying a Circuit Image

Using the same procedure as for copying lines, select [Edit]–[Copy Image] to copy the circuit edit image to the clipboard in bitmap format. The copied circuit image can be pasted to software such as MS-Paint and MS-Word.

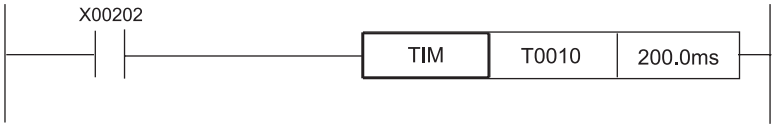
■ Canceling an Operation

You can undo the previous operation.

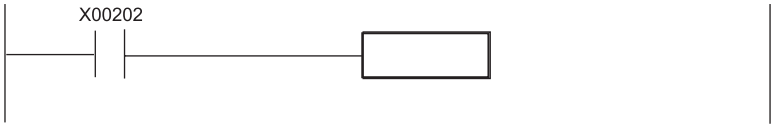
- You can recover an instruction or comment you have just deleted using the [Delete] key.
- The entered instruction reverts to its status prior to deletion.

1. Recovering Deleted Instruction/Comment
   Press the [Delete] key to delete the instruction or comment at the position cursor. If the deletion is a mistake, you can undo the operation.

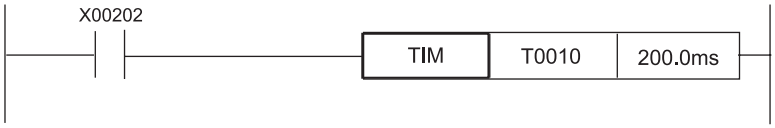
   Input example:



   1) The Timer instruction is deleted when the [Delete] key is pressed.



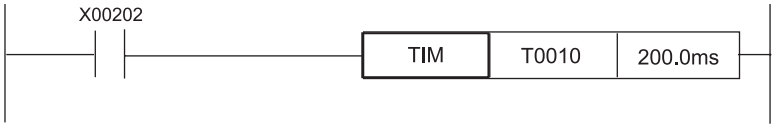
   2) Select [Edit]–[Undo].
   3) The Timer instruction is recovered.



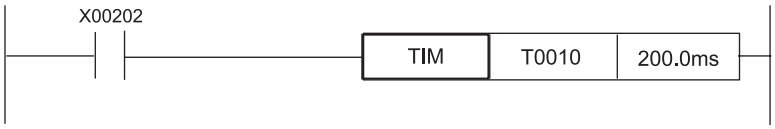
2. Revert to Status Prior to Input
   If you have entered an incorrect instruction, etc., you can delete the instruction and revert to the previous status.

   Example:

   1) When you enter—◯— in overwrite mode, the instruction is overwritten.



   2) Select [Edit]–[Undo].
   3) The timer instruction is recovered.



CAUTION

- Operations can be cancelled only when the input/deleted line is in the screen area. Once you scroll the screen so that the input/deleted line disappears from the screen, the operation cannot be cancelled. Operations cannot be cancelled after conversion too.
- Assignment of addresses to tag names cannot be reverted. (Registrations to the tag name definition remain unchanged.)

■ Index View

The index view uses circuit comments as headings, and hides circuits written up to the next circuit comment. The index view is effective for grasping the overall flow of the ladder circuit first, before editing the details.

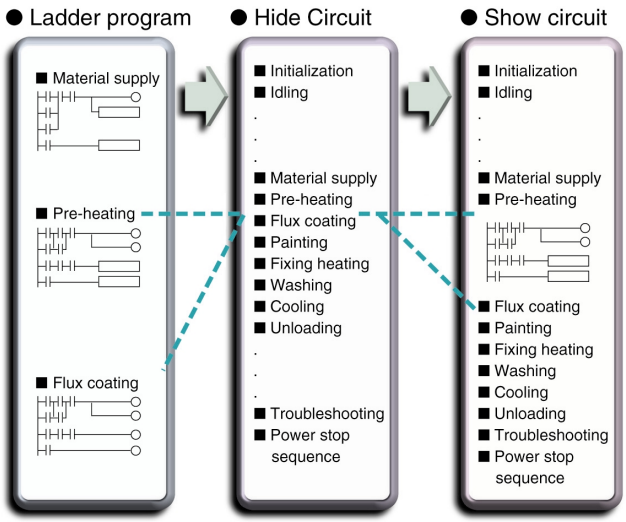


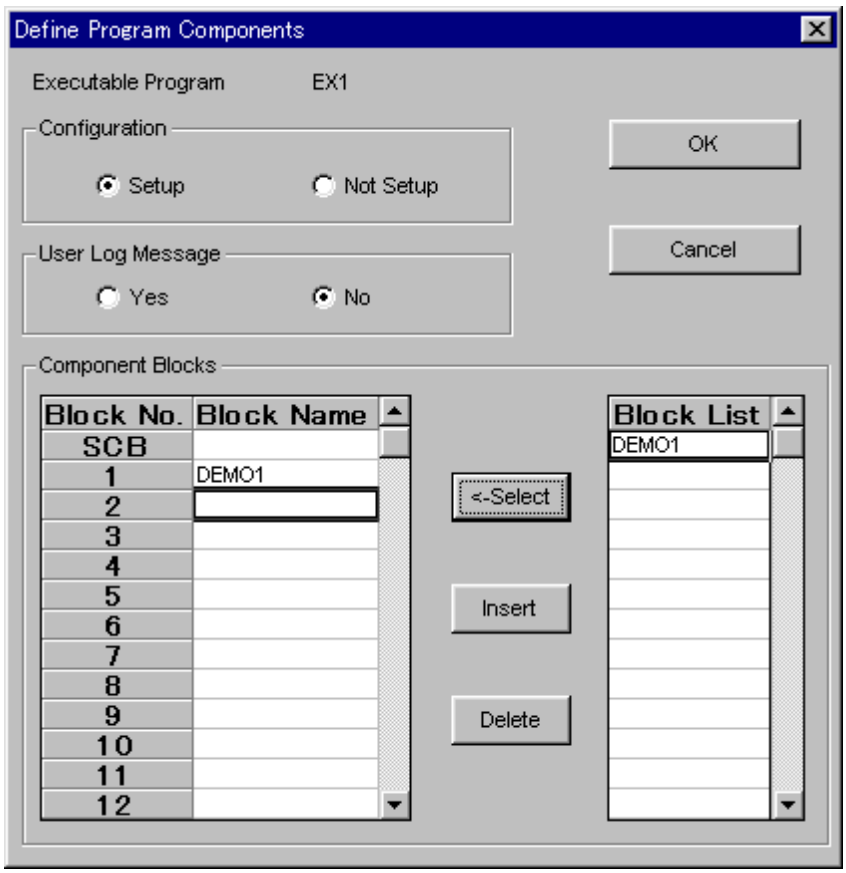
Figure Concept of Index View

1. Hide Circuits
   Bring the position cursor to the circuit comment and select [Edit]–[Hide Circuit]. The circuits up to the next circuit comment are hidden. The circuit comment is highlighted.
2. Show Circuit
   Bring the position cursor to the hidden circuit comment and select [Edit]–[Show Circuit]. The hidden circuit is displayed.
3. Hide All Circuits
   Select [Edit]–[Hide All Circuits]. All circuits in the block are hidden. However, this function does not work when the first line of the block has no circuit comment.
4. Show All Circuits
   Select [Edit]–[Show All Circuits]. All hidden circuits in the block are shown. When all circuits are shown, the position cursor line is displayed at the top.

5.2.3 Defining the Executable Program Components

Now, we define the file (DEMO1 block) saved earlier in step (10) of section 5.2.1 as a component of the executable program (JISYU1).

1. Select [Project]–[Define Program Components].
2. Enter “DEMO1” into block number 1 using the [Select] button.
3. Click the [OK] button to save the changes.



5.2.4 Downloading and Monitoring a Block

1. Select [Online]–[Download] to download the EX1 executable program.
2. Select [Online]–[Program Monitor] and double-click “DEMO1”.
3. The DEMO1 program monitor window opens. Turn on/off X00801 and X00802 and check the operation of the program.

5.3 Exercise 2 (Circuit Design Using Tag Names and Local Devices)

In Exercise 2, you will use tag names to design circuits, and then assign physical addresses to the tag names. You will use timers and counters as local devices.

5.3.1 Edit Ladder Diagram

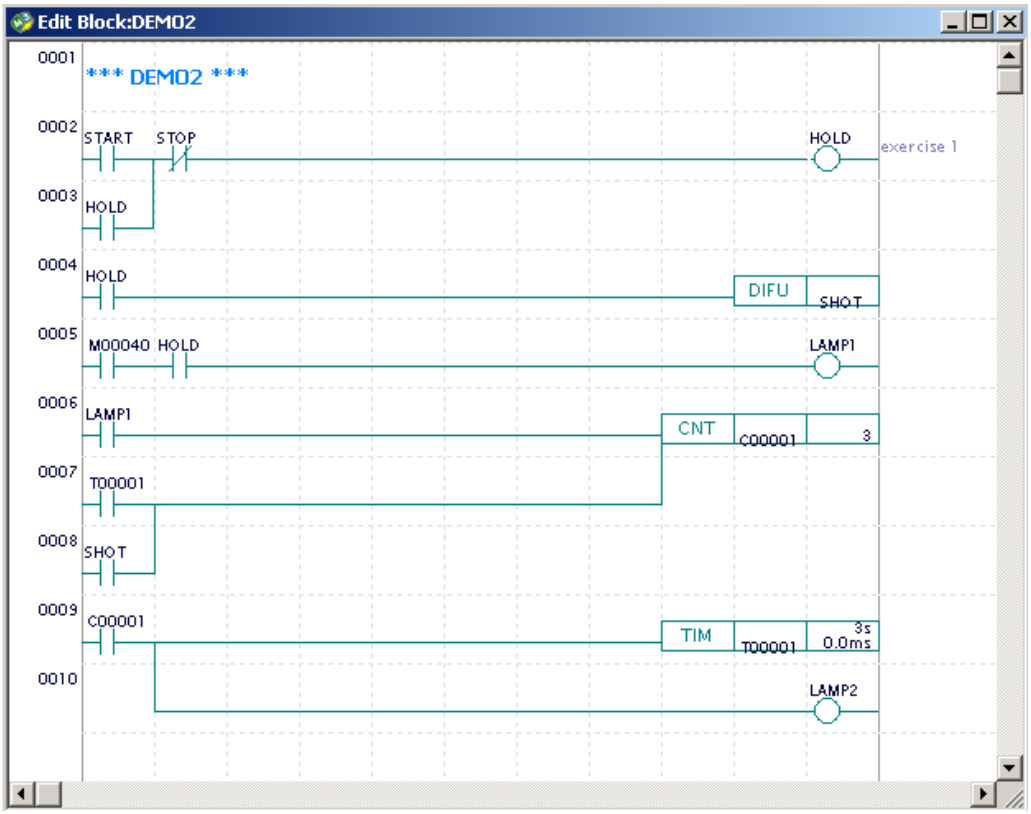
■ Outline of Exercise 2

In Exercise 2, you use tag names to design circuits instead of using physical addresses.

When designing circuits, copy the ladder diagram you created in DEMO 1 and modify it by adding devices.

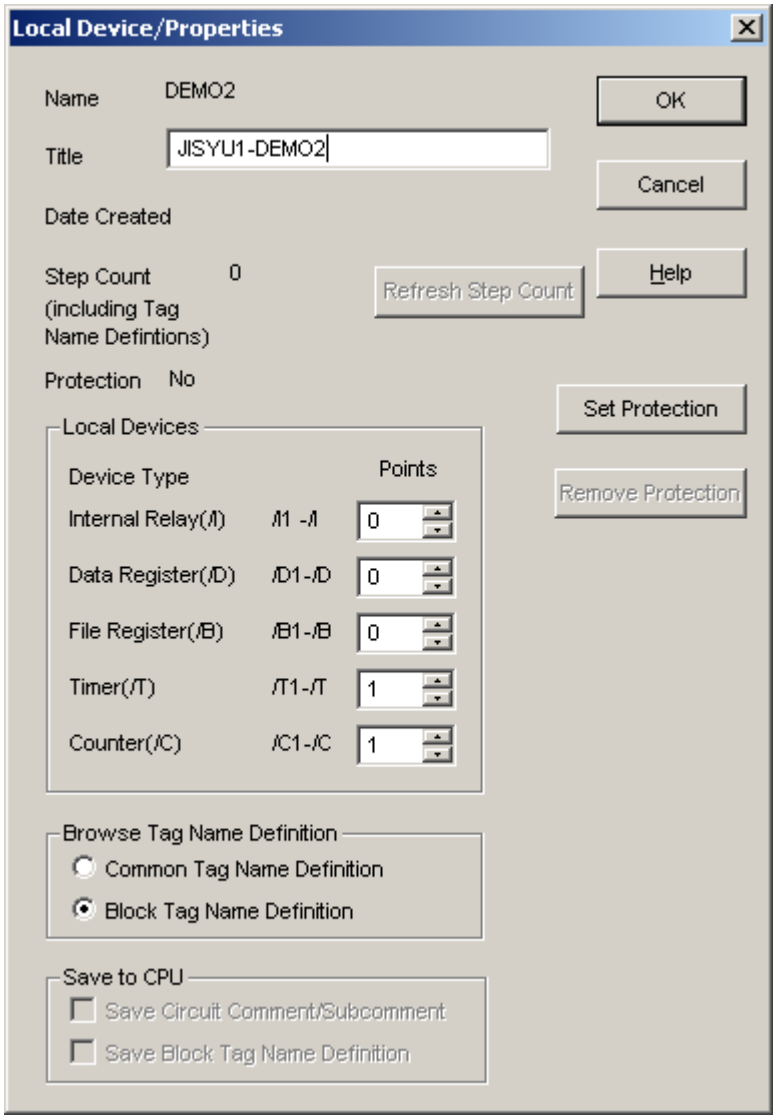
When you set the input switch (START) to ON, the counter (C0001) is started. When the counter counts three pulses (1-second cycle), the timer (T0001) is started. The timer times out 3 seconds after its start-up and resets the counter. These processes are carried out repeatedly.

When you set another input switch (STOP) to ON, the ladder circuit stops its operation.



■ Creating a New Block (DEMO2)

1. Close any edit block window or block monitor window currently displayed.
2. Select [File]–[New], enter “DEMO2” and click [OK].



3. In the [Local Device/Properties] screen, enter a title of you choice in the title field, select "1" for the number of timers and counters respectively, and click [OK].
4. To display the [Local Device/Properties] screen (if not yet displayed), first activate the [Edit Block] screen and then select [Edit]–[Local Device/Properties].

■ What are Local Devices?

- Local devices are devices specific to a block. Unlike normal devices (global devices), local devices are visible and can be used only within a block.
- You can allocate some normal devices as local devices in the configuration (you will learn how to do this in Section 5.3.3).
- Local devices are prefixed with a slash (/) character for identification.

  Notation Examples

/I00001	Local internal relay
/D00001	Local data register
/B00001	Local file register
/T00001	Local timer
/C00001	Local counter

  Addresses of local devices range from 1 to the number of local devices defined for each block. For example, if 32 internal relays (I) are allocated for local devices, then the addresses of the local devices run from /I00001 to /I00032.

  You can set the number of local devices in increments of 32 for internal relays, 2 for data and file registers, and 1 for timers and counters.

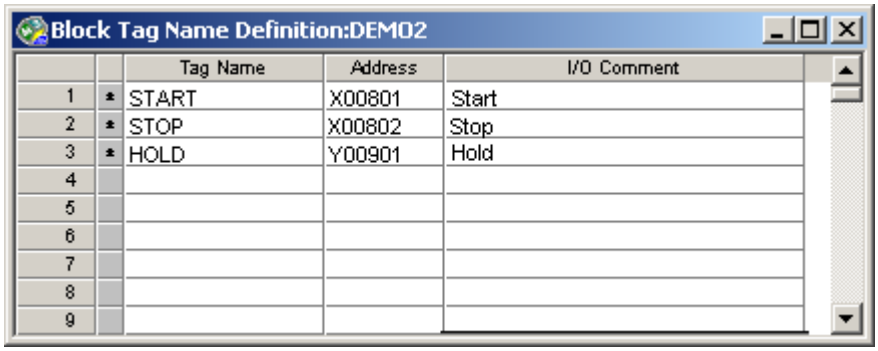
■ Copying and Editing a Block

1. Double-click “DEMO1” on the block list in the project window (displayed on the left of the screen).
2. Copy the DEMO1 program and paste it onto the Edit Block DEMO2 screen.
3. Close the “Edit Block: DEMO1” window.
4. Change the circuit comment to “DEMO2”.
5. Select [File]–[Save].

■ Defining Block Tag Names

1. Select [Edit]–[Block Tag Name Definition]. The Block Tag Name Definition DEMO2 window is displayed.
2. Click [Functions]–[Read Circuit].

   A message "Reading from changed circuit. Do you want to continue?" is displayed. Click [Yes].
3. On the Read Circuit screen, turn on the [Reads global device] checkbox, and click [OK].
4. The addresses used in DEMO2 block are displayed.
5. Define the tag names, addresses and I/O comments as shown below.

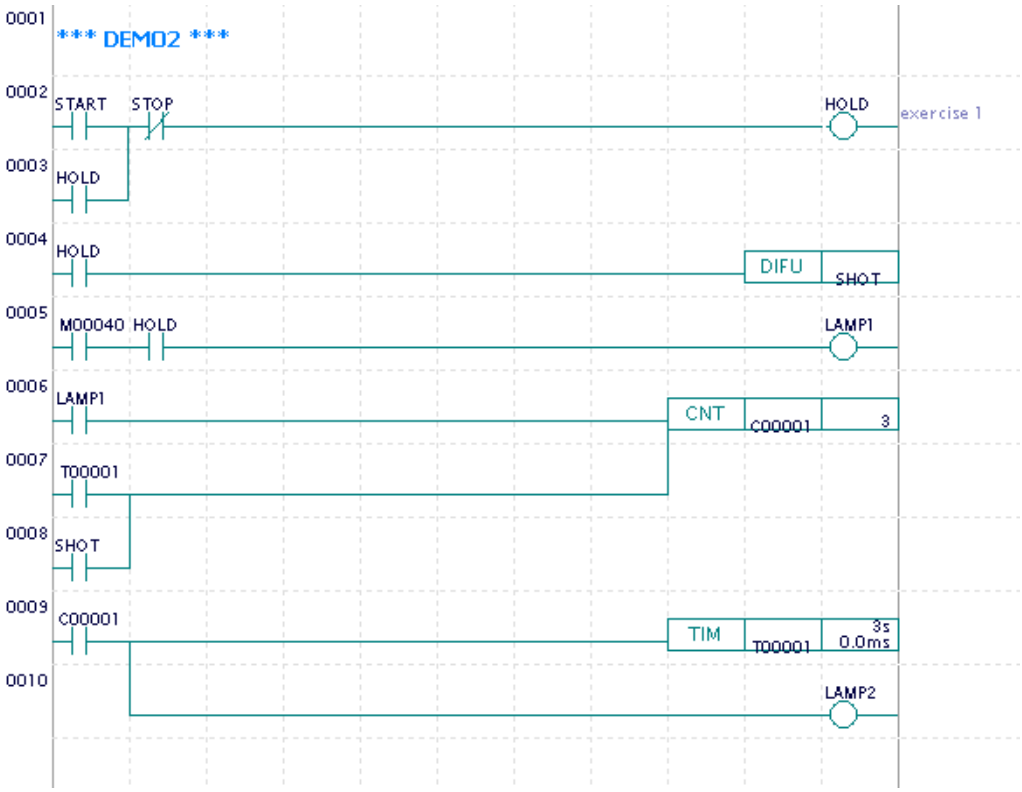


		Tag Name	Address	I/O Comment
1	*	START	X00801	Start
2	*	STOP	X00802	Stop
3	*	HOLD	Y00901	Hold
4				
5				
6				
7				
8				
9				

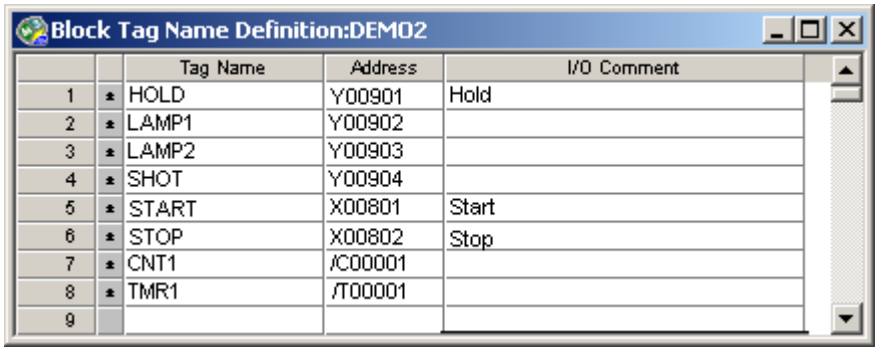
6. Click [File]–[Save].
7. Click [File]–[Close] to close the Block Tag Name Definition DEMO2 window.
8. To display addresses as tag names, data conversion is required. You will practice data conversion in Section 5.3.3.

■ Creating Block DEMO2

1. Enter and complete the remaining circuit as shown below.
   Local devices are displayed in red (non user-definable color). Tag names yet to be assigned with physical addresses are displayed in blue.



2. Select [File]–[Save].
3. Select [Edit]–[Block Tag Name Definition].
4. Click [Functions]–[Read Circuit] with the [Reads global device] checkbox turned off (default).
5. Enter tag names and physical addresses as shown below.
   To sort tag names or addresses, select [View]–[Display Format].
6. Select [File]-[Save] to close the screen.



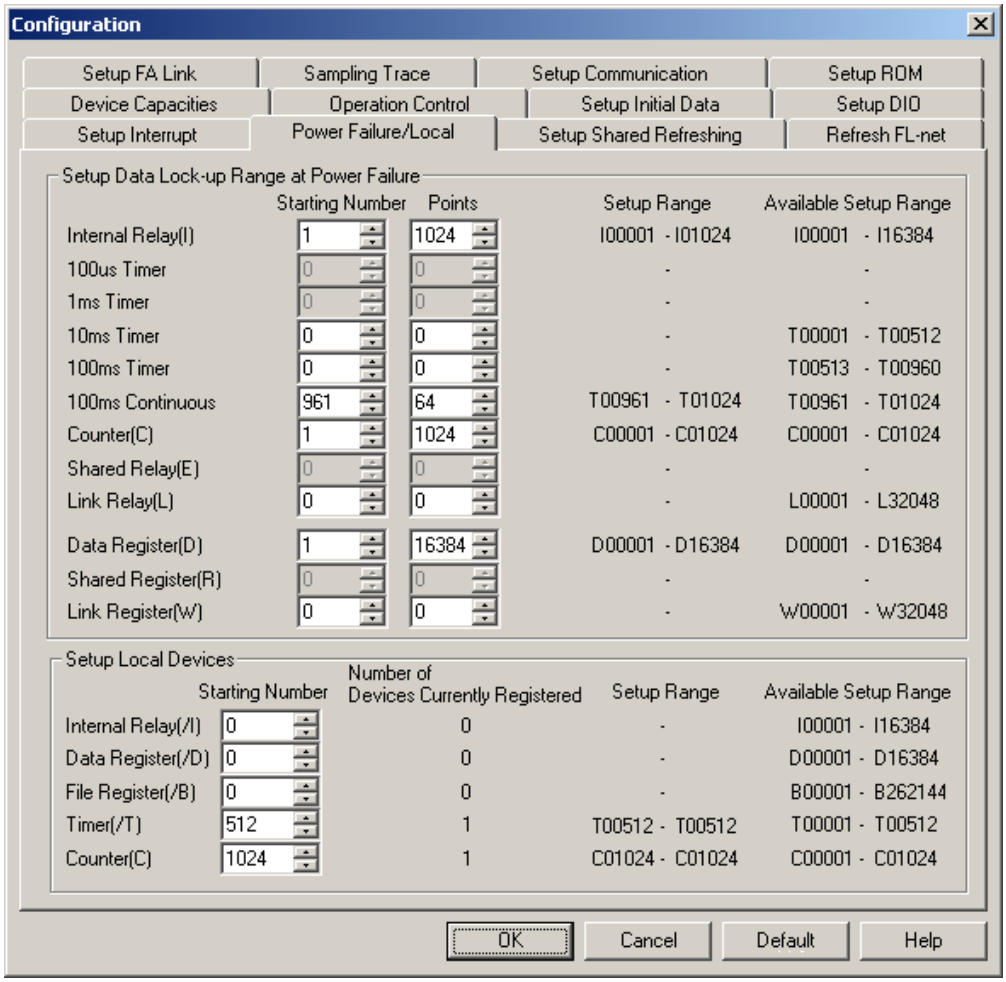
		Tag Name	Address	I/O Comment
1	*	HOLD	Y00901	Hold
2	*	LAMP1	Y00902	
3	*	LAMP2	Y00903	
4	*	SHOT	Y00904	
5	*	START	X00801	Start
6	*	STOP	X00802	Stop
7	*	CNT1	/C00001	
8	*	TMR1	/T00001	
9				

5.3.2 Defining Program Components

1. Select [Project]–[Define Program Components].
2. Delete DEMO1 in block number 1, and register (select) DEMO2.
3. Set [Configuration] to [Setup], and click [OK].
   (You must select [Setup] when using local devices.)

5.3.3 Setting a Starting Number for Local Devices

1. Select [Project]–[Configuration] to open the [Configuration] dialog box.
2. Click the [Power Failure/Local] tab.



3. Set a starting number for each local device type.

   The [Number of Devices Currently Registered] column displays the total number of local devices used in all blocks in the project. Taking this into consideration, set a starting number so that all allocated local device numbers fall within the device range.

   As only one local device is registered each for timer and counter in this exercise, the upper limit for the [Available Setup Range] is equal to the starting number as shown above.
4. Click [OK].
5. Select [Project]–[Check Program].

   Confirm that the message "No program error or warning" is displayed.
6. Select [Project]–[Convert Data]–[Tag Name Format] and click [OK].
7. Close and reopen the Edit Block DEMO2 window. Devices are now displayed as tag names.

5.3.4 Downloading and Monitoring a Block

1. Select [Online]–[Download] and downloads the EX1 executable program.
2. Select [Online]–[Block Monitor] and double-click DEMO2.
3. The DEMO2 block monitor window is displayed.
4. Turn off X802, turn on X801 and then turn it off. The circuit starts.
5. To stop the circuit, turn X802 on.

5.3.5 Useful Functions for Monitoring a Program

■ View Functions

1. Displaying Details
   Select [View]–[Details] to display the contents of devices in application instructions or the current values of timers and counters. Alternatively, you can also use the Display Details icon. Selecting [View]–[Details] again hides the details.
2. Changing the Display Format
   To change the display format of the details screen to hexadecimal, select [View]–[Display Format]–[Hexadecimal].
   You can also select string, or floating-point display formats.
3. Switching between Tag Name/Address Display
   Select [View]–[Display Address] or click the Display Address icon to display the addresses of devices.
   Selecting [View]–[Display Address] again toggles the addresses to tag names.
4. Displaying I/O Comments
   Select [View]–[Display I/O Comment] or click the Display I/O Comment icon.
   Repeating the operation hides the I/O comments.
5. Displaying Instruction Numbers
   Select [View]–[Display Instruction Number] or click the Display Instruction Number icon to display below the line numbers 5-digit instruction numbers followed by the character ‘N’. Program errors display with these instruction numbers.
6. Index View
   Index View (Hide/Show Circuit) allows you to display the ladder diagram with circuit comments as headings.

■ Device Monitor

1. With the FA-M3 connected, select [Online]–[Device Monitor].
   The Device Type sub-menu appears.

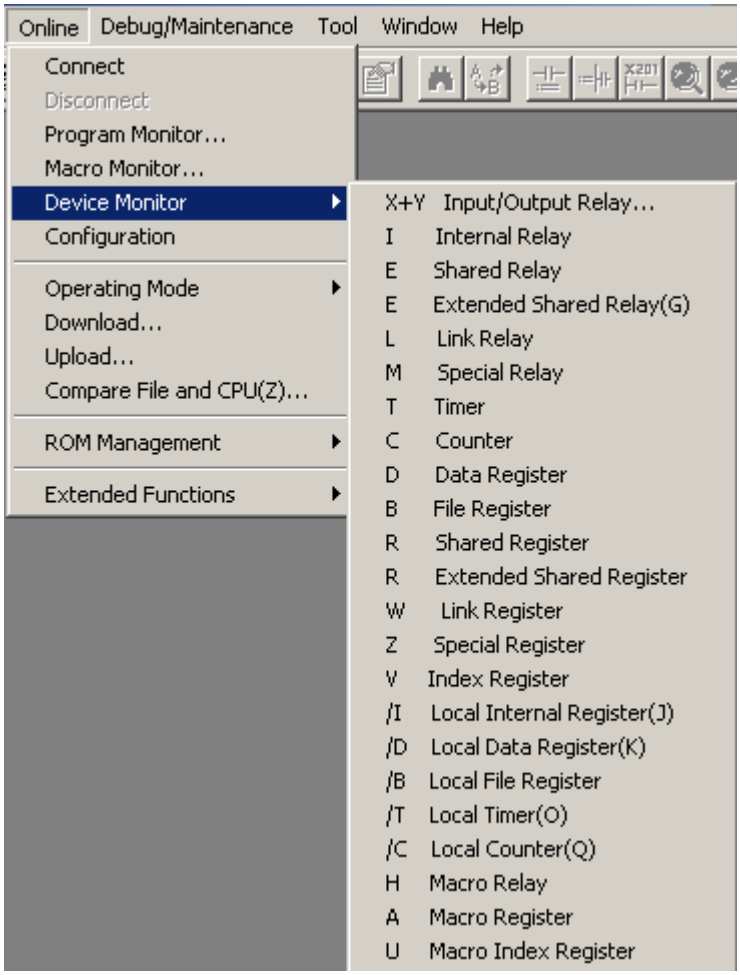


Figure Device Type Sub-menu

2. From the Device Type sub-menu, select the device for monitor display. The monitor screen for the target device appears. (Display is different if [Input/Output relay] or [Local Device] is selected.)

3. If [I/O Relay] is selected, the I/O Configuration screen shown in the figure on the next page appears. Select the slot for monitor display.

TIP

- If the I/O device does not have an I/O relay, the [Input/Output Relay] item will be displayed as inactive and cannot be selected.
- The color of the module name indicates whether the I/O device is used or not used by the program.

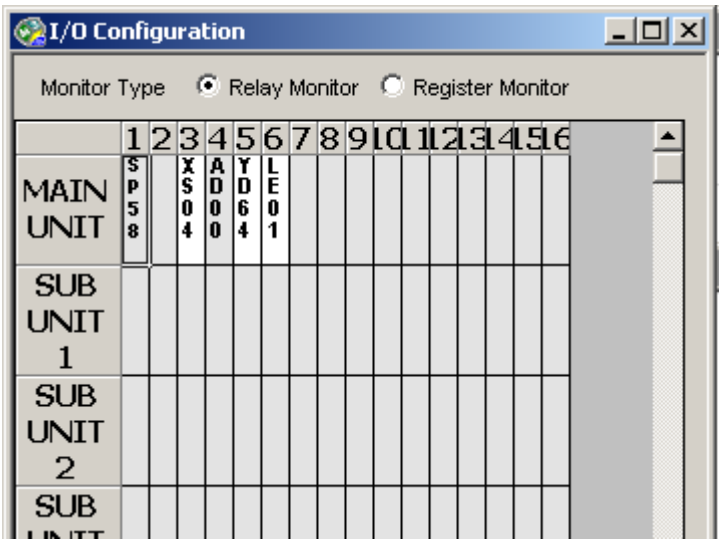


Figure I/O Configuration Screen

4. If [Local Device] is selected, the following dialog box appears. Select the block or macro of the local device to be displayed.

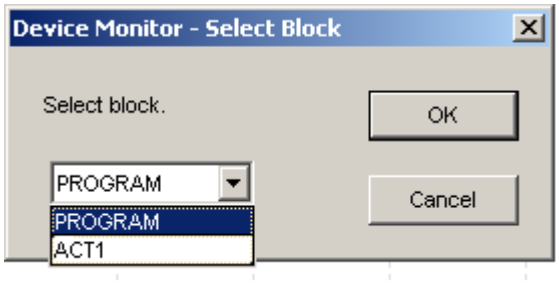


Figure Dialog Box for Selecting Block

TIP

The Device Monitor can display multiple screens even for identical devices or identical I/O relays.

5. Select [File]–[Close].

TIP

The I/O Configuration screen remains displayed even when the device monitor for the I/O relay is closed. To close the I/O Configuration screen, select [File]–[Close] on the I/O Configuration screen.

5.3.6 Debug Functions

The debugging functions are as follows:

- Forced set/reset of relays
- Change data in word/long word units for registers and relays
- Change current value of timers/counters
- Change set value of timer/counters
- Stop refresh
- Start/stop block

The debugging functions can be used when the CPU module's operation mode is in debug mode or stop mode.

■ Forced Setting/Resetting Relays

Forced set/reset forces the specified relay device on or off. A total of up to 32 relay devices can be forced set/reset. The forced set/reset can be carried out on the program monitor or the device monitor screens.

■ Devices that can be Forced Set/Reset

Devices that can be forced set/reset are as follows:

- Input relay X
- Output relay Y
- Internal relay I, /I
- Shared relay and extended shared relay E
- Link relay L
- Special relay M (write-enabled relays)
- Timer (time-up relay) T, /T
- Counter (count-up relay) C, /C

CAUTION

- Do not attempt to carry out a forced set/reset on any special relays that are not write-enabled. Otherwise, it may stop the CPU. See the "Sequence CPU Instruction Manual-Functions (IM34M6P12-03E)" for more details.
- Up to 32 devices can be forced set/reset. Any forced set/reset beyond the maximum will be ignored.
- Devices with index modification cannot be forced set/reset

■ Forced Setting/Resetting the X00801 Relay

1. Display the DEMO2 block monitor.
2. Turn off X00801 first (Next, we will force this relay to ON).
3. Turn on X00802, and then turn it off again. Check that the 3 LED indicators are off.
4. Move the position cursor and click the START (X00801) relay.
5. Select [Debug/Maintenance]–[Forced Set].
6. Click [Yes] to enter debug mode.
7. Relays (Devices) that are forced set or reset are enclosed in a rectangle.
8. Check that the LED indicators are lit.
9. Select [Debug/Maintenance]–[Forced Reset]. The START(X00801) relay resets (turns off).

■ Canceling Forced Set/Reset for the X00801 Relay

1. Check that the forced set/reset device is enclosed in a rectangle.
2. Move the position cursor to the device for which you wish to cancel the forced set/reset.
3. Select [Debug/Maintenance]–[Cancel Forced Set/Reset]. This cancels any forced set/reset for the device at the position cursor. Selecting [Cancel All Forced Set/Reset] releases all devices regardless of the location of the position cursor.

■ Changing the Preset Value of a Timer/Counter

1. First, bring the DEMO2 block monitor into view-details mode.
2. Move the position cursor to the T00001 timer.
3. Select [Debug/Maintenance]–[Change Preset Value of Timer/Counter].
4. Set the preset value to 10s and click [OK].

CAUTION

Even when you perform [Reflect on File], changes in the preset values will still not be reflected in the file. To do so, make the changes using online edit or perform an upload.

5. Set the preset value of counter C00001 to 10 similarly.

■ Changing the Current Value of a Timer/Counter

1. First, bring the DEMO2 block monitor into view-details mode.
2. Move the position cursor to the T00001 timer.
3. Select [Debug/Maintenance]–[Change Current Value of Timer/Counter].
4. Enter 5s to the current value field and click [OK]. Check that the current value is displayed as “5s”.
5. Set the current value of the C00001 counter to 5 counts similarly.
6. Close the block monitor window and the Edit Block window and proceed to the next exercise.

5.4 Exercise 3 (Structured Ladder Programming)

5.4.1 Edit Ladder Diagram

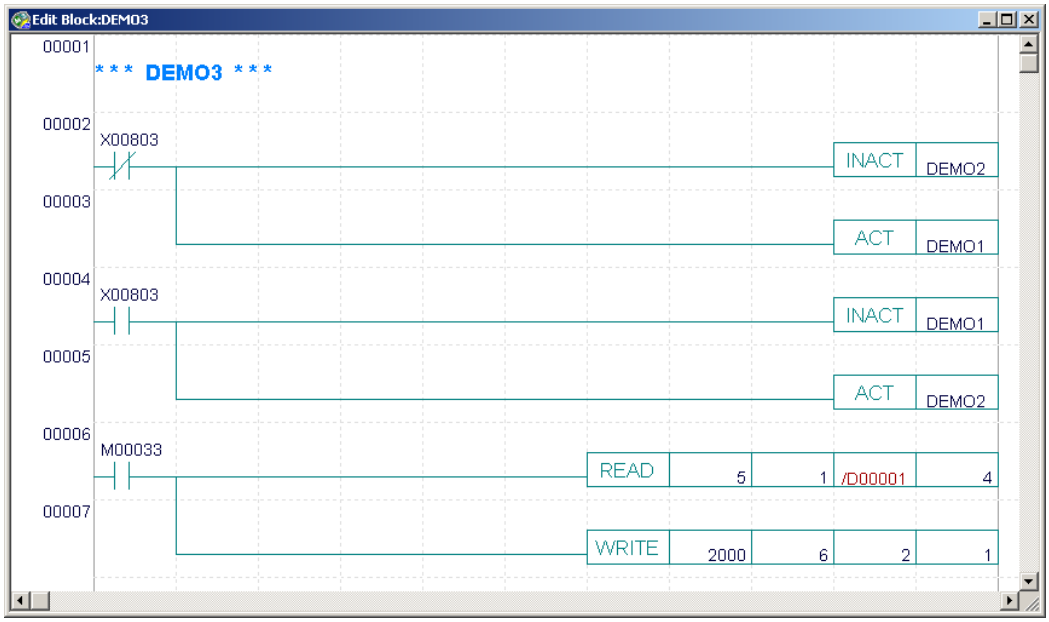
■ Outline of Exercise 3

In Exercise 3, you will perform structured ladder programming by creating a ladder diagram and combining it with the ladder diagrams you created in exercises 2 and 3. Four data registers are used as local devices starting with /D00001.

If X00803 is set to OFF, the program stops DEMO2 and starts DEMO1.

If X00803 is set to ON, the program stops DEMO1 and starts DEMO2.

The CPU reads four input voltages through channels 1-4 of the analog input module (in slot 5), and constantly outputs a value of 2000 through channel 2 of the analog output module (in slot 6).



Notes on Structured Programming

You can divide a ladder program into blocks, using one block for each function.
This provides the following advantages:

- You can standardise and reuse program blocks.
- You can divide the program into a maximum of 1,024 function blocks.
- It allows parallel program development by multiple developers.
- You can modify (debug), maintain or combine the individual blocks more easily.

■ Creating Block DEMO3

1. Select [File]–[New].
2. Enter “DEMO3” as the file name and click [OK].
3. Set the number of data registers used as local devices to 4, and click [OK].
4. Create the diagram as shown below and save it.

Notes on the READ/WRITE Instruction

Explanation on the READ/WRITE parameters used in this exercise is given below.

READ	5	1	/D00001	4
↑	↑	↑	↑	↑
Special module read instruction	Slot number where the analog input module is installed	Data position number of analog input value in channel 1	First device number for storing the read data	Number of data values to be read

The above READ instruction reads 4 data values from channel 1 of the analog input module in slot 5, and store them in /D00001 to /D00004

WRITE	2000	6	2	1
↑	↑	↑	↑	↑
Write instruction	Data to write	Number of the slot where the analog output module is installed	Data position number of analog output value in channel 2	Number of data values to write

The above WRITE instruction writes a value of 2000 to channel 2 of the analog output module installed in slot 6.

5.4.2 Setting Configuration

The contents of the configuration setup depend on the CPU type. Configuration setting items are as follows:

- Device Capacities
- Setup Data Lock-up Range at Power Failure/Local Devices
- Operation Control
- Setup Data Register Initial Data
- Setup DIO
- Setup FA Link
- Sampling Trace
- Setup Communication
- Setup ROM
- Setup Interrupt (only available for F3SP28, 38, 53, 58 and 59)
- Setup Shared Refreshing (only available for F3SP28, 38, 53, 58 and 59)

The following pages show the setting of the items that are more commonly set: device capacities, data lock-up range at power failure/local devices and operation control.

For details, refer to the instruction manual (IM 34M6Q15-01E).

■ Setting Device Capacities

The capacity for each type of device can be set.

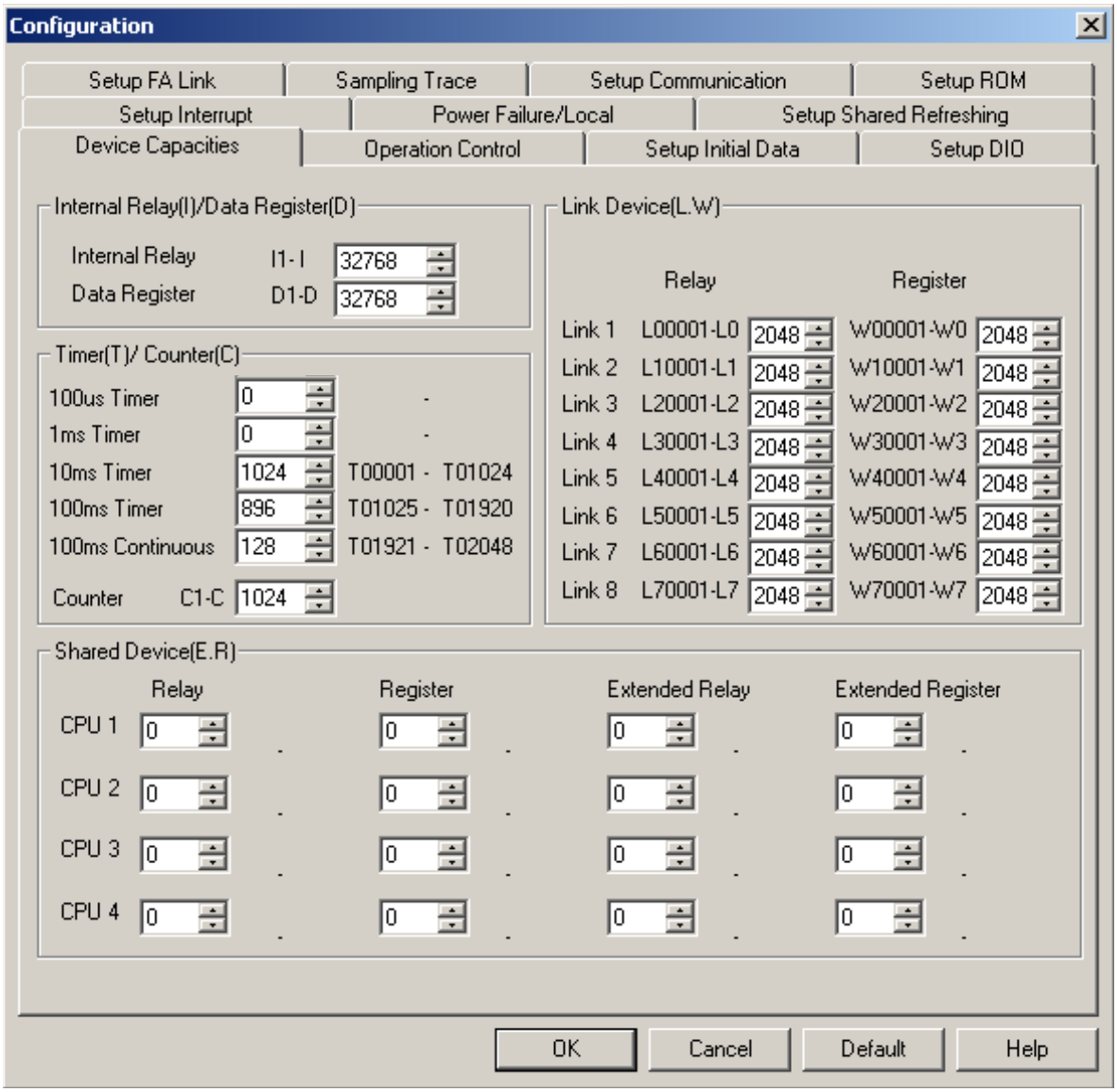


Figure Screen for Setting Device Capacities

Table Input Items for Setting Devices

Setting Item	Setting Method	Comments
Capacities of Internal Relay (I) and Data Register (D)	Set using the keys or the spin buttons.	
Capacities of Timer (T) and Counter (C)	Set using the keys or the spin buttons.	The starting number and ending number for each type of timer is shown.
Link Device (L) and (W)	Set each system number using the keys or the spin buttons.	
Shared Device (E, R)	Set each CPU using the keys or the spin buttons.	The starting number and ending number for each CPU is shown.

■ [Power Failure/Local] Tab

Use this tab to set up the data lock-up range at power failure and the local device range for various devices.

Set the starting number for the local devices (four data registers) to be used in DEMO3 after defining program components (see Section 5.4.4, "Defining Program Components and Downloading").

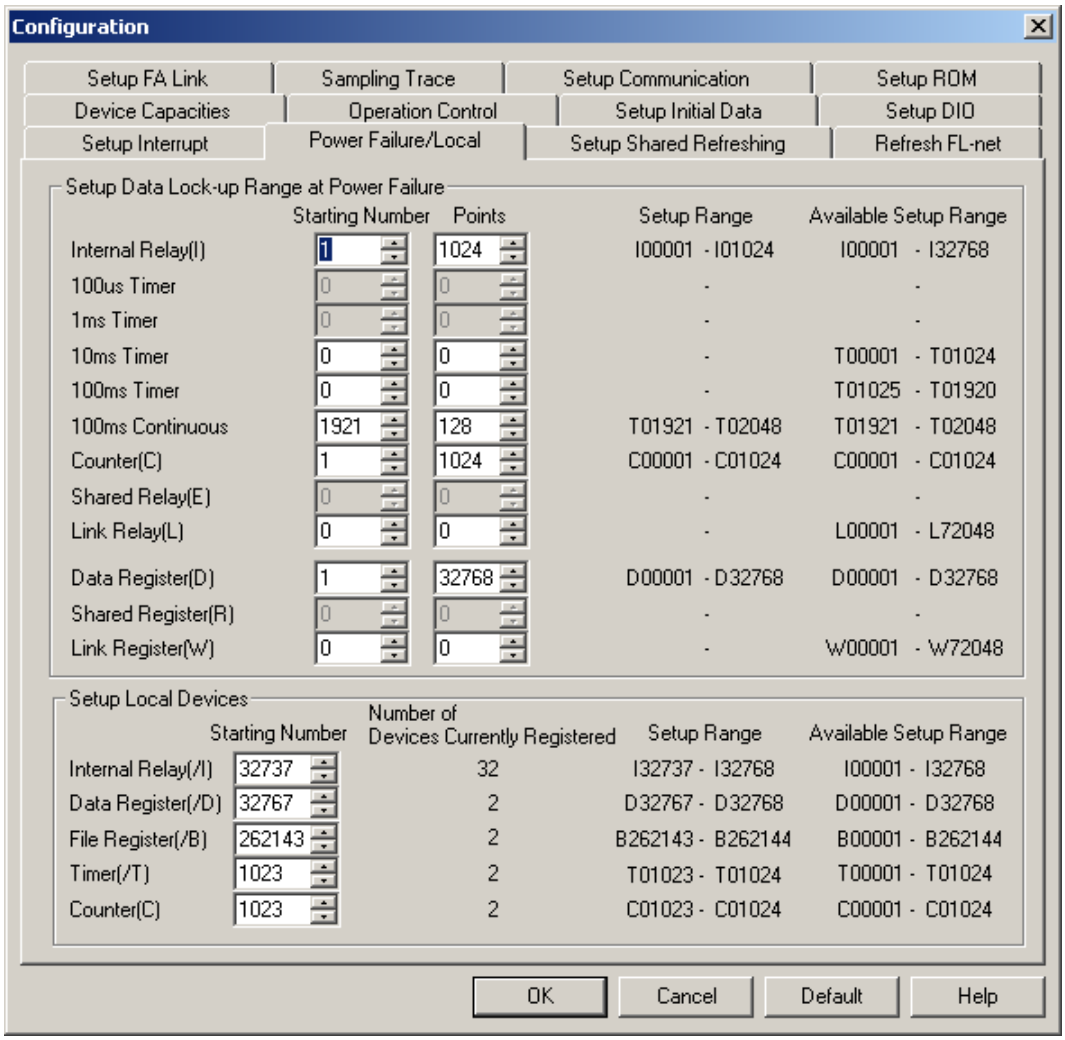


Figure [Power Failure/Local] Tab

Table Input Items for Setting Device Extensions

Setting Item	Setting Method	Comments
Setup Data Lock-up Range at Power Failure	Set each device using the keys or the spin buttons.	Set device capacities within range. The starting number and ending number are shown.
Setup Local Devices	Set the starting number for each device using the keys or the spin buttons.	The total number of devices registered for the block is displayed. Set the device capacities within range.

■ Setting Operation Control

The operation method can be set.

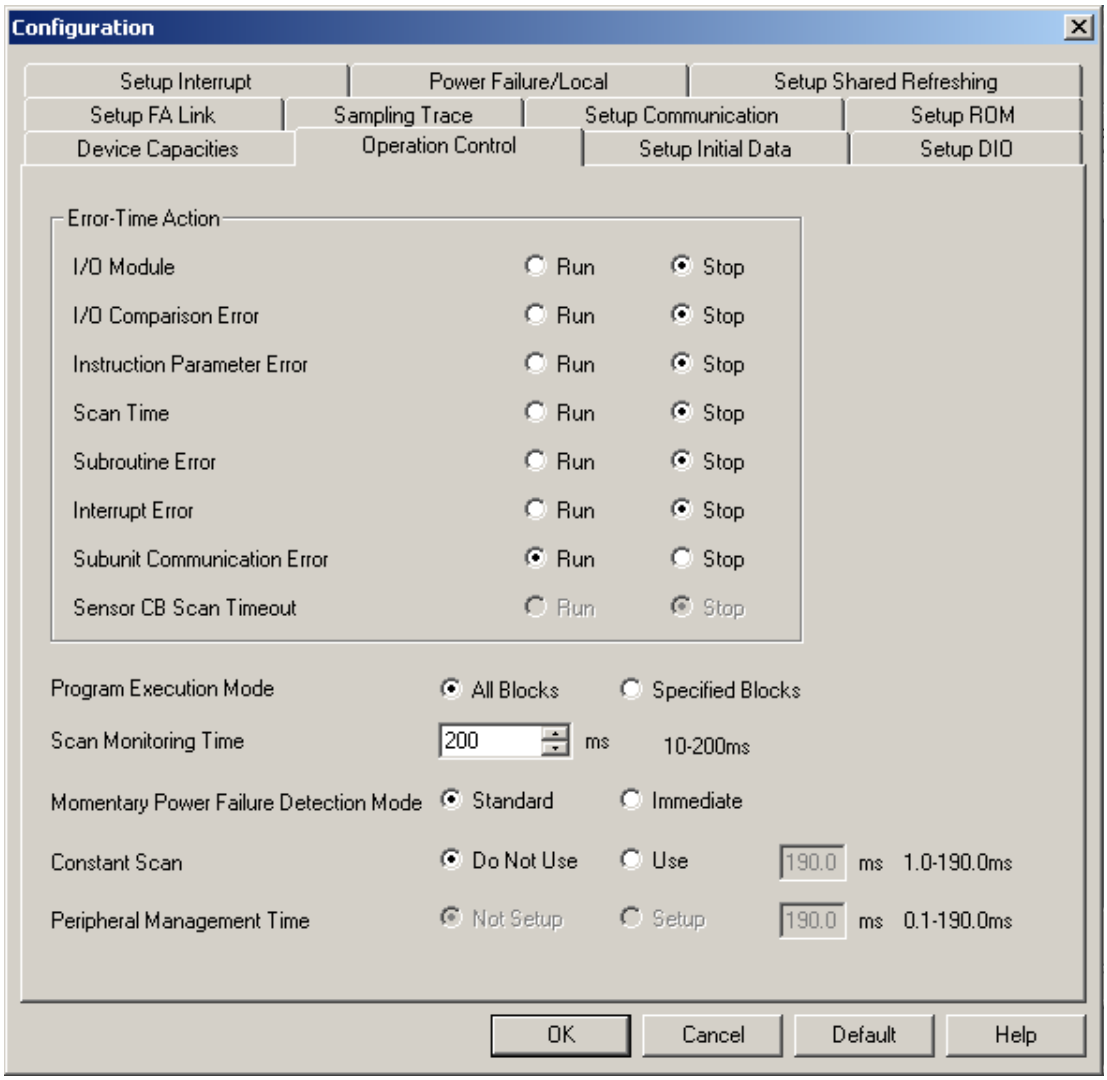


Figure Screen for Setting Operation Control

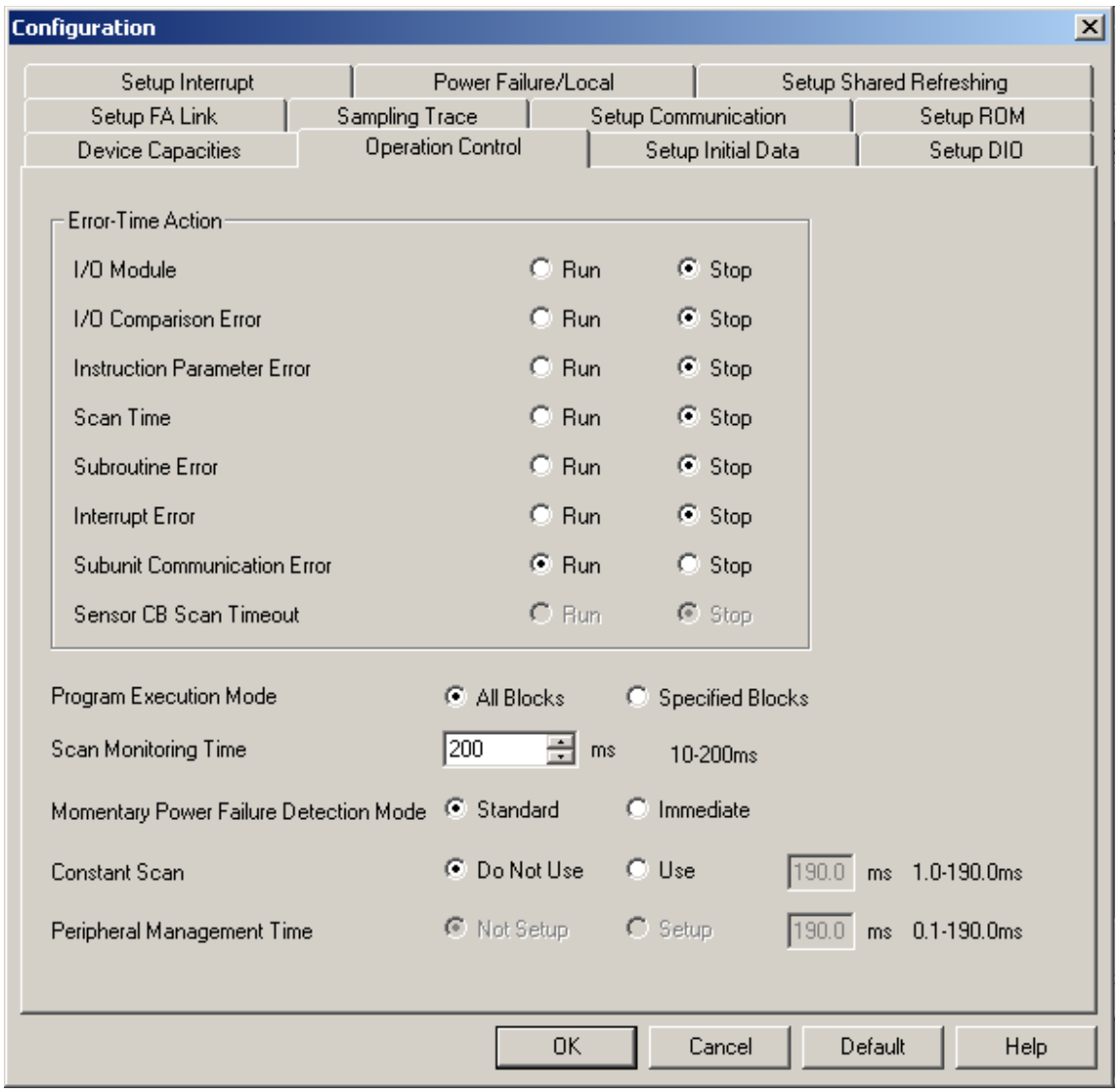
Table Input Items for Setting Operation Control

Setting Item	Setting Method	Comments
Error-Time Action	Click on the [Run] or [Stop] radio buttons.	
Program Execution Mode	Click on the [All Blocks] or [Specified Blocks] radio button.	
Scan Monitoring Time	Set the time using keyboard input.	
Momentary Power Failure Detection Mode	Click on the [Standard] or [Immediate] radio button.	
Constant Scan	Click on the [Use] or [Do Not Use] radio button, and if [Use] is clicked, enter the time from the keyboard.	
Peripheral Management Time	Click on the [Not Setup] or [Setup] radio button, and if [Setup] is clicked, enter the time from the keyboard.	

5.4.3 Setting Program Execution Mode

ACT/INACT instructions are instructions for starting and stopping a block. To use these instructions in a program, the program execution mode on the [Operation Control] tab in the configuration should be set to [Specified Blocks].

1. Select [Project]–[Configuration].
2. Select the [Operation Control] tab, set the program execution mode to [Specified Blocks] and click [OK].

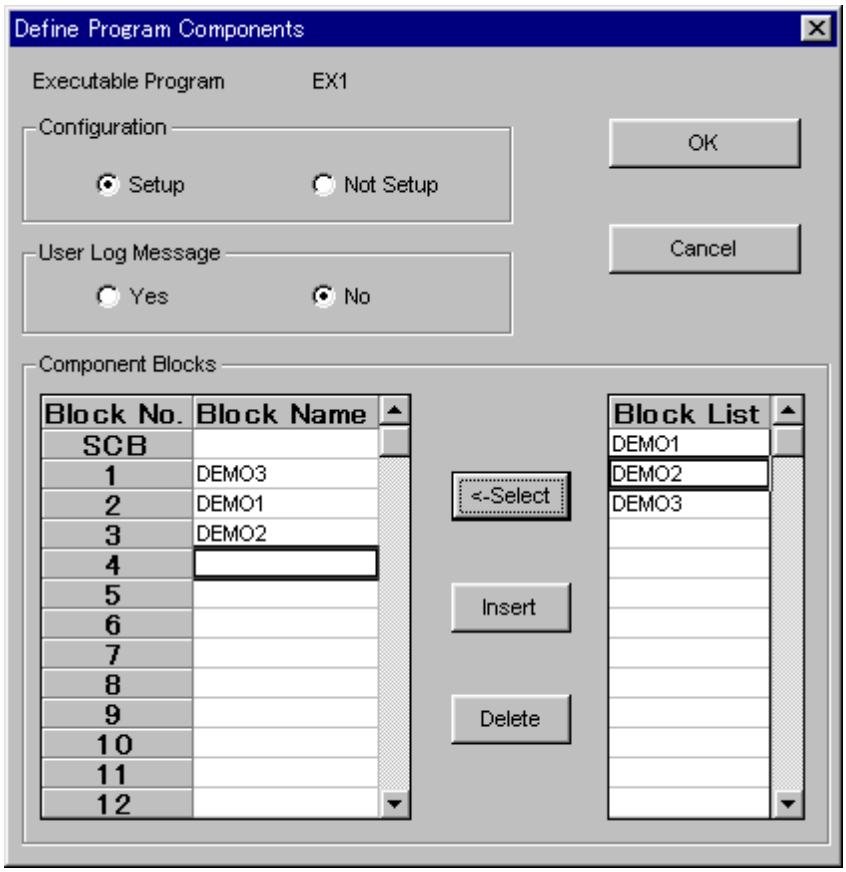


5.4.4 Defining Program Components and Downloading

1. Select [Project]–[Define Program Components].
2. Set DEMO3 to block number 1, DEMO2 to block number 2 and DEMO3 to block number 3 as shown in the figure below using the [Select] button.

CAUTION

If [Run Specified Block] is selected in the configuration, the block registered in block number 1 will be started.



3. Confirm that [Configuration] is set to [Setup], and click [OK].
4. Select [Project]–[Configuration], and click the [Power Failure/Local] tab.
5. Set the starting number for the four data registers used as local devices to a number equal to the upper limit of the available setup range minus 3.
6. Click [OK] to close the Configuration screen.
7. Select [Project]–[Check Program].
8. Select [Online]–[Download] to download the project. At this time, the message “Warning encountered. Transfer?“ is displayed. Click [Yes].
9. A duplicate use of coil warning message is displayed. The program is downloaded normally and starts running.

5.4.5 Checking the Operation

1. Select [Online]–[Program Monitor] and double-click DEMO3. The DEMO3 block monitor is displayed.
2. You can display multiple windows. Open the DEMO1 and DEMO2 block monitors too.
3. Turn off X00802, turn on X00801 and then turn it off again, and turn on X00803. DEMO2 starts.
4. Turn off X00803. DEMO1 starts.
5. You can see the active status of blocks (1 or 0) in the Select Block (Run Block Monitor) window.
6. You can select DEMO3 in the Select Block (Run Block Monitor) window and start (active status 1) or stop (active status 0) the block by selecting [Debug/Maintenance]–[Start Block] or [Stop Block]. (The ACT/INACT instructions of the program have priority over the start/stop operations here. For example, if DEMO3 is running, DEMO1 and DEMO2 are controlled by X00803)

CAUTION

If the program execution mode in the configuration is set to [Run All Blocks], individual blocks cannot be started or stopped. Instead, use [Online]–[Operation Mode]–[Run]/[Stop].

7. Input an analog voltage within the range of 0-5 V. Check that the value of /D00001 changes accordingly.
8. Check that the voltage meter reads 1 V (corresponding to an analog output data value of 2000).

5.4.6 Online Editing

Online editing is a function that modifies a CPU program while it is running. Online editing can be used when the CPU is in the debug or stop mode. Online editing can be used for blocks and macros.

Multiple users may edit the same program online concurrently provided they are editing different blocks or macros. Multiple users may not edit the same block or macro at the same time.

CAUTION

Do not online-edit a program that is currently controlling a machine. The scan time at the end of online editing is usually longer because of the time taken to reflect the online-edited program on the sequence CPU module. During this period, I/O devices cannot be refreshed and external devices cannot communicate with the CPU, which may cause unexpected machine operation.

CAUTION

- If another terminal has online-edited a block that you are online-editing, you cannot overwrite the changes and continue online editing. A warning message will be displayed. If so, terminate your online editing session without reflecting the edited program on the CPU.
- If another terminal has online-edited a block that you are monitoring so that the actual content of the block and the content displayed in the monitor is no longer the same, online editing cannot be started. In this case, close and reopen the monitor window before starting online editing.
- Online-editing a program in a window does not reflect the changes to the CPU. The edited program is reflected on the CPU only when you select [Convert] from the menu.
- Conversion is automatically performed after the following operations: [Delete] in line units, [Cut] in line units or [Delete Line]. Thus, changes made in line units are reflected on the CPU immediately.

  If you want to confirm line deletion operations only upon conversion, use [Temporary Delete]. Temporarily deleted lines are displayed with a different background color. Temporarily deleted circuits are permanently deleted when conversion is executed.
- If there is a conversion error, then only contents of areas without errors will be reflected on the CPU. To update all changes and exit, correct the conversion error. You may choose to exit without reflecting the invalid areas to the CPU but this may result in a displaced circuit comment in subsequent uploading if there was a conversion error in a circuit before or after the circuit comment.
- Copy, Paste and other editing functions that are available offline are also available online except that data copied offline cannot be pasted online.

■ Changing Data Using Online Edit

1. Open the DEMO3 program monitor window and close other windows.
2. Select [Debug/Maintenance]–[Start Online Editing]. [Online Editing] is displayed in the title bar of the block monitor.
3. Click [Yes] to enter debug mode.
4. Double-click data [2000] on the last line. The WRITE instruction parameter setting window is displayed.
5. Delete 2000, enter D1 and click [OK].
6. Select [Debug/Maintenance]–[Exit Online Editing].
7. Click [Yes] to write the changes to the CPU.
8. Change the input voltage (0-5V) and check that the needle of the voltage indicator changes with the data value.
9. Select [Online]–[Operation Mode]–[Run] to enter run mode.

■ Reflect to File during Online Edit

1. Select [File]–[Reflect on File]. (To reflect changes to a new file or to a different file name, select [Reflect on Another File])
2. Double-click DEMO3 from the block list in the project window to display the Edit Block window.
3. Check that the data changes have been reflected.

6. Maintenance Functions

These are functions to monitor the FA-M3's operation status and errors. The following functions are available.

● Display Alarm

This function displays any error and alarm status, which is currently generated.

● Display System Log

The FA-M3 stores events such as errors and power on along with time information in the CPU. You can use this function to display, save to file or print the system log.

● Display User Log

By executing a User Log instruction, an operation history of the user system such as errors, etc. can be stored to the CPU. You can use this function to display, save to file, and print the user log.

● Compare

This function compares the executable program in a project with the executable program downloaded to the CPU.

6.1 Display Alarm

This displays the status of alarms and errors currently generated in the connected FA-M3.

■ Layout of the Alarm Display Screen

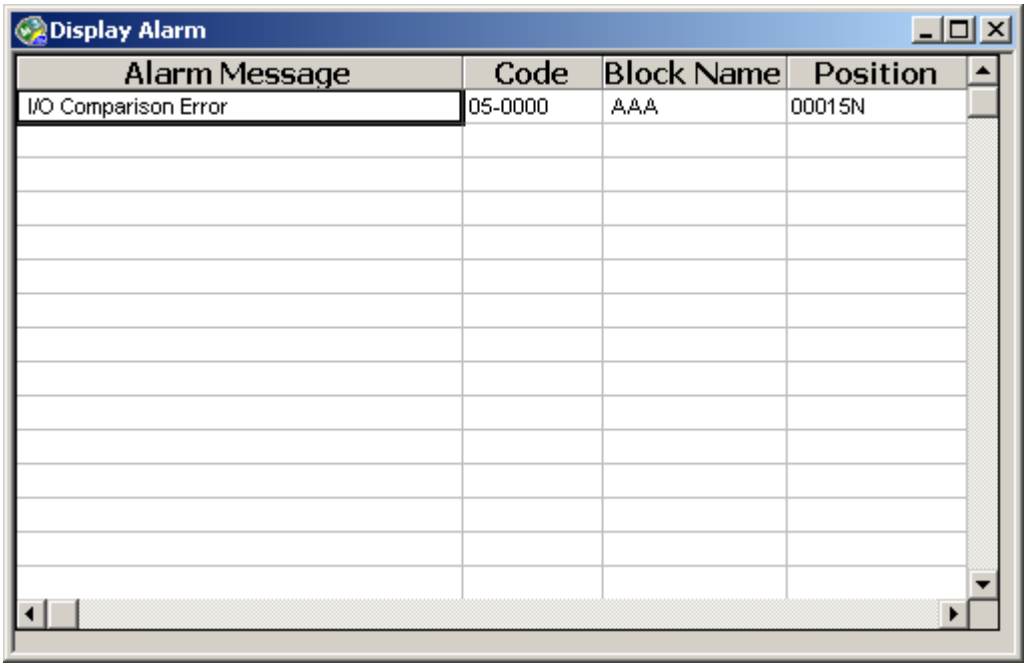


Figure Alarm Display Window

- Alarm message : The contents of the alarms will be displayed. Up to 128 messages can be displayed.
- Code : The alarm code
- Block name : The block where the alarm was generated
- Instruction number/slot number : Instruction number where the alarm was generated or the module slot number where the I/O error occurred

■ Displaying the Alarm Display Screen

1. While connected to the FA-M3, select [Debug/Maintenance]–[Display Alarm]. The alarm display screen will be displayed. [Display Alarm] in the menu will change to [Redisplay Alarm].
2. Select [Debug/Maintenance]–[Redisplay Alarm] and the current alarm status will be read from the CPU and redisplayed.

■ Canceling Alarms

This resets the alarm state (cancels non-fatal errors). Alarms that were generated in the past and are not now being generated will be canceled.

1. Select [Debug/Maintenance]–[Cancel Alarm].

■ Error Messages Displayed in the Alarm Monitor

This displays the error status output of the sequence CPU module. See the self-diagnosis section in the “Sequence CPU Instruction Manual-Functions” for further details.

Table Alarm Messages

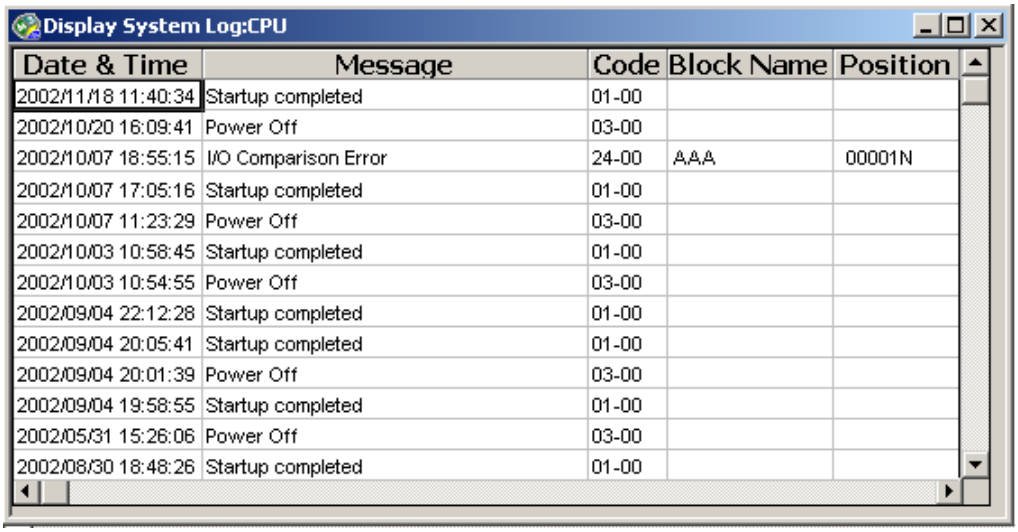
Message	Code	Description	Trouble-shooting
Self-diagnostics error	01-1002	The number of modules exceeds the range allowed by the CPU.	Check the module to be used
	01-1003	Module mapping error	Replace the hardware
	01-1004	Module access error	
	01-1005	System error	
	01-11XX	SPU error	
	01-1201	Program memory error	
	01-1202	Device memory error	
	01-1203	System memory error	
	01-1701	Invalid instruction found	
	01-1702	No END instruction	
	01-2001	Label mismatch	Modify the program
	01-2002	Maximum number of I/O points exceeded	
	01-8203	ROM cassette error (incompatible model)	Correct the ROM usage
	01-8204	ROM cassette error (cannot read)	Program is protected or hardware failure
Momentary power failure	02-0000	Momentary stop occurred	
Inter-CPU communication error	03-0000	Hardware failure	Replace the hardware
Instruction processing error	04-2101	Invalid instruction parameter range	Modify the program
	04-2102	Incorrect operation results	
	04-2103	Incorrect BIN/BCD conversion	
	04-2104	Invalid FIFO table pointer	
	04-2105	Device boundary exceeded	
	04-2106	FOR-NEXT mismatch	
	04-2201	Subroutine return destination does not exist	
	04-2202	Subroutine nesting exceeded 8	
	04-2301	Interrupt instruction return destination does not exist	
	04-2302	Subroutine wait exceeded 8	
	04-2501	Marco instruction return destination does not exist	
I/O comparison error	05-0000	I/O module installed state and program mismatch	
I/O error	06-0000	Cannot read/write to I/O module	Replace the hardware
Scan timeout	07-0000	Exceeded the scan timer monitoring period	Modify the program
FA link (1-8) error	09-0000 0A-0000 0B-0000 0C-0000 0D-0000 0E-0000 0F-0000 10-0000	FA link setting is incorrect	Correct the FA link setting
Battery error	11-0000	Battery error	Replace the CPU

Message	Code	Description	Trouble-shooting
Sub-unit transmitter error	12-0000	Cannot read/write to the module installed in the sub-unit	• Turn ON the sub-unit power supply • Check the optical FA bus or the optical FA bus 2 cables
Sub-unit transmitter switching has occurred	13-0000	Transmitter cable breakage in loop-connected remote I/O system	• Replace the optical FA bus or the optical FA bus 2 cables
Sensor control block scan timeout	14-0000	Exceeded the scan time monitoring period of the sensor control block	Modify the program.
**********	XX-XXXX	An undefined error has occurred	

6.2 Display System Log

This displays, saves to file, and prints log data such as errors or power ON events stored in the CPU. It can store a maximum of 70-150 pieces of data in memory, although the exact number varies according to the kind of information. As soon as it reaches capacity, it erases old data, starting with the oldest data, and stores new data.

■ Display System Log Screen Layout



Date & Time	Message	Code	Block Name	Position
2002/11/18 11:40:34	Startup completed	01-00		
2002/10/20 16:09:41	Power Off	03-00		
2002/10/07 18:55:15	I/O Comparison Error	24-00	AAA	00001N
2002/10/07 17:05:16	Startup completed	01-00		
2002/10/07 11:23:29	Power Off	03-00		
2002/10/03 10:58:45	Startup completed	01-00		
2002/10/03 10:54:55	Power Off	03-00		
2002/09/04 22:12:28	Startup completed	01-00		
2002/09/04 20:05:41	Startup completed	01-00		
2002/09/04 20:01:39	Power Off	03-00		
2002/09/04 19:58:55	Startup completed	01-00		
2002/05/31 15:26:06	Power Off	03-00		
2002/08/30 18:48:26	Startup completed	01-00		

Figure Display System Log Screen

- Date, time: : The date and time of logging is displayed as yyyy/mm/dd hh:mm:ss
- Message: : Log messages. The messages are displayed starting with the most recent data
- Detail code: : Error codes.
- Block name: : The name of the block where the error was generated is displayed.
- Instruction/Slot number : XXXXN is displayed for instruction numbers, and SLOT=XXXX for slot numbers.

SEE ALSO

See “Messages Displayed in the System Log” for a more detailed discussion of messages and codes in the system log.

■ Displaying the System Log

1. Select [Debug/Maintenance]–[Display System Log] while connected to the FA-M3. The system log display screen will appear. The [Display System Log] menu will change to [Redisplay System Log].
2. Selecting [Debug/Maintenance]–[Redisplay System Log] will read the most recent system log from the CPU and redisplay it.

■ Saving the System Log File

1. With the system log display screen open, select [File]–[Save As]. The following dialog box will be displayed.

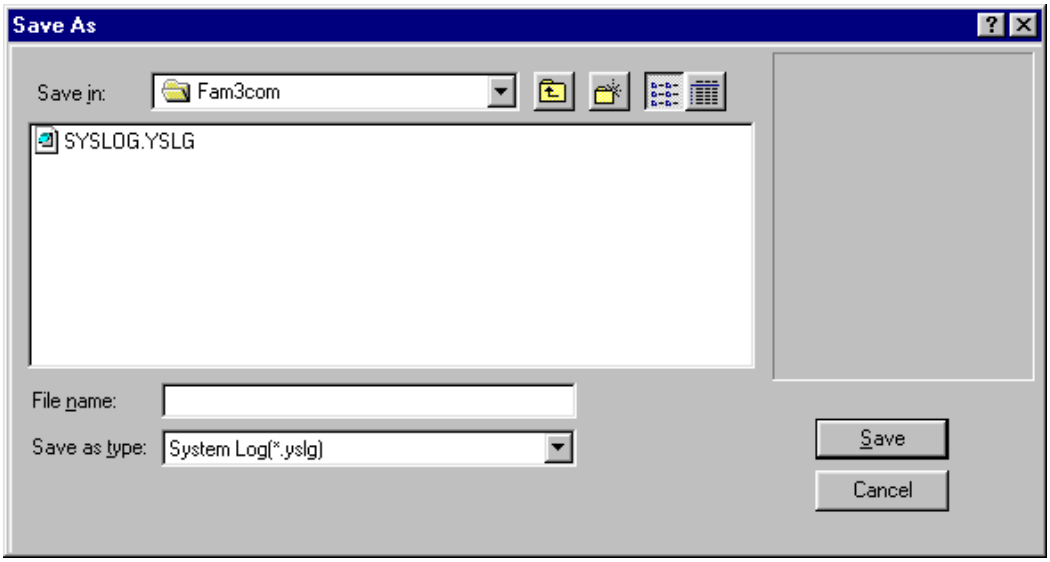


Figure Save System Log Dialog Box

2. Enter the file name in the File Name field and click the [Save] button.
3. The system log will be saved with the file extension ".yslg".

■ Reading From the System Log File

This reads the system log saved to a file.

1. Select [File]–[Open]–[Log File]. The following dialog box will be displayed.

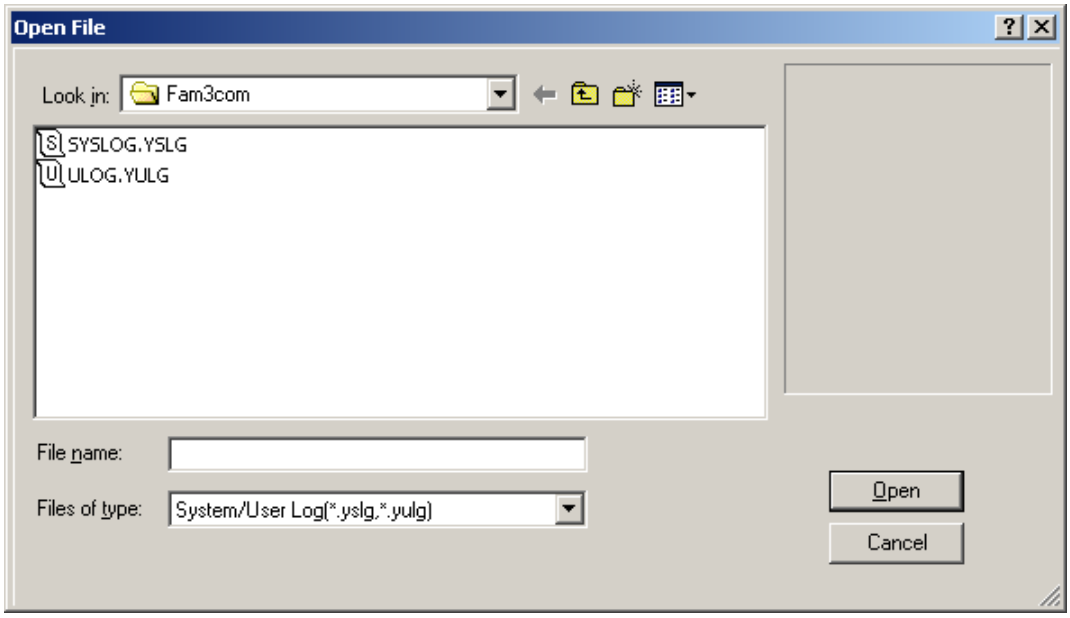


Figure Dialog Box for Opening a Log File

2. Select the file to be read from the displayed list of log files and then click the [Open] button.
3. The contents of the specified log file will be displayed.

■ Clearing the System Log

This clears the system log stored in the CPU.

1. With the CPU's Display System Log screen open, select [Debug/Maintenance]–[Clear Log].

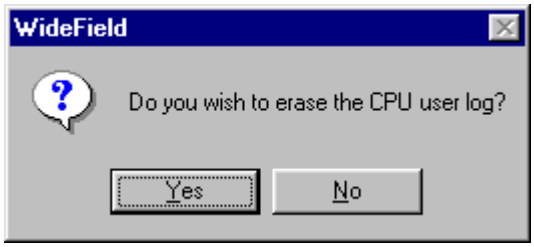


Figure System Log Clear Confirmation Dialog

2. Selecting [Yes] will clear the system log stored in the CPU, and the contents of the Display System Log screen will be redisplayed.

■ Messages Displayed in the System Log

This displays the operation log of the sequence CPU module. For further details, see the self-diagnosis section in the “Sequence CPU Instruction Manual-Functions.”

Table System Log Messages

Message	Description	Action
Startup completed	Initialization after power OFF completed normally	None
Momentary power failure	Momentary power failure has occurred	None
Power off	Power is off	None
Startup error	Error occurred during initialization after power supply turns ON	Replace the hardware
SPU error	Sequence CPU error	Replace the hardware
Memory error	Memory error	Replace the hardware
Battery error	Battery error	Replace the CPU
Scan timeout	Exceeded the scan timer monitoring period	Modify the program
Invalid instruction found	An invalid instruction is detected	Replace the hardware
FA link (1-8) error	FA link setting is incorrect	Correct the FA link setting
Program error	Program is incorrect	Replace the hardware
Instruction error	Error occurred during instruction execution	Modify the program
Subroutine error	Subroutine mapping error	Modify the program
Interrupt error	• Interrupt instruction return destination does not exist • Interrupt wait exceeded 8	Modify the program
I/O comparison error	• I/O module installation status and program mismatch • Using READ/WRITE on DIO • Using HRD/HWR instruction on DIO	Modify the program
Macro instruction error	Marco instruction return destination does not exist	Modify the program.
Inter-CPU communication error	Hardware failure	Replace the hardware
ROM cassette error	ROM cassette error	Replace the ROM cassette
I/O error	Cannot read/write to I/O module	Replace the hardware
Sub-unit transmitter error	Cannot read/write to the module installed in the sub-unit	• Turn ON the sub-unit power supply • Check the optical FA bus or the optical FA bus 2 cables
Sub-unit transmitter switching occurred	Transmitter cable breakage in loop-connected remote I/O system	• Replace the optical FA bus or the optical FA bus 2 cables

6.3 Display User Log

■ User Log

The user log functio1n, just like the system log function, records data that is generated such as user system errors or operation status. The user log function records data generated by user programs. The recorded data is called the user log and can be read using an instruction or the programming tool.

- The user log data is recorded by executing a user log instruction in a program. Up to 64 pieces of user log data can be recorded per CPU.
- The date and time of generation, the main code (1 word), and the sub-code (1 word) are recorded as user log data.
- You can store up to 64 messages corresponding to the main code (32 single-byte characters) in the CPU.
  You can also attach these messages to the main code and sub-code when you read the user log data.
- If the recorded user log data exceeds 64 pieces, it will be erased starting from the oldest data, and any new data will be appended.
- The recorded user log data can be read using the programming tool or a User Log Read instruction.
- The number of pieces of recorded user log data is stored in the Z105 special register.

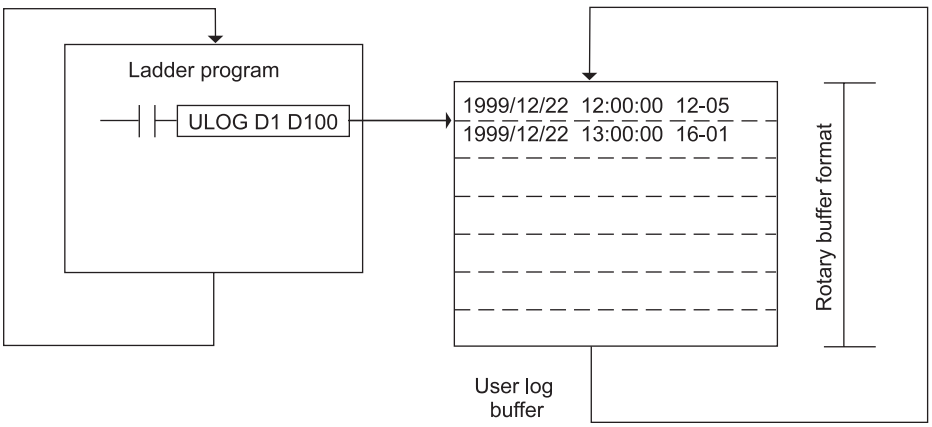
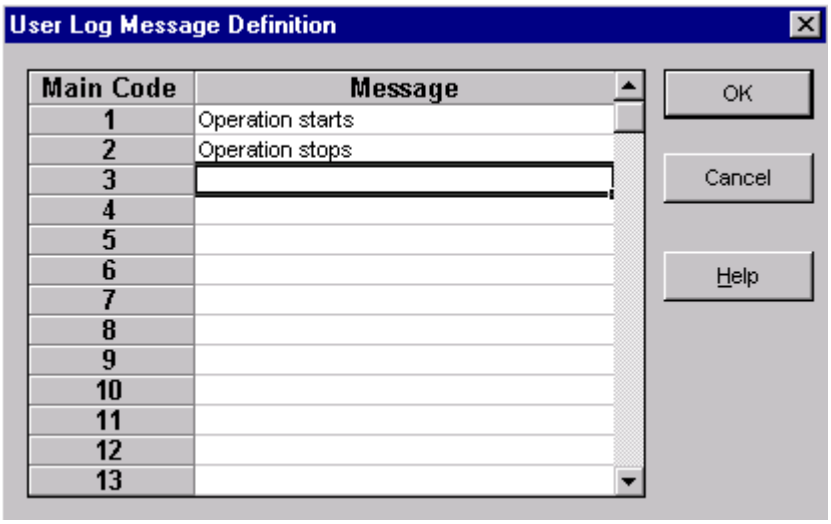


Figure User Log Function

■ Defining User Log Message

1. Select [Project]–[User Log Message].
2. Enter the messages for main code 1 and main code 2 as shown below.



■ Adding a User Log Save Instruction

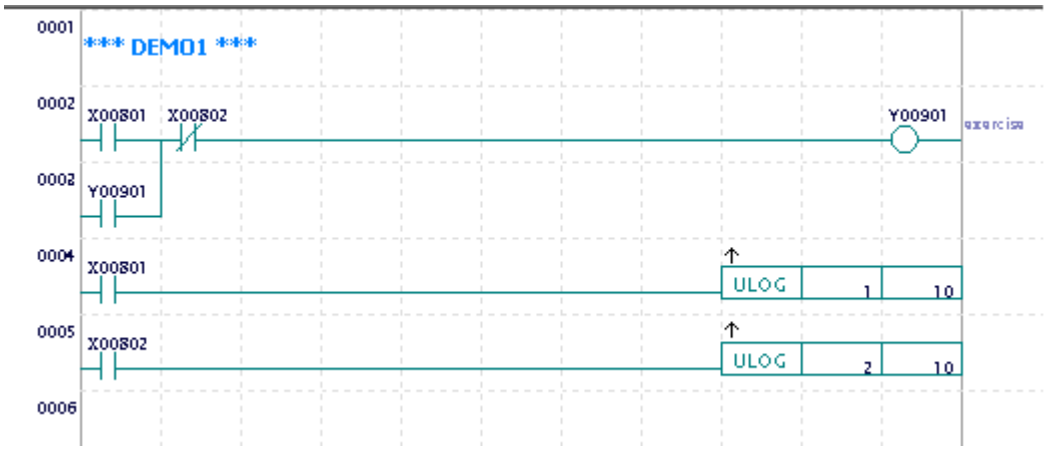
1. Double-click DEMO1 from the block list in the project window.
2. Add the User Log Save instruction shown below and save the file.

TIP

Meaning of instruction operands

S1 : Main Code. Describes the main code (1-64) representing the message.

S2: Sub Code. You can use this to define other information additional to the main code. (constant/register value, etc.)

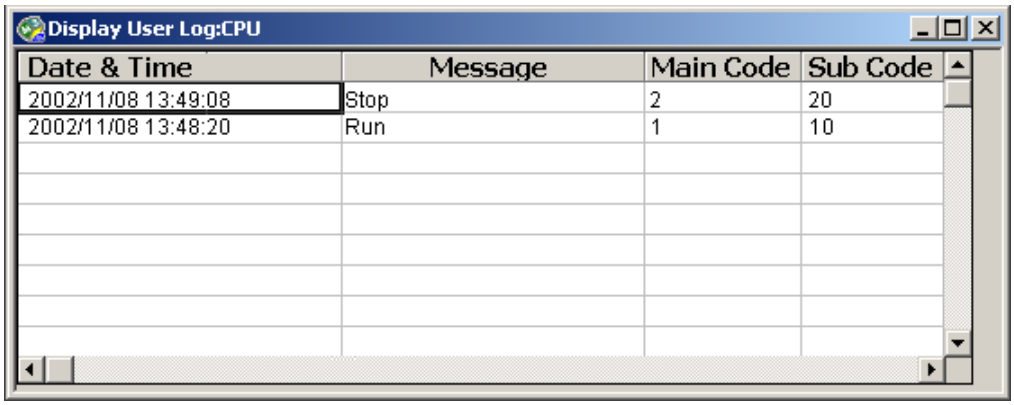


■ Defining and Downloading Program Components

1. Select [Project]–[Define Program Components].
2. Select [Yes] for the user log message item and click [OK].
3. Select [Online]–[Download] to download the program.
4. Turn off X802, turn on X801 and then turn if off again.
5. Turn on X802 and then turn if off again.

■ Displaying the Display User Log Screen

1. Select [Debug/Maintenance]–[Display User Log] while connecting to the FA-M3. The Display User Log screen appears. The [Display User Log] menu item changes to [Redisplay User Log].
2. Selecting [Debug/Maintenance]–[Redisplay User Log] reads the most recent user log information from the CPU and redisplays it.



■ Saving a User Log File

1. With the Display User Log screen open, select [File]–[Save As]. The following dialog box will be displayed.

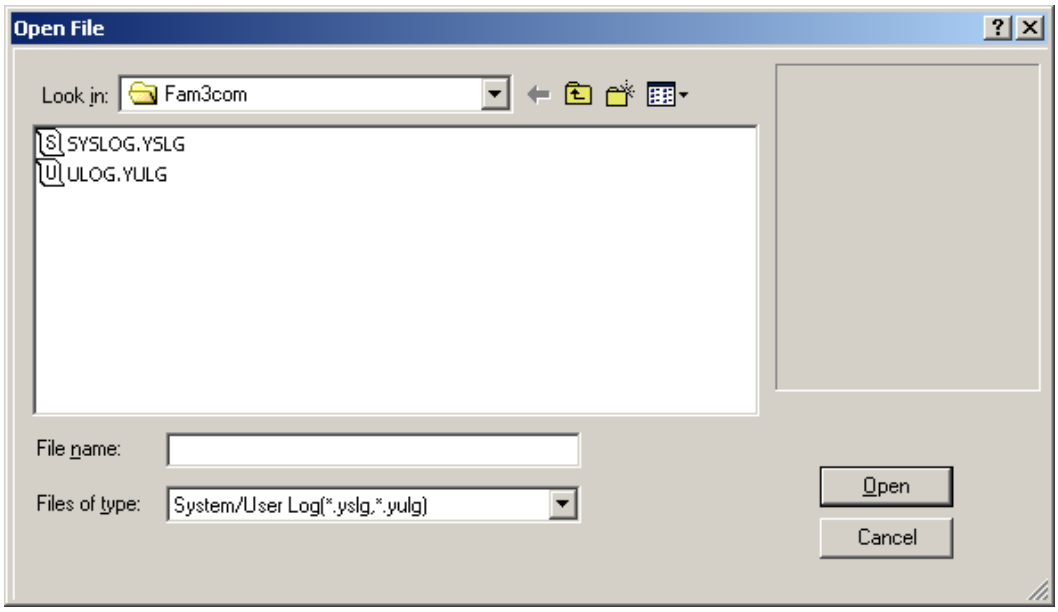


Figure Save User Log Dialog Box

2. Enter the file name in the [File Name] field and click the [Save] button.
3. The user log will be saved with file extension .yulg.

■ Reading from a User Log File

This reads the user log saved to a file.

1. Select [File]–[Open]–[Log File]. The following dialog box will be displayed.

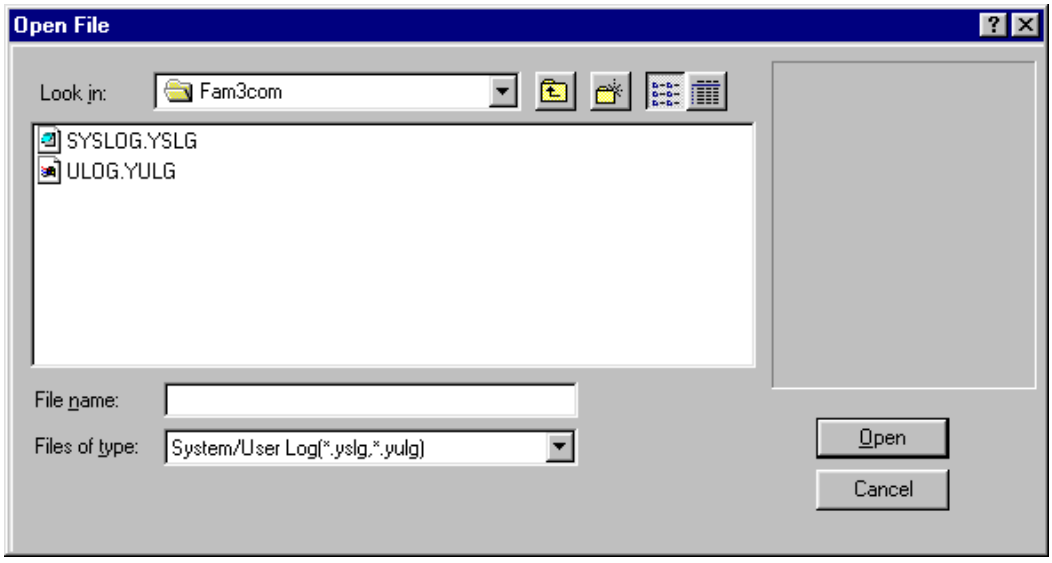


Figure Open Log File Dialog Box

2. Select the file to be read from the list of log files displayed and select the [Open] button.
3. The contents of the specified log file will be displayed.

■ Clearing the User Log

This clears the user log stored in the CPU.

1. With the Display User Log screen open, select [Debug/Maintenance]–[Clear Log].

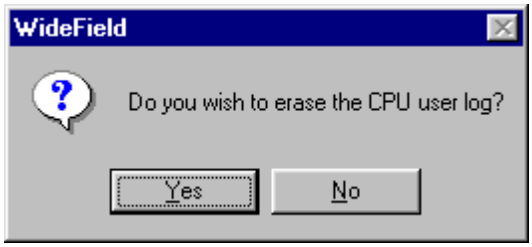


Figure Clear User Log Confirmation Dialog

2. Selecting [Yes] will clear the user log stored in the CPU and the contents of the Display User Log screen will be redisplayed.

6.4 Comparing Executable Programs

This compares executable programs downloaded to the FA-M3 and executable programs in the computer. The compare function compares executable program files managed in an open project, as well as configuration and user log messages.

■ Contents of the Compare

The following items are compared during the program comparison.

- Executable program configuration
  Number and names of blocks, etc.
- Configuration data
  Values of the configuration settings
- Contents of programs in each block
  Compares instructions, devices, and labels in 1-circuit units.
- User log messages
  Number of registered user log messages and their contents
- Position of circuit comments and sub-comments
  Compares whether a circuit comment and a sub-comment occupy the same position.

■ Limitations on the Compare Function

The Compare function cannot be used when the system is in the following states.

- A project is not opened.
- No CPU is attached, or the attached CPU is not a sequence CPU.
- The CPU type set in the open project is different from the connected CPU.
- A ROM pack is attached to the CPU.
- The CPU's operation mode is set to ROM writer mode.
- The CPU is running a process from another computer.

■ Procedure for Comparing

1. Select [Online]–[Compare File and CPU] with a project open and while connecting to the FA-M3.
2. The following dialog box will be displayed, along with all data being currently processed. The comparison first uploads a program, and then compares it. Selecting the [Cancel] button will stop the compare.

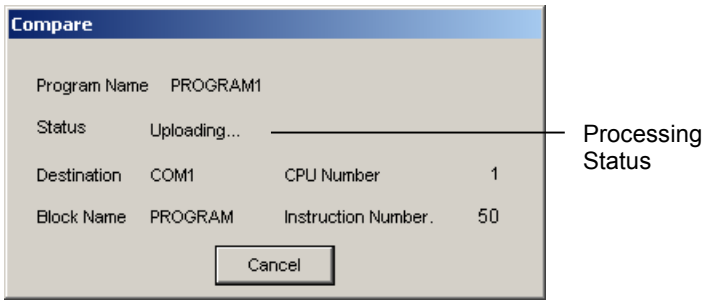


Figure Compare Dialog Box

3. If no discrepancies were found as a result of the comparison, the following dialog box will be displayed.

Figure Dialog Box Confirming Comparison Completed with No Inconsistency

4. If a discrepancy was found as a result of the comparison, the following comparison results screen will be displayed.

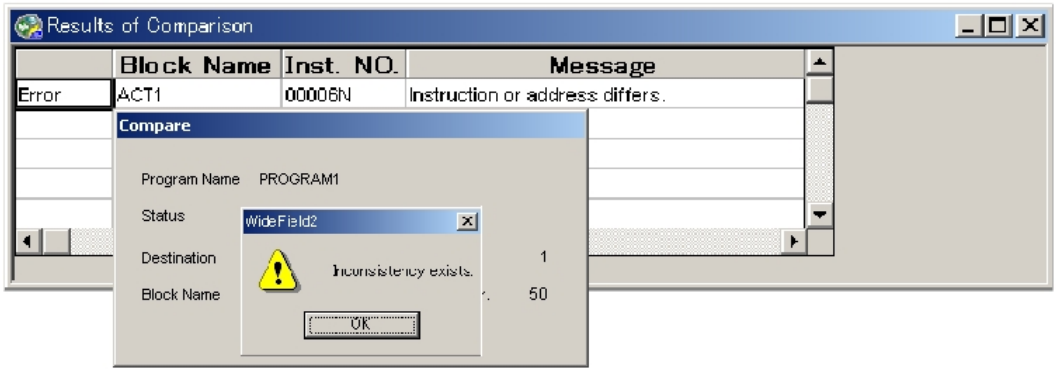


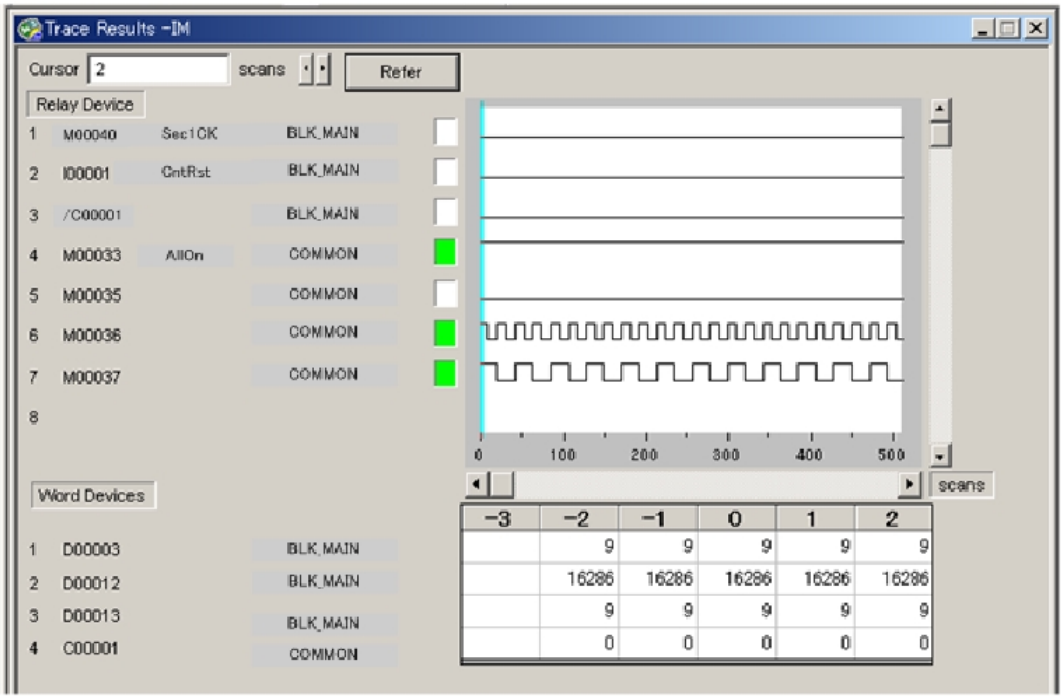
Figure Comparison Results Window

7. Sampling Trace

7.1 What is Sampling Trace?

The sampling trace function is used for storing states and contents of specified devices sequentially in the sampling trace memory of the CPU (only for F3SP25 and higher models). The tracing results can be displayed as scan charts or time charts using WideField2.

Up to 16 relay devices and 4 register devices can be sampled.



7.2 Sampling Trace Setup

You can set up sampling trace either online using the Sampling Trace Tool or offline using the Configuration dialog box.

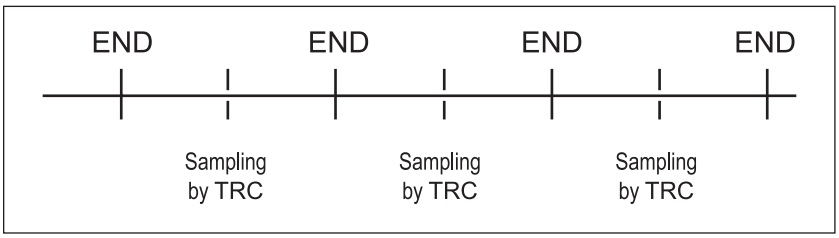
Offline sampling trace setup using the Configuration dialog box is stored and will not be affected when power is turned off. By setting up sampling trace to sample devices when a user system generates an error, you can save device statuses before and after an error. Offline sampling trace setup comes into effect when a program is downloaded.

Online sampling trace setup using the sampling trace tool is normally used during debugging or when you want to sample data temporarily. When power is turned off and then on again, the sampling trace setup from the Configuration dialog box comes into effect.

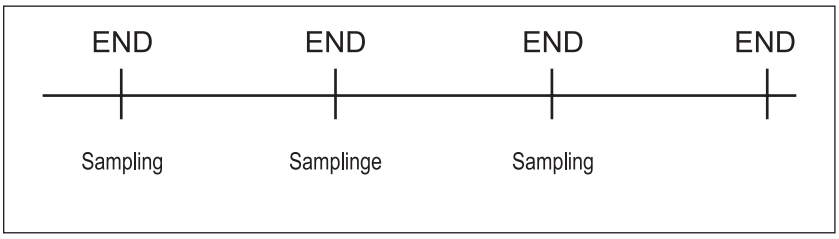
7.3 Sampling Modes

The following three sampling modes are available.

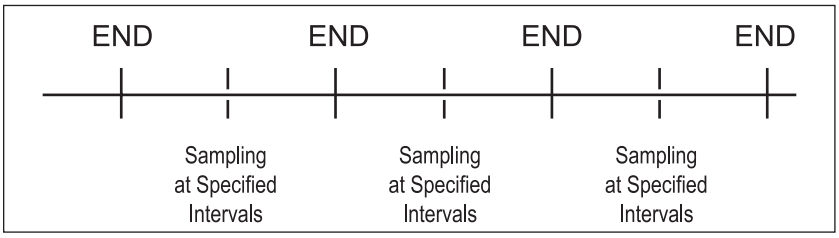
- When the TRC instruction is executed
  You can sample data of a specified contact at any point during a scan using the TRC instruction in a program.



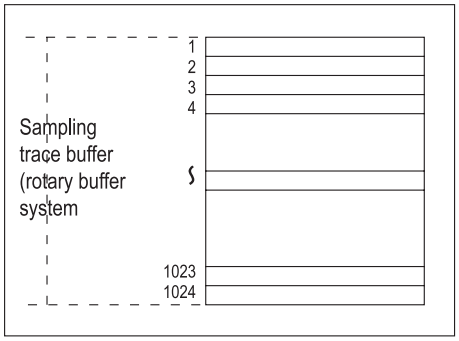
- When the END instruction is executed
  You can sample data of a specified contact at the end of each scan using the END instruction.



- When an interval is specified
  You can sample data of a specified contact at specified intervals regardless of scans.



You can specify sampling data in the following way.



Sampling data is stored sequentially in the sampling trace buffer (rotary buffer) of the CPU when a sampling trace is executed in a specified sampling mode (see the figure on the right).

The sampling trace buffer can store up to 1,024 trace data items for each specified device.

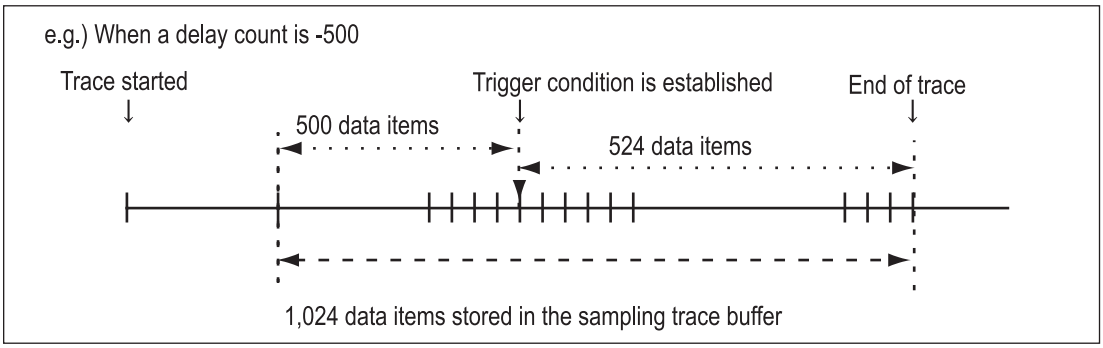
You can obtain the required 1,024 items of sequential data from all trace data collected. In this case, a trigger condition should be established as a reference point by specifying a delay count.

There are two ways to specify a delay count.

- Specifying a negative delay count
- Specifying a positive delay count

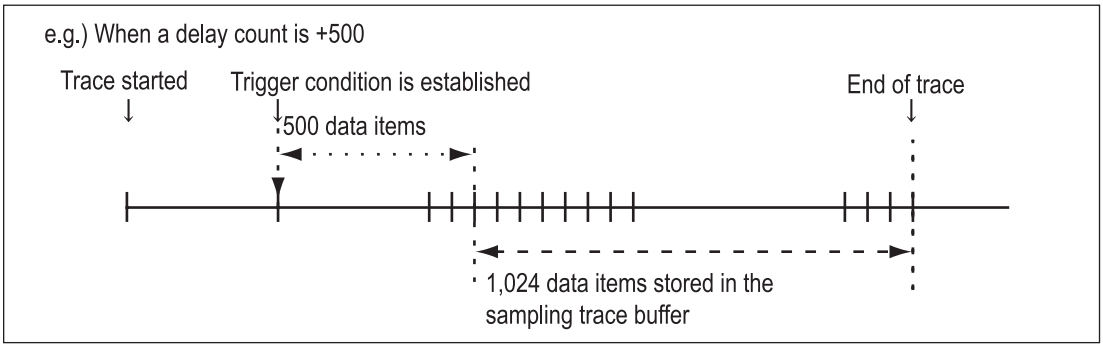
1. Specifying a negative delay count
   When you specify a negative delay count, the specified number of data items immediately before a trigger condition is established are collected, and then items following the trigger condition are collected until the total data items collected reaches 1,024. These data items are all stored in the sampling trace buffer.

   The following illustration shows an example when you specify a delay count as "-500."
   The 500 data items collected before the trigger condition is established and the 524 data items collected after the condition is established are stored as sampling data.



2. Specifying a positive delay count
   When you specify a positive delay count, 1,024 data items following the specified number of data items collected after a trigger condition is established are stored in the sampling trace buffer.

   The following illustration shows an example when you specify a delay count as "+500".
   The 1,024 data items following the 500 data items collected after the trigger condition is established are stored as sampling data.



7.4 Setting Sampling Trace

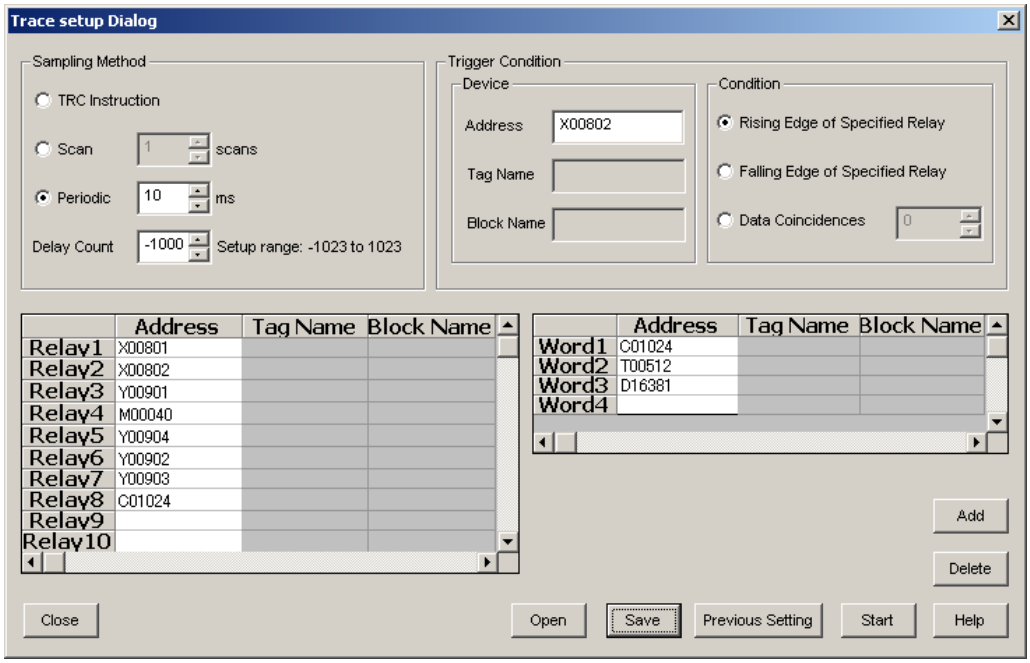
In this exercise, you will learn how to set up a sampling trace in online mode.

The procedure is the same as that for setting up sampling trace offline using the Configuration dialog box.

1. Download the executable program (JISYU1) and enter online mode with WideField2.
2. Select [Tool]–[Sampling Trace] to display the SmpTrace screen.
3. Select [Online]–[Sampling Trace Setup].
4. Enter data as shown below.

   When specifying tag names or local device names, you can use the [Add] button to display tag names and block names (you cannot specify tag names from the Configuration dialog box).

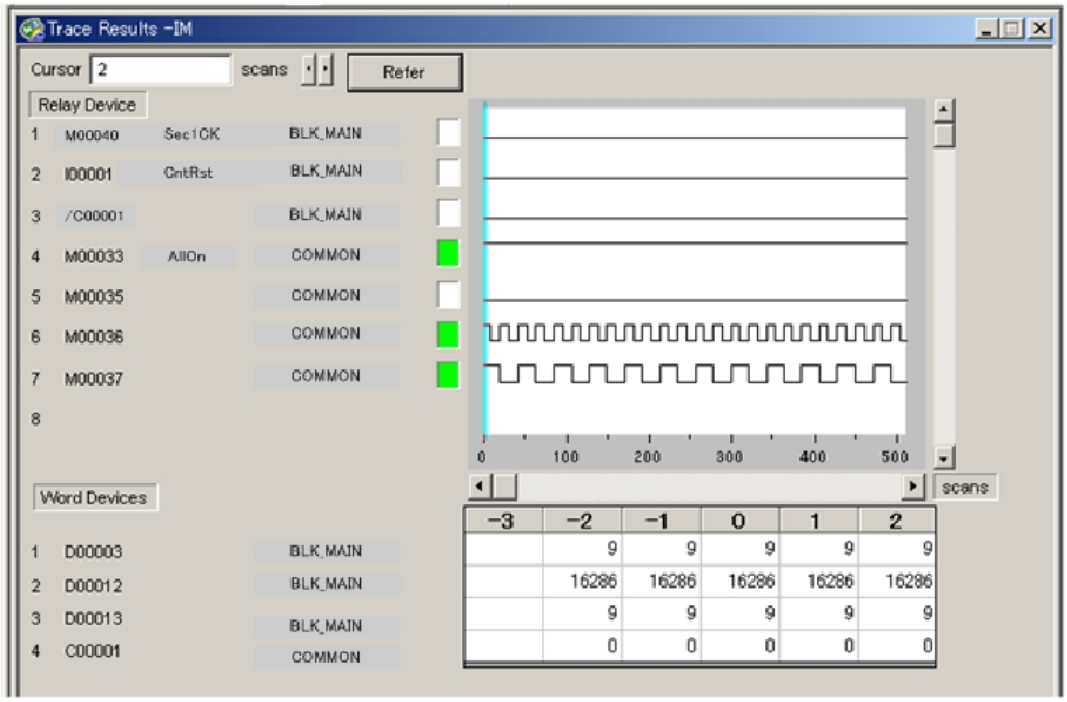
   In this exercise, global addresses are specified.



5. Click [Save] and save the file with any name (e.g., TRACE1). (To open the saved file later, click [Open] and specify the file name.)

7.5 Starting Sampling Trace and Displaying Sampling Trace Results

1. Turn on relay X00803 (to run DEMO2).
2. Turn on relay X00801 (START), and turn off relay X00802 (STOP).
3. Click [Start].
   "Wait for Trigger" is displayed at the lower right corner of the SmpTrace screen.
4. Wait for about 10 seconds, and then turn on the trigger condition X00802 (STOP).
   "Wait for Trigger" is replaced with "End of Tracing."
5. Select [Online]–[Sampling Trace Result]
6. The Trace Results window is displayed as shown below.
7. To save the results, select [File]–[Save As]. (To open the saved file later, select [File]–[Open]).



- A relay device is on if the square on its right is green.
- Clicking on the chart of a relay device moves the cursor the clicked position.
- To move the cursor in steps, use the buttons on the upper left of the screen.
- The "0" column in the Word Device area represents values corresponding to the current cursor position.
- To change from scan chart to time chart display, select [View]–[Time Chart].

8. Appendix

8.1 Special Relay (M)

Special relays have specific functions such as indicating operation and error states of the CPU.

Program mainly use the special relays as contact a or contact b.

■ Block Run Status

Block run status relays indicate which block is running when the CPU executes specified blocks.

Relay M001 corresponds to block 1, M002 to block 2 and so on.

Table Block Run Status

Item		Block run status		
Sequence CPU module	**Number**	**Name**	**Value**	**Description**
F3SP05, F3SP08, F3SP21	M0001 to M0032	Block n Run status relay	ON: Running OFF: Stopped	Indicates whether block n is running or stopped when the CPU executes specified blocks.
F3SP25, F3SP35 F3SP28, F3SP38 F3SP53, F3SP58, F3SP59	M0001 to M0032			
	M2001 to M3024			

Note: Run status relays for blocks 1 to 32 are M0001 to M0032 and M2001 to M2032 (M0001 to M0032 and M2001 to M2032 have identical values), and those for blocks 33 to 1024 are M2033 to M3024.

CAUTION

Do not write to special relays that are not designated as write-enabled including relays that are not listed in the above table (e.g. M067 to M128) because they are used by the CPU module system. If you write to these relays inadvertently, an operation might stop. (Forced Set/Reset in debug mode is also not allowed)

CAUTION

Do not specify an index-modified special relay as an output destination. Otherwise an instruction processing error will occur during execution.

CAUTION

Do not specify special relays as output destinations in continuous transfer ladder instructions and table output ladder instructions. Otherwise, an instruction processing error will occur during execution.

Continuous transfer instructions: BMOV instruction, BEST instruction, SMOV instruction, etc.

Table output instructions: ULOGR instruction, FIFWR instruction, etc.

■ Utility

Utility relays are used to provide timing in a program or instructions to the CPU on an operation

Table Utility (1/2)

Item	Utility		
No.	Name	Value	Description
M033	Always ON	ON OFF	Used in initialization or as a dummy contact in a program
M034	Always OFF	ON OFF	
M035	Enable 1 scan at operation start	1 scan	Enables only one scan when a program is started.
M036*	0.01 sec clock	0.005 s 0.005 s	Generates a 0.01 sec. clock.
M037*	0.02 sec. clock	0.01 s 0.01 s	Generates a 0.02 sec. clock.
M038*	0.1 sec. clock	0.05 s 0.05 s	Generates a 0.1 sec. clock.
M039*	0.2 sec. clock	0.1 s 0.1 s	Generates a 0.2 sec. clock.
M040*	1 sec. clock	0.5 s 0.5 s	Generates a 1 sec. clock.
M041*	2 sec. clock	1 s 1 s	Generates a 2 sec. clock.
M042*	1 min. clock	30 s 30 s	Generates a 1 min. clock.
M047*	1 ms clock	0.5ms 0.5ms	Generates a 1 ms clock.
M048*	2 ms clock	1ms 1ms	Generates a 2 ms clock.
M066	Subunit transfer path normal	ON: normal, optical FA bus uninstalled OFF: transfer path not established, transfer path error	
M097	Enable one scan at sensor control block start	ON: starting OFF: others	Enables one scan (First sensor control block is executing) when a sensor control block is started

*: M036 to M048 have their rising and falling clock edges synchronized.

SEE ALSO

For details on the Subunit Transfer Path Normal relay (M066), refer to the “Optical FA Bus Module, Optical FA Bus 2 Module Instruction Manual” (IM34M6H45-01E)

■ Sequence Operation and Mode Status

These types of relays indicate a sequence operation state or operation mode state.

Table Sequence Operation and Mode Status

Item	Sequence operation and mode status		
No.	**Name**	**Value**	**Description**
M129	Run mode flag	ON: Run mode OFF: Other mode	Indicates a CPU operation state.
M130	Debug mode flag	ON: Debug mode OFF: Other mode	Indicates a CPU operation state.
M131	Stop mode flag	ON: Stop mode OFF: Other mode	Indicates a CPU operation state.
M132	Suspend flag	ON: Suspends a program OFF: Executes a program	Indicates a program execution state in Debug mode.
M133	Execution flag (all blocks/specified blocks)	ON: Specified blocks OFF: All blocks	Indicates either all-block or specified-block operation.
M135	Run from ROM/RAM flag	ON: Runs the system from ROM OFF: Runs the system from RAM	Indicates whether the system runs from ROM or RAM.
M136	Run at power-on flag	ON: Runs at power-on. OFF: Others	Indicates that the system has entered the Run mode when the power is turned on or reset.
M137	Sensor control block operation status	ON: Start OFF: Stopped	Operation mode of sensor control block
M172 (write-enabled)	Set clock time	ON: Sets a clock time (or is setting it) OFF:	Requests to set clock data.
M173	Input-offline flag	ON: Offline OFF: Online	Indicates that input refresh is stopped.
M174	Output-offline flag	ON: Offline OFF: Online	Indicates that output refreshing is stopped.
M175	Shared-I/O-offline flag	ON: Offline OFF: Online	Indicates that shared refreshing is stopped.
M176	Link-I/O-offline flag	ON: Offline OFF: Online	Indicates that link refreshing is stopped.
M177–M187	Devices reserved for function expansion		
M188	Carry flag	ON: Enabled carry OFF: Disabled carry	Carry flags used for shift and rotation operations.
M189–M192	Devices reserved for function expansion		

SEE ALSO

For more information on time setting, refer to the time data special registers (Z).

■ Self-diagnosis Status

Self-diagnostics status relays reflect the results of sequence CPU self-diagnosis.

Table Self-diagnosis Status

Item	Self-diagnosis status		
No.	Name	Value	Description
M193	Self-diagnosis error	ON: An error is found OFF: No error is found	The results of the self-diagnosis are loaded in special registers Z17-Z19
M194	Battery error	ON: Error OFF: Normal operation	Indicates a backup battery error.
M195	Momentary power failure	ON: A momentary power failure occurs OFF: No momentary power failure	Indicates that a momentary power failure has occurred.
M196	Error in communication between CPUs	ON: Error OFF: Normal operation	Indicates an error in communication through shared relays/registers.
M197	CPU 1	ON: Exists OFF: Does not exist	Indicates whether a CPU exists in slot 1.
M198	CPU 2	ON: Exists OFF: Does not exist	Indicates whether a CPU exists in slot 2.
M199	CPU 3	ON: Exists OFF: Does not exist	Indicates whether a CPU exists in slot 3.
M200	CPU 4	ON: Exists OFF: Does not exist	Indicates whether a CPU exists in slot 4.
M201	Instruction processing error	ON: An error occurs OFF: No error	Details of the instruction processing error are loaded in special registers Z22-Z24
M202	I/O match error	ON: Error OFF: Normal operation	Indicates that a module installation state does not match program settings.
M203	I/O module error	ON: Error OFF: Normal operation	Indicates that the CPU cannot access an input/output module. The slot number of the corresponding module is loaded into special registers Z33-Z40.
M204	Scan timeout	ON: Error OFF: Normal operation	Indicates that scan time exceeds scan time monitoring time.
M210	Subunit transmission path error	ON: Error OFF: Transfer path not established or Transfer path normal	When an error occurs in an optical FA bus module, the slot number of the FA bus module is loaded in special registers Z89-Z96.
M211	Subunit transmission path switching error	ON: Error OFF: Transfer path not established or Transfer path normal	
M212	Sensor control block scan timeout	ON: Error OFF: Normal operation	The execution period of the sensor control block cannot be maintained.
M225	Sequence program execution in CPU 1	ON: Program executing OFF: Program stopped	Indicates whether the sequence program in CPU1 is running
M226	Sequence program execution in CPU 2	ON: Program executing OFF: Program stopped	Indicates whether the sequence program in CPU1 is running
M227	Sequence program execution in CPU 3	ON: Program executing OFF: Program stopped	Indicates whether the sequence program in CPU1 is running
M228	Sequence program execution in CPU 4	ON: Program executing OFF: Program stopped	Indicates whether the sequence program in CPU1 is running

SEE ALSO

For more information on subunit transmission path error (M210) and subunit transmission path switching error (M211), refer to the special relay/special register section in the “Optical FA Bus Module, Optical FA Bus 2 Module Instruction Manual” (IM34M6H45-01E)

■ FA Link Module Status

These relays show the status of the FA link.

SEE ALSO

For more information, refer to the special relay/special register section in the “FA Link, FA Link H, Optical FA Link H Module Instruction Manual” (IM34M5H43-01E)

Table FA Link Module Status

Item	FA link status		
No.	**Name**	**Value**	**Description**
M257-M480 M8321-M8992	FA link normal	ON: Error OFF: Normal	Indicates the FA link status

8.2 Special Register (Z)

Special registers have specific functions such as indicating operation or error states of the programmable controller.

■ Sequence Operation State

This type of registers indicates sequence operation states.

Table Sequence Operation State

Type	Sequence operation state		
No.	**Name**	**Value**	**Description**
Z001	Scan time (Run mode)	Latest scan time	Stores the latest scan time on a 100µs basis.
Z002	Minimum scan time (Run mode)	Minimum scan time	Stores the latest scan time on a 100-µs basis if it is shorter than the minimum scan time.
Z003	Maximum scan time (Run mode)	Maximum scan time	Stores the latest scan time on a 100-µs basis if it is longer than the maximum scan time.
Z004	Scan time (Debug mode)	Latest scan time	Stores the latest scan time on a 100-µs basis.
Z005	Minimum scan time (Debug mode)	Minimum scan time	Stores the latest scan time on a 100-µs basis if it is shorter than the minimum scan time.
Z006	Maximum scan time (Debug mode)	Maximum scan time	Stores the latest scan time on a 100-µs basis if it is longer than the maximum scan time.
Z007	Peripheral processing scan time	Latest scan time	Stores the latest scan time on a 100-µs basis. (Tolerance: Scan time for one control process)
Z008	Minimum peripheral processing scan time	Minimum scan time	Stores the latest scan time on a 100-µs basis if it is shorter than the minimum scan time. (Tolerance: Scan time for one control process)
Z009	Maximum peripheral processing scan time	Maximum scan time	Stores the latest scan time on a 100-µs basis if it is longer than the maximum scan time. (Tolerance: Scan time for one control process)

CAUTION

- Do not write to special registers (Z) that are not designated as write-enabled including registers that not listed in the above table (e.g. Z010 to Z016) because they are used by the CPU module system. If you write to these registers inadvertently, an operation might stop.
- Do not specify a special register (Z) with index modification as an output destination. Otherwise, an instruction processing error will occur during execution.
- Do not specify special registers (Z) as output destinations in continuous transfer ladder instructions and table output ladder instructions. Otherwise, an instruction processing error will occur during execution.

  Continuous transfer instructions: Block Move (BMOV) instruction, Block Set (BSET) instruction, String Move (SMOV) instruction, etc.
  Table output instructions: Read User Log (ULOGR) instruction, FIFO Write (FIFWR) instruction, etc.

■ Detailed Self-diagnosis Status

This type of registers reflects the results of sequence CPU self-diagnosis.

Table Detailed Self-diagnosis Status

Type	Detailed Self-diagnosis Status		
No.	**Name**	**Value**	**Description**
Z017	Self-diagnosis error	Self-diagnosis error number	These registers store self-diagnosis results.*
Z018		Self-diagnosis error block number	
Z019		Self-diagnosis error instruction number	
Z022	Instruction processing error	Instruction processing error number	These registers store information on errors, which occur during instruction processing.
Z023		Instruction processing error block number	
Z024		Instruction processing error instruction number	
Z027	I/O matching error	I/O matching error number	These registers store information on I/O matching errors.
Z028		I/O matching error block number	
Z029		I/O matching error instruction number	
Z033-Z040	I/O error	I/O error 16 2 1 0 ····· 1 0	If an I/O error occurs in a slot, the slot number is stored as a bit pattern in any of these registers. Z033 Main unit Z034 Subunit 1 Z035 Subunit 2 Z036 Subunit 3 Z037 Subunit 4 Z038 Subunit 5 Z039 Subunit 6 Z040 Subunit 7
Z041	Module identification	Main unit	Slot number 16 1 0 ····· 1 0 0: No module Not readable 1: Module identified
Z042		Subunit 1	
Z043		Subunit 2	
Z044		Subunit 3	
Z045		Subunit 4	
Z046		Subunit 5	
Z047		Subunit 6	
Z048		Subunit 7	
Z089	Subunit transfer path error slot	Main unit	Slot number 16 1 0 ····· 1 0 Optical FA bus module 0: Transfer path normal Transfer path not established Other module installed 1: Transfer path error (Subunit transfer path error, Subunit transfer path switching occurred)
Z090		Subunit 1	
Z091		Subunit 2*	
Z092		Subunit 3	
Z093		Subunit 4	
Z094		Subunit 5	
Z095		Subunit 6	
Z096		Subunit 7	

*: For details on error numbers (codes) to be stored in special registers, see Table 8.2, "Details on Self-diagnosis" (IM 34M6P13-01E).

SEE ALSO

For details on the Subunit Transfer Path Slot registers (Z089-Z096), refer to the “Fiber-optic FA-bus Module and Fiber-optic FA-bus Type 2 Module” (IM34M6H45-01E).

■ Utility

Table Utility

Type	Utility		
No.	**Name**	**Value**	**Description**
Z049 (write-enabled)	Clock data	Year (last 2 digits)	This register stores year data in the BCD format. For example, the year 1999, is stored as $0099 and the year 2000 is stored as $0000.
Z050 (write-enabled)		Month	This register stores month data in the BCD format. For example, January is stored as $0001
Z051 (write-enabled)		Day	This register stores day data in the BCD format. For example, the 28th is stored as $0028.
Z052 (write-enabled)		Hour	This register stores hour data in the BCD format. For example, 10 o'clock is stored as $0010.
Z053 (write-enabled)		Minute	This register stores minute data in the BCD format. For example, 15 minutes is stored as $0015.
Z054 (write-enabled)		Second	This register stores second data in the BCD format. For example, 30 seconds is stored as $0030.
Z055		Day of the week ($0-$6)	This register stores day-of-the-week data in BCD format. For example, Wednesday is stored as $0003.
Z056*	Constant scan time	Constant scan time value	Stores value in units of 0.1 ms. For example, 10ms is stored as 100.
Z057*	Constant scan time	Constant scan time value	Stores value in units of 1 ms. For example, 10ms is stored as 10.
Z058*	Scan time monitoring time	Scan time monitoring time value	Stores value in units of 1 ms. For example, 200ms is stored as 200.

*: For F3SP28, F3SP38, F3SP53, F3SP58, and F3SP59 only

- For the F3SPS□□-□S CPU modules, you can set the clock using the Set Date (DATE), Set Time (TIME), Set Date String (SDATE), or Set Time String (STIME) instruction.
- For the F3SPS□□-□N/-□H CPU modules, use the following procedure set the clock.
  1. Write to Z049-Z054 (Use the MOV P instruction. Using BMOV/BSET instruction will cause an instruction error).
  2. Turn on M172 within the same scan as step (1) (DIFU instruction, etc.).
  3. Turn off M172 in the next scan following step (2).
     Stop writing to Z049-Z054 in the next scan following step (2).

If there is an error in the setting data, the clock data is unchanged and the original value is restored.

- The precision of the clock data is as follows.

  Maximum day deviation ±8s (Actual value ±2s)

  However, when the power is turned off/on, the maximum day deviation is set again to –1.2/+2 s.

  You can enter a correction value using the programming tool.

  By entering an appropriate correction value, a correction is performed during power off/on, which cancels the deviation.

■ FA Link Module Status

This type of registers indicates the status of the FA link.

Table FA Link Module Information

Type	FA link module status		
No.	Name	Value	Description
Z065	Local station status	0: During initialization 1: Offline 2: Online	System 1 (FA link)
Z066	Cyclic transfer time		System 1 (FA link) Unit: 1ms
Z070	Local station status	0: During initialization 1: Offline 2: Online	System 2 (FA link)
Z071	Cyclic transfer time		System 2 (FA link) Unit: 1ms
Z257*	Local station status	0: During initialization 1: Offline 2: Online	System 3 (FA link)
Z258*	Cyclic transfer time		System 3 (FA link) Unit: 1ms
Z262*	Local station status	0: During initialization 1: Offline 2: Online	System 4 (FA link)
Z263*	Cyclic transfer time		System 4 (FA link) Unit: 1ms
Z267*	Local station status	0: During initialization 1: Offline 2: Online	System 5 (FA link)
Z268*	Cyclic transfer time		System 5 (FA link) Unit: 1ms
Z272*	Local station status	0: During initialization 1: Offline 2: Online	System 6 (FA link)
Z273*	Cyclic transfer time		System 6 (FA link) Unit: 1ms
Z277*	Local station status	0: During initialization 1: Offline 2: Online	System 7 (FA link)
Z278*	Cyclic transfer time		System 7 (FA link) Unit: 1ms
Z282*	Local station status	0: During initialization 1: Offline 2: Online	System 8 (FA link)
Z283*	Cyclic transfer time		System 8 (FA link) Unit: 1ms

*: For F3SP25, F3SP28, F3SP35, F3SP38, F3SP53, F3SP58, and F3SP59 only

TIP

Stations refer to units that make up a system.

■ CPU Module Status

Table CPU Module Status

Type	CPU module status	
No.	Name	Description
Z105	Number of stored user log records	For details of the user log function, see “6.3 Display User Log”
Z109*1	Sensor control block execution time	The time taken, starting from the beginning of the input refresh, until program execution and the end of the output refresh. (Unit: 10μs)
Z111*1	Sensor control block maximum execution time	Maximum sensor control block execution time (Unit: 10μs)
Z121 to Z128*2	CPU type information	CPU type code and firmware revision number

*1: For F3SP28, F3SP38, F3SP53, F3SP58, and F3SP59 only

*2: For F3SP28, F3SP38, F3SP53, F3SP58, and F3SP59:

For example, F3SP58-6S (firmware Rev. 1) is represented as follows:

Z121 “F3”
Z122 “SP”
Z123 “58”
Z124 “6S”
Z125 “/R”
Z126 “01”
Z127 “/ ”
Z128 “ ”

For F3SP05, F3SP08, F3SP21, F3SP25, and F3SP35:

For example, F3SP21-0N (firmware Rev. 14) is represented as follows:

Z121 “F3”
Z122 “SP”
Z123 “21”
Z124 “-0”
Z125 “*A”
Z126 “14”
Z127 “ ”
Z128 “ ”