Note:
To change the product logo for your own print manual or PDF, click "Tools > Manual Designer" and modify the print manual template.

CIMON-PLC

Title page 1

Use this page to introduce the product

by Tim Green

This is "Title Page 1" - you may use this page to introduce your product, show title, author, copyright, company logos, etc.

This page intentionally starts on an odd page, so that it is on the right half of an open book from the readers point of view. This is the reason why the previous page was blank (the previous page is the back side of the cover)

CIMON-PLC

Printed: 9월2012 in (whereever you are located)

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Special thanks to:

All the people who contributed to this document, to mum and dad and grandpa, to my sisters and brothers and mothers in law, to our secretary Kathrin, to the graphic artist who created this great product logo on the cover page (sorry, don't remember your name at the moment but you did a great work), to the pizza service down the street (your daily Capricciosas saved our lives), to the copy shop where this document will be duplicated, and and and...

Last not least, we want to thank EC Software who wrote this great help tool called HELP & MANUAL which printed this document.

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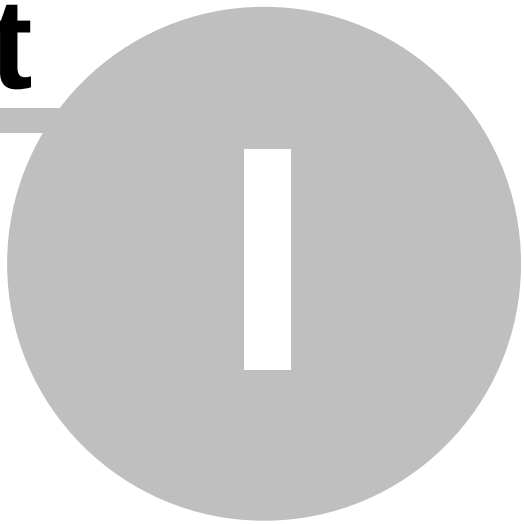
Foreword

This is just another title page
placed between table of contents
and topics

Top Level Intro

This page is printed before a new
top-level chapter starts

Part



1 Welcome to CIMON-PLC

Total Solution for Industrial Automation "CIMON - PLC" :

CIMON-PLC was developed with long-term experiences in automation fields. The product interfaces with various sub-devices such as sensors. controllers, motors, and controls the process equipment. It plays the role of 'brain' in various industrial sites.

CICON Update V4.03

This is Version of CICON provides following new functions.

- Supports "MPnA" and "XPnX" CPU. Click [Here] for more information
- Added project compatible feature and automatic connection feature between XP <-> MP
- Added the firmware download function for MP series CPU
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- Supports IO forced input/output function in the LD editor
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- Online editing possible during a CPU minor breakdown
- Added the ability to display the variables and the descriptions at the same time in the editor
- When CPU Type is changed, link parameters don't get deleted
- Improved the mouse input function of LD editor

For details see "**Click**"

Contents :

- CIMON - Training Kit
- FAQ

Top Level Intro

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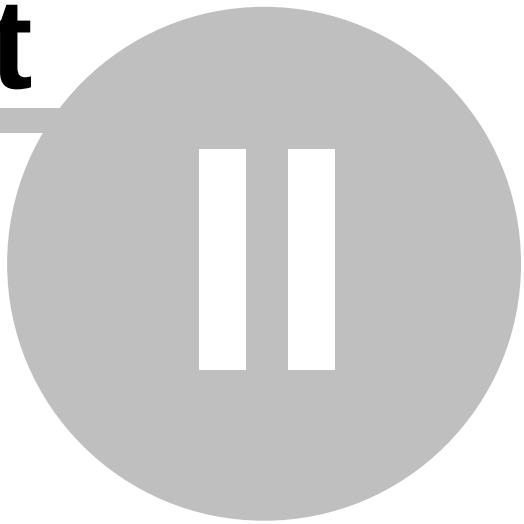
Part



2 Update News

This document is issued to notify the new release of CICON.
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Existing XP CPU projects can be used for MP CPU.
When trying to connect to online without changing the CPU type, CICON detects if it's the type of CPU that is compatible and rebuilds the project automatically so that the download proceeds immediately.

MP CPU firmware download function is added (CICON Build Ver.4.3 or higher)

Users can easily upgrade the firmware of the CPU and expansion modules (XPnA / CP / BP not supported)
Firmware can be downloaded at [Online] -> [Firmware Upgrade]
For detailed information, please refer to [Here].

Online Status Monitoring Window (Error status / Run, Stop status / Forced IO status)

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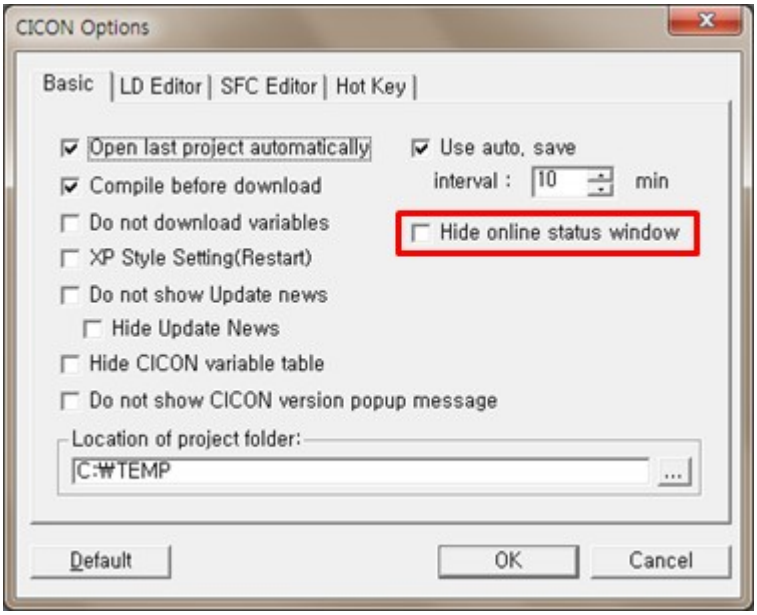
Button #1 – Online Status: This button shows the current online status. When it's in a normal status, the green light is turned on and when it's in an error state, the red light is turned on with a corresponding error code.
When there is an error, click on the button to see a detailed description of the error.

Button #2 – Mode Status: Run / Stop / Pause mode. During Run status, the yellow light is turned on.

Button #3 – Forced IO Status: If forced IO feature is enabled, the button turns to blue with the enabled device names.

Please go to [Tool] -> [CICON Options] and select [Hide online status window] and then restart CICON to turn this feature (Online status monitoring window) off.



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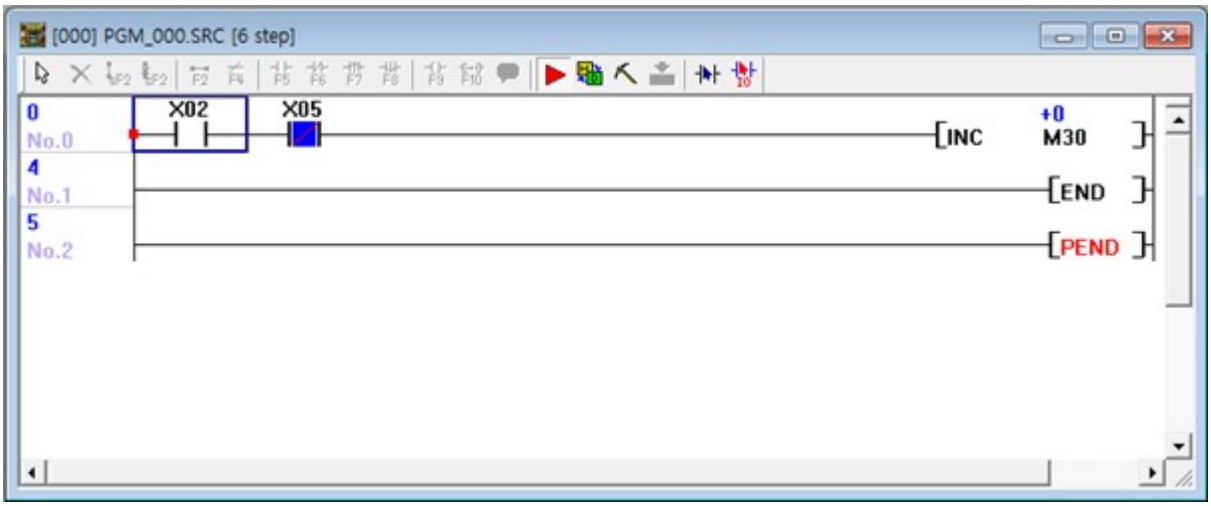
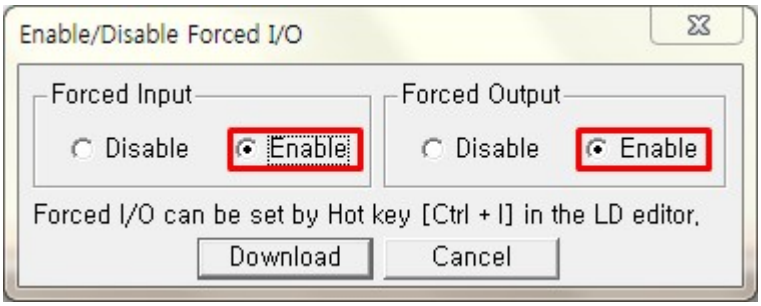
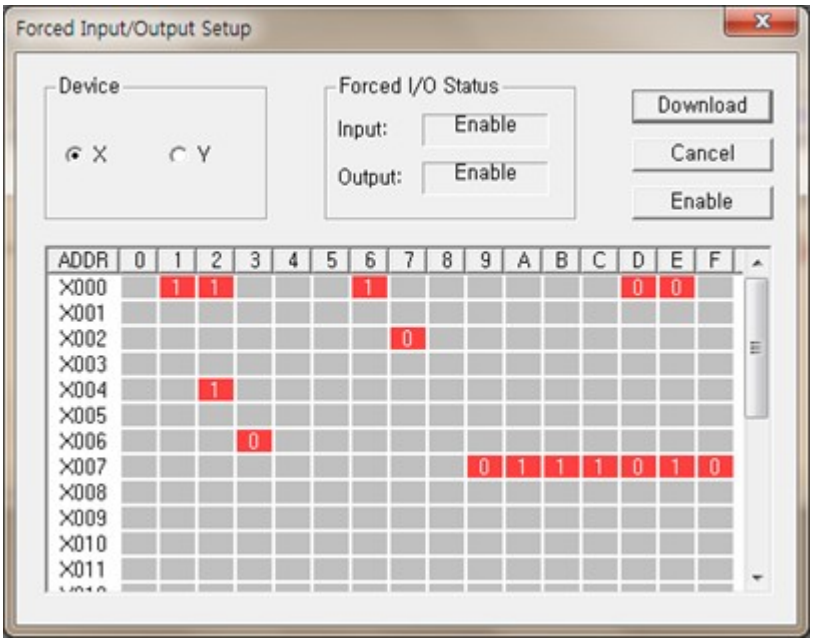
Forced IO function is used to select input device "X" and output device "Y" and force them to set or reset. Regardless of the sequence process, the forced IO's keep their set values.



In order to use Forced IO function, “Forced Input” and “Forced Output” must be set to “Enable” from [Debug] -> [Enable/Disable Forced I/O]



Device settings details can be found at [Debug] -> [Forced Input/Output Setup]
Details of the value that you set in the editor appears on this window and it is possible to change the settings on here.



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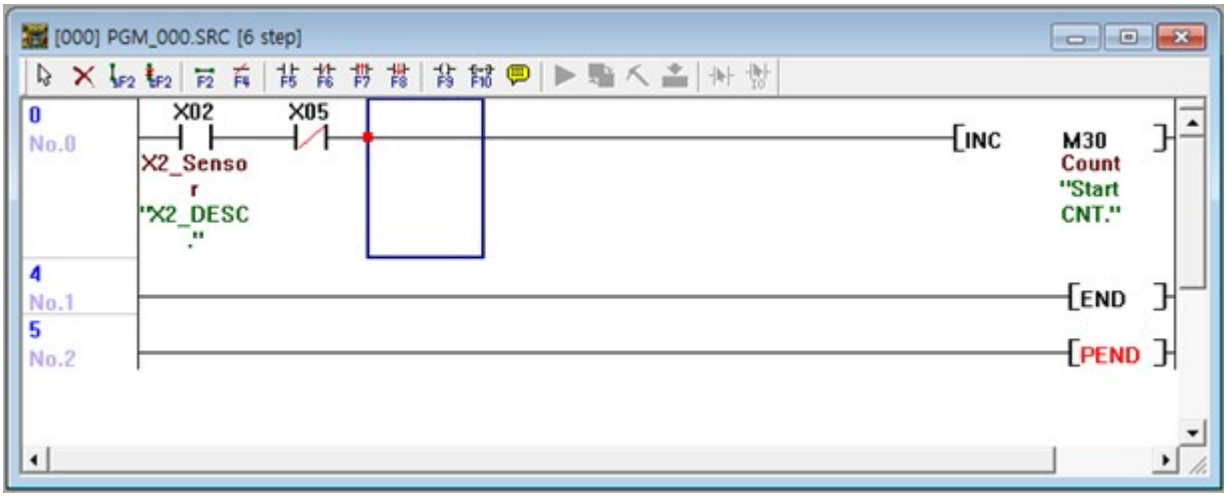
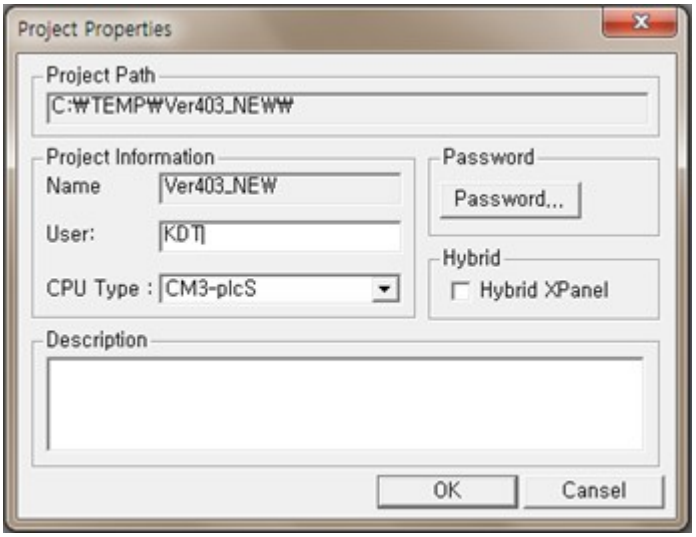
The ability to simultaneously display the descriptions and the variables has been added.
When selecting "Variable/Comment" from "View" tool, the comments and the variables get displayed at the same time as seen below.



When CPU Type is changed, link parameters don’t get deleted

When “CPU Type” is modified from [File] -> [Project Properties] as in the window below, the parameter file gets initialized.
In this case, the "PLC Link" parameters will not be initialized.



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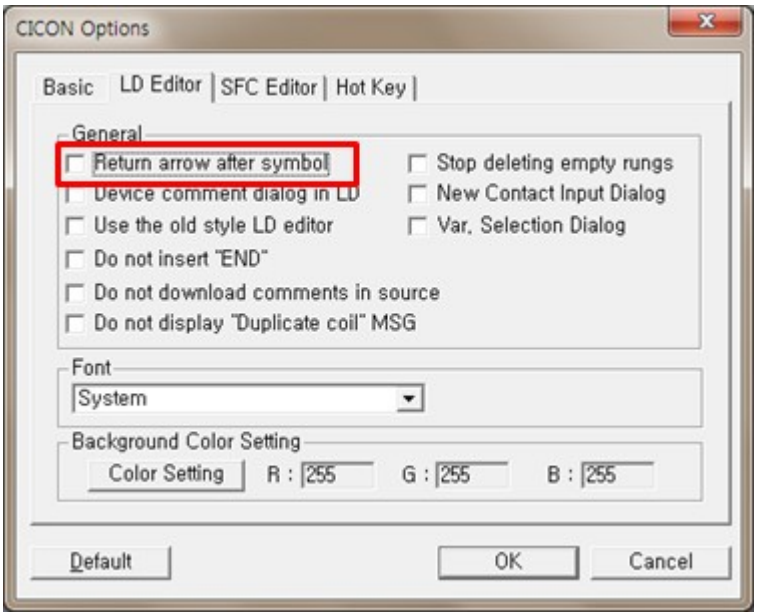
When editing scan programs in the LD editor using the mouse, it maintains the latest symbol (input tool) that was used from the tool bar so that users can create the program faster without the need to click the symbol (input tool) on the tool bar again.

In order to use this feature please deselect "Return arrow after symbol" from [Tool] -> [CICON Options] -> [LD Editor]



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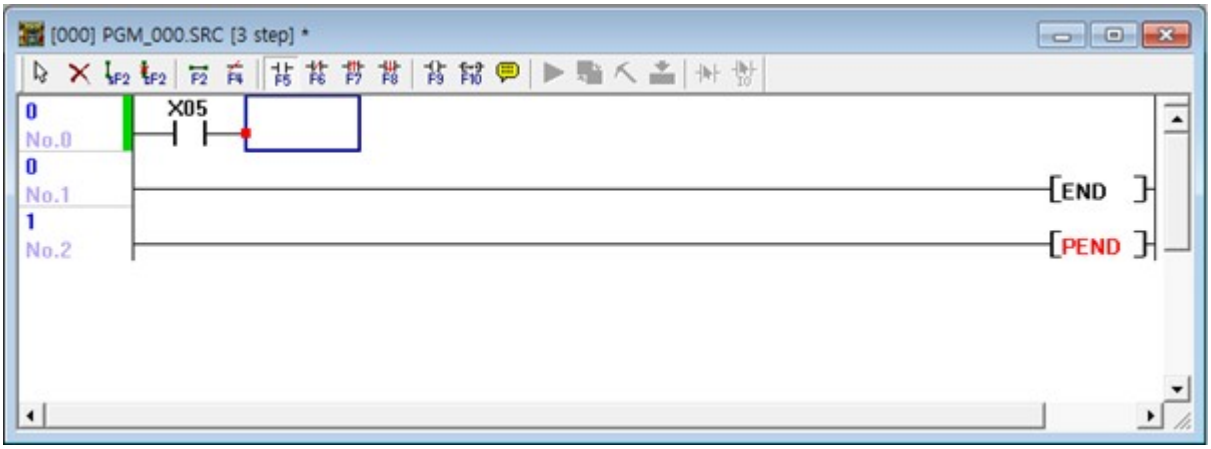

2.1 Update History

Ver 403

-

Ver 402

- CDMA Module NTWE-310 model added.

- PLCS TC module – Max. Temp. in changing function is added.
- Position Setup function is added.
- Module Input/Output points and IO module Icons are added.
- MP1A / MP2A / MP3A CPU Types added.

Ver 401

- CICON version 4.01 supports PID control for all types of CIMON PLC.

Ver 400

- SFC Program (Ver. 4.00)
- Device memory Export and Import
- “Stop deleting empty rungs” added
- Variable selection dialog
- Module Config Export for Simulator
- Detailed device information of double word in Cross Ref. added
- Full screen(Alt+Enter) and Variable table(F11)
- LD editor shows Rung number
- CICON Version pop up message
- All menus does not activate while compiling.
- “Don’t insert END” option added
- Maximum tempt. Setting in PLC-S TC module added.
- Variable indication when C device is used as word.
- “Prohibit Uploading sequence program” in PLC parameter
- FROM / TO window added
- Firmware upgrade mode
- Program ID(PID) shows at scan program and SFC program

Ver 310

- PLC-S AD MUX Module Added.
- PLC-S Ethernet Module Added.
- PLC-S Serial Module Added.
- PLC-S RS232 2CH. Module Added.
- Variable Export / Import function Added.
- IO Input module Filter Setting Program Added
- PID Special Program: PID_2 function Added.
- Incomplete Rung indication (Red and Green) in LD editor Added.
- Rung Number Added.

- Device Setting of Cross Reference is modified.
- Ch1 (RS232) and Ch2 (RS422/485) at PLC Parameter of PLC-S default setup modified.
- Segment Setup function in Protocol Program Added.

Ver 309

- CIMON Download Utility added
- DWORD viewer function in memory monitor added
- PLC-S training kit manual added.

Ver 308

- Check function for PLCS Firmware version added.
- Check function for PLCS MAC Address added.
- XP Style Setting added.
- New Contact Input Dialog added.
- Load cell setting program range.

Ver 307

- USB Driver for Windows7 64Bit added.

Ver 306

- Add PLC simulator.

Ver 305

- [Search]->[Find All] : [Find Next]function is added.
- Load Cell : Avr. Time / Weighing Mode(Not used) / Read added.
- PLC-S TC : [Internal Temp] is added.
- [Position Status] : Axis and Unit Setting functions are added.
- PLCS : Internal Comm. manual added.
- [Tool]->[CICON Options]->[LD Editor] : Font function is added.

Ver 304

- PLC-S D/A Module Setup modified. (Calibration function is added)
- PLC-S A/D D/A Module Setup modified. (D/A Calibration function is added)
- PLC-S Positioning program : “Inching Movement” is added
- PLC-S HSC manual is added.

- PLC-S Positioning manual is added.
- Special Card Init. Program is added.

Ver 303

- Auto delete function for empty line.
- U/I size of [Find and Replace] is modified.
- Prohibiting function for Upload sequence (PLC parameter)
- Calibration function for A/D D/A of PLCS A/D module.
- Auto USB Driver installation and upgrade function.(OS : XP)
- PLCS : PLC parameter "Pulse Catch Input" modified.(only available at X02, X03, X06)
- PLCS : PLC parameter "Ethernet" set-up modified. (DHCP)
- More than 2 special programs cannot be added in project.(when project is compiled, warning pop up)
- PLCS Positioning : device registration is added in Positioning data Setup.

Ver 302

- Test Version

Ver 301

- HSC Program for plcS
- Positioning Program for plcS
- Program for CM2-A
- Program for CM2-B
- Variable Table Upgrade

2.1.1 Ver403

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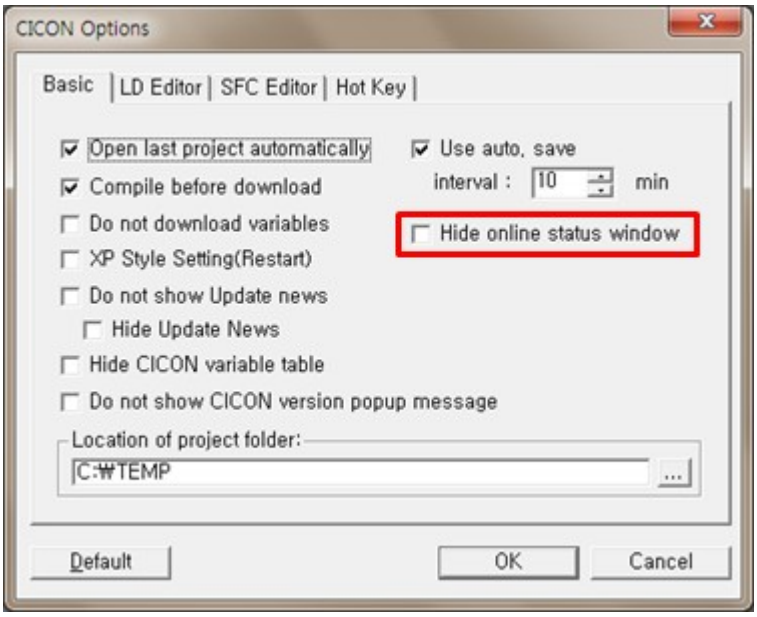

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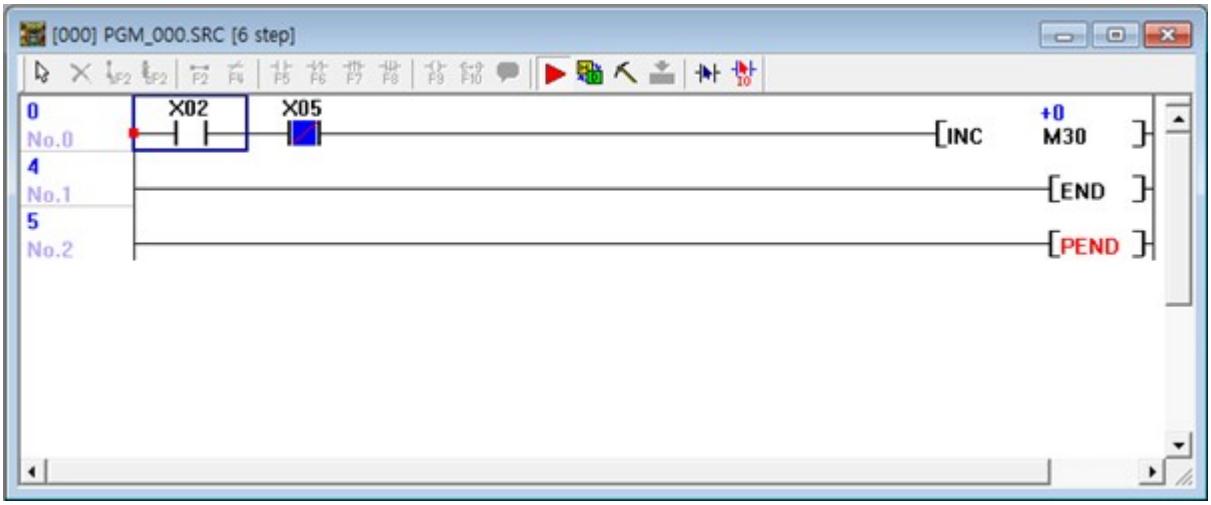

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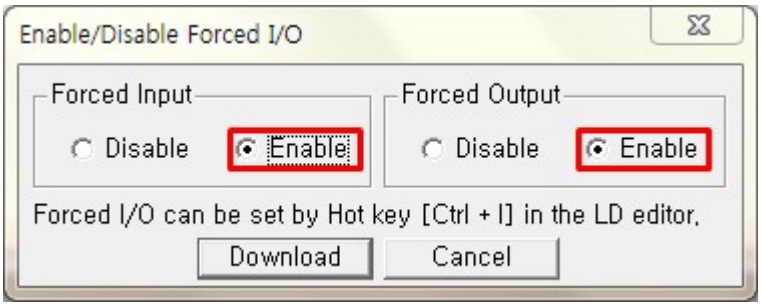

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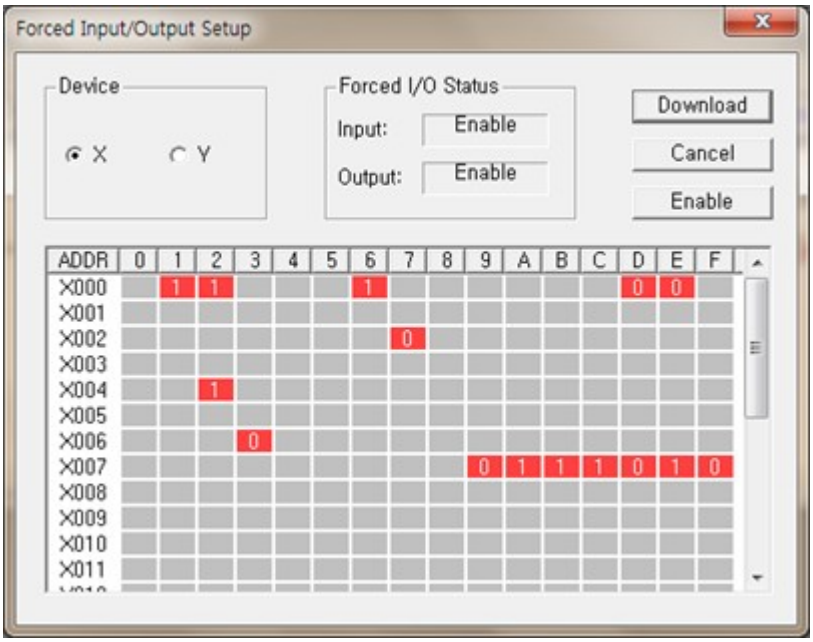

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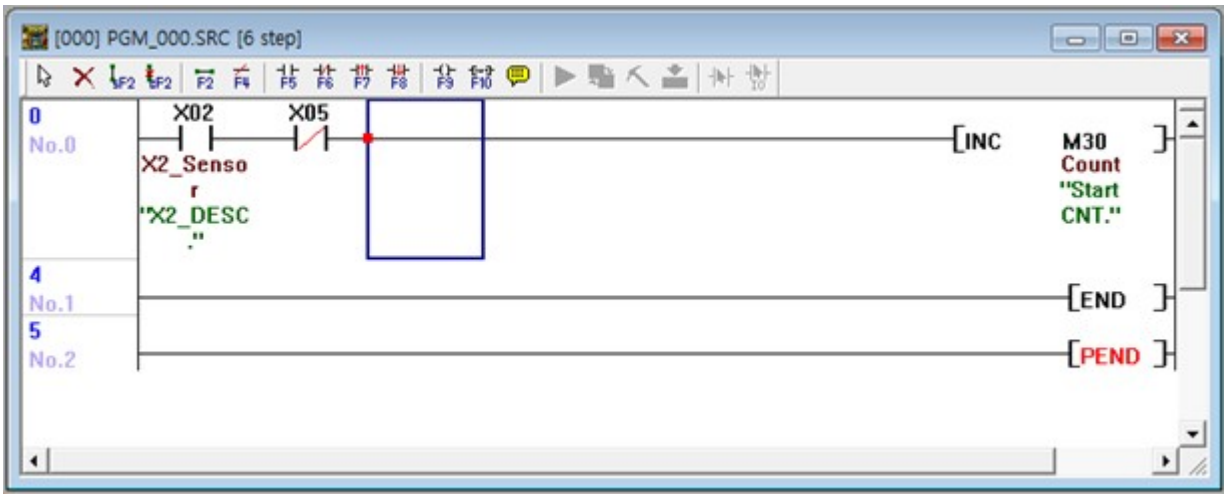

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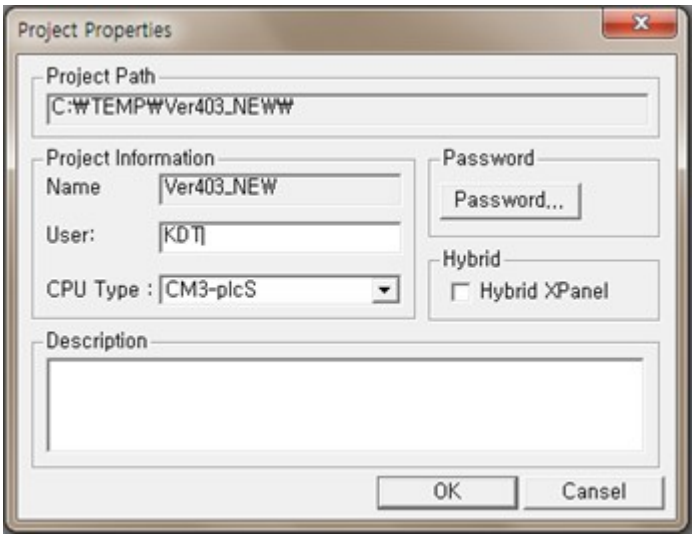

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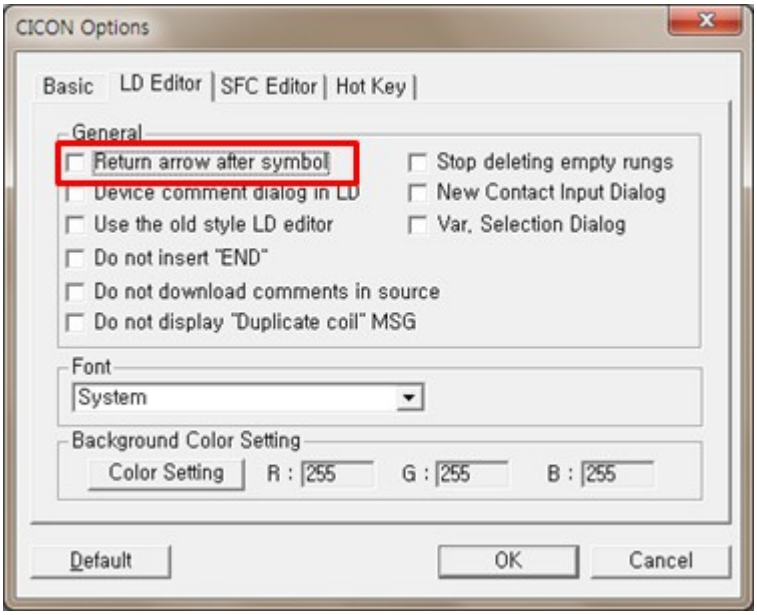

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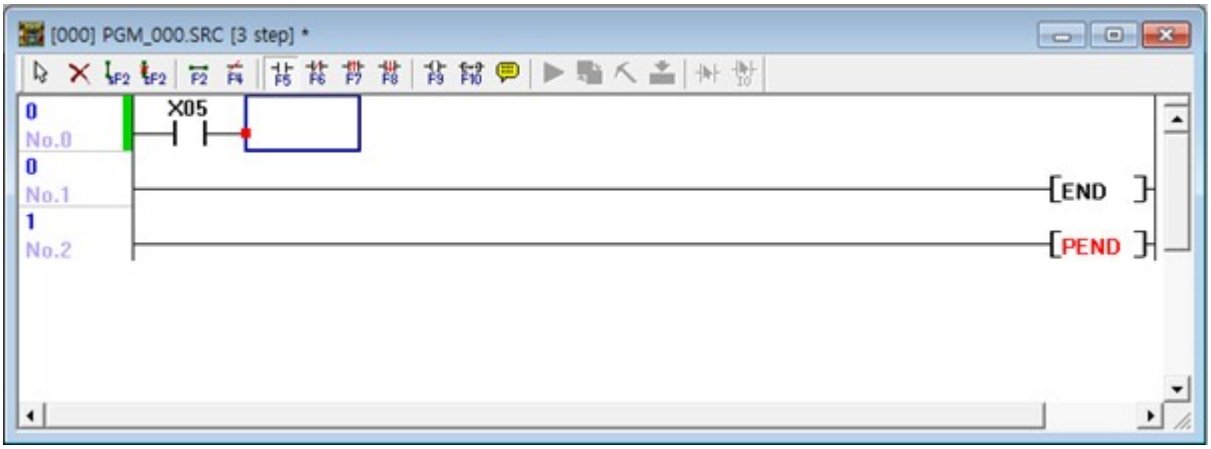


2.1.2 Ver402

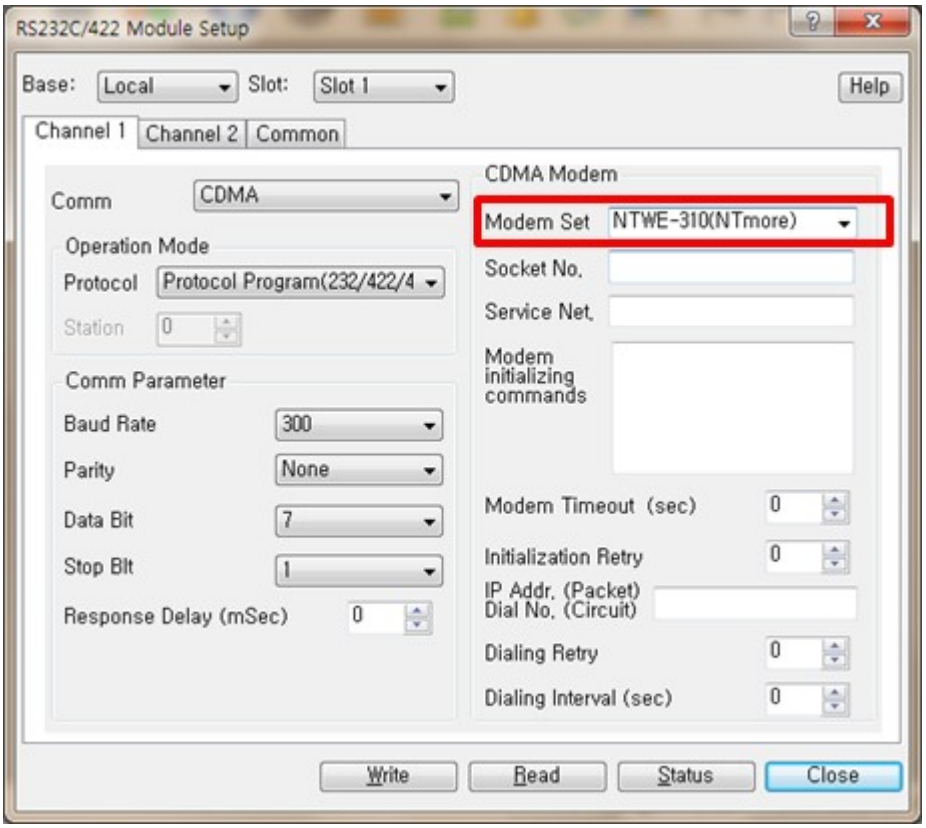
This document is issued to notify the new release of CICON.
This version of CICON provides following new functions.

- CDMA Module NTWE-310 model added.
- PLCS TC module – Max. Temp. in changing function is added.
- Position Setup function is added.
- Module Input/Output points and I/O module Icons are added.

- MP1A / MP2A / MP3A CPU Types added.

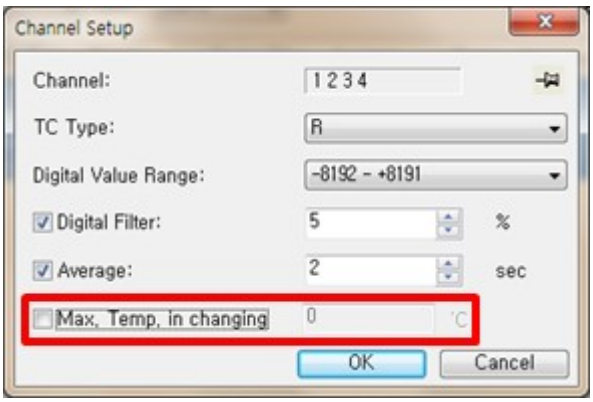
CDMA Module NTWE-310 model added.

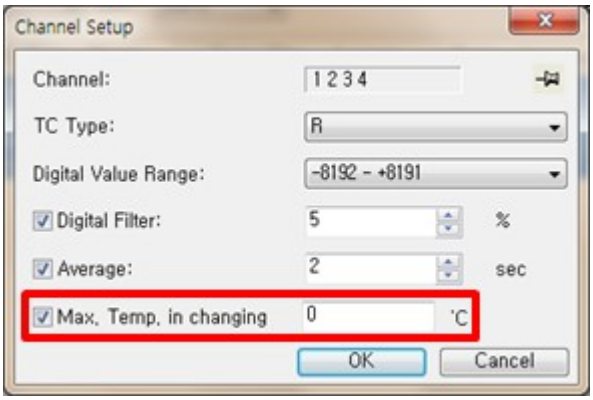
NTWE-310 modem is added. Refer to [Here] for details.



PLCS TC module – Max. Temp. in changing function is added.

Clcik Max. Temp. in changing or write “0” not to use this function

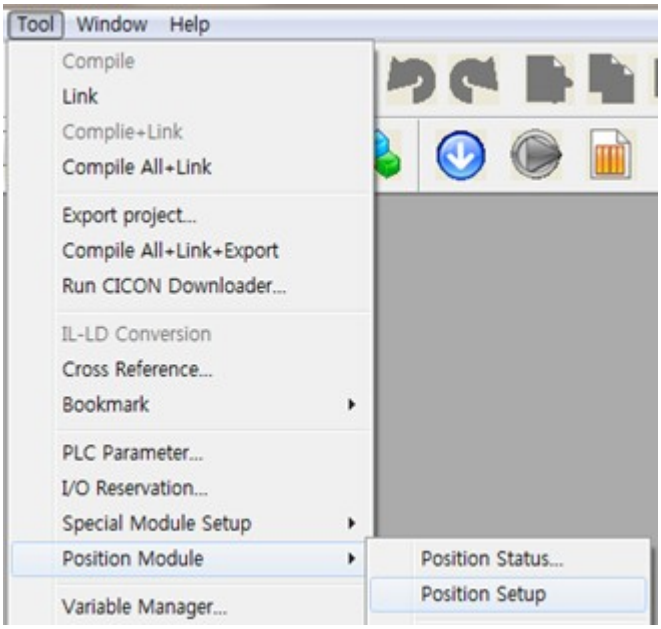




Position Setup function is added.

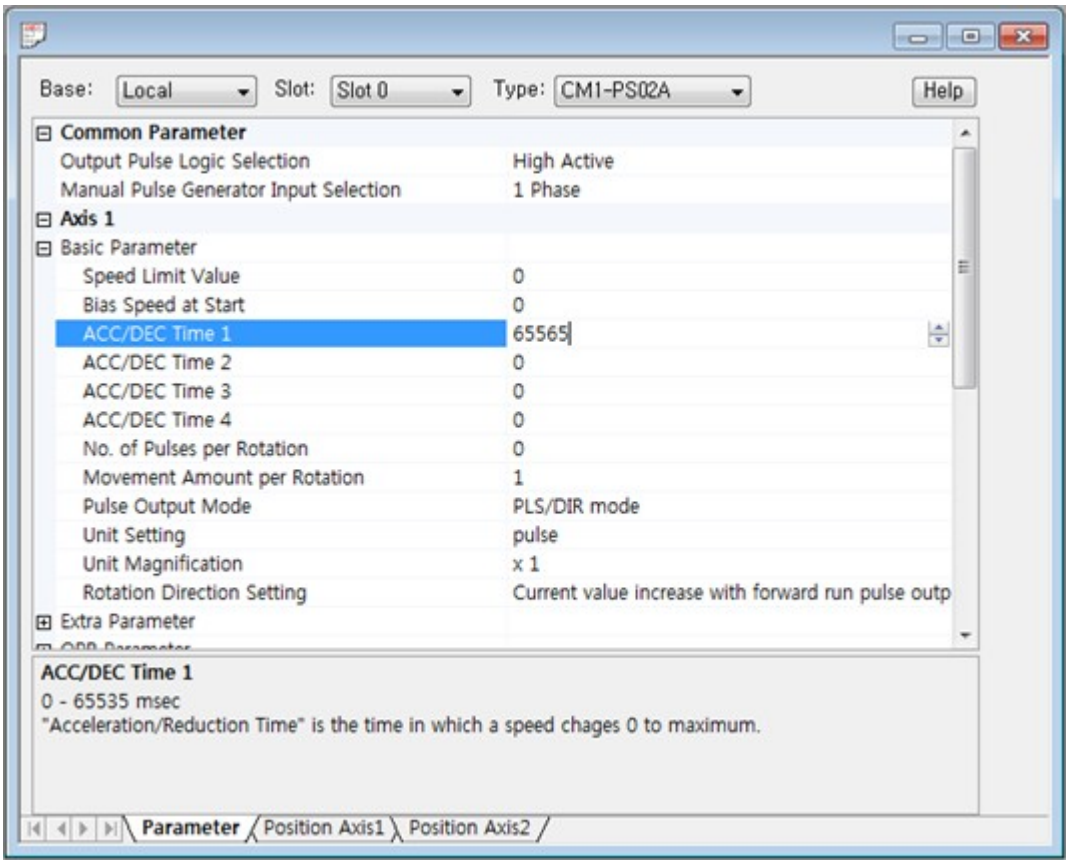
If user writes wrong value, warning message appears.

Click [Tool] -> [Position Module] -> [Position Setup]

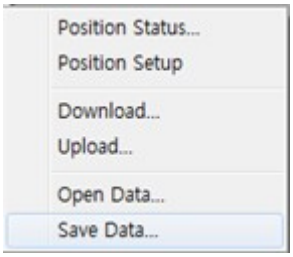


Write the value at "Basic Parameter" as following.

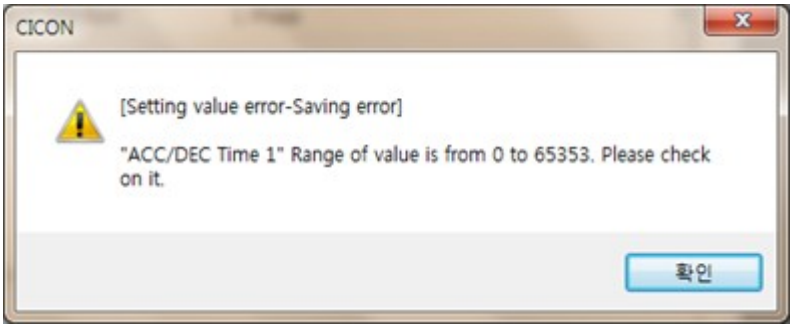
Ex) ACC/DEC Time 1(Range: 0 - 65535): Write 65565



After parameter setup, click [Tool] -> [Position Module] -> [Save Data]



Since the value(65565) of ACC/DEC Time 1 is out of range, warning message pops up.
If you change this value between 0~65535, it will be saved.

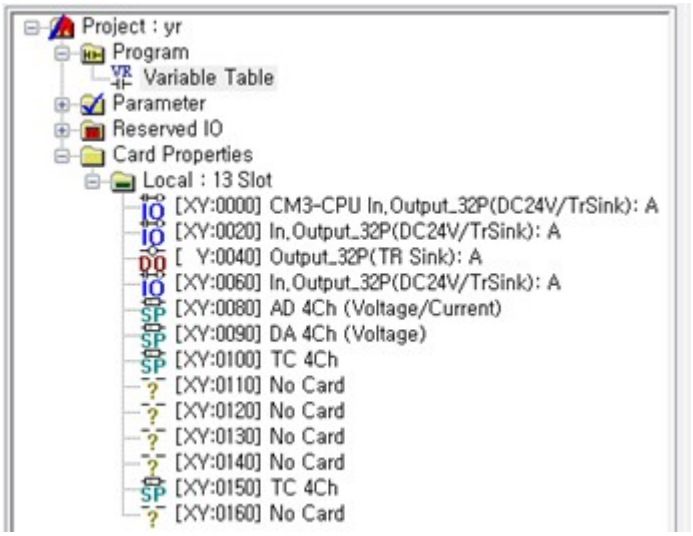


Module Input/Output points and IO module Icons are added.

IO points indicators "X" / "Y" / "XY" are added to Module information.

"X" : Input module "Y" : Output module "XY" : Input and output module

*IO module Icon is added.



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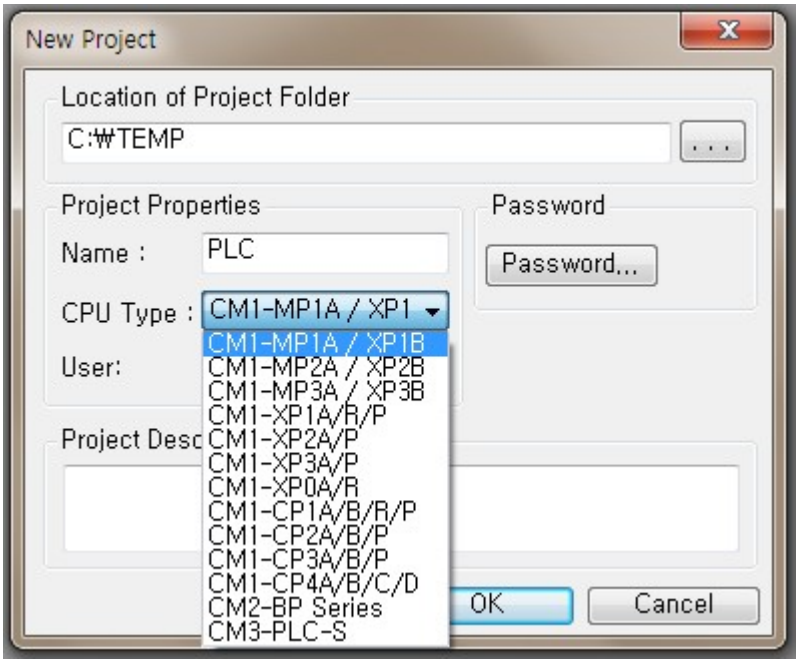


2.1.3 Ver401

This version of CICON provides following new functions.

- CICON version 4.01 supports PID control for all types of CIMON PLC.

PID2

CICON version 4.01 supports PID control for all types of CIMON PLC.
However New PID2 functions are available with below PLC type and firmware.

The PID2 can be supported by these Firmware Versions as below.

CPU	XP	CP	BP	PLC-S	MP	CICON
Version	V4.27	V4.26	X	V1.37	-	V.3.10

* "Self Learning" function does not support CP3U and CP4U CPU.
* MP Series is under development.

If CICON Ver.4.01 executes "online edit" with the PLC which has old firmware version(that does not support PID2), "Self Learning" and "Kp x 100" functions cannot be supported.

2.1.4 Ver400

This version of CICON provides following new functions.

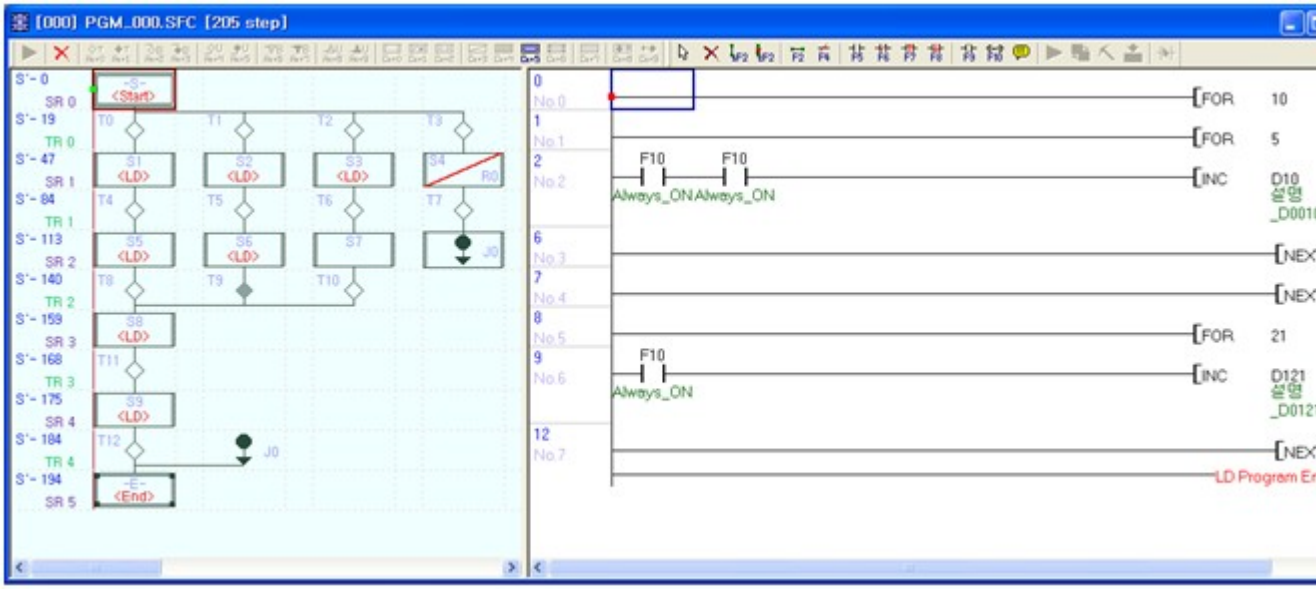
- SFC Program (Ver. 4.00)
- Device memory Export and Import

- “Stop deleting empty rungs” added
- Variable selection dialog
- Module Config Export for Simulator
- Detailed device information of double word in Cross Ref. added
- Full screen(Alt+Enter) and Variable table(F11)
- LD editor shows Rung number
- CICON Version pop up message
- All menus does not activate while compiling.
- “Don’t insert END” option added
- Maximum tempt. Setting in PLC-S TC module added.
- Variable indication when C device is used as word.
- “Prohibit Uploading sequence program” in PLC parameter
- FROM / TO window added
- Firmware upgrade mode
- Program ID(PID) shows at scan program and SFC program

SFC Program

SFC program added in Version 4.00

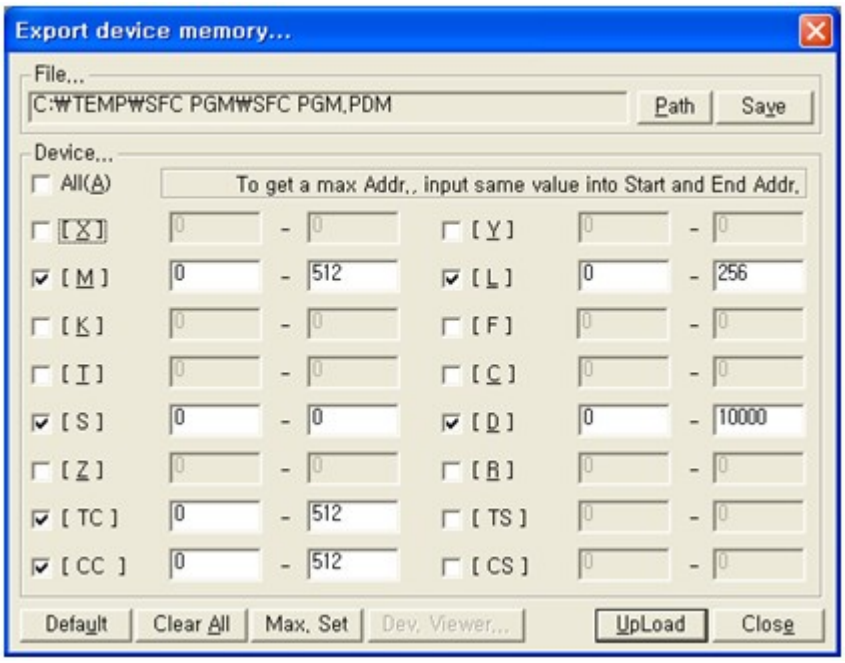
Click [here] to see more details.



Device memory Export and Import

You can access PLC and upload/download device memory.

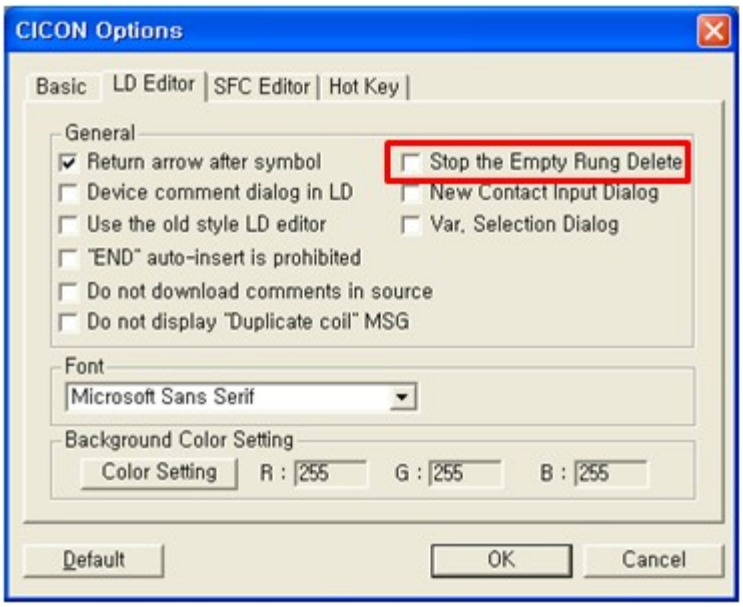
Click [here] to see more details.



Stop deleting empty rungs

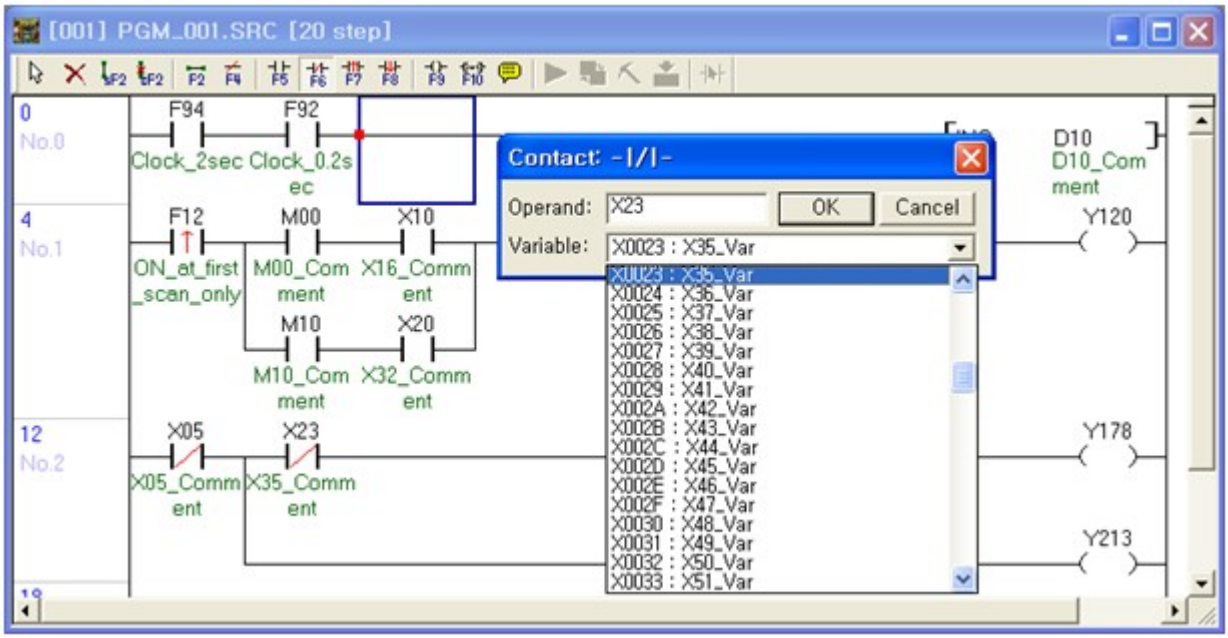
LD editor remove all empty rungs when you save the program.

If you do not want to use this function, click the ‘Stop deleting empty rungs’

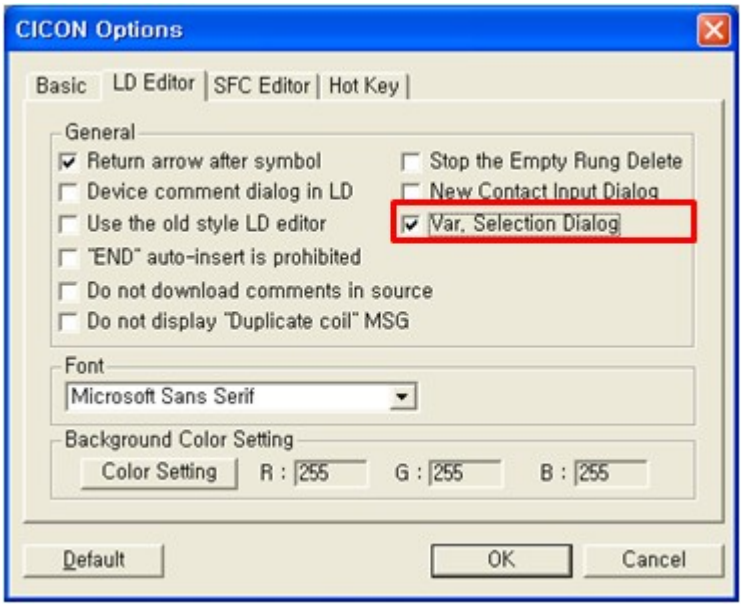


Variable selection dialog

You can choose address with variable.



In order to use this function, click ‘Var. Selection Dialog’ at CICON Options.

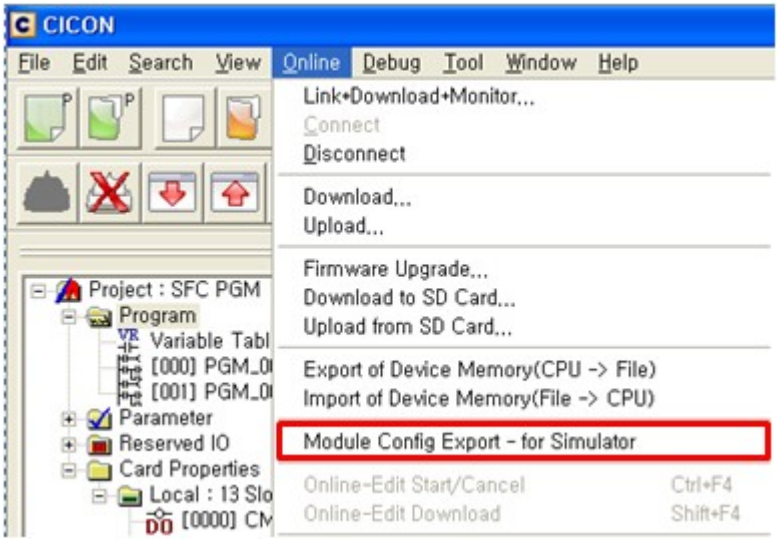


Module Config Export for Simulator

It is used to save module configuration and use it as simulator.

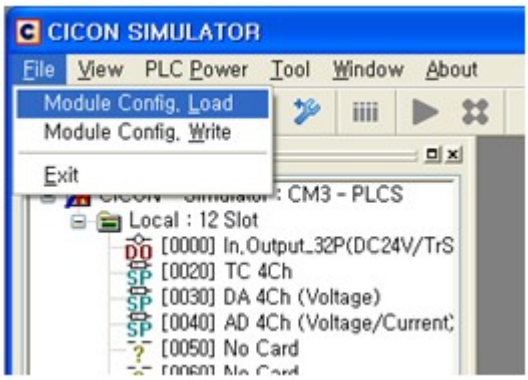
Once you save module configuration, you can open it at simulator to use it.

Click [Online] -> [Module Config Export] after connecting PLC online.



Write the file name and Save it.

Click [File] -> [Module Config. Load] to open saved ‘Module config file’

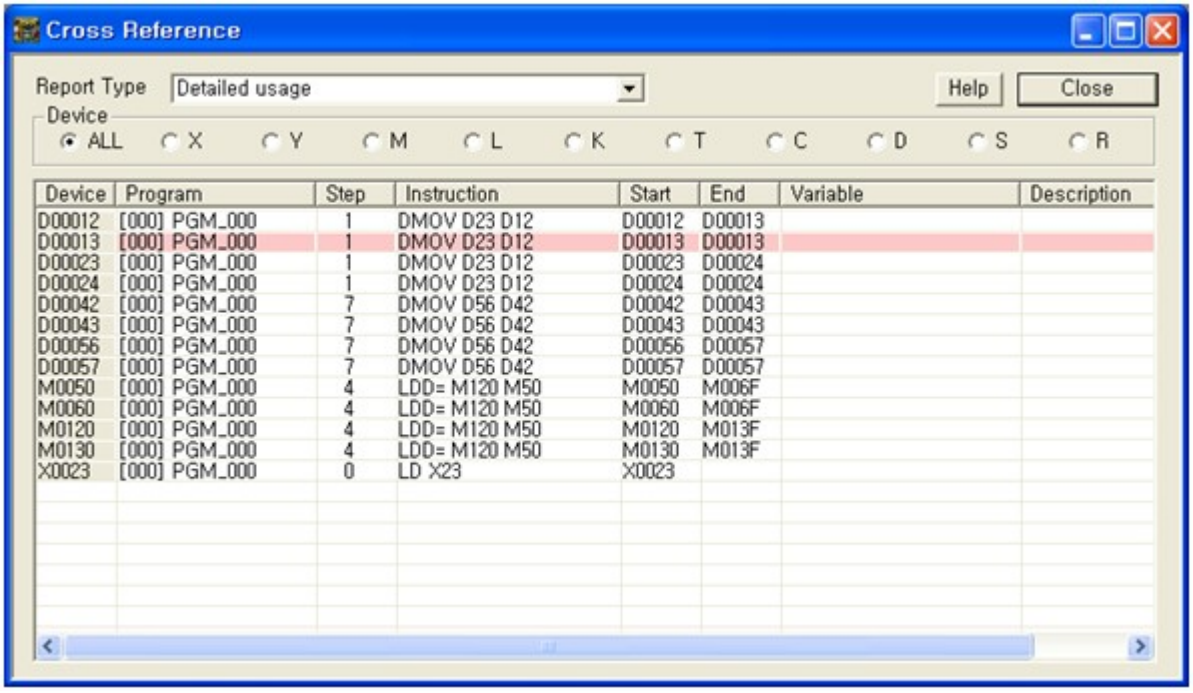


Detailed device information of double word in Cross Ref. added

If you use double words instruction, Cross reference shows detailed device which is related with word.

In case of “DINC D12”, it shows ‘D12’ and ‘D13’

* Instructions for block and more than double devices are exception.



Device	Program	Step	Instruction	Start	End	Variable	Description
D00012	[000] PGM_000	1	DMOV D23 D12	D00012	D00013		
D00013	[000] PGM_000	1	DMOV D23 D12	D00013	D00013		
D00023	[000] PGM_000	1	DMOV D23 D12	D00023	D00024		
D00024	[000] PGM_000	1	DMOV D23 D12	D00024	D00024		
D00042	[000] PGM_000	7	DMOV D56 D42	D00042	D00043		
D00043	[000] PGM_000	7	DMOV D56 D42	D00043	D00043		
D00056	[000] PGM_000	7	DMOV D56 D42	D00056	D00057		
D00057	[000] PGM_000	7	DMOV D56 D42	D00057	D00057		
M0050	[000] PGM_000	4	LDD= M120 M50	M0050	M006F		
M0060	[000] PGM_000	4	LDD= M120 M50	M0060	M006F		
M0120	[000] PGM_000	4	LDD= M120 M50	M0120	M013F		
M0130	[000] PGM_000	4	LDD= M120 M50	M0130	M013F		
X0023	[000] PGM_000	0	LD X23	X0023			

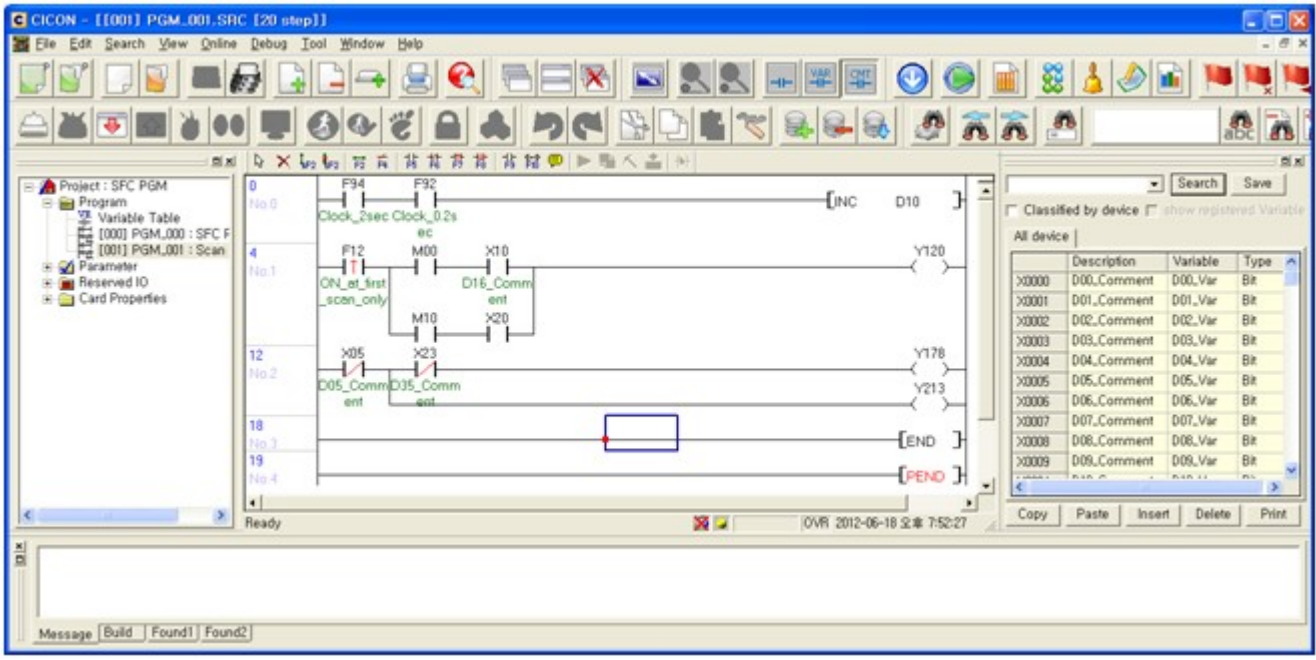
Full screen(Alt+Enter) and Variable table(F11)

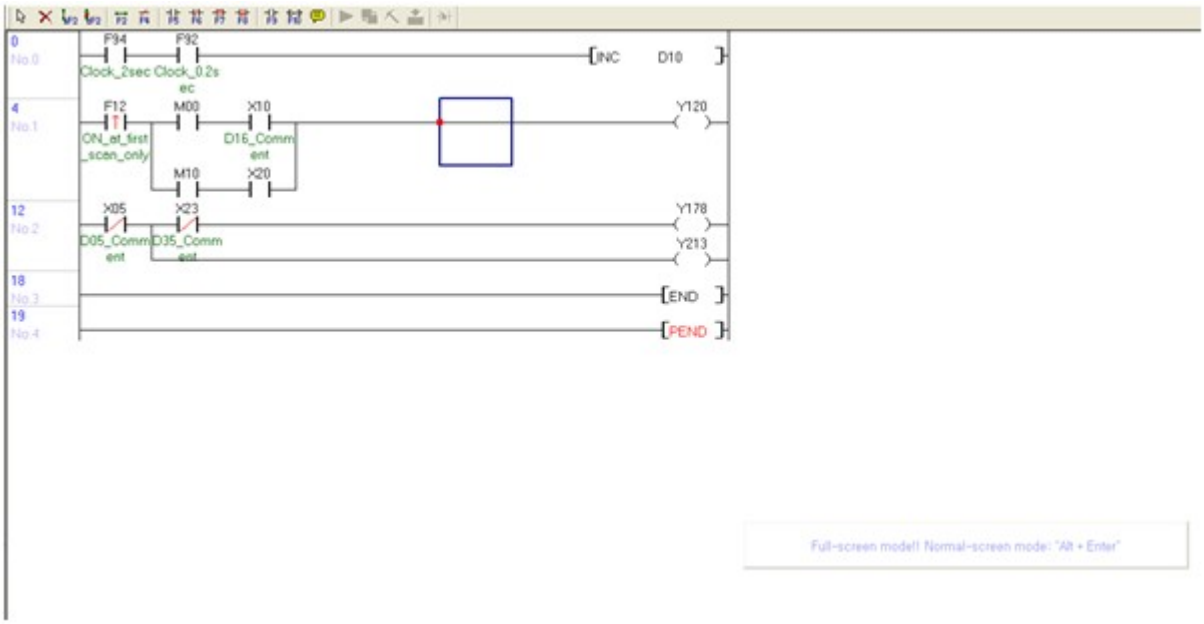
In order to see only scan program, Full screen feature is added.

Press “Alt + Enter” to see scan program with full screen.

If press ‘Alt + Enter” one more time, screen size comes back to small size.

* In order to disappear Variable table, press “F11”.





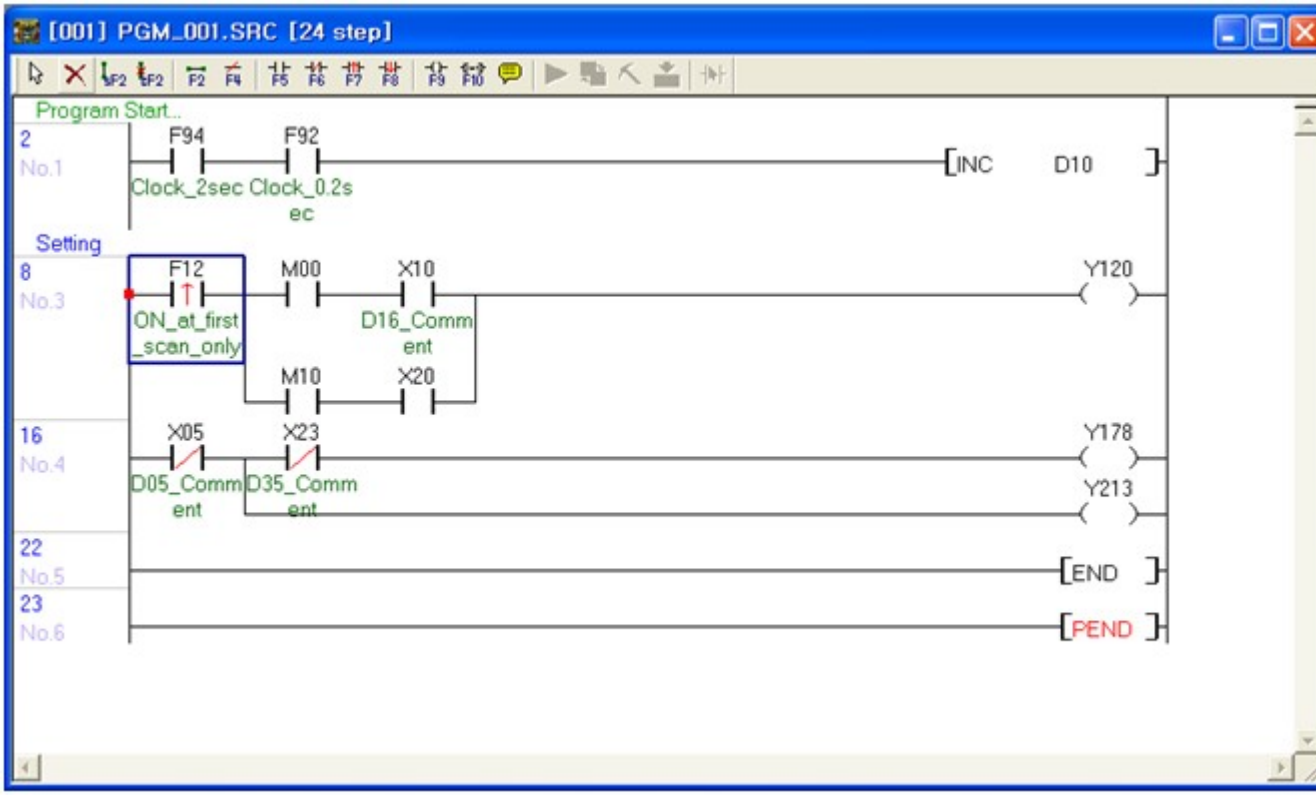
LD editor shows Rung number

LD Editor shows rung number.

Its function helps you to find out rung location.

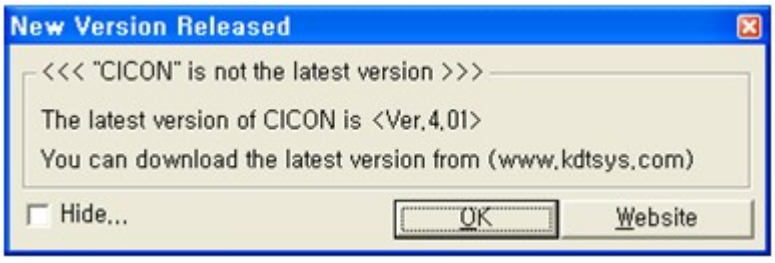
* The form of rung number is like “No.xxx” as below picture. (Rung and Row is totally different meaning.)

* If there is description, it is also considered to belong to rung number.



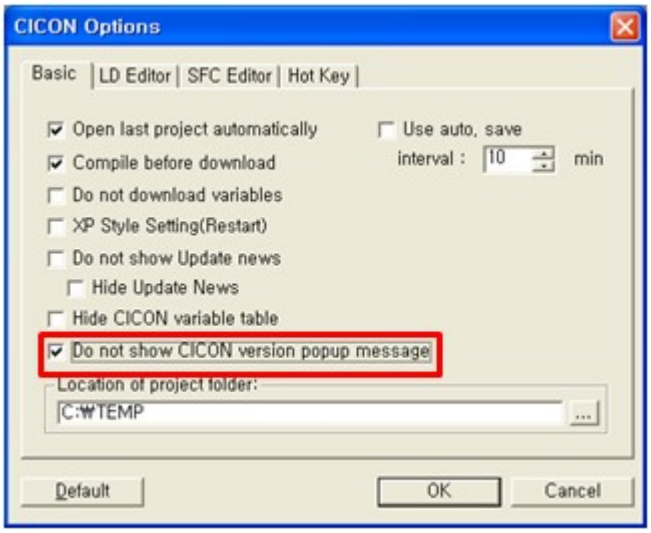
CICON Version pop up message (in case CICON is connected internet)

When you open CICON, CICON check the OS version if CICON is connected to internet.
If your OS version is not latest version, popup message appears as below.



OK : Close
Website : go to KDT website to download new CICON version.
Hide : Do not show this message again.

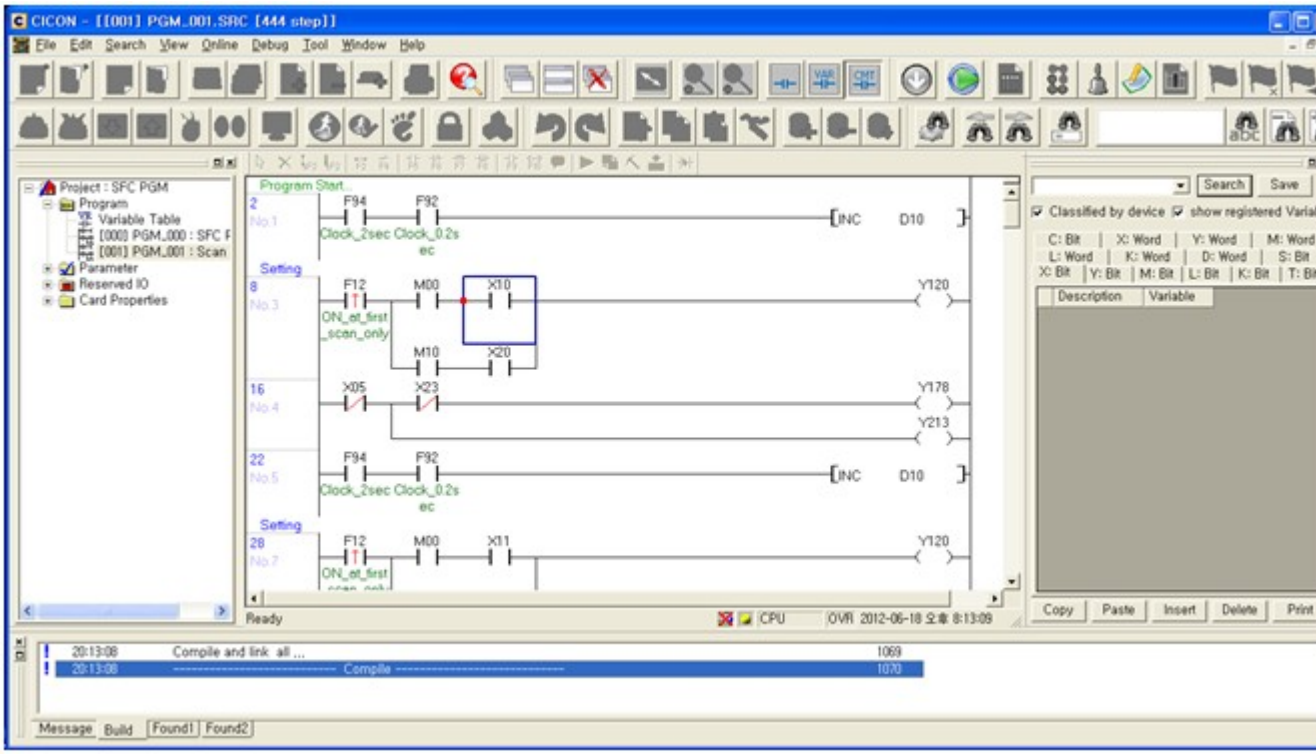
* If you do not want to see this message again, click [Tool] -> [CICON Options] and select 'Do not show CICON version popup message'



All menus does not activate while compiling.

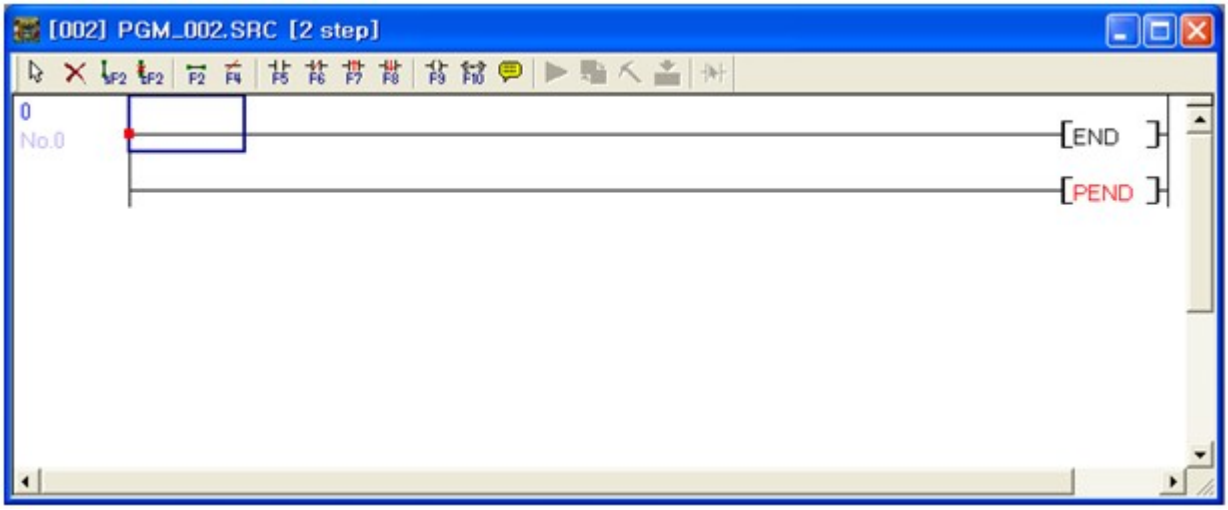
All menus are not activated while compiling.

You can use menus after compiling is completed.

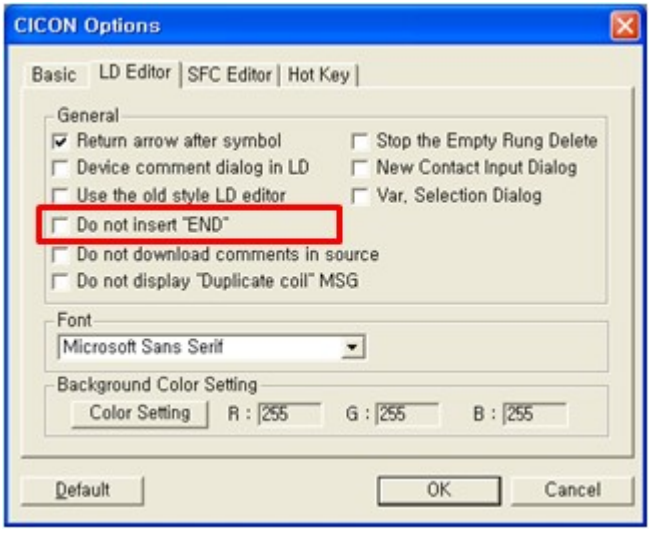


Do not insert END" option added

"END" and "PEND" are automatically inserted in scan program.



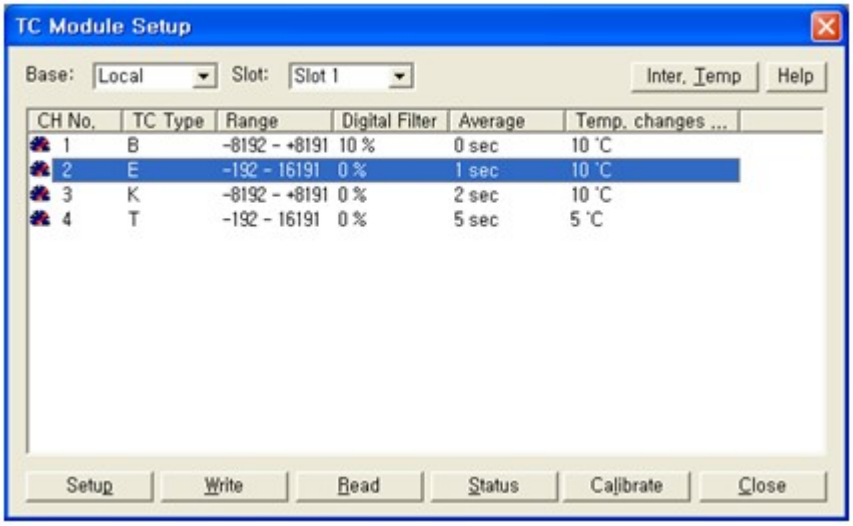
If you want to use this function, click [Tool] ->[CICON Options] -> [LD Editor] and select "Do not insert END"



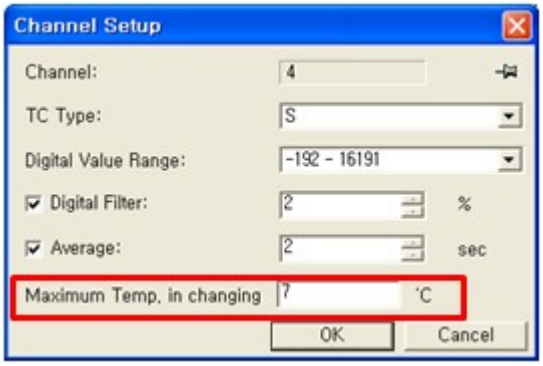
Maximum tempt. Setting in PLC-S TC module added.

"Maximum Temp. in changing" function in TC module Setup is added.
This function works with CM3-SP04ETO (TC module in range of PLCS)

TC Module Setup

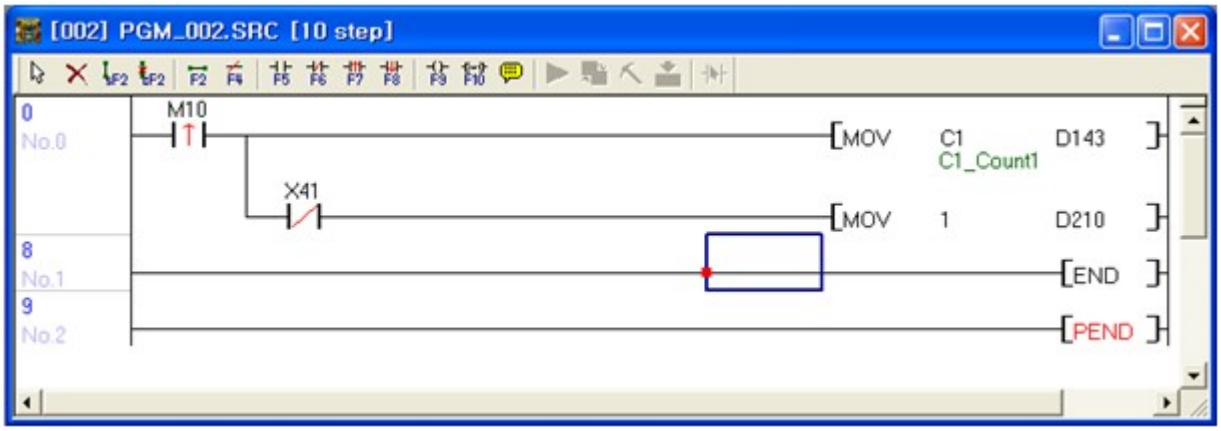


Channel Setup



Variable indication when C device is used as word.

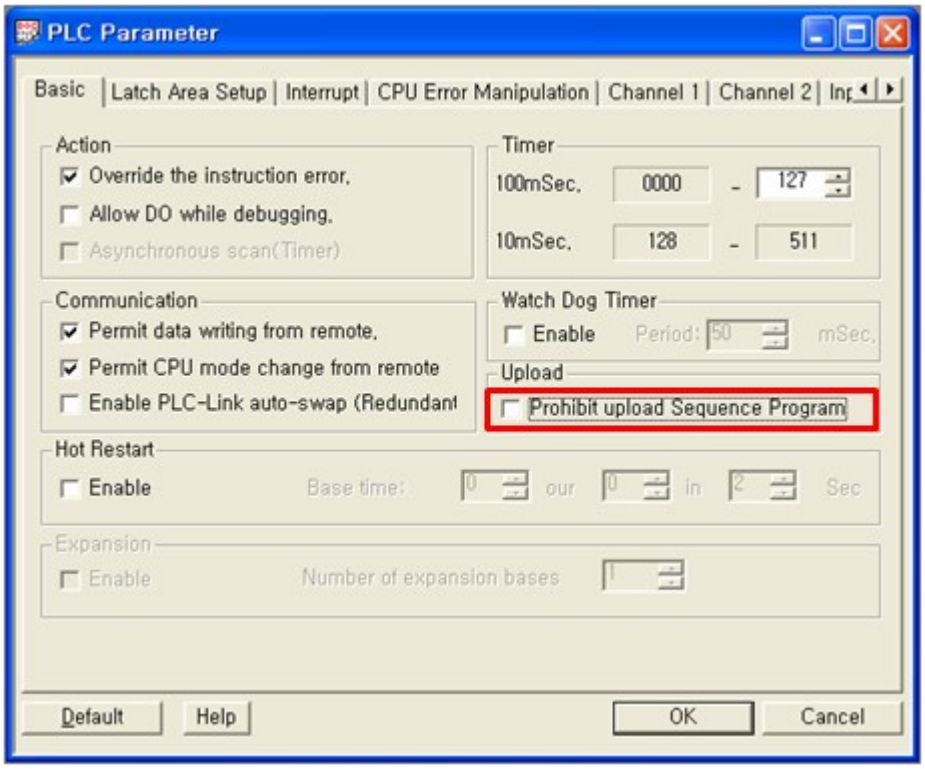
You can make comment and show it in scan program when C device is used word type.

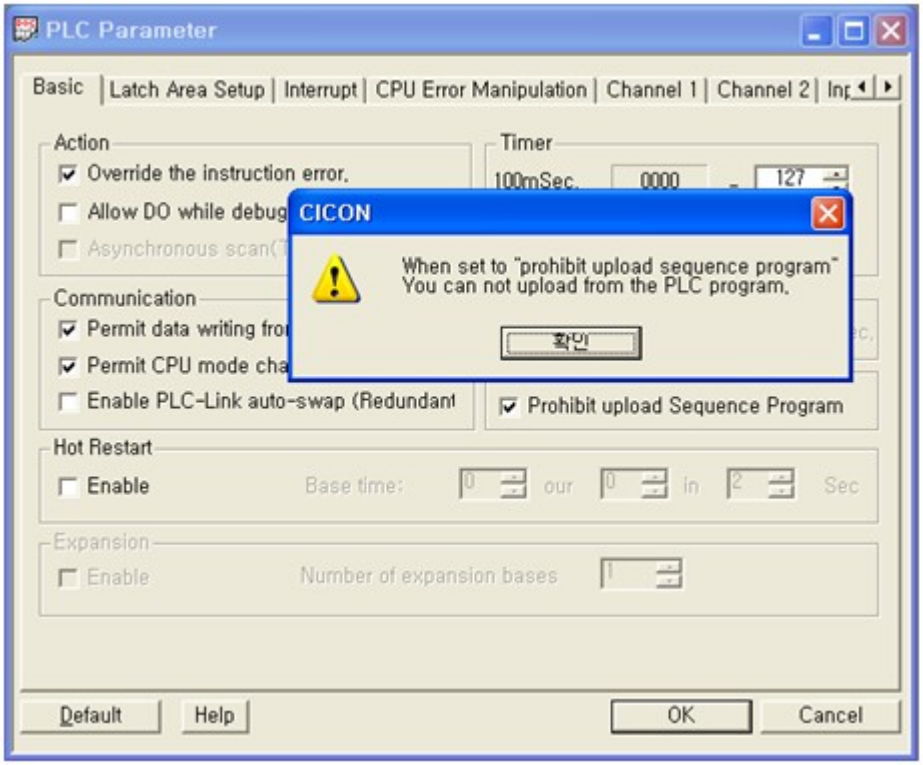


“Prohibit Uploading sequence program” in PLC parameter

It is used to prohibit uploading sequence program from PLC to PC.

If you select “Prohibit upload Sequence Program”, warning message pops up as below.





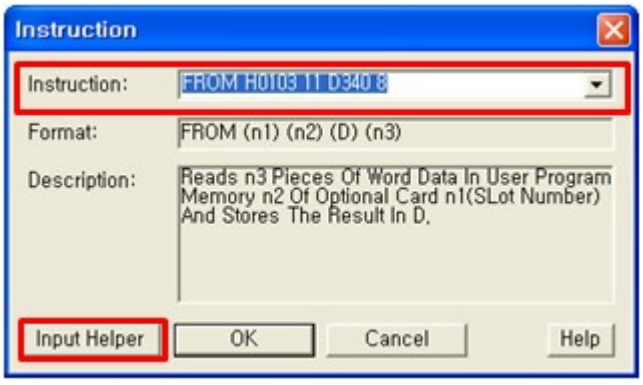
FROM / TO window added

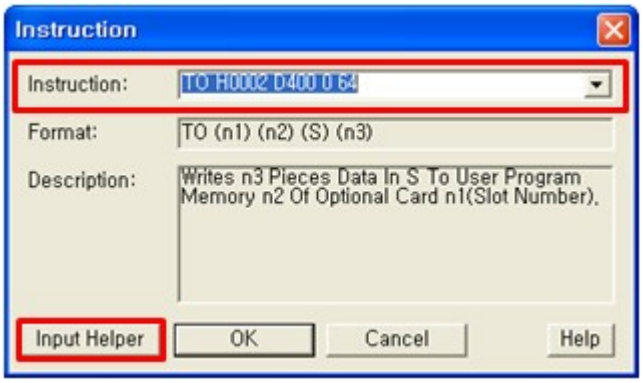
It is used to set up “FROM” and “TO” instruction in scan program.

When you press F10 or write “FROM” or “TO” instruction, there is “Input Helper” as below picture.

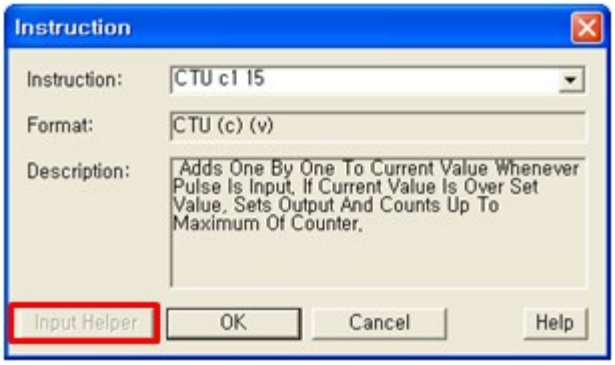
If you click ‘Input Helper’, ‘Instruction’ window pops up.

‘Instruction’ setting window helps you to make easy setting.

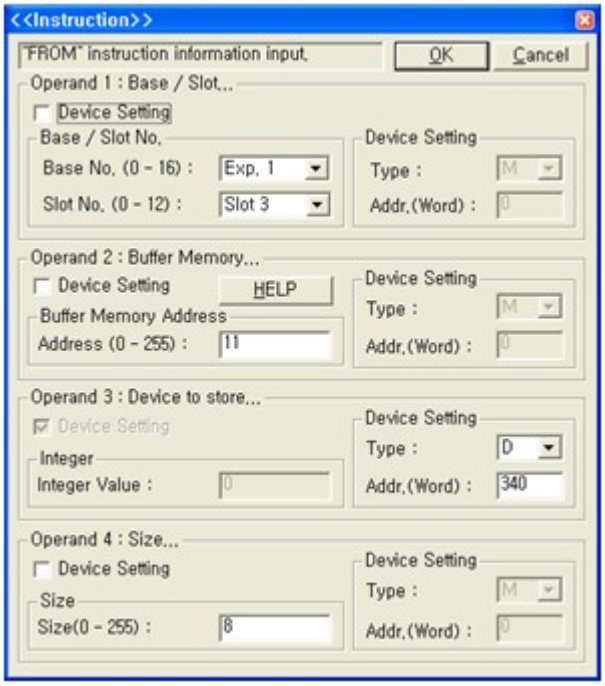




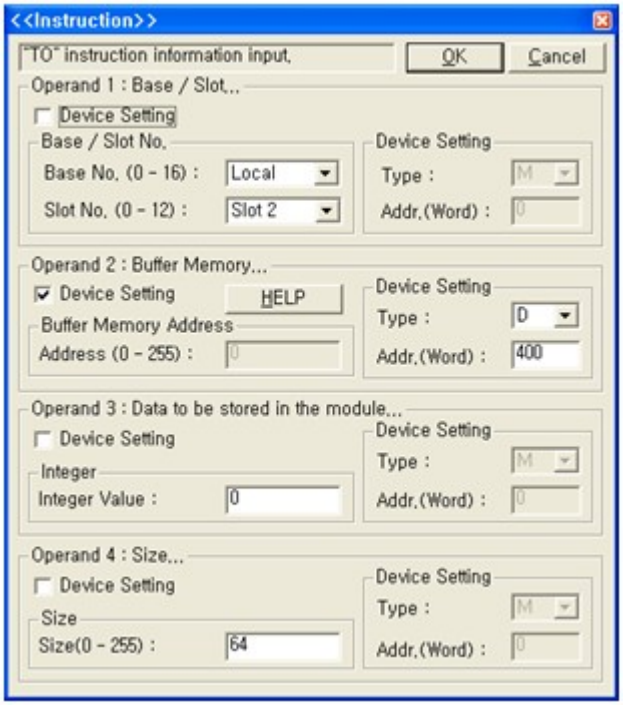
'Input Helper' is activated with only 'FROM' and 'TO' instruction.



* "FROM" instruction window

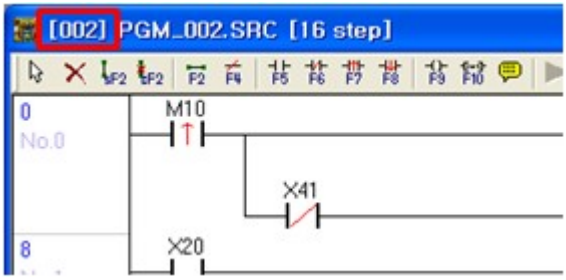


* "TO" instruction window



Program ID(PID) shows at scan program and SFC program

Program ID number is appeared in front of program name.



2.1.5 Ver310

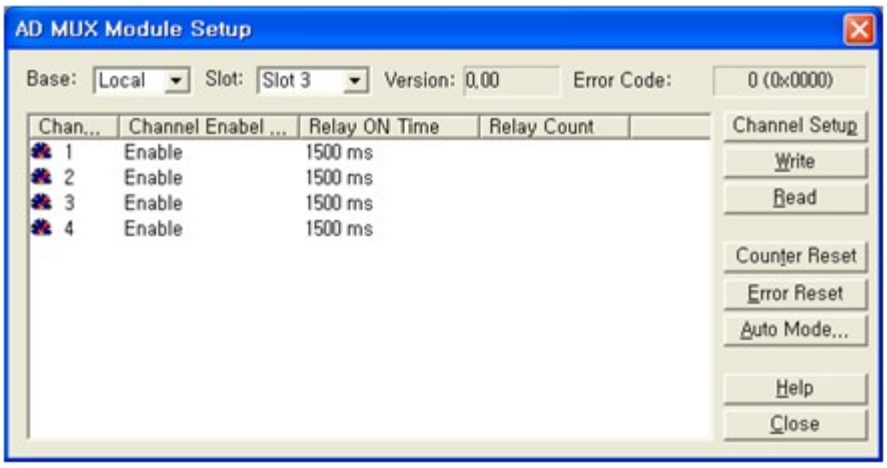
This version of CICON provides following new functions.

- PLC-S AD MUX Module Added.
- PLC-S Ethernet Module Added.
- PLC-S Serial Module Added.
- PLC-S RS232 2CH. Module Added.
- Variable Export / Import function Added.
- IO Input module Filter Setting Program Added

- PID Special Program: PID_2 function Added. Refer to [Here]
- Incomplete Rung indication (Red and Green) in LD editor Added.
- Rung Number Added.
- Device Setting of Cross Reference is modified.
- Ch1 (RS232) and Ch2 (RS422/485) at PLC Parameter of PLC-S default setup modified.
- Segment Setup function in Protocol Program Added.

PLC-S AD MUX Module Added

PLC-S AD MUX Module is newly added. Refer to [Here]

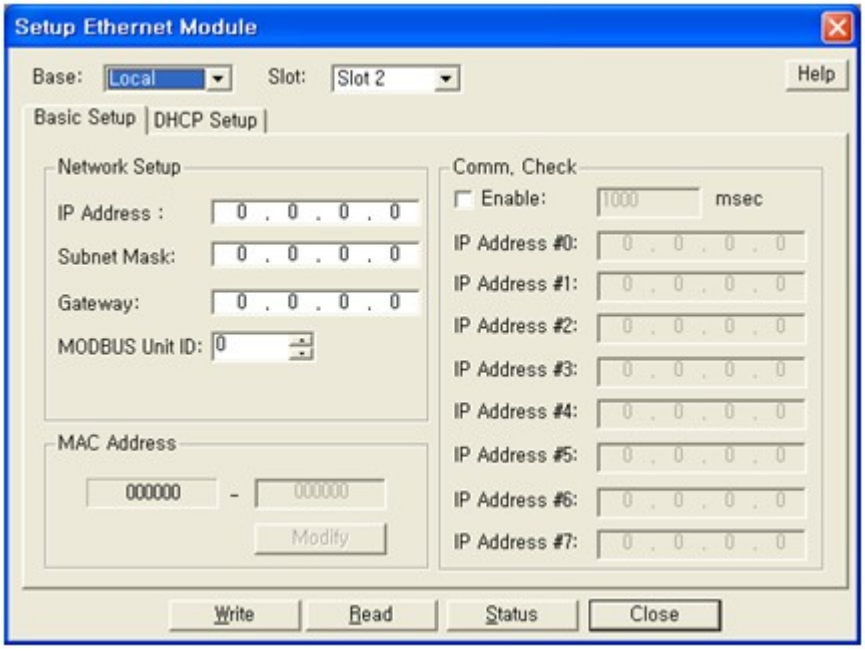


PLC-S Ethernet Module Added

PLC-S Ethernet Module is added. Refer to [Here].

Setup method is the same as that of XP / CP Type Ethernet Module.

-> The Setup Ethernet Module is available at Special Card Initialize Program and Simulator.

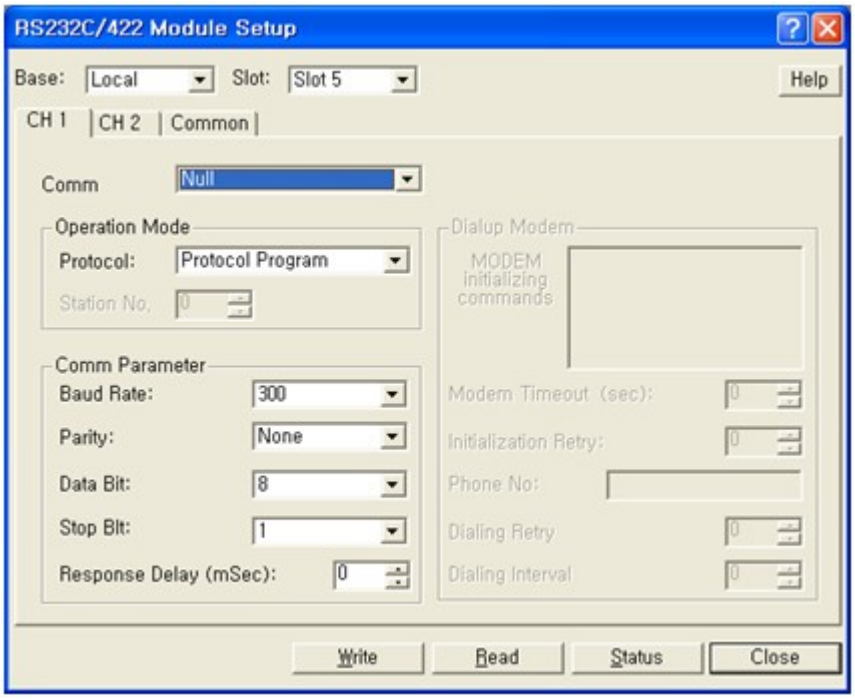


PLC-S Serial Module Added

PLC-S Serial Module is added. Refer to [Here].

Setup method is the same as that of XP / CP Type Serial Module.

-> The RS232C/433 Module Setup is available at Special Card Initialize Program and Simulator.

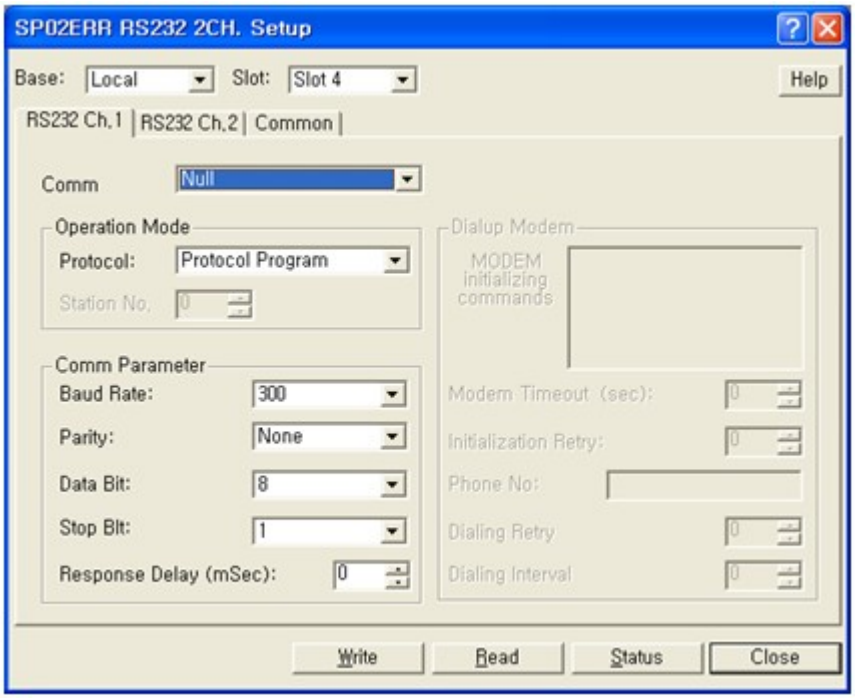


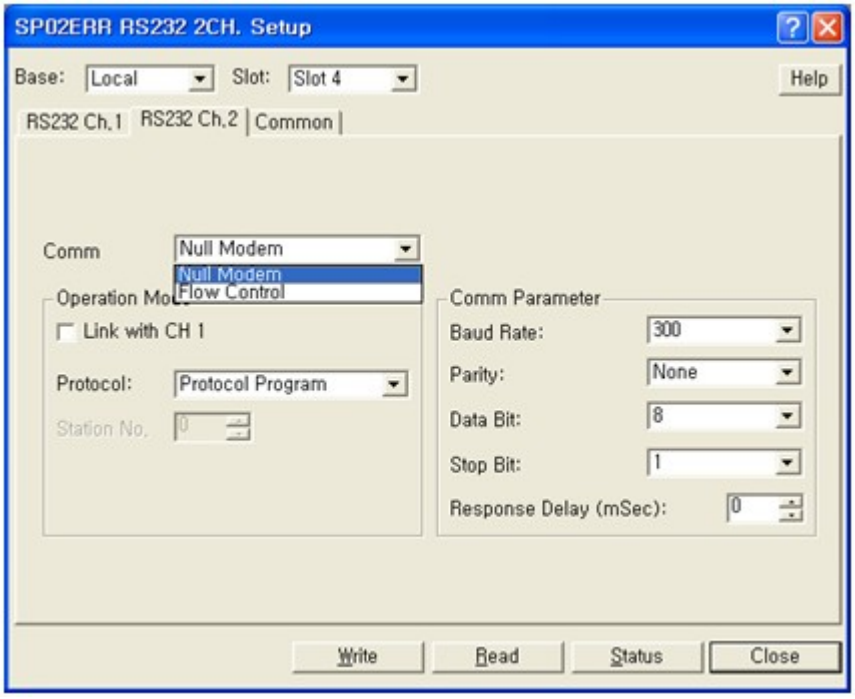
PLC-S RS232 2CH. Module Added

PLC-S RS232C 2CH. Module is added. Refer to [Here].

Setup method is almost the same as that of XP / CP Type Serial Module. Only difference is Communication Setup in CH.2 is changed to Null Modem and Flow Control.

-> The RS232C 2CH. Setup is available at Special Card Initialize Program and Simulator.

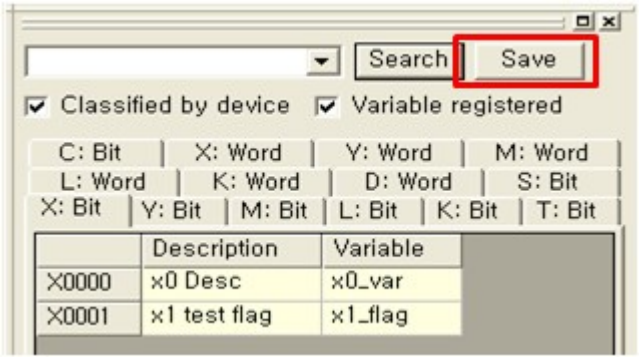




Variable Export / Import function Added

Export and save Variable data which is shown on project as file.

Click [Save] at Variable table before execute.



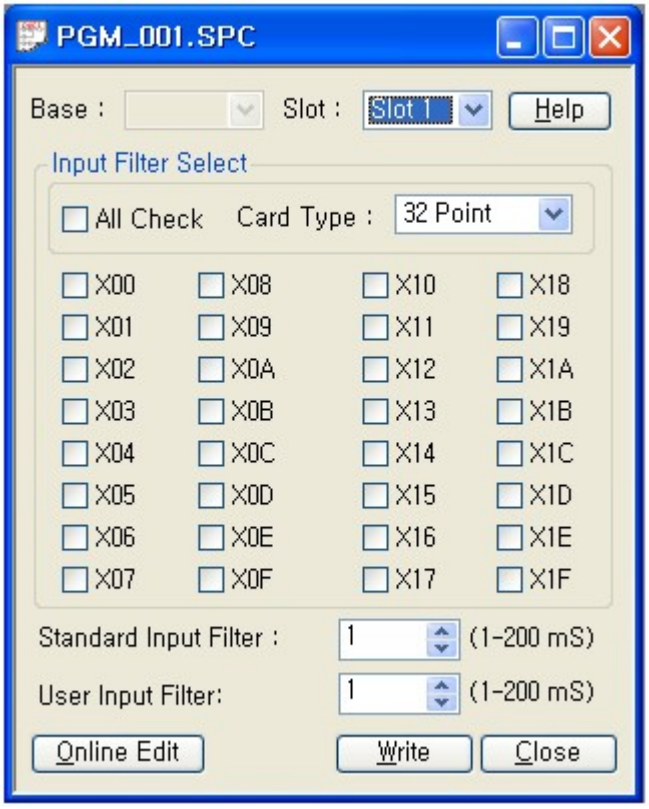
Execute [Variable Import] in order to open and apply variable table which is saved before to project.

IO Input module Filter Setting Program Added

IO Input module Filter Setting Program is added.

Setting method is the same with [Input Setting] of PLCS CPU.

Set up Slot number and Card Type as following.



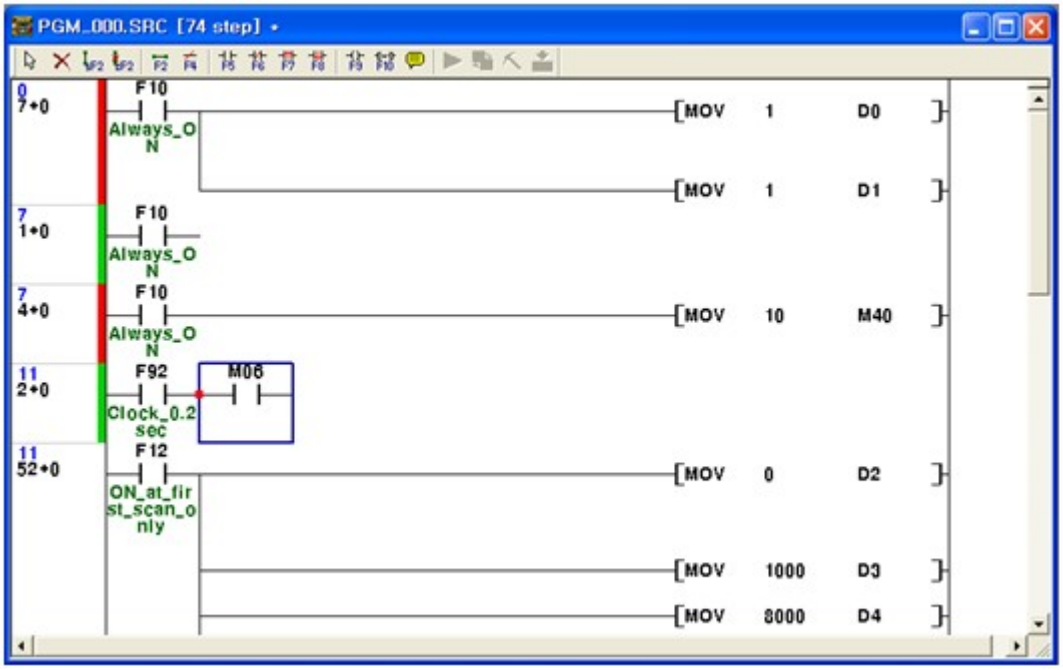
Incomplete Rung indication (Red and Green) in LD editor Added

If there are incomplete rungs, it becomes green in LD Editor as below.

***In order to arrange rungs without incomplete rungs, click [Edit] -> [Program Line-Up] or remove all incomplete rungs.**

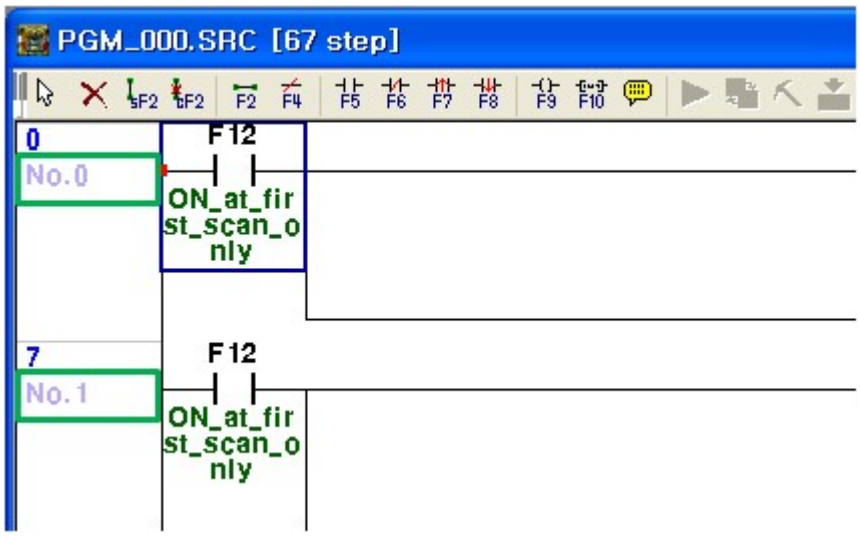
Red: Complete Rung.

Green: Incomplete Rung.

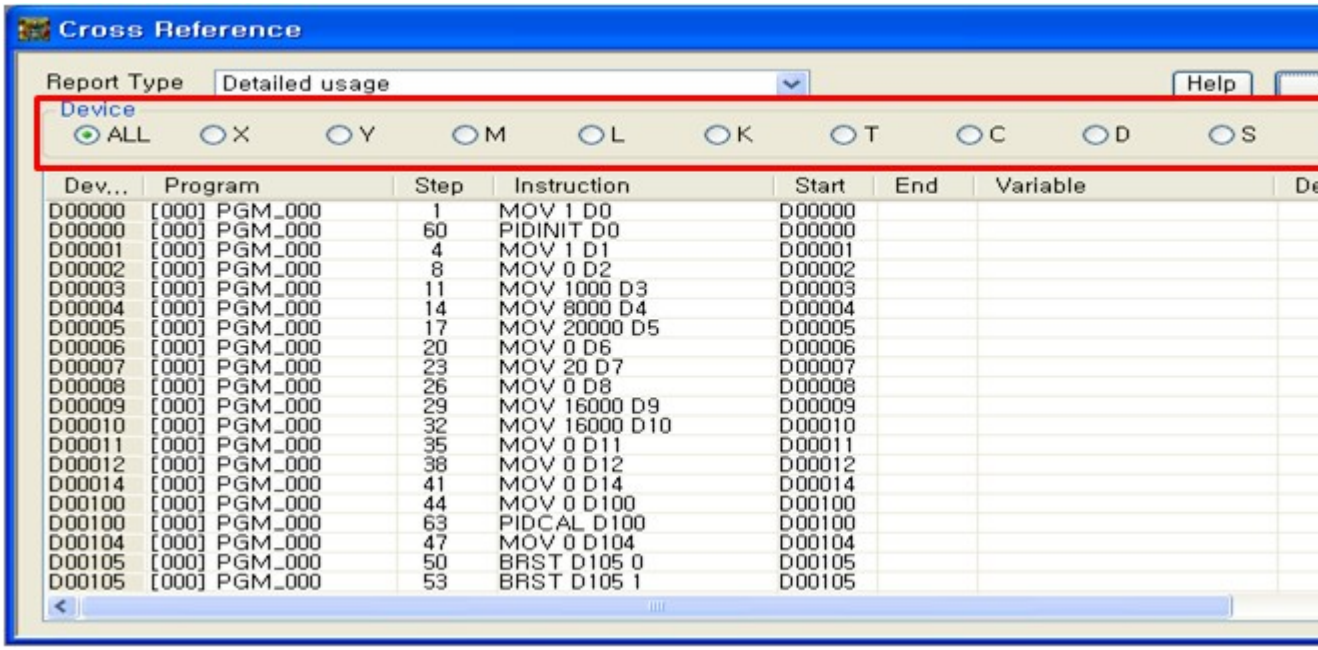


Rung Number Added

Rung number is shown at LD Editor as below.



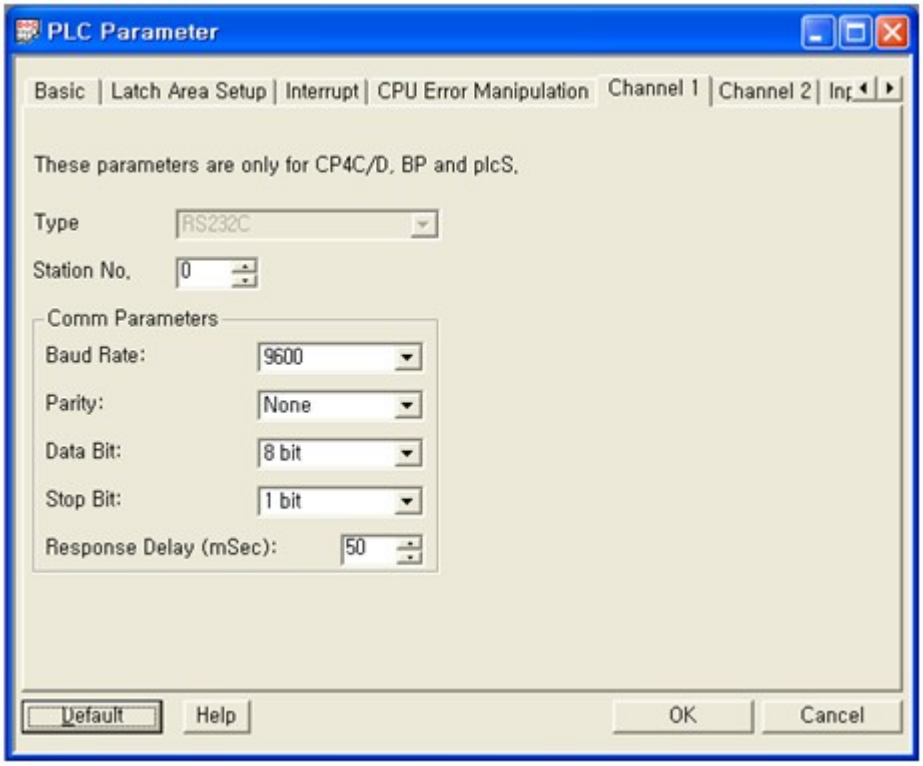
Device Setting of Cross Reference is modified

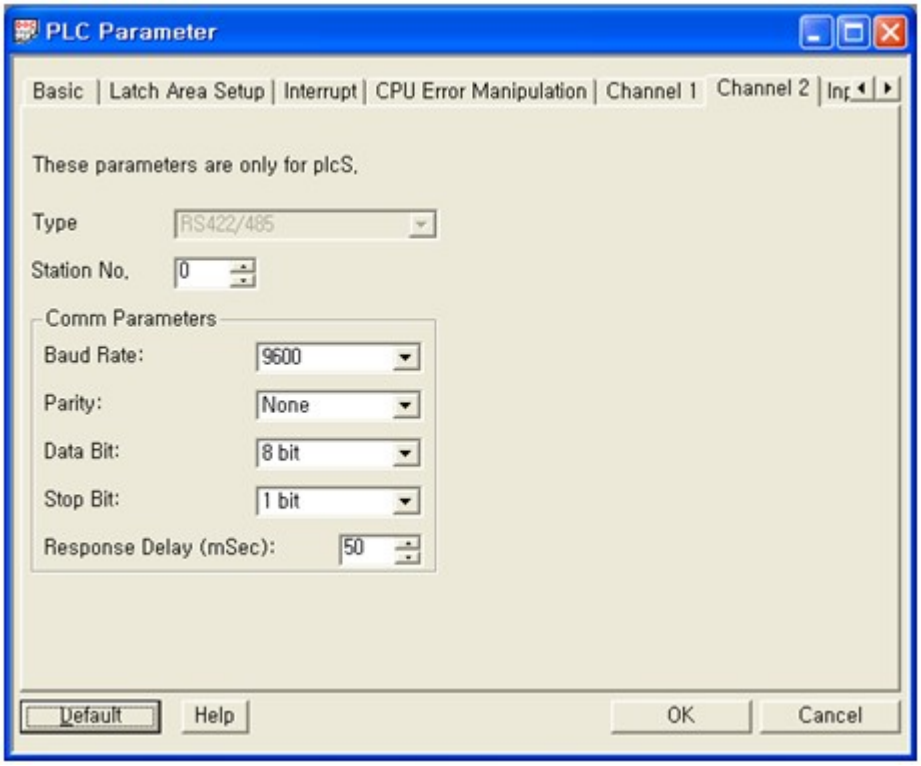


Dev...	Program	Step	Instruction	Start	End	Variable	De
D00000	[000] PGM_000	1	MOV 1 D0	D00000			
D00000	[000] PGM_000	60	PIDINIT D0	D00000			
D00001	[000] PGM_000	4	MOV 1 D1	D00001			
D00002	[000] PGM_000	8	MOV 0 D2	D00002			
D00003	[000] PGM_000	11	MOV 1000 D3	D00003			
D00004	[000] PGM_000	14	MOV 8000 D4	D00004			
D00005	[000] PGM_000	17	MOV 20000 D5	D00005			
D00006	[000] PGM_000	20	MOV 0 D6	D00006			
D00007	[000] PGM_000	23	MOV 20 D7	D00007			
D00008	[000] PGM_000	26	MOV 0 D8	D00008			
D00009	[000] PGM_000	29	MOV 16000 D9	D00009			
D00010	[000] PGM_000	32	MOV 16000 D10	D00010			
D00011	[000] PGM_000	35	MOV 0 D11	D00011			
D00012	[000] PGM_000	38	MOV 0 D12	D00012			
D00014	[000] PGM_000	41	MOV 0 D14	D00014			
D00100	[000] PGM_000	44	MOV 0 D100	D00100			
D00100	[000] PGM_000	63	PIDCAL D100	D00100			
D00104	[000] PGM_000	47	MOV 0 D104	D00104			
D00105	[000] PGM_000	50	BRST D105 0	D00105			
D00105	[000] PGM_000	53	BRST D105 1	D00105			

Ch1 (RS232) and Ch2 (RS422/485) at PLC Parameter of PLC-S default setup modified

The initial values of Channel 1 (RS232C) and Channel 2 (RS422/485) are changed to have the same settings.

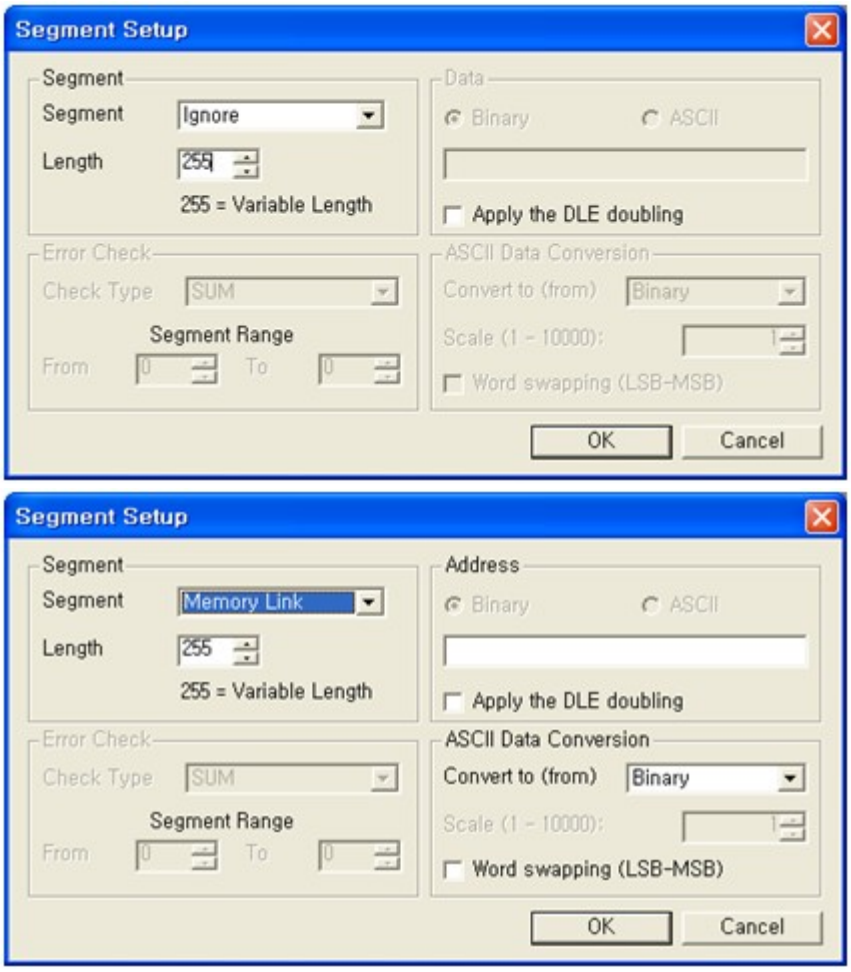




Segment Setup function in Protocol Program Added

There is the Segment Setup in Protocol Program.

1. Segment Type : "**Ignore**" or "**Memory Link**"
2. Length(Byte) : **255**



2.1.6 Ver309

This version of CICON provides following new functions.

- Download Utility added.
- DWORD viewer function in memory monitor added.
- PLC-S training kit manual added. Refer to [Here]

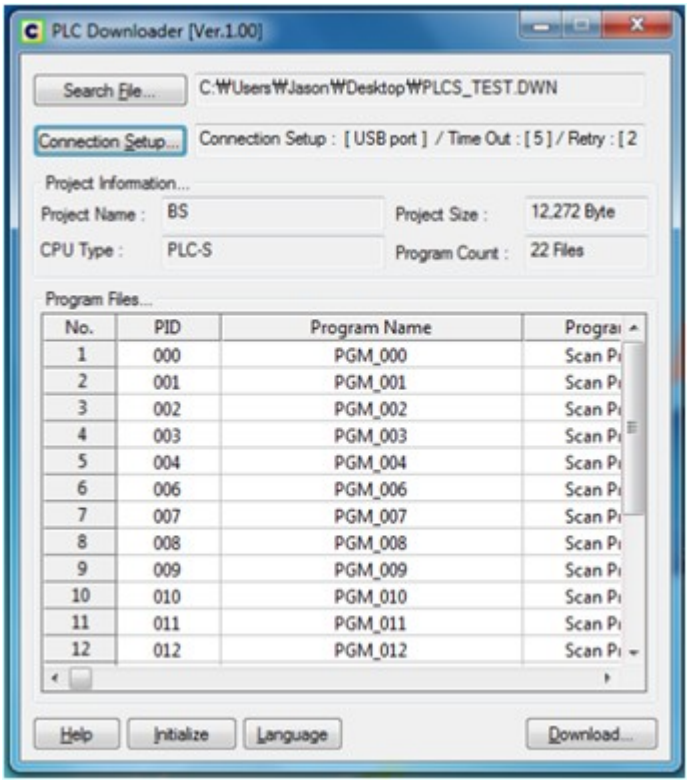
Download Utility added.

Download Utility added.

Download Utility is a tool for easy downloading of a project file created in CICON to PLC.

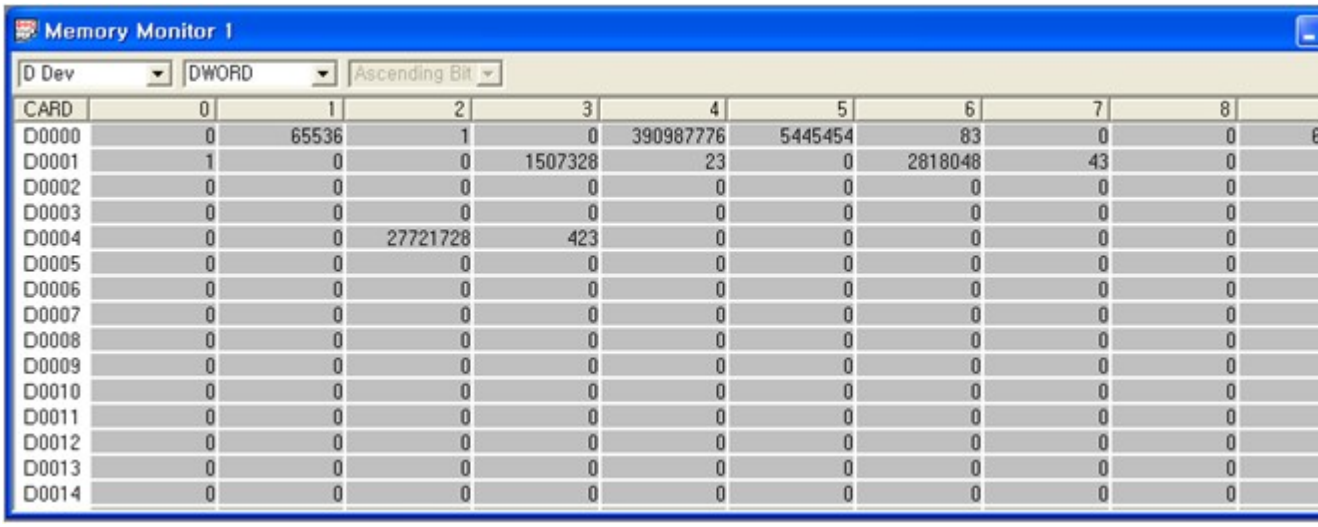
Project file, which is created in CICON by using "Export Project", can be used in PLC downloader CICON to download project files to PLC.

For detailed information, please refer to the manual.Refer to [Here]



Memory monitor - DWORD Viewer function added

DWORD Viewer for Word devide(D Dev/ R Dev/ T Cnt / T Set / C Cnt / C Set / Z Dev) has been added.



CARD	0	1	2	3	4	5	6	7	8
D0000	0	65536	1	0	390987776	5445454	83	0	0
D0001	1	0	0	1507328	23	0	2818048	43	0
D0002	0	0	0	0	0	0	0	0	0
D0003	0	0	0	0	0	0	0	0	0
D0004	0	0	27721728	423	0	0	0	0	0
D0005	0	0	0	0	0	0	0	0	0
D0006	0	0	0	0	0	0	0	0	0
D0007	0	0	0	0	0	0	0	0	0
D0008	0	0	0	0	0	0	0	0	0
D0009	0	0	0	0	0	0	0	0	0
D0010	0	0	0	0	0	0	0	0	0
D0011	0	0	0	0	0	0	0	0	0
D0012	0	0	0	0	0	0	0	0	0
D0013	0	0	0	0	0	0	0	0	0
D0014	0	0	0	0	0	0	0	0	0

2.1.7 Ver308

This version of CICON provides following new functions.

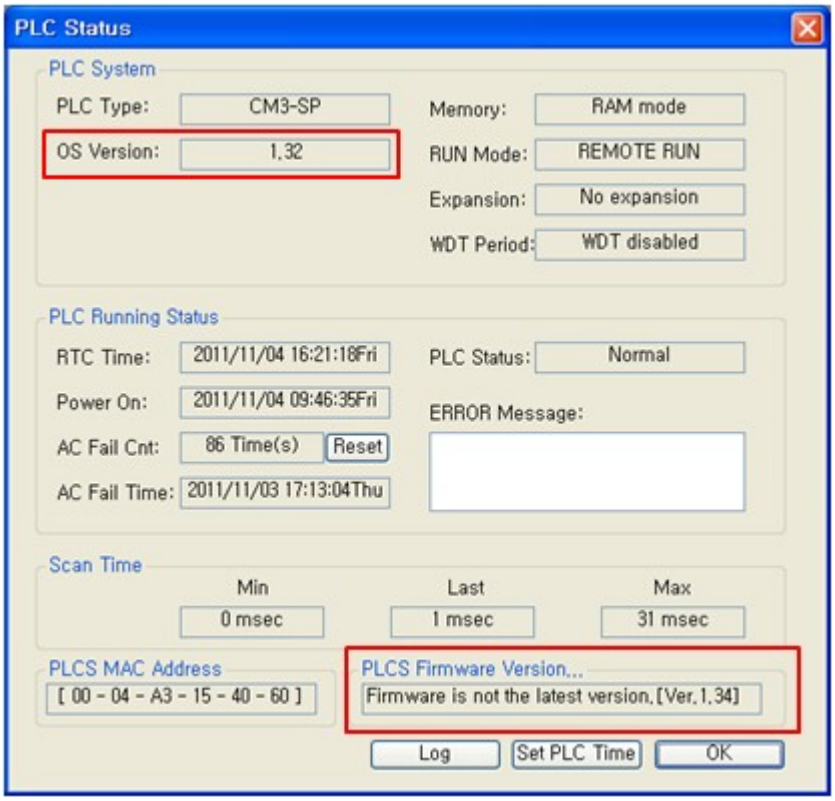
- Check function for PLCS Firmware version added.
- Check function for PLCS MAC Address added.
- XP Style Setting added.
- New Contact Input Dialog added.
- Load cell setting program range.

Check function for PLCS Firmware version added.

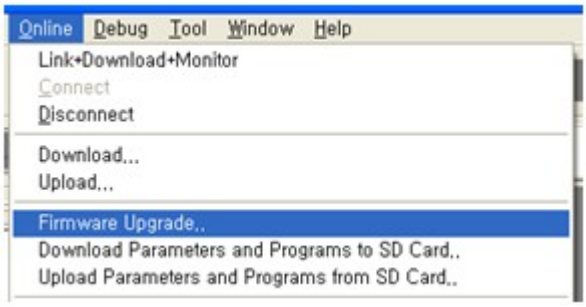
You can check firmware version of PLCS in CICON.

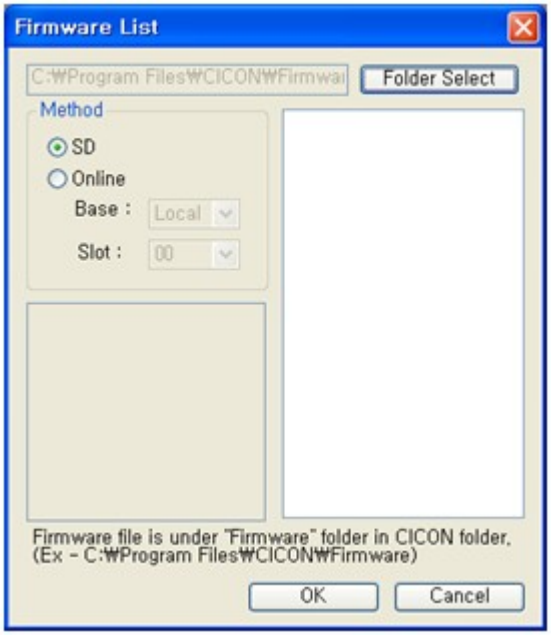
In order to check PLCS firmware version, connect PLCS to CICON and click [Online] -> [PLC Status]

If current OS version is not the latest version, you can check the OS version in “PLCS Firmware Version”.



If current OS version is not the latest version, you can upgrade it at [Online] -> [Firmware Upgrade]

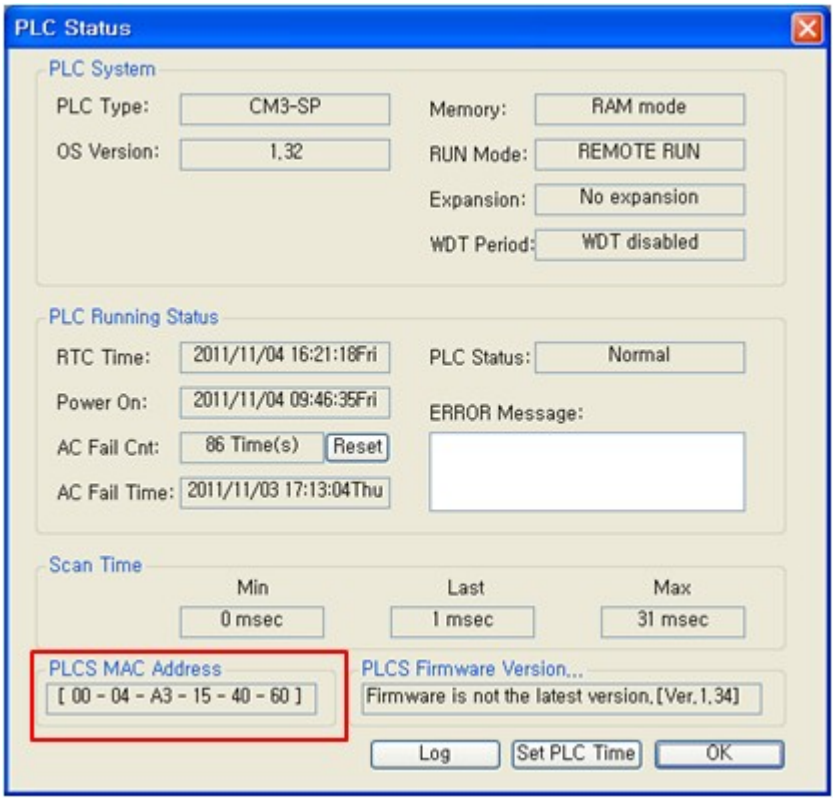




The new firmware file is under Firmware folder in CICON folder.
(ex. C:/Program Files/CICON/Firmware)

Check function for PLCS MAC Address added.

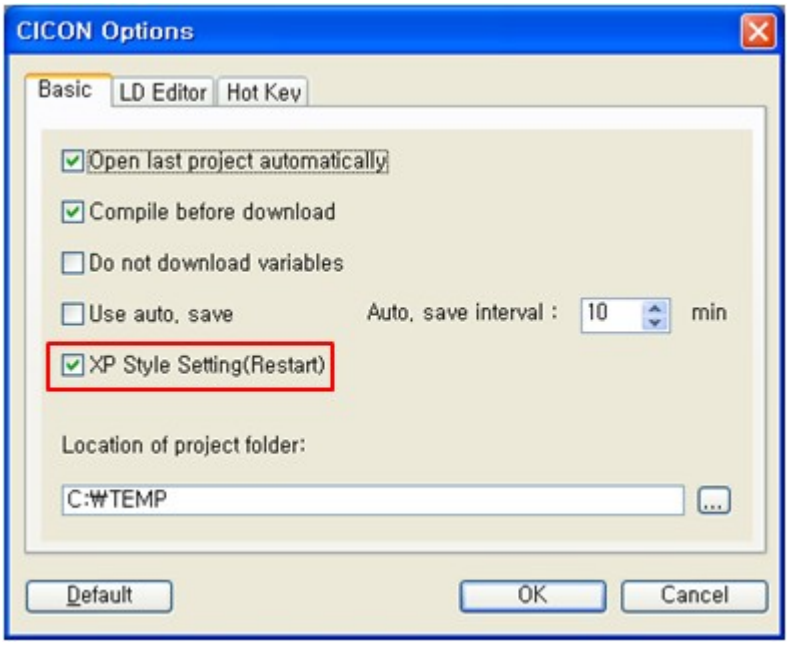
In order to check MAC Address, Connect PLCS to CICON with Online mode and click [Online] -> [PLC Status]



XP Style Setting(Restart) added.

You can change CICON style at [Tool] -> [CICON Options].

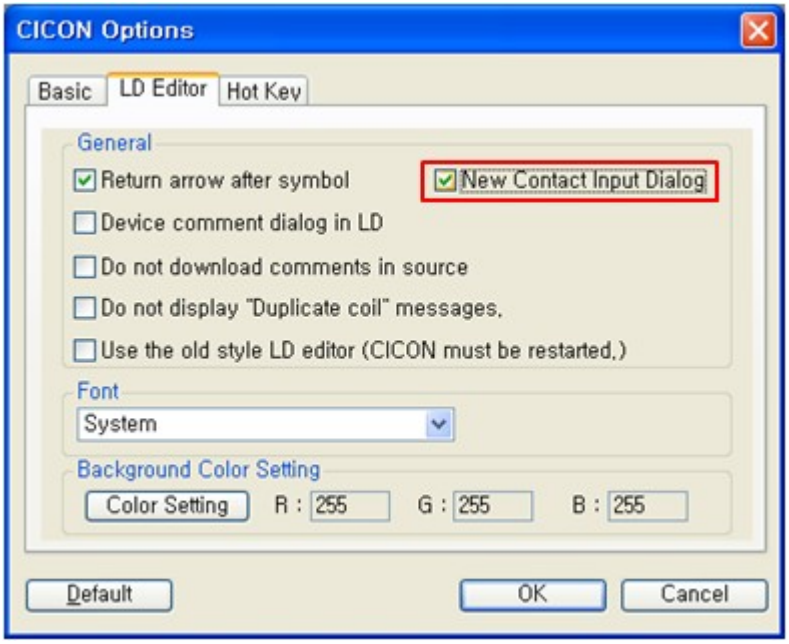
After checking “XP Style Setting”, restart CICON.



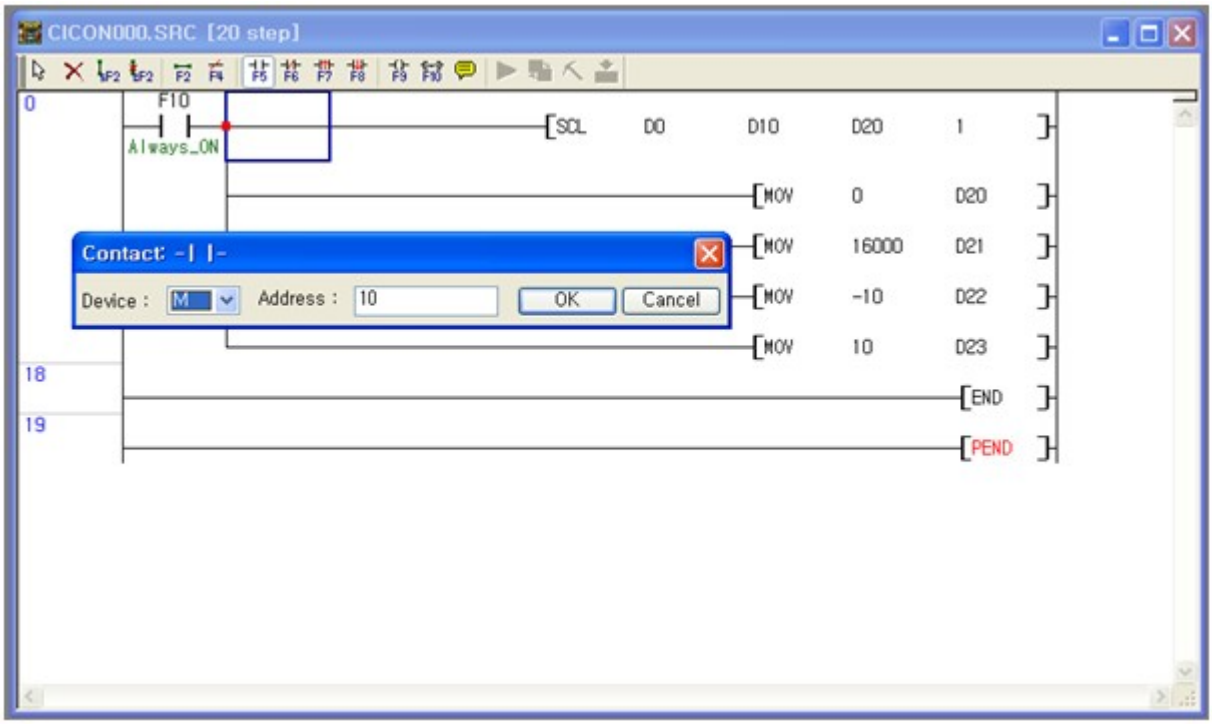
New Contact Input Dialog function added.

Instead writing contact address in scan program, you can choose Device and Address in “Contact Input Dialog box”.

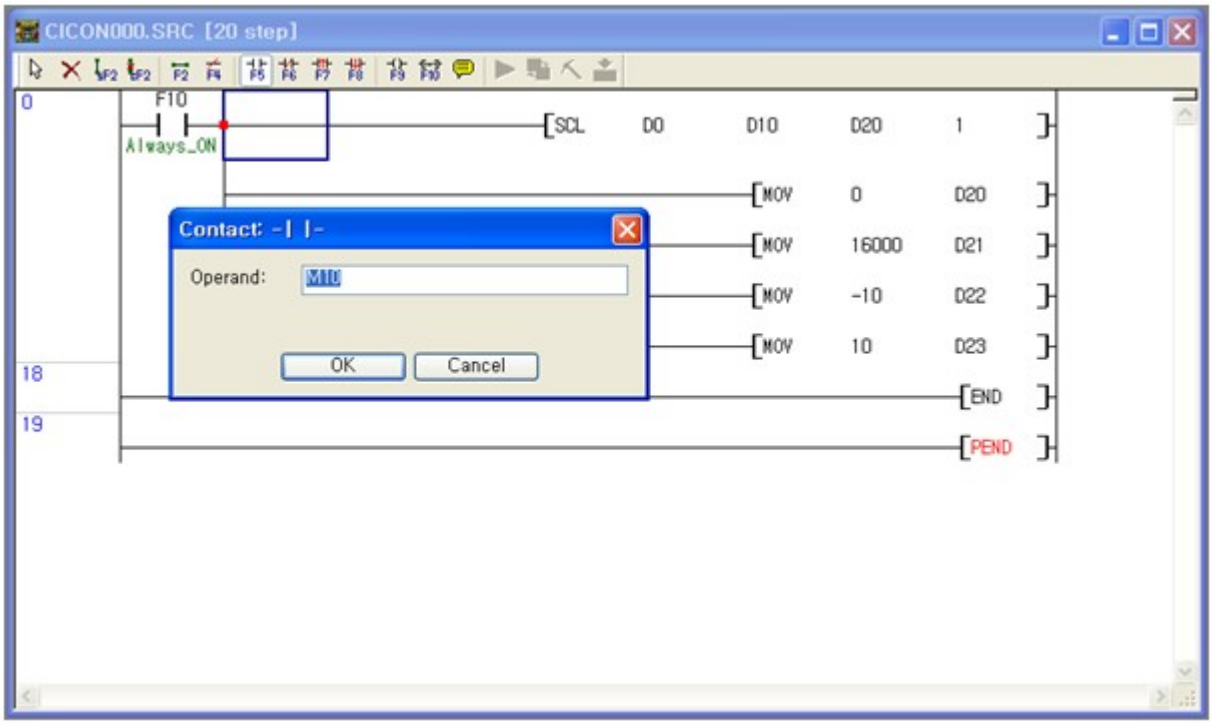
Click [Tool] -> [CICON Options] -> [LD Editor] and check “New Contact Input Dialog”



Now, you can see “Contact Dialog box” as below.

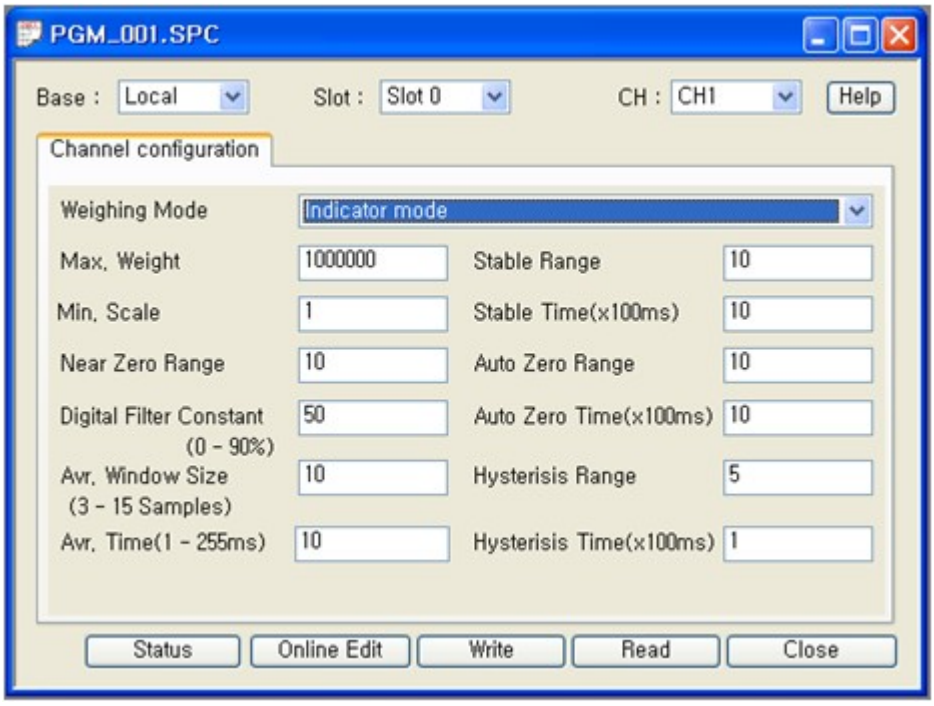


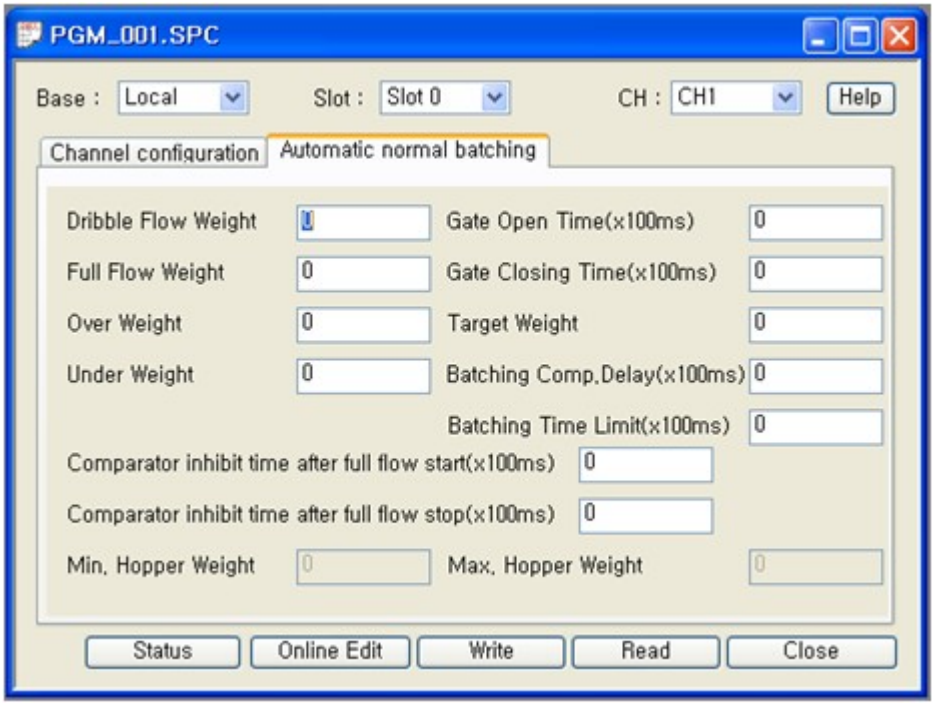
Current “Contact box” is as below.



Add the LoadCell setting program range

Input range of Load cell setting program added.





2.1.8 Ver307

This version of CICON provides following new functions.

- USB Driver for Windows7 64Bit added.

USB Driver for Windows7 64Bit added.

The user who has Windows7 64Bit now can connect PLC with USB cable.
64Bit driver is located at [CICON] -> [Usb_Driver] -> [OS_64Bit] Install USB Driver.
Select "USB Port" at CICON -> [Tool] -> [Connection Setup]. Refer to [Here]

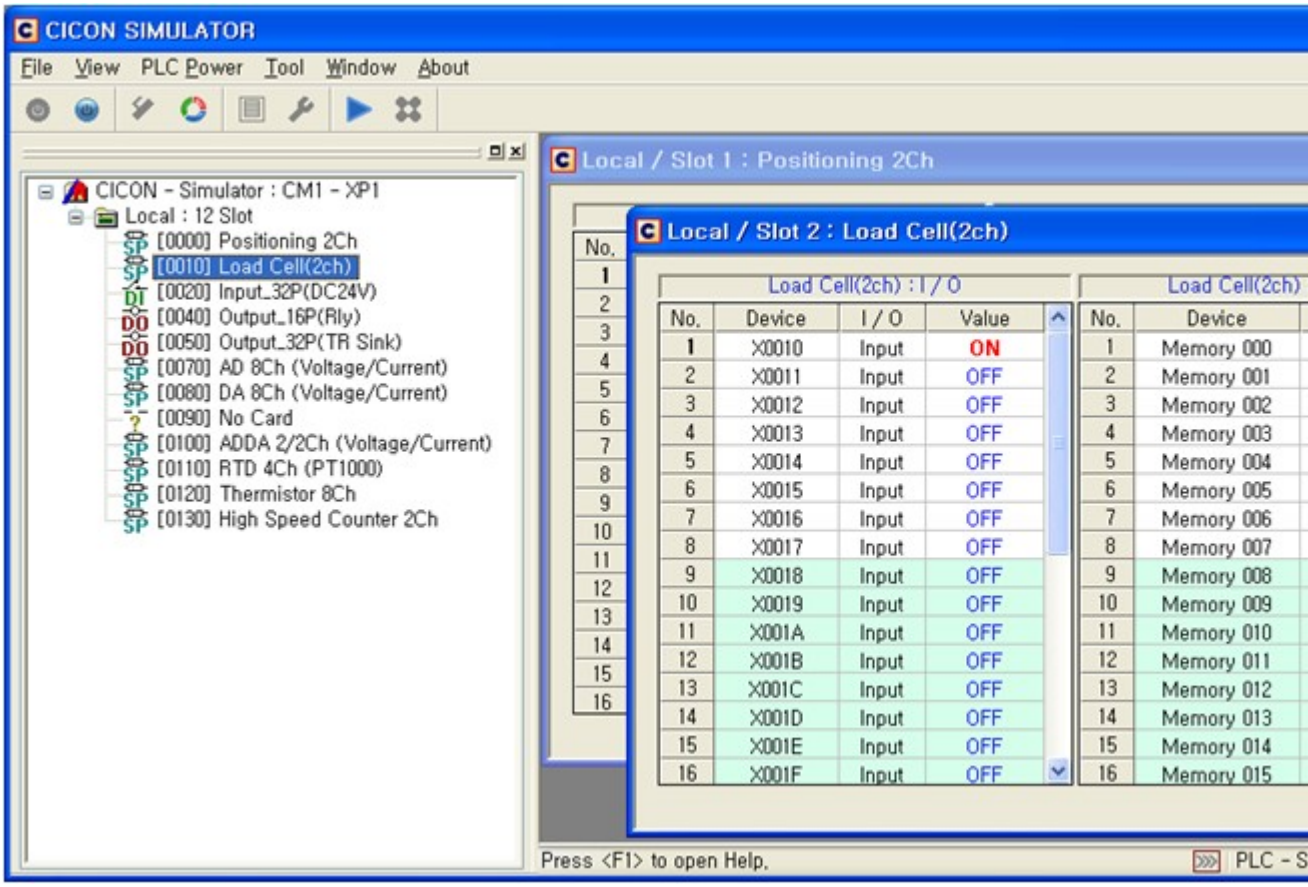
2.1.9 Ver306

This version of CICON provides following new functions.

- Add PLC simulator.

Add PLC simulator

User can monitor and control ladder program through PLC Simulator.
Click [Here] to see more detailed information.



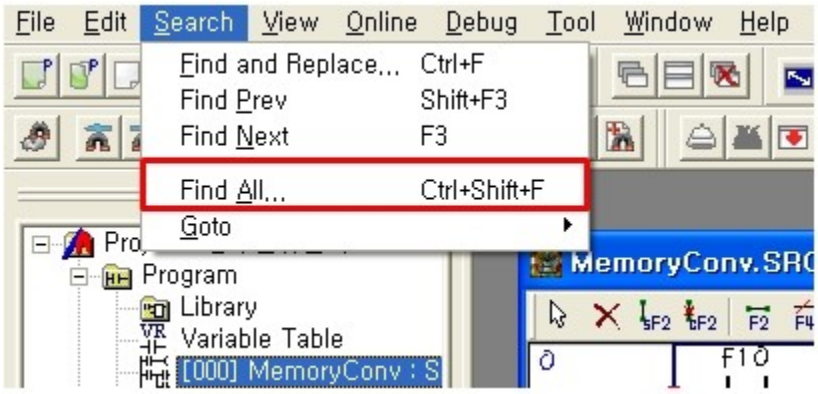
2.1.10 Ver305

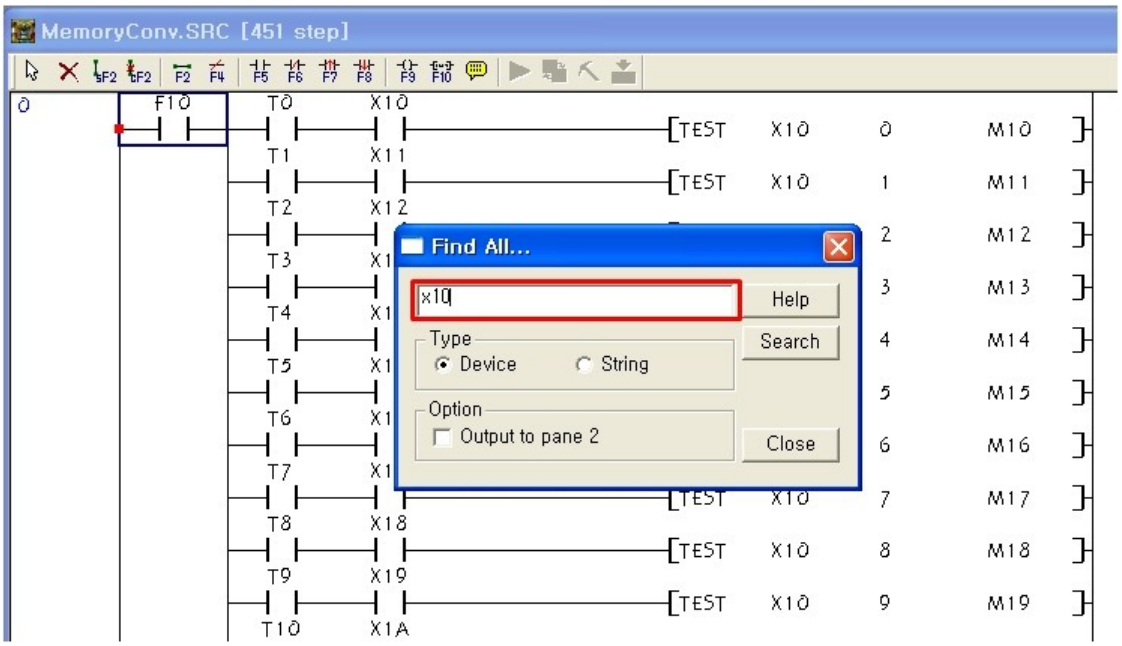
This version of CICON provides following new functions.

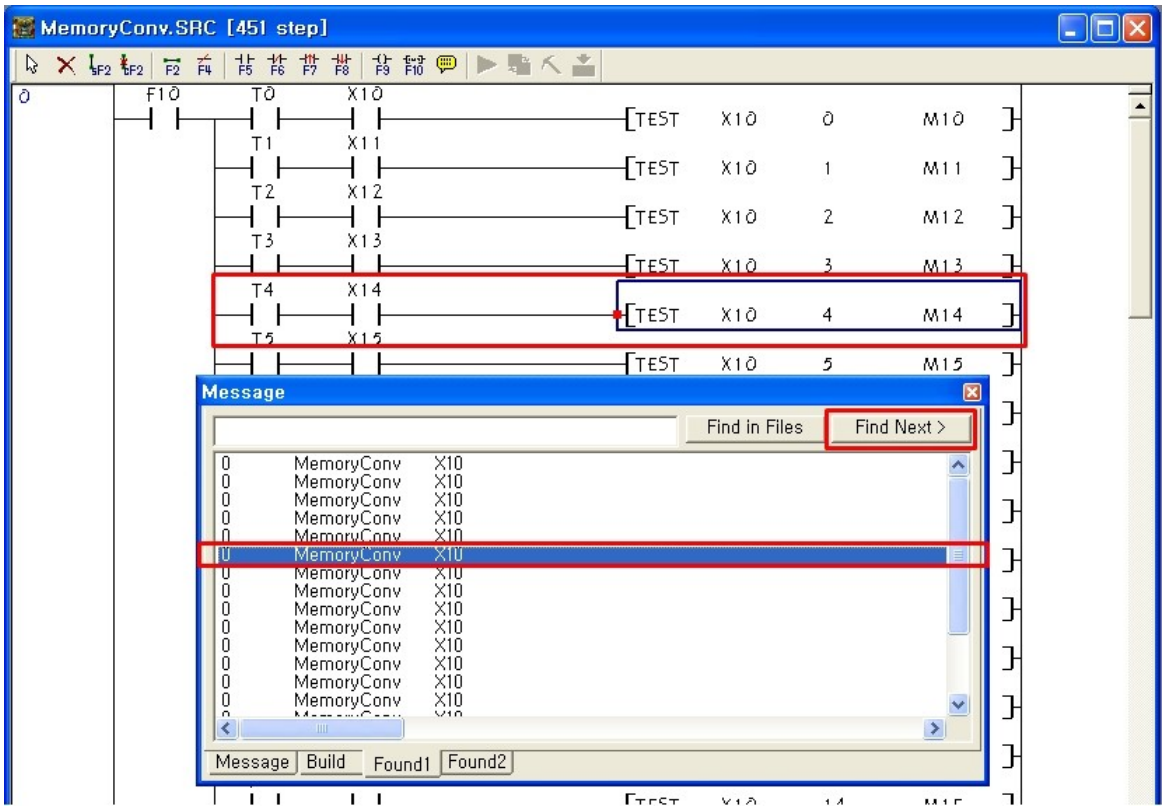
- [Search]->[Find All] : [Find Next]function is added.
- Load Cell : Avr. Time / Weighing Mode(Not used) / Read added.
- PLC-S TC : [Internal Temp] is added.
- [Position Status] : Axis and Unit Setting functions are added.
- PLCS : Internal Comm. manual added.
- [Tool]->[CICON Options]->[LD Editor] : Font function is added.

[Search]->[Find All] : [Find Next]function is added.

If you click [Find Next], it keep searching all scan programs.



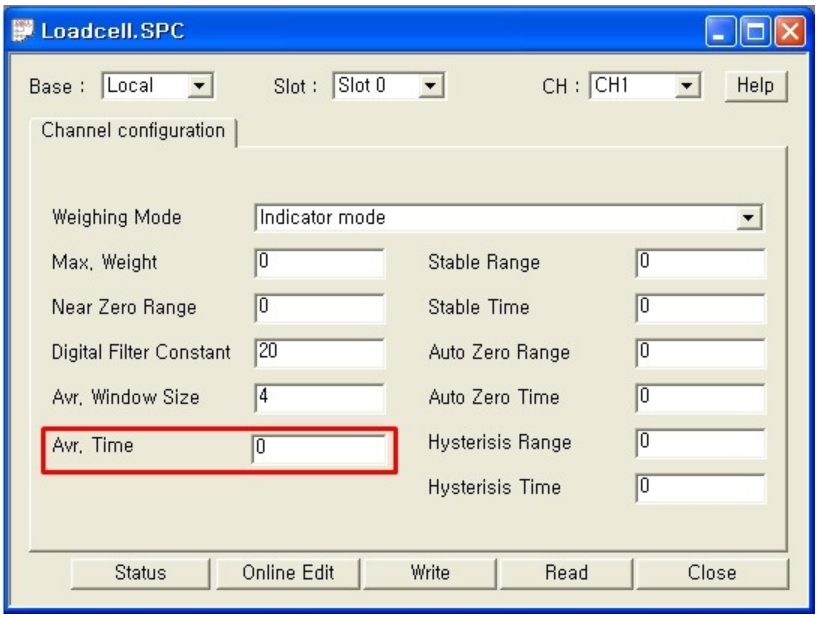




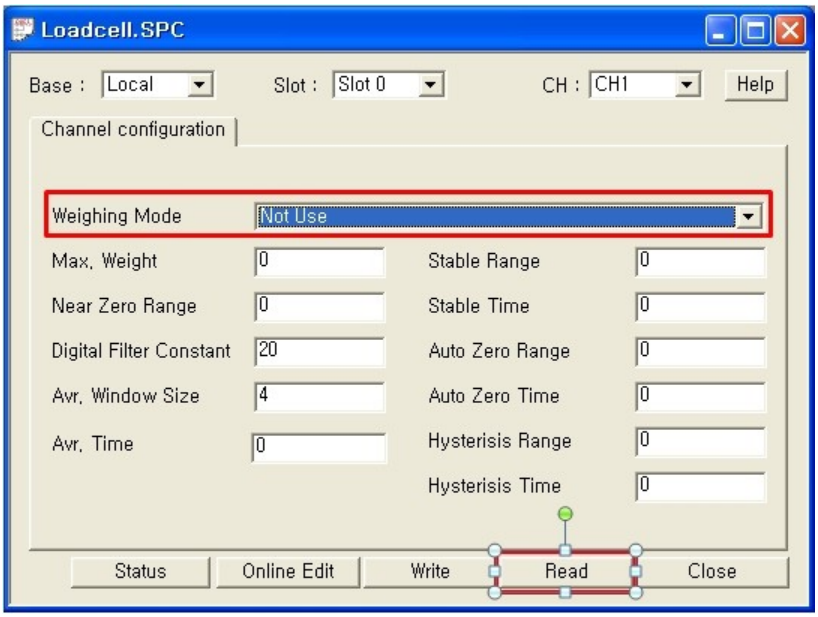
Load Cell : Avr. Time / Weighing Mode(Not used) / Read added.

Average Time function is added.

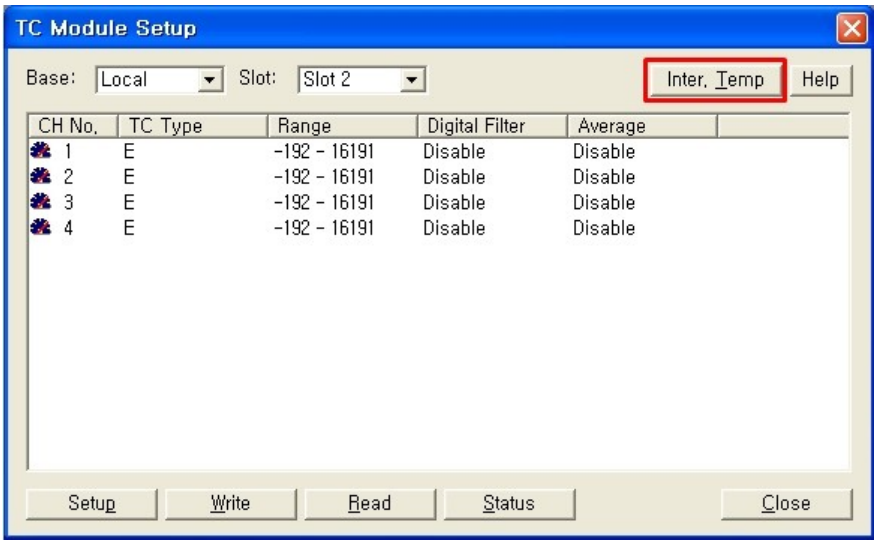
You can read value of module which is online connected through [Read].



You can select 'Not Use' in [Weighing Mode]



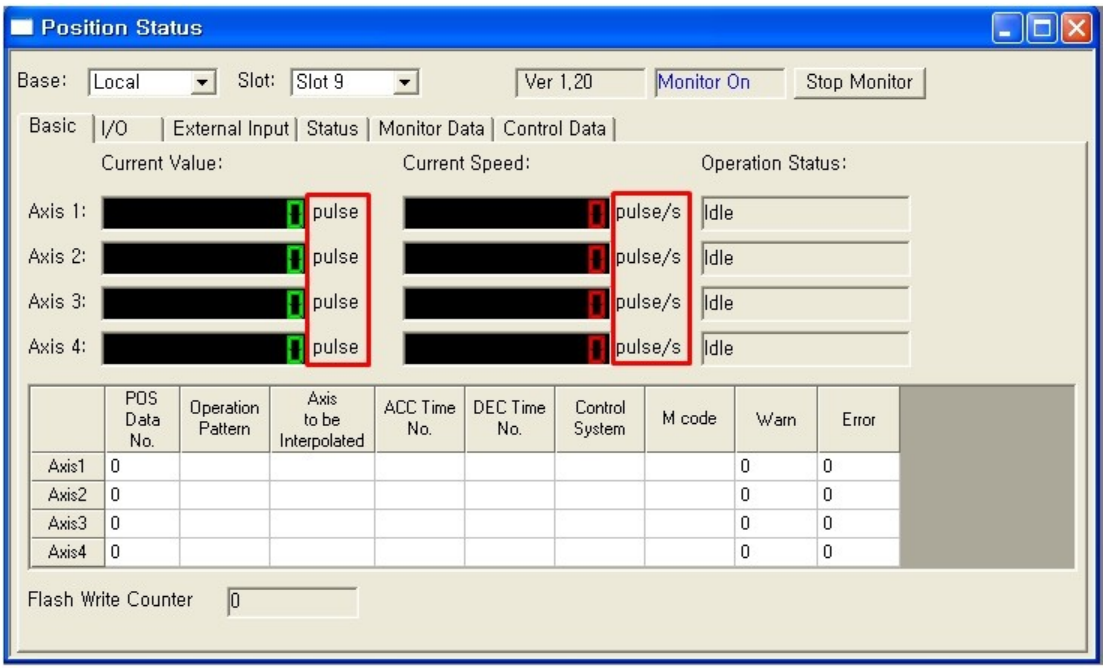
PLC-S TC : [Internal Temp] is added.

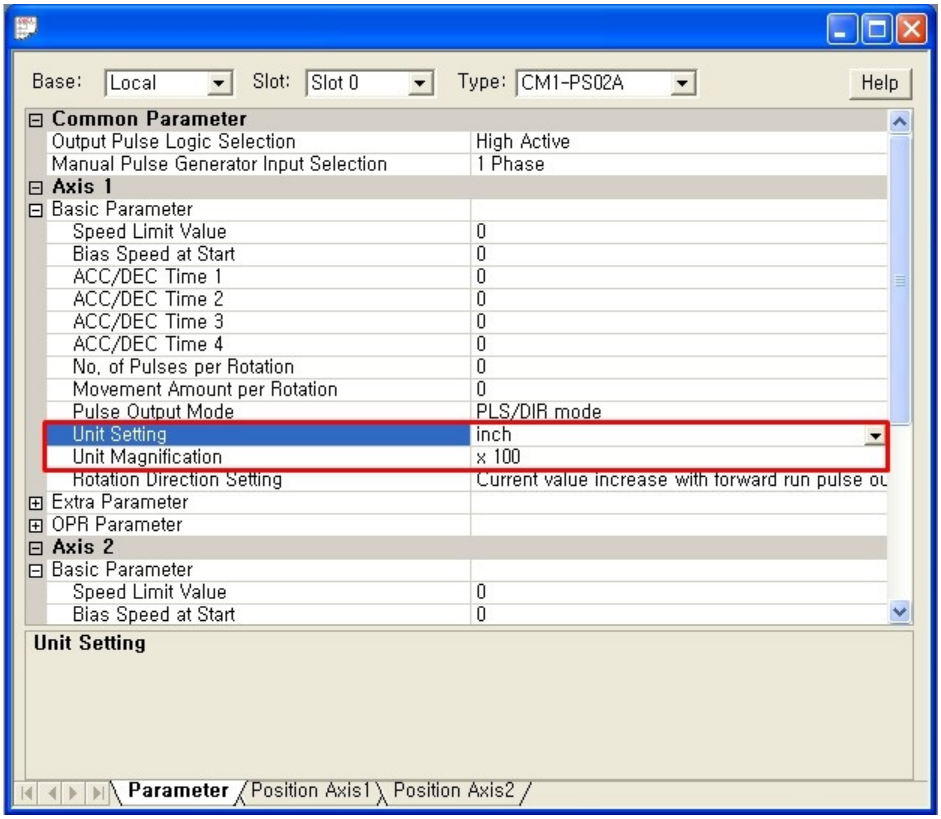


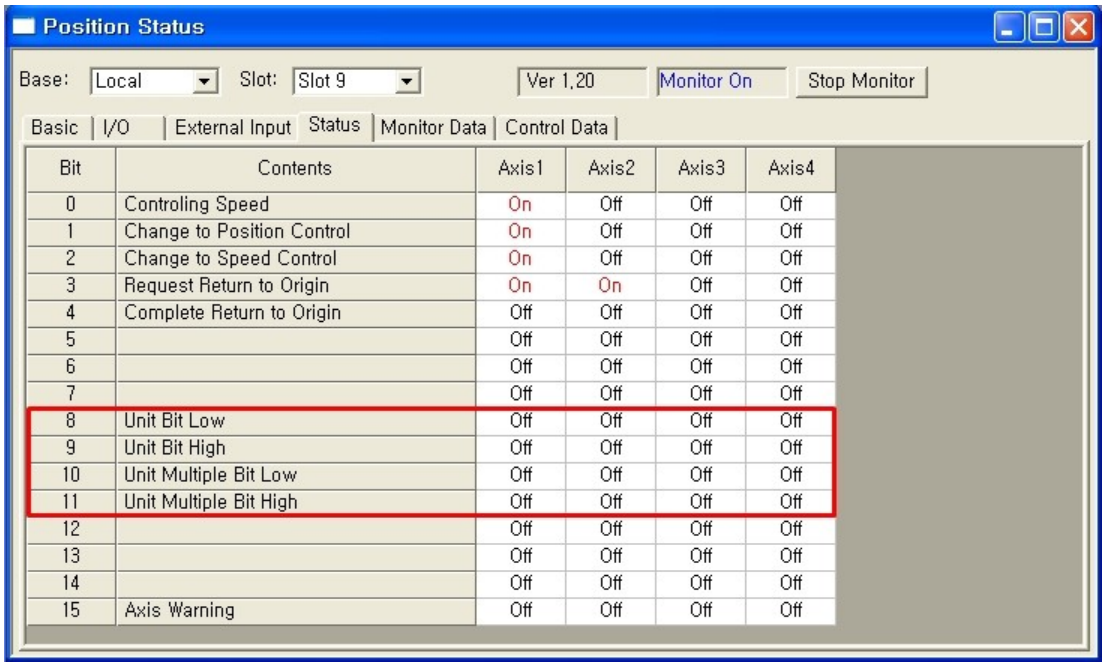
You can set up Internal Temperature from -10 to 65 and up to first decimal.

[Position Status] : Axis and Unit Setting functions are added.

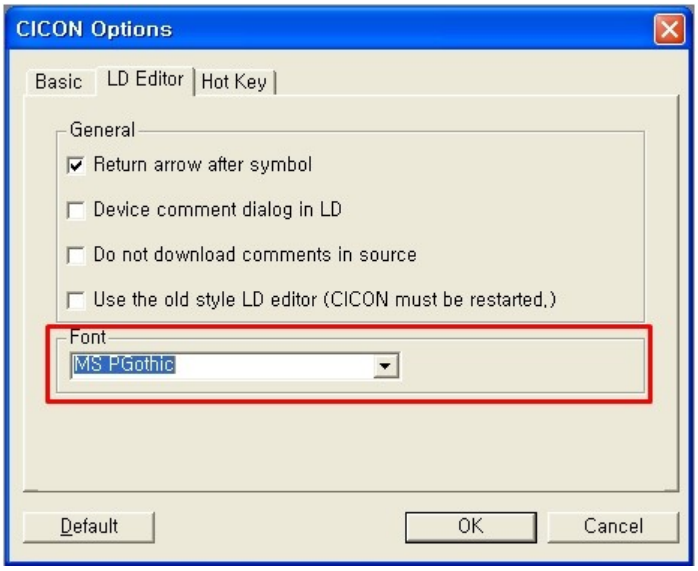
You can set up Current Axis and measurement in [Position Status].







[Tool]->[CICON Options]->[LD Editor] : Font function is added.



2.1.11 Ver304

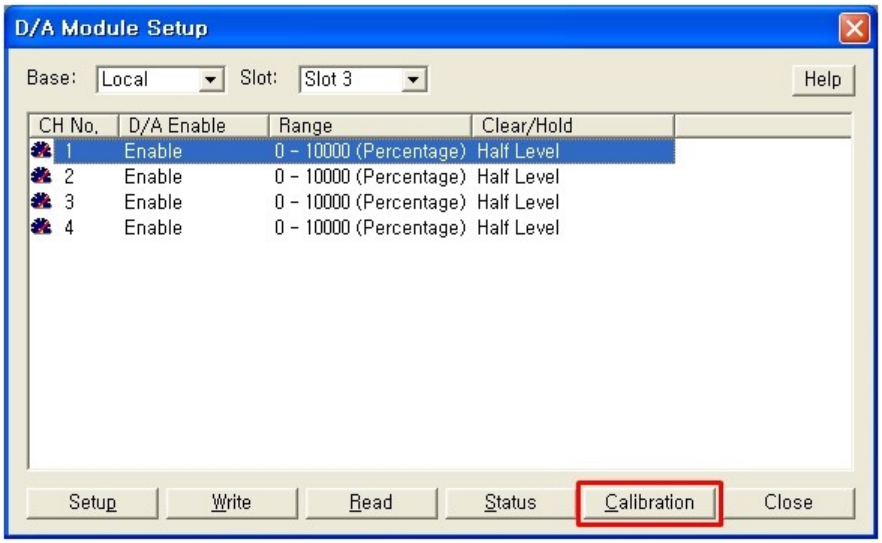
This version of CICON provides following new functions.

- PLC-S D/A Module Setup modified. (Calibration function is added)

- PLC-S A/D D/A Module Setup modified. (D/A Calibration function is added)
- PLC-S Positioning program : “Inching Movement” is added
- PLC-S HSC manual is added.
- PLC-S Positioning manual is added.
- Special Card Init. Program is added.

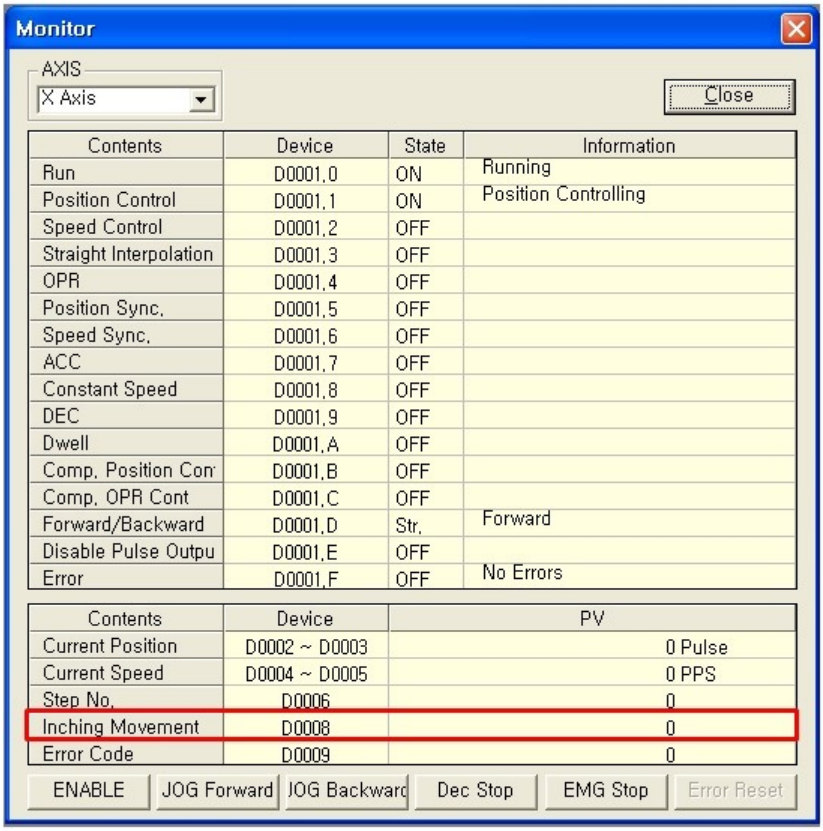
PLC-S D/A Module Setup modified. (Calibration function is added)

Calibration function is added. Please click here to go to manual.



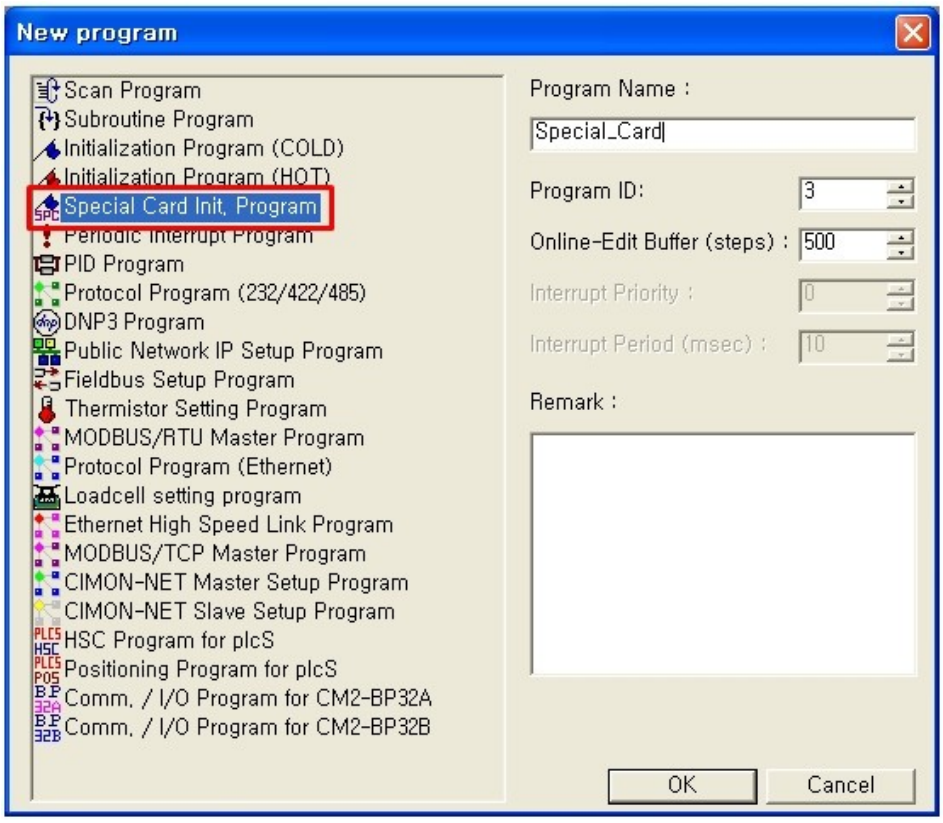
PLC-S Positioning program : “Inching Movement” is added

“Inching Movement” is added

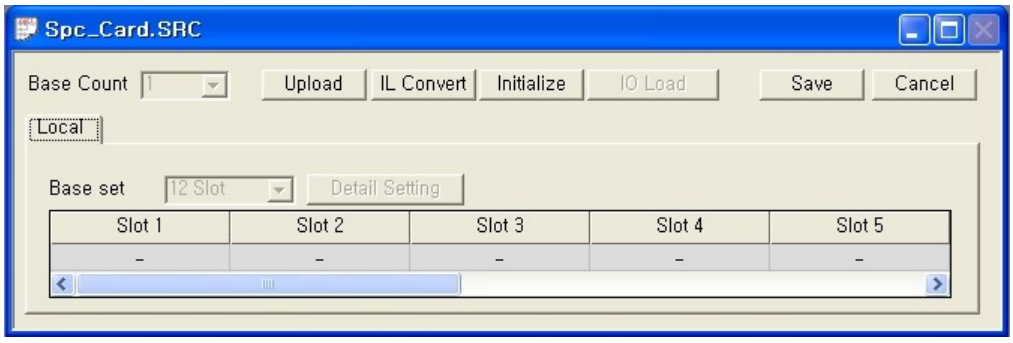


Special Card Init. Program is added.

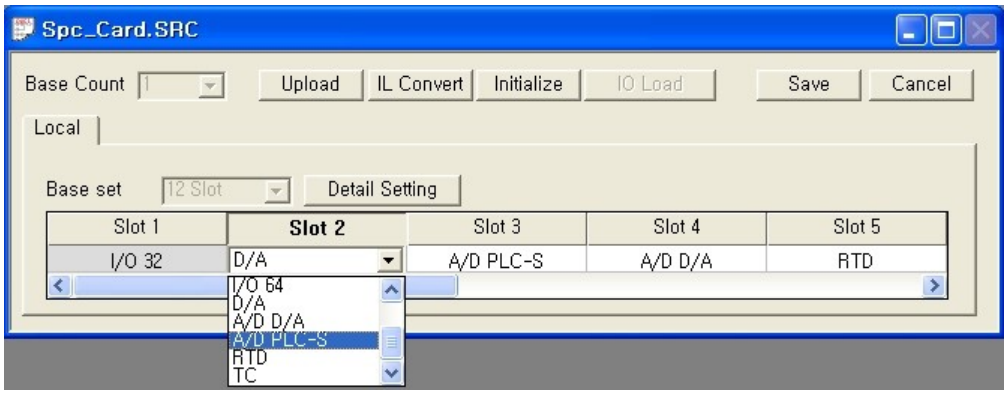
Please click here to go to manual.



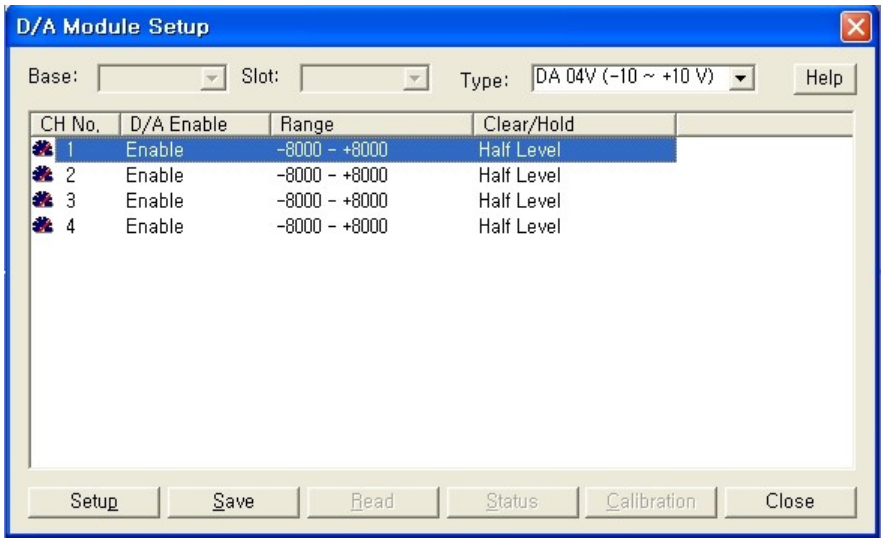
Special Card Init. Program...



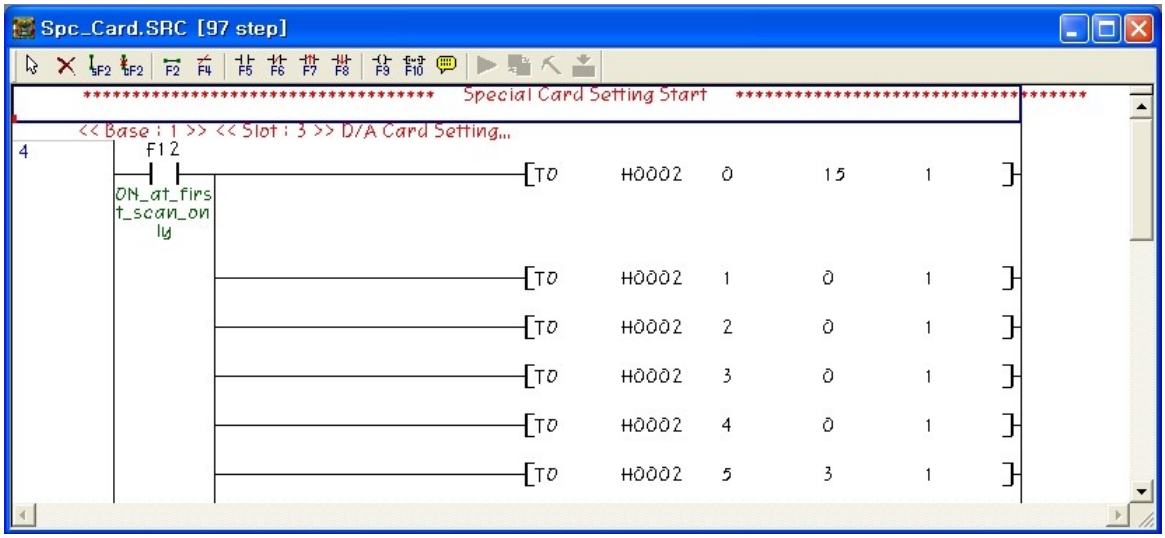
Special Card Setting...



D/A Module Setup Dialog...



I/L Convert



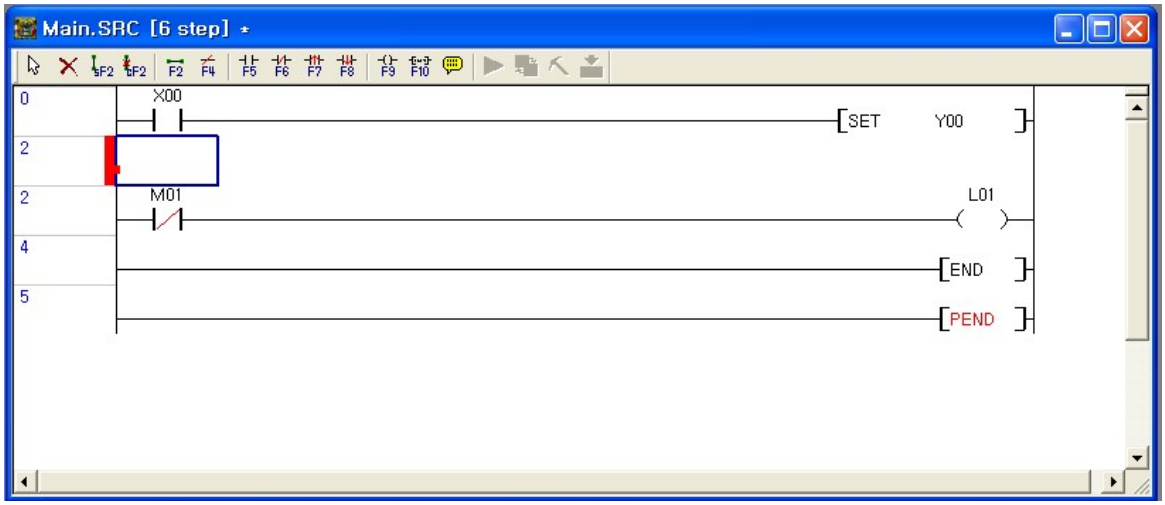
2.1.12 Ver303

This version of CICON provides following new functions.

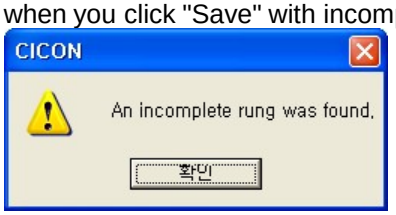
- Auto delete function for empty line.
- U/I size of [Find and Replace] is modified.
- Prohibiting function for Upload sequence (PLC parameter)
- Calibration function for A/D D/A of PLCS A/D module.
- Auto USB Driver installation and upgrade function.(OS : XP)
- PLCS : PLC parameter "Pulse Catch Input" modified.(only available at X02, X03, X06)
- PLCS : PLC parameter "Ethernet" set-up modified. (DHCP)
- More than 2 special programs cannot be added in project.(when project is compiled, warning pop up)
- PLCS Positioning : device registration is added in Positioning data Setup.

Auto delete function for empty line

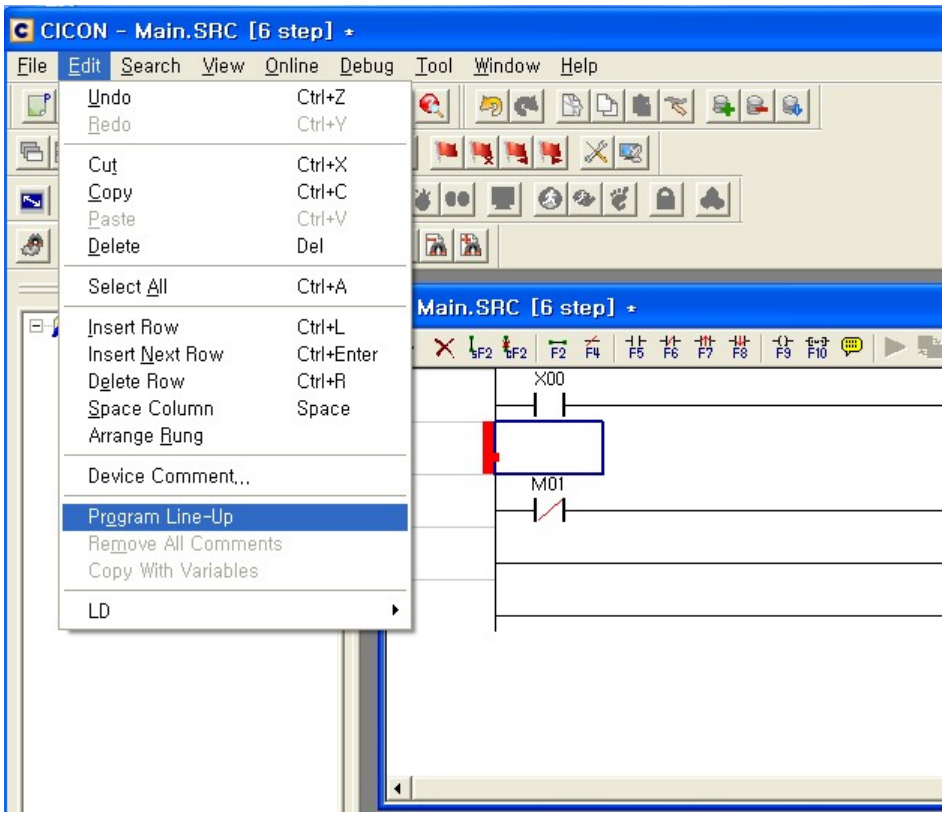
You can remove all incomplete rungs on your scan program.



when you click "Save" with incomplete rung, the below message pops up.

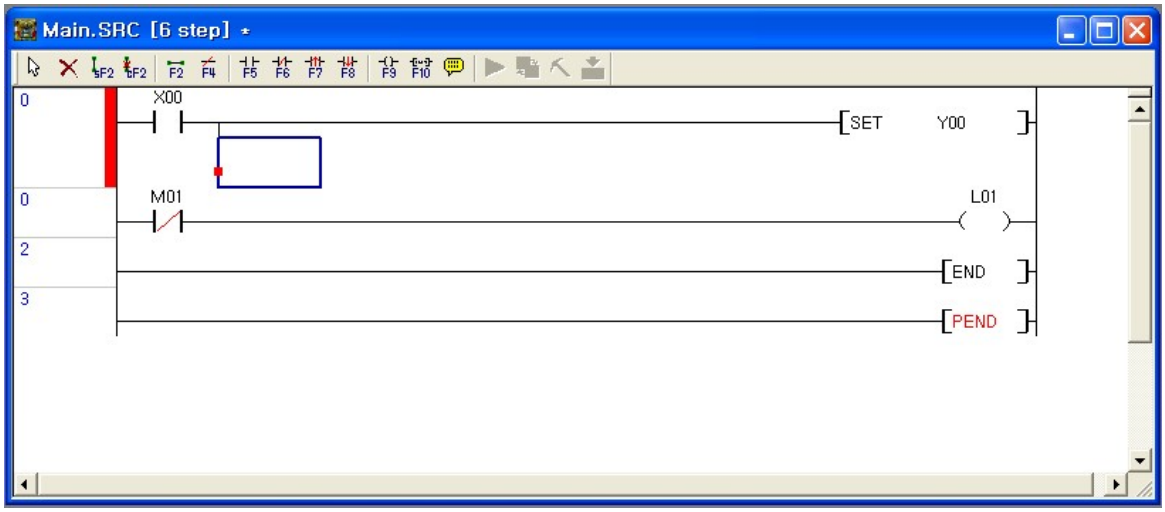


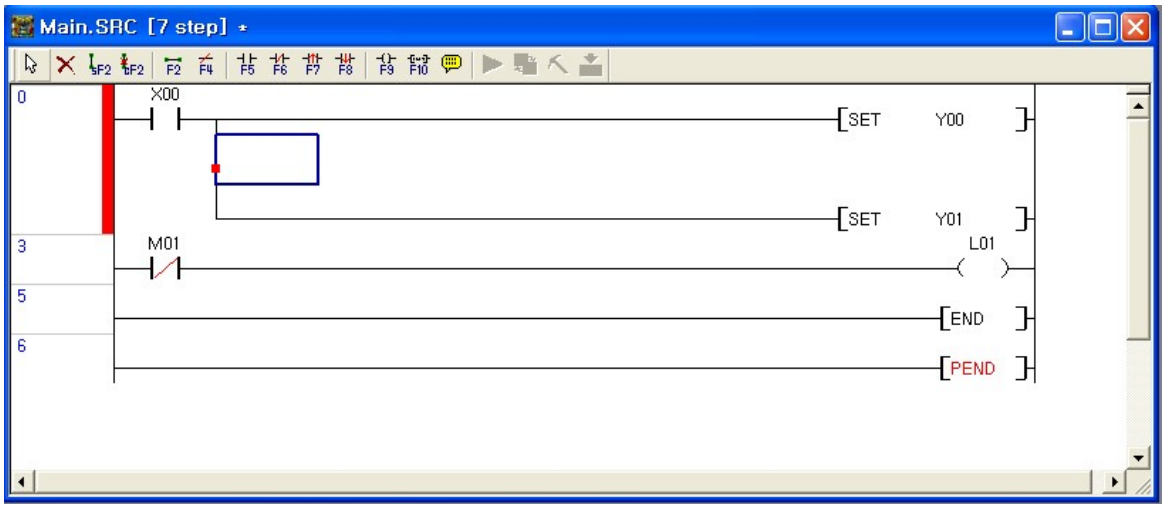
[Edit] -> [Program Line-Up] it will remove all incomplete rungs.



After removing incomplete rungs, you can check amount of deleted rungs at the message box.
You can restore deleted rungs with "Undo"

*** [Program Line-Up] will not work properly in below cases.**

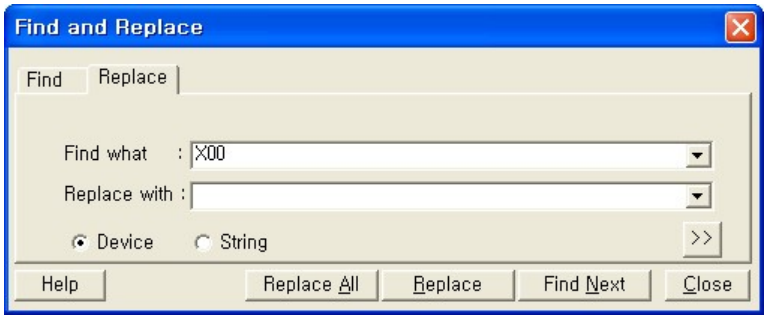




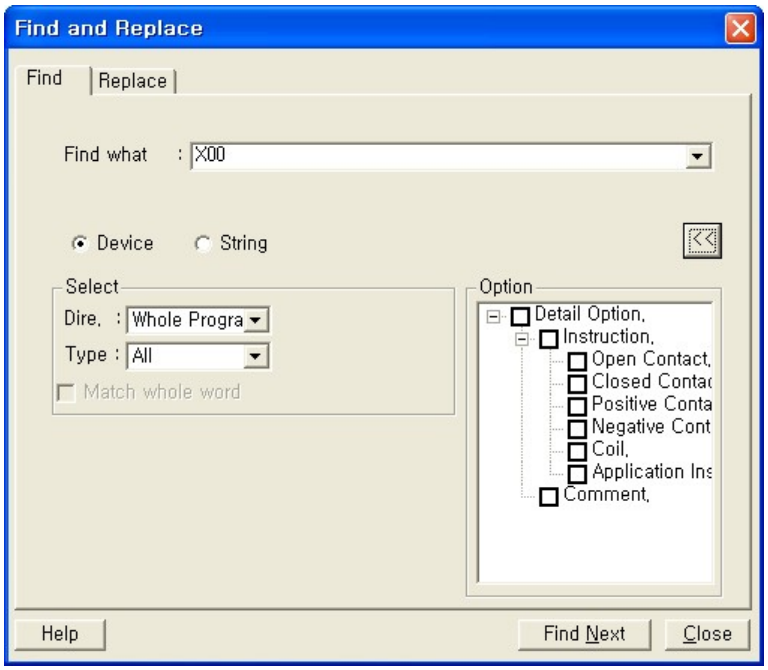
U/I size of [Find and Replace] is modified.

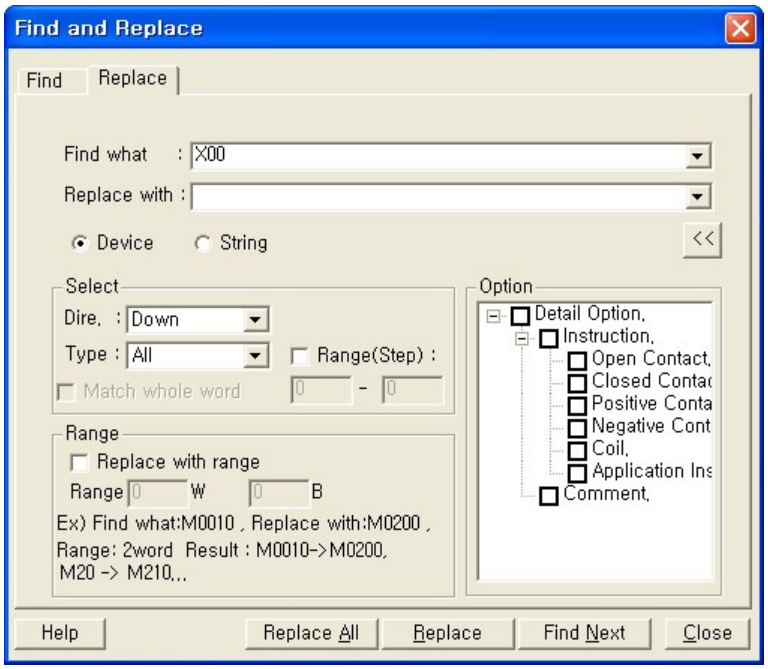
Screen of [Find and Replace] becomes smaller for user's convenient.

In case that mouse point is on scan program and indicates contact, [Find and Replace] indicates device on "Find what"

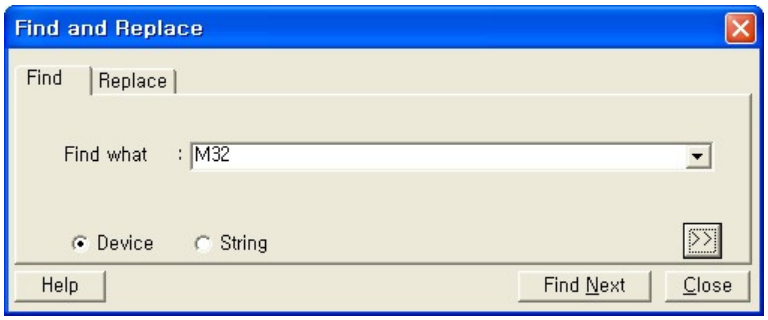


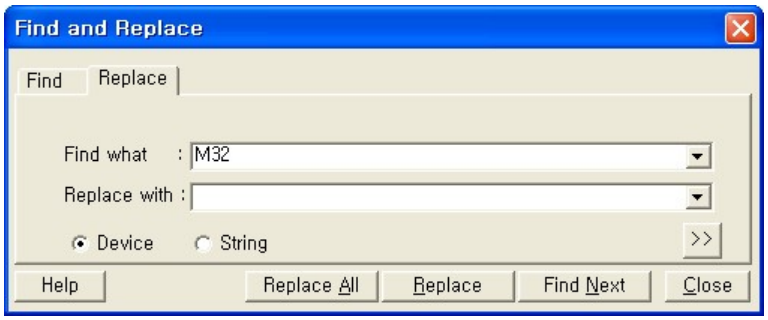
When you click ">>", you can see "Option"
click "<<" to close "Option"





***No need to write again after changing tab**





Prohibiting function for Upload sequence (PLC parameter)

Protect program uploading which is downloaded from CICON to PLC.
When you click "Prohibit upload sequence program", you cannot upload program again no matter password.

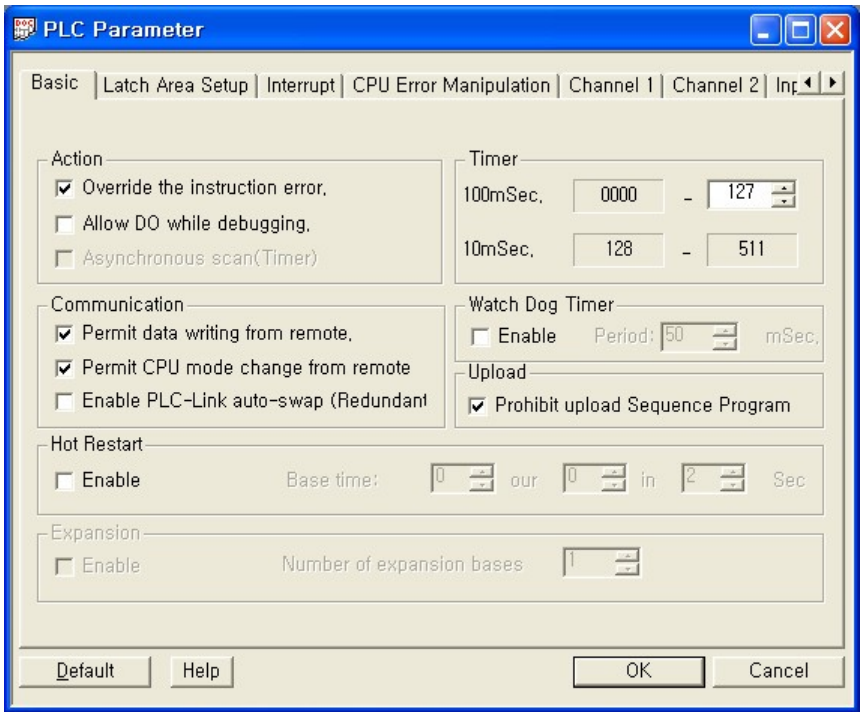
In order to use "Prohibit upload sequence program", please upgrade CICON version.

1. Install CICON Ver.3.03

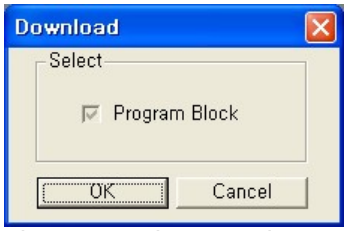
2. Upgrade firmware

Set up "Prohibit upload sequence program" on [PLC Parameter] as below.

Basic set-up is OFF.

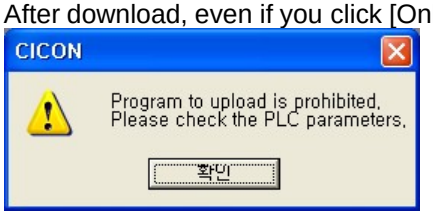


After checking "Prohibit upload Sequence Program", click [Online] -> [Download (PC->PLC)]



There are only two option "OK" and "Cancel".

After download, even if you click [Online] -> [Upload(PLC->PC)], you can see below message.



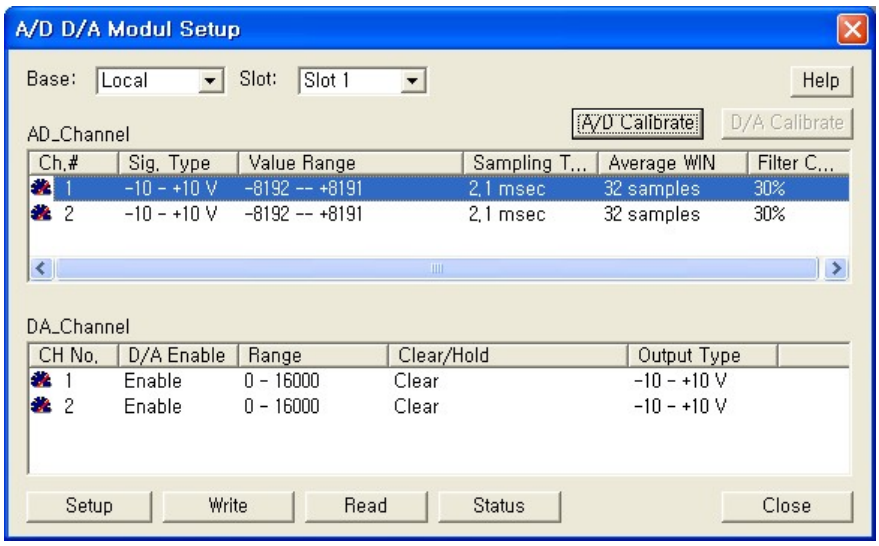
we

Error message pops up.

Calibration function for A/D D/A of PLCS A/D module

Modification function (minimum / maximum) for PLCS A/D module and PLCS A/D D/A module is added.

Click "A/D Calibrate"



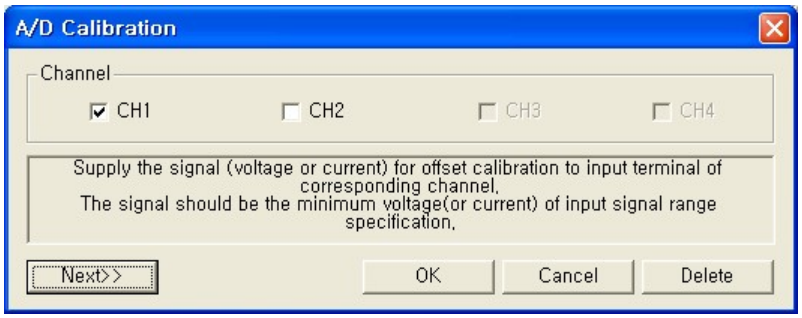
Select channel to be modified.

***You can select only one channel at once**

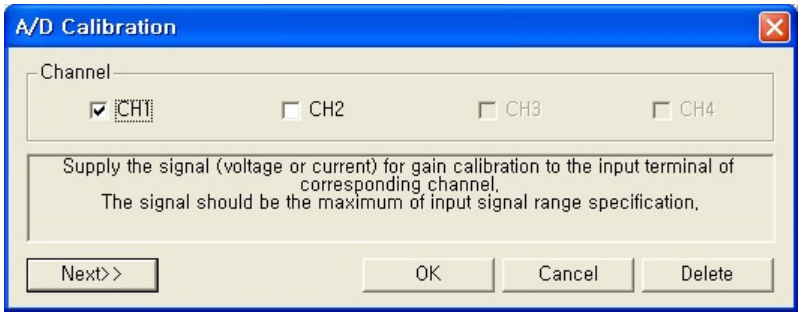
After selecting Channel, supply voltage(current) to input terminal as message.

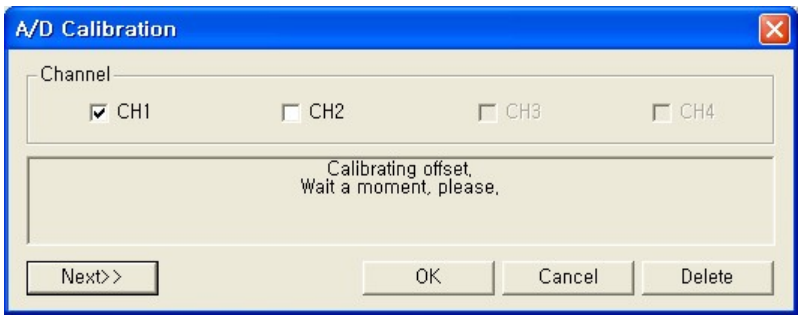
Supplied Voltage or Current should be minimized.

After supplying Voltage or Current, click "Next" for calibration.



After finishing calibration, supply maximum Voltage (Current)



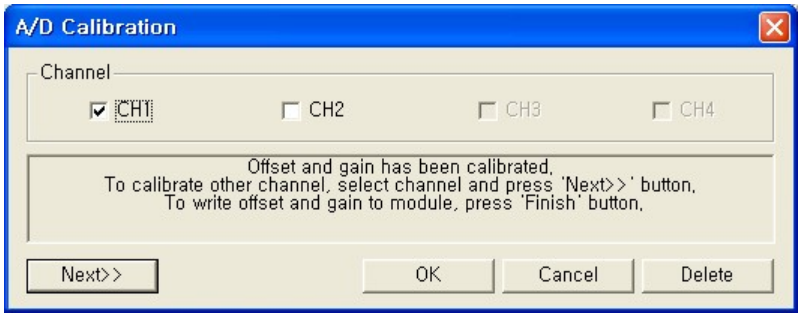


After finishing calibration, next Channel will be done by the same way.

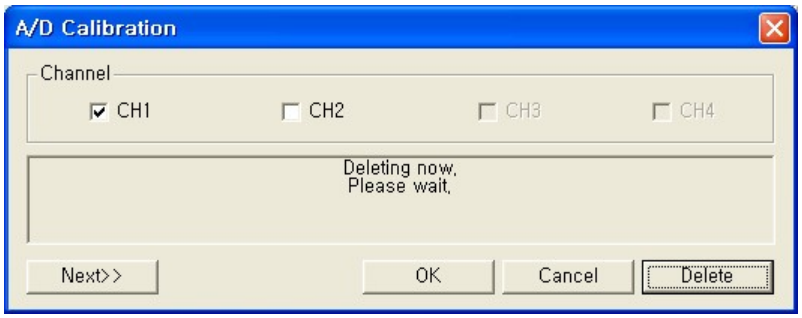
OK" to save the result and close calibration

"Delete" to delete calibration result

"Cancel" to close calibration.

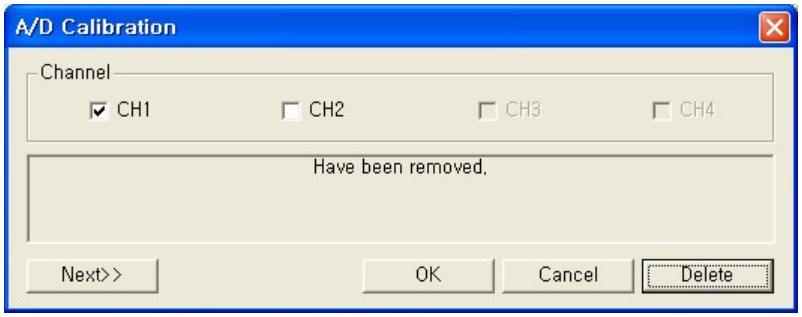


"Delete"



After "Delete", message pops up.

You can see status of Calibration in message box.



Auto USB Driver installation and upgrade function (OS : XP)

CICON USB Driver is installed automatically with MS Windows XP.

***Vista and Windows7 will be done soon.**

After running CICON Ver.3.03(Ver.3.04) and connecting USB Driver, below message pops up.

It only pops up in case CICON version is not new. (it will not appear again after installation.)

***New version of USB Driver is [VER.201008].**

Dialog Message is...

"USB drivers are not the latest version."

"delete the existing driver and you want to install the latest driver?"

Click "Continue(Y)"

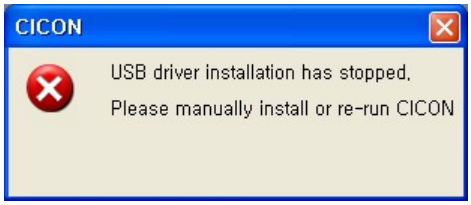
Warning message pops up for compatibility with Window XP.

Click "Continue" to install Driver

Click "Stop" to stop installation.

When installation is finished, OK message pops up at message box.

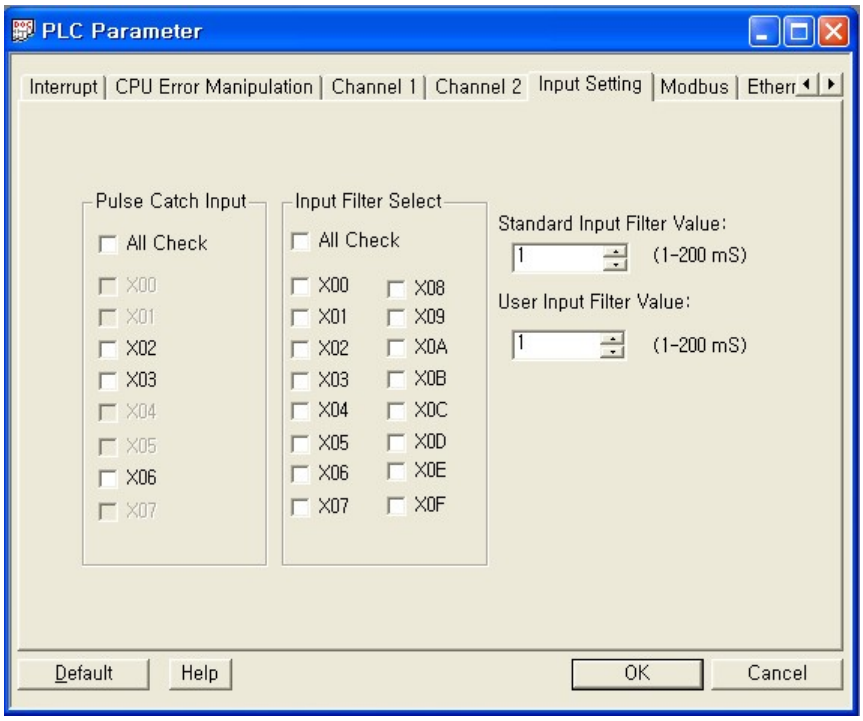
When "Stop", below message pops up.



PLCS : PLC parameter "Pulse Catch Input" modified (only available at X02, X03, X06)

As CPU is PLCS, [PLC parameter] -> [Input Setting] ->"Pulse Catch Input" is modified as below.

You can only select X02 / X03 / X06.



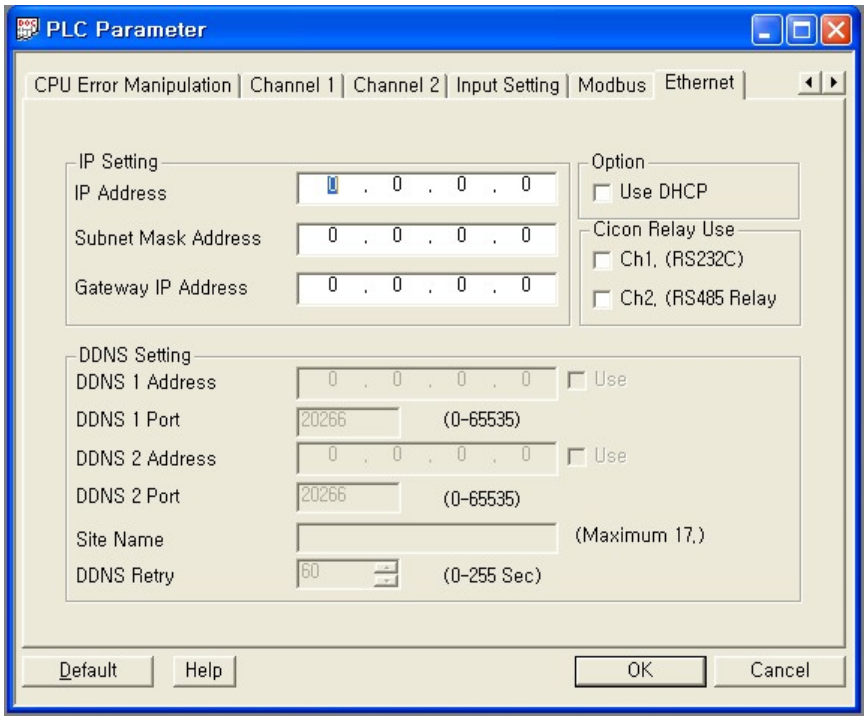
PLCS : PLC parameter "Ethernet" set-up modified. (DHCP)

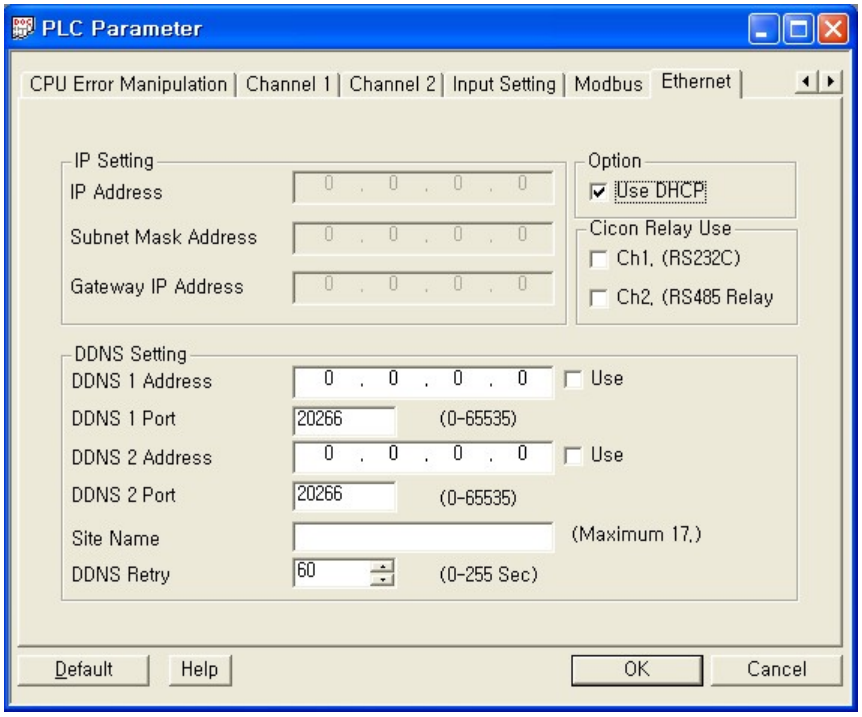
As CPU is PLCS, [PLC parameter] -> [Ethernet] is modified as below.

It separates into IP Setting and DDNS Setting.

"Use DHCP" checked : IP Setting is not available / DDNS Setting is available.

"Use DHCP" not checked : IP Setting is available / DDNS Setting is not available.





***Initial setting value**

"Use DHCP" : not checked

"DDNS 1Port" / "DDNS 2Port" : 20266

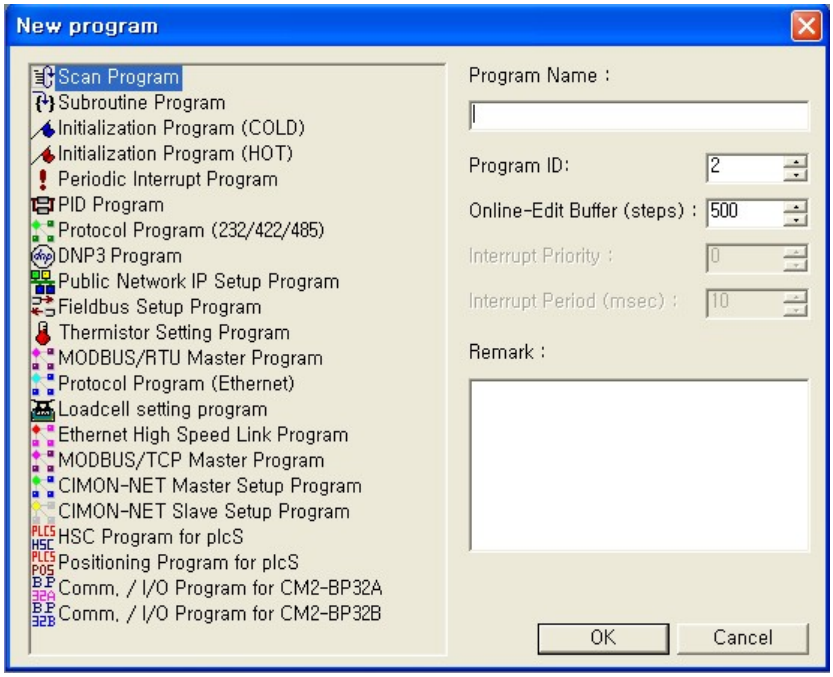
"DDNS Retry" : 60 Sec.

More than 2 special programs cannot be added in project. (when project is compiled, warning pop up)

Those special programs in project cannot be added more than 2 programs.

Check special programs as below

***If more than 2 special programs are added, compiled warning message pops up**



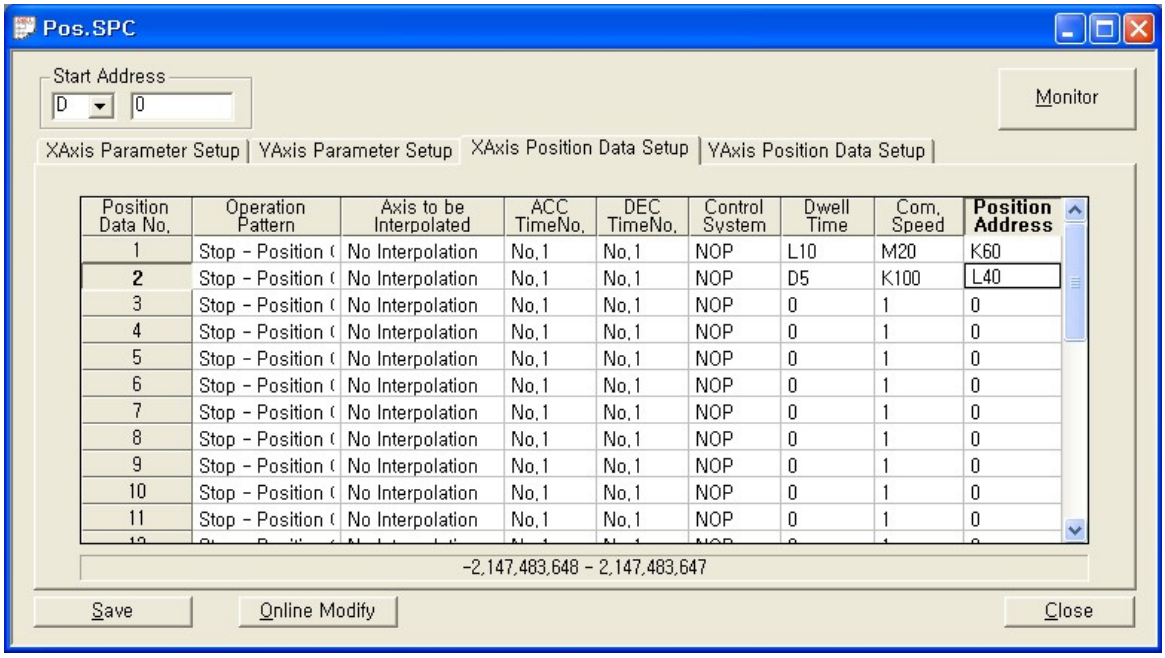
- Initialization Program (Cold)
- Initialization Program (Hot)
- Pid Program
- HSC Program for plcS
- Positioning Program for plcS
- Comm. / I/O Program for CM2-BP32A
- Comm. / I/O Program for CM2-BP32B
- Special card initialization Program is under development

PLCS Positioning : device registration is added in Positioning data Setup

When you set up Dwell Time / Comm. Speed / Position Address, you can add device.

Device type : [D] / [M] / [L] / [K]

***Only Decuple can be written at [M] / [L] / [K] except [D]. if not, warning pops up.**



2.1.13 Ver302

Test Version...

2.1.14 Ver301

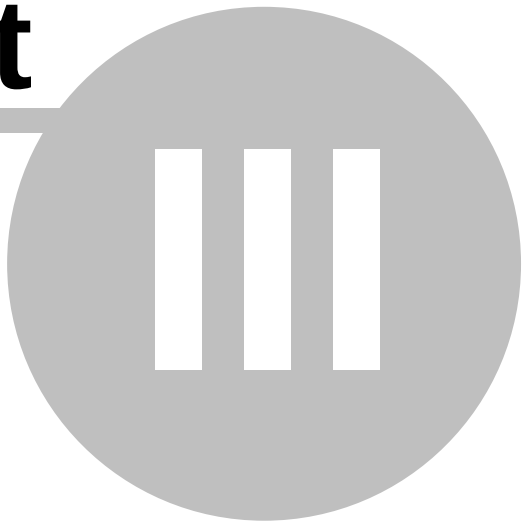
This version of CICON provides following new functions.

- HSC Program for plcS
- Positioning Program for plcS
- Program for CM2-A Type
- Program for CM2-B Type
- Variable Table Upgrade

Top Level Intro

This page is printed before a new
top-level chapter starts

Part



3 Quick Reference Manual

See :

Manual	Module
CIMON-PLC CPU	XP1A/R, XP2A, XP3A, CP3A/B/P, CP4A/B/C/D
CIMON-PLC CPU(MPnA / XPnX)	
CIMON-PLC Power	SPC, SPA, SP2B, SPR
CIMON-PLC Base	BS03A, BS04A, BS05A, BS08A, BS10A, BS12A, BS05R, BS08R, BS10R
CIMON-PLC RS232C/422/485 module	SC01A/B, SC02A, SC01DNP
CIMON-PLC Ethernet module	EC01A, EC10A/B, EC01DNP, EC04DNP
CIMON-PLC BACnet module	BN01A
CIMON-PLC DeviceNet module	DN01A
CIMON-PLC Profibus DP module	PD01A
CIMON-PLC Data Logger module	LG32A
CIMON-PLC Digital Input module	XD16A, XD16B, XD32B, XD32C, XD64C, XA08A, XA08B
CIMON-PLC Digital Output module	YR16A, YT16A, YT32A, YT64A, YS08A, YT16B, YT32B
CIMON-PLC Digital I/O module	XY16DR
CIMON-PLC AD Converters module	AD04VI, AD08V, AD08I, AD16I, AD16V
CIMON-PLC DA Converters module	DA08I, DA04I, DA08V, DA04V, DA16I, DA16V, DA04VA, DA08VA, DA16VA
CIMON-PLC High Speed Converters	HS02B, HS02D
CIMON-PLC Positioning module	PS02A
CIMON-PLC Loadcell module	WG02A, WG04A
CIMON-PLC TC04A Converters module	TC04A
CIMON-PLC RTD Converters module	RD04A/B, RD08A/B
CIMON-PLC Thermistor module	TH08A
CIMON-PLC Expansion module	EP01A, EP02A, EP03A
CIMON-PLC Redundant System	XP1R(CPU), RM01A, PC01A
CIMON-PLC Remote I/O Series	XD16A*. XD32A*, YT16A*, YT32A*, YR16A*, XY32DT*
CIMON-BP Series 32Main Block	BP32MDR*-*, BP32MDT*-*, BP32MDC*-*
CIMON-BP Series 16Main Block	BP16MDTA-*, BP16MDCA-*, BP16MRA-*, BP16MDTD-*, BP16MDCD-*, BP16MDRD-*

CIMON-BP 32 I/O Expansion Blocks module	BP32EDT, BP32EDC, BP32EDR
CIMON-BP 16 I/O Expansion Blocks module	BP16EDT, BP16EDC, BP16EDR, BP16EDO, BP16EOR, BP16EOT, BP16EOC
CM2-BP04EAA CM2-BP04EAA (Analog Expansion Blocks - Input 2Ch / Output 2Ch)	BP04EAA
CM2-BP04EAOAnalog Expansion Blocks - AD V/I 4Ch Input)	BP04EAO
CM2-BP04EOA (Analog Expansion Blocks - DA V/I 4Ch Output)	BP04EOA
CM2-BP04ERO CM2-BP04ERO (Analog Expansion Blocks)	BP04ERO
CM2-BP04ETO CM2-BP04ETO (Analog Expansion Blocks)	BP04ETO
CM2-BP32A***	BP32 A Type
CM2-BP32B***	BP32 B Type
CM3-PLCS CPU	1.CM3-SP32MDT / V / E / F / SD 2.CM3-SP16MDR / V / E / F

3.1 CIMON-PLC CPU

Modules :

- CM1-XP1A/2A/3A
- CM1-CP3A/B/P/U
- CM1-CP4A/B/C/D/U

Contents :

CIMON-PLC CPU Module For details see "**Click**" .

GENERAL SPECIFICATIONS

Item	Specification				Reference
Op.Temp.	Operating Temperature -10 ~65 ℃				
St.Temp	Storage Temperature □□-25 ~□□80 ℃				
Op.Hum	Operating Humidity 5 ~95%RH, Not Condensed				
St.Hum	Storage Humidity 5 ~95%RH, Not Condensed				
Vibration	In case of intermittent vibration			-	
	Frequency	Acceleration	Amplitude	Sweep	IEC61131-2
	10=□f=□□ 57Hz		0.075mm	10 times in X,Y,Z	
	57=□□f=□□ 150Hz	9.8m/s²{1G}	-		
	In case of continuous vibration				
	Frequency	Acceleration	Amplitude		
	10=□□f =□□57Hz		0.035mm		
	57=□□f= 150Hz	4.8m/s²{0.5G}			
Shock	□□Max. shock Acc. :147 m/s{15G} □□Time :11㎳ □□Pulse wave: Half sine wave pulse(3 times in X,Y,Z)				IEC61131-2
Noise	Square wave impulse noise	2,000 V			KDT Standard
	Electro-static discharge	Voltage :4kV (Contact discharge)			IEC61131-2 IEC1000-4-2
	Radiated electro-magnetic field	27 ~500 MHz,10 V/m			IEC61131-2 IEC1000-4-3
	Fast transient bust noise	Power Module	Digital I/O (24V or more)	Digital I/O (Less than 24V) Analog I/Ocomm.. Interface	IEC61131-2 IEC1000-4-4
		2kV	1kV	0.25kV	
Environ..	No corrosive gas and no dust				
Altitude	2,000m or less				
Pollution	2 or less				

Cooling	Natural Air Cooling	

XP CPU SPECIFICATIONS

Item		Specification		
		CM1-XP1A	CM1-XP2A	CM1-XP3A
Program Control Type		Stored Program, Cyclic Operation, Time Driven Interrupt		
Operation Method		Indirect, Direct by Instructions		
Program Language		IL(Instruction List), LD(Ladder Diagram)		
Data Processing Method		32 Bit		
Instruction	Sequence	55 Instruction		
	Application	389 Instruction		
Processing speed		75ns / Step		
Program Memory Capacity		128K Step	64K Step	64K Step
		2Mbyte	2Mbyte	2Mbyte
Expansion		Max. 16Bases		
Data Memory Capacity		1Mbyte		
Data Memory Capacity	X	8,192	4,096	2,048
	Y			
	M	16,000		
	K	16,000		
	L	16,000		
	F	2,048		
	T	4,096(10ms, 100ms Selective)		
	C	4,096		
	S	100Card*100Step		
	D	32,000		
	Z	2,048		
Timer	Type	On Delay, Off Delay, Accumulated, Monostable, Retriggerable		
	Range	0.01sec ~ 655.35sec		
Counter	Type	Up Counter, Down Counter, Up-Down Counter, Ring Counter		
	Range	-32,768 ~ 32,767		
Operation Mode		RUN, STOP, PAUSE, DEBUG		
Self-dianostic function		Watch-dog Timer, Memory Error, I/O Error, Battery Error, Power Supply Error		
Built-in funciton		- Floating point arithmetic - Computer Link (RS232C) - PID Control - Clock		

	- I/O Reservation - On-line Editable Program

CP CPU SPECIFICATIONS

Item		Specification	
		CM1-CP3A/B/P/U	CM1-CP4A/B/C/D/U
Program Control Type		Stored Program, Cyclic Operation, Time Driven Interrupt	
Operation Method		Indirect, Direct by Instructions	
Program Language		IL(Instruction List), LD(Ladder Diagram)	
Data Processing Method		16 Bit	
Instruction	Sequence	55 Instruction	
	Application	293 Instruction	
Processing speed		200ns / Step	
Program Memory Capacity		32K Step	16K Step
		512Kbyte	256Kbyte
Expansion		Max. 16Bases	Not available
Data Memory Capacity		512Kbyte	256Kbyte
Data Memory Capacity	X	1,024	384
	Y	1,024	384
	M	8,192	
	K	2,048	
	L	2,048	
	F	2,048	
	T	1,024(10ms, 100ms Selective)	
	C	1,024	
	S	100Card*100Step	
	D	10,000	5,000
	Z	2,048	
Timer	Type	On Delay, Off Delay, Accumulated, Monostable, Retriggerable	
	Range	0.01sec ~ 655.35sec	
Counter	Type	Up Counter, Down Counter, Up-Down Counter, Ring Counter	
	Range	-32,768 ~ 32,767	
Operation Mode		RUN, STOP, PAUSE, DEBUG	
Self-dianostic function		Watch-dog Timer, Memory Error, I/O Error, Battery Error, Power Supply Error	
Built-in funciton		- Computer Link (RS232C) - PID Control - Clock	

	- I/O Reservation - On-line Editable Program

DEVICE & ADDRESS

▶ Device

- Input : X
- Output : Y
- Auxiliary Relay : M
- Keep Relay : K
- Timer : T
- Counter : C
- Data Register : D
- Indirect Data Register : @D
- Link Relay : L
- Step Control Relay : S
- Internal Flag(Relay) : F

▶ Indicating Device Addresses

- Bit Data : [Device]+[Card No.]+[Bit No.]
  Device : X, Y, M, K, L, F
  Card No. : Decimal 3Characters
  Bit No. : Hexadecimal 1Character

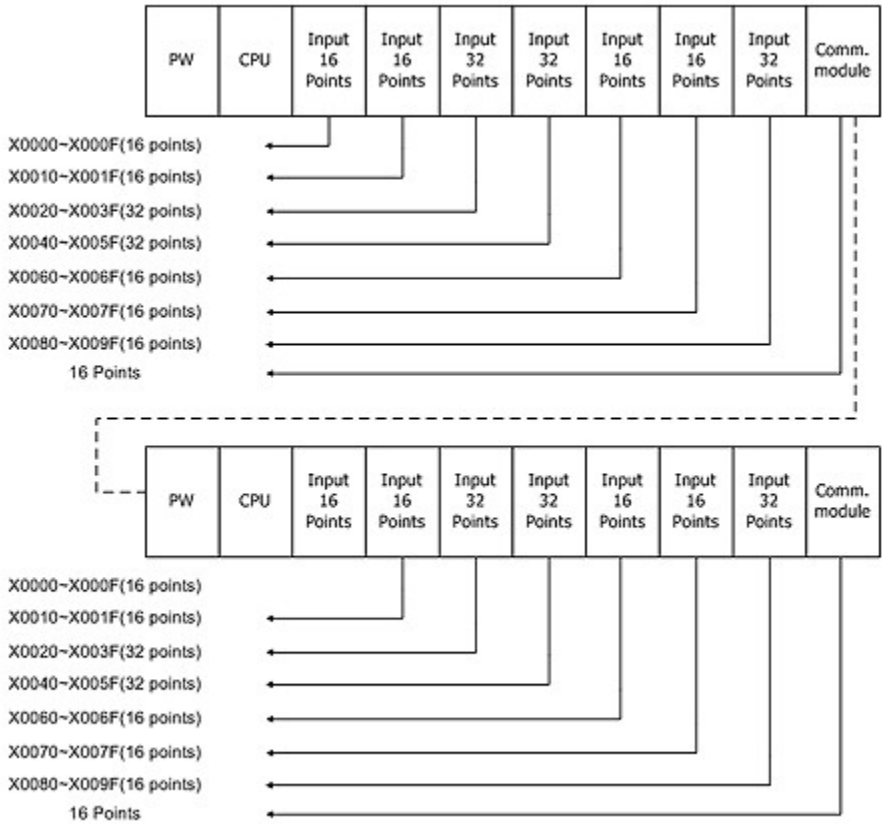
- Word Data : [Device]+[Card No.]
  Device : D, Z, T, C
  Card No. : Decimal 4Characters

- Timer, Counter Output contact : [Device]+[Bit No.]
  Device : T. C
  Bit No. : Decimal 4Characters

- Step Controller Contact : [Device]+[Card No.]+[.]+[Step No.]
  Device : S
  Card No. : Decimal 2Characters
  Step No. : Decimal 2Characters

- Bit Device in Word(Card) : [Device]+[Card No.]+[0]
  Device : X, Y, M, K, L, F
  Card No. : Decimal 3Characters

ASSIGNING I/O NUMBERS

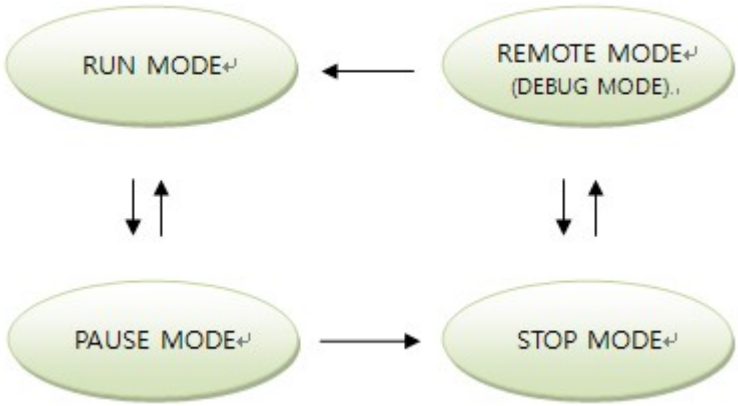


▶ IO addresses are continuously allocated between expansion bases.
The order of allocation is based on the expansion number which is configured by the rotary switch of

expansion module

▶ All non-digital IO modules and empty slots occupy 16points

MODE CHANGE



▶ The Arrow indicate convertible routes between modes each by a mode-conversion switch

▶ REMOTE Operation

REMOTE operation(RUN/STOP) is possible when the position of switch is moved from "STOP" to "PAUSE/RM"

FEATURES

▶ Built-in functions

✓ PID Control
All CPU models embed PID control function

✓ Clock(CP*A type exception)
Read a time RTC and store the result in the device assigned to F

✓ I/O Reservation
Detect whether a card is inserted to an assigned slot correctly and to reserve that a program is written without
changing the number of I/O when spare parts are substituted in case of expansion or break-down

✓ On-line Editable program
Edit the contents of a program while a PLC is in Run mode.

▶ Self-Diagnosis

✓ Watch-dog Timer
Detect the operation delay by an error in user's program

✓ Checking whether module Fixed or unfixed
Detect whether the slot of the card built in a base unfixed or connected incompletely

✓ Memory Check-Sum Error
In case that there is an error in the flash memory of CPU or an error occurs in

accessing Dual Port Ram,
the error is indicated in internal Flag Device F.

✓ Battery Discharge
In case that the voltage of the battery is less than standard one, the internal Flag F3.4 is set.

✓ Power Failure
A CPU module detects the instantaneous power failure when the voltage of input power is lower than the standard.
power is lower than the standard

CM1-CP4C RS-232 INTERFACE

▶ Supported Protocols : CIMON - HMI Loader(auto - detection)

▶ Pin Description(RJ45)

Pin	Name	Contents
1	DSR/RI	Data set Ready/Ring Indicator
2	DCD	Data Carrier Detect
3	DTR	Data Terminal Ready
4	SGND	Signal Ground
5	RD	Receive Data
6	TD	Transmit Data
7	CTS	Clear to Send
8	RTS	Request to Send

* RJ45 Male Connector Pin Numbering

CM1-CP4D RS-422/485 INTERFACE

▶Supported Protocols : CIMON - HMI Loader(auto - detection)

▶ Pin Description(RJ45)

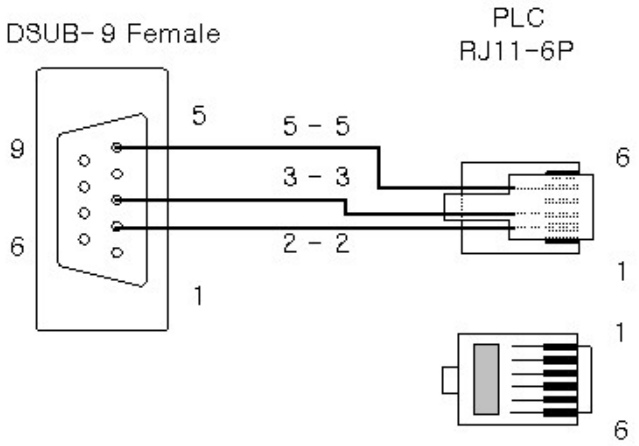
Pin	Name	Contents
1	SDA	Send Data(+)
2	SDB	Send Data(-)
3	RDA	Receive Data(+)
4	-	-

5	RDB	Receive Data(-)
6	-	-
7	-	-
8	SGND	Signal Ground

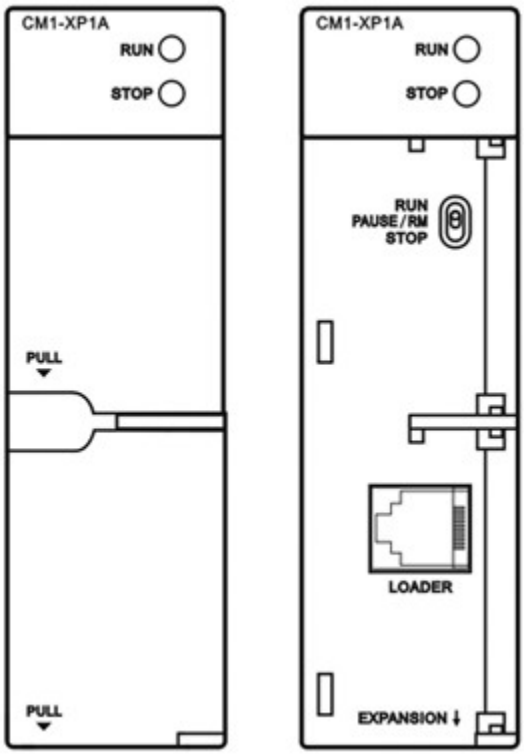
* RJ45 Male Connector Pin Numbering

LOADER CABLE WIRING

▶ PLC use the RJ11(6P) connector for Loader communication

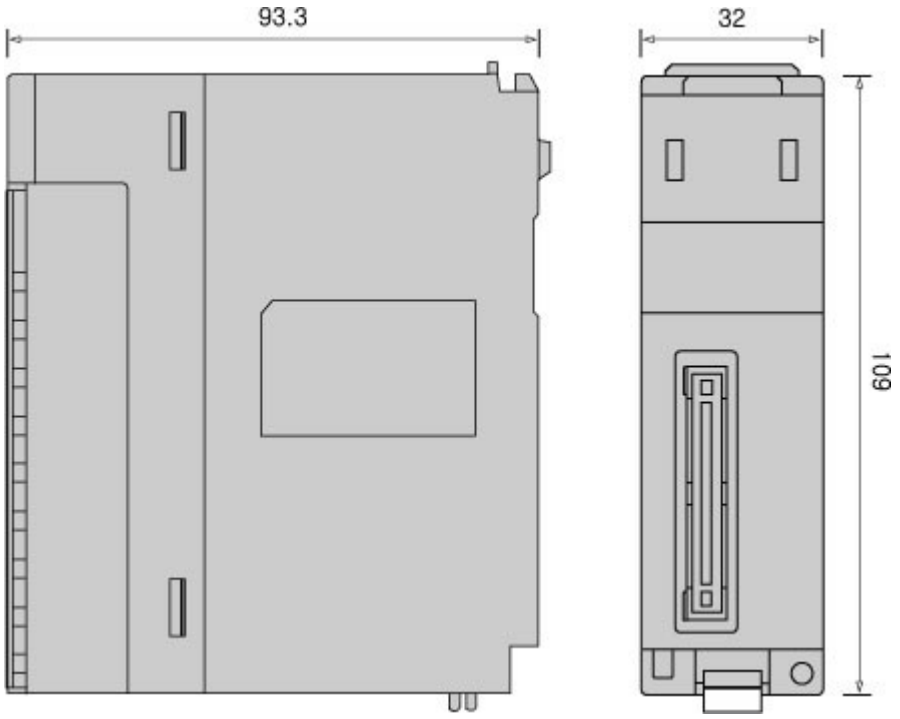


EXTERNAL VIEW(TOP)



DIMENSIONS

(Uint : mm)



SAFETY PRECAUTIONS

▶ Use the PLC in an environment that meets the general specifications given in the User's Manual of the CPU module being used.

▶ Take care that dregs are not put into a module case.

▶ Do not touch in the status that the power source is supplied. (It is prohibited to mount and dismount modules.)

▶ Do not dismount or disassemble a module.

▶ In Case that the voltage of the battery is less than standard one, the Internal Flag F3.4 is set up. At this time, the battery is to be replaced.

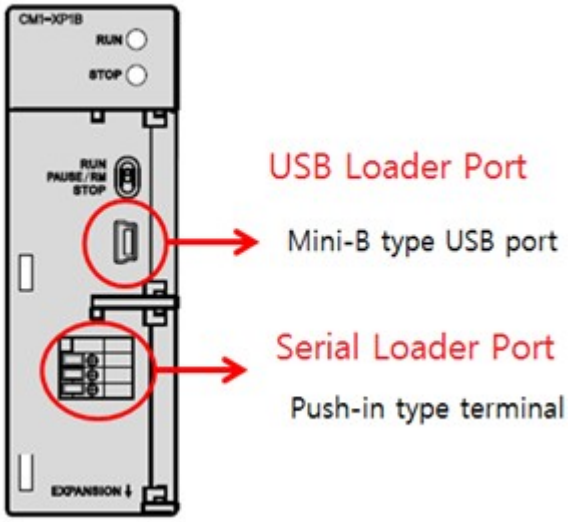
3.2 CIMON-PLC CPU(MPnA / XPnX)

New High-end CPUs are coming out soon.

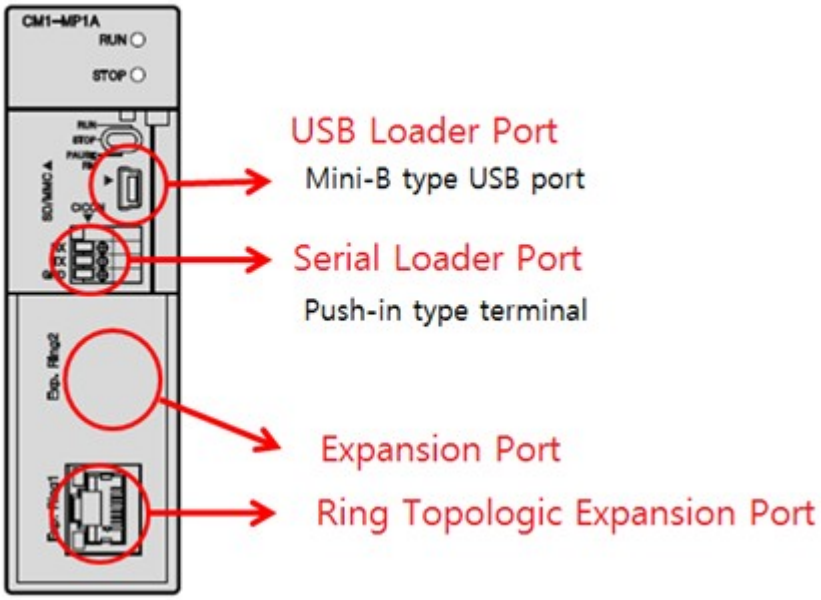
CM1-XPnB, the next model of CM1-XPnA and High-End CPU, CM-MPnA will be released soon.

Exterior shape

(1) XPnB



(2) MPnA



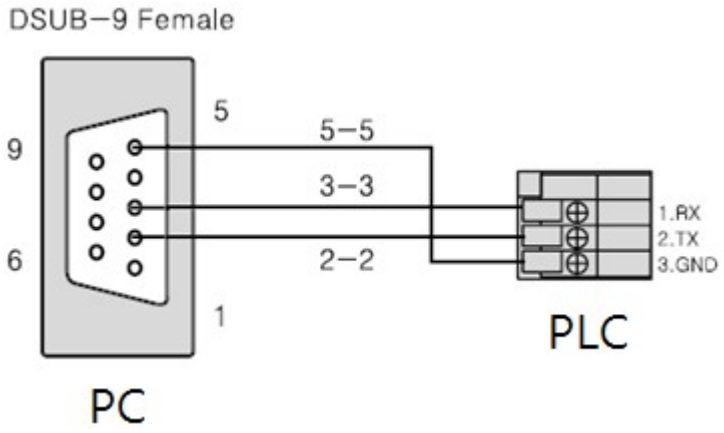
High-End performance of MPnA and XPnB

Powerful Communication

- Easy Connector

  1. Push-in type Loader Port

RJ-11 is replaced to Push-in type Loader Port(3pins) for easy connection.



2. Mini-B type USB Loader Port

The most common USB Mini-B type Loader Port is installed.

- Automatic Protocol detection

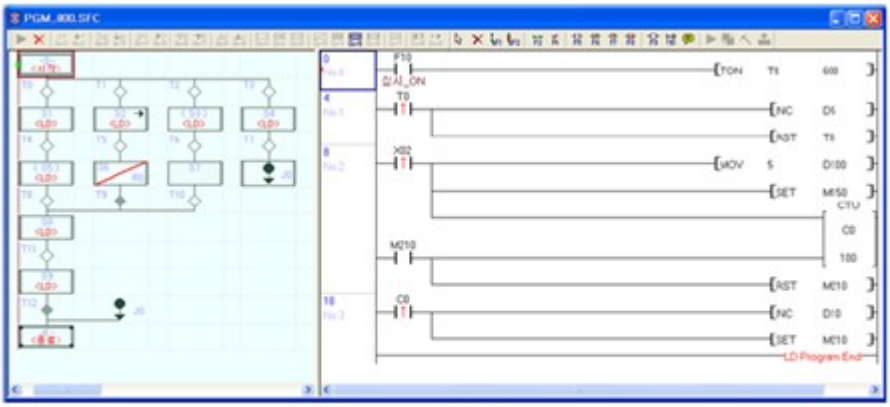
HMI, CICON, MODBUS/RTU Protocol supported.

Auto protocol detection function makes user to set communication parameter easily.

SFC Program

SFC Program is supported for MPnA and XPnB.

User has SFC and LD-IL for developing program.



※SFC only works with CICON 4.03 or higher version.

Firmware Upgrade

XPnB and MPnA supports Firmware upgrade function.

Unlike XPnA, user can upgrade firmware of MPnA and XPnB through CICON.

※CICON version: 4.03 or higher

Expansion Network

- Communication speed increased with Expansion

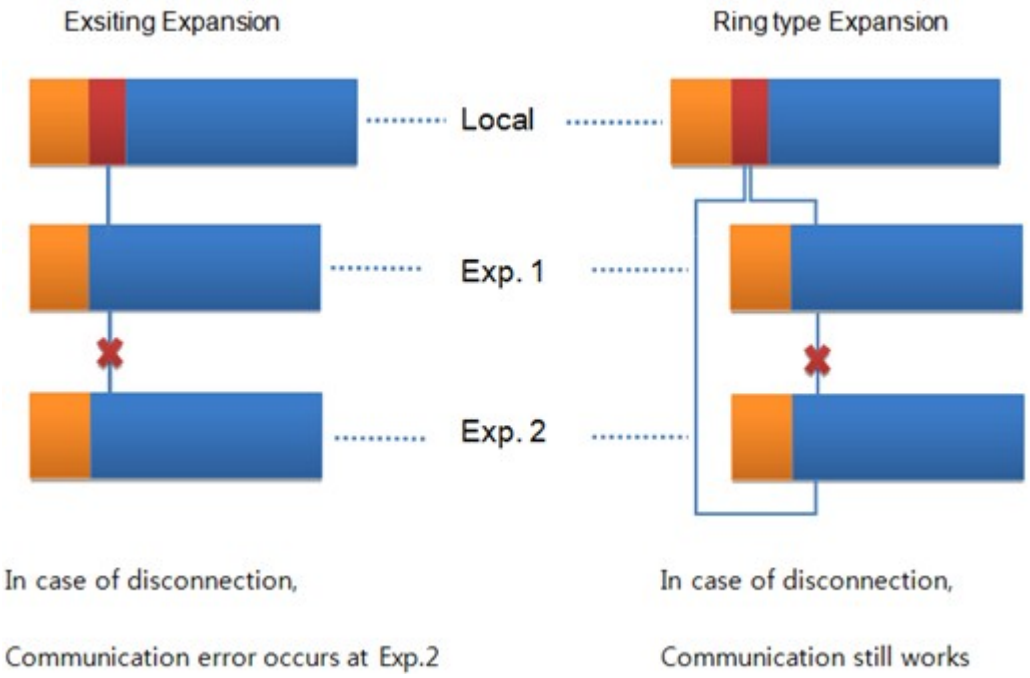
Communication of 10Mbps is upgraded to 100Mbps.

(※Communication module(100Mbps) for Expansion is under development.)

- Ring Topological Network

Ring type expansion network helps communication stable even if disconnection occurs one side of expansion line.

- Optical communication expansion supported.



Specifications

Item		Performance Specification		
		CM1-XP1A CM1-XP1B CM1-MP1A	CM1-XP2A CM1-XP2B CM1-MP2A	CM1-XP3A CM1-XP3B CM1-MP3A
Operation Method		Stored Program, Cyclic Operation, Time Driven Interrupt		
I/O Control Method		Indirect, Direct by Instruction		
Program Language		IL(Instruction List), LD(Ladder Diagram),SFC(MPnA/XPnB)		
Data Processing Method		32 Bit		
Instruction	Sequence	55 Instruction		

	Application	389 Instruction		
Program Memory Capacity		128K Step	64K Step	64K Step
		2Mbyte	2Mbyte	2Mbyte
BASE Expansion		Maximum16		
Data Memory Capacity		1Mbyte		
Device Memory Capacity	X	8,192	4,096	2,048
	Y			
	M	16,000		
	K	16,000		
	L	16,000		
	F	2,048		
	T	4,096(Option : 10ms / 100ms)		
	C	4,096		
	S	100Card*100Step		
	D	32,000		
	Z	2,048		
Timer	Type	On Delay, Off Delay, Integration, Monostable, Retriggerable		
	Range	0.01초~ 655.35 Sec.		
Counter	Type	Up Counter, Down Counter, Up-Down Counter, Ring Counter		
	Coefficient Range	-32,768 ~ 32,767		
Operation mode		RUN, STOP, PAUSE, DEBUG		
Self Diagnosis		Watch-Dog Timer, Memory Error, I/O Error, Battery Error, Power Error		
Battery Back-up		Over 3 years		
Built-in Function		- Floating point arithmetic - Computer Link(RS232C) - PID Control - Clock (RTC) - I/O Reservation - Online Edit - RS-232 1CH(HMI/CICON/MODBUS : MPnA, XPnB)		

3.3 CIMON-PLC RS232C/422/485 module

Modules :

- CM1-SC02A
- CM1-SC01A / B
- CM1-SC01DNP

Contents :

GENERAL SPECIFICATIONS

Item	Specification				Reference
Op.Temp.	Operating Temperature -10 ~65 ℃				
St.Temp	Storage Temperature □□-25 ~□□80 ℃				
Op.Hum	Operating Humidity 5 ~95%RH, Not Condensed				
St.Hum	Storage Humidity 5 ~95%RH, Not Condensed				
Vibration	In case of intermittent vibration			-	IEC61131-2
	Frequency	Acceleration	Amplitude	Sweep	
	10=□f=□□ 57Hz		0.075mm	10 times in X,Y,Z	
	57=□□f=□□ 150Hz	9.8m/s^2{1G}	-		
	In case of continuous vibration				
	Frequency	Acceleration	Amplitude		

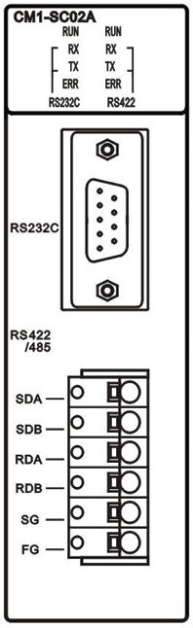
	10=□□f =□□57Hz		0.035mm		
	57=□□f= 150Hz	4.8m/s²{0.5G}			
Shock	□□Max. shock Acc. :147 m/s{15G} □□Time :11㎳ □□Pulse wave: Half sine wave pulse(3 times in X,Y,Z)				IEC61131-2
Noise	Square wave impulse noise	2,000 V			KDT Standard
	Electro-static discharge	Voltage :4kV (Contact discharge)			IEC61131-2 IEC1000-4-2
	Radiated electro-magnetic field	27 ~500 MHz,10 V/m			IEC61131-2 IEC1000-4-3
	Fast transient bust noise	Power Module	Digital I/O (24V or more)	Digital I/O (Less than 24V) Analog I/Ocomm.. Interface	IEC61131-2 IEC1000-4-4
		2kV	1kV	0.25kV	
Environ..	No corrosive gas and no dust				
Altitude	2,000m or less				
Pollution	2 or less				
Cooling	Natural Air Cooling				

Module SPECIFICATIONS

Model		CM-SC02A	CM1-SC01A	CM1-SC01B
Interface		RS232C / RS422/ RS485	RS232C	RS422 / RS485
Comm. Method	Null Modem	Direct communication between a PC and RS232C/RS422 port		
	Leased-Line Modem	Communication using a leased-line modem		
	Dial-up Modem	Remote communication using a dial-up modem		
Operation Mode	User Protocol	Communication using user protocol		
	HMI Protocol	Communication using exclusive protocol		
	MODBUS Protocol	Communication using Modicon protocol		
	PLC Link Protocol	Communication sharing data between CIMON-PLCs		
	Graphic Loader Protocol	Controls a PLC, using link function in the CICON.		
Data Type	Data Bit	7 or 8 bits		

	Stop Bit	1 or 2 bits
	Parity	Even/Odd/None
Synchronous Type		Asynchronous
Baud Rate		300bps / 600 / 1200 / 2400 / 4800 / 9600 / 19200 / 38400 / 76800 bps
Modem Link Function		Long-distance communication linking modem

FEATURES AND OPERATION



- As other makers' protocols are written to use RS-232 and RS-422(485) each, independent operation is available by protocols
  - It is available to use an exclusive protocol to read/write data.
  - The exclusive communication function suitable for the multi-drop configuration of 32 units access as max. is offered.
  - As modem communication function is built in, a PLC at a long distance can be controlled through exclusive communications
- Baud rate is set up in the range from 300bps to 38400bps
- It is available to set up RS232C/ RS422(485) communication port as independent or linked channel.
- 1:1 / 1:N / N:M communications (RS422 used) are supported
- Full–Duplex(RS422) and Half-Duplex(RS485) are supported
- RS485multi-drop communication system can be configured, using RS485 channel.

I/O SIGNALS

Signal Direction (CPU? Cnet)		Signal Direction(CPU? Cnet)	
Input	Signal Name	Output	Signal Name
X0	Error in module	Y0	Clear error
X1	Initialized	Y1	
X2		Y2	
X3		Y3	
X4	Rx data existing (CH1)	Y4	Clear Rx Buffer (CH1)

X5	Tx Buffer Empty (CH1)	Y5	Clear Tx Buffer (CH1)
X6	Rx Data Existing (CH2)	Y6	Clear Rx Buffer (CH2)
X7	Tx Buffer Empty (CH2)	Y7	Clear Tx Buffer (CH2)
X8		Y8	
X9		Y9	
XA	Modem Initialized	YA	Modem initialization request
XB	Dialing	YB	Dialing request (Line connection)
XC	Line connection	YC	Connection release request
XD		YD	
XE		YE	
XF	Parameter applied	YF	Parameter setup request

USER PROGRAM MEMORY DEVICES

Offset	Description	R/W
0	Status Code (0=Normal, Others=Error Code)	R
1	Mode	R/W
2	CH1 Port Parameter	R/W
3	CH2 Port Parameter	R/W
4	Number of retrying dialing	R/W
5	Interval of retrying dialing	R/W
6	Modem initialization/Dialing Timeout	R/W
7	Number of retrying modem initialization	R/W
8	Station Number	R/W
9	SND command timeout	R/W
10	RCV command timeout	R/W
11 … 31	Modem initialization command	R/W
…		
37	PLC Link station number	R
38	PLC Link Connection	R
39	PLC Link Connection	R
40	Dial Number(H)	R/W

..	Dial Number	R/W
49	Dial Number	R/W
50	Response Delay Time(CH1)	R/W
51	Response Delay Time(CH2)	R/W
…		
63	OS Version	R
64	User Message	R/W
…		
255		

SETTING UP PARAMETERS

1) Click the CICON to set up Specialty Card in Tool menu
2) Select RS232C/422 as Card Type, Base and Slot No.

   Base : Number of the base on which a communication module is mounted. If not expansion, select Local.

   Slot : Number of the slot on which a communication module is mounted.

   The slot number is counted from the slot next to a CPU module like 0,1---11.
3) Enter values to set up the parameters used in a communication card for Channel 1 and 2.

- Read : This is used to read and display the currently set parameter of the RS232C/422 module which is mounted on a slot from

  buffer memory.
- Current Status : This is used to read and display the error status, version and PLC link status from buffer memory.

USER COMMUNICATIONS

This is used when the communication frame defined in a user program is used to send and receive data in the program.

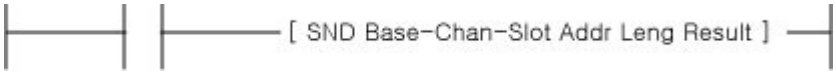
1) SND

- This is used to send the data as much as the length of the data requested from a computer link module.

Command	Description
Base-Chan-Slot	Base(1Byte): h00XX, Expansion base number in upper 1Byte (Local:00)

	Channel mode, Slot numberè hXX00 : RS-232C, hXX10 : RS-422
Addr	Address of the data sent
Leng	Length of the data sent (BYTE), Decimal figure, Maximum 500BYTE
Result	Address where the result of sending is noticed is assigned. (X,Y,M,L,K,T,C,D,@D,Z) Result Format : Bit 0 : If sending completed, 1Scan ON. If failed, always ON. Bit 1 : If failed, always ON Bit 2-7 : OFF Bit 8-F : Error Code (0=No Error)

2) Format



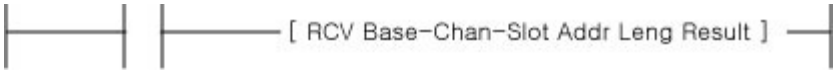
WIRING DIAGRAM

1) RCV

· This is used to store the data as much as the length of the data requested from a computer link module.

Command	Description
Base-Chan-Slot	Base(1Byte): h00XX, Expansion base number in upper 1Byte (Local:00)
	Channel mode, Slot number➔ hXX00 : RS-232C, hXX10 : RS-422
Addr	Address where data are received and stored
Leng	Length of the data received (BYTE), Decimal figure, Maximum 500BYTE
Result	Address where the result of receiving is noticed is assigned. (X,Y,M,L,K,T,C,D,@D,Z) Result Format : Bit 0 : If receiving completed, 1Scan ON. If failed, always ON. Bit 1 : If failed, always ON Bit 2-7 : OFF Bit 8-F : Error Code (0=No Error)

2) Format



HMI EXCLUSIVE SERVICE

This service is used to read or write the information and data in a PC and other devices, and to control a PLC (RUN, STOP, PAUSE).

As station numbers are assigned in the system configured with master and slave, multi-drop communication is available.

- In case of exclusive communication mode, station numbers for RS232C side and RS422 side are to be set up in specialty card setup.
- All the frames used in exclusive communication are composed of ASCII code.
- In case of multi-drop, access up to 32 stations is allowed.
- When station number is set up, duplicate station number is not to be set up in a network. In case of multi-drop network configuration, the baud rate, stop bit, parity bit and data bit of a RS232C/422module are to be same.
- To use HMI exclusive service, HMI protocol is to be selected as action mode in the specialty card setup of the CICON. If a RS232C/422module is used in inter-link mode, check CH 1 inter-link box in the action mode of CH 2. In this case, the data received to CH 1(RS232C) are received inside and sent to CH 2(RS422/485).

ERROR CODES FOR HMI EXCLUSIVE SERVICE

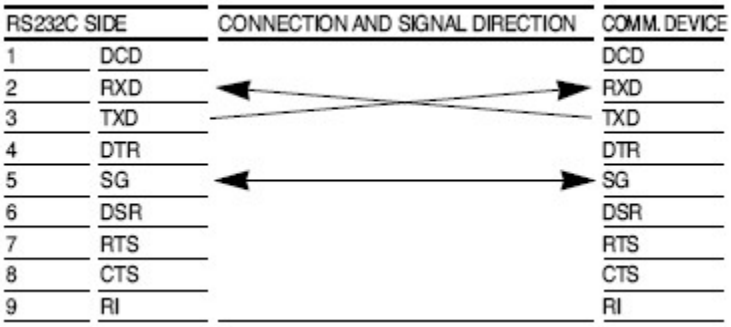
Error Code	Description
01	Receives unknown command code.
02	An error occurs in BCC.
03	CPU does not respond.
04	Receives unknown device code
05	Exceeds the device read.
06	Invalid address
07	Internal error
08	Receives the number of invalid data
09	Invalid data
10	Unregistered (Not initialized) frame number
11	Invalid monitor frame No. (0h – Fh) Invalid frame number

12	CPU is not in REMOTE status.
13	Invalid CPU status is assigned.
14	Error in the size of the data written
15	Error in changing remote mode
16	Error in writing to remote memory device

CONNECTION

[RS232]

- In case of null modem

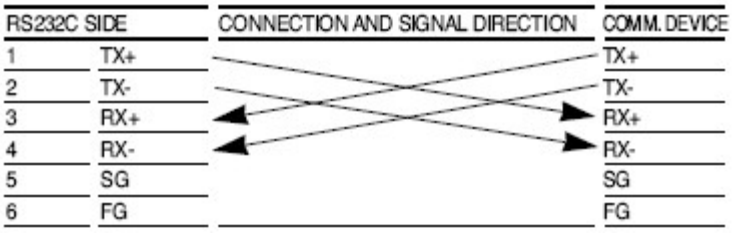


- In case of modem (Lease-line modem, Dial-up modem)

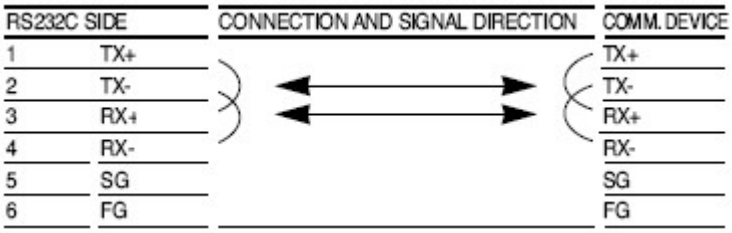
  * Connect each pin in 1 to 1 basis

[RS-422/485]

- In case of RS422



- In case of RS485



Modem COMMUNICATIONS

RS232C/422 has the function to use the public network for a long-distance network.
This function enables long-distance communication through public network by sending and receiving phone call after connecting a
RS232C/422 nodule to an external modem.

In case of modem specifications, it is required to use the modem complying with the recommendable specifications for reliability.
According to the performance of a modem and the state of a public network, the case that a line is not linked or the case that a
line is cut off while exchanging data may occur.

1. Baud rate: Over 14400bps
2. DTE Interface: CTS / RTS Flow Control
3. Command: AT Command
4. Error correction: While sending data
5. Controlling carrier: Controls to send carrier

How to connect an external modem with a RS232C/422module

1. Use RS-232C interface cable to connect a computer link module and an external type RS232C modem.
2. Connect a RS-232C interface cable to the RS-232C port of the computer link module and DTE link terminal.
3. Connect the telephone line of a public network to the line terminal of the modem.
4. If there is a telephone set, connect the telephone terminal of the modem with the telephone set.
5. Turning on the power for the PLC and the modem, make sure the modem is initialized.

MODBUS SERVICE

- This is used to access CPU Data Memory, using ModBus Protocol.
- This corresponds to Device Memory of all types.
- Address Map

Bit / Word	Modicon Address	CIMON-PLC Address	Size Cimon-PLC
Bit Read Input	100001 ~	X0000 ~	4096 Bits
	104097 ~	F0000 ~	2048 Bits
	106145 ~	T0000 ~	1024 Bits

	107169 ~ 108192	C0000 ~	1024 Bits
Bit Read Coil	000001 ~	Y0000 ~	4096 Bits
	004097 ~	M0000 ~	8192 Bits
	012289 ~	K0000 ~	2048 Bits
	014337 ~ 016384	L0000 ~	2048 Bits
Word Input Register	400001 ~	X0000 ~	256 Words
	400257 ~	F0000 ~	128 Words
	400385 ~	TC0000 ~	1024 Words
	401409 ~	CC0000 ~	1024 Words
	402433 ~ 402482	S0000 ~	50 Words
Word Holding Register	300001 ~	Y0000 ~	256 Words
	300257 ~	K0000 ~	128 Words
	300385 ~	TS0000~	1024 Words
	301409 ~	CS0000 ~	1024 Words
	302433 ~	L0000 ~	128 Words
	302561 ~	M0000 ~	512 Words
	303073 ~ 313072	D0000 ~	10000 Words

3.4 CIMON-PLC Power

Modules :

- CM1-SPA
- CM1-SPC
- CM1-SP2B
- CM1-SPR

Contents :

GENERAL SPECIFICATIONS

<table>
<tr><th>Item</th><th colspan="5">Specification</th><th>Reference</th></tr>
<tr><td>Op.Temp.</td><td colspan="5">Operating Temperature -10 ~65 ℃</td><td></td></tr>
<tr><td>St.Temp</td><td colspan="5">Storage Temperature □□-25 ~□□80 ℃</td><td></td></tr>
<tr><td>Op.Hum</td><td colspan="5">Operating Humidity 5 ~95%RH, Not Condensed</td><td></td></tr>
<tr><td>St.Hum</td><td colspan="5">Storage Humidity 5 ~95%RH, Not Condensed</td><td></td></tr>
<tr><td rowspan="9">Vibration</td><td colspan="4">In case of intermittent vibration</td><td>-</td><td></td></tr>
<tr><td>Frequency</td><td>Acceleration</td><td>Amplitude</td><td>Sweep</td><td rowspan="9">IEC61131-2</td></tr>
<tr><td>10=□f=□□ 57Hz</td><td></td><td>0.075mm</td><td rowspan="6">10 times in X,Y,Z</td></tr>
<tr><td>57=□□f=□□ 150Hz</td><td>9.8m/s^2{1G}</td><td>-</td></tr>
<tr><td colspan="3">In case of continuous vibration</td></tr>
<tr><td>Frequency</td><td>Acceleration</td><td>Amplitude</td></tr>
<tr><td>10=□□f =□□57Hz</td><td></td><td>0.035mm</td></tr>
<tr><td>57=□□f= 150Hz</td><td>4.8m/s^2{0.5G}</td><td></td></tr>
<tr><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td></td></tr>
<tr><td>Shock</td><td colspan="5">□□Max. shock Acc. :147 m/s{15G}
□□Time :11㎳
□□Pulse wave: Half sine wave pulse(3 times in X,Y,Z)</td><td>IEC61131-2</td></tr>
<tr><td rowspan="5">Noise</td><td>Square wave impulse noise</td><td colspan="4">2,000 V</td><td>KDT Standard</td></tr>
<tr><td>Electro-static discharge</td><td colspan="4">Voltage :4kV (Contact discharge)</td><td>IEC61131-2
IEC1000-4-2</td></tr>
<tr><td>Radiated electro-magneti c field</td><td colspan="4">27 ~500 MHz,10 V/m</td><td>IEC61131-2
IEC1000-4-3</td></tr>
<tr><td rowspan="2">Fast transient bust noise</td><td>Power Module</td><td>Digital I/O (24V or more)</td><td>Digital I/O (Less than 24V) Analog I/Ocomm.. Interface</td><td rowspan="2">IEC61131-2
IEC1000-4-4</td></tr>
<tr><td>2kV</td><td>1kV</td><td>0.25kV</td></tr>
<tr><td>Environ..</td><td colspan="5">No corrosive gas and no dust</td><td></td></tr>
<tr><td>Altitude</td><td colspan="5">2,000m or less</td><td></td></tr>
<tr><td>Pollution</td><td colspan="5">2 or less</td><td></td></tr>
<tr><td>Cooling</td><td colspan="5">Natural Air Cooling</td><td></td></tr>
</table>

Module SPECIFICATIONS

Item		CM1-SPA	CM1-SPC/SPR	CM1-SP2B
INPUT	Input Voltage	AC100-240V, 50/60Hz		DC 24V
	Input Current	0.25A MAX For 220VAC		1.8A MAX For 24VDC
	Inrush Current	Less then 30A		-
	Efficiency	More than 70%(regular input/load)		
	PF indicate	20ms more		
OUTPUT	Output Voltage / Output Current	+5V (3.5A) +24V (0.3A)	+5 (3.5A) +24V (0.3A) +15V (0.5A) -15V (0.3A)	+5 (3.5A) +15V (0.5A) -15V (0.3A)
Power supply Status indication		LED On.Off		

▶ Maximum allowable input power line disturbance is 20ms or less.

▶ Analog modules must be used with SPC or SP2B type power (AD, DA, RTD, TC, TH module)

Usage OF OUTPUT VOLTAGE

▶ **SPC / SP2B**

Output Voltage	Usage
+5V	Operation Power of all PLC module
+24V	External Sensor and Switch Power, Analog current output module
+15V	Operation Power of Analog Module
-15V	Operation Power of Analog Module

▶ **SPA**

Output Voltage	Usage

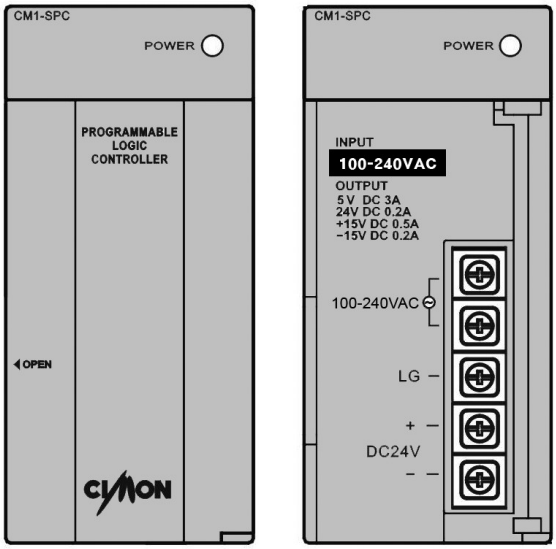
+5V	Operation Power of all PLC module
+24V	External Sensor and Switch Power, Analog current output module

Current Consumption

Item	Model	Current consumption
CPU Module	CM1-CP**	130 mA
Redundancy Module	CM1-RM01A	70 mA
	CM1-RC01A	290 mA
Expansion Module	CM1-EP***	270 mA
DC Input Module	CM1-XD16A	60 mA
	CM1-XD32C	100 mA
AC Input Module	CM1-XA08A	30 mA
	CM1-XA08B	30 mA
I/O Hybrid Module	CM1-XY16DR	180 mA
Relay Module	CM1-YR16A	250 mA
Transistor Module	CM1-YT16A	110 mA
	CM1-YT16B	110 mA
	CM1-YT32A	130 mA
	CM1-YT32B	130 mA
SSR Output Module	CM1-YS08A	120 mA
High Speed Counter Module	CM1-HS02B	290 mA
A/D Convert Module	CM1-AD04VI	50 mA
	CM1-AD08V	50 mA
	CM1-AD08I	55 mA
D/A Convert Module	CM1-DA04V	40 mA
	CM1-DA08V	50 mA
	CM1-DA04I	40 mA
	CM1-DA08I	50 mA
RTD Measuring Module	CM1-RD04A	50 mA
	CM1-RD04B	50 mA
TC Measuring Module	CM1-TC04A	60 mA
Communication Module	CM1-SC02A	190 mA
	CM1-SC01A	170 mA
	CM1-SC01B	170 mA
	CM1-SC01DNP	170 mA

	CM1-EC01A	290 mA
	CM1-EC01DNP	290 mA

Wiring



Warning

▶ Touching the electrical part nay be fatal- even after the Power module Has been disconnected from a power source :

Wait at least 5 minutes for current dissipate

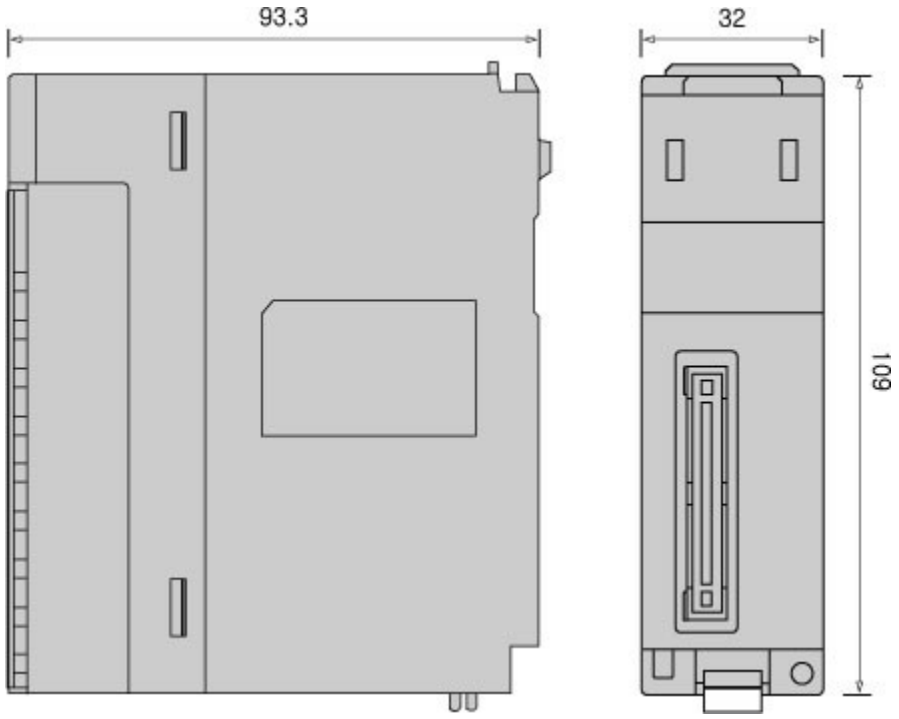
▶ Use only 60℃ copper conductor or equivalent.

▶ Use copper conductors in a size range of 12AWG(3.31mm²) to 220AWG(0.324mm²)

▶ The torque required to tighten these screw is 16 lbf· in(1.813N· m)

Outward Dimension

(Unit : mm)



3.5 CIMON-PLC Base

Modules :

- CM1-BS03A / 04A / 05A / 08A / 10A / 12A
- CM1-BS05R / 08R / 10R

Contents :

GENERAL SPECIFICATIONS

Item	Specification	Reference
Op.Temp.	Operating Temperature -10 ~65 ℃	
St.Temp	Storage Temperature □□-25 ~□□80 ℃	
Op.Hum	Operating Humidity 5 ~95%RH, Not Condensed	
St.Hum	Storage Humidity 5 ~95%RH, Not Condensed	

<table>
<tr><td rowspan="9">Vibration</td><td colspan="3">In case of intermittent vibration</td><td>-</td><td></td></tr>
<tr><td>Frequency</td><td>Acceleration</td><td>Amplitude</td><td>Sweep</td><td rowspan="8">IEC61131-2</td></tr>
<tr><td>10=□f=□□ 57Hz</td><td></td><td>0.075mm</td><td rowspan="6">10 times in X,Y,Z</td></tr>
<tr><td>57=□□f=□□ 150Hz</td><td>9.8m/s²{1G}</td><td>-</td></tr>
<tr><td colspan="3">In case of continuous vibration</td></tr>
<tr><td>Frequency</td><td>Acceleration</td><td>Amplitude</td></tr>
<tr><td>10=□□f =□□57Hz</td><td></td><td>0.035mm</td></tr>
<tr><td>57=□□f= 150Hz</td><td>4.8m/s²{0.5G}</td><td></td></tr>
<tr><td>Shock</td><td colspan="4">□□Max. shock Acc. :147 m/s{15G}
□□Time :11㎳
□□Pulse wave: Half sine wave pulse(3 times in X,Y,Z)</td><td>IEC61131-2</td></tr>
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<tr><td>Electro-static discharge</td><td colspan="3">Voltage :4kV (Contact discharge)</td><td>IEC61131-2
IEC1000-4-2</td></tr>
<tr><td>Radiated electro-magneti c field</td><td colspan="3">27 ~500 MHz,10 V/m</td><td>IEC61131-2
IEC1000-4-3</td></tr>
<tr><td rowspan="2">Fast transient bust noise</td><td>Power Module</td><td>Digital I/O (24V or more)</td><td>Digital I/O (Less than 24V) Analog I/Ocomm.. Interface</td><td rowspan="2">IEC61131-2
IEC1000-4-4</td></tr>
<tr><td>2kV</td><td>1kV</td><td>0.25kV</td></tr>
<tr><td>Environ..</td><td colspan="4">No corrosive gas and no dust</td><td></td></tr>
<tr><td>Altitude</td><td colspan="4">2,000m or less</td><td></td></tr>
<tr><td>Pollution</td><td colspan="4">2 or less</td><td></td></tr>
<tr><td>Cooling</td><td colspan="4">Natural Air Cooling</td><td></td></tr>
</table>

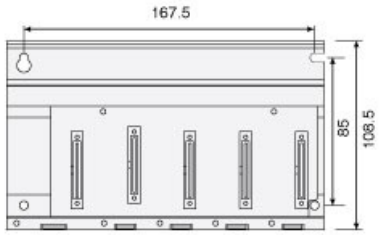
BASE SPECIFICATIONS

Model	No. of I/O Slot	Unit (mm)	weight
CM1-BS03A	3 Slot	183×108	258 g
CM1-BS04A	4 Slot	216×108	304.5 g
CM1-BS05A	5 Slot	247×108	345.5 g
CM1-BS08A	8 Slot	344×108	478 g
CM1-BS10A	10 Slot	408×108	571 g

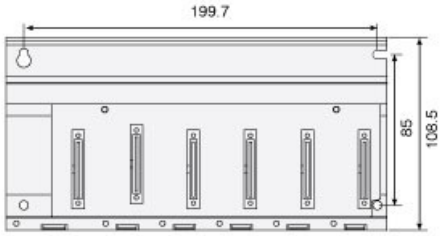
CM1-BS12A	12 Slot	473×108	683 g

Outward Dimension

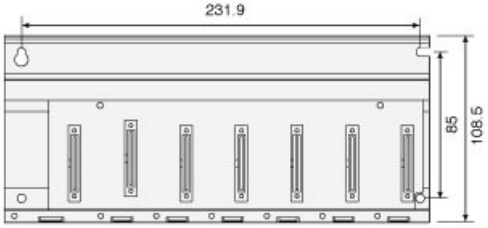
CM1-BS03A
weight : 258g



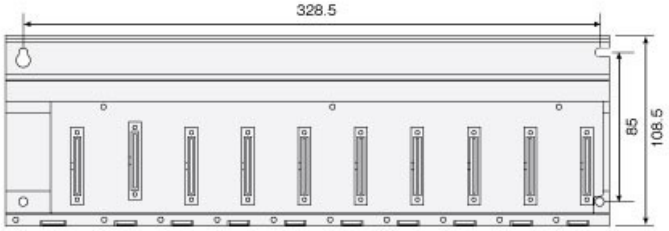
CM1-BS04A
weight : 304.5g



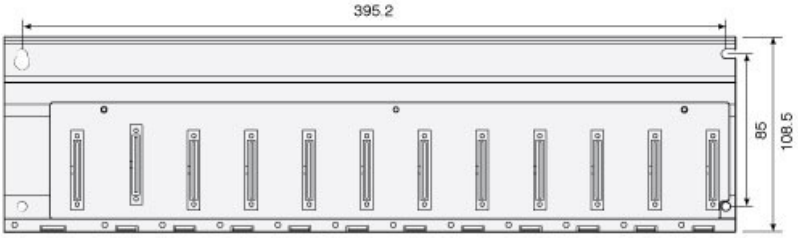
CM1-BS05A
weight : 345.5g



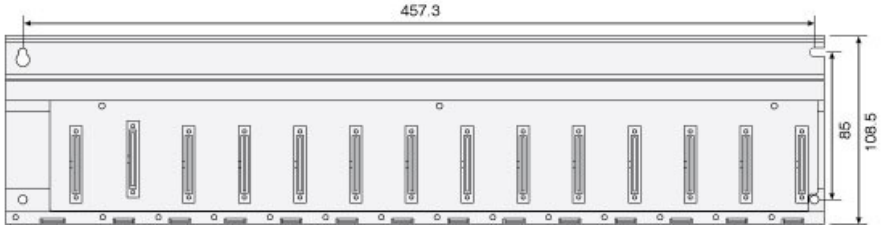
CM1-BS08A
weight : 478g



CM1-BS10A
weight : 573g



CM1-BS12A
weight : 683g



3.6 CIMON-PLC Ethernet module

Modules :

- CM1-EC01A
- CM1-EC10A / B
- CM1-EC01DNP / EC04DNP

Contents :

GENERAL SPECIFICATIONS

Item	Specification		Reference
Op.Temp.	Operating Temperature -10 ~65 ℃		
St.Temp	Storage Temperature □□-25 ~□□80 ℃		
Op.Hum	Operating Humidity 5 ~95%RH, Not Condensed		
St.Hum	Storage Humidity 5 ~95%RH, Not Condensed		
Vibration	In case of intermittent vibration	-	

	Frequency	Acceleration	Amplitude	Sweep	IEC61131-2
	10=□f=□□ 57Hz		0.075mm	10 times in X,Y,Z	
	57=□□f=□□ 150Hz	9.8m/s²{1G}	-		
	In case of continuous vibration				
	Frequency	Acceleration	Amplitude		
	10=□□f =□□57Hz		0.035mm		
	57=□□f= 150Hz	4.8m/s²{0.5G}			
Shock	□□Max. shock Acc. :147 m/s{15G} □□Time :11㎳ □□Pulse wave: Half sine wave pulse(3 times in X,Y,Z)				IEC61131-2
Noise	Square wave impulse noise	2,000 V			KDT Standard
	Electro-static discharge	Voltage :4kV (Contact discharge)			IEC61131-2 IEC1000-4-2
	Radiated electro-magnetic field	27 ~500 MHz,10 V/m			IEC61131-2 IEC1000-4-3
	Fast transient bust noise	Power Module	Digital I/O (24V or more)	Digital I/O (Less than 24V) Analog I/Ocomm.. Interface	IEC61131-2 IEC1000-4-4
		2kV	1kV	0.25kV	
Environ..	No corrosive gas and no dust				
Altitude	2,000m or less				
Pollution	2 or less				
Cooling	Natural Air Cooling				

MODULE SPECIFICATIONS

Item	Specification (10BASE-T)
Baud Rate	10 Mbps
Sending Type	Base Band
Max. Segment Length	100m(Node – Hub)
Max. No. of Nodes	4-Hub link
Max. Size of Protocol	1500 Byte
Communication Access	CSMA / CD
5V Current Consumption	280(㎃)

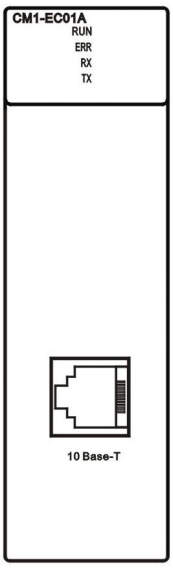
No. of Occupied Points	16 Points

■ Cable Specifications – Twisted-Pair Cable (UTP)

Item	Unit		Value
Conductor Resistance (Max.)	Ω / ㎞		93.5
Insulation Resistance (Min.)	㏁ · ㎞		2500
Internal Voltage	V / min.		AC 500
Characteristic Impedance	Ω (1 ~ 100㎒)		100± 15
Attenuation	Less than dB / 100m	10	6.5
		16	8.2
		20	9.3
Near-end Cross Talk Attenuation	Less than dB / 100m	10	47
		16	44
		20	42

※ As the cables for Ethernet connection are different according to system configuration and cable type,
consultation with an expert is required to install them

FEATURES AND OPERATION



■ Complies with IEEE802.3 standard

■ Supports the protocols like ARP, ICMP, IP, TCP and UDP.

■ Several Ethernet modules can be mounted on one base plate

■ Supports PLC link function for the communications between CIMON-PLCs. Allows communications up to 64 stations at the same time.

■ In case of PLC link communication, Ethernet modules up to 4 units can be mounted.

■ Ethernet module can be mounted on a expansion base plate.

LED No.	Indication	Description
0	RUN	ON in case of power supply.

1	ERR	Blinking in case of error in system.
2	RX	Blinking in case of receiving.
3	TX	Blinking in case of sending.

I/O SIGNALS

Signal Direction (CPU← Ethernet)		Signal Direction (CPU→ Ethernet)	
Input	Signal Name	Output	Signal Name
X0	Error in module	Y0	Request to clear error
X1	Initialized	Y1	Request to clear PLC link status
X2	User frame received	Y2	Request to clear received user frame
X3	User frame sending busy	Y3	Request to clear sending
X4		Y4	
X5		Y5	
X6		Y6	
X7		Y7	
X8		Y8	
X9		Y9	
XA		YA	
XB		YB	
XC	HMI TCP Link On-Service	YC	Request to unlink HMI TCP
XD		YD	
XE		YE	
XF	Parameter has been saved.	YF	Request to save parameter

USER PROGRAM MEMORY DEVICES

Offset	Description	R/W

0	Status Code (0=Normal, Others=Error Code)	R
1		
2		
3		
4	IP Address	R/W
5	IP Address	R/W
6	Net Mask	R/W
7	Net Mask	R/W
8	PLC Link Station	R
9	PLC Link Connection	R
10	PLC Link Connection	R
11	PLC Link Connection	R
12	PLC Link Connection	R
13	The last HMI Service IP Address	R
14	The last HMI Service IP Address	R
15	The last HMI Service Port	R
16	The last Loader Service IP Address	R
17	The last Loader Service IP Address	R
18	The last Loader Service Port	R
19	TCP Modbus Unit ID	R/W
20	Dest IP Address	
21	Dest IP Address	
22	Dest Port	
23	Source IP Address	
24	Source IP Address	
25	Source Port	
26	Gate Way	R/W
27	Gate Way	R/W

…		
30	DNP Host IP Address (Upper)	
31	DNP Host IP Address (Lower)	
32	DNP Host Station	
33	DNP My Station	
34	DNP Flags	
35	Dnp DataLink Rty/Dnp DataLink T.O	
36	Dnp Application Rty/Dnp AppicationT.O	
37~127	User Message	R/W
…		
128	PLC Link Number 0 Station IP Address (Upper)	R/W
129	PLC Link Number 0 Station IP Address (Lower)	R/W

…		
254	PLC Link Number 63 Station IP Address (Upper)	R/W
255	PLC Link Number 63 Station IP Address (Lower)	R/W

SETTING UP IP ADDRESS AND NETMASK

1) Click Tool = >Special Card Setup in the CICON.
2) Select Ethernet as Type and base and slot number.

Base: This is used to select the number of the base on which a module is mounted. If an Ethernet module is mounted on an expansion base, select the number of the base on which the module is mounted among Expansion 1, Expansion 2, ? and Expansion 16. Otherwise, select Local.

Slot No.: This is used to select the number of the slot on which an Ethernet module is mounted.

3) Enter IP Address and Net Mask used for an Ethernet module and click Download.
4) Press OK to set up IP Address and Net Mask for an Ethernet module following the above order.

- Upload Set Value : This is used to read and display current IP Address and Net Mask of the Ethernet module which is mounted on a slot from buffer memory.
- Current Status : This is used to display error status, the IP address and port for the last HMI service, the IP address and port for the last loader service and PLC Link status.

SETTING UP PLC LINK PARAMETERS

1) Select PLC Link in Parameter.
2) Ethernet modules up to 4 can be mounted on a base to set up PLC Link.
3) Select PLC Link.

· Network: Select Ethernet (Common, Exclusive).
· Base: This is used to select the base on which an Ethernet module is mounted. If an Ethernet module is mounted on the base on which a CPU module is mounted, select Local. In case of an Ethernet module mounted on an expansion base, select the number of the expansion base.
· Slot: Select the slot on which an Ethernet module is mounted.
· Station: Select a station number for PLC Link. But, the station number duplicated with other Ethernet module may cause an error.

4) Select PLC Link Type and enter the values of parameters to set up Comm. Block.
5) Select Add button to set up a sending block and a receiving block.
6) Select the sending interval, sending device and data size of a sending block.
7) Select the number of a receiving station and block, the address in which received data are stored and data size.

PLC LINK IN COMMON/EXCLUSIVE NETWORK

PLC Link in Common Network

PLC Link is used to exchange data and information with other party at a certain time periodically. The sending/receiving data size,
the interval and the device in the parameter of the CICON to exchange data can be set up.
IP Address of other node is stored in User Program Memory Device (128 ~ 255).

PLC Link in Exclusive Network

PLC Link is used to exchange data and information with other party at a certain time periodically. The sending/receiving data size,
the interval and the device in the parameter of the CICON to exchange data can be set up.

- Transport Layer : UDP/IP(IP Broadcasting)
- Maximum linked PLC : 64 units

Number of Link Points

Sending/Receiving Capacity per Station	Max. Block Number	Max. No. of Points per Block
4,096 words	**Block 64 (0~63)**	**64 words**

SAFETY PRECAUTIONS

- PLC Link station number of all communications modules including Ethernet module is to be different each other.
- If duplicate station number is accessed, an error occurs.
- Use the communication cable with assigned specification.
- Check whether communication cable is broken before installation.
- The cable other than assigned may cause communication disturbance.
- Connect communication cable correctly.
  Incomplete cable connection may cause serious communication disturbance.
- As shield cable has low flexibility, it is to be branched 30 cm or more away from the connector of a communications module.
  Bending perpendicularly or transforming by force may cause breaking cable or the connector in a communications module.
- In case of long-distance communication cable, wire a cable far away from power line or induction noise.

ERROR CODES FOR SYSTEM

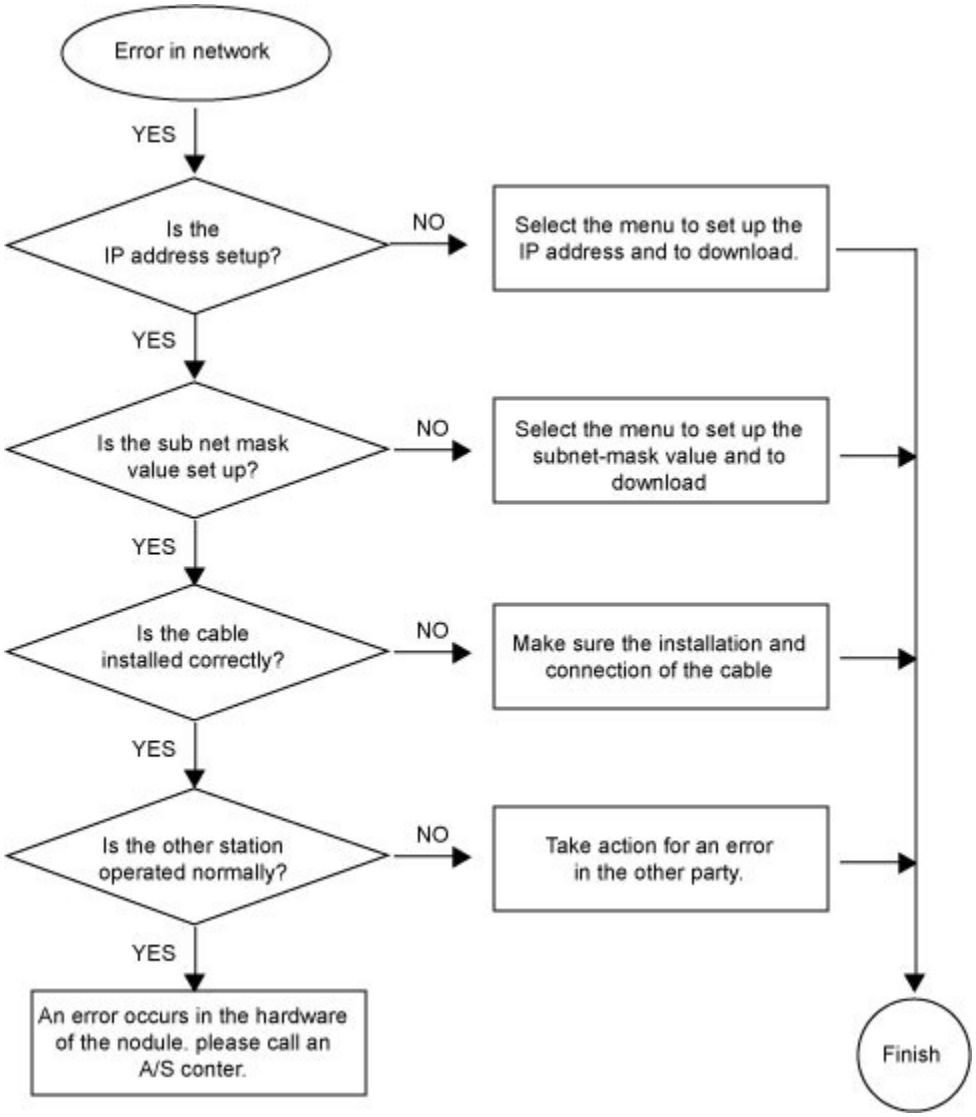
Code	Description
0000h	No error
0001h	A specialty module is not initialized.
0002h	EEPROM is not initialized.
0005h	Not able to write to buffer memory.
0006h	Not able to read buffer memory.
0007h	A CPU module is dismounted.
0008h	Station number for PLC LINK is duplicated.
000Dh	Buffer is overflowed.
000Fh	Accesses Graphic Loader over the maximum.
0010h	Not able to access EERROM.
0011h	Sending/receiving data size for PLC LINK is exceeded.
0012h	Not able to send specialty program.
0014h	No. of PLC LINK stations is over the Maximum.

ERROR CODES FOR EXCLUSIVE SERVICE

Code	Description
0000h	No error (Cmd=57h/77h, the response in case that the command is successfully processed.)
0001h	Error in system (No link with CPU)
0002h	Invalid device prefix
0003h	Invalid device address
0004h	Error in requested data size
0005h	Over 16 request blocks
0006h	The case that buffer memory send an error in data and size
0007h	Over receiving buffer capacity
0008h	Over sending time
0009h	Error in header
000Ah	Error in check-sum of received data

000Bh	Error in the information on frame length (Total received frame size)
000Ch	Error in the size to write
000Dh	Error in Bit Write Data
000Eh	Unknown command
000Fh	Disabling state from writing
0010h	Error in CPU process

TROUBLE SHOOTING



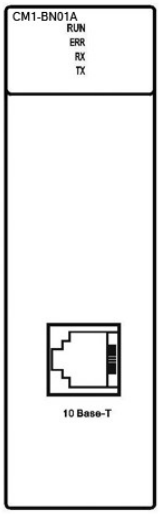
3.7 CIMON-PLC BACnet module

Modules :

- CM1-BN01A

Contents :

Feature of BACNET module



- Abbreviation of "Building Automation and Control Network" is open-type standard protocol for BAS.
- ASHRAE / ANSI, (USA), 1995
- It is applicable to many building utilities such as HVAC control system, lighting control system, emergency and security system, elevator control system, etc.
- It is easy to modify, change, expand and due to use of standard protocol.
- Supports BACnet which is the standard of BAS.
- Supports the functionality of BACnet class 3 servers.
- Choose Ethernet for communication physical layer.

GENERAL SPECIFICATIONS

Item	Specification	Reference
Op.Temp.	Operating Temperature -10 ~65 ℃	

<table>
<tr><td>St.Temp</td><td colspan="4">Storage Temperature □□-25 ~□□80 ℃</td><td></td></tr>
<tr><td>Op.Hum</td><td colspan="4">Operating Humidity 5 ~95%RH, Not Condensed</td><td></td></tr>
<tr><td>St.Hum</td><td colspan="4">Storage Humidity 5 ~95%RH, Not Condensed</td><td></td></tr>
<tr><td rowspan="8">Vibration</td><td colspan="3">In case of intermittent vibration</td><td>-</td><td></td></tr>
<tr><td>Frequency</td><td>Acceleration</td><td>Amplitude</td><td>Sweep</td><td rowspan="8">IEC61131-2</td></tr>
<tr><td>10=□f=□□ 57Hz</td><td></td><td>0.075mm</td><td rowspan="6">10 times in X,Y,Z</td></tr>
<tr><td>57=□□f=□□ 150Hz</td><td>9.8m/s²{1G}</td><td>-</td></tr>
<tr><td colspan="3">In case of continuous vibration</td></tr>
<tr><td>Frequency</td><td>Acceleration</td><td>Amplitude</td></tr>
<tr><td>10=□□f =□□57Hz</td><td></td><td>0.035mm</td></tr>
<tr><td>57=□□f= 150Hz</td><td>4.8m/s²{0.5G}</td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td>Shock</td><td colspan="4">□□Max. shock Acc. :147 m/s{15G}
□□Time :11㎳
□□Pulse wave: Half sine wave pulse(3 times in X,Y,Z)</td><td>IEC61131-2</td></tr>
<tr><td rowspan="5">Noise</td><td>Square wave impulse noise</td><td colspan="3">2,000 V</td><td>KDT Standard</td></tr>
<tr><td>Electro-static discharge</td><td colspan="3">Voltage :4kV (Contact discharge)</td><td>IEC61131-2
IEC1000-4-2</td></tr>
<tr><td>Radiated electro-magneti c field</td><td colspan="3">27 ~500 MHz,10 V/m</td><td>IEC61131-2
IEC1000-4-3</td></tr>
<tr><td rowspan="2">Fast transient bust noise</td><td>Power Module</td><td>Digital I/O (24V or more)</td><td>Digital I/O (Less than 24V) Analog I/Ocomm.. Interface</td><td rowspan="2">IEC61131-2
IEC1000-4-4</td></tr>
<tr><td>2kV</td><td>1kV</td><td>0.25kV</td></tr>
<tr><td>Environ..</td><td colspan="4">No corrosive gas and no dust</td><td></td></tr>
<tr><td>Altitude</td><td colspan="4">2,000m or less</td><td></td></tr>
<tr><td>Pollution</td><td colspan="4">2 or less</td><td></td></tr>
<tr><td>Cooling</td><td colspan="4">Natural Air Cooling</td><td></td></tr>
</table>

SPECIFICATION

Module specification

Model	CM1-BN01A
Protocol size	ANSI / ASHRAE 135-1995 (KS X 6909)

Protocol stack	UDP / IP
Physical Standard	ISO / IEC8802-3(IEEE 802.3, CSMA / CD, 10Base-T)
Data transfer speed	10Mbps
Transfer method	Base band
Max. Segment length	100m
Max. I/O data slave	Binary : 64 words, Analog : 1024 words
Object data type	BI, BO, BV, AZ, AO, AV
Service	Loader, BACNet protocol, PLC Link (Private / Public)

Cable specification − Twisted-Pair Cable (UTP)

ITEM	Unit		Value
Conductor Resistance (Max.)	? / ㎞		93.5
Insulation Resistance (Min.)	MΩ · ㎞		2500
Internal Voltage	V / min		AC 500
Characteristic Impedance	? (1 ~ 100㎒)		100±5
Near-end Cross Talk Attenuation	Less than dB / 100m	10	6.5
		16	8.2
		20	9.3
Near-end Cross Talk Attenuation	Less than dB / 100m	10	47
		16	44
		20	42

※ As the cables for Ethernet connection are different according to system configuration and cable type, consultation with an expert is required to install them.

Wiring Precautions

- PLC Link station number of all communications modules including BACNet module is to be different each other.
- If duplicate station number is accessed, an error occurs.
- Check whether communication cable is broken before installation.
- Use the communication cable with assigned specification. The cable other than assigned may cause communication disturbance.
- Connect communication cable correctly. Incomplete cable connection may cause serious communication disturbance.

· As shield cable has low flexibility, it is to be branched 30cm or more away from the connector of a communications module.
Bending perpendicularly or transforming by force may cause breaking cable or the connector in a communication module.

- In case of long-distance communication cable, wire a cable far away from power line or induction noise.

Internal I/O table

Direction : CPU ? BN01A		Direction : CPU ? BN01A	
Input	**Signal Description**	**Output**	**Signal Description**
X0	Module Error	**Y0**	Request to clear error
X1	Initialized	**Y1**	Request to clear PLC Link status
X2		**Y2**	
X3		**Y3**	
X4		**Y4**	
X5		**Y5**	
X6		**Y6**	
X7		**Y7**	
X8		**Y8**	
X9		**Y9**	
XA		**YA**	
XB		**YB**	
XC		**YC**	
XD		**YD**	
XE		**YE**	
XF	Parameter has been saved	**YF**	Request to save parameter

User Program Memory Device

offset	Description	R/W
0	Status Code (0= Normal, Others=Error Code)	R
…		

4	IP Address	R/W
5	IP Address	R/W
6	Net Mask	R/W
7	Net Mask	R/W
8	PLC Link Station	R
9	PLC Link Connection	R
10	PLC Link Connection	R
11	PLC Link Connection	R
12	PLC Link Connection	R
13	The last BACNet service IP address	R
14	The last BACNet service IP address	R
15	The last BACNet service IP Port	R
16	The last Loader service IP address	R
17	The last Loader service IP address	R
18	The last Loader service IP Port	R
…		
63	OS Version	R
…		
255		

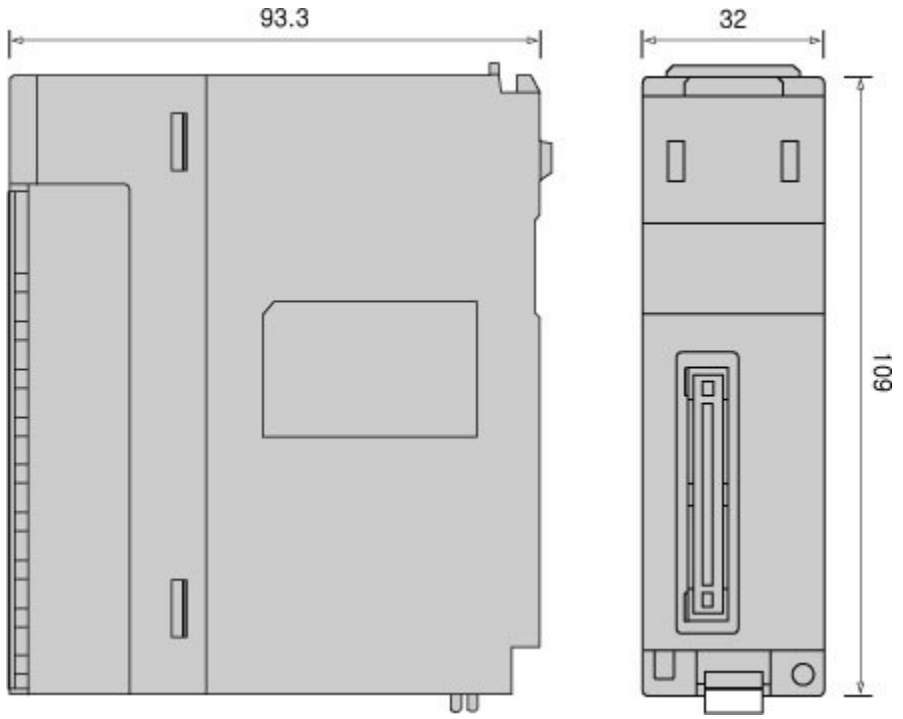
System Error Code

Error Code		Description
Decimal	Hexa-deciaml	
0	0x0000	No Error (Normal status)
1	0x0001	DPRAM initialize error
2	0x0002	EEPROM is not initialized
5	0x0005	Not able to write to buffer memory
6	0x0006	Not able to read buffer memory
7	0x0007	A CPU module is dismounted
8	0x0008	Station number for PLC Link is duplicated
13	0x000D	Buffer is overflowed

15	0x000F	Access Graphic Loader over the maximum
16	0x0010	Not able to access EEPROM
17	0x0011	Sending/Receiving data size for PLC Link is exceeded
18	0x0012	Not able to send specialty program
20	0x0014	Number of PLC Link station is over the maximum

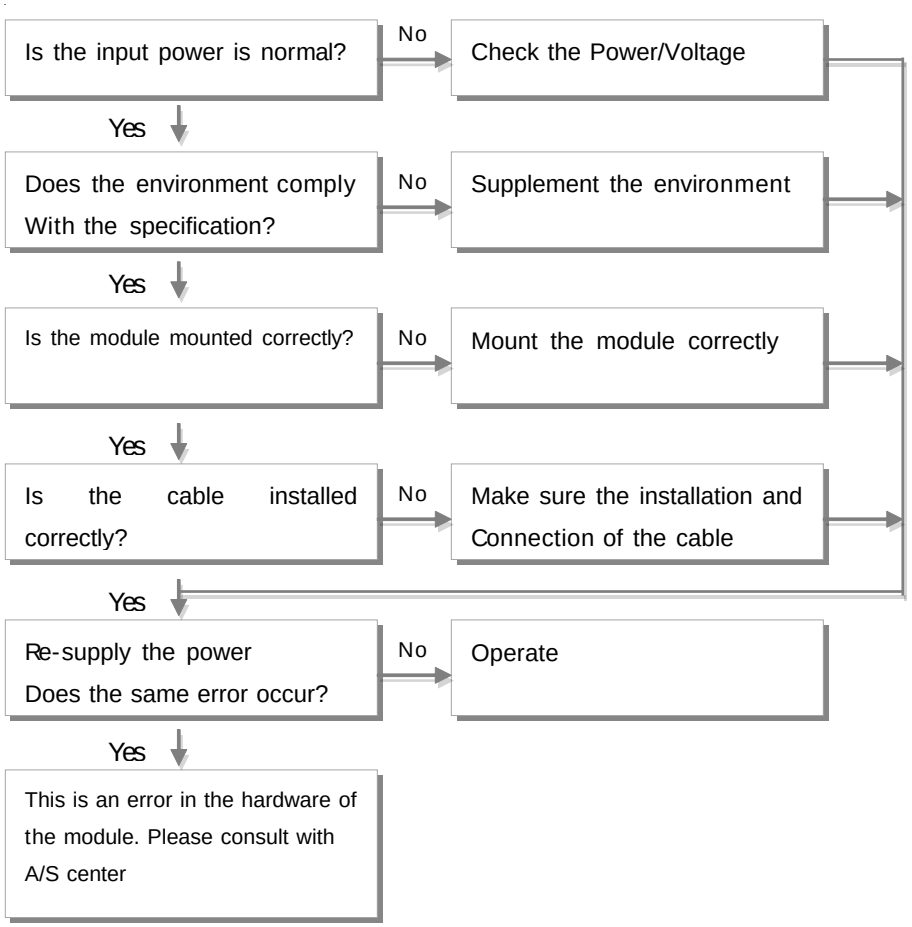
OUTWARD Demensions

(Unit : mm)



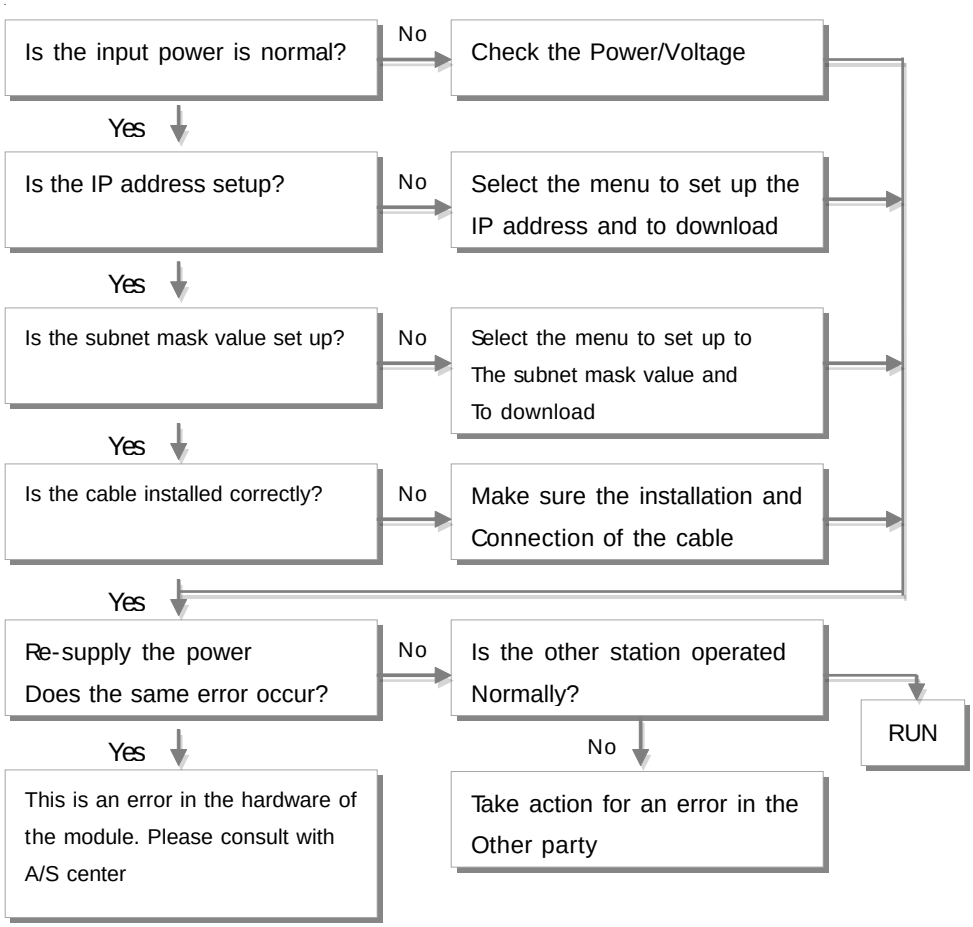
Error in Hardware

This corresponds Error Code 1, 2, 5, 6, 7, 16 and 18



Error in Network

This corresponds Error Code 8,13,15,17 and 20



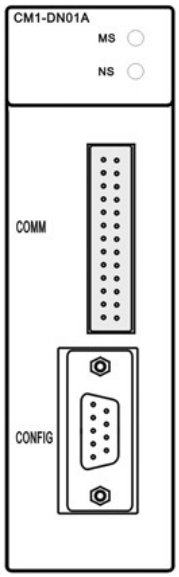
3.8 CIMON-PLC DeviceNet module

Modules :

- CM1-DN01A

Contents :

Feature of BACNET module



- Machine I/O is high speed network of open Structure by choosing Global Standard Devicenet
- Multi-Drop and T-type branch is available and Improves flexibility of network installation
- One network module can manage 63 slave modules And maximum 57,334 points of I/O
- Enable real time managing of lowest level input/output Machines within network system
- Functions such as sequence managing, processing Managing and motion managing can be used in many Different fields of managing sites
- Able to connect with various types of slave I/O
- Max 4 master modules are applicable with one CPU

GENERAL SPECIFICATIONS

<table>
<tr><th>Item</th><th colspan="5">Specification</th><th>Reference</th></tr>
<tr><td>Op.Temp.</td><td colspan="5">Operating Temperature -10 ~65 ℃</td><td></td></tr>
<tr><td>St.Temp</td><td colspan="5">Storage Temperature □□-25 ~□□80 ℃</td><td></td></tr>
<tr><td>Op.Hum</td><td colspan="5">Operating Humidity 5 ~95%RH, Not Condensed</td><td></td></tr>
<tr><td>St.Hum</td><td colspan="5">Storage Humidity 5 ~95%RH, Not Condensed</td><td></td></tr>
<tr><td rowspan="11">Vibration</td><td colspan="4">In case of intermittent vibration</td><td>-</td><td></td></tr>
<tr><td>Frequency</td><td>Acceleration</td><td>Amplitude</td><td>Sweep</td><td rowspan="10">IEC61131-2</td></tr>
<tr><td>10=□f=□□ 57Hz</td><td></td><td>0.075mm</td><td rowspan="9">10 times in X,Y,Z</td></tr>
<tr><td>57=□□f=□□ 150Hz</td><td>9.8m/s²{1G}</td><td>-</td></tr>
<tr><td colspan="3">In case of continuous vibration</td></tr>
<tr><td>Frequency</td><td>Acceleration</td><td>Amplitude</td></tr>
<tr><td>10=□□f =□□57Hz</td><td></td><td>0.035mm</td></tr>
<tr><td>57=□□f= 150Hz</td><td>4.8m/s²{0.5G}</td><td></td></tr>
<tr><td colspan="5"></td></tr>
<tr><td colspan="5"></td></tr>
<tr><td colspan="5"></td></tr>
<tr><td>Shock</td><td colspan="4">□□Max. shock Acc. :147 m/s{15G}</td><td>IEC61131-2</td></tr>
</table>

	☐☐Time :11㎳ ☐☐Pulse wave: Half sine wave pulse(3 times in X,Y,Z)				
Noise	Square wave impulse noise	2,000 V			KDT Standard
	Electro-static discharge	Voltage :4kV (Contact discharge)			IEC61131-2 IEC1000-4-2
	Radiated electro-magnetic field	27 ~500 MHz,10 V/m			IEC61131-2 IEC1000-4-3
	Fast transient bust noise	Power Module	Digital I/O (24V or more)	Digital I/O (Less than 24V) Analog I/Ocomm.. Interface	IEC61131-2 IEC1000-4-4
		2kV	1kV	0.25kV	
Environ..	No corrosive gas and no dust				
Altitude	2,000m or less				
Pollution	2 or less				
Cooling	Natural Air Cooling				

SPECIFICATION

Module specification

Model	CM1-DN01A			
Network	DeviceNet			
Communication speed	125kbps / 250kbps / 500kbps			
Transmission speed	Transmission speed	Network Max. length	Max. length	Total distance
	125k	500m (1640feet)	6m (20feet)	156m (512 feet)
	250k	250m (820feet)		78m (256 feet)
	500k	100m (328feet)		39m (128 feet)
No. of connect station	64 stations			
Cable	24V+ / 24V- / Shield / CAN H / CAN L (5 lines)			
No. of Max. Node	MAC ID (Node address) of Max. 64			
Diagnosis function	ID duplication check / inferior station check / detect operating status by LED			

Cable specification

Fea	Signal	Desc

ture	name	riptio n
Red	24 V+	Pow er
Whi te	CAN_ H	Sign al
Bar e	Drain	Shiel d
Blu e	CAN_ L	Sign al
Bla ck	24 V-	Pow er

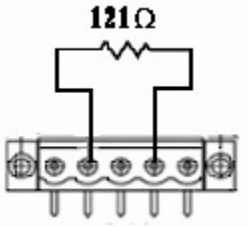
Precautions

- Use the PLC in an environment that meets the general specifications given In the User's Manual of the PD01A module being used.
- Do not dismount or disassemble a module.
- Do not touch in the status that power source is supplied. It is prohibited to mount and dismount module
- Take care that dregs are not put into a module case
- The termination is necessary needed in the trunk Line. For details see the "termination Register"? section in the manual.
- The station number of all communication devices including DeviceNet Module is to be different each other. If duplicate station number is accessed, An error occurs
- Please re-supply the power source when you want to apply a new transmission Speed to the network

Wiring Precautions

- Please use after understanding the wire diagram including rated voltage and terminal arrangement.
- The wiring together with high-voltage line or power line cause malfunction or breakdown due to induction jam.
  Design the wiring 100mm or more away from a high voltage line or a power line not to receive the influence by the variation of noise or magnetic field.
- Tighten the screws for terminal connection after turning off the power source.

- In case of tightening the screws of a terminal, tighten firmly according to the rated torque.
- Earth FG terminal in the third class, which is exclusive for PLC.
- Terminating Register
  Terminating register is necessary installed in the trunk line when you using DeviceNet.
  The requirement of the terminating register is below.



121 Ω 1%, 1/4W

- Caution
  - Do not install the terminating register in the drop line.
  - Do not install the terminating register in the Node.
    It may cause network disturbance.

Internal I/O table

Direction : CPU ? DN01A		Direction : CPU ? DN01A	
Input	**Signal Description**	**Output**	**Signal Description**
X0	Module Error	**Y0**	Error Clear request
X1	Initialized	**Y1**	
X2		**Y2**	
X3		**Y3**	
X4		**Y4**	
X5		**Y5**	
X6		**Y6**	
X7		**Y7**	
X8		**Y8**	
X9		**Y9**	
XA		**YA**	
XB		**YB**	
XC		**YC**	
XD		**YD**	
XE	Module RUN	**YE**	Link enable
XF		**YF**	

User Program Memory Device

offset	Description	R/W
0	Status Code (0= Normal, Others=Error Code)	R
…		
10	RunOK	
11	Link Error (Slave station 15~0)	
12	Link Error (Slave station 31~16)	R
13	Link Error (Slave station 47~32)	R
14	Link Error (Slave station 63~48)	R
15		
16		
17		
18		
19	Network State(Slave station 15~0)	R
20	Network State(Slave station 31~16)	R
21	Network State(Slave station 47~32)	R
22	Network State(Slave station 63~48)	R
23		
24		
25		
26		
…		
63	OS Version	R
…		
255		

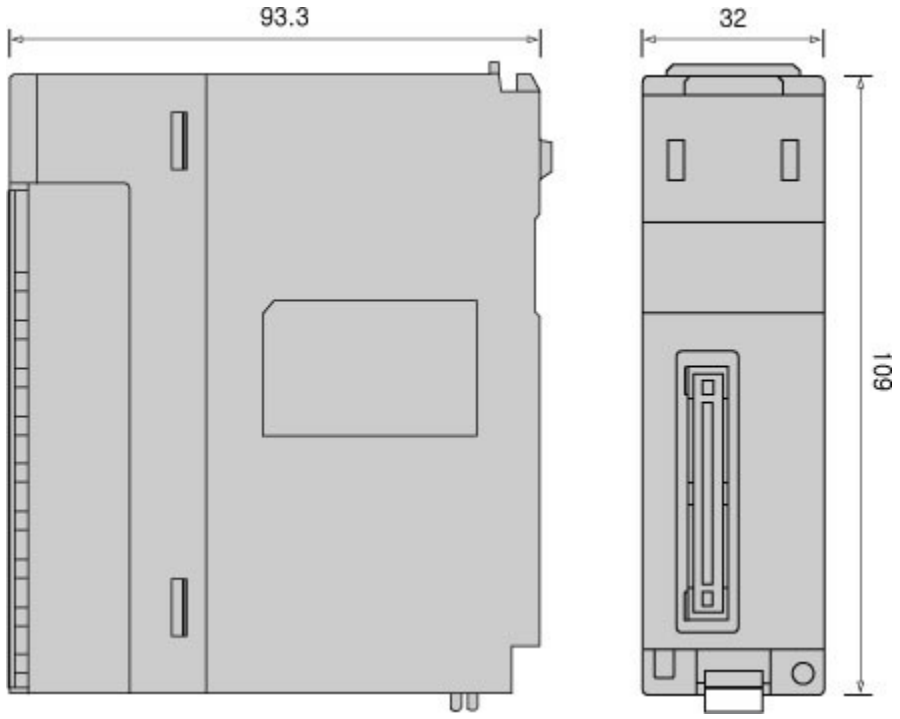
LED Display

Module status is shown with 2 LED display

LED		Status	Description
MS	Green	Blink (0.2sec)	No error detected and not connected with any devices
		Blink (3times/0.2 sec)	Power ON : No error detected, not configured parameter and not connected with any device Operating : Fatal error occurred
		On	Communication O.K
	Red	Blink (1sec)	Ready for F/W download
		Blink (0.2sec)	On F/W download
		Blink (3times/0.2 sec)	Fatal error occurred The module is required to repair
	Off		Module is off (Power source is not supplied)
NS	Green	On	Module O.K
		Blink (1sec)	Not connected with any device or module has wrong configuration
	Red	On	Module cannot access to the network
	Off		Device is not online

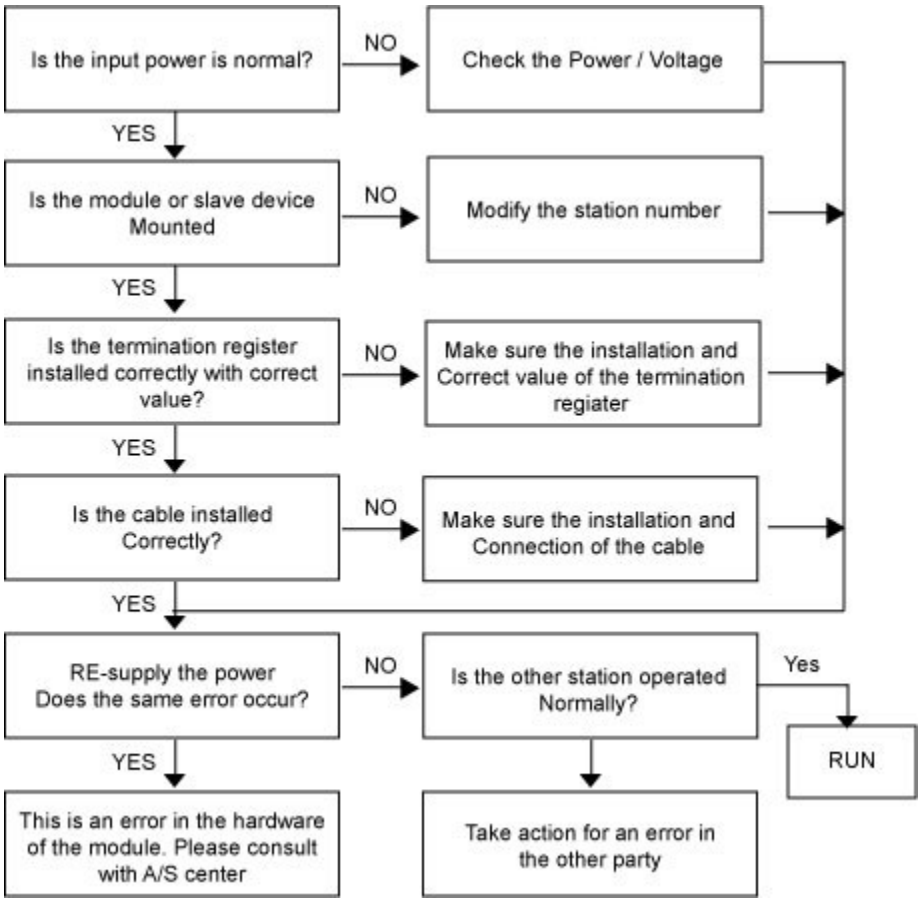
OUTWARD Demensions

(Unit : mm)



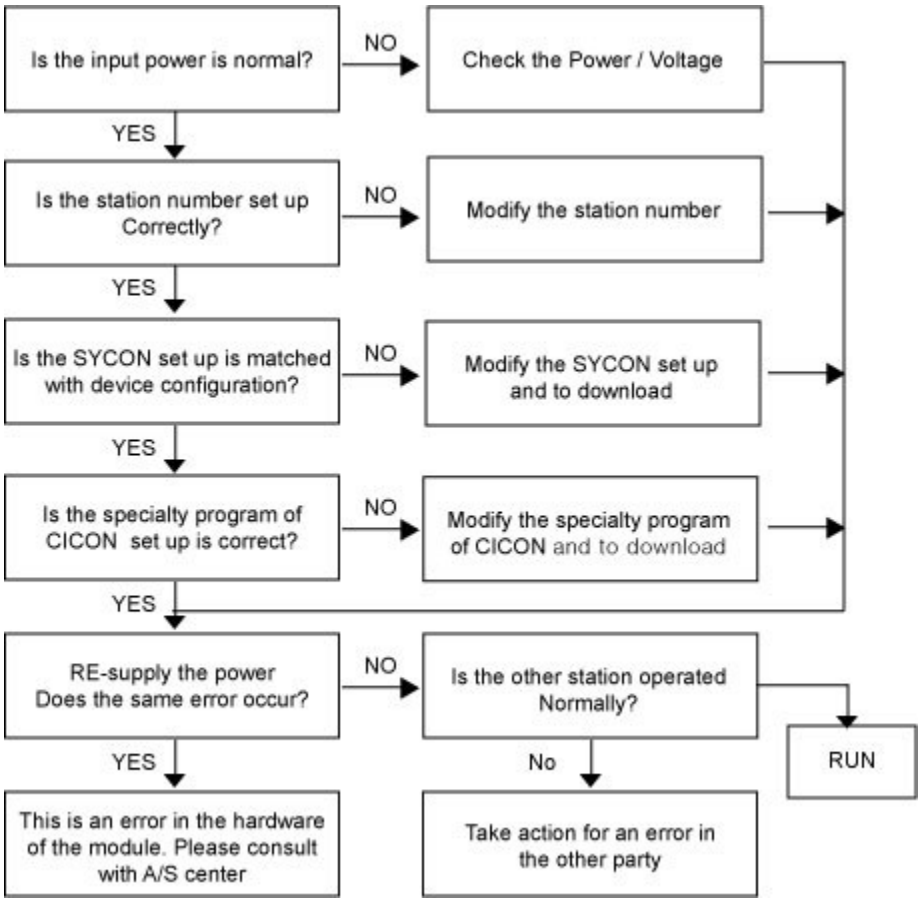
Trouble Shooting(1)

This corresponds Error Code 1, 2, 5, 6, 7, 16 and 18



Trouble Shooting(2)

This corresponds Error Code 11,12,13 and 15



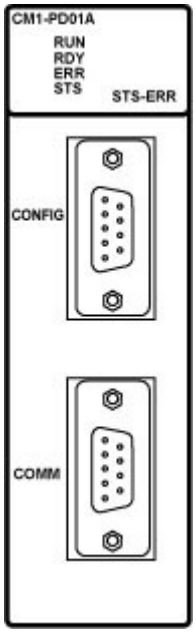
3.9 CIMON-PLC Profibus DP module

Modules :

- CM1-PD01A

Contents :

Feature of Profibus DP module



- Suitable to communication between Master Automization Machine and scatter Slave I/O Machine
- Support various communication speed(9.6kbps to 12mbps)
- RS485 communication method is used
- Field construction made easier due to use of twisted Pair cable
- Support Maximum of 127 station(32 per segment)
- Network setup is done with configuration tool

* 1kbytes input data can be transferred within 2ms
* Data transition can be done with order or without order
* Individual or Multi master network function available

GENERAL SPECIFICATIONS

Item	Specification				Reference
Op.Temp.	Operating Temperature -10 ~65 ℃				
St.Temp	Storage Temperature □□-25 ~□□80 ℃				
Op.Hum	Operating Humidity 5 ~95%RH, Not Condensed				
St.Hum	Storage Humidity 5 ~95%RH, Not Condensed				
Vibration	In case of intermittent vibration			-	
	Frequency	Acceleration	Amplitude	Sweep	IEC61131-2
	10=□f=□□ 57Hz		0.075mm	10 times in X,Y,Z	
	57=□□f=□□ 150Hz	9.8m/s²{1G}	-		
	In case of continuous vibration				
	Frequency	Acceleration	Amplitude		
	10=□□f =□□57Hz		0.035mm		

	57=☐☐f= 150Hz	4.8m/s²{0.5G}			
Shock	☐☐Max. shock Acc. :147 m/s{15G} ☐☐Time :11㎳ ☐☐Pulse wave: Half sine wave pulse(3 times in X,Y,Z)				IEC61131-2
Noise	Square wave impulse noise	2,000 V			KDT Standard
	Electro-static discharge	Voltage :4kV (Contact discharge)			IEC61131-2 IEC1000-4-2
	Radiated electro-magnetic field	27 ~500 MHz,10 V/m			IEC61131-2 IEC1000-4-3
	Fast transient bust noise	Power Module	Digital I/O (24V or more)	Digital I/O (Less than 24V) Analog I/Ocomm.. Interface	IEC61131-2 IEC1000-4-4
		2kV	1kV	0.25kV	
Environ..	No corrosive gas and no dust				
Altitude	2,000m or less				
Pollution	2 or less				
Cooling	Natural Air Cooling				

SPECIFICATIONS

Module specification

Model	CM1-PD01A
Network	Profibus DP
Interface	RS-485
Standard	EN50170 / EN50254
Media Access	Token passing & Polling
No. of Max slave connection / network	127
No. of Max slave connection / segment	32
Cable	Two wire shielded twist pair cable
Max. I/O Data slave	244 bytes
Max. I/O Data	I/O 3,584 bytes each

Configuration Tool	Sycon-PB

Cable specification

Feature	Cable #1	Cable #2
Impedance	135~165Ω (f=3 to 20MHz)	100~130 Ω (f>100KHz)
Capacity	<300nF/Km	<60nF/Km
Wire gauge	=0.34mm² (22AWG)	=0.22mm² (24AWG)

Communication distance according to the transmission speed and cable

Baud(Kbps)	9.6	19.2	93.75	187.5	500	1500	3000~
Cable #1	1200	1200	1200	1000	400	200	100
Cable #2	1200	1200	1200	600	200	70	-

Precautions

- Use the PLC in an environment that meets the general specifications given In the User's Manual of the PD01A module being used.
- Do not dismount or disassemble a module.
- Do not touch in the status that power source is supplied. It is prohibited to mount and dismount module
- Take care that dregs are not put into a module case

Wiring Precautions

- Please use after understanding the wire diagram including rated voltage and terminal arrangement.
- Tighten the screws for terminal connection after turning off the power source.
  In case of tightening the screws of a terminal, tighten firmly according to the rated torque.
- Earth FG terminal in the third class, which is exclusive for PLC.
- To make a termination is necessary needed.
- Use the specialty connector which is embedded inductor when you use high speed transmission speed over 1.5Mbps
- Do not use the branch line when you use high speed transmission speed over 1.5Mbps
- Keep station's distance over 1m when you using transmission speed over 12Mbps
- The wiring close to heat-generating device or material and directly contacted with oil for long time may cause short circuit or breakdown or malfunction.

In case of the installation environment with a lot of vibration, prevent a PLC from the vibration

- The wiring together with high-voltage line or power line cause malfunction or breakdown due to induction jam. Design the wiring 100mm or more away from a high voltage line or a power line not to receive the influence by the variation of noise or magnetic field.

Internal I/O table

Direction : CPU ? PD01A		Direction : CPU ? PD01A	
Input	**Signal Description**	**Output**	**Signal Description**
X0	Module Error	**Y0**	Error Clear
X1	Initialized	**Y1**	
X2		**Y2**	
X3		**Y3**	
X4		**Y4**	
X5		**Y5**	
X6		**Y6**	
X7		**Y7**	
X8		**Y8**	
X9		**Y9**	
XA		**YA**	
XB		**YB**	
XC		**YC**	
XD		**YD**	
XE	Module RUN	**YE**	Link enable
XF		**YF**	

Wring 1

Offset	Description	R/W
0	Status Code (0=Normal, Others=Error Code)	R
…		
10	RunOK (DP_STATE)	
11	Configured (Slave station 15~0)	

12	Configured (Slave station 31~16)	R
13	Configured (Slave station 47~32)	R
14	Configured (Slave station 63~48)	R
15	Configured (Slave station 79~64)	R
16	Configured (Slave station 95~80)	R
17	Configured (Slave station 111~96)	R
18	Configured (Slave station 127~112)	R
19	Network State Configured (Slave station 15~0)	R
20	Network State Configured (Slave station 31~16)	R
21	Network State Configured (Slave station 47~32)	R
22	Network State Configured (Slave station 63~48)	R
23	Network State Configured (Slave station 79~64)	R
24	Network State Configured (Slave station 95~80)	R
25	Network State Configured (Slave station 111~96)	R
26	Network State Configured (Slave station 127~112)	R
…		
63	OS Version	R
…		
255		

LED Display

Module status is shown with 5 LED display

LED	Status	Description
RUN	On	Communication O.K
	Off	Parameter setting error
	Blink	Communication stop
RDY	On	Module O.K
	Off	Module Error (hardware)
	Blink	Module Error (hardware or software)
ERR	On	Communication line error
	Off	Communication line O.K
STS	On	Secure token
	Off	Concede token to other Master station
SYS-ERR	On	Module initialize error
	Blink	Error in interface

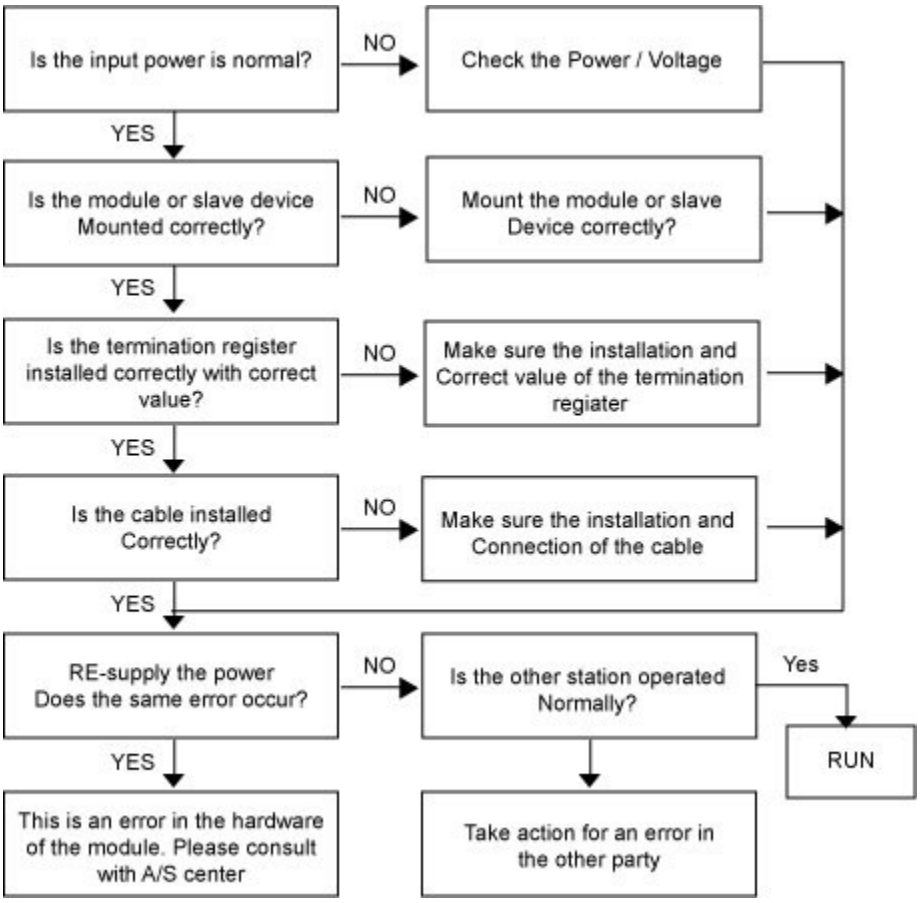
	Off	Normal status (Interface with CPU)

Error Code

Error Code		Description
10진 수	16진 수	
0	0x0000	No Error (Normal status)
1	0x0001	DPRAM initialize error
2	0x0002	Error in interface
3	0x0003	Error in interface
4	0x0004	Error in interface
5	0x0005	Error in interface
6	0x0006	A CPU module is dismounted
7	0x0007	Not able to send specialty program
8	0x0008	Error in interface
9	0x0009	Error in interface
10	0x000A	-
11	0x000B	Sending/receiving data size is exceeded (max 64 block each)
12	0x000C	Input/output data size is exceeded
13	0x000D	Data get form CPU is not matched with configuration data
14	0x000E	-
15	0x000F	I/O data size get from specialty program is not matched with configured I/O data size

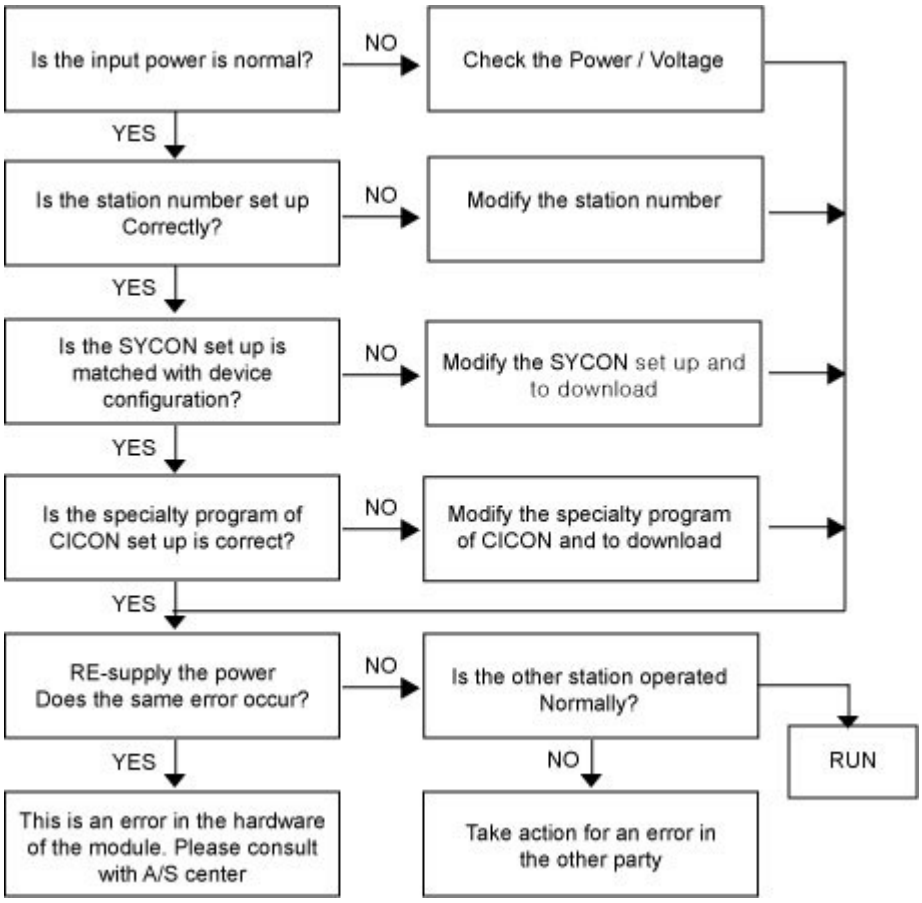
Trouble Shooting(1)

This corresponds Error Code 1, 2, 5, 6, 7, 8 and 9



Trouble Shooting(2)

This corresponds Error Code 11,12,13 and 15



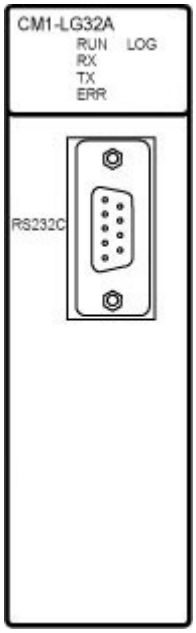
3.10 CIMON-PLC Data Logger module

Modules :

- CM1-LG32A

Contents :

Feature of Data Logger module



- Equipped with large capacity and non-combustible Log memory (32MB)
- Standalone real time data sampling and preserving
- Upon restoration of communication system, upper Level system (CIMON-SCADA)data can be obtained.
- Maximum 32word data can be sampled at the same Time with maximum of 10msec interval
- Built in HMI Protocol : no necessary of optional Communication card (RS232C,Support Modem)
- Self-diagnosis function(communication error, memory Error, capacity check, etc.)
- Trigger Logging by Sequence program
- Provide event logging (COS,VOC)

GENERAL SPECIFICATIONS

Item	Specification				Reference
Op.Temp.	Operating Temperature -10 ~65 ℃				
St.Temp	Storage Temperature □□-25 ~□□80 ℃				
Op.Hum	Operating Humidity 5 ~95%RH, Not Condensed				
St.Hum	Storage Humidity 5 ~95%RH, Not Condensed				
Vibration	In case of intermittent vibration			-	
	Frequency	Acceleration	Amplitude	Sweep	IEC61131-2
	10=□f=□□ 57Hz		0.075mm	10 times in X,Y,Z	
	57=□□f=□□ 150Hz	9.8m/s²{1G}	-		
	In case of continuous vibration				
	Frequency	Acceleration	Amplitude		
	10=□□f =□□57Hz		0.035mm		
	57=□□f= 150Hz	4.8m/s²{0.5G}			

Shock	☐☐Max. shock Acc. :147 m/s{15G} ☐☐Time :11㎳ ☐☐Pulse wave: Half sine wave pulse(3 times in X,Y,Z)				IEC61131-2
Noise	Square wave impulse noise	2,000 V			KDT Standard
	Electro-static discharge	Voltage :4kV (Contact discharge)			IEC61131-2 IEC1000-4-2
	Radiated electro-magnetic field	27 ~500 MHz,10 V/m			IEC61131-2 IEC1000-4-3
	Fast transient bust noise	Power Module	Digital I/O (24V or more)	Digital I/O (Less than 24V) Analog I/Ocomm.. Interface	IEC61131-2 IEC1000-4-4
		2kV	1kV	0.25kV	
Environ..	No corrosive gas and no dust				
Altitude	2,000m or less				
Pollution	2 or less				
Cooling	Natural Air Cooling				

SPECIFICATIONS

Module specification

Model		CM1-LG32A
Communication Mode	HMI Mode	CIMON HMI Protocol
	Terminal Mode	Text transmission
Data Mode	Data bit	7 / 8
	Stop bit	1 / 2
	Parity	Even / Odd / None
Synchronous		Asynchronous
Transmission speed		300 / 600 / 1200 / 4800 / 9600 / 19200 / 38400
Communication method		RS232C
Modem		Cable Modem or Dial up Modem
Log memory capacity		32 Mbytes
Sampling interval		10msec ~ 327670msec
Max. Logging data size		32 Words
Log data		Block sampling or Even data
Logging method		Periodic, Trigger, Event (COS / VOC)

Built in function	Memory condition check, Communication error check, and Memory capacity check

Wring Precautions

- Check whether communication cable is broken before installation.
- Use the communication cable with assigned specification. The cable other than assigned may cause communication disturbance.
- Connect communication cable correctly. Incomplete cable connection may cause serious communication disturbance.
- As shield cable has low flexibility, it is to be branched 30cm or more away from the connector of a communications module.
  Bending perpendicularly or transforming by force may cause breaking cable or the connector in a communication module.
  In case of long-distance communication cable, wire a cable far away from power line or induction noise.

Internal I/O table

Direction : CPU ? LG32A		Direction : CPU ? LG32A	
Input	**Signal Description**	**Output**	**Signal Description**
X0	Module Error	**Y0**	Request to clear error
X1	Initialized	**Y1**	Request to clear PLC Link status
X2		**Y2**	
X3		**Y3**	
X4		**Y4**	
X5		**Y5**	
X6		**Y6**	
X7		**Y7**	
X8		**Y8**	
X9		**Y9**	
XA		**YA**	
XB		**YB**	
XC		**YC**	
XD		**YD**	
XE		**YE**	
XF	Parameter has been saved	**YF**	Parameter has been saved

User Program Memory Device

Offset	Description	R/W
0	Status Code (0=Normal, Others=Error Code)	R
…		
4	IP Address	R/W
5	IP Address	R/W
6	Net Mask	R/W
7	Net Mask	R/W
8	PLC Link Station	R
9	PLC Link Connection	R
10	PLC Link Connection	R
11	PLC Link Connection	R
12	PLC Link Connection	R
13	The last BACNet service IP address	R
14	The last BACNet service IP address	R
15	The last BACNet service Port	R
16	The last Loader service IP address	R
17	The last Loader service IP address	R
18	The last Loader service Port	R
…		
63	OS Version	R
…		
255		

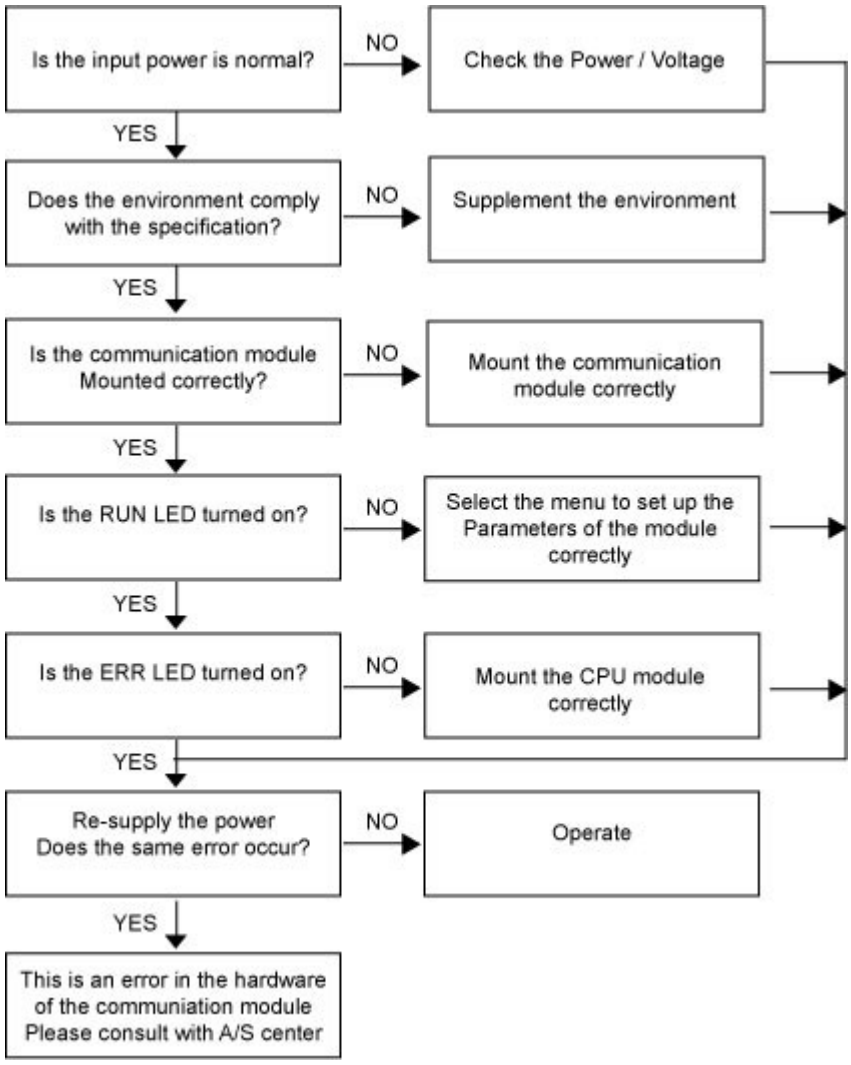
SYSTEM Error Code

Error Code		Description
Decimal	Hexa-deciaml	
0	0x0000	No Error (Normal status)

1	0x0001	DPRAM initialize error
2	0x0002	EEPROM is not initialized
5	0x0005	Not able to write to buffer memory
6	0x0006	Not able to read buffer memory
7	0x0007	A CPU module is dismounted
8	0x0008	Station number for PLC Link is duplicated
13	0x000D	Buffer is overflowed
15	0x000F	Access Graphic Loader over the maximum
16	0x0010	Not able to access EEPROM
17	0x0011	Sending/Receiving data size for PLC Link is exceeded
18	0x0012	Not able to send specialty program
20	0x0014	Number of PLC Link station is over the maximum

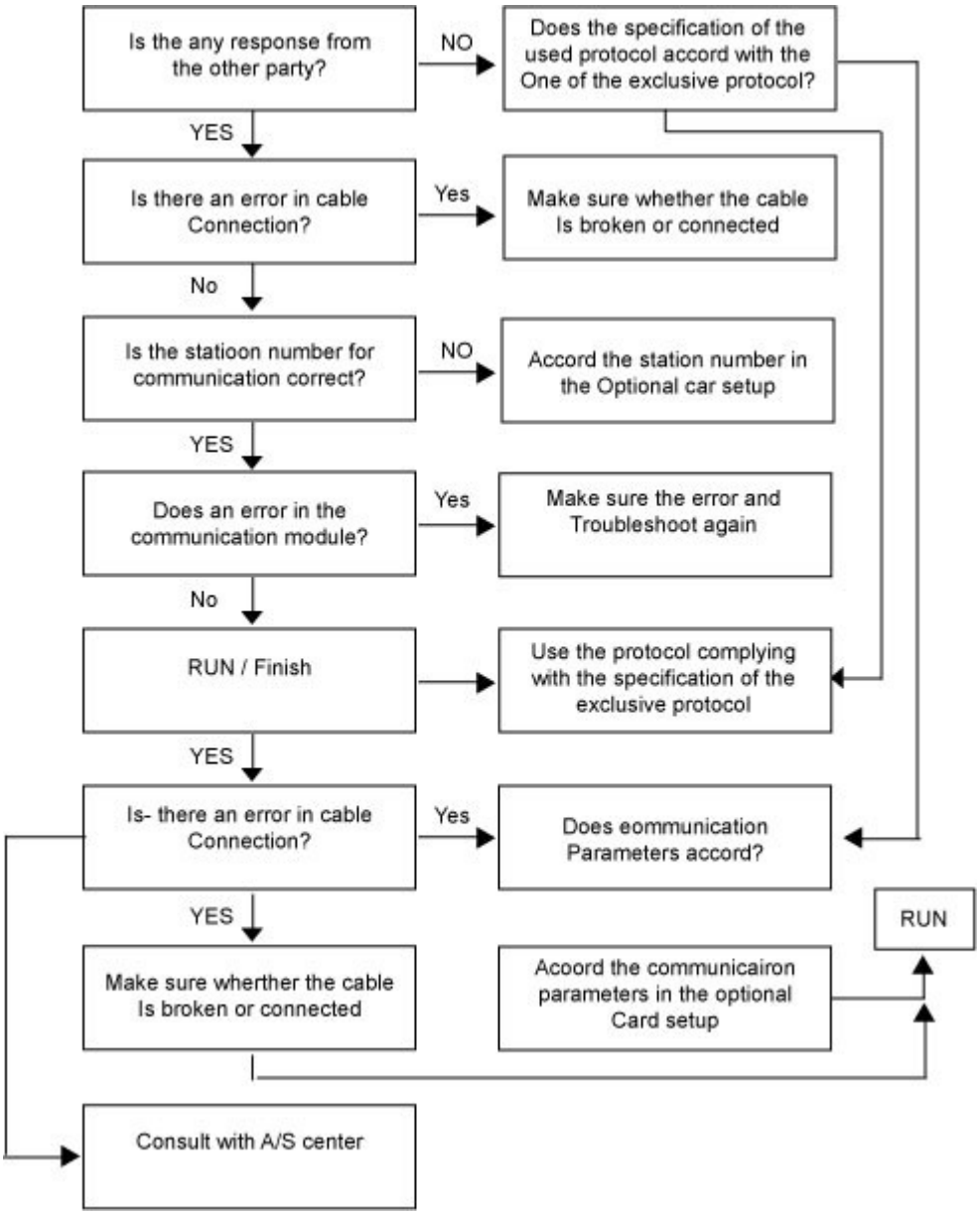
Trouble Hardware

This corresponds Error Code 1, 2, 3, 6 and 7



Error in Exclusive Communication

This corresponds Error Code 5



3.11 CIMON-PLC Digital Inputs

Modules :

- CM1-XD16A
- CM1-XD32C
- CM1-XA08A
- CM1- XA08B

Contents :

GENERAL SPECIFICATIONS

Item	Specification				Reference
Op.Temp.	Operating Temperature -10 ~65 ℃				
St.Temp	Storage Temperature □□-25 ~□□80 ℃				
Op.Hum	Operating Humidity 5 ~95%RH, Not Condensed				
St.Hum	Storage Humidity 5 ~95%RH, Not Condensed				
Vibration	In case of intermittent vibration			-	IEC61131-2
	Frequency	Acceleration	Amplitude	Sweep	
	10=□f=□□ 57Hz		0.075mm	10 times in X,Y,Z	
	57=□□f=□□ 150Hz	9.8m/s^2{1G}	-		
	In case of continuous vibration				
	Frequency	Acceleration	Amplitude		
	10=□□f =□□57Hz		0.035mm		
	57=□□f= 150Hz	4.8m/s^2{0.5G}			
Shock	□□Max. shock Acc. :147 m/s{15G} □□Time :11㎳ □□Pulse wave: Half sine wave pulse(3 times in X,Y,Z)				IEC61131-2
Noise	Square wave impulse noise	2,000 V			KDT Standard
	Electro-static discharge	Voltage :4kV (Contact discharge)			IEC61131-2 IEC1000-4-2
	Radiated electro-magnetic field	27 ~500 MHz,10 V/m			IEC1131-2 IEC1000-4-3
	Fast transient	Power	Digital I/O	Digital I/O	IEC1131-2

	bust noise	Module	(24V or more)	(Less than 24V) Analog I/Ocomm.. Interface	IEC1000-4-4
		2kV	1kV	0.25kV	
Environ..	No corrosive gas and no dust				
Altitude	2,000m or less				
Pollution	2 or less				
Cooling	Natural Air Cooling				

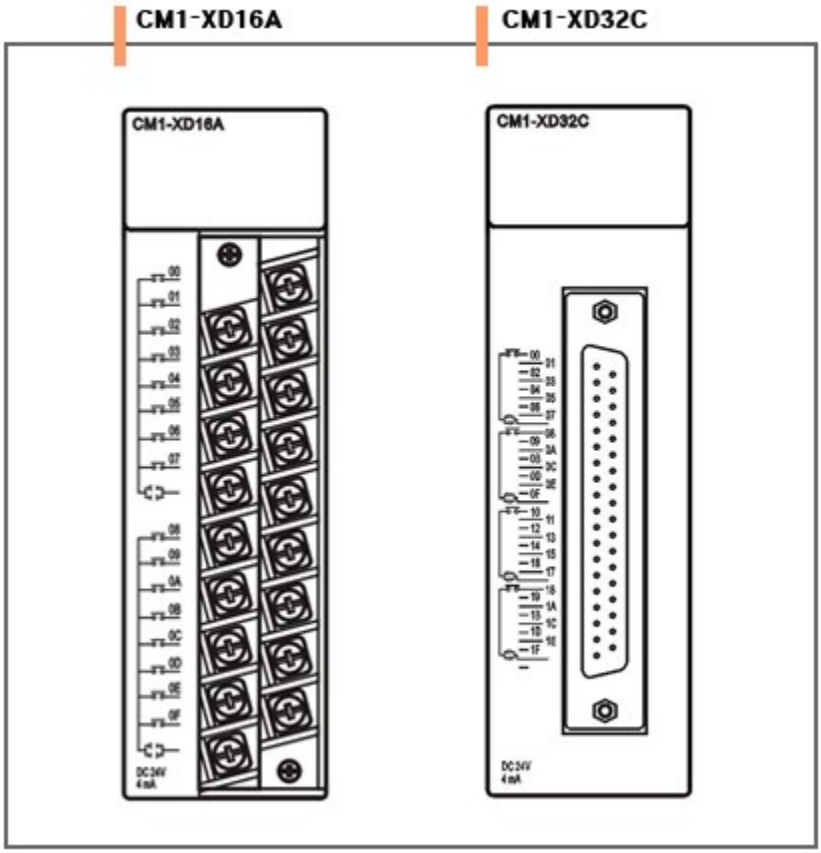
MODULE SPECIFICATIONS

ITEM		DC INPUT	
		CM1-XD16A	CM1-XD32C
Input Type		Both SINK and SOURCE (16 point)	Both SINK and SOURCE (32 point) 2A
Rated input Voltage		DC 24V	
Rated input Current		4 mA	
On Voltage/ On Current		DC 19V / 4mA	
Off Voltage/ Off Current		DC 11V / 1mA	
Response Time	Off->On	5ms or less	
	On->Off	5ms or less	
No.of Occupied Points		16 Points	32 Points
Common Type		18-Point / 1 COM	
Indication Current		60mA	100mA
Action Indication		LED is on when input is set	
Insulation Type		Photo-Coupler	

ITEM	AC INPUT	
	CM1-XA08A	CM1-XA08B
No. of Outputs	8 Points	
Rated input Voltage	AC200- 240V	AC90 -130V

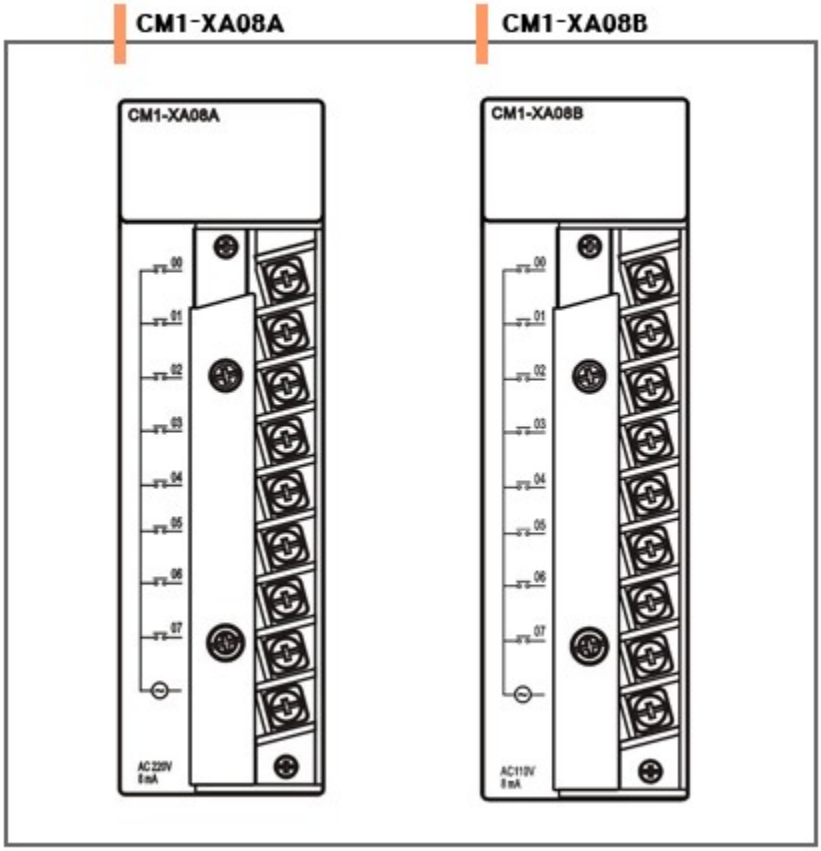
Rated input Current		9mA	5mA
On Voltage		AC 160V	AC 80V
Off Current		AC 60V	AC 30V
Response Time	Off->On	5ms or less	
	On->Off	5ms or less	
Common Type		8-Point / 1 COM	
Internal Current		30mA	
Action Indication		LED is on when input is set	
Insulation Type		Photo-Coupler	

FRONT VIEW



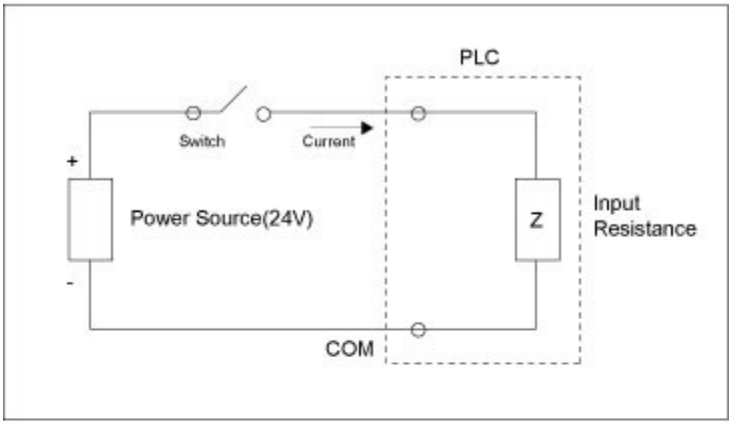
- The tightening torque if 6.99 in. 1b
- USE COPPER OF COPPER-CLAD ALUMINUM CONDUTORS
- “Class 2, adjacent to coltage ration(30V max.)”

FRONT VIEW

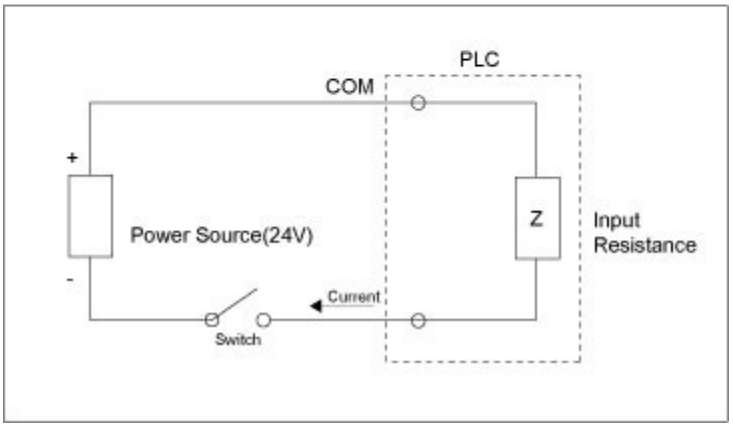


CONNECTION TYPE

Sink

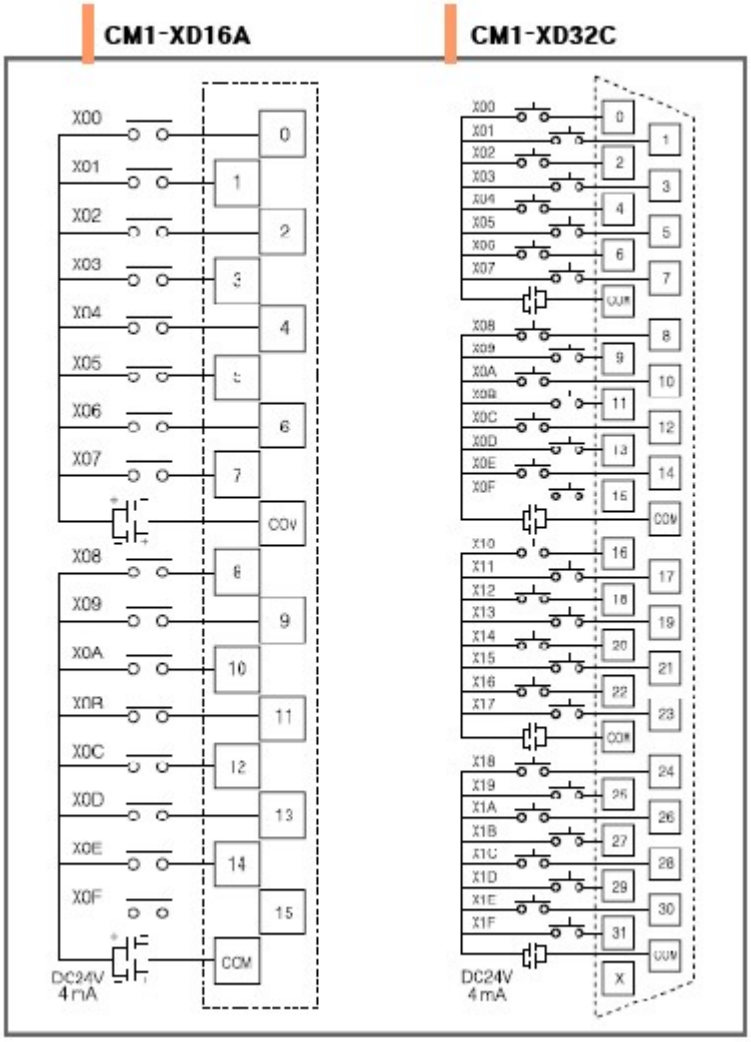


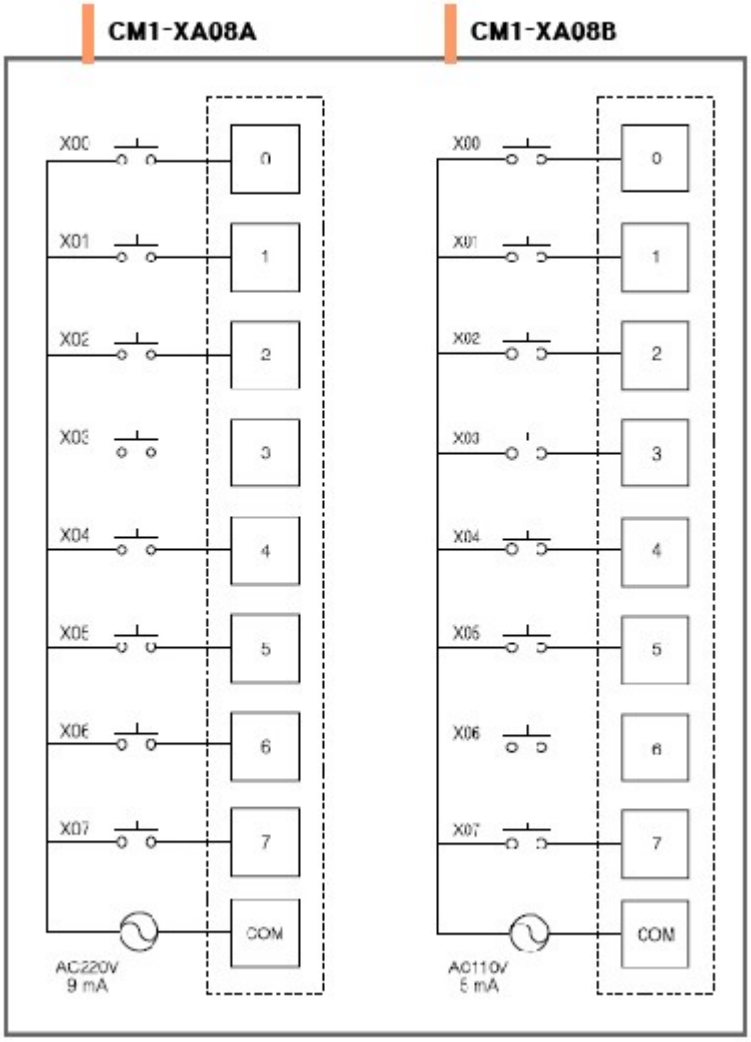
Source



- CM1-XD16A and CM1-XD32C are used for both Sink and Source

WIRING DIAGRAM





FEATURES AND OPERATION

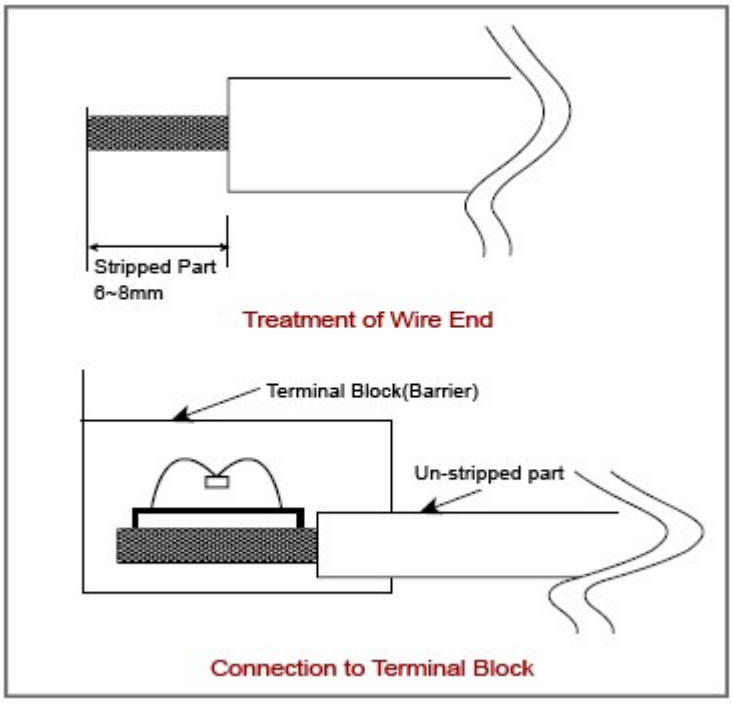
- All modules are photo-coupler- insulated.
- LED indication enables to make sure the operation of a module
- Terminal block type and one-touch module loading type lead Easy maintenance.
- CM1-XD16A and XD32C are DC24V input module.
  CM1-XA08A is AC 220V input module and CM1-XA08B is AC 110V input module.

BEFORE USING

- Please use after understanding the wire diagram including Rated voltage and terminal arrangement
- Do not touch in the status that the power source is supplied (It is prohibited to mount and dismount modules.)
- Tighten the screws for terminal connection after turning off The power source
- In case of tightening the screws of a terminal, tighten firmly According to the rated torque
- Earth FG terminal in the third class, which is exclusive for PLC.
- Design a system putting an input signal line 100mm or more Away from a high voltage line and a power line not to receive the Influence by the variation of noise or magnetic field.
- Under installation environment with a log of vibration, prevent a PLC from vibration
- Take care that dregs are not put into a module case. Do not dismount of disassemble a module

SAFETY PRECAUTIONS (1)

- In case of connection to a terminal block without contact Connector, the uncovered part of a wire is to be 6mm to 8mm.
  And take care that uncovered metal part of a wire is pushed out From a terminal block



- In case of a twisted wire, take care that it is not loosed.

SAFETY PRECAUTIONS (2)

- Use a cable for outside input signal of output converter Module differently from a cable for AC to prevent the influence
  Of surge or induction noise occurring from AC

- Select a cable, considering ambient temperature, allowable current. AWG22(0.3mm^2) or more cable is recommended.

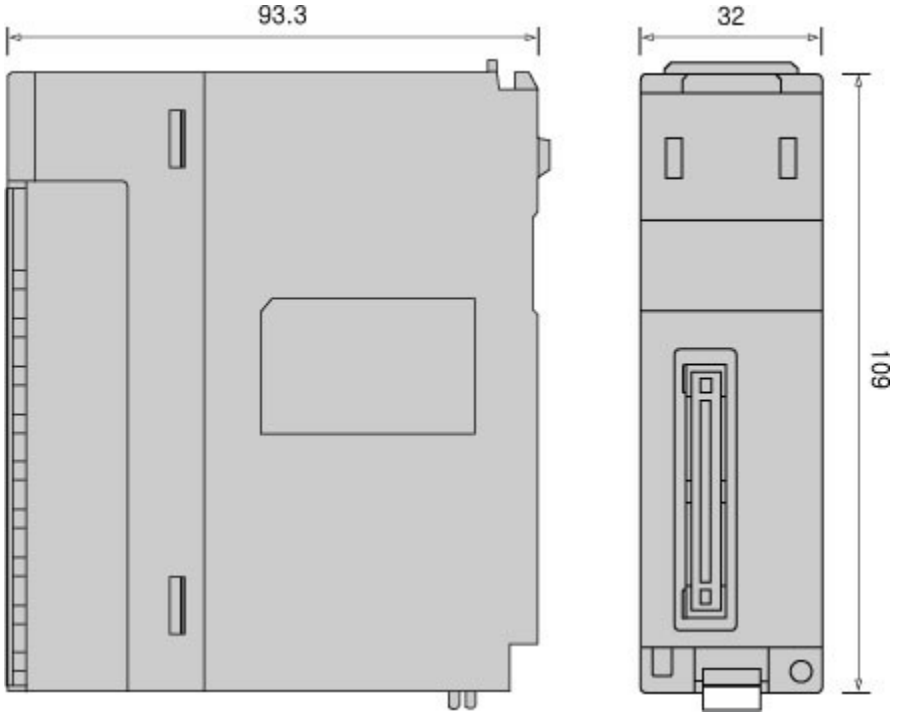
- The wiring close to heat-generation device or material and directly Contacted with oil for long time may cause short
  circuit or breakdown or malfunction. In case of the installation environment with a lot of vibration, prevent a PLC from the vibration.

- The wiring together with high-voltage line or power line may cause Malfunction or breakdown due to induction jam.
  Design the wring 100mm or more away from a high voltage line or a power line not to Receive the influence by the variation
  of noise or magnetic field.

- Do not dismount or disassemble a module.

OUTWARD DIMENSIONS

(UNIT : mm)



3.12 CIMON-PLC Digital Outputs

Modules :

- CM1-YR16A
- CM1-YS08A
- CM1-YT16A
- CM1-YT16B
- CM1-YT32A
- CM1-YT32B

Contents :

GENERAL SPECIFICATIONS

Item	Specification				Reference
Op.Temp.	Operating Temperature -10 ~65 ℃				
St.Temp	Storage Temperature □□-25 ~□□80 ℃				
Op.Hum	Operating Humidity 5 ~95%RH, Not Condensed				
St.Hum	Storage Humidity 5 ~95%RH, Not Condensed				
Vibration	In case of intermittent vibration			-	IEC61131-2
	Frequency	Acceleration	Amplitude	Sweep	
	10=□f=□□ 57Hz		0.075mm	10 times in X,Y,Z	
	57=□□f=□□ 150Hz	9.8m/s²{1G}	-		
	In case of continuous vibration				
	Frequency	Acceleration	Amplitude		
	10=□□f =□□57Hz		0.035mm		
	57=□□f= 150Hz	4.8m/s²{0.5G}			
Shock	□□Max. shock Acc. :147 m/s{15G} □□Time :11㎳ □□Pulse wave: Half sine wave pulse(3 times in X,Y,Z)				IEC61131-2
Noise	Square wave impulse noise	2,000 V			KDT Standard
	Electro-static discharge	Voltage :4kV (Contact discharge)			IEC61131-2 IEC1000-4-2
	Radiated electro-magneti c field	27 ~500 MHz,10 V/m			IEC1131-2 IEC1000-4-3
	Fast transient bust noise	Power Module	Digital I/O (24V or more)	Digital I/O (Less than 24V) Analog I/Ocomm.. Interface	IEC1131-2 IEC1000-4-4
		2kV	1kV	0.25kV	
Environ..	No corrosive gas and no dust				
Altitude	2,000m or less				

Pollution	2 or less	
Cooling	Natural Air Cooling	

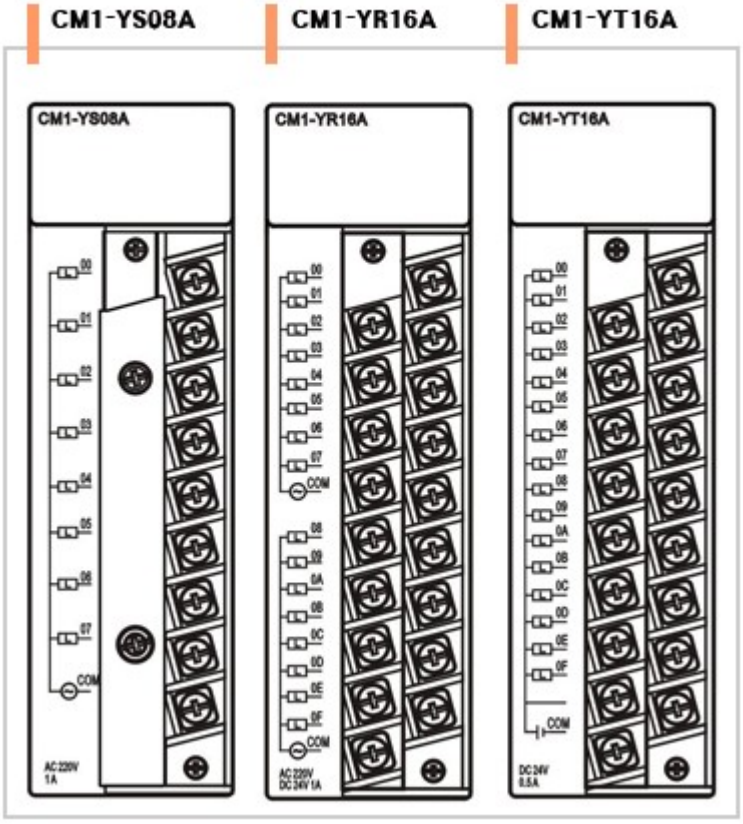
MODULE SPECIFICATIONS

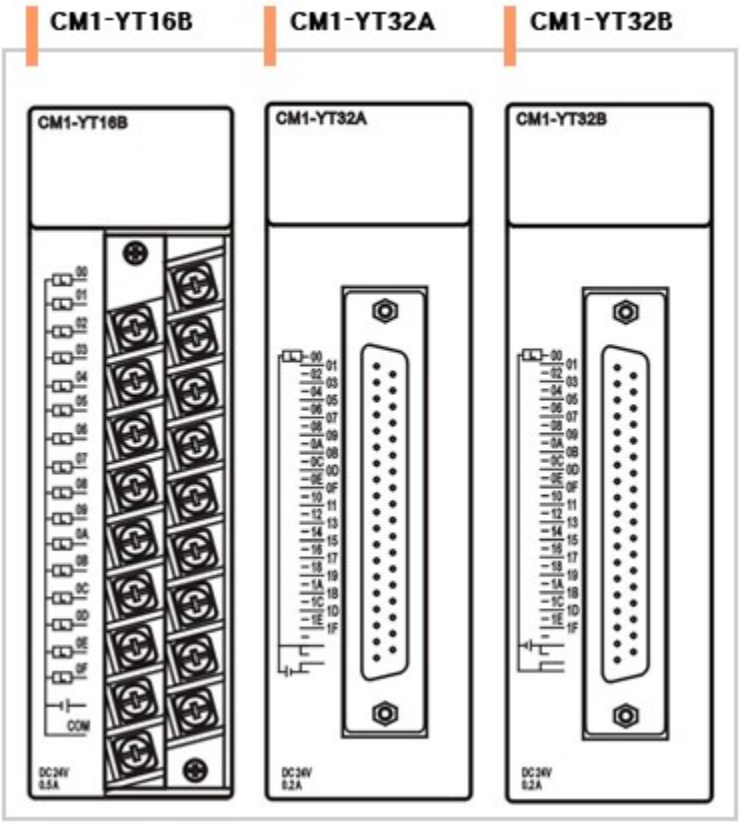
ITEM		RELAY OUTPUT	SSR OUTPUT
		CM1-YR16A	CM1-YS08A
No. of Outputs		16 Points	8 Points
Rated input Voltage		DC12/24V AC220V	AD100-240V
Rated input	1 Point	2A	1A
	1 Com	5A	2A
Response Time	Off->On	10ms or less	1 ms or less
	On->Off	5ms or less	0.5cycle+1ms or less
No.of Occupied Points		16 Points	32 Points
Common Type		8Point / 1 COM	8Point / 1 COM
Current Consumption		250 mA	120 mA
Indication		LED on if input on	LED on if input on
Insulation		Relay	Photo
Leaked Current off		X	2mA

ITEM		Transistor Output	
		CM1-YT16A / YT16B	CM1-YT32A / YT32B
No. of Outputs		16 Points	32 Points
Rated input Voltage		DC 12-24V	DC12-24V
Rated input	1 Points	0.5A	0.2A
	1Com	4A	4A
Response Time	Off->On	1ms or less	
	On->Off	1ms or less	
No. of Occupied Points		16 Points	32Points
Common Type		16Point / 1 COM	32Point / 1 COM

Current Consumption	110mA	130mA
Indication	LED on if input on	
Insulation	Photo-Coupler	

FRONT VIEW

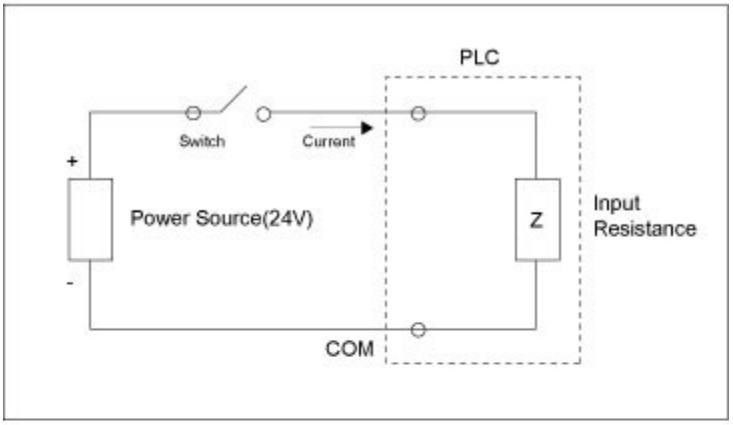




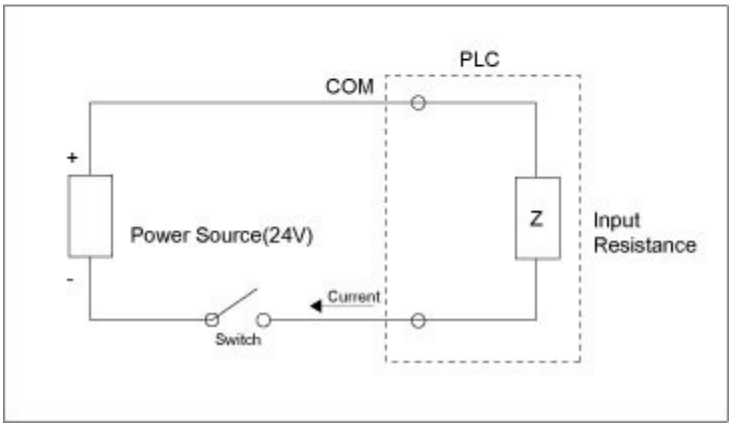
- The tightening torque if 6.99 in. 1b
- USE COPPER OF COPPER-CLAD ALUMINUM CONDUTORS
- “Class 2, adjacent to coltage ration(30V max.)”

CONNECTION TYPE

Sink



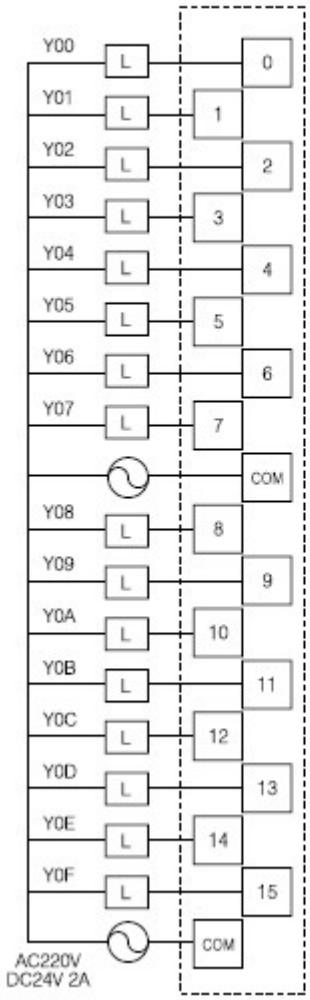
Source



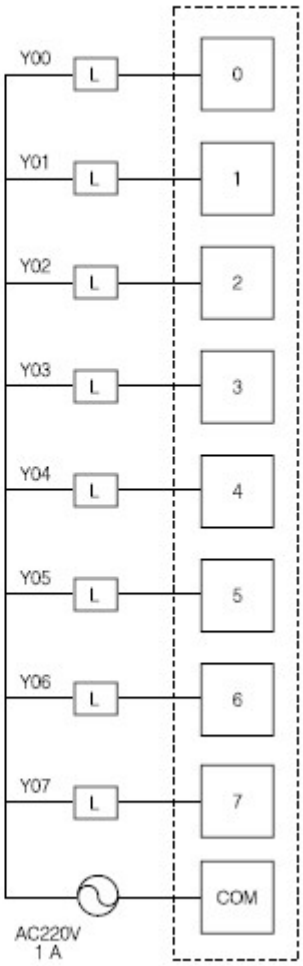
- CM1-XD16A and CM1-XD32C are used for both Sink and Source

WIRING DIAGRAM

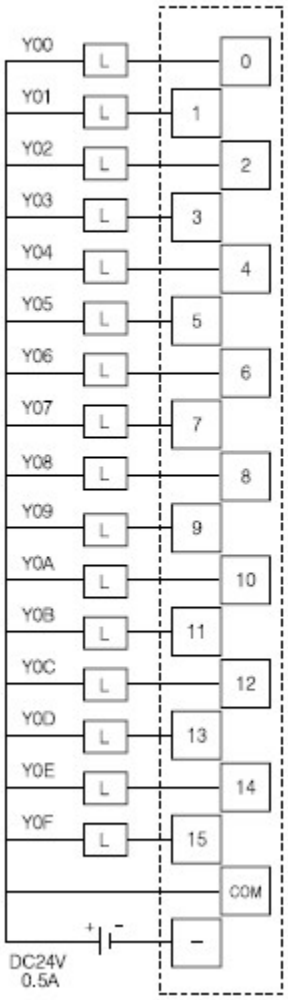
CM1-YR16A



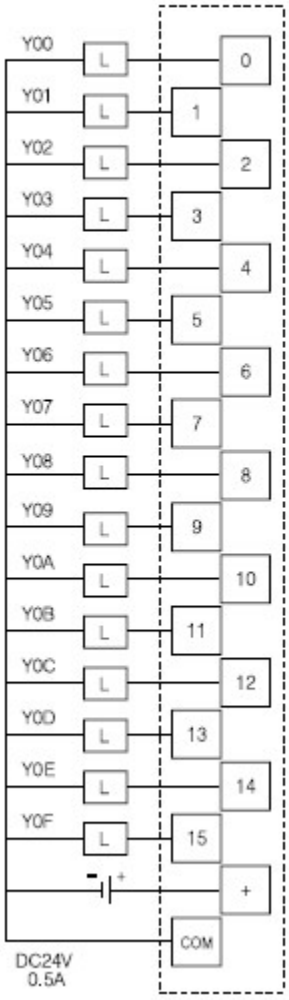
CM1-YS08A

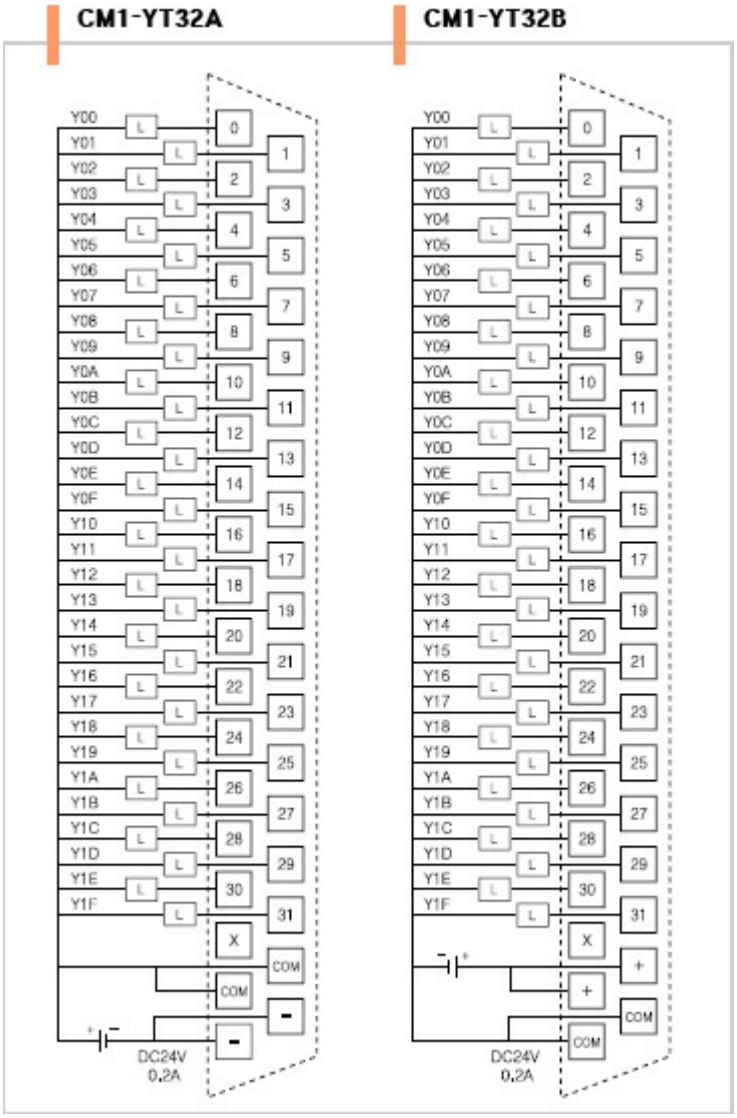


CM1-YT16A



CM1-YT16B





SAFETY PRECAUTIONS (1)

- Use a cable for outside input signal of output converter Module differently from a cable for AC to prevent the influence
  Of surge or induction noise occurring from AC

- Select a cable, considering ambient temperature, allowable current. AWG22(0.3mm^2) or more cable is recommended.

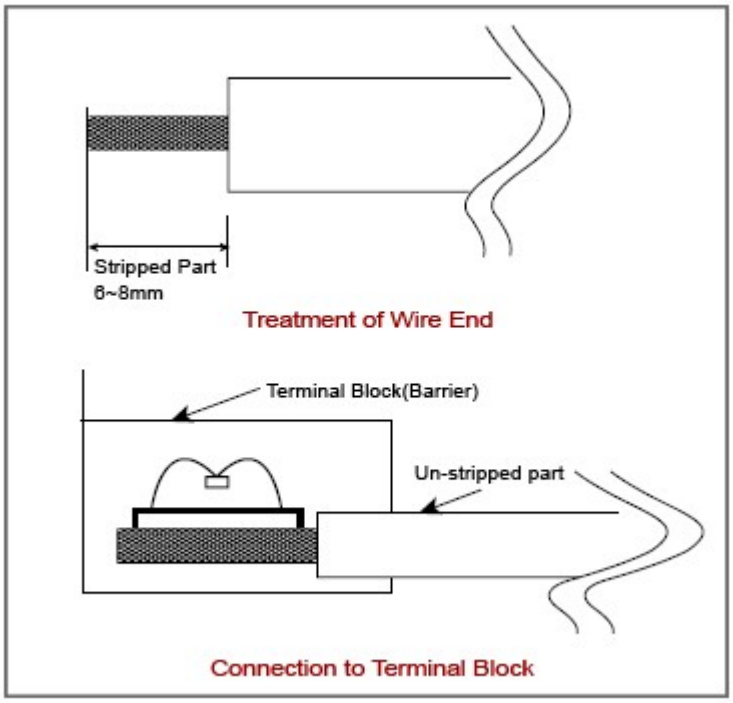
- The wiring close to heat-generation device or material and directly Contacted with oil for long time may cause short
  circuit or breakdown or malfunction. In case of the installation environment with a lot of vibration, prevent a PLC from the vibration.

- The wiring together with high-voltage line or power line may cause Malfunction or breakdown due to induction jam.
  Design the wring 100mm or more away from a high voltage line or a power line not to Receive the influence by the variation
  of noise or magnetic field.

- Do not dismount or disassemble a module.

SAFETY PRECAUTIONS (2)

- In case of connection to a terminal block without contact Connector, the uncovered part of a wire is to be 6mm to 8mm.
  And take care that uncovered metal part of a wire is pushed out From a terminal block



- In case of a twisted wire, take care that it is not loosed.

BEFORE USING

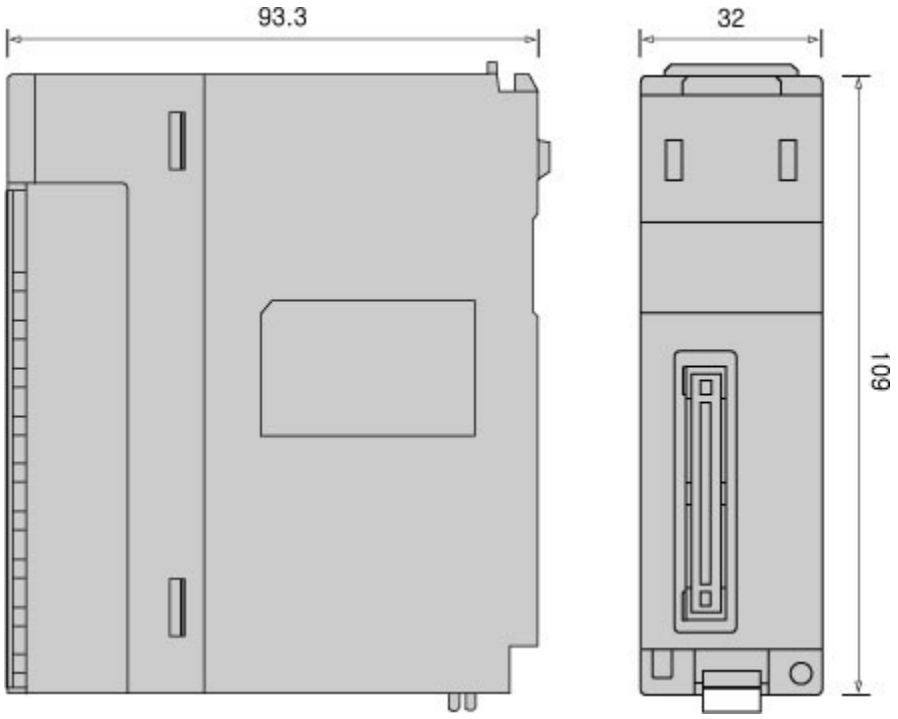
- Please use after understanding the wire diagram including Rated voltage and terminal arrangement
- Do not touch in the status that the power source is supplied (It is prohibited to mount and dismount

modules.)

- In case of tightening the screws of a terminal, tighten firmly According to the rated torque
- Earth FG terminal in the third class, which is exclusive for PLC.
- In case of the load of high open-close frequency, high capacity or low power factor by coil load of electromagnet, use a SSR output module (In case of using a relay output module, the life span of will shorten.)
- In case of driving Load L, the maximum open-close frequency is To be on and off for 1 second or more

OUTWARD DIMENSIONS

(UNIT : mm)



3.13 CIMON-PLC Combination I/O module

Modules :

- CM1-XY16DR

Contents :

GENERAL SPECIFICATIONS

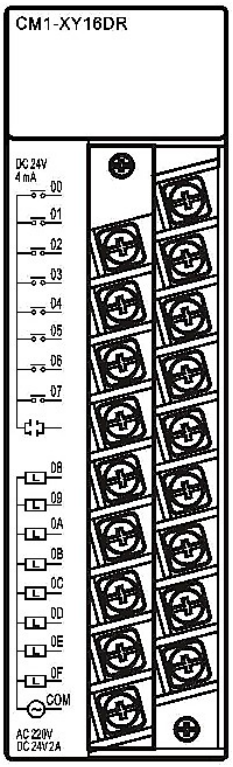
Item	Specification				Reference
Op.Temp.	Operating Temperature -10 ~65 ℃				
St.Temp	Storage Temperature □□-25 ~□□80 ℃				
Op.Hum	Operating Humidity 5 ~95%RH, Not Condensed				
St.Hum	Storage Humidity 5 ~95%RH, Not Condensed				
Vibration	In case of intermittent vibration			-	
	Frequency	Acceleration	Amplitude	Sweep	IEC61131-2
	10=□f=□□ 57Hz		0.075mm	10 times in X,Y,Z	
	57=□□f=□□ 150Hz	9.8m/s²{1G}	-		
	In case of continuous vibration				
	Frequency	Acceleration	Amplitude		
	10=□□f =□□57Hz		0.035mm		
	57=□□f= 150Hz	4.8m/s²{0.5G}			
Shock	□□Max. shock Acc. :147 m/s{15G} □□Time :11㎳ □□Pulse wave: Half sine wave pulse(3 times in X,Y,Z)				IEC61131-2
Noise	Square wave impulse noise	2,000 V			KDT Standard
	Electro-static discharge	Voltage :4kV (Contact discharge)			IEC61131-2 IEC1000-4-2
	Radiated electro-magneti c field	27 ~500 MHz,10 V/m			IEC1131-2 IEC1000-4-3
	Fast transient bust noise	Power Module	Digital I/O (24V or more)	Digital I/O (Less than 24V) Analog I/Ocomm.. Interface	IEC1131-2 IEC1000-4-4

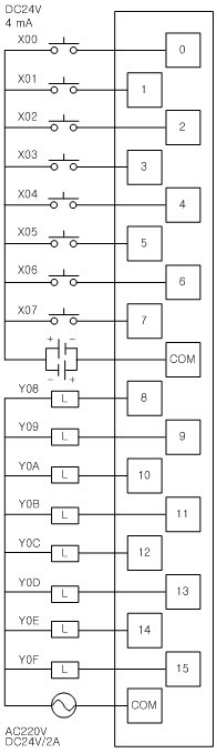
		2kV	1kV	0.25kV	
Environ..	No corrosive gas and no dust				
Altitude	2,000m or less				
Pollution	2 or less				
Cooling	Natural Air Cooling				

Module SPECIFICATIONS

Item		CM1-XY16DR	
		INPUT	OUTPUT
No. of I/O Points		8 Point	8 Point
		Both SINK and SOURCE	Relay
Rated input Voltage		DC 24V	-
Rated Load Voltage		-	DC12/24V AC220V
Rated Current		4mA	2A
On Voltage / On Current		DC19V/4mA	-
On Voltage / On Current		DC11V/1mA	
Response time	Off -> On	5㎳ or less	10㎳ or less
	On -> Off	5㎳ or less	5㎳ or less
Common Type		8 Points / 1COM	8 Points / 1COM
Action indication		LED is on when input or output is set	
Insulation Type		Photo-Coupler	Relay

Front View / Wiring Diagram

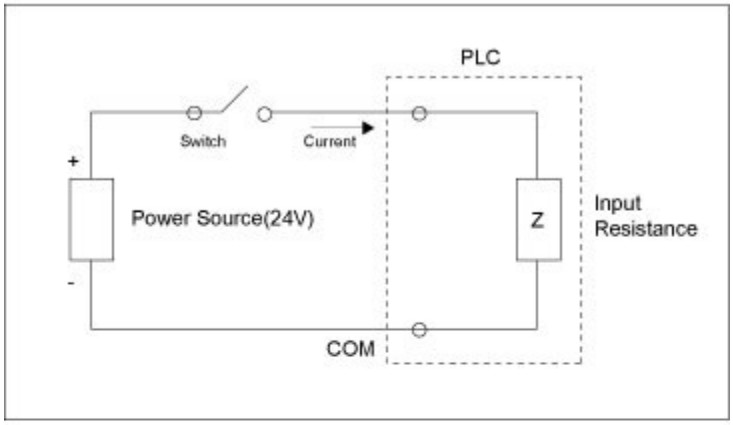




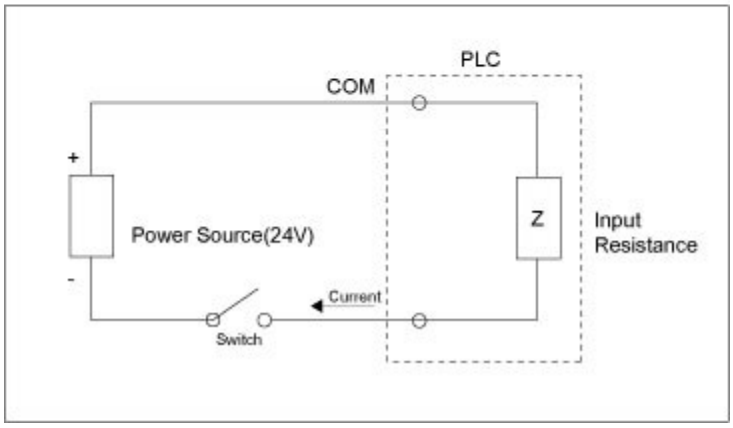
- **The tightening torque of 6.99 in 1b**
- **USE COPPER OR COPPER-CLAD ALUMINUM CONDUCTORS**
- **"Class 2, adjacent to voltage rating (30V max.)"**

Connection Type

Sink



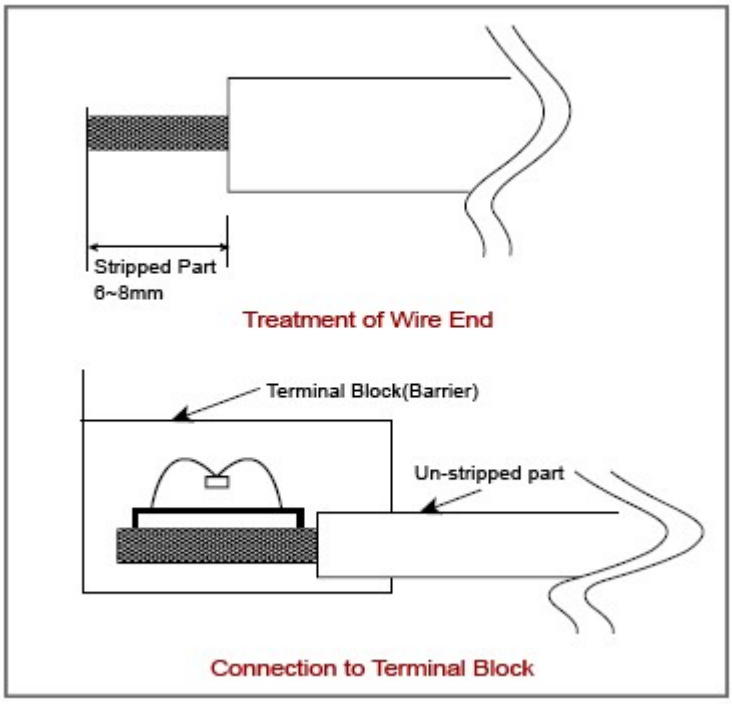
Source



* CM1-XY16DR is used for both Sink and Source

Safety Precautions(1)

1. In case of connection to a terminal block without contact connector the uncovered part of a wire is to be 6mm to 8mm.
   And take care that the uncovered metal part of a wire is pushed out from a terminal block



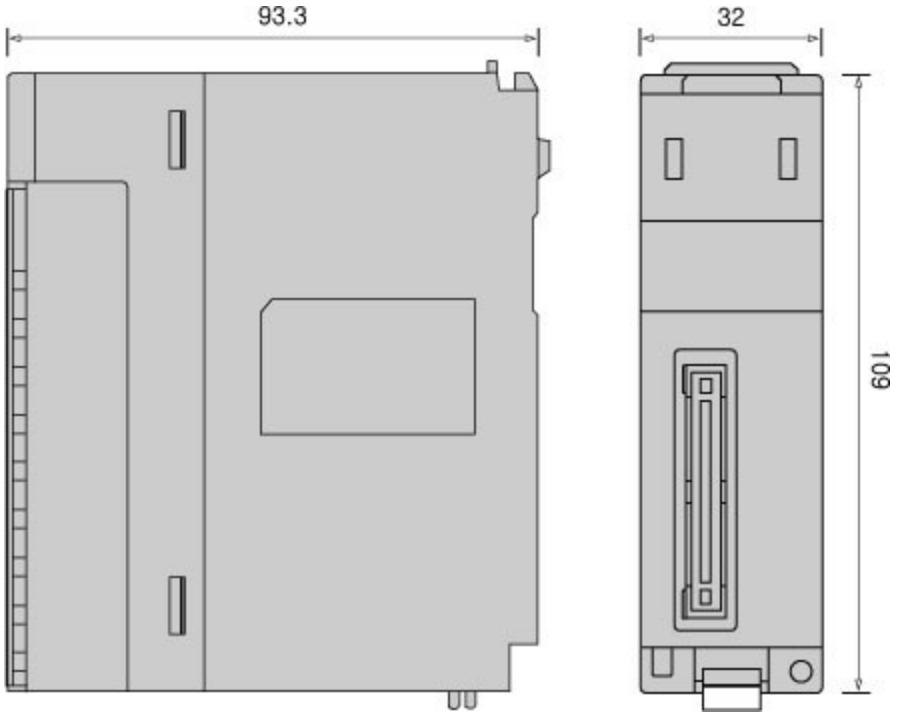
2. In case of a twisted wire, take care that it is not loosed

Safety Precautions(2)

- Use a cable for outside input signal of output converter module differently from a cable for AC to prevent the influence of surge or
  induction noise occurring from AC.
- Select a cable, considering ambient temperature, allowable current. AWG22(0.3mm^2) or more cable is recommended.
- The wiring close to heat-generating device or material and directly contacted with oil for long time may cause short circuit or
  breakdown or malfunction. In case of the installation environment with a lot of vibration, prevent a PLC from the vibration
- The wiring together with high-voltage line or power line may cause malfunction or breakdown due to induction jam.
  Design the wring100mm or more away from a high voltage line or a power line not to receive the influence by the variation of noise
  or magnetic field.
- Do not dismount or disassemble a module

Outward Dimension

(UNIT : mm)



Before Using

- Please use after understanding the wire diagram including raged voltage.
- Do not touch in the status that the power source is supplied.(It is prohibited to mount and dismount modules.)
- Tighten the screws for terminal connection after turning off the power source.
- In case of tightening the screws of a terminal, tighten firmly according to the rated torque.
- Earth FG terminal in the third class, which is exclusive for PLC.
- Design a system putting an input signal line 100mm or more away from high voltage line and a power line not to receive the
  influence by the variation of noise or magnetic field.
- Under installation environment with a lot of vibration, prevent a PLC from vibration.
- Take care that dregs are not put into a module case.

3.14 CIMON-PLC A/D Converters

Modules :

- CM1-AD04VI
- CM1-AD08I
- CM1-AD08V

Contents :

CIMON-PLC AD Converters Module For details see "**Click**"

GENERAL SPECIFICATIONS

Item	Specification				Reference
Op.Temp.	Operating Temperature -10 ~65 ℃				
St.Temp	Storage Temperature □□-25 ~□□80 ℃				
Op.Hum	Operating Humidity 5 ~95%RH, Not Condensed				
St.Hum	Storage Humidity 5 ~95%RH, Not Condensed				
Vibration	In case of intermittent vibration			-	
	Frequency	Acceleration	Amplitude	Sweep	IEC61131-2
	10=□f=□□ 57Hz		0.075mm	10 times in X,Y,Z	
	57=□□f=□□ 150Hz	9.8m/s²{1G}	-		
	In case of continuous vibration				
	Frequency	Acceleration	Amplitude		

	10=☐☐f =☐☐57Hz		0.035mm		
	57=☐☐f= 150Hz	4.8m/s²{0.5G}			
Shock	☐☐Max. shock Acc. :147 m/s{15G} ☐☐Time :11㎳ ☐☐Pulse wave: Half sine wave pulse(3 times in X,Y,Z)				IEC61131-2
Noise	Square wave impulse noise	2,000 V			KDT Standard
	Electro-static discharge	Voltage :4kV (Contact discharge)			IEC61131-2 IEC1000-4-2
	Radiated electro-magnetic field	27 ~500 MHz,10 V/m			IEC61131-2 IEC1000-4-3
	Fast transient bust noise	Power Module	Digital I/O (24V or more)	Digital I/O (Less than 24V) Analog I/Ocomm.. Interface	IEC61131-2 IEC1000-4-4
		2kV	1kV	0.25kV	
Environ..	No corrosive gas and no dust				
Altitude	2,000m or less				
Pollution	2 or less				
Cooling	Natural Air Cooling				

MODULE SPECIFICATIONS

	CM1-AD04VI	CM1-AD08V	CM1-AD08I
No. of Analog Inputs	4 Points	8 Points	8 Points
Analog Input	0~+5V(0~20mA) 1~+5V(4~20mA) 0 ~ +10V -10V ~ +10V	0 ~ +5V 1 ~ +5V 0 ~ +10V -10V~ +10V	0 ~ 20mA 4 ~ 20mA
Digital Output	0 ~ 16000(-8000 ~ 8000)		

<table>
<tr><td rowspan="8">Maximum Resolution</td><td>Input</td><td>Range of Analog Input</td><td>Max. Rresplution</td><td>Digital Output</td></tr>
<tr><td rowspan="4">Voltage</td><td>0 ~ +5V</td><td>312.5uV</td><td rowspan="6">0~16000
-8000~8000</td></tr>
<tr><td>1 ~ +5V</td><td>250uV</td></tr>
<tr><td>0 ~ +10V</td><td>625uV</td></tr>
<tr><td>-10V~+10V</td><td>1.25mV</td></tr>
<tr><td rowspan="2">Current</td><td>0 ~ 20mA</td><td>1.25㎃</td></tr>
<tr><td>4 ~ 20mA</td><td>1㎃</td></tr>
<tr><td>Precision</td><td colspan="4">±0.3%(Full Scale)</td></tr>
<tr><td>Conversion Rate</td><td colspan="4">5mS/1ch</td></tr>
<tr><td>Absolute Max. Input</td><td colspan="2">Voltage :±12V
Current : ±25mA</td><td>±12V</td><td>±25mA</td></tr>
<tr><td>Insulation</td><td colspan="4">Between input terminal and PLC: Photo-Coupler
Between channels: No</td></tr>
<tr><td>Occupied Points</td><td colspan="4">16 Points</td></tr>
<tr><td>Contact Terminal</td><td colspan="4">18-Point Terminal Block</td></tr>
<tr><td rowspan="3">Internal Current (mA)</td><td>+5V</td><td colspan="2">50</td><td>50</td><td>50</td></tr>
<tr><td>+15V</td><td colspan="2">40</td><td>40</td><td>40</td></tr>
<tr><td>-15V</td><td colspan="2">35</td><td>20</td><td>20</td></tr>
</table>

Features and Operation

- CM1-AD04VI is an A/D module to input 4-Ch voltage and 4-Ch current

  CM1-AD08I is an A/D module to input 8–Ch current.

  CM1-AD08V is an A/D module to input 8-Ch voltage.

- AD04VI 0~20mA, 4~20mA, 0~5V, 1~5V, -10~10V, 0~10V
  AD08I 0~20mA, 4~20mA
  AD08V 0~5V, 1~5V, -10~10V, 0~10V

- Average or sampling is used as the method to process input signal.

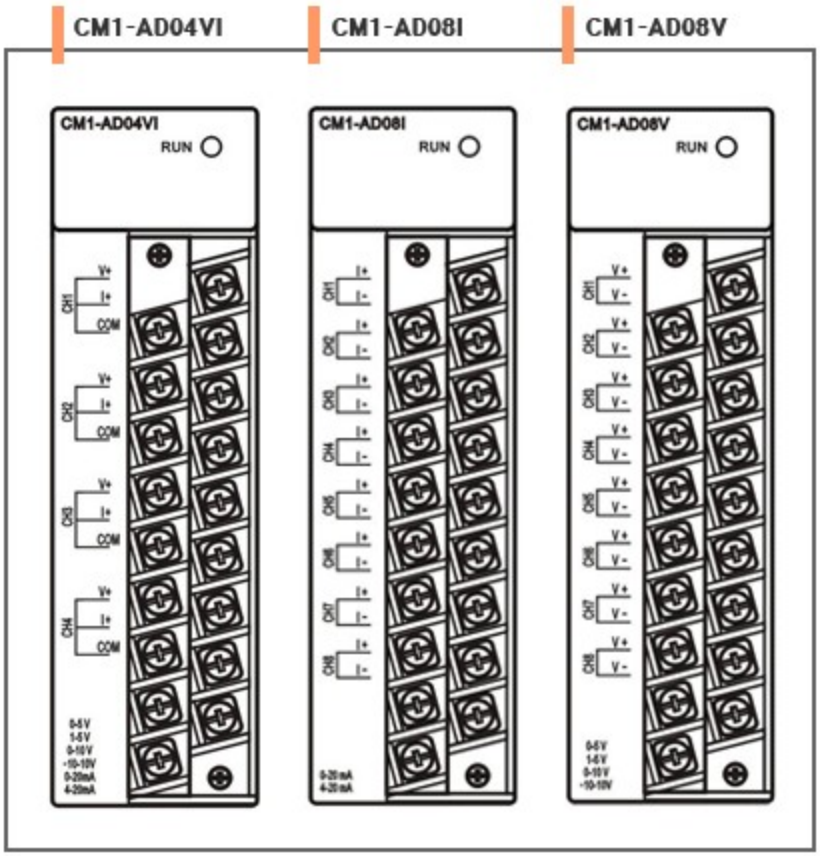
- As the resolution for the digital value is selected as 1/16000, the digital values of high resolution will be gotten.

- An input signal is converted to the digital value from 0 to 16000 or from –8000 to 8000. In

case of being out of the range,
it is converted from –192 to 16191 (-8192 ~ 8191). And in case of the range, it is fixed from 0 to 16000 (-8000 ~ 8000).

- To set up Offset/Gain value easily, use CICON Loader Program.
- The number of this modules used for one base is not limited.
- LED is on in case of normal status and blinks at the intervals of 0.3 sec in case of error.

FRONT VIEW



- AD04VI : Do not use Terminal 4,8,12,16,17 and18.
  In case of voltage input, use V+ terminal and COM terminal.
  In case of current input, use COM terminal, connecting V+ terminal with I+ terminal.

- AD08I : Do not use Terminal 17 and 18.
- AD08V : Do not use Terminal 17 and 18.

WRING

Measured values are input to all the channels grouped as Terminal 1-2-3, 5-6-7, 9-10-11 and 13-14-15.

In case of voltage input

	+ Terminal	- Terminal
Ch 1	Terminal 1	Terminal 3
Ch 2	Terminal 5	Terminal 7
Ch 3	Terminal 9	Terminal 11
Ch 4	Terminal 13	Terminal 15

In case of current input

	+ Terminal	- Terminal	Action
Ch 1	Terminal 2	Terminal 3	Connect 1-2
Ch 2	Terminal 6	Terminal 7	Connect 5-6
Ch 3	Terminal 10	Terminal11	Connect 9-10
Ch 4	Terminal 14	Terminal 15	Connect 13-14

※ Make sure polarity is correct before analog input to a terminal. Do not use Terminal 4, 8, 12, 16, 17 and 18.

Safety Precautions

- Use a cable for outside input signal of A/D converter module differently from a cable for AC to prevent the influence of surge or induction noise occurring from AC.
- Select a cable, considering ambient temperature, allowable current. AWG22(0.3mm^2) or more cable is recommended.
- The wiring close to heat-generating device or material and directly contacted with oil for long time may cause short circuit or breakdown or malfunction.

- The wiring together with high-voltage line or power line may cause malfunction or breakdown due to induction jam. Design the wring 100mm or more away from a high voltage line or a power line not to receive the influence by the variation of noise or magnetic field.

- The tightening torque if 6.99 in. 1b
- USE COPPER OF COPPER-CLAD ALUMINUM CONDUTORS
- “Class 2, adjacent to coltage ration(30V max.)”

I/O SIGNALS

Direction (CPU← A/D)		Direction (CPU→ A/D)	
Input	Signal Name	Output	Signal Name
X0	A/D Module Ready	Y0	Not Use
X1	Flag Indicating A/D-converted	Y1	
X2	Flag indicating operation condition setup	Y2	Requesting to set up operation condition
X3	Flag indicating channel switched	Y3	Requesting to switch channel
X4	Flag indicating offset or gain calibration mode	Y4	Requesting to calibrate offset or gain
X5	Not Use	Y5	Assigning offset or gain mode
X6		Y6	Not Use
X7		Y7	
X8		Y8	
X9		Y9	
XA		YA	
XB		YB	
XC		YC	
XD		YD	
XE		YE	Requesting to reset max. value and min. value
XF	Flag indicating error in A/D module	YF	Requesting to clear error

USER PROGRAM MEMORY DEVICES

Address		Description	R/W
Hexa	Deci		
0H	0	Enabling/disabling to A/D-convert Setup	R/W
1H	1	Average time & number of times of CH.1	R/W
2H	2	Average time & number of times of CH.2	R/W
3H	3	Average time & number of times of CH.3	R/W
4H	4	Average time & number of times of CH.4	R/W
5H	5	Average time & number of times of CH.5	R/W
6H	6	Average time & number of times of CH.6	R/W
7H	7	Average time & number of times of CH.7	R/W
8H	8	Average time & number of times of CH.8	R/W
9H	9	Assigning Averaging Process	R/W
AH	10	Flag Indicating A/D-converted	R
BH	11	Digital Output Value of CH.1	R
CH	12	Digital Output Value of CH.2	R
DH	13	Digital Output Value of CH.3	R
EH	14	Digital Output Value of CH.4	R
FH	15	Digital Output Value of CH.5	R
10H	16	Digital Output Value of CH.6	R
11H	17	Digital Output Value of CH.7	R
12H	18	Digital Output Value of CH.8	R
13H	19	Error Code	R
14H	20	Set Range (CH.1~CH.4)	R/W
15H	21	Set Range (CH.5~CH.8)	R/W
16H	22	Channel to Calibrate Offset	R/W
17H	23	Channel to Calibrate Gain	R/W

Address		Description	R/W
Hexa	Deci		

18H	24	Setting up Digital Output	R/W
19H	25	Not Use	-
1AH	26		
1BH	27		
1CH	28		
1DH	29		
1EH	30	Max. Value of CH.1	R
1FH	31	Min. Value of CH.1	R
20H	32	Max. Value of CH.2	R
21H	33	Min. Value of CH.2	R
22H	34	Max. Value of CH.3	R
23H	35	Min. Value of CH.3	R
24H	36	Max. Value of CH.4	R
25H	37	Min. Value of CH.4	R
26H	38	Max. Value of CH.5	R
27H	39	Min. Value of CH.5	R
28H	40	Max. Value of CH.6	R
29H	41	Min. Value of CH.6	R
2AH	42	Max. Value of CH.7	R
2BH	43	Min. Value of CH.7	R
2CH	44	Max. Value of CH.8	R
2DH	45	Min. Value of CH.8	R

ERROR CODES

In case of error in inputted data or in offset/gain setup, the following error code is stored Buffer Memory “19” and LED is blinking at the intervals of 0.3 second.

If “Tool” -> “Special Card Setup” -> “A/D Card Setup” -> “Current Status” is selected, a dialog box displaying error code will appear.

To clear an error code, select “Error code reset” button in the “A/D Card Status” of the CICON.

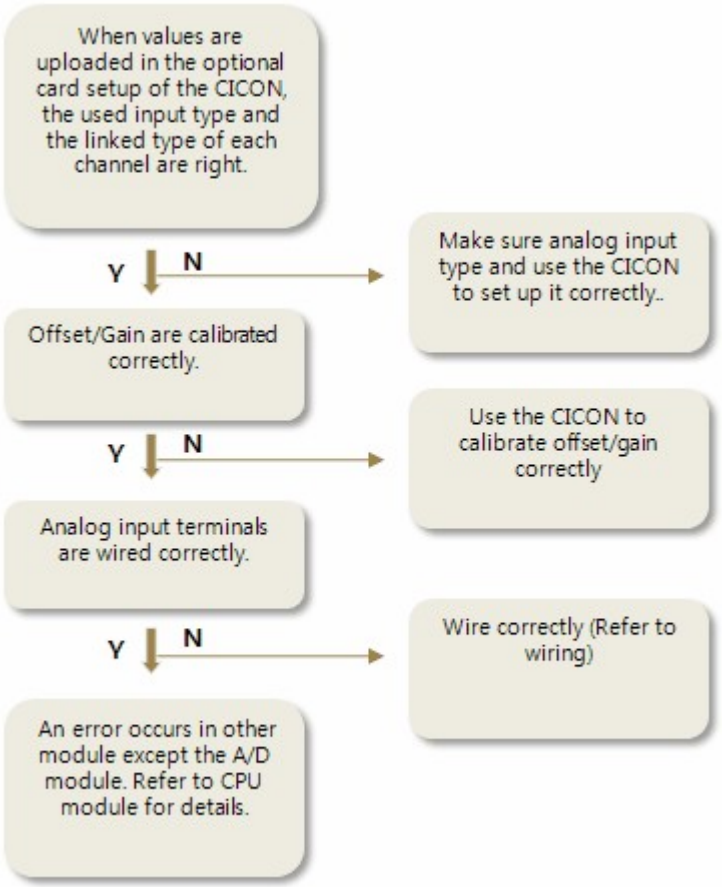
□: 1CH~4CH for AD04VI, 1CH~8CH for AD08I and AD08V

△: 0~3 for AD module

CODES	DESCRIPTIONS
1□	The case the range of input setup is wrong The case current is set up in AD08V or voltage is set up in AD08I
2□	The case average process time is out of range
3□	The case number of average process times is out of range
4□	The case an offset value is greater than a gain value
49	The case offset channels and gain channels are calibrated at the same time
10△	System error (A/S required.)

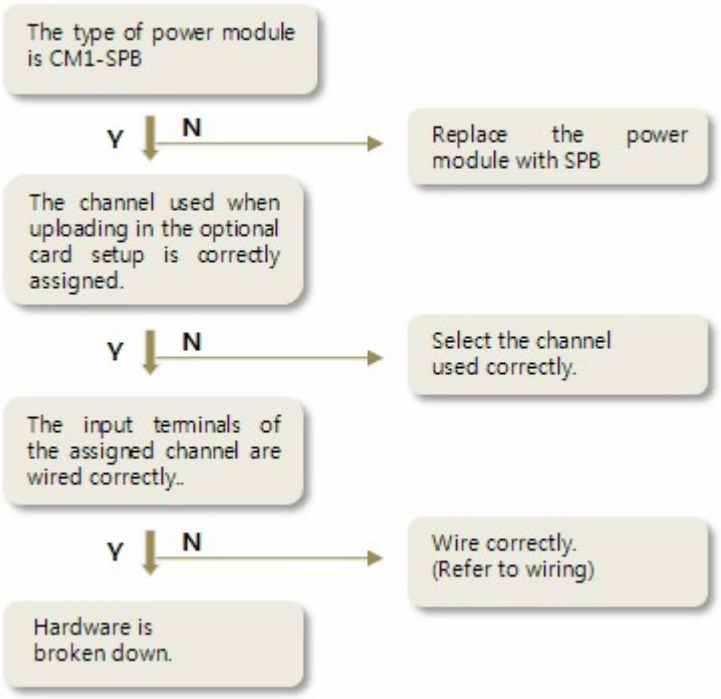
TROUBLE SHOOTING(1)

Analog input values do not correspond to digital output values



TROUBLE SHOOTING(2)

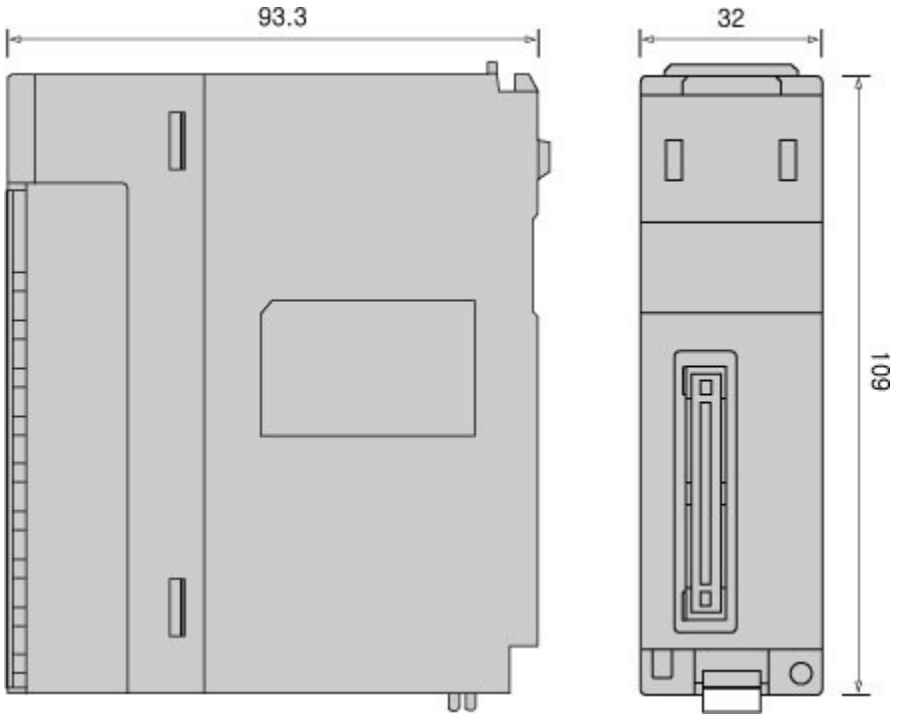
CPU module cannot read A/S-converted values.



OUTWARD DIMENSIONS

[un

it : mm]



3.15 CIMON-PLC D/A Converters

Modules :

- CM1-DA04V, DA08V, DA16V
- CM1-DA04I, DA08I, DA16I
- CM1-DA04VA, DA08VA, DA16VA

Contents :

GENERAL SPECIFICATIONS

Item	Specification				Reference
Op.Temp.	Operating Temperature -10 ~65 ℃				
St.Temp	Storage Temperature □□-25 ~□□80 ℃				
Op.Hum	Operating Humidity 5 ~95%RH, Not Condensed				
St.Hum	Storage Humidity 5 ~95%RH, Not Condensed				
Vibration	In case of intermittent vibration			-	IEC61131-2
	Frequency	Acceleration	Amplitude	Sweep	
	10=□f=□□ 57Hz		0.075mm	10 times in X,Y,Z	
	57=□□f=□□ 150Hz	9.8m/s²{1G}	-		
	In case of continuous vibration				
	Frequency	Acceleration	Amplitude		
	10=□□f =□□57Hz		0.035mm		
	57=□□f= 150Hz	4.8m/s²{0.5G}			
Shock	□□Max. shock Acc. :147 m/s{15G} □□Time :11㎳ □□Pulse wave: Half sine wave pulse(3 times in X,Y,Z)				IEC61131-2
Noise	Square wave impulse noise	2,000 V			KDT Standard
	Electro-static discharge	Voltage :4kV (Contact discharge)			IEC61131-2 IEC1000-4-2
	Radiated electro-magneti c field	27 ~500 MHz,10 V/m			IEC61131-2 IEC1000-4-3
	Fast transient bust noise	Power Module	Digital I/O (24V or more)	Digital I/O (Less than 24V) Analog I/Ocomm.. Interface	IEC61131-2 IEC1000-4-4
		2kV	1kV	0.25kV	
Environ..	No corrosive gas and no dust				
Altitude	2,000m or less				
Pollution	2 or less				
Cooling	Natural Air Cooling				

MODULE SPECIFICATIONS

		(DA04V)	(DA08V)	(DA04I)	(DA08I)
No. of Analog Output Points		4 Points	8 Points	4 Points	8 Points
Analog Output		-10V ~ +10V		4 ~ 20mA	
Digital Input		-192 ~ 16191(-8192~8191)			
Maximum Resolution		Output: Voltage; Digital Input Value: 0 ~ 16000 (-8000~8000); Range of: -10V ~ +10V; Max. Resolution: 1.25mV Output: Current; Digital Input Value: 0 ~ 16000 (-8000~8000); Range of: 4 ~ 20mA; Max. Resolution: 1.0μA			
Precision		0.1			
Conversion Rate		10ms/4ch.	15ms/8ch.	10ms/4ch.	15ms/4ch.
Absolute Max. Input		Voltage : ±12V Current : ±21mA			
Insulation		Between input terminal and PLC: Photo-coupler Between output channels: No Between externally supplied power and analog output: No			
Externally Supplied Power		None		+24V	
Occupied Point		16			
Contact terminal		18-point Terminal Block			
Internal Current (mA)	+5V	50		50	
	+15V	50		-	
	0V	30			
	24V	-		100	

FEATURES AND OPERATION

1) DA08I: 8-channel current (4~20mA) output
   DA04I: 4-channel current (4~20mA) output
   DA08V: 8-channel voltage (-10~10V) output
   DA04V: 4-channel voltage (-10~10V) output.

2) As the resolution for digital values is selected as 1/16000, the analog values of high resolution will be gotten

3) DA converter modules are used to convert the digital values for the signed binary data (Data: 14 bits) set up in a CPU to
analog signals (Voltage or current). The digital values in the range from 0 to 16000(-8000 ~ 8000) are converted to the
analog values in the range from 4 to 20mA (-10 ~ 10V)

4) If you use the CICON to set up hold or clear, DA output values will be outputted as offset value (4mA, -10V) or
current DA output value will be kept in case that a PLC is switched from RUN mode to STOP mode or an error occurs
in a CPU.

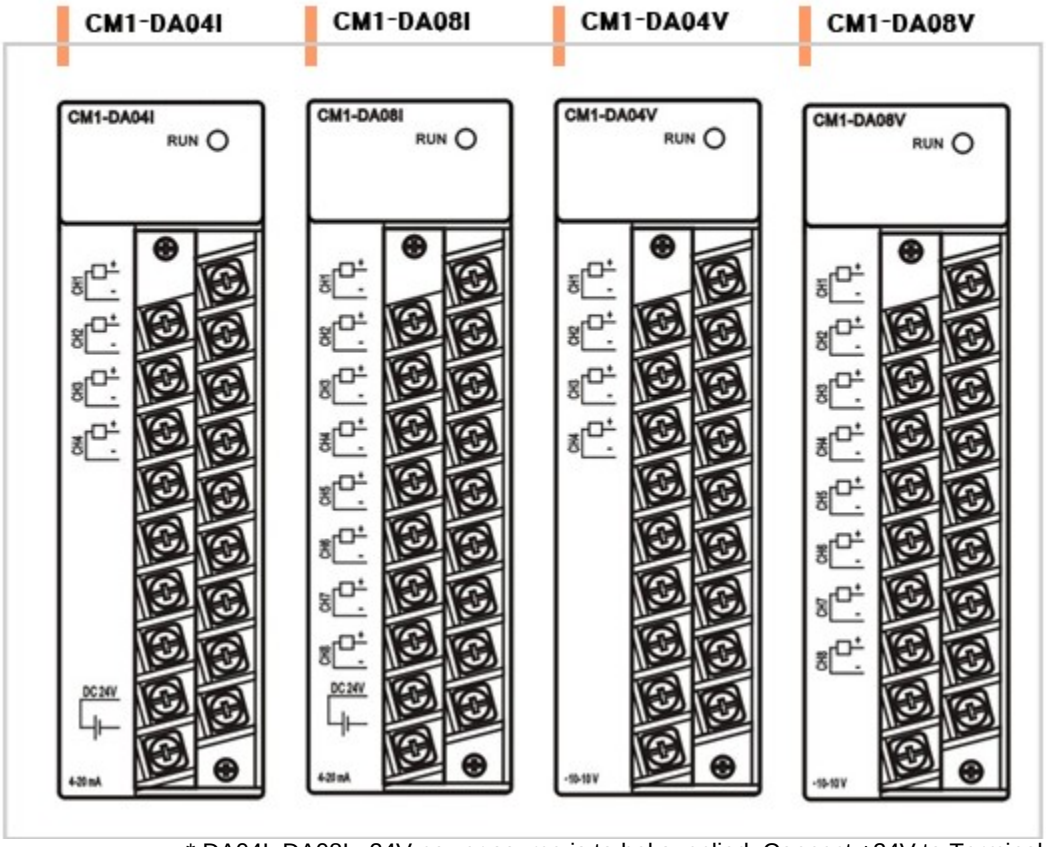
5) The channel disabled to convert outputs offset value (4mA,-10V).

6) To set up Offset/Gain value easily, use CICON Loader Program.

7) The number of this modules used for one base is not limited.

8) LED is on in case of normal status and blinks at the intervals of 0.3 sec in case of error.

FRONT VIEW



* DA04I, DA08I : 24V power source is to bel supplied. Connect +24V to Terminal 17 and 0V to Terminal 18.

WRING

In case of current output

Channel	+ Terminal	- Terminal
Ch 1	Terminal 1	Terminal 2
Ch 2	Terminal 3	Terminal 4
Ch 3	Terminal 5	Terminal 6
Ch 4	Terminal 7	Terminal 8
Ch 5	Terminal 9	Terminal 10
Ch 6	Terminal 11	Terminal 12
Ch 7	Terminal 13	Terminal 14
Ch 8	Terminal 15	Terminal 16

24V External Input	Terminal 17	Terminal 18

In case of voltage output

Channel	+ Terminal	- Terminal
Ch 1	Terminal 1	Terminal 2
Ch 2	Terminal 3	Terminal 4
Ch 3	Terminal 5	Terminal 6
Ch 4	Terminal 7	Terminal 8
Ch 5	Terminal 9	Terminal 10
Ch 6	Terminal 11	Terminal 12
Ch 7	Terminal 13	Terminal 14
Ch 8	Terminal 15	Terminal 16

※ In case of voltage output, do not use Terminal 17 and 18.

※ Make sure polarity is correct before analog input to a terminal

SAFETY PRECAUTIONS

1) Use a cable for outside input signal of D/A converter module differently from a cable for AC to prevent the influence of surge or induction noise occurring from AC.

2) Select a cable, considering ambient temperature, allowable current. 18AWG(0.823mm^2)~26AGW(0.405mm$^{2)}$ or more cable is recommended.

3) The wiring close to heat-generating device or material and directly contacted with oil for long time may cause short circuit or breakdown or malfunction.

4) The wiring together with high-voltage line or power line may cause malfunction or breakdown due to induction jam.
Design the wring 100mm or more away from a high voltage line or a power line not to receive the influence by the variation of noise or magnetic field.

I/O SIGNALS

Signal Direction(CPU← D/A)		Signal Direction(CPU→ D/A)	
Input	Signal Name	Output	Signal Name
X0	D/A module Ready	Y0	Not use

X1	Not use	Y1	
X2		Y2	
X3		Y3	
X4		Y4	
X5		Y5	
X6		Y6	
X7		Y7	
X8		Y8	
X9		Y9	
XA	Flag indicating operation condition setup	YA	Requesting to set up operation condition
XB	Flag indicating the channel switched	YB	Requesting to switch an channel
XC	Flag indicating the set value modified	YC	Requesting to modify an set value
XD	Flag indicating offset or gain calibration mode	YD	Requesting to calibrate offset or gain
XE	Not use	YE	Assigning offset or gain calibration mode
XF	Flag indicating an error in D/A module	YF	Requesting to clear an error

USER PROGRAM MEMORY DEVICES

Address		Name	Initial Value	R/W
Hexa	Deci			
0H	0	Enabling/disabling to D/A-convert setup	0	R/W
1H	1	Digital Value of CH.1	0	R/W
2H	2	Digital Value of CH.2	0	R/W
3H	3	Digital Value of CH.3	0	R/W
4H	4	Digital Value of CH.4	0	R/W
5H	5	Digital Value of CH.5	0	R/W
6H	6	Digital Value of CH.6	0	R/W
7H	7	Digital Value of CH.7	0	R/W
8H	8	Digital Value of CH.8	0	R/W
9H	9	Error Code	0	R
AH	10	Hold/Clear	0	R/W
BH	11	Set value check code of CH.1	0	R
CH	12	Set value check code of CH.2	0	R

DH	13	Set value check code of CH.3	0	R
EH	14	Set value check code of CH.4	0	R
FH	15	Set value check code of CH.5	0	R
10H	16	Set value check code of CH.6	0	R
11H	17	Set value check code of CH.7	0	R
12H	18	Set value check code of CH.8	0	R
13H	19	Channel to Calibrate offset	0	R/W
14H	20	Channel to calibrate gain	0	R/W
15H	21	Calibrated offset and gain	0	R/W
16H	22	Setting up digital input type	0	R/W
17H	23	Enabling/disabling to D/A-convert setup	0	R/W

ERROR CODES

In case of error in inputted data or in offset/gain setup, the following error code is stored Buffer Memory 19? and LED is
blinking at the intervals of 0.2 second.

If "Tool"? ->" Special Card Setup "? -> " A/D Card Setup "? -> " Current Status"? is selected, a dialog box displaying error code will appear.

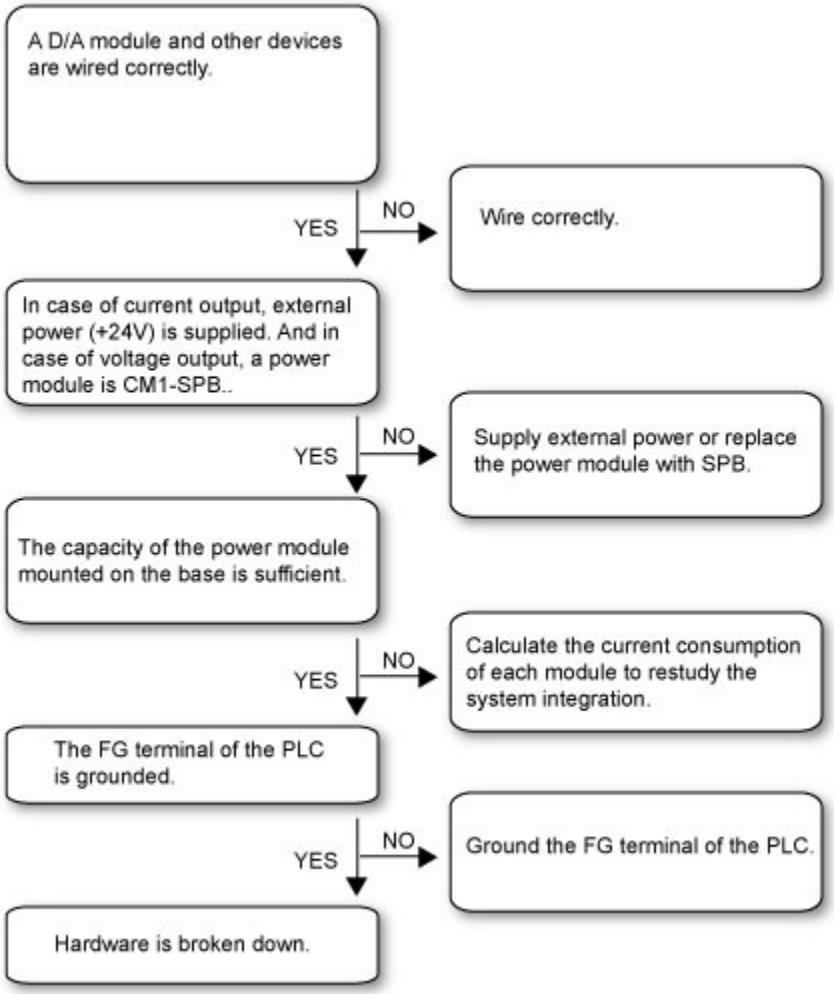
To clear an error code, select " Error code reset"? button in the " A/D Card Status" of the CICON.

Error Code	Description
1•	The case a set digital value is out of maximum range (16191, 8191)
2 •	The case a set digital value is out of minimum range (-192, -8192)
40	The case an offset value is greater than a gain value
41	The case both an offset and an gain are calibrated or plural channels are set up at the same time
42	The case a calibrated digital value is out of range when calibrating offset/gain
10△	System error(A/S required)

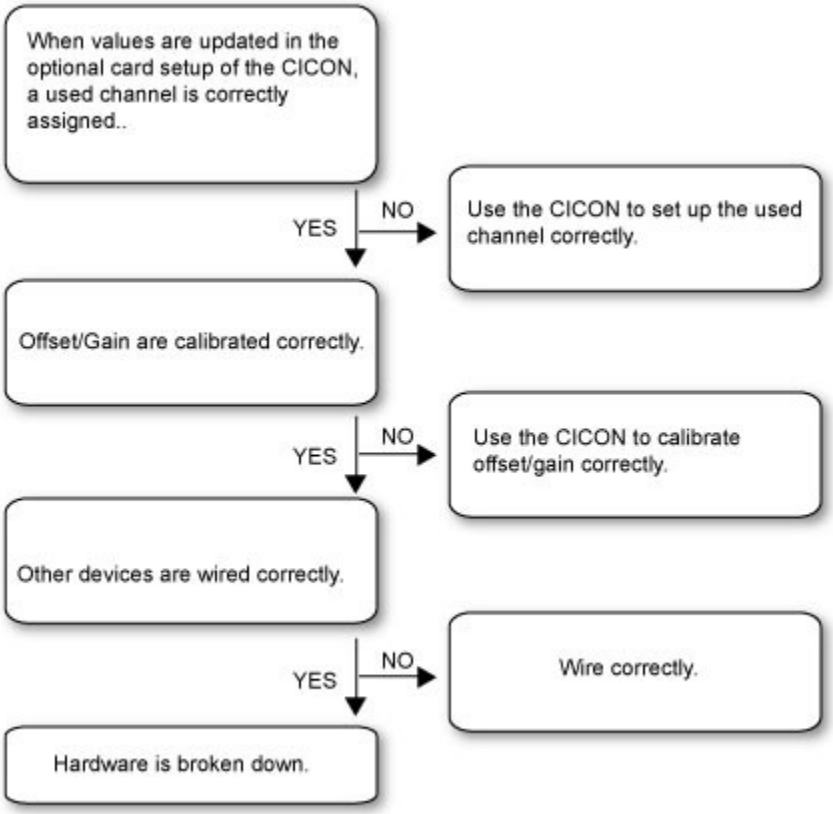
• : CH 1~ CH 4 for DA04I and DA04V / CH1~ CH 8 for DA08I and DA08V

△ : 0~3 for DA module

TROUBLE SHOOTING(1)

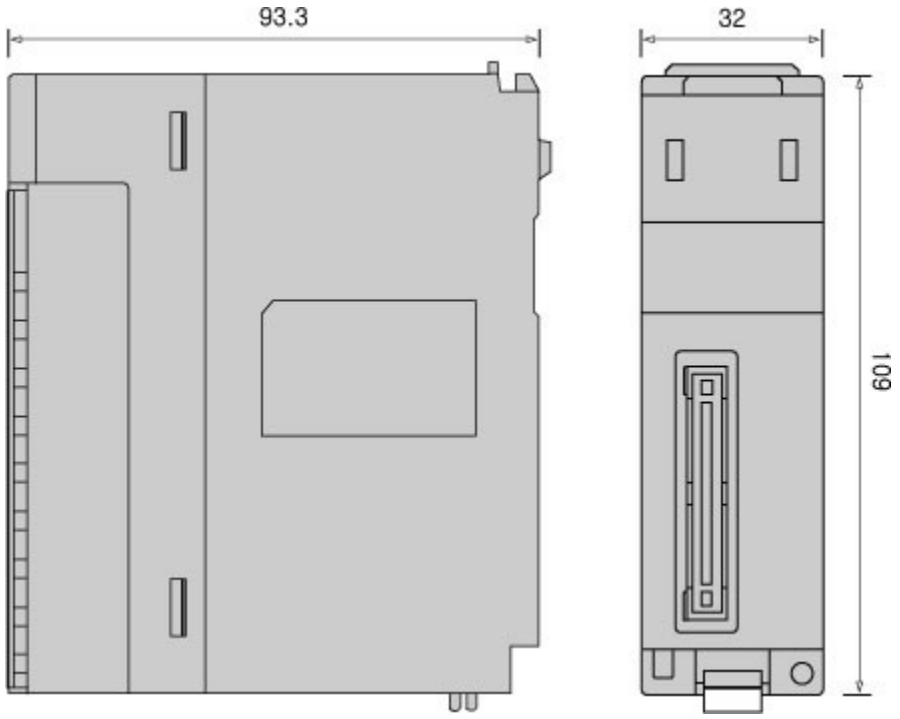


TROUBLE SHOOTING(2)



DIMENSIONS

(Unit : mm)



3.16 CIMON-PLC Positioning Module

Modules :

- CM1-PS02A

Contents :

GENERAL SPECIFICATIONS

Item	Specification				Reference
Op.Temp.	Operating Temperature -10 ~65 ℃				
St.Temp	Storage Temperature □□-25 ~□□80 ℃				
Op.Hum	Operating Humidity 5 ~95%RH, Not Condensed				
St.Hum	Storage Humidity 5 ~95%RH, Not Condensed				
Vibration	In case of intermittent vibration			-	IEC61131-2
	Frequency	Acceleration	Amplitude	Sweep	
	10=□f=□□ 57Hz		0.075mm	10 times in X,Y,Z	
	57=□□f=□□ 150Hz	9.8m/s²{1G}	-		
	In case of continuous vibration				
	Frequency	Acceleration	Amplitude		
	10=□□f =□□57Hz		0.035mm		
	57=□□f= 150Hz	4.8m/s²{0.5G}			
Shock	□□Max. shock Acc. :147 m/s{15G} □□Time :11㎳ □□Pulse wave: Half sine wave pulse(3 times in X,Y,Z)				IEC61131-2
Noise	Square wave impulse noise	2,000 V			KDT Standard
	Electro-static discharge	Voltage :4kV (Contact discharge)			IEC61131-2 IEC1000-4-2
	Radiated electro-magnetic field	27 ~500 MHz,10 V/m			IEC61131-2 IEC1000-4-3
	Fast transient bust noise	Power Module	Digital I/O (24V or more)	Digital I/O (Less than 24V) Analog I/Ocomm.. Interface	IEC61131-2 IEC1000-4-4
		2kV	1kV	0.25kV	
Environ..	No corrosive gas and no dust				
Altitude	2,000m or less				
Pollution	2 or less				
Cooling	Natural Air Cooling				

MODULE SPECIFICATIONS

Module Name	CM1-PS02A	
Axis	2 Axis	
Interpolation	2Axis Linear/Circular Interpolation	
Control Functions	Point to Point, Path, Speed	
Control Unit	Pulse, mm, inch, degree	
Position Data	600 / Axis	
Coordinate	Absolute/ Incremental	
Backup	Flash Rom Backup	
Control Type	Position Control	Absolute/Incremental
	Path Control	Absolute/Incremental
Positioning Range	• Absolute -214748364.8 ~ 214748364.7 ㎛ -21474.83648 ~ 21474.83647 inch 0 ~ 359.9999 degree -2147483648 ~ 2147483647 pulse • Incremental -214748364.8 ~ 214748364.7 ㎛ -21474.83648 ~ 21474.83647 inch 0 ~ 359.9999 degree -2147483648 ~ 2147483647 pulse	
Speed Command	0.01~ 20,000,000.00 mm/min 0.001 ~ 2,000,000.000 inch/min 0.001 ~ 2,000,000.000 degree/min 1 ~ 1,000,000 pulse/sec	
Acc./Dec. Process	Trapezoidal / S-pattern	
External Cabling	40 Pin Connector	
Max. Pulse Output	1 Mpps (Line Drive)	
Max. Distance	10 m	
Power Consume	240 mA / 5V	
I/O Occupation	16 Points	
Weight	168 g	

Feature

CM1-PSnnZ module is a pulse output modules for CP and XP series of CIMON PLCs.

PS02A type supports differential driver system pulse output. PSnnX is capable of driving not only motor but also stepping motor.

1) Control Axis

CM1-PS02A provides 2 axis pulse outputs and supports linear/circular interpolation.

2) Dedicated Instructions
CP and XP series of CIMON PLCs are embedding several dedicated instructions for PSnnX module.
These instructions provide easy and powerful control functions.

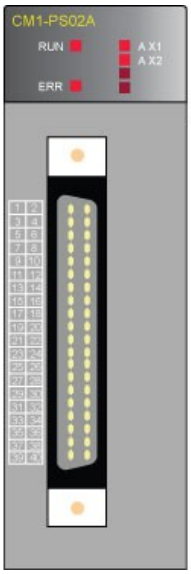
3) Manual operation
PSnnX module supports various kinds of manual operations, such as jog operation, inching operations.
And this module supports external connection of MPG(manual pulse generation).

4) PLC Compatibility
CP and XP CPUs of CIMON PLC supporting PSnnX module.

Internal I/O table

Direction : CPU ← PSnnX		Direction : CPU → PSnnX	
Input	**Signal Description**	**Output**	**Signal Description**
X0	Module Ready	**Y0**	CPU Ready
X1	Module Error	**Y1**	
X2		**Y2**	
X3		**Y3**	
X4	Command Ack. (Axis 1)	**Y4**	Positioning Start (Axis 1)
X5	Busy (Axis 1)	**Y5**	MPG Run (Axis 1)
X6	Error (Axis 1)	**Y6**	Forward JOG (Axis 1)
X7	Positioning Done (Axis 1)	**Y7**	Reverse JOG (Axis 1)
X8	M code ON (Axis 1)	**Y8**	Stop (Axis 1)
X9		**Y9**	
XA	Command Ack. (Axis 2)	**YA**	Positioning Start (Axis 2)
XB	Busy (Axis 2)	**YB**	MPG Run (Axis 2)
XC	Error (Axis 2)	**YC**	Forward JOG (Axis 2)
XD	Positioning Done (Axis 2)	**YD**	Reverse JOG (Axis 2)
XE	M code ON (Axis 2)	**YE**	Stop (Axis 2)
XF		**YF**	

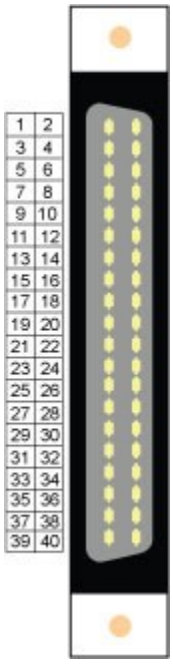
Front View



LED Display

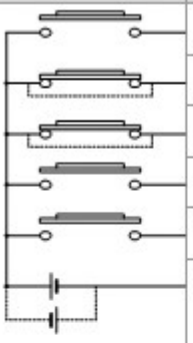
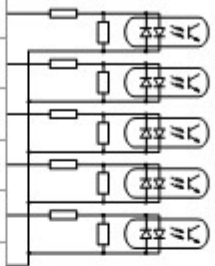
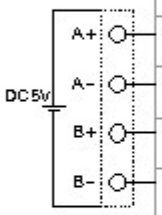
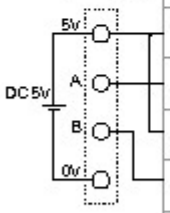
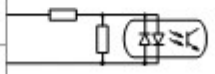
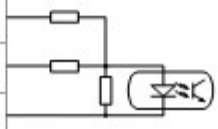
LED	Description	LED	Description
LED ON LED OFF LED TOGGLE	LED status symbol	CM1-PS04A RUN ERR A X1 A X2 A X3 A X4	Axis Error
CM1-PS04A RUN ERR A X1 A X2 A X3 A X4	Normal	CM1-PS04A RUN ERR A X1 A X2 A X3 A X4	System Error
CM1-PS04A RUN ERR A X1 A X2 A X3 A X4	Axis Running	CM1-PS04A RUN ERR A X1 A X2 A X3 A X4	Fatal Defect

Connector Pin Description

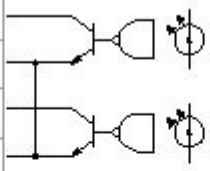
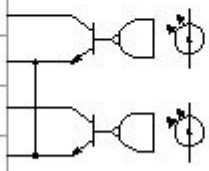
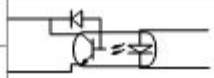
Connector	Signal	Pin A1	Pin A2	Description
	FP+	12	11	Pulse output (Line Drive Type)
	FP-	10	9	
	RP+	8	7	
	RP-	6	5	
	LMT U	40	39	Upper Limit Input
	LMT L	38	37	Lower Limit Input
	DOG	36	35	Near Point DOG Input
	STOP	34	33	External STOP Input
	ECMD	32	31	External Command Input
	COM1	30 28	29 27	COMMON (LMT U, LMT L, DOG, STOP, ECMD)
	RDY	20	19	Ready Signal Input from Driver
	COM2	18	17	COMMON (RDY)
	ZERO24	26	25	Zero Signal Input (+24V)
	ZERO05	24	23	Zero Signal Input (+5V)
	COM3	22	21	COMMON (ZERO24, ZERO05)
	CLEAR	16	15	Deviation Counter Clear Output
	COM4	14	13	COMMON (CLEAR)
	MPG A+	4		MPG/ENCODER A+ 입력
	MPG A-	3		MPG/ENCODER A- 입력
	MPG B+	2		MPG/ENCODER B+ 입력
	MPG B-	1		MPG/ENCODER B- 입력

* Deviation counter clear is an output signal of PSnnX module.

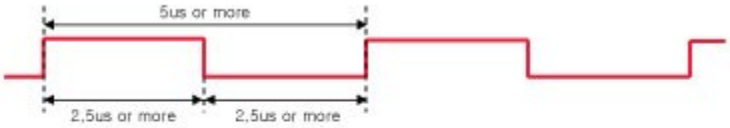
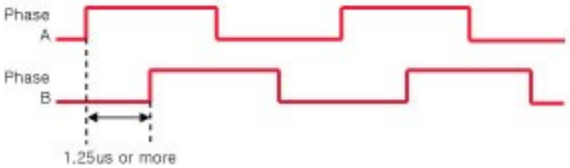
Input Signal

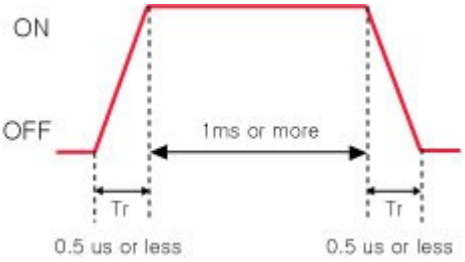
Output Signal	Pin	Internal Circuit	Signal Name
	35(36)		DOG
	39(40)		LMT U
	37(38)		LMT L
	33(34)		STOP
	31(32)		ECMD
	27,29 (28,30)		COM1
	4		MPG A+
	3		MPG A-
	2		MPG B+
	1		MPG B-
	4		MPG A+
	3		MPG A-
	2		MPG B+
	1		MPG B-
	19(20)		RDY
	17(18)		COM2
	25(26)		ZERO24
	23(24)		ZERO05
	21(22)		COM3

Output Signal

Output Signal	Pin	Internal Circuit	Signal Name
Pulse Output (Open Collector)	11(12)		FP+
	9(10)		FP-
	7(8)		RP+
	5(6)		RP-
Pulse Output (Line Driver)	11(12)		FP+
	9(10)		FP-
	7(8)		RP+
	5(6)		RP-
Others	15(16)		CLEAR
	13(14)		COM4

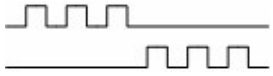
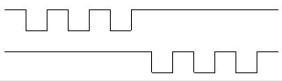
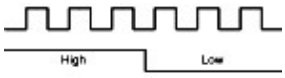
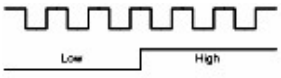
Input Signal Specification

Signal	Rated input	Working voltage range	ON Voltage/Current	OFF Voltage/Current	Input resistance	Response Time
DOG LMT U LMT L STOP ECMD	24V DC / 5mA	19.2-26.4 Vdc	19Vdc/4mA or more	11V DC / 1mA	2.7kΩ	
MPG Phase A (MPG A+,MPG A-) MPG Phase B (MPG B+,MPG B-)	5Vdc/7mA	4.25-5.5Vdc	2.5Vdc/3mA or more	1Vdc/1mA or less	940Ω	
	① Pulse Width  ② Phase  If the A phase leads B, the position address will be increased.					
RDY	24Vdc/5mA	19.2-26.4 Vdc	19Vdc/4mA or more	11Vdc/1mA	2.8kΩ	

Zero (Encoder Phase Z) (ZERO 5) (ZERO 24)	5Vdc/7mA	4.25-5.5 Vdc	2.5Vdc/3mA or more	1Vdc/1mA or less	600Ω	
	24V DC / 5mA	19.2V-26.4 Vdc	19Vdc/4mA or more	11Vdc/1mA	2.7kΩ	
						

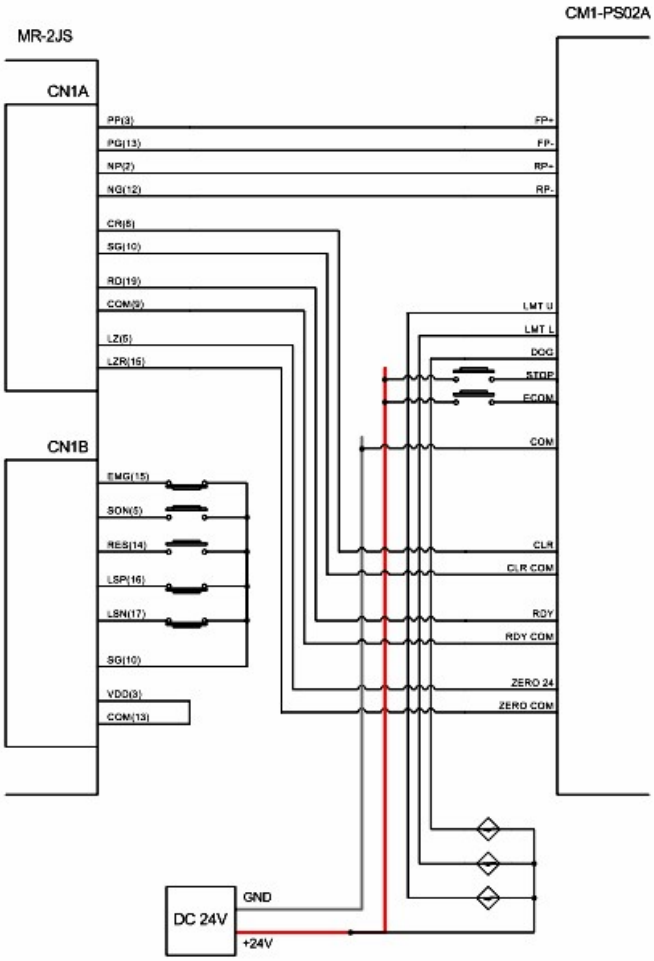
Output Signal Specification

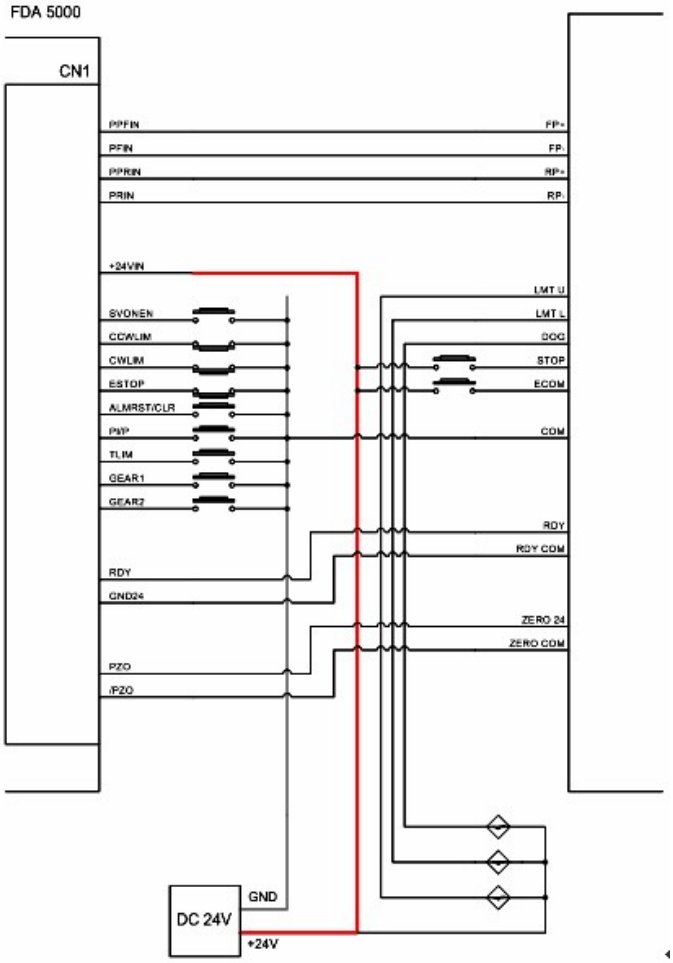
Signal	Rated voltage	Working voltag	Max. Current/Inrush current	Voltage Drop at ON	Leakage current at OFF
Pulse Output (CW/PULSE) Pulse Sign (CCW/SIGN)	5-24 Vdc	4.75-26.4 Vdc	50mA(1 point)/ 0.2A(10ms or less)	0.5 Vdc	0.1mA or less
	? Differential driver equivalent to AM26C31 ? The type of output pulse(CW/CCW, Pulse/Sign) is select by basic parameter settings				
Deviation Counter (CLEAR)	5-24 Vdc	4.75-26.4 Vdc	0.1A(1 point)/ 0.4A(10ms or less)	1 Vdc	0.1mA or less

Pulse Output Mode	Output Signal Level			
	Positive Logic		Negative Logic	
	Forward	Reverse	Forward	Reverse
CW CCW				
Pulse Sign				

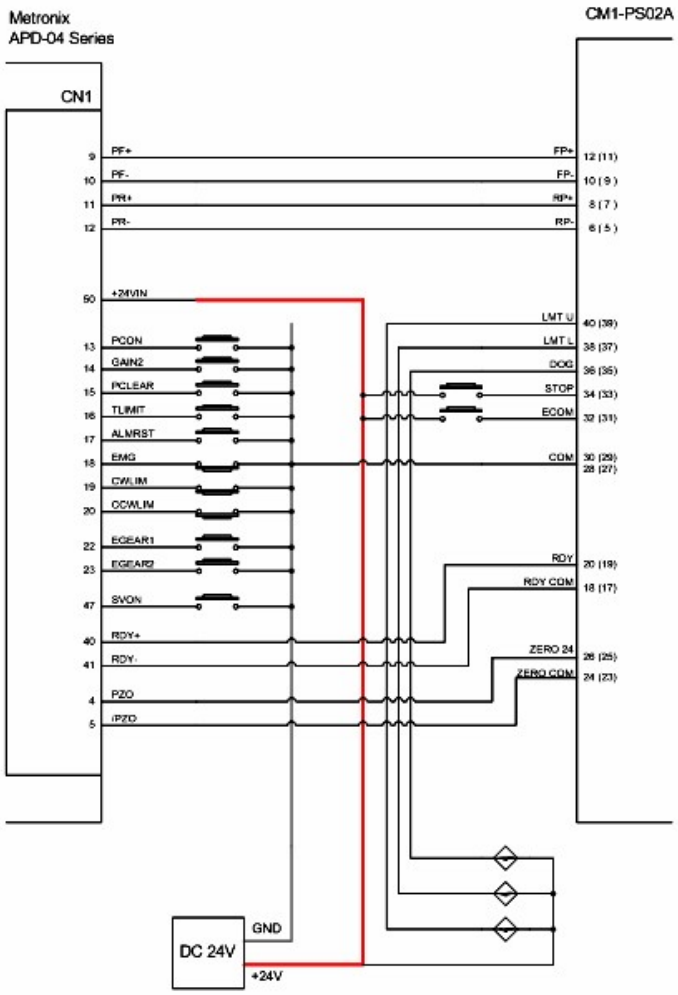
Wiring Example

Mitsubishi MR-J2S Series **LG Otis FD5000 Series**





Metronix APD-VS Series



Wiring Precaution

1) Please use after understanding the wire diagram including rated voltage and terminal arrangement.
2) The maximum distance from PSnnX to motor driver is 10m. Do not wire the device over maximum distance and use a general shielded cable.
3) The wiring together with high-voltage line or power line may cause malfunction or breakdown due to induction jam.
   Design the wiring 100mm or more away from a high voltage line or a power line not to receive the influence by the variation of noise or magnetic field.
4) Class 2, adjacent to voltage rating (30V max.).
5) Select a cable, considering ambient temperature, allowable current. Copper conductors in a size range of (3.31mm^2) to 22AWG(3.324mm^2) cable is recommended.

6) The wiring close to heat-generating device or material and directly contacted with oil for a long time may cause
short circuit or breakdown or malfunction. In case of the installation environment with a lot of vibration, prevent a PLC
from the vibration.

Precaution

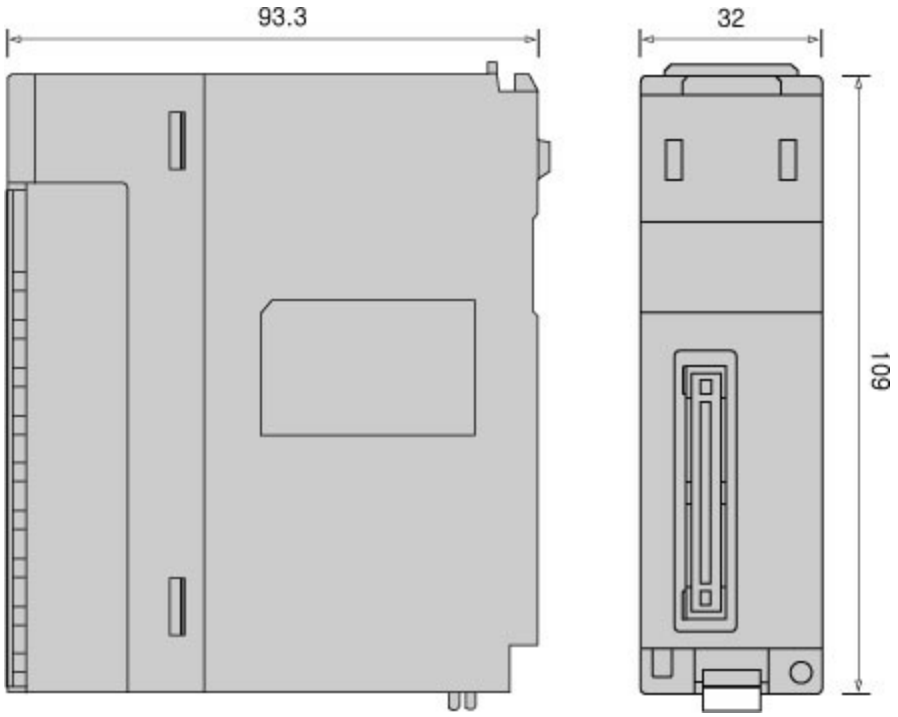
1) Use the PLC in an environment that meets the general specifications given in the User's Manual of the PSnnX module
being used.

2) Do not dismount or disassemble a module.

3) Do not touch in the status that the power source is supplied. (It is prohibited to mount and dismount module.
Take care that dregs are not put into a module case.

Dimension

(Unit : mm)



3.17 CIMON-PLC High Speed Convertrs

Modules :

- CM1-HS02B

- CM1-HS02D

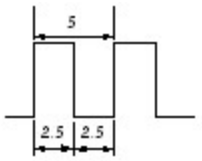
Contents :

GENERAL SPECIFICATIONS

<table>
<tr><th>Item</th><th colspan="5">Specification</th><th>Reference</th></tr>
<tr><td>Op.Temp.</td><td colspan="5">Operating Temperature -10 ~65 ℃</td><td></td></tr>
<tr><td>St.Temp</td><td colspan="5">Storage Temperature □□-25 ~□□80 ℃</td><td></td></tr>
<tr><td>Op.Hum</td><td colspan="5">Operating Humidity 5 ~95%RH, Not Condensed</td><td></td></tr>
<tr><td>St.Hum</td><td colspan="5">Storage Humidity 5 ~95%RH, Not Condensed</td><td></td></tr>
<tr><td rowspan="10">Vibration</td><td colspan="4">In case of intermittent vibration</td><td>-</td><td></td></tr>
<tr><td>Frequency</td><td>Acceleration</td><td>Amplitude</td><td>Sweep</td><td rowspan="9">IEC61131-2</td></tr>
<tr><td>10=□f=□□ 57Hz</td><td></td><td>0.075mm</td><td rowspan="8">10 times in X,Y,Z</td></tr>
<tr><td>57=□□f=□□ 150Hz</td><td>9.8m/s²{1G}</td><td>-</td></tr>
<tr><td colspan="3">In case of continuous vibration</td></tr>
<tr><td>Frequency</td><td>Acceleration</td><td>Amplitude</td></tr>
<tr><td>10=□□f =□□57Hz</td><td></td><td>0.035mm</td></tr>
<tr><td>57=□□f= 150Hz</td><td>4.8m/s²{0.5G}</td><td></td></tr>
<tr><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td></td></tr>
<tr><td>Shock</td><td colspan="5">□□Max. shock Acc. :147 m/s{15G}
□□Time :11㎳
□□Pulse wave: Half sine wave pulse(3 times in X,Y,Z)</td><td>IEC61131-2</td></tr>
</table>

Noise	Square wave impulse noise	2,000 V			KDT Standard
	Electro-static discharge	Voltage :4kV (Contact discharge)			IEC61131-2 IEC1000-4-2
	Radiated electro-magnetic field	27 ~500 MHz,10 V/m			IEC61131-2 IEC1000-4-3
	Fast transient bust noise	Power Module	Digital I/O (24V or more)	Digital I/O (Less than 24V) Analog I/Ocomm.. Interface	IEC61131-2 IEC1000-4-4
		2kV	1kV	0.25kV	
Environ..	No corrosive gas and no dust				
Altitude	2,000m or less				
Pollution	2 or less				
Cooling	Natural Air Cooling				

MODULE SPECIFICATIONS

Item \ Model		CM1-HS02B	CM1-HS02D
No.of I/O Points		16 Points	
No. of Channels		2 Channels	
Counter Input Signal	Phase	1-p Input/ 2-p Input	Line Drive Input
	Signal Level (ϕ A,ϕ B)	5/12/24 V DC 2~5mA	RS-422A(Line Drive)
Counting	Counting Rate	200 kPPS	
	Counting Range	32-bit signed binary values (-2147483648~2147483647)	
	Form	Up/Down Presetting Counting + Ring Counting	
	Min. Interval of Counting Pulse(uS) (Duty ratio 50%)		
Coincidence Output	Range of Comparison	32-bit signed binary values	
	Comparison	Set Value < Counted Value Set Value = Counted Value Set Value > Counted Value	
Outer Input	Presetting	5/12/24 V DC 2~5mA	

	Starting Function	
Outer Output	Coincidence Output	Transistor (Sink Type) Output Operating Voltage 12 ~ 24V

FEATURES AND OPERATION

1) Pulses in wide range can be counted. (-2147483648 ~ 2147483647) Counted values are stored in a buffer memory in signed 32-bit
binary value.

2) Pulse input type can be selected.
1-p input 1-m, 1-p input 1-m (Counting down by S/W), 1-p input 2-m, 1-p input 2-m (Counting down by S/W),
CW/CCW, 2-p input 1-m, 2-p input 2-m, 2-p input 4-m

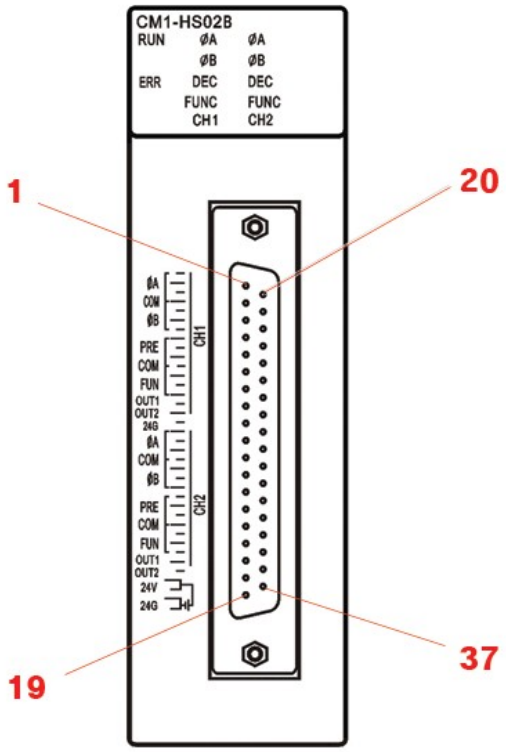
3) Counting form can be selected.
- Linear counting
Input pulses can be counted from -2147483648 to 2147483647. In case that a value is out of the range, overflow occurs.
- Ring counting
Input pulses are counted repeatedly between the max. value and the min. value of ring counting.

4) Coincidence output is available.(2 points/channel)
Comparing a current value with a set coincidence comparison value, the output can be on/off.

5) Four counting functions can be selected.
- Latch counting
- Sampling counting
- Periodic pulse counting
- Disabling to count

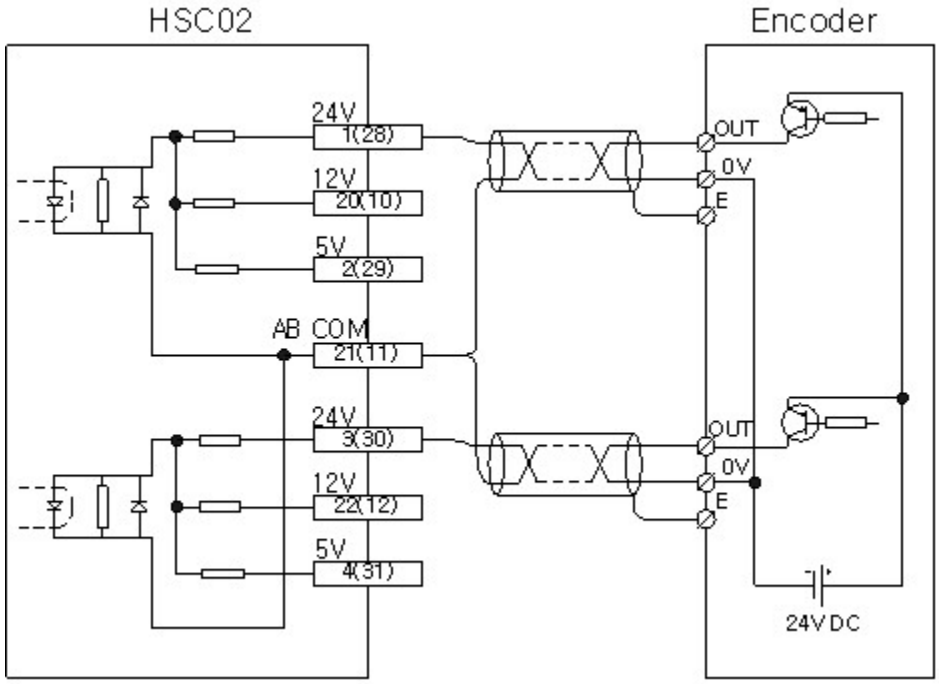
6) Presetting and counting function can be processed by outer control signals.

FRONT VIEW

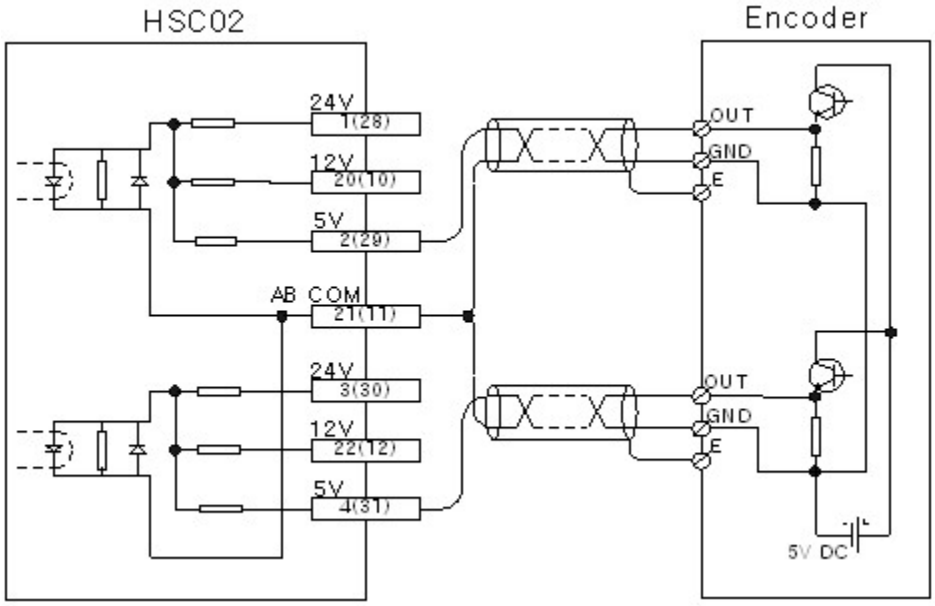


EXAMPLES OF WIRING

1) In case That an encoder is open collector output type (PNP)



2) In case that an encoder is voltage output type



SAFETY PRECAUTIONS

1) Use a cable for outside input signal of HSC converter module differently from a cable for AC to prevent the influence of surge
or induction noise occurring from AC.
2) Select a cable, considering ambient temperature, allowable current. 18AWG(0.823)~26AWG(0.405) or more cable is recommended.

3) The wiring close to heat-generating device or material and directly contacted with oil for long time may cause short circuit or breakdown
or malfunction. In case of the installation environment with a lot of vibration, prevent a PLC from the vibration.

4) The wiring together with high-voltage line or power line may cause malfunction or breakdown due to induction jam. Design the wring
100mm or more away from a high voltage line or a power line not to receive the influence by the variation of noise or magnetic field.

I/O SIGNALS

Signal Direction(CPU← HSC)			Signal Direction(CPU→ HSC)		
In	Signal Name		Out	Signal Name	
X0	CH1	DPRAM ACK Signal	Y0	CH1	Requesting to Reset Coincidence Signal 1
X1		Counted Value Greater 1	Y1		Requesting to Preset
X2		Counted Value Coincident 1	Y2		Enabling Coincidence Output
X3		Counted Value Less 1	Y3		DRRAM REQUEST
X4		Detecting Request for Outer Presetting	Y4		Enabling to Count
X5		Counted Value Greater 2	Y5		Requesting to Reset Detecting Outer Presetting
X6		Counted Value Coincident 2	Y6		Requesting to Start to Count
X7		Counted Value Less 2	Y7		Requesting to Reset Coincidence Signal 2
X8	CH2	Counted Value Greater 1	Y8	CH2	Requesting to Reset Coincidence Signal 1
X9		Counted Value Coincident 1	Y9		Requesting to Preset
XA		Counted Value Less 1	YA		Enabling Coincidence Output
XB		Detecting Request for Outer Presetting	YB		DRRAM REQUEST
XC		Counted value Greater 2	YC		Enabling to Count
XD		Counted Value Coincident 2	YD		Requesting to Reset Detecting Outer Presetting
XE		Counted Value Less 2	YE		Requesting to Start to Count
XF		DPRAM ACK Signal	YF		Requesting to Reset Coincidence Signal 2

USER PROGRAM DATA DEVICES

Address	Set Value	Initial Value	R/W

CH1		CH2					
He	De	He	De				
0H	0	20H	32	Currently Counted Value (Signed 32-bit)	L	0	R
1H	1	21H	33		H		
2H	2	22H	34	Flag Indicating Overflow Detected (If overflow in linea counting, 1)		0	R
3H	3	23H	35	Flag Indicating Sampling-counted or Periodic-pulse-counted		0	R
4H	4	24H	36	Latch-counted Value	L	0	R
5H	5	25H	37		H		
6H	6	26H	38	Sampling-counted Value	L	0	R
7H	7	27H	39		H		
8H	8	28H	40	Previous Periodic-pulse-counted Value	L	0	R
9H	9	29H	41		H		
AH	10	2AH	42	Current Periodic-pulse-counted Value	L	0	R
BH	11	2BH	43		H		
CH	12	2CH	44	Not Use		-	-
DH	13	2DH	45				
EH	14	2EH	46				
FH	15	2FH	47				
10H	16	30H	48	Preset Value (Signed 32-bit)	L	0	R/W
11H	17	31H	49		H		
12H	18	32H	50	Set Coincidence Comparison Value 1 (Signed 32-bit)	L	0	R/W
13H	19	33H	51		H		
14H	20	34H	52	Set Coincidence Comparison Value 2 (Signed 32-bit)	L	0	R/W
15H	21	35H	53		H		
16 H	22	36H	54	Set Lowest Limit Value of Ring Counting (Signed 32-bit)	L	0	R/W
17 H	23	37H	55		H		
18 H	24	38H	56	Set Upper Limit Value of Ring Counting (signed 32-bit)	L	0	R/W
19 H	25	39H	57		H		
1A H	26	3AH	58	Counting Function Setup (0:Disable 1:Latch 2:Sampling 3:Periodic-pulse)		0	R/W
1B H	27	3BH	59	Sampling/Periodic Time		0	R/W
1C H	28	3CH	60	Counting Mode (0:Linear 1:Ring)		0	R/W
1D H	29	3DH	61	Pulse Input Method (0:1-p 1-m 1:1-p 1-m (Counting down By S/W) 2:1-p 2-m 3:1-p 2-m (Counting down By S/W) 4:CW/CCW 5:2-p 1-m 6:2-p 2-m 7:2-p 4-m)		7	R/W
1E H	30	3EH	62	Counting down by S/W		0	R/W
1F H	31	3FH	63	Not Use		-	-

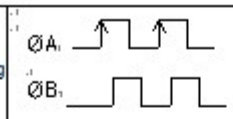
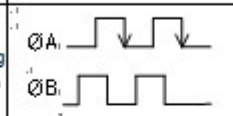
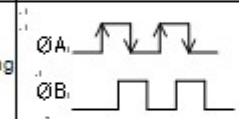
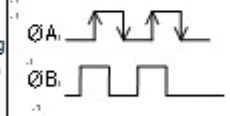
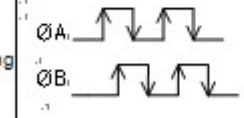
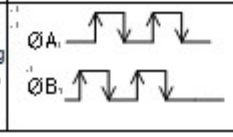
INPUT TERMINAL

	Signal	Terminal Pin No.		Signal	Terminal Pin No.
CH1	Phase A Pulse Input 24V	1	CH2	Phase A Pulse Input 24V	28
	Phase A Pulse Input 12V	20		Phase A Pulse Input 12V	10
	Phase A Pulse Input 5V	2		Phase A Pulse Input 5V	29
	AB common	21		AB common	11
	Phase B Pulse Input 24V	3		Phase B Pulse Input 24V	30
	Phase B Pulse Input 12V	22		Phase B Pulse Input 12V	12
	Phase B Pulse Input 5V	4		Phase B Pulse Input 5V	31
	Presetting Input 24V	23		Presetting Input 24V	13
	Presetting Input 12V	5		Presetting Input 12V	32
	Presetting Input 5V	24		Presetting Input 5V	14
	Presetting, Starting Function . Input Common	6		Presetting, Starting Function . Input Common	33
	Start Function Input 24V	25		Start Function Input 24V	15
	Start Function Input 12V	7		Start Function Input 12V	34
	Start Function Input 5V	26		Start Function Input 5V	16
	Coincidence Output 1	8		Coincidence Output 1	35
	Coincidence Output 2	27		Coincidence Output 2	17
Power Input	0V		Power Input	24V	36,18
				0V	37,19

PULSE INPUT TYPES

Pulse Input Method		Count Timing	
1-p 1-m	Counting	ØA ØB Y08(Y0B)	Counts at the rising edges of ØA. ØB and Y03(Y0B) are OFF.
	Counting Down	ØA ØB Y08(Y0B)	Counts at the falling edges of ØA. ØB and Y03(Y0B) are ON.
1-p 2-m	Counting	ØA ØB Y08(Y0B)	Counts at the rising and falling edges of ØA. ØB and Y03(Y0B) are OFF.
	Counting Down	ØA ØB Y08(Y0B)	Counts at the rising and falling edges of ØA. ØB and Y03(Y0B) are ON.
CW/CCW	Counting	ØA ØB	Counts at the rising edges of ØA. ØB is OFF.
	Counting Down	ØA ØB	ØA is OFF. Counts at the rising edges of ØB.

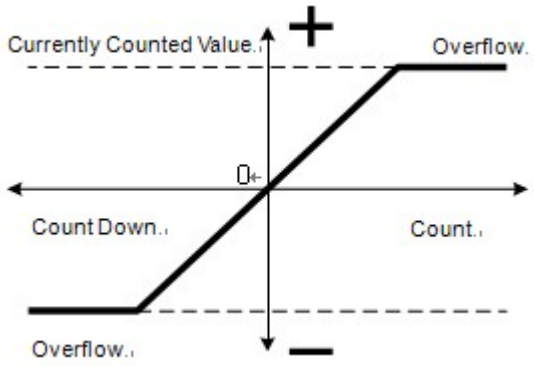
PULSE INPUT TYPES

Pulse Input Method	Count Timing		
2-p 1-m	Counting		If ØB is off, counts at the rising edges of ØA.
	Counting Down		If ØB is off, counts at the falling edges of ØA.
2-p 2-m	Counting		If ØB is off, counts at the rising edges of ØA. If ØB is on, counts at the falling edges of ØA.
	Counting Down		If ØB is on, counts at the rising edges of ØA. If ØB is off, counts at the falling edges of ØA.
2-p 4-m	Counting		If ØB is off, counts at the rising edges of ØA. If ØB is on, counts at the falling edges of ØA. If ØA is on, counts at the rising edges of ØB. If ØA is off, counts at the falling edges of ØB.
	Counting Down		If ØB is on, counts at the rising edges of ØA. If ØB is off, counts at the falling edges of ØA. If ØA is off, counts at the rising edges of ØB. If ØA is on, counts at the falling edges of ØB.

COUNTING FORMS

- Linear Counting

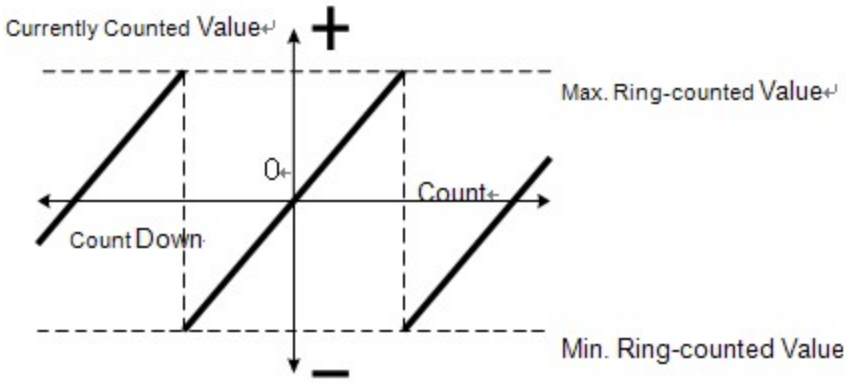
  Input pulses are counted in the range from -2147483648 to 2147483647



- Ring Counting

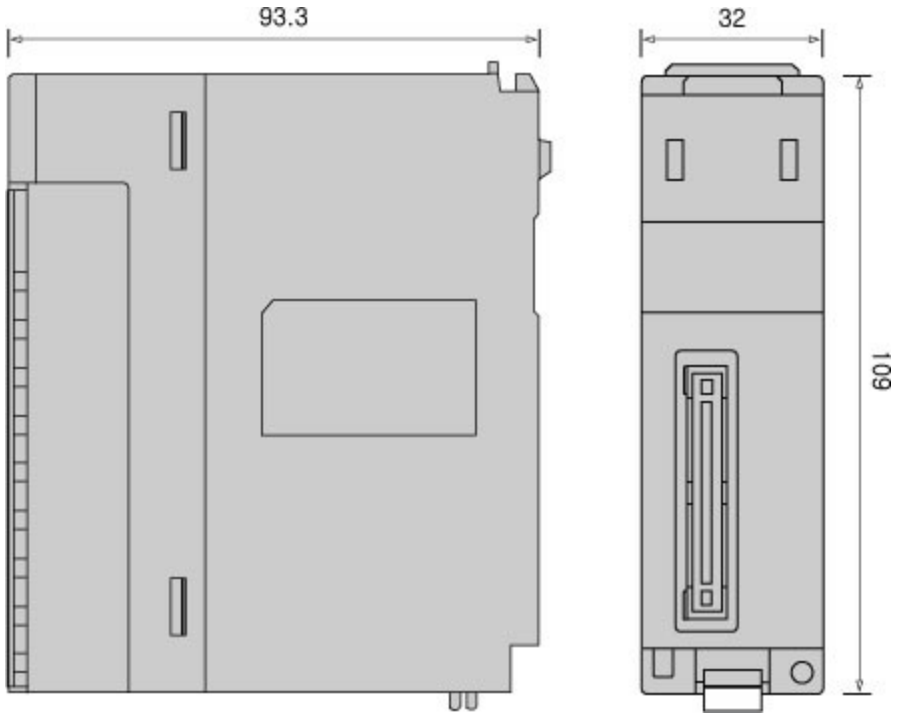
  Input pulses are counted repeatedly between the min. value and the max. value. Overflow error

does not occur.



DIMENSIONS

(Unit : mm)



3.18 CIMON-PLC Loadcell Module

Modules :

- CM1-WG02A
- CM1-WG04A

Contents :

GENERAL SPECIFICATIONS

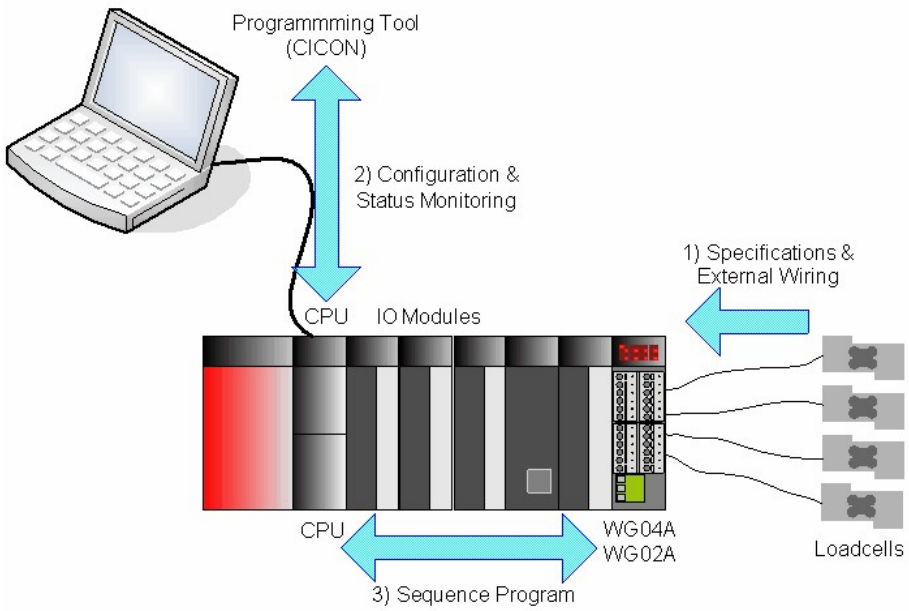
Item	Specification				Reference
Op.Temp.	Operating Temperature -10 ~65 ℃				
St.Temp	Storage Temperature □□-25 ~□□80 ℃				
Op.Hum	Operating Humidity 5 ~95%RH, Not Condensed				
St.Hum	Storage Humidity 5 ~95%RH, Not Condensed				
Vibration	In case of intermittent vibration			-	
	Frequency	Acceleration	Amplitude	Sweep	IEC61131-2
	10=□f=□□ 57Hz		0.075mm	10 times in X,Y,Z	
	57=□□f=□□ 150Hz	9.8m/s²{1G}	-		
	In case of continuous vibration				
	Frequency	Acceleration	Amplitude		
	10=□□f =□□57Hz		0.035mm		

	57=☐☐f= 150Hz	4.8m/s²{0.5G}			
Shock	☐☐Max. shock Acc. :147 m/s{15G} ☐☐Time :11㎳ ☐☐Pulse wave: Half sine wave pulse(3 times in X,Y,Z)				IEC61131-2
Noise	Square wave impulse noise	2,000 V			KDT Standard
	Electro-static discharge	Voltage :4kV (Contact discharge)			IEC61131-2 IEC1000-4-2
	Radiated electro-magnetic field	27 ~500 MHz,10 V/m			IEC61131-2 IEC1000-4-3
	Fast transient bust noise	Power Module	Digital I/O (24V or more)	Digital I/O (Less than 24V) Analog I/Ocomm.. Interface	IEC61131-2 IEC1000-4-4
		2kV	1kV	0.25kV	
Environ..	No corrosive gas and no dust				
Altitude	2,000m or less				
Pollution	2 or less				
Cooling	Natural Air Cooling				

MODULE SPECIFICATIONS

Item	Specification	
	WG02A	WG04A
Input Channel	2 Channel	4 Channel
Load Cell Type	Strain Gage	
Insulation Method	Photo-Coupler	
External Power Supply	DC24V, 2Watts	
Load Cell Excitation Voltage	DC5V ±5% (Up to 4x350ΩLoadcells / Channel)	
Full Scale Input Signal	3.6mV/V	
A/D Conversion Method	Sigma Delta	
A/D Converter Resolution	24 bits (1/1,600,000,000)	
A/D Program Resolution	1/6,000,000	
Weigh value resolution	1/10,000 (Max.)	
A/D Conversion Speed	20 times/sec	10 times/sec

Feature and Operation

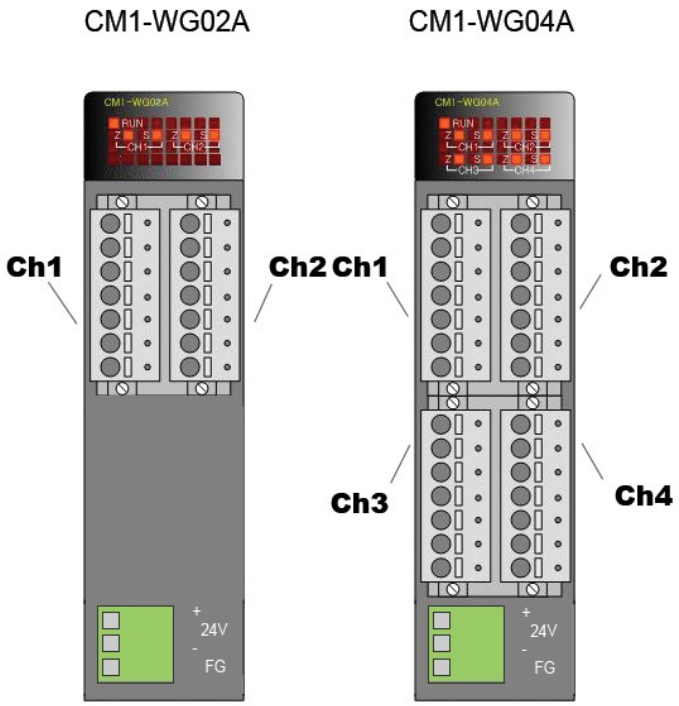


WG02A and WG04A modules provide the functionality for weighing system. These modules can be connected with various kinds
of loadcell units. WG04A can be connected with up to 4 independent loadcell signals at the same time.

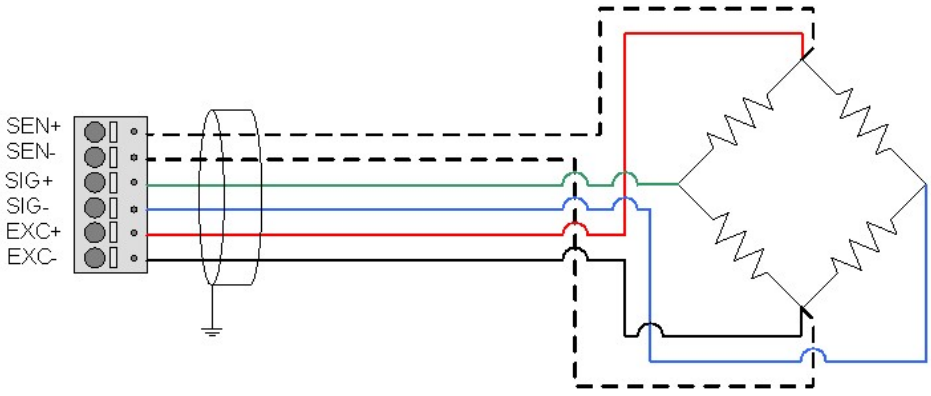
Weighing modules have following characteristics. :

1) Max. 4 Channels of independent signal inputs. (WG04A)
2) Supplies 5Vdc power to the connected loadcells for generating input signals.
3) 24 bits A/D converter
4) Provides 1 / 6,000,000 effective resolution.
5) Provides 6 internal ready to use batch programs.

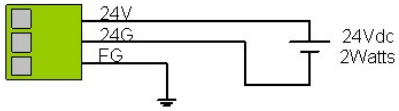
Weighing Module



Wiring



All 4 channels have the same pin-out that of above diagram. If 4-wire type loadcell is used, just leave the SEN+ and SEN- pin as opened.



WG0nA module needs the external power supply. The power module should have the capacity of

2 Watts or more,
and be separated with other power.

- USE COPPER OR COPPER-CLAD ALUMINUM CONDUTORS
-"Class 2, adjacent to voltage rating (30 V max.)? "

Internal I/O Table

Input Signal		Output Signal	
Point	Description	Point	Description
X00	Module Ready	Y00	
X01		Y01	
X02	Ch1 Command Ack	Y02	Ch1 Command
X03	Ch2 Command Ack	Y03	Ch2 Command
X04	Ch3 Command Ack	Y04	Ch3 Command
X05	Ch4 Command Ack	Y05	Ch4 Command
X06	Ch1 Batch Running	Y06	Ch1 Zero Command
X07	Ch2 Batch Running	Y07	Ch2 Zero Command
X08	Ch3 Batch Running	Y08	Ch3 Zero Command
X09	Ch4 Batch Running	Y09	Ch4 Zero Command
X0A	Ch1 Error	Y0A	Ch1 Tare Command
X0B	Ch2 Error	Y0B	Ch2 Tare Command
X0C	Ch3 Error	Y0C	Ch3 Tare Command
X0D	Ch4 Error	Y0D	Ch4 Tare Command
X0E		Y0E	
X0F		Y0F	

User Program Memory Devices(1)

OFFSET				Description		
Ch 1	Ch 2	Ch 3	Ch 4			
0	15	30	45	Measured weight (low word)		R
1	16	31	46	Measured weight (high word)		R
2	17	32	47	Status flags (bit mapped)		R
3	18	33	48	Control outputs (bitmapped)		R
4	19	34	49	-		-
5	20	35	50	Gross weight (Zero applied, low word)		R
6	21	36	51	Gross weight (Zero applied, high word)		R
7	22	37	52	Command main code		R/W

8	23	38	53	Command sub code (low word)		R/W
9	24	39	54	Command sub code (high word)		R/W
10	25	40	55	Net weight (Tare applied, low word)		R
11	26	41	56	Net weight (Tare applied, high word)		R
12	27	42	57	AD Data (raw value, low word)		R
13	28	43	58	AD Data (raw value, high word)		R
14	29	44	59	Error Code		R

User Program Memory Devices(2)

OFFSET				Description		
Ch 1	Ch 2	Ch 3	Ch 4			
70	116	162	208	Weighing Mode	0 ~ 6	R/W
71	117	163	209	-	-	-
72	118	164	210	Max. weight (low word)		R/W
73	119	165	211	Max. weight (high word)		
74	120	166	212	Zero range	0~65535	R/W
75	121	167	213	Motion detect range	0~65535	R/W
76	122	168	214	Motion detect time (100ms)	0~65535 (100mS)	R/W
77	123	169	215	Auto zero range	0~65535	R/W
78	124	170	216	Auto zero time period	0~65535 (100mS)	R/W
79	125	171	217	Hysteresis range	0~65535 (100mS)	R/W
80	126	172	218	Hysteresis time limit	0~65535 (100mS)	R/W
81	127	173	219	Avr. Window size	3~13	R/W

User Program Memory Devices(3)

OFFSET				Description		
Ch 1	Ch 2	Ch 3	Ch 4			
82	128	174	220	Digital filter constant	0~90%	R/W
83	129	175	221	Systems used area		R
84	130	176	222	Systems used area		R

85	131	177	223	Systems used area		R
86	132	178	224	Systems used area		R
87	133	179	225	Systems used area		R
88	134	180	226	Systems used area		R
89	135	181	227	Reserved		
90	136	182	228	Reserved		
91	137	183	229	Reserved		
92	138	184	230	Reserved		
93	139	185	231	Reserved		
94	140	186	232	Reserved		
95	141	187	233	Reserved		
96	142	188	234	Min. hopper weight (low word)	Max. Weight	R/W
97	143	189	235	Min. hopper weight (high word)		

User Program Memory Devices(4)

OFFSET				내 용		
Ch1	Ch2	Ch3	Ch4			
98	144	190	236	Dribble weight, high set point or set point # 1 (low word)	Max. Weight	R/W
99	145	191	237	Dribble weight, high set point or set point # 1 (high word)		
100	146	192	238	Full flow weight, low set point or set point # 2 (low word)	Max. Weight	R/W
101	147	193	239	Full flow weight, low set point or set point # 2 (high word)		
102	148	194	240	Over weight, High-High set point or set point #3 (low word)	Max. Weight	R/W
103	149	195	241	Over weight, High-High set point or set point #3 (high word)		
104	150	196	242	Under weight, Low-Low set point or set point #4 (low word)	Max. Weight	R/W
105	151	197	243	Under weight, Low-Low set point or set point #4 (high word)		

User Program Memory Devices(5)

OFFSET				내 용		
Ch 1	Ch 2	Ch 3	Ch 4			
106	152	198	244	Comparator inhibit time after full flow stop or set	0~65535	R/W

				point #5 (low word)	(100mS)	
107	153	199	245	Comparator inhibit time after full flow stop or set point #5 (high word)	0~65535 (100mS)	R/W
108	154	200	246	Gate open time for compensation or set point #6 (low word)	0~65535 (100mS)	R/W
109	155	201	247	Gate closing time for compensation or set point #6 (high word)	0~65535 (100mS)	R/W
110	156	202	248	Target weight for compensation or set point #7 (low word)	Max. Weight	R/W
111	157	203	249	Target weight for compensation or set point #7 (high word)		
112	158	204	250	Batch complete delay	0~65535 (100mS)	R/W
113	159	205	251	Batch limit time	0~65535 (100mS)	R/W
114	160	206	252	Max. hopper weight (low word)	Max. Weight	R/W
115	161	207	253	Max. hopper weight (high word)		

Error Code(1)

Code	Error	Description
0000	No error	
0001	No sensor	Check the loadcell cable and its connection
0002	Batch time out	Batch control is not complete within the period of setting (offset 113, 159, 205, 251)
0003	Unstable at zero operation	Zero operation(Y6/7/8/9) is issued at unstable state. Zero operation can be re-issued with this error.
0004	Unstable at tare operation	Tare operation(YA/B/C/D) is issued at unstable state. Tare operation can be re-issued with this error.
0005	NO External power supply	Check the external 24Vdc power supply.
0010	Unknown command	Check the version of WG0nA and CPU module.
0011	Parameter error on instruction	Check the parameter of WGBATCH instruction in sequence program.
Error codes which can be occurred on storing the basic parameters with command code 9.		
0020	Invalid weighing mode	The code of weighing mode must be within the range of 0 to 6.
0021	Invalid near zero range	When the configured value is larger than the maximum weight.
0022	Invalid stable range	When the configured value is larger than the maximum weight.
0023	Invalid auto zero range	When the configured value is larger than the maximum weight.

0024	Invalid hysteresis	When the configured value is larger than the maximum weight
0025	Invalid average window size	When the configured value is larger than 15.
0026	Invalid filter constant	When the configured value is larger than 90.

Error Code(2)

Code	Error codes which can be occurred on storing the basic parameters with command code 9.	
-	Batch Mode	Error
0030	Auto. Loss in Weight batch User controlled Loss in Weight Batch	Invalid 'Min. hopper weight'
0031	Auto. Normal Batch Auto. Loss in Weight Batch User Controlled Normal Batch User Controlled Loss in Weight Batch	Invalid 'dribble flow weight'
	Comparator	Invalid 'high' weight
	Weight Sorting	Invalid 'set point #1'
0032	Auto. Normal Batch Auto. Loss in Weight Batch User Controlled Normal Batch User Controlled Loss in Weight Batch	Invalid 'full flow weight'
	Comparator	Invalid 'low' weight
	Weight Sorting	Invalid 'set point #2'
0033	Auto. Normal Batch Auto. Loss in Weight Batch User Controlled Normal Batch User Controlled Loss in Weight Batch	Invalid 'over weight'
	Comparator	Invalid 'high-high weight'
	Weight Sorting	Invalid 'set point #3'
0034	Auto. Normal Batch Auto. Loss in Weight Batch User Controlled Normal Batch User Controlled Loss in Weight Batch	Invalid 'under weight'
	Comparator	Invalid 'low-low weight'
	Weight Sorting	Invalid 'set point #4'
0035	Weight Sorting	Invalid 'set point #5'
0036	Weight Sorting	Invalid 'set point #6'
0037	Auto. Normal Batch Auto. Loss in Weight Batch	Invalid 'target weight'
	Weight Sorting	Invalid 'set point #7'
0038	Auto. Loss in Weight Batch User Controlled Loss in Weight Batch	Invalid 'Max. hopper weight'

3.19 CIMON-PLC RTD Converters Module

Modules :

- CM1-RD04A, B
- CM1-RD08A, B

Contents :

GENERAL SPECIFICATIONS

Item	Specification				Reference
Op.Temp.	Operating Temperature -10 ~65 ℃				
St.Temp	Storage Temperature □□-25 ~□□80 ℃				
Op.Hum	Operating Humidity 5 ~95%RH, Not Condensed				
St.Hum	Storage Humidity 5 ~95%RH, Not Condensed				
Vibration	In case of intermittent vibration			-	IEC61131-2
	Frequency	Acceleration	Amplitude	Sweep	
	10=□f=□□ 57Hz		0.075mm	10 times in X,Y,Z	
	57=□□f=□□ 150Hz	9.8m/s²{1G}	-		
	In case of continuous vibration				
	Frequency	Acceleration	Amplitude		

	10=□□f =□□57Hz		0.035mm		
	57=□□f= 150Hz	4.8m/s²{0.5G}			
Shock	□□Max. shock Acc. :147 m/s{15G} □□Time :11㎳ □□Pulse wave: Half sine wave pulse(3 times in X,Y,Z)				IEC61131-2
Noise	Square wave impulse noise	2,000 V			KDT Standard
	Electro-static discharge	Voltage :4kV (Contact discharge)			IEC61131-2 IEC1000-4-2
	Radiated electro-magnetic field	27 ~500 MHz,10 V/m			IEC61131-2 IEC1000-4-3
	Fast transient bust noise	Power Module	Digital I/O (24V or more)	Digital I/O (Less than 24V) Analog I/Ocomm.. Interface	IEC61131-2 IEC1000-4-4
		2kV	1kV	0.25kV	
Environ..	No corrosive gas and no dust				
Altitude	2,000m or less				
Pollution	2 or less				
Cooling	Natural Air Cooling				

MODULE SPECIFICATIONS

	CM1-RD04A , RD08A	CM1-RD04B, RD08B
Available RTD	Pt100 (JIS C1640-1989, DIN 43760-1980) JPt100 (KS C1603-1991, JIS C1604-1981)	Pt1000 (DIN EN 60751)
Range of Temperature Input	Pt100 : -200.0°C to 600°C (18.48 to 313.59Ω) JPt100 : -200.0°C to 600°C (17.14 to 317.28Ω)	Pt1000 : -200.0°C to 600°C (18.48 to 313.59Ω)
Digital Output	Digitally converted value : 0 ~16,000(-8000~8000) Detected temperature value : -2000~6000 (First decimal place value X 10 times)	
Detecting the breaking of wires	3 wires by channels available	
Accuracy	±0.1 %([Full scale]	
Max. Conversion Rate	50ms / 1ch.	
Number of Temperature Inputs	4 ch. / 1 module	
Insulation	Between input terminal and PLC: Photo-Coupler Between output channels: No	

Contact terminal		18-point Terminal Block
No. of Occupied Points		16 Points
Internal Current (mA)	+5V	50
	+15V	30
	15V	10

FEATURES AND OPERATION

1) The temperature converted by a platinum resistance temperature detector of Pt100 or Jpt100 or Pt1000 can be displayed in ℃ or ℉
and the temperature values can be processed as digital values up to the first decimal place.

2) The converted temperature data are converted to 16-bit binary data, which can be processed as digital values.
The temperature in the range from -200℃ to 600℃ are converted to the values from 0 to 16000(-8000~8000).

3) The range of temperature is from –250℃ to 650℃ and the range of digital value is from –192 to 16191.

4) If a min. temperature value and a max. temperature value are set up, the min. value will be converted to 0(-8000) and
the max. value is 16000(8000).

5) The breaking of resistance temperature detectors and cables, and the excess of measuring range are detected by channels.

6) It is available to connect four points of a Pt100 or a JPt100 or a Pt1000 to a one module.

7) The number of modules used on one base is not limited.

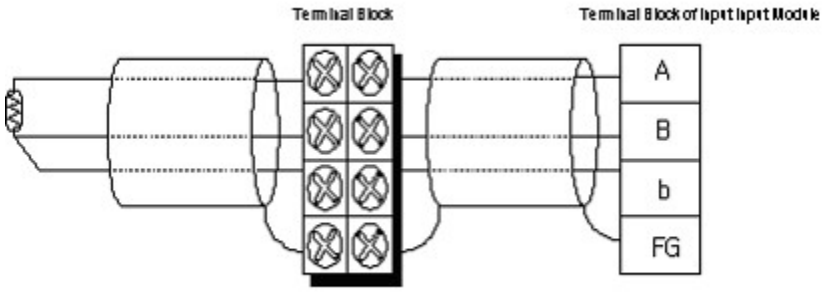
8) LED is lighted in case of normal status and blinks at the intervals of 0.3 second in case of error.

WRING

Measures values are inputted to all the channels grouped as Terminal 1-2-3, 5-6-7, 9-10-11 and 13-14-15..

CH	Terminal A	Terminal B	Terminal b	Terminal FG
Ch 1	Terminal 1	Terminal 2	Terminal 3	Terminal 18
Ch 2	Terminal 5	Terminal 6	Terminal 7	Terminal 18
Ch 3	Terminal 9	Terminal 10	Terminal 11	Terminal 18
Ch 4	Terminal 13	Terminal 14	Terminal 15	Terminal 18

Wiring Method



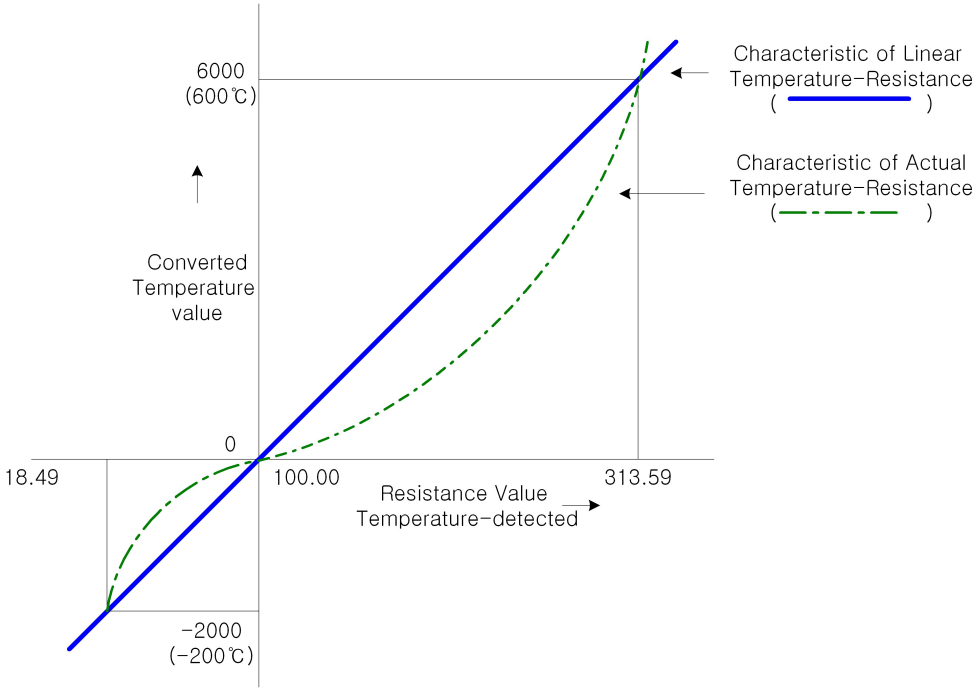
※ Connect the shields of a RTD and a wire to the FG of a RTD input module. The difference between the values of the wire
is to be 1Ω or less.

CHARACTERISTICS OF RTD CONVERSION

1) Pt100 or jPt100 has the resistance of 100Ω at 0℃ and the resistance value is varied according to temperature variation.

2) CM1-RTD gets resistance values by dividing voltage and converts it to a temperature value, storing the result in memory.

3) RTD input module linearizes the resistance input of non-linear RTD as follows.



I/O SIGNALS

Signal Direction (CPU ← RTD)		Signal Direction (CPU → RTD)	
Input	Signal Name	Output	Signal Name
X0	RTD Module Ready	Y0	Not use
X1	Flag Indicating RTD-converted	Y1	
X2	Flag indicating an operation condition setup	Y2	Requesting to set up an operation condition
X3	Not use	Y3	Not use
X4		Y4	
X5		Y5	
X6		Y6	
X7		Y7	
X8		Y8	
X9		Y9	
XA		YA	
XB		YB	
XC		YC	
XD		YD	
XE		YE	
XF	Flag indicating an error in RTD module	YF	Requesting to clear an error

USER PROGRAM MEMORY DEVICES

Address		Description	R/W
Hexa	Deci		
0H	0	Enabling/disabling to RTD-convert setup	R/W
1H	1	Detected temp. value of CH.1 (°C)	R
2H	2	Detected temp. value of CH.2 (°C)	R
3H	3	Detected temp. value of CH.3 (°C)	R
4H	4	Detected temp. value of CH.4 (°C)	R
5H	5	Detected temp. value of CH.5 (°C)	R
6H	6	Detected temp. value of CH.6 (°C)	R
7H	7	Detected temp. value of CH.7 (°C)	R
8H	8	Detected temp. value of CH.8 (°C)	R
9H	9	Assigning RTD type	R/W
AH	10	Not use	-
BH	11	Detected temp. value of CH.1 (°F)	R
CH	12	Detected temp. value of CH.2 (°F)	R
DH	13	Detected temp. value of CH.3 (°F)	R
EH	14	Detected temp. value of CH.4 (°F)	R
FH	15	Detected temp. value of CH.5 (°F)	R
10H	16	Detected temp. value of CH.6 (°F)	R
11H	17	Detected temp. value of CH.7 (°F)	R
12H	18	Detected temp. value of CH.8 (°F)	R
13H	19	Information on operating channels	R
14H	20	Not use	-
15H	21	Digitally converted value of CH.1	R

16H	22	Digitally converted value of CH.2	R
17H	23	Digitally converted value of CH.3	R
18H	24	Digitally converted value of CH.4	R
19H	25	Digitally converted value of CH.5	R
1AH	26	Digitally converted value of CH.6	R
1BH	27	Digitally converted value of CH.7	R
1CH	28	Digitally converted value of CH.8	R
1DH	29	Digital output setup	R/W

Address		Description	R/W
Hexa	Deci		
1EH	30	Assigning Average Process	-
1FH	31	Error code value of CH.1	R
20H	32	Error code value of CH.2	R
21H	33	Error code value of CH.3	R
22H	34	Error code value of CH.4	R
23H	35	Error code value of CH.5	R
24H	36	Error code value of CH.6	R
25H	37	Error code value of CH.7	R
26H	38	Error code value of CH.8	R
27H	39	Not use	-
28H	40		
29H	41	Max. temp. input value of CH.1	R/W
2AH	42	Max. temp. input value of CH.2	R/W
2BH	43	Max. temp. input value of CH.3	R/W
2CH	44	Max. temp. input value of CH.4	R/W
2DH	45	Max. temp. input value of CH.5	R/W
2EH	46	Max. temp. input value of CH.6	R/W
2FH	47	Max. temp. input value of CH.7	R/W
30H	48	Max. temp. input value of CH.8	R/W
31H	49	Max./Min. temp. setup data	R/W
32H	50	Error in max./min. setup	R
33H	51	Min. temp. input value of CH.1	R/W
34H	52	Min. temp. input value of CH.2	R/W
35H	53	Min. temp. input value of CH.3	R/W
36H	54	Min. temp. input value of CH.4	R/W
37H	55	Min. temp. input value of CH.5	R/W
38H	56	Min. temp. input value of CH.6	R/W
39H	57	Min. temp. input value of CH.7	R/W
3AH	58	Min. temp. input value of CH.8	R/W
3BH	59~62	Setting up average time/filter coefficient for CH1~CH4	R/W

ERROR CODES

In case that RTD or cable is broken down, or measured temperature values are greater than max. value or less than min. value, the following

error codes are stored in Buffer Memory from "31" to "38"? by channels and LED blinks at the intervals of 0.2 second.

If " Tool"? -> " Special Card Setup"? -> " RTD Card Setup"? -> " Current Status "? is selected, a dialog box displaying error code will appear.

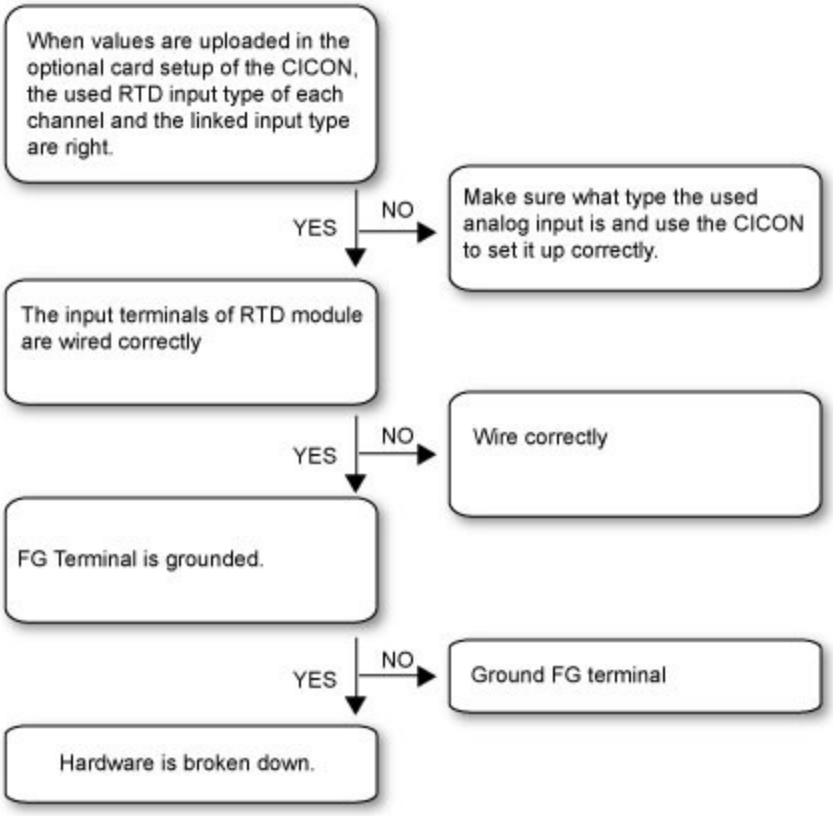
To clear an error code, select Error code reset? button in the RTD Card Status of the CICON.

△ is 0~3 for RTD modules.

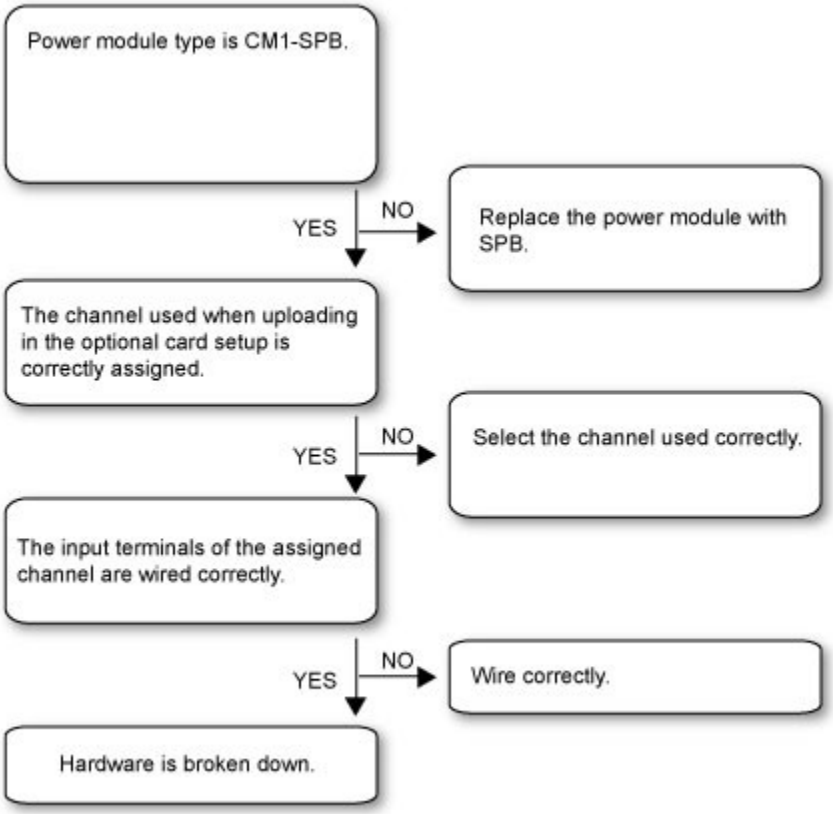
01	In case that A is broken
02	In case that B is broken
03	In case that b or both A and B are broken
04	In case that a measured temperature is over the range of max. and min. temperature.
10△	System error (A/S required)

In case of error in max. and min. temperature setup, the bit corresponding to Buffer Memory "50"? is 1 and LED blinks at the intervals of 0.2 second.

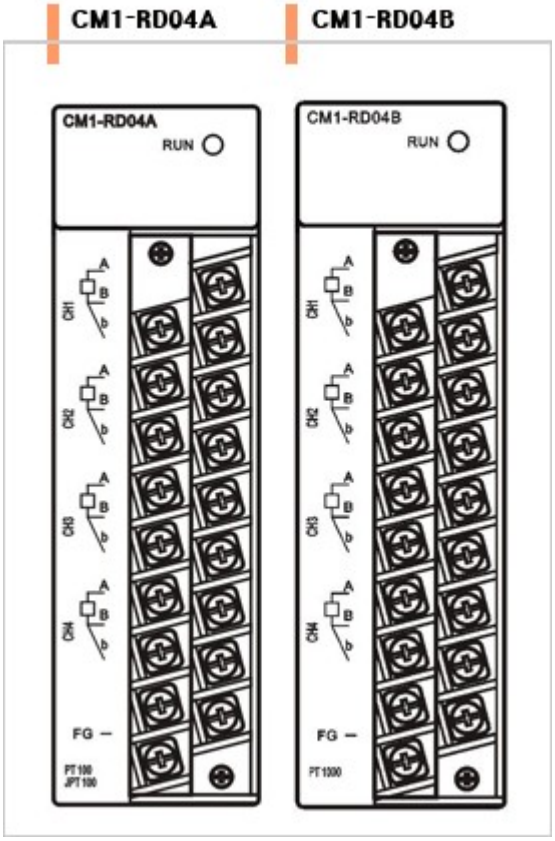
TROUBLE SHOOTING(1)



TROUBLE SHOOTING(2)



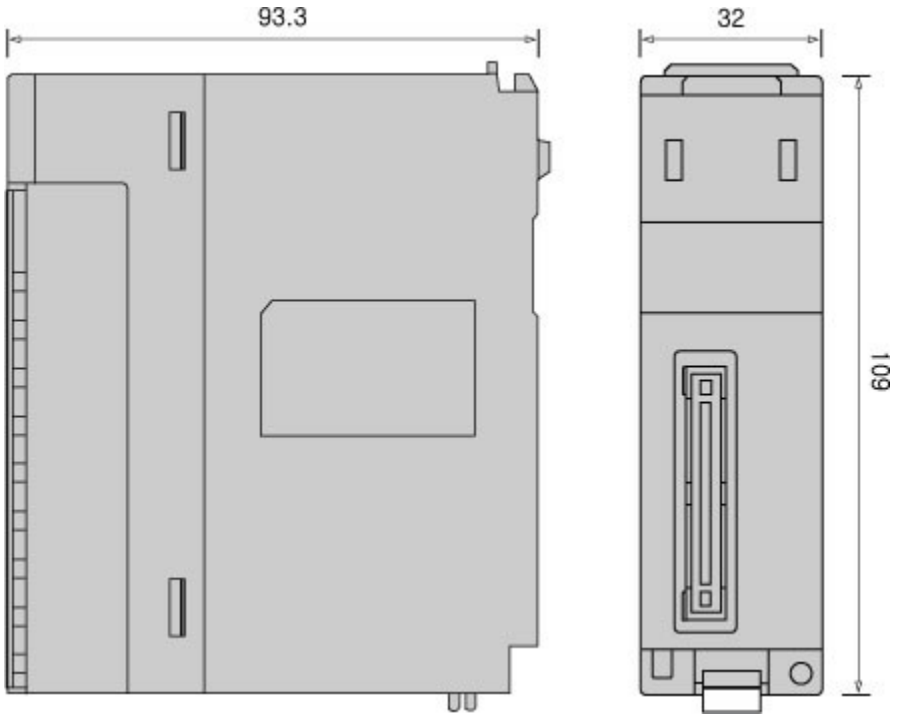
FRONT VIEW



- The tightening torque if 6.99 in. 1b
- USE COPPER OF COPPER-CLAD ALUMINUM CONDUTORS
- “Class 2, adjacent to coltage ration(30V max.)”

DIMENSIONS

(Unit : mm)



3.20 CIMON-PLC TC04A Converters Module

Modules :

- CM1-TC04A

Contents :

GENERAL SPECIFICATIONS

Item	Specification				Reference
Op.Temp.	Operating Temperature -10 ~65 ℃				
St.Temp	Storage Temperature □□-25 ~□□80 ℃				
Op.Hum	Operating Humidity 5 ~95%RH, Not Condensed				
St.Hum	Storage Humidity 5 ~95%RH, Not Condensed				
Vibration	In case of intermittent vibration			-	IEC61131-2
	Frequency	Acceleration	Amplitude	Sweep	
	10=□f=□□ 57Hz		0.075mm	10 times in X,Y,Z	
	57=□□f=□□ 150Hz	9.8m/s²{1G}	-		
	In case of continuous vibration				
	Frequency	Acceleration	Amplitude		
	10=□□f =□□57Hz		0.035mm		
	57=□□f= 150Hz	4.8m/s²{0.5G}			
Shock	□□Max. shock Acc. :147 m/s{15G} □□Time :11㎳ □□Pulse wave: Half sine wave pulse(3 times in X,Y,Z)				IEC61131-2
Noise	Square wave impulse noise	2,000 V			KDT Standard
	Electro-static discharge	Voltage :4kV (Contact discharge)			IEC61131-2 IEC1000-4-2
	Radiated electro-magnetic field	27 ~500 MHz,10 V/m			IEC61131-2 IEC1000-4-3
	Fast transient bust noise	Power Module	Digital I/O (24V or more)	Digital I/O (Less than 24V) Analog I/Ocomm.. Interface	IEC61131-2 IEC1000-4-4
		2kV	1kV	0.25kV	
Environ..	No corrosive gas and no dust				
Altitude	2,000m or less				
Pollution	2 or less				
Cooling	Natural Air Cooling				

MODULE SPECIFICATIONS

	Specification
Available	Type K, J, E, T, B, R, S ,N

Thermocouple					
Digital Output	Digitally converted value: 0 ~ 16000(-8000~8000), Converted temperature value:(Range of measured temp.X10)				
Range of Temperature	Type	Code	Range of Measured Temperature(℃)	Range of Measured Voltage(μV)	
	K	ITS-90	-200.0~1200.0	-5891~48828	
	J		-200.0~800.0	-7890~45498	
	E		-200.0~600.0	-8824~45085	
	T		-200.0~400.0	-5602~20869	
	B		400.0~1800.0	786~13585	
	R		0.0~1750.0	0~21006	
	S		0.0~1750.0	0~18612	
	N		-200.0~1250.0	-3990~43846	
RJC	Automatic				
Detecting the breaking of wires	By channels				
Accuracy	±[Full Scale]x0.3%+1°C(RJC Error)]				
Max. Converted Rate	50ms / 1 Channel				
No. of Input Channels	4 channels /module				
Insulation	Between input terminal and PLC: Photo- Couple, Between output channels: No				
Connection Termnal	18-point terminal block				
Current Consumption (mA)	+5V	60			
	+15V	30			
	-15V	10			

FEATURES AND OPERATION

1) The temperatures converted in the state that 7 kinds (K,J,E,T,R,S,B,N) of thermocouple are connected to a TC module can be indicated in
Centigrade or Fahrenheit (℃,℉) and the temperature values can be processed as digital values up to the first decimal place.

2) Converted temperature data are converted to 16-bit binary data, which can be processed as digital values. The min. value and the max.
value of each thermocouple are converted to 0 and 16000(-8000~8000).

3) Temperatures are expressed up to min. value of -50℃ and max. value of +50℃ and digital values are expressed in the
range from –192 to16191(-8192~8191).

4) If a min. temperature value and a max. temperature value are set up, the min. value will be converted to 0(-8000) and the max.
value to 16000(8000).

5) The breaking of thermocouple and cables and the excess of measuring range are detected by

channels.

6) It is available to connect 4 thermocouples with one module.

7) The number of modules used on one base is not limited.

8) Reference junction compensation by the temperature sensor mounted on a terminal is automatically performed.

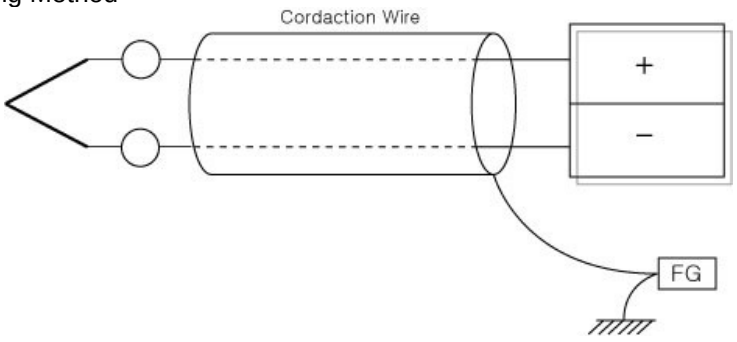
9) LED is on in case of normal status and blinks at the intervals of 0.2 second in case of error.

WRING

Measured values are inputted to all the channels grouped as Terminal 7-8, 9-10, 11-12, 13-14. Connect RJC to Terminal 1,3 and 5.

Channel	+ Terminal	- Terminal	FG Terminal
Ch 1	Terminal 7	Terminal 8	Terminal 18
Ch 2	Terminal 9	Terminal 10	Terminal 18
Ch 3	Terminal 11	Terminal 12	Terminal 18
Ch 4	Terminal 13	Terminal 14	Terminal 18

Wiring Method



※ Cable is to be used as conducting wires. Connect the shield part of a wire to FG terminal and ground it.

SAFETY PRECAUTIONS

1) Use a cable for outside input signal of D/A converter module differently from a cable for AC to prevent the influence of surge or induction

noise occurring from AC.

2) Select a cable, considering ambient temperature, allowable current. 18AWG(0.823)~26AWG

(0.405) or more cable is recommended.

3) The wiring close to heat-generating device or material and directly contacted with oil for long time may cause short circuit or

breakdown or malfunction.

4) The wiring together with high-voltage line or power line may cause malfunction or breakdown due to induction jam.

Design the wring 100mm or more away from a high voltage line or a power line not to receive the influence by the variation

of noise or magnetic field.

I/O SIGNALS

Signal Direction (CPU ← TC)		Signal Direction (CPU → TC)	
Input	Signal Name	Output	Signal Name
X0	TC Module Ready	Y0	Not use
X1	Flag indicating TC-converted	Y1	
X2	Flag indicating operation condition setup	Y2	Requesting to set up an operation condition
X3	Not use	Y3	Not use
X4		Y4	
X5		Y5	
X6		Y6	
X7		Y7	
X8		Y8	
X9		Y9	
XA		YA	
XB		YB	
XC		YC	
XD		YD	
XE		YE	
XF	Flag indicating an error in TC module	YF	Requesting to clear an error

USER PROGRAM MEMORY DEVICES

Address		Description	R/W
Hexa	Deci		
0H	0	Enabling/disabling to TC-converted setup	R/W
1H	1	Detected temp. value of CH.1 (°C)	R

2H	2	Detected temp. value of CH.2 (°C)	R
3H	3	Detected temp. value of CH.3 (°C)	R
4H	4	Detected temp. value of CH.4 (°C)	R
5H	5	Detected temp. value of CH.5 (°C)	R
6H	6	Detected temp. value of CH.6 (°C)	R
7H	7	Detected temp. value of CH.7 (°C)	R
8H	8	Detected temp. value of CH.8 (°C)	R
9H	9	Assigning TC type (CH.1~CH.4)	R/W
AH	10	Assigning TC type (CH.5~CH.8)	R/W
BH	11	Detected temp. value of CH.1 (°F)	R
CH	12	Detected temp. value of CH.2 (°F)	R
DH	13	Detected temp. value of CH.3 (°F)	R
EH	14	Detected temp. value of CH.4 (°F)	R
FH	15	Detected temp. value of CH.5 (°F)	R
10H	16	Detected temp. value of CH.6 (°F)	R
11H	17	Detected temp. value of CH.7 (°F)	R
12H	18	Detected temp. value of CH.8 (°F)	R
13H	19	Information on operating channels	R
14H	20	Assigning type setup data	R/W
15H	21	Digitally converted value of CH.1	R
16H	22	Digitally converted value of CH.2	R
17H	23	Digitally converted value of CH.3	R
18H	24	Digitally converted value of CH.4	R
19H	25	Digitally converted value of CH.5	R
1AH	26	Digitally converted value of CH.6	R
1BH	27	Digitally converted value of CH.7	R
1CH	28	Digitally converted value of CH.8	R
1DH	29	Digital output setup	-

Address		Specification	R/W
Hexa	Deci		
1EH	30	Assigning average process	-
1FH	31	Error code value of CH.1	R
20H	32	Error code value of CH.2	R
21H	33	Error code value of CH.3	R
22H	34	Error code value of CH.4	R
23H	35	Error code value of CH.5	R
24H	36	Error code value of CH.6	R
25H	37	Error code value of CH.7	R
26H	38	Error code value of CH.8	R
27H	39	Not use	-
28H	40		
29H	41	Max. temp. input value of CH.1	R/W
2AH	42	Max. temp. input value of CH.2	R/W
2BH	43	Max. temp. input value of CH.3	R/W

2CH	44	Max. temp. input value of CH.4	R/W
2DH	45	Max. temp. input value of CH.5	R/W
2EH	46	Max. temp. input value of CH.6	R/W
2FH	47	Max. temp. input value of CH.7	R/W
30H	48	Max. temp. input value of CH.8	R/W
31H	49	Assigning temp. setup data	R/W
32H	50	Error in Temp. error	R
33H	51	Min. temp. input value of CH.1	R/W
34H	52	Min. temp. input value of CH.2	R/W
35H	53	Min. temp. input value of CH.3	R/W
36H	54	Min. temp. input value of CH.4	R/W
37H	55	Min. temp. input value of CH.5	R/W
38H	56	Min. temp. input value of CH.6	R/W
39H	57	Min. temp. input value of CH.7	R/W
3AH	58	Min. temp. input value of CH.8	R/W
3B-3E	59-62	Setting up average time/filter coefficient for CH.1-Ch.4	R/W

ERROR CODES

In case that TC or cable is broken down, or measured temperature values are greater than max. value or less than min.
value, the following error codes are stored in Buffer Memory from "31"? to "38"? by channels and LED blinks at the intervals of 0.2 second.

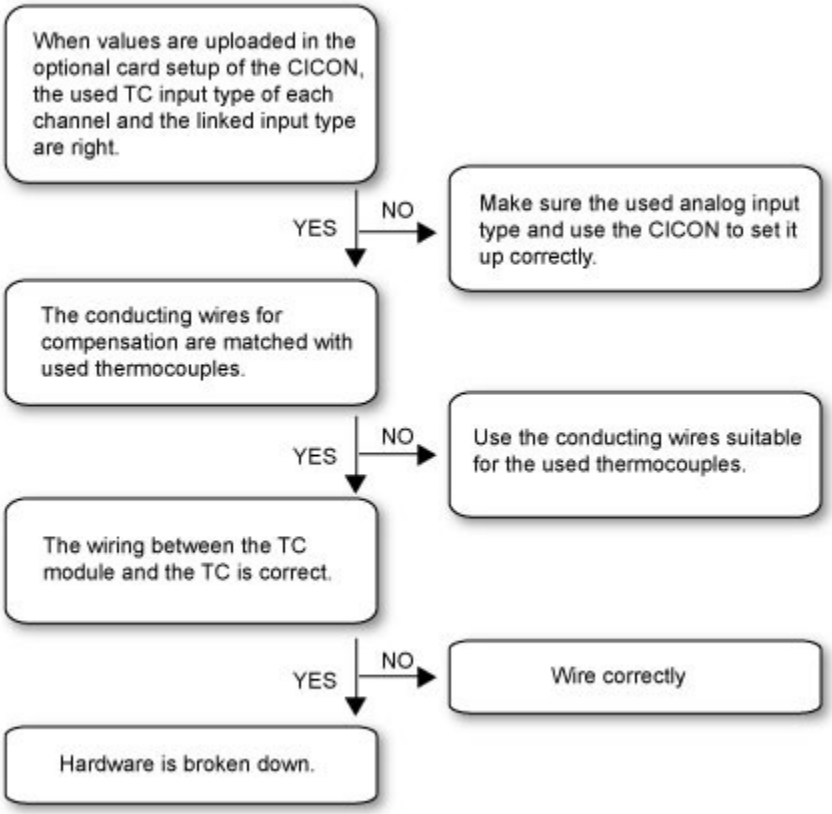
If "Tool"? -> "Special Card Setup"? -> "TC Card Setup"? -> "Current Status"? is selected, a dialog box displaying error code will appear.
To clear an error code, select " Error code reset"? button in the " TC Card Status"? of the CICON.

△ is 0~3 for TC modules.

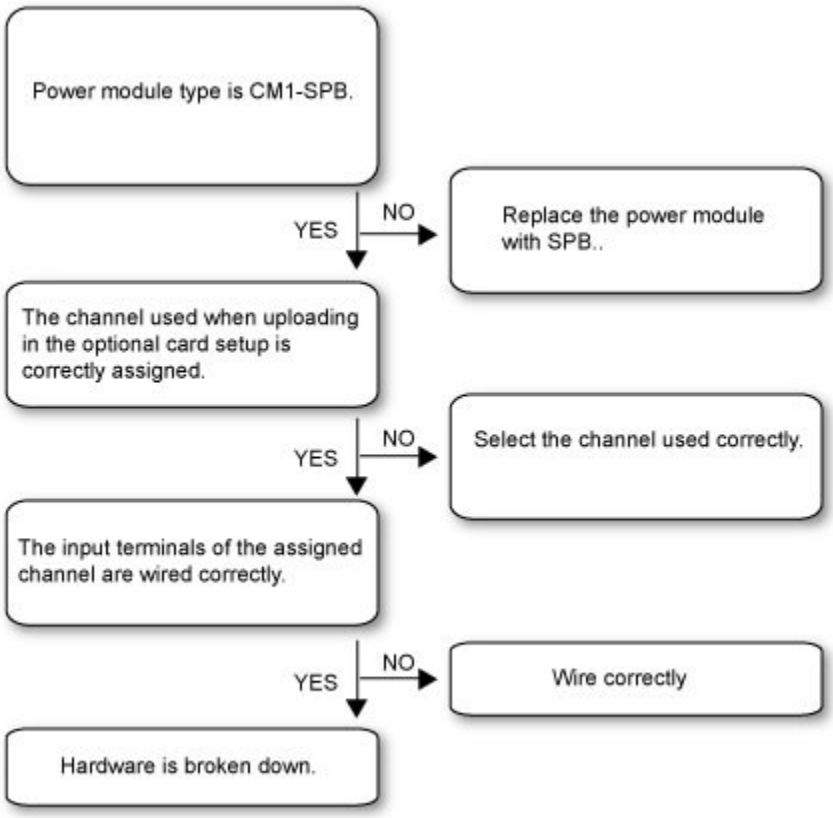
01	In case of the breaking of wires
02	Error in RJC
03	In case that TC type is wrongly set up
04	In case that measured temperature is over range
10△	System error (A/S required)

In case of error in max. and min. temperature setup, the bit corresponding to Buffer Memory " 50 "? is 1 and LED blinks at the intervals
of 0.2 second.

TROUBLE SHOOTING(1)

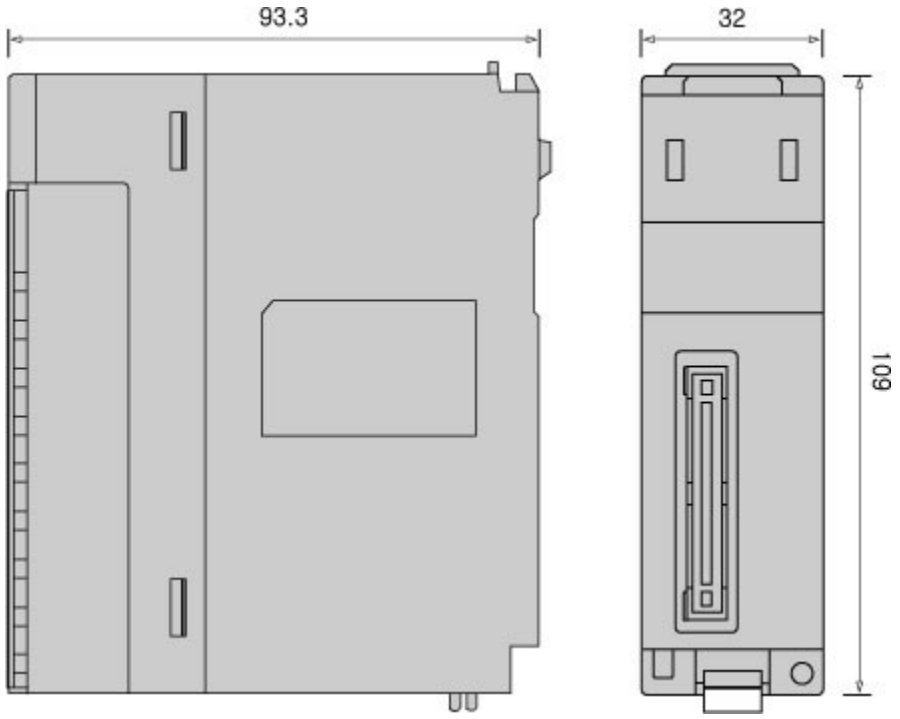


TROUBLE SHOOTING(2)



DIMENSIONS

(unit : mm)



3.21 CIMON-PLC Thermistor Module

Modules :

- CM1-TH08A

Contents :

GENERAL SPECIFICATIONS

<table>
<tr><th>Item</th><th colspan="5">Specification</th><th>Reference</th></tr>
<tr><td>Op.Temp.</td><td colspan="5">Operating Temperature -10 ~65 ℃</td><td></td></tr>
<tr><td>St.Temp</td><td colspan="5">Storage Temperature □□-25 ~□□80 ℃</td><td></td></tr>
<tr><td>Op.Hum</td><td colspan="5">Operating Humidity 5 ~95%RH, Not Condensed</td><td></td></tr>
<tr><td>St.Hum</td><td colspan="5">Storage Humidity 5 ~95%RH, Not Condensed</td><td></td></tr>
<tr><td rowspan="10">Vibration</td><td colspan="4">In case of intermittent vibration</td><td>-</td><td></td></tr>
<tr><td>Frequency</td><td>Acceleration</td><td>Amplitude</td><td colspan="2">Sweep</td><td rowspan="9">IEC61131-2</td></tr>
<tr><td>10=□f=□□ 57Hz</td><td></td><td>0.075mm</td><td colspan="2" rowspan="6">10 times in X,Y,Z</td></tr>
<tr><td>57=□□f=□□ 150Hz</td><td>9.8m/s²{1G}</td><td>-</td></tr>
<tr><td colspan="3">In case of continuous vibration</td></tr>
<tr><td>Frequency</td><td>Acceleration</td><td>Amplitude</td></tr>
<tr><td>10=□□f =□□57Hz</td><td></td><td>0.035mm</td></tr>
<tr><td>57=□□f= 150Hz</td><td>4.8m/s²{0.5G}</td><td></td></tr>
<tr><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td></td></tr>
<tr><td>Shock</td><td colspan="5">□□Max. shock Acc. :147 m/s{15G}
□□Time :11㎳
□□Pulse wave: Half sine wave pulse(3 times in X,Y,Z)</td><td>IEC61131-2</td></tr>
<tr><td rowspan="5">Noise</td><td>Square wave impulse noise</td><td colspan="3">2,000 V</td><td>KDT Standard</td></tr>
<tr><td>Electro-static discharge</td><td colspan="3">Voltage :4kV (Contact discharge)</td><td>IEC61131-2
IEC1000-4-2</td></tr>
<tr><td>Radiated electro-magneti c field</td><td colspan="3">27 ~500 MHz,10 V/m</td><td>IEC61131-2
IEC1000-4-3</td></tr>
<tr><td rowspan="2">Fast transient bust noise</td><td>Power Module</td><td>Digital I/O (24V or more)</td><td>Digital I/O (Less than 24V) Analog I/Ocomm.. Interface</td><td rowspan="2">IEC61131-2
IEC1000-4-4</td></tr>
<tr><td>2kV</td><td>1kV</td><td>0.25kV</td></tr>
<tr><td>Environ..</td><td colspan="5">No corrosive gas and no dust</td><td></td></tr>
<tr><td>Altitude</td><td colspan="5">2,000m or less</td><td></td></tr>
<tr><td>Pollution</td><td colspan="5">2 or less</td><td></td></tr>
<tr><td>Cooling</td><td colspan="5">Natural Air Cooling</td><td></td></tr>
</table>

MODULE SPECIFICATIONS

Item	Specification

Available Thermistor		NTC TYPE (Negative Temperature Coefficient)
Range of Thermistor Resistance		0~1M?
Resolution of Thermistor Resistance		0 ? ~40k? : 1? 40 k? ~400k? : 10? 400 k? ~1M? : 30?
Digital Output	Converted temperature value	Range of measured temp.(° C, ° F)X10
	Digitally converted value	0~16000 (-8000~8000)
Equation		Steinhart-Hart thermistor polynomial
Accuracy		± 0.3 %(Full Scale)
Max. Converted rate		1Sec(8ch)
No. of input Channel		8 Channels/module
Insulation		Between input terminal and PLC: Photo- Couple, Between output channels: No
Connection Terminal		18-point terminal block

I/O signals

Signal Direction (CPU ? RTD)		Signal Direction (CPU ? RTD)	
Input	Signal Name	Output	Signal Name
X0	Thermistor Module Ready	Y0	Not use
X1	Not use	Y1	
X2		Y2	
X3		Y3	
X4		Y4	
X5		Y5	
X6		Y6	
X7		Y7	
X8		Y8	
X9		Y9	
XA		YA	
XB		YB	
XC		YC	
XD		YD	
XE		YE	

XF	Flag indicating an error in Thermistor module	YF	Requesting to clear an error

User Program Memory Devices(1)

Address		Description	R/W
Hexa	Deci		
0H	0	Not use	-
1H	1	Detected temp. value of CH.1 (°C)	R
2H	2	Detected temp. value of CH.2 (°C)	R
3H	3	Detected temp. value of CH.3 (°C)	R
4H	4	Detected temp. value of CH.4 (°C)	R
5H	5	Detected temp. value of CH.5 (°C)	R
6H	6	Detected temp. value of CH.6 (°C)	R
7H	7	Detected temp. value of CH.7 (°C)	R
8H	8	Detected temp. value of CH.8 (°C)	R
9H	9	Not use	-
AH	10		
BH	11	Detected temp. value of CH.1 (°C)	R
CH	12	Detected temp. value of CH.2 (°C)	R
DH	13	Detected temp. value of CH.3 (°C)	R
EH	14	Detected temp. value of CH.4 (°C)	R
FH	15	Detected temp. value of CH.5 (°C)	R
10H	16	Detected temp. value of CH.6 (°C)	R
11H	17	Detected temp. value of CH.7 (°C)	R
12H	18	Detected temp. value of CH.8 (°C)	R
13H	19	Information on operating channels	R

Address		Description	R/W
Hexa	Deci		
14H	20	Not use	-
15H	21	Digitally converted value of CH.1	R
16H	22	Digitally converted value of CH.2	R
17H	23	Digitally converted value of CH.3	R
18H	24	Digitally converted value of CH.4	R
19H	25	Digitally converted value of CH.5	R
1AH	26	Digitally converted value of CH.6	R
1BH	27	Digitally converted value of CH.7	R
1CH	28	Digitally converted value of CH.8	R

1DH	29	Not use	-
1EH	30		
1FH	31	Error code value of CH.1	R
20H	32	Error code value of CH.2	R
21H	33	Error code value of CH.3	R
22H	34	Error code value of CH.4	R
23H	35	Error code value of CH.5	R
24H	36	Error code value of CH.6	R
25H	37	Error code value of CH.7	R
26H	38	Error code value of CH.8	R
27H	39	Not use	-
28H	40		

Error Code

In case that Thermistor or cable is broken down, or measured temperature values are greater than max. value or less than min. value,
the following error codes are stored in Buffer Memory from "31" to "38"? by channels and LED blinks at the intervals of 0.3 second.

If " Tool "? -> " Special Card Setup "? -> " Thermistor module "? -> " Current Status "? is selected, a dialog box displaying error code will appear.
To clear an error code, select " Error code reset "? button in the " Thermistor Card Status " of the CICON.

Error Code	Description
0	No error
1	In case of channel enable, when temperature – resistance table is not input
2	In case of the breaking of wires
4	In case that measured temperature is over range

Usage(1)

NTC Thermistor (Negative Temperature Coefficient) can be converted by module

To use module, it need R/T Table that provided by manufacturer The constants, A, B and C can be determined from resistance value

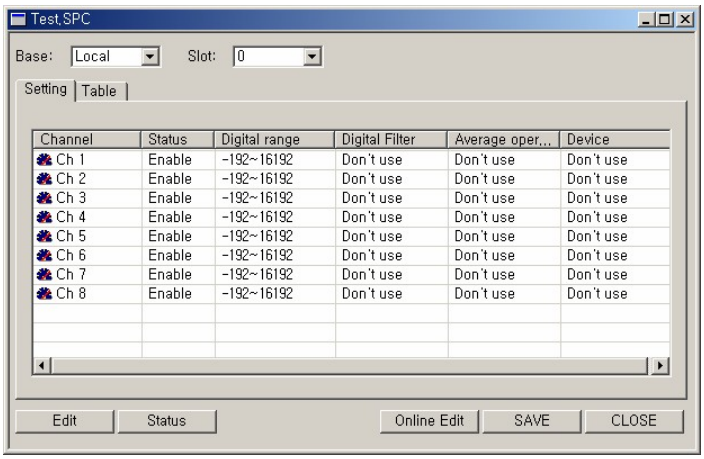
$1/T = A + B(\ln R) + C(\ln R)^3$
(Steinhart-Hart thermistor polynomial)

T = Kelvin temperature (°K) = 273 + °C
R = Resistance Value(?)

Usage(3)

Select New Program at CICON and register Thermistor Setting Program.

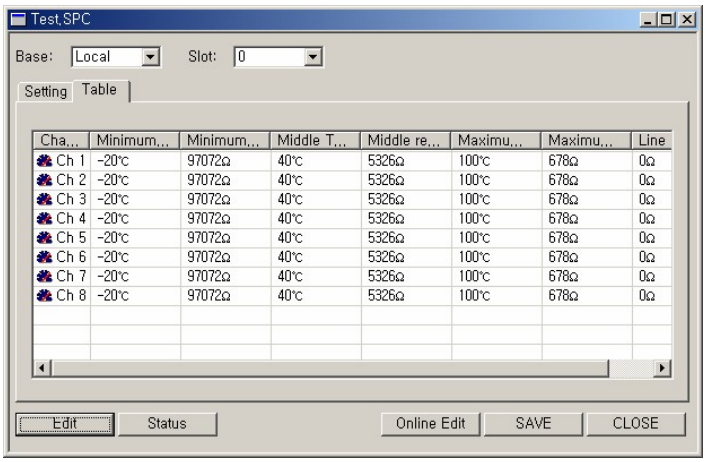
If you click OK on the above window, a Setup dialog box will appear as follows



Set up channel

Usage(4)

Click " Table" , set the temperature and resistance value that are selected Uasge(2).



Set the module is installed base and slot It can compile with one or more Scan Program and download to PLC

Wiring

Channel	Terminal +	Terminal -
1 Ch	Terminal 1	Terminal 2
2 Ch	Terminal 3	Terminal 4
3 Ch	Terminal 5	Terminal 6
4 Ch	Terminal 7	Terminal 8
5 Ch	Terminal 9	Terminal 10
6 Ch	Terminal 11	Terminal 12
7 Ch	Terminal 13	Terminal 14
8 Ch	Terminal 15	Terminal 16
FG	Terminal 18	

- The tightening torque of 6.99 in.lb
- USE COPPER OR COPPER-CLAD ALUMINUM CONDUTORS
- " Class 2, adjacent to voltage rating(30 V max.)"?

Caution: The terminal – can not wiring to common

Features and Operation

1) The temperatures converted by NTC Thermistor (Negative Temperature Coefficient) can be displayed in centigrade or
Fahrenheit(°C , °F) and the temperature values can be processed as digital values up to the first decimal place

2) The range of thermistor resistance is from 0Ω to 1MΩ

3) If a min. temperature value and a max. temperature value are set up, the min. value will be converted to

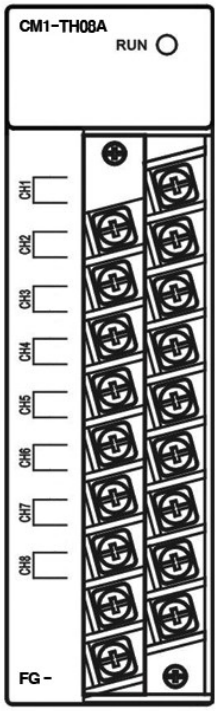
0(-8000) and
the max. value is 16000(8000).

4) The breaking of thermistor and cables and the excess of measuring range are detected by channels.

5) The number of modules used on one base is not limited.

6) LED is lighted in case of normal status and blinks at the intervals of 0.3 second in case of error.

FRONT VIEW



3.22 CIMON-PLC Expansion

Modules :

- CM1-EP01A
- CM1-EP02A
- CM1-EP03A

Contents :

- Front view
- Outward dimension

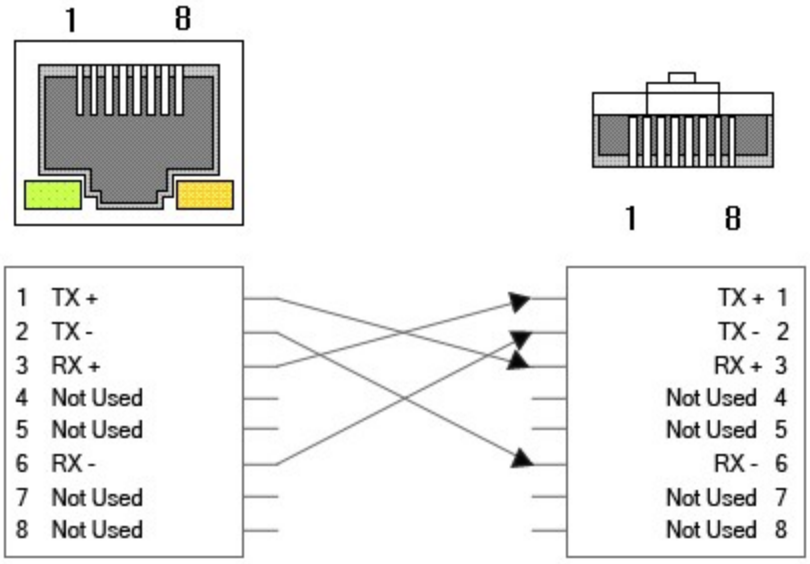
GENERAL SPECIFICATIONS

Item	Specification				Reference
Op.Temp.	Operating Temperature -10 ~65 ℃				
St.Temp	Storage Temperature □□-25 ~□□80 ℃				
Op.Hum	Operating Humidity 5 ~95%RH, Not Condensed				
St.Hum	Storage Humidity 5 ~95%RH, Not Condensed				
Vibration	In case of intermittent vibration			-	
	Frequency	Acceleration	Amplitude	Sweep	IEC61131-2
	10=□f=□□ 57Hz		0.075mm	10 times in X,Y,Z	
	57=□□f=□□ 150Hz	9.8m/s²{1G}	-		
	In case of continuous vibration				
	Frequency	Acceleration	Amplitude		
	10=□□f =□□57Hz		0.035mm		
	57=□□f= 150Hz	4.8m/s²{0.5G}			
Shock	□□Max. shock Acc. :147 m/s{15G} □□Time :11㎳ □□Pulse wave: Half sine wave pulse(3 times in X,Y,Z)				IEC61131-2
Noise	Square wave impulse noise	2,000 V			KDT Standard
	Electro-static discharge	Voltage :4kV (Contact discharge)			IEC61131-2 IEC1000-4-2
	Radiated electro-magnetic field	27 ~500 MHz,10 V/m			IEC61131-2 IEC1000-4-3
	Fast transient bust noise	Power Module	Digital I/O (24V or more)	Digital I/O (Less than 24V) Analog I/Ocomm.. Interface	IEC61131-2 IEC1000-4-4
		2kV	1kV	0.25kV	
Environ..	No corrosive gas and no dust				
Altitude	2,000m or less				
Pollution	2 or less				
Cooling	Natural Air Cooling				

Feature

- Series XP/CP allows expanding base up to 16
- Supports the high-speed expansion communication of 10BASE-T
- Built-in network Repeater
- Expansion of remote I/O function
- Distance between segments : Max. 100m (Max. entire expansion length : 1,600m)

Cable Wiring

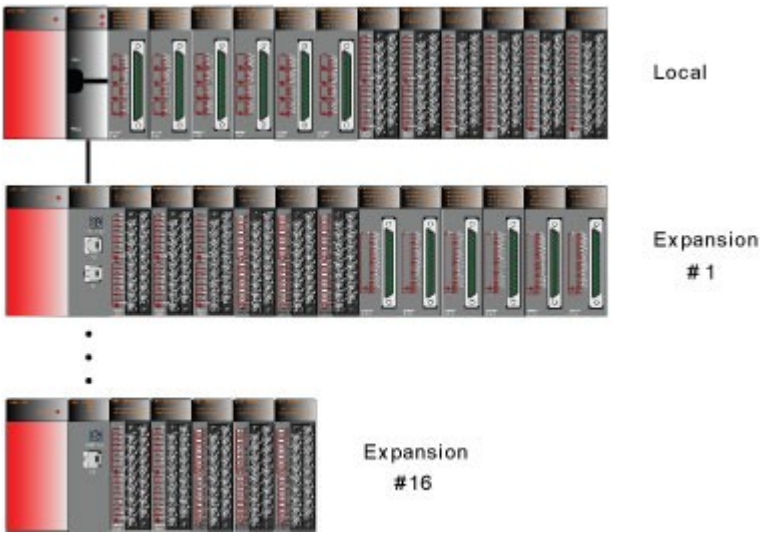


Expansion configuration

- PLC Parameter -> Basic -> Expansion

Sets PLC increment number as much as you want. If the number in the increment end is smaller than the setting value,

the increment communication error will occur.

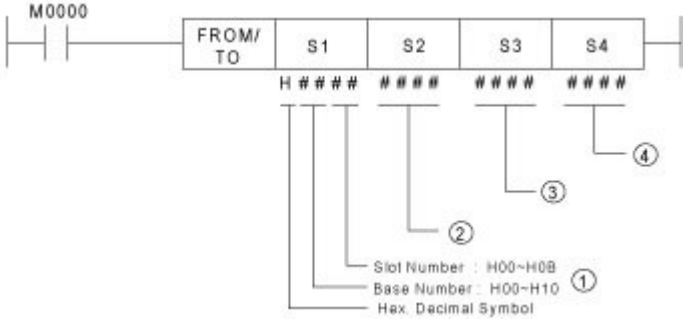


▶ IO addresses are continuously allocated between expansion bases.

▶ The order of allocation is based on the expansion number which is configured by the rotary switch of expansion module.

Base No.	Rotary Switch	Base No.	Rotary Switch
Exp. #1	0	Exp. #9	8
Exp. #2	1	Exp. #10	9
Exp. #3	2	Exp. #11	A
Exp. #4	3	Exp. #12	B
Exp. #5	4	Exp. #13	C
Exp. #6	5	Exp. #14	D
Exp. #7	6	Exp. #15	E
Exp. #8	7	Exp. #16	F

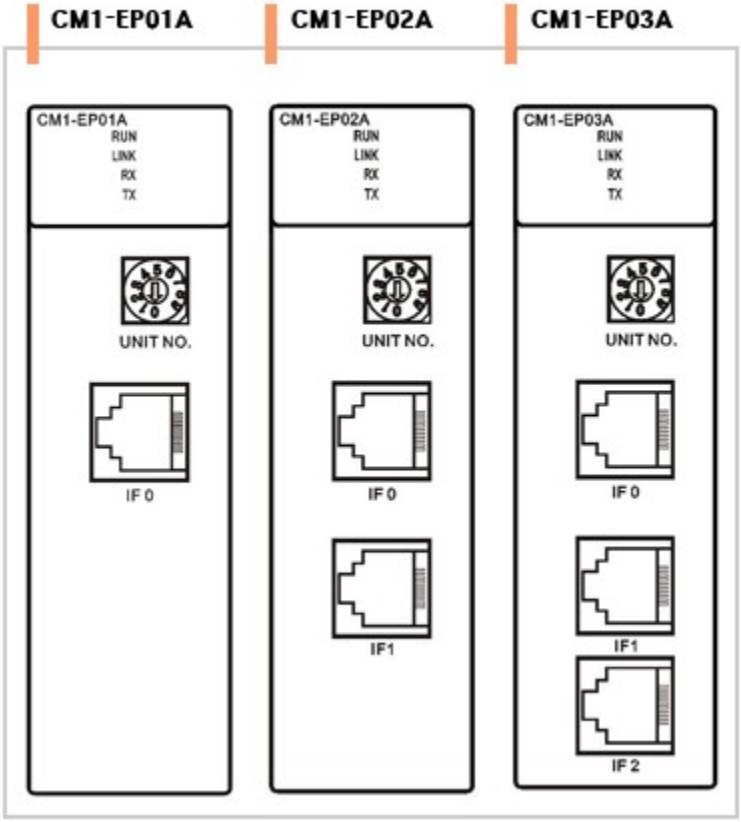
▶ FROM/TO instruction



▶ Keep in mind that base and slot numbers are "0" based.

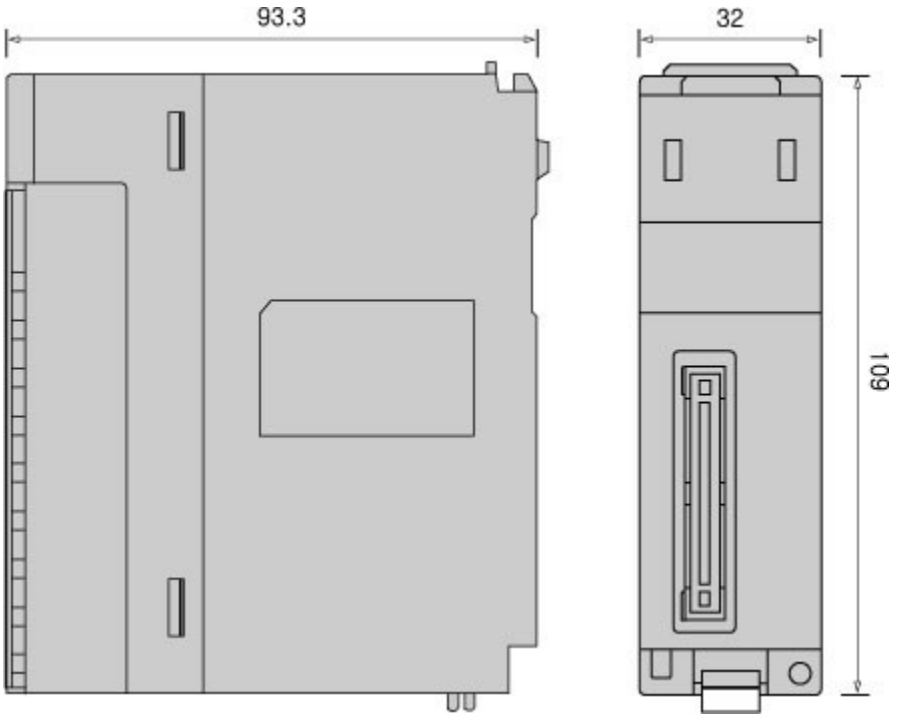
Base No.	Slot No.	form
Local	Slot #5	H0005 or 5
Expansion #1	Slot #0	H0100
Expansion #2	Slot #3	H0203
Expansion #9	Slot #8	H0908
Expansion #10	Slot #9	H0A09
Expansion #15	Slot #10	H0F0A
Expansion #16	Slot #11	H100B

Front view



Outward dimension

(Unit : mm)



3.23 CIMON-PLC Redundant System

Modules :

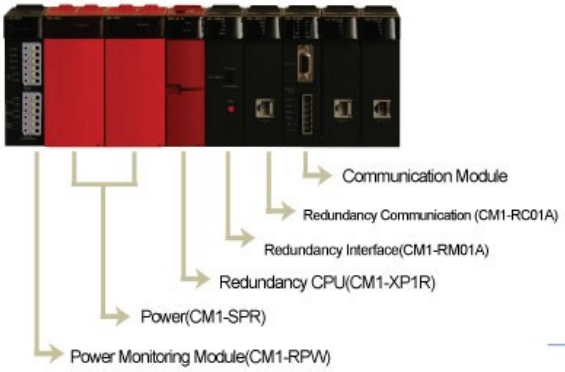
- CM1-XP1R (Redundancy CPU)
- CM1-RM01A (Redundancy Interface)
- CM1-RC01A (Redundancy Communication)
- CM1-RPW (Power Monitoring Module)
- CM1-RC01A (Power)

Contents :

GENERAL SPECIFICATIONS

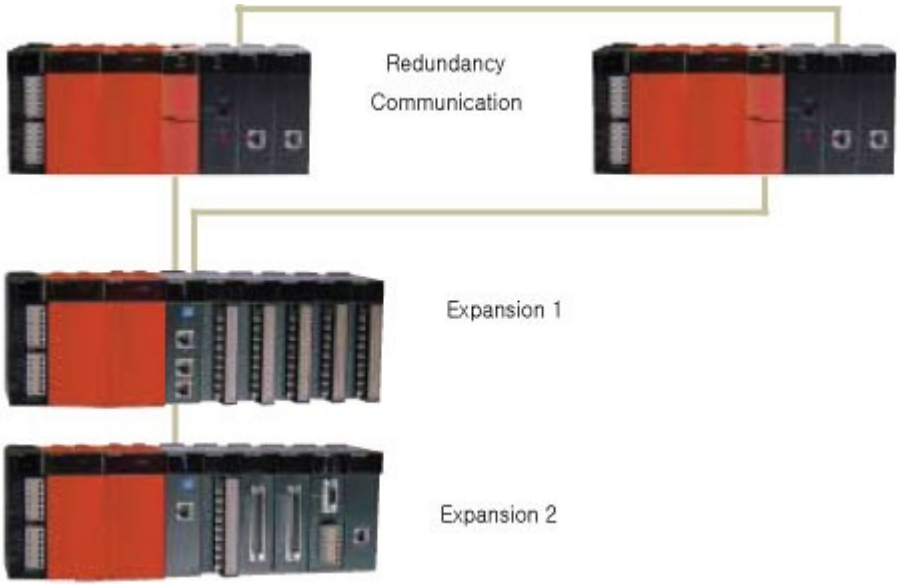
<table>
<tr><th>Item</th><th colspan="5">Specification</th><th>Reference</th></tr>
<tr><td>Op.Temp.</td><td colspan="5">Operating Temperature -10 ~65 ℃</td><td></td></tr>
<tr><td>St.Temp</td><td colspan="5">Storage Temperature □□-25 ~□□80 ℃</td><td></td></tr>
<tr><td>Op.Hum</td><td colspan="5">Operating Humidity 5 ~95%RH, Not Condensed</td><td></td></tr>
<tr><td>St.Hum</td><td colspan="5">Storage Humidity 5 ~95%RH, Not Condensed</td><td></td></tr>
<tr><td rowspan="10">Vibration</td><td colspan="4">In case of intermittent vibration</td><td>-</td><td></td></tr>
<tr><td>Frequency</td><td>Acceleration</td><td>Amplitude</td><td>Sweep</td><td rowspan="9">IEC61131-2</td></tr>
<tr><td>10=□f=□□ 57Hz</td><td></td><td>0.075mm</td><td rowspan="7">10 times in X,Y,Z</td></tr>
<tr><td>57=□□f=□□ 150Hz</td><td>9.8m/s²{1G}</td><td>-</td></tr>
<tr><td colspan="3">In case of continuous vibration</td></tr>
<tr><td>Frequency</td><td>Acceleration</td><td>Amplitude</td></tr>
<tr><td>10=□□f =□□57Hz</td><td></td><td>0.035mm</td></tr>
<tr><td>57=□□f= 150Hz</td><td>4.8m/s²{0.5G}</td><td></td></tr>
<tr><td></td><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td></td><td></td></tr>
<tr><td>Shock</td><td colspan="5">□□Max. shock Acc. :147 m/s{15G}
□□Time :11㎳
□□Pulse wave: Half sine wave pulse(3 times in X,Y,Z)</td><td>IEC61131-2</td></tr>
<tr><td rowspan="5">Noise</td><td>Square wave impulse noise</td><td colspan="3">2,000 V</td><td>KDT Standard</td></tr>
<tr><td>Electro-static discharge</td><td colspan="3">Voltage :4kV (Contact discharge)</td><td>IEC61131-2
IEC1000-4-2</td></tr>
<tr><td>Radiated electro-magneti c field</td><td colspan="3">27 ~500 MHz,10 V/m</td><td>IEC1131-2
IEC1000-4-3</td></tr>
<tr><td rowspan="2">Fast transient bust noise</td><td>Power Module</td><td>Digital I/O (24V or more)</td><td>Digital I/O (Less than 24V) Analog I/Ocomm.. Interface</td><td rowspan="2">IEC1131-2
IEC1000-4-4</td></tr>
<tr><td>2kV</td><td>1kV</td><td>0.25kV</td></tr>
<tr><td>Environ..</td><td colspan="5">No corrosive gas and no dust</td><td></td></tr>
<tr><td>Altitude</td><td colspan="5">2,000m or less</td><td></td></tr>
<tr><td>Pollution</td><td colspan="5">2 or less</td><td></td></tr>
<tr><td>Cooling</td><td colspan="5">Natural Air Cooling</td><td></td></tr>
</table>

Basic Composition of Redundancy Base



Base	Composition Unit	Applicable Module
CPU	Power Monitoring	CM1-RPW
	Base	CM1-BS05R
	Power	CM1- SPR
	CPU	CM1- XP1R
	Redundancy Interface	CM1-RM01A
	Redundancy Comm. Module	CM1-RC01A
	Redundancy Cable	CM0-CBE
	Communication Module	CM1-All comm. modules including CM1-EC01A
	Expansion Cable	CM0-CBE
Expansion	Expansion 1	CM1-EP03A or CM1-EP02A
	Expansion 2 or More	CM1-EP02A or CM1-EP01A
	Base	Modules of all kinds
	Power	
	I/O	

System Configuration



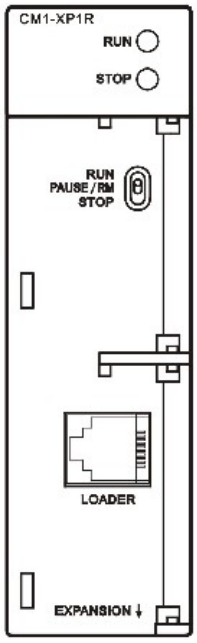
Feature

- Redundancy for a CPU module, power module, bases, and communication module is available.
- CPU redundancy system is composed of separate base for ideal redundancy structure.

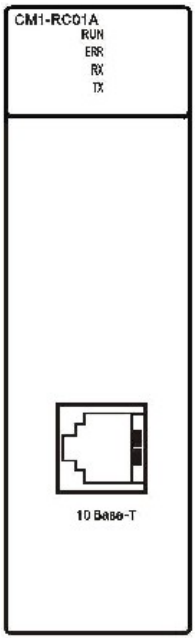
- In case an error occurs in an active CPU module, a back-up module is automatically switched to active one for continuous operation.
- Furnishes a test button to check and maintain a system easily.
- Enables the configuration of network redundancy.
- Enables backup within the control scan delay time of 50ms and high-speed active switching.
- Enables to construct redundancy network with a high-ranking computer.
- Supports Power redundancy.

Front View

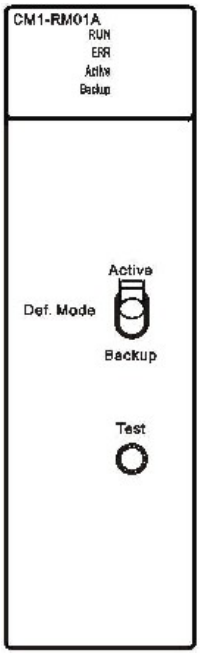
CM1-XP1R



CM1-RC01A



CM1-RM01A



3.24 CIMON-PLC Remote I/O Series

Modules :

- RP-XD16A
- RP-XD32A
- RP-YR16A
- RP-YT16A
- RP-YT32A
- RP-XY32DT

Contents :

GENERAL SPECIFICATIONS

<table>
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<tr><td>St.Temp</td><td colspan="5">Storage Temperature □□-25 ~□□80 ℃</td><td></td></tr>
<tr><td>Op.Hum</td><td colspan="5">Operating Humidity 5 ~95%RH, Not Condensed</td><td></td></tr>
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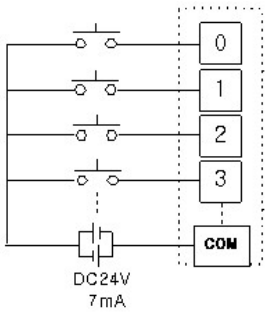
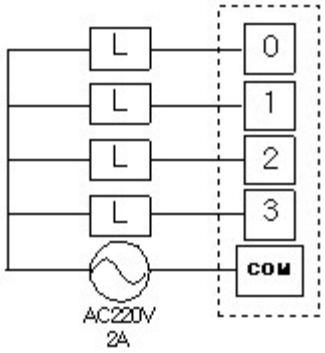
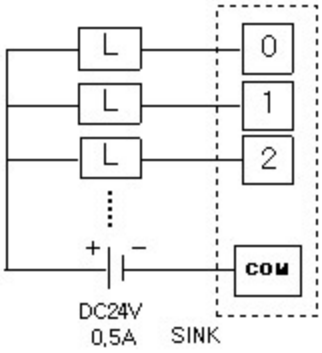
<tr><td rowspan="9">Vibration</td><td colspan="4">In case of intermittent vibration</td><td>-</td><td></td></tr>
<tr><td>Frequency</td><td>Acceleration</td><td>Amplitude</td><td>Sweep</td><td rowspan="8">IEC61131-2</td></tr>
<tr><td>10=□f=□□ 57Hz</td><td></td><td>0.075mm</td><td rowspan="7">10 times in X,Y,Z</td></tr>
<tr><td>57=□□f=□□ 150Hz</td><td>9.8m/s²{1G}</td><td>-</td></tr>
<tr><td colspan="3">In case of continuous vibration</td></tr>
<tr><td>Frequency</td><td>Acceleration</td><td>Amplitude</td></tr>
<tr><td>10=□□f =□□57Hz</td><td></td><td>0.035mm</td></tr>
<tr><td>57=□□f= 150Hz</td><td>4.8m/s²{0.5G}</td><td></td></tr>
<tr><td>Shock</td><td colspan="5">□□Max. shock Acc. :147 m/s{15G}
□□Time :11㎳
□□Pulse wave: Half sine wave pulse(3 times in X,Y,Z)</td><td>IEC61131-2</td></tr>
<tr><td rowspan="3">Noise</td><td>Square wave impulse noise</td><td colspan="4">2,000 V</td><td>KDT Standard</td></tr>
<tr><td>Electro-static discharge</td><td colspan="4">Voltage :4kV (Contact discharge)</td><td>IEC61131-2
IEC1000-4-2</td></tr>
<tr><td>Radiated electro-magnetic field</td><td colspan="4">27 ~500 MHz,10 V/m</td><td>IEC1131-2
IEC1000-4-3</td></tr>
</table>

	Fast transient bust noise	Power Module	Digital I/O (24V or more)	Digital I/O (Less than 24V) Analog I/Ocomm.. Interface	IEC1131-2 IEC1000-4-4
		2kV	1kV	0.25kV	
Environ..	No corrosive gas and no dust				
Altitude	2,000m or less				
Pollution	2 or less				
Cooling	Natural Air Cooling				

INPUT SPECIFICATIONS

Model		RP-XD16A	RP-XD32A	RP-XY32DT
Power		DC24V, 0.4A (19VDC - 28VDC)		
External Connecting Method		Terminal Connector		
Rated Input		DC24V / 7mA		
Input Point		16 points	32 points	16 points
On Voltage / On Current		DC19V or more / 3.5mA or more		
Off Voltage / Off Current		DC6V or less / 1.5mA or less		
Resp. time	Off --> On	3ms or less		
	On --> Off	3ms or less		
Common TYPE		16points Common		
Operation Display		LED		
Insulation Type		Photo Coupler		
Insulation Method		SINK / SRC Combination		
Internal Circuit				

OUTPUT SPECIFICATIONS

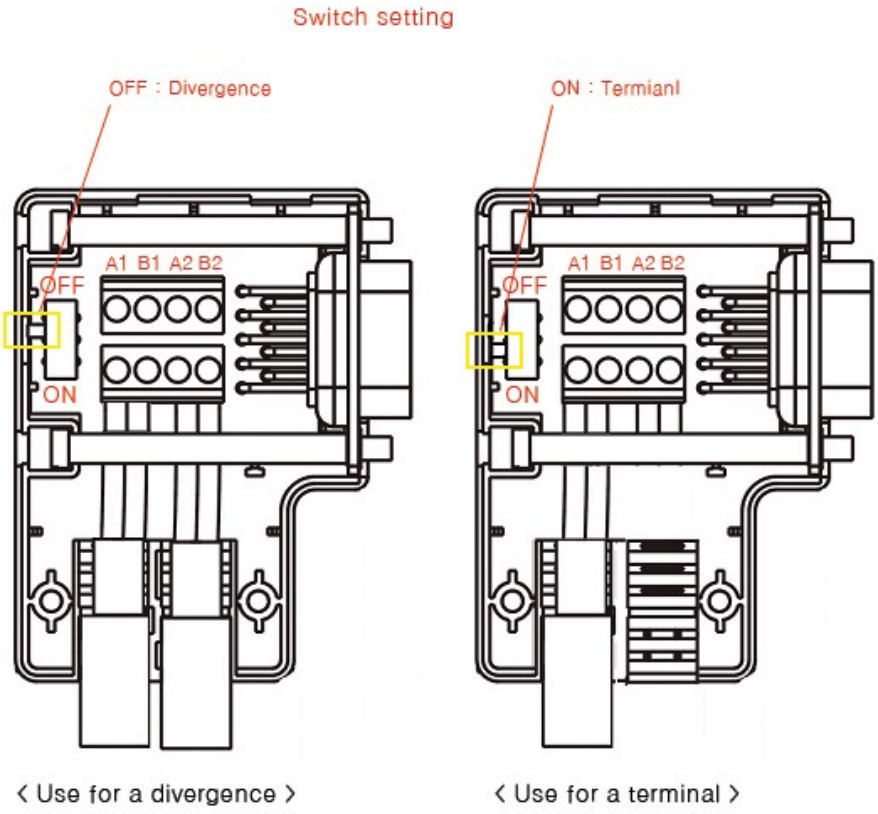
		RP-YR16A	RP-YT16A	RP-YT32A	RP-XY32DT
Power		DC24V, 0.4A (19VDC - 28VDC)			
Output point		16 points	16 points	32 points	16 points
Insulation Method		Relay	Photo Coupler		
Rated Output		DC24V 2A / 점 (Resistant Load), AC220V 2A (COSΨ=1)	DC24V, 0.5A / 1point, 4A / Common		
Surge		-	Clamp Diode		
Resp. time	Off --> On	10ms or less	2ms or less		3ms or less
	On --> Off	10ms or less	2ms or less		3ms or less
Common TYPE		8 points	16 points	32 points	16 points
Operation Display		LED			
External Connecting Method		Terminal Connector	-		
Insulation Method		-	Sink Type (NPN Transistror Open Colleector)		
Internal Circuit					

Communication SPECIFICATIONS

Network	Profibus-DP
Media Access	Logical Token Ring
Communication method	RS-485 (Electric)
Topology	Bus
Modulation Method	NRZ
Communication Cable	Shielded Twisted Pair

Transmission distance	1000m (9.6-187.5 kbps)
	400m (500 kbps)
	200m (1.5 Mbps)
	100m (3-12 Mbps)
No. of Nodes / Network	99 Station
No. of Nodes / Segment	32 Station

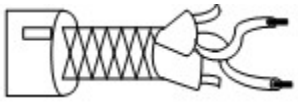
Connector



Cable Specification

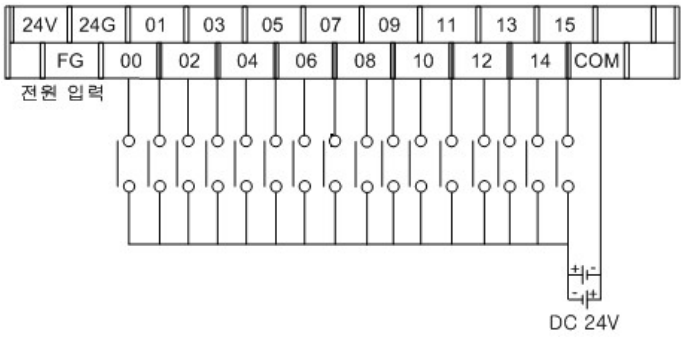
* LAPP KABEL
  Type : Network Components
  Protocol : DP-FMS

Item	Twinax
AWG	22
Type	UNITRONIC BUS DP FMS / FIP
Insulation	PE-Polyethylen
Shield	Aluminum Foil-Polyester Tape/Braid Shield
Electric Capacity	30 nF/km
Impedance	150Ω
No. of core	2 Core

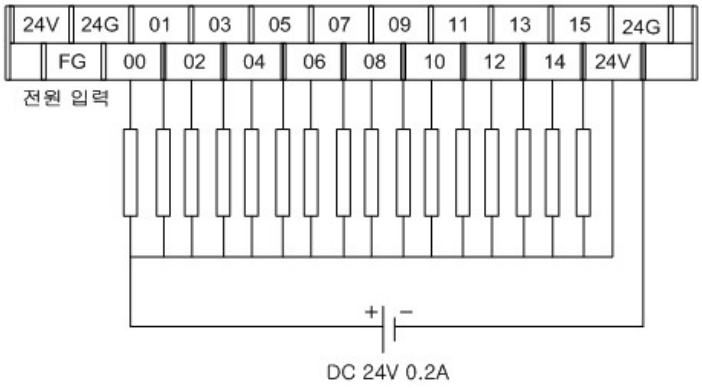


Wiring

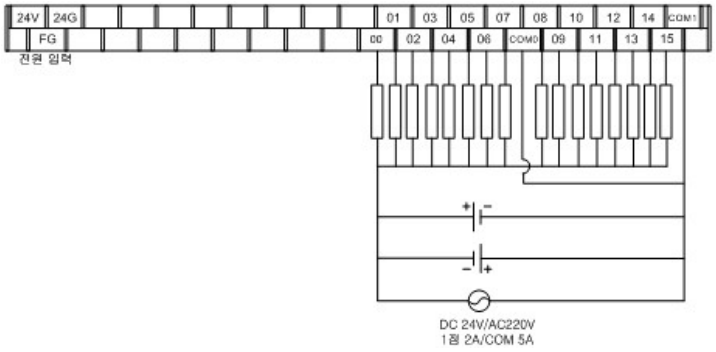
RP-XD16A



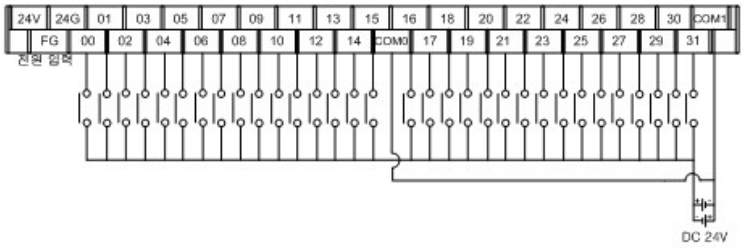
RP-YT16A



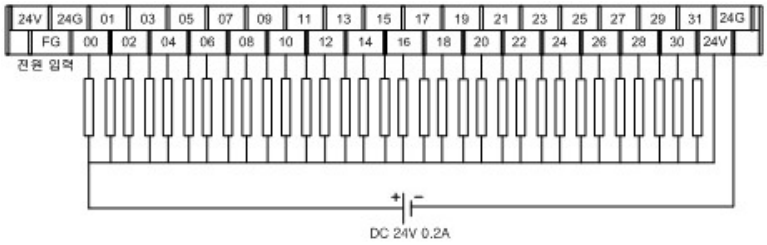
RP-YR16A



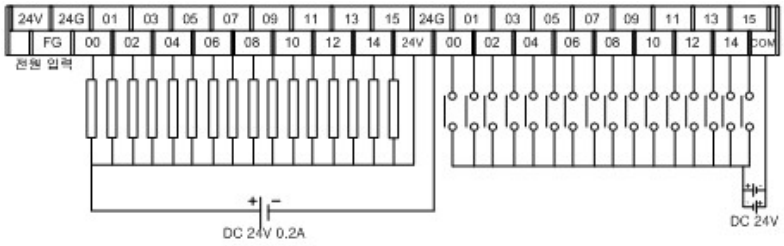
RP-XD32A



RP-YT32A



RP-XY32DT



Wiring Precaution

▶ Please use after understanding the wire diagram including rated voltage and terminal arrangement.

▶ Tighten the screws for terminal connection after turning off the power source.

▶ In case of tightening the screws of a terminal, tighten firmly according to the rated torque.

▶ Earth FG terminal in the third class, which is exclusive for PLC.

▶ Take care that dregs are not put into a module case.

▶ The wiring close to heat-generating device or material and directly contacted with oil for long time may cause short circuit or

breakdown or malfunction. In case of the installation environment with a lot of vibration, prevent a PLC from the vibration.

▶ The wiring together with high-voltage line or power line cause malfunction or breakdown due to induction jam.

Design the wiring 100mm or more away from a high voltage line or a power line not to receive the influence by the variation

of noise or magnetic field.

Precaution

▶ The Link station number of all module is to be different each other. If duplicate station number is accessed, an error occurs.

▶ Use the communication cable with assigned specification. The other than assigned may cause communication disturbance.

▶ Connect communication cable correctly. Incomplete cable connection may cause serious communication disturbance.

▶ Check whether communication cable is broken before installation.

▶ In case of long-distance communication cable, wire a cable far away from power line or induction noise.

▶ Do not change the station number in the status that the power source is supplied.

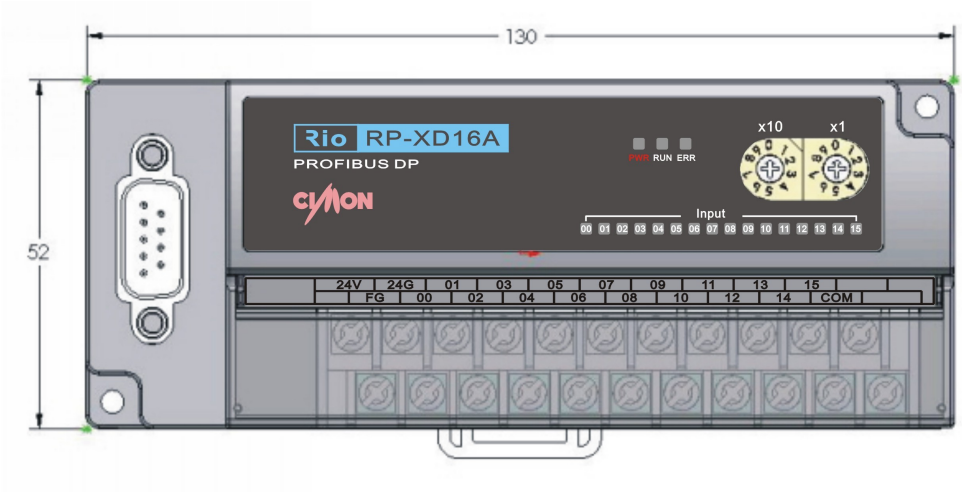
▶ It is prohibited to mount and dismount Remote I/O module.

▶ Please make initialize program to the master module. If there is not initialize program in the master module,

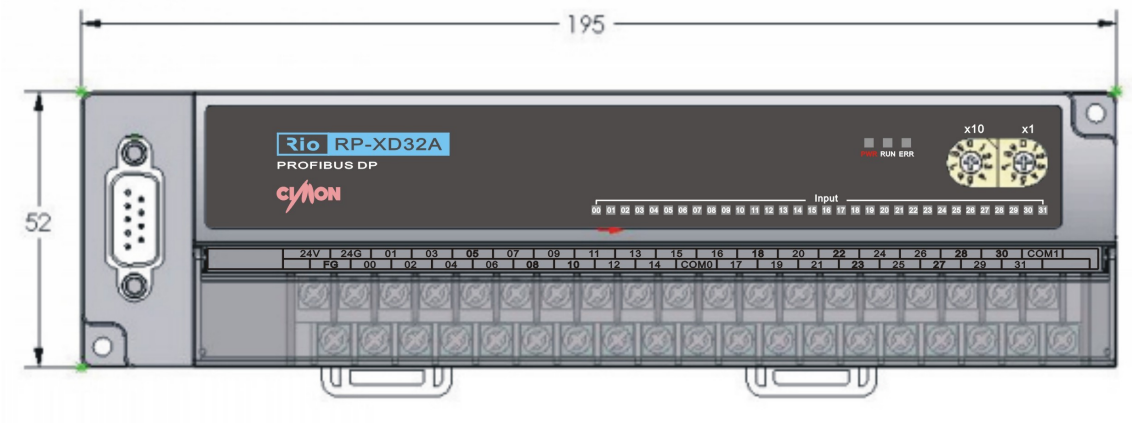
it may cause a communication error when the power failure occurred in Remote I/O.

Dimension

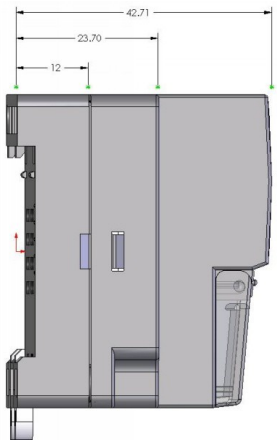
- **RP-XD16A / YT16A**



- **RP-XD32A / YT32A / YR16A / XY32DT**



- **RP Series**



3.25 CIMON-BP Series 32Main Block

Modules :

- CM2-BP32M***

Contents :

CIMON-BP Series 32Main Block Module For details see "**Click**"

GENERAL SPECIFICATIONS

Item	Specification	Reference
Op.Temp.	Operating Temperature -10 ~65 ℃	
St.Temp	Storage Temperature □□-25 ~□□80 ℃	

<table>
<tr><td>Op.Hum</td><td colspan="4">Operating Humidity 5 ~95%RH, Not Condensed</td><td></td></tr>
<tr><td>St.Hum</td><td colspan="4">Storage Humidity 5 ~95%RH, Not Condensed</td><td></td></tr>
<tr><td rowspan="8">Vibration</td><td colspan="3">In case of intermittent vibration</td><td>-</td><td></td></tr>
<tr><td>Frequency</td><td>Acceleration</td><td>Amplitude</td><td>Sweep</td><td rowspan="8">IEC61131-2</td></tr>
<tr><td>10=□f=□□ 57Hz</td><td></td><td>0.075mm</td><td rowspan="5">10 times in X,Y,Z</td></tr>
<tr><td>57=□□f=□□ 150Hz</td><td>9.8m/s²{1G}</td><td>-</td></tr>
<tr><td colspan="3">In case of continuous vibration</td></tr>
<tr><td>Frequency</td><td>Acceleration</td><td>Amplitude</td></tr>
<tr><td>10=□□f =□□57Hz</td><td></td><td>0.035mm</td></tr>
<tr><td>57=□□f= 150Hz</td><td>4.8m/s²{0.5G}</td><td></td></tr>
<tr><td>Shock</td><td colspan="4">□□Max. shock Acc. :147 m/s{15G}
□□Time :11㎳
□□Pulse wave: Half sine wave pulse(3 times in X,Y,Z)</td><td>IEC61131-2</td></tr>
<tr><td rowspan="5">Noise</td><td>Square wave impulse noise</td><td colspan="3">2,000 V</td><td>KDT Standard</td></tr>
<tr><td>Electro-static discharge</td><td colspan="3">Voltage :4kV (Contact discharge)</td><td>IEC61131-2
IEC1000-4-2</td></tr>
<tr><td>Radiated electro-magneti c field</td><td colspan="3">27 ~500 MHz,10 V/m</td><td>IEC1131-2
IEC1000-4-3</td></tr>
<tr><td rowspan="2">Fast transient bust noise</td><td>Power Module</td><td>Digital I/O (24V or more)</td><td>Digital I/O (Less than 24V) Analog I/Ocomm.. Interface</td><td rowspan="2">IEC1131-2
IEC1000-4-4</td></tr>
<tr><td>2kV</td><td>1kV</td><td>0.25kV</td></tr>
<tr><td>Environ..</td><td colspan="4">No corrosive gas and no dust</td><td></td></tr>
<tr><td>Altitude</td><td colspan="4">2,000m or less</td><td></td></tr>
<tr><td>Pollution</td><td colspan="4">2 or less</td><td></td></tr>
<tr><td>Cooling</td><td colspan="4">Natural Air Cooling</td><td></td></tr>
</table>

MODULE SPECIFICATIONS

Items	Specifications
Power Supply	AC100~ 240V / DC 24V (Max.20W)
Input	DC 24V

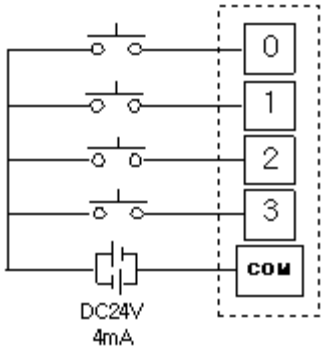
Output	Relay / TR SINK /TR SOURCE
Expansion	Max. 3 Unit (Max.2 Analog, Max 3 I/O units)
Main Block I/O	16 Inputs / 16 Outputs
Program Control	Stored Program, Cyclic Processing, TIME Driven Interrupt
I/O Processing	Indirect (or direct by instruction)
Language	IL(Instruction List), LD(Ladder Diagram)
Basic inst.	55 Instruction
Application Inst.	289 Instruction
Speed	200ns / Step(Basic Instruction)
Program Capacity	8k Step

▶ **I/O and Data Memory**

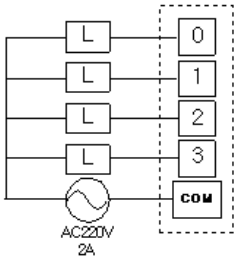
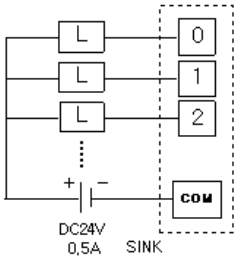
X	Y	M	L	K	F
128	128	4,096	1,024	1,024,	2,048
T	C	S	D	Z	
256,	256	100*100	5,000	1,024	

INPUT SPECIFICATIONS

Items		Specifications
Input Voltage		DC 24V
Nominal Input Current		4 mA
On Voltage /On Current		DC 19V/4mA
Off Voltage /Off Current		DC 11V/1mA
Resp. Time	Off → On	5㎳ or faster
	On → Off	5㎳ or faster
Common Type		4 Points Common
Operation Display		LED
Insulation Type		Photo-coupler

Input Type	SINK/SRC
Wiring Diagram	

OUTPUT SPECIFICATIONS

Items		Relay	Transister
Nominal Output Voltage		AC 220V / DC24V	DC12/24V
Max. Output Current		2A for 1 Point (5A for common)	0.2A for 1 Point (2A for common)
Resp. Time	Off → On	10ms or faster	1ms or faster
	On → Off	5ms or faster	1ms or faster
Common Type		4 Points	8 Points
Operation Display		LED	LED
Insulation Type		Relay	Photo-coupler
Wiring Diagram			

COMMUNICATION OPTION

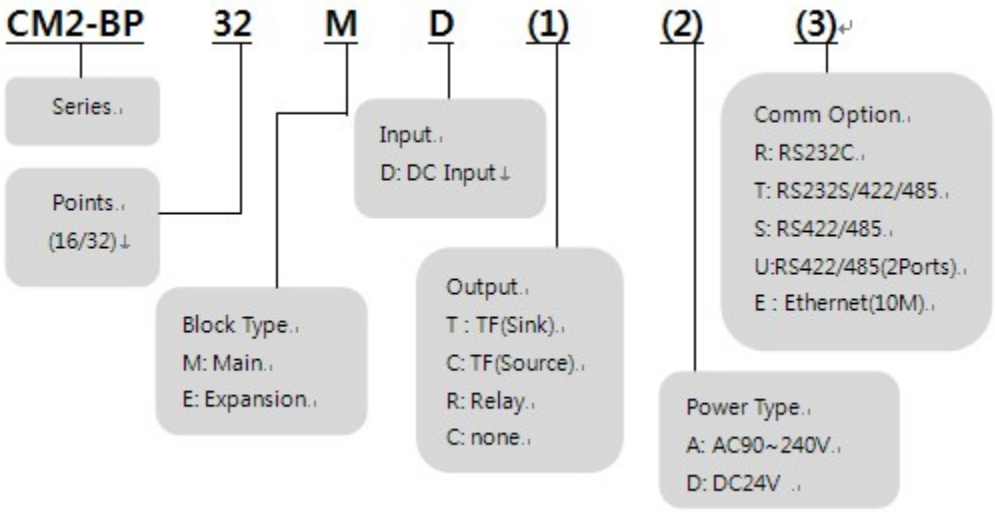
▶ RS232/422/485

구분		-T	-U	-R	-S
Channel Type		RS232C/RS422/485	RS422/485 (2 ports)	RS232C	RS422/485
Mode	HMI	Multi-Drop(max.32 stations)			
	Loader	Support	Support	X	X
	Program	Support	Support	X	X
Param	Data Bits	7 or 8 Bits			
	Stop Bits	1 or 2 Bits			
	Parity	Even / Odd / None			
Synchronize		Asynchronous			
Speed(bps)		300/600/1200/2400/9600/19200/38400			
Modem Supp.		Supports Dial-Up MODEM			

▶ Ethernet

Option(BPnnMxx-)	-E
Cable Type	10BASE-T
Comm. Speed	10Mbps
Max. Distance	10m(Node to HUB)
Max. HUB	Max.4 cascaded HUB
Max. Frame Size	1500Byte
Protocol	TCP/IP, UDP/IP

Main Block Line-Up

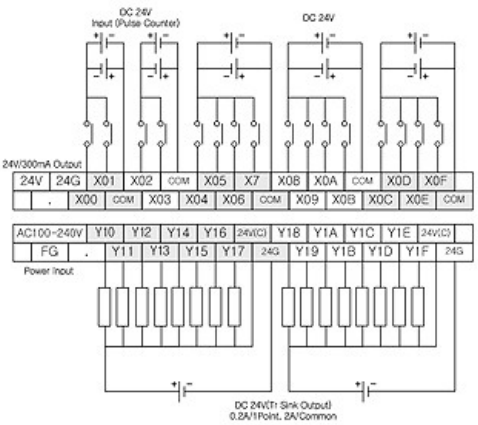


Model Name	Power	Input	Output	Option
CM2-BP32MDTA□	AC 90 - 240V	DC24V	TR(SINK)	R: RS232C T: RS232C/422/485 S: RS422/485 U: RS422/485 (2ports) E: Ethernet
CM2-BP32MDCA□			TR(SRC)	
CM2-BP32MDRA□			RELAY	
CM2-BP32MDTD□	DC 24V		TR(SINK)	
CM2-BP32MDCD□			TR(SRC)	
CM2-BP32MDRD□			RELAY	
CM2-BP16MDTA□	AC 90 - 240V		TR(SINK)	
CM2-BP16MDCA□			TR(SRC)	
CM2-BP16MDRA□			RELAY	
CM2-BP16MDTD□	DC 24V		TR(SINK)	
CM2-BP16MDCD□			TR(SRC)	
CM2-BP16MDRD□			RELAY	

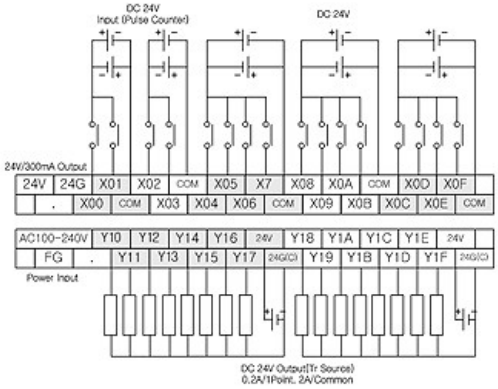
EXTERNAL WIRING

▶ **CM2-BP32MDTA□**

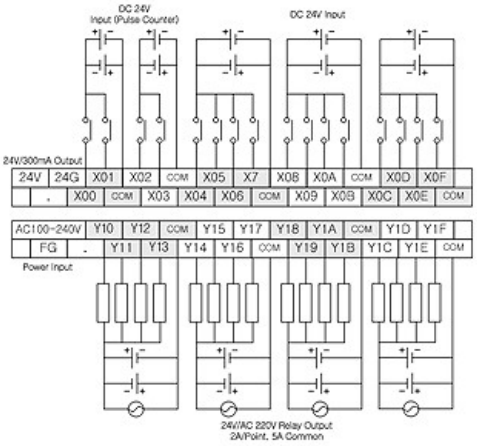
▶ **CM2-BP32MDCA□**



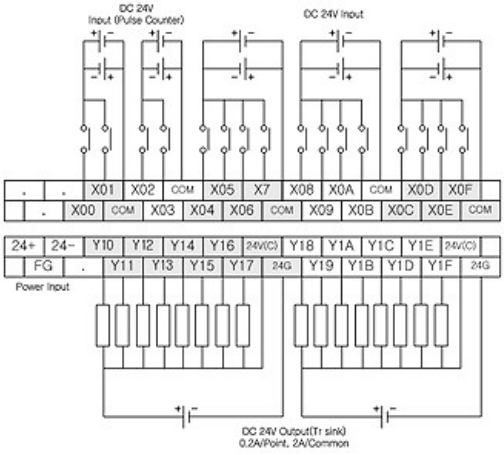
▶ **CM2-BP32MDRA□**



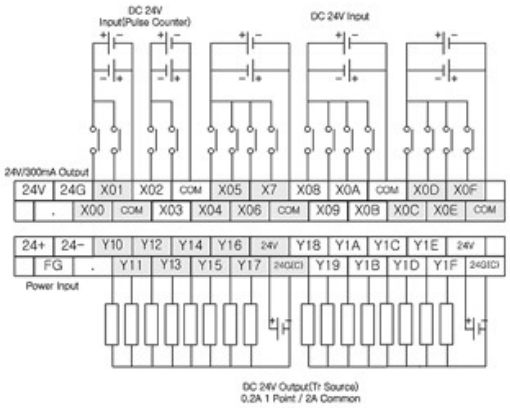
▶ **CM2-BP32MDTD□**

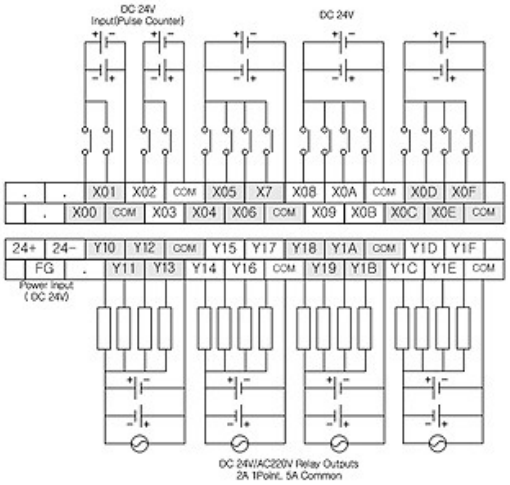


▶ **CM2-BP32MDCD□**

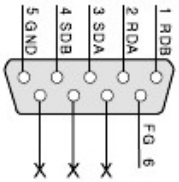


▶ **CM2-BP32MDRD□**

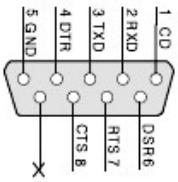




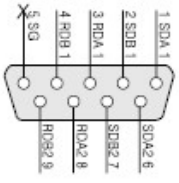
COMMUNICATION CABLE WIRING



RS422/485(Option S)



RS232(Option R)



RS422/485 2CH(Option U)

WIRING PRECAUTIONS

▶ Always ground the FG terminal for the PLC. There is a risk of electric shock or malfunction

▶ When turning on the power and operating the module after wiring Is completed, always attach the terminal cover

that comes with the Product.

▶ Tighten the terminal screws within the range of specified torque If the terminal screws are loose, it may result in

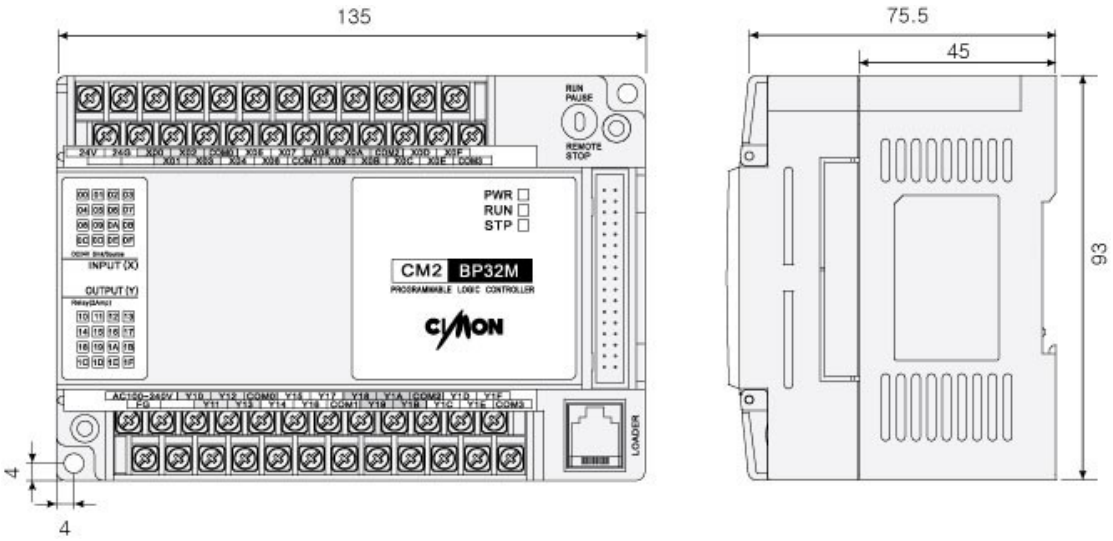
short circuits or malfunction

▶ Be careful not to let foreign matters such as sawdust or wire Chips get inside the module. These may cause fires,

failure or Malfunction.

OUTWARD DIMENSIONS

(Unit : mm)



INSTALLATION PRECAUTIONS

▶ Use the PLC in an environment that meets the general specifications Given in the User's Manual of the CPU module being used.

▶ Do not bunch the control wires or communication cables with the main circuit or power wires, or install them close to

each other. They should be installed 100mm (3.94 inch) or more from each other.

Not doing so could result in noise that may cause malfunction

▶ Switch all phases of the external power supply off when mounting or removing the module. Not doing so may cause

damage to the module.

▶ Do not directly touch the conductive area or electronic components Of the module. Doing so may cause malfunction

or failure in the Module.

3.26 CIMON-BP Series 16Main Block

Modules :

- CM2-BP16MDRA-*
- CM2-BP16MDTA-*
- CM2-BP16MDCA-*
- CM2-BP16MDRD-*
- CM2-BP16MDTD-*
- CM2-BP16MDCD-*

Contents :

GENERAL SPECIFICATIONS

<table>
<tr><th>Item</th><th colspan="5">Specification</th><th>Reference</th></tr>
<tr><td>Op.Temp.</td><td colspan="5">Operating Temperature -10 ~65 ℃</td><td></td></tr>
<tr><td>St.Temp</td><td colspan="5">Storage Temperature □□-25 ~□□80 ℃</td><td></td></tr>
<tr><td>Op.Hum</td><td colspan="5">Operating Humidity 5 ~95%RH, Not Condensed</td><td></td></tr>
<tr><td>St.Hum</td><td colspan="5">Storage Humidity 5 ~95%RH, Not Condensed</td><td></td></tr>
<tr><td rowspan="8">Vibration</td><td colspan="4">In case of intermittent vibration</td><td>-</td><td></td></tr>
<tr><td>Frequency</td><td>Acceleration</td><td>Amplitude</td><td>Sweep</td><td rowspan="8">IEC61131-2</td></tr>
<tr><td>10=□f=□□ 57Hz</td><td></td><td>0.075mm</td><td rowspan="6">10 times in X,Y,Z</td></tr>
<tr><td>57=□□f=□□ 150Hz</td><td>9.8m/s²{1G}</td><td>-</td></tr>
<tr><td colspan="3">In case of continuous vibration</td></tr>
<tr><td>Frequency</td><td>Acceleration</td><td>Amplitude</td></tr>
<tr><td>10=□□f =□□57Hz</td><td></td><td>0.035mm</td></tr>
</table>

	57=□□f= 150Hz	4.8m/s²{0.5G}			
Shock	□□Max. shock Acc. :147 m/s{15G} □□Time :11㎳ □□Pulse wave: Half sine wave pulse(3 times in X,Y,Z)				IEC61131-2
Noise	Square wave impulse noise	2,000 V			KDT Standard
	Electro-static discharge	Voltage :4kV (Contact discharge)			IEC61131-2 IEC1000-4-2
	Radiated electro-magnetic field	27 ~500 MHz,10 V/m			IEC1131-2 IEC1000-4-3
	Fast transient bust noise	Power Module	Digital I/O (24V or more)	Digital I/O (Less than 24V) Analog I/Ocomm.. Interface	IEC1131-2 IEC1000-4-4
		2kV	1kV	0.25kV	
Environ..	No corrosive gas and no dust				
Altitude	2,000m or less				
Pollution	2 or less				
Cooling	Natural Air Cooling				

MODULE SPECIFICATIONS

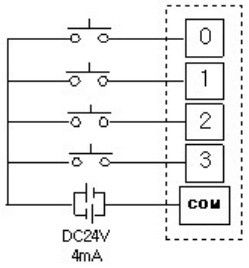
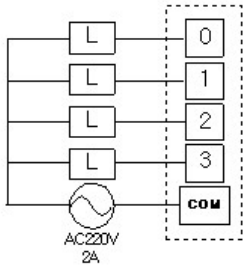
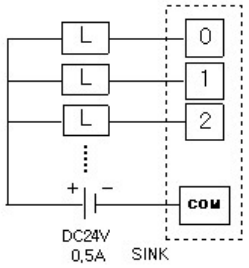
Items	Specifications
Power Supply	AC 220V / DC 24V (Max. 15W)
Input	DC 24V
Output	Relay / TR Sink / TR Source
Expansion	Not Supported
Main Block I/O	8 Inputs / 7 Outputs
Program Control	Stored Program, Cyclic Processing, Time Driven Interrupt
I/O Processing	Indirect (or direct by instruction)
Language	IL(Instruction List), LD(Ladder Diagrm)
Basic Inst.	62 Instructions
Application Inst.	308 Instructions
Speed	200㎱ / Step (Basic Instruction)
Program Capacity	8K Steps

▶ I/O and Data Memory

X	Y	M	L	K	F

8	7	4,096	1,024	1,024	2,048
T	C	S	D	Z	
256	256	100*100	5,000	1,024	

INPUT / OUTPUT SPECIFICATIONS

Items		DC Input	Relay Output	Transistor Output
Input Voltage		DC 24V	AC220V / DC24V	DC12/24V
Nominal Input/Output Current		4mA	1Points 2A / COM 5A	1Points 0.5A / COM 4A
On Voltage/Current		DC19V/4mA	-	-
Off Voltage/Current		DC11V/1mA	-	-
Resp. Time	Off -> On	5㎳ or faster	10㎳ or faster	1㎳ or faster
	On -> Off	5㎳ or faster	5㎳ or faster	1㎳ or faster
Common Type		4 Points	4 Points	8 Points
Operation Display		LED	LED	LED
Insulation Type		Photo coupler	Relay	Photo coupler
Input Type		SINK/SRC	-	-
Wiring Diagram				

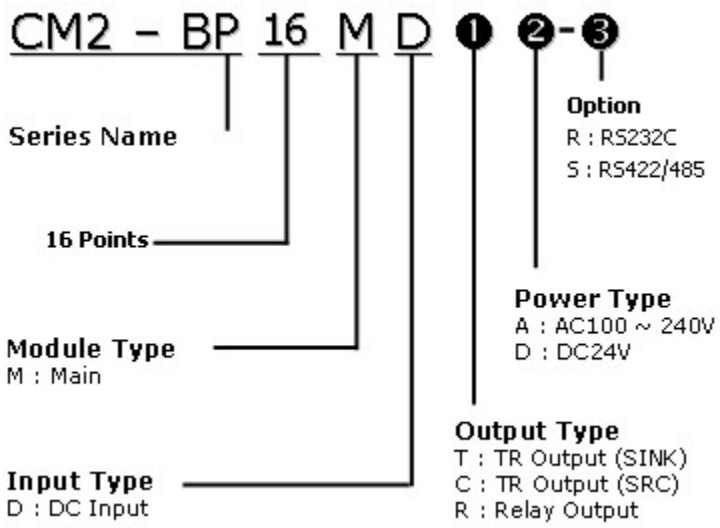
COMMUNICATION OPTIONS

▶ RS232/422/485

Option (**BP**nn**M**xxx-)		-**R**	-**S**
Channel Type		RS232C	RS422/485
Mode	HMI	Multi-Drop (max. 32 stations)	
Param	Data Bits	7 or 8 bits	
	Stop Bits	1 or 2 bits	
	Parity	Even / Odd / None	

Synchronize	Asynchronous
Speed (bps)	300/600/1200/2400/9600/19200/38400
Modem Supp.	Supports Dial-Up MODEM

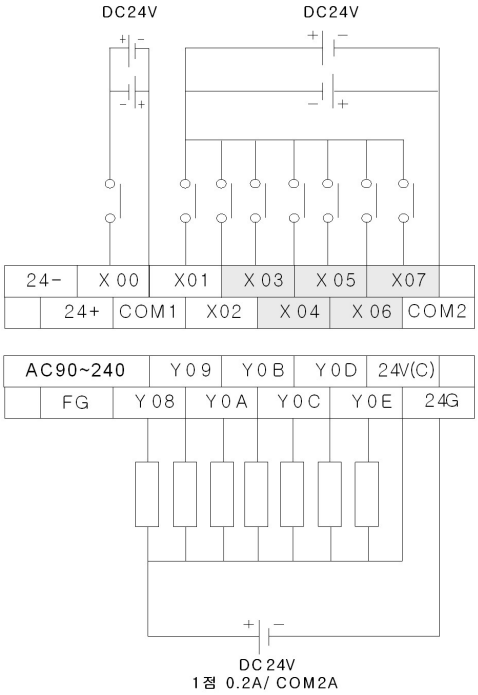
MAIN BLOCK LINE-UP

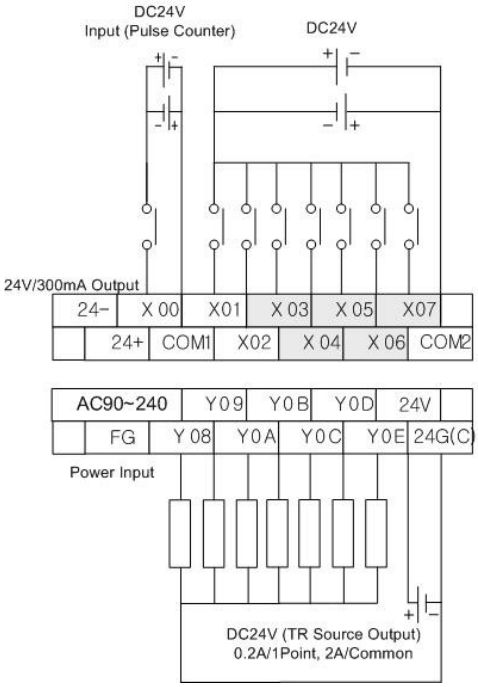


Model Name	Power	Input	Output	Option
CM2-BP16MDTA?	AC 90 ~ 240V		TR(SINK)	R : RS232C S : RS422/485
CM2-BP16MDCA?			TR(SRC)	
CM2-BP16MDRA?			RELAY	
CM2-BP16MDTD?	DC 24V		TR(SINK)	
CM2-BP16MDCD?			TR(SRC)	
CM2-BP16MDRD?			RELAY	

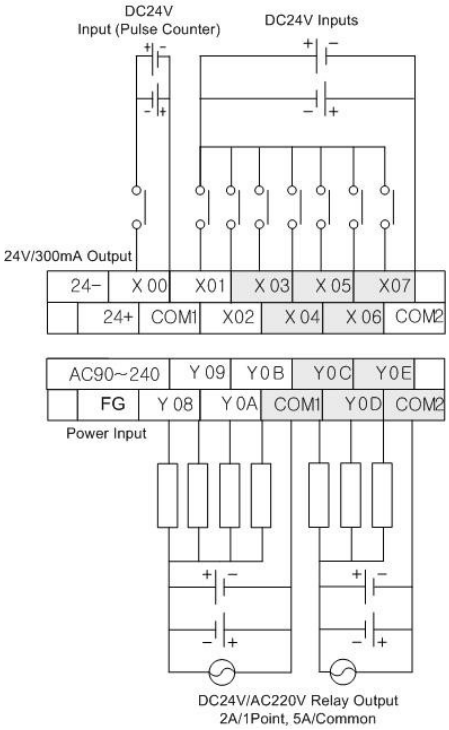
EXTERNAL WIRING

- **CM2-BP16MDTA***
- **CM2-BP16MDCA***

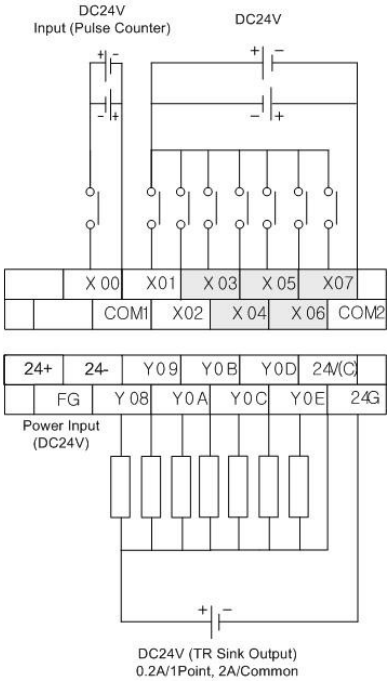


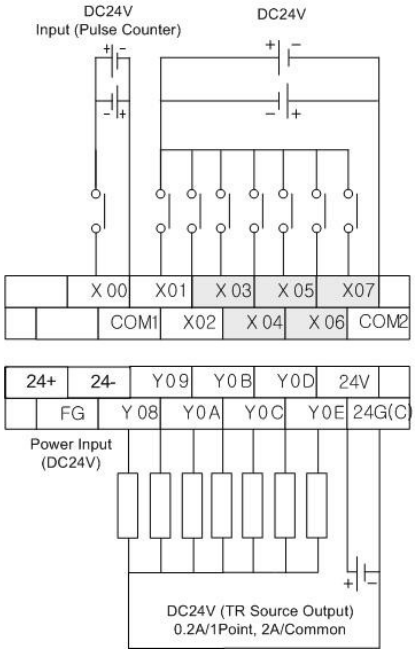


- **CM2-BP16MDRA***

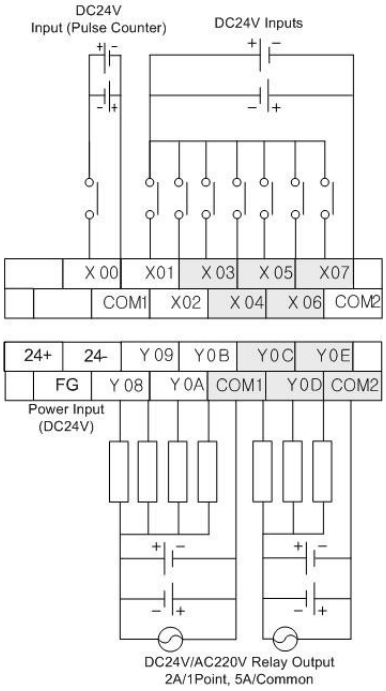


- **CM2-BP16MDTD***
- **CM2-BP16MDCD***



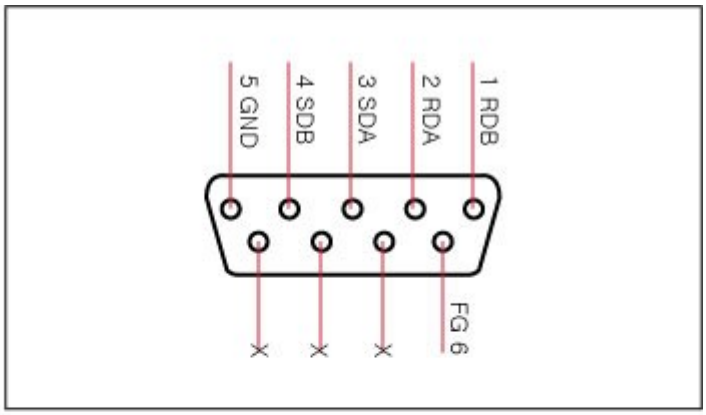


- **CM2-BP16MDRD***

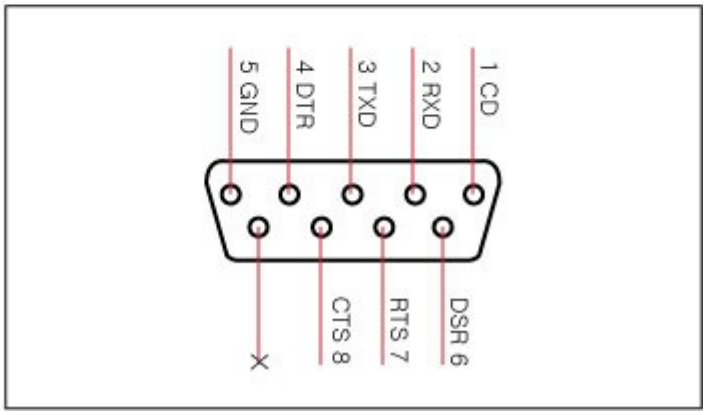


COMMUNICATION CABLE WIRING

RS422/485 (Options S)



RS232 (Options R)



WIRING PRECAUTIONS

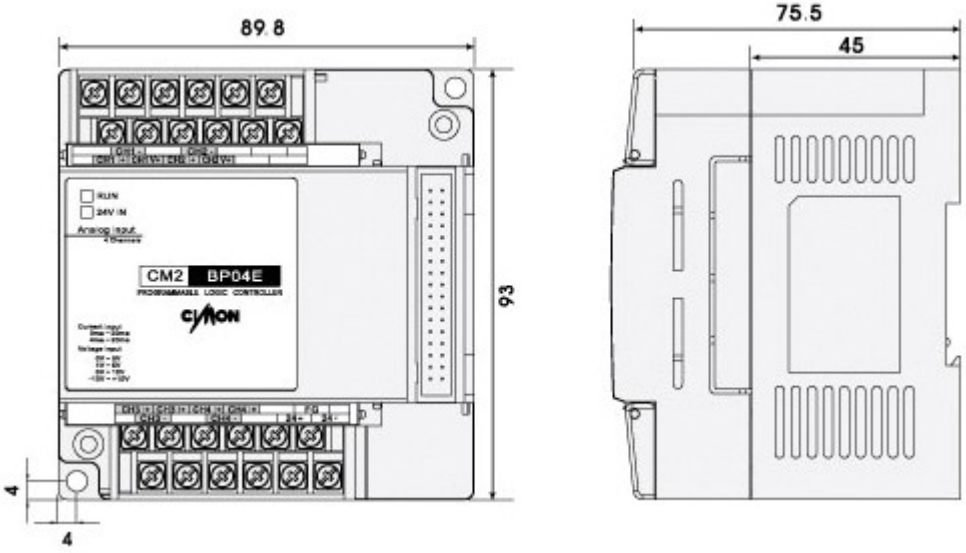
▶ Always ground the FG terminal for the PLC. There is a risk of electric shock or malfunction.

▶ When turning on the power and operating the module after wiring is completed, always attach the terminal cover that comes with the product.

▶ Tighten the terminal screws within the range of specified torque. If the terminal screws are loose, it may result in short circuits or malfunction.

▶ Be careful not to let foreign matters such as sawdust or wire chips get inside the module. These may cause fires, failure or malfunction.

DIMENSIONS



3.27 CIMON-BP 32 I/O Expansion Blocks

Modules :

- CM2-BP32EDT
- CM2-BP32EDC
- CM2-BP32EDR

Contents :

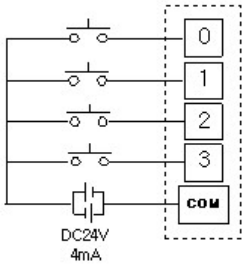
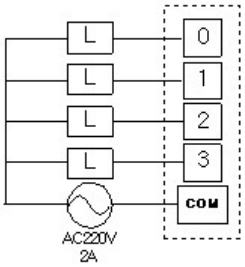
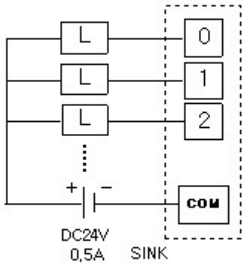
GENERAL SPECIFICATIONS

Item	Specification	Reference
Op.Temp.	Operating Temperature -10 ~65 ℃	
St.Temp	Storage Temperature □□-25 ~□□80 ℃	
Op.Hum	Operating Humidity 5 ~95%RH, Not Condensed	
St.Hum	Storage Humidity 5 ~95%RH, Not Condensed	

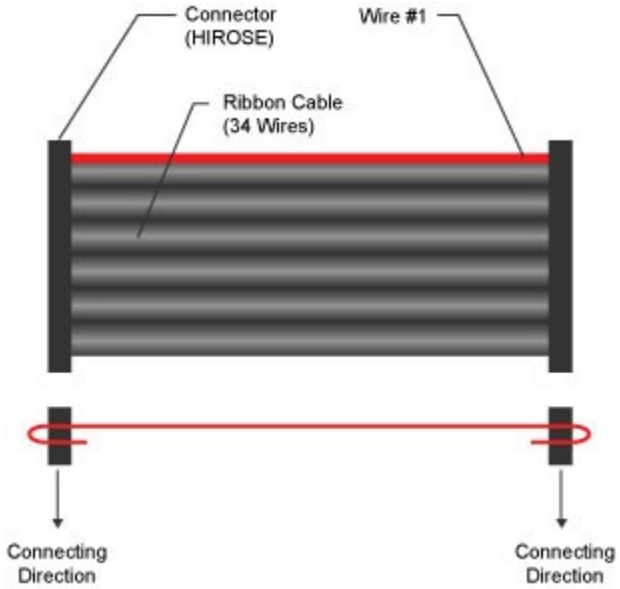
<table>
<tr><td rowspan="9">Vibration</td><td colspan="4">In case of intermittent vibration</td><td>-</td><td></td></tr>
<tr><td>Frequency</td><td>Acceleration</td><td>Amplitude</td><td>Sweep</td><td rowspan="8">IEC61131-2</td></tr>
<tr><td>10=□f=□□ 57Hz</td><td></td><td>0.075mm</td><td rowspan="6">10 times in X,Y,Z</td></tr>
<tr><td>57=□□f=□□ 150Hz</td><td>9.8m/s²{1G}</td><td>-</td></tr>
<tr><td colspan="3">In case of continuous vibration</td></tr>
<tr><td>Frequency</td><td>Acceleration</td><td>Amplitude</td></tr>
<tr><td>10=□□f =□□57Hz</td><td></td><td>0.035mm</td></tr>
<tr><td>57=□□f= 150Hz</td><td>4.8m/s²{0.5G}</td><td></td></tr>
<tr><td></td><td></td><td></td></tr>
<tr><td>Shock</td><td colspan="4">□□Max. shock Acc. :147 m/s{15G}
□□Time :11㎳
□□Pulse wave: Half sine wave pulse(3 times in X,Y,Z)</td><td>IEC61131-2</td></tr>
<tr><td rowspan="4">Noise</td><td>Square wave impulse noise</td><td colspan="3">2,000 V</td><td>KDT Standard</td></tr>
<tr><td>Electro-static discharge</td><td colspan="3">Voltage :4kV (Contact discharge)</td><td>IEC61131-2
IEC1000-4-2</td></tr>
<tr><td>Radiated electro-magneti c field</td><td colspan="3">27 ~500 MHz,10 V/m</td><td>IEC61131-2
IEC1000-4-3</td></tr>
<tr><td rowspan="2">Fast transient bust noise</td><td>Power Module</td><td>Digital I/O (24V or more)</td><td>Digital I/O (Less than 24V) Analog I/Ocomm.. Interface</td><td rowspan="2">IEC61131-2
IEC1000-4-4</td></tr>
<tr><td>2kV</td><td>1kV</td><td>0.25kV</td></tr>
<tr><td>Environ..</td><td colspan="4">No corrosive gas and no dust</td><td></td></tr>
<tr><td>Altitude</td><td colspan="4">2,000m or less</td><td></td></tr>
<tr><td>Pollution</td><td colspan="4">2 or less</td><td></td></tr>
<tr><td>Cooling</td><td colspan="4">Natural Air Cooling</td><td></td></tr>
</table>

INPUT/OUTPUT SPECIFICATIONS

ITEMS		DC INPUT	RELAY OUTPUT	TRANSISTOR OUTPUT
Input Voltage		DC 24V	AC220V / DC24V	DC12/24V
Nominal Input Current		4mA	1Point 2A / COM 5A	1Point 0.2A / COM 4A
On Voltage/Current		DC19V/4mA	-	-
Off Voltage/Current		DC11V/1mA	-	-
Resp. Time	Off -> On	5㎳ or faster	10㎳ or faster	1㎳ or faster
	On -> Off	5㎳ or faster	5㎳ or faster?	1㎳ or faster

Common Type	4 Points Common	4Points?	8Points
Operation Display	LED?	LED?	LED?
Insulation Type	Photo-coupler	RELAY	Photo-coupler
Input Type	SINK/SRC	-	-
Wiring Diagram			

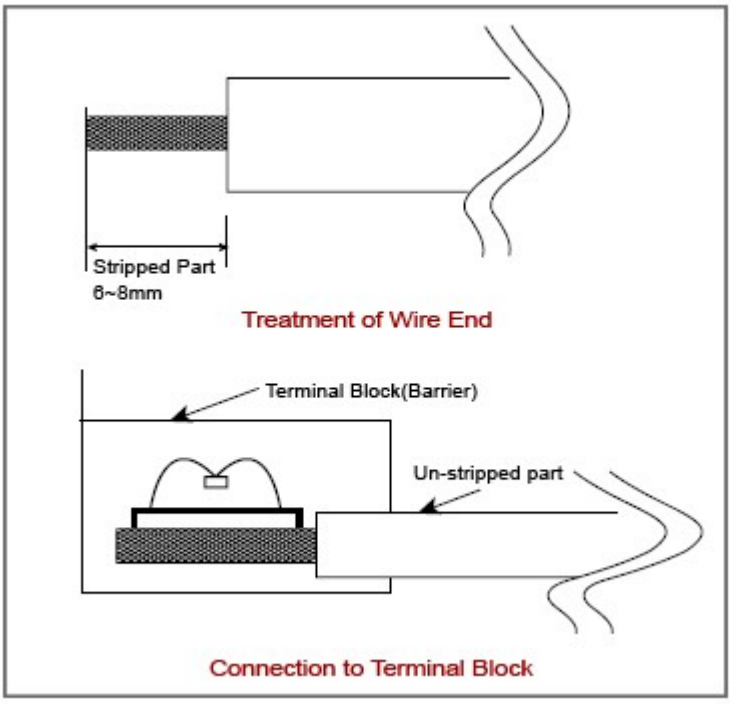
EXPANSION CABLE



SAFETY PRECAUTIONS(on wiring)

▶ In case of connecting to a terminal block without contact connector, the uncovered part of a wire is to be 6mm to 8mm.

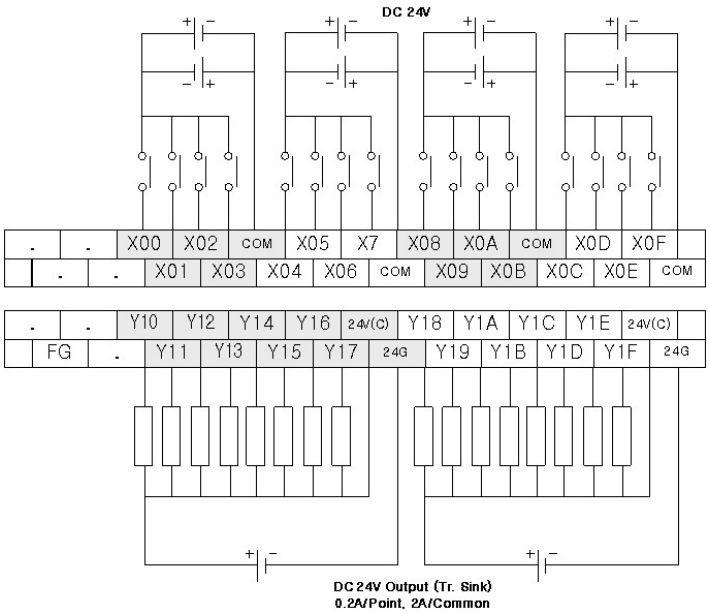
And take care that the uncovered metal part of a wire is pushed out from a terminal block.



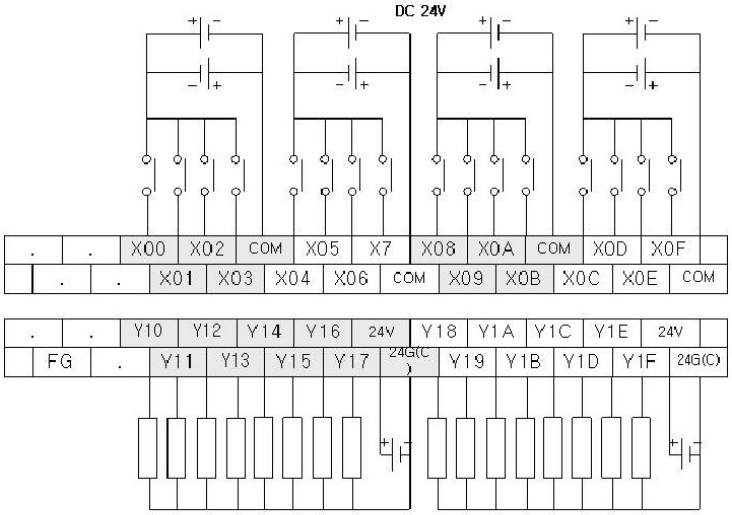
▶ In case of a twisted wire, take care that it is not loosed.

EXTERNAL WIRING

- **CM2-BP32EDT**

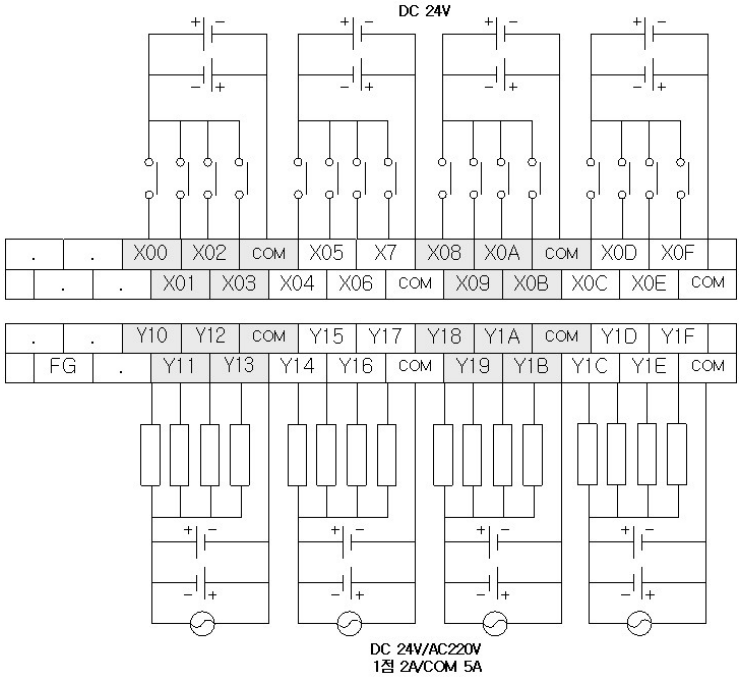


- **CM2-BP32EDC**



DC 24V Output (Tr. Source)
0.2A/Point, 2A/Common

- **CM2-BP32EDR**



DC 24V/AC220V
1점 2A/COM 5A

INSTALLATION PRECAUTIONS

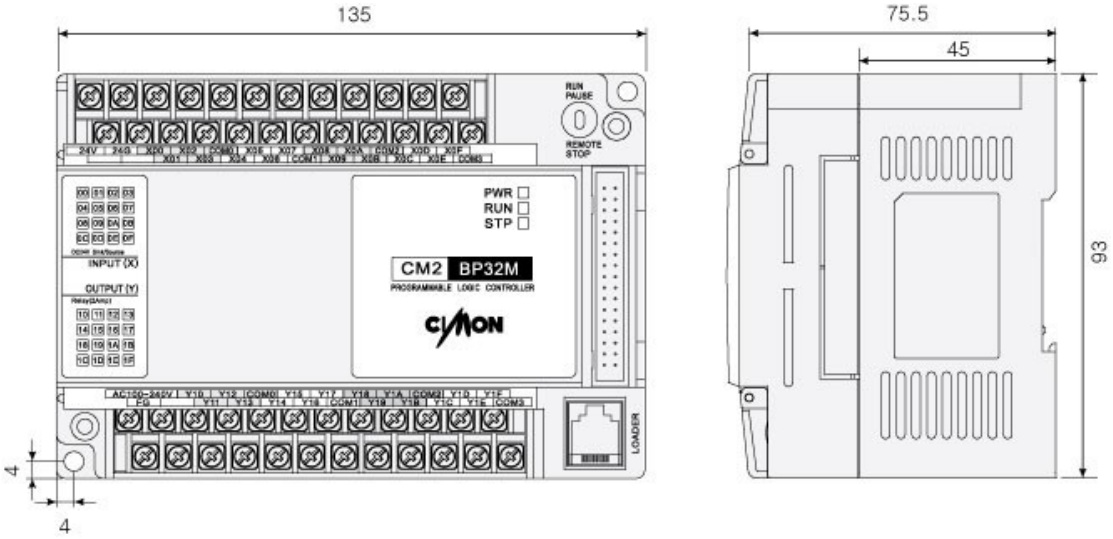
▶ Use the PLC in an environment that meets the general specifications given in the User's Manual of the CPU module being used.

▶ Do not bunch the control wires or communication cables with the main circuit or power wires, or install them close to each other.
They should be installed 100mm (3.94 inch) or more from each other. Not doing so could result in noise that may cause malfunction.

▶ Switch all phases of the external power supply off when mounting or removing the module. Not doing so may cause damage to the module.

▶ Do not directly touch the conductive area or electronic components of the module. Doing so may cause malfunction or failure in the module.

DIMENSIONS



3.28 CIMON-BP 16 I/O Expansion Blocks

Modules :

- CM2-BP16EDT
- CM2-BP16EDC
- CM2-BP16EDR
- CM2-BP16EDO
- CM2-BP16EOR
- CM2-BP16EOT
- CM2-BP16EOC

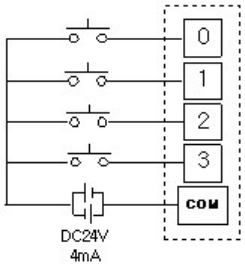
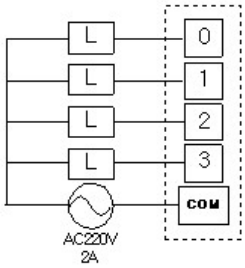
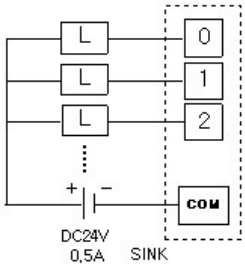
Contents :

GENERAL SPECIFICATIONS

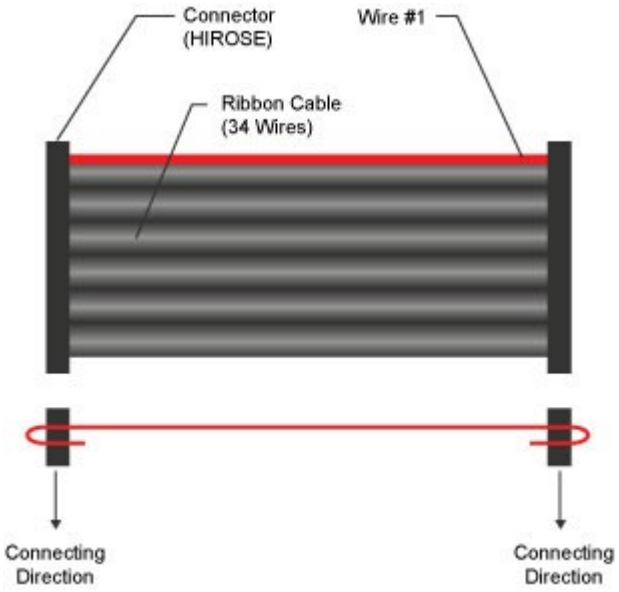
Item	Specification				Reference
Op.Temp.	Operating Temperature -10 ~65 ℃				
St.Temp	Storage Temperature □□-25 ~□□80 ℃				
Op.Hum	Operating Humidity 5 ~95%RH, Not Condensed				
St.Hum	Storage Humidity 5 ~95%RH, Not Condensed				
Vibration	In case of intermittent vibration			-	
	Frequency	Acceleration	Amplitude	Sweep	IEC61131-2
	10=□f=□□ 57Hz		0.075mm	10 times in X,Y,Z	
	57=□□f=□□ 150Hz	9.8m/s²{1G}	-		
	In case of continuous vibration				
	Frequency	Acceleration	Amplitude		
	10=□□f =□□57Hz		0.035mm		
	57=□□f= 150Hz	4.8m/s²{0.5G}			
Shock	□□Max. shock Acc. :147 m/s{15G} □□Time :11㎳ □□Pulse wave: Half sine wave pulse(3 times in X,Y,Z)				IEC61131-2
Noise	Square wave impulse noise	2,000 V			KDT Standard
	Electro-static discharge	Voltage :4kV (Contact discharge)			IEC61131-2 IEC1000-4-2
	Radiated electro-magneti c field	27 ~500 MHz,10 V/m			IEC61131-2 IEC1000-4-3
	Fast transient bust noise	Power Module	Digital I/O (24V or more)	Digital I/O (Less than 24V) Analog I/Ocomm.. Interface	IEC61131-2 IEC1000-4-4

		2kV	1kV	0.25kV	
Environ..	No corrosive gas and no dust				
Altitude	2,000m or less				
Pollution	2 or less				
Cooling	Natural Air Cooling				

INPUT/OUTPUT SPECIFICATIONS

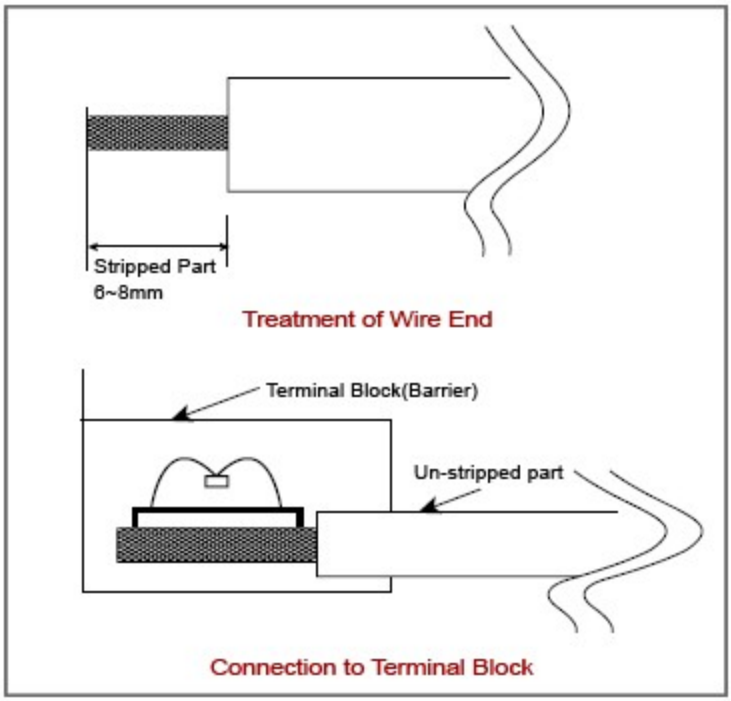
Items		DC INPUT	Relay Output	트랜지스터 출력
Input Voltage		DC 24V	AC220V / DC24V	DC12/24V
Nominal Input Current		4mA	1Point 2A / COM 5A	1Point 0.2A / COM 2A
On Voltage/Current		DC19V/4mA	-	-
Off Voltage/Current		DC11V/1mA	-	-
Resp. Time	Off -> On	5㎳ or faster	10㎳or faster	1㎳or faster
	On -> Off	5㎳ or faster	5㎳ or faster	1㎳or faster
Common Type		4 Points	4Points?	8 Points?
Operation Display		LED	LED	LED
Insulation Type		Photo coupler	Relay	Photo coupler
Input Type		SINK / SRC ?	-	-
Wiring Diagram				

EXPANSION CABLE



SAFETY PRECAUTIONS (ON Wiring)

▶ In case of connecting to a terminal block without contact connector, the uncovered part of a wire is to be 6mm to 8mm.
And take care that the uncovered metal part of a wire is pushed out from a terminal block.



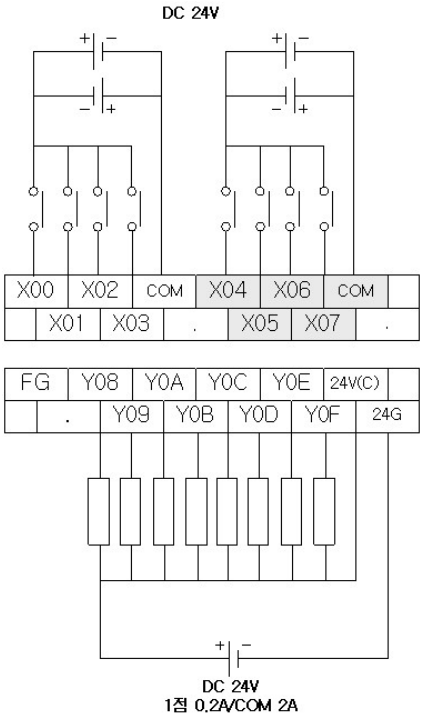
▶ In case of a twisted wire, take care that it is not loosed.

EXTERNAL WIRING

- **CM2-BP16EDT**

o INPUT : 8 Points

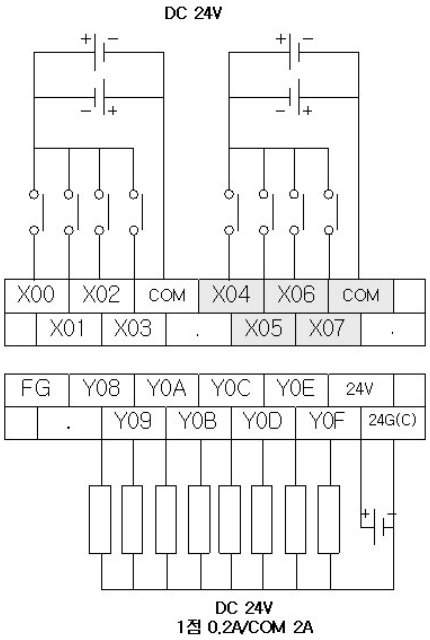
o OUTPUT : 8Points(TR SINK)



- **CM2-BP16EDC**

o INPUT : 8Points

o OUTPUT : 8Points(TR Source)



- **CM2-BP16EDR**

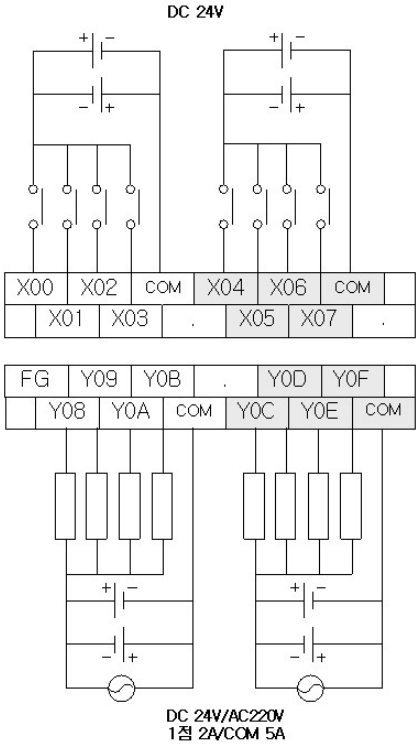
o INPUT : 8Points

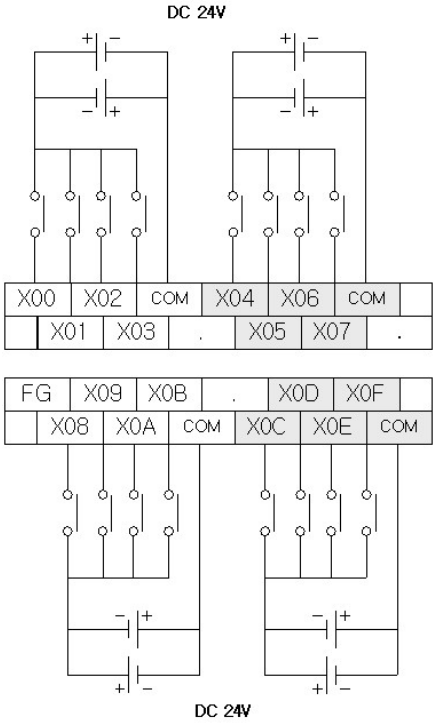
o OUTPUT : 8Points(RELAY)

- **CM2-BP16EDO**

o INPUT : 16Points

o OUTPUT : None





- **CM2-BP16EOR**

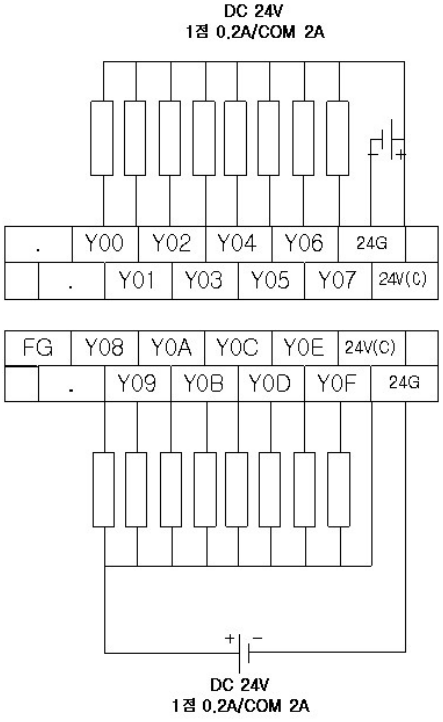
o INPUT : 0Points

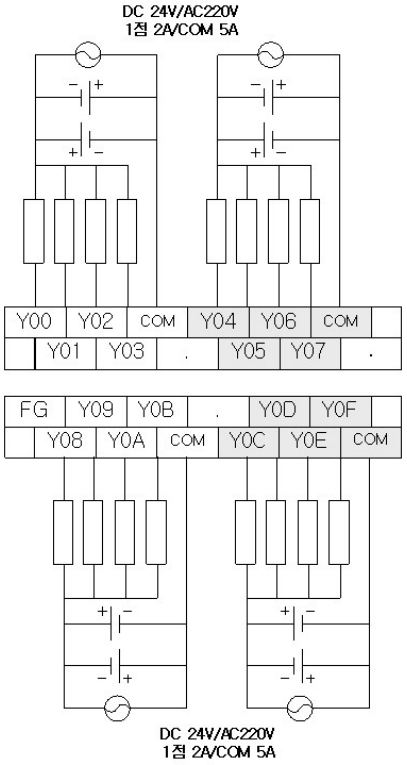
o OUTPUT : 16Points(RELAY)

- **CM2-BP16EOT**

o INPUT : 0Points

o OUTPUT : 16Points(TR Sink)

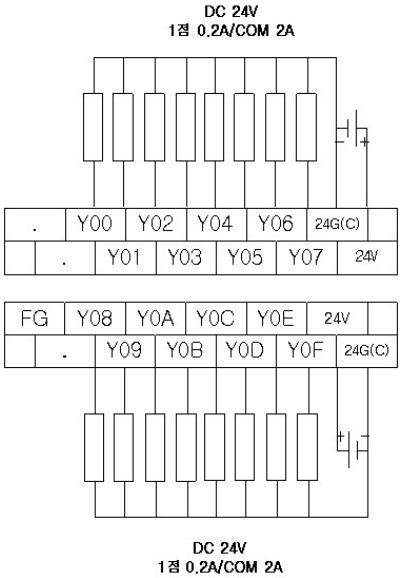




- **CM2-BP16EOC**

o INPUT : 0Points

o OUTPUT : 16Points(TR Source)



INSTALLATION PRECAUTIONS

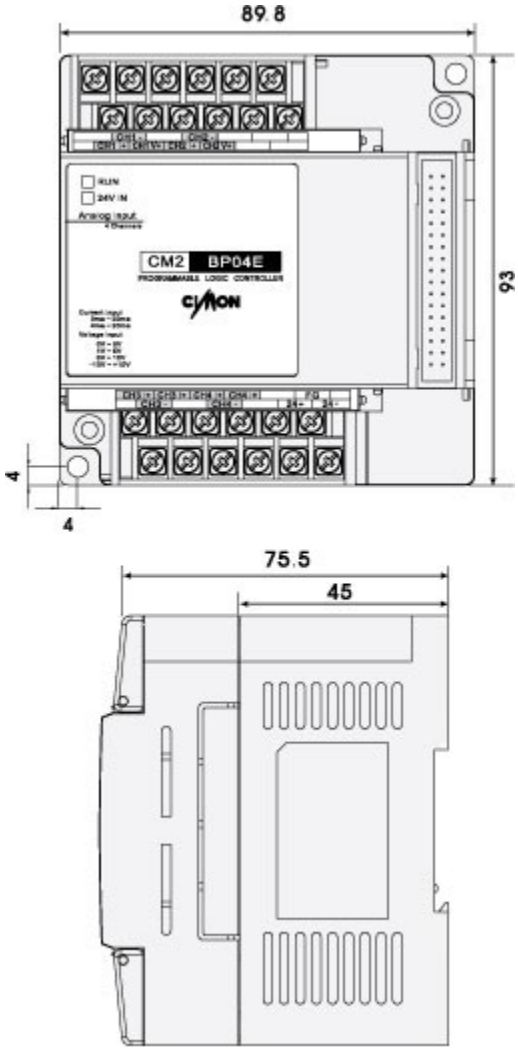
▶ Use the PLC in an environment that meets the general specifications given in the User's Manual of the CPU module being used.

▶ Do not bunch the control wires or communication cables with the main circuit or power wires, or install them close to each other.
They should be installed 100mm (3.94 inch) or more from each other. Not doing so could result in noise that may cause malfunction.

▶ Switch all phases of the external power supply off when mounting or removing the module. Not doing so may cause damage to the module.

▶ Do not directly touch the conductive area or electronic components of the module. Doing so may cause malfunction or failure in the module.

DIMENSIONS



3.29 CM2-BP04EAO (Analog Expansion Blocks - AD V/I 4Ch Input)

Modules :

- CM2-BP04EAO (Analog Expansion Blocks - AD V/I 4Ch Input)

Contents :

GENERAL SPECIFICATIONS

Item	Specification				Reference
Op.Temp.	Operating Temperature -10 ~65 ℃				
St.Temp	Storage Temperature □□-25 ~□□80 ℃				
Op.Hum	Operating Humidity 5 ~95%RH, Not Condensed				
St.Hum	Storage Humidity 5 ~95%RH, Not Condensed				
Vibration	In case of intermittent vibration			-	
	Frequency	Acceleration	Amplitude	Sweep	IEC61131-2
	10=□f=□□ 57Hz		0.075mm	10 times in X,Y,Z	
	57=□□f=□□ 150Hz	9.8m/s²{1G}	-		
	In case of continuous vibration				
	Frequency	Acceleration	Amplitude		
	10=□□f =□□57Hz		0.035mm		
	57=□□f= 150Hz	4.8m/s²{0.5G}			
Shock	□□Max. shock Acc. :147 m/s{15G} □□Time :11㎳ □□Pulse wave: Half sine wave pulse(3 times in X,Y,Z)				IEC61131-2
Noise	Square wave impulse noise	2,000 V			KDT Standard
	Electro-static discharge	Voltage :4kV (Contact discharge)			IEC61131-2 IEC1000-4-2
	Radiated electro-magneti c field	27 ~500 MHz,10 V/m			IEC61131-2 IEC1000-4-3
	Fast transient bust noise	Power Module	Digital I/O (24V or more)	Digital I/O (Less than 24V) Analog I/Ocomm.. Interface	IEC61131-2 IEC1000-4-4
		2kV	1kV	0.25kV	

Environ..	No corrosive gas and no dust	
Altitude	2,000m or less	
Pollution	2 or less	
Cooling	Natural Air Cooling	

MODULE SPECIFICATIONS

Items		Specifications	
Channels		4 Channels	
Input	V	0 ~ 5V 1 ~ 5V 0 ~ 10V -10 ~ 10V	
	I	0 ~ 20㎃ 4 ~ 20㎃	
Converted Data		0 ~ 16000 (-8000 ~ 8000)	
Precision	V	0 ~ 5V	0.3125㎷
		1 ~ 5V	0.25㎷
		0 ~ 10V	0.625㎷
		-10 ~ +10V	1.25㎷
	I	0 ~ 20㎃	1.25㎂
		4 ~ 20㎃	1.0㎂
Accuracy		0.3%(Full Scale)	
Conv. Speed		5㎳ / 1 Ch.	
Max. Input		V : ±12V I : ±25㎃	
Insulation		Photo-Coupler (Between Channel : Not Insulated)	
Occupied I/O		16 Points	
Terminal Block		12 Point Terminal Block X 2	
External Power		24VDC	
Power Consumption		70㎃	

User Program Memory MAP

Address		Descriptions	R/W
HEX	DEC		
0H	0	Channel Enable/Disable	R/W
1H	1	CH1 Avr. Filtering Constant	R/W
2H	2	CH2 Avr. Filtering Constant	R/W
3H	3	CH3 Avr. Filtering Constant	R/W
4H	4	CH4 Avr. Filtering Constant	R/W

5H	5	Reserved	-
6H	6		
7H	7		
8H	8		
9H	9	Avr. Filtering Method	R/W
AH	10	AD Conversion Completed Flags	R
BH	11	CH1 Converted Value	R
CH	12	CH2 Converted Value	R
DH	13	CH3 Converted Value	R
EH	14	CH4 Converted Value	R
FH	15	Reserved	-
10H	16		
11H	17		
12H	18		
13H	19	Error Code	R
14H	20	Input Signal Range	R/W
15H	21	Reserved	-
16H	22	Channel Select for Calib. (Offset)	R/W
17H	23	Channel Select for Calib (Gain)	R/W

Address		Descriptions	R/W
HEX	DEC		
18H	24	Converted Value Range	R/W
19H	25	Reserved	-
1AH	26		
1BH	27		
1CH	28		
1DH	29		
1EH	30	CH1 Max. Value	R
1FH	31	CH1 Min. Value	R
20H	32	CH2 Max. Value	R
21H	33	CH2 Min. Value	R
22H	34	CH3 Max Value	R
23H	35	CH3 Min. Value	R
24H	36	CH4 Max. Value	R
25H	37	CH4 Min. Value	R
26H	38	Reserved	-
27H	39		
28H	40		
29H	41		
2AH	42		
2BH	43		
2CH	44		
2DH	45		

I/O MAP

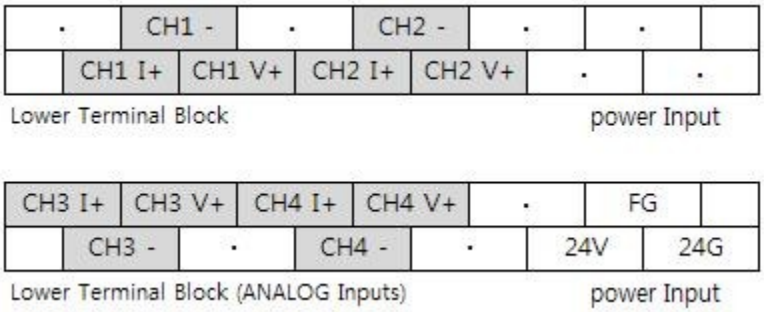
Direction : CPU ← A/D		Direction : CPU→ A/D	
Inputs	Descriptions	Outputs	Descriptions
X0	Module Ready	Y0	Reserved
X1	A/D Conversion Completed	Y1	
X2	Completed to Store Config. Data	Y2	Req. to Store Config. Data
X3	Ch. Selection Completed	Y3	Req. to Select Channel
X4	Calib. Mode	Y4	Req. to Calib. Mode
X5	Reserved	Y5	Calib. Mode Select (Offset/Gain)
X6		Y6	Reserved
X7		Y7	
X8		Y8	
X9		Y9	
XA		YA	
XB		YB	
XC		YC	
XD		YD	
XE		YE	Req. to Reset Min/Max.
XF	Error	YF	Req. to Clear Error

EXTERNAL WIRING

Codes	Descriptions
1•	Invalid input signal range defined. This error can be occurred when the module was configured with inadequate configuration tool. Assure the menu that had been used for configuration is Tool -> Optional Module Setup -> AD Module.
2•	Invalid average time was defined. This error can be occurred when the module was configured with inadequate configuration tool. Assure the menu that had been used for configuration is Tool -> Optional Module Setup -> AD Module.
3•	Invalid average count was defined. This error can be occurred when the module was configured with inadequate configuration tool. Assure the menu that had been used for configuration is Tool -> Optional Module Setup -> AD Module.
4•	Calibration error. This error will be occurred in case of inaccurate reference current or voltage signal is supplied during calibration.
49	Calibration error. ‘Offset’ and ‘Gain’ calibration must not be fulfilled simultaneously.
10△	System error. Check the CPU block and expansion cable.

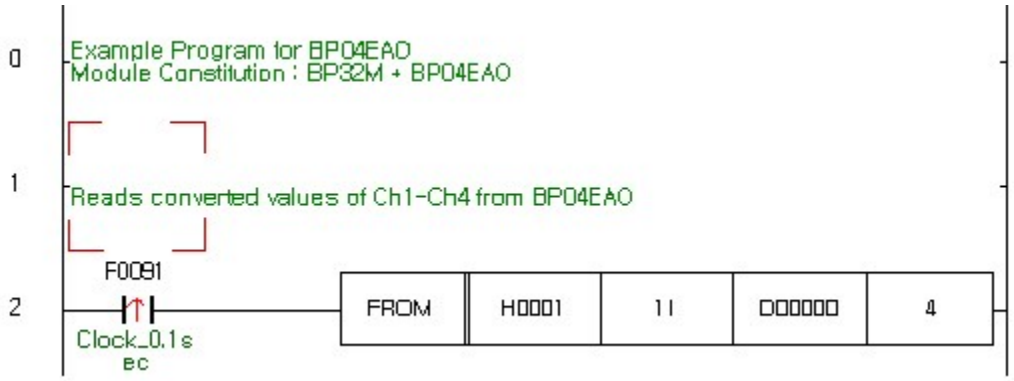
•is replaced with channel number (1 ~ 4) which is in trouble.
△ can be any number between 0 to 3

EXTERNAL WIRING



▶ In case of using current input, I+ and V+ terminal must be connected with shunt wire.

PROGRAMMING EXAMPLE



▶ **Rung 2**

FROM instruction was used to read converted value from BP04EAO module.
It reads converted values of Ch1 to Ch4 on every 0.1 second and stores to D00000 to D00003.
The first operand of this instruction 'H0001' means the first expanded block. If there was another block between CPU and AD, this operand should be 'H0002'.
The second operand '11' means the address of 'User Program Memory' where the converted value is stored in. (Refer to the MAP)
The third operand 'D00000' means the device area where the converted value would be moved to. The converted value of CH1 will be moved to D0000 and CH2 will be moved to D0001 and so on.
The last operand '4' means 4 WORD moving. If you assign '1' to this operand, only a converted value of CH1 would be moved to D0000.

TROUBLE SHOOTING

If there was any trouble with input signal, configuration or module itself, the RUN LED would blink every 0.2 second. In this case,

the error code can be read by CICON or address 19 of 'User Program Memory'.

▶ **Check following points first :**

- Assure external power is supplied correctly (DC24V)
- Check expansion cable between blocks.
- Change the CPU to STOP mode, and re-power the entire modules. If LED stops blinking, there will be some mistake in the sequence program. If LED still blinks, read following steps.

▶ **How to check the error code :**

Select Tool -> Optional Module Setup -> AD Module? menu of the CICON. A dialog box titled with AD module setup? will be popped-up. Assure the 'Base' number is '0' and 'Slot' number is appropriate number (1..3) for the module. Click the Status? button of this dialog box. Another dialog box titled with AD module status? will be popped-up, the error code will be displayed in this dialog box. CICON must be in connected status (On-Line) with PLC.

▶ **Erasing error code :**

After trouble fixing, click the " Reset Error " button in the dialog box titled with " AD module status "

FEATURES

▶ CM2-BP04EAO supports analog inputs of voltage and/or current up to 4 channels.

▶ Supported input signal types (I): 0~20mA, 4~20mA,

▶ Supported input signal types (V): 0~5V, 1~5V, -10~10V, 0~10V

▶ Various types of noise filter can be applied by simple configuration with CICON. It includes average based on sampling count, average based on time span and 2^{nd} order digital filter algorithm.

▶ Provides high precision digital converted data (1/16000)

▶ RUN LED will blink every 0.3 second in case of abnormal status. Check the error code by using CICON

INSTALLATION PRECAUTIONS

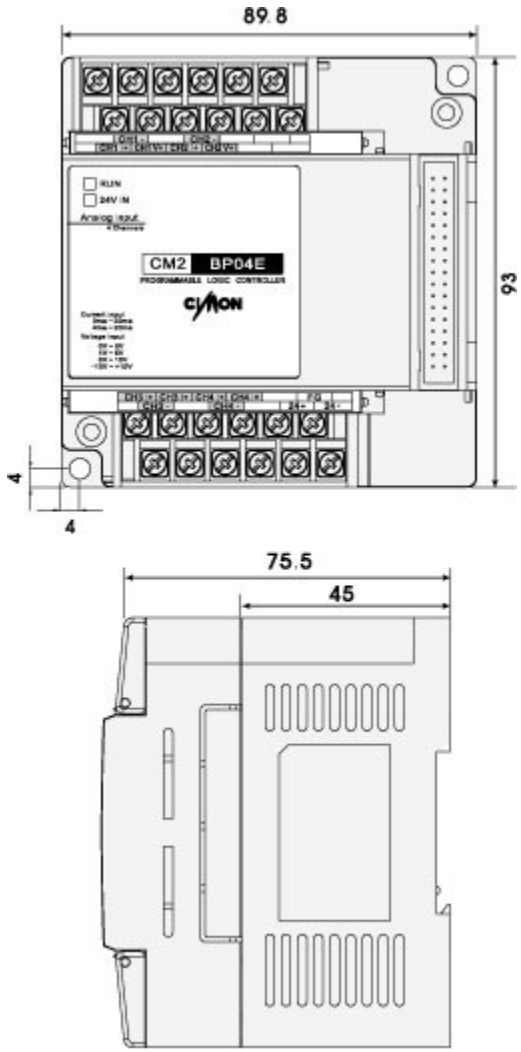
▶ Use the PLC in an environment that meets the general specifications given in the User's Manual of the CPU module being used.

▶ Do not bunch the control wires or communication cables with the main circuit or power wires, or install them close to each other. They should be installed 100mm (3.94 inch) or more from each other. Not doing so could result in noise that may cause malfunction.

▶ Switch all phases of the external power supply off when mounting or removing the module. Not doing so may cause damage to the module.

▶ Do not directly touch the conductive area or electronic components of the module. Doing so may cause malfunction or failure in the module.

DIMENSIONS



3.30 CM2-BP04EOA (Analog Expansion Blocks - DA V/I 4Ch Output)

Modules :

- CM2-BP04EOA (Analog Expansion Blocks - DA V/I 4Ch Output)

Contents :

GENERAL SPECIFICATIONS

Item	Specification				Reference
Op.Temp.	Operating Temperature -10 ~65 ℃				
St.Temp	Storage Temperature □□-25 ~□□80 ℃				
Op.Hum	Operating Humidity 5 ~95%RH, Not Condensed				
St.Hum	Storage Humidity 5 ~95%RH, Not Condensed				
Vibration	In case of intermittent vibration			-	
	Frequency	Acceleration	Amplitude	Sweep	IEC61131-2
	10=□f=□□ 57Hz		0.075mm	10 times in X,Y,Z	
	57=□□f=□□ 150Hz	9.8m/s²{1G}	-		
	In case of continuous vibration				
	Frequency	Acceleration	Amplitude		
	10=□□f =□□57Hz		0.035mm		
	57=□□f= 150Hz	4.8m/s²{0.5G}			
Shock	□□Max. shock Acc. :147 m/s{15G} □□Time :11㎳ □□Pulse wave: Half sine wave pulse(3 times in X,Y,Z)				IEC61131-2
Noise	Square wave impulse noise	2,000 V			KDT Standard
	Electro-static discharge	Voltage :4kV (Contact discharge)			IEC61131-2 IEC1000-4-2
	Radiated electro-magnetic field	27 ~500 MHz,10 V/m			IEC61131-2 IEC1000-4-3
	Fast transient	Power	Digital I/O	Digital I/O	IEC61131-2

	bust noise	Module	(24V or more)	(Less than 24V) Analog I/Ocomm.. Interface	IEC1000-4-4
		2kV	1kV	0.25kV	
Environ..	No corrosive gas and no dust				
Altitude	2,000m or less				
Pollution	2 or less				
Cooling	Natural Air Cooling				

MODULE SPECIFICATIONS

Items		Specifications	
Channels		4 Channels	
Analog Range	V	-10 ~ 10V	
	I	4 ~ 20㎃	
Digital Range		0 ~ 16000 (-8000 ~ 8000)	
Precision	V	-10 ~ +10V	1.25㎷
	I	4 ~ 20㎃	1.0㎂
Accuracy		±0.3% (Full Scale)	
Conv. Speed		15㎳ / 4 Channels	
Max. Output		V : ±12V I : ±21㎃	
Insulation		Photo-Coupler Between Channels : Not Insulated	
Occupied I/O		16 Points	
Terminal Block		12 Points Terminal Block X 2	
External Power		24VDC	
Power Consumption		70㎃	

I/O MAP

Direction CPU← D/A		Direction CPU→ D/A	
Inputs	Descriptions	Outputs	Descriptions
X0	Module Ready	Y0	Reserved
X1	Reserved	Y1	
X2		Y2	

X3		Y3	
X4		Y4	
X5		Y5	
X6		Y6	
X7		Y7	
X8		Y8	
X9		Y9	
XA	Conf. Data Stored.	YA	Req. to Store Config. Data
XB	Ch. Selection Completed	B	Req. to Select Channel
XC	Calib. Data Stored	YC	Req. to Store Calib. Data
XD	Conf. Mode	YD	Req. to Calib.
XE	Reserved	YE	Calib. Mode Select
XF	Error	YF	Req. to Clear Error

USER PROGRAM MEMORY MAP

Address		Descriptions	R/W
HEX	DEC		
0H	0	DA Conversion Enable/Disable	R/W
1H	1	CH1 Output Value	R/W
2H	2	CH2 Output Value	R/W
3H	3	CH3 Output Value	R/W
4H	4	CH4 Output Value	R/W
5H	5	Reserved	-
6H	6		
7H	7		
8H	8		
9H	9	Error Code	R
AH	10	HOLE/CLEAR Setting	R/W
BH	11	CH1 Output Value Check Code	R
CH	12	CH2 Output Value Check Code	R
DH	13	CH3 Output Value Check Code	R
EH	14	CH4 Output Value Check Code	R
FH	15	Reserved	-
10H	16		

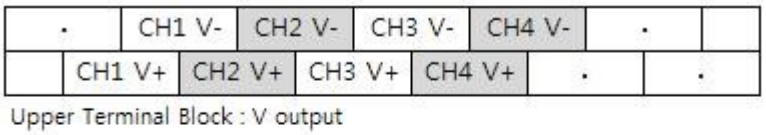
11H	17		
12H	18		
13H	19	Calib. Data (Offset Value)	R/W
14H	20	Calib. Data (Gain Value)	R/W
15H	21	Calib. Mode (Offset/Gail)	R/W
16H	22	Range of Output Value	R/W
17H	23	DA Output Enable/Disable	R/W
18H	24	Type(V/I) of Output Value	R/W

ERROR CODES

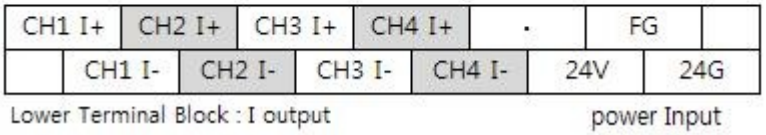
•is replaced with channel number (1 ~ 4) which is in trouble.
△ can be any number between 0 to 3

1•	Invalid output value assigned (too big value). Check the digital output values. They must be between -192 to 16191 or -8192 to 8191
2•	Invalid output value assigned (too small value). Check the digital output values. They must be between -192 to 16191 or -8192 to 8191
3•	Calibration error. Too big value was designated in offset or gain value.
4•	Calibration error. 'Offset' and 'Gain' calibration must not be fulfilled simultaneously.
49	Calibration error
10△	System error. Check the CPU block and expansion cable.

EXTERNAL WIRING



Upper Terminal Block : V output

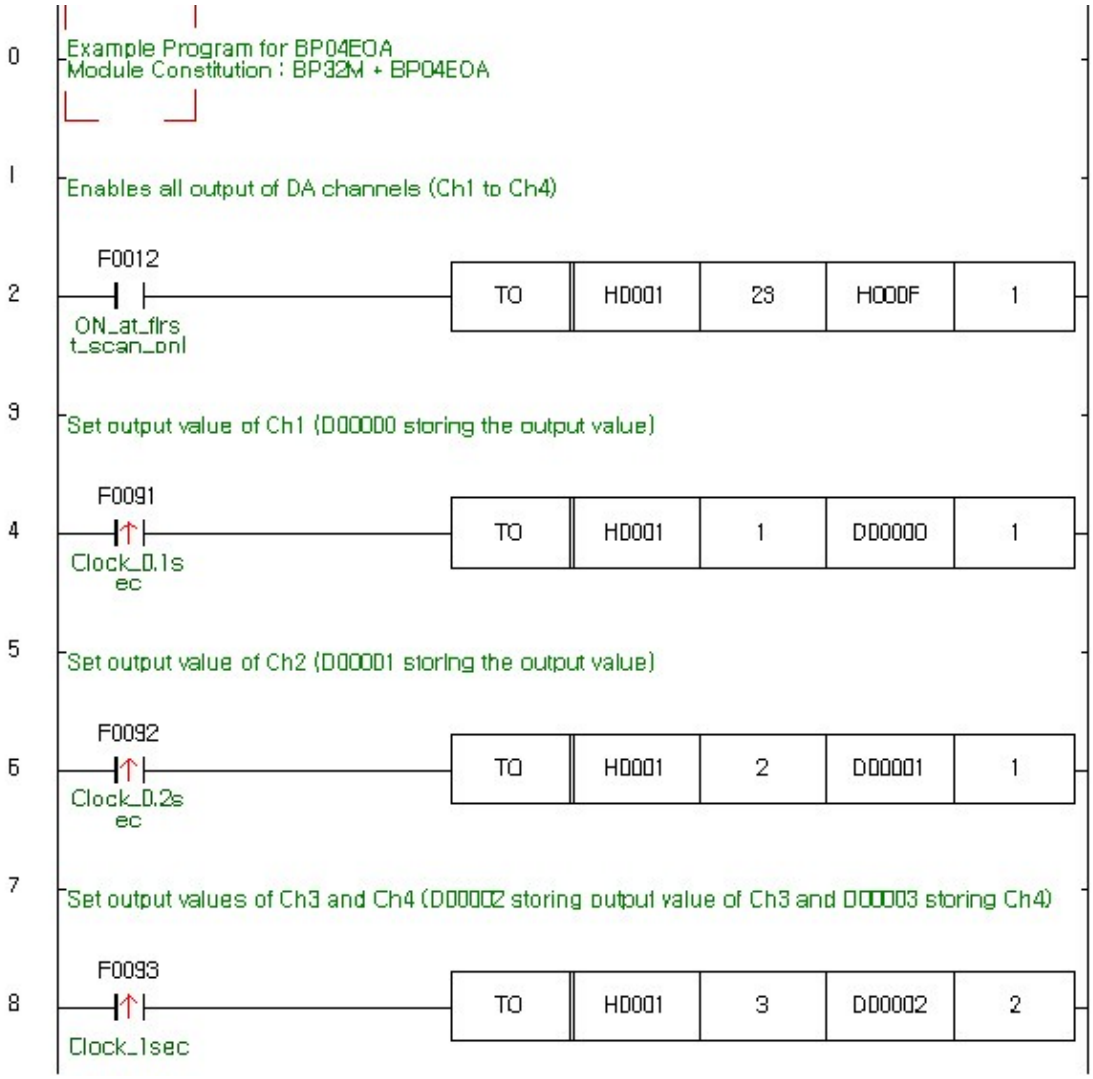


Lower Terminal Block : I output power Input

▶ Output signal types (current/voltage) are configurable with CICON for each channel.

▶ Assure the wired signal type is matched with the configuration for each channel.

PROGRAMMING EXAMPLE



▶ **Rung 2**

For safety purpose, the module doesn't output D/A signals without definite command from sequence program

or CICON. This rung sends signal output enable command to DA module by TO instruction.

PROGRAMMING EXAMPLE

Generally, for unburden CPU's scan speed, it's better to output all channel simultaneously than outputs one

by one channel.
Following example instruction shows this method.

TO H0001 1 D00000 4

PROGRAMMING EXAMPLE

The first operand 'H0001' means the first expanded block. If there was another block between CPU and DA,
this operand should be 'H0002'.
The second operand 23 means the address of this enable command buffer in 'User Program Memory'. (Refer to the MAP)
The third operand 'H000F' means enabling all outputs (CH1 to CH4). Each channel is allocated bitwisely. If you want to
enable only CH3, this value should be 'H0004'.
The fourth operand '1' means 1 WORD writing to 'User Program Memory'.

▶ **Rung 4**

Write output value of CH1 on every 0.1 second with a TO instruction. The second operand '1' means the address of
'User Program Memory' where the output value should be written to for Ch1. (Refer to the MAP)
The third operand 'D00000' means the device which is storing the digital value for signal output.
The last operand '1' means 1 WORD writing.

▶ **Rung 6**

Shows another example of one channel output. This rung is for Ch2 and the output value is stored in D00001.

▶ **Rung 8**

Shows simultaneous output example of multi-channel. This rung output signals to Ch3 and Ch4 simultaneously.
The digital values are stored in D00002 and D00003 for each channel.

TROUBLE SHOOTING

If there was any trouble with sensor, cable, configuration or module itself, the RUN LED would blink every 0.2 second. In this case,
the error code can be read by CICON or address 31 – 34 of 'User Program Memory'.

▶ **Check following points first :**

- Assure external power is supplied correctly (DC24V)
- Check expansion cable between blocks.
- Change the CPU to STOP mode, and re-power the entire modules. If LED stops blinking, there will be some
  mistake in the sequence program. If LED still blinks, read following steps.

▶ **How to check the error code :**

Select "Tool -> Optional Module Setup -> RTD Module? menu of the CICON. A dialog box titled with "RTD module setup?
will be popped-up. Assure the ‘Base’ number is ‘0’ and ‘Slot’ number is appropriate number (1..3) for the module.
Click the "Status? button of this dialog box. Another dialog box titled with "RTD module status? will be popped-up, the error code
will be displayed in this dialog box for each channel. CICON must be in connected status (On-Line) with PLC.

▶ **Erasing error code :**

After trouble fixing, click the "Reset Error?button in the dialog box titled with " RTD module status"

FEATURES

▶ CM2-BP04EOA provides the current and/or voltage analog signal outputs up to 4 channels.

Voltage Output Range : -10 ~ 10V
Current Output Range : 4 ~ 20㎃

▶ The analog outputs are high precision DA converted signal, and their resolutions are 1/16000.

▶ DA channel provide HOLD/CLEAR mode. When HOLD mode is selected this module maintains output even if CPU was stopped.

▶ Disabled DA channel maintains outputs 4㎃ or -10V

▶ When the RUN LED blinks, there might be some error. CICON will be helpful for checking and fixing the trouble.

▶ DA channels can be manually tested with CICON even if CPU was in STOP mode..

INSTALLATION PRECAUTIONS

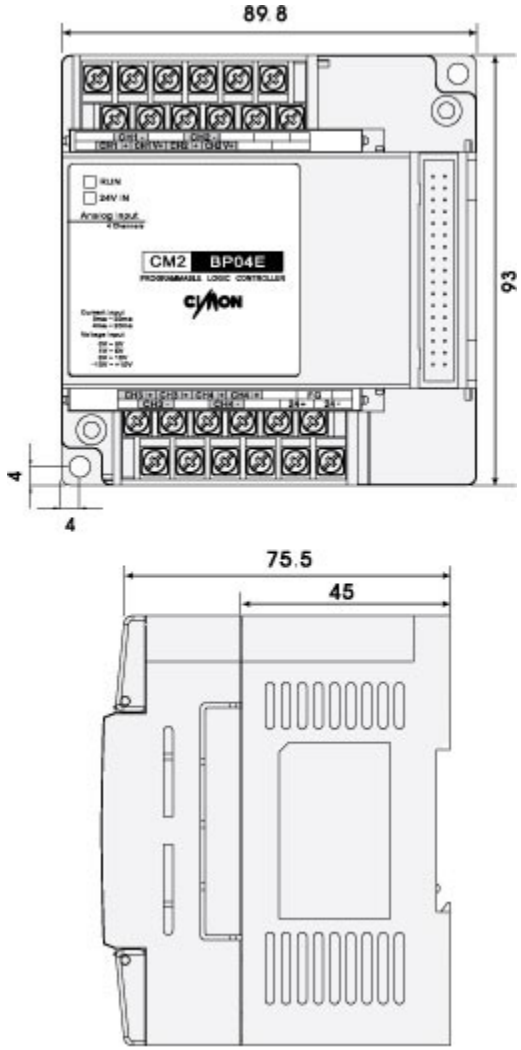
▶ Use the PLC in an environment that meets the general specifications given in the User’s Manual of the CPU module being used.

▶ Do not bunch the control wires or communication cables with the main circuit or power wires, or install them close to each other.
They should be installed 100mm (3.94 inch) or more from each other. Not doing so could result in noise that may cause malfunction.

▶ Switch all phases of the external power supply off when mounting or removing the module. Not doing so may cause damage to the module.

▶ Do not directly touch the conductive area or electronic components of the module. Doing so may cause malfunction or failure in the module.

DIMENSIONS



3.31 CM2-BP04EAA (Analog Expansion Blocks - Input 2Ch / Output 2Ch)

Modules :

- CM2-BP04EAA (Analog Expansion Blocks)

Contents :

GENERAL SPECIFICATIONS

<table>
<tr><th>Item</th><th colspan="5">Specification</th><th>Reference</th></tr>
<tr><td>Op.Temp.</td><td colspan="5">Operating Temperature -10 ~65 ℃</td><td></td></tr>
<tr><td>St.Temp</td><td colspan="5">Storage Temperature □□-25 ~□□80 ℃</td><td></td></tr>
<tr><td>Op.Hum</td><td colspan="5">Operating Humidity 5 ~95%RH, Not Condensed</td><td></td></tr>
<tr><td>St.Hum</td><td colspan="5">Storage Humidity 5 ~95%RH, Not Condensed</td><td></td></tr>
<tr><td rowspan="10">Vibration</td><td colspan="4">In case of intermittent vibration</td><td>-</td><td></td></tr>
<tr><td>Frequency</td><td>Acceleration</td><td colspan="2">Amplitude</td><td>Sweep</td><td rowspan="9">IEC61131-2</td></tr>
<tr><td>10=□f=□□ 57Hz</td><td></td><td colspan="2">0.075mm</td><td rowspan="7">10 times in X,Y,Z</td></tr>
<tr><td>57=□□f=□□ 150Hz</td><td>9.8m/s²{1G}</td><td colspan="2">-</td></tr>
<tr><td colspan="4">In case of continuous vibration</td></tr>
<tr><td>Frequency</td><td>Acceleration</td><td colspan="2">Amplitude</td></tr>
<tr><td>10=□□f =□□57Hz</td><td></td><td colspan="2">0.035mm</td></tr>
<tr><td>57=□□f= 150Hz</td><td>4.8m/s²{0.5G}</td><td colspan="2"></td></tr>
<tr><td></td><td></td><td colspan="2"></td></tr>
<tr><td></td><td></td><td colspan="2"></td></tr>
<tr><td>Shock</td><td colspan="5">□□Max. shock Acc. :147 m/s{15G}
□□Time :11㎳
□□Pulse wave: Half sine wave pulse(3 times in X,Y,Z)</td><td>IEC61131-2</td></tr>
<tr><td rowspan="4">Noise</td><td>Square wave impulse noise</td><td colspan="4">2,000 V</td><td>KDT Standard</td></tr>
<tr><td>Electro-static discharge</td><td colspan="4">Voltage :4kV (Contact discharge)</td><td>IEC61131-2
IEC1000-4-2</td></tr>
<tr><td>Radiated electro-magneti c field</td><td colspan="4">27 ~500 MHz,10 V/m</td><td>IEC61131-2
IEC1000-4-3</td></tr>
<tr><td rowspan="2">Fast transient bust noise</td><td>Power Module</td><td>Digital I/O (24V or more)</td><td>Digital I/O (Less than 24V) Analog I/Ocomm.. Interface</td><td rowspan="2">IEC61131-2
IEC1000-4-4</td></tr>
<tr><td>2kV</td><td>1kV</td><td>0.25kV</td></tr>
</table>

Environ..	No corrosive gas and no dust	
Altitude	2,000m or less	
Pollution	2 or less	
Cooling	Natural Air Cooling	

MODULE SPECIFICATIONS

Items		A/D Part	D/A Part
Number of Ch		2 Channels	2 Channels
Signal Range	Voltage	0 ~ 5V 1 ~ 5V 0 ~ 10V -10 ~ 10V	-10 ~ 10V
	Current	0 ~ 20㎃ 4 ~ 20㎃	4 ~ 20㎃
Digital Value Range		0 ~ 16000 (-8000 ~ 8000)	
Resolution	0 ~ 5V	0.3125㎷	-
	1 ~ 5V	0.25㎷	-
	0 ~ 10V	0.625㎷	-
	-10 ~ +10V	1.25㎷	1.25㎷
	0 ~ 20mA	1.25㎂	-
	4 ~ 20mA	1.0㎂	1.0㎂
Precision		±0.3% (Full Scale)	
Conversion Speed		5㎳/1Ch.	
Max. Signal Range		V : ±12V I : ±25㎃	V : ±12V I : ±21㎃
Insulation		PLC main circuit : Photo Coupler Between channels : Not Insulated	
Occupied I/O		6 Points	8 Points
Terminal Block		12 points T/B × 2pcs	
External Power Supply		24VDC	
Power Consumption		50㎃	

I/O MAP

Direction : CPU← AD/DA		Direction : CPU→ AD/DA	
Input	Descriptions	Output	Descriptions
X0	A/D Ready	Y0	Req. to Configure A/D
X1	A/D Converted Successfully	Y1	Req. to Select A/D Channel
X2	A/D Configured Successfully	Y2	Req. to Save Offset/Gain
X3	A/D Ch. Selected Successfully	Y3	Req. to Enter Offset/Gain Mode
X4	reserved	Y4	Req. to Clear Min/Max Log
X5	A/D Offset/Gain Mode	Y5	Reserved
X6	Reserved	Y6	Reserved
X7	A/D Error	Y7	Req. to Clear Error
X8	D/A Ready	Y8	Req. to Configure D/A
X9	Reserved	Y9	Req. to Select D/A Channel
XA	D/A Configured Successfully	YA	Req. to Save D/A Offset/Gain
XB	D/A Ch. Selected Successfully	YB	Req. to Enter D/A Offset/Gain Mode
XC	D/A Calibrated Successfully	YC	Req. to Calib. D/A
XD	D/A Offset/Gain Mode	YD	Reserved
XE	Reserved	YE	Reserved
XF	D/A Error	YF	Req. to Clear Error

USER PROGRAM MEMORY MAP

Addr.		Descriptions	R/W
Hex.	Dec.		
0H	0	A/D Conversion Enable	R/W
1H	1	Avr. Time/Count for CH1	R/W
2H	2	Avr. Time/Count for CH2	R/W
3H	3	Reserved	-
4H	4		
5H	5	Avr. Mode Enable	R/W

6H	6	A/D Conversion Status Flags	R
7H	7	CH1 Converted(Input) Value	R
8H	8	CH2 Converted(Input) Value	R
9H	9	Reserved	-
AH	10		
BH	11	A/D Error Code	R
CH	12	Input Range (CH1 ~ CH2)	R/W
DH	13	A/D Calib.(Offset) Channel Select	R/W
EH	14	A/D Calib.(Gain) Channel Select	R/W
FH	15	Range of Converted Value	R/W
10H	16	Reserved	-
11H	17		
12H	18		
13H	19		
14H	20	Max. Converted Value (CH1)	R/W
15H	21	Min. Converted Value (CH1)	R/W
16H	22	Max. Converted Value (CH2)	R/W
17H	23	Min. Converted Value (CH2)	R/W

Addr.		Decriptions	R/W
Hex.	Dec.		
18H	24	Reserved	-
19H	25		
1AH	26		
1BH	27		
1CH	28		
1DH	29		
1EH	30		
1FH	31		
20H	32	D/A Converting Enable	R/W
21H	33	CH1 Output Value	R/W
22H	34	CH2 Output Value	R/W
23H	35	Reserved	-
24H	36		
25H	37	D/A Error Code	R
26H	38	HOLD(1)/CLEAR(0) Mode Select	R/W
27H	39	Invalid Value was Written to CH1	R
28H	40	Invalid Value was Written to CH2	R

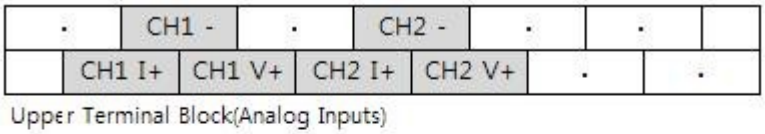
29H	41	Reserved	-
2AH	42		
2BH	43	D/A Calib.(Offset) Channel Select	R/W
2CH	44	D/A Calib.(Gain) Channel Select	R/W
2DH	45	Offset/Gain Value	R/W
2EH	46	Range of Digital Value	R/W
2FH	47	D/A Signal Output Enable	R/W
30H	48	Reserved	-

ERROR CODES

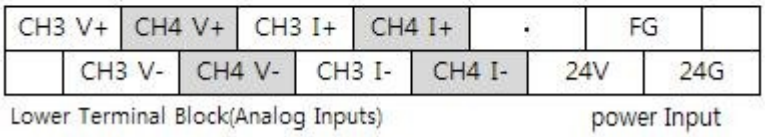
•is replaced with channel number (1 ~ 4) which is in trouble.
△ can be any number between 0 to 3

1•	Invalid input signal range defined. This error can be occurred when the module was configured with inadequate configuration tool. Assure the menu that had been used for configuration is "Tool -> Optional Module Setup -> AD/DA Module".
2•	Invalid average time was defined. This error can be occurred when the module was configured with inadequate configuration tool. Assure the menu that had been used for configuration is "Tool -> Optional Module Setup -> AD/DA Module".
3•	Invalid average count was defined. This error can be occurred when the module was configured with inadequate configuration tool. Assure the menu that had been used for configuration is "Tool -> Optional Module Setup -> AD/DA Module".
4•	Calibration error. This error will be occurred in case of inaccurate reference current or voltage signal is supplied during calibration.
49	Calibration error. 'Offset' and 'Gain' calibration must not be fulfilled simultaneously.
10△	System error. Check the CPU block and expansion cable.

EXTERNAL WIRING



Upper Terminal Block(Analog Inputs)



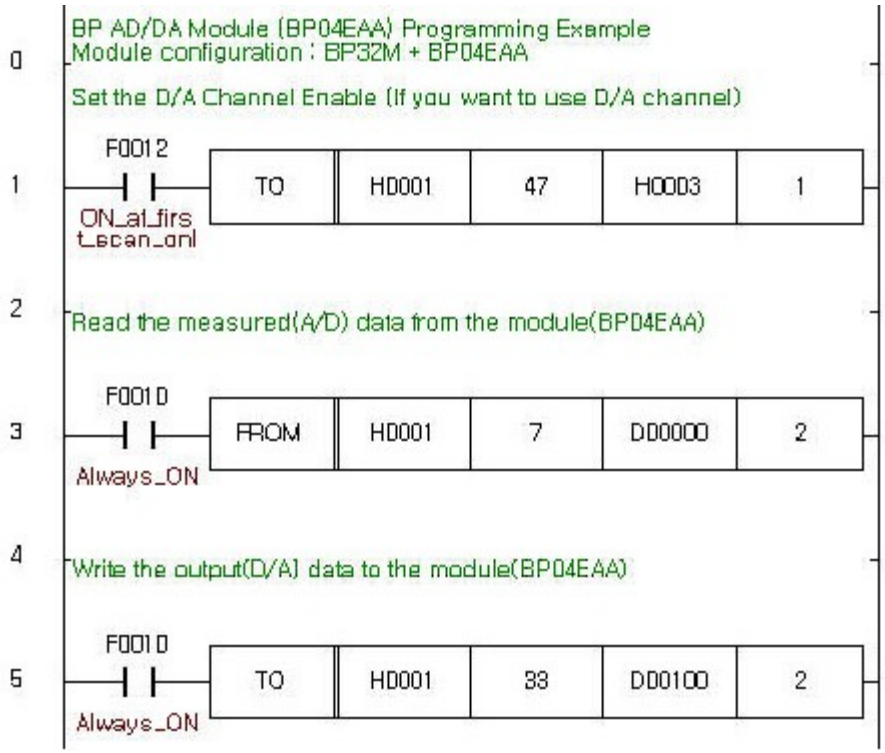
Lower Terminal Block(Analog Inputs) power Input

Wiring Method

	CH1			CH2		
V INPUT	CH1 I+ N/C	CH1 V+ Wire V+	CH- Wire V-	CH2 I+ N/C	CH2 V+ Wire V+	CH2- Wire V
I INPUT	Short CH1 I+ and CH1 V+ Wire I+		CH1 Wire I+	Short CH2 I+ and CH V+ Wire I+		CH2 Wire I-

	CH3		CH4	
V OUTPUT	CH3 V+: Wire V+ CH3 V-: Wire V-	CH3 I+:N/C CH3 I-: N/C	CH4 V+: Wire V+ CH4 V-: Wire V-	CH4 I+:N/C CH4 I-: N/C
I OUTPUT	CH3 V+:N/C CH3 V-: N/C	CH3 I+: Wire I+ CH3 I-: Wire I-	CH4 V+:N/C CH4 V-: N/C	CH4 I+: Wire I+ CH4 I-: Wire I-

PROGRAMMING EXAMPLE



▶ **Rung 1** For safety purpose, the module doesn't output D/A signals without definite command from sequence program or CICON.
This rung sends signal output command to AD/DA module with TO instruction.
The first operand 'H0001' means the first expanded block.

If there was another block between CPU and AD/DA, this operand should be 'H0002'. The second operand 47 means the address of this command buffer in 'User Program Memory'.

(Refer to the MAP)

PROGRAMMING EXAMPLE

The third operand 'H0003' means enable output of CH3 and CH4. Each channel is allocated bitwisely. If you want to enable only CH3, this value should be 'H0001'. The fourth operand '1' means 1 WORD writing to 'User Program Memory'.

▶ **Rung 3**

Read AD converted value of CH1 and CH2 on every scan. FROM instruction was used, and the first operand of it has the same meaning with TO instruction.

The second operand '7' means the address of 'User Program Memory' where the measured value is stored in. (Refer to the MAP)

The third operand 'D00000' means which device area the measured value would be moved to. The measured value of CH1 will be moved to D0000 and CH2 will be moved to D0001. The last operand '2' means 2 WORD moving. If you assign '1' to this operand, only a measured value of CH1 would be moved to D0000.

▶ **Rung 5**

Write DA values to CH3 and CH4 on every scan simultaneously with a TO instruction. The second operand '33' means the address of 'User Program Memory' where the output value should be written to. (Refer to the MAP)

The third operand 'D00100' means the device which is storing the digital value for signal output.

The last operand '2' means 2 WORD simultaneous writing.

TROUBLE SHOOTING

If there was any trouble with sensor, cable, configuration or module itself, the RUN LED would blink every 0.3 second. In this case, the error code can be read by CICON or address 31 – 34 of 'User Program Memory'.

▶ **Check following points first :**

- Assure external power is supplied correctly (DC24V)
- Check expansion cable between blocks.
- Change the CPU to STOP mode, and re-power the entire modules. If LED stops blinking, there will be some mistake in the sequence program. If LED still blinks, read following steps.

▶ **How to check the error code :**

Select " Tool -> Optional Module Setup -> RTD Module? menu of the CICON. A dialog box titled with "RTD module setup? will be popped-up.

Assure the 'Base' number is '0' and 'Slot' number is appropriate number (1..3) for the module. Click

the "Status? button of this dialog box.
Another dialog box titled with "RTD module status? will be popped-up, the error code will be displayed in this dialog box for each channel.
CICON must be in connected status (On-Line) with PLC.

▶ **Erasing error code :**

After trouble fixing, click the 밠eset Error? button in the dialog box titled with "RTD module status".

FEATURES

▶ CM2-BP04EAA is a hybrid type analog I/O block for BP series CIMON-PLC. It is composed with 2 channels of voltage/current
AD and 2 channels of voltage/current DA

▶ AD channels support 0~20mA, 4~20mA, 0~5V, 1~5V, 0~10V and -10~10V input signal ranges.

▶ DA Channels support -10~10V and 4~20mA output signal ranges.

▶ Input signal filtering function such as averaging and digital filtering can be selectable by their constant configuration.

▶ High resolution (1/16000) analog signal or digital value is provided.

▶ AD channels provide additional converted value range to nominal resolution (16000) which is useful in detecting abnormal
input signal such as overshoot or under-shoot. The real range of converted value is -192 ~ 16191 (or -8192 ~ 8191)

▶ DA channel provide HOLD/CLEAR mode. When HOLD mode is selected this module maintains output even if CPU was stopped.

▶ Disabled DA channel maintains outputs 4㎃ or -10V

▶ When the RUN LED blinks, there might be some error. CICON will be helpful for checking and fixing the trouble.

▶ DA channels can be manually tested with CICON even if CPU was in STOP mode.

INSTALLATION PRECAUTIONS

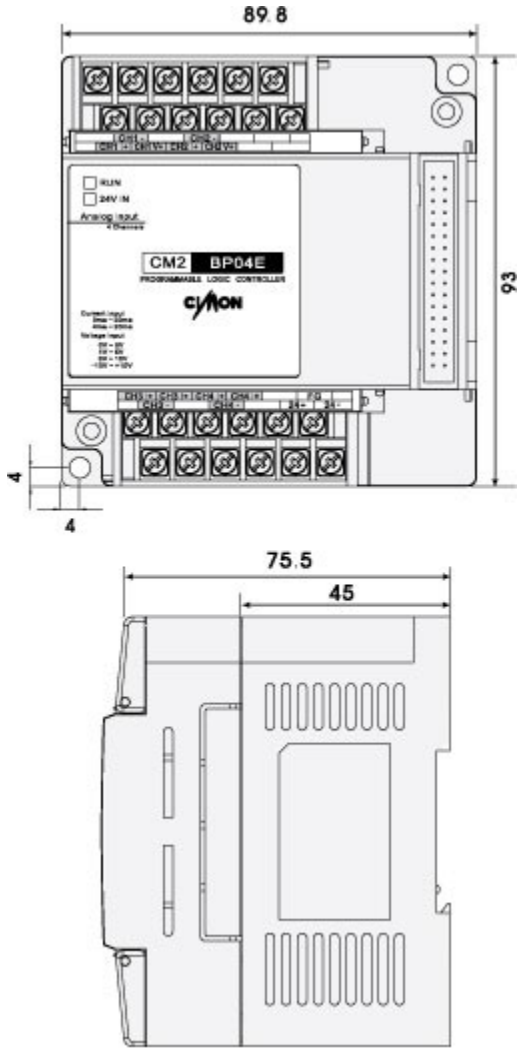
▶ Use the PLC in an environment that meets the general specifications given in the User's Manual of the CPU module being used.

▶ Do not bunch the control wires or communication cables with the main circuit or power wires, or install them close to each other.
They should be installed 100mm (3.94 inch) or more from each other. Not doing so could result in noise that may cause malfunction.

▶ Switch all phases of the external power supply off when mounting or removing the module. Not doing so may cause damage to the module.

▶ Do not directly touch the conductive area or electronic components of the module. Doing so may cause malfunction or failure in the module.

DIMENSIONS



3.32 CM2-BP04ERO (Analog Expansion Blocks)

Modules :

- CM2-BP04ERO (Analog Expansion Block)

Contents :

GENERAL SPECIFICATIONS

Item	Specification				Reference
Op.Temp.	Operating Temperature -10 ~65 ℃				
St.Temp	Storage Temperature □□-25 ~□□80 ℃				
Op.Hum	Operating Humidity 5 ~95%RH, Not Condensed				
St.Hum	Storage Humidity 5 ~95%RH, Not Condensed				
Vibration	In case of intermittent vibration			-	IEC61131-2
	Frequency	Acceleration	Amplitude	Sweep	
	10=□f=□□ 57Hz		0.075mm	10 times in X,Y,Z	
	57=□□f=□□ 150Hz	9.8m/s²{1G}	-		
	In case of continuous vibration				
	Frequency	Acceleration	Amplitude		
	10=□□f =□□57Hz		0.035mm		
	57=□□f= 150Hz	4.8m/s²{0.5G}			
Shock	□□Max. shock Acc. :147 m/s{15G} □□Time :11㎳ □□Pulse wave: Half sine wave pulse(3 times in X,Y,Z)				IEC61131-2
Noise	Square wave impulse noise	2,000 V			KDT Standard
	Electro-static discharge	Voltage :4kV (Contact discharge)			IEC61131-2 IEC1000-4-2
	Radiated electro-magneti c field	27 ~500 MHz,10 V/m			IEC61131-2 IEC1000-4-3
	Fast transient bust noise	Power Module	Digital I/O (24V or more)	Digital I/O (Less than 24V) Analog I/Ocomm.. Interface	IEC61131-2 IEC1000-4-4
		2kV	1kV	0.25kV	

Environ..	No corrosive gas and no dust	
Altitude	2,000m or less	
Pollution	2 or less	
Cooling	Natural Air Cooling	

MODULE SPECIFICATIONS

Items	Specifications
Supported RTD	Pt 100 (JIS C1640-1989, DIN 43760-1980) JPt100 (KS C1603-1991, JIS C1604-1981)
Rangeof Temperature	Pt 100 : -200.0°C ~ 600°C (18.48 ~ 313.59Ω) JPt100 : -200.0°C ~ 600°C (17.14 ~ 317.28Ω)
Range of Internal Value	Scaled Value : 0 ~ 16,000 (or -8000 ~ 8000) Temperature Value : -2000 ~ 6000
Supported Cable	3-Wire
Accuracy	±0.1 % [Full scale]
Speed	400㎳ / Channel
Channels	4 Channels / 1 Module
Insulation	Photo-coupler (Between Channels : Not Insulated)
Terminal Block	12 points Terminal Block ×2
Occupied I/O	16 points
External Power	24VDC
Power Consumption	35㎃

I/O MAP

Direction (CPU ? BP04ERO)		Direction (CPU ? BP04ERO)	
Inputs	Descriptions	Outputs	Descriptions
X0	Module Ready	Y0	Reserved
X1	Measuring Completed	Y1	

X2	Config. Completed	Y2	Req. of Stoing Config. Data
X3	Reserved	Y3	Reserved
X4		Y4	
X5		Y5	
X6		Y6	
X7		Y7	
X8		Y8	
X9		Y9	
XA		YA	
XB		YB	
XC		YC	
XD		YD	
XE		YE	
XF	Error	YF	Req. to Clear Error

USER PROGRAM MEMORY MAP

Address		Descriptions	R/W
HEX	DEC		
0H	0	Channel Enable/Disable	R/W
1H	1	CH1 Temp. (°C x 10)	R
2H	2	CH2 Temp. (°C x 10)	R
3H	3	CH3 Temp. (°C x 10)	R
4H	4	CH4 Temp. (°C x 10)	R
5H	5	Reserved	-
6H	6		
7H	7		
8H	8		
9H	9	RTD Type	R/W
AH	10	Reserved	-
BH	11	CH1 Temp. (°C x 10)	R
CH	12	CH2 Temp. (°C x 10)	R
DH	13	CH3 Temp. (°C x 10)	R
EH	14	CH4 Temp. (°C x 10)	R
FH	15	Reserved	-
10H	16		
11H	17		
12H	18		
13H	19	Channel Status	R
14H	20	Reserved	-

15H	21	CH1 Scaled Value	R
16H	22	CH2 Scaled Value	R
17H	23	CH3 Scaled Value	R
18H	24	CH4 Scaled Value	R
19H	25	Reserved	-
1AH	26		
1BH	27		
1CH	28		
1DH	29	Range of Scaled Value	R/W
1EH	30	Average Mode Configuration	R/W

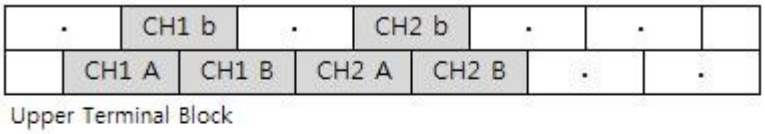
Address		Descriptions	R/W
HEX	DEC		
1FH	31	CH1 Error Code	R
20H	32	CH2 Error Code	R
21H	33	CH3 Error Code	R
22H	34	CH4 Error Code	R
23H	35	Reserved	-
-	-		
28H	40		
29H	41	CH1 Min. Temp.	R/W
2AH	42	CH2 Min. Temp.	R/W
2BH	43	CH3 Min. Temp	R/W
2CH	44	CH4 Min. Temp	R/W
2DH	45	Reserved	-
2EH	46		
2FH	47		
30H	48		
31H	49	Ch. Select for Scale Config.	R/W
32H	50	Scale Config. Error Code	R
33H	51	CH1 Min. Temp.	R/W
34H	52	CH2 Min. Temp.	R/W
35H	53	CH3 Min. Temp.	R/W
36H	54	CH4 Min. Temp.	R/W
37H	55	Reserved	-
38H	56		
39H	57		
3AH	58		
3BH	59	CH1 Avr. Param. / Filter Const.	R/W
3CH	60	CH2 Avr. Param. / Filter Const.	R/W
3DH	61	CH3 Avr. Param. / Filter Const.	R/W
3EH	62	CH4 Avr. Param. / Filter Const.	R/W

ERROR CODES

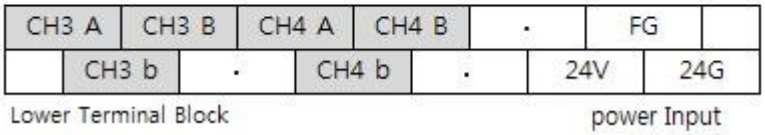
Codes	Descriptions
01	'A' terminal was not wired. Check the cable of sensor
02	'B' terminal was not wired. Check the cable of sensor.
03	'b' or 'A' and 'B' terminals were not wired. Check the cable of sensor.
04	Scaling error occurred. Check the configuration of the scaling.
10△	Fatal Error

△ will be replaced by channel number - 1 (0..3)

EXTERNAL WIRING

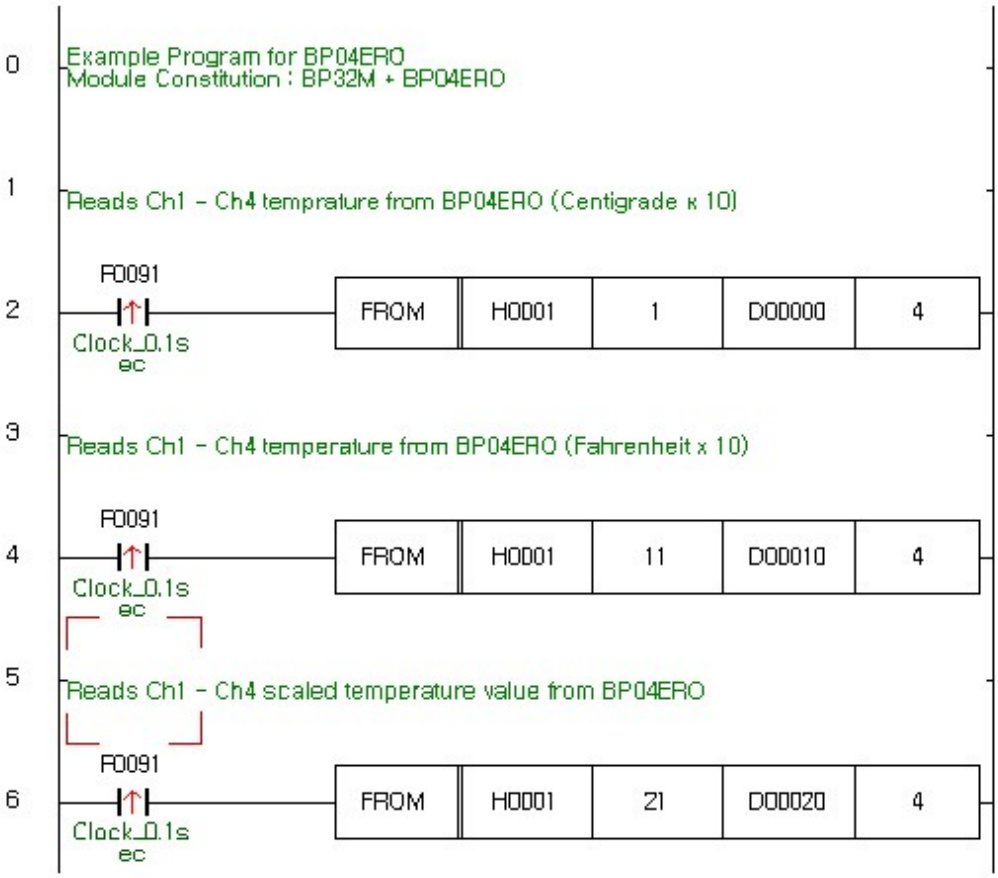


Upper Terminal Block



Lower Terminal Block power Input

PROGRAMMING EXAMPLE



▶ **Rung 2** This rung reads temperature as centigrade values from the module.
The first operand 'H0001' means the first expanded block. If there was another block between CPU and BP04ERO, this operand should be 'H0002'.
The second operand 1 means the address of 'User Program Memory' where the measured temperature of channel 1 is stored as unit of centigrade. (Refer to the MAP)
The third operand 'D00000' means the internal device address where the read temperature value will be stored.

TROUBLE SHOOTING

The fourth operand '4' means 4 WORD reading. That is, the temperature of Ch1 will be stored in D0000, Ch2 in D00001, Ch3 in D00002, Ch4 in D00003.

▶ **Rung 4**

This rung executes the same operation as rung 2 except that it reads the temperature values in Fahrenheit and stores them in D00010 to D00013.
The address of 'User Program Memory' for temperature in Fahrenheit is 11 to 14. (Ch1 – Ch4, Refer to the MAP)

▶ **Rung 6**

This rung executes the same operation as rung 2 and rung 4 except that it reads the scaled temperature values and stores them to D00020 to D00023.
The address of 'User Program Memory' for scaled temperature is 21 to 24. (Ch1 – Ch4, Refer to the MAP

TROUBLE SHOOTING

If there was any trouble with sensor, cable, configuration or module itself, the RUN LED would blink every 0.3 second. In this case,
the error code can be read by CICON or address 31 – 34 of 'User Program Memory'.

▶ **Check following points first :**

- Assure external power is supplied correctly (DC24V)
- Check expansion cable between blocks.
- Change the CPU to STOP mode, and re-power the entire modules. If LED stops blinking, there will be some mistake in the sequence program.
  If LED still blinks, read following steps.

▶ **How to check the error code :**

Select " Tool -> Optional Module Setup -> RTD Module? menu of the CICON. A dialog box titled with "RTD module setup? will be popped-up.

Assure the 'Base' number is '0' and 'Slot' number is appropriate number (1..3) for the module. Click the "Status? button of this dialog box.

Another dialog box titled with "RTD module status? will be popped-up, the error code will be displayed in this dialog box for each channel.

CICON must be in connected status (On-Line) with PLC.

▶ **Erasing error code :**

After trouble fixing, click the 밠eset Error? button in the dialog box titled with "RTD module status".

FEATURES

▶ CM2-BP04ERO module supports PT100 (or JPT100) RTD sensors up to 4 channels. It provides measured temperature values in unit of Centigrade(℃)
and Fahrenheit(℉) and up to the first decimal place.

▶ 14 bits value is provided also to processing the temperature data of each channel. This is a scaled value of measured temperature, and the range of
scaling is configurable with CICON. It allows more wide applications

▶ The diagnostic function embedded in the module allows to know the trouble on cable or sensor for each channel.

▶ RUN LED will blink every 0.2 second in case of abnormal status. Check the error code by using CICON.

INSTALLATION PRECAUTIONS

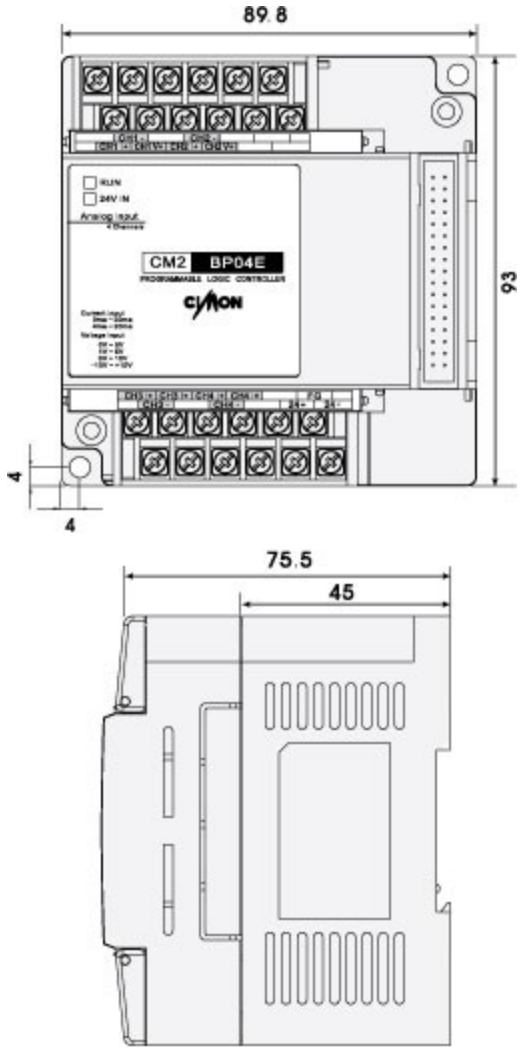
▶ Use the PLC in an environment that meets the general specifications given in the User's Manual of the CPU module being used.

▶ Do not bunch the control wires or communication cables with the main circuit or power wires, or install them close to each other.
They should be installed 100mm (3.94 inch) or more from each other. Not doing so could result in noise that may cause malfunction.

▶ Switch all phases of the external power supply off when mounting or removing the module. Not doing so may cause damage to the module.

▶ Do not directly touch the conductive area or electronic components of the module. Doing so may cause malfunction or failure in the module.

DIMENSIONS



3.33 CM2-BP04ETO (Analog Expansion Blocks)

Modules :

- CM2-BP04ETO (Analog Expansion Blocks)

Contents :

GENERAL SPECIFICATIONS

Item	Specification				Reference
Op.Temp.	Operating Temperature -10 ~65 ℃				
St.Temp	Storage Temperature □□-25 ~□□80 ℃				
Op.Hum	Operating Humidity 5 ~95%RH, Not Condensed				
St.Hum	Storage Humidity 5 ~95%RH, Not Condensed				
Vibration	In case of intermittent vibration			-	IEC61131-2
	Frequency	Acceleration	Amplitude	Sweep	
	10=□f=□□ 57Hz		0.075mm	10 times in X,Y,Z	
	57=□□f=□□ 150Hz	9.8m/s²{1G}	-		
	In case of continuous vibration				
	Frequency	Acceleration	Amplitude		
	10=□□f =□□57Hz		0.035mm		
	57=□□f= 150Hz	4.8m/s²{0.5G}			
Shock	□□Max. shock Acc. :147 m/s{15G} □□Time :11㎳ □□Pulse wave: Half sine wave pulse(3 times in X,Y,Z)				IEC61131-2
Noise	Square wave impulse noise	2,000 V			KDT Standard
	Electro-static discharge	Voltage :4kV (Contact discharge)			IEC61131-2 IEC1000-4-2
	Radiated electro-magnetic field	27 ~500 MHz,10 V/m			IEC61131-2 IEC1000-4-3

	Fast transient bust noise	Power Module	Digital I/O (24V or more)	Digital I/O (Less than 24V) Analog I/Ocomm.. Interface	IEC61131-2 IEC1000-4-4
		2kV	1kV	0.25kV	
Environ..	No corrosive gas and no dust				
Altitude	2,000m or less				
Pollution	2 or less				
Cooling	Natural Air Cooling				

MODULE SPECIFICATIONS

Items	Specifications			
TC Type	K, J, E, T, B, R, S, N			
Meas. Value	● Raw Value : 0 ~ 16000 (or -8000 ~ 8000), ● Temp. Value : Real Temp. x 10			
Range	Type	DIN	Range(℃)	Range(㎶)
	K	ITS-90	-200.0~1200.0	-5891~48828
	J		-200.0~800.0	-7890~45498
	E		-200.0~600.0	-8824~45085
	T		-200.0~400.0	-5602~20869
	B		400.0~1800.0	786~13585
	R		0.0~1750.0	0~21006
	S		0.0~1750.0	0~18612
	N		-200.0~1250.0	-3990 ~43846
Compensation	Automatically by accompanied RJC sensor			
Diag.	Sensor break detection			
Accuracy	± [Full Scale x 0.3% + 1℃ (includes RJC accuracy)]			
Speed	500㎳/Ch.			
Ch.	4 Channels			
Insulation	Photo-coupler (Between channels : not insulated)			
Terminal Block	12 point Terminal Block ? 2			
Ext. Power	24VDC, 35 mA			

FEATURES

▶ CM2-BP04ETO module supports seven different thermocouple types (K,J,E,T,R,S,B). The converted temperature value can be processed in Centigrade(℃) or Fahrenheit(℉) up to the first decimal place.

▶ 14 bits value is provided also to processing the temperature data of each channel. This is a scaled value of measured temperature, and the range of scaling is configurable with CICON. It allows more wide applications

▶ The diagnostic function embedded in the module allows to know the trouble on cable or sensor for each channel.

▶ This module supports up to 4 thermocouple channels.

▶ Temperature compensation is fulfilled automatically with accompanied reference Junction compensation (RJC) sensor.

▶ RUN LED will blink every 0.3 second in case of abnormal status. Check the error code by using CICON.

I/O MAP

Direction CPU ? BP04ETO		Direction CPU ? BP04ETO	
Inputs	Descriptions	Outputs	Descriptions
X0	Module Ready	Y0	Reserved
X1	Measuring Completed	Y1	
X2	Config. Store Done	Y2	Req. to Store Configuration Data
X3	Reserved	Y3	Reserved
X4		Y4	
X5		Y5	
X6		Y6	
X7		Y7	
X8		Y8	
X9		Y9	
XA		YA	
XB		YB	
XC		YC	
XD		YD	

XE		YE	
XF	Error	YF	Req. to Clear Error

USER PROGRAM MEMORY MAP

Address		Descriptions	R/W
HEX	DEC		
1FH	31	CH1 Error Code	R
20H	32	CH2 Error Code	R
21H	33	CH3 Error Code	R
22H	34	CH4 Error Code	R
23H	35	Reserved	-
24H	36		
25H	37		
26H	38		
27H	39		
28H	40		
29H	41	CH1 Max. Temp.	R/W
2AH	42	CH2 Max. Temp.	R/W
2BH	43	CH3 Max. Temp.	R/W
2CH	44	CH4 Max. Temp.	R/W
2DH	45	Reserved	-
2EH	46		
2FH	47		
30H	48		
31H	49	Ch. Select for Scale Config.	R/W
32H	50	Scale Config. Error Code	R
33H	51	CH1 Min. Temp.	R/W
34H	52	CH2 Min. Temp.	R/W
35H	53	CH3 Min. Temp.	R/W
36H	54	CH4 Min. Temp.	R/W
37H	55	Reserved	-
38H	56		
39H	57		
3AH	58		
3BH	59	CH1 Avr. Param. / Filter Const.	R/W
3CH	60	CH2 Avr. Param. / Filter Const.	R/W
3DH	61	CH3 Avr. Param. / Filter Const.	R/W
3EH	62	CH4 Avr. Param. / Filter Const.	R/W

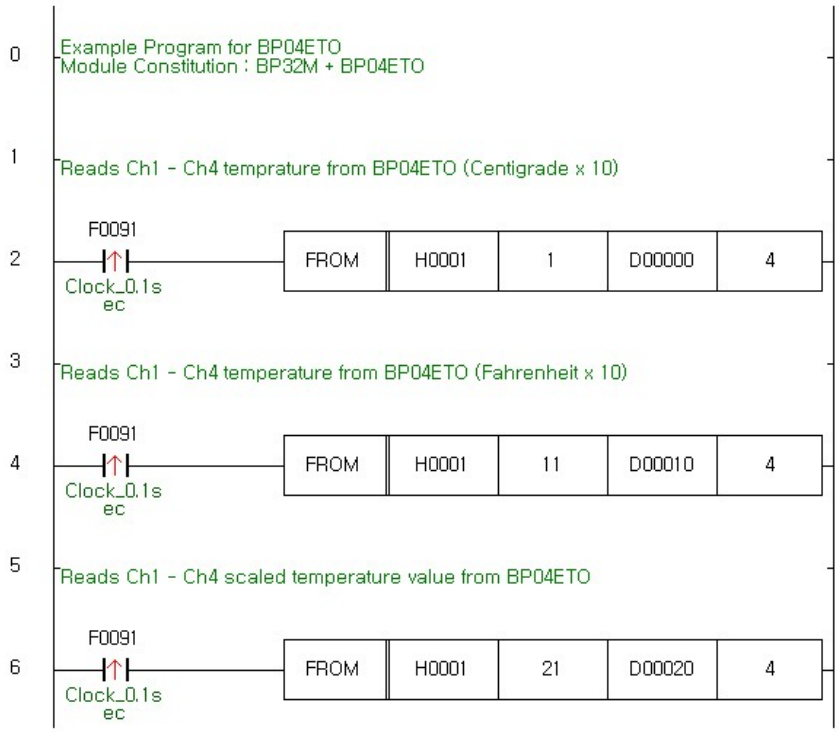
Address		Descriptions	R/W
HEX	DEC		
1FH	31	CH1 Error Code	R

20H	32	CH2 Error Code	R
21H	33	CH3 Error Code	R
22H	34	CH4 Error Code	R
23H	35	Reserved	-
24H	36		
25H	37		
26H	38		
27H	39		
28H	40		
29H	41	CH1 Max. Temp.	R/W
2AH	42	CH2 Max. Temp.	R/W
2BH	43	CH3 Max. Temp.	R/W
2CH	44	CH4 Max. Temp.	R/W
2DH	45	Reserved	-
2EH	46		
2FH	47		
30H	48		
31H	49	Ch. Select for Scale Config.	R/W
32H	50	Scale Config. Error Code	R
33H	51	CH1 Min. Temp.	R/W
34H	52	CH2 Min. Temp.	R/W
35H	53	CH3 Min. Temp.	R/W
36H	54	CH4 Min. Temp.	R/W
37H	55	Reserved	-
38H	56		
39H	57		
3AH	58		
3BH	59	CH1 Avr. Param. / Filter Const.	R/W
3CH	60	CH2 Avr. Param. / Filter Const.	R/W
3DH	61	CH3 Avr. Param. / Filter Const.	R/W
3EH	62	CH4 Avr. Param. / Filter Const.	R/W

ERROR CODES

Code	Descriptions
01	Module cannot detect the sensor. Check the cable of sensor or sensor itself.
02	Reference junction compensation sensor error. Check the RJC sensor which is accompanied with the module.
03	Invalid sensor type is defined. Assure the menu that had been used for configuration is “Tool -> Optional Module Setup -> TC Module”.
04	Scaling error occurred. Check the configuration of scaling.
10△	Fatal error.

LED Display



▶ **Rung 2** This rung reads temperature as centigrade values from the module.
The first operand 'H0001' means the first expanded block. If there was another block between CPU and BP04ETO, this operand should be 'H0002'.
The second operand 1 means the address of 'User Program Memory' where the measured temperature
of channel 1 is stored as unit of centigrade. (Refer to the MAP)
The third operand 'D00000' means the internal device address where the read temperature value will be stored.

PROGRAMMING EXAMPLE

The fourth operand '4' means 4 WORD reading. That is, the temperature of Ch1 will be stored in D0000, Ch2 in D00001, Ch3 in D00002,
Ch4 in D00003.

▶ **Rung 4** This rung executes the same operation as rung 2 except that it reads the temperature values in Fahrenheit and stores
them in D00010 to D00013. The address of 'User Program Memory' for temperature in Fahrenheit is 11 to 14.
(Ch1 − Ch4, Refer to the MAP)

▶ **Rung 6** This rung executes the same operation as rung 2 and rung 4 except that it reads the scaled temperature values and

stores them to D00020 to D00023. The address of 'User Program Memory' for scaled temperature is 21 to 24.

(Ch1 − Ch4, Refer to the MAP)

TROUBLE SHOOTING

If there was any trouble with sensor, cable, configuration or module itself, the RUN LED would blink every 0.2 second. In this case,

the error code can be read by CICON or address 31 − 34 of 'User Program Memory'.

▶ **Check following points first :**

- Assure external power is supplied correctly (DC24V)
- Check expansion cable between blocks.
- Change the CPU to STOP mode, and re-power the entire modules. If LED stops blinking, there will be some mistake in the sequence program. If LED still blinks,read following steps.

▶ **How to check the error code :**

Select "Tool -> Optional Module Setup -> TC Module" menu of the CICON. A dialog box titled with "TC module setup" will be popped-up.

Assure the 'Base' number is '0' and 'Slot' number is appropriate number (1..3) for the module. Click the "Status" button of this dialog box.

Another dialog box titled with "TC module status" will be popped-up, the error code will be displayed in this dialog box for each channel.

CICON must be in connected status (On-Line) with PLC.

▶ **Erasing error code :**

After trouble fixing, click the "Reset Error" button in the dialog box titled with "TC module status".

INSTALLSTION PRECAUTIONS

▶ Use the PLC in an environment that meets the general specifications given in the User's Manual of the CPU module being used.

▶ Do not bunch the control wires or communication cables with the main circuit or power wires, or install them close to each other.

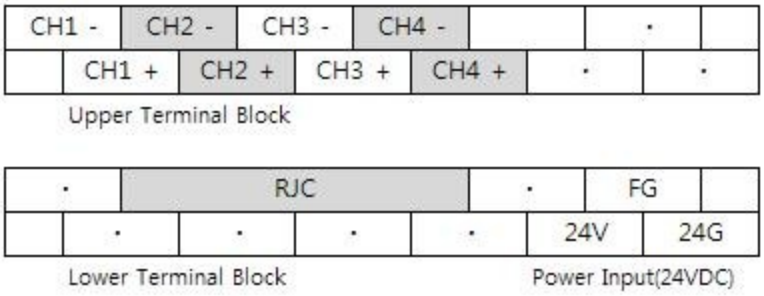
They should be installed 100mm (3.94 inch) or more from each other. Not doing so could result in noise that may cause malfunction.

▶ Switch all phases of the external power supply off when mounting or removing the module. Not doing so may cause damage to the module.

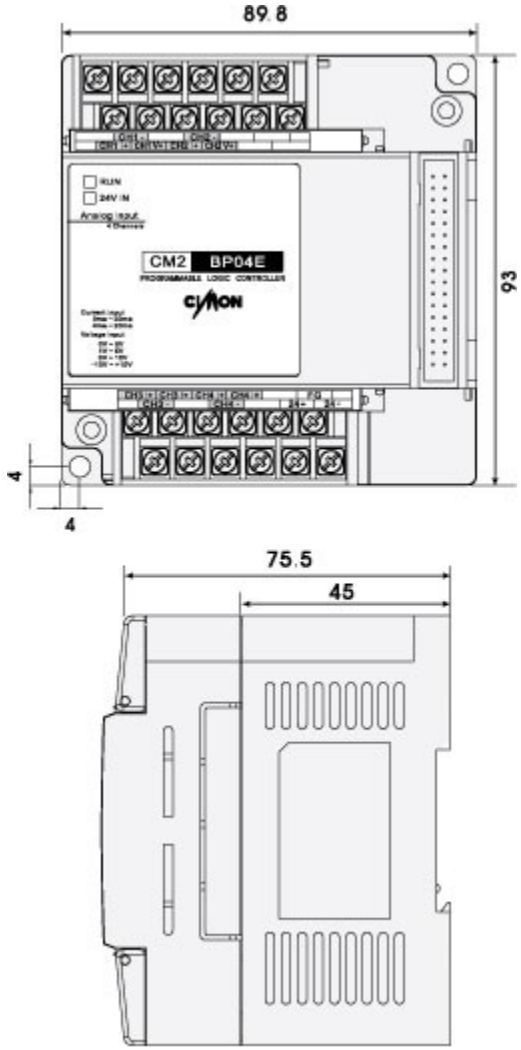
▶ Do not directly touch the conductive area or electronic components of the module. Doing so may cause malfunction or failure

in the module.

EXTERNAL WIRING



DIMENSIONS



3.34 CM2-BP32A***

Modules :

- CM2-BP32A***

Contents :

GENERAL SPECIFICATIONS

Item	Specification				Reference
Op.Temp.	Operating Temperature -10 ~65 ℃				
St.Temp	Storage Temperature □□-25 ~□□80 ℃				
Op.Hum	Operating Humidity 5 ~95%RH, Not Condensed				
St.Hum	Storage Humidity 5 ~95%RH, Not Condensed				
Vibration	In case of intermittent vibration			-	
	Frequency	Acceleration	Amplitude	Sweep	IEC61131-2
	10=□f=□□ 57Hz		0.075mm	10 times in X,Y,Z	
	57=□□f=□□ 150Hz	9.8m/s²{1G}	-		
	In case of continuous vibration				
	Frequency	Acceleration	Amplitude		
	10=□□f =□□57Hz		0.035mm		
	57=□□f= 150Hz	4.8m/s²{0.5G}			
Shock	□□Max. shock Acc. :147 m/s{15G} □□Time :11㎳ □□Pulse wave: Half sine wave pulse(3 times in X,Y,Z)				IEC61131-2
Noise	Square wave impulse noise	2,000 V			KDT Standard
	Electro-static discharge	Voltage :4kV (Contact discharge)			IEC61131-2 IEC1000-4-2
	Radiated electro-magneti c field	27 ~500 MHz,10 V/m			IEC61131-2 IEC1000-4-3
	Fast transient bust noise	Power Module	Digital I/O (24V or more)	Digital I/O (Less than 24V) Analog I/Ocomm.. Interface	IEC61131-2 IEC1000-4-4
		2kV	1kV	0.25kV	
Environ..	No corrosive gas and no dust				
Altitude	2,000m or less				
Pollution	2 or less				

Cooling	Natural Air Cooling	

MODULE SPECIFICATIONS

Analog Input			
	Current	Voltage	
Channels	2 channels		
Rated I/O	0 ~ 20 mA,	0~5V , 0 ~10V	
Resolution	10bits		
Conversion time	1 scan		
Analog Output			
	Current	Voltage	
Channels	2 channels		
Rated I/O	4 ~20 mA	0 ~10V	
Resolution	8bits		
Conversion time	1 scan		
Digital Input			
Channels	8 channels		
Power	DC 24V		
I/O voltage	ON voltage 19V / OFF voltage 11V		
COMMON	2 Points/COM(HSC CH1,2), 2Points/COM(HSC CH3,4), 4Points/COM		
Digital Output			
Channels	8 channels		
	Relay	Tr Sink	Tr Source
Power	AC220V/DC24V	DC 24V	DC 24V
I/O Current	1 Point 2A/ COM 5A	1 Point 0.2A / COM2A	1 Point 0.2A / COM2A
COMMON	4 Points/COM	8 Points/COM	8 Points/COM
Inner 422/485 , 1CH HMI Comm.Only			

COMM. CONFIGURATION

Address : D4988 (R/W)

Parity bit	Data bit	STOP bit	Comm. speed
0: NONE 1: EVEN 2: ODD	0 : 8 bit 1 : 7 bit	0 : 485, 1 bit 1 : 485, 2 bit 2 : 422, 1 bit 3 : 422, 2 bit	0 : 300 bps 1 : 600 bps 2 : 1200 bps 3 : 2400 bps 4 : 4800 bps 5 : 9600 bps 6 : 19200 bps 7 : 38400 bps
B15~B12	B11~B8	B7~B4	B3~B0
Address : D4989 (R/W)			
Response delay time : 0 ~ 200 ms		Stations : 0 ~ 31	
B15~B8		B7~B0	

- A bit for modifying set values

M2553	A demanding bit for modifying set values
M255B	A completing bit for modifying set values

- When M 2553 sets ON, setting values modify. And then M25B sets ON.
- After M255B sets ON, setting values run
- When M255B sets ON, M2553 must set OFF.

- " A bit for modifying set values" apply with " Comm. configuration" and "Analog input/Output configuration".

I/O CONFIGURATION

AD	D4990 R/W	Rated input 0 : 0~20mA, 0~5V 1 : 0~10V		Conversion Permission/Ban 0 : Ban 1 : Permission	
		B15~B12	B11~B8	B7~B4	B3~B0
		CH2	CH1	CH2	CH1
	D4991 R/W	Average : 0 ~ 255		Average : 0 ~ 255	
		B15~B8		B7~ B0	
		CH2		CH1	
	D4992 R	CH1 digital conversion : 0 ~ 1000			
		B15~B0			
	D4993 R	CH2 digital conversion : 0 ~ 1000			
		B15~B0			
	D4994	Reserved			
	D4995	Reserved			
DA	D4996 R/W	-		Conversion Permission/Ban 0 : Ban	

				1 : Permission	
		B15~B8		B7~B4	B3~B0
		-		CH2	CH1
	D4997 R/W	HOLD/CLEAR 0 : CLEAR, 1 : HOLD		Current/Voltage output 0: Voltage ,1: Current	
		B15~B12	B11~B8	B7~B4	B3~B0
		CH2	CH1	CH2	CH1
	D4998 R/W	B15~B0			
		CH1 digital output : 0 ~ 250			
	D4999 R/W	B15~B0			
		CH2 digital output : 0 ~ 250			

- The data at D4990, D4991, D4996 and D4997 can convert values with Scan-Programs or memory monitor

- The data at D4990, D4991, D4996, D4997 can keep former values in case of the power set ON/OFF or module controlled RUN<_>STOP.

- The data at D4990, D4991, D4996 and D4997 is stored in inner flash when power set off. And the data read former data from the flash,

stored in the memory when power set ON.

COMMUNICATION OPTIONS

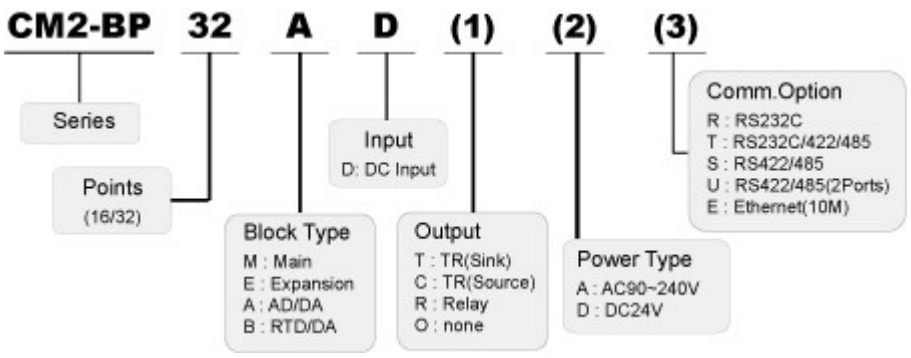
▶ RS232/422/485

Option (**BP**nn**A**xxx-)		**-T**	**-U**	**-R**	**-S**
Channel Type		RS232C RS422/485	RS422/485 (2 ports)	RS232C	RS422/485
Mode	HMI	Multi-Drop (max. 32 stations)			
	Loader	Support	Support	X	X
	Program	Support	Support	X	X
Param	Data Bits	7 or 8 bits			
	Stop Bits	1 or 2 bits			
	Parity	Even / Odd / None			
Synchronize		Asynchronous			
Speed (bps)		300/600/1200/2400/9600/19200/38400			
Modem Supp.		Supports External modem unit			

▶ Ethernet

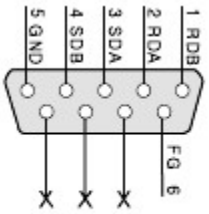
Option (**BP**nn**A**xxx-)	-**E**
Cable Type	10BASE -T
Comm. Speed.	10Mbps
Max. Distance	100m (Node to HUB)
Max. HUB	Max. 4 cascaded HUB
Max. Frame Size	1500 bytes
Protocol	CSMA / CD

MAIN BLOCK LINE-UP

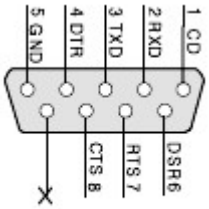


Model Name	Power	Input	Output	Option
CM2 - BP32ADTA?	AC 90 ~ 240V	DC 24V	TR(SINK)	R : RS232C T : RS232C RS422/485 S : RS422/485 U : RS422/485 (2 ports) E : Ethernet
CM2 - BP32ADCA?			TR(SRC)	
CM2 - BP32ADRA?			RELAY	
CM2 - BP32ADTD?	DC 24V	DC 24V	TR(SINK)	
CM2 - BP32ADCD?			TR(SRC)	
CM2 - BP32ADRD?			RELAY	

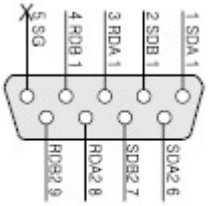
COMMUNICATION CABLE WIRING



RS422/485(S)



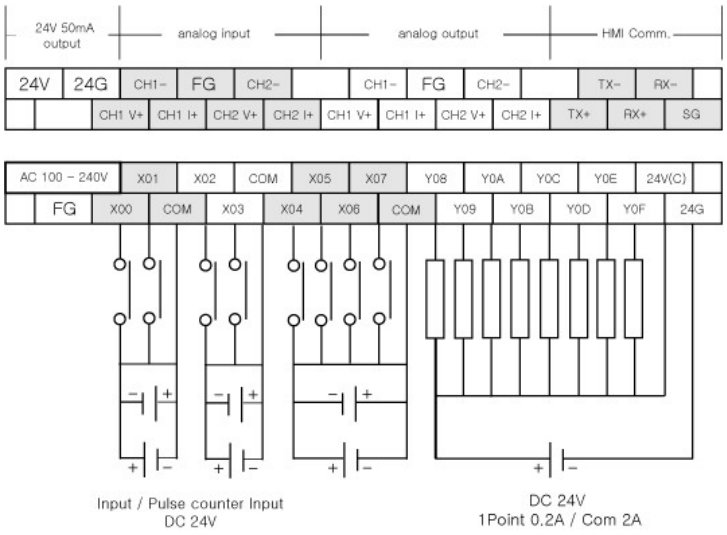
RS232C(R, T)



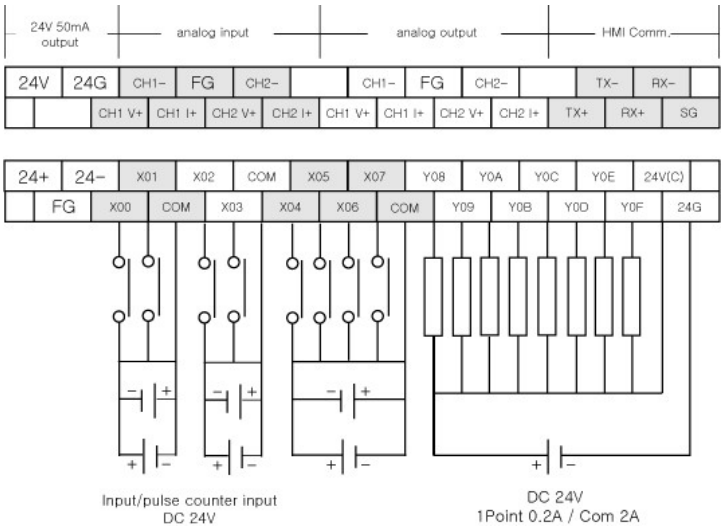
RS422/485 2채널(U)

EXTERNAL WIRING

CM2-BP32ADTA ?

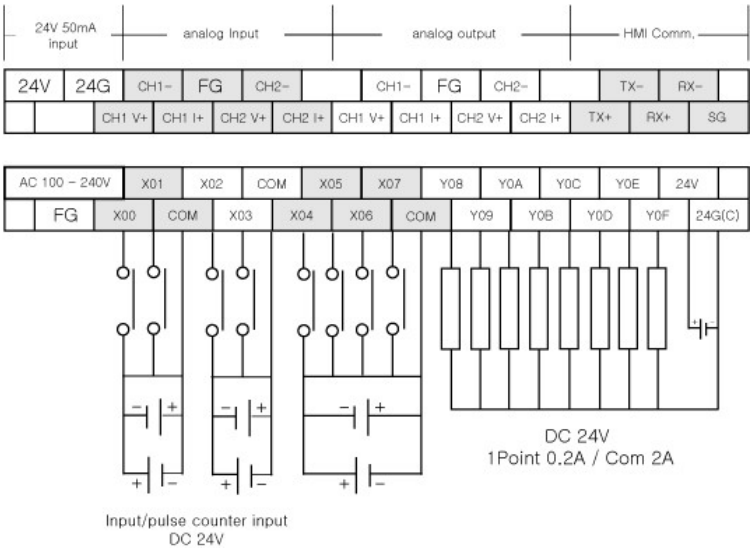


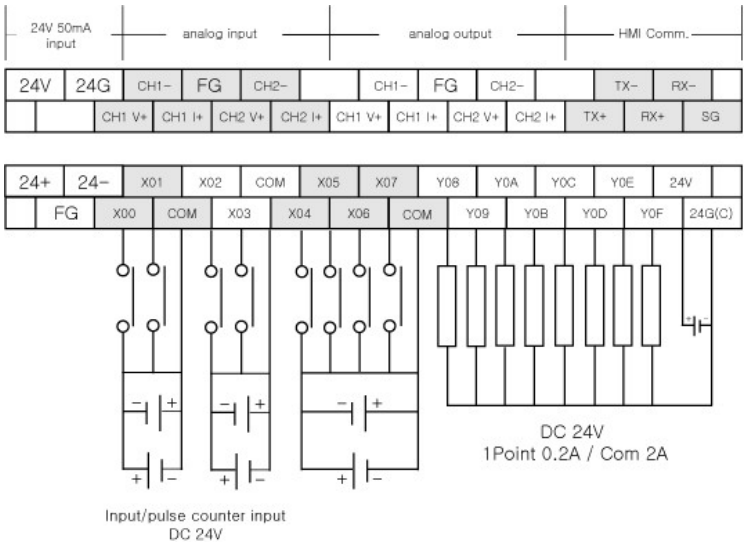
CM2-BP32ADTD ?



CM2-BP32ADCA ? **CM2-BP32ADCD**

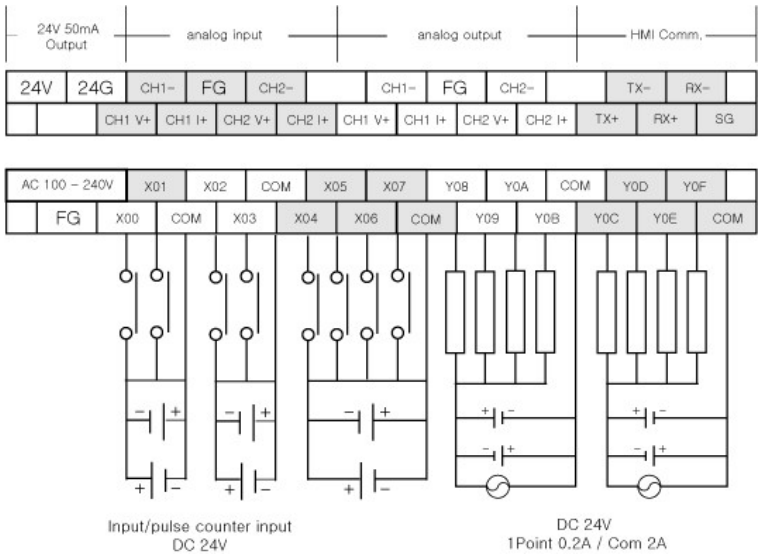
?

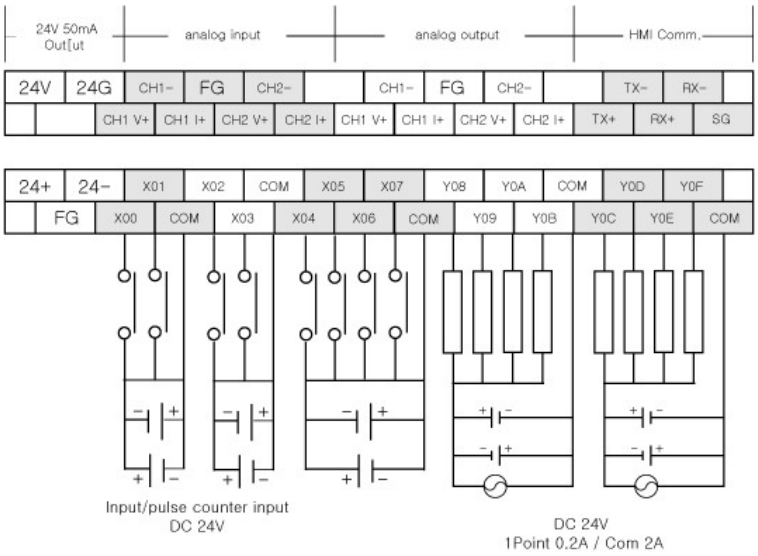




CM2-BP32ADRA ? **CM2-BP32ADRD**

?





CH1, CH2 analog input/output termimals

	CH 1 (Analog input)			CH 1 (Analog input)		
Voltage input	CH 1 V+ V+ input	CH 1 I+ Unnecessary	CH 1 - V - input	CH 2 V+ V+ input	CH 2 I+ Unnecessary	CH 2 - V - input
Current input	CH 1 V+, CH1 I+ Connect I+ input		CH I- I - input	CH 2 V+, CH2 I+ Connect I+ input		CH 2- I - input
	CH 1 (Analog output)			CH 1 (Analog output)		
Voltage output	CH 1 V+ V+ ouput	CH 1 I+ Unnecessary	CH 1 - V - ouput	CH 2 V+ V+ ouput	CH 2 I+ Unnecessary	CH 2 - V - ouput
Current output	CH 1 V+, CH1 I+ Connect I+ ouput		CH I- I - ouput	CH 2 V+, CH2 I+ Connect I+ ouput		CH 2- I - ouput

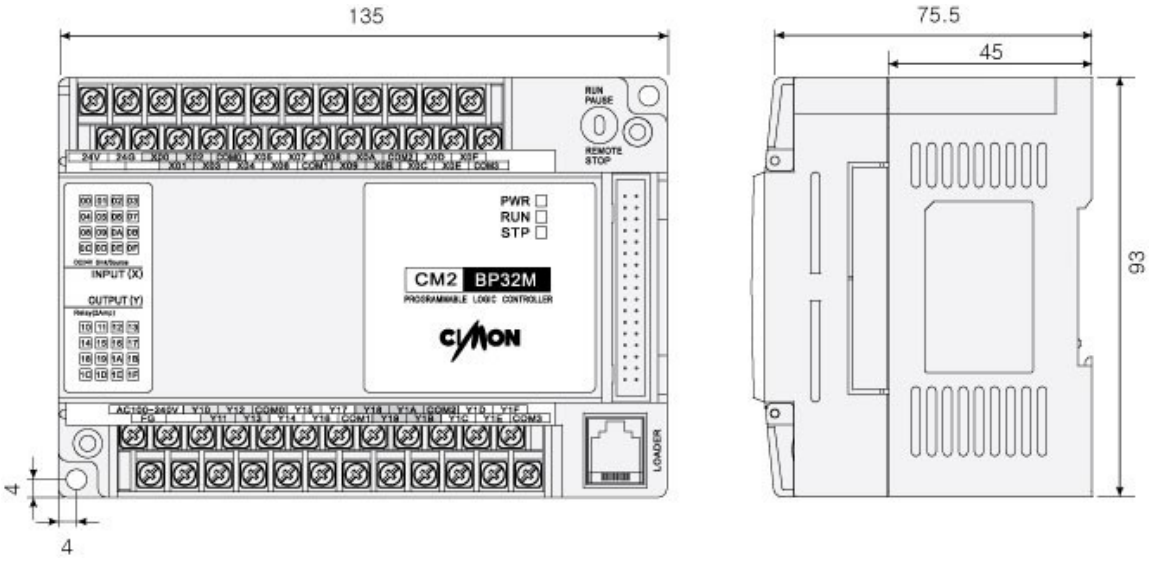
WIRING PRECATIONS

- Always ground the FG terminal for the PLC. There is a risk of electric shock or malfunction.
- When turning on the power and operating the module after wiring is completed, always attach the terminal cover that comes with the product.
- Tighten the terminal screws within the range of specified torque. if the terminal screws are loose, it may result in short circuits or malfunction.

- Be careful not to let foreign matters such as sawdust or wire chips get inside the module. These may cause fires, failure or malfunction

DIMENSIONS

Unit : mm



3.35 CM2-BP32B***

Modules :

- CM2-BP32B***

Contents :

- WIRING PRECATIONS
- DIMENSIONS

GENERAL SPECIFICATIONS

Item	Specification				Reference
Op.Temp.	Operating Temperature -10 ~65 ℃				
St.Temp	Storage Temperature □□-25 ~□□80 ℃				
Op.Hum	Operating Humidity 5 ~95%RH, Not Condensed				
St.Hum	Storage Humidity 5 ~95%RH, Not Condensed				
Vibration	In case of intermittent vibration			-	IEC61131-2
	Frequency	Acceleration	Amplitude	Sweep	
	10=□f=□□ 57Hz		0.075mm	10 times in X,Y,Z	
	57=□□f=□□ 150Hz	9.8m/s²{1G}	-		
	In case of continuous vibration				
	Frequency	Acceleration	Amplitude		
	10=□□f =□□57Hz		0.035mm		
	57=□□f= 150Hz	4.8m/s²{0.5G}			
Shock	□□Max. shock Acc. :147 m/s{15G} □□Time :11㎳ □□Pulse wave: Half sine wave pulse(3 times in X,Y,Z)				IEC61131-2
Noise	Square wave impulse noise	2,000 V			KDT Standard
	Electro-static discharge	Voltage :4kV (Contact discharge)			IEC61131-2 IEC1000-4-2
	Radiated electro-magneti c field	27 ~500 MHz,10 V/m			IEC61131-2 IEC1000-4-3
	Fast transient bust noise	Power Module	Digital I/O (24V or more)	Digital I/O (Less than 24V) Analog I/Ocomm.. Interface	IEC61131-2 IEC1000-4-4
		2kV	1kV	0.25kV	
Environ..	No corrosive gas and no dust				
Altitude	2,000m or less				
Pollution	2 or less				
Cooling	Natural Air Cooling				

MODULE SPECIFICATIONS

RTD Input			
Input type	Pt100, JPT100		
Channels	2 channels		
Rated I/O	-200 ~ 200 ℃		
Resolution	0.5 ℃/ 10 bits		
Conversion time	1 scan		
Analog Output			
	Current	Voltage	
Channels	2 channels		
Rated I/O	4 ~20 mA	0 ~10V	
Resolution	8bits		
Conversion time	1 scan		
Digital Input			
Channels	8 channels		
Power	DC 24V		
I/O voltage	ON voltage 19V / OFF voltage 11V		
COMMON	2 Points/COM(HSC CH1,2), 2Points/COM(HSC CH3,4), 4Points/COM		
Digital Output			
Channels	8 channels		
	Relay	Tr Sink	Tr Source
Power	AC220V/DC24V	DC 24V	DC 24V
I/O Current	1 Point 2A/ COM 5A	1 Point 0.2A / COM2A	1 Point 0.2A / COM2A
COMMON	4 Points/COM	8 Points/COM	8 Points/COM
Inner 422/485 , 1CH HMI Comm.Only			

COMM. CONFIGURATION

Address : D4988 (R/W)			
Parity bit	Data bit	STOP bit	Comm. speed

0: NONE 1: EVEN 2: ODD	0 : 8 bit 1 : 7 bit	0 : 485, 1 bit 1 : 485, 2 bit 2 : 422, 1 bit 3 : 422, 2 bit	0 : 300 bps 1 : 600 bps 2 : 1200 bps 3 : 2400 bps 4 : 4800 bps 5 : 9600 bps 6 : 19200 bps 7 : 38400 bps
B15~B12	B11~B8	B7~B4	B3~B0
Address : D4989 (R/W)			
Response delay time : 0 ~ 200 ms		Stations : 0 ~ 31	
B15~B8		B7~B0	

- A bit for modifying set values

M2553	A demanding bit for modifying set values
M255B	A completing bit for modifying set values

- When M 2553 sets ON, setting values modify. And then M255B sets ON.
- After M255B sets ON, setting values run
- When M255B sets ON, M2553 must set OFF.

- " A bit for modifying set values" apply with " Comm. configuration" and "Analog input/Output configuration".

I/O CONFIGURATION

AD	D4990 R/W	Input type 0 : Pt100 1: JPT100		Conversion Permission/Ban 0 : Ban 1 : Permission	
		B15~B12	B11~B8	B7~B4	B3~B0
		CH2	CH1	CH2	CH1
	D4991 R/W	Average : 0 ~ 255		Average : 0 ~ 255	
		B15~B8		B7~ B0	
		CH2		CH1	
	D4992 R	CH1 temperature conversion(℃) : -200~200(℃-2000~2000)			
		B15~B0			
	D4993 R	CH2 temperature conversion(℃) : -200~200(℃-2000~2000)			
		B15~B0			
	D4994R	CH1 digital conversion : 0 ~ 1000			
		B15~B0			
	D4995R	CH2 digital conversion : 0 ~ 1000			
		B15~B0			

DA	D4996 R/W	-		Conversion Permission/Ban 0 : Ban 1 : Permission	
		B15~B8		B7~B4	B3~B0
		-		CH2	CH1
	D4997 R/W	HOLD/CLEAR 0 : CLEAR, 1 : HOLD		Current/Voltage output 0: Voltage ,1: Current	
		B15~B12	B11~B8	B7~B4	B3~B0
		CH2	CH1	CH2	CH1
	D4998 R/W	B15~B0			
		CH1 digital output : 0 ~ 250			
	D4999 R/W	B15~B0			
		CH2 digital output : 0 ~ 250			

- The data at D4990, D4991, D4996 and D4997 can convert values with Scan-Programs or memory monitor

- The data at D4990, D4991, D4996, D4997 can keep former values in case of the power set ON/OFF or module controlled RUN<_>STOP.

- The data at D4990, D4991, D4996 and D4997 is stored in inner flash when power set off. And the data read former data from the flash,

stored in the memory when power set ON.

COMMUNICATION OPTIONS

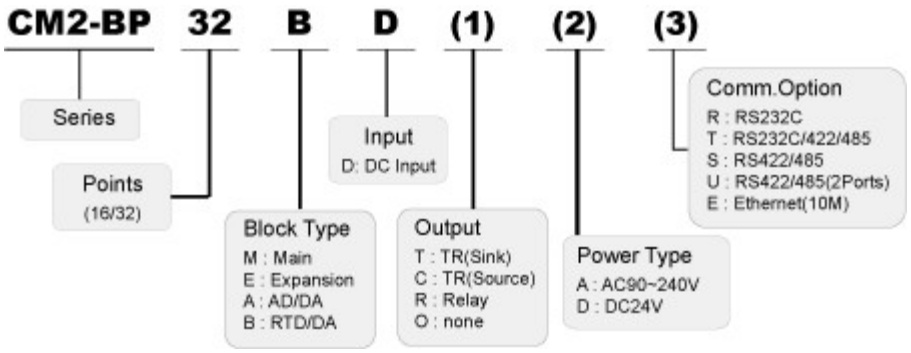
▶ RS232/422/485

Option (**BP**nnBxxx-)		**-T**	**-U**	**-R**	**-S**
Channel Type		RS232C RS422/485	RS422/485 (2 ports)	RS232C	RS422/485
Mode	HMI	Multi-Drop (max. 32 stations)			
	Loader	Support	Support	X	X
	Program	Support	Support	X	X
Param	Data Bits	7 or 8 bits			
	Stop Bits	1 or 2 bits			
	Parity	Even / Odd / None			
Synchronize		Asynchronous			
Speed (bps)		300/600/1200/2400/9600/19200/38400			
Modem Supp.		Supports External modem unit			

▶ Ethernet

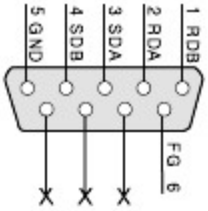
Option (**BP**nnBxxx-)	**-E**
Cable Type	10BASE -T
Comm. Speed.	10Mbps
Max. Distance	100m (Node to HUB)
Max. HUB	Max. 4 cascaded HUB
Max. Frame Size	1500 bytes
Protocol	CSMA / CD

MAIN BLOCK LINE-UP

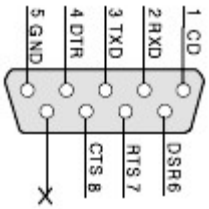


Model Name	Power	Input	Output	Option
CM2 - BP32BDTA?	AC 90 ~ 240V	DC 24V	TR(SINK)	R : RS232C T : RS232C RS422/485 S : RS422/485 U : RS422/485 (2 ports) E : Ethernet
CM2 - BP32BDCA?			TR(SRC)	
CM2 - BP32BDRA?			RELAY	
CM2 - BP32BDTD?	DC 24V	DC 24V	TR(SINK)	
CM2 - BP32BDCD?			TR(SRC)	
CM2 - BP32BDRD?			RELAY	

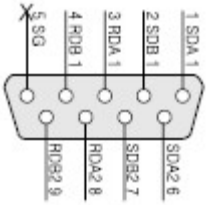
COMMUNICATION CABLE WIRING



RS422/485(S)



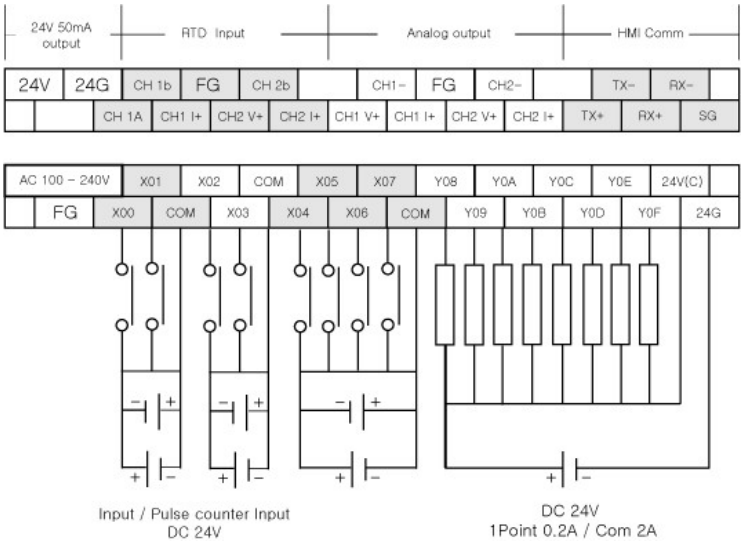
RS232C(R, T)



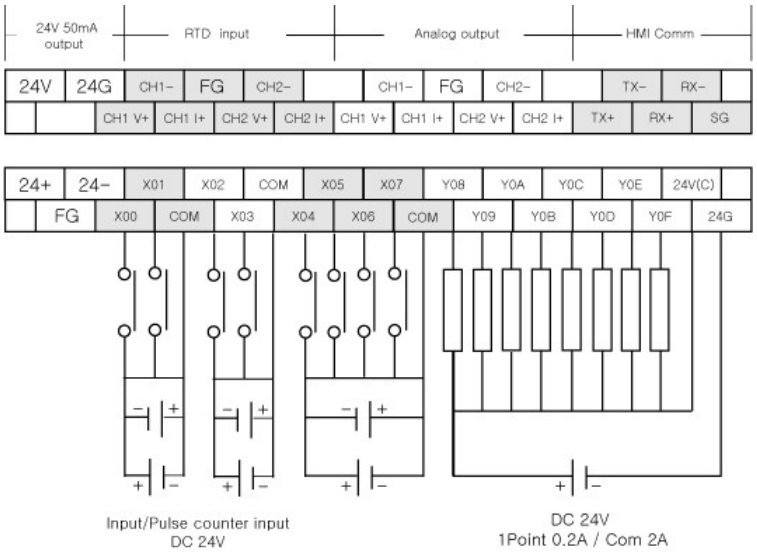
RS422/485 2채널(U)

EXTERNAL WIRING

CM2-BP32BDTA ?

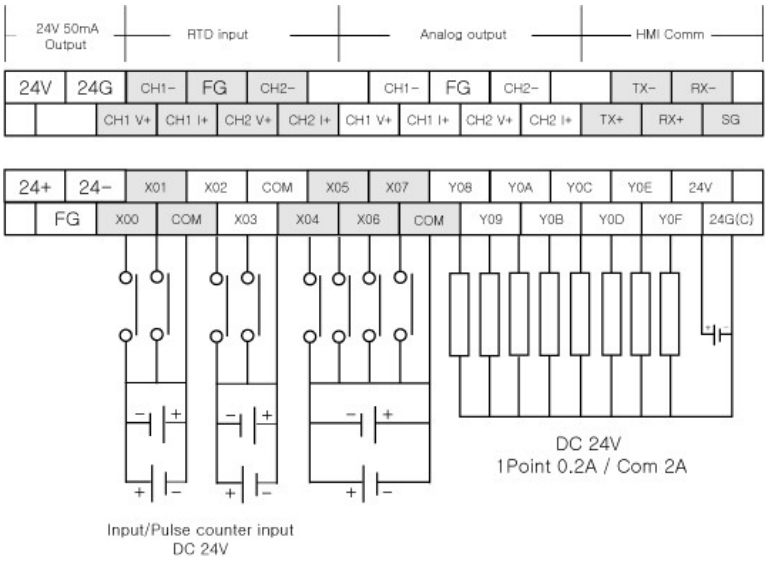


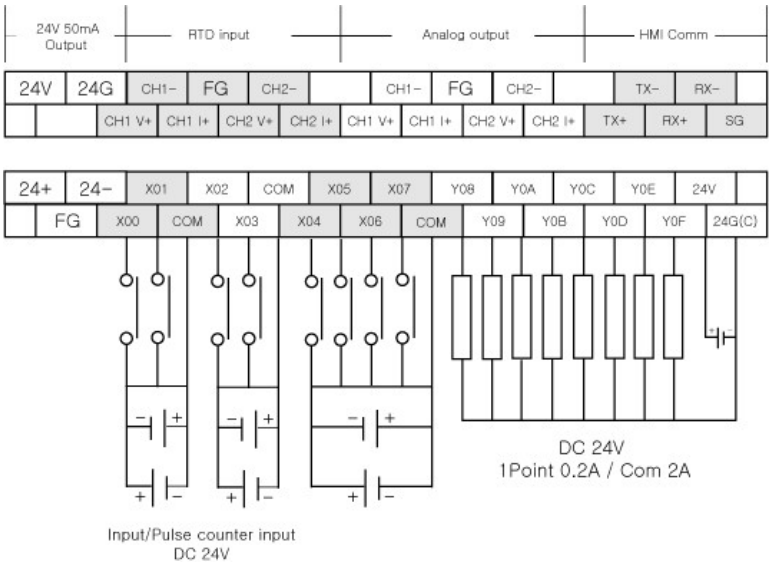
CM2-BP32BDTD ?



CM2-BP32BDCA ? **CM2-BP32BDCD**

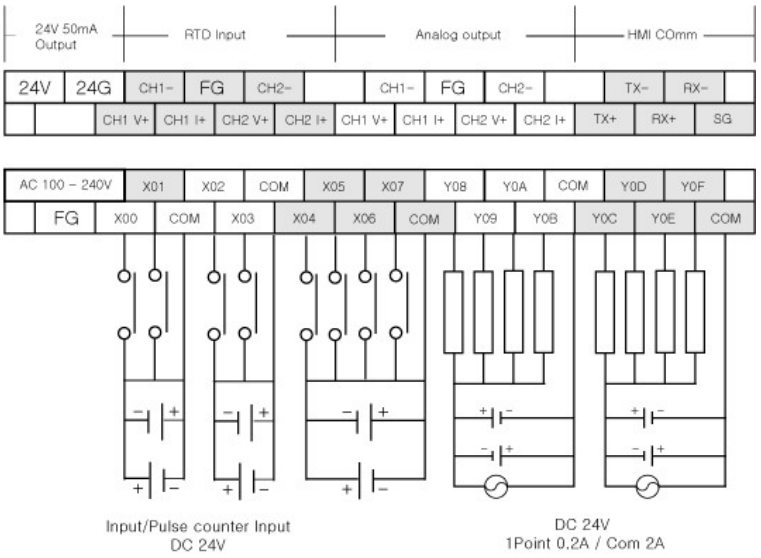
?

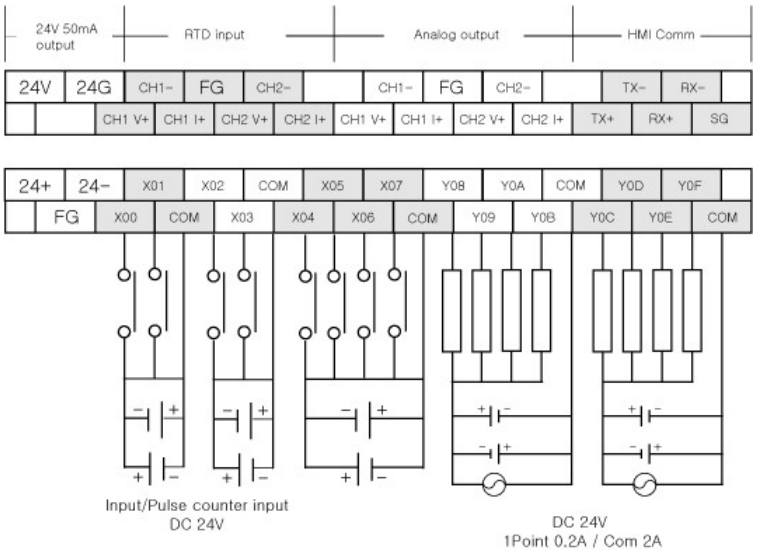




CM2-BP32BDRA ? **CM2-BP32BDRD**

?





CH1, CH2 RTD input/output terminals

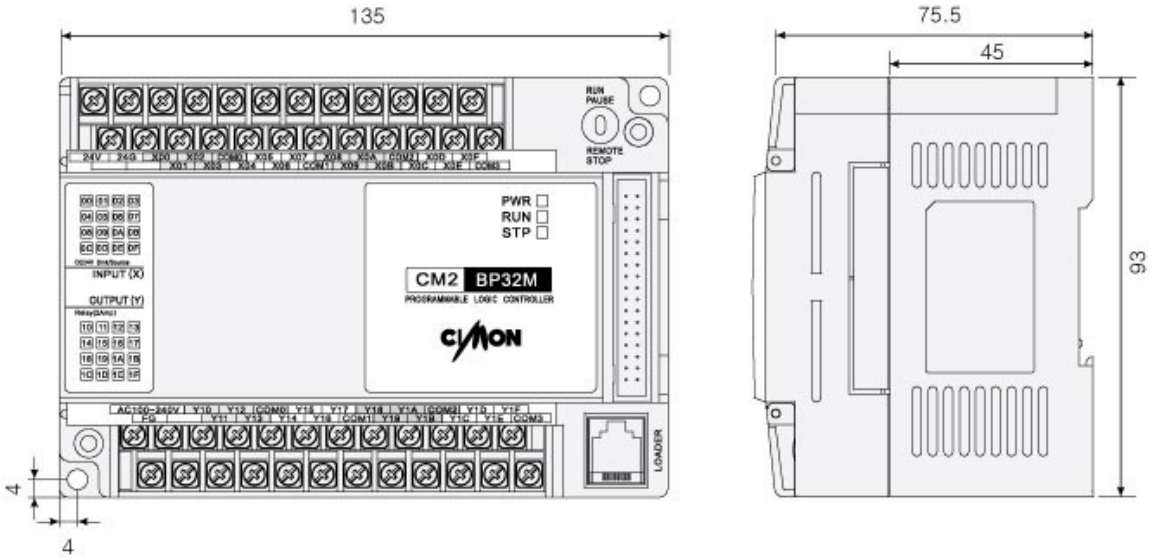
	CH 1 (RTD input)			CH 2 (RTD input)		
	CH 1A Ainput	CH 1B B input	CH 1b b input	CH 2 A A input	CH 2 B B input	CH 2 b b input
	CH 1 (Analog output)			CH 2 (Analog output)		
Voltage output	CH 1 V+ V+ output	CH 1 I+ Unnecessary	CH 1 − V − output	CH 2 V+ V+ output	CH 2 I+ Unnecessary	CH 2 − V − output
Current output	CH 1 V+, CH1 I+ Connect I+ output		CH I− I − output	CH 2 V+, CH2 I+ Connect I+ output		CH 2− I − output

WIRING PRECATIONS

- Always ground the FG terminal for the PLC. There is a risk of electric shock or malfunction.
- When turning on the power and operating the module after wiring is completed, always attach the terminal cover that comes with the product.
- Tighten the terminal screws within the range of specified torque. if the terminal screws are loose, it may result in short circuits or malfunction.
- Be careful not to let foreign matters such as sawdust or wire chips get inside the module. These may cause fires, failure or malfunction

DIMENSIONS

Unit : mm



3.36 CM3-PLCS CPU

Modules :

CM3-PLCS CPU

Contents :

- Terminal I/O Pin Map
- Communication Interface
- Built-in Comm. Specification
- Dimension
- Safety Instructions

General Specifications

<table>
<tr><th>Items</th><th colspan="4">Specification</th><th>Reference</th></tr>
<tr><td>Ambient Temp</td><td colspan="4">-10ºC ~ 65ºC</td><td></td></tr>
<tr><td>Storage Temp</td><td colspan="4">-25ºC ~ 80ºC</td><td></td></tr>
<tr><td>Ambient Humidity</td><td colspan="4">5 ~95%RH, (Non-condensing)</td><td></td></tr>
<tr><td>Storage Humidity</td><td colspan="4">5 ~95%RH, (Non-condensing)</td><td></td></tr>
<tr><td rowspan="8">Vibration</td><td colspan="4">Occasional vibration</td><td rowspan="8">IEC 61131-2</td></tr>
<tr><td>Frequency</td><td>Acceleration</td><td>Pulse width</td><td>Times</td></tr>
<tr><td>10 <= f < 57Hz</td><td>-</td><td>0.075 mm</td><td rowspan="3">X,Y,Z Each direction, 10 times</td></tr>
<tr><td>57 <= f <= 150Hz</td><td>9.8m/s2{1G}</td><td>-</td></tr>
<tr><td colspan="3">Continuous vibration</td></tr>
<tr><td>Frequency</td><td>Acceleration</td><td>Pulse width</td></tr>
<tr><td>10 <= f < 57Hz</td><td>-</td><td>0.035 m</td></tr>
</table>

			m		
	57 <= f <=150Hz	4.9m/s2{0.5G}	-		
Shocks	• Peak acceleratioin : 147 m/S2 • Duration : 11ms • Pulse wave type : Half-sine (3times each X,Y,Z 3 direction)				IEC 61131-2
Impulse Noise	Square wave impulse noise	+-2,000 V			KDT Standard
	Electrostatic discharge	Voltage :4kV (Contact discharge)			IEC 61131-2 IEC 1000-4-2
	Radiated electromagnetic field noise	27 ~500 MHz,10 V/m			IEC 61131-2 IEC 1000-4-3
	Fast transient/ Burst noise	Power	Digital I/O (24V or more)	Digital I/O(24V or less) Analog I/O Comm. Interface	IEC 61131-2 IEC 1000-4-4
		2 kV	2 kV	0.25 kV	
	Voltage	2KV/1min		0.5KV/1min	
Operation ambience	Free from corrosive gases and excessive dust				
Altitude	2,000m or less				
Pollution degree	2 or less				
Cooling method	Air-cooling				

PLC-S CPU Performance Specification(Specifications)

Items		Specifications
Power		DC24V
Program Control Method		Stored Program, Process-Driven Interrupt, Time Driven Interrupt
I/O Control Method		Indirect method, Directed by program instruction
Program language		IL(Instruction List), LD(Ladder Diagram)
Data Processing Type		32 Bit
Instructions	Sequence	55 Instruction
	Application	389 Instruction
Processing speed (Sequence)		200ns / Step
Program capacity		10K Step
Max. I/O, Max. expansion		384 pts / 1 main Block + Max. 11 Block
Operation mode		Run, Stop, Remote Run, Remote Stop
Back-up method		Retain Setting Data.
Total program		128
Program types	Scan	(127-Program block)
	Cyclic task	16
	Special	126
	Initial task	2 (_INIT,_H_INIT)
	Subroutine	126Count
Self-diagnosis		Detects errors of scan time, memory, I/O and power supply, battery error
Re-start		Cold, Hot re-start
Device memory capacity	X	1024 pts (X0000 – X063F)
	Y	1024 pts (Y0000 – Y063F)
	M	8192 pts (M0000 – M511F)
	L	4096 pts (L0000 – L255F)
	K	4096 pts (K0000 – K255F)
	F	2048 pts (F0000 – F127F)
	T	512 pts (T0000 – T0511)
	C	512 pts (C0000 – C0511)
	S	100 states x 100 set (00.00 - 99.99)
	D	10000 words (D0000 - D9999)
	Z	1024 words (Call Stack : Z0000 - Z0063, Z1000 - Z1063)
	R	16 pts (Index)
High Speed Counter		20Kpps, 2 Phase 2Ch.
Positioning		Max. 100Kpps, 2 Axis, Linear interpolation
PID		32 Channels, Auto-Tuning
RTC		Embedded (Battery CR2032 Backup)
Comm. Channel		Standard : USB Loader, Serial 1(RS232C) Optional : Serial 1Ch(RS485), Ethernet 1Ch
Etc.		

Device & Address

▶ **Device**

- Input : X
- Output : Y
- Sub Relay : M
- Keep Relay : K
- Timer : T
- Counter : C
- Data Device : D
- Sub Data Device : @D
- Link Relay : L
- Step control Relay : S
- Special Relay : F
- Index registor : R

▶ **Device Address**

- Bit Data: [Device]+[Card No.]+[Bit No.]

Device : X, Y, M, K, L, F, Card No. : 10Dec(Decimal). 3 Characters

Bit No. : 16Hex. 1 Character

Ex) X0100 -> 10Dec. (word) + 16Hex(Last Bit)

: [10th Address and 0th bit]

- Word Data: [Device]+[Card No.]

Device : D, Z, T, C, Card No. : 10Dec. 4Characters

Ex) D0100 -> 10Dec. (Word) : [100th word Address]

- Timer, Counter Output: [Device]+[Bit No.]

Device : T. C, Bit No. : 10Dec. 4Characters

Ex) T0100 -> 10Dec. (Word) : [T 100th Bit Address]

- Step Controller I/O: [Device]+[Card No.]+[.]+[Step No.]

Device : S

Card No. : 10Dec. 2Characters, Step No. : 10Dec. 2Characters

Ex) Sxx.xx -> xx is 10Dec. (0~99)

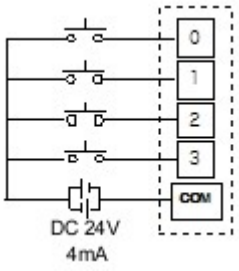
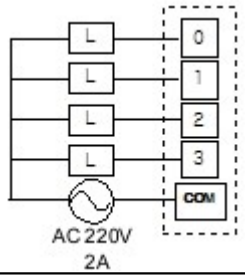
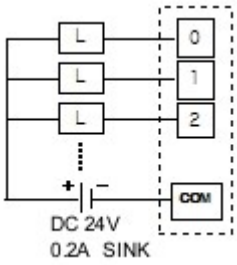
- assign Bit Device to Word: [Device]+[Card No.]+[0]

Device : X, Y, M, K, L, F, Card No. : 10Dec. 3Characters

Ex) X010 -> 10Dec. (Word), [X 10th Address]

I/O Specification

Items	DC Input	Relay Output	TR Output

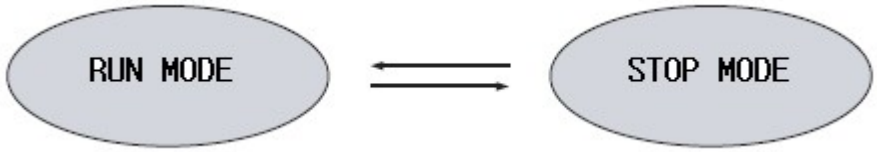
Rated I/O Voltage	DC 24V	AC 220V / DC 24V	DC 12V / 24V
Rated I/O Current	4mA	1point 2A / COM 5A	1point 0.2A, COM 2A
On V/A	DC19V / 3mA	-	-
Off V/A	DC6V / 1mA	-	-
Response time	3ms or less	10ms or less	1ms or less
Operation indicator	Input ON, LED ON	Input ON, LED ON	Input ON, LED ON
Insulation method	Photo coupler insulation	Relay Insulation	Photo coupler insulation
Input method	SINK/SRC	-	-
Output method	-	Relay	Sink
Circuit Diagram			

Names of Part and Mode Change

▶ Slot number is assigned in order from left.

✓ Max. expansion modules are 11 except CPU.

▶ Mode change



▶ Operation mode is changed by mode switch.

▶ The mode can be changed through CICON but when power reset,

✓ RUN/STOP mode is decided through switch position.

Features of CPU

▶ Built-in Functions

✓ PID Control

It operates 32LOOP PID without PID module.

✓ RTC

It reads time from RTC and save it in F device address.

✓ I/O reservation.

It scans module at designated slot.

It refers to reservation function which writes a program without I/O change in case of expansion, damage or replacement.

✓ Online Edit

Program can be edited while Run mode.

▶ **Features**

✓ SD/MMC Built-in.

Scan program or firmware can be upgraded by SD memory card.

(Stop mode -> Power off -> Insert SD card -> Run -> Stop -> Run -> Stop : firmware will be upgrade automatically.)

✓ 20Kpps High Speed Counter (2Channel) Built-in.

2PH. 2/4Multi. Input mode possible, Voltage input type (Open collector)

✓ 100Kpps 2axis Pulse Output built-in. (Positioning)

Pulse+Direction Output, Position/Speed/Speed-Position, Position-Speed Control.

✓ Max. 3 communications can work simultaneously. (Ethernet, RS232, RS485)

CIMON HMI, MODBUS RTU/TCP, PLC Link, Protocol program(user protocol), Loader protocol support, Remote access & up/down load support.

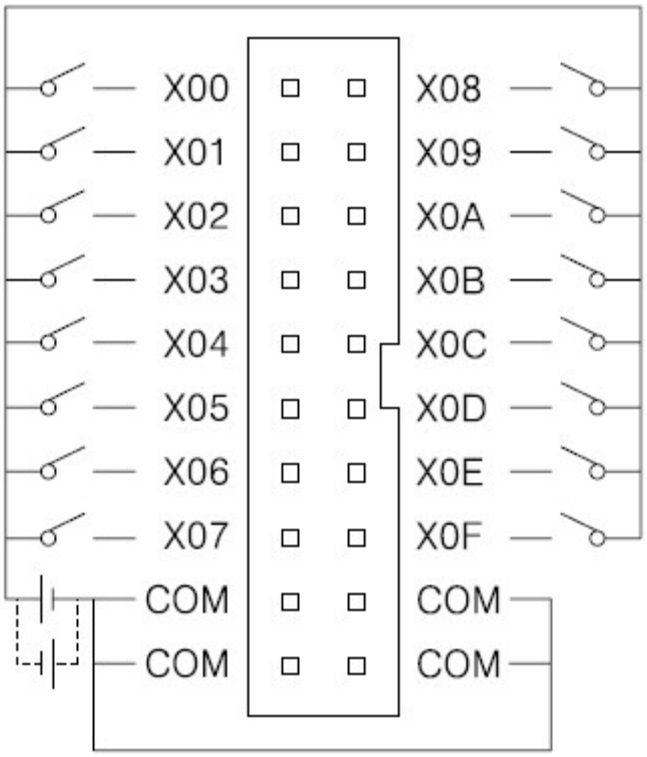
✓ Abundant memory (10K Step)

✓ Data reserved in case of Power cut

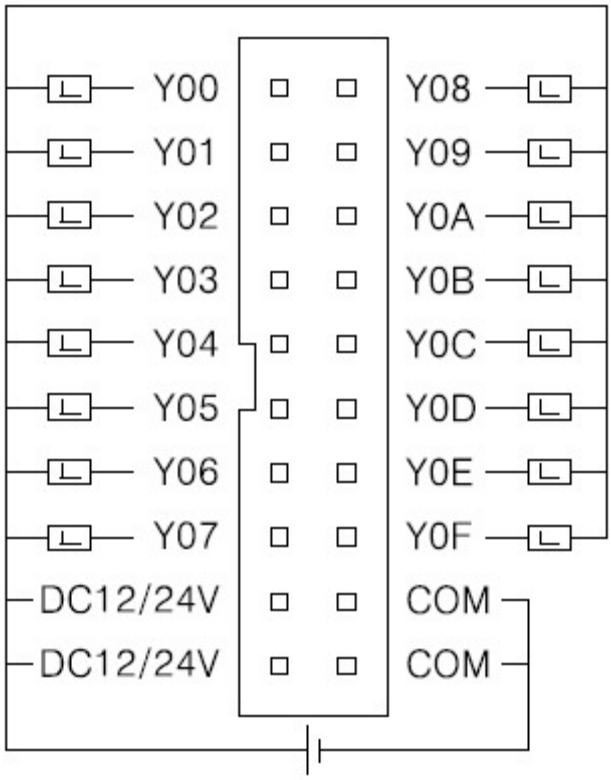
Built-in Flash memory enabling permanent backup of program without any separate battery.

CPU I/O Pin Map

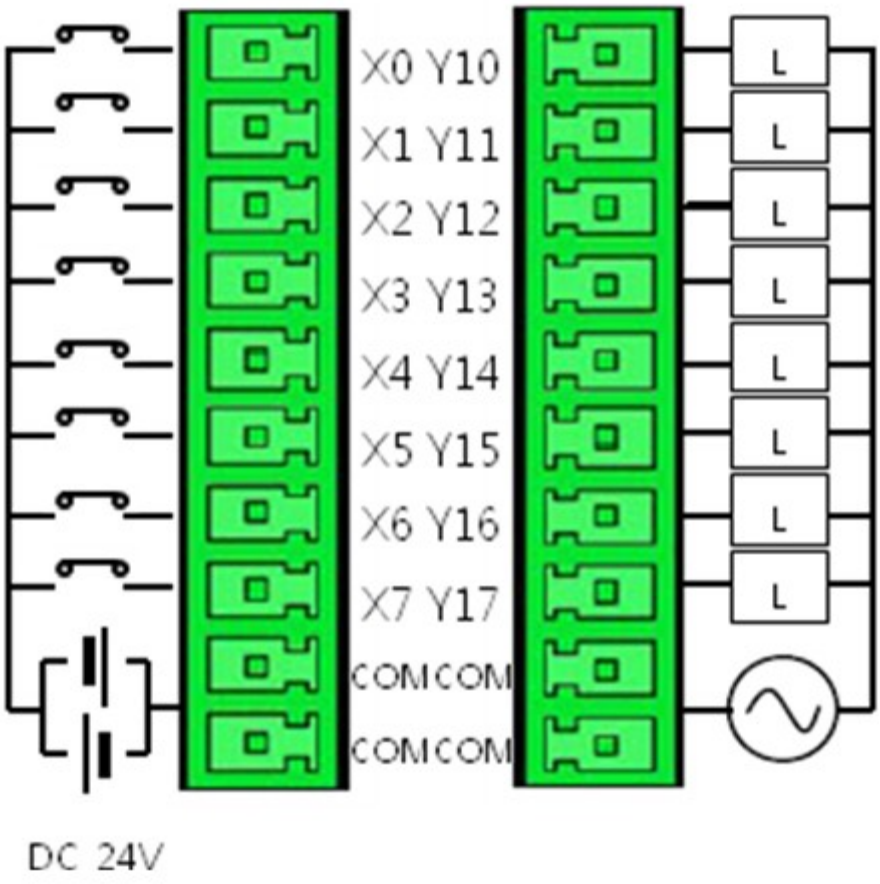
▶ MDT Inpur



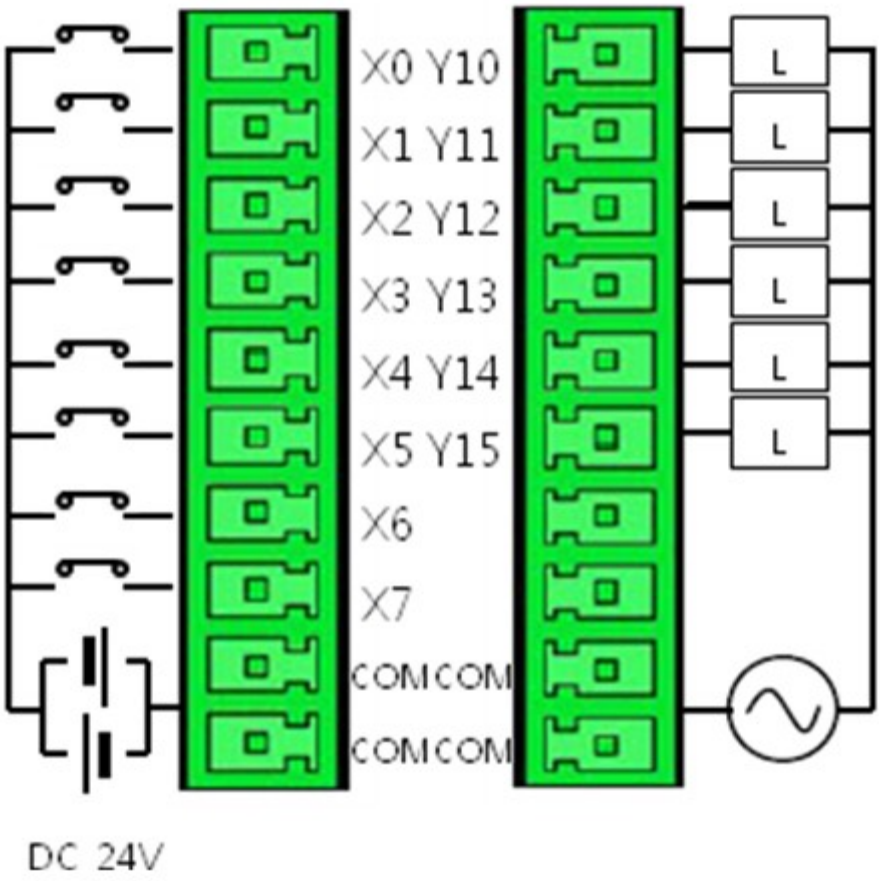
▶ MDT Output



▶ SP16MDR, SP16MDRV I/O



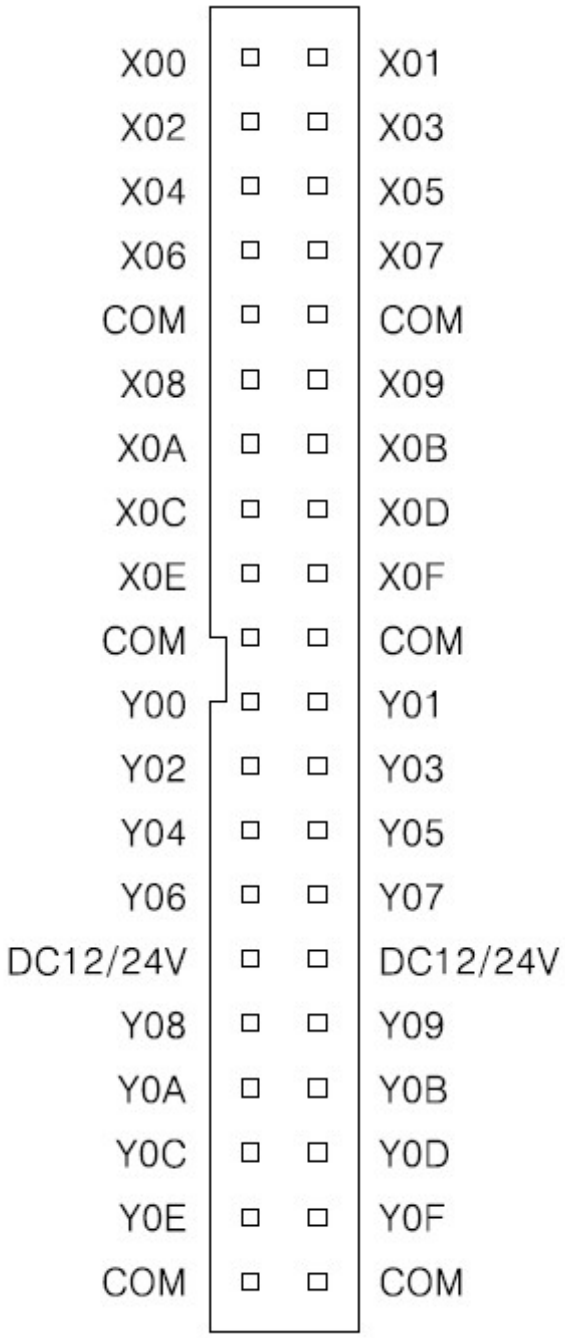
▶ SP16MDRE, SP16MDRF I/O

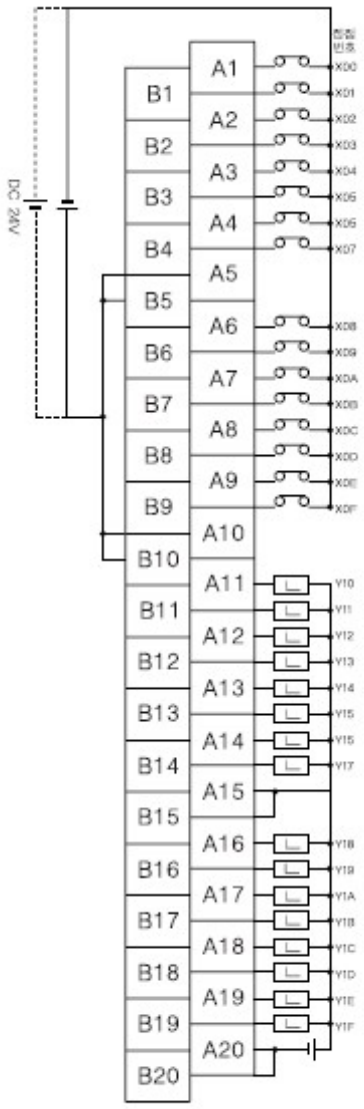


▶ In case of SP16MDRE and SP16MDRF, relay output is 6 points.

Terminal I/O Pin Map

▶ Terminal (CM0-TM32M)



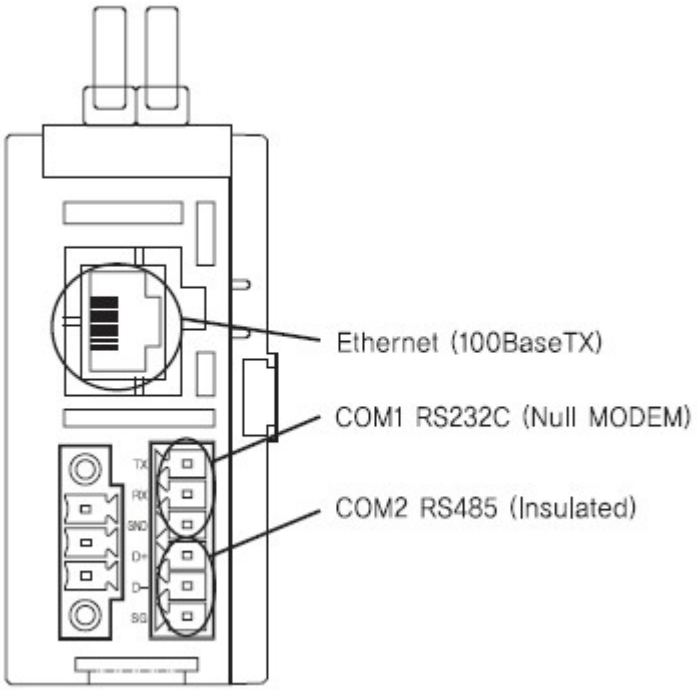


CM0-TB32M	CM3-SP32MDT
A1	X00
B1	X01
A2	X02
B2	X03
A3	X04
B3	X05
A4	X06
B4	X07
A5	COM
B5	COM
A6	X08
B6	X09
A7	X0A
B7	X0B
A8	X0C
B8	X0D
A9	X0E
B9	X0F
A10	COM
B10	COM
A11	Y10
B11	Y11
A12	Y12
B12	Y13
A13	Y14
B13	Y15
A14	Y16
B14	Y17
A15	DC12/24V
B15	DC12/24V
A16	Y18
B16	Y19
A17	Y1A
B17	Y1B
A18	Y1C
B18	Y1D
A19	Y1E
B19	Y1F
A20	COM
B20	COM

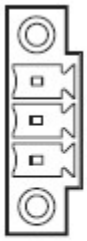
▶ Terminal(CM0-TM32M) has its own Terminal Cable.

Terminal Cable : CM0-SCB15M

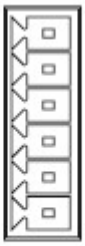
Communication Interface



▶ Power and RS232/485 Terminal map



Pin	Name
1	24V
2	24G
3	FG



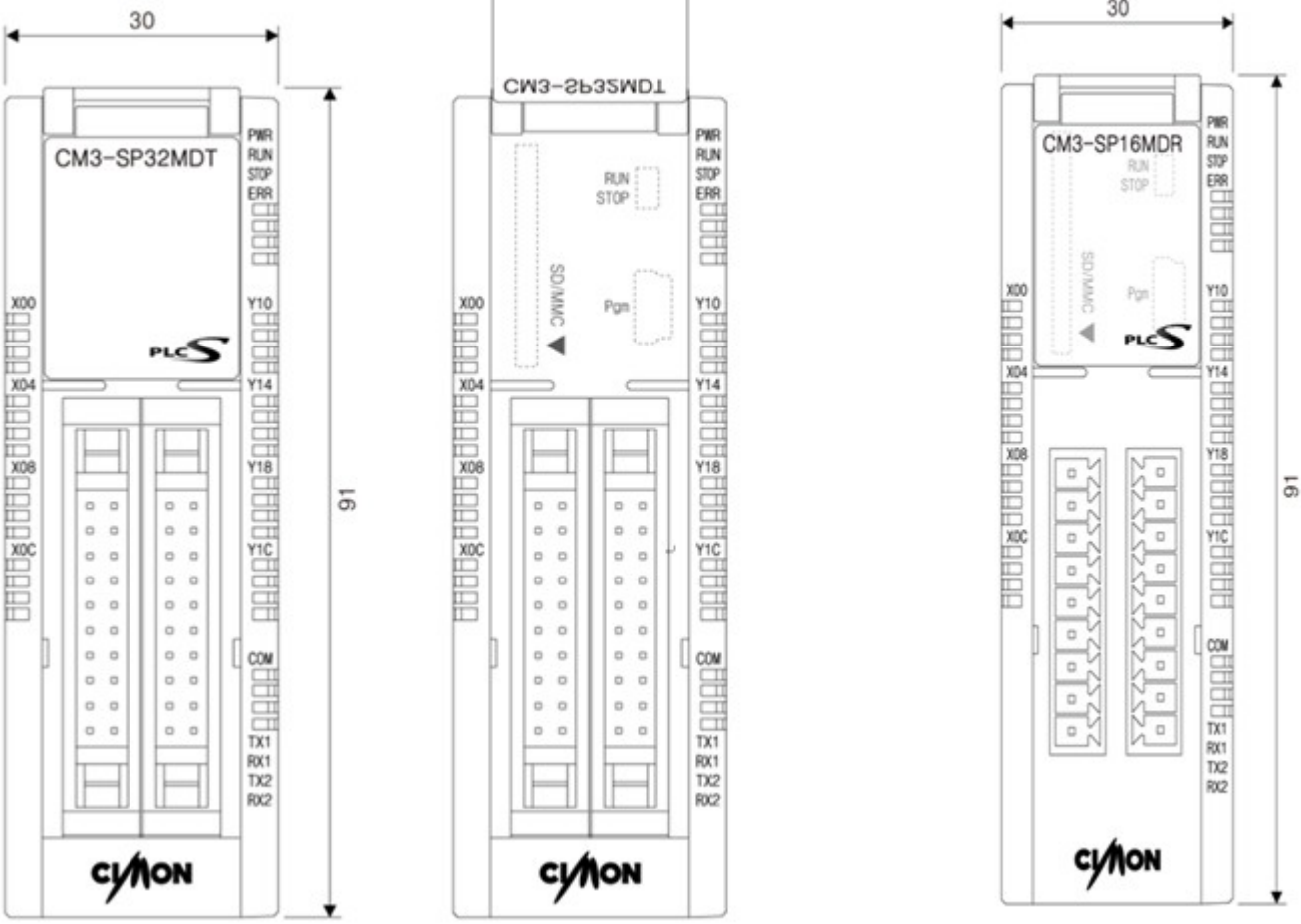
Pin	Name
1	TX
2	RX
3	GND
4	D+
5	D–
6	SG

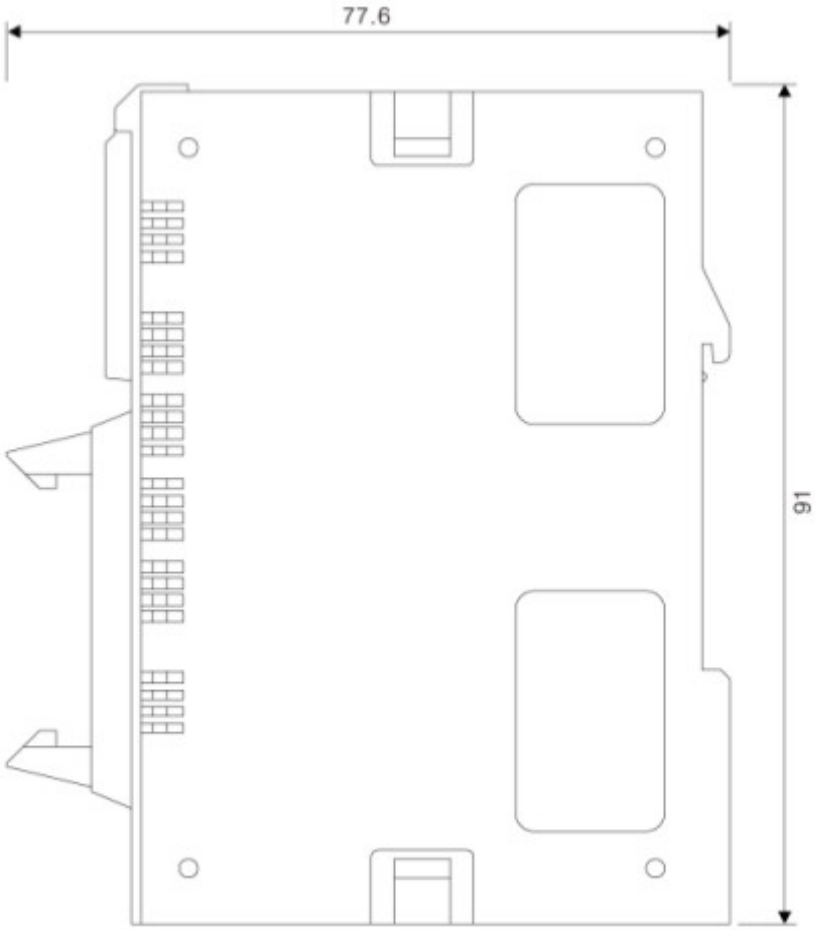
Built-in Comm. Specification

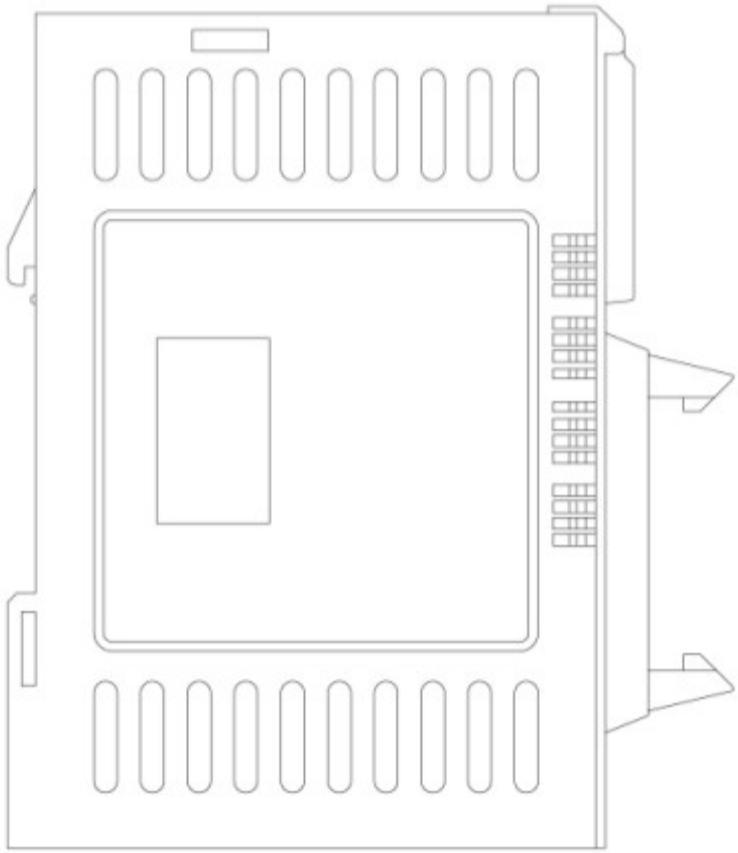
Items		RS232C	RS422/485	Ethernet
Power		Supplied by CPU		
Comm. Mode	Dedicated protocol	HMI protocol (1:n)		
	Loader protocol	O	O	O
	User defined protocol	O	O	
	MODBUS	O	O	O

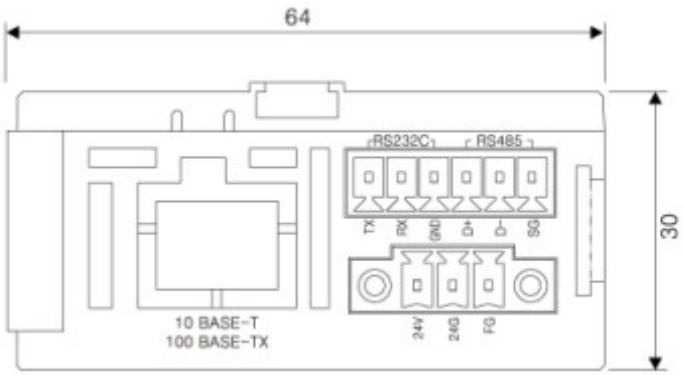
	PLC Link			O
	DHCP			O
Types	Data Bit	8Bit		
	Stop Bit	1 or 2Bit		
	Parity	Even / Odd / None		
Synchronization		Asynchronous		
Transmission speed		300~38400		10/100Mbps
Modem		Long distance comm. is possible by external modem		

Dimension









Safety Instructions

▶ Use PLC only in the environment specified in PLC manual or general standard of data sheet.

▶ Do not let any metallic foreign materials inside the products which may cause electric shock, fire or abnormal operation.

▶ Do not touch or install the module when PLC power is on.

▶ Do not disassemble or remodel the module.

▶ When F3,4(Special relay address for battery error) is on, change the battery

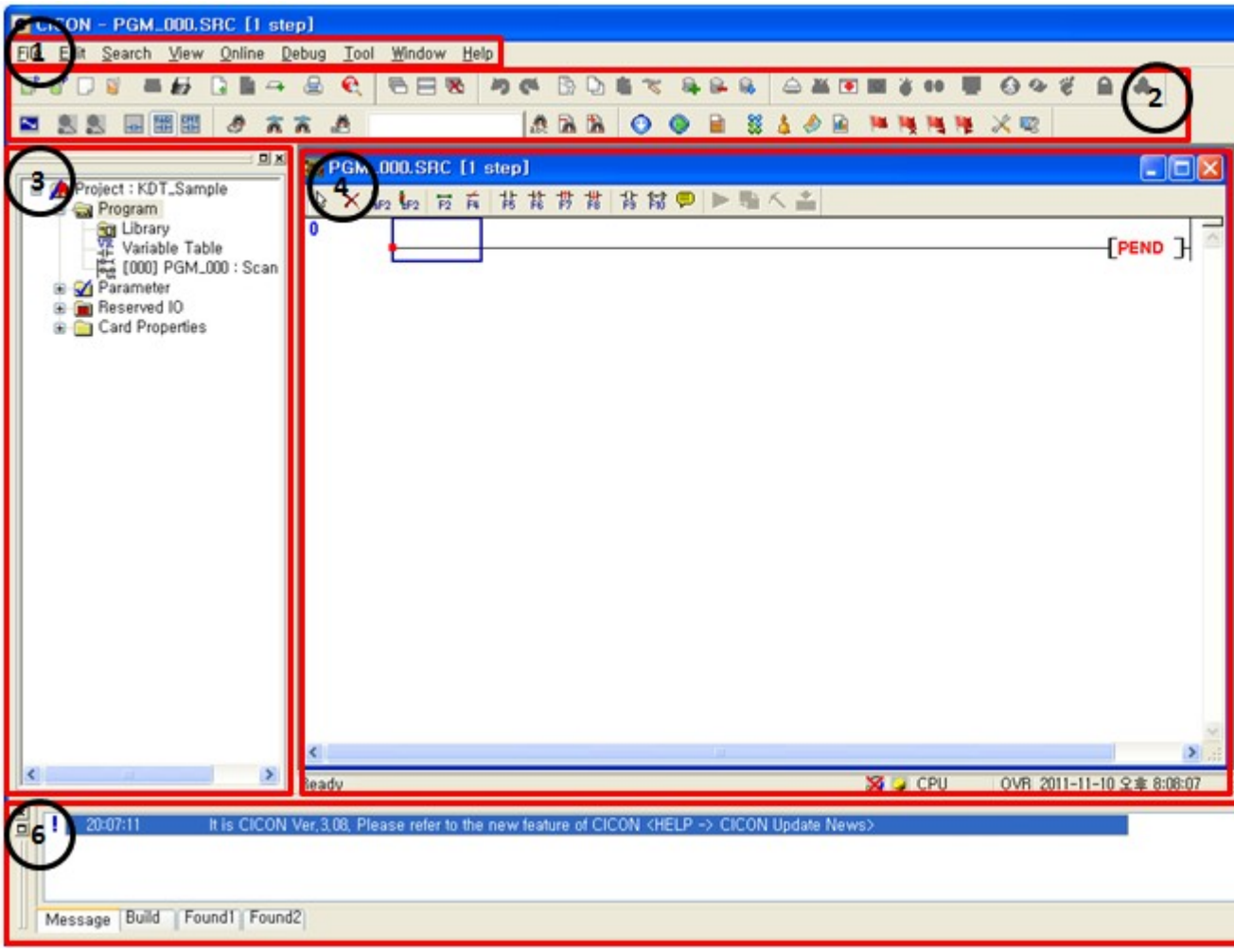
Top Level Intro

This page is printed before a new
top-level chapter starts

Part

4 CICON - PLC Loader Program

CICON Loader Program :



1. Menu Bar
2. Tool Bar
3. Project Window
4. Work Windows(Edit Window)
5. Message Window
6. Variable Window

- Provides convenient interface to edit program easily.
- Supports link function of various types by using CPU Loader, RS232C/422/485 and Ethernet.
- Enables to diagnose program errors and system by using debug functions easily.

See :

- Requirements for Installation
- Installation
- CICON Components
- Essential Function
- Programming(Single Programs)
- Programming(Multiple Programs)
- Scan Program
- Communication Setting Program
- Special Program
- SFC Program
- PLC Control
- Special Card Setting
- PLC Simulator
- Downloader
- Appendix

4.1 Requirements for Installation

Recommended hardware specification for CICON installation.

❖ **PC** Pentium 133Mhz CPU or faster, 64MB RAM or more including the expansion memory.

❖ **Serial Port** More than 1 serial port is required which connect with PLC loader port or RS232C/422/485 module.

❖ **Ethernet** Ethernet port is required which connect with PLC Ethernet module.

❖ **Hard disk** At least 13MB free hard space is required to install all CICON installation files and use CICON properly.

❖ **Mouse** To fully use CICON function, a Korea/English Windows compatible mouse is needed that can be connected to the PC.

❖ **OS** Windows 98SE/2000/XP Korean version is recommended.

4.2 Installation

Download

Connect to our web site and download the latest CICON program.
(Visit **"Customer Support"** -> **"General Download."**)

Installation

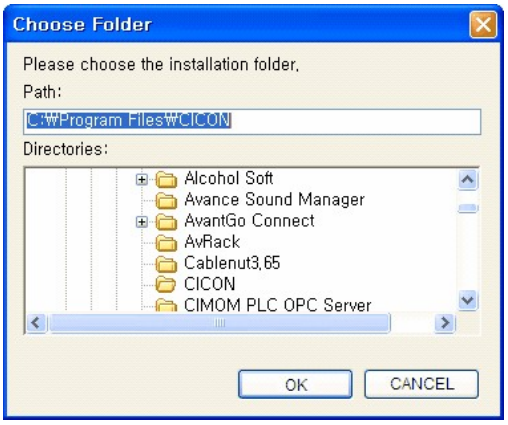
1. Double click the installation file.

2. Select the language used for installation and click the [OK] button.

3. Click the [Next] button when the next window appears.

4. Select your preferred installation location on the **"Choose Destination Location"** window and click the [Next (N)] button.

5. To change the **"Destination Folder"**, click the [Browse...] button to select or input new folder.



6. Select the installation type in the "Setup Type" window and click the "Next (N)" button.

7. Select the program folder in the "Select Program Folder" and click the "Next (N)" button.

You will be able to start the CICON program by selecting **Start -> All Programs -> CIMON -> CICON**, if you have selected the default installation settings.

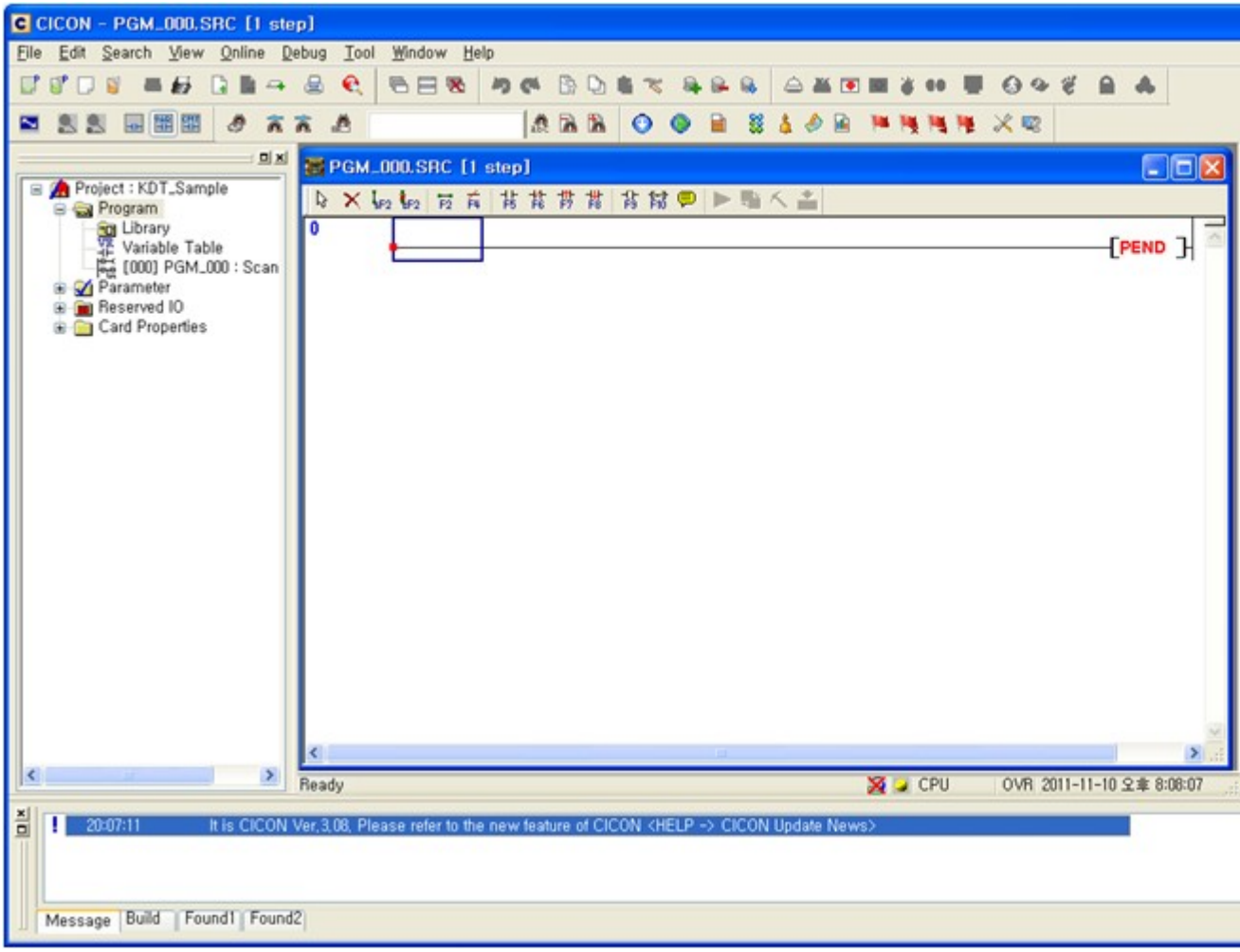
4.3 CICON Components

Provides convenient interface to edit program easily.

See :

- Screen Configuration
- CICON Menu
- CICON Option

4.3.1 Screen Configuration



Click Menu bar Toolbar Project window Work window Edit window Message window

Menu bar

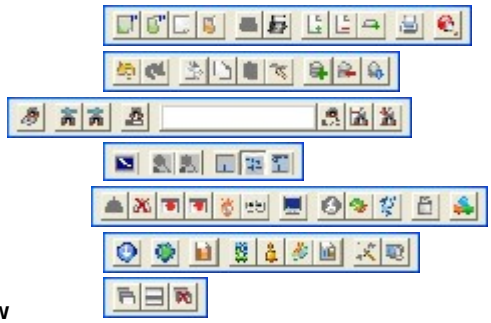
File Edit View Online Debug Tool Window Help

Manu names provided by CICON will be displayed.
When you click the menu, the associated dropdown menu will be displayed, and you can use various CIMON functions.

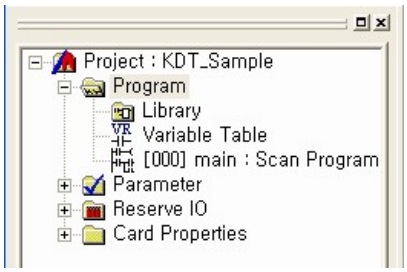
Toolbar

Frequently used menu icon buttons are displayed on the toolbar.

Basic
Edit
Search
View
Online
Tool
Window



Project window

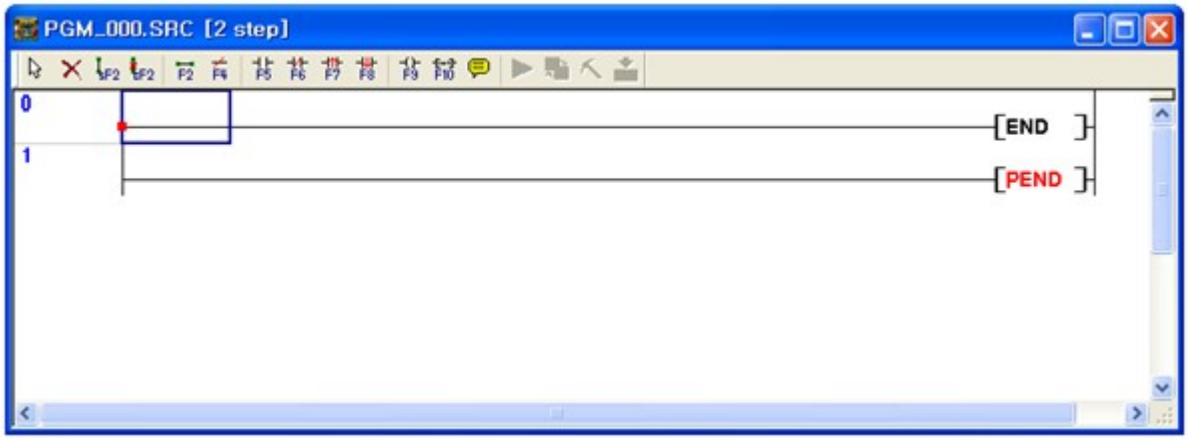


You can check the name of the project that you have opened.
In the project, you can find programs registered in the project, and find and modify PLC parameters, and check the status of modules mounted online.

Work window

In this window, your working details will be displayed.

Edit window

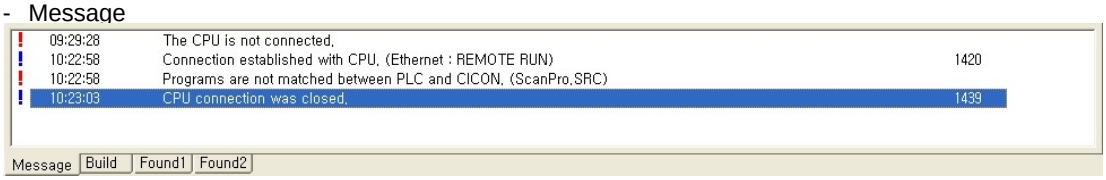


There are several types of edit window such as Edit Variable, Edit LD, and Edit Parameter window. You can use these windows to edit program, parameter, and configuration respectively.

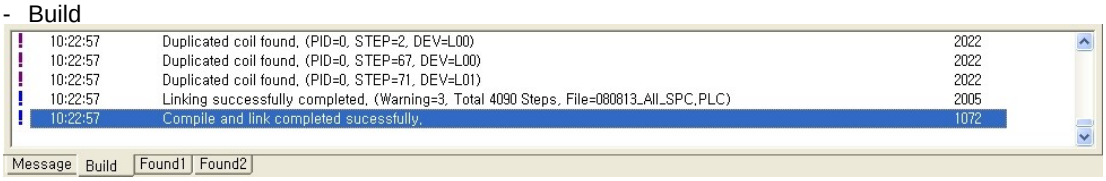
Message window

Message window will display the result of compilation, download, and search.
Message list will be displayed. To check the scrolled-up message, move the slide button on the right side.

- Message



- Build



- Found1/2

4.3.2 CICON Menu

Click File Edit View Online Debug Tools Windows Help

File

Menu	Note
New Project	Creates a new project.
Open Project	Opens the project that was already created.
Close Project	Closes the working project.
New Program	Creates a new program.
Open Program	Opens the program that was already created.
Close Program	Closes the working program.
Save Program	Saves the working program.
Save As	Saves the working program with a different name.
Save All	Saves all programs belonging to the working project.
Insert Program to project	Adds the existing program to the project.
Remove Program from Project	Deletes the selected from the project.
Print	Prints out the working program.
Preview	Shows the print preview screen.
Print Setup	Modifies the printer and printer setting.
Page Setup	Adjusts margins of the printing page.
Recent Files	Shows the list of programs that were edited/created recently. When you click the file, it will be executed.
Recent Project	Shows the list of projects that were edited/created recently. When you click the file, it will be executed.
Exit	Exits from the program.

Edit

Menu	Note
Undo	Cancels the job that was made just before.
Redo	Cancels the undoing job that was made just before.
Cut	Copies the selected area in the clipboard first and deletes the selected area.
Copy	Copies the selected area in the clipboard.
Paste	Pastes the clipboard contents into the designated area.
Delete	Deletes the contents of the selected area.
Copy With Variable	Use to copy the IL program that was composed using the variable name.

Select All	Selects the entire program area.
Find All	Searches for the scan program registered in the project, and displays the result on the message window.
Find	Searches for the contents in the working program.
Find Previous	Searches for the contents located above the current position.
Find Next	Searches for the contents located below the current position.
Replace	Finds and replaces the selected contents.
Go to	Moves to the designated line number.
Insert Line	Inserts a blank line below the selected position of LD Editor.
Insert Next Line	Inserts a blank line above the selected position of LD Editor.
Delete Line	Deletes the selected line.
Device Comment	
Space Column	Moves the selected contact to the right by one column.
Reduce Program	Arranges the program at the selected area of the LD program.
Remove All Comment	Clears all comments of the working program.

View

Menu	Note
Toolbar	Shows/Hides CICON toolbar.
Status Bar	Shows/Hides CICON status bar.
Project Window	Shows/Hides project window.
Message Window	Shows/Hides message window.
IL Edit Toolbar	Shows/Hides the toolbar on the IL Edit window.
IL Edit Help	Shows/Hides IL Edit Help window.
Variable Editor Toolbar	Shows/Hides to toolbar on the Variable Edit window.
Zoom In/Out	Zooms in/out the LD Edit window.
Variable/Comment	Controls displays of device variable name/description on the LD Edit window.
Language	Selects the CICON display language.

Online

Menu	Note
Link+Download +Monitor	Proceeds connection, download, and monitoring automatically.
Connect	Makes a PLC connection attempt.
Disconnect	Disconnects from PLC in the online state.
Download	Downloads the compiled program.
Upload	Uploads the program that was downloaded to PLC.
Run Edit Start/Cancel	Starts or cancels modification while running.

Run Edit Download	Downloads the modified program while running.
Memory monitor	Populates the Memory Monitor.
Start Monitoring Program	Starts program monitoring.
Stop Monitoring Program	Stops program monitoring.
Compare/Check Program	Verifies whether the editing program matches the program downloaded to PLC.
Erase Program	Deletes the program saved in the PLC RAM.
Flash Memory	Changes the mode of PLC RAM/ROM operation, copies the RAM program to the ROM, or deletes the ROM.
Change Mode	Runs, stops, pauses PLC when the PLC mode switch is in the remote mode.
BP Latch	Saves the BP latch area in the data file, or downloads the file data into the BP.
Enable/Disable Module	Prevents I/O mounting/dismounting error of the specified slot.
PLC Password	Sets the connection password for PLC.
Get Card Property	Reads the information on the module mounted on PLC and displays it on the Project Window.
PLC Status	Checks the PLC CPU state and sets the time.

Debug

Menu	Note
Run Debugging/ Continue	Starts debugging.
Stop Debugging	Stops debugging.
Run for Scans..	Maintains operation as long as the scanned area.
Assign/Release Break Point	Sets or clears the break point.
Release All Break Points	Clears all break point settings.
Enable Forced Input/ Output	Allows forced I/O.
Forced Input/Output Setup	Sets forced I/O.

Tools

Menu	Note
Compile	Compiles the working file.
Line	Links the compiled file.
Compile+Link	Complies and links sequentially.
Compile+All Link	Compiles and links the entire project.

IL-LD Conversion	Converts the editing program to IL or LD.
Device Table	Displays the devices used in the project.
PLC Parameter	Opens the PLC Parameter Setting window.
Release I/O	Opens the I/O Reservation Setting window.
Variable Manager	Starts Variable Manager.
Optional Module Setup	Opens the Special Card Setting window.
Position Module	Opens the Position Setting Module window.
Device Trend	Opens Device Trend.
CICON Option	Performs settings related with CICON operation.
Connection Setup	Sets communication for connection to PLC.

Windows

Menu	Note
Next Window	Creates the same window with the working window.
Cascade type	Arranges the editing windows with a cascading layout.
Tile type	Arranges the editing windows with a tiling layout.
Arrange Icons	Arranges the minimized windows under the working window.

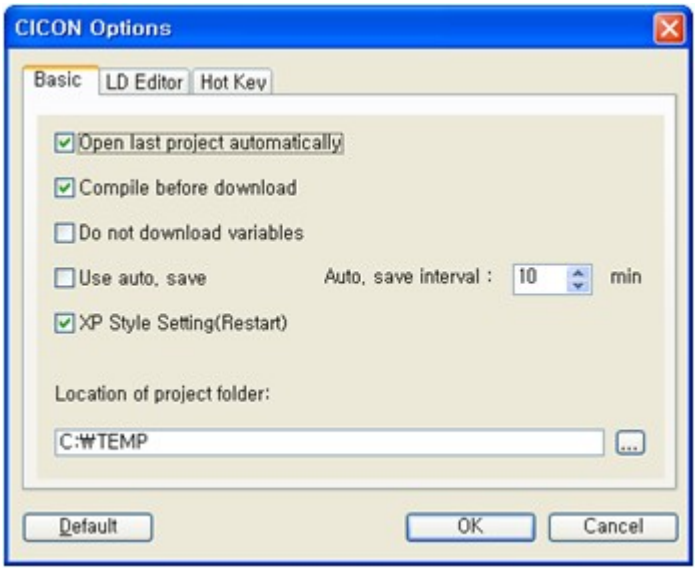
Help

Menu	Note
Help	Opens the help text on CICON.
About CICON...	Displays the CICON information like the version number.

4.3.3 CICON Option

-Basic

Select the [Tool]-[CICON Options]-[Basic] tab.



Open last project automatically

The project that was opened last will be automatically opened when starting CICON.

Compile before download

If the downloading program was modified, it will be automatically compiled.

Do not download variables

Variables are excluded at the time of compilation. The variable table will not be saved in PLC.

Use auto. save

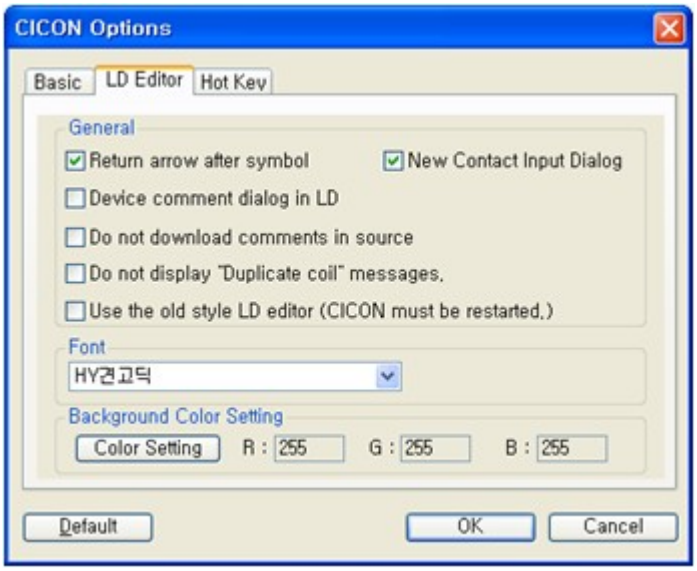
Automatically saves the project at the specified time period.

Location of project folder

Specifies the default folder for new project

LD Editor

Select the [Tool]-[CICON Options]-[LD Editor] tab.



Return arrow after symbol

After entering the symbol, the mouse cursor become " Selecte "? status

Device command dialog in LD

When this option is selected, the Device Description Input window will be automatically populated if the device is used that is not registered

in the variable table of LD program.

Do not download comments in source

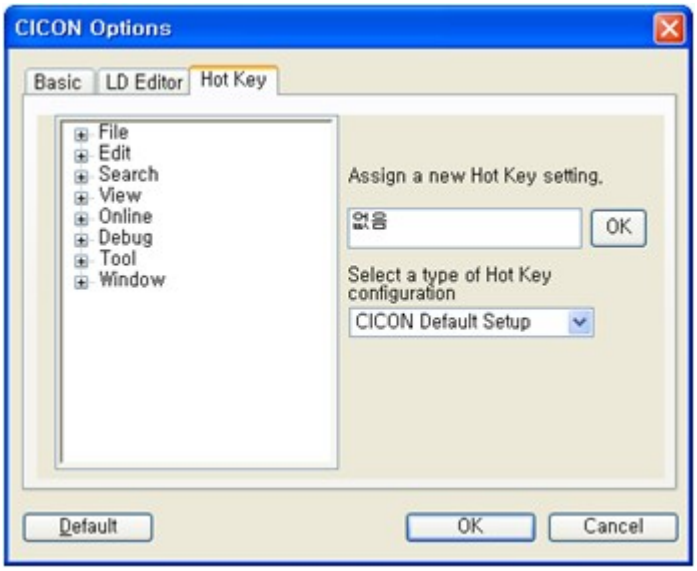
Comments in source programs will be removed at the time of compilation. The comment section of uploaded source file will be displayed as a blank

Use the old style LD editor(CICON must be restarted.)

Use old style editor (To apply this function is necessary needed to restart the CICON)

Hot Key

Shortcut keys can be specified for all the instructions. Select the [Tool]-[CICON Options]-[Hot Key] tab.



a: used to select the menu to specify its shortcut key on the list.

b: used to create a shortcut key for the selected meun.

Click the [OK]button..

4.4 Essential Function

See :

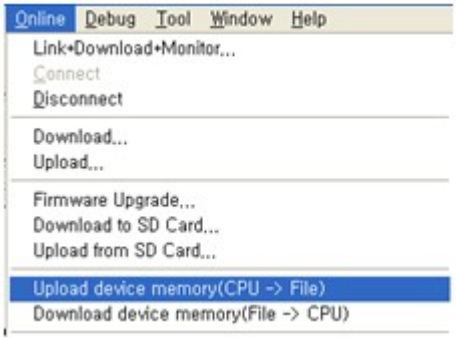
- Device Memory Export / Import

4.4.1 Device Memory Export Import

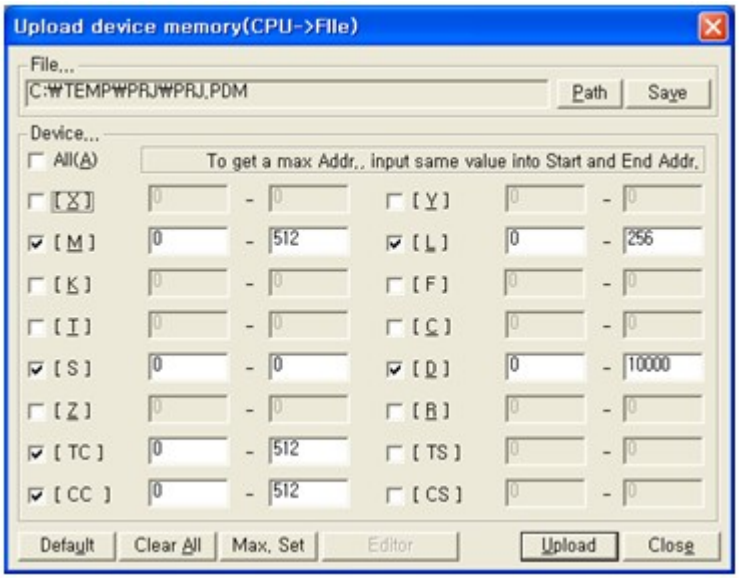
You can upload and download device memory of CPU which is online.

Upload Device Memory (CPU -> File)

In order to upload device memory from PLC to PC, click “Upload Device Memory” after PLC is online state.



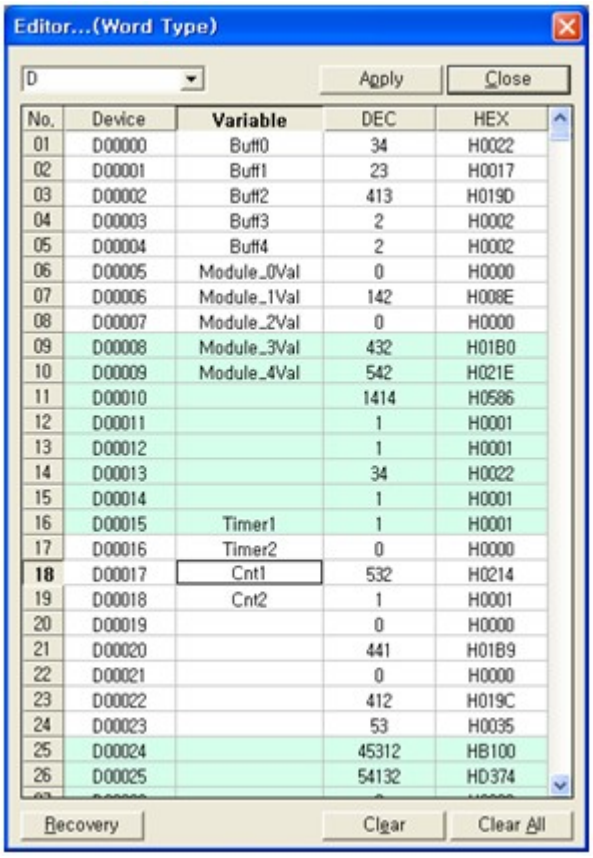
You can see Upload device memory window as below.
The initial device values and address are based on latch address.



1. File: It shows the path that uploaded device memory will be saved.
2. Path... : In order to make or select the file where uploaded device will be saved, click the ‘Path’. Default path is project folder.
3. Save: It is used to save the uploaded device memory to file. Click the ‘Save’ after editing device value in ‘ Editor’.
4. Device: Select device memory that you want to upload. You can setup starting and ending address.
5. Default: Default is Latch address settings.
6. Clear all: Remove all device memory address.
7. Max. set: Setup all device memory address as maximum
8. Editor: Uploaded device memory is shown in this window. You can edit device value here. It is activated when you click ‘Upload’.
9. Upload: It is used to upload device value based on selected address.
10. Close: It is used to close the “Upload device memory”

* The starting and ending address are subject to change based on CPU type.
* If you setup the same value both starting and ending address, it automatically become maximum setup.

You can see the below picture if you click “Editor” after uploading.



Apply: In order to save the changed value, click the ‘Apply’.

After click ‘Apply’, click ‘Save’ to save all device memory to file.

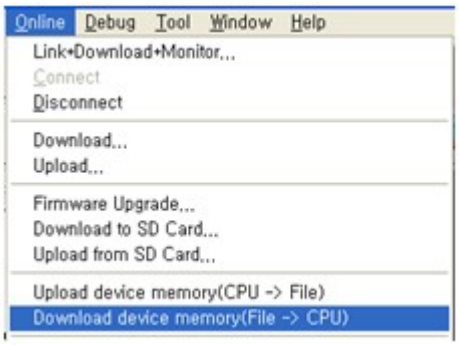
Recovery: It is used to change the value to the last state.

Clear: It is used to initialize the value to ‘0’. In order to save this value, click ‘Apply’

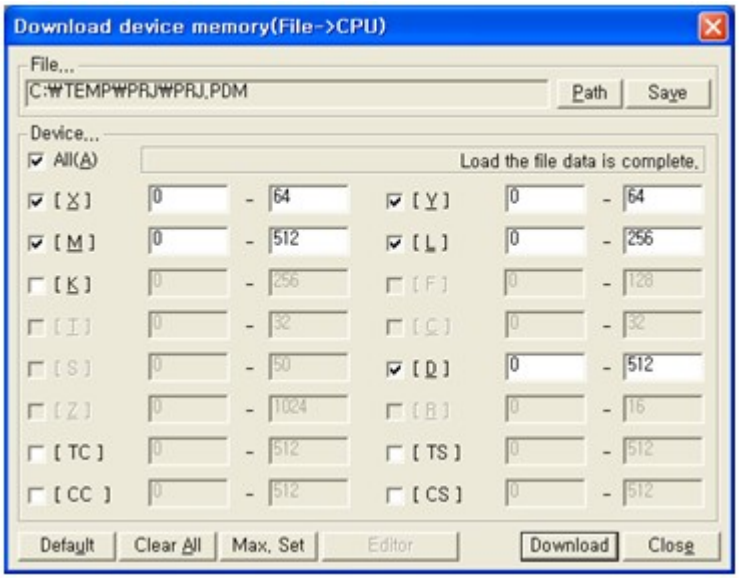
Clear All: It is used to initialize all values to ‘0’. In order to save this value, click ‘Apply’

Download Device Memory (File -> CPU)

In order to download device memory to PLC, click “Download Device Memory” after PLC is online.



You can see Download device memory window as below.



1. File: It shows the path that uploaded device memory is saved.
2. Path... : In order to select the file that has saved device memory, click the ‘Path’.
Default path is project folder.
3. Save: It is used to save the uploaded device memory to file.
Click the ‘Save’ after editing device value in ‘Editor’.
4. Device: Select device memory that you want to download. You can setup starting and ending address.
* Device address which you can’t download is as following.
[F] / [T] / [C] / [S] / [Z] / [R]
5. Default: It is used to setup maximum value of device among latch address.
6. Clear All: Remove all device memory address.
7. Max. Set: Setup all device memory address as maximum
8. Editor: Downloaded device memory is shown in this window. You can edit device value here.
It is activated when you click ‘Path’.
9. Download : Download device value to PLC based on selected address
10. Close : Close the “Upload device memory”

4.5 Programming (Single Programs)

Contents of Example Programs :

The lamp (Y0010) flashes when the input switch(X0000) is pushed. (Turning on and off are repeated.)
If the switch X0000 is pressed while the lamp is on, the lamp will be turned off. On the contrary, the lamp will be turned on if the switch X0000 is pressed while the lamp is turned off.

Contents :

4.5.1 Creating a project

Click the **New Project** sub-menu under the **File** menu.

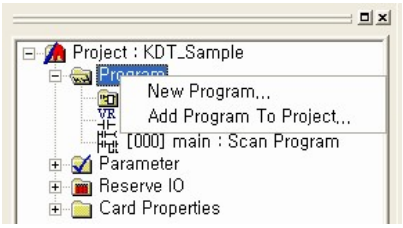
- Input the **Project Name**.
- Select the **CPU Type** to use. If you don't select correct CPU type, CICON cannot connect with PLC. Therefore, make sure to select the correct CPU type.
- Input the **User or Description** if it is needed.
- Press the **[Password]** button to set the password. If you set the password, you will be prompted to input the password whenever you open the project.

If you want to modify the information such as CPU type, composer, program description, and password,

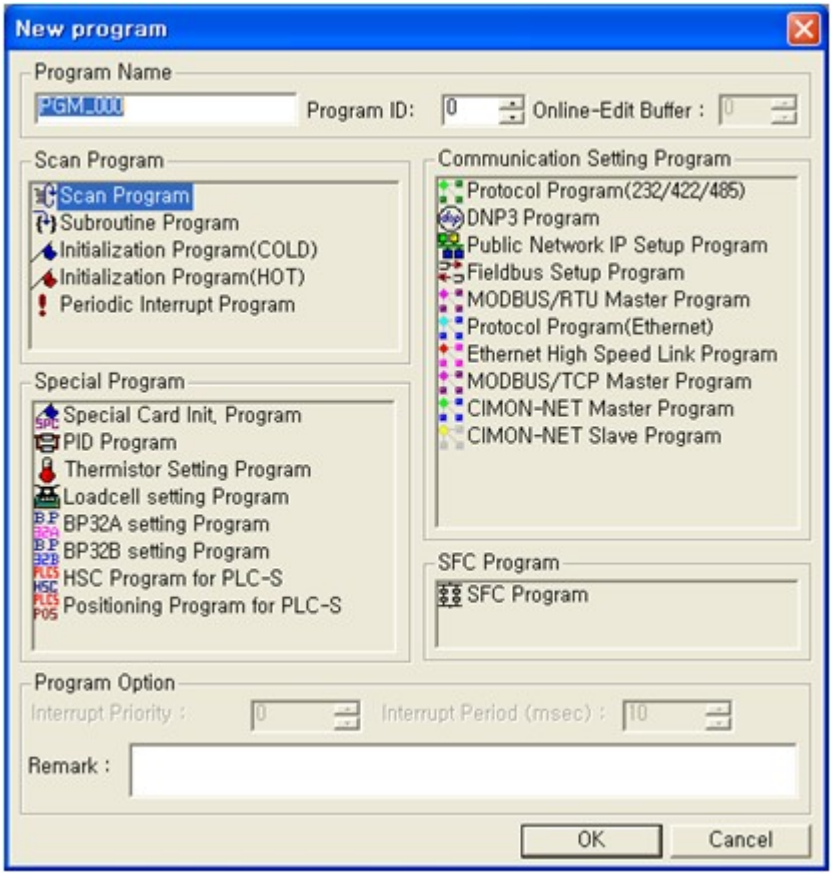
select the **Project Properties** sub-menu under the **File** menu.

4.5.2 Registering a new program

If you register a new project, the project name displayed on the **Project Window** will be changed to the registered one.



Select **Program** in the Project Window and click the right mouse button and then, select the **New Program** popup menu.

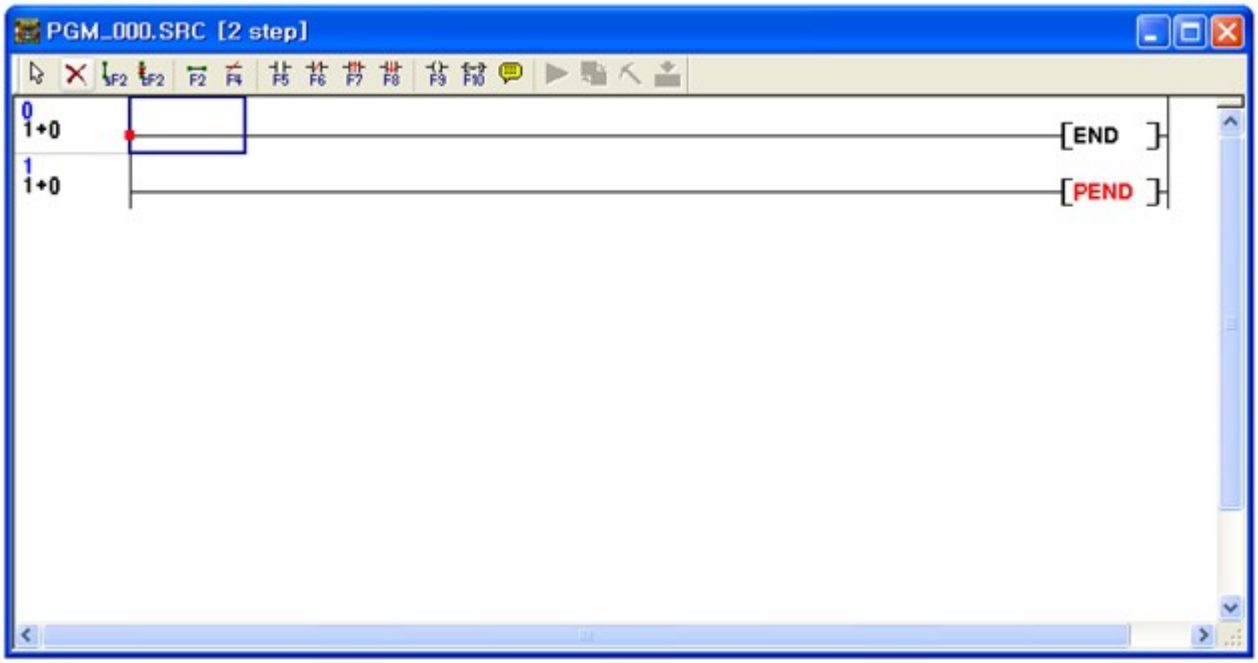


Select **Scan Program** and input the program name.

If several programs are registered in the project, programs will be executed by the order of smaller Program ID,

For Run Edit(step) allocates space for modification while running the program.

4.5.3 Writing Scan Program



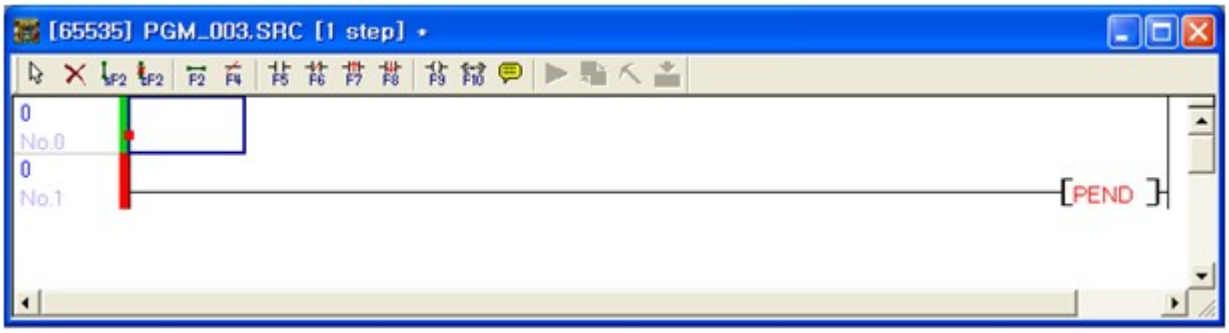
Description of the menu bar

Button	Menu	Note
	Select	Selects the intended contact or command in the LD program.
	Delete	Deletes the selected contact or command.
F2	Horizontal line	Draws a horizontal line at the selected position.
SF2	Vertical line	Draws a vertical line at the selected position.
F4	Not	Inverts the result of the previous paragraph.
F5	Normally open contact	Inserts a normally open contact.

	Normally closed contact	Inserts a normally closed contact.
	Positive transition-sensing contact	Inserts a positive transition-sensing contact.
	Negative transition-sensing contact	Inserts a negative transition-sensing contact.
	Coil	Inputs a coil.
	Command	Populates the command input window.
	Counter command	Populates the counter command input window.
	Comment	Populates the command input window.
	Original size	Restores the original size of the LD Edit window.
	Zoom in	Zooms in the LD Edit window.
	Zoom Out	Zooms out the LD Edit window.
	Start/Stop monitoring	Starts or Stops program monitoring.
	Convert data	Changes the value to decimal or hexadecimal value that is displayed when monitoring the LD program.
	Start/Stop editing in running	Starts or Stops modification while the program is running.
	Download edited program in running	Downloads the modified program while running.

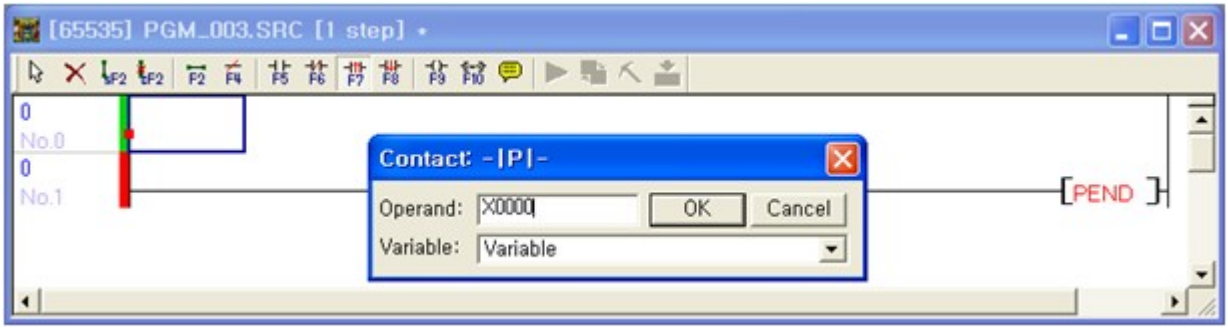
Steps of writing a program

The example is hot to write a ladder diagram in the registered scan program by using the LD editor.

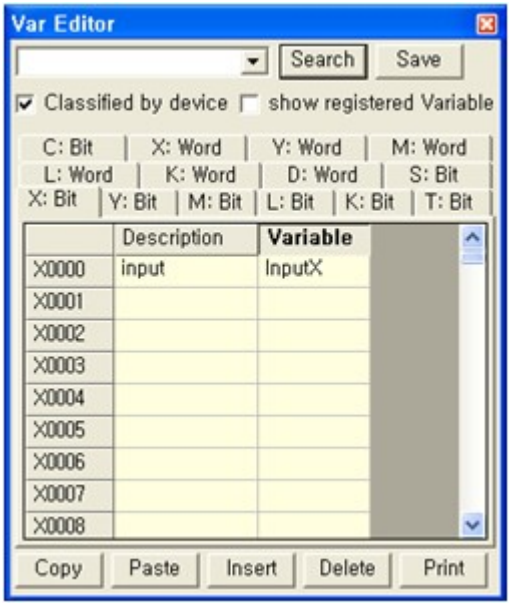


1. Insert a row to input the program pressing the **[Ctrl + L]** key.

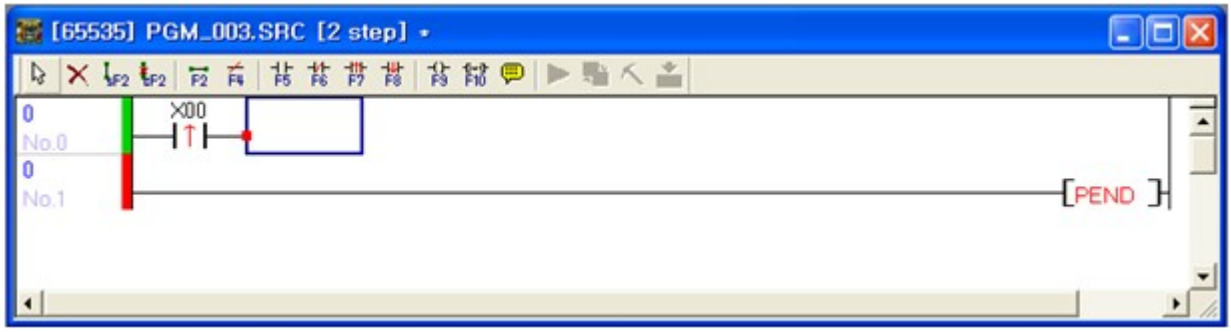
Click the  button on the toolbar to show the positive transition-sensing contact window. Input **"X0000"** .?



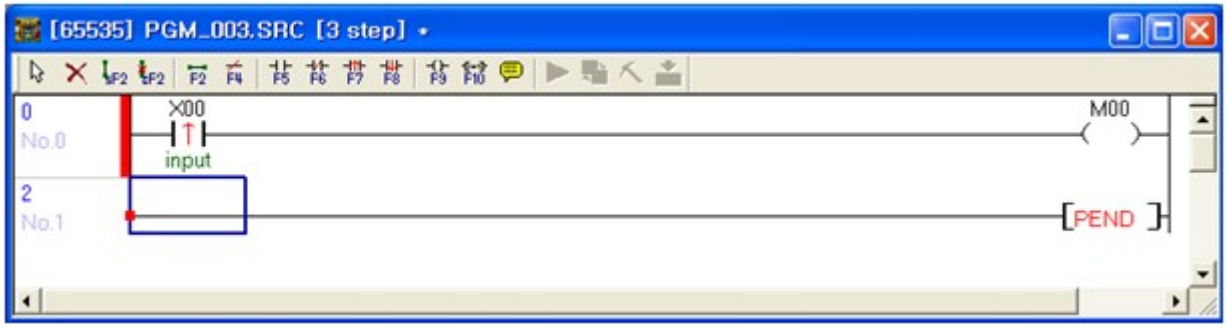
2. Click the **[Select Var]** button to use the device registered in the variable table.



Click the [OK] button to finish entering contact ().

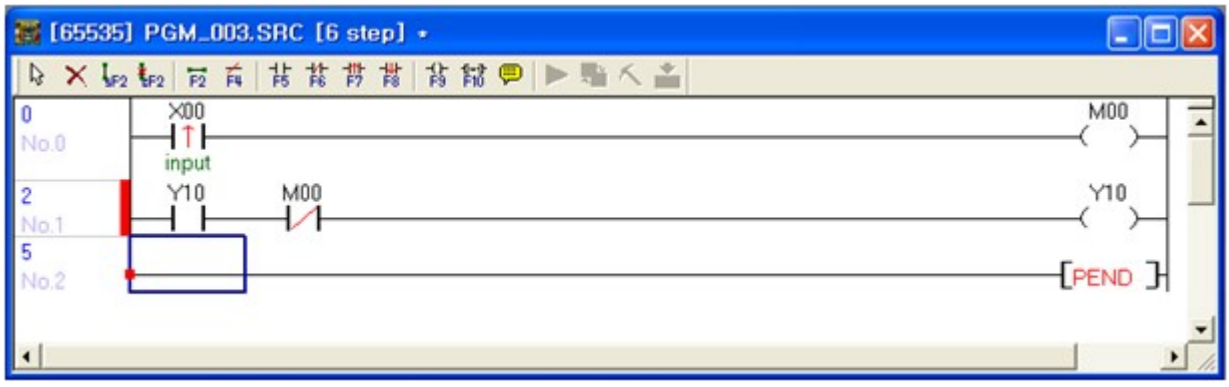


3. Click the F9 button on the toolbar and input **"M0000"** in the coil dialog.



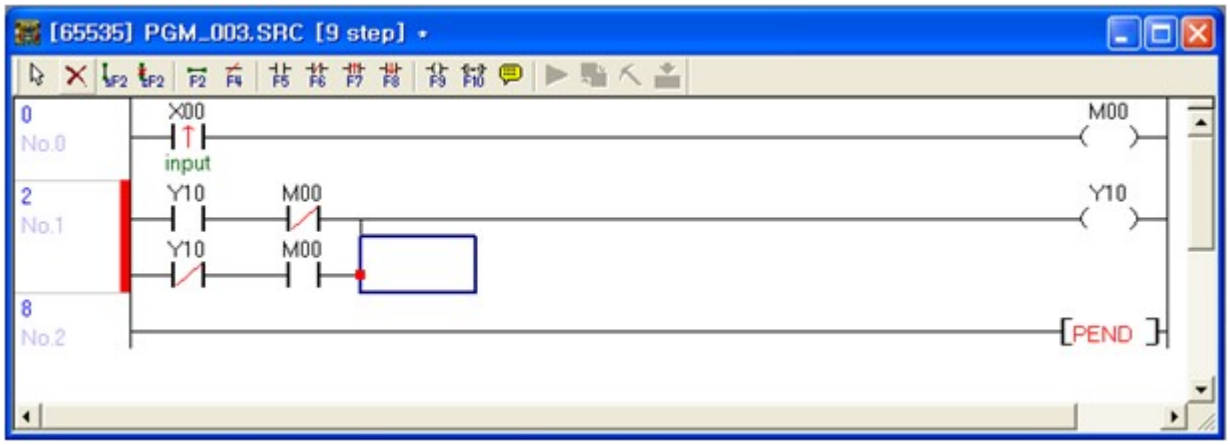
4. Insert a row using the **[Ctrl + L]** key and click the F5 button to input **"Y0010"**.

   Click the F6 button to input **"M0000"** and click the F9 button to input **"Y0010"**.?

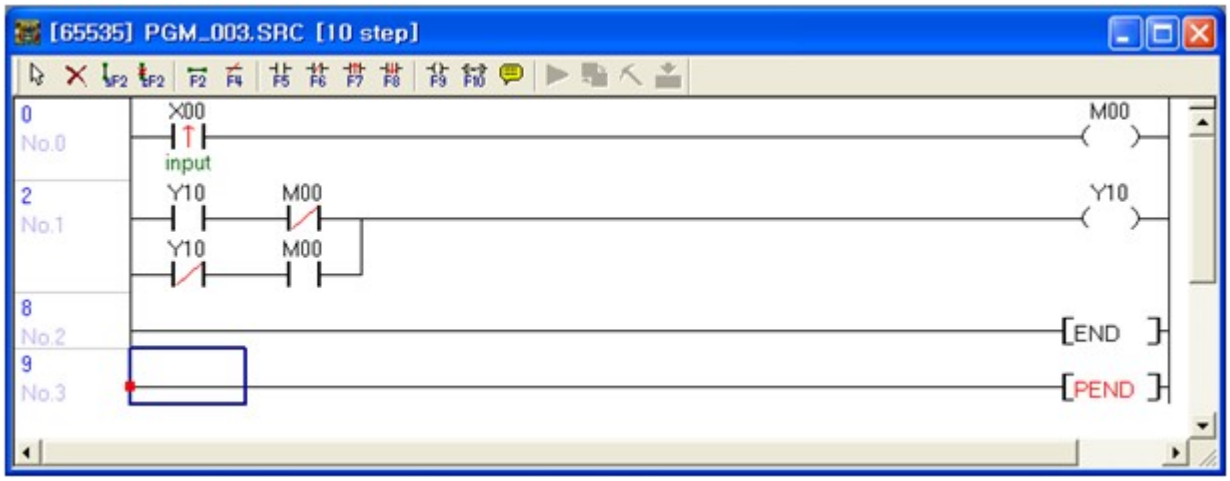


5. Insert a row using the **[Ctrl + L]** key and click the F6 button to input **"Y0010"**.

   Input **"M0000"** using the F5 button and connect two lines using the SF2 button.



6. Insert a row using the **[Ctrl + L]** key and click the F10 button to input the END command.



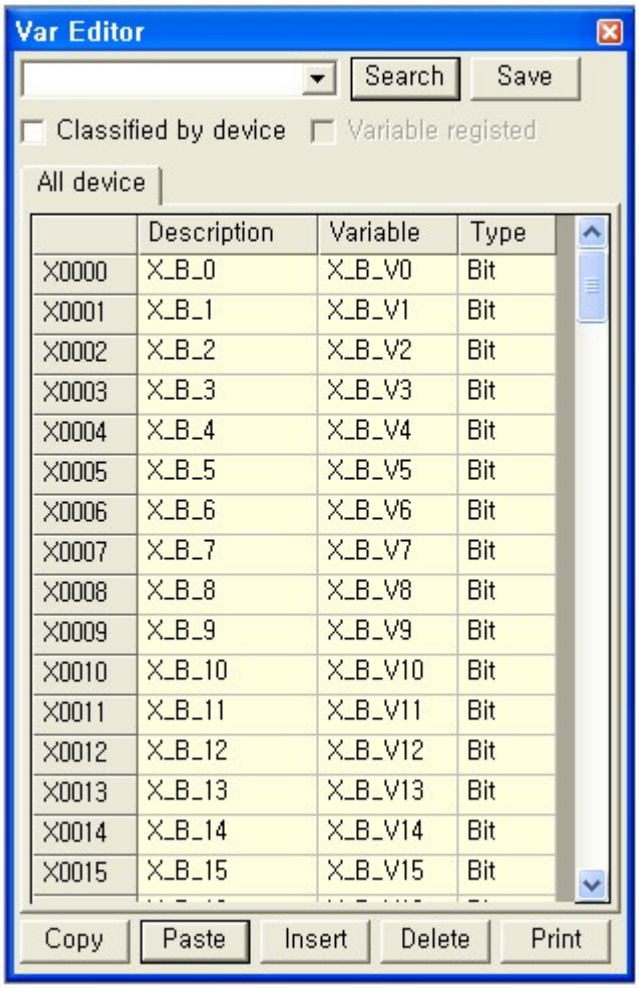
7. Click **File -> Save Program** menu to save the entered program.

4.5.4 Entering a variable table

Variable Table

Menu -> [View] -> [Variable Windows]

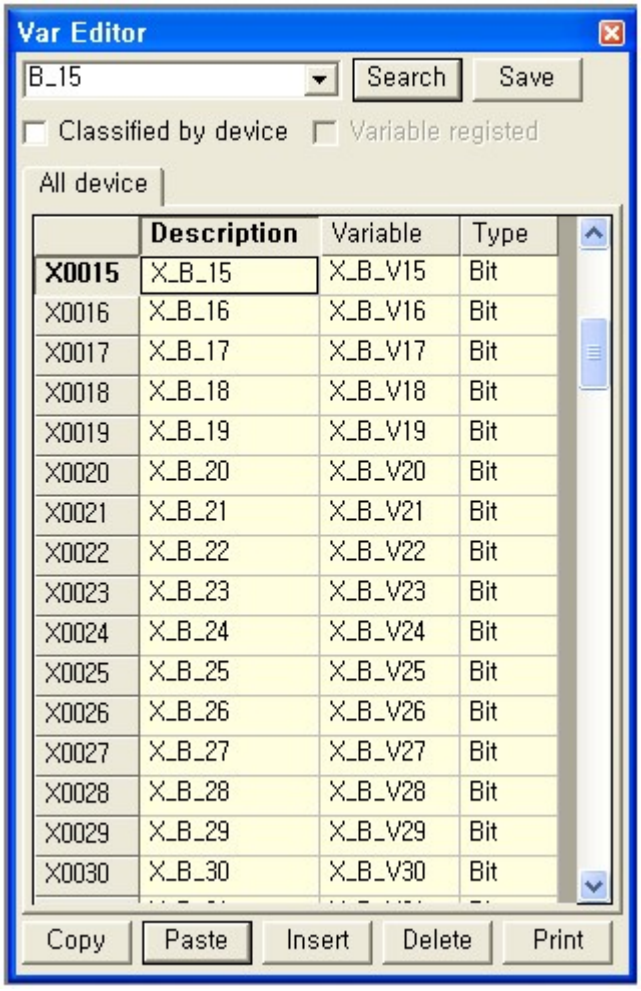
Variable table is activated as below.



1. Search

You can search device address, description, variable name and type in this function.

You do not need to write whole name on [Search]. It searches variable without full name.



2. Save

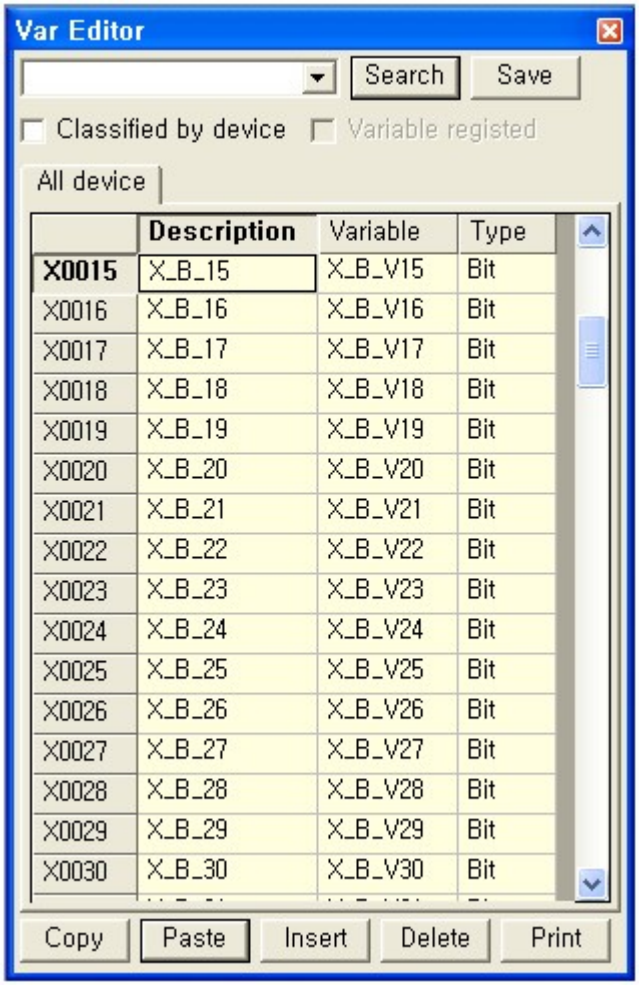
Save variable table after editing.

After saving variable, message appears in Message window.

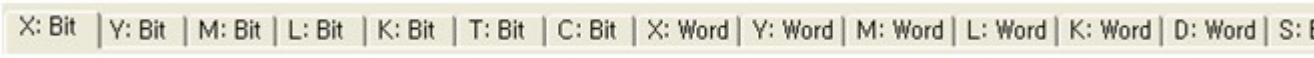
***If CICON is closed without saving variable, variable table will be disappeared. Click [Save] before closing CICON**

3. Classified by device

If it is selected, variable table is classified by device.



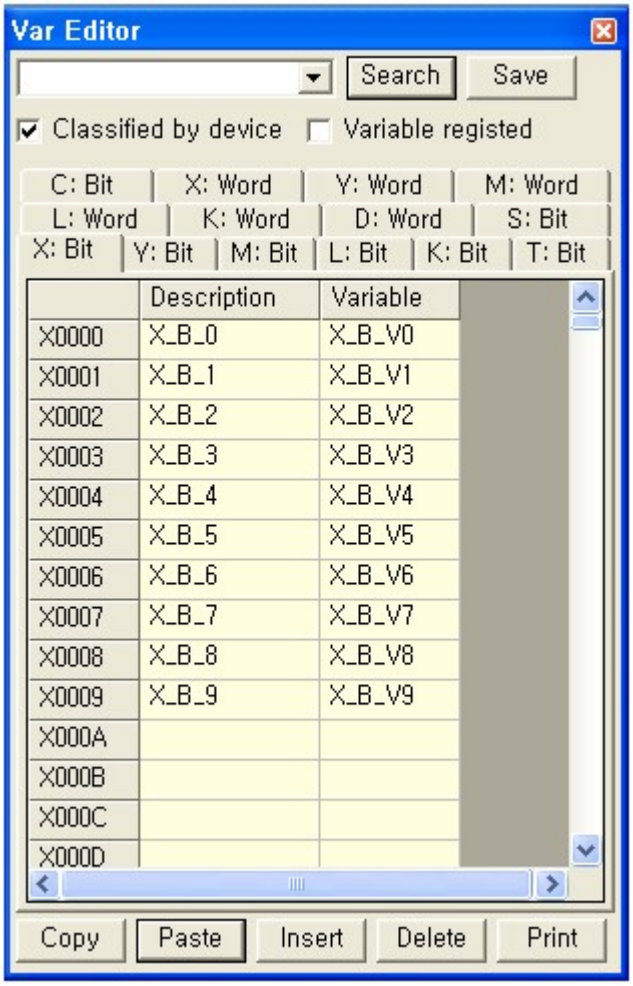
If [Classified by device] is not selected, device will be shown in order as below.



4. Variable registered

If [Variable registered] is selected, it shows only registered variables.

In case of device which is not registered, it shows blank and it is editable.



5. Device

Device is comprised of Bit and Word.

Bit Device : X / Y / M / L / K / T / C / S

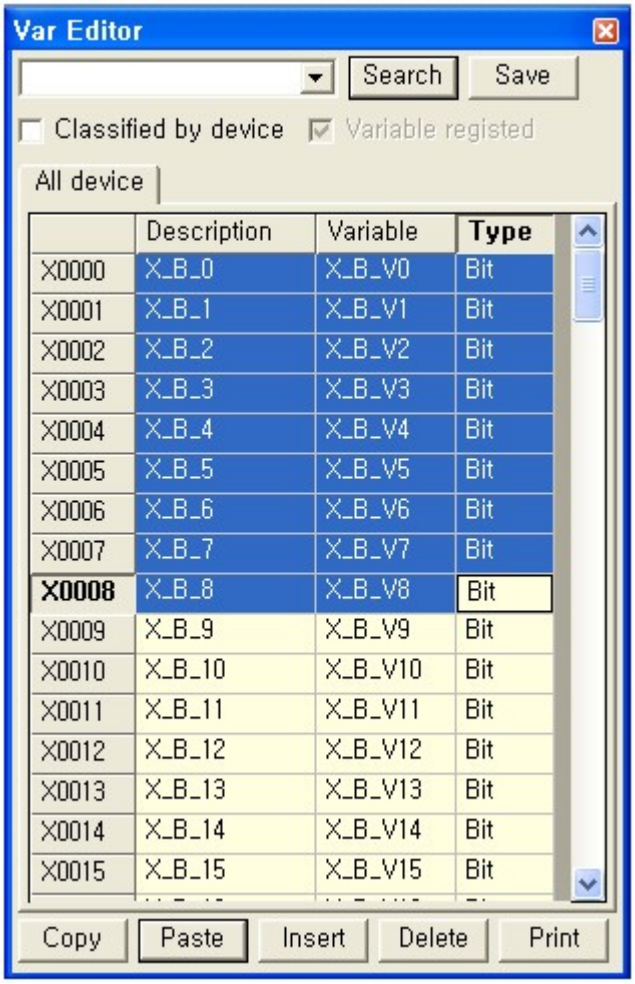
Word Device : X / Y / M / L / K / D

6. Copy

You can copy device, description, variable and type.

Drag mouse and click [Copy]

***This function is the same with right click of mouse and copy.**



Open Microsoft Excel and paste (Ctrl+V)

	A	B	C	D
1	X0000	X_B_0	X_B_V0	Bit
2	X0001	X_B_1	X_B_V1	Bit
3	X0002	X_B_2	X_B_V2	Bit
4	X0003	X_B_3	X_B_V3	Bit
5	X0004	X_B_4	X_B_V4	Bit
6	X0005	X_B_5	X_B_V5	Bit
7	X0006	X_B_6	X_B_V6	Bit
8	X0007	X_B_7	X_B_V7	Bit
9	X0008	X_B_8	X_B_V8	Bit

***If you want to copy device address, drag your mouse from device address.**

7. Paste

After editing Excel, copy the variable and click [Paste] to paste variable table.

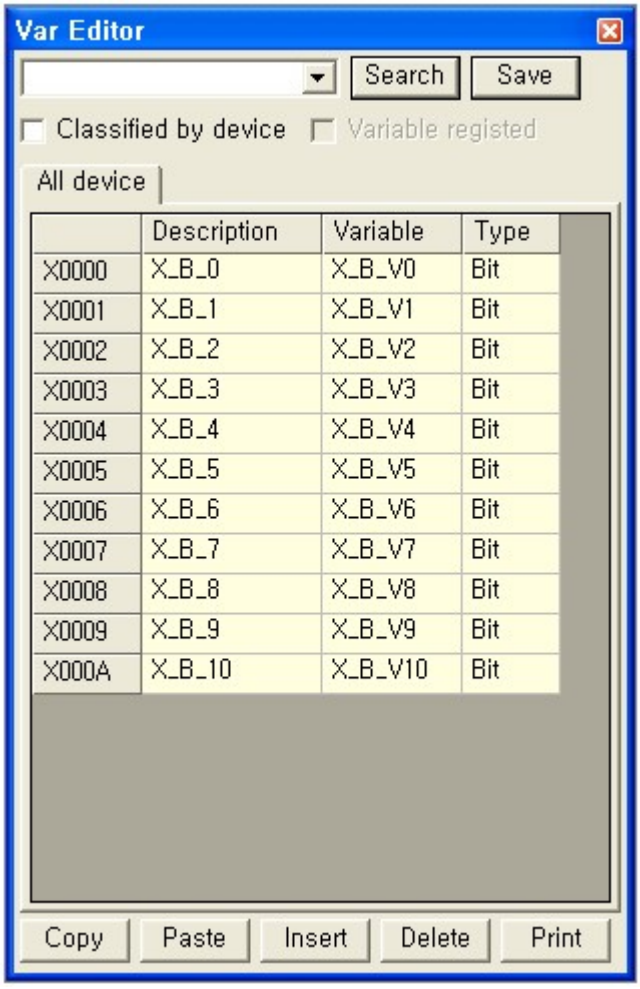
	A	B	C	D
1	X0000	X_B_0	X_B_V0	Bit
2	X0001	X_B_1	X_B_V1	Bit
3	X0002	X_B_2	X_B_V2	Bit
4	X0003	X_B_3	X_B_V3	Bit
5	X0004	X_B_4	X_B_V4	Bit
6	X0005	X_B_5	X_B_V5	Bit
7	X0006	X_B_6	X_B_V6	Bit
8	X0007	X_B_7	X_B_V7	Bit
9	X0008	X_B_8	X_B_V8	Bit
10	X0009	X_B_9	X_B_V9	Bit
11	X000A	X_B_10	X_B_V10	Bit

***Device address does not need to be in rows by consecutive number.**

***If you add new device address, device address, description, variable, type will be made in order of precedence.**

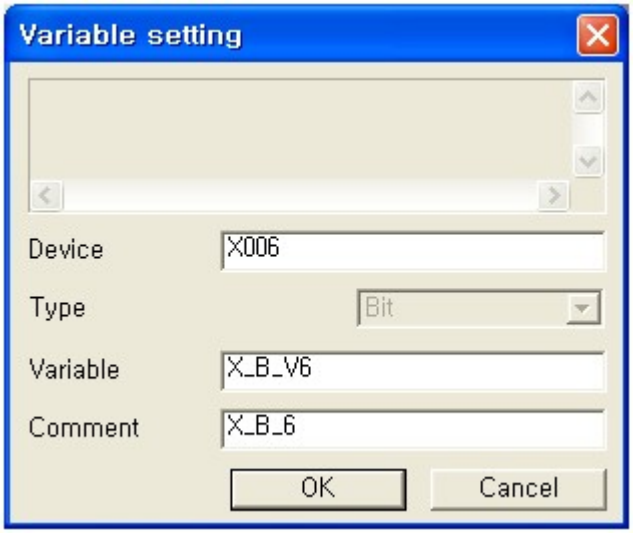
(if description and variable are not used, you should write any text. If it is blank, Pate will not work)

New device, description, variable and type will be added in Variable table as below.



8. Insert

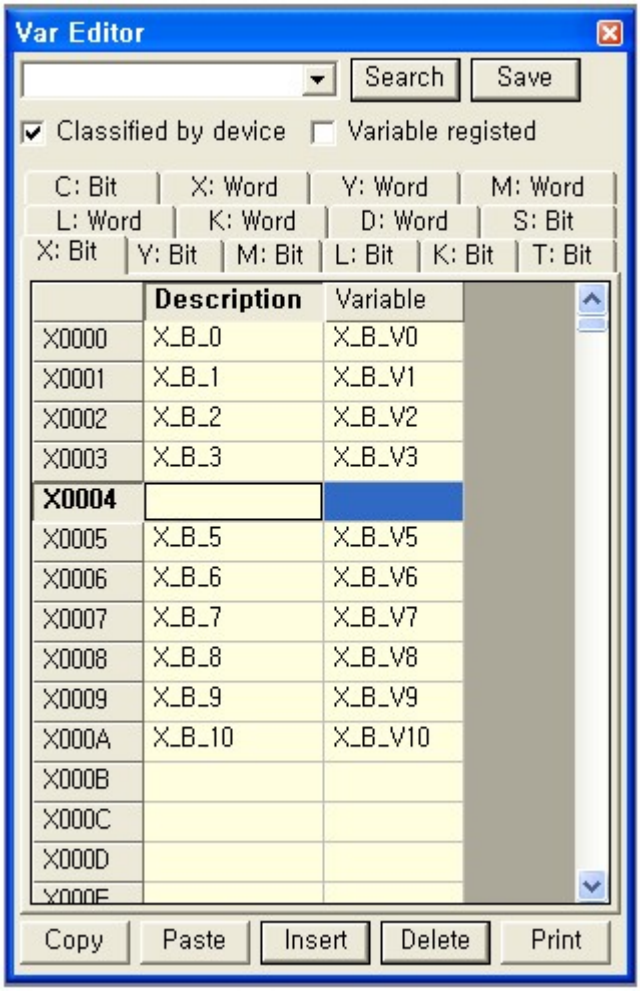
If you click [Insert], Variable setting pops up. Click "OK" to insert variable after fill out blank.



9. Delete

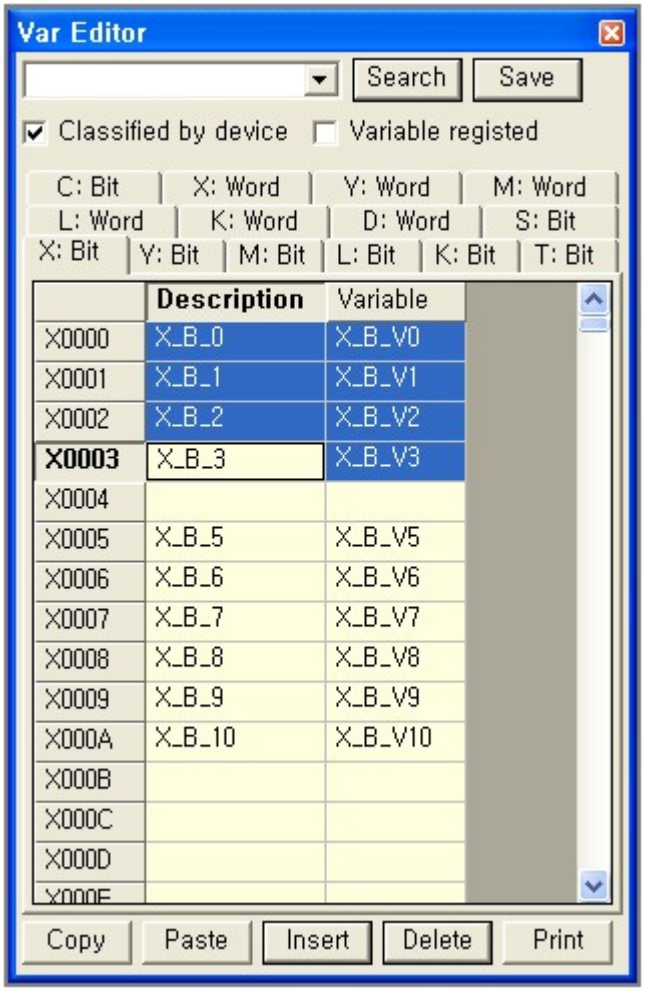
After selecting Description or Variable that you want to delete, click "Delete".

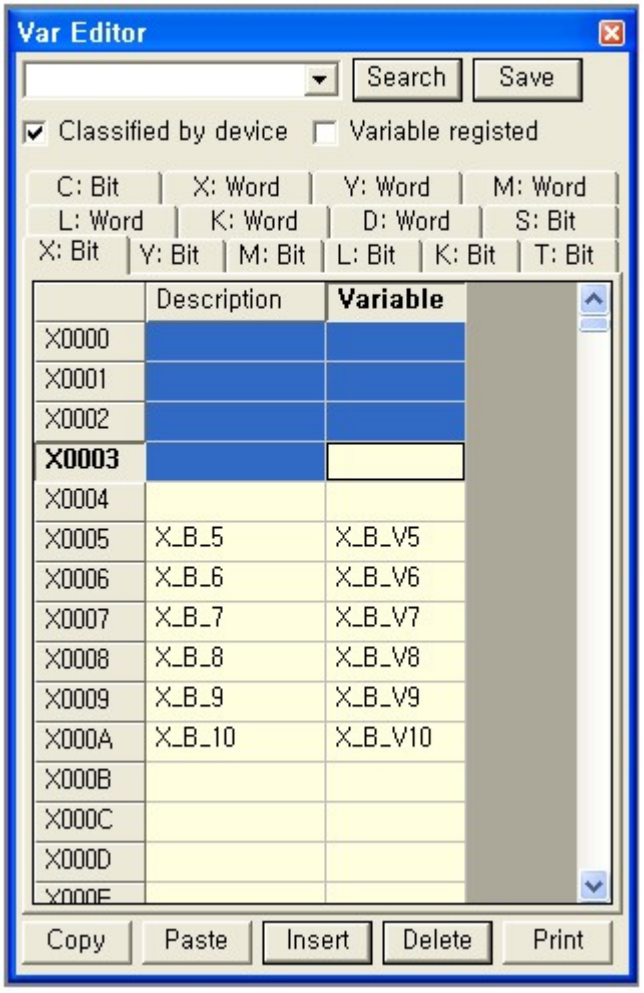
*** You can delete variable with "Delete" key on keyboard.**



10. Delete(Blocks)

You can delete several blocks as below. Select blocks and click "Delete"

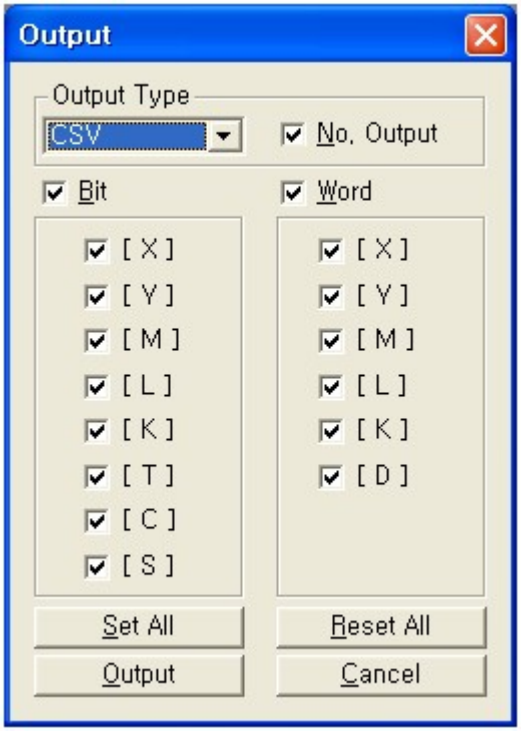




***When you delete blocks, Description and variable are deleted only.**

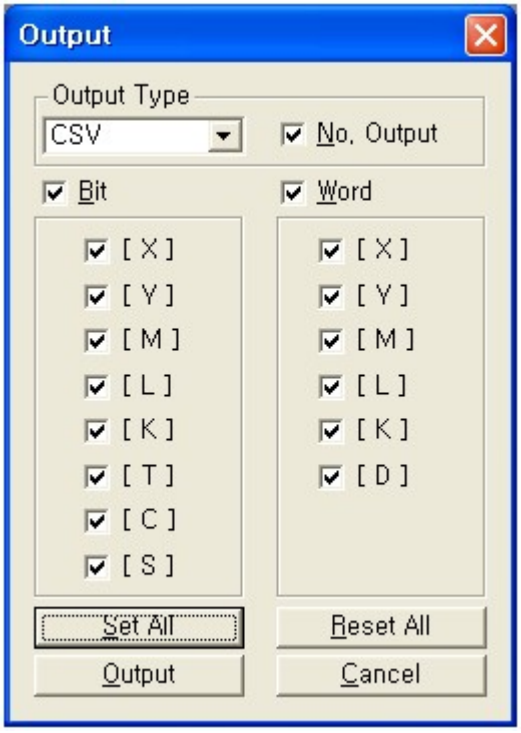
11. Print

When you click "Print", Output window pops up as below.

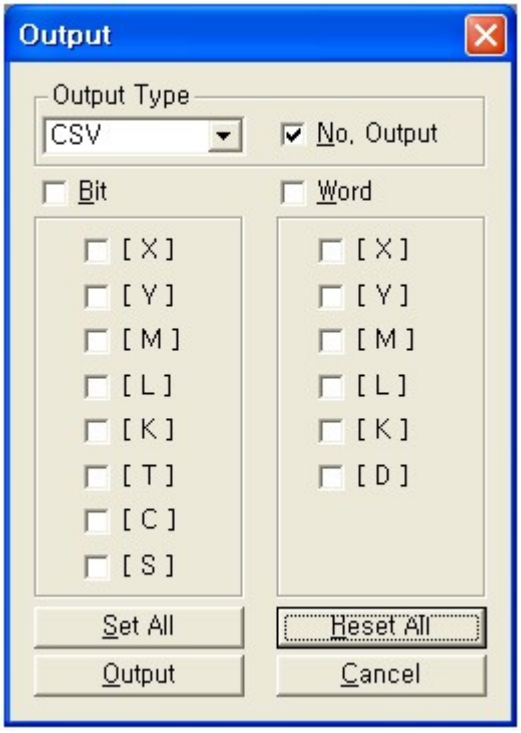


1. Output Type : you can choose CSV file and Printer type.

2. When variable table is printed, number of output is added.
3. Bit : Selection for Bit Type device
4. Word : Selection for Word Type device?
5. Each Device : Select device which you want to print.
6. Set All : select all devices.



7. Reset All : reset all devices.



8. Print : When you select CSV, CSV file save dialog pops up.
After writing file name and click "Save", CSV file is made as below.

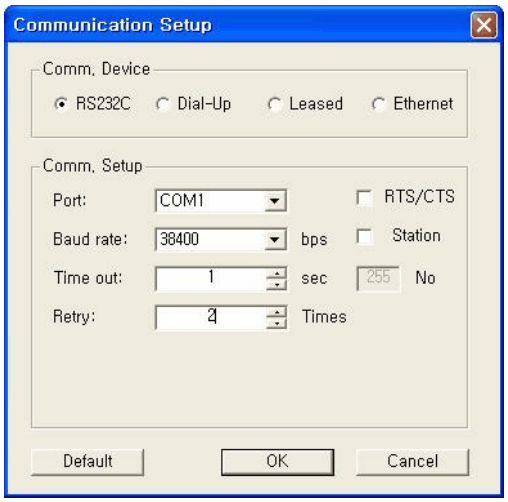
	A	B	C	D	E
1	No.	Device	Descriptio	Variable	Type
2	1	X0005	X_B_5	X_B_V5	Bit
3	2	X0006	X_B_6	X_B_V6	Bit
4	3	X0007	X_B_7	X_B_V7	Bit
5	4	X0008	X_B_8	X_B_V8	Bit
6	5	X0009	X_B_9	X_B_V9	Bit
7	6	X000A	X_B_10	X_B_V10	Bit

4.5.5 Communication Setting

Change the settings of CICON connection to connect to PLC.

Click the **Tool -> Connection Setup** menu.

RS232C



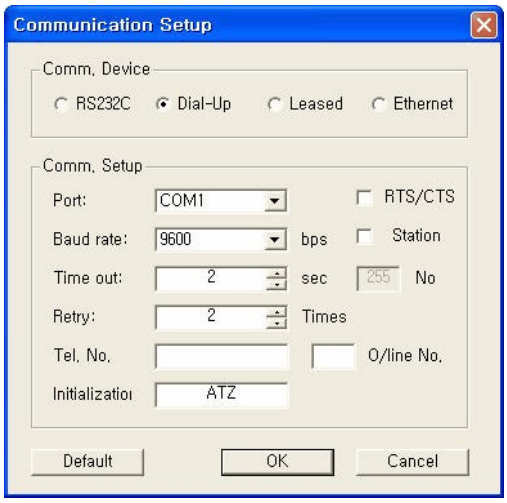
If you want to connect directly to PLC through the PC COM port, select RS232 and modify the items in the Communication Setting column.

Select COM port which you want to use in Port item.

Select the baud rate which is identical with the baud rate of PLC in Boad rate item.

The baud rate of CPU loader port is fixed to 38,400 bps. But the baud rate of communication module is changeable.

Dial-Up

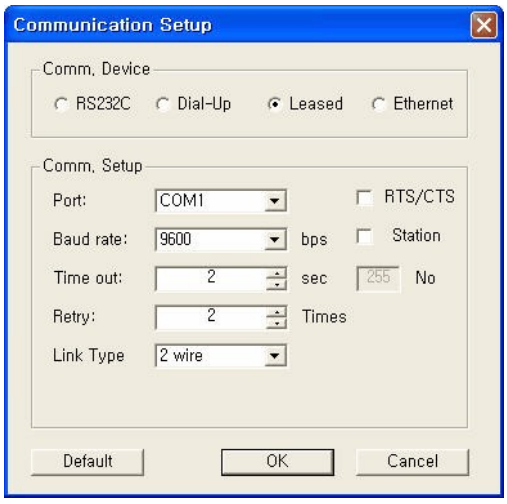


If you want to connect to PLC via dial-up modem, select **Dial-Up Modem** and modify the **Comm. Setup** items properly.

Input the phone number of the PLC connected party into **Tel No** item

Input the AT command to initialize the modem connected to the PC.

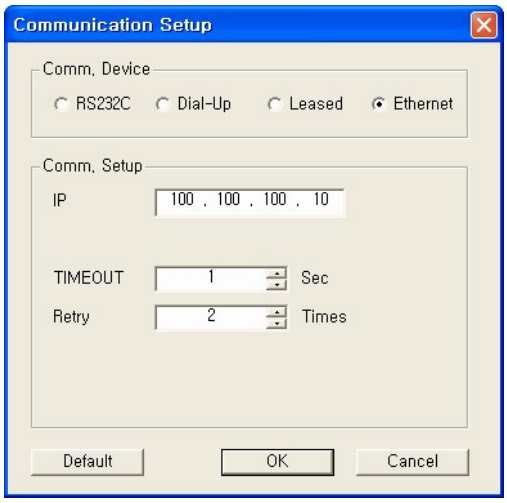
Leased



If you want to connect to PLC via leased line modem, select the Leased and modify the Comm. Setup items properly.

Select 2-wire or 4-wire for the Link Type filed.

Ethernet

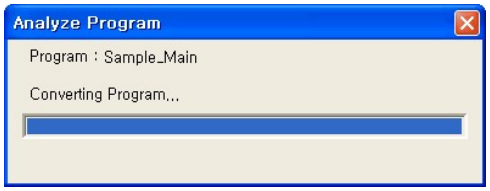


If you want to connect to PLC via Ethernet, select the **Ethernet** and input the PLC IP address.

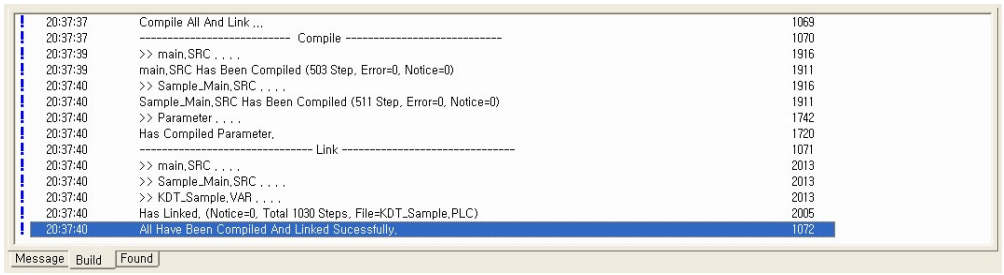
4.5.6 Compile/Link

Create the program data file to download to PLC using Compile/Link function.

Select **Tools -> Compile All+Link** to create the file to download to PLC.



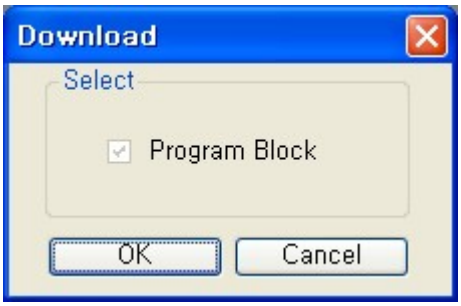
The Message window will display the progress and result of **"Compile All+Link"**



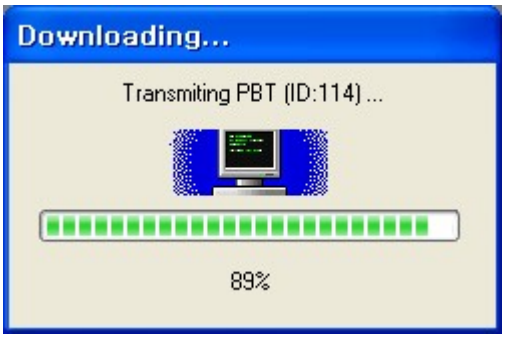
4.5.7 Download

Use this function to download the complied/linked file.

Select **Online -> Download** menu to use this function.



click the [OK] button.

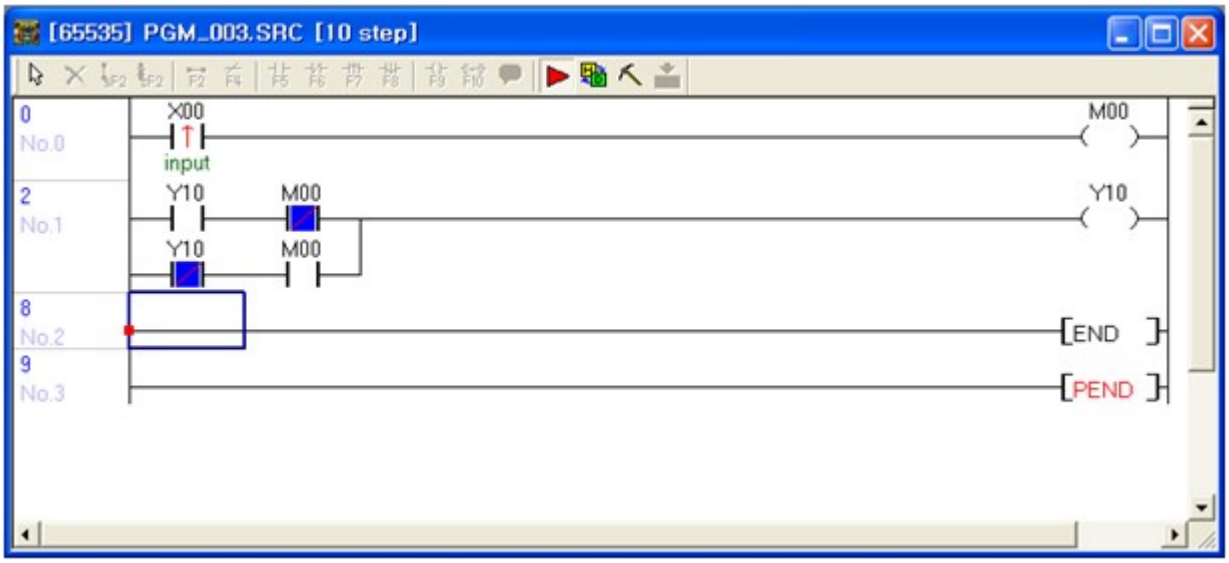


Then, the Downloading window will appear that shows the progress of download.

The result of downloading can be checked in the Message window.

4.5.8 Monitoring

Use the  button on the LD Editing window to monitor the program.



If the status of contact is On, it will be displayed in blue color.

You can modify the status of contact and device values using **[Shift + Mouse Double Click]**.

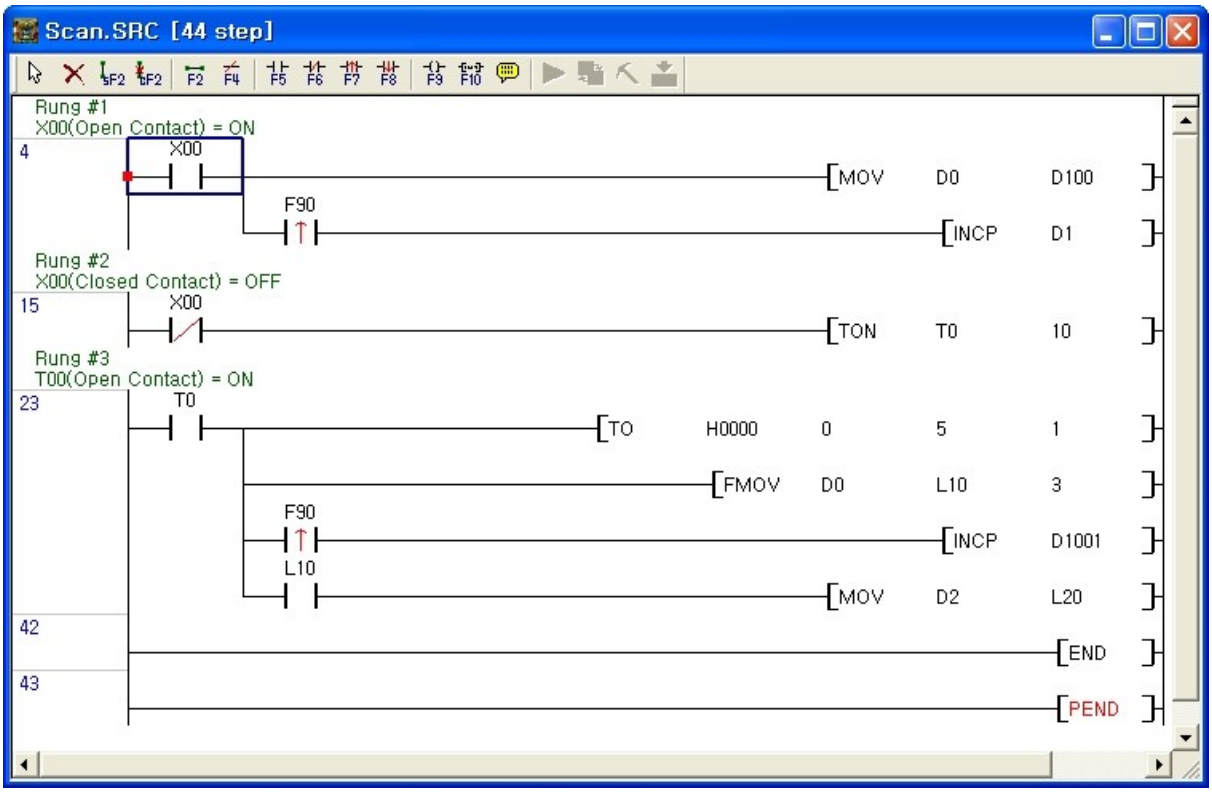
4.5.9 Find and Replace

Find and Replace

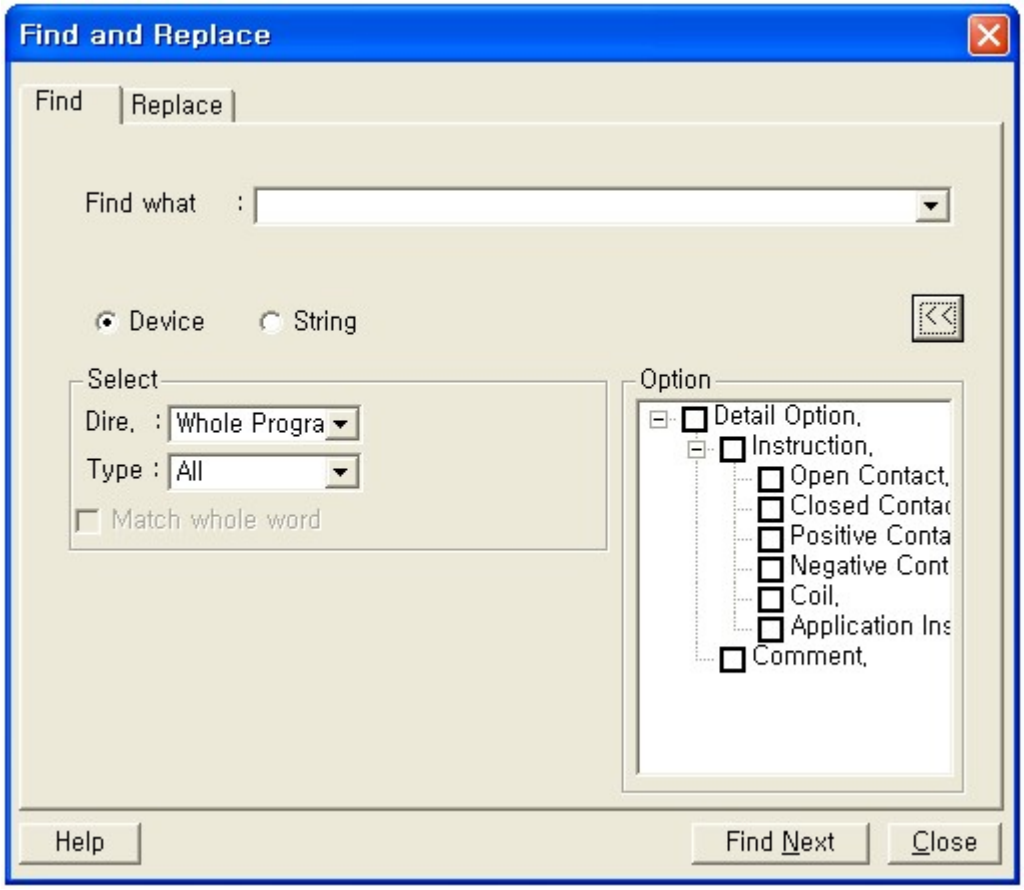
This is used to find or change the device and the String in LD program,

[Find]

1. Select the basic row of the direction.



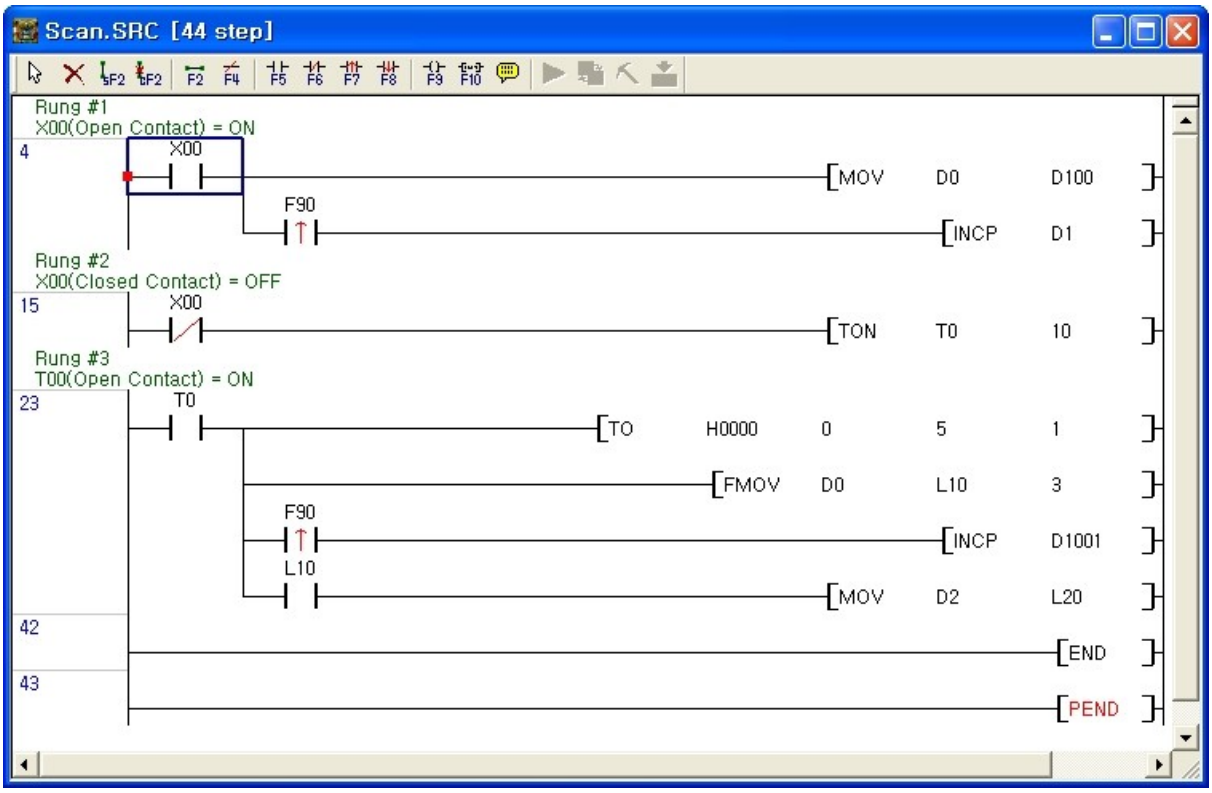
2. Select the [Search]-[Find/Replace].
3. Select the [Find]tab.



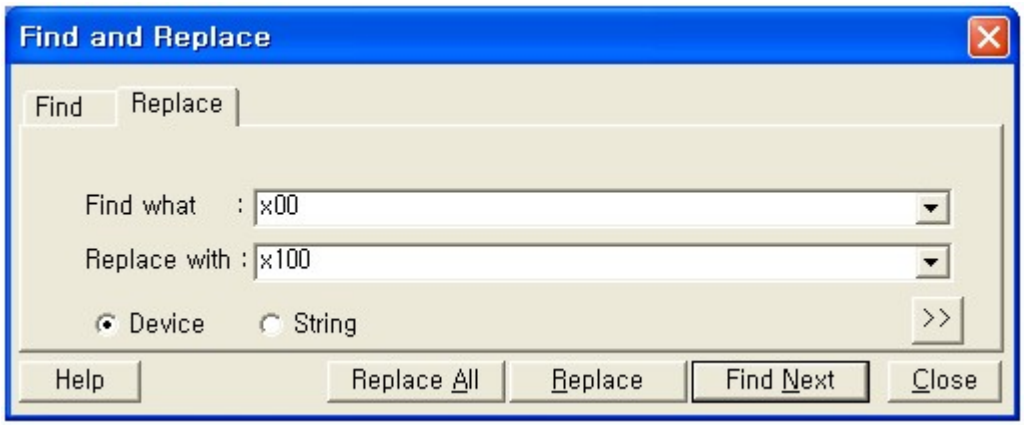
- Find what : used to specify the device find.
- Device : This function is used to find the device.
- String : This function is used to find the string of rung comment, Application instruction and label except the device.
- Direction : used to specify the location to find or downward form the lins presently selected in the LD editor.
- Type : used to select the device type to find.
- Match whole word Only : If All identical checked, it will find the string only exactly identical to the string specified in the detail to find.
- Option : If Option checked, used to find specific contact point, specific coil comment , and application instruction used in LD editor.

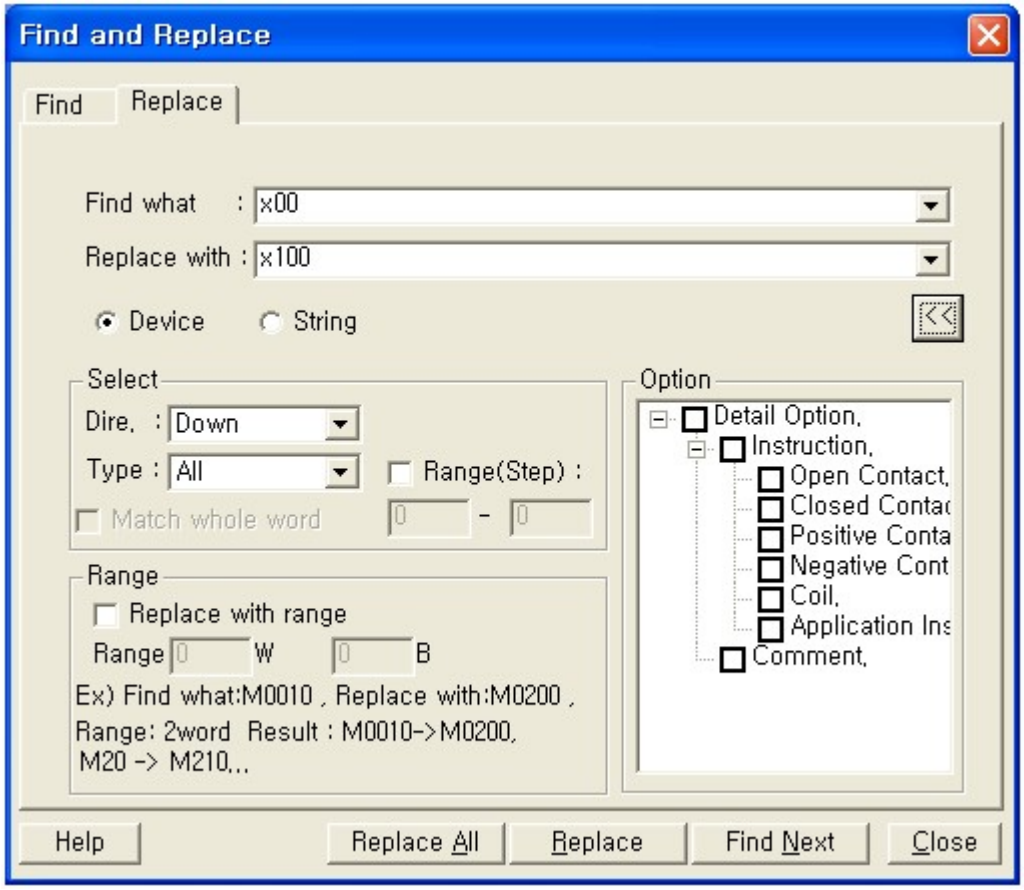
[Replace]

1. Select the basic row of the direction.



2. Select the [Search]-[Find/Replace].
3. Select the [Replace] tab.

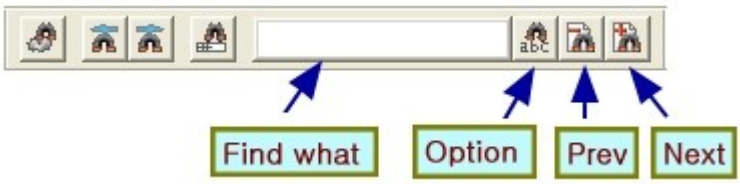




- Device : This function is used to find the device.
- String : This function is used to find the string of rung comment, Application instruction and label except the device.
- Direction : used to specify the location to find or downward form the lins presently selected in the LD editor.
- Type : used to select the device type to find.
- Range(Step) : If step is selected, find and replace is operated in a range of start step and last step specified..
- Match whole word Only : If All identical checked, it will find the string only exactly identical to the string specified in the detail to find.
- Option : If Option checked, used to find specific contact point, specific coil comment , and application instruction used in LD editor.
- Range : used to specify the number of devices to replace with range.It will be adtive only when.

Quick Search

This is used to quick search the device and the String in LD program,
Check the [View]-[Tool bar]-[Search].

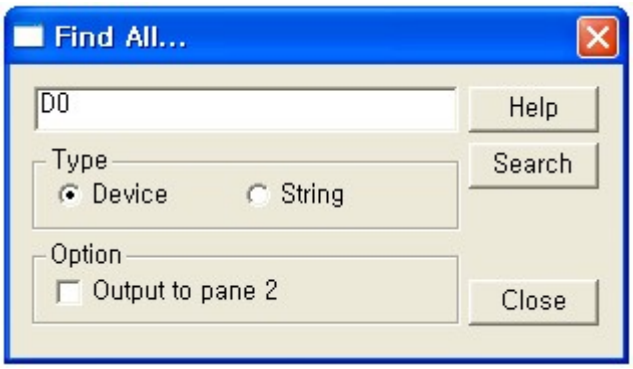


4.5.10 Find All

This is used to find the device and the String in all program.

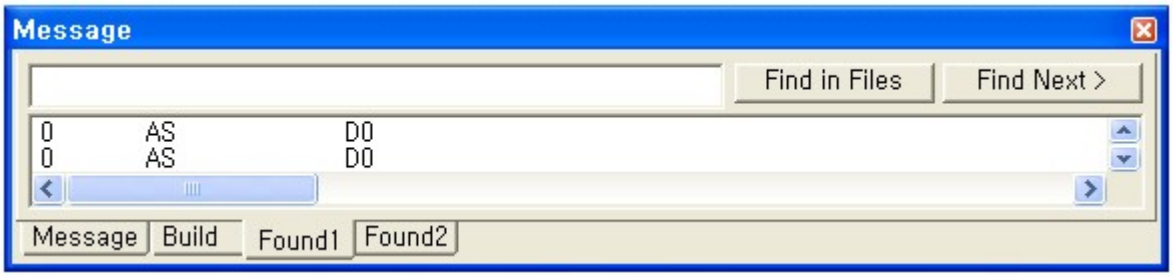
Find All

Select the [Search]-[Find All]



- Device : used to specify the device find.
- String : This function is used to find the string of rung comment, Application instruction and device.
- Output to pane 2 : Basically the result is output to found 1 result window, but if this chect box is selected,
  the result will be [Output to pane 2] result window.

output

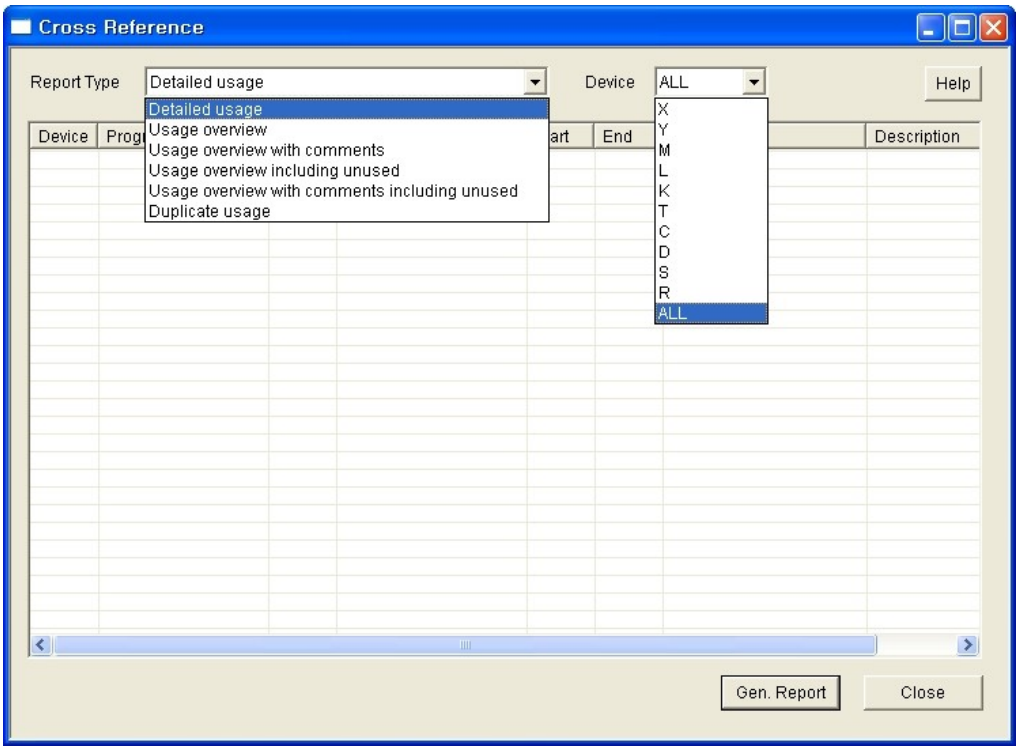


4.5.11 Cross Reference

The Cross Reference provides an overview of the use of addresses within the CICON user program.
It makes you obtain a list of the addresses of PLC memory areas according to the report type

selected.

(It lists the content of a specified PLC memory area according to the six kinds of report type which is selected.)

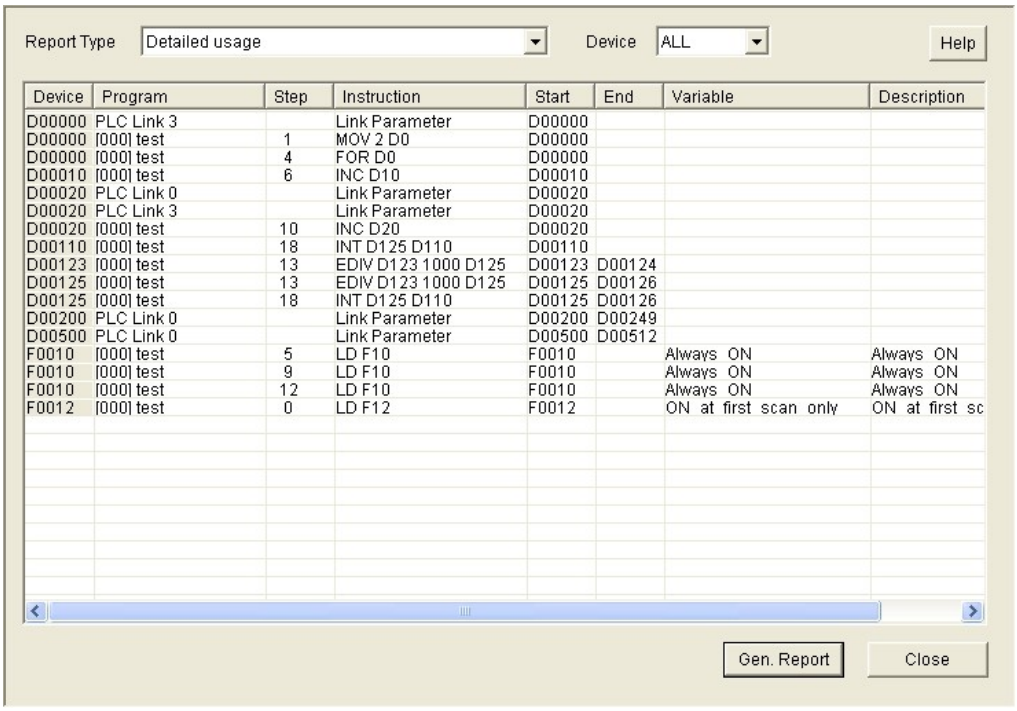


1. Detailed usage

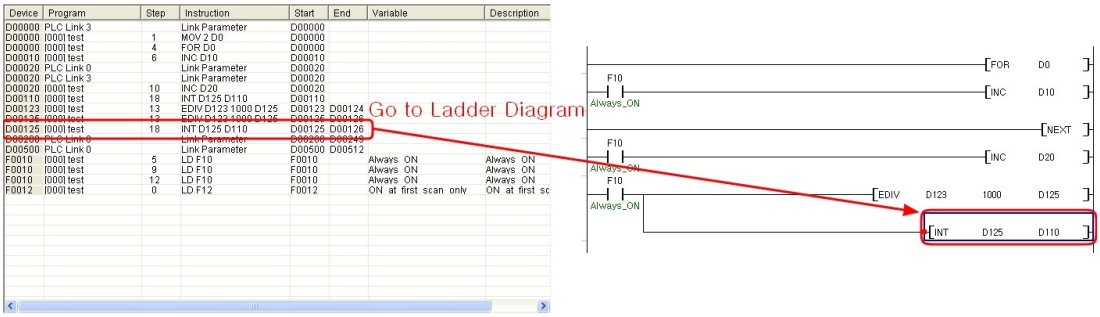
Displays information about the usage or any address used within the PLC programs. The program name, step number, instruction,

start address, end address, variable and description details relating to each usage are shown. Double click the left-mouse button to

move where the address is used in the ladder diagram.

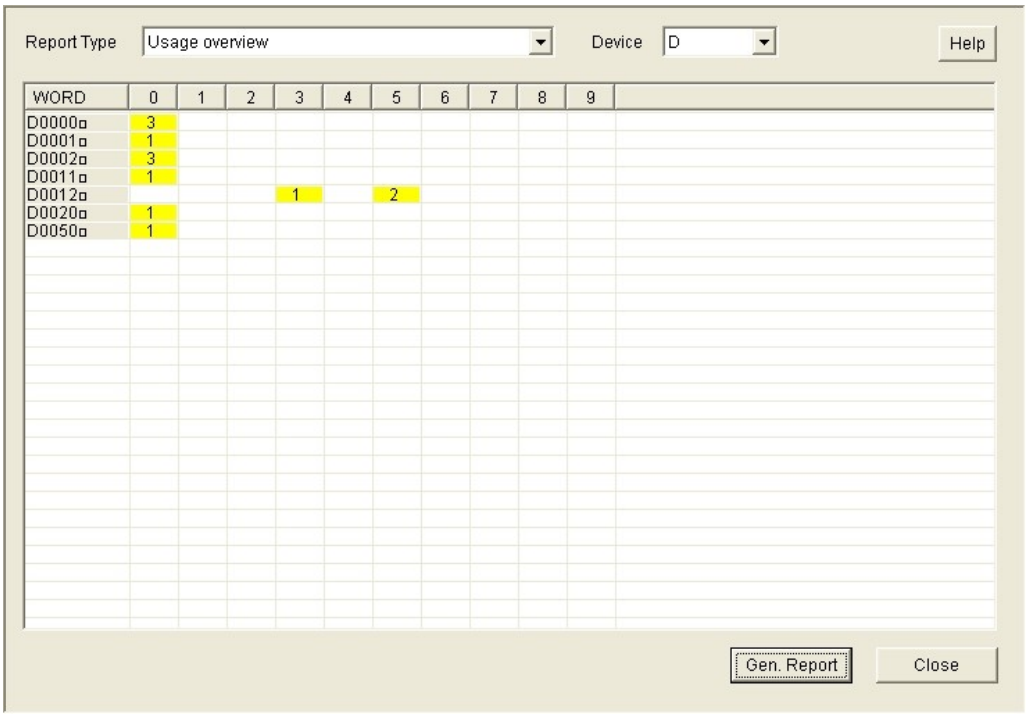


Device	Program	Step	Instruction	Start	End	Variable	Description
D00000	PLC Link 3		Link Parameter	D00000			
D00000	[000] test	1	MOV 2 D0	D00000			
D00000	[000] test	4	FOR D0	D00000			
D00010	[000] test	6	INC D10	D00010			
D00020	PLC Link 0		Link Parameter	D00020			
D00020	PLC Link 3		Link Parameter	D00020			
D00020	[000] test	10	INC D20	D00020			
D00110	[000] test	18	INT D125 D110	D00110			
D00123	[000] test	13	EDIV D123 1000 D125	D00123	D00124		
D00125	[000] test	13	EDIV D123 1000 D125	D00125	D00126		
D00125	[000] test	18	INT D125 D110	D00125	D00126		
D00200	PLC Link 0		Link Parameter	D00200	D00249		
D00500	PLC Link 0		Link Parameter	D00500	D00512		
F0010	[000] test	5	LD F10	F0010		Always ON	Always ON
F0010	[000] test	9	LD F10	F0010		Always ON	Always ON
F0010	[000] test	12	LD F10	F0010		Always ON	Always ON
F0012	[000] test	0	LD F12	F0012		ON at first scan only	ON at first sc



2. Usage overview

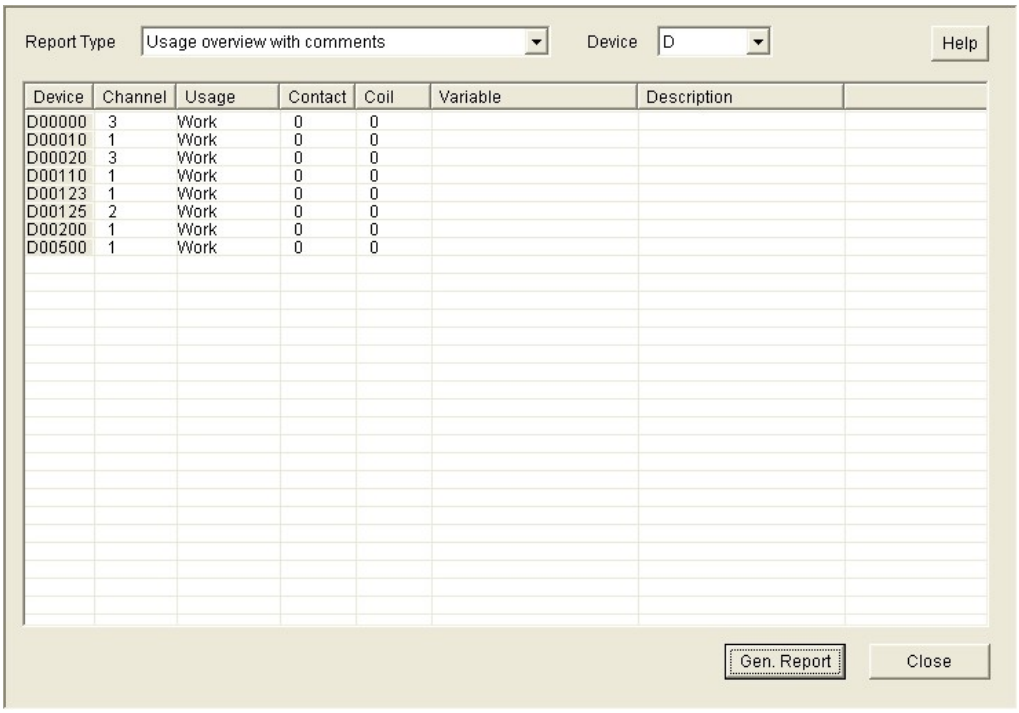
Displays a usage overview the selected device, showing only the addresses that are in use. For each used device, a usage count is displayed.



3. Usage overview with comments

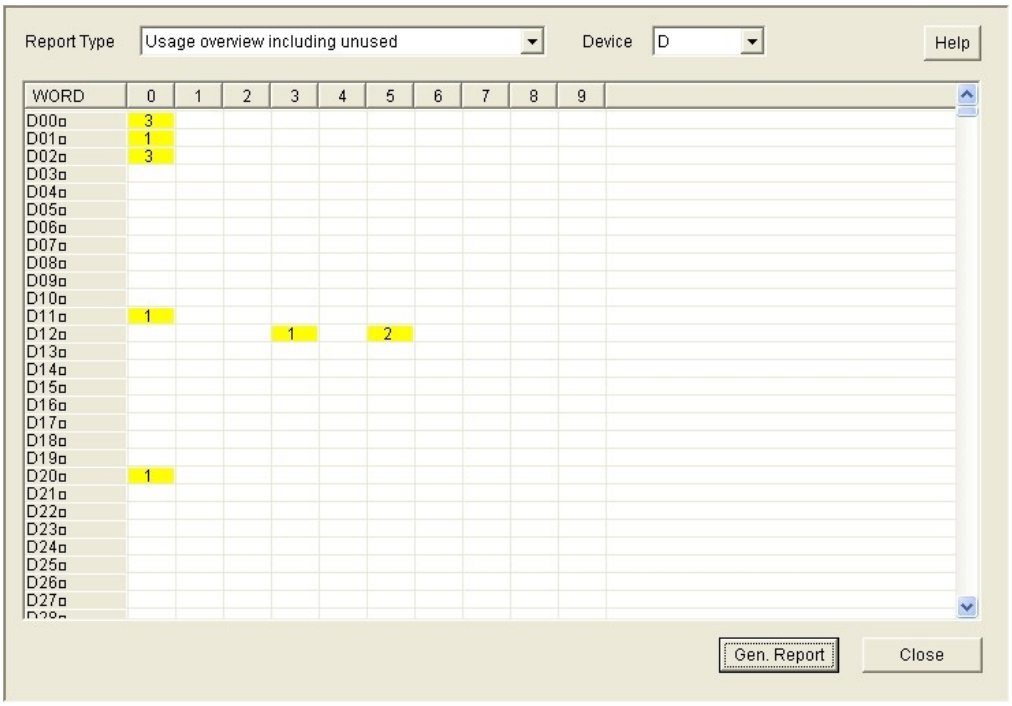
Displays a usage overview the selected device, showing only the addresses that are in use.

For each address, a usage count and its comment are displayed. Usage count used as a contact or coil in programs is displayed respectively.



4. Usage overview including unused

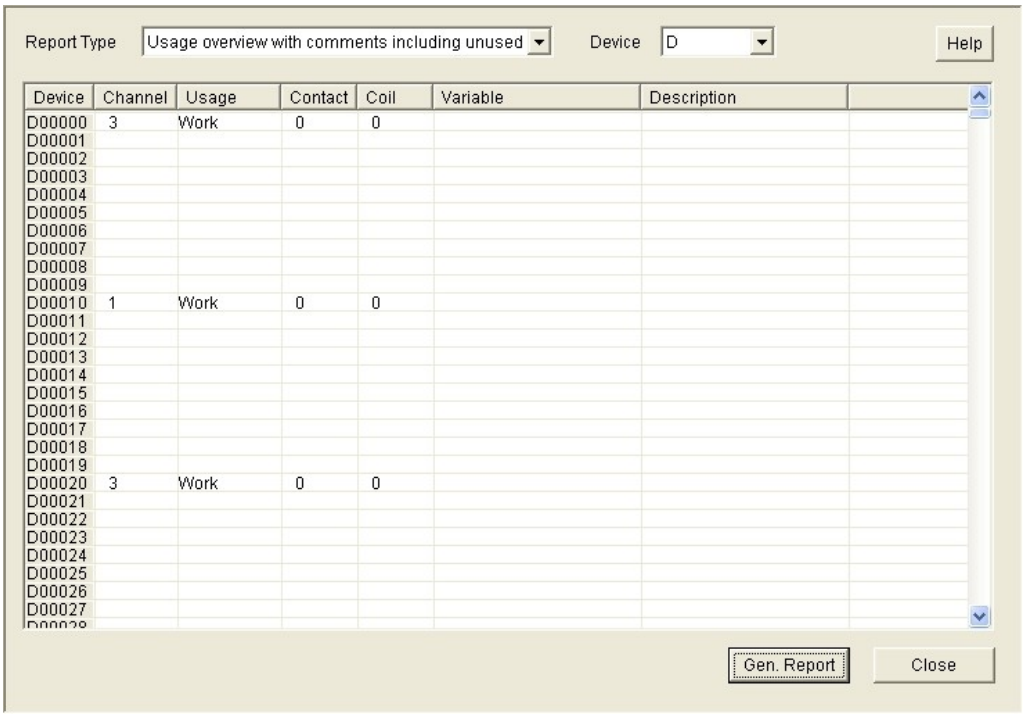
Displays an overall summary of the usage for the selected device, including devices that are not used.



5. Usage overview with comments including unused

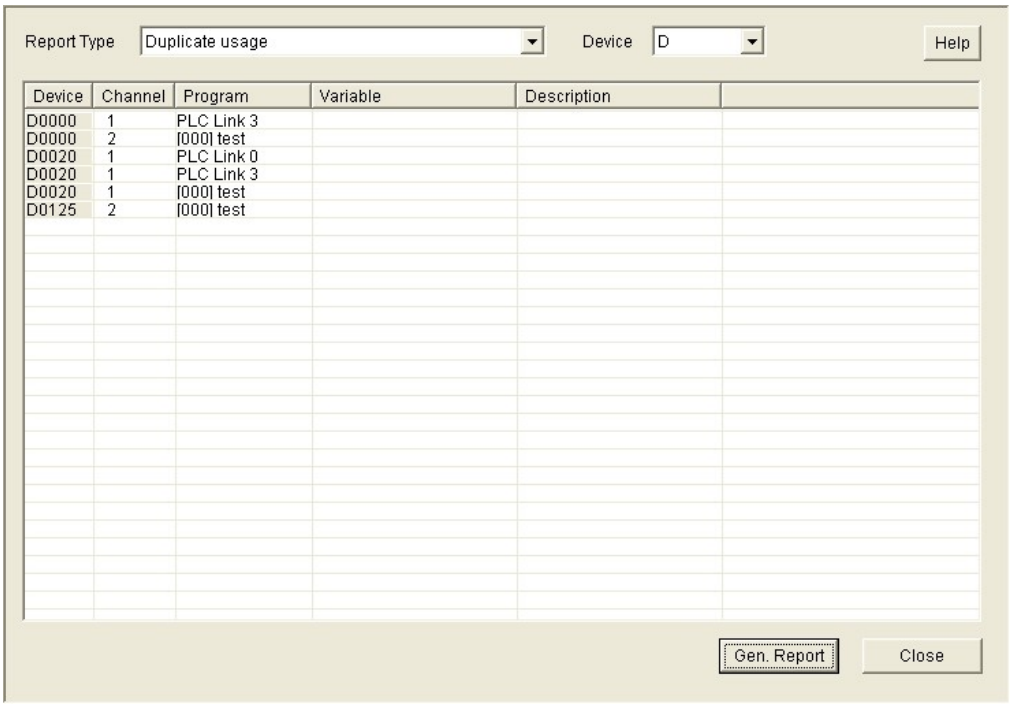
Displays a usage overview the selected device, including devices that are not used.

For each address, a usage count and its comment are displayed. Usage count used as a contact or coil in programs is displayed respectively.



6. Duplicate usage

Displays information about the usage of device used in more than one time with count.



4.5.12 Bookmark

This function can make you easy to move where designated rung in the program by user.

The rules of designation of Bookmark are below:

1. Can designate a Bookmark by Rung
2. Cannot designate a Bookmark at the comment
3. Can use this function in the LD only
4. The maximum count of Bookmark is 512.

Description of Bookmark function is below. (“Tool” – “Bookmark”)

Item	Toolbar Icon	Description
Bookmark Set/Release		Set or release a bookmark where the cursor located rung
Bookmark Release all		Release all bookmarks in the program
Prev. Bookmark		Move to previous bookmark position
Next Bookmark		Move to next bookmark position

4.6 Programming (Multiple Programs)

Contents of Example Programs :

Add the following functions to the example program in the chapter 4.

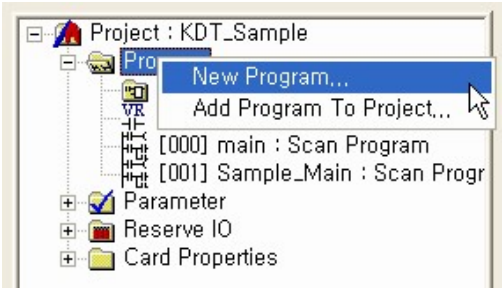
Fill D00000~D00099 with 10 for PLC operation, using the initialization program (Cold).

Turn the lamp (Y0000) on for 5 seconds and turn it off for 3 seconds repetitively, using the timer contact.

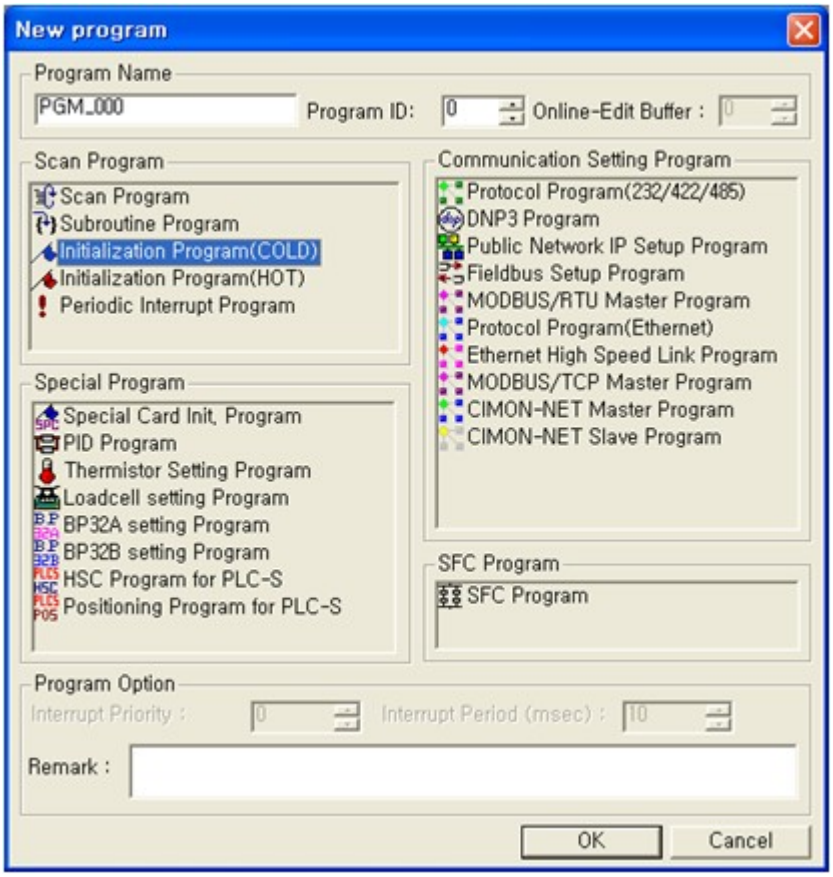
Contents :

4.6.1 Add a new program

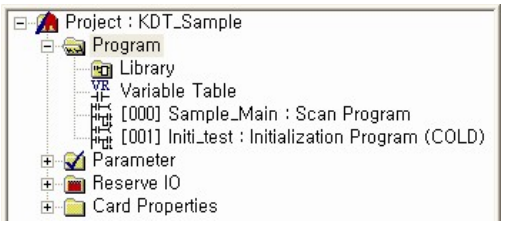
Click the **right mouse button** on the Program in the Project window, in order to add a **new program**.



Select the **Initialization Program (Cold)** and set program name, ID, and free space.

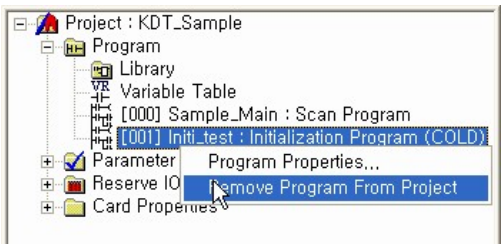


You can check the newly registered program in the Project window.



4.6.2 Remove program from project

Select the program to delete fist.

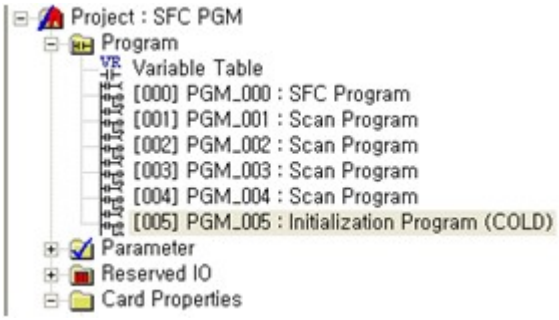


Click the **right mouse button** on the selected program, and select the **"Remove Program From Project"** popup menu.

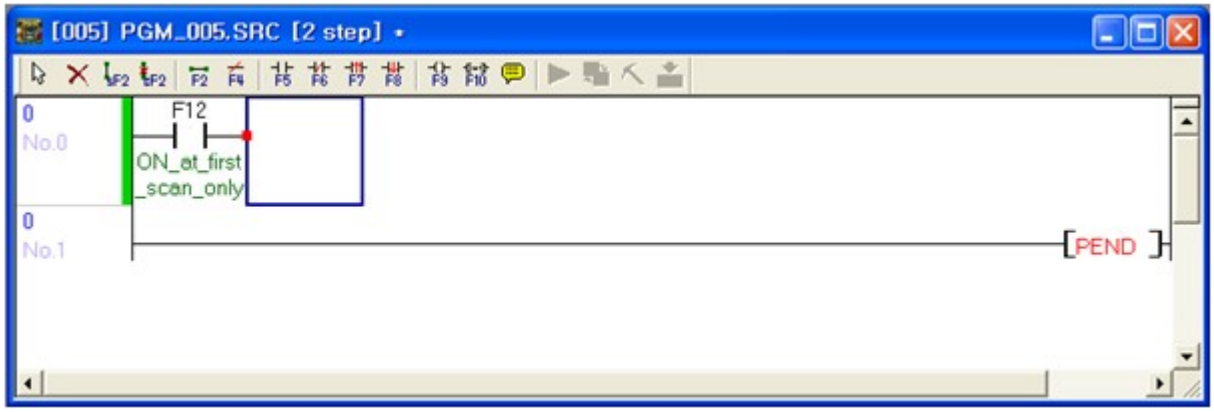
4.6.3 Writing / Managing Program

Wiring a program ,

1. Double click the Initialization Program in the Project window.

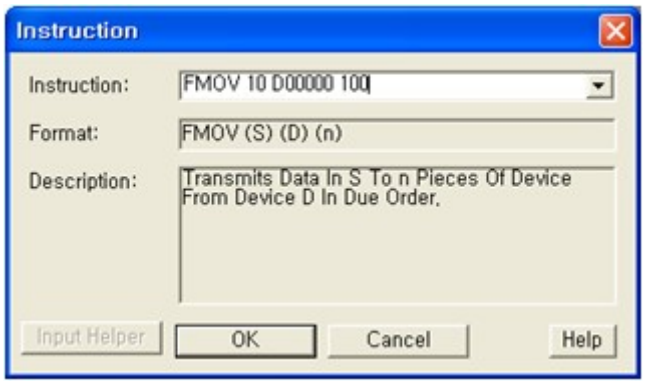


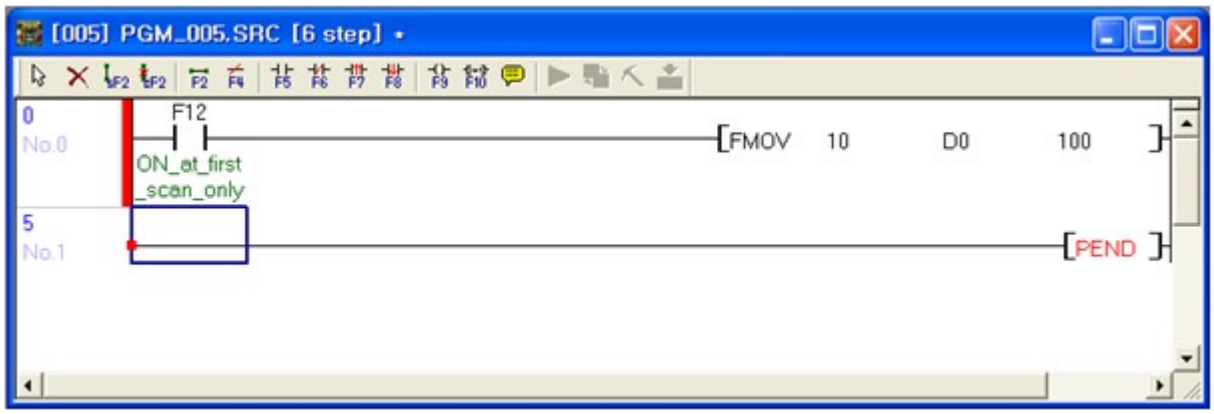
Write the initialization program in the LD Editing window.



2. Insert a row in the Edit window using **[Ctrl+L]** key and then, click the F5 button to input the contact

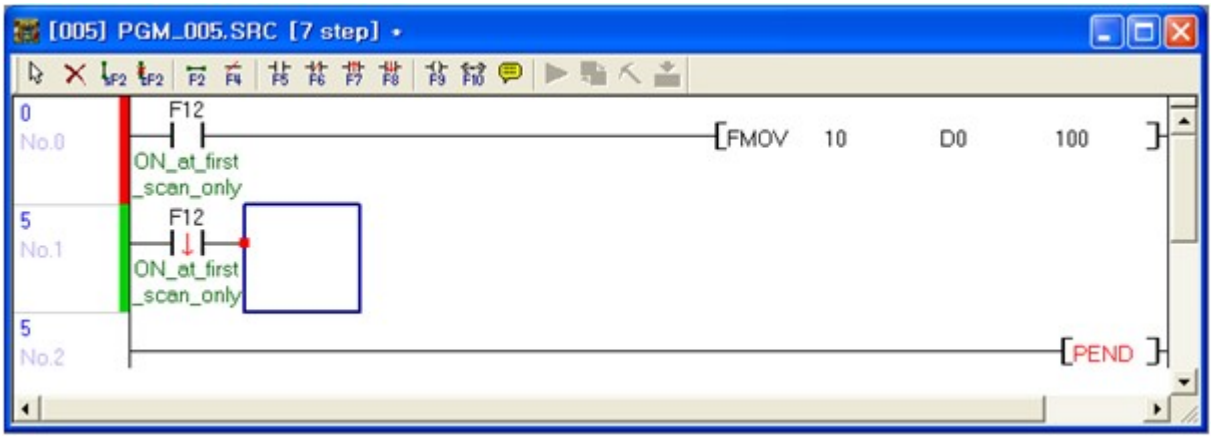
"F0012".



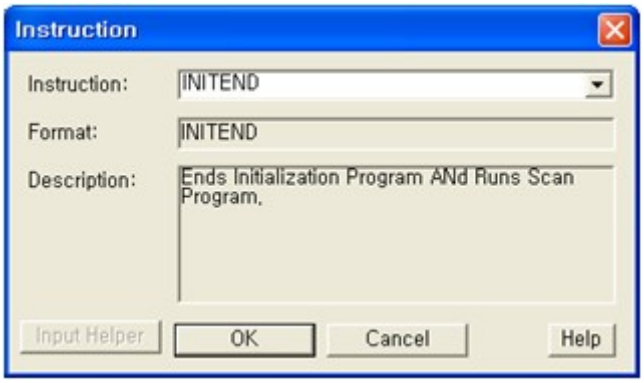


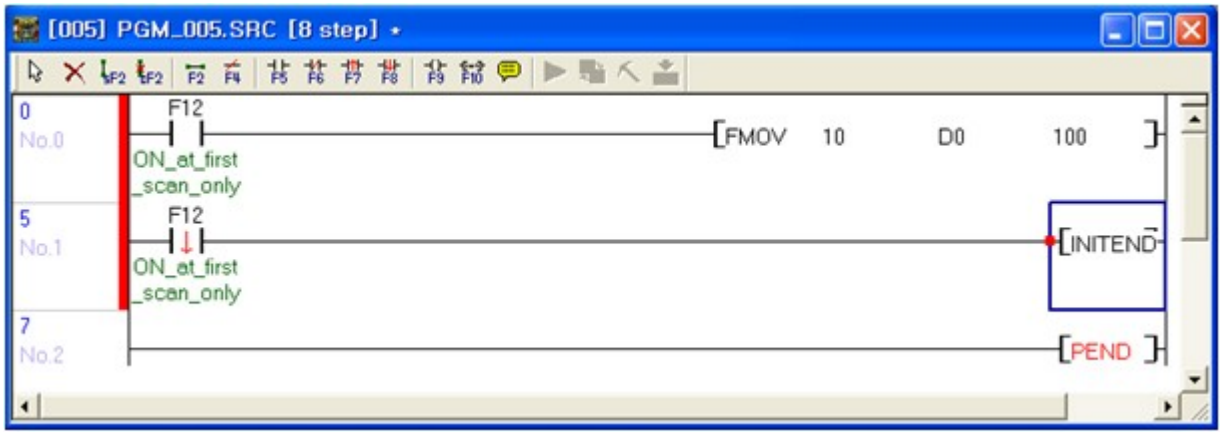
Click the F10 button to input the **"FMOV"** command.

3. Insert a raw using **[Ctrl+L]** key and click the F8 button to input **"F0012"**.

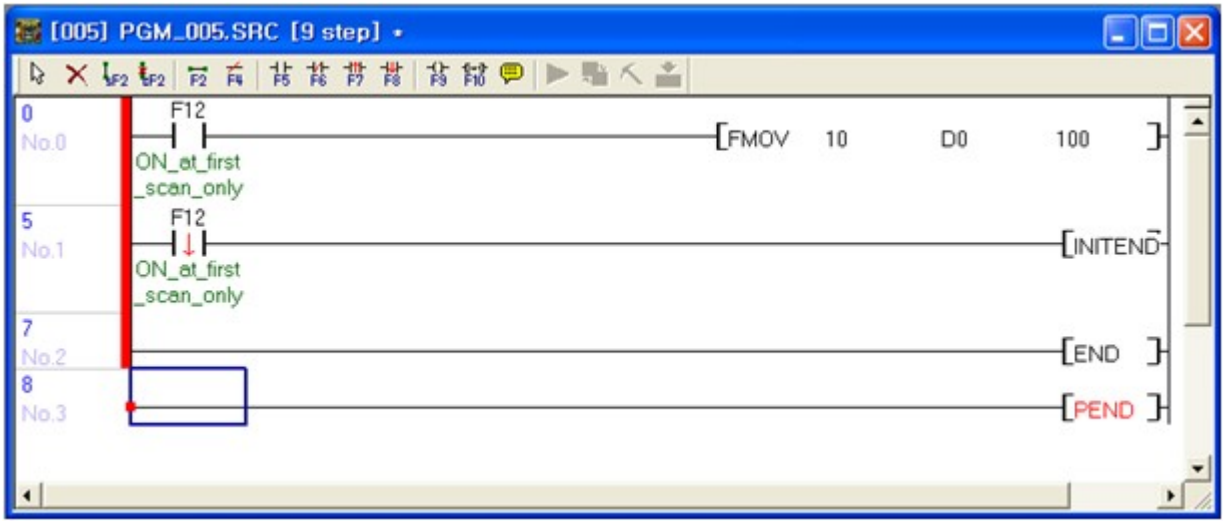


4. Click the F10 button to input the **"INITEND"** command.



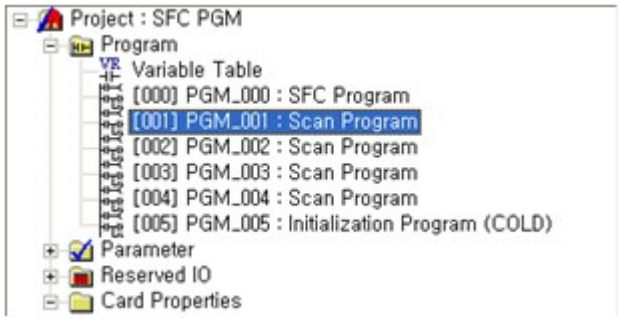


5. Insert a raw using **[Ctrl+L]** key and click the F10 button to input the **"END"** command

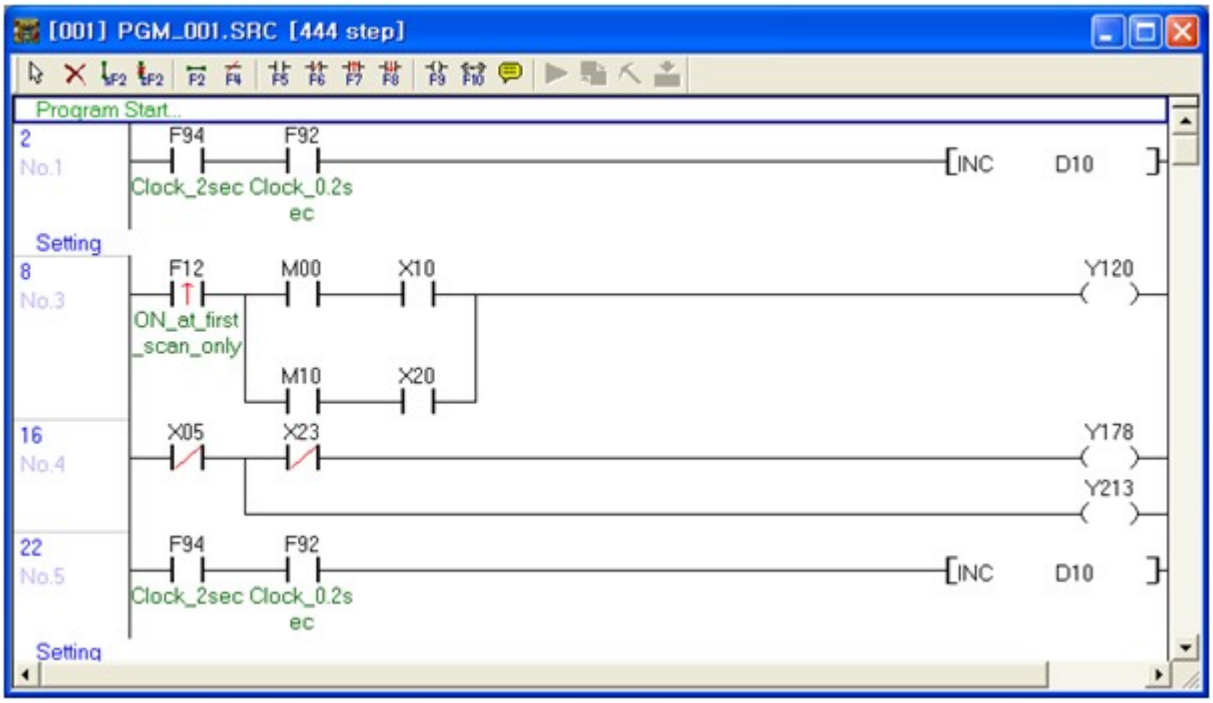


6. Select **File -> Save Program** menu to save the editing program.

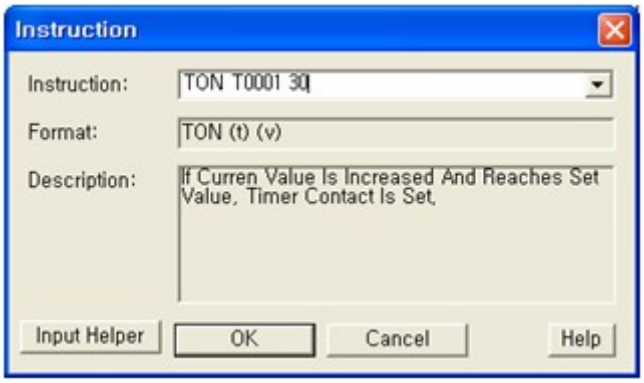
Double click the Scan Program in the Project window ,

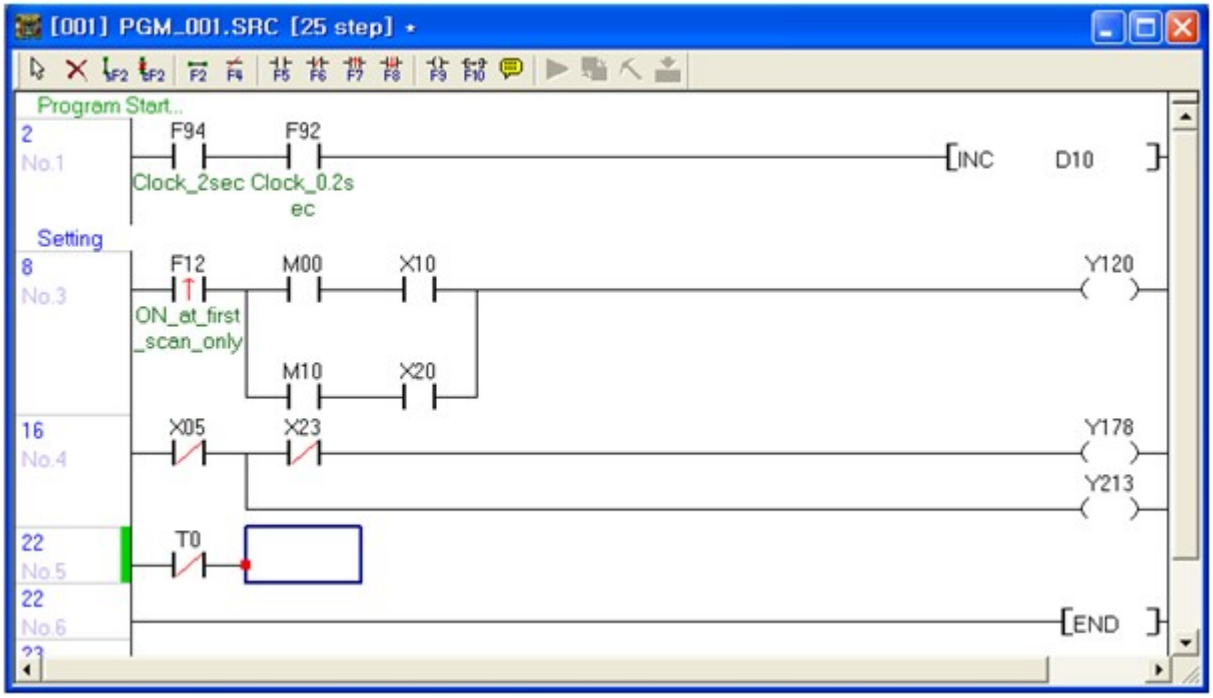


Edit the scan program in the LD Editing window.



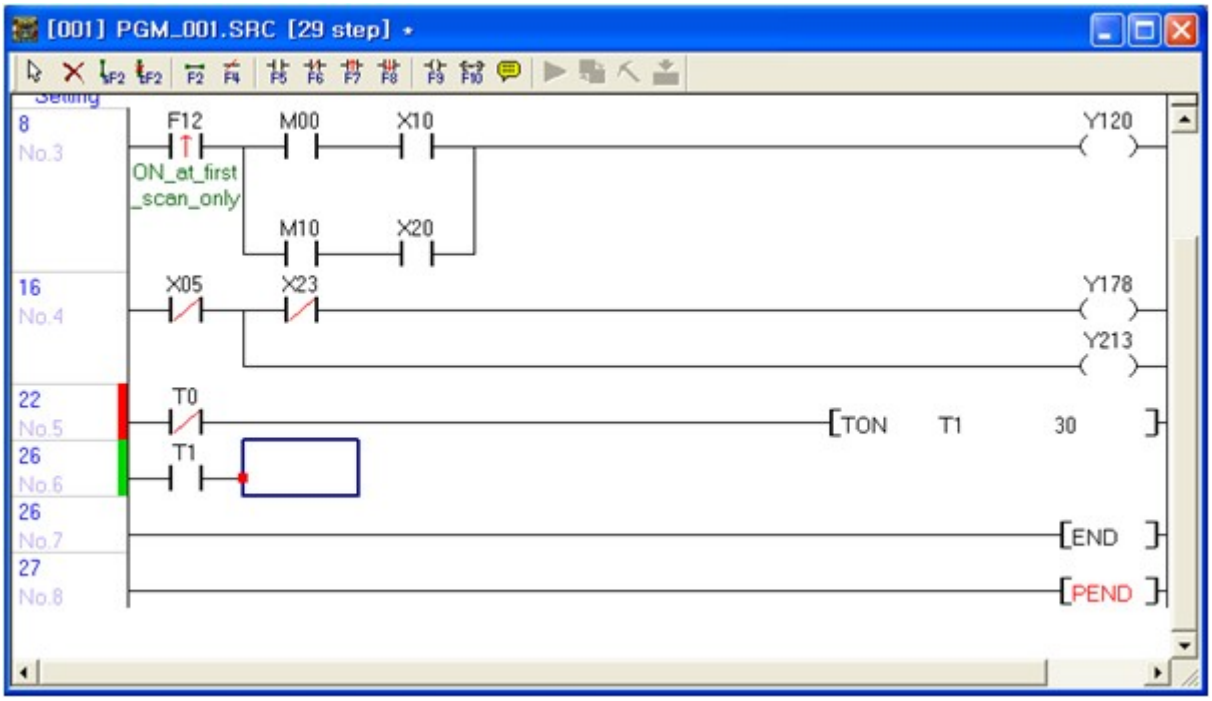
1. Insert a raw using **[Ctrl+L]** key and click the F6 button to input **"T0000"**.?

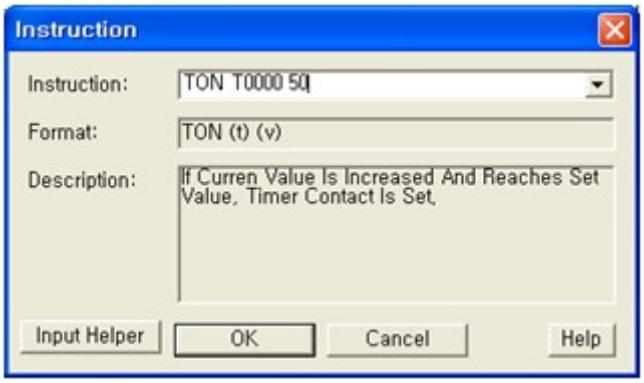




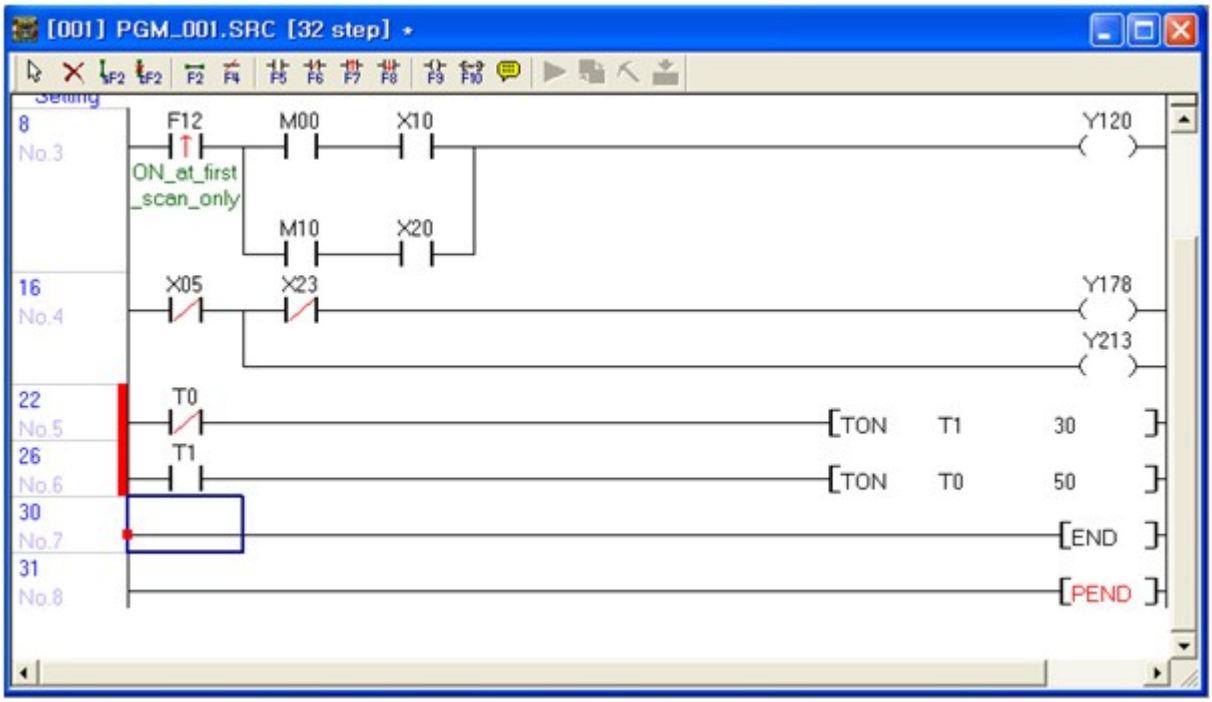
Click the F10 button to input the **"TON"** command.

2. Insert a raw using **[Ctrl+L]** key and click the F5 button to input **"T0001"**.

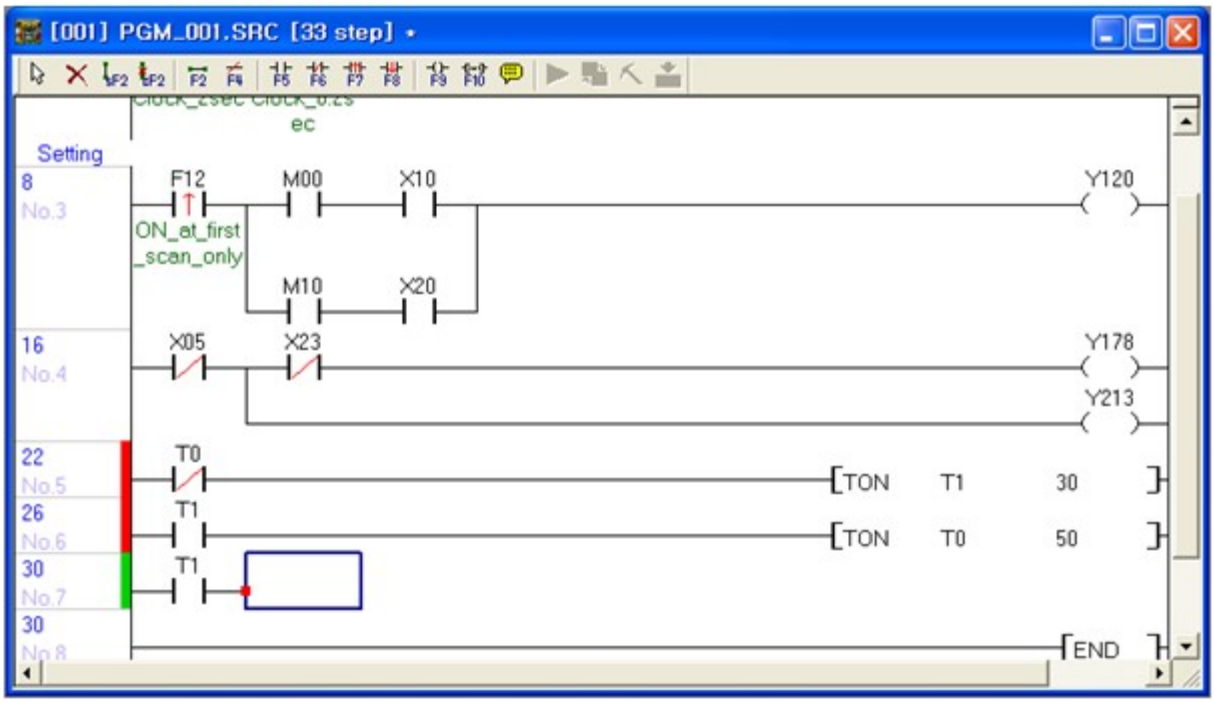




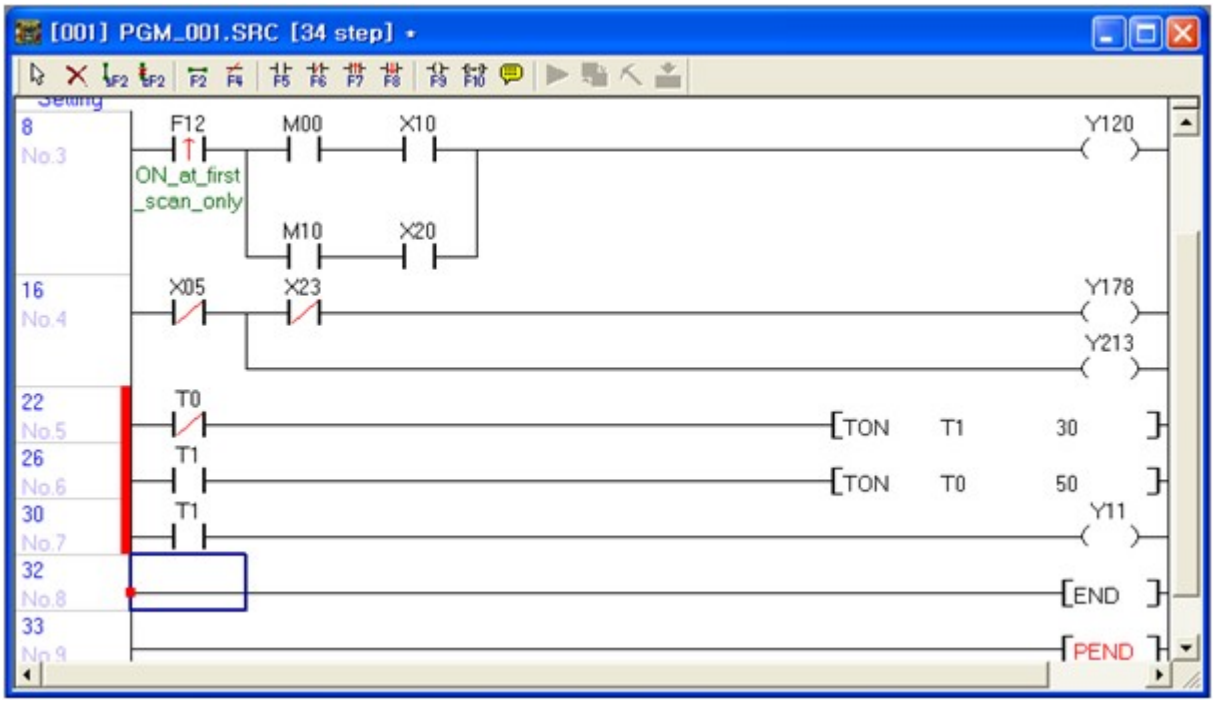
3. Click the F10 button to input the **"TON"** command.



4. Insert a raw using **[Ctrl+L]** key and click the F5 button to input **"T0001"**.



5. Click the F9 button to input **"Y0011"**.



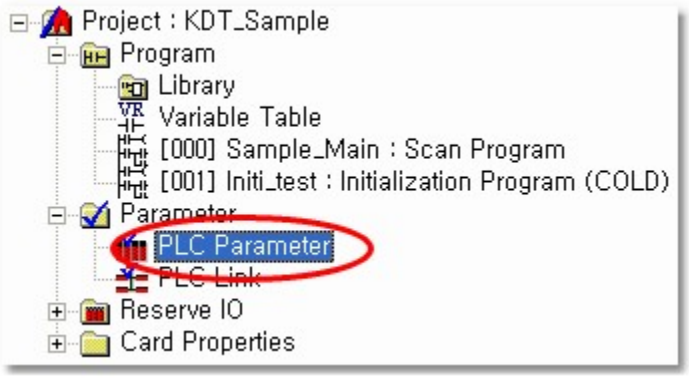
6. Select **File -> Save Program** menu to save the edited program.

4.6.4 Parameter Setting

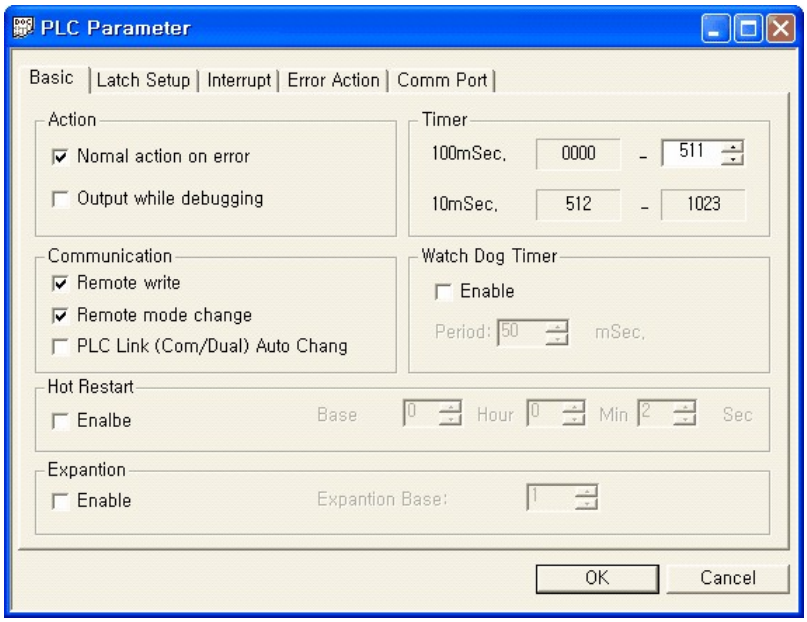
PLC parameters are used for settings of PLC operation, whereas PLC link is used for PLC data communication settings.

PLC parameters

Double click **"PLC Parameter"** under Parameter in the Project window.



Default setting



Normal action on error If this option is selected, PLC will run normally even though the operation error occurs while the scan program is running.

Output while debugging Enables output display during debugging.

Timer Sets the contact area that will run 100ms or 10ms among 1,024 timer contacts.

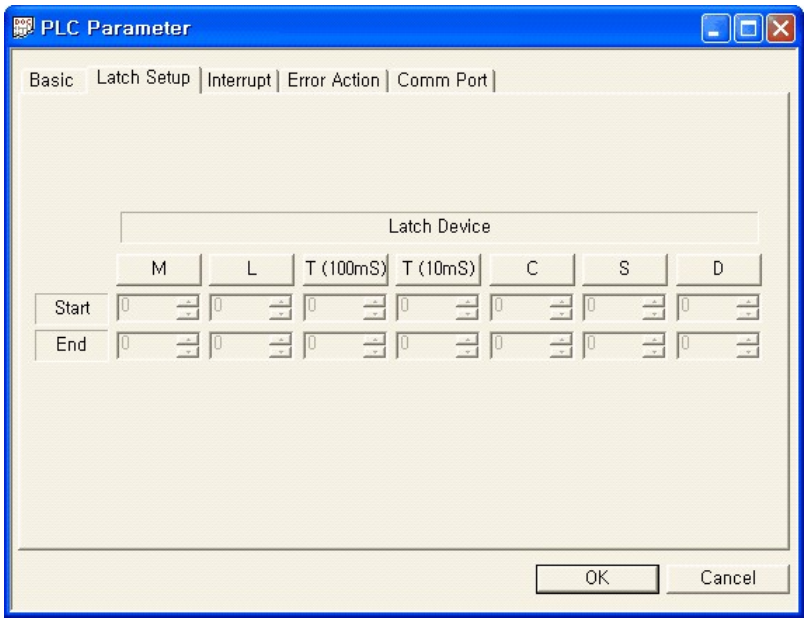
Remote write Enables PC control using the communication module.

Remote mode change Enables to change the PLC operation module using the communication module.

PLC Link (Com/Dual) Auto Change	Enables automatic PLC link switching function. This option is valid only for the CPU supporting redundancy.
Watch Dog Timer	If you want to use WDT, check Enable and set Period. If the PLC scan time exceeds the setting time, the WDT error will be generated.
Hot Restart	If the power supply is resumed within the defined time, the Initialization Program (hot) will be executed while keeping the PLC memory value. To use this function, the CPU should be equipped with RTC.
Expansion	Sets PLC increment number as much as you want. If the number in the increment end is smaller than the setting value, the increment communication error will occur.

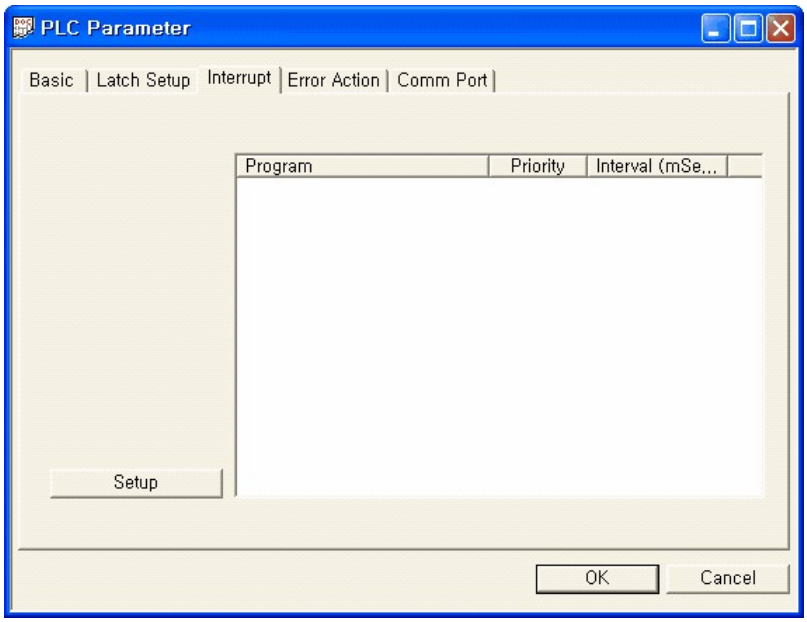
Latch Setup

Sets the PLC latch area. If you click the button with the device name on it, you can set the area. Latch area values will be maintained even though PLC stops or the power is turned off.



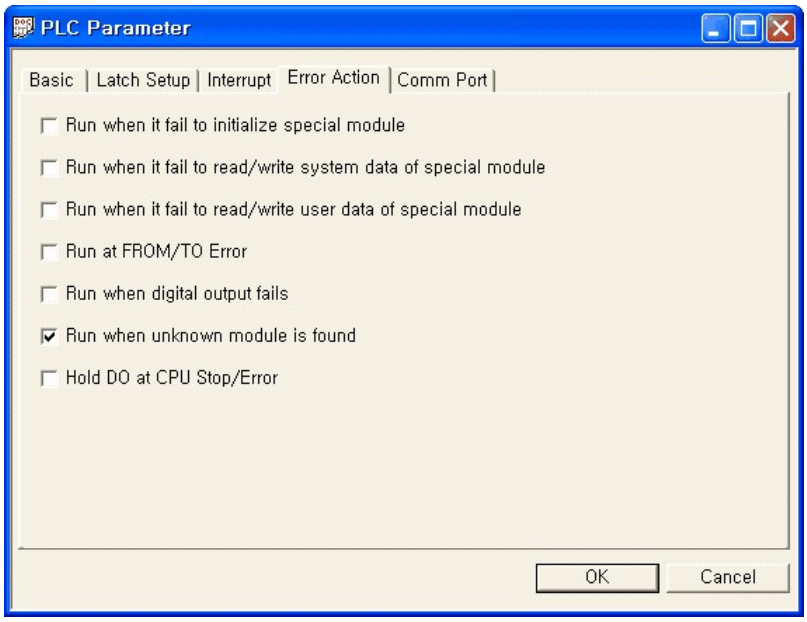
Interrupt

Manages interrupt programs registered in the project. You can modify the interrupt interval and priority in this window.



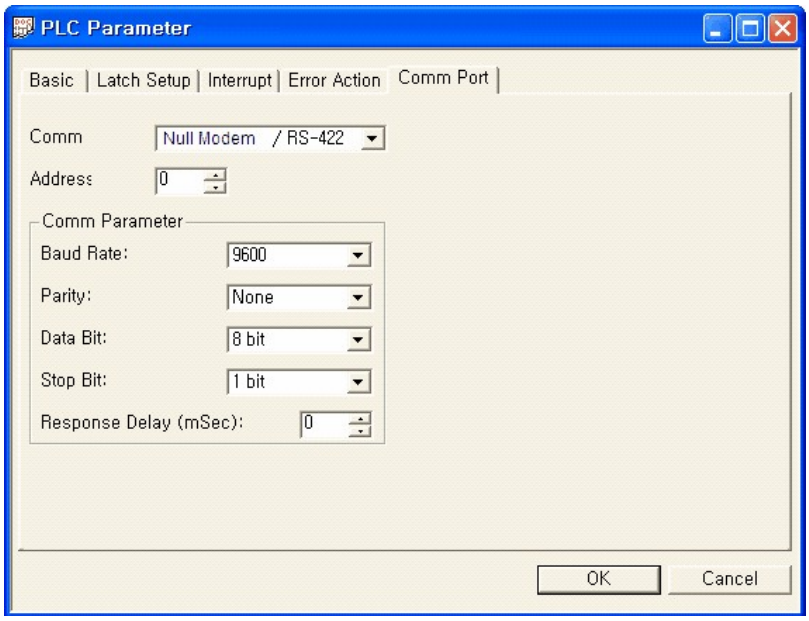
Error Action

Set the actions to be taken when the PLC error occurs.



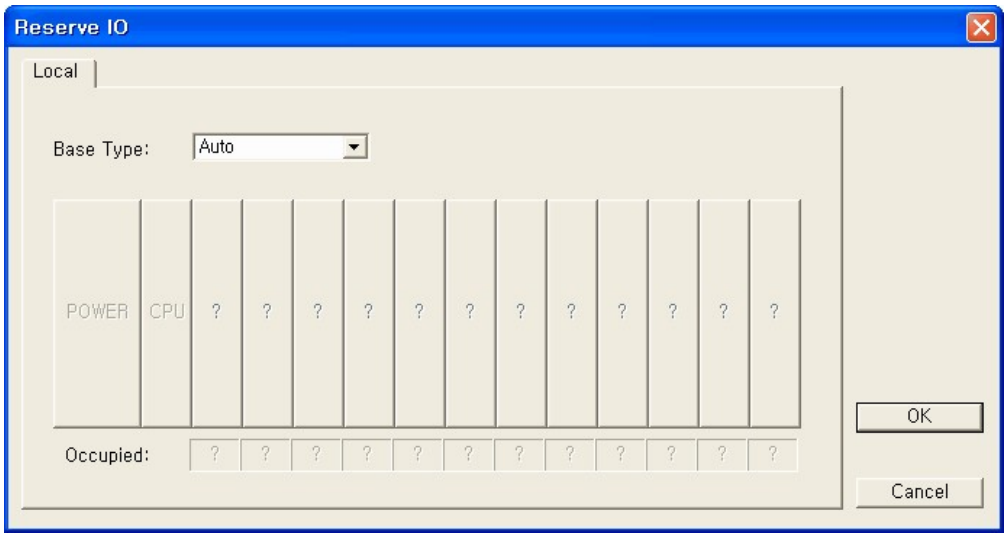
Comm port

You can modify settings of the reserved communication port of CM1-CP4C/D or block type model -R, or -S type.
This function is not applicable for other CPU type.



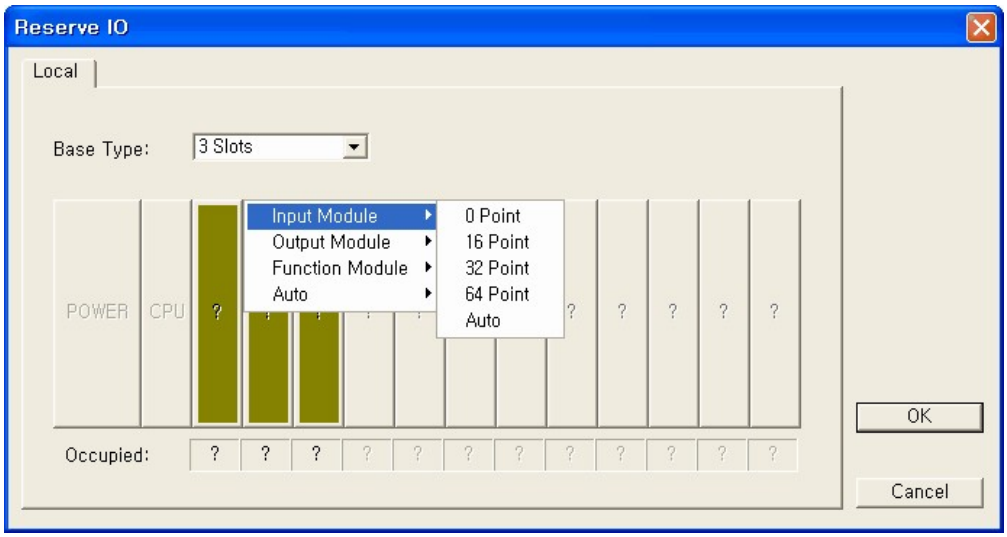
4.6.5 Reserve I/O

You can specify word size and type of module in Reserve **I/O dialog**.



Base type: Select the base type to set. The setting icon will vary according to type selection.

Card setting



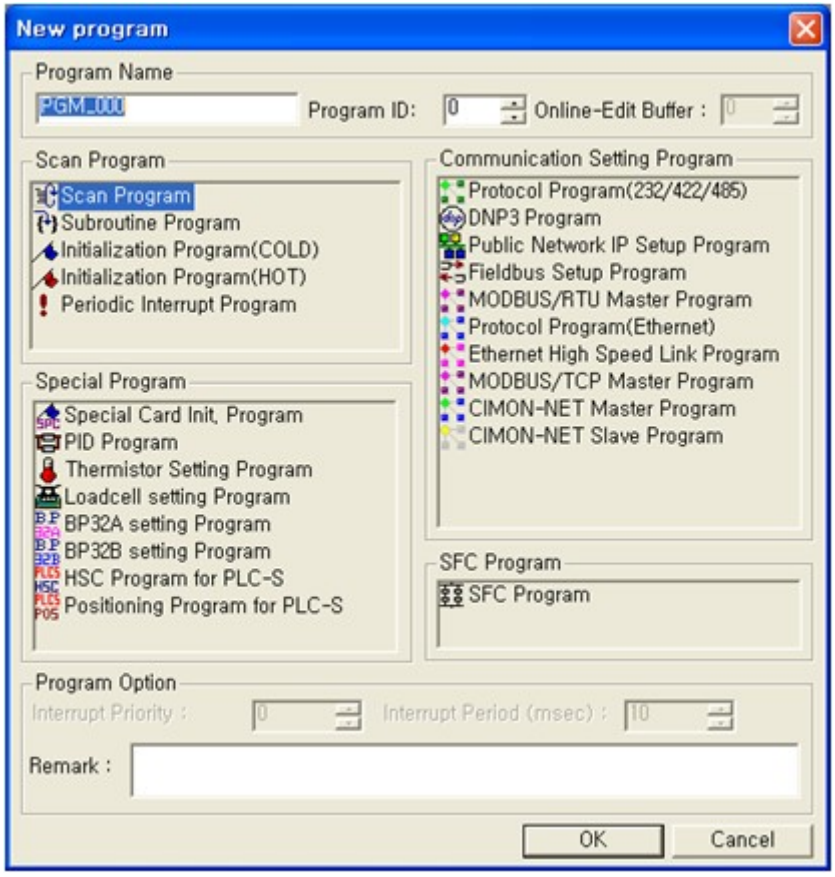
When you select the base type, the slots that can be set will be activated.
Select the slot to set and then, set the module to set.

If 64 points input is selected, the bar will be displayed in light green color and "DI" will be displayed at the center, as shown above.
The "Occupied" means how many (4*16=64) addresses are occupied by the specified slot.

4.7 Scan Program

Program Types ,

Select **"File -> New Program"** menu to create a new program.



Scan Program

Program that processes the signal repeated regularly at every scan.

Sub-routine Program

Program composed of sub-routines that are called by "ECALL" command in the scan program.

Initialization Program (Cold)

Program that is started when the power is supplied or the mode is changed to the Run mode. It also

sets the initialization data or initializes the peripheral or special module.

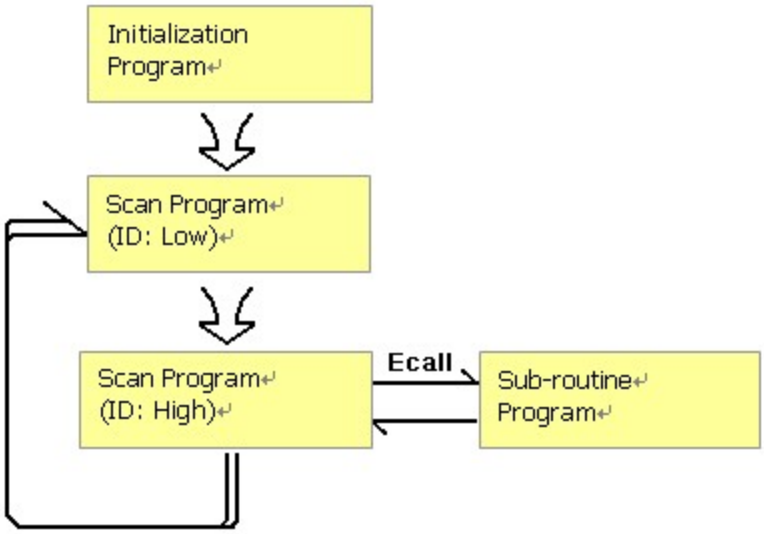
Initialization Program (Hot)

If the power fails temporarily within the setting time when the Hot Restart function is enabled, the Initialization Program (hot) is executed first while keeping previous values and the scan program is executed successively.

Periodic Interrupt Program

Program executed at the specified intervals.

Program execution diagram ,



The initialization program runs at the initial state of PLC running, whereas the scan program runs repetitively while PLC is running. The sub-routine program runs only when it is called by the "ECALL" command while the scan program is running.

4.7.1 Scan Program

The scan program processes the signal repeated regularly at every scan.

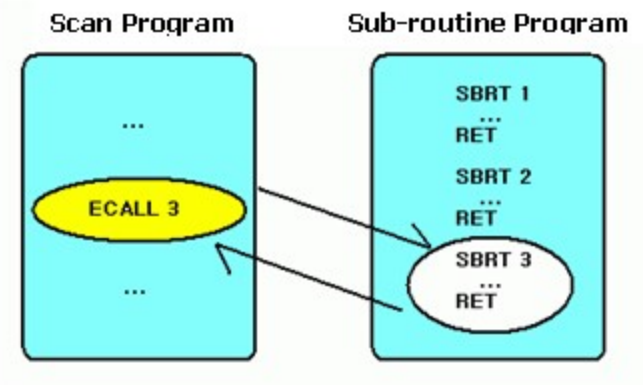
Scan program properties

Program name Displays the name of the program.

Program ID Decides the priority of program execution, program execution starts from the smaller ID.

For Run Edit (Step) Free space is reserved for the modification function while the program is running.

4.7.2 Sub-routine Program

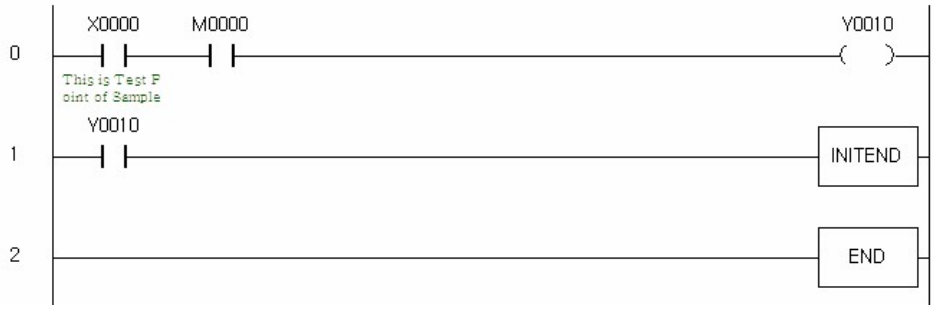


The Sub-routine Program is a collection of programs that are called by the "ECALL" command in the scan program. The scan program calls SBRT n ~ RET commands in the sub-routine program according to the "ECALL" command.

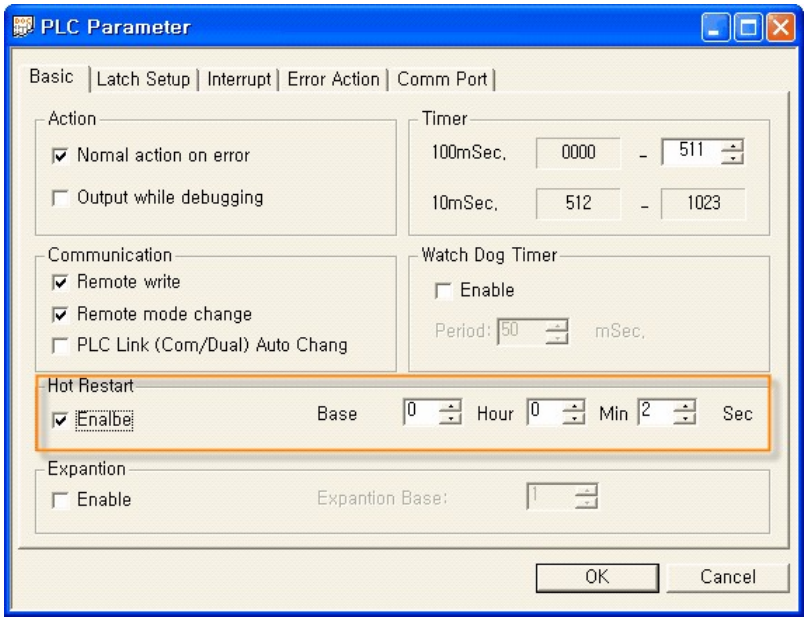
4.7.3 Initialization Program (Cold)

Program that is started when the power is supplied or the mode is changed to the RUN mode.
The scan program is executed after running of the initialization program is complete.
It also sets the initialization data to run the scan program or initializes the peripheral or special module.

You must use the "INITEND" command to stop the initialization program.



4.7.4 Initialization Program (Hot)



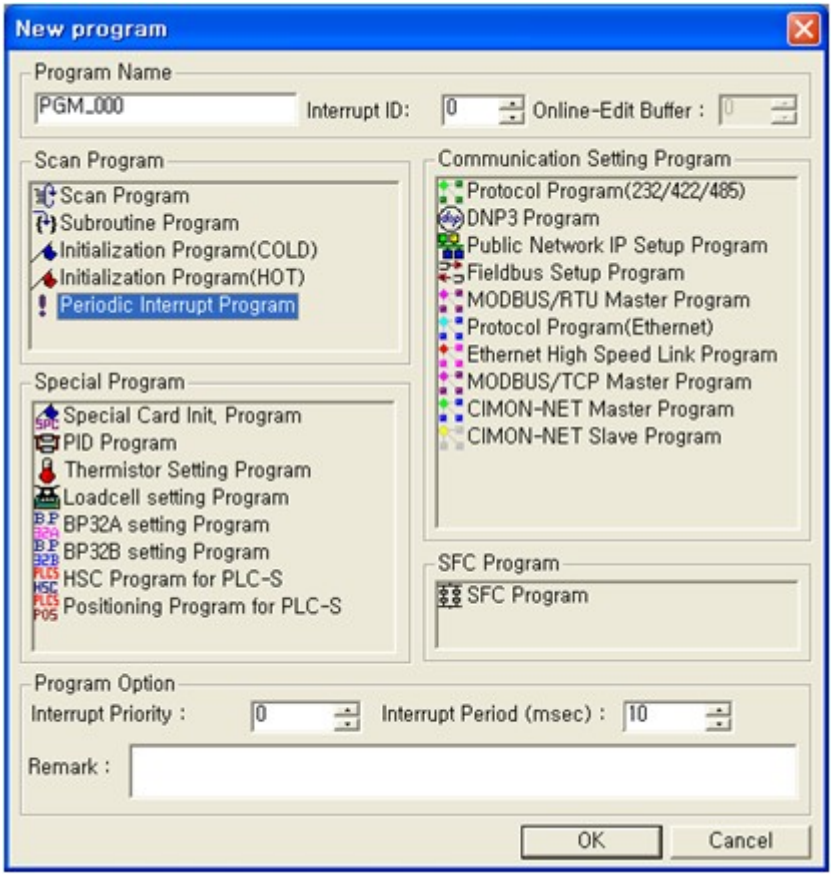
Set the Hot Restart function in the PLC Parameter window. Once this function is selected, it will be started if the temporary power failure occurs within the setting time.

Run the initialization program (hot) while keeping previous values (device values at the time of power off) and then, run the scan program.

You must use the "INITEND" command to stop the initialization program.

4.7.5 Periodic Interrupt Program

The selected program will be executed at intervals specified by **Interrupt Period**.



How to set the interrupt program

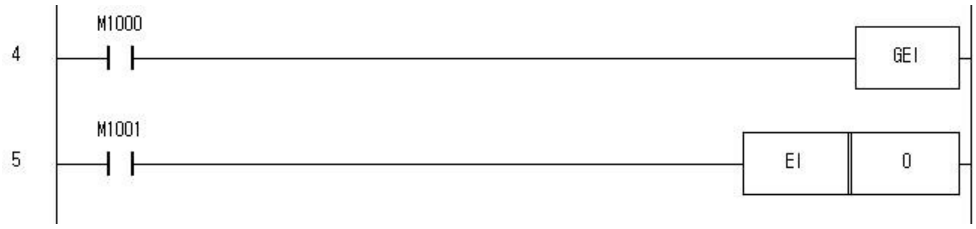
Set the unique interrupt ID from 0 to 15.

Free space is reserved for the modification function while the program is running.

The interrupt with lower **Interrupt Level** will be executed first. The Interrupt Level of the program must not be same with other program.

Input the **Interrupt Period**, which is the interval of program execution. The allowable setting range is 10 ~ 655,350ms.

If you want to run the interrupt program, use the **"GEI"** command to enable the usage of the interrupt program and then, execute the program using the **"EI"** command.



4.8 Communication Setting Program

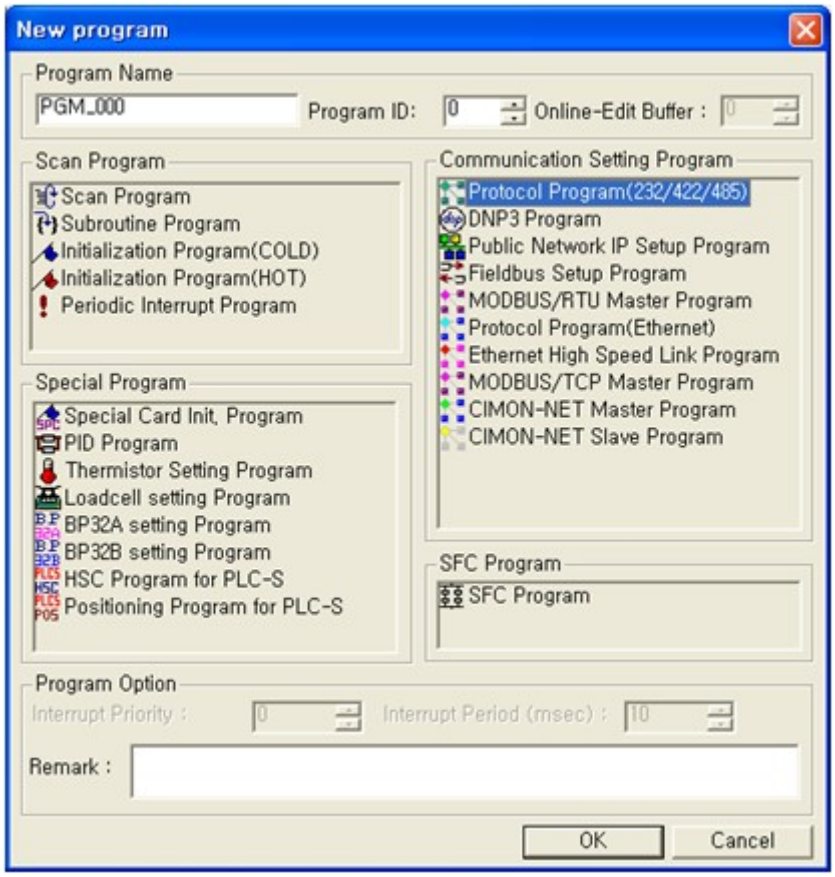
Contents :

4.8.1 Protocol Program

The protocol program enables the user to manually define the communication frame of the serial communication module.

Registering the protocol program

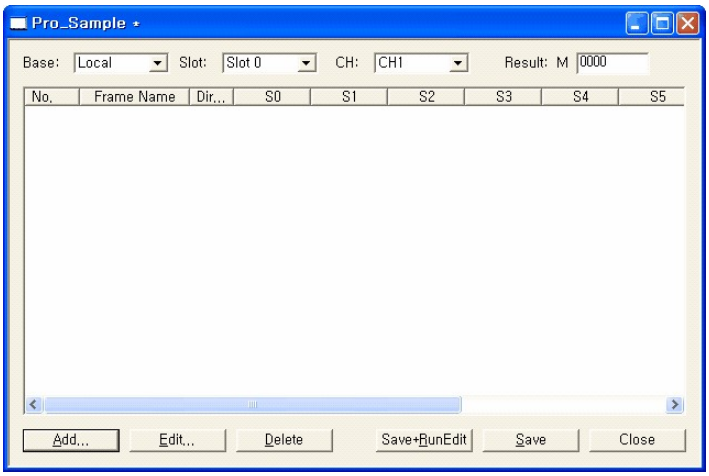
Select **"File -> New Program"** menu.



Input the **Program Name**, **Program ID**, and **Program Free Space field**.
Click the [OK] button.

Composing protocol program

Example of writing a program : The sample program reads 5 words from %MW100 of Glofa PLC, and saves it in 5 words from D00100 of CIMON PLC. Communication is established using the channel #1 (RS232) of the serial communication module, which is mounted in local base, slot #0.

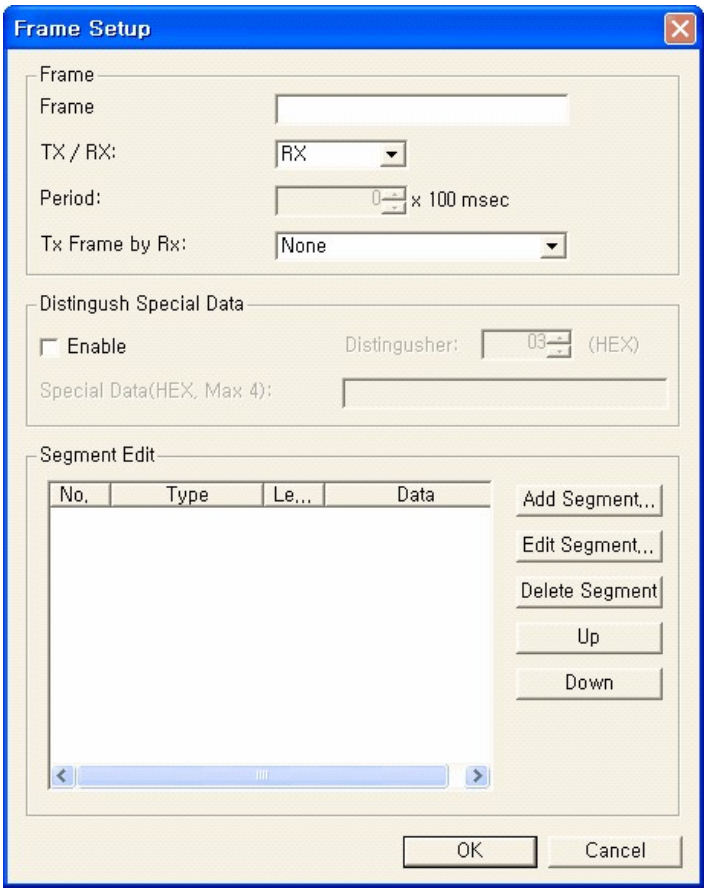


- **Base:** Local (Module mounted base)
- **Slot:** Slot 0 (Module mounted slot)
- **CH:** Ch1 (Channel to use: Ch1 (RS232) and Ch2 (RS422/485))
- **Result:** M0000 (Specifying the device to save the communication result)

Available function buttons are as follows.

- **Add:** Defines and adds new frame.
- **Edit:** Edits the registered frame.
- **Delete:** Deletes the registered frame.
- **Save+RunEdit:** Saves the edited details and instantly applies to PLC, if it is online.
- **Save:** Saves the modified details.

To move the frame position, Cut (Ctrl+X), move position, and paste it (Ctrl+V).



When you click the **[Add]** button, the Define Frame window will appear.

"Input the setting items."

- **Frame:** Name to separate the frame.
- **Tx/Rx:** Sets the communication direction – sending or receiving.
- **Period:** Sending frames will be automatically sent at the specified interval.
- **Tx frame by Rx:** Specifies the frame that corresponds to the response.

"Functions related with segment editing"

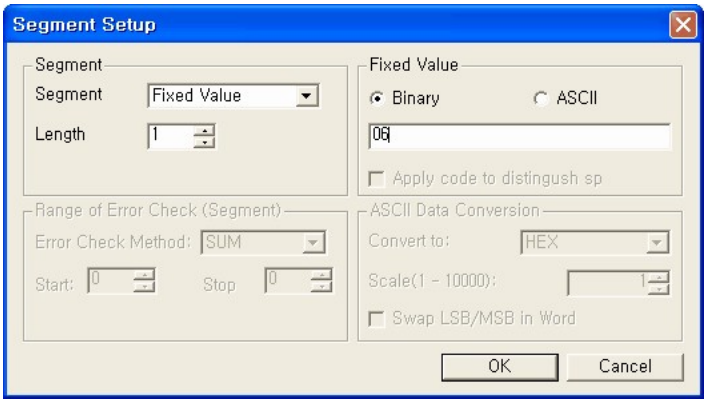
- **Add segment:** Defines and adds a new segment.
- **Edit segment:** Edits the registered segment details.
- **Delete segment:** Deletes the selected segment.
- **up:** Moves the selected segment upwards.
- **down:** Moves the selected segment downward.

1. Defining a frame

(Rx frame of the continuous read command for the direct variable)

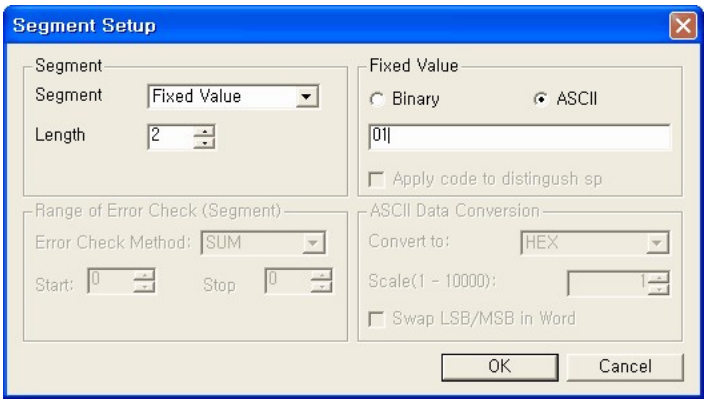
Defines the frame contents to interpret the response frame for the continuous read requesting frame of the Glofa PLC's direct variable.

- **Defining a segment (header)**



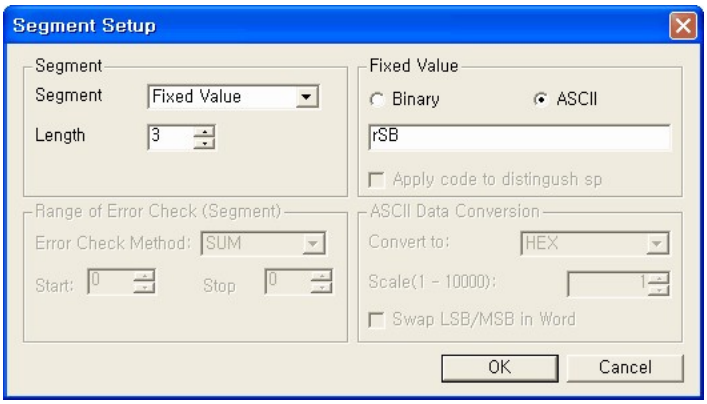
Sets the header of the protocol.
The header for the ACK response frame is ACK (06H), and should be set as shown above.

- **Defining a segment (station number)**



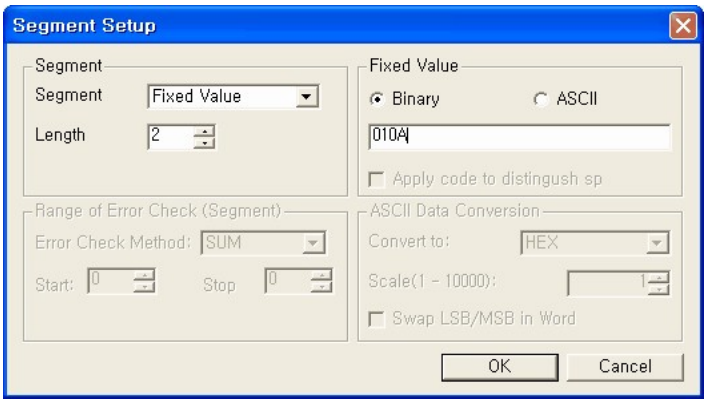
Sets the station number area for the protocol.
Input the station number of the counterpart (LG Glofa).
The station number is "01" (1) and should be set as shown above.

- **Defining a segment (command + command type)**



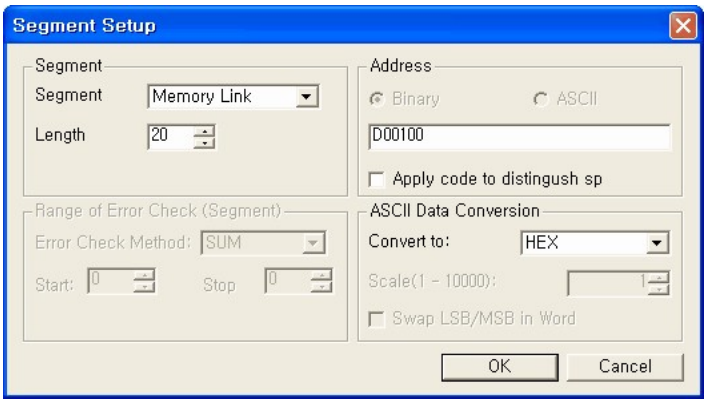
Continuous read command for the direct variable + command type rSB(r + SB), which should be set as shown above.

- **Defining a segment (number of blocks + number of data)**



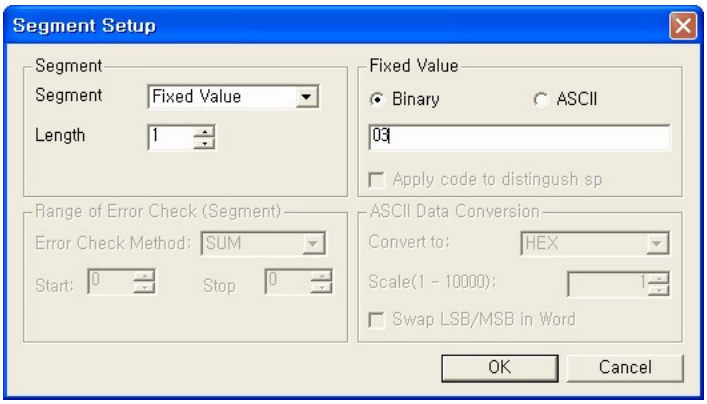
The number of block is 1 and data is 10 (= 5Word * 2, 0AH), and should be set (01+0A) as shown above.

- **Defining a segment (data)**



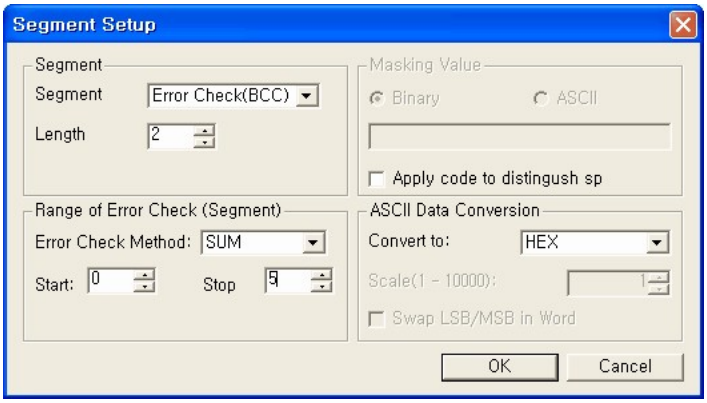
Set as shown above to save 5 word data received from Glofa PLC in 5 words from D00100 of CIMON PLC.
To display 5 word data as an ASCII code, 20 bytes (= 5 words * 4 characters) are needed.

- **Defining a segment (tail)**



The tail of the ACK frame is ETX(03H), and set as shown above.

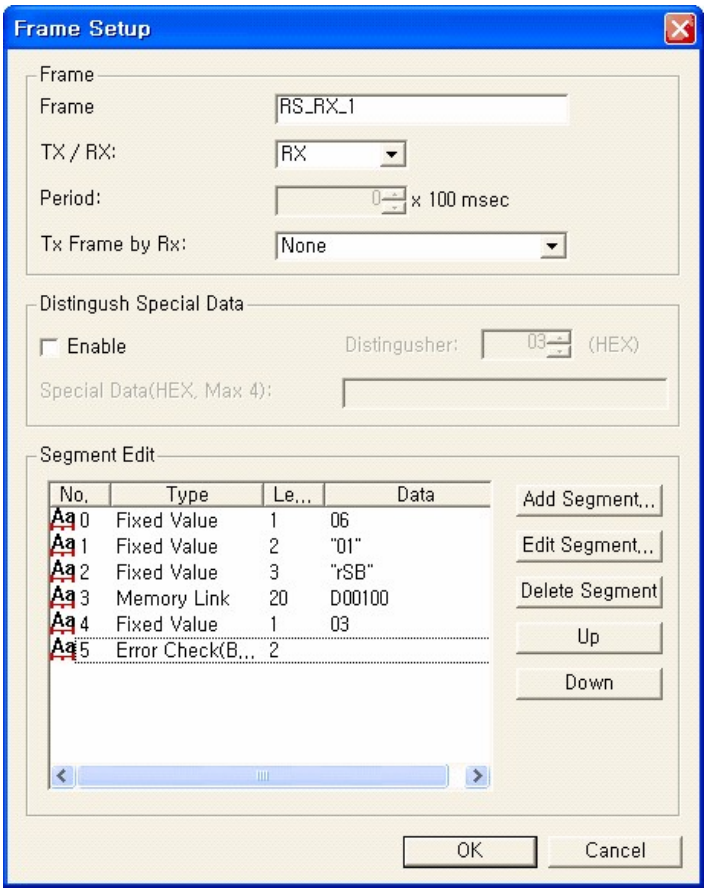
- **Defining a segment (BCC)**



BCC is the ASCII converted value of the least significant 1 byte out of the ASCII value that adds from the header to the tail.
Set as above – 2 byte length, 0 ~ 5 segment, SUM error check, hexadecimal ASCII data conversion.

2. Finishing defining a frame

(Rx frame of the continuous read command for the direct variable)



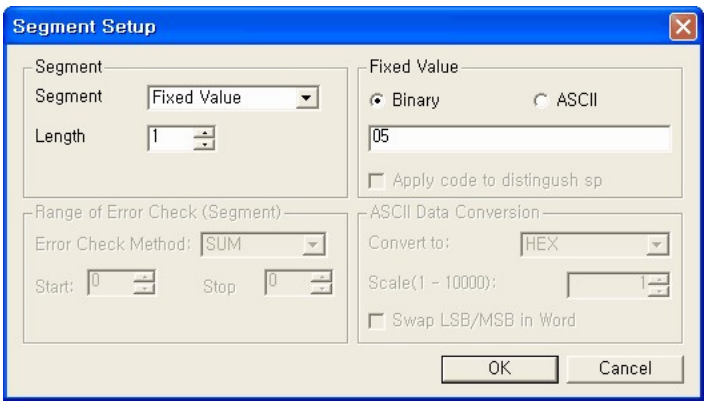
The communication direction is the receiving frame, and set as shown above.

3. Defining a frame

(Tx frame of the continuous read command for the direct variable)

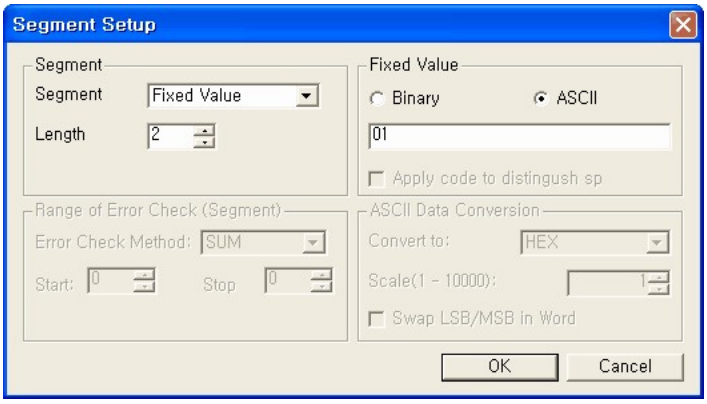
Defines the request frame of the continuous read command for the direct variable.

- **Defining a segment (Header)**



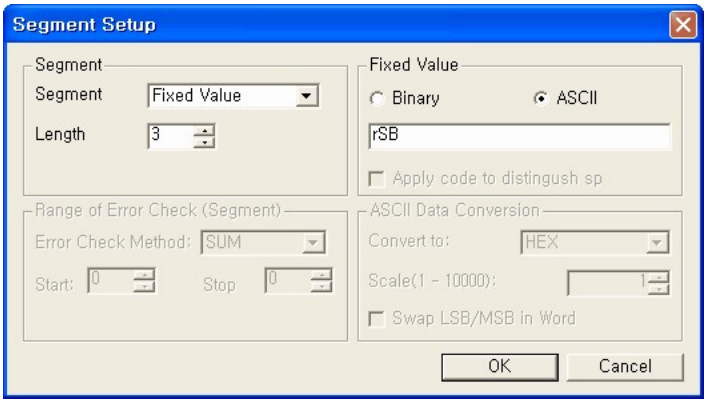
The header of the request frame is ENQ(05H), and set as shown above.

- **Defining a segment (station number)**



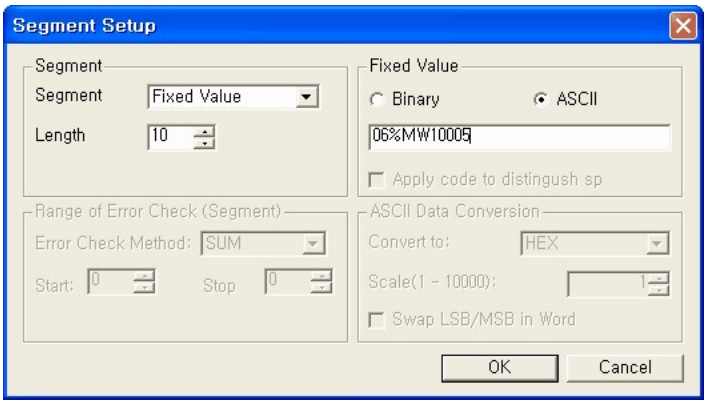
Set the station number as "01"(1).
(See the contents in the "Rx frame of the continuous read command for the direct variable" section.)

- **Defining a segment (command + command type)**



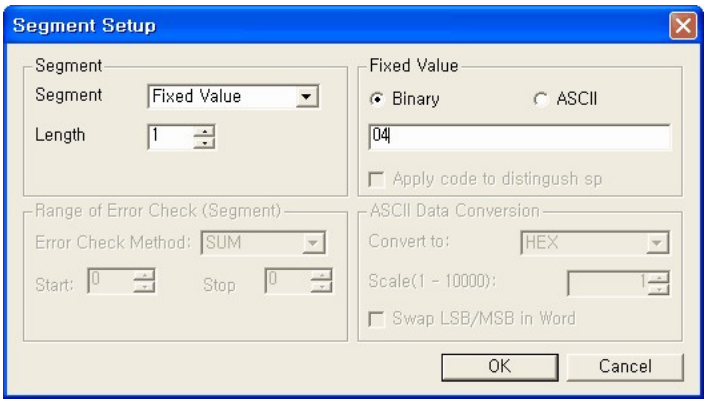
Set continuous read command for the direct variable + command type as "rSB".?
(See the contents in the Rx frame of the continuous read command for the direct variable? section.)

- **Defining a segment (variable length + variable name + number of data)**



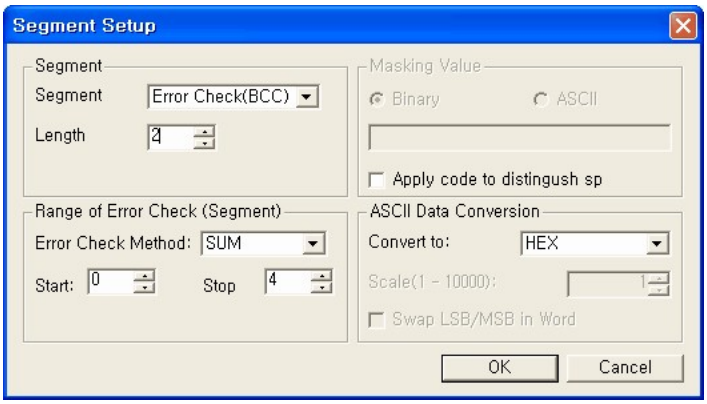
Set the variable length as 6 bytes (06H), and direct variable as "%MW100", and the number of data as 5 words (05H) as shown above. ("06" + "%MW100" + "05")

- **Defining a segment (tail)**



The tail of the request frame is EOT (04H), and set as shown above.

- **Defining a segment (BCC)**

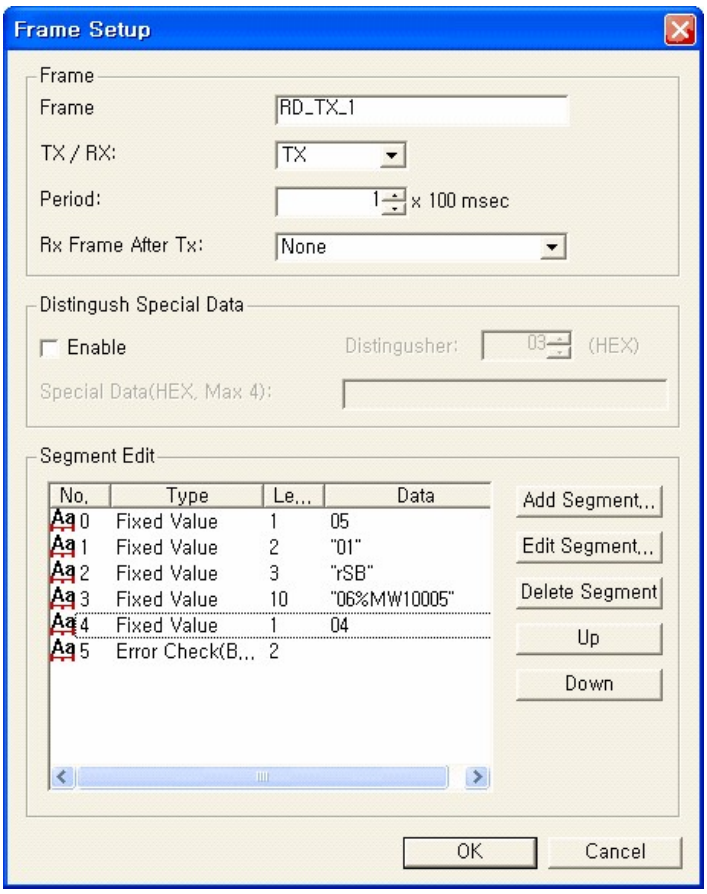


BCC is the ASCII converted value of the least significant 1 byte out of the ASCII value that adds from the header to the tail.

Set as above – 2 byte length, 0 ~ 5 segment, SUM error check, hexadecimal ASCII data conversion.

4. Finishing defining a frame

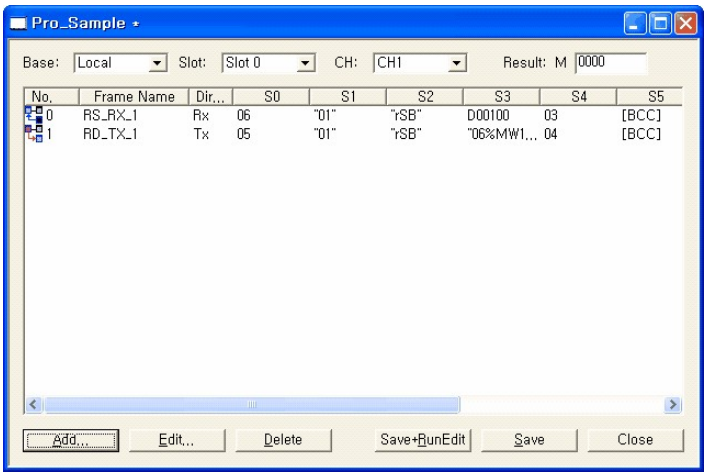
(Tx frame of the continuous read command for the direct variable)



Set the communication direction as sending frame, and communication interval as 100msec, and receiving frame for sending as RD_RX_1 as shown above.

5. Finishing frame registration

(Continuous read request of the direct variable, as receiving the response frame)



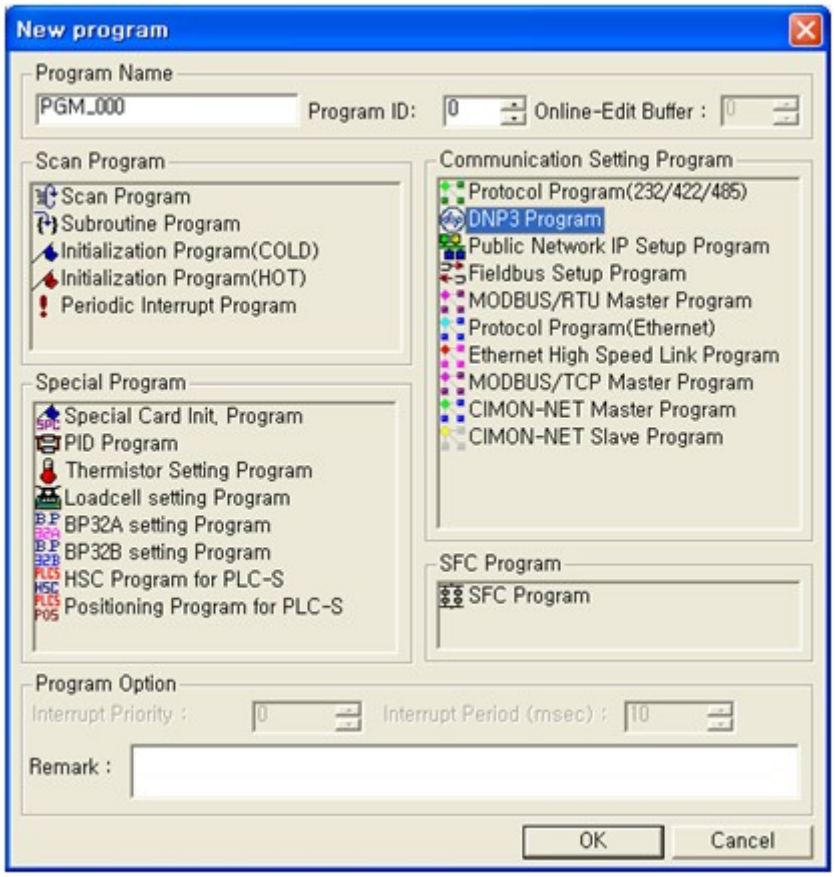
Communication will be established by the protocol program only without the separate scan programming.

4.8.2 DNP3 Program

Connect the device defined in the DNP3 protocol to the PLC device.

Registering the protocol program

Select **"File -> New Program"** menu.



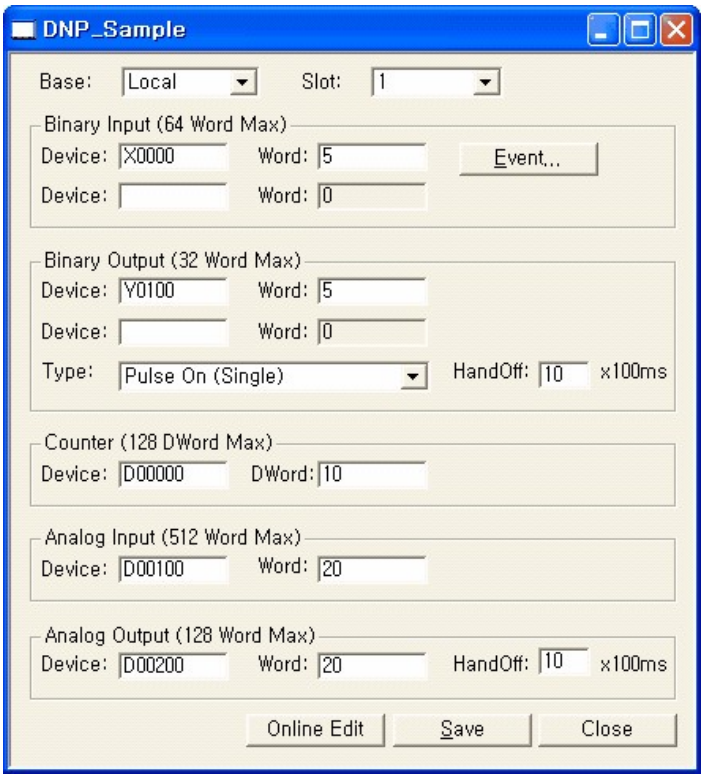
Input **Program Name**, **Program ID**, and **Program Free Space field.**

Click the [OK] button.

Writing a DNP3 program

Example of writing a program :

When setting the DNP communication module device at local base, slot #1.



Set 5 words from X0000 in the **Binary Input** field.

Set 5 words from Y0100 in the **Binary Output** field.

Set **Binary Output type** as Pulse On, and **Hand Off** as 1 second.

Set 20 words from D00000 in the **Counter** field.

Set 20 words from D00100 in the **Analog Input** field.

Set 20 words from D00200 in the **Analog Output** field.

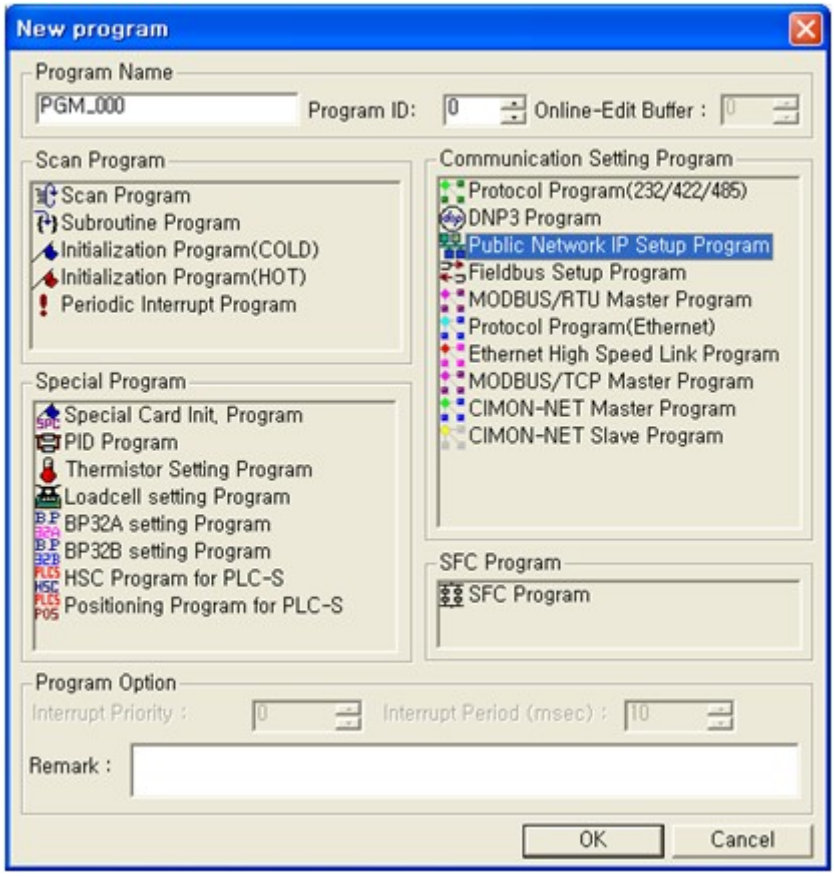
Set **Hand Off** in **Analog Output** as 1 second.

4.8.3 Public Network IP Setting Program

If some PLC links use the common network, register the IP and station number in the common network IP setting program in order to identify the IPs on the network using the station number.

Registering a protocol program

Select **"File -> New Program"** menu.



Input **Program Name**, **Program ID**, and **Program Free Space field**.

Click the [OK] button.

Writing a common network IP setting program

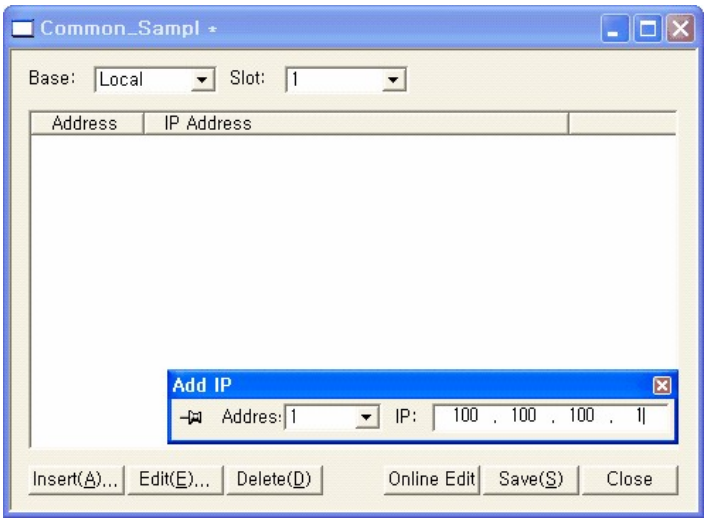
Example of writing a program :

When configuring the common network using the Ethernet module at local base, slot #1.

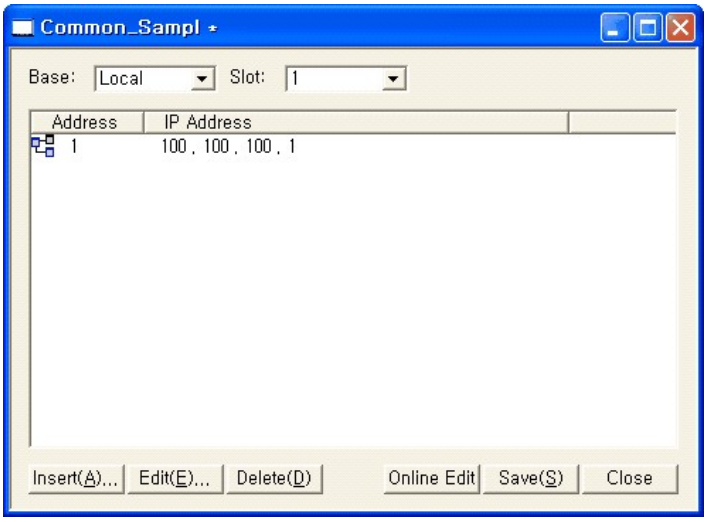
Set the IP address of the mounted module as **"100.100.100.1,"** and set the station number as 1.

Register the IP **"100.100.100.2"** in the station number 2.

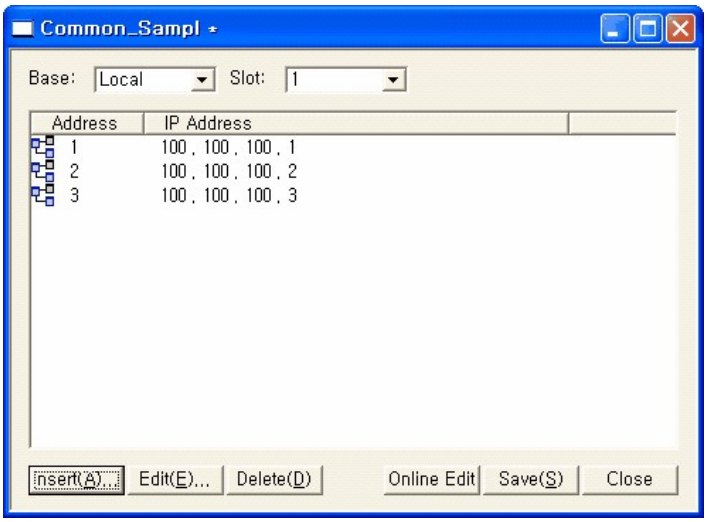
Register the IP **"100.100.100.3"** in the station number 3.



Click the [Insert] button to display the "Add IP" window.
Select the station number (1) in the "Add IP" window, and input the IP address (100.100.100.1) and then, press the **[Enter]** key.



Register the station number 2 and 3 using the same method.

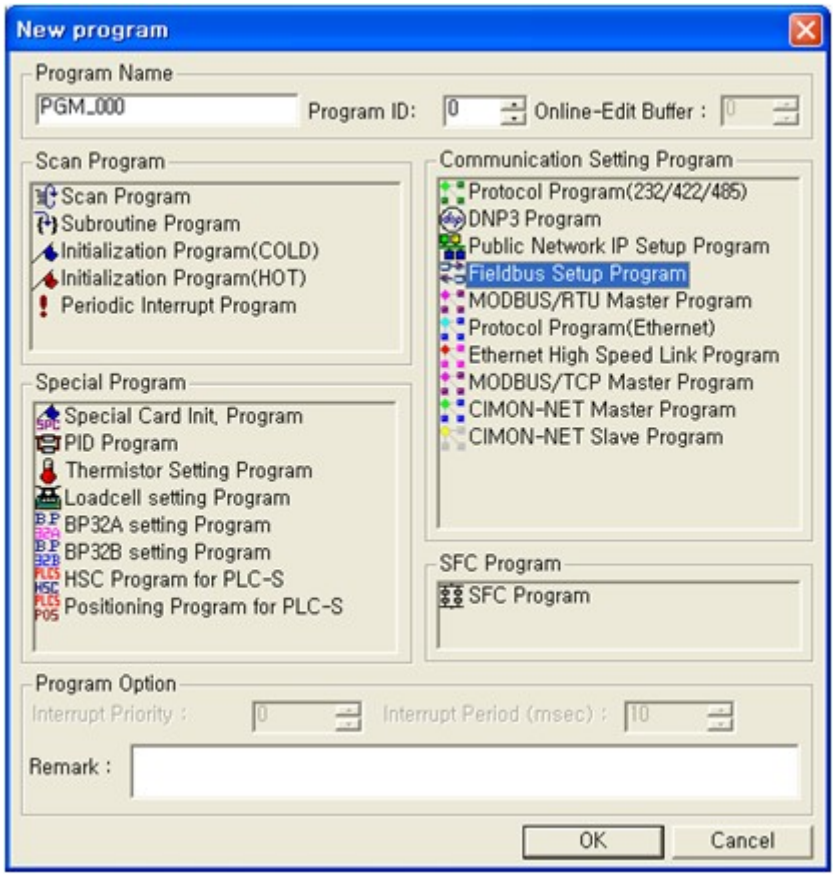


4.8.4 Field Bus Communication Block Setup Program

When controlling the remote I/O using the internal PLC device in the Profibus DP or DeviceNet Master module, set the I/O area using the field bus communication block setting program.

Registering a protocol program

Select **"File -> New Program"** menu.



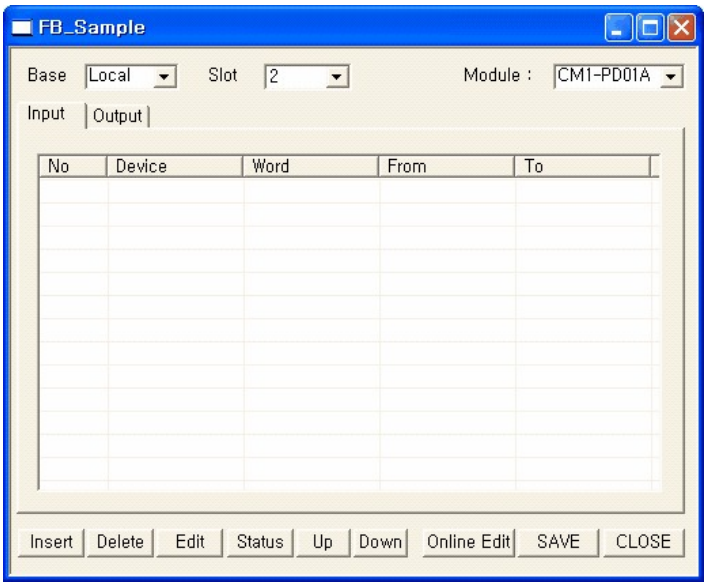
Input **Program Name**, **Program ID**, and **Program Free Space field**.

Click the [OK] button.

Writing a field bus communication block setting program

Example of writing a program :

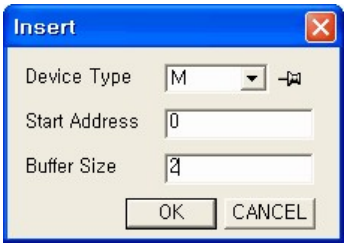
When controlling the remote I/O using the filed bus (PD01A: Profibus DP) master module at local base, slot #2, the number of remote I/O connected to the field bus master is 32 point inputs and 16 point outputs.



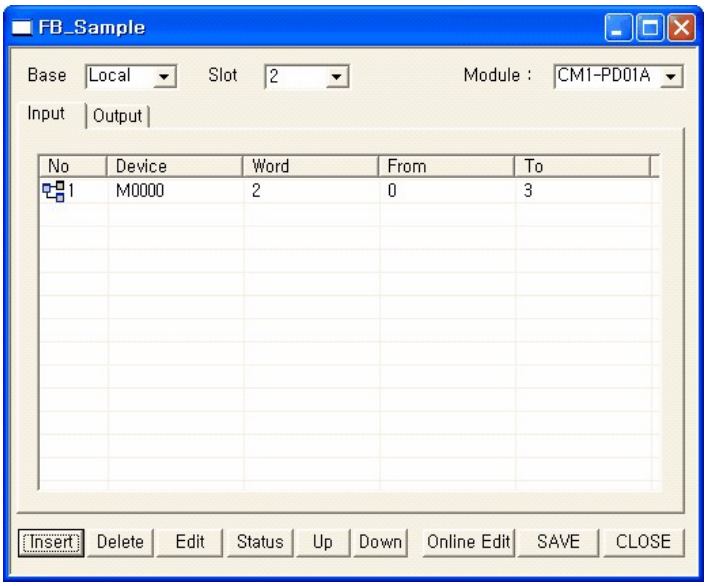
Select local in Base, 2 in Slot, and CM1-PD01A in module type.

When reading the input of the remote I/O as much as 2 words (32 bit) from M0000.

Select the [Input] tab. Click the [Insert] button.

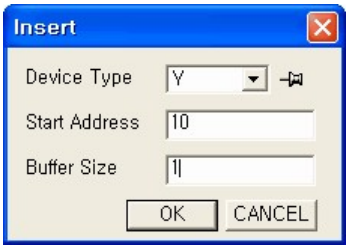


Select M as Device, 0 as Starting Address, and 2 as Buffer Size. Click the [OK] button.

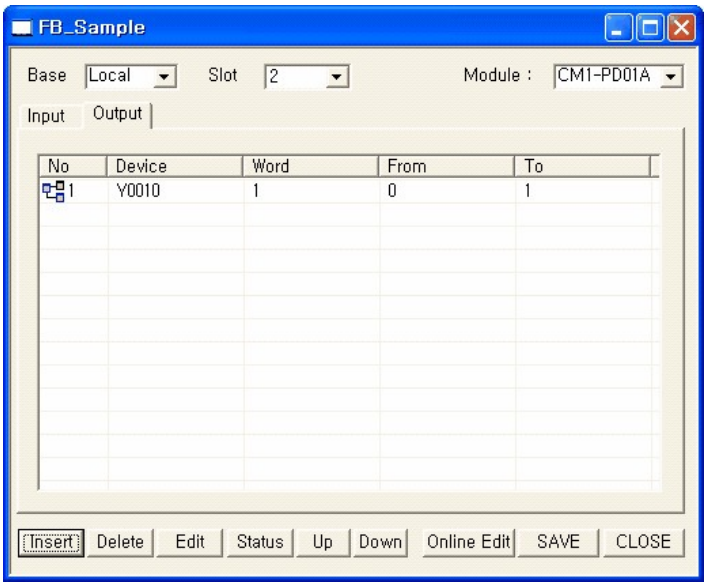


When setting 1 word (16 bit) data from Y0010 as the output of the remote I/O.

Select the [Output] tab. Click the [Insert] button.



Select Y as Device, 10 as Starting Address, and 1 as Buffer Size. Click the [OK] button.

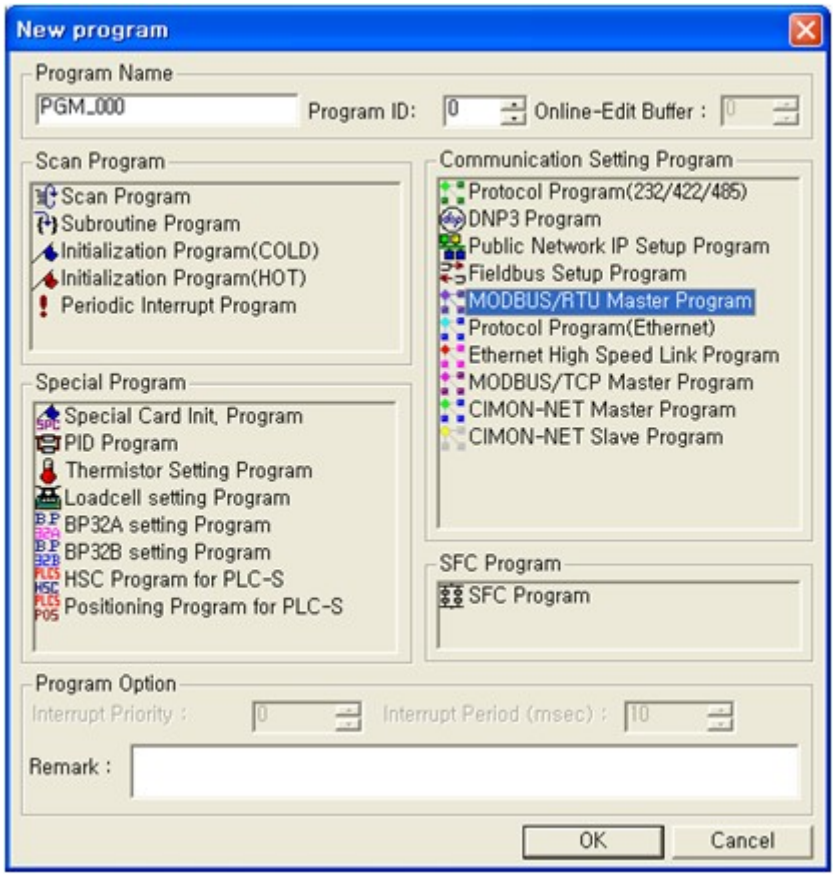


4.8.5 Modbus Master Program

Define the communication block (read/write) using the Modbus master special program, in order to read or write the data from/to the Modbus slave using the serial communication module.

Registering a protocol program

Select **"File -> New Program"** menu.



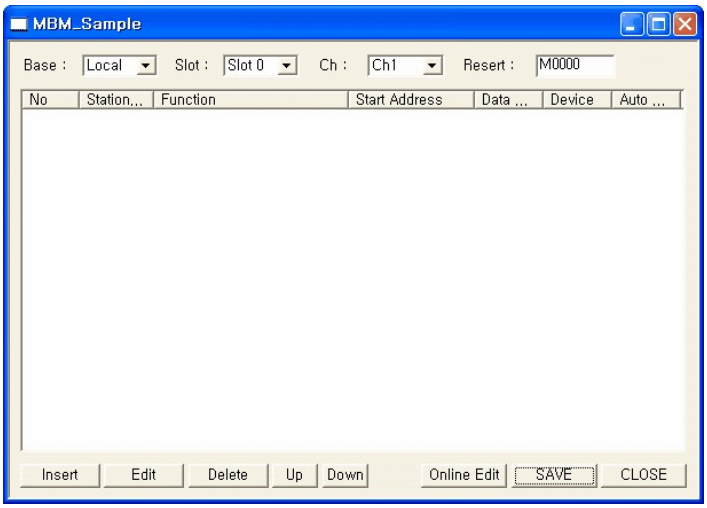
Input **Program Name**, **Program ID**, and **Program Free Space field**.

Click the [OK] button.

Writing a Modbus master special program

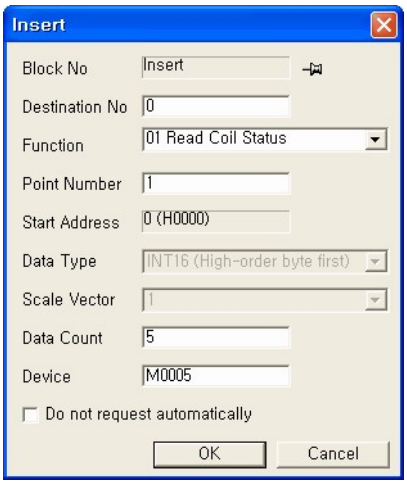
Example of writing a program

When controlling the remote I/O using the filed bus (PD01A: Profibus DP) master module at local base, slot #2, the number of remote I/O connected to the field bus master is 32 point inputs and 16 point outputs.



Communication block that reads 5 data from the coil status (starting address: 0) of the slave (station number: 1), and saves it in 5 bits from M0005.

Click the [Add] button.



Input the **Counterparty's Station Number (1).**

Select the Function **(01 Read Coil Status)**.

Input the Point Number **(1)**. Input the number that is bigger than **Start Address** by 1.

If the data to read is bit, the data type is meaningless.

Input the Number of Data **(5)**.

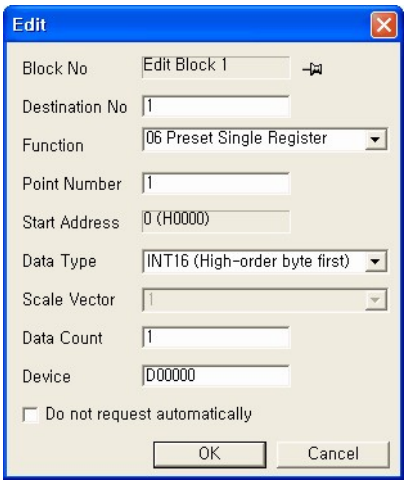
Input the Device **(M0005)**.

If you don't select **"Do not request automatically"** option, the communication block will be automatically processed.

Click the **[OK]** button.

Communication block that writes 4 words from D00000 at the signal register (starting address: 0) of the slave (station number: 1).

Click the [Add] button.



Input the Destination No **(1)**.

Select the Function **(06 Preset Single Register)**.

Input the Point Number **(1)**. Input the number that is bigger than Start Address by 0.

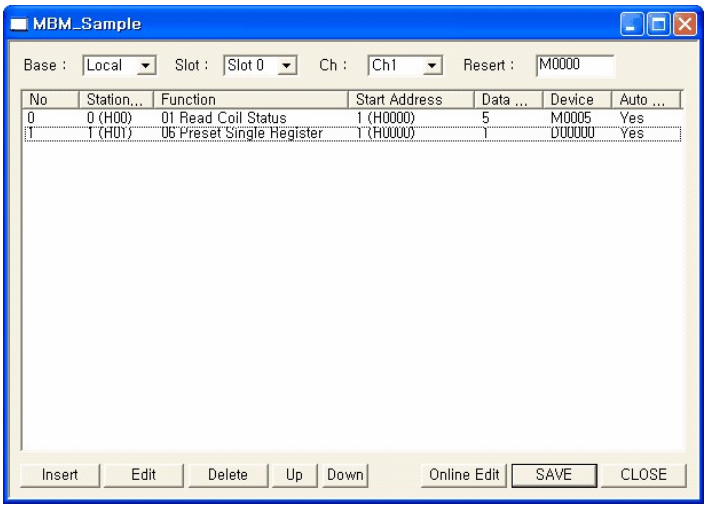
Select the Data Type **(INT16:High order byte first)**.

Input the Data Count **(1)**.

Input the Device **(D00000)**.

If you don't select **"Do not request automatically"** option, the communication block will be automatically processed.

Click the **[OK]** button.



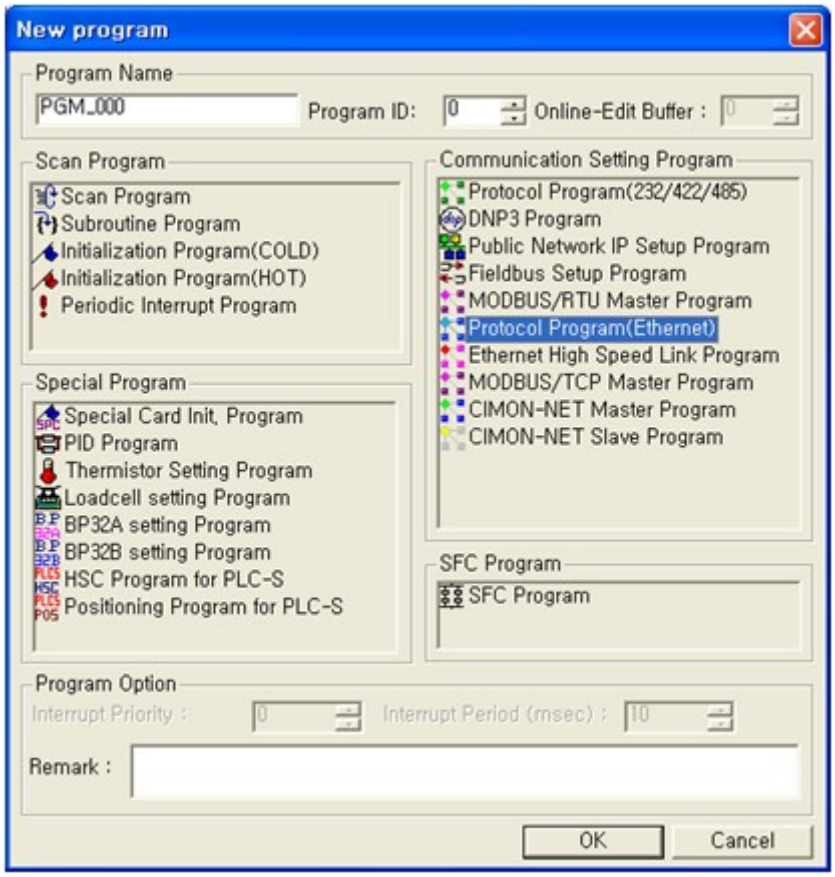
You can change the block location using the Up (Up) or Down (Down) button.

4.8.6 Ethernet Protocol Program

Special program that enables the user to define the communication frame of the Ethernet communication module.

Registering a protocol program

Select **"File -> New Program"** menu.



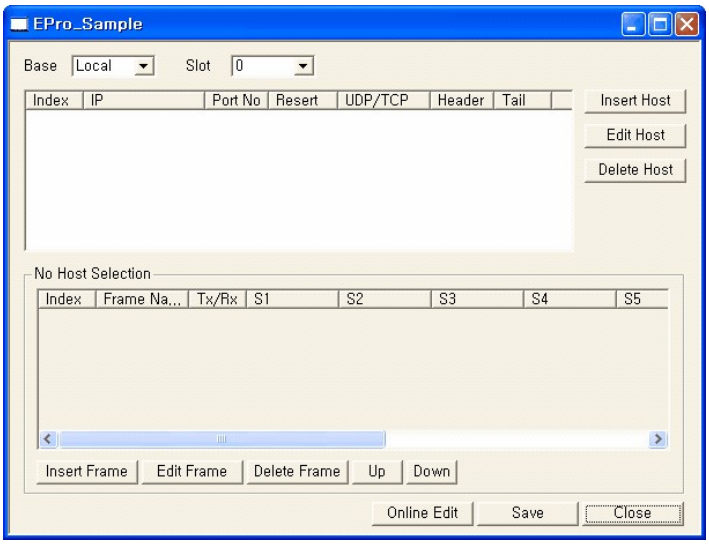
Input **Program Name**, **Program ID**, and **Program Free Space field**.

Click the [OK] button.

Composing protocol program

Example of writing a program

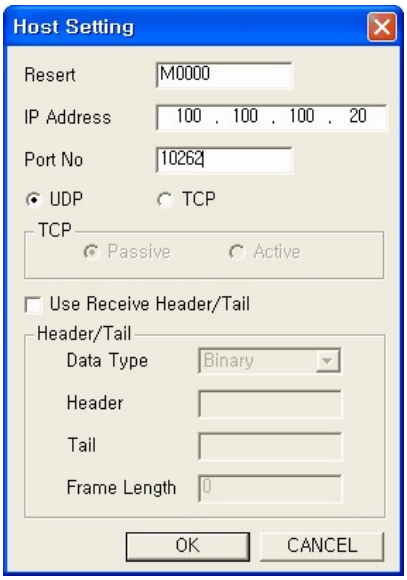
The example program reads 5 words from D00100 of the counterparty's CIMON PLC (100.100.100.20) using the dedicated service, and saves it in 5 words from D00100 of CIMON PLC. Communication is established using the Ethernet communication module mounted in local base, slot #0.



1. Registering a host

Registers the PLC Ethernet card to read the data.

Click the [Add Host] button.



Input the device **(M0000)** to save the Communication Result.

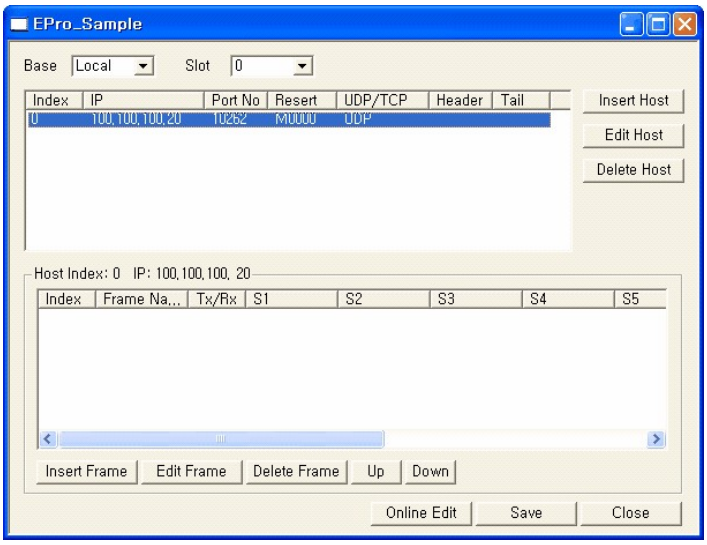
Input the counterparty's IP **(100.100.100.20)**.

Input the Port Number **(10262)** to use for communication. The port number in the dedicated service uses TCP (10260) and UDP (10262).

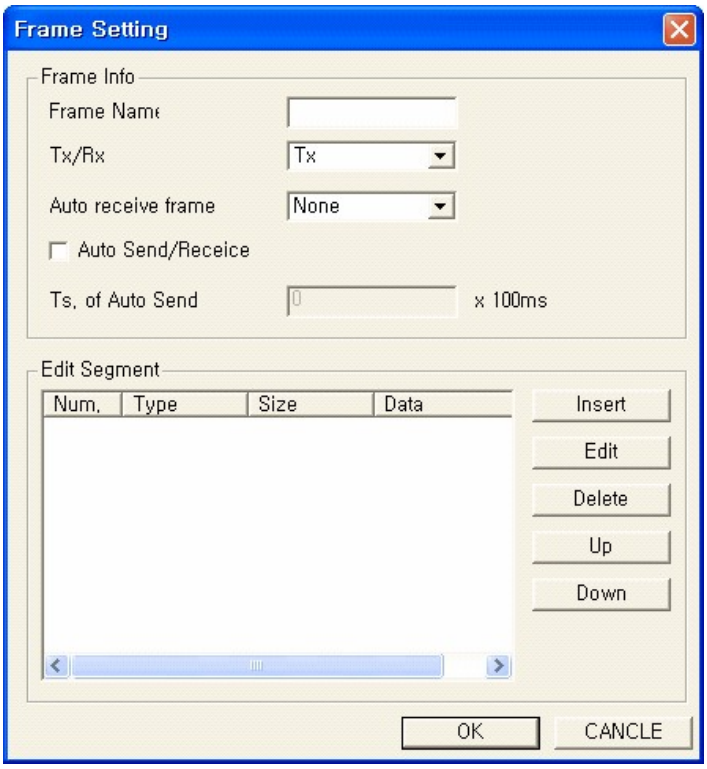
Select "**UDP**".

Click the **[OK]** button.

Receive Header/Tail is used if the entire frame has the header and tail but received after split. All frames are combined from the time when a header is received to the one when a tail is received, and it is processed as a frame (request or response).



2. Registering a frame



Select a host and click the [Add Frame] button, the Define Frame window will appear.

[Input the setting items.]

- **Frame name:** Name to separate the frame.
- **Tx/Rx:** Sets the communication direction – sending or receiving.
- **Auto Send/Receive:** Sending frames will be automatically sent at the specified interval.
- **Ts. Of Auto Send:** Specifies the frame that corresponds to the response.

[Functions related with segment editing]

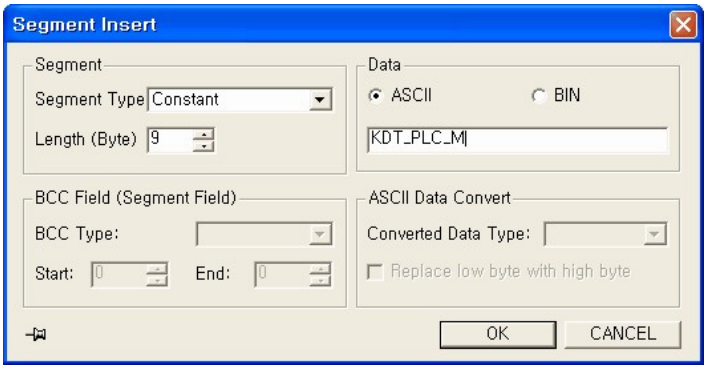
- **Insert:** Defines and adds a new segment.
- **Edit:** Edits the registered segment details.

3. Defining a frame

(Rx frame for the Word Block Read command)

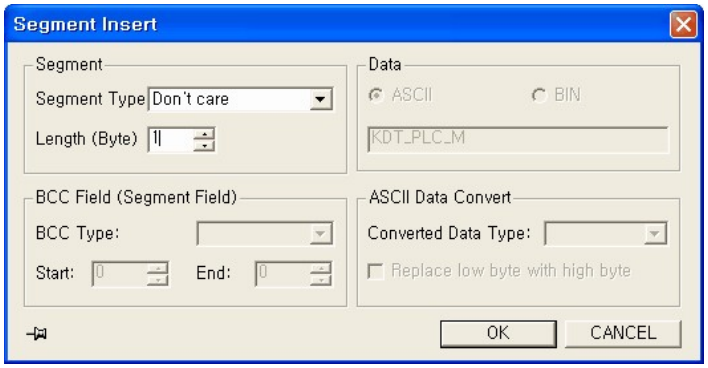
Defines the frame contents to interpret the response frame against the Word Block Read request frame of CIMON PLC.

- **Defining a segment (ID)**



Sets the ID in the protocol.
The ID for the dedicated service is "KDT_PLC_M", and set as shown above.

- **Defining a segment (Frame No.)**



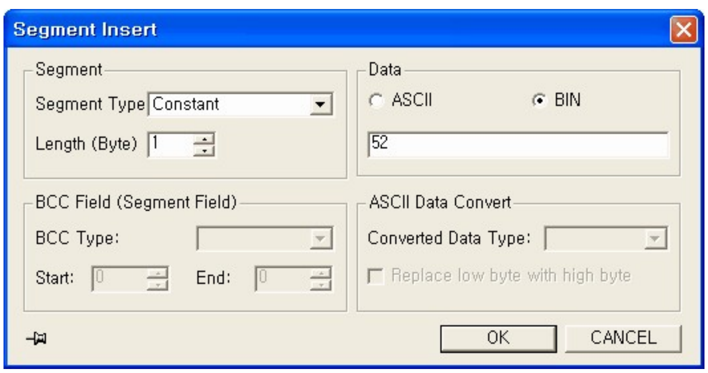
Set the frame number area in the protocol.

Select "Don’t care" for the segment type since it is not related with the data. The area designated as 뫮on’t care?will not be

compared.

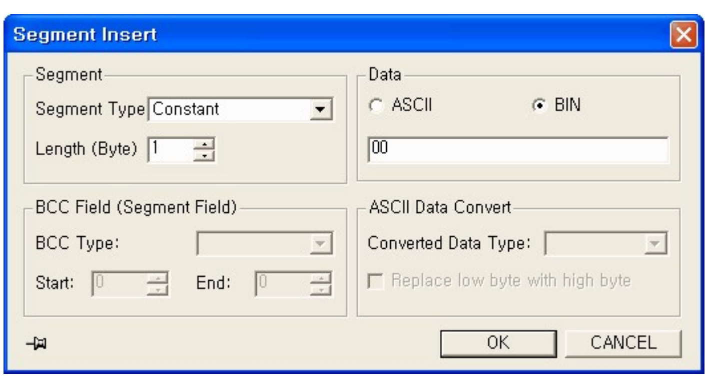
Length is 1 bytes, and set as shown above.

- **Defining a segment (Cmd)**



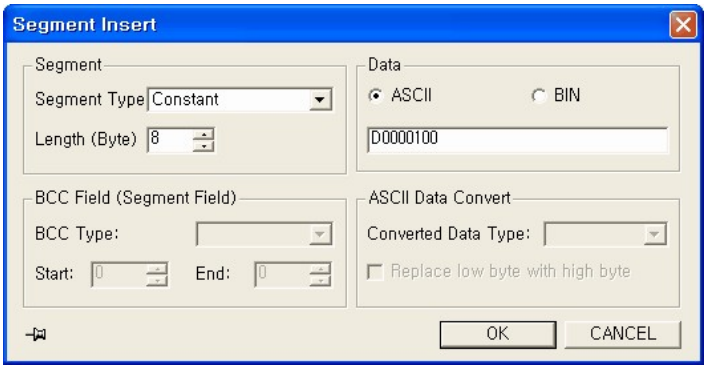
The command of the ACK response against Word Block Read is 52h, and set as shown above.

- **Defining a segment (Res: Reserved area 00h)**



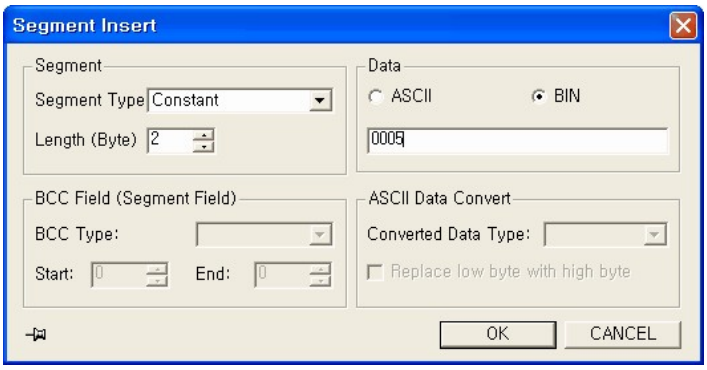
The reserved area is 00h, and set as shown above.

- **Defining a segment (Data area: Requesting device)**



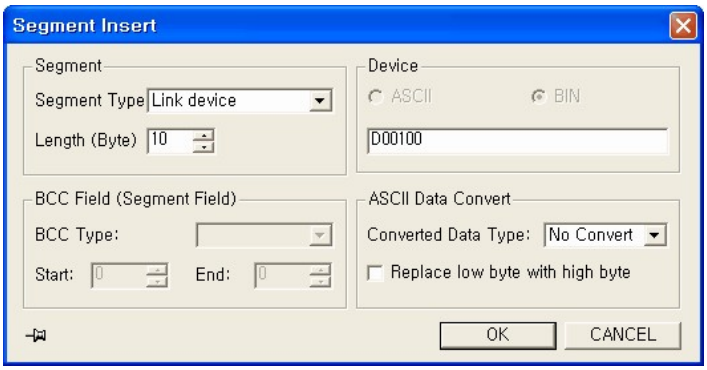
Since 5 words data from D00100 is requested, the requesting device of the response frame is received as D001000. Set as shown above.

- **Defining a segment (Data area: Number of requesting data)**



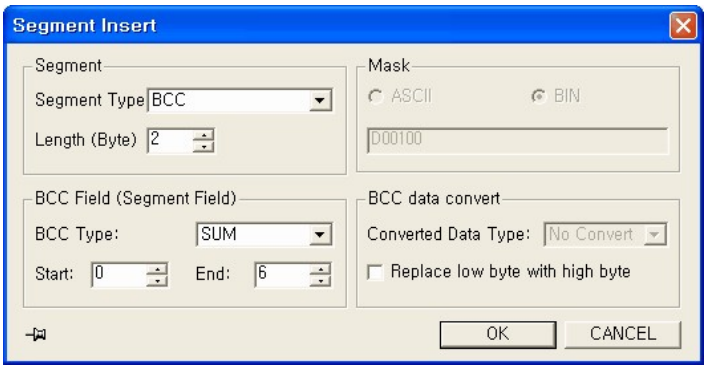
The number of requesting data is received as 005h since 5 data is requested. Set as shown above.

- **Defining a segment (Data area: Receiving data)**



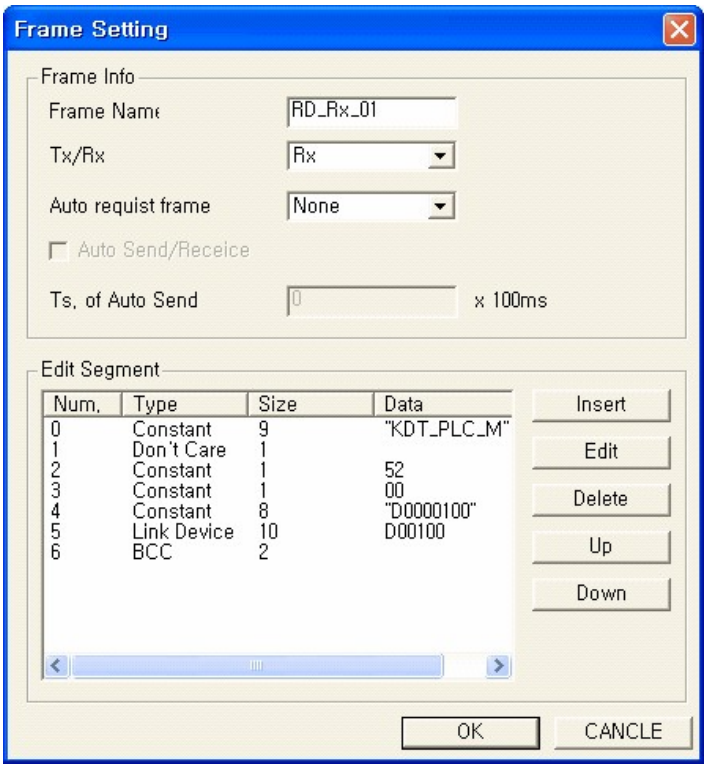
Set as shown above in order to save the received data in D00100 sequentially, since the requested data is received by the order.

- **Defining a segment (Check Sum)**



The checksum area is the entire frame area, and set as shown above.

4. **Finishing defining a frame** (Rx frame for Word Block Read)



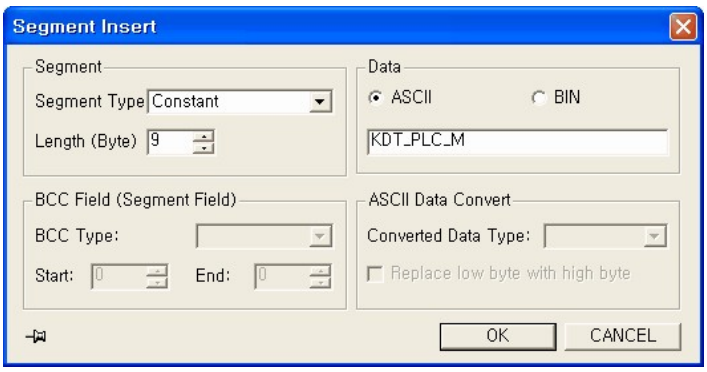
The communication direction is the receiving frame, and set as shown above.

5. Defining a frame

(Word Block Read Tx frame)

Defines the request frame for Word Block Read.

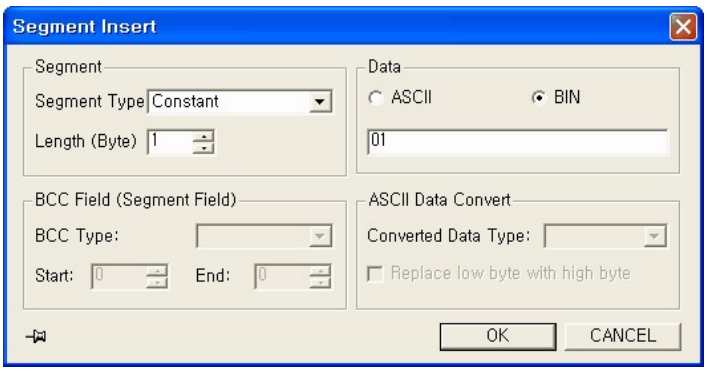
- **Defining a segment (ID)**



Sets the ID in the protocol.

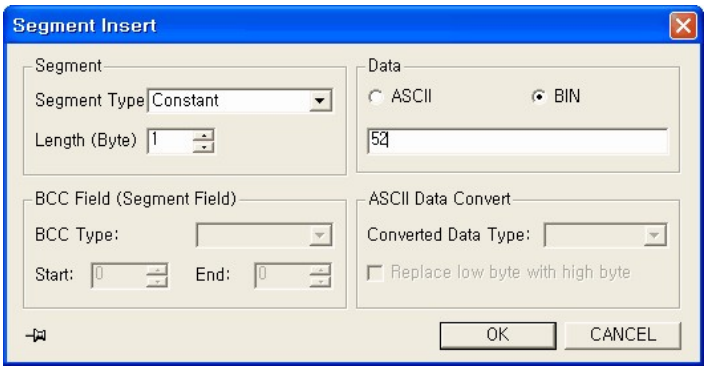
The ID for the dedicated service is "KDT_PLC_M", and set as shown above.

- **Defining a segment (Frame No.)**



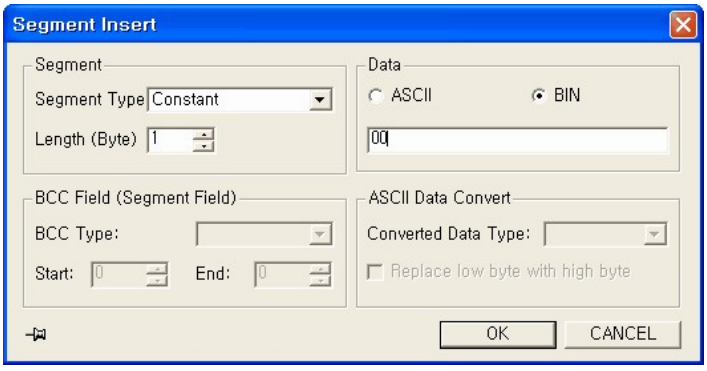
Set the frame number area in the protocol.
Length is 1 bytes, and set as shown above.

- **Defining a segment (Cmd)**



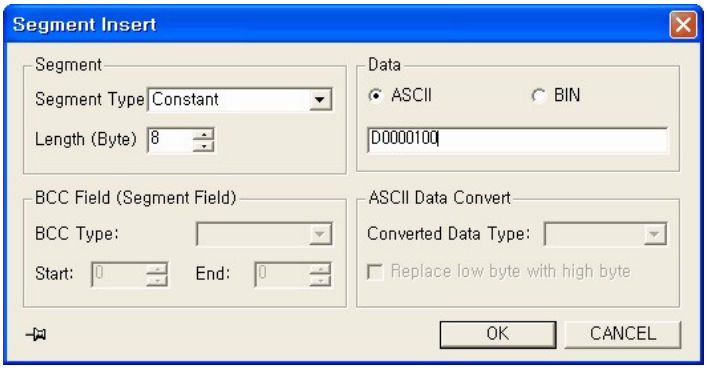
The command of the ACK response against Word Block Read is 52h, and set as shown above

- **Defining a segment (Res: Reserved area 00h)**



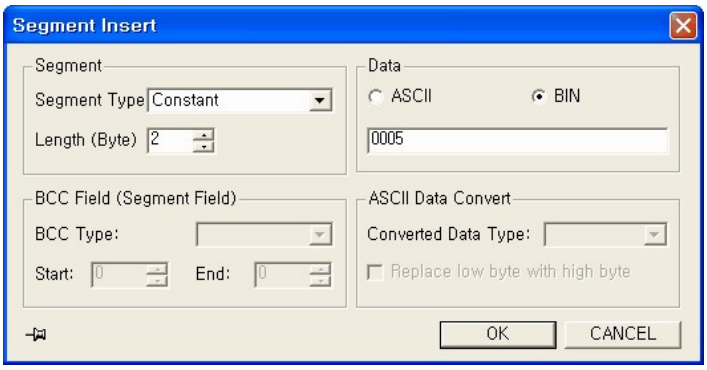
The reserved area is 00h, and set as shown above.

- **Defining a segment (Data area: Requesting device)**



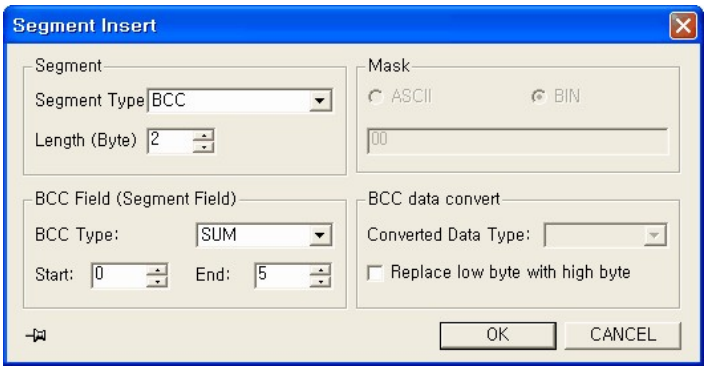
Since 5 words data from D00100 is requested, the requesting device of the response frame is received as D001000. Set as shown above.

- **Defining a segment (Data area: Number of requesting data)**



The number of requesting data is received as 005h since 5 data is requested. Set as shown above.

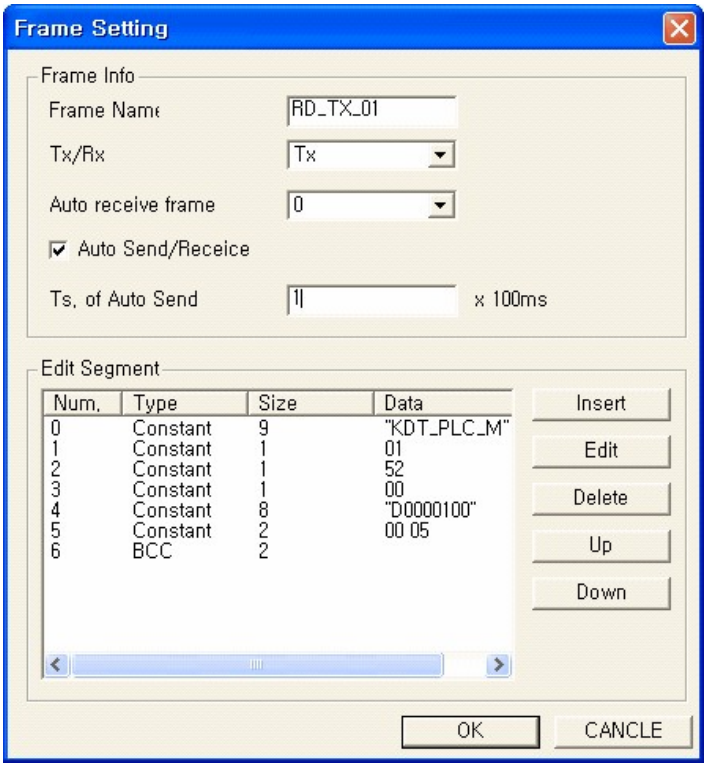
- **Defining a segment (Check Sum)**



The checksum area is the entire frame area, and set as shown above.

6. Finishing frame registration

(Tx frame for Word Block Read)



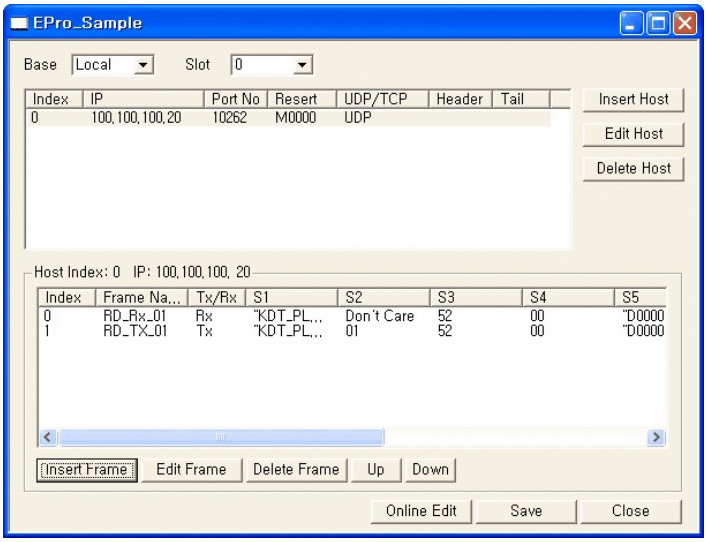
Set the Communication Direction as the sending frame.

Set the Automatic Receiving Frame after Sending so that the system automatically waits for receiving of the specified frame (0) after sending.

Set the Automatic Sending Interval as 0.1 second so that communication is established at every 0.1 second.

7. Finishing frame registration

(Word Block Read request and response frame receiving)



Communication will be established by the protocol program only without the separate scan programming.

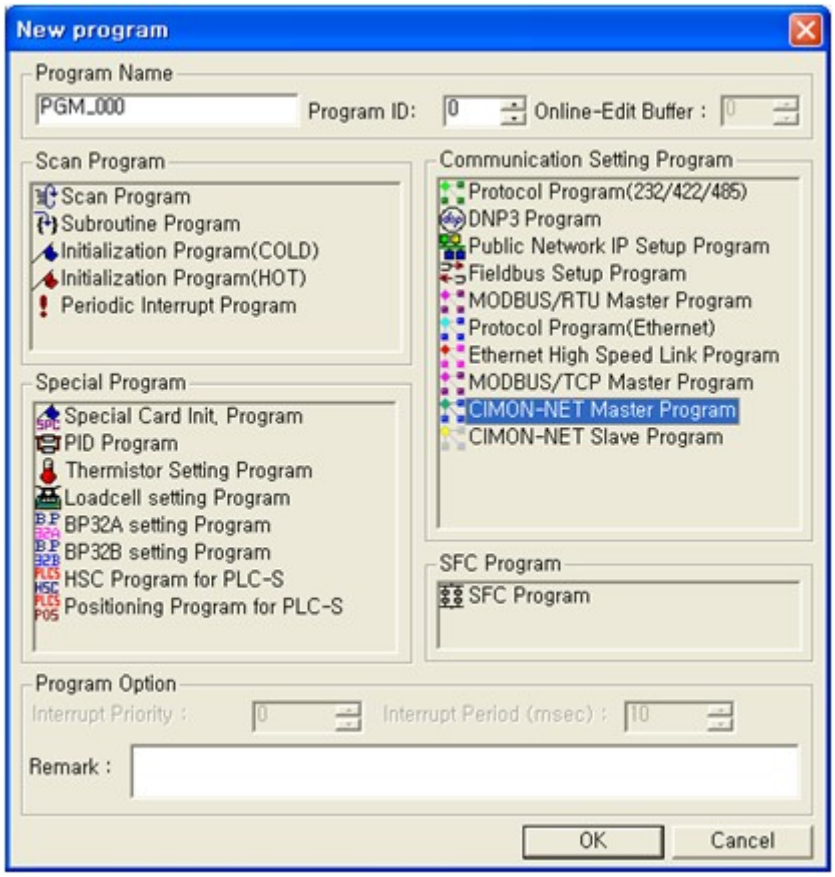
4.8.7 CIMONNET Communication Block Setup Program

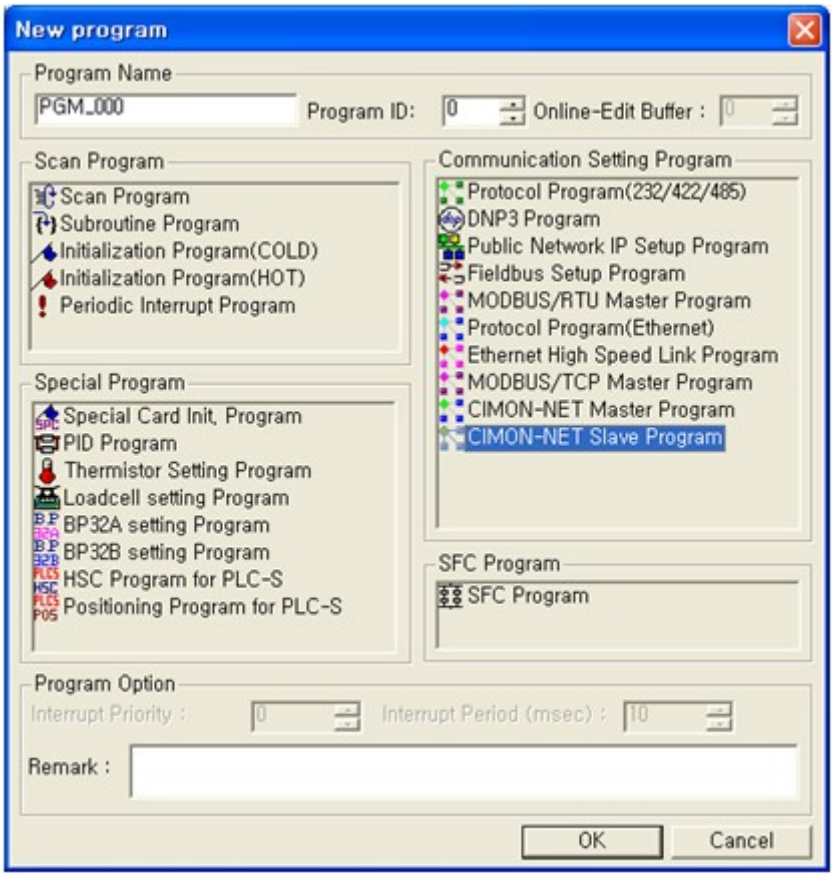
This service is to exchange data between CIMONPLCs.

An CIMON-NET Master Module(CM1-CN01M) and CIMON-NET Slave Module(CM1-CN01S) is used

Registering a protocol program

Select File->New Program menu



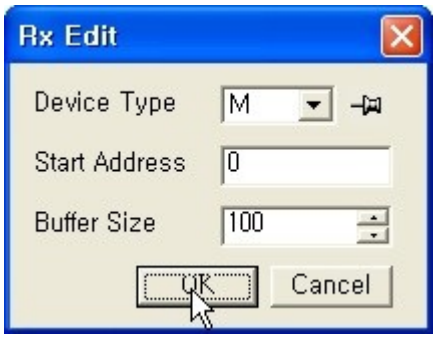


Input Program Name, Program ID, and Program free space field.
Click the [OK] button…

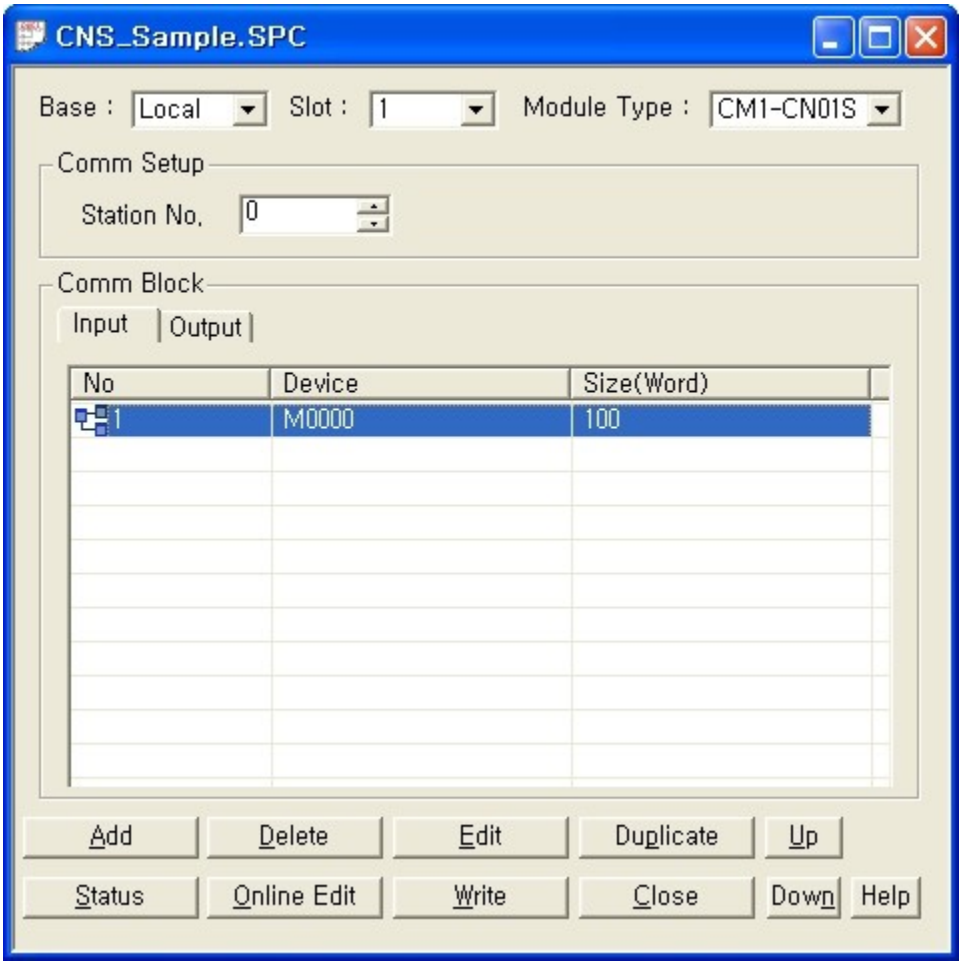
Writing a CIMON-NET Communication Block Setting Program

Example of writing a program.
Select Local as Base, 1 as Slot, CM1-CN01S as Module Type, and 0 as Station No.
Input : When sending the 100 words data from M0000 to the Master module.
Output : When storing the 50 words data from D00100 from the Master module.

-Input
Select the [Input] tab
Click the [Add] button



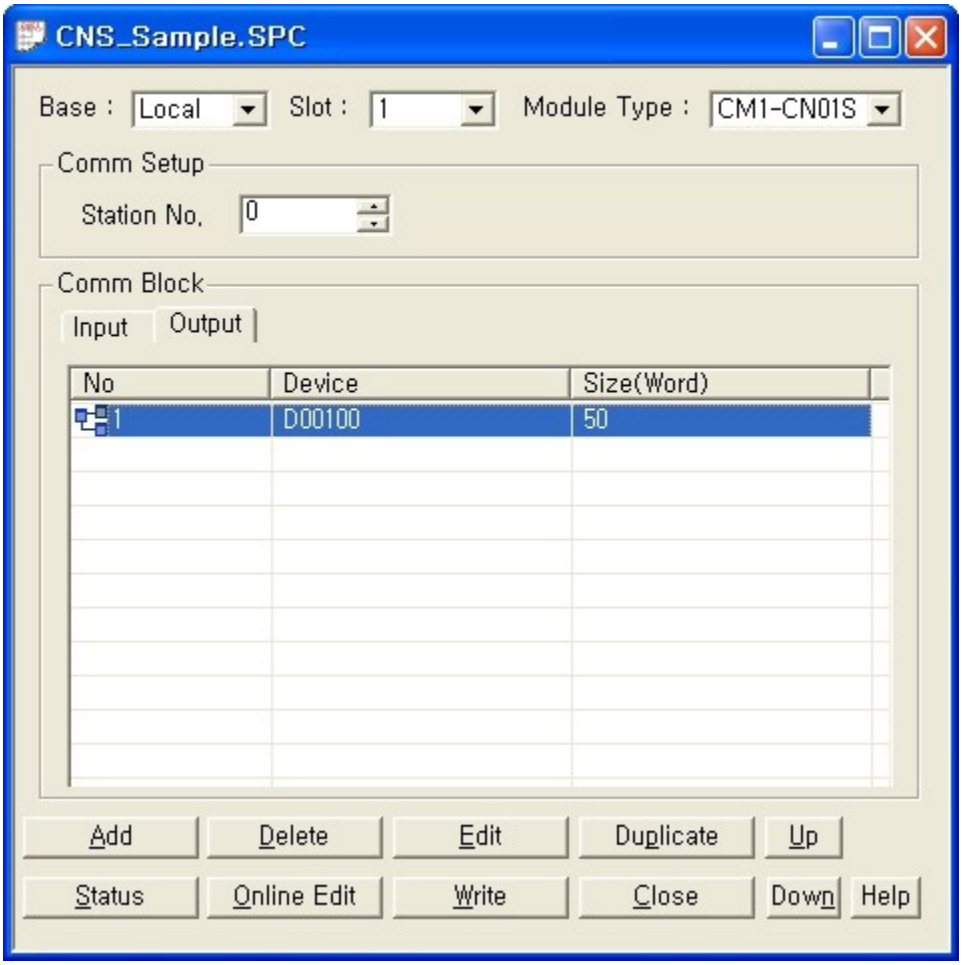
Select M as Device Type, 0 as Start Address, and 100 as Buffer Size.
Click the [OK] button…



-Output

Select the [Output] tab.
Click the [Add] button…

Select D as Device Type, 100 as Start Address, and 50 as Buffer Size.
Click the [OK] button…



Click the [Write] button…

4.9 Special Program

Contents :

- Special Card Init. Program

- PID Special Program
- Thermistor setting Program
- Loadcell setting Program
- HSC Program for PLC-S
- Positioning Program for PLC-S
- IO Input Filter Setting Program

4.9.1 Special Card Init. Program

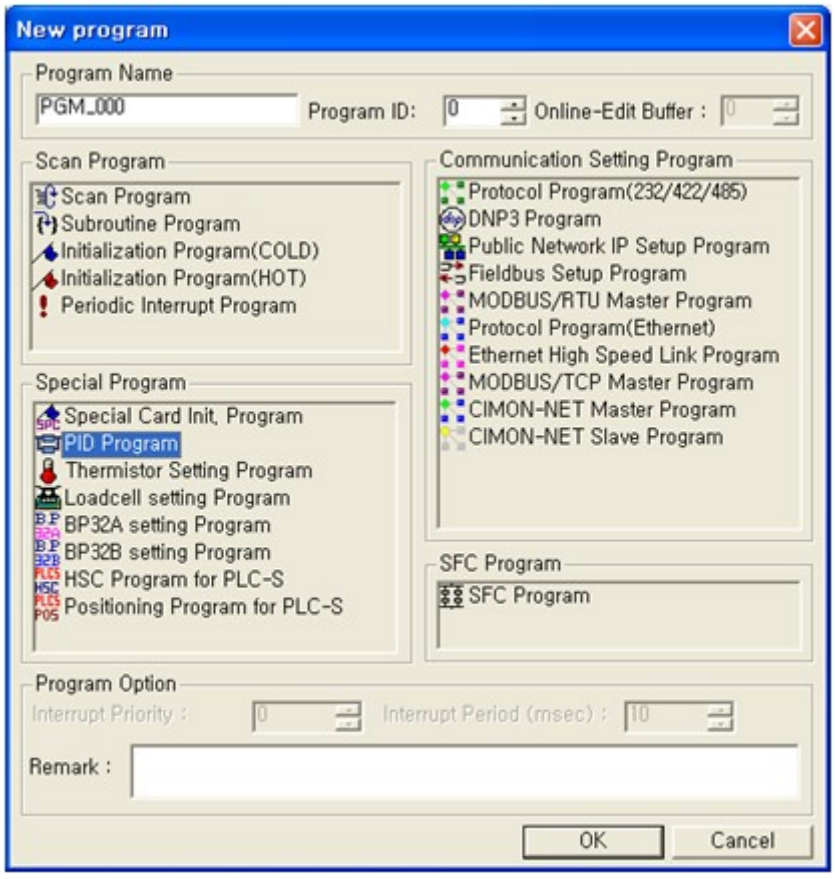
Enter topic text here.

4.9.2 PID Special Program

The PID special program is designed to conveniently use the PID operation function, which is the CPU built-in function.

Registering the PID program

Select **"File -> New Program"** menu.

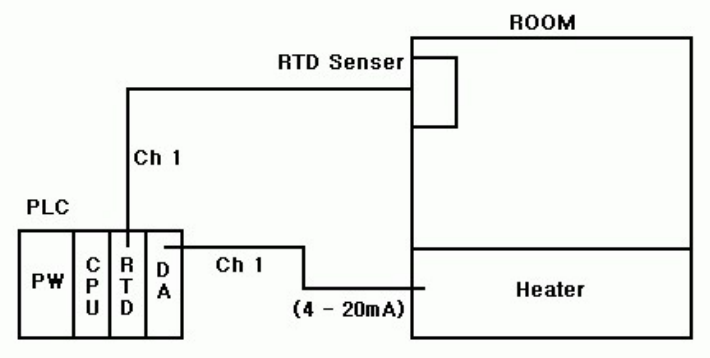


Input Program **Name**, **Program ID**, and **For Run Edit(step)**.

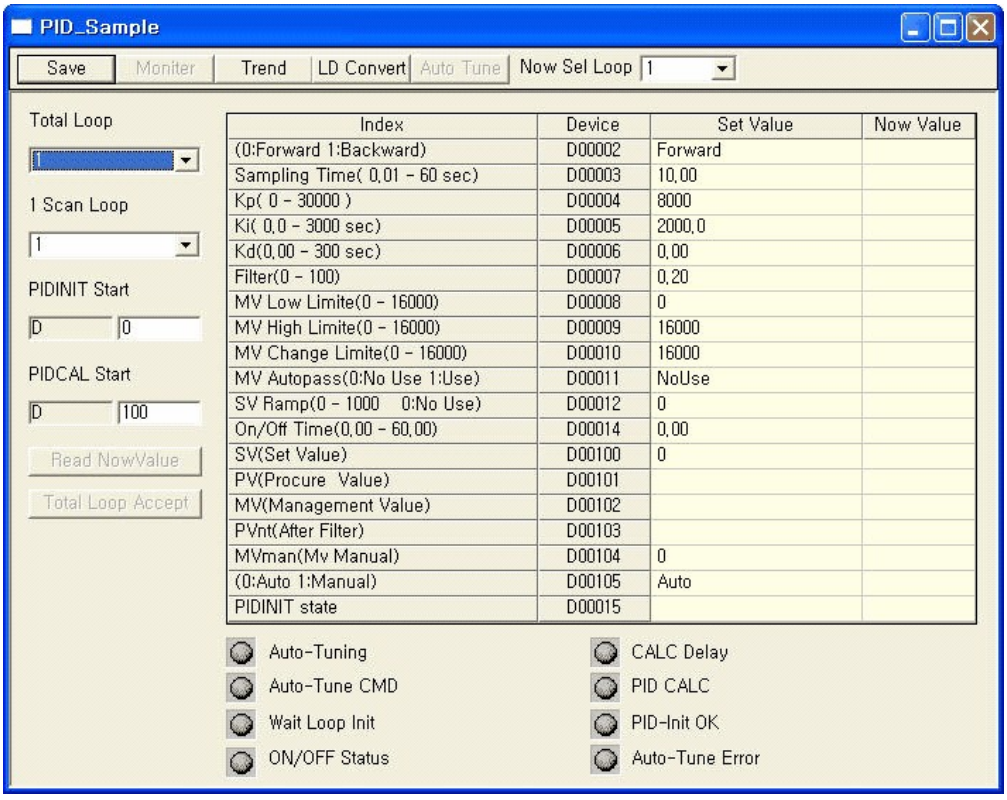
Click the **[OK]** button.

Writing a PID program

Example of writing a program : Configuration diagram of the control system



This sample program takes measurement of the temperature inside a room using the RTD sensor, and controls 4 – 20mA output to keep the room temperature as settings. Temperature is measure using the channel 1 of the RTD module, and the output is controlled using the channel 1 of the DA card.



Number of entire loop(Total Loop)

Sets the number of loops that execute PID operation.
One PID operation loop should be used to control one controlling object. Up to 32 controlling objects can be set. Set "1" since there is only 1 controlling object. (1 ~ 32)

Number of execution loops for 1 scan(1 Scan Loop)

Sets the **number of execution loops in 1 scan** when there are several loops.
Set "1" as the **number of execution loops for 1 scan** since the number of entire loop is 1.

PIDINIT starting area(PIDINIT Start)

Parameters to be referred by **PIDINIT** command are saved from the specified area. The first loop uses 22 loops including the number of entire loop and execution loops for 1 scan. From second loop, 20 words area is used whenever a new loop is added. In the above figure, D00000 ~ D00021 area is set for the PIDINIT parameter area.

PIDCAL starting area(PIDCAL Start)

Parameters to be referred by **PIDCAL** command and **PIDCAL** result value are saved from the specified area. 20 words area is additionally used whenever a new loop is added. In the above figure, D00100 ~ D00119 area is set for the PIDCAL parameter area. Be careful that the area overlaps the PIDINIT area.

Current loop(Now Sel LooPp)

Select the loop to edit or monitor among the entire loop.
"1" is set for the current loop field since there is one loop.

Select operation formula (0: Forward operation, 1: Reverse operation)

- **Forward operation:** Operation that makes the measurement value to be close to the target value by outputting the movement volume (MV), if the measurement value (PV) is **smaller** than the target value (SV). Heating operation belongs to this operation type.

- **Reverse operation:** Operation that makes the PV to be close to the target value by outputting the MV, if the PV is **greater** than the SV. Cooling operation belongs to this operation type.

Select Forward operation (0) since heating is currently controlled.

Sampling time

Sets the interval of executing PID operation. The interval should be set shorter for the system that the measurement value instantly responds to output variation.
Since it is set to 1 second in the above example, PID operation is performed at 1 second interval and the MV changes. (0.01 ~ 60)

Proportional integer (Kp)

Constant value that is multiplies by the deviation (Sv –Pv) in the proportional operation "**Mv = Kp * (Sv – Pv)**", which performs proportional operation of PID control.
If the proportional integer (kp) is greater in the above formula, the PV reaches the SV faster. However, if this value is too big, it can negatively affects stabilized control due to vibration.
In the above example, this value is set to 8000. It should be adjusted according to the system while running the program. (0.01 ~ 100)

Integral integer (Ki)

The integral operation **"Mv = P * E + P * 1/Ki *∑Edt"** adds/deducts the deviation value to/from the manipulation value depending on the time in order to remove the deviation, if the difference (E) occurs between Sv and Pv. (0.0 ~ 3000)
Proportional operation for the small difference does not significantly affect the change of the manipulation value. Therefore, perform integral operation to obtain the difference removal effect.
In the above example, this value is set to 2000. It should be adjusted according to the system while running the program, like the proportional integer.

Differential integer (Kd)

The differential operation **"Mv = Kp * E + Kp * dE/dt"** suppresses occurrence of the difference by computing the manipulation value that is proportional to speed change, in order to remove the difference if it occurs due to the change of Sv or disturbance.
Differential time or differential integer is the time that the manipulation value of differential operation becomes that of proportional operation since occurrence of the difference by differential operation.
In the above example, this value is set to 0, which means no differential operation control. (0.00 ~ 300)

Filter coefficient (Filter)

Sets the extent that the filter effect is applied for the measurement value (PV) that is entered from the A/D card. (0.00 ~ 1)

Lower limit of MV (MV Low Limite)

Sets the lower limit of the MV that is calculated by PID operation at the time of automatic PID operation.
If the MV is smaller than the lower MV limit (MVLL), the MVLL will be applied as the MV.
In the above example, the MVLL is set to 0. Therefore, the MV smaller than 0 will not be displayed in the automatic operation mode. (0 ~ 16000)

Upper limit of MV (MV High Limite)

Sets the upper limit of the MV that is calculated by PID operation at the time of automatic PID operation.
If the MV is greater than the lower MV limit (MVLL), the MVLL will be applied as the MV.
In the above example, the MVLL is set to 16000. Therefore, the MV bigger than 16000 will not be displayed in the automatic operation mode. (0 ~ 16000)

Variation ratio limitation of MV (MV Change Limite)

The value set in this field will be applied, if MV variation is bigger than the variation ration limitation of MV, when compares MV of the previous scan with that of this scan. (0 ~ 16000)
In the above example, the variation ration limitation of MV is set to 6000. Therefore, the variation amount will be set to 6000 if the operation result is bigger than 6000.

Automatic MV transfer (0: Use, 1: No use)

- **Use:** If the user changes the PID control mode from automatic to manual, the MV calculated in the automatic mode will be applied to the manual MV (MVman).
- **No use:** The value set as MVman will be applied to the MV in the manual mode.

In the above example, this field is set to Use (1), MVman is equal to MV in the automatic operation mode.

SV ramp (0: No use, 1~1000)

To suppress occurrence of overshoot due to abrupt change of the Sv, and control stably, if the Sv is changed, the change is divided into the setting stage, and applied incrementally by increasing/decreasing it by the sampling interval (Ts).
If set to ?00" and Sv changes, Sv is incrementally applied internally at the interval of Ts (sampling interval: 1 second), and it reaches the modified setting value after (Sv slope function: 100)*Ts (time).
In the above example, it is set to ?". Therefore, this function will be
disabled.

ON/OFF control time(On/Off time)

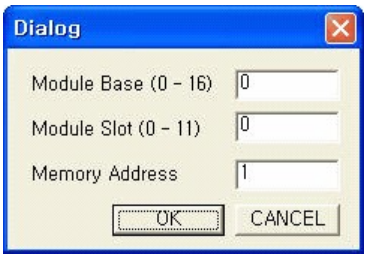
Sets the On/Off interval time to control PID using On/.Off control function. (If set to On, the upper MV will be displayed as the MV.)
If the On/Off control time is set, the setting value becomes the on/off interval.
The ratio of On/Off in one interval is set by the current MV.
For example, if the setting value is 0.1 and the current MV is 80000, the On state will be kept for 0.05 second and Off will be kept for 0.05 second. Or, if the MV is set to 32000, the On state will be kept for 0.02 second, and Off state will be kept for 0.08 second.
In the above example, it is set to ?". Therefore, this function will be
disabled.

Setting value (SV)

Input the target value to control.
For example, if 0 ~ 100% is used as the digital value of 0 ~ 16000, set 8000 in order to set 50%.
In the above example, the temperature value is controlled. Therefore, input temperature to set * 10? For example, if temperature is 35.5℃, input 355. (0 ~ 16000)

Procure value (PV)

The current measurement value of the controlling object. The value can be read from the analog input card by the user, and the value can be updated periodically.
Double click the measurement value. (0 ~ 16000)

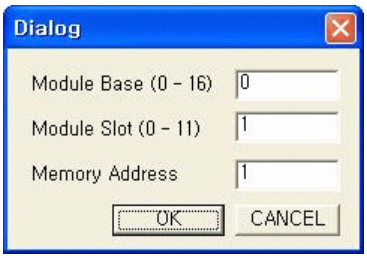


- Specify the base that the RTD card to read its value is mounted. **(Input 0, since it is the local base.)**
- Specify the slot that the TRD card is mounted. **(Input 0, since it is the slot #0.)**
- Set the RTD card memory area to read. **(Input 1 to use the ℃ value in the channel 1 of the TRD module. See the user memory area of the special card.)**

When you click the [OK] button, you can see the complete **"FROM"** command.

MV (0 ~ 16000)

MV is the result value of PID operation. The user can display it on the controlling object using the analog output card.
Double click the MV.



- Specify the base that the D/A card for output is mounted. **(Input 0, since it is a local base.)**
- Specify the slot that the D/A card is mounted. **(Input 1, since it is the slot #1.)**
- Set the D/A card memory area to write the value. **(Input 1, since the D/A module channel #1 will be used. See the user memory area of the special card.)**

When you click the [OK] button, you can see the complete **"To"** command.

Measurement value after filtering (PVnf)

A filter is used to prevent the temporary difference due to noise of the PV. The PV is filtered and saved in the measurement value after filtering (PVnf) area. At this time, if the filtering coefficient (? is 0, a filter is not applied to the PV.

MV Manual

If the PID mode is manual, PID is not controlled, and the value set as MVman will be displayed as the MV.

Auto/Manual selection

Selects whether the controlling object will be controlled automatically using PID, or the value set in the MVman area will be displayed.

PIDINIT state

Displays the error state occurred while initializing PID operation.

Save, Compile, and Download

Click the **[Save]** button if parameter setting is complete.

- Select **"CICON menu -> Tools -> Compile+Link"**.
- Select **"CICON menu -> Online -> Link+Download+Monitor"** to download the program down to PLC.

If working is complete normally, the monitoring mode will be selected.
If you click the **[Stop Monitoring]** button, monitoring will be stopped and the editing mode will be selected.

Monitoring

The monitoring result value will be displayed on the window during monitoring.
If you double click the current value during monitoring, you can modify the value in the specified device area.
The modified value will be applied to PID control from the following scan.

To change the parameter during operation.
Check whether monitoring is in progress. (The current value is displayed during monitoring.)
Double click the current value of the parameter to modify.

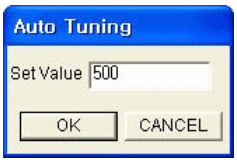
Input the value that fits into the input value range, since it is displayed on the window together with the specified device.

PID AutoTuning

You can easily find parameters (proportional, integral, and differential integer) that are appropriate for the system, using the automatic PID tuning function.

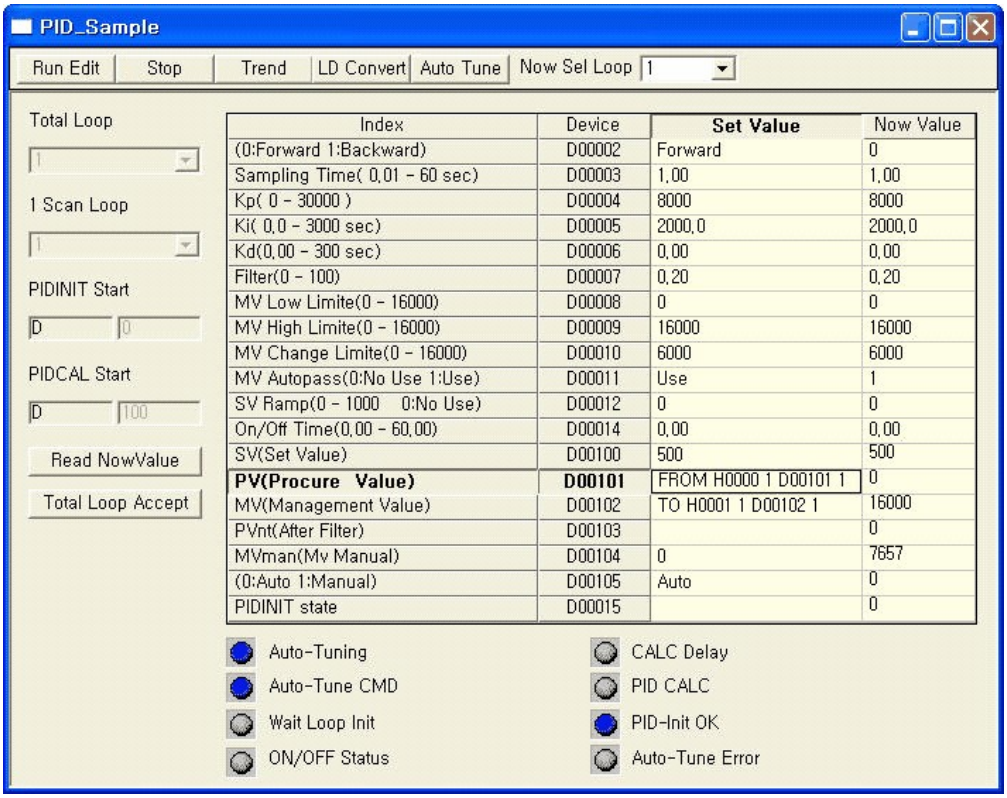
[Note] Before starting automatic tuning, the environment should not affect the output value as much as possible. In the above example, normal temperature is recommended that the heater is not running.

Download the currently working PID program down to PLC.
Click the [Monitor] button in the PID program to enter into the monitoring mode.
Click the [Auto Tuning] button.

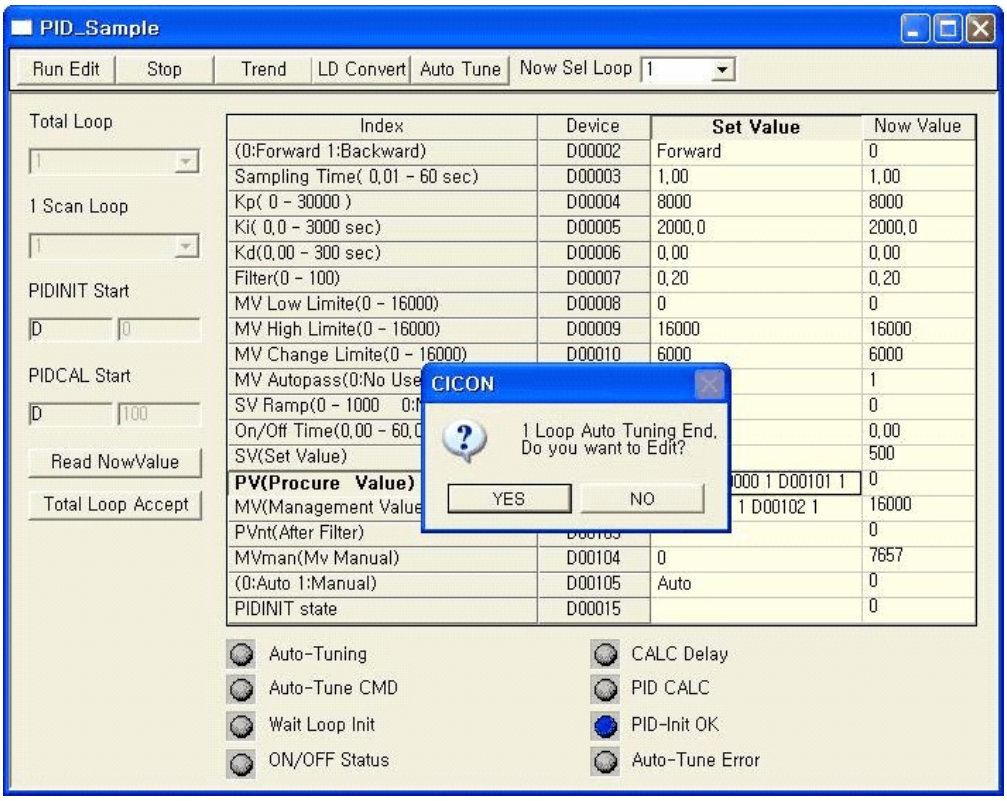


Input the setting value. (The setting value should be greater than the measurement value for the forward control, in order to complete auto tuning normally. On the contrary, it should be smaller than the measurement value, in case of the reverse control.)\
The input value in the above example (forward direction) should be greater than the value that is being measured currently. It is recommended to input the temperature set most frequently (50℃).

Click the [OK] button.



Auto Tuning is in Progress, and **Auto Tuning Command is Received** fields are turned on in blue color, and auto tuning is started.
The output value is fixed at the upper limit value during auto tuning.
The system response characteristic at the maximum output is checked when processing parameters.
When auto tuning is completed, **Auto Tuning is in Progress**, and **Auto Tuning Command is Received** fields are turned off, and parameters calculated by auto tuning will be displayed on current values of **Proportional Integer, Integral Integer**, and Differential **Integer.**



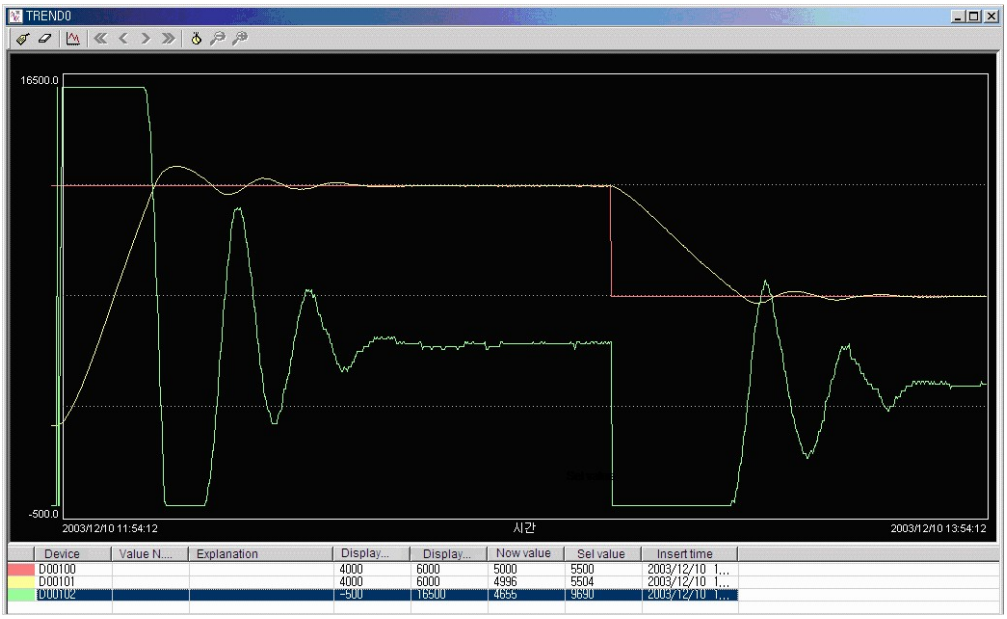
You will see that the current value of proportional integer and integral integer is changed.

[Note] Parameters calculated by automatic tuning on this occasion are not applied to other system. The system characteristic can also vary if the heater output or sensor location is changed in the system. Check the message in the "Auto Tuning Complete" message window, and click the [Yes] button to apply the result value to the program.
Alternatively, click the [No] button and select the completed loop and then, click the [Read Now Value] button to apply the result value (Now value) of the selected loop to the program.

Setting values that are modified through saving, compilation, and download will be applied to PLD control. PID auto tuning is performed for each loop. Loops other than the one performing tuning will perform normal PID control.

Linkage with the trend

Click the [Trend] button at the top of the program to populate the Trend window that shows loop setting value, measurement value, and manipulation volume.



- **Green line:** Manipulation volume
- **Red line:** Setting value
- **Yellow line:** Measurement value

The above figure shows the screen that monitors the trend of forward direction heating control.

Converting PID program to LD

Click the **[LD Convert]** button to convert the PID program to LD.

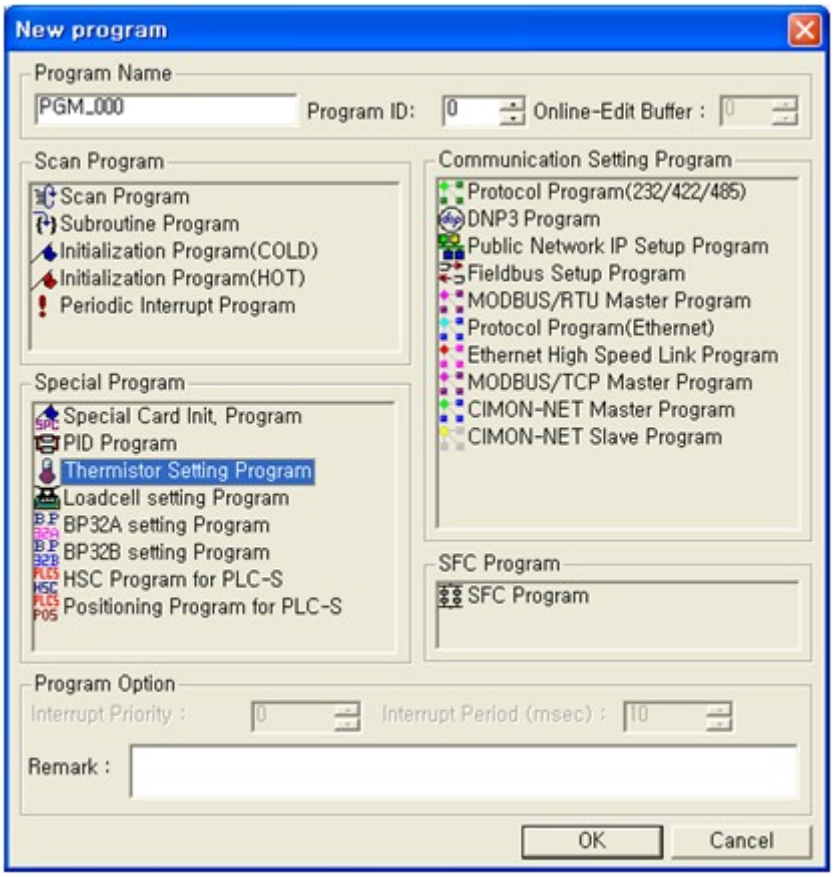
[Note] Once the program is converted to LD, it cannot be restored.

4.9.3 Thermistor setting Program

CM1-TH08A is used to measure the temperature by calibrating thermistor resister. Please refer to the manual of thermistor module?

Registering NEW Program

Select [File – New program..], and input " Program Name"?

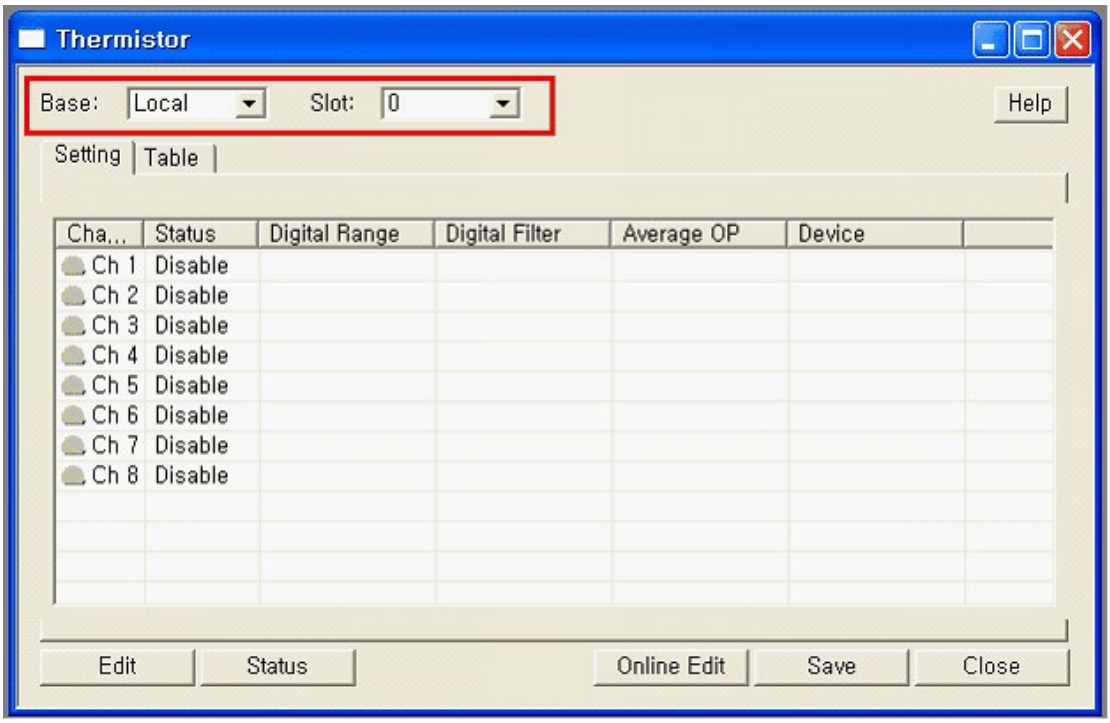


Select the [OK] button.

Writing a thermistor program

Example of writing a thermistor program

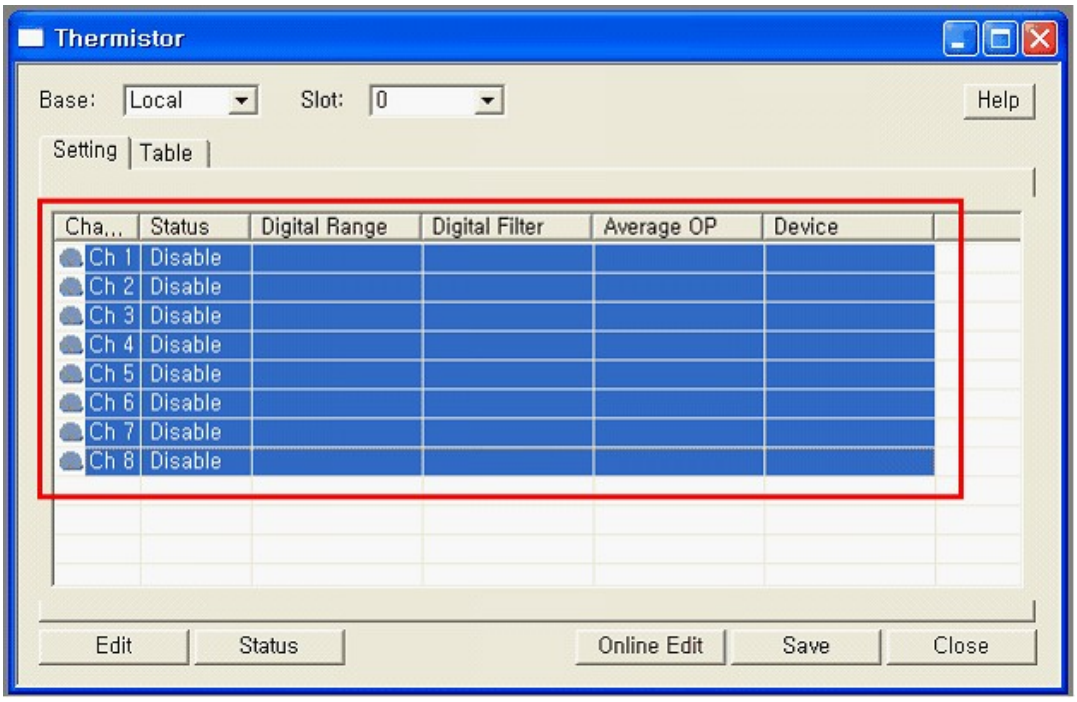
After Registering NEW program, below the box appear.



Register " BASE" and " Slot " which set thermistor.

Setting Channels

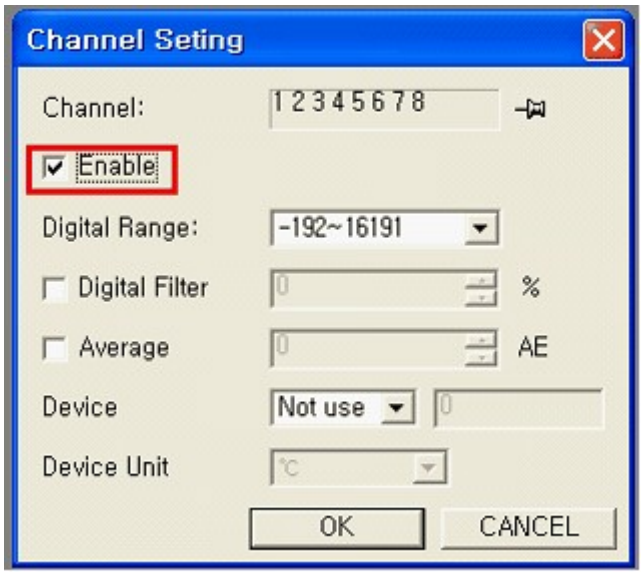
Setting Tab: This is used to set "Status", " Digital Range" ,"Digital Filter", "Average OP" and "Device"



- Drag a mouse, you can select many channels.
- If you want only one channel, select a channel by clicking a mouse.
- By using a ctrl-Key, you can select channels what you want.

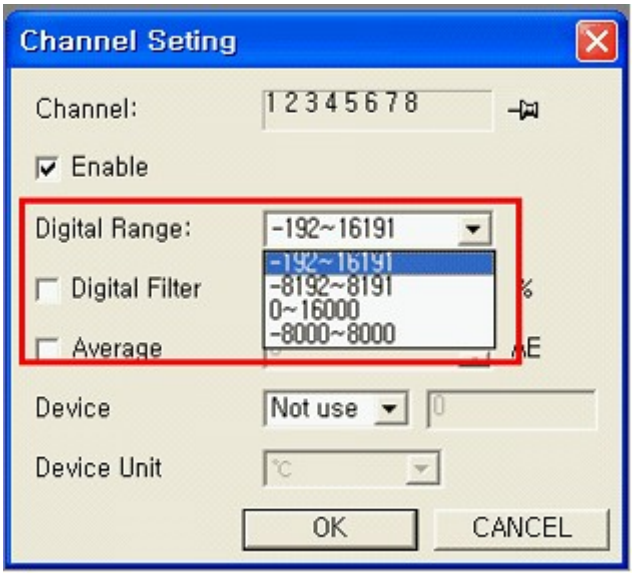
1. Select "EDIT", below the box appear

2. Select or unselect the blank, "enable"



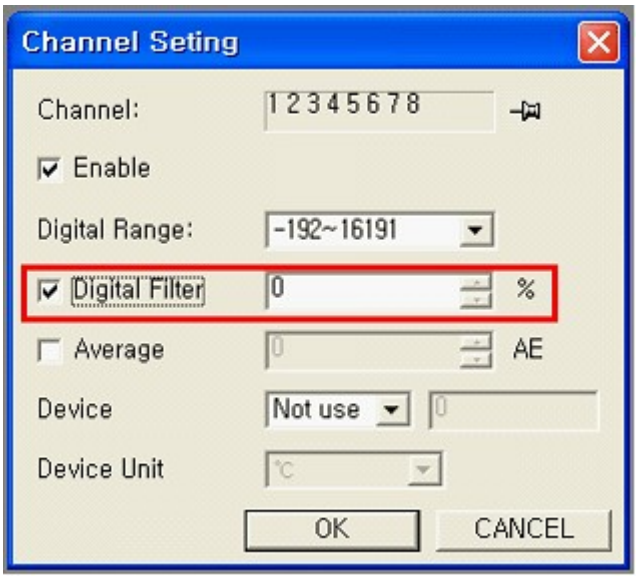
Check the blank "Enable", you can change values.

Digital Range : it is used to convert the max/min temperature to digital value by a temperature converting table.



Digital Filter : It is used to set up in case of hunting by outside noise for converted temperature.

It is restricted converted ranges before storing converted temperature.

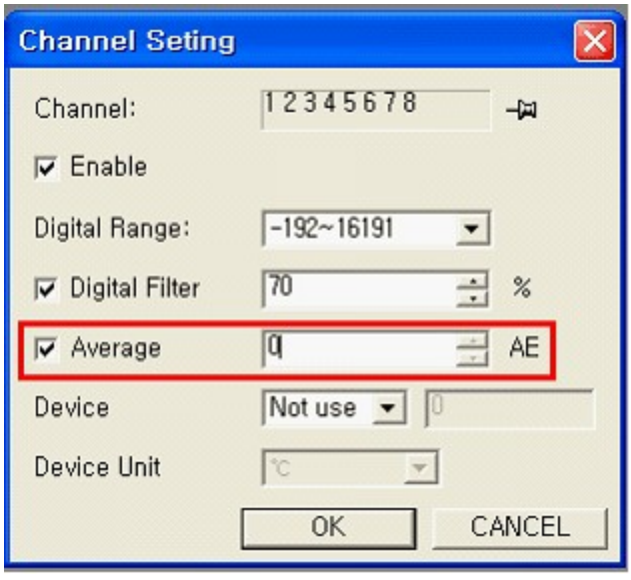


Range of set value : 0 ~ 70 %

Example : Values which stored the buffer memory is present values by adjusting Digital Filter.

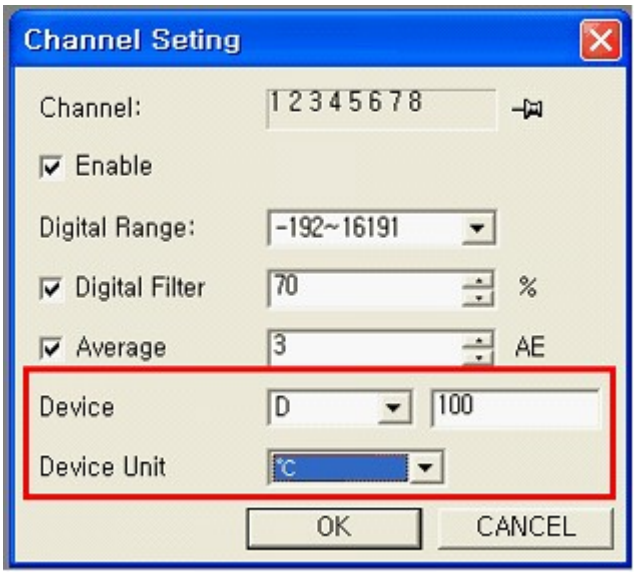
Present Value = Present value + (formal value – present value) * Digital Filter(%) / 100

Average : ?It is used to set up calibrating value for average times



Range of set value : 0 ~ 255 sec.

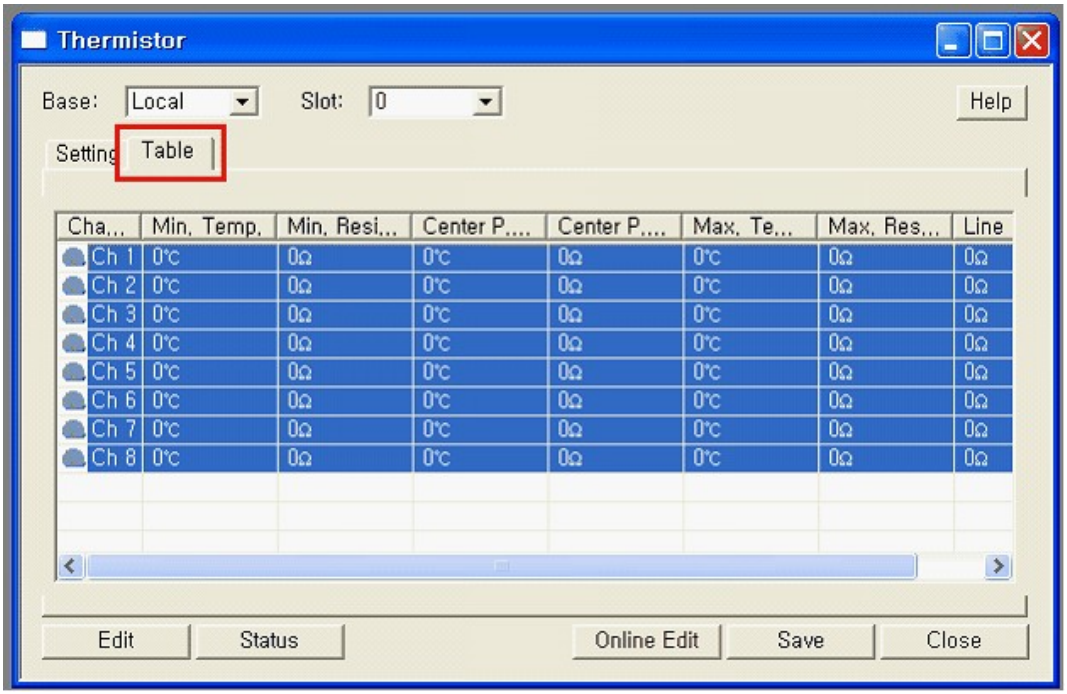
Device : It is used to store converted temperature in CPU memory.



- Enable domain: X, Y, M, L, K, D
- Type of stored data: ℉, ℃, digital value

- Example: If you set like above the box, you can store ℃ value in D100.

Table Tab : It is used to input the temperature, and resistance of a thermistor



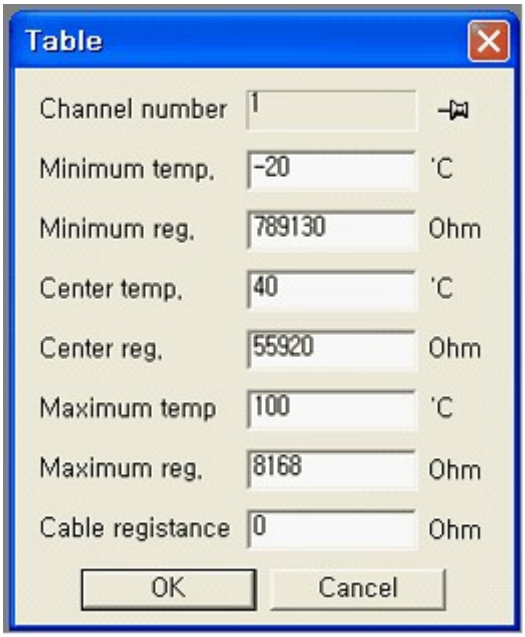
Please register the values refer to temperature-resistance table by provided manual from thermistor cooperation.

- Center P. temperature = Max. Temperature – (Max. Temperature – Min. Temperature) / 2

- In case of inputting the temperature-resistance table incorrectly, converted temperature value is out of range (0.3%)

  Example : Max. temperature = 100℃, Min. temperature = -20℃
  100 – (100 - (- 20) / 2 = 100 – 60 = 40℃

- Register temperature values (Max. = 100℃, Center = 40℃, Min. = -20℃), and then Input resistance values of each temperature



- Resistance value is except for a decimal point
- Cable resistance: It is used to settle a resistance of cable resistance.

4.9.4 HSC Program for PLC-S

Enter topic text here.

4.9.5 Positioning Program for PLC-S

Enter topic text here.

4.9.6 IO Input Filter Setting Program

Enter topic text here.

4.10 SFC Program

Preparing...

4.11 PLC Control

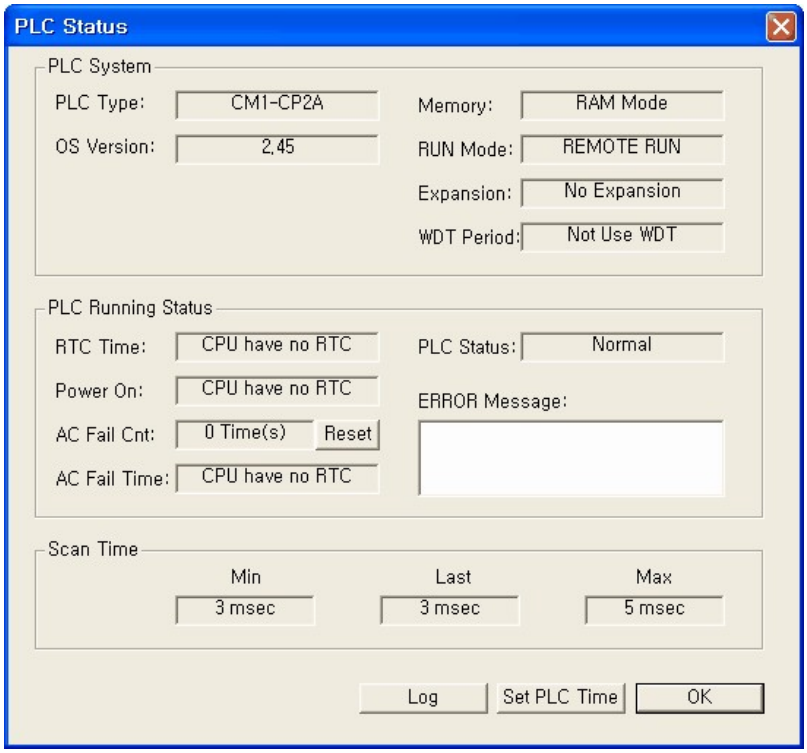
PLC Control :

- PLC Status
- PLC Time Setting
- Change operation mode
- RAM Operation
- ROM Operation

4.11.1 PLC Status

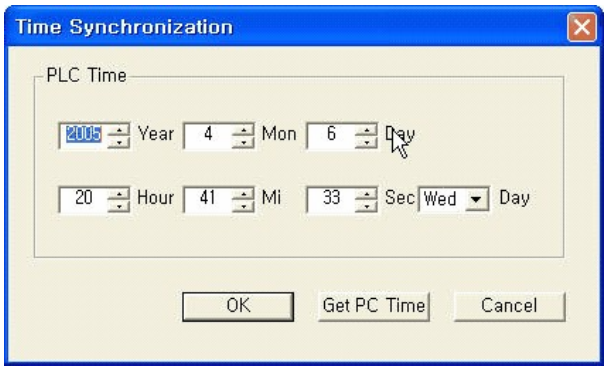
You can check the current PLC status, firmware version, and so on.

Select **"Online -> PLC Status"** menu while connected to PLC.



4.11.2 PLC Time Setting

You can set the time in the **PLC Status** window if the CPU is integrated with RTC.



To synchronize the current time in the PC with that of PLC, click **[Get PC Time]** button and the **[OK]** button.

4.11.3 Change operation mode

The operation mode can be controlled only when the PC mode switch is set to Remote.

The mode can be changed to **Run**, **Stop**, or **Pause** mode.

To change to the Run mode, select **"Online -> Change Mode -> Run Mode"** while connected.

4.11.4 RAM Operation

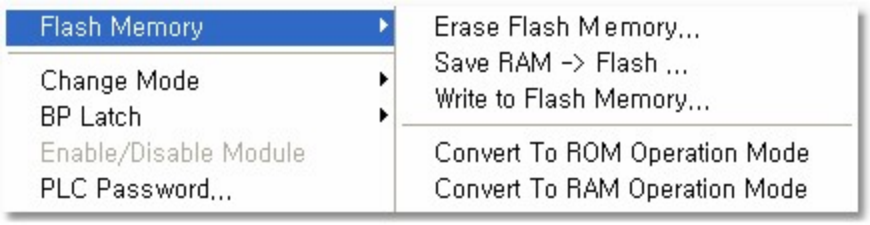
Programs saved in RAM is used to run PLC. RAM data is kept using the battery.

4.11.5 ROM Operation

When running PLC, the ROM data is copied over to the RAM and the RAM program is used. The data will be kept regardless the battery state but the RAM data should be written to the ROM again to save it. Copying the data from RAM to ROM should be performed in the STOP mode.

Related functions

Select "Online -> Flash Memory" menu while connected to use the related functions.



Type	Note
Erase flash memory	Clears programs and parameters saved in the ROM.
Save RAM -> Flash	Copies the RAM program over to the ROM.
Write to Flash Memory	Copies the working project directly to the ROM.
Convert To ROM Operation Mode	Switches the CPU to the ROM operation mode.
Convert To RAM Operation Mode	Switches the CPU to the RAM operation mode.

4.12 Special Card Setting

Double click the module to set in the Module Property of the Project window while connected to PLC, or select **Tools -> Optional Module Setup** menu.

See :

- Ethernet Module
- RS232/422 Module
- Logger (RS232) Module
- DNP3 (Ethernet) Module
- DNP3 (232/422) Module
- BACnet (Slave) Module
- AD Conversion Module
- DA Conversion Module
- AD/DA Conversion Module
- RTD Conversion Module

- TC Conversion Module
- High-speed Counter
- AD MUX Module

4.12.1 Ethernet Module

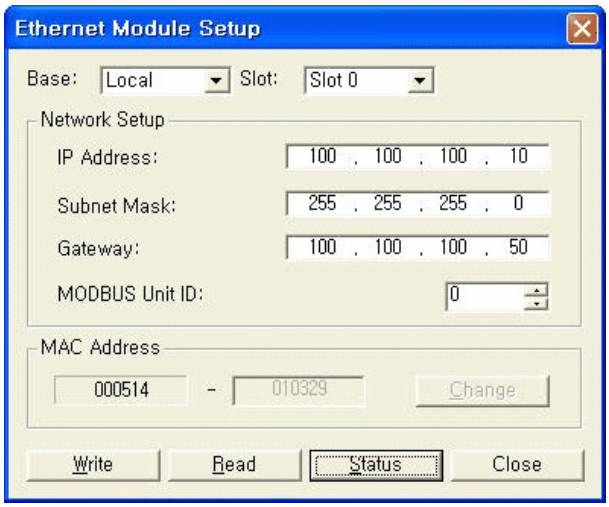
Select **"Tools -> Optional Module Setup -> Ethernet Module"** menu.

If several Ethernet modules are mounted, you can select the intended card by specifying base and slot.

Example of setting ,

Take the steps described below to change the Ethernet module setting as follow, which is mounted in local base and slot number 0.

- **IP:** 100.100.100.10
- **Subnet mask:** 255.255.255.0
- **Gateway:** 100.100.100.50

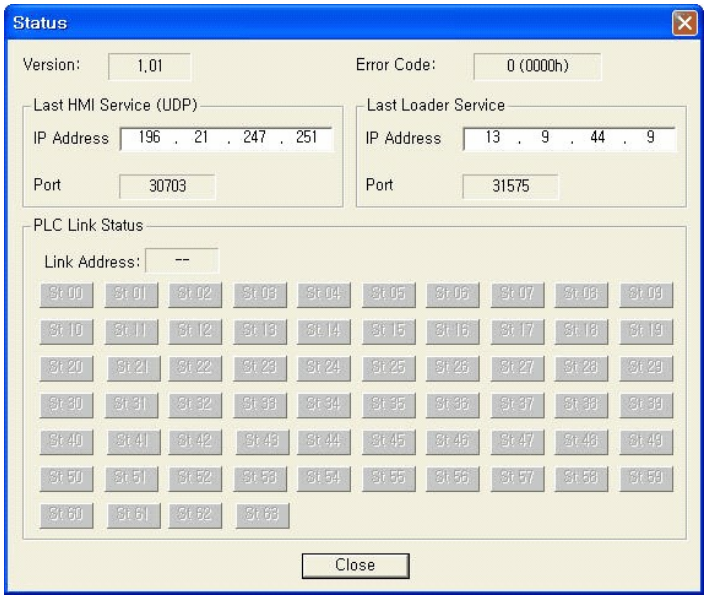


Input as shown in the figure and click the **[Write]** button.

If processed normally, the confirmation window will be displayed.

Click the **[Read]** button again to see if there is no error in the settings.

Click the **[Status]** button to check error codes and communication status of the communication card.



4.12.2 RS232/422 Module

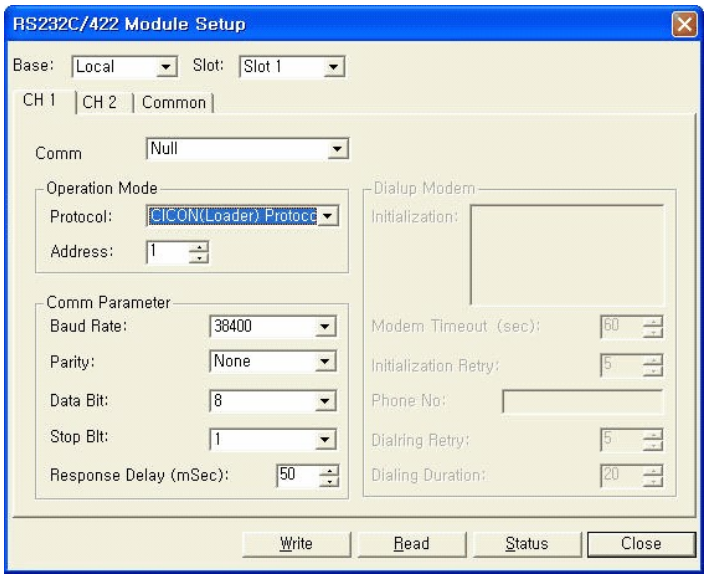
Select **"Tools -> Optional Module Setup -> RS232/422"** Module.

If several RS232/422 modules are mounted, you can change the target card by specifying base and slot.

Example of settings ,

Set the module as shown below if you want to make the loader connection using the channel number 1 of RS232/422 module, which is mounted in local base, slot number 1.

Select the [Ch 1] tab.



- Select the "**Null Modem**" communication method to establish 1:1 connection using the cable.
- Select the **"CICON (Loader) protocol"**.
- Set communication speed to **38400**,
- error detection to **none**,
- data bit to **8**,
- stop bit to **1**.

It is recommended to set the response (transmission) delay time between PC and PLC to approximately 50ms.

Click the **[Write]** button.

Check the setting completion message.

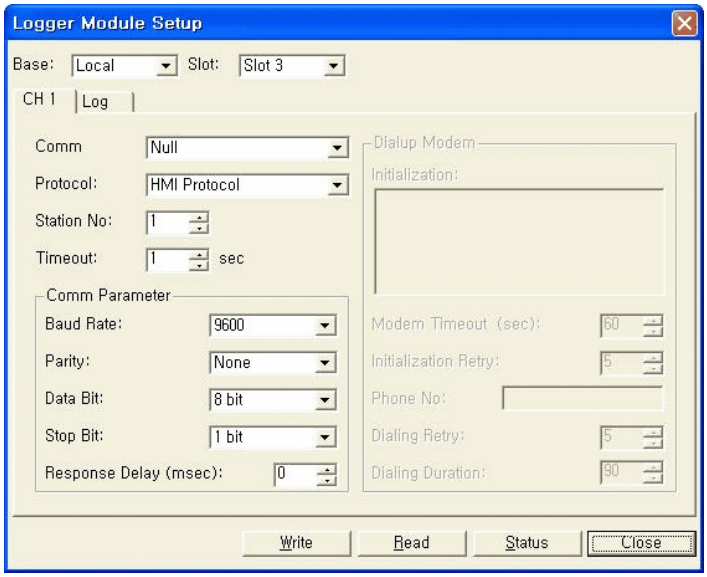
4.12.3 Logger (RS232) Module

Select **"Tools -> Optional Module Setup -> Logger (RS-232)"** Module menu.
If several RS232/422 modules are mounted, you can change the target card by specifying base and slot.

Example of setting ,

Set the module as shown below if you want to establish a connection to HMI using the channel number 1 of logger (RS-232) module, which is mounted in local base, slot number 3.

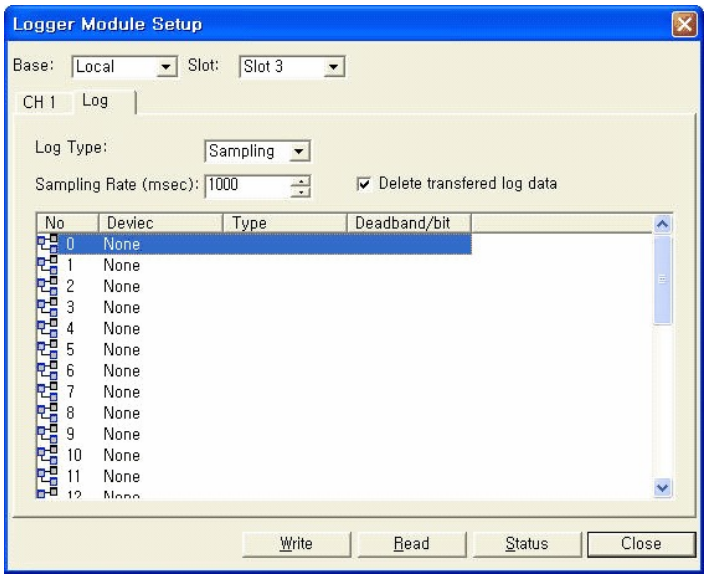
Select the [Ch 1] tab.



- Select the **"Null Modem"** communication method to establish 1:1 connection using the cable.
- Select the **"HMI protocol".**
- Set communication speed to **9600**,
- error detection to **none,**
- data bit to **8**,
- stop bit to **1**.

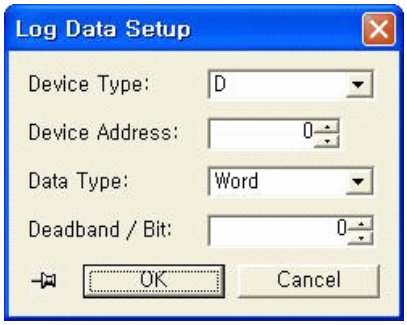
It is recommended to set the response (transmission) delay time between PC and PLC to approximately 50ms.

Click the Log tab.



- Take the following steps to log the data of D00000.?
- Select the logging method **(Sampling)**.
- Input the logging interval **(1000)**.
- Click the **"Delete transmitted log data"**. option.

Double click the block to designate (block #0).



- Select the device type **(D)**.
- Input the starting address **(0)**.
- Select the data type **(word)**.
- If the data type is word, Deadband/Bit is meaningless. Set any number **(0)**.

Click the [OK] button.

Click the [Write] button.

Check the OK message.

4.12.4 DNP3 (Ethernet) Module

Select **"Tools -> Optional Module Setup -> DNP3 (Ethernet)"** Module menu.

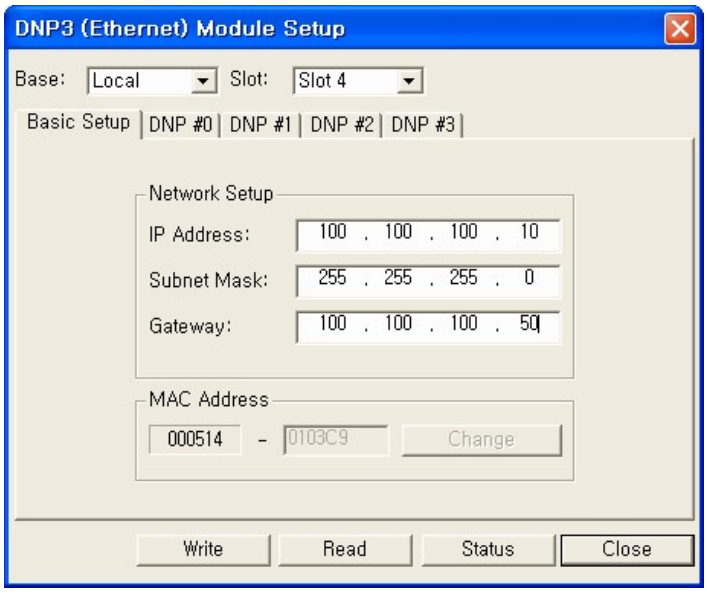
If several DNP3 (Ethernet) modules are mounted, you can change the target card by specifying base and slot.

Example of settings ,

When establishing a DNP communication by changing settings of the DNP3 (Ethernet) module mounted in local base, slot 4.

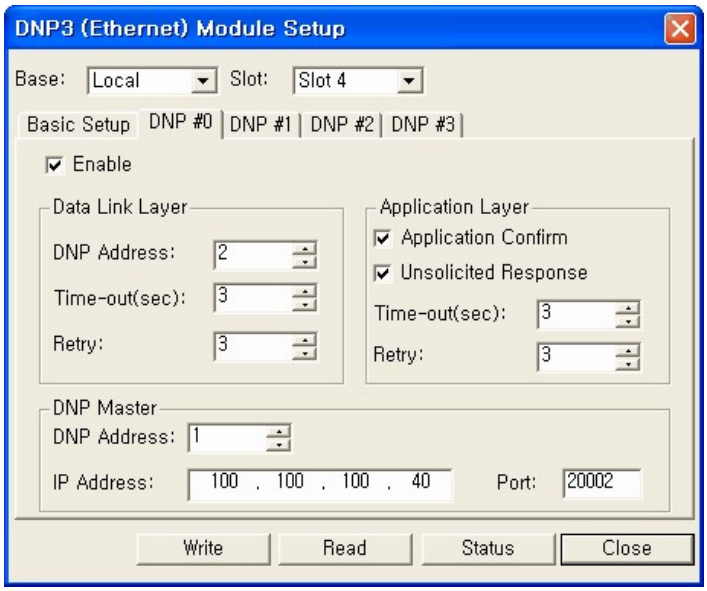
Select the Basic Setup tab.

- **IP:** 100.100.100.10
- **Subnet mask:** 255.255.255.0
- **Gateway:** 100.100.100.50



Input parameters as shown above.

Select the DNP#0 tab.



[Set "Data Link Layer"]

- **DNP address:** Input the DNP address to assign to the communication card.
- **Timeout (sec):** Input the timeout value.
- **Retry (times):** Input retrial times.

[Set "Application Layer"]

- **Request application confirmation:** Select this option to request the application confirmation to the host.
- **Use unsolicited response:** Select this option to use the unsolicited response.

[Set default host]

- **DNP Address:** Input the address of the host to communicate with.
- **IP Address:** Input the host IP address.
- **Port number:** Input the host port number.

Click the **[Write]** button.

Check the OK message.

4.12.5 DNP3 (232/422) Module

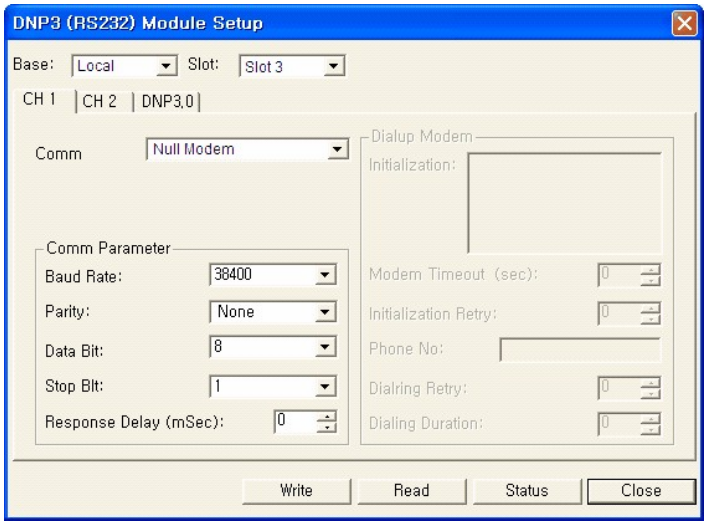
Select **"Tools -> Optional Module Setup ->DNP3 (232/422)"** Module menu.

If several DNP3 (232/422) modules are mounted, you can change the target card by specifying base and slot.

Example of Settings ,

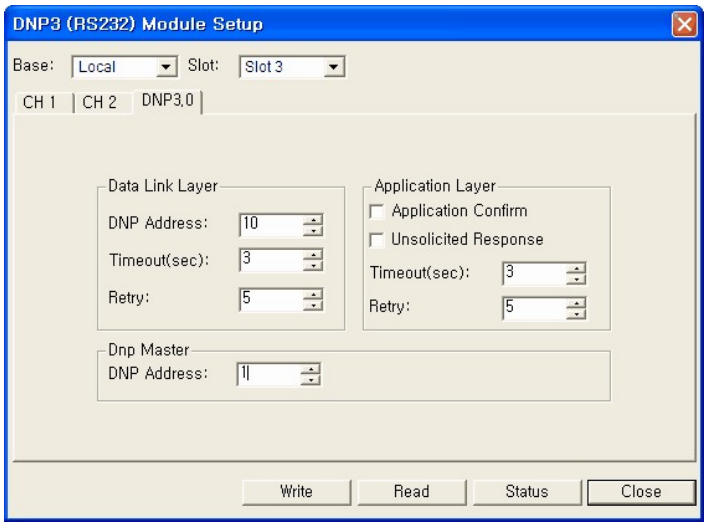
When establishing a DNP communication by changing settings of the DNP3 (232/422) module mounted in local base, slot #3.

Select the [Ch 1] tab.



- Select the **"Null Modem"** communication method to establish 1:1 connection using the cable.
- Set communication speed to **38400**,
- error detection to even,
- data bit to **8,**
- stop bit to **1**.

Select the DNP3.0 tab.



[Set data link layer]

- **DNP address:** Input the DNP address to assign to the communication card.
- **Timeout (sec):** Input the timeout value.
- **Retry :** Input retrial times.

[Application layer]

- **Application confirmation:** Select this option to request the application confirmation to the host.
- **Unsolicited response:** Select this option to use the unsolicited response.

[Set Dnp Master]

- **DNP address:** Input the address of the Master to communicate with.

Click the **[Write]** button.

Check the OK message.

4.12.6 BACnet (Slave) Module

Select **"Tools -> Optional Module Setup ->BACnet(Slave)"** Module menu

If several BACnet modules are mounted, you can change the target card by specifying base and slot.

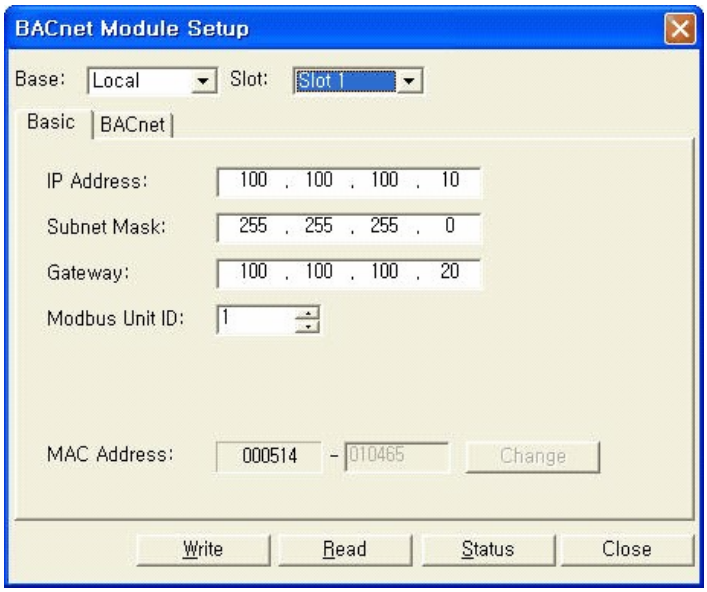
Example of Settings ,

When establishing a BACnet communication using BACnet module mounted in local base, slot #1.

Default Setting tab

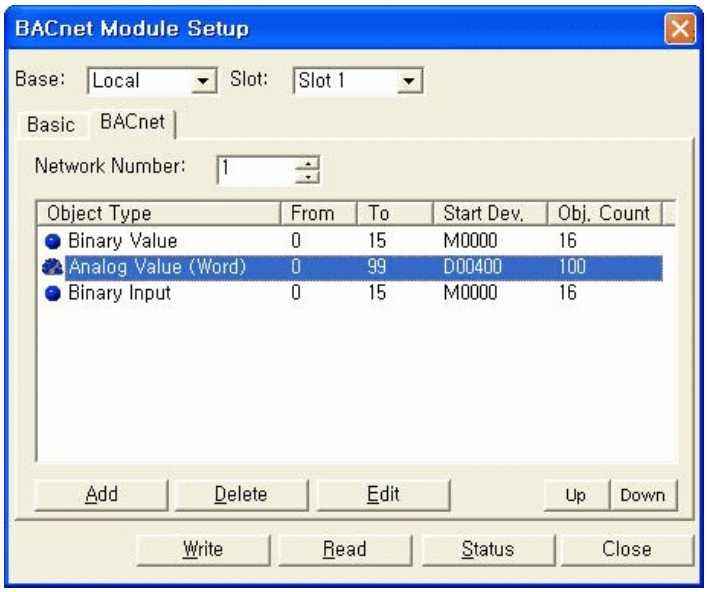
Sets the IP and other information related with Ethernet communication.

- **IP:** 100.100.100.10
- **Subnet mask:** 255.255.255.0
- **Gateway:** 100.100.100.20



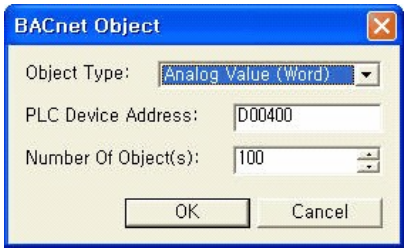
BACnet Setting tab:

Register the device according to the BACnet protocol.
To reply to the request of the master station, the device for the request object type should have been registered.



The Network Number filed is used to identify the specific BACnet module when several BACnet modules exist in the same network. Master separates slaves to request the data, using the network number.
Register a new device using the [Add] button.
Set as described below to set analog input (object type) as 100 words from D00400.

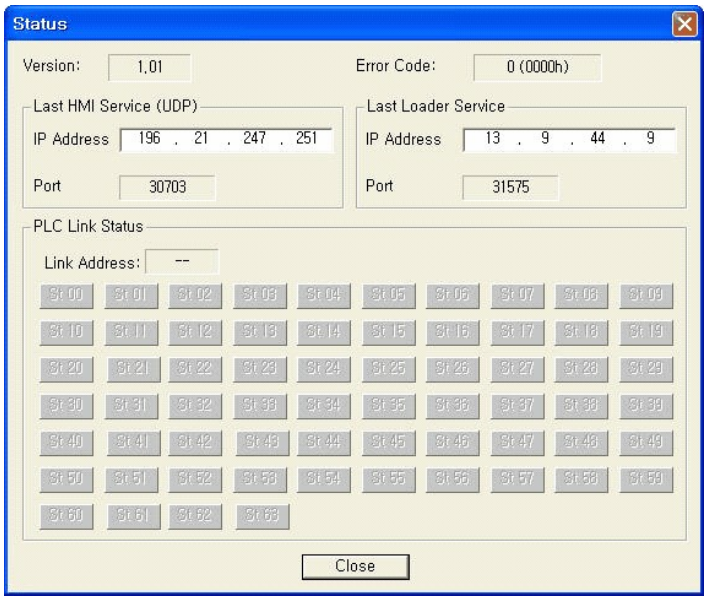
Click the **[Add]** button.



- Select **"Analog Value (Word)"** as the object type.
- Input "**D00400**" in the PLC Device Address field.
- Input **"100"** in the Number Of Object(s) field.

Click the **[OK]** button.

Click the **[Status]** button to check error codes and the communication status of the communication card.



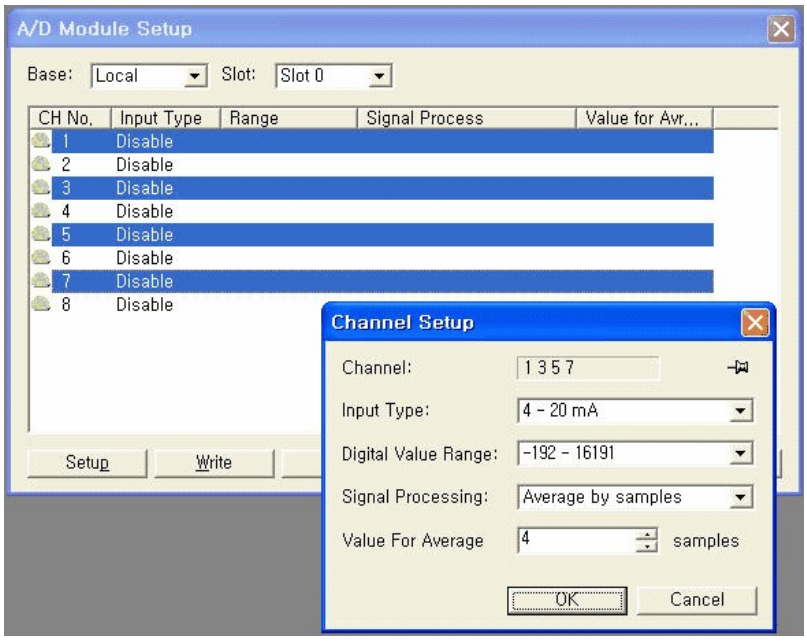
4.12.7 AD Conversion Module

Select **"Tools -> Optional Module Setup -> AD"** Module menu.

If several AD conversion modules are mounted, you can change the target card by specifying base and slot.

Example of Settings ,

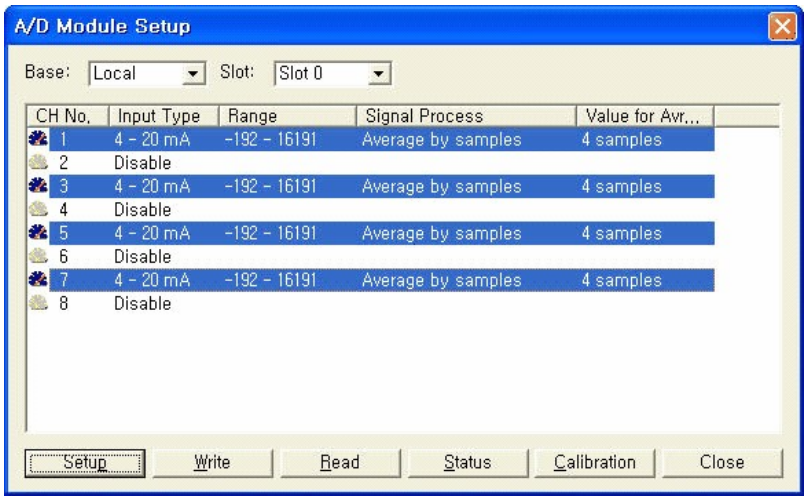
When calculating the average of 4 times sampling after 4 ~ 20mA analog input of the AD conversion module channel 1, 3, 5, and 7 to 0 ~ 160000, which are mounted in local base, slot #0.



Click the channel **(1, 3, 5, and 7)** to set while pressing down the Shift key.
Click the [Setup] button.

- Select the Input Type **(4 – 20mA)**.
- Select the Digital Value Range **(-192 – 16191)**.
- Select the Signal Processing **(Get the sampling average as much as the standard value)**.
- Input the Value For Average **(4)**.

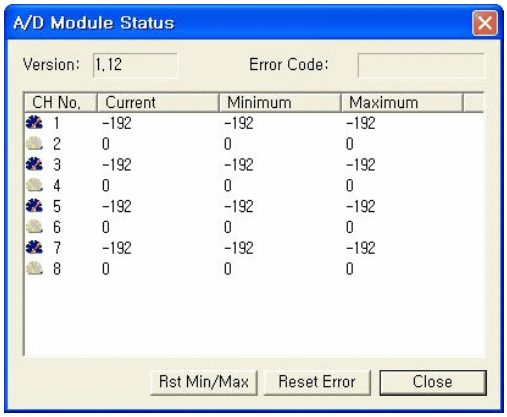
Click the [OK] button.



Click the **[Write]** button after checking the contents in the AD Module Setup window.

Click the **[Read]** button to check whether setting values are correct.

Click the **[Status]** button to check the current A/D module status.

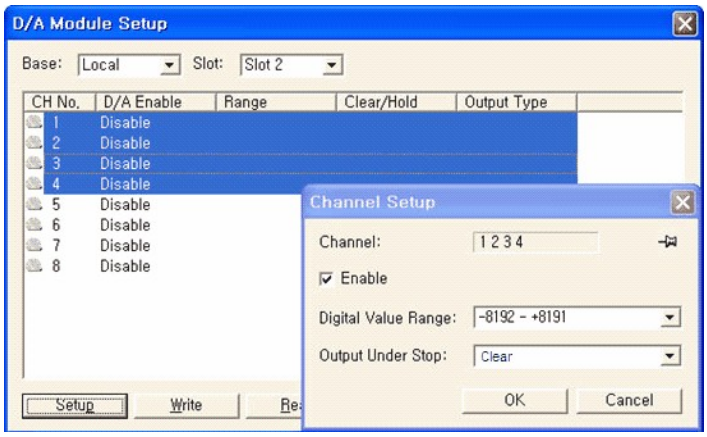


4.12.8 DA Conversion Module

Select **"Tools -> Optional Module Setup -> DA"** Module menu.
If several DA conversion modules are mounted, you can change the target card by specifying base and slot.

Example of Settings , 1"

In this example, when -1 ~ 20mA output of setting DA conversion module channel 1, 2, 3, and 4, which are mounted on local base, slot #0, is set as -8000 ~ 8000, the DA output is cleared in the PLC stop mode.

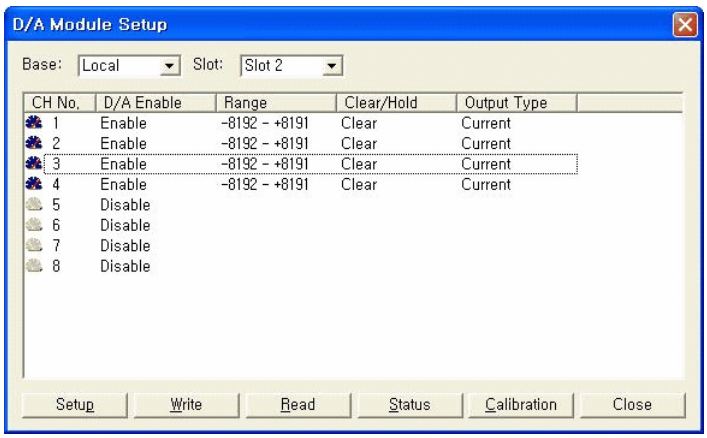


Click the channel (1, 2, 3, and 4) to set using the mouse. Click the **[Setup]** button.

- Click the **Enable**.

- Select the Digital Value Range **(-8192 ~ 8191)**.
- Input the Output Under Stop **(Clear)**.

Click the **[OK]** button.



Click the **[Write]** button after checking the contents in the D/A Module Setting window.

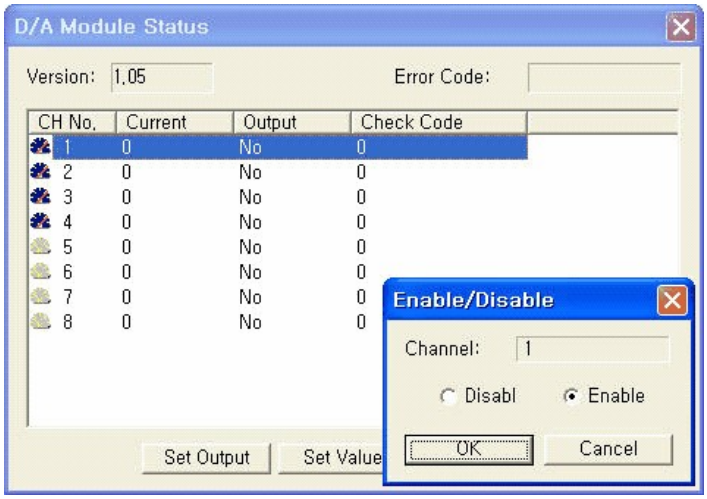
Click the **[Read]** button to check whether setting values are correct.

Click the **[Status]** button to check the current D/A module status, and insert the D/A output temporarily.

Example of Settings , 2"

Take the following steps to send 12mA output to the DA module channel #1.

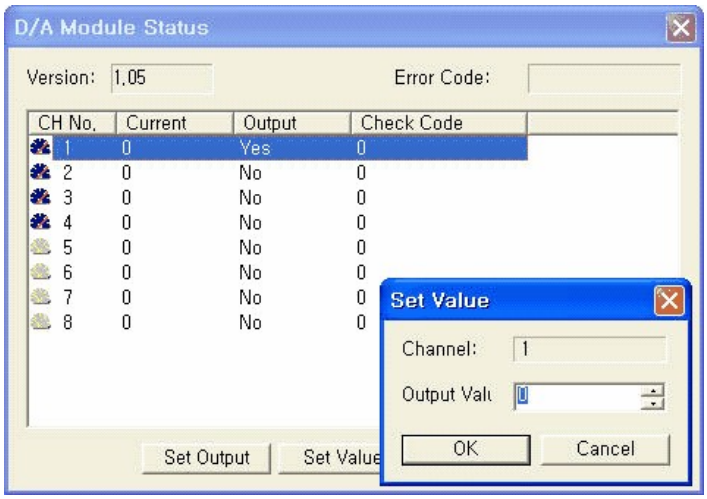
Check whether PLC is in the Run mode.



Click the **[Module Status]** button to display the **"RTD Module Status"** window.

Select the channel #1 and click **[Set Output]** button.

Select the Allow option in the **Disable/Enable** Output window, and click the **[OK]** button.



Click the **[Set Value]** button.

Input the output value **(0)** on the **"set Value"** window.

Click the **[OK]** button.

4.12.9 AD/DA Conversion Module

"Tool -> Option Module Setting -> AD/DA" Module menu.

If several AD/DA conversion modules are mounted, you can change the target card by specifying base and slot.

Example of Settings ,

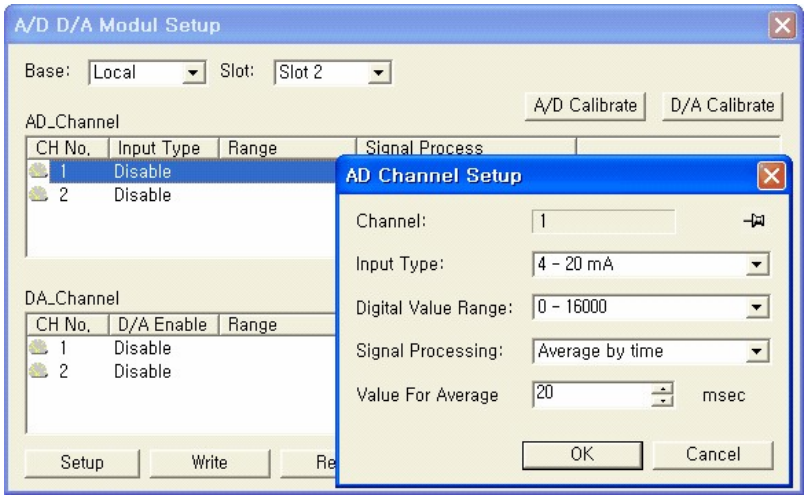
When setting each channel of the AD/DA conversion module as described below, which is mounted on local base, slot #0.

AD channel

Ch.	Input Type	Digital Conversion Range	Signal Processing	Standard Value of Average Operation
1	Current (4-20mA)	0 - 16000	Average during the base period	20msec
2	Voltage (0 – 10V)	0 - 16000	Average during the base period	20msec

DA channel

Ch.	Output Type	Digital Input Range	Stop Mode Output
1	Current (4-20mA)	0 - 16000	Clear
2	Voltage (0 – 10V)	0 - 16000	Clear

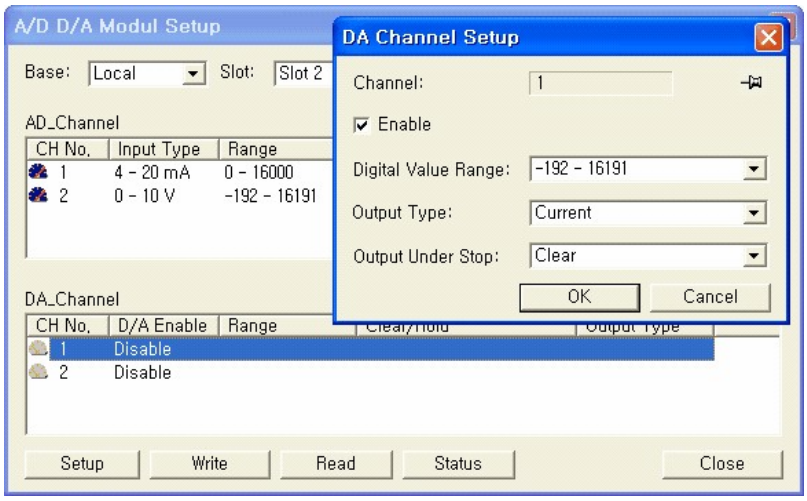


Click the AD channel 1 to set using the mouse. Click the **[Setup]** button.

- Select the Input Type **(4 – 20mA)**.
- Select the Digital Value Range **(0 ~16000)**.
- Select the Signal Processing **(Average by time)**.
- Input the Value for average **(20)**.

Click the **[OK]** button.

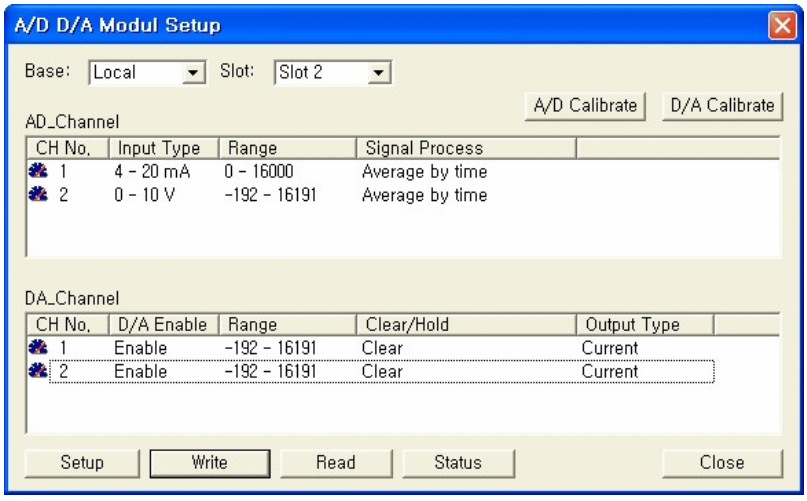
- Set the AD channel 2 using the same method.
- However, set the Input Signal to 0 – 10V.?



Click the **AD channel 1** to set using the mouse. Click the **[Setup]** button.

- Click the **Enable**.
- Select the Digital Value Range **(-192 ~ 16191)**.
- Set the Output Type **(Current)**.
- Input the Output Under Stop **(Clear)**.
- Click the **[OK]** button.

Set the **DA channel 2** using the same method.
However, set Voltage as the Select Output Type.



Click the **[Write]** button after checking the contents in the A/D D/A Module Setting window.
Click the **[Read]** button to check whether setting values are correct.
Click the **[Status]** button to check the current A/D D/A module status, and insert the D/A output temporarily.

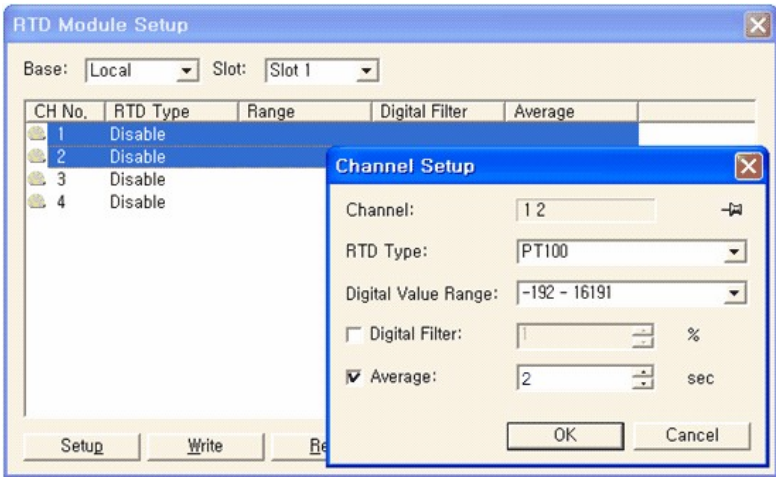
4.12.10 RTD Conversion Module

Select **"Tools -> Option Module Setup -> RTD Module"** menu.

If several RTD conversion modules are mounted, you can change the target card by specifying base and slot.

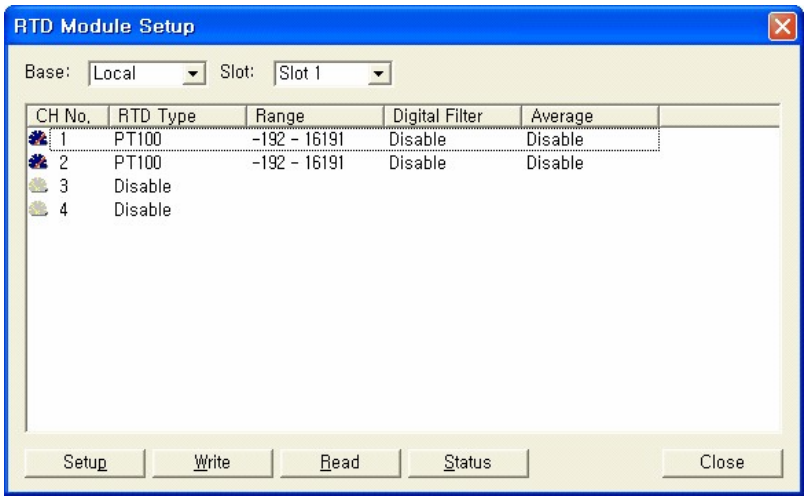
Example of Settings , 1"

When measuring the value through 2 seconds average operation after converting the temperature value to 0 ~ 160000, by connecting PT100 sensor to the RTD conversion module channel 1 and 2, which are mounted on local base, slot #1.



Click the channel **(1 and 2)** to set while pressing down the Shift key. Click the **[Setup]** button.

- Select the RTD Type **(PT100)**.
- Select the Digital Value Range **(-192 – 16191 or 0 ~ 16000)**.
- Click Average and input the time **(2)**.
- Click the **[OK]** button.



Click the **[Write]** button after checking the contents in the RTD Module Setting window.

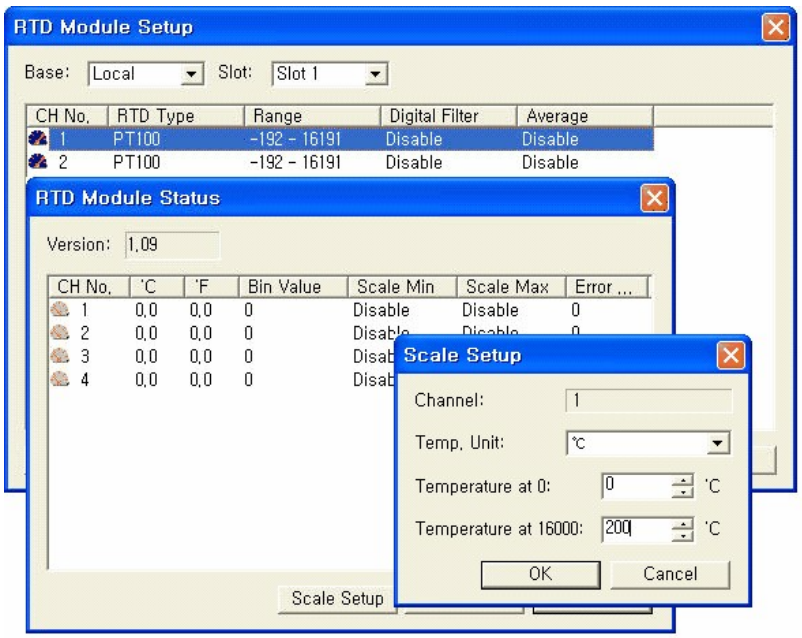
Click the **[Read]** button to check whether setting values are correct.

Click the **[Status]** button to check the current RTD module status, and set the scale.

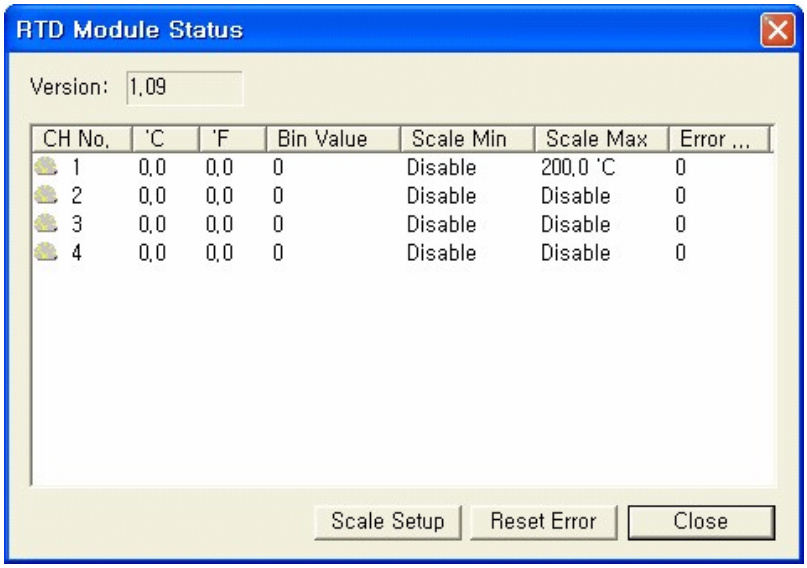
Using the scale setting, you can figure out the digital conversion value at the intended temperature range.

Example of Settings, 2"

When setting the digital measurement value of the temperature 0℃ ~ 200℃ at the RTD module channel #1 to 0 ~ 16000.



- Click the **[Module Status]** button to display the "**RTD Module Status**" window.
- Select the channel **(1)** and click the **[Set Scale]** button.
- Select the **Temp. Unit (℃)**.
- Input "**0**" as the Temperature at 0.
- Input "**200**" as the Temperature at 16000.
- Click the **[OK]** button.



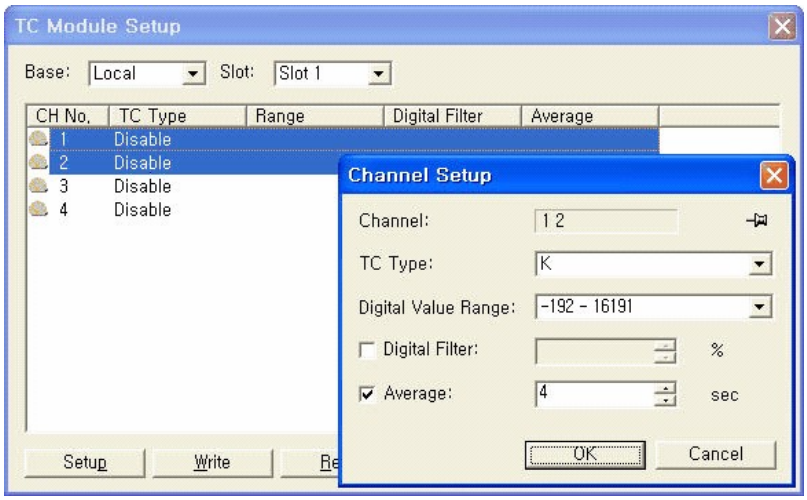
You can see Celsius and Fahrenheit value of each channel, as well as the digital conversion value in the "**RTD Module Status**" window.

4.12.11 TC Conversion Module

Select **"Tools -> Option Module Setup -> TC Module"** menu.
If several TC conversion modules are mounted, you can change the target card by specifying base and slot.

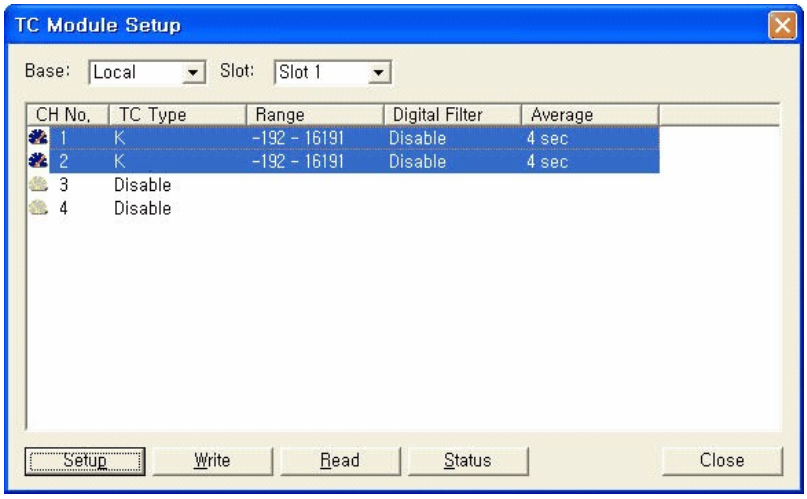
Example of Settings, 1"

When measuring the value through 4 seconds average operation after converting the temperature value to 0 ~ 160000, by connecting K type sensor to the TC conversion module channel 1 and 2, which are mounted on local base, slot #1.



Click the channel **(1 and 2)** to set while pressing down the Shift key. Click the **[Set Channel]** button.

- Select the TC Type **(K)**.
- Select the Digital Value Range **(-192 – 16191 or 0 ~ 16000)**.
- Click Average and input the time **(4)**.
- Click the **[OK]** button.



Click the **[Write]** button after checking the contents in the TC Module Setting window.

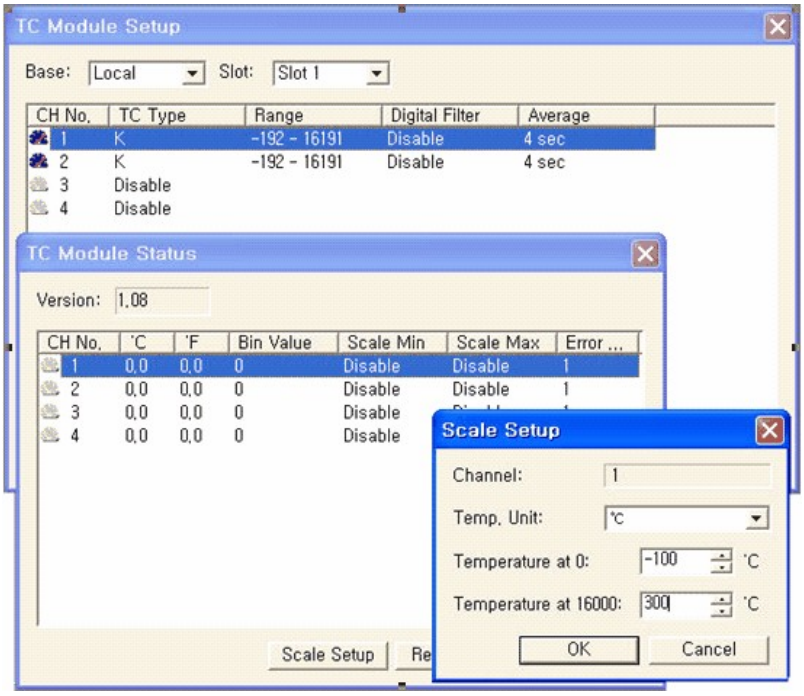
Click the **[Read]** button to check whether setting values are correct.

Click the **[Status]** button to check the current D/A module status, and set the scale.

Using the scale setting, you can figure out the digital conversion value at the intended temperature range.

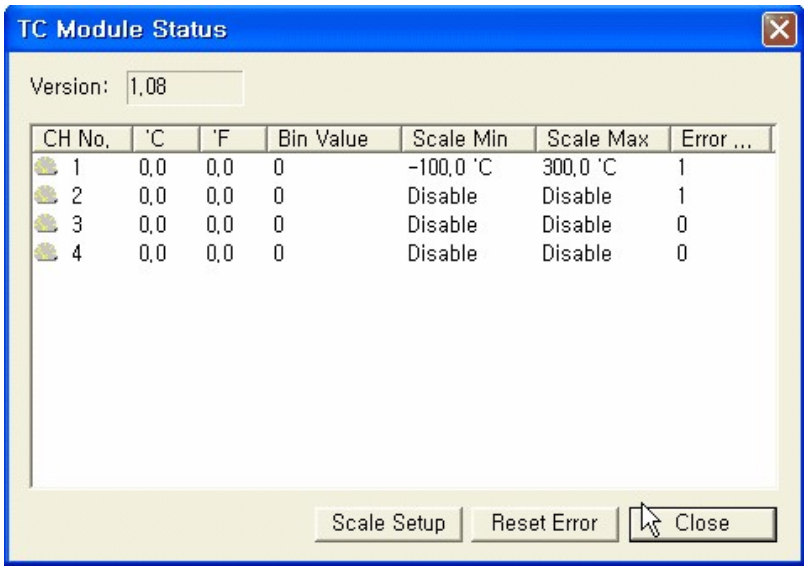
Example of Settings , 2"

When setting the digital measurement value of the temperature -100℃ ~ 300℃at the TC module channel #1 to 0 ~ 16000.



Click the **[Module Status]** button to display the **"TC Module Status"** window.

- Select the channel **(1)** and click the **[Set Scale]** button.
- Select the Temp. Unit **(℃)**.
- Input **"-100"** as the Temperature at 0.
- Input **"300"** as the Temperature at 16000.
- Click the **[OK]** button.



You can see Celsius and Fahrenheit value of each channel, as well as the digital conversion value in the **"TC Module Status"** window.

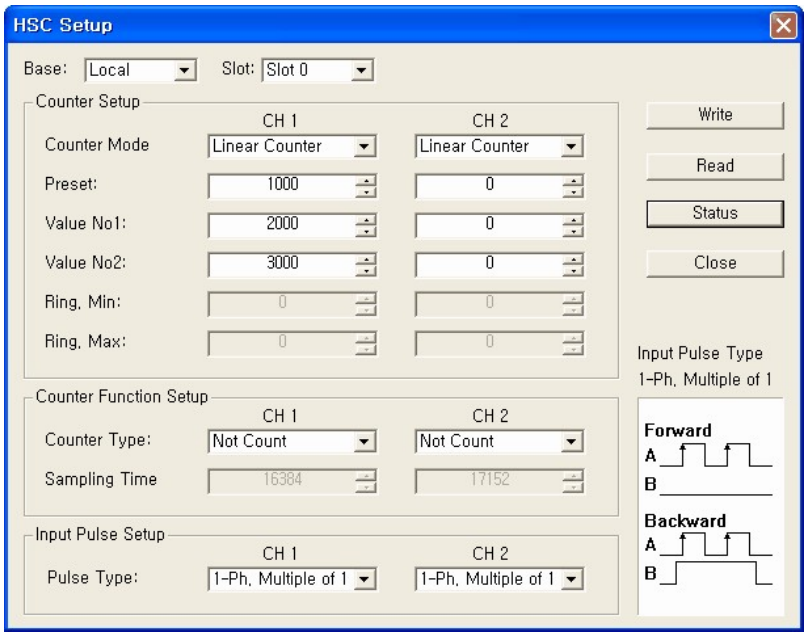
4.12.12 High-speed Counter

Select **"Tools -> Optional Module Setup -> High-speed Counter"** menu.

If several high-speed counter modules are mounted, you can change the target card by specifying base and slot.

Example of Settings ,

When counting the input signal using the channel 1 of the high-speed counter mounted in local base, slot #2, the input type should be "1 phase 1 multiplying" and the counter mode should be a "linear counter".?



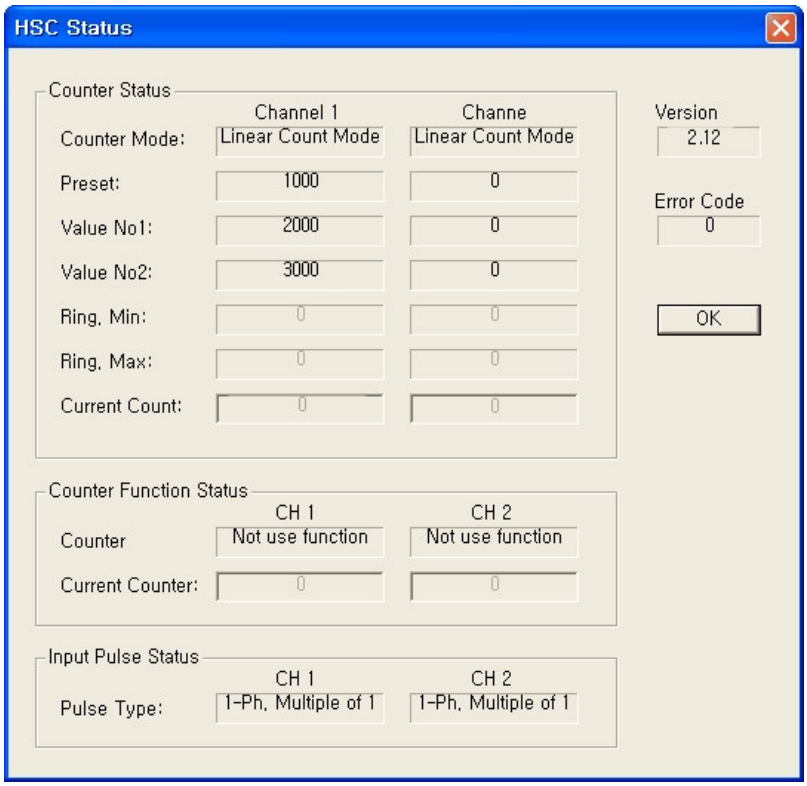
- Set the Counter Mode of the channel **1 as the linear counter**.
- Input **"1000"** in the Preset. If the free set setting is required, the current counter value is replaced with the preset setting value.
- Input "**2000"** in the Value No. **1**.
- Input "3000" in the Value No. **2**.
- Select **"Not Count"** in the Counter Function Setup field. Counting will be enables only when both "Counter Allowing Command" and "Start Counter Function" are on.
- Select the Pulse Type – **"1-Ph. Multiple of 1"**

.

Click the **[Write]** button.

Click the **[Read]** button to check all settings are correct.

Click the **[Status]** button to check the current status of the high-speed counter.



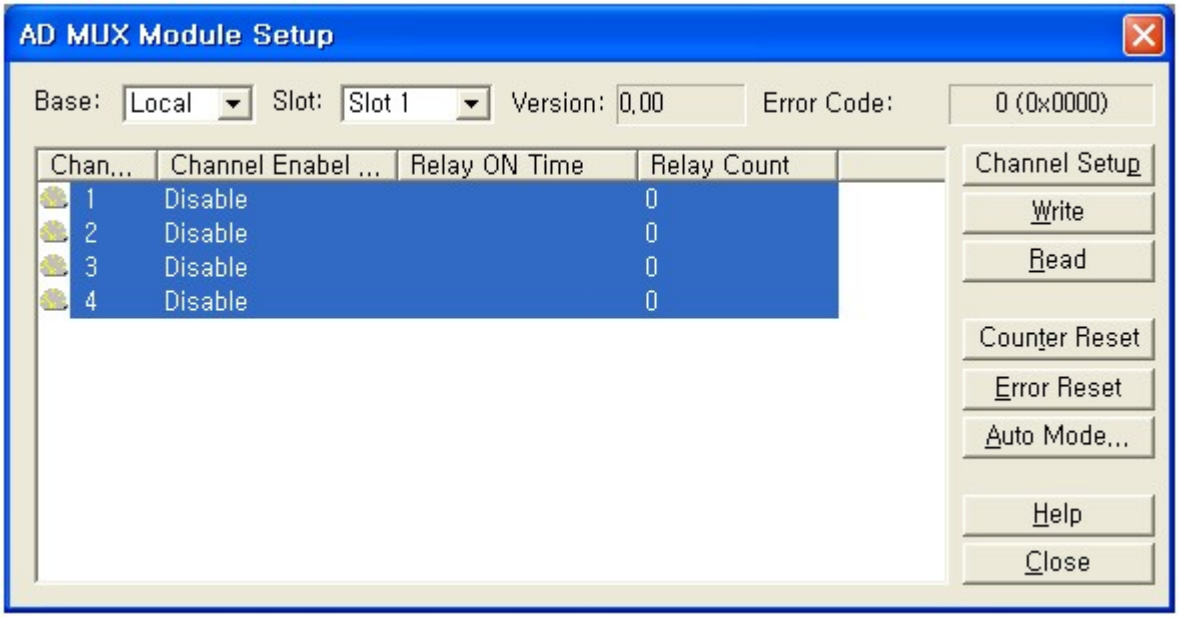
4.12.13 AD MUX Module

Go to “Special Module Setup” on the “Tools” menu and select “AD MUX Module”
In case there is more than one AD MUX Module, the user can set the base and slot number and select them as desired modules. (For PLCS, “Base” should always be “Local” on the parameter) For detailed information please refer to [PLCS AD MUX Module]

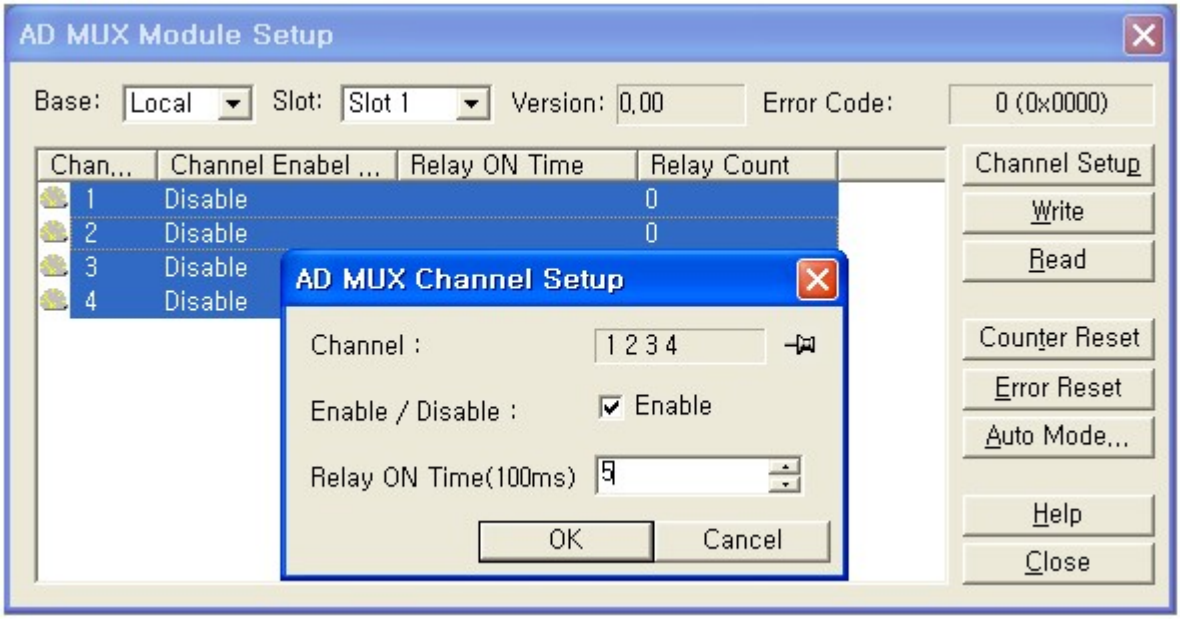
Example of Settings ,

This example is to Enable the channels 1,2,3,4 and configure the relay ON time as 500ms of the AD MUX Module which is installed on the 0th slot of a local base.

1. Hold down the Ctrl key and select desired channels (1,2,3,4)



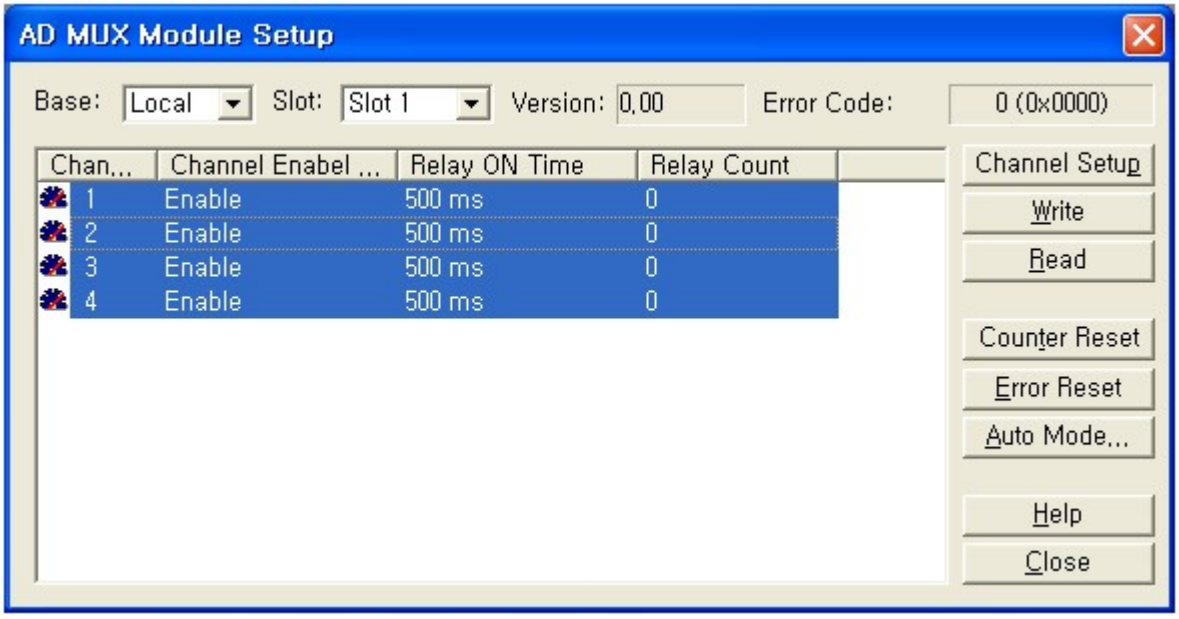
2.Click “Channel Setup” button



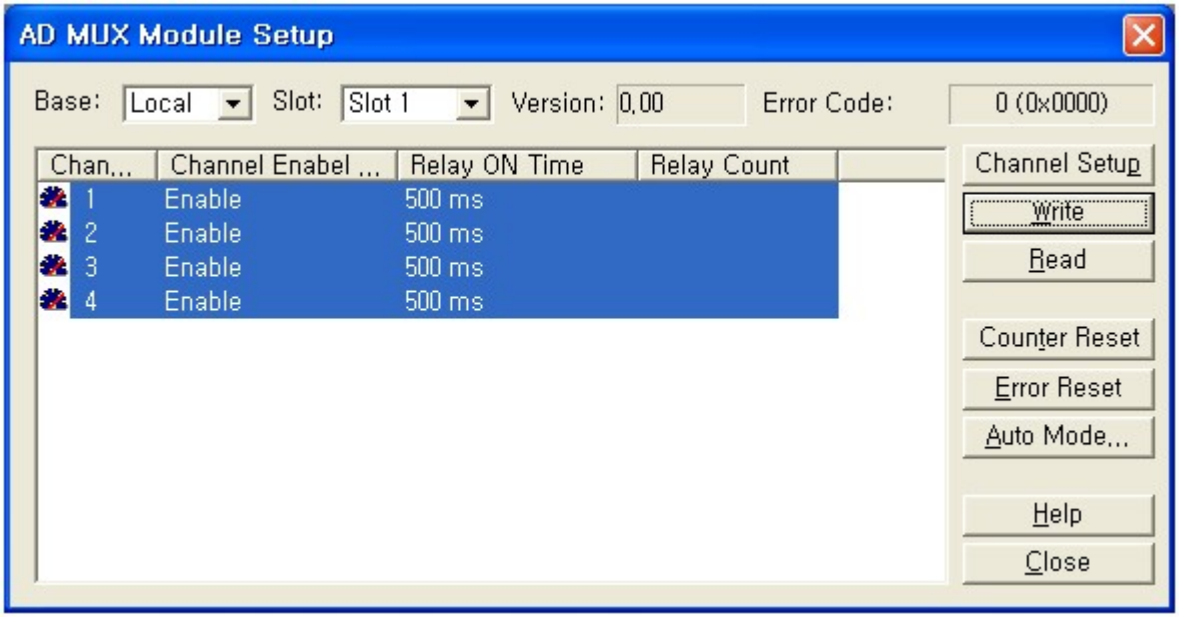
Select the check box “Enable” for enabling the channels.

Input “5” for Relay ON Time (100ms)

Click [OK] button.



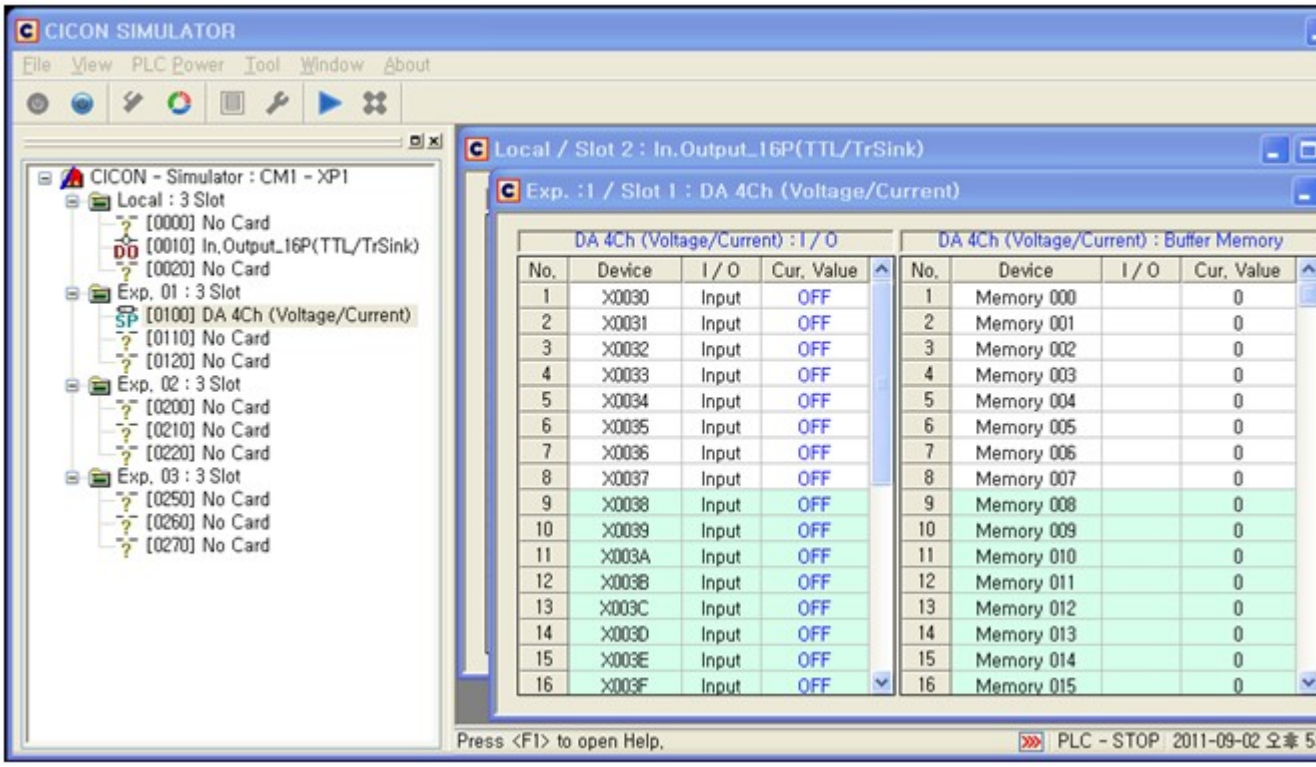
3.Check the information in AD MUX Module Setup box and click “Write” button on the right-hand side.



4.Click "Read" button to make sure the setup information is correct.

4.13 PLC Simulator

User can monitor and control ladder program through PLC Simulator.



- Simulator Features
- Simulator Screen Layout
- Simulator Settings
- CICON - PLC Simulator Manual

4.13.1 Simulator Features

Features

- **It is possible to download and upload scan program.**

- **Online Mode**

  PLC Online Mode function is supported. Click [Here] for more information.

- **All types of PLC available**

  XP Series / CP Series / BP / PLCS.

  Simulator can run without changing CPU type,

- **Expansion Base available**

  Simulator supports Expansion base of XP Series / CP Series and IO starting address settings.

  Click [Here] for more information.

- **Simulator can run the same device with PLC**

  I/O Settings & Buffer memory Settings of Special card.

  Click [Here] for more information.

- **Remain settings of Expansion Base / Module**

  Once setting value of expansion base and module is saved, it remains in Simulator.

  (You do not need to setup again)

Notice

- **Before you install CICON(Ver.3.06), remove previous version.**

  Otherwise, Simulator may not work properly.

  [Control Panel] -> [Add or Remove Programs] -> Remove CICON.

- **The scan period of PLC Simulator depends on performance of PC.**

  In case of timer instruction which is affected by scan period, scan speed does not affect Simulator.

- **PLC Simulator is the virtual PLC software which runs in PC**

  Simulator might be interrupted according to performance of PC and other circumstance.

- **Simulator is only available to operate scan program.**

  Special program and Communication program are not available.

- **PLC Simulator is a tool to simulate scan program.**

  Screen and functions of PLC Simulator

4.13.2 Simulator Screen Layout

Screen and functions of PLC Simulator

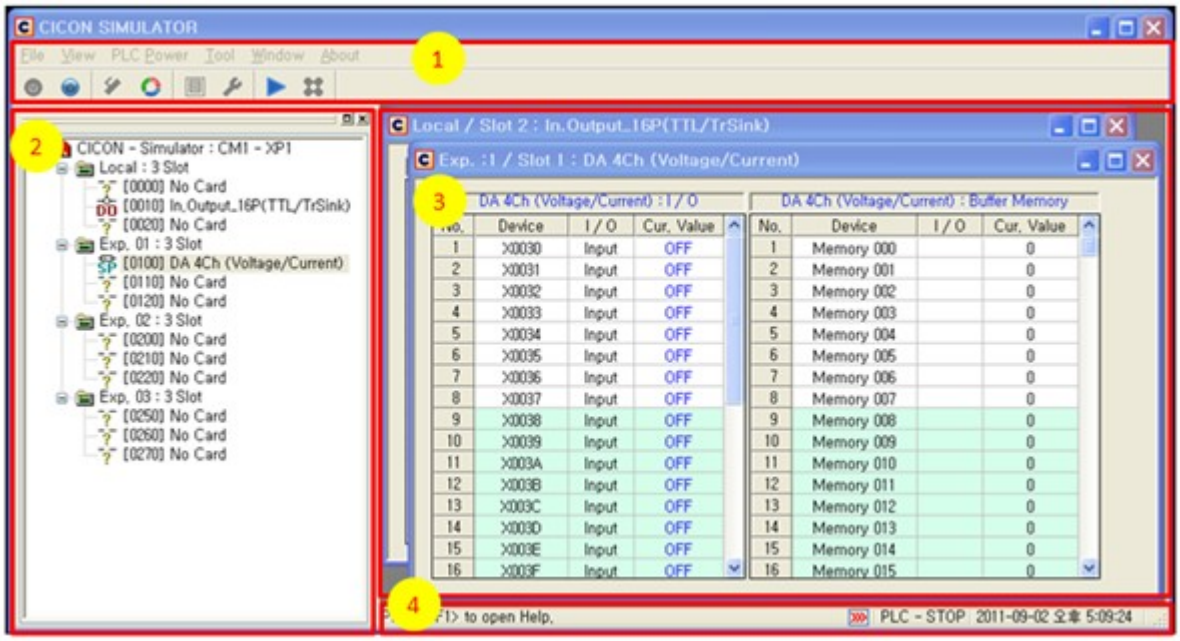
PLC Simulator Screen Layout

- Basic Screen
- Tool bar
- Module Information Window
- CPU Config
- PLC Mode
- Module Monitor
- Module Setting
- Status Information
- Warnings and Errors

4.13.2.1 Basic Screen

Screen Layout

Screen Layout of Simulator.



1) Menu & Toolbar - All functions of Simulator are operated by Toolbar.

2) Module Info Windows - Local & Expansion Base and Slot information are indicated.

3) Work Space – Module Settings window is indicated.

4) Status windows - Description of function and status of Simulator are indicated.

- **Menu Layout**
  - File : Exit
  - View : Tool bar / Status / Language
  - PLC Power : POWER ON / OFF
  - Tool : CPU Config / PLC Mode / Module Monitor / Module Setting
  - Window : Next Window / Cascade Type / Tile Type / Arrange Icon
  - About : About Simulator...

4.13.2.2 Tool bar

Screen Layout

- **Power Toolbar**

Power OFF : It is used to make PLC power off.

CPU Config	PLC Mode	Module Monitor	Module Setting
O	X	O	O

Power ON : It is used to make PLC power On and connect to CICON.

CPU Config	PLC Mode	Module Monitor	Module Setting
X	O	O	X

*** When PLC Power turns OFF, downloaded program will be reset. You have to download program again after Power Off.**

- **Basic Toolbar**

CPU Config : It is used to set up CPU type when Power is OFF. Click [Here] for more information.

PLC Mode : It is used to set up PLC mode (Run/Stop) when Power is ON. Click [Here] for more information.

- **Module Toolbar**

Module Monitor : It is used to open Module Monitor. (It works when Power is ON/OFF) Click [Here] for more information.

Module Setting : It is used to set up Module. (It works only when Power is OFF) Click [Here] for more information.

- **Status Toolbar**

PLC Run : PLC Run mode.(It works only when Power is ON)

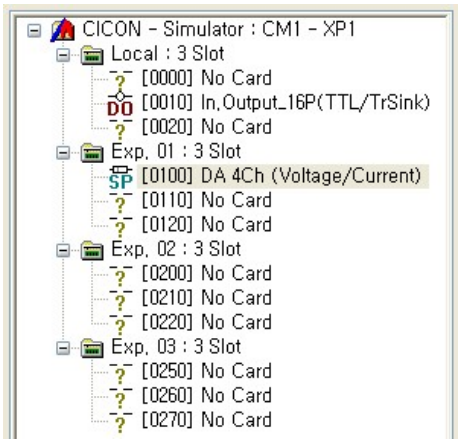
PLC Stop : PLC Stop mode.(It works only when Power is ON)

4.13.2.3 Module Information Window

Screen Layout

Module Info Windows indicates virtual PLC configuration.

Module Info Windows is similar in interface to Project Windows of CICON.



[Module Info Windows]

Module Info Windows indicates following.

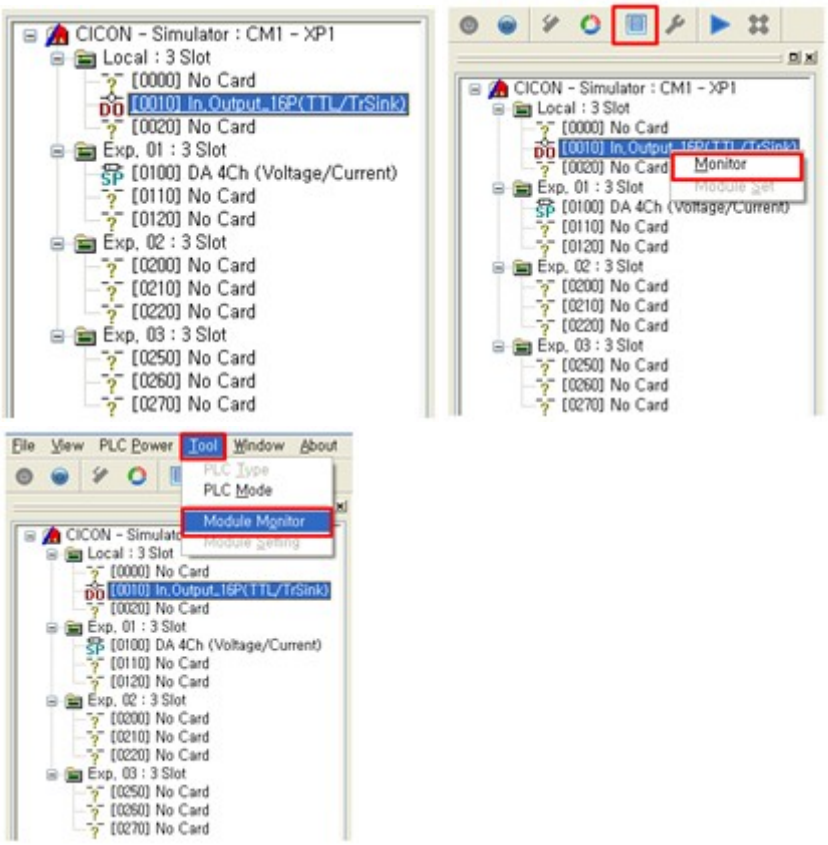
1. CPU type
2. Local Base / Expansion Base information
3. Module settings per Slot
4. IO point Information

[Module Info Windows] is updated and indicates information automatically when [PLC Type] or [Module Setting] is changed.

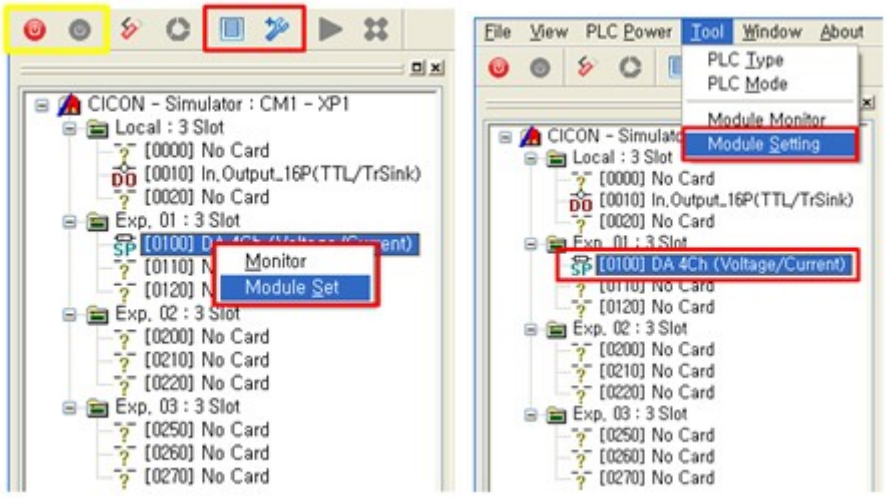
Monitor Function

- **There are 4 ways to open Module Monitor.**
  - Double click module list at [Module Info Windows]
  - Select module list at [Module Info Windows] and click [Module Monitor] icon at Toolbar.
  - Select module list and Click right button of mouse -> [Monitor]

- Select module list at [Module Info Windows] and click [Tool] -> [Module Monitor]



- **There are 3 ways to open Module Setting. (Module Setting only works when Power is OFF)**
  - Select module list at [Module Info Windows] and click [Module Setting] icon at Toolbar.
  - Select module list and Click right button of mouse -> [Module Set]
  - Select module list at [Module Info Windows] and click [Tool] -> [Module Setting]



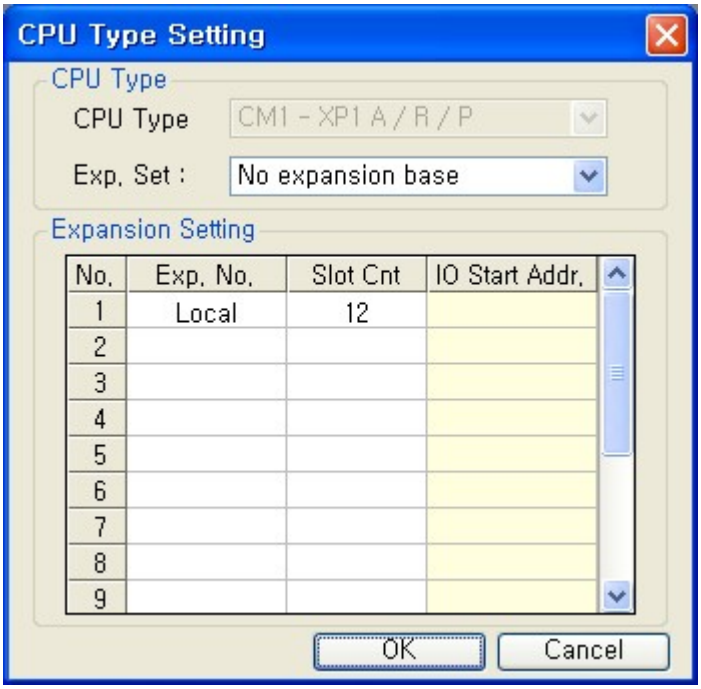
4.13.2.4 CPU Config

Screen Layout

If CPU type is XP or CP(Except CP4) at [PLC Type], Base slot, expansion base and IO staring address can be set up.

If CPU type is BP, expansion can be set up limitedly. In case of PLCS, you can only select CPU type(13 Slot is fixed).

*** [CPU Type] is fixed at CICON and cannot be changed in Simulator. In order to change CPU type, go to CICON [File] -> [Project Properties]**



1) CPU Type : [CPU Type] is fixed at CICON and cannot be changed in Simulator.

2) Expansion Setting : It is used to set up expansion base up to Max. 16Base.

CPU Type - CP4 : No Expansion Base

CPU Type - BP4 : Only Available to select number of expansion module.

CPU Type - PLCS : Expansion Setting is fixed.(CPU 1Slot + Exp. Set 12Slot) You can select CPU Type (32MDT/16MDR)

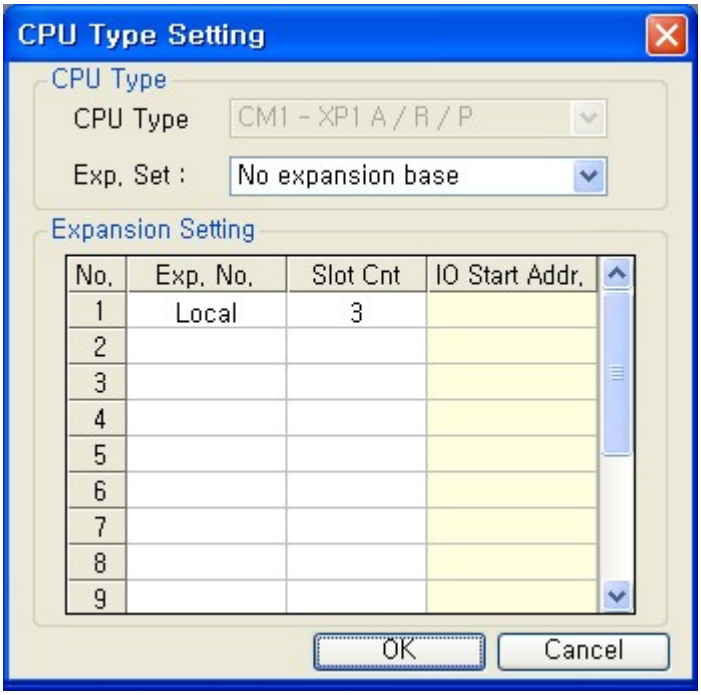
3) Expansion Setting : "No." / "Exp. No." are indicated automatically.

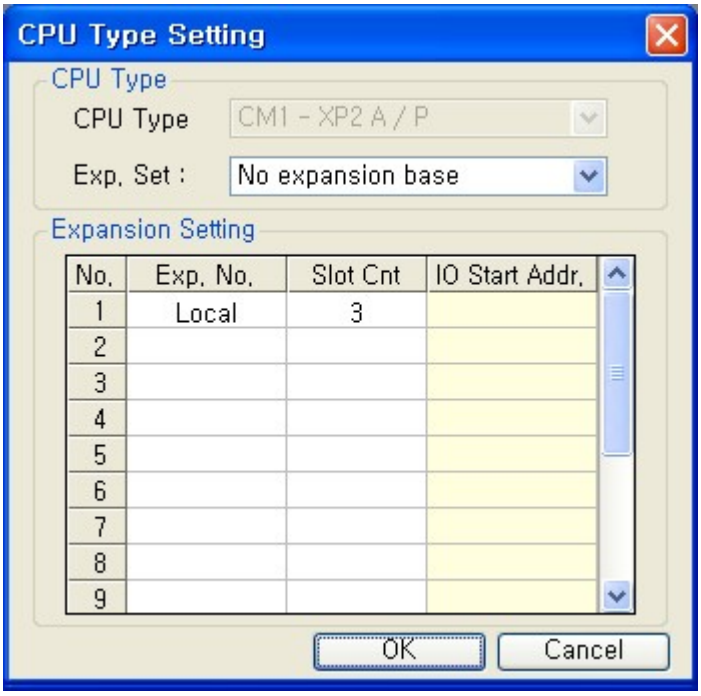
- Slot Cnt : 3 / 4 / 5 / 8 / 10 / 12Slot can be selected.
- IO Starting Address: It is used to set up IO starting address of Expansion Base.(Write number in tens)

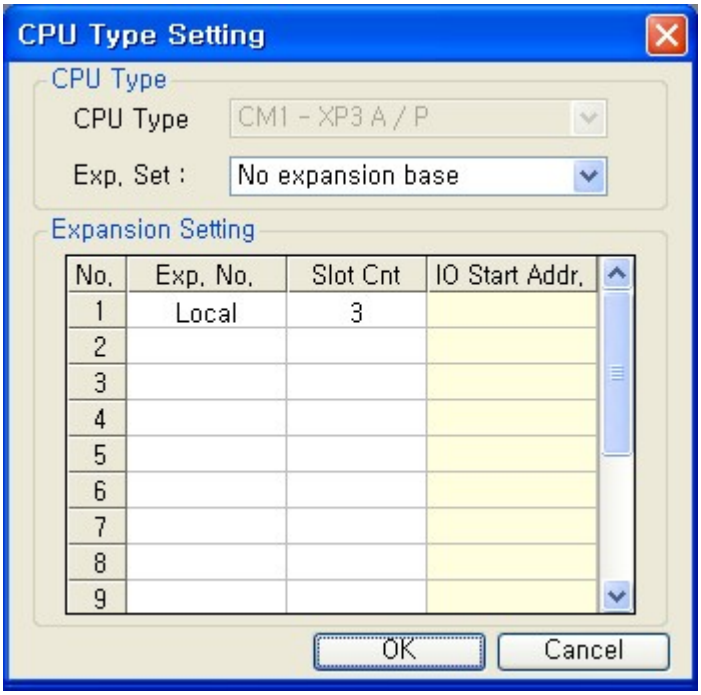
***When IO starting address is set up in Simulator, it must be same with "Base I/O address Allocation" at [Reserved IO] in CICON.**

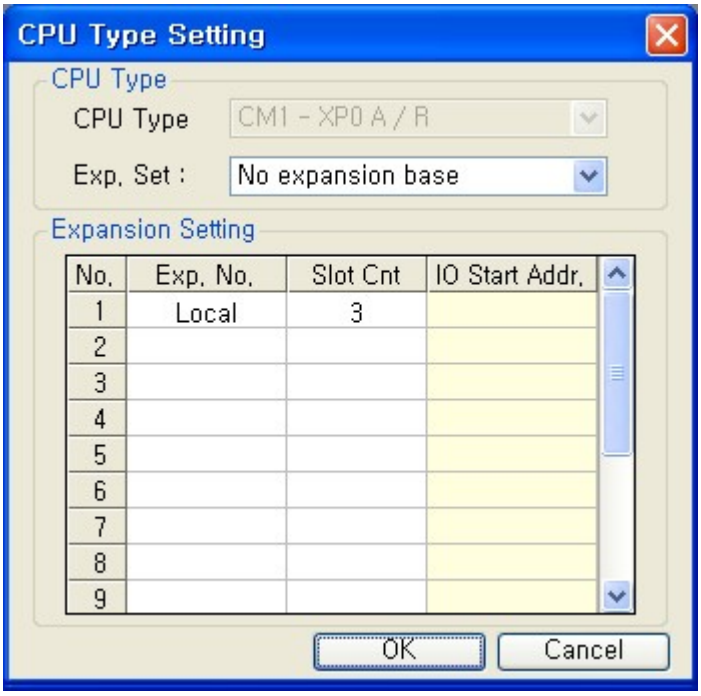
Screen Type

- **CPU Type : XP Series**

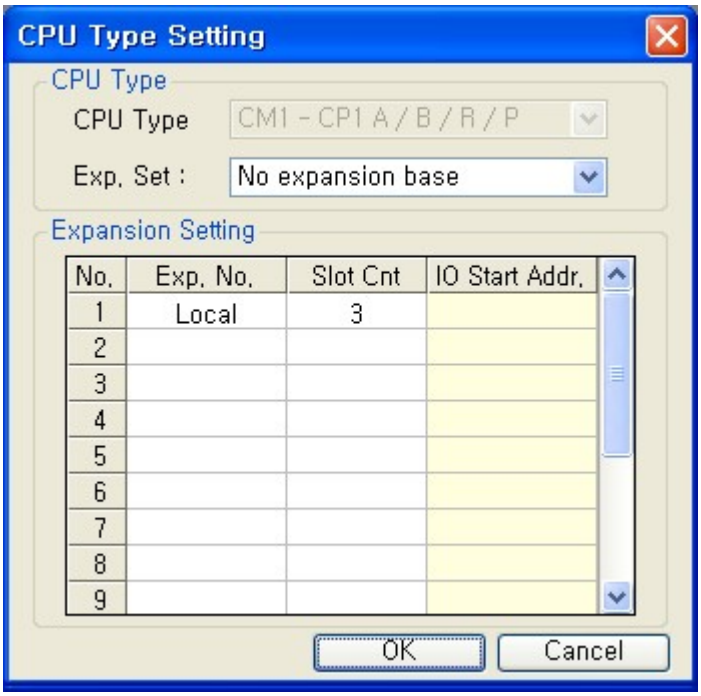


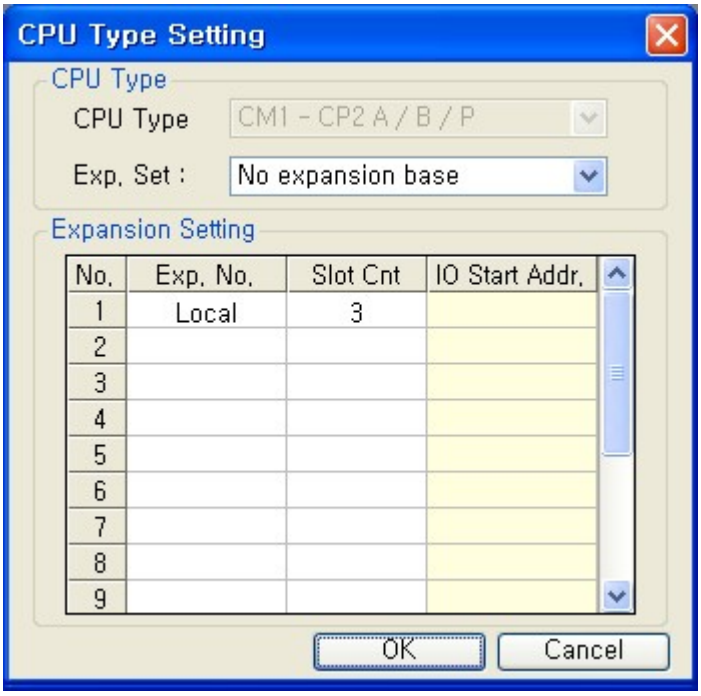


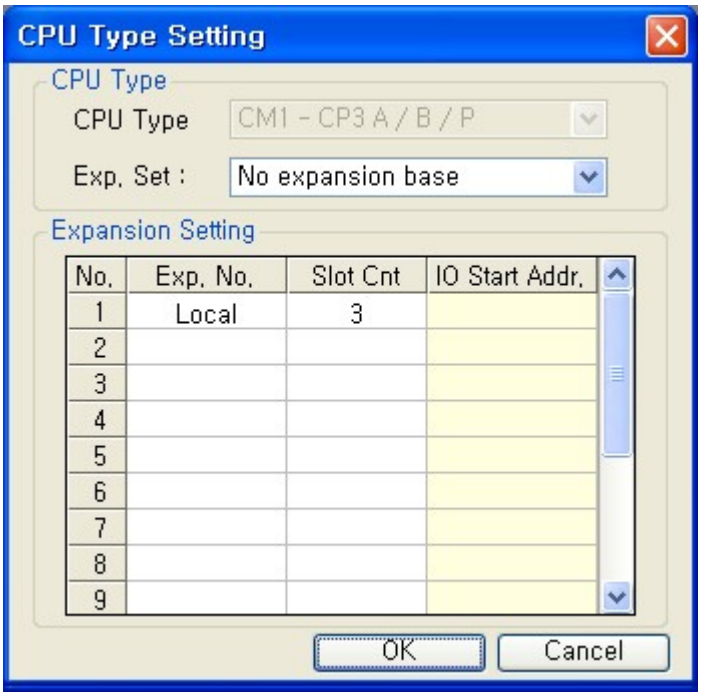


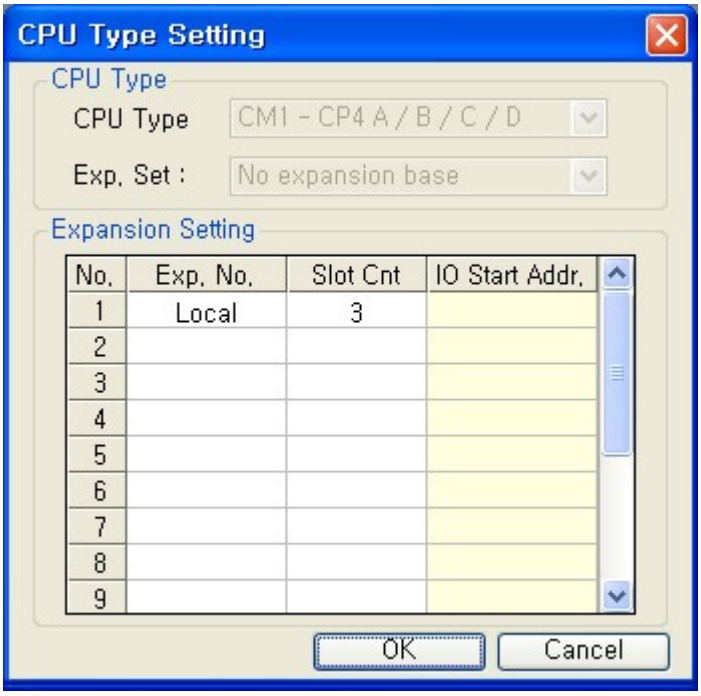


- **CPU Type : CP Series**

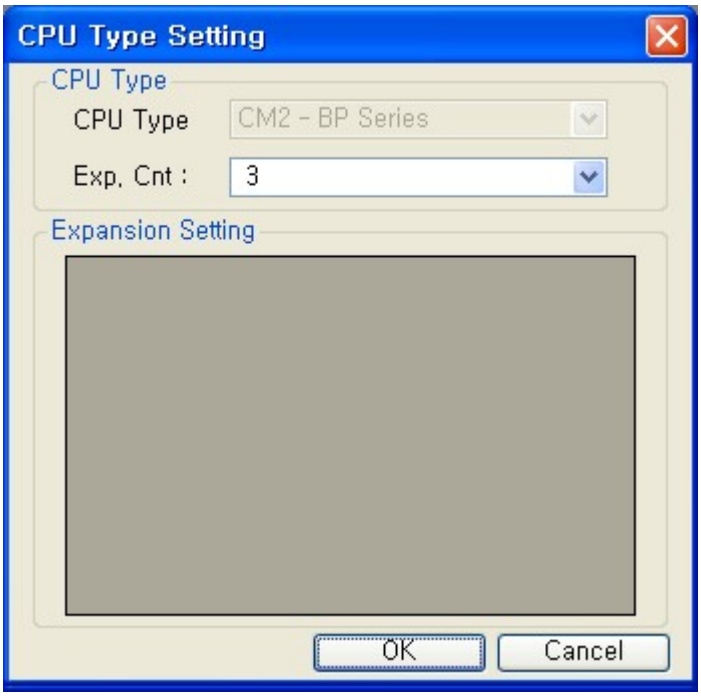




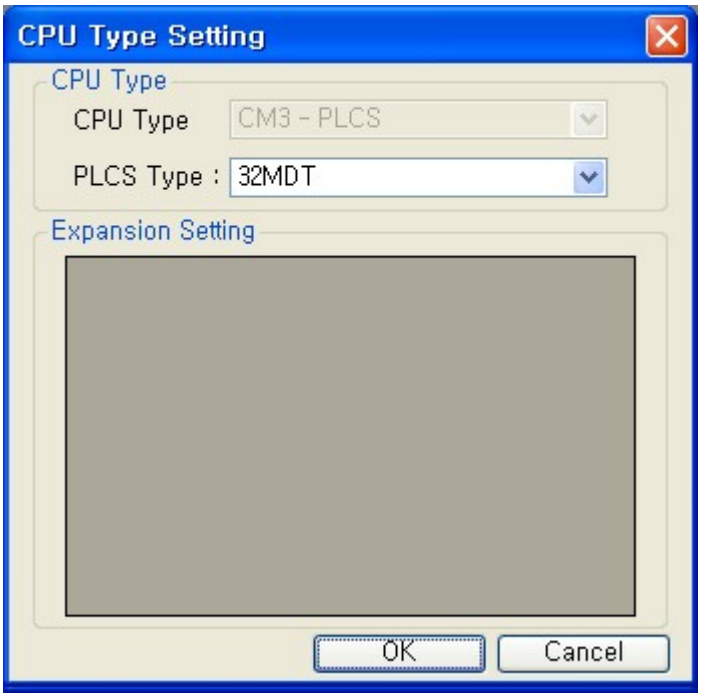




- **CPU Type : BP**



- **CPU Type : PLCS**



4.13.2.5 PLC Mode

Screen Layout

- **Stop Mode** : Stop PLC operation.

Stop Mode in Toolbar

- **Run Mode** : Run PLC operation

Run Mode in Toolbar

4.13.2.6 Module Monitor

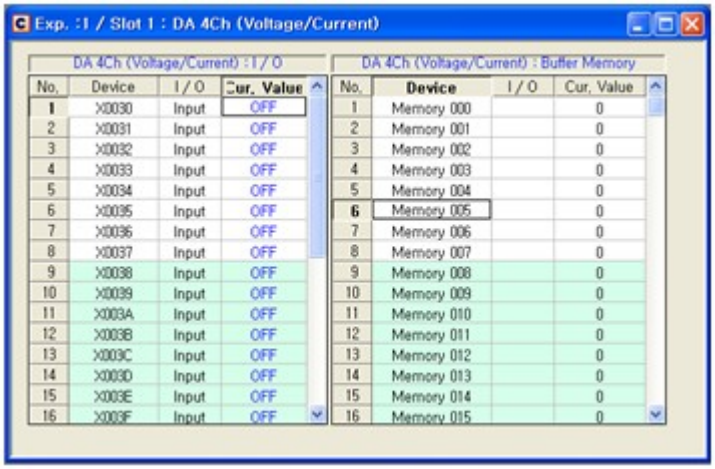
Screen Layout

[Module Monitor] is used to check IO signal and buffer memory value.

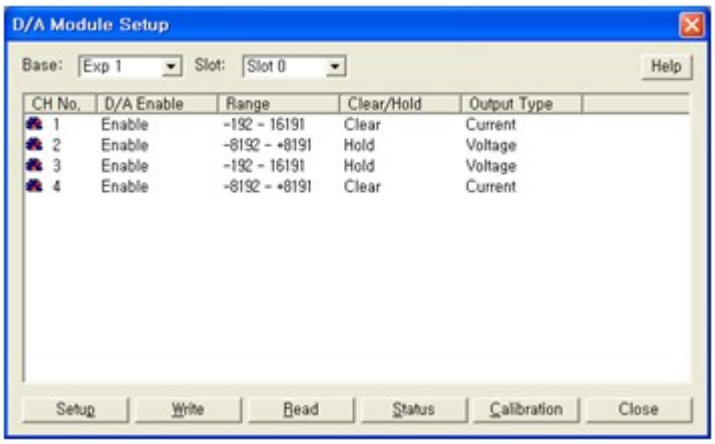
- I/O Module : I/O Monitor
- Special Module : I/O Monitor + Buffer Memory

User can set up ON / OFF for I/O signal (Double click) and write 0~0xFFFF for Buffer memory.

***Buffer memory address is from 0~255. Refer to buffer memory table in Help for each modules.**



Each CICON and PLC Simulator can check setting values one another.

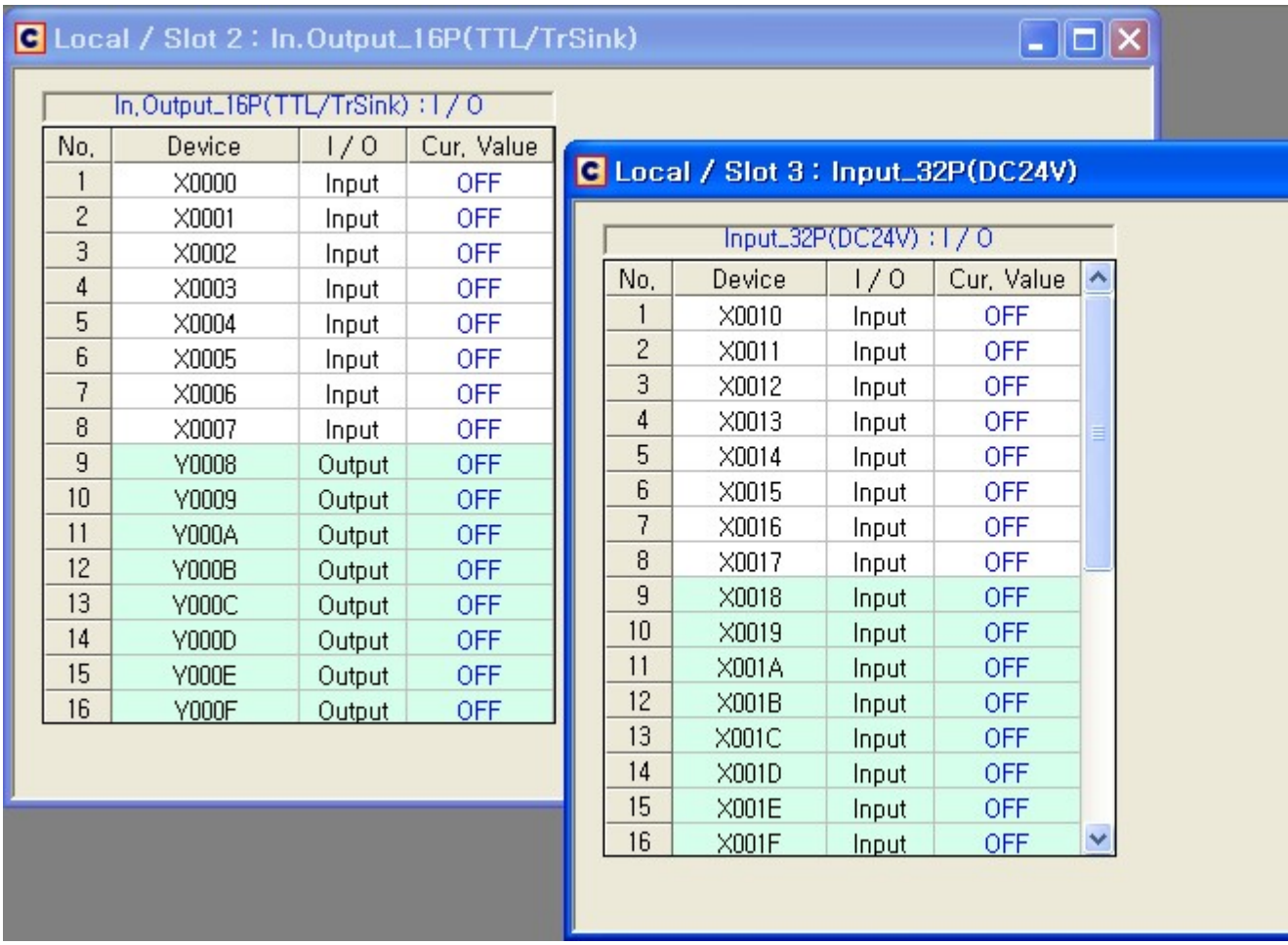


Monitor Type

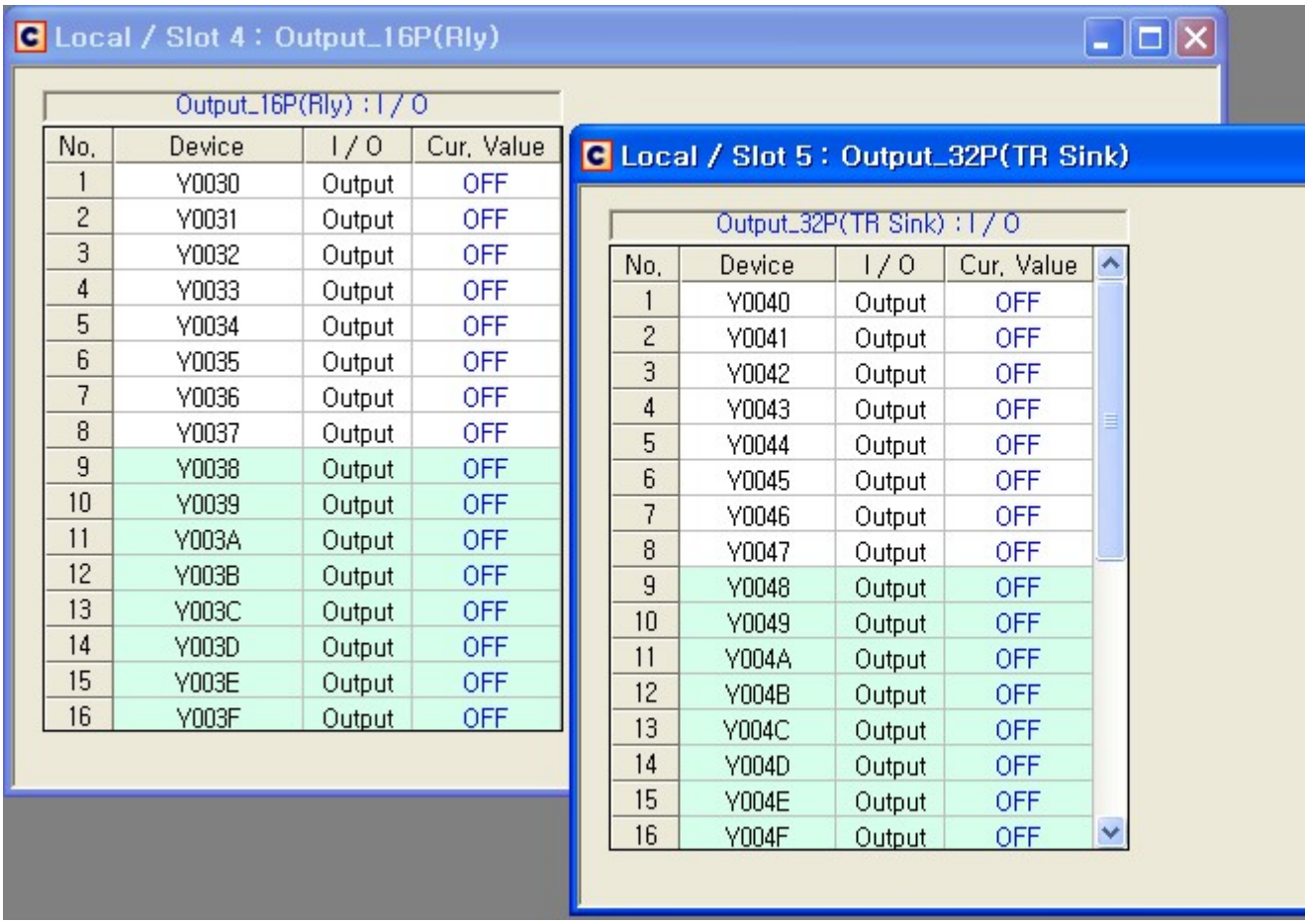
I/O points of Module Monitor is different according to Module Type.

Basic Module Monitor is as below pictures.

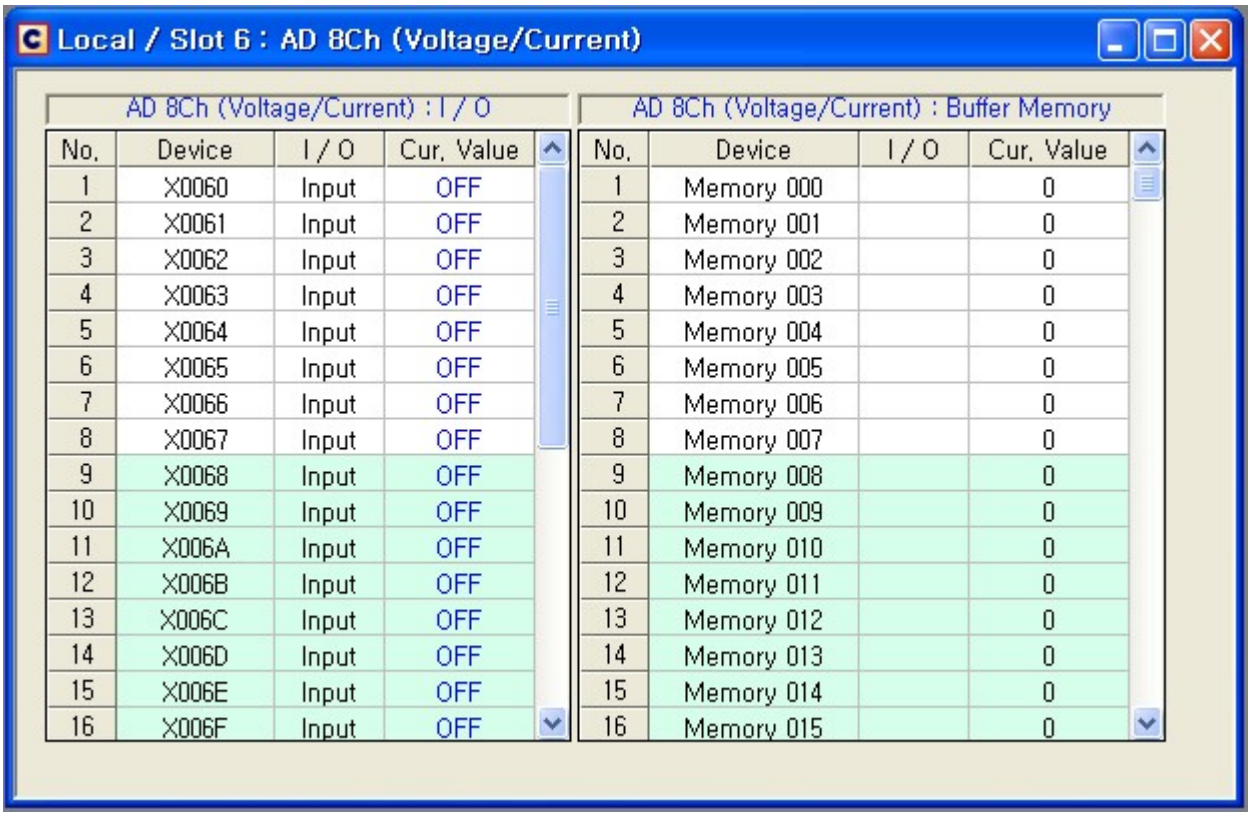
Input Module Monitor



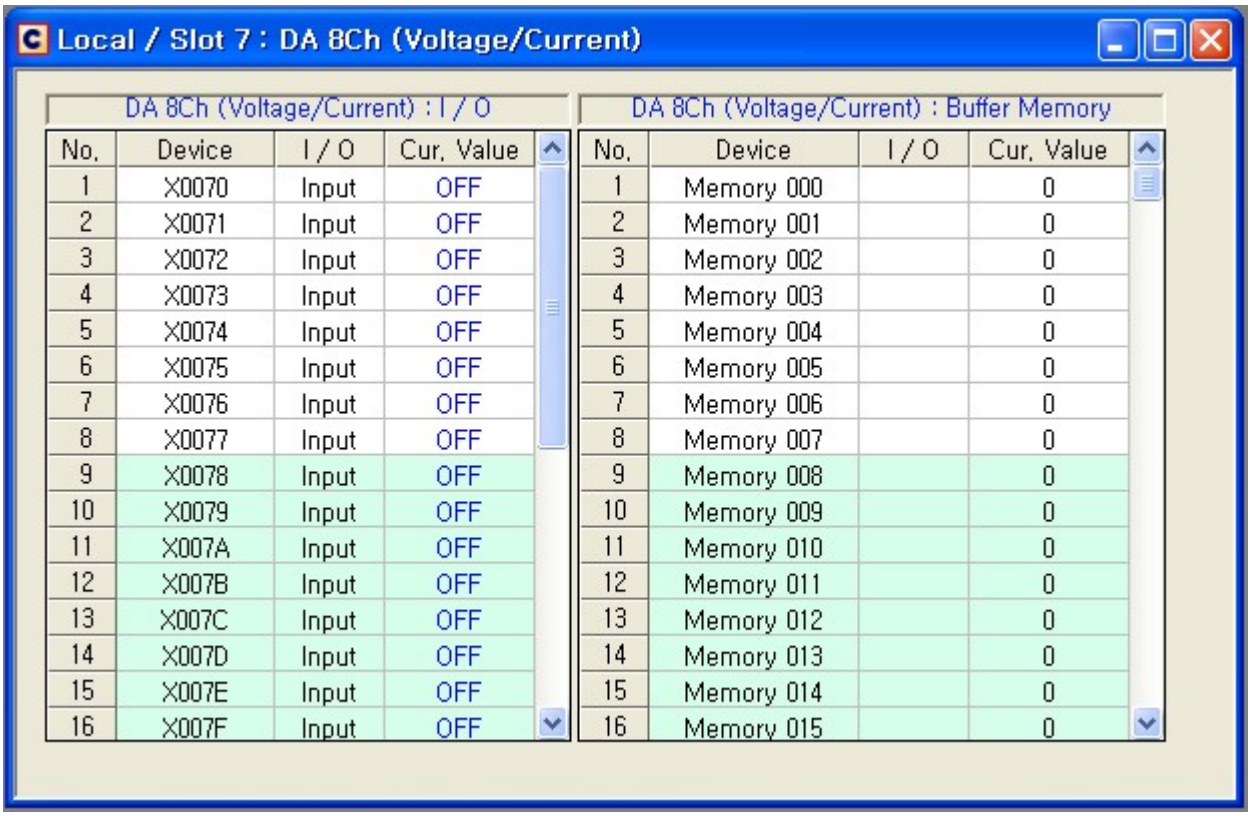
Output Module Monitor



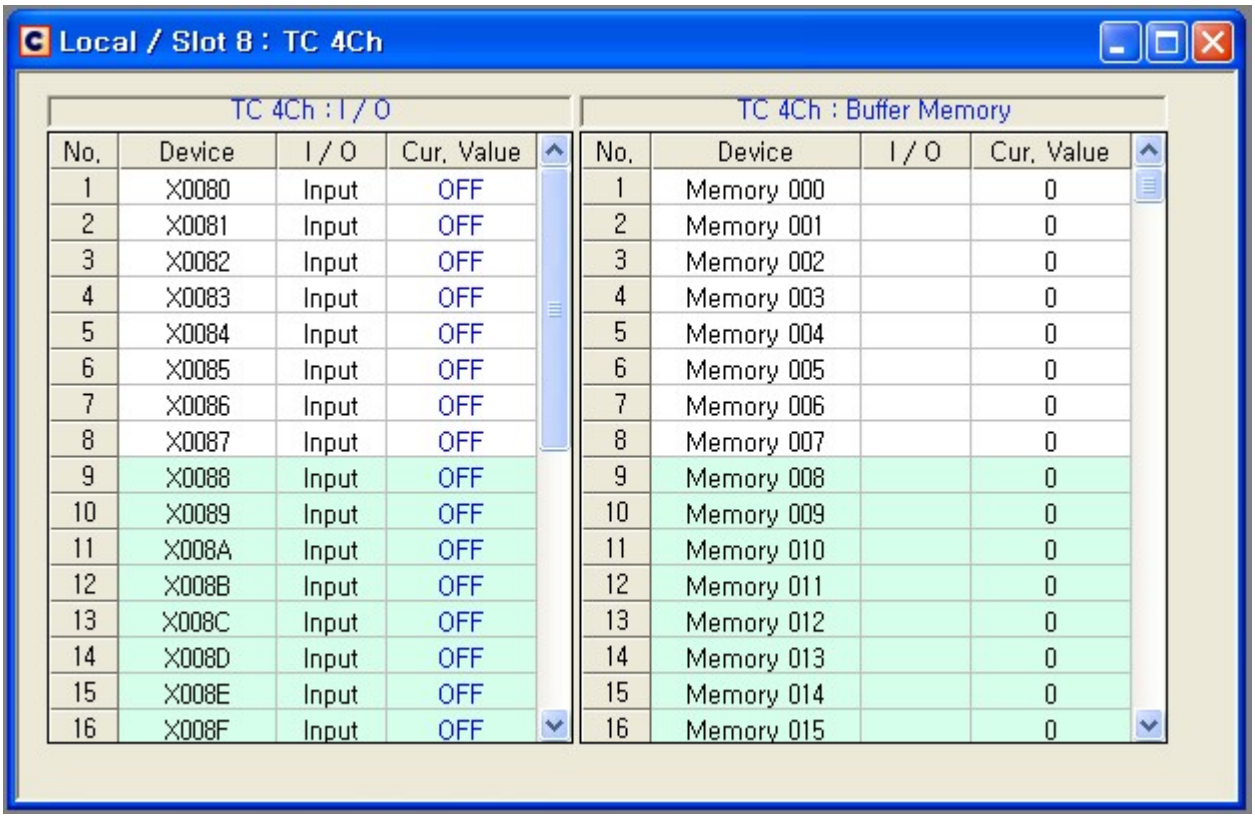
Special Card Monitor : AD 8Ch. (Voltage/Current)



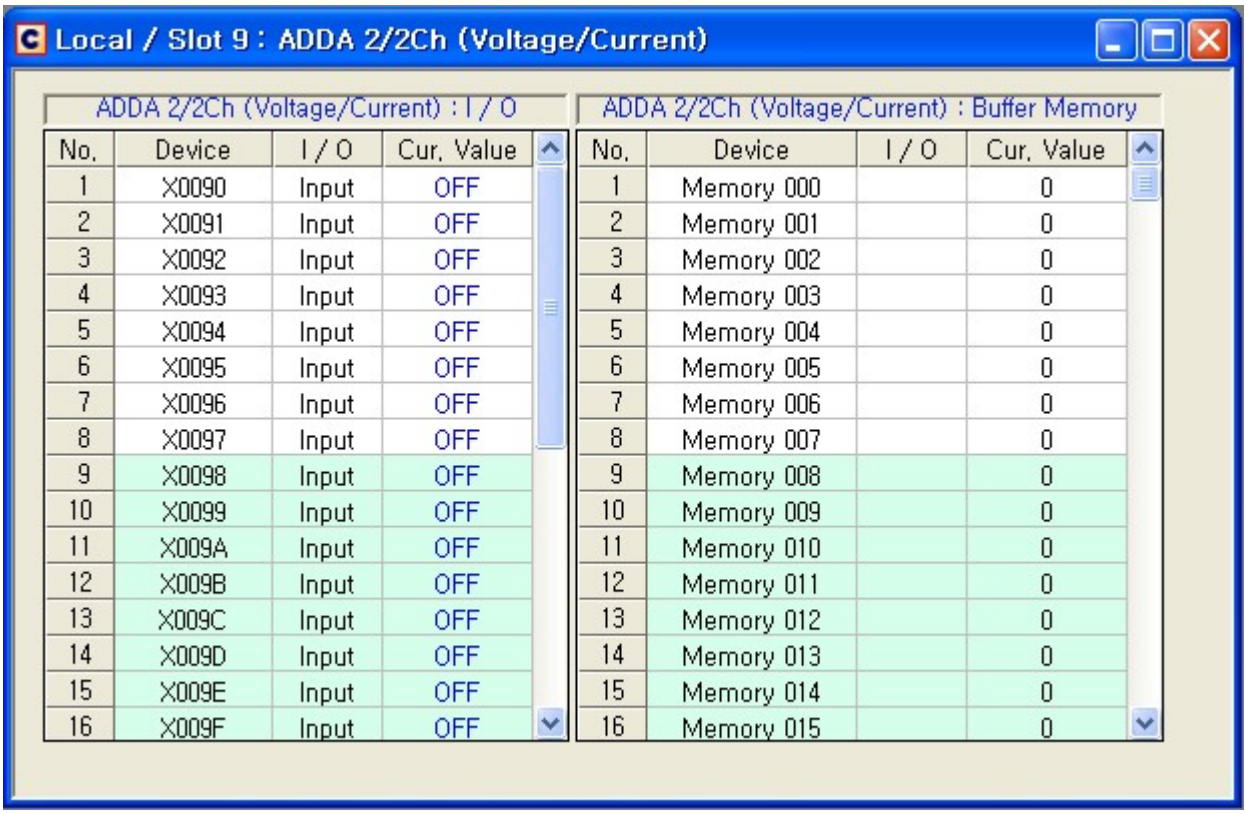
Special Card Monitor : DA 8Ch. (Voltage/Current)



Special Card Monitor : TC 4Ch.



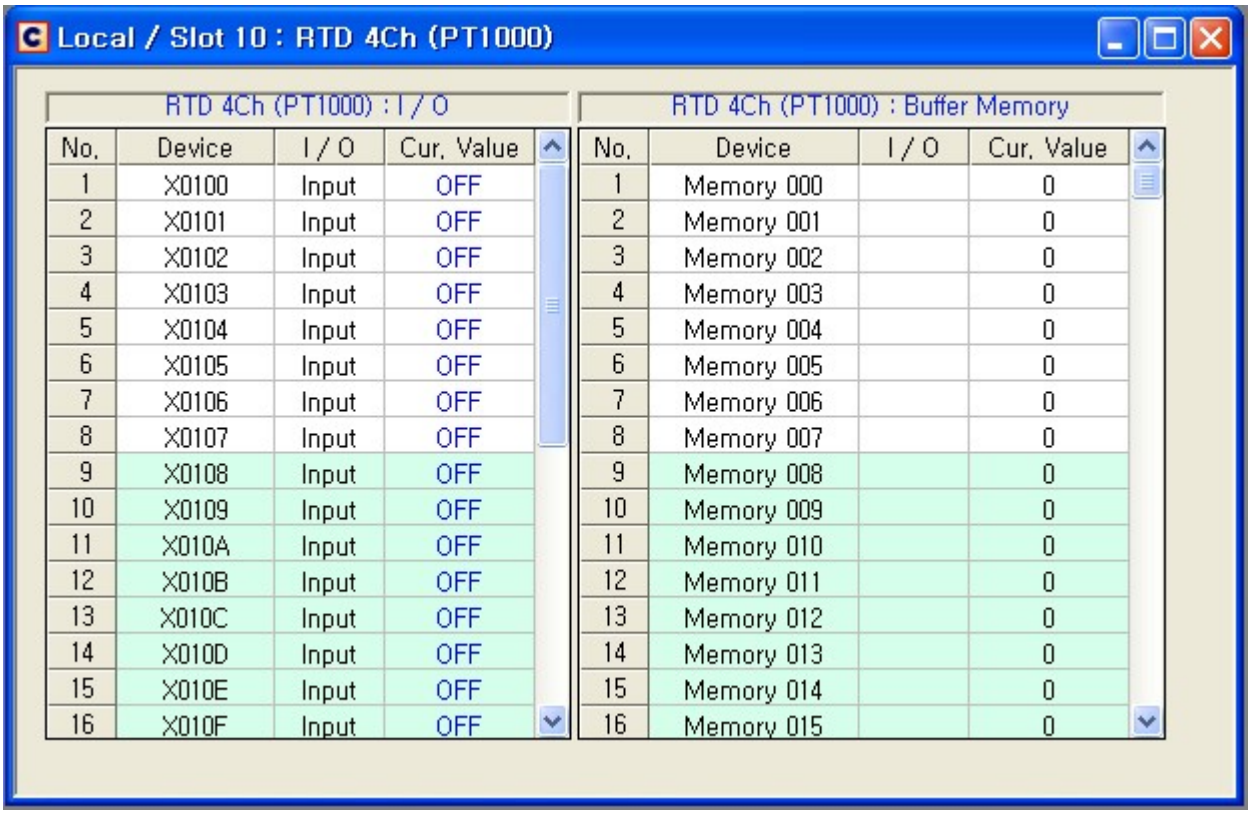
Special Card Monitor : ADDA 2/2Ch. (Voltage/Current)



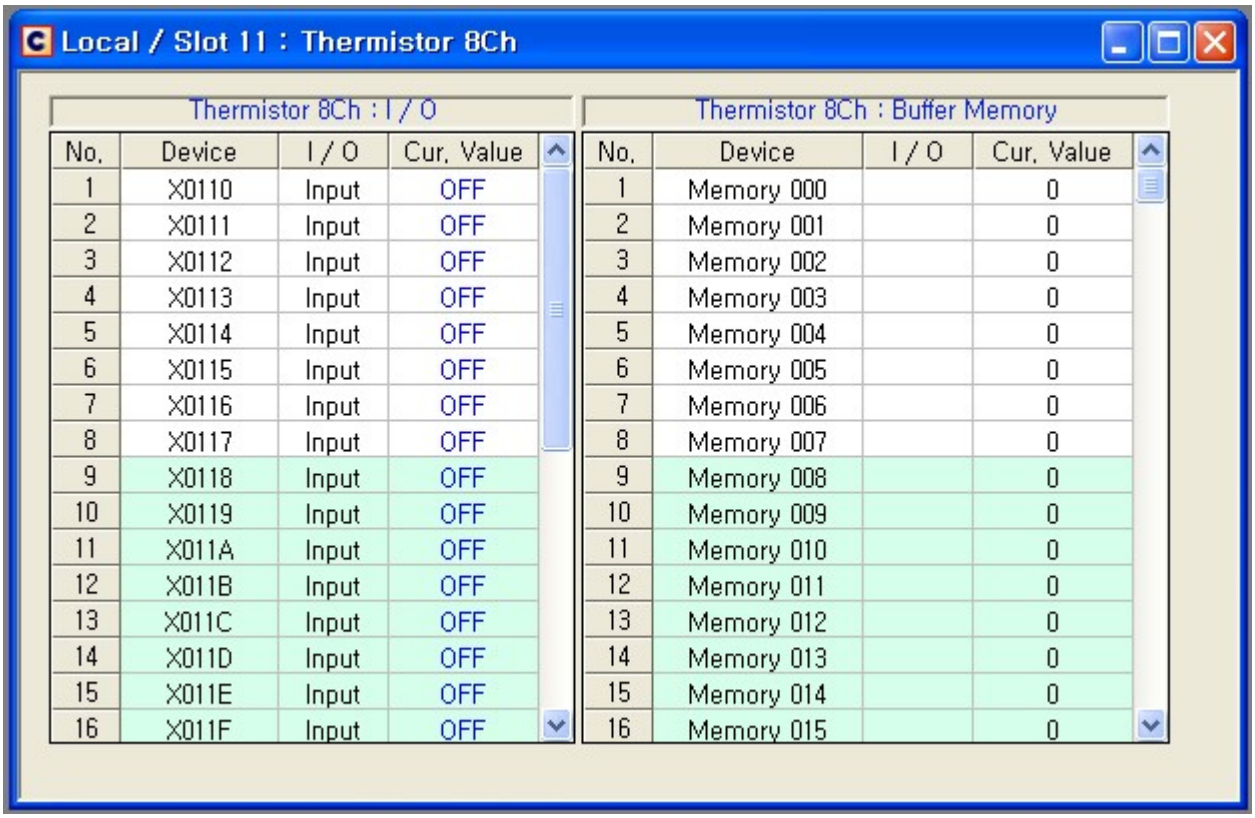
No.	Device	I / O	Cur. Value
1	X0090	Input	OFF
2	X0091	Input	OFF
3	X0092	Input	OFF
4	X0093	Input	OFF
5	X0094	Input	OFF
6	X0095	Input	OFF
7	X0096	Input	OFF
8	X0097	Input	OFF
9	X0098	Input	OFF
10	X0099	Input	OFF
11	X009A	Input	OFF
12	X009B	Input	OFF
13	X009C	Input	OFF
14	X009D	Input	OFF
15	X009E	Input	OFF
16	X009F	Input	OFF

No.	Device	I / O	Cur. Value
1	Memory 000		0
2	Memory 001		0
3	Memory 002		0
4	Memory 003		0
5	Memory 004		0
6	Memory 005		0
7	Memory 006		0
8	Memory 007		0
9	Memory 008		0
10	Memory 009		0
11	Memory 010		0
12	Memory 011		0
13	Memory 012		0
14	Memory 013		0
15	Memory 014		0
16	Memory 015		0

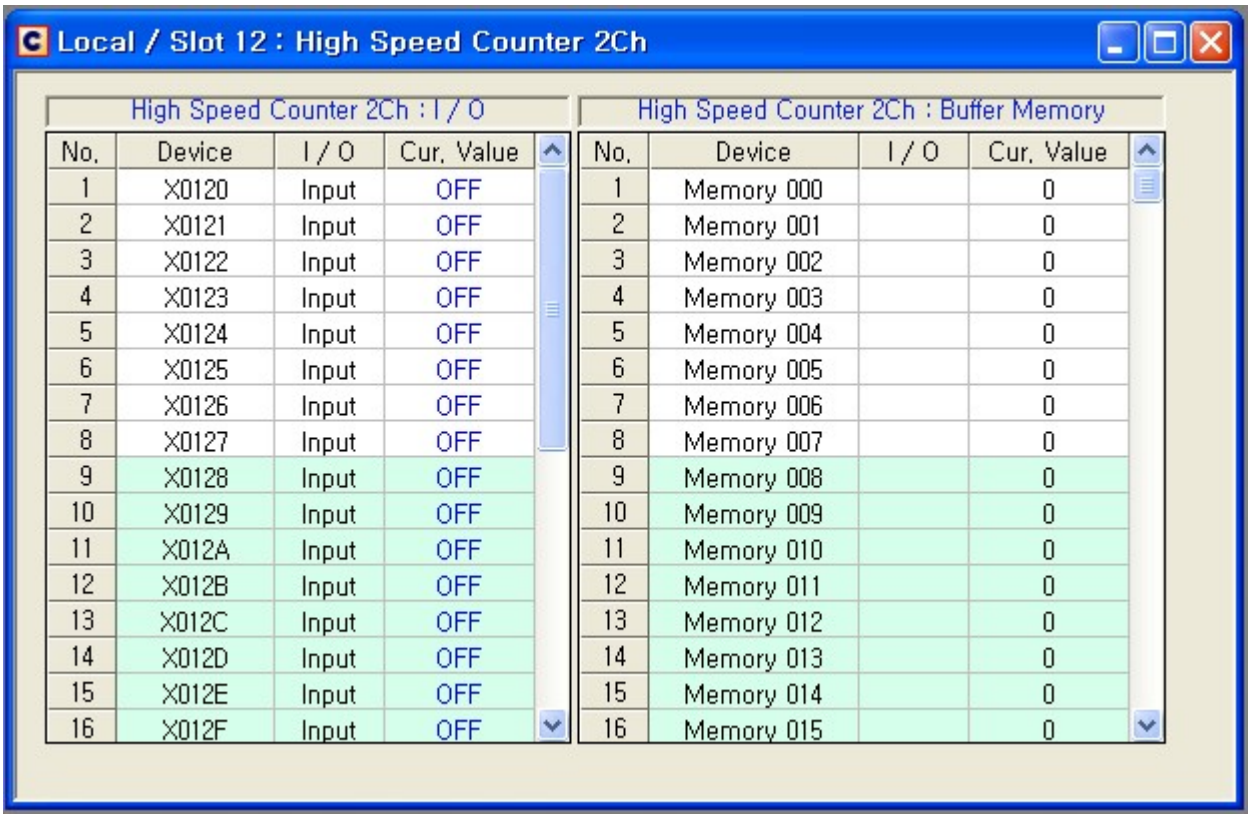
Special Card Monitor : RTD 4Ch. (PT1000)



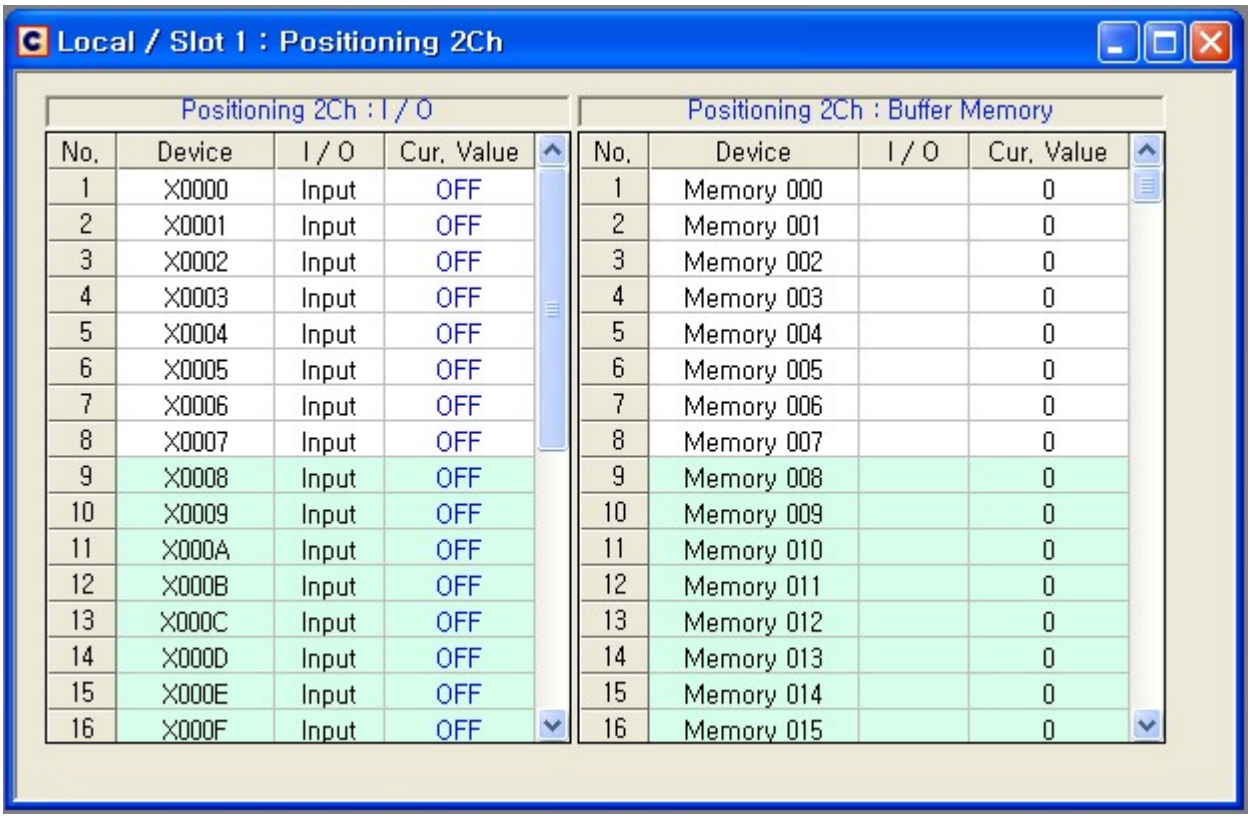
Special Card Monitor : Thermistor 8Ch.



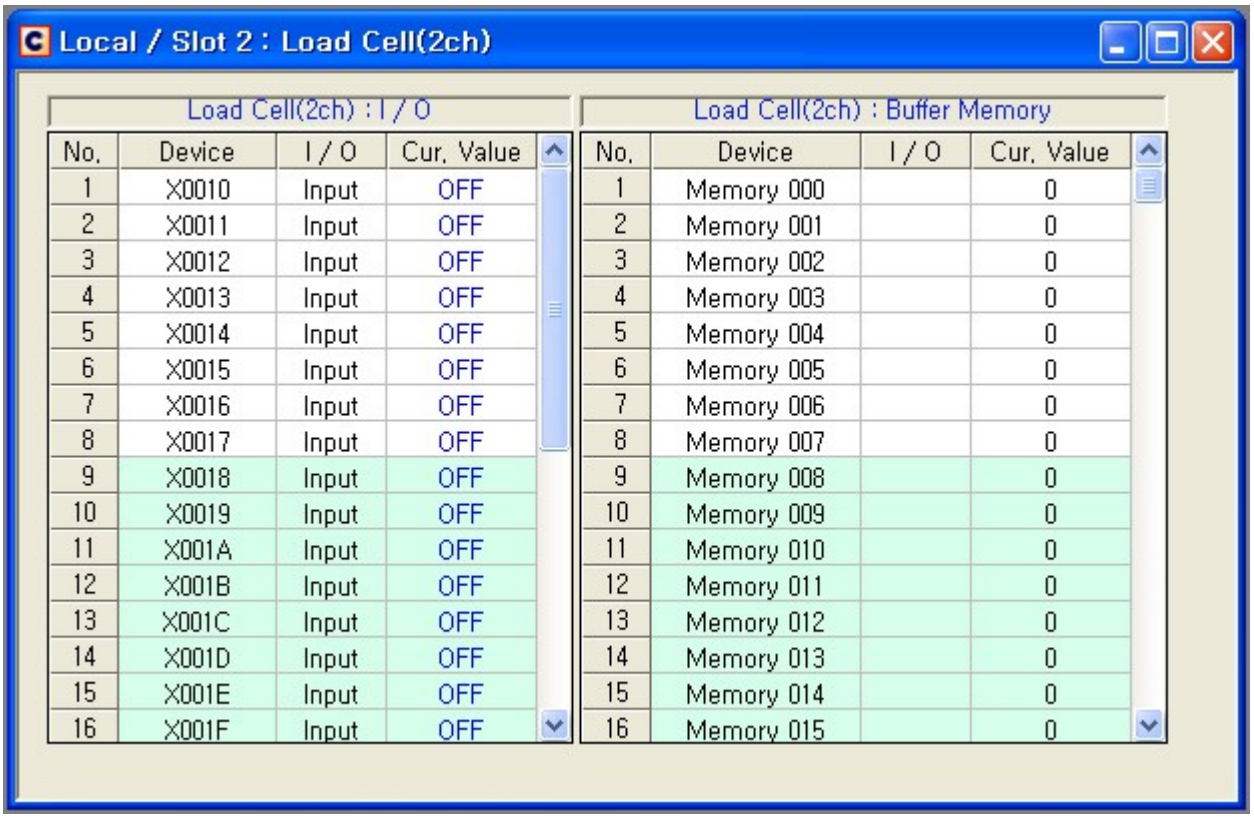
Special Card Monitor : High Speed Counter 2Ch.



Special Card Monitor : Positioning 2Ch.



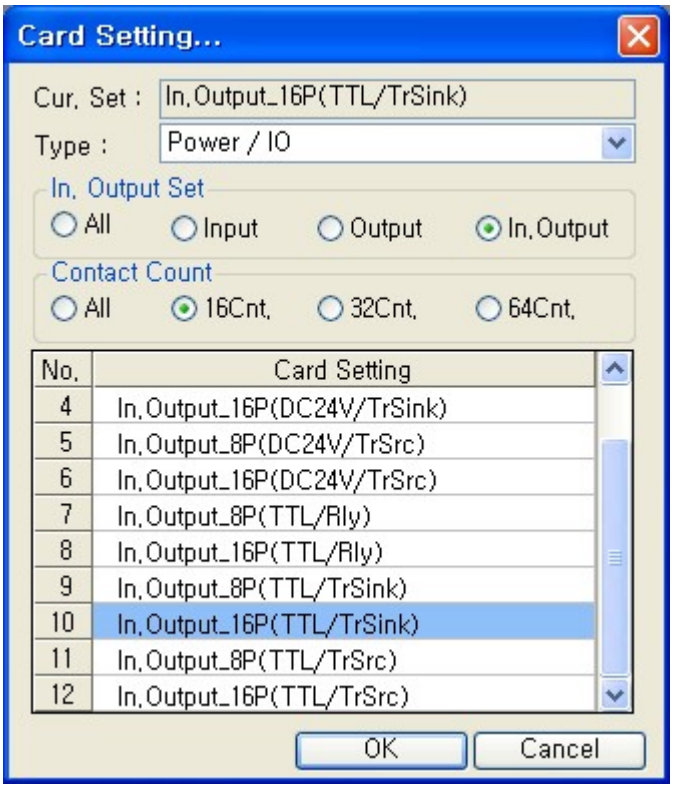
Special Card Monitor : Load Cell(2Ch.)

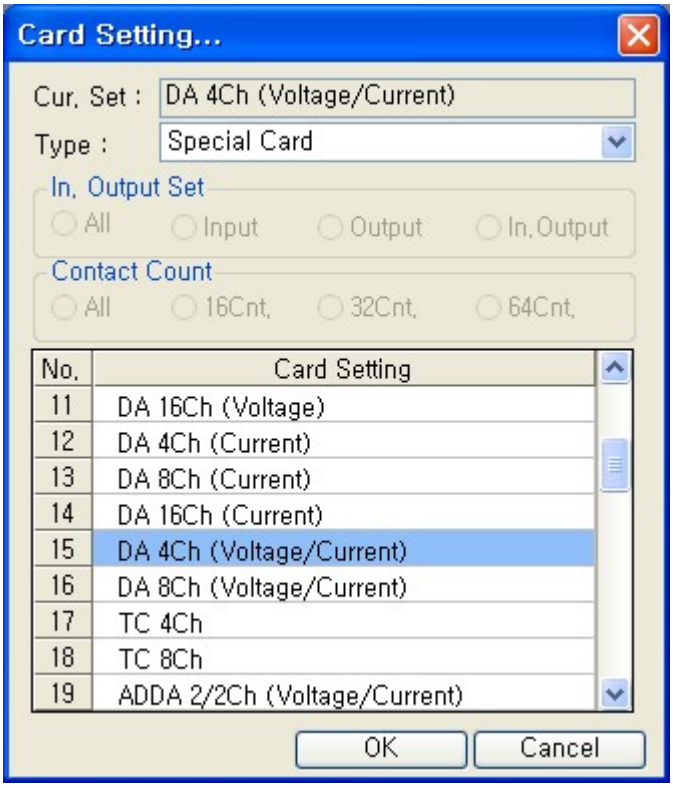


4.13.2.7 Module Setting

Screen Layout

Module Setting is used to set up module.





1) Current Set : Present module name

Click "Cancel" to close Module Setting without save module.

2) Type : Select Module

All : It indicates all modules

Power / IO : It indicates power modules and I/O modules

3) I/O Type : Selected I/O type will be indicated in "Card Setting"

4) I/O Points : Selected I/O Points will be indicated in "Card Setting"

5) Available Modules : Available modules are displayed. Select one of modules and click "OK" to save settings.

Present Module is highlighted in blue at Available Modules.

***The I/O of Special Module is fixed with 16 points.**

***If you do not need to select module, select "No Card" in [Type]**

- **Notice**

"Module Setting" is saved as file in below folder.

CICON [Tool] -> [CICON Options] -> [Location of Project Folder] -> "CICON_SIMULATOR" -> <SIM_CONFIG.SIM>

This file affects Simulator operation. If you modify or remove, PLC Simulator may not work properly.

If users set up "PLC Type" or "Module Setting" and save it as file, users can get back saved Setting value after changing settings.

4.13.2.8 Status Information

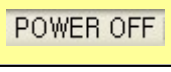
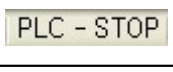
Screen Layout

Status Windows shows status of Simulator in real time.

- **Communication Status**

		
Communication Status	**Connecting with CICON**	**Disconnecting with CICON**

- **Power and PLC Status**

Power and PLC Status	PLC Power OFF	PLC Power ON STOP Mode	PLC Power ON RUN Mode

- **Present Time**

2011-08-30 오후 4:24:23

4.13.2.9 Warnings and Errors

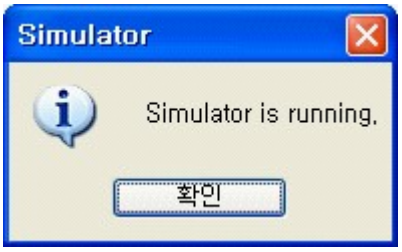
Screen Layout

There are some Warnings and Errors in Simulator as following.

When you click PLC OFF while Simulator is connecting to CICON, below message will appear.

When you click Exit in Simulator, below message will appear.

If you click [Tool] -> [Run PLC Simulator] while Simulator is running, below message will appear.

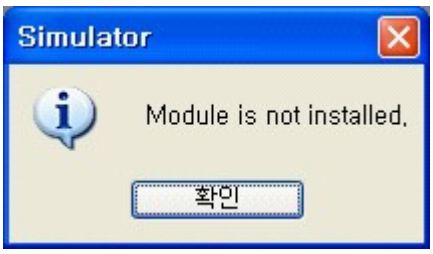


If you run Simulator with "CICON Simulator.exe" in Simulator folder, below message will appear.
(Do not click "CICON Simulator.exe" file)

When you change language to English, below message will appear.

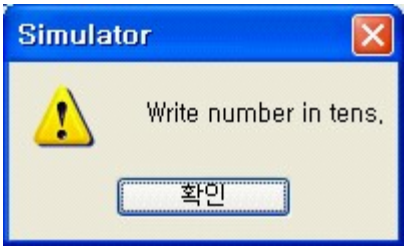
When you change language to Korean, below message will appear.

When you double click "No card" in [Module Info Windows], below message will appear.

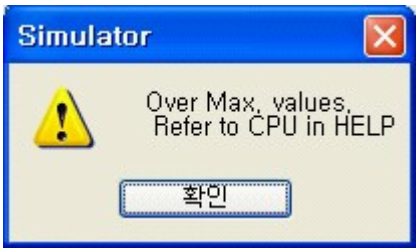


If you click "Module Setting" without selecting module in "Module Info Windows", below message will appear.
Select module first in "Module Info Windows" and click "Module Setting"

If you do not write address number in tens at "IO Starting Address" in [PLC Type], below message will appear.



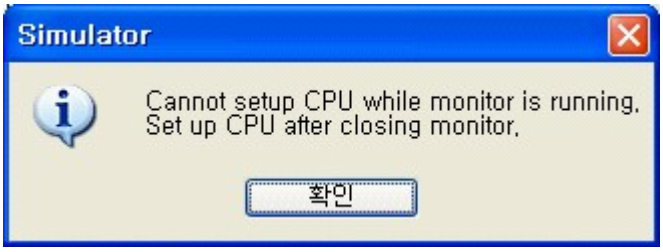
If you write bigger number than Max. number at "IO Starting Address" in [PLC Type], below message will appear.
Check device range in CICON HELP.



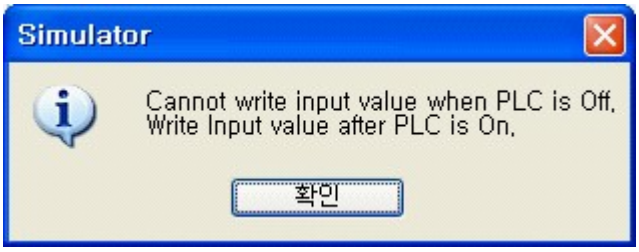
If you write smaller number than "IO Address allocation" of Prior expansion at "IO Starting Address" in [PLC Type], below message will appear.

If you write bigger number than "IO Address allocation" of Next expansion at "IO Starting Address" in [PLC Type], below message will appear.

If you click "Module Setting" while "Module Monitor" is displayed, below message will appear.

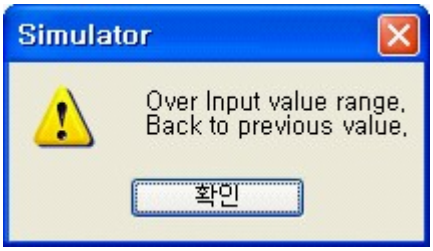


If you click buffer memory in "Module Monitor" when PLC is OFF, below message will appear.



In case of access range of buffer memory in Module Monitor, below message will appear.

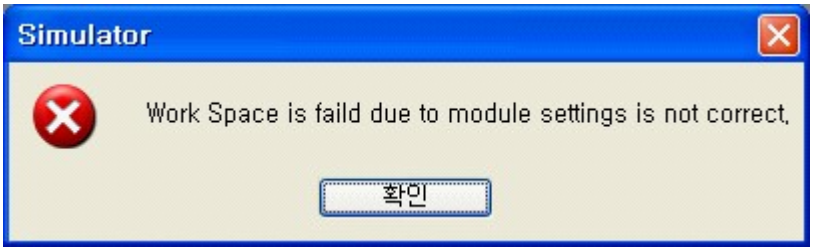
Range: 0 ~ 65535



If you select "Special Card" at Slot 0 in [Module Setting] when CPU is BP Type, below message will appear.

Only Power I/O is possible at Slot 0.

If Module Setting is not saved properly, below message will appear.



4.13.3 Simulator Settings

In order to operate PLC Simulator properly, CPU Config. and Module Setting should be set up correctly. Refer to below instruction.

PLC Simulator Setting Instruction

- CPU Config
- Module Setting

4.13.3.1 CPU Config

If you run PLC Simulator, Simulator monitor appear as below.

There is only CPU module in "Module Info Windows".
You should set up module, Expansion for simulator.

Simulator starts with PLC Power ON and PLC Stop mode.

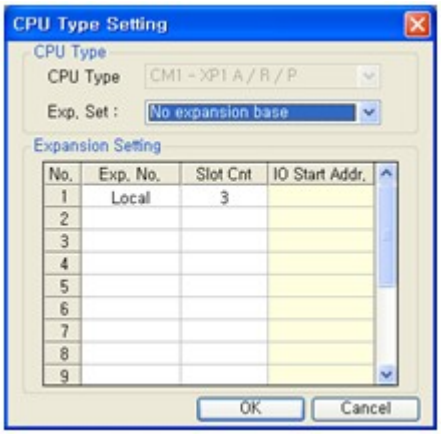
In order to set up [CPU Config], turn Off PLC Power.

***When PLC Power is off, download program will be reset. You should download program from CICON to Simulator.**

When PLC Power is off, below message will appear.

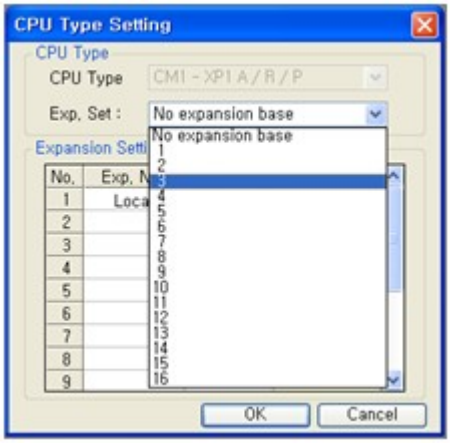
Click [CPU Config] to set up Module and Expansion.

Select Expansion number, Slot number, and IO Starting Address.

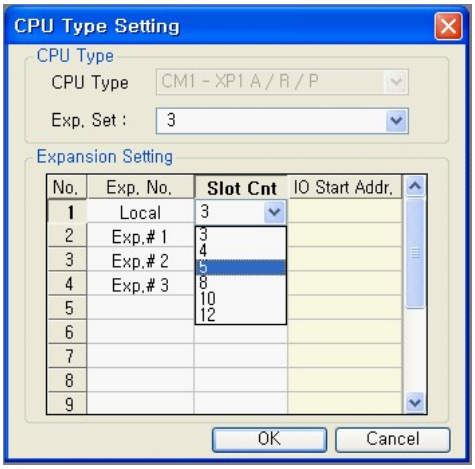


- **Expansion Setting** : There are Max. 16 Base expansion.

If Expansion number is selected, Slot 3 is a basic setting.



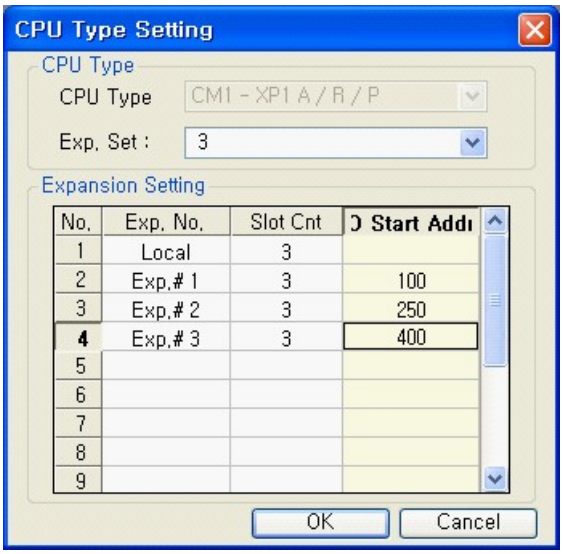
- **Slot number** : 3Slot ~ 12Slot



- **IO Starting Address** : IO Starting Address can be set up from Expansion Base #1.

  Write IO Starting Address in tens.

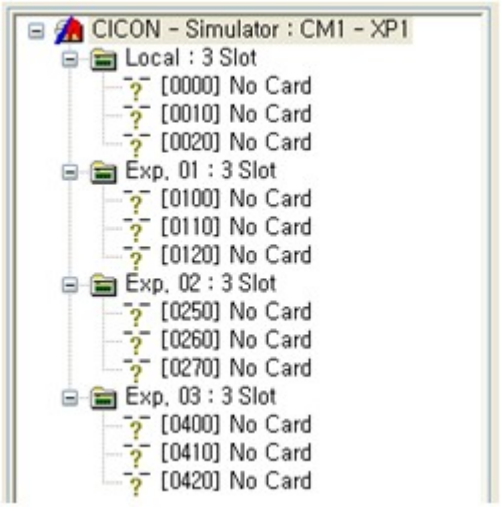
  IO Starting Address should be bigger than prior expansion and small than next expansion as below picture.



(Example of IO Starting Address)

After click OK, updated module and expansion information are indicated in [Module Info Windows]

- Local Base : 3Slot (IO Start Address : None)
- Expansion Base #1 : 3Slot (IO Start Address : 100)
- Expansion Base #2 : 3Slot (IO Start Address : 250)
- Expansion Base #3 : 3Slot (IO Start Address : 400)



4.13.3.2 Module Setting

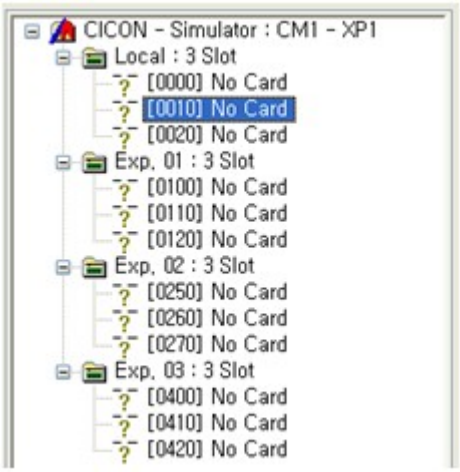
IO Module Setting

In order to set up [Module Setting], Turn PLC Power Off.

***When PLC Power is off, download program will be reset. You should download program from CICON to Simulator.**

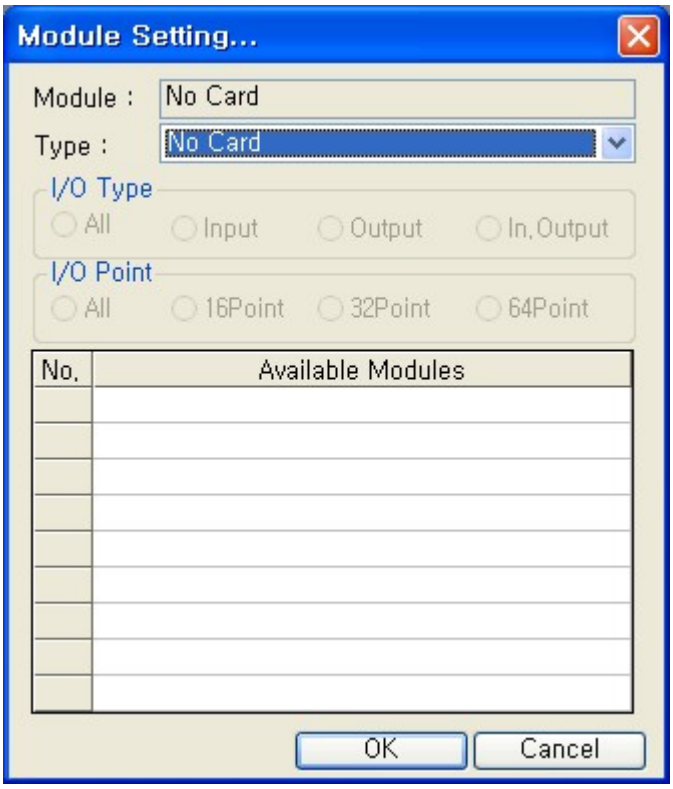
Click one of slots in [Module Info Windows]

Example) Local Base - Slot 2

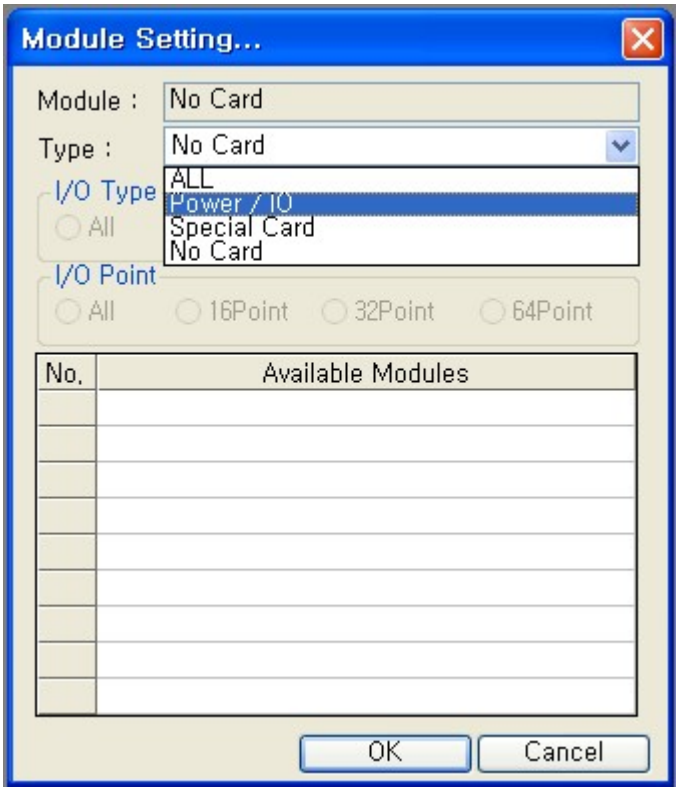


Click [Tool] -> [Module Setting]

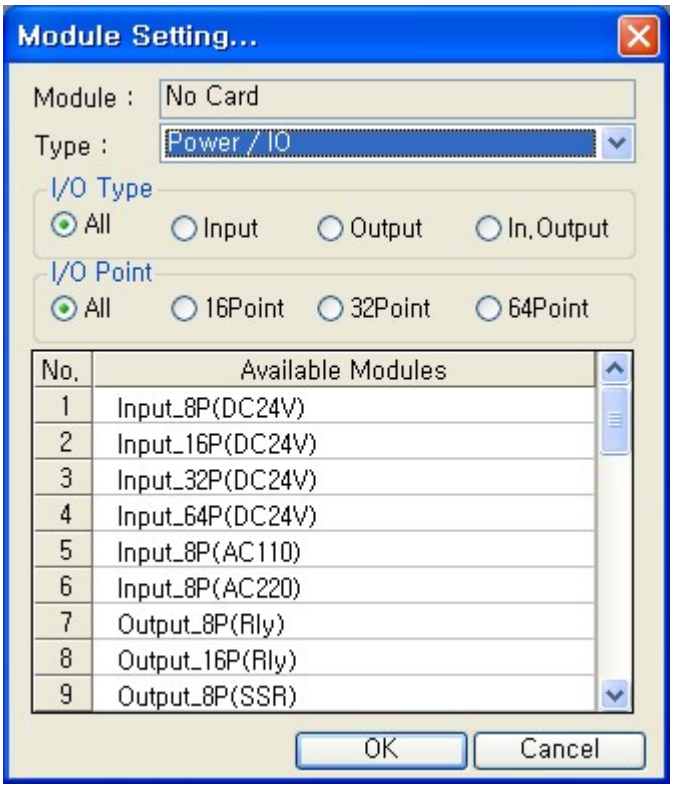
[Module Setting]



Select "Power / IO" at Type

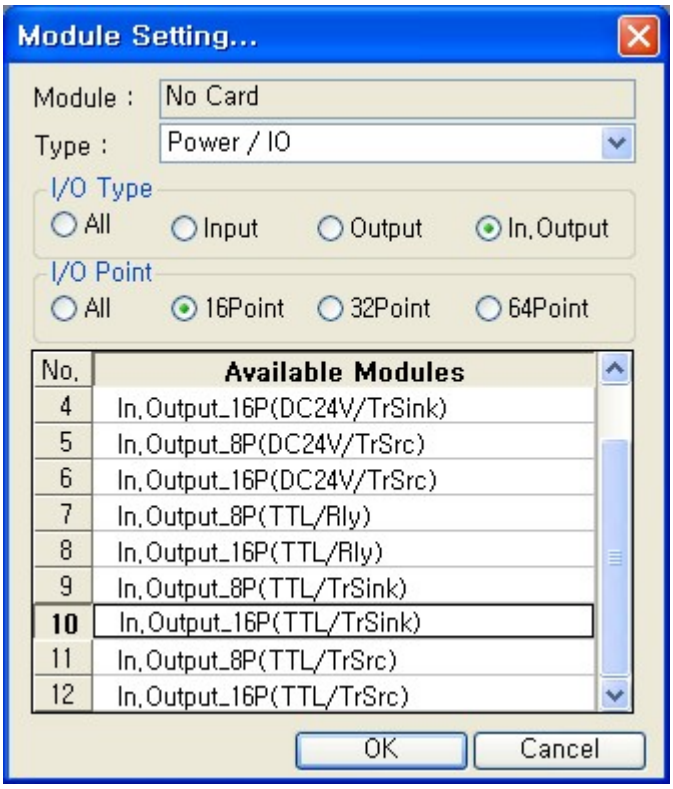


I/O Type, I/O Points and Module Setting are activated.

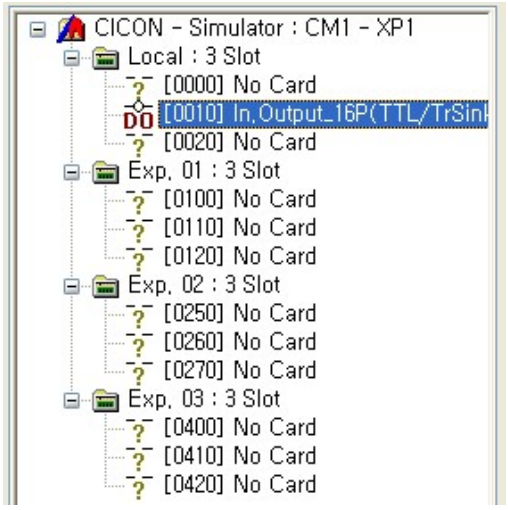


Click "In.Output" and "16points".

Click In.Output_16P(TTL/TrSink) and "OK" to save it.



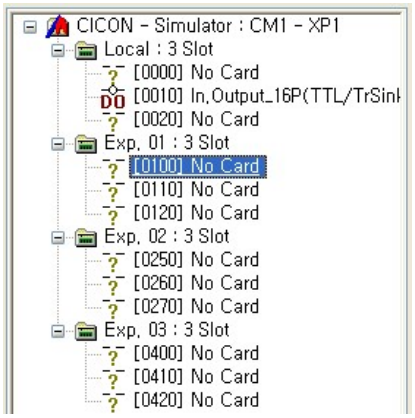
There is a selected module in [Module Info Windows]



Special Module Setting

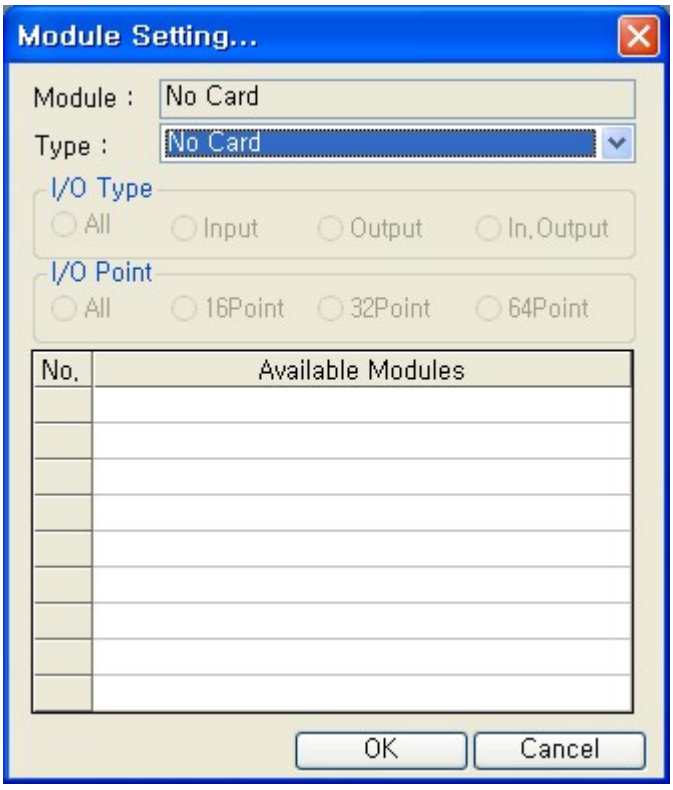
Click one of slots in [Module Info Windows]

Example) Expansion #1 Base - Slot 1

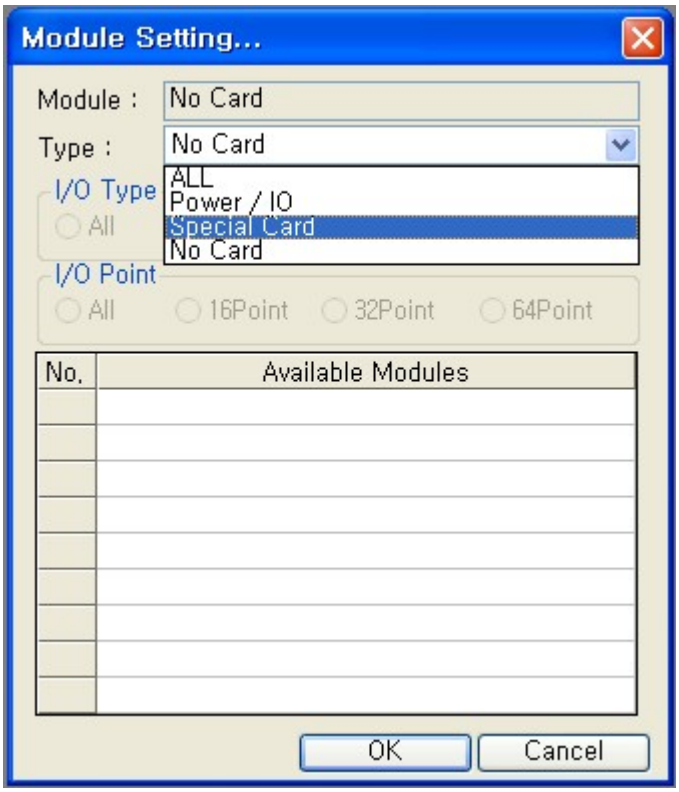


Click [Tool] -> [Module Setting]

[Module Setting]

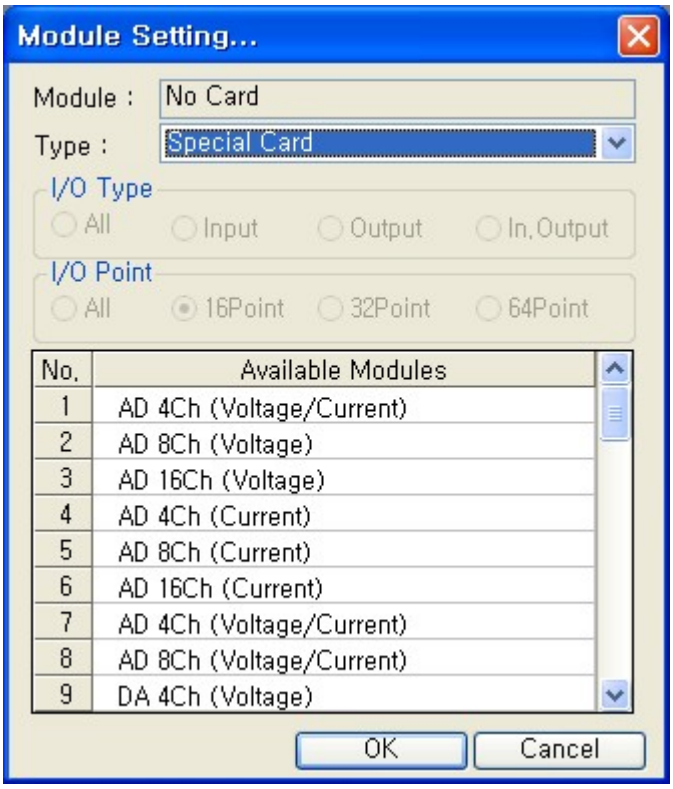


Select "Special Card" at [Type].

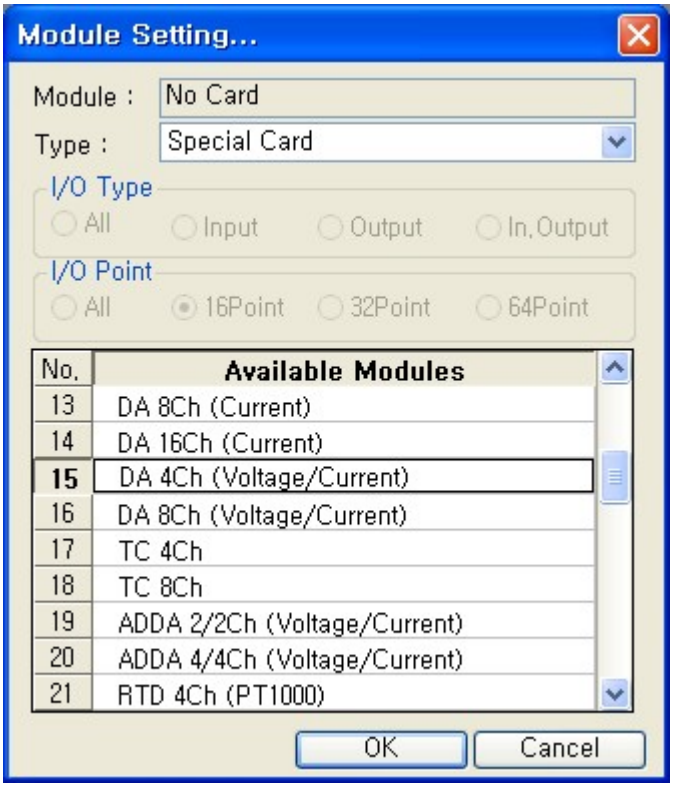


Module Setting is activated.

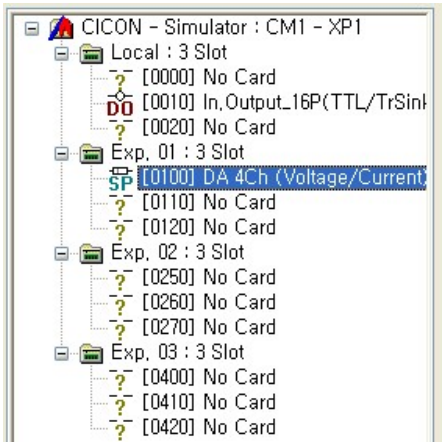
*** In case of Special card, I/O 16point is fixed.**



Select DA 4Ch (Voltage/Current) and "OK" to save it.



There is a selected module in [Module Info Windows]



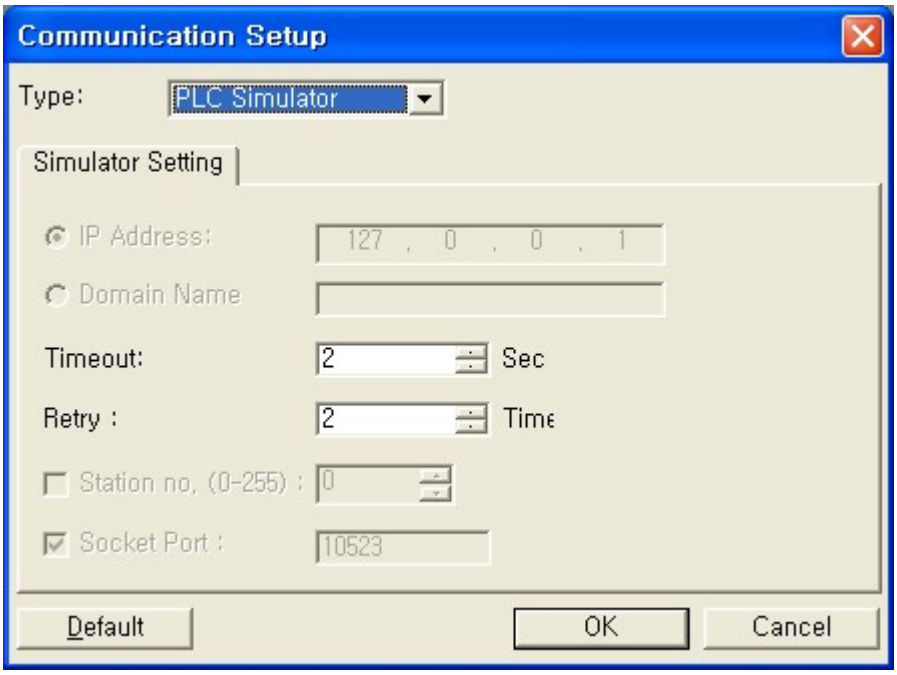
4.13.4 CICON - PLC Simulator Manual

CICON - PLC Simulator Manual

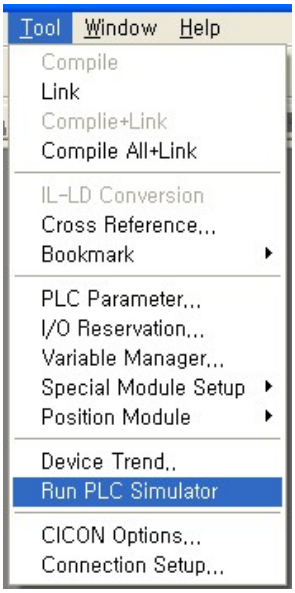
- Run PLC Simulator
- Connect
- Scan Program Download
- Run Edit
- Online Mode

4.13.4.1 Run Plc Simulator

CICON -> [Tool] -> [Communication Setup], select "PLC Simulator"

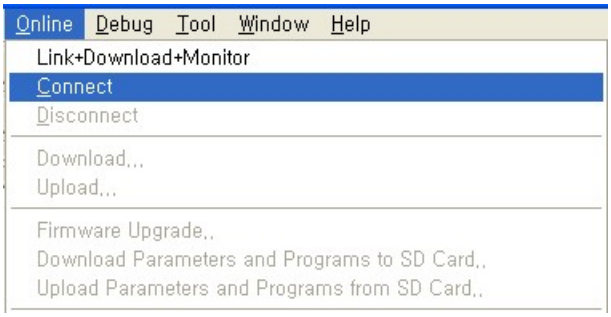


In order to start Simulator, go to CICON -> [Tool] -> [Run PLC Simulator]



If you click [Run PLC Simulator] without PLC Simulator setting in [Communication Setup], below message will appear.

Another way to operate PLC Simulator, go to CICON -> [Online] -> [Link+Download+Monitor] or [Connect]

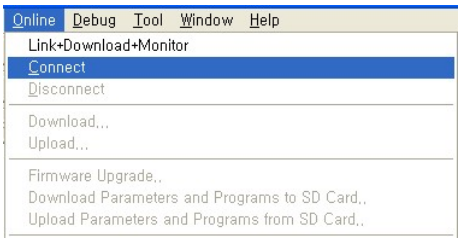


If you click "YES", PLC Simulator will be operated.

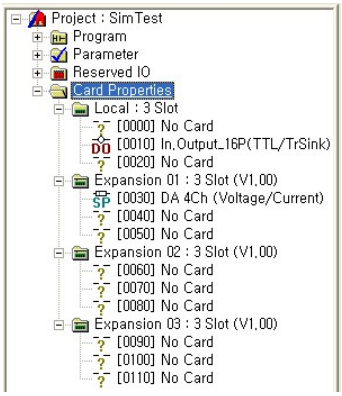
4.13.4.2 Connect

CICON [Online] -> [Connect]

If "PLC Simulator" is selected in [Communication Setup], PLC Simulator will be operated when you click [Connect].



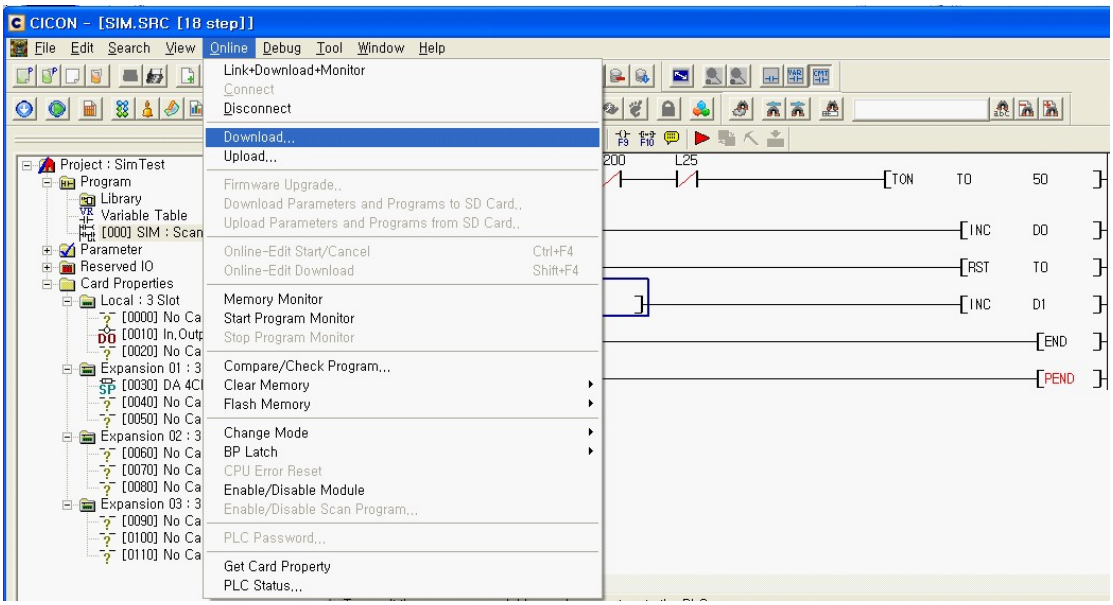
After Simulator operated, there is module information at "Module Info Windows"



There is a message "Connection established with CPU" which means CICON and Simulator are connected.

4.13.4.3 Scan Program Download

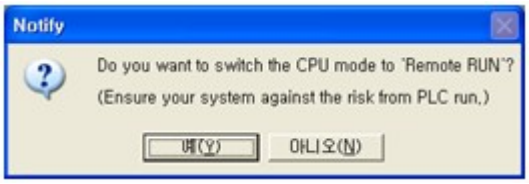
After PLC Simulator operated, download scan program from CICON to Simulator.



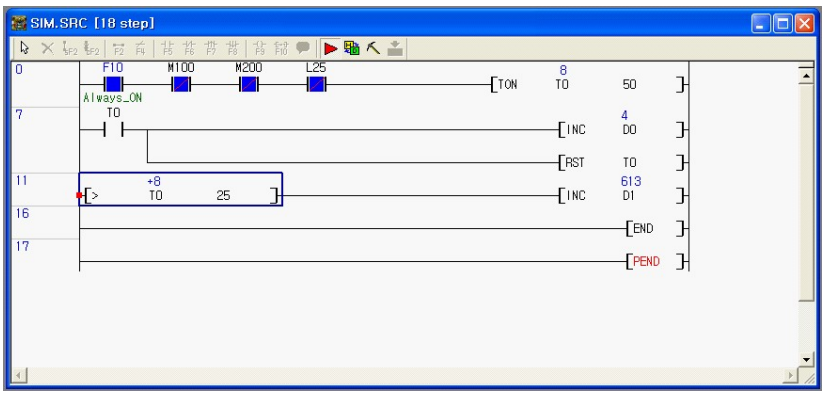
Click [Online] -> [Download]

[Downloading]

Click "YES" to finish download.



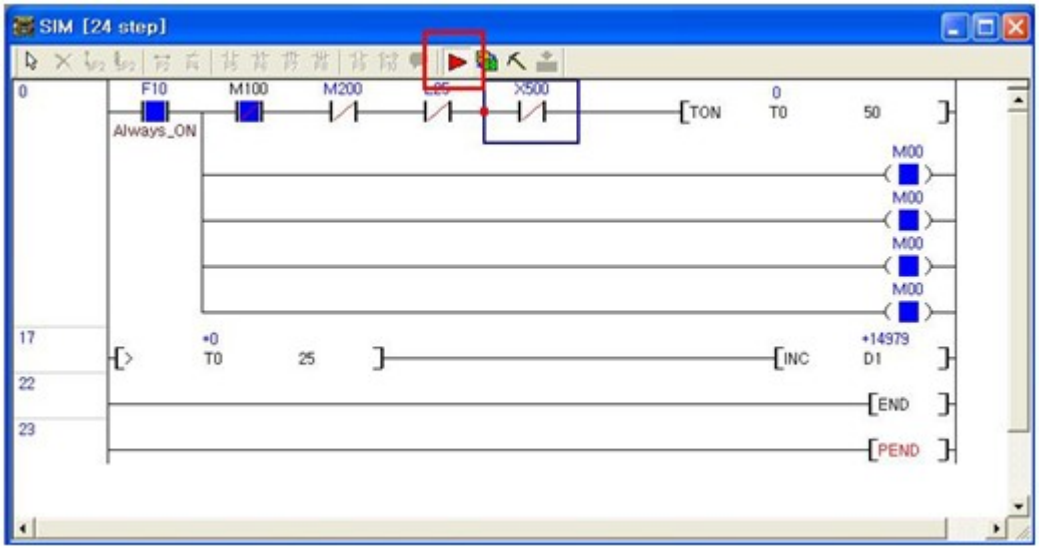
You can monitor scan program as below when PLC Simulator is connected to CICON and PLC is Run mode.



4.13.4.4 Run Edit

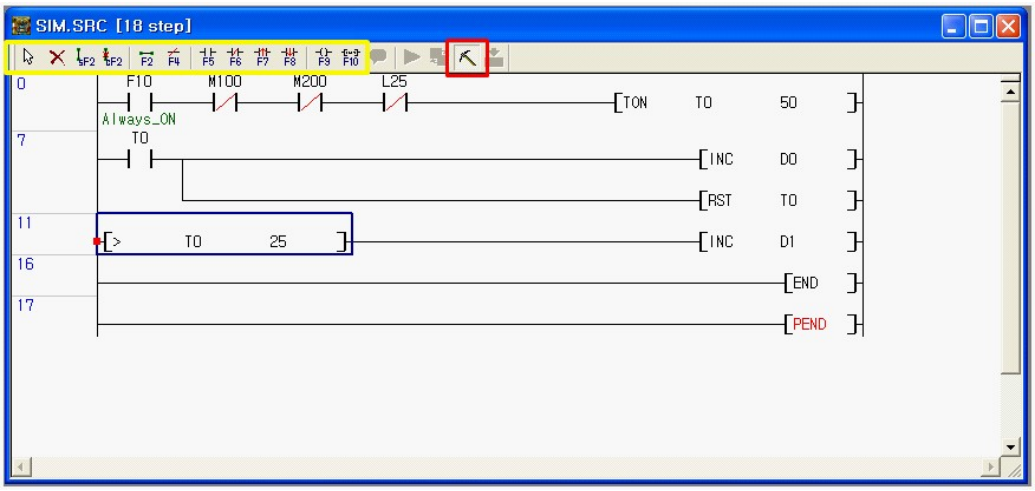
Open Scan program in CICON.

- You can monitor scan program when PLC Simulator is connected to CICON and PLC is Run mode. Online Editing is possible only if Monitor is ON as below picture (See the red box)

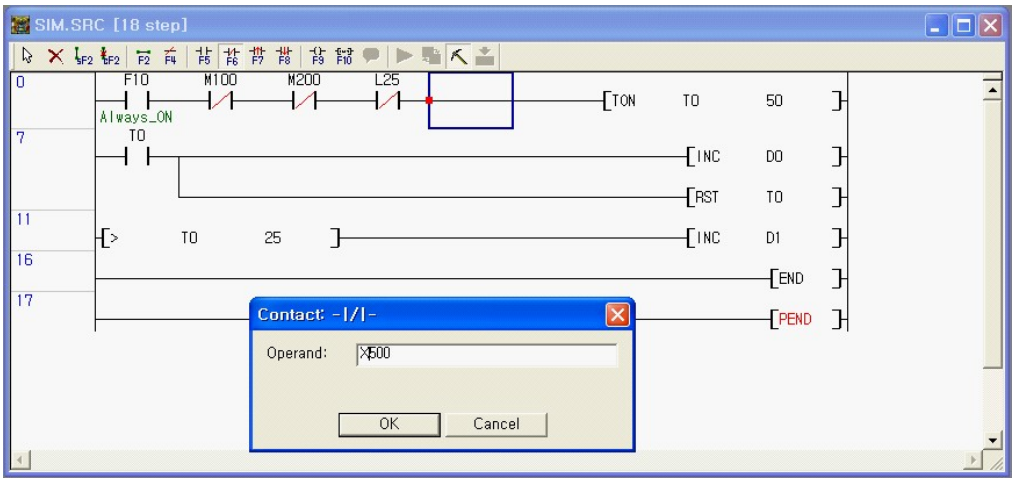


Click [Online Edit Start/Cancel] icon as below picture. (See the red box)

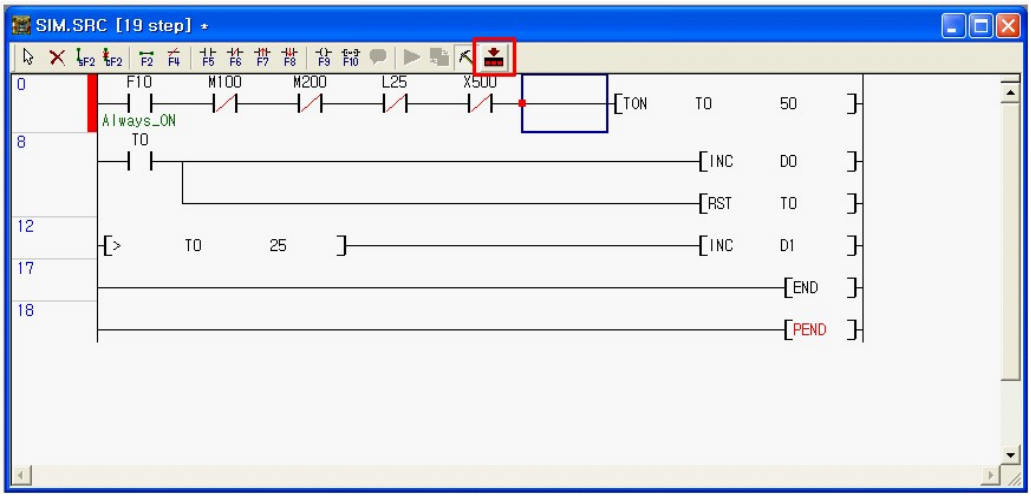
When [Online Edit Start/Cancel] is selected, editing tool is activated. (See the yellow box)



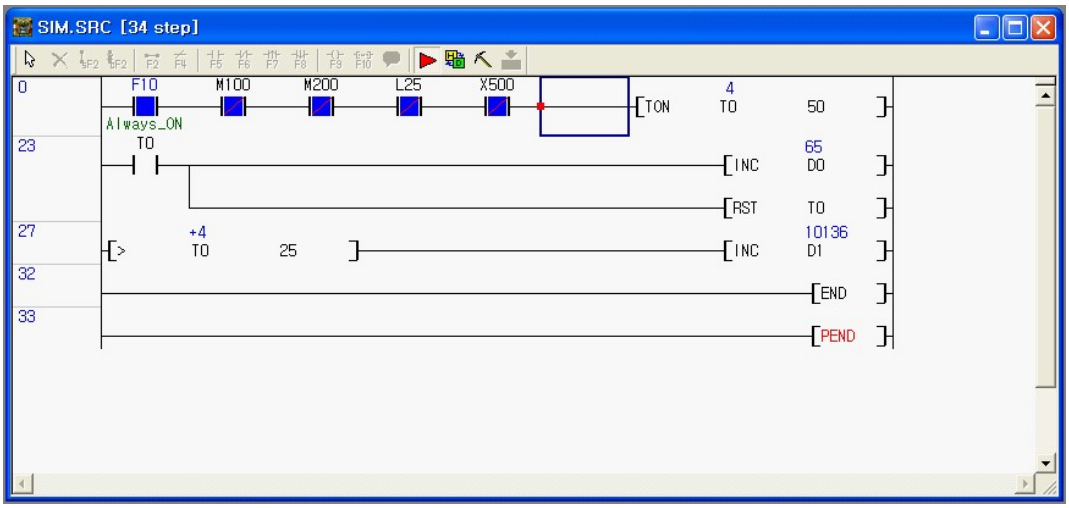
Write value you want to edit.



After finishing editing, click [Online-Edit Download] icon to download it to PLC. (See the red box)

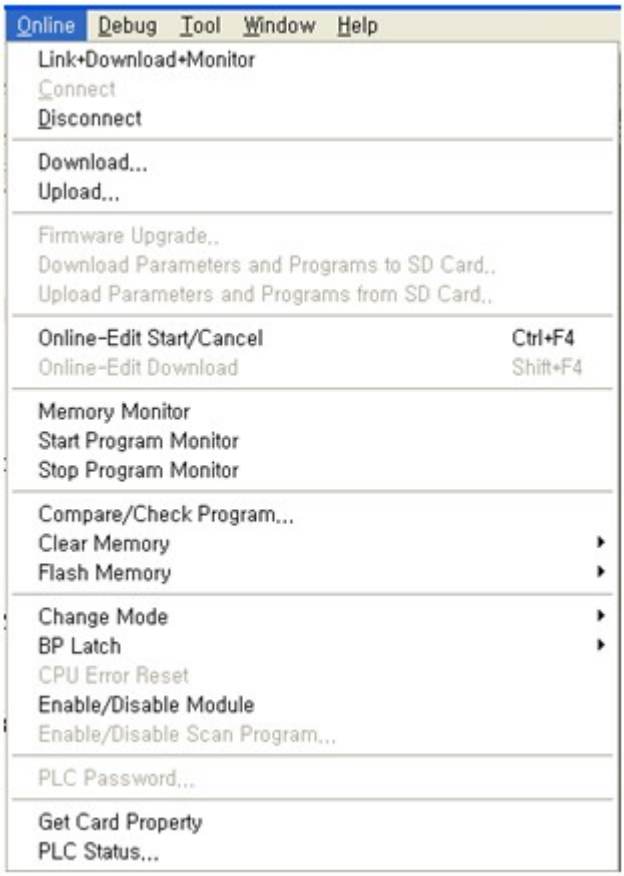


Changed scan program is downloaded as below picture.



4.13.4.5 Online Mode

As PLC Simulator is connected to CICON, some Online menu is activated as below.



1) Link + Download + Monitor : It is used to connect to PLC Simulator and download scan program together.

2) Connect / Disconnect : It is used to connect or disconnect to PLC Simulator.

3) Download... : It is used to download scan program to PLC Simulator.

4) Upload... : It is used to upload scan program from PLC Simulator to CICON

5) Memory Monitor : It is used to open Memory Monitor.

6) Start Program Monitor / Stop Program Monitor : It is used to start or top monitoring scan program.

7) Compare / Check Program.... : It is used to compare scan program between CICON and PLC Simulator. If scan program is not matched each others, proper monitoring is not possible.

8) Clear Memory

- Erase Program: It is used to remove scan programs in PLC Simulator.
- Clear All Data from PLC...: It is used to remove all data in PLC Simulator. (Except Module setting value)

9) Flash Memory : Not supported

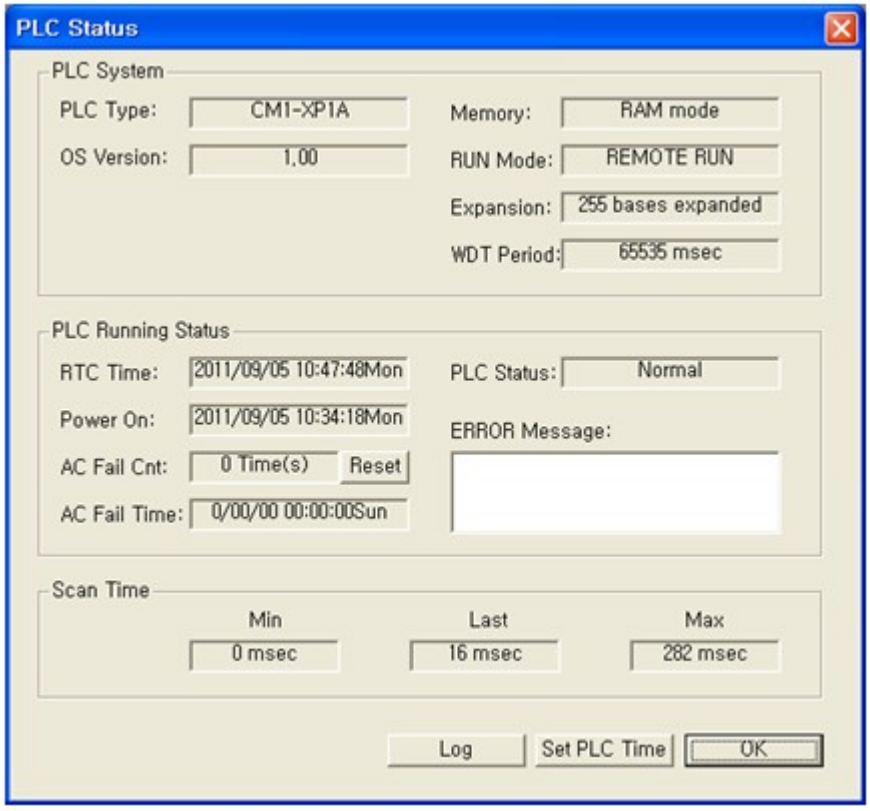
10) Change Mode : It is used to change PLC mode in PLC Simulator.

- RUN: PLC Run
- STOP: PLC Stop
- PAUSE: Not supported

11) BP Latch : Not supported

12) Get Card Property : It is used to renew module information.

13) PLC Status... : It is used to show PLC Status.



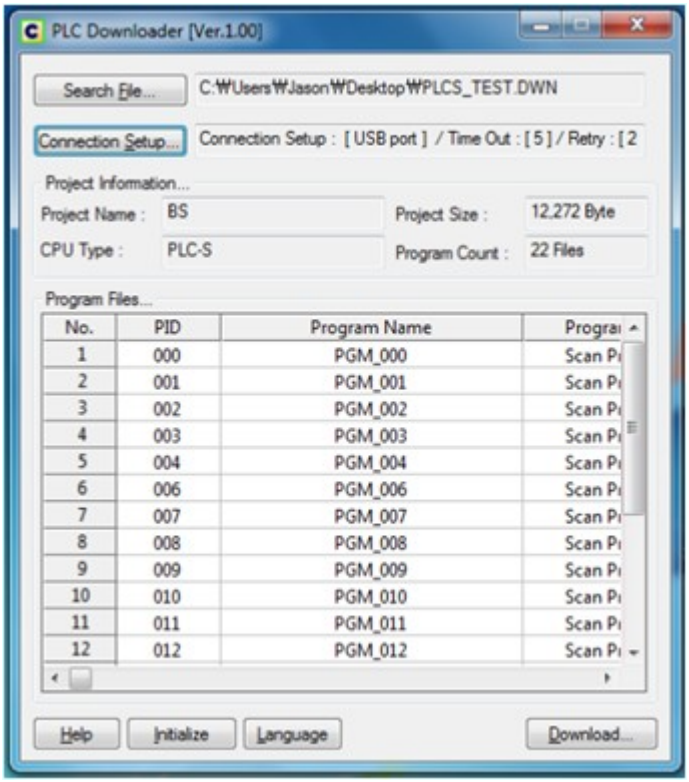
4.14 Downloader

Downloader lets program files be downloaded to the PLC directly without using CICON.

After completing and compiling a program, a special file for Download Utility can be created through the "Export Project" function in CICON.

Downloader .exe file can be found through "Start" -> "All Programs" -> "CIMON"

By using Downloader, PLC programs can be downloaded onto the PLC without exposing the contents.



- Types of Downloader
- Downloader Screen Configuration
- Creating Downloadable Project File
- Downloading in PLC Downloader

4.14.1 Types of Downloader

CIMON Download Utility has two different programs: CICON Downloader and PLC Downloader. Essentially, they have the same functions and features except that CICON Downloader relies on the CICON Software while the PLC Downloader is a separate program that can be utilized without CICON.

CICON Downloader

When installing CICON, CICON Downloader is automatically installed and vice-versa for uninstallation.

CICON Downloader can be found in [CICON Downloader] folder inside of CICON folder.
(Ex. C:\Program Files\CICON\CICON Downloader\CICON Downloader)
OR
CICON Downloader can be executed by "Start" -> "All Programs" -> "CIMON" -> "CICON Downloader"

CICON Downloader cannot be executed only by having the "CICON Downloader.exe" as this program is dependent on the CICON Software.
In this case, CICON software is used for PLC connection.

PLC Downloader

PLC Downloader needs to be downloaded and installed separately. This program is not included in CICON.

PLC Downloader can be found in [PLC Downloader] folder.
(Ex. C:\Program Files\PLC Downloader)
OR
PLC Downloader can be executed by "Start" -> "All Programs" -> "CIMON" -> "PLC Downloader"

PLC Downloader is an independent software which does not require CICON.
With the PLC Downloader, user can connect and download project files to PLC's without requiring other software.

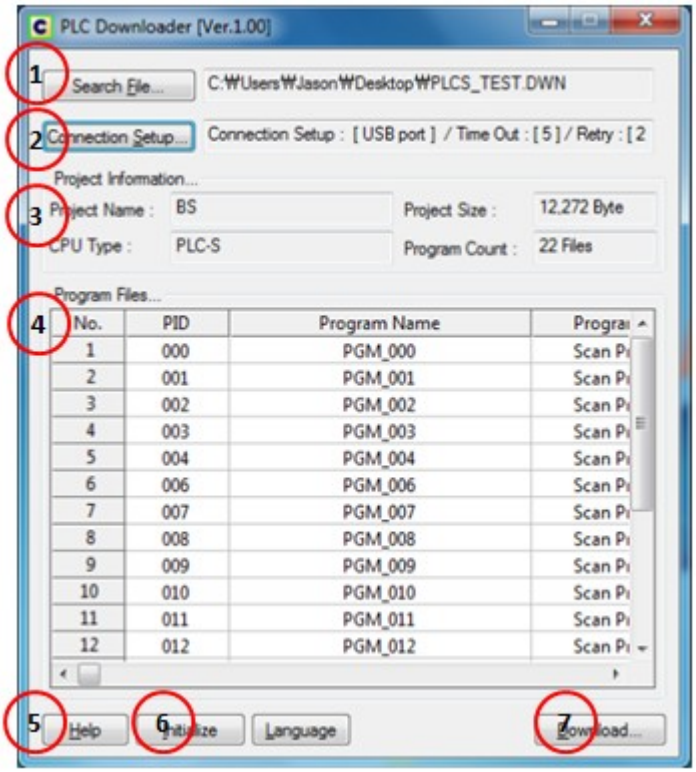
A USB Driver is included in the installation folder so the user can easily install the USB Driver and connect to the PLC easily.

Example of using PLC Downloader:

1. The integrator finishes a project and converts the file to .DWN file by using "Export Project" function in CICON.
2. The integrator sends the .DWN project file to the user.
3. The user receives .DWN project file and downloads the project file to the PLC by using PLC Downloader without knowing the contents of the file.

4.14.2 Downloader Screen Configuration

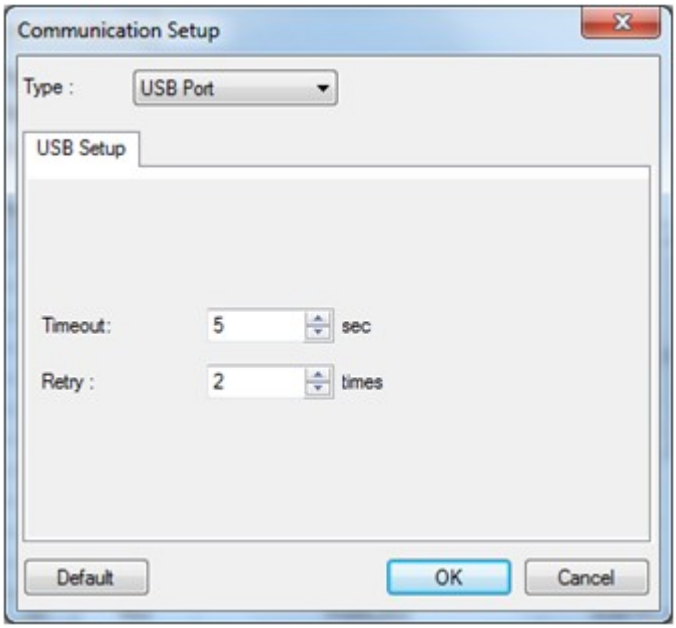
Screen Layout



Screen Configuration

1. Search File: Choose the path of the project file that needs to be downloaded to the PLC.
   - The file extension should be ".DWN" format - ".DWN" format files can be created in CICON.
   - Please refer to [Creating Downloadable Project File] for detailed information.

2. Connection Setup: Choose a connection method. (same as Communication Setup in CICON)
   - Connection types are "Serial Port" / "Dial-up Modem" / "Leased Line Modem" / "Ethernet" / "PLC Simulator" / "USB Port"
   - If the communication method is not correct, the program automatically terminates after an attempt to connect.
   *While attempting to connect, if the connection type is not selected correctly, there might be a delay period - combination of "Timeout" time and connection time.



3. Project information: indicates project information of a chosen download file (".DWN")
   - Project Name / Project Size / CPU Type / number of registered program files.
   - Please check this information before downloading.

4. Program Information: Shows program information of a selected program in the project.
   - Program ID (PID) / Program Name / Program Type.

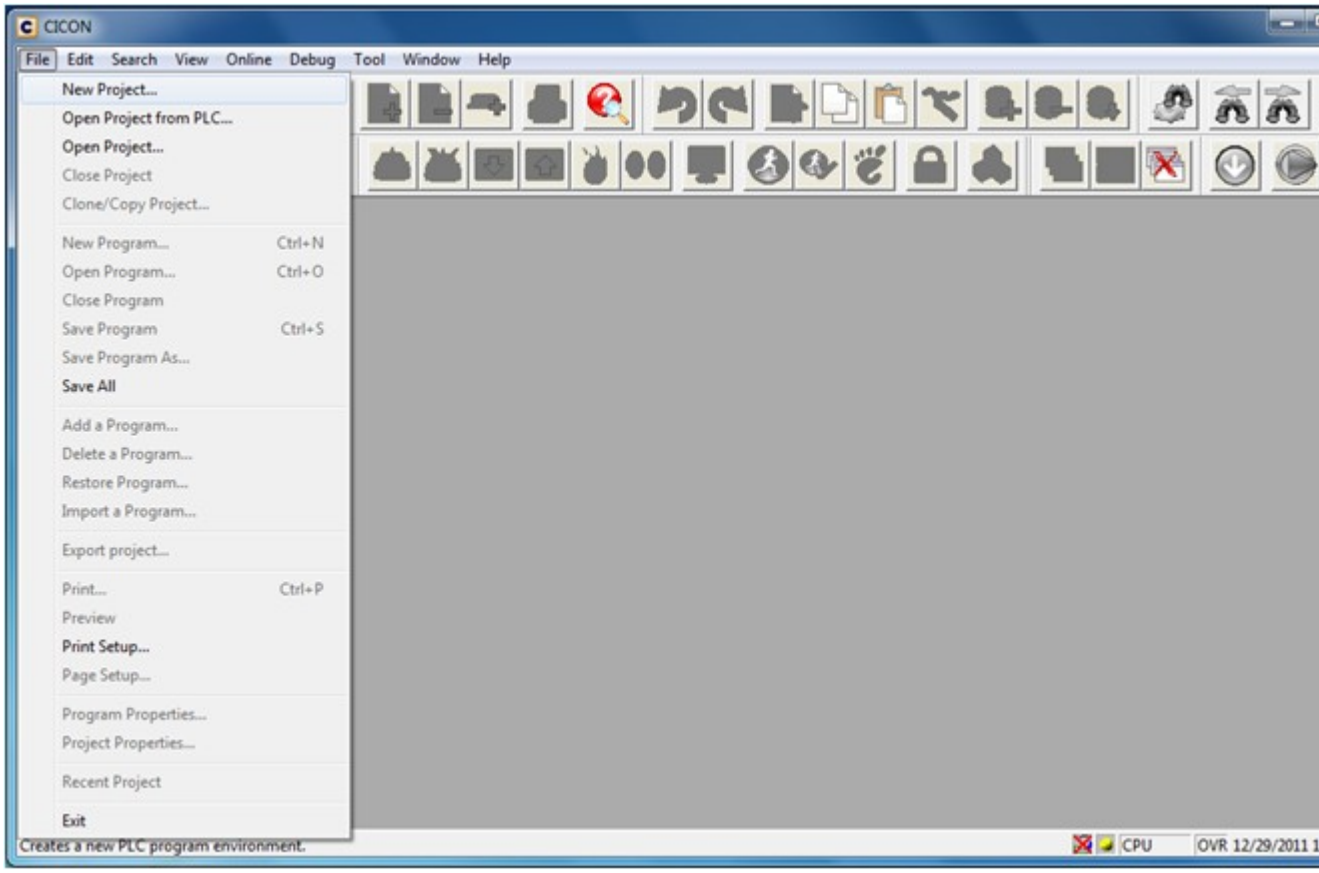
5. Help: Opens PLC Downloader manual.

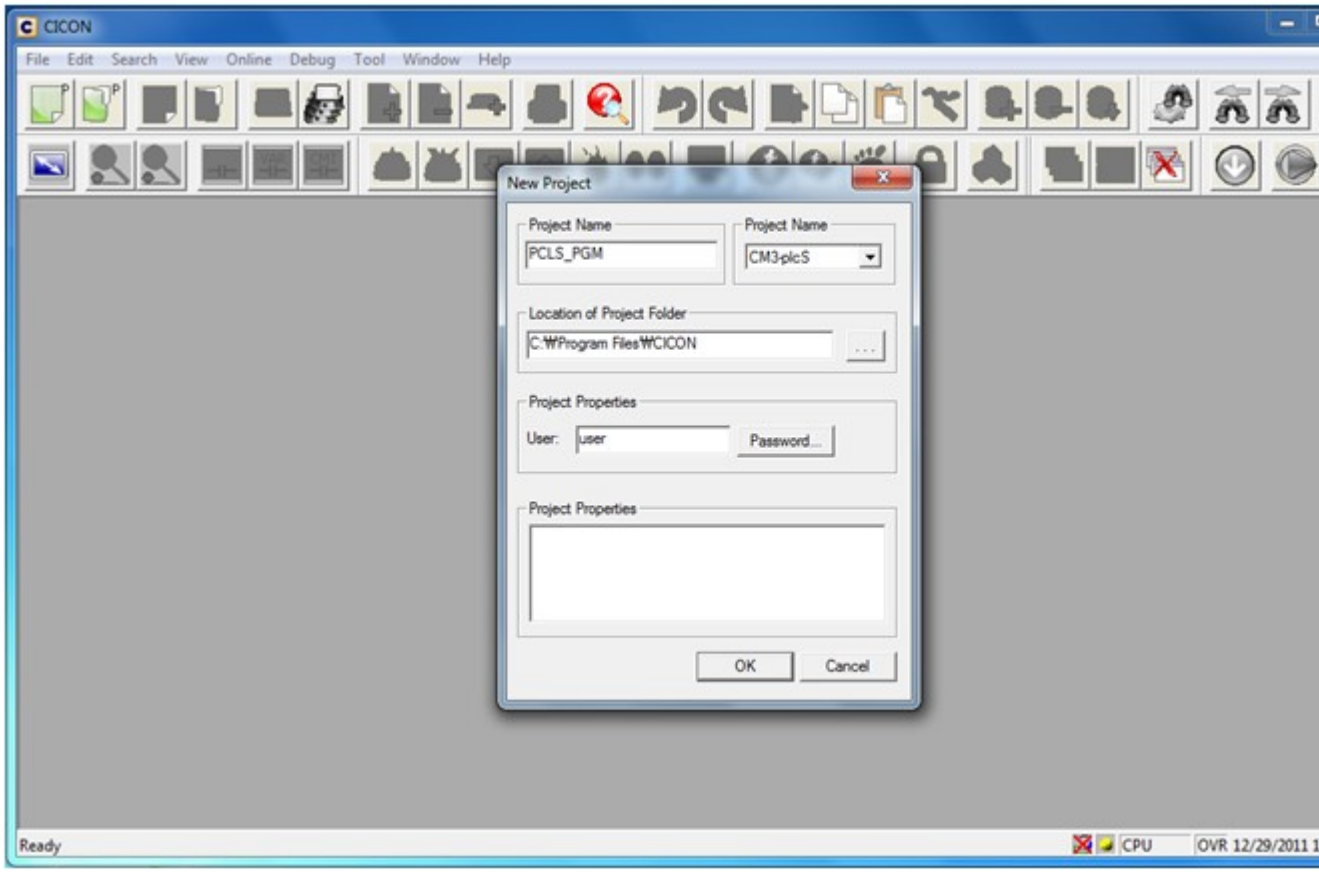
6. Initialize: Deletes all the selected information.

7. Download: Downloads the project files to the PLC based on the selected settings.
   - Please refer to [Downloading in PLC Downloader] for detailed information.

4.14.3 Creating Downloadable Project File

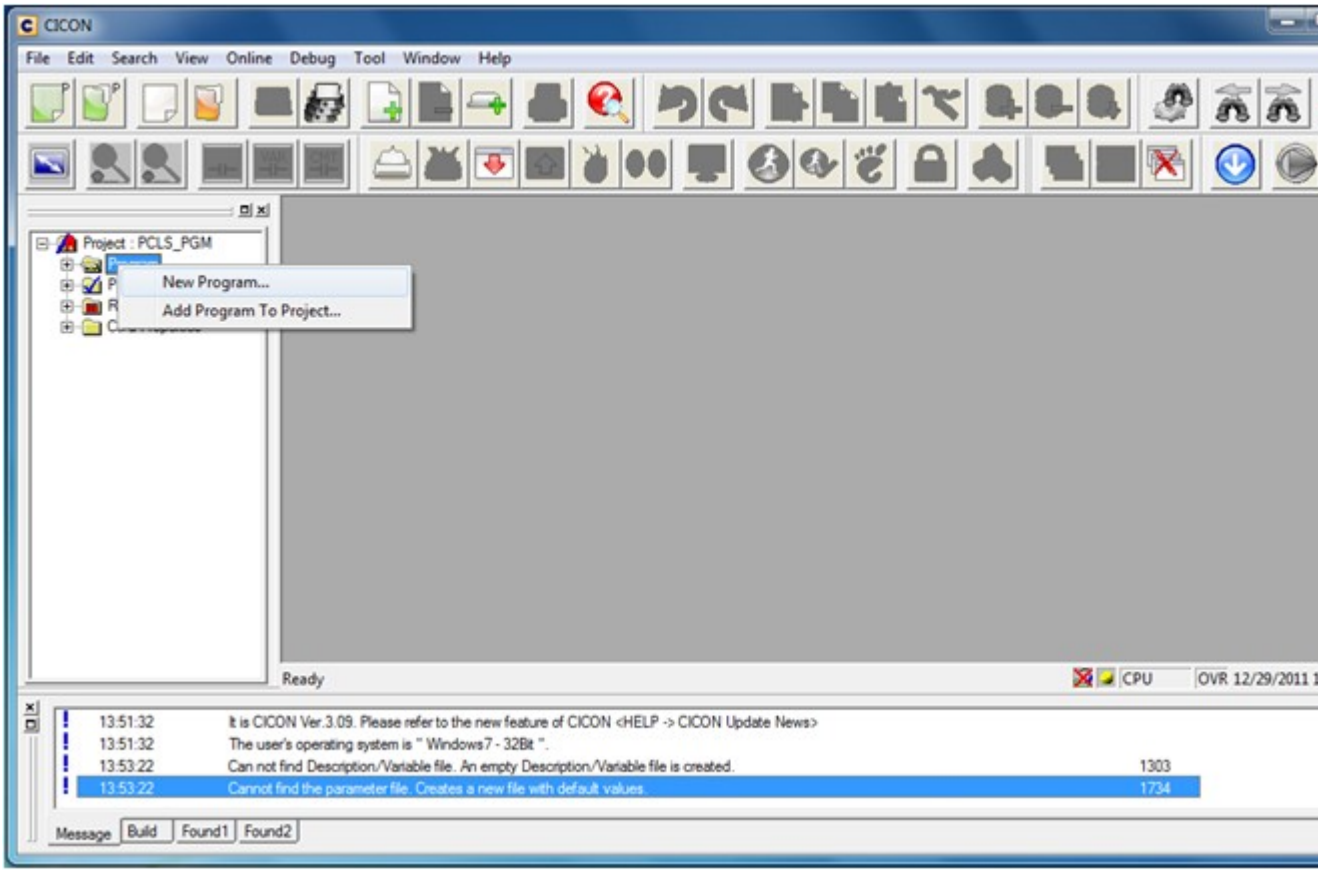
Open CICON to create a new project by selecting "New Project" from the "File" menu.

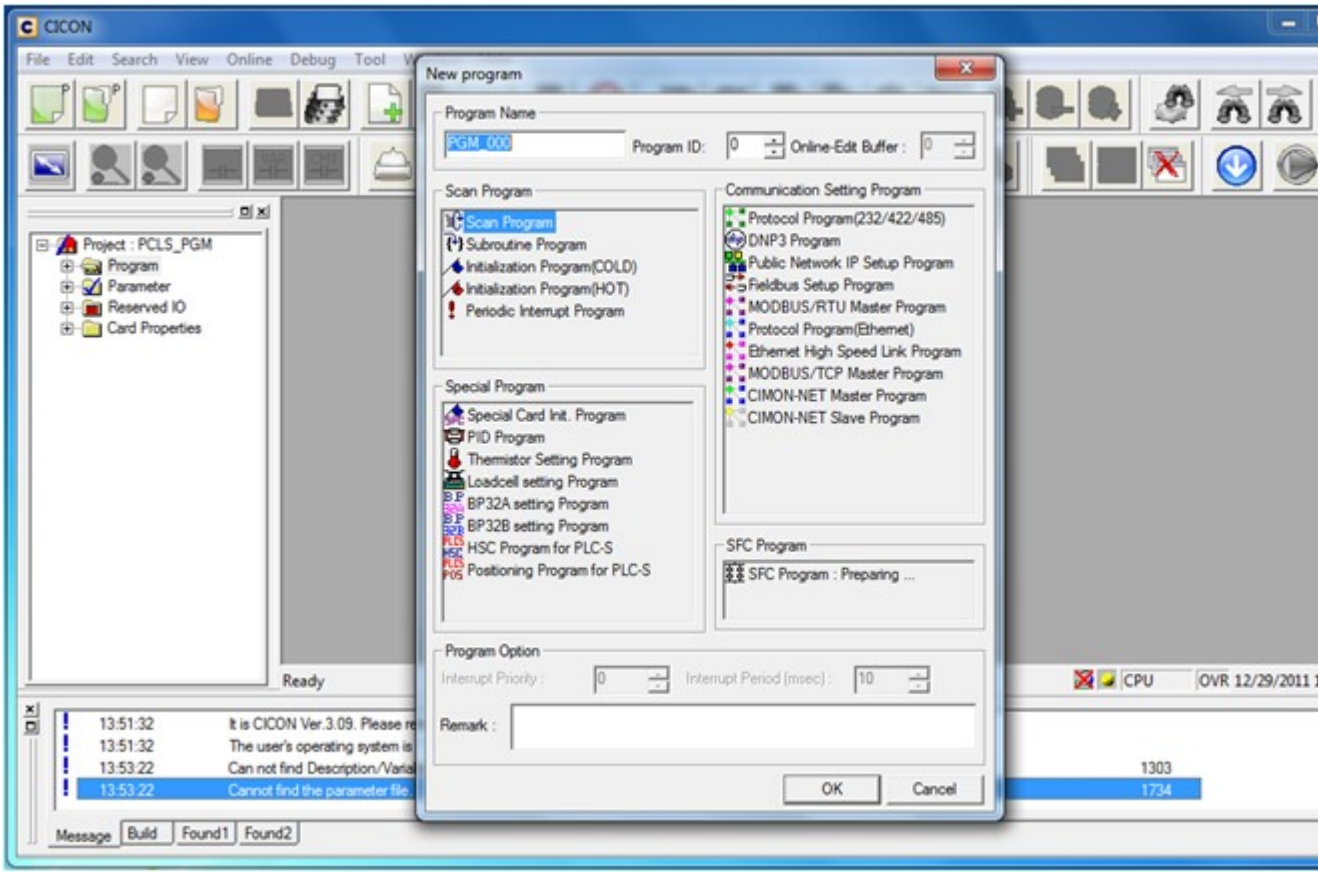




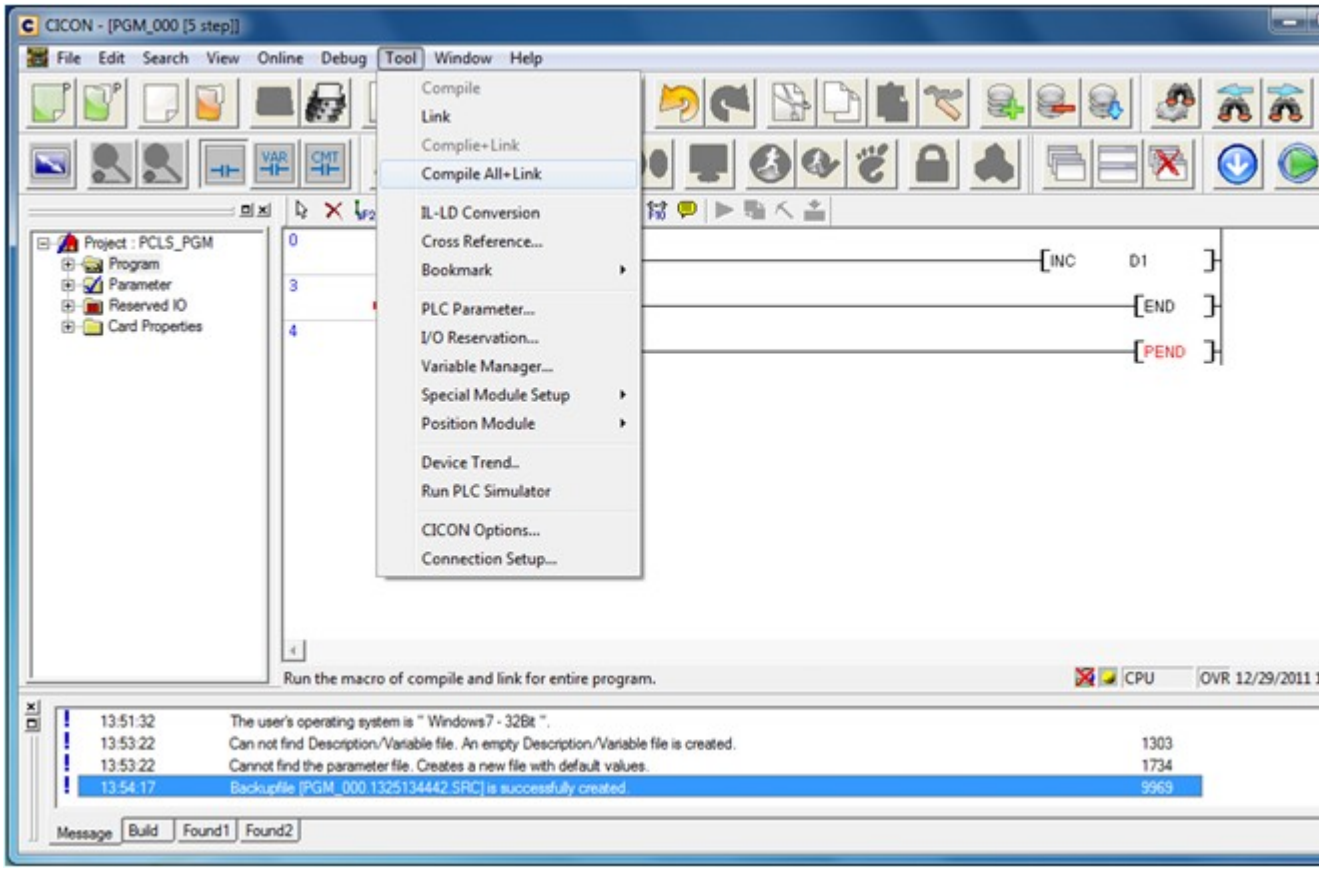
After creating the new project, please register a scan program.

At least one scan program is needed for compiling.

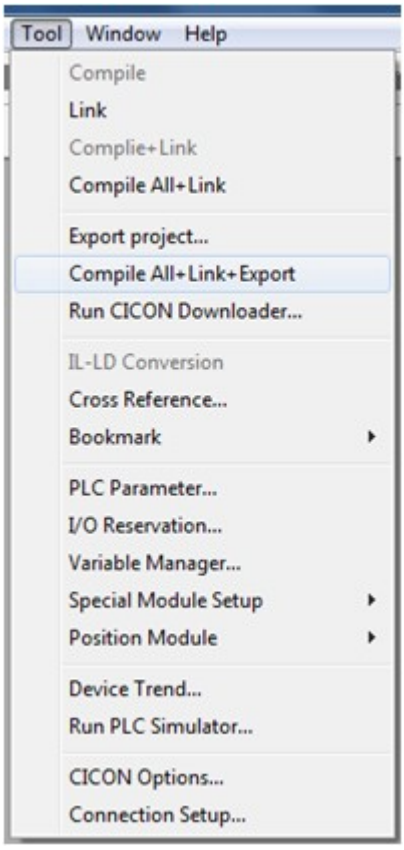




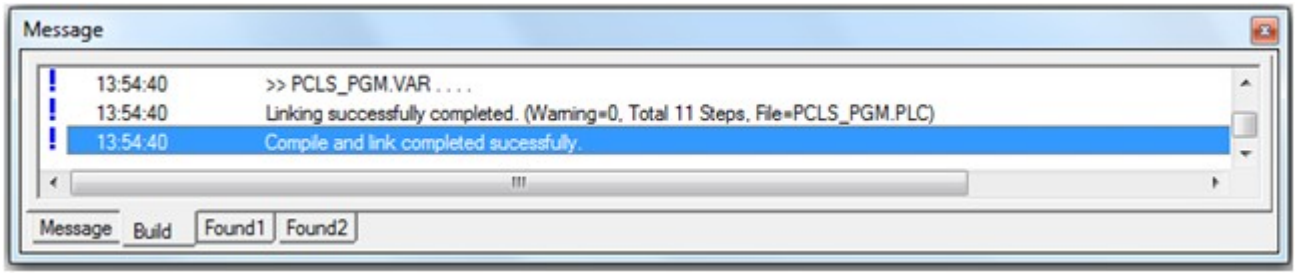
Compile the selected project by selecting "Compile All + Link" on the "Tool" menu.



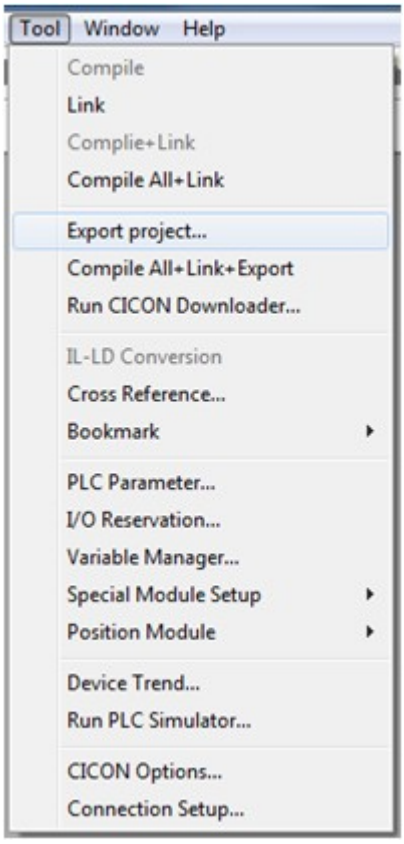
"Compile All + Link + Export" menu has been added.



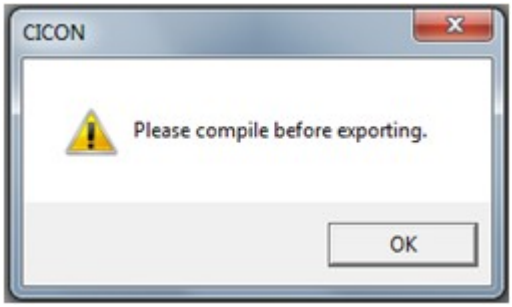
After compiling and linking has been successfully completed, a message will show as below.
If there is an error or compiling has failed, an error message would show in the same box as below. In that case, please check the error and respond accordingly.



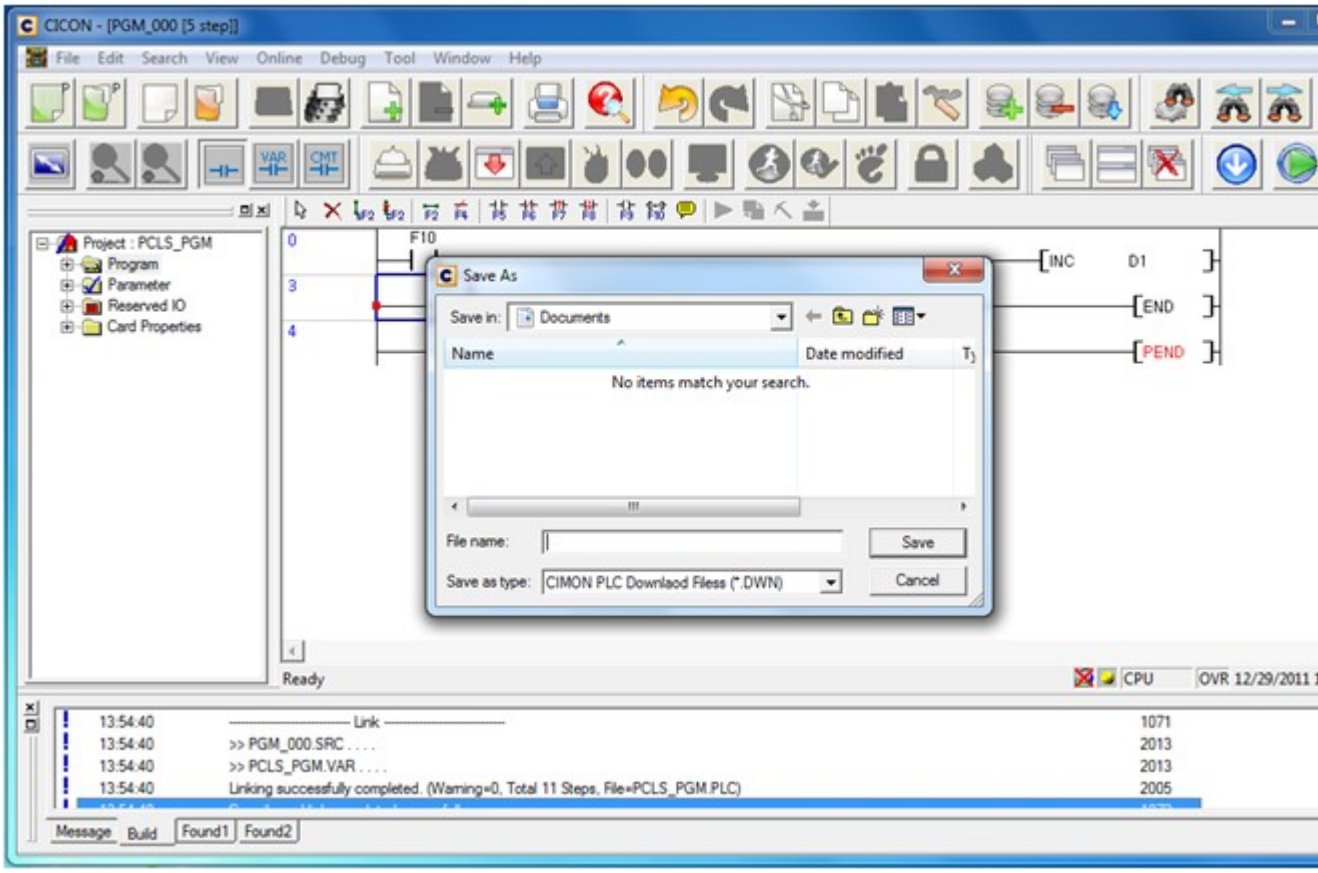
Select "Tool" -> "Export Project"



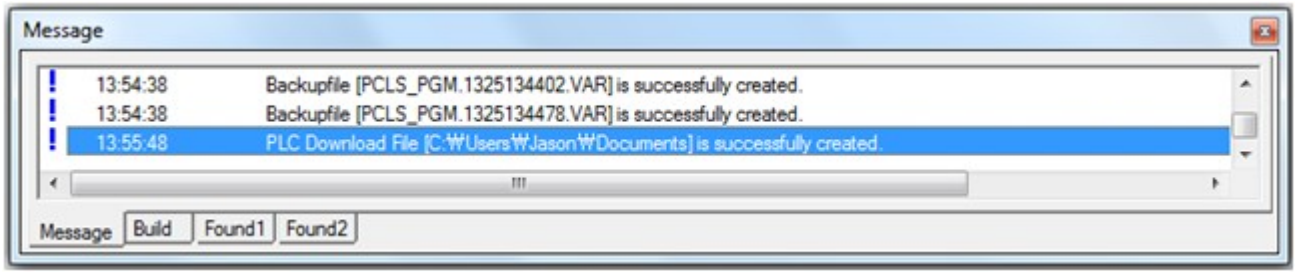
"Export Project" function converts already compiled files to a .DWN downloader file. If compiling has failed or did not compile at all, "Export Project" function cannot be used.
If there has been a change in parameter or program after compiling a project, another compilation is needed.



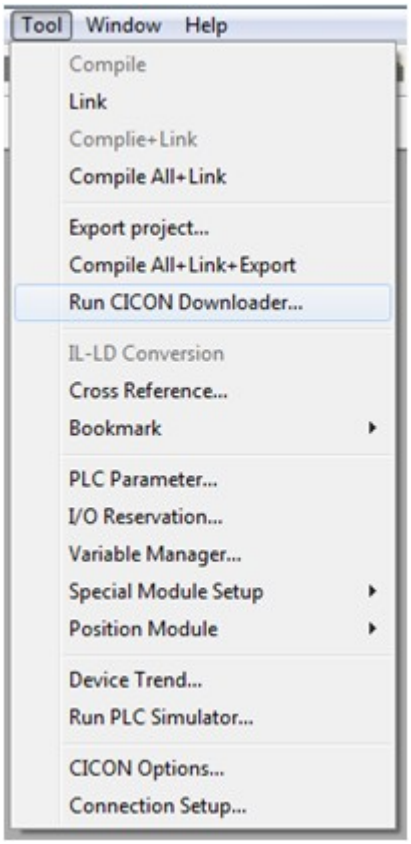
After clicking "Export Project", a window pops up and asks the location where the .DWN file would be saved. Please choose the location and select "Save" button.



If "Export Project" has been successfully completed, a message appears in the message window as below.

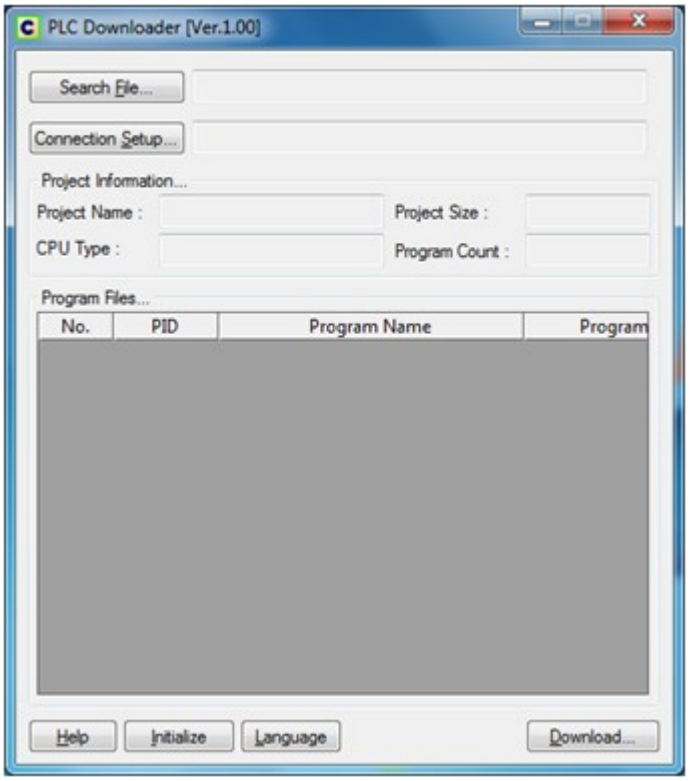


"Tool" -> "Run CICON Downloader" menu has been added.



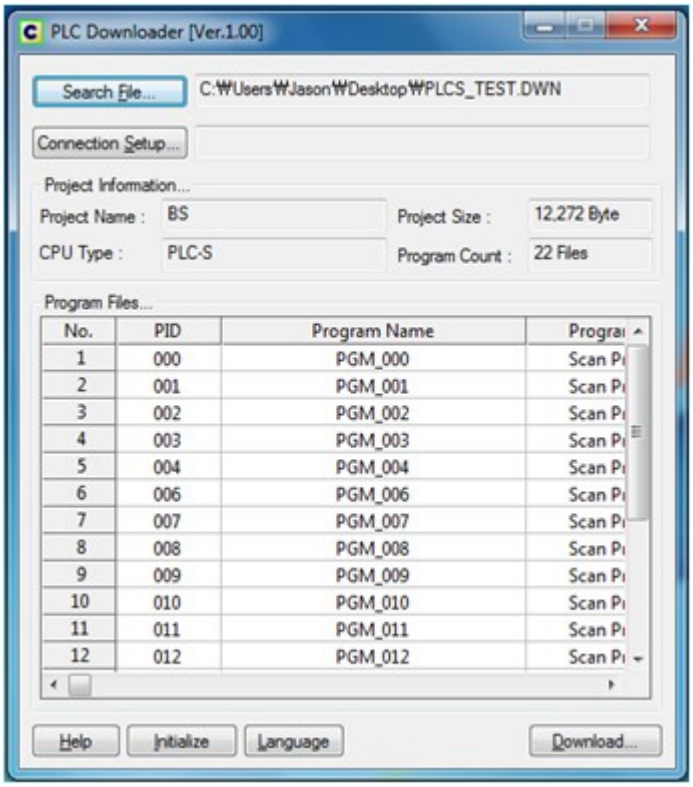
4.14.4 Downloading in PLC Downloader

Screen as below appears after starting "Downloader"

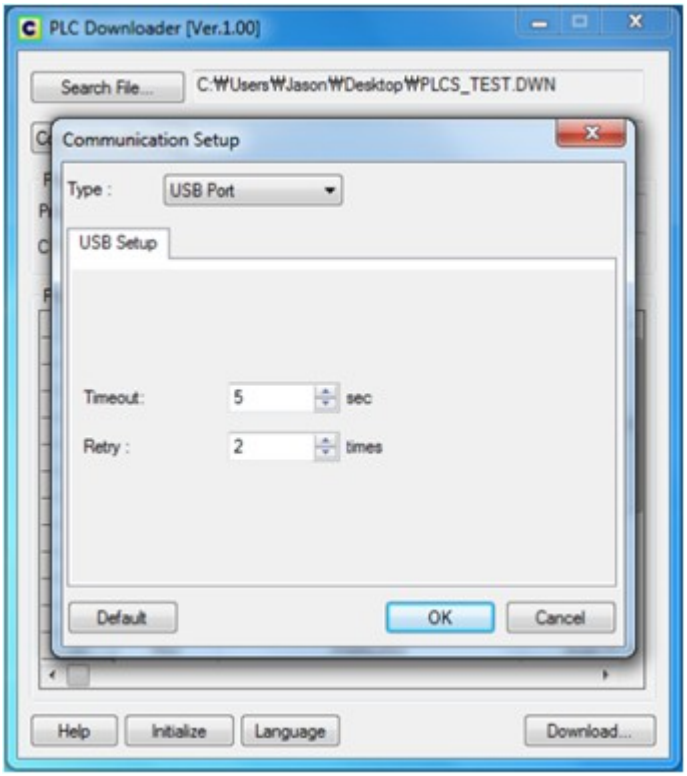


"Search File" button is used to search for a .DWN project file.
Please choose a project file and click "Open"
.DWN project file needs to be already created by "Export Project" from CICON
Please refer to [Creating Downloadable Project File] for detailed information.

Project information gets shown in the Project Information field.
Please check if the project information is correct.
CPU Type cannot be changed and is fixed to what the user selected in CICON.
If the project's CPU Type and the actual CPU Type does not match, connection will automatically fail.

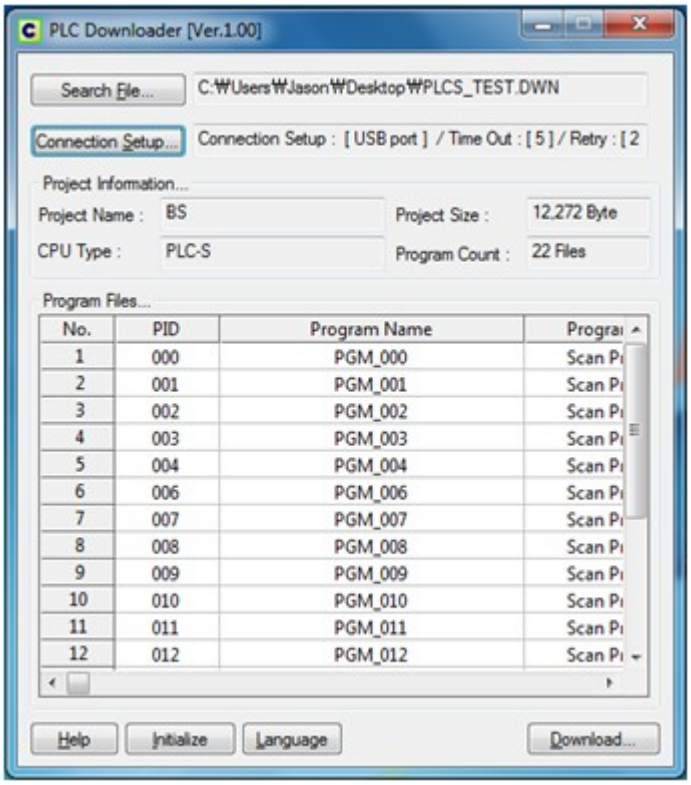


After checking the Project information, please click "Connection Setup" button to select communication type. All the parameters should be changed according to the actual communication settings of the PLC in the window shown below.



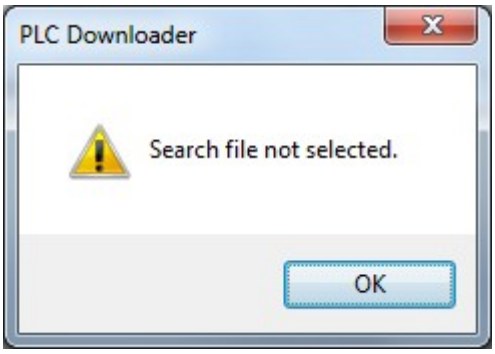
After the communication setup is completed, click "OK".

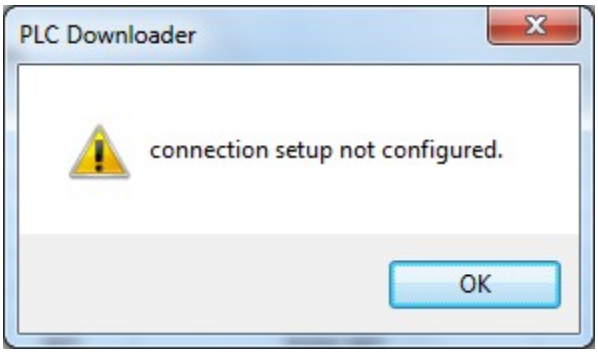
Selected "Connection Setup" information appears in the window as below.



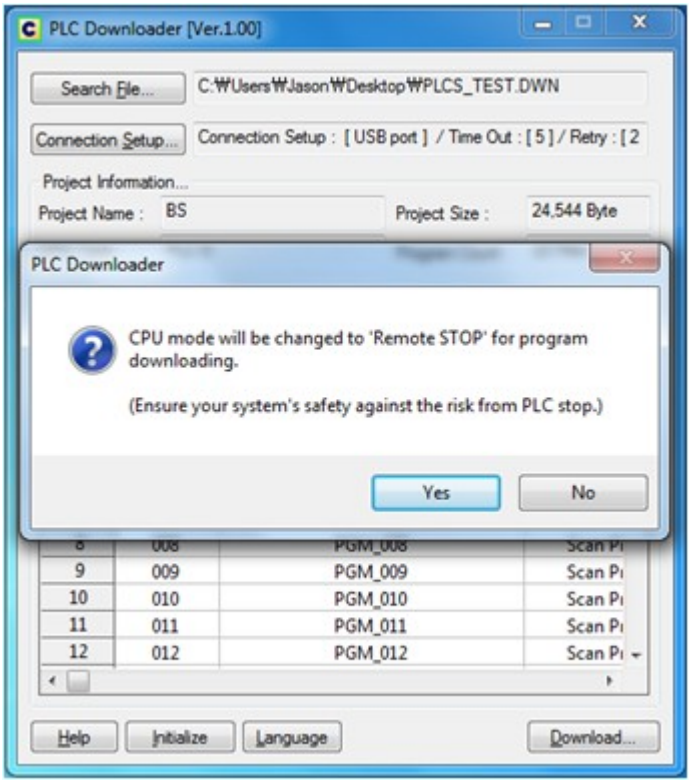
After "Search File" and "Connection Setup" configuration is completed, Start Downloading by clicking "Download".

If download file is not selected or connection setup is not completed, an error message pops up as below.

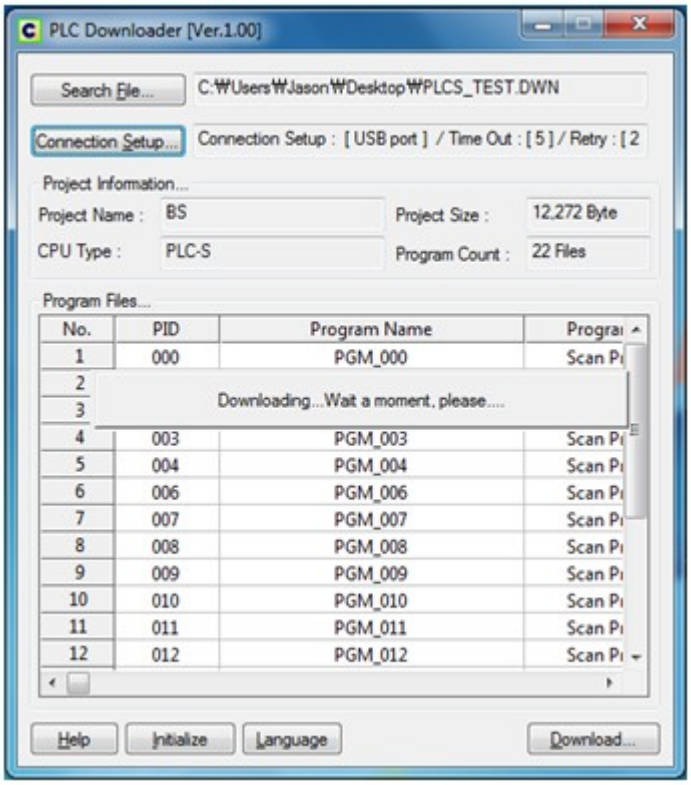




Once download is started, the software checks the CPU mode and requests the user to change the mode to a correct mode in a pop-up window shown as below.

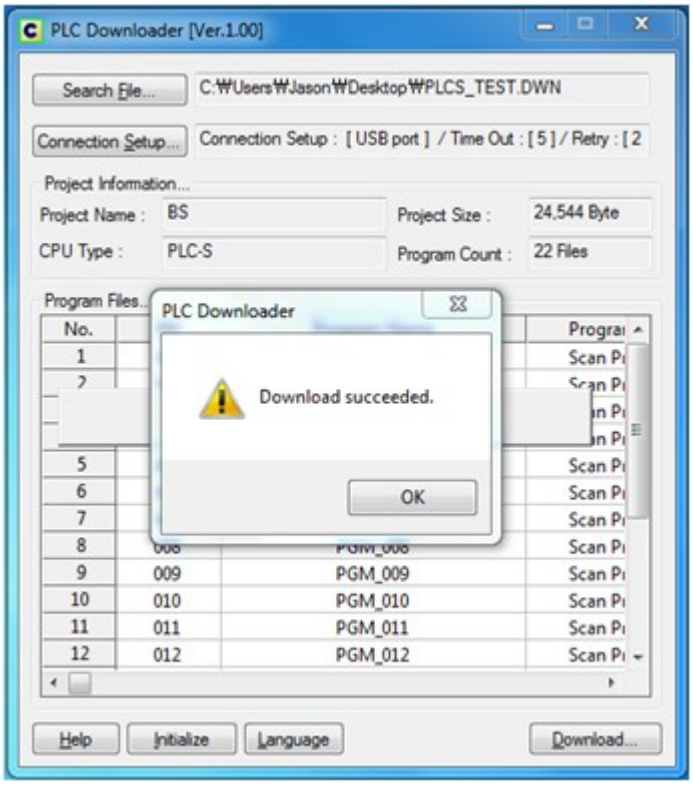


After clicking "Yes", download starts once the CPU mode is in the correct status. During the download, a message "Downloading... Wait a moment please" appears.
Depending on how big the project file is, it can take from 10 seconds up to 2 minutes.

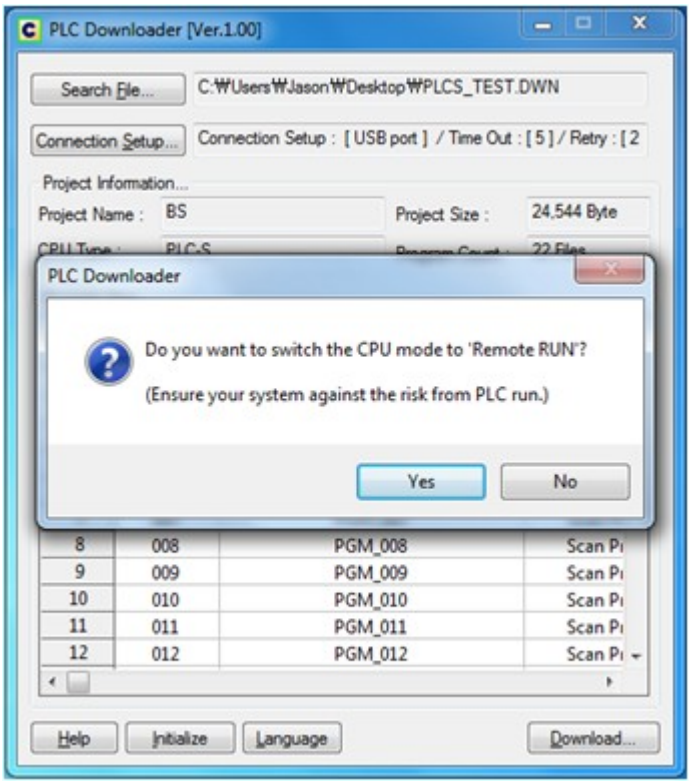


An error message shows when the cable disconnects or the CPU turns off while downloading. Please proceed with caution since this can cause a malfunction of PLC.

After the download is completed, a message pops up as below. Please click "OK" to complete the download.



Lastly, a window pops up asking to change the CPU mode to "Run".



4.15 Appendix

Appendix :

- Shortcut Key
- Loader Cabling Diagram
- Installation of USB Device Driver

4.15.1 Shortcut Key

Edit menu

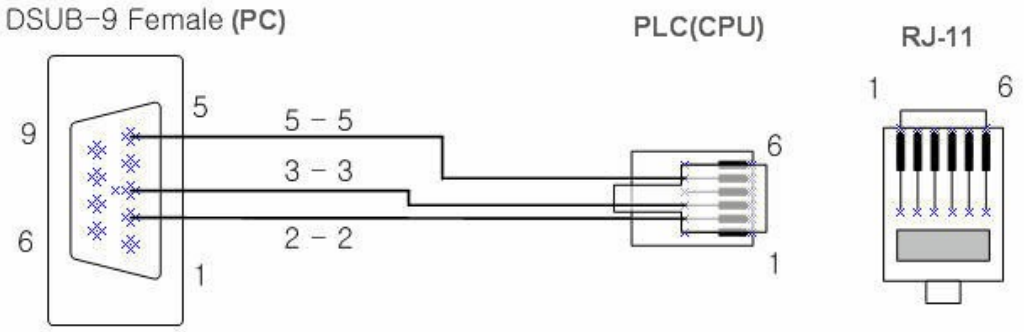
Shortcut Key	Note
Ctrl + N	New File
Ctrl + O	Open File
Ctrl + P	Print File
Ctrl + S	Save File
Ctrl + Z	Undo
Ctrl + Y	Redo
Ctrl + F	Find
Ctrl + Shift + F	Find All
F3	Find Next
Shift + F3	Find Previous
Ctrl + H	Find Replace
Ctrl + G	Move

LD Edit Window

Shortcut Key	Note
F2	Input a horizontal Line
Shift + F2	Input a vertical Line
F4	Not Input
F5	Input contact "a"
F6	Input contact "b"
F7	Input rising pulse contact
F8	Input declining pulse contact
F9	Input coil
F10	Input command

F11	Input counter command
F12	Input comment
Ctrl + L	Insert Line Before
Ctrl + R	Delete Line
Ctrl + Enter	Insert Line Next
Space	Push One Column
Del	Delete
Ctrl + Home	Move home
Ctrl + Direction Button	Draws a connection line

4.15.2 Loader Cabling Diagram



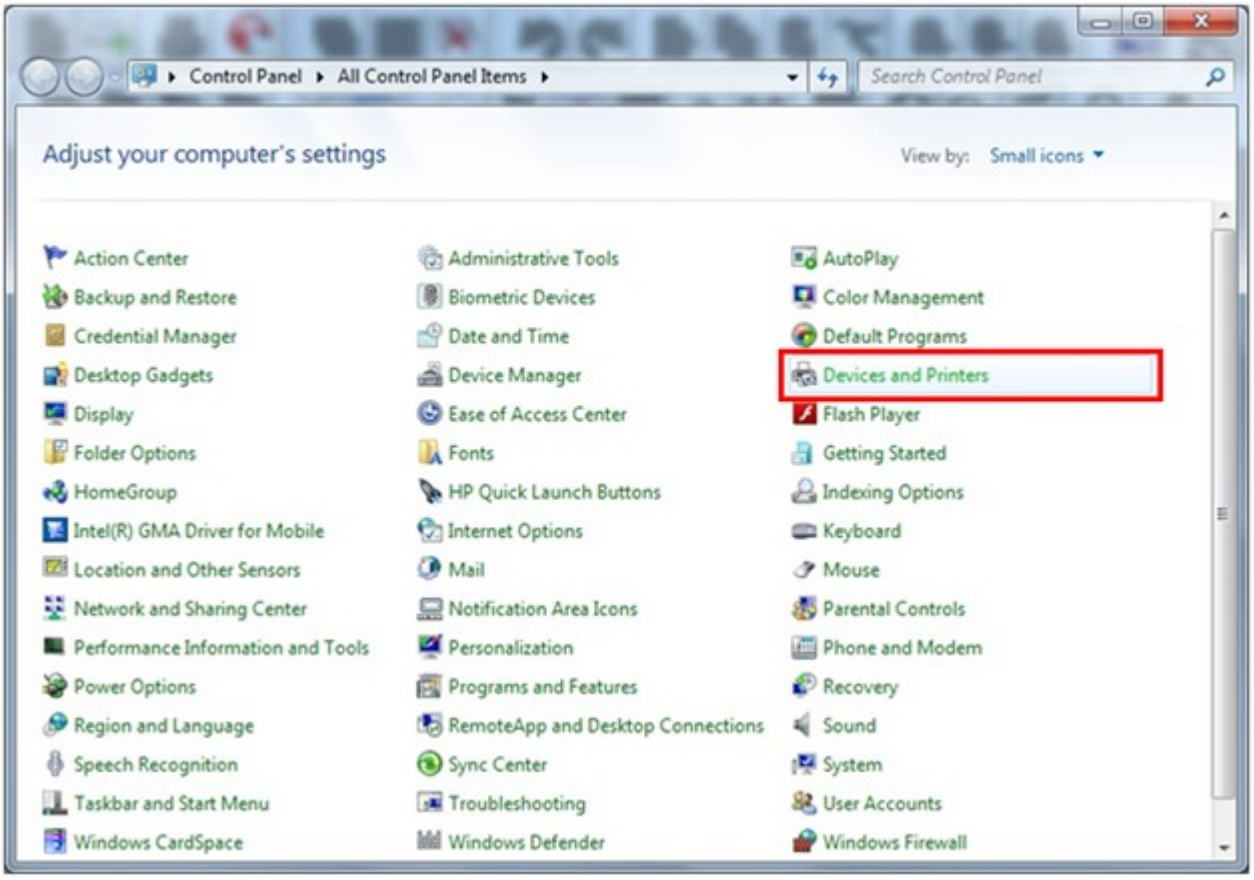
Description on DSUB-9 pins	Description on RJ-11 pins
2: Rx	2: Tx
3: Tx	3: Rx
5: SG	5: SG

4.15.3 Installation of USB Device Driver

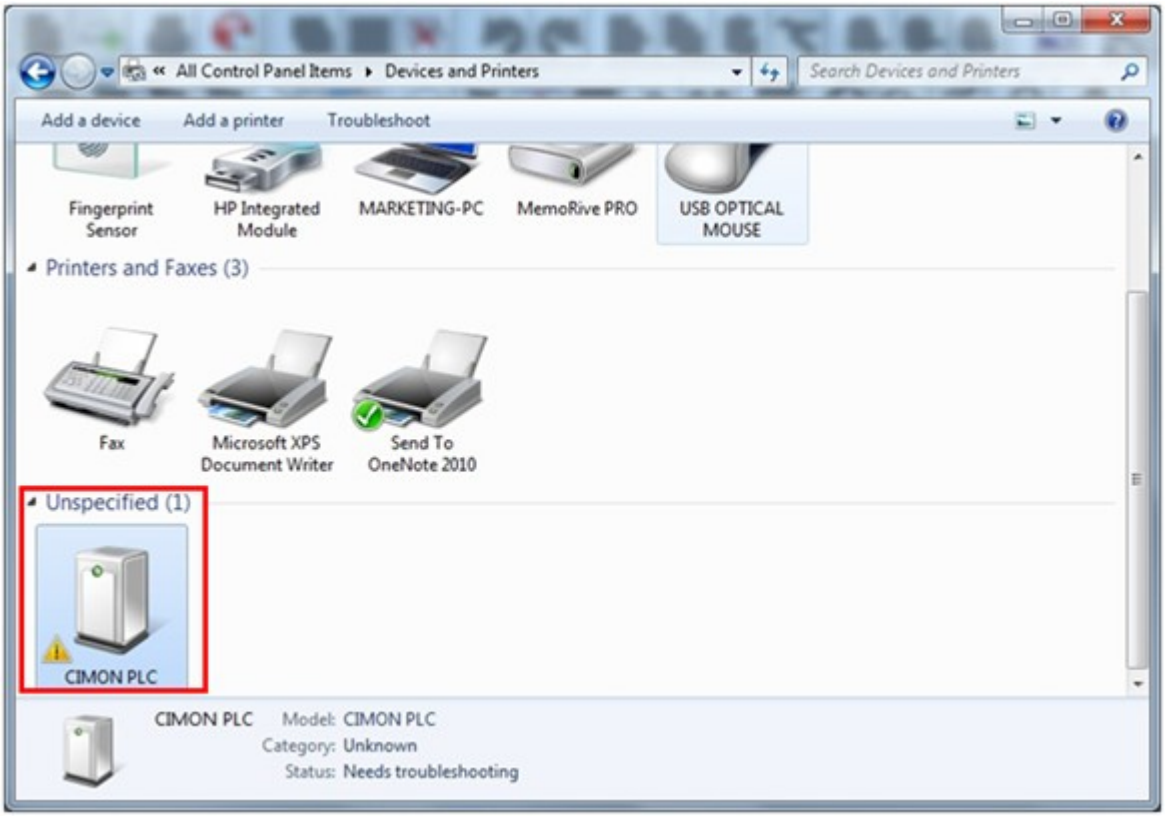
Windows XP : USB device driver is installed automatically when you run CICON after CICON installation.

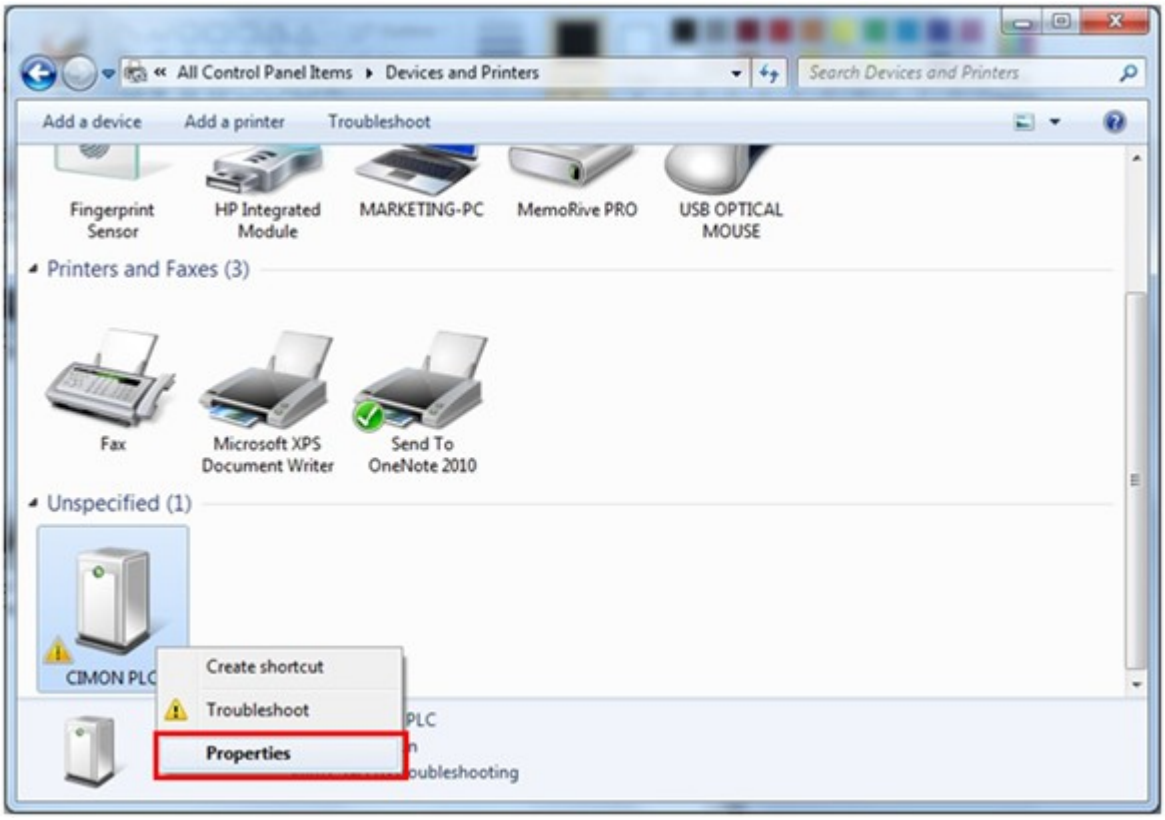
Windows 7 : Install USB device driver as following steps :

1. Turn PLC power on and connect PLC to PC with USB cable. Select [Control Panel] -> [Devices and Printers]

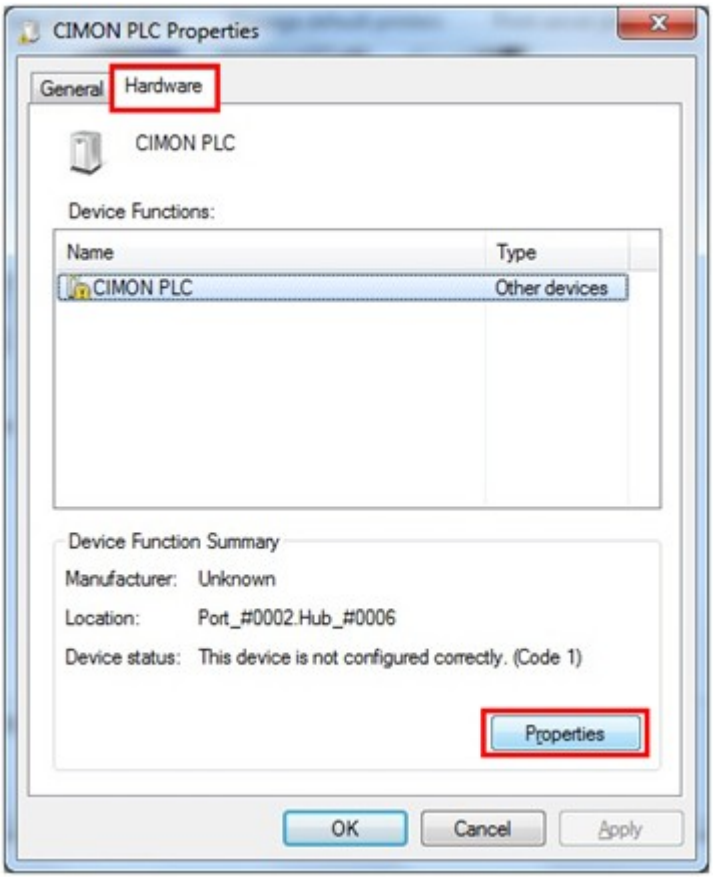


2. There is CIMON PLC in [Unspecified]. Click the right button of the mouse with cursor on the [CIMON PLC] and select [Properties]

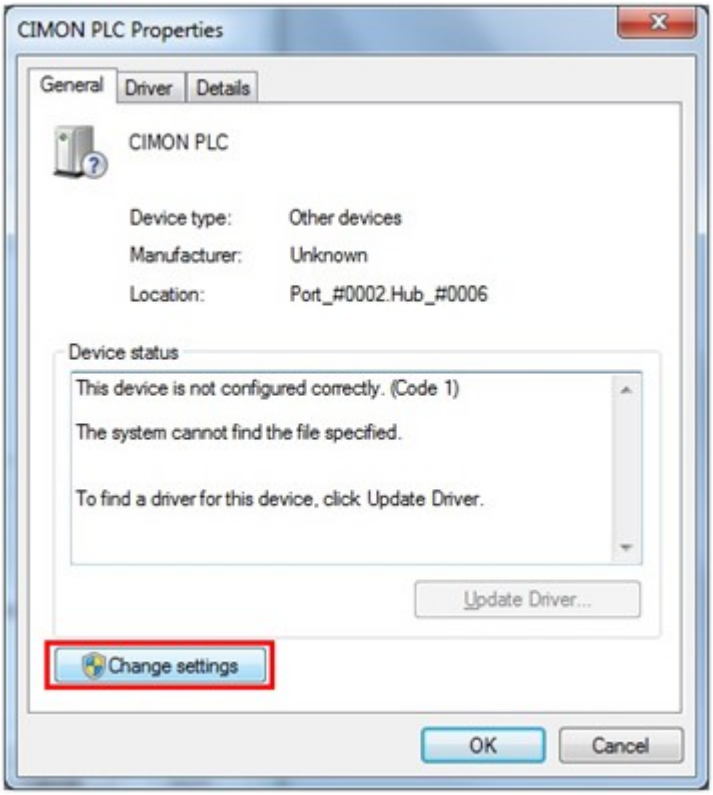




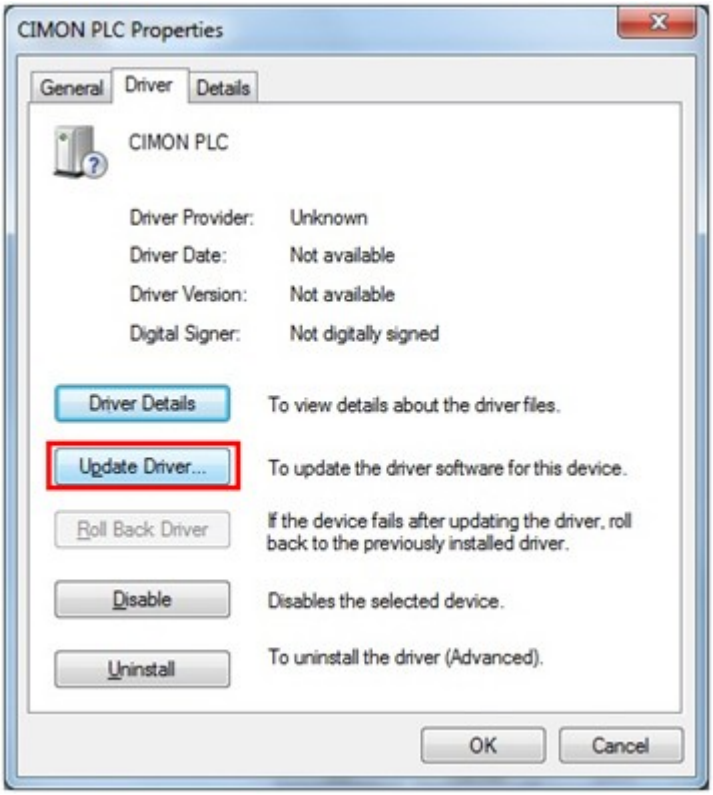
3. Select [Hardware] tap and click [Properties]



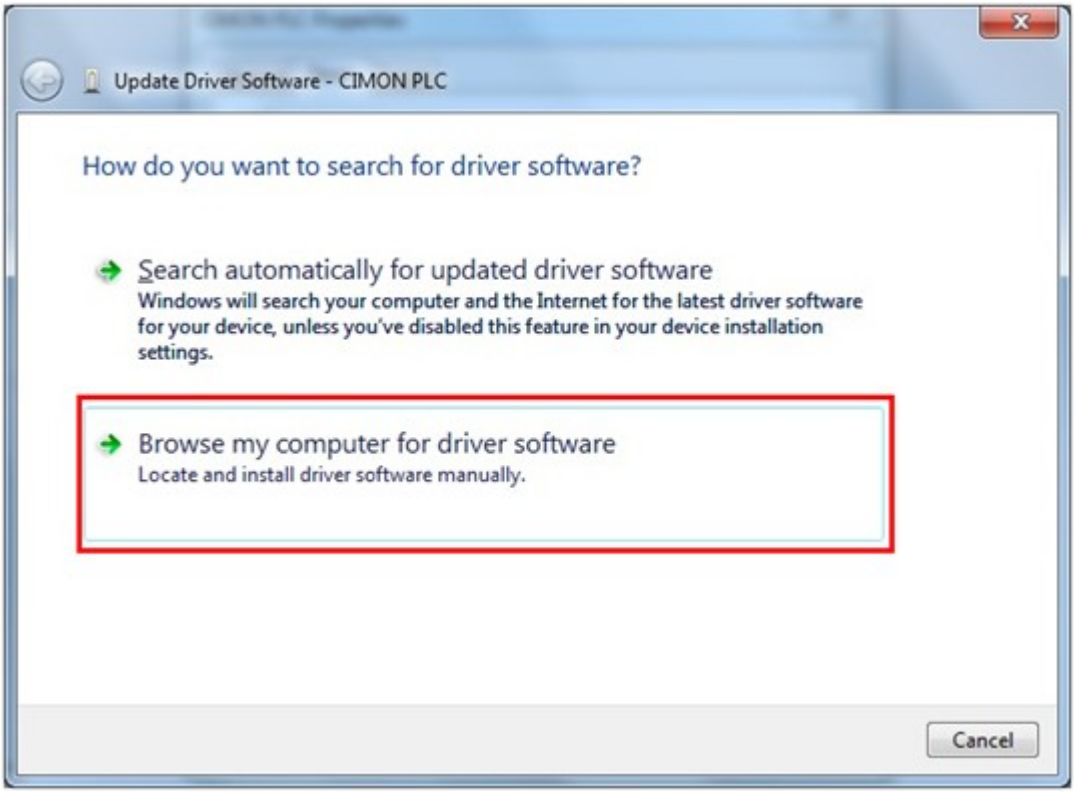
4. Click [Change settings]



5. Select [Driver] tap and click [Update Driver]

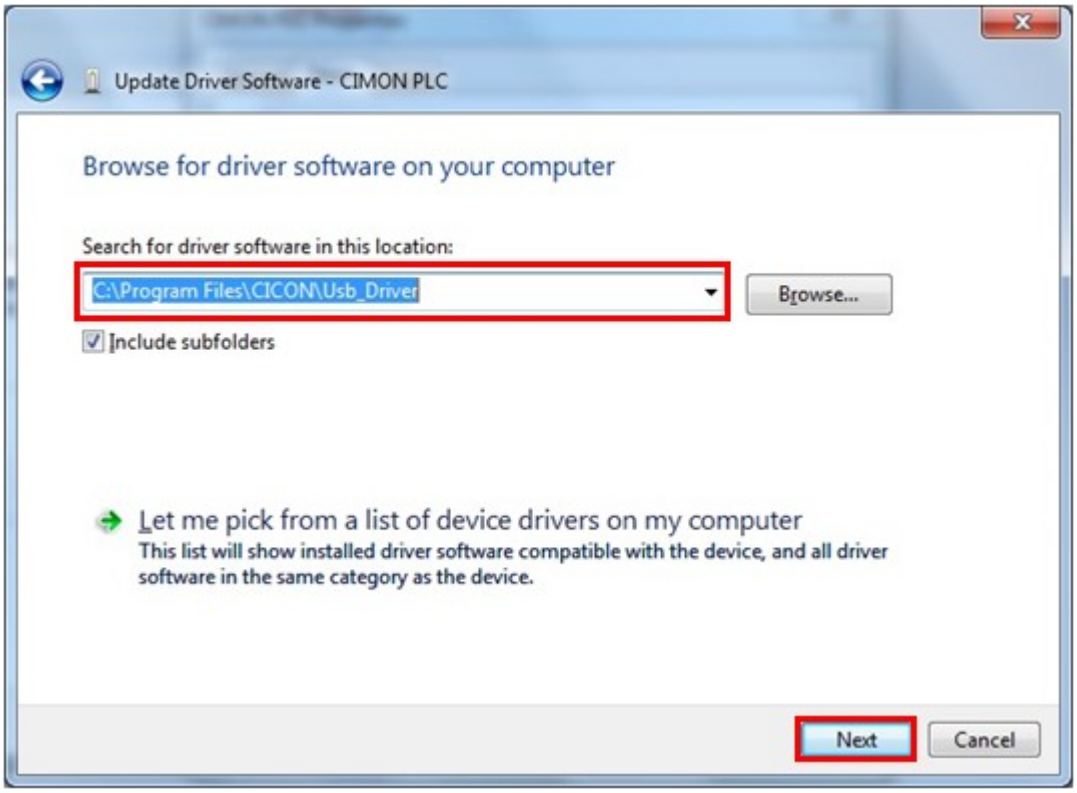


6. Select [Browse my computer for driver software] at [Update Driver Software – CIMON PLC]



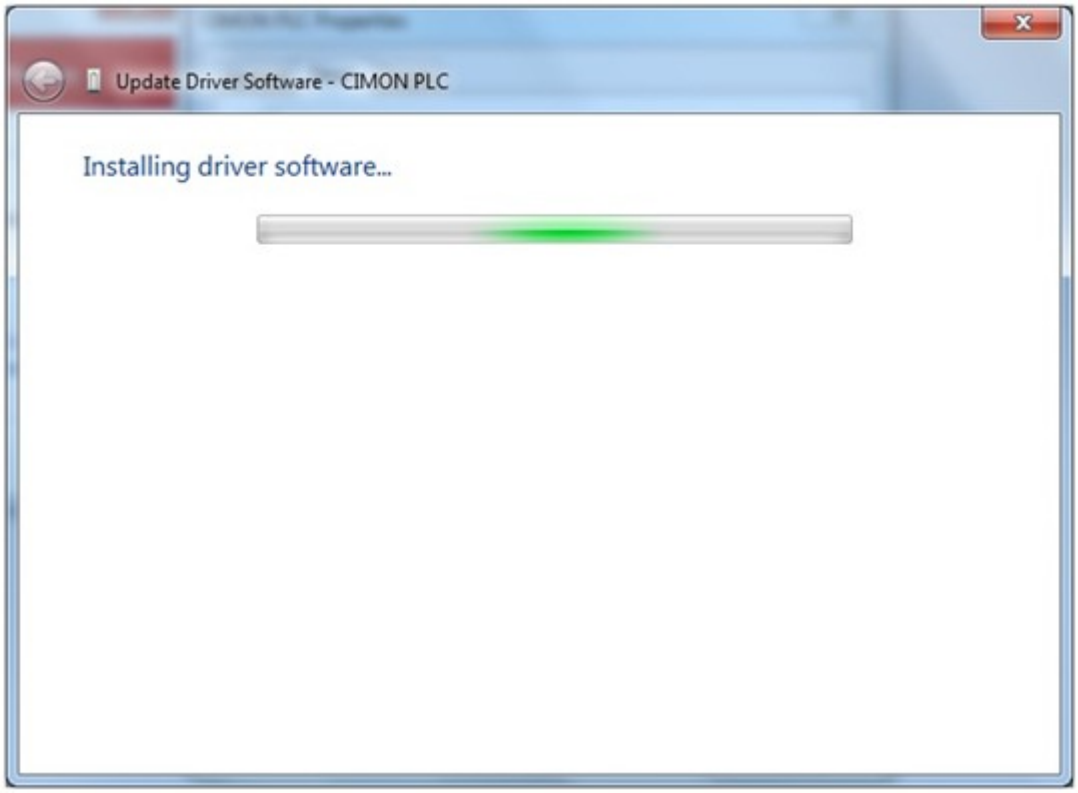
7. Select [Usb_Driver] folder where CICON is installed and click [Next]

*** In case of Windows 7 64Bit, Select [Usb_Driver] -> [OS_64Bit] folder.**

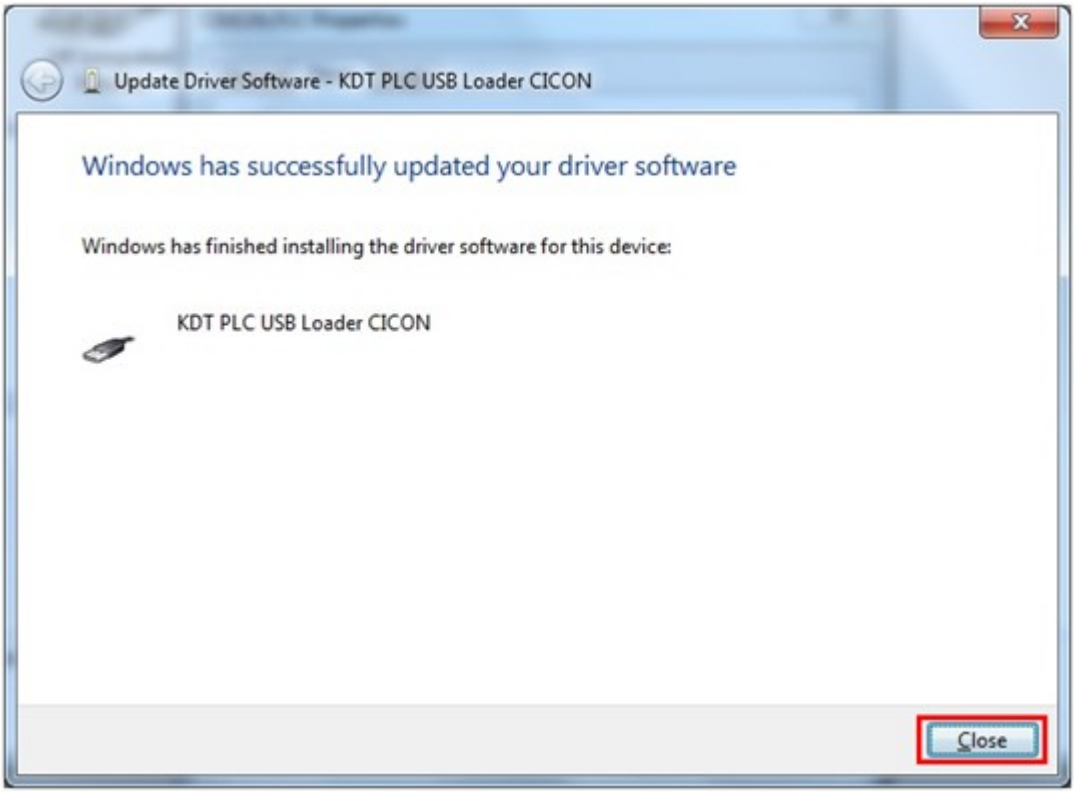


8. Select [Install this driver software anyway] at [Windows Security]

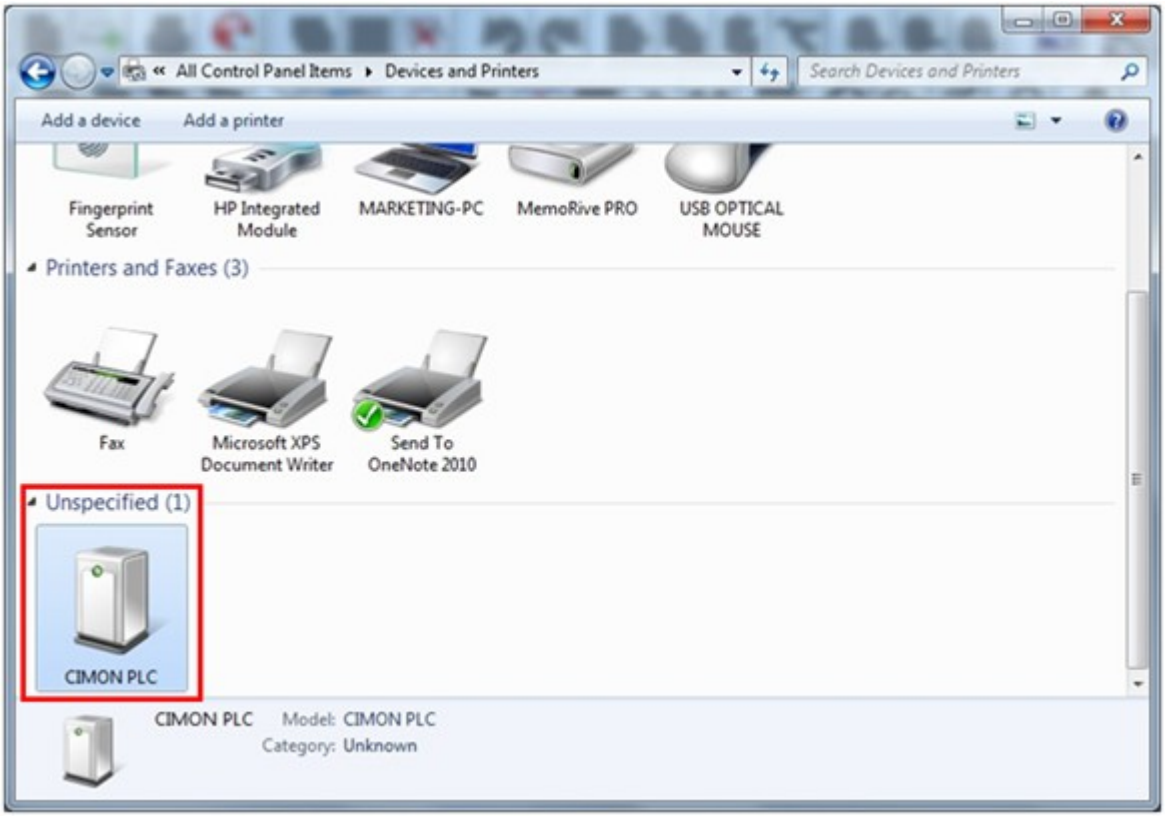
9. The Driver Software is being installed.

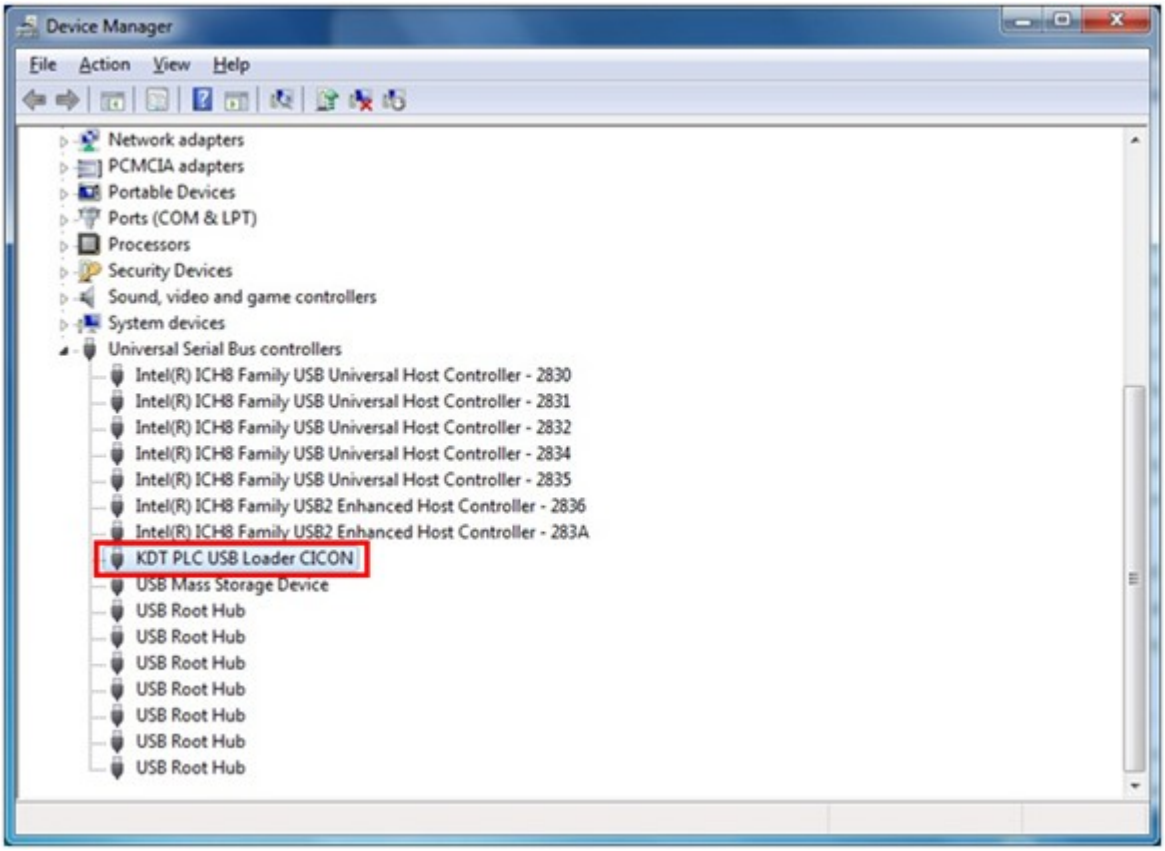


10. If USB Driver is installed successfully, [KDT PLC USB Loader CICON] appears.
Click [Close] to finish installation.

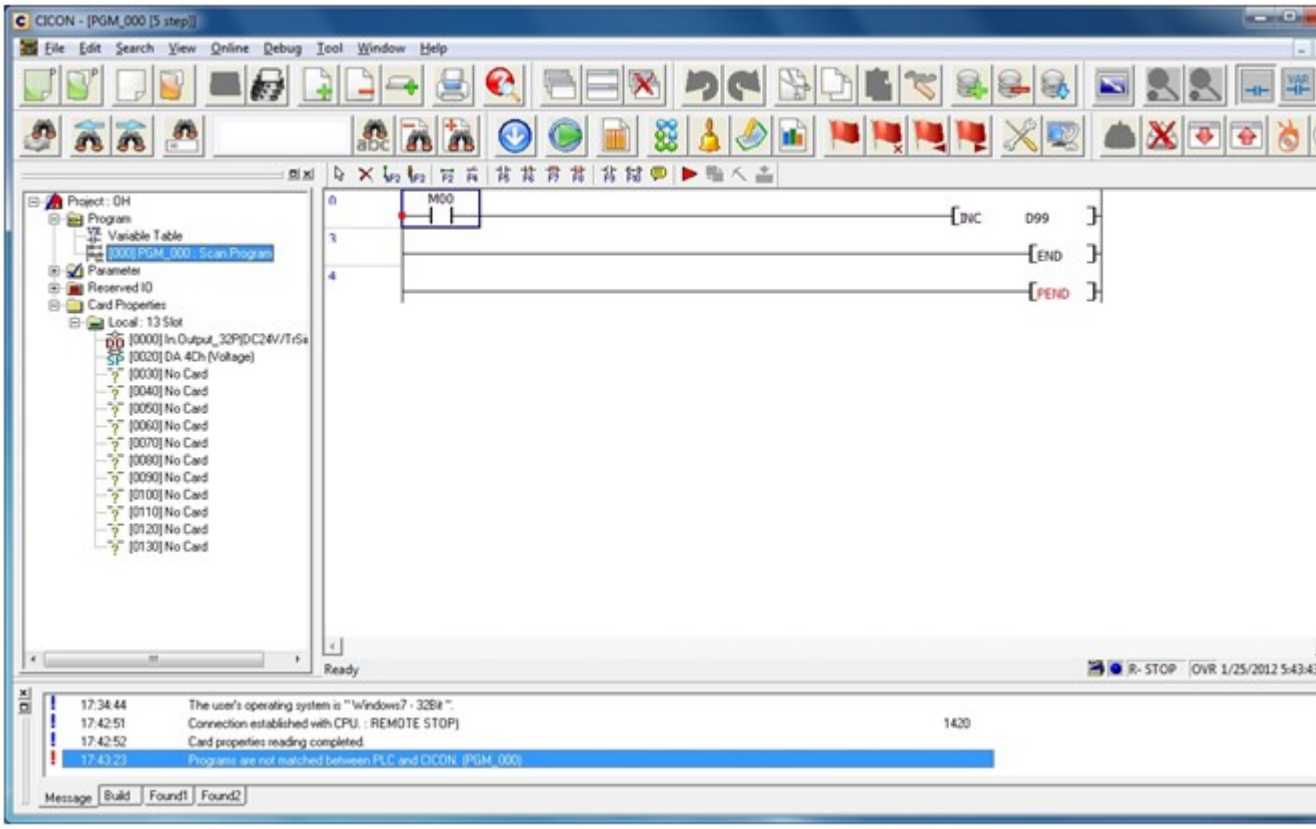


11. If USB Driver is installed successfully, [KDT PLC USB Loader CICON] appears under [Universal Serial Bus Controllers]





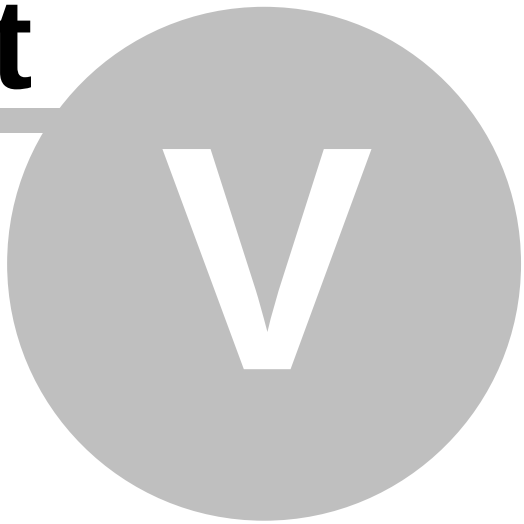
12. CICON can connect PLC through USB cable.



Top Level Intro

This page is printed before a new top-level chapter starts

Part



5 PLC Common

CIMON-PLC CPU :

- Compact and high performance PLC (supports redundant CPU configuration
- CPU embedded PID function (max. 32 loops)
- High compatibility between CPU series : uses the same programming tool (CICON)
- Provides the programming tool (CICON) free.
- Supports floating point instructions. (XP CPU)

Contents :

5.1 Index Register

Index register(R) indicates device indirectly using with device. Index register has 16 ranges for R0 ~ R15, each range could be inputted by -32768~32767.

1. The restrictions on using index register

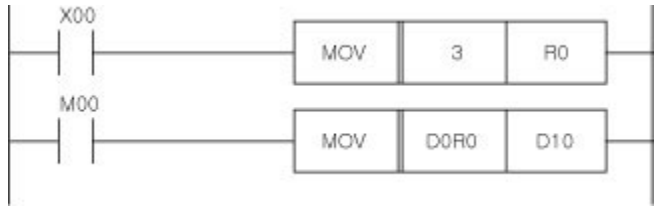
   Index register could be only used about application Instructions. Basic Instructions couldn't use with it.
   Also, device S(Step Relay), T(Timer), C(counter) couldn't use index register.

2. Action of index register.

Using at the word device.

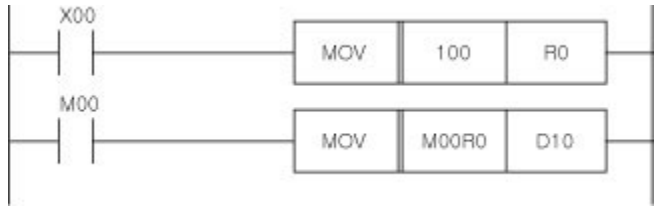
The value of indicated index is working as word unit.

Example	Description

	The value of R0 is 3.When the state of M00 is ON, the value of D10 from MOV command is to be D(0+R0), not to be D0. So, the moved value to D10 is the value of D03 by using MOV command.

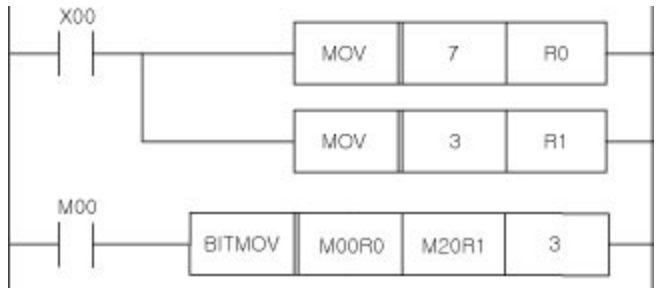
Using word commands from bit device.

It works as word unit by catching rest of indicated value that is divided by 16.

Example	Description
	R0 value is 100. When the state of M00 is ON, the value of D10 from MOV command is to be M(00+60). The value is the quotient of 100 divided by 16 that is expressed by word unit. So, the moved value to D10 is the word value of M60 by using MOV command.

Using bit commands from bit device.

The value of indicated index is working as bit unit.

Example	Description
	RO is 7, R1 is 3. When the state of M00 is ON, 3 bits moves to M(20+3) from M(00+7) by using MOV command. So, 3 bits move to M23 from M07.

Commands and operands for acting bit device.
The third operand of TEST, TESTP, DTEST, DTESTP
The third operand of DUTY
The first and second operand of BITMOVE, BITMOVP

5.2 Instruction List - Type

IN THIS TOPIC :				
Contact	Arithmetic (DWORD)	Rotation (DWORD)	BIT	User Clock
Connection	Arithmetic (BCD)	Rotation (DWORD, Carry)	TIME	Table
Output	Arithmetic (BCD, DWORD)	Shift	Timer	Redundant System
Master Control	Arithmetic (Floating decimal point)	Shift (BIT)	Counter	Scan program Enable / Disable
Jump	INC / DEC	Shift (WORD)	Read / Write	Occur random number
Call	Complement	Conversion (BIN -> BCD)	Communication	Scale
Interrupt	MIN / MAX	Conversion (BCD -> BIN)	Communication (SPC Program)	etc
Loop	Transmit Data	Conversion (BIN -> ASCII)	Watch Dog Tmer	[****]
END	Exchange Data	Conversion (ASCII -> BIN)	Carry	
Compare	Logical	Conversion (BCD -> ASCII)	Refresh	
Compare (DWORD)	Logical (DWORD)	Conversion (Floating decimal point, XP)	PID	
Compare (Block)	Logical (Block)	Decode / Encode	Position (CP, XP)	
Compare (Floating decimal point)	Rotation	7 Segment	Trigonometric (XP Series)	
Arithmetic	Rotation (Carry)	Union / Disunion	Exponent, Logarithm (XP)	

Contact

Instruction	Type of Input	Note
LD	LD (S)	Takes ON/OFF Data For a Contact Of One Circuit AS Operation Result.
LDI	LDI (S)	Takes ON/OFF Data For b Contact Of One Circuit As Operation Result.
LDP	LDP (S)	If Input Condition Is ON From OFF, Sets For One Scan.
LDF	LDF (S)	If Input Condition Is OFF From ON, Sets For One Scan.
AND	AND (S)	AND-Operates Contact a Of The Assigned Contact And Connected Contants In Series, And Takes The Result As Operation Result.
ANDI	ANDI (S)	AND-Operates Contact b Of The assigned Contact And The Connected Contact In Series, Takes The Result As Operation Result.
ANDF	ANDF (S)	If Input Condition To Contact To Detect Connection In Series Is Off From On, Device S Is Set For One Scan.

ANDP	ANDP (S)	If Input Condition To Contact To Detect Connection In Series Is On From Off, Device S Is Set For One Scan.
OR	OR (S)	OR-Operates a Contact Of The Assigned Contact And The Connected Contact In Parallel And Takes The Result As Operation Result.
ORI	ORI (S)	OR-Operates b Contact Of the Assigned Contact And The Connected Contact In Parallel, And Takes The Result As Operation Result.
ORP	ORP (S)	If Input Condition Of Connection In Parallel Contact Is OFF From ON, Sets For One Scan.
ORF	ORF (S)	If Input Condition Of Connection In Parallel Contact Is OFF From ON, Sets For One Scan.
INV	INV	Inverts The Left Circuit, A Contact Circuit To B Contact Circuit And B Contact Circuit To A Contact Circuit.

Connection

Instruction	Type of Input	Note
ANB	ANB	AND-Operates Blocks And Takes The Result As Operation Result.
ORB	ORB	OR-Operates Blocks And Takes The result As Operation Result.
MPS	MPS	It IS Used To Branch At First. Stores Operation Result In Memory.
MRD	MRD	It Is Used To Relay Branching. Reads The Stored State From Memory And Operates The Result.
MPP	MPP	It Is Used to End Branching. Reads The Stored State From Memory And Operates The Result.

Output

Instruction	Type of Input	Note
OUT	OUT (D)	Outputs Operation Result To The Assigned Contact.
SET	SET (D)	If Input Condition Is ON, Keeps Output Contact In ON State. Though The Input Is OFF, Keeps Setting Output.
PLS	PLS (D)	If INput Condition IS ON From OFF, Sets The Assigned Contact For One Scan. Otherwise, Resets.
PLF	PLF (D)	If Input Condition Is OFF From ON, Sets The Assigned Contact For One Scan. Otherwise, Resets.

Master Control

Instruction	Type of Input	Note

MC	MC (n)	If Input Of MC Is ON, Operates Up To Same MCR. If Input Conditon Is OFF, Does Not Operates.
MCR	MCR (n)	If Input Of MC Is ON, Operates Up To Same MCR. If Input Conditon Is OFF, Does Not Operates.

Jump

Instruction	Type of Input	Note
JME	JME (n)	If Input Of JMP n Instruction Is On, Jumps Next To JME n And Does Not Process All The Instructions Up To JME n.
JMP	JMP (n)	If Input Of JMP n Instruction Is On, Jumps Next To JME n And Does Not Process All The Instructions Up To JME n.
JMPP	JMPP (n)	If JMPP n Instruction Input Is On, Jumps Next To JME n And Does Not Process All The Instructions Up To JME n.

Call

Instruction	Type of Input	Note
CALL	CALL (n)	If Input Condition Is ON While Processing Program, Processes The Program Between The SBRT n To The RET According To The CALL n.
CALLP	CALLP (n)	If Input Condition Is ON While Processing Program, Processes The Program Between The SBRT n To The RET According To The CALL n.
ECALL	ECALL (Progam ID) (n)	Calls Sub-Routine From Other Program File. (Pn-Point Number Of Sub-Routine)
ECALLP	ECALLP (Program ID) (n)	Calls Sub-Routine From Other Program File. (Pn-Point Number Of Sub-Routine)
SBRT	SBRT (n)	If Input Condition Is ON While Running Program, Runs The Program Between SBRT n And RET Accoding To CALL n.
RET	RET	If Input Condition Is ON While Running Program, Runs The Program Between SBRT n And RET Accoding To CALL n.

Interrupt

Instruction	Type of Input	Note
EI	EI (n)	Operates Time Driven Interrrupt Assigned To n.
DI	DI (n)	Stops Operating Time Driven Interrupt Assigned To n.
GEI	GEI	Operates Time Driven Interrrupt In Entire Program.
GDI	GDI	Stops Operating Time Driven Interrrupt In Entire Program.

IRET	IRET	Shows THe End OF Interrupt Program.

Loop

Instruction	Type of Input	Note
FOR	FOR (n)	Runs The Step Next To NEXT Instruction After Has Processed Between FOR And NEXT At n Times.
NEXT	NEXT	Runs The Step Next To NEXT Instruction After Has Processed Between FOR And NEXT At n Times.
BREAK	BREAK	Comes Out From The FOR ~ NEXT Instruction.
BREAKP	BREAKP	Comes Out From The FOR ~ NEXT Instruction.

END

Instruction	Type of Input	Note
END	END	It Is The Instruction To Inform Ending Main Routine Program. In Case Jump Instruction Prior To It Is Operated, It Is Not Operated.
CEND	CEND	If input condition is turned on, ends main routine program.
CENDP	CENDP	If input condition is turned on, ends main routine program.
PEND	PEND	It Means End Of Program And Is Put On The Last Part.
STOP	STOP	To Stop Operation At The Time When Users Want, Converts To Program Mode After Finishing The Scan In Progress.
INITEND	INITEND	Ends Initialization Program ANd Runs Scan Program.

Compare

Instruction	Type of Input	Note
LD<	LD< (S1) (S2)	If Data In S1 Is Less Than Data In S2, Sets Result Of The Current Operation.
LD<=	LD<= (S1) (S2)	If Data In S1 Is Less Than Or Equal To Data In S2, Sets Result Of The Current Operation.
LD<>	LD<> (S1) (S2)	If Data In S1 Is Not Equal To Data In S2, Sets Result Of The Current Operation.
LD=	LD= (S1) (S2)	If Data In S1 Is Equal To Data In S2, Sets Result Of The Current Operation.
LD>	LD> (S1) (S2)	If Data In S1 Is Greater Than Data In S2, Sets Result Of The Current Operation.
LD>=	LD>= (S1) (S2)	If Data In S1 Is Greater Than Or Equal To Data In S2, Sets Result Of The Current Operation.

AND<	AND< (S1) (S2)	If Data S1 Is Less Than Data S2, ON. If Greater Than Or Equal To, OFF. AND-Operates The Result And Result Of The Current Operation.
AND<=	AND<= (S1) (S2)	If Data S1 Is Less Than Or Equal To Data S2, ON. If Greater Than, OFF. AND-Operates The Result And Result Of The Current Operation.
AND<>	AND<> (S1) (S2)	If Data S1 And Data S2 Are Not Equal, ON. If Equal, OFF. AND-Operates The Result And Result Of The Current Operation.
AND=	AND= (S1) (S2)	If Data S1 And Data S2 Are Equal, ON. If TNot Equal, OFF. AND-Operates The Result And Result Of The Current Operation.
AND>	AND> (S1) (S2)	If Data S1 Is Greater Than Data S2, ON. If Less Than Or Equal To, OFF. AND-Operates The Result And Result Of The Current Operation.
AND>=	AND>= (S1) (S2)	If Data S1 Is Greater Than Or Equal To Data S2, ON. If Less Than, OFF. AND-Operates The Result And Result Of The Current Operation.
OR<	OR< (S1) (S2)	If Data In S1 Is Less Than Data In S2, Sets.If Greater Than Or Equal To, Resets. OR-Operates The Result And Result Of The Current Operation.
OR<=	OR<= (S1) (S2)	If Data In S1 Is Less Than Or Equal To Data In S2, Sets. If Greater Than, Resets. OR-Operates The Result And Result Of The Current Operation.
OR<>	OR<> (S1) (S2)	If Data In S1 Is Not Equal To Data In S2, Sets. If Equal To, Off. OR-Operates The Result And Result Of The Current Operation.
OR=	OR= (S1) (S2)	If Data In S1 Is Equal To Data In S2, Sets. If Not Equal To, Resets. OR-Operates The Result And Result Of The Current Operation.
OR>	OR> (S1) (S2)	If Data In S1 Is Greater than Data In S2, Sets. If Less than Or Equal To, Resets. OR-Operates The Result And Result Of The Current Operation.
OR>=	OR>= (S1) (S2)	If Data InS1 Is Greater Than Or Equal To Data In S2, Sets. If Less Than, Resets. OR-Operates The Result And Result Of The Current Operation.
UCMP	UCMP (S1) (S2)	

Compare (DWORD)

Instruction	Type of Input	Note
LDD<	LDD< (S1) (S2)	If Data In S1 Is Less Than Data In S2, Sets Result Of The Current Operation.
LDD<=	LDD<= (S1) (S2)	If Data In S1 Is Less Than Or Equal To Data In S2, Sets Result Of The Current Operation.
LDD<>	LDD<> (S1) (S2)	If Data In S1 Is Not Equal To Data In S2, Sets Result Of The Current Operation.
LDD=	LDD= (S1) (S2)	If Data In S1 Is Equal To Data In S2, Sets Result Of The Current Operation.
LDD>	LDD> (S1) (S2)	If Data In S1 Is Greater Than Data In S2, Sets Result Of The Current Operation.
LDD>=	LDD>= (S1) (S2)	If Data In S1 Is Greater Than Or Equal To Data In S2, Sets Result

		Of The Current Operation.
ANDD<	ANDD< (S1) (S2)	If Double-Word Data S1 Is Less Than Double-Word Data S2, ON. If Greater Than Or Equal To, OFF. AND-Operates The Result And Result Of The Current Operation.
ANDD<=	ANDD<= (S1) (S2)	ANDD<= (S1) (S2)" , "If Double-Word Data S1 Is Less Than Or Equal To Double-Word Data S2, On. If Greater Than, OFF. AND-Operates The Result And Result Of The Current Operation.
ANDD<>	ANDD<> (S1) (S2)	ANDD<> (S1) (S2)" , "If Double-Word Data S1 Is Not Equal To Double-Word Data S2, ON. If Equal To, OFF. AND-Operates The Result And Result Of The Current Operation.
ANDD=	ANDD= (S1) (S2)	ANDD= (S1) (S2)" , "If Double-Word Data S1 Is Equal To Double-Word Data S2, ON. If Not Equal to, OFF.AND-Operates The Result And Result Of The Current Operation.
ANDD>	ANDD> (S1) (S2)	ANDD> (S1) (S2)" , "If Double-Word Data S1 Is Greater Than Double-Word Data S2, ON. If Less Than, OFF. AND-Operates The Result And Result Of The Current Operation.
ANDD>=	ANDD>= (S1) (S2)	ANDD>= (S1) (S2)" , "If Double-Word Data S1 Is Greater Than Or Equal To Double-Word Data S2, ON. If Less Than, OFF. AND-Operates The Result And Result Of The Current Operation.
ORD<	ORD< (S1) (S2)	If Data In S1 Is Less Than Data In S2, Sets. If Greater Than Or Equal To, Off. OR-Operates The Result And Result Of The Current Operation.
ORD<=	ORD<= (S1) (S2)	If Data In S1 Is Less Than Or Equal To Data In S2, Sets. If Greater Than, Resets. OR-Operates The Result And Result Of The Current Operation.
ORD<>	ORD<> (S1) (S2)	If Data In S1 Is Not Equal To Data In S2, Sets. If Equal To, resets. OR-Operates The Result And Result Of The Current Operation.
ORD=	ORD= (S1) (S2)	If Data In S1 Is Equal To Data In S2, Sets. If Not Equal To, Resets. OR-Operates The Result And Result Of The Current Operation.
ORD>	ORD> (S1) (S2)	If Data In S1 Is Greater Than Data In S2, Sets. If Less Than Or Equal To, Resets. OR-Operates The Result And Result Of The Current Operation.
ORD>=	ORD>= (S1) (S2)	If Data In S1 Is Greater Than Or Equal To Data In S2, Sets. If Less Than, Resets. OR-Operates The Result And Result Of The Current Operation.

Compare (Block)

Instruction	Type of Input	Note
BK=	BK= (S1) (S2) (D) (B) (n)	Compare [n] of 16 bit data from the device designated by [S1] with [n] of 16 bit data from the device designated by [S2] and stores the results from bit [n] of the device designated by [D]. Compare 16 bit data with [n] of 16 bit data from the device designated by [S2] and stores the results from bit [n] of the device designated by [D].
BK=P	BK=P (S1) (S2) (D) (B) (n)	Compare [n] of 16 bit data from the device designated by [S1] with [n] of 16 bit data from the device designated by [S2] and stores the results from bit [n] of the device designated by [D]. Compare 16 bit data with [n] of 16 bit data from the device designated by [S2] and stores the results from bit [n] of the device

		designated by [D].
BK<>	BK<> (S1) (S2) (D) (B) (n)	Compare [n] of 16 bit data from the device designated by [S1] with [n] of 16 bit data from the device designated by [S2] and stores the results from bit [n] of the device designated by [D]. Compare 16 bit data with [n] of 16 bit data from the device designated by [S2] and stores the results from bit [n] of the device designated by [D].
BK<>P	BK<>P (S1) (S2) (D) (B) (n)	Compare [n] of 16 bit data from the device designated by [S1] with [n] of 16 bit data from the device designated by [S2] and stores the results from bit [n] of the device designated by [D]. Compare 16 bit data with [n] of 16 bit data from the device designated by [S2] and stores the results from bit [n] of the device designated by [D].
BK<	BK< (S1) (S2) (D) (B) (n)	Compare [n] of 16 bit data from the device designated by [S1] with [n] of 16 bit data from the device designated by [S2] and stores the results from bit [n] of the device designated by [D]. Compare 16 bit data with [n] of 16 bit data from the device designated by [S2] and stores the results from bit [n] of the device designated by [D].
BK<P	BK<P (S1) (S2) (D) (B) (n)	Compare [n] of 16 bit data from the device designated by [S1] with [n] of 16 bit data from the device designated by [S2] and stores the results from bit [n] of the device designated by [D]. Compare 16 bit data with [n] of 16 bit data from the device designated by [S2] and stores the results from bit [n] of the device designated by [D].
BK<=	BK<= (S1) (S2) (D) (B) (n)	Compare [n] of 16 bit data from the device designated by [S1] with [n] of 16 bit data from the device designated by [S2] and stores the results from bit [n] of the device designated by [D]. Compare 16 bit data with [n] of 16 bit data from the device designated by [S2] and stores the results from bit [n] of the device designated by [D].
BK<=P	BK<=P (S1) (S2) (D) (B) (n)	Compare [n] of 16 bit data from the device designated by [S1] with [n] of 16 bit data from the device designated by [S2] and stores the results from bit [n] of the device designated by [D]. Compare 16 bit data with [n] of 16 bit data from the device designated by [S2] and stores the results from bit [n] of the device designated by [D].
BK>	BK> (S1) (S2) (D) (B) (n)	Compare [n] of 16 bit data from the device designated by [S1] with [n] of 16 bit data from the device designated by [S2] and stores the results from bit [n] of the device designated by [D]. Compare 16 bit data with [n] of 16 bit data from the device designated by [S2] and stores the results from bit [n] of the device designated by [D].
BK>P	BK>P (S1) (S2) (D) (B) (n)	Compare [n] of 16 bit data from the device designated by [S1] with [n] of 16 bit data from the device designated by [S2] and stores the results from bit [n] of the device designated by [D]. Compare 16 bit data with [n] of 16 bit data from the device designated by [S2] and stores the results from bit [n] of the device designated by [D].
BK>=	BK>= (S1) (S2) (D) (B) (n)	Compare [n] of 16 bit data from the device designated by [S1] with [n] of 16 bit data from the device designated by [S2] and stores the results from bit [n] of the device designated by [D]. Compare 16 bit data with [n] of 16 bit data from the device designated by [S2] and stores the results from bit [n] of the device designated by [D].
BK>=P	BK>=P (S1) (S2) (D) (B) (n)	Compare [n] of 16 bit data from the device designated by [S1] with [n] of 16 bit data from the device designated by [S2] and stores the results from bit [n] of the device designated by [D].

		Compare 16 bit data with [n] of 16 bit data from the device designated by [S2] and stores the results from bit [n] of the device designated by [D].

Compare (Floating decimal point)

Instruction	Type of Input	Note
LDE<	LDD< (S1) (S2)	If Float Data In S1 Is Less Than Float Data In S2, Sets Result Of The Current Operation.
LDE<=	LDD<= (S1) (S2)	If Float Data In S1 Is Less Than Or Equal To Float Data In S2, Sets Result Of The Current Operation.
LDE<>	LDD<> (S1) (S2)	If Float Data In S1 Is Not Equal To Float Data In S2, Sets Result Of The Current Operation.
LDE=	LDD= (S1) (S2)	If Float Data In S1 Is Equal To Float Data In S2, Sets Result Of The Current Operation.
LDE>	LDD> (S1) (S2)	If Float Data In S1 Is Greater Than Float Data In S2, Sets Result Of The Current Operation.
LDE>=	LDD>= (S1) (S2)	If Float Data In S1 Is Greater Than Or Equal To Float Data In S2, Sets Result Of The Current Operation.
ANDE<	ANDD< (S1) (S2)	If Float Data In S1 Is Less Than Float Data In S2, Sets Result Of The Current Operation.
ANDE<=	ANDD<= (S1) (S2)	If Float Data In S1 Is Less Than Or Equal To Float Data In S2, Sets Result Of The Current Operation.
ANDE<>	ANDD<> (S1) (S2)	If Float Data In S1 Is Not Equal To Float Data In S2, Sets Result Of The Current Operation.
ANDE=	ANDD= (S1) (S2)	If Float Data In S1 Is Equal To Float Data In S2, Sets Result Of The Current Operation.
ANDE>	ANDD> (S1) (S2)	If Float Data In S1 Is Greater Than Float Data In S2, Sets Result Of The Current Operation.
ANDE>=	ANDD>= (S1) (S2)	If Float Data In S1 Is Greater Than Or Equal To Float Data In S2, Sets Result Of The Current Operation.
ORE<	ORD< (S1) (S2)	If Float Data In S1 Is Less Than Float Data In S2, Sets Result Of The Current Operation.
ORE<=	ORD<= (S1) (S2)	f Float Data In S1 Is Less Than Or Equal To Float Data In S2, Sets Result Of The Current Operation.
ORE<>	ORD<> (S1) (S2)	If Float Data In S1 Is Not Equal To Float Data In S2, Sets Result Of The Current Operation.
ORE=	ORD= (S1) (S2)	If Float Data In S1 Is Equal To Float Data In S2, Sets Result Of The Current Operation.
ORE>	ORD> (S1) (S2)	If Float Data In S1 Is Greater Than Float Data In S2, Sets Result Of The Current Operation.
ORE>=	ORD>= (S1) (S2)	If Float Data In S1 Is Greater Than Or Equal To Float Data In S2, Sets Result Of The Current Operation.

Arithmetic

Instruction	Type of Input	Note
ADD	ADD (S1) (S2) (D)	Adds Data S1 To Data S2, And Stores The Result In Device D.
ADDP	ADDP (S1) (S2) (D)	Adds Data S1 To Data S2, And Stores The Result In Device D.
SUB	SUB (S1) (S2) (D)	Subtracts Data In S2 From Data In S1 And Stores The Result In Device D.
SUBP	SUBP (S1) (S2) (D)	Subtracts Data In S2 From Data In S1 And Stores The Result In Device D.
MUL	MUL (S1) (S2) (D)	Multiplies Data In S1 By Data In S2 And Stores The Result In D.
MULP	MULP (S1) (S2) (D)	Multiplies Data In S1 By Data In S2 And Stores The Result In D.
DIV	DIV (S1) (S2) (D)	Divides Data In S1 By Data In S2 And Stores The Resutl In Device D.
DIVP	DIVP (S1) (S2) (D)	Divides Data In S1 By Data In S2 And Stores The Resutl In Device D.
WMUL	WMUL (S1) (S2) (D)	Multiplies BIN 32-bit data designated by S1, S1+1 and BIN 32-bit data designated by S2, S2+1 and stores the result in the device designated by D, D+1.
WMULP	WMULP (S1) (S2) (D)	Multiplies BIN 32-bit data designated by S1, S1+1 and BIN 32-bit data designated by S2, S2+1 and stores the result in the device designated by D, D+1.
WDIV	WDIV (S1) (S2) (D)	This is used to divide the double data in the device assigned to S1, S1+1 by the DOUBLE data in the device assigned to S2, S2 +1 storing the quotient of the result in the device assigned to D
WDIVP	WDIVP (S1) (S2) (D)	This is used to divide the double data in the device assigned to S1, S1+1 by the DOUBLE data in the device assigned to S2, S2 +1 storing the quotient of the result in the device assigned to D
WSUM	WSUM (S) (D) (n)	Summed up all 16bit binary data for n words from the device designated at S, and stored it in the device designated at D
WSUMP	WSUMP (S) (D) (n)	Summed up all 16bit binary data for n words from the device designated at S, and stored it in the device designated at D

Arithmetic (DWORD)

Instruction	Type of Input	Note
DADD	DADD (S1) (S2) (D)	Adds Double- Word Data In S2 To Double-Word Data In S1 And Stores The Result In Device D.
DADDP	DADDP (S1) (S2) (D)	Adds Double- Word Data In S2 To Double-Word Data In S1 And Stores The Result In Device D.
DSUB	DSUB (S1) (S2) (D)	Subtract Double- Word Data In S2 From Double-Word Data In S1 And Stores The result In D.
DSUBP	DSUBP (S1) (S2) (D)	Subtract Double- Word Data In S2 From Double-Word Data In S1 And Stores The result In D.
DMUL	DMUL (S1) (S2) (D)	Multiplies Double-Word Data In S1 By Double-Word Data In S2 And Stores The Result In D.
DMULP	DMULP (S1) (S2) (D)	Multiplies Double-Word Data In S1 By Double-Word Data In S2 And Stores The Result In D.

DDIV	DDIV (S1) (S2) (D)	Divides Double-Word Data In S1 By Double-Word Data In S2 And Stores The Result In Device D.
DDIVP	DDIVP (S1) (S2) (D)	Divides Double-Word Data In S1 By Double-Word Data In S2 And Stores The Result In Device D.
DWMUL	WMUL (S1) (S2) (D)	Multiplies BIN 32-bit data designated by S1, S1+1 and BIN 32-bit data designated by S2, S2+1 and stores the result in the device designated by D, D+1.
DWMULP	WMULP (S1) (S2) (D)	Multiplies BIN 32-bit data designated by S1, S1+1 and BIN 32-bit data designated by S2, S2+1 and stores the result in the device designated by D, D+1.
DWDIV	WDIV (S1) (S2) (D)	This is used to divide the double data in the device assigned to S1, S1+1 by the DOUBLE data in the device assigned to S2, S2 +1 storing the quotient of the result in the device assigned to D
DWDIVP	WDIVP (S1) (S2) (D)	This is used to divide the double data in the device assigned to S1, S1+1 by the DOUBLE data in the device assigned to S2, S2 +1 storing the quotient of the result in the device assigned to D

Arithmetic (BCD)

Instruction	Type of Input	Note
BADD	BADD (S1) (S2) (D)	Adds 4 Digits BCD Data In S1 To 4 Digits BCD Data In S2, And Stores The Result In Device D.
BADDP	BADDP (S1) (S2) (D)	Adds 4 Digits BCD Data In S1 To 4 Digits BCD Data In S2, And Stores The Result In Device D.
BSUB	BSUB (S1) (S2) (D)	Subtracts 4 Digits BCD Data In S2 From 4 Digits BCD Data In S1 And Stores The Result In Device D.
BSUBP	BSUBP (S1) (S2) (D)	Subtracts 4 Digits BCD Data In S2 From 4 Digits BCD Data In S1 And Stores The Result In Device D.
BMUL	BMUL (S1) (S2) (D)	Mutiplies 4 Digits BCD Data In S1 By 4 Digits BCD Data In S2.
BMULP	BMULP (S1) (S2) (D)	Mutiplies 4 Digits BCD Data In S1 By 4 Digits BCD Data In S2.
BDIV	BDIV (S1) (S2) (D)	Divides 4 Digits BCD Data In S1 By 4 Digits BCD Data In S2 And Stores The Result In Device D.
BDIVP	BDIVP (S1) (S2) (D)	Divides 4 Digits BCD Data In S1 By 4 Digits BCD Data In S2 And Stores The Result In Device D.

Arithmetic (BCD, DWORD)

Instruction	Type of Input	Note
DBADD	DBADD (S1) (S2) (D)	Adds 4 Digits BCD Double-Word Data In S2 To 4 Digits BCD Double-Word Data In S1 And Stores The Result In Device D.
DBADDP	DBADDP (S1) (S2) (D)	Adds 4 Digits BCD Double-Word Data In S2 To 4 Digits BCD Double-Word Data In S1 And Stores The Result In Device D.
DBSUB	DBSUB (S1) (S2) (D)	Subtracts 8 Digits BCD Data In S2 From 8 Digits BCD Data In S1.
DBSUBP	DBSUBP (S1) (S2) (D)	Subtracts 8 Digits BCD Data In S2 From 8 Digits BCD Data In S1.

DBMUL	DBMUL (S1) (S2) (D)	Multiplies 8 Digits BCD Data In S1 By 8 Digits BCD Data In S2.
DBMULP	DBMULP (S1) (S2) (D)	Multiplies 8 Digits BCD Data In S1 By 8 Digits BCD Data In S2.
DBDIV	DBDIV (S1) (S2) (D)	Divides 8 Digits BCD Data In S1 By 8 Digits BCD Data And Stores The Result In Device D.
DBDIVP	DBDIVP (S1) (S2) (D)	Divides 8 Digits BCD Data In S1 By 8 Digits BCD Data And Stores The Result In Device D.

Arithmetic (Floating decimal point, XP)

Instruction	Type of Input	Note
EADD	EADD (S1) (S2) (D)	This is used to add the floating-point data in the device assigned to S1 to the floating-point data in the device assigned to S2, storing the result in the device assigned D.
EADDP	EADDP (S1) (S2) (D)	This is used to add the floating-point data in the device assigned to S1 to the floating-point data in the device assigned to S2, storing the result in the device assigned D.
ESUB	ESUB (S1) (S2) (D)	This is used to subtract the Floating-point data in the device assigned to S2 from the Floating-point data in the device assigned to S1, storing the result in the device assigned to D.
ESUBP	ESUBP (S1) (S2) (D)	This is used to subtract the Floating-point data in the device assigned to S2 from the Floating-point data in the device assigned to S1, storing the result in the device assigned to D.
EMUL	EMUL (S1) (S2) (D)	This is used to multiply the Floating-point data assigned to S1 by the Floating-point data in the device assigned to S2, storing the result in the device assigned to D.
EMULP	EMULP (S1) (S2) (D)	This is used to multiply the Floating-point data assigned to S1 by the Floating-point data in the device assigned to S2, storing the result in the device assigned to D.
EDIV	EDIV (S1) (S2) (D)	This is used to divide the floating-point data in the device assigned to S1 to the floating-point data in the device assigned to S2, storing the result in the device assigned D.
EDIVP	EDIVP (S1) (S2) (D)	This is used to divide the floating-point data in the device assigned to S1 to the floating-point data in the device assigned to S2, storing the result in the device assigned D.

INC / DEC

Instruction	Type of Input	Note
INC	INC (D)	Adds 1 To Data Value In D And Stores The Result In D Again.
INCP	INCP (D)	Adds 1 To Data Value In D And Stores The Result In D Again.
DINC	DINC (D)	Adds 1 To Double-Word Data Value In D And Stores The Result In D Again.
DINCP	DINCP (D)	Adds 1 To Double-Word Data Value In D And Stores The Result In D Again.
DEC	DEC (D)	Subtracts 1 From Data Value In D And Stores The Result In

		Device D Again.
DECP	DECP (D)	Subtracts 1 From Data Value In D And Stores The Result In Device D Again.
DDEC	DDEC (D)	Subtracts 1 From Double-Word Data Value In D And Stores The Result In Device D Again.
DDECP	DDECP (D)	Subtracts 1 From Double-Word Data Value In D And Stores The Result In Device D Again.

Complement

Instruction	Type of Input	Note
NEG	NEG (D)	Sign-Inverts Contents Of Data In D And Stores The Result In D Again.
NEGP	NEGP (D)	Sign-Inverts Contents Of Data In D And Stores The Result In D Again.
DNEG	DNEG (D)	Sign-Inverts Contents Of Double-Word Data In D And Stores The Result In D Again.
DNEGP	DNEGP (D)	Sign-Inverts Contents Of Double-Word Data In D And Stores The Result In D Again.

MIN / MAX

Instruction	Type of Input	Note
MAX	MAX (S) (D) (n)	Stores The Biggest Value Among n Pieces Of Data From Data In S, Its Location And Number Of The Values In D.
MAXP	MAXP (S) (D) (n)	Stores The Biggest Value Among n Pieces Of Data From Data In S, Its Location And Number Of The Values In D.
MIN	MIN (S) (D) (n)	Stores The Smallest Value Among n Pieces Of Data From Data In S, Its Location And Number Of The Values In D.
MINP	MINP (S) (D) (n)	Stores The Smallest Value Among n Pieces Of Data From Data In S, Its Location And Number Of The Values In D.
DMAX	DMAX (S) (D) (n)	Stores The Biggest Value Among n Pieces Of Data From Double-Word Data Of S, Its Location And Number Of The Values In D.
DMAXP	DMAXP (S) (D) (n)	Stores The Biggest Value Among n Pieces Of Data From Double-Word Data Of S, Its Location And Number Of The Values In D.
DMIN	DMIN (S) (D) (n)	Stores The Smallest Value Among n Pieces Of Data From Double-Word Data Of S, Its Location And Number Of The Values In D.
DMINP	DMINP (S) (D) (n)	Stores The Smallest Value Among n Pieces Of Data From Double-Word Data Of S, Its Location And Number Of The Values In D.

Transmit Data

Instruction	Type of Input	Note
MOV	MOV (S) (D)	Transmits Word Data In Device S To Device D.
MOVP	MOVP (S) (D)	Transmits Word Data In Device S To Device D.
DMOV	DMOV (S) (D)	Transmits Double-Word Data In Device S To Device D.
DMOVP	DMOVP (S) (D)	Transmits Double-Word Data In Device S To Device D.
CML	CML (S) (D)	Inverts Each Bit Of Data In Device S And Stores The Result In Device D.
CMLP	CMLP (S) (D)	Inverts Each Bit Of Data In Device S And Stores The Result In Device D.
DCML	DCML (S) (D)	Inverts Each Bit Of Double-Word Data In S And Stores The Result In Device D.
DCMLP	DCMLP (S) (D)	Inverts Each Bit Of Double-Word Data In S And Stores The Result In Device D.
BMOV	BMOV (S) (D) (n)	Transmits n Pieces Of Data In S To Device D.
BMOVP	BMOVP (S) (D) (n)	Transmits n Pieces Of Data In S To Device D.
FMOV	FMOV (S) (D) (n)	Transmits Data In S To n Pieces Of Device From Device D In Due Order.
FMOVP	FMOVP (S) (D) (n)	Transmits Data In S To n Pieces Of Device From Device D In Due Order.
WBMOV	WBMOV (S) (D) (fm)	transfer bit data from S to D, obey fm
WBMOVP	WBMOVP (S) (D) (fm)	transfer bit data from S to D, obey fm

Exchange Data

Instruction	Type of Input	Note
XCH	XCH (D1) (D2)	Exchanges Word Data In S With Word Data In D.
XCHP	XCHP (D1) (D2)	Exchanges Word Data In S With Word Data In D.
DXCH	DXCH (S) (D)	Exchanges Double-Word Data In S With Double-Word Data In D Each Other.
DXCHP	DXCHP (S) (D)	Exchanges Double-Word Data In S With Double-Word Data In D Each Other.
BXCH	BXCH (D1) (D2) (n)	Exchanges n Pieces Of Data In Device S And n Pieces Of Data In Device D Each Other.
BXCHP	BXCHP (D1) (D2) (n)	Exchanges n Pieces Of Data In Device S And n Pieces Of Data In Device D Each Other.
SWAP	SWAP (D)	Exchanges The Upper Byte Of Data In D With The Lower Byte Of It And Stores The Result In Device D.
SWAPP	SWAPP (D)	Exchanges The Upper Byte Of Data In D With The Lower Byte Of It And Stores The Result In Device D.

Logical

Instruction	Type of Input	Note
WAND	WAND (S1) (S2) (D)	AND-Operates Data In S1 And Data In S2, And Stores In Device D.
WANDP	WANDP (S1) (S2) (D)	AND-Operates Data In S1 And Data In S2, And Stores In Device D.
WOR	WOR (S1) (S2) (D)	OR-Operates Data In S1 And Data In S2, And Stores The Result In Device D.
WORP	WORP (S1) (S2) (D)	OR-Operates Data In S1 And Data In S2, And Stores The Result In Device D.
WXOR	WXOR (S1) (S2) (D)	Exclusive - OR-Operates Data In S1 And Data In S2, And Stores The Result In D.
WXORP	WXORP (S1) (S2) (D)	Exclusive - OR-Operates Data In S1 And Data In S2, And Stores The Result In D.
WXNR	WXNR (S1) (S2) (D)	Exclusive - NOR-Operates Data In S1 And Data In S2, And Stores The Result In D.
WXNRP	WXNRP (S1) (S2) (D)	Exclusive - NOR-Operates Data In S1 And Data In S2, And Stores The Result In D.

Logical (DWORD)

Instruction	Type of Input	Note
DAND	DAND (S1) (S2) (D)	AND-Operates Data In Device S1 And Data In Device S2, And Stores The Result In Device D.
DANDP	DANDP (S1) (S2) (D)	AND-Operates Data In Device S1 And Data In Device S2, And Stores The Result In Device D.
DOR	DOR (S1) (S2) (D)	OR-Operates Data In S1 And 32 Bit Data In S2, And Stores The Result In D.
DORP	DORP (S1) (S2) (D)	OR-Operates Data In S1 And 32 Bit Data In S2, And Stores The Result In D.
DXOR	DXOR (S1) (S2) (D)	Exclusive - OR-Operates Double-Word Data In S1 And Double-Word Data In S2, And Stores The Result In D.
DXORP	DXORP (S1) (S2) (D)	Exclusive - OR-Operates Double-Word Data In S1 And Double-Word Data In S2, And Stores The Result In D.
DXNR	DXNR (S1) (S2) (D)	Exclusive - NOR-Operates Double-Word Data In S1 And Double-Word Data In S2, And Stores The Result In D.
DXNRP	DXNRP (S1) (S2) (D)	Exclusive - NOR-Operates Double-Word Data In S1 And Double-Word Data In S2, And Stores The Result In D.

Logical (Block)

Instruction	Type of Input	Note

BKAND	BKAND (S1) (S2) (D) (n)	AND-Operates n Pieces Of Data In Device S1 And n Pieces OF Data In Device S2, And Stores The Result In Device D.
BKANDP	BKANDP (S1) (S2) (D) (n)	AND-Operates n Pieces Of Data In Device S1 And n Pieces OF Data In Device S2, And Stores The Result In Device D.
BKOR	BKOR (S1) (S2) (D) (n)	OR-Operates n Pieces Of Data In S1 And n Pieces Of Data In S2, And Stores The Result In Device D.
BKORP	BKORP (S1) (S2) (D) (n)	OR-Operates n Pieces Of Data In S1 And n Pieces Of Data In S2, And Stores The Result In Device D.
BKXOR	BKXOR (S1) (S2) (D) (n)	Exclusive - OR-Operates n Pieces Of Data In S1 And n Pieces Of Data In S2, And Stores The Result In Device D.
BKXORP	BKXORP (S1) (S2) (D) (n)	Exclusive - OR-Operates n Pieces Of Data In S1 And n Pieces Of Data In S2, And Stores The Result In Device D.
BKXNR	BKXNR (S1) (S2) (D) (n)	Exclusive - NOR-Operates n Pieces Of Data In S1 And n Pieces Of Data In S2, And Stores The Result In Device D.
BKXNRP	BKXNRP (S1) (S2) (D) (n)	Exclusive - NOR-Operates n Pieces Of Data In S1 And n Pieces Of Data In S2, And Stores The Result In Device D.

Rotation

Instruction	Type of Input	Note
ROL	ROL (D) (n)	Shifts Left 16 Pieces Of Bit In D As Much As n Bits. Shifts The Uppermost Bit To The Lowest Bit And Carry Flag.
ROLP	ROLP (D) (n)	Shifts Left 16 Pieces Of Bit In D As Much As n Bits. Shifts The Uppermost Bit To The Lowest Bit And Carry Flag.
ROR	ROR (D) (n)	Shifts Right 16 Pieces Of Bit In D As Much As n Bits. Shifts The Lowest Bit To Carry Flag And Carry Flag To The Uppermost Bit.
RORP	RORP (D) (n)	Shifts Right 16 Pieces Of Bit In D As Much As n Bits. Shifts The Lowest Bit To Carry Flag And Carry Flag To The Uppermost Bit.

Rotation (Carry)

Instruction	Type of Input	Note
RCL	RCL (D) (n)	Shifts Left 16 Pieces Of Bit In D As Much As n Bits. Shifts The Uppermost Bit To Carry Flag And Carry Flag To The Lowest Bit.
RCLP	RCLP (D) (n)	Shifts Left 16 Pieces Of Bit In D As Much As n Bits. Shifts The Uppermost Bit To Carry Flag And Carry Flag To The Lowest Bit.
RCR	RCR (D) (n)	Shifts Right 16 Pieces Of Bit In D As Much As n Bits. Shifts The Lowest Bit To Carry Flag And Carry Flag.
RCRP	RCRP (D) (n)	Shifts Right 16 Pieces Of Bit In D As Much As n Bits. Shifts The Lowest Bit To Carry Flag And Carry Flag.

Rotation (DWORD)

Instruction	Type of Input	Note
DROL	DROL (D) (n)	Shifts Left 32 Bits In D As Much As n Bits. Shifts The Uppermost Bit To The Lowest Bit And Carry Flag.
DROLP	DROLP (D) (n)	Shifts Left 32 Bits In D As Much As n Bits. Shifts The Uppermost Bit To The Lowest Bit And Carry Flag.
DROR	DROR (D) (n)	Shifts Right 32 Bits In D As Much As n Bits. Shifts The Lowest Bit To Carry Flag And Carry Flag To The Uppermost Bit.
DRORP	DRORP (D) (n)	Shifts Right 32 Bits In D As Much As n Bits. Shifts The Lowest Bit To Carry Flag And Carry Flag To The Uppermost Bit.

Rotation (DWORD, Carry)

Instruction	Type of Input	Note
DRCL	DRCL (D) (n)	Shifts Left 32 Bits In D As Much As n Bits. Shifts The Uppermost Bit To Carry Flag And Carry Flag To The Lowest Bit.
DRCLP	DRCLP (D) (n)	Shifts Left 32 Bits In D As Much As n Bits. Shifts The Uppermost Bit To Carry Flag And Carry Flag To The Lowest Bit.
DRCR	DRCR (D) (n)	Shifts Right 32 Bits In D As Much As n Bits. Shifts The Lowest Bit To The Uppermost Bit And Carry Flag.
DRCRP	DRCRP (D) (n)	Shifts Right 32 Bits In D As Much As n Bits. Shifts The Lowest Bit To The Uppermost Bit And Carry Flag.

Shift

Instruction	Type of Input	Note
SFL	SFL (D) (n)	Shifts Left Data Bit In D As Much As n Bits. Fills Lower n Bits With 0 And Stores the Result In D.
SFLP	SFLP (D) (n)	Shifts Left Data Bit In D As Much As n Bits. Fills Lower n Bits With 0 And Stores the Result In D.
SFR	SFR (D) (n)	Shifts Right Data Bit In D As Much As n Bits. Fills Upperr n Bits With 0 And Stores the Result In D.
SFRP	SFRP (D) (n)	Shifts Right Data Bit In D As Much As n Bits. Fills Upperr n Bits With 0 And Stores the Result In D.

Shift (BIT)

Instruction	Type of Input	Note
BSFL	BSFL (D) (n)	n Pieces Of Data Are Shifted Left From Data In Device D And The

		Shifted Lowest Data Is Filled With 0.
BSFLP	BSFLP (D) (n)	n Pieces Of Data Are Shifted Left From Data In Device D And The Shifted Lowest Data Is Filled With 0.
BSFR	BSFR (D) (n)	n Pieces Of Data Are Shifted Right From Data In Device D And The Shifted Uppermost Data Is Filled With 0.
BSFRP	BSFRP (D) (n)	n Pieces Of Data Are Shifted Right From Data In Device D And The Shifted Uppermost Data Is Filled With 0.

Shift (WORD)

Instruction	Type of Input	Note
DSFL	DSFL (D) (n)	Shifts Left Double-Word Data Bits In D As Much As n Bits. Fills Lower n Bits With 0 And Stores Them In D.
DSFLP	DSFLP (D) (n)	Shifts Left Double-Word Data Bits In D As Much As n Bits. Fills Lower n Bits With 0 And Stores Them In D.
DSFR	DSFR (D) (n)	Shifts Right Double-Word Data Bits In D As Much As n Bits. Fills Upper n Bits With 0 And Stores Them In D.
DSFRP	DSFRP (D) (n)	Shifts Right Double-Word Data Bits In D As Much As n Bits. Fills Upper n Bits With 0 And Stores Them In D.

Conversion (BIN -> BCD)

Instruction	Type of Input	Note
BCD	BCD (S) (D)	Converts BIN Data Value In S To BCD Data And Stores The Result In Device D.
BCDP	BCDP (S) (D)	Converts BIN Data Value In S To BCD Data And Stores The Result In Device D.
DBCD	DBCD (S) (D)	Converts BIN DOuble-Word Data Value In S To BCD Double-Word Data And Stores The Result In Device D.
DBCDP	DBCDP (S) (D)	Converts Double-Word BIN Data Value In S To BCD Data And Stores The result In Device D.

Conversion (BCD -> BIN)

Instruction	Type of Input	Note
BIN	BIN (S) (D)	Converts 4 Digits BCD Data Value In S To BIN Data And Stores The Result In Device D.
BINP	BINP (S) (D)	Converts 4 Digits BCD Data Value In S To BIN Data And Stores The Result In Device D.
DBIN	DBIN (S) (D)	Converts 8 Digits BCD Data Value In S To BIN Data And Stores

		The Result In Device D.
DBINP	DBINP (S) (D)	Converts 8 Digits BCD Data Value In S To BIN Data And Stores The Result In Device D.

Conversion (BIN -> ASCII)

Instruction	Type of Input	Note
BINDA	BINDA (S) (D)	Converts BIN Data In S To Decimal ASCII Code And Stores The Result In Device D.
BINDAP	BINDAP (S) (D)	Converts BIN Data In S To Decimal ASCII Code And Stores The Result In Device D.
DBINDA	DBINDA (S) (D)	Converts BIN Data In S To Decimal ASCII Code And Stores The Result In Device D.
DBINDAP	DBINDAP (S) (D)	Converts BIN Data In S To Decimal ASCII Code And Stores The Result In Device D.

Conversion (ASCII -> BIN)

Instruction	Type of Input	Note
DABIN	DABIN (S) (D)	Converts Decimal ASCII Code In Device S To 16bit BIN Data And Stores The Result In Device D.
DABINP	DABINP (S) (D)	Converts Decimal ASCII Code In Device S To 16bit BIN Data And Stores The Result In Device D.
DDABIN	DDABIN (S) (D)	Converts Decimal ASCII Code In S To 32 Bit BIN Data And Stores The Result In Device D.
DDABINP	DDABINP (S) (D)	Converts Decimal ASCII Code In S To 32 Bit BIN Data And Stores The Result In Device D.

Conversion (BIN -> HEX ASCII)

Instruction	Type of Input	Note
BINHA	BINHA (S) (D)	Converts BIN Data In S To Hexadecimal ASCII Code And Stores The Result In Device D.
BINHAP	BINHAP (S) (D)	Converts BIN Data In S To Hexadecimal ASCII Code And Stores The Result In Device D.
DBINHA	DBINHA (S) (D)	Converts BIN Data In S To Hexadecimal ASCII Code And Stores The Result In D.
DBINHAP	DBINHAP (S) (D)	Converts BIN Data In S To Hexadecimal ASCII Code And Stores The Result In D.

Conversion (HEX ASCII -> BIN)

Instruction	Type of Input	Note
HABIN	HABIN (S) (D)	Converts Hexadecimal ASCII COde In S To 16 Bit BIN Data And Stores The Result In D.
HABINP	HABINP (S) (D)	Converts Hexadecimal ASCII COde In S To 16 Bit BIN Data And Stores The Result In D.
DHABIN	DHABIN (S) (D)	Converts Hexadecimal ASCII Code In S To 32 BIt BIN Data And Stores The Result In Device D.
DHABINP	DHABINP (S) (D)	Converts Hexadecimal ASCII Code In S To 32 BIt BIN Data And Stores The Result In Device D.

Conversion (BCD -> ASCII)

Instruction	Type of Input	Note
BCDDA	BCDDA (S) (D)	Converts 4 Digits BCD Data In S To Decimal ASCII Code And Stores The Result In Device D.
BCDDAP	BCDDAP (S) (D)	Converts 4 Digits BCD Data In S To Decimal ASCII Code And Stores The Result In Device D.
DBCDDA	DBCDDA (S) (D)	Converts 8 Digits BCD Data In S To Decimal ASCII Code And Stores The Result In Device D.
DBCDDAP	DBCDDAP (S) (D)	Converts 8 Digits BCD Data In S To Decimal ASCII Code And Stores The Result In Device D.

Conversion (Floating decimal point, XP)

Instruction	Type of Input	Note
FLT	FLT (S) (D)	Converts 16-bit BIN data designated by S to floating decimal point real number, and stores at device number designated by D .
FLTP	FLTP (S) (D)	Converts 16-bit BIN data designated by S to floating decimal point real number, and stores at device number designated by D .
DFLT	DFLT (S) (D)	Converts 32-bit BIN data designated by S to floating decimal point real number, and stores at device number designated by D
DFLTP	DFLTP (S) (D)	Converts 32-bit BIN data designated by S to floating decimal point real number, and stores at device number designated by D
INT	INT (S) (D)	Converts the floating decimal point real number designated at S into BIN 16-bit data and stores it at the device number designated at D
INTP	INTP (S) (D)	Converts the floating decimal point real number designated at S into BIN 16-bit data and stores it at the device number designated at D

RAD	RAD (S) (D)	Converts units of angle size from angle units designated by S to radian units, and stores result at device number designated by D.
RADP	RADP (S) (D)	Converts units of angle size from angle units designated by S to radian units, and stores result at device number designated by D.
DEG	DEG (S) (D)	Converts Unit of angle size from radian units designated by S to angles, and stores result at device number designated by D.
DEGP	DEGP (S) (D)	Converts Unit of angle size from radian units designated by S to angles, and stores result at device number designated by D.
EMOV	EMOV (S) (D)	This is used to transfer the Floating-point data in the device assigned to S to the device assigned to D.
EMOVP	EMOVP (S) (D)	This is used to transfer the Floating-point data in the device assigned to S to the device assigned to D.

Decode / Encode

Instruction	Type of Input	Note
DECO	DECO (S) (D) (n)	Decodes Lower n Bits In S And Sets The Contact Corresponding To Result Of Device D.
DECOP	DECOP (S) (D) (n)	Decodes Lower n Bits In S And Sets The Contact Corresponding To Result Of Device D.
ENCO	ENCO (S) (D) (n)	Encodes The Uppermost Bit Location Which Is Set As 1 In 2^n Of S And Stores The Result In D In Numerical Value Data.
ENCOP	ENCOP (S) (D) (n)	Encodes The Uppermost Bit Location Which Is Set As 1 In 2^n Of S And Stores The Result In D In Numerical Value Data.

7 Segment

Instruction	Type of Input	Note
SEG	SEG (S) (D)	Decodes n Pieces Of Number From Start Bit In S As 7 Segment By The Set Format And Stores The Result In D.
SEGP	SEGP (S) (D)	Decodes n Pieces Of Number From Start Bit In S As 7 Segment By The Set Format And Stores The Result In D.

Union / Disunion

Instruction	Type of Input	Note
DIS	DIS (S) (D) (n)	Stores n(n=1 Means 4 Bits) Pieces Of Numerical Value Data From S In Lower Bit As Much As n From D Each.
DISP	DISP (S) (D) (n)	Stores n(n=1 Means 4 Bits) Pieces Of Numerical Value Data From S In Lower Bit As Much As n From D Each.

UNI	UNI (S) (D) (n)	Combines Each Lower 4 Bits Of n(n=1 Means 4 Bits) Pieces Of Data In S, And Stores the Result In Device D.
UNIP	UNIP (S) (D) (n)	Combines Each Lower 4 Bits Of n(n=1 Means 4 Bits) Pieces Of Data In S, And Stores the Result In Device D.

BIT

Instruction	Type of Input	Note
TEST	TEST (S1) (S2) (D)	Stores Bit Of The Assigned Order Among Data Bits In S1. If The Result Is 1, Sets. If 0, Resets.
TESTP	TESTP (S1) (S2) (D)	Stores Bit Of The Assigned Order Among Data Bits In S1. If The Result Is 1, Sets. If 0, Resets.
DTEST	DTEST (S1) (S2) (D)	Stores The Bit Of Order Assigned to S2 In Double-Word Data Bit Of S1 In D. If It Is 1, Sets. If 0, Resets.
DTESTP	DTESTP (S1) (S2) (D)	Stores The Bit Of Order Assigned to S2 In Double-Word Data Bit Of S1 In D. If It Is 1, Sets. If 0, Resets.
BSET	BSET (D) (n)	Sets nth Bit In Data Bits In Device D.
BSETP	BSETP (D) (n)	Sets nth Bit In Data Bits In Device D.
BRST	BRST (D) (n)	Resets nth Bit in Word Data Bits In Device D.
BRSTP	BRSTP (D) (n)	Resets nth Bit in Word Data Bits In Device D.
BITMOV	BITMOV (S) (D) (n)	Sends the data in the device assigned to S as much as n bits from the start device number in the device assigned to D.
BITMOVP	BITMOVP (S) (D) (n)	Sends the data in the device assigned to S as much as n bits from the start device number in the device assigned to D.
ANDBT	ANDBT (S1) (S2)	AND-Operates the bit of the order assigned to S2 in the word device data assigned to S1 and Contact A.
ANDBTI	ANDBTI (S1) (S2)	
LDBT	LDBT (S1) (S2)	LD-Operates the bit of the order assigned to S2 in the word device data assigned to S1 and Contact A.
LDBTI	LDBTI (S1) (S2)	
ORBT	ORBT (S1) (S2)	OR-Operates the bit of the order assigned to S2 in the word device data assigned to S1 and Contact A.
ORBTI	ORBTI (S1) (S2)	
SUM	SUM (S) (D)	Counts Number Of Bit Data Which Are Set As 1 In Data Of S And Stores The Number.
SUMP	SUMP (S) (D)	Counts Number Of Bit Data Which Are Set As 1 In Data Of S And Stores The Number.
DSUM	DSUM (S) (D)	Counts Number Of Bit Data Which Are Set As 1 In Double-Word Data Of S And Stores The Number.
DSUMP	DSUMP (S) (D)	Counts Number Of Bit Data Which Are Set As 1 In Double-Word Data Of S And Stores The Number.

TIME

Instruction	Type of Input	Note
DATE+	DATE+ (S1) (S2) (D)	Adds Hour, Minute And Second Data In S2 To Hour, Minute And Second Data In S1 Each Other, And Stores The Result In D In Due Order.
DATE+P	DATE+P (S1) (S2) (D)	Adds Hour, Minute And Second Data In S2 To Hour, Minute And Second Data In S1 Each Other, And Stores The Result In D In Due Order.
DATE-	DATE- (S1) (S2) (D)	Subtrats Hour, Minute And Second Data In S2 From Hour, Minute And Second Data In S1 Each Other, And Stores The Result In D In Due Order.
DATE-P	DATE-P (S1) (S2) (D)	Subtrats Hour, Minute And Second Data In S2 From Hour, Minute And Second Data In S1 Each Other, And Stores The Result In D In Due Order.
SECOND	SECOND (S) (D)	Converts Hour, Minute And Second Data In S To Second Data Each And Stores The Result In D.
SECONDP	SECONDP (S) (D)	Converts Hour, Minute And Second Data In S To Second Data Each And Stores The Result In D.
HOUR	HOUR (S) (D)	Converts Second Data In S To Hour, Minute And Second Data And Stores The Result In D In Due Order.
HOURP	HOURP (S) (D)	Converts Second Data In S To Hour, Minute And Second Data And Stores The Result In D In Due Order.
DATERD	DATERD (D)	Reads Year, Month, Day, Hour, Minute, Second And Day Of Week Data From CPU Clock Device And Stores Them In Device D In Due Order.
DATERDP	DATERDP (D)	Reads Year, Month, Day, Hour, Minute, Second And Day Of Week Data From CPU Clock Device And Stores Them In Device D In Due Order.
DATEWR	DATEWR (S)	Year, Month, Day, Hour, Minute, Second And Day Of Week Data In S Are Written In CPU Clock Device.
DATEWRP	DATEWRP (S)	Year, Month, Day, Hour, Minute, Second And Day Of Week Data In S Are Written In CPU Clock Device.

Timer

Instruction	Type of Input	Note
TON	TON (S) (t)	If Curren Value Is Increased And Reaches Set Value, Timer Contact Is Set.
TOFF	TOFF (S) (t)	When Input Condition Is Off, The Set Value Is Subtracted. If Current Value Reaches 0, Output Is Reset.
TMR	TMR (S) (t)	Though Current Value Is Increased And Input Is On-Off Reapeatly, If The Current Value Is Accumulated Whenever It Is On And Reaches Set Time, Timer Contact Is Set.
TMON	TMON (S) (t)	Though Output Is Set And Input Is Set-Reset Repeatly, If Current Value Is Subtracted Whenever It Is Set And Reaches 0, Timer Output Is Reset.
TRTG	TRTG (S) (t)	If Output Is Set And Current Value Is Subtracted To Reach 0, Output Is Reset. If Output Is Reset Before Current Value Is 0, Current Value Is Set Up As Set Value.

Counter

Instruction	Type of Input	Note
CTU	CTU (S) (t)	Adds One By One To Current Value Whenever Pulse Is Input. If Current Value Is Over Set Value, Sets Output And Counts Up To Maximum Of Counter.
CTD	CTD (S) (t)	Subtracts One By One From Set Value Whenever Rising Edge Is Input. If The Value Is 0, Sets Output.
CTUD	CTUD (S) (t)	Adds One By One Whenever Pulse Is Input To Up Terminal. Substracts One By One Whenever Pulse Is Input To Down Terminal. If Current Value Is Over Set Value, Sets Output.
CTR	CTR (S) (t)	Adds One By One Whenever Pulse Is Input. If The Value Reaches Set Value, Sets Output. If Input Signal Is On From Off, Current Value Is Increased From 0.

Read / Write

Instruction	Type of Input	Note
FROM	FROM (n1) (n2) (D) (n3)	Reads n3 Pieces Of Word Data In User Program Memory n2 Of Optional Card n1(SLot Number) And Stores The Result In D.
FROMP	FROMP (n1) (n2) (D) (n3)	Reads n3 Pieces Of Word Data In User Program Memory n2 Of Optional Card n1(SLot Number) And Stores The Result In D.
DFRO	DFRO (n1) (n2) (D) (n3)	Reads n3 Pieces Of Double-Word Data In User Program Memory n2 Of Optional Card n1(Slot Number) And Stores Them In Device D.
DFROP	DFROP (n1) (n2) (D) (n3)	Reads n3 Pieces Of Double-Word Data In User Program Memory n2 Of Optional Card n1(Slot Number) And Stores Them In Device D.
TO	TO (n1) (n2) (S) (n3)	Writes n3 Pieces Data In S To User Program Memory n2 Of Opetional Card n1(Slot Numer).
TOP	TOP (n1) (n2) (S) (n3)	Writes n3 Pieces Data In S To User Program Memory n2 Of Opetional Card n1(Slot Numer).
DTO	DTO (n1) (n2) (S) (n3)	Writes n3 Pieces Of Double-Word Data In S To User Program Memory n2 Of Optional Card n1(Slot Number).
DTOP	DTOP (n1) (n2) (S) (n3)	Writes n3 Pieces Of Double-Word Data In S To User Program Memory n2 Of Optional Card n1(Slot Number).
FREAD	FREAD (n1) (n2) (D) (n3) (n4)	Read n3 words of data from the address designated by n2 ofthe system memory of the special function module designated by n1. Then, stores the data in the area starting from the device designated by D. The result of instruction is stored to the device designated by n3.
FREADP	FREADP (n1) (n2) (D) (n3) (n4)	Read n3 words of data from the address designated by n2 ofthe system memory of the special function module designated by n1. Then, stores the data in the area starting from the device designated by D.

		The result of instruction is stored to the device designated by n3.
FWRITE	FWRITE (n1) (n2) (D) (n3) (n4)	Write n3 words of data from the device designated by D to the area starting from the address designated by n2 of the system memory of the special function module designated by n1.
FWRITEP	FWRITEP (n1) (n2) (D) (n3) (n4)	Write n3 words of data from the device designated by D to the area starting from the address designated by n2 of the system memory of the special function module designated by n1.

Communication

Instruction	Type of Input	Note
SND	SND (Slot)(S)(Size) (Result)	Transmits Data In Device Of Master Atation To Device Of Slave Station.
SNDP	SNDP (Slot)(S)(Size) (Result)	Transmits Data In Device Of Master Atation To Device Of Slave Station.
RCV	RCV (Slot)(D)(Size) (Result)	Reads And Brings Data In Slave Station To Device Of Master Station.
RCVP	RCVP (Slot)(D)(Size) (Result)	Reads Data In Slave Station To Device Of Master Station.

Communication (SPC Program)

Instruction	Type of Input	Note
RECV	RECV (PID) (F_Name) (Result)	Compares the data received from master station with the data (F_Name) set up by Special Function Program(PID), storing them in the assigned device.
RECVP	RECVP (PID) (F_Name) (Result)	Compares the data received from master station with the data (F_Name) set up by Special Function Program(PID), storing them in the assigned device.
SEND	SEND (PID) (F_Name) (Result)	Sends the data(F_Name) set up by Special Function Program (PID) from master station to the device of slave station.
SENDP	SENDP (PID) (F_Name) (Result)	Sends the data(F_Name) set up by Special Function Program (PID) from master station to the device of slave station.

Watch Dog Time

Instruction	Type of Input	Note
WDT	WDT	Resets Watch Dog Timer While Operating Program.
WDTP	WDTP	Resets Watch Dog Timer While Operating Program.

Carry

Instruction	Type of Input	Note
STC	STC	If Input Condition Is On, Sets Carry Flag.
CLC	CLC	If Input Condition Is ON, Resets Carry Flag.

Refresh

Instruction	Type of Input	Note
RFS	RFS (S) (n)	Refreshes n Pieces Of Device Which Are Assigned To S For One Scan.
RFSP	RFSP (S) (n)	Refreshes n Pieces Of Device Which Are Assigned To S For One Scan.

PID

Instruction	Type of Input	Note
PIDCAL	PIDCAL (S)	Assigns Device Where Result Value Of PID Operation IS Stored As S.
PIDINIT	PIDINIT (S)	Assigns Device Where The Set Value For PID Operation Is Stored As S.

Trigonometric (XP Series)

Instruction	Type of Input	Note
SIN	SIN (S) (D)	Calculates SIN (sine) value of angle designated at S and stores the operation result in the device number designated at D.
COS	COS (S) (D)	Performs COS (cosine) on angle designated by S and stores operation result at device number designated by D .
TAN	TAN (S) (D)	Performs tangent (TAN) operation on angle data designated by S , and stores operation result in device designated by D.
ASIN	ASIN (S) (D)	Calculates angle from sin value designated by S, and stores operation result at word device designated by D
ACOS	ACOS (S) (D)	Calculates angle from COS value designated by S, and stores operation result at word device designated by D
ATAN	ATAN (S) (D)	Calculates angle from tan value designated by S, and stores operation result at word device desig
BSIN	BSIN (S) (D)	Calculates the sin value of the designated value, and stores the

		sign of the operation result in the device at D, and the operation result in the device designated at D+1 and D+2.
BCOS	BCOS (S) (D)	Calculates the cos value of the designated value, and stores the sign of the operation result in the device at D, and the operation result in the device designated at D+1 and D+2.
BTAN	BTAN (S) (D)	Calculates TAN (tangent) value for value (angle) designated by S , and stores the sign for the operation result in the word device designated by D , and the operation result in the word device designated by D +1 and D +2.
BASIN	BASIN (S) (D)	Calculates angle from sin value designated by S, and stores operation result at word device designated by D
BACOS	BACOS (S) (D)	Calculates angle from COS value designated by S, and stores operation result at word device designated by D
BATAN	BATAN (S) (D)	Calculates angle from sin value designated by S, and stores operation result at word device designated by D

Exponent, Logarithm (XP Series)

Instruction	Type of Input	Note
SQR	SQR (S) (D)	Calculates square root of value designated at S , and stores the operation result in the device number designated at D .
EXP	EXP (S) (D)	Calculates exponent for value designated by S, and stores the result of the operation at the device designate by D
LOG	LOG (S) (D)	Calculates natural logarithm of value designated by S taking e as base, and stores operation results at device designated by D.
BSQR	BSQR (S) (D)	Store appointed data to area that is specified by D after square root arithmetic by S.
BDSQR	BDSQR (S) (D)	Store appointed data to area that is specified by D after square root arithmetic by S.

User Clock

Instruction	Type of Input	Note
DUTY	DUTY (n1) (n2) (D)	Turns scan designated by n1 ON for user timing block designated by D, and scan designated by n2 OFF.

Table

Instruction	Type of Input	Note
FPOP	FPOP (DEV) (TBL)	Find Last Data In Table
FINS	FINS (DEV) (TBL) (n)	Insert a Data In Table
FDEL	FDEL (DEV) (TBL) (n)	Delete a Data From Table
FIFR	FIFR (DEV) (TBL)	Read the oldest data from [TBL+1] and stores it at the device designated by [DEV].

		After the execution of FIFR, the data in the table moves to the previous device and the last data will be zero. The number of data of the data table will be decreased.
FIFRP	FIFRP (DEV) (TBL)	Read the oldest data from [TBL+1] and stores it at the device designated by [DEV]. After the execution of FIFR, the data in the table moves to the previous device and the last data will be zero. The number of data of the data table will be decreased.
FIFW	FIFW (DEV) (TBL)	Stores the 16 bit data designated by [DEV] at the end of the data table designated by [TBL]. The number of data blocks stored at [TBL] will be increased.
FIFWP	FIFWP (DEV) (TBL)	Stores the 16 bit data designated by [DEV] at the end of the data table designated by [TBL]. The number of data blocks stored at [TBL] will be increased.

Redundant System

Instruction	Type of Input	Note
ATVP	ATVP	Swap Active Status in Redundant System

Scan program Enable / Disable

Instruction	Type of Input	Note
EPGM	EPGM (n)	Permit driving of scan program that correspond to ID that is established by n. Change relevant scan program to Enable status in Disable status by DPGM command. if Disable Program command is not inputed at Mode conversion, it is all Enable PBT states
DPGM	DPGM (n)	Permit driving of scan program that correspond to ID that is established by n. Change relevant scan program to Enable status in Disable status by DPGM command. if Disable Program command is not inputed at Mode conversion, it is all Enable PBT states

Occur random number

Instruction	Type of Input	Note
RND	RND (D)	Generates random number of from 0 to 32767, and stores at device designated by D
SRND	SRND (D)	Updates random number series according to the 16-bit BIN data being stored in device designated by S.

Scale

Instruction	Type of Input	Note
SCL	SCL (S) (D) (P) (n)	Converts signed binary data into signed binary data according to Scale parameter table .
SCLP	SCLP (S) (D) (P) (n)	Converts signed binary data into signed binary data according to Scale parameter table .

Position (CP, XP)

Instruction	Type of Input	Note
ABRST1	ABRST1 (Base/Slot) (S) (D)	
ABRST2	ABRST2 (Base/Slot) (S) (D)	
ABRST3	ABRST3 (Base/Slot) (S) (D)	
ABRST4	ABRST4 (Base/Slot) (S) (D)	
PSTRT1	PSTRT1 (Base/Slot) (S) (D)	
PSTRT2	PSTRT2 (Base/Slot) (S) (D)	
PSTRT3	PSTRT3 (Base/Slot) (S) (D)	
PSTRT4	PSTRT4 (Base/Slot) (S) (D)	
TEACH1	TEACH1 (Base/Slot) (S) (D)	
TEACH2	TEACH2 (Base/Slot) (S) (D)	
TEACH3	TEACH3 (Base/Slot) (S) (D)	
TEACH4	TEACH4 (Base/Slot) (S) (D)	
PFWRT	PFWRT (Base/Slot) (S) (D)	
PINT	PINT (Base/Slot) (S) (D)	

etc

Instruction	Type of Input	Note
;	; (notes)	Shows Description.
DESCI	DESCI (notes)	Shows Description.
NOP	NOP	As No Operation Instruction, Does Not Influence Operation Result Of The Corresponding Circuit.

5.3 Instruction List - Alphabetic

Instruction	Type of Input	Note
;	; (notes)	Shows Description.
ACOS		Calculates angle from COS value designated by S, and stores operation result at word device designated by D
ACOSP		Calculates angle from COS value designated by S, and stores operation result at word device designated by D
ADD	ADD (S1) (S2) (D)	Adds Data S1 To Data S2, And Stores The Result In Device D.
ADDP	ADDP (S1) (S2) (D)	Adds Data S1 To Data S2, And Stores The Result In Device D.
ANB	ANB	AND-Operates Blocks And Takes The Result As Operation Result.
AND	AND (S)	AND-Operates Contact a Of The Assigned Contact And Connected Contants In Series, And Takes The Result As Operation Result.
AND<	AND< (S1) (S2)	If Data S1 Is Less Than Data S2, ON. If Greater Than Or Equal To, OFF. AND-Operates The Result And Result Of The Current Operation.
AND<=	AND<= (S1) (S2)	If Data S1 Is Less Than Or Equal To Data S2, ON. If Greater Than, OFF. AND-Operates The Result And Result Of The Current Operation.
AND<>	AND<> (S1) (S2)	If Data S1 And Data S2 Are Not Equal, ON. If Equal, OFF. AND-Operates The Result And Result Of The Current Operation.
AND=	AND= (S1) (S2)	If Data S1 And Data S2 Are Equal, ON. If TNot Equal, OFF. AND-Operates The Result And Result Of The Current Operation.
AND>	AND> (S1) (S2)	If Data S1 Is Greater Than Data S2, ON. If Less Than Or Equal To, OFF. AND-Operates The Result And Result Of The Current Operation.
AND>=	AND>= (S1) (S2)	If Data S1 Is Greater Than Or Equal To Data S2, ON. If Less Than, OFF. AND-Operates The Result And Result Of The Current Operation.
ANDBT	ANDBT (S1) (S2)	AND-Operates the bit of the order assigned to S2 in the word device data assigned to S1 and Contact A.
ANDD<	ANDD< (S1) (S2)	If Double-Word Data S1 Is Less Than Double-Word Data S2, ON. If Greater Than Or Equal To, OFF. AND-Operates The Result And Result Of The Current Operation.
ANDD<=	ANDD<= (S1) (S2)	ANDD<= (S1) (S2)" , "If Double-Word Data S1 Is Less Than Or Equal To Double-Word Data S2, On. If Greater Than, OFF. AND-Operates The Result And Result Of The Current Operation.
ANDD<>	ANDD<> (S1) (S2)	ANDD<> (S1) (S2)" , "If Double-Word Data S1 Is Not Equal To Double-Word Data S2, ON. If Equal To, OFF. AND-Operates The Result And Result Of The Current Operation.
ANDD=	ANDD= (S1) (S2)	ANDD= (S1) (S2)" , "If Double-Word Data S1 Is Equal To Double- Word Data S2, ON. If Not Equal to, OFF.AND-Operates The Result And Result Of The Current Operation.

ANDD>	ANDD> (S1) (S2)	ANDD> (S1) (S2)" , "If Double-Word Data S1 Is Greater Than Double-Word Data S2, ON. If Less Than, OFF. AND-Operates The Result And Result Of The Current Operation.
ANDD>=	ANDD>= (S1) (S2)	ANDD>= (S1) (S2)" , "If Double-Word Data S1 Is Greater Than Or Equal To Double-Word Data S2, ON. If Less Than, OFF. AND-Operates The Result And Result Of The Current Operation.
ANDE<	ANDE< (S1) (S2)	f Float Data S1 Is Less Than float Data S2, ON. If Greater Than Or Equal To, OFF. AND-Operates The Result And Result Of The Current Operation.
ANDE<=	ANDE<= (S1) (S2)	If Float Data S1 Is Less Than Or Equal To Float Data S2, On. If Greater Than, OFF. AND-Operates The Result And Result Of The Current Operation.
ANDE<>	ANDE<> (S1) (S2)	If Float Data S1 Is Not Equal To Float Data S2, ON. If Equal To, OFF. AND-Operates The Result And Result Of The Current Operation.
ANDE=	ANDE= (S1) (S2)	If Float Data S1 Is Equal To Float Data S2, ON. If Not Equal to, OFF. AND-Operates The Result And Result Of The Current Operation.
ANDE>	ANDE> (S1) (S2)	If Float Data S1 Is Greater Than Float Data S2, ON. If Less Than, OFF. AND-Operates The Result And Result Of The Current Operation.
ANDE>=	ANDE>= (S1) (S2)	If Float Data S1 Is Greater Than Or Equal To Float Data S2, ON. If Less Than, OFF. AND-Operates The Result And Result Of The Current Operation
ANDF	ANDF (S)	If Input Condition To Contact To Detect Connection In Series Is Off From On, Device S Is Set For One Scan.
ANDI	ANDI (S)	AND-Operates Contact b Of The assigned Contact And The Connected Contact In Series, Takes The Result As Operation Result.
ANDP	ANDP (S)	If Input Condition To Contact To Detect Connection In Series Is On From Off, Device S Is Set For One Scan.
ASIN	ASIN (S) (D)	Calculates angle from sin value designated by S, and stores operation result at word device designated by D
ASINP	ASIN (S) (D)	Calculates angle from sin value designated by S, and stores operation result at word device designated by D
ATAN	ATAN (S) (D)	Calculates angle from tan value designated by S, and stores operation result at word device designated by D
ATANP	ATAN (S) (D)	Calculates angle from tan value designated by S, and stores operation result at word device designated by D
ATVP	ATVP	Swap Active Status in Redundant System
BACOS	BACOS (S) (D)	Calculates angle from COS value designated by S, and stores operation result at word device designated by D
BACOSP	BACOSP (S) (D)	Calculates angle from COS value designated by S, and stores operation result at word device designated by D
BADD	BADD (S1) (S2) (D)	Adds 4 Digits BCD Data In S1 To 4 Digits BCD Data In S2, And Stores The Result In Device D.

BADDP	BADDP (S1) (S2) (D)	Adds 4 Digits BCD Data In S1 To 4 Digits BCD Data In S2, And Stores The Result In Device D.
BASIN	BASIN (S) (D)	Calculates angle from sin value designated by S, and stores operation result at word device designated by D
BASINP	BASINP (S) (D)	Calculates angle from sin value designated by S, and stores operation result at word device designated by D
BATAN	BATAN (S) (D)	Calculates angle from sin value designated by S, and stores operation result at word device designated by D
BATANP	BATANP (S) (D)	Calculates angle from sin value designated by S, and stores operation result at word device designated by D
BCD	BCD (S) (D)	Converts BIN Data Value In S To BCD Data And Stores The Result In Device D.
BCDDA	BCDDA (S) (D)	Converts 4 Digits BCD Data In S To Decimal ASCII Code And Stores The Result In Device D.
BCDDAP	BCDDAP (S) (D)	Converts 4 Digits BCD Data In S To Decimal ASCII Code And Stores The Result In Device D.
BCDP	BCDP (S) (D)	Converts BIN Data Value In S To BCD Data And Stores The Result In Device D.
BCOS	BCOS (S) (D)	Calculates the cos value of the designated value, and stores the sign of the operation result in the device at D, and the operation result in the device designated at D+1 and D+2.
BCOSP	BCOS (S) (D)	Calculates the cos value of the designated value, and stores the sign of the operation result in the device at D, and the operation result in the device designated at D+1 and D+2.
BDIV	BDIV (S1) (S2) (D)	Divides 4 Digits BCD Data In S1 By 4 Digits BCD Data In S2 And Stores The Result In Device D.
BDIVP	BDIVP (S1) (S2) (D)	Divides 4 Digits BCD Data In S1 By 4 Digits BCD Data In S2 And Stores The Result In Device D.
BDSQR		Store appointed data in area that is specified by D after square root arithmetic by S.
BDSQRP		Store appointed data in area that is specified by D after square root arithmetic by S.
BIN	BIN (S) (D)	Converts 4 Digits BCD Data Value In S To BIN Data And Stores The Result In Device D.
BINDA	BINDA (S) (D)	Converts BIN Data In S To Decimal ASCII Code And Stores The Result In Device D.
BINDAP	BINDAP (S) (D)	Converts BIN Data In S To Decimal ASCII Code And Stores The Result In Device D.
BINHA	BINHA (S) (D)	Converts BIN Data In S To Hexadecimal ASCII Code And Stores The Result In Device D.
BINHAP	BINHAP (S) (D)	Converts BIN Data In S To Hexadecimal ASCII Code And Stores The

		Result In Device D.
BINP	BINP (S) (D)	Converts 4 Digits BCD Data Value In S To BIN Data And Stores The Result In Device D.
BITMOV	BITMOV (S) (D) (n)	Sends the data in the device assigned to S as much as n bits from the start device number in the device assigned to D.
BITMOVP	BITMOVP (S) (D) (n)	Sends the data in the device assigned to S as much as n bits from the start device number in the device assigned to D.
BKAND	BKAND (S1) (S2) (D) (n)	AND-Operates n Pieces Of Data In Device S1 And n Pieces OF Data In Device S2, And Stores The Result In Device D.
BKANDP	BKANDP (S1) (S2) (D) (n)	AND-Operates n Pieces Of Data In Device S1 And n Pieces OF Data In Device S2, And Stores The Result In Device D.
BK=	BK= (S1) (S2) (D) (B) (n)	Compare [n] of 16 bit data from the device designated by [S1] with [n] of 16 bit data from the device designated by [S2] and stores the results from bit [n] of the device designated by [D]. Compare 16 bit data with [n] of 16 bit data from the device designated by [S2] and stores the results from bit [n] of the device designated by [D].
BK=P	BK=P (S1) (S2) (D) (B) (n)	Compare [n] of 16 bit data from the device designated by [S1] with [n] of 16 bit data from the device designated by [S2] and stores the results from bit [n] of the device designated by [D]. Compare 16 bit data with [n] of 16 bit data from the device designated by [S2] and stores the results from bit [n] of the device designated by [D].
BK<>	BK<> (S1) (S2) (D) (B) (n)	Compare [n] of 16 bit data from the device designated by [S1] with [n] of 16 bit data from the device designated by [S2] and stores the results from bit [n] of the device designated by [D]. Compare 16 bit data with [n] of 16 bit data from the device designated by [S2] and stores the results from bit [n] of the device designated by [D].
BK<>P	BK<>P (S1) (S2) (D) (B) (n)	Compare [n] of 16 bit data from the device designated by [S1] with [n] of 16 bit data from the device designated by [S2] and stores the results from bit [n] of the device designated by [D]. Compare 16 bit data with [n] of 16 bit data from the device designated by [S2] and stores the results from bit [n] of the device designated by [D].
BK<	BK< (S1) (S2) (D) (B) (n)	Compare [n] of 16 bit data from the device designated by [S1] with [n] of 16 bit data from the device designated by [S2] and stores the results from bit [n] of the device designated by [D]. Compare 16 bit data with [n] of 16 bit data from the device designated by [S2] and stores the results from bit [n] of the device designated by [D].
BK<P	BK<P (S1) (S2) (D) (B) (n)	Compare [n] of 16 bit data from the device designated by [S1] with [n] of 16 bit data from the device designated by [S2] and stores the results from bit [n] of the device designated by [D]. Compare 16 bit data with [n] of 16 bit data from the device designated by [S2] and stores the results from bit [n] of the device designated by [D].

BK<=	BK<= (S1) (S2) (D) (B) (n)	Compare [n] of 16 bit data from the device designated by [S1] with [n] of 16 bit data from the device designated by [S2] and stores the results from bit [n] of the device designated by [D]. Compare 16 bit data with [n] of 16 bit data from the device designated by [S2] and stores the results from bit [n] of the device designated by [D].
BK<=P	BK<=P (S1) (S2) (D) (B) (n)	Compare [n] of 16 bit data from the device designated by [S1] with [n] of 16 bit data from the device designated by [S2] and stores the results from bit [n] of the device designated by [D]. Compare 16 bit data with [n] of 16 bit data from the device designated by [S2] and stores the results from bit [n] of the device designated by [D].
BK>	BK> (S1) (S2) (D) (B) (n)	Compare [n] of 16 bit data from the device designated by [S1] with [n] of 16 bit data from the device designated by [S2] and stores the results from bit [n] of the device designated by [D]. Compare 16 bit data with [n] of 16 bit data from the device designated by [S2] and stores the results from bit [n] of the device designated by [D].
BK>P	BK>P (S1) (S2) (D) (B) (n)	Compare [n] of 16 bit data from the device designated by [S1] with [n] of 16 bit data from the device designated by [S2] and stores the results from bit [n] of the device designated by [D]. Compare 16 bit data with [n] of 16 bit data from the device designated by [S2] and stores the results from bit [n] of the device designated by [D].
BK>=	BK>= (S1) (S2) (D) (B) (n)	Compare [n] of 16 bit data from the device designated by [S1] with [n] of 16 bit data from the device designated by [S2] and stores the results from bit [n] of the device designated by [D]. Compare 16 bit data with [n] of 16 bit data from the device designated by [S2] and stores the results from bit [n] of the device designated by [D].
BK>=P	BK>=P (S1) (S2) (D) (B) (n)	Compare [n] of 16 bit data from the device designated by [S1] with [n] of 16 bit data from the device designated by [S2] and stores the results from bit [n] of the device designated by [D]. Compare 16 bit data with [n] of 16 bit data from the device designated by [S2] and stores the results from bit [n] of the device designated by [D].
BKOR	BKOR (S1) (S2) (D) (n)	OR-Operates n Pieces Of Data In S1 And n Pieces Of Data In S2, And Stores The Result In Device D.
BKORP	BKORP (S1) (S2) (D) (n)	OR-Operates n Pieces Of Data In S1 And n Pieces Of Data In S2, And Stores The Result In Device D.
BKXNR	BKXNR (S1) (S2) (D) (n)	Exclusive - NOR-Operates n Pieces Of Data In S1 And n Pieces Of Data In S2, And Stores The Result In Device D.
BKXNRP	BKXNRP (S1) (S2) (D) (n)	Exclusive - NOR-Operates n Pieces Of Data In S1 And n Pieces Of Data In S2, And Stores The Result In Device D.
BKXOR	BKXOR (S1) (S2) (D) (n)	Exclusive - OR-Operates n Pieces Of Data In S1 And n Pieces Of Data In S2, And Stores The Result In Device D.
BKXORP	BKXORP (S1) (S2) (D) (n)	Exclusive - OR-Operates n Pieces Of Data In S1 And n Pieces Of Data In S2, And Stores The Result In Device D.

BMOV	BMOV (S) (D) (n)	Transmits n Pieces Of Data In S To Device D.
BMOVP	BMOVP (S) (D) (n)	Transmits n Pieces Of Data In S To Device D.
BMUL	BMUL (S1) (S2) (D)	Mutiplies 4 Digits BCD Data In S1 By 4 Digits BCD Data In S2.
BMULP	BMULP (S1) (S2) (D)	Mutiplies 4 Digits BCD Data In S1 By 4 Digits BCD Data In S2.
BREAK	BREAK	Comes Out From The FOR ~ NEXT Instruction.
BREAKP	BREAKP	Comes Out From The FOR ~ NEXT Instruction.
BRST	BRST (D) (n)	Resets nth Bit in Word Data Bits In Device D.
BRSTP	BRSTP (D) (n)	Resets nth Bit in Word Data Bits In Device D.
BSET	BSET (D) (n)	Sets nth Bit In Data Bits In Device D.
BSETP	BSETP (D) (n)	Sets nth Bit In Data Bits In Device D.
BSFL	BSFL (D) (n)	n Pieces Of Data Are Shifted Left From Data In Device D And The Shifted Lowest Data Is Filled With 0.
BSFLP	BSFLP (D) (n)	n Pieces Of Data Are Shifted Left From Data In Device D And The Shifted Lowest Data Is Filled With 0.
BSFR	BSFR (D) (n)	n Pieces Of Data Are Shifted Right From Data In Device D And The Shifted Uppermost Data Is Filled With 0.
BSFRP	BSFRP (D) (n)	n Pieces Of Data Are Shifted Right From Data In Device D And The Shifted Uppermost Data Is Filled With 0.
BSIN	BSIN (S) (D)	Calculates the sin value of the designated value, and stores the sign of the operation result in the device at D, and the operation result in the device designated at D+1 and D+2
BSINP	BSINP (S) (D)	Calculates the sin value of the designated value, and stores the sign of the operation result in the device at D, and the operation result in the device designated at D+1 and D+2
BSQR	BSQR (S) (D)	Store appointed data to area that is specified by D after square root arithmetic by S.
BSQRP	BSQRP (S) (D)	Store appointed data to area that is specified by D after square root arithmetic by S.
BSUB	BSUB (S1) (S2) (D)	Subtracts 4 Digits BCD Data In S2 From 4 Digits BCD Data In S1 And Stores The Result In Device D.
BSUBP	BSUBP (S1) (S2) (D)	Subtracts 4 Digits BCD Data In S2 From 4 Digits BCD Data In S1 And Stores The Result In Device D.
BTAN	BTAN (S) (D)	Calculates TAN (tangent) value for value (angle) designated by S , and stores the sign for the operation result in the word device designated by D , and the operation result in the word device designated by D +1 and D +2
BTANP	BTANP (S) (D)	Calculates TAN (tangent) value for value (angle) designated by S , and stores the sign for the operation result in the word device designated by D , and the operation result in the word device designated by D +1 and D +2
BXCH	BXCH (D1) (D2) (n)	Exchanges n Pieces Of Data In Device S And n Pieces Of Data In Device D Each Other.
BXCHP	BXCHP (D1) (D2) (n)	Exchanges n Pieces Of Data In Device S And n Pieces Of Data In Device

		D Each Other.
CALL	CALL (n)	If Input Condition Is ON While Processing Program, Processes The Program Between The SBRT n To The RET According To The CALL n.
CALLP	CALLP (n)	If Input Condition Is ON While Processing Program, Processes The Program Between The SBRT n To The RET According To The CALL n.
CEND	CEND	If input condition is turned on, ends main routine program.
CENDP	CENDP	If input condition is turned on, ends main routine program.
CLC	CLC	If Input Condition Is ON, Resets Carry Flag.
CML	CML (S) (D)	Inverts Each Bit Of Data In Device S And Stores The Result In Device D.
CMLP	CMLP (S) (D)	Inverts Each Bit Of Data In Device S And Stores The Result In Device D.
COS	COS (S) (D)	Performs COS (cosine) on angle designated by S and stores operation result at device number designated by D
COSP	COSP (S) (D)	Performs COS (cosine) on angle designated by S and stores operation result at device number designated by D
CTD	CTD (S) (t)	Subtracts One By One From Set Value Whenever Rising Edge Is Input. If The Value Is 0, Sets Output.
CTR	CTR (S) (t)	Adds One By One Whenever Pulse Is Input. If The Value Reaches Set Value, Sets Output. If Input Signal Is On From Off, Current Value Is Increased From 0.
CTU	CTU (S) (t)	Adds One By One To Current Value Whenever Pulse Is Input. If Current Value Is Over Set Value, Sets Output And Counts Up To Maximum Of Counter.
CTUD	CTUD (S) (t)	Adds One By One Whenever Pulse Is Input To Up Terminal. Substracts One By One Whenever Pulse Is Input To Down Terminal. If Current Value Is Over Set Value, Sets Output.
DABIN	DABIN (S) (D)	Converts Decimal ASCII Code In Device S To 16bit BIN Data And Stores The Result In Device D.
DABINP	DABINP (S) (D)	Converts Decimal ASCII Code In Device S To 16bit BIN Data And Stores The Result In D.
DADD	DADD (S1) (S2) (D)	Adds Double- Word Data In S2 To Double-Word Data In S1 And Stores The Result In Device D.
DADDP	DADDP (S1) (S2) (D)	Adds Double- Word Data In S2 To Double-Word Data In S1 And Stores The Result In Device D.
DAND	DAND (S1) (S2) (D)	AND-Operates Data In Device S1 And Data In Device S2, And Stores The Result In Device D.
DANDP	DANDP (S1) (S2) (D)	AND-Operates Data In Device S1 And Data In Device S2, And Stores The Result In Device D.
DATE-	DATE- (S1) (S2) (D)	Subtrats Hour, Minute And Second Data In S2 From Hour, Minute And Second Data In S1 Each Other, And Stores The Result In D In Due Order.
DATE+	DATE+ (S1) (S2) (D)	Adds Hour, Minute And Second Data In S2 To Hour, Minute And Second Data In S1 Each Other, And Stores The Result In D In Due Order.

DATE+P	DATE+P (S1) (S2) (D)	Adds Hour, Minute And Second Data In S2 To Hour, Minute And Second Data In S1 Each Other, And Stores The Result In D In Due Order.
DATE-P	DATE-P (S1) (S2) (D)	Subtrats Hour, Minute And Second Data In S2 From Hour, Minute And Second Data In S1 Each Other, And Stores The Result In D In Due Order.
DATERD	DATERD (D)	Reads Year, Month, Day, Hour, Minute, Second And Day Of Week Data From CPU Clock Device And Stores Them In Device D In Due Order.
DATERDP	DATERDP (D)	Reads Year, Month, Day, Hour, Minute, Second And Day Of Week Data From CPU Clock Device And Stores Them In Device D In Due Order.
DATEWR	DATEWR (S)	Year, Month, Day, Hour, Minute, Second And Day Of Week Data In S Are Written In CPU Clock Device.
DATEWRP	DATEWRP (S)	Year, Month, Day, Hour, Minute, Second And Day Of Week Data In S Are Written In CPU Clock Device.
DBADD	DBADD (S1) (S2) (D)	Adds 4 Digits BCD Double-Word Data In S2 To 4 Digits BCD Double-Word Data In S1 And Stores The Result In Device D.
DBADDP	DBADDP (S1) (S2) (D)	Adds 4 Digits BCD Double-Word Data In S2 To 4 Digits BCD Double-Word Data In S1 And Stores The Result In Device D.
DBCD	DBCD (S) (D)	Converts BIN DOuble-Word Data Value In S To BCD Double-Word Data And Stores The Result In Device D.
DBCDDA	DBCDDA (S) (D)	Converts 8 Digits BCD Data In S To Decimal ASCII Code And Stores The Result In Device D.
DBCDDAP	DBCDDAP (S) (D)	Converts 8 Digits BCD Data In S To Decimal ASCII Code And Stores The Result In Device D.
DBCDP	DBCDP (S) (D)	Converts Double-Word BIN Data Value In S To BCD Data And Stores The result In Device D.
DBDIV	DBDIV (S1) (S2) (D)	Divides 8 Digits BCD Data In S1 By 8 Digits BCD Data And Stores The Result In Device D.
DBDIVP	DBDIVP (S1) (S2) (D)	Divides 8 Digits BCD Data In S1 By 8 Digits BCD Data And Stores The Result In Device D.
DBIN	DBIN (S) (D)	Converts 8 Digits BCD Data Value In S To BIN Data And Stores The Result In Device D.
DBINDA	DBINDA (S) (D)	Converts BIN Data In S To Decimal ASCII Code And Stores The Result In Device D.
DBINDAP	DBINDAP (S) (D)	Converts BIN Data In S To Decimal ASCII Code And Stores The Result In Device D.
DBINHA	DBINHA (S) (D)	Converts BIN Data In S To Hexadecimal ASCII Code And Stores The Result In D.
DBINHAP	DBINHAP (S) (D)	Converts BIN Data In S To Hexadecimal ASCII Code And Stores The Result In D.
DBINP	DBINP (S) (D)	Converts 8 Digits BCD Data In S To BIN Data And Stores The Result In Device D.
DBMUL	DBMUL (S1) (S2) (D)	Multiplies 8 Digits BCD Data In S1 By 8 Digits BCD Data In S2.

DBMULP	DBMULP (S1) (S2) (D)	Multiplies 8 Digits BCD Data In S1 By 8 Digits BCD Data In S2.
DBSUB	DBSUB (S1) (S2) (D)	Subtracts 8 Digits BCD Data In S2 From 8 Digits BCD Data In S1.
DBSUBP	DBSUBP (S1) (S2) (D)	Subtracts 8 Digits BCD Data In S2 From 8 Digits BCD Data In S1.
DCML	DCML (S) (D)	Inverts Each Bit Of Double-Word Data In S And Stores The Result In Device D.
DCMLP	DCMLP (S) (D)	Inverts Each Bit Of Double-Word Data In S And Stores The Result In Device D.
DDABIN	DDABIN (S) (D)	Converts Decimal ASCII Code In S To 32 Bit BIN Data And Stores The Result In Device D.
DDABINP	DDABINP (S) (D)	Converts Decimal ASCII Code In S To 32 Bit BIN Data And Stores The Result In Device D.
DDEC	DDEC (D)	Subtracts 1 From Double-Word Data Value In D And Stores The Result In Device D Again.
DDECP	DDECP (D)	Subtracts 1 From Double-Word Data Value In D And Stores The Result In Device D Again.
DEG	DEG (S) (D)	Converts Unit of angle size from radian units designated by S to angles, and stores result at device number designated by D.
DEGP	DEGP (S) (D)	Converts Unit of angle size from radian units designated by S to angles, and stores result at device number designated by D.
DDIV	DDIV (S1) (S2) (D)	Divides Double-Word Data In S1 By Double-Word Data In S2 And Stores The Result In Device D.
DDIVP	DDIVP (S1) (S2) (D)	Divides Double-Word Data In S1 By Double-Word Data In S2 And Stores The Result In Device D.
DEC	DEC (D)	Subtracts 1 From Data Value In D And Stores The Result In Device D Again.
DECO	DECO (S) (D) (n)	Decodes Lower n Bits In S And Sets The Contact Corresponding To Result Of Device D.
DECOP	DECOP (S) (D) (n)	Decodes Lower n Bits In S And Sets The Contact Corresponding To Result Of Device D.
DECP	DECP (D)	Subtracts 1 From Data Value In D And Stores The Result In Device D Again.
DFLT	DFLT (S) (D)	Converts 16-bit BIN data designated by S to floating decimal point real number, and stores at device number designated by D
DFLTP	DFLTP (S) (D)	Converts 16-bit BIN data designated by S to floating decimal point real number, and stores at device number designated by D
DFRO	DFRO (n1) (n2) (D) (n3)	Reads n3 Pieces Of Double-Word Data In User Program Memory n2 Of Optional Card n1(Slot Number) And Stores Them In Device D.
DFROP	DFROP (n1) (n2) (D) (n3)	Reads n3 Pieces Of Double-Word Data In User Program Memory n2 Of Optional Card n1(Slot Number) And Stores Them In Device D.
DGBIN	DGBIN (S) (D)	Converts Gray code data at device designated by S to BIN 32-bit data and

		stores at device designated by D.
DGBINP	DGBINP (S) (D)	Converts Gray code data at device designated by S to BIN 32-bit data and stores at device designated by D.
DGRY	DGRY (S) (D)	Converts BIN data at the device designated by S to Gray code, and stores result at device designated by D
DGRYP	DGRYP (S) (D)	Converts BIN data at the device designated by S to Gray code, and stores result at device designated by D
DHABIN	DHABIN (S) (D)	Converts Hexadecimal ASCII Code In S To 32 BIt BIN Data And Stores The Result In Device D.
DHABINP	DHABINP (S) (D)	Converts Hexadecimal ASCII Code In S To 32 BIt BIN Data And Stores The Result In Device D.
DI	DI (n)	Stops Operating Time Driven Interrupt Assigned To n.
DINC	DINC (D)	Adds 1 To Double-Word Data Value In D And Stores The Result In D Again.
DINCP	DINCP (D)	Adds 1 To Double-Word Data Value In D And Stores The Result In D Again.
DINT	DINT (S) (D)	Converts floating decimal point type real number designated by S to BIN 32-bit data, and stores the result at the device number designated by D and D+1.
DINTP	DINTP (S) (D)	Converts floating decimal point type real number designated by S to BIN 32-bit data, and stores the result at the device number designated by D and D+1.
DIS	DIS (S) (D) (n)	Stores n(n=1 Means 4 Bits) Pieces Of Numerical Value Data From S In Lower Bit As Much As n From D Each.
DISP	DISP (S) (D) (n)	Stores n(n=1 Means 4 Bits) Pieces Of Numerical Value Data From S In Lower Bit As Much As n From D Each.
DIV	DIV (S1) (S2) (D)	Divides Data In S1 By Data In S2 And Stores The Resutl In Device D.
DIVP	DIVP (S1) (S2) (D)	Divides Data In S1 By Data In S2 And Stores The Resutl In Device D.
DMAX	DMAX (S) (D) (n)	Stores The Biggest Value Among n Pieces Of Data From Double-Word Data Of S, Its Location And Number Of The Values In D.
DMAXP	DMAXP (S) (D) (n)	Stores The Biggest Value Among n Pieces Of Data From Double-Word Data Of S, Its Location And Number Of The Values In D.
DMIN	DMIN (S) (D) (n)	Stores The Smallest Value Among n Pieces Of Data From Double-Word Data Of S, Its Location And Number Of The Values In D.
DMINP	DMINP (S) (D) (n)	Stores The Smallest Value Among n Pieces Of Data From Double-Word Data Of S, Its Location And Number Of The Values In D.
DMOV	DMOV (S) (D)	Transmits Double-Word Data In Device S To Device D.
DMOVP	DMOVP (S) (D)	Transmits Double-Word Data In Device S To Device D.
DMUL	DMUL (S1) (S2) (D)	Multiplies Double-Word Data In S1 By Double-Word Data In S2 And Stores The Result In D.
DMULP	DMULP (S1) (S2) (D)	Multiplies Double-Word Data In S1 By Double-Word Data In S2 And Stores

		The Result In D.
DNEG	DNEG (D)	Sign-Inverts Contents Of Double-Word Data In D And Stores The Result In D Again.
DNEGP	DNEGP (D)	Sign-Inverts Contents Of Double-Word Data In D And Stores The Result In D Again.
DOR	DOR (S1) (S2) (D)	OR-Operates Data In S1 And 32 Bit Data In S2, And Stores The Result In D.
DORP	DORP (S1) (S2) (D)	OR-Operates Data In S1 And 32 Bit Data In S2, And Stores The Result In D.
DPGM	DPGM (n)	Disable program.
DRCL	DRCL (D) (n)	Shifts Left 32 Bits In D As Much As n Bits. Shifts The Uppermost Bit To Carry Flag And Carry Flag To The Lowest Bit.
DRCLP	DRCLP (D) (n)	Shifts Left 32 Bits In D As Much As n Bits. Shifts The Uppermost Bit To Carry Flag And Carry Flag To The Lowest Bit.
DRCR	DRCR (D) (n)	Shifts Right 32 Bits In D As Much As n Bits. Shifts The Lowest Bit To The Uppermost Bit And Carry Flag.
DRCRP	DRCRP (D) (n)	Shifts Right 32 Bits In D As Much As n Bits. Shifts The Lowest Bit To The Uppermost Bit And Carry Flag.
DROL	DROL (D) (n)	Shifts Left 32 Bits In D As Much As n Bits. Shifts The Uppermost Bit To The Lowest Bit And Carry Flag.
DROLP	DROLP (D) (n)	Shifts Left 32 Bits In D As Much As n Bits. Shifts The Uppermost Bit To The Lowest Bit And Carry Flag.
DROR	DROR (D) (n)	Shifts Right 32 Bits In D As Much As n Bits. Shifts The Lowest Bit To Carry Flag And Carry Flag To The Uppermost Bit.
DRORP	DRORP (D) (n)	Shifts Right 32 Bits In D As Much As n Bits. Shifts The Lowest Bit To Carry Flag And Carry Flag To The Uppermost Bit.
DSFL	DSFL (D) (n)	Shifts Left Double-Word Data Bits In D As Much As n Bits. Fills Lower n Bits With 0 And Stores Them In D.
DSFLP	DSFLP (D) (n)	Shifts Left Double-Word Data Bits In D As Much As n Bits. Fills Lower n Bits With 0 And Stores Them In D.
DSFR	DSFR (D) (n)	Shifts Right Double-Word Data Bits In D As Much As n Bits. Fills Upper n Bits With 0 And Stores Them In D.
DSFRP	DSFRP (D) (n)	Shifts Right Double-Word Data Bits In D As Much As n Bits. Fills Upper n Bits With 0 And Stores Them In D.
DSUB	DSUB (S1) (S2) (D)	Subtract Double- Word Data In S2 From Double-Word Data In S1 And Stores The result In D.
DSUBP	DSUBP (S1) (S2) (D)	Subtract Double- Word Data In S2 From Double-Word Data In S1 And Stores The result In D.
DSUM	DSUM (S) (D)	Counts Number Of Bit Data Which Are Set As 1 In Double-Word Data Of S And Stores The Number.
DSUMP	DSUMP (S) (D)	Counts Number Of Bit Data Which Are Set As 1 In Double-Word Data Of S

		And Stores The Number.
DTEST	DTEST (S1) (S2) (D)	Stores The Bit Of Order Assigned to S2 In Double-Word Data Bit Of S1 In D. If It Is 1, Sets. If 0, Resets.
DTESTP	DTESTP (S1) (S2) (D)	Stores The Bit Of Order Assigned to S2 In Double-Word Data Bit Of S1 In D. If It Is 1, Sets. If 0, Resets.
DTO	DTO (n1) (n2) (S) (n3)	Writes n3 Pieces Of Double-Word Data In S To User Program Memory n2 Of Optional Card n1(Slot Number).
DTOP	DTOP (n1) (n2) (S) (n3)	Writes n3 Pieces Of Double-Word Data In S To User Program Memory n2 Of Optional Card n1(Slot Number).
DUTY	DUTY (n1) (n2) (D)	Turns scan designated by n1 ON for user timing block designated by D, and scan designated by n2 OFF
DWDIV	DWDIV (S1) (S2) (D)	This is used to divide the double data in the device assigned to S1, S1+1 by the DOUBLE data in the device assigned to S2, S2+1 storing the quotient of the result in the device assigned to D
DWDIVP	DWDIV (S1) (S2) (D)	This is used to divide the double data in the device assigned to S1, S1+1 by the DOUBLE data in the device assigned to S2, S2+1 storing the quotient of the result in the device assigned to D
DWMUL	DWMUL (S1) (S2) (D)	Multiplies BIN 32-bit data designated by S1, S1+1 and BIN 32-bit data designated by S2, S2+1 and stores the result in the device designated by D, D+1.
DWMULP	DWMUL (S1) (S2) (D)	Multiplies BIN 32-bit data designated by S1, S1+1 and BIN 32-bit data designated by S2, S2+1 and stores the result in the device designated by D, D+1.
DXCH	DXCH (S) (D)	Exchanges Double-Word Data In S With Double-Word Data In D Each Other.
DXCHP	DXCHP (S) (D)	Exchanges Double-Word Data In S With Double-Word Data In D Each Other.
DXNR	DXNR (S1) (S2) (D)	Exclusive - NOR-Operates Double-Word Data In S1 And Double-Word Data In S2, And Stores The Result In D.
DXNRP	DXNRP (S1) (S2) (D)	Exclusive - NOR-Operates Double-Word Data In S1 And Double-Word Data In S2, And Stores The Result In D.
DXOR	DXOR (S1) (S2) (D)	Exclusive - OR-Operates Double-Word Data In S1 And Double-Word Data In S2, And Stores The Result In D.
DXORP	DXORP (S1) (S2) (D)	Exclusive - OR-Operates Double-Word Data In S1 And Double-Word Data In S2, And Stores The Result In D.
EADD	EADDP (S1) (S2) (D)	This is used to add the floating-point data in the device assigned to S1 to the floating-point data in the device assigned to S2, storing the result in the device assigned D.
EADDP	EADDP (S1) (S2) (D)	This is used to add the floating-point data in the device assigned to S1 to the floating-point data in the device assigned to S2, storing the result in the device assigned D.

ECALL	ECALL (Program ID) (n)	Calls Sub-Routine From Other Program File. (Pn-Point Number Of Sub-Routine)
ECALLP	ECALLP (Program ID) (n)	Calls Sub-Routine From Other Program File. (Pn-Point Number Of Sub-Routine)
EDIV	EDIV (S1) (S2) (D)	This is used to divide the floating-point data in the device assigned to S1 to the floating-point data in the device assigned to S2, storing the result in the device assigned D.
EDIVP	EDIVP (S1) (S2) (D)	This is used to divide the floating-point data in the device assigned to S1 to the floating-point data in the device assigned to S2, storing the result in the device assigned D.
EI	EI (n)	Operates Time Driven Interrrupt Assigned To n.
EMOV	EMOV (S) (D)	This is used to transfer the Floating-point data in the device assigned to S to the device assigned to D.
EMOVP	EMOVP (S) (D)	This is used to transfer the Floating-point data in the device assigned to S to the device assigned to D.
ENCO	ENCO (S) (D) (n)	Encodes The Uppermost Bit Location Which Is Set As 1 In 2^n Of S And Stores The Result In D In Numerical Value Data.
ENCOP	ENCOP (S) (D) (n)	Encodes The Uppermost Bit Location Which Is Set As 1 In 2^n Of S And Stores The Result In D In Numerical Value Data.
END	END	It Is The Instruction To Inform Ending Main Routine Program. In Case Jump Instruction Prior To It Is Operated, It Is Not Operated.
EPGM	EPGM (n)	Enable program
ESUB	ESUB (S1) (S2) (D)	This is used to subtract the Floating-point data in the device assigned to S2 from the Floating-point data in the device assigned to S1, storing the result in the device assigned to D.
ESUBP	ESUBP (S1) (S2) (D)	This is used to subtract the Floating-point data in the device assigned to S2 from the Floating-point data in the device assigned to S1, storing the result in the device assigned to D.
EXP	EXP (S) (D)	Calculates exponent for value designated by S, and stores the result of the operation at the device designate by D
EXPP	EXPP (S) (D)	Calculates exponent for value designated by S, and stores the result of the operation at the device designate by D
FDEL	FDEL (DEV) (TBL) (n)	Delete A Data From Data Table
FIFR	FIFR (DEV) (TBL)	Read the oldest data from [TBL+1] and stores it at the device designated by [DEV]. After the execution of FIFR, the data in the table moves to the previous device and the last data will be zero. The number of data of the data table will be decreased.
FIFRP	FIFRP (DEV) (TBL)	Read the oldest data from [TBL+1] and stores it at the device designated by [DEV]. After the execution of FIFR, the data in the table moves to the previous

		device and the last data will be zero. The number of data of the data table will be decreased.
FIFW	FIFW (DEV) (TBL)	Stores the 16 bit data designated by [DEV] at the end of the data table designated by [TBL]. The number of data blocks stored at [TBL] will be increased.
FIFWP	FIFWP (DEV) (TBL)	Stores the 16 bit data designated by [DEV] at the end of the data table designated by [TBL]. The number of data blocks stored at [TBL] will be increased.
FINS	FINS (DEV) (TBL) (n)	Insert A Data in Data Table
FLT	FLT (S) (D)	Converts 16-bit BIN data designated by S to floating decimal point real number, and stores at device number designated by D .
FLTP	FLTP (S) (D)	Converts 16-bit BIN data designated by S to floating decimal point real number, and stores at device number designated by D .
FMOV	FMOV (S) (D) (n)	Transmits Data In S To n Pieces Of Device From Device D In Due Order.
FMOVP	FMOVP (S) (D) (n)	Transmits Data In S To n Pieces Of Device From Device D In Due Order.
FOR	FOR (n)	Runs The Step Next To NEXT Instruction After Has Processed Between FOR And NEXT At n Times.
FPOP	FPOP (DEV) (TBL)	Find Last Data in Data Table
FREAD	FREAD (n1) (n2) (D) (n3) (n4)	Read n3 words of data from the address designated by n2 ofthe system memory of the special function module designated by n1. Then, stores the data in the area starting from the device designated by D. The result of instruction is stored to the device designated by n3.
FREADP	FREADP (n1) (n2) (D) (n3) (n4)	Read n3 words of data from the address designated by n2 ofthe system memory of the special function module designated by n1. Then, stores the data in the area starting from the device designated by D. The result of instruction is stored to the device designated by n3.
FROM	FROM (n1) (n2) (D) (n3)	Reads n3 Pieces Of Word Data In User Program Memory n2 Of Optional Card n1(SLot Number) And Stores The Result In D.
FROMP	FROMP (n1) (n2) (D) (n3)	Reads n3 Pieces Of Word Data In User Program Memory n2 Of Optional Card n1(SLot Number) And Stores The Result In D.
FWRITE	FWRITE (n1) (n2) (D) (n3) (n4)	Write n3 words of data from the device designated by D to the area starting from the address designated by n2 of the system memory of the special function module designated by n1.
FWRITEP	FWRITEP (n1) (n2) (D) (n3) (n4)	Write n3 words of data from the device designated by D to the area starting from the address designated by n2 of the system memory of the special function module designated by n1.
GBIN	GBIN (S) (D)	Converts Gray code data at device designated by S to BIN 16-bit data and stores at device designated by D.
GBINP	GBINP (S) (D)	Converts Gray code data at device designated by S to BIN 16-bit data and stores at device designated by D.
GDI	GDI	Stops Operating Time Driven Interrrupt In Entire Program.

GEI	GEI	Operates Time Driven Interrrupt In Entire Program.
GRY	GRY (S) (D)	Converts BIN data at the device designated by S to Gray code, and stores result at device designated by D.
GRYP	GRYP (S) (D)	Converts BIN data at the device designated by S to Gray code, and stores result at device designated by D.
HABIN	HABIN (S) (D)	Converts Hexadecimal ASCII COde In S To 16 Bit BIN Data And Stores The Result In D.
HABINP	HABINP (S) (D)	Converts Hexadecimal ASCII COde In S To 16 Bit BIN Data And Stores The Result In D.
HOUR	HOUR (S) (D)	Converts Second Data In S To Hour, Minute And Second Data And Stores The Result In D In Due Order.
HOURP	HOURP (S) (D)	Converts Second Data In S To Hour, Minute And Second Data And Stores The Result In D In Due Order.
INC	INC (D)	Adds 1 To Data Value In D And Stores The Result In D Again.
INCP	INCP (D)	Adds 1 To Data Value In D And Stores The Result In D Again.
INITEND	INITEND	Ends Initialization Program ANd Runs Scan Program.
INT	INT (S) (D)	Converts the floating decimal point real number designated at S into BIN 16-bit data and stores it at the device number designated at D.
INTP	INTP (S) (D)	Converts the floating decimal point real number designated at S into BIN 16-bit data and stores it at the device number designated at D.
INV	INV	Inverts The Left Circuit, A Contact Circuit To B Contact Circuit And B Contact Circuit To A Contact Circuit.
IRET	IRET	Shows THe End OF Interrupt Program.
JME	JME (n)	If Input Of JMP n Instruction Is On, Jumps Next To JME n And Does Not Process All The Instructions Up To JME n.
JMP	JMP (n)	If Input Of JMP n Instruction Is On, Jumps Next To JME n And Does Not Process All The Instructions Up To JME n.
JMPP	JMPP (n)	If JMPP n Instruction Input Is On, Jumps Next To JME n And Does Not Process All The Instructions Up To JME n.
LD	LD (S)	Takes ON/OFF Data For a Contact Of One Circuit AS Operation Result.
LD<	LD< (S1) (S2)	If Data In S1 Is Less Than Data In S2, Sets Result Of The Current Operation.
LD<=	LD<= (S1) (S2)	If Data In S1 Is Less Than Or Equal To Data In S2, Sets Result Of The Current Operation.
LD<>	LD<> (S1) (S2)	If Data In S1 Is Not Equal To Data In S2, Sets Result Of The Current Operation.
LD=	LD= (S1) (S2)	If Data In S1 Is Equal To Data In S2, Sets Result Of The Current Operation.
LD>	LD> (S1) (S2)	If Data In S1 Is Greater Than Data In S2, Sets Result Of The Current Operation.
LD>=	LD>= (S1) (S2)	If Data In S1 Is Greater Than Or Equal To Data In S2, Sets Result Of The

		Current Operation.
LDBT	LDBT (S1) (S2)	LD-Operates the bit of the order assigned to S2 in the word device data assigned to S1 and Contact A.
LDBTI	LDBTI (S1) (S2)	These are used to read the bit data assigned to S2 among the word addresses in Device D assigned to S1, starting the operation for Contact A (LDBT) and the one for Contact B(LDBTI). The information(On/Off) on the assigned Device are received and taken as the result of their operation
LDD<	LDD< (S1) (S2)	If Data In S1 Is Less Than Data In S2, Sets Result Of The Current Operation.
LDD<=	LDD<= (S1) (S2)	If Data In S1 Is Less Than Or Equal To Data In S2, Sets Result Of The Current Operation.
LDD<>	LDD<> (S1) (S2)	If Data In S1 Is Not Equal To Data In S2, Sets Result Of The Current Operation.
LDD=	LDD= (S1) (S2)	If Data In S1 Is Equal To Data In S2, Sets Result Of The Current Operation.
LDD>	LDD> (S1) (S2)	If Data In S1 Is Greater Than Data In S2, Sets Result Of The Current Operation.
LDD>=	LDD>= (S1) (S2)	If Data In S1 Is Greater Than Or Equal To Data In S2, Sets Result Of The Current Operation.
LDF	LDF (S)	If Input Condition Is OFF From ON, Sets For One Scan.
LDI	LDI (S)	Takes ON/OFF Data For b Contact Of One Circuit As Operation Result.
LDP	LDP (S)	If Input Condition Is ON From OFF, Sets For One Scan.
LOG	LOG (S) (D)	Calculates natural logarithm of value designated by S taking e as base, and stores operation results at device designated by D.
LOGP	LOGP (S) (D)	Calculates natural logarithm of value designated by S taking e as base, and stores operation results at device designated by D.
MAX	MAX (S) (D) (n)	Stores The Biggest Value Among n Pieces Of Data From Data In S, Its Location And Number Of The Values In D.
MAXP	MAXP (S) (D) (n)	Stores The Biggest Value Among n Pieces Of Data From Data In S, Its Location And Number Of The Values In D.
MC	MC (n)	If Input Of MC Is ON, Operates Up To Same MCR. If Input Conditon Is OFF, Does Not Operates.
MCR	MCR (n)	If Input Of MC Is ON, Operates Up To Same MCR. If Input Conditon Is OFF, Does Not Operates.
MIN	MIN (S) (D) (n)	Stores The Smallest Value Among n Pieces Of Data From Data In S, Its Location And Number Of The Values In D.
MINP	MINP (S) (D) (n)	Stores The Smallest Value Among n Pieces Of Data From Data In S, Its Location And Number Of The Values In D.
MOV	MOV (S) (D)	Transmits Word Data In Device S To Device D.
MOVP	MOVP (S) (D)	Transmits Word Data In Device S To Device D.
MPP	MPP	It Is Used to End Branching. Reads The Stored State From Memory And

		Operates The Result.
MPS	MPS	It IS Used To Branch At First. Stores Operation Result In Memory.
MRD	MRD	It Is Used To Relay Branching. Reads The Stored State From Memory And Operates The Result.
MUL	MUL (S1) (S2) (D)	Multiplies Data In S1 By Data In S2 And Stores The Result In D.
MULP	MULP (S1) (S2) (D)	Multiplies Data In S1 By Data In S2 And Stores The Result In D.
NEG	NEG (D)	Sign-Inverts Contents Of Data In D And Stores The Result In D Again.
NEGP	NEGP (D)	Sign-Inverts Contents Of Data In D And Stores The Result In D Again.
NEXT	NEXT	Runs The Step Next To NEXT Instruction After Has Processed Between FOR And NEXT At n Times.
NOP	NOP	As No Operation Instruction, Does Not Influence Operation Result Of The Corresponding Circuit.
OR	OR (S)	OR-Operates a Contact Of The Assigned Contact And The Connected Contact In Parallel And Takes The Result As Operation Result.
OR<	OR< (S1) (S2)	If Data In S1 Is Less Than Data In S2, Sets.If Greater Than Or Equal To, Resets. OR-Operates The Result And Result Of The Current Operation.
OR<=	OR<= (S1) (S2)	If Data In S1 Is Less Than Or Equal To Data In S2, Sets. If Greater Than, Resets. OR-Operates The Result And Result Of The Current Operation.
OR<>	OR<> (S1) (S2)	If Data In S1 Is Not Equal To Data In S2, Sets. If Equal To, Off. OR-Operates The Result And Result Of The Current Operation.
OR=	OR= (S1) (S2)	If Data In S1 Is Equal To Data In S2, Sets. If Not Equal To, Resets. OR-Operates The Result And Result Of The Current Operation.
OR>	OR> (S1) (S2)	If Data In S1 Is Greater than Data In S2, Sets. If Less than Or Equal To, Resets. OR-Operates The Result And Result Of The Current Operation.
OR>=	OR>= (S1) (S2)	If Data InS1 Is Greater Than Or Equal To Data In S2, Sets. If Less Than, Resets. OR-Operates The Result And Result Of The Current Operation.
ORB	ORB	OR-Operates Blocks And Takes The result As Operation Result.
ORBT	ORBT (S1) (S2)	OR-Operates the bit of the order assigned to S2 in the word device data assigned to S1 and Contact A.
ORBTI	ORBTI (S1) (S2)	These are to read the bit data assigned to S2 among the word addresses in Device D assigned to S1, connecting in a series with Contact A(ANDBT) and Contact B(ANDBTI). The information(On/Off) on the assigned device are received and AND-operated with the result of the operation till then. The results of the AND-operation is taken as their operation.
ORD<	ORD< (S1) (S2)	If Data In S1 Is Less Than Data In S2, Sets. If Greater Than Or Equal To, Off. OR-Operates The Result And Result Of The Current Operation.
ORD<=	ORD<= (S1) (S2)	If Data In S1 Is Less Than Or Equal To Data In S2, Sets. If Greater Than, Resets. OR-Operates The Result And Result Of The Current Operation.
ORD<>	ORD<> (S1) (S2)	If Data In S1 Is Not Equal To Data In S2, Sets. If Equal To, resets. OR-Operates The Result And Result Of The Current Operation.
ORD=	ORD= (S1) (S2)	If Data In S1 Is Equal To Data In S2, Sets. If Not Equal To, Resets. OR-

		Operates The Result And Result Of The Current Operation.
ORD>	ORD> (S1) (S2)	If Data In S1 Is Greater Than Data In S2, Sets. If Less Than Or Equal To, Resets. OR-Operates The Result And Result Of The Current Operation.
ORD>=	ORD>= (S1) (S2)	If Data In S1 Is Greater Than Or Equal To Data In S2, Sets. If Less Than, Resets. OR-Operates The Result And Result Of The Current Operation.
ORE<	ORE (S1) (S2)	If Data In S1 Is Less Than Data In S2, Sets. If Greater Than Or Equal To, Off. OR-Operates The Result And Result Of The Current Operation
ORE<=	ORE<= (S1) (S2)	If Data In S1 Is Less Than Or Equal To Data In S2, Sets. If Greater Than, Resets. OR-Operates The Result And Result Of The Current Operation.
ORE<>	ORE<> (S1) (S2)	If Data In S1 Is Not Equal To Data In S2, Sets. If Equal To, resets. OR-Operates The Result And Result Of The Current Operation
ORE=	ORE= (S1) (S2)	If Data In S1 Is Equal To Data In S2, Sets. If Not Equal To, Resets. OR-Operates The Result And Result Of The Current Operation.
ORE>	ORE> (S1) (S2)	If Data In S1 Is Greater Than Data In S2, Sets. If Less Than Or Equal To, Resets. OR-Operates The Result And Result Of The Current Operation.
ORE>=	ORE>= (S1) (S2)	If Data In S1 Is Greater Than Or Equal To Data In S2, Sets. If Less Than, Resets. OR-Operates The Result And Result Of The Current Operation.
ORF	ORF (S)	If Input Condition Of Connection In Parallel Contact Is OFF From ON, Sets For One Scan.
ORI	ORI (S)	OR-Operates b Contact Of the Assigned Contact And The Connected Contact In Parallel, And Takes The Result As Operation Result.
ORP	ORP (S)	If Input Condition Of Connection In Parallel Contact Is OFF From ON, Sets For One Scan.
OUT	OUT (D)	Outputs Operation Result To The Assigned Contact.
PEND	PEND	It Means End Of Program And Is Put On The Last Part.
PIDCAL	PIDCAL (S)	Assigns Device Where Result Value Of PID Operation IS Stored As S.
PIDINIT	PIDINIT (S)	Assigns Device Where The Set Value For PID Operation Is Stored As S.
PLF	PLF (D)	If Input Condition Is OFF From ON, Sets The Assigned Contact For One Scan. Otherwise, Resets.
PLS	PLS (D)	If INput Condition IS ON From OFF, Sets The Assigned Contact For One Scan. Otherwise, Resets.
RAD	RAD (S) (D)	Converts units of angle size from angle units designated by S to radian units, and stores result at device number designated by D.
RADP	RADP (S) (D)	Converts units of angle size from angle units designated by S to radian units, and stores result at device number designated by D.
RCL	RCL (D) (n)	Shifts Left 16 Pieces Of Bit In D As Much As n Bits. Shifts The Uppermost Bit To Carry Flag And Carry Flag To The Lowest Bit.
RCLP	RCLP (D) (n)	Shifts Left 16 Pieces Of Bit In D As Much As n Bits. Shifts The Uppermost Bit To Carry Flag And Carry Flag To The Lowest Bit.
RCR	RCR (D) (n)	Shifts Right 16 Pieces Of Bit In D As Much As n Bits. Shifts The Lowest Bit To Carry Flag And Carry Flag.

RCRP	RCRP (D) (n)	Shifts Right 16 Pieces Of Bit In D As Much As n Bits. Shifts The Lowest Bit To Carry Flag And Carry Flag.
RCV	RCV (Slot)(D)(Size) (Result)	Reads And Brings Data In Slave Station To Device Of Master Station.
RCVP	RCVP (Slot)(D)(Size) (Result)	Reads Data In Slave Station To Device Of Master Station.
RECV	RECV (PID) (F_Name) (Result)	Compares the data received from master station with the data(F_Name) set up by Special Function Program(PID), storing them in the assigned device.
RECVP	RECVP (PID) (F_Name) (Result)	Compares the data received from master station with the data(F_Name) set up by Special Function Program(PID), storing them in the assigned device.
RET	RET	If Input Condition Is ON While Running Program, Runs The Program Between SBRT n And RET Accoding To CALL n.
RFS	RFS (S) (n)	Refreshes n Pieces Of Device Which Are Assigned To S For One Scan.
RFSP	RFSP (S) (n)	Refreshes n Pieces Of Device Which Are Assigned To S For One Scan.
RND	RND (D)	Generates random number of from 0 to 32767, and stores at device designated by D
RNDP	RNDP (D)	Generates random number of from 0 to 32767, and stores at device designated by D
ROL	ROL (D) (n)	Shifts Left 16 Pieces Of Bit In D As Much As n Bits. Shifts The Uppermost Bit To The Lowest Bit And Carry Flag.
ROLP	ROLP (D) (n)	Shifts Left 16 Pieces Of Bit In D As Much As n Bits. Shifts The Uppermost Bit To The Lowest Bit And Carry Flag.
ROR	ROR (D) (n)	Shifts Right 16 Pieces Of Bit In D As Much As n Bits. Shifts The Lowest Bit To Carry Flag And Carry Flag To The Uppermost Bit.
RORP	RORP (D) (n)	Shifts Right 16 Pieces Of Bit In D As Much As n Bits. Shifts The Lowest Bit To Carry Flag And Carry Flag To The Uppermost Bit.
RST	RST (D)	If Input Condition Is ON, Keeps Output Contact In OFF State. Though The Input Is OFF, Keeps Resetting Output.
SBRT	SBRT (n)	If Input Condition Is ON While Running Program, Runs The Program Between SBRT n And RET Accoding To CALL n.
SCL	SCL (S) (D) (P) (n)	Converts signed binary data into signed binary data according to Scale parameter table .
SCLP	SCLP (S) (D) (P) (n)	Converts signed binary data into signed binary data according to Scale parameter table .
SECOND	SECOND (S) (D)	Converts Hour, Minute And Second Data In S To Second Data Each And Stores The Result In D.
SECONDP	SECONDP (S) (D)	Converts Hour, Minute And Second Data In S To Second Data Each And Stores The Result In D.
SEG	SEG (S) (D)	Decodes n Pieces Of Number From Start Bit In S As 7 Segment By The Set Format And Stores The Result In D.

SEGP	SEGP (S) (D)	Decodes n Pieces Of Number From Start Bit In S As 7 Segment By The Set Format And Stores The Result In D.
SEND	SEND (PID) (F_Name) (Result)	Sends the data(F_Name) set up by Special Function Program(PID) from master station to the device of slave station.
SENDP	SENDP (PID) (F_Name) (Result)	Sends the data(F_Name) set up by Special Function Program(PID) from master station to the device of slave station.
SET	SET (D)	If Input Condition Is ON, Keeps Output Contact In ON State. Though The Input Is OFF, Keeps Setting Output.
SFL	SFL (D) (n)	Shifts Left Data Bit In D As Much As n Bits. Fills Lower n Bits With 0 And Stores the Result In D.
SFLP	SFLP (D) (n)	Shifts Left Data Bit In D As Much As n Bits. Fills Lower n Bits With 0 And Stores the Result In D.
SFR	SFR (D) (n)	Shifts Right Data Bit In D As Much As n Bits. Fills Upperr n Bits With 0 And Stores the Result In D.
SFRP	SFRP (D) (n)	Shifts Right Data Bit In D As Much As n Bits. Fills Upperr n Bits With 0 And Stores the Result In D.
SIN	SIN (S) (D)	Calculates SIN (sine) value of angle designated at S and stores the operation result in the device number designated at D
SINP	SINP (S) (D)	Calculates SIN (sine) value of angle designated at S and stores the operation result in the device number designated at D
SND	SND (Slot)(S)(Size) (Result)	Transmits Data In Device Of Master Atation To Device Of Slave Station.
SNDP	SNDP (Slot)(S)(Size) (Result)	Transmits Data In Device Of Master Atation To Device Of Slave Station.
SQR	SQR (S) (D)	Calculates square root of value designated at S , and stores the operation result in the device number designated at D
SQRP	SQRP (S) (D)	Calculates square root of value designated at S , and stores the operation result in the device number designated at D
SRND	SRND (S)	Updates random number series according to the 16-bit BIN data being stored in device designated by S
SRNDP	SRNDP (S)	Updates random number series according to the 16-bit BIN data being stored in device designated by S
STC	STC	If Input Condition Is On, Sets Carry Flag.
STOP	STOP	To Stop Operation At The Time When Users Want, Converts To Program Mode After Finishing The Scan In Progress.
SUB	SUB (S1) (S2) (D)	Subtracts Data In S2 From Data In S1 And Stores The Result In Device D.
SUBP	SUBP (S1) (S2) (D)	Subtracts Data In S2 From Data In S1 And Stores The Result In Device D.
SUM	SUM (S) (D)	Counts Number Of Bit Data Which Are Set As 1 In Data Of S And Stores The Number.
SUMP	SUMP (S) (D)	Counts Number Of Bit Data Which Are Set As 1 In Data Of S And Stores The Number.
SWAP	SWAP (D)	Exchanges The Upper Byte Of Data In D With The Lower Byte Of It And

		Stores The Result In Device D.
SWAPP	SWAPP (D)	Exchanges The Upper Byte Of Data In D With The Lower Byte Of It And Stores The Result In Device D.
TAN	TAN (S) (D)	Performs tangent (TAN) operation on angle data designated by S , and stores operation result in device designated by D .
TANP	TANP (S) (D)	Performs tangent (TAN) operation on angle data designated by S , and stores operation result in device designated by D .
TEST	TEST (S1) (S2) (D)	Stores Bit Of The Assigned Order Among Data Bits In S1. If The Result Is 1, Sets. If 0, Resets.
TESTP	TESTP (S1) (S2) (D)	Stores Bit Of The Assigned Order Among Data Bits In S1. If The Result Is 1, Sets. If 0, Resets.
TMON	TMON (S) (t)	Though Output Is Set And Input Is Set-Reset Repeatly, If Current Value Is Subtracted Whenever It Is Set And Reaches 0, Timer Output Is Reset.
TMR	TMR (S) (t)	Though Current Value Is Increased And Input Is On-Off Reapeatly, If The Current Value Is Accumulated Whenever It Is On And Reaches Set Time, Timer Contact Is Set.
TO	TO (n1) (n2) (S) (n3)	Writes n3 Pieces Data In S To User Program Memory n2 Of Optional Card n1(Slot Number).
TOFF	TOFF (S) (t)	When Input Condition Is Off, The Set Value Is Subtracted. If Current Value Reaches 0, Output Is Reset.
TON	TON (S) (t)	If Curren Value Is Increased And Reaches Set Value, Timer Contact Is Set.
TOP	TOP (n1) (n2) (S) (n3)	Writes n3 Pieces Data In S To User Program Memory n2 Of Opetional Card n1(Slot Numer).
TRTG	TRTG (S) (t)	If Output Is Set And Current Value Is Subtracted To Reach 0, Output Is Reset. If Output Is Reset Before Current Value Is 0, Current Value Is Set Up As Set Value.
UCMP	UCMP (S1) (S2)	Compares BIN 16-bit data the nth point from the device number designated by S1 with BIN 16-bit data the nth point from the device number designated by S2 , and the result are stores Flag F(F0120 ~ F0125)
UCMPP	UCMPP (S1) (S2)	Compares BIN 16-bit data the nth point from the device number designated by S1 with BIN 16-bit data the nth point from the device number designated by S2 , and the result are stores Flag F(F0120 ~ F0125)
UNI	UNI (S) (D) (n)	Combines Each Lower 4 Bits Of n(n=1 Means 4 Bits) Pieces Of Data In S, And Stores the Result In Device D.
UNIP	UNIP (S) (D) (n)	Combines Each Lower 4 Bits Of n(n=1 Means 4 Bits) Pieces Of Data In S, And Stores the Result In Device D.
WAND	WAND (S1) (S2) (D)	AND-Operates Data In S1 And Data In S2, And Stores In Device D.
WANDP	WANDP (S1) (S2) (D)	AND-Operates Data In S1 And Data In S2, And Stores In Device D.
WBMOV	WBMOV (S) (D) (fm)	transfer data from S to D, obey fm
WBMOVP	WBMOVP (S) (D) (fm)	transfer data from S to D, obey fm

WDIV	WDIV (S1) (S2) (D)	This is used to divide the word data in the device assigned to S1 by the word data in the device assigned to S2, storing the quotient of the result in the device assigned to D
WDIVP	WDIVP (S1) (S2) (D)	This is used to divide the word data in the device assigned to S1 by the word data in the device assigned to S2, storing the quotient of the result in the device assigned to D
WDT	WDT	Resets Watch Dog Timer While Operating Program.
WDTP	WDTP	Resets Watch Dog Timer While Operating Program.
WMUL	WMUL (S1) (S2) (D)	Multiplies BIN 16-bit data designated by S1 and BIN 16-bit data designated by S2 , and stores the result in the device designated by D.
WMULP	WMULP (S1) (S2) (D)	Multiplies BIN 16-bit data designated by S1 and BIN 16-bit data designated by S2 , and stores the result in the device designated by D.
WOR	WOR (S1) (S2) (D)	OR-Operates Data In S1 And Data In S2, And Stores The Result In Device D.
WORP	WORP (S1) (S2) (D)	OR-Operates Data In S1 And Data In S2, And Stores The Result In Device D.
WSUM	WSUM (S) (D) (n)	Summed up all 16bit binary data for n words from the device designated at S, and stored it in the device designated at D
WSUMP	WSUMP (S) (D) (n)	Summed up all 16bit binary data for n words from the device designated at S, and stored it in the device designated at D
WXNR	WXNR (S1) (S2) (D)	Exclusive - NOR-Operates Data In S1 And Data In S2, And Stores The Result In D.
WXNRP	WXNRP (S1) (S2) (D)	Exclusive - NOR-Operates Data In S1 And Data In S2, And Stores The Result In D.
WXOR	WXOR (S1) (S2) (D)	Exclusive - OR-Operates Data In S1 And Data In S2, And Stores The Result In D.
WXORP	WXORP (S1) (S2) (D)	Exclusive - OR-Operates Data In S1 And Data In S2, And Stores The Result In D.
XCH	XCH (D1) (D2)	Exchanges Word Data In S With Word Data In D.
XCHP	XCHP (D1) (D2)	Exchanges Word Data In S With Word Data In D.
ABRST1	ABRST1 (Base/Slot) (S) (D)	
ABRST2	ABRST2 (Base/Slot) (S) (D)	
ABRST3	ABRST3 (Base/Slot) (S) (D)	
ABRST4	ABRST4 (Base/Slot) (S) (D)	
PSTRT1	PSTRT1 (Base/Slot) (S) (D)	
PSTRT2	PSTRT2 (Base/Slot) (S) (D)	
PSTRT3	PSTRT3 (Base/Slot) (S) (D)	

PSTRT4	PSTRT4 (Base/Slot) (S) (D)	
TEACH1	TEACH1 (Base/Slot) (S) (D)	
TEACH2	TEACH2 (Base/Slot) (S) (D)	
TEACH3	TEACH3 (Base/Slot) (S) (D)	
TEACH4	TEACH4 (Base/Slot) (S) (D)	
PFWRT	PFWRT (Base/Slot) (S) (D)	
PINIT	PINIT (Base/Slot) (S) (D)	

5.4 Internal Flag(Relay) F

This is used to get information about the state or PLC, time, day and so on.

F Zone	Function	Description
F0000	F0000 : Run Mode	In case of RUN Mode, ON
	F0001 : Program Mode	In case of Program Mode, ON
	F0002 : Pause Mode	In case of Pause Mode, ON
	F0003 : Debug Mode	In case of Debug Mode, ON
	F0007 : Remote Mode	In case of Remote Mode, ON
	F000F : Execute Stop Instruction	In case of Executing Stop, ON
F0010	F0010 : Always ON	Always ON
	F0011 : Always OFF	Always OFF
	F0012 : ON at first scan only	ON for a SCAN
	F0013 : OFF at first scan only	OFF for a SCAN
	F0014 : Toggle at each scan	Invert every scan Unused
F0020	Reserved	-
F0030	F0030 : Major Breakdown	In case of major breakdown error, ON
	F0031 : Minor Breakdown	In case of minor breakdown error, OFF
	F0032 : WDT Error	In case of Watchdog Timer error, ON
	F0033 : I/O combined Error	In case of I/O combined Error, ON
	F0034 : Battery voltage low	In case of low voltage than standard, ON
	F0037 : Forced ON/OFF	In case of forced ON/OFF to I/O, ON
F0040	F0040 ~ 7 : I/O Error	If reserved I/O and mounted I/O are different, number of different SLOT stored. (0 ~ 11)
	F0048 ~ F : I/O Error	If reserved I/O and mounted I/O are different, number of different expansion stored. (0 ~ 11)
F0050	Error Code	-

F0070	In case of Dual Port RAM Access Error, Details	
	F0070 ~ 7	Number of slot(0 ~ 11) stored.
	F0078 ~ F	Number of expansions (0 ~ F) stored.
F0080	CM1-CP1A : "1A"	Type of PLC is displayed as ASCII value.
	CM1-CP1B : "1B"	
	CM1-CP1R : "1R"	
	CM1-CP2A : "2A"	
	CM1-CP2B : "2B"	
	CM1-CP3A : "3A"	
	CM1-CP3B : "3B"	
	CM1-CP4A : "4A"	
	CM1-CP4B : "4B"	
	CM1-BP : "B0"	
F0090	F0090 : 0.02s Interval SYSTEM CLOCK	ON / OFF in a constant interval under RUN operation. (During operation, initial value is 0)
	F0091 : 0.1s Interval SYSTEM CLOCK	
	F0092 : 0.2s Interval SYSTEM CLOCK	
	F0093 : 1s Interval SYSTEM CLOCK	
	F0094 : 2s Interval SYSTEM CLOCK	
	F0095 : 10s Interval SYSTEM CLOCK	
	F0096 : 20s Interval SYSTEM CLOCK	
	F0097 : 1m Interval SYSTEM CLOCK	
F0100	F0100 : USER CLOCK 0	User can use "DUTY" instruction to cycle On / Off. (Initial setting is Off)
	F0101 : USER CLOCK 1	
	F0102 : USER CLOCK 2	
	F0103 : USER CLOCK 3	
	F0104 : USER CLOCK 4	
	F0105 : USER CLOCK 5	
	F0106 : USER CLOCK 6	
	F0107 : USER CLOCK 7	
	F0108 - F10F : Not Use	
F0110	F0110 : In case of operation error, ON	To modify whenever operation
	F0111 : Zero Flag	Zero Flag
	F0112 : Carry Flag	Carry Flag
	F0118 : In case all outputs OFF, ON	In case all outputs OFF, ON
	F0119 : DPRAM Access Error	Details are stored in F0007

F0120	F0120 : < Flag	Less, ON
	F0121 : = Flag	Less or equal, ON
	F0122 : = Flag	Equal, ON
	F0123 : > Flag	Greater, ON
	F0124 : = Flag	Greater or equal, ON
	F0125 : ? Flag	Not equal, ON
F0130	On Slot 0, I/O is mounted	
F0140	On Slot 1, I/O is mounted	
F0150	On Slot 2, I/O is mounted	
F0160	On Slot 3, I/O is mounted	
F0170	On Slot 4, I/O is mounted	
F0180	On Slot 5, I/O is mounted	
F0190	On Slot 6, I/O is mounted	
F0200	On Slot 7, I/O is mounted	
F0210	On Slot 8, I/O is mounted	
F0220	On Slot 9, I/O is mounted	
F0230	On Slot A, I/O is mounted	
F0240	On Slot B, I/O is mounted	
F0250	On Slot C, I/O is mounted	
F0260	On Slot D, I/O is mounted	
F0270	On Slot E, I/O is mounted	
F0280	On Slot F, I/O is mounted	
F0290	Reserved	
F0300	Minimum Scan Time (Unit : msec)	
F0310	Current Scan Time (Unit : msec)	
F0320	Maximum Scan Time (Unit : msec)	
F0330 ~ F0390	Reserved	
F0400	Stored year in clock data (EX : 2001)	
F0410	Stored month and date in clock data (Upper : Month , Lower : Date)	
F0420	Stored day of the week and jour in clock data (Upper : weekday, Lower : Second)	
F0430	Stored minute and second in clock data (Upper : minute, Lower : Second)	
F0440	Reserved	
F0450	Year when power is On is stored. (EX " 2001)	
F0460	Month and day when power is ON is stored.	
F0470	Day of the week and Hour when power is ON is stored.	
F0480	Minute and Second when power is ON is stored.	
F0490	Reserved	
F0500	Count AC Fail	
F0510	Year in case of AC Fail is stored. (EX : 2001)	
F0520	Month and Day in case of AC Fail is stored.	
F0530	Day of the week and Hour in case of AC Fail is stored.	

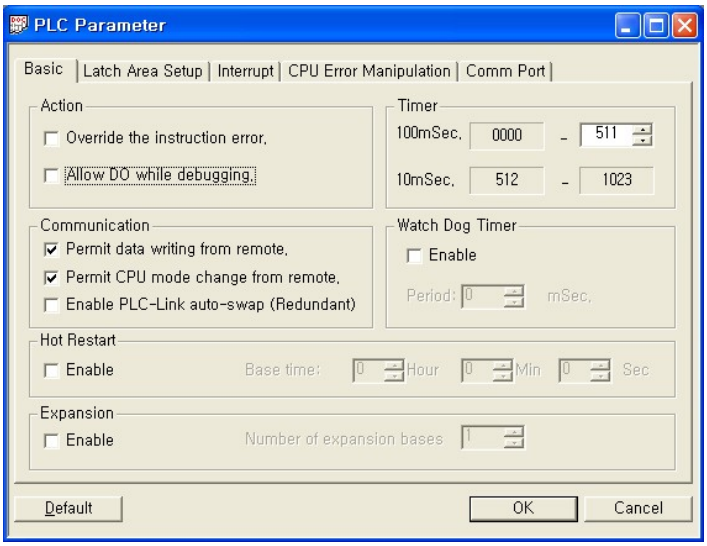
F0540	Minute and Second in case of AC Fail is stored.

5.5 Programming

- Setting up Parameter
- Processing in CPU
- Form of Programs
- Self-Diagnosis
- Built-In Functions

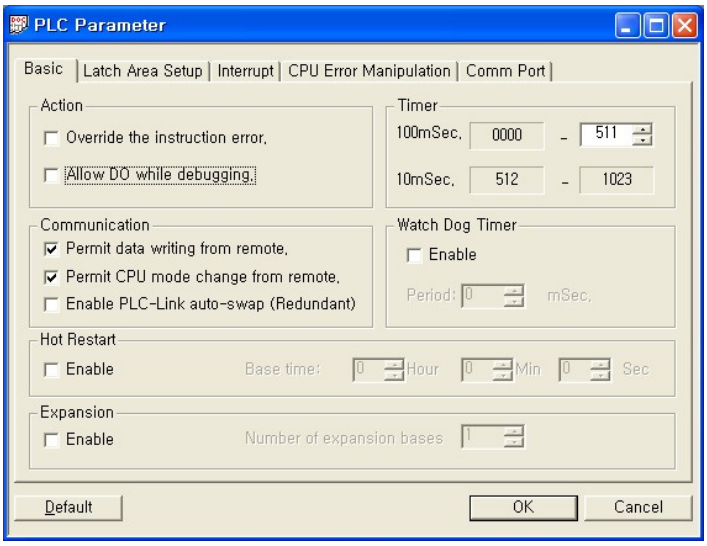
5.5.1 Setting up Parameter

If you select "Parameter -> General" on the project window of the CICON, a Parameter window will appear as follows.



- Basic
- Latch Area Setup
- Interrupt

5.5.1.1 Basic



Action

- Normal Action In Case Of Operation Error
  This is used to decide whether CPU is operated continuously in case of error such as operation overflow.

- Output While Debugging
  This is the function used to select whether to output and debug actually in debug mode or to change an internal device without outputting.

Timer Device

Item	Available Device
XP CPU	T0000 ~ T4095
CP CPU	T0000 ~ T1023
BP CPU	T0000 ~ T0255

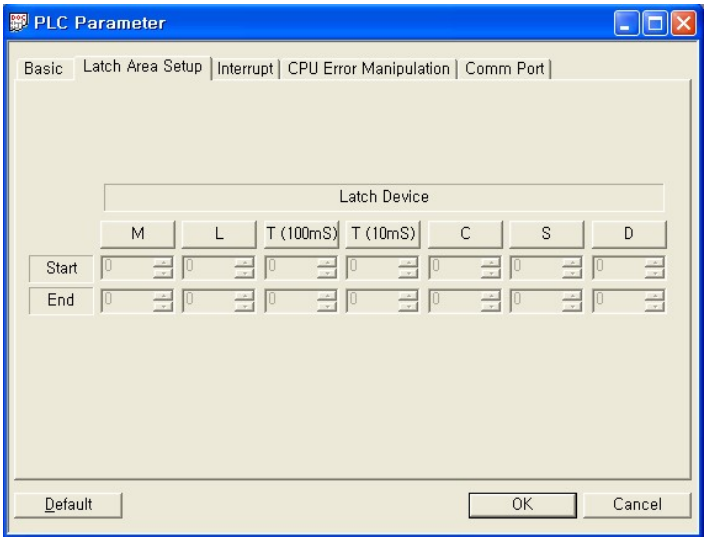
Watch Dog Time

To protect an error in program operation, it is available to set up WDT from 10 to 60000㎳ as maximum by 10㎳ Otherwise, it is not used.

Expansion

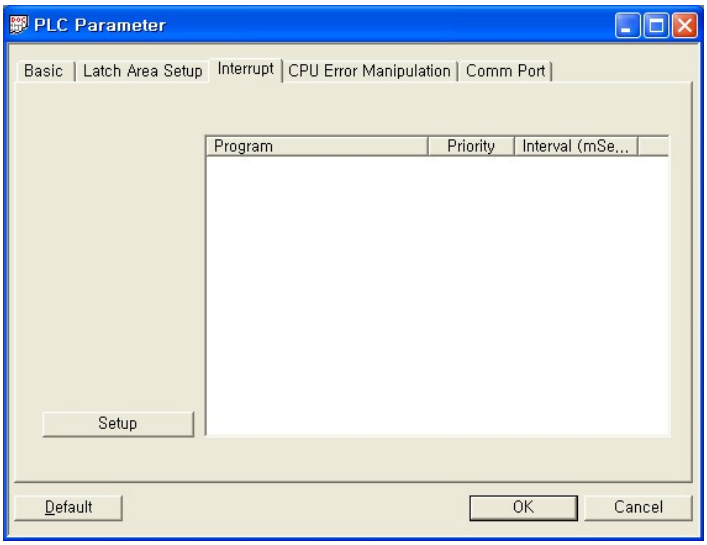
This is used to set up whether expansion is used or not.

5.5.1.2 Latch Area Setup



When Program(stop) mode is converted to RUN mode or RUN mode is converted to program(Stop) mode after power is ON, this is used to assign non-volatile devices to keep current data.

5.5.1.3 Interrupt



- This is used to set up constant interval interrupt to decide priority.
- The priority of the interrupt set up as 0 is the highest.
- Set range: 10㎳ ~ 655,350㎳

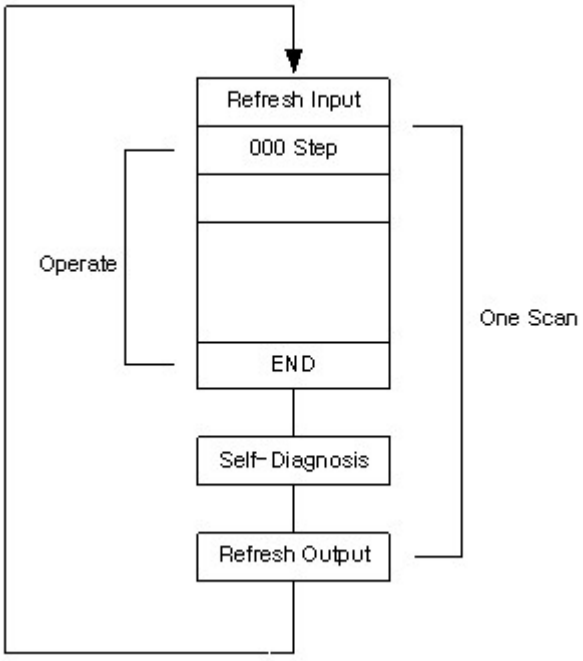
Instructions Relevant to Interrupt

Name	Symbol	Function
EI DI	EI n DI n	Permits Interrupt(By channels) Permits Interrupt(By channels)
GEI GDI	GEI GDI	Permits Interrupt(By channels) Permits Interrupt(By channels)
IRET	IRET	Ends Interrupt Program

5.5.2 Processing in CPU

- Processing Operation
- Actions by Modes
- Converting Memory Mode
- Restart Mode

5.5.2.1 Processing Operation



Refresh Input

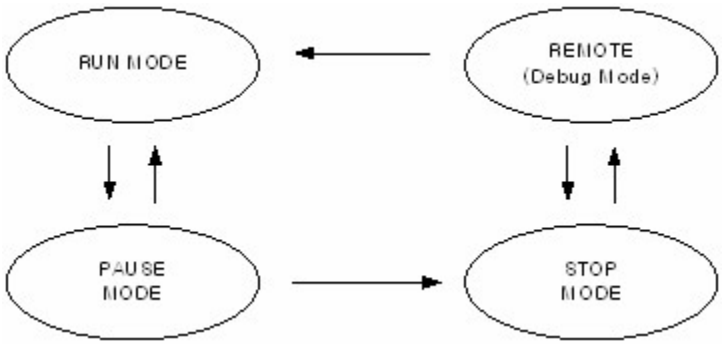
This is used to read data from an input module before a program is run, and to store the result in the device assigned to input(X) in a lump.

Refresh Output

This is used to operate END instruction and to output the data in the device assigned to output(Y) of data memory to an output module.

5.5.2.2 Actions by Modes

There are four modes. The arrows indicate convertible routes between modes each by a mode-conversion switch.



5.5.2.3 Converting Memory Mode

Type of Memory Modes

RAM Operation Mode

- This mode is operated by the program stored in the RAM of a CPU card.
- In the characteristic of RAM, power being continuously supplied, the stored programs are not cleared. If power is OFF, the power from the battery in CPU is supplied.
- In case that the voltage of the battery is less than standard one, the Internal Flag F3.4 is set up. At this time, the battery is to be replaced. If there is no battery, the programs are kept by the inside super capacitor for several minutes.
- As the operation time is less than the time to download to flash memory(Around a half or 30%), the RAM

operation mode is good to debug IL/LD program.

ROM Operation Mode

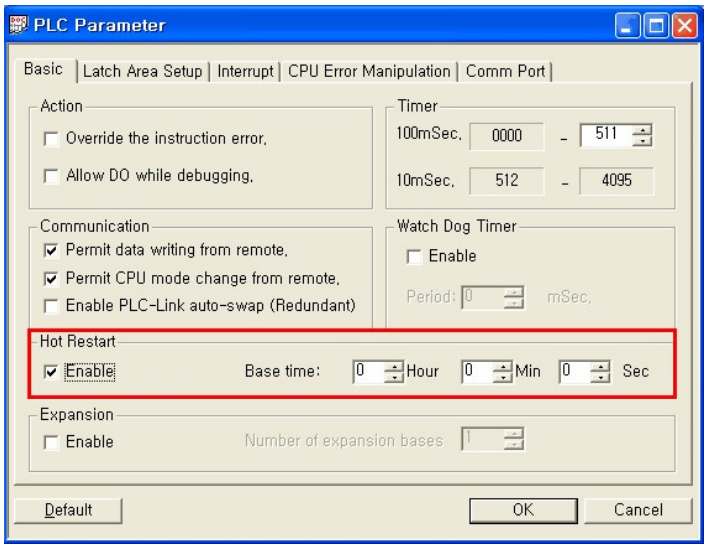
- This mode is operated by the program stored in the flash memory of a CPU card.
- If the power is OFF and ON after the ROM operation mode is set up, the program stored in a flash memory is copied to RAM and is operated. In this case, the program stored in RAM is cleared.
- If a program is stored in flash memory, the one is almost not cleared.
- It is safe to store a program in flash memory after making IL/LD program to operate in the ROM operation mode.

Setting Up in the CICON

- **Clear Flash Memory :** This is used to clear the program stored in flash memory.
- **Store In Flash Memory From RAM :** This is used to copy the program stored in RAM and to store it in flash memory.
- **Store In Flash Memory :** This is used to store the PLC operation program made by LD or IL in a flash memory directly.
- **ROM Operation Mode :** This is used to operate with the program stored in flash memory.
- **RAM Operation Mode :** This is used to operate the program stored in RAM.

5.5.2.4 Restart Mode

This is used to set up how to initialize variables and a system when the operation of a PLC is started in RUN mode by resuppling power or converting mode. There are two types such as Cold Restart and Hot Restart.



If you check the Hot Restart in the Parameter, a PLC is operated in the Hot Restart mode up to the Base Time. Otherwise, it is operated in the Cold Restart mode.

Cold Restart

- The operation is in this mode if the Hot Restart is not checked in the Parameter.
- This is used to clear all data as '0' and to enter the initialization value for only the variables with initialization values.

Hot Restart

- If the operation is in the RUN mode when power is off and is resupplied, and the time from power failure to resupply is within the set time to permit the Hot Restart, the operation is in the Hot Restart mode.
- This is used to restore all data and the factors for running a program to the state prior to power failure and to operate.
- As a program is run again in the state prior to power failure, the program is kept continuously against instantaneous break-down.
- In case that it is over the set time to permit the Hot Restart, the operation is in the Cold Restart mode.
- In case that the data is not kept against power failure, the operation is in the Cold Restart mode.

5.5.3 Type of Programs

Scan Program

- This is used to process constantly repeated signals every one scan.

Sub-Routine Program

- This is the program run by ECALL instruction in a scan program.

Initialization Program(Cold)

- This is run in case power is on and CPU is in RUN mode.
- This is used to set up the initial data for running a scan program, and to initialize other devices or the Internal Flags.

Initialization Program (Hot)

- This is run in case that resuppling time is within set time when power failure occurs under Hot Restart.
- After an initialization program(Hot) is run in the state to keep the former value, a scan program is run.

Constant Interval Interrupt Program

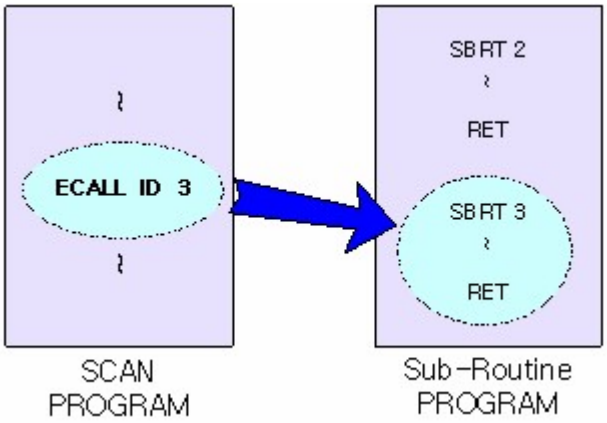
- This is the program run at regular intervals.

5.5.3.1 Scan Program

- This is used to process constantly repeated signals every one scan.

- Properties of Scan Program
  a. The input scan program is run in the order of program ID and is not duplicated.
  b. The Program Spare is the spare space to online-edit a program
  c. Select Scan Program as Program Type.

5.5.3.2 Sub-Routine Program



- This is the program run by ECALL instruction in a scan program.
- This is used to operate the instructions between SBRT n and RET in a sub-routine program according to the ECALL instruction in a scan program.
- Enter sub-routine file ID and sub-routine number to the ECALL instruction.

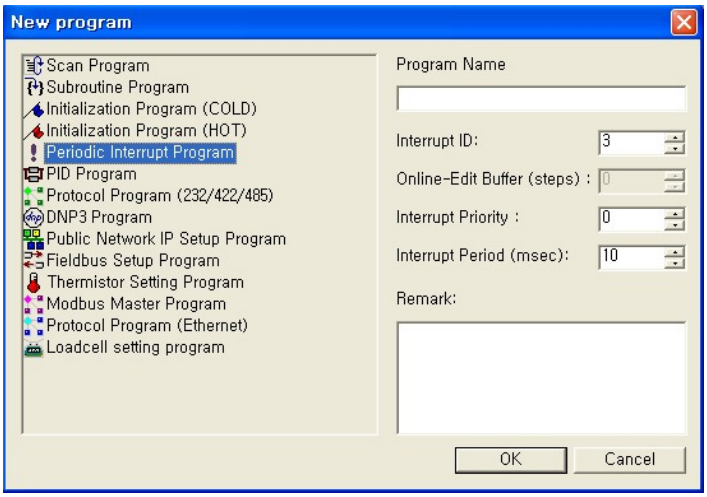
5.5.3.3 Initialization Program (Cold)

- This is run in case that power is ON and CPU is in RUN mode.
- After an initialization program is run, a scan program is run.
- This is used to set up the initial data for running a scan program, and to initialize other devices or Internal Flags.
- To end an initialization program, use INITEND instruction.

5.5.3.4 Initialization Program (Hot)

- This is run in case that resuppling time is within set time when power failure occurs under Hot Restart.
- After an initialization program(Hot) is run in the state to keep the former value, a scan program is run.
- After an initialization program is run, a scan program is run.
- To end an initialization program, use INITEND instruction.

5.5.3.5 Interrupt Program



- As content interval interrupt, this program is run at regular intervals.

- Setting Up Interrupt Program
  a. Assign the Interrupt ID in the range from 0 to 15, not to be duplicated.
  b. The Program Spare is the spare space to online-edit a program.
  c. Select the Constant Interval as Program Type.
  d. The lower number is , the higher priority is. The priority(Interrupt ID) is not to be duplicated with other program.
  e. Input the interval at which a program is run. (Setup Range 10ms ~ 655,350ms)
  f. A corresponding interrupt program is run by the EI instruction after it enables the interrupt program to be used by GEI instruction.

5.5.4 Self-Diagnosis

Scan Watch Dog Timer

- Watch Dog Timer is used to detect the operation delay by an error in user's program. (Enter a value in the range from 10㎳ to 6 s as the detecting time of the Watch Dog Timer in the Parameter.)
- While monitoring the scan time elapsed under operation, if it is detected to be over set time, the operation of a PLC is stopped immediately and all the output is reset.
- The ways to clear the error state of Watch Dog Timer are to resupply power or to convert mode to STOP mode.
- If an error in Watch Dog Timer occurs, Internal Flag F3.2 is set.

Checking whether Module Fixed or Unfixed

- This is the function used to detect whether the slot of the card built in a base is unfixed or connected incompletely.
- An error is indicated in case that a built module is unfixed or connected incompletely when power is ON.

Memory Check-Sum Error

- In case that there is an error in the flash memory of CPU or an error occurs in accessing Dual Port Ram, the error is indicated in Internal Flag Device F.

Battery Discharge

- The battery specifications are as follows.

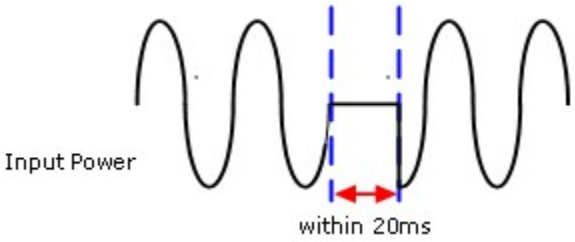
Item	Specification
Rated Voltage	DC 3.0 V
Usage	Program & Data Back-up, RTC Operation in case power failure
Type	Lithum Battery, 3V

- In case that the voltage of the battery is less than standard one, the Internal Flag F3.4 is set. At this time, the battery is to be replaced. If there is no battery, the programs are kept by an inside super capacitor for several minutes.

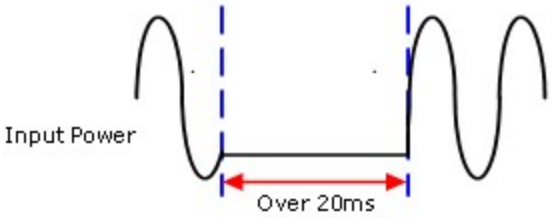
Power Failure

- A CPU module detects the instantaneous power failure when the voltage of input power is lower than the standard.
- If the CPU detects the instantaneous power failure, the following operation is processed to protect an error in action.

The case of instantaneous power failure is within 20㎳



The case of instantaneous power failure over 20ms



5.5.5 Built-In Functions

Clock Function

This is used to read a time from RTC and to store the result in the device assigned to F.

Device F	Stored Details	Example
F040	Year of Clock Data	Year 2001 H07d1
F041	Month & Day of Clock Data (Upper:Month, Lower:Day)	July 20 H0714
F042	Hour & Minute of Clock Data (Upper:Hour, Lower:Minute)	12 : 30 H0c1e
F043	Second & Day of the Week (Upper:Second, Lower:Day of the Week)	10s Friday H0a05

Indicating Days of the Week

Sun	Mon	Tue	Wed	Tur	Fri	Sat
0	1	2	3	4	5	6

Setting Up I/O Reservation Function

This is the function used to detect whether a card is inserted to an assigned slot correctly and to reserve that a program is written without changing the number of I / O when spare parts are substituted in case of expansion or break-down.

- It is available to assign the common points of I/O for each slot by 0 point or 16 points or 32 points or 64 points.

- In case that common points is less than actual points, the I/O points used are reduced. In case that common points are greater than actual points, the I/O points used are increased to be Dummy points.

- Actual points are occupied in the slots which are not assigned and 16 points are used in common with a blank slot.

- The case that an inserted module is different type from an set module is processed as major error.

- Example to assign I/O addresses
  In case that parameters are not assigned, assigning I/O devices according to the state of I/O

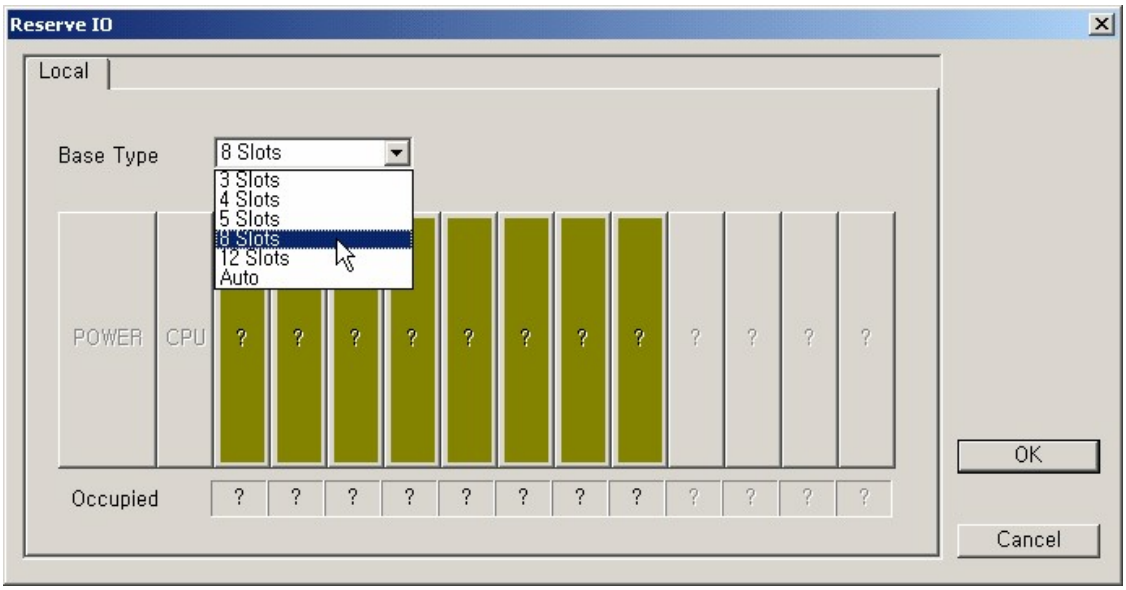
In case of 8 slots

POWER	CPU	00 ~ 0F	10 ~ 1F	20 ~ 2F	30 ~ 3F	40 ~ 4F	50 ~ 5F	60 ~ 6F	70 ~ 7F

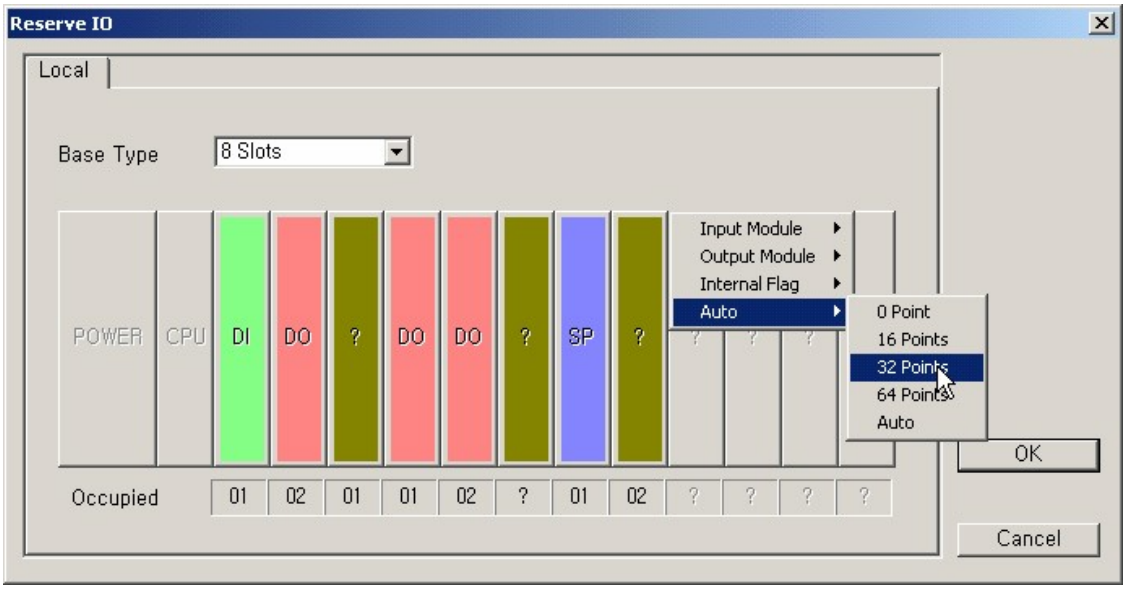
In case parameters are assigned, assigning I/O devices according to the state of I/O

POWER	CPU	Input 16p	Input 32p	Blank	Output 8p	Output 16p	Output 32p	Blank	I.Flag 16p
		00 ~ 0F	10 ~ 2F	30 ~ 3F	40 ~ 47	50 ~ 5F	60 ~ 7F	80 ~ 8F	90 ~ 9F

If you select "Reserve I/O" in a Parameter dialog box or double-click "Reserve I/O" on a Project window, a "Reserve IO" dialog box will appear. Select the "Base Type" in the dialog box.
If the Automatic is selected, I/O addresses are automatically assigned according to the points of inserted cards .



Reserving I/O



- Reserving I/O by modules is available and the points for I/O devices are secured by the Automatic.
- The case that an inserted module is different type from a set module is processed as major error. For example, if an output module is inserted after an input module is mounted, it is processed as major error. The points of assigned cards are indicated on the bottom.

Online-Editing a Program

- This is the function to edit the contents of a program while a PLC is in e Run mode.

- Steps to Online-Edit a program
  1. Enter the Program Spare in the Program Block dialog box to edit a program while it runs. 100 Steps are assigned as a initial value.
  2. Click the Start Program while running icon while a PLC runs.
  3. If you click the Finish icon after a program has been edited, the edited program will be downloaded and the PLC is operated by the program.

5.6 Instruction Overview

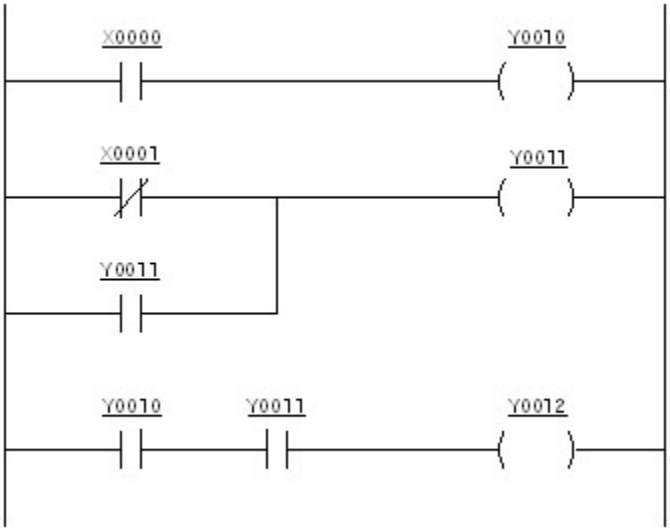
- Types of Instructions
- Configuration of Instructions
- Numerical Values
- Processing in Bit
- Processing in Word
- Error
- Basic Instructions
- Application Instructions

5.6.1 Devices

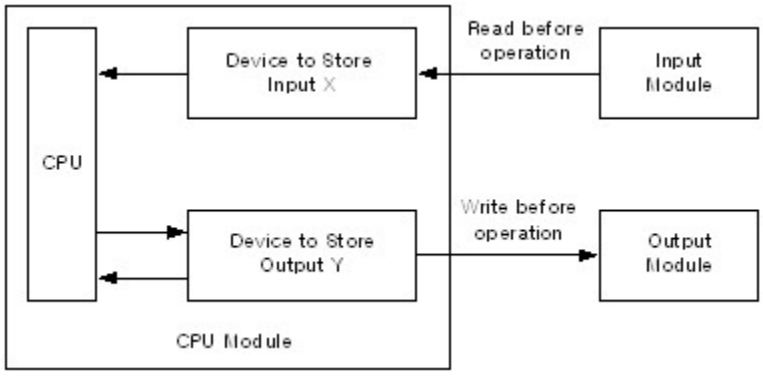
- Input/Output X, Y
- Auxiliary Relay M
- Keeep Relay K
- Link Relay L
- Timer T
- Counter C
- Data Register D
- Indirect Data Register @D
- Index Qualification R
- Step Control Relay S
- Internal Flag (Relay) F
- Indicating Device Addresses
- CPU device memory capacity

5.6.1.1 Input/Output X, Y

Input/Output X, Y are the devices corresponding to outer devices. X, as input part, is used to receive signals from the push buttons and the limit switches that are used as input devices. Y is used to deliver the result of the operation to the solenoid valves, motors, lamps and etc that are used as output devices.
As input status is reserved in Input X, Contact a & b of it can be used. In Output Y, only Contact a can be used.



< Configuration of Input/Output Circuit >



< Input/Output Device Setup Process >

As X & Y have the devices corresponding to contacts of each input/output module in a one-to-one ratio in <Figure 2>, in case that a PLC is scanning, an operation will run irrelevantly to the contact status of the input/output module in the memory(X, Y) of CPU. After the operation, the contents in Memory Device Y corresponding to the output contact are outputted to an output module. For the next operation, the contact status

of the input module is reserved in the Memory Device X corresponding to the input contact.

5.6.1.2 Auxiliary Relay M

Direct output to outside is not available by the relay in a PLC but the output in connection with Input/Output X, Y is available. In case that power is on and a PLC runs, the devices except the device assigned to non-volatile device will be cleared as 0. Contact a & b can be used.

5.6.1.3 Keeep Relay K

This is used as same as Auxiliary Relay M. In case that power is on or a PLC runs, Contact a & b can be used as the device for storing previous data. If the followings are run, data will be cleared.

1. Data initialization program
2. Clear in handy loader
3. Clear in CICON

5.6.1.4 Link Relay L

This is the device used as special contact in case that a computer link module and a data link module are used. It is not available to output directly to outside. In case that a computer link module and a data link module are not used, this can be used as same as Auxiliary Relay M.

5.6.1.5 Timer T

The standard timings are 10ms and 100ms. According to 5 instruction types, counting types are different each other. The value can be set up to max. hFFFF(65535) in decimal or hexadecimal number.

S1 : Timer Contact Number

S2 : Set value

5.6.1.6 Counter C

- The value can be set up to max. hFFFF(65535) in decimal or hexadecimal number.
- Type of counter : CTU, CTD, CTUD, CTR
- Reference : Counter Instruction

5.6.1.7 Data Register D

This, in which internal data are stored, is used to read and write in 16 bit & 32 bit. In case of 32 bit, an assigned number will be Lower 16 bit and the number + 1 will be Upper 16 bit.

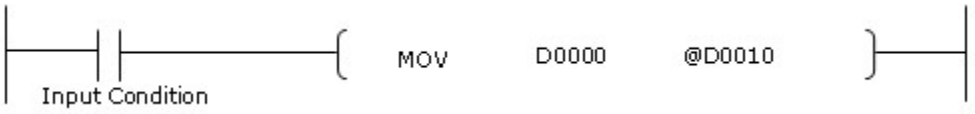
[Ex] In case of using 32 bit instruction for D0010,

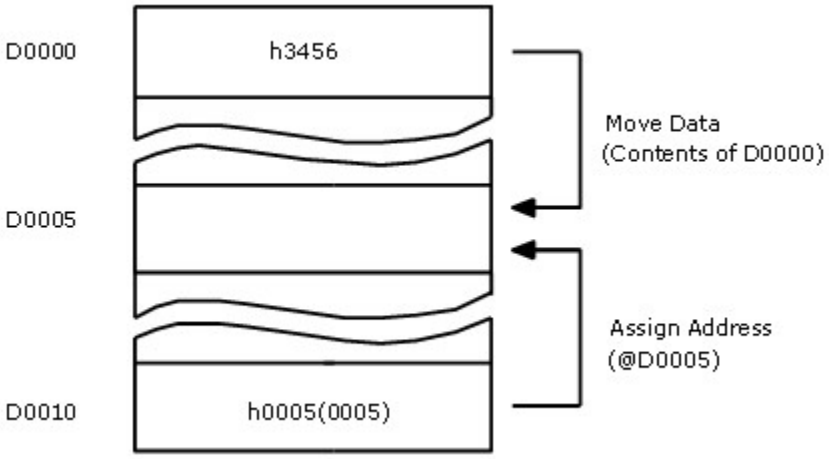
- D0010 : Lower 16 bit
- D0011 : Upper 16 bit

5.6.1.8 Indirect Data Register @D

This is used to assign the data value in Data Register to the Destination number of an instruction.

[Ex.]



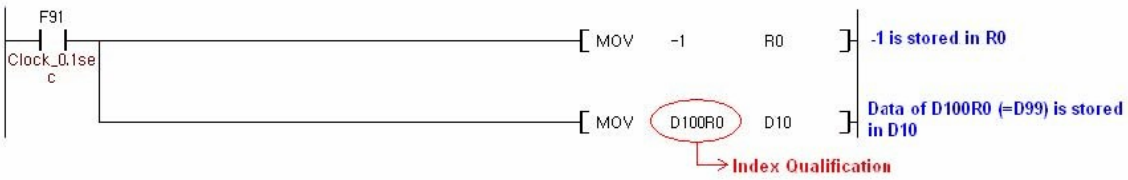


5.6.1.9 Index Qualification R

This is issued to notify a new sequence programming scheme of CIMON PLCs (CP and XP CPU). The new scheme provides another indirect addressing solution by using 16 index registers.

Index Qualification

An index register is used for index qualification (indirect addressing) of a device in sequence program. Index qualification uses one index register and is specified by 16 bit data (-32767 – 32767 or 0000h – FFFFh). The index registers are represented as 'R00' – 'R15'. Following sample sequence program shows a simple index qualification example.



The index qualification data type is dependent on the type of referenced device. Following table explains the data types of the values stored in the index registers.

Device	Qualified data type	Remark
X, Y, M, L, K, F	The value in index register represents the number of bits. (bit offset)	If these devices were referenced in the word type instruction, the remainder of index value divided by 16 is ignored. For example, assume that R0 is 18, and following instruction was used : **MOV M0030R0 D0100** Then, the word value stored in M0040 will be moved to D0100. That is, any value between 16 and 31 in R0 brings the same result with the above instruction.
D	The value in index register represents the number of words. (word offset)	
T, C, S, Z	Cannot be qualified by the index register	

Supporting CPUs

The index qualification is supported by following version of CPU

- **CP Series**
  - Modules : CM1-CP4A/B/C/D/U, CM1-CP3A/B/P/U
  - OS Version : V3.0 or later

- **XP Series**
  - Modules : CM1-XP1A, CM1-XP2A, CM1-XP3A, CM1-XP1R
  - OS Version : V3.0 or later

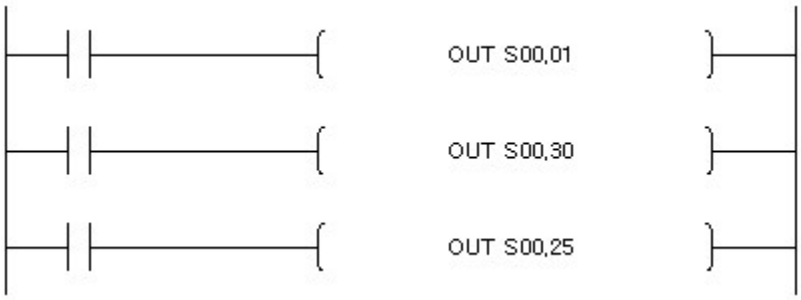
Required CICON

The index qualification is supported by following version of CICON.

- **CICON Version : V2.0 or later**

5.6.1.10 Step Control Relay S

This is used for Last-in-First- out and sequential control by instructions(OUT, SET). In case that power is on or a PLC starts to RUN, the devices except the device assigned by a parameter will be cleared as 0.



- OUT S00.30 : The last programmed step has priority in the same condition.

- SET S00.02 : Current step runs just in case that the previous step has run.
- SET S00.00 : SET xx.00, which is the condition to clear, runs irrelevantly to order.

5.6.1.11 Internal Flag (Relay) F

This is used to get information about the state or PLC, time, day and so on.

F Zone	Function	Description
F0000	F0000 : Run Mode	In case of RUN Mode, ON
	F0001 : Program Mode	In case of Program Mode, ON
	F0002 : Pause Mode	In case of Pause Mode, ON
	F0003 : Debug Mode	In case of Debug Mode, ON
	F0007 : Remote Mode	In case of Remote Mode, ON
	F000F : Execute Stop Instruction	In case of Executing Stop, ON
F0010	F0010 : Always ON	Always ON
	F0011 : Always OFF	Always OFF
	F0012 : ON at first scan only	ON for a SCAN
	F0013 : OFF at first scan only	OFF for a SCAN
	F0014 : Toggle at each scan	Invert every scan Unused
F0020	Reserved	-
F0030	F0030 : Major Breakdown	In case of major breakdown error, ON
	F0031 : Minor Breakdown	In case of minor breakdown error, OFF
	F0032 : WDT Error	In case of Watchdog Timer error, ON
	F0033 : I/O combined Error	In case of I/O combined Error, ON
	F0034 : Battery voltage low	In case of low voltage than standard, ON
	F0037 : Forced ON/OFF	In case of forced ON/OFF to I/O, ON

F0040	F0040 ~ 7 : I/O Error	If reserved I/O and mounted I/O are different, number of different SLOT stored. (0 ~ 11)
	F0048 ~ F : I/O Error	If reserved I/O and mounted I/O are different, number of different expansion stored. (0 ~ 11)
F0050	Error Code	-
F0070	In case of Dual Port RAM Access Error, Details	
	F0070 ~ 7	Number of slot(0 ~ 11) stored.
	F0078 ~ F	Number of expansions (0 ~ F) stored.
F0080	CM1-CP1A : "1A"	Type of PLC is displayed as ASCII value.
	CM1-CP1B : "1B"	
	CM1-CP1R : "1R"	
	CM1-CP2A : "2A"	
	CM1-CP2B : "2B"	
	CM1-CP3A : "3A"	
	CM1-CP3B : "3B"	
	CM1-CP4A : "4A"	
	CM1-CP4B : "4B"	
	CM1-BP : "B0"	
F0090	F0090 : 0.02s Interval SYSTEM CLOCK	ON / OFF in a constant interval under RUN operation. (During operation, initial value is 0)
	F0091 : 0.1s Interval SYSTEM CLOCK	
	F0092 : 0.2s Interval SYSTEM CLOCK	
	F0093 : 1s Interval SYSTEM CLOCK	
	F0094 : 2s Interval SYSTEM CLOCK	
	F0095 : 10s Interval SYSTEM CLOCK	
	F0096 : 20s Interval SYSTEM CLOCK	
	F0097 : 1m Interval SYSTEM CLOCK	
F0110	F0110 : In case of operation error, ON	To modify whenever operation
	F0111 : Zero Flag	Zero Flag
	F0112 : Carry Flag	Carry Flag
	F0118 : In case all outputs OFF, ON	In case all outputs OFF, ON
	F0119 : DPRAM Access Error	Details are stored in F0007
F0120	F0120 : < Flag	Less, ON
	F0121 : = Flag	Less or equal, ON
	F0122 : = Flag	Equal, ON
	F0123 : > Flag	Greater, ON
	F0124 : = Flag	Greater or equal, ON

	F0125 : ? Flag	Not equal, ON
F0130	On Slot 0, I/O is mounted	
F0140	On Slot 1, I/O is mounted	
F0150	On Slot 2, I/O is mounted	
F0160	On Slot 3, I/O is mounted	
F0170	On Slot 4, I/O is mounted	
F0180	On Slot 5, I/O is mounted	
F0190	On Slot 6, I/O is mounted	
F0200	On Slot 7, I/O is mounted	
F0210	On Slot 8, I/O is mounted	
F0220	On Slot 9, I/O is mounted	
F0230	On Slot A, I/O is mounted	
F0240	On Slot B, I/O is mounted	
F0250	On Slot C, I/O is mounted	
F0260	On Slot D, I/O is mounted	
F0270	On Slot E, I/O is mounted	
F0280	On Slot F, I/O is mounted	
F0290	Reserved	
F0300	Minimum Scan Time (Unit : msec)	
F0310	Current Scan Time (Unit : msec)	
F0320	Maximum Scan Time (Unit : msec)	
F0330 ~ F0390	Reserved	
F0400	Stored year in clock data (EX : 2001)	
F0410	Stored month and date in clock data (Upper : Month , Lower : Date)	
F0420	Stored day of the week and jour in clock data (Upper : weekday, Lower : Second)	
F0430	Stored minute and second in clock data (Upper : minute, Lower : Second)	
F0440	Reserved	
F0450	Year when power is On is stored. (EX " 2001)	
F0460	Month and day when power is ON is stored.	
F0470	Day of the week and Hour when power is ON is stored.	
F0480	Minute and Second when power is ON is stored.	
F0490	Reserved	
F0500	Count AC Fail	
F0510	Year in case of AC Fail is stored. (EX : 2001)	
F0520	Month and Day in case of AC Fail is stored.	
F0530	Day of the week and Hour in case of AC Fail is stored.	
F0540	Minute and Second in case of AC Fail is stored.	

5.6.1.12 Indicating Device Addresses

Bit Data

[Device Symbol] + [Card No.] + [Bit No.]

- Usable Device Symbol : X, Y, M, K, L, F
- Card No. : Decimal 3 Character
- Bit No. : Hexadecimal 1 Character
- Ex. : X000E, Y0012, M034F, K0120, L023C, F0093

Word Data

[Device Symbol] + [Card No.]

- Usable Device Symbol : D, Z, T, C
- Card No. : Decimal 4 Character
- Ex. : D1234, Z0001, T0011, C1023

Timer, Counter Output Contact

[Device Symbol] + [Bit No.]

- Usable Device Symbol : T, C
- Card No. : Decimal 4 Character
- Ex. : T0003, C0567

Step Controller Contact

[Device Symbol] + [Card No.] + [.] + [Bit No.]

- Usable Device Symbol : S
- Card No. : Decimal 2 Character
- Step No. : Decimal 2 Character
- Ex. : S00.00, S12.78

Bit Device in Words(Card)

[Device Symbol] + [Card No.] + [0]

- Usable Device Symbol : X, Y, M, K, L, F

- Card No. : Decimal 3 Character
- Ex. : X0110, Y0330, M0440, K0000, L0040, F0130

5.6.1.13 CPU device memory capacity

XP CPU

Device Type	X	Y	M	L	K	F	T	C	S	D	Z	R
XP1R/A	8,192	8,192	16,000	16,000	16,000	2,048	4,096	4,096	100 *100	32,000	2,048	16
XP2A	4,096	4,096										
XP3A	2,048	2,048										

CP CPU

Device Type	X	Y	M	L	K	F	T	C	S	D	Z	R
CM1-CP3A/B/P	1,024	1,024	8192	2,048	2,048	2,048	1,024	1,024	100* 100	10,000	2,048	16
CM1-CP4A/B/C/D	384	384								5,000		

BP CPU

Device Type	X	Y	M	L	K	F	T	C	S	D	Z
BP32M	128	128	4,096	1,024	1,024	2,048	256	256	100* 100	5,000	1,024
BP16M	8	7								1,000	

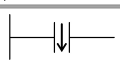
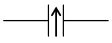
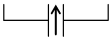
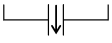
PLCS CPU

Device Type	X	Y	M	L	K	F	T	C	S	D	Z	R
CM3-SP32MDT/V/E/F	1,024	1,024	8,192	4,096	4,096	2,048	512	512	100* 100	10,000	1,024	16
CM3-SP16MDR/V/E/F												

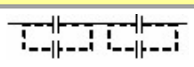
5.6.2 Basic Instructions

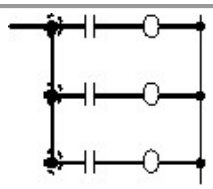
- Contact Instruction
- Connection Instruction

5.6.2.1 Contact Instruction

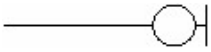
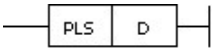
Group	Instruction Sign	Symbol	Details of Process	Excution Condition	No. of Step
Contact	LD		Starts Logical operation (Contact a)		1
	LDI		Starts Logical operation (Contact b)		1
	AND		Logical product (Contact a connection in series)		1
	ANDI		Logical product NOT(Contact b connection in series)		1
	OR		Logical sum (Contact a connection in parallel)		1
	ORI		Logical sum NOT(Contact b connection in parallel)		1
	LDP		Starts leading edge pulse operation		1
	LDF		Starts Trailing edge pulse operation		1
	ANDP		Leading edge pulse series connection		1
	ANDF		Trailing edge pulse series connection		1
	ORP		Leading edge pulse parallel connection		1
	ORF		Trailing edge pulse parallel connection		1
	INV		Inverts result of operation. (NOT)		1

5.6.2.2 Connection Instruction

Group	Instruction Sign	Symbol	Details of Process	Execution Condition	No. of Steps
Connection	ANB		AND between logical BLKs (Connection in series)		1

	ORB		OR between logical BLK (Connection in Parallel)		1
	MPS		Remembers result of operation		1
	MRD		Reads memory in MPS		1
	MPP		Reads and resets memory in MPS		1

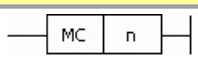
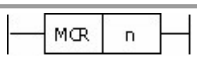
5.6.2.3 Output Instruction

Group	Instruction Sign	Symbol	Details of Process	Execution Condition	No. of Steps
Output	OUT		Output a device		1
	SET		Sets a device		1
	RST		Resets a device		1
	PLS		Generates the pulse for 1 scan of program in case input signal is in rising edge.		1
	PLF		Generates the pulse for 1 scan of program in case input signal is in falling edge.		1

5.6.2.4 Step Control Instruction

Group	Instruction Sign	Symbol	Details of Process	Execution Condition	No. of Steps
Step Control	OUT Sxx.xx		후입 우선 제어 Device 의 Output		1
	SET Sxx.xx		Step Control Device SET		1

5.6.2.5 Master Control Instruction

Group	Instruction Sign	Symbol	Details of Process	Execution Condition	No. of Steps
Master Control	MC		Start a master control		1
	MCR		Ends a master control		1

5.6.2.6 Termination Instruction

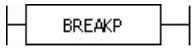
Group	Instruction Sign	Symbol	Details of Process	Execution Condition	No. of Steps
END	PEND	PEND	Ends a Main Routine Program		1
	END	END	Ends a Sequence Program		1
	CEND	CEND		⎍	
	CENDP	CENDP		⎍↑	

5.6.2.7 Program branch Instruction

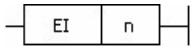
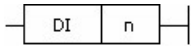
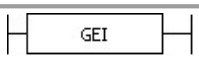
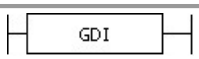
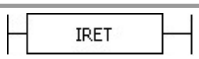
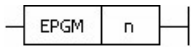
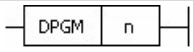
Group	Instruction Sign	Symbol	Details of Process	Execution Condition	No. of Steps
Jump	JMP	JMP n		⎍	2
	JMPP	JMPP n		⎍↑	2
	JME	JME n			2
Sub-routine	CALL	CALL n	Executes sub-routine program n when input condition is met.	⎍	2
	CALLP	CALLP n		⎍↑	2
	ECALL	ECALL n		⎍	3
	ECALLP	ECALLP n		⎍↑	3
	SBRT	SBRT n		⎍	2
	RET	RET			1

5.6.2.8 Structure Creation Instruction

Group	Instruction Sign	Symbol	Details of Process	Execution Condition	No. of Steps
Repeat	FOR	FOR n	Runs the instructions from (FOR) to (NEXT) n times		2
	NEXT	NEXT			1
End	BREAK	BREAK	Forces to end the instruction from (FOR) to (NEXT)		1

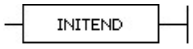
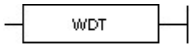
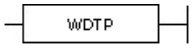
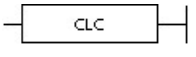
	BREAKP				1

5.6.2.9 Program run control Instruction

Group	Instruction Sign	Symbol	Details of Process	Execution Condition	No. of Steps
Interrupt Program	EI				2
	DI				2
	GEI				1
	GDI				1
	IRET				1
Scan Program	EPGM				2
	DPGM				2

[참고] EPGM, DPGM명령은 같은 스캔에서 같은 프로그램에 대해 동시에 조건이 On되어서는 안됩니다.

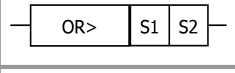
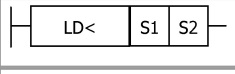
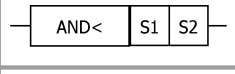
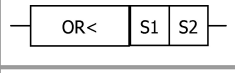
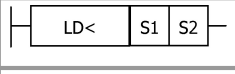
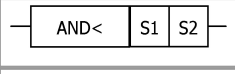
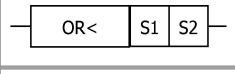
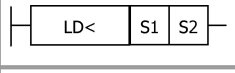
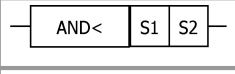
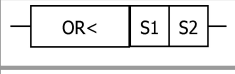
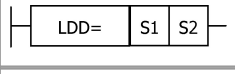
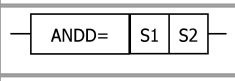
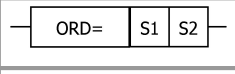
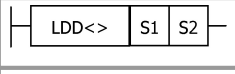
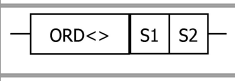
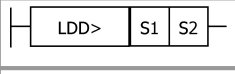
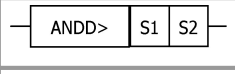
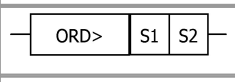
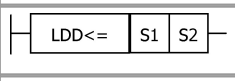
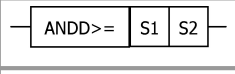
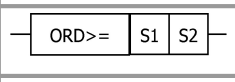
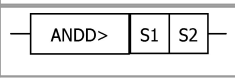
5.6.2.10 Other Instructions

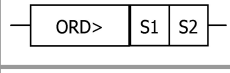
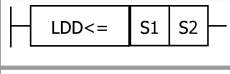
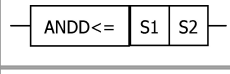
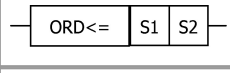
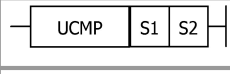
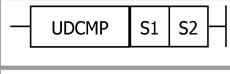
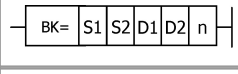
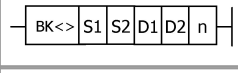
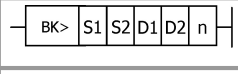
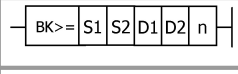
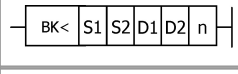
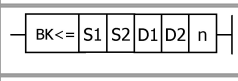
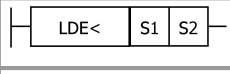
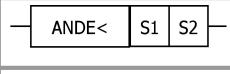
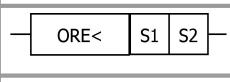
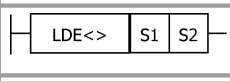
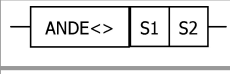
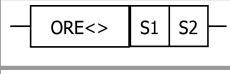
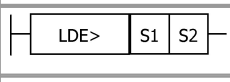
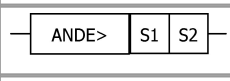
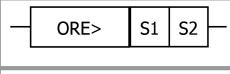
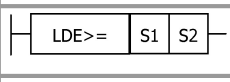
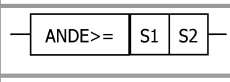
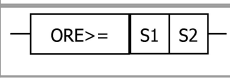
Group	Instruction Sign	Symbol	Details of Process	Execution Condition	No. of Steps
Stop	STOP		Converts to program mode after ending the current scan to stop running at the desired time		1
Run	INITEND		Ends an initialization program and run a scan program		1
WDT Reset	WDT		Resets WDT(Watch dog time) in a sequence Program		1
	WDTP				1
Carry	STC		Makes a Carry Flag contact ON		1
	CLC		Makes a Carry Flag OFF		1

5.6.3 Application Instructions

5.6.3.1 Comparison Operation Instruction

Group	Instruction Sign	Symbol	Details of Process	Execution Condition	No. of Steps
Compare 16 BIT Data	LD=	LD= S1 S2	If (S1)=(S2), Switches ON. If (S1)≠(S2), Switches OFF		3
	AND=	AND= S1 S2			3
	OR=	OR= S1 S2			3
	LD<>	LD<> S1 S2	If (S1) ≠ (S2), Switches ON If (S1)=(S2), Switches OFF.		3
	AND<>	AND<> S1 S2			3
	OR<>	OR<> S1 S2			3
	LD>	LD> S1 S2	If (S1)>(S2), Switches ON. If (S1)<=(S2), Switches OFF.		3
	AND>	AND> S1 S2			3

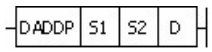
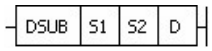
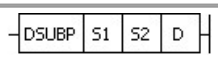
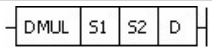
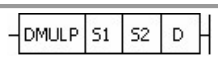
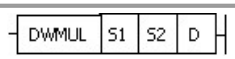
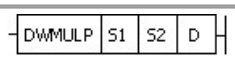
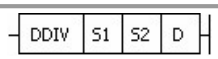
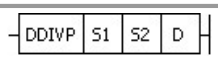
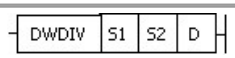
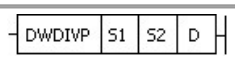
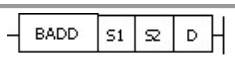
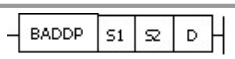
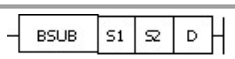
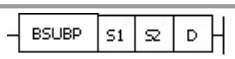
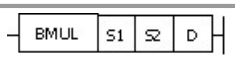
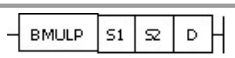
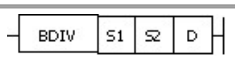
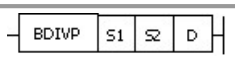
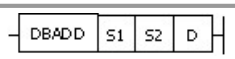
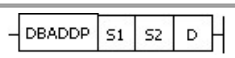
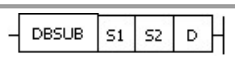
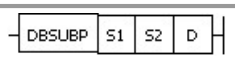
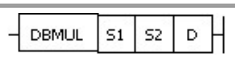
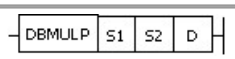
	OR>				3
	LD>=		If (S1)>=(S2), Switches ON. If (S1)<(S2), Switches OFF.		3
	AND>=				3
	OR>=				3
	LD<		If (S1)<(S2), Switches ON. If (S1)>=(S2), Switches OFF		3
	AND<				3
	OR<				3
	LD<=		If (S1)<=(S2), Switches ON. If (S1)>(S2), Switches OFF.		3
	AND<=				3
	OR<=				3
Compare 32 BIT Data?	LDD=		If (S1+1,S1) =(S2+1,S2), switches ON. If (S1+1,S1) ≠(S2+1,S2), switches OFF.		3
	ANDD=				3
	ORD=				3
	LDD<>		If (S1+1,S1)≠(S2+1,S2), switches ON. If (S1+1,S1)=(S2+1,S2), switches OFF.		3
	ANDD<>				3
	ORD<>				3
	LDD>		If (S1+1,S1)>(S2+1,S2), switches ON If (S1+1,S1)<=(S2+1,S2), switches OFF.		3
	ANDD>				3
	ORD>				3
	LDD>=		If (S1+1,S1)>=(S2+1,S2), switches ON. If (S1+1,S1)<(S2+1,S2), switches OFF.		3
	ANDD>=				3
	ORD>=				3
	LDD<		If (S1+1,S1)<(S2+1,S2), switches ON. If (S1+1,S1)>=(S2+1,S2), Switches OFF		3
	ANDD<				3

	ORD<				3
	LDD<=		If S1+1,S1)<=(S2+1,S2), switches ON. If (S1+1,S1)>(S2+1,S2), switches OFF.		3
	ANDD<=				3
	ORD<=				3
Compare 16Bit/32Bit Unsigned Data	UCMP				3
	UDCMP				3
Compare Block	BK=				6
	BK<>				6
	BK>				6
	BK>=				6
	BK<				6
	BK<=				6
Compare Real number	LDE=				3
	ANDE=				3
	ORE=				3
	LDE<>		((S1,S1+1) ? (S2,S2+1), switches ON. (S1,S1+1) = (S2,S2+1), switches OFF.		3
	ANDE<>				3
	ORE<>				3
	LDE>		(S1,S1+1) > (S2,S2+1), switches ON. (S1,S1+1) <= (S2,S2+1), switches OFF.		3
	ANDE>				3
	ORE>				3
	LDE>=		(S1,S1+1) >= (S2,S2+1), switches ON. (S1,S1+1) < (S2,S2+1), switches OFF.		3
	ANDE>=				3
	ORE>=				3

	LDE<	LDE< S1 S2	(S1,S1+1) < (S2,S2+1), switches ON. (S1,S1+1) <= (S2,S2+1), switches OFF.		3
	ANDE<	ANDE< S1 S2			3
	ORE<	ORE< S1 S2			3
	LDE<=	LDE<= S1 S2	(S1,S1+1) <= (S2,S2+1), switches ON. (S1,S1+1) > (S2,S2+1), switches OFF		3
	ANDE<=	ANDE<= S1 S2			3
	ORE<=	ORE<= S1 S2			3

5.6.3.2 Arithmetic Operation Instruction

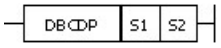
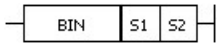
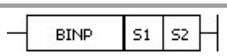
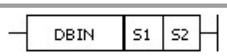
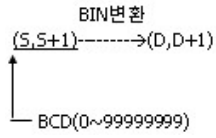
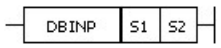
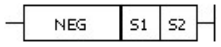
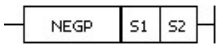
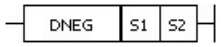
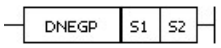
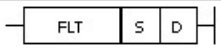
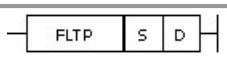
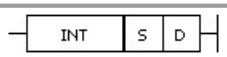
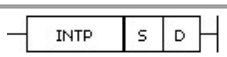
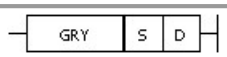
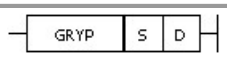
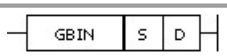
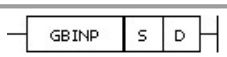
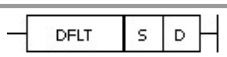
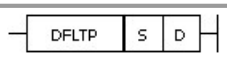
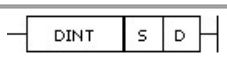
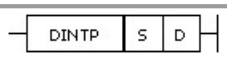
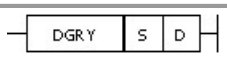
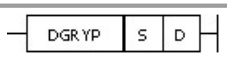
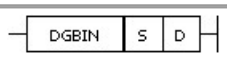
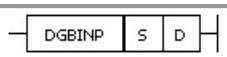
Group	Instruction Sign	Symbol	Details of Process	Execution Condition	No. of Steps
Add/Subtract/Multiply/Divide BIN 16-bit	ADD	ADD S1 S2 D	(S1) + (S2) -> (D)		4
	ADDP	ADDP S1 S2 D			4
	SUB	SUB S1 S2 D	(S1) - (S2) ->(D)		4
	SUBP	SUBP S1 S2 D			4
	MUL	MUL S1 S2 D	(S1) * (S2) -> (D.D+1)		4
	MULP	MULP S1 S2 D			4
	WMUL	WMULP S1 S2 D	(S1) * (S2) -> (D)		4
	WMULP	WMULP S1 S2 D			4
	DIV	DIV S1 S2 D	(S1) / (S2) -> (D,D+1)		4
	DIVP	DIVP S1 S2 D			4
	WDIV	WDIV S1 S2 D	(S1) / (S2) -> (D)		4
	WDIVP	WDIVP S1 S2 D			4
	WSUM	WSUM S D n	(S)+(n)Word data -> (D, D+1)		4
	WSUMP	WSUMP S D n			4
Add/Subtract/Multiply/Divide BIN	DADD	DADD S1 S2 D	(S1,S1+1) + (S2,S2+1) -> (D,D+1)		4

32-bit	DADDP				4
	DSUB		(S1,S1+1) - (S2,S2+1) ->(D,D+1)		4
	DSUBP				4
	DMUL		(S1,S1+1) * (S2,S2+1) -> (D,D+1,D+2, D+3)		4
	DMULP				4
	DWMUL		(S1, S1+2) * (S2, S2+1) -> (D,D+1)		4
	DWMULP				4
	DDIV		(S1,S1+1) / (S2,S2+1) ->(D,D+1. D+2, D+3)		4
	DDIVP				4
	DWDIV		(S1,S1+1) / (S2,S2+1) -> (D,D+1)		4
	DWDIVP				4
Add/Subtract/Multiply/Divide BCD 16-bit	BADD		(S1) + (S2) -> (D)		4
	BADDP				4
	BSUB		(S1) - (S2) ->(D)		4
	BSUBP				4
	BMUL		(S1) * (S2) ->(D,D+1)		4
	BMULP				4
	BDIV		(S1) / (S2) -> (D,D+1)		4
	BDIVP				4
Add/Subtract BCD 8-Digit	DBADD		(S1,S1+1) + (S2,S2+1) -> (D,D+1)		4
	DBADDP				4
	DBSUB		(S1,S1+1) - (S2,S2+1) -> (D,D+1)		4
	DBSUBP				4
	DBMUL		(S1,S1+1) * (S2,S2+1) -> (D,D+1)		4
	DBMULP				4

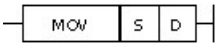
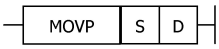
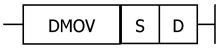
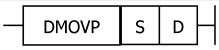
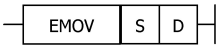
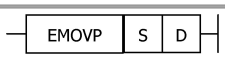
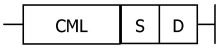
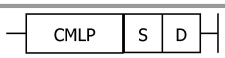
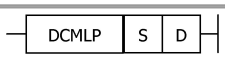
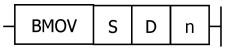
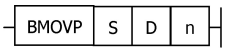
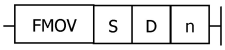
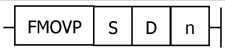
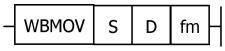
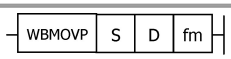
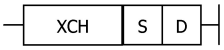
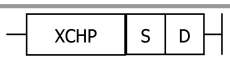
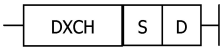
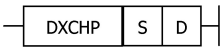
	DBDIV	DBDIV S1 S2 D	(S1,S1+1) / (S2,S2+1) -> (D,D+1)		4
	DBDIVP				4
Neal Number	EADD	EADD S1 S2 D	(S1,S1+1) + (S2,S2+1) ->(D,D+1)		4
	EADDP	EADDP S1 S2 D			4
	ESUB	ESUB S1 S2 D	(S1,S1+1) - (S2,S2+1) -> (D,D+1)		4
	ESUBP	ESUBP S1 S2 D			4
	EMUL	EMUL S1 S2 D	(S1,S1+1) * (S2,S2+1) ->(D,D+1)		4
	EMULP	EMULP S1 S2 D			4
	EDIV	EDIV S1 S2 D	(S1,S1+1) / (S2,S2+1) -> (D,D+1)		4
	EDIVP	EDIVP S1 S2 D			4
BIN DATA Increment	INC	INC D	D + 1 -> D		2
	INCP	INCP D			2
	DINC	DINC D	(D,D+1) + 1 -> (D,D+1)		2
	DINCP	DINCP D			2
BIN DATA Decrement	DEC	DEC D	D – 1 -> D		2
	DECP	DECP D			2
	DDEC	DDEC D	(D,D+1) – 1 -> (D,D+1)		2
	DDECP	DDECP D			2

5.6.3.3 Data Conversion Instruction

Group	Instruction Sign	Symbol	Details of Process	Execution Condition	No. of Steps
BIN -> BCD	BCD	BCD S1 S2	BCD변환 (S)----------→(D) BIN(0~9999)		3
	BCDP	BCDP S1 S2			3
	DBCD	DBCD S1 S2	BCD변환 (S,S+1)--------→(D,D+1)		3

	DBCDP				3
BCD -> BIN	BIN				3
	BINP				3
	DBIN				3
	DBINP				3
Invert Sign	NEG		(D) ---(D)		3
	NEGP				3
	DNEG		(D,D+1) ---(D,D+1)		3
	DNEGP				3
Data Conversion	FLT		(S) : 16bit BIN ? (D,D+1) : 32bit실수		3
	FLTP				3
	INT		(S,S+1) : 32bit실수 ? (D) : 16bit BIN		3
	INTP				3
	GRY		(S) : 16bit BIN ? (D) : 16bit Gray		3
	GRYP				3
	GBIN		(S) : 16bit Gray ? (D) : 16bit BIN		3
	GBINP				3
	DFLT		(S,S+1) : 32bit BIN ? (D,D+1) : 32bit실수		3
	DFLTP				3
	DINT		(S,S+1) : 32bit실수 ? (D,D+1) : 32bit BIN		3
	DINTP				3
	DGRY		(S,S+1) : 32bit BIN ? (D,D+1) : 32bit Gray		3
	DGRYP				3
	DGBIN		(S,S+1) : 32bit Gray ? (D,D+1) : 32bit BIN		3
	DGBINP				3

5.6.3.4 Data Transfer Instruction

Group	Instruction Sign	Symbol	Details of Process	Execution Condition	No. of Steps
Transfer	MOV		(S)->(D)		3
	MOVP				3
	DMOV		(S,S+1) ? (D,D+1)		3
	DMOVP				3
	EMOV		(S,S+1) ? (D,D+1)		3
	EMOVP				3
Transfer Not	CML		(S) ? (D)		3
	CMLP				3
	DCML		(S,S+1) -> (D,D+1)		3
	DCMLP				3
Transfer Block	BMOV				4
	BMOVP				4
	FMOV				4
	FMOVP				4
BIT Data Move	WBMOV				4
	WBMOVP				4
Exchange	XCH		(S)->(D)		3
	XCHP				3
	DXCH		(S,S+1) (D,D+1)		3
	DXCHP				3
Exchange Block	BXCH		(S)n (D)n		4

	BXCHP				4
Exchange Byte	SWAP	SWAP D	High Byte Low Byte (D) High Byte Low Byte		2
	SWAPP	SWAPP D			2

5.6.3.5 Data Table operation Instruction

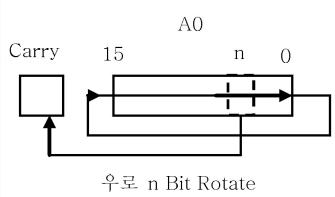
Group	Instruction Sign	Symbol	Details of Process	Execution Condition	No. of Steps
Data Table Operation	FIFW	FIFW S D			3
	FIFWP	FIFWP S D			3
	FIFR	FIFR S D			3
	FIFRP	FIFRP S D			3
	FPOP	FPOP S D			3
	FPOPP	FPOPP S D			3
	FINS	FINS S D n			4
	FINSP	FINSP S D n			4
	FDEL	FDEL S D n			4
	FDELP	FDELP S D n			4

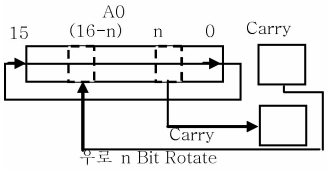
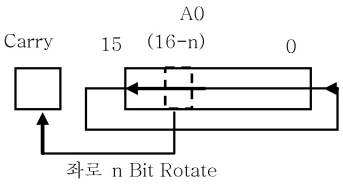
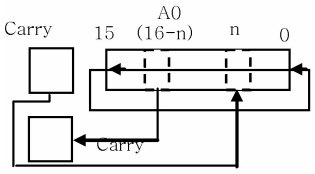
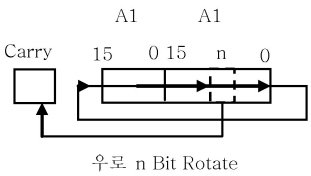
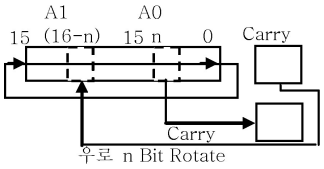
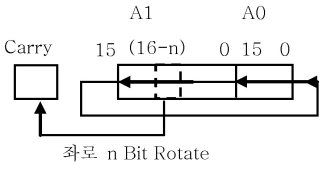
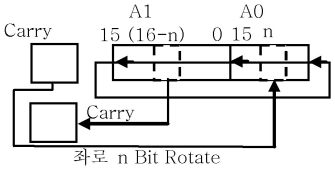
5.6.3.6 Logic operation Instruction

Group	Instruction Sign	Symbol	Details of Process	Execution Condition	No. of Steps
AND	WAND	WAND S1 S2 D	(S1)∧ (S2)->(D)		4
	WANDP	WANDP S1 S2 D			4
	DAND	DAND S1 S2 D	(D+1,D)∧ (S+1,S) ->(D+1,D)		4
	DANDP	DANDP S1 S2 D			4
OR	WOR	WOR S1 S2 D	(S1)∨(S2)->(D)		4
	WORP	WORP S1 S2 D			4

	DOR	DOR S1 S2 D	(D+1,D)∨(S+1,S) ->(D+1,D)		4
	DORP	DORP S1 S2 D			4
Exclusive OR	WXOR	WXOR S1 S2 D	(S1) ∀(S2) -> (D)		4
	WXORP	WXORP S1 S2 D			4
	DXOR	DXOR S1 S2 D	(S1+1,S1) ∀ (S2+1,S2) ->(D+1,D)		4
	DXORP	DXORP S1 S2 D			4
Exclusive NOR	WXNR	WXNR S1 S2 D	(S1)∀(S2) -> (D)		4
	WXNRP	WXNRP S1 S2 D			4
	DXNR	DXNR S1 S2 D	(S1+1,S1) ∀ (S2+1,S2) ->(D+1,D)		4
	DXNRP	DXNRP S1 S2 D			4
AND	BKAND	BKAND S D n	(S1) ∧ (S2) -> (D)		4
	BKANDP	BKANDP S D n			4
OR	BKOR	BKOR S D n	(S1) ∨ (S2) ->(D)		4
	BKORP	BKORP S D n			4
Exclusive OR	BKXOR	BKXOR S D n	(S1) ∀ (S2) ->(D)		4
	BKXORP	BKXORP S D n			4
Exclusive NOR	BKXNR	BKXNR S D n	(S1) ∀ (S2) ->(D)		4
	BKXNRP	BKXNRP S D n			4

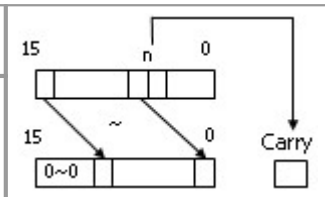
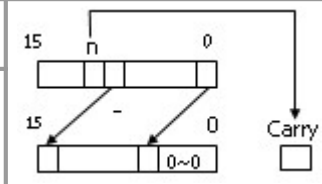
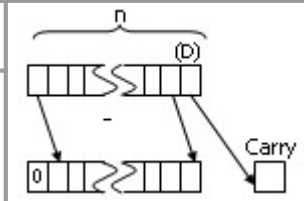
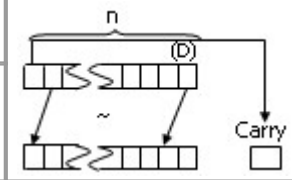
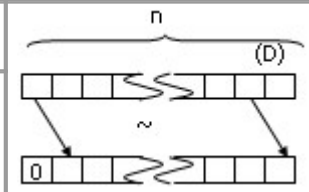
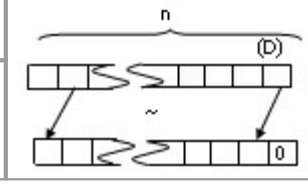
5.6.3.7 Rotation Instruction

Group	Instruction Sign	Symbol	Details of Process	Execution Condition	No. of Steps
Right Rotation	ROR	ROR D n			3
	RORP	RORP D n			3

	RCR	RCR D n			3
	RCRP	RCRP D n			3
Left Rotation	ROL	ROL D n			3
	ROLP	ROLP D n			3
	RCL	RCL D n			3
	RCLP	RCLP D n			3
Right Rotation	DROR	DROR D n			3
	DRORP	DRORP D n			3
	DRCR	DRCR D n			3
	DRCRP	DRCRP D n			3
Left Rotation	DROL	DROL D n			3
	DROLP	DROLP D n			3
	DRCL	DRCL D n			3
	DRCLP	DRCLP D n			3

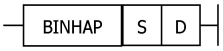
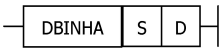
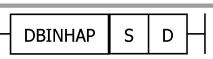
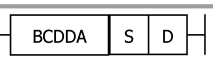
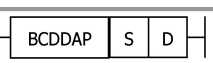
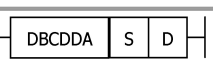
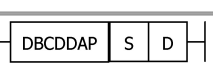
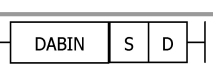
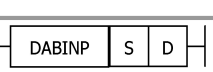
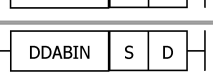
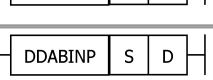
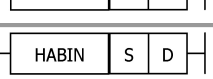
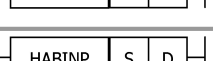
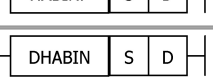
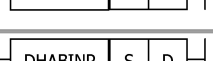
5.6.3.8 Shift Instruction

Group	Instruction Sign	Symbol	Details of Process	Execution Condition	No. of Steps

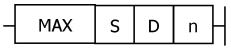
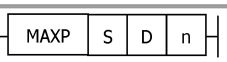
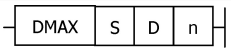
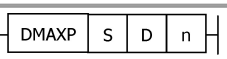
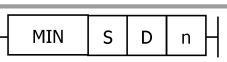
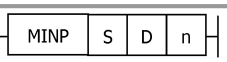
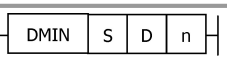
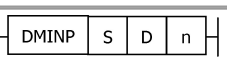
n BIT Shift	SFR	SFR D n			3
	SFRP	SFRP D n			3
	SFL	SFL D n			3
	SFLP	SFLP D n			3
1 BIT Shift	BSFR	BSFR D n			3
	BSFRP	BSFRP D n			3
	BSFL	BSFL D n			3
	BSFLP	BSFLP D n			3
1 WORD Shift	DSFR	DSFR D n			3
	DSFRP	DSFRP D n			3
	DSFL	DSFL D n			3
	DSFLP	DSFLP D n			3

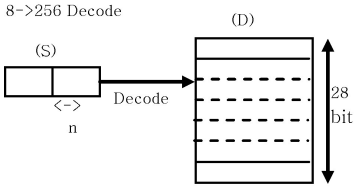
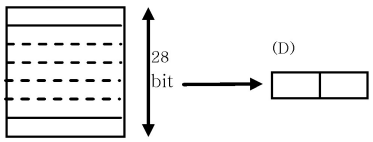
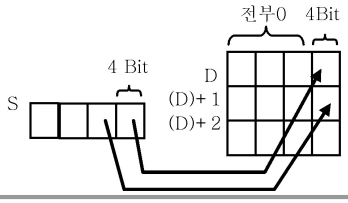
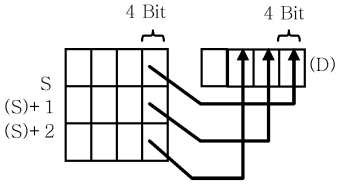
5.6.3.9 Character string Processing Instruction

Group	Instruction Sign	Symbol	Details of Process	Execution Condition	No. of Steps
Exchange ASCII	BINDA	BINDA S D	Converts to ASCII Code and stores in D.		3
	BINDAP	BINDAP S D			3
	DBINDA	DBINDA S D			3
	DBINDAP	DBINDAP S D			3
	BINHA	BINHA S D	Hexadecimalizes, converts to ASCII Code and stores in D.		3

	BINHAP				3
	DBINHA				3
	DBINHAP				3
	BCDDA		Converts BCD 4 digits to ASCII code and stores in D.		3
	BCDDAP				3
	DBCDDA				3
	DBCDDAP				3
Exchange BIN Data	DABIN		Stores Decimal ASCII data as BIN 16-bit data		3
	DABINP				3
	DDABIN		Decimal ASCII data를 BIN 32Bit data로 저장		3
	DDABINP				3
	HABIN		Stores hexaDecimal ASCII data as BIN 16Bit data		3
	HABINP				3
	DHABIN		Stores hexaDecimal ASCII data as BIN 32Bit data		3
	DHABINP				3

5.6.3.10 Data Processing Instruction

Group	Instruction Sign	Symbol	Details of Process	Execution Condition	No. of Steps
Maximum value search	MAX		Searches max. in n-block of 16bit and store in D.		4
	MAXP				4
	DMAX		Stores 1st max. in the searched device.		4
	DMAXP				4
Minimum value search	MIN		Searches min, in n-block of 16bit and stores in D.		4
	MINP				4
	DMIN		Stores 1st min. in the searched device.		4
	DMINP				4

SET bit check	SUM	SUM S D	Searches sum, in n-block of 16bit and stores in D.		3
	SUMP	SUMP S D			3
	DSUM	DSUM S D	Stores 1st sum. in the searched device.		3
	DSUMP	DSUMP S D			3
Segment	SEG	SEG S D			3
	SEGP	SEGP S D			3
Decode Encode	DECO	DECO S D n	8->256 Decode 		4
	DECOP	DECOP S D n			4
	ENCO	ENCO S D n	256-> 8 Encode 		4
	ENCOP	ENCOP S D n			4
Dissociate Unite	DIS	DIS S D			3
	DISP	DISP S D			3
	UNI	UNI S D			3
	UNIPP	UNIPP S D			3
Data Scaling	SCL	SCL S D T n			5
	SCLP	SCLP S D T n			5
	DSCL	DSCL S D T n			5
	DSCLP	DSCLP S D T n			5

5.6.3.11 Bit Processing Instruction

Group	Instruction Sign	Symbol	Details of Process	Execution Condition	No. of Steps

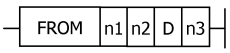
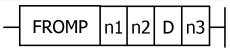
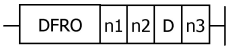
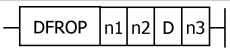
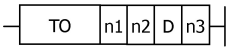
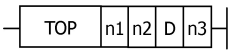
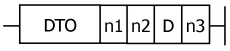
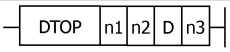
TEST	TEST	TEST S1 S2 D			4
	TESTP	TESTP S1 S2 D			4
	DTEST	DTEST S1 S2 D			4
	DTESTP	DTESTP S1 S2 D			4
BIT SET RESET	BSET	BSET D n			3
	BSETP	BSETP D n			3
	BRST	BRST D n			3
	BRSTP	BRSTP D n			3

5.6.3.12 Clock Instruction

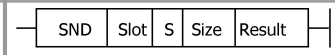
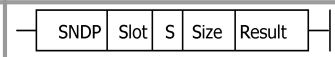
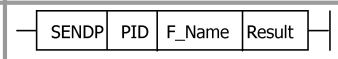
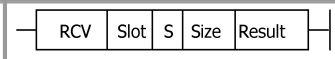
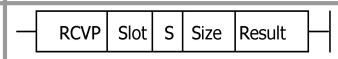
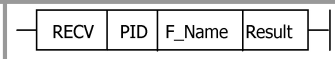
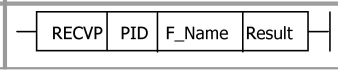
Group	Instruction Sign	Symbol	Details of Process	Execution Condition	No. of Steps
Add and subtract clock data	DATA+	DATA+ S1 S2 D	(S1)h.m.s+(S2)h.m.s -> in D		4
	DATA+P	DATA+P S1 S2 D			4
	DATA-	DATA- S1 S2 D	(S1)h.m.s-(S2)h.m.s -> in D		4
	DATA-P	DATA-P S1 S2 D			4
Convert time data format	SECOND	SECOND S D	(S) h.m.s ->in (D) in sec		3
	SECONDP	SECONDP S D			3
	HOUR	HOUR S D	(S)s -> in (D) in h.m.s		3
	HOURP	HOURP S D			3
Read and write clock data	DATERD	DATERD D	y.m.d.h.m.s in CPU -> in (D)		2
	DATERDP	DATERDP D			2
	DATEWR	DATEWR D	y.m.d.h.m.s in (S) -> in CPU		2
	DATEWRP	DATEWRP D			2

5.6.3.13 Buffer Memory Access Instruction

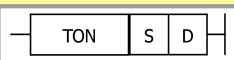
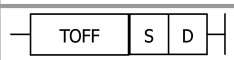
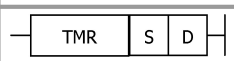
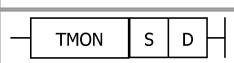
Group	Instruction Sign	Symbol	Details of Process	Execution Condition	No. of Steps

DATA Read	FROM		Reads data in optional unit.		5
	FROMP				5
	DFRO				5
	DFROP				5
DATA Write	TO		Write data to optional unit.		5
	TOP				5
	DTO				5
	DTOP				5

5.6.3.14 Instruction for Data Link

Group	Instruction Sign	Symbol	Details of Process	Execution Condition	No. of Steps
Sending Data	SND		Sends data to other station.		5
	SNDP				5
	SEND				4
	SENDP				4
Receiving Data	RCV		Receives data from other station.		5
	RCVP				5
	RECV				4
	RECVP				4

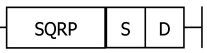
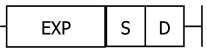
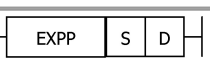
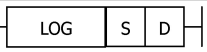
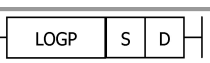
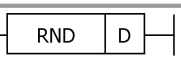
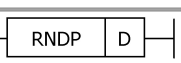
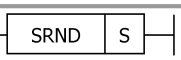
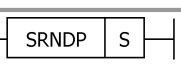
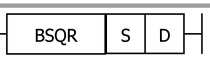
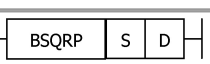
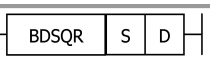
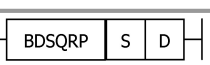
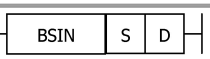
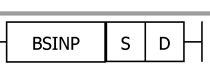
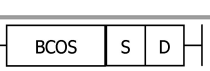
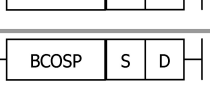
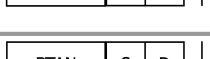
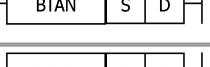
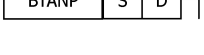
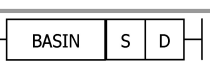
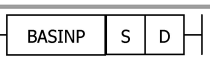
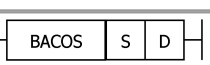
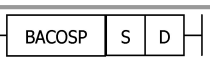
5.6.3.15 Timer / Counter

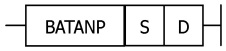
Group	Instruction Sign	Symbol	Details of Process	Execution Condition	No. of Steps
TIMER	TON		Set value -> Timer ON, OFF		3
	TOFF				3
	TMR		Irreverently to ON, OFF, set value -> Timer ON, OFF		3
	TMON				3

	TRTG	TRTG S D	Refer to manual		3
COUNTER	CTU	CTU S D	Add counter -> if over set value, ON.		3
	CTD	CTD S D	Subtract counter -> If 0, ON.		3
	CTUD	CTUD S D	Refer to manual		3
	CTR	CTR S D	Refer to manual		3

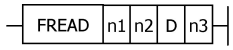
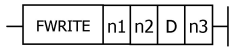
5.6.3.16 Real number operation Instruction

Group	Instruction Sign	Symbol	Details of Process	Execution Condition	No. of Steps
Trigonometric	SIN	SIN S D	Calculates SIN (sine) value of angle designated at S and stores the operation result in the device number designated at D.		3
	SINP	SINP S D			3
	COS	COS S D	Performs COS (cosine) on angle designated by S and stores operation result at device number designated by D .		3
	COSP	COSP S D			3
	TAN	TAN S D	Performs tangent (TAN) operation on angle data designated by S , and stores operation result in device designated by D.		3
	TANP	TANP S D			3
	ASIN	ASIN S D	Calculates angle from sin value designated by S, and stores operation result at word device designated by D		3
	ASINP	ASINP S D			3
	ACOS	ACOS S D	Calculates angle from COS value designated by S, and stores operation result at word device designated by D		3
	ACOSP	ACOSP S D			3
	ATAN	ATAN S D	Calculates angle from tan value designated by S, and stores operation result at word device desig		3
	ATANP	ATANP S D			3
Conversion	RAD	RAD S D	Converts units of angle size from angle units designated by S to radian units, and stores result at device number designated by D.		3
	RADP	RADP S D			3
	DEG	DEG S D	Converts Unit of angle size from radian units designated by S to angles, and stores result at device number designated by D.		3
	DEGP	DEGP S D			3
square root	SQR	SQR S D	Calculates square root of value designated at S , and stores the operation result in the device number		5

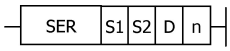
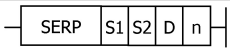
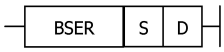
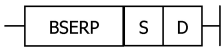
	SQRP		designated at D .		5
Exponent	EXP		Calculates exponent for value designated by S, and stores the result of the operation at the device designate by D		5
	EXPP				5
Logarithm	LOG		Calculates natural logarithm of value designated by S taking e as base, and stores operation results at device designated by D.		
	LOGP				
Occur random number	RND		Generates random number of from 0 to 32767, and stores at device designated by D		
	RNDP				
	SRND		Updates random number series according to the 16-bit BIN data being stored in device designated by S.		
	SRNDP				
BCD Logarithm	BSQR		Store appointed data to area that is specified by D after square root arithmetic by S.		
	BSQRP				
	BDSQR				
	BDSQRP				
BCD Trigonometric	BSIN		Calculates the sin value of the designated value, and stores the sign of the operation result in the device at D, and the operation result in the device designated at D+1 and D+2.		3
	BSINP				3
	BCOS		Calculates the cos value of the designated value, and stores the sign of the operation result in the device at D, and the operation result in the device designated at D+1 and D+2.		3
	BCOSP				3
	BTAN		Calculates TAN (tangent) value for value (angle) designated by S , and stores the sign for the operation result in the word device designated by D , and the operation result in the word device designated by D +1 and D +2.		3
	BTANP				3
	BASIN		Calculates angle from sin value designated by S, and stores operation result at word device designated by D		3
	BASINP				3
	BACOS		Calculates angle from COS value designated by S, and stores operation result at word device designated by D		3
	BACOSP				3
	BATAN		Calculates angle from sin value designated by S, and stores operation		3

	BATANP				3

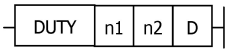
5.6.3.17 Read / Write Instruction

Group	Instruction Sign	Symbol	Details of Process	Execution Condition	No. of Steps
Special Module Data Read	FREAD				5
Special Module Data Write	FWRITE				5

5.6.3.18 Search Instruction

Group	Instruction Sign	Symbol	Details of Process	Execution Condition	No. of Steps
	SER				5
	SERP				5
	BSER				3
	BSERP				3

5.6.3.19 Other Instructions

Group	Instruction Sign	Symbol	Details of Process	Execution Condition	No. of Steps
	DUTY				4
	ATVP				4

5.6.4 Configuration of Instructions

1) It is available to separate most of instructions into instruction part and device part. The usage is as follows.

- **Instruction part :** This is to indicate the function of an instruction.
- **Device :** This is to indicate the data used in an instruction.

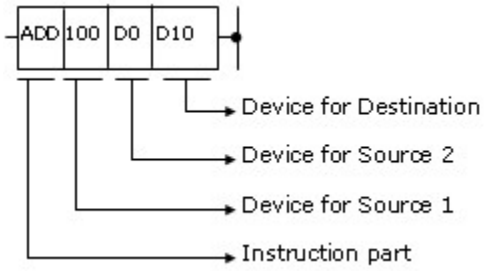
2) The configuration of instructions by combination of an instruction part and a device part is classified as follows.

- **(Instruction part) :** This is an instruction used not to change the status of a device and to control a program mainly.
  [EX.] END,PEND

- **(Instruction part) + (Device) :** According to ON/OFF control on a device and the ON/OFF status of a device, this is used to control an execution condition and to jump in a program.

- **(Instruction part) + (Device for source) + (Device for Destination) :** This is used to operate the data in a destination and the data in a source, and to the result in the destination.

- **(Instruction part) + (Device for source1) + (Device for source2) + (Device for Destination) :** This is used to operate the data in Source1 and the data in Source2, and store the result in the Destination.



- **Source(s)**
  - o Source is the data used in operation.

  - o The devices to assign are as follows.
    a. Integer : This is used to assign numerical value used in operation. As this is set in programming, this is a fixed value which is not changed during the execution of a program.
    b. Bit Device, Word Device : This is used to assign the device where data used in operation is stored. Accordingly, it is necessary to store the data before operation in the assigned device. During execution of Program, by changing the data stored in the assigned device, it is available to change the data for the instruction.

- **Destination(D)**
  - o The data after operation is stored in a destination. But, For the combination instruction of (Instruction part) + (source Device) + (Destination Device), it is necessary to store the data used for an operation in the destination before the operation
  - o A destination should be the device where data is stored.

- The abbreviations for Source and Destination are as follows.

5.6.5 Numerical Values

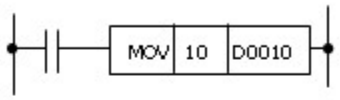
This is used to distinguish positive and negative for the upper bit of 16Bit and 32Bit. Accordingly, the numerical values used for 16Bit and 32Bit are as follows.

- 16Bit : -32768~32767
- 32Bit : -2147483648~2147483647

Point

(1) How to set up a numerical value

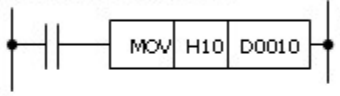
1) Decimal Number



10 is stored in D0010 in BIN.

-10 is stored in D0010 in BIN.

2) Hexadecimal Number



10 is stored in D0010 in hexadecimal BIN.

(2) Dividing FFFEH by 2

16Bit Instruction

As FFFE is to be -2, -2 ÷ 2 = -1 (FFFFH) is stored in D0000.

32Bit Instruction

As FFFE is to be -2, 65534 ÷ 2 = 32767 (7FFF) is stored in D0000.

The numerical value for 16Bit and 32Bit over the range (Over – Flow, Under Flow), in case of basic instructions, are processed as follows.

[Table. Contents of the process in case the numerical value is over the range]

	Processing 16Bit Data		Processing 32Bit Data	
	Decimal	Hexadecimal	Decimal	Hexadecimal
Over Flow	32764	7FFCH	2147483644	7FFFFFFCH
	32765	7FFDH	2147483645	7FFFFFFDH
	32766	7FFEH	2147483646	7FFFFFFEH
	32767	7FFFH	2147483647	7FFFFFFFH
	-32768	8000H	-2147483648	80000000H
	-32767	8001H	-2147483647	80000001H
	-32766	8002H	-2147483646	80000002H
	-32765	8003H	-2147483645	80000003H
	Processing 16Bit Data		**Processing 32Bit Data**	
	Decimal	Hexadecimal	Decimal	Hexadecimal
Under Flow	-32765	8003H	-2147483645	80000003H
	-32766	8002H	-2147483646	80000002H
	-32767	8001H	-2147483647	80000001H
	-32768	8000H	-2147483648	80000000H
	32767	7FFFH	2147483647	7FFFFFFFH
	32766	7FFEH	2147483646	7FFFFFFEH
	32765	7FFDH	2147483645	7FFFFFFDH
	32764	7FFCH	2147483644	7FFFFFFCH

Also, in case of Over Flow and Under Flow Carry Flag, Error Flag is not changed.

5.6.6 Error

- In case an operation error occurs while a basic instruction or an application instruction is operated, Error Flag(F0110) is set.

- When an operation error occurs, whether processing sequence is stopped or continued can be selected in Parameter setup(3.5 16).

5.6.7 Types of Instructions

Basic Instructions

Types of Instructions	Meaning
Contact Instruction	Operation start, series connection, parallel connection
Connection Instruction	Ladder block connection, creation of pulses from operation results, store/

	read operation results
Output Instruction	Bit device output, pulse output, output reversal
Step Control Instruction	step control
Master Control Instruction	Master control
Termination Instruction	Program termination
Program branch Instruction	Program jumps
Structure Creation Instruction	Repeated operation, subroutine program calls, index qualification in ladder units.
Program run control Instruction	Enable of prohibit interrupt programs
Other Instructions	Stop, INITEND, WDT Reset, Carry

Application Instructions

Types of Instructions	Meaning
Comparison Operation Instruction	Comparisons such as =, >, <
Arithmetic Operation Instruction	Addition, subtraction, multiplication or divison of BIN or BCD
Data Conversion Instruction	
Data Transfer Instruction	
Data Table Operation Instruction	Read
Logic Operation Instruction	Logical operations such as logical sum, logical product, etc.
Rotation Instruction	Rotation of designated data
Shift Instruction	Shift of designated data
Character string Processing Instruction	Character string (ASCII code data) processing
Data Processing Instruction	Data processing including data searches, decoding, encoding, and the like
Bit Processing Instruction	Sets and resets bit data; bit extraction
Clock Instruction	Read / Write clock data
Timer / Counter	Timer / Counter
Buffer Memory Access Instruction	Read / Write from buffer memory of special functions modules
Instruction for Data Link	
Real number operation Instruction	
Read / Write Instruction	Special Module Data Read / Write
Search Instruction	

Other Instruction	

5.6.8 Processing in Bit

This is to process in bit when a bit device (X, Y, M, L, S, F) is assigned.
In case of using a sequence instruction, the device processed is 1Bit(1Point) in a bit device. It is not available to assign two or more bits.

[Ex.] LD X0000, OUT Y0020

5.6.9 Processing in Word

This is to process the device operated in word. There are two types to process in word such as 16Bit(1Word) and 32Bit(2Word).

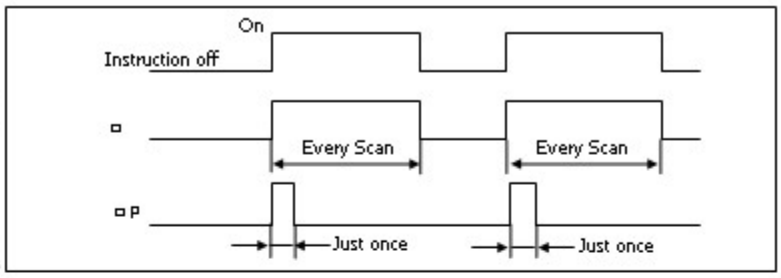
5.6.10 Form of Instructions

Sequence Instructions, basic Instructions and application Instructions are configured as follows.

Execution Condition

O in case digits are assigned to bit device.

Execution condition of + and +P instruction



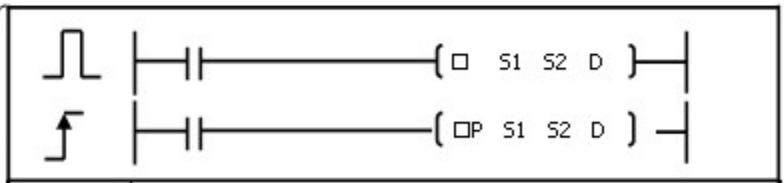
Symbol of Instruction.

Adding & Subtracting BIN 16Bit ····· ADD, ADDP, SUM, SUMP

O for usable device.

Instruction		Usable Device												No. of Steps	Flag		
		M	X	Y	K	L	F	T	C	Z	D	N	Integer		Error	Zero	Carry
	S1	O	O	O	O	O	O	O	O	O	O	O	O	5	O		
	S2	O	O	O	O	O	O	O	O	O	O	O	O				
	D	O		O	O	O		O	O	O	O	O					

Type in circuit mode.

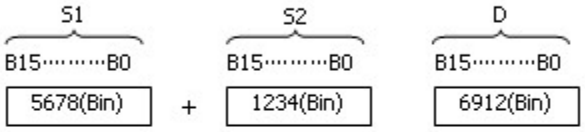


S1	Number of the start device among the devices where the data to be AND is stored
S2	
D	Number of the start device where the result of AND is stored

Functions +

Explaining instruction.

(1) The BIN Data in the device assigned to S1 is added to the BIN Data in the device assigned to S2 and the result is stored in the device assigned to (D).



(2) It is available to assign the data from –32768 to 32767 (BIN 16Bit) to S1, S2.

(3) It is available in the uppermost BIN(B15) to decide whether S1, S2 and D Data is positive or negative.

B15	Decision
0	Positive
1	Negative

(4) When 16th Bit is over flow, Carry Flag is reset.

5.7 Basic Instruction

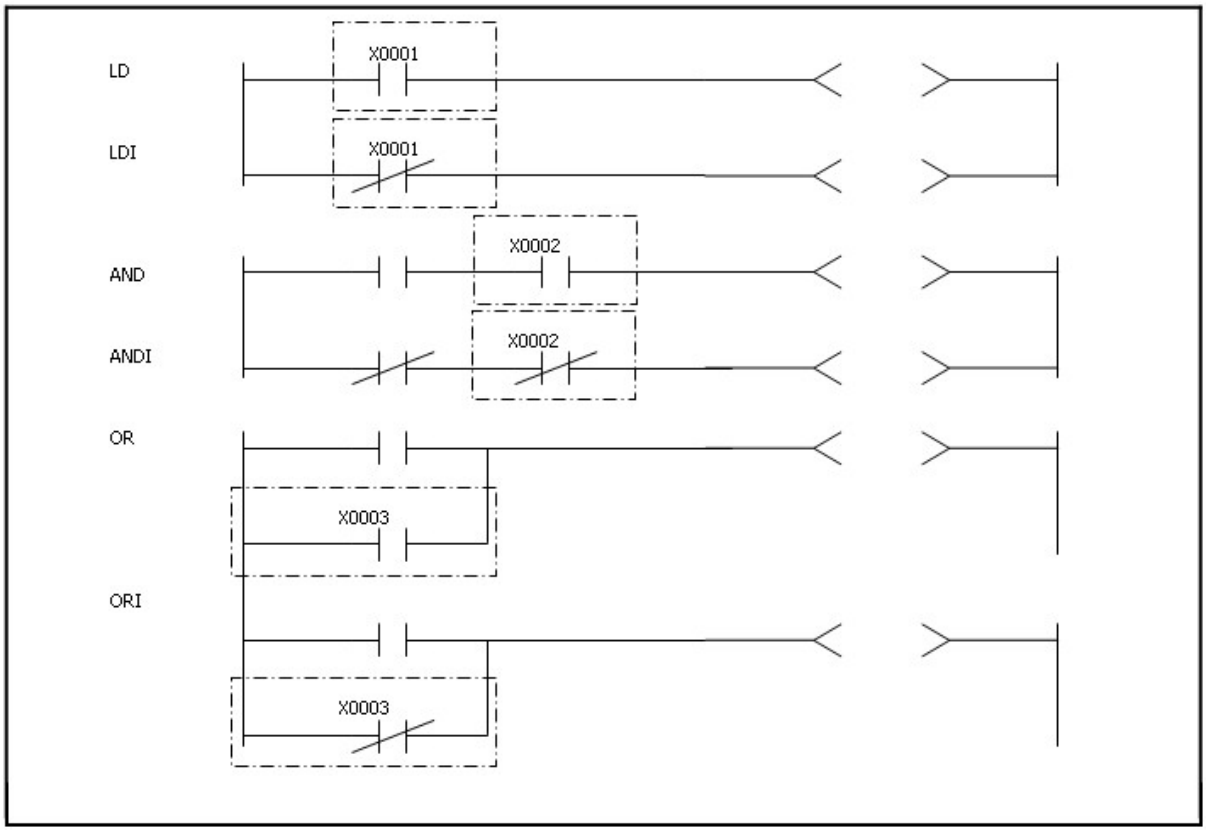
Contents :

5.7.1 Contact Instruction

Contents :

5.7.1.1 Start Operation, Connect in A Series, Connect in A Parallel : LD, LDI, AND, ANDI, OR, ORI

Instruction		Usable Device												No.of Steps	Flag		
		M	X	Y	K	L	F	T	C	S	Z	D	@D	Integer		Error	Zero	Carry
LD (I) AND (I) OR (I)	S	o	o	o	o	o	o	o	o	o					1			

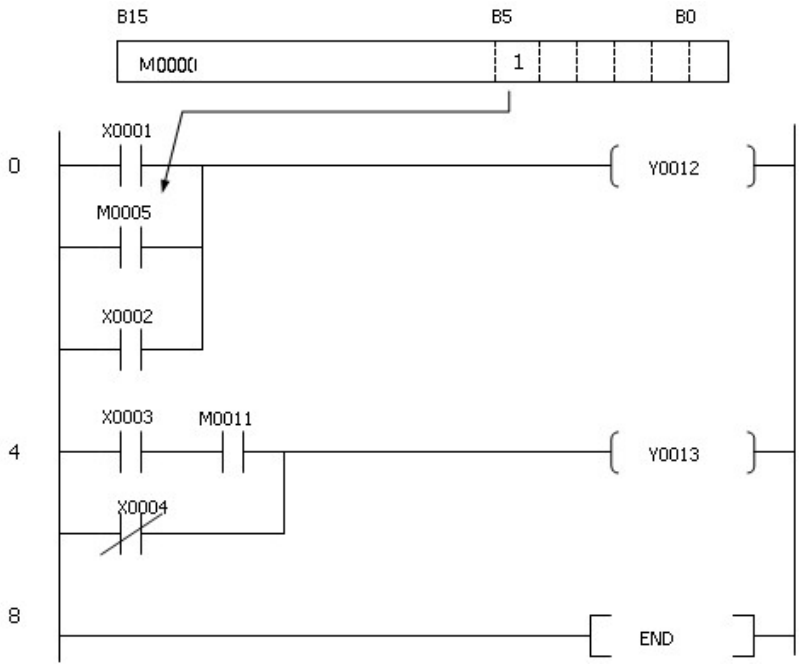


LD, LDI

Functions :

The LD in used to start the operation of Contact A and the LDI is used to start the operation of Contact B. The information(ON/OFF) on the assigned device are read, being taken as the result of their operation.

Example of program :



List Mode

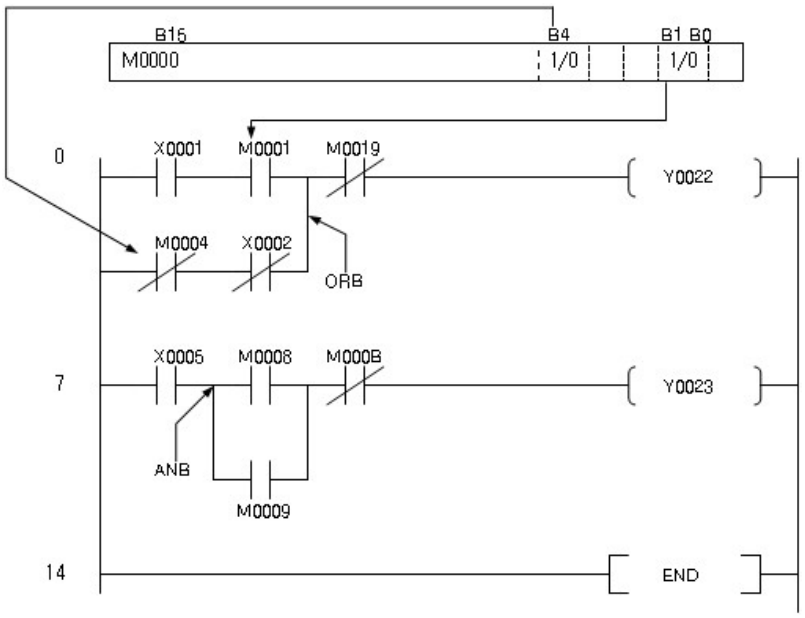
Steps	Instruction	Device
0	LD	X0001
1	OR	M0005
2	OR	X0002
3	OUT	Y0012
4	LD	X0003
5	AND	M0011
6	ORI	X0004
7	OUT	Y0013
8	END	

OR, ORI

Functions :

The OR is used to connect in a parallel instruction with Contact A and ORI is used to connect in a parallel with Contact B. The information(ON/OFF) on the assinged device is read and OR-operated with the result of the operation till then. The result of the OR-operation is takenas the result of their operation.

Example of program :



List Mode

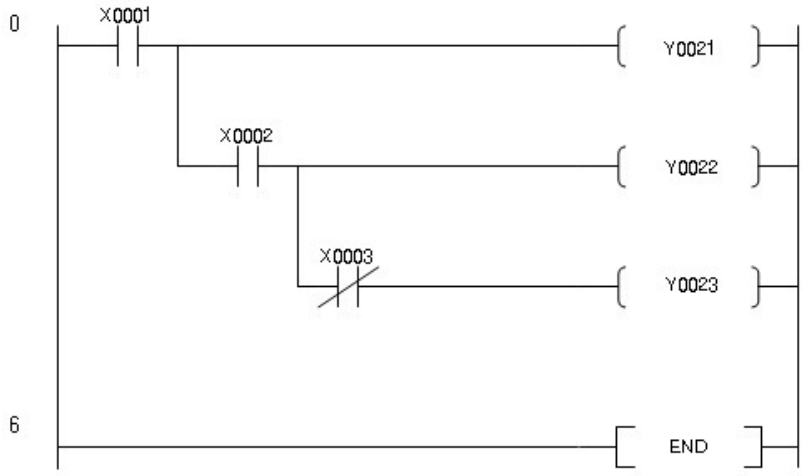
Steps	Instruction	Device
0	LD	X0001
1	AND	M0001
2	LDI	M0004
3	ANDI	X0002
4	ORB	
5	ANDI	M0019
6	OUT	Y0022
7	LD	X0005
8	LD	M0008
10	OR	M0009
11	ANB	
12	ANDI	M000B
13	OUT	Y0023
14	END	

AND, ANDI

Functions :

The AND is used to connect in a series with Contact A and the ANDI is used to connect in a series with Contact B. The information(ON/OFF) on the assigned device are read and AND-operated with the result of the operation till then. The result of the AND-operation is taken as the result of their operation.

Example of program :



List Mode

Steps	Instruction	Device
0	LD	X0001
1	OUT	Y0021
2	AND	X0002
3	OUT	Y0022
4	ANDI	X0003
5	OUT	Y0023
6	END	

5.7.1.2 For Rising-Falling Edge, Start Operation, Connect in Series, Connect in Parallel : LDP, LDF, ANDP, ANDF, ORP, ORF

Instruction		Usable Device													No.of Steps	Flag		
		M	X	Y	K	L	F	T	C	S	Z	D	@D	Integer		Error	Zero	Carry
LDP (F) ANDP (F) ORP (F)	S	o	o	o	o	o	o	o	o						1			

LDP

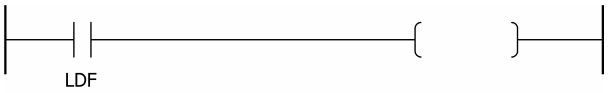
Functions :

This is used to read the rising edge of a circuit. If an input condition is turned on from off, this is set for one scan.

LDF

Functions :

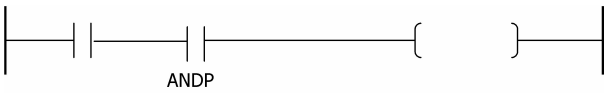
This is used to read the falling edge of a circuit. If an input condition is turned off from on, this is set for one scan.



ANDP

Functions :

This is used as the contact to read the rising edge in connection in series. If an input condition is turned on from off, this is set for one scan. If the left connection is turned on, the right connection is set for one scan.



ANDF

Functions :

This is used to read the falling edge in connection in series. If an input condition is turned off from on, this is set for one scan. If the left connection is turned on, the right connection is set for one scan.

ORP

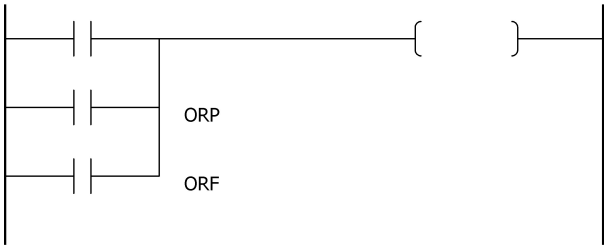
Functions :

This is used to read the rising edge in connection in parallel. If an input condition is turneded on from off, this is set for one scan. If the left connection is turned on, the right connection is set for one scan.

ORF

Functions :

This is used to read the falling edge in connection in parallel. If an input condition is turned off from on, this is set for one scan. If the left connection is turned on, the right connection is set for one scan.



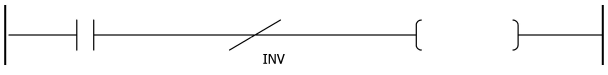
5.7.1.3 Invert Result of Operation : INV

Instruction	Usable Device													No.of Steps	Flag		
	M	X	Y	K	L	F	T	C	S	Z	D	@D	Integer		Error	Zero	Carry
INV														1			

INV

Functions :

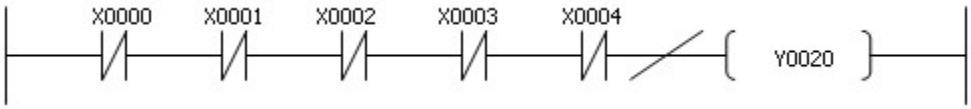
If you use the INV instruction[NOT], Contact “A” circuit is converted to Contact “B” circuit and Contact “B” circuit is inverted to Contact “A” circuit(Connection in series circuit to connection in parallel circuit, connection in parallel circuit to connection in series circuit) for the circuit on the left of the INV instruction.



Example of program :

Program A and B are examples to output the same result.

- Program A



- Program B

5.7.1.4 Start Operation by Bit in Data Device : LDBT, LDBTI, ANDBT, ANDBTI, ORBT, ORBTI

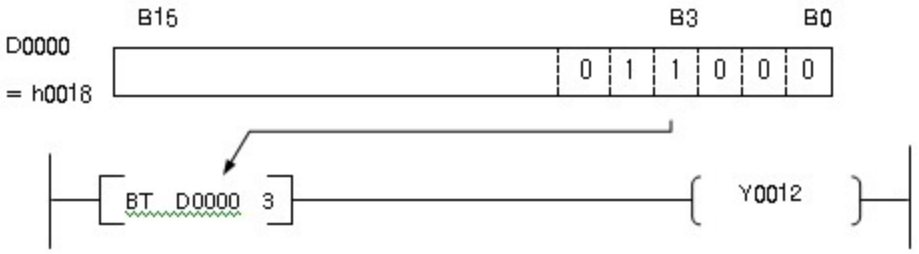
Instruction		Usable Device													No.of Steps	Flag		
		M	X	Y	K	L	F	T	C	S	Z	D	@D	Integer		Error	Zero	Carry
LDBT (I) ANDBT (I) ORBT (I)	S1										o	o	o		3			

LDBT, LDBTI

Functions :

These are used to read the bit data assigned to S2 among the word addresses in Device D assigned to S1, starting the operation for Contact A(LDBT) and the one for Contact B(LDBTI). The information(On/Off) on the assigned Device are received and taken as the result of their operation.

Example of program :



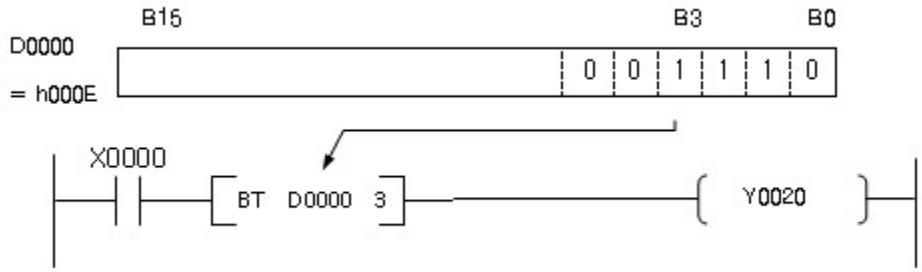
If the third bit of D0000 is turned on, Output Y0012 is set.

ANDBT, ANDBTI

Functions :

These are to read the bit data assigned to S2 among the word addresses in Device D assigned to S1, connecting in a pararell with Contact A(ORBT) and Contact B(ORBTI). The information(On/Off) on the assigned device are received and OR-operated with the result of the operation till then. The results of the OR-operation is taken as their operation.

Example of program :



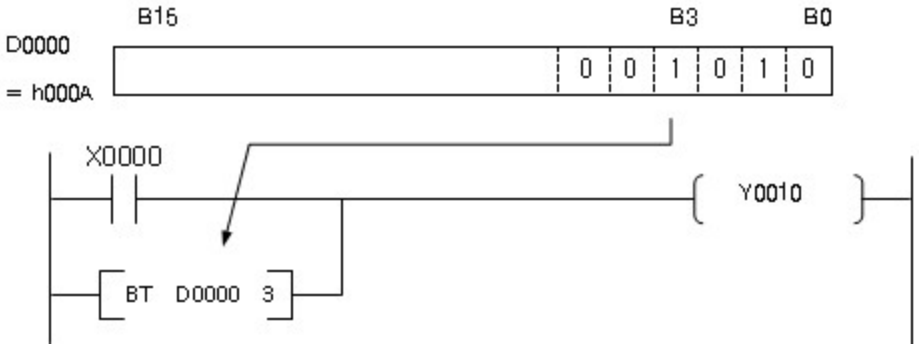
If X0000 is turned on or the third bit of D0000 is turned on, Output Y0010 is set.

ORBT, ORBTI

Functions :

These are to read the bit data assigned to S2 among the word addresses in Device D assigned to S1, connecting in a series with Contact A(ANDBT) and Contact B(ANDBTI). The information(On/Off) on the assigned device are received and AND-operated with the result of the operation till then. The results of the AND-operation is taken as their operation.

Example of program :



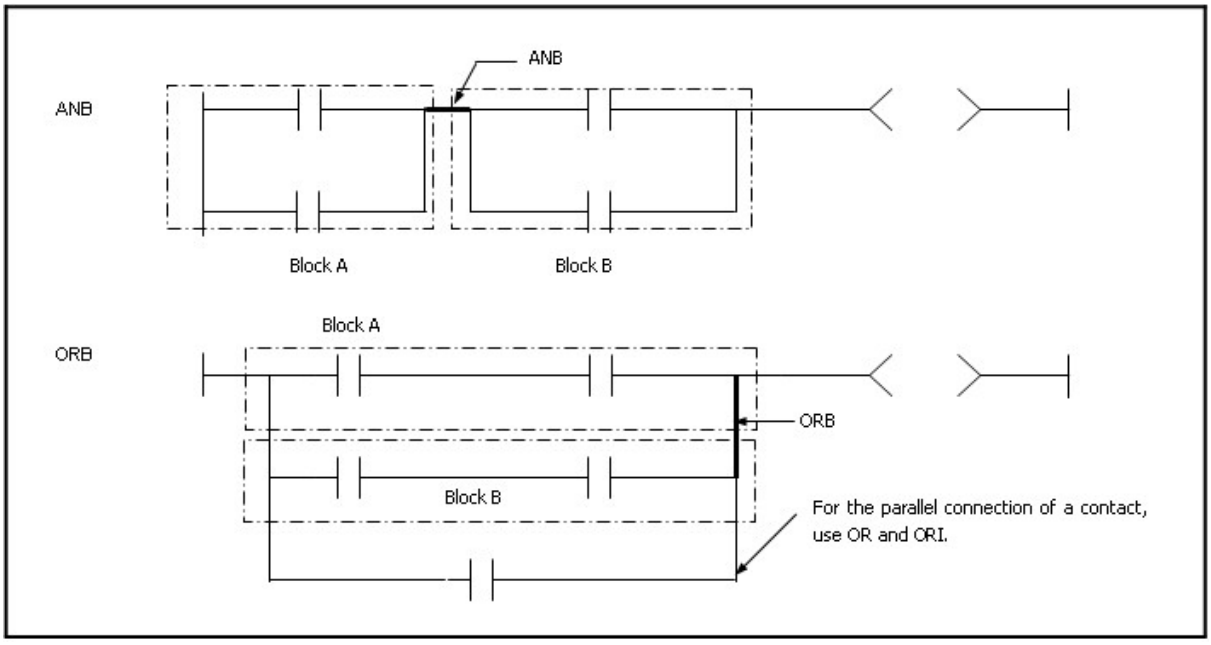
If X0000 is turned on or the third bit of D0000 is turned on, Output Y0010 is set.

5.7.2 Connection Instruction

Contents :

5.7.2.1 Connect in Series, Connect in Parallel by Blocks : ANB, ORB

Instruction	Usable Device													No.of Steps	Flag		
	M	X	Y	K	L	F	T	C	S	Z	D	@D	Integer		Error	Zero	Carry
ANB ORB														1			

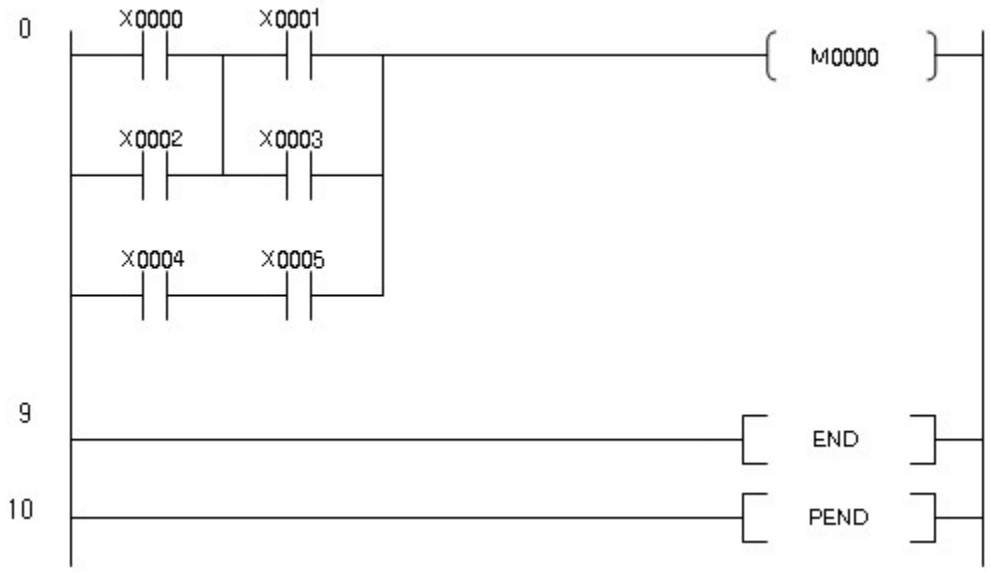


ANB

Functions :

This is used to AND-operate Block A and Block B, taking the result as the result of the operation. The ANB is not a contact symbol but a connection symbol. I In case of writing the ANB continuously, maximum 15 instructions(16 blocks) are available.

Example of program :



[List Mode]

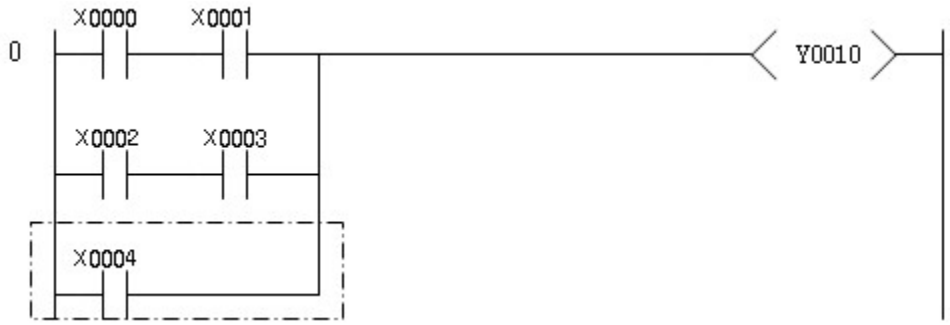
Steps	Instruction	Device
0	LD	X0000
1	OR	X0002
2	LD	X0001
3	OR	X0003
4	ANB	
5	LD	X0004
6	AND	X0005
7	ORB	
8	OUT	M0000
9	END	
10	PEND	

ORB

Functions :

This is used to OR-operate Block A and Block B, taking the result as the result of the operation. The ORB is used to connect the circuit block over two contacts in parallel. To connect the circuit block of contacts, use the OR and the ORI. The ORB is not necessary.

Example of program :



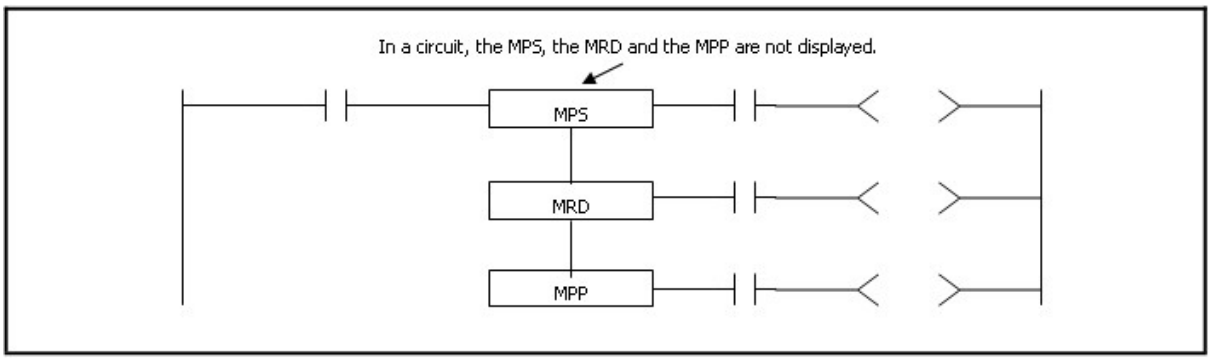
[List Mode]

Steps	Instruction	Device
0	LD	X0000
1	AND	X0001
2	LD	X0002
3	AND	X0003
4	ORB	
5	OR	X0004
6	OUT	Y0010

The ORB is not a contact symbol but a connection symbol. In case of writing the ORB continuously, maximum 15 instructions(16 blocks) are available.

5.7.2.2 Branch Multiply : MPS, MRD, MPP

Instruction		Usable Device													No.of Steps	Flag		
		M	X	Y	K	L	F	T	C	S	Z	D	@D	Integer		Error	Zero	Carry
MPS MRD MPP	S														1			



MPS

Functions :

This is used to start branching in a ladder. This is used to read the result of the operation prior to the MPS instruction, continuing to operate the next instructions with it.

MRD

Functions :

This is used to relay branching in a ladder. This is used to read the result of the operation prior to the current MRD instruction, continuing to operate the next instructions with in.

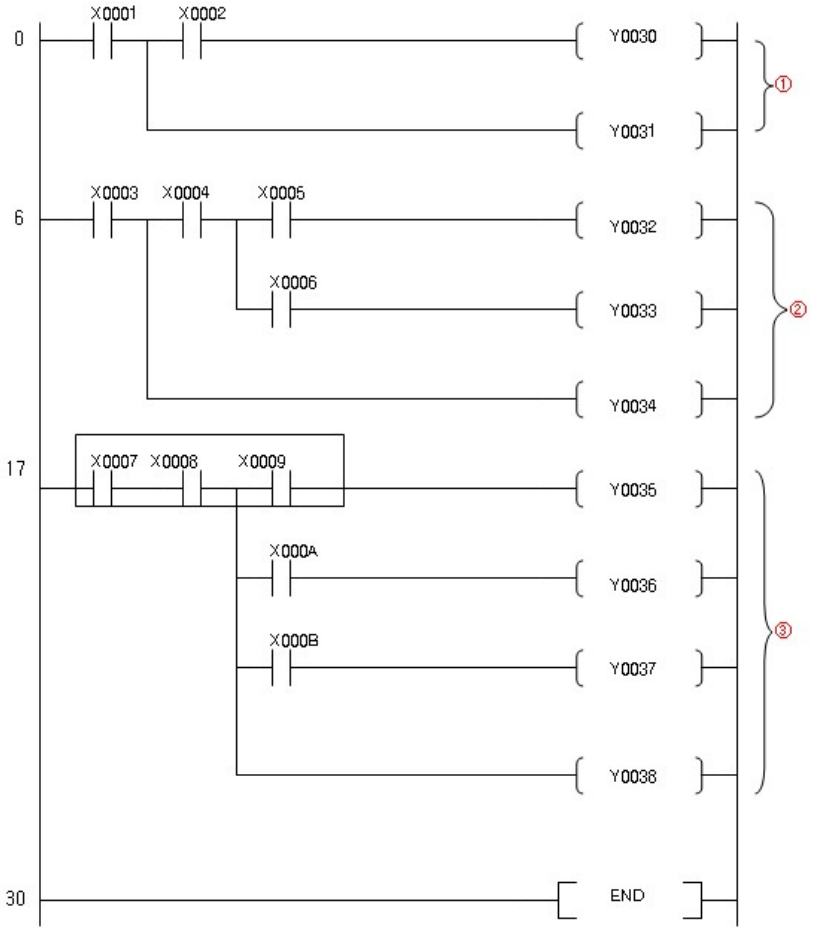
MPP

Functions :

This is used to finish branching in a ladder. This is used to clear the result of the operation prior to the MPP instruction.

Example of program :

- A program to use the MPS instruction, the MRD instruction and the MPP instruction

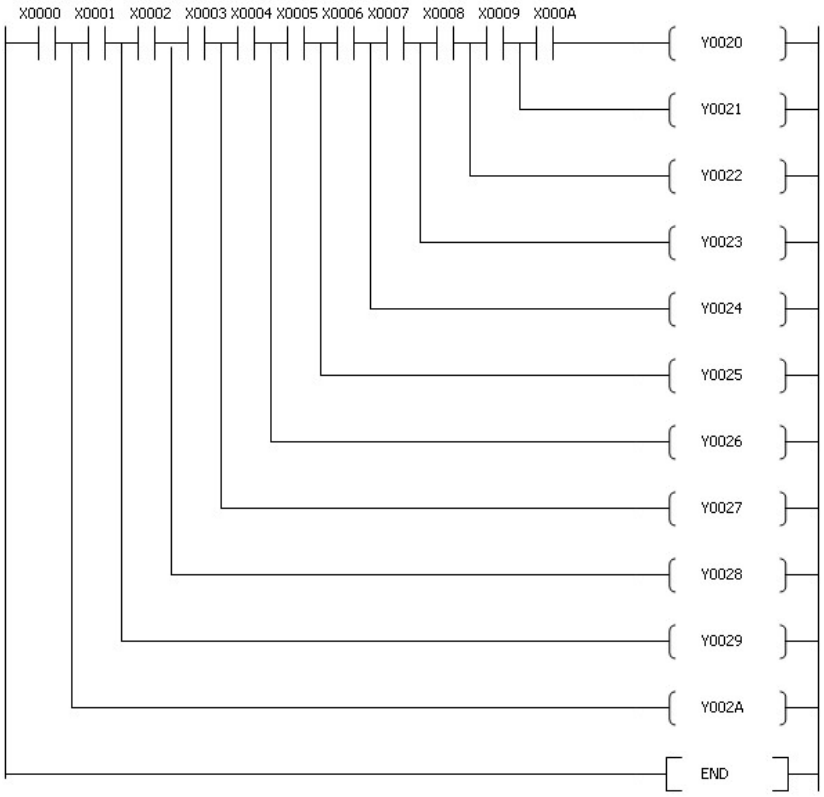


[List Mode]

	Steps	Instruction	Device
①	0	LD	X0001
①	1	MPS	
①	2	AND	X0002
①	3	OUT	Y0030
①	4	MPP	
①	5	OUT	Y0031
②	6	LD	X0003
②	7	MPS	
②	8	AND	X0004
②	9	MPS	
②	10	AND	X0005
②	11	OUT	Y0032
②	12	MPP	
②	13	AND	X0006
②	14	OUT	Y0033
②	15	MPP	

②	16	OUT	Y0034
③	17	LD	X0007
③	18	AND	X0008
③	19	MPS	
③	20	AND	X0009
③	21	OUT	Y0035
③	22	MRD	
③	23	AND	X000A
③	24	OUT	Y0036
③	25	MRD	
③	26	AND	M000B
③	27	OUT	Y0037
③	28	MPP	
③	29	OUT	Y0038
③	30	END	

- An example to use the MPS instruction and the MPP instruction



[List Mode]

Steps	Instruction	Device	Steps	Instruction	Device

0	LD	X0000	23	OUT	Y0021
1	MPS		24	MPP	
2	AND	X0001	25	OUT	Y0022
3	MPS		26	MPP	
4	AND	X0002	27	OUT	Y0023
5	MPS		28	MPP	
6	AND	X0003	29	OUT	Y0024
7	MPS		30	MPP	
8	AND	X0004	31	OUT	Y0025
9	MPS		32	MPP	
10	AND	X0006	33	OUT	Y0026
11	MPS		34	MPP	
12	AND	X0006	35	OUT	Y0027
13	MPS		36	MPP	
14	AND	X0007	37	OUT	Y0028
15	MPS		38	MPP	
16	AND	X0008	39	OUT	Y0029
17	MPS		40	MPP	
20	AND	X000A	41	OUT	Y002A
21	OUT	Y0021	42	END	
22	MPP				

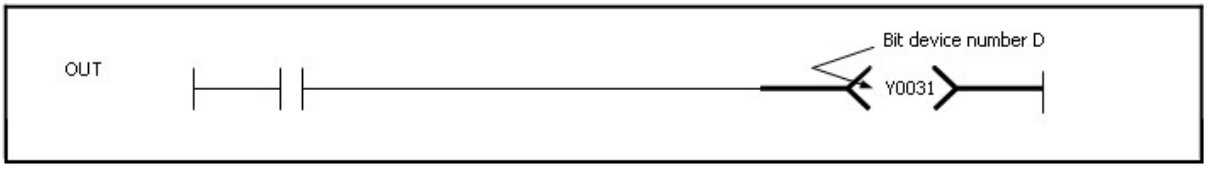
5.7.3 Output Instruction

Contents :

5.7.3.1 Bit Device Timer, Counter : OUT

Instruction	Usable Device													No.of Steps	Flag		
	M	X	Y	K	L	F	T	C	S	Z	D	@D	Integer		Error	Zero	Carry

OUT	S	o		o	o	o				o					1			



OUT

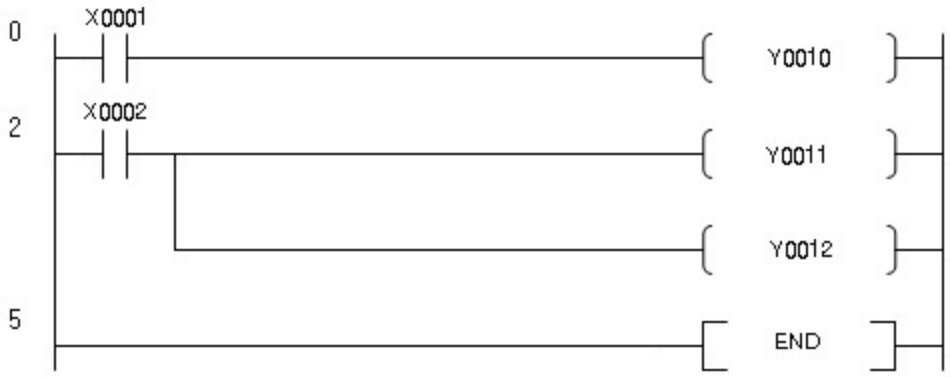
Functions :

This is used to output the result of the operation prior to the OUT instruction to the assigned device.

Result of Operation	OUT Instruction		
	Coil	Contact	
		Contact A	Contact B
OFF	OFF	OFF	ON
ON	ON	ON	OFF

Example of program :

- A program to output with an output unit

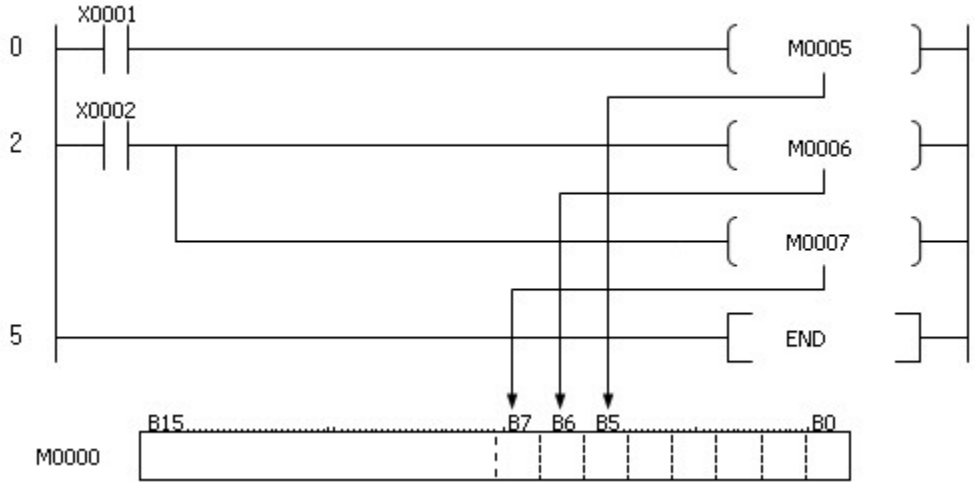


[List Mode]

Steps	Instruction	Device
0	LD	X0001
1	OUT	Y0010
2	LD	X0002
3	OUT	Y0011
4	OUT	Y0012

5	END	

- A case that a word device is made of a bit

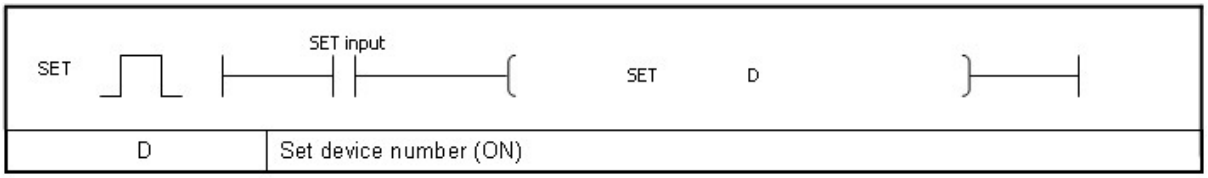


[List Mode]

Steps	Instruction	Device
0	LD	X0001
1	OUT	X0005
2	LD	X0002
3	OUT	M0006
4	OUT	M0007
5	END	

5.7.3.2 Bit Device set : SET

Instruction		Usable Device													No.of Steps	Flag		
		M	X	Y	K	L	F	T	C	S	Z	D	@D	Integer		Error	Zero	Carry
SET	S	o		o	o	o				o					1			



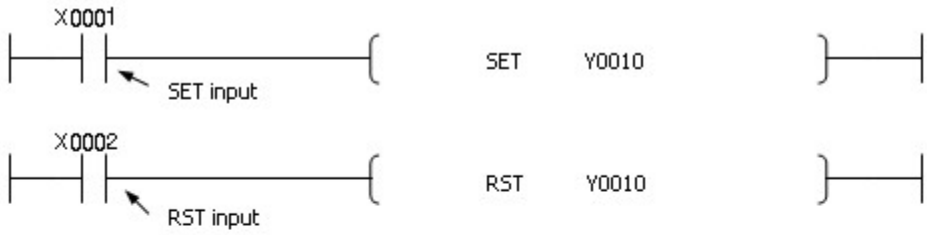
D	Set device number (ON)

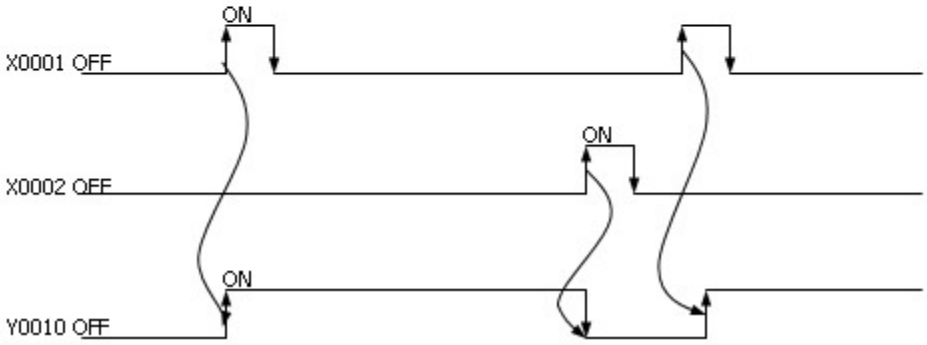
Error Flag(F110)	In case that a device is assigned to @D, if overflow is generated, it is set.

SET

Functions :

This is used to set the assigned device. A turned-on device keeps turn-on status though the SET instruction is not operated and can be reset by the RST instruction.





Example of program :

- A program to set Y0022 if X0001 is turned on and to reset Y0023 if X0002 is turned on

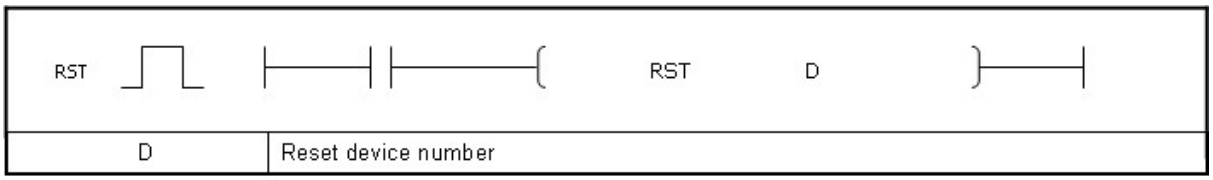
[List Mode]

Steps	Instruction	Device

0	LD	X0001
1	SET	Y0022
2	LD	X0002
3	RST	Y0023
4	END	

5.7.3.3 Bit Device Reset : RST

Instruction		Usable Device													No.of Steps	Flag		
		M	X	Y	K	L	F	T	C	S	Z	D	@D	Integer		Error	Zero	Carry
RST	S	o		o	o	o		o							1			



RST

Functions :

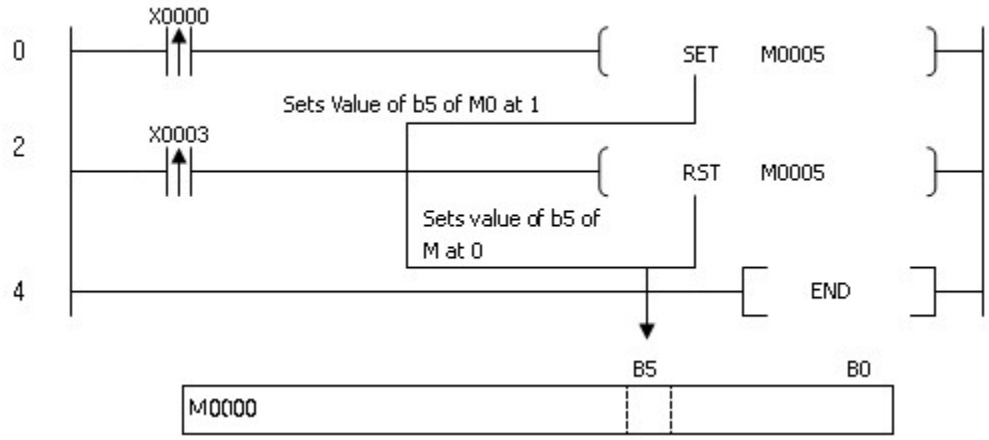
If the RST instruction is operated, the status of the assigned devices is as follows.

Device	Status
Y, M, L, S, F	Coil and contact is reset
T, C	The current value is 0. Coil and contact is reset.

If the RST instruction is not operated, the status of a device is not changed.
The state of the RST is the same as the following circuit.

Example of program :

- A program to set 0 as the assigned device

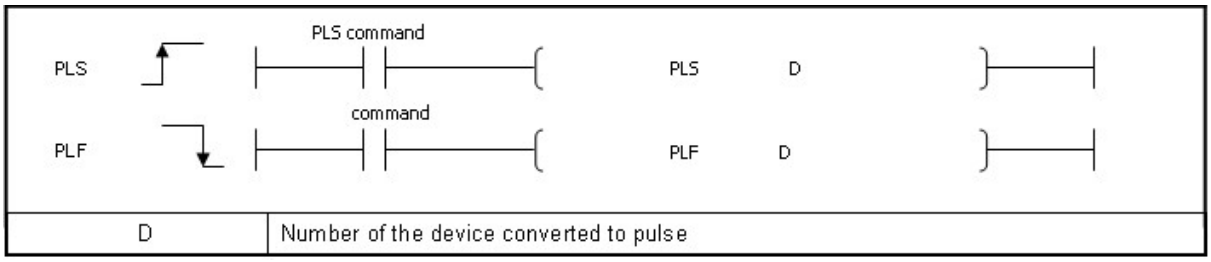


[List Mode]

Steps	Instruction	Device
0	LDP	X0000
1	SET	M0005
2	LDP	X0003
3	RST	M0005
4	END	

5.7.3.4 Output for a Scan at Rising Edge and Falling Edge : PLS, PLF

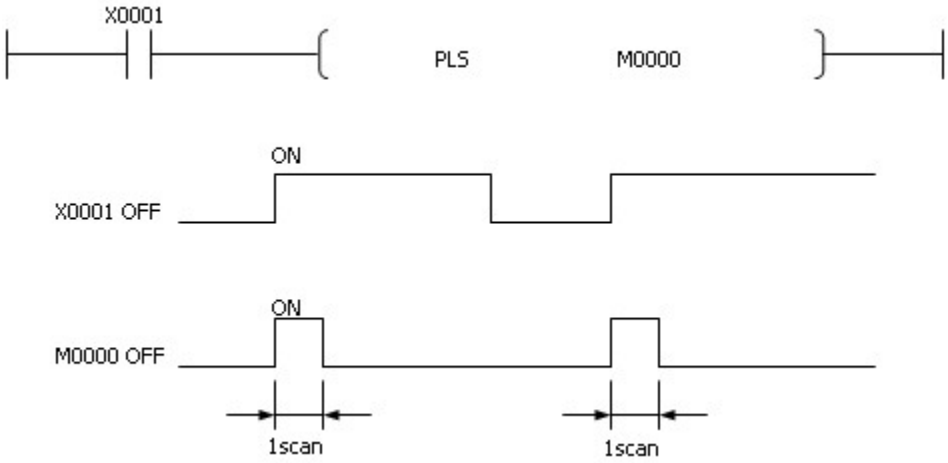
Instruction		Usable Device													No.of Steps	Flag		
		M	X	Y	K	L	F	T	C	S	Z	D	@D	Integer		Error	Zero	Carry
PLS PLF	S	o		o	o	o									1			



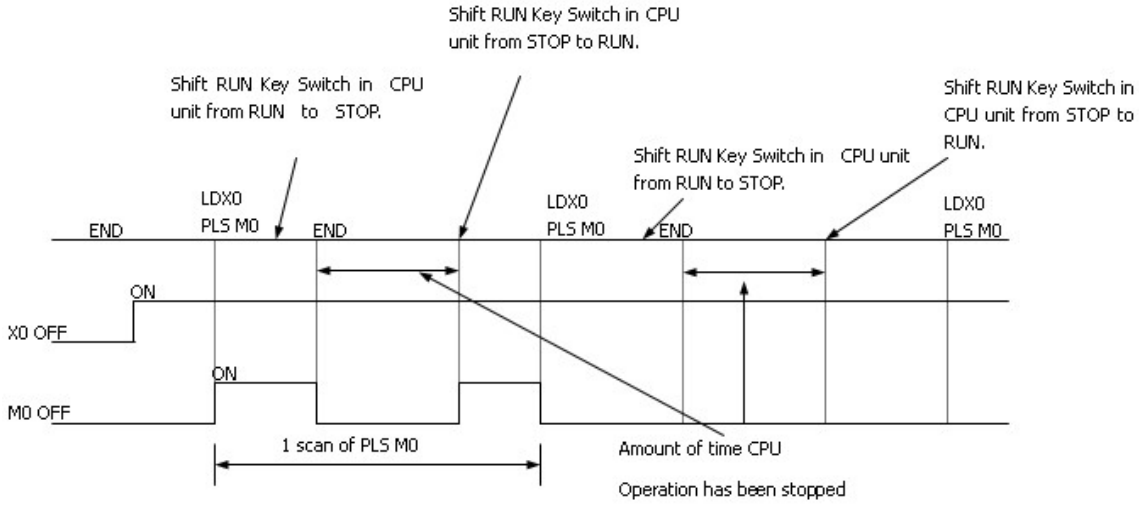
PLS

Functions :

If the PLS instruction is operated, the assigned device is set for one scan. Otherwise, it is reset. In case the PLS instruction is operated on the device assigned to LATCH LAY(L), if the power is turned on, it is set.

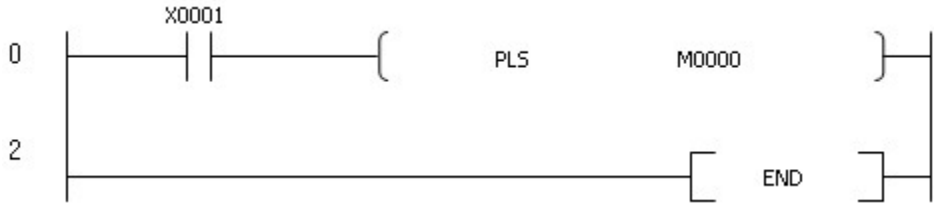


Though the RUN Key Switch is shifted from RUN to STOP and from STOP to RUN again after the PLS instruction is operated, the PLS instruction is not operated.



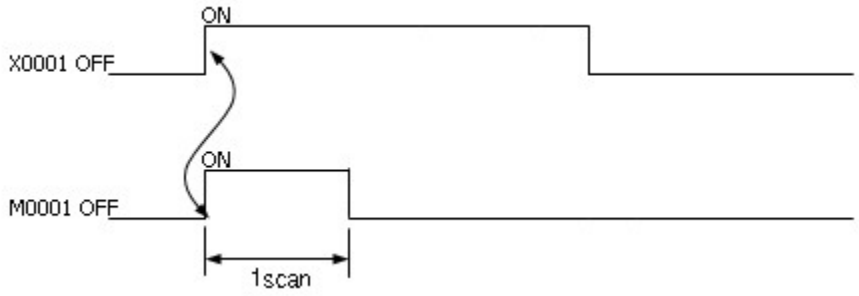
Example of program :

- A program to operate the PLS instruction if X0001 is turned on



[List Mode]

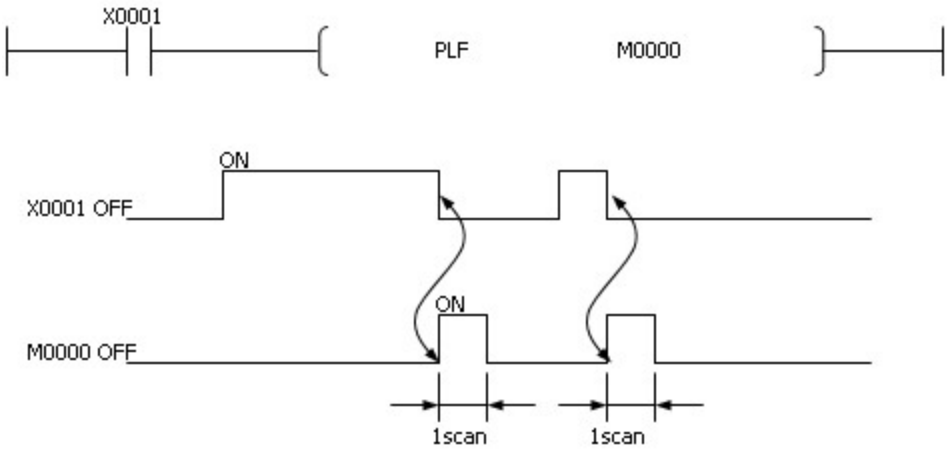
Steps	Instruction	Device
0	LD	X0001
1	PLS	M0000
2	END	



PLF

Functions :

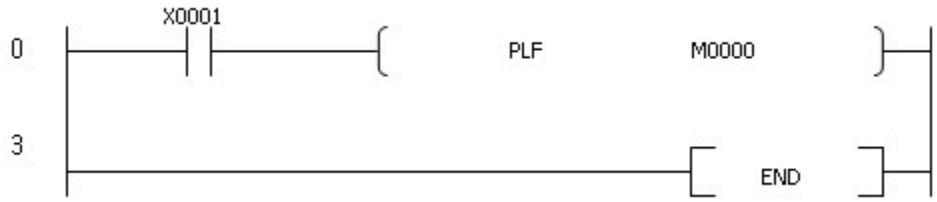
If the PLF instruction is turned off from on, the assigned device is set for one scan. Otherwise, it is reset.



Though the Run Key Switch is shifted from RUN to STOP and from STOP to RUN again after the PLF instruction is operated, the PLF instruction is not operated.

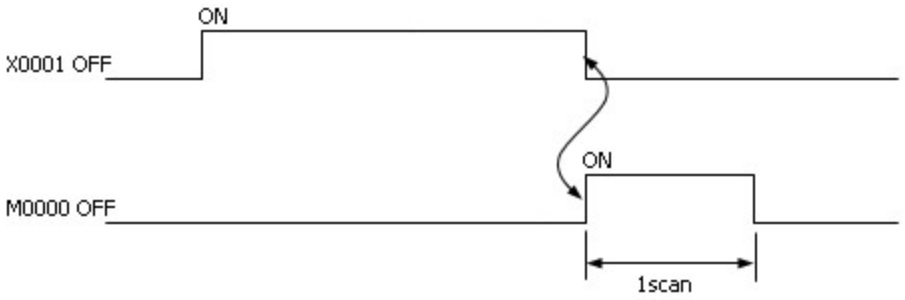
Example of program :

- A program to operate the PLF instruction if X0001 is turned off



[List Mode]

Steps	Instruction	Device
0	LD	X0001
1	PLF	M0000
2	END	

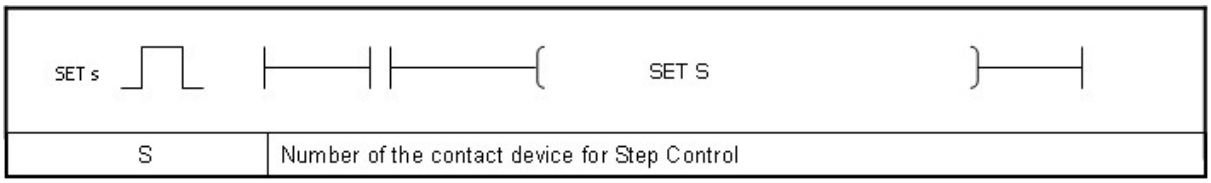


5.7.4 Step Control Instruction

Contents :

5.7.4.1 Step Control : SET Sxx.xx

Instruction		Usable Device													No.of Steps	Flag		
		M	X	Y	K	L	F	T	C	S	Z	D	@D	Integer		Error	Zero	Carry
SET	S									o					1			



S	Number of the contact device for Step Control

SET S

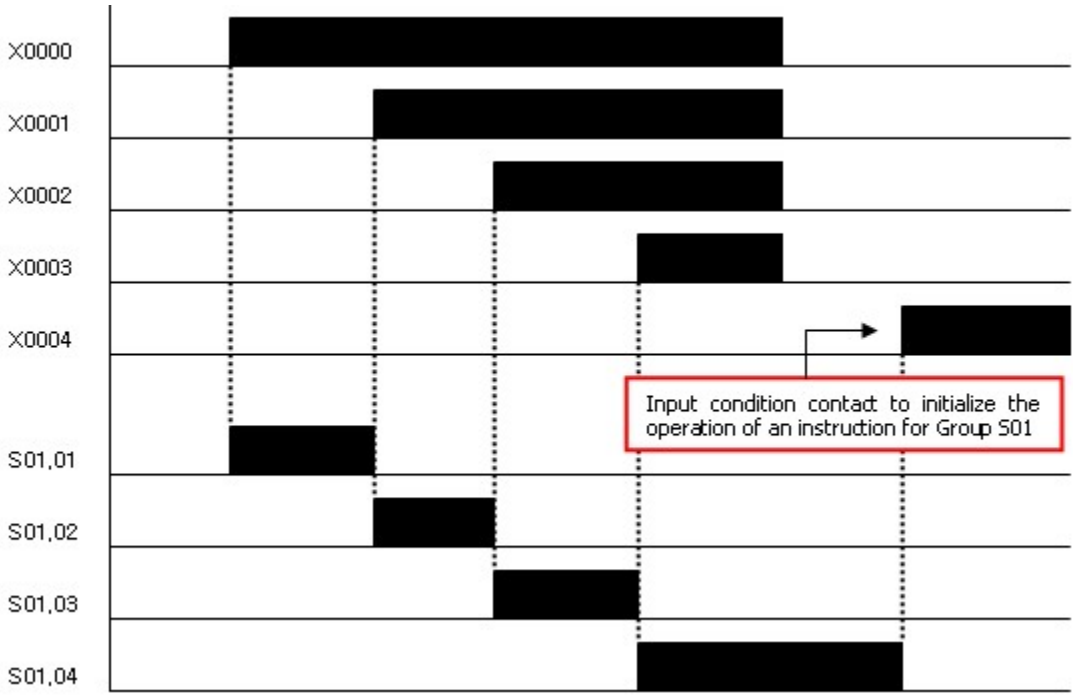
Functions :

- In a group, if previous step number is on, current step number is set.
- In case that current step number is on, though input contact is off, it keeps on status.
- Though input condition contacts in a group are simultaneously on, a step number is set.
- The operation of SET Sxx.xx instruction is initialized by setting Input Contact Sxx.00.

Example of Program :

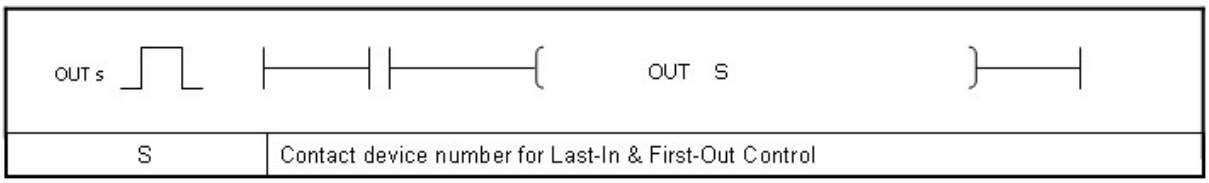
- The Step Control program using Program Group S01.xx.

- If the previous step and the condition contact of current step are on, the current step contact will be set.



5.7.4.2 Last-In & First-Out Control : OUT Sxx.xx

Instruction		Usable Device													No.of Steps	Flag		
		M	X	Y	K	L	F	T	C	S	Z	D	@D	Integer		Error	Zero	Carry
OUT	S									o					1			



S	Contact device number for Last-In & First-Out Control

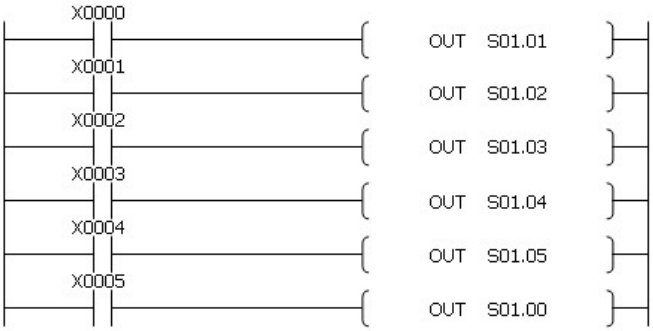
OUT S

Functions :

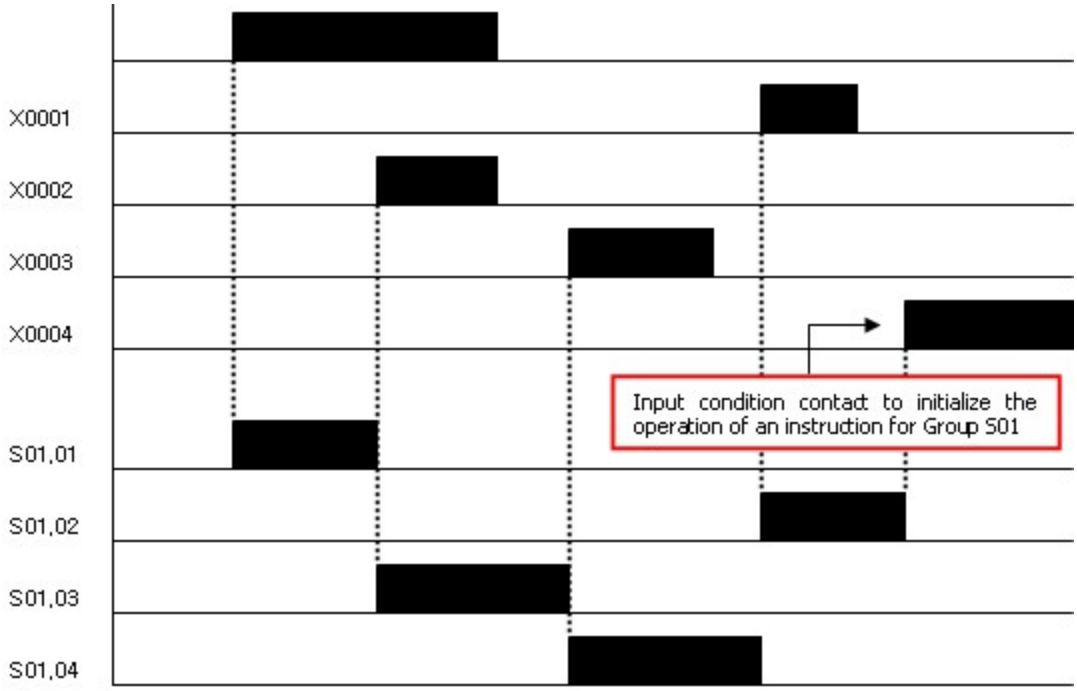
- In a group, though a lot of input condition contacts are on, only a step number is set.
- In case that input conditions are simultaneously on, the last programmed one is set first.
- In case that current step number is on, though input contact is off, it keeps on status.
- The operation of OUT Sxx.xx instruction is initialized by setting Input Contact Sxx.00.

Example of Program :

- The Last-In & First-Out program using Program Group S01.xx.



- Time Chart

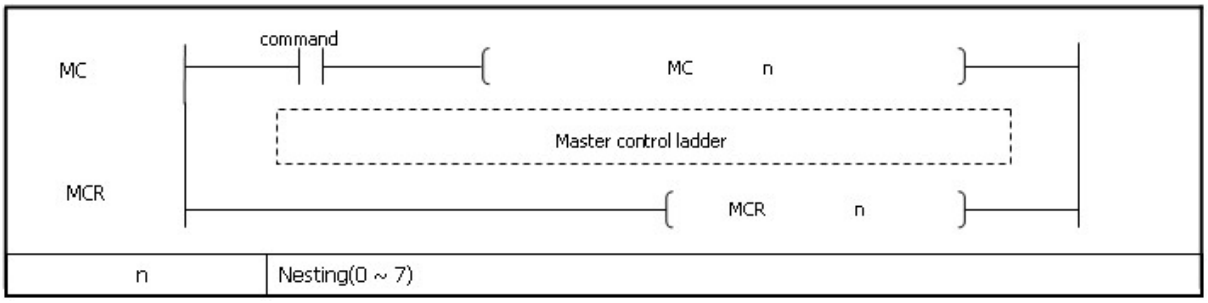


5.7.5 Master Control Instruction

Contents :

5.7.5.1 Set or Reset Master Control : MC, MCR

Instruction		Usable Device													No.of Steps	Flag		
		M	X	Y	K	L	F	T	C	S	Z	D	@D	Integer		Error	Zero	Carry
MC	S													o	1			



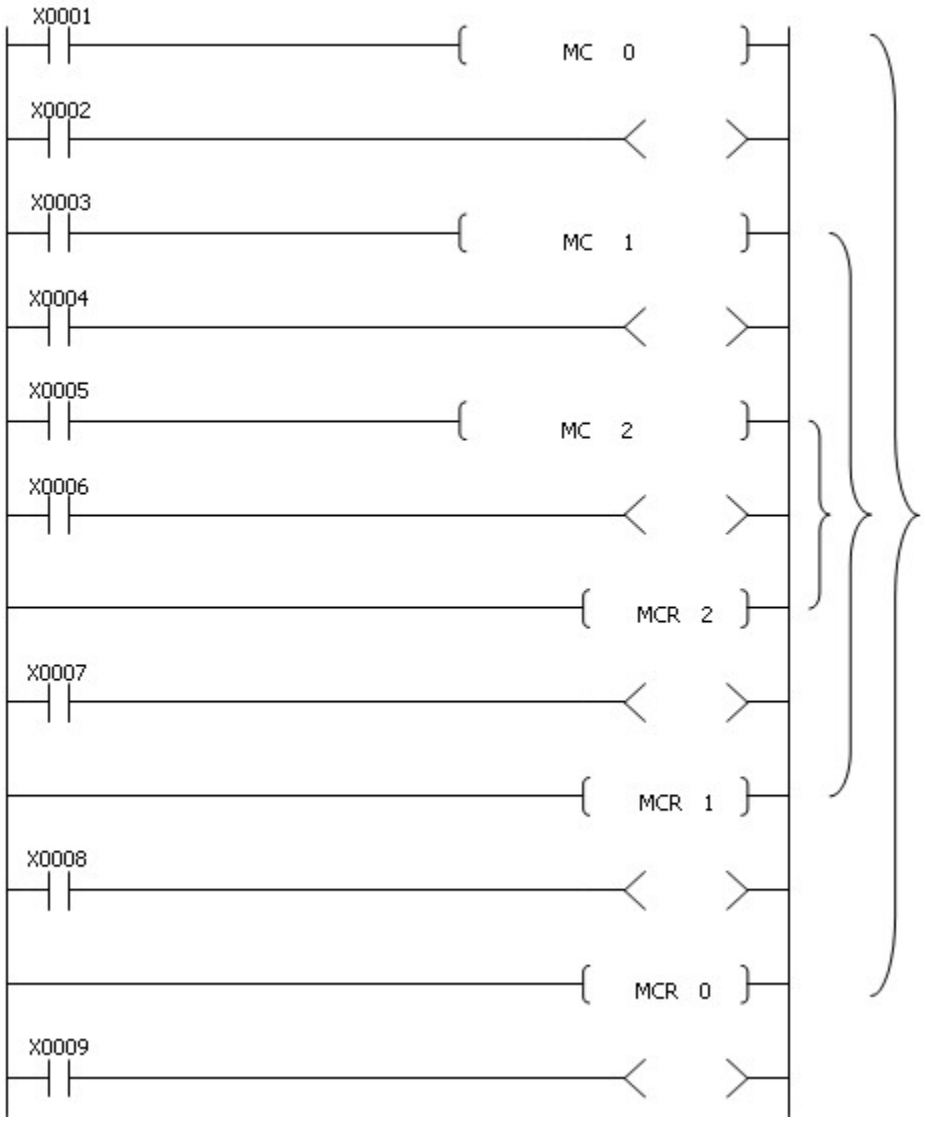
MC, MCR

Functions :

If the input condition of the MC is turned on, the instructions from MC number to the same MCR number as MC number are operated. If the input condition is turned off, no instructions are operated. Nesting is available up to 8 couples(n0 ~ 7). In case of nesting. The MC is operated from lower nesting number and the MCR is operated from higher nesting number. Irrelevant to the operation of the MC instruction, the scan from the MC instruction to the MCR instruction is run. The MCR is used to release the Master Control and display that the Master Control is not operated. If the MC-operated block with high order of priority is released, the MC-operated blocks with low order of priority are released.

Example of program :

- If X0001 is turned on, the MC is set. If it is turned off, the MC is reset



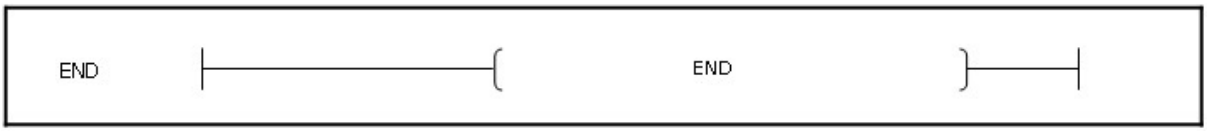
In order MC1 is operated, X0001 has to be turned on. In order MC2 is operated, X0003 has to be turned on after MC1 is operated. In order MC3 is operated, X0005 has to be turned on after MC1 was operated and MC2 is operated.

5.7.6 Termination Insruction

Contents :

5.7.6.1 End Main Routine Program : END

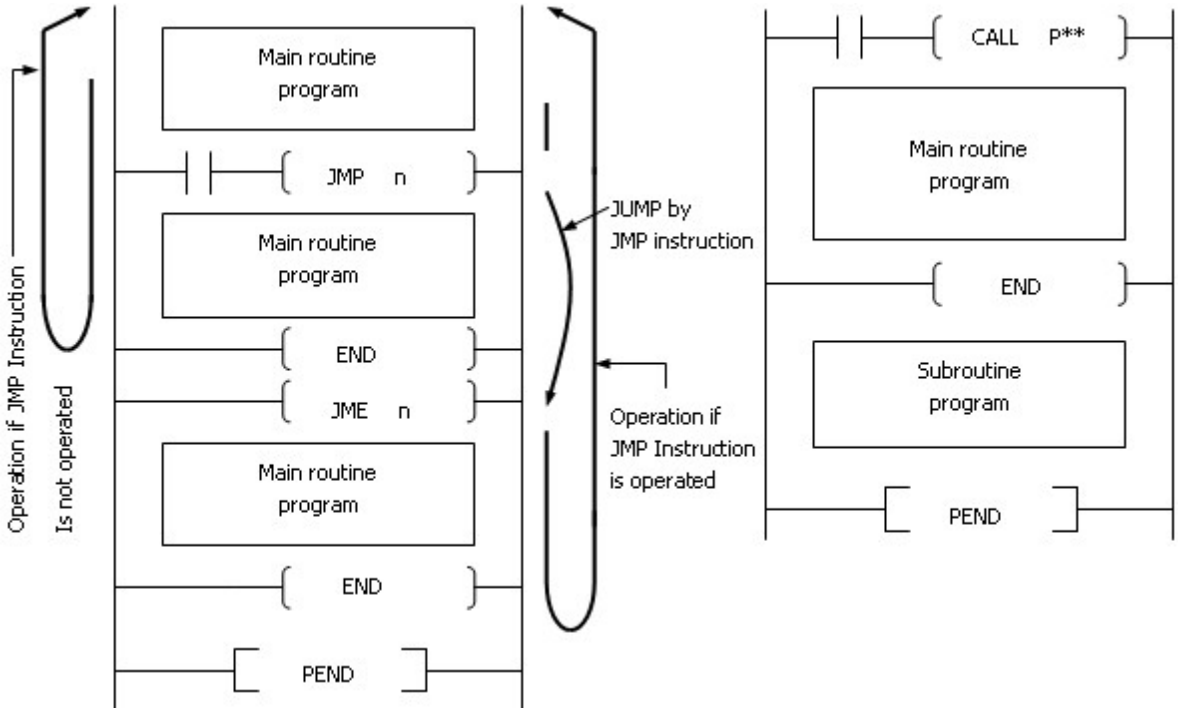
Instruction		Usable Device													No.of Steps	Flag		
		M	X	Y	K	L	F	T	C	S	Z	D	@D	Integer		Error	Zero	Carry
END	S														1			



END

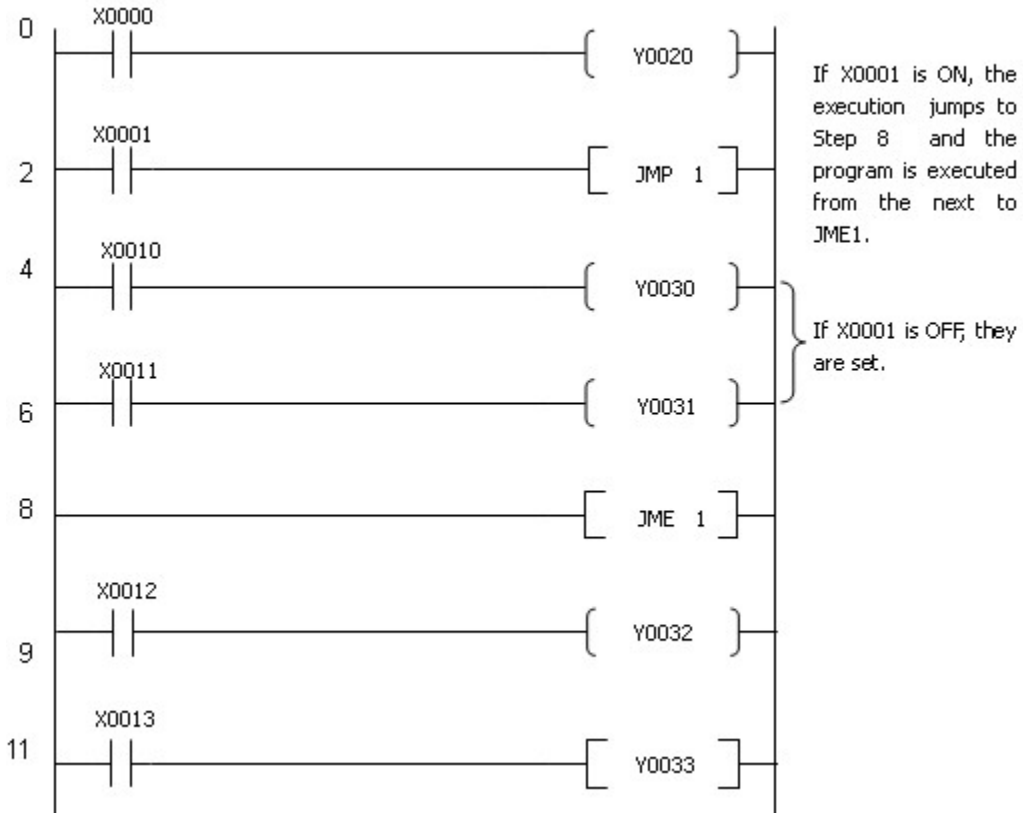
Functions :

This is used to end Main Routine Program.



Example of program :

- A program using the JMP instruction

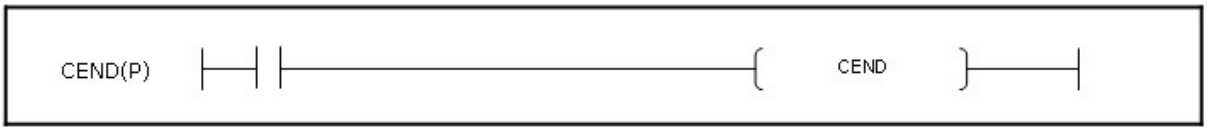


[List Mode]

Steps	Instruction	Device
0	LD	X0000
1	OUT	Y0020
2	LD	X0001
3	JMP	1
4	LD	X0010
5	OUT	Y0030
6	LD	X0011
7	OUT	Y0031
8	JME	1
9	PEND	
10	PEND	

5.7.6.2 End Main Rotion Program Conditionally : CEND, CENDP

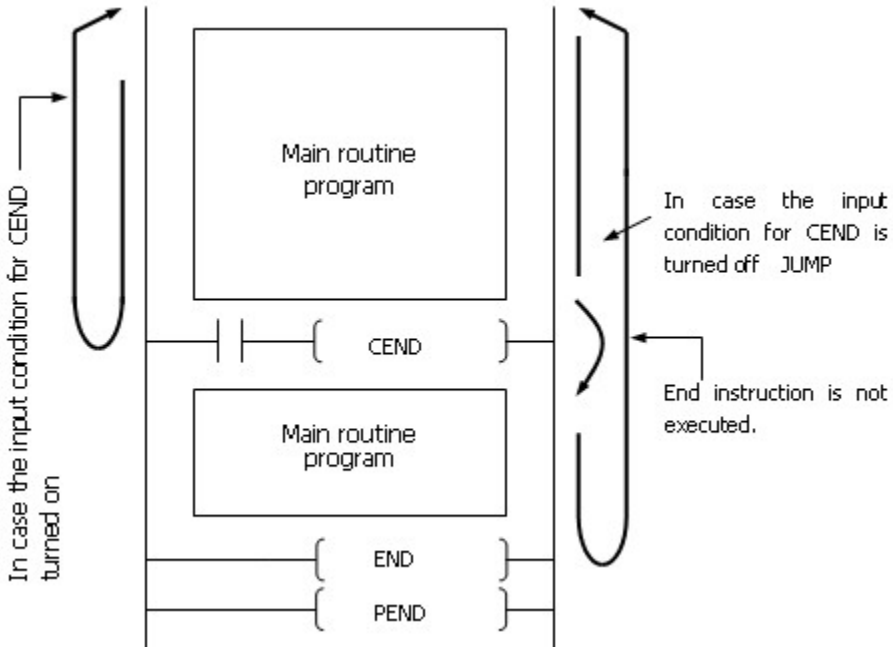
Instruction	Usable Device													No.of Steps	Flag		
	M	X	Y	K	L	F	T	C	S	Z	D	@D	Integer		Error	Zero	Carry
CEND (P)														1			



CEND

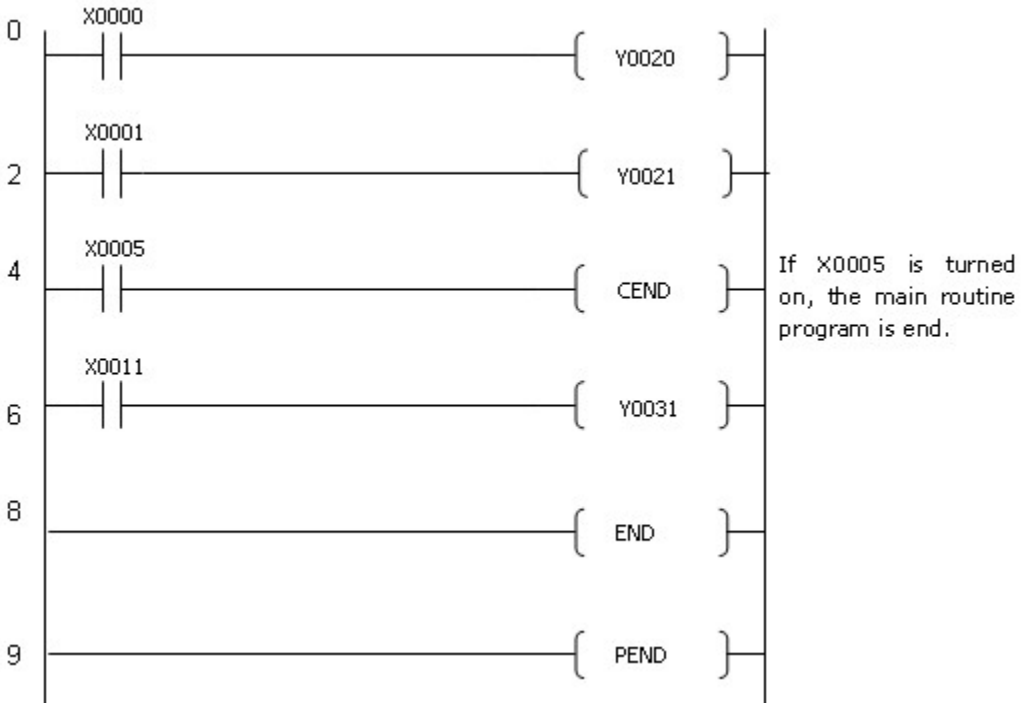
Functions :

Incase the condition to execute an instruction is truned on, this is used to end a main routine program. The different point from the END is the condition to execute an instruction(Input condition). The END instruction should be at the last of a main routine program.



Example of program :

- If X0005 is turned on, a Main Routine Program is ended

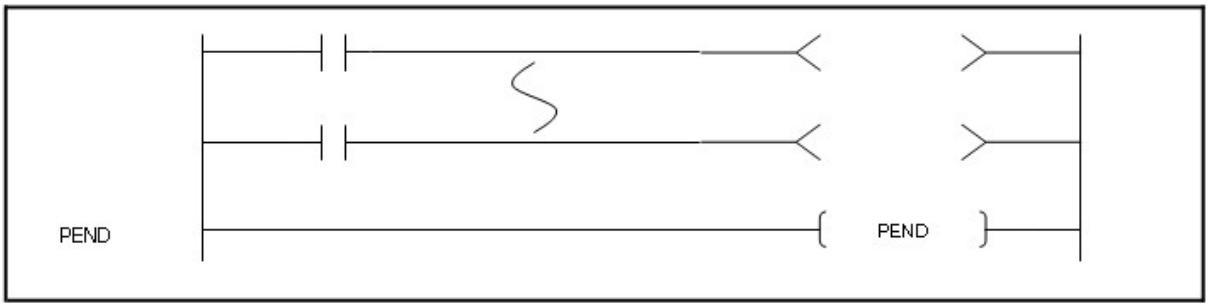


[List Mode]

Steps	Instruction	Device
0	LD	X0000
1	OUT	Y0020
2	LD	X0001
3	OUT	Y0021
4	LD	X0005
5	CEND	
6	LD	X0011
7	OUT	Y0031
8	END	
9	PEND	

5.7.6.3 End Sequence Program : PEND

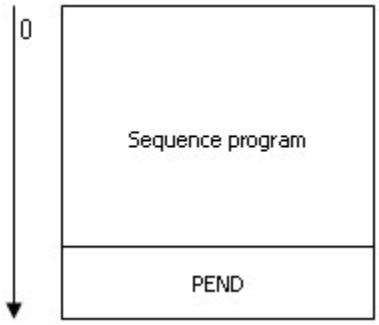
Instruction		Usable Device													No.of Steps	Flag		
		M	X	Y	K	L	F	T	C	S	Z	D	@D	Integer		Error	Zero	Carry
PEND	S														1			



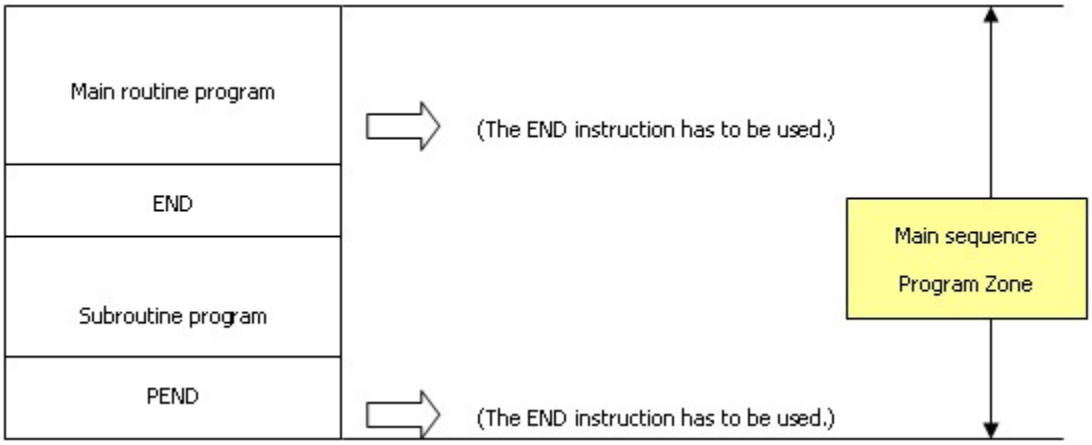
PEND

Functions :

This is used to end a program. Scanning is ended at this step and go back to 0 step.



While Main Sequence Program and Sub Sequence Program are run, it is not able to use the PEND instruction. In case the PEND is needed while a program is run, use the END instruction. In case of Main Routine Program, Sub Routine Program, Interrupt Program, Sub Sequence Program, how to use the END instruction and the PEND instruction is as follows.

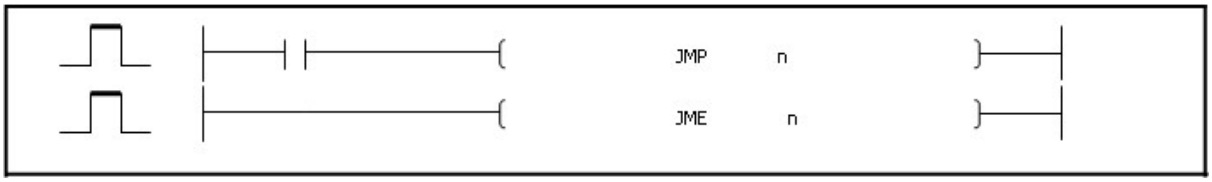


5.7.7 Program branch Instruction

Contents :

5.7.7.1 Jump : JMP, JMPP, JME

Instruction		Usable Device													No.of Steps	Flag		
		M	X	Y	K	L	F	T	C	S	Z	D	@D	Integer		Error	Zero	Carry
JMP (P) JME	n													o	1			



JMP, JME

Functions :

If the input for the JMP n instruction is turned on, the execution of a program jumps next to JME n and all of the instructions between JMP n and JME n are not operated.

Several JMP instructions pair with a JME instruction and can be used as a JMP instruction.

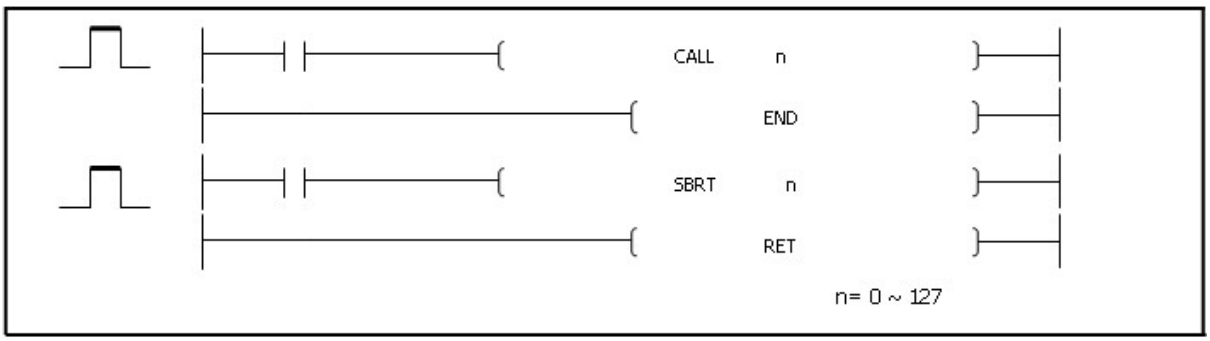
The number from 0 to 127 can be used as JMP Number n. But, the number should not be the same as the number of sub-routine(SBRT, RET) function. Please note that the JMP instruction between SBRT-operated block and RET-operated block is treated as an error.

Example of program :

A program that all of the instructions between JMP1 instruction and JME1 instruction if Input Signal X000F is turned on.

5.7.7.2 Branch Sub-Routine : CALL, CALLP, SBRT, RET

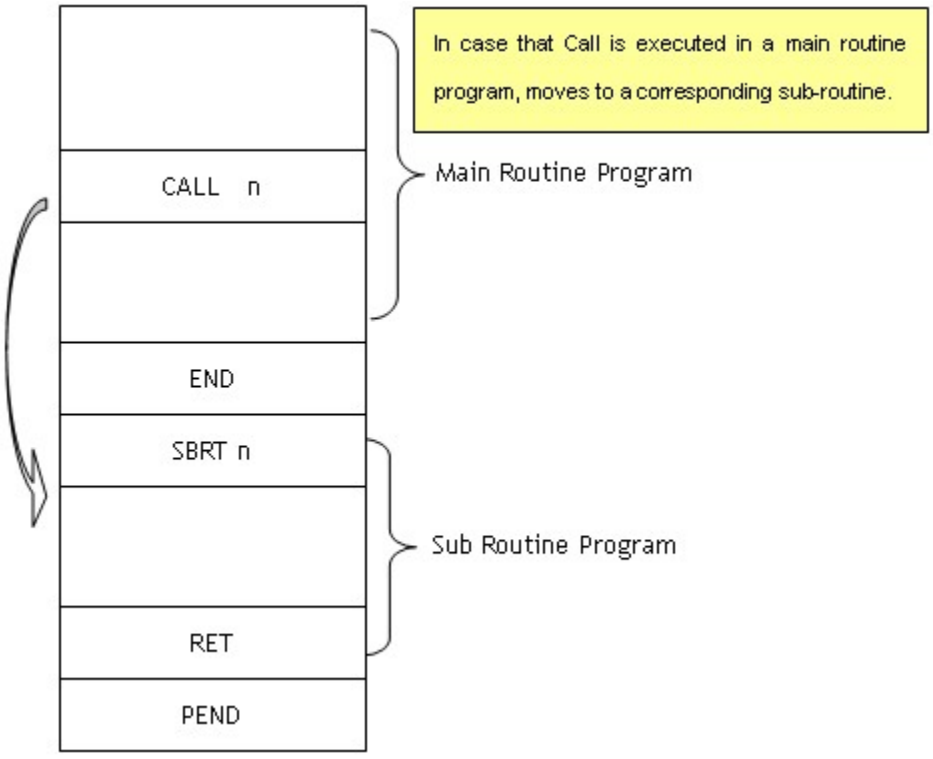
Instruction		Usable Device													No.of Steps	Flag		
		M	X	Y	K	L	F	T	C	S	Z	D	@D	Integer		Error	Zero	Carry
CALL (P)	n													o	1			
SBRT	n													o	1			
RET															1			



CALL, SBRT, RET

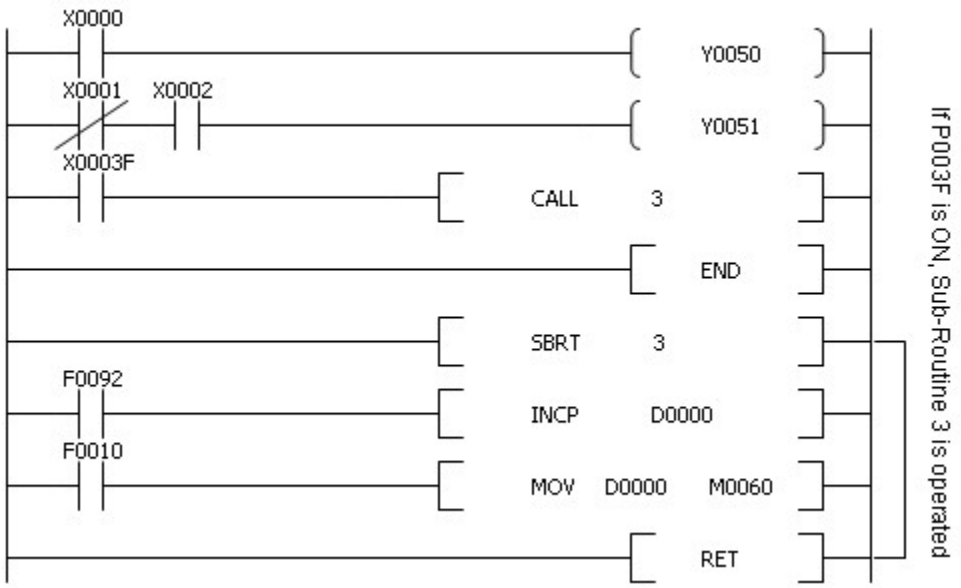
Functions :

In case an input condition is turned on while an program is executed, this is used to the program between the SBRT n and the RET according to the CALL n.



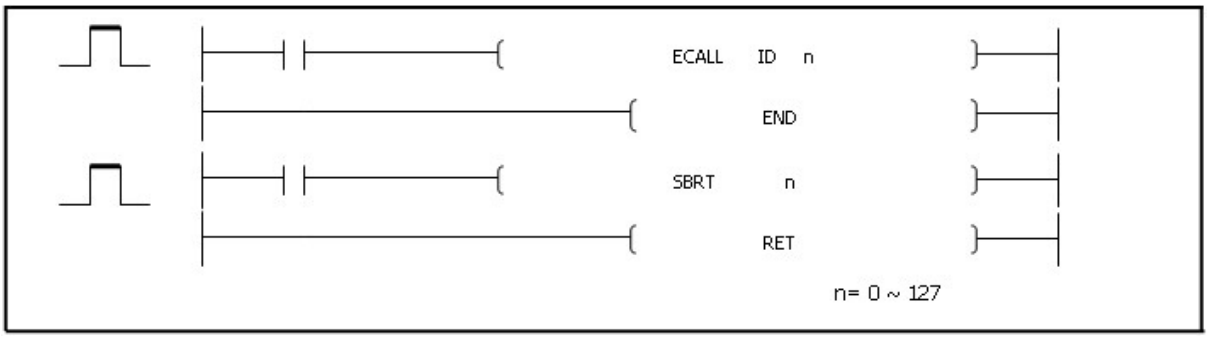
CALL No. can be used by nesting. Certainly, the instructions between the SBRT n instruction and the RET instruction are put next to the END instruction. Condition to be tread as Error : The case n is less than 00 or bigger than 127, The case there is the CALL n and not the SBRT n, The case there is the SBRT n alone or there is the RET alone. A CALL can be applied to execute another SBRT between a SBRT. Maximum is 16 times.

Example of program :



5.7.7.3 Call Sub-Routine between Program Files : ECALL, ECALLP, SBRT, RET

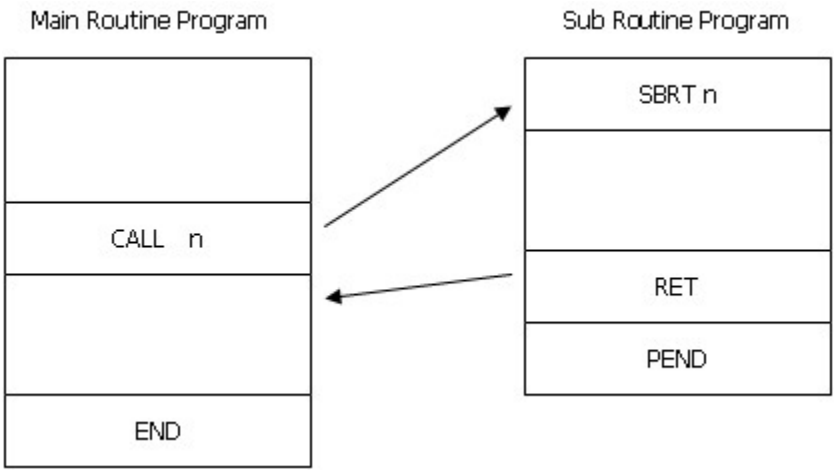
Instruction		Usable Device													No.of Steps	Flag		
		M	X	Y	K	L	F	T	C	S	Z	D	@D	Integer		Error	Zero	Carry
ECALL (P)	ID													o	3			
	n													o				
SBRT	n													o	1			
RET															1			



ECALL, SBRT, RET

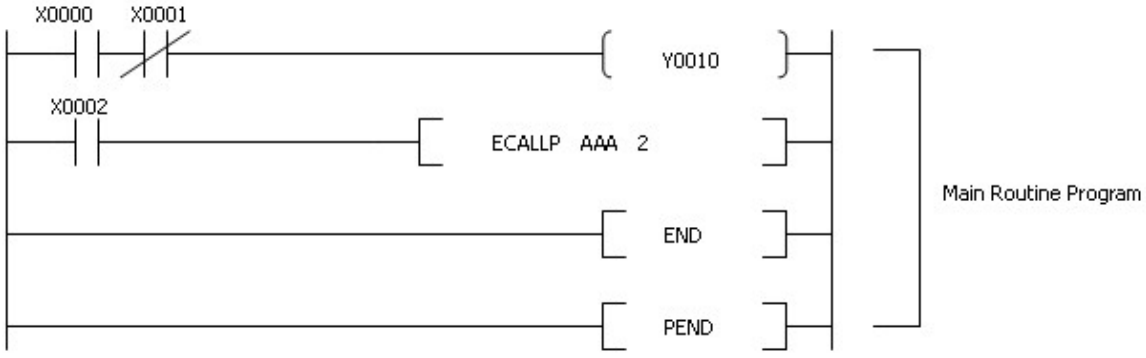
Functions :

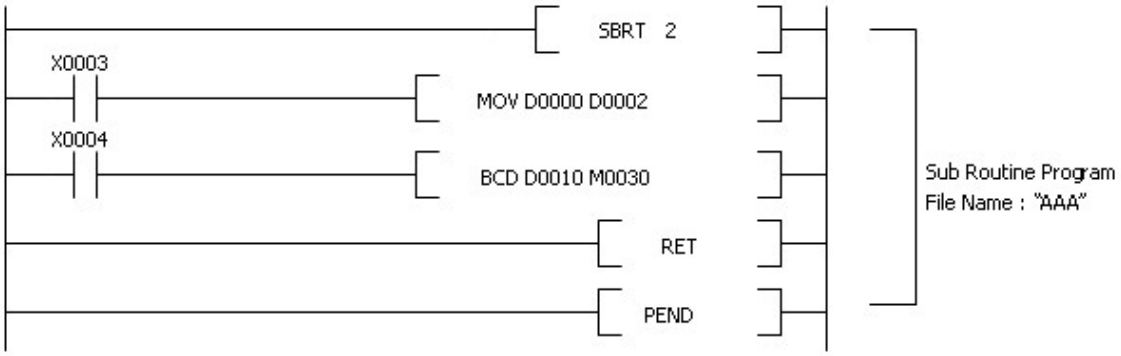
In case an input condition is turned on while a program is executed, this is used to move to the corresponding ID program according to the ECALL ID n, executing the program between SBRT n and RET in the program of the corresponding ID.



ECALL ID n can be used by nesting. The SBRT n and RET program of the corresponding number should exist in the program of the corresponding ID. Condition to be treated as Error : The case n is less than 00 or bigger than 127, The case there is the ECALL ID n and not n in the corresponding file, The case there is the SBRT n instruction alone or there is the RET instruction alone. A CALL or a ECALL can be applied to execute another SBRT between a SBRT.

Example of program :





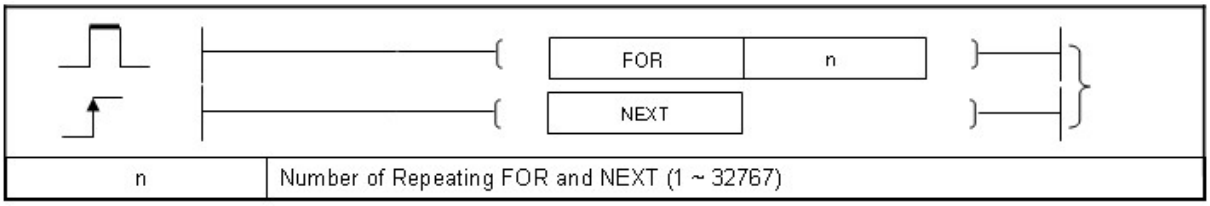
If Input Condition X0002 is turned on, the ECALLP is executed and the program between the SBRT 2 and RET in Sub Routine Program File " AAA" is executed.

5.7.8 Structure Creation Instruction

Contents :

5.7.8.1 FOR-NEXT : FOR, NEXT

Instruction		Usable Device													No.of Steps	Flag		
		M	X	Y	K	L	F	T	C	S	Z	D	@D	Integer		Error	Zero	Carry
FOR	S	o	o	o	o	o	o	o	o	o	o	o	o	o	2	o		
NEXT	S														o			



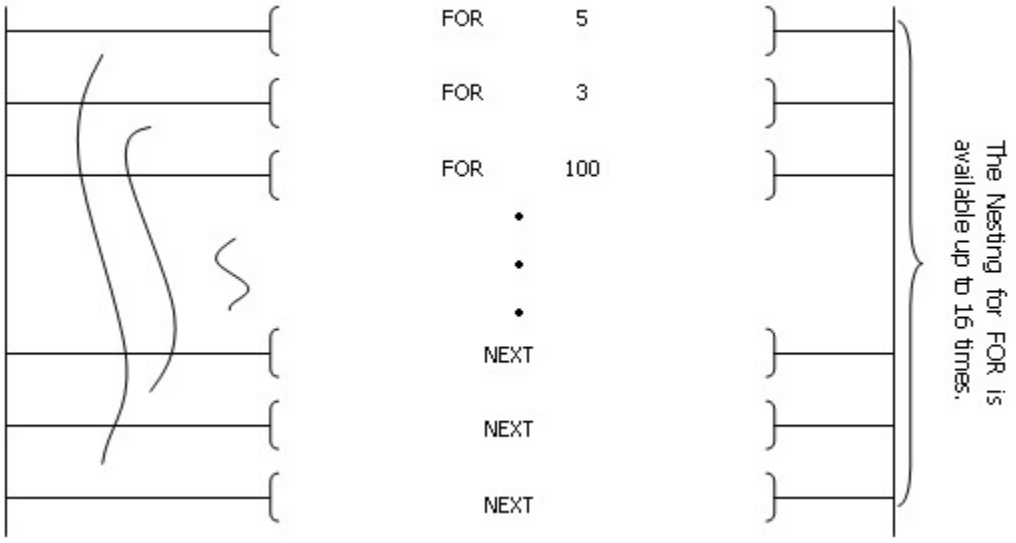
n	Number of Repeating FOR and NEXT (1 ~ 32767)

Error (F110)	In case that a device is assigned to @D, if overflow is generated, it is set.

FOR, NEXT

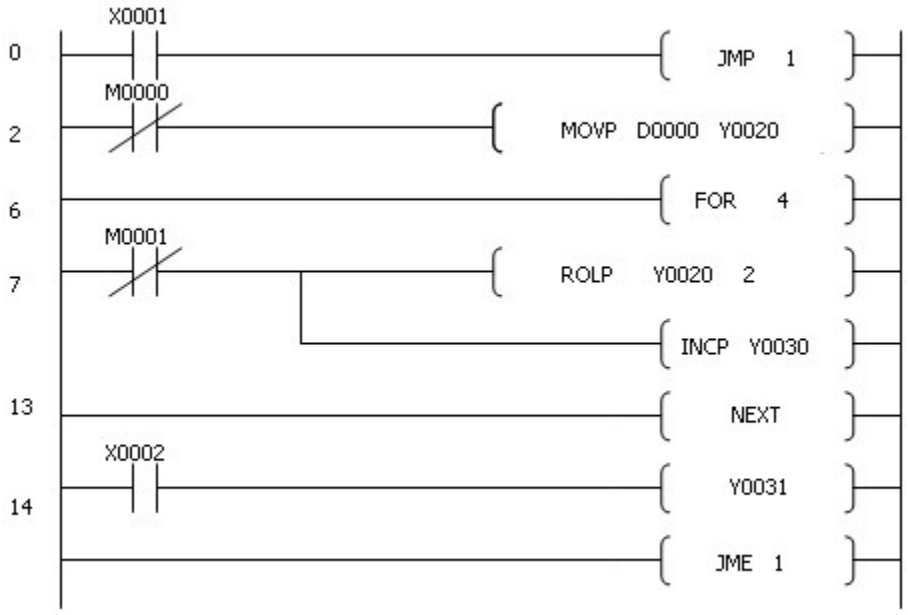
Functions :

This is used to operate the instructions between the FOR and the NEXT n at n times. After that, the step next to the NEXT n is executed. n can be assigned to one of the numbers between 1 and 32767. In case one of the numbers between -32767 and 0 is assigned, this instruction is operated as n=1. The Nesting for the FOR is available up to 16 times.



Example of program :

A program to operate the FOR - NEXT instruction if X0001 is turned off and not to operate it if X0001 is turned on.



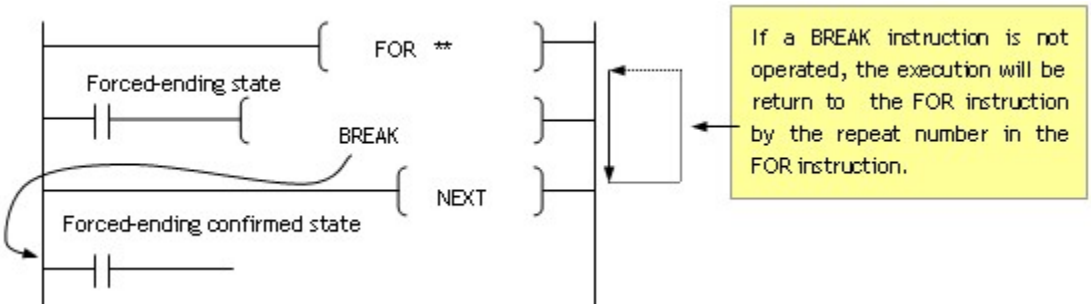
5.7.8.2 Force FOR-NEXT to End : BREAK, BREAKP

Instruction		Usable Device													No.of Steps	Flag		
		M	X	Y	K	L	F	T	C	S	Z	D	@D	Integer		Error	Zero	Carry
BREAK (P)	S														1			

BREAK

Functions :

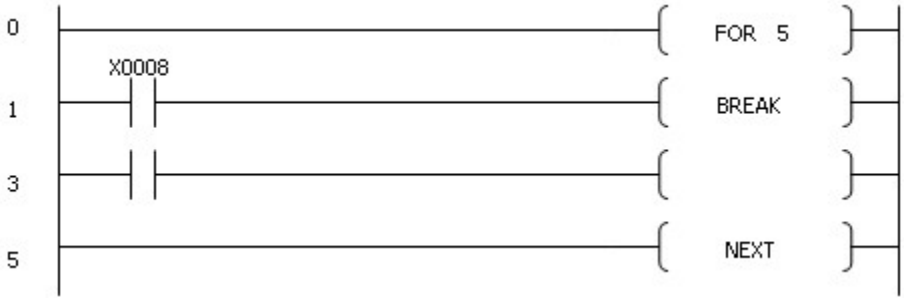
This is used to force the FOR - NEXT to end repeating.



The BREAK can be used while the FOR-NEXT is operated. The BREAK can be in a nesting level. In case it is operated in multiple nesting levels, BREAK instructions as same as the numbers in them will be executed.

Example of program :

A program to operated the FOR - NEXT instruction of X0008 is turned off and not to operate it if X0008 is turned on



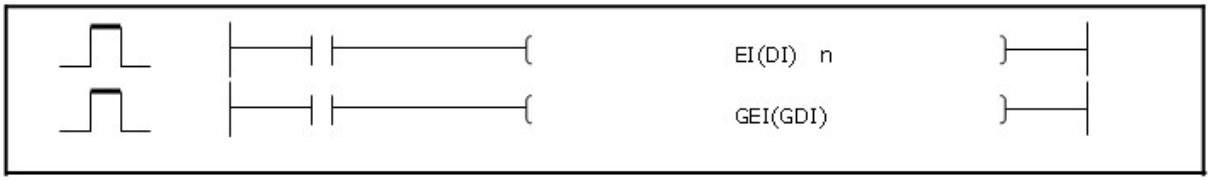
5.7.9 Program run control Instruction

Contents :

5.7.9.1 Enable or Disable to Interrupt : EI, DI, GEI, GDI

Instruction	Usable Device	No.o	Flag

		M												f Steps	Error		
EI, DI	n												o	1			
GEI, GDI														1			



EI

Functions :

This is used to enable the interrupt ID program assigned to n to operate Time Driven Interrupt. The interrupt set up by a parameter can be operated after this instruction is operated. If the Mode is converted to RUN, an interrupt program is in the DI status. To use a interrupt program routine, the GEI should be executed and then the EI should be executed.

DI

Functions :

This is used to disable the interrupt ID program assigned to n to operate Time Driven Interrupt. After this instruction is operated, an interrupt ID program assigned to n is not executed.

GEI

Functions :

This is used to enable all the programs that are assigned to interrupt to operate Time Driven Interrupt. The interrupt set up by a parameter can be operated after this instruction is operated. If the Mode is converted to RUN, all the interrupt programs are in the DI status. To use all the Interrupt program routines, the GEI should be executed.

GDI

Functions :

This is used to enable all the interrupt ID programs to operate Time Driven Interrupt. After this instruction is operated, all the interrupt ID program routines are not executed.

5.7.9.2 Return : IRET

Instruction		Usable Device													No.of Steps	Flag		
		M	X	Y	K	L	F	T	C	S	Z	D	@D	Integer		Error	Zero	Carry
IRET	n														1			

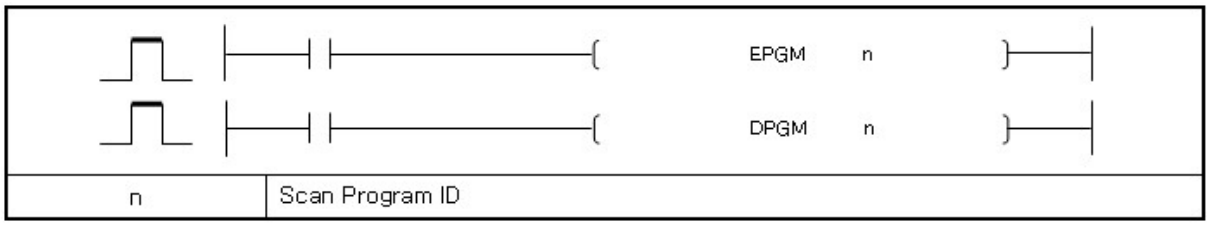
IRET

Functions :

This is used to end an interrupt program. This is used in the interrupt program assigned to Time Driven Interrupt.

5.7.9.3 Enable, Disable PBT : EPGM, DPGM

Instruction		Usable Device													No.of Steps	Flag			Usable CPU		
		M	X	Y	K	L	F	T	C	S	Z	D	@D	Integer		Error	Zero	Carry	XP	CP	BP
EPGM DP	n													o	1				o	o	o



EPGM

Functions :

Permit driving of scan program that correspond to ID that is established by n.
Change relevant scan program to Enable status in Disable status by DPGM command.
If Disable Program command is not input at Mode conversion, it is all Enable PBT states

DPGM

Functions :

After this command is executed, ID's program that correspond to n is unpractised
Must do in Enable Program state using EPGM command to run program again.

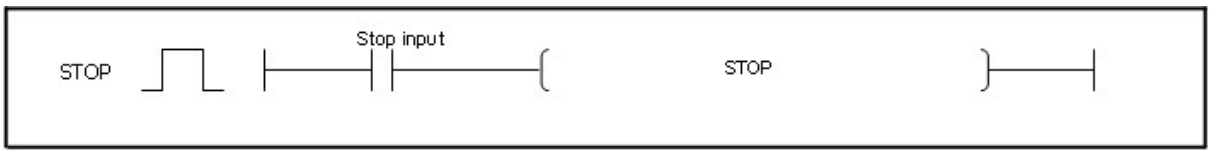
5.7.10 Other Instructions

Contents :

- I/O Refresh : RFS, RFSP

5.7.10.1 Stop Sequence Program : STOP

Instruction		Usable Device													No.of Steps	Flag		
		M	X	Y	K	L	F	T	C	S	Z	D	@D	Integer		Error	Zero	Carry
STOP	S														1			



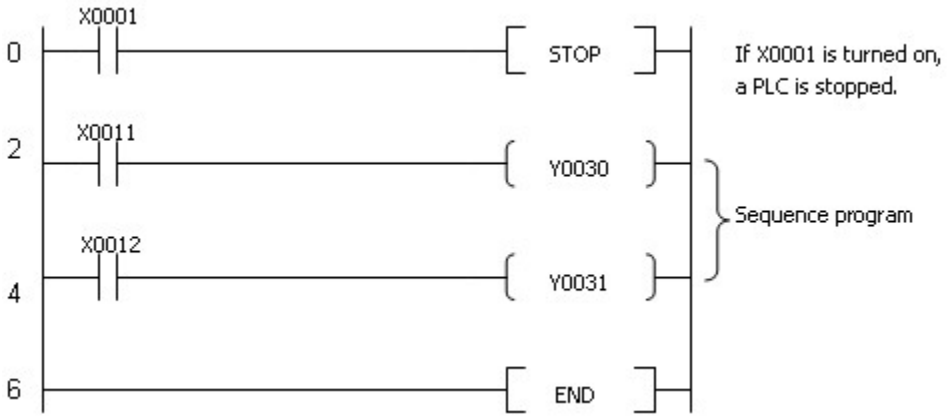
STOP

Functions :

This is used to stop the operation of instructions by resetting output Y if input is turned on. (The function is the same as the case that the RUN Key Switch is shifted to STOP.) To restart the operation of instructions after the STOP instruction is operated, the RUN Key Switch is shifted to STOP and to RUN. Do not put the STOP instruction in Interrupt Program, Sub Routine Program and FOR ~ NEXT.

Example of program :

- A program to stop a PLC if X0001 is turned on

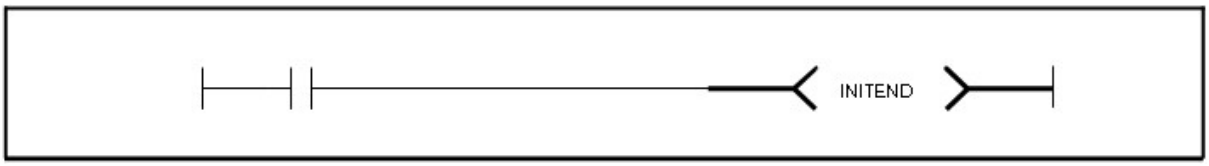


[List Mode]

Steps	Instruction	Device
0	LD	X0001
1	STOP	
2	LD	X0011
3	OUT	Y0030
4	LD	X0012
5	OUT	Y0031
6	END	

5.7.10.2 End Initialization Program and Execute Scan Program : INITEND

Instruction		Usable Device													No.of Steps	Flag		
		M	X	Y	K	L	F	T	C	S	Z	D	@D	Integer		Error	Zero	Carry
INITEND	S														1			



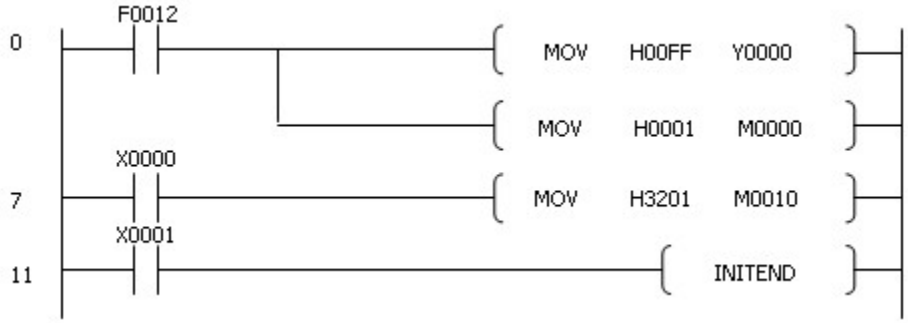
INITEND

Functions :

This is used to end an initialization program after the current scan, executing a scan program. To run a scan program, the INITEND instruction should be used. Unless this instruction is not used, the initialization program will be run continuously. The INITEND instruction can not be used in any program except an initialization program.

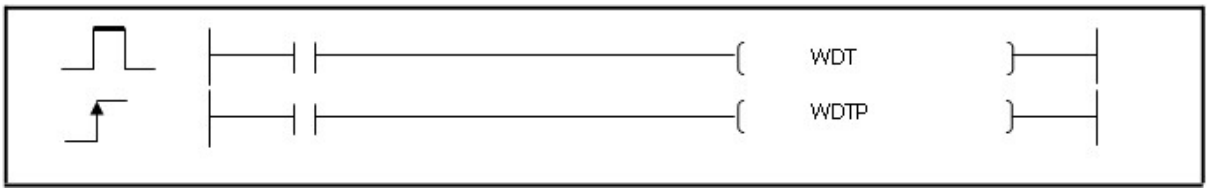
Example of program :

- A program to end an initialization program



5.7.10.3 Reset WDT : WDT, WDTP

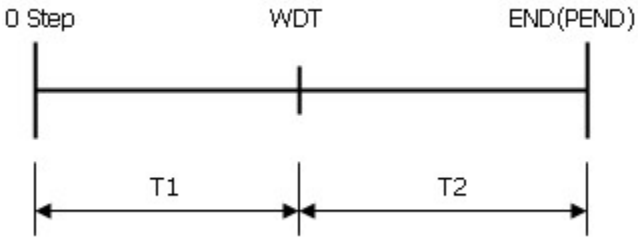
Instruction	Usable Device													No.of Steps	Flag		
	M	X	Y	K	L	F	T	C	S	Z	D	@D	Integer		Error	Zero	Carry
WDT														1			



WDT

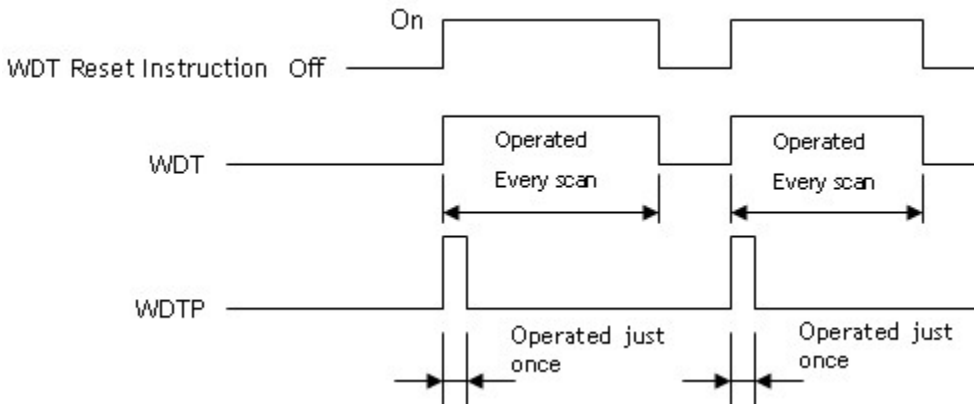
Functions :

This is used to reset Watch Dog Timer in a Sequence Program. This is used for the case that the time from Step 0 to END(FEND) is over the set value as Watch Dog Timer according to conditions in a Sequence Program. In case Scan Timer is over every set value as Scan Watch Dog Timer, the set value should be changed as Watch Dog Timer in Parameter setup of other devices. Please note neither T1, which is from 0 Step to a WDT instruction, nor T2, which is from the WDT instruction to an END(FEND) instruction, is over the set value for Watch Dog Timer.



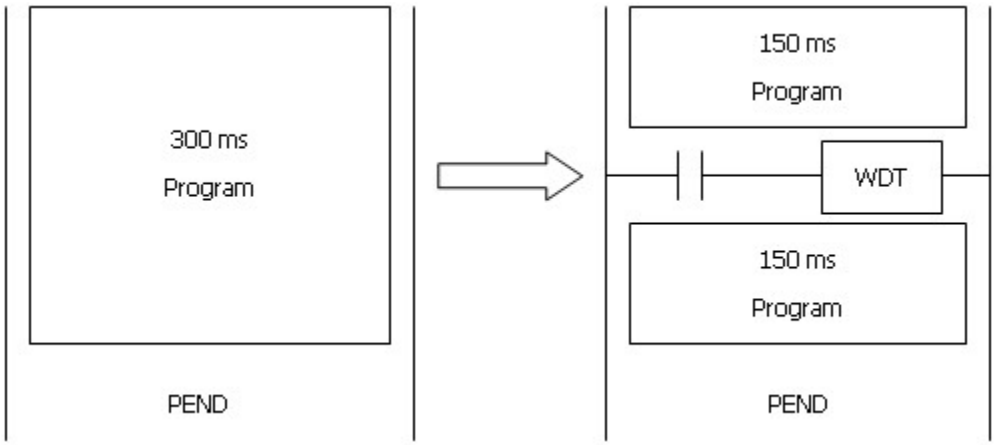
Please note that it takes too long to reset the output in case of error, though the WDT instruction can be used over twice for one scan.
Operating condition

The condition to operate the WDT Reset is as follows.



Example of program :

A program that Watch Dog Timer is set up as much as 150ms and it takes 300ms from 0 to PEND(END) instruction according to the execution condition of Program



5.7.10.4 Set or Reset Carry Flag : STC, CLC

Instruction		Usable Device													No.of Steps	Flag		
		M	X	Y	K	L	F	T	C	S	Z	D	@D	Integer		Error	Zero	Carry
STC, CLC	n														1			o

Carry(F112)	In case of STC, if an input condition is ON, it is set.
	In case of CLC, if an input condition is ON, it is reset.
	If the input condition of STC or CLC is OFF, there is no change.

STC

Functions :

If an input condition is turned on, Carry Flag(F112) is set.

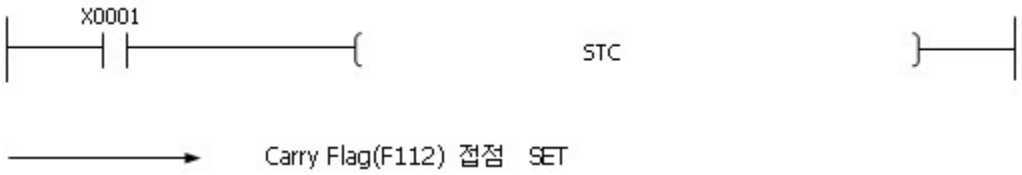
CLC

Functions :

If an input conditon is turned on, Carry Flag(F112) is reset.

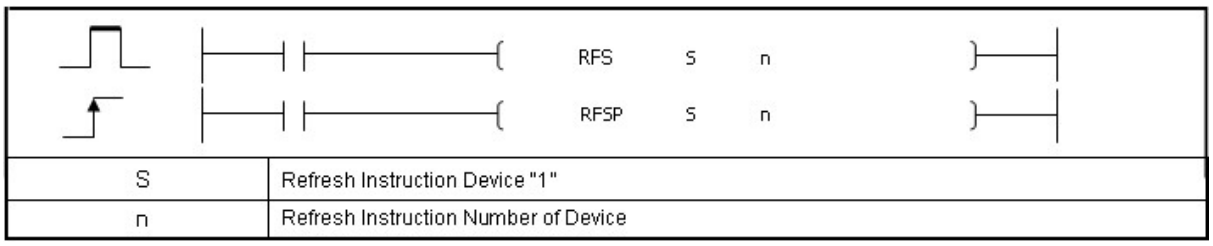
Example of program :

- A program to set Carry Flag(F112) if input X0001 is turned on



5.7.10.5 I/O Refresh : RFS, RFSP

Instruction		Usable Device													No.of Steps	Flag		
		M	X	Y	K	L	F	T	C	S	Z	D	@D	Integer		Error	Zero	Carry
RFS (P)	S		o	o											3			
	n	o	o	o	o	o	o	o	o	o	o	o	o	o				

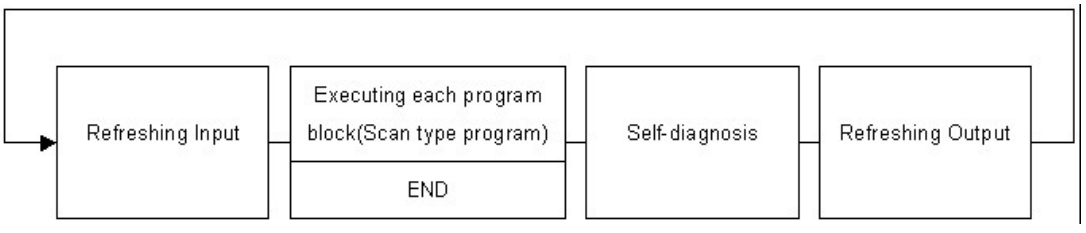


S	Refresh Instruction Device "1"
n	Refresh Instruction Number of Device

RFS

Functions :

In case the condition to execute an instruction is turned on, this is used to refresh the devices of input modules and output modules while scanning.



If the condition for the RFS instruction is turned on while scanning as the above order, input and output are enviously refreshed again. Executing the refresh instruction, the new input and output while scanning can be understood. After the refresh instruction is executed, the instruction according to the new input is executed.

Example of program :

If M0000 is turned on, 8 input devices from X0000 are refreshed.

5.8 Application Instruction

Contents :

Calculation of totals for 16bit data : WSUM, WSUMP

- Data conversion Instruction :
  - Convert BCD : BCD, BCDP, DBCD, DBCDP
  - Convert BIN : BIN, BINP, DBIN, DBINP
  - Invert Sing for BIN 16 Bit and 32 Bit Data : NEG, NEGP, DNEG, DNEGP
  - Conversion from BIN 16 and 32 Bit Data to floating decimal point : FLT, FLTP, DFLT, DFLTP
  - Conversion from floating decimal point data to BIN 16 and 32 Bit Data : INT, INTP, DINT, DINTP
  - Conversion from BIN Data to Gray Code : GRY, GRYP, DGRY, DGRYP
  - Conversion from Gray code to BIN Data : GBIN, GBINP, DGBIN, DGBINP

- Data transfer Instruction:
  - Transfer 16 Bit or 32 Bit Data : MOV, MOVP, DMOV, DMOVP
  - Transfer Block : BMOV, BMOVP
  - Floating-point data transfer Instruction : EMOV, EMOVP
  - Invert 16 Bit Data Bit : CML, CMLP, DCML, DCMLP
  - Exchange 16 Bit and 32 Bit Data : XCH, XCHP, DXCH, DXCHP
  - Exchange Block Data : BXCH, BXCHP
  - Transfer Identical 16 Bit Data Block : FMOV, FMOVP
  - Bit data transfer : WBMOV, WBMOVP
  - Transfer Bit Data : BITMOV, BITMOVP
  - Exchange Upper and Lower Byte : SWAP, SWAPP

- Data Table operation Instruction :
  - Writing data to the data table : FIFW, FIFWP
  - Reading the first data from the data table : FIFR, FIFRP
  - Reading the last data from the data table : FPOP, FPOPP
  - Inserting a data in the data table : FINS, FINSP
  - Deleting a data from the data table : FDEL, FDELP

- Logic operation Instruction :
  - Word AND : WAND, WANDP, DAND, DANDP
  - Word OR : WOR, WORP, DOR, DORP
  - Word Exclusive OR : WXOR, WXORP, DXOR, DXORP
  - Word Exclusive NOR : WXNR, WXNRP, DXNR, DXNRP
  - Block Logical Product : BKAND, BKANDP
  - Block Logical Sum : BKOR, BKORP
  - Block Exclusive OR : BKXOR, BKXORP
  - Block Non-Exclusive Logical Sum : BKXNR, BKXNRP

- Rotation Instruction :
  - Rotate Right : ROR, RORP, DROR, DRORP
  - Rotate Right With Carry : RCR, RCRP, DRCR, DRCRP

Rotate Left : ROL, ROLP, DROL, DROLP
Rotate Left With Carry : RCL, RCLP, DRCL, DRCLP

- Shift Instruction :
  Shift Right or Shift Left 16Bit Data as n Bits : SFR, SFRP, SFL, SFLP
  Shift Right or Shift Left 16 Bit Data as 1 Bit : BSFR, BSFRP, BSFL, BSFLP
  Shift Right or Shift Left n Word Data as 1 Word : DSFR, DSFRP, DSFL, DSFLP

- Character String Processing Instruction :
  Convert BIN 16 Bit or 32 Bit Data to Decimal ASCII : BINDA(p), DBINDA(P)
  Convert BIN 16 Bit or 32 Bit Data to Hexadecimal ASCII : BINHA(P)), DBINHA(P)
  Convert BCD 4 Digit or 8 Digit to Decimal ASCII Data : BCDDA(P), DBCDDA(P)
  Convert Decimal ASCII to BIN 16 Bit or 32 Bit Data : DABIN(P), DDABIN(P)
  Convert hexadecimal ASCII to BIN 16 bit Data : HABIN(P), DHABIN(P)

- Data Processing Instruction :
  Search 16 Bit and 32 Bit Data for Maximum Value : MAX, MAXP, DMAX, DMAXP
  Search for 16 Bit and 32 Bit Data for Minimum Value : MIN, MINP, DMIN, DMINP
  Check 16 Bit and 32 Bit Data : SUM, SUMP, DSUM, DSUMP
  Decode in 7-Segment : SEG, SEGP
  Decode 8 Bit Data or Encode 256 Bit Data : DECO, DECOP, ENCO, ENCOP
  Dissociate or Unite 16 Bit Data : DIS, DISP, UNI, UNIP
  Data Scaling according to the specified linear function : SCL, SCLP

- Bit Processing Instruction :
  Move Bit Device : TEST(P), DTEST(P)
  Set or Reset Bit in Word Device : BSET, BSETP, BRST, BRSTP

- Clock Instruction :
  Add Clock Data : DATE+, DATE+P
  Subtract Clock Data : DATE-, DATE-P
  Convert Clock Data Format : SECOND(P), HOUR(P)
  Reading Clock Data : DATERD, DATERDP
  Writing Clock Data : DATEWR, DATEWRP

- Timer / Counter :
  Set after Delay : TON
  Reset after Delay : TOFF
  Accumulate Time : TMR
  Redecrease Time Relevantly to Input (OFF to ON) : TRTG
  Decrease Time Irrelevantly to Input : TMON
  Count : CTU

Count Down : CTD
Count and Count Down : CTUD
Count and Set Conditionally : CTR

- Buffer Memory Access Instruction :
  Read 1 Word or 2 Word Data in Optional Unit : FROM, FROMP, DFRO, DFROP
  Write 1 Word or 2 Word Data in optional Unit : TO, TOP, DTO, DTOP

- Instruction for Data Link :
  Receive Data : RCV, RCVP
  Receive Data : RECV, RECVP
  Send Data : SEND, SENDP
  Send Data : SND, SNDP

- Read / Write Instruction :
  Setting Data Memory Access Instruction Special function module Setting Data Read : FREAD, FREADP
  Setting Data Memory Access Instruction Special function module Setting Data Write : FWRITE, FWRITEP

- Real number operation Instruction :
  SIN operation on floating decimal point Data : SIN, SINP
  COS Operation on floationg decimal point data : COS, COSP
  TAN operation on floating decimal point Data : TAN, TANP
  SIN-1 Operation on floating point data : ASIN, ASINP
  COS-1 Operation on floating point data : ACOS, ACOSP
  TAN-1 Operation on floating point data : ATAN, ATANP
  Conversion form floating decimal point angle to radian : RAD, RADP
  Conversion from floating decimal point radian to angle : DEG, DEGP
  Square root operations for floating decimal point Data : SQR, SQRP
  Exponent operation on floating decimal point dataInstruction : EXP, EXPP
  Natural logarithm operations on floating decimal point Data : LOG, LOGP
  Random number generate and series Update : RND, RNDP, SRND, SRNDP
  BCD of 4 Digit, Square root of 8 Digit : BSQR, BSQRP, BDSQR, BDSQRP
  BCD Type SIN-1 Operation : BASIN, BASINP
  BCD Type COS Operation : BCOS, BCOSP
  BCD Type TAN Operation : BTAN, BTANP
  BCD type SIN operation : BSIN, BSINP
  BCD type COS-1 Operation : BACOS, BACOSP
  BCD Type TAN-1 Operation : BATAN, BATANP

- etc:
  Timing pulse generation : DUTY
  Swap Active Status in Redundant System : ATVP

5.8.1 Comparison operation Instruction

Contents :

5.8.1.1 Compare 16 Bit and 32 Bit Data : LDx, LDDx, ANDx, ANDDx, OR, ORDx

Instruction		Usable Device												No.of Steps	Flag		
		M	X	Y	K	L	F	T	C	Z	D	@D	Integer		Error	Zero	Carry
LDx, LDDx ANDx, ANDDx, ORx, ORDx	S1	o	o	o	o	o	o	o	o	o	o	o	o	o	o	-	-
	S2	o	o	o	o	o	o	o	o	o	o	o	o	o			

Error (F110)	In case That a Device is assigned to @D, if overflow is generated, it is set.

LD x, LDDx (x : =, <, >, <=, >=, <>)

Functions :

These are used to compare the data in the device assigned to S1 with the data in the device assigned to S2, turning on the result of the current operation, if it coincides with Condition x. The comparison of S1 and S2 executes SIGNED operation. Accordingly, the result of LD x is h8000 (-32768) ~ hFFFF (-1) < 0 ~ h7FFF (32767) and the result of LDD x is h80000000 (-2147483648) ~ hFFFFFFFF (-1) < 0 ~ h7FFFFFFF (2147483647)

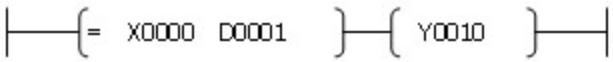
Condition x	Condition	Result of Operation
=	S1 = S2	ON
<=	S1 = S2	ON
>=	S1 = S2	ON
<>	S1 ? S2	ON
<	S1 < S2	ON

>	S1 > S2	ON

The results of the operation beside the aboves are turned off

Example of program :

- A program to compare the word data in X0000 and the word data in D0001

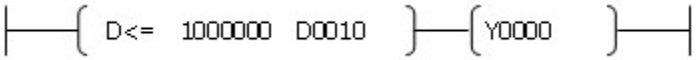


If the data in X0000 and the data in D0001 are same, Y0010 is set.

- A program to compare Integer 1000 with the data in D0001

If the data in D0001 is greater than or equal to 1000, Y0010 is set.

- A program to compare the double-word data in the device assigned to D0010 with Integer 1,000,000



If the data in D0010 is less than or equal to 1,000,000, Y0000 is turned on.

AND x, ANDD x (x : =, <, >, <=, >=, <>)

Functions :

These are used to compare the data in the device assigned to S1 with the data in the device assigned to S2, turning on the result of the current operation, if it coincides with Condition x and turing the result of the current operation, if it coincides with Condition x. And these are used to AND-operate the result of the comparison and the result of the current operation, taking the result of AND-operation as the result of the entire operation. The comparison of S1 and S2 executes SIGNED operation. Accordingly, the result of AND x is h8000 (-32768) ~ hFFFF (-1) < 0 ~ h7FFF (32767) and the result of ANDD x is h80000000 (-2147483648) ~ hFFFFFFFF (-1) < 0 ~ h7FFFFFFF (2147483647)

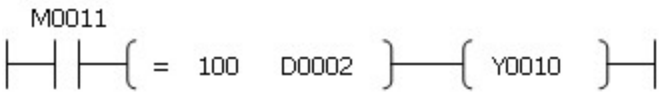
Condition x	Condition	Result of Operation
=	S1 = S2	ON

<=	S1 = S2	ON
>=	S1 = S2	ON
<>	S1 ? S2	ON
<	S1 < S2	ON
>	S1 > S2	ON

Irrevalently the results of the current operation. The result of the operations beside the aboves are turned off.

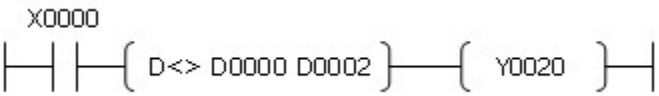
Example of program :

- A program to compare 100 with the word data in D0002



If M0011 is turned on and the data in D0002 is 100, Y0010 is turned on.

- A program to compare the double-word data in D0000 with the double-word data in D0002



If X0000 is turned on and the double-word data in D0000 is different from the double-word data in D0002, Y0020 is turned on.

OR x, ORD x (x : =, <, >, <=, >=, <>)

Functions :

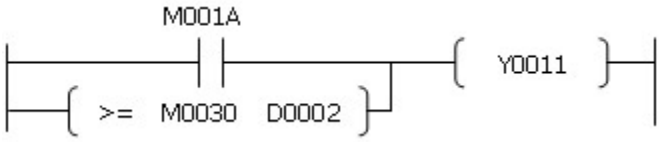
These are used to compare the data in the device assigned to S1 with the data in the device assigned to S2, turning on the result of the current operation, if it coincides with Condition x and turing the result of the current operation, if it coincides with Condition x. And these are used to OR-operate the result of the comparison and the result of the current operation, taking the result of OR-operation as the result of the entire operation. The comparison of S1 and S2 executes SIGNED operation.
Accordingly, the result of OR x is h8000 (-32768) ~ hFFFF (-1) < 0 ~ h7FFF (32767) and the result of ORD x is h80000000 (-2147483648) ~ hFFFFFFFF (-1) < 0 ~ h7FFFFFFF (2147483647).

Condition x	Condition	Result of Operation
=	S1 = S2	ON
<=	S1 = S2	ON
>=	S1 = S2	ON
<>	S1 ? S2	ON
<	S1 < S2	ON
>	S1 > S2	ON

Irevalently the result of the current operation. The results of the operations beside the aboves are turned off.

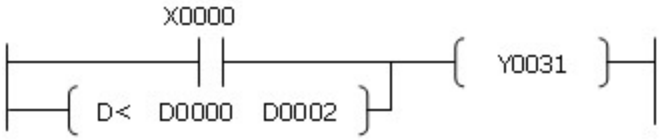
Example of Program :

- A program to compare the word data in M0030 with the word data in D0002



If M001A is turned on or the data in M0030 is greater than or equal to the data in D0002, Y0011 is turned on.

- A program to compare the data in D0000 with the data in D0002



If X0000 is turned on or the double-word data in D0000 is less than the data in D0002, Y0031 is turned on.

5.8.1.2 16 Bit, 32 Bit Unsigned Data Comparisons : UCMP, UDCMP

Instruction		Usable Device												No.of Steps	Flag		
		M	X	Y	K	L	F	T	C	Z	D	@D	Integer		Error	Zero	Carry
UCMP	S1	o	o	o	o	o	-	-	-	o	o	o	o	3	o	o	o

	S2	o	-	o	o	o	-	-	-	o	o	o	o				

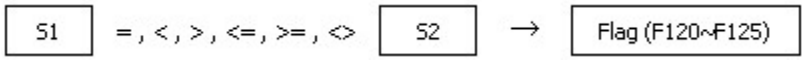
S1	Comparison data or data save the number
S2	Paralleled data or data save the number

Error (F110)	In case That a Device is assigned to @D, if overflow is generated, it is set.

UCMP(P)

Explanation :

Compares BIN 16-bit data the nth point from the device number designated by S1 with BIN 16-bit data the nth point from the device number designated by S2 , and the result are stores Flag F(F0120 ~ F0125)

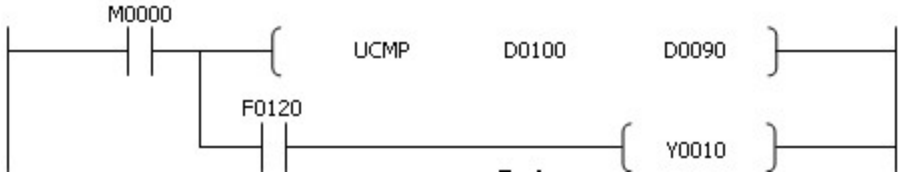


- the result are stores Flag F(F0120 ~ F0125)

A condition	Result
S1 < S2	F0120
S1 = S2	F0121
S1 = S2	F0122
S1 > S2	F0123
S1 = S2	F0124
S1 ? S2	F0125

Example of Program:

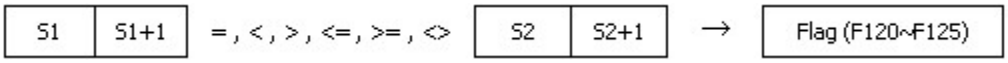
A comparison operation When M0000 goes ON, comparing the data for the number of points D00100 with the data the number of points D00090 ,when the result is equal flag F0120 set On.



UDCMP(P)

Explanation :

Compares BIN 32-bit data the nth point from the device number designated by S1,S1+1 with BIN 32-bit data the nth point from the device number designated by S2 ,S2+1 , and the result are stores Flag F(F0120 ~ F0125)

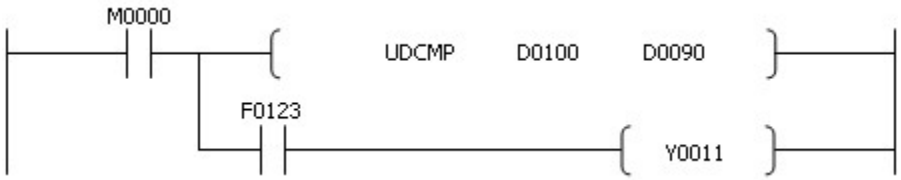


- the result are stores Flag F(F0120 ~ F0125)

A condition	Reslut
S1 < S2	F0120
S1 = S2	F0121
S1 = S2	F0122
S1 > S2	F0123
S1 = S2	F0124
S1 ? S2	F0125

Example of Program :

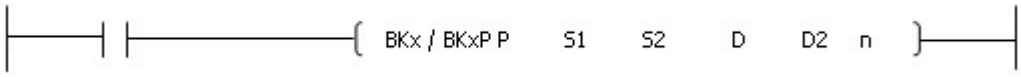
A comparison operation When M0000 goes ON, comparing the data for the number of points D00100 with the data the number of points D00090 ,when the result is equal flag F0120 set On.



5.8.1.3 INT 16 Block Data Comparison : BK=, BK<>, BK>, BK<=, BK<, BK>=, BK=P, BK<>P, BK>P, BK<=P, BK<P, BK>=P

Instruction		Usable Device												No.of Steps	Flag			Usable CPU		
		M	X	Y	K	L	F	T	C	Z	D	@D	Integer		Error	Zero	Carry	XP	CP	BP
BK	S1	o	o	o	o	o	o	o	o	o	o	o	o	6	o	-	-	o	o	-

S2	o	o	o	o	o	o	o	o	o	o	o	o	
D1	o	-	o	o	o	-	-	-	o	o	o	-	
D2	o	o	o	o	o	o	o	o	o	o	o	o	
n	o	o	o	o	o	o	o	o	o	o	o	-	



S1	Assigned data or number of device
S2	Number of the device to which the data compared is assigned
D1	Number of the device to store the result of block comparison
D2	
n	Number of the blocks compared

Error (F110)	In case That a Device is assigned to @D, if overflow is generated, it is set.

BK

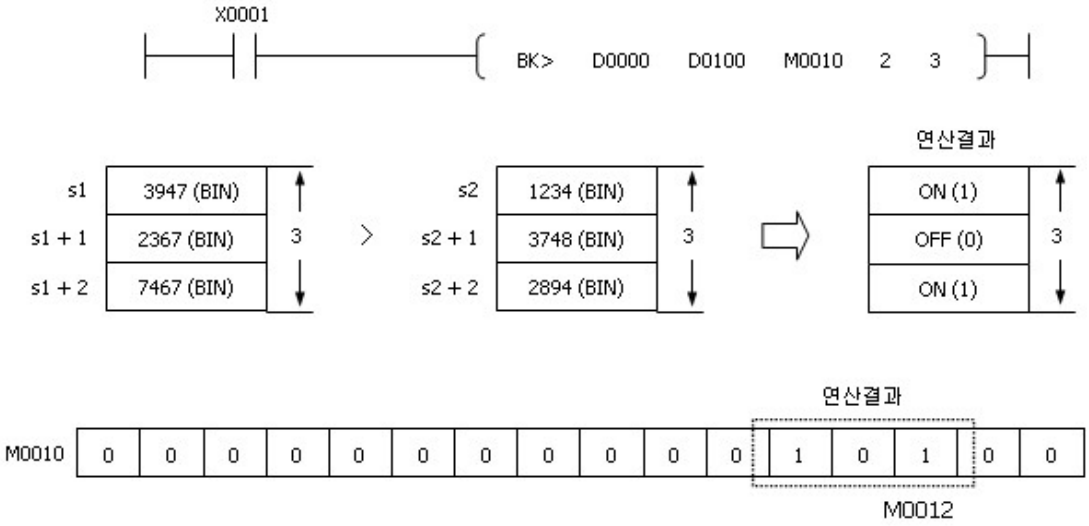
Functions :

- This is used to compare n number of word data in the device assigned to S1 with n number of word data in the device assigned to S2, storing the result in the device assigned to D.
- If the result of comparison is true, the device assigned to D is set.
- If the result of comparison is false, the device assigned to D is reset.
- Comparison is operated in word.
- S1 is the value between –32768 and 32767.
- The result of comparison operation according to each instruction

Instruction	Condition	Result	Instruction	Condition	Result
BK=	s1 = s2	ON(1)	BK=	s1 ? s2	OFF(0)
BK<>	s1 ? s2		BK<>	s1 = s2	
BK>	s1 > s2		BK>	s1 = s2	
BK<=	s1 = s2		BK<=	s1 > s2	
BK<	s1 < s2		BK<	s1 = s2	
BK>=	s1 = s2		BK>=	s1 < s2	

Example of Program :

The program used to compare 8 word data from the word data in the device assigned to M0000 with 8 word data from the word data in the device assigned to M0100 each.



If X0000 is on and 8 word data from the word data in the device assigned to M0000 is greater than or equal to 8 word data from the word data in the device assigned to M0100, Y0011 is set.

5.8.2 Arithmetic operation Instruction

Contents :

5.8.2.1 ADD BIN : ADD, DADD, ADDP, DADDP

Instruction		Usable Device												No.of Steps	Flag		
		M	X	Y	K	L	F	T	C	Z	D	@D	Integer		Error	Zero	Carry
ADD(P) DADD(P)	S1	o	o	o	o	o	o	o	o	o	o	o	o	4	o	-	-
	S2	o	-	o	o	o	o	o	o	o	o	o	o				
	D	o	-	o	o	o	-	o	o	o	o	o	-				

S1, S2	Assigned data or number of device
D	Number of destination device

Error (F110)	In case That a Device is assigned to @D, if overflow is generated, it is set.

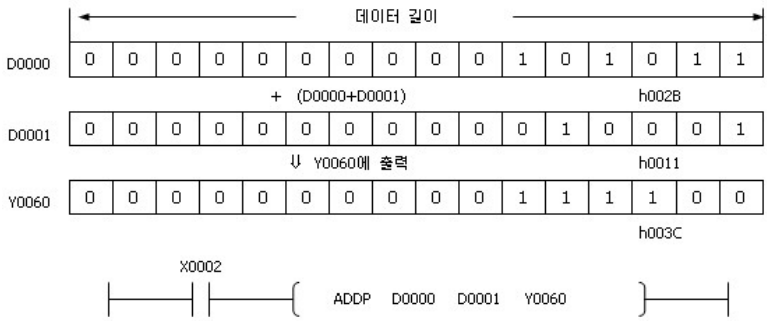
ADD

Functions :

This is used to add the word data in the device assigned to S1 to the word data in the device assigned to S2, storing the result in the device assigned D.

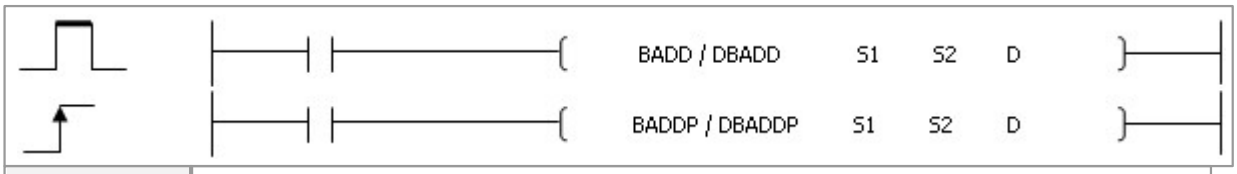
Example of program :

A program to add the data in the device assigned to D0000 to the data in the device assigned to D0001, output the result to Y0060 when program input signal X0002 is turned on



5.8.2.2 ADD BCD : BADD, BADDP, DBADD, DBADDP

Instruction		Usable Device												No.of Steps	Flag		
		M	X	Y	K	L	F	T	C	Z	D	@D	Integer		Error	Zero	Carry
BADD(P) DBADD(P)	S1	o	o	o	o	o	o	o	o	o	o	o	o	4	o	-	-
	S2	o	o	o	o	o	o	o	o	o	o	o	o				
	D	o	-	o	o	o	-	o	o	o	o	o	-				



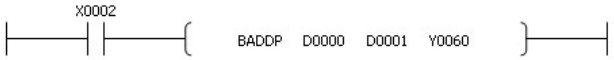
S1, S2	Assigned data or number of device
D	Number of destination device

Error (F110)	In case That a Device is assigned to @D, if overflow is generated, it is set.

BADD

Example of program :

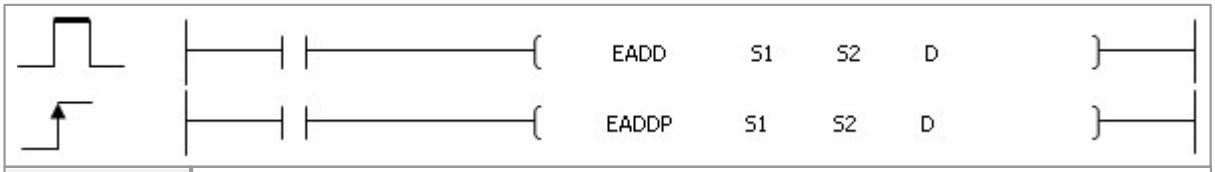
A program to add the data in the device assigned to D0000 to the data in the device assigned to D0001, outputting the result to Y0060 when program input signal X0002 is turned on



5.8.2.3 Floating-point four arithmetical operations arithmetic(Addition) : EADD, EADDP

Instruction	Usable Device												No.of	Flag			Usable CPU		
	M	X	Y	K	L	F	T	C	Z	D	@D	Integer		Error	Zero	Carry	XP	CP	BP

														Steps						
EADD(P)	S1	o	o	o	o	o	-	-	-	o	o	o	-	4	o	-	-	o	-	-
	S2	o	o	o	o	o	-	-	-	o	o	o	-							
	D	o	-	o	o	o	-	-	-	o	o	o	-							



S1, S2	Assigned data or number of device
D	Number of destination device

Error (F110)	In case That a Device is assigned to @D, if overflow is generated, it is set.

EADD(P)

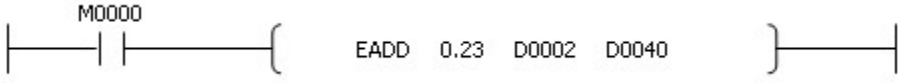
Functions :

This is used to add the floating-point data in the device assigned to S1 to the floating-point data in the device assigned to S2, storing the result in the device assigned D.
The result of the operation to add S1 to S2 is stored in D.
According to the result of an operation, error flag(F110) is set.

Example of program :

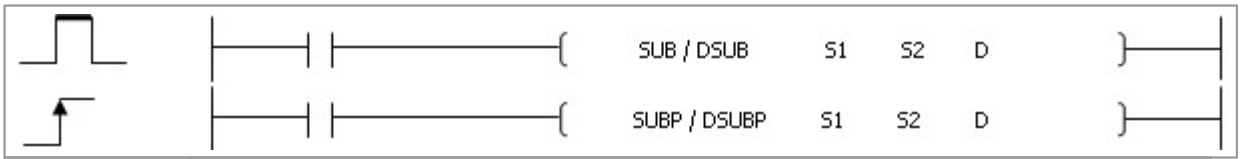
- A program to add the floating-point data in the device assigned to D00000 to the floating-point data in the device assigned to D00004, output the result to Y0040 when program input signal X0002 is turned on.

- A program to add the floating-point data 0.23 to the floating-point data in the device assigned to D00002, outputing the result to D00040 when program input signal M0000 is turned on.



5.8.2.4 Subtract BIN : SUB, SUBP, DSUB, DSUBP

Instruction		Usable Device												No.of Steps	Flag		
		M	X	Y	K	L	F	T	C	Z	D	@D	Integer		Error	Zero	Carry
SUB(P) DSUB(P)	S1	o	o	o	o	o	o	o	o	o	o	o	o	4	o	-	-
	S2	o	o	o	o	o	o	o	o	o	o	o	o				
	D	o	-	o	o	o	-	o	o	o	o	o	-				



S1, S2	Assigned data or number of device
D	Number of destination device

Error (F110)	In case That a Device is assigned to @D, if overflow is generated, it is set.

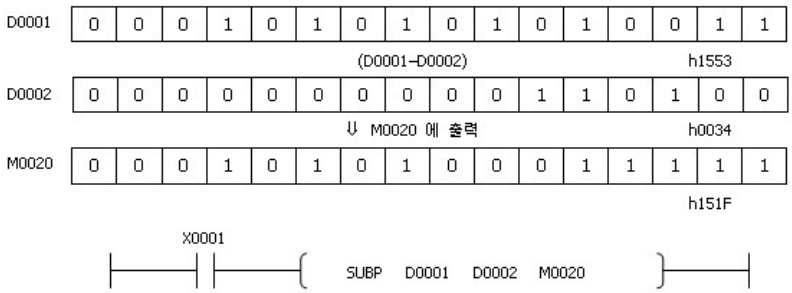
SUB

Functions :

This is used to subtract the word data in the device assigned to S2 from the word data in the device assigned to S1, storing the result in the device assigned to D.

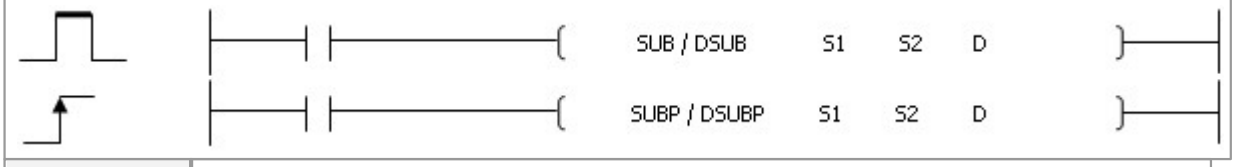
Example of program :

A program to subtract the data in the device assigned to D0002 from the data in the device assigned to D0001, storing the result in M0020 when an input signal X0001 is turned on



5.8.2.5 Subtract BCD : BSUB, BSUBP, DBSUB, DBSUBP

Instruction		Usable Device												No.of Steps	Flag		
		M	X	Y	K	L	F	T	C	Z	D	@D	Integer		Error	Zero	Carry
BSUB(P) DBSUB(P)	S1	o	o	o	o	o	o	o	o	o	o	o	o	4	o	-	-
	S2	o	o	o	o	o	o	o	o	o	o	o	o				
	D	o	-	o	o	o	-	o	o	o	o	o	-				



S1, S2	Assigned data or number of device
D	Number of destination device

Error (F110)	In case That a Device is assigned to @D, if overflow is generated, it is set.

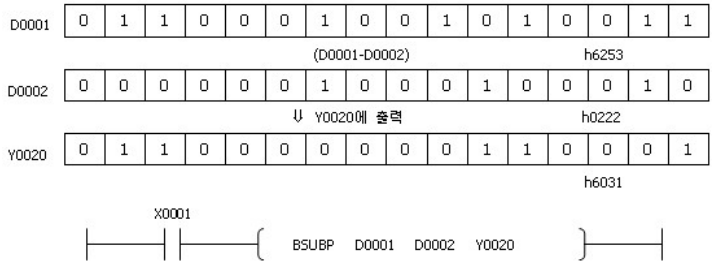
BSUB

Functions :

This is used to subtract the BCD word data in the device assigned to S2 from the BCD word data in the device assigned to S1, storing the result in the device assigned to D.

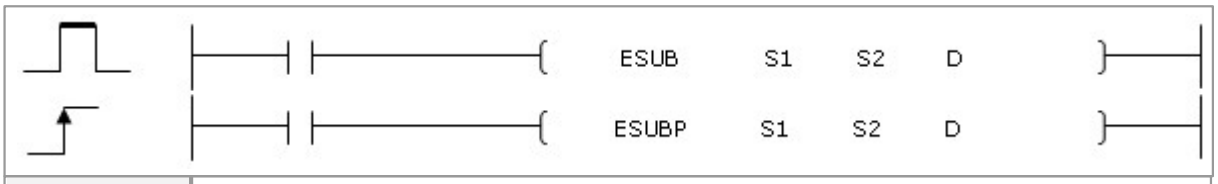
Example of program :

A program to subtract the data in the device assigned to D0002 from the data in the device assigned to D0001, storing the result in Y0020 when an input signal X0001 is turned on



5.8.2.6 Floating-point four arithmetical operations arithmetic(Subtraction) : ESUB, ESUBP

Instruction		Usable Device												No.of Steps	Flag			Usable CPU		
		M	X	Y	K	L	F	T	C	Z	D	@D	Integer		Error	Zero	Carry	XP	CP	BP
ESUB(P)	S1	o	o	o	o	o	-	-	-	o	o	o	-	4	o	-	-	o	-	-
	S2	o	o	o	o	o	-	-	-	o	o	o	-							
	D	o		o	o	o	-	-	-	o	o	o	-							



S1, S2	Assigned data or number of device
D	Number of destination device

Error (F110)	In case That a Device is assigned to @D, if overflow is generated, it is set.

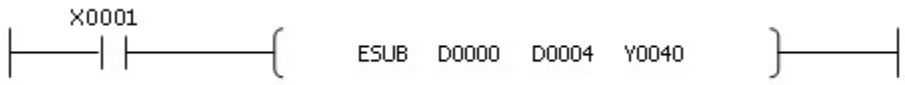
ESUB(P)

Functions :

This is used to subtract the Floating-point data in the device assigned to S2 from the Floating-point data in the device assigned to S1, storing the result in the device assigned to D.

Example of program :

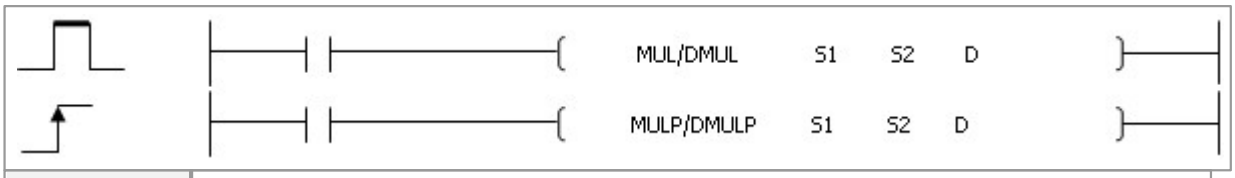
A program to subtract the Floating-point data in the device assigned to D00004 from the Floating-point data in the device assigned to D00000, storing the result in Y0040 when an input signal X0002 is turned on.



5.8.2.7 Multiply BIN : MUL, MULP, DMUL, DMULP

Instruction		Usable Device												No.of Steps	Flag		
		M	X	Y	K	L	F	T	C	Z	D	@D	Integer		Error	Zero	Carry
MUL(P)	S1	o	o	o	o	o	o	o	o	o	o	o	o	4	o	-	-

	S2	o	o	o	o	o	o	o	o	o	o	o	o				
	D	o	-	o	o	o	-	o	o	o	o	o	-				



S1, S2	Assigned data or number of device
D	Number of destination device

Error (F110)	In case That a Device is assigned to @D, if overflow is generated, it is set.

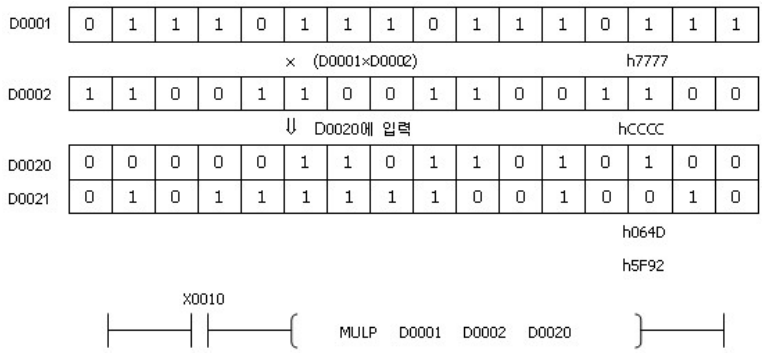
MUL

Functions :

This is used to multiply the word data assigned to S1 by the word data in the device assigned to S2, storing the lower 16 bits of the result in the device assigned to D and the upper 16 bits of the result in the device assigned to D+1.

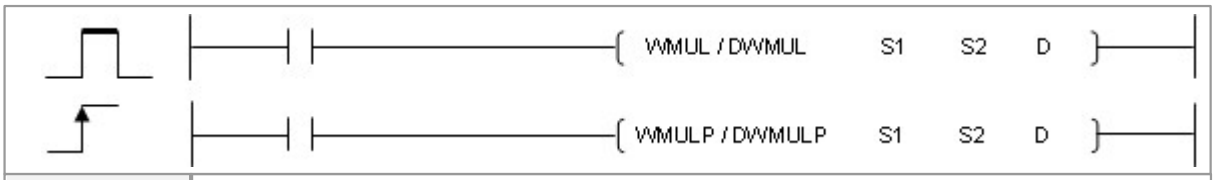
Example of program :

A program to multiply the data in the device assigned to D0001 by the data in the device assigned to D0002, storing the lower Hex 4 digit number in D0020 and the upper Hex 4 digit number in D0021 when program input signal X0010 is turned on



5.8.2.8 BIN 16 Bit and BIN 32 Bit multiplication operations : WMUL, WMULP, DWMUL, DWMULP

Instruction		Usable Device												No.of Steps	Flag			Usable CPU		
		M	X	Y	K	L	F	T	C	Z	D	@D	Integer		Error	Zero	Carry	XP	CP	BP
WMUL(P) DWMUL (P)	S1	o	o	o	o	o	-	-	-	o	o	o	-	4	o	-	-	o	o	o
	S2	o	o	o	o	o	-	-	-	o	o	o	-							
	D	o	-	o	o	o	-	-	-	o	o	o	-							



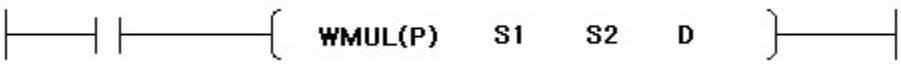
S1, S2	Assigned data or number of device
D	Number of destination device

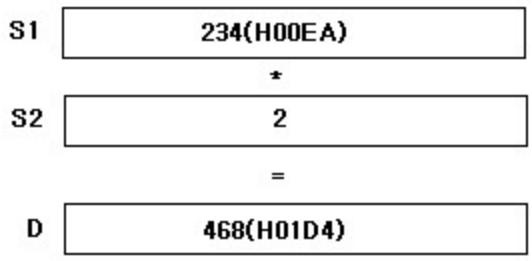
Error (F110)	In case That a Device is assigned to @D, if overflow is generated, it is set.

WMUL

Functions :

Multiplies BIN 16-bit data designated by S1 and BIN 16-bit data designated by S2 , and stores the result in the device designated by D.





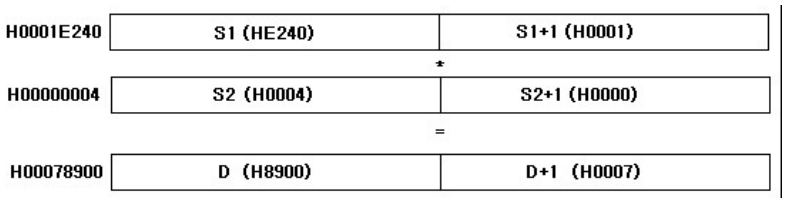
Example of program :

A program to multiply the word data in the device assigned to D00000 by the word data in the device assigned to D00010, storing the result in the device assigned to D00020 when program input signal M0000 is turned on

DWMUL

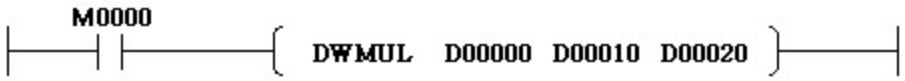
Functions :

Multiplies BIN 32-bit data designated by S1, S1+1 and BIN 32-bit data designated by S2, S2+1 and stores the result in the device designated by D, D+1.



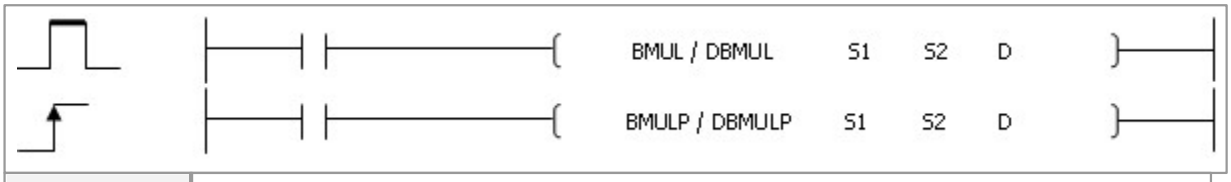
Example of program :

A program to multiply the word data in the device assigned to D00000, D00001 by the word data in the device assigned to D00010, D00011 storing the result in the device assigned to D00020, D00021 when program input signal M0000 is turned on



5.8.2.9 Multiply BCD : BMUL, BMULP, DBMUL, DBMULP

Instruction		Usable Device												No.of Steps	Flag		
		M	X	Y	K	L	F	T	C	Z	D	@D	Integer		Error	Zero	Carry
BMUL(P) DBMUL(P)	S1	o	o	o	o	o	o	o	o	o	o	o	o	4	o	-	-
	S2	o	o	o	o	o	o	o	o	o	o	o	o				
	D	o	-	o	o	o	-	o	o	o	o	o	-				



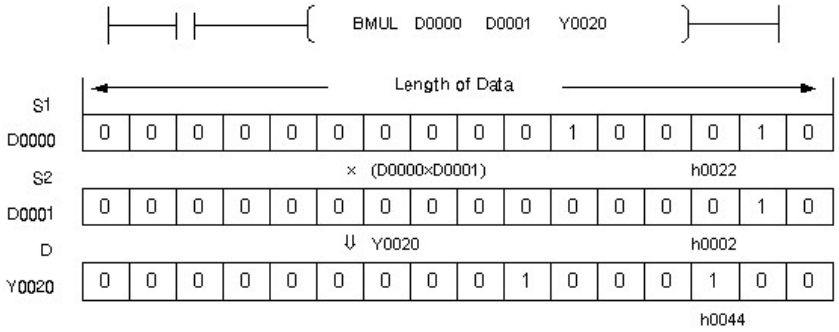
S1, S2	Assigned data or number of device
D	Number of destination device

Error (F110)	In case That a Device is assigned to @D, if overflow is generated, it is set.

BMUL

Functions :

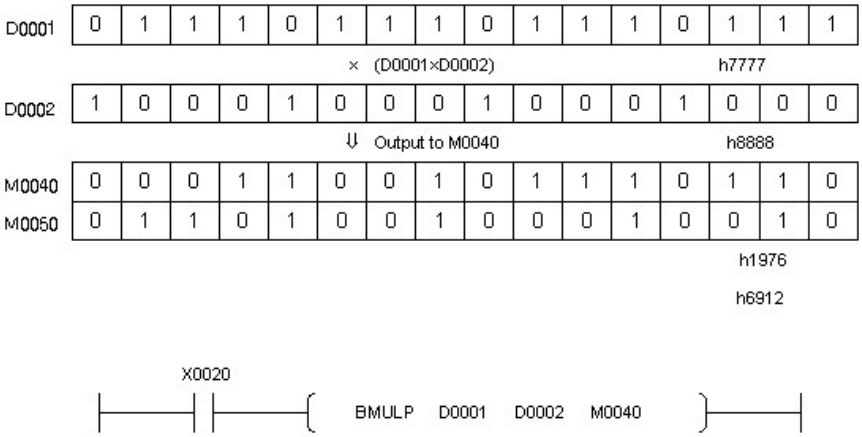
This is used to multiply the BCD word data in the device assigned to S1 by the BCD word data in the device assigned to S2, storing the low 16 bits of the result in the device assigned to D and the high 16 bits of the result in the device assigned to D+1.



The result of the operation to multiply S1 D0000 by S2 D0001 is stored in D Y0020. According to the result of an operation, error(F110) and Zero(F111) are set.

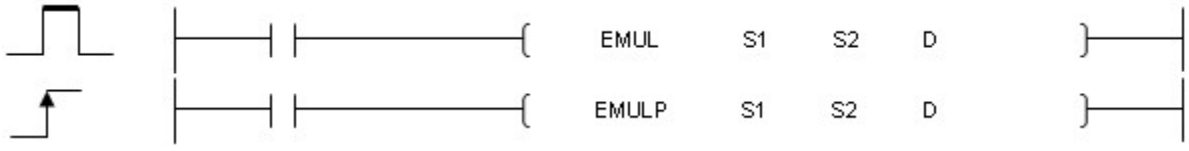
Example of program :

A program to multiply the data in the device assigned to D0001 by the data in the device assigned to D0002, storing the lower Hex 4 digit number in M0004 and the upper Hex 4 digit number in M0005 when program input signal X0020 is turned on



5.8.2.10 Floating-point four arithmetical operations arithmetic(Multiplication) : EMUL, EMULP

Instruction		Usable Device												No.of Steps	Flag			Usable CPU		
		M	X	Y	K	L	F	T	C	Z	D	@D	Integer		Error	Zero	Carry	XP	CP	BP
EMUL(P)	S1	o	o	o	o	o	-	-	-	o	o	o	-	4	o	-	-	o	-	-
	S2	o	o	o	o	o	-	-	-	o	o	o	-							
	D	o	-	o	o	o	-	-	-	o	o	o	-							



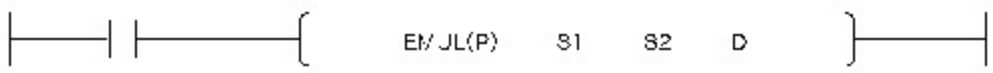
S1, S2	Assigned data or number of device
D	Number of destination device

Error (F110)	In case That a Device is assigned to @D, if overflow is generated, it is set.

EMUL(P)

Functions :

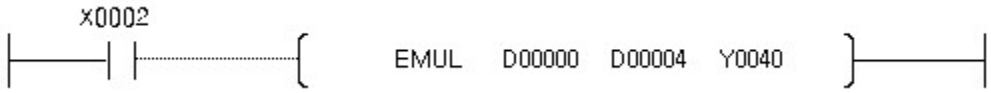
This is used to multiply the Floating-point data assigned to S1 by the Floating-point data in the device assigned to S2, storing the result in the device assigned to D.



The result of the operation to multiply S1 by S2 is stored in D.
According to the result of an operation, error(F110) is Set.

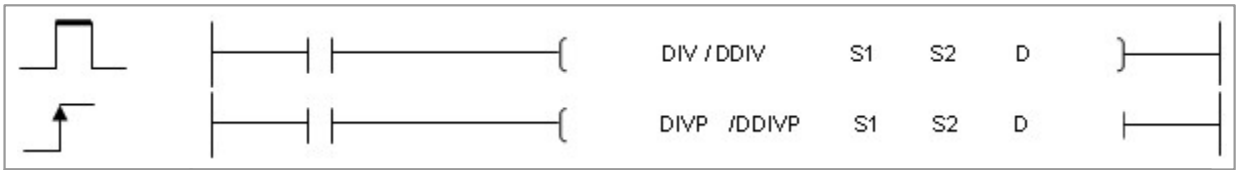
Example of program :

A program to multiply the Floating-point data in the device assigned to D00000 by the Floating-point data in the device assigned to D00004, storing the result in the device assigned to Y0040 when program input signal X0002 is turned on



5.8.2.11 Divide BIN : DIV, DIVP, DDIV, DDIVP

Instruction		Usable Device												No.of Steps	Flag		
		M	X	Y	K	L	F	T	C	Z	D	@D	Integer		Error	Zero	Carry
DIV(P) DDIV(P)	S1	o	o	o	o	o	o	o	o	o	o	o	o	4	o	-	-
	S2	o	o	o	o	o	o	o	o	o	o	o	o				
	D	o	-	o	o	o	-	o	o	o	o	o	-				



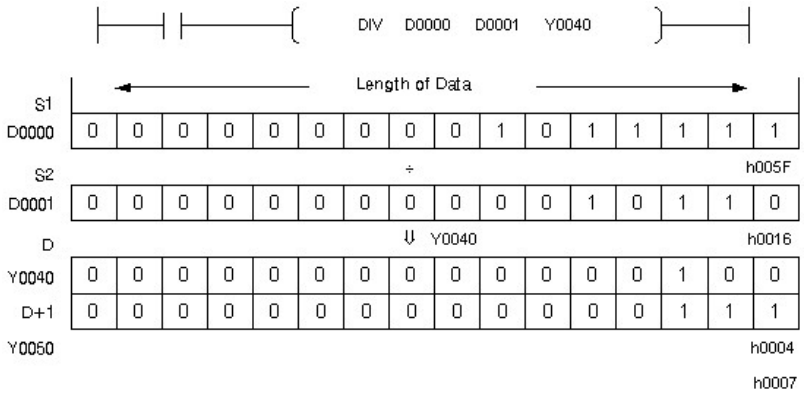
S1, S2	Assigned data or number of device
D	Number of destination device

Error (F110)	In case That a Device is assigned to @D, if overflow is generated, it is set.

DIV

Functions :

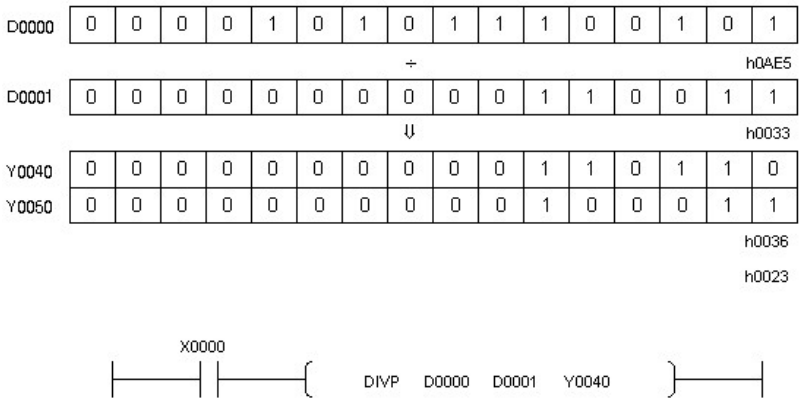
This is used to divide the word data in the device assigned to S1 by the word data in the device assigned to S2, storing the quotient of the result in the device assigned to D and the remainder of the result in D+1.



In the result of the operation to divide S1 D0000 by S2 D0001, the quotient is stored in D Y0040 and the remainder is stored in D+1 Y0050. I According to the result of an operation, error(F110) is set.

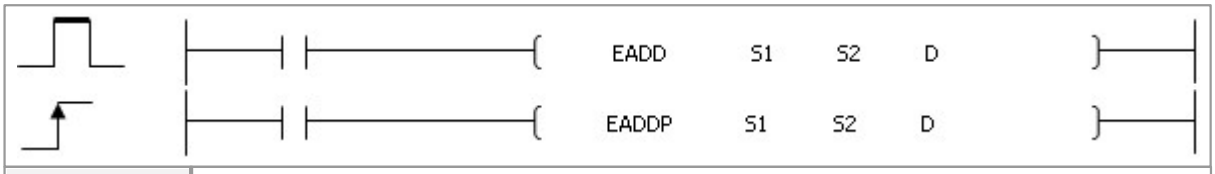
Example of program :

A program to the data in the device assigned to D0000 by the data in the device assigned to D0001, storing the quotient of the result in Y0040 and the remainder of the result in Y0050 whenever program input signal X0000 Is turned on



5.8.2.12 BIN 16 Bit, 32 Bit division operations : WDIV, WDIVP, DWDIV, DWDIVP

Instruction		Usable Device												No.of Steps	Flag			Usable CPU		
		M	X	Y	K	L	F	T	C	Z	D	@D	Integer		Error	Zero	Carry	XP	CP	BP
WDIV(P) DWDIV(P)	S1	o	o	o	o	o	o	o	o	o	o	o	o	4	o	-	-	o	o	o
	S2	o	o	o	o	o	o	o	o	o	o	o	o							
	C1	o	-	o	o	o	-	o	o	o	o	o	-							



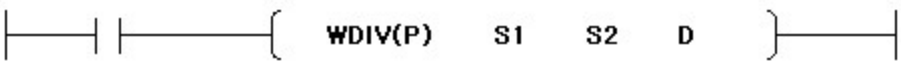
S1, S2	Assigned data or number of device
D	Number of destination device

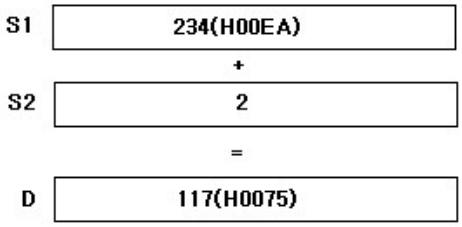
Error (F110)	In case That a Device is assigned to @D, if overflow is generated, it is set. Divide "0" in the case. (S2="0")

WDIV

Functions :

This is used to divide the word data in the device assigned to S1 by the word data in the device assigned to S2, storing the quotient of the result in the device assigned to D





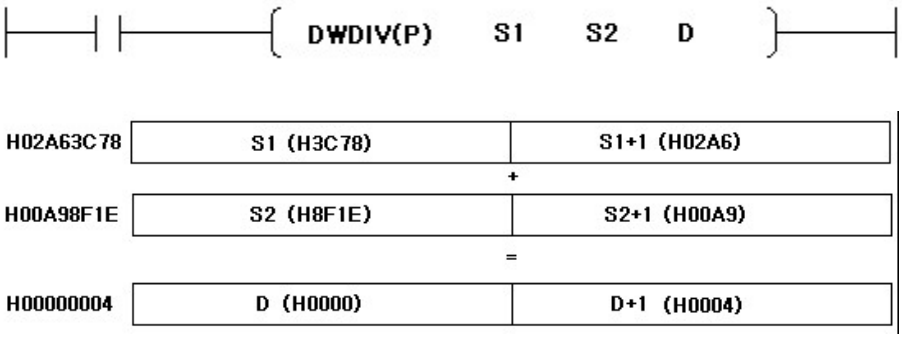
Example of Program :

Program that divide D0000's data and D0010's data whenever input signal M0000 does ON and store share to D0020

DWDIV

Functions :

This is used to divide the double data in the device assigned to S1, S1+1 by the DOUBLE data in the device assigned to S2, S2+1 storing the quotient of the result in the device assigned to D

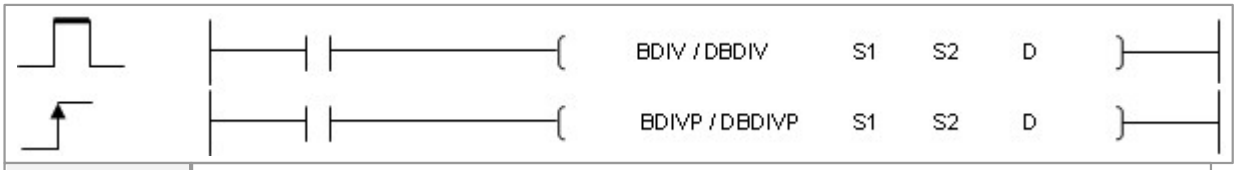


Example of Program :

Program that divide D0000, D0001's data and D0010, D0011's data whenever input signal M0000 does ON and store share to D0020, D0021

5.8.2.13 Divide BCD : BDIV, BDIVP, DBDIV, DBDIVP

Instruction		Usable Device												No.of Steps	Flag		
		M	X	Y	K	L	F	T	C	Z	D	@D	Integer		Error	Zero	Carry
BDIV(P) DBDIV(P)	S1	o	o	o	o	o	o	o	o	o	o	o	o	4	o	-	-
	S2	o	o	o	o	o	o	o	o	o	o	o	o				
	D	o	-	o	o	o	-	o	o	o	o	o	-				



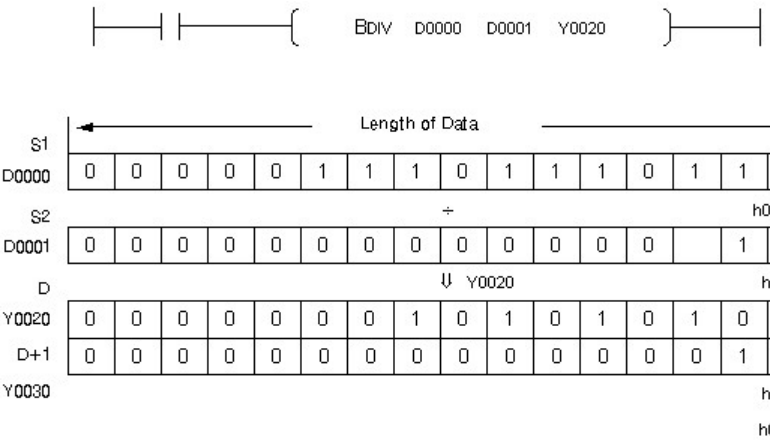
S1, S2	Assigned data or number of device
D	Number of destination device

Error (F110)	In case That a Device is assigned to @D, if overflow is generated, it is set.

BDIV

Functions :

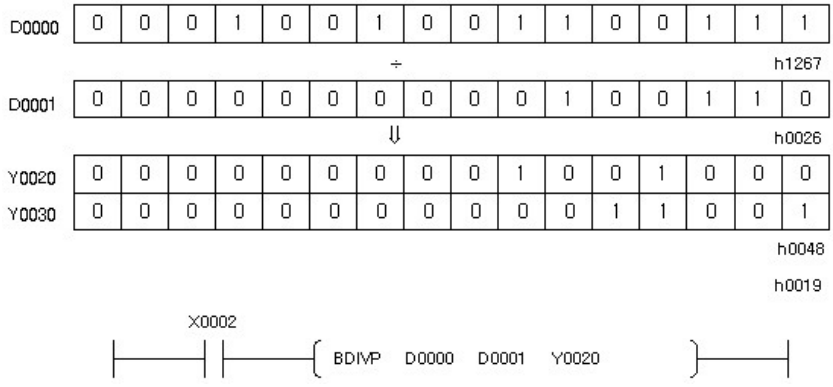
This is used to divide the BCD word data in the device assigned to S1 by the BCD word data in the device assigned to S2, storing the quotient of the result in the device assigned to D and the remainder of the result in D+1.



In the result of the operation to divide S1 D0000 by S2 D0001, the quotient is stored in D Y0020 and the remainder is stored in D+1 Y0030. According to the result of an operation, error(F110) is set.

Example of program :

A program to the data in the device assigned to D0000 by the data in the device assigned to D0001, storing the quotient of the result in Y0020 and the remainder of the result in Y0030 whenever program input signal X0002 is turned on



5.8.2.14 Floating-point four arithmetical operations arithmetic(Division) : EDIV, EDIVP

Instruction		Usable Device												No.of Steps	Flag			Usable CPU		
		M	X	Y	K	L	F	T	C	Z	D	@D	Integer		Error	Zero	Carry	XP	CP	BP
EDIV(P)	S1	o	o	o	o	o	-	-	-	o	o	o	-	4	o	-	-	o	-	-
	S2	o	o	o	o	o	-	-	-	o	o	o	-							
	C1	o	-	o	o	o	-	-	-	o	o	o	-							

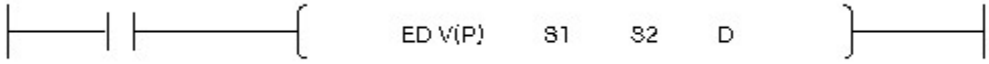
S1, S2	Assigned data or number of device
D	Number of destination device

Error (F110)	In case That a Device is assigned to @D, if overflow is generated, it is set.

EDIV(P)

Functions :

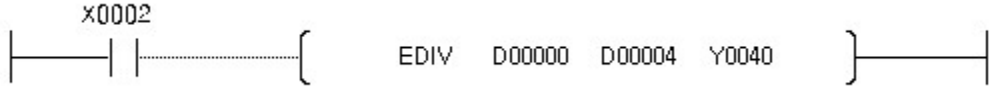
This is used to divide the floating-point data in the device assigned to S1 to the floating-point data in the device assigned to S2, storing the result in the device assigned D.



The result of the operation to divide (Division) S1 to S2 is stored in D.
According to the result of an operation, error flag(F110) is set.

Example of program :

A program to divide (Division) the floating-point data in the device assigned to D00000 to the floating-point data in the device assigned to D00004, output the result to Y0040 when program input signal X0002 is turned on.



5.8.2.15 Increase 16 and 32 Bit BIN Data : INC, INCP, DINC, DINCP

Instruction		Usable Device												No.of Steps	Flag		
		M	X	Y	K	L	F	T	C	Z	D	@D	Integer		Error	Zero	Carry
INC (P) DINC (P)	D	o	-	o	o	o	-	o	o	o	o	o	-	2	o	-	

D	Number of the device to increase the data corresponding to its own as 1

Error (F110)	In case That a Device is assigned to @D, if overflow is generated, it is set.

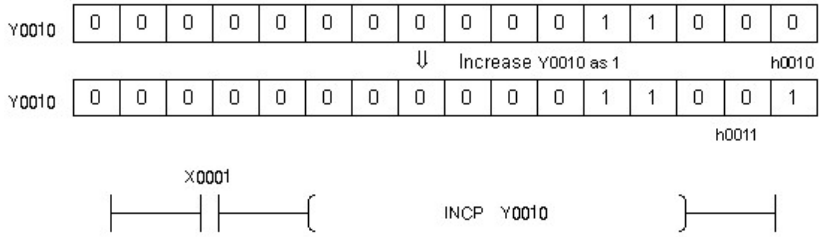
INC

Functions :

This is used to add 1 to the data corresponding to D, storing the result to D. In case the operation condition of INCP/ DINCP is changed from OFF to ON, they are operated for one scan. The operation object for DINC / DINCP is 32BIT data.

Example of program :

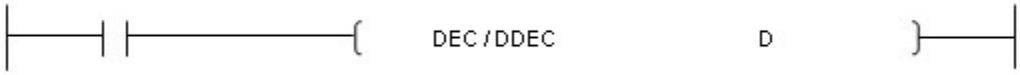
A program to increase the data in the device assigned to Y0010 as 1 from h0018 to h0019 when an program input signal X0001 is turned on



5.8.2.16 Decrease BIN Data : DEC, DECP, DDEC, DDECP

Instruction	Usable Device											No.of	Flag		
	M	X	Y	K	L	F	T	C	Z	D	@D	Inte		Error	Zero	Carry

													ger	Steps			
INC (P) DINC (P)	D	o	-	o	o	o	-	o	o	o	o	o	-	2	o	-	-



D	Number the device to decrease the data corresponding to its own as 1

Error (F110)	In case That a Device is assigned to @D, if overflow is generated, it is set.

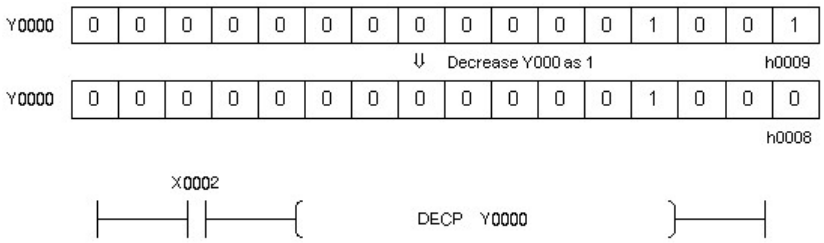
DEC

Functions :

This is used to subtract 1 from the data corresponding to D, storing the result to D. In case the operation condition of INCP/ DINCP is changed from OFF to ON, they are operated for one scan. The operation object for DDEC / DDECP is 32BIT data.

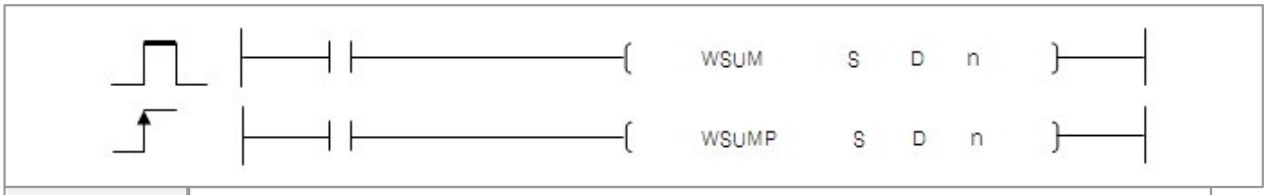
Example of program :

A program to decrease the data in the device assigned to Y0000 as 1 from h0009 to h0008 when a program input signal X0002 is ON



5.8.2.17 Calculation of totals for 16bit data : WSUM, WSUMP

Instruction		Usable Device												No.of Steps	Flag			Usable CPU		
		M	X	Y	K	L	F	T	C	Z	D	@D	Integer		Error	Zero	Carry	XP	CP	BP
WSUM WSUM(P)	S	o	o	o	o	o	o	o	o	o	o	o	-	4	o	-	-	o	-	-
	D	o	o	o	o	o	-	o	o	o	o	o	-							
	n	o	-	o	o	o	-	o	o	o	o	o	o							



S	First device number of devices where data for calculating total value is stored
D	First device number of devices storing total value
n	Number of data blocks

Error (F110)	In case that a device is assigned to @S or @D, if overflow is generated, it is set The range n points from the device assigned to S exceeds the relevant device

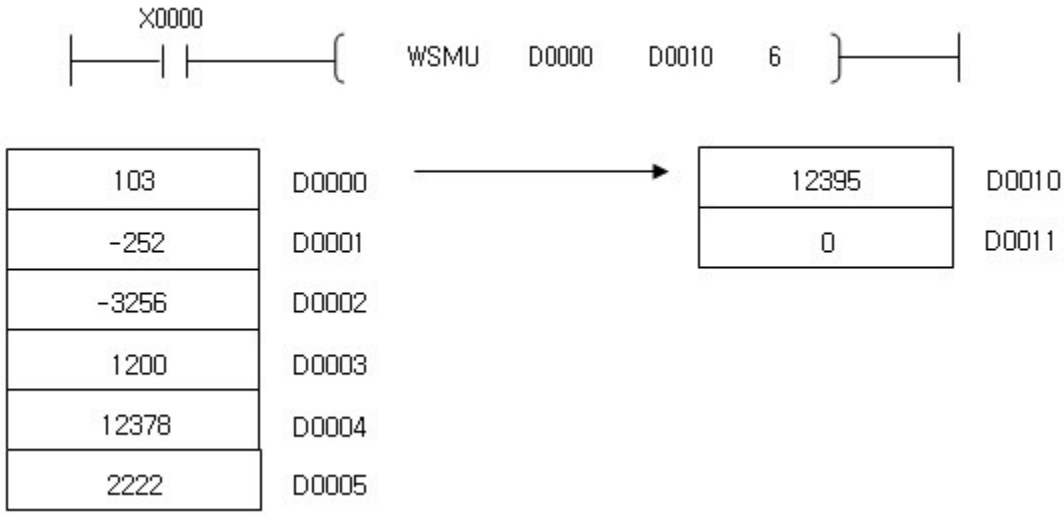
WSUM, WSUMP

Functions :

Summed up all 16bit binary data for n words from the device designated at S, and stored it in the device designated at D

Example of program :

A program to sum up the 16bit binary data from D0000 to D0005 when X0000 goes on,
and stores it in DD0010 and D0011

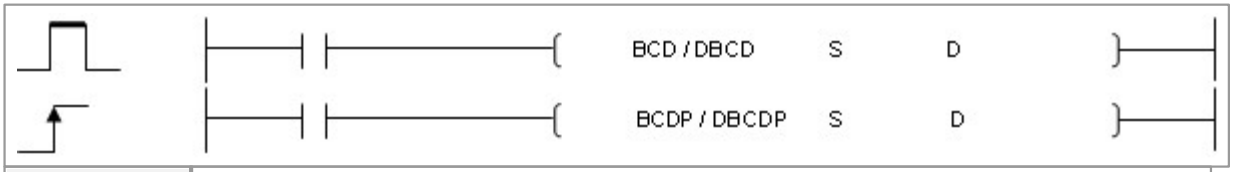


5.8.3 Data conversion Instruction

Contents :

5.8.3.1 Convert BCD : BCD, BCDP, DBCD, DBCDP

Instruction		Usable Device												No.of Steps	Flag		
		M	X	Y	K	L	F	T	C	Z	D	@D	Integer		Error	Zero	Carry
BCD (P)	S	o	o	o	o	o	o	o	o	o	o	o	o	3	o	-	-
	D	o	-	o	o	o	-	o	o	o	o	o	-				
DBCD (P)	S	o	o	o	o	o	o	o	o	o	o	o	o	3	o	-	-
	D	o	-	o	o	o	-	o	o	o	o	o	-				



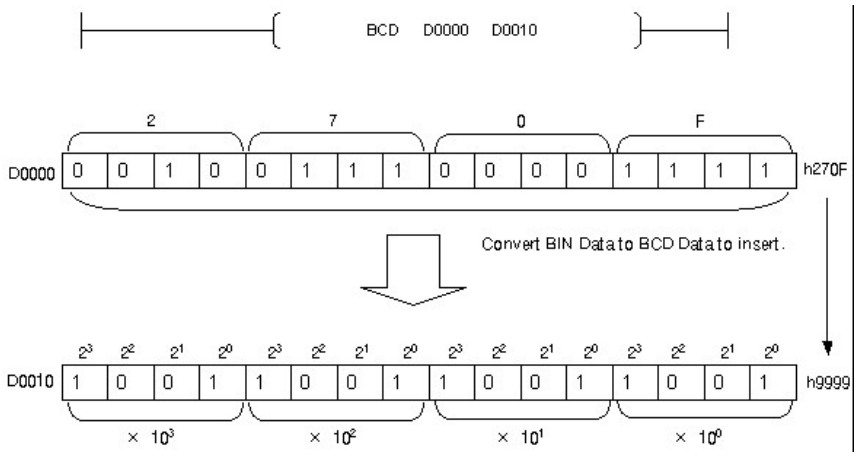
S	Number of the device where BIN Data is stored or BIN Data
D	Device for storing the converted data in BCD

Error (F110)	If S is over Hex 270F, flag is set.

BCD

Functions :

This is used to convert S BIN Data or the data corresponding to the device to which BIN Data is stored in BCD, storing the result in the device assigned to D.

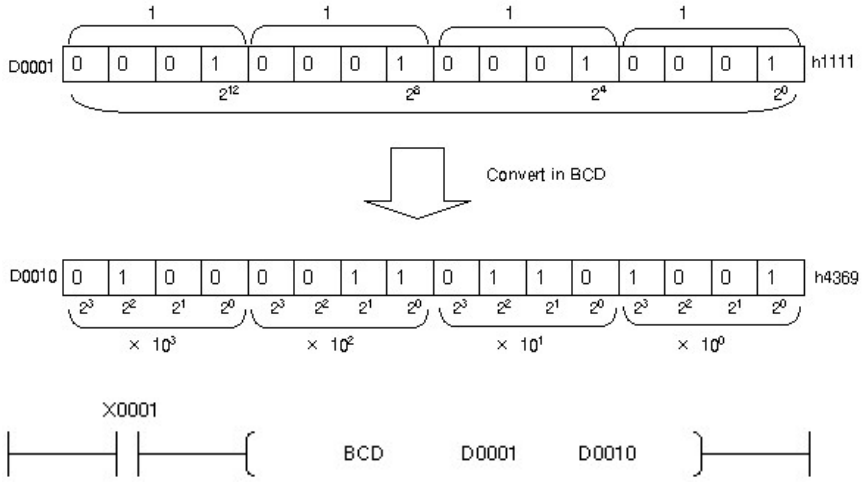


Instruction	Length of Data	
	Range of BIN Data	
BCD BCDP	16 Bit	0 ~ H270F 0 ~ 9999
DBCD DBCDP	32 Bit	0 ~ H05F5E0FF 0 ~ 99999999

If BCD Data exceed the range, Error Flag(F110) is set.

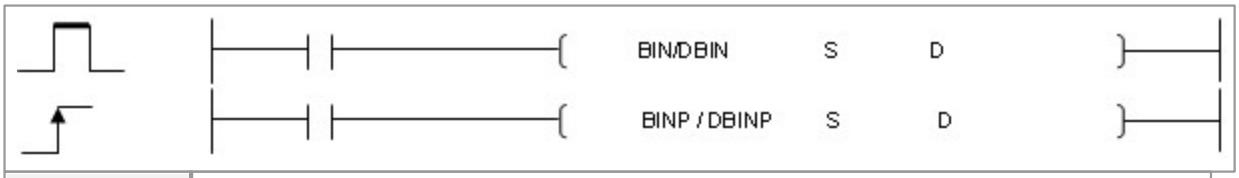
Example of program :

A program convert the data in the device assigned to D0001in BCD, output the result to D0010 when input signal X0001 is turned on



5.8.3.2 Convert BIN : BIN, BINP, DBIN, DBINP

Instruction		Usable Device												No.of Steps	Flag		
		M	X	Y	K	L	F	T	C	Z	D	@D	Integer		Error	Zero	Carry
BIN (P)	S	o	o	o	o	o	o	o	o	o	o	o	o	3	o	-	-
	D	o	-	o	o	o	-	o	o	o	o	o	-				
DBIN (P)	S	o	o	o	o	o	o	o	o	o	o	o	o	3	o	-	-
	D	o	-	o	o	o	-	o	o	o	o	o	-				



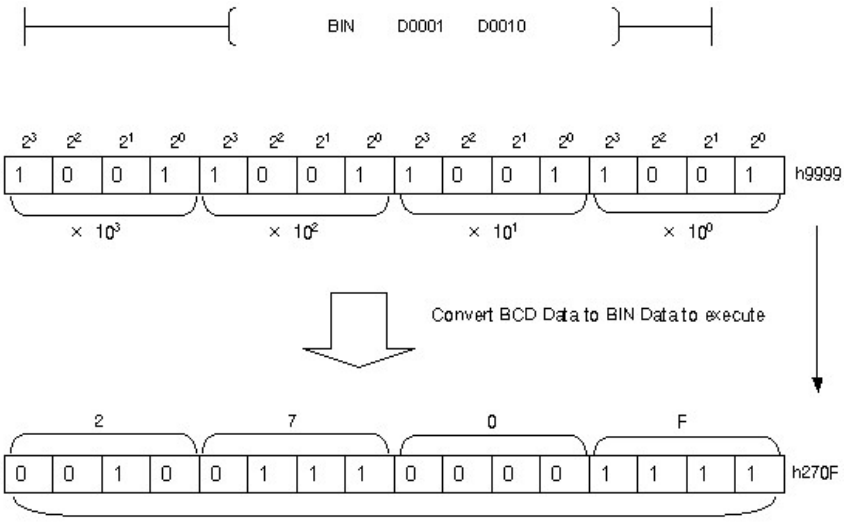
S	Number of the device where BCD Data is stored or BCD Data
D	Device for storing the converted data in BIN

Error (F110)	Unless S is not a data in the type of BCD, Flag is set.

BIN

Functions :

This is used to convert BCD Data in the device assigned to S1 or the data corresponding to the Data in BCD-stored device in BIN, storing the result in the device assigned to D.



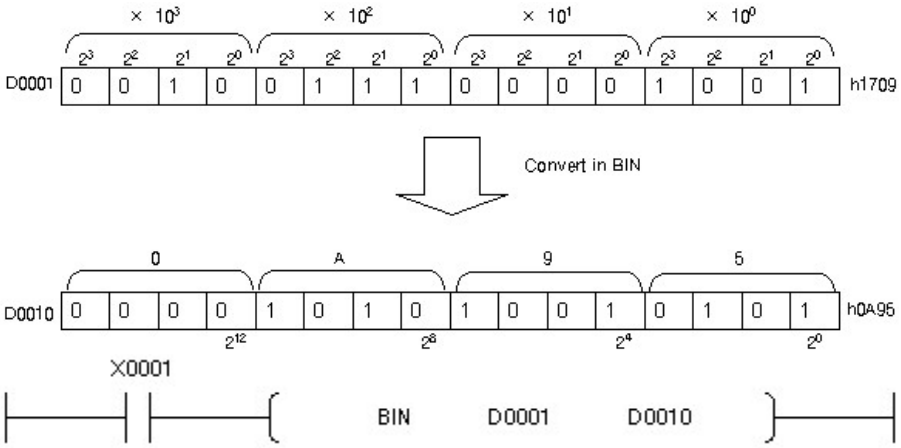
Instruction	Length of Data
	Range of BIN Data

BIN BINP	16 Bit	0 ~ 9999 0 ~ H270F
DBIN DBINP	32 Bit	0 ~ H05F5E0FF 0 ~ 99999999

If BCD data exceed the range, Error Flag(F110) is set.

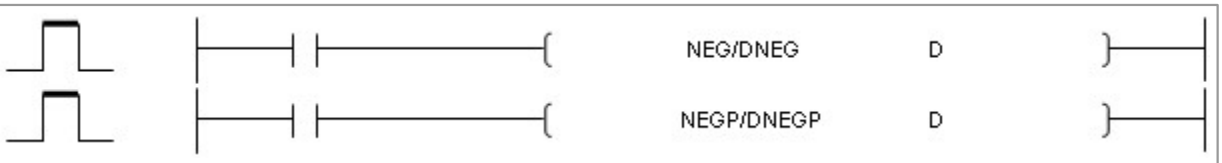
Example of program :

A program convert the data in the device assigned to D0001in BIN, storing the result in D0010 when input signal X0001 is ON



5.8.3.3 Invert Sing for BIN 16 Bit and 32 Bit Data : NEG, NEGP, DNEG, DNEGP

Instruction		Usable Device												No.of Steps	Flag		
		M	X	Y	K	L	F	T	C	Z	D	@D	Integer		Error	Zero	Carry
NEG(P) DNEG(P)	D	o	-	o	o	o	-	o	o	o	o	o	-	2	o	-	-



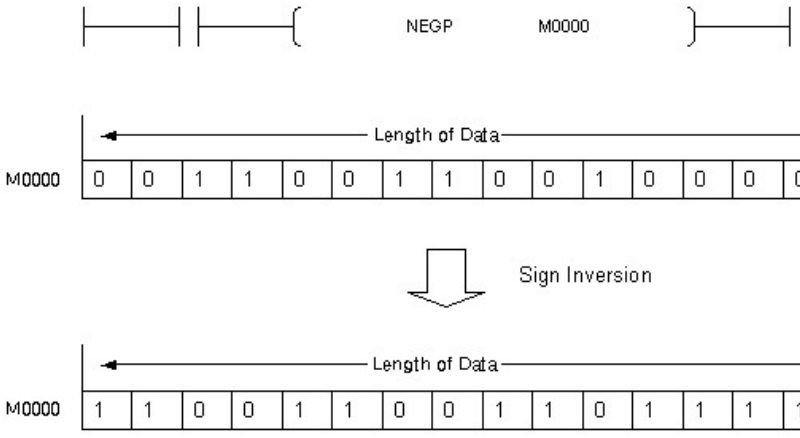
D	First number of device storing data for the complement of 2 operation

Error (F110)	There are no operation errors associated with the NEG(P) or DNEG(P) instruction.

NEG

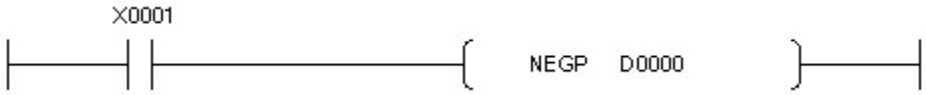
Functions :

This is used to invert the sign of the data corresponding to the device assigned to D, storingthe result to D.



Example of program :

A program to convert the data in the device assigned to D0000 in a negative number to store in D0000



5.8.3.4 Conversion from BIN 16 and 32 Bit Data to floating decimal point : FLT, FLTP, DFLT, DFLTP

Instruction		Usable Device												No.of Steps	Flag			Usable CPU		
		M	X	Y	K	L	F	T	C	Z	D	@D	Integer		Error	Zero	Carry	XP	CP	BP
FLT (P)	S	o	o	o	o	o	o	o	o	o	o	o	o	4	o	-	-	o	-	-
DFLT (P)	D	o	-	o	o	o	-	-	-	o	o	o	-							

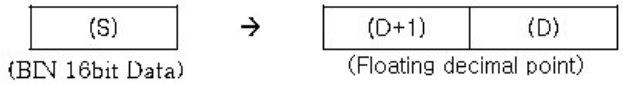
S	First device number where integer data for the purpose of conversion to floating decimal point data is being stored
D	First device number that will store converted floating decimal point data

Error (F110)	There are no errors associated with the FLT(P) of DFLT(P) instructions.

FLT(P)

Functions :

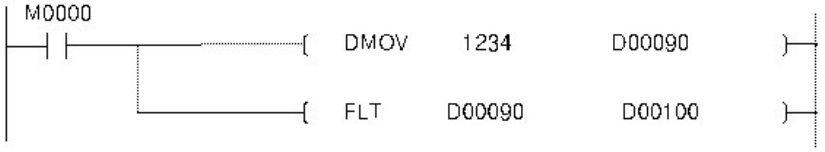
Converts 16-bit BIN data designated by S to floating decimal point real number, and stores at device number designated by D .



BIN values between -32768 and 32767 can be designated by S .

Example of program :

Store data 1234 to change to D00090.
Convert from D00090's data to floating point data and store to D00100.



DFLT(P)

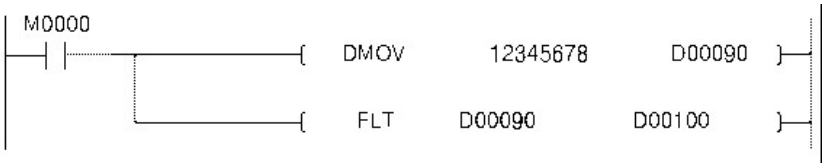
Functions :

Converts 32-bit BIN data designated by S to floating decimal point real number, and stores at device number designated by D .

BIN values between -2147483648 and 2147483647 can be designated by S +1 and S .

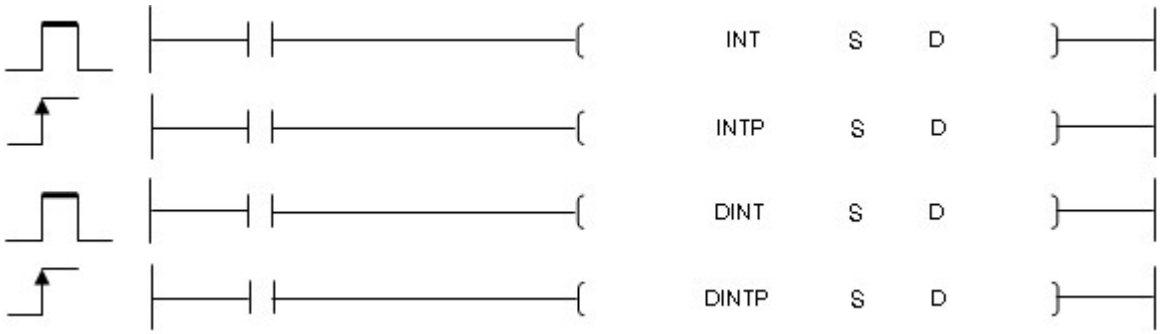
Example of program :

Store data 1234 to change to D00090.
Convert D00090's data to floating point data and store to D00100.



5.8.3.5 Conversion from floating decimal point data to BIN 16 and 32 Bit Data : INT, INTP, DINT, DINTP

Instruction		Usable Device												No.of Steps	Flag			Usable CPU		
		M	X	Y	K	L	F	T	C	Z	D	@D	Integer		Error	Zero	Carry	XP	CP	BP
INT(P)	S	o	o	o	o	o	-	-	-	o	o	o	-	4	o	-	-	o	-	-
DINT(P)	D	o	-	o	o	o	-	o	o	o	o	o	o							



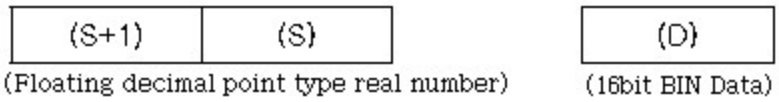
S	First device number storing floating decimal point data that will be converted to BIN value
D	First device number to store BIN value after conversion

Error (F110)	In the following cases an operation error occurs, the error flag (SM0) turns On, and an error code is stored at SD0. • The floating decimal point type data designated by S when the INT instruction was used outside the -31768 to 32767 range. • The floating decimal point type data designated by S when the DINT instruction was used was outside the -2147483648 to 2147483647 range.

INT(P)

Functions :

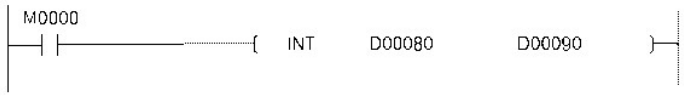
Converts the floating decimal point real number designated at S into BIN 16-bit data and stores it at the device number designated at D.



The range of floating decimal point type real numbers that can be designated at S+1 or S is from -32768 to 32768.
After conversion, the first digit after the decimal point of the real number is rounded off.

Example of program :

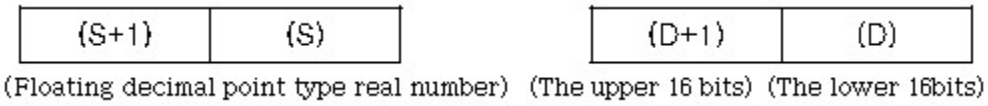
The following program converts the floating decimal point type real number at D00080 and D00081 to BIN 16-bit data, and stores the result at D00090.



DINT(P)

Functions :

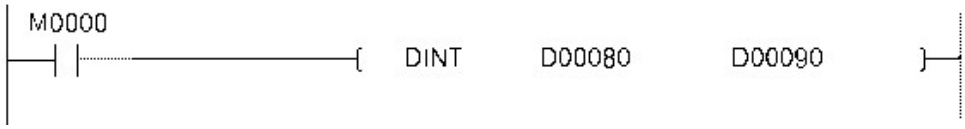
Converts floating decimal point type real number designated by S to BIN 32-bit data, and stores the result at the device number designated by D and D+1.



The range of floating decimal point type real numbers that can be designated at S+1 or S is from -2147483648 to 2147483647.
After conversion, the first digit after the decimal point of the real number is rounded off.

Example of program :

The following program converts the floating decimal point type real number at D00080 and D00081 to BIN 32-bit data and stores the result at D00090 and D00091.



5.8.3.6 Conversion from BIN Data to Gray Code : GRY, GRYP, DGRY, DGRYP

Instruction		Usable Device												No.of Steps	Flag			Usable CPU		
		M	X	Y	K	L	F	T	C	Z	D	@D	Integer		Error	Zero	Carry	XP	CP	BP
GRY(P) DGRY(P)	S	o	o	o	o	o	o	o	o	o	o	o	o	4	o	-	-	o	o	o
	D	o	-	o	o	o	-	o	o	o	o	o	o							

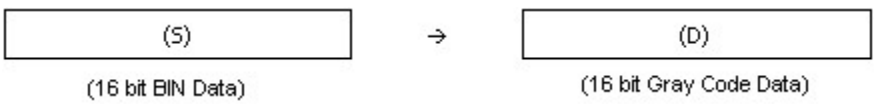
S	BIN data, or first number of the device where BIN data is stored
D	First number of device to store Gray code after conversion

Error (F110)	In the following cases an operation error occurs, the error flag (SM0) turns On, and an error code is stored an SD0. • The data at S is a negative number

GRY

Functions :

Converts BIN data at the device designated by S to Gray code, and stores result at device designated by D.



Gray code Conversion table :

Hexadecimal digit	BCD code	Gray code
0	0000	0000
1	0001	0001
2	0010	0011
3	0011	0010
4	0100	0110
5	0101	0111
6	0110	0101
7	0111	0100
8	1000	1100
9	1001	1101
A	1010	1111
B	1011	1110
C	1100	1010
D	1101	1011
E	1110	1001
F	1111	1000

5.8.3.7 Conversion from Gray code to BIN Data : GBIN, GBINP, DGBIN, DGBINP

Instruction		Usable Device												No.of Steps	Flag			Usable CPU		
		M	X	Y	K	L	F	T	C	Z	D	@D	Integer		Error	Zero	Carry	XP	CP	BP
GBIN(P) DGBIN(P)	S	o	o	o	o	o	o	o	o	o	o	o	o	4	o	-	-	o	-	-
	D	o	-	o	o	o	-	o	o	o	o	o	o							

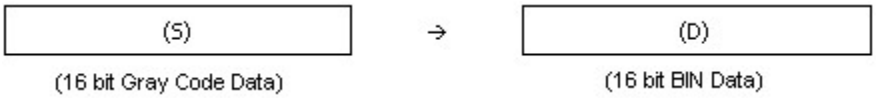
S	Gray code data or the first number of device where Gray code data is being stored
D	First number of the device to store BIN data after conversion

Error (F110)	In the following cases an operation error occurs, the error flag (SM0) turns On, and an error code is stored an SD0. • Data at S when GBIN instruction was issued is outside the 0 to 32767 range. • Data at S when DGBIN instruction was issued is outside the 0 to 2147483647 range.

GBIN

Functions :

Converts Gray code data at device designated by S to BIN 16-bit data and stores at device designated by D.

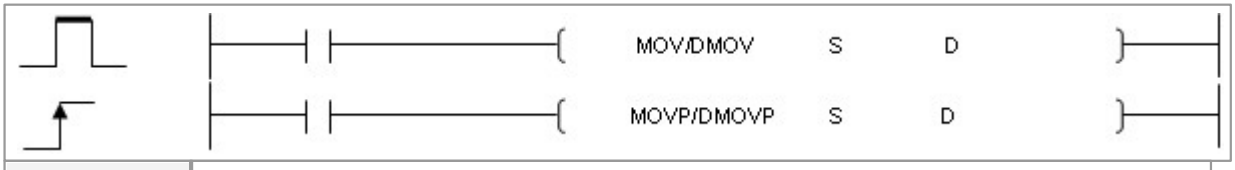


5.8.4 Data transfer Instruction

Contents :

5.8.4.1 Transfer 16 Bit or 32 Bit Data : MOV, MOVP, DMOV, DMOVP

Instruction		Usable Device												No.of Steps	Flag		
		M	X	Y	K	L	F	T	C	Z	D	@D	Integer		Error	Zero	Carry
MOV(P)	S	o	o	o	o	o	o	o	o	o	o	o	o	3	o	-	-
	D	o	-	o	o	o	-	o	o	o	o	o	-				
DMOV(P)	S	o	o	o	o	o	o	o	o	o	o	o	o	3	o	-	-
	D	o	-	o	o	o	-	o	o	o	o	o	-				



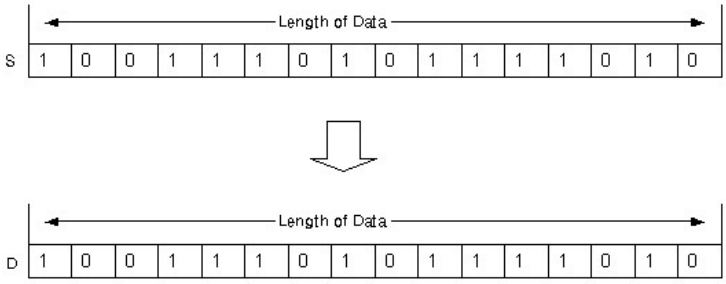
S	Source data or first number of device storing data
D	Number of destination device

Error (F110)	There are no operation errors associated with the MOV(P) or DMOV(P) instructions.

MOV

Functions :

This is used to transfer the data in the device assigned to S to the device assigned to D. MOV(P) instruction and DMOV(P) instruction transfer the data of 1Word(16-bit).



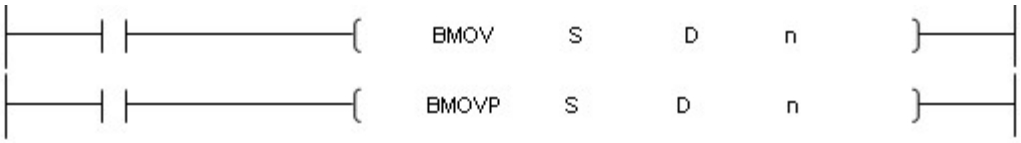
DMOV(P) instruction transfer the data of2Word(32 Bit).

Example of program :

A program that the data in the device assigned to M0000 CARD is transferred to the device assigned to M0010 CARD by using MOV instruction when input signal X0001 is turned on

5.8.4.2 Transfer Block : BMOV, BMOVP

Instruction		Usable Device												No.of Steps	Flag		
		M	X	Y	K	L	F	T	C	Z	D	@D	Integer		Error	Zero	Carry
BMOV(P)	S	o	o	o	o	o	o	o	o	o	o	o	-	4	o	-	-
	D	o	o	o	o	o	-	o	o	o	o	o	-				
	n	o	o	o	o	o	o	o	o	o	o	o	o				



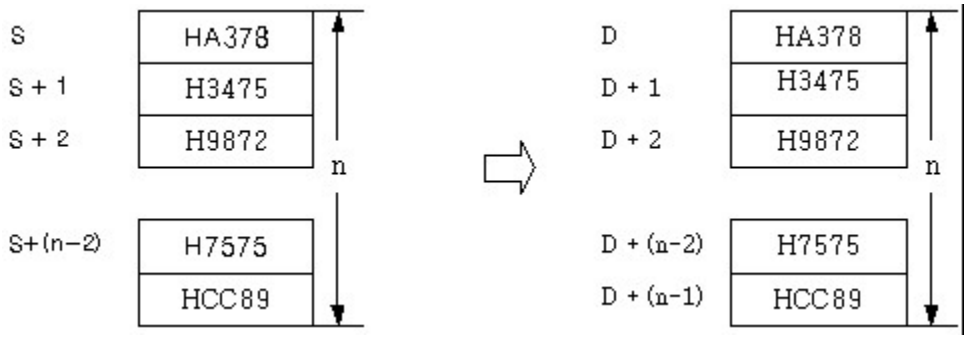
S	First number of device storing data to be transferred
D	First number of destination device
n	Number of transfers

Error (F110)	In the following cases an operation error occurs, the error flag (SM0) turns ON, and an error code is stored a SD0. • The device range n-points from S or D exceeds the relevant device. • The number of transfers exceeds 6144 when a special direct device is used.

BMOV

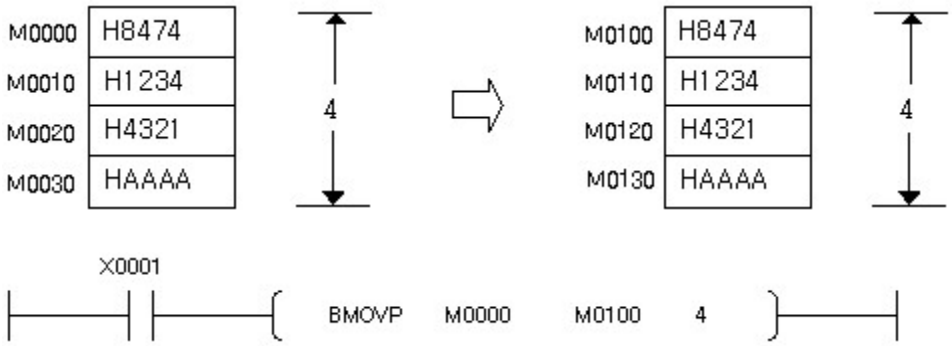
Functions :

This is used to transfer the word data in n devices from the device assigned to S to n word data devices from the device assigned to D.



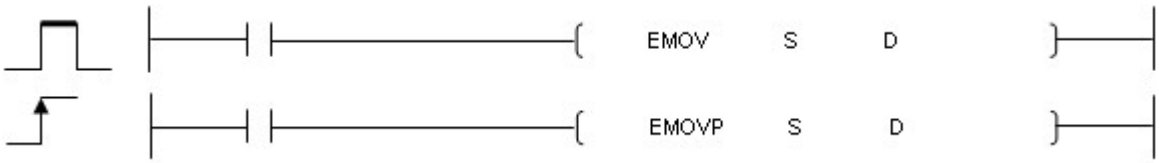
Example of program :

Whenever input signal X0001 is turned on, the word data in 4 devices from the device assigned to M0000 are transferred to the devices from the one assigned to M0100 to the one assigned to M0130.



5.8.4.3 Floating-point data transfer Instruction : EMOV, EMOVP

Instruction		Usable Device												No.of Steps	Flag			Usable CPU		
		M	X	Y	K	L	F	T	C	Z	D	@D	Integer		Error	Zero	Carry	XP	CP	BP
EMOV(P)	S1	o	o	o	o	o	-	-	-	o	o	o	-	4	o	-	-	o	-	-
	S2	o	o	o	o	o	-	-	-	o	o	o	-							
	C1	o	-	o	o	o	-	-	-	o	o	o	-							



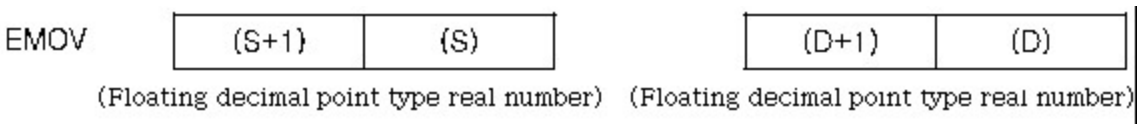
S1, S2	Assigned data or number of device
D	Number of destination device

Error (F110)	In case That a Device is assigned to @D, if overflow is generated, it is set.

EMOV(P)

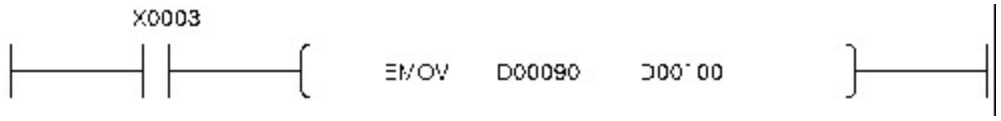
Functions :

This is used to transfer the Floating-point data in the device assigned to S to the device assigned to D.



Example of program :

A program that the Floating-point data in the device assigned to D00090 is transferred to the device assigned to D00100 by using MOV instruction when input signal X0003 is turned on.



5.8.4.4 Invert 16 Bit Data Bit : CML, CMLP, DCML, DCMLP

Instruction		Usable Device												No.of Steps	Flag		
		M	X	Y	K	L	F	T	C	Z	D	@D	Integer		Error	Zero	Carry
CML(P) DCML(P)	S	o	o	o	o	o	o	o	o	o	o	o	o	3	o	-	-
	D	o	-	o	o	o	-	o	o	o	o	o	-				

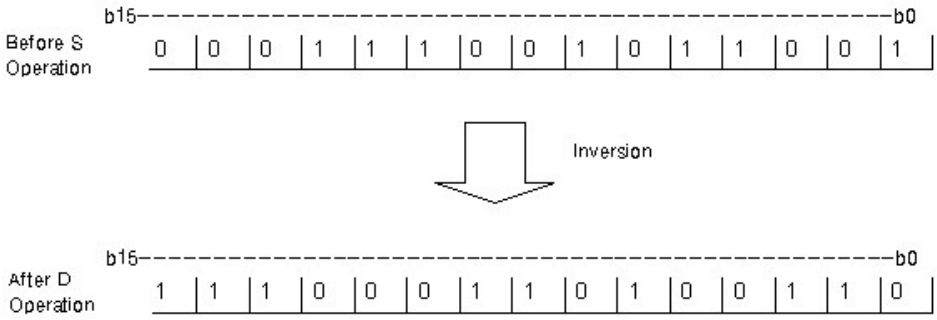
S	Data to be inverted, or number of device storing this data
D	Number of device that will store results of inversion

Error (F110)	In case That a Device is assigned to @D, if overflow is generated, it is set.

CML

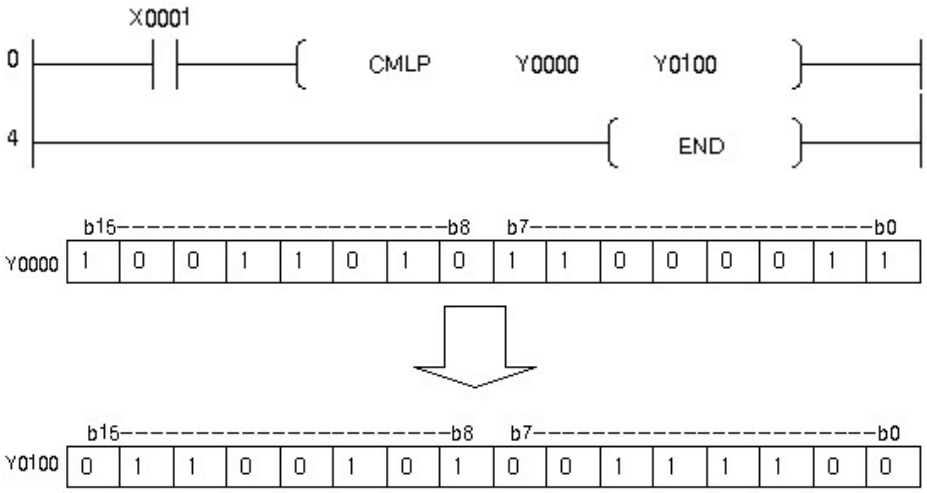
Functions :

This is used to invert each bit in the data corresponding to Device S, storing the result in D.



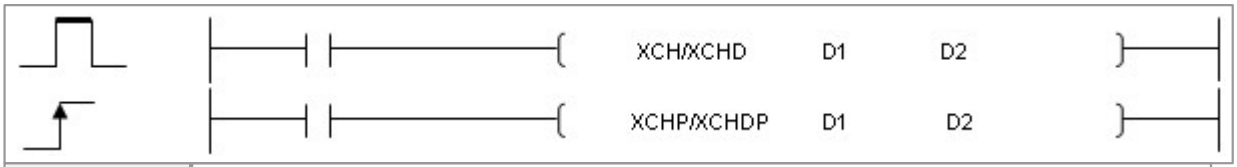
Example of program :

A program invert the data in the device assigned to Y0100, storing the result in device Y0100 when input signal X0001 is turned on



5.8.4.5 Exchange 16 Bit and 32 Bit Data : XCH, XCHP, DXCH, DXCHP

Instruction		Usable Device												No.of Steps	Flag		
		M	X	Y	K	L	F	T	C	Z	D	@D	Integer		Error	Zero	Carry
XCH(P) DXCH(P)	D1	o	-	o	o	o	-	o	o	o	o	o	-	3	o	-	-
	D2	o		o	o	o	-	o	o	o	o	o	-				



D1, D2	First number of device storing data to be exchanged

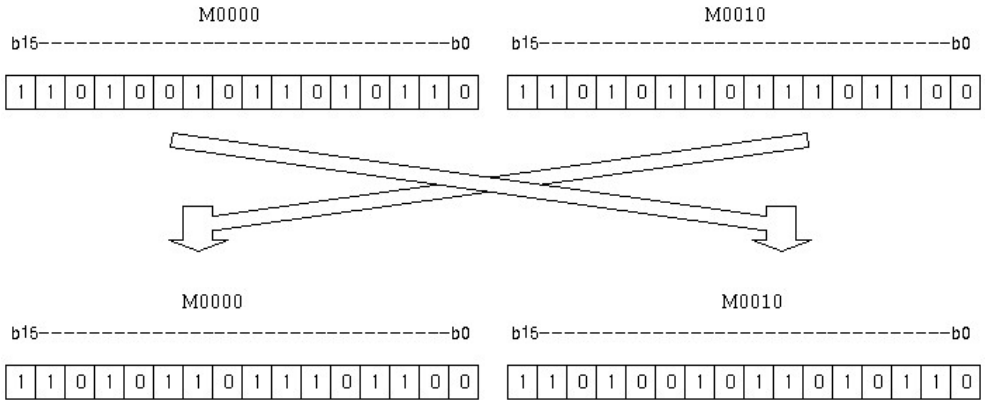
Error (F110)	There are no errors associated with the XCH(P) and DXCH(P) instructions

XHC

Functions :

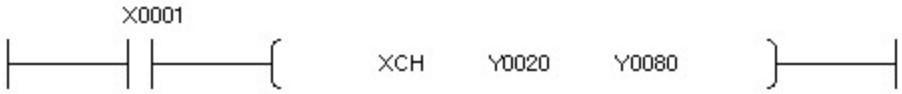
This is used to exchange the data in the device assigned to M0000 and the data in the device assigned to

M0010 with each other.



Example of program :

A program to exchange Y0020 and Y0080 with each other when input signal X0001 is ON



The data in the device assigned to Y0020 and the data in the device assigned to Y0080 are exchanged with each other.

5.8.4.6 Exchange Block Data : BXCH, BXCHP

Instruction		Usable Device												No.of Steps	Flag		
		M	X	Y	K	L	F	T	C	Z	D	@D	Integer		Error	Zero	Carry
BXCH BXCHP	D1	o	-	o	o	o	-	o	o	o	o	o	-	4	o	-	-
	D2	o	-	o	o	o	-	o	o	o	o	o	-				
	n	o	o	o	o	o	o	o	o	o	o	o	o				

D1, D2	First number of device storing data to be exchanged

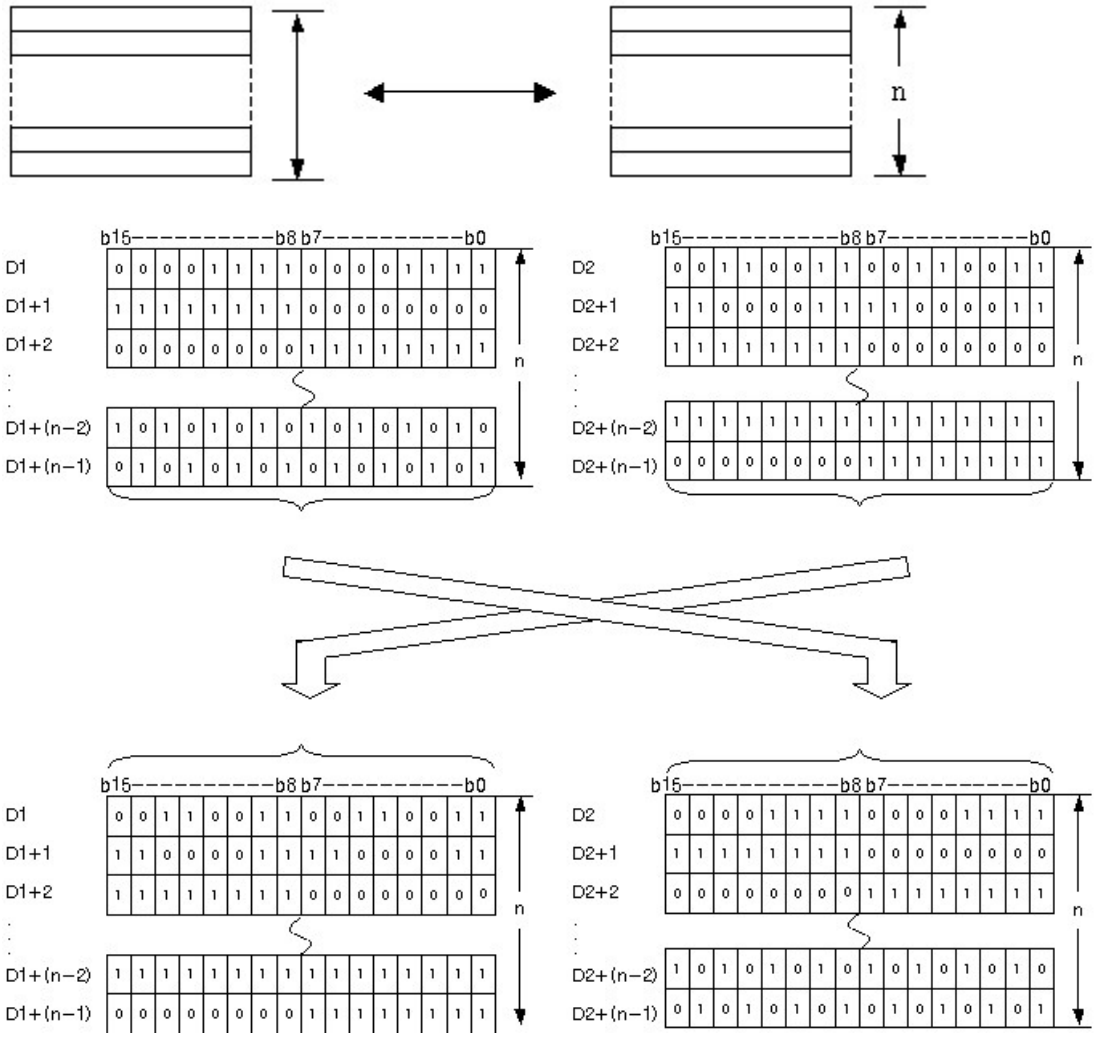
n	Number of exchanges

Error (F110)	In case That a Device is assigned to @D, if overflow is generated, it is set.

BXCH

Functions :

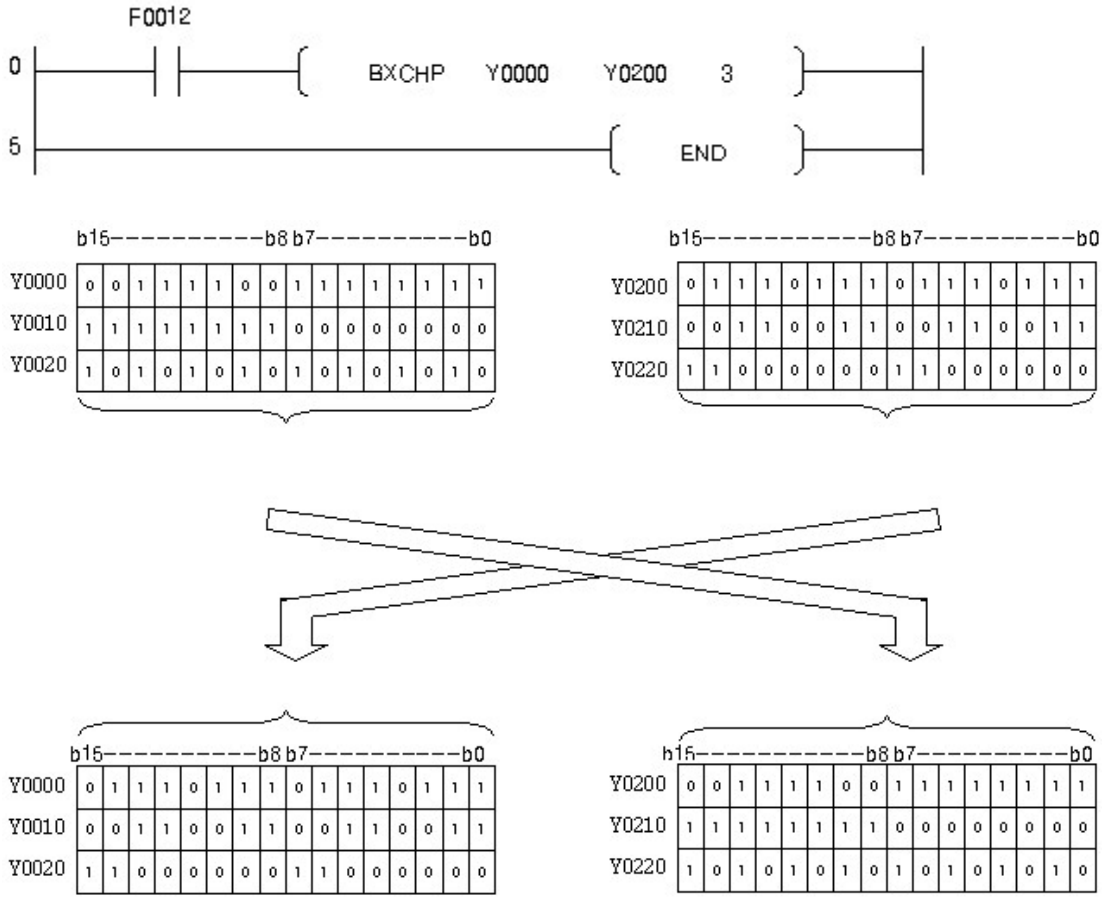
This is used to exchange the data in n devices from the device assigned to D1and the data in n devices from the device assigned to D2 with each other.



Example of program :

A program to exchange the data in 3 devices from the device assigned to Y0000 and the data in 3 devices

from the device assigned to Y0200 with each other when input signal F0012 is turned on



5.8.4.7 Transfer Identical 16 Bit Data Block : FMOV, FMOVP

Instruction		Usable Device												No.of Steps	Flag		
		M	X	Y	K	L	F	T	C	Z	D	@D	Integer		Error	Zero	Carry
FMOV FMOVP	S	o	o	o	o	o	o	o	o	o	o	o	o	4	o	-	-
	D	o	-	o	o	o	-	o	o	o	o	o	-				
	n	o	o	o	o	o	o	o	o	o	o	o	o				

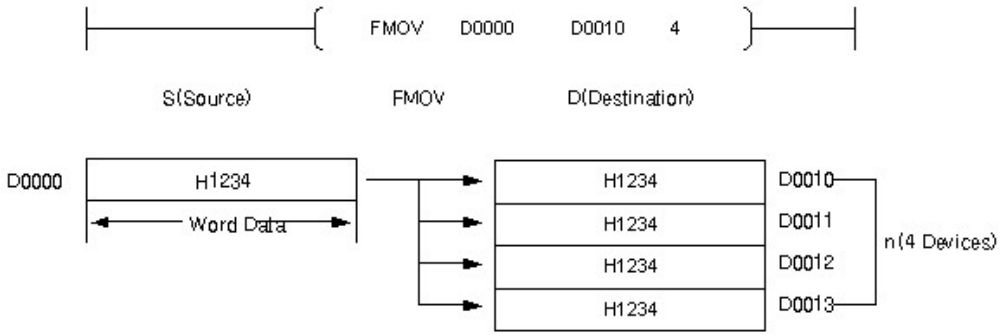
S	Data to transfer, or first number of device storing data to transfer
D	First number of destination device
n	Number of transfers

Error (F110)	In the following cases an operation error occurs, the error flag (SM0) turns ON, and an error code is stored at SD0. • The device range n-points from D exceeds the device range. • The number of transfers exceeds 6144 when a special direct device is used.

FMOV

Functions :

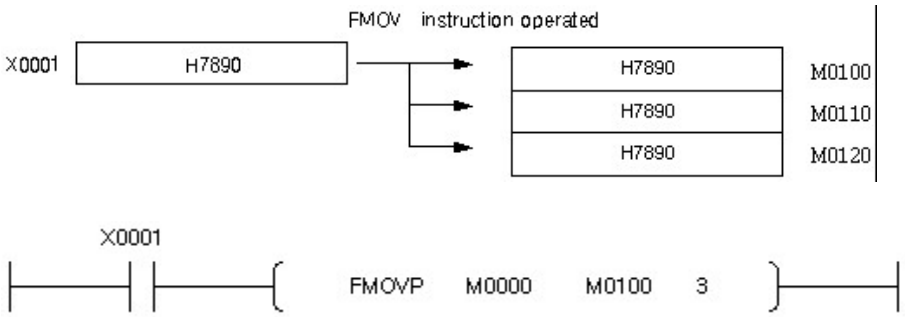
This is used to transfer the data in the device assigned to S to the device assigned to D from the start device in the order of number at n times. This is used to initialize a specific device for data mainly.



If the range of n exceeds the assigned device, error flag(F110) is set. The corresponding instruction is not operated.

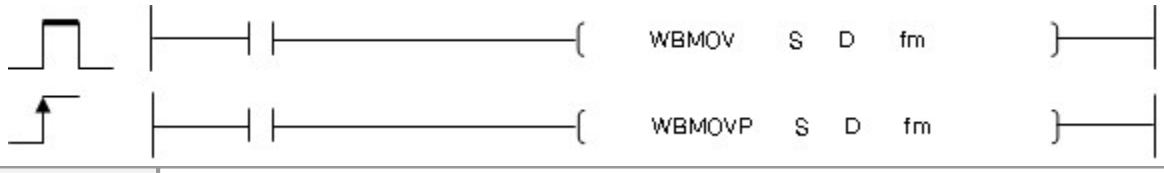
Example of program :

A program to store the word data in the device assigned to M0000 in the devices assigned to M0100, M0110, M0120 whenever input signal X0001 is turned on



5.8.4.8 Bit data transfer : WBMOV, WBMOVP

Instruction		Usable Device												No.of Steps	Flag			Usable CPU		
		M	X	Y	K	L	F	T	C	Z	D	@D	Integer		Error	Zero	Carry	XP	CP	BP
WBMOV WBMOVP	S	o	o	o	o	o	o	o	o	o	o	o	-	4	o	-	-	o	o	o
	D	o	-	o	o	o	-	-	o	o	o	o	-							
	fm	o	o	o	o	o	o	o	o	o	o	o	o							



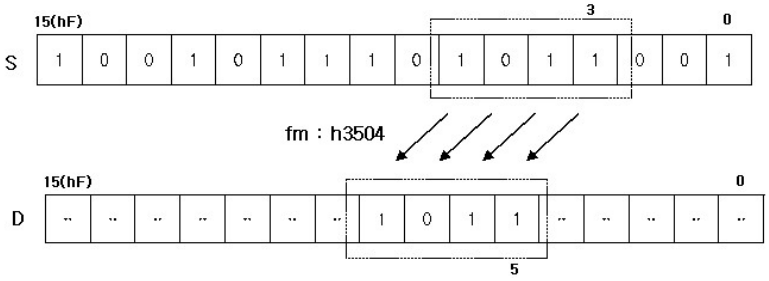
S	Set up data or number of Area
D	Set up data or number of Area
fm	Start BIT and transfers BIT numbers of S(Source), D(destination)

Error (F110)	In case That a Device is assigned to @D, if overflow is generated, it is set.

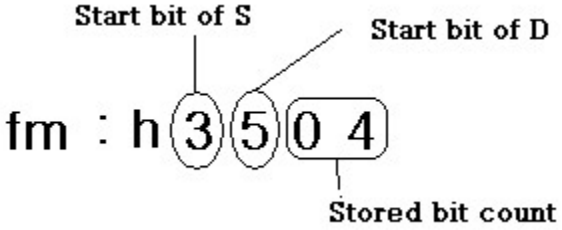
WBMOV(P)

Explanation :

Transfer data from S to D, obey fm

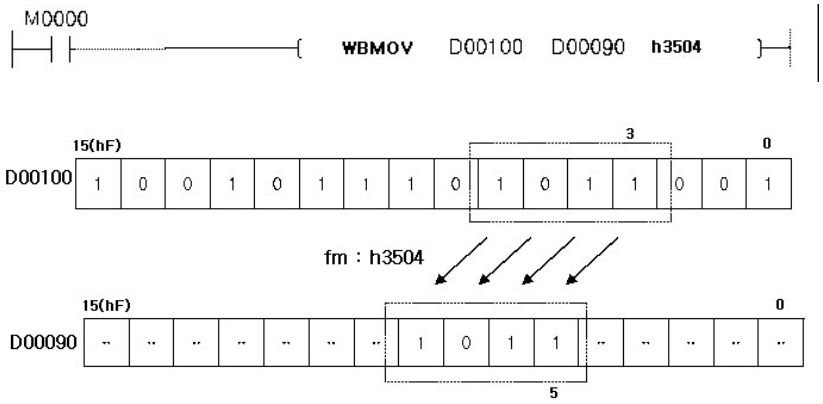


- fm : Copying rule



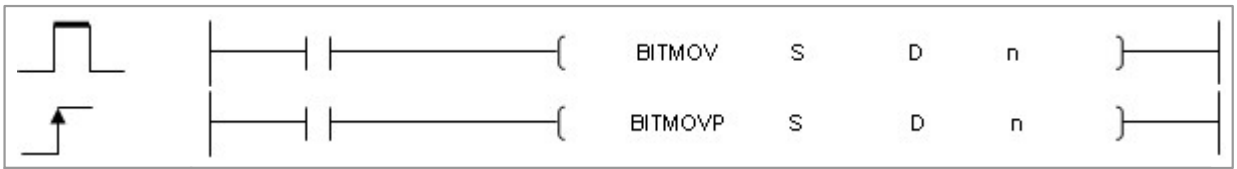
Example of Program :

When M0000 is On, transfer data from D00100 to D00090 , obey h3504



5.8.4.9 Transfer Bit Data : BITMOV, BITMOVP

Instruction		Usable Device												No.of Steps	Flag		
		M	X	Y	K	L	F	T	C	Z	D	@D	Integer		Error	Zero	Carry
BITMOV BITMOVP	S	o	o	o	o	o	o	o	o	o	-	-	o	4	o	-	-
	D	o	-	o	o	o	-	o	o	o	-	-	-				
	n	o	o	o	o	o	o	o	o	o	o	o	o				



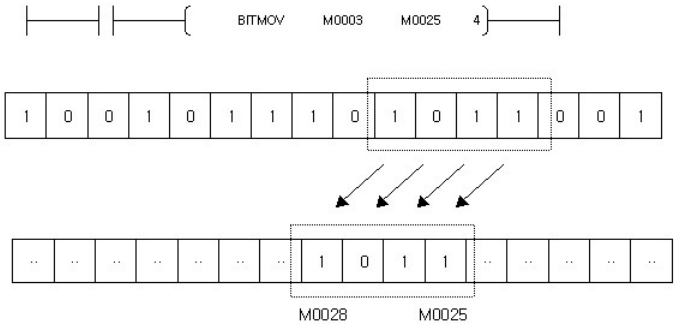
S	Source used to transfer data (By Bits)
D	Number of the start one among destination devices to which data is transferred (By Bits)
n	Number of the bits transferred from the device assigned to S to the device assigned to D

Error (F110)	If the range of n exceeds the assigned device, it is set. A corresponding instruction is not operated.

BITMOV

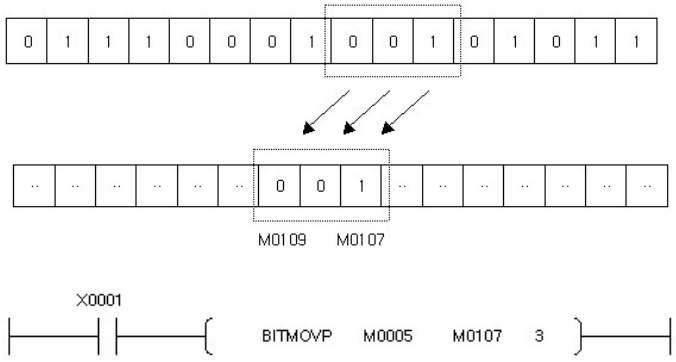
Functions :

This is used to transfer the data in the device assigned to S as much as n bits from the start device number of the device assigned to D.



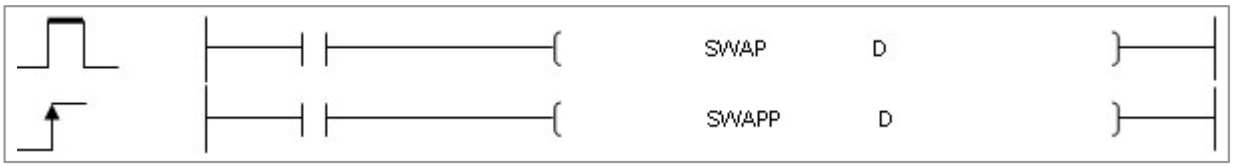
Example of program :

A program to store 3 bit data from M0005 among the word data in M0000 in the device from M0107 in due order



5.8.4.10 Exchange Upper and Lower Byte : SWAP, SWAPP

Instruction		Usable Device												No.of Steps	Flag		
		M	X	Y	K	L	F	T	C	Z	D	@D	Integer		Error	Zero	Carry
SWAP(P)	D	o	-	o	o	o	-	o	o	o	o	o	-	2	o	-	-



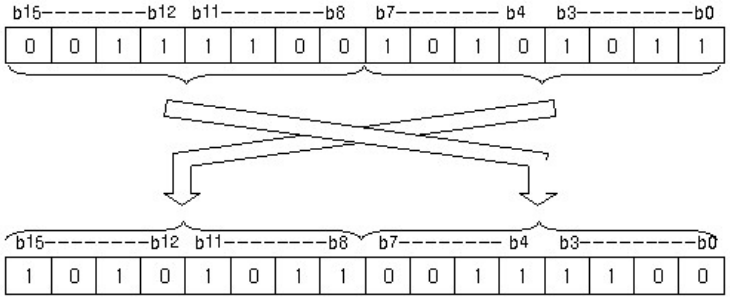
D	First number of device where data is stored

Error (F110)	There are no operation errors associated with the SWAP(P) Instructions.

SWAP

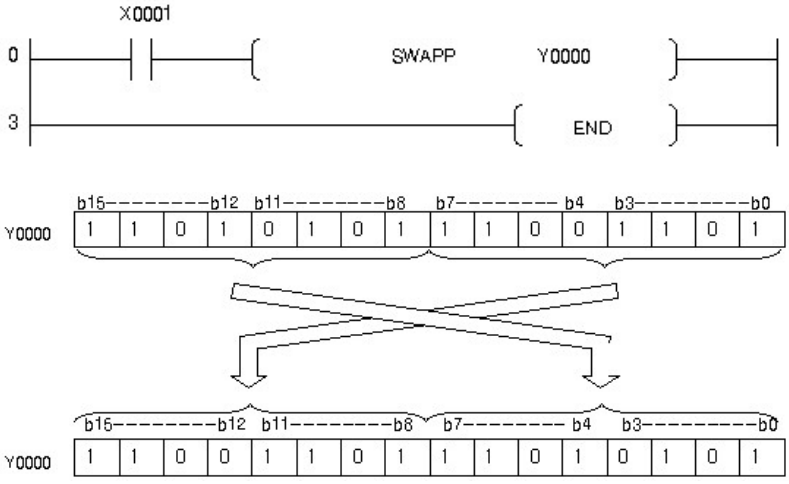
Functions :

This is used to exchange the upper byte and the lower byte of the data in the device assigned to D with each other, storing the result in the device assigned to D.



Example of program :

A program to exchange the upper 8 bit and the lower 8 bit of the data in the device assigned to Y0000, storing the result in Y0000 when input signal X0001 is turned on

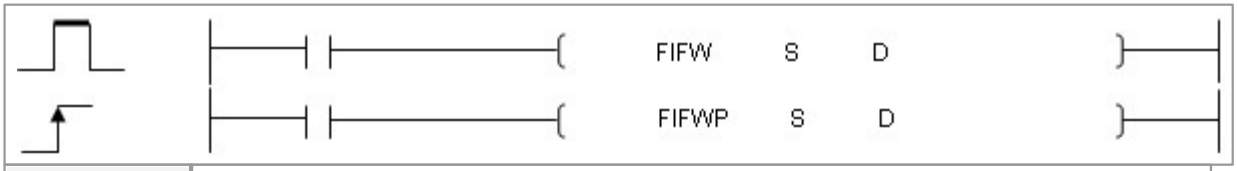


5.8.5 Data Table operation Instruction

Contents :

5.8.5.1 Writing data to the data table : FIFW, FIFWP

Instruction		Usable Device												No.of Steps	Flag		
		M	X	Y	K	L	F	T	C	Z	D	@D	Integer		Error	Zero	Carry
FIFW (P)	S	o	o	o	o	o	o	o	o	o	o	o	o	3	o	-	-
	D	o	-	o	o	o	-	-	-	o	o	o	-				



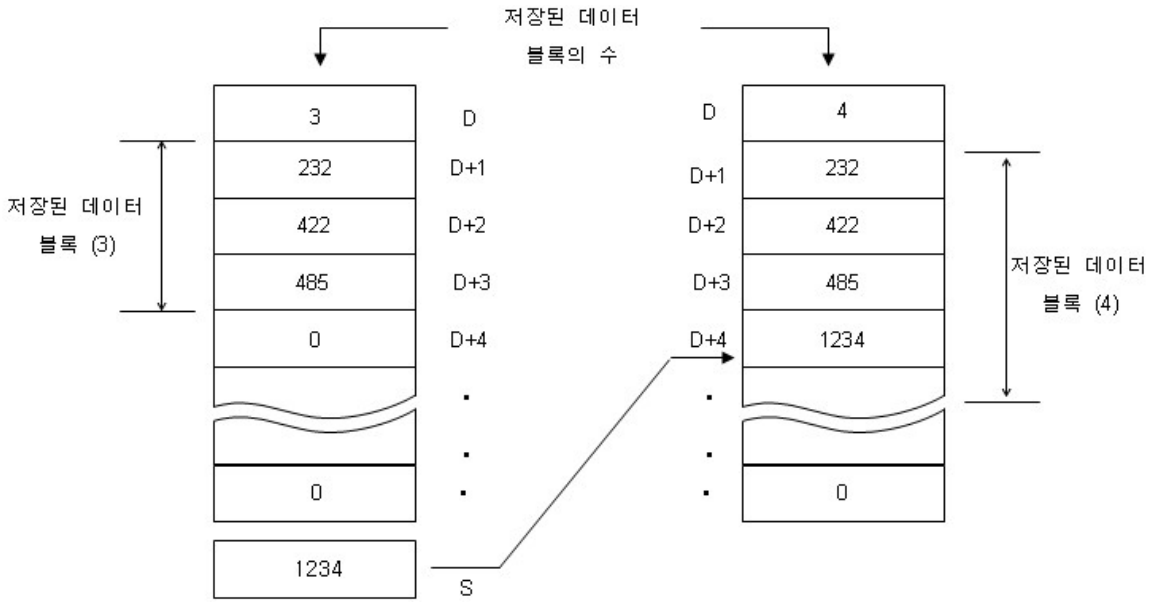
S	Data to write to table or number of device storing such data
D	First number of table

Error (F110)	In case That a Device is assigned to @D, if overflow is generated, it is set. if the number of the devices assigned to D is over the range of the corresponding device, it is set.

FIFW

Function :

Stores the 16 bit data designated by [DEV] at the end of the data table designated by [TBL].
The number of data blocks stored at [TBL] will be increased.

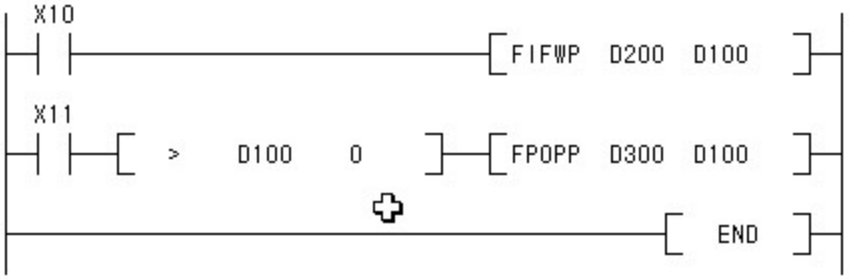


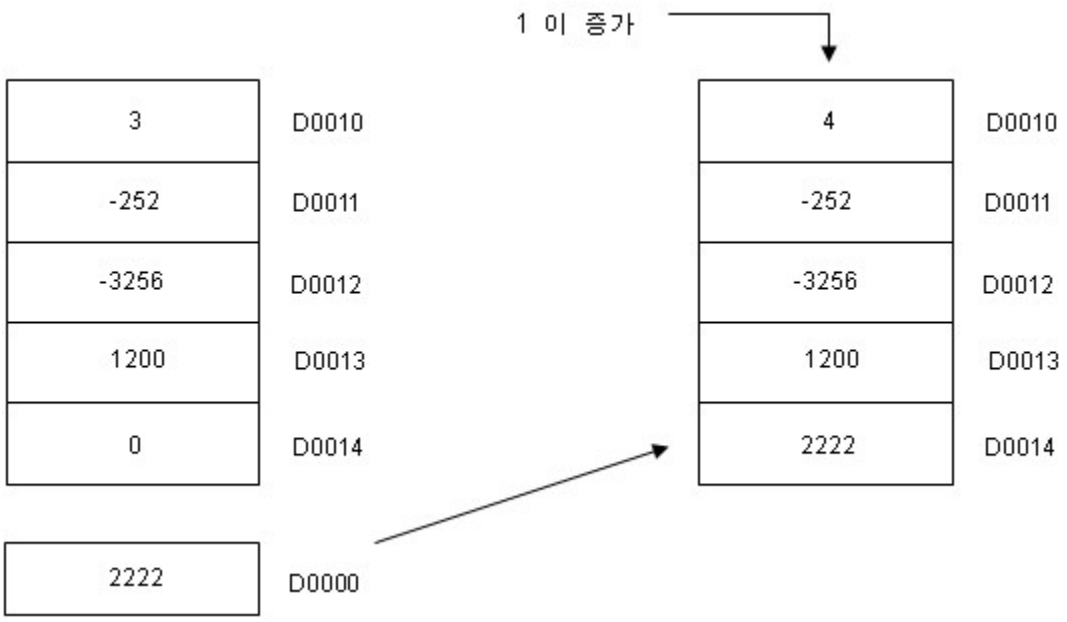
Error :

If data table range when the FIFW instruction was executed exceeds the relevant device range, a error flag F110 turns on.

Example of program :

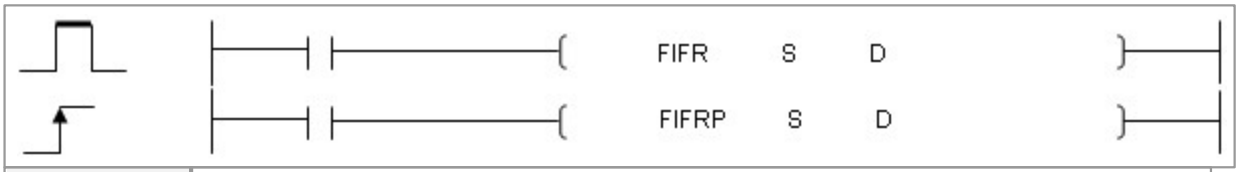
If X10 turns ON, the value stored at D300, 632 will be store at D107 which is the end of the data table and the value stored at D100 will increased to 7.





5.8.5.2 Reading the first data from the data table : FIFR, FIFRP

Instruction		Usable Device												No.of Steps	Flag		
		M	X	Y	K	L	F	T	C	Z	D	@D	Integer		Error	Zero	Carry
FIFR (P)	S	o	o	o	o	o	o	o	o	o	o	o	o	3	o	-	-
	D	o	-	o	o	o	-	-	-	o	o	o	-				



S	Initial number of storage device for data read from table
D	Initial number of table

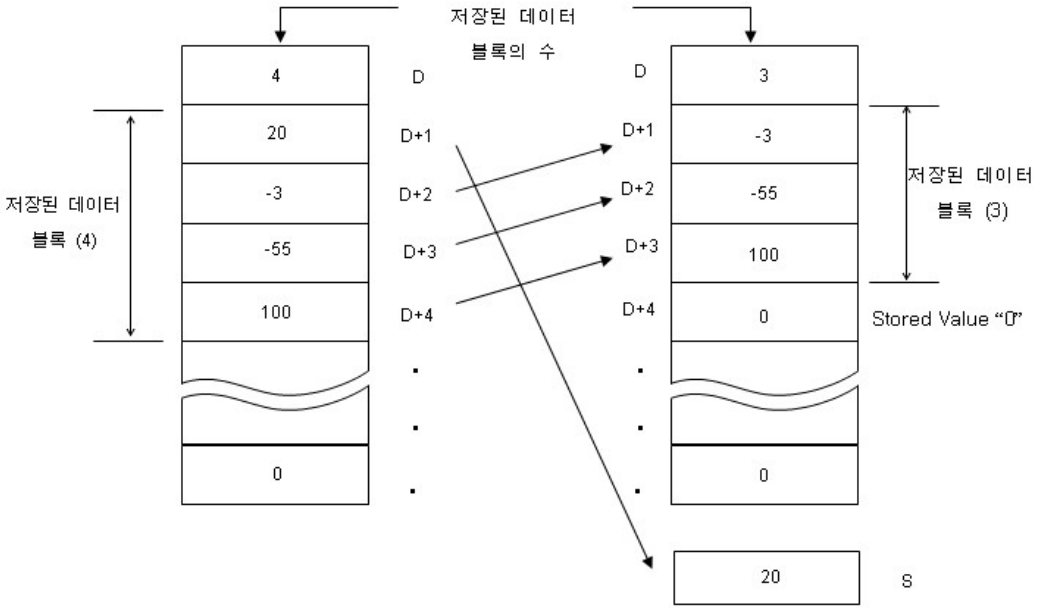
Error (F110)	In case That a Device is assigned to @D, if overflow is generated, it is set. If the number of the devices assigned to D is over the range of the corresponding device, it is set.

FIFR

Function :

Read the oldest data from [TBL+1] and stores it at the device designated by [DEV].

After the execution of FIFR, the data in the table moves to the previous device and the last data will be zero.
The number of data of the data table will be decreased.

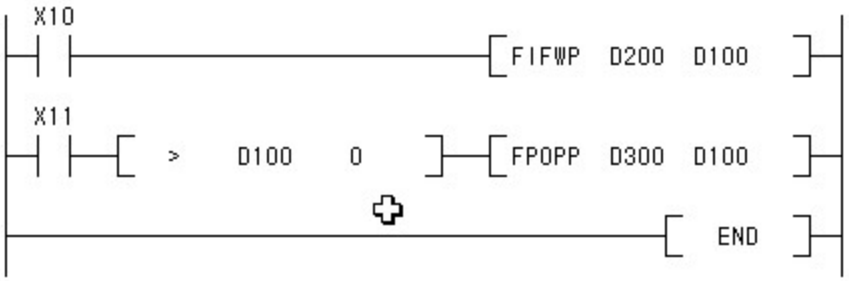


Error :

If FIFR is executed when the value of [TBL] is 0, the error flag F110 turns ON.
You should attempt to avoid executing FIFR if the value stored at [TBL] is 0.

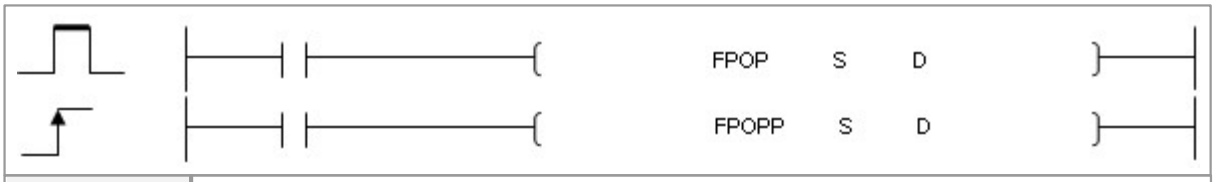
Example :

If X10 turns ON, the value of D101 in the data table will be stored at D300.
After execution of FIFRP, the value of D100 reduces to 6 and the data in the table moves to the previous device.
The value of the last device of the data table will be 0.



5.8.5.3 Reading the last data from the data table : FPOP, FPOPP

Instruction		Usable Device												No.of Steps	Flag		
		M	X	Y	K	L	F	T	C	Z	D	@D	Integer		Error	Zero	Carry
FPOP(P)	S	o	o	o	o	o	o	o	o	o	o	o	o	3	o	-	-
	D	-	-	-	-	-	-	-	-	o	o	o	-				



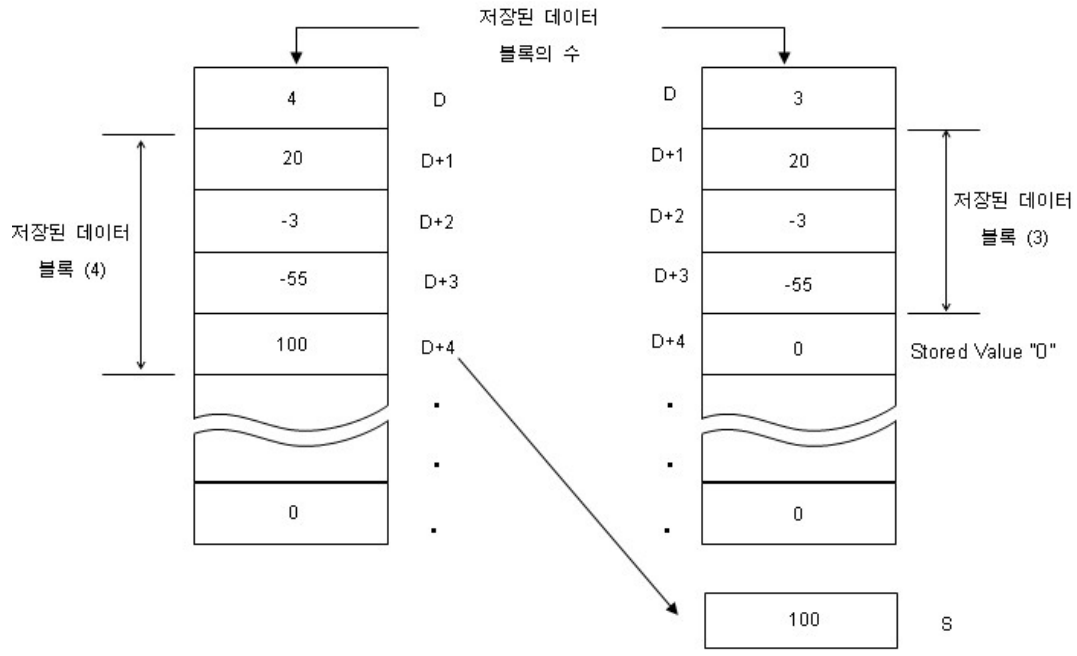
S	Initial number of storage device for data read from table
D	Initial number of table

Error (F110)	In case That a Device is assigned to @D, if overflow is generated, it is set. If the number of the devices assigned to D is over the range of the corresponding device, it is set.

FPOP

Function :

Read the last data from the end of the data table and stores it at the device designated by [DEV].
After the execution of FPOP, the last data will be zero and the number of data of the data table will be decreased.

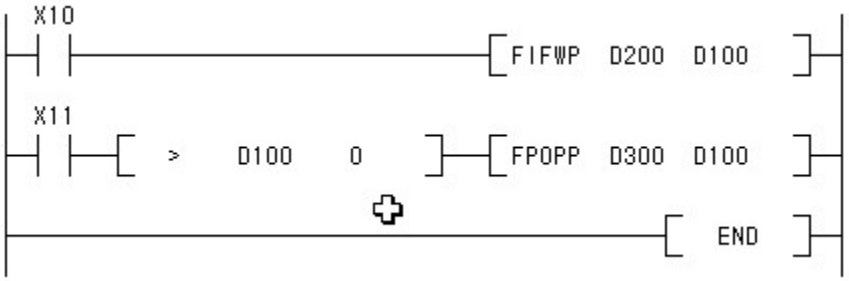


Error :

If FPOP is executed when the value of [TBL] is 0, the error flag F110 turns ON.
You should attempt to avoid executing FPOP if the value stored at [TBL] is 0.

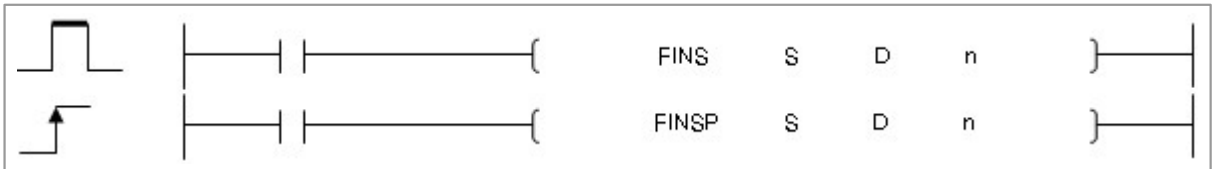
Example of program :

If X10 turns ON, 159 which is the value of D200 will be stored at D107 which is the end device of the data table and the value of D100 will be increased to 7.
If X11 turns ON continuously, 159 which is the value of D107 will be stored at D300 and the value of D107 will be 0 and the value of D100 will be decreased to 6.



5.8.5.4 Inserting a data in the data table : FINS, FINSP

Instruction		Usable Device												No.of Steps	Flag		
		M	X	Y	K	L	F	T	C	Z	D	@D	Integer		Error	Zero	Carry
FINS (P)	S	o	o	o	o	o	o	o	o	o	o	o	o	4	o	-	-
	D	-	-	-	-	-	-	-	-	o	o	o	-				
	n	o	o	o	o	o	o	o	o	o	o	o	o				



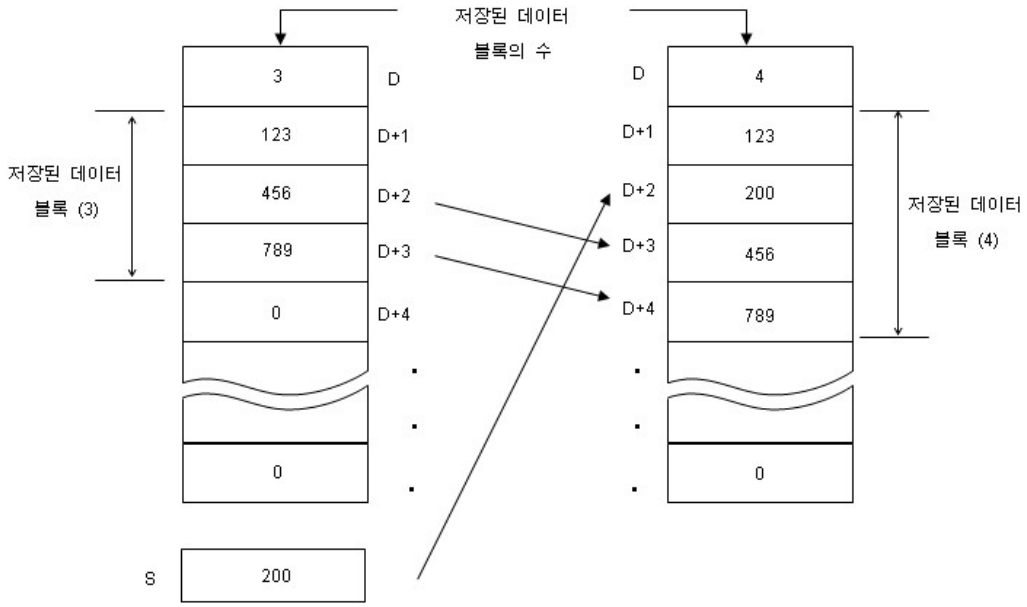
S	Inserted data or first device number of devices that will store inserted data Fist devices number of devices that will store deleted data
D	Initial number of table
n	Table position for data for insertion of deletion

Error (F110)	In case That a Device is assigned to @D, if overflow is generated, it is set. If the number of the devices assigned to D is over the range of the corresponding device, it is set.

FINS

Function :

Inserts the 16 bit data designated by [DEV] at the device [TBL+n].
After the execution of FINS, the data in the table following the deleted device will move backward by one device.
The value of the device [TBL] will be increased.

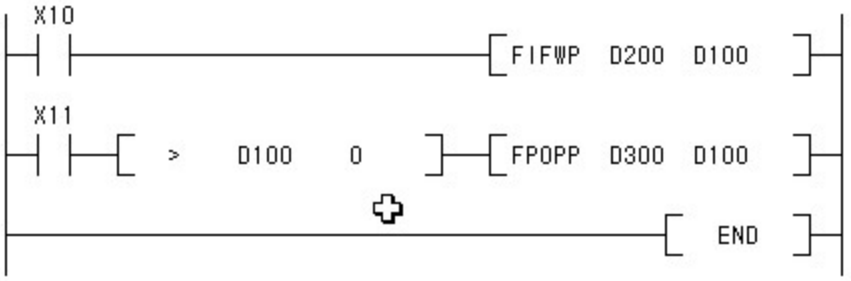


Error :

If n is less than 1 or greater than the value of [TBL] plus 1, the error flag F110 turns ON.

Example of program :

If X10 turns ON, 951 which is the value of D300 will be inserted at D105.
Data of the data table following D105 will move backward by one device and the value of D100 will be 7.



5.8.5.5 Deleting a data from the data table : FDEL, FDELP

Instruction		Usable Device												No.of Steps	Flag		
		M	X	Y	K	L	F	T	C	Z	D	@D	Integer		Error	Zero	Carry
SUB(P)	S	o	o	o	o	o	o	o	o	o	o	o	o	4	o	-	-

DSUB(P)	D	-	-	-	-	-	-	-	-	o	o	o	-				
	n	o	o	o	o	o	o	o	o	o	o	o	o				

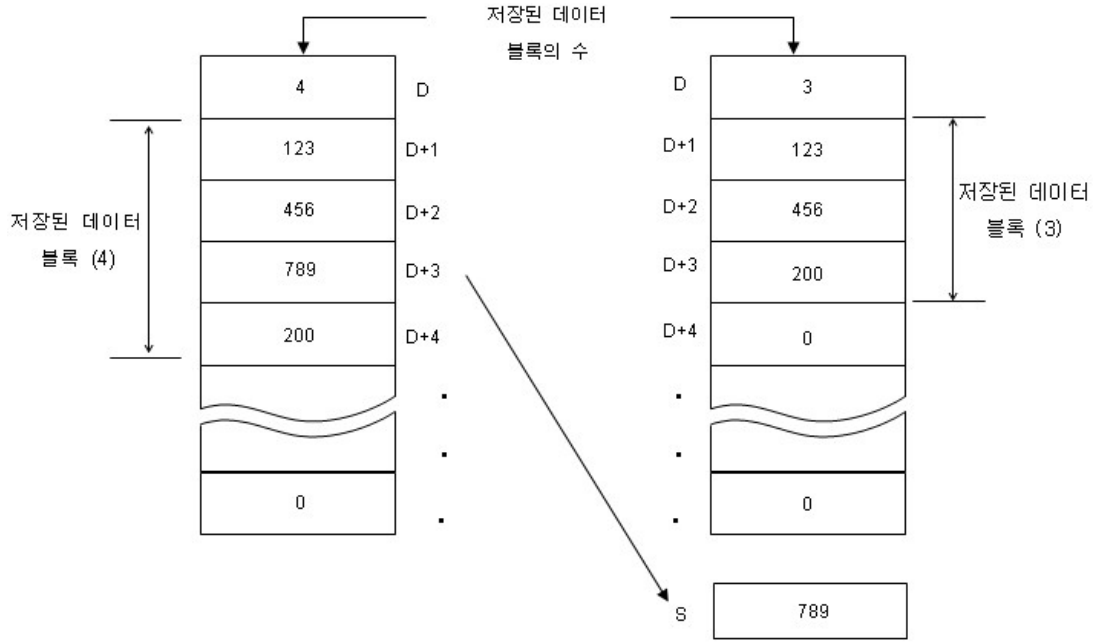
S	Inserted data or first device number of devices that will store inserted data Fist devices number of devices that will store deleted data
D	Initial number of table
n	Table position for data for insertion of deletion

Error (F110)	In case That a Device is assigned to @D, if overflow is generated, it is set. If the number of the devices assigned to D is over the range of the corresponding device, it is set.

FDEL

Function :

Delete the value of [TBL+n] and store it at the device designated by [DEV].
After the execution of FDEL, the data in the table following the deleted device will move forward by one device and the value of the end device will be 0.

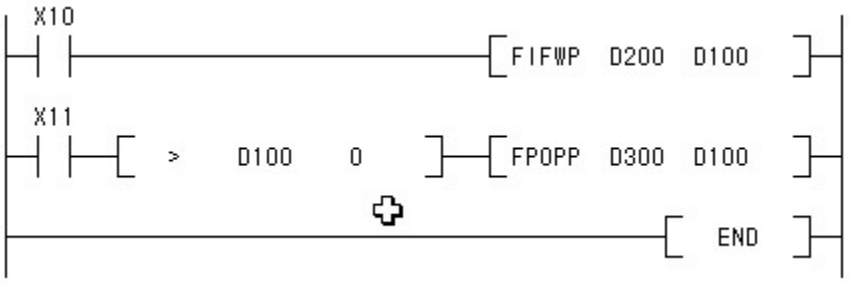


Error :

If n is less than 1 or greater than the value of [TBL], the error flag F110 turns ON.
If FDEL is executed when the value of [TBL] is 0, the error flag F110 turns ON.
You should attempt to avoid executing FDEL if the value stored at [TBL] is 0.

Example :

If X10 turns ON, -23 which is the value of D105 will be stored at D300.
The data of the data table following D106 moves forward and the value of D107 will be 0 and the value of D100 will be decrease.



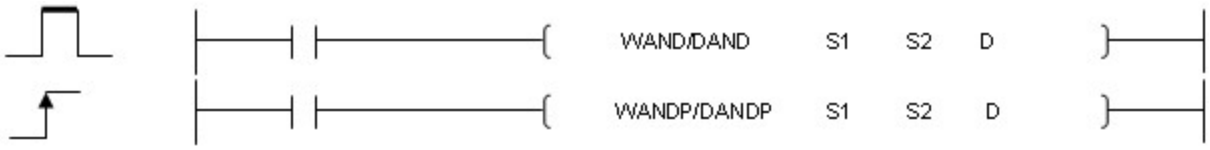
5.8.6 Logic operation Instruction

Contents :

5.8.6.1 Logical products with 16-bit and 32-bit data : WAND(P), DAND(P)

Instruction	Usable Device	No.of	Flag

		M												Steps	Error		
WAND(P) DAND(P)	S1	o	o	o	o	o	o	o	o	o	o	o	o	4	o		
	S2	o	o	o	o	o	o	o	o	o	o	o	o				
	D	o		o	o	o*		o	o		o	o					



*Available in case a computer link module and a data link module are not used.

S1, S2	Data from which logical product will be determined, or initial number of devices storing such data
D	Initial number of devices where logical product operation results will be stored

Error (F110)	In case That a Device is assigned to @D, if overflow is generated, it is set.

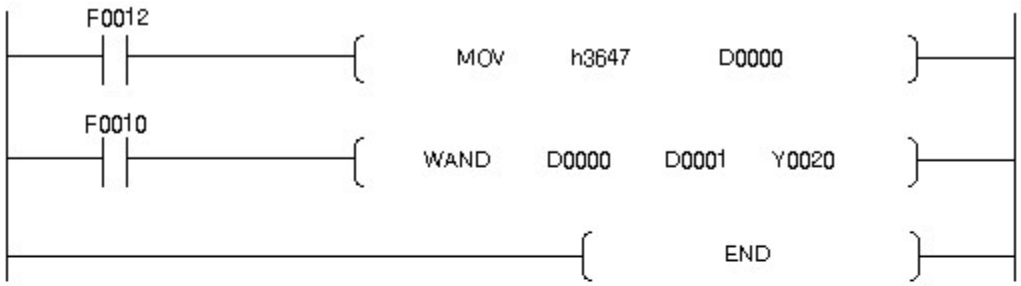
WAND

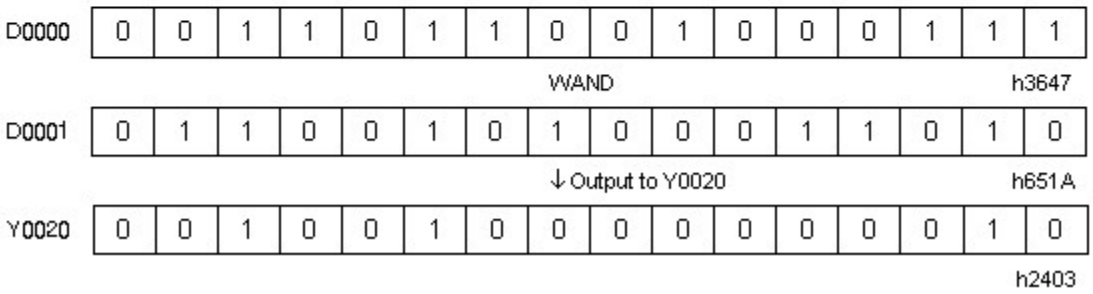
Functions :

This is used to AND-operate each bit data in the device assigned to S1 and each bit data in the device assigned to S2, storing 1 in case the data of each data are 1 simultaneously and, otherwise, 0 in each bit of the assigned device. The WANDP instruction and the DANDP instruction are operated for a scan in case the input condition to operate these instructions is changed (From OFF to ON). The DAND instruction and the DANDP instruction are operated for 32Bit data.

Example of program :

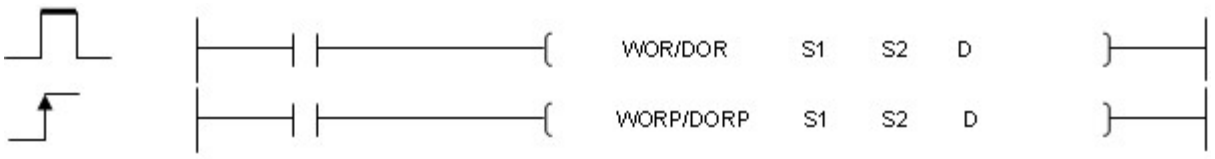
A program to operate the WAND instruction for data in the device assigned to D0000 and D0001, outputing the result to the device assigned to Y0020





5.8.6.2 Word OR : WOR, WORP, DOR, DORP

Instruction		Usable Device												No.of Steps	Flag		
		M	X	Y	K	L	F	T	C	S	D	@D	Integer		Error	Zero	Carry
WOR(P) DOR(P)	S1	o	o	o	o	o	o	o	o	o	o	o	o	4	o	-	-
	S2	o	o	o	o	o	o	o	o	o	o	o	o				
	D	o	-	o	o	o	-	o	o	o	o	o	-				



*Available in case a computer link module and a data link module are not used.

S1, S2	Data or device where data is stored
D	Device where the data from the operation of OR instruction is stored

Error (F110)	In case That a Device is assigned to @D, if overflow is generated, it is set.

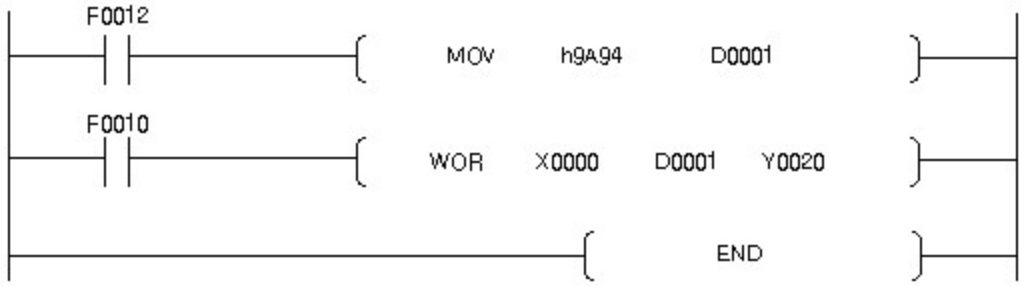
WOR

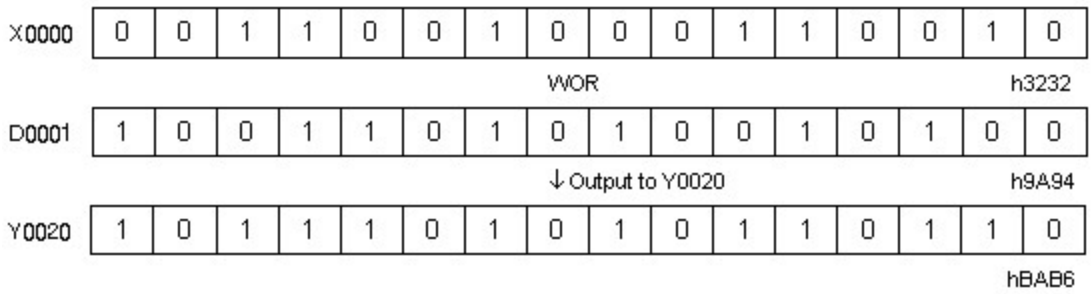
Functions :

This is used to OR-operate each bit data in the device assigned to S1 and each bit data in the device assigned to S2, storing 1 in case the data of each data are 1 simultaneously and, otherwise, 0 in each bit of the assigned device. The WOR instruction and the DORP instruction are operated for a scan in case the input condition to operate these instructions is changed (From OFF to ON). The DOR instruction and the DORP instruction are operated for 32Bit data.

Example of program :

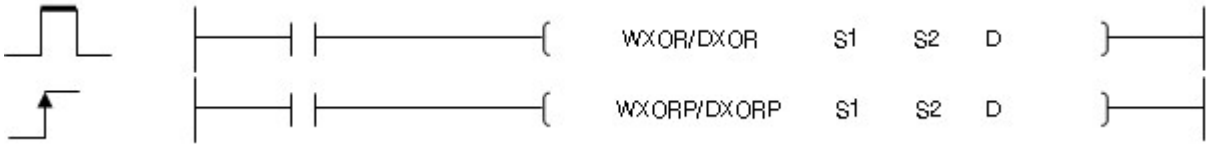
A program to operate the WOR instruction for data in the device assigned to X0000 and D0001, storing the result in the device assigned to Y0020





5.8.6.3 Word Exclusive OR : WXOR, WXORP, DXOR, DXORP

Instruction		Usable Device												No.of Steps	Flag		
		M	X	Y	K	L	F	T	C	S	D	@D	Integer		Error	Zero	Carry
WXOR (P) DXOR (P)	S1	o	o	o	o	o	o	o	o	o	o	o	o	4	o	-	-
	S2	o	o	o	o	o	o	o	o	o	o	o	o				
	D	o	-	o	o	o*	-	o	o	-	o	o	-				



*Available in case a computer link module and a data link module are not used.

S1, S2	Data or device where data is stored
D	Device where the data from the operation of XOR instruction is stored

Error (F110)	In case That a Device is assigned to @D, if overflow is generated, it is set.

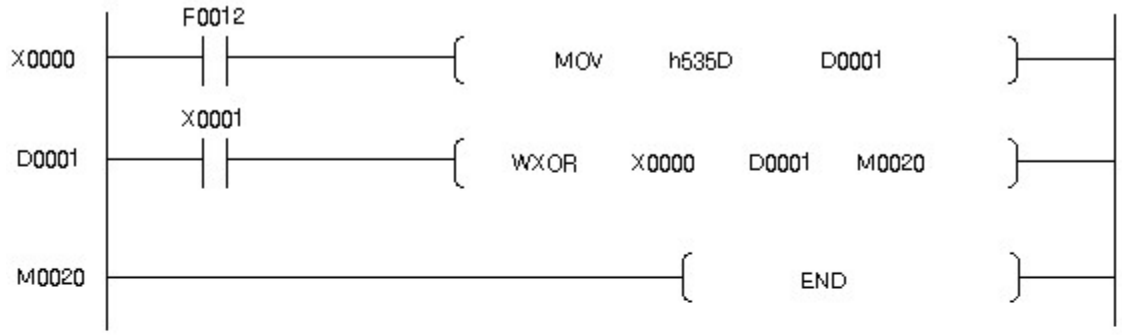
WXOR

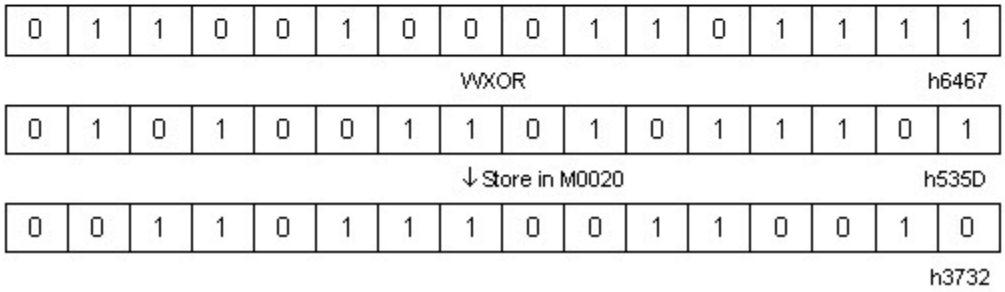
Functions :

This is used to XOR-operate each bit data in the device assigned to S1 and each bit data in the device assigned to S2, storing 1 in case the data of each data are 1 simultaneously and, otherwise, 0 in each bit of the assigned device. The WXORP instruction and the DXORP instruction are operated for a scan in case the input condition to operate these instructions is changed (From OFF to ON). The DXOR instruction and the DXORP instruction are operated for 32Bit data.

Example of program :

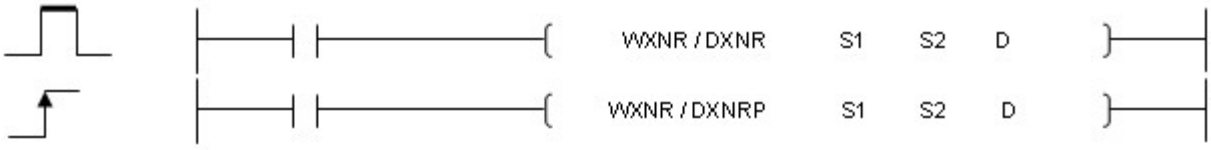
A program to operate the WXOR instruction for data in the device assigned to X0000 and D0001, storing the result in the device assigned to M0020





5.8.6.4 Word Exclusive NOR : WXNR, WXNRP, DXNR, DXNRP

Instruction		Usable Device												No.of Steps	Flag		
		M	X	Y	K	L	F	T	C	S	D	@D	Integer		Error	Zero	Carry
WXNR (P) DXNR (P)	S1	o	o	o	o	o	o	o	o	o	o	o	o	4	o	-	-
	S2	o	o	o	o	o	o	o	o	o	o	o	o				
	D	o	-	o	o	o	-	o	o	-	o	o	-				



*Available in case a computer link module and a data link module are not used.

S1, S2	Data or device where data is stored
D	Device where the data from operation of XNOR instruction is stored

Error (F110)	In case That a Device is assigned to @D, if overflow is generated, it is set. A corresponding instruction is not operated.

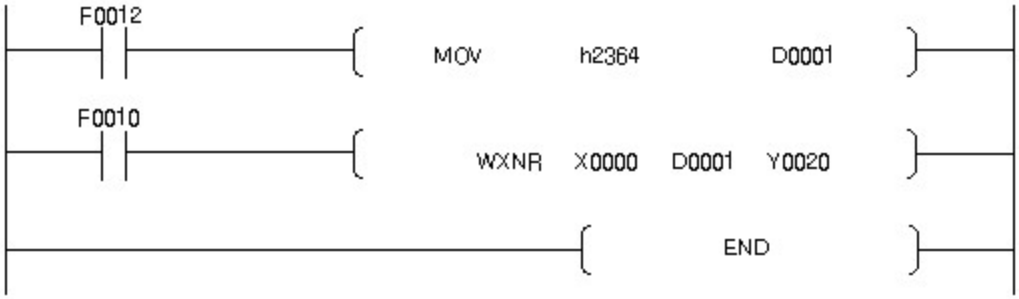
WXNR

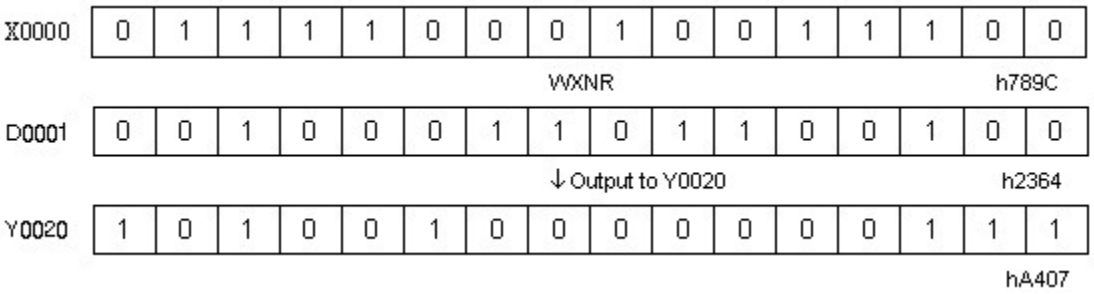
Functions :

This is used to Exclusive NOR-operate each bit data in the device assigned to S1 and each bit data in the device assigned to S2, storing 1 in case the data of each data are 1 simultaneously and, otherwise, 0 in each bit of the assigned device. The WXNRP instruction and the DXNRP instruction are operated for a scan in case the input condition to operate these instructions is changed (From OFF to ON). The DXNR instruction and the DXNRP instruction are operated for 32Bit data.

Example of program :

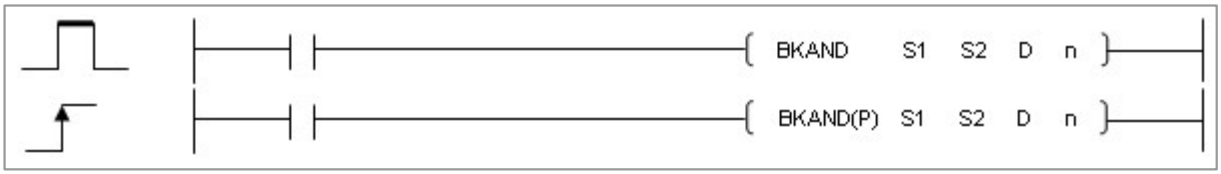
A program to operate the Exclusive NOR instruction for data in the device assigned to X0000 and D0001, outputing the result in the device assigned to Y0020





5.8.6.5 Block Logical Product : BKAND, BKANDP

Instruction		Usable Device												No.of Steps	Flag		
		M	X	Y	K	L	F	T	C	Z	D	@D	Integer		Error	Zero	Carry
BKAND BKANDP	S1	o	o	o	o	o	o	o	o	o	o	o	o	5	o	-	-
	S2	o	o	o	o	o	o	o	o	o	o	o	o				
	D	o	-	o	o	o	-	o	o	o	o	o	-				
	n	o	o	o	o	o	o	o	o	o	o	o	o				



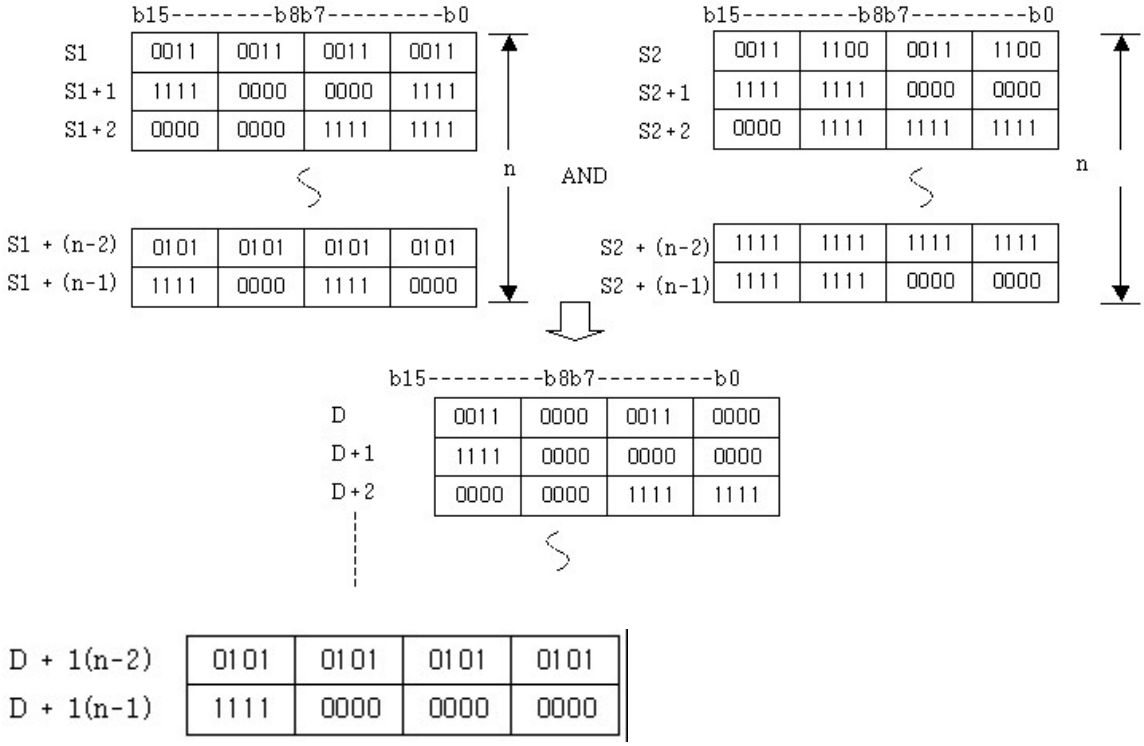
S1	First number of the devices where the data subjected to the logical product operation is stored
S2	First number of the logical operation data or the devices where the logical operation data is stored
D	First number of the devices where the operation result are stored
n	Number of operation data bits

Error (F110)	In case That a Device is assigned to @D, if overflow is generated, it is set.

BKAND

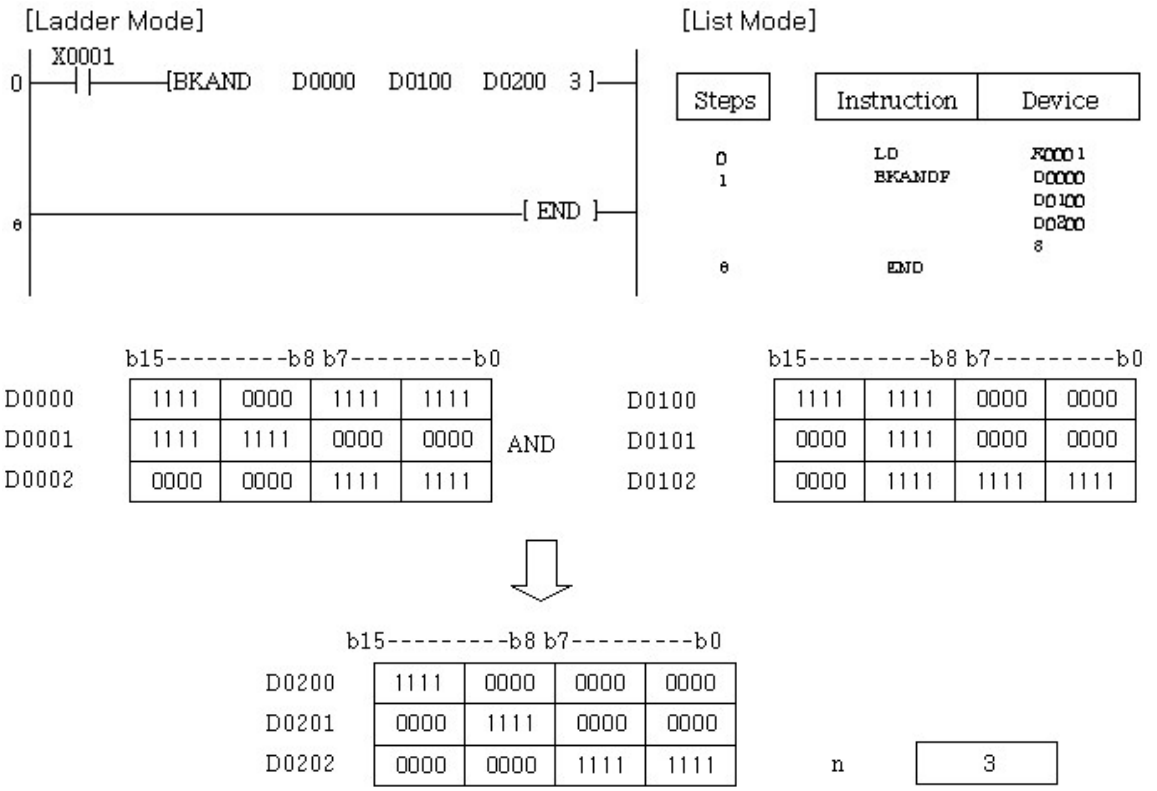
Functions :

This is used to AND-operate the n-sized device assigned to S1 and the n-sized device assigned to S2, storing the result in the device assigned to D.



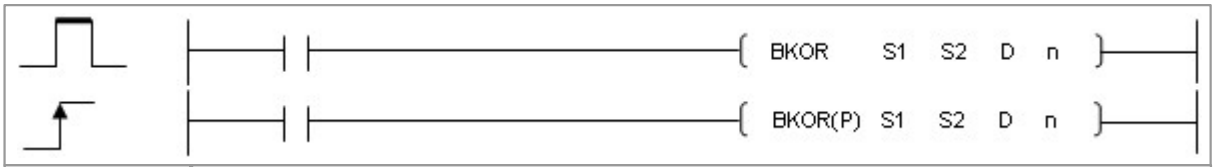
Example of program :

A program to AND-operate the three devices from D0000 and the three devices from D0100, storing the result in the device assigned to D0200 when X0001 assigned to S1 is turned on



5.8.6.6 Block Logical Sum : BKOR, BKORP

Instruction		Usable Device												No.of Steps	Flag		
		M	X	Y	K	L	F	T	C	Z	D	@D	Integer		Error	Zero	Carry
BKOR BKORP	S1	o	o	o	o	o	o	o	o	o	o	o	o	5	o	-	-
	S2	o	o	o	o	o	o	o	o	o	o	o	o				
	D	o	-	o	o	o	-	o	o	o	o	o	-				
	n	o	o	o	o	o	o	o	o	o	o	o	o				

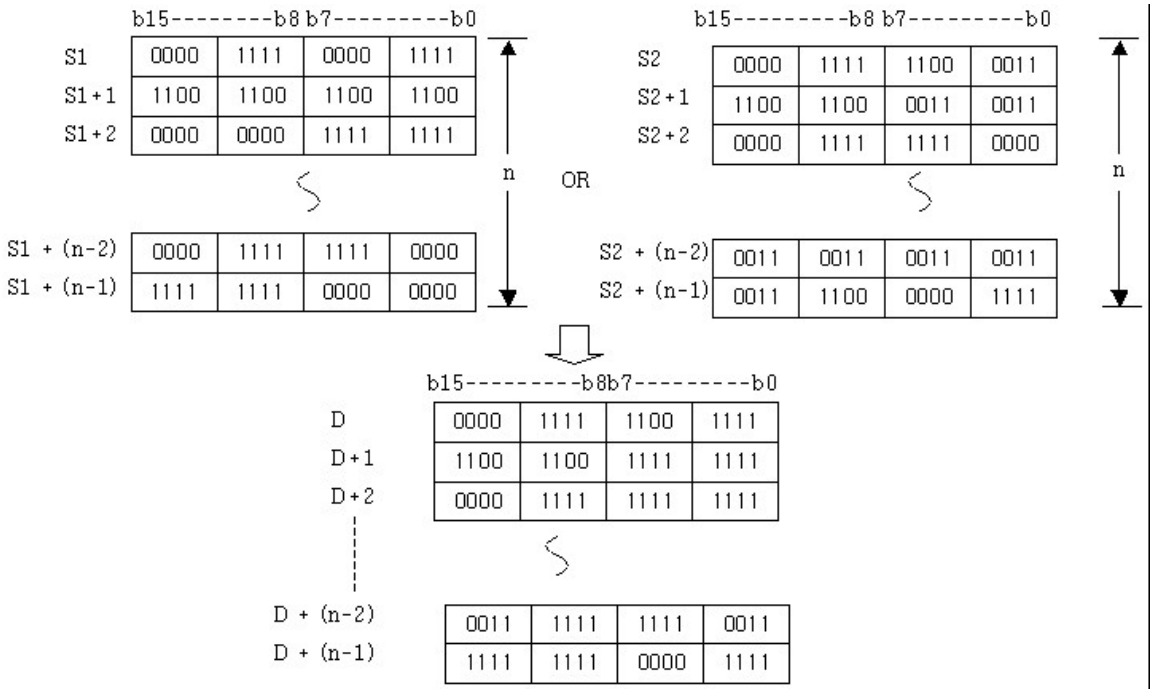


S1	First number of the devices where the data subjected to the logical product operation is stored
S2	First number of the logical operation data or the devices where the logical operation data is stored
D	First number of the devices where the operation result are stored
n	Number of operation data bits

BKOR

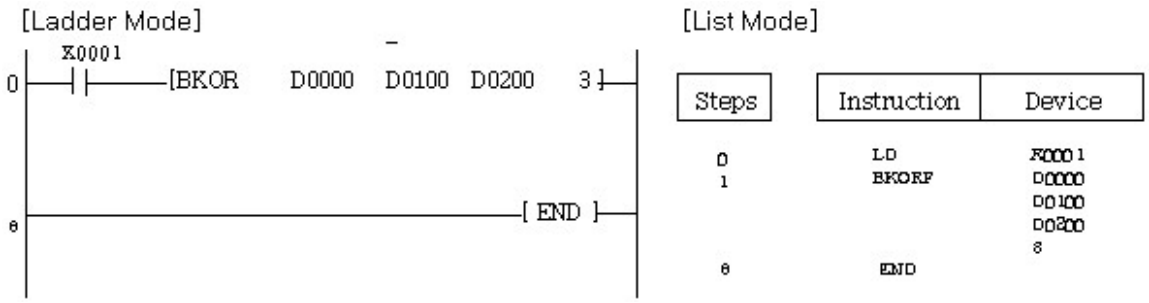
Functions :

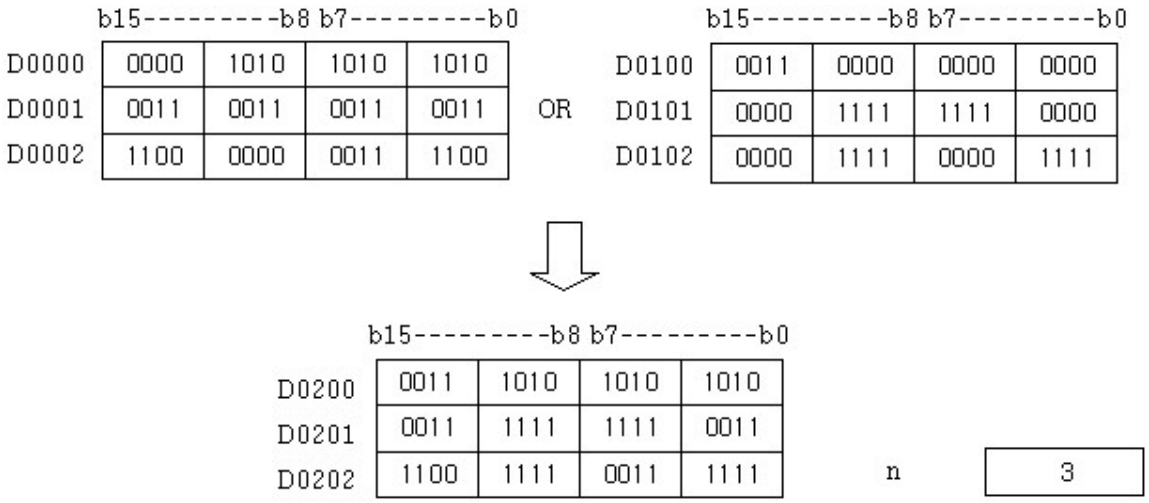
This is used to OR-operate the n-sized device assigned to S1 and the n-sized device assigned to S2, storing the result in the device assigned to D.



Example of program :

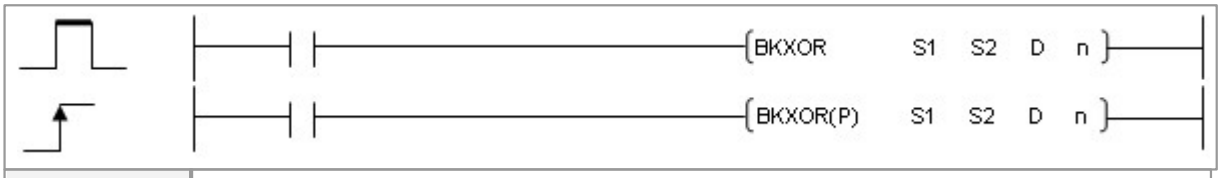
A program to OR-operate the three devices from D0000 and the three devices from D0100, storing the result in the device assigned to D0200 when X0001 assigned to S1 is turned on





5.8.6.7 Block Exclusive OR : BKXOR, BKXORP

Instruction		Usable Device												No.of Steps	Flag		
		M	X	Y	K	L	F	T	C	Z	D	@D	Integer		Error	Zero	Carry
BKXOR BKXORP	S1	o	o	o	o	o	o	o	o	o	o	o	o	5	o	-	-
	S2	o	o	o	o	o	o	o	o	o	o	o	o				
	D	o	-	o	o	o	-	o	o	o	o	o	-				
	n	o	o	o	o	o	o	o	o	o	o	o	o				



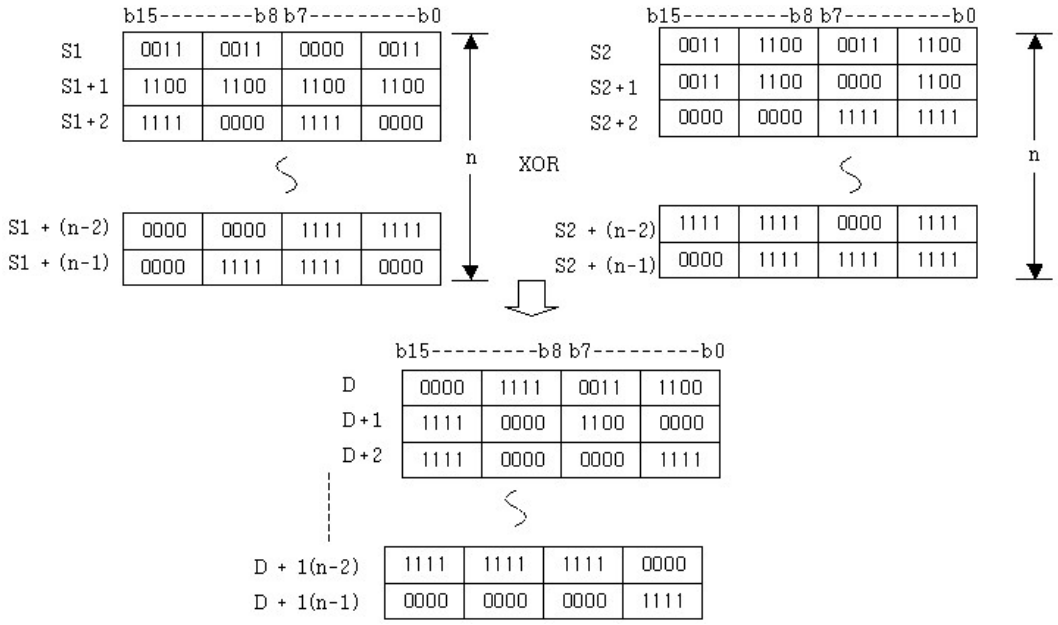
S1	First number of the devices where the data subjected to the logical product operation is stored
S2	First number of the logical operation data or the devices where the logical operation data is stored
D	First number of the devices where the operation result are stored
n	Number of operation data bits

Error (F110)	In case That a Device is assigned to @D, if overflow is generated, it is set.

BKXOR

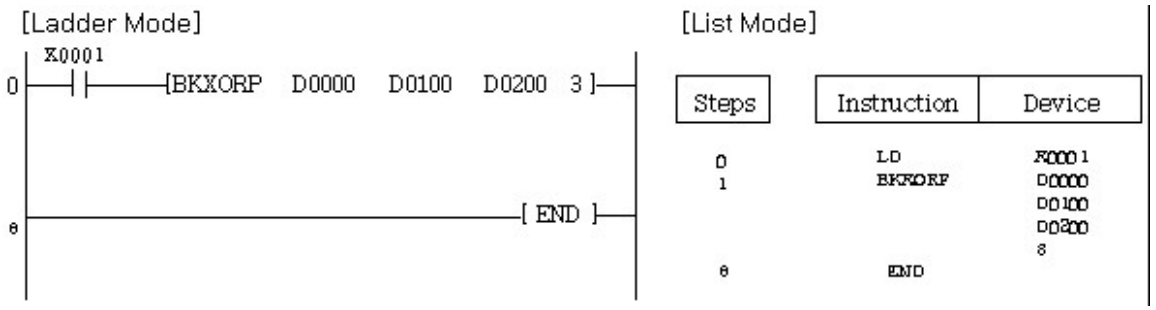
Functions :

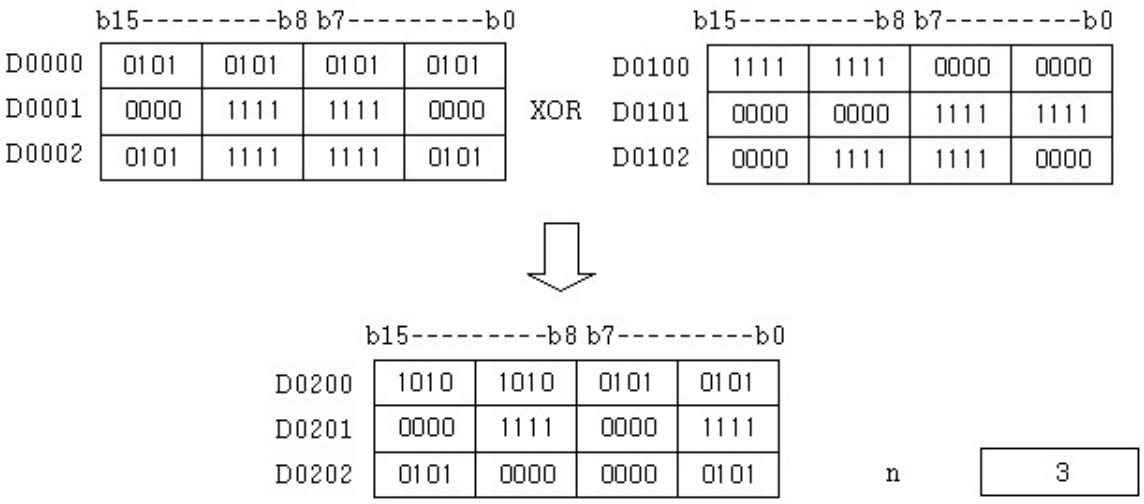
This is used to XOR-operate the n-sized device assigned to S1 and the n-sized device assigned to S2, storing the result in the device assigned to D.



Example of program :

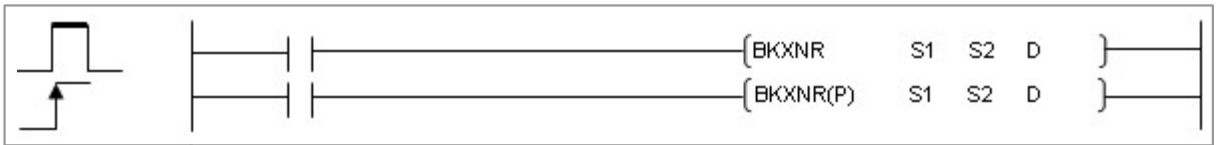
A program to XOR-operate the three devices from D0000 and the three devices from D0100, storing the result in the device assigned to D0200 when X0001 assigned to S1 is ON





5.8.6.8 Block Non-Exclusive Logical Sum : BKXNR, BKXNRP

Instruction		Usable Device												No.of Steps	Flag		
		M	X	Y	K	L	F	T	C	Z	D	@D	Integer		Error	Zero	Carry
BKXNR BKXNRP	S1	o	o	o	o	o	o	o	o	o	o	o	o	5	o	-	-
	S2	o	o	o	o	o	o	o	o	o	o	o	o				
	D	o	-	o	o	o	-	o	o	o	o	o	-				
	n	o	o	o	o	o	o	o	o	o	o	o	o				



S1	First number of the devices where the data subjected to the logical product operation is stored
S2	First number of the logical operation data or the devices where the logical operation data is stored
D	First number of the devices where the operation result are stored
n	Number of operation data bits

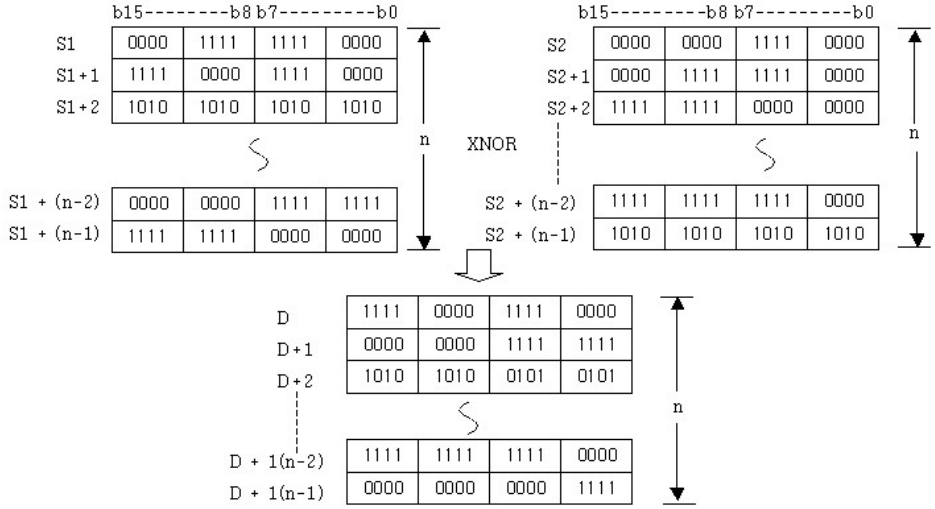
Error (F110)	In case That a Device is assigned to @D, if overflow is generated, it is set.

BKXNR

Functions :

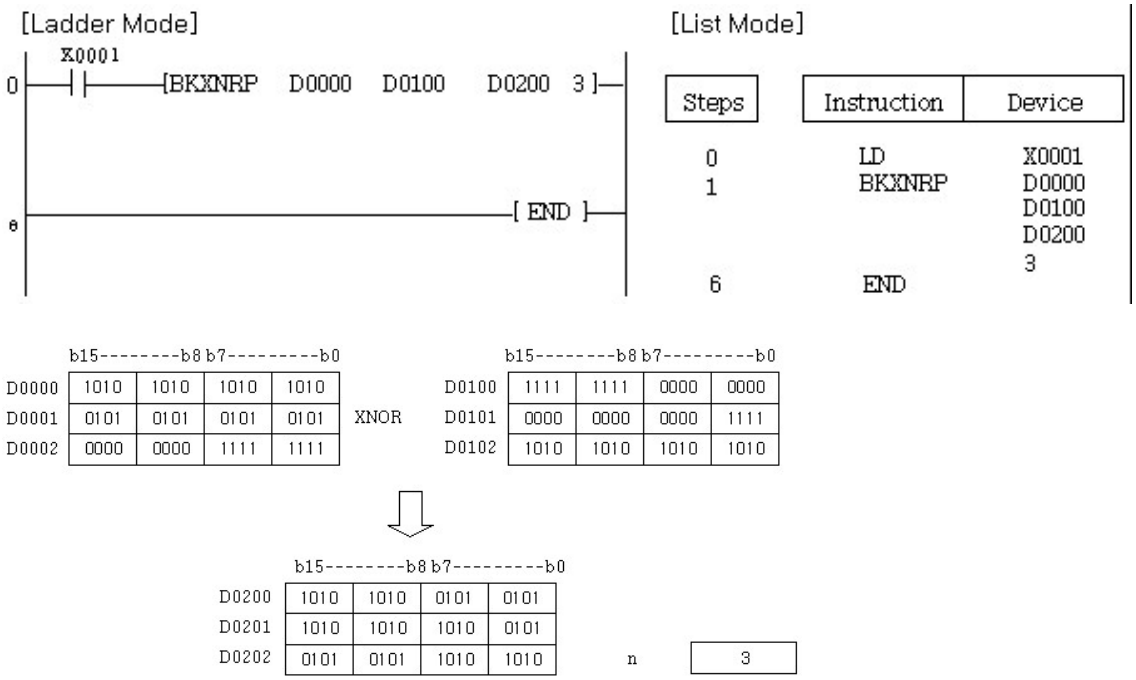
This is used to XNR-operate the n-sized device assigned to S1 and the n-sized device assigned to S2,

storing the result in the device assigned to D.



Example of program :

A program to XNR-operate the three devices from D0000 and the three devices from D0100, storing the result in the device assigned to D0200 when X0001 assigned to S1 is turned on

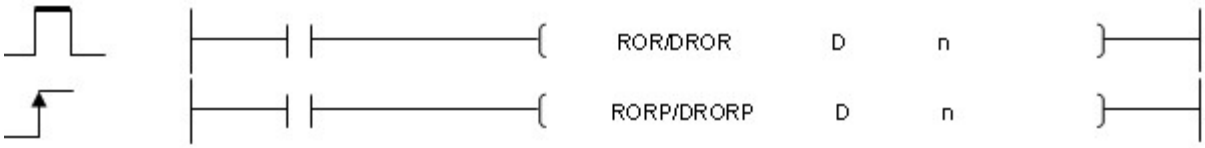


5.8.7 Rotation Instruction

Contents :

5.8.7.1 Rotate Right : ROR, RORP, DROR, DRORP

Instruction		Usable Device												No.of Steps	Flag		
		M	X	Y	K	L	F	T	C	Z	D	@D	Integer		Error	Zero	Carry
ROR (P) DROR (P)	D	o	-	o	o	o	-	o	o	o	o	o	-	3	o	-	o
	n	o	o	o	o	o	o	o	o	o	o	o	o				



* Available in case a computer link module and data link module are not used.

D	Initial number of devices to perform rotation
n	Number of rotations Functions

Error (F110)	In case that a device is assigned to @D, if overflow is generated, flat is set. the corresponding instruction is not operated.
Carry (F112)	While rotating right, if carry occurs, carry flag is set.

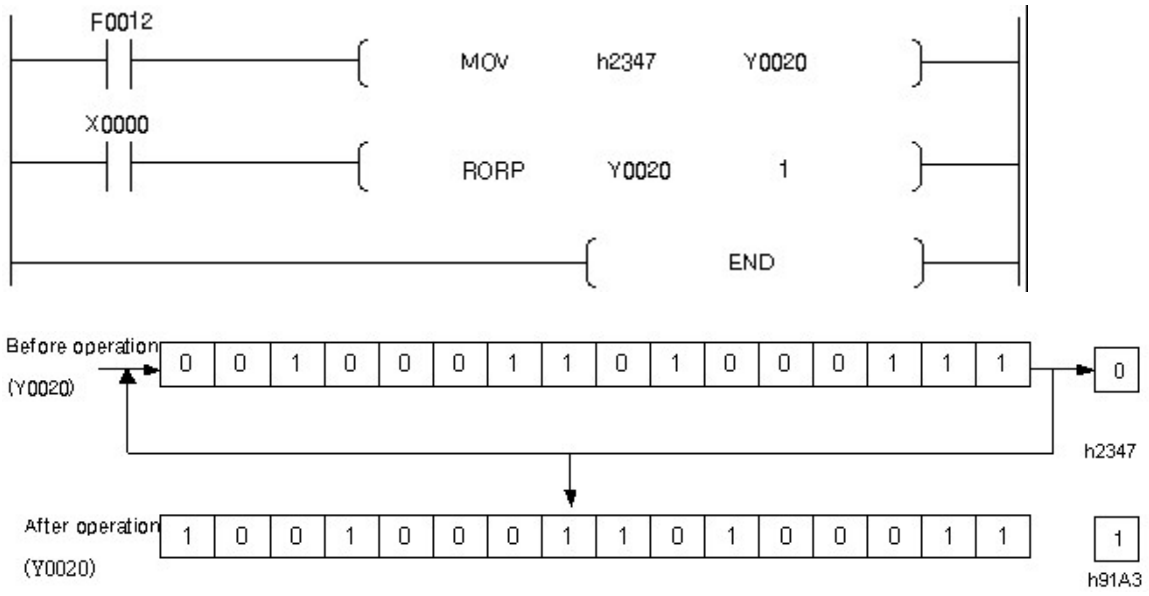
ROR

Functions :

This is used to rotate right 16 bits in a word data as much as n bits. The lowest bit is rotated to carry flag (F 112) and the uppermost bit. (Rotated within a word). The RORP instruction and the DRORP instruction are operated for one scan in case the operation condition of them is changed from OFF to ON. The DROR instruction and the DRORP instruction are operated for 32BIT data.

Example of program :

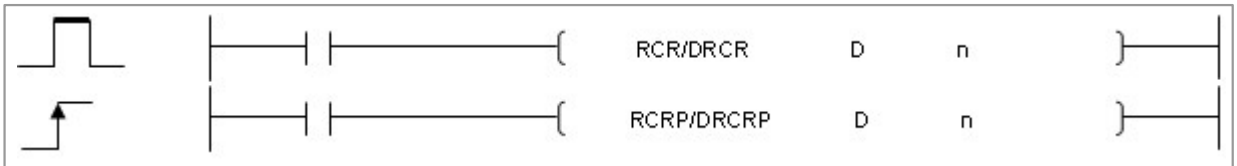
A program to rotate right the data in the device assigned to Y0020 a bit by a bit, setting carry flag(F112) when input signal X0000 is turned on



The data in the device assigned to Y0020 is rotated right.

5.8.7.2 Rotate Right With Carry : RCR, RCRP, DRCR, DRCRP

Instruction		Usable Device												No.of Steps	Flag		
		M	X	Y	K	L	F	T	C	Z	D	@D	Integer		Error	Zero	Carry
RCR (P) DRCR (P)	D	o	-	o	o	o	-	o	o	o	o	o	-	3	o		o
	n	o	o	o	o	o	o	o	o	o	o	o	o				



* Available in case a computer link module and data link module are not used.

D	Device where the data rotated right is stored
n	Number of the bits rotated right

Error (F110)	In case that a device is assigned to @D, if overflow is generated, flat is set. the corresponding instruction is not operated.
Carry (F112)	While rotating right, if carry occurs, carry flag is set.

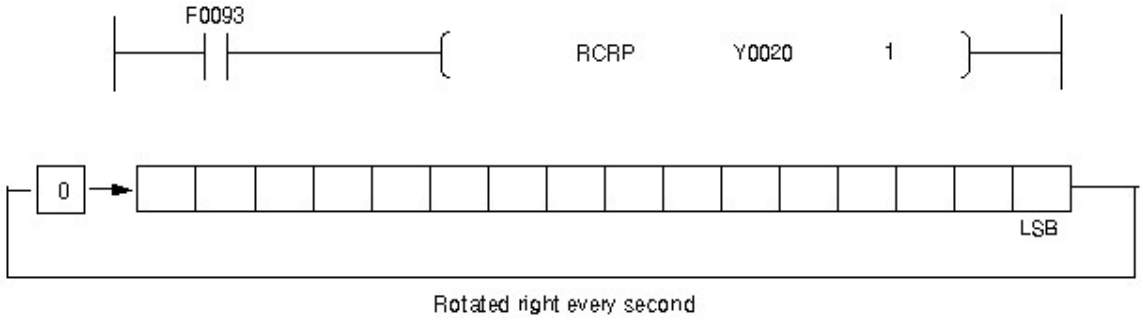
RCR

Functions :

This is used to rotate right 16 bits in a word data as much as n bits. The lowest bit is rotated to carry flag (F 112) and carry flag (F112) is rotated to the uppermost bit. The RCRP instruction and the DRCRP instruction are operated for a scan in case the operation condition of them is turned on from off. The DRCR instruction and the DRCRP instruction are operated for 32BIT data.

Example of program :

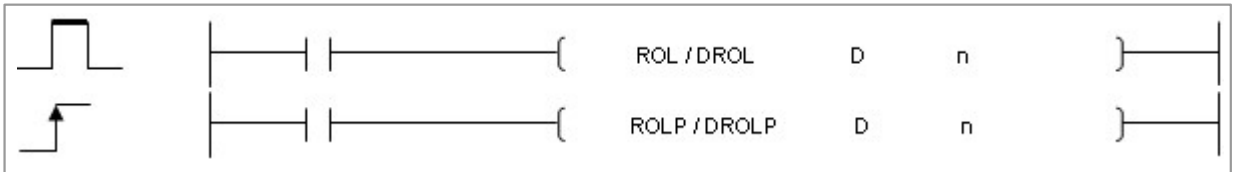
A program to rotate right the data in the device assigned to Y0020 including carry flag (F112) according to the status of Input Signal F0093 of which clock cycle is a second.



The data in the device assigned to Y0020 including carry flag(F112) is rotated right.

5.8.7.3 Rotate Left : ROL, ROLP, DROL, DROLP

Instruction		Usable Device												No.of Steps	Flag		
		M	X	Y	K	L	F	T	C	Z	D	@D	Integer		Error	Zero	Carry
ROL (P) DROL (P)	D	o	-	o	o	o	-	o	o	o	o	o	-	3	o	-	o
	n	o	o	o	o	o	o	o	o	o	o	o	o				



* Available in case a computer link module and data link module are not used.

D	Device where the data rotated right is stored
n	Number of the bits rotated right

Error (F110)	In case that a device is assigned to @D, if overflow is generated, flat is set. the corresponding instruction is not operated.
Carry (F112)	While rotating right, if carry occurs, carry flag is set.

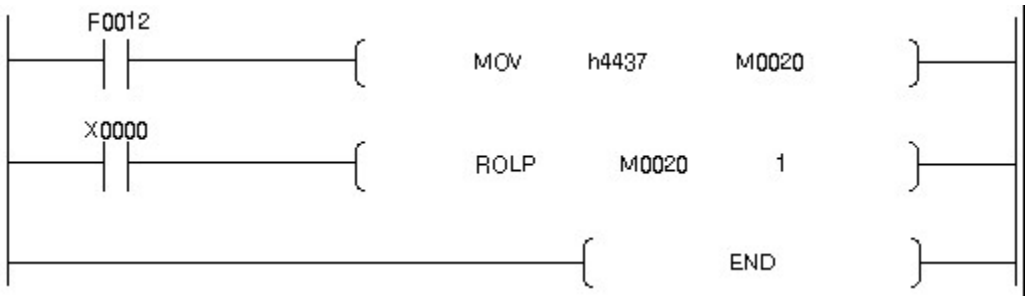
ROL

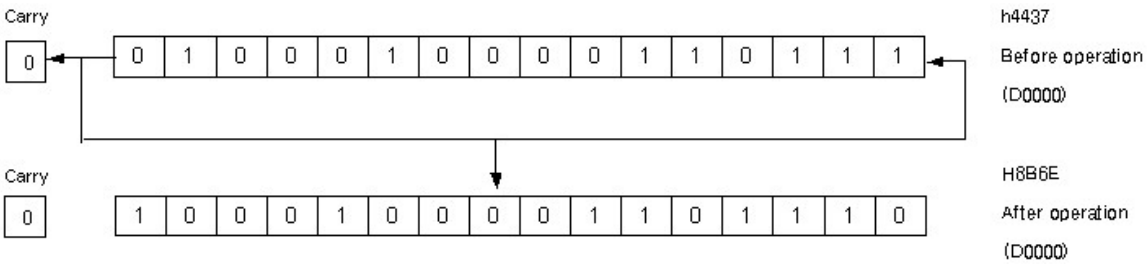
Functions :

This is used to rotate left 16 bits in a word data as much as n bits. The lowest bit is rotated to carry flag (F 112) and the uppermost bit. (Rotated within a word). The ROLP instruction and the DROLP instruction are operated for a scan in case the operation condition of them is turned on from off. The DROL instruction and the DROLP instruction are operated for 32BIT data.

Example of program :

A program to rotate left the data in the device assigned to M0020 a bit by a bit, setting carry flag(F112) when input signal X0000 is turned on

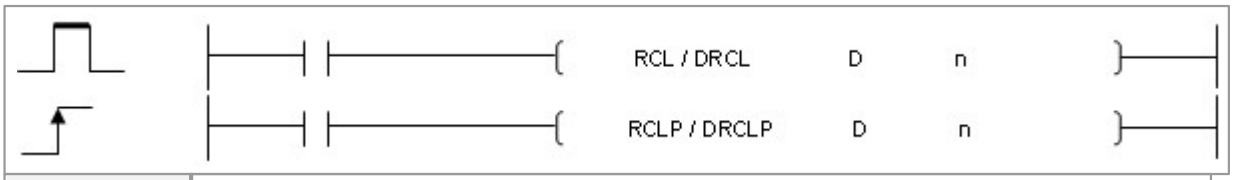




The data in the device assigned to Y0020 is rotated left.

5.8.7.4 Rotate Left With Carry : RCL, RCLP, DRCL, DRCLP

Instruction		Usable Device												No.of Steps	Flag		
		M	X	Y	K	L	F	T	C	Z	D	@D	Integer		Error	Zero	Carry
RCL (P) DRCL (P)	D	o	-	o	o	o	-	o	o	o	o	o	-	3	o	-	o
	n	o	o	o	o	o	o	o	o	o	o	o	o				



D	Device where the data rotated right is stored
n	Number of the bits rotated right

Error (F110)	In case that a device is assigned to @D, if overflow is generated, flat is set. the corresponding instruction is not operated.
Carry (F112)	While rotating right, if carry occurs, carry flag is set.

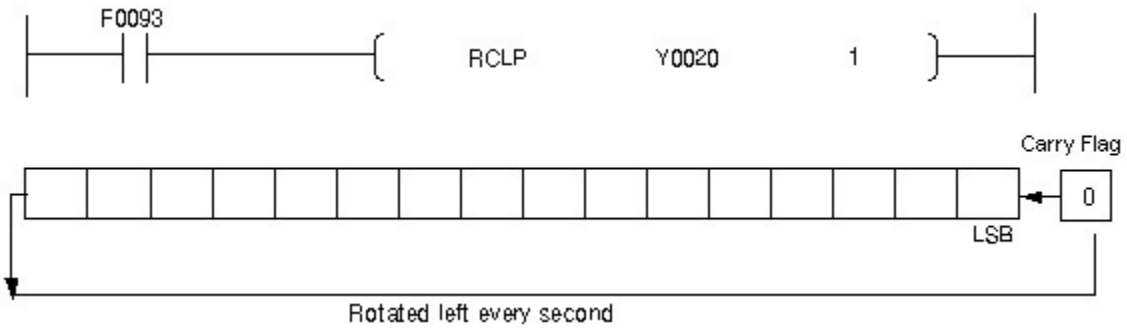
RCL

Functions :

This is used to rotate left 16 bits in a word data as much as n bits. The lowest bit is rotated to carry flag (F 112) and carry flag (F112) is rotated to the uppermost bit. The RCLP instruction and the DRCLP instruction are operated for one scan in case the operation condition of them is turned on from off. The DRCL instruction and the DRCLP instruction are operated for 32BIT data.

Example of program :

A program to rotate left the data in the device assigned to Y0020 including carry flag (F112) according to the state of input signal F0093 of which clock cycle is a second.



The data in the device assigned to Y0020 including carry flag(F112) is rotated left.

5.8.8 Shift Instruction

Contents :

5.8.8.1 Shift Right or Shift Left 16Bit Data as n Bits : SFR, SFRP, SFL, SFLP

Instruction		Usable Device												No.of Steps	Flag		
		M	X	Y	K	L	F	T	C	Z	D	@D	Integer		Error	Zero	Carry
SFR (P) SFL (P)	D	o	-	o	o	o	-	o	o	o	o	o	-	3	o	-	o
	n	o	o	o	o	o	o	o	o	o	o	o	o				

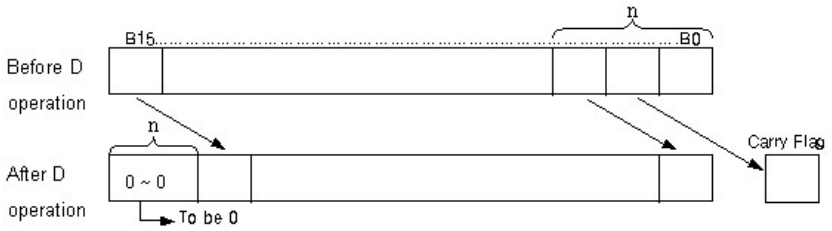
D	First device number of devices where shift data is being stored
n	Number of Shifts

Error (F110)	In case that a device is assigned to @D, if overflow is generated, it is set.
Carry (F112)	If the result of an operation is overflow, it is set.

SFR

Functions :

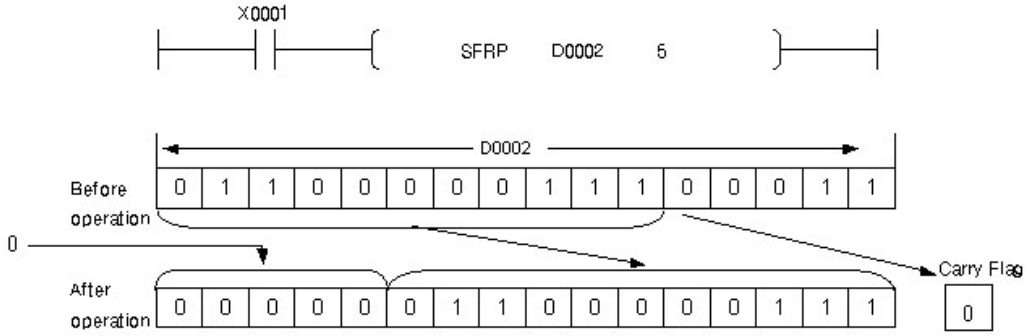
This is used to shift right 16bit data in the device assigned to D as much as n bits



The data from the uppermost bit to nth bit are 0. When the data in the device assigned to T or C is shifted, the current values are shifted. (Set values are not shifted.)

Example of program :

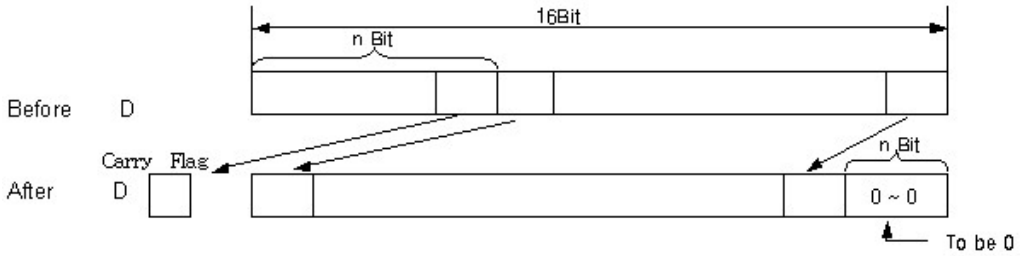
A program to shift right the data in the device assigned to D0002 as much as 5 bits when X0001' s on



SFL

Functions :

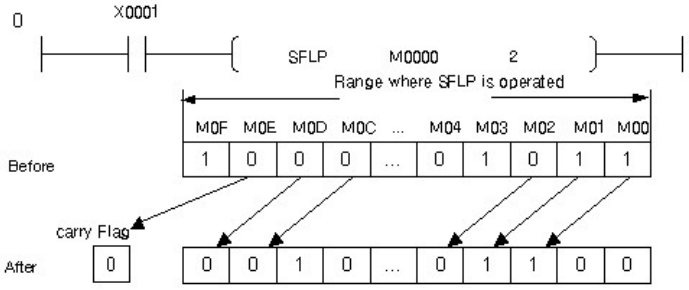
This is used to shift left 16bit data in the device assigned to D as much as n bits.



The data from the lowest bit to nth bit are 0. In case of the data in the device assigned to T or C, the current value is shifted.(Not set values)

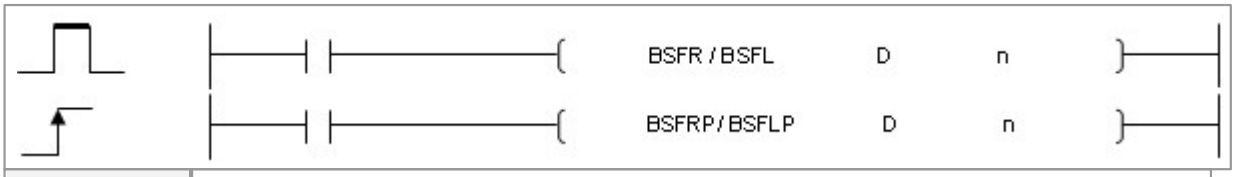
Example of program :

A program to shift left the data in the device assigned to M0000 as much as 2 bits when X0001' s on



5.8.8.2 Shift Right or Shift Left 16 Bit Data as 1 Bit : BSFR, BSFRP, BSFL, BSFLP

Instruction		Usable Device												No.of Steps	Flag		
		M	X	Y	K	L	F	T	C	Z	D	@D	Integer		Error	Zero	Carry
BSFR (P) BSFL (P)	D	o	-	o	o	o	-	-	-	-	-	-	-	3	o	-	o
	n	o	o	o	o	o	o	o	o	o	o	o	o				



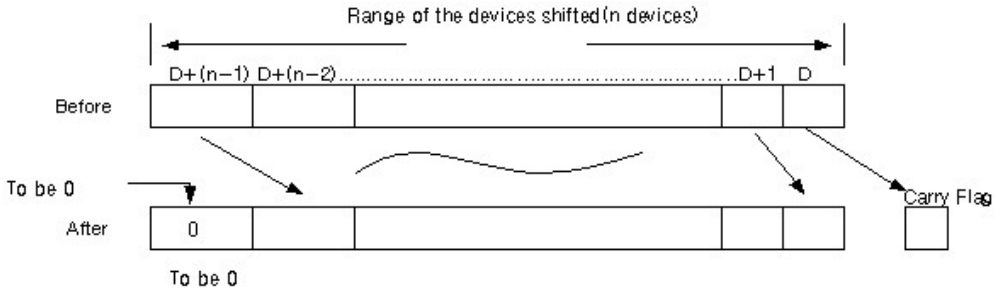
D	First device number of devices to shift
n	Number of devices where shift will be conducted

Error (F110)	In case that a device is assigned to @D, if overflow is generated, it is set.
Carry (F112)	If the result of an operation is overflow, it is set.

BSFR

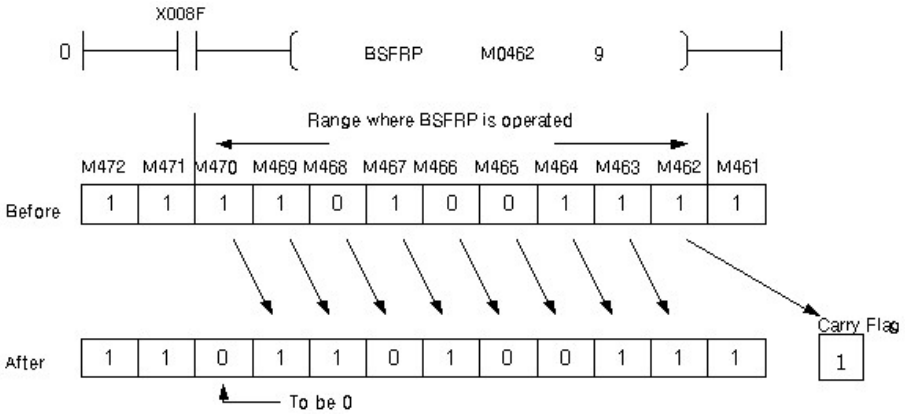
Functions :

This is used to shift right n a-bit-devices as much as a-bit-device from the device assigned to D.



Example of program :

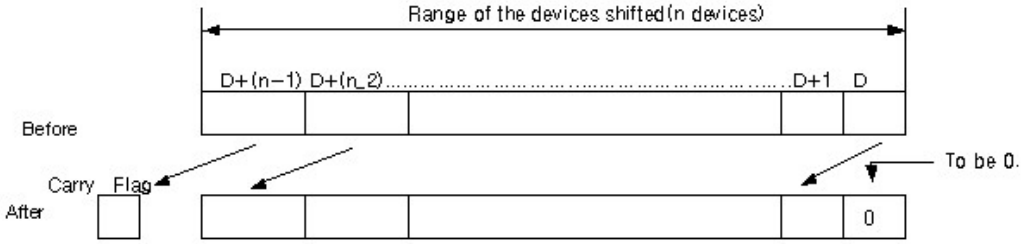
A program to shift right the data in the devices from the one assigned to M0462 to the one assigned to M0470 when X008F is turned on



BSFL

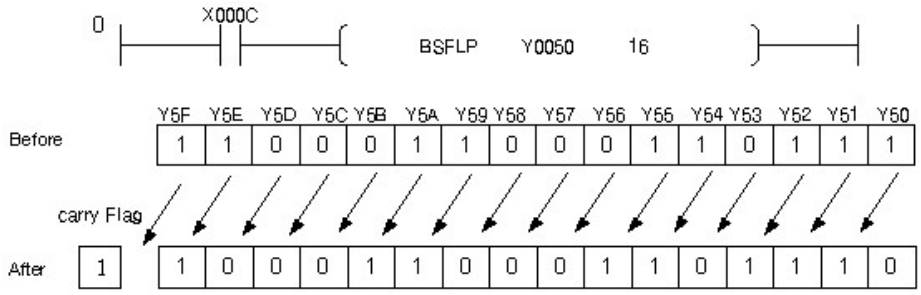
Functions :

This is used to shift left n a-bit-devices as much as a-bit-device from the device assigned to D.



Example of program :

A program to shift left the data in the devices from the one assigned to Y0050 to the one assigned to Y005F when X000C is turned on.



5.8.8.3 Shift Right or Shift Left n Word Data as 1 Word : DSFR, DSFRP, DSFL, DSFLP

Instruction		Usable Device												No.of Steps	Flag		
		M	X	Y	K	L	F	T	C	Z	D	@D	Integer		Error	Zero	Carry
DSFR (P) DSFL (P)	D	o	-	o	o	o	-	o	o	o	o	o	-	3	o	-	o
	n	o	o	o	o	o	o	o	o	o	o	o	o				

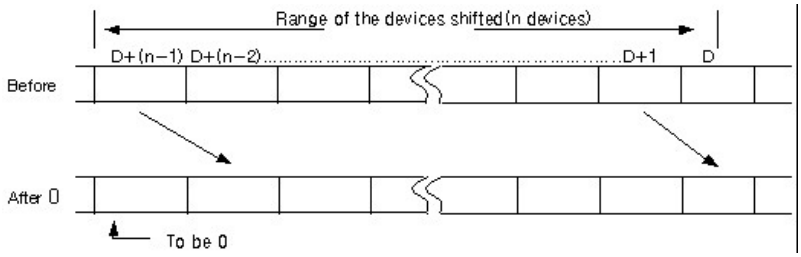
D	First device number of devices to shift
n	Number of devices where shift will be conducted

Error (F110)	In case that a device is assigned to @D, if overflow is generated, it is set.
Carry (F112)	If the result of an operation is overflow, it is set.

DSFR

Functions :

This is used to shift right n devices as much as a device from the device assigned to D.

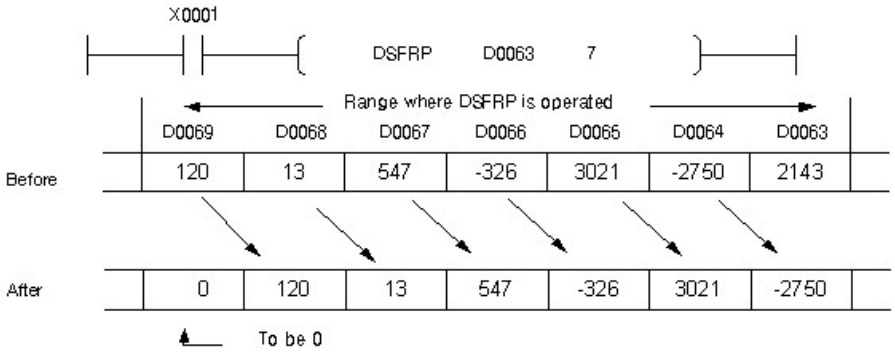


The uppermost device is 0. In case of the data in the device assigned to T or C, the current value is shifted.

(Not set values)

Example of program :

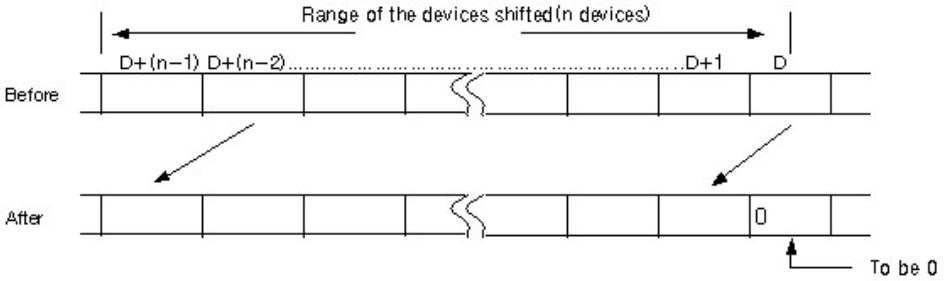
A program to shift right the data in the devices from the one assigned to D0063 to the one assigned to D0069 when X0001 is turned on



DSFL

Functions :

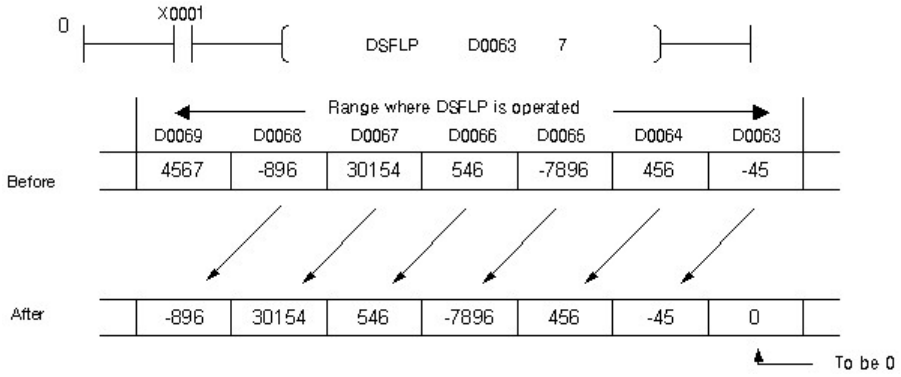
This is used to shift left n devices as much as a device from the device assigned to D.



The lowest device is 0. In case of the data in the device assigned to T or C, the current value is shifted.(Not set values)

Example of program :

A program to shift left the data in the devices from the one assigned to D0063 to the one assigned to D0069 when X0001 is turned on

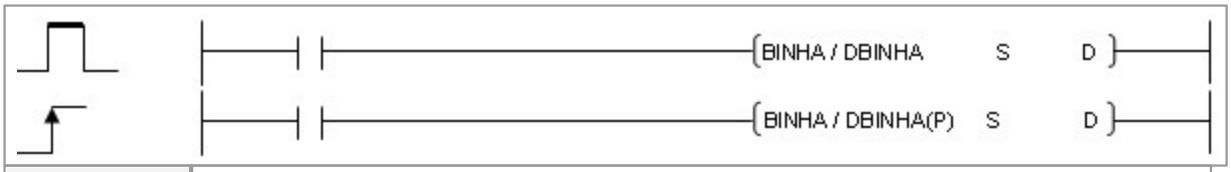


5.8.9 Character String Processing Instruction

Contents :

5.8.9.1 Convert BIN 16 Bit or 32 Bit Data to Decimal ASCII : BINDA(P), DBINDA(P)

Instruction		Usable Device												No.of Steps	Flag		
		M	X	Y	K	L	F	T	C	Z	D	@D	Integer		Error	Zero	Carry
BINDA (P) DBINDA (P)	S	o	o	o	o	o	o	o	o	o	o	o	o	3	o	-	-
	D	o	-	o	o	o	-	o	o	o	o	o	-				



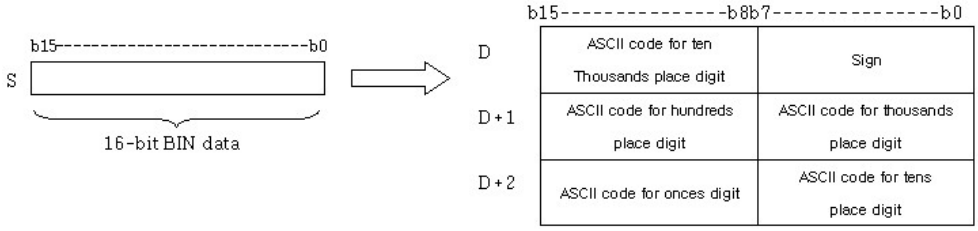
S	BIN data to be converted to ASCII
D	First device number of devices where conversion results will be stored

Error (F110)	In case that a device is assigned to @D, if overflow is generated, it is set.

BINDA

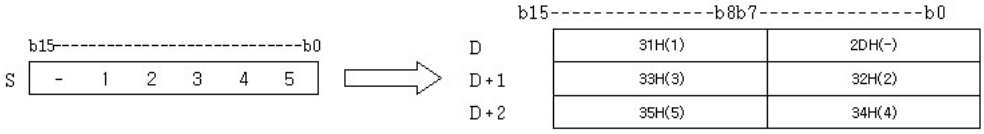
Functions :

This is used to hexadecimalize the numbers of BIN-16 bit data in the address assigned to S to convert them to each ASCII code, storing the result from the address assigned to D.

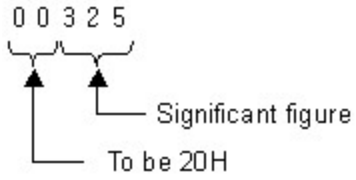


Example of program :

if a value in S is -12345, the result of the operation is stored in D as follows.



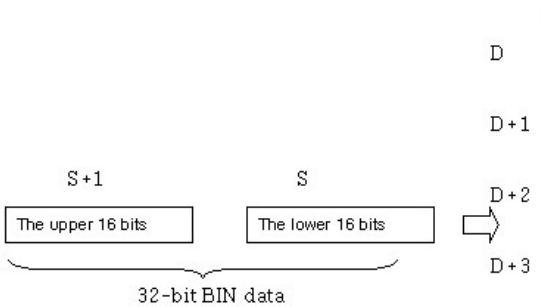
The range of BIN data in S is from -32768 to 32767. The result is stored in D as follows. If BIN data is a positive number, sign 20H is stored. Otherwise, 2DH is stored. 0 in the left of the significant digits are stored as 20H.



DBINDA

Functions :

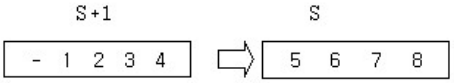
This is used to decimals the numbers of BIN-32 bit data in the address assigned to S to convert them to each ASCII code, storing the result from the address assigned to D.



b15----------b8b7----------b0

D	ASCII code for Billions place digit	Sign
D+1	ASCII code for ten Millions place digit	ASCII code for hundred Millions place digit
D+2	ASCII code for hundreds thousands place digit	ASCII code for Millions place digit
D+3	ASCII code for Thousands place digit	ASCII code for ten Thousands place digit
D+4	ASCII code for tens place digit	ASCII code for Hundreds place digit
D+5	"20H"	ASCII code for ones digit

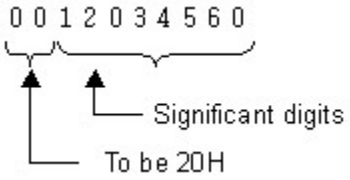
For example, if a value in S is ?12345678, the result of the operation is stored in D as follows.



b15----------b8b7----------b0

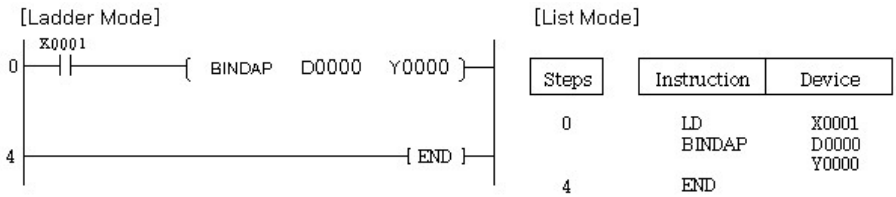
D	20H(space)	2DH(-)
D+1	31H(1)	20H(space)
D+2	33H(3)	32H(2)
D+3	35H(5)	34H(4)
D+4	37H(7)	36H(6)
D+5	20H	38H(8)

The range of BIN data in S is form -2147483648 to 2147483647. The result is stored in D as follows. If BIN data is a positive number, sign 20H is stored.
Otherwise, 2DH is stored. 0 in the left of the significant digits are stored as 20H.



Example of program :

A program to decimalize BIN 16bit Data in the device assigned to D0000 to convert them to each ASCII code, outputting the result to Y0000 when X0001 is turned on.

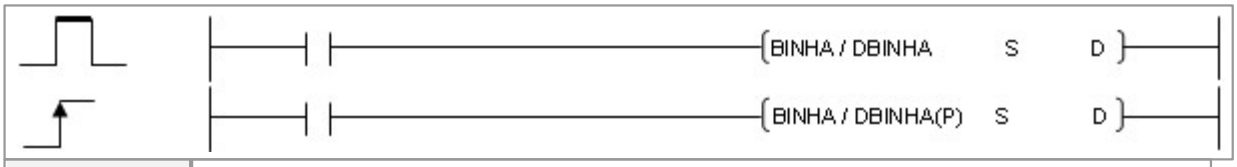


[List Mode]

Steps	Instruction	Device
0	LD	X0001
	BINDAP	D0000
		Y0000
4	END	

5.8.9.2 Convert BIN 16 Bit or 32 Bit Data to Hexadecimal ASCII : BINHA(P)), DBINHA(P)

Instruction		Usable Device												No.of Steps	Flag		
		M	X	Y	K	L	F	T	C	Z	D	@D	Integer		Error	Zero	Carry
BINHA (P) DBINHA (P)	S	o	o	o	o	o	o	o	o	o	o	o	o	3	o	-	-
	D	o	-	o	o	o	-	o	o	o	o	o	-				

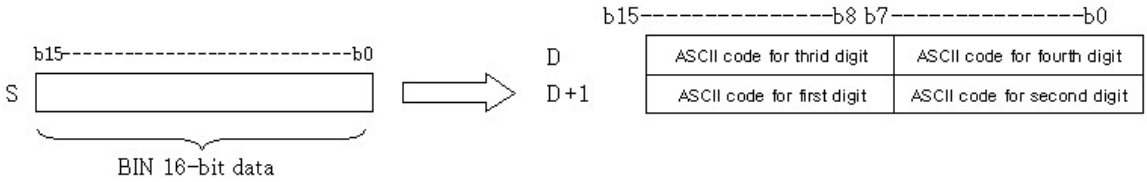


S	BIN data to be converted to ASCII
D	First device number of devices where conversion results will be stored

BINHA

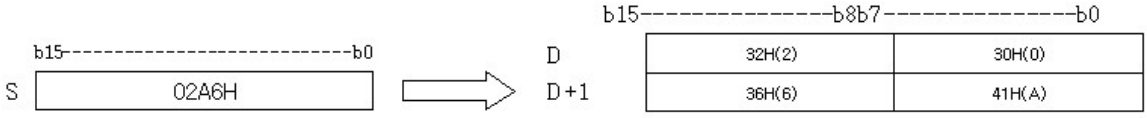
Functions :

This is used to hexadecimalize the numbers of BIN-16 bit data in the address assigned to S to convert them to each ASCII code, storing the result from the address assigned to D.



Example of program :

if a value in S is 02A6H, the result of the operation is stored in D as follows.

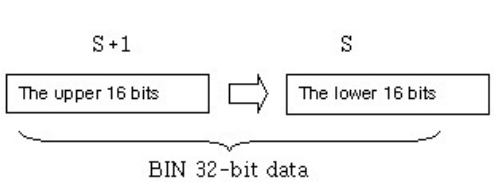


The range of BIN data in S is from 0 to FFFFH. The result stored in D is in a four-digit hexadecimal value. 0 in the left of the significant digits are stored as 0.

DBINHA

Functions :

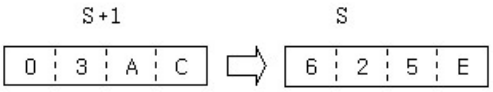
This is used to decimalize the numbers of BIN-32 bit data in the address assigned to S to convert them to each ASCII code, storing the result from the address assigned to D.



b15----------b8b7----------b0

D	ASCII code for seventh digit	ASCII code eighth digit
D+1	ASCII code for fifth digit	ASCII code for sixth digit
D+2	ASCII code for third digit	ASCII code for fourth digit
D+3	ASCII code for first digit	ASCII code for second digit

For example, if a value in S is 03AC625EH, the result of the operation is stored in D as follows.



b15----------b8b7----------b0

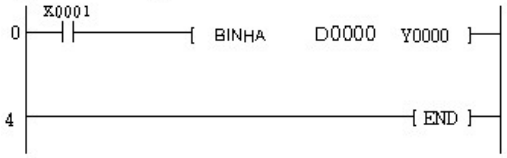
D	33H(3)	30H(0)
D+1	43H(C)	41H(A)
D+2	32H(2)	36H(6)
D+3	45H(E)	35H(5)

The range of BIN data in S is from 0 to FFFFFFFFH. The result stored in D is in a four-digit hexadecimal value. 0 in the left of the significant digits are stored as 0.

Example of program :

A program to hexadecimals BIN 16bit Data in the device assigned to D0000 to convert them to each ASCII code, outputting the result to Y0000 when X0001 is turned on

[Ladder Mode]



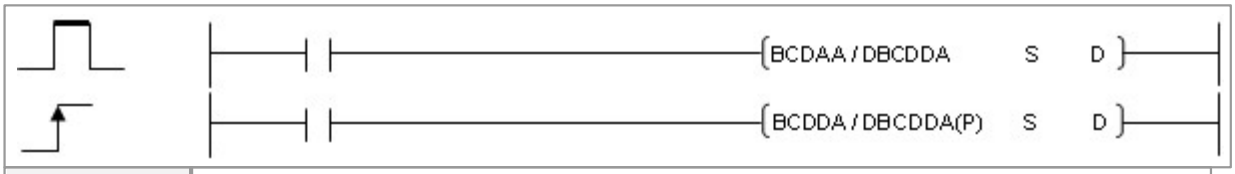
[List Mode]

Steps	Instruction	Device
0	LD	X0001
1	BINHAP	D0000
		Y0000
4	END	

5.8.9.3 Convert BCD 4 Digit or 8 Digit to Decimal ASCII Data : BCDDA(P), DBCDDA(P)

Instruction		Usable Device												No.of Steps	Flag		
		M	X	Y	K	L	F	T	C	Z	D	@D	Integer		Error	Zero	Carry
BCDDA (P)	S	o	o	o	o	o	o	o	o	o	o	o	o	3	o	-	-

DBCDDA (P)	D	o	-	o	o	o	-	o	o	o	o	o	-				



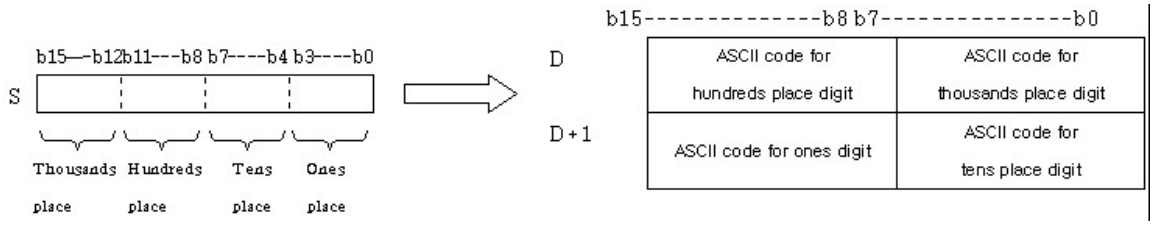
S	BCD data which will be converted to ASCII
D	First device number of devices where conversion results will be stored

Error (F110)	In case that a device is assigned to @D, if overflow is generated, it is set.

BCDDA

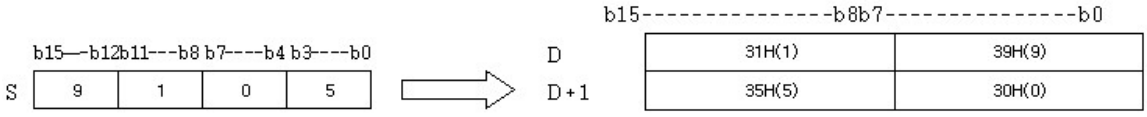
Functions :

This is used to hexadecimalize the numbers of BCD four-figure in the address assigned to S to convert them to each ASCII code, storing the result from the address assigned to D.

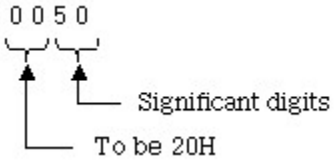


Example of program :

if a value in S is 9105, the result of the operation is stored in D as follows.



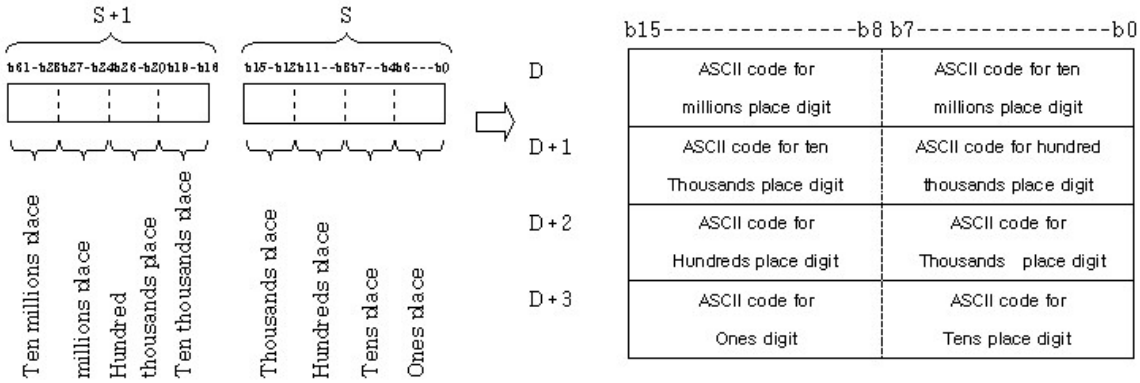
The range of BCD data in S is from 0 to 9999. The result of the operation is stored in D, 0 in the left of the significant digits are stored as 20H.



DBCDDA

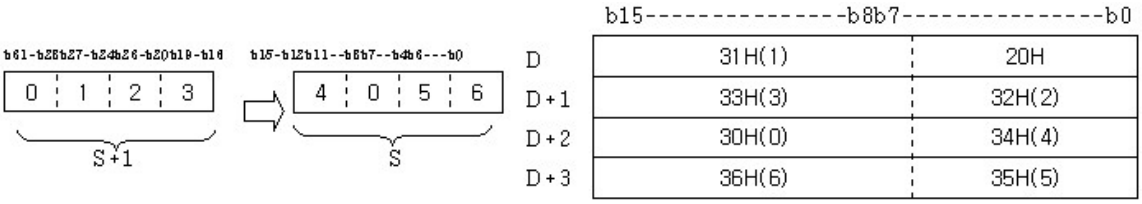
Functions :

This is used to hexadecimals the numbers of BCD eight digits in the address assigned to S to convert them to each ASCII code, storing the result from the address assigned to D.

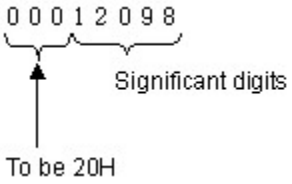


Example of program :

if a value in S is 01234056, the result of the operation is stored in D as follows.



The range of BCD data in S is from 0 to 99999999. The result of the operation is stored in D, 0 in the left of the significant digits are stored as 20H.

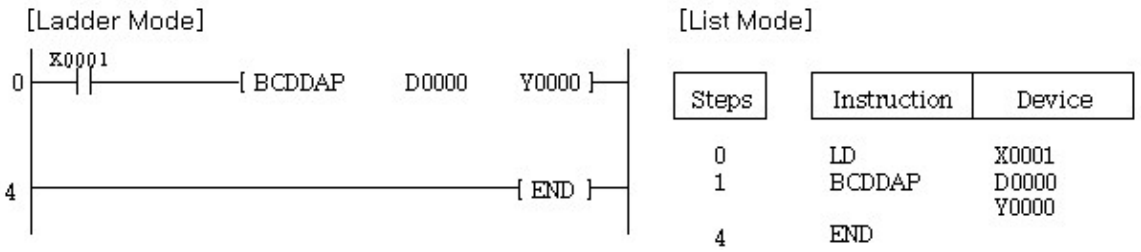


Operation Error :

An error occurs in the following cases. Error flag is turned on and Error Code is stored in SD0. When BCDDA instruction is operated, the case data is less than 0 or greater than 9999. When DBCDDA

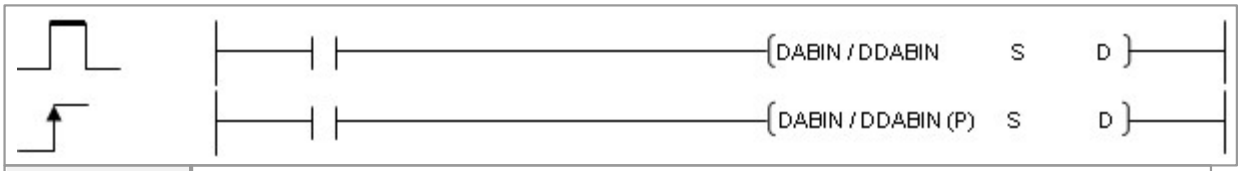
instruction is operated, the case data is less than 0 or greater than 9999.

Example of program : A program to decimalize BCD four digits in the device assigned to D0000 to convert them to each ASCII code, outputting the result to Y0000 when X0001 is turned on



5.8.9.4 Convert Decimal ASCII to BIN 16 Bit or 32 Bit Data : DABIN(P), DDABIN(P)

Instruction		Usable Device												No.of Steps	Flag		
		M	X	Y	K	L	F	T	C	Z	D	@D	Integer		Error	Zero	Carry
DABIN (P) DDABIN (P)	S	o	o	o	o	o	o	o	o	o	o	o	o	3	o	-	-
	D	o	-	o	o	o	-	o	o	o	o	o	-				



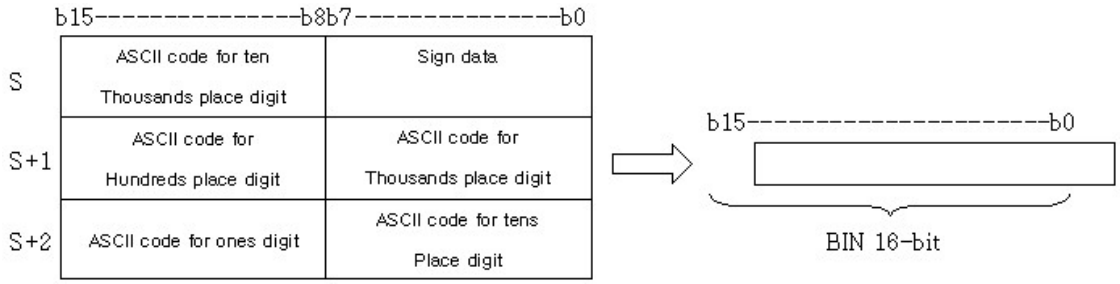
S	First device number of devices where ASCII data that will be converted to BIN value is being stored
D	First device number of devices where conversion results will be stored

Error (F110)	In case that a device is assigned to @D, if overflow is generated, it is set.

DABIN

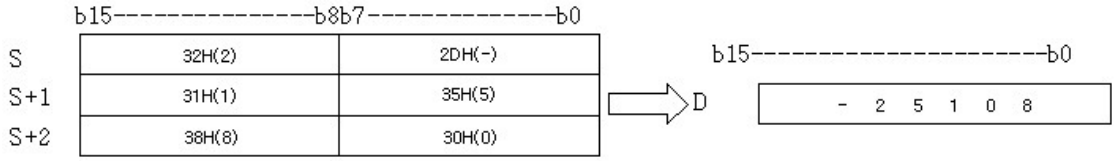
Functions :

This is used to store the decimal ASCII data, which is in the address assigned to S, in the address assigned to D in BIN 16-Bit data.



Example of program :

if the ASSCII code in S is ?25018H, the result of the operation is stored in D as follows.

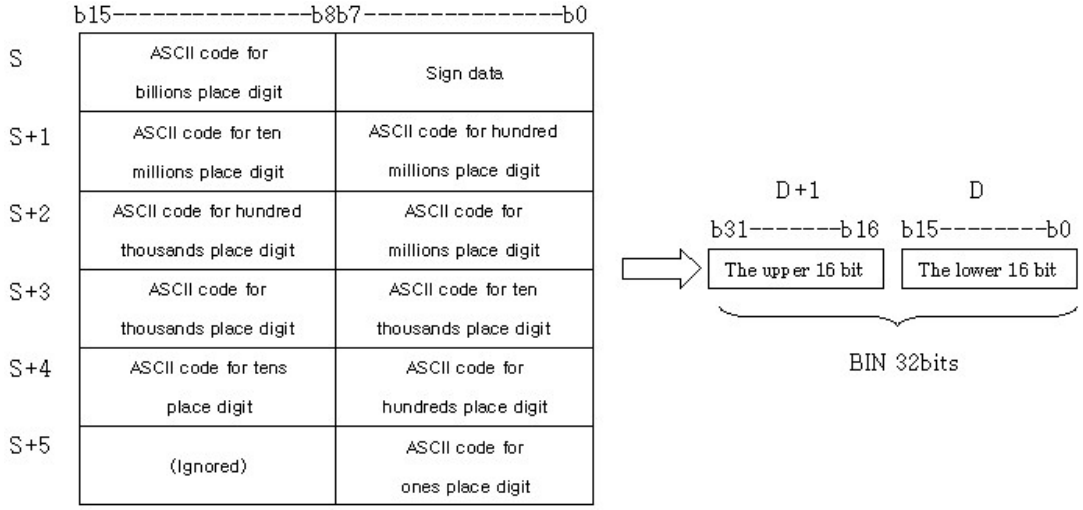


The range of the ASCII data in the addresses assigned to S and S+2 is from -32768 to 32767. Sign “20H” is stored when it is a positive number and “2DH” is stored when is a negative number. The range of ASCII codes is from “30H” to “39H”. If the address of ASCII code is 20H or 00H, it is operated as 30H.

DDABIN

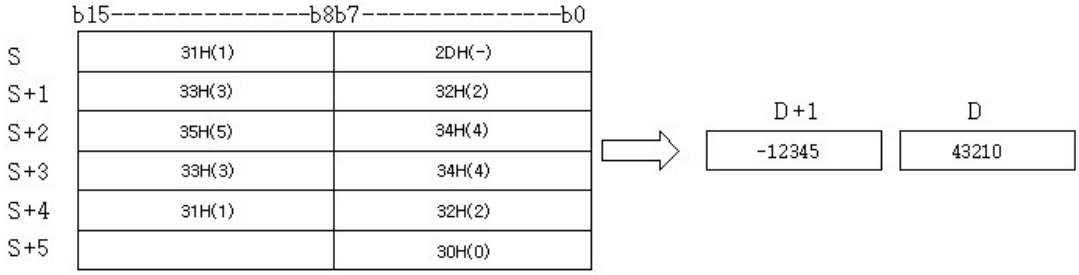
Functions :

This is used to store the decimal ASCII data, which is in the address assigned to S, in the address assigned to D in BIN 32-Bit data.



Example of program :

if the ASSCII code in S is -123454321, the result of the operation is stored in D+1 and D as follows.



The range of the ASCII data in the addresses assigned to S and S+5 is from -2147483648 to 2147483647. Additionally, the data stored in the upper byte of S+5 is disregarded. If the value of the converted data is a positive number ,"sign" data is 20H. If a negative number, 2DH. The range of ASCII codes is from "30H" to "39H". If the address of ASCII code is 20H or 00H, it is operated as 30H.

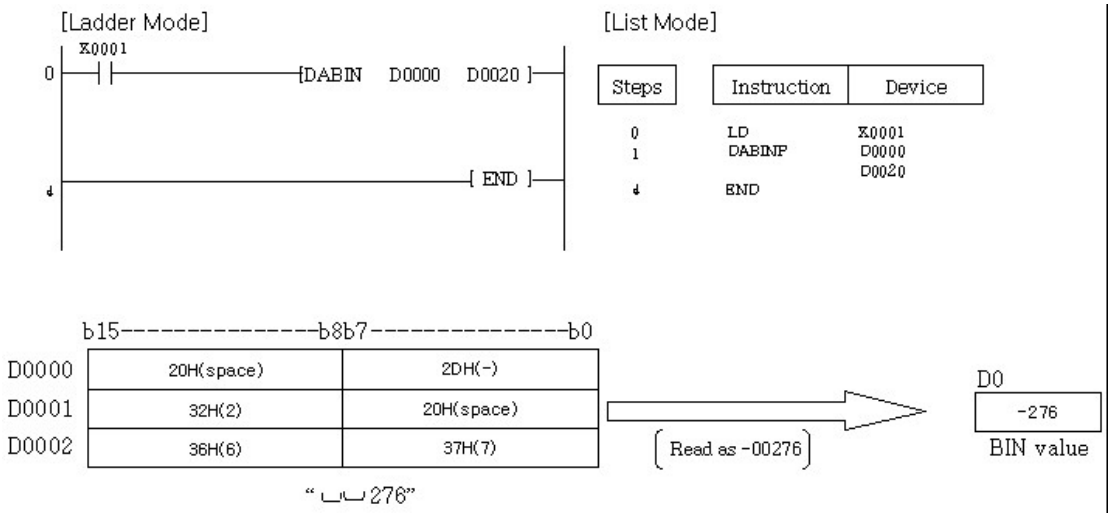
Operation Error :

An error occurs in the following cases. Error flag is turned on and Error Code is stored in SD0.

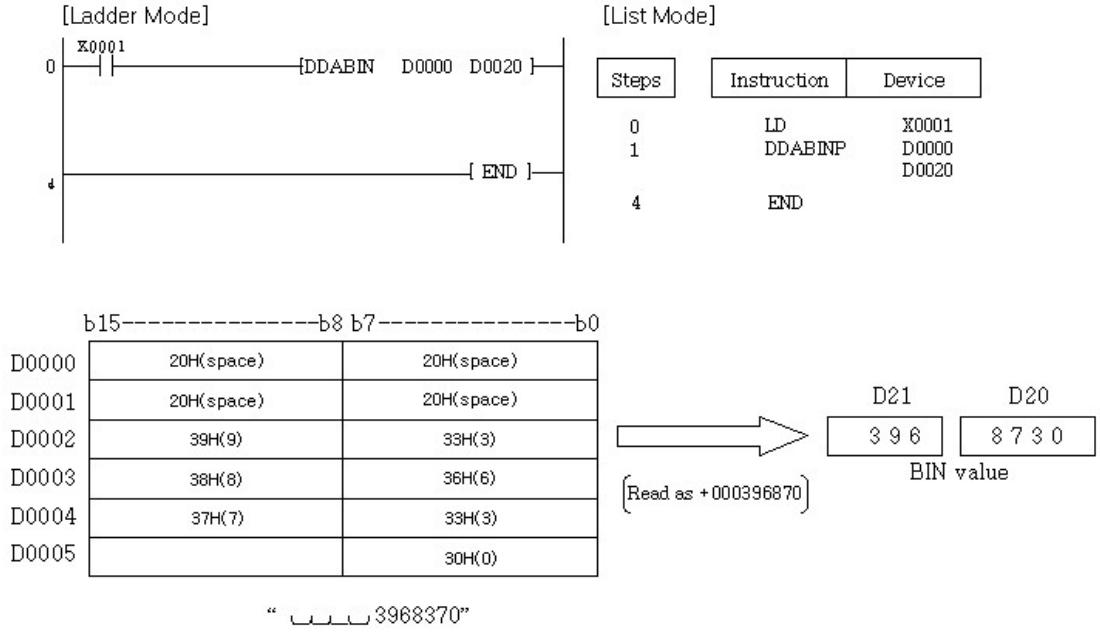
- The case the range of the ASCII codes in the addresses from the one is assigned to S to the one assigned to S+5, are not from 30H to 39H or 20H or 00H.
- The ASCII data in the addresses from the one assigned to S to the one assigned to S+5 are out of range.
- Range of DABIN instruction : -32768 to 32767
  Range of DDABIN instruction : -2147483648 to 2147483647

Example of program :

A program to convert decimal 5 digits-ASCII data and the signs for the addresses from the one assigned to D0000 to the one assigned to D0002 to Bin, storing the result in D0020

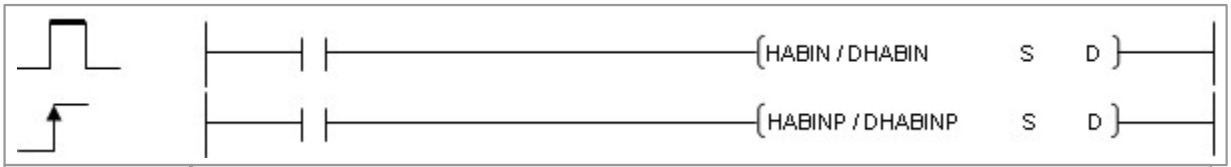


A program to convert decimal 10 digits-ASCII data and the signs for the addresses from the one assigned to D0000 to the one assigned to D0005 to Bin, storing the result in D0020 and D0021



5.8.9.5 Convert hexadecimal ASCII to BIN 16 bit Data : HABIN(P), DHABIN(P)

Instruction		Usable Device												No.of Steps	Flag		
		M	X	Y	K	L	F	T	C	Z	D	@D	Integer		Error	Zero	Carry
HABIN (P) DHABIN (P)	S	o	o	o	o	o	o	o	o	o	o	o	o	3	o	-	-
	D	o	-	o	o	o	-	o	o	o	o	o	-				



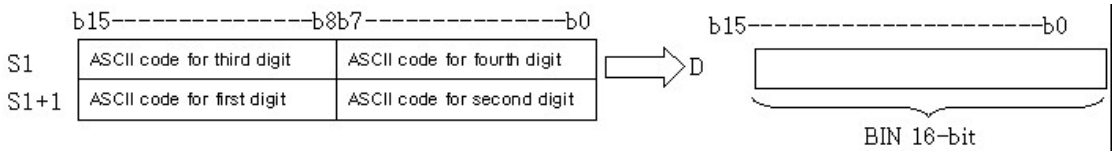
S	First device number of devices where ASCII data that will be converted to BIN value is being stored
D	First device number of devices where conversion results will be stored

Error (F110)	In case that a device is assigned to @D, if overflow is generated, it is set.

HABIN

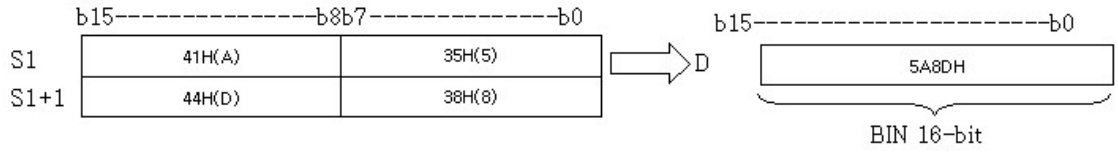
Functions :

This is used to store the hexadecimal ASCII data, which is in the address assigned to S, in the address assigned to D in BIN 16-Bit data.



Example of program :

if the ASCII code in S is 5A8DH, the result of the operation is stored in D as follows.

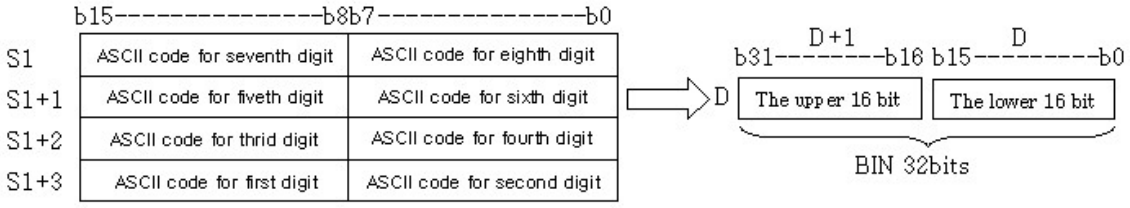


The range of the ASCII data in the addresses assigned to S and S+1 is from 0000H to FFFH. The range of ASCII codes is from " 30H" to " 39H" and from " 41H" to " 46H" .

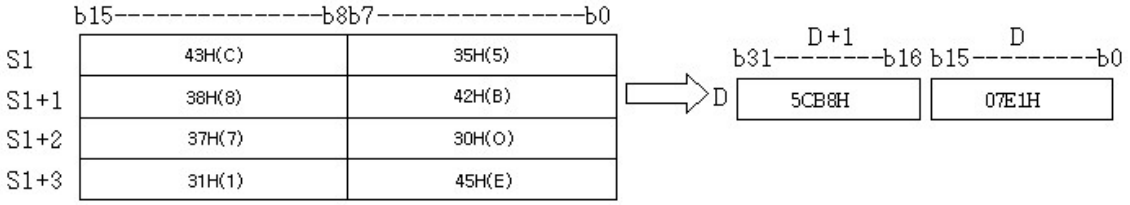
DHABIN

Functions :

This is used to store the hexadecimal ASCII data, which is in the address assigned to S, in the address assigned to D in BIN 32-Bit data.



Example of program : if the ASCII code in S is 5CB807E1H, the result of the operation is stored in D+1 and D as follows.

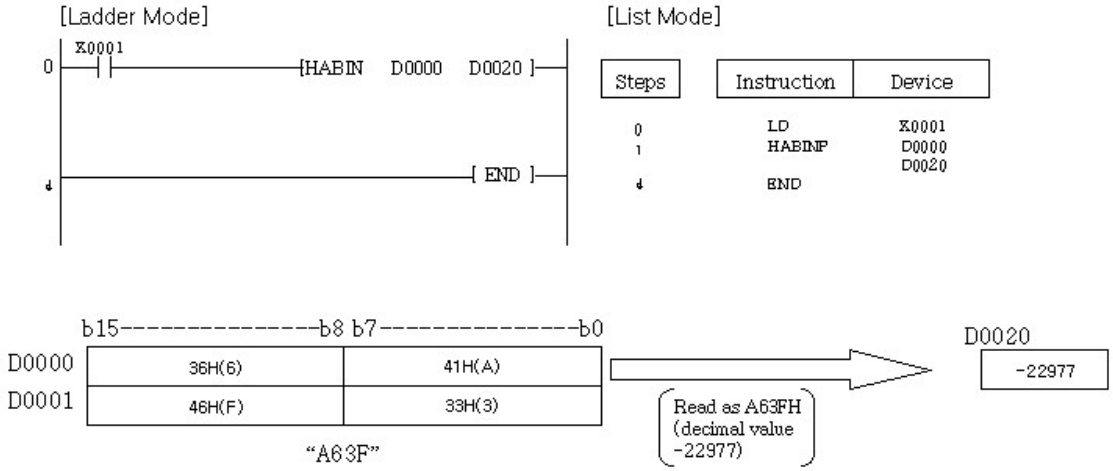


The range of the ASCII data in the addresses assigned to S and S+3 from 00000000H to FFFFFFFFH. The range of ASCII codes is from “30H” to “39H” and from “41H” to “46H”.

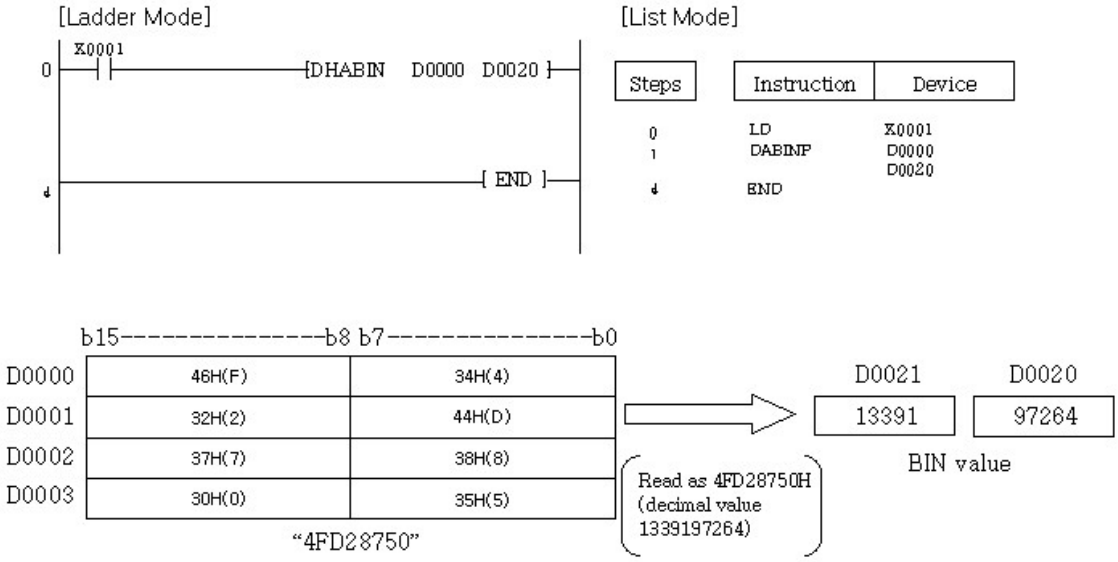
Operation Error :

An error occurs in the following cases. Error flag is turned on and Error Code is stored in SD0. The case the range of the ASCII codes in the addresses from the one assigned to S to the one assigned to S+3 are not from 30H to 39H or from “41H” to “46H”.

Example of program : A program to convert the hexadecimal 4 digits-ASCII data, which is in the addresses from the one assigned to D0000 to the one assigned to D0001, to BIN data, storing the result in D0020.



A program to convert the hexadecimal 8 digits-ASCII data, which is in the addresses from the one assigned to D0000 to the one assigned to D0003, to BIN data, storing the result in D0020 and D0021.



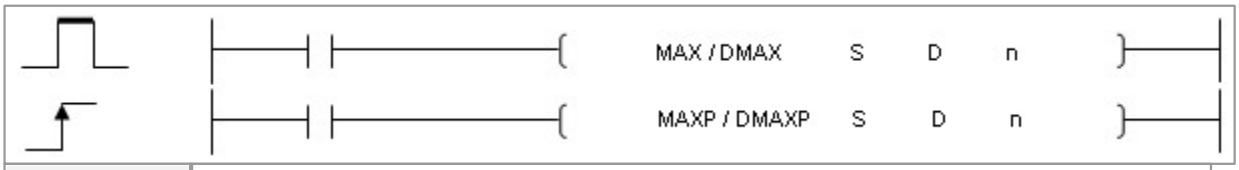
5.8.10 Data Processing Instruction

Contents :

- Data Scaling according to the specified linear function : SCL, SCLP

5.8.10.1 Search 16 Bit and 32 Bit Data for Maximum Value : MAX, MAXP, DMAX, DMAXP

Instruction		Usable Device												No.of Steps	Flag		
		M	X	Y	K	L	F	T	C	Z	D	@D	Integer		Error	Zero	Carry
MAX (P) DMAX (P)	S	o	o	o	o	o	o	o	o	o	o	o	-	4	-	-	-
	D	o	-	o	o	o	-	o	o	o	o	o	-				
	n	o	o	o	o	o	o	o	o	o	o	o	o				

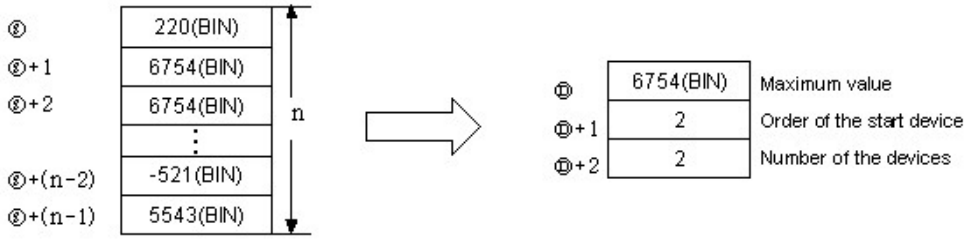


S	First number of devices for Maximum value search
D	First number of devices where results of maximum value search are stored
n	Number of data blocks searched

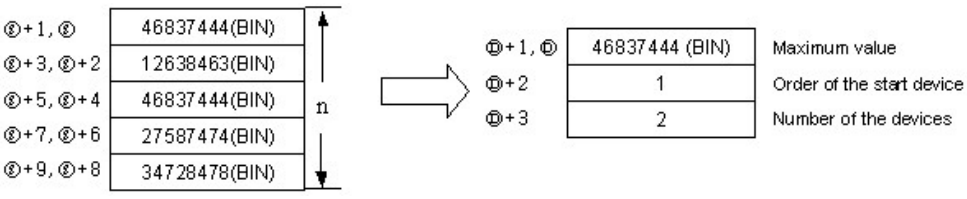
MAX

Functions :

The MAX instruction is used to search the n pieces of 16-bitdata-device assigned to S for maximum value, storing it in the device assigned to D.

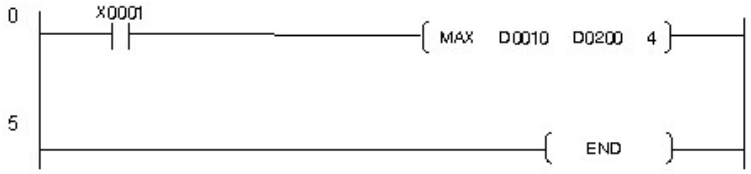


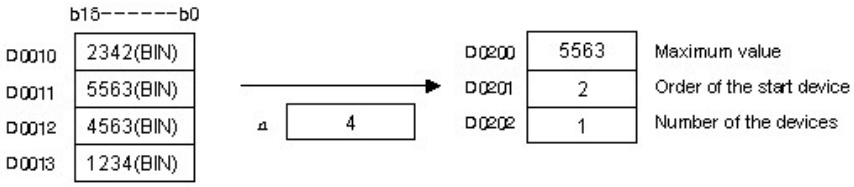
The DMAX instruction is used to search the n pieces of 32bit-data-device assigned to S for maximum value, storing it in the device assigned to D.



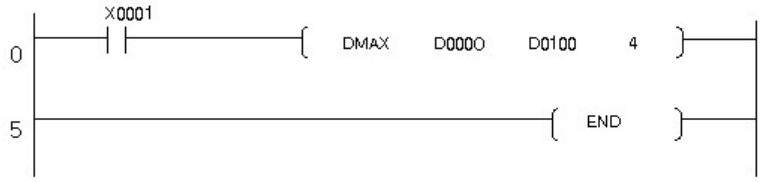
Example of program :

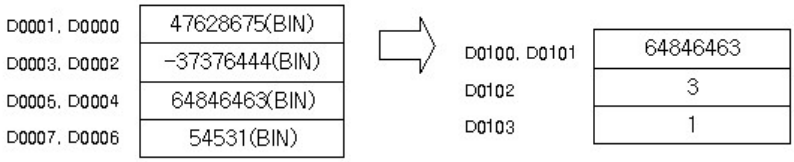
A program to search the data in the n pieces of device from D0010 for maximum value, storing the maximum value, the order of the start device and the number of the devices among the devices assigned to D from D0200.





A program to search the 32bit-data devices from D0000 to D0007 for maximum value, storing the information on it in the devices from D0100 to D0103 when X0001 is turned on

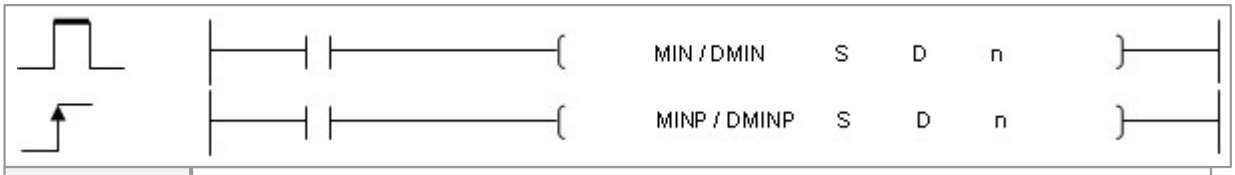




5.8.10.2 Search for 16 Bit and 32 Bit Data for Minimum Value : MIN, MINP, DMIN, DMINP

Instruction		Usable Device												No.of Steps	Flag		
		M	X	Y	K	L	F	T	C	Z	D	@D	Integer		Error	Zero	Carry
MIN (P)	S	o	o	o	o	o	o	o	o	o	o	o	-	4	-	-	-

DMIN (P)	D	o	-	o	o	o	-	o	o	o	o	o	-				
	n	o	o	o	o	o	o	o	o	o	o	o	o	o				

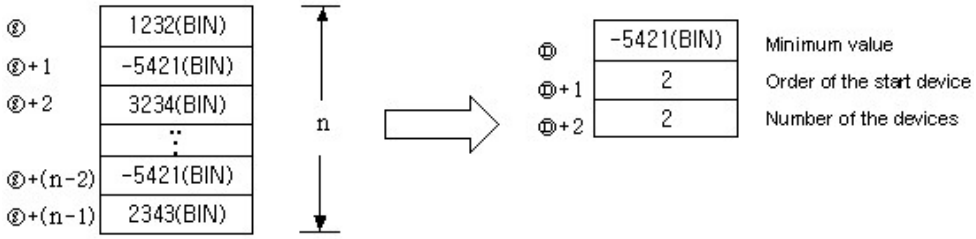


S	First device number of devices subject to search for minimum value
D	First device number of devices that will store the results of the minimum value search
n	Number of data blocks searched

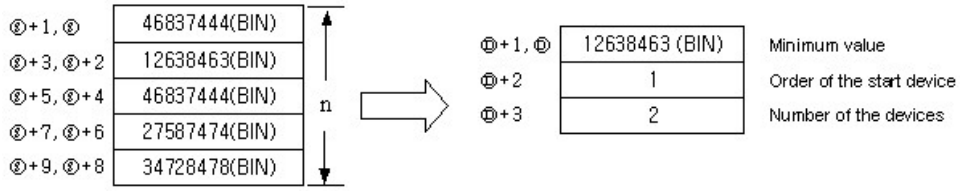
MIN

Functions :

The MIN instruction is used to search the n pieces of 16-bitdata-device assigned to S for minimum value, storing it in the device assigned to D.

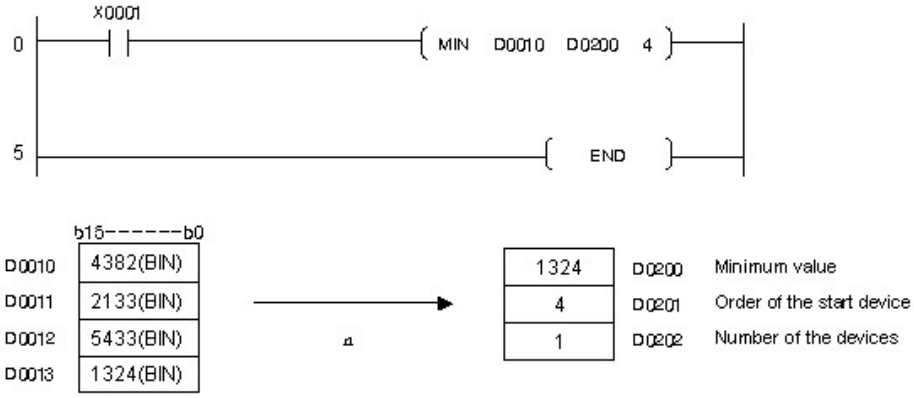


The DMIN instruction is used to search the n pieces of 32bit-data-device assigned to S for maximum value, storing it in the device assigned to D.

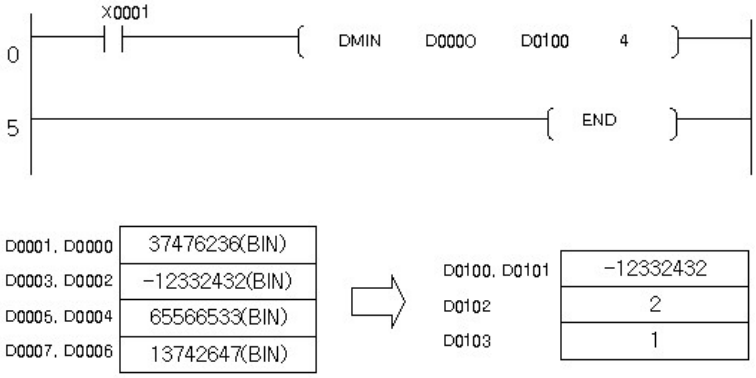


Example of program :

A program to search the data in the n pieces of device from D0010 for minimum value, storing the maximum value, the order of the start device and the number of the devices among the devices assigned to D from D0200.

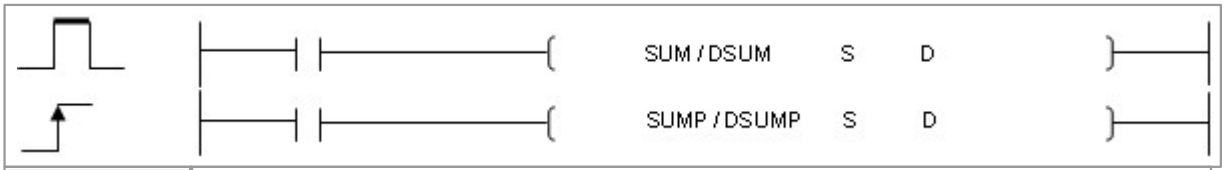


A program to search the 32bit-data devices from D0000 to D0007 for minimum value, storing the information on it in the devices from D0100 to D0103 when X0001 is turned on



5.8.10.3 Check 16 Bit and 32 Bit Data : SUM, SUMP, DSUM, DSUMP

Instruction		Usable Device												No.of Steps	Flag		
		M	X	Y	K	L	F	T	C	Z	D	@D	Integer		Error	Zero	Carry
SUM (P) DSUM (P)	S	o	o	o	o	o	o	o	o	o	o	o	o	3	-	-	-
	D	o	-	o	o	o	-	o	o	o	o	o	-				

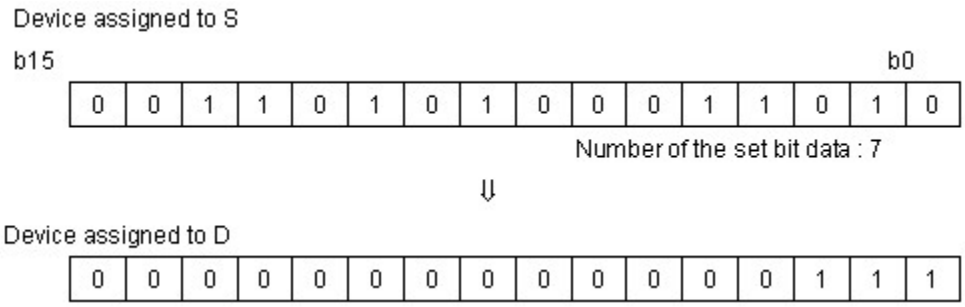


S	Number of the start one among the device where Shift Data are stored
D	Number of the start device where the result is stored

SUM

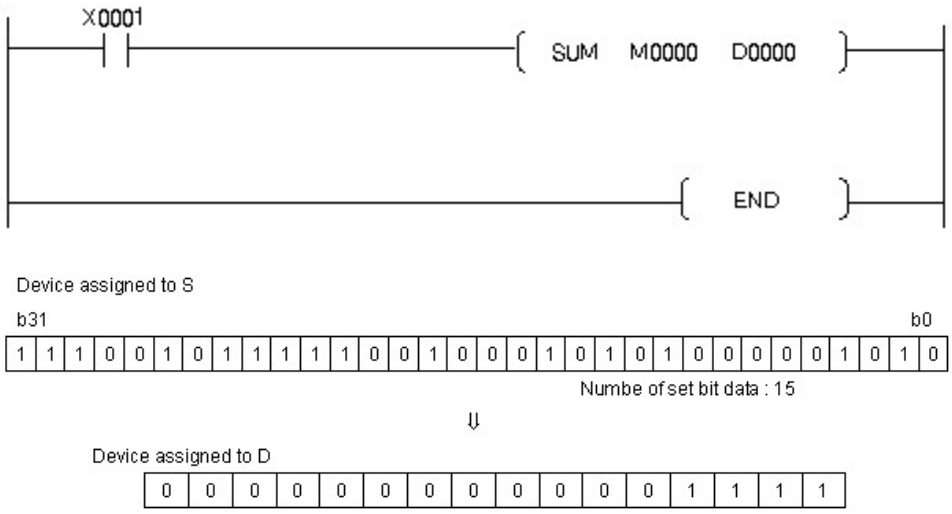
Functions :

This is used to check the number of set bit data among the word data bits in the device assigned to S, storing the number in the word data device assigned to D.



Example of program :

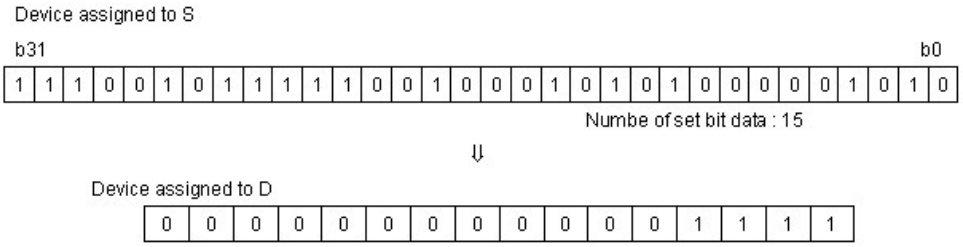
A program to check the number of set bit data among the word data of M0000, storing the number in D0000, if X0001 is turned on



DSUM

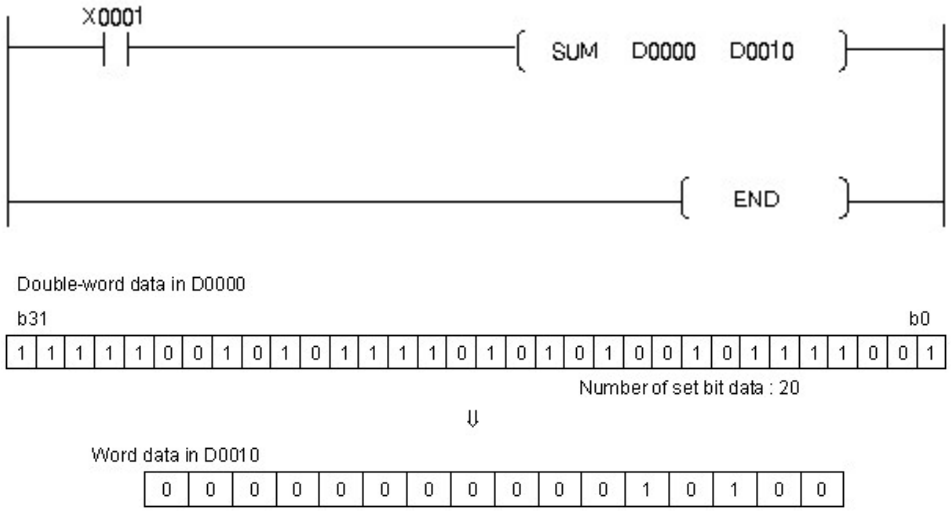
Functions :

This is used to check the number of set bit data among the double-word data in the device assigned to S, storing the number in the word data device assigned to D.



Example of program :

A program to check the number of set bit data among the double-word data in the device assigned to D0000, storing the number in the device assigned to D0010, if X0001 is turned on



5.8.10.4 Decode in 7-Segment : SEG, SEGP

Instruction		Usable Device												No.of Steps	Flag		
		M	X	Y	K	L	F	T	C	Z	D	@D	Integer		Error	Zero	Carry
SEG SEGP	S	o	o	o	o	o	o	o	o	o	o	o	o	3	o	-	-
	D	o	-	o	o	o	-	o	o	o	o	o	-				

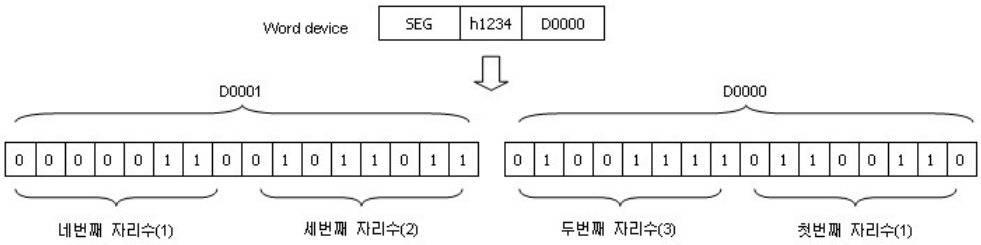
S	Decoded data or first device number of devices where decoded data is being stored
D	First device number of devices where decoding results are stroed

Error (F110)	In case that a device is assigned to @D, if overflow is generated, it is set.

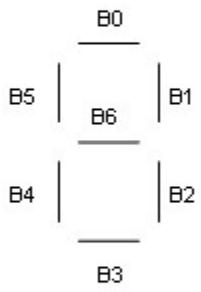
SEG

Functions :

This is used to convert the data in the word device assigned to S to 7segment-decoded data in the order of digit, storing the result in double words device.

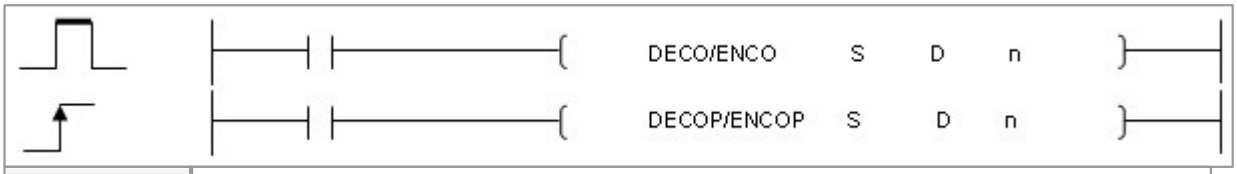


7-segment decode display :

(s)		Configuration of 7 Segments	(D)							
Hexa-decimal	Bit Pattern		B7	B6	B5	B4	B3	B2	B1	B0
0	0000		0	0	1	1	1	1	1	1
1	0001		0	0	0	0	0	1	1	0
2	0010		0	1	0	1	1	0	1	1
3	0011		0	1	0	0	1	1	1	1
4	0100		0	1	1	0	0	1	1	0
5	0101		0	1	1	0	1	1	0	1
6	0110		0	1	1	1	1	1	0	1
7	0111		0	0	1	0	0	1	1	1
8	1000		0	1	1	1	1	1	1	1
9	1001		0	1	1	0	1	1	1	1
A	1010		0	1	1	1	0	1	1	1
B	1011		0	1	1	1	1	1	0	0
C	1100		0	0	1	1	1	0	0	1
D	1101		0	1	0	0	1	1	1	0
E	1110		0	1	1	1	1	0	0	1
F	1111		0	1	1	1	0	0	0	1

5.8.10.5 Decode 8 Bit Data or Encode 256 Bit Data : DECO, DECOP, ENCO, ENCOP

Instruction		Usable Device												No.of Steps	Flag		
		M	X	Y	K	L	F	T	C	Z	D	@D	Integer		Error	Zero	Carry
DECO (P) ENCO (P)	S	o	o	o	o	o	o	o	o	o	o	o	o	4	o	-	-
	D	o	-	o	o	o	-	o	o	o	o	o	-				
	n	o	o	o	o	o	o	o	o	o	o	o	o				



S	The data decoded or the data encoded, or number of the device where the data decoded or the data encoded is stored
D	Number of device where encoding results will be stored
n	Valid bit length (1 - 8)

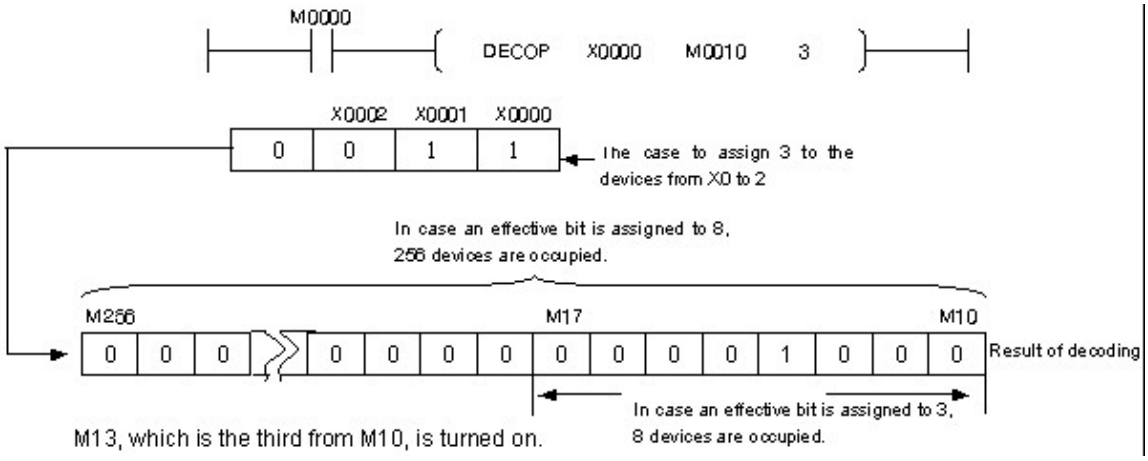
Error (F110)	In case that a device is assigned to @D, if overflow is generated, it is set.

DECO

Functions :

This is used to decode the lower n bit data in the device assigned to S, storing the result in the device assigned to D in 2 n bit. In case n is 0, data is not decoded. The 2n bit data in the device assigned to D is not changed. A bit device is treated as 1 bit and a word device is treated as 16 bits. n is available from 1 to 8.

Example of program :

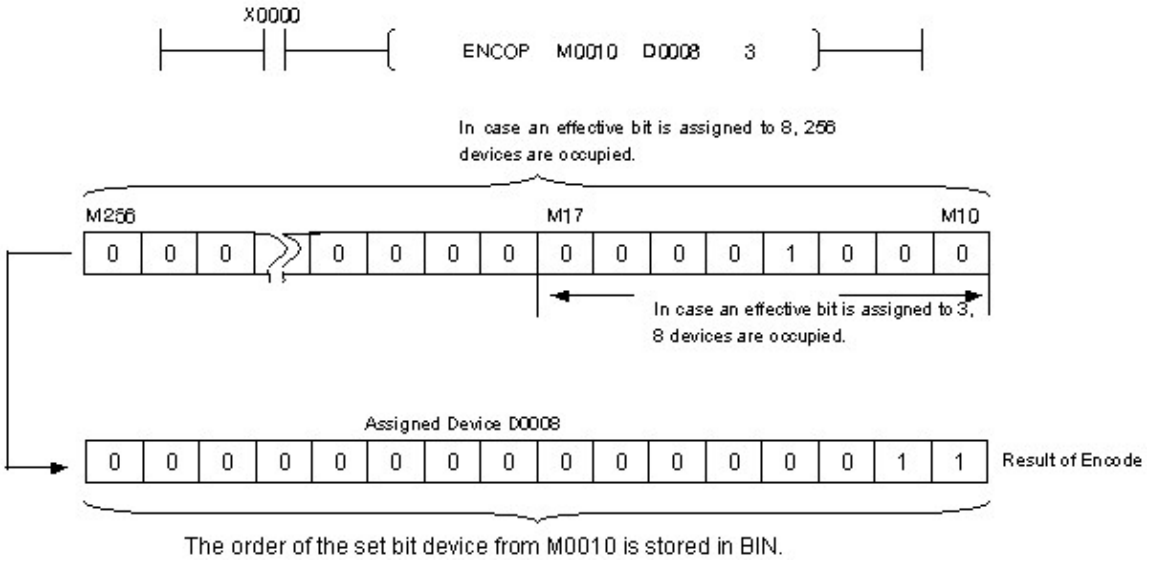


ENCO

Functions :

This is used to encode the 2n bit data in the device assigned to S, storing the result in D. n is available from 1 to 8. In case n is 0, data is not decoded. The data in the device assigned to D is not changed. A bit device is treated as 1 bit and a word device is treated as 16 bits. n is available from 1 to 8. A plural number of 1 bit is encoded in the last bit device.

Example of program :



5.8.10.6 Dissociate or Unite 16 Bit Data : DIS, DISP, UNI, UNIP

Instruction		Usable Device												No.of Steps	Flag		
		M	X	Y	K	L	F	T	C	Z	D	@D	Integer		Error	Zero	Carry
DIS (P) UNI (P)	S	o	o	o	o	o	o	o	o	o	o	o	o	4	o	-	-
	D	o	-	o	o	o	-	o	o	o	o	o	-				
	n	o	o	o	o	o	o	o	o	o	o	o	o				

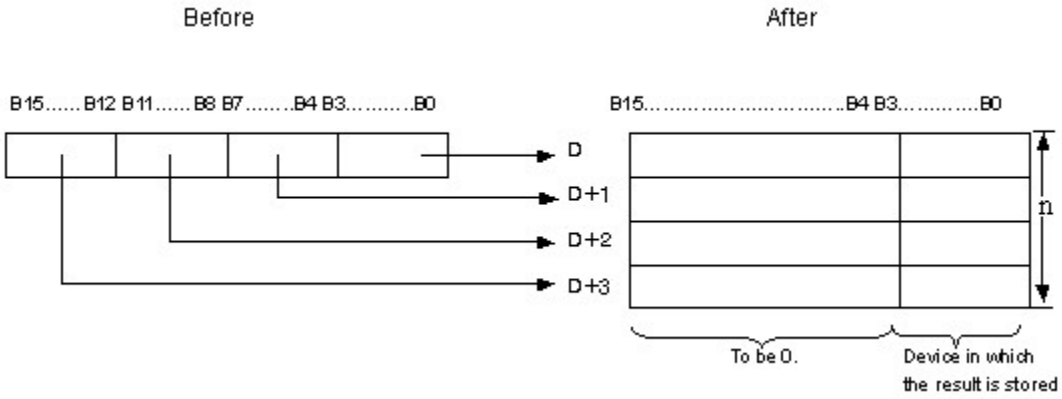
S	First device number of devices where data to be dissociated is stored
D	First device number of devices where dissociated data is stored
n	Number of dissociations (1 - 4)

Error (F110)	In case that a device is assigned to @D, if overflow is generated, it is set.

DIS

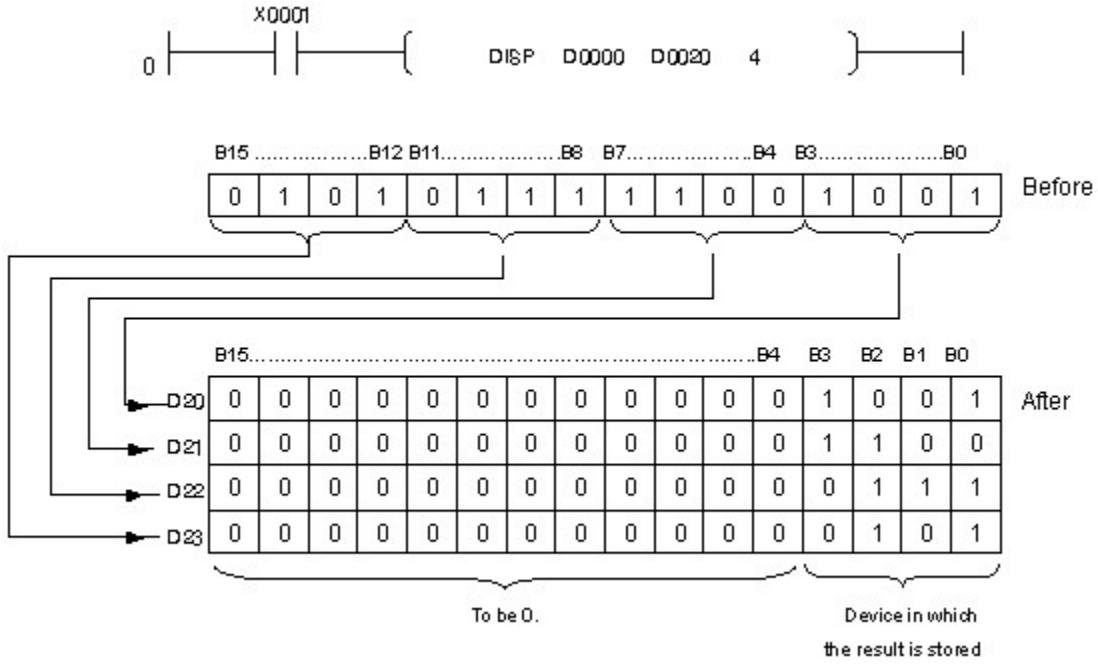
Functions :

This is used to store the lower n digits(n digits 4 bits) of the 16 bit data, which is in the device assigned to S, in the lower 4 bits of the n pieces of device from the device assigned to D. The upper 12 bits of the data, which is in the n pieces of device from the device assigned to D, is 0. n is available from 1 to 4. In case n is 0, data is not decoded. The data in the device assigned to D is not changed.



Example of program :

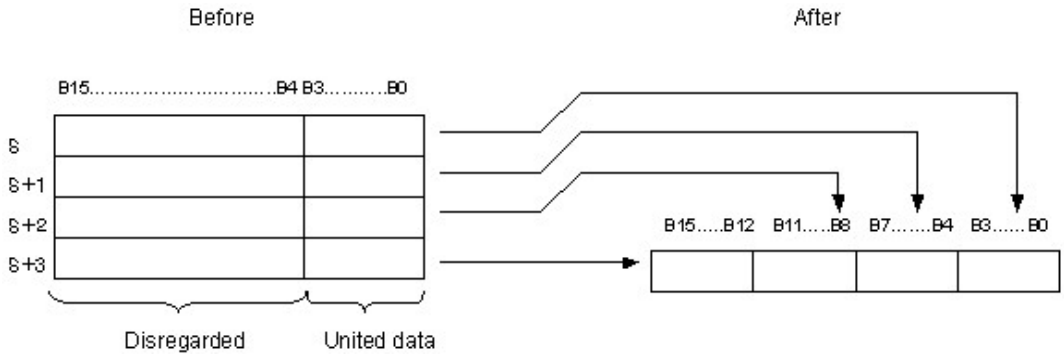
A program to store the 16 bit data in the device assigned to D0000 every 4 bits in the devices from the one assigned to D0020 to the one assigned to 0023 when X0001 is turned on



UNI

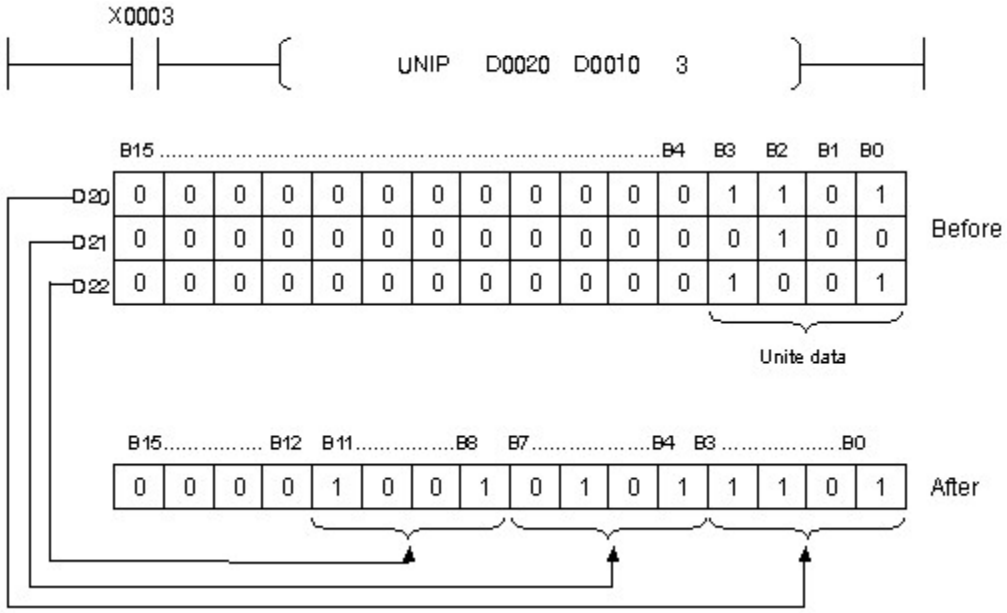
Functions :

This is used to unite the lower 4 bits of the 16 bit data, which is in the n pieces of device from the device assigned to S, to the 16 bit device assigned to D. The upper(4-n) bits of the data in the device assigned to D is 0. n is available from 1 to 4. In case n is 0, data is not decoded. The data in the device assigned to D is not changed.



Example of program :

A program to store the lower 4 bit data, which is in the devices from the one assigned to D0020 to the one assigned to 0022, in the device assigned to D0010 when X0003 is turned on



5.8.10.7 Data Scaling according to the specified linear function : SCL, SCLP

Instruction		Usable Device												No.of Steps	Flag			Usable CPU		
		M	X	Y	K	L	F	T	C	Z	D	@D	Integer		Error	Zero	Carry	XP	CP	BP
SCL SCLP	S	o	o	o	o	o	o	o	o	o	o	o	o	5	o	-	-	o	o	o
	D	o	-	o	o	o	-	-	-	o	o	o	-							
	T	o	-	-	o	o	-	-	-	o	o	o	-							
	n	o	o	o	o	o	o	o	o	o	o	o	o							

S	Scaling according to the Data
D	Scaling changed Data
T	Scaling Data saved Table
n	Number of Scaling according Data

Error (F110)	In case that a device is assigned to @D, if overflow is generated, it is set. Src.Start , Src.End same case, it is set. (not operation instruction)

SCL(P)

Explanation :

Converts signed binary data into signed binary data according to Scale parameter table .

[Scale parameter table(4 word)]

P	Scaling Source Data Minimum Value (Src. Start)
P + 1	Scaling Source Data Maximum Value (Src. End)
P + 2	Scaled Destination Data Minimum Value (Dest. Start)
P + 3	Scaled Destination Data Maximun Value (Dest. End)

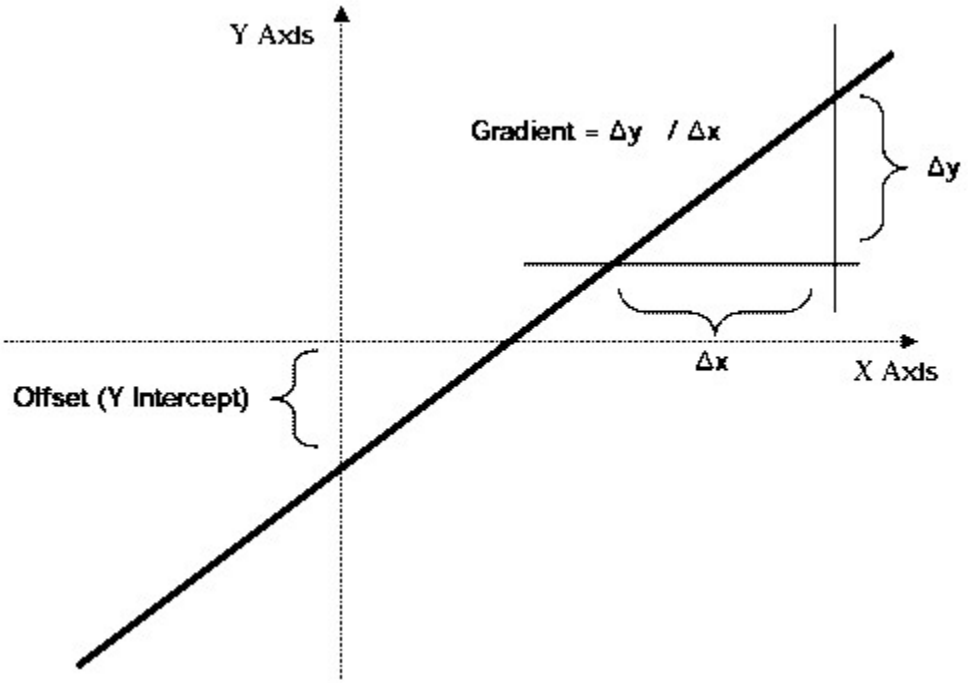
[A scaling formula]

1. Destination = Source * Gradient(2) + Offset(3)

$$2.\ \text{Gradient} = \frac{\text{Dest.End} - \text{Dest.Start}}{\text{Src.End} - \text{Src.Start}}$$

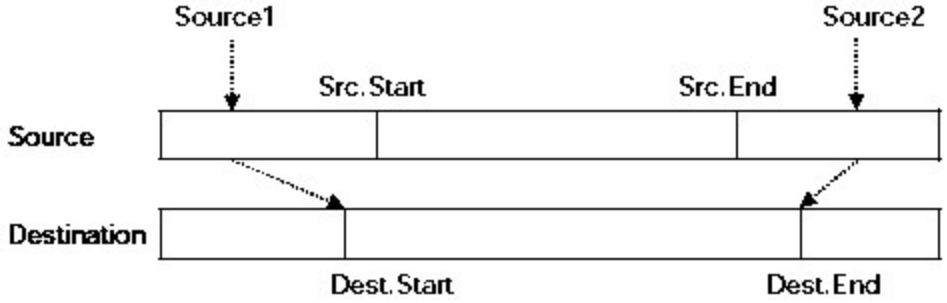
$$3.\ \text{Offset (Y Intercept)} = \text{Dest.Start} - \text{Gradient} * \frac{\text{Src.Start}}{\text{Src.End}}$$

[Graph]



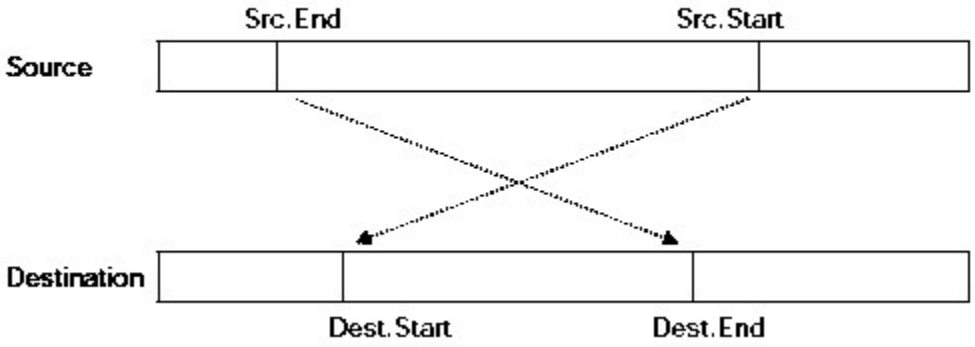
When S get out of Source Data range, Destination Data is stored Dest.Start or Dest.End.

- ✓ **When S is Source1, D is stored Dest.Start**
- ✓ **When S is source2, D is stored Dest.End**



Src.End < Src.Start , Dest.End < Dest.Start

✓ When gradient is a negative number

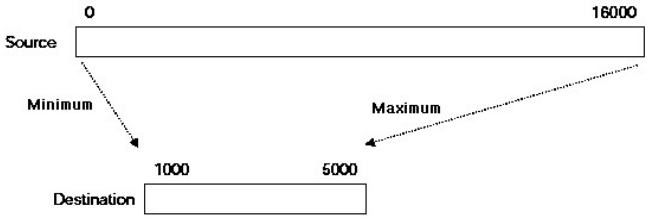


Example of program :

When X0000 is set, Convert signed binary data(D00000) into signed binary data(D00100) according to scale parameter table(D00200).

[Scale parameter table D00200]

D0200	0	← Minimum scaling source data
D0201	16000	← Maximum scaling source data
D0202	1000	← Minimum scaled destination data
D0203	5000	← Maximum scaled destination data



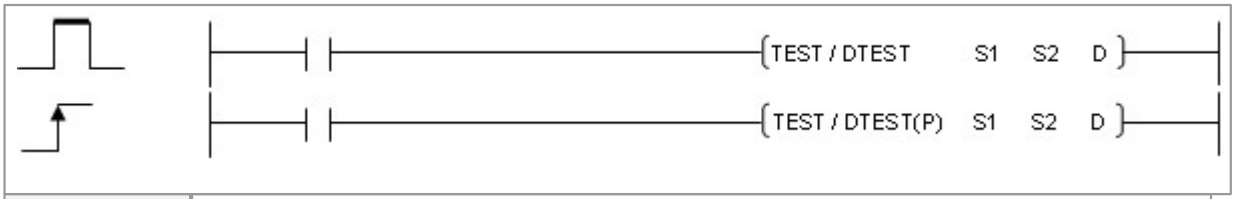
Source Device	Scaling Value		Destination Device	Scaled Value
D0000	14000	→	D0100	4500
D0001	12000	→	D0101	4000
D0002	0	→	D0102	1000
D0003	4000	→	D0103	2000
D0004	8000	→	D0104	3000
D0005	6000	→	D0105	2500
D0006	4500	→	D0106	2125
D0007	2100	→	D0107	1525
D0008	9600	→	D0108	3400
D0009	7800	→	D0109	2950

5.8.11 Bit Processing Instruction

Contents :

5.8.11.1 Bit tests : TEST, TESTP, DTEST, DTESTP

Instruction		Usable Device												No.of Steps	Flag		
		M	X	Y	K	L	F	T	C	Z	D	@D	Integer		Error	Zero	Carry
TEST (P) DTEST (P)	S1	o	o	o	o	o	o	o	o	o	o	o	-	4	o	-	-
	S2	o	o	o	o	o	o	o	o	o	o	o	o				
	D	o	-	o	o	o	-	o	o	-	-	-	-				



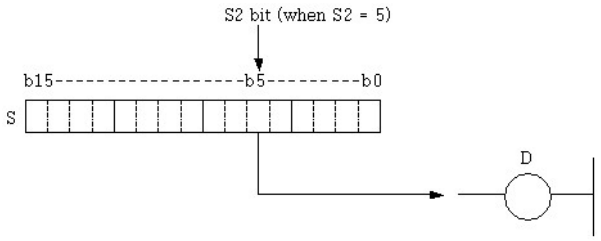
S1	Number of device storing extracted bit data
S2	Location of extracted bit data
D	Number of bit device storing extracted bit data

Error (F110)	In case That a Device is assigned to @D, if overflow is generated, it is set.

TEST

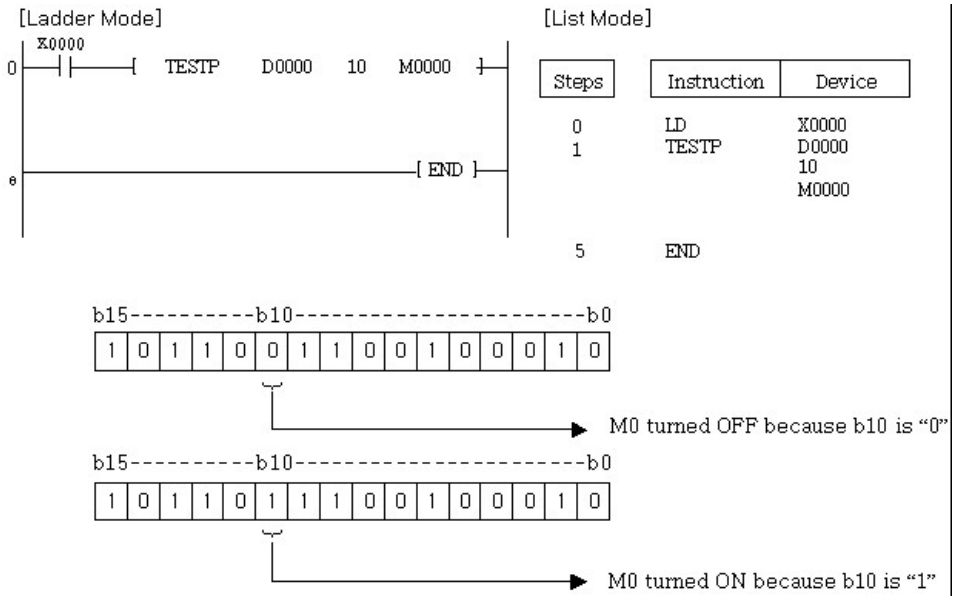
Functions :

This is used to select a bit data at the location expressed as S2 in the word device assigned to S1, storing it in bit the device assigned to D. If the bit device assigned to D is 0, it is reset. If 1, it is set. S2 indicates the location of an individual bit in the device assigned to S1. (0~15)

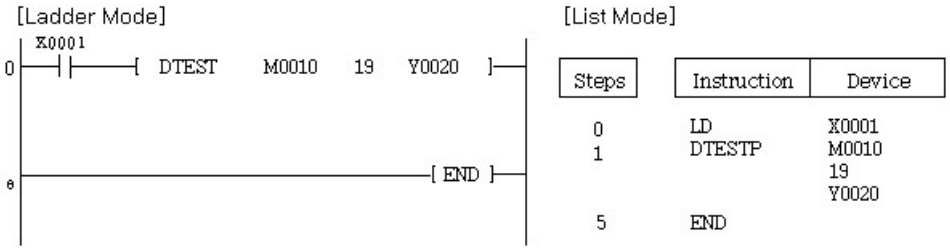


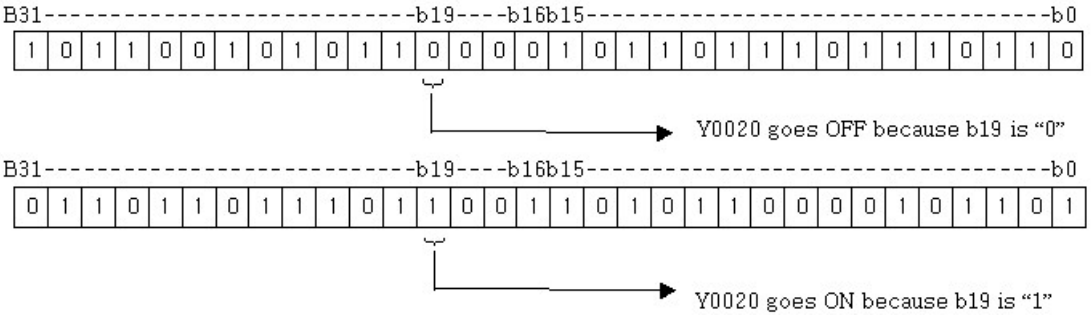
Example of program :

A program to set or reset M0000 according to the state of 10th bit in a word device



A program to set or reset Y0020 according to the state of 19th bit in two word devices, which are M0010 and M0020.

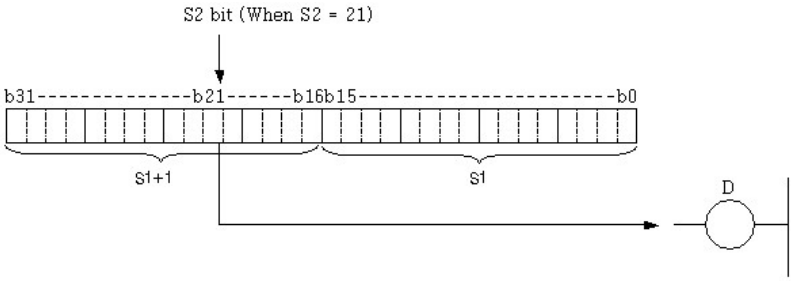




DTEST

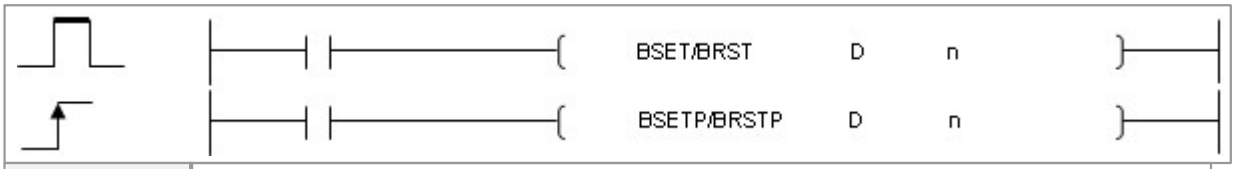
Functions :

This is used to select a bit data at the location expressed as S2 in the two word devices assigned to S1 and S2, storing it in the bit device assigned to D. If the bit device assigned to D is 0, it is reset. If 1, it is set. S2 indicates the location of an individual bit in the two devices assigned to S1 and S2. (0~31)



5.8.11.2 Set or Reset Bit in Word Device : BSET, BSETP, BRST, BRSTP

Instruction		Usable Device												No.of Steps	Flag		
		M	X	Y	K	L	F	T	C	Z	D	@D	Integer		Error	Zero	Carry
BSET (P) BRST (P)	S	o	-	o	o	o	-	o	o	o	o	o	-	3	o	-	-
	D	o	o	o	o	o	o	o	o	o	o	o	o				



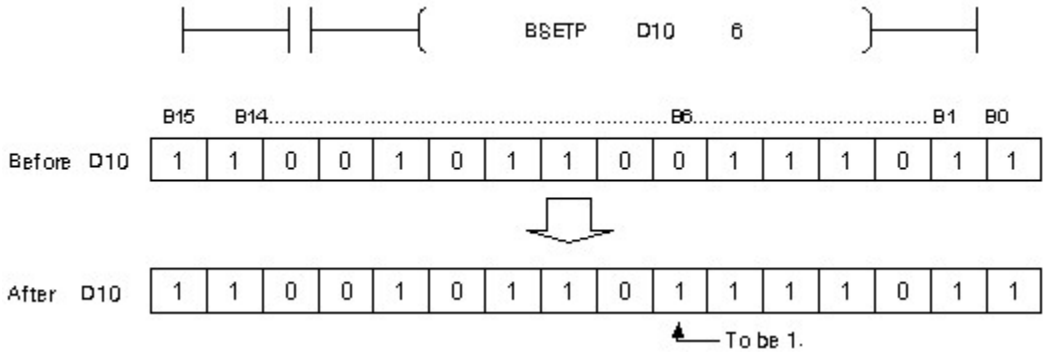
S	Device number where bit set or reset will be conducted
D	Bit number where bit or reset will be conducted

Error (F110)	In case that a device is assigned to @D, if overflow is generated, it is set.

BSET

Functions :

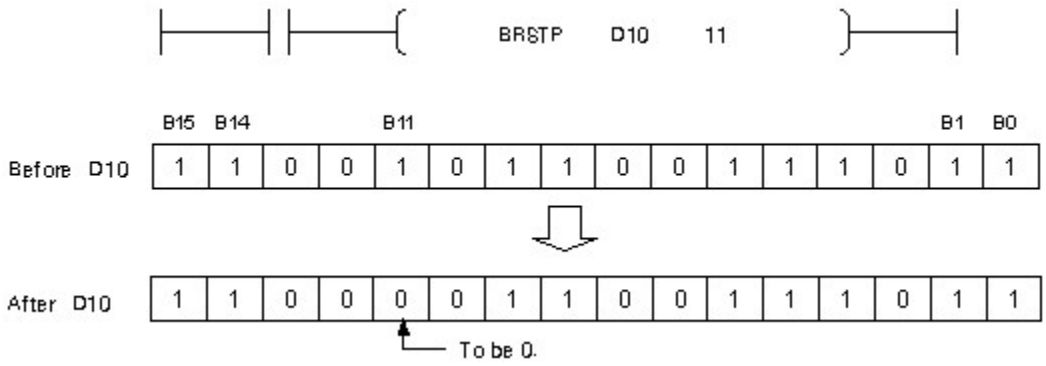
This is used to set the nth bit in the word device assigned to D. n is available from 0 to 15. If n is over 15, this instruction is operated for the lower 4 bits.



BRST

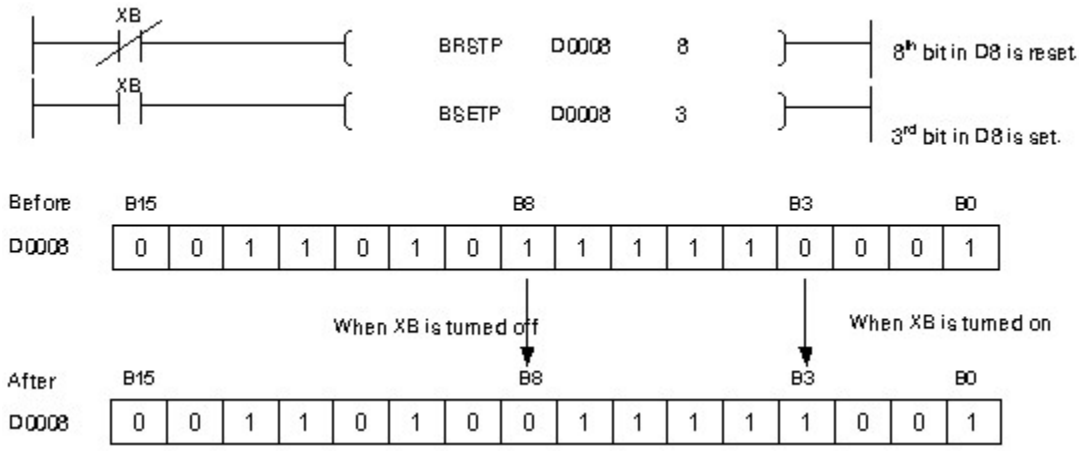
Functions :

This is used to reset the nth bit in the word device assigned to D. n is available from 0 to 15. If n is over 15, this instruction is operated for low 4 bits.



Example of program :

A program to reset the 8th bit(B8) in the device assigned to D0008 when X000B is turned on, setting the 3rd bit(B3) in the device assigned to D0008 when X000B is turned on

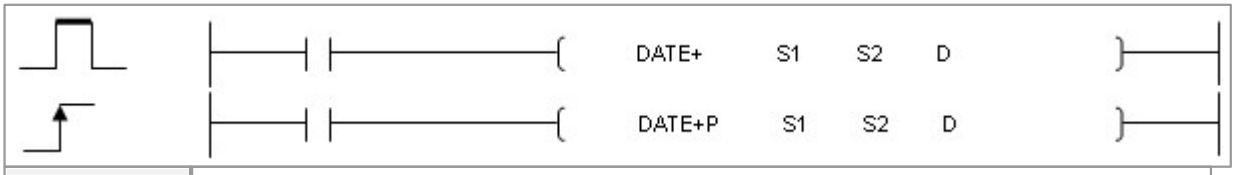


5.8.12 Clock Instruction

Contents :

5.8.12.1 Add Clock Data : DATE+, DATE+P

Instruction		Usable Device												No.of Steps	Flag		
		M	X	Y	K	L	F	T	C	Z	D	@D	Integer		Error	Zero	Carry
DATE+ DATE+P	S1	o	o	o	o	o	o	o	o	o	o	o	-	4	o	-	-
	S2	o	o	o	o	o	o	o	o	o	o	o	-				
	D	o	-	o	o	o	-	o	o	o	o	o	-				



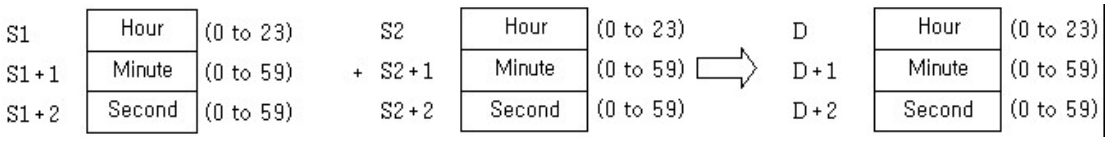
S1	Time data to be added to
S2	Added time (clock) data
D	First device number of devices where addition results of clock (time) dta

Error (F110)	In case that a device is assigned to @D, if overflow is generated, it is set.

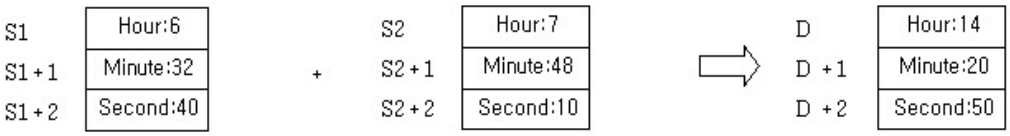
DATE+

Functions :

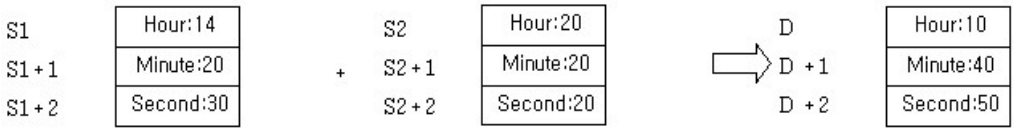
This is used to add the clock data in the devices from the one assigned to S2 to the clock data in the devices from the one assigned to S1, storing the result in the devices from the one assigned to D.



For example, the result of adding 7:48:10 to 6:32:40 is as follows.



If the result of adding clock data is over 24 hours, 24 hours are subtracted from the one. For example, in case of adding 20:20:20 to 14:20:30, the result is not 34:40:50 but 10:40:50.



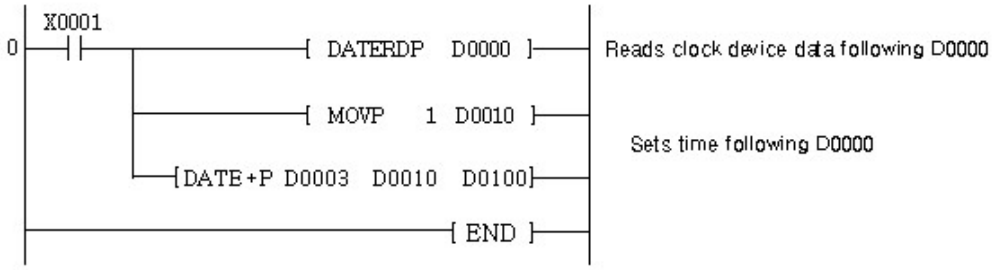
Operation Error :

If the data in S1 and S2 is over the range, error flag is turned on.

Example of program :

A program to add an hour to a clock data in clock device D0003, storing the result in D100 when X0001 is turned on.

[Ladder Mode]

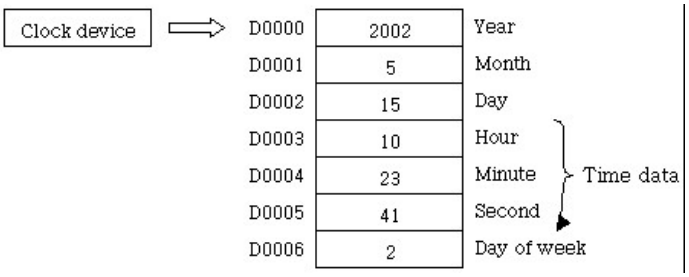


[List Mode]

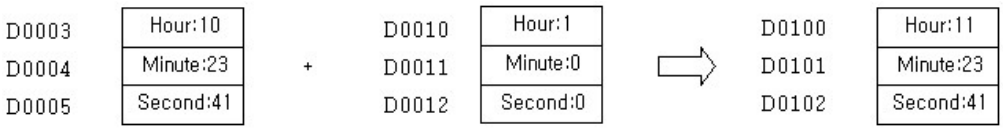
Steps	Instruction	Device
0	LD	X0001
1	DATERDP	D0000
3	MOVP	1
		D0010
6	DATE+P	D0003
		D0010
		D0100
11	END	

[Operation]

The DATERDP is an instruction to read clock data from a clock device.

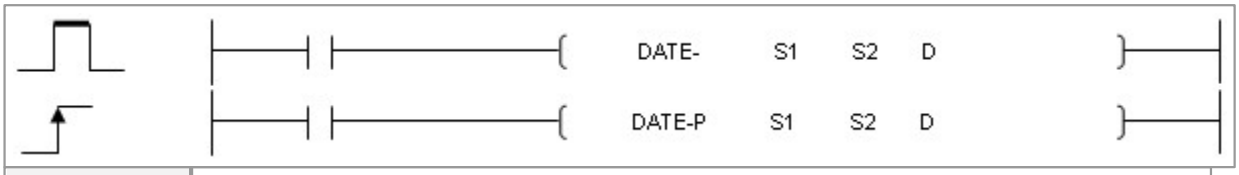


The DATE+P is an instruction to add a clock data.



5.8.12.2 Subtract Clock Data : DATE-, DATE-P

Instruction		Usable Device												No.of Steps	Flag		
		M	X	Y	K	L	F	T	C	Z	D	@D	Integer		Error	Zero	Carry
DATE- DATE-P	S1	o	o	o	o	o	o	o	o	o	o	o	-	4	o	-	-
	S2	o	o	o	o	o	o	o	o	o	o	o	-				
	D	o	-	o	o	o	-	o	o	o	o	o	-				



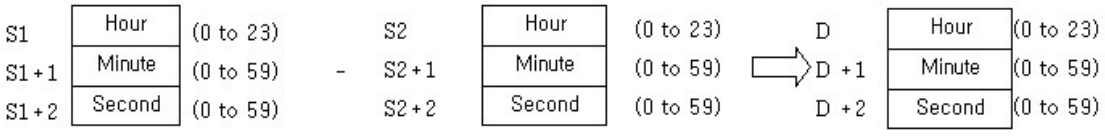
S1	First device number of devices where time data to be subtracted from is being stored
S2	First device number of devices where subtraction time (clock time) data is being stored
D	First device number of devices where clock time (time) data of results of subtraction operation is being stored

Error (F110)	In case that a device is assigned to @D, if overflow is generated, it is set.

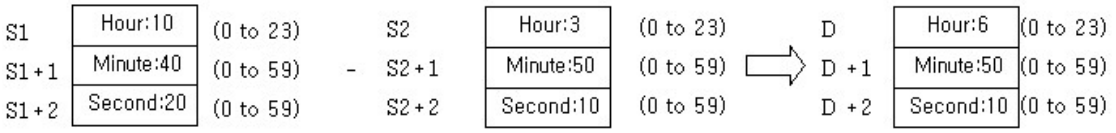
DATE-

Functions :

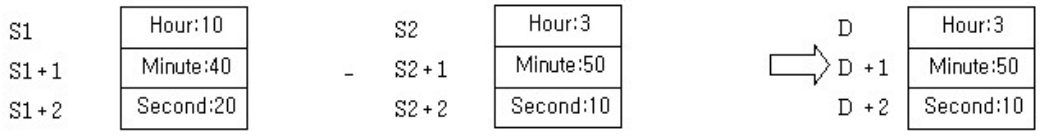
This is used to subtract the clock data in the devices from the one assigned to S2 from the clock data in the devices from the one assigned to S1, storing the result in the devices from the one assigned to D.



For example, the result of subtracting 3:50:10 from 10:40:20 is as follows.



If the result of subtracting clock data is a negative number, 24 hours are added to the one. For example, in case of subtracting 10:42:12 from 4:50:32, the result is not -1:8:20 but 18:8:20.

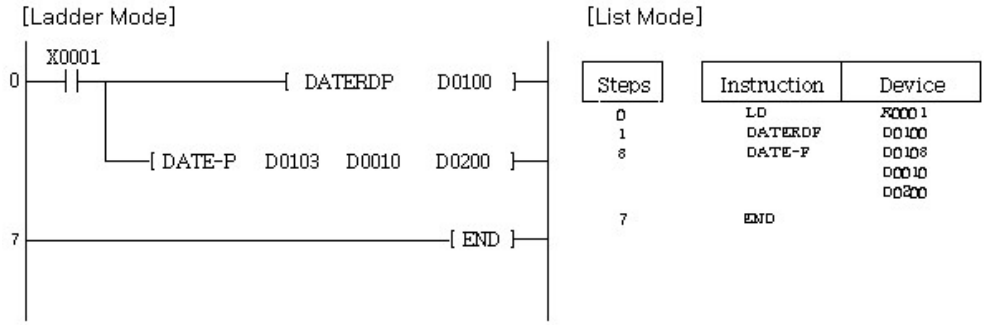


Operation Error :

If the data in S1 and S2 is over the range, error flag is turned on.

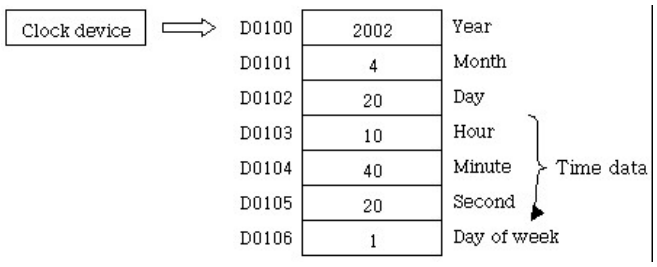
Example of Program :

A program to subtract the clock data in clock device D0010 from the clock data in clock device D0100, storing the result in D0200 when X0001 is turned on.

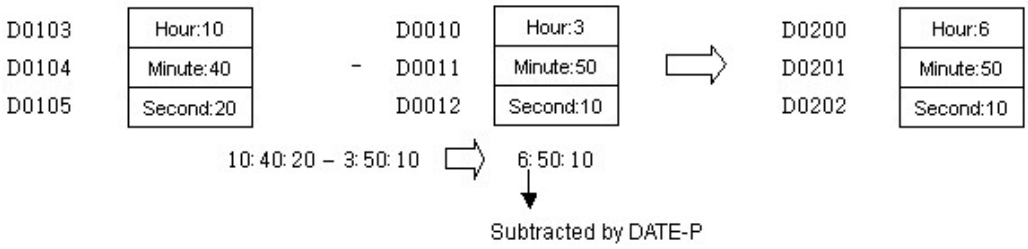


[Operation]

The DATEDP is an instruction to read clock data from a clock device.

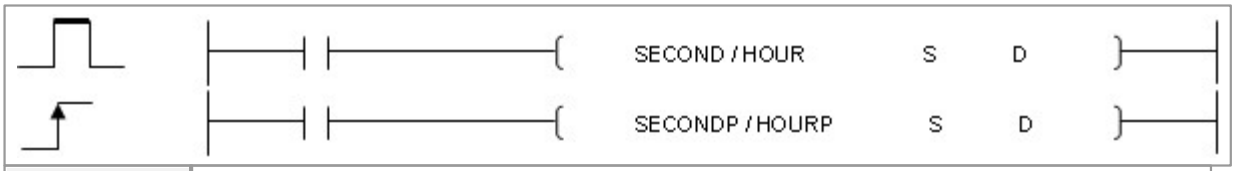


The DATE-P is an instruction to subtract a clock data.



5.8.12.3 Convert Clock Data Format : SECOND(P), HOUR(P)

Instruction		Usable Device												No.of Steps	Flag		
		M	X	Y	K	L	F	T	C	Z	D	@D	Integer		Error	Zero	Carry
SECOND(P) HOUR(P)	S	o	o	o	o	o	o	o	o	o	o	o	-	3	o	-	-
	D	o	-	o	o	o	-	o	o	o	o	o	-				



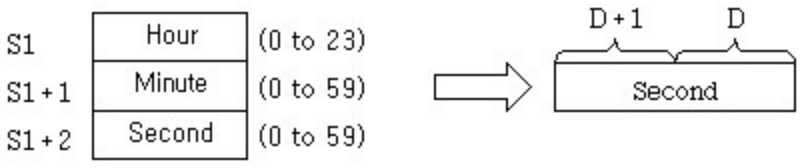
S	The start address among the addresses where the clock data before converted is stored
D	The start address among the addresses where the clock data after converted is stored

Error (F110)	In case that a device is assigned to @D, if overflow is generated, it is set.

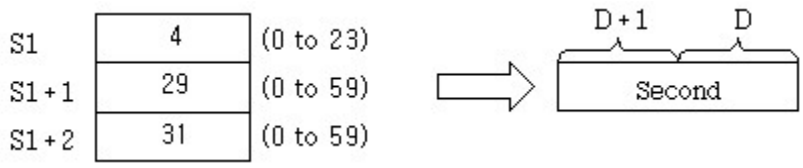
SECOND

Functions :

This is used to convert the clock data in the devices from the one assigned to S1 to seconds, storing the result in the device assigned to D.



For example, if 4 hours 24 minutes 31 seconds are changed in seconds, the result is as follows.

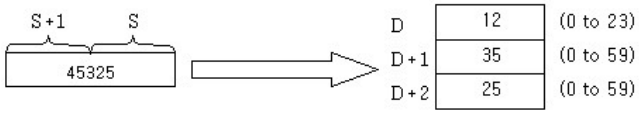


HOUR

Functions :

This is used to convert the seconds data in the device assigned to S to hours-minutes-seconds, storing the result in the address assigned to D.

For example, if 45325 seconds are assigned, they are converted to hours-minutes-seconds as follows.

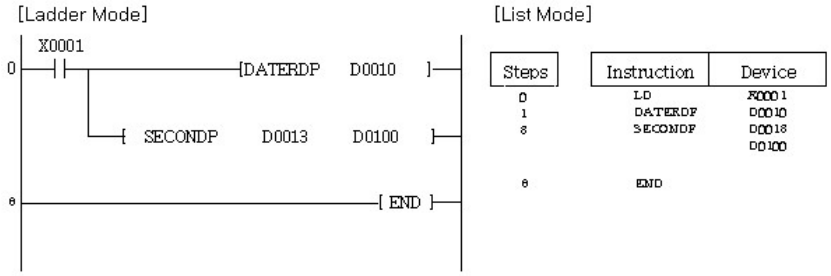


Operation Error :

If the data in S is over the range, error flag is turned on.

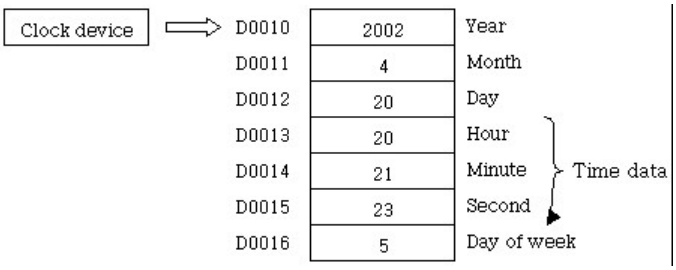
Example of program :

A program to convert the clock data, which is in the clock device assigned to D0013, to seconds, storing the result in the device assigned to D0100 and D0101 when X0001 is turned on

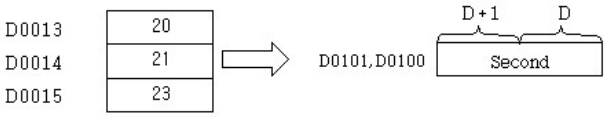


[Operation]

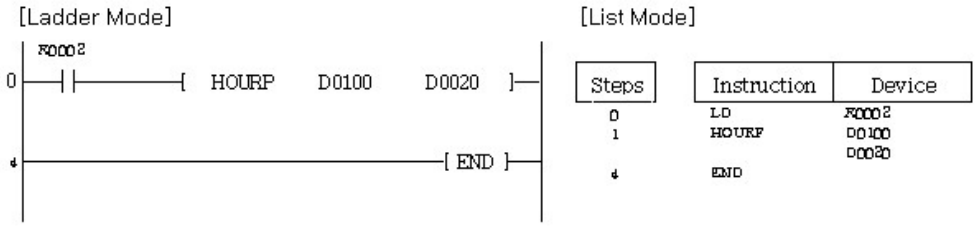
The DATERDP is an instruction to read clock data from a clock device.



The SECONDP is an instruction to convert a hours-minutes-seconds clock data to seconds.

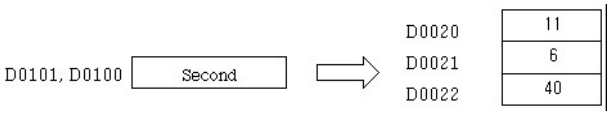


A program to convert the seconds clock data, which is in the clock device assigned to D0100 and D0101, to hours-minutes-seconds, storing the result in the devices from the device assigned to D0020 when X0002 is turned on



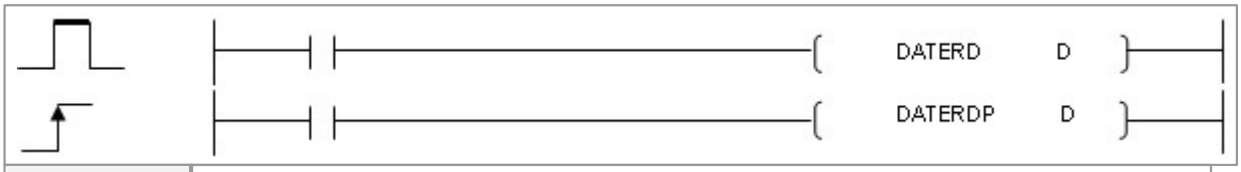
[Operation]

The HOURP is an instruction to convert a seconds clock data to hours-minutes-seconds.



5.8.12.4 Reading Clock Data : DATERD, DATERDP

Instruction		Usable Device												No.of Steps	Flag		
		M	X	Y	K	L	F	T	C	Z	D	@D	Integer		Error	Zero	Carry
DATERD(P)	D	o	-	o	o	o	-	o	o	o	o	o	-	2	o	-	-



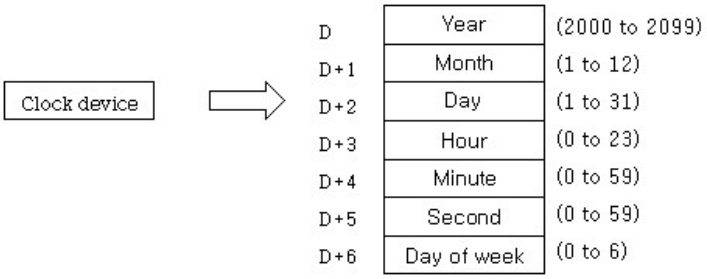
D	Address where the clock data read is stored

Error (F110)	In case that a device is assigned to @D, if overflow is generated, it is set.

DATERD

Functions :

This is used to read the clock data in a clock device, bringing it to the data in the devices for year, month, day, hour, minute, second and day of week from the device assigned to D.



The “year” in the device assigned to D is indicated in four digits. The day of week in the device assigned to D+6 is stored in the data from 0 to 6 to indicate days of week from Sunday to Saturday.

Day of week	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
Stored data	0	1	2	3	4	5	6

A leap year is compensated automatically.

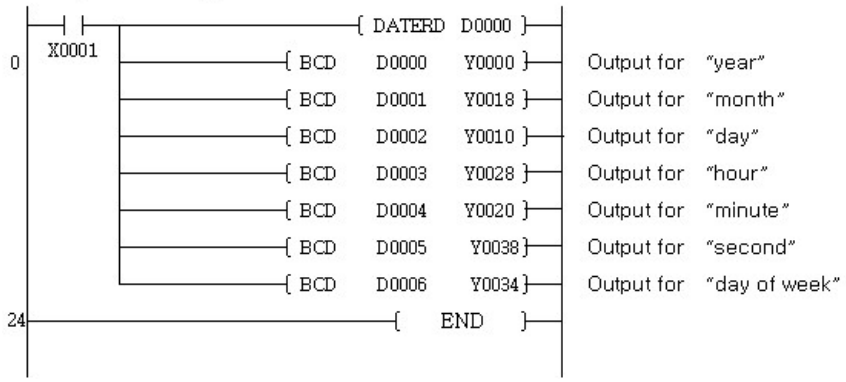
Example of program :

A program to read a clock data, outputting the result in BCD

Year..... Y0000 to Y000F
Month..... Y0018 to Y001F
Day..... Y0010 to Y0017
Hour..... Y0028 to Y002F
Minute..... Y0020 to Y0027
Second..... Y0038 to Y003F

Week..... Y0034 to Y0037

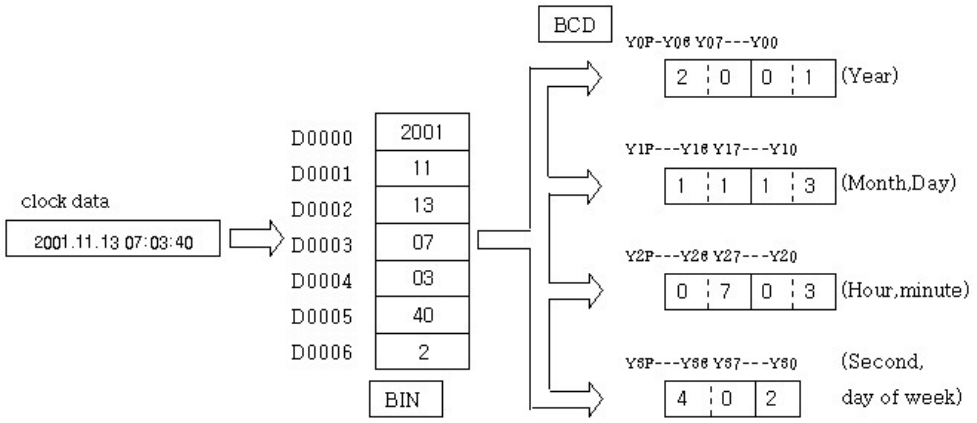
[Ladder Mode]



[List Mode]

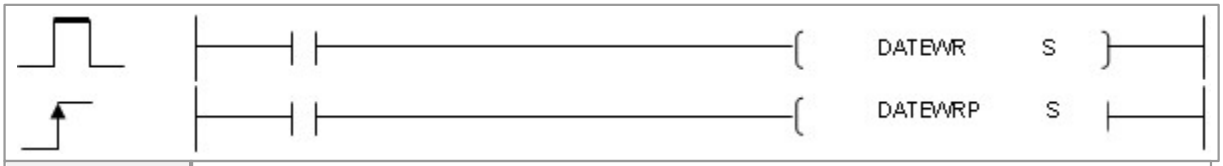
Steps	Instruction	Device
0	LD	X0001
1	DATERDP	D0000
3	BCD	D0000 Y0000
6	BCD	D0001 Y0018
9	BCD	D0002 Y0010
12	BCD	D0003 Y0028
15	BCD	D0004 Y0020
18	BCD	D0005 Y0030
21	BCD	D0006 Y0034
24	END	

[Operation]



5.8.12.5 Writing Clock Data : DATEWR, DATEWRP

Instruction		Usable Device												No.of Steps	Flag		
		M	X	Y	K	L	F	T	C	Z	D	@D	Integer		Error	Zero	Carry
DATEWR(P)	S	o	o	o	o	o	o	o	o	o	o	o	-	3	o	-	-



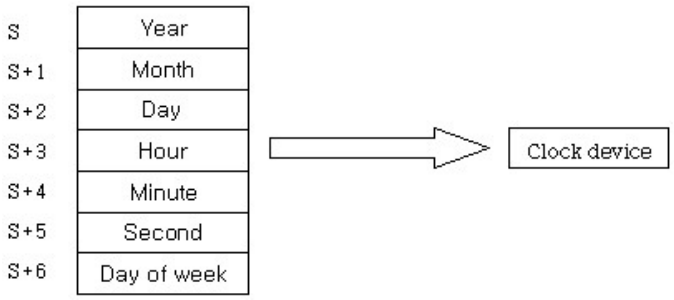
S	First device number of devices that is storing clock data to be written to the clock device.

Error (F110)	In case that a device is assigned to @D, if overflow is generated, it is set.

DATEWR

Functions :

This is used to write the clock data, which is in the devices from the one assigned to S, to CPU Clock Device.



The values are inputted in BIN. The year in the device assigned to S is indicated in four digits between 2000 to 2099. The month in the device assigned to S+1 is indicated in a number between 1 and 12 (1M~12M). The day in the device assigned to S+2 is indicated in a number between 1 and 31. The hour in the device assigned to S+3 is indicated in a number between 0 to 23. The minute in the device assigned to S+4 is indicated in a number between 0 and 59. The second in the device assigned to S+5 is indicated in a number between 0 and 59. The day of week in the device assigned to S+6 is indicated in a number between 0 and 6. (Sunday~Saturday)

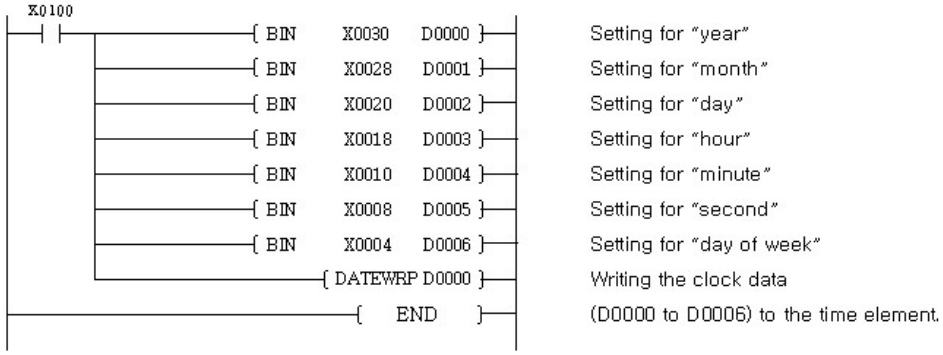
Day of the week	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
Stored data	0	1	2	3	4	5	6

Example of program :

A program to write clock data in a clock device in BCD when X0100 is turned on

Year..... Y0030 to Y003F
Month..... Y0028 to Y002F
Day..... Y0020 to Y0027
Hour..... Y0018 to Y001F
Minute..... Y0010 to Y0017
Second..... Y0008 to Y000F
Week..... Y0004 to Y0007

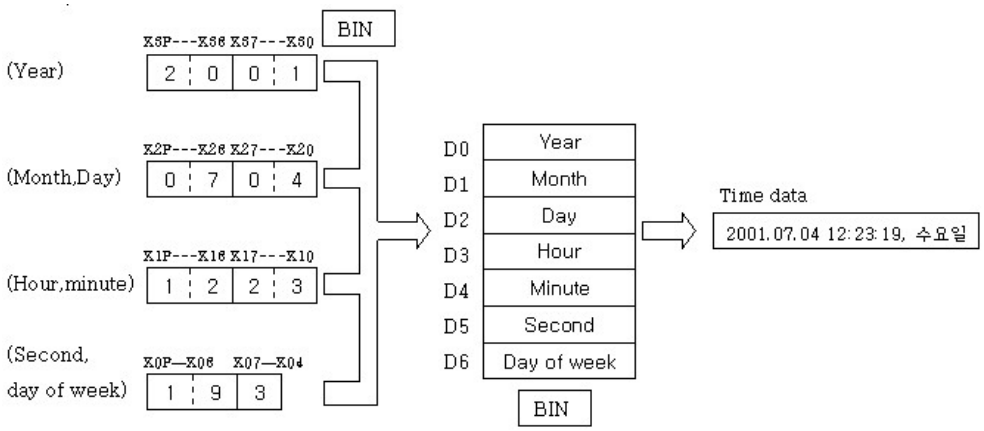
[Ladder Mode]



[List Mode]

Steps	Instruction	Device
0	LD	X0100
1	BIN	X0030 D0000
4	BIN	X0028 D0001
7	BIN	X0020 D0002
10	BIN	X0018 D0003
13	BIN	X0010 D0004
16	BIN	X0008 D0005
19	BIN	X0004 D0006
22	DATAWRP	D0000
24	END	

[Operation]



5.8.13 Timer / Counter

Contents :

- Redecrease Time Relevantly to Input (OFF to ON) : TRTG
- Decrease Time Irrelevantly to Input : TMON
- Count : CTU
- Count Down : CTD
- Count and Count Down : CTUD
- Count and Set Conditionally : CTR

5.8.13.1 Set after Delay : TON

Instruction		Usable Device												No.of Steps	Flag		
		M	X	Y	K	L	F	T	C	Z	D	@D	Integer		Error	Zero	Carry
TON	S	-	-	-	-	-	-	o	-	-	-	-	-	3	-	-	-
	t	-	-	-	-	-	-	-	-	-	o	-	o				

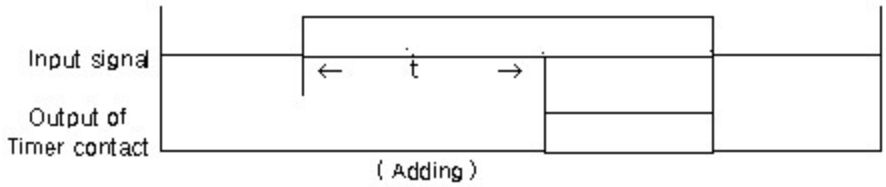
Set time(t) = Basic interval (0.1 sec or 0.001 sec) * Set value (0 ~ 65535)

S	Timer contact number
t	Set value on a timer

TON

Functions :

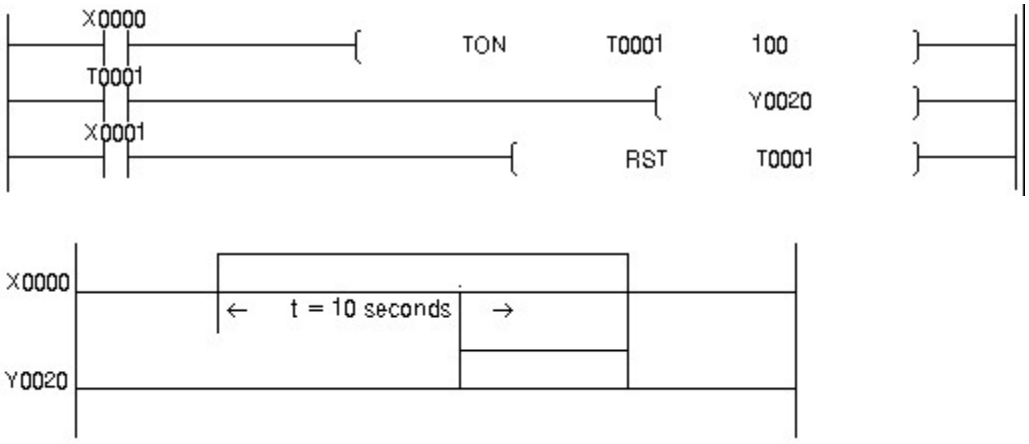
This is used to increase the current value from when an input condition is turned on, setting a timer if it reaches the set value(t) on the timer. If an input condition is turned off or the reset instruction is operated, the timer is reset and the current value is 0.



Example of program :

The timer is set if the current value of it is as same as the set value in 10 seconds after X0000 is turned on. The current value is 0 if an input condition is turned off before it reaches the set value. The current value is

0 if X0001 is turned on.



5.8.13.2 Reset after Delay : TOFF

Instruction		Usable Device												No.of Steps	Flag		
		M	X	Y	K	L	F	T	C	Z	D	@D	Integer		Error	Zero	Carry
TOFF	S	-	-	-	-	-	-	o	-	-	-	-	-	3	-	-	-
	t	-	-	-	-	-	-	-	o	-	o	-	o				

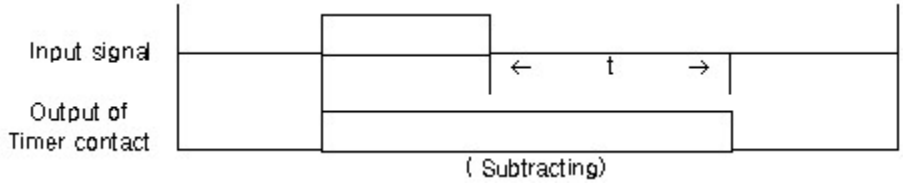
Set time(t) = Basic interval (0.1 sec or 0.001 sec) * Set value (0 ~ 65535)

S	Timer contact number
t	Set value on a timer

TOFF

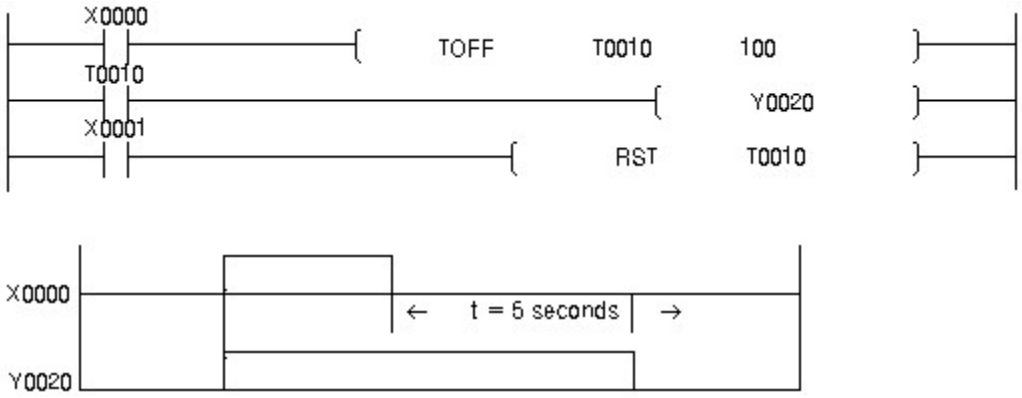
Functions :

The current value of a timer is the set value and it is set while an input condition is turned on. This is used to decrease the current value of the timer from the set value when an input condition is turned off, resetting the timer if the value reaches 0. If the reset instruction is operated, a timer is reset and the current value is 0.



Example of program :

When Contact X0000 is turned on, Contact T0010 is set and Y0020 is set. When Contact X0000 is turned off, the value of the timer start on being decreased. If the current value reaches 0, the timer contact is reset. The timer is reset and the current value is 0 if X0001 is turned on.



5.8.13.3 Accumulate Time : TMR

Instruction		Usable Device												No.of Steps	Flag		
		M	X	Y	K	L	F	T	C	Z	D	@D	Integer		Error	Zero	Carry
TMR	S	-	-	-	-	-	-	o	-	-	-	-	-	3	-	-	-
	t	-	-	-	-	-	-	-	-	-	o	-	o				

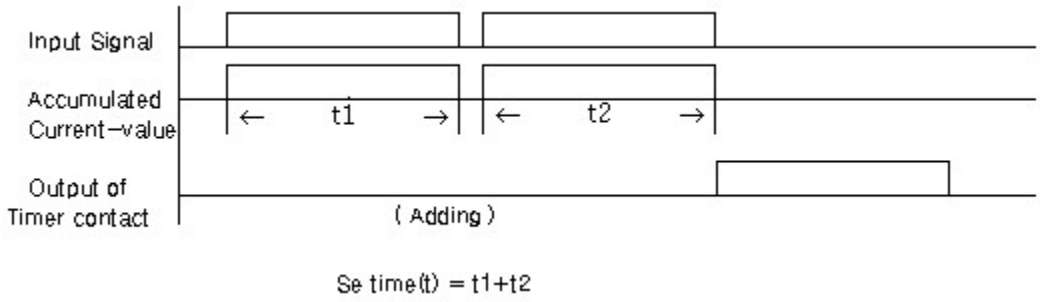
Set time(t) = Basic interval (0.1 sec or 0.001 sec) * Set value (0 ~ 65535)

S	Timer contact number
t	Set value on a timer

TMR

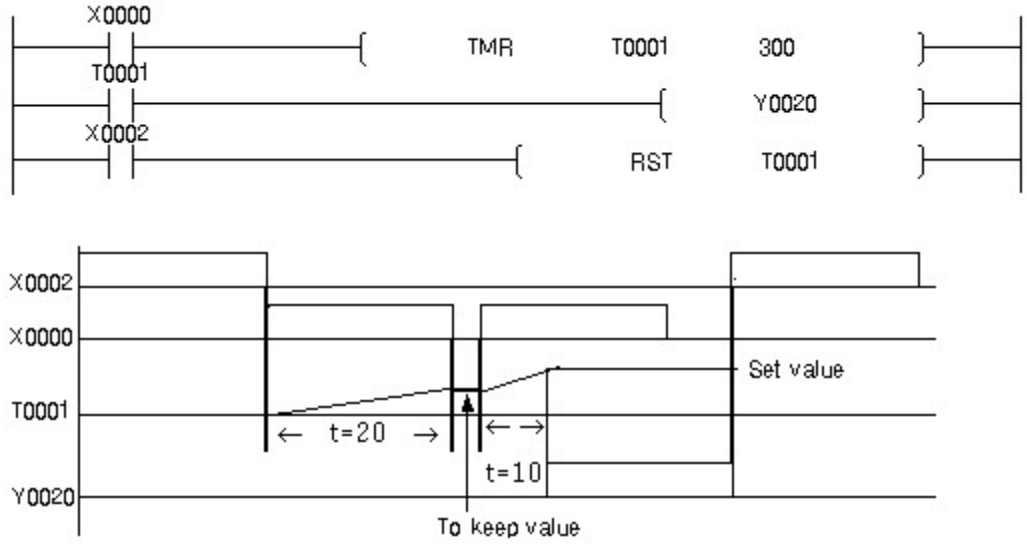
Functions :

This is used to increase the current value from whenever an input condition is turned on, setting a timer if it reaches the set value(t) on the timer. To keep the current value of the timer in case of power failure, a non-volatile device is used. If the input condition to reset is turned on, the timer is reset and the current value is 0.



Example of program :

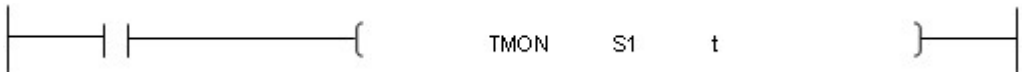
When T0001 is turned on after Contact X0000 has turned ON-OFF-ON, Contact Y0020 is set for 30 seconds(=t1 + t2). If Reset Signal X0002 is turned on, the current value is 0 and Y0020 is reset.



5.8.13.4 Decrease Time Irrelevantly to Input : TMON

Instruction	Usable Device												No.of	Flag		
	M	X	Y	K	L	F	T	C	Z	D	@D	Inte		Error	Zero	Carry

													ger	Steps			
TMON	S	-	-	-	-	-	-	o	-	-	-	-	-	3	-	-	-
	t	-	-	-	-	-	-	-	-	-	o	-	o				



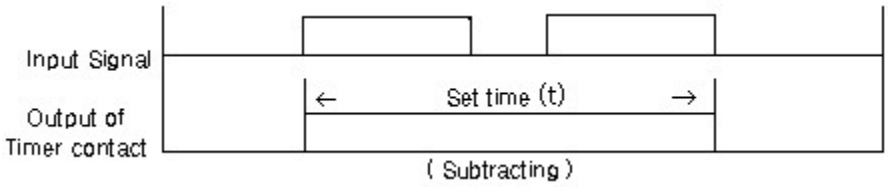
Set time(t) = Basic interval (0.1 sec or 0.001 sec) * Set value (0 ~ 65535)

S	Timer contact number
t	Set value on a timer

TMON

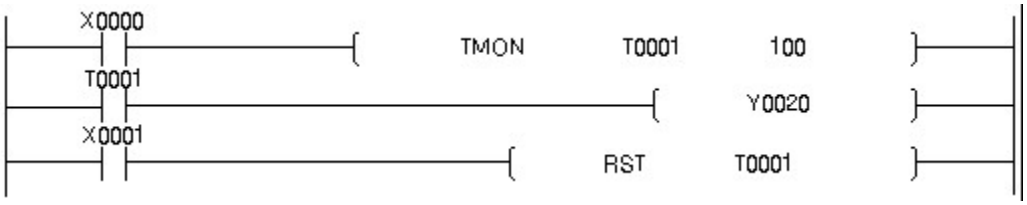
Functions :

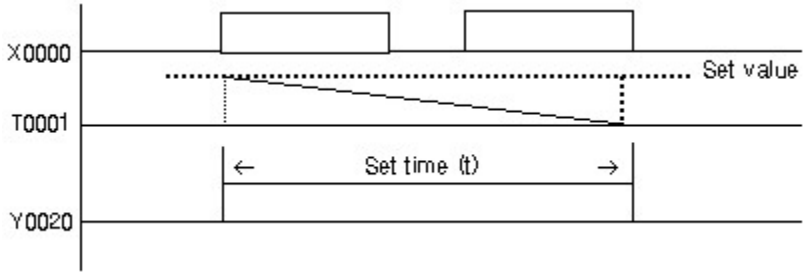
This is used to decrease the current value of a timer from the set value when an input condition is turned on to set the timer, resetting the timer if the value reaches 0. After the timer is set, it is disregarded to change the input condition from ON to OFF. If the input condition to reset is turned on, the timer is reset and the current value is 0.



Example of program :

When Contact X0000 is turned on, Contact T0001 is set and the current value of the timer is decreased. Though X0000 repeats turning on and off while the current value is decreased, it continues to be decreased. If Reset signal X0001 is turned on, the current value is 0 and Y0020 is reset.





5.8.13.5 Redecrease Time Relevantly to Input (OFF to ON) : TRTG

Instruction		Usable Device												No.of Steps	Flag		
		M	X	Y	K	L	F	T	C	Z	D	@D	Integer		Error	Zero	Carry
TRTG	S	-	-	-	-	-	-	o	-	-	-	-	-	3	-	-	-
	t	-	-	-	-	-	-	-	-	-	o	-	o				

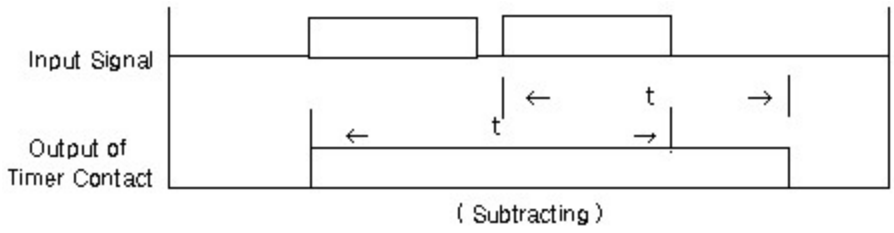
Set time(t) = Basic interval (0.1 sec or 0.001 sec) * Set value (0 ~ 65535)

S	Timer contact number
t	Set value on a timer

TRTG

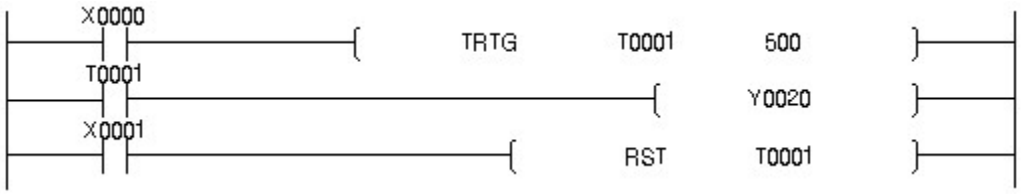
Functions :

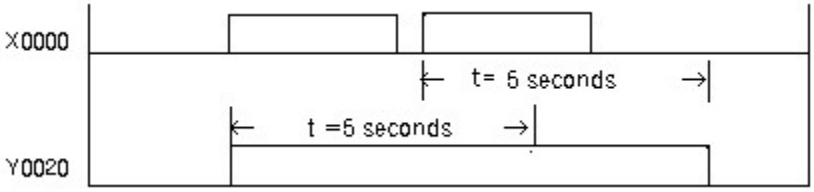
This is used to decrease the current value of a timer from the set value when an input condition is turned on to set the timer, resetting the timer if the value reaches 0. If the input condition is turned on from off again before the current value is 0, this instruction reset the current value as the set value. If the input condition to reset is turned on, the timer is reset and the current value is 0.



Example of program :

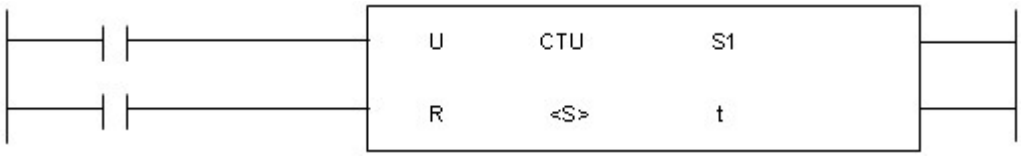
When X0000 is turned on, Contact T0001 is set. If the current value of the timer is decreased to reach 0, Y0020 is set. If the input condition of X0000 is turned on from off before the current value reaches 0, the current value is to be the current value and is decreased again. If Reset signal X0001 is turned on, the current value is 0 and Y0020 is reset.





5.8.13.6 Count : CTU

Instruction		Usable Device												No.of Steps	Flag		
		M	X	Y	K	L	F	T	C	Z	D	@D	Integer		Error	Zero	Carry
CTU	S	-	-	-	-	-	-	-	o	-	-	-	-	3	-	-	-
	t	-	-	-	-	-	-	-	-	-	o	-	o				



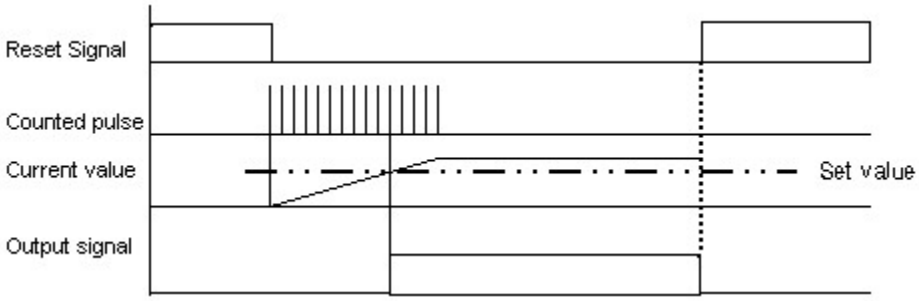
Set time(t) = Basic interval (0.1 sec or 0.001 sec) * Set value (0 ~ 65535)

S	Timer contact number
t	Set value on a counter

CTU

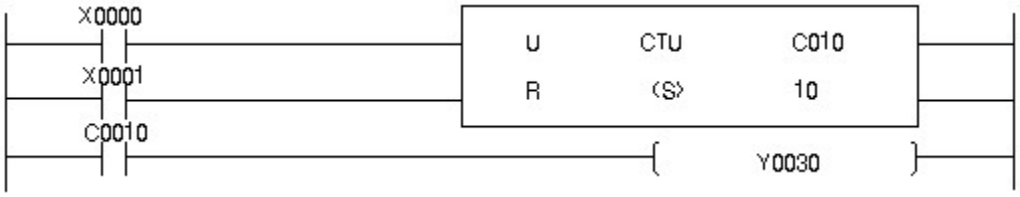
Functions :

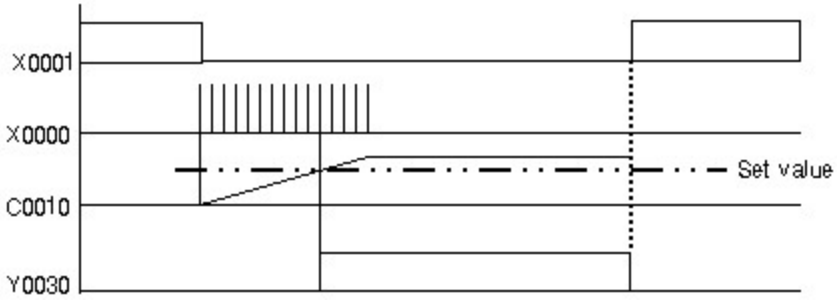
This is used to increase the current value of a counter 1 by 1 whenever the rising edge of a pulse is input. If the value is over the set value, the counter is set and the value is counted up to maximum (65535). If the input condition to reset is turned on, the counter is reset and the current value is 0.



Example of program :

When the current value and the set value are the same by counting the rising edge input to Contact X0000, Y0030 is set. If Reset signal X0001 is turned on, the current value is 0 and Y0030 is reset.





5.8.13.7 Count Down : CTD

Instruction		Usable Device												No.of Steps	Flag		
		M	X	Y	K	L	F	T	C	Z	D	@D	Integer		Error	Zero	Carry
CTD	S	-	-	-	-	-	-	-	o	-	-	-	-	3	-	-	-
	t	-	-	-	-	-	-	-	-	-	o	-	o				

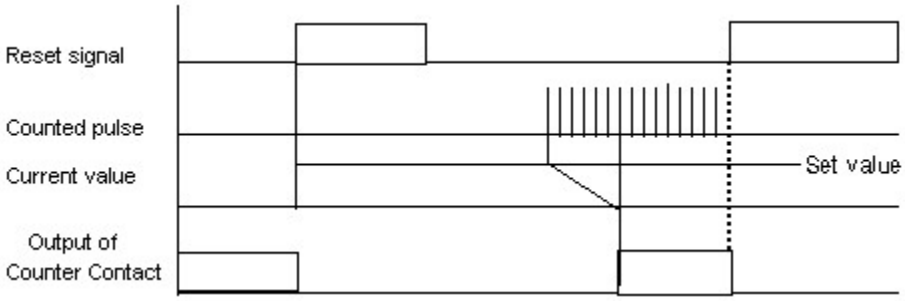
Set time(t) = Basic interval (0.1 sec or 0.001 sec) * Set value (0 ~ 65535)

S	Timer contact number
t	Set value on a counter

CTD

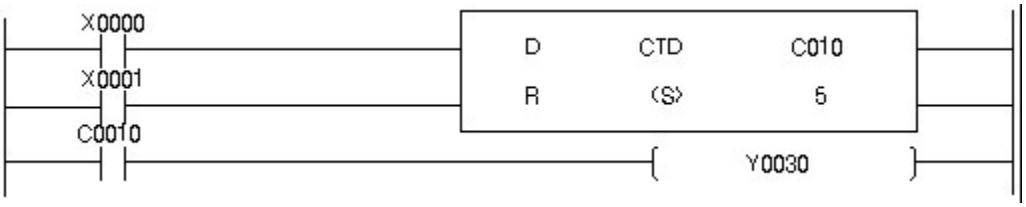
Functions :

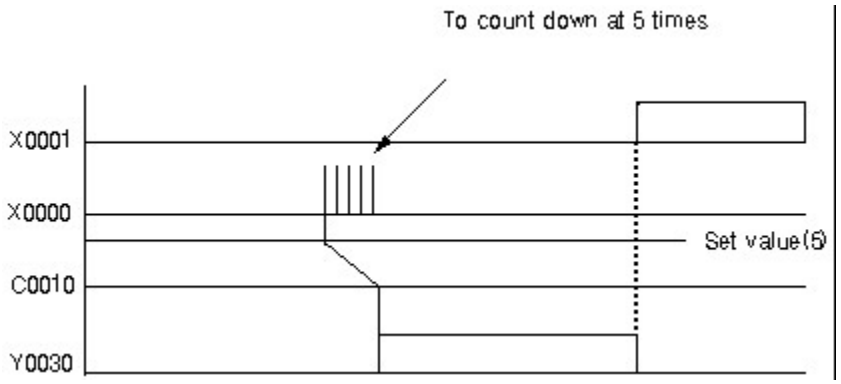
This is used to decrease the current value of a counter 1 by 1 whenever the rising edge of a pulse is input, setting the counter if the value is 0. If the input condition to reset is turned on, the counter is reset and the current value is 0.



Example of Program :

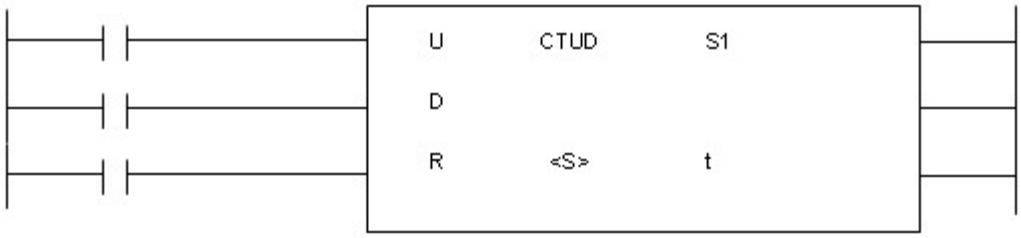
If the current value is 0 by counting down the rising edge input to Contact X0000 at 5 times, Y0030 is set. If Reset signal X0001 is turned on, the current value is the set value and Y0030 is reset.





5.8.13.8 Count and Count Down : CTUD

Instruction		Usable Device												No.of Steps	Flag		
		M	X	Y	K	L	F	T	C	Z	D	@D	Integer		Error	Zero	Carry
CTUD	S	-	-	-	-	-	-	-	o	-	-	-	-	3	-	-	-
	t	-	-	-	-	-	-	-	-	-	o	-	o				



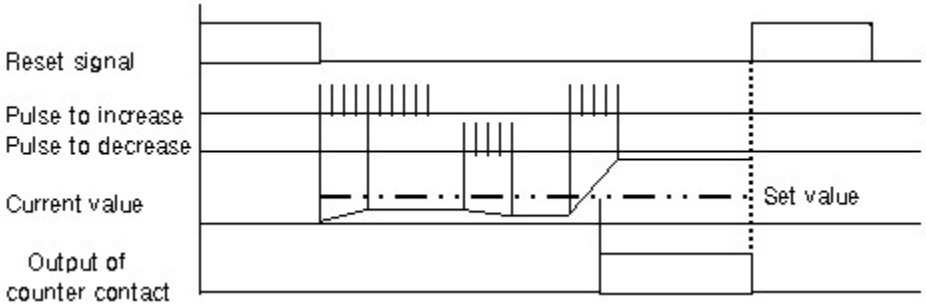
Set time(t) = Basic interval (0.1 sec or 0.001 sec) * Set value (0 ~ 65535)

S	Timer contact number
t	Set value on a counter

CTUD

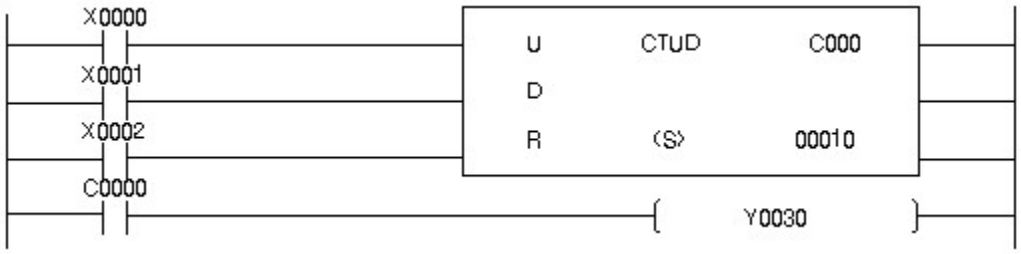
Functions :

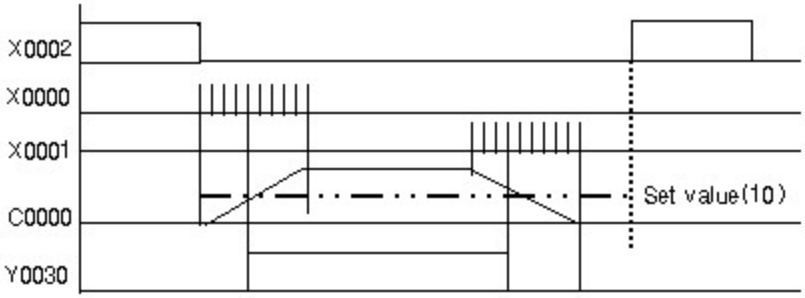
This is used to increase the current value of an up-counter 1 by 1 whenever the rising edge of a pulse is input. If the value is over the set value, the counter is set and the value is counted up to maximum (65535). This is used to decrease the current value of a down-counter 1 by 1 whenever the rising edge of a pulse is input. If the input condition to reset is turned on, the current value is 0. IF the rising edge of a pulse is input to up-counter and down-counter simultaneously, the current value is not changed.



Example of Program :

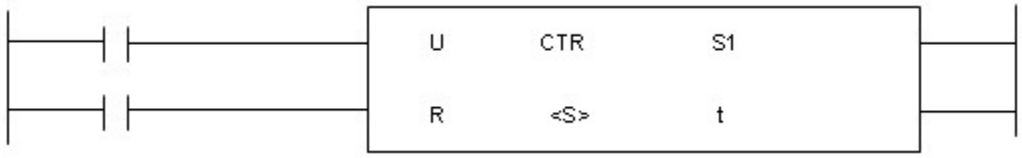
When the current value and the set value are the same by counting up the rising edge input to Contact X0000, Y0030 is set. The current value is counted down by inputting the rising edges of pulses to Contact X0001. If the input condition to reset is ON, the counter is reset and the current value is 0.





5.8.13.9 Count and Set Conditionally : CTR

Instruction		Usable Device												No.of Steps	Flag		
		M	X	Y	K	L	F	T	C	Z	D	@D	Integer		Error	Zero	Carry
CTR	S	-	-	-	-	-	-	-	o	-	-	-	-	3	-	-	-
	t	-	-	-	-	-	-	-	-	-	o	-	o				



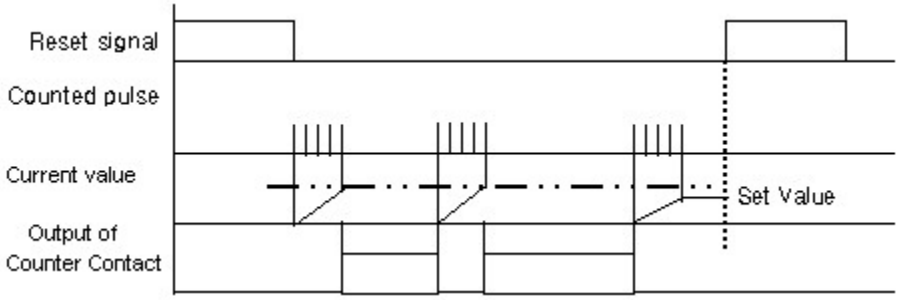
Set time(t) = Basic interval (0.1 sec or 0.001 sec) * Set value (0 ~ 65535)

S	Timer contact number
t	Set value on a counter

CTR

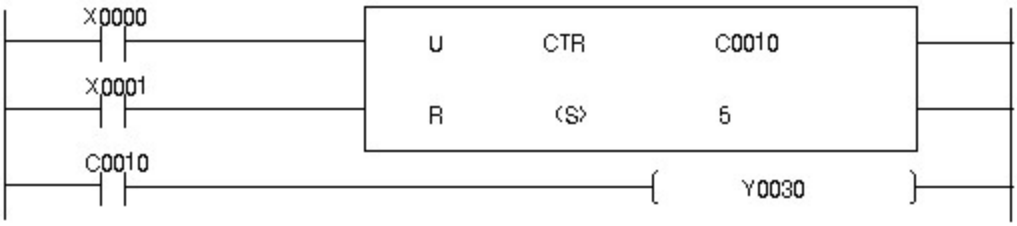
Functions :

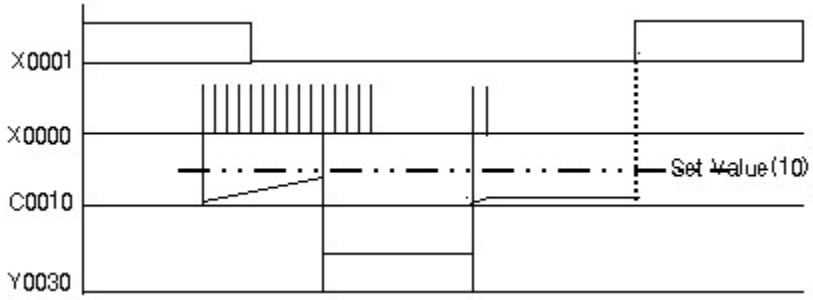
This is used to increase the current value of an counter 1 by 1 whenever the rising edge of a pulse is input, resetting the current value when the input signal is turned on from off after the current value reaches the set value. If the current value reaches the set value, the counter is set. If the current value is less than the set value or th input condition to reset is turned on, the counter is reset.



Example of Program :

When the current value and the set value are the same by counting up the rising edge input to Contact X0000, Y0030 is set. If the rising edge input to Contact X0000 is counted down at 6 times, Y0030 is turned off and the current value is set as 0. If Reset signal X0001 is turned on, the current value is reset as 0.



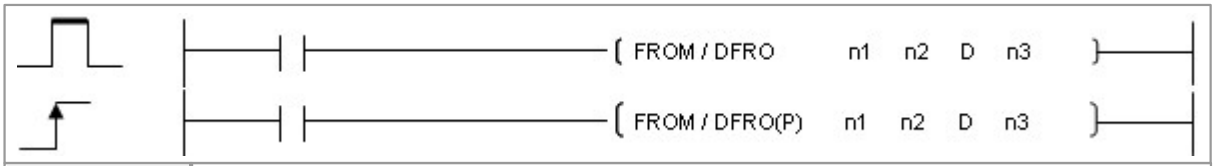


5.8.14 Buffer Memory Access Instruction

Contents :

5.8.14.1 Read 1 Word or 2 Word Data in Optional Unit : FROM, FROMP, DFRO, DFROP

Instruction		Usable Device												No.of Steps	Flag		
		M	X	Y	K	L	F	T	C	Z	D	@D	Integer		Error	Zero	Carry
FROM (P) DFRO (P)	n1	o	o	o	o	o	o	o	o	o	o	o	o	5	o	-	-
	n2	o	o	o	o	o	o	o	o	o	o	o	o				
	D	o	-	o	o	o		o	o	o	o	o	-				
	n3	o	o	o	o	o	o	o	o	o	o	o	o				



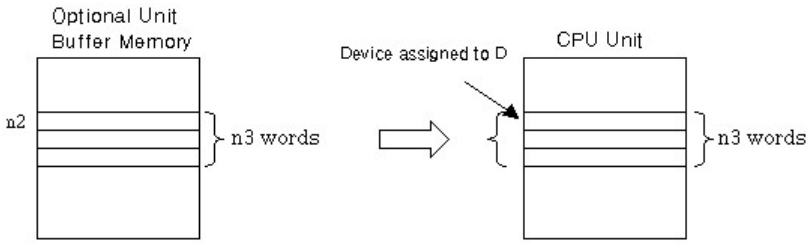
n1	Head I/O number of intelligent function module/special function module
n2	First address of data to read
D	First device number of devices which will store read data
n3	Number of the read data

Error (F110)	In case that a device is assigned to @D, if overflow is generated, it is set.

FROM

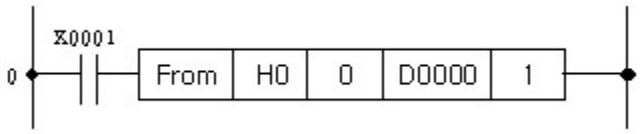
Functions :

This is used to read n3 pieces of word data in the address assigned to n2, which is in the buffer memory assigned to n2 of the optional unit assigned to n1, and to store the result in the devices from the device assigned to D.



Example of Program :

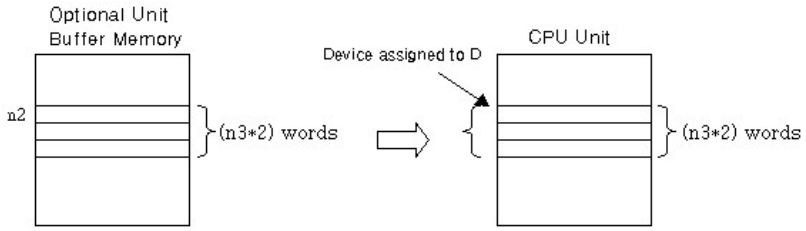
A program to read Word Data D0000 in Address 0, which is in Buffer Memory of AD Card fixed on the 0 Slot of a base unit



DFRO

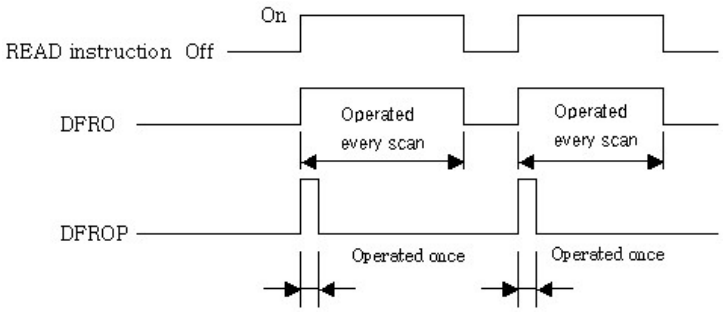
Functions :

This is used to read (n3*2) pieces of word data in the address assigned to n2, which is in the optional unit buffer memory assigned to n2, storing the result in the devices from the device assigned to D.



Operation condition :

The operation conditions of the Read instruction are as follows.

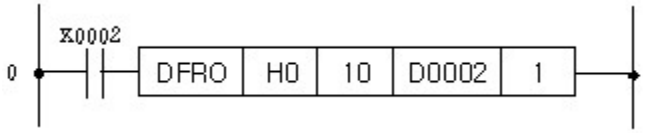


Operation Error :

In case of the following operation error, error flag is turned on. The case not to access an optional unit, the case the unit assigned to n1 is not an optional one, and the case n3 pieces of word data in the device assigned to D are over its own range.

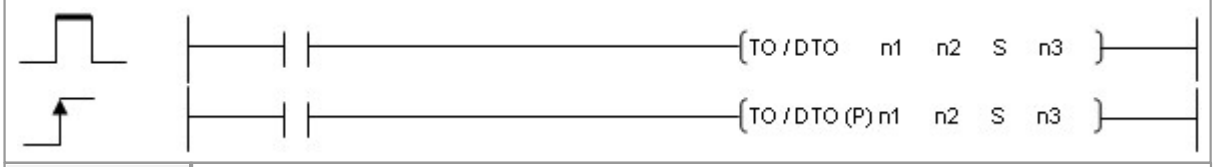
Example of Program :

A program to read Word Data D0002 in Address 10, which is in Buffer Memory of AD Card fixed on the 0 Slot of a base unit



5.8.14.2 Write 1 Word or 2 Word Data in optional Unit : TO, TOP, DTO, DTOP

Instruction		Usable Device												No.of Steps	Flag		
		M	X	Y	K	L	F	T	C	Z	D	@D	Integer		Error	Zero	Carry
TO (P) DTO (P)	n1	o	o	o	o	o	o	o	o	o	o	o	o	5	o	-	-
	n2	o	o	o	o	o	o	o	o	o	o	o	o				
	S	o	o	o	o	o	o	o	o	o	o	o	o				
	n3	o	o	o	o	o	o	o	o	o	o	o	o				



n1	Head I/O number of intelligent function module/special function module

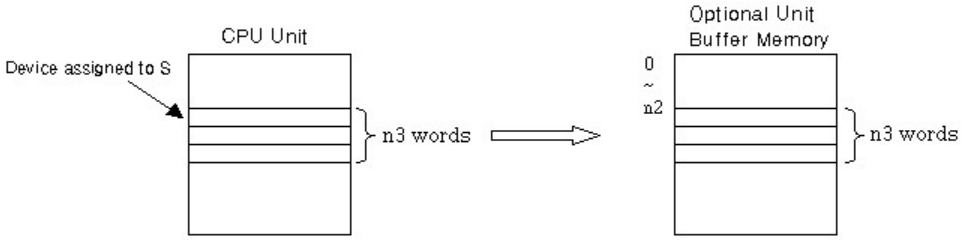
n2	First address for the data write operation
S	Start device number among the devices where written data are atored
n3	Number of read data

Error (F110)	In case that a device is assigned to @D, if overflow is generated, it is set.

TO

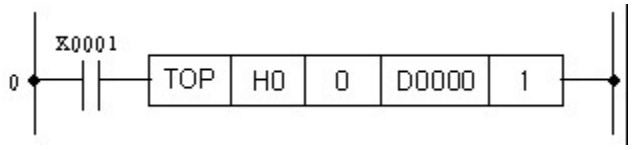
Functions :

This is used to write n3 pieces of word data, which is in the device assigned to S, to the addresses from the buffer memory assigned to n2 of the optional unit assigned to n1.



Example of Program :

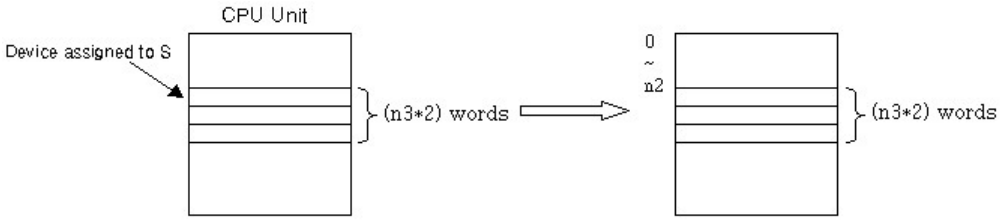
A program to write Word Data D0000 to Address 0, which is in the Buffer Memory of AD Card fixed on Slot 0 of a base unit when X0001 is turned on



DTO

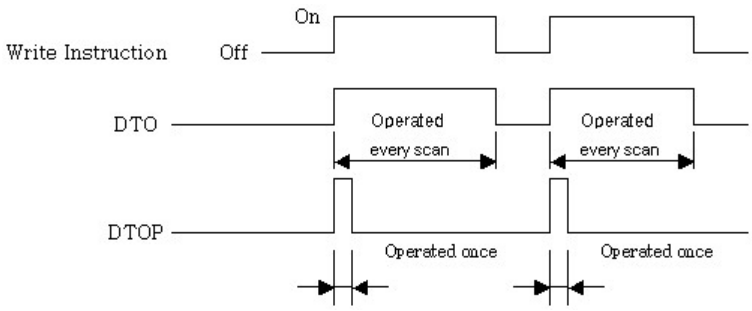
Functions :

This is used to write (n3*2) pieces of word data, which is in the device assigned to S, to the addresses from the buffer memory assigned to n2 of the optional unit assigned to n1.



Operation condition :

The operation conditions of the Write instruction are as follows.

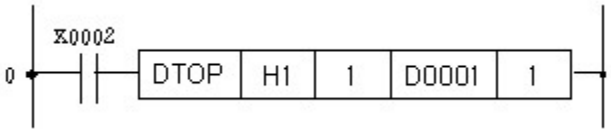


Operation error :

In case of the following operation error, error flag is turned on. The case not to access an optional unit, the case the unit assigned to n1 is not an optional one, and the case n3 pieces of word data in the device assigned to D are over its own range.

Example of Program :

A program to write Word Data D0001 to Address 1 and Word Data D0002 to Address 2, which are in the Buffer Memory of AD Card fixed on Slot 1 of a base unit when X0002 is turned on

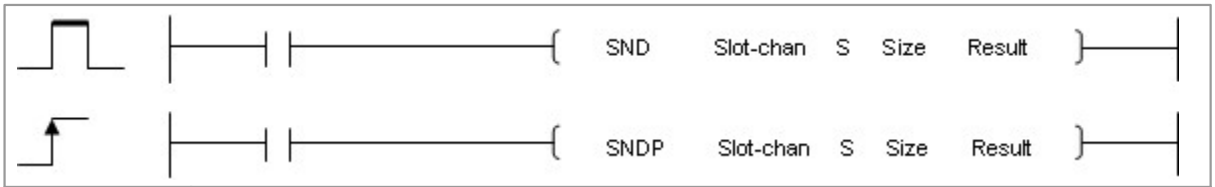


5.8.15 Instruction for Data Link

Contents :

5.8.15.1 Send Data : SND, SNDP

Instruction		Usable Device												No.of Steps	Flag		
		M	X	Y	K	L	F	T	C	Z	D	@D	Integer		Error	Zero	Carry
SND SNDP	Slot-chan	o	o	o	o	o	o	o	o	o	o	o	o	5	o	-	-
	D	o	o	o	o	o	-	o	o	o	o	o	o				
	Size	o	o	o	o	o	-	o	o	o	o	o	o				
	Result	o	o	o	o	o	-	o	o	o	o	o	-				



Slot-chan	Communication-card-mounted slot number and form of communication
D	Address of the start device where the prime data is stored
Size	Length of the frame sent in Byte
Result	Word device to which a sent result is noticed

Error (F110)	In case that a device is assigned to @D, if overflow is generated, it is set.

SND

Functions :

This is a instruction to send the data in the device, which is in a mater unit and assigned to S, to a slave unit..

How to assign a slot number for the Slot-chan and type of communication.

a. Express in hexadecimal number

b. Select the upper byte(Bit 8 ~ F) as extension number(Local device : 0, extended devices : 1~F)

c. Assign a bit from 5th bit to 8th bit(Bit 4 ~ 7) in the lower byte as type of communication. (0 : RS232C, 1 : RS422)

How to assign a device to S(Tx Data) : Assign the start address among the addresses for the devices where the prime data sent is stored

How to assign the Size : Assign the length of the frame sent in Byte (Maximum 500Bytes)

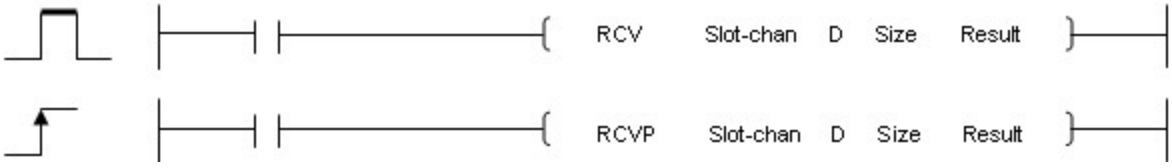
Result : Assign the word device to which the sent result in noticed
Result format : 1st Bit(Bit 0) - If a piece of data is sent, it is set for a scan. Otherwise, it is always set. 2nd Bit(Bit 1) - If a piece of data is not sent, it is always set. 3rd Bit to 8th Bit(Bit 2~7) - OFF. 9th Bit to 16th Bit (Bit 8~F) - Error Code (0 = No Error)

Example of Program :

A program to send the data in the devices, which is in a master unit, from the one assigned to D0100 to the one assigned to D0103(4 words) to a slave unit by using the RS232C communication card fixed on the 3rd slot of the 2nd extended device. The sent result is stored in M0100.

5.8.15.2 Receive Data : RCV, RCVP

Instruction		Usable Device												No.of Steps	Flag		
		M	X	Y	K	L	F	T	C	Z	D	@D	Integer		Error	Zero	Carry
RCV RCVP	Slot-chan	o	o	o	o	o	o	o	o	o	o	o	o	5	o	-	-
	D	o	o	o	o	o	-	o	o	o	o	o	o				
	Size	o	o	o	o	o	-	o	o	o	o	o	o				
	Result	o	o	o	o	o	-	o	o	o	o	o	-				



Slot-chan	Communication-card-mounted slot number and form of communication
D	Address of the start device where the prime data received is stored
Size	Length of the frame received in Byte

Result	Word device to which a received result is noticed

Error (F110)	In case that a device is assigned to @D, if overflow is generated, it is set.

RCV

Functions :

This is a instruction to receive the data, which is in the device of a mater unit, in the device which is in a slave unit and assigned to D.

- How to assign a slot number for the Slot-chan and type of communication

a. Express in hexadecimal number.
b. Select the upper byte(Bit 8 ~ F) as extension number(Local device : 0, extended devices : 1~F).
c. Assign a bit from 5th bit to 8th bit(Bit 4 ~ 7) in the lower byte as type of communication. (0 : RS232C, 1 : RS422)
d. Assign a bit from 1st bit to 4th bit(Bit 0 ~ 3) as Slot number

- **How to assign a device to D(Rx Data) :** Assign the start address in the addresses for the devices where the prime data received is stored.

- **How to assign the Size :** Assign the length of the frame received in Byte (Maximum 500Bytes)

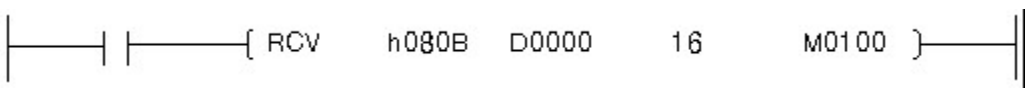
- **Result :** Assign the word device to which the received result is noticed.

- **Result format :**

a. 1st Bit(Bit 0) : If a piece of data is received, it is set for a scan. Otherwise, it is always set.
b. 2nd Bit(Bit 1) : If a piece of data is not received, it is always set.
c. 3rd Bit to 8th Bit (Bit 2~7) : OFF.
d. 9th Bit to 16th Bit (Bit 8~F) : Error Code (0 = No Error)

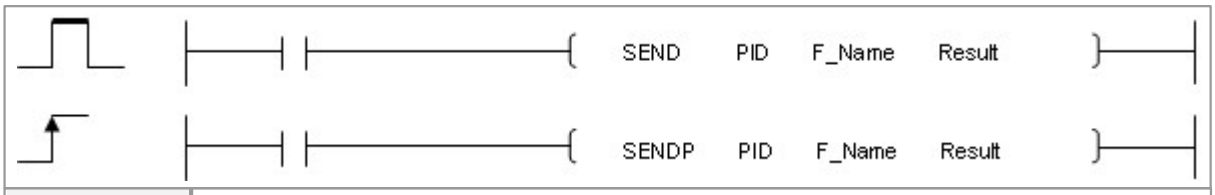
Example of Program :

A program to received the data, which is in the device of a master unit, in the devices of a slave unit from the one assigned to D0000 to the one assigned to D0007(8 words) by using the RS232C communication card fixed on the 12th slot of the 8th extended device. The sent result is stored in M0100.



5.8.15.3 Send Data : SEND, SENDP

Instruction		Usable Device												No.of Steps	Flag		
		M	X	Y	K	L	F	T	C	Z	D	@D	Integer		Error	Zero	Carry
SEND SENDP	PID	o	o	o	o	o	o	o	o	o	o	o	o	4	o	-	-
	F-Name	o	o	o	o	o	-	-	-	o	o	o	o				
	Result	o	o	o	o	o	-	-	-	o	o	o	-				



PID	Name of special program or program ID
F_Name	Frame name or frame number
Result	Word device receiving a sent result

Error (F110)	In case that a device is assigned to @D, if overflow is generated, it is set.

SEND

Functions :

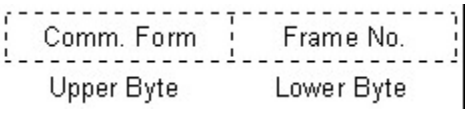
This is used to send a user frame data from a master station to slave stations. To use this instruction, the protocol of the action mode in the RS232C/422 card setup should be the user protocol and the download button be pressed. User frame can be edited by using the frame editor of special program.(Refer to the communication module or CICON manual for the details.)

- **Assigned PID :** Special program name or special program ID.

- **Assigned F_Name :**

a. Frame name or frame number can be assigned. In case of frame number, it should be assigned according to the following form.

b. Format in case of frame number : Upper byte(Bit 8~F) is Communication form(0 : RS232C, 1 : RS422/485), Lower byte(Bit 0~7) is Frame number in special program

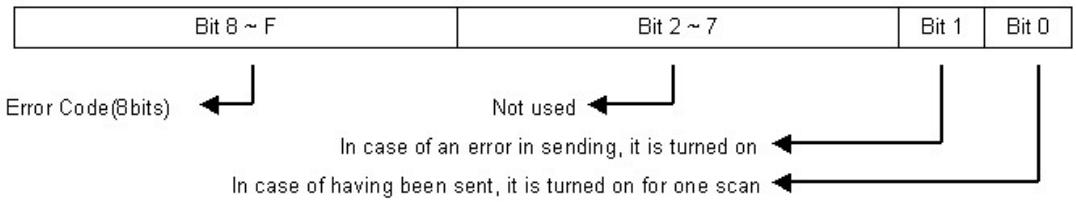


Ex.) In case Fram 3 is sent by using RS232C ? SEND (PID) h0003 (Result)

- **Result :**

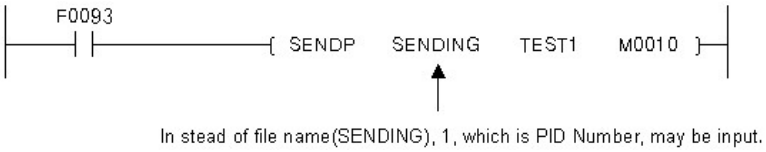
Word device receiving the sent result should be assigned.

Result format : 1st Bit(Bit 0) - When the data have been sent, it is turned on for one scan. 2nd Bit(Bit 1) - When the data have not been sent, it is always turned on. 3rd Bit ~ 8th Bit(Bit 2~7) - Turned off. 9th Bit ~ 16th Bit(Bit 8~F) - Error Code (0 = No Error)



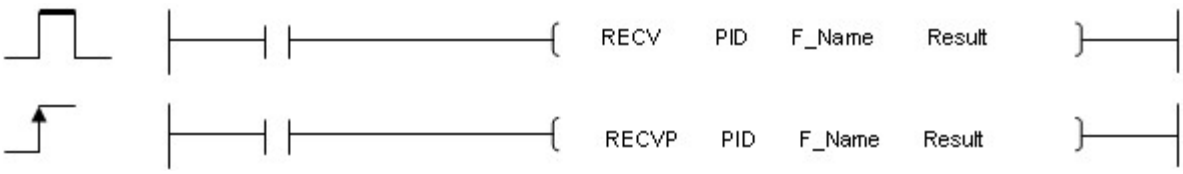
Example of Program :

A program to read the frame name data of a master station by using a RS232C/422 communication card, sending the frame assigned with the frame editor(Frame assigned to"TEST1") in the special program assigned to SENDING(PID:1) to a slave station. The sent result is stored in M0010.



5.8.15.4 Receive Data : RECV, RECVP

Instruction		Usable Device												No.of Steps	Flag		
		M	X	Y	K	L	F	T	C	Z	D	@D	Integer		Error	Zero	Carry
RECV RECVP	PID	o	o	o	o	o	o	o	o	o	o	o	o	4	o	-	-
	F-Name	o	o	o	o	o	-	-	-	o	o	o	o				
	Result	o	o	o	o	o	-	-	-	o	o	o	-				



PID	Name of special program or program ID
F_Name	Frame name or frame number

Result	Word device receiving a received result

Error (F110)	In case that a device is assigned to @D, if overflow is generated, it is set.

RECV

Functions :

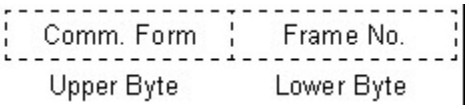
This, which is use in slave stations, is used to receive a frame data from a master station. In case the received frame coincide with user frame and is normal frame, the flag indicating received is turned on. To use this instruction, the protocol of the action mode in the RS232C/422 card setup should be the user protocol and the download button be pressed. User frame can be edited by using the frame editor of special program.(Refer to the communication module or CICON manual for the details.)

- **Assigning PID :** Special program name or special program ID

- **Assigning F_Name**

a. Frame name or frame number can be assigned. In case of frame number, it should be assigned according to the following form.

b. Format in case of frame number : Upper byte (Bit 8~F) is Communication form (0 : RS232C, 1 : RS422/485), Lower byte (Bit 0~7) is Frame number in special program.

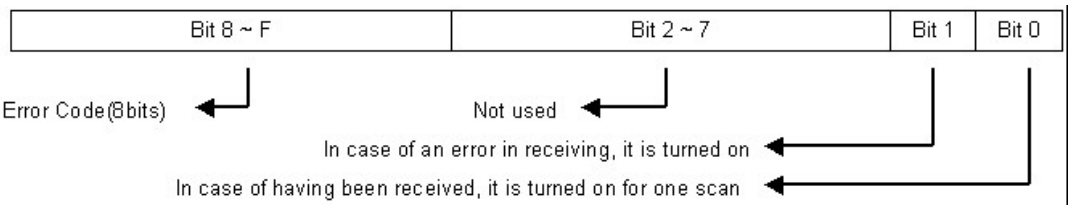


Ex.) In case Frame 5 is received by using RS422 ? RECV (PID) h0105 (Result)

- **Result :**

a. A word device receiving th received result should be assigned

b. Result fromat : 1st Bit(Bit 0) - When the data have been received, it is turned on for one scan. 2nd Bit (Bit 1) - When the data have not been received, it is always turned on. 3rd Bit ~ 8th Bit(Bit 2~7) : Turned off. 9th Bit ~ 16th Bit(Bit 8~F) : Error Code (0 = No Error)



Example of Program :

Data are received from a master station by using RS232C/422 communication card. After the data are received, the assigned frame name data is read. The following is a program to receive the frame asisgned with the frame editor(Frame assigned to “TEST2”) in the special program assigned to RECEIVING(PID:2) in a slave station. The received result is stored in M0020.

In stead of file name(RECEIVING), 2, which is PID Number, may be input.

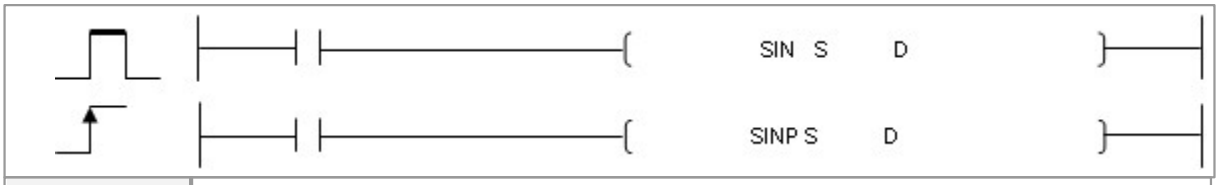
5.8.16 Real number operation Instruction

Contents :

5.8.16.1 SIN operation on floating decimal point Data : SIN, SINP

Instruction	Usable Device												No.of	Flag			Usable CPU		
	M	X	Y	K	L	F	T	C	Z	D	@D	Inte		Error	Zero	Carry	XP	CP	BP

													ger	Steps						
SIN SINP	S	o	o	o	o	o	-	-	-	o	o	o	-	3	o	-	-	o	-	-
	D	o	-	o	o	o	-	-	-	o	o	o	-							



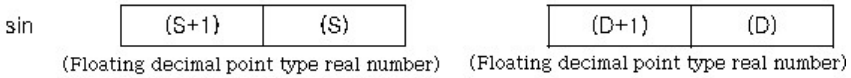
S	First device number of devices where angle data on which SIN(sine) operation will be performed is being stored
D	First device number of the devices where the operation result is stored

Error (F110)	When the specified device contains -0

SIN(P)

Explanation :

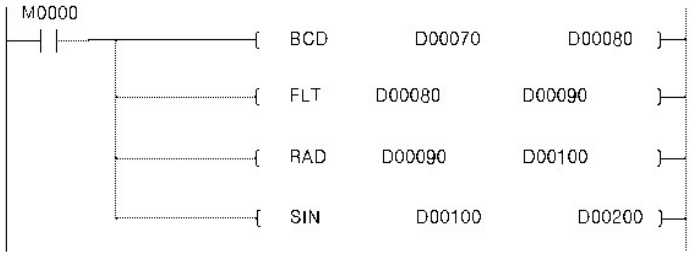
Calculates SIN (sine) value of angle designated at S and stores the operation result in the device number designated at D.



Angles designated at S are set in radian units (degrees× π/180).
For conversion between degrees and radian values, see the RAD and DEG instructions.

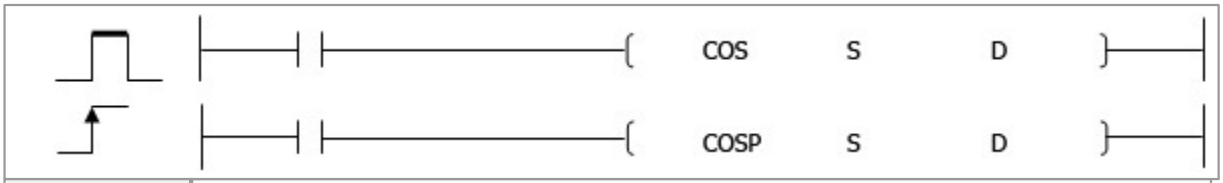
Example of Program :

Input angles for SIN operation
Convert input angles to floating decimal point type real numbers
Convert angles to radian values
Perform sine operation on converted radian values



5.8.16.2 COS Operation on floationg decimal point data : COS, COSP

Instruction		Usable Device												No.of Steps	Flag			Usable CPU		
		M	X	Y	K	L	F	T	C	Z	D	@D	Integer		Error	Zero	Carry	XP	CP	BP
COS COSP	S	o	o	o	o	o	-	-	-	o	o	o	-	3	o	-	-	o	-	-
	D	o	-	o	o	o	-	-	-	o	o	o	-							



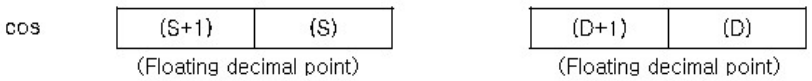
S	First device number of devices where angle data on which COS(cosine) operation will be performed is being stored
D	First device number of the devices where the operation result is stored

Error (F110)	When the specified device contains -0

COS(P)

Functions :

Performs COS (cosine) on angle designated by S and stores operation result at device number designated by D .

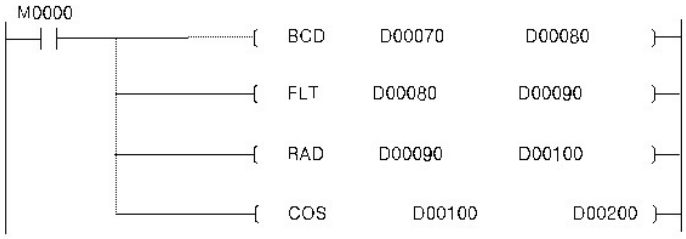


Angles designated at S are set in radian units (degrees × /180).
Angle <- -> Radian For conversion between degrees and radian values, see the RAD and DEG

instructions.

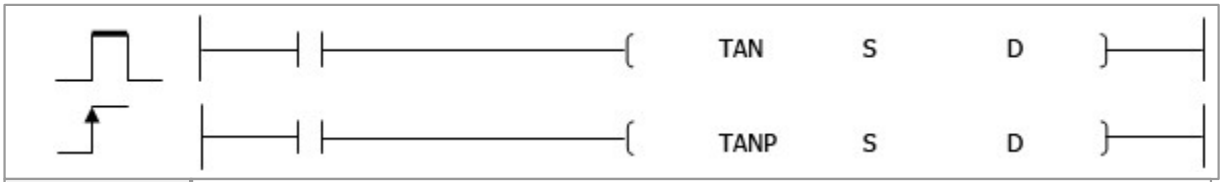
Example of Program :

Input angle D00070 to do COS arithmetic to D00080.
Change from D00080's data to floating point data and input to D00090.
Change from D00090's floating point data to Radian data and put to D00100.
Store D00100's cos arithmetic result to D00200.



5.8.16.3 TAN operation on floating decimal point Data : TAN, TANP

Instruction		Usable Device												No.of Steps	Flag			Usable CPU		
		M	X	Y	K	L	F	T	C	Z	D	@D	Integer		Error	Zero	Carry	XP	CP	BP
TAN TANP	S	o	o	o	o	o	-	-	-	o	o	o	-	3	o	-	-	o	-	-
	D	o	-	o	o	o	-	-	-	o	o	o	-							



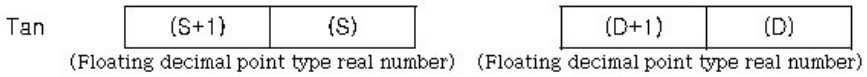
S	First device number of devices where angle data on which TAN(tangent) operation is to be performed is being stored
D	First device number of the devices where the operation result is stored

Error (F110)	• Operation result are "0", or are outside the range shown below : $\pm 2^{-127} \leq$ operation result 1 $< \pm 2^{-129}$ • When the specified device contains -0

TAN(P)

Explanation :

Performs tangent (TAN) operation on angle data designated by S , and stores operation result in device designated by D .



Angles designated at S are set in radian units (degrees× π/180).

For conversion between degrees and radian values, see the RAD and DEG instructions.

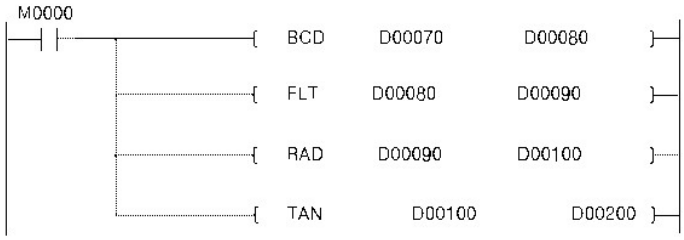
Example of Program :

Input angle data(D00070) for TAN operation(D00080))

Convert input angles(D00080) to floating decimal point type real numbers(D00090)

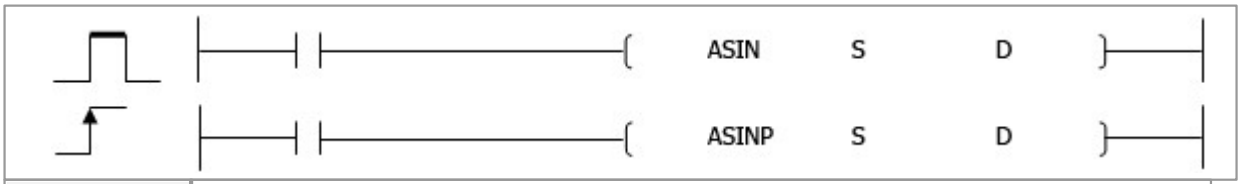
Convert angles(D00090) to radian values(D00100)

TAN operation(D00100) with converted radian value(D00200)



5.8.16.4 SIN-1 Operation on floating point data : ASIN, ASINP

Instruction		Usable Device												No.of Steps	Flag			Usable CPU		
		M	X	Y	K	L	F	T	C	Z	D	@D	Integer		Error	Zero	Carry	XP	CP	BP
ASIN ASINP	S	o	o	o	o	o	-	-	-	o	o	o	-	3	o	-	-	o	-	-
	D	o	-	o	o	o	-	-	-	o	o	o	-							



S	First device number of devices where angle data on which SIN-1(inverse sine) operation is to

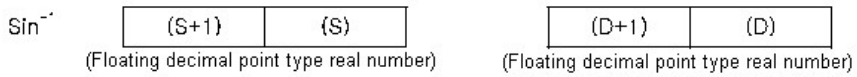
	be performed is being stored
D	First device number of the devices where the operation result is stored

Error (F110)	• The value designated by S is outside the range of from -1.0 to 1.0 • When the specified device contains -0

ASIN(P)

Functions :

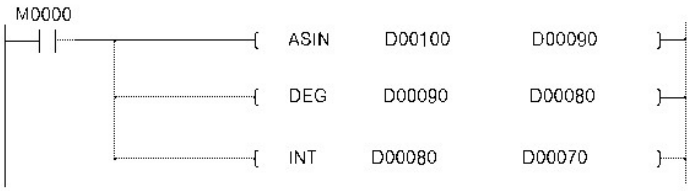
Calculates angle from sin value designated by S, and stores operation result at word device designated by D



The sin value designated by S must be inside of the range from -1.0 to 1.0.
The angle stored at D is a value in radian units.
For more information about the conversion between radian and degree, refer to descriptions of DEG and RAD

Example of Program :

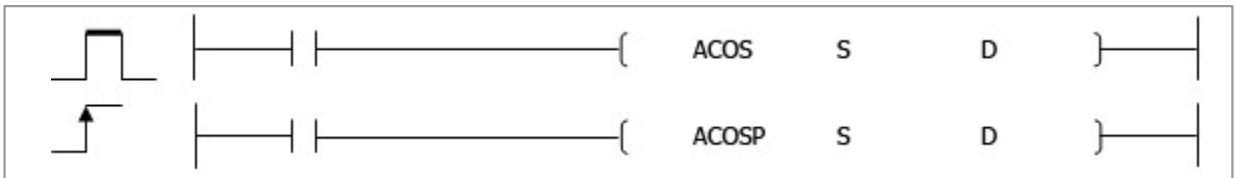
sin-1 operation calculates angle in radian from D00100 and stores the result to D00090.
Converts the radian value in D00090 to degree and stores it to D00080.
Converts the floating point value in D00080 to integer and store it to D00070.



5.8.16.5 COS-1 Operation on floating point data : ACOS, ACOSP

Instruction	Usable Device												No.of Step	Flag			Usable CPU		
	M	X	Y	K	L	F	T	C	Z	D	@D	Integer		Error	Zero	Carry	XP	CP	BP

													s						
ACOS ACOSP	S	o	o	o	o	o	-	-	-	o	o	o	-	3	o	-	-	o	-	-
	D	o	-	o	o	o	-	-	-	o	o	o	-							



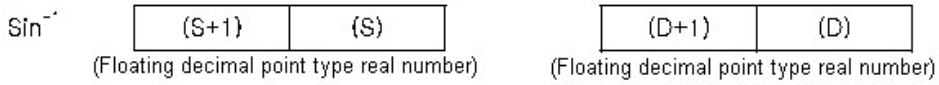
S	First device number of devices where COS value on which COS-1 (inverse cosine) operation is to be performed is stored
D	First device number of the devices where the operation result is stored

Error (F110)	• The value designated by S is outside the range of from -1.0 to 1.0 • When the specified device contains -0

ACOS(P)

Function :

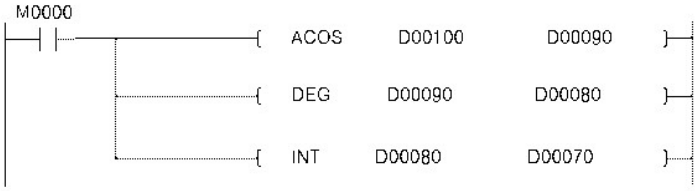
Calculates angle from COS value designated by S, and stores operation result at word device designated by D



The COS value designated by S must be inside of the range from -1.0 to 1.0.
The angle stored at D is a value in radian units.
For more information about the conversion between radian and degree, refer to descriptions of DEG and RAD

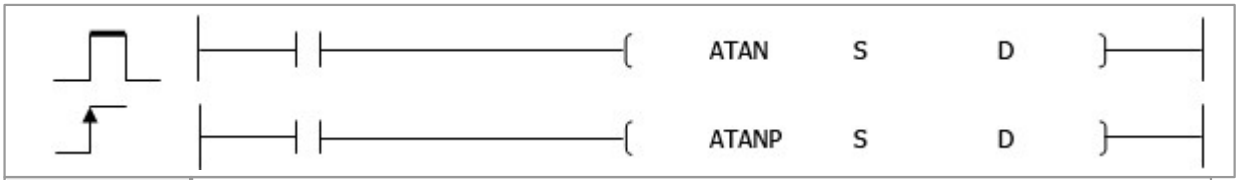
Example of Program :

cos-1 operation calculates angle in radian from D00100 and stores the result to D00090.
Converts the radian value in D00090 to degree and stores it to D00080.
Converts the floating point value in D00080 to integer and store it to D00070.



5.8.16.6 TAN-1 Operation on floating point data : ATAN, ATANP

Instruction		Usable Device												No.of Steps	Flag			Usable CPU		
		M	X	Y	K	L	F	T	C	Z	D	@D	Integer		Error	Zero	Carry	XP	CP	BP
ATAN ATANP	S	o	o	o	o	o	-	-	-	o	o	o	-	3	o	-	-	o	-	-
	D	o	-	o	o	o	-	-	-	o	o	o	-							



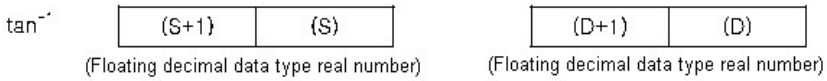
S	First device number of devices storing TAN value on which TAN-1 (inverse tangent) value will be performed
D	First device number of the devices where the operation result is stored

Error (F110)	When the specified device contains -0

ATAN(P)

Function :

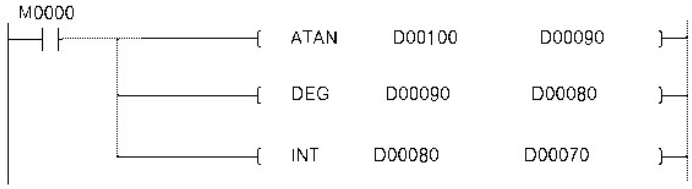
Calculates angle from tan value designated by S, and stores operation result at word device designated by D



The tan value designated by S must be inside of the range from -1.0 to 1.0.
The angle stored at D is a value in radian units.
For more information about the conversion between radian and degree, refer to descriptions of DEG and RAD

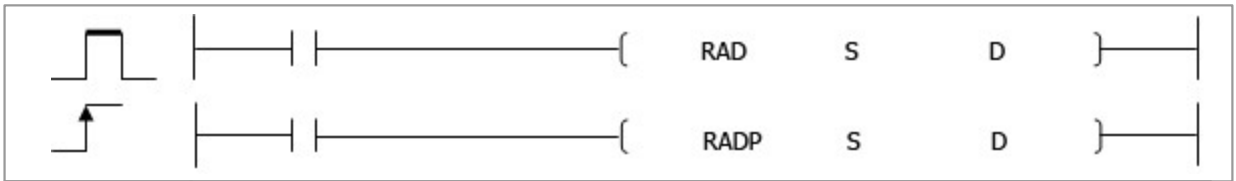
Example of Program :

tan-1 operation calculates angle in radian from D00100 and stores the result to D00090.
Converts the radian value in D00090 to degree and stores it to D00080.
Converts the floating point value in D00080 to integer and store it to D00070.



5.8.16.7 Conversion form floating decimal point angle to radian : RAD, RADP

Instruction		Usable Device												No.of Steps	Flag			Usable CPU		
		M	X	Y	K	L	F	T	C	Z	D	@D	Integer		Error	Zero	Carry	XP	CP	BP
RAD RADP	S	o	o	o	o	o	-	-	-	o	o	o	-	3	o	-	-	o	-	-
	D	o	-	o	o	o	-	-	-	o	o	o	-							



S	First device number of devices storing angle to be converted to radian
D	First device number of devices where radian value will be stored after conversion

Error (F110)	When the specified device contains -0

RAD(P)

Function :

Converts units of angle size from angle units designated by S to radian units, and stores result at device number designated by D.

RAD

(S+1)	(S)

floating decimal point : °

(D+1)	(D)

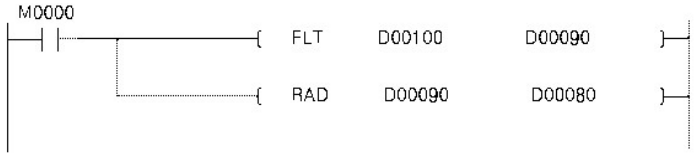
floating decimal point : rad

Conversion from degree to radian units is performed according to the following equation

$$\text{Radian unit} = \text{Degree unit} \times (\pi / 180)$$

Example of Program :

Conversion of input data to floating point type real number.
The following program converts the angle at D90 to radians, and stores results as floating decimal point type real number at D80.



5.8.16.8 Conversion from floating decimal point radian to angle : DEG, DEGP

Instruction		Usable Device												No.of Steps	Flag			Usable CPU		
		M	X	Y	K	L	F	T	C	Z	D	@D	Integer		Error	Zero	Carry	XP	CP	BP
DEG DEGP	S	o	o	o	o	o	-	-	-	o	o	o	-	3	o	-	-	o	-	-
	D	o	-	o	o	o	-	-	-	o	o	o	-							

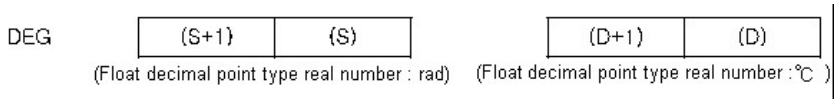
S	First device number of devices storing radian angle to be converted to degrees
D	First device number of devices where degree value will be stored after conversion

Error (F110)	When the specified device contains -0

DEG(P)

Explanation :

Converts Unit of angle size from radian units designated by S to angles, and stores result at device number designated by D.

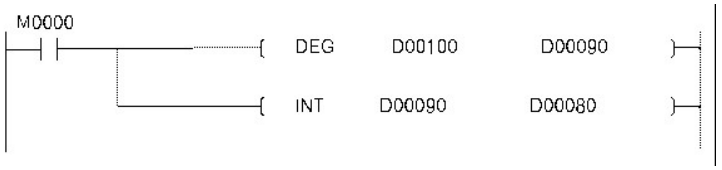


The conversion from radians to angle is performed according to the following equation.

[Angle unit = Radian unit * (180 / π)]

Example of program :

Convert radian(D00100) value to angle(D00090).
convert floating decimal point type real number angle(D00090) to integer value(D00080).



5.8.16.9 Square root operations for floating decimal point Data : SQR, SQRP

Instruction		Usable Device												No.of Steps	Flag			Usable CPU		
		M	X	Y	K	L	F	T	C	Z	D	@D	Integer		Error	Zero	Carry	XP	CP	BP
SQR SQRP	S	o	o	o	o	o	-	-	-	o	o	o	-	3	o	-	-	o	-	-
	D	o	-	o	o	o	-	-	-	o	o	o	-							

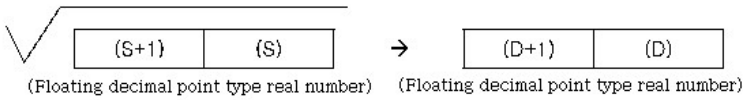
S	First device number of devices storing data on which square root operation will be conducted
D	First device number of devices where degree value will be stored after conversion

Error (F110)	• The value designated by S is a negative number • When the specified device contains -0

SQR(P)

Explanation :

Calculates square root of value designated at S , and stores the operation result in the device number designated at D .



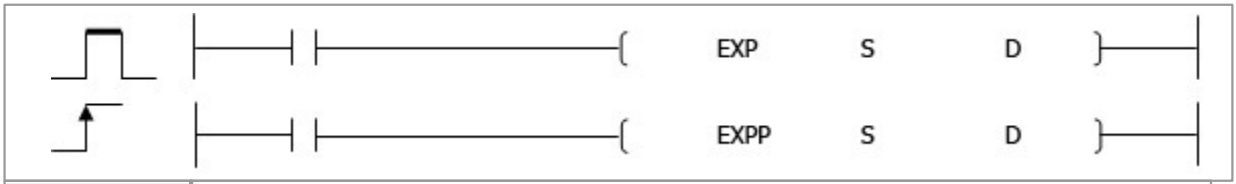
Only positive values can be designated by S (Operation cannot be performed on negative numbers.)

Example of Program :

Conversion of input data to floating decimal point type real number
Calculation of square root

5.8.16.10 Exponent operation on floating decimal point dataInstruction : EXP, EXPP

Instruction		Usable Device												No.of Steps	Flag			Usable CPU		
		M	X	Y	K	L	F	T	C	Z	D	@D	Integer		Error	Zero	Carry	XP	CP	BP
EXP EXPP	S	o	o	o	o	o	-	-	-	o	o	o	-	3	o	-	-	o	-	-
	D	o	-	o	o	o	-	-	-	o	o	o	-							



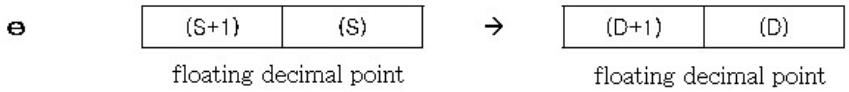
S	First device number of devices storing data on which exponent operation will be performed
D	First device number of the devices where the operation result is stored

Error (F110)	• Operation result are not within the range indicated : $\pm 2^{-127} \leq$ (operation results) $< \pm 2^{129}$ • When the specified device contains -0

EXP(P)

Function :

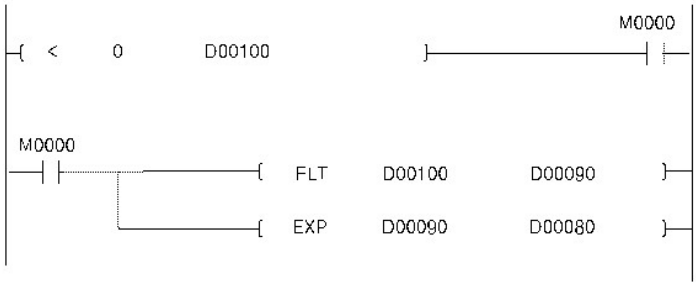
Calculates exponent for value designated by S, and stores the result of the operation at the device designate by D



Exponent operations are calculated talking the base e to be“ 2.71828”

Example of Program :

Compares decimal value 0 to the data at D100, and establishes continuity if the D100 data is less than 0. (Check of the range of values for operation)
Conversion of input data to floating point type real number.
Performs an exponent operation on the value at D90, and stores the result as a floating decimal point real number at D0 and D1.



5.8.16.11 Natural logarithm operations on floating decimal point Data : LOG, LOGP

Instruction	Usable Device												No.of Steps	Flag			Usable CPU		
	M	X	Y	K	L	F	T	C	Z	D	@D	Integer		Error	Zero	Carry	XP	CP	BP

LOG LOGP	S	o	o	o	o	o	-	-	-	o	o	o	-	3	o	-	-	o	-	-
	D	o	-	o	o	o	-	-	-	o	o	o	-							

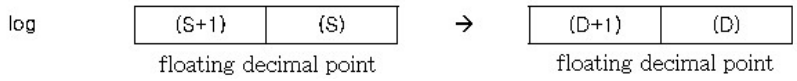
S	First device number of devices storing data for natural logarithm operation
D	First device number of the devices where the operation result is stored

Error (F110)	• The value designated be S is negative • Operation result are not within the range indicated : $\pm 2^{-127} \leq$ (operation results) $< \pm 2^{129}$ • When the specified device contains -0

LOG(P)

Function :

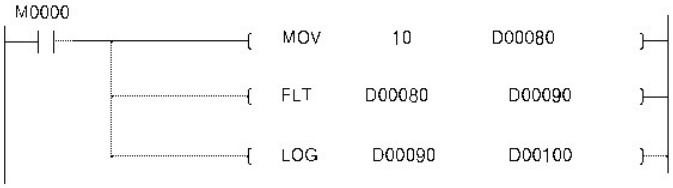
Calculates natural logarithm of value designated by S taking e as base, and stores operation results at device designated by D.



Only positive values can be designated by S. (Operation cannot be performed on negative numbers.)

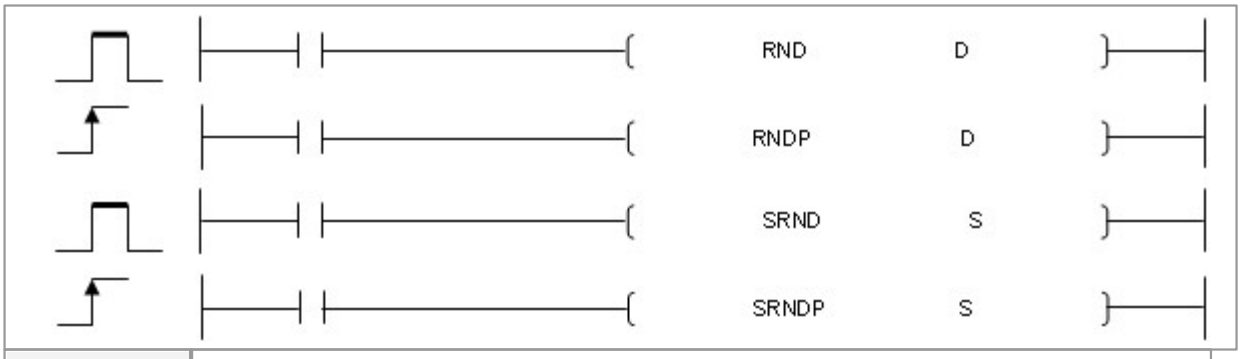
Example of Program :

The following program seeks the natural logarithm of the value "10" set by D00080.
Conversion of input data to floating point type real number. Stores the result at D00100.



5.8.16.12 Random number generate and series Update : RND, RNDP, SRND, SRNDP

Instruction		Usable Device												No.of Steps	Flag			Usable CPU		
		M	X	Y	K	L	F	T	C	Z	D	@D	Integer		Error	Zero	Carry	XP	CP	BP
RND(P) SRND(P)	S	o	-	o	o	o	-	o	o	o	o	o	o	2	o	-	-	o	-	-
	D	o	-	o	o	o	-	o	o	o	o	o	o							



S	First device number of devices to store random number
D	Random number serial data or first device number of devices where such data is being stored

Error (F110)	There are no operation errors associated with the RND(P) or SRND(P) instructions

RND(P)

Explanation :

Generates random number of from 0 to 32767, and stores at device designated by D

Example of Program :

The following program stores random number at D00100 when M0000 is ON.

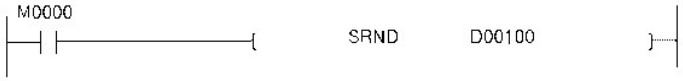
SRND(P)

Explanation :

Updates random number series according to the 16-bit BIN data being stored in device designated by S

Example of Program :

The following program updates a random number series according to the contents of D00100 when M0000 goes ON.



5.8.16.13 BCD of 4 Digit, Square root of 8 Digit : BSQR, BSQRP, BDSQR, BDSQRP

Instruction		Usable Device												No.of Steps	Flag			Usable CPU		
		M	X	Y	K	L	F	T	C	Z	D	@D	Integer		Error	Zero	Carry	XP	CP	BP
BSQR (P) BDSQR (P)	S	o	o	o	o	o	-	-	-	o	o	o	o	3	o	-	-	o	-	-
	D	o	-	o	o	o	-	-	-	o	o	o	o							

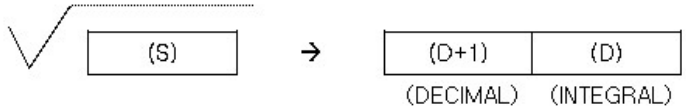
S	Data on which square root calculation will be performed, or number of device where such data is being stored
D	First device number of devices that will store square root calculation results

Error (F110)	The data designated by S is not a BCD value

BSQR(P)

Functions :

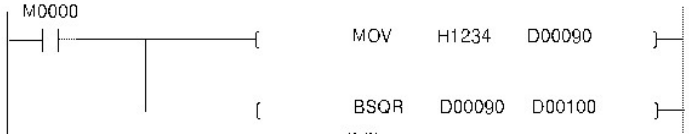
Store appointed data to area that is specified by D after square root arithmetic by S.



Appointed value is between 9999 from 0 by BCD value by S.
D, D+1 relationship value by each BCD value 0 ~ 9999 store .
Value of D+1, D+2 is - 1.0000 ~ 1.0000 extent's BCD data.
Arithmetic result amounts to value that round off to the nearest whole number decimal fifth figure.
Therefore, there is error of ± 1 with the decimal department 4th figure.

Example of Program :

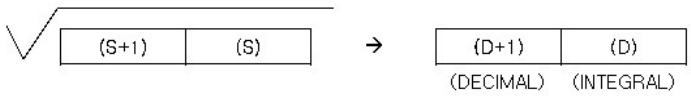
Store BCD data 1234 to do square root arithmetic to D00090.
Store D00090's data to D00100 after square root arithmetic.
Integer with arithmetic result is stored to D00100 and decimal is stored to D00101.



BDSQR(P)

Functions :

Store appointed data in area that is specified by D after square root arithmetic by S.

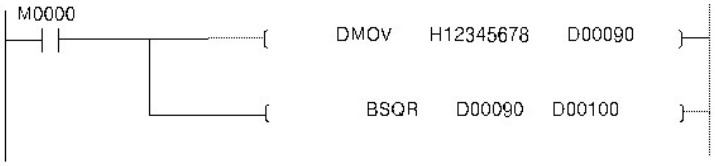


Store appointed data in area that is specified by D after square root arithmetic by S.
Appointed value is between 99999999 from 0 by BCD value by S, S+1.
D, D+1 relationship value stores 0 ~ 9999 by each BCD value.
Arithmetic result amounts to value that round off to the nearest whole number decimal department fifth figure. Therefore, error of ± 1 of the decimal department 4th figure occur.

Example of Program :

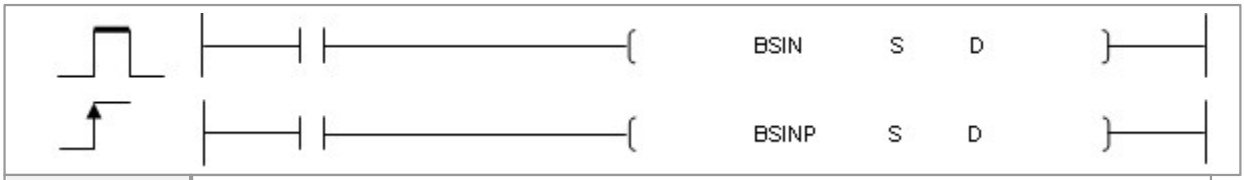
Store to BCD data 12345678 Reul D00090s to do square root arithmetic.
Store D00090's data to D00100 after square root arithmetic.

Integer with arithmetic result is stored to D00100 and decimal is stored to D00101.



5.8.16.14 BCD Type SIN operation : BSIN, BSINP

Instruction		Usable Device												No.of Steps	Flag			Usable CPU		
		M	X	Y	K	L	F	T	C	Z	D	@D	Integer		Error	Zero	Carry	XP	CP	BP
BSIN BSINP	S	o	o	o	o	o	-	-	-	o	o	o	o	3	o	-	-	o	-	-
	D	o	-	o	o	o	-	-	-	o	o	o	o							



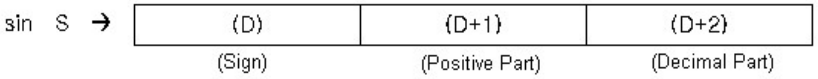
S	Data on which SIN (sine) operation will be performed, or number of device where such data is being stored
D	First device number of the devices where the operation result is stored

Error (F110)	• The data designated by S is not a BCD value • The data designated by S is not in the range of from 0 to 360

BSIN(P)

Function :

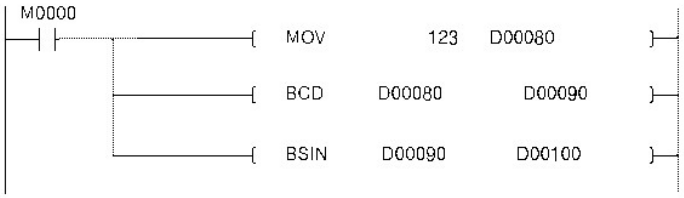
Calculates the sin value of the designated value, and stores the sign of the operation result in the device at D, and the operation result in the device designated at D+1 and D+2.



The value designated at S is a BCD value which can be between 0 to 360 degrees
The sign for the operation result stored in D will be "0" if the result is a positive value, and "1" if the result is a negative value.
The operation results stored in D+1 and D+2 are BCD values between -1.0000 and 1.0000
The operation results are rounded off from the fifth decimal place.

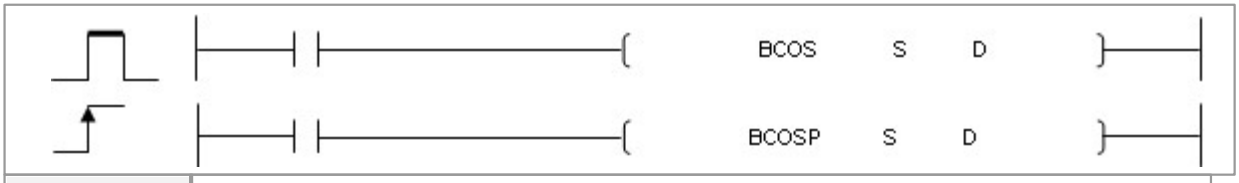
Example of Program :

Stores 123 to D00080.
Convert the value at D00080 to BCD and stores it at D00090
Calculates the cos value from the value D00090 and stores it at D00100 , D00101 , D00102.



5.8.16.15 BCD Type COS Operation : BCOS, BCOSP

Instruction		Usable Device												No.of Steps	Flag			Usable CPU		
		M	X	Y	K	L	F	T	C	Z	D	@D	Integer		Error	Zero	Carry	XP	CP	BP
BCOS BCOSP	S	o	o	o	o	o	-	-	-	o	o	o	o	3	o	-	-	o	-	-
	D	o	-	o	o	o	-	-	-	o	o	o	o							



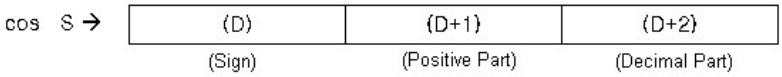
S	Data on which COS (cosine) operation will be performed, or first device number of devices storing such data
D	First device number of the devices where the operation result is stored Functions

Error (F110)	• The data designated by S is not a BCD value • The data designated by S is not in the range of from 0 to 360

BCOS(P)

Function :

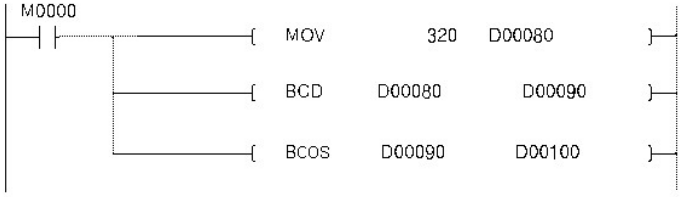
Calculates the cos value of the designated value, and stores the sign of the operation result in the device at D, and the operation result in the device designated at D+1 and D+2.



The value designated at S is a BCD value which can be between 0 to 360 degrees
The sign for the operation result stored in D will be "0" if the result is a positive value, and "1" if the result is a negative value.
The operation results stored in D+1 and D+2 are BCD values between -1.0000 and 1.0000
The operation results are rounded off from the fifth decimal place.

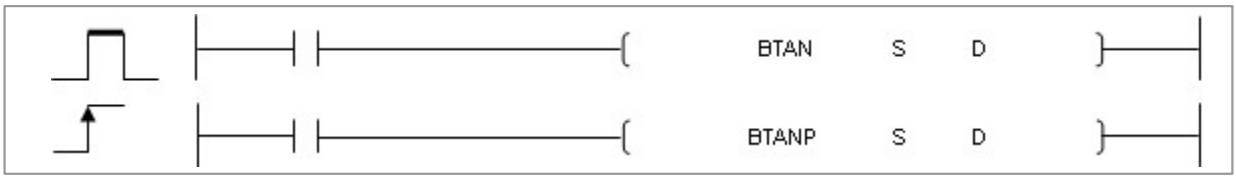
Example of program :

Stores 320 to D00080.
Convert the value at D00080 to BCD and stores it at D00090
Calculates the cos value from the value D00090 and stores it at D00100 , D00101 , D00102.



5.8.16.16 BCD Type TAN Operation : BTAN, BTANP

Instruction		Usable Device												No.of Steps	Flag			Usable CPU		
		M	X	Y	K	L	F	T	C	Z	D	@D	Integer		Error	Zero	Carry	XP	CP	BP
BTAN BTANP	S	o	o	o	o	o	-	-	-	o	o	o	o	3	o	-	-	o	-	-
	D	o	-	o	o	o	-	-	-	o	o	o	o							



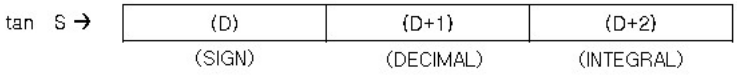
S	Data on which TAN (tangent) operation is to be performed, or first device number of devices where such data is being stored
D	First device number of the devices where the operation result is stored

Error (F110)	• The data designated by S is not a BCD value • The data designated by S is not in the range of from 0 to 360 • The data designated by S is 90º or 270º

BTAN(P)

Functions :

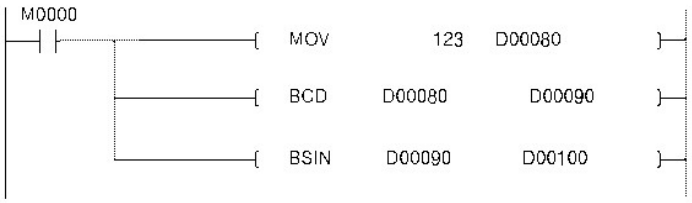
Calculates TAN (tangent) value for value (angle) designated by S , and stores the sign for the operation result in the word device designated by D , and the operation result in the word device designated by D +1 and D +2.



The value designated at S is a BCD value which can be between 0 and 360 degrees (in units of degrees).
The sign for the operation result stored in D will be "0" if the result is a positive value, and "1" if the result is a negative value.
The operation results stored at D +1 and D +2 are BCD values within the range of from -57.2900 and 57.2900.
Operation results are rounded off from the fifth decimal place.

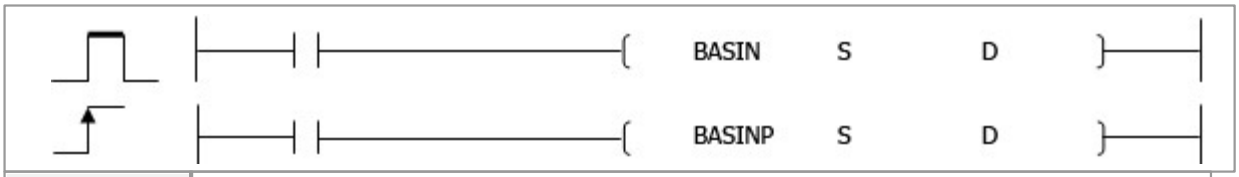
Example of Program :

Store angle 320 to D00080.
Convert D00080's data to BCD data and store to D00090.
Store cos arithmetic result of D00090's BCD data to D00100, D00101, D00102.



5.8.16.17 BCD Type SIN-1 Operations : BASIN, BASINP

Instruction		Usable Device												No.of Steps	Flag			Usable CPU		
		M	X	Y	K	L	F	T	C	Z	D	@D	Integer		Error	Zero	Carry	XP	CP	BP
BASIN BASINP	S	o	o	o	o	o	-	-	-	o	o	o	o	3	o	-	-	o	-	-
	D	o	-	o	o	o	-	-	-	o	o	o	o							



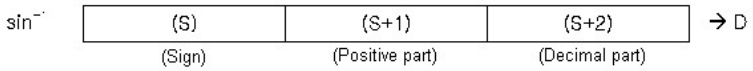
S	Data on which SIN^{-1} (inverse sine) operation will be performed, or device number where such data is being stored
D	First device number of the devices where the operation result is stored

Error (F110)	• The data designated by S is not a BCD value • The data designated by S is not in the range of from -1.000 to 1.000

BASIN(P)

Function :

Calculates angle from sin value designated by S, and stores operation result at word device designated by D



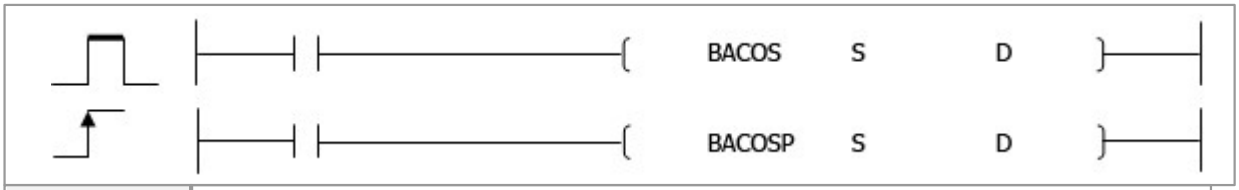
A sign for the operation data is set at S: (positive=0, negative=1)
The part before the decimal point and fraction part are stored at S+1, S+2 respectively as BCD value.
(Settings can be between 0 and 1.0000)
The Operation results stored at D will be a BCD value in the range of 0~180°
The Calculation results are a value from which the decimal fraction part has been rounded.

Example of Program :

The result of sin-1 0.1234 is stored at D00200.

5.8.16.18 BCD Type COS-1 Operation : BACOS, BACOSP

Instruction		Usable Device												No.of Steps	Flag			Usable CPU		
		M	X	Y	K	L	F	T	C	Z	D	@D	Integer		Error	Zero	Carry	XP	CP	BP
BACOS BACOSP	S	o	o	o	o	o	-	-	-	o	o	o	o	3	o	-	-	o	-	-
	D	o	-	o	o	o	-	-	-	o	o	o	o							



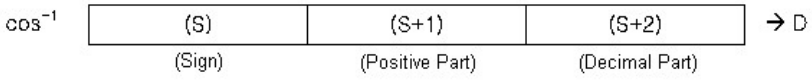
S	Data on which COS^{-1} (inverse cosine) operation will be performed, or first device number of devices where such data is being stored
D	First device number of the devices where the operation result is stored

Error (F110)	• The data designated by S is not a BCD value • The data designated by S is not in the range of from -1.000 to 1.000

BACOS(P)

Function :

Calculates angle from COS value designated by S, and stores operation result at word device designated by D



A sign for the operation data is set at S: (positive=0, negative=1)

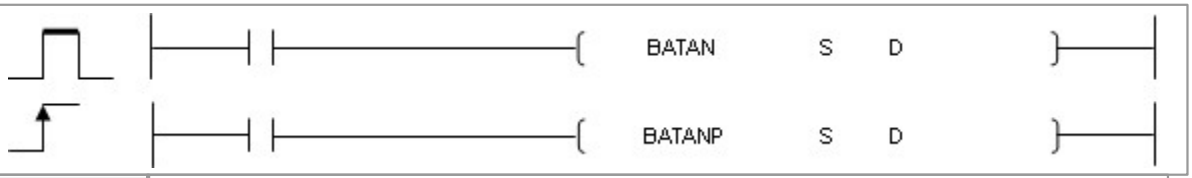
The part before the decimal point and fraction part are stored at S+1, S+2 respectively as BCD value.
(Settings can be between 0 and 1.0000)
The Operation results stored at D will be a BCD value in the range of 0~180°
The Calculation results are a value from which the decimal fraction part has been rounded.

Example of Program :

The result of cos-1 0.1234 is stored at D00200.

5.8.16.19 BCD Type TAN-1 Operation : BATAN, BATANP

Instruction		Usable Device												No.of Steps	Flag			Usable CPU		
		M	X	Y	K	L	F	T	C	Z	D	@D	Integer		Error	Zero	Carry	XP	CP	BP
BATAN BATANP	S	o	o	o	o	o	-	-	-	o	o	o	o	3	o	-	-	o	-	-
	D	o	-	o	o	o	-	-	-	o	o	o	o							



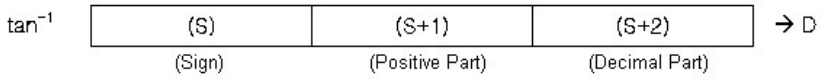
S	Data on which TAN^{-1} (inverse tangent) operation is to be performed, or first device number of devices storing such data
D	First device number of the devices where the operation result is stored

Error (F110)	• The data designated by S is not a BCD value

BATAN(P)

Function :

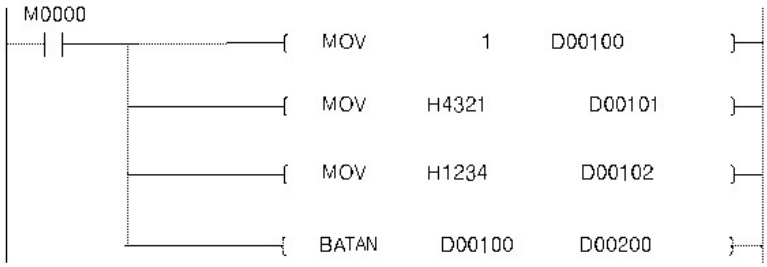
Calculates angle from sin value designated by S, and stores operation result at word device designated by D



A sign for the operation data is set at S: (positive=0, negative=1)
The part before the decimal point and fraction part are stored at S+1, S+2 respectively as BCD value. (Settings can be between 0 and 1.0000)
The Operation results stored at D will be a BCD value in the range of 0~180°
The Calculation results are a value from which the decimal fraction part has been rounded.

Example of Program :

The result of tan-1 -4321.1234 is stored at D00200.



5.8.17 Read / Write Instruction

Contents :

5.8.17.1 Setting Data Memory Access Instruction Special function module Setting Data Read : FREAD, FREADP

Instruction	Usable Device												No.of Step	Flag			Usable CPU		
	M	X	Y	K	L	F	T	C	Z	D	@D	Integer		Error	Zero	Carry	XP	CP	BP

														s						
FREAD FREADP	n1	o	o	o	o	o	o	o	o	o	o	o	o	6	o	-	-	o	o	-
	n2	o	o	o	o	o	o	o	o	o	o	o	o							
	D	o	o	o	o	o	-	-	-	o	o	o	-							
	n3	o	o	o	o	o	o	o	o	o	o	o	o							
	n4	o	-	o	o	o	-	-	-	o	o	o	-							

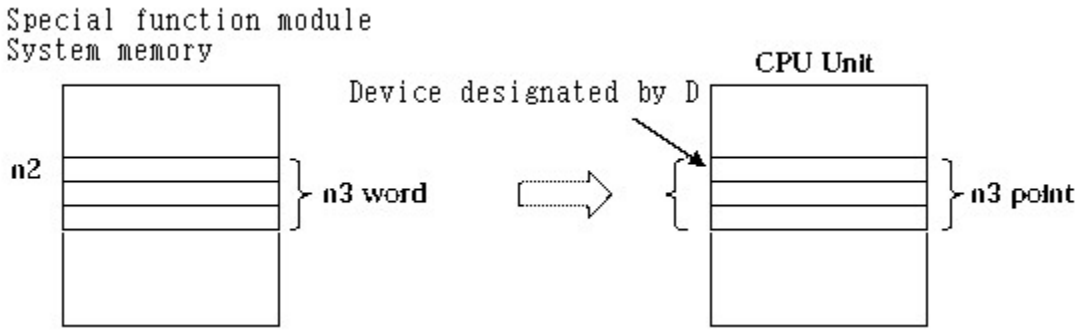
n1	Start I/O number of a optional unit
n2	Head number of the device storing the data
D	First device number of devices which will store read data
n3	Number of read data
n4	Word device to which the FREAD result is notice

Error (F110)	In case that a device is assigned to @D, if overflow is generated, it is set.

FREAD(P)

Functions :

Read n3 words of data from the address designated by n2 of the system memory of the special function module designated by n1.
Then, stores the data in the area starting from the device designated by D.
The result of instruction is stored to the device designated by n3.



How to assign a Base/Slot number(n1)

- Express in hexadecimal number.
- Select the upper byte(Bit8~F) as Base(Extension) number (Local:0, Extended:1~F)
- Assign the lower byte(Bit0~7) as Slot number(00h~ 0Bh)

How to assign a Offset(n2)

- Assign the first address of data to read. (See the special function module's Memory map)

How to assign a Size(n3)

- Assign the number of data to read.
- In the case, the value designated by n3 is must be conform to 0 < Size(n3) < 32,767, an operation error occurs.
- If n3(Size)=0, there will be no operation.

How to assign a Result(n4)

- Assign the word device to which FREAD result is noticed.
- Result format

Bit No.	Note
0	When the instruction is in progress, it is set
1	When the instruction is completed, it is set
2	When the Error is occurred, it is set
3 ~ 7	0 (Not used)
8 ~ 15	[Error Code] 00h : No error 01h : Overflow of 1 Scan dealing capacity 02h : Exceeds the relevant device range 03h : Offset value assign by n3 is out of range

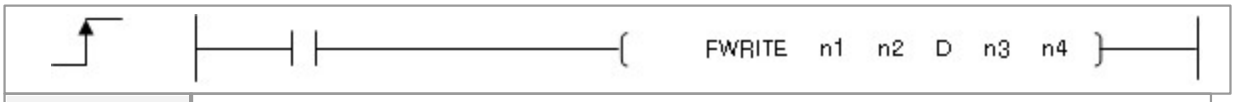
Example of Program :

The program used to read 10 words of data in Address 0, which is in the System Memory of the special function module fixed on the 1st slot of the 1st extended device, and stores data in the area starting frump the device designated by D0000.
A FREAD result is stored in M0000.

5.8.17.2 Setting Data Memory Access Instruction Special function module Setting Data Write : FWRITE, FWRITEP

Instruction	Usable Device												No.of Steps	Flag			Usable CPU		
	M	X	Y	K	L	F	T	C	Z	D	@D	Integer		Error	Zero	Carry	XP	CP	BP

FWRITE FWRITEP	n1	o	o	o	o	o	o	o	o	o	o	o	o	6	o	-	-	o	o	-
	n2	o	o	o	o	o	o	o	o	o	o	o	o							
	D	o	-	o	o	o	-	-	-	o	o	o	-							
	n3	o	o	o	o	o	o	o	o	o	o	o	o							
	n4	o	-	o	o	o	-	-	-	o	o	o	-							



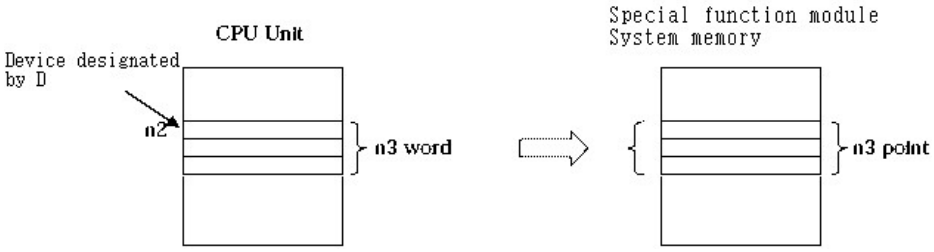
n1	Start I/O number of a optional unit
n2	First address of data to write
D	First device number of devices which will store write data
n3	Number of write data
n4	Word device to which the FWRITE result is notice

Error (F110)	In case that a device is assigned to @D, if overflow is generated, it is set.

FWRITE(P)

Functions :

Write n3 words of data from the device designated by D to the area starting from the address designated by n2 of the system memory of the special function module designated by n1.



How to assign a Base/Slot number (n1)

- Express in hexadecimal number.
- Select the upper byte(Bit8~F) as Base(Extension) number (Local:0, Extended:1~F)
- Assign the lower byte(Bit0~7) as Slot number(00h~ 0Bh)

How to assign a Offset (n2)

- Assign the first address of data to write. (See the special function module's Memory map)

How to assign a Size (n3)

- Assign the number of data to write.
- In the case, the value designated by n3 is must be conform to 0 < Size(n3) < 32,767, an operation error occurs.
- If n3(Size)=0, there will be no operation.

How to assign a Result (n4)

- Assign the word device to which FREAD result is noticed.
- Result format

Bit No.	Note
0	When the instruction is in progress, it is set
1	When the instruction is completed, it is set
2	When the Error is occurred, it is set
3 ~ 7	0 (Not used)
8 ~ 15	[Error Code] 00h : No error 01h : Overflow of 1 Scan dealing capacity 02h : Exceeds the relevant device range 03h : Offset value assign by n3 is out of range

Example of Program :

The program used to write 20 words of data from the device designated by D0020 to the area starting from the Address 28, which is in the System Momory of the special function module fixed on the 5th slot of the 3rd extended device.
A FWRITE result is stored in M0000.

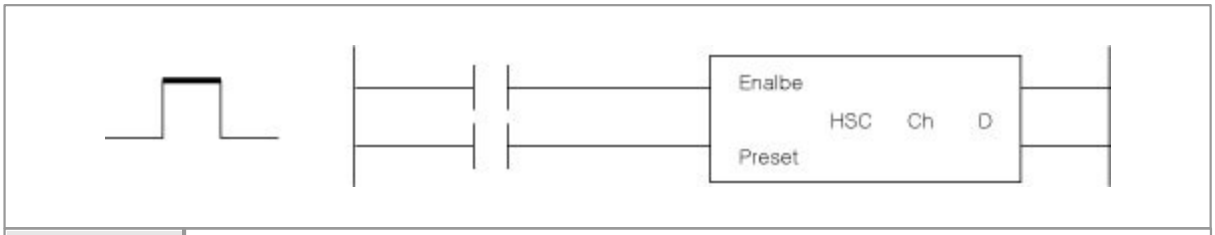
5.8.18 Instruction for High Speed Counter

See :

- Operating/Preset High Speed Counter : HSC
- Operating/Preset/SW-Adding or Subtracting High Speed Counter : HSCSW

5.8.18.1 Enable/Preset High Speed Counter : HSC

Instruction		Usable Device													No.of Steps	Flag		
		M	X	Y	K	L	F	T	C	S	Z	D	@D	Inte-ger		Error	Zero	Carry
HSC	Ch	○	○	○	○	○	-	-	-	-	○	○	○	○	3	-	-	-
	D	-	○	○	○	○	-	-	-	-	○	○	○	-				



Ch	Channel used for HSC instruction
D	Device, which is assigned to D, where counted values are stored

Error(F110)	In case that a device is assigned to @D, if overflow is generated, it is set.

Functions and Features

- This requires two execution conditons like enable and preset.
- Counting and counting-down by Phase B(SW input)can not be controlled.

- Counted values are signed 32-bit binary(-2147483648 ~ 2147483647) and are stored in the device assigned to double-word D.

- If enable signal is on, the pulses inputted from the terminal of the corresponding channel can be counted.
- If enable signal is off, the pulses inputted from the terminal of the corresponding channel is not counted.
- If enable signal is on again, pulses are continuously counted with the value in the device assigned to D.
- To keep counting status, enable signal is to be on continuously.

- If preset signal is on, the value counted on a corresponding channel is converted to the preset value assigned in the
  bulit-in HSC setup.

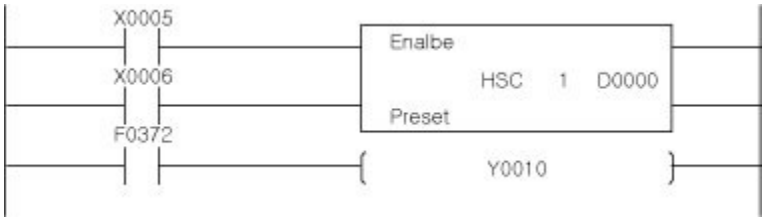
- Instructions according to input condition

Input Condition	Status	Description
Enable	On	Enabes HSC.

	Off	Disables HSC.
Preset	On	Converts the current value to prest value.

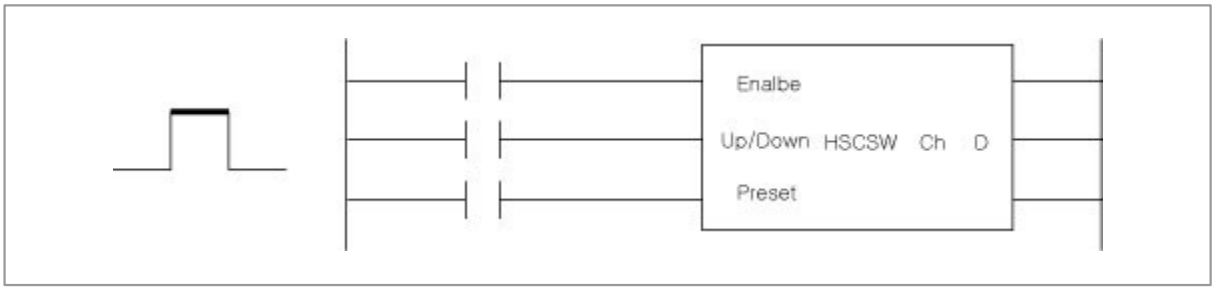
Example of Program

- If X0005 is turned on, the pulses inputted from the terminal corresponding to Channel 1 are counted and the counted result is stored in Double-word D0000. If X0006 is on, the counted value is conveted to a preset value.And, in case that the counted value is over the value set up as Coincidence 1, the falg indicating coincidence output(F0372) is on and the output to Y0010 is on.(Refer to flag indicating coincidence ouput)



5.8.18.2 Operating/Preset/SW-Adding or Subtracting High Speed Counter : HSCSW

Instruction		Usable Device													No. of Steps	Flag		
		M	X	Y	K	L	F	T	C	S	Z	D	@D	Integer		ERROR	ZERO	Carry
HSCSW	Ch	O	O	O	O	O	-	-	-	-	O	O	O	O	3	-	-	-
	D	-	O	O	O	O	-	-	-	-	O	O	O	-				



Ch	Channel used for HSC instruction.
D	Device, which is assigned to D, where counted values are stored

에러(F110)	In case that a device is assigned to @D, if overflow is generated, it is set.

Function and Features

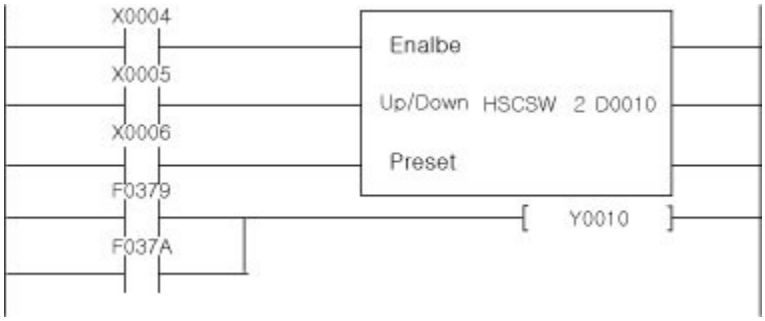
- This requires 3 execution conditions like enable, preset and up/down. Phase A is used to receive high speed pulse
input with a terminal and Phase B is used to control up/down counting by SW input.
- This is used in only case built-in HSC, 1-phase 1-multiple(PhaseB: SW input), 1-phase 2-multiple(Phase B: SW input)
are set in the PLC patameter.
- Counted values are signed 32-bit binary(-2147483648 ~ 2147483647) and are stored in the device assigned to double-word D.
- If enable signal is on, the pulses inputted from the terminal of the corresponding channel can be counted.
- If enable signal is off, the pulses inputted from the terminal of the corresponding channel is not counted.
- If enable signal is on again, pulses are continuously counted with the value in the device assigned to D.
- To keep counting status, enable signal is to be on continuously.
- If preset signal is on, the value counted on a corresponding channel is converted to the preset value assigned in
the bulit-in HSC setup.
- To count down, the up/down, which is an input condition, is to be continuously on. If it is off, pulses are counted.
- Instructions according to input condition

Input Condition	Status	Description
Enable	On	Enabes HSC.
	Off	Disables HSC.
Up / Down	On	Counts down
	Off	Counts
Preset	On	Converts the current value to prest value.

Example of Program

- If X0004 is turned on, the pulses inputted from the terminal corresponding to Channel 1 are counted and the counted result is stored in Double-word D0010. If X0005 is on, counting is converted to counting-down. If X0006 is on, counted value is conveted to a preset value.

- And, in case that counted value is over the value set up as Coincidence 1, the falg indicating coincidence output(F0379, F037A) is on and the output to Y0010 is on.(Refer to flag indicating coincidence ouput)

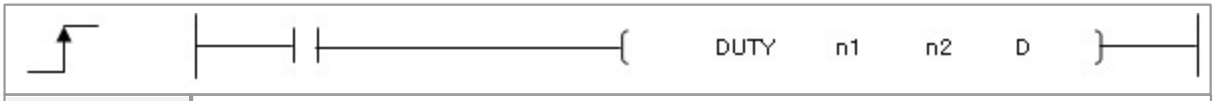


5.8.19 Other Instructions

Contents :

5.8.19.1 Timing pulse generation : DUTY

Instruction		Usable Device												No.of Steps	Flag			Usable CPU		
		M	X	Y	K	L	F	T	C	Z	D	@D	Integer		Error	Zero	Carry	XP	CP	BP
DUTY	n1	o	o	o	o	o	o	o	o	o	o	o	o	4	o	-	-	o	o	o
	n2	o	o	o	o	o	o	o	o	o	o	o	o							
	D	-	-	-	-	-	o	-	-	-	-	-	-							



n1	Number of scans forcing ON
n2	Number of scans forcing OFF

D	Timing clock for use by user (F0100 ~ F0107)

DUTY

Functions :

Turns scan designated by n1 ON for user timing block designated by D, and scan designated by n2 OFF.

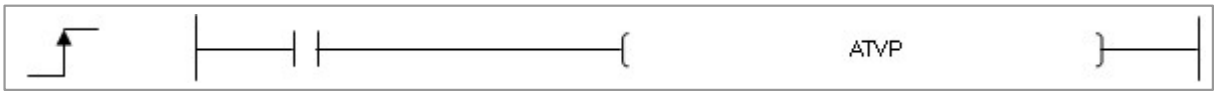
Scan execution type programs use F0100 through F0107.

Example of Program :

USER CLOCK The following program turns F0100 ON for 10 scan, and OFF for 20 scans.

5.8.19.2 Swap Active Status in Redundant System : ATVP

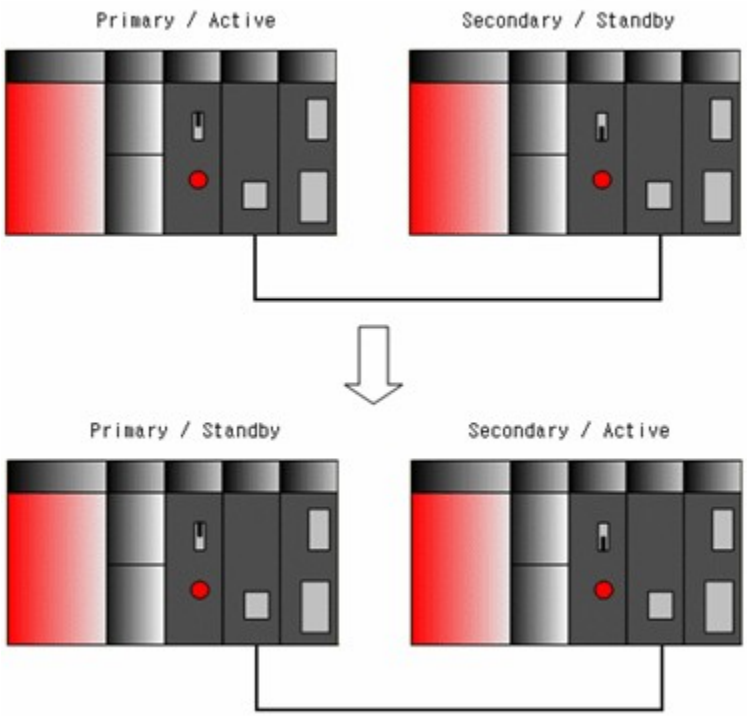
Instruction	Usable Device												No.of Steps	Flag			Usable CPU		
	M	X	Y	K	L	F	T	C	Z	D	@D	Integer		Error	Zero	Carry	XP	CP	BP
ATVP	-	-	-	-	-	-	-	-	-	-	-	-	1	o	-	-	o	-	-



ATVP

Function :

Exchange active and standby state in redundant system.

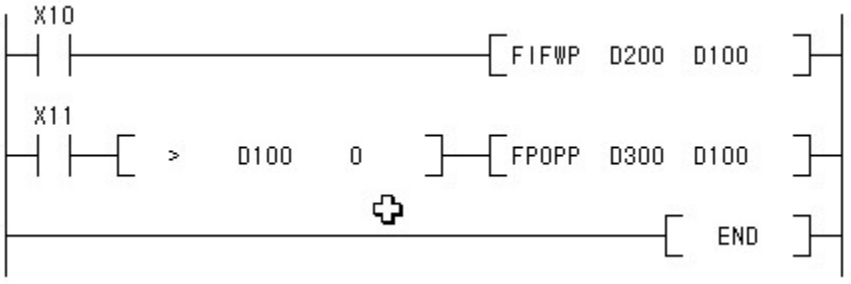


Error :

If standby CPU is abnormal, error flag F110 turns ON.

Example of Program :

If X10 will be turned ON, A active CPU goes standby and A standby CPU goes active.



5.9 PID CONTROL

Contents :

5.9.1 PID2 notice

CICON version 4.01 supports PID control for all types of CIMON PLC.
However New PID2 functions are available with below PLC type and firmware.

The PID2 can be supported by these Firmware Versions as below.

CPU	XP	CP	BP	PLC-S	MP	CICON
Version	V4.27	V4.26	X	V1.37	-	V.3.10

* ”Self Learning” function does not support CP3U and CP4U CPU.
* MP Series is under development.

If CICON Ver.4.01 executes “online edit” with the PLC which has old firmware version(that does not support PID2), “Self Learning” and “Kp x 100” functions cannot be supported.

5.9.2 PID Control Function

The PID control process showing as above configuration receives the process variable (PV) and controls the manipulation variable (MV) in order to adjust the PV to match the set value (SV). D/A conversion module is used for MV output.

5.9.3 PID Basics

Direct action and Reverse action

Direct action: It will lead the MV to increase when the PV is larger than the SV.
Reverse action: It will lead the MV to decrease when the PV is larger than the SV.

Proportional (P) control action

Proportional control (P) generates the MV in proportion to the error (E: difference between SV and PV).
In the P control action, the MV is calculated as follows.
$MV=K_P + E$
K_P : Proportional gain
If the KP value is too large, the control process is getting fast but the system will be in danger to oscillate. If the value is too small, the control process is getting slow to make it stable.

Under proportional control, the offset (residual error) will remain until the operator manually changes the bias on the controller's output to remove the offset.

Integral (I) control action

Integral (I) control will generate the MV in proportion to the time-integral of the error (E). Integral action eliminates offset. If the integral time is set too long, the controller will be sluggish, if it is too short, the control lop will oscillate and become unstable.

The Integral (I) action is used with PI control or PID control. It is not used by itself.

Derivative (D) control action

Derivative (D) control will generate the MV in proportion to the rate of change in the error (E). By adding the D control, quick corrective action can be obtained at the beginning of upset condition.
If the derivative time is set too long, oscillations will occur and the control loop will run unstable. If the derivative time is set 0, the derivative control does not function.

The Derivative control is used with PI and PID control. It is never used alone.

5.9.4 PID Control formula

PID Formula :

[Forward Action]

- $\mathbf{MV_n = MV_{n-1} + K_p\{(E_n - E_{n-1}) + (T_s/K_i)*E_n + (K_d/T_s)*(2PV_{nf-1} - PV_{nf} - PV_{nf-2})\}}$
- $\mathbf{E_n = SV - PV_{nf}}$

[Reverse Action]

- $MV_n = MV_{n-1} + K_p\{(E_n - E_{n-1}) + (T_s/K_i)*E_n - (K_d/T_s)*(2PV_{nf-1} - PV_{nf} - PV_{nf-2})\}$
- $E_n = PV_{nf} - SV$

[Filtered Present Value]

- $PV_{nf} = PV_n + \alpha(PV_{nf-1} - PV_n)$

En : Currently Sampling Deviation
En-1 : Deviation at an Interval before
Kp : Propotional Integer
Ki : Integral Integer
Kd : Differential Integer
Ts : Sampling Interval
α : Filter Coefficient
MVn : Present manipulation value
MVn-1 : Manipulation value of the preceding sampling cycle
SV : Set Value
PVn : Process value of the present sampling cycle.
PVnf : Process value of the present sampling cycle (after filtering).
PVnf-1 : Process value of the preceding sampling cycle (after filtering).
PVnf-2 : Process value of the sampling cycle two cycles before (after filtering).

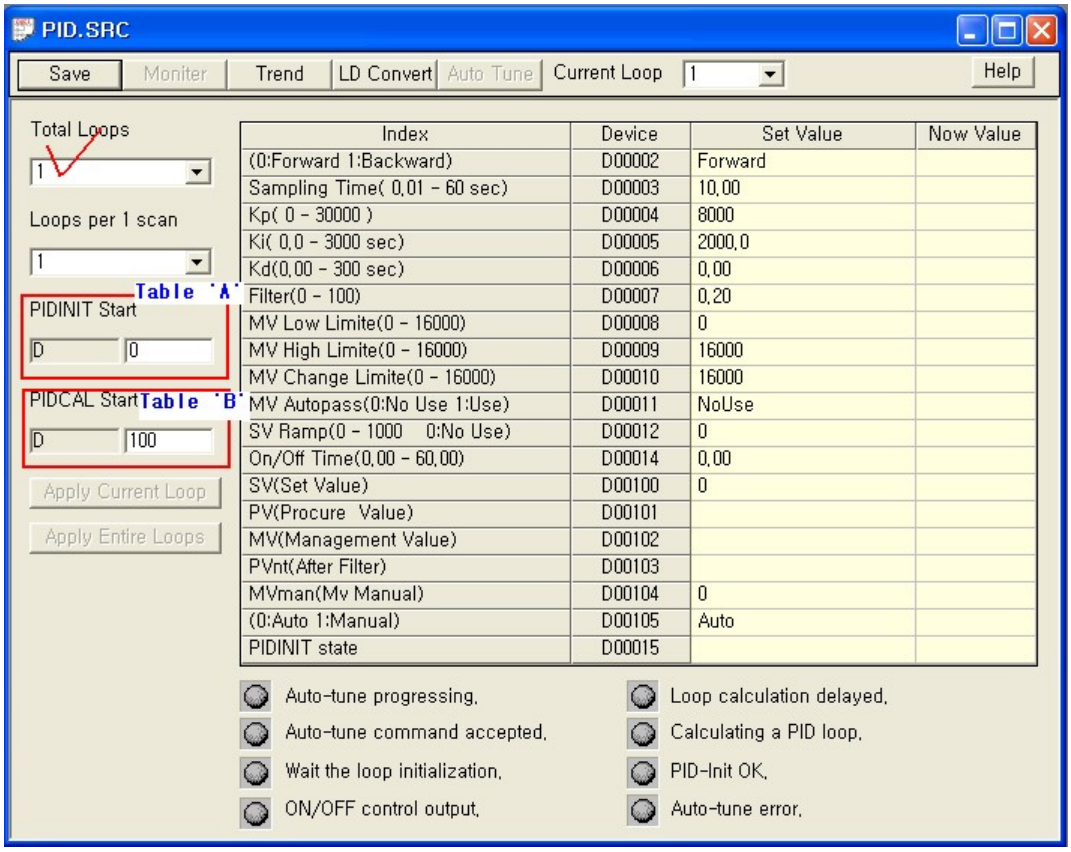
5.9.5 PID Instruction

Specifications

Item		Specification	Remarks
Range to Set PID Constant	Proportional Constant(K_p)	1 – 10000 (0.01 – 100.00)	
	Integral Constant (K_i)	0 – 30000 (0.0s – 3000.0s)	0 : No Integral Operation
	Differential Constant (K_d)	0 – 30000 (0.00s – 300.00s)	0 : No Differential Operation
Sampling Interval (T_s)		1 – 6000 (0.01s – 60.00s)	
Range of Set Value(SV)		0 – 16,000	
Range of Current Value(PV)		0 – 16,000	
Range of Manipulated Output Value(MV)		0 – 16,000	
Range of Manually Manipulated Value		0 – 16,000	

PID Control Loop	32 Loop	
Control Operation	Normal/Reverse Operation	
Type of Operation	Differentiates measured values	

PID Special Program :



Automatically created PID program by above dialog box uses two data tables for the loop control. As shown in the above picture,

one table ('A') is manipulated for PID initialization and the other table ('B') is used for the actual PID calculation. **These two tables are summarized as followings. These device memory areas should not be overlapped by the other program memory area.**

PIDINIT Instruction (A)

Instruction Operation

This is used to check the items set up for PID operation, and to initialize the devices for PID operation.

PIDINIT instruction is to be operated once initially in an initialization program. If an error occurs in

a set value or etc.
while initializing, the PIDCAL instruction in a main program is not operated. But, in case of several loops, corresponding
loops only are not operated.

Instruction Form

PIDINIT " The start address among the devices where set values are stored "
Ex) If the set values of PID are stored from D0008 => PIDINIT D0008

Set Items

Offset	Item	Description	Range	Remarks
0	Number of Loops		1 – 32	Common for entire loops
1	Number of Loops for a Scan		1 – 32	
2(0)	Operation Expression	Normal(0)/Reverse(1)	0 / 1	By loops
3(1)	Sampling Interval (T_S)	0.01 – 60.00s	1 – 6000	
4(2)	Proportional Integer (K_p)	0.01 – 100.00	1 – 10000	
5(3)	Integral Integer (K_i)	0.01 – 300.00s	0 – 30000	
6(4)	Differential Integer (K_d)	0.00 – 300.00s	0 – 30000	
7(5)	Filter Coefficient (α)	0.00 – 1.00	0 – 100	
8 (6)	Min. Manipulated Value (MVLL)	0 – 16000	0 – 16000	
9 (7)	Max. Manipulated Value (MVHL)	0 – 16000	0 – 16000	
10 (8)	Variation Rate Limit of Manipulated Value (?MVL)	0 – 16000	0 – 16000	
11 (9)	MV Transfer	Not Use(0)/Use(1)	0 / 1	
12 (10)	SV Steadiness	Not Use(0)/Use(1)	0 / 1	
13 (11)	States of PIDINIT	Indicates Errors	*Table	
14 (12)	Devices for PID operation	Not Available to Users		
15 (13)				
16 (14)				
17 (15)				
18 (16)				
19 (17)				
20 (18)				
21 (19)				

Statuses of PIDINIT

CODE	Item	Description	Range
0	No Error		By Loops
1	Error in Operation Expression	In the case a value except 0 and 1 is selected	
2	Error in Sampling Interval (T_S)	In the case a value is out of the range(1~6000)	
3	Error in Proportional Integer (K_p)	In the case a value is out of the range(1~10000)	
4	Error in Integral Integer (K_i)	In the case a value is out of the range(0~30000)	
5	Error in Differential Integer (K_d)	In the case a value is out of the range(0~30000)	
6	Error in Filter Coefficient (α)	In the case a value is out of the range (0~100)	
7	Error in Min. Manipulated Value (MVLL)	In the case a value is out of the range(0~16000)	
8	Error in Max. Manipulated Value (MVHL)	In the case a value is out of the range(0~16000)	
9	Error in Variation Rate Limit of Manipulated Value (?MVL)	In the case a value is out of the range(0~16000)	
10	Error in MV Transfer	In the case a value except 0 and 1 is selected	
11	Error in SV Steadiness	In the case a value except 0 and 1 is selected	
12	Error in Number of Loops	In the case a value is out of the range(1~32)	Common for all the loops, Stored in the start Loop Status device
13	Error in Number of Loops for a Scan	Though there is no error in the value, PID operation is omitted due to small number.	

1. Number of Loops

This is used to set up the number of loops to operate PID. To control an object, one PID operation loop is used.

2. Number of Loops for a Scan

This is used to set up the number of loops for one scan in case of several loops at sampling intervals.

3. Operation Expression

Normal(0) : This is the operation to output a manipulated value(MV) to get a current value to a target value in case that the current value(PV) is less than the target value(SV).

Reverse(1) : This is the operation to output a manipulated value(MV) to get a current value near to a target value in case the current value(PV) is greater than the target value(SV).

4. Sampling Interval(Ts)

This is used to set up the interval at which PID is operated.

5. Proportional Integer (Kp)

This, as the constant which is multiplied to a deviation(Sv – Pv) in the proportional operation " Mv = Kp * (Sv –Pv) " , is the constant for the proportional operation of PID control. In the above expression, a current value
reaches a target value fast if a proportional integer(Kp) is big. But, if this value is too big, that gives bad influence on a stable control.

6. Integral Integer (Ki)

This is the constant to add deviation to a manipulated value or subtract deviation from the manipulated value according
to time continuously in the integral operation "Mv = P * E + P * 1/Ki * ∫ Edt? in order to clear the deviation, in case that the deviation(E)
between a target value(Sv) and a current value(Pv) occurs. As proportional operation is not big influence on the variation of a manipulated
value, in case of small deviation, the effect to clear the deviation can be gotten by integral operation. Integral time is the one for which the
manipulated value in integral operation is to be the value in proportional operation after deviation occurs in the integral operation.

7. Differential Integer (Kd)

This is the constant used to operate a manipulated value in proportion to variation speed, and to control the variation of the deviation in the differential operation "Mv = Kp * E + Kp * dE/dt"? in order to clear the deviation, in case that the deviation occurs. Integral time is the one for which the manipulated value in differential operation is to be the value in proportional operation after deviation occurs in the differential operation.

8. Filter Coefficient (α)

This is used to set up the range of the filtering effect on the measured value(PV), which is inputted from an A/D card. The closer it goes to 0, the less filtering effect is.

9. Min. Manipulated Value (MVLL)

This is used to set up the min. manipulated value from the PID operation in auto mode. In case that a manipulated value(MV) is less than the min. manipulated value (MVLL), the value is applied as the minimum.

10. Max. Manipulated Value (MVHL)

This is used to set up the max. manipulated value from the PID operation in auto mode. In case a manipulated value(MV) is greater than the min. manipulated value(MVHL), the value is applied as the maximum.

11. Variation Rate Limit of Manipulated Value (?MVL)

This is used to apply the set value for Variation Rate Limit of Manipulated Value if a variation value, comparing the manipulated value(MV) for the previous scan to the manipulated value(MV) for current scan, is greater than the set value for Variation Rate of Manipulated Value.

12. MV Transfer

MV Transfer Use(1) : This is used to apply the manipulated value(MV) in auto mode to a manually manipulated value(MV_{MAN}) in case
that PID control is operated in auto mode and is converted to manual mode.

MV Transfer Use(0) : This is used to apply the manipulated value(MV) in manual mode to a manually manipulated value(MV_{MAN}).

13. SV Steadiness

To control the occurrence of over shoot due to a sharply changed target value(SV) and to keep stable control, this is used to divide a variation value into 10 steps, and to increase or decrease the value progressively at sampling intervals(Ts) when a target value is changed.

14. States of PIDINIT

This is used to indicate the status of error while PID operation is initialized.

PIDCAL Instruction(B)

Instruction Operation

This is used to execute PID operation.

Form of Instruction

PIDCAL " The start address among the devices where the result values of PID operation are stored "

Ex) If the result values of PID operation are stored from D0100 => PIDCAL D0100

Result Items

Offset	Item	Description	Range	Remarks
0	Set Value (SV)	0 – 16000		By loops
1	Measured Value (PV)	0 – 16000		
2	Manipulated Value (MV)	0 – 16000		
3	Measured Value after Filtering (PVnf)	0 – 16000		
4	Manually Manipulated Value (MV_{MAN})	0 – 16000		
5	Manual/Auto	Auto(0) / Manual(1)		
6	State Code			
7				
8				
9				
10				
11				
12				
13				
14				
15				
16				

17				
18				
19				

1. **Set Value (SV : 0 ~ 16,000)**
   This is used to input the target value controlled.

2. **Measured Value (PV : 0 ~ 16,000)**
   This is the current value of the object controlled, which is read from an A/D card. The value in the device where a measured
   value is stored, is to be read from the A/D card using "FROM"? instruction and be updated periodically.

3. **Manipulated Value (MV : 0 ~ 16,000)**
   This is the result value of the PID operation, which is output to the object controlled through a D/A card.

4. **?Measured Value after Filtered (PVnf : 0 ~ 16,000)**
   The filter is used to protect the instantaneous deviation of the measured value(PV) caused by noise.
   The measured value(PV) is filtered and stored in the device assigned to the measured value after filtered(PVnf).
   At this time, if the filter coefficient(α) is 0, the measured value(PV) is not filtered.

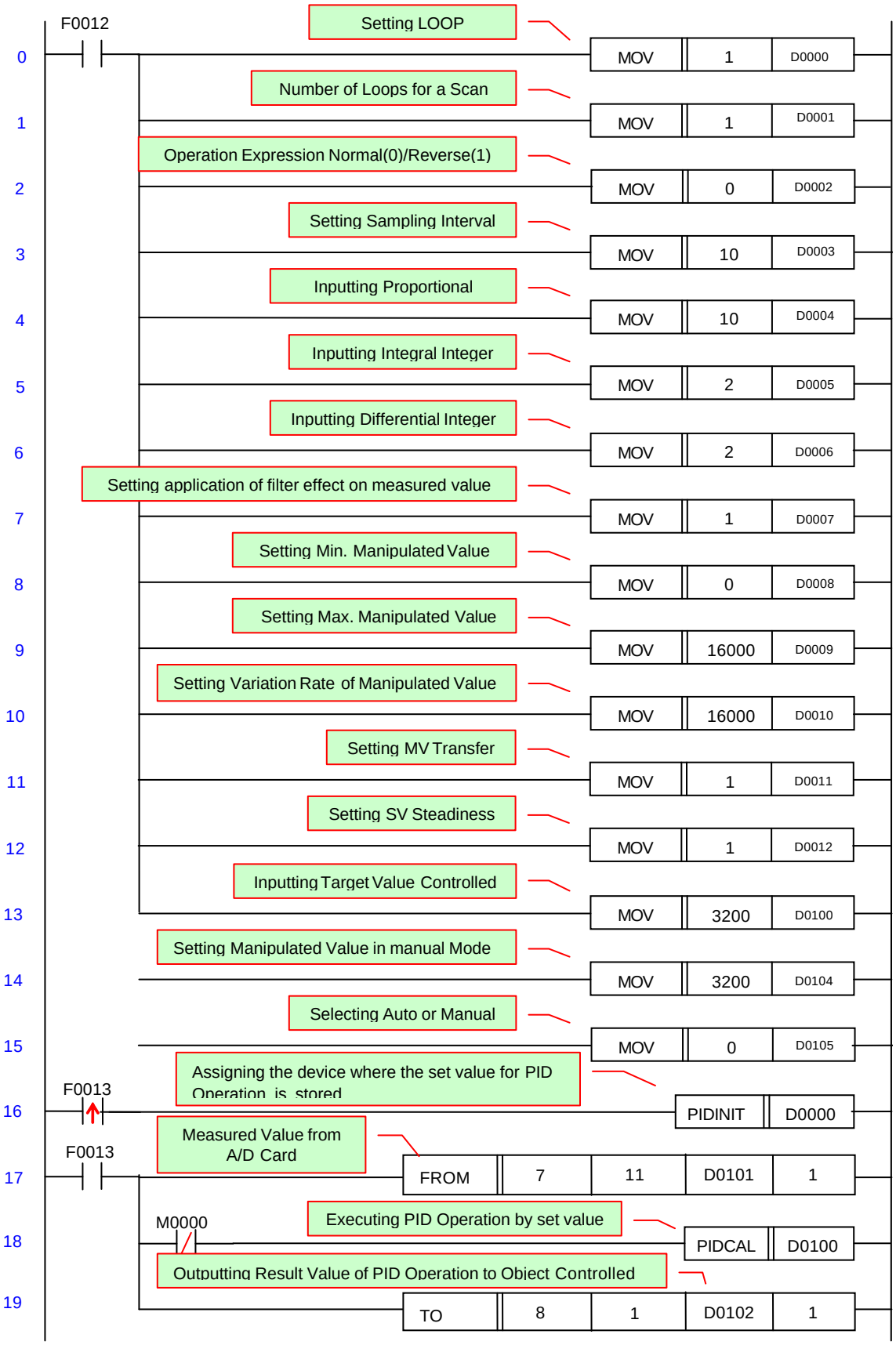
5. **? Manually Manipulated Value (MV_{MAN})**
   The value set up as manually manipulated value (MV_{MAN}) is outputted as manipulated value (MV).

6. **Manual/Auto (0 / 1)**
   This is used to select whether the object controlled is controlled by using PID or the value set up in a manually manipulated
   value (MV_{MAN}) is output to the object controlled.

7. **? Status Code**
   Each of set values is initialized for PID operation. To check that, PID initialization instruction(PID INIT) is used. At this time,
   if there is an error in the set value or during PID operation, the error is stored in the device assigned to status code. Also,
   in case of an error, PID operation instruction(PIDCAL) cannot be operated.

Example of PIDINIT Program and PIDCAL Program

Assumption is to store the set values in the devices from D0000 each and the result values in the devices from D0020 each,
and is to operate a loop. And an AD card is fixed on the 7th slot and a DA card on the 8th.



5.10 TROUBLE SHOOTING

Trouble Shooting :

- CPU Error Code Table

5.10.1 CPU Error Code Table

Error Code	Error	additional info. (F70)		A point of error time	CPU run state	LED		Solution to clear error.
		0xXX00	0x00XX			RUN	STOP	
0x0101	RAM fault			Power On	STOP	off	blinking	
0x0102	Flash Memory fault			Flash Memory Read/ Write	STOP	off	blinking	
0x0103	User Program error (RAM)			Power On	STOP	off	blinking	
0x0104	User Program error (Flash Memory)			Power On	STOP	off	blinking	
0x0105	Parameter, PBT checksum error			Power On	STOP	off	blinking	
0x0106	Flash Data error, Backup Data load fail			STOP->RUN , Power On	STOP	off	blinking	
0x0107	Program error in ROM pack, program loading canceled			STOP->RUN , Power On	STOP	off	blinking	
0x0201	RTC fault			SCAN	RUN	on	blinking	
0x0203	User WDT error			At all time	STOP	off	blinking	
0x0205	Batter fault (low voltage)			At all time	RUN	on	blinking	
0x0301	Base type is mismatched with the reservation			Power On	STOP	off	blinking	
0x0302	Module was unplugged (or plugged)	Base	Slot	At all time	STOP	off	blinking	
0x0303	Module type reservation error	Base	Slot	At all time	STOP	off	blinking	
0x030	I/O capacity reservation			Power On	STOP	off	blinking	

4	error							
0x0305	Error in initializing special function module	Base	Slot	Power On	STOP	off	blinking	
0x0306	Error in reading/writing system memory of special function module	Base	Slot	At all time	RUN/ STOP	on/off	blinking	
0x0307	Error in reading/writing user memory of special function module	Base	Slot	At all time	RUN/ STOP	on/off	blinking	
0x0308	Communication fault in expansion system	Base	Slot	At all time	STOP	off	blinking	
0x030A	I/O fault in expansion base.			Extension communication	STOP	off	blinking	
0x030B	NAK from expansion	Base		At all time	STOP	off	blinking	
0x030C	FROM/TO instruction error (no special function module)	Base	Slot	When called FROM/ TO command.	RUN/ STOP	on/off	blinking	
0x030D	Two or more RM modules are detected			Power On	STOP	off	blinking	
0x030E	DO(Digital output) error (please refer to the memory F0070)	Base	Slot	At all time	RUN/ STOP	on/off	blinking	
0x030F	Timeout in expansion communication							
0x0310	Special function module access error (user memory) from expansion							
0x0311	Fail to read/write special function module in expansion base							
0x0312	Error in initial mode switch position of RM. Please check the Primary/Secondary mode							
0x0313	Fail to read/write special function module in expansion base during performing instruction for special	Base	Slot	Power On	RUN/ STOP	on/off	off	

	module							
0x0314	Module was unplugged (or plugged) on a expansion base	Base	Slot	At all time	STOP	off	blinking	
0x0315	Unknown module is detected	Base	Slot	Power On	STOP	off	blinking	
0x316	Designation of "Base IO address allocation" is duplicate with last IO address of preceding base.			At all time	STOP	off		
0x317	SP16EOR Expansion cards are more than 4. Up to four can be used.							
0x0401	Unknown or invalid instruction			STOP->RUN , Power On	STOP	off	blinking	
0x0402	Too large user program size			Compile	STOP	off	blinking	
0x0403	Error in reading/writing D memory	Step (WORD)		Compile	STOP	off	blinking	
0x0404	FOR/NEXT syntax error	Step (WORD)		Compile	STOP	off	blinking	
0x0405	JMP/CALL syntax error	Step (WORD)		Compile	STOP	off	blinking	
0x0406	JME/SBRT index cannot exceed 127	Step (WORD)		Compile	STOP	off	blinking	
0x0407	Duplicated JME/SBRT index	Step (WORD)		Compile	STOP	off	blinking	
0x0408	Invalid location of JME instruction	Step (WORD)		Compile	STOP	off	blinking	
0x0409	Invalid location of JMP instruction	Step (WORD)		Compile	STOP	off	blinking	
0x040A	SBRT nesting error			Compile	STOP	off	blinking	
0x040B	No RET instruction found in subroutine (SBRT)			Compile	STOP	off	blinking	
0x040C	FOR loop nesting limit error			Compile	STOP	off	blinking	
0x040D	The No. of base/slot of a special module in a special program is			STOP->RUN , Power On	STOP	off	blinking	

	wrong							
0x0501	Invalid instruction	Step (WORD)		when command called	STOP	off	blinking	
0x0502	CALL level (nested CALL) error	Step (WORD)		when command called	STOP	off	blinking	
0x0503	@D out of range	Step (WORD)		when command called	STOP	off	blinking	
0x0504	There is no scan program to execute			STOP -> RUN	STOP	off	blinking	
0x0505	Accessed out of device range			Compile	STOP	off	blinking	

Top Level Intro

This page is printed before a new
top-level chapter starts

Part

6 XP / CP Series(CM1)

Contents :

6.1 Brochure

Contents :

6.1.1 Description Specifications

<table>
<tr><th>Item</th><th colspan="6">Specification</th></tr>
<tr><td>Operating Temperature</td><td colspan="6">-10 ~ 65</td></tr>
<tr><td>Storage Temperature</td><td colspan="6">-25 ~ 80</td></tr>
<tr><td>Operating Humidity</td><td colspan="6">5 ~ 95%RH, Not condensed.</td></tr>
<tr><td>Storage Humidity</td><td colspan="6">5 ~ 95%RH, Not condensed.</td></tr>
<tr><td rowspan="8">Vibration</td><td colspan="6">In case of intermittent vibration</td></tr>
<tr><td>Frequency</td><td colspan="2">Acceleration</td><td>Amplitude</td><td colspan="2">Sweep</td></tr>
<tr><td>10 ≤ f< 57Hz</td><td colspan="2">-</td><td>0.075mm</td><td colspan="2" rowspan="2">10 times in each direction (X,Y,Z)</td></tr>
<tr><td>57 ≤ f < 150 Hz</td><td colspan="2">9.8m/s2 {1G}</td><td>-</td></tr>
<tr><td colspan="6">In case of continuous vibration</td></tr>
<tr><td>Frequency</td><td colspan="2">Acceleration</td><td>Amplitude</td><td colspan="2">Sweep</td></tr>
<tr><td>10 ≤ f < 57Hz</td><td colspan="2">-</td><td>0.035mm</td><td colspan="2" rowspan="2">10 times in each direction (X,Y,Z)</td></tr>
<tr><td>57 ≤ f < 150 Hz</td><td colspan="2">4.9m/s2 {1G}</td><td>-</td></tr>
<tr><td>Shock</td><td colspan="6">- Max. Shock Acc.: 147 m/s2 {15G}
- Time : 11ms(3 times in X, Y, Z)
- Pulse Wave : Half sine wave pulse</td></tr>
<tr><td rowspan="4">Noise</td><td>Impulse noise</td><td colspan="5">Communication modules : ±1500V
Except by communication Module : ± 2000</td></tr>
<tr><td>Electrostatic discharge</td><td colspan="5">Voltage: 4 kV(Contact discharge)</td></tr>
<tr><td>Radiated electro-magnetic field</td><td colspan="5">27 ~ 500 MHz. 10 V/m</td></tr>
<tr><td rowspan="2">Fast Transient Bust Noise</td><td>Item</td><td>Power Module</td><td>Digital I/O (24V or more)</td><td colspan="2">Digital I/O(Less than 24V) Analog I/O Comm. interface</td></tr>
<tr><td>Voltage</td><td>2KV</td><td>1KV</td><td colspan="2">0.25KV</td></tr>
<tr><td>Environment</td><td colspan="6">No corrosive gas and no dust.</td></tr>
<tr><td>Altitude</td><td colspan="6">2,000m or less</td></tr>
</table>

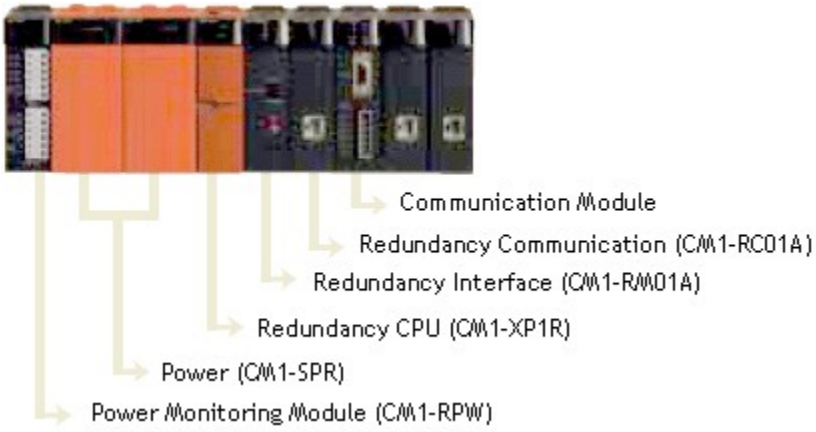
6.1.2 Redundant System

- Redundancy of CPU module, power modules, bases, and communication modules is available.
- CPU redundancy system is composed of separate bases for ideal redundancy structure.
- In case an error occurs in an active CPU module, a back-up module is automatically converted to active one for continuous operation.
- Furnishes a test button to check and maintain a system easily.
- Enables the configuration of network redundancy.
- Enables backup within the control scan delay time of 50ms and high-speed active conversion.
- Enables to construct redundancy network with a high-ranking computer.

- Supports Power redundancy.

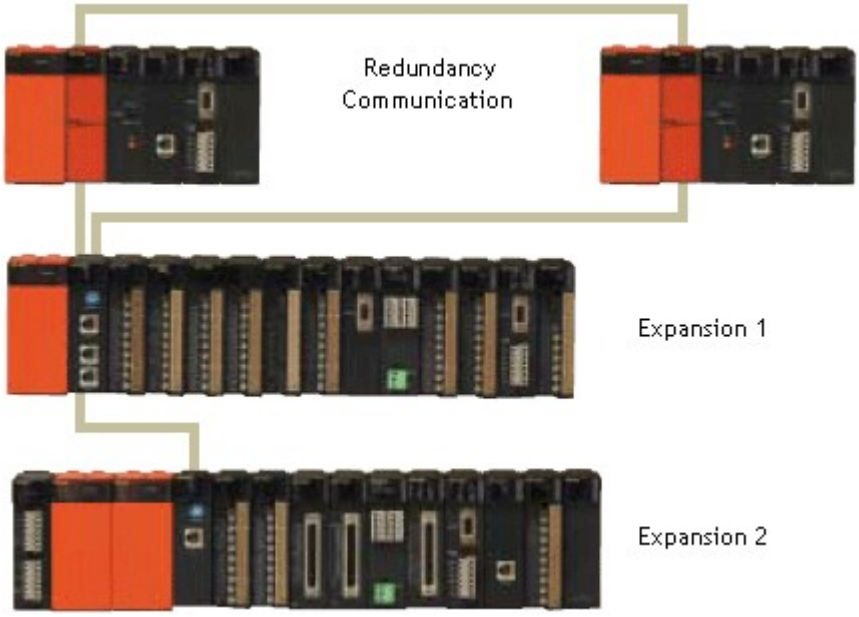
Contents :

Basic Composition of Redundancy Base :



Base	Composition Unit	Applicable Module
CPU	Base	All base modules
	Power	All power modules
	CPU	CM1-XP1R
	Redundancy Interface	CM1-RM01A
	Redundancy Comm. Module	CM1-RC01A
	Redundancy Cable	CM0-CBE
	Communication Module	CM1-All comm. modules including CM1-EC01A
Expansion	Expansion Cable	CM0-CBE
	Expansion 1	CM1-EP03A or CM1-EP02A
	Expansion 2 or More	CM1-EP02A or CM1-EP01A
	Base / Power / I/O	Modules of all kinds

System Configuration :



CM1-RPW (Redundant Power Monitoring Module) :

- Power status is visualized by LEDs.
- Power status signals are provided by digital output (DC 24V, Transistor, Sink)

- **LED status window**

A Line	Status LEDs for Power "A"
B Line	Status LEDs for Power "B"
OK	ON when all powers are good
5	ON when main power output is good
+15	ON when analog power (+15V) is good
-15	ON when analog power (-15V) is good
PF	ON when there is no internal power fail signal
24	ON when service power (24V) is good

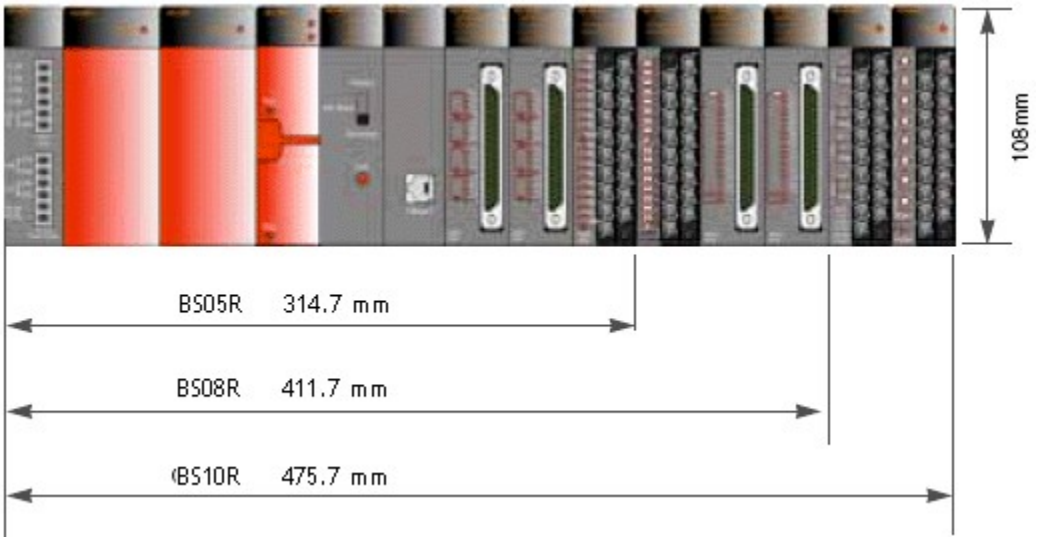
- **Status Output (4 points, 0.5A, ...)**

A_OK	ON when analog power (+15V) is good
B_OK	ON when analog power (-15V) is good
A_NG	ON when there is no internal power fail signal
B_NG	ON when service power (24V) is good

Base for power redundancy :

- Three types of bases are provided for power redundancy

Model	No. of slots	Size (mm)
CM1-BS05R	5 slots	314.7 * 108
CM1-BS08R	8 slots	411.7 * 108
CM1-BS10R	10 slots	475.7 * 108



6.1.3 CPU

Click XP CPU CP CPU

XP CPU :

- High speed processing(75 ns/step) by 32bit PLC processor
- Provides more than 400 instructions
- Abundant range of device limit provided : Maximum Input & Output of 8192 point, Data limit of 32000 Word variable(M-domain, K-domain, L-domain)
- Compact sized high efficient unit.
- Supports floating point instructions

Item	Specification

	CM1-XP1R / A	CM1-XP2A	CM1-XP3A
Program Control Type	Stored Program, Cyclic Operation, Time Driven Interrupt		
Program Language	IL (Instruction List), LD (Ladder Diagram)		
Data Processing	32 Bits		
Instructions	55 basic instructions + 389 extended instructions		
Processing Speed	75 nsec / step		
Program Memory	128 Ksteps	64 Ksteps	
I/O Capacity	8192	4096	2048
Data Memory	1 MB		
Timer	4096 (10mS, 100mS Selectable : 0.01 ~ 6553.5 Sec)		
Counter	4096		
Internal Flash Memory	2 MB		
Expansion	Max. 16 Bases		
Functions	Redundant (XP1R), Max. 128 Program, Floating Point, RTC, USB		

Model	X	Y	M	L	K	F	T	C	S	D	Z
XP1R/A	8,192	8,192	16,000	16,000	16,000	2,048	4,096	4,096	100 *100	32,000	2,048
XP2A	4,096	4,096									
XP3A	2,048	2,048									

CP CPU :

- Self-dianosic system gives easy error manipulation
- Maximum of 16 base expansion
- A separate communication port mounted (CM1-CP4C:RS232C, CM1-CP4D:RS422/485)
- Supports variable types of programming
- Provides more than 300 instruction

Item	Specification	
	CM1-CP3 A / B / P / U	CM1-CP4 A / B / C / D / U
Program Control Type	Stored Program, Cyclic Operation, Time Driven Interrupt	
Program Language	IL (Instruction List), LD (Ladder Diagram)	
Data Processing	16 Bits	
Instructions	55 basic instructions + 293 extended instructions	
Processing Speed	200 nsec / step	
Program Memory	32 Ksteps	16 Ksteps

I/O Capacity	1024	384
Data Memory	512 Kbyte	256 Kbyte
Timer	1024 (10mS, 100mS Selectable : 0.01 ~ 6553.5 Sec)	
Counter	1024	
Internal Flash Memory	512 KB	256 KB
Expansion	Max. 16 Bases	Not Expansible
Optional Functions	RTC, Communication Port (RS232C or RS422/485), USB	

Model	X	Y	M	L	K	F	T	C	S	D	Z
CM1-CP3A/B/P	1,024	1,024	8192	2,048	2,048	2,048	1,024	1,024	100 *100	10,000	2,048
CM1-CP4A/B/C/D	384	384								5,000	

6.1.4 Base

Feature :

Innovative I/O expansion by high speed communication.

- Expansion distance : up to 100m (base to base)
- Max. 16 bases expansion

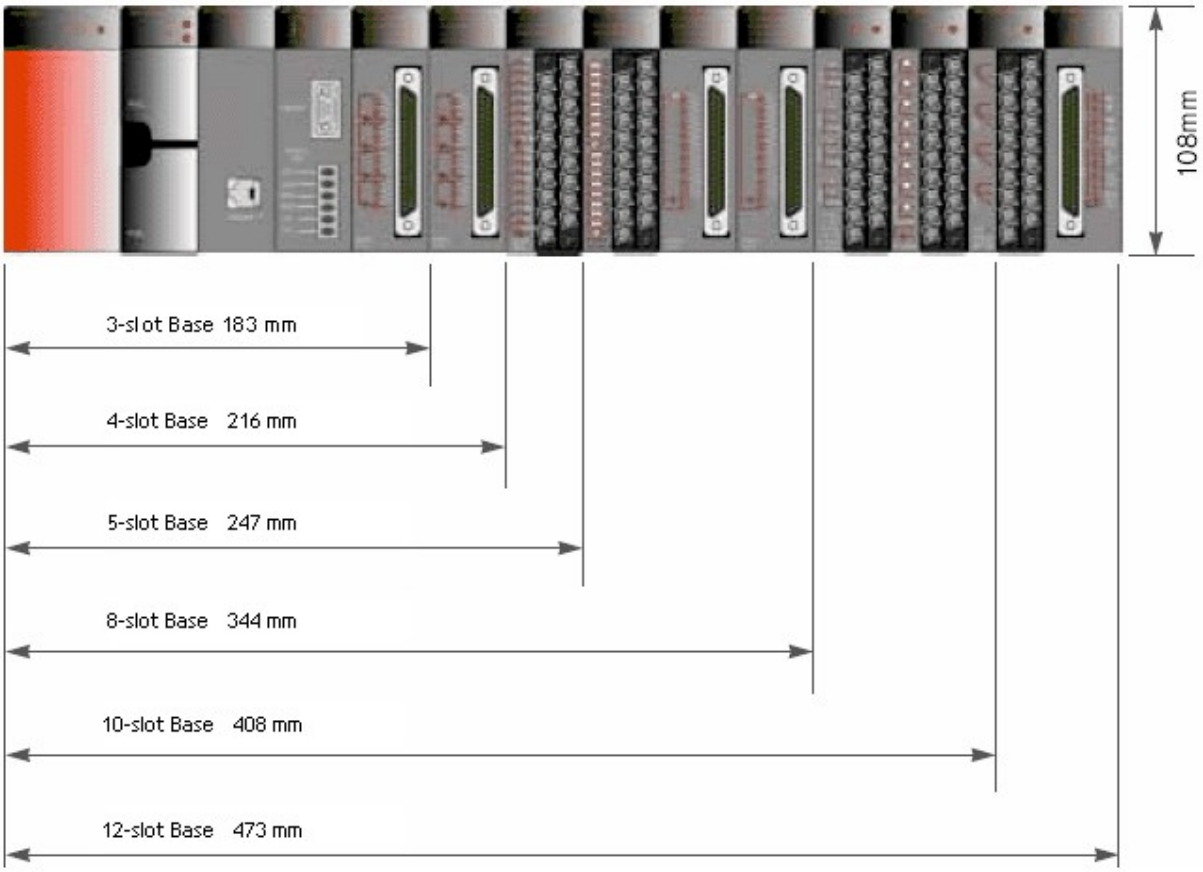
Various Types of Base :

Base types as 3, 4, 5, 8, 10 and 12 slots allow optimal system configuration.

Model	IO slots	Size (mm)	Weight(g)
CM1 - BS03A	3 slots	183 x 108	259
CM1 - BS04A	4 slots	216 x 108	304.5
CM1 - BS05A	5 slots	247 x 108	345.5
CM1 - BS08A	8 slots	344 x 108	478
CM1 - BS10A	10 slots	408 x 108	573
CM1 - BS12A	12 slots	473 x 108	683

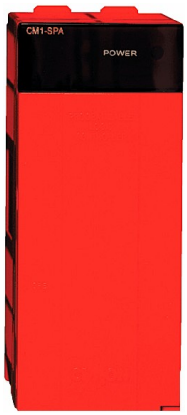
Minimization of Mounting Space :

Even high-performance, the size is as minimized as it could be to save the mounting space.



6.1.5 Power

Feature :



- Internal Power disturbance detection circuitary prevents data damage or malfunction.
- Provides 24Vdc service power output (0.2A)
- Supports redundant power configuration (SPR)
  - o Power modules are monitored by CM1-RPW
  - o Three types of base are provided for power redundancy

Item	CM1 - SPA	CM1 - SPC	CM1 - SPR	CM1 - SPB

Input	Input Voltage	AC 100 - 240 V, 50/60Hz		DC 24V
	Input Current	0.25A MAX for 220VAC		1.8A MAX for 24VDC
	Inrush Current	30A or less		-
	Efficiency	70 % or more (Reated Input / Load)		
	Power Disturbance Susceptibility	20ms or less		
Output	Output Voltage / Output Current	+5V (3.5A) +24V (0.5A)	+5V (3.5A) +15V (0.5A) -15V (0.3A) +24V (0.5A)	+5V (3.5A) +15V (0.5A) -15V (0.3A)
Operating Indicator		LED ON / OFF		

Current Consumption :

Capacity of the power module must be checked using following table

Item	Model	Current Consumption	Item	Model	Current Consumption
CPU	CM1-CP**	130 mA	A/D Convert	CM1-AD04VI	50 mA
Redundancy Module	CM1-RM01A	70 mA		CM1-AD08V	50 mA
	CM1-RC01A	290 mA		CM1-AD08I	55 mA
Expansion	CM1-EP**	270 mA	D/A Convert	CM1-DA04V	40 mA
DC Input	CM1-XD16A	60 mA		CM1-DA08V	50 mA
	CM1-XD32C	100 mA		CM1-DA04I	40 mA
AC Input	CM1-XA08A	30 mA		CM1-DA08I	50 mA
	CM1-XA08B	30 mA	RTD Measuring	CM1-RD04A	50 mA
I/O Hybrid	CM1-XY16ER	180 mA		CM1-RD04B	50 mA
Relay	CM1-YR16A	250 mA	TC Measuring	CM1-TC04A	60 mA
Transistor	CM1-YT16A	110 mA	Commnunication	CM1-SC02A	190 mA
	CM1-YT16B	110 mA		CM1-SC01A	170 mA
	CM1-YT32A	130 mA		CM1-SC01B	170 mA
	CM1-YT32B	130 mA		CM1-SC01DNP	170 mA
SSR Output	CM1-YS08A	120 mA		CM1-EC01A	290 mA
High-Speed	CM1-HS02B	290 mA		CM1-EC01DNP	290 mA

❖ Analog modules must be used with SPC or SP2B type power (AD, DA, RTD, TC modules)

6.1.6 Communication

- Simple and easy configuration with dialog box
- Provides user protocol programming function for communication with other devices
- Supports the connection through the internet (Ethernet)
- Data link between PLSs through RS232C, RS 485 Ethernet or internet
- Feature
  - **Ethernet :** Support PLC Link function for high-speed data communication among CIMON-PLC modules and enable to communicate with 64 stations as maximum at the same time.
  - **RS232C/422/485 :** Enable to control a PLC at a long distance with modem communication function. allows setting up diverse baud rate from 300bps to 76800bps
  - **Profibus :** Supports various communication speed(9.6kbps ~ 12Mbps). 1Kbyte input data can be transferred within 2ms.
  - **DeviceNET :** Multi-drop and T-type branch is available and improves flexibility of network installation. enables real time managing of lowest level input/output machines within network system. Able to connect with various types of slave I/O.
  - **BACnet :**Supports BACnet which is the standard of BAS. Supports the functionality of BACnet class 3 servers.

Ethernet :

- IComply with IEEE802.3 code
- Support protocols like SRP, ICMP, IC, TCP, UDP
- No limit on the number of the units mounted on a base.
- Support PLC Link function for high-speed data communication among CIMON-PLC modules and enable to communicate with 64 stations as maximum at the same time.

Item	CM1-EC01A	CM1-EC01DNP	CM1-EC04DNP	CM1-EC10A	CM1-EC10B

Media Interface		10BASE-T			10BASE-T 100BASE-TX	100BASE-FX
Baudrate		10 Mbps			100 Mbps	
Media		UTP/STP Category5	UTP/STP Category5		UTP/STP Category5 Auto MIDX	SC, Multi-Mode (1310nm)
Node Distance		100m (Node<->Hub)				2km
Service Capacity		UDP 9 Services TCP 9 Services	Single Host	4Hosts	UDP 16 Services TCP 16 Services	
SERVICE	Loader	Yes				
	HMI Protocol	Yes	No		Yes	
	MODBUS/TCP					
	PLC Link (Public Net)					
	PLC Link (Private Net)				No	
	High-Speed Link (Private Net)	No			Yes	
	DNP 3.0	No	Yes		No	

RS232C / 422 / 485 :

- Read and write data by using an HMI protocol
- Provide communication function suitable for multi-drop configuration which is able to link 32 units as maximum
- Enable to control a PLC at a long distance with modem communication function
- Allows setting up diverse baud rate from 300bps to 76800bps
- Enable to use RS232C / RS422 (RS485)) communication port by setting p as a independent channel or a linked channel.
- Support 1:1 / 1:N / N:M communication (In case of using RS422 channel)
- Support full-duplex (RS422) and half-duplex (RS485) communication form
- Enable to use RS485 channel as RS485 multi-drop communication channel through the parameter setup
- Support DNP 3.0 protocol (CM1-SC01DNP)
- Equipped with self-diagnosis function and loop-back diagnosis function for diagnosing a breakdown simply

Model	CM1-SC01A	CM1-SC01B	CM1-SC02A	CM1-SC01DNP
Interface	RS232C	RS422/485	RS232C/422/485	RS232C

Comm Mode	HMIMode	CIMON HMI Protocol(Supports 1 : n Communication)	-
	Loader Mode	CICON Communication	-
	MODBUS	MODBUS RTU Mode(Slave and Master)	-
	DNP	-	DNP 3.0 Protocol
	User definition Mode	Protocol Program	
Form of Data	Data Bit	7 or 8 Bit	
	Stop Bit	1 or 2 Bit	
	Parity	Even / odd / None	
Sync		Asynchronous	
Baud Rate		300 / 600 / 1200 / 2400 / 4800 / 9600 / 19200 / 38400 / 76800	
Modem Link		Long-distance communication by linking with a modem unit	

Profibus DP module :

Profibus is manufacturer selective (vendor independence) and is used vastly for work Automization as an open type fieldbus. The characteristics of open type are sated in Europe standard EN501070 and EN50204. Profibus enables communication between different manufacturer's devices without any special interface required. Profibus is very efficient and highly on conditions where careful consideration is required to communicate in complex and high speed environment. Even when more advanced technology comes in effect, Profibus will be the industrial communication system who will be ready for the futrure.

- Suitable to communicate between Master Automation Machine and Scatter Slave I/O Machine.
- Supports various communication speed (9.6kbps - 12Mbps)
- RS485 Communication method is used
- Field construction made easier due to use of Twisted Pair Cable
- Supports Maximum of 127 station (32 per segment)
- Network setup is done with Configuration tool
- 1Kbyte input data can be transferred within 2ms
- Data transition can be done with order or without order
- Individual or Multi master network function available

	CM1-PD01A	CM1-PD01B
Interface	RS 485	
Network	Profibus DP	

Media Access	Token Passing & Polling	
Cable	Two wire Shielded twisted pair cable	
Number of Max slave connection/network	127	
Number of Max slave connection/segment	32	
Max. I/O Data slave	244 Byte	
Max. I/O Data	I/O 3,584 Byte each	I/O 512 Byte each
Configuration Tool	Sycon-PB	
Configuration Port	RS232C	
Communication Parameter setting	High-speed link parameter communication setting	

Transmission	9.6K(bps)	19.2K	93.75K	187.5K	500K	1,500K	12,000K
Distance	1200m	1200m	1200m	1000m	400m	200m	100m

DeviceNet module :

Open type communication standard DeviceNet enables compatibility among different manufactures' similar typed components.

- Machine I/O is high speed network of open structure by choosing Global Standard DeviceNet.
- Multi-drop and T-type branch is available and improves flexibility of network installation
- One network module can manage 63 slave modules and maximum 57334 points of I/O
- Enables real time managing of lowest level input/output machines within network system
- Functions such as seguence managing, processing managing and motion managing can be used in many different fields of managing sites.
- Able to connect with various types of slave I/O
- Max 4 master modules are applicable with one CPU.

Model	CM1-DN01A			
Transmission speed	Speed	Network Max. Length	Max length	Total distance
	125K	500m(1640feet)	6m(20feet)	156m(512feet)
	250	250m(820feet)		78m(256feet)
	500K	100m(328feet)		39m(128feet)
Number of connect	64 stations			

station	
Cable	24V+ / 24V- / Shield / CAN H / CAN L(5lines)
Number of Max. Node	MAC ID (Nod Address) of Max. 64
Diagnosis function	ID duplication check, inferior station check. Detect operating status by LED

BACnet module :

Abbreviation of Building Automation and Control Networks and is open-type standard protocol for the building auto-control.

- Supports BACnet which is the standard of building automated system.
- Supports the functionality of BACnet class 3 servers.
- chose Ethernet for communication Physical layer.

Model	CM1-BN01A
Protocol size	ANSI / ASHRAE 135-1995 (KS X 6909)
Protocol stack	UDP/IP
Physical Standard	ISO / IEC8802-3 (IEEE 802.3, CSMA/CD, 10BASE-T)
Data transfer speed	10 Mbps
Transfer method	Base Band
Max/ Segment length	100m
Max. I/O data slave	244 Byte

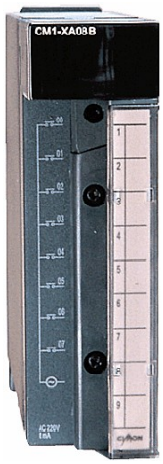
6.1.7 Digital I/O

- Internal circuitary is insulated by photo-coupler of relay.
- Furnish a LED Indicator.
- DC Inputs , AC Inputs, Combination I/O, Relay Output & SSR Output, Transistor Output

DC Inputs :

Model		CM1-XD16A	CM1-XD32C	CM1-XD64C	CM1-XD16B	CM1-XD32B
No. of Input Points		16	32	64	16	32
Rated Input Voltage		DC 24V				
Rated Input Current		4mA				
ON Voltage / ON Current		DC 19V / 4mA			DC 15V / 4mA	
OFF Voltage / OFF Current		DC 11V / 1mA			DC 12V / 1mA	
Response Time	OFF ->> ON	5ms or less				
	ON ->> OFF	5ms or less				
Common Type		8 Points				
Operation Indication		LED is turned on when there is input signal				
Insulation Type		Photo Coupler				
Input Type		SINK / SOURCE				

AC Inputs :

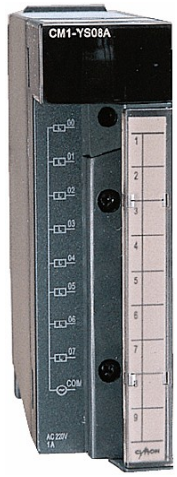


Model		CM1 – XA08A	CM1 – XA08B
No. of Input Points		8 Points	
Rated Input Voltage		AC 200 ~ 240V	AC 90 ~ 130V
Rated Input Current		9mA	5mA
ON Voltage / ON Current		AC 160V	AC 80V
OFF Voltage / OFF Current		AC 60V	AC30V
Response Time	OFF ->> ON	5ms or less	
	ON ->> OFF	5ms or less	
Common Type		8 Points	
Operation Indication		LED is turned on when there is input signal	
Insulation Type		Photo Coupler	

Combination I/O :

Model		Combination I/O	
		CM1 - XY16DR	
No. of I/O Points		8 points	8 points
		SINK / SRC	Relay
Rated I/O Voltage		DC 24V	DC 12 / 24V
		-	AC 220V
Rated I/O Current		4 mA	2 A
On Voltage / On Current		DC 19V / 4mA	-
Off Voltage / Off Current		DC 11V / 1mA	-
Response Time	Off -> On	5 ms or less	
	On -> Off	5 ms or less	
Common Type		8 Points	
Operation Indication		LED is turned on in case input is turned on.	
Insulation Type		Photo Coupler	Realy

Relay Output & SSR Output :



		Relay Output		SSR Output
		CM1-YR16A	CM1-YR32A	CM1-YS08A
No. of Output Points (Point)		16 Points	32 Points	8 Points
Rated Load Voltage		DC 12/24V		AC100 ~ 240V
		AC 220V		50 /60 Hz
Rated Load Current	1 Point	2A		1A
	1Com	5A		2A

Response Time	OFF ->> ON	10ms or less	1ms or less
	ON ->> OFF	5ms or less	0.5 cycle + 1ms or less
Common Type		8 Points	8 Points
Operation Indication		LED is turned ON when there is output signal	
Insulation Type		Relay	Photo Coupler

Transistor Outputs :

		CM-YT16A	CM1-YT16B	CM1-YT32A	CM1-YT32B	CM-YT64A
No. of Output Points		16/SINK	16/SRC	32/SINK	32/SRC	64/SINK
Rated Load Voltage		DC 12 ~ 24V				
Rated Load Current	1Point	0.5A	0.5A	0.2A	0.2A	0.1A
	1Com	4A				
Response Time	OFF ->> ON	1ms or less				
	ON ->> OFF	1ms or less				
Common Type		16 Points	16 Points	32 Points	32 Points	64 Points
Operation Indication		LED is turned on when there is output signal				
Insulation Type		Photo Coupler				

6.1.8 Analog I/O

High resolution : 1 / 16,000 (14 bits)

Simple and easy configuration with dialog box.

Module Name	Type	Specification
CM1 - AD04VI	AI	4 Ch : Voltage / Current Input (Selectable) : 14 bits
CM1 - AD08V		8 Ch : Voltage Input : 14 bits
CM1 - AD08I		8 Ch : Current Input : 14 bits
CM1 - DA04V	AO	4 Ch : Voltage Output : 14 bits : -10V ~ +10V
CM1 - DA08V		8 Ch : Voltage Output : 14 bits : -10V ~ +10V
CM1 - DA04I		4 Ch : Current Output : 14 bits : 4 ~ 20mA
CM1 - DA08I		8 Ch : Current Output : 14 bits : 4 ~ 20mA
CM1 - DA04VA		4 Ch : Voltage Output : 14 bits : 0V ~ +10V
CM1 - DA08VA		8 Ch : Voltage Output : 14 bits : 0V ~ +10V

A / D converters :

- 8/4 channels per module
- Converts ratings variously by setting offset and gain value
- Selectable digital converted range from -8000 or 8000 or 0 to 16000 per channel
- Realizing lower current consumption per channel
- Must be used with SPC or SP2B power module

Model		CM1-AD04VI	CM1-AD08V	CM1-AD16V	CM1-AD08I	CM1-AD16I
No. of Input Channel		4	8	16	8	16
Analog Input	Voltage	0 ~ +5V 1 ~ +5V 0 ~ +10V -10V ~ +10V	0 ~ +5V 1 ~ +5V 0 ~ +10V -10V ~ +10V		-	
	Current	0 ~ 20mA 4 ~ 20mA	-		0 ~ 20mA 4 ~ 20mA	
Digital Output		-192~16192, -8000~8000, 0~16000, -8000~8000 (14bit)				
Max. Resolution		Input / Range of Input / Max. Resolution / Digital Output				

	Voltage	0 ~ +5V	0.3125mV	0 ~ 16000 -8000 ~ 8000	
		1 ~ +5V	0.25mV		
		0 ~ +10V	0.625mV		
		-10V ~ +10V	1.25mV		
	Current	0 ~ 20mA	1.25mA		
		4 ~ 20mA	1mA		
Precision		0.3%(Full Scale)			
Max. Conversion Rate		5mS/1ch			
Absolute Max. Input	Voltage	12V	12V	25mA	
	Current	25mA		25mA	
Insulation Type		Photo Coupler			

D / A converters :

- 8/4 channels per module
- Selectable digital converted range from -8000 or 8000 or 0 to 16000 per channel
- Realizing lower current consumption per channel
- Various / Flexible output modules by output range
- Must be used with SPC or SP2B power module

Model	DA04V	DA08V	DA16V	DA04I	DA08I	DA16I
No. of Input Ch.	4	8	16	4	8	16
Analog Output	-10V ~ +10V			4 ~ 20mA		
Digital	-192 ~ 16191(-8192~8191)					

<table>
<tr><td>Input</td><td colspan="6"></td></tr>
<tr><td>Max. Resolution</td><td colspan="6"><table>
<tr><td>Output</td><td>Digital Input</td><td>Range ofAnalog Output</td><td>Max. Resolutions</td></tr>
<tr><td rowspan="2">Voltage</td><td>0 ~ 16000 (-8000~8000)</td><td>-10V ~ +10V</td><td>1.25mV</td></tr>
<tr><td>0 ~ 16000 (-8000~8000)</td><td>0 ~ 10V</td><td>0.625mV</td></tr>
<tr><td>Current</td><td>0 ~ 16000 (-8000~8000)</td><td>4 ~ 20mA</td><td>1.0mA</td></tr>
</table></td></tr>
<tr><td>Precision</td><td colspan="6">±0.1%(Full Scale)</td></tr>
<tr><td>Conversion Rate</td><td>10ms</td><td>16ms</td><td>28ms</td><td>10ms</td><td>16ms</td><td>28ms</td></tr>
<tr><td>Absolute Max. Output</td><td colspan="6">Voltage : ±15V / Current : +24mA</td></tr>
<tr><td>Insulation Type</td><td colspan="6">Photo Coupler</td></tr>
</table>

6.1.9 Temperature

- High resolution : 1 / 16,000 (14 bits)
- Simple and easy configuration with dialog box.
- RTD, TC, NTC module

*RD**A/B module :*

- Compatible with 3-wired Pt. 100/DIN and JIS standard type
- Self-diagnostic function detecting sensor's breakdown per channel
- High accuracy (less than 0.1% of full scale)
- Must be used with SPC or SP2B power module

RTD Type	RD04A / RD08A	Pt100 (KS C1640-1989, DIN 43760-1980) JPt100 (KS C1603-1991, JIS C1604-1981)

	RD04B / RD08B	Pt1000 (DIN EN 60751) Ni1000 (DIN 43760)	
Range of Input Temperatures	RD04A / RD08A	Pt100 : -200.0 to 600ºC (18.48 to 313.59W) JPt100 : -200.0ºC to 600ºC (17.14 to 317.28W)	
	RD04B / RD08B	Pt1000 : -200.0ºC to 600ºC (184.8 to 3135.9W) Ni1000 : -50.0ºC to 160ºC (695.2 to 1986.3W)	
Digital Output	Digitally Converted Value : 0 ~ 16,000(-8000~8000) Detected Temperature Value : -2000~6000(Value of the first decimal Place X 10)		
Breakdown Dtection	3 Wires by Channels		
Precision	0.1 %(Full Scale)		
Max. Conversion Rate	50ms / Channel		
No. of Input Channels	RD04A, B	4 Channel	
	RD08A, B	8 Channel	
Insulation Type	Photo Coupler (No Insulation between channels)		
Connection Terminal	18 Points Terminal		
Current Consumption (mA)	+5V	50	
	+15V	30	
	-15V	10	

TC04A module :

- Direct input from temperature sensor's eliminates the external transducer
- Thermocouple sensors compatible with K-J-E-B-R-S Type
- Self-diagnostic function detecting sensor's breakdown per channel
- Cold junction compensation is also equipped (automatic)
- Acceptable for worldwide standard as ANSI, DIN, BS, JIS and KS
- Must be used with SPC or SP2B power module

Model	CM1-TC04A
Available TC	K, J, E, T, B, R, S
Digital Ouput	Digitally Converted value : 0 ~ 16000(-8000~8000), Converted Temperature Value : (Range of Measured Temperature X 10)

Range of Input Temperatures	Type of TC	Standard	Range of Measured Temperatures(℃)	Range of Measured Voltage
	K	KS ANSI DIN BS JIS	-200.0 ~ 1200.0	-5891 ~ 48828
	J		-200.0 ~ 800.0	-7890 ~ 45498
	E		-200.0 ~ 600.0	-8824 ~ 45085
	T		-200.0 ~ 400.0	-5602 ~ 20869
	B		400.0 ~ 1800.0	786 ~ 13585
	R		0.0 ~ 1750.0	0 ~ 21006
	S		0.0 ~ 1750.0	0 ~ 18612
Compensation Type	Automatic Compensation			
Breakdown Detection	Detection by Channels			
Precision	[(Full Scale)x0.3%+1ºC(error for base contact compensation)]			
Max. Conversion Rate	50ms / Chennel			
No. of Input Ch	4 Channel / Module			
Connection Terminal	18 Points Terminal			
Current Consumption (mA)	+5V	60		
	+15V	30		
	-15V	10		

Thermistor module :

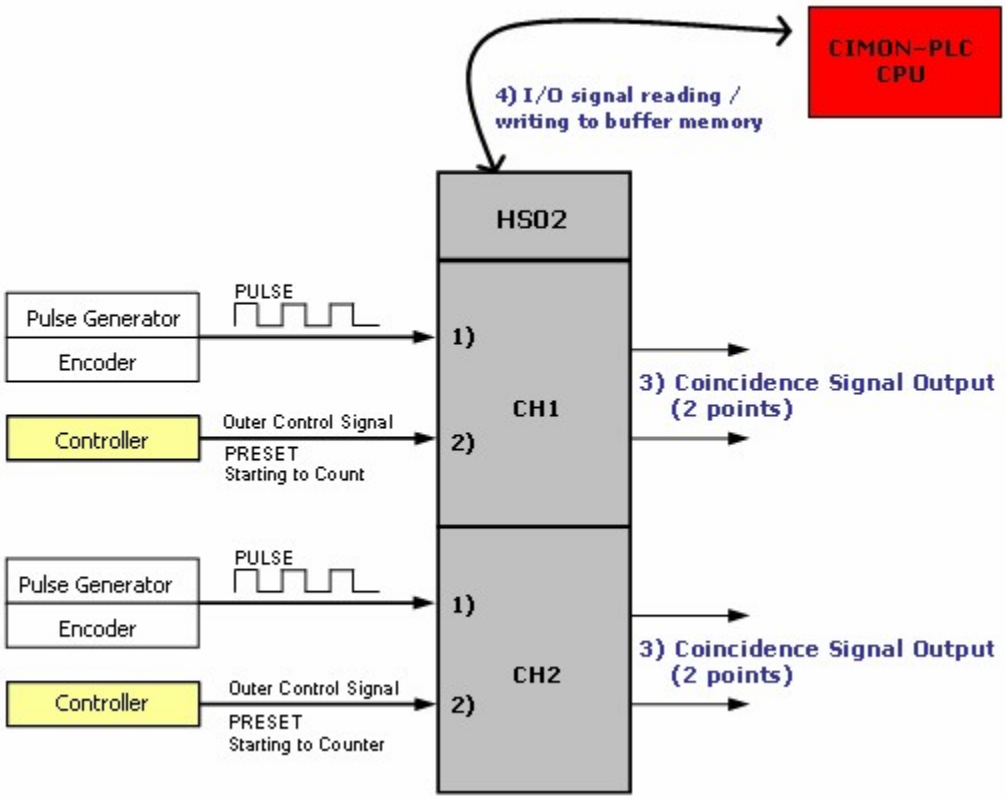
- Max. 8 channel NTC thermistor with one module
- Possible to measure NTC (Negative Temperature Coefficient) type Thermistor
- Temperature data accuracy of one decimal place.
- For each channel, this unit could detect any thermistor's single line input and assuming over setting of input.
- In the use of the Thermistor temperature-resistance table, it is able to input desired maximum, medium and minimum temperature(C) point and Resistance(Q) to measure.

Model	CM1-TH08A
Thermistor	NTC TYPE
Range of Thermistor Input Resistance	0 ~ 1M?
Resolution of Thermistor Input Resistance	0? ~ 40k? : 1? 40k? ~ 400k? : 10? 400k? ~ 1M? : 30?

Convert range	Temperature Convert value	ºC, ºF (0.1ºC Resolution)
	Digital value	0 ~ 16000, -8000 ~ 8000
Resistance-Temperature Calculation		Steinhart-Hart thermistor polynomial
Precision		0.3%(Full Scale)
Max. Conversion Rate		1Sec(8ch)
Temperature Input Point		8 Points
Insulation method		Photo Coupler
Connection Terminal		18 Points

6.1.10 High-Speed Counter

Operation Outline :



Features of High-Speed Counter :

1) Pulses in a wide range can be counted.(-2147483648 ~ 2147483647)

A counted value is stored in buffer memory in signed 32-bit binary value.

2) Pulse input type can be selected.

1-p input 1-m, 1-p input 2-m, CW/CCW, 2-p input 1-m, 2-p input 2-m, 2-p input 4-m

3) Counting form can be selected.

One between the following forms can be selected.

- **Linear counting :** Input pulses can be counted from -2147483648 to 2147483647. In case that a value is out of the range, overflow occurs.
- **Ring counting :** Input pulses are counted repeatedly between the maximum value and the minimum value of ring counting.

4) Coincidence output is available.

Comparing a current value with a set coincidence comparison value, output can be on/off.

5) Four counting functions can be selected.

- **Latch counting :** A currently counted value is stored in buffer memory (04H, 05H, 24H and 25H) according to the signal to start to count (Y06 and Y0E).
- **Sampling counting :** The value counted for the time set by the signals to start to count (Y06, Y0E) is stored in buffer memory (06H, 07H, 26H and27H). If a set time is passed, the value counted before signals (Y06, Y0E) are inputted will be kept.
- **Periodic pulse counting :** The values (08H, 09H, 28H and 29H) counted before the time set up by signals (Y06, Y0E) and currently counted values (0AH, 0BH, 2AH and 2BH) are stored in buffer memory.
- **Disabling to count :** If signals (Y06, Y0E) or the signals to enable to count (Y04, Y0C) are off, pulses will not be counted. The counted values are accumulated in buffer memory for storing current count (00H, 01H).

6) Presetting and counting function can be processed by outer control signals.

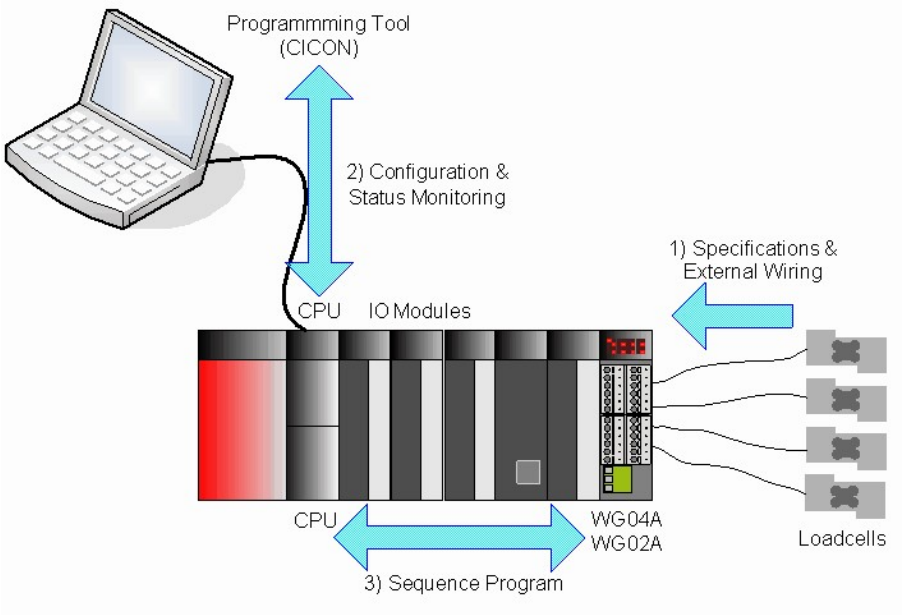
		CM1-HS02B	CM1-HS02D
No. of I/O points		16 Points	
No. of Channels		2 Channels	
Counting Input Signal	Phase	1-Phase Input/ 2-Phase Input	
	Signal Level(A, B)	5/12/24 V DC (2~5mA)	RS-422 Line Drive
Counting	Counting Rate	200 kPPS	
	Counting Range	Signed 32-bit binary value (-2147483648~2147483647)	
	Form	Up/Down Presetting Counting + Ring Counting	

Coincidence Output	Range of Comparison	Signed 32-bit binary values
	Result of Comparison	Set Value < Counted Value Set Value = Counted Value Set Value > Counted Value
Outer Input	Presetting	5/12/24 V DC 2~5mA
	Starting Function	
Outer Output	Coincidence Output	Transistor(Sink Type) Output Operating Voltage 12~24V

6.1.11 Load Cell

WG02A and WG04A modules provide the functionality for weighing system. These modules can be connected with various kinds of loadcell units. WG04A can be connected with up to 4 independent loadcell signals at the same time.

Operation Outline :



Load Cell modules have following characteristics :

- Max. 4 Channels of independent signal inputs. (WG04A)
- Supplies 5Vdc power to the connected loadcells for generating input signals.
- 24 bits A/D converter

- Provides 1 / 6,000,000 effective resolution.
- Provides 6 internal ready to use batch programs.

Item	Specifications	
	WG02A	WG04A
Channel	2 Channels	4 Channels
Supported L/C Type	Strain Gage	
Insulation	Photo-Coupler	
External Power Supply	DC24V, 2 Watts	
L/C Excitation Voltage	5Vdc (Up to 4 x 350 Ohm loadcells / Channel)	
Full Scale Input Signal	3.6mV / V (18mV)	
A/D Converter Resolution	24 bits (1 / 1,600,000,000)	
A/D Program Resolution	1 / 6,000,000	
A/D Conversion Speed	20 Times / Sec.	10 Times / Sec.

6.1.12 Data Logger

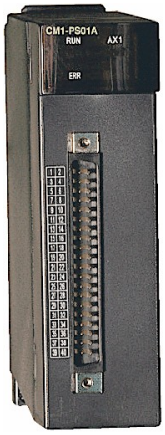
- Equipped with large capacity and non-combustible log memory (32MB or 64MB)
- Standalone real time data sampling & preserving
- Upon restoration of communication system, upper level system(HMI) data can be obtained
- Maximum of 32 word data can be sampled at the same time with maximum of 10mSec interval.
- Built-in HMI protocol : no necessary of optional communication card (RS232C, Support Modem) Self-diagnostic function (communication error, memory error, capacity check, etc)
- Trigger Logging by Sequence program
- Provide event logging (COS, VOC)

		CM1-LG32A	CM1-LG64A
Communication Mode	HMI Mode	CIMON HMI Protocol	
	Terminal Mode	Text transmission	
Data Mode	Data bit	7 / 8	
	Stop bit	1 / 2	
	Parity	Even / Odd / None	
Synchronous		Asynchronous	

Transmission Speed	300 / 600 / 1200 / 4800 / 9600 / 19200 / 38400	
Communication method	RS232C	
Modem	Cable modem or dial up modem	
Log memory capacity	32 Mbytes	64Mbytes
Sampling interval	10mSec ~ 327,670mSec	
Max. Logging data size	32 Words	
Log data	Block sampling or Event Data	
Logging method	Periodic, Trigger, Event (COS / VOC)	
Built in function	• Memory condition check • Communication error check • Memory capacity check	

6.1.13 Positioning Module

CM1-PSnnX module is a pulse output modules for CP and XP series of CIMON PLCs. PS02A type supports differential driver system pulse output. PSnnX is capable of driving not only servo motor but also stepping motor



- Enable to set max. 600 positioning data include positioning address and operating method.
- Possible to operate position control, speed control, position/speed switch control, or speed/position switch control by control method designed according to positioning data.
- Positioning control of the each axis : speed control, arc/linear interpolation, separate/synchronous operation
- Origin point return method
  - Search origin point after approximate origin point OFF
  - Search origin point after reducing speed when approximate origin point ON
  - Search origin point by origin point and upper/lower limit switch
- Enable to set immovable origin point

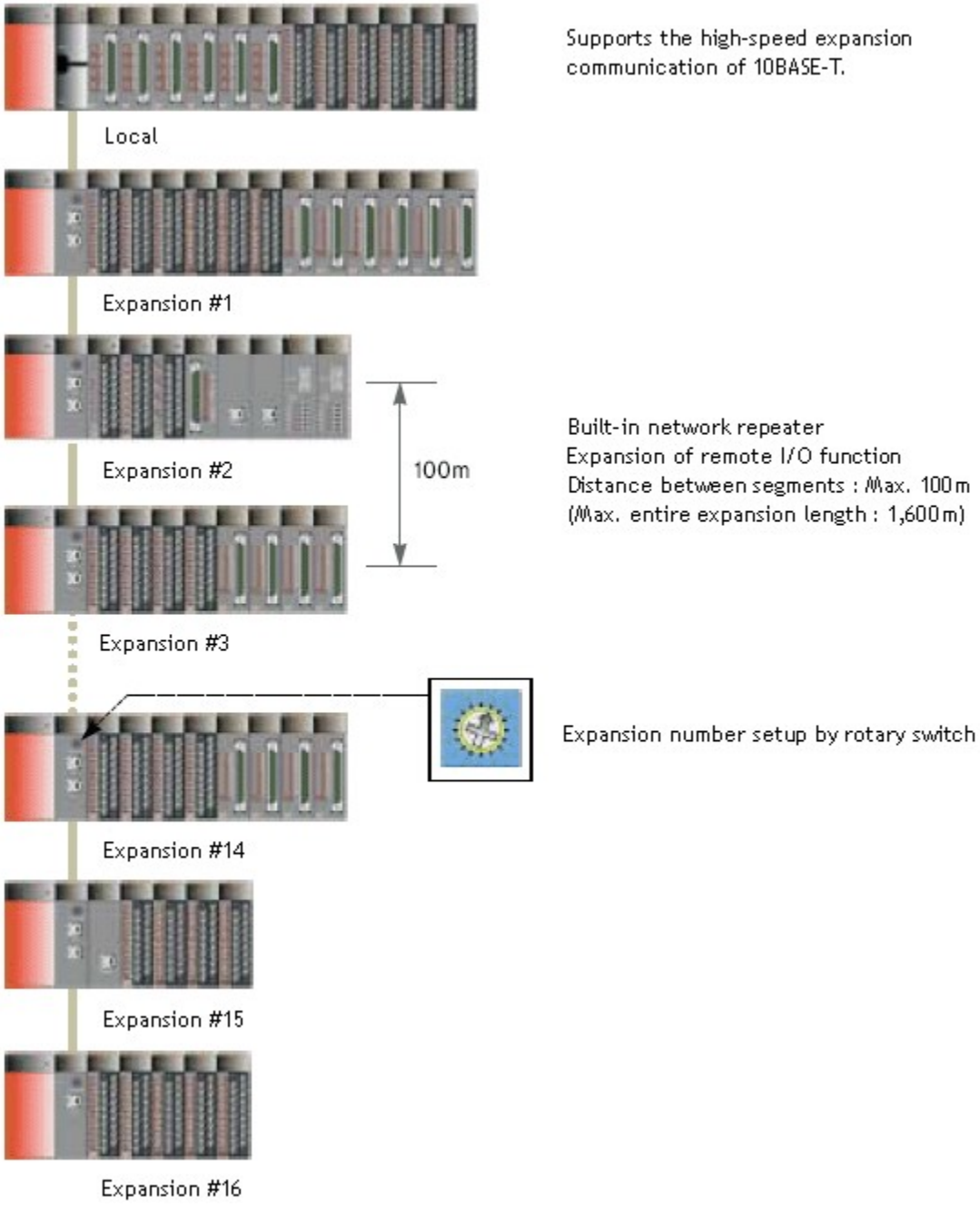
	CM1-PS202A
Number of Axis	2
Interpolation	2axis linear / arc interpolation
Control method	Position, locus, speed, speed/position, position/speed control
Setting Unit	Pulse, mm, inch, degree
Positioning Data	600 / axis
Positioning Method	Absolute or relative method
Backup	Flash Rom Backup (parameter, positioning data, block data, condition data

Position address	Position address method	Position control absolute/relative coordinate method Position/Speed switching control-relative coordinate method Speed/Position switching control-absolute/relative coordinate method Locus control-absolute/relative coordinates method
	Position address range	• Absolute coordinates method ➢ -2147478364.8 ~ 214748364.7㎲ ➢ -21474.83648 ~ 21474.83647 inch ➢ 0 ~ 359.9999 degree ➢ -2147483648 ~ 2147483647 pulse
		• Relative coordinate method ➢ -214748364.8 ~ 214748364.7㎲ ➢ -21474.83648 ~ 21474.83647 inch ➢ -21474.83648 ~ 21474.83647 degree ➢ -2147483648 ~ 2147483647 pulse
		• Speed/Position Switching control(relative coordinate method), Position/seed switching control ➢ 0 ~ 214748364.7 ㎲ ➢ 0 ~ 21474.83647 inch ➢ 0 ~ 21474.83647 degree ➢ 0 ~ 2147483647 pulse
		• Speed/Position Switching control (Absolute coordinate method) ➢ 0 ~ 359.9999 degree
	Positioning speed range	0.1 ~ 20,000,000.00 (mm/min) 0.001 ~ 2,000,000.000 (inch / min) 0.001 ~ 2,000,000.000 (degree/min) 1 ~ 1,000,000 (pulse/sec)
	Acceleration/Deceleration pattern	Trapezoidal / S-curve
	Acceleration/Deceleration time	125 ~ 1*106 PPS/sec
External disconnection method		40 Pin Connector
Connector of external		40 Pin Male (Fujitsu)
Max. Output pulse		1 MPPS (Line Driver Pulse Output)
Max. Distance		10m / B Type : 2m
Number of Flash Rom saving		25 times after power on

6.1.14 Expansion

Module Name	Type	Specification
CM1 - EP01A	Expansion	1 expansion port, no expansion hub
CM1 - EP02A		2 expansion ports, expansion hub embedded
CM1 - EP03A		3 expansion ports, for redundant CPU configuration

Series CP allows expanding a base up to 16 :



6.1.15 Accessories

- **Dummy Module for empty slot**

Model Name	CM0-DM
Note	Dummy

- **Flash memory pack**

Model Name	CM1-FM512
Note	Flash memory

- **Loader Cable**

Model Name	CM0-CBL15/30
Note	1.5m/3.0m

- **Expansion Cable for XP/CP Series**

Model Name	CM0-CBE05
Note	0.5m

- **Expansion Cable for BP Series**

Model Name	CM2-CBE05
Note	5cm

- **CPU battery for data backup**

Model Name	CM0-BAT
Note	Battery

- **Base Slot Cover**

Model Name	CM2-CBE05
Note	5cm

6.1.16 Training KIT

- To Study basic knowledge and applications on PLC
- To improve applicable capability of trainees at site
- To master the capability to use PLC application instructions
- To master the capability to control analog signals
- To understand how to configure RS232C/422/485
- To master the capability to configure and operate a site monitoring & operation system

Features of Training Kit :

- Compose of high-performance module type PLC components.
- Enables to practice the advanced functions of various types like on-line editing, forced input/output, initialization program by using an exclusive loader program (CICON)
- Enable to perform PLC training without connection with other devices.
- Equipped with toggle switches, push buttons and so on to use output lamps and an display for a simulation load.
- Equipped with an analog input signal generator and a level meter to make sure analog output signals.
- Enable to practice PID control by using analog converters.
- Equipped with a photo sensor and an encoder to detect easily the number of revolutions by using.
- Enables computer link in series communication type through computer exclusive terminal of CPU
- Enables remote control and monitoring in connection with HMI S/W
- Composed of a system with very suitable input/output points in module type to improve the capability of programming for site situation.
- Composed of attachable-detachable type to switch input, output and optional modules freely, if necessary.
- Enables training from basic to application

Accessories :

- Power Cable (Rated 7A 250V)
- CM0-CBL15 . 1.5m Loader Cable
- Users Manual
- RS-232C cable
- CD including CICON, application program samples & CIMON HMI S/W Demo

PLC Module Composition :

Module Name	Type	Specification
CM1-CP4A	CPU	16K step program memory capacity
CM1-SPC	Power	Voltage output 5 / 24 / +15 / -15 V
CM1-BS08A	Base	8-slot Base
CM1-XD32C	Digital input	32 point input module
CM1-YT32B	Digital output	32 point source output module
CM1-YR16A		16 point relay output module
CM1-AD08V	Analog input	14 bit 8ch voltage Analog Input
CM1-DA04V	Analog output	14 bit 4ch voltage Analog Output
CM1-SC02A	Communication	RS232C / 422 / 485
CM1-EC01A		10 Mbps Ethernet
CM1-HS02A	HSC	200 kpps 2 Ch high speed Counter

6.2 Serial Communication Module

This manual is the technical details about RS232C/422(Computer Network) module among the network modules for CIMON-PLC system.
In this module, the function of the link with diverse communication devices, such as other makers' PLC and PC, with the protocols of different types and the function of modem communication to control a PLC at a long distance are furnished. The features are as follows.

Features :

- As other makers' protocols are written to use RS-232 channel and RS-422(RS-485) channel each, independent operation is available by protocols.
- It is available to use an exclusive protocol to read/write data.
- The function of the exclusive communication suitable for multi-drop configuration of 32 units access as maximum is offered.

- As modem communication function is built in, a PLC at a long distance can be controlled through exclusive communication.
- Baud rate can be set up in the range from 300bps to 38400bps variously.
- It is available to set up RS232C / RS422(RS485) communication port as independent channel or linked channel.
- 1:1 / 1:N / N:M communication (In case RS422 channel is used) are supported.
- Full – Duplex(RS422) and Half-Duplex(RS485) communication method are supported.
- RS485 multi-drop communication system can be configured, using RS485 channel.

See :

- Specifications
- Operation Setup
- Internal I/O
- Shared Memory
- Network Example
- Communication Services
- Installing and Testing
- Trouble Shooting
- Appendix

6.2.1 Specifications

RS 232C/422/485 Specifications :

- SC02A Dimensions
- SC01A Dimensions
- SC01B Dimensions
- General Specifications
- Module Specifications
- Cable Specifications
- Termination Register

6.2.1.1 General Specifications

The general specifications for CIMON PLC communication modules are as follows.

<table>
<tr><th>Item</th><th colspan="5">Specification</th></tr>
<tr><td>Operating Temperature</td><td colspan="5">-10 ~ 65ºC</td></tr>
<tr><td>Storage Temperature</td><td colspan="5">-25 ~ 80ºC</td></tr>
<tr><td>Operating Humidity</td><td colspan="5">5 ~ 95%RH, Not condensed.</td></tr>
<tr><td>Storage Humidity</td><td colspan="5">5 ~ 95%RH, Not condensed.</td></tr>
<tr><td rowspan="6">Vibration</td><td colspan="5">In case of intermittent vibration</td></tr>
<tr><td>Frequency</td><td>Acceleration</td><td>Amplitude</td><td colspan="2">Sweep</td></tr>
<tr><td>10 ≦ f< 57Hz</td><td>-</td><td>0.075mm</td><td colspan="2" rowspan="2">10 times in each direction (X,Y,Z)</td></tr>
<tr><td>57 ≦ f < 150 Hz</td><td>9.8m/s2 {1G}</td><td>-</td></tr>
<tr><td colspan="5">In case of continuous vibration</td></tr>
<tr><td>Frequency</td><td>Acceleration</td><td>Amplitude</td><td colspan="2">Sweep</td></tr>
<tr><td>10 ≦ f < 57Hz</td><td>-</td><td>0.035mm</td><td colspan="2" rowspan="2">10 times in each direction (X,Y,Z)</td></tr>
<tr><td>57 ≦ f < 150 Hz</td><td>4.9m/s2 {1G}</td><td>-</td></tr>
<tr><td>Shock</td><td colspan="5">- Max. Shock Acc.: 147 m/s2 {15G}
- Time : 11㎳(3 times in X, Y, Z)
- Pulse Wave : Half sine wave pulse</td></tr>
<tr><td rowspan="4">Noise</td><td>Square wave impulse noise</td><td colspan="4">±1500V</td></tr>
<tr><td>Electrostatic discharge</td><td colspan="4">Voltage: 4 kV(Contact discharge)</td></tr>
<tr><td>Radiated electro-magnetic field</td><td colspan="4">27 ~ 500 MHz. 10 V/m</td></tr>
<tr><td>Fast Transient Bust Noise</td><td>Item</td><td>Power Module</td><td>Digital I/O (24V or more)</td><td>Digital I/O(Less than 24V) Analog I/O Comm. interface</td></tr>
<tr><td></td><td>Voltage</td><td>2KV</td><td>1KV</td><td>0.25KV</td></tr>
<tr><td>Environment</td><td colspan="5">No corrosive gas and no dust.</td></tr>
<tr><td>Altitude</td><td colspan="5">2,000m or less</td></tr>
<tr><td>Pollution</td><td colspan="5">Less than 2</td></tr>
<tr><td>Cooling</td><td colspan="5">Natural Air cooling</td></tr>
</table>

6.2.1.2 Module Specifications

<table>
<tr><th colspan="2">Model</th><th>CM-SC02A</th><th>CM1-SC01A</th><th>CM1-SC01B</th></tr>
<tr><td colspan="2">Interface</td><td>RS232C / 422 / 485</td><td>RS232C</td><td>RS422 / 485</td></tr>
<tr><td></td><td>Null Modem</td><td colspan="3">Direct communication between a PC and RS232C/RS422 port</td></tr>
</table>

Communication Method	Leased-Line Modem	Communication using a leased-line modem
	Dial-up Modem	Remote communication using a dial-up modem
Operation Mode	User Protocol	Communication using user protocol
	HMI Protocol	Communication using exclusive protocol
	MODBUS Protocol	Communication using Modicon protocol
	Graphic Loader Mode	Controls a PLC, using link function in the CICON
Data Type	Data Bit	7 or 8 bits
	Stop Bit	1 or 2 bits
	Parity	Even / Odd / None
Synchronous Type		Asynchronous
Baud Rate		300bps / 600 / 1200 / 2400 / 4800 / 9600 / 19200 / 38400bps
Modem Link Function		Long-distance communication linking modem

6.2.1.3 Cable Specifications

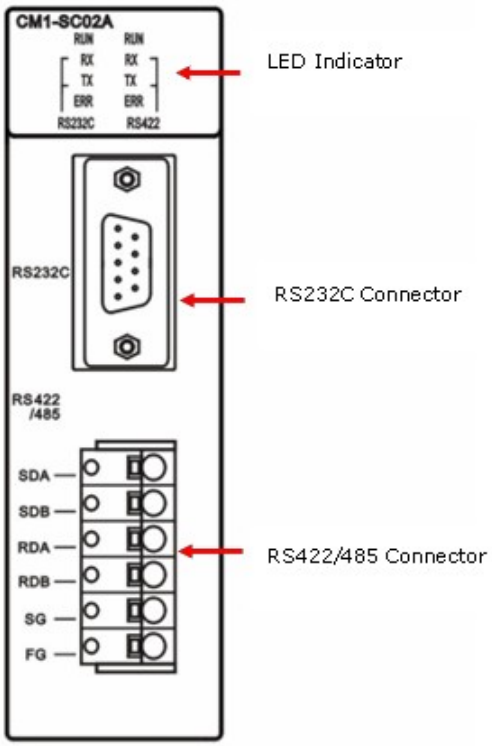
In case of communication, especially, communication distance and baud rate is to be considered among items. In case of the communication using RS-232C port and RS-422/RS-485 port provided from a PLC, to minimize the noise received from outside, a twisted-fair cable for RS-232 is to be used.

6.2.1.4 Termination Register

In case of communication through RS-422 channel, a termination register is to be connected to outside. As termination register protects the signal from the distortion by reflected wave in case of a long-distance communication, the register (1/2W) with the same value as the feature impedance of a cable is to be connected to the termination of a network. In case of recommended cable, connect the termination register of 120? to both ends of the line.

6.2.1.5 SC02A Dimensions

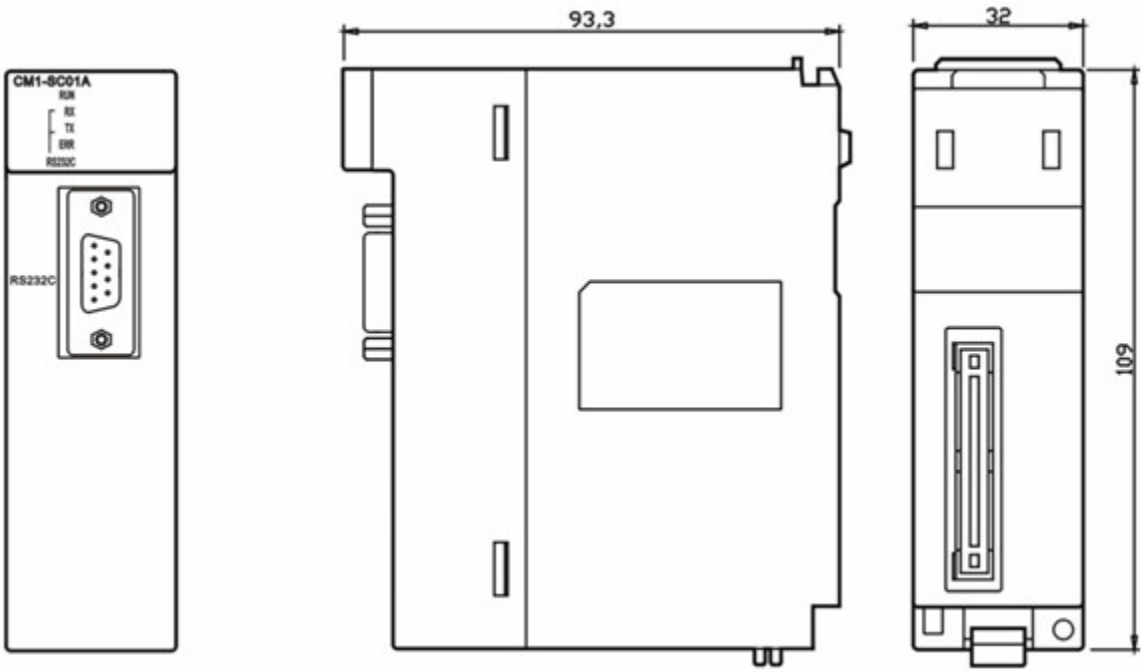
Unit : mm



Name	Description
LED Indicator	Indicates operation status.
RS232C Connector	RS232C connector to connect with an outer device
RS422/485 Connector	RS422/485 connector to connect with an outer device

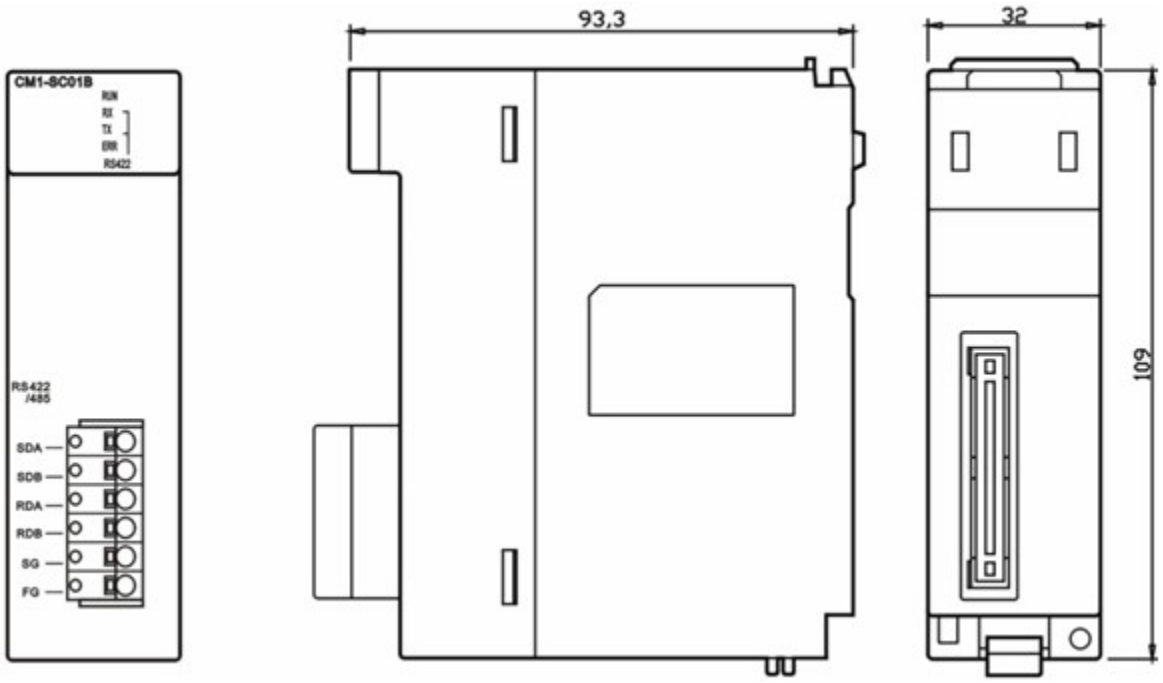
6.2.1.6 SC01A Dimensions

Unit : mm



6.2.1.7 SC01B Dimensions

Unit : mm



6.2.2 Operation Setup

Operation Setup :

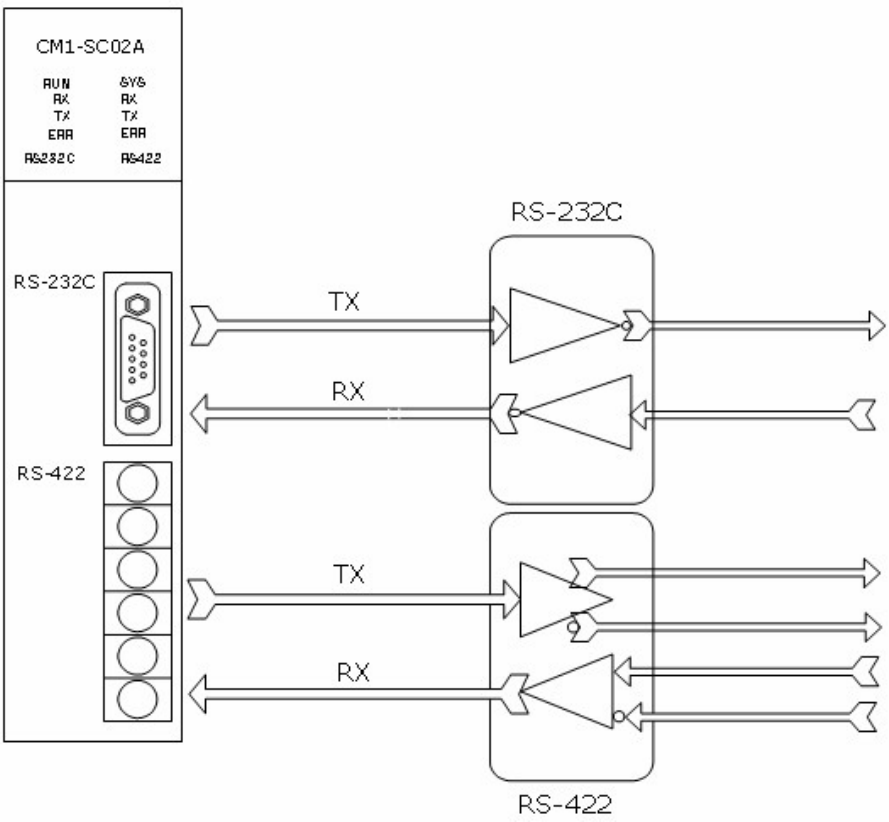
- Operation Mode Setup
- Series Interface Method

6.2.2.1 Operation Mode Setup

Independent mode and linked mode are used as communication operation mode.
Default is independent mode.

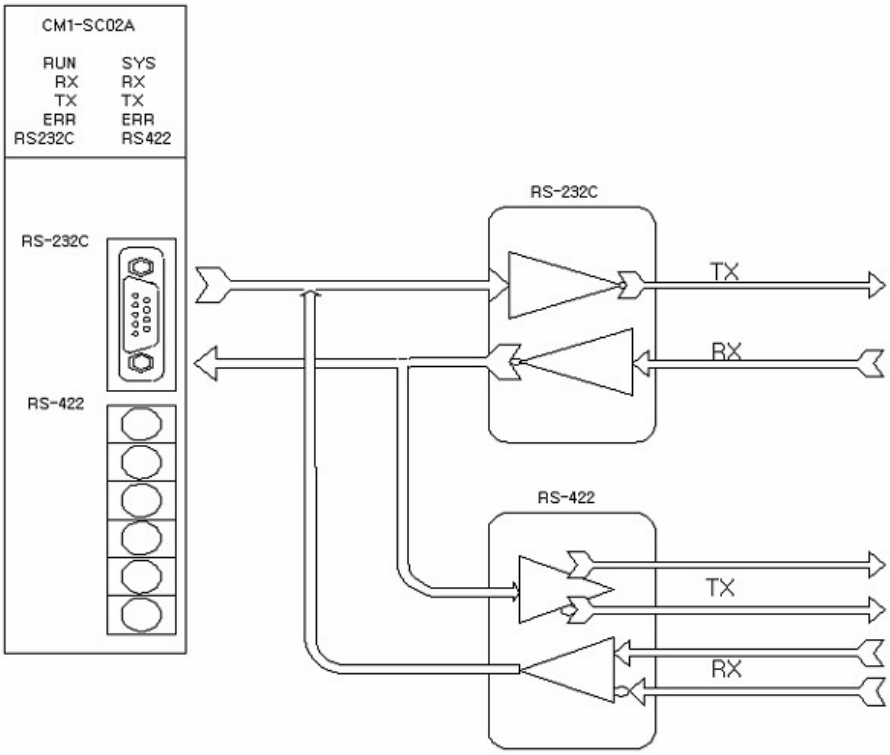
Independent Mode of Channel Operation

As RS-232C channel and RS-422 channel are operated independently each other, sending and receiving are available as individual sending standard at one time. By channels, the sending standard can be set up, and the operation can be started and stopped.



Linked Mode of Channel Operation

The data received through RS-232C channel and RS-422 channel are sent through RS-232C channel.
In the linked mode, RS-232C channel is automatically set up as main channel and the station number is the same as the main channel. The data received through RS-232C channel is both received in RS232C/422 module and sent through RS-422 channel. The data received through RS-422 channel is not received in RS232C/422 module but is automatically sent through RS-232C channel.



6.2.2.2 Series Interface Method

RS-232C channel is communicated with other device with a 9-pin connector.

It is directly communicated with a long-distance device, using a modem, as well as with other device.

Pin	Function	Name	Direction of Signal	Description
1	Carrier Detect	CD	Inside to outside	Signal wire that DCE informs DTE about the detection of carrier
2	Received Data	RXD	Outside to inside	Signal wire receiving data
3	Transmitted Data	TXD	Inside to outside	Signal wire sending data
4	Data Terminal	DTR	Inside to	Signal wire that DTE informs DCE about the state that DTE is

	Ready		outside	able to send and receive
5	Signal Ground	SG	Both directions	Ground wire for signal
6	Data Set Ready	DSR	Outside to inside	Signal wire that DCE informs DTE about the state that DCE is able to send and to receive
7	Request To Send	RTS	Inside to outside	DTE is ready and requests DCE to send data.
8	Clear To Send	CTS	Outside to inside	Signal wire that DCE inform DTE about the state that DCE is able to send
9	Ring	RI	Outside to inside	Signal wire that DCE inform DTE of receiving RING

Connection with a modem

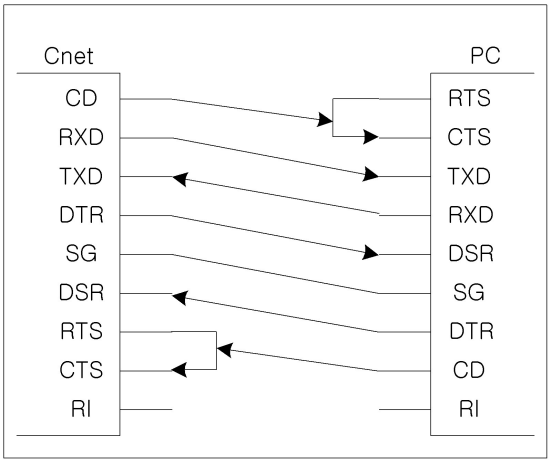
A long-distance communication is available.

modem interface is described.

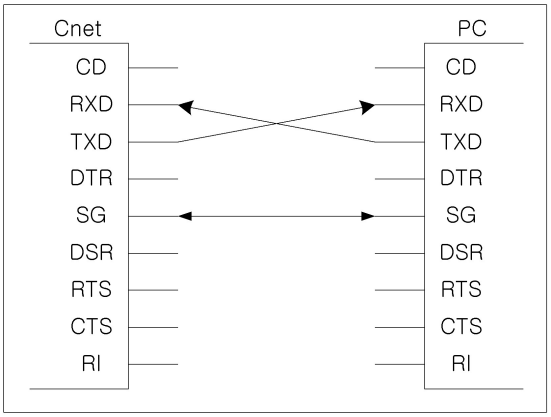
PLC(RS-232C)		Signal Direction	Modem	
Pin	Name		Name	Pin
1	CD	←	CD	8
2	RXD	←	RXD	3
3	TXD	→	TXD	2
4	DTR	→	DTR	20
5	SG	—	SG	7
6	DSR	←	DSR	6
7	RTS	→	RTS	4
8	CTS	←	CTS	5
9	RI	←	RI	22

Connection with a null modem

- PLC and Computer/Communication device: There are 3-wire type and 7-wire type.



- In case that a PC is connected with a RS-232C connector, RXD, TXD and SG is to be connected in 3-wire type.



RS-422 Interface

A 6-pin connector is used for RS-422 interface. The functions and names of the pin and the flow of data are described as follows.

Pin	Name	Direction of Signal PLC Device	Function
1	SDA	→	Sends data. (+)
2	SDB	→	Sends data. (-)
3	RDA	←	Receives data. (+)
4	RDB	←	Receives data. (-)
5	S.G	←	Ground wire of signal

6	F.G		Ground wire of frame

RS-422 channel can be connected with other device for RS-422 and RS-485 (Multi-drop).

Computer Link		Direction of Signal PLC Device	Outside Communication Device
Pin	Name		
1	SDA	→	RDA
2	SDB	→	RDB
3	RDA	←	SDA
4	RDB	←	SDB
5	S.G	↔	S.G
6	F.G	↔	F.G

The following is an example to connect RS-485 channel with an outside device. At this time, as a sending wire shares with a receiving one (Half Duplex), the channel mode is to be set up as RS-485.

Computer Link		Direction of Signal PLC Device	Outside Device
Pin	Name		
1	SDA	→	SDA
2	SDB	→	SDB
3	RDA	←	RDA
4	RDB	←	RDB
5	S.G	↔	S.G
6	F.G	↔	F.G

6.2.3 Internal I/O

Device	Description For Signal	Device	Description For Signal
X0000	Error in module	Y0000	Clear error
X0001	Initialized (Card Ready)	Y0001	
X0002		Y0002	
X0003		Y0003	
X0004	Rx Data Existing(Ch1)	Y0004	Clear Rx Buffer (Ch1)

X0005	Tx Buffer Empty(Ch1)	Y0005	Clear Tx Buffer (Ch1)
X0006	Rx Data Existing(Ch2)	Y0006	Clear Rx Buffer (Ch2)
X0007	Tx Buffer Empty(Ch2)	Y0007	Clear Tx Buffer (Ch2)
X0008		Y0008	
X0009		Y0009	
X000A	Modem Initialized	Y000A	Modem Initialization Request
X000B	Dialing	Y000B	Dialing Request(Line Connection)
X000C	Detect DCD Signal	Y000C	Connection Release Request
X000D	Detect DSR Signal	Y000D	
X000E		Y000E	
X000F	Parameter Applied	Y000F	Parameter Setup Request

6.2.4 Shared Memory

Offset	Description	R/W	Remarks
0	Status Code (0=Normal, Others=Error)		
1	Mode		
2	CH1 Port Parameter		
3	CH2 Port Parameter		
4	Number of Retrying Dialing		1 – 5
5	Interval of Retrying Dialing		20 – 300 secs
6	Modem Initialization/Dialing Timeout		1 – 60 secs
7	Number of Retrying Modem Initialization		1 – 5 times
8	Station Number		0 – 31(Ch1=High,Ch2=Low)
9	SND Command Timeout		0 – 3000 sec
10	RCV Command Timeout		0 – 3000 sec
11 ~31	Modem Initialization Command		
…			
37	PLC Link Station Number	R	Not Link Join(0xFF)
38	PLC Link Connection	R	Stn0 ~ Stn15
39	PLC Link Connection	R	Stn16 ~ Stn31
40	Dial Number (H)	R/W	
…			
49	Dial Number (L)		
50	Response Delay Time(CH1)	R/W	Delay Time(0~200ms)
51	Response Delay Time(CH2)	R/W	Delay Time(0~200ms)
…			
62			

63	OS Version	R	
64 - 255	User Message	R/W	216 Word (432 Bytes)

The user data memory device is divided into the contents set up to an optional card and the memory indicating error code. And set contents are stored in buffer memory and finally are stored in Eprom by I/O Point Map.

See :

- Mode
- Parameter

6.2.4.1 Mode

Code	RS232C	RS422/485
0x00--	Independent (User)	-
0x01--	Independent (HMI Protocol)	
0x02--	Independent (MODBUS Protocol)	
0x03--	Independent (PLC LINK Protocol)	
0x04--	Independent (Graphic Loader I/F)	
0x--00	-	Independent (User)
0x--01		Independent (HMI Protocol)
0x--02		Independent (MODBUS Protocol)
0x--03		Independent (PLC LINK Protocol)
0x--04		Independent (Graphic Loader I/F)
0x80FF	Linked (User)	
0x81FF	Linked (HMI Protocol)	
0x82FF	Linked (MODBUS Protocol)	
0x84FF	Linked (Graphic Loader I/F)	

6.2.4.2 Parameter

Bit	내 용
0	Data Bit : 0=7, 1=8
1	Parity : 0=Even, 1=Odd
2	Parity : 0=None, 1=사용 (Bit 설정에 따름)

<table>
<tr><td>3</td><td>Stop Bit : 0=1 Bit, 1=2</td></tr>
<tr><td>4</td><td rowspan="4">통신속도
(0=300, 1=600, 2=1200, 3=2400, 4=4800, 5=9600, 6=19200, 7=38400, 8=76800)</td></tr>
<tr><td>5</td></tr>
<tr><td>6</td></tr>
<tr><td>7</td></tr>
<tr><td>8</td><td rowspan="3">Network Type
<table><tr><th>Code</th><th>Channel 1</th><th>Channel 2</th></tr><tr><td>0</td><td>NULL Modem</td><td>RS422</td></tr><tr><td>1</td><td>전용선모뎀</td><td>RS485</td></tr><tr><td>2</td><td>Dial-Up Modem</td><td>N/A</td></tr><tr><td>3-7</td><td>N/A</td><td>N/A</td></tr></table></td></tr>
<tr><td>9</td></tr>
<tr><td>10</td></tr>
<tr><td>11~15</td><td>System (Reserved)</td></tr>
</table>

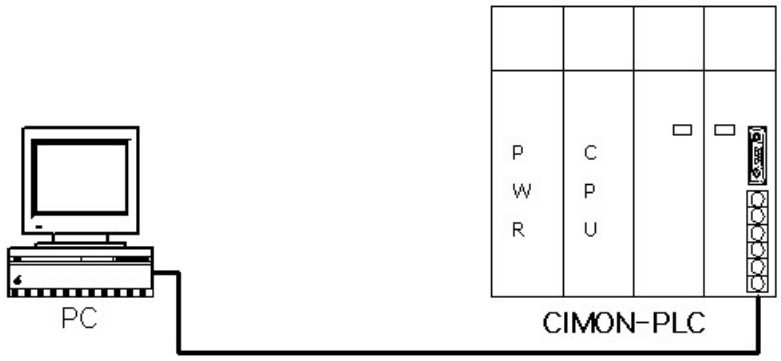
6.2.5 Network Example

System Configuration :

- 1:1 Communication between CIMON PLC and PC
- 1:1 Communication between CIMON PLC and 3rd vendor device
- 1:2 Communication with 3rd vendor device via modem
- 1:2 Communication with 3rd vendor device
- 1:N long distance communication via modem
- 1:N Multi-drop communication
- 1:N Multi-drop communication between various devices via modem
- 1:N Multi-drop communication between various devices
- An example of CIMON PLC network
- An example of CIMON PLC network including 3rd vendor devices

6.2.5.1 1:1 Communication between CIMON PLC and PC

The following is to use RS-232C channel or RS-422 channel, and the exclusive protocol of the CIMON PLC to configure a network.

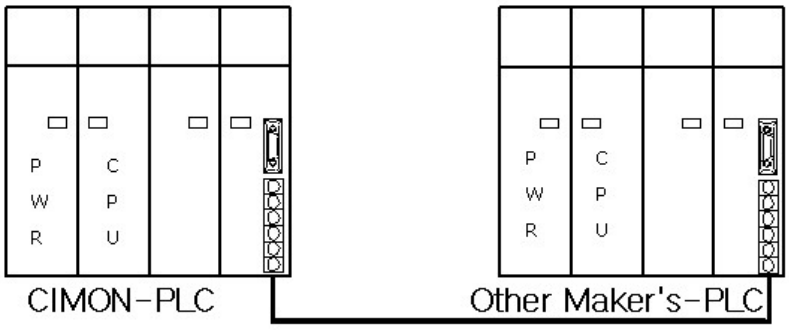


Components and parameters of computer link module,

Component	Name of Module	Parameter	Ex. of Station No.
PC	Built-in RS-232C	-	-
PLC	CM1-SC02A	Exclusive Comm., Independent Mode	0

6.2.5.2 1:1 Communication between CIMON PLC and 3rd vendor device

The following is the network configuration when linking other maker's PLC with a computer module.



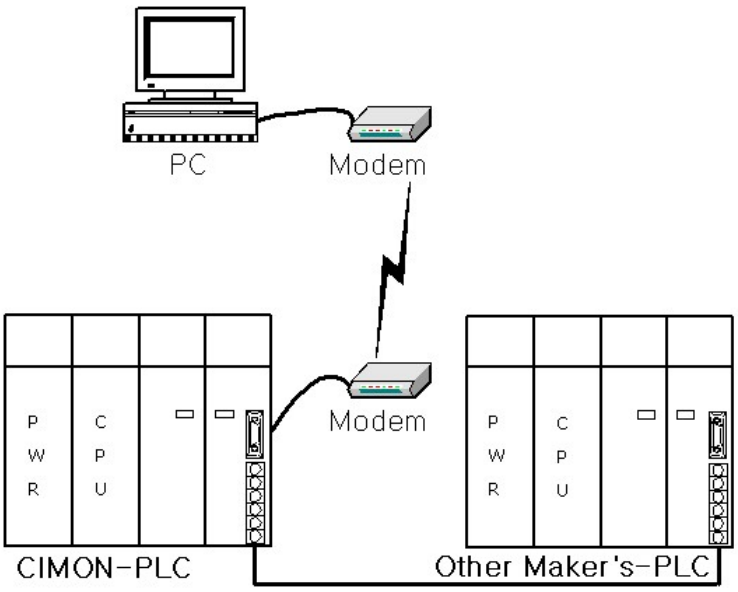
Components and parameters of computer link module,

Component	Name of Module	Parameter	Ex. of Station No.
PLC	CM1-SC02A	User Communication, Independent Mode	1

Other maker's PLC	CM1-SC02A	-	-

6.2.5.3 1:2 Communication with 3rd vendor device via modem

RS-232C and a modem are used for a long-distance communication.

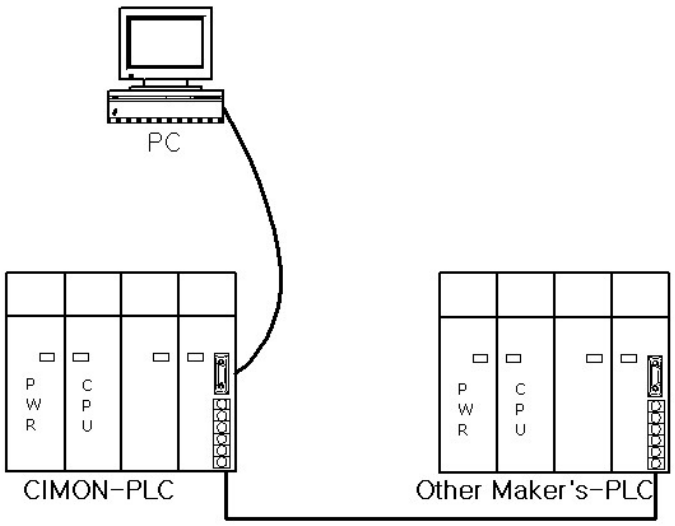


Components and parameters of computer link module,

Component	Name of Module	Parameter		Ex. of Station No.
PC	Built-in RS-232C	-		-
PLC	CM1-SC02A	RS-232C	Exclusive Comm.	0
		RS-485	User Comm.	
		Independent Mode		
Other maker's PLC	-	-		-

6.2.5.4 1:2 Communication with 3rd vendor device

A RS-232C cable is used for interface.

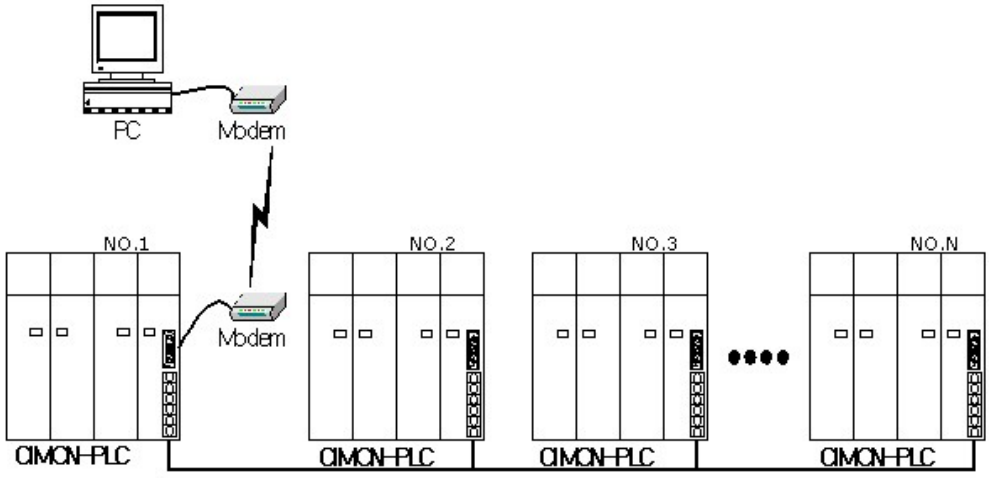


Components and parameters of computer link module,

Component	Name of Module	Parameter		Ex. of Station No.
PC	Built-in RS-232C	-		-
PLC	CM1-SC02A	RS-232C	Exclusive Comm.	0
		RS-422	User Comm.	
		Independent Mode		
Other maker's PLC	-	-		-

6.2.5.5 1:N long distance communication via modem

A modem and RS-232C are used for a long-distance communication.

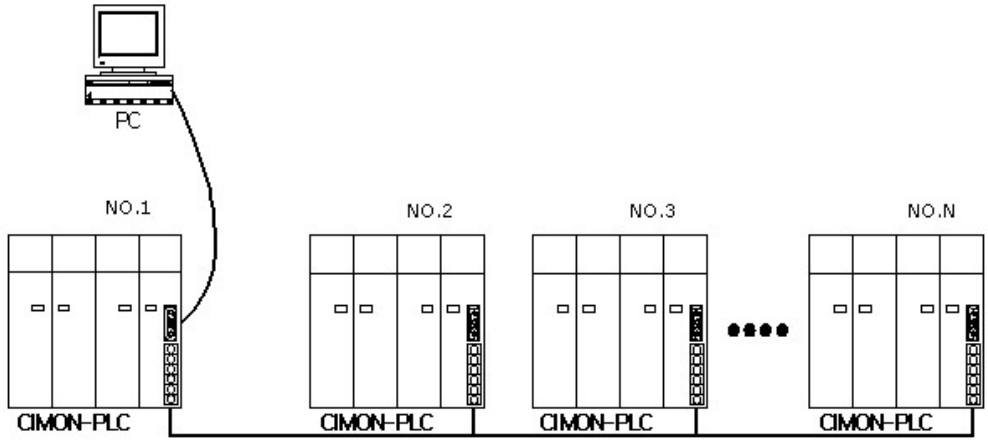


Components and parameters of computer link module,

Component	Name of Module	Parameter		Ex. of Station No.
PC	Built-in RS-232C	-		-
PLC NO.1	CM1-SC02A	RS-232C	Exclusive Comm. (RS-232C Mode)	0
		RS-422	Exclusive Comm.	
		Linked Mode		
PLC NO.2	CM1-SC02A	RS-232C	Exclusive Comm.	1
		RS-422	Exclusive Comm.	
		Independent Mode		
PLC NO.N	CM1-SC02A	RS-232C	Exclusive Comm.	31
		RS-422	Exclusive Comm.	
		Independent Mode		

6.2.5.6 1:N Multi-drop communication

A RS-232C cable is used to connect a PC with a PLC. RS-422 cables are used to connect between PLCs.

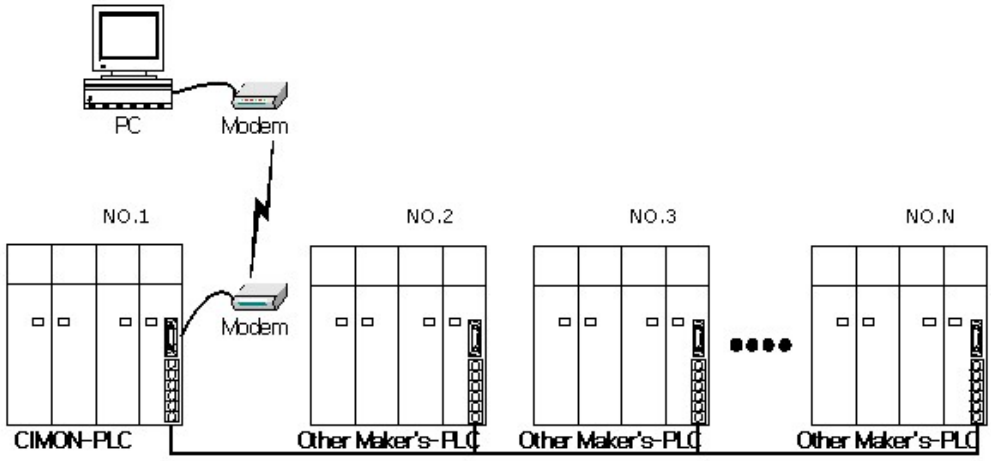


Components and parameters of computer link module,

Component	Name of Module	Parameter		Ex. of Station No.
PC	Built-in RS-232C	-		-
PLC NO.1	CM1-SC02A	RS-232C	Exclusive Comm.	0
		RS-422	Exclusive Comm.	
		Linked Mode		
PLC NO.2	CM1-SC02A	RS-232C	Exclusive Comm.	1
		RS-422	Exclusive Comm.	
		Independent Mode		
PLC NO.3	CM1-SC02A	RS-232C	Exclusive Comm.	2
		RS-422	Exclusive Comm.	
		Independent Mode		
PLC NO.N	CM1-SC02A	RS-232C	Exclusive Comm.	31
		RS-422	Exclusive Comm.	
		Independent Mode		

6.2.5.7 1:N Multi-drop communication between various devices via modem

A RS-232C cable is used to connect a PC with a PLC. RS-422 cables are used to connect between PLCs.

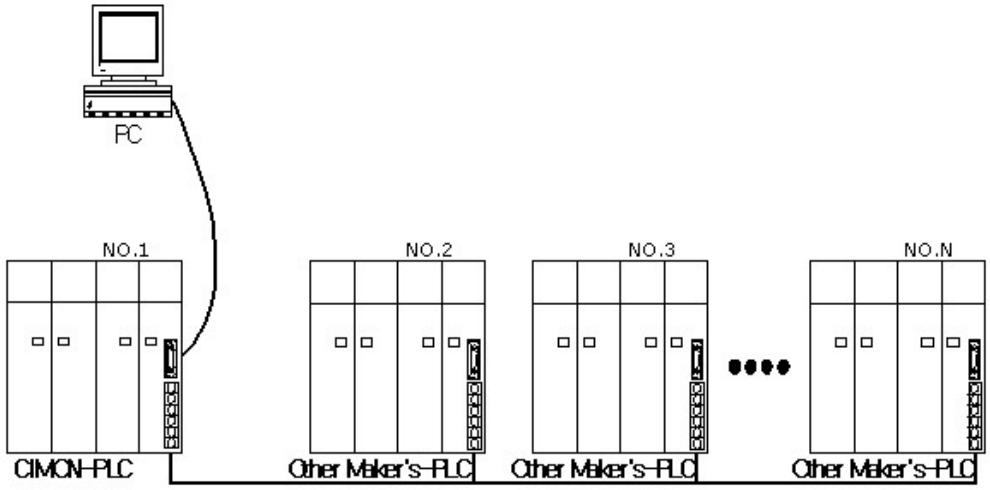


Components and parameters of computer link module,

Component	Name of Module	Parameter		Ex. of Station No.
PC	Built-in RS-232C	-		-
PLC NO.1	CM1-SC02A	RS-232C	Exclusive Comm. (RS-232C Mode)	0
		RS-422	User Comm.	
		Independent Mode		
PLC NO.2	CM1-SC02A	RS-232C	-	-
		RS-422	-	
		-		
PLC NO.3	CM1-SC02A	RS-232C	-	-
		RS-422	-	
		-		
PLC NO.N	CM1-SC02A	RS-232C	-	-
		RS-422	-	
		-		

6.2.5.8 1:N Multi-drop communication between various devices

A RS-232C cable is used to connect a PC with a PLC. RS-422 cables are used to connect between PLCs.

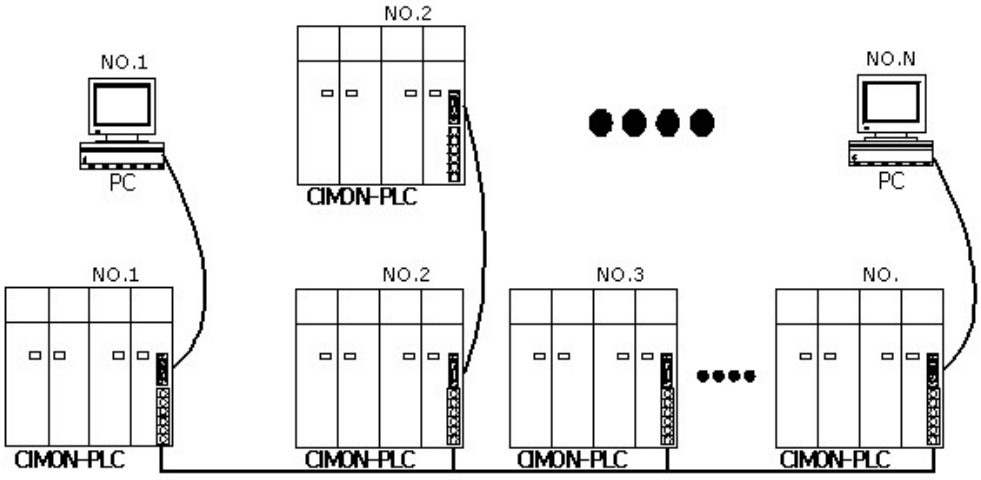


Components and parameters of computer link module,

Component	Name of Module	Parameter		Ex. of Station No.
PC	Built-in RS-232C	-		-
PLC NO.1	CM1-SC02A	RS-232C	HMI Comm. (RS-232C Mode)	0
		RS-422	User Comm.	
		Independent Mode		
PLC NO.2	CM1-SC02A	RS-232C	-	-
		RS-422	-	
		-		
PLC NO.3	CM1-SC02A	RS-232C	-	-
		RS-422	-	
		-		
PLC NO.N	CM1-SC02A	RS-232C	-	-
		RS-422	-	
		-		

6.2.5.9 An example of CIMON PLC network

A RS-232C cable is used to connect a PC with a PLC. A modem can be used in case of long-distance communication. RS-422 cables are used to connect between PLCs.

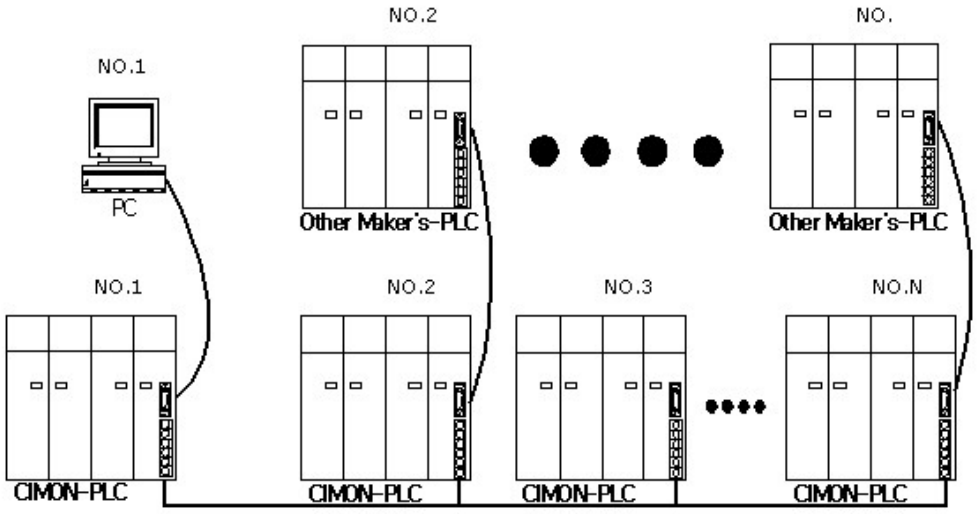


Components and parameters of computer link module,

Component	Name of Module	Parameter		Ex. of Station No.
PC NO.1	Built-in RS-232C	-		-
PC NO.N	Built-in RS-232C	-		-
PLC NO.1	CM1-SC02A	RS-232C	Exclusive Comm.	0
		RS-422	Exclusive Comm.	
		Linked Mode		
PLC NO.2	CM1-SC02A	RS-232C	User Comm.	1
		RS-422	Exclusive Comm.	
		Independent Mode		
PLC NO.2	CM1-SC02A	RS-232C	Exclusive Comm.	2
		RS-422	Exclusive Comm.	
		Independent Mode		
PLC NO.M	CM1-SC02A	RS-232C	Exclusive Comm.	31
		RS-422	Exclusive Comm.	
		Independent Mode		

6.2.5.10 An example of CIMON PLC network including 3rd vendor devices

A RS-232C cable is used to connect a PC with a PLC. A modem can be used in case of long-distance communication. RS-422 cables are used to connect between PLCs



Components and parameters of computer link module,

Component	Name of Module	Parameter		Ex. of Station No.
PC NO.1	Built-in RS-232C	-		-
PLC NO.1	CM1-SC02A	RS-232C	Exclusive Comm.	0
		RS-422	Exclusive Comm.	
		Linked Mode		
PLC NO.2	CM1-SC02A	RS-232C	User Comm.	1
		RS-422	Exclusive Comm.	
		Independent Mode		
PLC NO.N	CM1-SC02A	RS-232C	User Comm.	2
		RS-422	Exclusive Comm.	
		Independent Mode		
Other maker's PLC NO.2	-	-		-
Other maker's PLC NO.M	-	-		-

6.2.6 Communication Services

Communication Services :

1. User Communication (SND, RCV)

6.2.6.1 User Communication (SND, RCV)

Exclusive Commands for Computer Communication,

This is used when the communication frame defined in a user program is used to send and receive data in a program.

SND

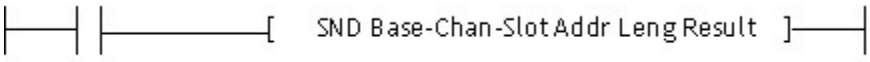
This is used to send data as much as the length of the data requested from a computer link module.

CMD	Usable Device											
	M	X	Y	K	L	F	T	C	S	D	@D	Integer
Base												O
Chan												O
Slot												O
Addr	O	O	O	O	O	O	O	O	O	O	O	
Leng												O
Result	O	O	O	O	O		O	O	O	O	O	

COMMAND	Description
Base-Chan-Slot	**Base:** The number of the base where a computer link module is mounted is indicated. In case of expansion base, the number (1~16) of a corresponding base is

	indicated. In case of local one, the number is '0'. **Channel Mode:** Ch 1(RS232:0) and Ch 2(RS422:1). **Slot No.:** The number of the slot where a computer link module is mounted [Ex.] In case of local base, Slot 2, Channel 1(RS232) -> h0002 : RS-232C [Ex.] In case of expansion base (1), Slot 1, Channel 2(RS422) -> h0111 : RS-422
Addr	Address of the data sent
Leng	Length of the data sent (BYTE), Decimal figure, Max. 500BYTE
Result	The address where the result of sending is noticed is assigned. (X,Y,M,L,K,T,C,D,@D,Z) **Result Format :** • Bit 0 : When sending completed, 1Scan ON. When failed, always ON. • Bit 1 : When sending failed, always ON. • Bit 2-7 : OFF • Bit 8-F : Error Code (0=No Error)

FORMAT



RCV

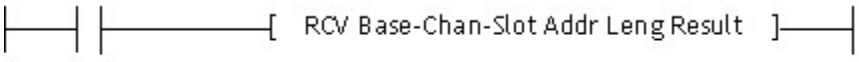
This is used to store data as much as the length of the data requested from a computer link module.

CMD	Usable Device											
	M	X	Y	K	L	F	T	C	S	D	@D	Integer
Base												O
ChNo												O
Slot												O
Addr	O	O	O	O	O	O	O	O	O	O	O	
Leng												O
Result	O	O	O	O	O		O	O	O	O	O	

COMMAND	Description
Base-Chan-Slot	**Base:** The number of the base where a computer link module is mounted is indicated. In case of expansion base, the number (1~16) of a corresponding base is

	indicated. In case of local one, the number is '0'. **Channel Mode:** Ch 1(RS232:0) and Ch 2(RS422:1). **Slot No.:** The number of the slot where a computer link module is mounted [Ex.] In case of local base, Slot 0, Channel 1(RS232)-> h0000 : RS-232C [Ex.] In case of expansion base (1), Slot 4, Channel 2(RS422)-> h0114 : RS-422
Addr	Address where data are received and stored
Leng	Length of the data received (BYTE), Decimal figure, Max. 500BYTE
Result	The address where the result of receiving is noticed is assigned. (X,Y,M,L,K,T,C,D,@D,Z) **Result Format :** • Bit 0 : When receiving completed, 1Scan ON. When failed, always ON • Bit 1 : When receiving failed, always ON • Bit 2-7 : OFF • Bit 8-F : Error Code (0=No Error)

FORMAT



6.2.6.2 User Communication (SEND, RECV)

This is used to define communication frames in the protocol editor, sending or receiving the frames in a program. User communications is the mode that other companies' protocols can be defined in the CIMON PLC to communicate communications modules with other devices. Diverse communications protocols are used according to manufacturers and all the protocols cannot be built in. And if a protocol is defined properly to an application field and a program is written, communications with other devices is available according to a defined protocol. If a protocol editor is used to define protocol frames (In the CICON), it is available to write and edit other manufacturers' protocols. To use as user communication mode for correct data communication, the information about the contents of the protocol used is to be correct and a program using the instructions to control sending/receiving in a PLC as well as editing frames be written. This chapter explains the communication specifications and the directions for use of user protocols.
The modes of communications modules operated as a user protocol are as follows.

Module Name	RS232C	RS422/485	Remarks
CM1-SC01A	User Protocol	X	X

CM1-SC01B	X	User Protocol	X
CM1-SC02A	User Protocol	User Protocol	Linked
	User Protocol	User Protocol	Independent
	User Protocol	HMI User Protocol	Independent
	User Protocol	Modbus RTU User Protocol	Independent
	User Protocol	PLC Link User Protocol	Independent
	User Protocol	CICON User Protocol	Independent
	HMI User Protocol	User Protocol	Independent
	Modbus RTU User Protocol	User Protocol	Independent
	PLC Link User Protocol	User Protocol	Independent
	CICON User Protocol	User Protocol	Independent

But, Make sure the version before using user protocol (SEND, RECV) function.

	CICON	CM1-CPXXX(CPU)	CM1-SCXXX (RS232C/422/485)
Version	1.83.0043	V 1.56	V 1.20

To use user protocols, a version should be higher than the versions described above.
Otherwise, consult with the head office to upgrade.

See :

- Operation Procedure of User Communications
- Registering and Editing a Special Program
- Instructions for User Program
- Error Codes for User Communications
- Example of Programming for User Communications
- Example of Application of MODICON (MODBUS) protocol
- Sending/Receiving communication frames at communication intervals

6.2.6.2.1 Operation Procedure of User Communications

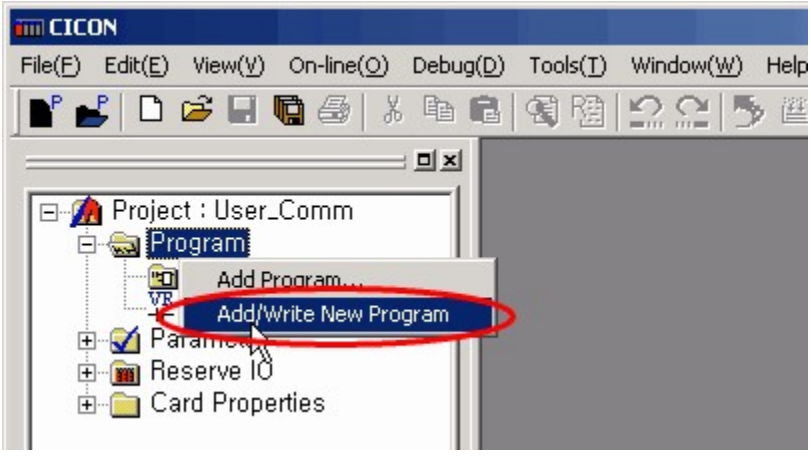
As user communications require to use a frame editor and write a CICON program, it is set up as the following order.

Programming Order for User Communications ,

1. Register a special program to define frames.
2. Edit the protocol in the special program.
3. Write a PLC program for sending/receiving in the CICON.
4. Download the PLC program and the special program.
5. Convert CPU status to RUN mode.
6. Normal communication starts.

6.2.6.2.2 Registering and Editing a Special Program

1. Select the add/write new program in the CICON.

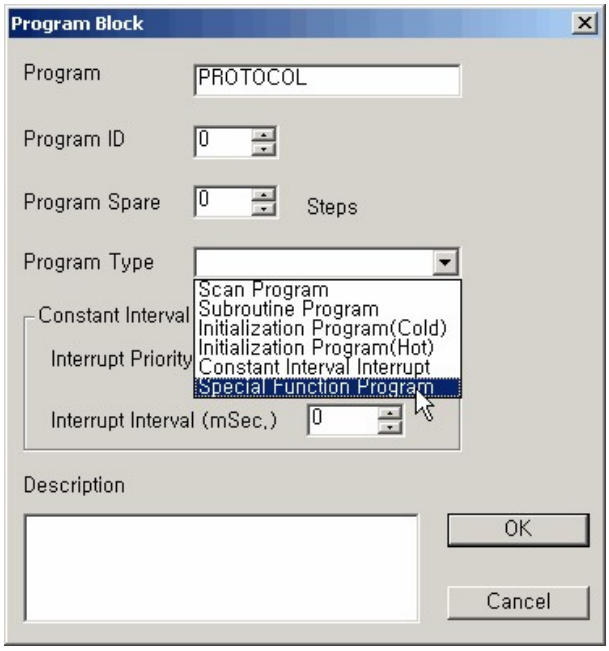


2. If you select the add/write new program, the program block dialog box will appear as follows.

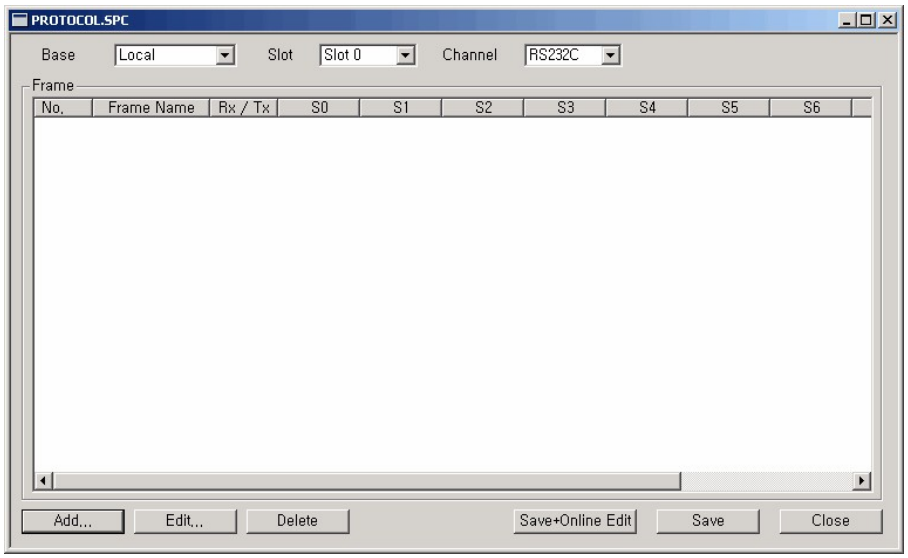
- **Program:** This is used to define the name of special program. Up to 12 letters can be entered.

- **Program ID:** This is used to define ID for each program.
- **Program Spare:** This is to indicate the max. size for editing the protocols in a special program while CPU status is run.
- **Program Type:** This is used to select the type of the program registered at this time. Here, select the special program.

If you finish registering the parameters, press the **[OK]** button.



3. If you press the [OK] button, the dialog box for registering protocols will appear.

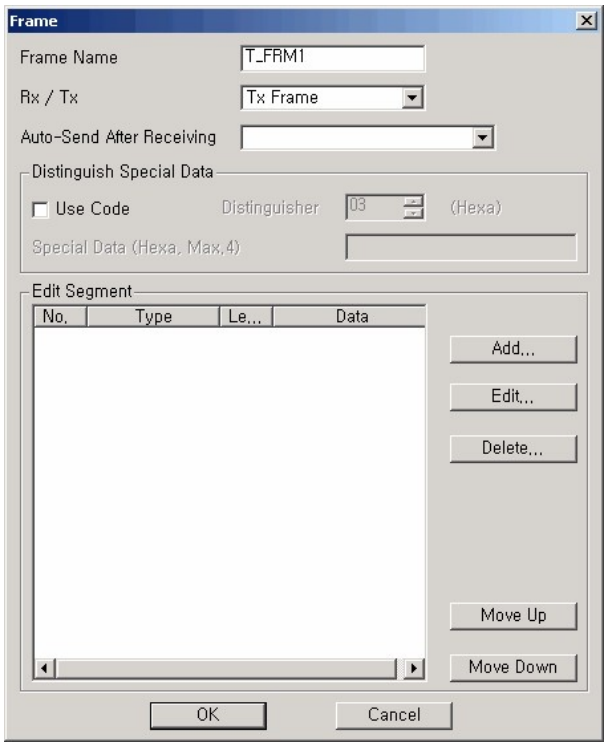


In a created PROTOCOL.SPC file, protocols can be registered.

- **Base:** This is used to select the base where a communication card (CM1- SCXXX) is mounted.
- **Slot:** This is used to select the slot where a communication card (CM1-SCXXX) is mounted. Slot number is counted from the slot next to a CPU module.
- **Channel:** This is used to select the communication port between a master and a slave.
- **Result:** This is used to send data without SEND command as sending interval is set up and, if a receiving frame is defined, to indicate whether a defined receiving frame is normally received. (Memory device: M0000)
  a. Received: The bit corresponding to the frame number in M0000 is on for 1 scan.
  b. Not Received: The bit corresponding to the frame number in M0020 is on for 1 scan.

4. If you select the add button, the dialog box for adding a frame will appear.

- **Frame Name:** This is used to register a frame name. (Max. 20 letters)
- **Comm. Direction:** This is used to select whether the frame registered is the one sent or the one received.



- **Comm. Interval:** Frames are automatically sent at intervals without SEND command in a PLC program. If Comm. interval is '0', frames will be sent only by SEND command. A PLC program is not needed in case of sending/receiving frames by using comm. interval.

  [Receiving frame for sending] This corresponds to the case comm. frames are sending ones.
  If a corresponding frame is sent and the receiving frame for the sending frame is registered, the registered frame will be received without RECV command in the PLC program.

- **Auto-send after Receiving:** This is operated in case that comm. direction is the frame received. If a corresponding frame is received, the frame registered for sending will be automatically sent without the command to send in a PLC program.

- **Use Code:** This is used to distinguish a special data from the data in the frames sent/received. In case that there is the same letter as the corresponding distinguishes among the data in the frames sent/received, registered data are attached next to the distinguishes to be sent or received.

  For example, the case hexadecimal FEh is registered to a distinguishes and FFh to special data.

Header	Length	Cmd	MSG	Checksum
FEh	03h	3Ch	3Fh	FEh

Header	Length	Cmd	MSG	Checksum	Special Data
FEh	03h	3Ch	3Fh	FEh	FFh

Up to 4 special data can be registered. If 4 special data are registered, they will be sent/received continuously next to a distinguisher.

- **Add:** This is used to add segments to write a frame. Up to 10 segments can be registered.
- **Edit:** This is used to edit the segments in a made frame.
- **Delete:** This is used to delete the segments in a made frame.
- **Move Up:** This is used to switch the location of the segments in a made frame. A selected one is moved up one step by one step.
- **Move Down:** This is used to switch the location of the segments in a made frame. A selected one is moved down one step by one step.

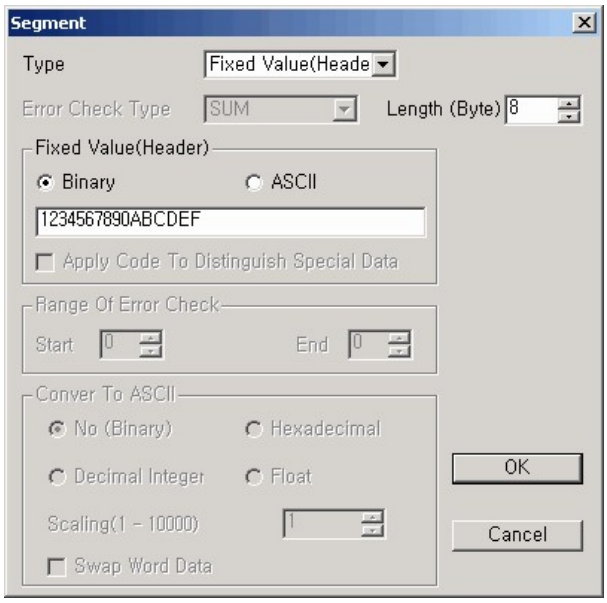
5. To make a frame, segments should be added.

SEGMENT0	SEGMENT1	.....	SEGMENT8	SEGMENT9

1. Type

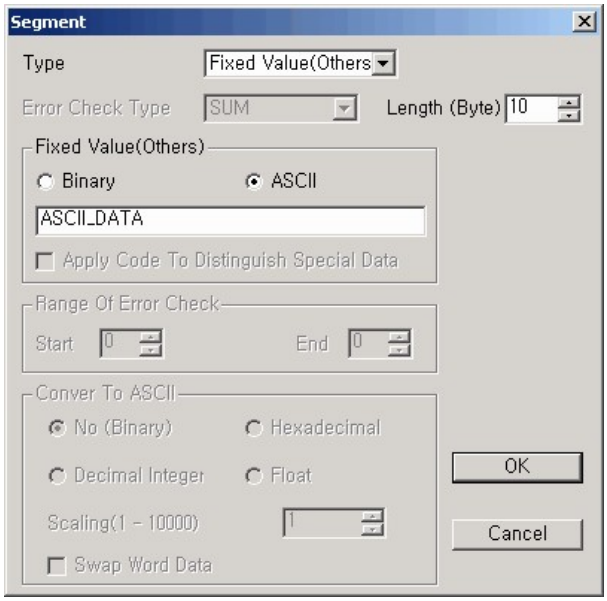
[Fixed Value (Header)]

This means the first data in the frame made. The value is to be assigned in the type of ASCII or Binary. In case that data is in Binary type, assign in hexadecimal number and a byte data in 2-place hexadecimal number. In case of ASCII type, a letter is processed as byte data.



[Fixed Value (Others)]

This is the segment assigning general data in the frame made.



Assign constant value in the type of ASCII or Binary.
In case that data is in Binary type, assign in hexadecimal number and a byte data in 2-place hexadecimal number. In case of ASCII type, a letter is processed as byte data.

- Fixed Value (Header, Tail, Others) Data Sent

PLC	12345678	12345678

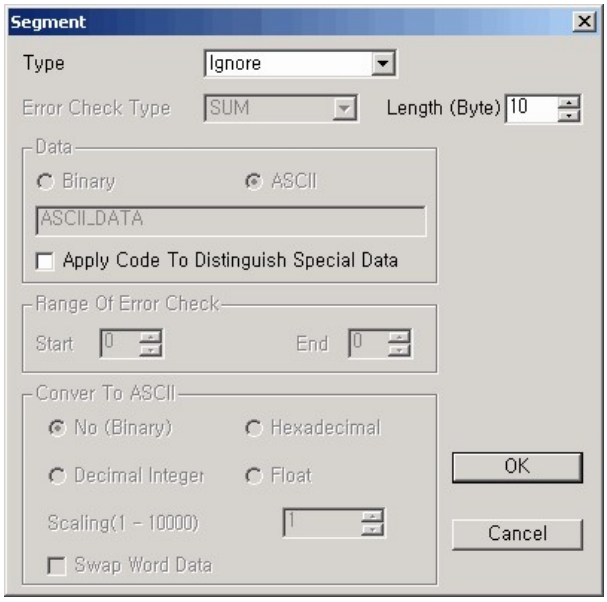
Data Conversion	Binary	ASCII
Other Device	12345678	3132333435363738

- Fixed Value (Header, Tail, Others) Data Received

Other Device	12345678	3132333435363738
Data Conversion	Binary	ASCII
PLC	12345678	3132333435363738

[Ignore]

This segment is used to ignore assigned-length data after receiving, irrelevantly to the value of received data. This can be set up in case of only the frame received. If the use code is applied, it is distinguished that the letters like the distinguisher of special data are continuously received and the data next to the distinguisher are disregarded. It is available to apply the use code.



[Memory Link]

This segment is used to send the data stored in the memory of CPU as much as an assigned length or store received data in the memory device of CPU as much as assigned length. The maximum data size is 250Byte. If the use code is applied, it is distinguished that the letters like the distinguisher of the special data are continuously received and the data next to the distinguisher are disregarded. It is available to apply the use code.

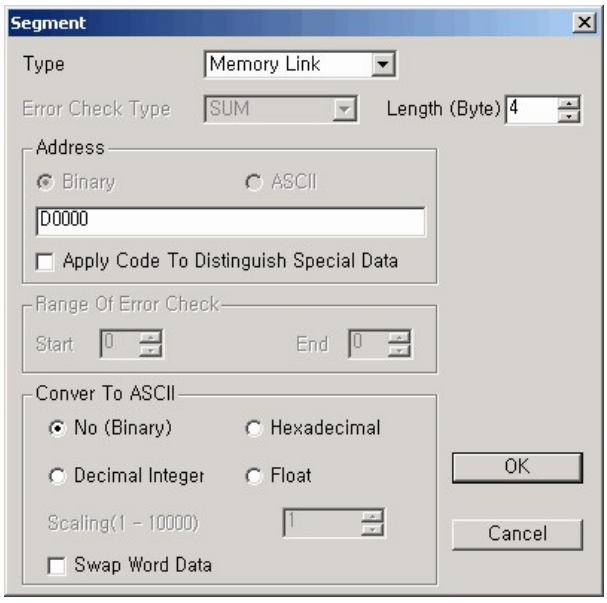
- **Convert to ASCII**

No(Binary) This is used to send/receive the data in the memory device of CPU as they are.

Hexadecimal Integer This is used to convert the data in the memory device of CPU to hexadecimal ASCII data, sending the result. And to convert received hexadecimal ASCII data to binary data, storing the result in the memory of CPU.

Decimal Interger This is used to convert the data in the memory device of CPU to decimal ASCII data, sending the result. And to convert the received decimal ASCII data to binary data, storing the result in the memory of CPU.

Real Number(Float) This is used to scale the data in the memory of CPU(Ratio.1-10000), sending the result. And to scale the received data(Ratio.1-10000), storing the result in the memory of CPU.



If you select the swap word data, upper 1 byte data and lower 1 byte data of the data sent/received are swapped. For example, if the data stored in the memory of CPU is h1234(ASC:1234), the actual data sent will be h3412(ASC:3421). If a received data is h1234(ASC:1234), the actually received data h3412(ASC:3412) will be stored in the memory of CPU.

- Memory Link Data Sent

PLC	1234h	1234h	1234h	1234h
Data Conversion	No(Binary)	Hexadecimal Integer	Decimal Integer	Real Number (Scaling:10)
Other Device	1234h	31323334	34363630	01D2h

- Memory Link Data Received

Other Device	1234h	31323334	34363630	1234h
Data Conversion	No(Binary)	Hexadecimal Integer	Decimal Integer	Real Number

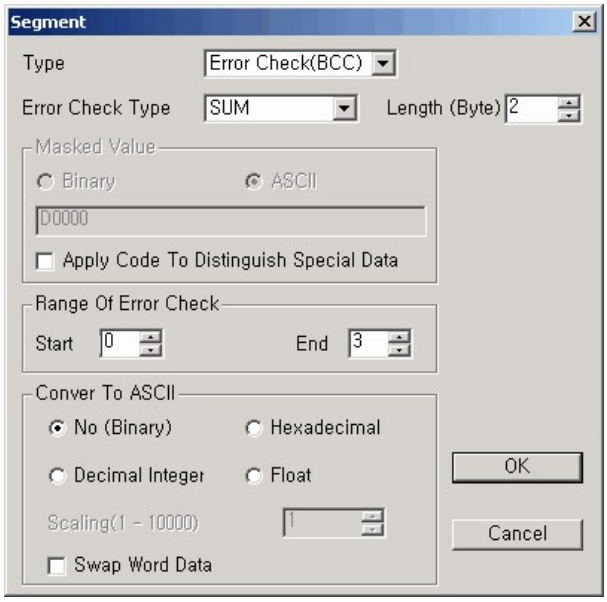
				(Scaling:10)
PLC	1234h	1234h	1234h	B608h

2. Error Check Type

This is used to check whether the data of a frame are correctly sent/received. It is available to distinguish special data.

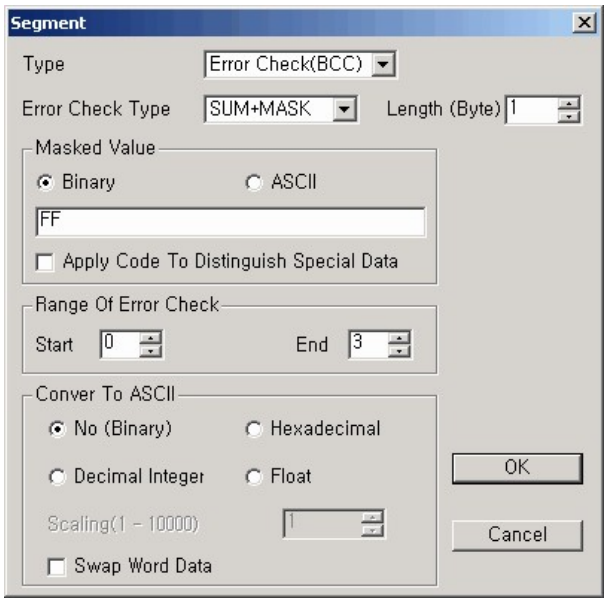
[SUM]

This is used to binary-sum an edited frame from the first of a selected range to the last of it and to send/receive data as much as a set length (Byte). Enter a range in the error check range (Range of segments). Refer to the memory link for ASCII data conversion.



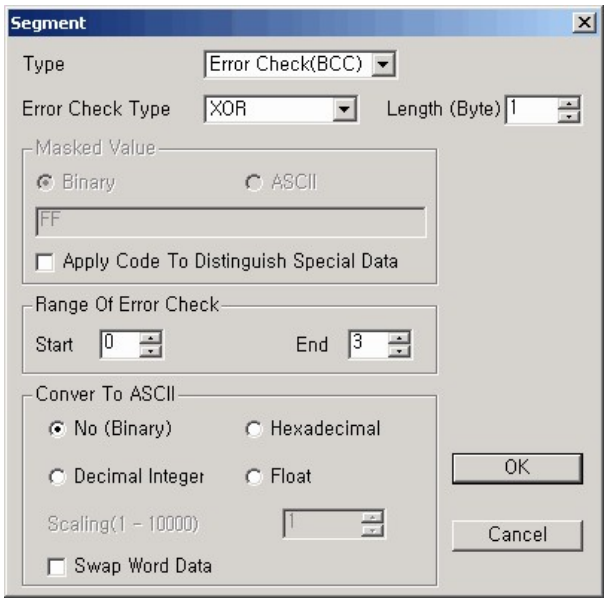
[SUM+MASK]

This is used to binary-sum an edited frame from the first of a selected range to the last of it, masking the binary-summed data with masking value (FFh) and to send/receive data as much as a set length (Byte). Refer to the memory link for ASCII data conversion.



[XOR]

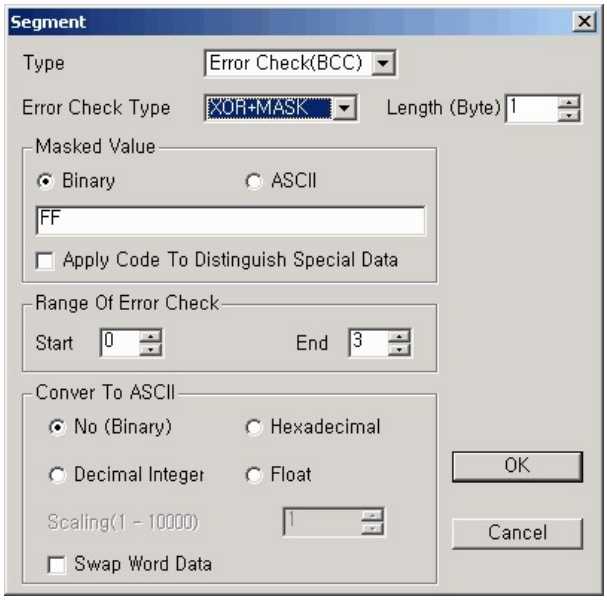
This is used to binary-or an edited frame from the first of a selected range to the last of it and to send/receive the data as much as a set length (Byte). Refer to the memory link for ASCII data conversion.



[XOR+MASK]

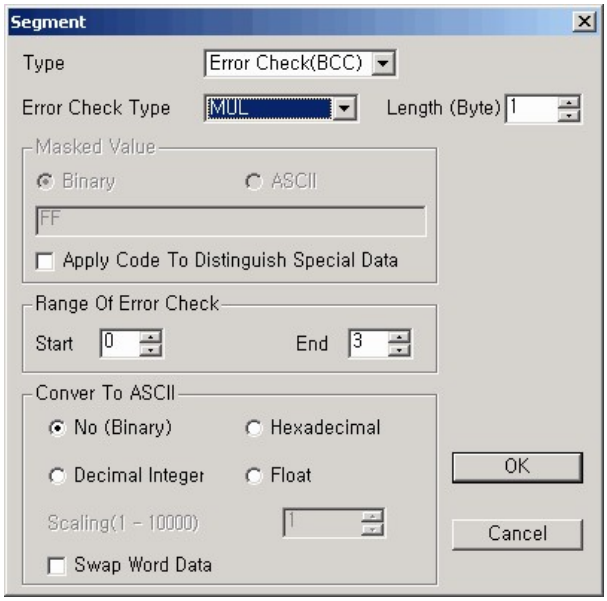
This is used to binary-or an edited frame from the first of a selected range to the last of it, masking the binary-summed data with masking value (FFh) and to send/receive the data as much as a set length

(Byte). Refer to the memory link for ASCII data conversion.



[MUL]

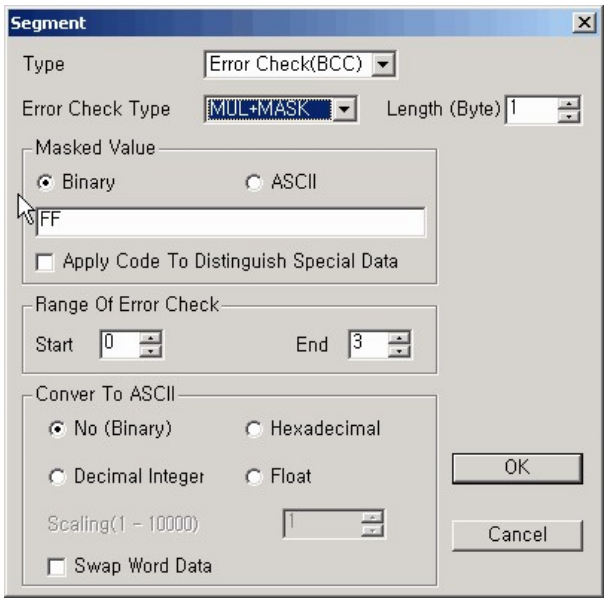
This is used to binary-mul an edited frame from the first of a selected range to the last of it and to send/receive the data as much as a set length (Byte).



[MUL+MASK]

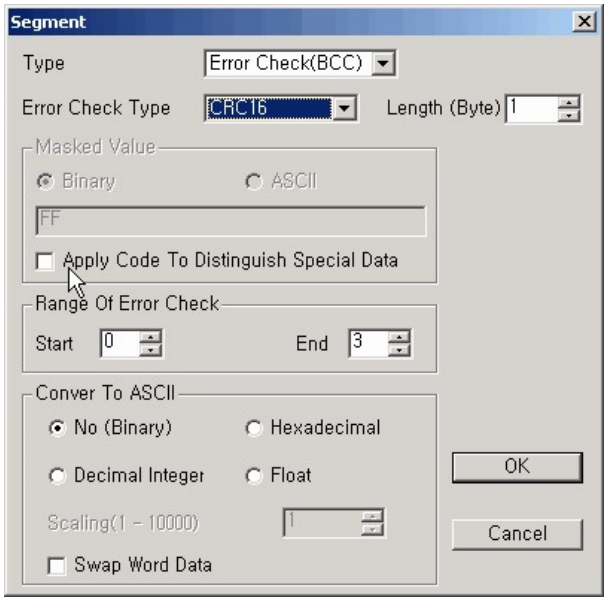
This is used to binary-mul an edited frame from the first of a selected range to the last of it, masking the

binary-summed data with masking value (FFh) and to send/receive the data as much as a set length (Byte).



[CRC16]

This is used to CRC16 an edited frame from the first of a selected range to the last of it.



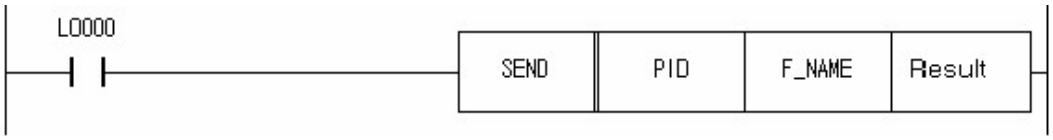
6.2.6.2.3 Instructions for User Program

SEND(P)

Function

This is the instruction used to send frame data of user type from a master station to slave stations. To use this instruction, a user protocol is to be selected as action mode protocol and to be downloaded in the RS232C/422/485 card setup. SEND instruction is to be executed by pulse.

FORAMT



- **PID:** This is used to assign the name or the ID of special program.

- **F_NAME**

1. This is used to enter a frame name or to assign a frame number. The number is to be assigned according to the following form.

2. Format in case of assigning a frame number
   a. Upper byte(Bit 8-F): Assigning communication form(0: RS232C, 1: RS422/485)
   b. Lower byte(Bit 0-7): Frame number in special program

Assigning communication form (Upper byte)	Frame number (Lower byte)

[Ex.] In case communication form is RS232C and the frame of which number is 3 is sent,

SEND (PID) h0003 (Result)

Result

- The word device informed of the result of sending is assigned.

- Result Format
  a. First Bit(Bit 0): In case of having been sent, 1 Scan On.

b. Second Bit(Bit 1): In case of having not been sent, always On.

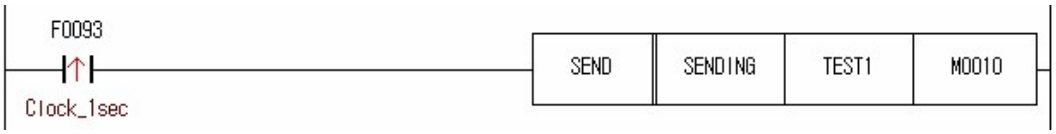
c. Third Bit – Eighth Bit(Bit 2-7): Always Off.

d. Ninth Bit – Sixteenth Bit(Bit 8-F): Error Code.(0=No Error)

Error Code	Not Use	In case of an error in sending, On	In case of having been sent, 1Scan On
Bit 8 ~ F	Bit 2 ~ 7	Bit 1	Bit 0

Example of Application

The following is an example of PLC program that a frame is sent to a slave station, in case that the special program file name of a master station is SENDING and the frame name registered to a protocol editor is TEST1.

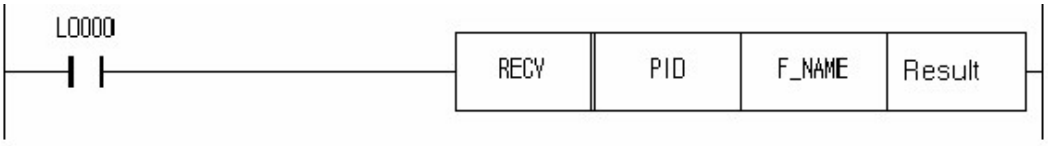


RECV(P)

Function

This is the instruction used in slave stations to receive frame data from a master station. In case that a data accords with the frame of user form and is normal frame, the flag indicating received(Bit 0) is turned on. To use this instruction, a user protocol is to be selected as action mode protocol and to be downloaded in the RS232C/422/485 card setup. RECV instruction is to be executed by pulse.

FORAMT



- **PID:** This is used to assign the name or the ID of special program.

- **F_NAME**

1. This is used to enter a frame name or to assign a frame number. The number is to be assigned according to the following form.

2. Format in case of assigning a frame number

a. Upper byte(Bit 8-F): Assigning communication form(0: RS232C, 1: RS422/485)

b. Lower byte(Bit 0-7): Frame number in special program

Assigning communication form (Upper byte)	Frame number (Lower byte)

[Ex.] In case communication form is RS422/485 and the frame of which number is 5 is sent,

RECV (PID) h0105 (Result)

Result

- The word device informed of the result of sending is assigned.

- Result Format

  e. First Bit(Bit 0): In case of having been sent, 1 Scan On.

  f. Second Bit(Bit 1): In case of having not been sent, always On.

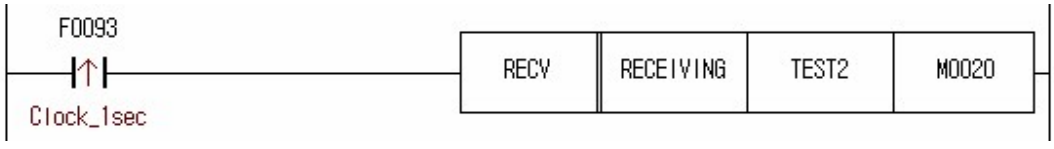
  g. Third Bit – Eighth Bit(Bit 2-7): Always Off.

  h. Ninth Bit – Sixteenth Bit(Bit 8-F): Error Code.(0=No Error)

Error Code	Not Use	In case of an error in receiving, On	In case of having been received, 1Scan On
Bit 8 ~ F	Bit 2 ~ 7	Bit 1	Bit 0

Example of Application

Using RS232C/422/485 card, slave stations receive data from a master station. After receiving the data, the slave stations compare them with assigned frame data. The following is an example of PLC program that the frame is sent to a slave station, in case that a special program file name is RECEVING and the frame name registered in a protocol editor is TEST2.



6.2.6.2.4 Error Codes for User Communications

Error Code	Description
18 (12h)	The range to check errors is wrongly set up.
19 (13h)	There is no registered frame.
20 (14h)	Segments are not registered to the frame.
21 (15h)	The communication direction of the frame is wrongly set up.
22 (16h)	Sending/receiving frames are disabled.
23 (17h)	Access to buffer memory is failed.
24 (18h)	The size of each segment data is over.
25 (19h)	When swapping word data, the size of the data is wrong.
26 (20h)	The entire length of sending/receiving frame is over 600Byte.
27 (21h)	The size of data is wrongly assigned.

6.2.6.2.5 Example of Programming for User Communications

The following shows an example of configuration of communication system and frame between a CIMON-PLC and other manufacturer's PLC to explain the programming method for user communication. It is the case that the 18-byte data in Memory D0000 of the CIMON-PLC are written to other manufacturer's PLC and the 24-byte data of other manufacturer's PLC are read and stored in Memory D0020 of the CIMON-PLC.

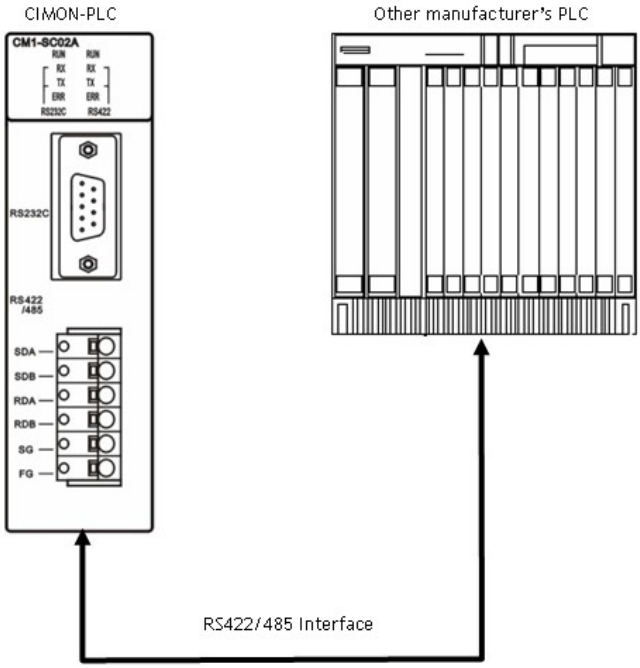
PLC protocol of other manufacturer,

Frame requesting to write (CIMON-PLC -> Other manufacturer's PLC)

Header	Station (H)	Station (L)	Command	Size (H)	Size (L)	Data	Tail	Error Check(H)	Error Check(L)
ENQ	0	1	W	1	2	18Byte	EOT	?	?

Frame responding to request to read (Other manufacturer's PLC -> CIMON-PLC)

Header	Station (H)	Station (L)	Command	Size (H)	Size (L)	Data	Tail	Error Check (H)	Error Check (L)
STX	0	1	R	1	8	24Byte	ETX	?	?



Description for Protocols,

1) Frame Requesting to Write

ENQ and EOT, which are the control letters of ASCII code, are used at the header and the tail.
Command 'W' is used.
The length of data indicates 18 bytes(12h).

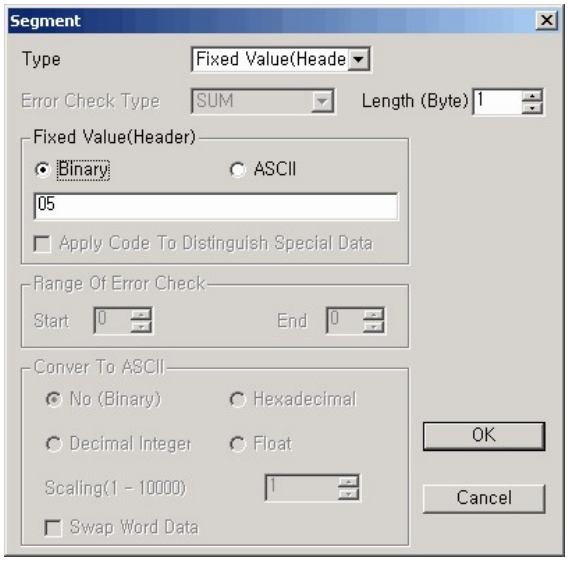
Order of Sending	Start ----------> End									
Type of Frame	Header	Fixed Value (Others)					Data	Tail	Error Check	
Frame sent	ENQ	0	1	W	1	2	Variable Data	EOT	H	L
Binary	05h	30h	31h	57h	31h	32h	D0000	04h		
ASCII		'0'	'1'	'W'	'1'	'2'	D0000			

12-byte data in the memory for sending data of CPU (CIMON-PLC D0000) are sent.
The error check is to binary-sum ASCII code values from the header to the tail. Calculated data is varied according to frame.

To make the above frame sent in a protocol editor, binary or ASCII can be selected as fixed value. In case of binary like the above table, enter a hexadecimal value. In case of ASCII, enter letters. But, hexadecimal 2-digit number occupies 1 byte and a letter occupies 1 byte.

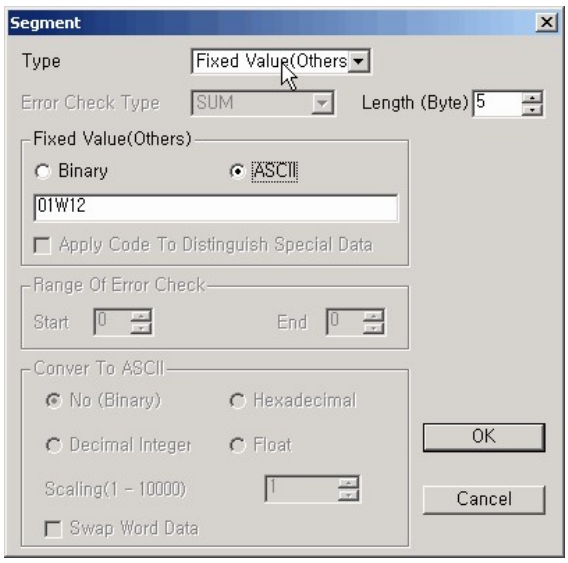
Using the protocol editor, make the frame sent of other manufacturer's protocol as the following procedure.

1. **Fixed Value (Header):** This is the first data of a frame.



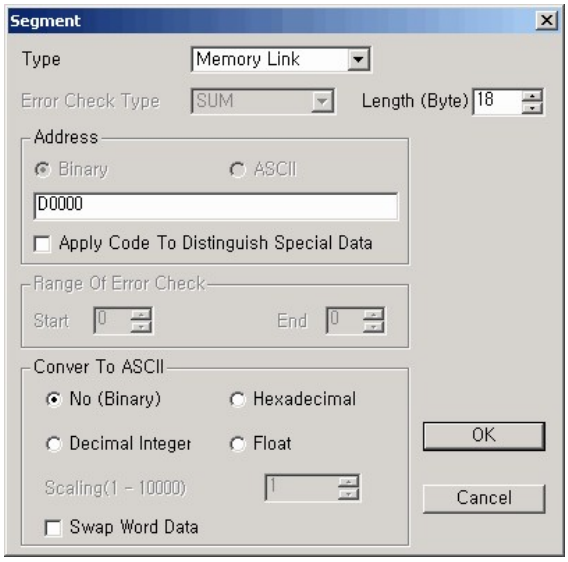
Binary 05h is ENQ. Hexadecimal 2-digit number occupies **1 byte**.

2. **Fixed Value (Others):** As a data is displayed in ASCII, a letter occupies 1 byte.



Binary data (30 31 57 31 32) can be displayed.

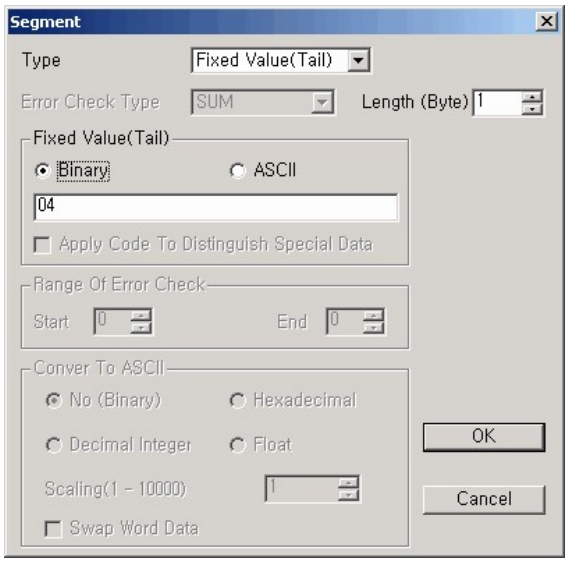
3. **Memory Link:** If an address is selected as D0000 with the length of 18 bytes, the 18-byte data stored in D0000 will be sent without ASCII conversion.



Convert to ASCII Data :

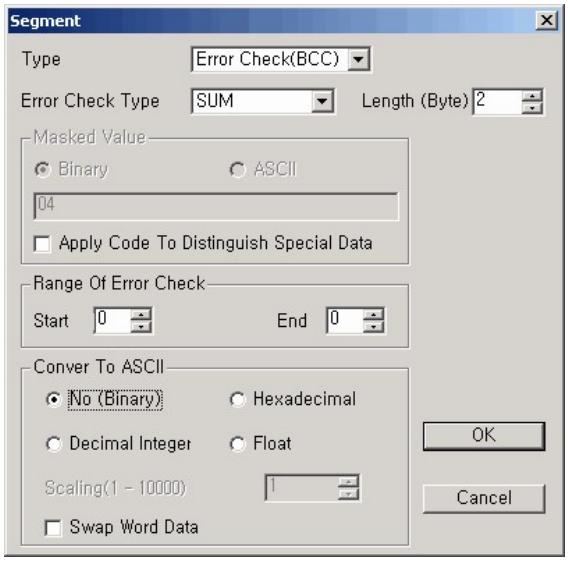
- No(Binary): The data stored in the memory of CPU is sent without conversion. For example, if the length of a data is 2 bytes and the value is 0x1234(2Byte), Data 1234 will be sent.
- Hexadecimal Integer: A data is converted to ASCII data and the result is sent. As actually sent data are '1','2','3','4', in case that a data value is 0x1234, 4 bytes is to be set up as the length of the data.
- Decimal Integer: 0x1234 is equivalent to decimal 4660. As actually sent data are '4','6','6','0', 4 bytes is to be set up as the length of the data.
- Real Number: In case that scaling is 10, Data Value 0x1234 is divided by 10 and the result is sent in binary data. The actual sent data is 0x01D2.

4. **Fixed Value (Tail):** This is the last data of a frame.

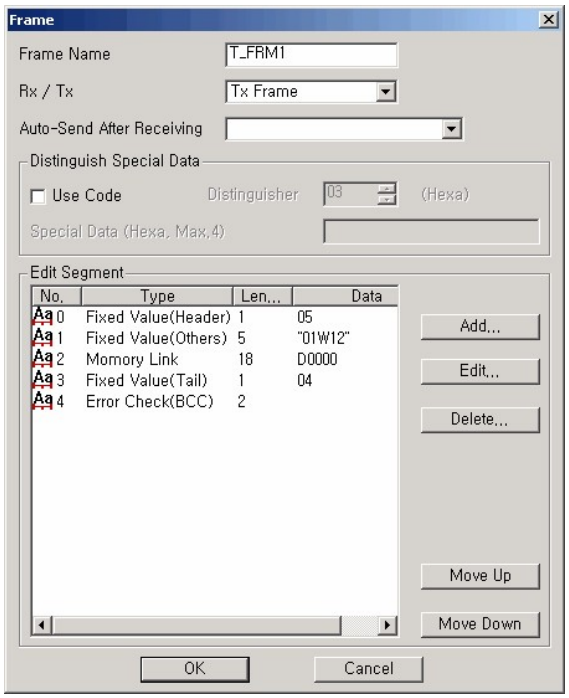


Binary 04h is EOT. Hexadecimal 2-digit number occupies **1 byte.**

5. **Error Check:** The data of the frame sent are binary-summed as much as a set value in the range of error check. Refer to the memory link for ASCII data conversion.



6. The frame sent has been edited.



2) Frame Responding to Request to Read

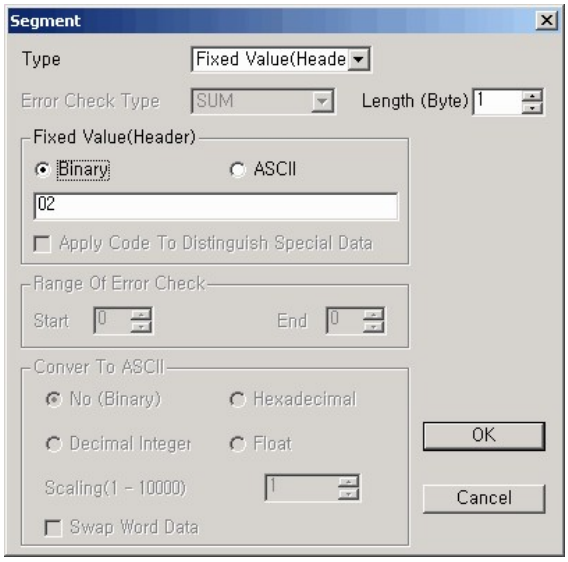
Order of Sending	Start ----------> End									
Type of Frame	Header	Fixed Value (Others)					Data	Tail	BCC	
Frame sent	STX	0	1	R	1	8	Variable Data	ETX	H	L
Binary	02h	30h	31h	57h	31h	38h	D0000	03h		
ASCII		'0'	'1'	'R'	'1'	'8'	D0000			

STX and ETX, which are the control letters of ASCII code, are used at the header and the tail.
Command 'R' is used.
The length of a data displays 24 bytes(18).
24-byte data in the memory for sending data of CPU are sent.
Error check is to binary-sum ASCII code values from the header to the tail. A calculated data is varied according to frame.

To make the above frame received in a protocol editor, binary or ASCII can be selected as fixed value. In case of binary like the above table, enter a hexadecimal value. In case of ASCII, enter letters. But, hexadecimal 2-digit number occupies 1 byte and a letter occupies 1 byte.

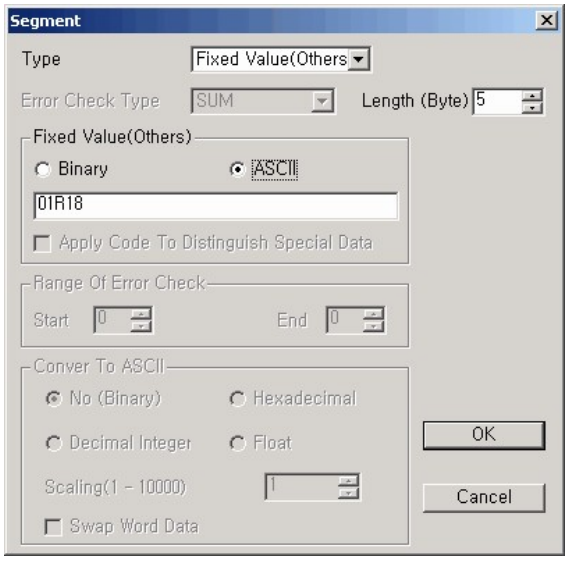
Using a protocol editor, make the frame sent of other manufacturer's protocol as the following procedure.

1. **Fixed Value (Header):** This is the first data of a frame.



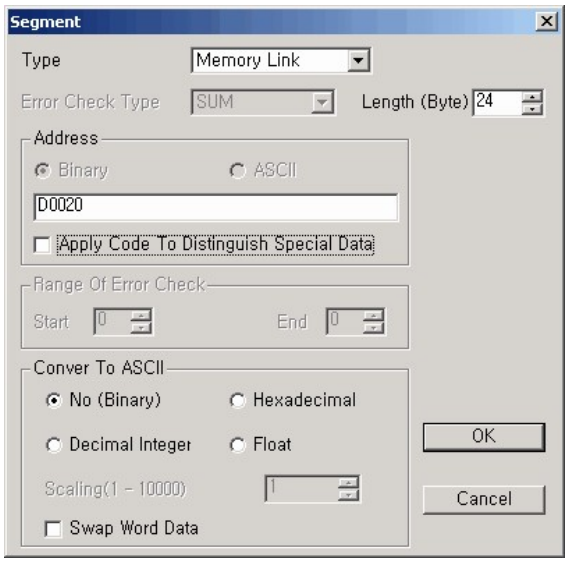
Binary 02h is STX. Hexadecimal 2-digit number occupies **1 byte**.

2. **Fixed Value (Others):** As a data is displayed in ASCII, a letter occupies 1 byte.



Binary data (30 31 52 31 38) can be displayed.

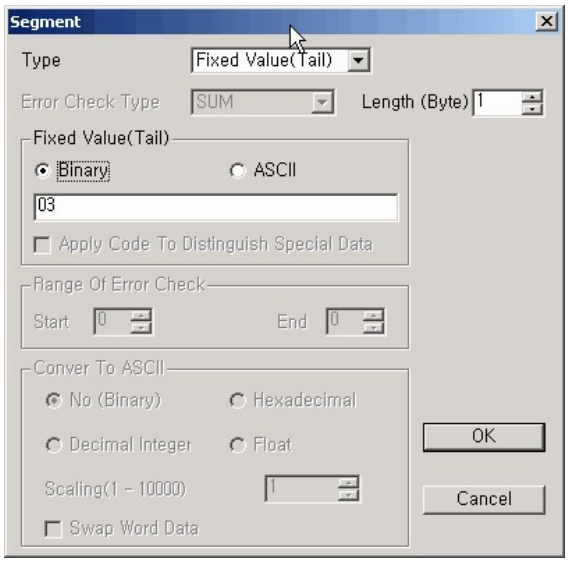
3. **Memory Link:** As D0020 is selected as address, 24-byte data is sent without ASCII conversion.



Convert to ASCII Data

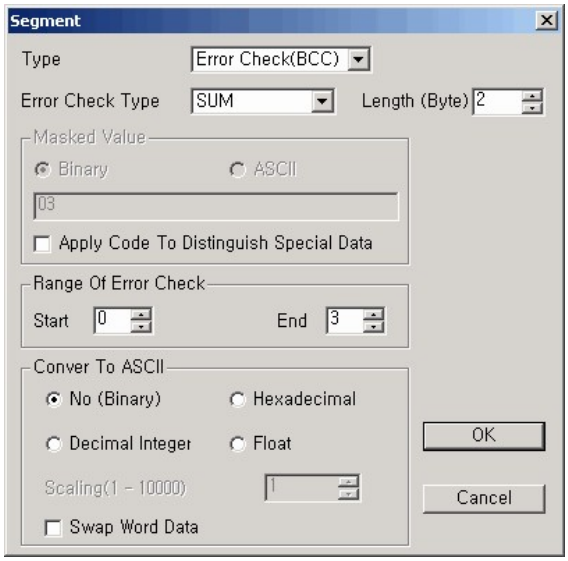
- No(Binary): A received data is stored in the memory of CPU without conversion. For example, if the length of a data is 2 bytes and the value is 0x1234(2Byte), Data h1234 will be stored in the memory of CPU.
- Hexadecimal Integer: A received data is converted to hexadecimal integer and the result is stored. And Data '1','2','3','4' are received. In this case, the actually stored data is 0x1234. But, 4 bytes are set up as the length of the data.
- Decimal Integer: A received data is converted to decimal integer and the result is stored. And Data '4','6','6','0' are received. In this case, the actually stored data is 0x1234. But, 4 bytes are set up as the length of the data.
- Real Number: In case that scaling is 10, Data Value 0x1234 is multiplied by 10 and the result is received in binary data. The actual sent data is 0xB608.

4. **Fixed Value (Tail):** This is the last data of a frame.



Binary 04h is ETX. Hexadecimal 2-digit number occupies **1 byte.**

5. **Error Check:** The data of the frame sent are binary-summed as much as a set value in the range of error check. Refer to the memory link for ASCII data conversion.

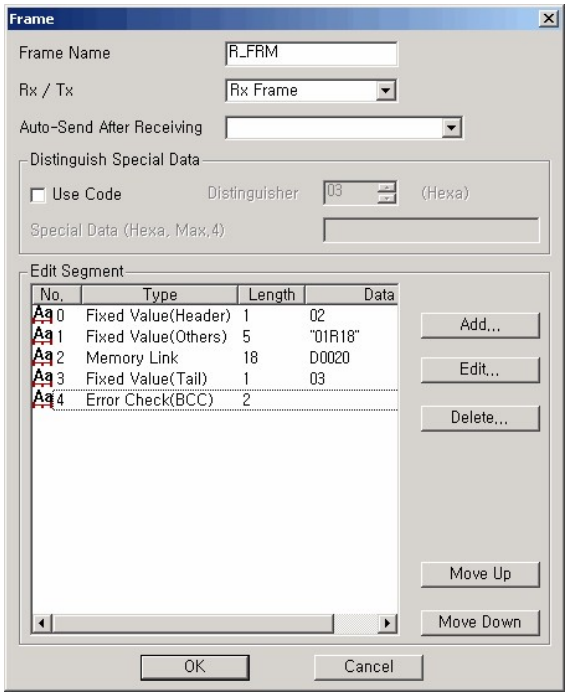


Range of Error Check (Segment) : Start: 0 / End: 3

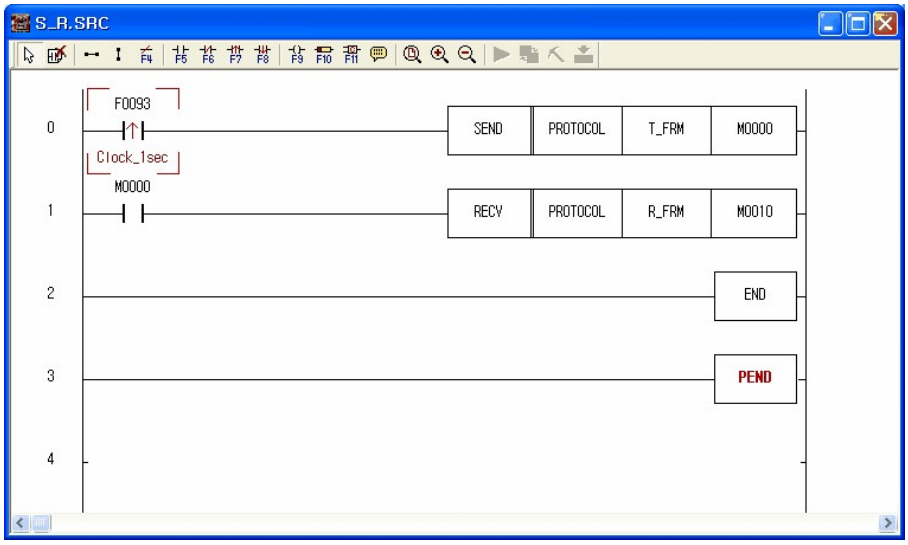
Segment 0	Segment 1	Segment 2	Segment 3

Error Check = Segment 0 + Segment 1 + Segment 2 + Segment 3

6. The frame received has been edited.



PLC Program: Use a protocol editor to send a registered frame every second. If the frame is sent, M0000 is turned on for one scan to execute Receive command. Send/Receive command is to be turned on for one scan.



6.2.6.2.6 Example of Application of MODICON (MODBUS) protocol

It is available to configure a communication system and frames between a CIMON-PLC and other manufacturer's PLC using Modbus Protocol.
The following is an example for request to read 16-bit data from other manufacturer's PLC using Modbus Protocol to a CIMON-PLC. If a requesting frame is received from other manufacturer's PLC, the received frame will be evaluated. If correct, it will be sent automatically.

Structure of Modbus Protocol Request (Other manufacturer's PLC)

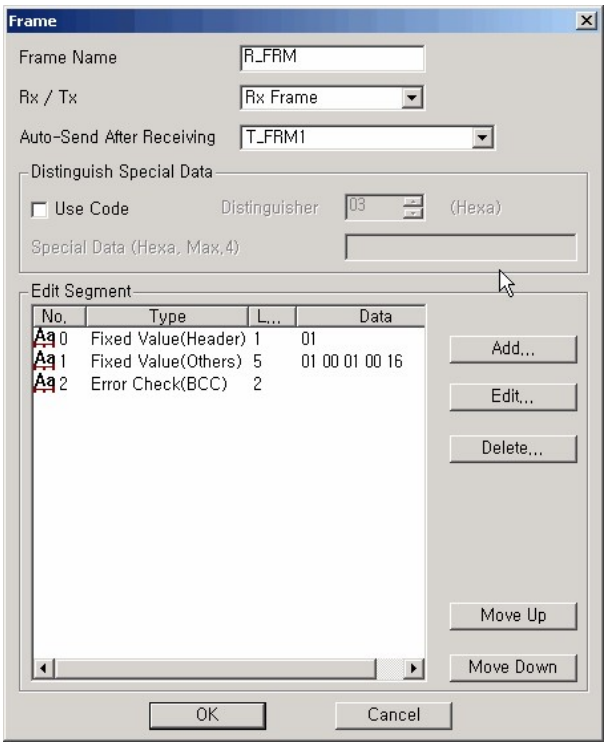
Slave Address	Function	Starting Address(H)	Start Address(L)	No. Point(H)	No. Point(H)	BCC(H)	BCC(L)
01	01	00	01	0	16	?	?

Structure of Modbus Protocol Response (CIMON-PLC)

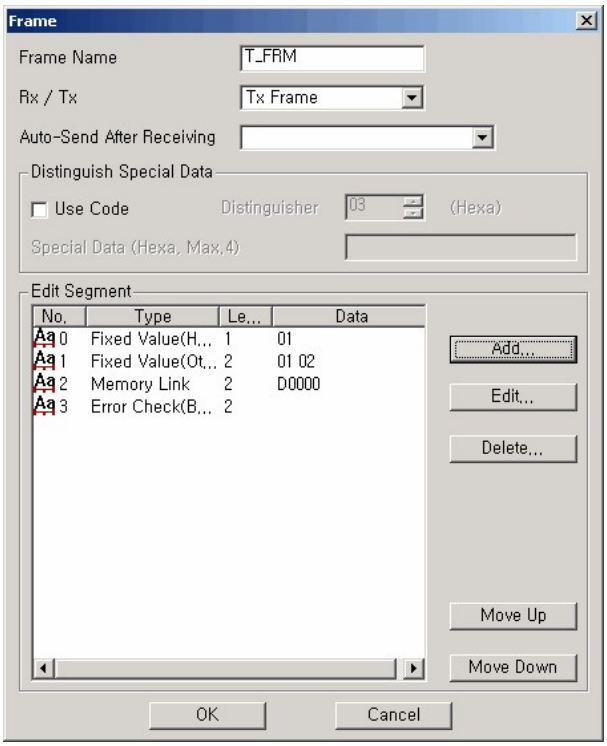
Slave Address	Function	Byte Count	Data	Data	BCC(H)	BCC(L)
01	01	02	CD	6B	?	?

Setting up the requesting frame received from other manufacturer's PLC

Select the auto-send after receiving. But, the frame sent automatically is to be registered.

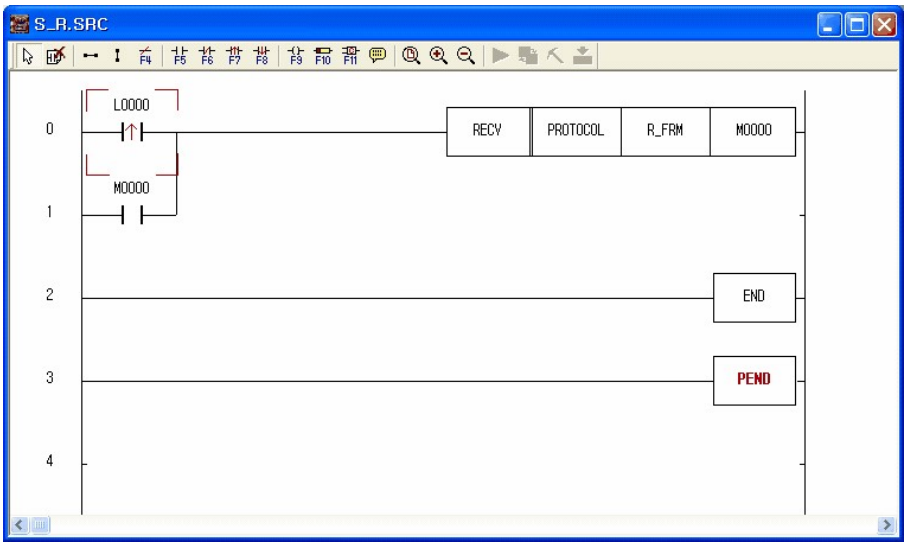


Setting up a responding frame



PLC Program:

If Data Value L0000 is '1', the received data is evaluated. The frame registered to the auto-send after receiving is sent without SEND command. Also, M0000 is or-operated and the above will be continuously processed if a frame is received.



6.2.6.2.7 Sending/Receiving communication frames at communication intervals

The following is the example of a communication system and frame composition between a master CIMON-PLC and a slave CIMON-PLC by using CIMON-PLC exclusive protocol.

A master PLC requests 5-word data of Memory Device 'D0000' at every 100ms.
Enter parameters as follows.

- Master PLC : User Protocol
- Slave PLC : HMI Protocol

Request Frame Format of CIMON-PLC Exclusive Protocol

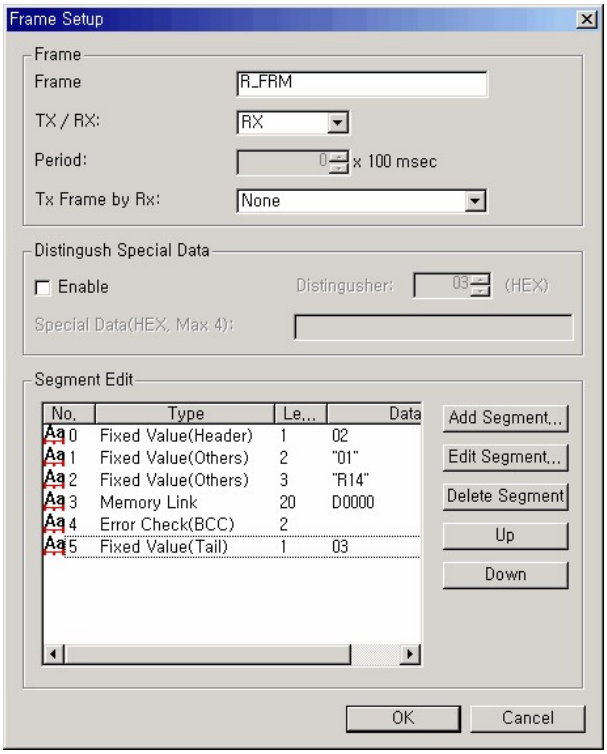
ENQ	Stn H	Stn L	Cmd	Leng H	Leng L	Data	BCC H	BCC L	EOT
ENQ	0	1	R	0	A	D0000000 05	?	?	EOT

Response Frame Format of CIMON-PLC Exclusive Protocol

STX	Stn H	Stn L	Cmd	Leng H	Leng L	Data	BCC H	BCC L	ETX
STX	0	1	R	1	4	0000 0000 0000 0000 0000	?	?	ETX

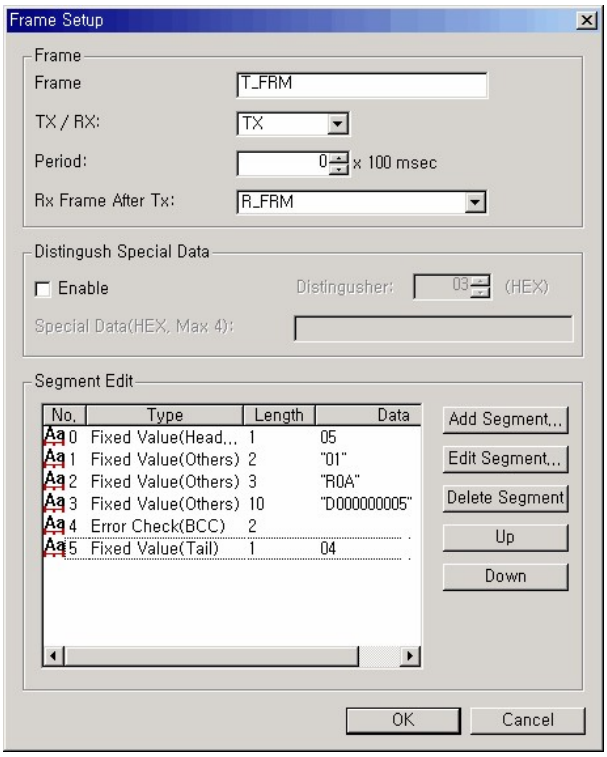
Response frame of master side

This is used to define the response frame received from a slave CIMON-PLC.
Sending frames are sent from a master PLC and expected receiving frames are registered.



Request frame of master side

This is used to define the request frames sent to a slave CIMON-PLC.
Sending frame is sent from a master PLC at every 100ms and the above-defined receiving frame is registered to the receiving frame for sending.
If a sending frame is sent and a registered frame is received, the bit corresponding to the frame number of communication result memory device(If frame number is 1, communication result bit is M0001) will be on for one scan.



6.2.6.3 CIMON PLC - HMI Protocol

This service is used to have a PC and other devices read and write the information and data in a PLC, and to have them control a PLC (RUN, STOP, PAUSE). In the system composing of a Master and a Slave, if station numbers are assigned, multi-drop communication is available.

See :

- Structure of Frame
- Details of Command

6.2.6.3.1 Structure of Frame

Request Frame (Master) :

The frame that an outside communication device requests to a computer link module

ENQ	Stn H	Stn L	Cmd	Leng H	Leng L	Data	BCC H	BCC L	EOT

Response Frame (Slave) :

The frame that a computer link module responds to an outside communication device

STX	Stn H	Stn L	Cmd	Leng H	Leng L	Data	BCC H	BCC L	ETX

1) The structure of a sending frame and the one of a receiving frame are same.

2) The same as the command codes received from a request frame (Master) are used for response frame. But, if there is an error in communication or process, Code E is responded.

3) Description for Codes

Code	Hex Value	Description
ENQ	05H	Master Frame Header
EOT	04H	Master Frame Tail
STX	02H	Slave Header
ETX	03H	Slave Tail
Stn	00H~1FH, FFH	PLC Station Number
Cmd		Command
Leng		Length of Data Device (Length Bytes), Hexadecimal
Data		Data Device according to Command (Length Bytes)
BCC		Remainder value when dividing the binary-sum from Cmd to the end of data by 256

4) Commands

The commands used for exclusive communication service are as follows.

Command	Code	ASCII	Function
Read Word Data	52H	R	Reads Word Memory Device.
Write Word Data	57H	W	Writes to Word Memory Device.
Read Bit Data	72H	r	Reads Bit Memory Device.
Write Bit Data	77H	w	Writes to Bit Memory Device.
Change PLC Mode	4DH	M	Changes PLC Mode.
Register Monitoring Device	58H	X	Registers Monitoring Device.
Read Monitoring Device	59H	Y	Reads Registered Monitoring Device
Respond Error	45H	E	Responds Error in PLC.

6.2.6.3.2 Details of Command

List :

- Read Word Data
- Write Word Data
- Read Bit Data
- Write Bit Data
- Change PLC Mode
- Register Monitoring Device
- Read Monitoring Device
- Error Response

Read Word Data

Function

- This is used to read the data in the word device of a PLC. (Max. 63 words)
- Device Symbol: X, Y, M, L, K, F, Z, TC, TS, CC, CS, D, S

Request Frame (Master)

- COMMAND: 'R'

- Data Device Format

Address 8 Char	Size (Word) Hexadecimal, 2 Char	.....	Address 8 Char	Size (Word) Hexadecimal, 2 Char

[Master(Request Format)]

HEADER	Stn H	Stn L	Cmd	Leng H	Leng L	Data	BCC H	BCC L	EOT
ENQ	02		R	0A		D0000001 01	B9		EOT
05H	30H	32H	52H	30H	41H	4430303030303031 3031H	42H	39H	04H

Leng is the length of a data and its value means the length of a data (D0000001 01).

Data means the address really read (D0000001) and the length of the word data read (01).
BCC is the remainder value when dividing the binary-sum from Cmd to the end of data by 256.

Response Frame (Slave)

- COMMAND (In completed case: 'R' / In failed case: 'E')

- Format of Data Device

[Completed Case]

PLC Data

Word Data 4 Char	Word Data 4 Char	.....	Word Data 4 Char

Slave(Response Format)

HEADER	Stn H	Stn L	Cmd	Leng H	Leng L	Data	BCC H	BCC L	ETX
STX	02		R	04		F4AC	B4		ETX
02H	30H	32H	52H	30H	34H	46344143H	42H	34H	03H

The request frame received from a master is used as the response frame of a PLC.
BCC is the remainder value when dividing binary-sum from Cmd to the end of data by 256.
As the response frame is processed, Cmd is 'R'. (* Leng means the length of a data (F4AC).

[Failed Case]

Error Code

Error Code 2 Char

Slave(Response Format)

HEADER	Stn H	Stn L	Cmd	Leng H	Leng L	Error Code	BCC H	BCC L	ETX
STX	02		E	02		02	09		ETX
02H	30H	32H	45H	30H	32H	3032H	30H	39H	03H

The request frame received from a master is used as the response frame of a PLC.
BCC is the remainder value when dividing the binary-sum from Cmd to the end of data by 256.
As the response frame is not processed, Cmd is 'E'. (*Leng means the length of error code(02).)

* Error code displays the type of an error. Please refer to the 'ERROR RESPONSE'.

[Ex.] Read data from Address D00040 of Station 02H.

Master (Request Format)

HEADER	Stn H	Stn L	Cmd	Leng H	Leng L	Data	BCC H	BCC L	EOT
ENQ	02		R	0A		D0000040 01	BC		EOT
05H	30H	32H	52H	30H	41H	4430303030303430 3031H	42H	43H	04H

Completed Case> reads 1-word data 'F4AC'

Slave(Response Format)

HEADER	Stn H	Stn L	Cmd	Leng H	Leng L	Data	BCC H	BCC L	ETX
STX	02		R	04		F4AC	B4		ETX
02H	30H	32H	52H	30H	34H	46344143H	42H	34H	03H

Failed Case> Error in BCC

Slave(Response Format)

HEADER	Stn H	Stn L	Cmd	Leng H	Leng L	Error Code	BCC H	BCC L	ETX
STX	02		E	02		02	09		ETX
02H	30H	32H	45H	30H	32H	3032H	30H	39H	03H

Write Word Data

Function

- This is used to write a data to the word device of a PLC.
- **Device Symbol:** X, Y, M, L, K, F, Z, TC, TS, CC, CS, D, S

Request Frame

- COMMAND: 'W'

- Format of Data Device

Address 8 Char	Size (Word) Hexadecimal, 2 Char	Word Data Hexadecimal, Size*4 Char	.....	Address 8 Char	Size (Word) Hexadecimal, 2 Char	Word Data Hexadecimal, Size*4 Char

[Master (Request Format)]

HEADER	Stn H	Stn L	Cmd	Leng H	Leng L	Data	BCC H	BCC L	EOT

ENQ	02		W	0E		D0000010 01 FA34	B0		EOT
05H	30H	32H	57H	30H	45H	4430303030303130 3031 46413334H	42H	30H	04H

Leng is the length of a data and its value means the length of the Data (D0000010 01 FA34).
The address really written (D0000010), the length of the data (01) and the data written (FA34) are input in the Data (D1000 02 FA34).
BCC is the remainder value (F3) when dividing the binary-sum from Cmd to the end of data by 256.

Response Frame

- COMMAND (In completed case: ‘W’ / In failed case: ‘E’)
- Format of Data Device

[Completed Case]

No Data

Slave (Response Format)

HEADER	Stn H	Stn L	Cmd	Leng H	Leng L	BCC H	BCC L	ETX
STX	02		W	00		B7		ETX
02H	30H	32H	57H	30H	30H	42H	37H	03H

The request frame received from a master is used as the response frame of a PLC.
BCC is the remainder value when dividing the binary-sum from Cmd to the end of data by 256.
As the response frame is processed, Cmd is ‘W’.
Leng means the length of a data.

[Failed Case]

Error Code

Error Code 2 Char

Slave (Response Format)

HEADER	Stn H	Stn L	Cmd	Leng H	Leng L	Error Code	BCC H	BCC L	ETX
STX	02		E	02		01	08		ETX
02H	30H	32H	45H	30H	32H	3031H	30H	38H	03H

The request frame received from a master is used as the response frame of a PLC.

BCC is the remainder value when dividing the binary-sum from Cmd to the end of data by 256.
As the response frame is not processed, Cmd is ‘E’.
Leng(02) means the length of Error Code(01).
Error code displays the type of an error. Please refer to the ‘ERROR RESPONSE’.

[[Ex.] Write FA34H to Address D0010 and 8D41H to Address D0020.]

Master (Request Format)

HEADER	Stn H	Stn L	Cmd	Leng H	Leng L	Data	BCC H	BCC L	EOT
ENQ	02		W	12		D0000010 02 FA34 8D41	AF		EOT
05H	30H	32H	57H	31H	32H	4430303030303130 3032 46413334 38443431H	41H	46H	04H

Completed Case>

Slave (Response Format)

HEADER	Stn H	Stn L	Cmd	Leng H	Leng L	BCC H	BCC L	ETX
STX	02		W	0		B7		ETX
02H	30H	32H	57H	30H	30H	42H	37H	03H

Failed Case>Receiving unknown command code (01H).

Slave (Response Format)

HEADER	Stn H	Stn L	Cmd	Leng H	Leng L	Error Code	BCC H	BCC L	ETX
STX	02		E	02		01	08		ETX
02H	30H	32H	45H	30H	32H	3031H	30H	38H	03H

Read Bit Data

Function

- This is used to read the data in the bit device of a PLC.
- Device Symbol: X, Y, M, L, K, F, Z, T, C

Request Frame

- COMMAND: ‘r’

- Format of Data Device

Address 8 Char	Size (Bit) Hexadecimal, 2 Char	.....	Address 8 Char	Size (Bit) Hexadecimal, 2 Char

Master(Request Format)

HEADER	Stn H	Stn L	Cmd	Leng H	Leng L	Data	BCC H	BCC L	EOT
ENQ	03		r	0A		M000010F 02	F9		EOT
05H	30H	33H	72H	30H	41H	4D303030313030 46 3032H	46H	39H	04H

Leng is the length of a data and its value means the length of Data (M000010F 02H).
The address really read(M000010F) and the length of the data(02) are input in the Data.
BCC is the remainder value when dividing the binary-sum from Cmd to the end of data by 256.

Response Frame

- COMMAND (In completed case: ‘r’ / In failed case: ‘E’)
- Format of Data Device

[Completed Case]

PLC Data

Bit Data 1 Char	Bit Data 1 Char	.....	Bit Data 1 Char

Slave (Response Format)

HEADER	Stn H	Stn L	Cmd	Leng H	Leng L	Data	BCC H	BCC L	ETX
STX	01		r	02		0 1	35		ETX
02H	30H	31H	72H	30H	32H	30 31H	33H	35H	03H

The request frame received from a master is used as the response frame of a PLC.
BCC is the remainder value when dividing the binary-sum from Cmd to the end of data by 256.
As the response frame is processed, Cmd is ‘r’.
Leng(02) means the length of the Data(0 1).

[Failed Case]

Error Code

Error Code 2 Char

Slave(Response Format)

HEADER	Stn H	Stn L	Cmd	Leng H	Leng L	Error Code	BCC H	BCC L	ETX
STX	03		E	02		01	08		ETX
02H	30H	33H	45H	30H	32H	3031H	30H	38H	03H

The request frame received from a master is used as the response frame of a PLC.
BCC is the remainder value when dividing the binary-sum from Cmd to the end of data by 256.
As the response frame is not processed, Cmd is 'E'.
Leng(02) means the length of Error Code(01).
Error code indicates the type of an error. Please refer to the 'ERROR RESPONSE'.

[Ex.] Read the bit data in Address M0104 and Address M0105 of Station 03 PLC.

Master (Request Format)

HEADER	Stn H	Stn L	Cmd	Leng H	Leng L	Data	BCC H	BCC L	EOT
ENQ	03		r	0A		M0000104 02	E7		EOT
05H	30H	33H	72H	30H	41H	4D3030303031 3034 3032H	45H	37H	04H

Completed Case > Reads Data '0 1'.

Slave (Response Format)

HEADER	Stn H	Stn L	Cmd	Leng H	Leng L	Data	BCC H	BCC L	ETX
STX	03		r	02		0 1	35		ETX
02H	30H	33H	72H	30H	32H	30 31H	33H	35H	03H

Failed Case > Error in BCC

Slave (Response Format)

HEADER	Stn H	Stn L	Cmd	Leng H	Leng L	Error Code	BCC H	BCC L	ETX
STX	03		E	02		02	09		ETX
02H	30H	33H	45H	30H	32H	3032H	30H	39H	03H

Write Bit Data

Function

- This is used to write data to the bit device of a PLC.
- Device Symbol : X, Y, M, L, K, F, Z, T, C

Request Frame

- COMMAND : ‘w’

- Format of Data Device

Address 8 Char	Size (Bit) Hexadecimal, 2 Char	Bit Data Size*1 Char	.....	Address 8 Char	Size (Bit) Hexadecimal, 2 Char	Bit Data Size*1 Char

Master(Request Format)

HEADER	Stn H	Stn L	Cmd	Leng H	Leng L	Data	BCC H	BCC L	EOT
ENQ	03		w	0D		M0000101 03 110	82		EOT
05H	30H	33H	77H	30H	42H	4D303030303130 31 3033 313130H	38H	32H	04H

Leng(0B) is the length of data and its value means the length of Data (M0000101 03 110).
The address really written(M0000101), the length of the data(03) and the data written(110) are input in the Data.
BCC is the remainder value when dividing the binary-sum from Cmd to the end of data by 256.

Response Frame

- COMMAND (In completed case: ‘w’ / In failed case: ‘E’)

- Format of Data Device

[Completed Case]

No Data

Slave(Response Format)

HEADER	Stn H	Stn L	Cmd	Leng H	Leng L	BCC H	BCC L	ETX
STX	03		w	00		D7		ETX
02H	30H	33H	77H	30H	30H	44H	37H	03H

The request frame received from a master is used as the response frame of a PLC.
BCC is the remainder value when dividing the binary-sum from Cmd to the end of data by 256.
As the response frame is processed, Cmd is ‘w’.
Leng(00) means the length of the data.

[Failed Case]

Error Code

Error Code 2 Char

Slave(Response Format)

HEADER	Stn H	Stn L	Cmd	Leng H	Leng L	Error Code	BCC H	BCC L	ETX
STX	02		E	02		04	0B		ETX
02H	30H	32H	45H	30H	32H	3034H	30H	42H	03H

The request frame received from a master is used as the response frame of a PLC.
BCC is the remainder value when dividing the binary-sum from Cmd to the end of data by 256.
As the response frame is not processed, Cmd is 'E'.
Leng(02) means the length of Error Code (04).
Error code indicates the type of an error. Please refer to the 'ERROR RESPONSE'.

[Ex.] Write bit data to Bit Address M0104.

Master(Request Format)

HEADER	Stn H	Stn L	Cmd	Leng H	Leng L	Data	BCC H	BCC L	EOT
ENQ	01		w	0D		M0000104 03 110	82		EOT
05H	30H	31H	77H	30H	44H	4D303030303130 34 3033 313130H	38H	32H	04H

Completed Case

Slave(Response Format)

HEADER	Stn H	Stn L	Cmd	Leng H	Leng L	BCC H	BCC L	ETX
STX	01		w	00		D7		ETX
02H	30H	31H	77H	30H	30H	44H	37H	03H

Failed Case> Data Size Overflow

Slave (Response Format)

HEADER	Stn H	Stn L	Cmd	Leng H	Leng L	Error Code	BCC H	BCC L	ETX
STX	01		E	02		04	0B		ETX
02H	30H	31H	45H	30H	32H	3034H	30H	42H	03H

Change PLC Mode

Function

- This is used to change the operation mode of a PLC.

Request Frame

- COMMAND : ‘M’

- Format of Data Device

Mode Code

Mode	Code
Run	0
Program	1
Pause/Remote	2

Master(Request Format)

HEADER	Stn H	Stn L	Cmd	Leng H	Leng L	Data	BCC H	BCC L	EOT
ENQ	01		M	01		0	DE		EOT
05H	30H	31H	4DH	30H	31H	30H	44H	45H	04H

Leng(01) is the length of data.
Mode code value(0) is input in the Data(0).
BCC is the remainder value when dividing the binary-sum from Cmd to the end of data by 256.
Only the case CPU is under REMOTE status is available.

Response Frame

- COMMAND (In completed case: ‘M’ / In failed case: ‘E’)

- Format of Data Device

[Completed Case]

No Data

Slave(Response Format)

HEADER	Stn H	Stn L	Cmd	Leng H	Leng L	BCC H	BCC L	ETX
STX	01		M	00		AD		ETX

02H	30H	31H	4DH	30H	30H	41H	44H	03H

The request frame received from a master is used as the response frame of a PLC.
BCC is the remainder value when dividing the binary-sum from Cmd to the end of data by 256.
As the response frame is processed, Cmd is 'M'.
Leng(00) means the length of the data.

[Failed Case]

Error Code

Error Code 2 Char

Slave(Response Format)

HEADER	Stn H	Stn L	Cmd	Leng H	Leng L	Error Code	BCC H	BCC L	ETX
STX	02		E	02		03	0A		ETX
02H	30H	32H	45H	30H	32H	3033H	30H	41H	03H

The request frame received from a master is used as the response frame of a PLC.
BCC is the remainder value when dividing the binary-sum from Cmd to the end of data by 256.
As the response frame is not processed, Cmd is 'E'.
Leng(02) means the length of Error Code (03).
Error code indicates the type of an error. Please refer to the 'ERROR RESPONSE'.

[Ex.] Change the operation mode of a PLC to PAUSE/REMOTE mode.

Master(Request Format)

HEADER	Stn H	Stn L	Cmd	Leng H	Leng L	Data	BCC H	BCC L	EOT
ENQ	01		M	01		2	E0		EOT
05H	30H	31H	4DH	30H	31H	32H	45H	30H	04H

Completed Case

Slave(Response Format)

HEADER	Stn H	Stn L	Cmd	Leng H	Leng L	BCC H	BCC L	ETX
STX	01		M	00		AD		ETX
02H	30H	31H	4DH	30H	30H	41H	44H	03H

Failed Case > Invalid mode

Slave(Response Format)

HEADER	Stn H	Stn L	Cmd	Leng H	Leng L	Error Code	BCC H	BCC L	ETX
STX	01		E	02		03	0A		ETX
02H	30H	31H	45H	30H	32H	3033H	30H	41H	03H

Register Monitoring Device

Function

- This is used to register a monitoring device.
- 16 devices can be registered as maximum. (Distinguishing by Frame No., 0h – Fh)
- Individual device should be continuous and is limited to 63 words as maximum.

Request Frame

- COMMAND : ‘X’

- Format of Data Device

Frame No. 1 Char	Word Address 8 Char	Word Size Hexadecimal, 2 Char

Master(Request Format)

HEADER	Stn H	Stn L	Cmd	Leng H	Leng L	Data			BCC H	BCC L	EOT
ENQ	01		X	0B		0	D0000001	02	C0		EOT
05H	30H	31H	58H	30H	42H	30H	4430303030 303031H	3032H	43H	30H	04H

Leng(0B) is the length of a data.
The Mode code(0), the Address(D0000001) and the Size(02) are input in the Data (0 D00001 02).
BCC is the remainder value when dividing the binary-sum from Cmd to the end of data by 256.

Response Frame

- COMMAND (In completed case: ‘X’ / In failed case: ‘E’)

- Format of Data Device

[Completed Case]

No Data

Slave(Response Format)

HEADER	Stn H	Stn L	Cmd	Leng H	Leng L	BCC H	BCC L	ETX
STX	01		X	00		B8		ETX
02H	30H	31H	58H	30H	30H	42H	38H	03H

The request frame received from a master is used as the response frame of a PLC.
BCC is the remainder value when dividing the binary-sum from Cmd to the end of data by 256.
As the response frame is processed, Cmd is ‘X’.
Leng(00) means the length of the data.

[Failed Case]

Error Code

Error Code 2 Char

Slave(Response Format)

HEADER	Stn H	Stn L	Cmd	Leng H	Leng L	Error Code	BCC H	BCC L	ETX
STX	01		E	02		07	0E		ETX
02H	30H	31H	45H	30H	32H	3037H	30H	45H	03H

The request frame received from a master is used as the response frame of a PLC.
BCC is the remainder value when dividing the binary-sum from Cmd to the end of data by 256.
As the response frame is not processed, Cmd is ‘E’.
Leng(02) means the number of Error Codes (07).
Error code indicates the type of an error. Please refer to the ‘ERROR RESPONSE’.

[Ex.] Register Frame 1 and Addresses from D0011 to D0014 to Station 1.

Master(Request Format)

HEADER	Stn H	Stn L	Cmd	Leng H	Leng L	Data	BCC H	BCC L	EOT
ENQ	01		X	0B		1 D0000011 04	C5		EOT
05H	30H	31H	58H	30H	42H	31 443030303030 3131 3034H	43H	35H	04H

Completed Case

Slave(Response Format)

HEADER	Stn H	Stn L	Cmd	Leng H	Leng L	BCC H	BCC L	ETX
STX	01		X	00		B8		ETX
02H	30H	31H	58H	30H	30H	42H	38H	03H

Failed Case > Invalid Monitor Frame No.(0h~Fh)

Slave(Response Format)

HEADER	Stn H	Stn L	Cmd	Leng H	Leng L	Error Code	BCC H	BCC L	ETX
STX	01		E	02		07	0E		ETX
02H	30H	31H	45H	30H	32H	3037H	30H	45H	03H

Read Monitoring Device

Function

- This is used to read the registered monitoring device.

Request Frame

- COMMAND : 'Y'

- Format of Data Device

Frame No. 1 Char

Master(Request Format)

HEADER	Stn H	Stn L	Cmd	Leng H	Leng L	Data	BCC H	BCC L	EOT
ENQ	01		Y	01		0	EA		EOT
05H	30H	31H	59H	30H	31H	30H	45H	41H	04H

Leng(01) is the length of a data.

Frame No. is input in the Data(0).

BCC is the remainder value when dividing the binary-sum from Cmd to the end of data by 256.

Response Frame

- COMMAND (In completed case: 'Y' / In failed case: 'E')

- Format of Data Device

[Completed Case]

Frame No.	Word Data 4 Char	.....	Word Data 4 Char

Slave(Response Format)

HEADER	Stn H	Stn L	Cmd	Leng H	Leng L	Data	BCC H	BCC L	EOT
ENQ	01		Y	05		0 87F3	D6		EOT
05H	30H	31H	59H	30H	35H	30 38374633H	44H	36H	04H

The request frame received from a master is used as the response frame of a PLC.
BCC is the remainder value when dividing the binary-sum from Cmd to the end of data by 256.
As the response frame is processed, Cmd is ‘Y’.
Leng(05) means the length of the Data(0 87F3).

[Failed Case]

Error Code

Error Code 2 Char

Slave(Response Format)

HEADER	Stn H	Stn L	Cmd	Leng H	Leng L	Error Code	BCC H	BCC L	ETX
STX	01		E	02		08	0F		ETX
02H	30H	31H	45H	30H	32H	3038H	30H	46H	03H

The request frame received from a master is used as the response frame of a PLC.
BCC is the remainder value when dividing the binary-sum from Cmd to the end of data by 256.
As the response frame is not processed, Cmd is ‘E’.
Leng(02) means the length of Error Code(08H).
Error code indicates the type of an error. Please refer to the ‘ERROR RESPONSE’.

[Ex.] If Frame 2h, Address D1005 and Address D1006 are registered as a monitoring device, read the registered device.

Master(Request Format)

HEADER	Stn H	Stn L	Cmd	Leng H	Leng L	Data	BCC H	BCC L	EOT

ENQ	01		Y	01		2	EC		EOT
05H	30H	31H	59H	30H	31H	32H	45H	43H	04H

Completed Case

Slave(Response Format)

HEADER	Stn H	Stn L	Cmd	Leng H	Leng L	Data	BCC H	BCC L	EOT
ENQ	01		Y	09		2 87F3 32E7	BD		EOT
05H	30H	31H	59H	30H	39H	32 38374633 33324537H	42H	44H	04H

Failed Case > Number of the unregistered(Not initialized) frame

Slave(Response Format)

HEADER	Stn H	Stn L	Cmd	Leng H	Leng L	Error Code	BCC H	BCC L	ETX
STX	01		E	02		08	0F		ETX
02H	30H	32H	45H	30H	32H	3038H	30H	46H	03H

Error Response

Function

- This is the function to inform a master of error occurring in the process of a communication frame or a request frame and is used in a response frame only.

Request Frame

- All request frames

Response Frame

- COMMAND : ‘E’
- Format of Data Device

Error Code

Error Code 2 Char

Error Code	Description
01	Receives unknown command code.
02	An error occurs in BCC.
03	CPU does not respond.
04	Receives unknown device code.
05	Exceeds the device read.
06	Invalid address.
07	Internal error
08	Receives the number of invalid data
09	Invalid data
10	Unregistered (Not initialized) frame number
11	Invalid Monitor Frame No. (0h – Fh) Invalid frame number
12	CPU is not in REMOTE status.
13	Invalid CPU status is assigned.
14	An error occurs in the size of the data written.
15	It is disabled to write.
16	It is disabled to change mode.

6.2.6.4 Dial-Up Modem Communication

Outline

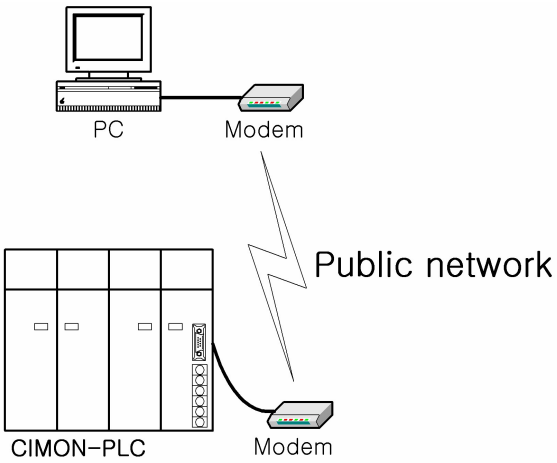
This function is to use the public network for a long-distance network.

Modem Specifications

In case of modem communications, it is required to use the modem complying with the recommendable specifications for reliability.
According to the performance of a modem and the state of a public network, the case that a line is not linked or the case that a link is cut off while exchanging data may occur.

- **Baud Rate** Over 14400 bps
- **DTE Interface** CTS / RTS Flow Control
- **Command** Hayes Exchange AT Command

- **Error Correction** Error Correction Function while Sending data
- **Controlling carrier** Controls to send carrier



Modem Link

Order of Modem Installation

1. Use RS-232C interface cable to connect a computer link module and an external type RS-232C modem.
2. Connect a RS-232C interface cable to the RS-232C port of the computer link module and DTE link terminal.
3. Connect the telephone line of a public network to the line terminal of the modem.
4. If there is a telephone set, connect the phone terminal of the modem with the telephone set.
5. Turning on the power for the PLC and the modem, make sure the modem is initialized.

Parameters Setup for Modem Communications

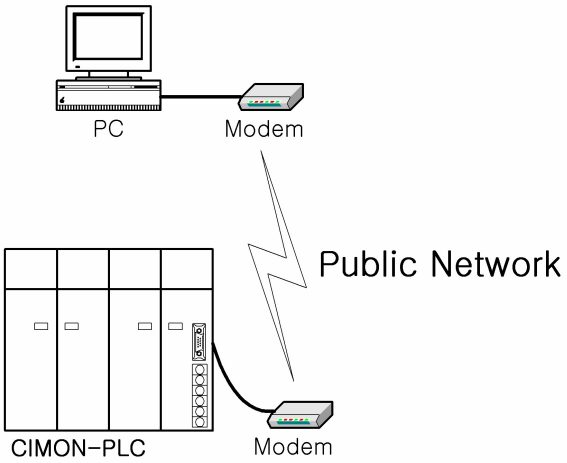
As all modems provide the functions discriminated by manufacturers, the parameters for modems are to be set up.
The modem operation mode is set up with the initialization command of a modem. The same operation mode is to be set up for the two modems used.

1. Select the menu to run the graphic loader(CICON).
2. Select menu to set up communication parameters such as communication channel, modem, baud rate, parity bit, stop bit, station number and communication type.
3. If a modem is set up, it will be available to set up the initialization command. Enter the modem initialization command set up.

4. Enter the default value for basic parameters such as station number, communication method, parity bit, stop bit and initialization command. Baud rate is to be set up according to the maximum rate of a modem.

CICON Link Service through Modem

- **This function is used to write programs, to download user programs, to debug programs and to monitor in the network system that a PLC is linked through a computer link module by remote control without moving the physical link of the CICON.**



When a master(CICON) is far away from a slave(PLC), using the function of the modem link, a PLC can be linked with the CICON.
As it is available to link with the PLC located at the place difficult to access as well as to link with a PLC at a long distance without moving the contents of the PLC, using the communication service of the CICON, programming is easy after installation. This function reduces the time and efforts taken when installing and modifying.

- **CICON-Modem Link Method**

This service is to link a computer link module with the CICON through a modem. After the CICON is connected with a telephone, the order of remote link is as follows.

1. Select the menu to set up a dial-up modem and the CICON protocol as the parameters of a computer link module. And select the menu to set up baud rate.
2. After connecting a modem with a computer link module and a telephone wire to the modem, turn the power on.
3. Select the menu to initialize the modem.

4. After the CICON is run, select the environment setup in the tools.
5. Select the dial-up and set the values for other parameters.
6. If the CICON dials, the message that the dial-up link is completed will appear.
7. It is available to control the PLC at a remote place.

6.2.6.5 Leased Line Modem Communication

Outline

A computer link module is used for the long-distance communication using a leased line through a leased line modem of external type and the control of the modem for communication.

Leased Line Modem Specifications

The performance of the leased line modem communication using a computer link module is decided according to the state of a leased line. For reliable communication, the modem complying with a recommended standard is to be used.

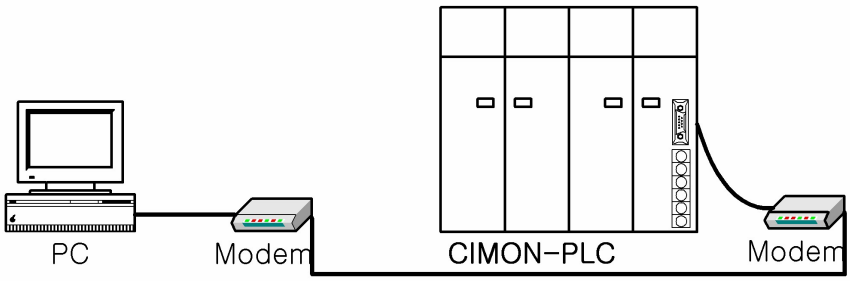
- **Baud Rate** Over 1200 bps
- **DTE Interface** CTS / RTS Flow Control
- **Error Correction** Corrects error when sending data
- **Carrier Control** Controls to send carrier
- **Line Control** Full duplex/Half duplex(2-wire, 4-wire)
- **RTS/CTS Delay Time** Within 500ms

Modem Link Method

Order to Link a Computer Link Module with a Modem

1) Connect a RS-232C cable to an external type modem and a computer link module.

2) Select the menu to set up the leased modem method as the communication method in the CICON.



3) Make sure the modem is initialized after inputting the power to it.

4) If the modem is not initialized normally, make sure the communication method is set up as the leased line modem communication and the wiring of the RS-232C cable.

5) The wiring of the RS232C cable is 1:1 connection.

6.2.6.6 RS485 PLC Link Service

Outline

CM1-SC01A/SC01B/SC02A card are used for this service, which is the protocol using a RS485 Network to exchange data between the CIMON PLCs. The specifications are as follows.

- Maximum connected PLCs : 32 units
- Up to 32 sending blocks per PLC can be assigned.
- The interval of communication for each sending block can be set up in the range from 50ms to 3s.
- The data of up to 64 words per one sending block can be sent.
- The number of the communication blocks assigned to each PLC, summing receiving blocks and sending blocks, is up to 64.
- The necessary blocks selected among the sending blocks of other PLCs in a network are assigned to receiving blocks.

Link Points

Max. Comm. Points	Max. Sending Points	Max. Block No.	Max. Points per Block
4,096	2,048	64Points (0~63)	64

Processing the Sent Data and the Received Data under PLC Link

An Example is taken to explain how data are processed when they are sent or received under PLC Link.

- **Sending Party :** This is used to set up the data read, the number of the block where data is sent, data size and sending interval to a sending party in broadcasting method.
- **Receiving Party :** This is used to set up the station number and block number for the sent data to a receiving party in broadcasting method to receive a desired data.

[Ex.] Station 0 sends the data of Device D0000 and Station 1 stores received data in Device Y0000.

Sending Party (Station: 0)

Type	Block Number	Sending Interval	Address	Size
Sending Block	0	100ms	D0000	10 Words

Receiving Party (Station: 1)

Type	Station Number	Block Number	Address	Size
Receiving Block	0	0	Y0000	4 Words

The block number of a sending party and the one of a receiving party are the same as 0, and the station number of the sending party is set up as 0 like the one of the receiving party. In this condition, the receiving party can receive every 100ms and the data sent from the sending party every 100ms. Though the sending party sends the data of 10-word size, the receiving party selects and receives the necessary data of 4-word size. But, if the size of received data is greater than the size of sent data, the PLC will receive the data as much as the size of the sent data.

Setting up PLC Link Parameter

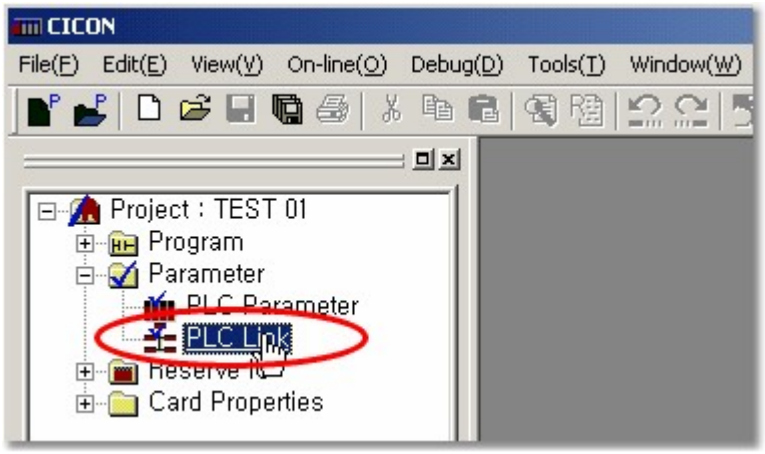
To run PLC Link and to exchange data between communication modules, the parameter is to be set up in

the CICON.

1) Creating a Project in the CICON

Select the menu to run the CICON and to open a corresponding project.

[Picture 6-1]



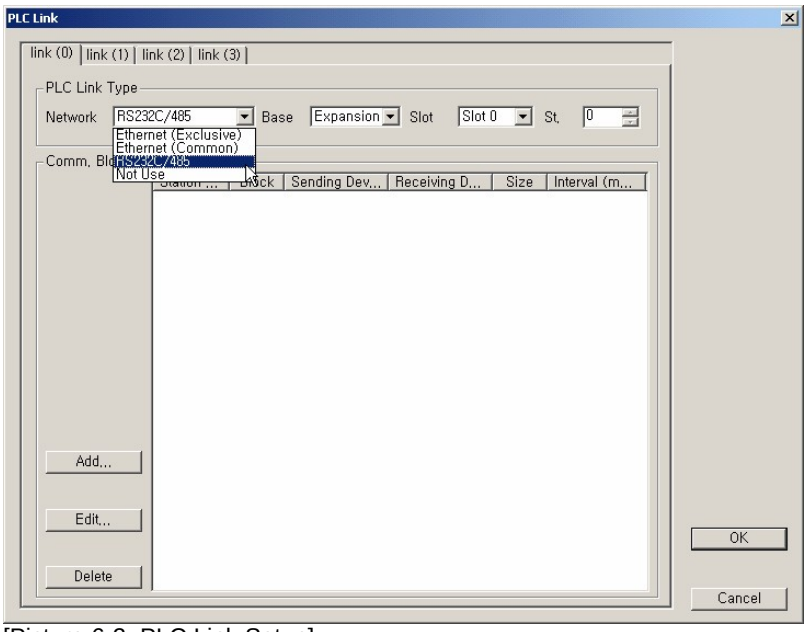
2) Setting up PLC Link Parameter

1. Selecting PLC Link Parameter:

If you select the PLC Link on the window like [Picture 6-1], a PLC link dialog box will appear. In the dialog box, up to 4 communication modules can be set up for one CPU. To set up the PLC Link to a mounted communication module, select Link(0), Link(1), Link(2) and Link(3) on the top of the dialog box and enter the values for each communication module

a. Setting up PLC Link Type:

PLC Link Type is used to set up basic items such as network type, base, slot number, station number and so on.



[Picture 6-2. PLC Link Setup]

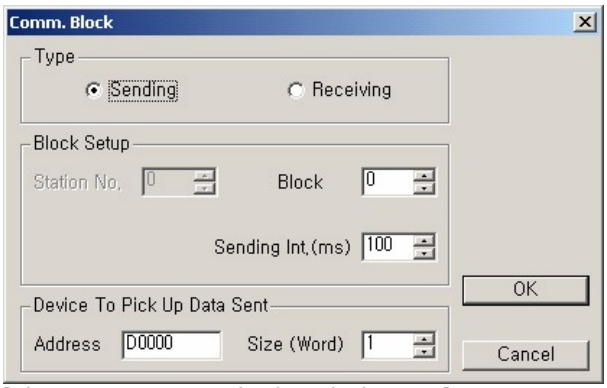
Network This is used to set up the type of the communication module for PLC Link. If you do not use PLC Link, select the Not Use.
Here, select the RS232C/485.

Base This is used to select the base where the communication module for PLC Link is mounted. For example, if there is no expansion base (The base where a expansion card is mounted), select the Local. If there is expansion base (The base where a expansion card is mounted), select the Expansion Base where the communication module is mounted.

Slot This is used to select the slot number of the base where a communication module is mounted.

b. Setting up the communication block for PLC Link:

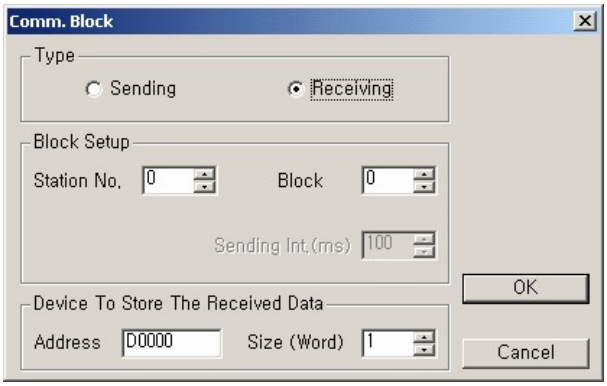
Communication Block is used to register the information about sending/receiving real data. If you select RS232C/422 as Network and the Add button in [Picure 6-2. PLC Link Setup], a Communication Block dialog box will appear like [Picture 6-3. Communication Block Setup].



[Picture 6-3. Communication Block Setup]

Sending When communication modules communicate each other, this is used to send a selected block.

Receiving When communication modules communicate each other, this is used to receive a selected block.



Station No. When communication modules communicate each other, in case of sending data, it is not necessary to set up station number. But, in case of receiving data, the station number of a receiving communication module is to be selected. The station number can be set up in the range from 0 to 63.

Block No. The communication modules for a sending party communicate with each peculiar block number. In the same way, the communication modules for a receiving party have each peculiar block number to receive data. The receiving block number is used to detect the data that a receiving party wants together with the station number when the party communicates with a sending party. But, the block number can be set up in the range from 0 to 31. To receive the data of a sending party, the same number is to be set up as the block number for the sending party and the block number for a receiving party.

Sending Interval The sending interval, the parameter for deciding the interval at which data are sent, can be set up in the range from 50ms to 3sec according to users' need. For example, if 50 ms is set up as sending interval, the data will be sent every 50ms.

Device to Pick up Data Sent & Device to Store The Received Data (Address):

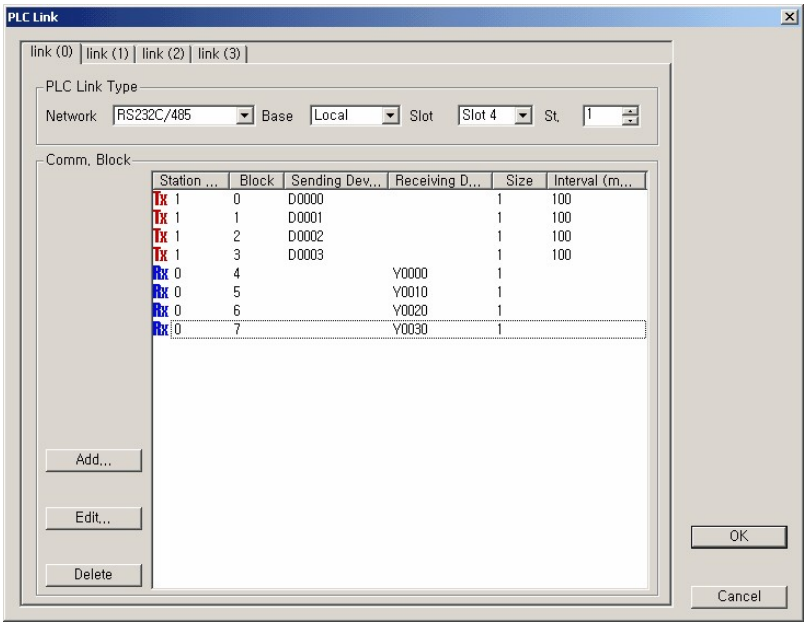
- When sending: This is used to set up the device where the data sent are read.
- When receiving: This is used to set up the device where received data are stored.

Device to Pick up Data Sent & Device to Store The Received Data (Size):

This, the size of the data sent or received, can be set up by the word. But, the size is from one word to 64 words. If the data size of a sending device is greater than the size of the data set up to a receiving device, the necessary data as much as the size of the one set up to the receiving device can be received selectively and used.

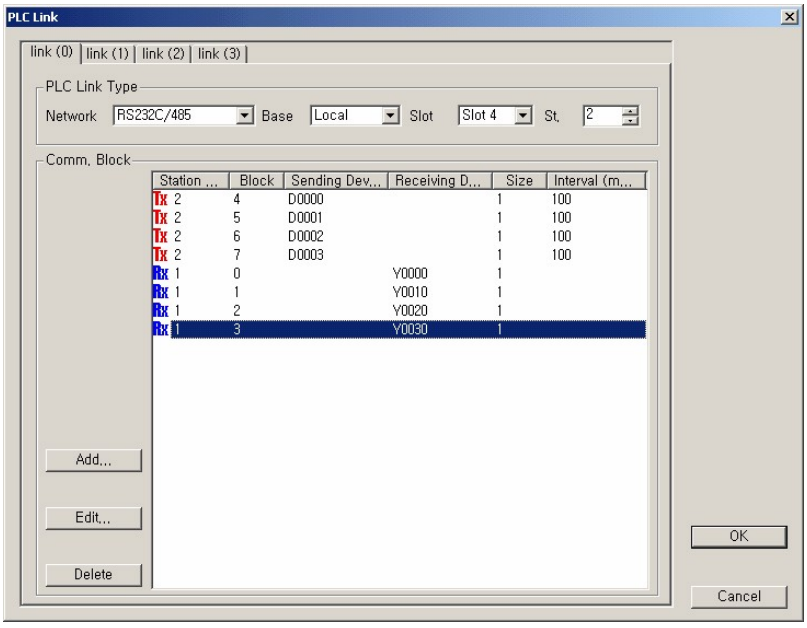
[Ex.] The communication module of Station 1 sends Block 0, 1, 2 and 3, and receives Block 4, 5, 6 and 7. And the communication module of Station 2 sends Block 4, 5, 6, and 7, receives 0, 1, 2 and 3. An RS232C/422 card is mounted on Slot 4. Each data size is one word and the interval is 50 ms each.
Such case is taken as an example and the PLC link parameter for it is configured as follows.

[Station 1]



Station 1 sends the data of the sending devices from D0000 to D0003 by the word at each interval. The received data will be written to the corresponding addresses in the receiving devices from Y0000 to Y0030, if the corresponding station and blocks are in accord.

[Station 2]



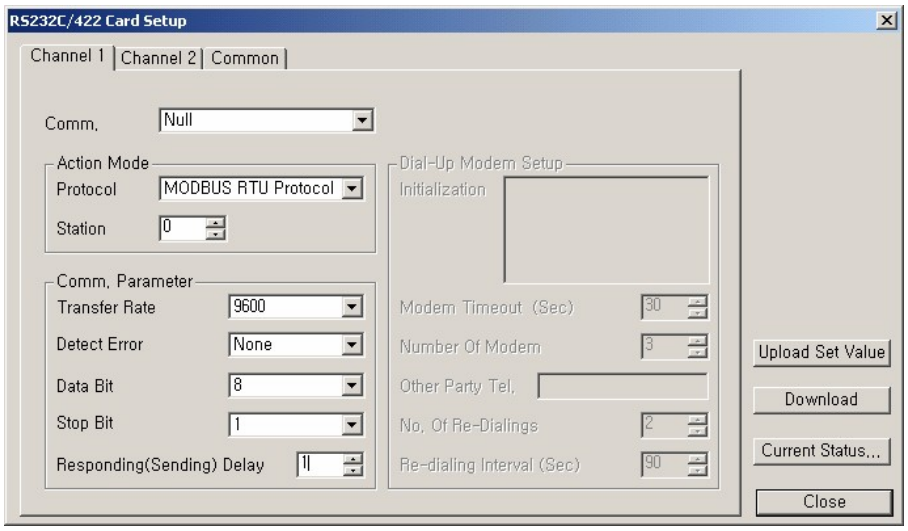
Enter 2 as the sending station number and 4, 5, 6, 7 as the block number to send at each interval. If so, the RS232C/422 module of Station 1 receives, comparing the receiving station and the blocks. In the same way, Station 2 compares the numbers of the blocks in the received frames with Block 0, 1, 2, and 3 of Station 1. And if they are the same, Station 2 receives them and writes the data to the devices from Y0000 to Y0030.

6.2.6.7 MODBUS Protocol Service

Outline

This is to access CPU data, using MODBUS protocol in a PC.

Parameter Setup



Select the MODBUS RTU Protocol as the protocol in the Action Mode and enter the station number of the communication card as the station number. If the parameters are set up, press the download button. If they are downloaded and you press the upload button, the downloaded value will be uploaded.

Modbus Command

Command	Description	Remarks
1 (Read Coil)	Accesses the bit device where data can be read and written.	Read Bit
2 (Read Input)	Accesses the bit device where data can be read.	Read Bit
3 (Read Holding)	Accesses the word device where data can be read and written.	Read Word
4 (Read Input)	Accesses the word device where data can be read.	Read Word
5 (Force Single Coil)	Accesses the bit device where data can be written.	Write Bit
6 (Preset Single Register)	Accesses the word device where data can be written.	Write Word
15 (Force Multiple Coils)	Accesses the bit device where data can be written.	Write Bit
16 (Preset Multiple Regs)	Accesses the word device where data can be written.	Write Word

Address Map

Device Memories of all kinds can be corresponded.

Bit / Word	Modicon Address	CIMON-PLC Address	Size CIMON-PLC
Bit Read Input	100001 ~ 104096	X 0000 ~	4096 Bits
	104097 ~ 106144	F 0000 ~	2048 Bits
	106145 ~ 107168	T 0000 ~	1024 Bits

	107169 ~ 108192	C 0000 ~	1024 Bits
Bit Read Coil	000001 ~ 004096	Y 0000 ~	4096 Bits
	004097 ~ 012288	M 0000 ~	8192 Bits
	012289 ~ 014336	K 0000 ~	2048 Bits
	014337 ~ 016384	L 0000 ~	2048 Bits
Word Input Register	400001 ~ 400256	X 0000 ~	256 Words
	400257 ~ 400384	F 0000 ~	128 Words
	400385 ~ 401408	TC 0000 ~	1024 Words
	401409 ~ 402432	CC 0000 ~	1024 Words
	402433 ~ 402482	S 0000 ~	50 Words
Word Holding Register	300001 ~ 300256	Y 0000 ~	256 Words
	300257 ~ 300384	K 0000 ~	128 Words
	300385 ~ 301408	TS 0000 ~	1024 Words
	301409 ~ 302432	CS 0000 ~	1024 Words
	302433 ~ 302560	L 0000 ~	128 Words
	302561 ~ 303072	M 0000 ~	512 Words
	303073 ~ 313072	D 0000 ~	10000 Words

Bit(Read Inputl, Read Coil) occupies Modicon Address bit by bit.

[Ex.] Read Input -> 100001: X0000, 100002: X0001,....., 100017: X0010,.....

[Ex.] Read Coil -> 000001: Y0000, 000002: Y0001,..... , 000017: Y0010,.....

Word(Input Register, Holding Register) occupies Modicon Address word by word.

[Ex.] Input Register -> 400001: X0000, 400002->X0010, 400003->X0020,.....

[Ex.] Holding Register -> 302561: M0000, 302562: M0010, 302563: M0020,.....

[Note] Some MODBUS Master devices can read and write the devices from 1 to 9999 in the range of the address of each data type. In this case, as the part corresponding to the device greater than Modicon Address 9999 in the data of a PLC cannot be accessed, the access memory of the user program may be controlled.

6.2.6.8 MODBUS Master Special module program Service

Outline

1.1 General information

CM1-SC01A/SC01B/SC02A cards are used for this service, which is the protocol using RS232/485 MODBUS Master to exchange data between the Slaves. The specifications are as follows.

- Maximum connectable Slaves: 128 units.
- Easy to recognize to communicate successful or not with result bits of communication.
- Sequnce program is not necessary when periodic communication.
- It is Flexible for Slaves supported variable commands
- To communication in special events is possible with command, "SEND"?

CAUTION, identify a version of program for MODBUS Master special program. If it cannot support program as lower version, please make sure whether it is the recommend version

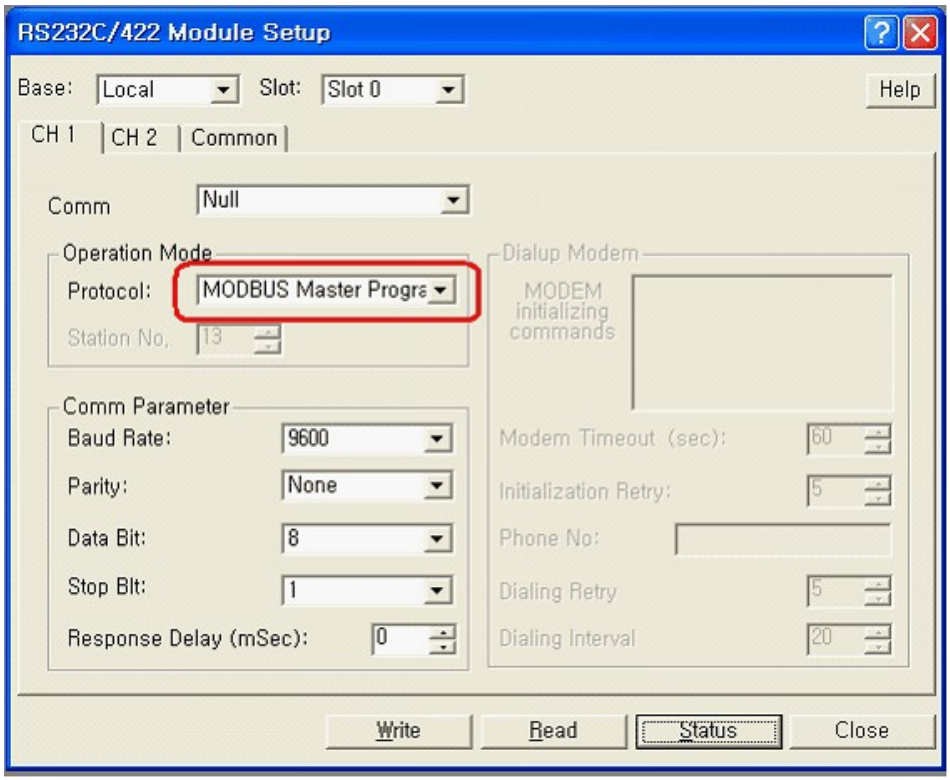
	CICON	CM1-CPxx(CPU)	CM1-SC0xx
Version	V1.89	V1.56	V1.40

1.2 Supported MODBUS RTU commands

Command	Substance	Remark	Domain
1 (Read Coil)	Read the bit device coil	Read Bit	0X
2 (Read Input)	Read the bit device input	Read Bit	1X
3 (Read Holding)	Read the word device holding register	Read Word	4X
4 (Read Input)	Read the word device input	Read Word	3X
5 (Force Single Coil)	Write the bit device coil	Write Bit	0X
6 (Preset Single Register)	Write Accesses the word device register	Write Word	4X
16 (Preset Multiple Regs.)	Write the word device register	Write Word	4X

SETTING UP COMMUNICATION CARD

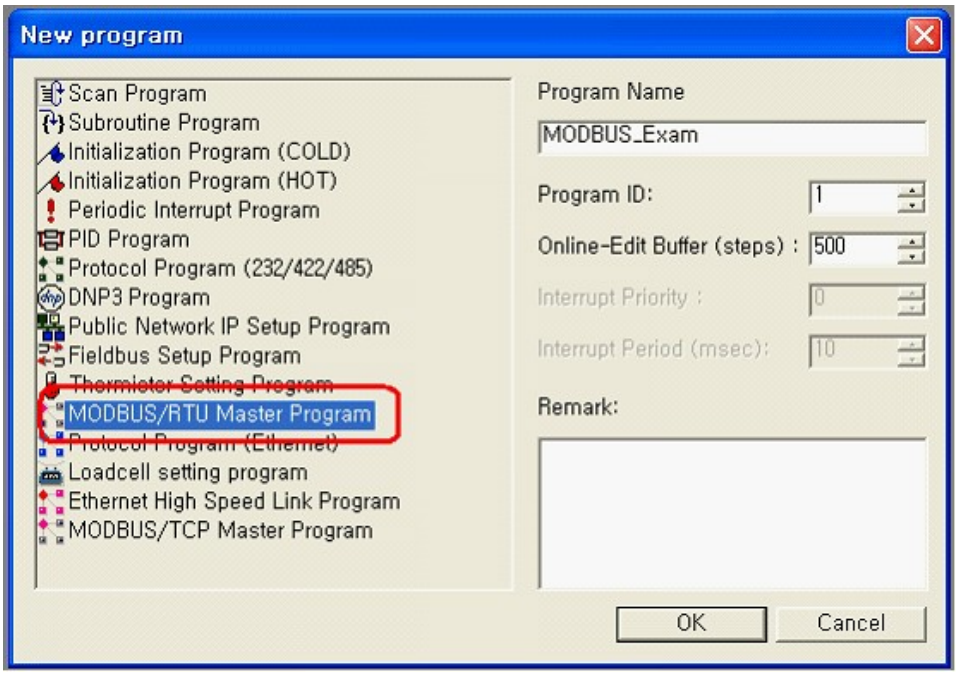
To run MODBUS Master function, the parameter have to be set up in the special module setup. After running the CICON, select the menu **[tool - Special Module Setup – RS232C/422 module...]**
Please select "MODBUS Master Program".



REGISTER SPECIAL PROGRAM

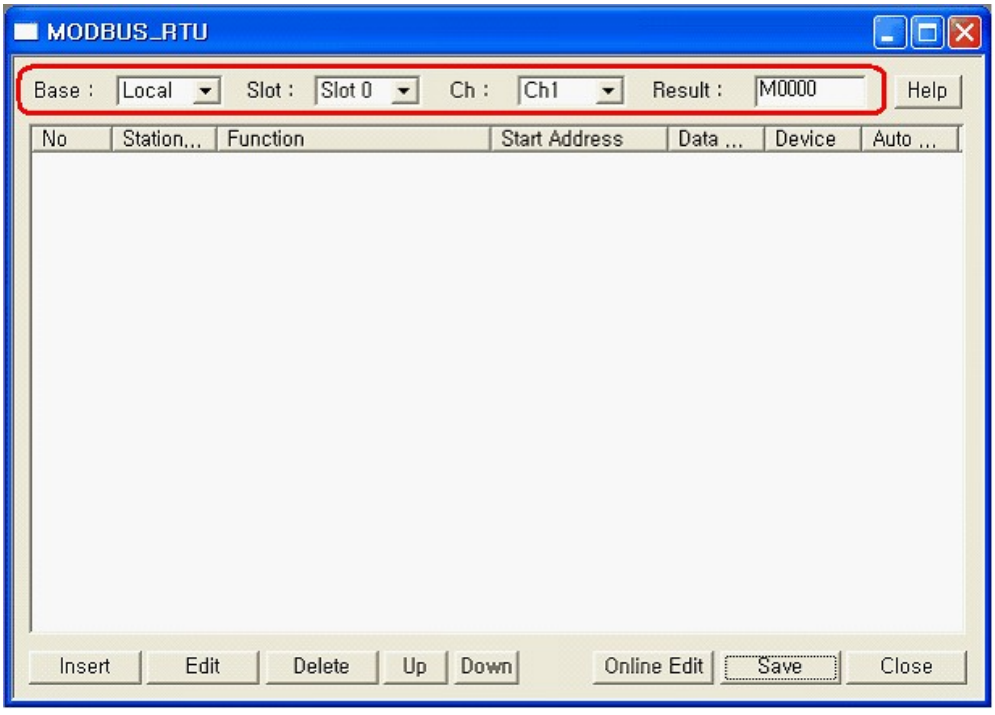
3.1 Start scan program

- Select [NEW program – MODBUS/RTU Master Program], and register program name.



Select the [OK] button.

3.2 MODBUS_RTU dialog box will appear, set up a device.



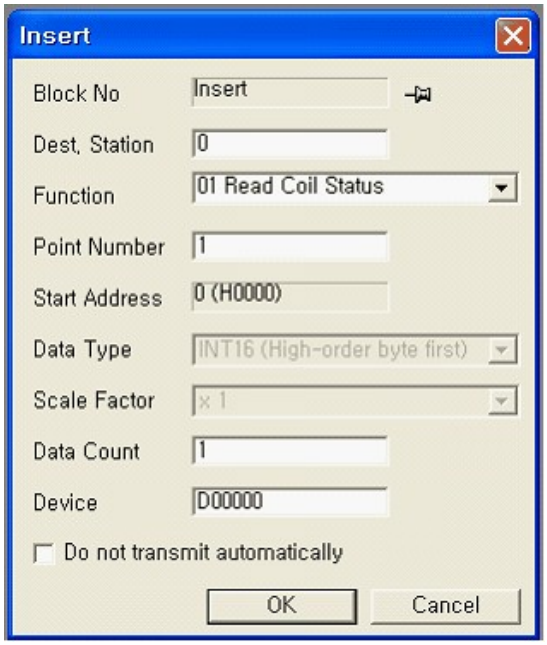
- Base: This is used select the base of MODBUS/RTU Master module configured.

- Slot: This is used select the slot of MODBUS/RTU Master module configured.
- Ch : This is used select the channel of MODBUS/RTU Master module configured.
- Result: This is used to appear the send/receive data's result of communication frame.

result	Frame No.	The comm. Result Flag		The comm. Result Flag Running	
		Succeed	Fail	Succeed	Fail
M0000	0	M0000	M0080	1 Scan On	On at all times Off at communication flag success
	11	M000B	M000B		
	127	M007F	M007F		

Example of configuration " result " M0000

3.4 REGISTER COMM. BLOCK



- Dest. Station. : This is used to select a station number of RTU MODBUS Slave configured, In case of connecting between several slaves used through RS422/485 communication, the station number have to be different between slaves each other.
- Function : This is used to select a suitable function when a data read/write between slaves. Please refer to the manual of "Command"
- Point Number : Resister read/write domains referred to a address table of slaves. Please refer to " Address table in SLAVE "
- Start Address: It is used to register the address of a read/write domain which is referred to address tables of slave. Please refer to the manual of " Address table of slave "

- Data Type : This is used to select a type of send/receive data between slaves. Only selected analog data (Function 3, 4, 6, 16),
  they are valid

Data Type	Valid Data(Byte)	Result Data(Byte)
INT16(High-Order byte first)	12 34	12 34
INT16(Low-Order byte first)	12 34	34 12
INT32(High-Order byte first)	12 34 56 78	56 78 12 34
INT32(Low-Order byte first)	12 34 56 78	34 12 78 56
Float(High-Order byte first)	12 34 56 78	56 78 12 34
Float(Low-Order byte first)	12 34 56 78	34 12 78 56

- Scale Vector: Not Necessary
- Data Count: This is used to set up a count of read/write slaves data.

Command(Function)	Data Size
1 - Read Coil Status 2 - Read Input Status	Bit Size
3 – Read Holding Registers 4 – Read Input Registers	Word Size
5 – Force Single Coil	Not Necessary.(1Bit Write)
6 – Preset Single Registers	Not Necessary.(2Byte Write)
16 - Preset Multiple Registers	Word Size

- device: This is used to select a device address of send/receive data stored.

Function	device	Substance
Read Function	D0000	Address stored receive data between slaves
Write Function	D0010	Address stored send data between slaves

- Do not transmit Automatically : This is used to communicate the block configured MODBUS

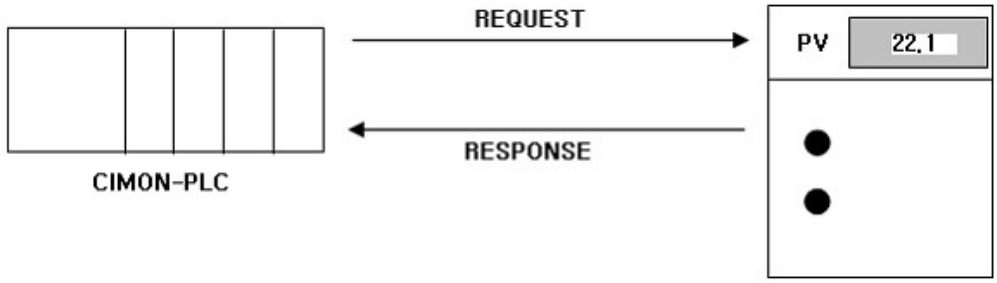
RTU Master

program sequencely(0~15). When you don't use this function, check the blank. It is possible to receive data if only

SEND command when check the blank,

Example of MODBUS RTU Master Special Programming Communication

Following picture shows slaves, communication system and frame structure which supported CIMON-PLC and MODBUS RTU Protocol.



[Information of slave]

Parameter of slave	Substance
Comm. Protocol	MODBUS RTU protocol(Slave)
Comm. Type	RS232C
Station	1
Baud Rate	9600bps
Parity	None
Data bit	8
Stop bit	1

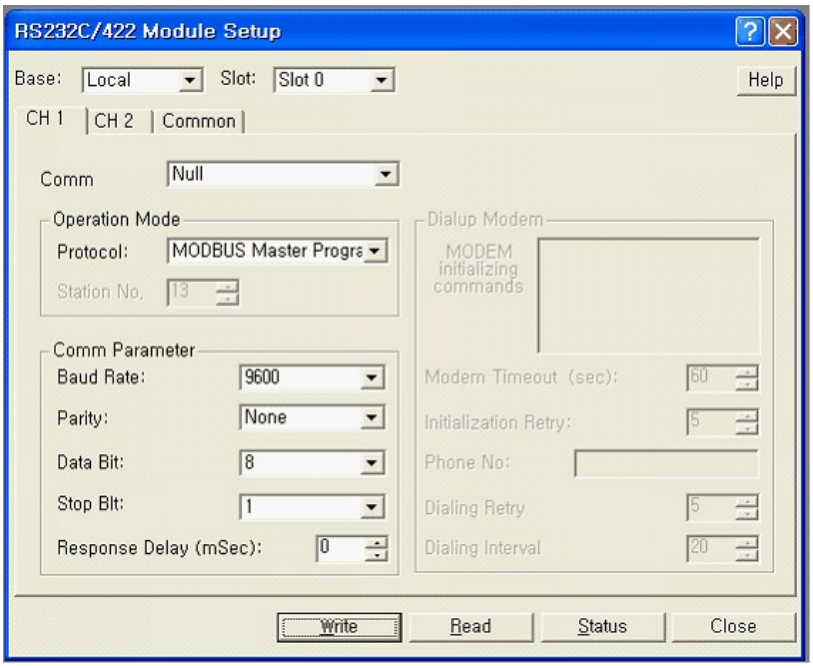
[Address table of slave]

Address	Substance	PLC device address
00001	PV(present)	D00000

00002	SV(set value)	D00010
…	…	…

4-1. EXAMPLE OF REGISTE

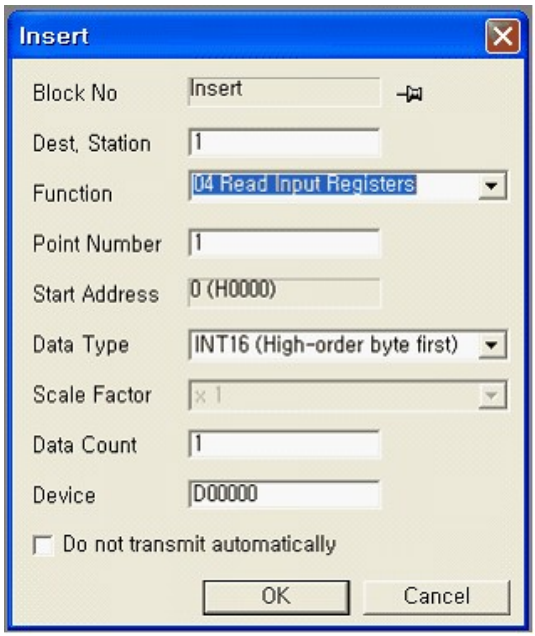
1. Register " special module setup ". Please refer to " Communication Setup "



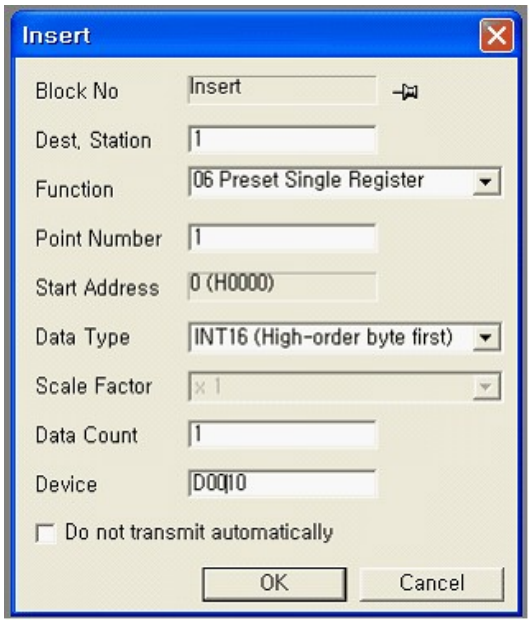
2. Register " a communication parameter of slave" . Please compare to " special module setup " whether it's the same or not.

3. Register " MODBUS RTU MASTER special program "

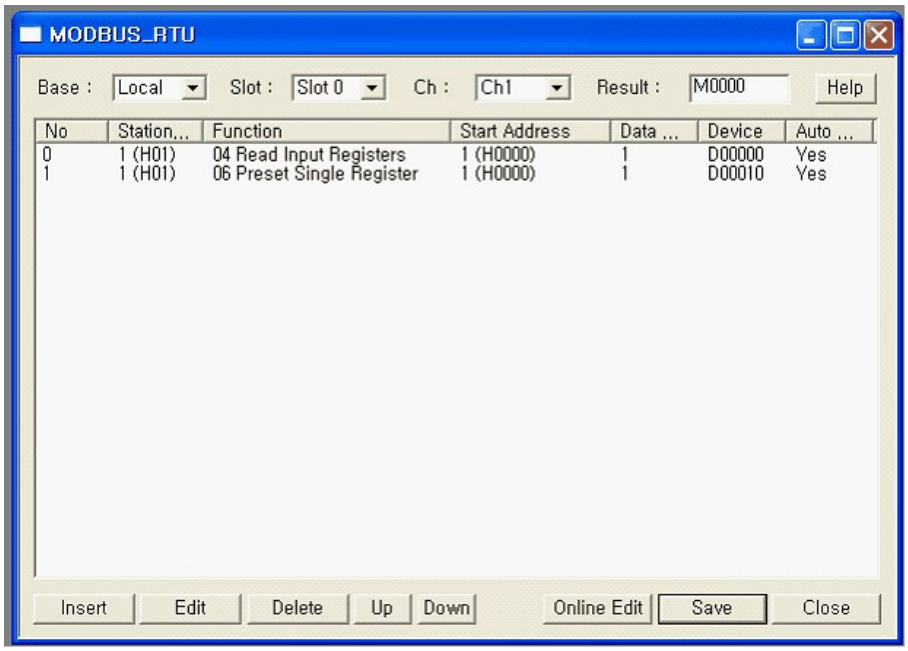
   a. Register a communication block for receiving PV value



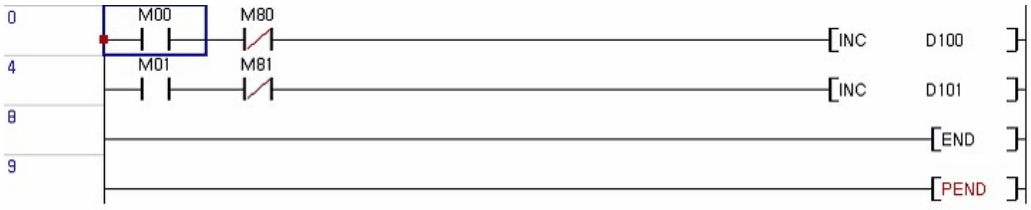
b. Register a communication block for sending SV value



c. Complete to register two communication blocks ,‘a’ and ‘b’



4. Download PLC program. After downloading, please change the mode to " RUN "
5. Program PLC scan program for debugging.
   a. In case of succeed in receiving PV value, Increase a data in D00100..
   b. In case of succeed in sending SV value, Increase a data in D00101.



6.2.7 Installing and Testing

Installing and Testing :

- Order of Installation
- Safety Precautions

- Testing

6.2.7.1 Order of Installation

1. Prepare the components for system configuration.

2. Mount a communication module in the state that the power for a PLC is not supplied.

3. Make sure there are dust and remains in the connecter of the base where the communication module will be mounted and whether the connecter pins of the communication module are broken.

4. The maximum number of modules mounted on one base is 8.
   When you mount this module, insert the connecting part on the bottom of the module to the slot of a base exactly in the state that the communication cable is not connected and press the power sufficient to lock the module to the base completely. Otherwise, an error in the interface with CPU may occur.

5. Tighten the screws at both ends of the RS232C cable to secure connection.

6. Input the power after connecting the communication cable. Make sure whether the module is operated normally, observing the operation of the LED. In case of normal operation, select the menu to set up various parameters for the communication module and to download the program to run.

6.2.7.2 Safety Precautions

1. Select communication method correctly.

2. Select the action mode of a computer link module correctly and click it to set up. If the action mode is set up wrongly, the communication may be disabled.

3. If the station number is duplicated in the state that the action mode is set up as the exclusive communication mode, there will be an error in communication.

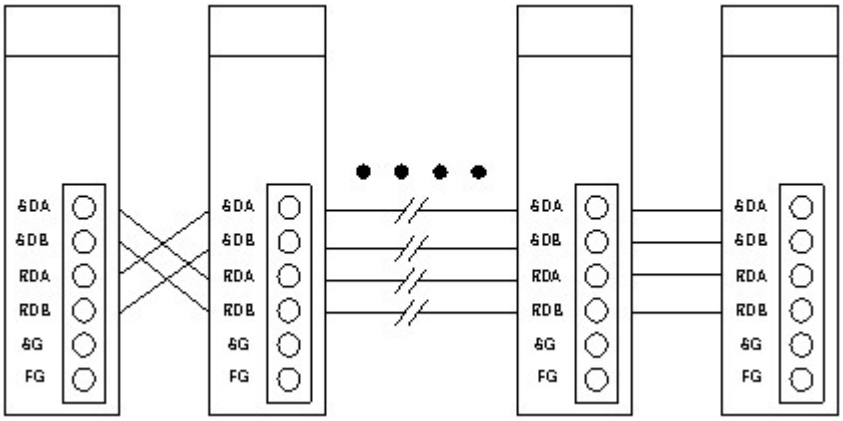
4. Use the cable of the assigned standard as the communication cable.

5. Check where the communication cable is broken.

6. Tighten the screws to fix the communication cable connecter.

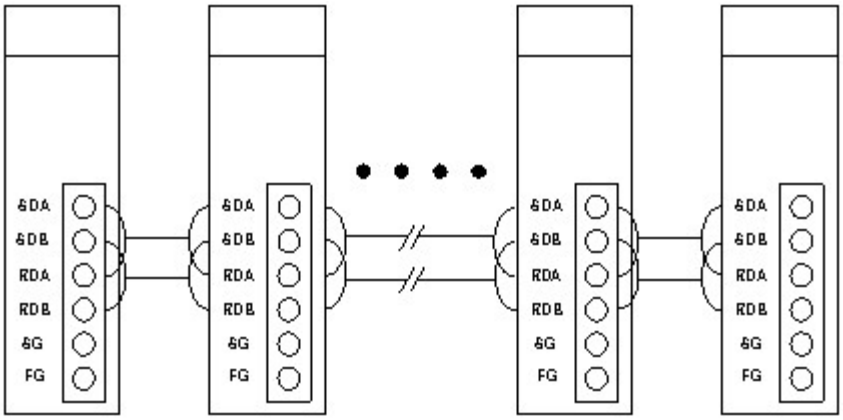
7. Connect the cable of Channel 2(RS422/RS485) correctly.

- **Installation of RS422 Cable :**
  Connect TX with RX between the first two stations. Connect TX with TX and RX with RX, between other stations.



- **Installation of RS485 Cable :**

  Connect SDA with SDB and RDA with RDB each other in 2-wire type connection.



6.2.7.3 Testing

Check Points before Testing ,

Check Point	Description
Mount of This Module	Is it all right the mounted state of this communication module on the base?
Mount of Standard Modules	Does the power used for the power module comply with its specifications? Is it all right the mounted state of the standard modules? Does a battery connect with the CPU module?
Connection of Comm. Cable	Is it all right the connected state of the communication cable?

Testing ,

Start

Supplying the Power :

1) Make sure the input power.
2) Make sure the connection of the communication cable.
3) Supply the power.
4) Make sure whether the power LED lamp of the power module is on.
5) Make sure the state of the LED in the CPU module
6) Make sure whether the state of the LED is operated normally.

Select the menu in the CICON to set up the communication parameters of RS232/422 and to download them to the communication module.

Write user program in the CICON and select the menu to download it to the CPU.

Make sure whether the communication module is operated according to the program.

Finish

6.2.8 Trouble Shooting

Trouble Shooting :

- Error Codes
- Error in Hardware
- Error in Exclusive Communications
- Error in Modem Link when Linking CICON

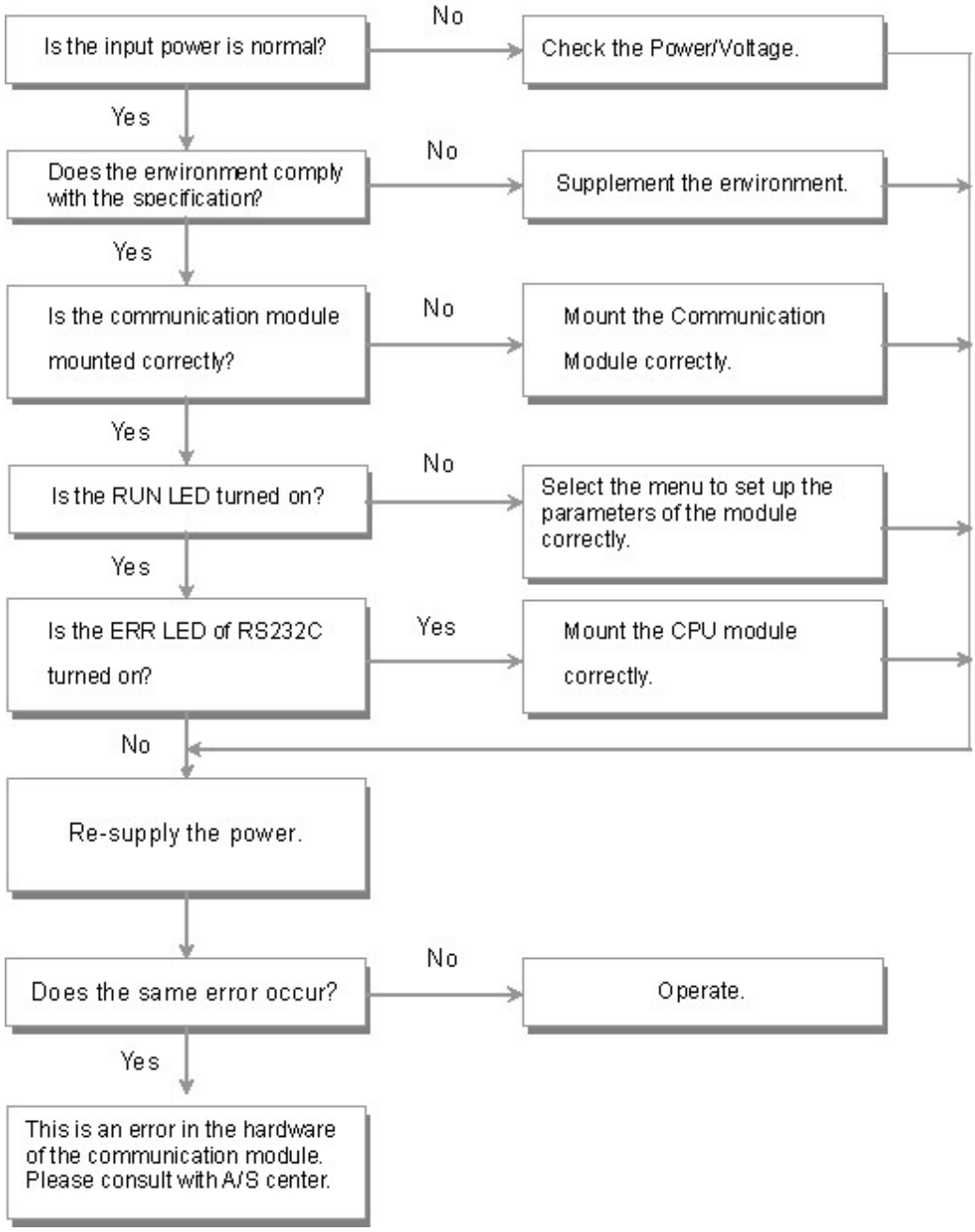
6.2.8.1 Error Codes

Error Code Hexa(Deci)	Description	Remarks

0x0000 (0)	No error	
0x0001 (1)	A module is not initialized.	
0x0005 (5)	A CPU module does not respond.	
0x0006 (6)	Not able to access buffer memory.	
0x0007 (7)	A CPU module is dismounted from a base plate.	
0x0009 (9)	CTS signal does not come from modem.	
0x000A (10)	A modem is not initialized.	
0x000D (13)	Station number for PLC Link is duplicated.	
0x0010 (16)	Link between modems is failed.	
0x0012 (18)	SND command is duplicated.	
0x0013 (19)	RCV command is duplicated.	
0x0014 (20)	Invalid serial port is used.	
0x0016 (22)	Unregistered frame for sending/receiving	
0x0017	A segment is not registered to a frame.	
0x0018	The registration of Sending/receiving frame is wrong.	
0x001D	Sending/receiving size is over the maximum.	

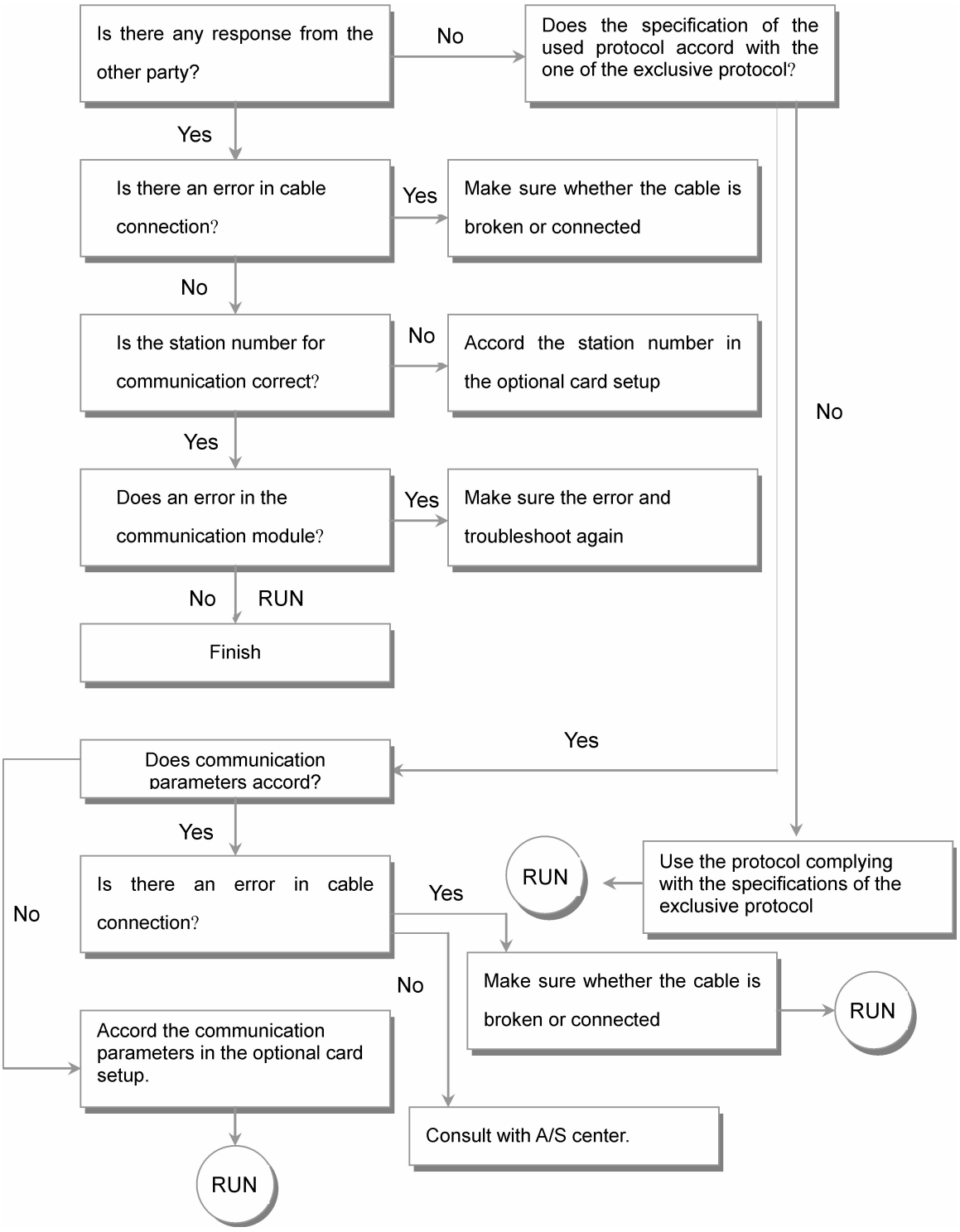
6.2.8.2 Error in Hardware

This corresponds to Error Code 1, 2, 3, 6 and 7.



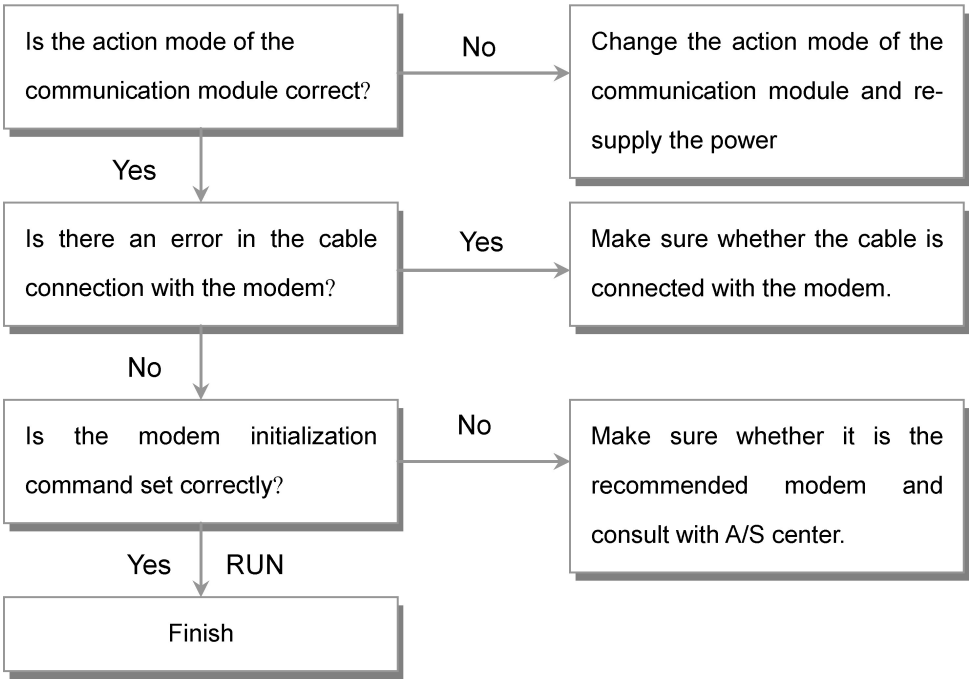
6.2.8.3 Error in Exclusive Communications

This corresponds Error Code 5.



6.2.8.4 Error in Modem Link when Linking CICON

This corresponds Error Code 4, 9 and10.



6.2.9 Appendix

Appendix :

- Definitions
- ASCII Code Table

6.2.9.1 Definitions

Communication Method

Simplex	This communication method is that the flow of information is always constant in one direction. Information cannot be transferred in reverse direction.
Half Duplex	As one-wire cable is used, this communication method is that information can be transferred in both directions not at the same time, but at regular intervals.

Full Duplex As two-wire cable is used, this communication method is that data can be sent and received at the same time.

Sending Method

According to rate, safety and economical efficiency when data are sent, sending method is classified into series sending and parallel sending. Advantage, disadvantage and features for each method are described as follows.

Series sending This method is to send data bit by bit through one cable. Though baud rate is slow, installation cost is cheap and software is simple.

Parallel sending This method is used for a video card or a hard disc in a computer and is to transfer data by one byte (8 bits). Though baud rate is fast and data is transferred exactly, there is disadvantage that the longer sending distance is, the higher installation cost is.

Protocol This is the communication rule prescribed in advance between a sending party and a receiving party to send and receive efficient and confident information without error among more than two (2) computers and terminal units.

Asynchronous method This method is to send word by word in synchronism in case of series sending. Start bit is sent in front of one character and the character code is sent. Finally, Stop bit is sent.

Node This is the location where the data in the tree structure of a network is. Each node is composed of the device storing data and the pointer device for sub-node.

BPS and CPS

- BPS : Bits Per Second
- CPS : Characters Per Second

BPS means the number of sending bits in a second. CPS, the abbreviation for characters per second, is the unit of printer speed and means the number of the characters printed by a printer in a second.

Packet This is a bundle of the data used when sending data. The data communicated between two stations is divided into suitable-size Packets and the packets are sent one by one. Packet includes the information about control such as receiving party, address or control code as well as a certain-size data.

Port This is the part of the computer used to communicate with other devices. In case of computer link communication, this means RS-232C port or RS-422(485) port.

RS232C This, one of the communication interface codes established by Electronics Industry Association (EIA), is mainly used to link with diverse devices such as computer, terminal unit, printer, floater and modem. And this is a synchronous series communication interface or an asynchronous series communication interface. There is the disadvantage that sending distance is short and only one to one communication is available, but cost is cheap.

RS422 / RS485 This, one of series communication interfaces such as RS-232C, is used in longer sending distance than the one of RS-232C and one to N access is available. RS-422(1:N) is used for Full Duplex communication with 4 signal lines and RS-485(N:M) is used for Half Duplex communication with 2 signal lines.

BCC Block Check Character
As series sending may send distorted signal due to the influence of noise to sending line, this is the data that is for a receiving party to decide whether signal is normal or distorted. A receiving party calculates the data received up to the front of BCC and compares the result with received BCC to decide whether signal is normal or not.

FRAME This, the constant-size data sent in data communication, includes additional information such as destination code, control character for synchronism, parity or CRC to detect an error as well as data.

6.2.9.2 CIMON-PLC/HMI Protocal

CIMON-PLC / HMI Protocal Manual.

See :

Structure of Frame / Exclusive Communication / Error Response

6.2.9.2.1 Structure of Frame

Request Frame (Master) : The frame that an outside communication device requests to a computer link module

ENQ	Stn H	Stn L	Cmd	Leng H	Leng L	Data	BCC H	BCC L	EOT

Response Frame (Slave) : The frame that a computer link module responds to an outside communication device

STX	Stn H	Stn L	Cmd	Leng H	Leng L	Data	BCC H	BCC L	ETX

1) The structure of a sending frame and the one of a receiving frame are same.

2) The same as the command codes received from a request frame (Master) are used for response frame.
But, if there is an error in communication or process, Code E is responded.

Description for Codes

Code	Hex Value	Description
ENQ	05H	Master Frame Header
EOT	04H	Master Frame Tail
STX	02H	Slave Header
ETX	03H	Slave Tail
Stn	00H~1FH, FFH	PLC Station Number
Cmd		Command
Leng		Length of Data Device (Length Bytes), Hexadecimal
Data		Data Device according to Command (Length Bytes)
BCC		Remainder value when dividing the binary-sum from Cmd to the end of data by 256

Commands : The commands used for exclusive communication service are as follows

Command	Code	ASCII	Function
Read Word Data	52H	R	Reads Word Memory Device.
Write Word Data	57H	W	Writes to Word Memory Device.
Read Bit Data	72H	r	Reads Bit Memory Device.
Write Bit Data	77H	w	Writes to Bit Memory Device.
Mode Change	4DH	M	Changes PLC Mode.
Register Monitoring Device	58H	X	Registers Monitoring Device.
Monitor Read	59H	Y	Reads Registered Monitoring Device
Error Response	45H	E	Responds Error in PLC.

6.2.9.2.2 Exclusive Communications

IN THIS TOPIC :

READ WORD DATA

Function

- This is used to read the data in the word device of a PLC. (Max. 63 words)
- Device Symbol : X, Y, M, L, K, F, Z, TC, TS, CC, CS, D, S

Request Frame (Master)

- COMMAND : 'R'
- Data Device Format

Address 8 Char	Size (Word) Hexadecimal, 2 Char	.....	Address 8 Char	Size (Word) Hexadecimal, 2 Char

Master(Request Format)

HEADER	Stn H	Stn L	Cmd	Leng H	Leng L	Data	BCC H	BCC L	EOT
ENQ	02		R	0A		D0000001 01	B9		EOT
05H	30H	32H	52H	30H	41H	4430303030303031 3031H	42H	39H	04H

Leng is the length of a data and its value means the length of a data (D0000001 01).
Data means the address really read (D0000001) and the length of the word data read (01).
BCC is the remainder value when dividing the binary-sum from Cmd to the end of data by 256

Response Frame (Slave)

- COMMAND (In completed case: 'R' / In failed case: 'E')
- Format of Data Device

[Completed Case]

PLC DATA

Word Data 4 Char	Word Data 4 Char	.....	Word Data 4 Char

Slave(Response Format)

HEADER	Stn H	Stn L	Cmd	Leng H	Leng L	Data	BCC H	BCC L	ETX
STX	02		R	04		F4AC	B4		ETX
02H	30H	32H	52H	30H	34H	46344143H	42H	34H	03H

The request frame received from a master is used as the response frame of a PLC.
BCC is the remainder value when dividing binary-sum from Cmd to the end of data by 256.
As the response frame is processed, Cmd is 'R'..
Leng means the length of a data (F4AC).

[Failed Case]

Error Code

Error Code 2 Char

Slave(Response Format)

HEADER	Stn H	Stn L	Cmd	Leng H	Leng L	Error Code	BCC H	BCC L	ETX
STX	02		E	02		02	09		ETX
02H	30H	32H	45H	30H	32H	3032H	30H	39H	03H

The request frame received from a master is used as the response frame of a PLC.
BCC is the remainder value when dividing the binary-sum from Cmd to the end of data by 256.
As the response frame is not processed, Cmd is 'E'.
Leng means the length of error code(02).

Error code displays the type of an error. Please refer to the 'ERROR RESPONSE'.

Ex.) Read data from Address D00040 of Station 02H.
Master(Request Format)

HEADER	Stn H	Stn L	Cmd	Leng H	Leng L	Data	BCC H	BCC L	EOT
ENQ	02		R	0A		D0000040 01	BC		EOT
05H	30H	32H	52H	30H	41H	4430303030303430 3031H	42H	43H	04H

Completed Case> reads 1-word data 'F4AC'
Slave(Response Format)

HEADER	Stn H	Stn L	Cmd	Leng H	Leng L	Data	BCC H	BCC L	ETX

STX	02		R	04		F4AC	B4		ETX
02H	30H	32H	52H	30H	34H	46344143H	42H	34H	03H

Failed Case> Error in BCC
Slave(Response Format)

HEADER	Stn H	Stn L	Cmd	Leng H	Leng L	Error Code	BCC H	BCC L	ETX
STX	02		E	02		02	09		ETX
02H	30H	32H	45H	30H	32H	3032H	30H	39H	03H

Write WORD DATA ?

Function

- This is used to write a data to the word device of a PLC.
- Device Symbol : X, Y, M, L, K, F, Z, TC, TS, CC, CS, D, S

Request Frame

- COMMAND : 'W'
- Format of Data Device

Address 8 Char	Size (Word) Hexadecimal, 2 Char	Word Data Hexadecimal, Size*4 Char	.....	Address 8 Char	Size (Word) Hexadecimal, 2 Char	Word Data Hexadecimal, Size*4 Char

Master(Request Format)

HEADER	Stn H	Stn L	Cmd	Leng H	Leng L	Data	BCC H	BCC L	EOT
ENQ	02		W	0E		D0000010 01 FA34	B0		EOT
05H	30H	32H	57H	30H	45H	4430303030303130 3031 46413334H	42H	30H	04H

Leng is the length of a data and its value means the length of the Data (D0000010 01 FA34).
The address really written (D0000010), the length of the data (01) and the data written (FA34) are input in the Data (D1000 02 FA34).
BCC is the remainder value (F3) when dividing the binary-sum from Cmd to the end of data by 256.

Response Frame

- COMMAND (In completed case: 'W' / In failed case : 'E')
- Format of Data Device

[Completed Case]

No Data?

Slave(Response Format)

HEADER	Stn H	Stn L	Cmd	Leng H	Leng L	BCC H	BCC L	ETX
STX	02		W	00		B7		ETX
02H	30H	32H	57H	30H	30H	42H	37H	03H

The request frame received from a master is used as the response frame of a PLC.
BCC is the remainder value when dividing the binary-sum from Cmd to the end of data by 256.
As the response frame is processed, Cmd is 'W'.
Leng means the length of a data.

[Failed Case]

ERROR CODE

Error Code 2 Char

Slave(Response Format)

HEADER	Stn H	Stn L	Cmd	Leng H	Leng L	Error Code	BCC H	BCC L	ETX
STX	02		E	02		01	08		ETX
02H	30H	32H	45H	30H	32H	3031H	30H	38H	03H

The request frame received from a master is used as the response frame of a PLC.

BCC is the remainder value when dividing the binary-sum from Cmd to the end of data by 256.

As the response frame is not processed, Cmd is 'E'.

Leng(02) means the length of Error Code(01).

Error code displays the type of an error. Please refer to the 'ERROR RESPONSE'.

Ex.) Write FA34H to Address D0010 and 8D41H to Address D0020.
Master(Request Format)

HEADER	Stn H	Stn L	Cmd	Leng H	Leng L	Data	BCC H	BCC L	EOT
ENQ	02		W	12		D0000010 02 FA34 8D41	80		EOT
05H	30H	32H	57H	31H	32H	4430303030303130 3032 46413334 38443431H	38H	30H	04H

Completed Case > No Data?

Slave(Response Format)

HEADER	Stn H	Stn L	Cmd	Leng H	Leng L	BCC H	BCC L	ETX
STX	02		W	0		B7		ETX

02H	30H	32H	57H	30H	30H	42H	37H	03H

Failed Case>Receiving unknown command code (01H).
Slave(Response Format)

HEADER	Stn H	Stn L	Cmd	Leng H	Leng L	Error Code	BCC H	BCC L	ETX
STX	02		E	02		01	08		ETX
02H	30H	32H	45H	30H	32H	3031H	30H	38H	03H

Read BIT DATA

Function

- This is used to read the data in the bit device of a PLC.
- Device Symbol : X, Y, M, L, K, F, Z, T, C

Request Frame

- COMMAND : 'r'
- Format of Data Device

Address 8 Char	Size (Bit) Hexadecimal, 2 Char	.....	Address 8 Char	Size (Bit) Hexadecimal, 2 Char

Master(Requset Format)

HEADER	Stn H	Stn L	Cmd	Leng H	Leng L	Data	BCC H	BCC L	EOT
ENQ	03		r	0A		M000010F 02	F9		EOT
05H	30H	33H	72H	30H	41H	4D303030313030 46 3032H	46H	39H	04H

• Leng is the length of a data and its value means the length of Data (M000010F 02H).
• The address really read(M000010F) and the length of the data(02) are input in the Data.
• BCC is the remainder value when dividing the binary-sum from Cmd to the end of data by 256.

Response Frame

- COMMAND (In completed case: 'r' / In failed case: 'E')
- Format of Data Device

[Completed Case]

PLC Data

Bit Data	Bit Data	.....	Bit Data

1 Char	1 Char		1 Char

Slave(Response Format)

HEADER	Stn H	Stn L	Cmd	Leng H	Leng L	Data	BCC H	BCC L	ETX
STX	01		r	02		0 1	35		ETX
02H	30H	31H	72H	30H	32H	30 31H	33H	35H	03H

Ÿ The request frame received from a master is used as the response frame of a PLC.
Ÿ BCC is the remainder value when dividing the binary-sum from Cmd to the end of data by 256.
Ÿ As the response frame is processed, Cmd is 'r'.
Ÿ Leng(02) means the length of the Data(0 1).

[Failed Case]

Error Code

Error Code 2 Char

Slave(Response Format)

HEADER	Stn H	Stn L	Cmd	Leng H	Leng L	Error Code	BCC H	BCC L	ETX
STX	03		E	02		01	08		ETX
02H	30H	33H	45H	30H	32H	3031H	30H	38H	03H

ŸThe request frame received from a master is used as the response frame of a PLC.

ŸBCC is the remainder value when dividing the binary-sum from Cmd to the end of data by 256.

ŸAs the response frame is not processed, Cmd is 'E'.

ŸLeng(02) means the length of Error Code(01).

ŸError code indicates the type of an error. Please refer to the 'ERROR RESPONSE'.

Ex.) Read the bit data in Address M0104 and Address M0105 of Station 03 PLC.
Master(Request Format)

HEADER	Stn H	Stn L	Cmd	Leng H	Leng L	Data	BCC H	BCC L	EOT
ENQ	03		r	0A		M0000104 02	E7		EOT
05H	30H	33H	72H	30H	41H	4D3030303031 3034 3032H	45H	37H	04H

Completed Case > Reads Data '0 1'.
Slave(Response Format)

HEADER	Stn H	Stn L	Cmd	Leng H	Leng L	Data	BCC H	BCC L	ETX
STX	03		r	02		0 1	35		ETX
02H	30H	33H	72H	30H	32H	30 31H	33H	35H	03H

Failed Case > Error in BCC
Slave (Response Format)

HEADER	Stn H	Stn L	Cmd	Leng H	Leng L	Error Code	BCC H	BCC L	ETX
STX	03		E	02		02	09		ETX
02H	30H	33H	45H	30H	32H	3032H	30H	39H	03H

Write BIT DATA

Function

- This is used to write data to the bit device of a PLC
- Device Symbol : X, Y, M, L, K, F, Z, T, C

Request Frame

- COMMAND : 'w'
- Format of Data Device
-

Address 8 Char	Size (Bit) Hexadecimal, 2 Char	Bit Data Size*1 Char	…	Address 8 Char	Size (Bit) Hexadecimal, 2 Char	Bit Data Size*1 Char

Master(Request Format)

HEADER	Stn H	Stn L	Cmd	Leng H	Leng L	Data	BCC H	BCC L	EOT
ENQ	03		w	0D		M0000101 03 110	7F		EOT
05H	30H	33H	77H	30H	44H	4D303030303130 31 3033 313130H	37H	46H	04H

• Leng(0B) is the length of data and its value means the length of Data (M0000101 03 110).
• The address really written(M0000101), the length of the data(03) and the data written(110) are input in the Data.
• BCC is the remainder value when dividing the binary-sum from Cmd to the end of data by 256.

Response Frame

- COMMAND (In completed case: 'w' / In failed case: 'E')
- Format of Data Device

[Completed Case]

No Data

Slave(Response Format)

HEADER	Stn H	Stn L	Cmd	Leng H	Leng L	BCC H	BCC L	ETX
STX	03		w	00		D7		ETX
02H	30H	33H	77H	30H	30H	44H	37H	03H

ŸThe request frame received from a master is used as the response frame of a PLC.
ŸBCC is the remainder value when dividing the binary-sum from Cmd to the end of data by 256.
ŸAs the response frame is processed, Cmd is 'w'.
ŸLeng(00) means the length of the data.

[Failed Case]

Error Code

Error Code 2 Char

Slave(Response Format)

HEADER	Stn H	Stn L	Cmd	Leng H	Leng L	Error Code	BCC H	BCC L	ETX
STX	02		E	02		04	0B		ETX
02H	30H	32H	45H	30H	32H	3034H	30H	42H	03H

- The request frame received from a master is used as the response frame of a PLC.
- BCC is the remainder value when dividing the binary-sum from Cmd to the end of data by 256.
- As the response frame is not processed, Cmd is 'E'.
- Leng(02) means the length of Error Code (04).
- Error code indicates the type of an error. Please refer to the 'ERROR RESPONSE'.

Ex.) Write bit data to Bit Address M0104.

Master(Request Format)

HEADER	Stn H	Stn L	Cmd	Leng H	Leng L	Data	BCC H	BCC L	EOT
ENQ	01		w	0D		M0000104 03 110	82		EOT
05H	30H	31H	77H	30H	44H	4D303030303130 34 3033 313130H	38H	32H	04H

< Completed Case >

Slave(Response Format)

HEADER	Stn H	Stn L	Cmd	Leng H	Leng L	BCC H	BCC L	ETX
STX	01		w	00		D7		ETX

02H	30H	31H	77H	30H	30H	44H	37H	03H

Failed Case > Data Size Overflow

Slave(Response Format)

HEADER	Stn H	Stn L	Cmd	Leng H	Leng L	Error Code	BCC H	BCC L	ETX
STX	01		E	02		04	0B		ETX
02H	30H	31H	45H	30H	32H	3034H	30H	42H	03H

Change PLC Mode

Function

- This is used to change the operation mode of a PLC. .

Request Frame

- COMMAND : 'M'
- Format of Data Device

Mode Code

Mode	Code
Run	0
Program	1
Pause / Remote	2

Master(Request Format)

HEADER	Stn H	Stn L	Cmd	Leng H	Leng L	Data	BCC H	BCC L	EOT
ENQ	01		M	01		0	DE		EOT
05H	30H	31H	4DH	30H	31H	30H	44H	45H	04H

• Leng(01) is the length of data.

• Mode code value(0) is input in the Data(0).

? • BCC is the remainder value when dividing the binary-sum from Cmd to the end of data by 256.

• Only the case CPU is under REMOTE status is available.

Response Frame

- COMMAND (In completed case: 'M' / In failed case: 'E')
- Format of Data DEvice

[Completed Case] No Date?

Slave(Response Format)

HEADER	Stn H	Stn L	Cmd	Leng H	Leng L	BCC H	BCC L	ETX
STX	01		M	00		AD		ETX
02H	30H	31H	4DH	30H	30H	41H	44H	03H

- The request frame received from a master is used as the response frame of a PLC.
- BCC is the remainder value when dividing the binary-sum from Cmd to the end of data by 256.
- As the response frame is processed, Cmd is 'M'.
- Leng(00) means the length of the data.

[Failed Case]

Error Code

Error Code 2 Char

Slave(Response Format)

HEADER	Stn H	Stn L	Cmd	Leng H	Leng L	Error Code	BCC H	BCC L	ETX
STX	02		E	02		03	0A		ETX
02H	30H	32H	45H	30H	32H	3033H	30H	41H	03H

ŸThe request frame received from a master is used as the response frame of a PLC.
ŸBCC is the remainder value when dividing the binary-sum from Cmd to the end of data by 256.
ŸAs the response frame is not processed, Cmd is 'E'.
ŸLeng(02) means the length of Error Code (03).
ŸError code indicates the type of an error. Please refer to the 'ERROR RESPONSE'.

Ex.) Change the operation mode of a PLC to PAUSE/REMOTE mode.

Master(Requset Format)

HEADER	Stn H	Stn L	Cmd	Leng H	Leng L	Data	BCC H	BCC L	EOT
ENQ	01		M	01		2	E0		EOT
05H	30H	31H	4DH	30H	31H	32H	45H	30H	04H

Completed Case

Slave(Response Format)

HEADER	Stn	Stn	Cmd	Leng	Leng	BCC	BCC	ETX

	H	L		H	L	H	L	
STX	01		M	00		AD		ETX
02H	30H	31H	4DH	30H	30H	41H	44H	03H

< Failed CAse > Invalid mode

Slave(Response Format)

HEADER	Stn H	Stn L	Cmd	Leng H	Leng L	Error Code	BCC H	BCC L	ETX
STX	01		E	02		03	0A		ETX
02H	30H	31H	45H	30H	32H	3033H	30H	41H	03H

Register Monitoring Device

Function

- This is used to register a monitoring device.
- 16 devices can be registered as maximum. (Distinguishing by Frame No., 0h – Fh)
- Individual device should be continuous and is limited to 63 words as maximum.

Request Frame

- COMMAND : 'X'
- Format of Data Device
-

Frame No. 1 Char	Word Address 8 Char	Word Size 16진 2 Char

Master(Request Format)

HEADER	Stn H	Stn L	Cmd	Leng H	Leng L	Data			BCC H	BCC L	EOT
ENQ	01		X	0B		0	D0000001	02	C0		EOT
05H	30H	31H	58H	30H	42H	30H	4430303030303031H	3032H	43H	30H	04H

• Leng(0B) is the length of a data.

• The Mode code(0), the Address(D0000001) and the Size(02) are input in the Data (0 D00001 02).

• BCC is the remainder value when dividing the binary-sum from Cmd to the end of data by 256.

Response Frame

- COMMAND (In completed case: 'X' / In failed case: 'E')

- Format of Data Device

[Completed Case]

No Data

Slave(Response Format)

HEADER	Stn H	Stn L	Cmd	Leng H	Leng L	BCC H	BCC L	ETX
STX	01		X	00		B8		ETX
02H	30H	31H	58H	30H	30H	42H	38H	03H

• The request frame received from a master is used as the response frame of a PLC.

• BCC is the remainder value when dividing the binary-sum from Cmd to the end of data by 256.

• As the response frame is processed, Cmd is 'X'.

• Leng(00) means the length of the data.

[Failed Case]

Error Code

Error Code 2 Char

Slave(Response Format)

HEADER	Stn H	Stn L	Cmd	Leng H	Leng L	Error Code	BCC H	BCC L	ETX
STX	01		E	02		07	0E		ETX
02H	30H	31H	45H	30H	32H	3037H	30H	45H	03H

The request frame received from a master is used as the response frame of a PLC.
BCC is the remainder value when dividing the binary-sum from Cmd to the end of data by 256.
As the response frame is not processed, Cmd is 'E'.
Leng(02) means the number of Error Codes (07).
Error code indicates the type of an error. Please refer to the 'ERROR RESPONSE'.

Ex.) Register Frame 1 and Addresses from D0011 to D0014 to Station 1.

Master(Response Format)

HEADER	Stn H	Stn L	Cmd	Leng H	Leng L	Data	BCC H	BCC L	EOT
ENQ	01		X	0B		1 D0000011 04	C5		EOT
05H	30H	31H	58H	30H	42H	31 443030303030 3131 3034H	43H	35H	04H

< Completed Case >

Slave(Response Format)

HEADER	Stn H	Stn L	Cmd	Leng H	Leng L	BCC H	BCC L	ETX
STX	01		X	00		B8		ETX
02H	30H	31H	58H	30H	30H	42H	38H	03H

Failed CAse > Invalid Monitor Frame No.(0h~Fh)

Slave(Response Format)

HEADER	Stn H	Stn L	Cmd	Leng H	Leng L	Error Code	BCC H	BCC L	ETX
STX	01		E	02		07	0E		ETX
02H	30H	31H	45H	30H	32H	3037H	30H	45H	03H

Read Monitoring Device

Function

- This is used to read the registered monitoring device..

Request Frame

- COMMAND : 'Y'
- Format of Data Device

Frame No. 1 Char

Master(Request Format)

HEADER	Stn H	Stn L	Cmd	Leng H	Leng L	Data	BCC H	BCC L	EOT
ENQ	01		Y	01		0	EA		EOT
05H	30H	31H	59H	30H	31H	30H	45H	41H	04H

Leng(01) is the length of a data.
Frame No. is input in the Data(0).
BCC is the remainder value when dividing the binary-sum from Cmd to the end of data by 256.

Request Frame

- COMMAND (In completed case: 'Y' / In failed case: 'E')
- Format of Data Device

[Completed Case]

Frame No.	Word Data 4 Char	.....	Word Data 4 Char

Slave(Response Format)

HEADER	Stn H	Stn L	Cmd	Leng H	Leng L	Data	BCC H	BCC L	EOT
ENQ	01		Y	05		0 87F3	D6		EOT
05H	30H	31H	59H	30H	35H	30 38374633H	44H	36H	04H

- The request frame received from a master is used as the response frame of a PLC.
- BCC is the remainder value when dividing the binary-sum from Cmd to the end of data by 256.
- As the response frame is processed, Cmd is 'Y'.
- Leng(05) means the length of the Data(0 87F3).

[Failed Case]

Error Code

Error Code 2 Char

Slave(Response Format)

HEADER	Stn H	Stn L	Cmd	Leng H	Leng L	Error Code	BCC H	BCC L	ETX
STX	01		E	02		08	0F		ETX
02H	30H	31H	45H	30H	32H	3038H	30H	46H	03H

ŸThe request frame received from a master is used as the response frame of a PLC.

ŸBCC is the remainder value when dividing the binary-sum from Cmd to the end of data by 256.

ŸAs the response frame is not processed, Cmd is 'E'.

ŸLeng(02) means the length of Error Code(08H).

ŸError code indicates the type of an error. Please refer to the 'ERROR RESPONSE'.

Ex.) If Frame 2h, Address D1005 and Address D1006 are registered as a monitoring device, read the registered device.

Master(Request Format)

HEADER	Stn H	Stn L	Cmd	Leng H	Leng L	Data	BCC H	BCC L	EOT
ENQ	01		Y	01		2	EC		EOT
05H	30H	31H	59H	30H	31H	32H	45H	43H	04H

< Completed Case >

Slave(Response Format)

HEADER	Stn H	Stn L	Cmd	Leng H	Leng L	Data	BCC H	BCC L	ETX
STX	01		Y	09		2 87F3 32E7	BD		ETX
02H	30H	31H	59H	30H	39H	32 38374633 33324537H	42H	44H	03H

< Failed Case > Number of the unregistered(Not initialized) frame
Slave(Response Format)

HEADER	Stn H	Stn L	Cmd	Leng H	Leng L	Error Code	BCC H	BCC L	ETX
STX	01		E	02		08	0F		ETX
02H	30H	32H	45H	30H	32H	3038H	30H	46H	03H

6.2.9.2.3 Error Response

Function

- This is the function to inform a master of error occurring in the process of a communication frame or a request frame and is
  used in a response frame only.

Request Frame

- All request frames

Response Frame

- COMMAND : 'E'
- Format of Data Device
- Error Code

Error Code
2 Char

Error Code	Description
00	No error.
01	Receives unknown command code.
02	An error occurs in BCC.
03	CPU does not respond.
04	Receives unknown device code.
05	Exceeds the device read.
06	Invalid address.
07	Internal error
08	Receives the number of invalid data
09	Invalid data
10	Unregistered (Not initialized) frame number

11	Invalid Monitor Frame No. (0h – Fh) Invalid frame number
12	CPU is not in REMOTE status.
13	Invalid CPU status is assigned.
14	An error occurs in the size of the data written.
15	It is disabled to write.
16	It is disabled to change mode.

6.2.9.3 ASCII Code Table

BIN	Hex	Symbol	BIN	Hex	Symbol	BIN	Hex	Symbol	BIN	Hex	Symbol
0	0	NUL	**32**	20	(space)	**64**	40	@	**96**	60	`
1	1	SOH	**33**	21	!	**65**	41	A	**97**	61	a
2	2	STX	**34**	22	"	**66**	42	B	**98**	62	b
3	3	ETX	**35**	23	#	**67**	43	C	**99**	63	c
4	4	EOT	**36**	24	$	**68**	44	D	**100**	64	d
5	5	ENQ	**37**	25	%	**69**	45	E	**101**	65	e
6	6	ACK	**38**	26	&	**70**	46	F	**102**	66	f
7	7	BEL	**39**	27	'	**71**	47	G	**103**	67	g
8	8	BS	**40**	28	(	**72**	48	H	**104**	68	h
9	9	TAB	**41**	29	)	**73**	49	I	**105**	69	i
10	A	LF	**42**	2A	*	**74**	4A	J	**106**	6A	j
11	B	VT	**43**	2B	+	**75**	4B	K	**107**	6B	k
12	C	FF	**44**	2C	,	**76**	4C	L	**108**	6C	l
13	D	CR	**45**	2D	-	**77**	4D	M	**109**	6D	m
14	E	SO	**46**	2E	.	**78**	4E	N	**110**	6E	n
15	F	SI	**47**	2F	/	**79**	4F	O	**111**	6F	o
16	10	DLE	**48**	30	0	**80**	50	P	**112**	70	p
17	11	DC1	**49**	31	1	**81**	51	Q	**113**	71	q
18	12	DC2	**50**	32	2	**82**	52	R	**114**	72	r
19	13	DC3	**51**	33	3	**83**	53	S	**115**	73	s
20	14	DC4	**52**	34	4	**84**	54	T	**116**	74	t
21	15	NAK	**53**	35	5	**85**	55	U	**117**	75	u
22	16	SYN	**54**	36	6	**86**	56	V	**118**	76	v
23	17	ETB	**55**	37	7	**87**	57	W	**119**	77	w
24	18	CAN	**56**	38	8	**88**	58	X	**120**	78	x
25	19	EM	**57**	39	9	**89**	59	Y	**121**	79	y
26	1A	SUB	**58**	3A	:	**90**	5A	Z	**122**	7A	z
27	1B	ESC	**59**	3B	;	**91**	5B	[	**123**	7B	{
28	1C	FS	**60**	3C	<	**92**	5C	\	**124**	7C	|
29	1D	GS	**61**	3D	=	**93**	5D	]	**125**	7D	}

30	1E	RS	**62**	3E	>	**94**	5E	^	**126**	7E	~
31	1F	US	**63**	3F	?	**95**	5F	_	**127**	7F	□

6.3 Ethernet Module

CIMON-PLC Ethernet :

- Support protocols like ARP, ICMP, IP, TCP, UDP.
- No limit on the number of the units mounted on a base.
- Support PLC Link function for high-speed data communication among CIMON-PLC modules and enable to communicate with 64 stations as maximum at the same time.
- Support DNP3.0 protocol. (CM1-EC01DNP)

Item		CM1-EC01A	CM1-EC01DNP	CM1-EC04DNP	CM1-EC10A	CM1-EC10B
Media Interface		10BASE-T			10BASE-T 100BASE-TX	100BASE-FX
Baudrate		10 Mbps			100 Mbps	
Media		UTP/STP Category5	UTP/STP Category5		UTP/STP Category5 Auto MIDX	SC, Multi-Mode (1310nm)
Node Distance		100m (Node<->Hub)				2km
Service Capacity		UDP 9 Services TCP 9 Services	Single Host	4Hosts	UDP 16 Services TCP 16 Services	
SERVICE	Loader	Yes				
	HMI Protocol	Yes	No		Yes	
	MODBUS/TCP	Yes	No		Yes	
	PLC Link (Public Net)	Yes	No		Yes	
	PLC Link (Private Net)	Yes	No		No	
	High-Speed Link (Private Net)	No	No		Yes	
	DNP 3.0	No	Yes		No	

Contents :

6.3.1 New Products : EC10A /B

New Modules

Fast Ethernet modules for CP/XP PLC series :

- **CM1-EC10A : 100BASE-TX**
- **CM1-EC10B : 100BASE-FX (Fiber Optic)**

What's New?

These new modules include and support all functions of CM1-EC01A. Moreover, these modules provide additional functions as described below.

PLC Link Enhancements

- One CPU system can manage more than 4 different PLC link networks at the same time.
- Fast data processing speed.

Service Capacity Enhancements

- EC01A : 18 channels (UDP 9 channels + TCP 9 channels)
- EC10A/B : 32 channels (UDP 16 channels + TCP 16 channels)

Auto media detection (CM1-EC10A)

- Auto MDI / MDIX (no need to prepare twisted cable)
- Auto Negotiation (10 Mbps / 100 Mbps)

Specification

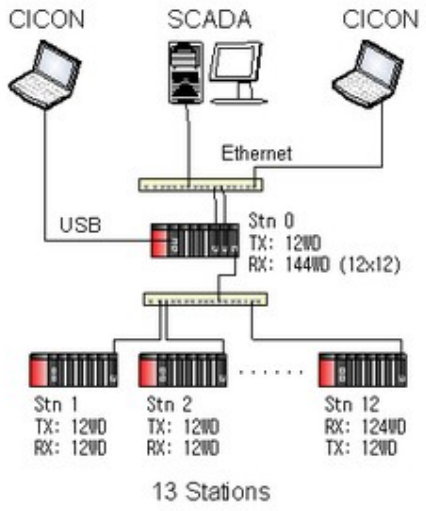
Items	Specifications

	CM1-EC10A	CM1-EC10B
Media Interface	10BASE-T / 100BASE-TX	100BASE-FX
Services	• CICON (programming tool) service • PLC Link (private/public network) service • HMI protocol service (TCP/IP, UDP/IP) • MODBUS/TCP service • User protocol programming function	
Service Channels	UDP/IP : 16 ch TCP/IP : 16 ch	
Max. Segment Distance	100 m	2 km
Max. Frame Size	1500 Bytes	
Media	UTP/STP Category 5 Auto MDIX	SC, Multimode (1310nm)

6.3.2 CIMON Ethernet PLC Link Performance Test

Test Overview

- **Purpose :** Measuring the data transmission delay in Ethernet PLC Link of CIMON PLC.
- **Protocol :** The Ethernet PLC link configured by the special program of CICON.
- **Tested Module :** CM1-XP3A, CM1-EC10A
- **Test Period :** 07th Dec. 2006 – 11th Dec. 2006
- **Test Network :** The network is a data link system between 13 stations. A master station has three Ethernet modules. Each of these modules served a CIMON-SCADA system, a CICON and the PLC link network. Following picture explains above network configuration.



Measuring

Stn0

1. STN0 had additional two Ethernet modules for CIMON-SCADA and CICON service (Total 3 EC10As).
2. STN0 manipulated two bit flags for other PLC stations each in network. One bit for transmit (Tx bit) and another bit for received flag (Rx bit).
3. Controlled the Tx bit not to be the same state with Rx bit.
4. Measured the time span between Tx bit control and Rx bit change.
5. The average and maximum delay were calculated from above measured time span data.
6. The time span was measured by means of the 10 mSec. timer of CPU.

Stn1 – Stn12

1. The sequence program copied the Rx bit to Tx bit.

(Note) The Tx period of all stations are configured as 20mSec.

Measured

The measured values after 96 hours (4 days) continuous test are as follows.

- Maximum Delay : 110 – 130 mSec. (110mSec. for 11 stations, 130mSec. for 1 station)
- Average Delay : 40 – 50 mSec.

Conclusion

Above measured time delays include both two directions of data transmission. Consequently, the delay time of single direction can be induced as followings. (a half of above measured values)

- **Maximum Delay : 55 – 65 mSec.**
- **Average Delay : 20 – 25 mSec.**

Notice that this test is based on the 20mSec. transmission period. That is, above delay time cannot be necessarily the minimum delay of CIMON PLC link system. If the test was progressed under 10mSec period, the measured delay would be smaller than above.

6.3.3 Specifications

CIMON-PLC Ethernet Module Specifications :

6.3.3.1 General Specifications

The general specifications for CIMON PLC communication modules are as follows.

Item	Specification				
Operating Temperature	-10 ~ 65ºC				
Storage Temperature	-25 ~ 80ºC				
Operating Humidity	5 ~ 95%RH, Not condensed.				
Storage Humidity	5 ~ 95%RH, Not condensed.				
Vibration	In case of intermittent vibration				
	Frequency	Acceleration	Amplitude	Sweep	
	10 ≤ f< 57Hz	-	0.075mm	10 times in each direction (X,Y,Z)	
	57 ≤ f < 150 Hz	9.8m/s2 {1G}	-		
	In case of continuous vibration				
	Frequency	Acceleration	Amplitude	Sweep	
	10 ≤ f < 57Hz	-	0.035mm	10 times in each direction (X,Y,Z)	
	57 ≤ f < 150 Hz	4.9m/s2 {1G}	-		
Shock	- Max. Shock Acc.: 147 m/s2 {15G} - Time : 11ms(3 times in X, Y, Z) - Pulse Wave : Half sine wave pulse				
Noise	Square wave impulse noise	±1500V			
	Electrostatic discharge	Voltage: 4 kV(Contact discharge)			
	Radiated electro-magnetic field	27 ~ 500 MHz. 10 V/m			
	Fast Transient Bust Noise	Item	Power Module	Digital I/O (24V or more)	Digital I/O(Less than 24V) Analog I/O Comm. interface
		Voltage	2KV	1KV	0.25KV
Environment	No corrosive gas and no dust.				
Altitude	2,000m or less				

Pollution	Less than 2
Cooling	Natural Air cooling

6.3.3.2 Module Specifications

Item		Specification (10BASE-T)
Sending Specification	Baud Rate	10 Mbps
	Sending Type	Base Band
	Max. Segment Length	100m(Node – Hub)
	Max. Protocol Size	1500 Byte
	Communication Access Type	CSMA / CD
Basic Specification	Internal 5V power Consumption(㎃)	280mA
	Weight(g)	460g

6.3.3.3 Cable Specifications

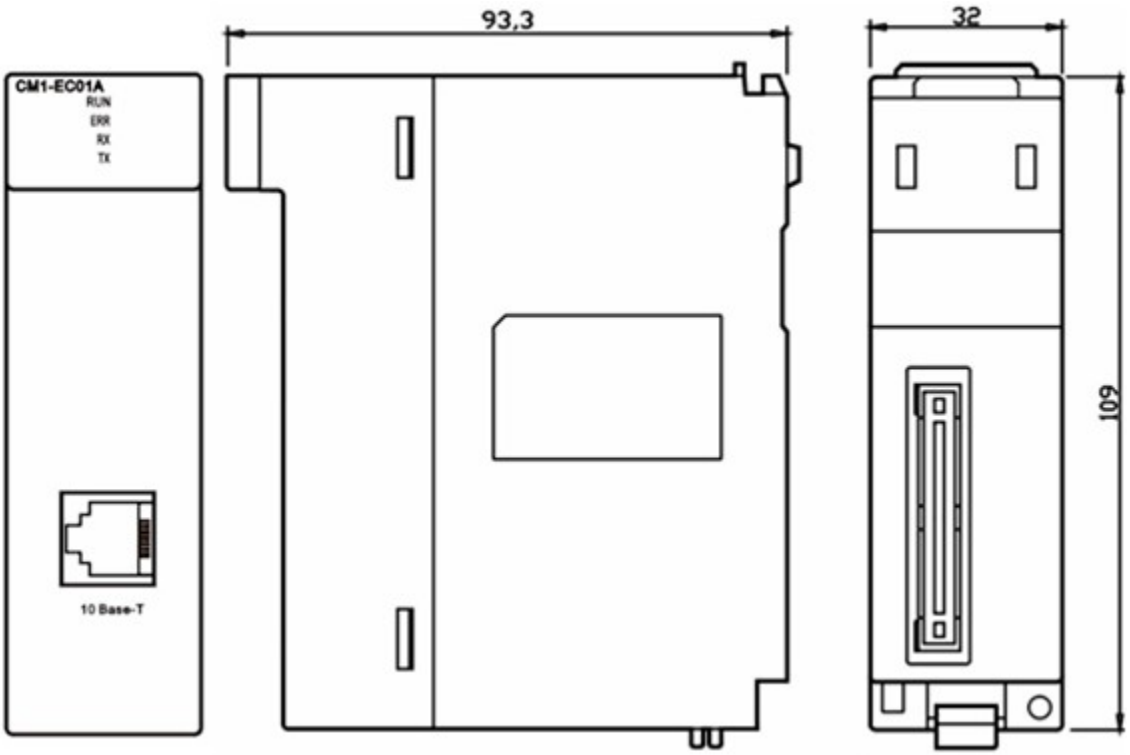
Twisted-Pair Cable(UTP)

Item	Unit		Value
Conductor Resistance (Maximum)	? / km		93.5
Insulation Resistance (Minimum)	M? . km		2500
Internal Voltage	V / min		AC 500
Characteristic Impedance	? (1 ~ 100MHz)		100 ± 15
Attenuation	Less than dB / 100m	10	6.5
		16	8.2
		20	9.3
Near-end Cross talk Attenuation	Less than dB / 100m	10	47
		16	44
		20	42

※As the cables for Ethernet connection are different according to system configuration and cable type, consultation with an expert is required to install them..

6.3.3.4 Dimensions

Unit : mm



LED Indicator

LED No,	Indication	Description
0	RUN	ON in case of Power supply.
1	ERR	Blinking in case of error in system.
2	RX	Blinking in case of receiving.
3	TX	Blinking in case of sending.

6.3.4 Internal I/O Table

Device	Description of Signal	Device	Description of Signal
X0000	Error In Module	Y0000	Request To Clear Error
X0001	Initialized	Y0001	-
X0002	-	Y0002	-
X0003	-	Y0003	-
X0004	-	Y0004	-
X0005	-	Y0005	-
X0006	-	Y0006	-
X0007	-	Y0007	-
X0008	-	Y0008	-
X0009	-	Y0009	-

X000A	-	Y000A	-
X000B	-	Y000B	-
X000C	-	Y000C	-
X000D	-	Y000D	-
X000E	-	Y000E	-
X000F	Parameter Has Been Saved	Y000F	Request To Save Parameter

6.3.5 Shared Memory

Offset	Description	R/W	Remarks
0	Status Code (0=Normal, Others=Error Code)	R	
1			
2			
3			
4	IP Address	R/W	
5	IP Address	R/W	
6	Net Mask	R/W	
7	Net Mask	R/W	
8	PLC Link Station	R	
9	PLC Link Connection	R	
10	PLC Link Connection	R	
11	PLC Link Connection	R	
12	PLC Link Connection	R	
13	The Last HMI Service IP Address	R	
14	The Last HMI Service IP Address	R	
15	The Last HMI Service Port	R	
16	The Last Loader Service IP Address	R	
17	The Last Loader Service IP Address	R	
18	The Last Loader Service Port	R	
19	TCP Modbus Unit ID	R/W	
20	Dest IP Address		
21	Dest IP Address		
22	Dest Port		
23	Source IP Address		
24	Source IP Address		
25	Source Port		
26	Gate Way	R/W	
27	Gate Way	R/W	
…			
30	DNP Host IP Address (Upper)		Ethernet DNP3.0

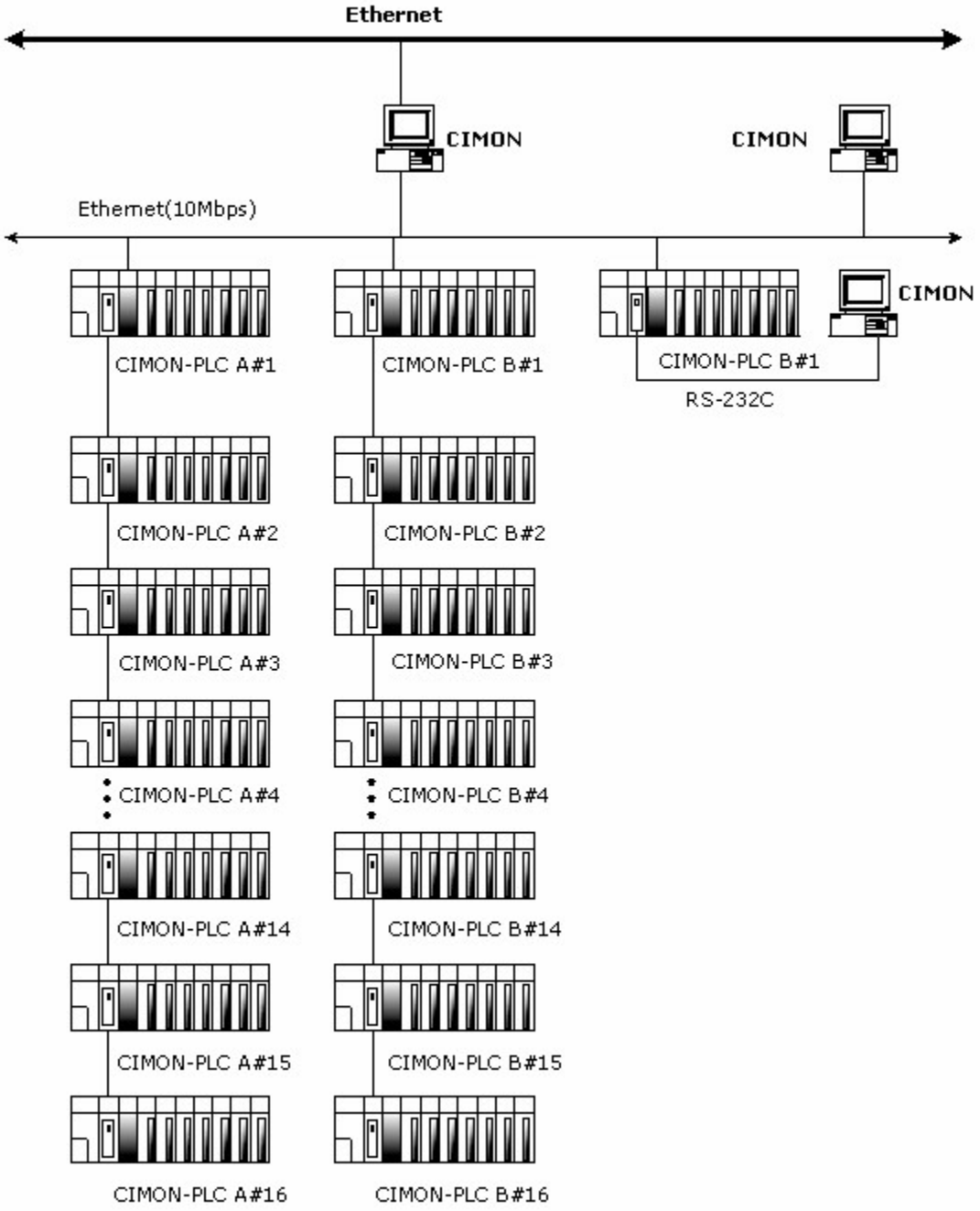
31	DNP Host IP Address (Lower)		
32	DNP Host Station		
33	DNP My Station		
34	DNP Flags		
35	DNP DataLink Rty(Upper)/DNP DataLink T.O(Lower)		
36	DNP Application Rty(Upper)/DNP Application T.O(Lower)		
…			
37~127	User Message	R/W	182 Byte
128	PLC Link Number 0 Station IP Address(Upper)	R/W	In case of common network PLC link, IP Address of the corresponding station
129	PLC Link Number 0 Station IP Address(Lower)	R/W	
130	PLC Link Number 1 Station IP Address(Upper)	R/W	
131	PLC Link Number 1 Station IP Address(Lower)	R/W	
…		R/W	
254	PLC Link Number 63 Station IP Address(Upper)	R/W	
255	PLC Link Number 63Station IP Address(Lower)	R/W	

6.3.6 System Configuration

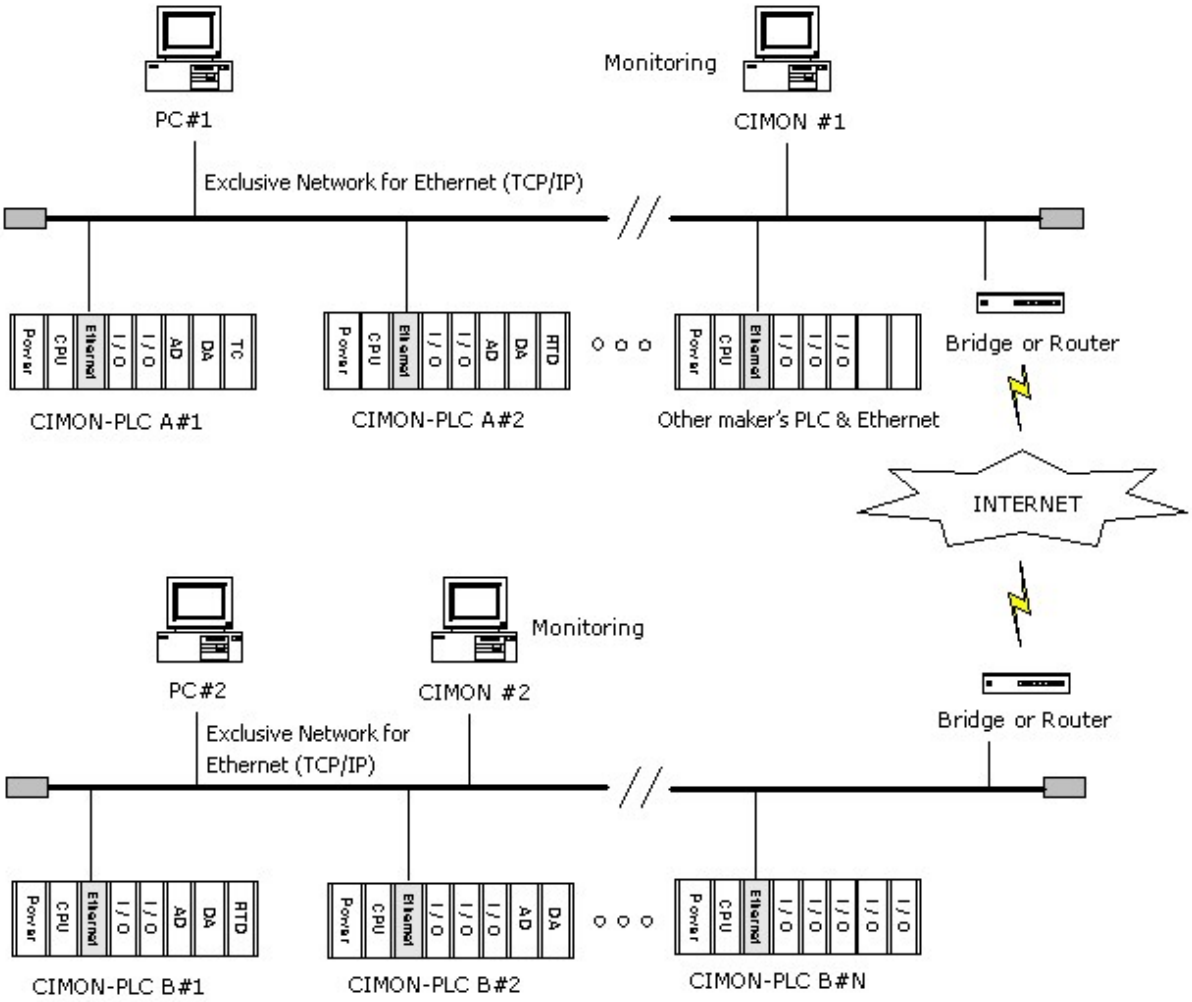
Contents :

6.3.6.1 CIMON PLC Network SYSTEM

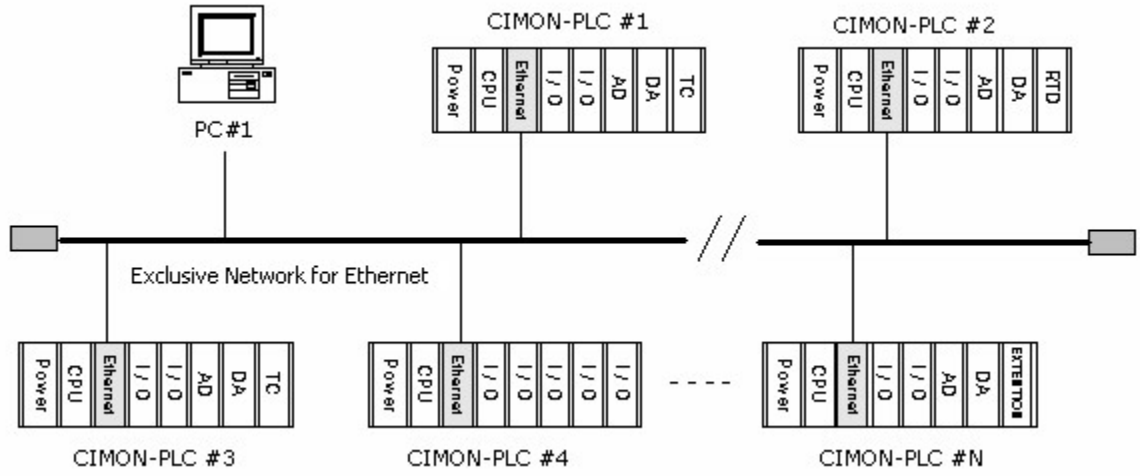
❖ Communication with 16 station as maximum is available



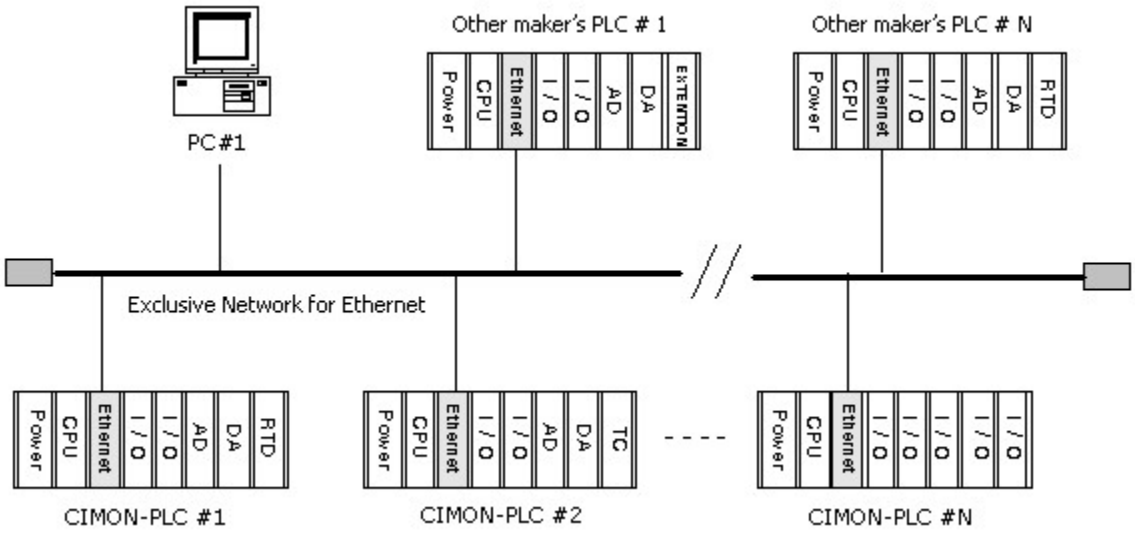
6.3.6.2 CIMON PLC Ethernet SYSTEM



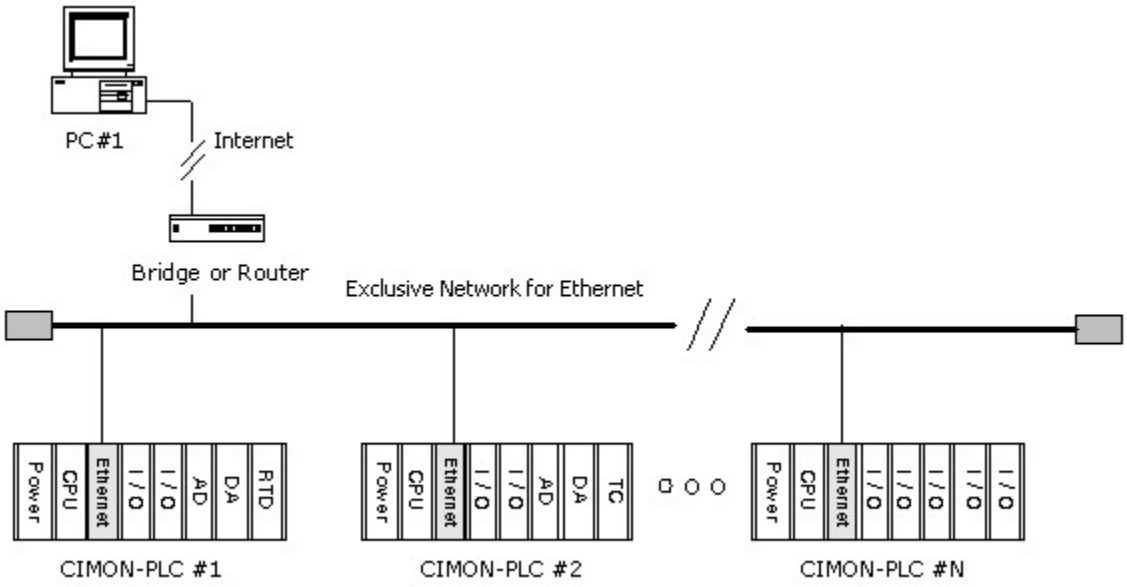
6.3.6.3 CIMON PLC Ethernet SYSTEM (Exclusive)



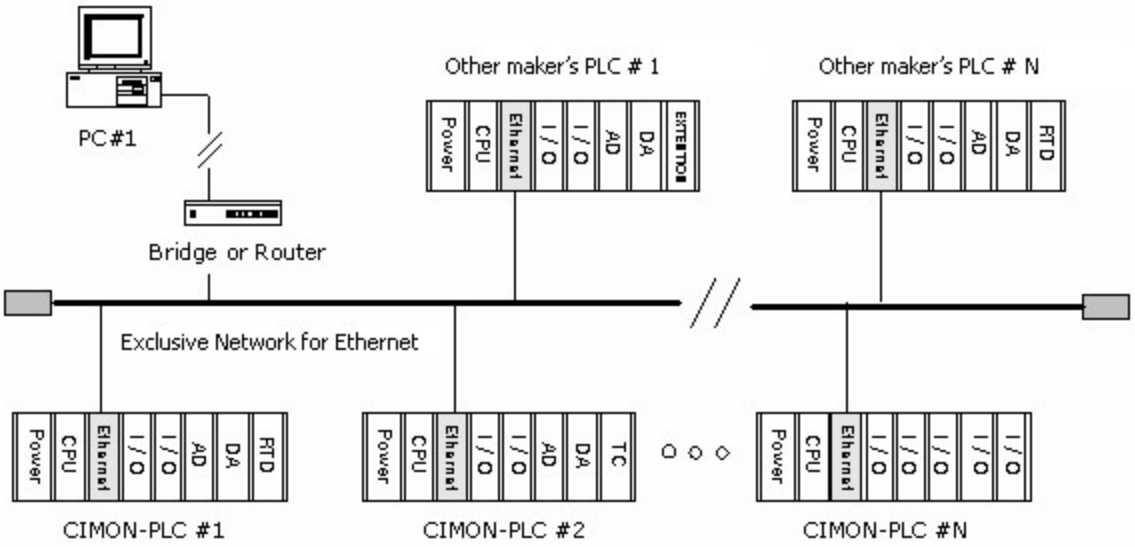
6.3.6.4 CIMON PLC Ethernet SYSTEM (Exclusive+Other)



6.3.6.5 CIMON PLC Ethernet SYSTEM (Internet+Exclusive)



6.3.6.6 CIMON PLC Ethernet SYSTEM (Internet+Exclusive+Other)



6.3.7 Communication Funcions

Exclusive Service for CIMON PLC Ethernet

- Transport Layer: UDP/IP, TCP/IP
- Half-Duplex (UDP/IP, TCP/IP)
- Service Port: 10262(UDP/IP), 10260(TCP/IP)

PLC Link in Exclusive Network

This link is the protocol used to exchange high baud rate and large capacity data between CIMON PLCs. An Ethernet card is used. The specifications are as follows.

- Transport Layer : UDP/IP (IP Broadcasting)
- Port : 10264
- Maximum number of Ethernet Modules connected: 64 modules
- Each sending block has its peculiar communication interval and sends in broadcasting type.
- Up to 64 words data can be sent, using a sending block.
- The communication block set up to each PLC (Ethernet Module) can be assigned up to 64 blocks, putting sending blocks and sending blocks together.
- A necessary block among other PLCs (Ethernet Module) in a network can be selected and assigned to a receiving block.

PLC Link Service in Common Network

This link is the protocol used to exchange low baud and large capacity data between CIMON PLCs. An Ethernet card is used. The specifications are as follows.

- Transport Layer : UDP/IP
- Port : 10268
- Maximum number of Ethernet Modules connected: 64 modules
- Up to 32 blocks per PLC can be assigned to sending blocks.
- Up to 32 blocks per PLC can be assigned to receiving blocks.
- Each receiving block has its peculiar communication interval.
- Up to 64 words data can be sent, using a sending block.
- The communication block set up to each PLC (Ethernet Module) can be assigned up to 64 blocks, putting sending blocks and sending blocks together.
- A necessary block among other PLCs (Ethernet Module) in a network can be selected and assigned to a receiving block.
- The IP Address of other node is stored in User Program Memory device (From 128th word), using Instruction TO. But, if there is not the block requesting to receive, the IP Address of the other may be stored.

Graphic Loader Service

Ethernet module is used to link with Graphic Loader (CICON). The specifications are as follows.

- Transport Layer : UDP/IP (IP Broadcasting)
- Service Port : 10266

TCP Modbus Service

Open Modbus Protocol is used to access the corresponding device. The specifications are as follows.

- Transport Layer : TCP/IP
- Service Port : 502

6.3.7.1 Graphic Loader Service

- Transport Layer: UDP/IP
- Port: 10266

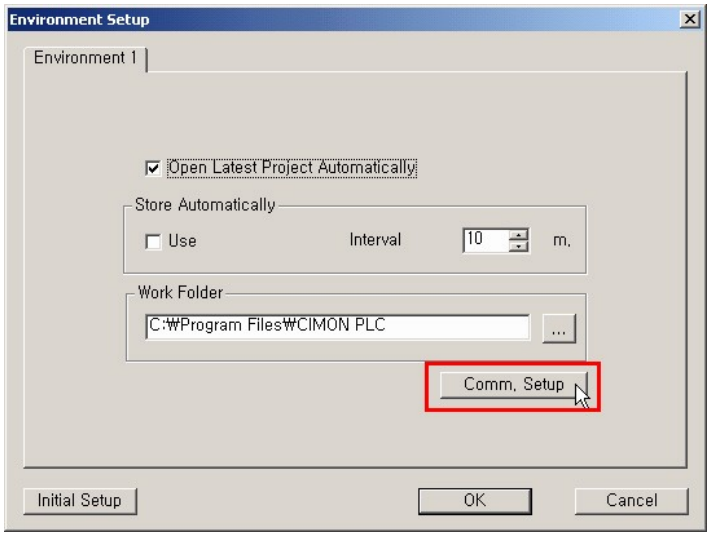
This function is to write a program, to download and upload users' program, to debug and to monitor remotely without moving physical connection in Ethernet network system, using the CICON.
Especially, this is a convenient function to access each device easily at a place, in case that the devices connected to a network are scattered away.

Setting Up to link with the CICON

All the PLCs linked with the CICON network can access each other through the CICON communication service.

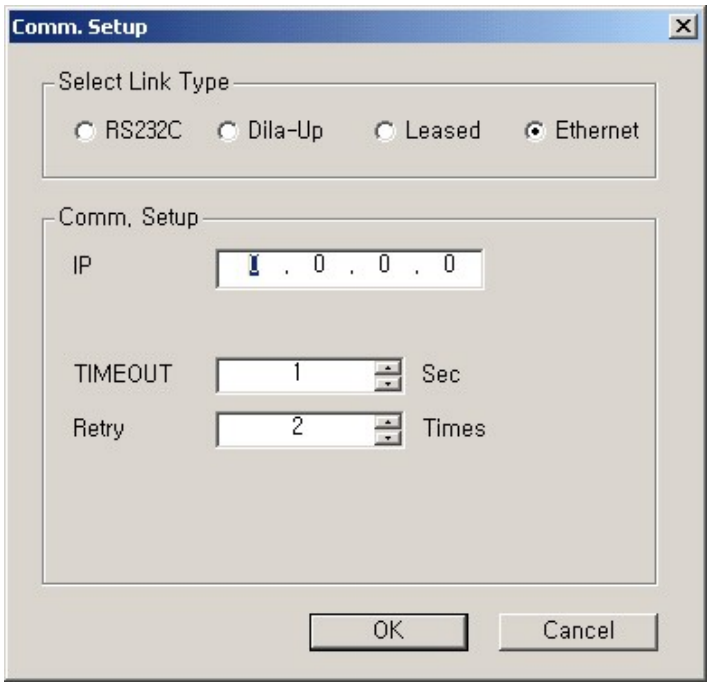
1. Setting up

a. Select the Environment Setup in the Tools of the CICON menu bar.



But, the environment is to be set up in unlinked state.

b. As the above picture, click the Communication Setup. The following dialog box will appear.

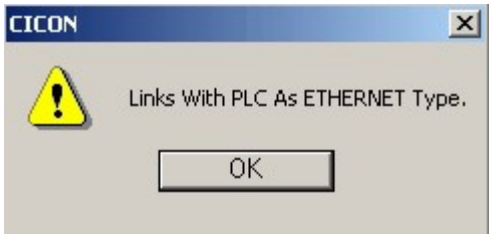


c. Enter the values in the dialog box.

- Select Link Type: This is used to select link type with the CICON. Select Ethernet.
- Comm. Setup: Enter the same as the IP address of the Ethernet module connected with the CICON. And Enter the TIMEOUT and the Retry.

d. Press the OK button.

2. Linking : The CICON runs to link.



3. Press the "OK" button.

6.3.7.2 Exclusive Service for CIMON PLC Ethernet

- Transport Layer : UDP/IP, TCP/IP
- Half-Duplex (UDP/IP, TCP/IP)
- Service Port : 10262(UDP/IP), 10260(TCP/IP)

To use this service, which uses the protocol built in the module of the CIMON PLC, TCP port 10260 and UDP port 10262 are to be used.
This service is used to download and upload a PLC program, and to control a PLC. And it is used to read the information and the data in a PLC from a PC and other devices, and to write the information and the data in a PLC to a PC and other devices.
Though the exclusive service, the communication between a PC and an Ethernet module is available.

Types of Data

Types of Memory Device

M (Internal Memory)

This is used not to output but to configure a logic circuit.

X (Input)

This is the input part receiving data directly.

Y (Output)

This is the output part transferring the result of an operation.

K (Keep)

This is used like M but is used as the device conserving the precious data when the power is ON or the RUN starts. The data is conserved till the power is ON again though it is OFF. It can be processed with ?ata Clear?function in the Loader to delete the
data.

L (Link)

It is unable to output to outside directly for data link with upper device and lower one. When the power is ON and the RUN starts, the part except the device assigned to a parameter is deleted as 0 and there is no

default non-volatile device. In case that this is not used for link and high-speed counter, this can be used like M.

F (Internal Flag)

This has the device having the operation state, setting type, card number, system clock contact and user clock contact for a PLC. It is available to input an instruction with only Operand.

T (Timer)

There are the instructions of 5 types and the counting method is different according to instruction. If input condition is realized, a timer will start to count. And if timer reaches set time or 0, contact output is ON. The maximum set value is FFFFh and the value can be expressed in decimal figure or in hexadecimal figure.
ON Delay, Off Delay, Accumulation ON Delay, Monostable, Retriggerable

C (Counter)

Counter counts at the rising edge of input condition and stop counting at reset input to delete current value as 0 or to substitute it as set value. According to the instructions of 4 types, counting method is different. The maximum set value is FFFFh and the value can be expressed in decimal figure or in hexadecimal figure.
Up Counter, Down Counter, Up/Down Counter, Ring Counter

S (Step Control)

This, which is the relay for step control, is classified into the priority of Last-In and the step control according to using the instructions (OUT, SET). This is composed of 2-step instruction. The device except the one assigned to a parameter when the power is ON and the RUN starts is deleted as the first step, 0.

D (Data Register)

This is used to store the internal data. It is available to read and write in 32-bit.

Type of Data	Example of Use
Bit	X013F, Y0028, L0119
Word	Y0120, M0040, K0100

6.3.7.3 PLC Link in Exclusive Network

This service is to exchange high baud rate and large capacity data between CIMON PLCs. An Ethernet card is used.
PLC Link, a communication method between CIMON PLC communication modules, is used to exchange data and information with the other party at a certain time periodically. Sending/Receiving Data Size, Interval and Device in the Parameter of the CICON to exchange data can be set up. This is the PLC Link service to regard the network speed as important.

Features :

- The total of 64 blocks, 32 Sending blocks and 32 Receiving blocks each, can be set up for each communication module.

  Link Points

Max. Comm. Points	Max. Sending Points	Max. Block Points	Max. Points Per Block
4,096	2,048	64(0~63)	64

  64-word data can be sent for each block.

- Users can use the CICON to set up a peculiar sending interval. The sending interval can be set up in the range from 50ms to 3sec.

- Users can use the CICON to set up a specific device and data size for sending/receiving data.

Contents :

6.3.7.3.1 Processing Sent/Received Data under PLC Link

An Example is taken to explain how data are processed when they are sent or received under PLC Link.

- **Sending Party :** This is used to set up the data read, what number data is sent to, data size and sending interval to a sending party in broadcasting method.
- **Receiving Party :** This is used to set up station number and the block number of sent data to a receiving party in broadcasting method to receive desired data.

[Ex.]

Station 0 sends the data of Device D0000,
Station 1 requests the received data every 100ms and stores them in Device Y0000.

Sending Party (Station : 0)

Type	Block Number	Sending Interval	Address	Size
Sending Block	0	100ms	D0000	10 Words

Receiving Party (Station : 1)

Type	Station Number	Block Number	Address	Size
Receiving Block	0	0	Y0000	4 Words

The block number of a sending party and the one of a receiving party are the same as 0, and the station number of a sending party is set up like the one of the receiving party as 0. In this condition, the receiving party can receive every 100ms the data sent from the sending party every 100ms. Though the sending party sends the data of 10-word size, the receiving party selects and receives the necessary data of 4-word size. But, the size of the sent data is to be as same as or less than the one of the received data.

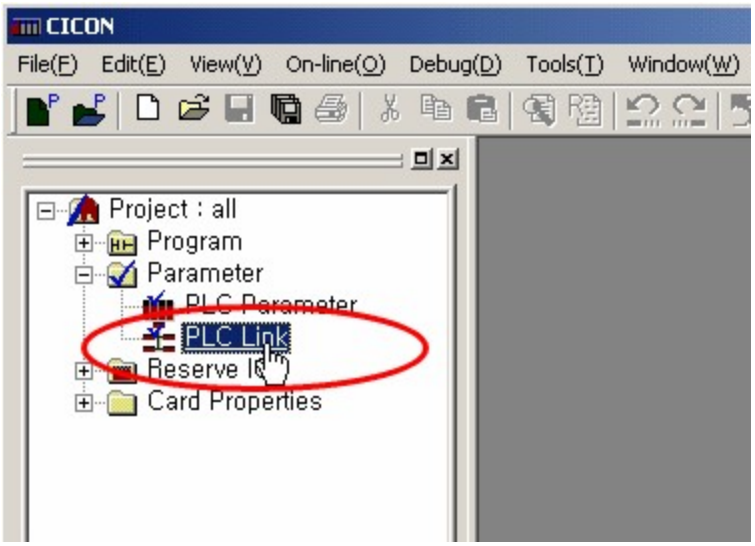
6.3.7.3.2 Setting up PLC Link Parameter

To run PLC Link and to exchange data between communication modules, the parameter is to be set up in the CICON.

Creating a Project in the CICON

Select the menu to run the CICON and to open a corresponding project.

Picture . Select the "PLC Link"



Setting up PLC Link Parameter

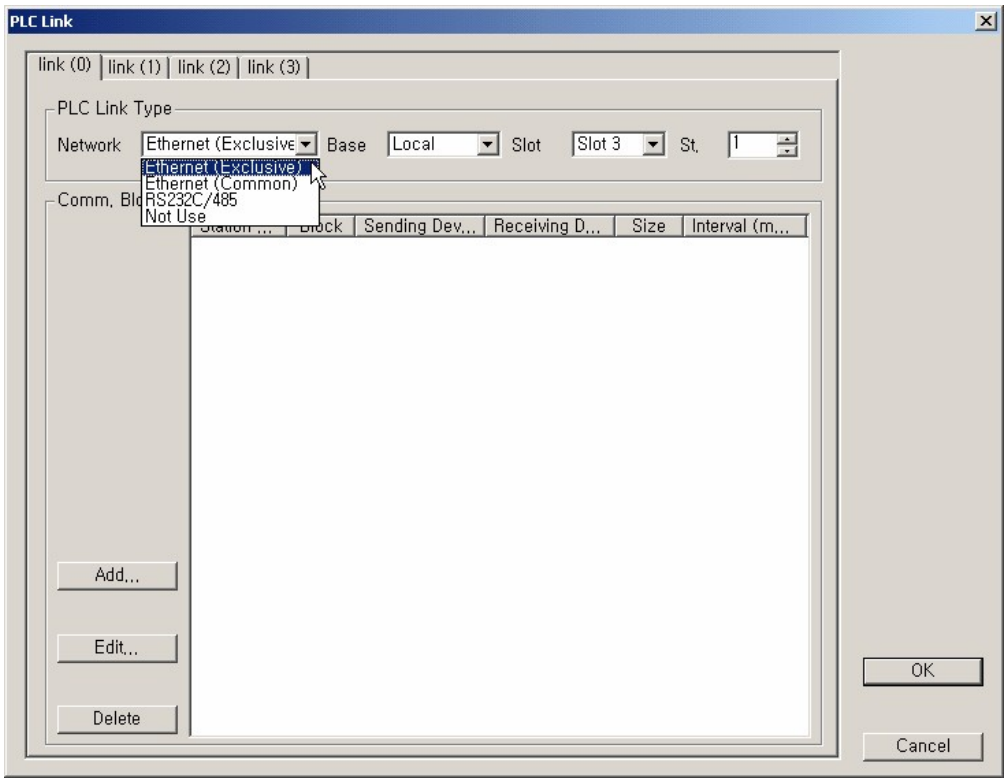
1) Selecting PLC Link Parameter :

If you select the PLC Link on the window as [Picture. Select the "PLC Link"], a PLC Link dialog box will appear. In the dialog box, up to 4 communication modules can be set up for one CPU. To set up PLC Link to a mounted communication module, select Link(0), Link(1), Link(2) and Link(3) on the top of the dialog box and enter the values for each communication module.

2) Setting up PLC Link Type :

PLC Link Type is used to set up basic items such as network type, base, slot number, station number and so on.

Picture. PLC Link Setup



Network This is used to set up the type of the communication module for PLC Link. If you do not use PLC Link, select the Not Use. Here, select the Ethernet(Exclusive).

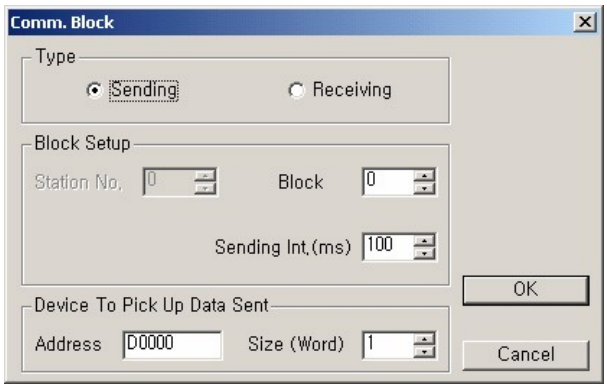
Base This is used to select the base where the communication module for PLC Link is mounted. For example, if there is no base expansion (The base where a expansion card is mounted), select the Local. If there is base expansion (The base where a expansion card is mounted), select the Expansion Base where the communication module is mounted.

Slot This is used to select the slot number of the base where the communication module is mounted.

3) Setting up the communication block for PLC Link :

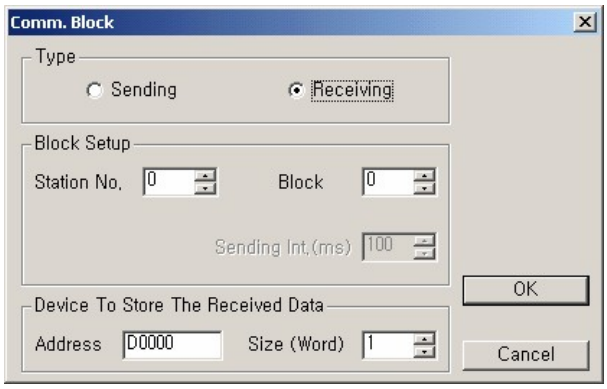
Communication Block is used to register the information about sending/receiving real data. If you select the Ethernet(Exclusive) as the Network and the Add button in "Picure. PLC Link Setup", a Communication Block dialog box will appear like follows.

Picture. Communication Block Setup



Sending When communication modules communicate each other, this is used to send a selected block.

Receiving When communication modules communicate each other, this is used to receive a selected block.



Station No. When communication modules communicate each other, in case of sending data, it is not necessary to set up station number. But, in case of receiving data, the station number of a receiving communication module is to be selected. The station number can be set up in the range from 0 to 63.

Block No. The communication modules for a sending party communicate with each peculiar block number. In the same way, the communication modules for a receiving party have each peculiar block number to receive the data. The receiving block number is used to detect the data that a receiving party wants together with station number when a party communicates with a sending party. But, the block number can be set up in the range from 0 to 31. To receive the data of a sending party, the same number is to be set up as the block number for the sending party and the block number for a receiving party.

Sending Sending interval, a parameter to decide the interval at which data are sent, can be set

Interval up in the range from 50 ms to 3 sec according to users' need. For example, if 50 ms is set up as sending interval, data will be sent every 50ms.

Device To Pick Up Data Sent & Device To Store The Received Data (Address)

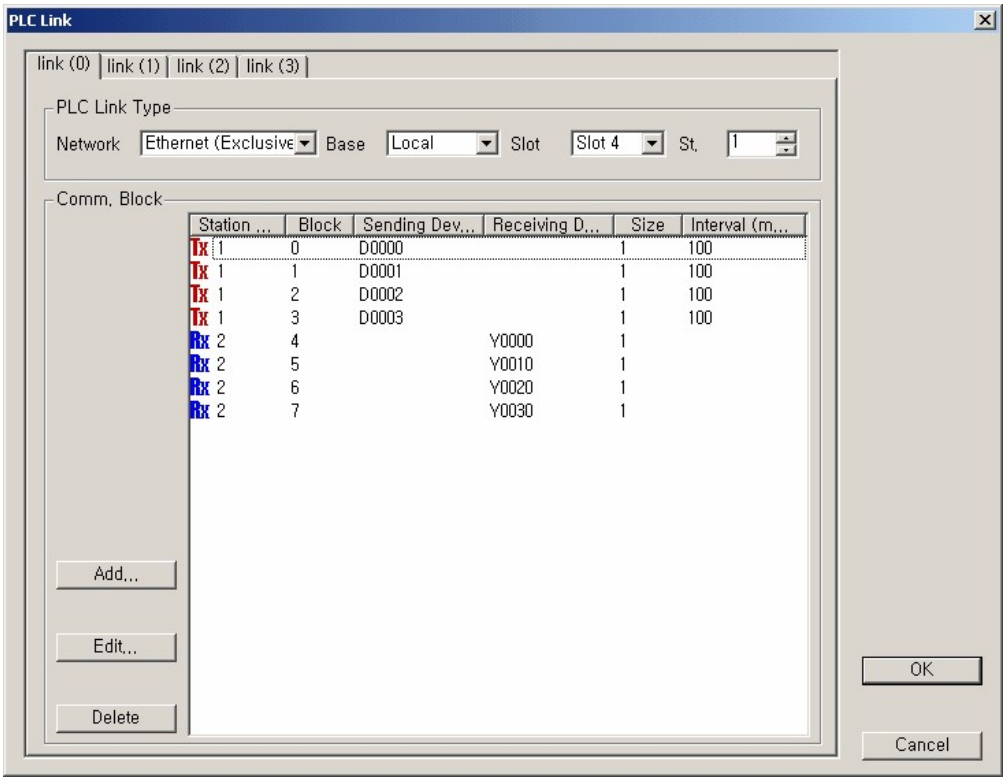
- When sending : This is used to set up the device where the data sent are read.
- When receiving : This is used to set up the device where the received data are stored.

Device To Pick Up Data Sent & Device To Store The Received Data (Size)

This, the size of the data sent or received, can be set up by the word. But, the size is from one word to 64 words. If the data size of a sending device is greater than the size of the data set up to a receiving device, the necessary data as much as the size of the one set up to the receiving device can be received selectively and used.

[Ex.] The communication module of Station 1 sends Block 0, 1, 2 and 3, and receives Block 4, 5, 6 and 7. And the communication module of Station 2 sends Block 4, 5, 6, and 7, receives 0, 1, 2 and 3. An Ethernet card is mounted on Slot 4. Each data size is one word and the interval is 50 ms each. Such case is taken as an example and the PLC link parameter for it is configured as follows.

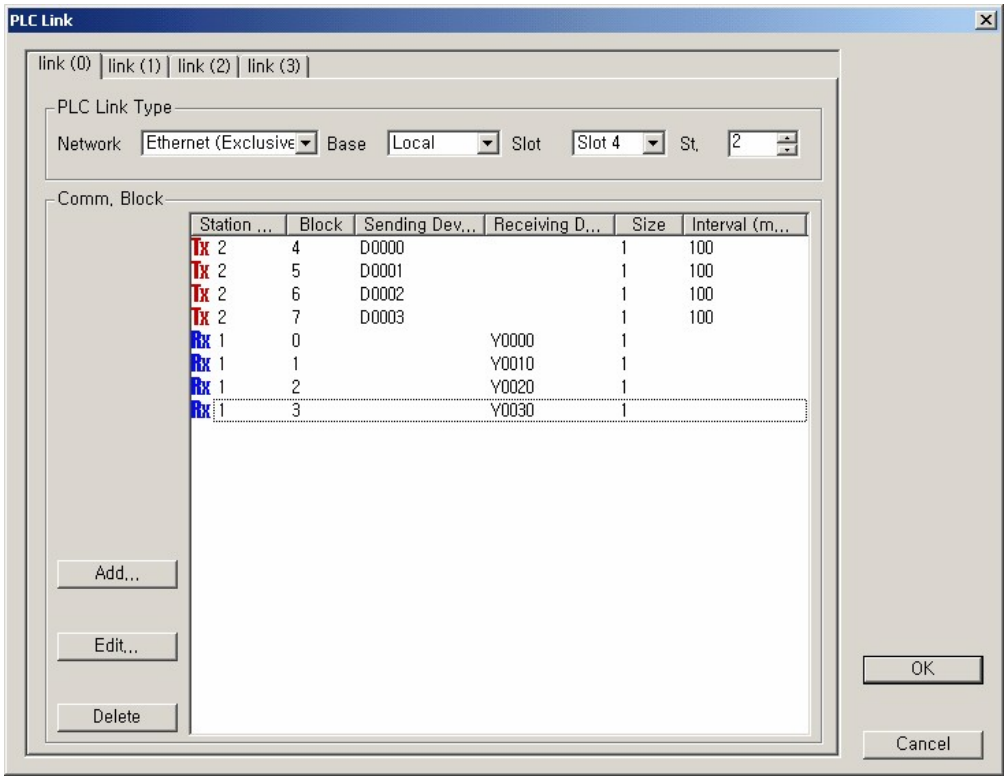
a. Station 1



Station 1 sends the data of the sending devices from D0000 to D0003 by the word at each interval.

The data received to corresponding addresses will be written in the receiving devices from Y0000 to Y0030, if the corresponding station and blocks are in accord.

b. Station 2



Enter 2 as the sending station number and 4, 5, 6, 7 as the block number to send at each interval. If so, the Ethernet module of Station 1 receives, comparing the receiving station and the blocks.
In the same way, Station 2 compares the numbers of the blocks in the received frames with Block 0, 1, 2, and 3 of Station 1. And if they are same, Station 2 receives them and writes the data to the devices from Y0000 to Y0030.

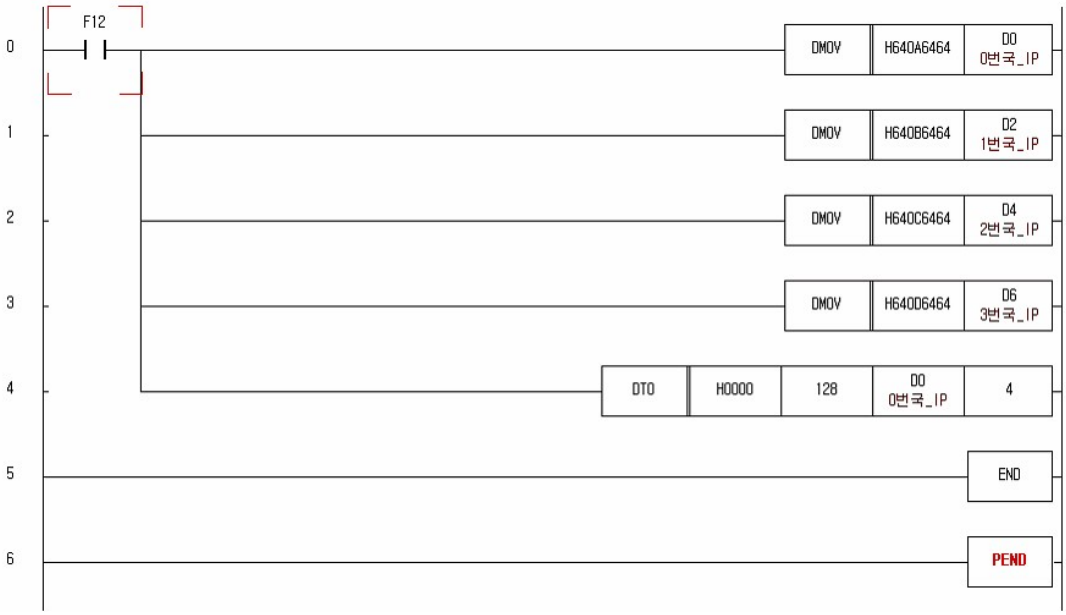
6.3.7.3.3 IP Configuration

When you use PLC link in common network, you must configure IP address of receiving data station. Configured IP address is used to reply IP address when required receiving data.

IP Configuration in CICON

- Use TO command for saving IP address at the user program.
- Example: Saving IP address of receiving station at the each Ethernet module PLC Link constructed.

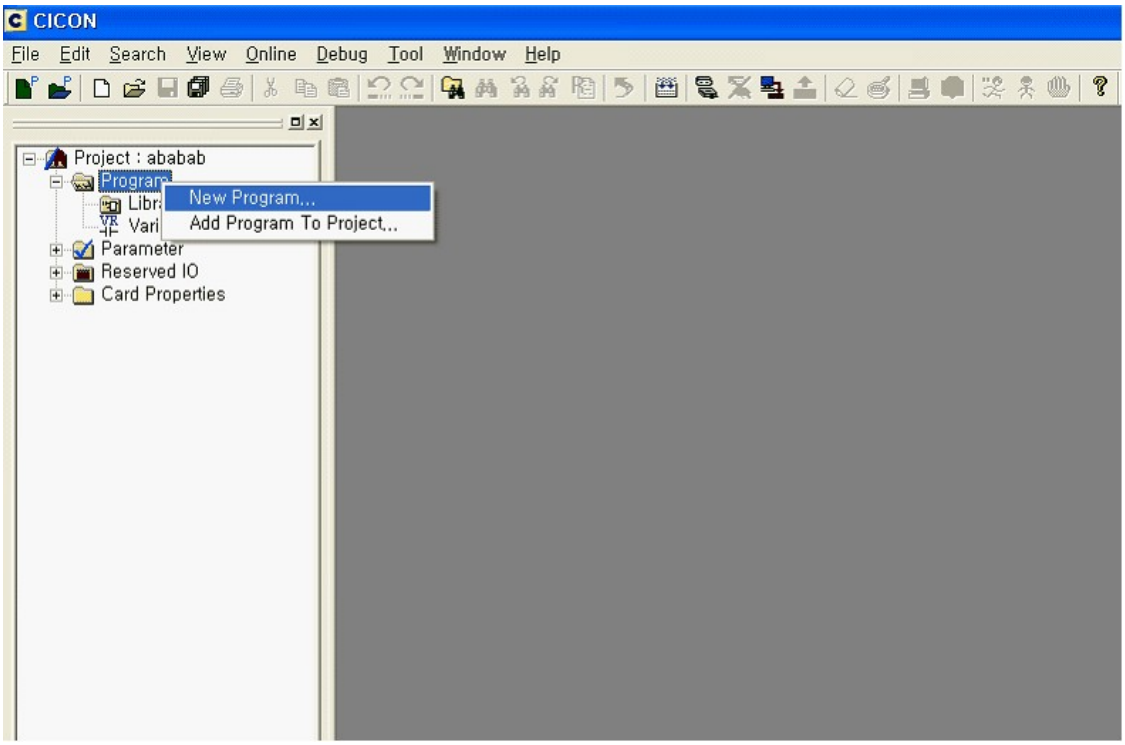
Station	Ethernet module IP Address	PLC Address
0	100.100.100.10	D00000~1
1	100.100.100.11	D00002~3
2	100.100.100.12	D00004~5
3	100.100.100.13	D00006~7

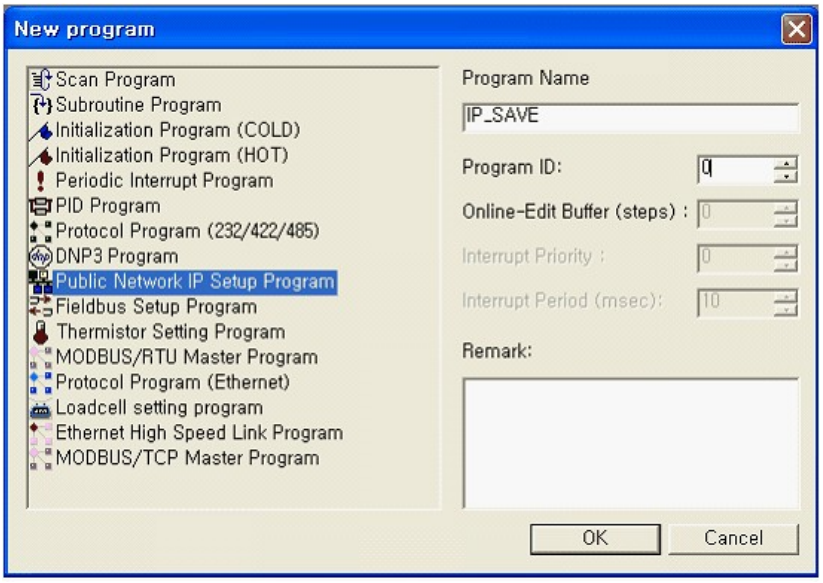


0 Row : Input IP address of Ethernet module configured link station 0. (D0: h6464, D1: h640A)
1 Raw : Input IP address of Ethernet module configured link station 1. (D2: h6464, D3: h640B)
2 Raw : Input IP address of Ethernet module configured link station 2. (D4: h6464, D5: h640C)
3 Raw : Input IP address of Ethernet module configured link station 3. (D6: h6464, D7: h640D)
4 Raw : Save stored memory from D0 to D7 at the instructed buffer memory area (Offset 128).
More details of the using TO command refer the CPU command.

IP Configuration at the CICON program

- Configure IP address at the each Ethernet module constructed PLC link.
- It is not need to make user program at the CICON.
- Example - Make new CICON project and add new program.





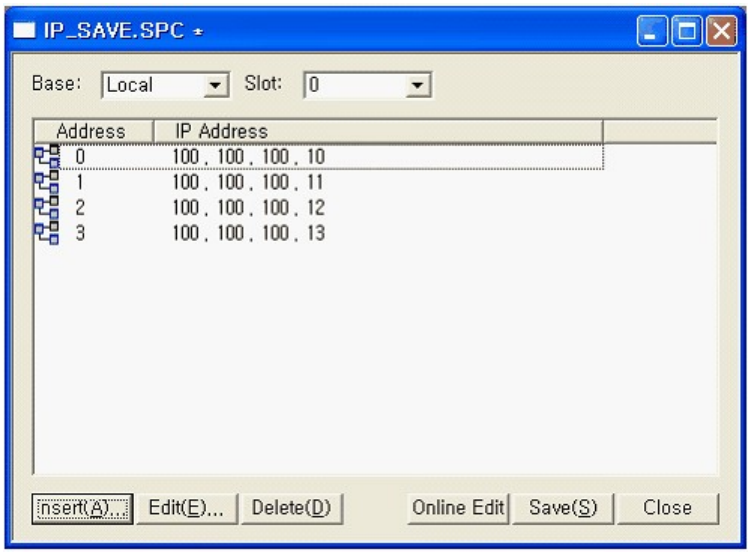
Come out the dialog box to make an entry program block.

Program name : Make an entry program name that will be registered project window.

Sort of Program : Select program to be registered. The sort of program to be Registered is Public network IP setup program.

Confirm the program name and the sort of program.

- Come out the IP_SAVE.SPC dialog box.



- Base : Select the base adapted Ethernet module that will be constructed PLC link.
- Slot : Select the base slot adapted Ethernet module that will be constructed PLC link.
- Address : It is the number of PLC link parameter configured.
- IP Address : When PLC parameter had configured, it was the selected Ethernet module IP.

If you configure the above explanations, it will be same the program at the programmed in user program.

6.3.7.4 PLC Link Service in Common Network

This service is to exchange high baud rate and large capacity data between CIMON PLCs. An Ethernet card is used.
PLC Link, a communication method between CIMON PLC communication modules, is used to exchange data and information with the other party at a certain time periodically. Users can assign the Sending/Receiving Data Size, the Interval and the Device in the Parameter of the CICON to exchange data. This PLC Link service regards network itself as important.

Features :

- The total of 64 blocks, 32 Sending blocks and 32 Receiving blocks each, can be set up for each communication module.

Link Points

Max. Comm. Points	Max. Sending Points	Max. Block Points	Max. Points Per Block
4,096	2,048	64(0~63)	64

64-word data can be sent for each block.

- Users can use the CICON to set up a peculiar receiving interval. The receiving interval can be set up in the range from 50ms to 3sec.
- Users can use the CICON to set up a specific device and data size for sending/receiving data.
- Users refer to User Data Memory Map in the CIOCN to set up the IP of a corresponding station.

Contents :

6.3.7.4.1 Processing Sent/Received Data under PLC Link

An Example is taken to explain how data are processed when they are sent or received under PLC Link.

- **Sending Party :** This is used to set up the data read, what number data is sent to, data size and sending interval to a sending party.
- **Receiving Party :** This is used to set up station number and the block number of the data read from a corresponding station at receiving intervals to a receiving party to receive desired data. The IP address of the station requesting to receive is to be stored in the buffer memory (128th word).

[Ex.]

Station 0 sends the data of Device D0000,
Station 1 requests the received data every 100ms and stores them in Device Y0000.

Sending Party (Station : 0)

Type	Block Number	Sending Interval	Address	Size
Sending Block	0	0	D0000	10 Words

Receiving Party (Station : 1)

Type	Station Number	Block Number	Receiving Interval	Address	Size
Receiving Block	0	0	100ms	Y0000	4 Words

The block number of a sending party and the one of a receiving party are the same as 0, and the station number of a sending party is set up like the one of the receiving party as 0. In this condition, the receiving party sends data every 100 ms, and the sending party receive the data makes sure whether there is a corresponding block. If there is the block, the sending party will send the corresponding data. Though the sending party sends the data of 10-word size, the receiving party selects and receives the necessary data

of 4-word size.

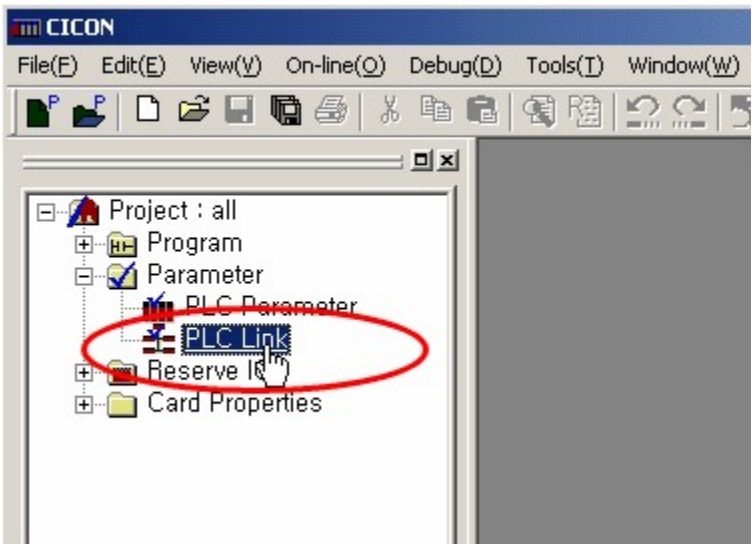
6.3.7.4.2 Setting up PLC Link Parameter

To run PLC Link and to exchange data between communication modules, the parameter is to be set up in the CICON.

Creating a Project in the CICON

Select the menu to run the CICON and to open a corresponding project.

Picture. Select the "PLC Link"



Setting up the PLC Link Parameter

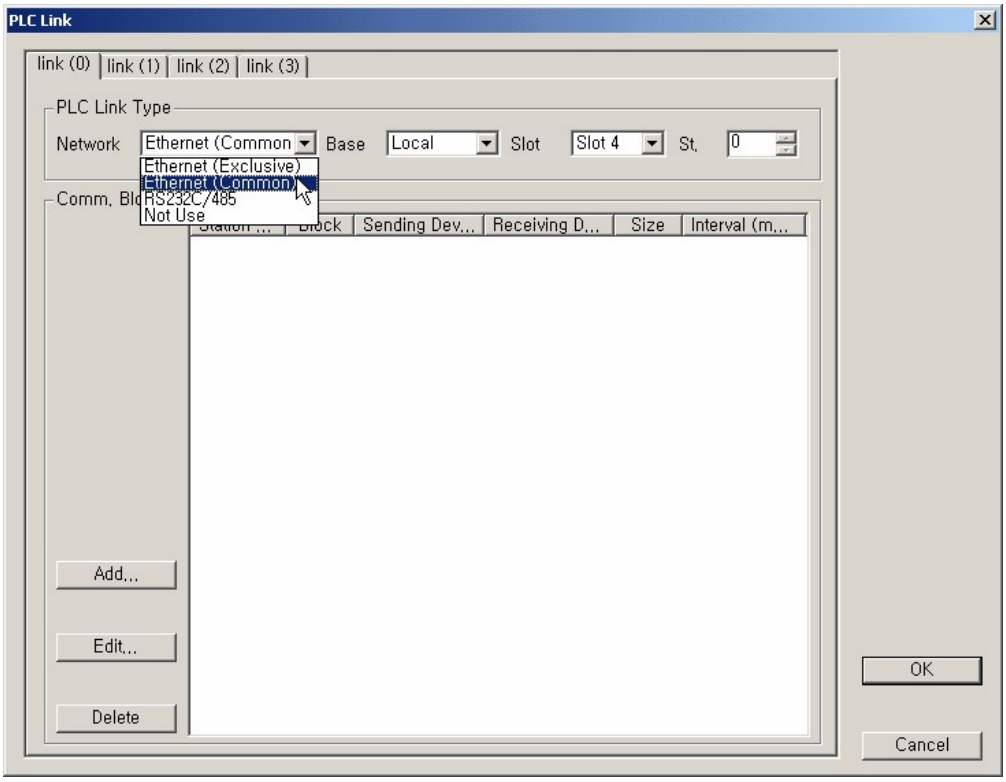
1) Selecting the PLC Link Parameter

If you select the PLC Link on the window like [Picture. Select the "PLC Link"], a PLC Link dialog box to set up the parameters will appear.
Link(0), Link(1), Link(2) and Link(3) on the top of [Picture 6-2. PLC Link Setup] mean the maximum number of mounted communication modules according to PLC CPU.
Up to 4 communication modules can be set up for one CPU.

2) Setting up the PLC Link Type

The PLC Link Type is used to set up basic items such as network type, base, slot number, station number and so on.

Picture. PLC Link Setup



Network This is used to set up the type of the communication module for PLC Link. If you do not use PLC Link, select the Not Use. Here, select the Ethernet (Exclusive).

Base This is used to select the base where the communication module for PLC Link is mounted. For example, if not base expansion (The base where a expansion card is mounted), select the Local. If base expansion (The base where a expansion card is mounted), select the Expansion Base where the communication module is mounted.

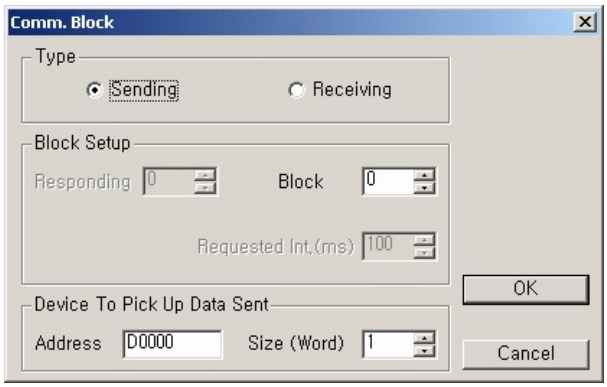
Slot This is used to select the slot number of the base where a communication module is mounted.

3) Setting up the communication block for PLC Link

Communication Block is used to register the information about sending/receiving real data. If you select

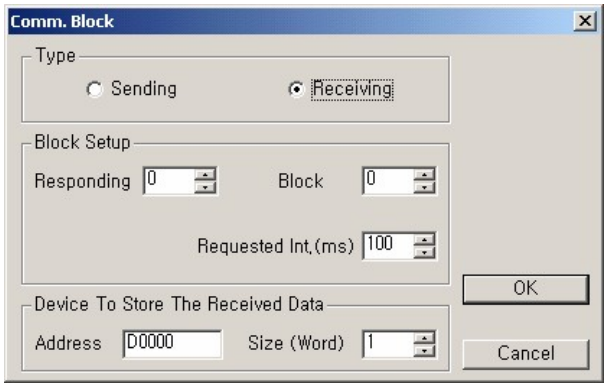
the Ethernet (Exclusive) as the Network and the Add button in **Picure. PLC Link Setup**, a Communication Block dialog box will appear like **Picture. Communication Block Setup**.

Picture. Communication Block Setup



Sending When communication modules communicate each other, this is used to send a selected block.

Receiving When communication modules communicate each other, this is used to receive a selected block.



Station No. When communication modules communicate each other, in case of sending data, it is not necessary to set up station number. But, in case of receiving data, the station number of a receiving communication module is to be selected. The station number can be set up in the range from 0 to 63.

Block No. The communication modules for a sending party communicate with each peculiar block number. In the same way, the communication modules for a receiving party have each peculiar block number to receive data. Receiving block number is used to detect the data that a receiving party wants together with the station number when a party communicates with a sending party. But, the block number can be set up in the range

from 0 to 31. To receive the data of a sending party, the same number is to be set up as the block number for the sending party and the block number for a receiving party.

Receiving Interval Receiving interval, a parameter to decide the interval at which data are sent, can be set up in the range from 50 ms to 3 sec according to users' need. For example, if 50 ms is set up as sending interval, data will be sent every 50ms.

Device To Pick Up Data Sent & Device To Store The Received Data (Address)

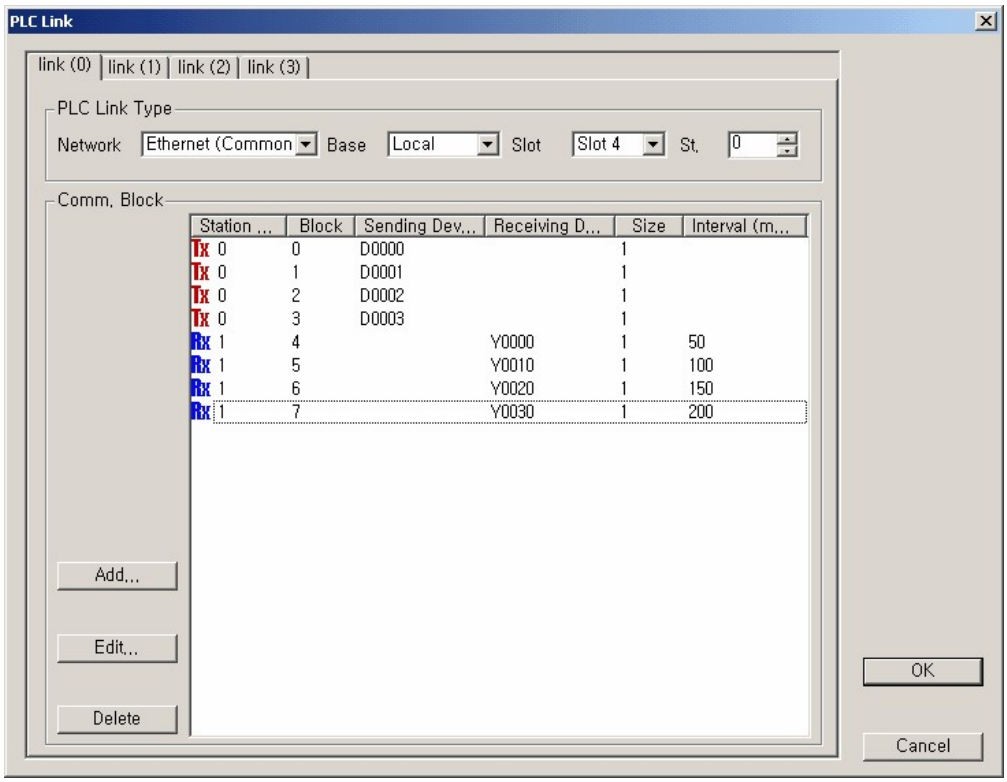
- When sending: This is used to set up the device where the data sent are read.
- When receiving: This is used to set up the device where the received data are stored.

Device To Pick Up Data Sent & Device To Store The Received Data (Size)

This, the size of the data sent or received, can be set up by the word. But, the size is from one word to 64 words. If the data size of a sending device is greater than the size of the data set up to a receiving device, the necessary data as much as the size of the one set up to the receiving device can be received selectively and used.

[Ex.] The communication module of Station 0 sends Block 0, 1, 2 and 3, and receives Block 4, 5, 6 and 7. And the communication module of Station 1 sends Block 4, 5, 6, and 7, receives 0, 1, 2 and 3. An Ethernet card is mounted at Slot 4. Each data size is one word and the interval is 50 ms, 100 ms, 150 ms and 200 ms. Such case is taken as an example and the PLC link parameter for it is configured as follows.

a. Station 0

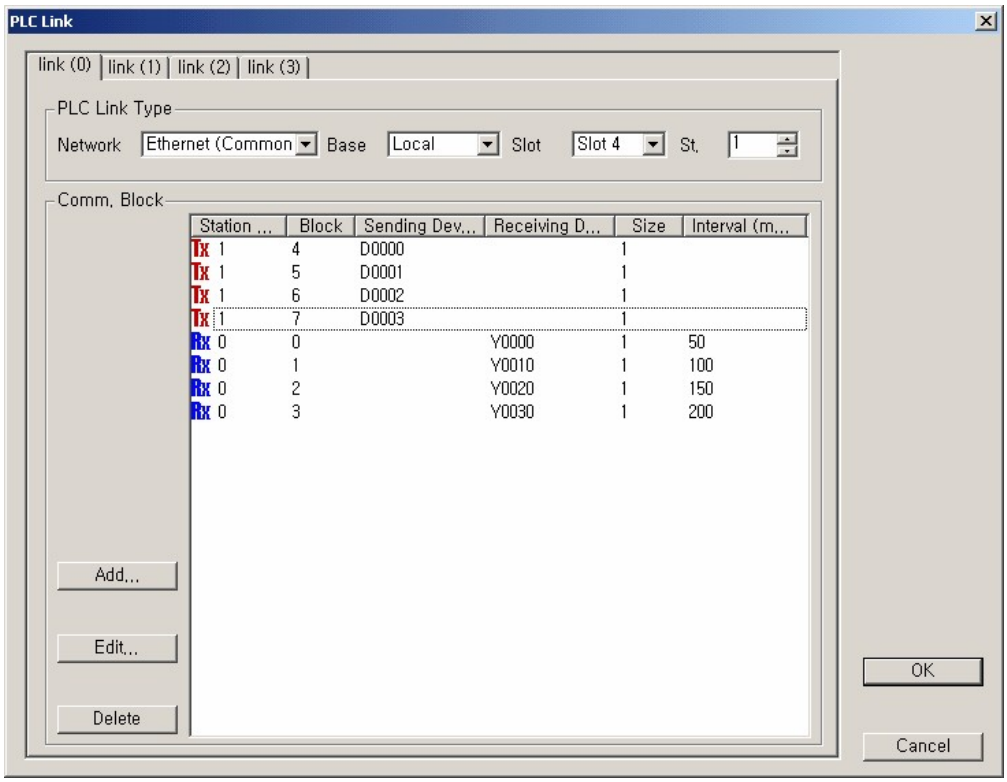


- **Sending Station :** If the frame requesting to receive is sent from other station, the station number and the block numbers of the received frame will be compared with sending blocks. If they are in accord, the data for the corresponding sending blocks are sent to the station requesting to receive.

- **Receiving Station :** The receiving frames are sent to the corresponding station at each receiving interval. The station receiving a sent frame makes sure whether there are corresponding blocks. If yes, the station sends the corresponding blocks. The receiving station stores the received data in the corresponding receiving device.

- The IP address of a corresponding station is to be stored in user data device. (Refer to No. 128 User Data Device in the user data memory map.)

b. Station 1



- **Sending Station :** If the frame requesting to receive is sent from other station, the station number and the block numbers of a received frame will be compared with sending blocks. If they are in accord, the data for the corresponding sending blocks are sent to the station requesting to receive.

- **Receiving Station :** The receiving frames are sent to the corresponding station at each receiving interval. The station receiving a sent frame makes sure whether there are corresponding blocks. If yes, the station sends the corresponding blocks. The receiving station stores the received data in the corresponding receiving device.

- The IP address of a corresponding station should be stored in user data device. (Refer to No. 128 User Data Device in the user data memory map.)

6.3.7.5 TCP Modbus Service

This function is to access CPU data memory with a PC through TCP Modbus protocol.

- Transport Layer: TCP/IP
- Half-Duplex (TCP/IP)

- Service Port: 502

TCP Modbus Command

Command	Description	Remarks
1 (Read Coil)	Accesses the bit device where data can be read and written.	Bit Read
2 (Read Input)	Accesses the bit device where data can be read.	Bit Read
3 (Read Holding)	Accesses the word device where data can be read and written.	Word Read
4 (Read Input)	Accesses the word device where data can be read.	Word Read
5 (Force Single Coil)	Accesses the bit device where data can be read.	Bit Write
6 (Preset Single Register)	Accesses the word device where data can be written.	Word Write
15 (Force Multiple Coils)	Accesses the bit device where data can be written.	Bit Write
16 (Preset Multiple Regs)	Accesses the word device where can be written.	Word Write

Address Map

TCP Modbus can correspond to the device memories of all types.

Bit / Word	Modicon Address	CIMON-PLC Address	Size CIMON-PLC
Bit Read Input	100001 ~ 104096	X 0000 ~	4096 Bits
	104097 ~ 106144	F 0000 ~	2048 Bits
	106145 ~ 107168	T 0000 ~	1024 Bits
	107169 ~ 108192	C 0000 ~	1024 Bits
Bit Read Coil	000001 ~ 004096	Y 0000 ~	4096 Bits
	004097 ~ 012288	M 0000 ~	8192 Bits
	012289 ~ 014336	K 0000 ~	2048 Bits
	014337 ~ 016384	L 0000 ~	2048 Bits
Word Input Register	300001 ~ 300256	X 0000 ~	256 Words
	300257 ~ 300384	F 0000 ~	128 Words
	300385 ~ 301408	TC 0000 ~	1024 Words
	301409 ~ 302432	CC 0000 ~	1024 Words
	302433 ~ 302482	S 0000 ~	50 Words
Word Holding Register	400001 ~ 400256	Y 0000 ~	256 Words
	400257 ~ 400384	K 0000 ~	128 Words
	400385 ~ 401408	TS 0000 ~	1024 Words
	401409 ~ 402432	CS 0000 ~	1024 Words
	402433 ~ 402560	L 0000 ~	128 Words
	402561 ~ 403072	M 0000 ~	512 Words
	403073 ~ 413072	D 0000 ~	10000 Words

Bit (Read Input, Read Coil) occupies the Modicon Address bit by bit.

[Ex.] Read Input -> 100001 : X0000, 100002: X0001, ... , 100017: X0010, ...

[Ex.] Read Coil -> 000001 : Y0000, 000002: Y0001, ..., 000017: Y0010, ...

Word(Input Register, Holding Register) occupies the Modicon address word by word.

[Ex.] Input Register -> 300001 : X0000, 300002->X0010, 300003->X0020, ...

[Ex.] Holding Register -> 402561 : M0000, 402562: M0010, 402563: M0020, ...

[Note] Some MODBUS Master devices can read/write the devices from 1 to 9999 in the range of each data type address. In this case, as the part corresponding to the devices that are greater than Modicon Address 9999 among PLC data cannot access, user programs may need to be processed.

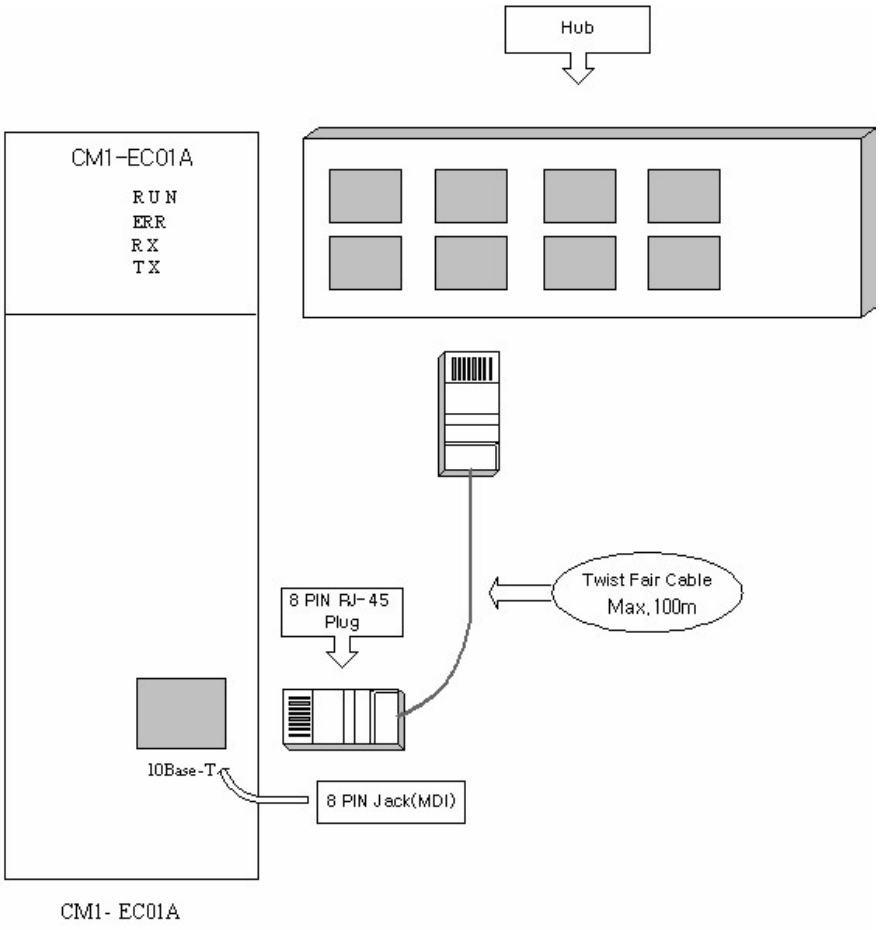
6.3.8 Installing and Testing

Safety Precautions :

- The maximum Ethernet communication modules mounted on the PLC standard base are four (4).
- Make sure the basic components necessary for the configuration of a system and mount suitable communication modules. Select the cable used for this communication module.
- When you mount this communication module, make sure whether there is dust and remains in the base connector to mount and whether the connector pins of this module are broken.
- Mount the modules in the state of the power-off.
- When you mount this module, insert the connecting part on the bottom of the module to the slot of a base exactly in the state that the communication cable is not connected and press the power sufficient to lock the module to the base completely. Otherwise, an error in the interface with CPU may occur.
- The cable used for this communication module is 10BASE-T cable.

Contents :

6.3.8.1 Installing 10BASE-T



Installation of 10 BASE-T

- The maximum segment length of 10 BASE-T is 100m (Length between a module and a hub). Generally, the straight cable that sending (TD) and receiving (RD) are twisted inside is used. In case you connect two communication modules one to one, use in the cross cable type.

- When you connect a hub to an optional card (Ethernet card), use one to one (Straight cable) connecting cable.
  The connection is like the following table. But, as the jack is for 8 pins, the remaining lines are connected as they are.

Pin Number	Signal	Straight Cable Between Hub and Module
1	TD+	1 – 1
2	TD-	2 – 2

3	RD+	3 – 3
6	RD-	6 - 6
4, 5, 7, 8	Not Used	

- Twist Line RD(+) – Line TD(+) and Line RD(-) – Line TD(-) to make one to one Cross cable.

Pin Number	Signal	One to One Cross Cable
1	TD+	1 – 3
2	TD-	2 – 6
3	RD+	3 – 1
6	RD-	6 - 2
4, 5, 7, 8	Not Used	

- As 10 BASE-T cable is structurally weak against external noise, twist the lines for Pin 1 and Pin 2, which are TD+ and TD-, and the lines for Pin 3 and Pin 6, which are RD+ and RD-, each other. After that, assemble the two twisted lines to make the wiring resistant against noise.
- The power for a hub is to be separated from the power for a PLC. Use the power resistant against noise as the power for a hub.
- The cable is to be installed 100㎜away from the line on which high current flows such as power line.
- Please consult with an expert to process and manufacture cable terminal.

6.3.8.2 Testing

Suggestions for system configuration

- The PLC Link station numbers of all other communication modules as well as Ethernet module should be different each other.
- If duplicated station number is accessed in case of PLC Link, an error will occur in communication.
- In case of normal operation, the mode switch of the CPU should be shifted to the RUN mode.
- Use the communication cable of the assigned standard.
- Check whether the communication cable is cut or short.
- The use of other cable except the assigned may cause serious communication obstruction.
- Tighten up the communication cable connecter to fix cable connection. Otherwise, the serious obstruction to communication may occur.
- As the flexibility of a coaxial cable is low, it should be branched over 30 cm down from the connecter of a communication module. If you bend a coaxial cable perpendicularly or transform it unreasonably, the

cable may be cut and the connecter of the communication module may be broken.

- In case of a long-distance communication cable, the cable should be wired away from the power line or the induced noise.
- If the ERR LED the communication module is ON, make sure and take action for the reason of an error in the module, referring to Chapter 9 Troubleshooting. If you follow-up as the manual, please call an A/S center.

Items Confirmed Before Test

The following is the explanation for the contents confirmed before you test.

Communication Module Mounted on a PLC

Item	Description
S/W	Is the CICON installed and operated well?
Communication Cable	Are the connection of the communication cable and the state of tap all right? Is the connection of each cable open roof type?
Module	Is the communication module mounted on the base?

Order of Test

The following shows the order from post-installation for a PLC to test.

Start

Inputting Power

- Make sure input power
- Make sure the connection of communication cable
- Input Power
- Make sure whether the power LED of the power is ON
- Make sure the state of the LED of the CPU module
- Make sure whether the state of the LED of the communication module is normal.

Programming :

- After programming in the CICON, to write the result to CPU.

Checking Sequence :

- Make sure the operation of the communication module according to the program.

Editing Program :

- If there is an error in the sequence program, edit.

Preserving Program

- To store the program in a floppy disc or a hard disc.
- To print the program and the list with a printer.
- To store the program in a memory module, if necessary.

Finish

If an error code of optional card is received in the CICON, and the ERR Led of an Ethernet card is ON or blinks, please call an A/S center.

6.3.8.3 Maintenance and Check up

The checkups for the following items are needed every three-month. Please take action, if necessary.

Item		Method	Standard	Action
Ambience	Temperature	Thermometer /Hygrometer	0 ~ 55 ℃	Adjust according to general standard.
	Humidity		5 ~ 95%RH	
	Pollution level	Measuring Corrosive Gas	No Corrosive gas	
Module	Loosening, shaking	Moving communication Module.	Mounted tightly	Tighten nuts.
	Dust, remains	Inspection with the naked eye	No dust, no remains	
Connection	Loosening terminal screw	Tightening with a driver	No loosening	Tighten.
	Compressed terminal	Inspection with the naked eye	Suitable gap	Correct.
	Connecter loosened	Inspection with the naked eye	No loosening	Tighten the connecter fixing screw.
Power voltage		Measuring voltage between the terminal for AC 110 and the terminal for 220V	AC 85 ~ 132V AC 170 ~ 264V	Change the power supply.

6.3.9 Trouble Shooting

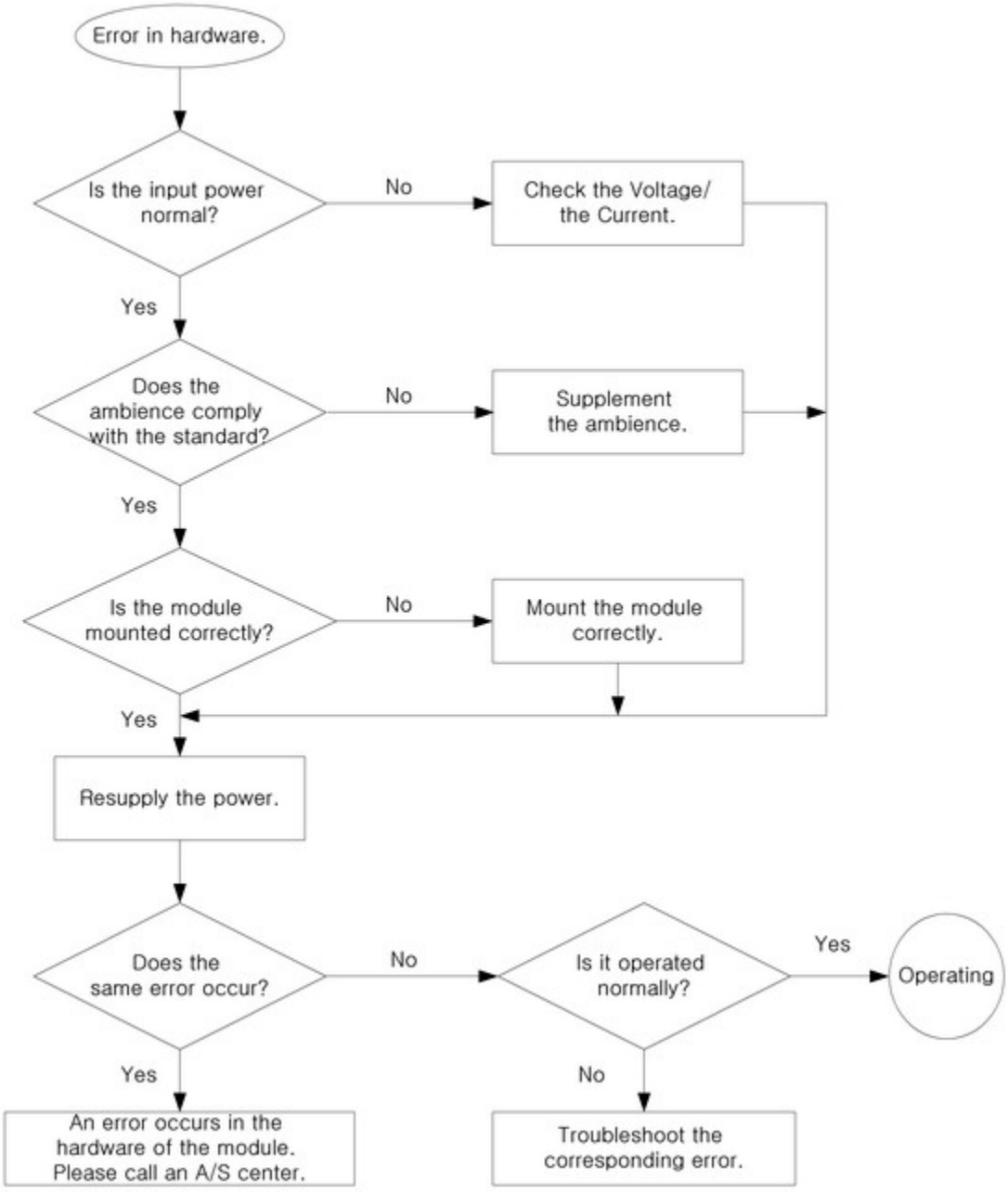
Contents :

6.3.9.1 Error Codes for System

Error Code		Description	Remarks
Deci	Hexa		
0	0x0000	No error	
1	0x0001	A specialty module is not initialized.	
2	0x0002	EEPROM is not initialized.	
3	0x0003	-	
4	0x0004	-	
5	0x0005	Not able to write to buffer memory.	
6	0x0006	Not able to read buffer memory.	
7	0x0007	A CPU module is dismounted.	
8	0x0008	Station number for PLC LINK is duplicated.	
9	0x0009	-	
10	0x000A	-	
11	0x000B	-	
12	0x000C	-	
13	0x000D	Buffer is overflowed.	
14	0x000E	-	
15	0x000F	Accesses Graphic Loader over the maximum.	
16	0x0010	Not able to access EERROM.	
17	0x0011	Sending/receiving data size for PLC LINK is exceeded.	
18	0x0012	Not able to send specialty program.	
19	0x0013	-	
20	0x0014	No. of PLC LINK stations is over the Maximum.	

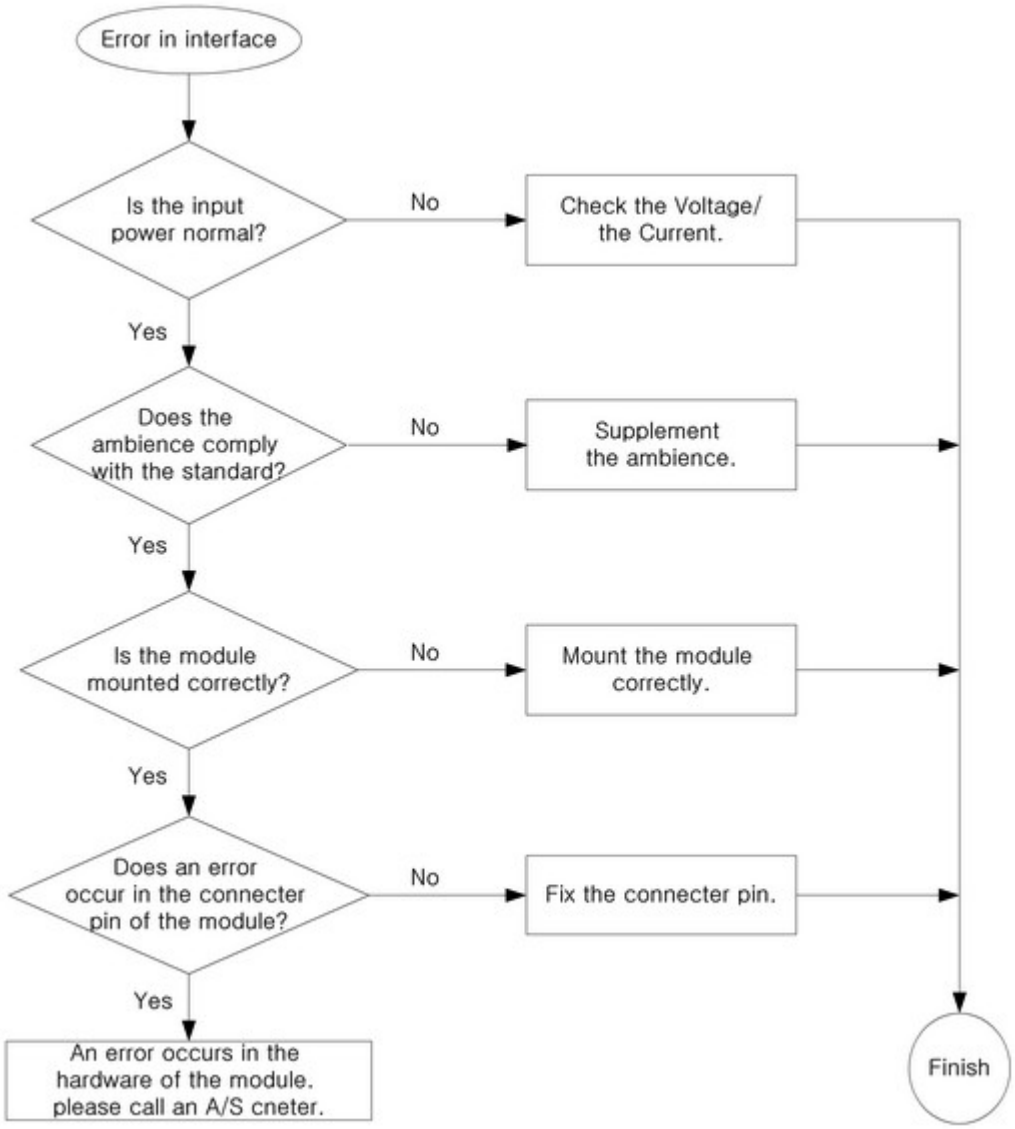
6.3.9.2 Error in Hardware

This corresponds to Error Code 1, 2, 6 and 7.



6.3.9.3 Error in Interface

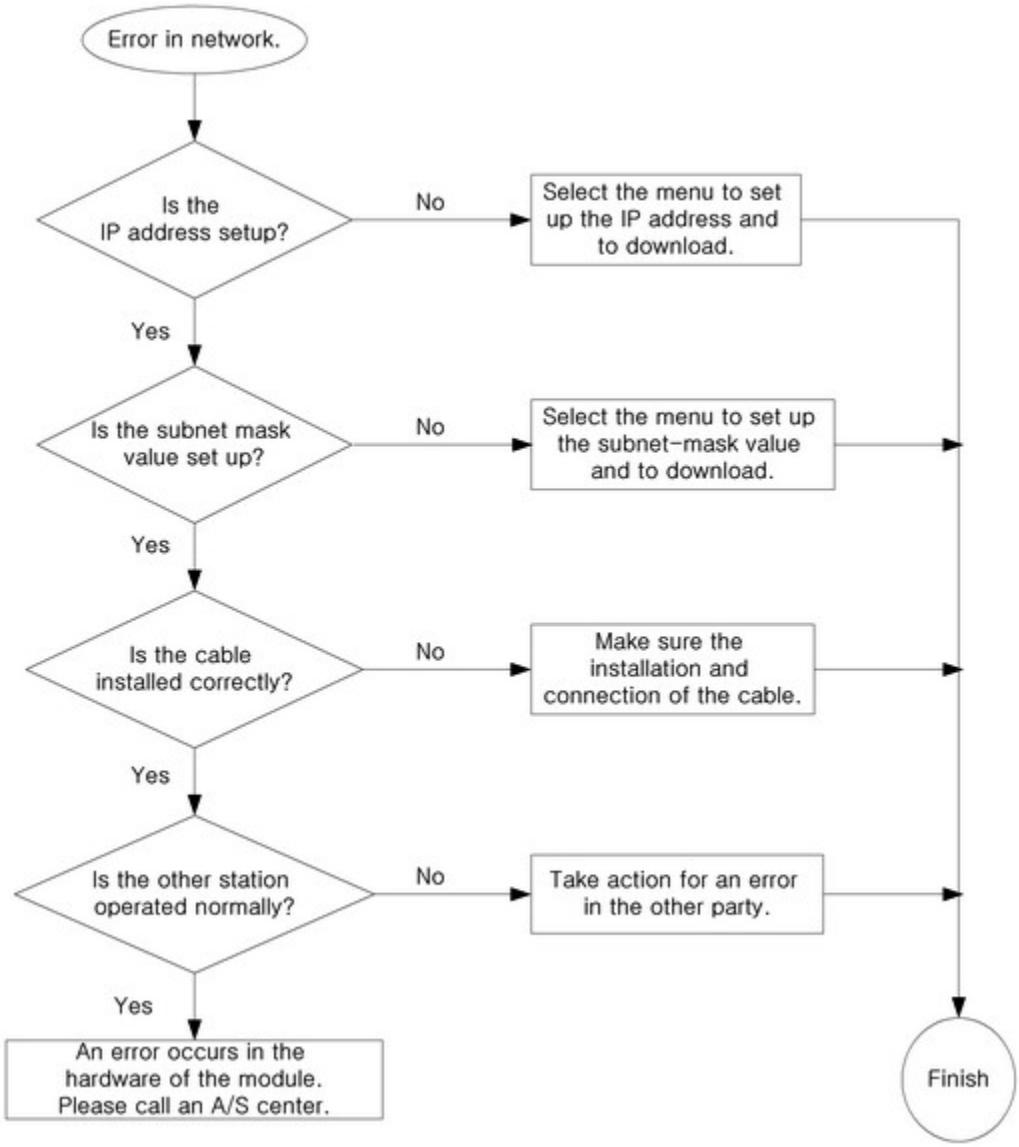
This corresponds to Error Code1, 3, 5, 6 and 7.



6.3.9.4 Error in Network

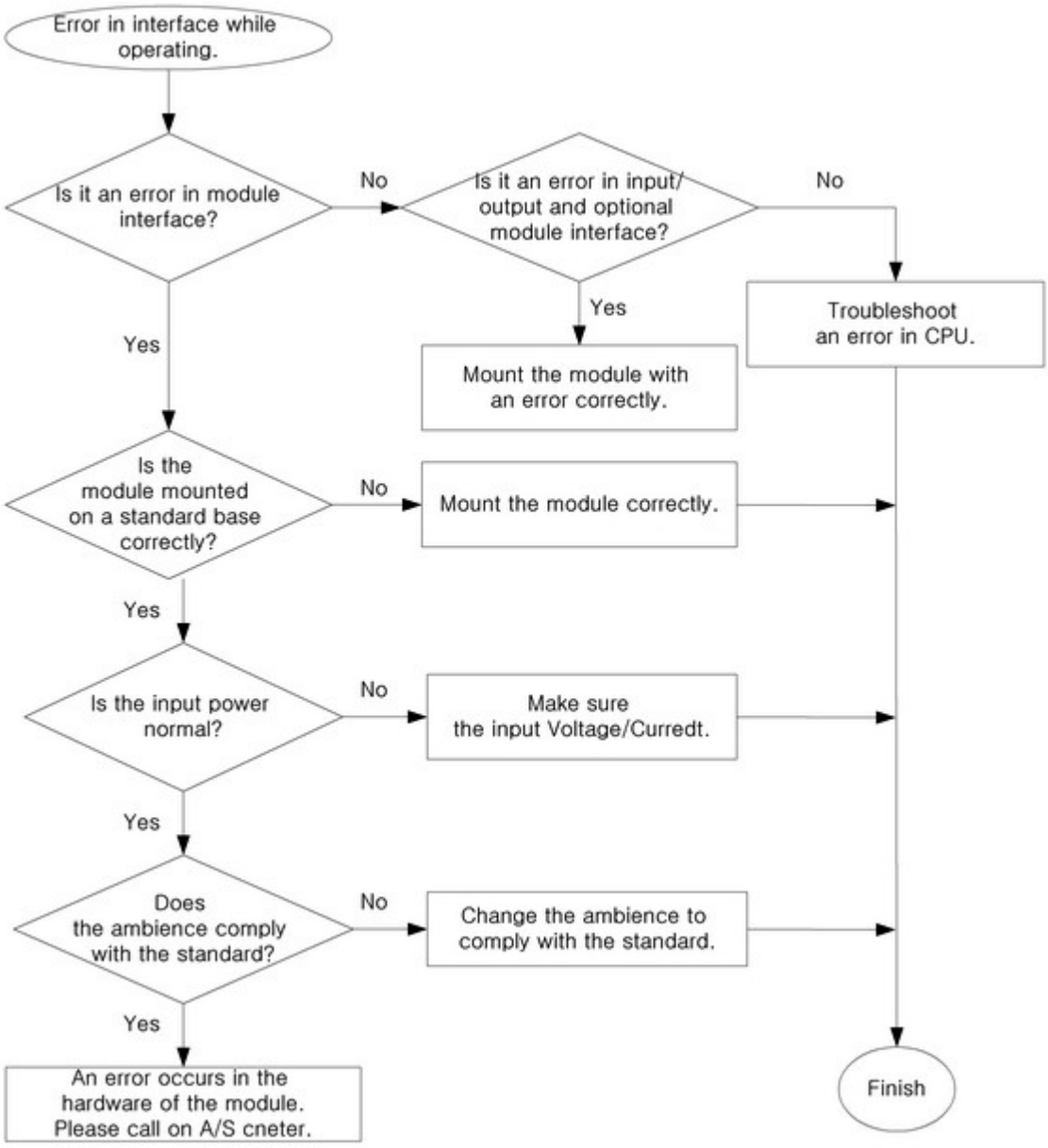
Communication and networking are bad.

This corresponds to Error Code 3, 4 and 6.

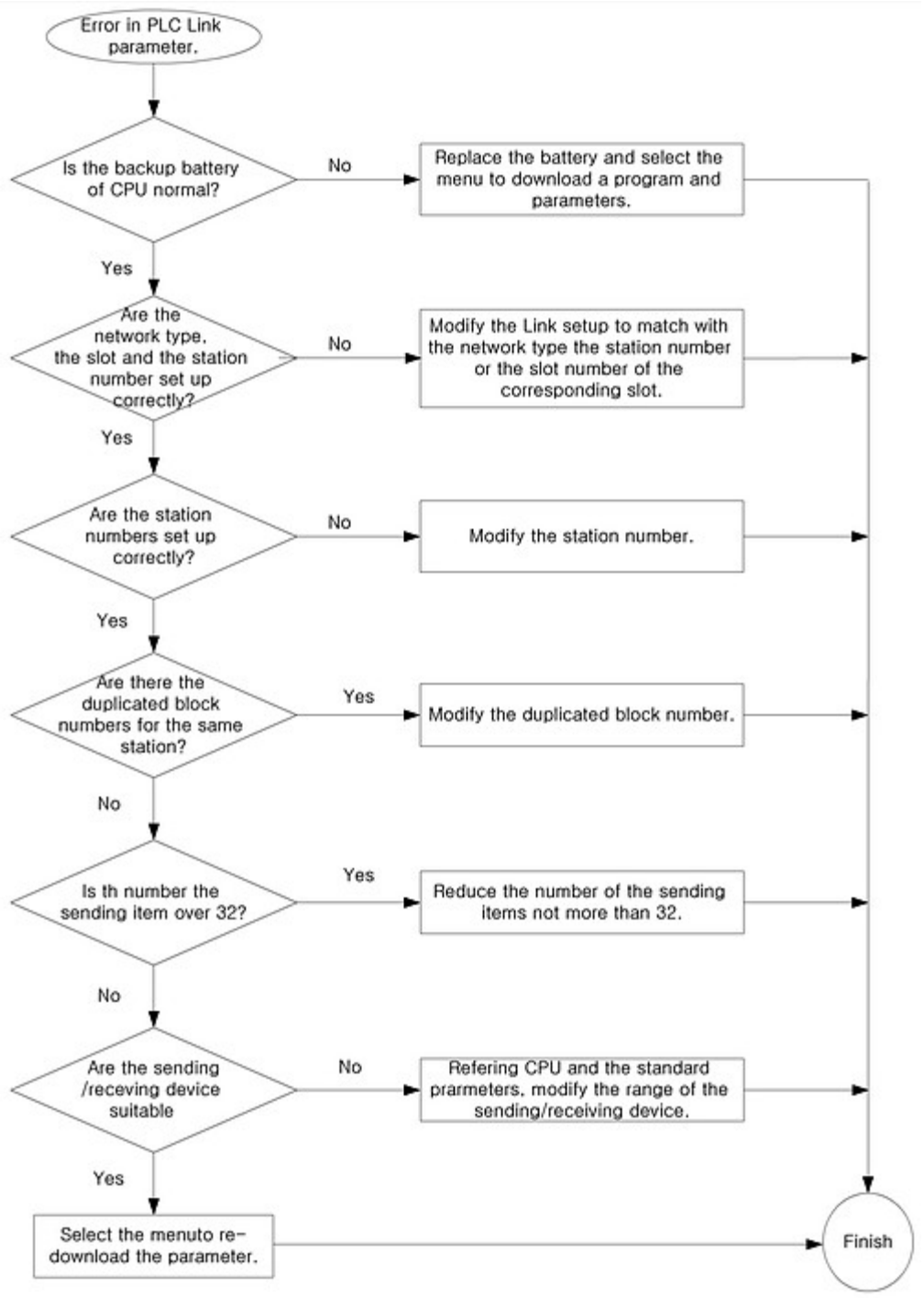


6.3.9.5 Error in the Interface with CPU while Operating

This corresponds to Error Code 3, 6 and 7.



6.3.9.6 Error in PLC Link Parameter



6.3.9.7 Error in PLC Link Operation

This corresponds to Error Code 8, 9, 10, 11, 12, 13 and 14.

6.3.10 CIMON PLC HMI Protocol Service

Contents :

6.3.10.1 Structure of Frames

Application Frame of CIMON PLC Ethernet Module

Application Data Format	
Application Header Format	Application Instruction Format

Master Frame Format (PC Party)

ID	Frame No.	Cmd	Res.	Length	Data	Check Sum

Item	Size (Byte)	Description
ID	9	Company ID
Frame No.	1	Frame Number
Cmd	1	Command
Res.	1	Reserved Device
Length	2	Length of Data Field
Data	1456	Data Device
Check Sum	2	Accuracy Check of Data

a) ID

This is a 9-byte string like ?KDT_PLC_M

”

.

b) Frame No.

This, 1-byte data with the range from 0 to 127, is the number of the frame controlled by Master party. The start of this number can be any one within the range. But, when a new frame is sent, the number should be the value that '1' is increased to the number given to the previous frame. If the frame of the same number is received in Slave party in the state that the response frame to the previous frame is not sent, the frame will be disregarded. If the response frame to the previous frame is sent and the frame of the same number is received, Slave party will respond normally.

c) Cmd

In Master, 1-byte command as the following table can be used and the format of 'Data' field is selected according to each command.

Cmd Code	Function	Remarks
52h	Word Block Read	Reads data by the word.
57h	Word Block Write	Writes data by the word.
72h	Bit Block Read	Reads data by the bit.
77h	Bit Block Write	Writes data by the bit.

d) Res.

Reserved. (1 Byte, 00h) – Reserved device

e) Length

This is the 2-byte value indicating the size of 'Data' field. (Hexadecimal Figure)

f) Check-Sum

This is used to check the accuracy of data. After the data are received one by one and are summed, they are compared with the last coming check-sum to check whether an error occurs.
This is 2-byte value. After the entire frame is binary-summed by the byte, the lower 2-byte in the result value is used.

Slave Frame (Ethernet Module Party)

ID	Frame	Cmd	Res.	Length	Data	Check Sum

	No.					

a) ID

This is a 9-byte string like ?KDT_PLC_S

”

.

b) Frame No.

This is 1-byte data. The value that 128 are added to the number of the command frame received from the Master is used. As the Master receiving response frame expects the number of the response frame from the frame number used to command frame, it can be checked whether a frame is normal, using this Frame No.

c) Cmd

In Slave, 1-byte command as the following table can be used and the format of ‘Data’ field is selected according to each command.

Cmd Code	Function	Remarks
52h	Word Block Data	
72h	Bit Block Data.	
41h	ACK Resp.	

d) Res.

Reserved. (1 Byte, 00h) – Reserved Device

e) Length

This is the 2-byte value indicating the size of ‘Data’ field. (Hexadecimal Figure)

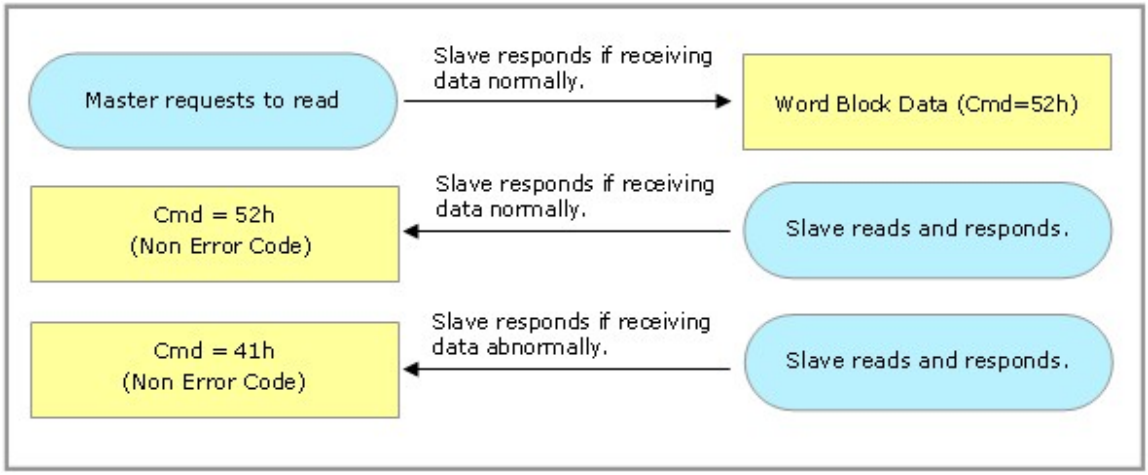
f) Check-Sum

This is used to check the accuracy of data. After data are received one by one and are summed, they are compared with the last coming check-sum to check whether an error occurs.

This is 2-byte value. After the entire frame is binary-summed by the byte, the lower 2-byte in the result value is used.

6.3.10.2 Word Block Read

This function is to assign PLC device memory directly to read according to memory data type. The data can be assigned up to 16 pieces repeatedly. The total sum of the word data should be not over 512 words.



Requested Format (PC -> PLC)

- Word Block Read (Master sends.)
- Cmd – 52h

ID	Frame No.	Cmd	Res.	Length	Data	Check Sum

ID : This is a 9-byte string like ?KDT_PLC_M

”

.

FrameNo : This, a 1-byte data with the range from 0 to 127, is the number of the frame controlled by Master party.

Cmd : 1 Byte, 52h(Word Block Read)

Res : 1 byte of the reserved device (00h)

Length : Total number of the bytes of a frame data device

Data : (Ex.) The case to read 128 words from ‘Y00000’

Offset (Byte)	Meaning of Data	Ex.	Remarks

0	Main Device Prefix (ASCII)	'Y'	Assigns the ASCII Prefix of the word device supported from a PLC.
1	Sub-Device Prefix or '0' (ASCII)	'0'	Sub-Prefix in case of the 2-character prefix device
2	Device Address (ASCII)	'0'	The word address or the card number of a corresponding device is used. That is, in case of bit device such as X/Y, the last number should be '0'.
3		'0'	
4		'0'	
5		'0'	
6		'0'	
7		'0'	
8	Read Size (Word)	00h	Value in the range from 0001h to 0200h (1~512)
9		80h	

Check Sum : This is 2-byte value. After the entire frame is binary-summed by the byte, the lower 2-byte in the result value is used.

Responded Format

ACK Response

This is the frame sending the data of the word block that Master requests to read, in case of receiving Master's request correctly and responding.

Cmd – 52h

Data Device:

Offset (Byte)	Meaning of Data	Ex.	Remarks
0 ~ 9	Block Address		The first 10 bites of the data in the block assigned to a Master frame are copied and stored.
10	Word Data #0		The first word data of Read Block
11			
12	Word Data #1		The second word data of Read Block
13			
.....			
m-1	Word Data #n		The last word data of Read Block
m			

NACK Response

In case that the service to 'Word Block Read' cannot be given due to an error in a system or other reason, Cmd – 41h

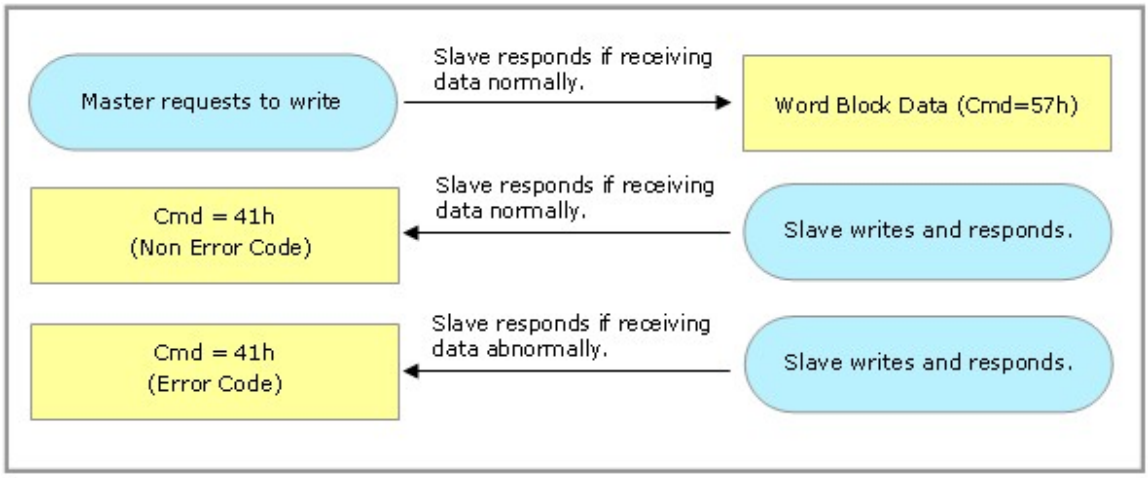
In the case of responding to Error Code (Refer to the Error Code table for the Exclusive Service.)

Data Device

Offset (Byte)	Meaning of Data	Ex.	Remarks
0	Error Code	00h	Error Code (Error in the size of a requested data)
1		04h	

6.3.10.3 Word Block Write

This function is to assign PLC device memory directly to write according to memory data type. The data can be assigned up to 16 pieces repeatedly.
But, The total sum of word data is not to be over 64 words.



Requested Format (PC -> PLC)

- Word Block Write (Master sends.)
- Cmd – 57h

ID	Frame No.	Cmd	Res.	Length	Data	Check Sum

ID : This is a 9-byte string like ?KDT_PLC_M
”

.

FrameNo : This, 1-byte data with the range from 0 to 127, is the number of the frame controlled by Master party.

Cmd : 1 Byte, 57h(Word Block Read)

Res : 1 byte of reserved device (00h)

Length : Total number of the bytes of a frame data device

Data : The case to write 2 words as 1 and 256 each from 'Y0000'

Offset (Byte)	Meaning of Data	Ex.	Remarks
0	Main Device Prefix (ASCII)	'Y'	Assigns the ASCII Prefix of the word device supported from a PLC.
1	Sub-Device Prefix or '0' (ASCII)	'0'	Sub-Prefix in case of the 2-character prefix device (TC, TS, CC, CS)
2	Device Address (ASCII)	'0'	The word address or the card number of a corresponding device is used. That is, in case of bit device such as X/Y, the last number is to be '0'.
3		'0'	
4		'0'	
5		'0'	
6		'0'	
7		'0'	
8	Write Size (Word)	00h	Value in the range from 0001h to 0040h (1~64)
9		02h	
10	Write Data (Word)	00h	Write Value
11		01h	
12	Write Data (Word)	01h	Write Value
13		00h	

Check Sum : This is 2-byte value. After the entire frame is binary-summed by the byte, the lower 2-byte in the result value is used.

Responded Format

ACK Response

This is the frame responding to 'Word Block Write' that Master requests to write, in case of receiving Master's request correctly and responding.

Cmd – 41h

Data Device

Offset (Byte)	Meaning of Data	Ex.	Remarks
0	Error Code	00h	Error Code (Non Error Code)
1		00h	

NACK Response

In case that the service to 'Word Block Write' cannot be given due to error in a system or other reason, Cmd – 41h

In the case of responding to Error Code (Refer to the Error Code table for the Exclusive Service.)

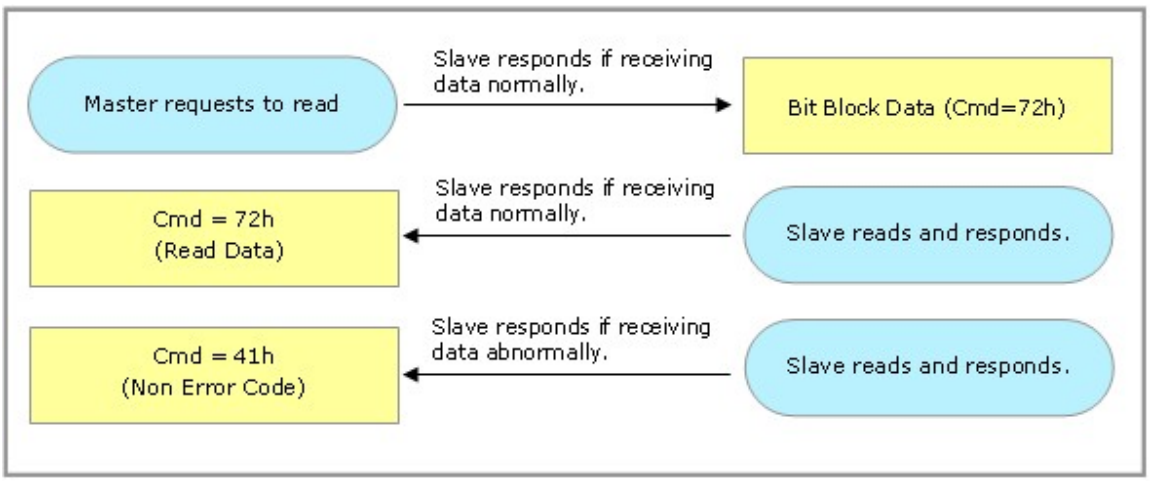
Data Device

Offset (Byte)	Meaning of Data	Ex.	Remarks
0	Error Code	00h	Error Code (Over Number of the Write Blocks)
1		06h	

6.3.10.4 Bit Block Read

This function is to assign PLC device memory directly to read bit block. The data can be assigned up to 16 pieces repeatedly.

But, The total sum of the word data is not to be over 1024 bits.



Requested Format (PC -> PLC)

- Bit Block Read(Master sends.)
- Cmd – 72h

ID	Frame No.	Cmd	Res.	Length	Data	Check Sum

ID : This is a 9-byte string like ?KDT_PLC_M
”

.

FrameNo : This, 1-byte data with the range from 0 to 127, is the number of the frame controlled by Master party.

Cmd : 1 Byte, 72h(Word Block Read)

Res : 1 byte of a reserved device (00h)

Length : Total number of the bytes of a frame data device

Data : (Ex.) The case to read 128 bits from ‘T0000’

Offset (Byte)	Meaning of Data	Ex.	Remarks
0	Main Device Prefix (ASCII)	‘T’	Assigns the ASCII Prefix of the bit device supported from a PLC.
1	Sub-Device Prefix or ‘0’ (ASCII)	‘0’	Sub-Prefix in case of the 2-character prefix device (TC, TS, CC, CS)
2	Device Address (ASCII)	‘0’	The bit address of a corresponding device is used.
3		‘0’	
4		‘0’	
5		‘0’	
6		‘0’	
7		‘0’	
8	Read Size (Bit)	00h	Value in the range from 0001h to 0400h (1~1024)
9		80h	

Check Sum : This is 2-byte value. After the entire frame is binary-summed by the byte, the lower 2-byte in the result value is used.

Responded Format

ACK Response

This is the frame sending the data of the bit block that Master requests to read, in case of receiving Master' s request correctly and responding.
Cmd – 72h

Data Device

Offset (Byte)	Meaning of Data	Ex.	Remarks
0 ~ 9	Block Address	-	The first 10 bites in the data of the block assigned to a Master frame are copied and stored.
10	Bit Data #0	'1'	The first bit data of Read Block
11	Bit Data #1	'1'	The second bit data of Read Block
.....			
m	Bit Data #n		The last bit data of Read Block

NACK Response

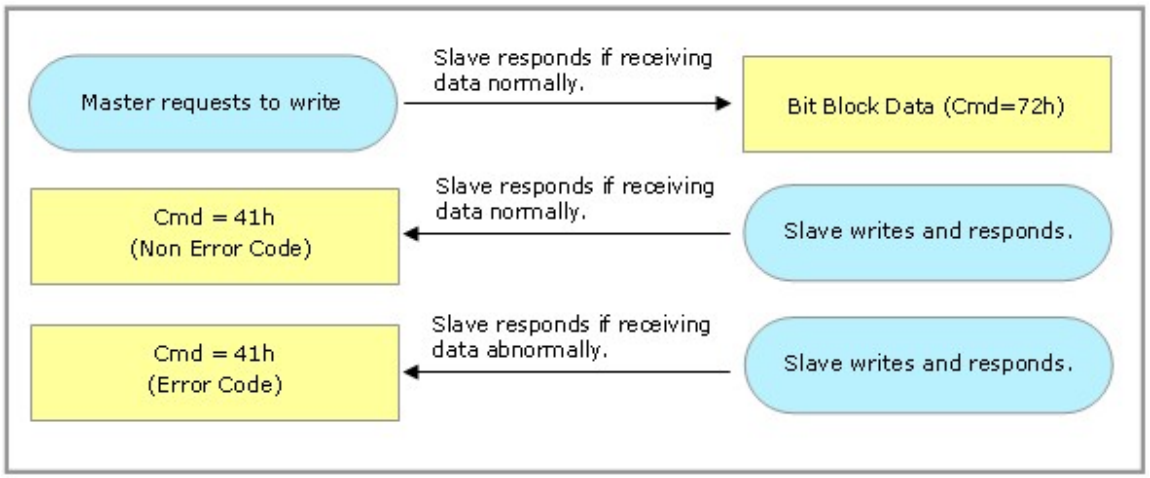
In case that the service to 'Word Block Read' cannot be given due to error in a system or other reason,
Cmd – 41h
In the case of responding to Error Code (Refer to the Error Code table for the Exclusive Service.)

Data Device

Offset (Byte)	Meaning of Data	Ex.	Remarks
0	Error Code	00h	Error Code (Error in the size of the requested data)
1		04h	

6.3.10.5 Bit Block Write

This function is to assign PLC device memory directly to write the bit block. The data can be assigned up to 16 pieces repeatedly.
But, The total sum of the word data is not to be over 256 bits.



Requested Format (PC -> PLC)

- Bit Block Write (Master sends.)
- Cmd – 77h

ID	Frame No.	Cmd	Res.	Length	Data	Check Sum

ID : This is a 9-byte string like ?KDT_PLC_M

”

.

FrameNo : This, a 1-byte data with the range from 0 to 127, is the number of the frame controlled by Master party.

Cmd : 1 Byte, 77h(Bit Block Write)

Res : 1 byte of a reserved device (00h)

Length : Total number of the bytes of a frame data device

Data : (Ex.) ‘The case to write 4 bits as 1, 0, 0, 1 from Y0000D’

Offset(Byte)	Meaning of Data	Ex.	Remarks
0	Main Device Prefix (ASCII)	‘Y’	Assigns the ASCII Prefix of the bit device supported from a PLC.
1	Sub-Device Prefix or ‘0’ (ASCII)	‘0’	Sub-Prefix in case of the 2-character prefix device
2	Device Address	‘0’	The bit address of a corresponding device is used.

3	(ASCII)	‘0’	
4		‘0’	
5		‘0’	
6		‘0’	
7		‘D’	
8	Write Size (Bit)	00h	Number of bits, Value in the range from 0001h to 0100h (1~256)
9		04h	
10	Bit Data	‘1’	Bit Value (ASCII, Set=’1’, Reset=’0’)
11	Bit Data	‘0’	Bit Value (ASCII, Set=’1’, Reset=’0’)
12	Bit Data	‘0’	Bit Value (ASCII, Set=’1’, Reset=’0’)
13	Bit Data	‘1’	Bit Value (ASCII, Set=’1’, Reset=’0’)

Check Sum : This is 2-byte value. After the entire frame is binary-summed by the byte, the lower 2-byte in the result value is used.

Responded Format

ACK Response

This is the frame responding to ‘Bit Block Write’ that Master requests to write, in case of receiving Master’s request correctly and responding.
Cmd – 41h

Data Device

Offset(Byte)	Meaning of Data	Ex.	Remarks
0	Error Code	00h	Error Code (Non Error Code)
1		00h	

NACK Response

In case that the service to ‘Bit Block Write’ cannot be given due to error in a system or other reason,
Cmd – 41h
In the case of responding to Error Code (Refer to the Error Code table for the Exclusive Service.)

Data Device

Offset(Byte)	Meaning of Data	Ex.	Remarks
0	Error Code	00h	Error Code (Error in Bit Write Data)

1		0Dh	

6.3.10.6 Error Codes for Exclusive Service

Code	Description
0000h	No Error (Cmd=57h/77h, the response in case that the command is successfully processed.)
0001h	Error in system (No link with CPU)
0002h	Invalid Device Prefix
0003h	Invalid Device Address
0004h	UDP_ERR_READ_DATASIZE (Error in requested data size)
0005h	UDP_ERR_BLOCK_SIZE (Over 16 requested blocks)
0006h	The case that buffer memory send an error in data and size
0007h	Over receiving buffer capacity
0008h	Over sending time
0009h	UDP_ERR_INVALID_HEADER (Error in header)
000Ah	Error in Check-Sum (Check-Sum of received data)
000Bh	Error in the information on Frame Length (Total received frame size)
000Ch	UDP_ERR_WRITE_DATASIZE (Error in the size to write)
000Dh	Unknown Bit Value (Error in Bit Write Data)
000Eh	Unknown Command
000Fh	Disabling state from writing
0010h	Error in CPU process

6.4 A/D Converters

A/D Modules are used to convert analog signals (Direct voltage or current) from the outside to signed 16-bit binary digital values.

Features :

- CM1-AD04VI is the A/D module used to input 4-Channel voltage and 4-Channel current.
  CM1-AD08I is the A/D module used to input 8–Channel current.
  CM1-AD08V is the A/D module used to input 8-Channel voltage.

- CM1-AD04VI 0~20mA,4~20mA,0~5V,1~5V,-10~10V,0~10V
  CM1-AD08I 0~20mA, 4~20mA

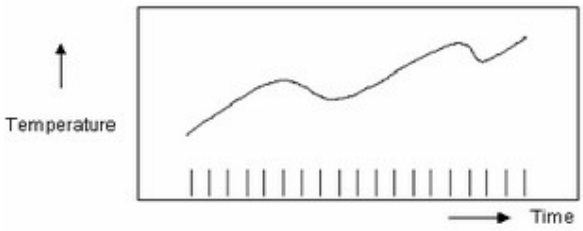
CM1-AD08V 0~5V, 1~5V, -10~10V, 0~10V

An input signal is converted to a digital value from 0 to 16000 or from –8000 to 8000.

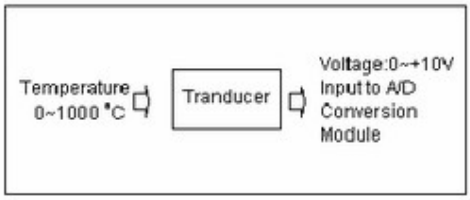
- Average or sampling is the method used to process input signal.
- As the resolution for digital value is selected as 1/16000, high-resolution digital values will be gotten.
- The number of the modules used for one base is not limited.

Contents :

6.4.1 General Idea

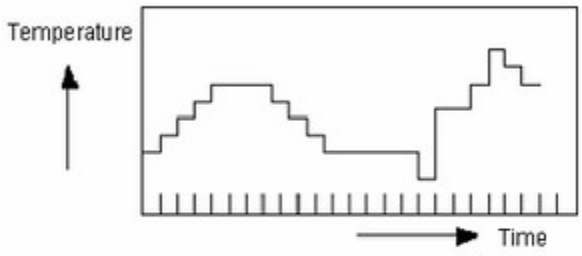


[Figure 1.1] Analog Value

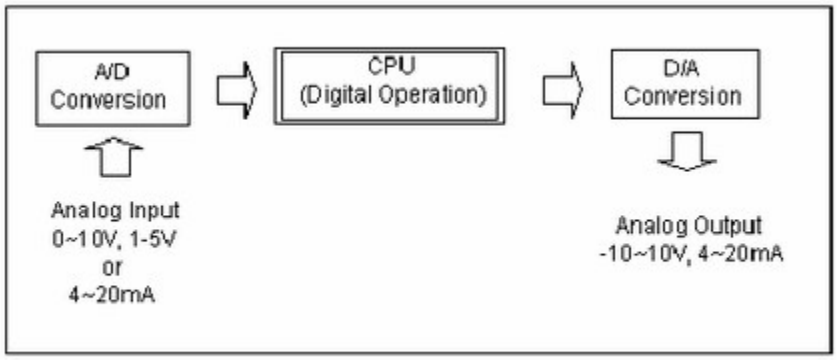


[Figure 1.2] Example of Tranducer

Digital Value - D



[Figure 1.3] Digital value



[Figure 1.4] Process in a PLC

The value shown as number such as 0, 1, 2 and 3, and varied non-continuously is called digital value. ON signal and OFF signal are shown as the digital value of 0 and 1. BCD values and binary values are also digital values.

To operate with digital values, analog values cannot be inputted directly to a CPU module.

Therefore, analog values are to be converted to digital values like Picture 1.4, and to be inputted to a CPU.

To output analog values, it is necessary to convert the digital values in a CPU to analog values.

6.4.2 Specifications

- General Specification
- Technical Specification
- Dimensions

6.4.2.1 General Specification

Item	Specification			
Operating Temperature	-10 ~ 65ºC			
Storage Temperature	-25 ~ 80ºC			
Operating Humidity	5 ~ 95%RH, Not condensed.			
Storage Humidity	5 ~ 95%RH, Not condensed.			
Vibration	In case of intermittent vibration			
	Frequency	Acceleration	Amplitude	Sweep
	10 ≤ f< 57Hz	-	0.075mm	10 times in each direction (X,Y,Z)
	57 ≤ f < 150 Hz	9.8m/s2 {1G}	-	
	In case of continuous vibration			
	Frequency	Acceleration	Amplitude	Sweep
	10 ≤ f < 57Hz	-	0.035mm	10 times in each direction (X,Y,Z)
	57 ≤ f < 150 Hz	4.9m/s2 {1G}	-	
Shock	- Max. Shock Acc.: 147 m/s2 {15G} - Time : 11ms - Pulse Wave : Half sine wave pulse			
Noise	Square wave impulse noise	±1500V		
	Electrostatic discharge	Voltage: 4 kV(Contact discharge)		
	Radiated electro-magnetic field	27 ~ 500 MHz. 10 V/m		
	Fast Transient Bust Noise	Item	Power Module	Digital I/O (24V or more) / Digital I/O(Less than 24V) Analog I/O Comm. interface
		Voltage	2KV	1KV / 0.25KV
Environment	No corrosive gas and no dust.			
Altitude	2,000m or less			
Pollution	Less than 2			
Cooling	Natural Air cooling			

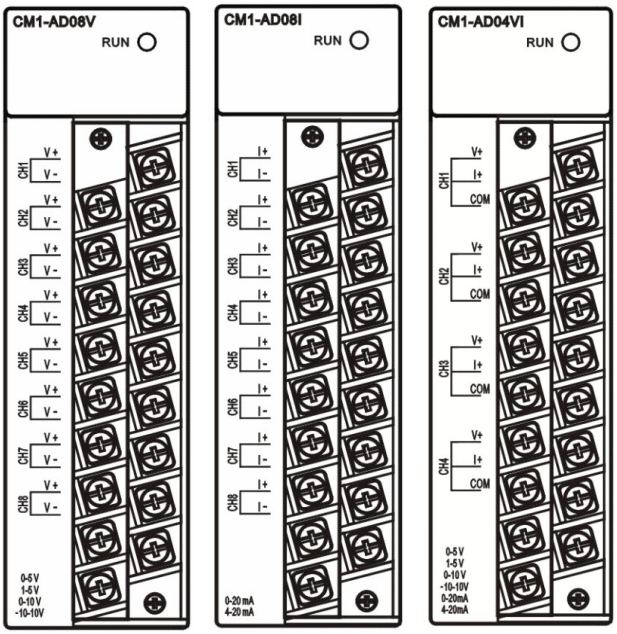
6.4.2.2 Technical Specification

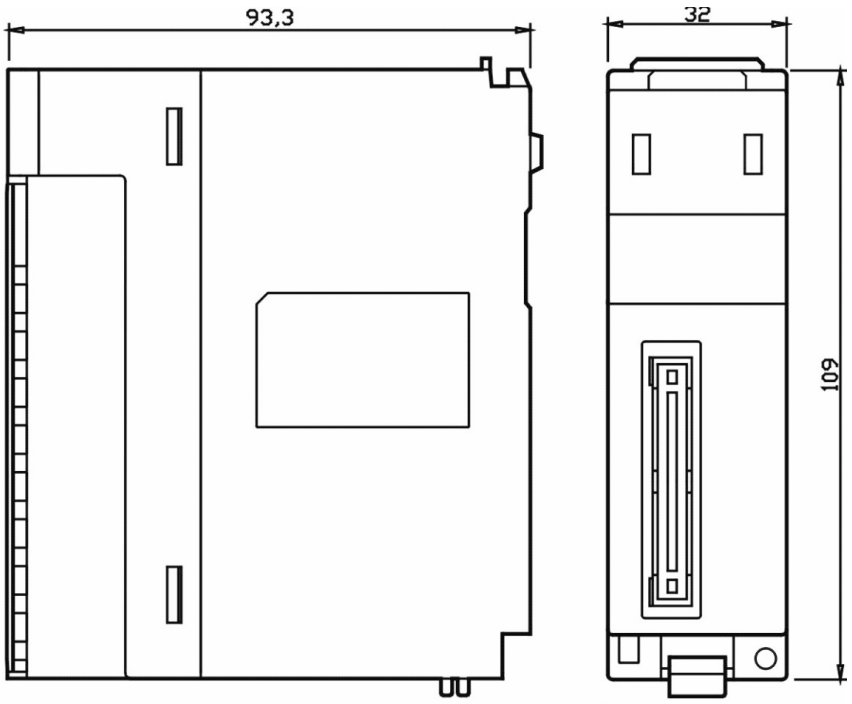
Model Item	CM1-AD04VI	CM1-AD08V	CM1-AD08I
No. of Analog Input Points	4 points	8 points	8 points
Analog Input	0 ~ 20mA 4 ~ 20mA 0 ~ +5V 1 ~ +5V 0 ~ +10V -10V ~ +10V	0 ~ +5V 1 ~ +5V 0 ~ +10V -10V ~ +10V	0 ~ 20mA 4 ~ 20mA
Digital Output	0~16000(-8000~8000)		

Maximum Resolution	Input	Range of Analog Input	Max. Resolution	Digital Output
	Voltage	0 ~ +5V	0.25mV	0 ~ 16000 -8000 ~ 8000
		1 ~ +5V	0.3125mV	
		0 ~ +10V	0.625mV	
		-10V ~ +10V	1.25mV	
	Current	0 ~ 20mA	1.25mA	
Precision	±0.3%(Full Scale)			
Conversion Rate	5mS/1ch			
Absolute Maximum Input	Voltage : ±12V Current : ±25mA	±12V	±25mA	
Type of Insulation	Between input terminal and PLC : Photo Coupler Insulation Between Channels : No Insulation			
Occupied Points	16 points			
Contact Terminal	18-point Terminal Block			
Internal Current (mA)	+5V	50	50	50
	+15V	40	40	40
	0V	35	20	20

6.4.2.3 Dimensions

Unit : mm





6.4.3 Features of I/O Conversion

Features of I/O conversion mean the gradient of the straight line connecting offset values and gain values when the analog signals (Voltage or current) from the outside of a PLC are converted to digital values.
An offset value is the analog input value(Voltage or current) corresponding to the digital output value of 0(-8000) and a gain value is the analog input value(Voltage or Current) corresponding to the digital output value of 16000(8000).

Contents :

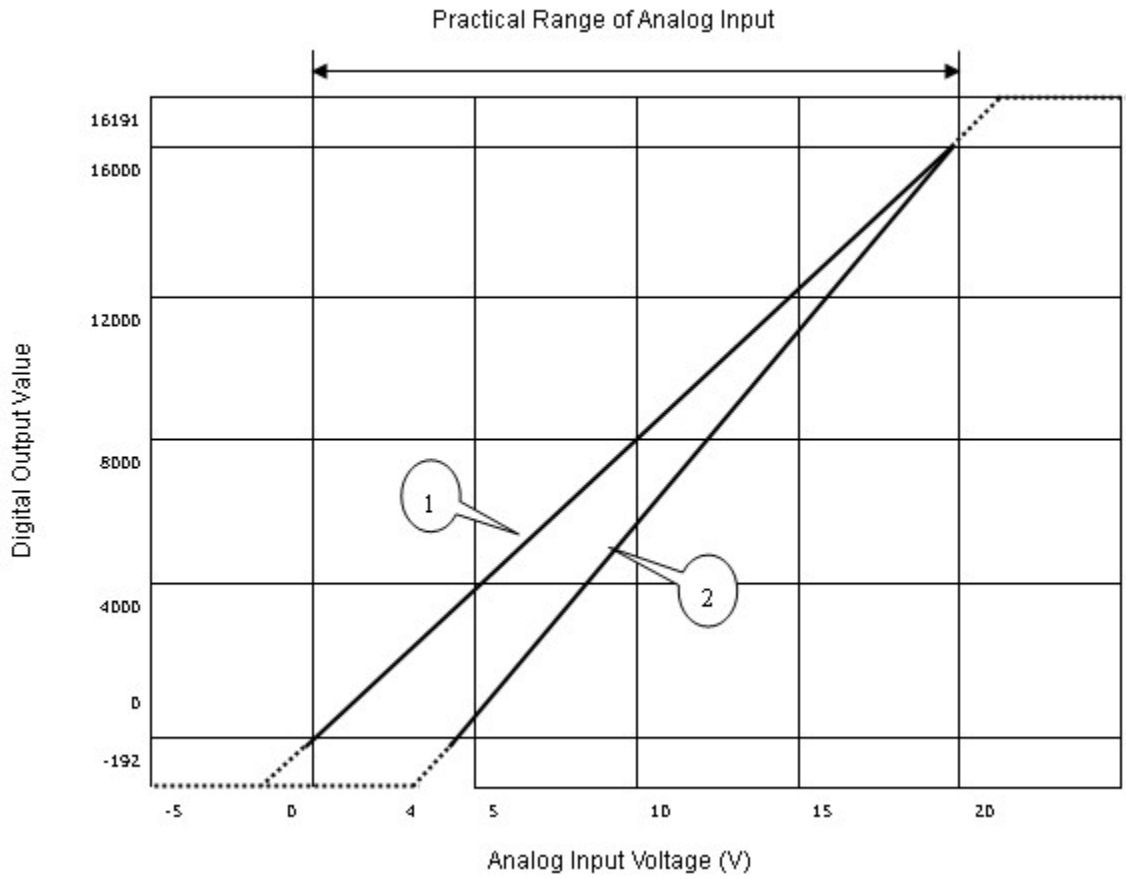
6.4.3.1 AD04VI

No.	Range of Analog Input	Offset	Gain	Digital Output Value	Max. Resolution
1	1 ~ 5V	1V	5V	0 ~ 16000 (-8000~8000)	0.25mV
2	0 ~ 5V	0V	5V		0.3125mV
3	0 ~ 10V	0V	10V		0.625mV

4	-10 ~ 10V	-10V	10V		1.25mV

In case that the analog inputs corresponding to the digital output values out of the range come, the maximum and the minimum of the digital output values are fixed as –192 and 16191(-8192 & 8191).

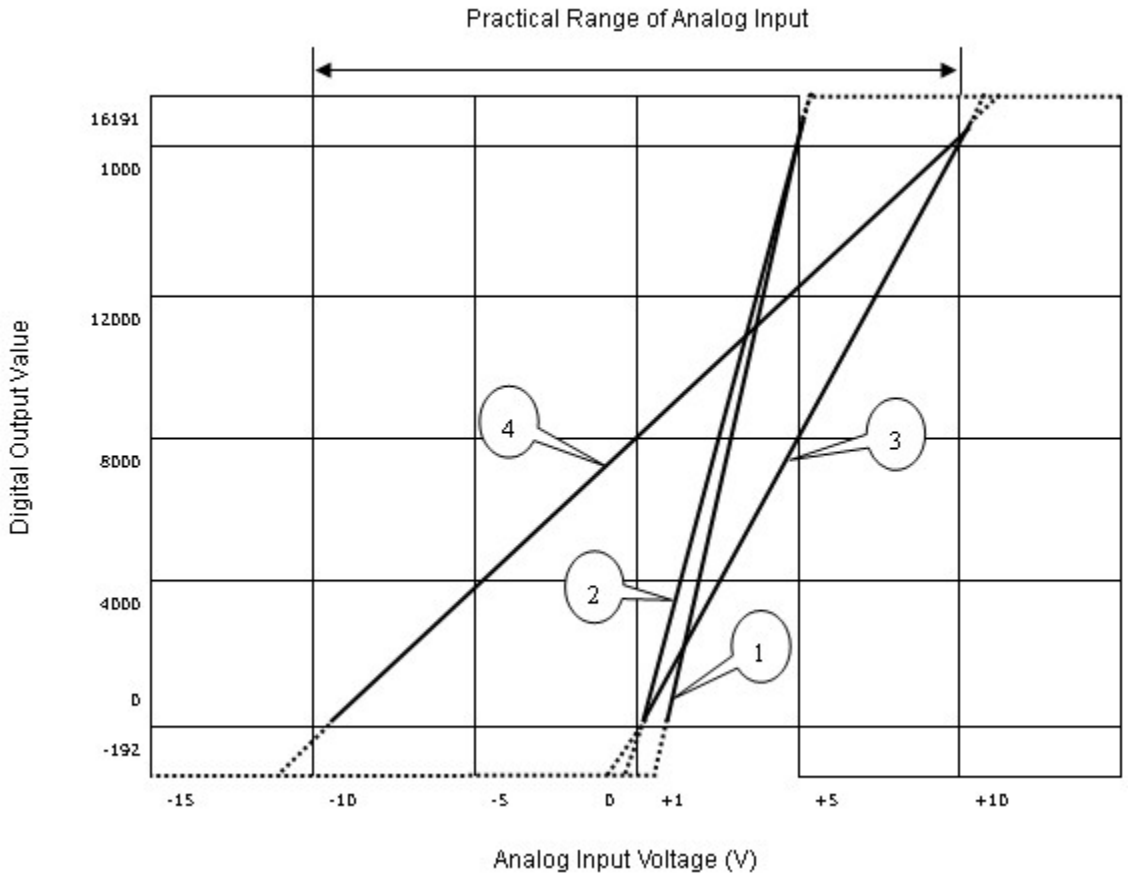
6.4.3.2 AD08I



No.	Range of Analog Input	Offset	Gain	Digital Output Value	Max. Resolution
1	0 ~ 20mA	0mA	20mA	0 ~ 16000(-8000~8000)	1.25mA
2	4 ~ 20mA	4mA	20mA		1mA

In case that the analog inputs corresponding to the digital output values out of the range come, the maximum and the minimum of the digital output values are fixed as –192 and 16191(-8192 & 8191).

6.4.3.3 AD08V



No.	Range of Analog Input	Offset	Gain	Digital Output Value	Max. Resolution
1	1 ~ 5V	1V	5V	0 ~ 16000(-8000~8000)	0.25mV
2	0 ~ 5V	0V	5V		0.3125mV
3	0 ~ 10V	0V	10V		0.625mV
4	-10 ~ 10V	-10V	10V		1.25mV

In case that the analog inputs corresponding to the digital output values out of the range come, the maximum and the minimum of the digital output values are fixed as –192 and 16191(-8192 & 8191).

6.4.4 Wiring

Safety Precautions :

- Use separate cables for AC and outside input signals of an A/D converter module to keep from the serge

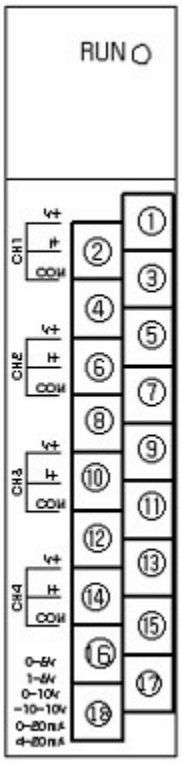
or the induced noise occurring from the AC.

- Select a wire, considering ambient temperature and allowable current. AWG22(0.3㎜) or more is recommended as the thickness of the wire.
- Keep the wire out of heat-generating device, toxic substance and oil. They may cause breakdown or malfunction.
- Make sure polarity before inputting analog value to a terminal block.
- The wiring together with high-voltage line or power line may cause malfunction or breakdown.

Contents :

6.4.4.1 AD04VI

Measured values are inputted to all the channels grouped as Terminal 1-2-3, 5-6-7, 9-10-11 and 13-14-15.



[In case of voltage input]

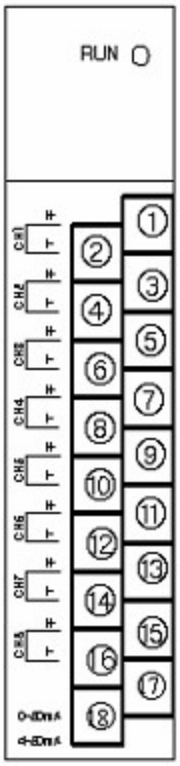
	+ Terminal	- Terminal
Ch 1	Terminal 1	Terminal 3
Ch 2	Terminal 5	Terminal 7
Ch 3	Terminal 9	Terminal 11
Ch 4	Terminal 13	Terminal 15

[In case of current input]

	+Terminal	- Terminal	Action
Ch 1	Terminal 2	Terminal 3	Connect 1-2
Ch 2	Terminal 6	Terminal 7	Connect 5-6
Ch 3	Terminal 10	Terminal 11	Connect 9-10
Ch 4	Terminal 14	Terminal 15	Connect 13-14

- +15V and -15V are used for AD04VI, AD08I and AD08V.
- POWER module is to be CM1-SPB or CM1-SPC.

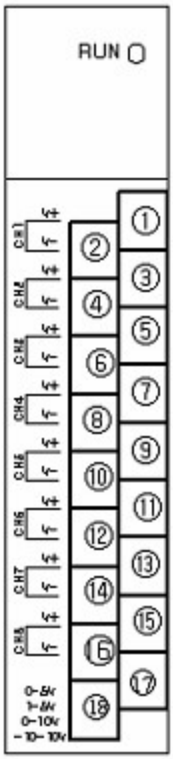
6.4.4.2 AD08I



Terminal 17 and Terminal 18 are not used.

	+ Terminal	- Terminal
Ch 1	Terminal 1	Terminal 2
Ch 2	Terminal 3	Terminal 4
Ch 3	Terminal 5	Terminal 6
Ch 4	Terminal 7	Terminal 8
Ch 5	Terminal 9	Terminal 10
Ch 5	Terminal 11	Terminal 12
Ch 7	Terminal 13	Terminal 14
Ch 8	Terminal 15	Terminal 16

6.4.4.3 AD08V



Terminal 17 and Terminal 18 are not used.

	+ Terminal	- Terminal
Ch 1	Terminal 1	Terminal 2
Ch 2	Terminal 3	Terminal 4
Ch 3	Terminal 5	Terminal 6
Ch 4	Terminal 7	Terminal 8
Ch 5	Terminal 9	Terminal 10
Ch 6	Terminal 11	Terminal 12
Ch 7	Terminal 13	Terminal 14
Ch 8	Terminal 15	Terminal 16

6.4.5 Internal I/O Table

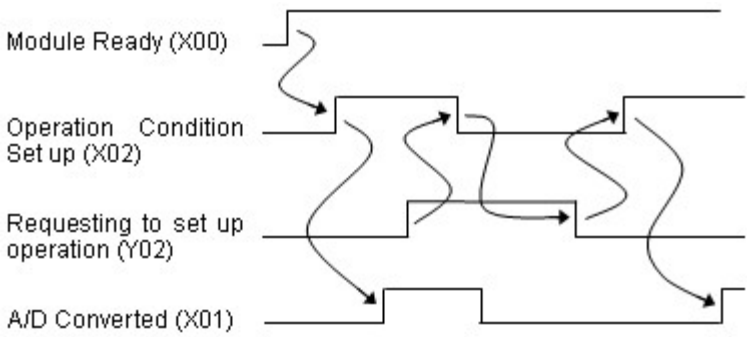
Direction of Signal(CPU ?A/D Module)		Direction of Signal(CPU ?A/D Module)	
Input	Name of Signal	Output	Name of Signal
X00	A/D module ready	Y00	Not use
X01	Flag indicating A/D-converted	Y01	
X02	Flag indicating operation condition set up	Y02	Requesting to set up operation condition
X03	Flag indicating the channel switched	Y03	Requesting to switch an channel
X04	Flag indicating offset or gain calibration mode	Y04	Requesting to calibrate offset or gain
X05	Not use	Y05	Assigning offset or gain calibration mode
X06		Y06	Not use
X07		Y07	
X08		Y08	
X09		Y09	
X0A		Y0A	
X0B		Y0B	

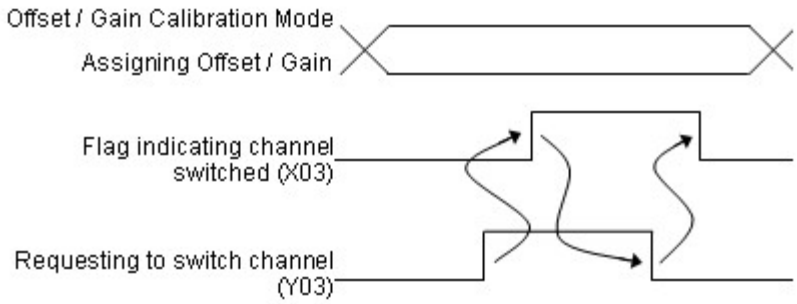
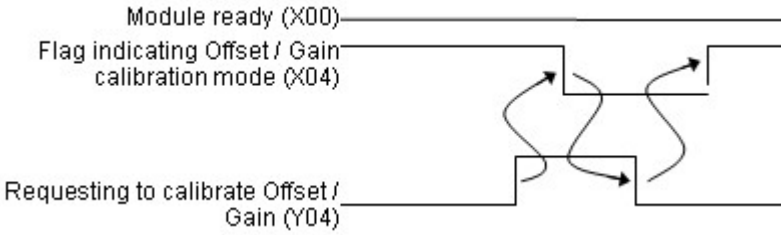
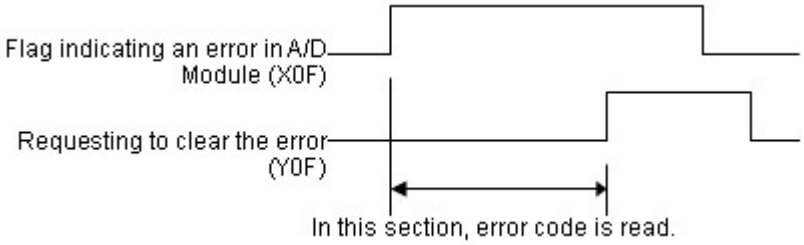
X0C		Y0C	
X0D		Y0D	
X0E		Y0E	Requesting to reset max. value/min. value
X0F	Flag indicating an error in A/D module	Y0F	Requesting to clear the error

The numbers of I/O signals is for the case an A/D module is mounted on Slot 0 of a local base.

Contents :

6.4.5.1 Input Signals

Device NO.	Signal Name	Description
X00	A/D module ready	1) If the power is inputted to a CPU or a CPU is reset, A/D conversion will be ready. At this time, this signal is set and A/D conversion is processed. 2) When this signal is off, A/D conversion is not processed. In the following case, A/D module ready will be reset. • During Offset/Gain calibration mode
X01	Flag indicating A/D-converted	If all the enabled channels convert, this signal will be set.
X02	Flag indicating operation condition set up	1) This is used as the interlock condition to set/reset request to set up operation condition(Y02) when enabling/disabling to A/D-convert is switched. 2) When this signal(X02) is reset, A/D conversion is not processed. In the following case, flag indicating operation condition set up will be reset. • When module ready is reset. • When requesting to set up operation condition is set. 
X03	Flag indicating the channel	1) This is used as the interlock condition to set/reset request to switch a channel (Y03) when the channel for calibrating offset and gain is switched.

	switched	2) Refer to Chapter 7 for offset/gain calibration. 
X04	Flag indicating Offset or Gain calibration mode	1) This is used as the interlock condition to set/reset requesting to calibrate offset/gain(Y04) when registering value after an offset/a gain are calibrated. 2) Refer to Chapter 7 for offset/gain calibration. 
X0F	Flag indicating an error in A/D module	1) If an error occurs in writing to buffer memory, this flag will be set. 2) To clear error code, request to clear the error(Y0F) is be set. 

6.4.5.2 Output Signals

DeviceNO.	Signal Name	Description
Y02	Requesting to set up operation condition	1) This is set when the contents of enabling/disabling to A/D-convert, assigning average process, the average time and the average number of times when average process is assigned are available.

		2) Refer to X02(Flag indicating operation condition set up) for set/reset timing.
Y03	Requesting to switch an channel	1) This is set when switching the channel for offset/gain calibration. 2) Refer to X03(Flag indicating channel switched) for set/reset timing
Y04	Requesting to calibrate offset or gain	1) This is set when the calibrated values of offsets/gains are registered to A/D module. 2) Refer to X04(Flag indicating offset/gain calibration mode) for set/reset timing.
Y05	Assigning offset or gain mode	1) This is set when assigning offset/gain calibration mode. 2) When it is reset, normal mode(A/D Conversion mode. 3) If offsets/gains are set up, this is to be reset.
Y0E	Requesting to reset maximum value and minimum value	1) If the request to reset maximum value and minimum value is set, the maximum value and minimum value stored in buffer memory will be cleared. 2) After this is set, this is to be reset.
Y0F	Requesting to clear an error	1) This is set to clear the error. 2) Refer to X0F(Flag indicating an error in A/D module) for set/reset timing.

6.4.6 Buffer Memory

Address		Description		Address		Description	
Hexa	Deci			Hexa	Deci		
0H	0	Enabling/disabling to A/D-convert setup	R/W	17H	23	Channel to calibrate gain	R/W
1H	1	Average time & average number of times of CH1	R/W	18H	24	Setting up digital output 1	R/W
2H	2	Average time & average number of times of CH2	R/W	19H	25	Setting up digital output 2	R/W
3H	3	Average time & average number of times of CH3	R/W	1AH	26	Not use	
4H	4	Average time & average number of times of CH4	R/W	1BH	27		
5H	5	Average time & average number of times of CH5	R/W	1CH	28		
6H	6	Average time & average number of times of CH6	R/W	1DH	29		
7H	7	Average time & average number of times of CH7	R/W	1EH	30	Max. value of CH1	R
8H	8	Average time & average number of times of CH8	R/W	1FH	31	Min. value of CH1	R
9H	9	Assigning averaging process	R/W	20H	32	Max. value of CH2	R
AH	10	Flag indicating A/D-converted	R	21H	33	Min. value of CH2	R
BH	11	Digital output value of CH1	R	22H	34	Max. value of CH3	R
CH	12	Digital output value of CH2	R	23H	35	Min. value of CH3	R
DH	13	Digital output value of CH3	R	24H	36	Max. value of CH4	R

EH	14	Digital output value of CH4	R	25H	37	Min. value of CH4	R
FH	15	Digital output value of CH5	R	26H	38	Max. value of CH5	R
10H	16	Digital output value of CH6	R	27H	39	Min. value of CH5	R
11H	17	Digital output value of CH7	R	28H	40	Max. value of CH6	R
12H	18	Digital output value of CH8	R	29H	41	Min. value of CH6	R
13H	19	Error code	R	2AH	42	Max. value of CH7	R
14H	20	Set range(CH1 ~ CH4)	R/W	2BH	43	Min. value of CH7	R
15H	21	Set range(CH5 ~ CH8)	R/W	2CH	44	Max. value of CH8	R
16H	22	Channel to calibrate offset	R/W	2DH	45	Min. value of CH8	R

- Each data is word type.
- Buffer memory from CH.5 to CH.8 cannot be used for 4-channel module.
- R/W indicates whether reading/writing from a PLC is enabled. (R : Reading is enabled. / W : Writing is enabled.)

6.4.6.1 Enabling / Disabling to A/D Convert (Address "0")

Buffer Memory Address "0"

- This is used to set up whether enabling or disabling to A/D-convert by the channels.
- To make it available to set up enabling/disabling to A/D-convert, requesting to set up operation condition (Y02) is to be set and reset.
- Default value is set up as disabling A/D conversion.
- As a set value is stored in EEPROM, the A/D module is operated as previously set value even though the power is on and off.

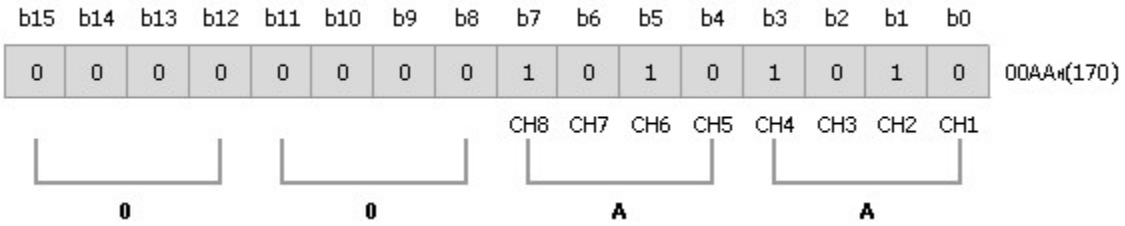
1 : Enabling to A/D Convert / 0 : Disabling to A/D Convert

b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	B5	b4	b3	b2	b1	b0
D	D	D	D	D	D	D	D	CH8	CH7	CH6	CH5	CH4	CH3	CH2	CH1

The data from b4 to b15 of AD04VI and the data from b8 to b15 of AD08I and ADO8V are fixed as "0".

Example :

In case that the channels for A/D conversion are 2,4,6,8, 00AAH(170) is to be written to Buffer Memory Address "0" and requesting to set up operation condition (Y02) is to be set and reset.



6.4.6.2 Average Time / Average Number of Times (Address "1 - 8")

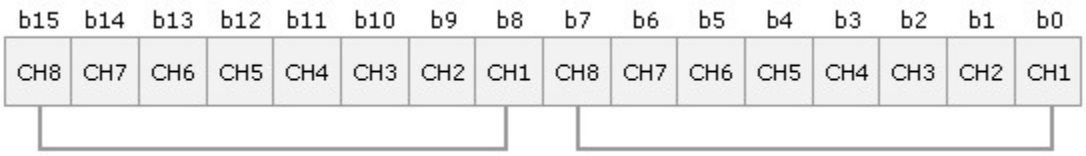
Buffer Memory Address "1 ~ 8"

- These are used to set up the average time and the average number of times for an assigned channel.
- To make the setup available, requesting to set up operation condition (Y02) is to be set and reset.
- The ranges available to set up are as follows.
  (Average process by number of times: 4 ~ 62500 times / Average process by time: 20 ~ 5000ms)
- Default value is fixed as "0".
- As a set value is stored in EEPROM, the A/D module is operated as previously set value even though the power is on and off.

6.4.6.3 Assigning Average Process (Address "9")

Buffer Memory Address "9"

- Use the CICON to select sampling process or average process, and to write a set value to Buffer Memory "9"
- To make the setup available, requesting to set up operation condition (Y02) is to be set and reset.
- In case that average process is selected, use the CICON to select average time or number of times.
- Default value is set up as the sampling process and averaging number of times for all channels.
- As a set value is stored in EEPROM, the A/D module is operated as previously set value even though the power is on and off.

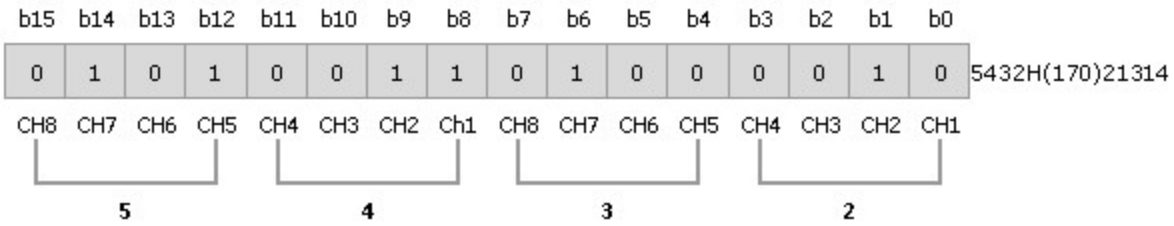


Assigning the channels for average process
1 : Average Process
0 : Sampling Process

Assigning time and number of times
1 : Averaging Time
0 : Averaging Number of Times

Example :

In case that Channel 1 and 5 are assigned to averaging number of times, Channel 2 and 7 to averaging time and the rest to the sampling process, requesting to set up operation condition(Y02) is set and reset after 5342H(21314) is stored in Buffer Memory Address "9".

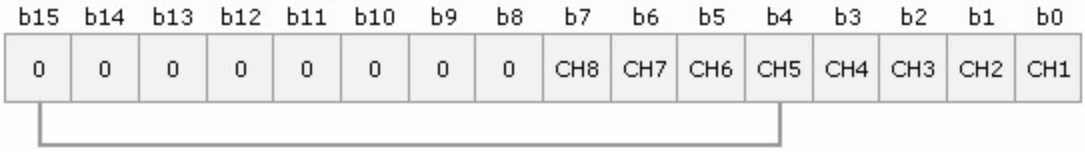


6.4.6.4 A/D Converted (Address "10")

Buffer Memory Address "10"

- If an assigned channel is A/D-converted first, the memory for A/D-converted will be set. And, flag indicating A/D-converted (X02) will be set if all channels are A/D-converted first
- If requesting to set up operation condition (Y03) is on, the memory will be reset. And if a corresponding channel is A/D-converted, the memory will be set.
- In case of 4-channel module, the data from b4 to b7(CH5 ~ CH8) are disregarded.

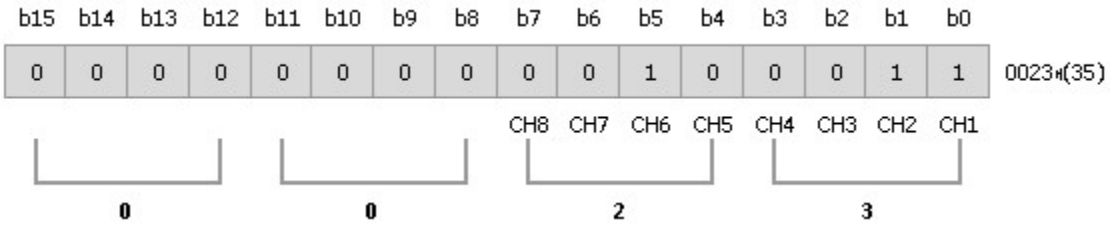
1 : A/D Converted / 0 : A/D Converting or not use



The data from b4 of AD04VI and the data from b8 to b15 of AD08I and AD08V are fixed as "0".

Example :

When Channel 1,2 and 6 are enabled to A/D-convert and all the channels A/D-convert, 0023H(35) is stored in Buffer Memory Address ?0?as
follows.



6.4.6.5 Digital OutPut Value (Address "11 - 18")

Buffer Memory Address "11 ~ 18"

- A/D-converted digital output values are stored in buffer memory addresses from 11 to 18 by channels.
- Digital output values are indicated in signed 16-bit binary value.
- The range of output values is from 0(-8000) to 16000(8000). In case that values are out of the range, they are outputted in the range from –192 to 16191 or –8192 to 8191.

6.4.6.6 Error Codes (Address "19")

Buffer Memory Address "19"

- The error codes detected from an A/D module are stored in these addresses.
- is from 1 to 4 for AD04VI and from 1 to 8 for AD08I and AD08V(The number means the channel.). ?is from 1 to 3.
- If an error occurs, it will be kept till it is cleared or the power is off. If an error is not cleared after it occurs, an newly occurring error will be disregarded. (To clear an error, use the CICON to set or reset the YOF (Requesting to clear error).)

[Error codes are decimal figure.]

Error code	Description
1□	The case that the range of input setup is wrong The case that current is set up in AD08V or voltage is set up in AD08I
2□	The case that average process time is out of range
3□	The case that number of average process times is out of range
4□	The case that an offset value is greater than a gain value
49	The case that offset channels and gain channels are calibrated at the same time
10◇	Error in system (A/S required)

6.4.6.7 Range of Input Setup (Address "20, 21")

Buffer Memory Address "20","21"

- These are used to set up the range of inputs by channels for an A/D converter module.
- To make the setup available, requesting to set up operation condition(Y02) is to be set and reset.
- The set values of the channels from 1 to 4 are stored in Buffer Memory Address "20" and the set values of the channels from 5 to 8 are stored in Buffer Memory Address "21".
- In case of 4-channel module, Buffer Memory Address "21" is disregarded.
- The range of the default values for AD04VI, AD08I is from 4 to 20(mA) and the range for AD08V is from 1 to 5V.
- As a set value is stored in EEPROM, the A/D module is operated as previously set value even though the power is on and off.

	b15 ~ 12	b11 ~ b8	b7 ~ b4	b3 ~ b0
Buffer Memory Address "20"	CH 4	CH 3	CH 2	CH 1
Buffer Memory Address "21"	CH 8	CH 7	CH 6	CH 5

The set values are as follows.

Range of Input	Set Value
4 ~ 20(mA)	0
0 ~ 20(mA)	1
1 ~ 5(V)	2
0 ~`5(V)	3
-10 ~ 10(V)	4
0 ~ 10(V)	5

6.4.6.8 Offset/Gain Calibration Mode (Address "22, 23")

Buffer Memory Address "22", "23"

- These are used to assign the channel of which offset/gain are calibrated.
- The channel to calibrate an offset is assigned to Buffer Memory Address "22" and the channel to calibrate an gain is assigned to Buffer Memory Address "23".
- It is available to set up two channels at the same time. But, an offset and a gain is to be calibrated each. (One of Buffer Memory Address "22" and "23" should be set up as "0".) If both are set up at the same time, an error(Error code "49") occurs in offset/gain calibration mode.
- In case of a 4-channel module, the data from b4 to b7(For channels from 5 to 8) are disregarded.

	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Address "22" (Offset)	0	0	0	0	0	0	0	0	CH8	CH7	CH6	CH5	CH4	CH3	CH2	CH1
Address "23" (Gain)	0	0	0	0	0	0	0	0	CH8	CH7	CH6	CH5	CH4	CH3	CH2	CH1

1 : Set Channel / 0 : Invalid

6.4.6.9 Digital Output Setup Mode (Address "24, 25")

Buffer Memory Address "24, 25"

- This is used to decide whether the range of digital output value is -192 ~ 16191, -8192 ~ 8191, 0 ~ 16000, -8000 ~ 8000.
- To make this setup available, requesting to set up operation condition (Y02) is to be set and reset.
- If the corresponding bit of each channel is 0, the range of values is from –192 to 16191. If it is 1, the range of values is from -8192 to 8191.
- Default value is set up as 0(-192~16191).
- As a set value is stored in EEPROM, the A/D module is operated as previously set value even though the power is on and off.

	b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
Address "24"	0	0	0	0	0	0	0	0	CH8	CH7	CH6	CH5	CH4	CH3	CH2	CH1
Address "25"	0	0	0	0	0	0	0	0	CH8	CH7	CH6	CH5	CH4	CH3	CH2	CH1

Address 24	Address 25	Digital Output
0	0	-192 ~ 16191
0	1	-8192 ~ 8191
1	0	0 ~ 16000
1	1	-8000 ~ 8000

6.4.6.10 Devices to Strore Max. and Min. (Address "30 - 45")

Buffer Memory Address "30 - 45"

- These are used to store the maximum value or the minimum value of converted digital output values by channels.
- If requesting to set up operation condition (Y02) is set and setup is changed, or requesting to reset the maximum value and the minimum value, the values stored in all the channels will be cleared as "0". The maximum value and the minimum value are stored from when they are cleared and A/D conversion starts.
- The maximum value and the minimum value are also stored in the channel assigned to average process according to the time for sampling process.

6.5 D/A Converters

D/A Modules are used to convert signed 16-bit binary digital values to analog signals (Direct voltage or direct current).

Features :

- DA16I is a 16-channel current (4~20mA) output DA module.
  DA08I is an 8-channel current (4~20mA) output DA module.
  DA04I is a 4-channel current (4~20mA) output DA module.

  DA16V is a 16-channel current (-10~10V) output DA module.
  DA08V is an 8-channel voltage (-10~10V) output DA module.
  DA04V is a 4-channel voltage (-10~10V) output DA module.

- As the resolution for digital values is selected as 1/16000, high-resolution analog values will be gotten

- DA converter modules are used to convert the digital values for signed 16-bit binary data (Data: 14 bits) set up in a CPU to analog signals (Voltage or current). The digital values in the range from 0 to 16000((-8000~8000) are converted to the analog values in the range from 4 to 20mA(-10~10V).

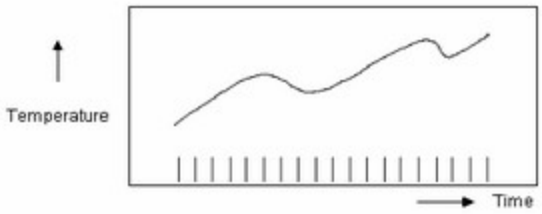
- If you use the CICON to set up hold or clear, a DA output value will be outputted as offset value(4mA,-10V) or a current DA output value will be kept in case that a PLC is switched from RUN mode to STOP mode or an error occurs in a CPU.

- The channel disabled to convert outputs offset value(4mA,-10V).

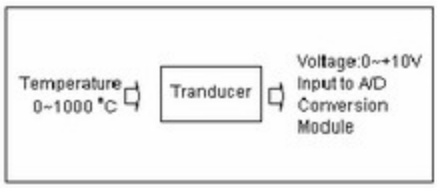
- The number of modules on one base is not limited.
  (But, they can be used within the range satisfying the capacity of a power module.)

Contents :

6.5.1 General Idea

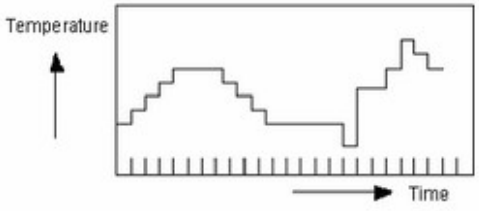


[Figure 1.1] Analog Value

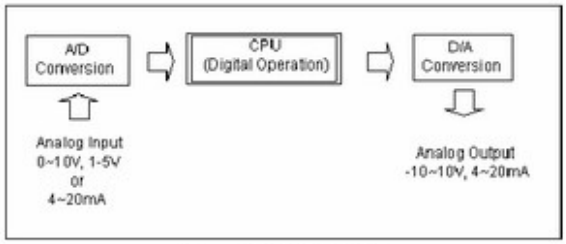


[Figure 1.2] Example of Tranducer

Digital Value - D



[Figure 1.3] Digital value



[Figure 1.4] Process in a PLC

The values shown as number such as 0, 1, 2 and 3, and varied non-continuously are called digital values. ON signal and OFF signal are shown as the digital value of 0 and 1. BCD values and binary values are also digital values.

To operate in digital value, analog values cannot be inputted directly to a CPU module.
Therefore, analog value is to be converted to digital value like Picture 1.4, being inputted to a CPU.
To output analog values, it is necessary to convert the digital values in a CPU to analog values.

6.5.2 Specifications

CIMON-PLC D/A Converters :

- General Specification
- Technical Specification
- Dimensions

6.5.2.1 General Specification

Item	Specification			
Operating Temperature	-10 ~ 65ºC			
Storage Temperature	-25 ~ 80ºC			
Operating Humidity	5 ~ 95%RH, Not condensed.			
Storage Humidity	5 ~ 95%RH, Not condensed.			
Vibration	In case of intermittent vibration			
	Frequency	Acceleration	Amplitude	Sweep
	10 ≦ f< 57Hz	-	0.075mm	10 times in each direction (X,Y,Z)
	57 ≦ f < 150 Hz	9.8m/s2 {1G}	-	
	In case of continuous vibration			
	Frequency	Acceleration	Amplitude	Sweep
	10 ≦ f < 57Hz	-	0.035mm	10 times in each direction (X,Y,Z)
	57 ≦ f < 150 Hz	4.9m/s2 {1G}	-	
Shock	- Max. Shock Acc.: 147 m/s2 {15G} - Time : 11㎳(3 times in X, Y, Z) - Pulse Wave : Half sine wave pulse			
Noise	Square wave impulse noise	±1500V		
	Electrostatic discharge	Voltage: 4 kV(Contact discharge)		
	Radiated electro-magnetic field	27 ~ 500 MHz. 10 V/m		
	Fast Transient Bust	Item	Power	Digital I/O	Digital I/O(Less than 24V)

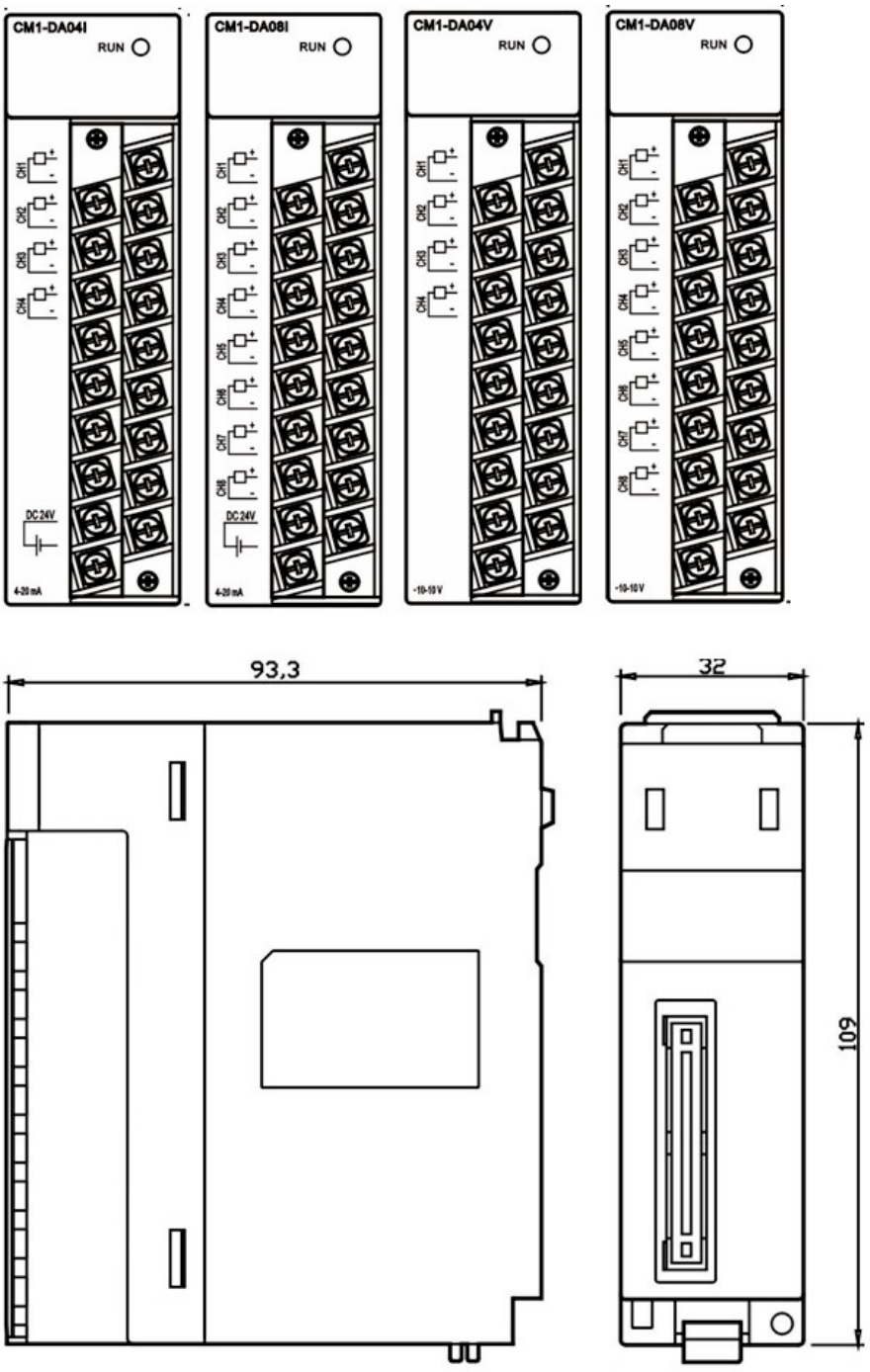
	Noise		Module	(24V or more)	Analog I/O Comm. interface
		Voltage	2KV	1KV	0.25KV
Environment	No corrosive gas and no dust.				
Altitude	2,000m or less				
Pollution	Less than 2				
Cooling	Natural Air cooling				

6.5.2.2 Technical Specification

	DA04V	DA08V	DA16VI	DA16I	DA04I	DA08I
Analog Output Points	4Point	8Point	16Points	16Point	4Point	8Point
Analog Output	-10V ~ +10V		0 ~ 10V		4 ~ 20mA	
Digital Input	-192 ~ 16191(-8192~8191)					
Maximum Resolution	Output	Digital Input Value	Range of Analog Output	Max. Resolution		
	Voltage	0 ~ 16000 (-8000~8000)	-10V ~ +10V	1.25mV		
		0 ~ 16000 (-8000~8000)	0 ~ 10V	0.625mV		
	Current	0 ~ 16000 (-8000~8000)	4 ~ 20mA	1.0mA		
Precision	±0.1%(Full Scale)					
Conversion Rate	10ms/4CH / 15ms/8CH				10ms/4CH	15ms/8CH
Absolute Maximum Input	• Voltage : ±15V • Current : +24mA					
Type of Insulation	• Between input terminal and PLC : Photo Coupler Insulation • Between output channels : No Insulation • Between the externally supplied power and analog output: No Insulation					
Supplied power	None				+24V	
Occupied Points	16Points					
Contact Terminal	18Point Terminal Block					
Internal Current (mA) +5V	50				50	
Internal Current (mA) +15V	50				-	
Internal Current (mA) -15V	30					
Internal Current (mA) +24V	-				100	

6.5.2.3 Dimensions

Unit : mm



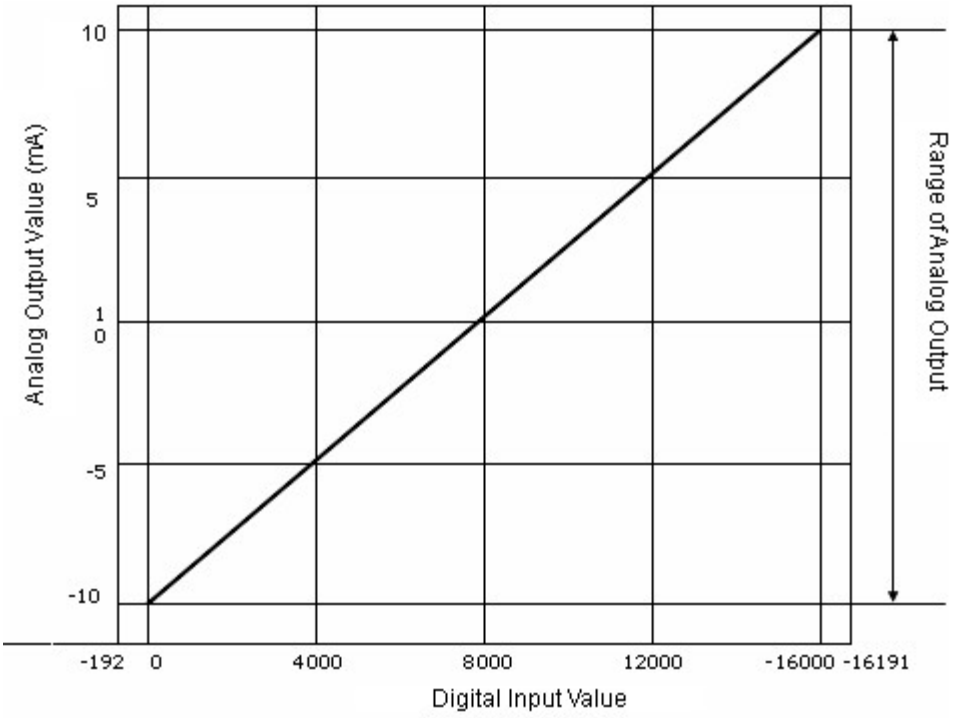
6.5.3 Features of I/O Conversion

Features of I/O conversion mean the gradient of the straight line connecting an offset value and a gain value when the analog signals(Voltage or current) from the outside of a PLC are converted to digital value.

Offset value is the analog input value(Voltage or current) corresponding to the digital output value of 0(-8000) and Gain value is the analog input value(Voltage or Current) corresponding to the digital output value of 16000(8000).
value(Voltage or Current) corresponding to the digital output value of 16000(8000).

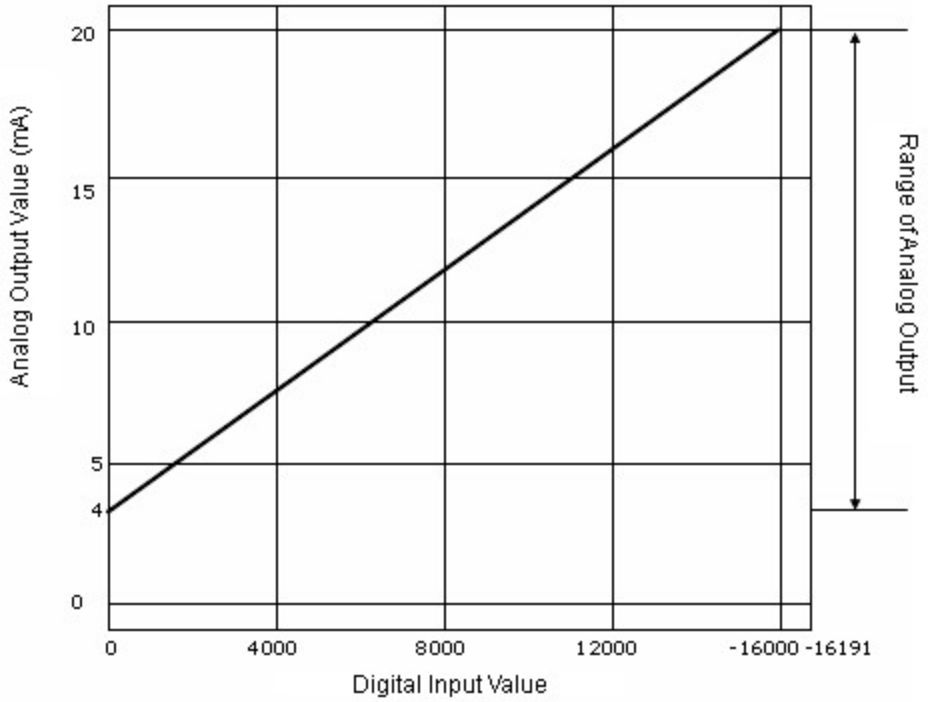
Contents :

6.5.3.1 Features of Voltage Output (DA04V, DA08V)



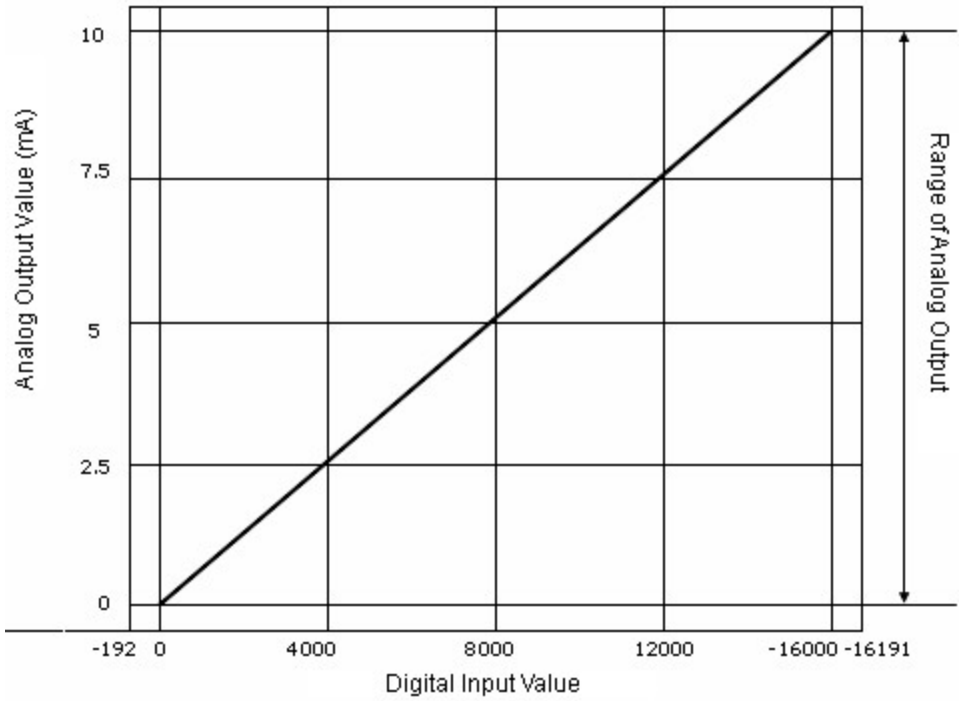
Range of Analog Outputs	Offset	Gain	Digital Input Value	Max. Resolution
-10 ~ 10V	-10V	10V	0 ~ 16000 (-8000~8000)	1.25mV

6.5.3.2 Features of Current Output (DA04I , DA08I)



Range of Analog Outputs	Offset	Gain	Digital Input Value	Max. Resolution
4 ~ 20V	4mA	20mA	0 ~ 16000 (-8000~8000)	1.0mV

6.5.3.3 Features of Voltage and Current Output (DA04VA , DA08VA)



Range of Analog Outputs	Offset	Gain	Digital Input Value	Max. Resolution
0 ~ 10V	0V	10V	0 ~ 16000 (-8000~8000)	0.625mV

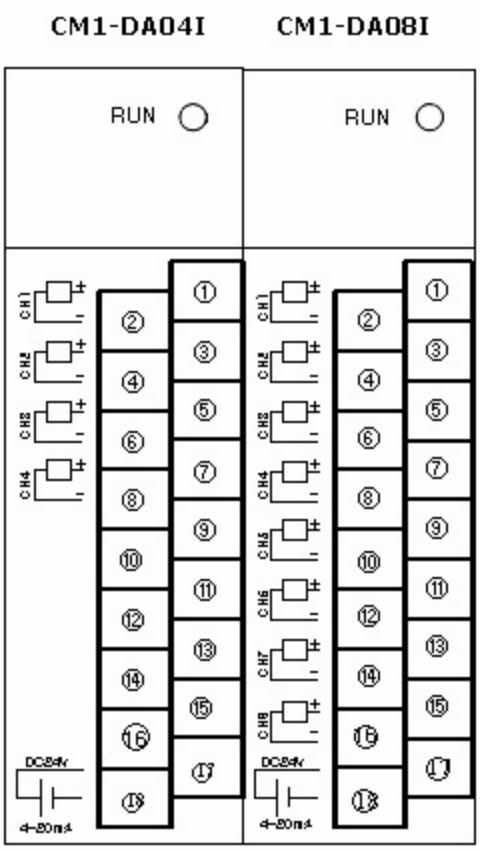
6.5.4 Wiring

Safety Precautions :

- Use separate cables for AC and outside input signals of a D/A converter module to keep from the serge or the induced noise occurring from AC.
- Select wires, considering ambient temperature and allowable current. AWG22(0.3) or more is recommended as wire thickness.
- Keep wires out of heat-generating device, toxic substance and oil. They may cause breakdown or malfunction.
- Make sure polarity before inputting an analog value to a terminal block.
- The wiring together with high-voltage line or power line may cause malfunction or breakdown.

Contents :

6.5.4.1 DA04I, DA08I

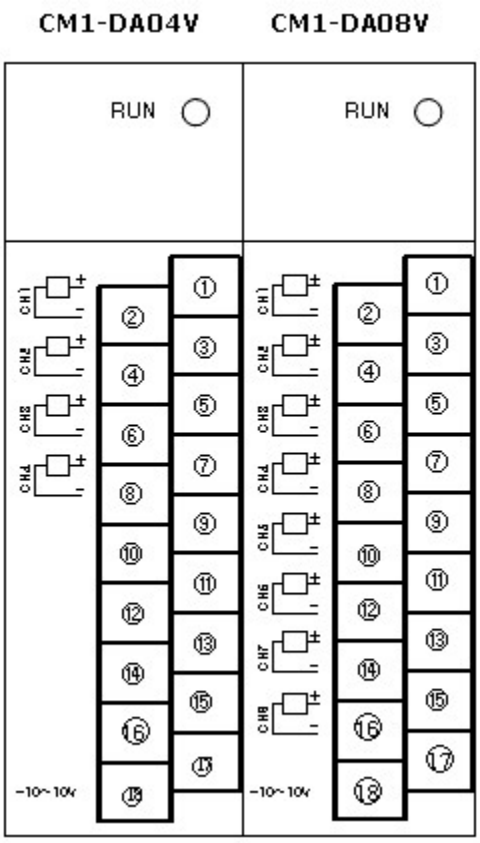


The channels from 5 to 8 of DA04I are not used.
DC +24V is to be supplied to Ch. 17 and 18.

	+ Terminal	- Terminal
Ch 1	Terminal 1	Terminal 2
Ch 2	Terminal 3	Terminal 4
Ch 3	Terminal 5	Terminal 6
Ch 4	Terminal 7	Terminal 8
Ch 5	Terminal 9	Terminal 10
Ch 5	Terminal 11	Terminal 12
Ch 7	Terminal 13	Terminal 14
Ch 8	Terminal 15	Terminal 16
External Input 24V	Terminal 17	Terminal 18

In case of DA04I and DA08I, the voltage of +5V through the base and the voltage of +24V from the outside is necessary. The external power (24V) is to be supplied by CM1-SPA or CM1-SPC or other power supply device.

6.5.4.2 DA04V, DA08V, DA04VA, DA08VA



The channels from 5 to 8 of the DA04V are not used.
Terminal 17 and Terminal 18 are not used in case that the power is outputted.

	+ Terminal	- Terminal
Ch 1	Terminal 1	Terminal 2
Ch 2	Terminal 3	Terminal 4
Ch 3	Terminal 5	Terminal 6
Ch 4	Terminal 7	Terminal 8
Ch 5	Terminal 9	Terminal 10
Ch 5	Terminal 11	Terminal 12
Ch 7	Terminal 13	Terminal 14
Ch 8	Terminal 15	Terminal 16

** DA04VA, DA08VA "0 ~ 10V"

In case of DA04V and DA08V, the voltage of +5V, +15V and -15V are used through the base. CM-SPB or CM1-SPC is required.

6.5.5 Internal I/O Table

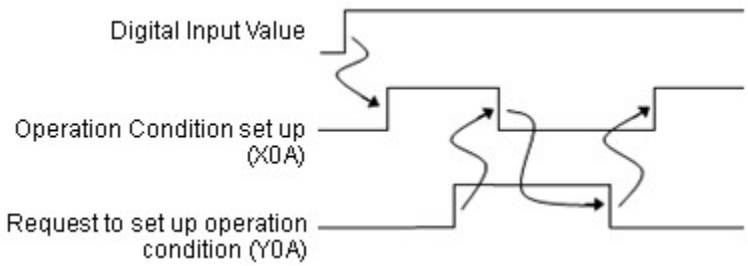
Signal Direction (CPU ?D/A Module)		Signal Direction (CPU ?D/A Module)	
Input	Signal Name	Output	Signal Name
X00	D/A module ready	Y00	Not use
X01	Not use	Y01	
X02		Y02	
X03		Y03	
X04		Y04	
X05		Y05	
X06		Y06	
X07		Y07	
X08		Y08	
X09		Y09	
X0A	Flag indicating operation condition set up	Y0A	Requesting to set up operation condition

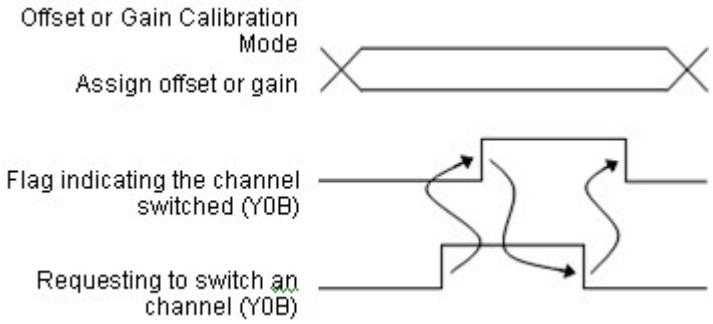
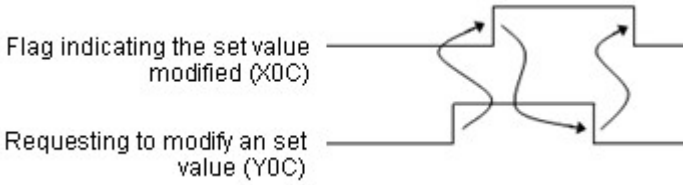
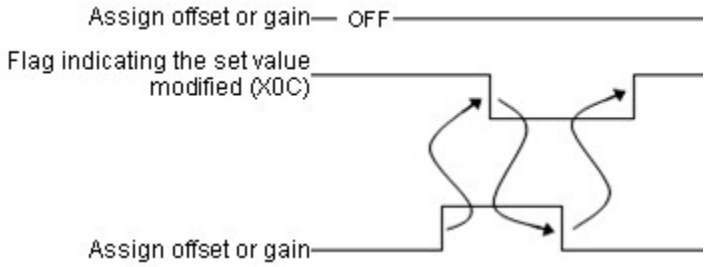
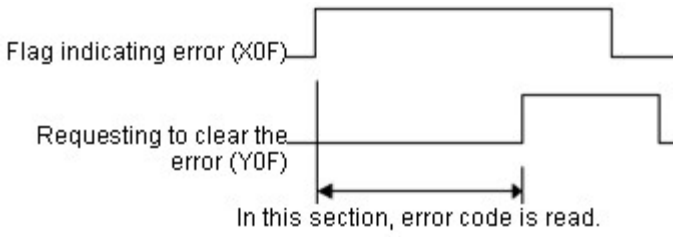
X0B	Flag indicating the channel switched	Y0B	Requesting to switch an channel
X0C	Flag indicating the set value modified	Y0C	Requesting to modify an set value
X0D	Flag indicating offset or gain calibration mode	Y0D	Requesting to calibrate offset or gain
X0E	Not use	Y0E	Assigning offset or gain calibration mode
X0F	Flag indicating an error in D/A module	Y0F	Requesting to clear an error

The numbers of I/O signal are the ones of the case that a D/A module is mounted on Slot 0 of a local base.

Contents :

6.5.5.1 Input Signals

Device NO.	Signal Name	Description
X00	D/A module ready	1) If the power is inputted to a CPU or a CPU is reset, D/A conversion will be ready. At this time, this signal is set and D/A conversion is processed. 2) When this signal is off, D/A conversion is not processed. In the following case, D/A module ready will be reset. During offset/gain calibration mode
X0A	Flag indicating operation condition set up	1) This is used as the interlock condition to set/reset request to set up operation condition(Y0A) when enabling / disabling to D/A- convert is switched. 2) In the following case, flag indicating operation condition set up will be reset. When module ready(X00) is reset. When requesting to set up operation condition(Y0A) is set. 
X0B	Flag indicating the channel switched	1) This is used as the interlock condition to set/reset request to switch a channel (Y03) when the channel of which offset and gain are calibrated is switched.

		
X0C	Flag indicating the set value modified	1) This is used as the interlock condition to set/reset Requesting to modify a set value(Y0C) when offset/gain are calibrated. 
X0D	Flag indicating offset or gain calibration mode	1) This is used as the interlock condition to set/reset Requesting to calibrate offset/gain when offset/gain are calibrated. 
X0F	Flag indicating an error in D/A module	1) If an error occurs in writing to buffer memory, the flag is set. 2) To clear error code, requesting to clear an error(Y0F) is set. 

6.5.5.2 Output Signals

Device NO.	Name of Signal	Description
Y0A	Requesting to set up operation condition	1) This is set when the contents of enabling/disabling to D/A- convert, hold/clear are effective. 2) Refer to X0A(Flag indicating operation set up) for set/reset timing.
Y0B	Requesting to switch an channel	1) This is set when the channel for offset/gain calibration is changed. 2) Refer to X0B(Flag indicating channel switched) for set/reset timing
Y0C	Requesting to modify an set value	1) This is set and reset if an analog output value is increased or decreased when offset/gain are calibrated. 2) According to the value set up to Buffer Memory Address 21, analog output is increased or decreased.
Y0D	Requesting to calibrate offset or gain	1) This is used to calibrate offset/gain and store the value. 2) Refer to X0D for set/reset timing.
Y0E	Assigning offset or gain calibration mode	1) This is used to set when it is started to calibrate offset/gain and to reset when they has been calibrated.
Y0F	Requesting to clear an error	1) This is set to clear the error. 2) Refer to X0F(Flag indicating error occurring in D/A module) for set/reset timing.

6.5.6 Buffer Memory

Address		Description	Default value	R/W
Hexa	Deci			
0H	0	Enabling/disabling to D/A convert setup	0	R/W
1H	1	Digital value of CH.1	0	R/W
2H	2	Digital value of CH.2	0	R/W
3H	3	Digital value of CH.3	0	R/W
4H	4	Digital value of CH.4	0	R/W
5H	5	Digital value of CH.5	0	R/W
6H	6	Digital value of CH.6	0	R/W
7H	7	Digital value of CH.7	0	R/W
8H	8	Digital value of CH.8	0	R/W
9H	9	Error code	0	R
AH	10	Hold/Clear	0	R/W
BH	11	Set value check code of CH1	0	R

CH	12	Set value check code of CH2	0	R
DH	13	Set value check code of CH3	0	R
EH	14	Set value check code of CH4	0	R
FH	15	Set value check code of CH5	0	R
10H	16	Set value check code of CH6	0	R
11H	17	Set value check code of CH7	0	R
12H	18	Set value check code of CH8	0	R
13H	19	Channel to calibrate offset	0	R/W
14H	20	Channel to calibrate gain	0	R/W
15H	21	Calibrated offset value and gain value	0	R/W
16H	22	Setting up digital input type	0	R/W
17H	23	Enabling / Disabling D/A output setup	0	R/W

- The channels from 5 to 8 are not used for a 4-channel module.
- The type of every data is word.
- R/W indicates whether reading/writing from a PLC is enabled. (R : Reading is enabled / W : Writing is enabled)

6.5.6.1 Enabling / Disabling to D/A Convert (Address "0")

Buffer Memory Address "0"

- This is used to set up whether enabling or disabling to D/A-convert by the channels.
  To make it available to set up enabling/disabling to D/A-convert, requesting to set up operation condition (Y0A) is to be set and reset.
- Default value is set up as disabling D/A conversion.
- As a set value is stored in EEPROM, the A/D module is operated as previously set value even though the power is on and off.

0 : Disabling D/A Conversion / 1 : Enabling to D/A Convert

b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	B5	b4	b3	b2	b1	b0
0	0	0	0	0	0	0	0	CH8	CH7	CH6	CH5	CH4	CH3	CH2	CH1

DA04I / DA04V / DA04VA = b4 ~ b15

DA08I / DA08V / DA08VA = b8 ~ b15

Data fixed "0"

6.5.6.2 Digital Value by Channels (Address "1 - 8")

Buffer Memory Address "1 ~ 8"

- These are the devices where signed 16-bit binary values are written to D/A-convert.
- In case that the values within and except the range of setup are written, the values that a D/A module gets are as follows.

Range of Output	Range of Setup	In case that the value except setup range, the value that a D/A module gets
-10V ~ 10V 0 ~ 10V 4mA ~ 20mA	-192 ~ 16191 (Actual: 0 ~ 16000) -8192 ~ 8191 (Actual:-8000~8000)	16191(8192) or more: 16191(8191) -192(-8193) or less: -192(-8192)

- When digital values are inputted, it is not necessary to set/reset requesting to set up operation condition (Y0A).

6.5.6.3 Error Codes (Address "9")

Buffer Memory Address "9"

- The error codes detected from a D/A module are stored in these addresses.
- is from 1 to 4 for DA04I, DA04V and DA04VA and from 1 to 8 for DA08I, DA08V and DA08VA(The number means the channel.)
- ◇ is from 1 to 3
- If an error occurs, it will be kept till it is cleared or the power is off. If an error is not cleared after it occurs, a newly occurring error will be disregarded

[Error codes are decimal figure.]

Error code	Description
1?	The case that a set digital input value is out of maximum range (16191, 8191)
2?	The case that a set digital input value is out of minimum range (-192, -8192)
40	The case that an offset value is greater than a gain value
41	The case that both an offset and an gain are calibrated or two channels are set up at the same time
42	The case that a calibrated digital value is out of range when offset/gain is calibrated
10◇	Error in system (A/S required)

6.5.6.4 Setting up Hold / Clear (Address "10")

Buffer Memory Address "10"

- This is used to keep analog output values as previous values or output an offset value when a PLC stops or an error occurs in it.
- 0 : Clear , 1 : Hold
- To make hold/clear setup available, requesting to set up operation condition(Y0A) is to be set and reset.
- Default value is clear.
- As a set value is stored in EEPROM, the A/D module is operated as previously set value even though the power is on and off.

The combination of analog output statuses is as follows.

CM1-DA04I, CM1-DA08I

Enabling / Disabling to D/A convert (Buffer Memory Address "0")	Enable			Disable
Enabling / Disabling output by channels (Buffer Memory Address "23")	Enable		Disable	-
Setting up Hold & Clear (Buffer Memory Address "10")	Hold	Clear	-	-
PLC CPU RUN, PAUSE	A digital value is D/A converted and the result is output in analog value.		4mA	4mA
PLC CPU STOP	Keep	4mA	4mA	4mA
PLC CPU Heavy-Error	Keep	4mA	4mA	4mA

CM1-DA04V, CM1-DA08V

Enabling / Disabling to D/A convert (Buffer Memory Address "0")	Enable			Disable
Enabling / Disabling output by channels (Buffer Memory Address "23")	Enable		Disable	-
Setting up Hold & Clear (Buffer Memory Address "10")	Hold	Clear	-	-

Digital Input Type (Buffer Memory Address "22")	-192 ~16191	-8192 ~8191	-192 ~16191	-8192 ~8191	-192~ 16191	-8192 ~8191	
PLC CPU RUN, PAUSE	A digital value is D/A converted and the result is output in analog value.				-10V	0V	-10V
PLC CPU STOP	Keep		-10V	0V	-10V	0V	-10V
PLC CPU Heavy-Error	Keep		-10V	0V	-10V	0V	-10V

CM1-DA04VA, CM1-DA08VA

Enabling / Disabling to D/A convert (Buffer Memory Address "0")	Enable			Disable
Enabling / Disabling output by channels (Buffer Memory Address "23")	Enable		Disable	-
Setting up Hold & Clear (Buffer Memory Address "10")	Hold	Clear	-	-
PLC CPU RUN, PAUSE	A digital value is D/A converted and the result is output in analog value.		0V	0V
PLC CPU STOP	Keep	0V	0V	0V
PLC CPU Heavy-Error	Keep	0V	0V	0V

6.5.6.5 Set Value Check Code by Channels (Address "11 - 18")

Buffer Memory Address "11 ~ 18"

- These are the devices where the result of checking whether set digital values are within the range of setup or not is stored.
- In case of the digital value except the range of setup, the following check codes are stored.

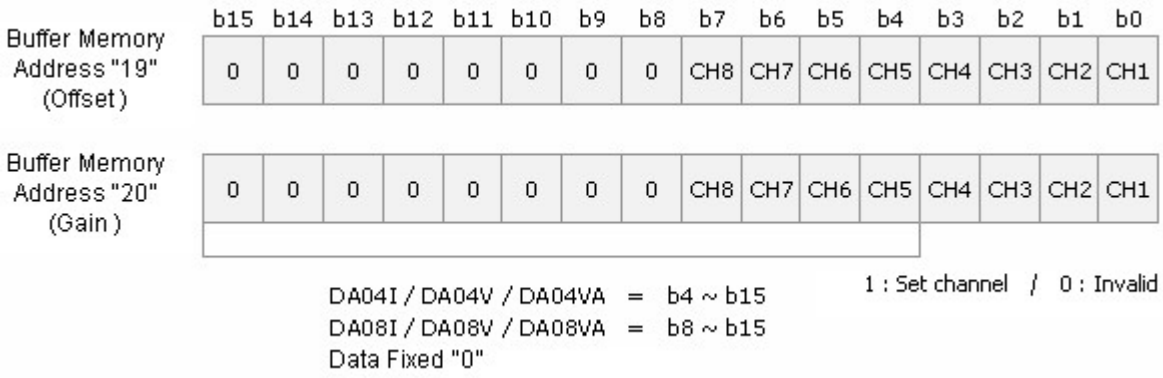
Check code	Description
000FH	The case that a digital value is greater than the maximum
00F0H	The case that a digital value is less than the minimum
00FFH	The case, in the state that the value less than the minimum is written and not cleared, the digital value greater than the maximum is written or the case contrary to that

- A stored check code is not reset though a digital value is within the range of setup.
- To reset set value check codes by channels, after the digital values are changed to the values within the range of setup, requesting to clear error(Y0F) is to be set.

6.5.6.6 Channel to Calibrate Offset / Gain (Address " 19, 20")

Buffer Memory address "19","20"

- These are used to set up the channels for calibrating an offset and a gain.
- One between an offset and a gain, and one among channels can be assigned.
  If the channels for calibrating both an offset and a gain are assigned at the same time or two channels are assigned, Error 41 will occur.



6.5.6.7 Calibrated Offset Value and Gain Value (Address "21")

Buffer Memory Address "21"

- This is used to calibrate an offset value and a gain value little by little.
- Refer to Chapter 7 for offset/gain calibration.

6.5.6.8 Set up Digital Input Type (Address "22")

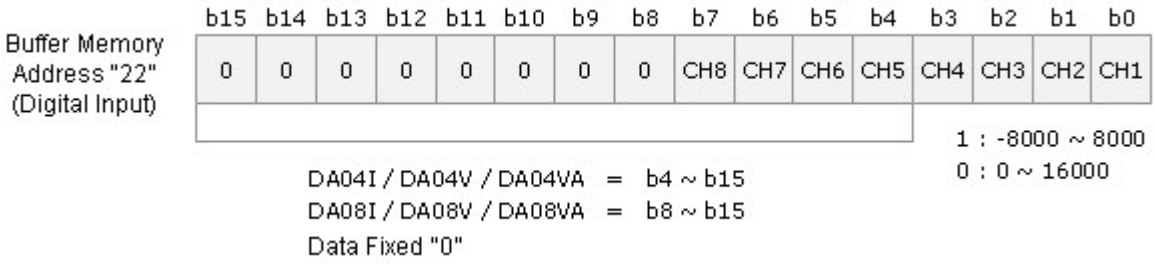
Buffer Memory Address "22"

- This is used to set up digital input type.
- To make it available to set up digital input type, requesting to set up operation condition (Y0A) is to be set and reset.

	Type of Digital Input	Analog Output
0	-192 ~ 16191(Actual : 0 ~ 16000)	4 ~ 20mA

1	-8192 ~ 8192(Actual : -8000 ~ 8000	-10 ~ 10V 0 ~ 10V

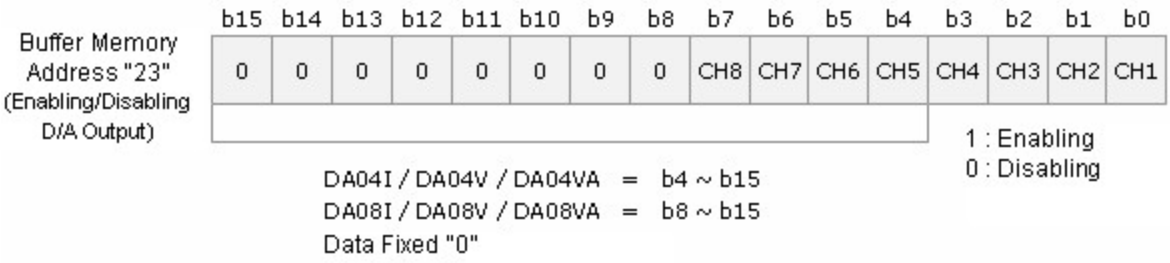
- Default value is 0 (-192~16191).
- As a set value is stored in EEPROM, the A/D module is operated as previously set value even though the power is on and off.



6.5.6.9 Enabling / Disabling D/A Output (Address "23")

Buffer Memory Address "23"

- This is used to set up whether D/A output is enabled or disabled.
- In case that D/A output is disabled, it is not necessary to set and reset requesting to set up operation condition (Y0A).
- Default value is to disable D/A output.



6.6 RTD Module

RTD converter modules are used to receive inputs from a resistance temperature detector of Pt100 or jPt100 or Pt1000 to measure their temperatures and to convert the temperatures to signed 16-bit binary digital values.

Features :

- The temperatures converted by the platinum resistance temperature detector of Pt100 or JPt100 or Pt1000 can be displayed in centigrade or Fahrenheit(ºC, ºF) and the temperature values can be processed as digital values up to the first decimal place.

- Converted temperature data are converted to 16-bit binary data, which can be processed as digital values. The temperatures in the range from -200ºC to 600ºC are converted to the values from 0 to16000(-8000~8000).

- The range of temperatures is from -250ºC to 650ºC and the range of digital values is from –192 to 16191.

- If a minimum temperature value and a maximum temperature value are set up, the minimum value will be converted to 0(-8000) and the maximum value to 16000(8000).

- The breaking of resistance temperature detectors and cables, and the excess of measuring range are detected by channels.

- It is available to connect four points of a Pt100 or a JPt100(RD04A) or a Pt1000(RD04B) to one module.

- The number of the modules mounted on one base is not limited.

- LED is lighted in case of normal status and blinks at the intervals of 0.3 second in case of error

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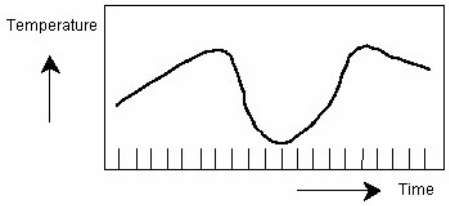
Click :

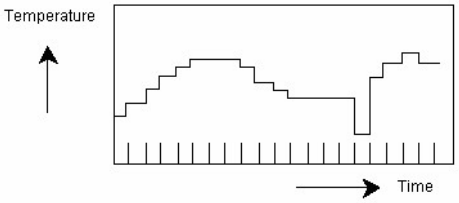
- General Idea
- Specifications
- Installing and Wiring
- Internal I/O Table
- Shared Memory
- CICON - Setting up RTD Card
- Trouble Shooting

6.6.1 General Idea

Analog Value - A,



[Figure 1.1] Analog Value

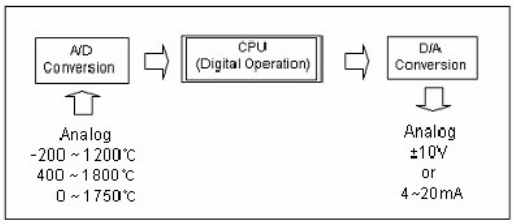


[Figure 1.2] Digital Value

The value varied continuously such as voltage, current, temperature, speed, pressure, flow and so on are called analog values. For the example of temperature, it is continuously varied with time like Picture 1.1. Varied temperatures like this are processed as digital values by the RTD module in a PLC.

Digital Value - D,

The value shown as number such as 0, 1, 2 and 3, and varied non-continuously are called digital values. ON signal and OFF signal are shown as the digital value of 0 and 1. BCD values and binary values are also digital values.



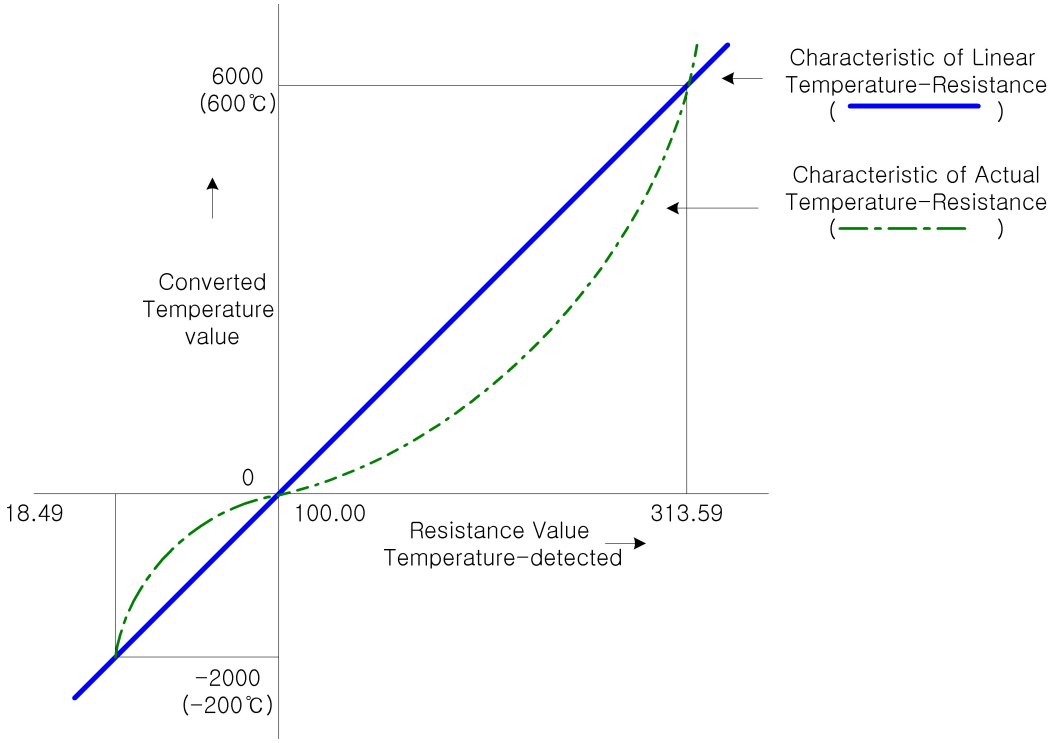
[Figure 1.3] Process in a PLC

To operate with digital values, analog values cannot be inputted directly to a CPU module.
Therefore, analog values is to be converted to digital values like Picture 1.4, being inputted to a CPU.
To output analog values, it is necessary to convert the digital values in a CPU to analog values.

Platinum Resistance Temperature Detector,

This is a sensor used to detect temperatures in the type of a resistance.
RTD Pt100 and RTD jPt100 indicate the output of 100.00 ? for 0ºC.
RTD Pt1000 indicates the output of 1000.00 ? for 0ºC.

Characteristics of Temperature Conversion,



- The resistance values of a Pt100 are varied according to the variation of the temperature around it.
- RTD modules linearize the non-linear resistance input of RTD as the above diagram.
- Temperature values are stored in the memory of a RTD module in the converted temperature values.
- A PLC CPU reads the converted temperature values stored in the memory of the RTD module.

Enabling/Disabling to RDT-Convert

1) It is available to assign enabling/disabling to RTD-convert to input channels.
2) As unused channels can be assigned to disabling to RDT-convert, the time for sampling is reduced.

Detected Temperature Values

1) The centigrade or the Fahrenheit values of converted temperatures are stored in a memory.(Actual Temperature * 10)

2) Converted temperatures are converted to the values in the range from 0 to 16000.

Information about Operating Channels

1) The information on the currently operating channels is indicated.
2) In case of the breaking of the wires among the currently enabled channels, the corresponding bit is 0.
3) The bit corresponding to disabled channels is 0.

Detecting the Breaking of Wires

1) The breaking of the wires connected to a RTD for each channel can be checked.
2) If the breaking of wires is detected, a RTD module will keep the temperature value before broken and not convert anymore. Error code is indicated and LED blinks at the intervals of 0.3 sec.
3) In case that a shield line is connected or disconnected due to bad contact, a RTD module converts when connected and keeps current temperature value when disconnected. Error code is indicated and LED blinks at the intervals of 0.3 sec.

Setting up Digital Output

1) The range of the digital output values stored in a buffer memory can be selected as -192~16191 or -8192~8191.

Setting up Maximum and Minimum Temperature

1) RTD modules convert the temperatures from –200 to 600℃to the digital values from 0(-8000) to 16000(8000). The maximum value and the minimum value of temperatures can be set up.
2) If a maximum and a minimum value are set up, RDT modules convert the minimum to 0(-8000) and the maximum to 16000(8000).

6.6.2 Specifications

6.6.2.1 General Specifications

<table>
<tr><th>Item</th><th colspan="5">Specification</th></tr>
<tr><td>Operating Temperature</td><td colspan="5">-10 ~ 65ºC</td></tr>
<tr><td>Storage Temperature</td><td colspan="5">-25 ~ 80ºC</td></tr>
<tr><td>Operating Humidity</td><td colspan="5">5 ~ 95%RH, Not condensed.</td></tr>
<tr><td>Storage Humidity</td><td colspan="5">5 ~ 95%RH, Not condensed.</td></tr>
<tr><td rowspan="8">Vibration</td><td colspan="5">In case of intermittent vibration</td></tr>
<tr><td>Frequency</td><td>Acceleration</td><td>Amplitude</td><td colspan="2">Sweep</td></tr>
<tr><td>10 ≤ f< 57Hz</td><td>-</td><td>0.075mm</td><td colspan="2" rowspan="2">10 times in each direction (X,Y,Z)</td></tr>
<tr><td>57 ≤ f < 150 Hz</td><td>9.8m/s2 {1G}</td><td>-</td></tr>
<tr><td colspan="5">In case of continuous vibration</td></tr>
<tr><td>Frequency</td><td>Acceleration</td><td>Amplitude</td><td colspan="2">Sweep</td></tr>
<tr><td>10 ≤ f < 57Hz</td><td>-</td><td>0.035mm</td><td colspan="2" rowspan="2">10 times in each direction (X,Y,Z)</td></tr>
<tr><td>57 ≤ f < 150 Hz</td><td>4.9m/s2 {1G}</td><td>-</td></tr>
<tr><td>Shock</td><td colspan="5">- Max. Shock Acc.: 147 m/s2 {15G}
- Time : 11ms(3 times in X, Y, Z)
- Pulse Wave : Half sine wave pulse</td></tr>
<tr><td rowspan="5">Noise</td><td>Square wave impulse noise</td><td colspan="4">±1500V</td></tr>
<tr><td>Electrostatic discharge</td><td colspan="4">Voltage: 4 kV(Contact discharge)</td></tr>
<tr><td>Radiated electro-magnetic field</td><td colspan="4">27 ~ 500 MHz. 10 V/m</td></tr>
<tr><td rowspan="2">Fast Transient Bust Noise</td><td>Item</td><td>Power Module</td><td>Digital I/O (24V or more)</td><td>Digital I/O(Less than 24V) Analog I/O Comm. interface</td></tr>
<tr><td>Voltage</td><td>2KV</td><td>1KV</td><td>0.25KV</td></tr>
<tr><td>Environment</td><td colspan="5">No corrosive gas and no dust.</td></tr>
<tr><td>Altitude</td><td colspan="5">2,000m or less</td></tr>
<tr><td>Pollution</td><td colspan="5">Less than 2</td></tr>
<tr><td>Cooling</td><td colspan="5">Natural Air cooling</td></tr>
</table>

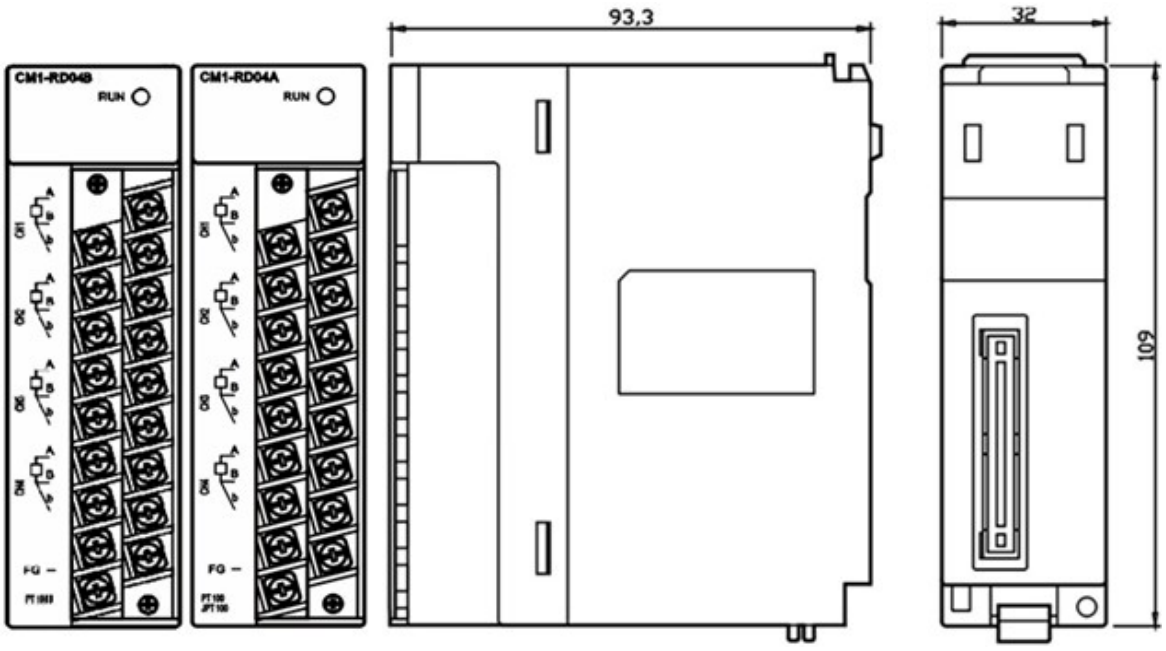
6.6.2.2 Module Specifications

<table>
<tr><th>Item</th><th colspan="2">Specification</th></tr>
<tr><td rowspan="2">Available RTD</td><td>RD04A</td><td>Pt 100 (JIS C1640-1989, DIN 43760-1980)
JPt100 (KS C1603-1991, JIS C1604-1981)</td></tr>
<tr><td>RD04B</td><td>Pt1000 (DIN EN 60751)</td></tr>
</table>

Range of Temperature Input	RD04A	Pt 100 : -200.0°C to 600°C (18.48 to 313.59W) JPt100 : -200.0°C to 600°C (17.14 to 317.28W)
	RD04B	Pt1000 : -200.0°C to 600°C (185.201 to 3137.080W)
Digital Output	Digitally Converted Value : 0 ~ 16,000(-8000~8000) Detected Temperature Value : -2000~6000(First Decimal Place Value X 10 times)	
Detecting the breaking of wires	3 wires by channels available	
Accuracy	±0.3%(Full Scale)	
Max. Conversion Rate	50ms / channel	
Number of Temperature Input Points	4 channels / module	
Insulation Type	Between input terminal and PLC : Photo Coupler Insulation Between output channels : No Insulation	
Contact Terminal	18-point Terminal Block	
Internal Current (mA)	+5V	50
	+15V	30
	-15V	10

6.6.2.3 Outward View and Dimensions

Unit :mm



6.6.3 Installing and Wiring

Installation Environment

Conditions

- Install in a waterproof and dust proof control panel.
- Install at the place without continuous shock or vibration.
- Keep out of the direct rays of the sun.
- No dew caused by sudden temperature variation.
- Keep ambient temperature from 0 to 55 C.

Works

- In case of making bolthole or wiring, keep a PLC from dust and dregs.
- Install at the place for easy operation.
- Do not install together with high-voltage device and same panel.
- The distance between ducts and modules is to be over 50㎜.
- Ground at the place where the environment of noise is good.

Cautions

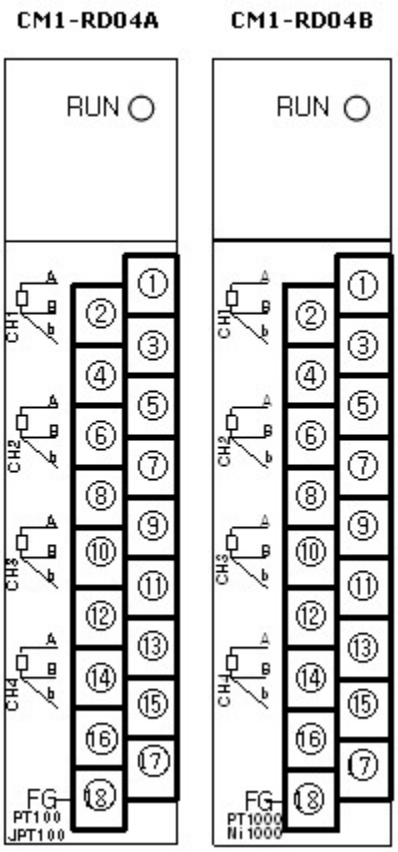
- Do not drop or shock.
- Do not separate a PCB from a case. That may be the reason of breakdown.
- In case of wiring, take care that dregs come into the top of a module. If there are, remove them.
- Mount or take out a module after turning off the power.

Safety Precautions

- Use separate cables for AC and outside input signals of an RTD converter module to keep from the serge or the induced noise occurring from the AC.
- Select the wire, considering ambient temperature, allowable current. AWG22(0.3 mm2) or more is recommended as the thickness of the wire.
- Keep the wire out of heat-generating device, toxic substance and oil. They may cause breakdown or malfunction.
- Make sure polarity before inputting analog value to a terminal block.
- The wiring together with high-voltage line or power line may cause malfunction or breakdown.

Example of Wiring

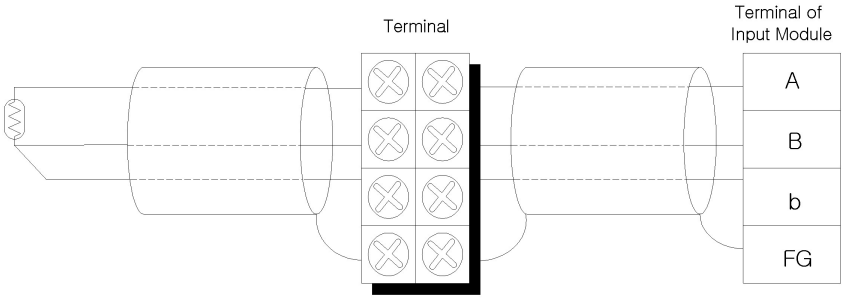
Measured values are inputted to all the channels grouped as Terminal 1-2-3, 5-6-7, 9-10-11 and 13-14-15.



[Wiring Method]

Channel	Terminal A	Terminal B	Terminal b	Terminal FG
Ch 1	Terminal 1	Terminal 2	Terminal 3	Terminal 18
Ch 2	Terminal 5	Terminal 6	Terminal 7	Terminal 18
Ch 3	Terminal 9	Terminal 10	Terminal 11	Terminal 18
Ch 4	Terminal 13	Terminal 14	Terminal 15	Terminal 18

- Connect the shields of a RTD and a wire to the FG of a RTD input module.
- The difference between the values of the wires is to be 1? or less.



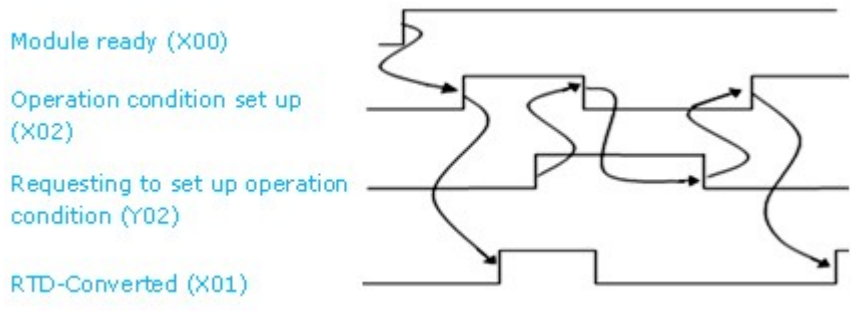
6.6.4 Internal I/O Table

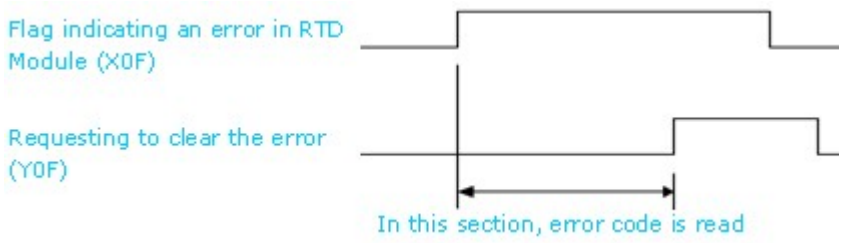
Signal Direction (CPU <- RTD Module)		Signal Direction (CPU -> RTD Module)	
Input	Signal Name	Output	Signal Name
X00	RTD module ready	Y00	Not use
X01	Flag indicating RTD-converted	Y01	
X02	Flag indicating operation condition set up	Y02	Requesting to set up operation condition

X03	Not Use	Y03	Not use
X04		Y04	
X05		Y05	
X06		Y06	
X07		Y07	
X08		Y08	
X09		Y09	
X0A		Y0A	
X0B		Y0B	
X0C		Y0C	
X0D		Y0D	
X0E		Y0E	
X0F	Flag indicating an error in RTD Module	Y0F	Requesting to clear an error

** The numbers of I/O signal are the ones of the case that a RTD module is mounted on Slot 0 of a local base.

6.6.4.1 Input Signals

NO	Name of Signal	Description
X00	RTD module ready	• If power is inputted to a CPU or a CPU is reset, RTD conversion will be ready. At this time, this signal is set and RTD conversion is processed.
X01	Flag indicating RTD-converted	• If all the enabled channels convert, this signal will be set.
X02	Flag indicating operation condition set up	• This is used as the interlock condition to set/reset request to set up operation condition (Y02) when enabling/disabling to RTD-convert is switched. • When this signal(X02) is reset, RTD conversion is not processed. In the following case, flag indicating operation condition set up will be reset. When requesting to set up operation condition is set. 

X0F	Flag indicating an error in RTD module	• If an error occurs in writing to buffer memory, this flag will be set. • To clear error code, request to clear an error(Y0F) is be set. 

6.6.4.2 Output Signals

NO.	Name of Signal	Description
Y02	Requesting to set up operation condition	• This is set when the contents of enabling/disabling to RTD-convert, assigning RTD set data and the max./min. temperature setup are available. • Refer to X02 for set/reset timing.
Y0F	Requesting to clear an error	• This is set to clear an error. • Refer to X0F(Flag indicating an error in RTD module) for set/reset timing

6.6.5 Shared Memory

Address		Description	R/W	Address		Description	R/W
Hexa	Deci			Hexa	Deci		
0H	0	Enabling/disabling to RTD-convert setup	R/W	1EH	30	Assigning Average Process	R/W
1H	1	Detected temp. value of CH.1(°C)	R	1FH	31	Error code value of CH.1	R
2H	2	Detected temp. value of CH.2(°C)	R	20H	32	Error code value of CH.2	R
3H	3	Detected temp. value of CH.3(°C)	R	21	33	Error code value of CH.3	R
4H	4	Detected temp. value of CH.4(°C)	R	22	34	Error code value of CH.4	R
5H	5	Detected temp. value of CH.5(°C)	R	23	35	Error code value of CH.5	R
6H	6	Detected temp. value of CH.6(°C)	R	24	36	Error code value of CH.6	R
7H	7	Detected temp. value of CH.7(°C)	R	25	37	Error code value of CH.7	R
8H	8	Detected temp. value of CH.8(°C)	R	26	38	Error code value of CH.8	R
9H	9	1)Assigning RTD type	R/W	27	39	Not use	-
AH	10	Not use	-	28	40		
BH	11	Detected temp. value of CH.1 (°F)	R	29	41	Max. temp. input value of CH.1	R/W
CH	12	Detected temp. value of CH.2 (°F)	R	2A	42	Max. temp. input value of CH.2	R/W
DH	13	Detected temp. value of CH.3 (°F)	R	2B	43	Max. temp. input value of CH.3	R/W

EH	14	Detected temp. value of CH.4 (°F)	R	2C	44	Max. temp. input value of CH.4	R/W
FH	15	Detected temp. value of CH.5 (°F)	R	2D	45	Max. temp. input value of CH.5	R/W
10H	16	Detected temp. value of CH.6 (°F)	R	2E	46	Max. temp. input value of CH.6	R/W
11H	17	Detected temp. value of CH.7 (°F)	R	2F	47	Max. temp. input value of CH.7	R/W
12H	18	Detected temp. value of CH.8 (°F)	R	30	48	Max. temp. input value of CH.8	R/W
13H	19	Information on operating channels	R	31	49	Max./min. temp. setup data	R/W
14H	20	Not use	-	32	50	Error in max./min. setup	R
15H	21	Digitally converted value of CH.1	R	33	51	Min. temp. input value of CH.1	R/W
16H	22	Digitally converted value of CH.2	R	34	52	Min. temp. input value of CH.2	R/W
17H	23	Digitally converted value of CH.3	R	35	53	Min. temp. input value of CH.3	R/W
18H	24	Digitally converted value of CH.4	R	36	54	Min. temp. input value of CH.4	R/W
19H	25	Digitally converted value of CH.5	R	37	55	Min. temp. input value of CH.5	R/W
1AH	26	Digitally converted value of CH.6	R	38	56	Min. temp. input value of CH.6	R/W
1BH	27	Digitally converted value of CH.7	R	39	57	Min. temp. input value of CH.7	R/W
1CH	28	Digitally converted value of CH.8	R	3A	58	Min. temp. input value of CH.8	R/W
1DH	29	Digital output setup	R/W	3B-3E	59-62	Setting up average time /filter coefficient for CH1-CH4	R/W

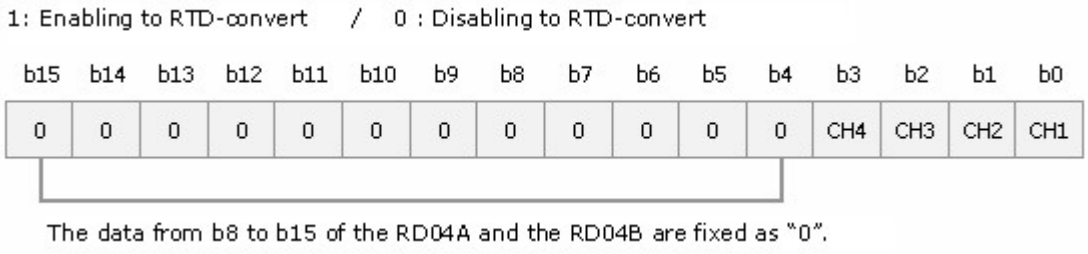
Note 1) Only RD04A is for R/W and RD04B cannot be used.

- The buffer memory from CH.5 to CH.8 cannot be used for 4-channel module.
- Each data is word type
- R/W indicates whether reading/writing from a PLC is enabled. (R : Reading is enabled. W : Writing is enabled.)

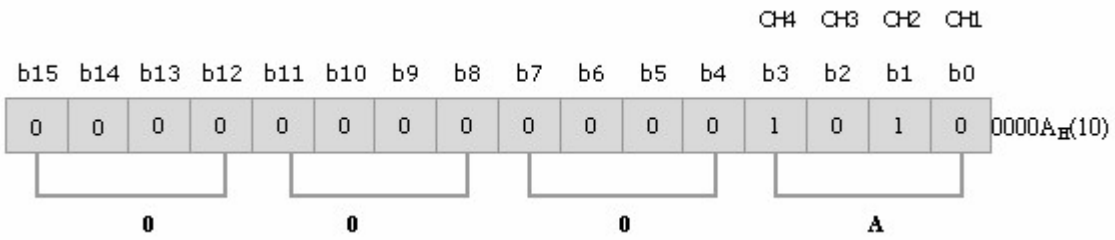
6.6.5.1 Enabling/Disabling to RTD-Convert ("0")

Buffer Memory Address "0"

- This is used to set up whether enabling or disabling to RTD-convert by the channels.
- To make it available to set up enabling/disabling to RTD-convert, requesting to set up operation condition (Y02) is to be set and reset.
- Disabling to RTD-convert is set up as default value.
- As a set value is stored in EEPROM, a RTD module is operated as previously set value even though power is on and off.



- **[Ex.]** In case that the channels for A/D conversion are 2,4, 00AAH(170) is to be written to Buffer Memory Address "0" and requesting to set up operation condition (Y02) is to be set and reset.



6.6.5.2 Detected Temperature Values °C ("1-8")

Buffer Memory Address "1~8"

- The temperature values detected by RTD conversion are indicated.
  The values stored in a memory are actual temperature value * 10.

- The range of the temperatures converted is from -200ºC to 600ºC. In case that they are over the range, they are fixed within the range from –250ºC to 650ºC.

6.6.5.3 Assigning RTD Type ("9")

Buffer Memory Address "9" for RD04A only, not for RD04B

- To make it available to set up enabling/disabling to RTD-convert, requesting to set up operation condition (Y02) is to be set and reset.

- Default value is Pt100 for the RD04A and Pt1000 for the RD04B.

- As a set value is stored in EEPROM, a RTD module is operated as previously set value even though power is on and off. 0 : Pt100 1 : jPt100

6.6.5.4 Detected Temperature Values °F ("11-18")

Buffer Memory Address "11 ~ 18"

- The temperature values detected by RTD conversion are indicated.
  The values stored in a memory are actual temperature value * 10.

- The range of the temperatures converted is from –392 to 1112 ºF . In case that they are over the range, they are fixed within the range from –482 to1202 ºF .

6.6.5.5 Information about Operating Channels ("19")

Buffer Memory Address "19"

- The information about currently operating channels is indicated.

- Among enabled channels, 0 is stored as the bit of the channels to which the wires connected are broken and 1 is stored as the bit of operating channels.

- The bit corresponding to disabled channel is 0.

6.6.5.6 Digitally Converted Values ("21-28")

Buffer Memory Address "21"~"28"

- When the temperature measured by a RTD is -200ºC, the value is stored as 0(-8000). When the temperature is 600ºC, the value is stored as 16000(8000).

- If a maximum and a minimum temperature value are inputted, the minimum value will be stored as 0(-8000) and the maximum as16000 (8000).

6.6.5.7 Digital Output Setup ("29")

Buffer Memory Address "29"

- This is used to select whether the range of digital output values is from 0 to 16000 or from –8000 to 8000.
- If 0 is set up, the range is from 0 to 16000. If 1, it is from –8000 to 8000.
- To make digital output setup available, requesting to set up an operation condition (Y02) is to be set and reset.
- The range from 0 to 16000 is set up as default value.
- As a set value is stored in EEPROM, the RTD module is operated as previously set value even though power is on and off.

6.6.5.8 Assigning Average Process ("30")

Buffer Memory Address "30"

- This is used to enable or disable the average process of a RTD module.
- To make enabling/disabling average process, requesting to set up an operation condition(Y02) is to be set and reset.
- Disabling average process is set up as default value.
- As a set value is stored in EEPROM, a RTD module is operated as previously set value even though power is on and off.

1: Enable / 0 : Disable

b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
0	0	0	0	0	0	0	0	0	0	0	0	CH4	CH3	CH2	CH1

6.6.5.9 Error Codes ("31-38")

Buffer Memory Address "31 ~ 38"

- The error codes detected from a RTD module are stored in these addresses.
- ◇ is from 1 to 3.
- If an error occurs, it will be kept till it is cleared or power is off. If an error is not cleared after it occurs, a newly occurring error will be disregarded.

- Error codes are decimal figure.

01	In case that A is broken
02	In case that B is broken
03	In case that b or both A and B is broken
04	In case that a measured temperature is over the range of max. and min. temperature
10?◇	Error in system (A/S required)

6.6.5.10 Buffer Memory Address ("41-58")

Maximum Temperature Input Values (Buffer Memory Address "41"~"48")

Max./Min. temperature setup data (Buffer Memory Address "49")

Error in max./min. setup (Buffer Memory Address "50")

Minimum temperature input value (Buffer Memory Address "51"~"58")

- This is used to input the max. value and min. value of desired temperatures.

- To make the max. value or min. value setup available, the bits corresponding to the temperature setup data(Address 49) of a set channel is to be set and requesting to set up an operation condition(Y02) be set and reset.

- Error in max./min. setup is to enter the bits of a corresponding channel if the input minimum value is greater than the input maximum value.

6.6.5.11 Setting up Average Time/Filter Coefficeient for Ch1-Ch4 ("59-62")

Buffer Memory Address "59~62"

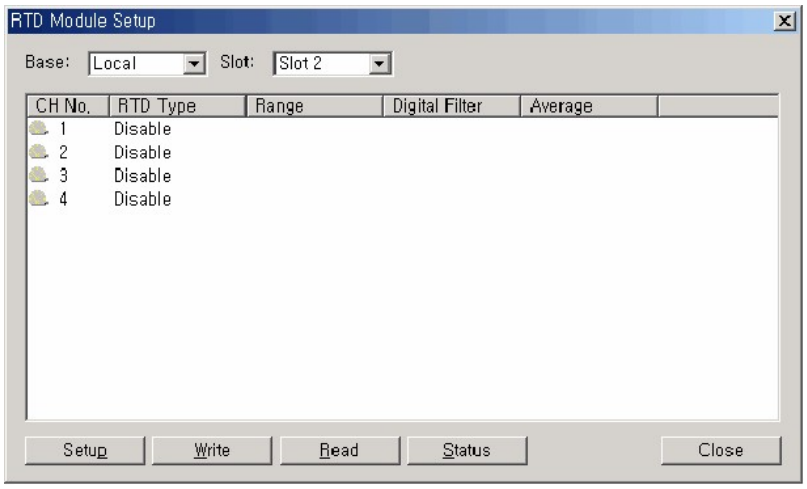
- This is used to store a set filter coefficient value and a set average time value.

- In 1 word, lower 1 byte : Set average time value : 1~255 sec.
  Upper 1 byte: Set filter coefficient value : 0~70 %
  In case that filtering function is not used, set value is 0.

- **[Ex.]** If the average process value of Channel 1 is 2sec. and the filter coefficient of it is 50, 3202H(12802) is stored in Buffer Memory 49.

6.6.6 CICON - Setting up RTD Card

If you select the RTD in the Optional Card Setup dialog box of the Tool, a RTD Module Setup dialog box will appear. The number of the base and slot where an RTD module is mounted are automatically shown. And if you double-click the corresponding RTD module in the project window, the following dialog box will appear, too. The values that are currently set up in the RTD module are shown.



Click :

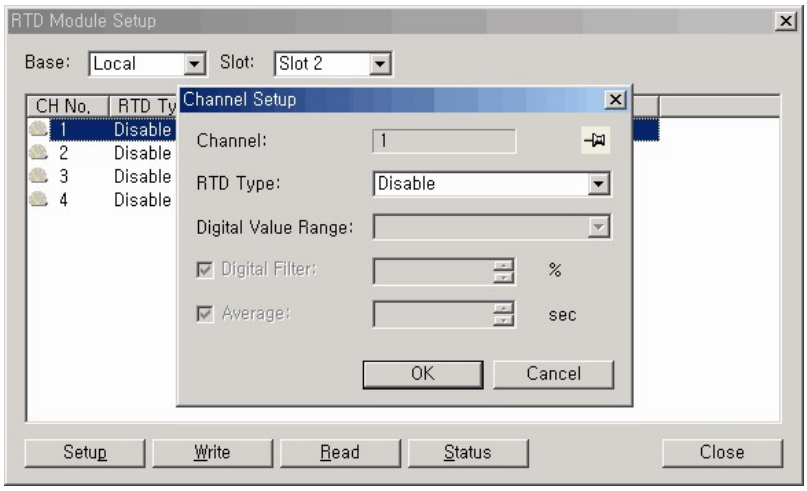
- Setting up Channels
- Initialization Program on a Local Base
- Comparing Converted Values on an Expansion Base

6.6.6.1 Setting up Channels

Setting up Channels

1. If you double-click the corresponding channel on the above window or click 

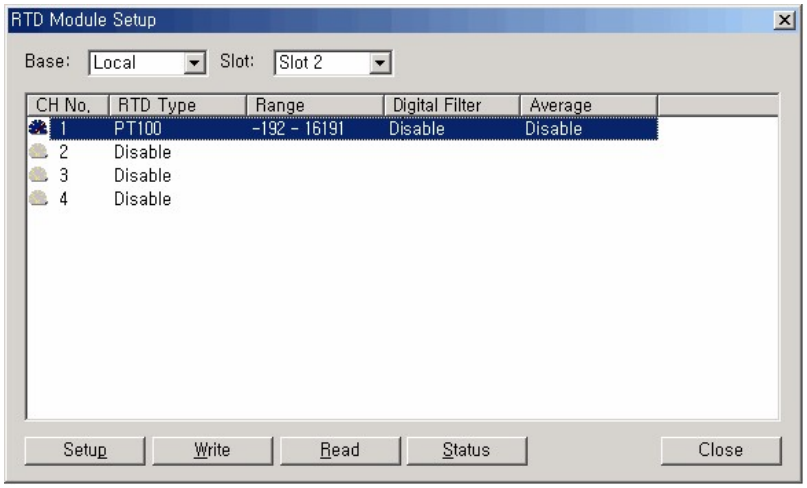
after selecting a channel, a Channel Features Setup dialog box will appear as follows.



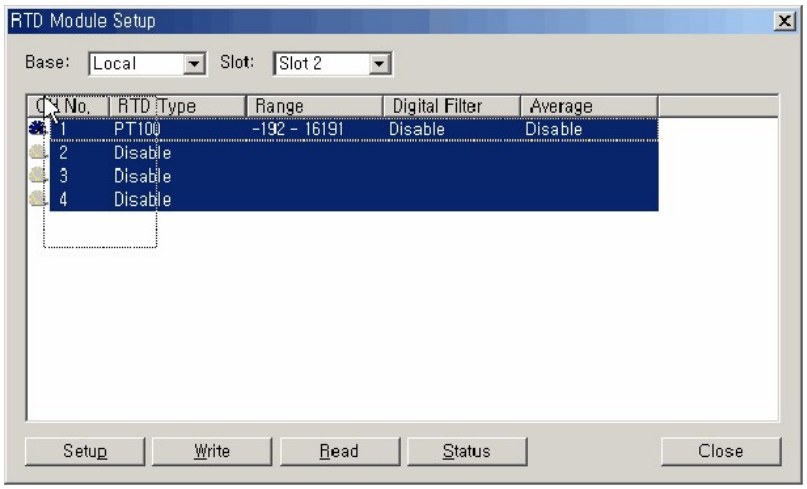
- **RTD Type :** PT100 and JPT100 for RD04A / PT1000 for RD04B
- **Range of Digitally Converted Values :** -192~16191, -8192~8191
- **Digital Filter :** 0~70%
- **Average Operation :** 1~255sec.

If you click  , the icon is changed to  . Click the channel in the AD Module Setup dialog box to revise the set values for a corresponding channel.

2. Click 'OK' after the channel is set up.



3. If you select all channels with the mouse as follows and  **, it will be available to set up all the channels.**



4. Click  **to operate the RTD card with set values.**

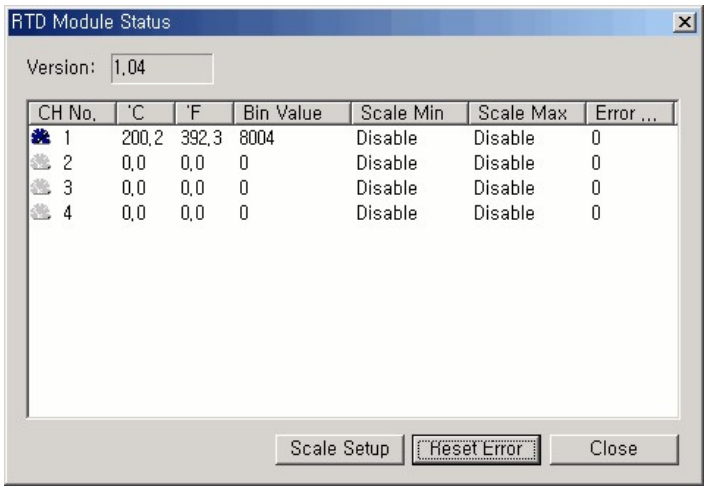
The message "Set values are recorded in module" is shown in the message bar.

After the set values are stored in EEPROM, even power is on/off, analog input values are converted with currently set channel values.

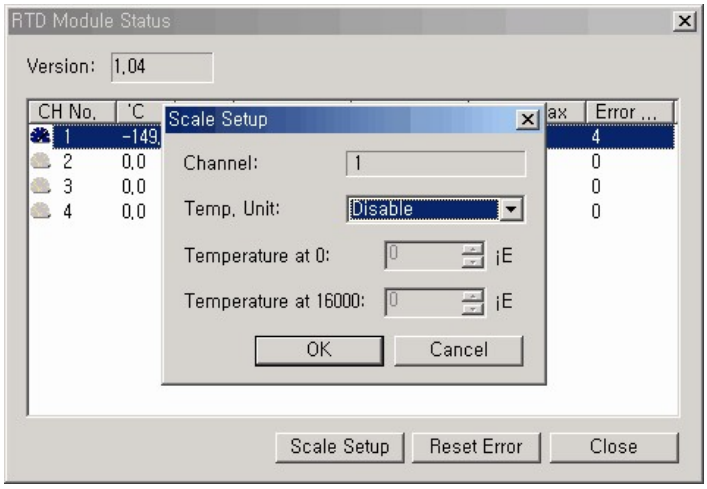
5.  **is used to read the currently set values in the AD card.**

Status

If you click  in the RTD Module Setup dialog box, the OS version, you can make sure the converted values and the Error Code for the RTD card and the scale of the converted temperature values can be set up.



If you select a channel and click Scale Setup, the following dialog box will appear.



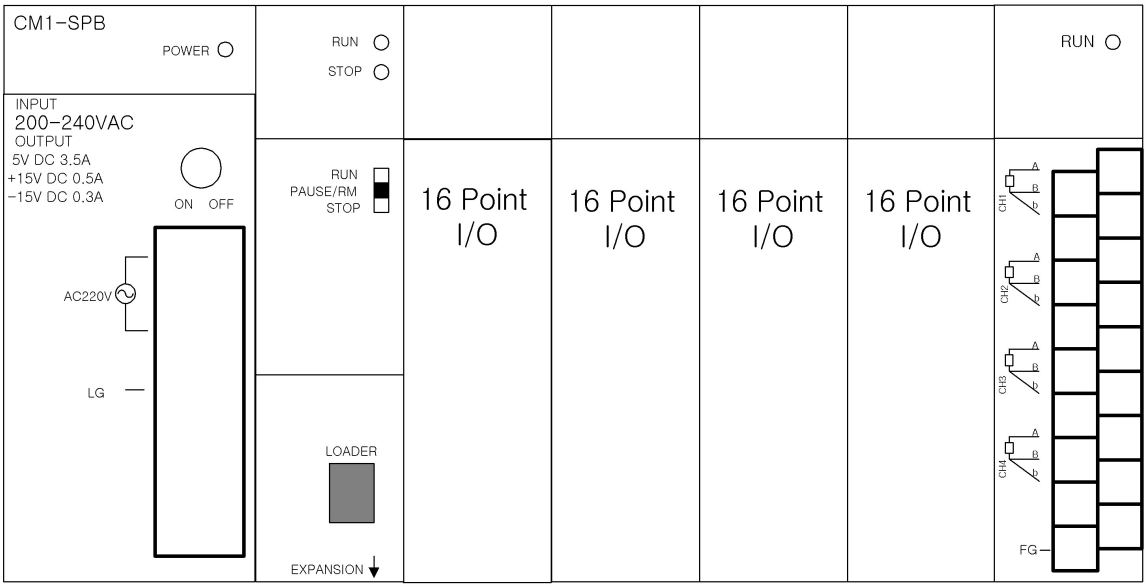
- The default digital value scale for -200ºC ~ 600ºC is 0(-8000) ~16000(8000). To revise the maximum and minimum temperature value, the Scale Setup is to be selected and the temperature when digital values are 0 and 16000 is be set up.

- A set scale value is not stored in EEPROM. To apply this setup in case that power is on/off, write the part for applying the scale value in SCAN program.

6.6.6.2 Initialization Program on a Local Base

Configuration :

The case that a RD04A is mounted on Slot 4 of a local base (5-slot base)



Initial Setup :

Used Channel	Channel 1	Channel 2
RTD Type	PT100	jPT100
Digital Output Type	-192~16191	-8192~8191
Max. Temp. Input Value	600℃	500℃
Min. Temp. Input Value	-200℃	0℃

Explanation for Program :

1. The value set up to buffer memory is inputted as TO command.

2. Channel 1 uses the initially set value(-200~600ºC) as max. and min. temp. and Channel 2 uses the range (0~500ºC).(The min. and max. value are converted to digital values from 0 to 16000.)

3. Flag requesting to set up an operation condition is on.

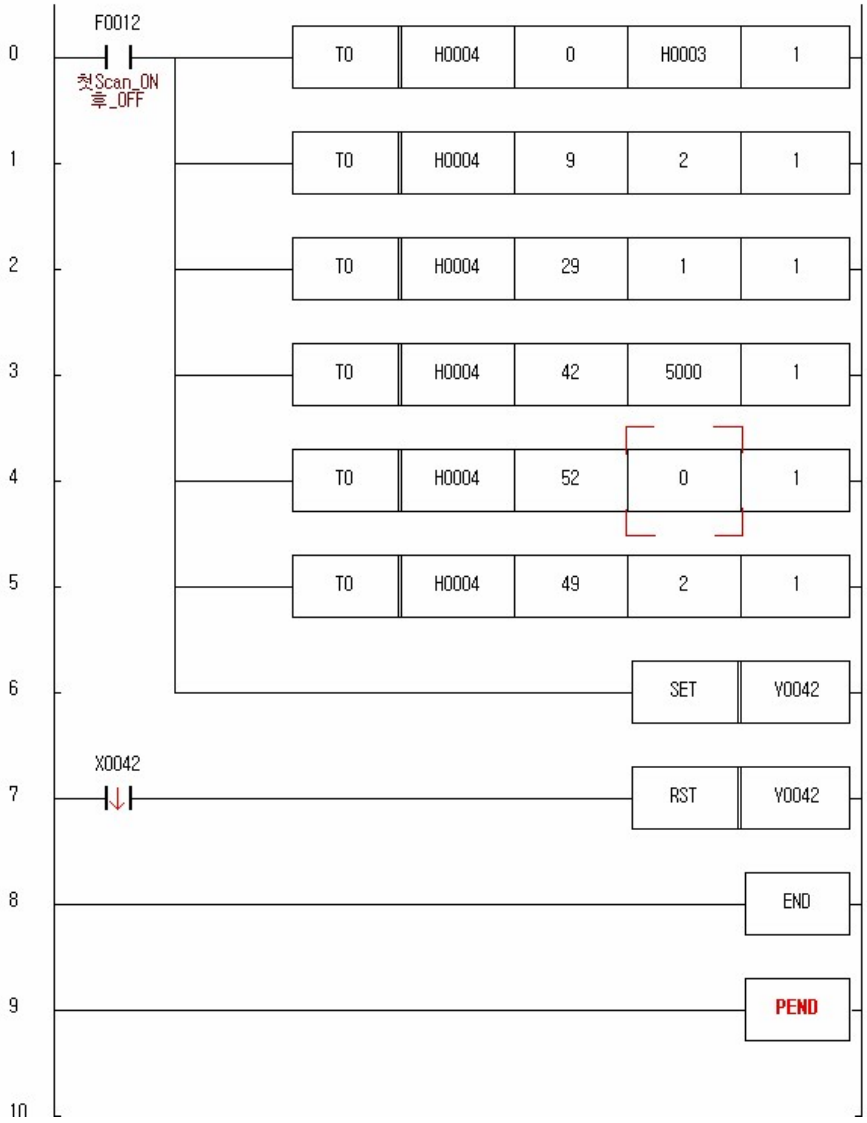
4. After making sure that flag indicating operation condition set up of the AD module is 0, flag requesting operation condition is off.

Point

- If flag requesting to set up an operation condition is set and reset, a RTD module is operated with the set values inputted to buffer memory by TO command. Otherwise, it is continuously operated with previously set values.

- **The initialization of an analog module can be set up in the optional card setup.**

Program :



Row 0 : Converting Channel 1 and 2 is enabled.

Row 1 : Channel 1: PT100, Channel 2: jPT100

Row 2 : Channel 1: -8192~8191, Channel 2: -192~16191 Setting up digital input type

Row 3 : Maximum temperature input value for Channel 2 -> 500ºC

Row 4 : Minimum temperature input value for Channel 2 -> 0ºC

Row 5 : The set maximum and minimum temperature data is for Channel 2.

Row 6 : Requesting to set up operation condition(Y42) is set.

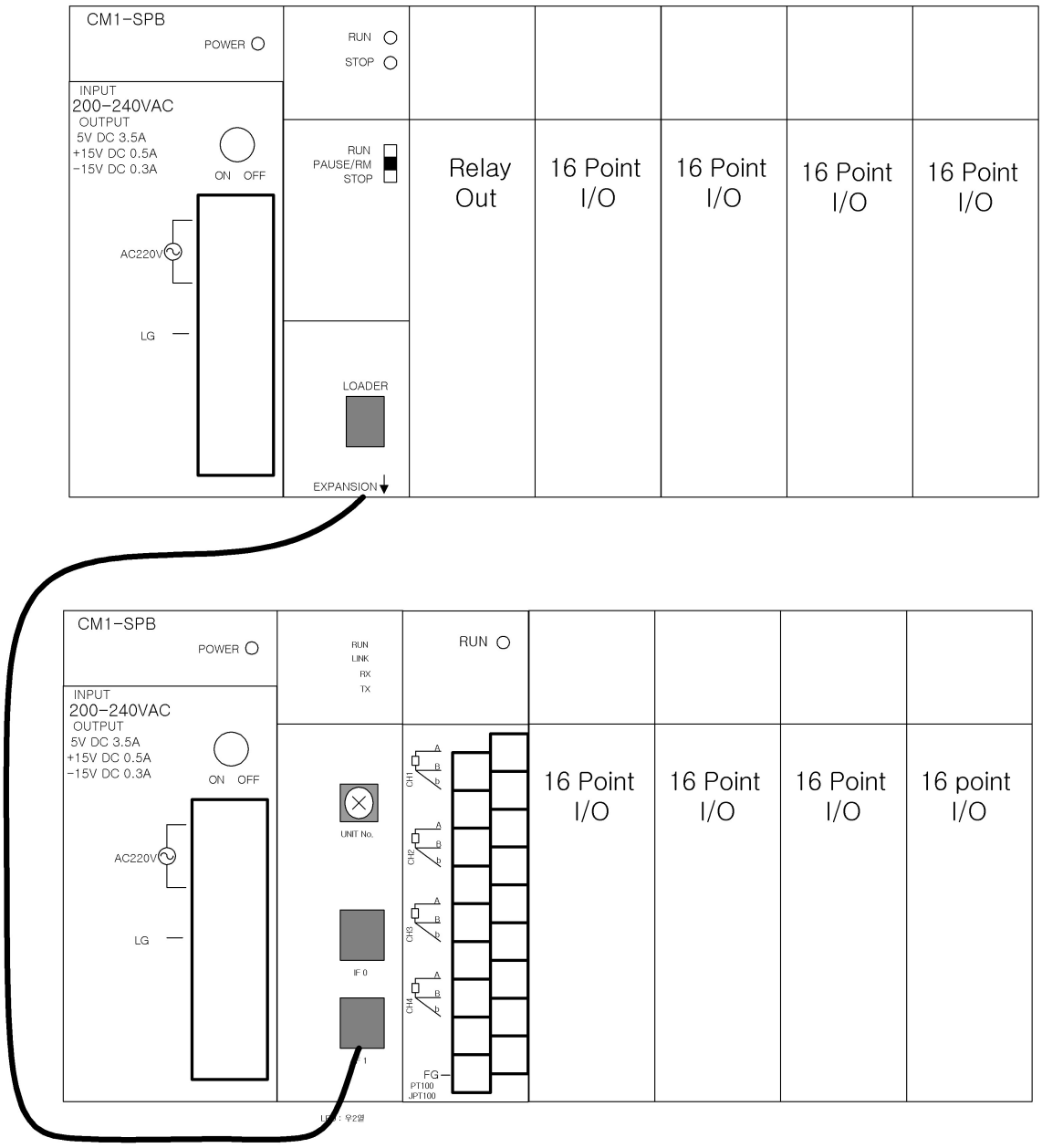
Row 7 : When Indicating operation condition set up(X4A) is on falling edge, requesting to set up operation condition(Y4A) is reset-> The set values of the RTD module has been changed.

Row 8 : end

6.6.6.3 Comparing Converted Values on an Expansion Base

Configuration :

- 5-slot local base : On Slot 0, mount an YR16A.
- 5-slot expansion : On Slot 0, mount a RD04A.
- 5-slot expansion : On Slot 0, mount a RD04A.



Initial Setup :

Used Channel	Channel 1
Type of RTD	PT100
Type of Digital Output	-192~16191
Max. Temp. Input Value	400ºC
Min. Temp. Input Value	-100ºC

Explanation for Program(Scan Program) :

1. The value set up to buffer memory is inputted as TO command.

2. Flag requesting to set up an operation condition is on.

3. After making sure that flag indicating operation condition set up of the RTD module is 0, flag requesting operation condition is off.

4. After being initialized, the RTD module starts to be converted according to the set values.

5. If the value of Buffer Memory 1 where converted temperature value is stored is
   - more than -100ºC and less than or equal to 0ºC, Y0000 is on.
   - more than 0ºC and less than or equal to 300ºC, Y0001 is on.
   - more than 300ºC and less than 400ºC, Y0002 is on.

6. In case that the wire is cut-off after reading the information about the operation channel, Y0003 is on and Operation Outputs(Y0000~Y0002) are off.

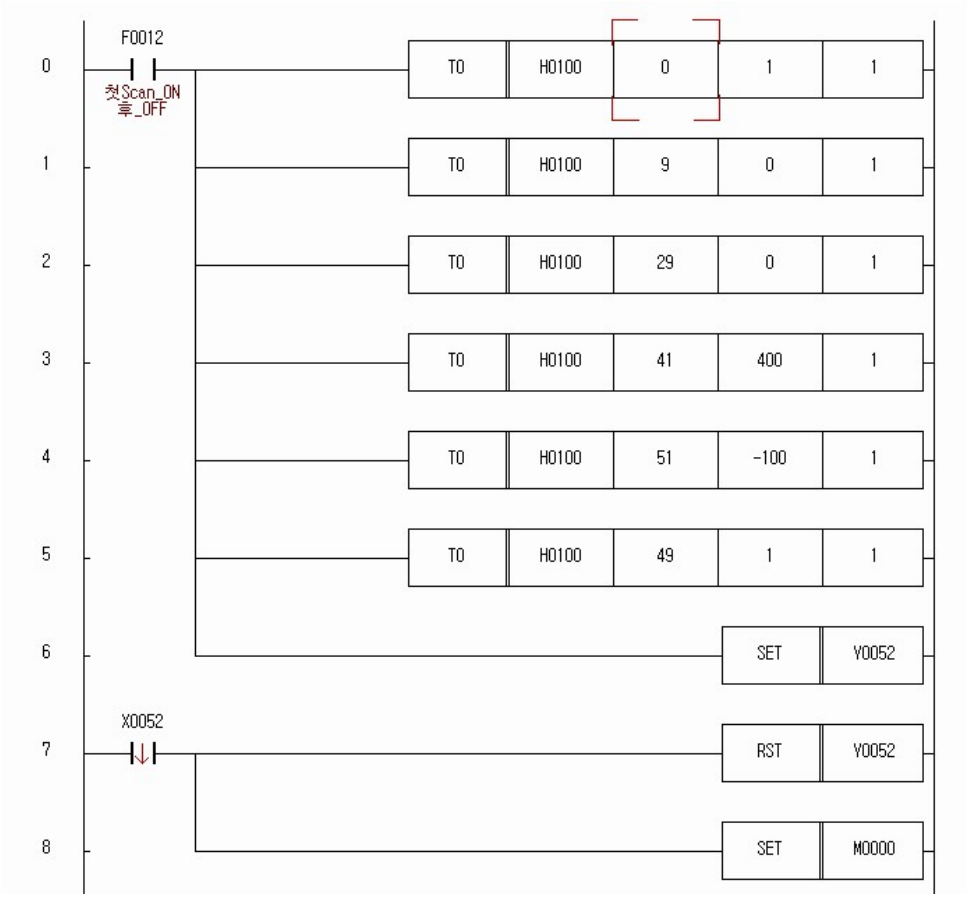
7. Select the menu to register Scan program in the CICON.

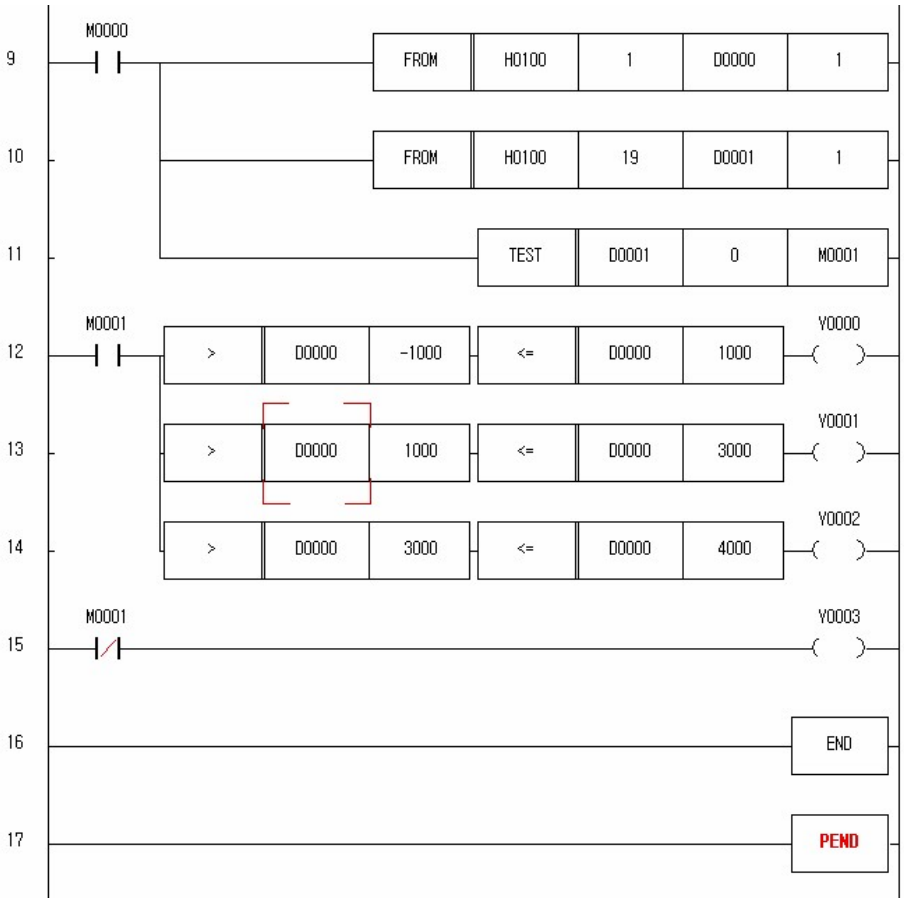
Point

- If flag requesting to set up an operation condition is set and reset, a RTD module is operated with the set values inputted to buffer memory by TO command. Otherwise, it is continuously operated with previously set values.

- **The initialization of an analog module can be set up in the optional card setup.**

Scan Program :





Row 0 : Expansion 1-Slot 0-Channel 1: Enable to convert

Row 1 : Channel 1: PT100

Row 2 : Channel 1: -192~16192 is set up as digital input.

Row 3 : Channel 1: Maximum temperature input value is 400ºC.

Row 4 : Minimum temperature input value: -100ºC

Row 5 : Data for setting up temperature

Row 6 : Requesting to set up operation condition(Y52) is set.

Row 7 : When Indicating operation condition set up(X5A) is on falling edge, requesting to set up operation condition(Y5A) is reset-> The set values of the RTD module has been changed.

Row 8 : To start the comparison program after the set values of RTD have been revised, M0000 is set.

Row 9 : The converted temperature value of Channel 1 is read and stored in D0000.

Row 10 : The information about operating channel is read and stored in D0001.

Row 11 : Through the information about the operating channel, it is checked whether the wire for Channel 1 is cut-off.

Row 12 : If the converted temperature value of Channel 1 is more than -100ºC and less than 100ºC, Y0000 is output.

Row 13 : If the converted temperature value of Channel 1 is more than 100ºC and less than or equal to 300ºC, Y0001 is output.

Row 14 : If the converted temperature value of Channel 1 is more than 300ºC and less than or equal to 400ºC, Y0002 is output.
Row 15 : In case the wire is cut-off, Y0003 is output.
Row 16 : END

Explanation for Program(Scan Program) :

Comparing Temperature Values

The value actually stored in buffer memory is "Actual Temperature * 10?and is indicated up to the first decimal place.
Accordingly, to compare with the temperature value in the buffer memory, you multiply the temperature value compared by 10 and compare the result with the read value.
If the value read from a buffer memory and stored in the D0000 is 3304, it is actually 330.4ºC.
To compare with 330ºC, compare 3304 with 3300(330*10).

Comparing Digital Values

The RD04A module converts the temperatures from –200 to 600ºC to the digital values from 0 to16000.
If a max. and a min. temperature value are set up, the input max. and min. temperature value are converted to 0 and 16000.

As the max. and min. temperature value are –100 and 500ºC, -100ºC is converted to 0 and 500ºC to 16000.

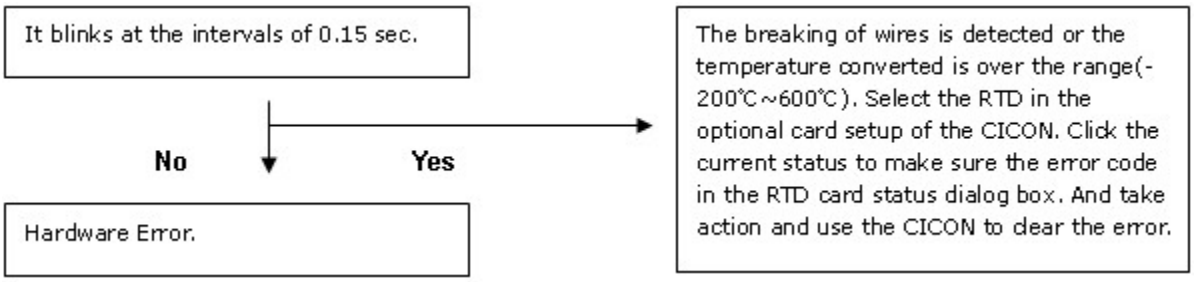
600(ºC) : 16000(Digital Value) = 1(ºC) : X(Digital Value)
X = 26.66 The digital value per one ºC is about 26.666.

Accordingly,
when –100ºC, the digital value is 0
when 300ºC, the digital value is 26.666*(100+300) = 10666.
when 400ºC, the digital value is 26.666*(100+400) = 13333.

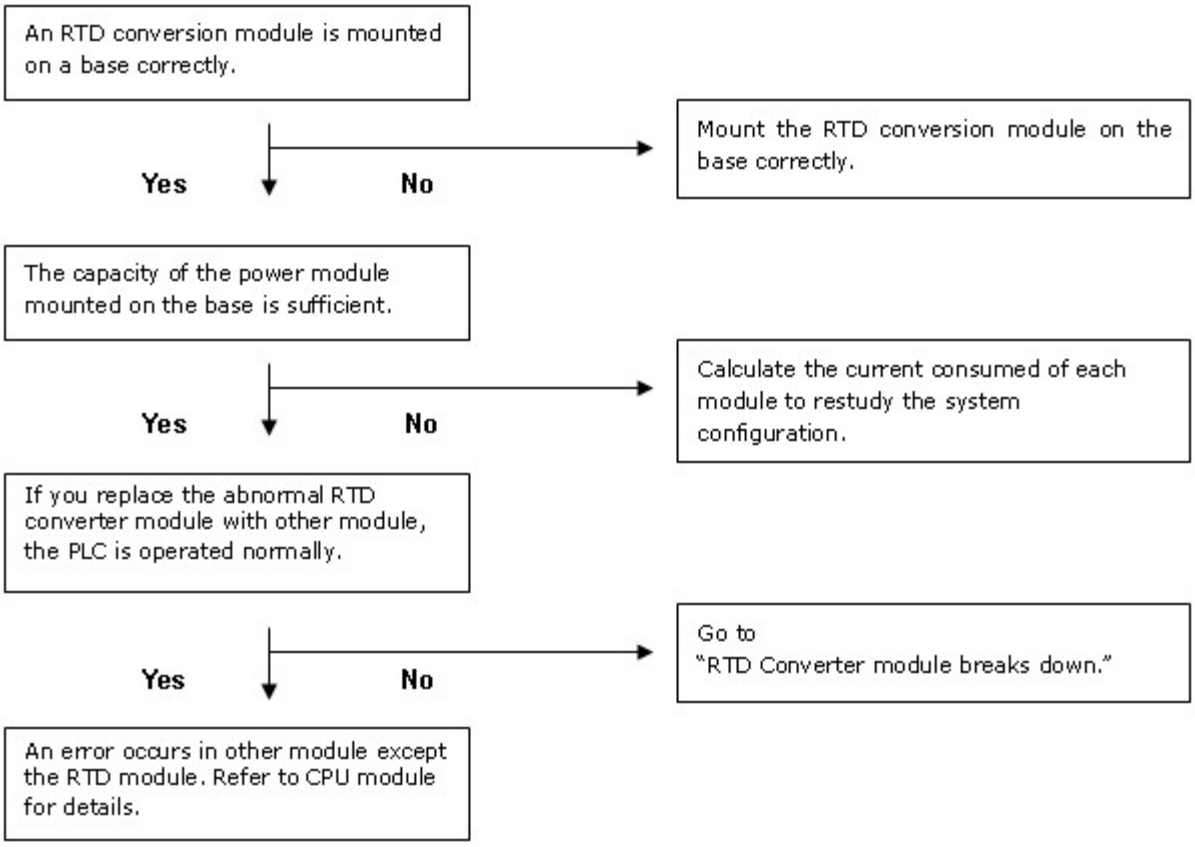
6.6.7 Trouble Shooting

- RUN LED blinks

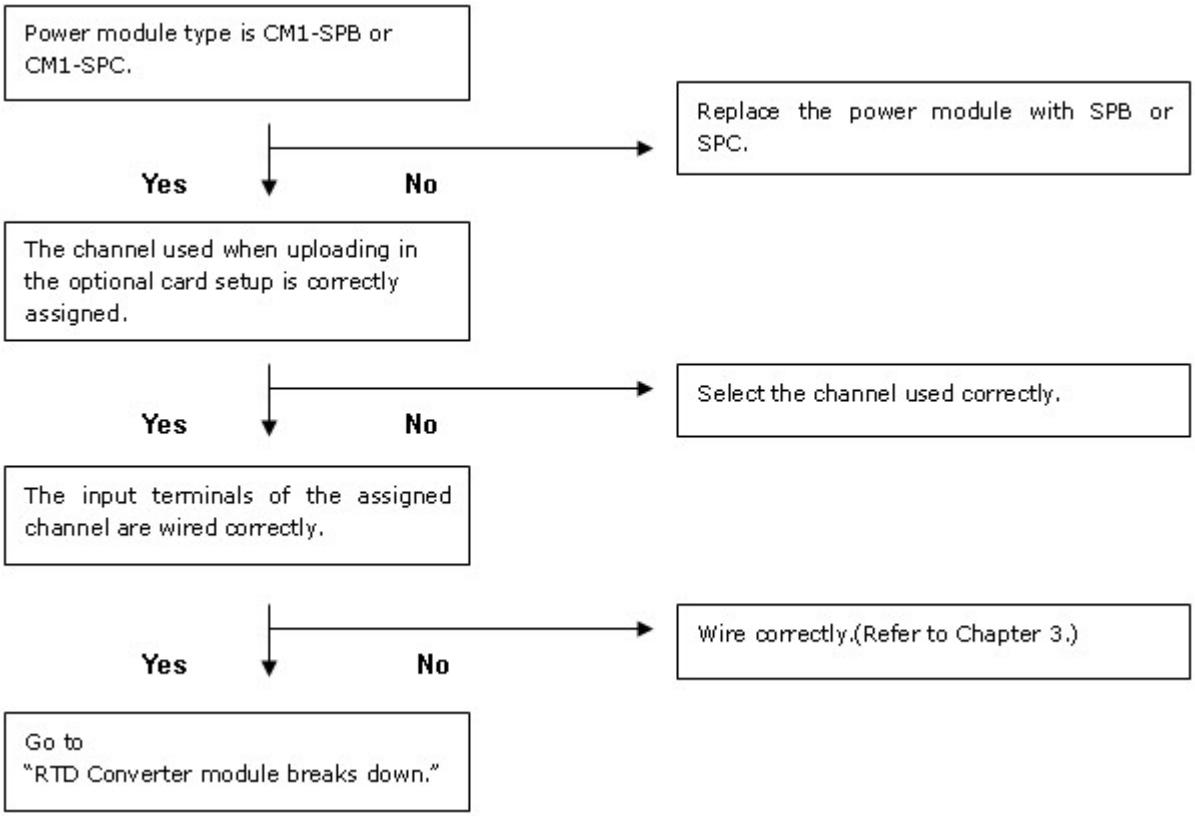
6.6.7.1 RUN LED blinks



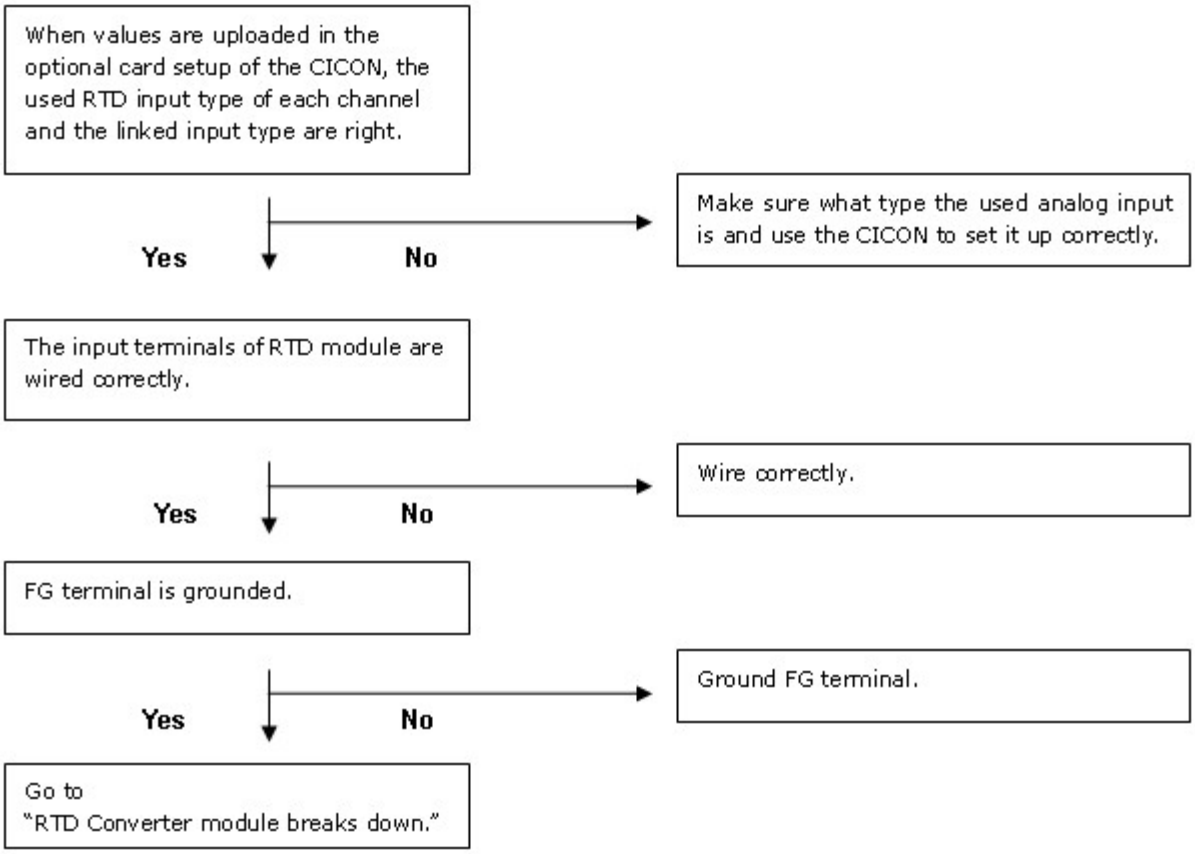
6.6.7.2 RUN LED is out



6.6.7.3 CPU module cannot read converted temperature values



6.6.7.4 RTD input values do not correspond to detected temperature values



6.6.7.5 RTD Converter module breaks down

The hardware of the RTD module breaks down.

Please call to a distributor.

6.7 TC Module

TC converter modules are used to receive inputs from thermocouples (K, J, E, T, B ,R,S), to measure their temperatures and to convert the temperatures to signed 16-bit binary digital value.
Seven kinds of thermocouple can be directly connected to a TC converter module to convert temperature(ºC) data to the digital values used in PLCs.

Features :

- The temperatures converted in the state that 7 kinds(K, J, E, T, R, S, B) of thermocouple are connected to a TC module can be indicated in Centigrade or Fahrenheit(ºC, ºF) and the temperature values can be

processed as digital values up to the first decimal place.

- Converted temperature data are converted to 16-bit binary data, which can be processed as digital values. The min. value and the max. value of each thermocouple are converted to 0 and 16000(-8000~8000).
- Temperatures are expressed up to min. value of -50°C and max. value of +50°C and digital values are expressed in the range from –192 to 16191(- 8192~8191).
- If a minimum temperature value and a maximum temperature value are set up, the minimum value will be converted to 0(-8000) and the maximum value to 16000(8000).
- The breaking of thermocouples and cables and the excess of measuring range are detected by channels..
- It is available to connect 4 thermocouples with one module.
- The number of the modules used on one base is not limited.
- Reference junction compensation by the temperature sensor mounted on a terminal is automatically performed.

Click :

- General Idea
- Specifications
- Installing and Wiring
- Internal I/O Table
- Shared Memory
- CICON - Setting up TC Card
- Trouble Shooting

6.7.1 Specifications

- General Specifications
- Module Specifications
- Outward View and Dimensions

6.7.1.1 General Specifications

<table>
<tr><th>Item</th><th colspan="5">Specification</th></tr>
<tr><td>Operating Temperature</td><td colspan="5">-10 ~ 65ºC</td></tr>
<tr><td>Storage Temperature</td><td colspan="5">-25 ~ 80ºC</td></tr>
<tr><td>Operating Humidity</td><td colspan="5">5 ~ 95%RH, Not condensed.</td></tr>
<tr><td>Storage Humidity</td><td colspan="5">5 ~ 95%RH, Not condensed.</td></tr>
<tr><td rowspan="8">Vibration</td><td colspan="5">In case of intermittent vibration</td></tr>
<tr><td>Frequency</td><td>Acceleration</td><td>Amplitude</td><td colspan="2">Sweep</td></tr>
<tr><td>10 ≦ f< 57Hz</td><td>-</td><td>0.075mm</td><td colspan="2" rowspan="2">10 times in each direction (X,Y,Z)</td></tr>
<tr><td>57 ≦ f < 150 Hz</td><td>9.8m/s2 {1G}</td><td>-</td></tr>
<tr><td colspan="5">In case of continuous vibration</td></tr>
<tr><td>Frequency</td><td>Acceleration</td><td>Amplitude</td><td colspan="2">Sweep</td></tr>
<tr><td>10 ≦ f < 57Hz</td><td>-</td><td>0.035mm</td><td colspan="2" rowspan="2">10 times in each direction (X,Y,Z)</td></tr>
<tr><td>57 ≦ f < 150 Hz</td><td>4.9m/s2 {1G}</td><td>-</td></tr>
<tr><td>Shock</td><td colspan="5">- Max. Shock Acc.: 147 m/s2 {15G}
- Time : 11㎳(3 times in X, Y, Z)
- Pulse Wave : Half sine wave pulse</td></tr>
<tr><td rowspan="5">Noise</td><td>Square wave impulse noise</td><td colspan="4">±1500V</td></tr>
<tr><td>Electrostatic discharge</td><td colspan="4">Voltage: 4 kV(Contact discharge)</td></tr>
<tr><td>Radiated electro-magnetic field</td><td colspan="4">27 ~ 500 MHz. 10 V/m</td></tr>
<tr><td rowspan="2">Fast Transient Bust Noise</td><td>Item</td><td>Power Module</td><td>Digital I/O (24V or more)</td><td>Digital I/O(Less than 24V) Analog I/O Comm. interface</td></tr>
<tr><td>Voltage</td><td>2KV</td><td>1KV</td><td>0.25KV</td></tr>
<tr><td>Environment</td><td colspan="5">No corrosive gas and no dust.</td></tr>
<tr><td>Altitude</td><td colspan="5">2,000m or less</td></tr>
<tr><td>Pollution</td><td colspan="5">Less than 2</td></tr>
<tr><td>Cooling</td><td colspan="5">Natural Air cooling</td></tr>
</table>

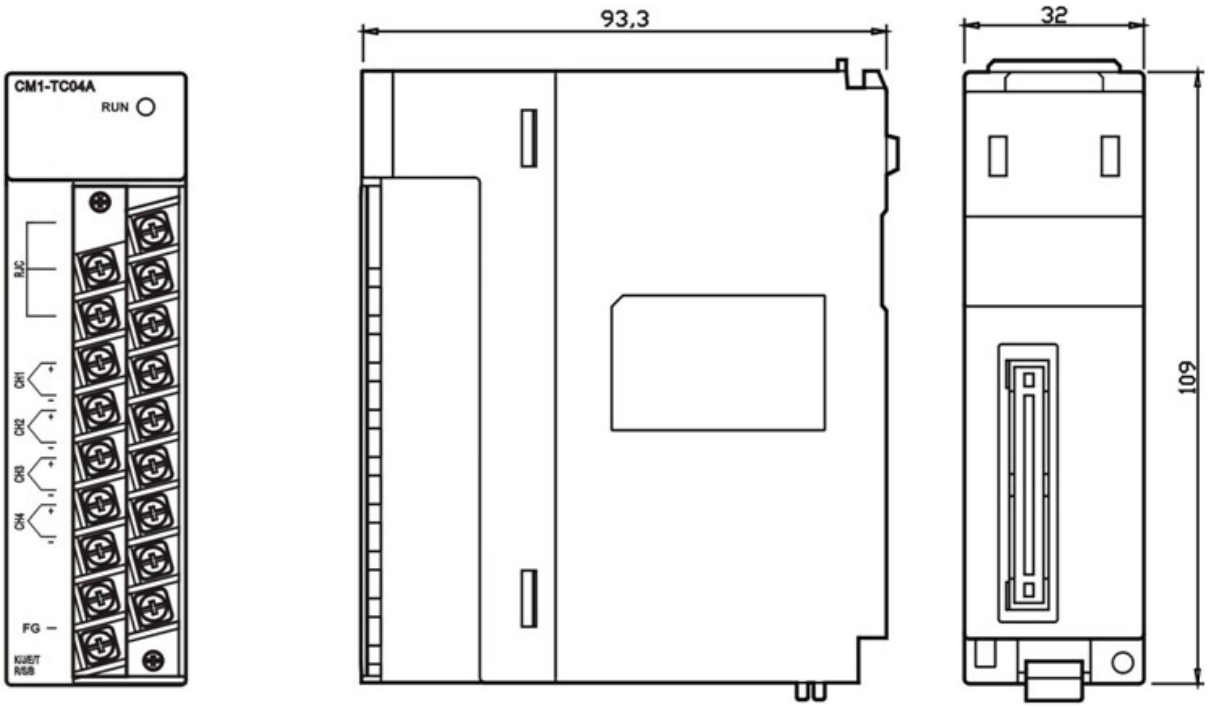
6.7.1.2 Module Specifications

	Specification
Available Thermocouple	Type K, J, E, T, B, R, S ,N
Digital Output	• Digitally Converted Value : 0 ~ 16000(-8000~8000), • Converted Temperature Value:(Range of Measured Temp.X10)

<table>
<tr><td>Range of Temperature</td><td colspan="3">
<table>
<tr><th>Type of Thermocouple</th><th>DIN Code</th><th>Range of Measured Temp.(^OC)</th><th>Range of (mV)</th></tr>
<tr><td>K</td><td rowspan="8">ITS-90</td><td>-200.0~1200.0</td><td>-5891~48828</td></tr>
<tr><td>J</td><td>-200.0~800.0</td><td>-7890~45498</td></tr>
<tr><td>E</td><td>-200.0~600.0</td><td>-8824~45085</td></tr>
<tr><td>T</td><td>-200.0~400.0</td><td>-5602~20869</td></tr>
<tr><td>B</td><td>400.0~1800.0</td><td>786~13585</td></tr>
<tr><td>R</td><td>0.0~1750.0</td><td>0~21006</td></tr>
<tr><td>S</td><td>0.0~1750.0</td><td>0~18612</td></tr>
<tr><td>N</td><td>-200 ~1250.0</td><td>-3990~43846</td></tr>
</table>
</td></tr>
<tr><td>RJC</td><td colspan="3">Automatic</td></tr>
<tr><td>Detecting the breaking of wires</td><td colspan="3">By channels</td></tr>
<tr><td>Accuracy</td><td colspan="3">±[(Full Scale)x0.3%+1ºC(RJC Error)]</td></tr>
<tr><td>Max. converted Rate</td><td colspan="3">50ms / channel</td></tr>
<tr><td>No. of Input Channels</td><td colspan="3">4 channels / module</td></tr>
<tr><td>Type of Insulation</td><td colspan="3">• Between input terminal and PLC : Photo Coupler Insulation
• Between output channels : No Insulation</td></tr>
<tr><td>Connection Terminal</td><td colspan="3">18-point Terminal</td></tr>
<tr><td rowspan="3">Current Consumtion (mA)</td><td>+5V</td><td colspan="2">60</td></tr>
<tr><td>+15V</td><td colspan="2">30</td></tr>
<tr><td>-15V</td><td colspan="2">10</td></tr>
</table>

6.7.1.3 Outward View and Dimensions

Unit : mm



6.7.2 Installing and Wiring

Installation Environment

Conditions

- Install in a waterproof and dustproof control panel.
- Install at the place without continuous shock or vibration.
- Keep out of the direct rays of the sun.
- No dew caused by sudden temperature variation.
- Keep the ambient temperature from 0 to 55 ^{o}C.

Works

- In case of making bolthole or wiring, keep a PLC from dust and dregs.
- Install at the place to operate easily.
- Do not install together with high-voltage device and same panel.
- The distance between ducts and modules is to be over 50 ^{o}C.
- Ground at the place where the environment of noise is good.

Cautions

- Do not drop or shock.

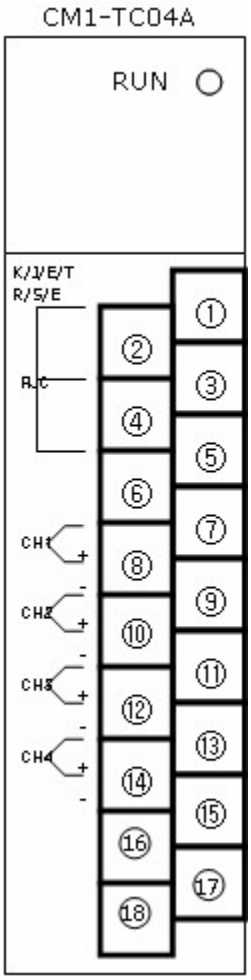
- Do not separate a PCB from a case. That may be the reason of breakdown.
- In case of wiring, take care that dregs come into the top of a module. If there are, remove them.
- Mount or take out a module after turning off power.

Safety Precautions

- Use separate cables for AC and outside input signals of a TC converter module to keep from the serge or the induced noise occurring from the AC.
- Select the wire, considering ambient temperature, allowable current. AWG22(0.3 mm2) or more is recommended as the thickness of the wire.
- Keep the wire out of heat-generating device, toxic substance and oil. They may cause breakdown or malfunction.
- Make sure polarity before inputting analog value to a terminal block.
- The wiring together with high-voltage line or power line may cause malfunction or breakdown.

Example of Wiring

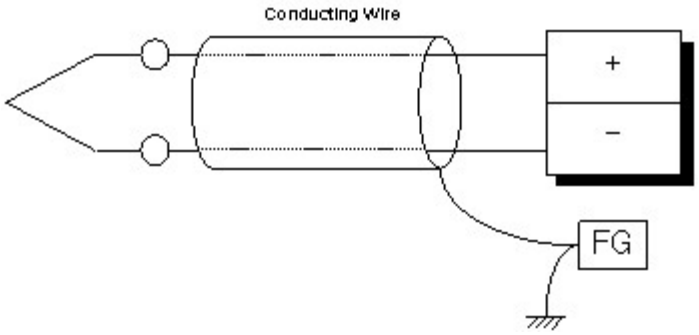
Measured values are inputted to all the channels grouped as Terminal 7-8, 9-10, 11-12, 13-14.



[Wiring Method]

Channel	Terminal +	Terminal -	Terminal FG
Ch 1	Terminal 7	Terminal 8	Terminal 18
Ch 2	Terminal 9	Terminal 10	Terminal 18
Ch 3	Terminal 11	Terminal 12	Terminal 18
Ch 4	Terminal 13	Terminal 14	Terminal 18

Cable is to be used as conducting wires.
Connect the shield part of a wire to FG terminal(No. 18) and ground it.
Connect RJC to Terminal 1, 3 and 5.



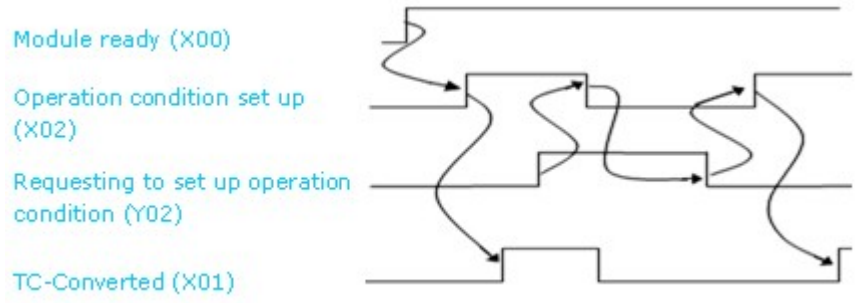
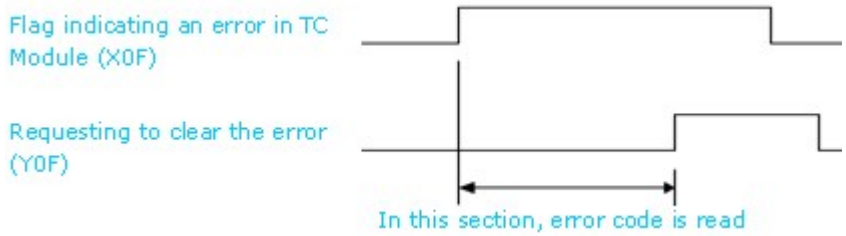
6.7.3 Internal I/O Table

Signal Direction (CPU <- TC Module)		Signal Direction (CPU -> TC Module)	
Input	Signal Name	Output	Signal Name
X00	TC module ready	Y00	Not use
X01	Flag indicating TC-converted	Y01	
X02	Flag indicating operation condition set up	Y02	Requesting to set up operation condition
X03	Not Use	Y03	Not Use
X04		Y04	
X05		Y05	
X06		Y06	
X07		Y07	
X08		Y08	
X09		Y09	
X0A		Y0A	

X0B		Y0B	
X0C		Y0C	
X0D		Y0D	
X0E		Y0E	
X0F	Flag indicating an error in RTD Module	Y0F	Requesting to clear an error

** The numbers of I/O signal are the one of the case that a TC module is mounted on Slot 0 of a local base.

6.7.3.1 Input Signals

NO.	Name of Signal	Description
X00	TC module Ready	• If power is inputted to a CPU or a CPU is reset, TC conversion will be ready. At this time, this signal is set and TC conversion is processed.
X01	Flag indicating TC-converted	• If all enabled channels convert, this signal will be set..
X02	Flag indicating operation condition set up	• This is used as the interlock condition to set/reset request to set up operation condition(Y02) when enabling/disabling to TC-convert is switched. • When this signal(X02) is reset, TC conversion is not processed. In the following case, flag indicating operation condition set up will be reset. When requesting to set up operation condition is set. 
X0F	Flag indicating an error in TC module	• If an error occurs in writing to buffer memory, this flag will be set. • To clear error code, request to clear the error(Y0F) is be set. 

6.7.3.2 Output Signals

NO.	Name of Signal	Description
Y02	Requesting to set up operation condition	• This is set when the contents of enabling/disabling to TC-convert, assigning TC set data and the max./min. temperature setup are available. • Refer to X02 for set/reset timing.
Y0F	Requesting to clear an error	• This is set to clear an error. • Refer to X0F(Flag indicating an error in TC module) for set/reset timing

6.7.4 Shared Memory

Address		Description	R/W	Address		Description	R/W
Hexa	Deci			Hexa	Deci		
0H	0	Enabling/disabling to TC-convert setup	R/W	1EH	30	Assigning Average Process	-
1H	1	Detected temp. value of CH.1(°C)	R	1FH	31	Error code value of CH.1	R
2H	2	Detected temp. value of CH.2(°C)	R	20H	32	Error code value of CH.2	R
3H	3	Detected temp. value of CH.3(°C)	R	21H	33	Error code value of CH.3	R
4H	4	Detected temp. value of CH.4(°C)	R	22H	34	Error code value of CH.4	R
5H	5	Detected temp. value of CH.5(°C)	R	23H	35	Error code value of CH.5	R
6H	6	Detected temp. value of CH.6(°C)	R	24H	36	Error code value of CH.6	R
7H	7	Detected temp. value of CH.7(°C)	R	25H	37	Error code value of CH.7	R
8H	8	Detected temp. value of CH.8(°C)	R	26H	38	Error code value of CH.8	R
9H	9	Assigning TC type(CH.1~CH.4)	R/W	27H	39	Not use	-
AH	10	Assigning TC type(CH.5~CH.8)	R/W	28H	40		
BH	11	Detected temp. value of CH.1 (°F)	R	29H	41	Max. temp. input value of CH.1	R/W
CH	12	Detected temp. value of CH.2 (°F)	R	2AH	42	Max. temp. input value of CH.2	R/W
DH	13	Detected temp. value of CH.3 (°F)	R	2BH	43	Max. temp. input value of CH.3	R/W
EH	14	Detected temp. value of CH.4 (°F)	R	2CH	44	Max. temp. input value of CH.4	R/W

FH	15	Detected temp. value of CH.5 (°F)	R	2DH	45	Max. temp. input value of CH.5	R/W
10H	16	Detected temp. value of CH.6 (°F)	R	2EH	46	Max. temp. input value of CH.6	R/W
11H	17	Detected temp. value of CH.7 (°F)	R	2FH	47	Max. temp. input value of CH.7	R/W
12H	18	Detected temp. value of CH.8 (°F)	R	30H	48	Max. temp. input value of CH.8	R/W
13H	19	Information on operating channels	R	31H	49	Assigning temp. setup data	R/W
14H	20	Assigning type setup data	R/W	32H	50	Error in temp. setup	R
15H	21	Digitally converted value of CH.1	R	33H	51	Min. temp. input value of CH.1	R/W
16H	22	Digitally converted value of CH.2	R	34H	52	Min. temp. input value of CH.2	R/W
17H	23	Digitally converted value of CH.3	R	35H	53	Min. temp. input value of CH.3	R/W
18H	24	Digitally converted value of CH.4	R	36H	54	Min. temp. input value of CH.4	R/W
19H	25	Digitally converted value of CH.5	R	37H	55	Min. temp. input value of CH.5	R/W
1AH	26	Digitally converted value of CH.6	R	38H	56	Min. temp. input value of CH.6	R/W
1BH	27	Digitally converted value of CH.7	R	39H	57	Min. temp. input value of CH.7	R/W
1CH	28	Digitally converted value of CH.8	R	3AH	58	Min. temp. input value of CH.8	R/W
1DH	29	Digital output setup	R/W	3B-3E	59-62	Setting up average time /filter coefficient for CH1-CH4	R/W

- The buffer memory from CH.5 to CH.8 cannot be used for 4-channel module.
- Each data is word type
- R/W indicates whether reading/writing from a PLC is enabled. (R : Reading is enabled. / W : Writing is enabled.)

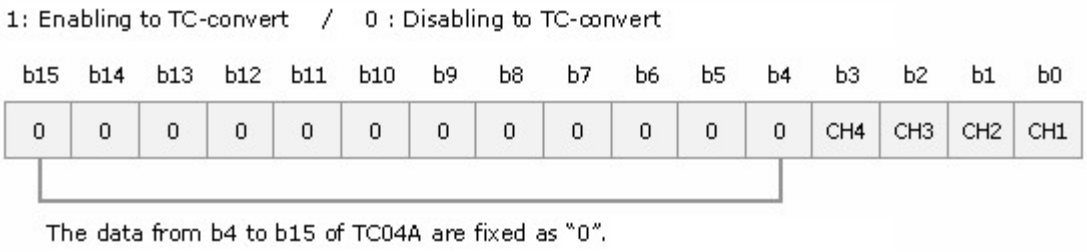
6.7.4.1 Enabling/Disabling to TC-Convert ("0")

Buffer Memory Address "0"

- This is used to set up whether enabling or disabling to TC-convert by the channels.

- To make it available to set up enabling/disabling to TC-convert, requesting to set up operation condition(Y02) is to be set and reset.

- The default value is set up as disabling to TC-convert.
- As a set value is stored in EEPROM, the TC module is operated as previously set value even though power is on and off.



6.7.4.2 Detected Temperature Values °C ("1-8")

Buffer Memory Address "1~8"

- The temperature values detected by TC conversion are indicated.
  The values stored in a memory are actual temperature value * 10.
- Range of the temperatures converted

TC Type	Rated Range of Measured Temperatures(°C)	Max. Indicated Range of Measured Temperatures(°C)
K	-200.0~1200.0	-250.0~1250.0
J	-200.0~800.0	-250.0~850.0
E	-200.0~600.0	-250.0~650.0
T	-200.0~400.0	-250.0~450.0
B	400.0~1800.0	350.0~1850.0
R	0.0~1750.0	-50.0~1800.0
S	0.0~1750.0	-50.0~1800.0

- In case of the temperatures out of the rated range, they are outputted up to 50℃less than as the minimum and 50℃greater than the range as the maximum.

6.7.4.3 Assigning TC Type ("9")

Buffer Memory Address "9"

- To make the TC type setup available, after a type is set up, the bit corresponding to the type setup data (Buffer Memory Address 20) is to be 1 and requesting operation condition setup (Y02) is to be set and reset.
- Default value is assigned to Type K.
- As a set value is stored in EEPROM, a TC module is operated as previously set value even though power is on and off.

[Set values according to TC type]

TC Type	K	J	E	T	R	S	B
Set Value	0	1	2	3	4	5	6

	b15 - b12	b11 - b8	b7 - b4	b3 - b0
Buffer Memory Address "9"	CH.4	CH.3	CH.2	CH.1

6.7.4.4 Detected Temperature Values °F ("11-18")

Buffer Memory Address "11 ~ 18"

- The Fahrenheit temperature values detected by TC conversion are indicated.
- The values stored in memory are actual temperature value * 10.

6.7.4.5 Information about Operating Channels ("19")

Buffer Memory Address "19"

- The information about currently operating channels is indicated.
- Among enabled channels, 0 is stored as the bit of the channels to which the wires connected are broken and 1 is stored as the bit of operating channels.

- The bit corresponding to disabled channel is 0.

6.7.4.6 Digitally Converted Values ("21-28")

Buffer Memory Address "21~28"

- The temperatures measured by a TC are stored as the digital values in the range from 0(-8000) to 16000(8000). In case of the values out of the range, they are stored as the values in the range from -192(-8192) to 16191(8191).

- If a maximum and a minimum temperature value are input, the minimum value will be stored as 0(-8000) and the maximum as16000(8000).

6.7.4.7 Digital Output Setup ("29")

Buffer Memory Address "29"

- This is used to select whether the range of digital output values is from 0 to 16000 or from –8000 to 8000.

- If 0 is set, the range is from 0 to 16000. If 1, it is from –8000 to 8000.

- To make the digital output setup available, requesting to set up an operation condition(Y02) is to be set and reset.

- Default value is set up as the range from 0 to 16000.

- As a set value is stored in EEPROM, a TC module is operated as previously set value even though power is on and off.

6.7.4.8 Assigning Average Process ("30")

Buffer Memory Address "30"

- This is used to enable or disable the average process of a TC module.

- To make enabling/disabling average process, requesting to set up an operation condition (Y02) is to be set and reset.

- Disabling average process is set up as default value.
- As a set value is stored in EEPROM, a TC module is operated as previously set value even though power is on and off.

1: Enable / 0 : Disable

b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
0	0	0	0	0	0	0	0	0	0	0	0	CH4	CH3	CH2	CH1

6.7.4.9 Error Codes ("31-38")

Buffer Memory Address "31~ 38"

- The error codes detected from a TC module are stored in these addresses.
- If an error occurs, it will be kept till it is cleared or power is off. If an error is not cleared after it occurs, a newly occurring error will be disregarded.
- ◇ is from 1 to 3.
- Error codes are decimal figure.

01	In case of the breaking of wires
02	Error in RJC
03	In case that TC type is wrongly set up
04	In case that measured temp. is over range
10◇	Error in system (A/S required)

6.7.4.10 Buffer Memory Address ("41-58")

Maximum Temperature Input Values(Buffer Memory Address "41"~"48")

Max./Min. temperature setup data(Buffer Memory Address "49")

Error in max./min. setup(Buffer Memory Address "50")

Minimum temperature input value(Buffer Memory Address "51"~"58")

- This is used to input the max. value and min. value of desired temperatures.

- To make the max. value or min. value setup available, the bits corresponding to the temperature setup data(Address 49) of a set channel is to be set and requesting to set up an operation condition(Y02) be set and reset.

- The error in max./min. setup is to enter the bits of the corresponding channel if an input minimum value is greater than an input maximum value.

- Initial values are set up as the max. value and the min. value of the rated measured range.

- The max. value and the min. value changed by users are not stored in EEPROM. If you turn off and on power, they will be the initial values(Refer to "Detected Temperature Values ºC"). To use an input maximum value and an input minimum value, it is necessary to program then directly.

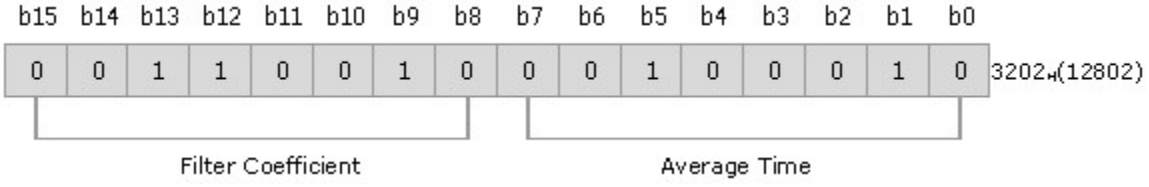
6.7.4.11 Setting up Average Time/Filter Coefficient for Ch1-Ch4 ("59-62")

Buffer Memory Address "59 ~ 62"

- This is used to store a set filter coefficient value and a set average time value.

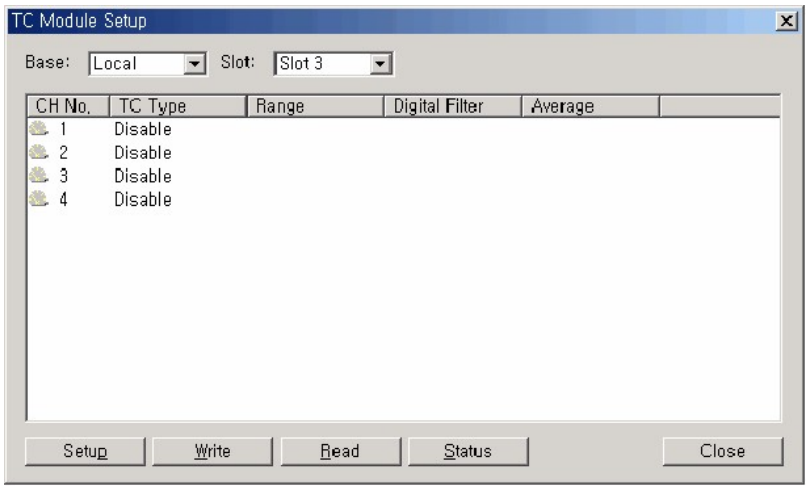
- **In 1 word, lower 1 byte : Set average time value :** 1~255 sec.
  Upper 1 byte: Set filter coefficient value : 0~70 %
  In case the filtering function is not used, the set value is 0.

- **[Ex.]** If the average process value of Channel 1 is 2sec. and the filter coefficient of it is 50, 3202H(12802) is stored in Buffer Memory 49.



6.7.5 CICON - Setting up TC Card

If you select the TC in the Optional Card Setup dialog box of the Tool, a TC Module Setup dialog box will appear. The number of the base and slot where a TC module is mounted are automatically shown. And if you double-click the corresponding TC module in the project window, the following dialog box will appear, too. The values that are currently set up in the TC module are shown.



Click :

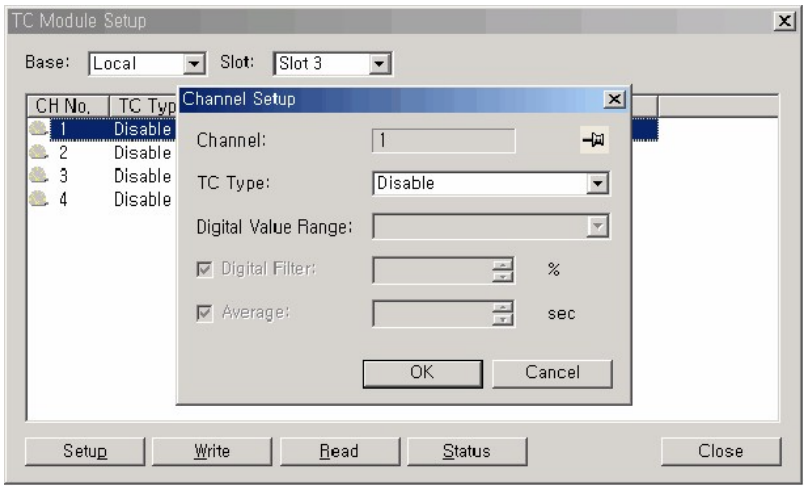
- Setting up Channels
- Initialization Program on a Local Base
- Comparing Converted Values on an Expansion Base

6.7.5.1 Setting up Channels

Setting up Channels

1. If you double-click the corresponding channel on the above window or click 

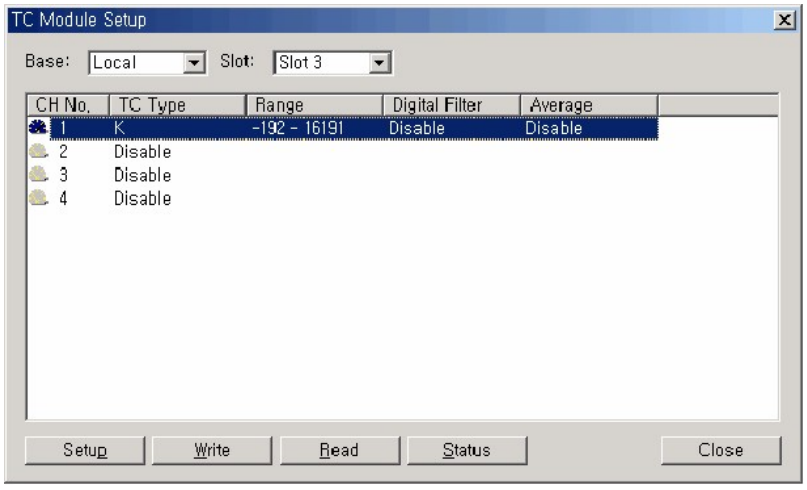
after selecting a channel, a Channel Features Setup dialog box will appear as follows.



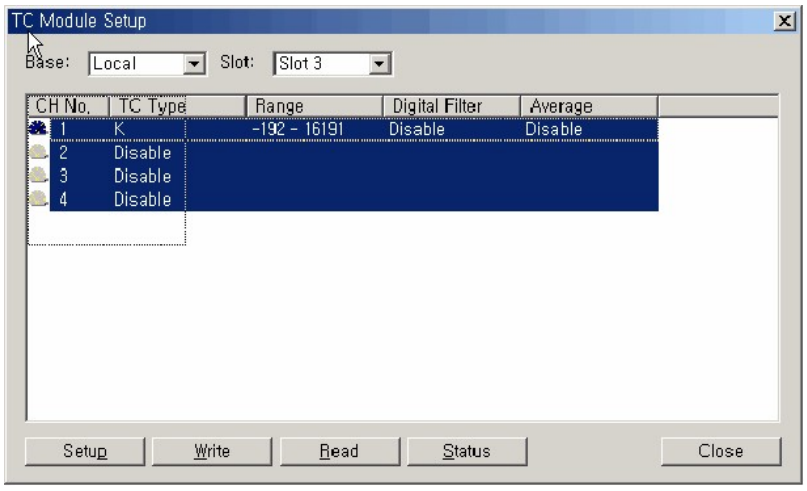
- **TC Type :** K,J,E,T,R,S,B
- **Range of Digitally Converted Values :** -192~16191, -8192~8191
- **Digital Filter :** 0~70%
- **Average Operation :** 1~255sec.

If you click  , the icon is changed to  . Click the channel in the AD Module Setup dialog box to revise the set values for a corresponding channel.

2. Click 'OK' after the channel is set up.



3. If you select all channels with the mouse as follows and  **, it will be available to set up all the channels.**



4. Click 

to operate the TC card with set values.

The message "Set values are recorded in module" is shown in the message bar.

After the set values are stored in EEPROM, even power is on/off, analog input values are converted with currently set channel values.

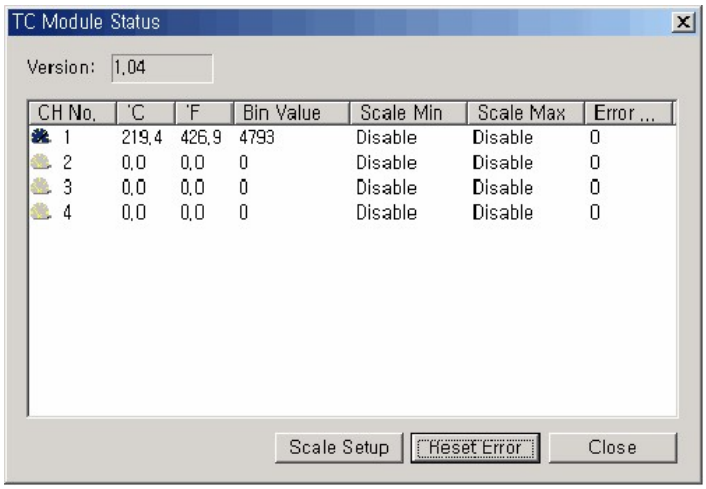
5. 

is used to read the currently set values in the AD card.

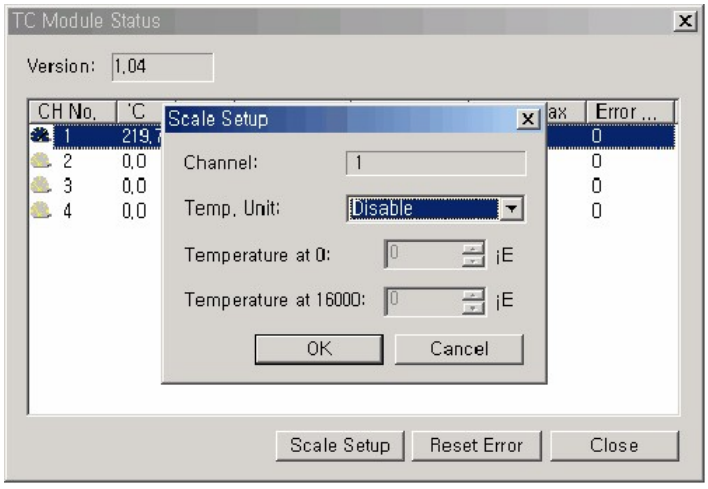
Status

If you click 

in the TC Module Setup dialog box, the OS version, you can make sure the converted values and the Error Code for the TC card and the scale of the converted temperature values can be set up.



If you select a channel and click Scale Setup , the following dialog box will appear.



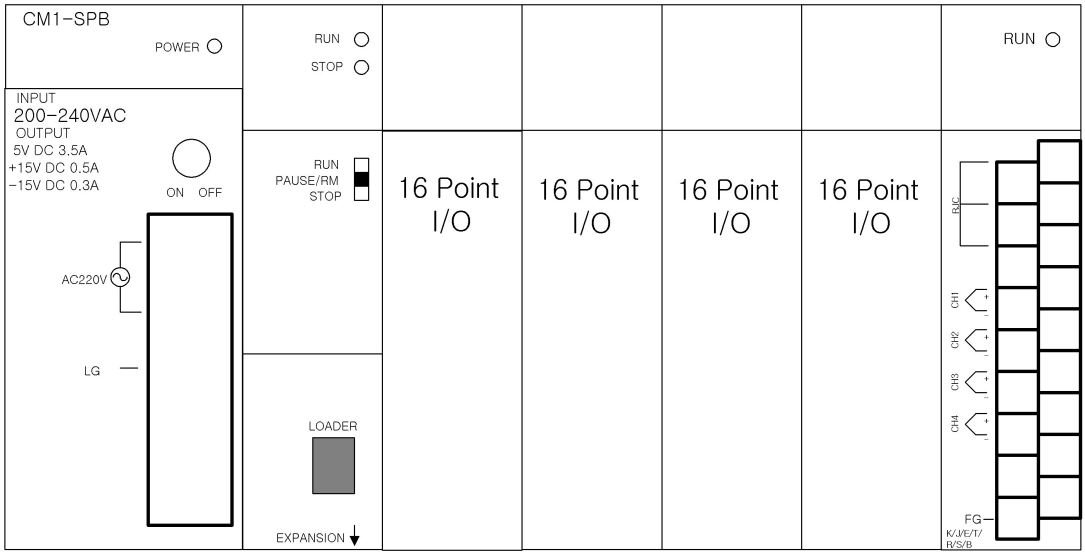
- If the scale is not set up, the temperature values of each thermocouple are converted to the range {0(-8000) ~16000(8000)}. To revise the maximum and minimum temperature value, the Scale Setup is to be selected and the temperature when the digital value is 0 and 16000 is to be set up.

- A set scale value is not stored in EEPROM. To apply this setup in case that power is on/off, write the part for applying the scale value in SCAN program.

6.7.5.2 Initialization Program on a Local Base

Configuration :

The case that TC04A is mounted on Slot 4 of a local base (5-slot base)



Initial Setup :

Used Channel	Channel 1	Channel 2
TC Type	K	J
Digital Output Type	-192~16191	-8192~8191
Max. Temp. Input Value	1200ºC	600ºC
Min. Temp. Input Value	-200ºC	-100ºC

Explanation for Program :

1. The value set up to buffer memory is inputted as TO command.

2. Channel 1 uses an initially set value (-200~1200ºC) as max. and min. temp. and Channel 2 uses the range (-100~500ºC).(The min. and max. value are converted to digital values from 0 to 16000.)

3. Flag requesting to set up operation condition is on.

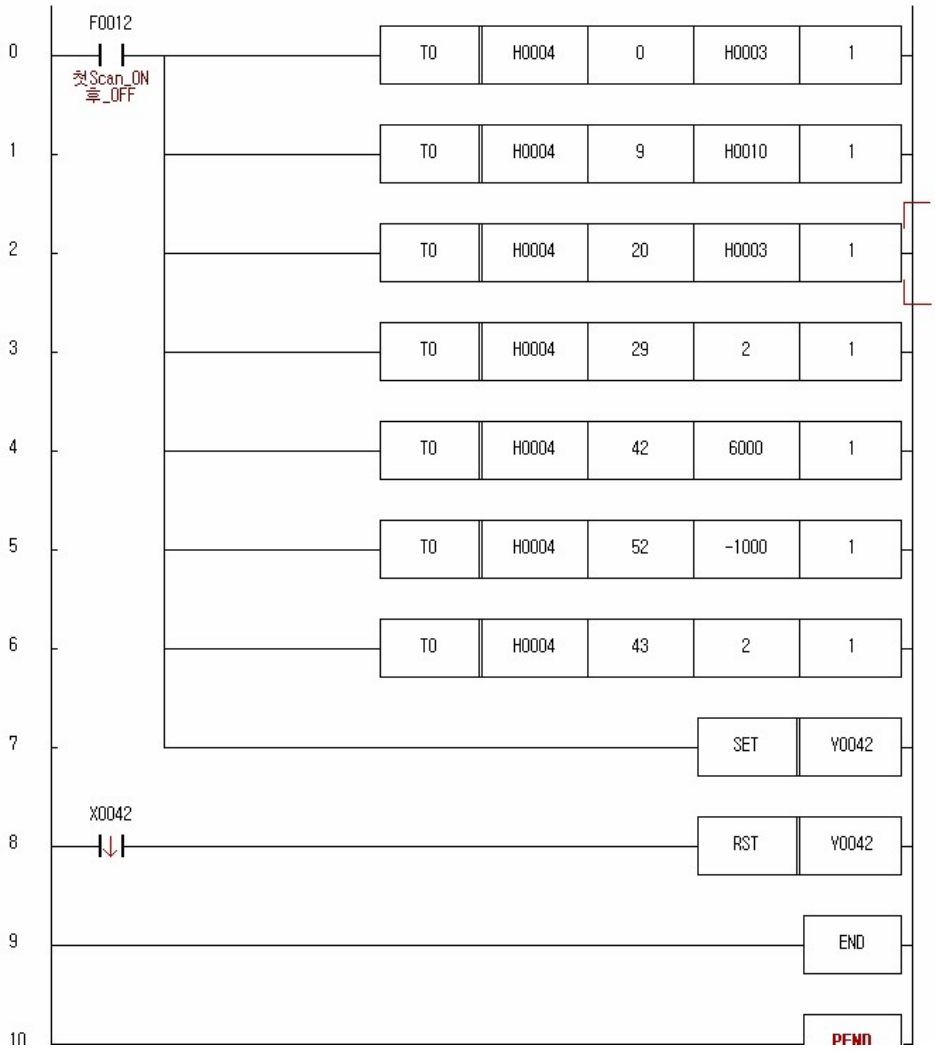
4. After making sure
   Flag indicating operation condition set up of the AD module is 0, flag requesting operation condition is off.

Point

- If flag requesting to set up an operation condition is set and reset, a TC module is operated with the set values inputted to buffer memory by TO command. Otherwise, it is continuously operated with previously set values.

- **The initialization of an analog module can be set up in the optional card setup.**

Program :



Row 0 : Converting Channel 1 and 2 is enabled.

Row 1 : Channel 1: Type K, Channel 2: Type J

Row 2 : Data for setting up TC type

Row 3 : Channel 1: -192~16191, Channel 2: -8192~8191 Setting up digital input type

Row 4 : Maximum temperature input value for Channel 2 -> 600ºC

Row 5 : Minimum temperature input value for Channel 2 -> -100ºC

Row 6 : Set maximum and minimum temperature data is for Channel 2.

Row 7 : Requesting to set up operation condition(Y42) is set.

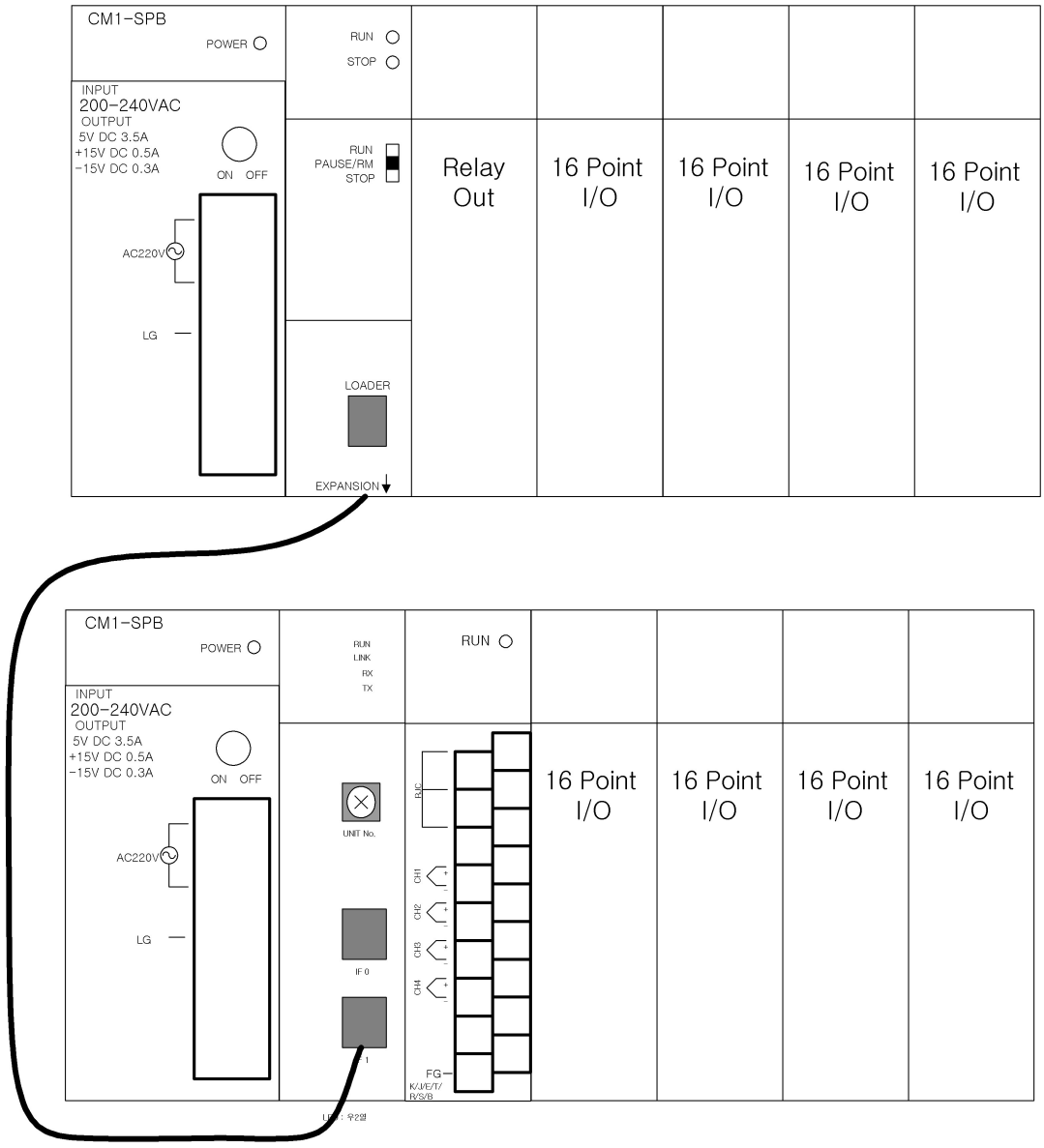
Row 8 : When indicating operation condition set up(X4A) is on falling edge, requesting to set up operation condition(Y4A) is reset-> The set values of a TC module has been changed.

Row 9 : end

6.7.5.3 Comparing Converted Values on an Expansion Base

Configuration :

- 5-slot local base : Mount an YR16A on Slot 0.
- 5-slot expansion : Mount a TC04A on Slot 0.



Initial Setup :

Used Channel	Channel 1
TC Type	K
Digital Output Type	-8192~8191
Max. Temp. Input Value	1200ºC
Min. Temp. Input Value	-200ºC

Explanation for Program(Initialization Program) :

1. The value set up to buffer memory is inputted as TO command.

2. After making sure that TC module ready is 1 and flag indicating operation condition set up is 1, requesting to set up operation condition is set.

3. After making sure that TC module ready is 1 and flag indicating operation condition set up is 0, requesting to set up operation condition is reset.

4. After being initialized, a TC module starts to be converted according to set values.

5. If the value of Buffer Memory 1 where a converted temperature value is stored is
   more than -100ºC and less than or equal to 0ºC, Y0000 is on.
   more than 0ºC and less than or equal to 300ºC, Y0001 is on.
   more than 300ºC and less than 400ºC, Y0002 is on.

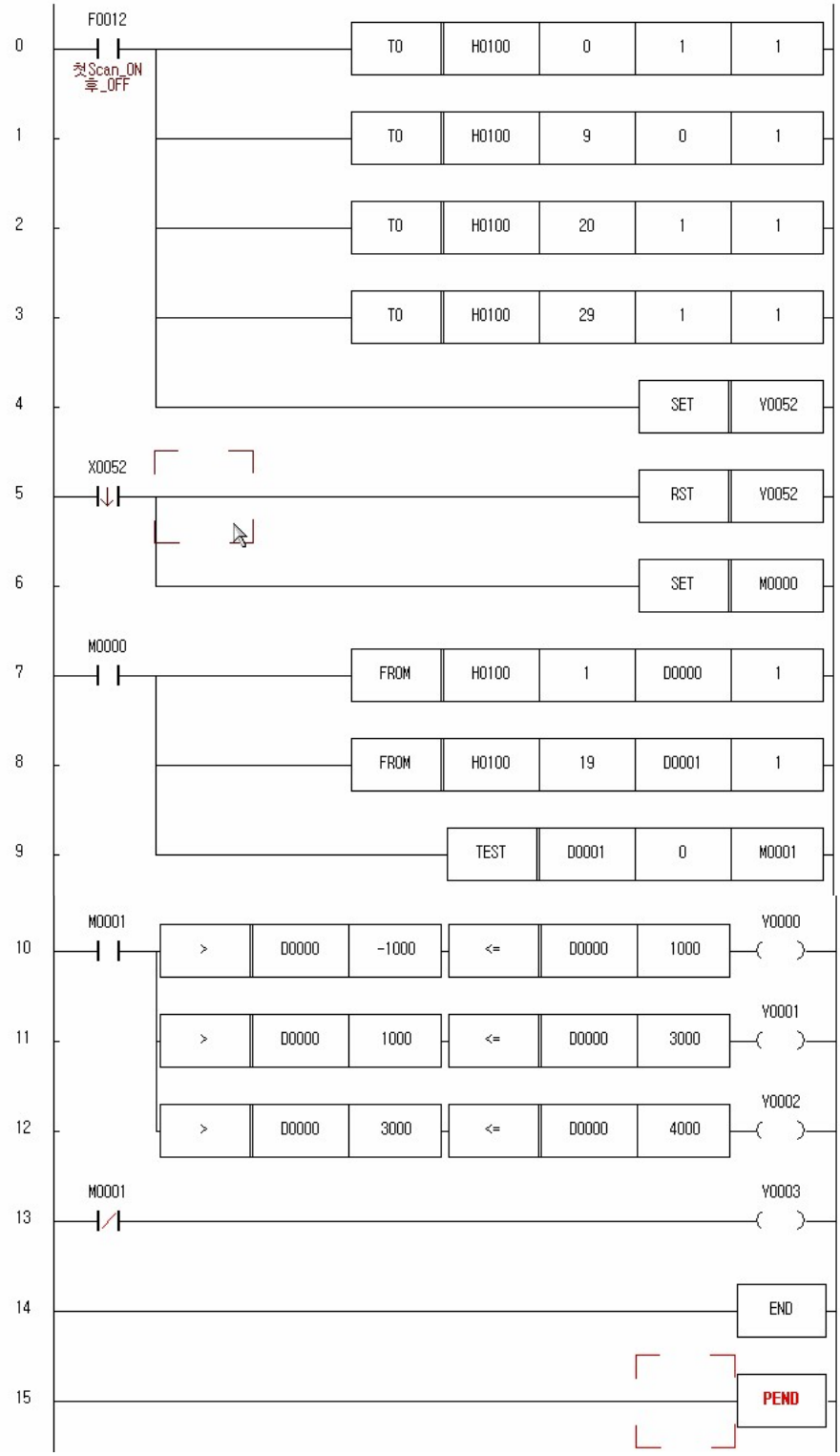
6. In case that a wire is cut-off after reading the information about an operation channel, Y0003 is on and Operation Outputs(Y0000~Y0002) are off.

Point

- If flag requesting to set up an operation condition is set and reset, a TC module is operated with the set values inputted to buffer memory by TO command. Otherwise, it is continuously operated with previously set values.

- **The initialization of an analog module can be set up in the optional card setup.**

Scan Program :



Row 0 : Expansion 1-Slot 0-Channel 1: Enable to convert

Row 1 : Channel 1: Type K

Row 2 : Data for setting up TC type of Channel 1

Row 3 : Setting up digital output type : -192~16191

Row 4 : Requesting to set up operation condition(Y52) is set.

Row 5 : Row 7 : When indicating operation condition set up(X5A) is on falling edge, requesting to set up operation condition(Y5A) is reset-> The set values of the TC module has been changed.

Row 6 : To start the comparison program after the set values of TC have been revised, M0000 is set.

Row 7 : The converted temperature value of Channel 1 is read and stored in D0000.

Row 8 : The information about an operating channel is read and stored in D0001.

Row 9 : Through the information about the operating channel, it is checked whether the wire for Channel 1 is cut-off.

Row 10 : If the converted temperature value of Channel 1 is more than -100ºC and less than or equal to 100ºC, Y0000 is output.

Row 11 : If the converted temperature value of Channel 1 is more than 100ºC and less than or equal to 300ºC, Y0001 is output.

Row 12 : If the converted temperature value of Channel 1 is more than 300ºC and less than or equal to 400ºC, Y0002 is output.

Row 13 : In case the wire is cut-off, Y0003 is outputted.

Row 14 : END

Explanation for Program(Scan Program) :

Comparing Temperature Values

The value actually stored in buffer memory is Actual Temperature * 10?and is indicated up to the first decimal place.
Accordingly, to compare with the temperature value in the buffer memory, you multiply the temperature value compared by 10 and compare the result with the read value.
If the value stored in D0000, being read from buffer memory, is 3304, it is actually 330.4ºC.
To compare with 330ºC, compare 3304 with 3300(330*10).

Comparing Digital Values

A TC04A module converts the min. value and the max. value of inputted temperatures for every thermocouple(K,J,E,T,R,S,B) to the digital value of 0 and 16000. If a max. and a min. temperature value are set up, the inputted max. and min. temperature value are converted to 0 and 16000.

As the min. and the max. temperature value are set up as initial values in the following program, -200ºC is converted to 0 and 1200ºC to 16000.

1400(ºC) : 16000(Digital Value) = 1(ºC) : X(Digital Value)
X = The digital value per one ºC is about 11.428

Accordingly,

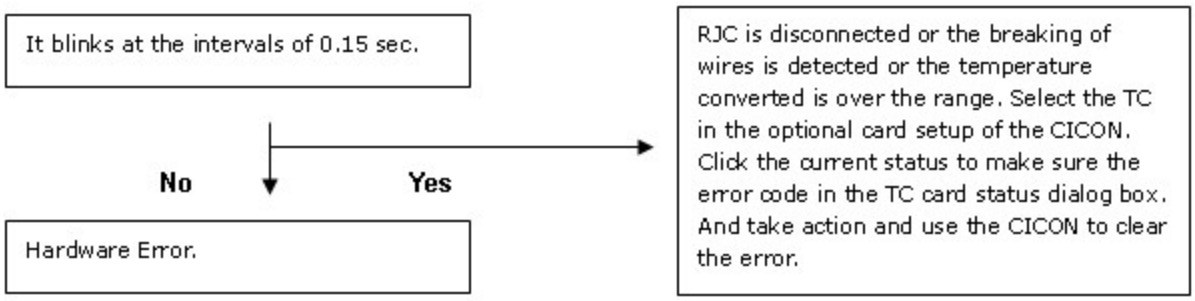
when –100ºC, the digital value is 11.428*(100) = 1142

when 300ºC, the digital value is 11.428*(200+300) = 5714

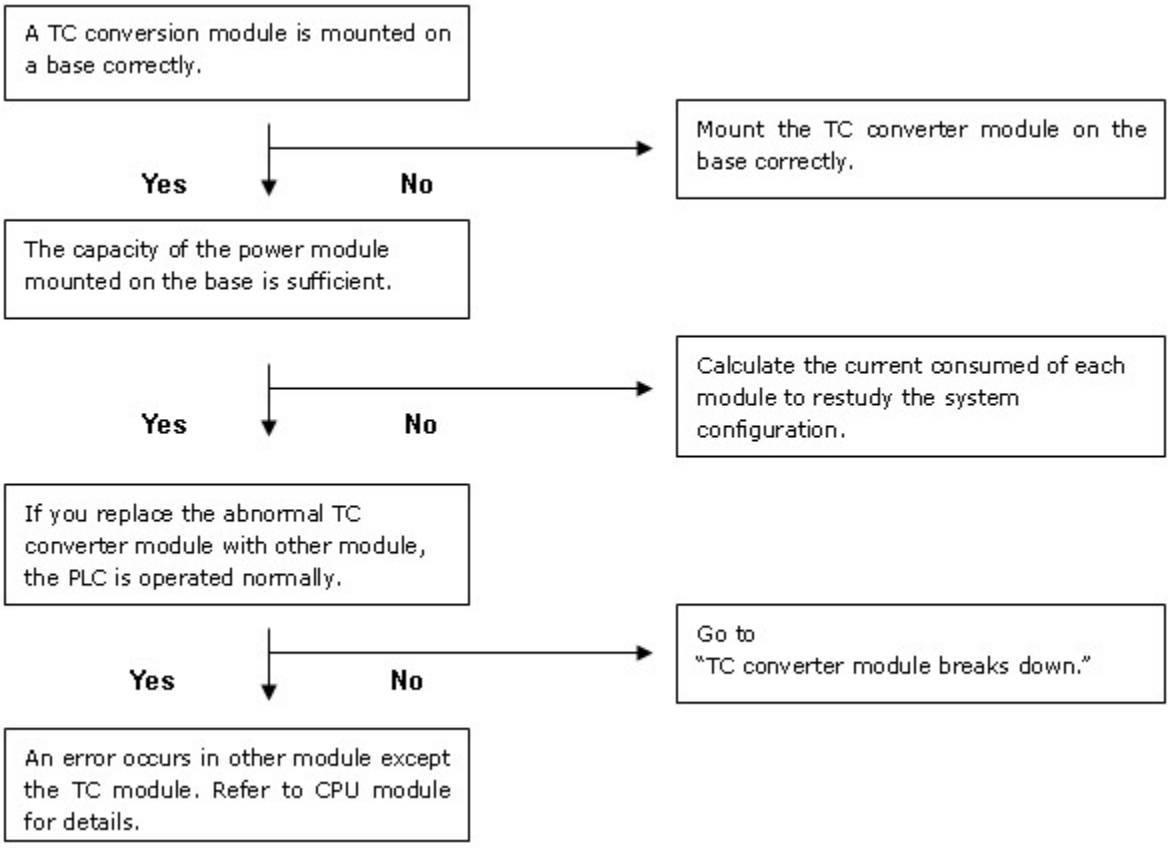
when 400ºC, the digital value is 11.428*(200+400) = 6856

6.7.6 Trouble Shooting

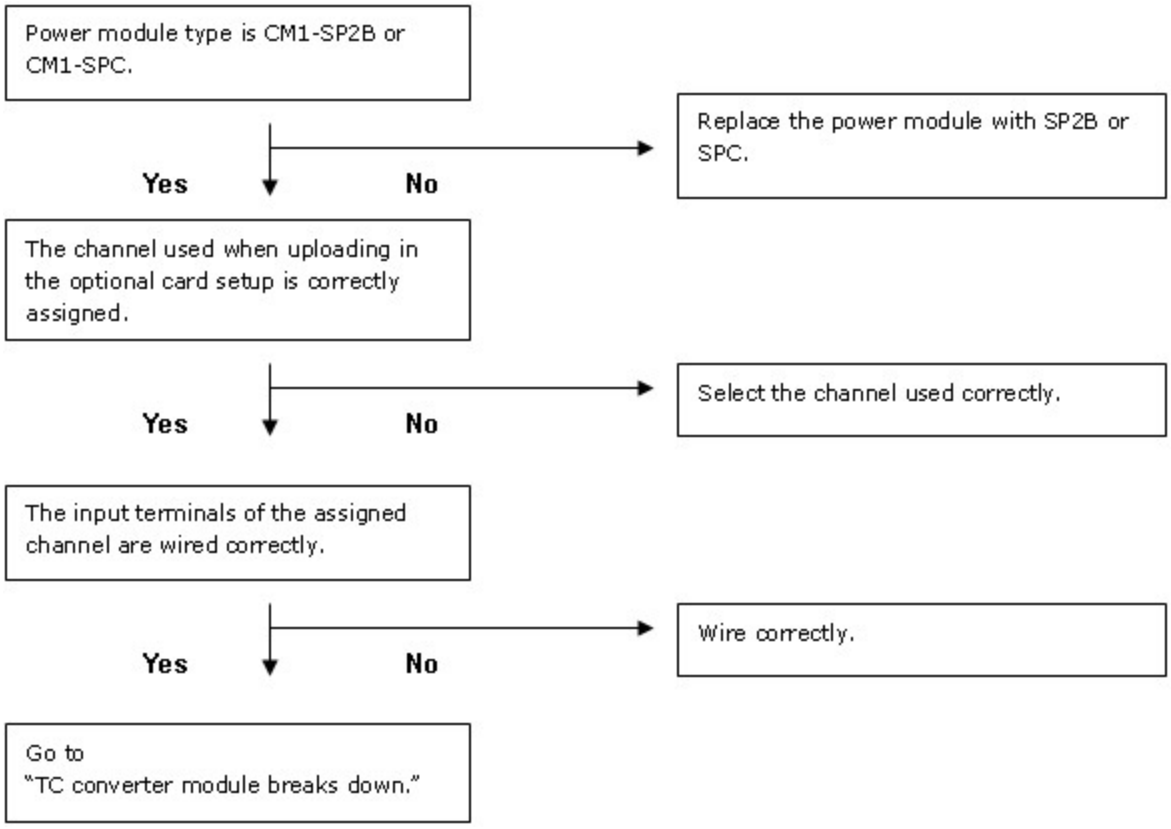
6.7.6.1 RUN LED blinks



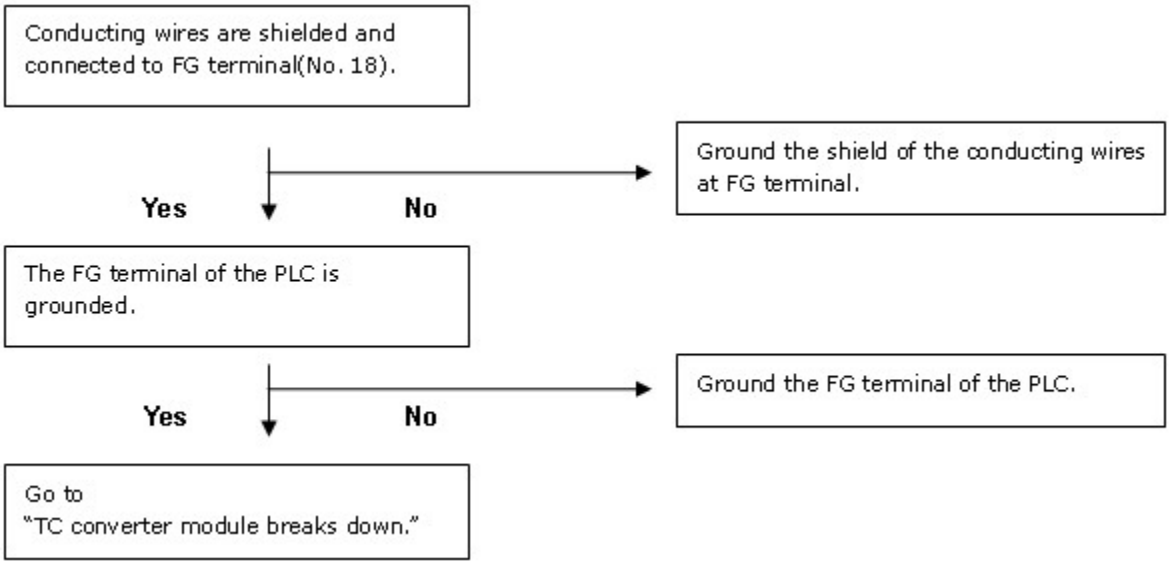
6.7.6.2 RUN LED is out



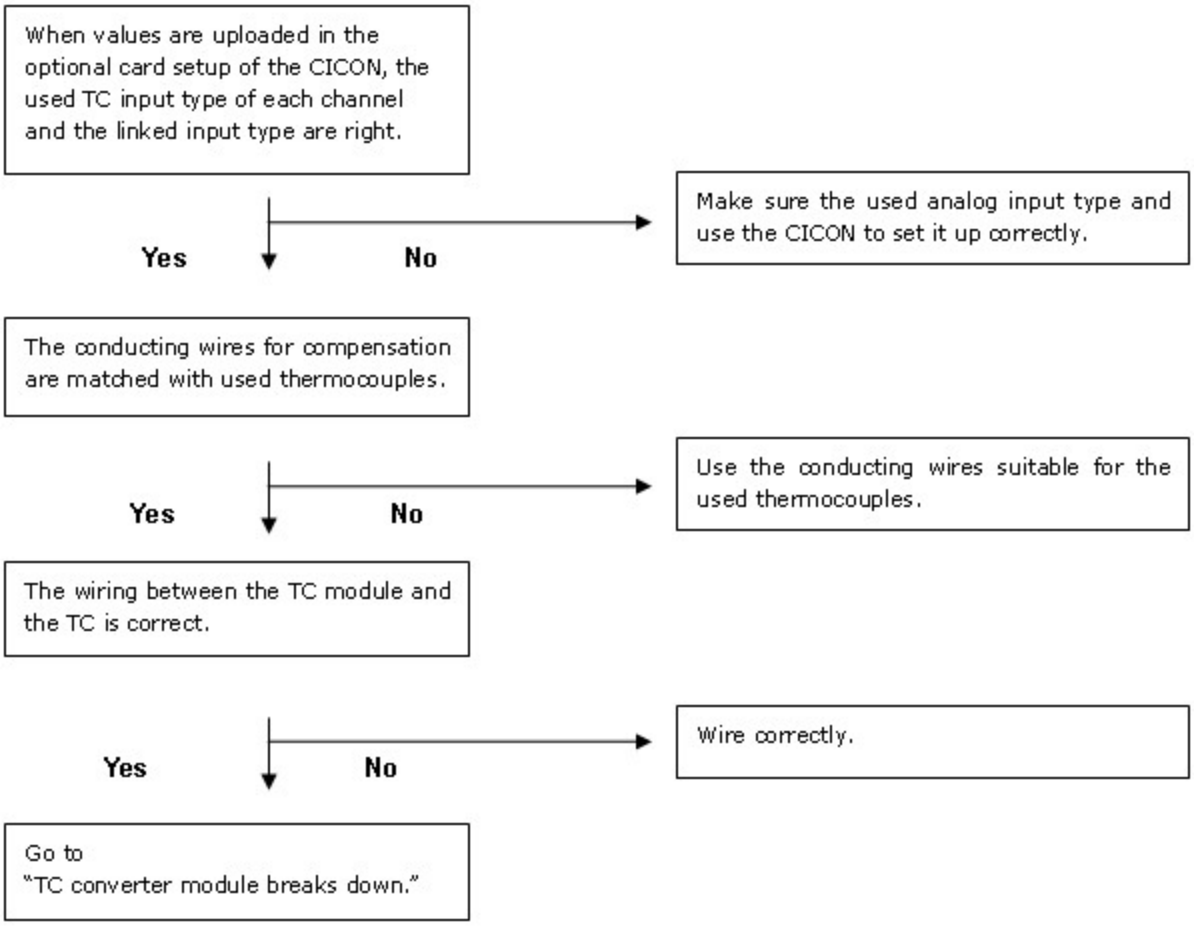
6.7.6.3 CPU Module cannot read converted temperature values



6.7.6.4 Converted temperature values fluctuate



6.7.6.5 TC input values do not conrrespond to detected temperature values



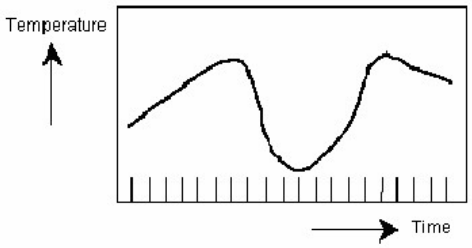
6.7.6.6 TC converter module breaks down

The hardware of the TC module breaks down.

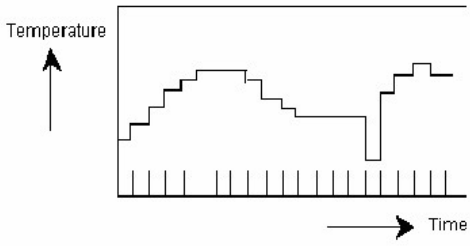
Please call to a distributor.

6.7.7 General Idea

Analog Value



[Figure 1.1] Analog Value



[Figure 1.2] Digital Value

The values varied continuously such as voltage, current, temperature, speed, pressure, flow and so on are called analog value. For the example of temperature, it is continuously varied with time like Picture 1.1. Varied temperature like this is processed as digital values by the TC module in a PLC.

Digital Value

The values shown as the number such as 0, 1, 2 and 3, and varied non-continuously are called digital values. ON signal and OFF signal are shown as the digital value of 0 and 1. BCD values and binary values are also digital values.

Conducting Wire for Compensation

This is the conducting wire used to compensate the error(Variation of temperature) caused by the distance between the terminal of a thermocouple and the input terminal of a TC module. In the range of temperatures(G TYPE: -20~90℃ H TYPE: 0~150 ℃), almost same feature of thermal electromotive force is gotten at both terminals.

Thermocouple

This is a temperature sensor to join the metals of two kinds and to use the thermal electromotive effect that electromotive force is generated between the two metals and thermal current flows if temperature difference is given at the joined point. The magnitude of electromotive force depends on the kind of joined metals and the temperature of both joined points, not the shape or the size of metals, or variation of temperature.

Features of Temperature Conversion

As the thermal electromotive force for the temperature of a thermocouple has non-linear feature, the TC-converted digital values are processed linearly and are output as the detected temperature values.

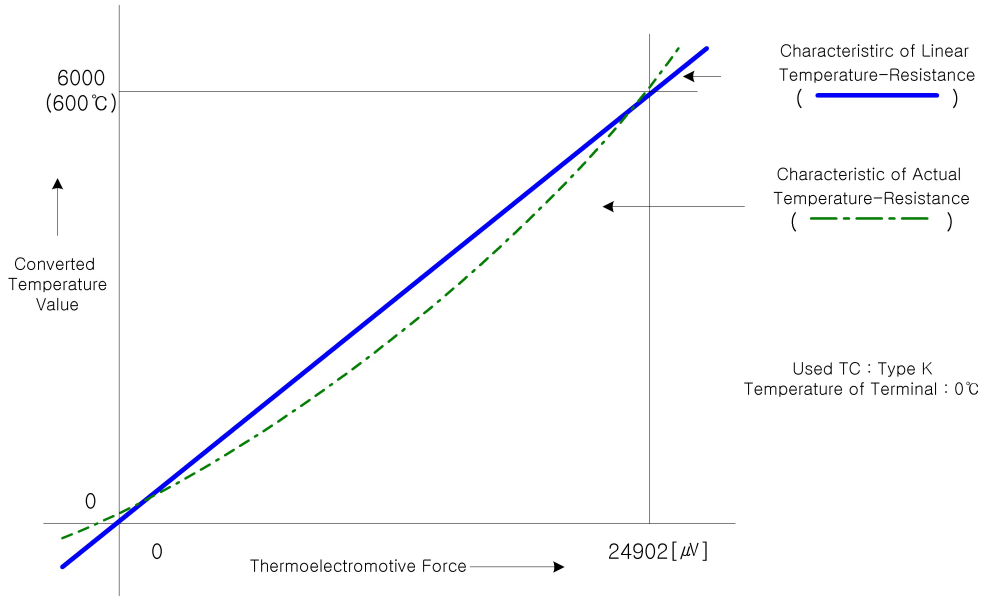
Detecting the Breaking of Wires

When the joined thermocouple or a certain part of a conducting wire for compensating is broken, the voltage over the measured range is input by the internal circuit to detect the breaking of the wires and the breaking of wires are detected.

RJC : Reference Junction Compensation

As the tables of thermal electromotive forces in several codes are based on 0℃, the difference between the current temperature at the measured point(Input terminal) and the actual base temperature(0℃) is compensated.

Characteristics of Temperature Conversion



- The thermal electromotive forces of each thermocouple are varied according to the variation of the temperature around them.
- TC converter modules linearize non-linear thermal electromotive forces as the above diagram.
- Temperature values are stored in the memory of a TC module in converted temperature values.
- A PLC CPU reads the converted temperature values stored in the memory of a TC module.

Enabling/Disabling to TC-convert

1) It is available to assign input channels to enabling/disabling to TC-convert.
2) As unused channels can be assigned to disabling to TC-convert, the time for sampling is reduced.

Detected Temperature Values

1) The centigrade or Fahrenheit values of converted temperatures are stored in memory.(Actual Temperature * 10).
2) Converted temperatures are converted to the values in the range from 0 to 16000.

Information about Operating Channels

1) The information about currently operating channels is indicated.
2) In case of the breaking of the wires among currently enabled channels, a corresponding bit is 0.
3) The bit corresponding to disabled channels is 0.

Detecting the Breaking of Wires

1) The breaking of the wires connected to a RTD for each channel can be checked.
2) If the breaking of wires is detected, a RTD module will keep the temperature value before broken and not convert anymore. Error code is indicated and LED blinks at the intervals of 0.3 sec.
3) In case that a shield line is connected or disconnected due to bad contact, a RTD module converts when connected and keeps current temperature value when disconnected. Error code is indicated and LED blinks at the intervals of 0.3 sec.

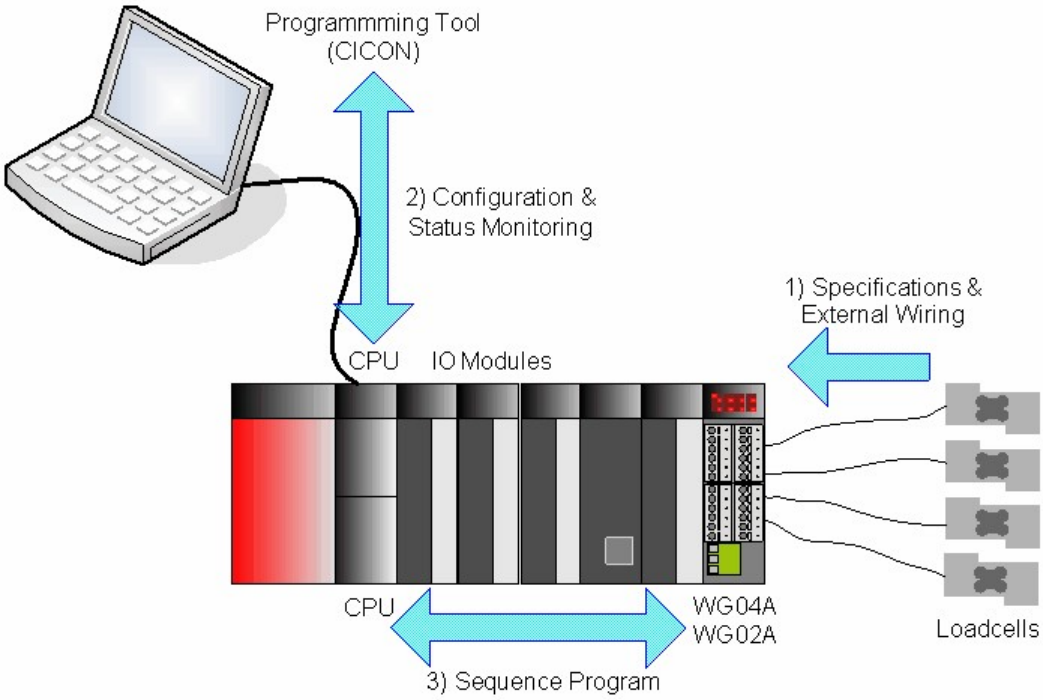
Setting up Digital Output

1) The range of the digital output values stored in buffer memory can be selected as -192~16191 or -8192~8191.

Setting up Maximum and Minimum Temperature

1) TC modules convert the allowed temperatures of each thermocouple to the digital values from 0(-8000) to 16000(8000). The maximum value and the minimum value of temperatures can be set up.
2) If a maximum and a minimum value are set up, TC modules convert the minimum to 0(-8000) and the maximum to 16000(8000).

6.8 Weighing



WGnnX modules provide the functionality for weighing system. These modules can be connected with various kinds of loadcell units. WG04A can be connected with up to 4 independent loadcell signals at the same time.

Weighing modules have following characteristics. :

- Max. 4 Channels of independent signal inputs. (WG04A)
- Supplies 5Vdc power to the connected loadcells for generating input signals.
- 24 bits A/D converter
- Provides 1 / 40,000 effective resolution.
- Provides 8 internal ready to use batch programs.

Contents :

6.8.1 Specifications

Specifications :

- General Specifications
- Module Specifications
- Front View

6.8.1.1 General Specification

Item	Specification				
Operating Temperature	-10 ~ 65ºC				
Storage Temperature	-25 ~ 80ºC				
Operating Humidity	5 ~ 95%RH, Not condensed.				
Storage Humidity	5 ~ 95%RH, Not condensed.				
Vibration	In case of intermittent vibration				
	Frequency	Acceleration	Amplitude	Sweep	
	10 ≤ f< 57Hz	-	0.075mm	10 times in each direction (X,Y,Z)	
	57 ≤ f < 150 Hz	9.8m/s2 {1G}	-		
	In case of continuous vibration				
	Frequency	Acceleration	Amplitude	Sweep	
	10 ≤ f < 57Hz	-	0.035mm	10 times in each direction (X,Y,Z)	
	57 ≤ f < 150 Hz	4.9m/s2 {1G}	-		
Shock	• Max. Shock Acc. : 147 m/s2 {15G} • Time : 11㎳(3 times in X, Y, Z) • Pulse Wave : Half sine wave pulse				
Noise	Square wave impulse noise	±2000V			
	Electrostatic discharge	Voltage: 4 kV(Contact discharge)			
	Radiated electro-magnetic field	27 ~ 500 MHz. 10 V/m			
	Fast Transient Bust Noise	Item	Power Module	Digital I/O (24V or more)	Digital I/O(Less than 24V) Analog I/O Comm. interface
		Voltage	2KV	1KV	0.25KV
Environment	No corrosive gas and no dust.				
Altitude	2,000m or less				
Pollution	Less than 2				

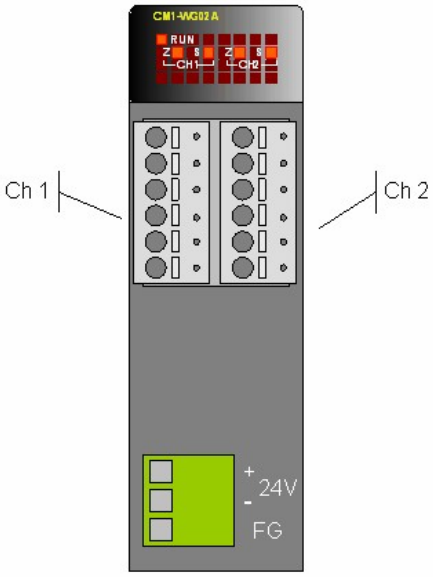
Cooling	Natural Air cooling

6.8.1.2 Module Specification

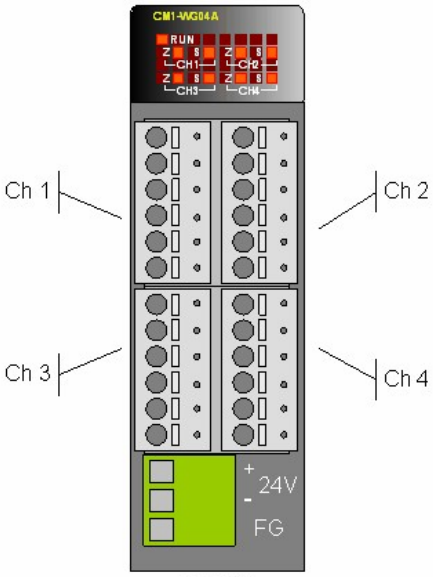
Item	Specifications				
	WG02A	WG04A	WG02C	WG02D	WG02E
Channel	2 Channels	4 Channels	2Ch. Standard	2Ch. Dynamic Weighing	2Ch. Wide Range
Supported L/C Type	Strain Gage				
Insulation	Photo-Coupler				
External Power Supply	DC24V, 2 Watts				
L/C Excitation Voltage	5Vdc (Up to 4 x 350 Ohm loadcells / Channel)				
Full Scale Input Signal	3.6mV / V (18mV)		2.0mV / V		3.6mV / V
A/D Converter Resolution	24 bits				
A/D Program Resolution	1 / 10,000		1 / 40,000		
A/D Conversion Speed	20 Times / Sec.	10 Times / Sec.	1,000 Times / Sec.		

6.8.1.3 Front View

[WG02A / WG04A]



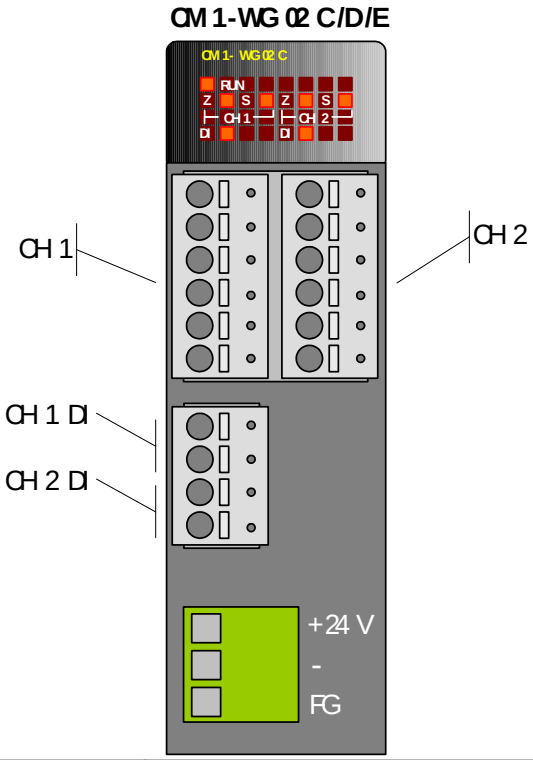
WG02A



WG04A

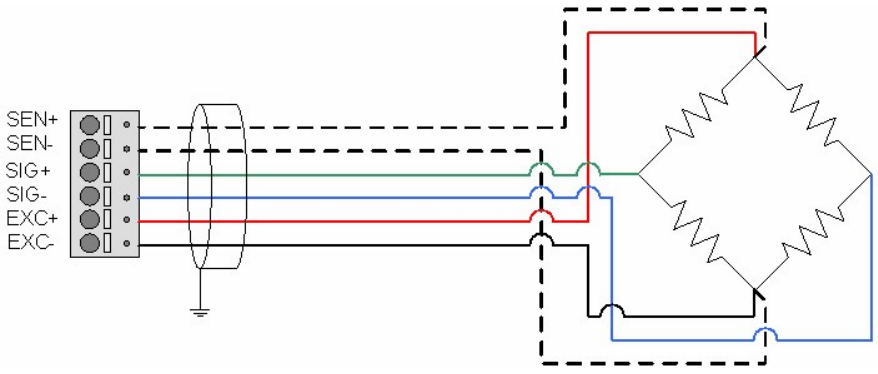
LED	Description
RUN	Turn on after successful initialization when powered. If there is any error on hardware or configuration, this lamp will blink at every 0.2 second.
Z (Zero)	Turned on when measured weight is within the range of zero. Otherwise this lamp will be turned off.
S (Stable)	Turned on when measured weight variation is within the range of stable. Otherwise this lamp will be turned off.

[WG02C / WG02D / WG02E]

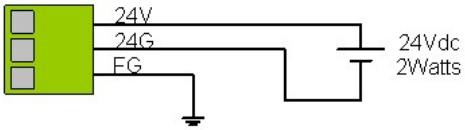


LED	Description
RUN	Turn on after successful initialization when powered. If there is any error on hardware or configuration, this lamp will blink at every 0.2 second.
Z (Zero)	Turned on when measured weight is within the range of zero. Otherwise this lamp will be turned off.
S (Stable)	Turned on when measured weight variation is within the range of stable. Otherwise this lamp will be turned off.
DI	Turned on when 24Vdc input signal is detected on DI pin of each channel. Otherwise this lamp will be turned off.

6.8.2 Wiring



All 4 channels have the same pin-out that of above diagram. If 4-wire type loadcell is used, just leave the SEN+ and SEN- pin as opened.



WGnnX module needs the external power supply. The power module should have the capacity of 2 Watts or more, and be separated with other power.

6.8.3 Internal I/O and Shared Memory

Internal I/O Table

Input Signals		Output Signals	
Point	Description	Point	Description
X00	Module Ready	Y00	
X01	Zero/Tare Req. Processed	Y01	
X02	Ch1 Command Ack.	Y02	Ch1 Command
X03	Ch2 Command Ack.	Y03	Ch2 Command
X04	Ch3 Command Ack.	Y04	Ch3 Command
X05	Ch4 Command Ack.	Y05	Ch4 Command
X06	Ch1 Batch Running	Y06	Ch1 Zero Command (Req.)
X07	Ch2 Batch Running	Y07	Ch2 Zero Command (Req.)
X08	Ch3 Batch Running	Y08	Ch3 Zero Command (Req.)
X09	Ch4 Batch Running	Y09	Ch4 Zero Command (Req.)
X0A	Ch1 Error	Y0A	Ch1 Tare Command (Req.)
X0B	Ch2 Error	Y0B	Ch2 Tare Command (Req.)
X0C	Ch3 Error	Y0C	Ch3 Tare Command (Req.)
X0D	Ch4 Error	Y0D	Ch4 Tare Command (Req.)
X0E		Y0E	
X0F		Y0F	

WG0nA module has its own internal I/O signals. These signals are not actually connected to real inputs and outputs. But those signals provide a simple method for command issuing and status monitoring between CPU and WG0nA.

Input Signals

Input signals provide the most frequently referencing status flags of WG0nA module, not only the module ready signal (X0), but also the command acknowledge (X2/3/4/5), batch control status (X6/7/8/9) and error status (XA/B/C/D) of each channel. X1 signal is a response(OK) signal of zero/tare command(request, Y6..YD). X1 is turned on when the zero/tare command was processed successfully, and turned off when all zero/tare command(request) signals are turned off.

Output Signals

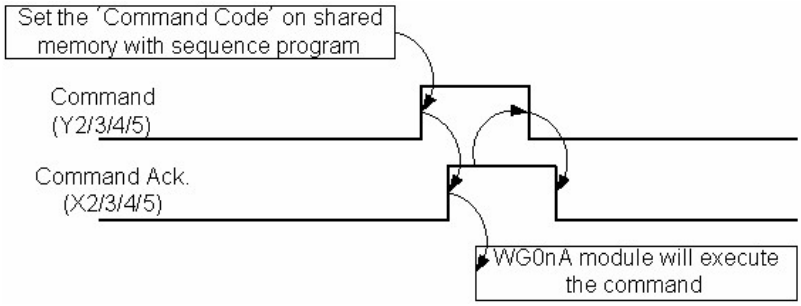
Outputs are used as a command issuing signals from CPU. Three kinds of commands can be issued by these outputs.

- **General Purpose Command (Y2/3/4/5) :**

Most of commands are issued by this signal. Before issuing this signal, the command code should be assigned to the command main code (offset 7, 22, 37 or 52) and command sub code (offset 8-9, 23-24, 38-39 or 53-54) fields of shared memory. Following table shows the possible command main codes.

Command	Name	Function
H0001 (1)	Error Clear	Clear the current error code and state. If the trouble which caused the error was removed, the error code will be cleared to zero and error signal (XA/B/C/D) will be turned off.
H0002 (2)	Batch Start	Starts the batch process. Before issuing this command the weighing mode and the related configurations should be set in shared memory.
H0003 (3)	Batch Stop	Stops the current executing batch process. After this command, all the output signals will be turned off.
H0004 (4)	Calibration	The measured raw value at the time when this command was issued will be treated as the zero.
H0005 (5)	Set Span	To perform a span calibration place the calibration mass onto the scale, and then issue this command with the size of the calibration mass in command sub-code. Span calibration must be performed after zero calibration.
H0006 (6)	Store the Calibration Data	All the calibration data will be stored in non-volatile memory of WG0nA module. These calibration data will be restored automatically at every power on.
H0007 (7)	Zero Reset	Reset the current zero. This command makes the gross weight be same with the measured weight.
H0008 (8)	Tare Reset	Reset the current tare. This command makes the net weight be same with the gross weight.

Following timing chart shows the step of issuing the command to the WG0nA module.



- **Zero Command (Y6/7/8/9) :**

When the zero output signal changes from off to on, current measured weight (offset 0, 15, 30, 45) will be a origin of gross weight (offset 5, 20, 35, 50) zero. X1 will be turned on if zeroing process was completed successfully. For successful zero, the weighing status must be stable. The status of stability can be acquired from status flags (offset 2, 17, 32, 47) of shared memory. After this command, the new origin of zero is stored in non-volatile memory and automatically restored at power on.

- **Tare Command (Y6/7/8/9) :**

When the tare output signal changes from off to on, current gross weight (offset 5, 20, 35, 50) will be a origin of net weight (offset 10, 25, 40, 55) zero. X1 will be turned on if tare process was completed successfully. For successful tare operation, the weighing status must be stable. The status of stability can be acquired from status flags (offset 2, 17, 32, 47) of shared memory. Tare data are stored in the volatile memory and net weight is the same with gross weight at initial state such as power on.

6.8.4 Shared Memory

Data in this memory is shared with CPU through the system bus in base unit. All these data can be accessed by using the instruction (D)FROM and (D)TO instructions. Please refer to the CPU manual for more information of those instructions.

OFFSET				Description		
Ch1	Ch2	Ch3	Ch4			
0	15	30	45	Measured weight (low word)		R
1	16	31	46	Measured weight (high word)		R
2	17	32	47	Status flags (bit mapped)		R
3	18	33	48	Control outputs (bit mapped)		R
4	19	34	49			
5	20	35	50	Gross weight (Zero applied, low word)		R
6	21	36	51	Gross weight (Zero applied, high word)		R
7	22	37	52	Command main code		R/W
8	23	38	53	Command sub code (low word)		R/W

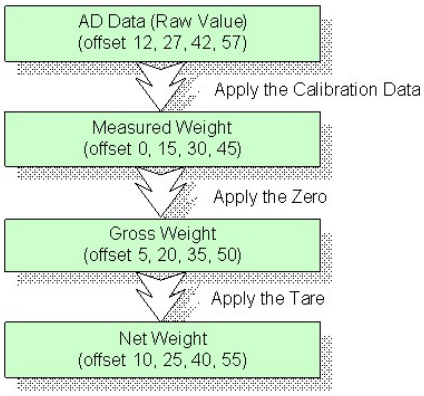
OFFSET				Description		
Ch1	Ch2	Ch3	Ch4			
9	24	39	54	Command sub code (high word)		R/W
10	25	40	55	Net weight (Tare applied, low word)		R
11	26	41	56	Net weight (Tare applied, high word)		R
12	27	42	57	AD data (raw value, low word)		R
13	28	43	58	AD data (raw value, high word)		R
14	29	44	59	Error Code		R
60						
61						
62						
63				OS Version		R
64						
65						
66						
67						
68						
69						
70	116	162	208	Weighing Mode		R/W
71	117	163	209	Min. Scale Value	5	R/W
72	118	164	210	Max. weight (low word)		R/W
73	119	165	211	Max. weight (high word)		
74	120	166	212	Zero range	1% of Max. weight	R/W
75	121	167	213	Motion detect range	1% of Max. weight	R/W
76	122	168	214	Motion detect time	100 mSec.	R/W
77	123	169	215	Auto zero range	1% of Max. weight	R/W
78	124	170	216	Auto zero time period	100 mSec.	R/W
79	125	171	217	Hysteresis range	1% of Max. weight	R/W
80	126	172	218	Hysteresis time limit	100 mSec.	R/W
81	127	173	219	Avr. Window size and Time	3 - 13	R/W
82	128	174	220	Digital filter constant	0 - 90%	R/W
83	129	175	221			
84	130	176	222			
85	131	177	223			
86	132	178	224			
87	133	179	225			
88	134	180	226			
89	135	181	227			
90	136	182	228			
91	137	183	229			
92	138	184	230			
93	139	185	231			

OFFSET				Description		
Ch1	Ch2	Ch3	Ch4			
94	140	186	232			
95	141	187	233			
96	142	188	234	Min. hopper weight (low word)	Max. Weight	R/W
97	143	189	235	Min. hopper weight (high word)		
98	144	190	236	Dribble weight, high set point or set point #1 (low word)	Max. Weight	R/W
99	145	191	237	Dribble weight, high set point or set point #1 (high word)		
100	146	192	238	Full flow weight, low set point or set point #2 (low word)	Max. Weight	R/W
101	147	193	239	Full flow weight, low set point or set point #2 (high word)		
102	148	194	240	Over weight, High-High set point or set point #3 (low word)	Max. Weight	R/W
103	149	195	241	Over weight, High-High set point or set point #3 (high word)		
104	150	196	242	Under weight, Low-Low set point or set point #4 (low word)	Max. Weight	R/W
105	151	197	243	Under weight, Low-Low set point or set point #4 (high word)		
106	152	198	244	Comparator inhibit time after full flow start or set point #5 (low word)	100 mSec.	R/W
107	153	199	245	Comparator inhibit time after full flow stop or set point #5 (high word)	100 mSec.	R/W
108	154	200	246	Gate open time for compensation or set point #6 (low word)	100 mSec.	R/W
109	155	201	247	Gate closing time for compensation or set point #6 (high word)	100 mSec.	R/W
110	156	202	248	Target weight for compensation or set point #7 (low word)	Max. Weight	R/W
111	157	203	249	Target weight for compensation or set point #7 (high word)		
112	158	204	250	Batch complete delay	100 mSec.	R/W
113	159	205	251	Batch limit time	100 mSec.	R/W
114	160	206	252	Max. hopper weight (low word)	Max. Weight	R/W
115	161	207	253	Max. hopper weight (high word)		
254						
255						

6.8.4.1 Monitoring Data

offset 0-69

Measured Weight (offset 0, 15, 30, 45)



This weight is the most primitive weight. It is not affected by any other commands during normal operation. Only the calibration and span (command main code : 5 and 6) commands can change its property. Left figure shows all the weight values provided by WG0nA module and their characteristics.

Status Flags (offset 2, 17, 32, 47)

Following table shows the bit mapped flags of WG0nA module. The flags from bit 8 to F can be used as input only for the batch control.

Bit	Flag	ON condition
0	Zero	On when net weight is within the zero range This flag is affected by the set value of zero range (offset 74, 120, 166, 212)
1	Stable	On when current weight is within the motion detection range during motion detection time. This flag is affected by the set value of motion detect range (offset 75, 121, 167, 213) and time (offset 76, 122, 168, 214)
2	Over weight	On when gross weight is above the Max. weight set value. (offset 72, 118, 164, 210)
3		
4		
5		
6		
7		
8	Over	On when net weight is above the ‘ over weight’ set value. (offset 102, 148, 194, 240)

Bit	Flag	ON condition
9	Under	On when net weight is below the ‘ under weight’ set value. (offset 104, 150, 196, 242)
A	Hopper-Full	On when gross weight is above the Max. hopper weight. (offset 114, 160, 206, 252)
B	Batch Completed	On at the end of batch process.
C	Batching time over	On when the time of batching process is over the set period. (offset 113, 159, 205, 251)
D		
E		
F		

Control Outputs (offset 3, 18, 33, 48)

Following table shows the bit mapped outputs of WG0nA module. These outputs have their meaning only for the batch control.

Bit	Flag	ON condition
0	Full Flow	Full-Flow gate signal output
1	Dribble Flow	Dribble-Flow gate signal output
2	High-High	Net Weight >= High High set point
3	High	Net Weight >= High set point
4	Low	Net Weight <= Low set point
5	Low-Low	Net Weight <= Low Low set point
6	Hopper gate	Hopper gate signal output
7	Micro Flow	Micro-Flow gate signal output
8	Weight 0	Net Weight < Set point #1
9	Weight 1	Set point #1 <= Net Weight < Set point #2
A	Weight 2	Set point #2 <= Net Weight < Set point #3
B	Weight 3	Set point #3 <= Net Weight < Set point #4
C	Weight 4	Set point #4 <= Net Weight < Set point #5
D	Weight 5	Set point #5 <= Net Weight < Set point #6
E	Weight 6	Set point #6 <= Net Weight < Set point #7
F	Weight 7	Set point #7 <= Net Weight

Gross Weight (offset 5, 20, 35, 50)

This weight is the zero applied measured weight (offset 0, 15, 30, 45). Zero can be applied by Y6/7/8/9 output signals.

Tare Weight (offset 10, 25, 40, 55)

This weight is the tare applied gross weight (offset 5, 20, 35, 50). Tare can be applied by YA/B/C/D output signals.

AD data (offset 12, 27, 42, 57)

24 bits raw data from ad converter. This value is used for calculating the measured weight. (offset 0, 15, 30, 45)

Error code (offset 14, 29, 44, 59)

The error code of each channel is stored in this field. In normal state this field holds zero. When an error is occurred, non-zero value is stored in this field and error input signal (XA/B/C/D) of relevant channel is turned on. The error code and signal can be cleared by ‘ error clear (1)’ command after removing the fault reason. Following table shows the detailed error code summary.

Code	Error	Description
H0000	No error	
H0001	No sensor	Check the loadcell cable and its connection
H0002	Batch time out	Batch control is not completed within the period of setting (offset 113, 159, 205, 251)
H0003	Unstable at zero operation	Zero operation (Y6/7/8/9) is issued at unstable state. Zero operation can be re-issued with this error.
H0004	Unstable at tare operation	Tare operation (YA/B/C/D) is issued at unstable state. Tare operation can be re-issued with this error.
H0005	No external power supply	Check the external 24Vdc power supply.
H0010	Unknown command from sequence	Check the version of WG0nA and CPU module.
H0011	Parameter error on instruction	Check the parameter of WGBATCH instruction in sequence program.

6.8.4.2 Basic Configuration Data

Offset 70–95, 116-141, 162-187, 208-233

The shared memory area of offset 70-235 holds the basic configuration data for operation. Those configuration data can be modified through the CICON or sequence program of CPU. The case of CICON is described in the previous section (3.2 Basic configuration with the special program).

Weighing Mode (offset 70, 116, 162, 208)

This field holds the encoded operating mode. For more information of each operating mode, please refer to the section of ‘ Batch Program’

Set Value	Mode
H0000	Indicator Mode
H0001	Automatic Normal Batch
H0002	Automatic Loss in Weight Batch
H0003	User Controlled Normal Batch
H0004	User Controlled Loss in Weight Batch
H0005	Comparator Mode
H0006	Weight Sorting
H0007	Dynamic Weighing (Fluid material)
H0008	Dynamic Weighing (Solid material)
H0009	Disabled

Other Parameters :

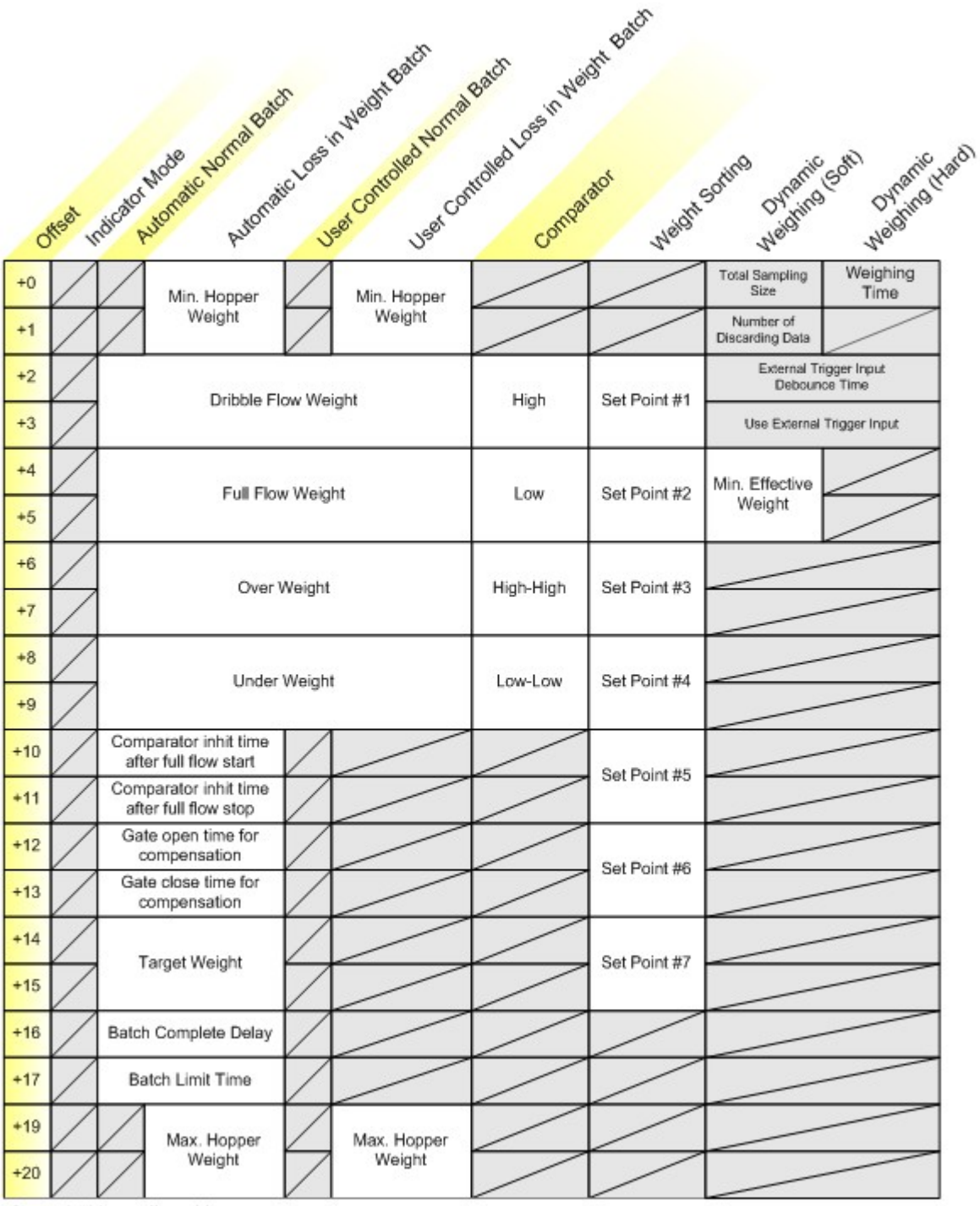
Please refer to the section of ‘ Basic configuration with the special program’ .

6.8.4.3 Batch Control Parameters

Offset 96-115, 142-161, 188-207, 234-253

This area of shared memory holds the parameters for batch control. WGnnX module supports 8 different kinds of batch control modes and 1 simple indicator mode. Each batch control needs their operating parameters. That is, each data in this shared memory area has different meaning according to the ‘weighing mode’ assigned in offset 70, 116, 162, 208. Following table summarizes the parameter according to the each weighing mode.

For more information of each parameter, please refer to the section of ‘ 4. Batch Program.’



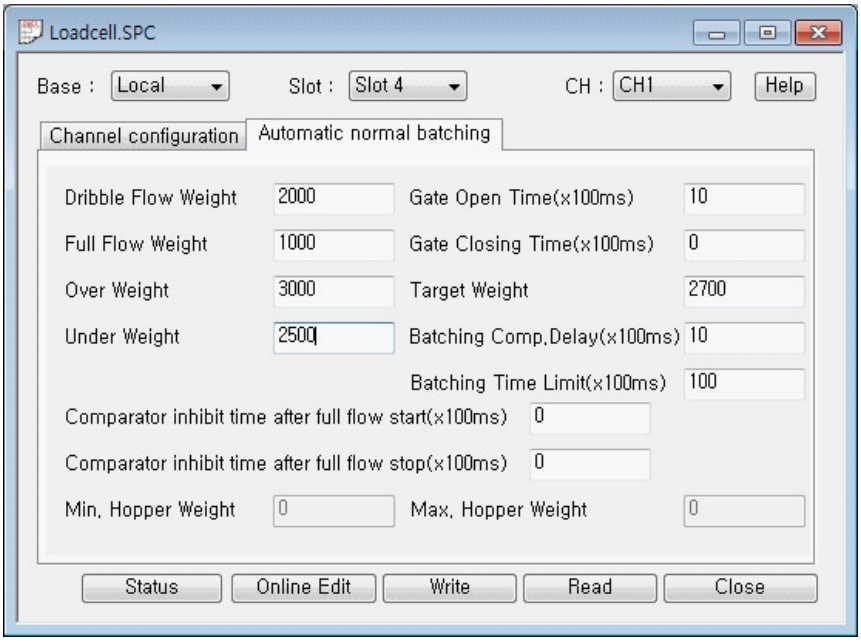
Channel #1 base offset : 96
Channel #2 base offset : 142
Channel #3 base offset : 188
Channel #4 base offset : 234

6.8.5 Batch Program

Contents :

6.8.5.1 Automatic Normal Batch

This batch control is weighted automatically by controlling the full flow and dribble flow signals. The batch control is started by ‘ Start (Y2/3/4/5)’ signal or “ WGBATCH” instruction. The batching data must firstly be configured by special program (load cell setting program) or written into the shared memory area of WG0nA module by sequence program. Following captured screen shows the parameters needed for configuring the ‘ Automatic Normal Batch’ control. This dialog box can be shown in ‘ Load cell setting program’ .



Dribble Flow Weight

offset 98, 144, 190, 236

If the net weight is above this weight, the dribble flow gate signal is turned off.

Full Flow Weight

offset 100, 146, 192, 238

If the net weight is above this weight, the full flow gate signal is turned off.

Over Weight

offset 102, 148, 194, 240

If the net weight is above this weight, the over signal is turned on.

Under Weight

offset 104, 150, 196, 242

If the net weight is below this weight, the under signal is turned on.

Comparator Inhibit Time after full flow start / stop

Start offset 106, 152, 198, 244
Stop offset 107, 153, 199, 245

The comparator inhibit functions are to prevent gate vibration (or other factors) from causing jitter on the comparator, which may result in incorrect batching. The comparator is inhibited for the times specified after the full flow is started and stopped.
The unit of this field is 100 milli-seconds. That is, the value of 10 means 1 second.

Batching Complete Delay

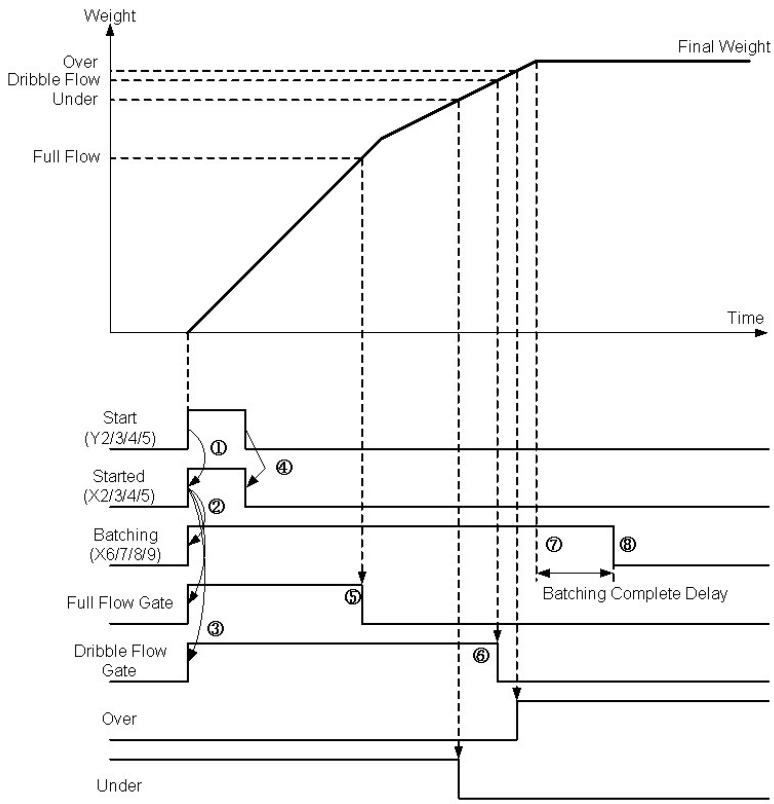
offset 112, 158, 204, 250

This sets the delay time before compensation begins. The delay time is measured from the time that the dribble flow is turned off. If no compensation is required the batch will be complete after this delay has elapsed.
The unit of this field is 100 milli-seconds. That is, the value of 10 means 1 second.

Batching Limit Time

offset 113, 159, 205, 251

If the weighing does not finish within the set time after the start of the batch the error signal (XA/B/C/D) will be turned on and the batching time out flag (bit 12th) of status word will be turned on. These signals will go off when the error clear command is issued.
This function may be disabled by specifying 0 for the time limit. And the unit of this field is 100 milli-seconds. That is, the value of 10 means 1 second.

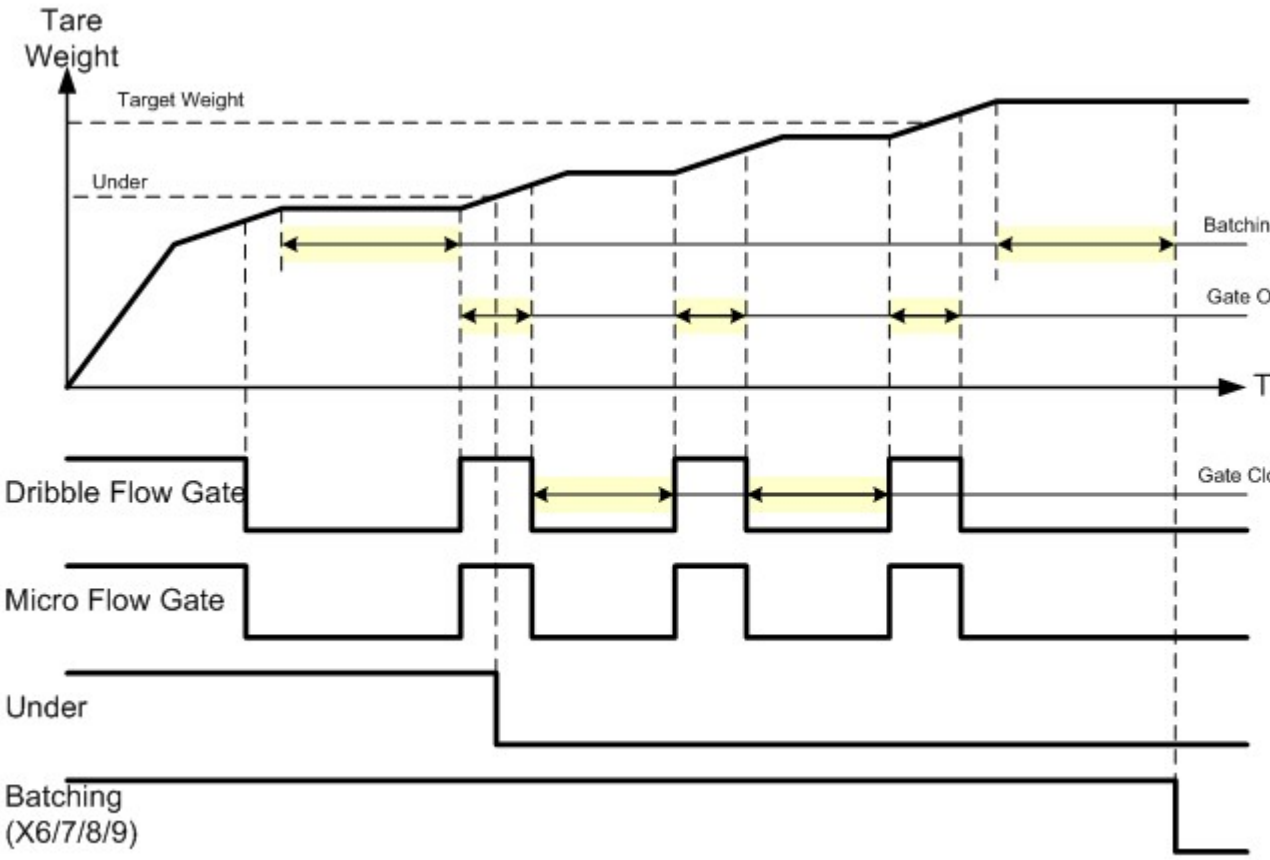


Gate Open / Closing Time and Target Weight : Compensation

Gate open time offset : 108, 154, 200, 246
Gate close time offset : 109, 155, 201, 247
Target weight offset : 110, 156, 202, 248

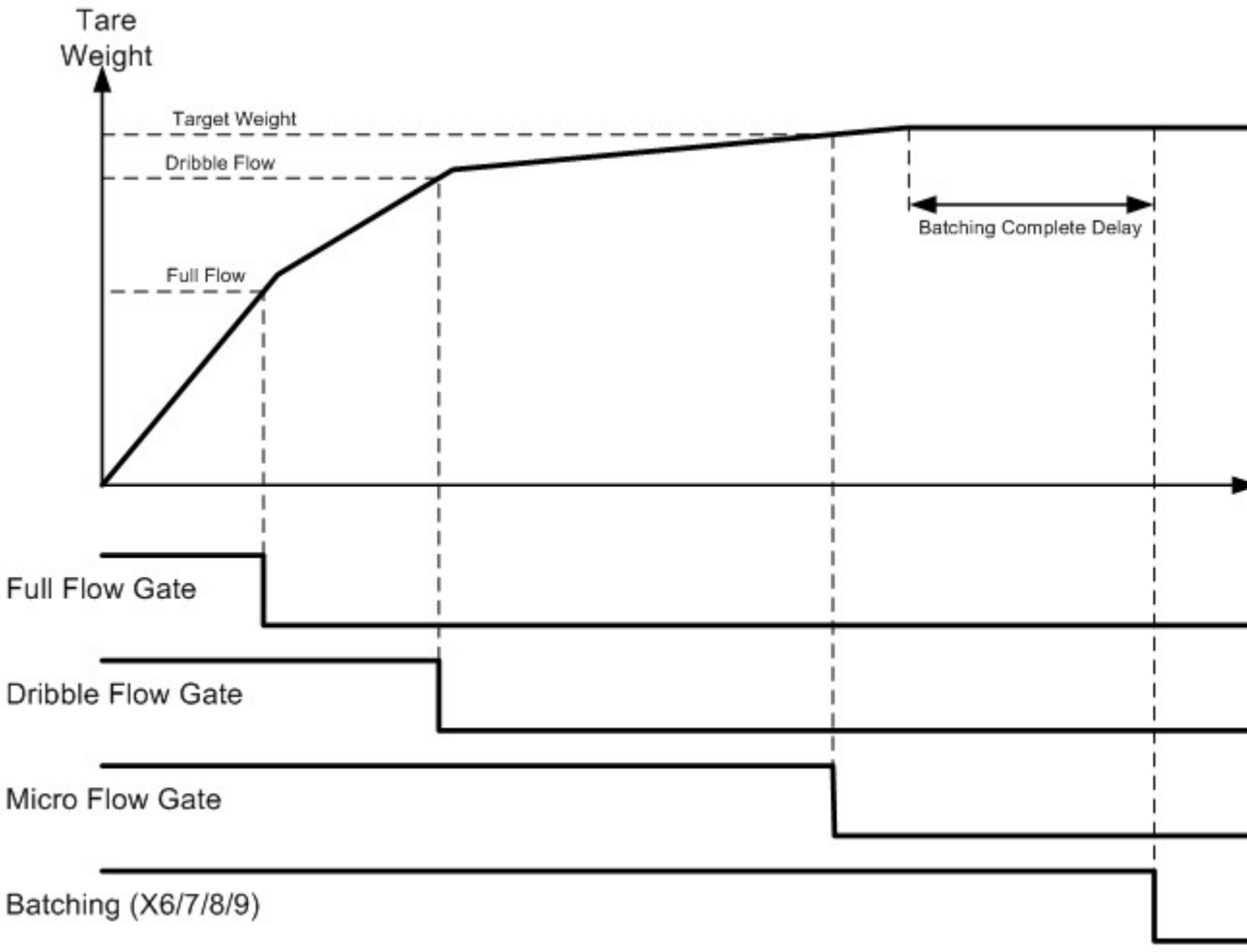
If the weight is below the under weight set point after the dribble flow has been turned off, compensation is performed. The dribble flow signal is turned on (for the gate open time) and off (for the gate closing time) repeatedly until the compensation target is reached. The net weight is compared against the target weight after the gate closing time has elapsed. If the gate open or closing times are set to zero compensation will not be performed.
Micro flow gate signal has special operation patterns for each compensation mode. Following table shows the difference for each compensation mode.

Mode	Condition	Micro Flow Gate
No Compensation	• Target Weight is set as zero	Micro Flow Gate has the same operation pattern as Dribble Flow Gate (Fig. A)
ON/OFF Compensation	• 'Under' signal ON • All compensation parameters are non-zero (Target Weight, Gate Open Time, Gate Close Time)	
Continuous Compensation	• Target Weight is non-zero • Gate Open/Close Time is zero	Micro Flow Gate operates independently with Dribble Flow Gate (Fig. B)



<Fig. A : On/Off Compensation>

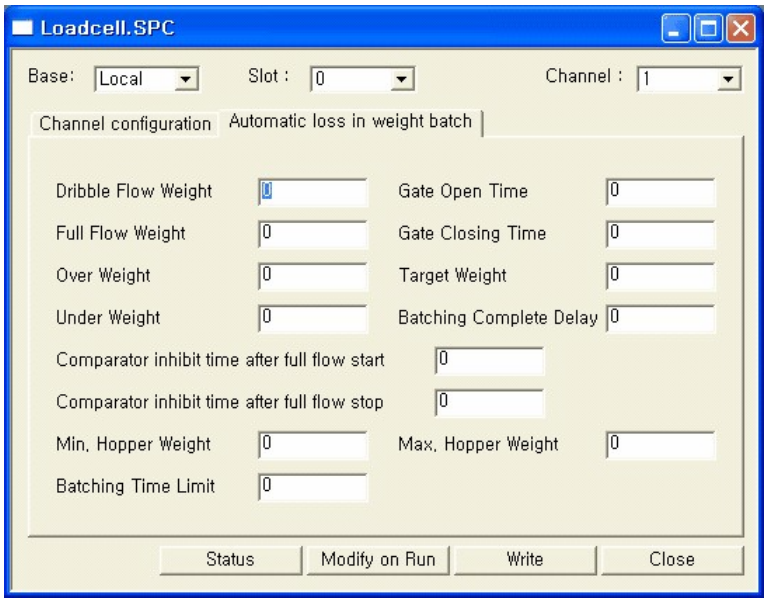
The units of 'Gate Open / Closing Time' fields are 100 milli-seconds. That is, the value of 10 means 1 second.



<Fig. B : Continuous Compensation>

6.8.5.2 Automatic Loss in Weight Batch

This batch control is weighed automatically by controlling the full flow and dribble flow signals. The batch is weighed by measuring the loss in weight as the material is discharged from the weighing hopper. The batch control is started by **' Start (Y2/3/4/5)'** signal or **"WGBATCH"** instruction. And also, this batch needs **' Tare (YA/B/C/D)'** input from sequence program during the progress. The batching data must firstly be configured by special program (load cell setting program) or written into the shared memory area of WG0nA module by sequence program. Following captured screen shows the parameters needed for configuring the **' Automatic Loss in Weight Batch'** control. This dialog box can be shown in ' Load cell setting program' .



Dribble Flow Weight

offset 98, 144, 190, 236

If the net weight is below this weight, the dribble flow gate signal is turned off.

Full Flow Weight

offset 100, 146, 192, 238

If the net weight is below this weight, the full flow gate signal is turned off.

Over Weight

offset 102, 148, 194, 240

If the net weight is below this weight, the over signal is turned on.

Under Weight

offset 104, 150, 196, 242

If the net weight is above this weight, the under signal is turned on.

Comparator Inhibit Time after full flow start / stop

Start offset 106, 152, 198, 244
Stop offset 107, 153, 199, 245

The comparator inhibit functions are to prevent gate vibration (or other factors) from causing jitter on the comparator, which may result in incorrect batching. The comparator is inhibited for the times specified after the full flow is started and stopped.
The unit of this field is 100 milli-seconds. That is, the value of 10 means 1 second.

Batching Complete Delay

offset 112, 158, 204, 250

This sets the delay time before compensation begins. The delay time is measured from the time that the dribble flow is turned off. If no compensation is required the batch will be complete after this delay has elapsed.
The unit of this field is 100 milli-seconds. That is, the value of 10 means 1 second.

Batching Limit Time

offset 113, 159, 205, 251

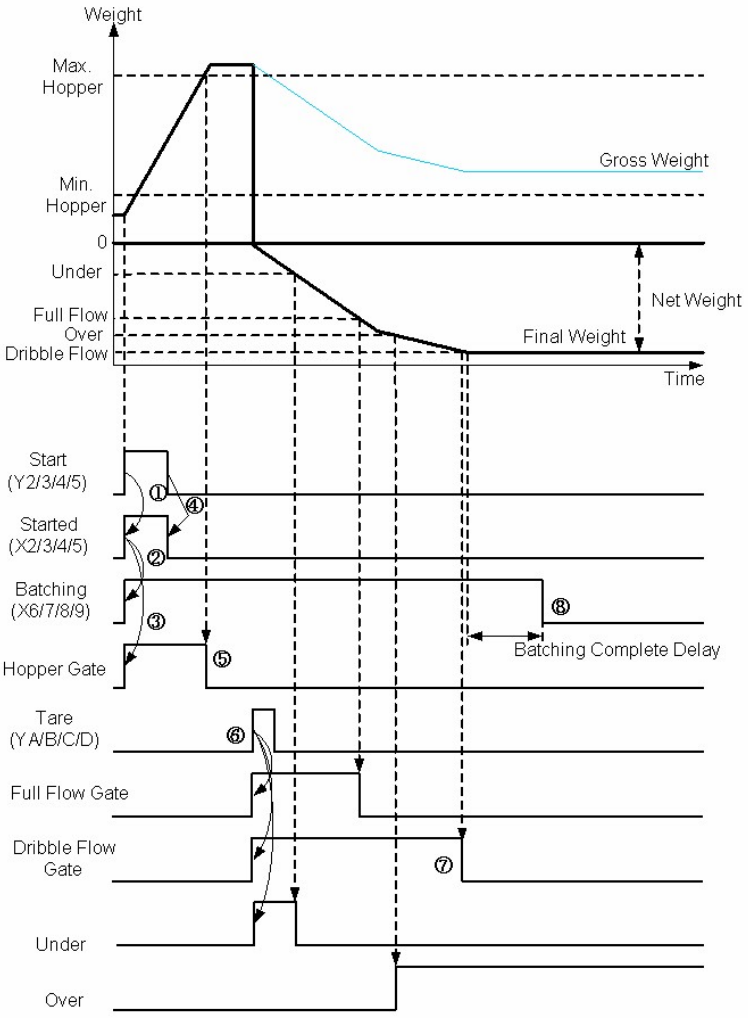
If the weighing does not finish within the set time after the start of the batch the error signal (XA/B/C/D) will be turned on and the batching time out flag (bit 12th) of status word will be turned on. These signals will go off when the error clear command is issued.
This function may be disabled by specifying 0 for the time limit. And the unit of this field is 100 milli-seconds. That is, the value of 10 means 1 second.

Min. Hopper Weight / Max. Hopper Weight

Min. Hopper Weight offset 96, 142, 188, 234
Max. Hopper Weight offset 114, 160, 206, 252

After the starting with Y2/3/4/5 signal of automatic loss in weight batch, WG0nA module checks the gross weight of hopper. If the gross weight is under the ' Min. Hopper Weight' , the ' Hopper Gate' bit (Bit 6) of control signal (offset 3, 18, 33, 48) is turned on. This signal is turned on until the gross weight is increased to the value of ' Max. Hopper Weight' .

If the gross weight is above of the Min. Hopper Weight, the ' Tare' (YA/B/C/D) signal should be turned on for the progress of batch control. Remaining batch control is performed based on net weight (offset 10, 25, 40, 55).



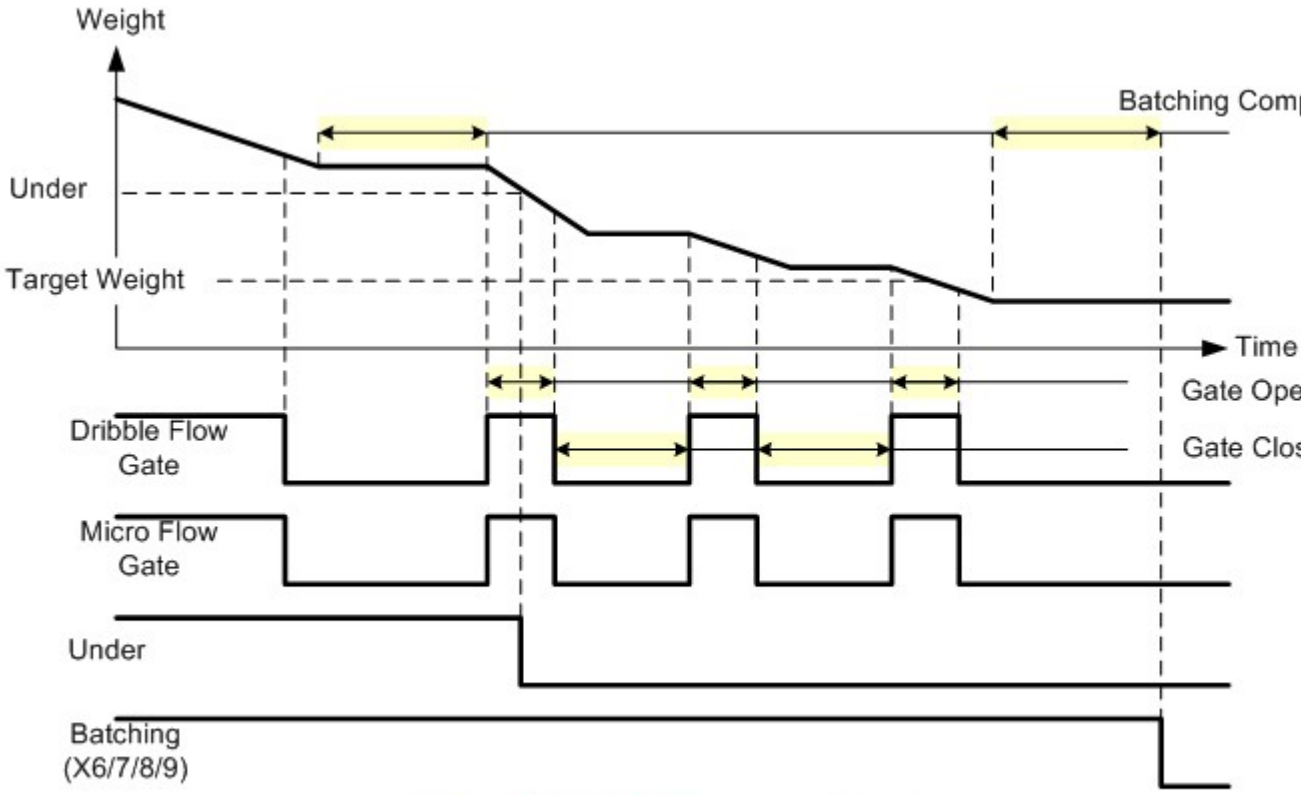
Gate Open / Closing Time and Target Weight : Compensation

Gate open time offset : 108, 154, 200, 246
Gate close time offset : 109, 155, 201, 247
Target weight offset : 110, 156, 202, 248

If the net weight is above the under weight set point after the dribble flow has been turned off,

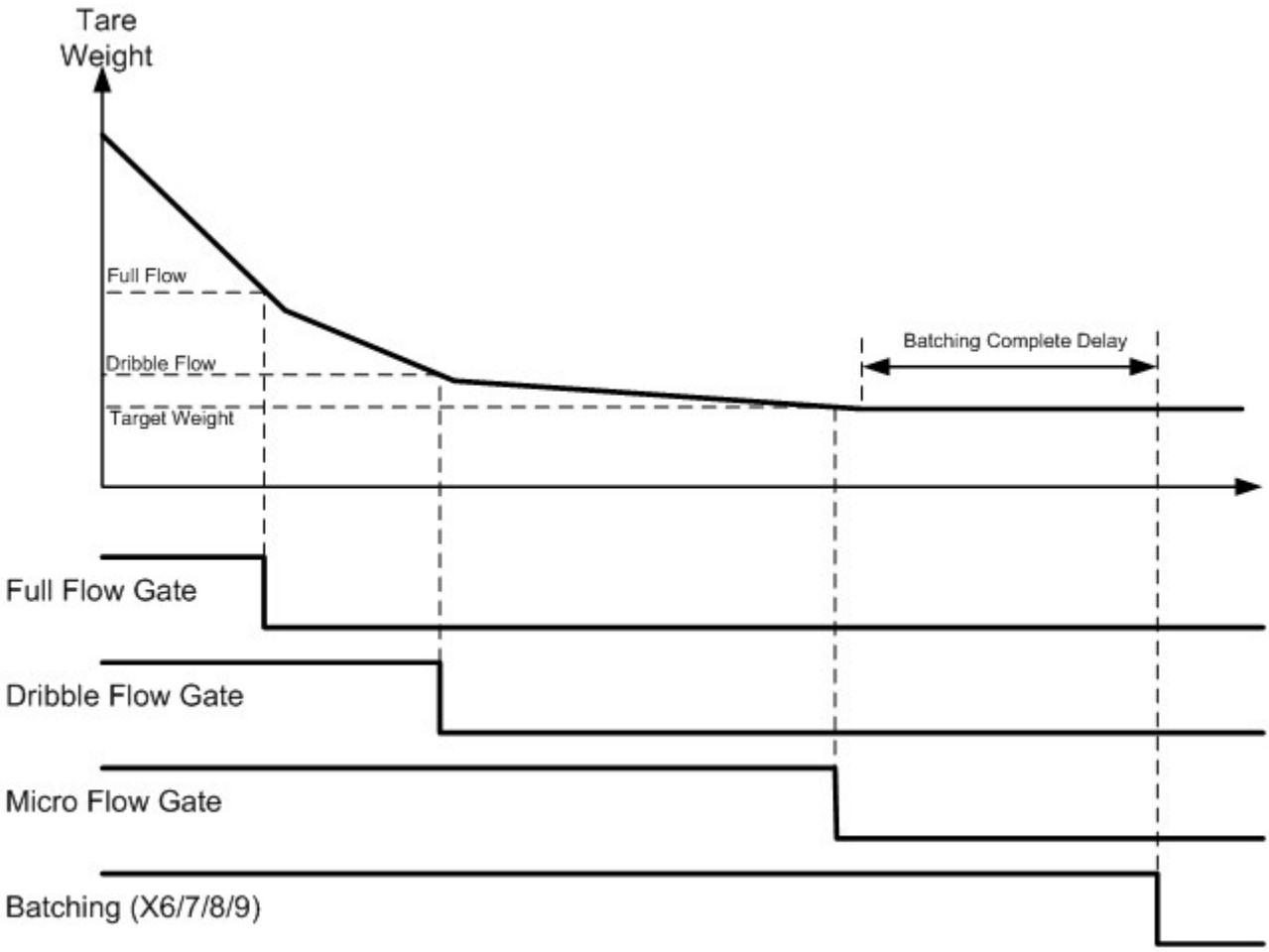
compensation is performed. The dribble flow signal is turned on (for the gate open time) and off (for the gate closing time) repeatedly until the compensation target is reached. The net weight is compared against the target weight after the gate closing time has elapsed. If the gate open or closing times are set to zero no compensation is performed.
The units of ' Gate Open / Closing Time' fields are 100 milli-seconds. That is, the value of 10 means 1 second.

See the section 'Automatic Normal Batch' for Micro Flow Gate operation pattern.



<Fig. A : On/Off Compensation>

The units of 'Gate Open / Closing Time' fields are 100 milli-seconds. That is, the value of 10 means 1 second.

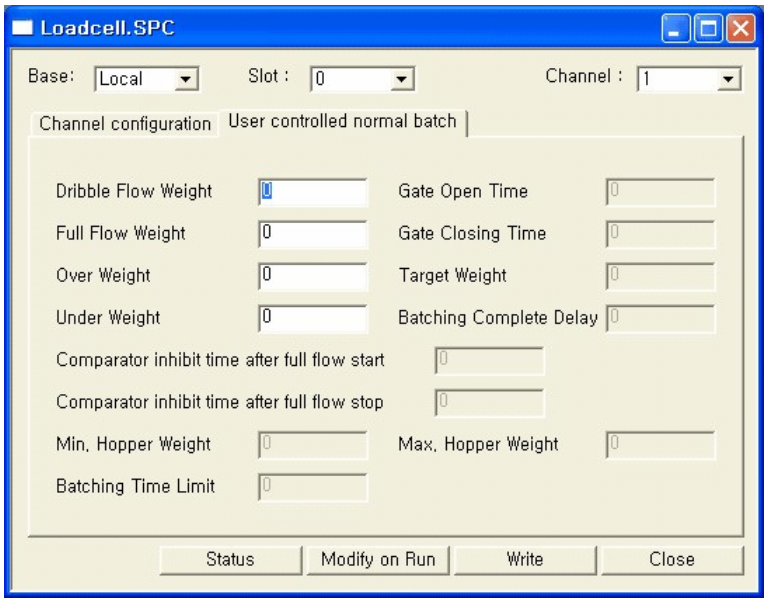


<Fig. B : Continuous Compensation>

6.8.5.3 User Controlled Normal Batch

This mode performs normal batch weighing but the comparator output is dependant only on the net weight data. This mode, while being more flexible than the automatic mode described in section "Automatic Normal Batch", is more difficult to implement as the actual full flow and dribble flow outputs must be controlled by a sequence program. No compensation is performed in this mode.

After starting of this mode batch control, the batching signal (X6/7/8/9) is turned on until when the WGSTOP instruction or ‘ Batch Stop’ command (code 3) with Y2/3/4/5 signal is issued by sequence program.



Dribble Flow Weight

offset 98, 144, 190, 236

If the net weight is above this weight, the dribble flow gate signal is turned off.

Full Flow Weight

offset 100, 146, 192, 238

If the net weight is above this weight, the full flow gate signal is turned off.

Over Weight

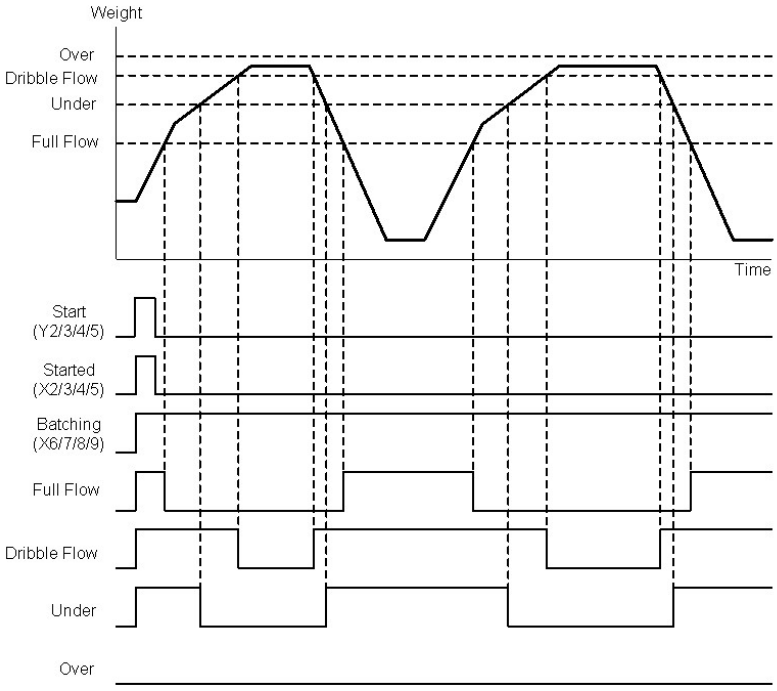
offset 102, 148, 194, 240

If the net weight is above this weight, the over signal is turned on.

Under Weight

offset 104, 150, 196, 242

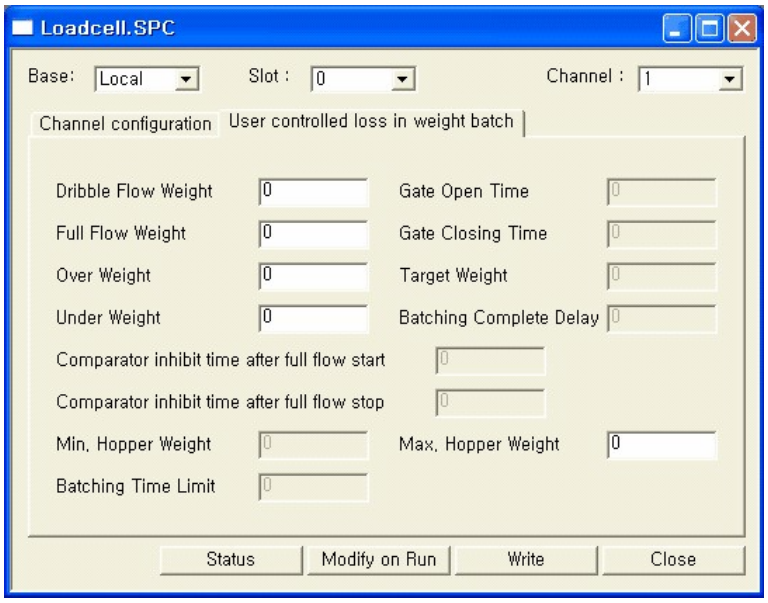
If the net weight is below this weight, the under signal is turned on.



6.8.5.4 User Controlled Loss in Weight Batch

This mode performs loss in weight batching but the comparator output is dependant only on the net weight data. This mode, while being more flexible than the automatic mode described in section "Automatic Loss in Weight Batch", is more difficult to implement. No compensation is performed in this mode.

After starting of this mode batch control, the batching signal (X6/7/8/9) is turned on until when the WGSTOP instruction or ‘ Batch Stop’ command (code 3) with Y2/3/4/5 signal is issued by sequence program.



Dribble Flow Weight

offset 98, 144, 190, 236

If the net weight is below of this weight, the dribble flow gate signal is turned on.

Full Flow Weight

offset 100, 146, 192, 238

If the net weight is below of this weight, the full flow gate signal is turned on.

Over Weight

offset 102, 148, 194, 240

If the net weight is below of this weight, the over signal is turned on.

Under Weight

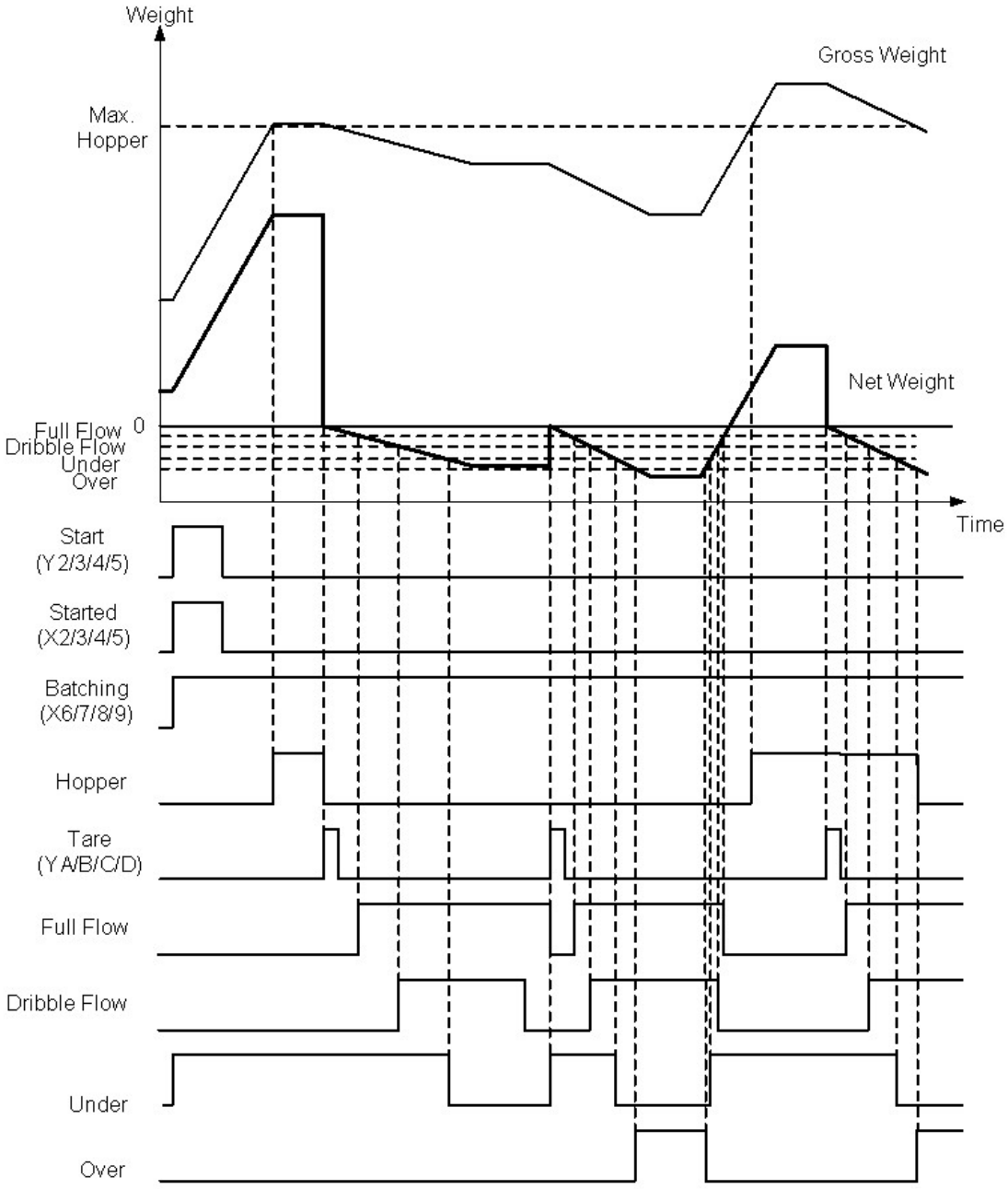
offset 104, 150, 196, 242

If the net weight is above of this weight, the under signal is turned on.

Max. Hopper Weight

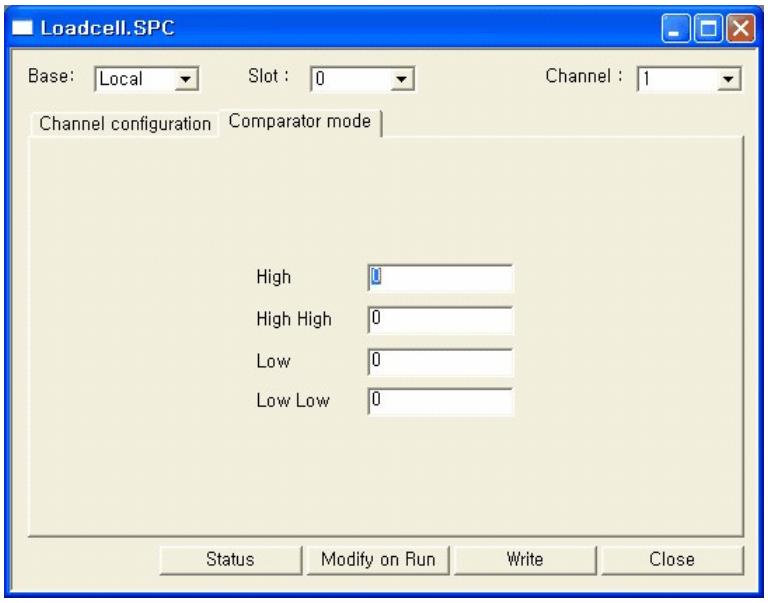
Max. Hopper Weight offset 114, 160, 206, 252

If the gross weight is above of this weight, the ‘ Hopper Gate’ bit (Bit 6) of control signal (offset 3, 18, 33, 48) is turned on.



6.8.5.5 Comparator Mode

This mode performs only comparison between set values and net weight.



High

offset 98, 144, 190, 236

If the net weight is above of this weight, the ‘ High’ bit (Bit 3) of control output is turned on.

High High

offset 102, 148, 194, 240

If the net weight is above of this weight, the ‘ High-High’ bit (Bit 2) of control output is turned on.

Low

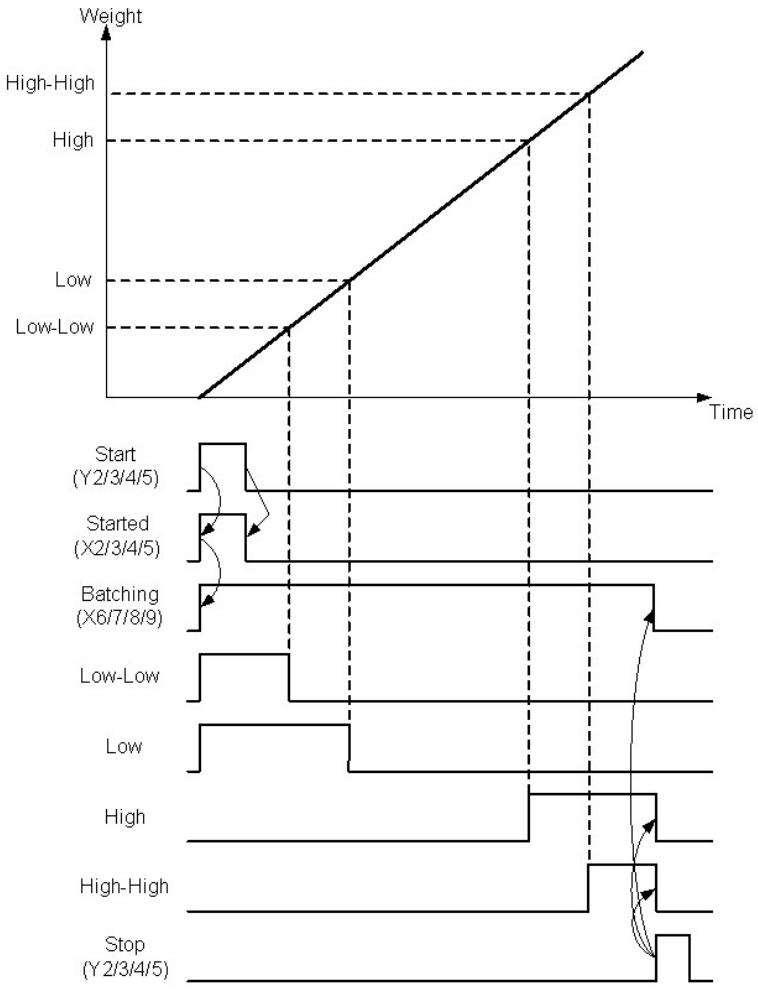
offset 100, 146, 192, 238

If the net weight is below of this weight, the ‘ Low’ bit (Bit 4) of control output is turned on.

Low Low

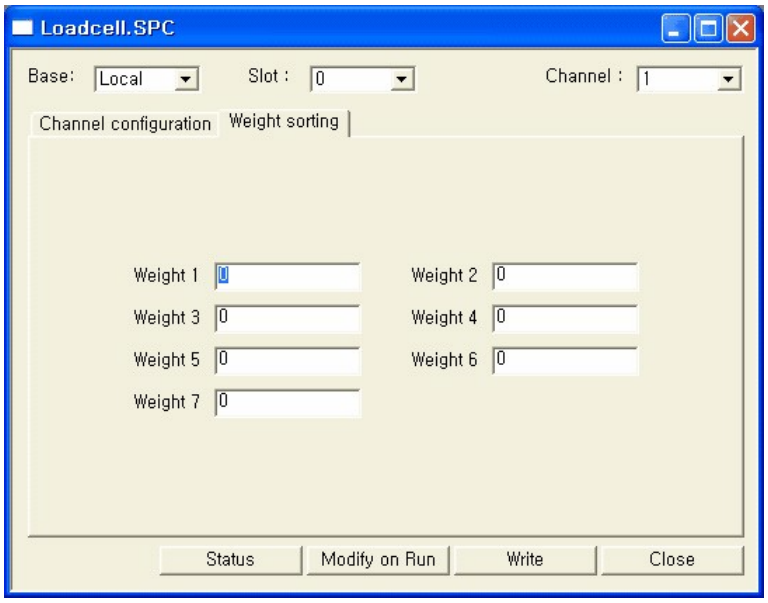
offset 104, 150, 196, 242

If the net weight is below of this weight, the ‘ Low-Low’ bit (Bit 5) of control output is turned on.



6.8.5.6 Weight Sorting Mode

This mode gets 7 different boundaries (set values) for classifying the 8 different ranges of weight. Each 8 ranges have their output bits in control outputs (offset 3, 18, 33, 48). At any time, only one bit of control outputs is set according to the current measured net weight.



Weight 1

offset 98, 144, 190, 236

If the net weight is lower than this value, the ‘ weight 0’ bit (bit 8) in control outputs is set.

Weight 2

offset 100, 146, 192, 238

If the net weight is between ‘ Weight 1’ set value and this value, the ‘ weight 1’ bit (bit 9) in control outputs is set.

Weight 3

offset 102, 148, 194, 240

If the net weight is between ‘ Weight 2’ set value and this value, the ‘ weight 2’ bit (bit A) in control outputs is set.

Weight 4

offset 104, 150, 196, 242

If the net weight is between ‘ Weight 3’ set value and this value, the ‘ weight 3’ bit (bit B) in control outputs is set.

Weight 5

offset 106, 152, 198, 244

If the net weight is between ‘ Weight 4’ set value and this value, the ‘ weight 4’ bit (bit C) in control outputs is set.

Weight 6

offset 108, 154, 200, 246

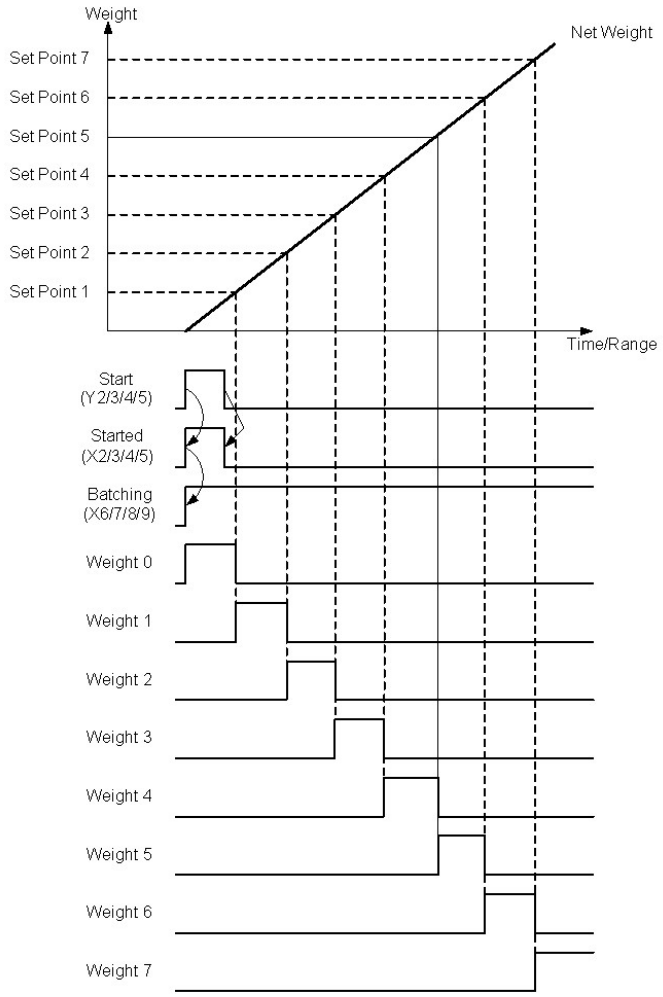
If the net weight is between ‘ Weight 5’ set value and this value, the ‘ weight 5’ bit (bit D) in control outputs is set.

Weight 7

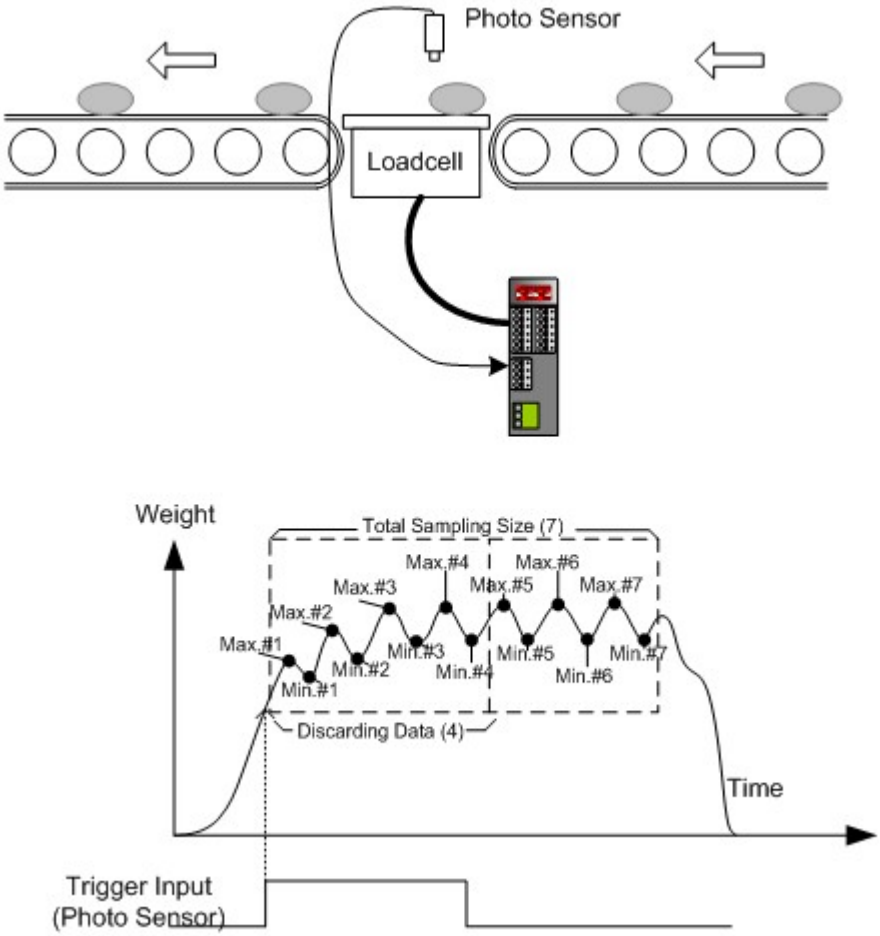
offset 110, 156, 102, 248

If the net weight is between ‘ Weight 6’ set value and this value, the ‘ weight 6’ bit (bit E) in control outputs is set. Or if the net weight is higher than this
value, the ‘ weight 7’ bit (bit F) in control outputs is set.

Control Outputs		Range
8	Weight 0	Net Weight < Weight 1
9	Weight 1	Weight 1 <= Net Weight < Weight 2
A	Weight 2	Weight 2 <= Net Weight < Weight 3
B	Weight 3	Weight 3 <= Net Weight < Weight 4
C	Weight 4	Weight 4 <= Net Weight < Weight 5
D	Weight 5	Weight 5 <= Net Weight < Weight 6
E	Weight 6	Weight 6 <= Net Weight < Weight 7
F	Weight 7	Net Weight > Weight 7



6.8.5.7 Dynamic Weighing(Fluid Material)



This dynamic weighing batch program is supported by WG02D model only. WG02D model is specially tuned for weighing fluid object like egg, filled bottle etc at high speed (typical speed : 0.5 sec). Measured weight of fluid object has a special characteristic. Series of measured values have wave pattern. A measuring idea can be suggested by this characteristic. Actual weight of the object would be located at the middle point of minimum and maximum wave cycle approximately.

Total Sampling Size (1..100)

offset 98, 144, 190, 236

Designate the total number of wave cycles for processing the dynamic weighing. WG02D module samples maximum and minimum value pairs of each cycle up to this set value. This parameter can be decided by heuristic method.

Number of Discarding Data (0..99)

offset 99, 145, 191, 237

If there can be unstable cycles during the beginning of measurement, this parameter can be used for discarding them. It can be useful for enhancing accuracy. WG02D module calculates the final weight with remaining cycle data.

External Trigger Input Debounce Time (0..100 mSec)

offset 100, 146, 192, 238

This parameter is useful for rejecting the noise on external trigger input. The input pulse which has shorter pulse width than this value will be ignored.

Use External Trigger Input

offset 101, 147, 193, 239

It should be set as '1' which enables the external trigger input port.

Minimum Effective Weight

offset 102, 148, 194, 240

It is useful to remove the initial unstable data of each weighing object from average calculation. Designate the lower limit weight for average calculation here.

6.8.5.8 Dynamic Weighing(Solid Material)

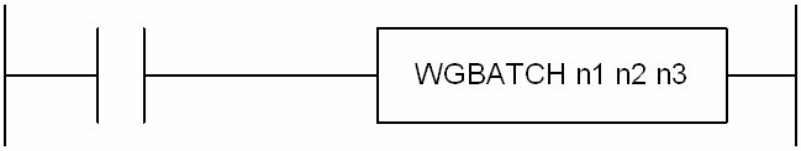
Future implementation.

6.8.6 Instructions for Weighing

Contents :

6.8.6.1 WGBATCH

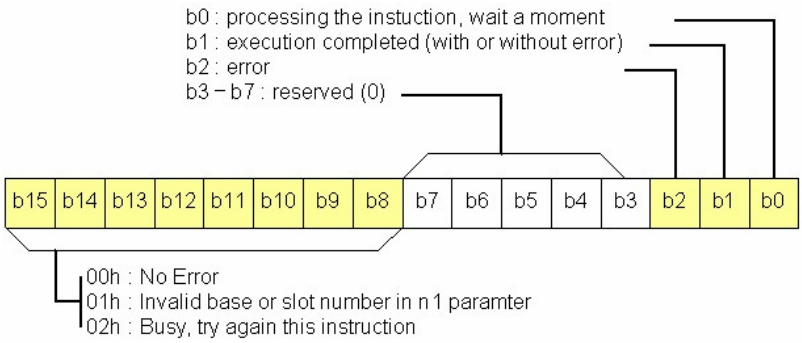
This instruction initiates a batch control.



- **n1 :** The base number and its slot number where the WG0nA module installed. This parameter gets a word value. The base number (00H - 10H) must be assigned to the high byte of the word and the low byte of the word must be the slot number (00H – 0BH). For example, 0105H of n1 parameter means, the WG0nA module is installed in the 6th slot of the first expansion base.

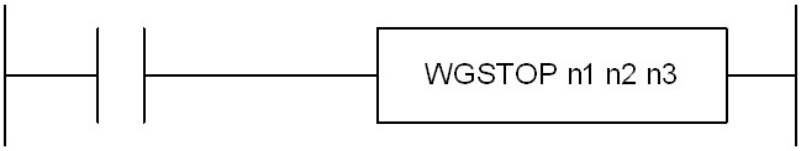
- **n2 :** A channel number of WG0nA. (1 – 4)

- **n3 :** A word sized memory device can be used as the n3 parameter. This memory device will hold the result code of execution. Before issuing instruction this memory device should be cleared to zero.
  The result code includes error code and other flags as following figure.



6.8.6.2 WGSTOP

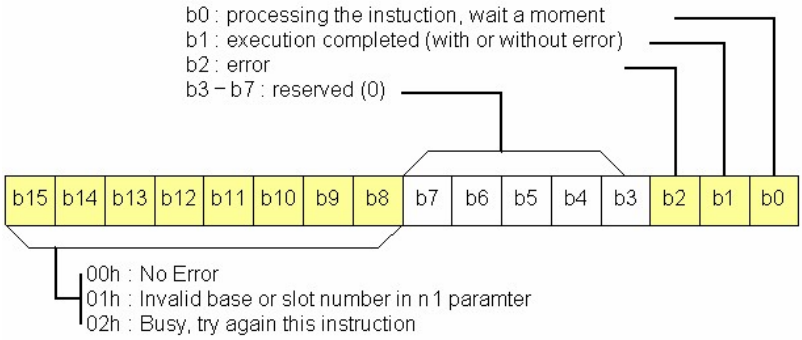
This instruction stops a running batch control.



- **n1 :** The base number and its slot number where the WG0nA module installed. This parameter gets a word value. The base number (00H - 10H) must be assigned to the high byte of the word and the low byte of the word must be the slot number (00H – 0BH). For example, 0105H of n1 parameter means, the WG0nA module is installed in the 6th slot of the first expansion base.

- **n2 :** A channel number of WG0nA. (1 – 4)

- **n3 :** A word sized memory device can be used as the n3 parameter. This memory device will hold the result code of execution. Before issuing instruction this memory device should be cleared to zero.
  The result code includes error code and other flags as following figure.

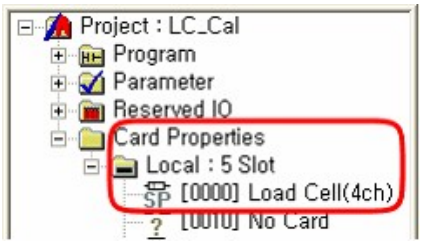


6.8.7 Calibration

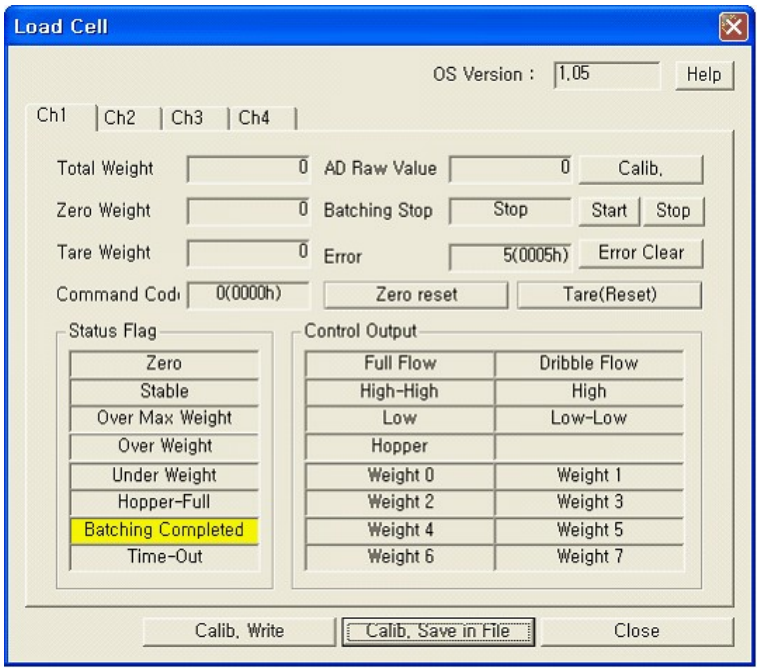
Contents :

6.8.7.1 How to calibrate

A. Double click the loadcell module in the Card Properties of Project windows.



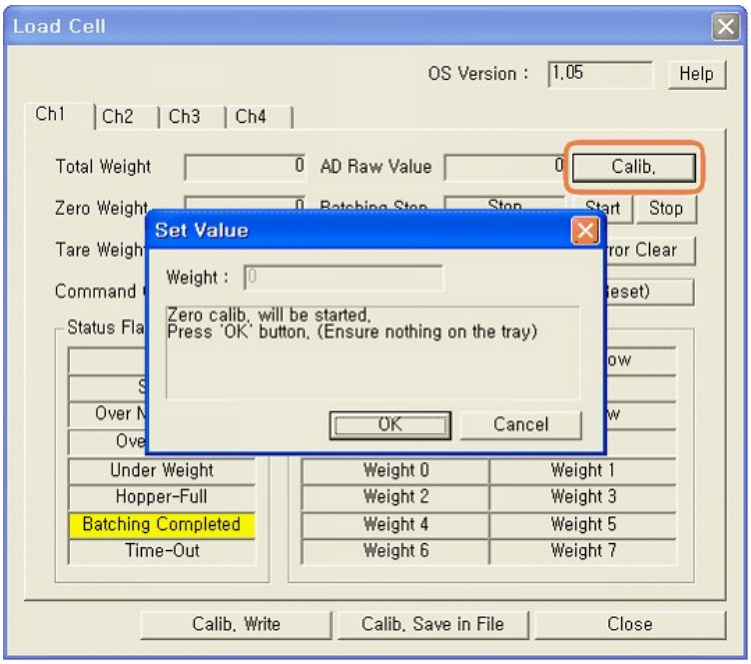
Then Status window will be activated below.



B. In case of calibrating channel 1

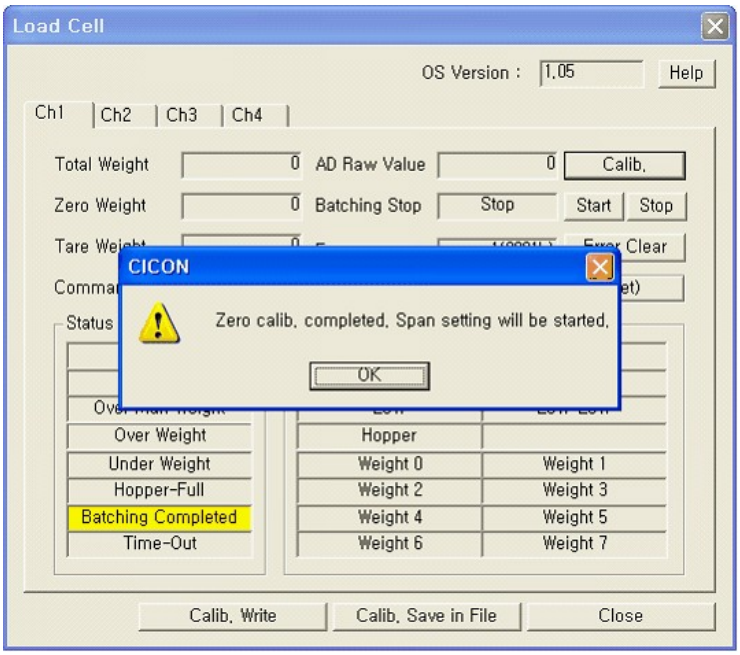
i. Set the weight to zero when the module is wired with loadcell unit.

ii. If you press the “Calib.” Button then “Set Value”± window will be activated.



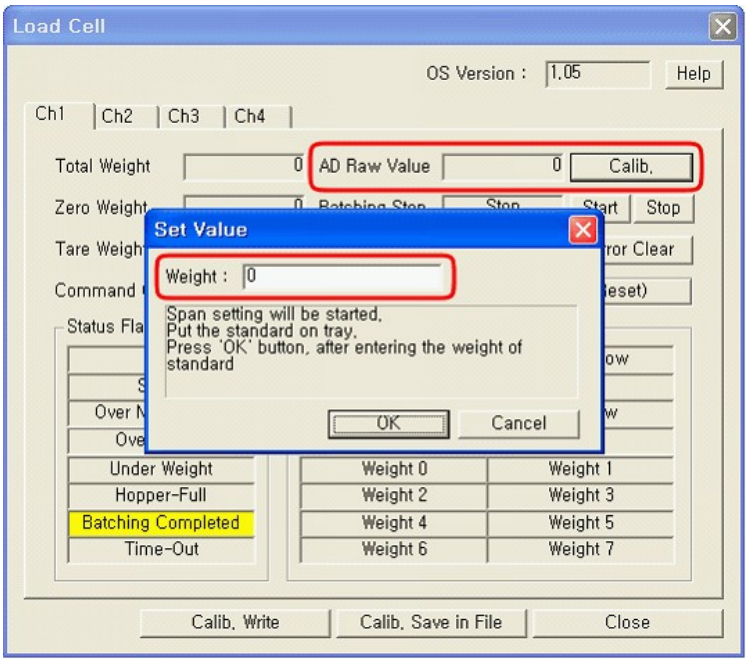
Press the “OK” button when the converted value is stable.

iii. Then following dialog box will appear.



Press the “OK” button.

C. Then configuration dialog box of span weight will be appeared below.



i. Set the span weight and press the “OK" button when the measuring value is stable.

How to set the span weight

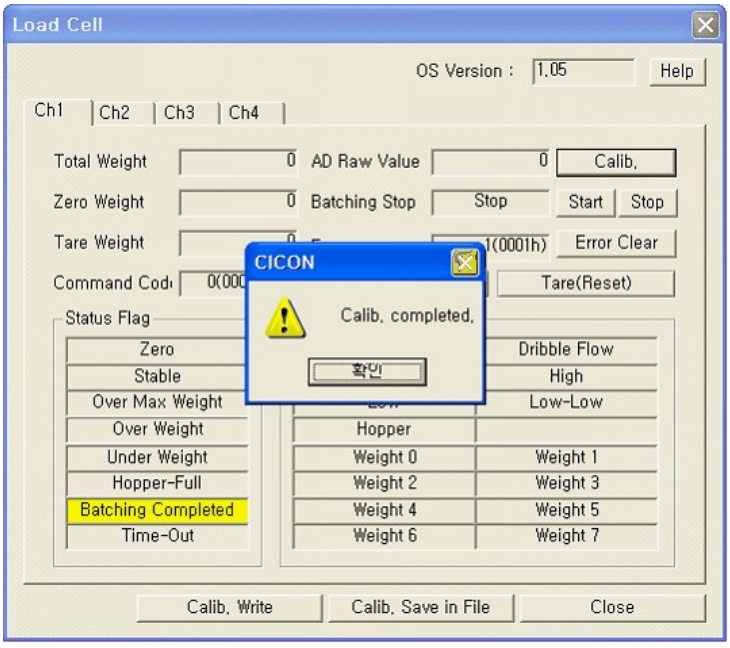
To set the proper span weight in the above dialog box, two kind of resolutions should be considered together.
One of them is the resolution of the loadcell itself.
Assume the specification of the loadcell is 100Kg, 2mV/V ±¾0.1% for further discussion.
As written in the above example specification, the resolution of loadcell is 0.1%, such that the actual resolution of the loadcell can be calculated from the percentage.

100g (100Kg * 0.1%)

The other resolution to be considered is WGnnA module. This module provides 1/6000(±¾ 0.016%) resolution, when the signal is 2mV/V. This value imply the actual weight resolution as

16g (100Kg * 0.016%)

You can understand the final and effective resolution of this example is 100g. This means high resolution(16g) of the module(WGnnA) cannot be utilized, since the signal from the loadcell sensor has 100g resolution.
Put this final resolution in your mind, and then choose the weight to load for span calibration. The loading weight should be at least 20% of maximum capacity of the loadcell.
If you choose 20Kg for span calibration, set the "°Weight"± field of the above dialog box as 200. The "°200"± is the induced value of 20Kg from your system resolution(100g) as calculated before.



Then you can see the "Calib. Completed" dialog box. This is the end of calibration of channel 1.

After the calibration, you can get this measured value using “DFRO” instruction or batch control.

ii. All 4 channels (or 2 channels) are configured with same way.

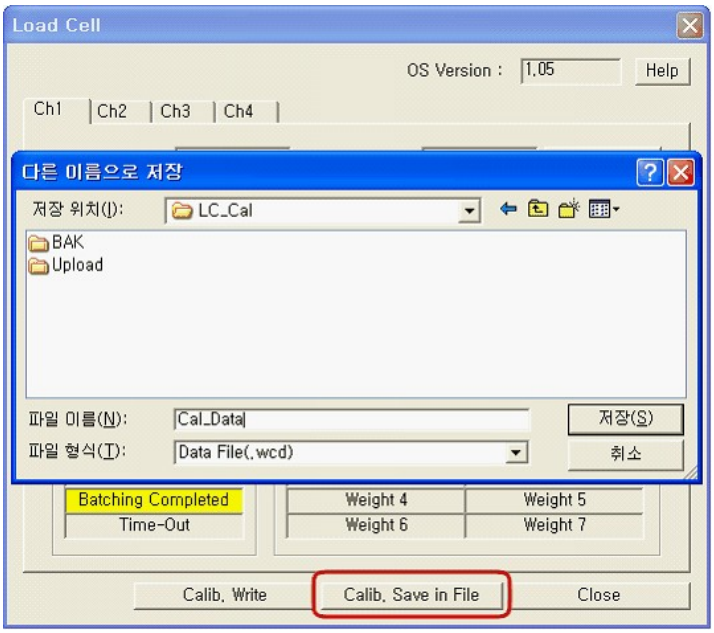
6.8.7.2 Save and download a configuration data

The configuration data can be stored as a file. This function can make using the same configuration data to another weighing module.

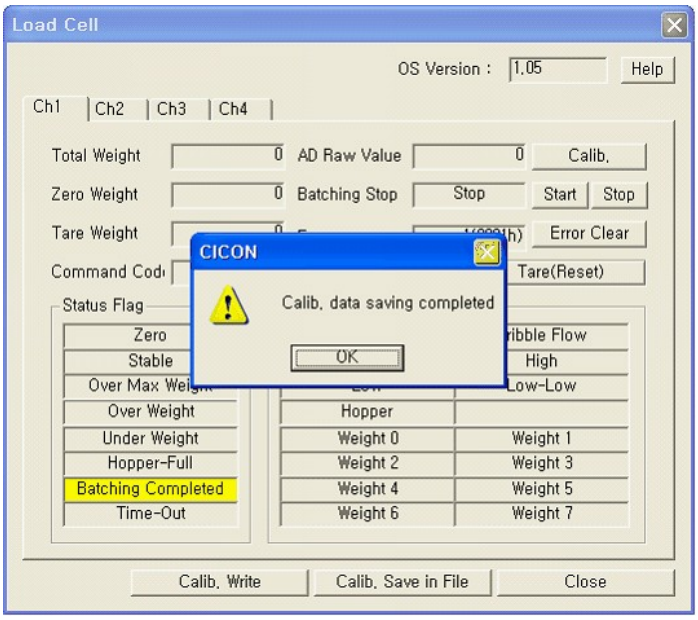
Save and download a configuration data accomplish all 4 channels (or 2 channel). So please do configure all channels before storing a configuration data.

A. Save a configuration data

If you want to store a configuration data as a file, press the “Calib. Save in File”± button after configuration. The file is stored with ‘wcd’ extension (‘*.wcd’).

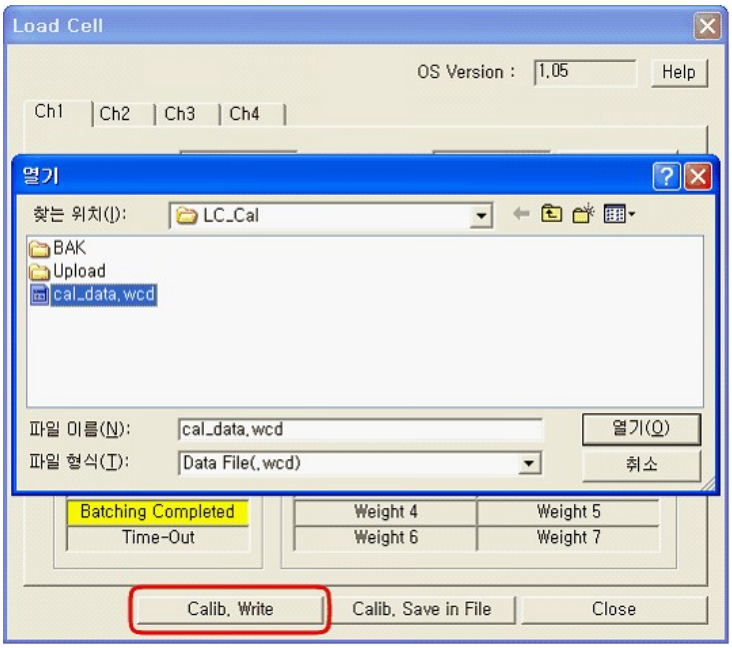


Give a file name to store and press ‘OK’. The following dialog box will appears.

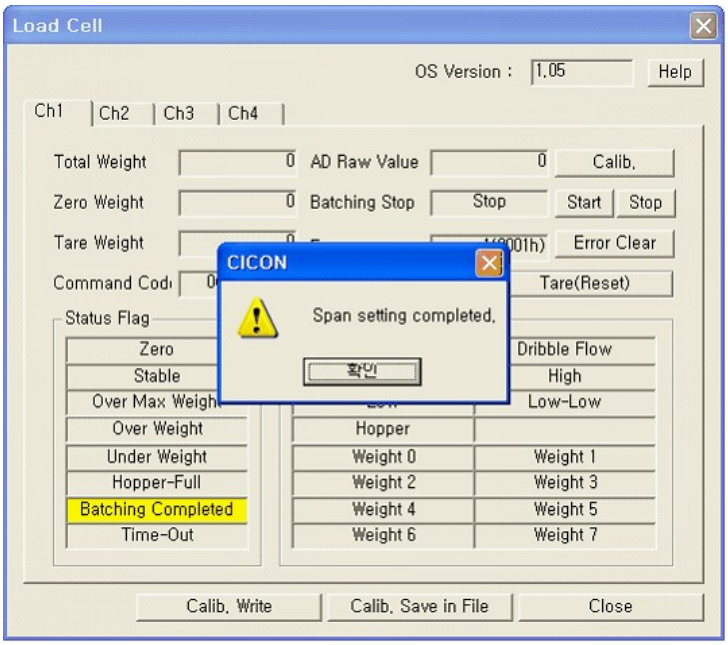


B. Download a configuration data

If you want to download a configuration data which is stored as a file, press “Calib. Write” button.

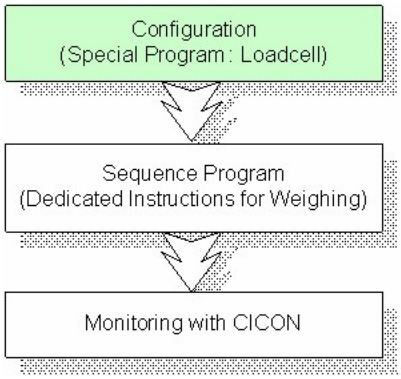


Select a configuration data file to download and press “OK”. The following dialog box will appears.

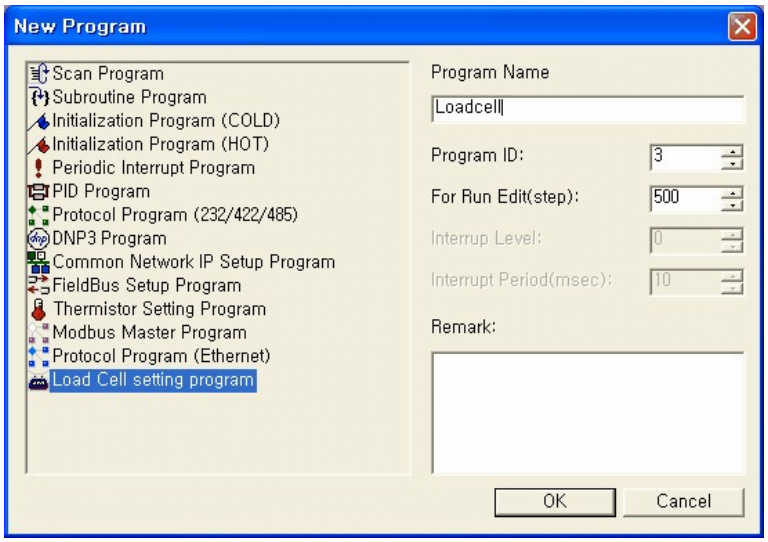


6.8.8 Configure

Create a Special Program :



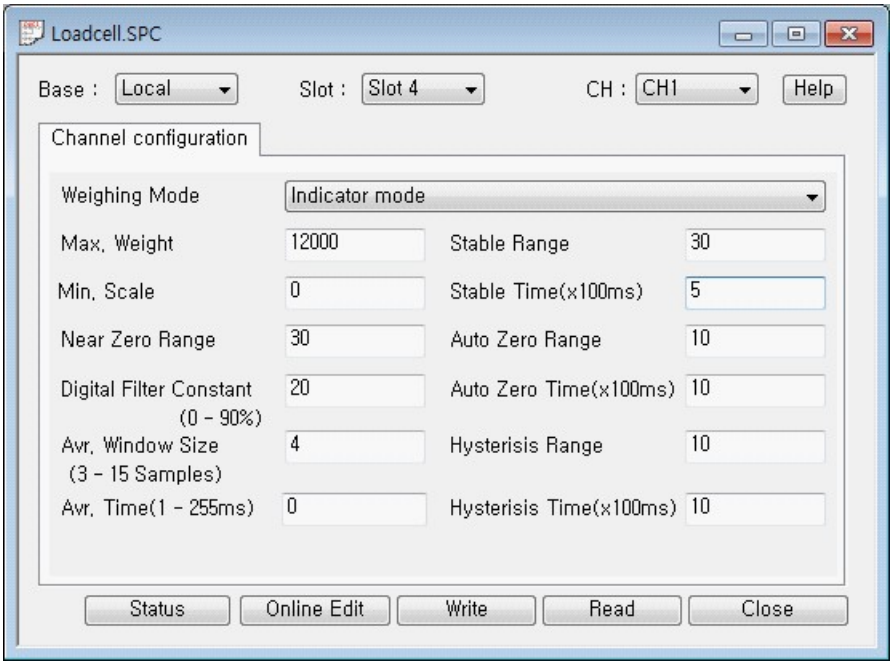
The first step is configuring the WG0nA module. This configuration can be done by one of the ‘ special program’ of CICON. Following picture shows the dialog box creating a new program for weighing module. Choose the ‘ Load Cell setting program’ type in this dialog box.



After the confirming of above dialog box, a new dialog box will be opened. This new dialog box is a configuration programming tool for weighing module.

Contents :

6.8.8.1 Basic Configuration with Special Program



- Weighing Mode (70, 116, 162, 208)
- Min. Scale (71, 117, 163, 209)
- Max. Weight (72, 118, 164, 210)
- Near Zero Range (74, 120, 166, 212)
- Digital Filter Constant (82, 128, 174, 220)
- Avr. Window Size and Time (81, 127, 173, 219)
- Stable Range & Time (75, 121, 167, 213), (76, 122, 168, 214)
- Auto Zero Range & Time (77, 123, 169, 215), (78, 124, 170, 216)
- Hysteresis Range & Time (79, 125, 171, 217), (80, 126, 172, 218)

Weighing Mode

[Configuration data location] Offset 70, 116, 162, 208 of shared memory.

WGnnX module provides 7 different operating modes. Choose one of following modes. The more precise information of each batch control will be described in next section. (Batch Program section)

- **Indicator Mode :** Most simple operating mode. This mode provides the measured weight only and has no control functionality.

- **Automatic normal batching :** A batch is weighed automatically by controlling the full flow and dribble flow signals.

- **Automatic loss in weight batching :** A batch is weighed automatically by controlling the full flow and dribble flow signals. The batch is weighed by measuring the loss in weight as the material is discharged from the weighing hopper.

- **User controlled normal batching :** This mode performs normal batch weighing but the comparator output is dependant only on the current weight data. This mode, while being more flexible than the automatic mode, is more difficult to implement as the full flow and dribble flow signals must be turned off by a sequence program before the hopper is discharged. No compensation is performed.

- **User controlled loss in weight batching :** This mode performs loss in weight batching but the comparator output is dependant only on the current weight data. This mode, while being more flexible than the automatic mode, is more difficult to implement. No compensation is performed.

- **Comparator Mode :** This mode performs comparison only. 4 set points (low-low, low, high, high-high) and 4 comparator output signals are provided. These output signals can be used as a kind of alarm signal.

- **Weight Sorting :** This mode performs comparison only. But, 7 set points and 8 comparator output signals are provided. And at anytime, only one of 8 output signals will be turned on.

Min. Scale

[Configuration data location] Offset 71, 117, 163, 209 of shared memory.

Set the display digit span value. For example, if set value was ‘5’, measured weight will be displayed as 0, 5, 10, 15 ... so on.

Max. Weight

[Configuration data location] Offset 72, 118, 164, 210 of shared memory.

Maximum weight that the loadcell can measure.

Near Zero Range

[Configuration data location] Offset 74, 120, 166, 212 of shared memory.

Valid set range : within 1% of Max. Weight.

If current measured weight is within this range, the zero signal will be turned on.

Digital Filter Constant

[Configuration data location] Offset 82, 128, 174, 220 of shared memory.

Valid set value (%) : 0 - 90 %

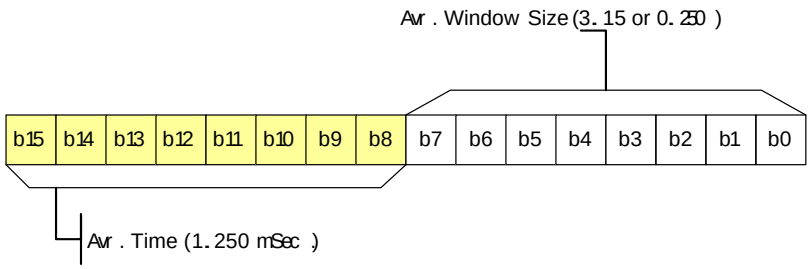
WG0nA module has a digital filter for removing the noise from loadcell output signal. This filter can be described as the following fomula.

Dnf = Dn + α(Dnf-1 – Dn)
Dn : Current Sampling Data
Dnf : Current Filtered Data
Dnf-1 : Previous Filtered Data
α : Filter Constant (%)

This field requires the value of α in percent. If this value is zero, the digital filter will not be applied to the measured data.

Avr. Window Size and Time

[Configuration data location] Offset 81, 127, 173, 219 of shared memory.



Valid set value for Windows Size :

3 - 15 Samples (WGnnA)

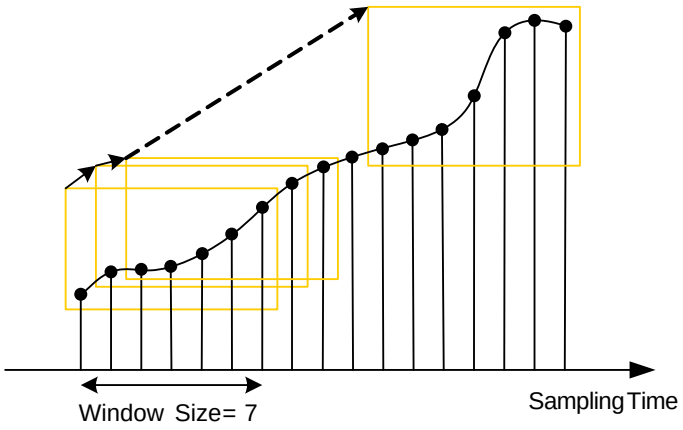
0 - 250 SAmples (WG02C/D/E)

Valid set value for Time :

1 -250 mSec.

The weight data that can be used in batch control and sequence program is the average of a number of AD samples. This parameter sets the number of samples for the average and the sampling time between each sampled data. The number of samples used does not affect the update rate of the weight data, because the average is a ‘moving window’ type as shown in following figure.

If the set value is zero, the averaging function will not be activated.



Stable Range & Time

[Configuration data location] Offset 75, 121, 167, 213 of shared memory.
Valid set range : within 1% of Max. Weight.

[Configuration data location] Offset 76, 122, 168, 214 of shared memory.
Valid set time (unit of 100 msec) : 1 – 100 (100msec – 10,000msec)

A weight which does not change within the specified range for the time specified is considered to be stable and the stable output will be set to ON.
If one of these set values is zero, the stable detect function will not be activated.

Auto Zero Range & Time

[Configuration data location] Offset 77, 123, 169, 215 of shared memory.
Valid set range : within 1% of Max. Weight.

[Configuration data location] Offset 78, 124, 170, 216 of shared memory.
Valid set time (unit of 100 msec) : 1 – 100 (100msec – 10,000msec)

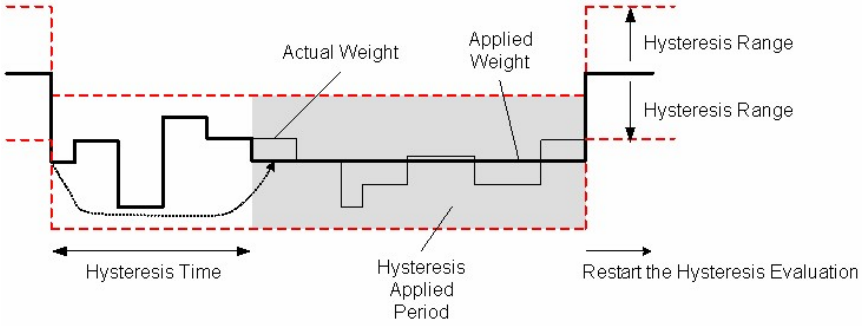
The auto zero function removes the zero drift in the system by periodically rezeroing the measured weight when it is near zero. The auto zero range is the maximum zero shift that will be corrected and the time period is the minimum time between corrections. If the measured weight shifts from zero to a value outside the auto zero range (within the zero time period) the weight will not be rezeroed.
If one of these set values is zero, the auto zeroing function will not be activated.

Hysteresis Range & Time

[Configuration data location] Offset 79, 125, 171, 217 of shared memory.
Valid set range : within 1% of Max. Weight.

[Configuration data location] Offset 80, 126, 172, 218 of shared memory.
Valid set time (unit of 100 msec) : 1 – 100 (100msec – 10,000msec)

The hysteresis function suppresses flicker of the measured weight data. If the weight changes, within the range specified, and returns to the previous value within the time limit specified the measured weight data will not be affected.
If one of these set values is zero, the hysteresis function will not be activated.



6.9 High-speed Counter

Features :

1) Pulses in a wide range can be counted.(-2147483648 ~ 2147483647)

A counted value is stored in buffer memory in signed 32-bit binary value.

2) Pulse input type can be selected.

1-p input 1-m, 1-p input 2-m, CW/CCW, 2-p input 1-m, 2-p input 2-m, 2-p input 4-m

3) Counting form can be selected.

One between the following forms can be selected.

- **Linear counting :** Input pulses can be counted from -2147483648 to 2147483647. In case that a value is out of the range, overflow occurs.
- **Ring counting :** Input pulses are counted repeatedly between the maximum value and the minimum value of ring counting.

4) Coincidence output is available.

Comparing a current value with a set coincidence comparison value, output can be on/off.

5) Four counting functions can be selected.

- **Latch counting :** A currently counted value is stored in buffer memory (04H, 05H, 24H and 25H) according to the signal to start to count (Y06 and Y0E).
- **Sampling counting :** The value counted for the time set by the signals to start to count (Y06, Y0E) is stored in buffer memory (06H, 07H, 26H and27H). If a set time is passed, the value counted before signals (Y06, Y0E) are inputted will be kept.
- **Periodic pulse counting :** The values (08H, 09H, 28H and 29H) counted before the time set up by signals (Y06, Y0E) and currently counted values (0AH, 0BH, 2AH and 2BH) are stored in buffer memory.
- **Disabling to count :** If signals (Y06, Y0E) or the signals to enable to count (Y04, Y0C) are off, pulses will not be counted. The counted values are accumulated in buffer memory for storing current count (00H, 01H).

6) Presetting and counting function can be processed by outer control signals.

Table of contents ,

6.9.1 Overview

The specifications of CM1-HS02 are as follows.

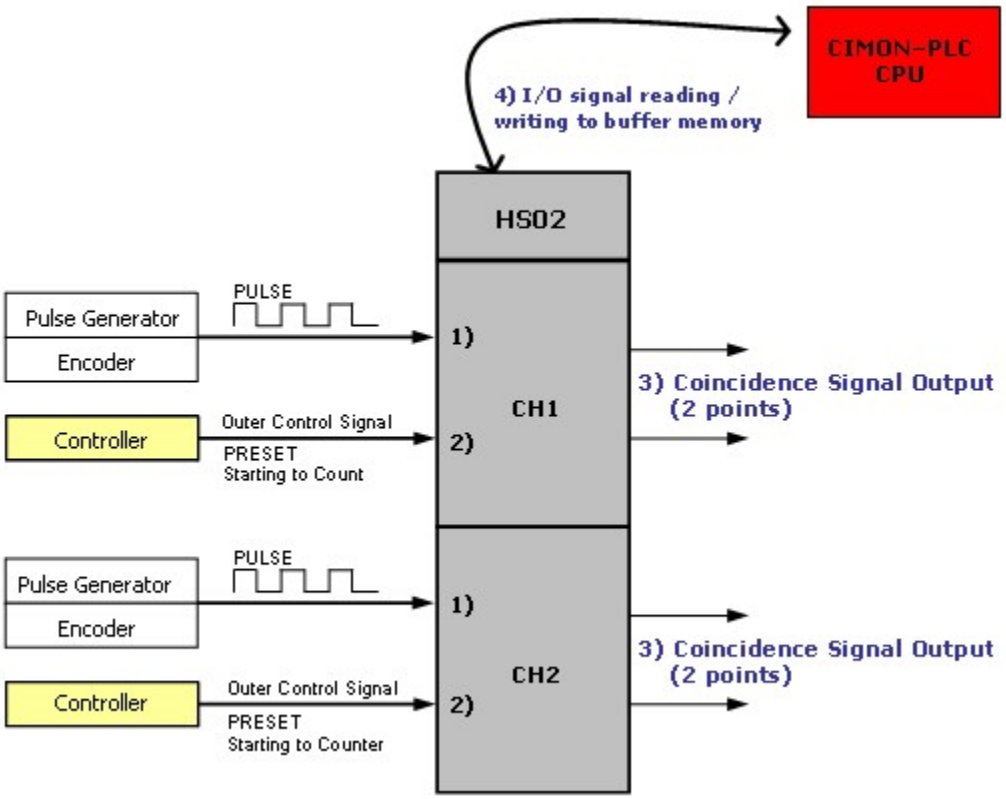
Item	CM1-HS02**

I/O Type	DC Input, Line Drive Input, PNP Open Collector Output
Max. Counting Rate	200Kpps
Number of Channels	2 Channels

The following input method can be selected for HS02 module.

- 1-phase input 1-multiple
- 1-phase input 2-multiple
- CW/CCW
- 2-phase input 1-multiple
- 2-phase input 2-multiple
- 2-phase input 4-multiple

The entire operation of HS02 is as follows.



1) The pulses coming to a pulse input terminal are counted.
2) The module presets a counted value and starts to counting function by outer control signal.
3) Comparing the current value with a set coincidence comparison value, the module outputs coincident signal.(2 points)
4) The I/O signals and the contents of buffer memory can be confirmed by a scan program.

6.9.2 Specifications

Specifications :

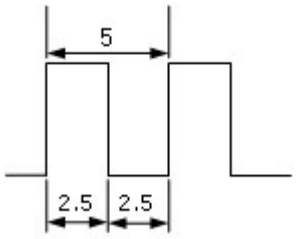
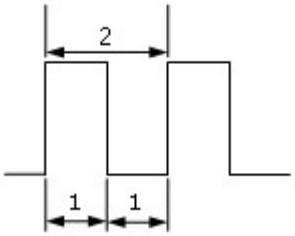
- General Specifications
- Module Specifications
- Outward view and Dimensions

6.9.2.1 General Specifications

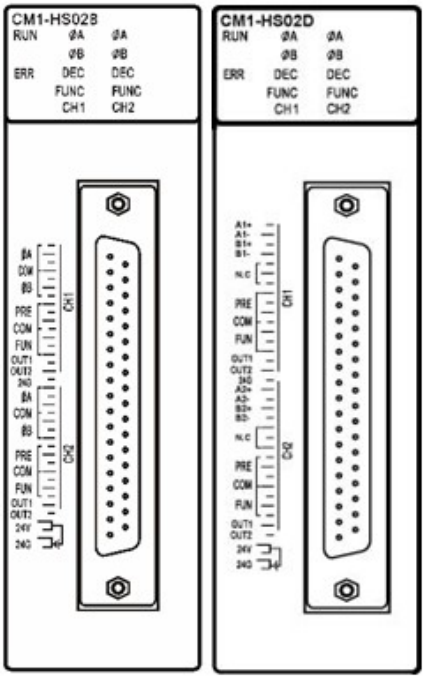
Item	Specification			
Operating Temperature	-10 ~ 65ºC			
Storage Temperature	-25 ~ 80ºC			
Operating Humidity	5 ~ 95%RH, Not condensed.			
Storage Humidity	5 ~ 95%RH, Not condensed.			
Vibration	In case of intermittent vibration			
	Frequency	Acceleration	Amplitude	Sweep
	10 ≦ f< 57Hz	-	0.075mm	10 times in each direction (X,Y,Z)
	57 ≦ f < 150 Hz	9.8m/s2 {1G}	-	
	In case of continuous vibration			
	Frequency	Acceleration	Amplitude	Sweep
	10 ≦ f < 57Hz	-	0.035mm	10 times in each direction (X,Y,Z)
	57 ≦ f < 150 Hz	4.9m/s2 {1G}	-	
Shock	• Max. Shock Acc. : 147 m/s2 {15G} • Time : 11㎳(3 times in X, Y, Z) • Pulse Wave : Half sine wave pulse			
Noise	Square wave impulse noise	±2000V		
	Electrostatic discharge	Voltage: 4 kV(Contact discharge)		
	Radiated electro-magnetic field	27 ~ 500 MHz. 10 V/m		
	Fast Transient Bust Noise	Item	Power Module	Digital I/O (24V or more)	Digital I/O(Less than 24V) Analog I/O Comm. interface

		Voltage	2KV	1KV	0.25KV
Environment	No corrosive gas and no dust.				
Altitude	2,000m or less				
Pollution	Less than 2				
Cooling	Natural Air cooling				

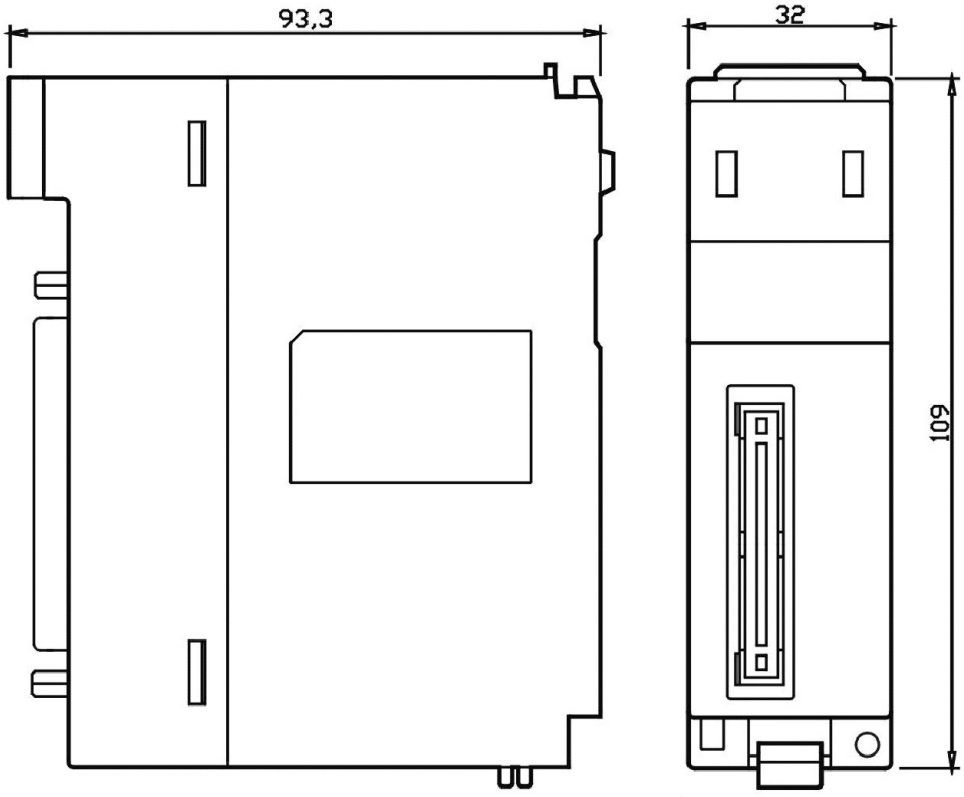
6.9.2.2 Module Specifications

		CM1-HS02B	CM1-HS02D
No. of I/O points		16 Points	
No. of Channels		2 Channels	
Counting Input Signal	Phase	1-Phase Input/ 2-Phase Input	
	Signal Level(φA,φB)	5/12/24 V DC (2~5mA)	RS-422 Line Drive
Counting	Counting Rate	200 kPPS	
	Counting Range	Signed 32-bit binary value (-2147483648~2147483647)	
	Form	Up/Down Presetting Counting + Ring Counting	
	Min. Interval of Counting Pulse(uS) (Duty ratio 50%)		
Coincidence Output	Range of Comparison	Signed 32-bit binary values	
	Result of Comparison	Set Value < Counted Value Set Value = Counted Value Set Value > Counted Value	
Outer Input	Presetting	5/12/24 V DC 2~5mA	
	Starting Function		
Outer Output	Coincidence Output	Transistor(Sink Type) Output Operating Voltage 12~24V	

6.9.2.3 Dimensions



LED	Use
RUN	The module is operating.
ERR	An error occurs.
ØA	Voltage is being input to A-phase input terminal.
ØB	Voltage is being input to B-phase input terminal.
DEC	Input pulses are being counted down.
FUNC	Voltage is being input to the terminal for starting function.

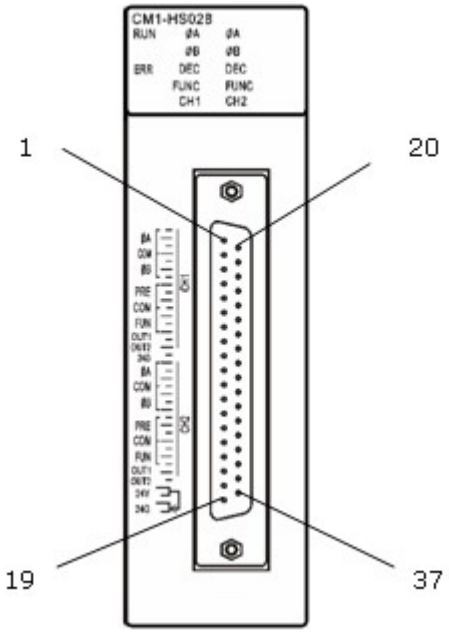


6.9.3 Installing and Wiring

Installing and Wiring :

- Installing
- Wiring - Safety Precautions
- Arrangement of HS02B pin
- Arrangement of HS02D pin
- Examples of Wiring

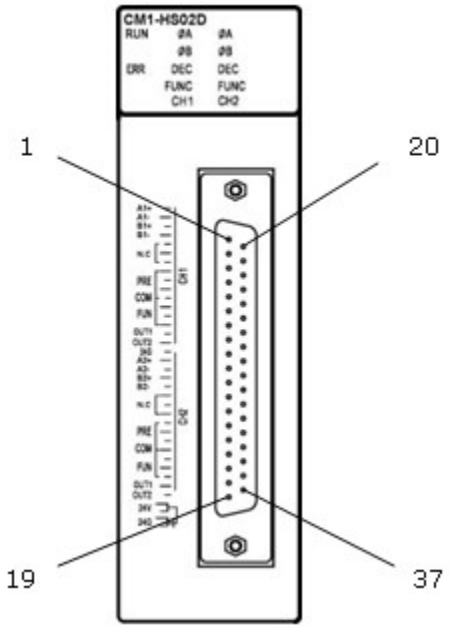
6.9.3.1 Arrangement of HS02B pin



	Signal	Terminal Pin No.		Signal	Terminal Pin No.
CH1	Phase A Pulse Input 24V	1	CH2	Phase A Pulse Input 24V	28
	Phase A Pulse Input 12V	20		Phase A Pulse Input 12V	10
	Phase A Pulse Input 5V	2		Phase A Pulse Input 5V	29
	AB common	21		AB common	11
	Phase B Pulse Input 24V	3		Phase B Pulse Input 24V	30
	Phase B Pulse Input 12V	22		Phase B Pulse Input 12V	12

	Phase B Pulse Input 5V	4		Phase B Pulse Input 5V	31
	Presetting Input 24V	23		Presetting Input 24V	13
	Presetting Input 12V	5		Presetting Input 12V	32
	Presetting Input 5V	24		Presetting Input 5V	14
	Presetting, Starting Function Input common	6		Presetting, Starting Function Input common	33
	Starting Function Input 24V	25		Starting Function Input 24V	15
	Starting Function Input 12V	7		Starting Function Input 12V	34
	Starting Function Input 5V	26		Starting Function Input 5V	16
	Coincidence Output 1	8		Coincidence Output 1	35
	Coincidence Output 2	27		Coincidence Output 2	17
	Power Input for Coincidence Output(CH1, CH2)			24V	36,18
				0V	37,19

6.9.3.2 Arrangement of HS02D pin



	Signal	Terminal Pin No.		Signal	Terminal Pin No.
CH1	Phase A Pulse Input	1	CH2	Phase A Pulse Input	28
	Phase A- Pulse Input	20		Phase A- Pulse Input	10
	Phase B Pulse Input	2		Phase B Pulse Input	29
	Phase B- Pulse Input	21		Phase B- Pulse Input	11
	N.C	3		N.C	30
	N.C	22		N.C	12

	N.C	4		N.C	31
	Presetting Input 24V	23		Presetting Input 24V	13
	Presetting Input 12V	5		Presetting Input 12V	32
	Presetting Input 5V	24		Presetting Input 5V	14
	Presetting, Starting Function Input common	6		Presetting, Starting Function Input common	33
	Starting Function Input 24V	25		Starting Function Input 24V	15
	Starting Function Input 12V	7		Starting Function Input 12V	34
	Starting Function Input 5V	26		Starting Function Input 5V	16
	Coincidence Output 1	8		Coincidence Output 1	35
	Coincidence Output 2	27		Coincidence Output 2	17
	Power Input for Coincidence Output(CH1, CH2)			24V	36,18
				0V	37,19,9

6.9.3.3 Installing

Installation Environment

Conditions

- Install in a waterproof and dustproof control panel.
- Install at the place without continuous shock or vibration.
- Keep out of the direct rays of the sun.
- No dew caused by sudden temperature variation.
- Keep ambient temperature from 0 to 55°C.

Works

- In case of making bolthole or wiring, keep a PLC from dust and dregs.
- Install at the place for easy operation.
- Do not install together with high-voltage device and same panel.
- The distance between a duct and a module is to be over 50 mm.
- Ground at the place where noise environment is good.
-

Cautions

1. Do not drop or shock.
2. Do not separate a PCB from a case. That may cause breakdown.
3. In case of wiring, take care that dregs come into the top of a module. If there are, remove them.
4. Mount or take out a module after turning off the power.

6.9.3.4 Wiring - Safety Precautions

In case of inputting pulses in high rate, take note of noise in wiring especially.

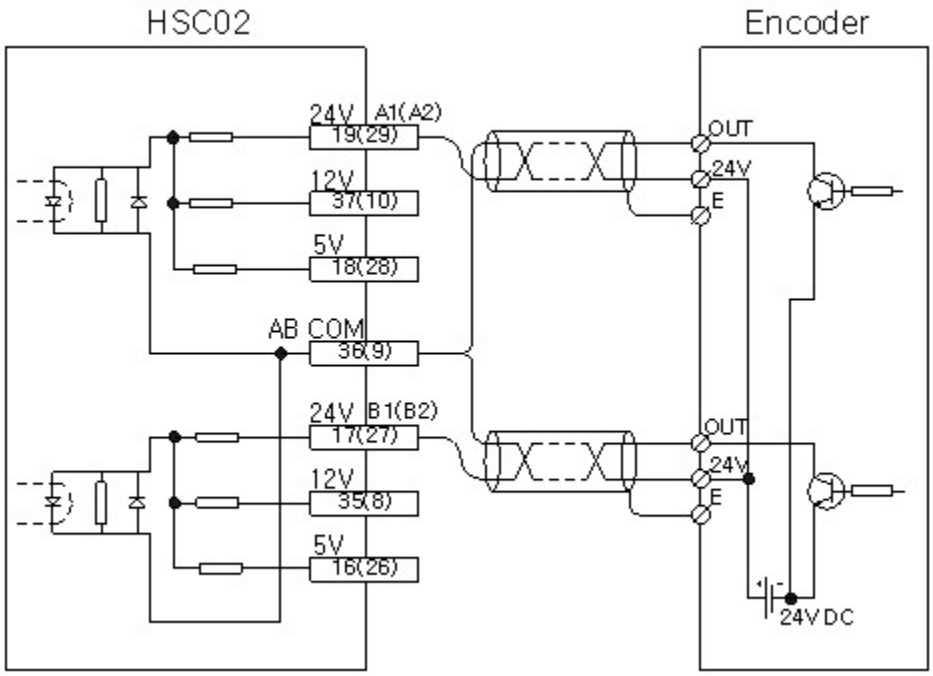
1. Use twist pair shield wires and ground in Degree 3.
2. Wire separately from power cable and I/O cables that cause noise.
3. Use stable power source as the power source for filter.
4. In case of 1-phase input, connect only Phase A. In case of 2-phase input, connect Phase A and B.

6.9.3.5 Examples of Wiring

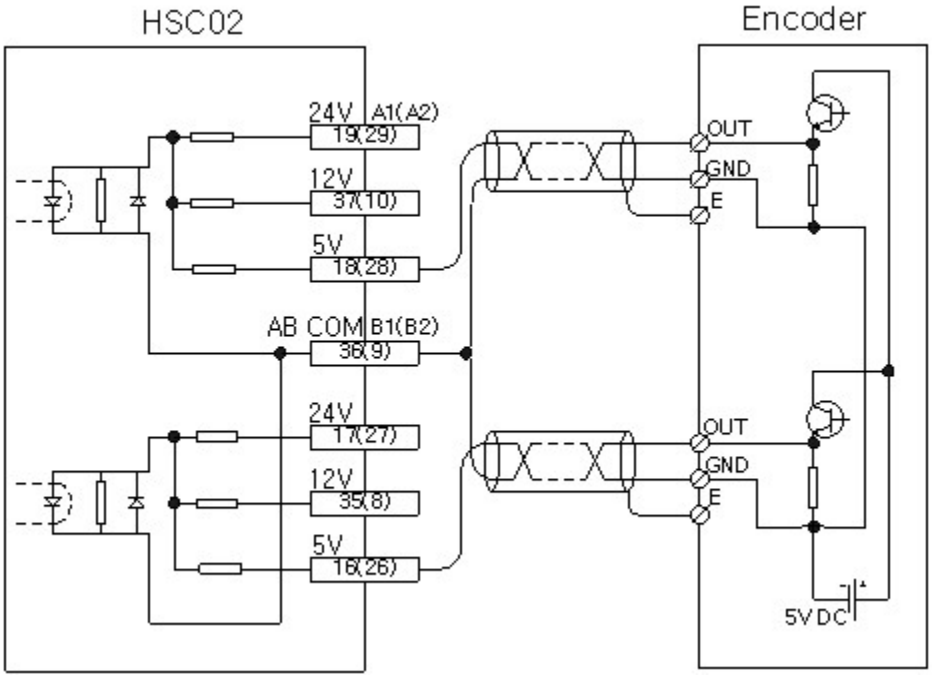
Examples of wiring :

- In case that an encoder is open collector output type
- In case that an encoder is voltage output type
- In case the signal for outer presetting and the one for starting function are inputted.
- Coincidence Output
- Line Driver

In case that an encoder is open collector output type

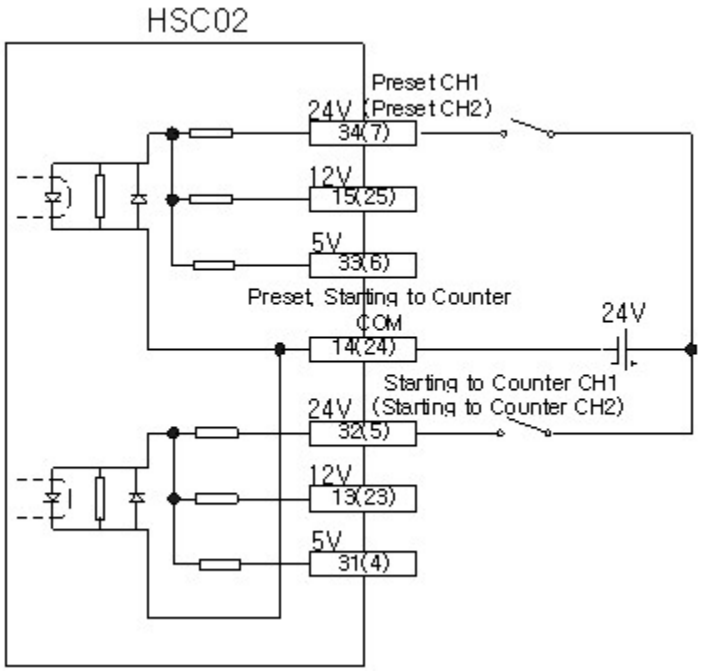


In case that an encoder is voltage output type

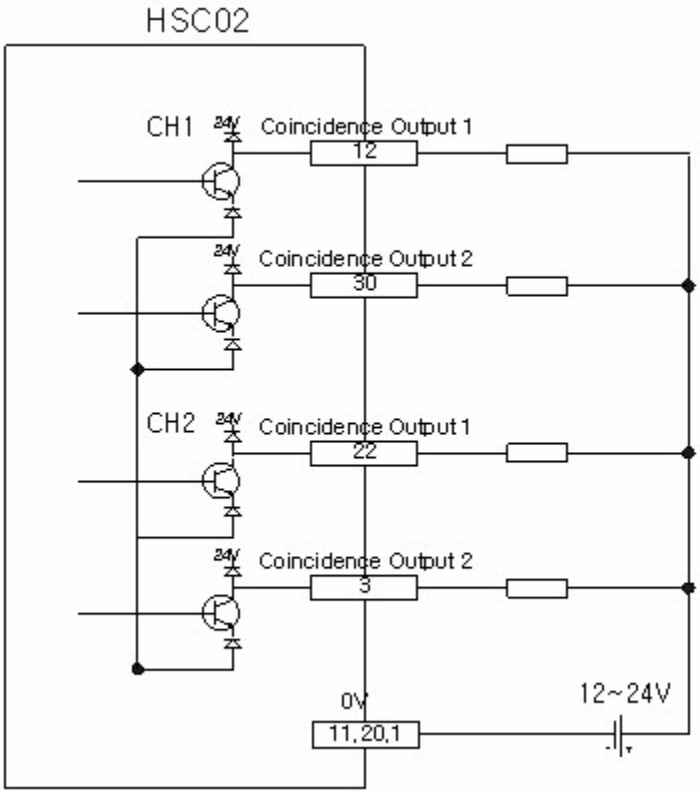


In case the signal for outer presetting and the one for starting function are

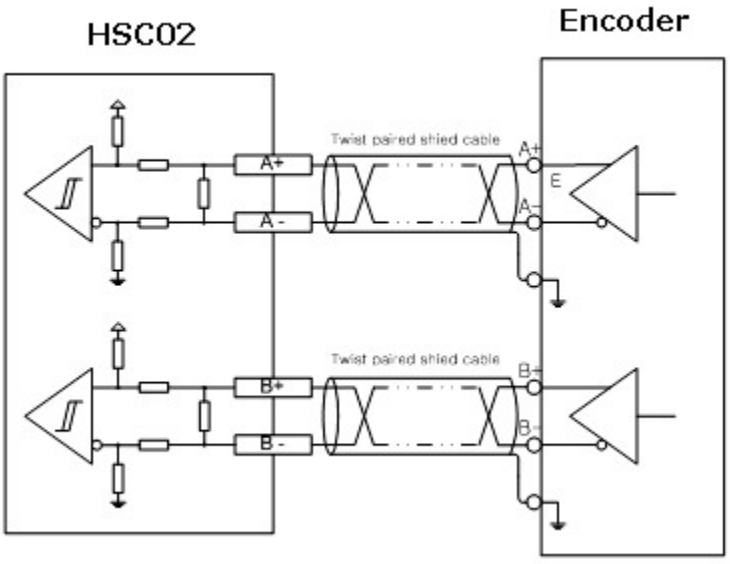
inputted



Coincidence Output



Line Driver



6.9.4 Internal I/O

Signal Direction (CPU ?HSC Module)			Signal Direction (CPU ?HSC Module)		
Input	Signal Name		Output	Signal Name	
X00	CH1	DPRAM ACK Signal	Y00	CH1	Requesting to Reset Coincidence Signal 1
X01		Counted Value Greater 1	Y01		Requesting to Preset
X02		Counted Value Coincident 1	Y02		Enabling Coincidence Output
X03		Counted Value Less 1	Y03		DRRAM REQUEST
X04		Detecting Request for Outer Presetting	Y04		Enabling to Count
X05		Counted Value Greater 2	Y05		Requesting to Reset Detecting Outer Presetting
X06		Counted Value Coincident 2	Y06		Requesting to Start to Count
X07		Counted Value Less 2	Y07		Requesting to Reset Coincidence Signal 2
X08	CH2	Counted Value Greater 1	Y08	CH2	Requesting to Reset Coincidence Signal 1
X09		Counted Value Coincident 1	Y09		Requesting to Preset
X0A		Counted Value Less 1	Y0A		Enabling Coincidence Output
X0B		Detecting Request for Outer Presetting	Y0B		DRRAM REQUEST
X0C		Counted Value Greater 2	Y0C		Enabling to Count
X0D		Counted Value Coincident 2	Y0D		Requesting to Reset Detecting Outer Presetting
X0E		Counted Value Less 2	Y0E		Requesting to Start to Count
X0F		DPRAM ACK Signal	Y0F		Requesting to Reset Coincidence Signal 2

Click Input Signals Output Signals

6.9.4.1 Input Signals

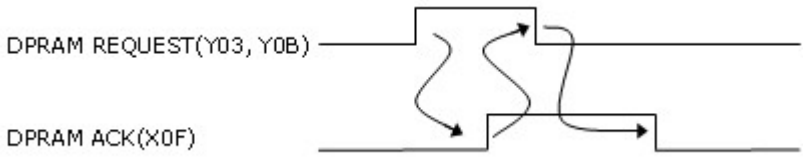
Channel		HSC -> CPU	Description
CH1	CH2		
X01	X08	Counted Value Greater 1	(If "Current Value"(CH1:0H,1H CH2:20H,21H) > "Set Coincidence Comparison Value 1"(CH1:12H,13H CH2:32H,33H), these are on.
X02	X09	Counted Value Coincident 1	(If "Current Value"(CH1:0H,1H CH2:20H,21H) ="Set Coincidence Comparison Value 1"(CH1:12H,13H CH2:32H,33H), these are set. (If " Requesting to Reset Coincidence Signal 1"(Y00(Y08)) is on, these are reset.
X03	X0A	Counted Value Less 1	("Current Value ""(CH1:0H,1H CH2:20H,21H) < "Set Coincidence Comparison Value 1"(CH1:12H,13H CH2:32H,33H), these are set.
X04	X0B	Detecting Request for Outer Presetting	(When the signal to preset is detected from the outer input terminal, these are set and latched. (If "Requesting to Reset Detecting Outer Presetting"(Y05(Y0D)) is on, these are reset.
X05	X0C	Counted Value Greater 2	("Current Value"(CH1:0H,1H CH2:20H,21H) > "Set Coincidence Comparison Value 2"(CH1:14H,15H CH2:34H,35H), these are set.
X06	X0D	Counted Value Coincident 2	("Current Value"(CH1:0H,1H CH2:20H,21H) = "Set Coincidence Comparison Value 2"(CH1:14H,15H CH2:34H,35H), these are set.

			(If " Requesting to Reset Coincidence Signal 2" (Y07(Y0F)) is on, these are reset.
X07	X0E	Counted Value Less 2	("Current Value"(CH1:0H,1H CH2:20H,21H) < "Set Coincidence Comparison Value 2"(CH1:14H,15H CH2:34H,35H), these are set.
X00	X0F	DPRAM ACK	(Response to DPRAM REQUEST When the contents of DPRAM are set up to the module, these are set.

6.9.4.2 Output Signals

Channel		HSC <- CPU	Operation Timing	Description
CH 1	CH 2			
Y00	Y08	Requesting to Reset Coincidence Signal 1	⊓	These are turned on to reset "Counted Value Coincident 1" (X02(X09)).
Y01	Y09	Requesting to Preset	↑⊓	These are turned on to preset.
Y02	Y0A	Enabling Coincidence Output	⊓	These are turned on to enable to output "Counted Value Coincident"(X02/X09 X06/X0D) to an outer terminal.
Y03	Y0B	DRRAM REQUEST	↑⊓	These are turned on to make the contents of DPRAM available.
Y04	Y0C	Enabling to Count	⊓	These are turned on to enable to count.
Y05	Y0D	Requesting to Reset Detecting Outer Presetting	⊓	These are turned on to reset "Detecting Request for Outer Presetting (X04(X0B))".
Y06	Y0E	Requesting to Start to Count	↑⊓	These are turned on to start the latch or the sampling counting function.
			⊓	These are turned on to start the disabling to count or the periodic pulse counting.
Y07	Y0F	Requesting to Reset Coincidence Signal 2	⊓	These are turned on to reset "Counted Value Coincident 2"(X06(X0D)).

** Timing of DPRAM REQUEST(Y03, Y0B) and DPRAM ACK(X0F) to make DPRAM setup available.



6.9.5 Shared Memory

Address	Set Value	Initial	R/W

CH1						Value	
Hexa	Deci	Hexa	Deci				
0H	0	20H	32	Currently Counted Value(Signed 32-bit)	L	0	R
1H	1	21H	33		H		
2H	2	22H	34	Flag Indicating Overflow Detected (If overflow in Linear Counting, 1)		0	R
3H	3	23H	35	Flag Indicating Sampling-counted or Periodic-pulse-counted		0	R
4H	4	24H	36	Latch-counted Value	L	0	R
5H	5	25H	37		H		
6H	6	26H	38	Sampling-counted Value	L	0	R
7H	7	27H	39		H		
8H	8	28H	40	Previous Periodic-pulse-counted Value	L	0	R
9H	9	29H	41		H		
AH	10	2AH	42	Current Periodic-pulse-counted Value	L	0	R
BH	11	2BH	43		H		
CH	12	2CH	44	Not Use		-	-
DH	13	2DH	45				
EH	14	2EH	46				
FH	15	2FH	47				
10H	16	30H	48	Preset Value(Signed 32-bit)	L	0	R/W
11H	17	31H	49		H		
12H	18	32H	50	Set Coincidence Comparison Value 1(Signed 32-bit)	L	0	R/W
13H	19	33H	51		H		
14H	20	34H	52	Set Coincidence Comparison Value 2(Signed 32-bit)	L	0	R/W
15H	21	35H	53		H		
16 H	22	36H	54	Set Lowest Limit Value of Ring Counting(Signed 32-bit)	L	0	R/W
17 H	23	37H	55		H		
18 H	24	38H	56	Set Upper Limit Value of Ring Counting(Signed 32-bit)	L	0	R/W
19 H	25	39H	57		H		
1A H	26	3AH	58	Counting Function Setup (0:Disable 1:Latch 2:Sampling 3:Periodic Pulse)		0	R/W
1B H	27	3BH	59	Sampling / Periodic Time		0	R/W
1C H	28	3CH	60	Counting Mode(0:Linear 1:Ring)		0	R/W
1D H	29	3DH	61	Pulse Input Method (0:1-phase 1-multiple(H/W Input to Phase B) 1:1-phase 1-multiple(S/W Input to Phase B) 2:2-phase 2-multiple(H/W Input to Phase B) 3:2-phase 2-multiple(S/W Input to Phase B) 4:CW/CCW 5:2-phase 1-multiple 6:2-phase 2-multiple 7:2-phase 4-multiple)		7	R/W
1E H	30	3EH	62	Counting down by software		0	R/W
1F H	31	3FH	63	Not Use		-	-

6.9.5.1 Currently-counted Value (Signed 32-bit)

Buffer Memory (ch1: 00H, 01H / ch2: 20H, 21H)

- This is used to store currently counted values.
- The range is from -2147483648 to 2147483637(Signed 32-bit).

6.9.5.2 Flag Indicating Overflow Detected

Buffer Memory (ch1: 02H / ch2: 22H)

- In case of linear counting, this is used to store overflow status.

Status	Buffer Memory Data
No Overflow	0
Overflow Occurs.	1

6.9.5.3 Flag Indicating Sampling-counted or Periodic-Pulse Counted

Buffer Memory (ch1: 03H / ch2:23H)

- When sampling counting or periodic pulse counting is selected, this is used to store the counting status.

Status	Buffer Memory Data
Stop Counting	0
Counting	1

6.9.5.4 Latch-counted Value

Buffer Memory (ch1: 04H, 05H / ch2: 24H, 25H)

- When a HSC module latch-counts, this is used to store the latch-counted value.
- The range is from -2147483648 to 2147483637(Signed 32-bit).

6.9.5.5 Sampling-counted Value

Buffer Memory (ch1: 06H, 07H / ch2: 26H, 27H)

- When a HSC module sampling-counts, this is used to store the sampling-counted value.
- The range is from -2147483648 to 2147483637(Signed 32-bit).

6.9.5.6 Previous and Current Periodic-pulse-counted Value

Buffer Memory (ch1: 08H~0BH / ch2: 28H~2BH)

- When a HSC module periodic-pulse-counts, this is used to store the previous and the current periodic-pulse-counted value.
- The range is from -2147483648 to 2147483637(Signed 32-bit).

6.9.5.7 Preset Value

Buffer Memory (ch1: 10H, 11H / ch2: 30H, 31H)

- This is used to store the preset value for counting.
- The range is from -2147483648 to 2147483637(Signed 32-bit).
- To make the set value available, DPRAM REQ(Y03,Y0B) of I/O devices are to be on and off.
- As a set value is stored in EEPROM, the HSC module is operated as previously set value even though the power is on and off.

6.9.5.8 Set Coincidence Comparison Value 1 & 2

Buffer Memory (ch1: 12H~15H / ch2: 32H~35H)

- This is used to store a set value, which is compared with the current value for coincidence output.
- Two coincidence output values can be set up by channels.
- The range is from -2147483648 to 2147483637(Signed 32-bit).

- To make a set value available, DPRAM REQ(Y03,Y0B) of the I/O devices are to be on and off.
- As a set value is stored in EEPROM, the HSC module is operated as previously set value even though the power is on and off.

6.9.5.9 Set Lowest Limit Value and Upper Limit Value of Ring Counting

Buffer Memory (ch1: 16H~19H / ch2: 36H~39H)

- In case of ring counting, this is used to select its range.
- The range is from -2147483648 to 2147483637(Signed 32-bit).
- To make a set value available, DPRAM REQ(Y03,Y0B) of the I/O devices are to be on and off.
- As a set value is stored in EEPROM, the HSC module is operated as previously set value even though the power is on and off.

6.9.5.10 Counting Function Setup

Buffer Memory (ch1: 1AH / ch2: 3AH)

- This is used to set up which counting is used.
- To make a set value available, DPRAM REQ(Y03,Y0B) of the I/O devices are to be on and off.
- Refer to Chapter 7 for the details.

Status	Buffer memory Data
Disabling to Count	0
Latch Counting	1
Sampling Counting	2
Periodic Counting	3

- As a set value is stored in EEPROM, the HSC module is operated as a previously set value even though the power is on and off.

6.9.5.11 Sampling / Periodic Time

Buffer Memory (ch1: 1BH / ch2: 3BH)

- When sampling or periodic pulse counting is selected, this is used to store the value for setting up the time used.
- The range is from 0 to 65535 and the unit is 10mS.
- To make a set value available, DPRAM REQ(Y03,Y0B) of the I/O devices are to be on and off.
- As a set value is stored in EEPROM, the HSC module is operated as previously set value even though the power is on and off.

6.9.5.12 Counting Mode

Buffer Memory (ch1: 1CH / ch2: 3CH)

- This is used to set up whether linear counting or ring counting is operated.
- To make a set value available, DPRAM REQ(Y03,Y0B) of the I/O devices are to be on and off.
- Refer to Chapter 6 for the details.

Mode of Counting	Buffer Memory Data
Linear Counting	0
Ring Counting	1

- As a set value is stored in EEPROM, the HSC module is operated as previously set value even though the power is on and off.

6.9.5.13 Pulse Input Method

Buffer Memory (ch1: 1DH / ch2: 3DH)

- This is used to select the method to input the pulses counted.
- To make a set value available, DPRAM REQ(Y03,Y0B) of the I/O devices are to be on and off.
- Refer to Chapter 6 for the details.

Input Method	Operation Mode(Buffer memory Data)
1-phase 1-multiple(Phase B H/W Input)	0
1-phase 1-multiple (Phase B S/W Input)	1

1-phase 2-multiple (Phase B H/W Input)	2
1-phase 2-multiple (Phase B S/W Input)	3
CW/CCW	4
2-phase 1-multiple	5
2-phase 2-multiple	6
2-phase 4-multiple	7

- As a set value is stored in EEPROM, the HSC module is operated as previously set value even though the power is on and off.

6.9.5.14 Subtract Command by software

Buffer Memory (ch1: 1EH / ch2: 3EH)

- If 1 is written to buffer memory when a HSC module is counting in 1-phase input, the module can count down.
- To count down by software, 1(1-phase 1-multiple Phase B software input) or 3(1-phase 2-multiple Phase B software input) is to be inputted to buffer memory for pulse input method (ch1:1DH, ch2:3DH).
- As a set value is stored in EEPROM, the HSC module is operated as previously set value even though the power is on and off.

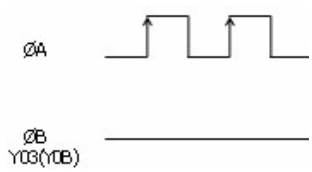
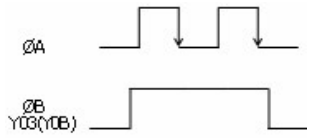
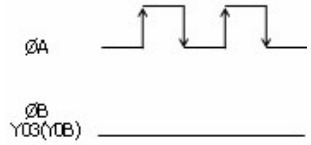
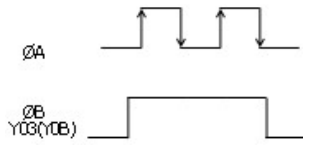
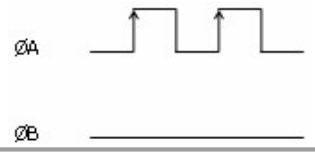
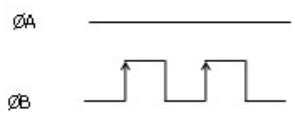
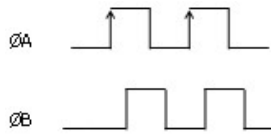
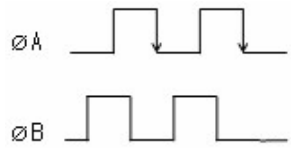
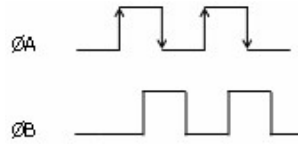
6.9.6 Basic Functions

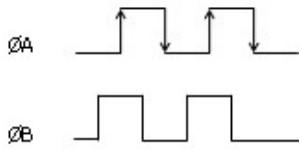
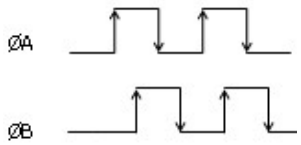
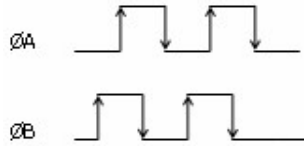
Basic Functions :

- Understanding Pulse Input Method and Counting Method
- Counting Forms
- Coincidence Output
- Presetting

6.9.6.1 Understanding Pulse Input Method and Counting Method

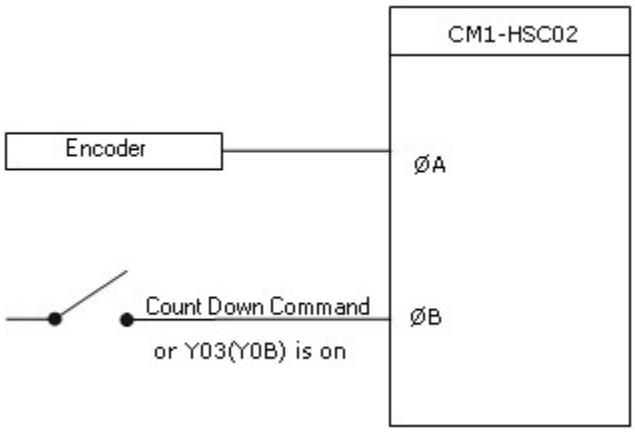
Type of Pulse Input Method ,

Pulse Input Method	Count Timing		
1-phase 1-multiple	Counting		A module counts at the rising edges of ØA. ØB is off.
	Counting Down		A module counts at the falling edges of ØA. ØB is on.
1-phase 2-multiple	Counting		A module counts at the rising and falling edges of ØA. ØB is off.
	Counting Down		A module counts at the rising and falling edges of ØA. ØB is on.
CW/CCW	Counting		A module counts at the rising edges of ØA. ØB is off.
	Counting Down		ØA is off. A module counts at the rising edges of ØB.
2-phase 1-multiple	Counting		When ØB is off, a module counts at the rising edges of ØA.
	Counting Down		When ØB is off, a module counts at the falling edges of ØA.
2-phase 2-multiple	Counting		When ØB is off, a module counts at the rising edges of ØA. When ØB is on, a module counts at the falling edges of ØA.

	Counting Down		When ØB is on, a module counts at the rising edges of ØA. When ØB is off, a module counts at the falling edges of ØA.
2-phase 4-multiple	Counting		When ØB is off, a module counts at the rising edges of ØA. When ØB is on, a module counts at the falling edges of ØA. When ØA is on, a module counts at the rising edges of ØB. When ØA is off, a module counts at the falling edges of ØB.
	Counting Down		When ØB is on, a module counts at the rising edges of ØA. When ØB is off, a module counts at the falling edges of ØA. When ØA is off, a module counts at the rising edges of ØB. When ØA is on, a module counted at the falling edges of ØB.

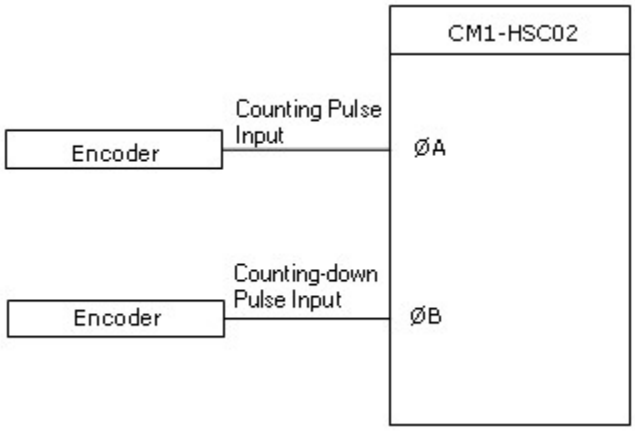
1-phase Pulse Input

1-multiple or 2-multiple can be selected. The relation between Phase A and counting down is as follows.



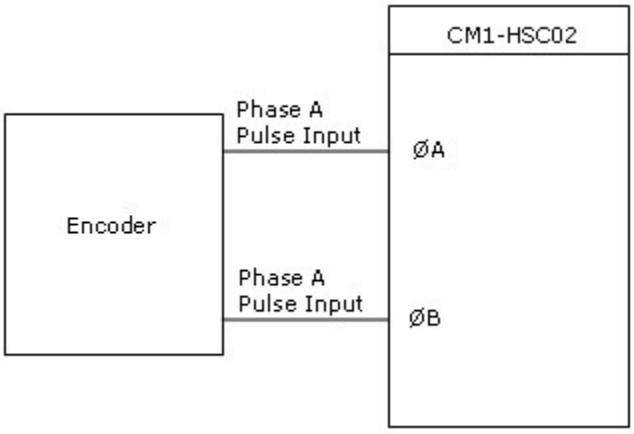
CW/CCW Pulse Input

If there is pulse input in Phase A, the module counts. If there is pulse input in Phase B, the module counts down. The relation between Phase A and Phase B is as follows.



2-phase Pulse Input

1-multiple or 2-multiple or 4-multiple can be selected. It is decided whether the module counter or counts down by the difference between Phase A and Phase B. The relation between Phase A and Phase B is follows.

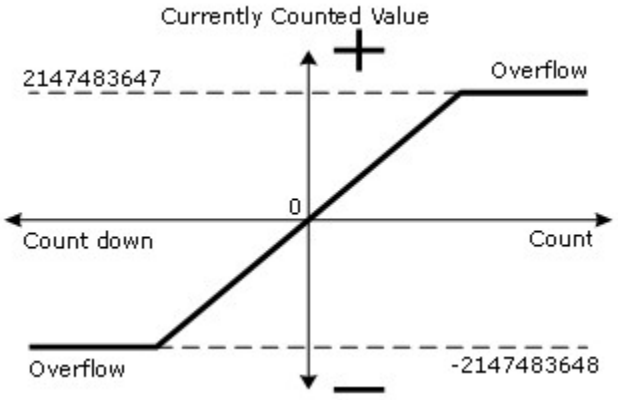


6.9.6.2 Counting Forms

Linear Counting

Linear Counting

- If linear counting is selected, input pulses are counted in the range from –2147483648 to 2147483647.
- This is used in the combination of presetting function and coincidence output function.



Overflow Error

- This occurs when the value is linear-counted down over –2147483648 or linear-counted over 2147483647.
- If overflow occurs, the devices for detecting overflow in buffer memory (ch1:02H,ch2:22H) will be set and the counting is stopped. Even though pulse inputs come continuously, the counted value is fixed as –2147483648 or 2147483647.
- If the value is preset, overflow error will be cleared and the device for detecting overflow in buffer memory will be 0.

Point

When values are linear-counted and ring-counted

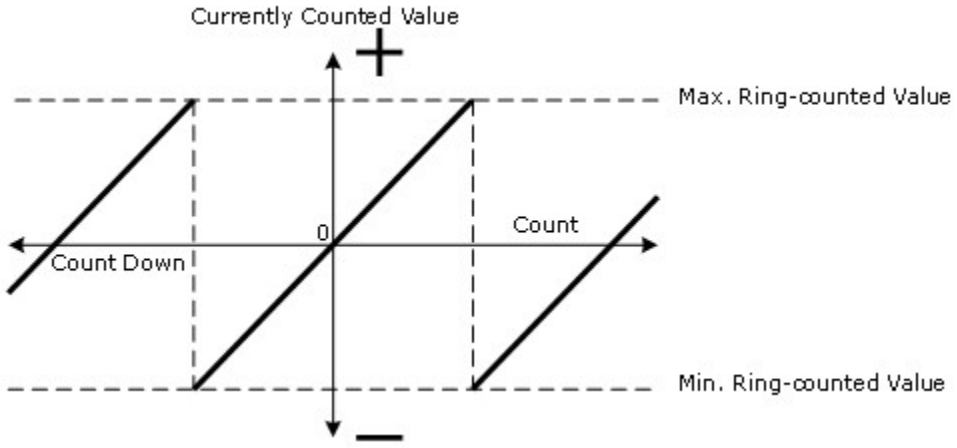
In case that a currently counted value is greater than the maximum ring-counted value, it is to be preset as the value less than or equal to the maximum ring-counted value to ring-count when being linear-counted, and it is to be preset as the value greater than or equal to the minimum ring-counted value to ring-count when being linear-counted down.

If the value is not preset, it will be linear-counted. (The case that Max. ring-counted value > Min. ring-counted value)

Ring Counting

Ring Counting

If ring counting is selected, input pulses are counted repeatedly between the minimum ring-counted value(ch1:16H,17H ch2:36H,37H) and the maximum ring-counted value(ch1:18H,19H ch2:38H,39H). The overflow for ring counting does not occur. Ring counting is used in the combination of presetting and coincidence output function.



Range of Ring Counting

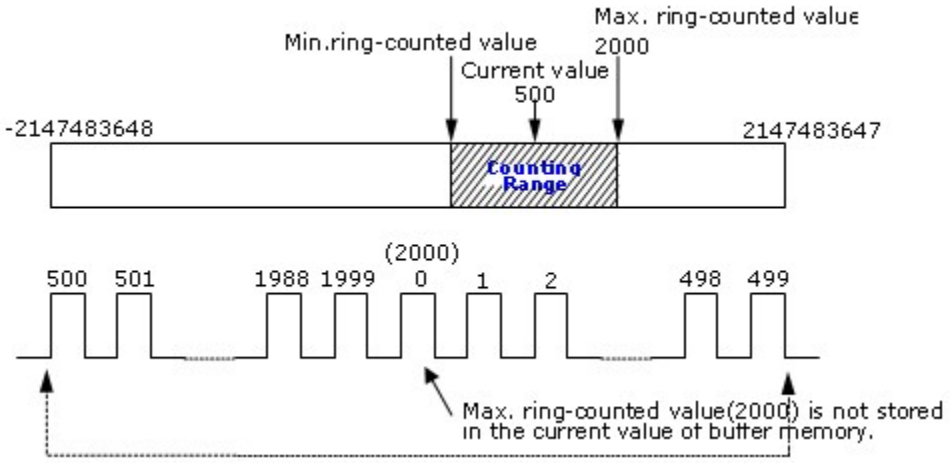
The range of ring-counted pulses is from the minimum value(ch1:16H,17H ch2:36H,37H) to maximum value(ch2:18H,19H ch2:38H,39H).

1) Min. ring-counted Value <= Current Value <= Max. ring-counted Value

Counting In the case that a current value reaches the maximum ring-counted value, the minimum ring-counted value is automatically stored in the current value.

Counting down In the case that a current value reaches the min. ring-counted value, when the next counting-down pulse comes, the value "Max. ring-counted value – 1" is stored in the current value.

While input pulses are being counted or counted down, the maximum ring-counted value is not stored in the currently counted value of buffer memory.

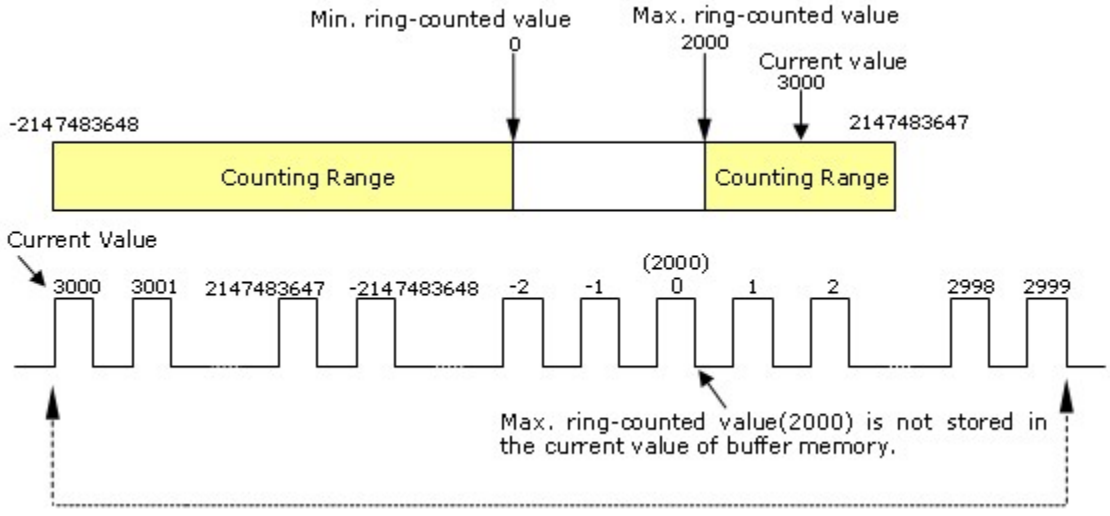


2) Current Value <= Min. ring-counted Value or Current Value >= Max. ring-counted Value

Counting In the case that a current value reaches the minimum ring-counted value, when next counting pulse comes, the value "Max. ring-counted value + 1" is stored in the current value.

Counting down In the case that a current value reaches the maximum ring-counted value, the minimum ring-counted value is automatically stored in the current value.

While input pulses are being counted or counted down, the maximum ring-counted value is not stored in the currently counted value of buffer memory.



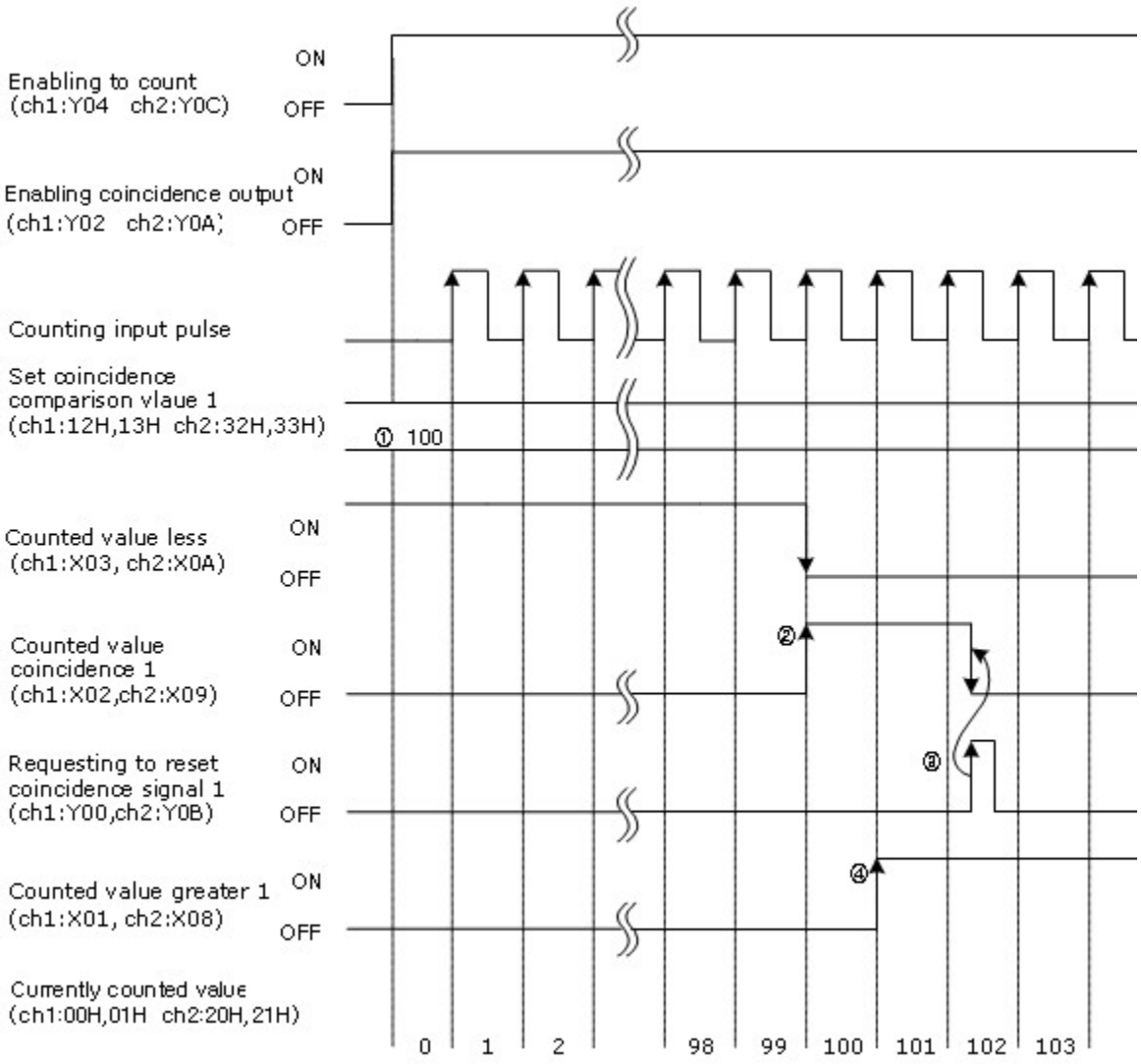
3) The maximum ring-counted value equals to the minimum ring-counted value

Any value in signed 32-bit binary can be ring-counted regardless of current value.

6.9.6.3 Coincidence Output

This is used to output coincidence signal when a currently counted value is compared, being coincided with a set value. The coincidence output can be set up for 2 points each channel.

To output coincidence signal, enabling coincidence output (Y02(Y0A)) is to be on.



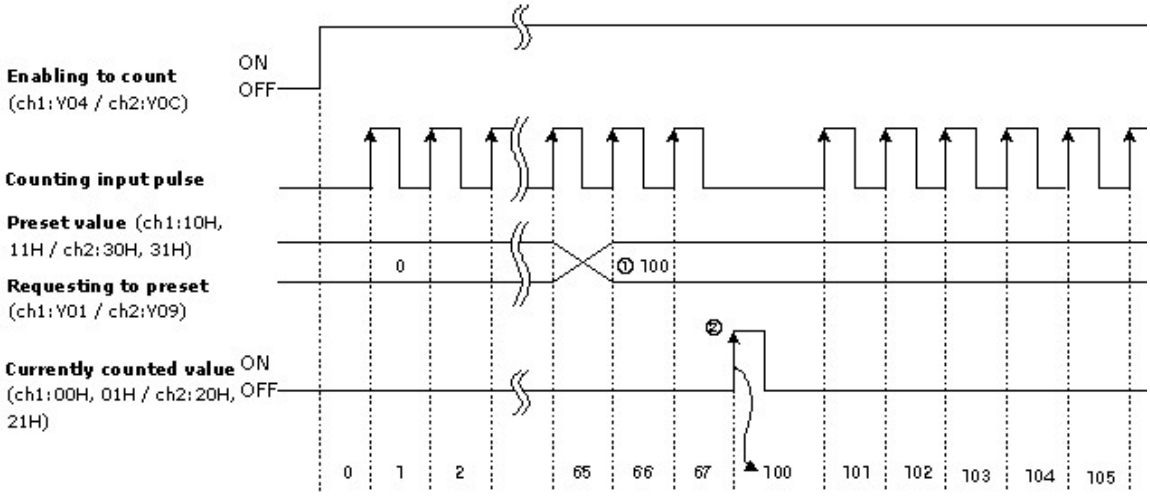
No.	Description
1	The set coincidence output value is stored in the set coincidence comparison value 1(ch1: 12H,13H,ch2:32H,33H) in signed 32-bit binary.
2	When the currently counted value equals to the set coincidence output value, the counted value less is off and the counted value coincident is on.
3	If the requesting to reset coincidence signal is on, the counted value coincident is reset. If the counted value coincident is kept on, the next coincidence signal is not output.
4	If the counted value is greater than the set coincidence output value, the counted value greater is on.

6.9.6.4 Presetting

Presetting is used to write a currently counted value in an integer value as preset value.
There are two presetting methods, which are sequence program and outer control signal.

Presetting by Sequence Program ,

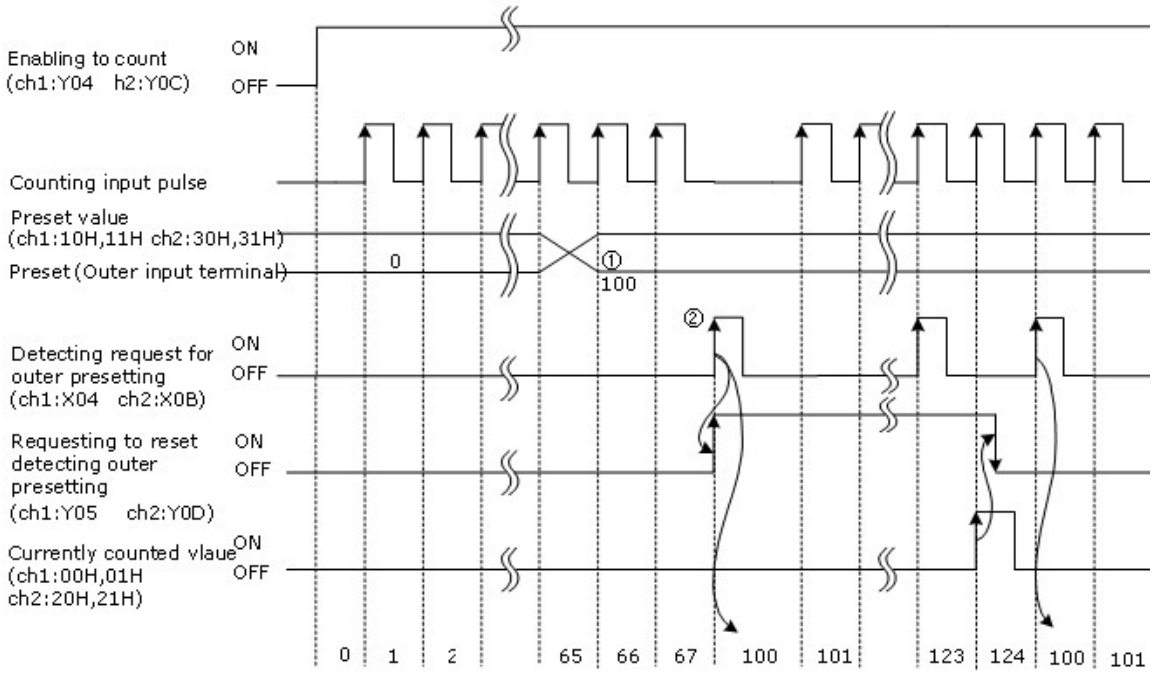
If Y01(Y09) is on by sequence program, a currently counted value is preset.



No	Description
1	The number is stored in the preset value(ch1:10H,11H, ch2:31H,32H) of the buffer memory in signed 32-bit binary.
2	At the rising edge of the requesting to preset(From off to on), the currently counted value of the buffer memory is set up as the preset value of the buffer memory. The value is preset irrelevantly to the enabling to count(Y04(Y0C)).

Presetting by outer control signal ,

If a voltage is inputted to a presetting input terminal, a currently counted value is preset.



No	Description
1	A number is stored in the preset value (ch1:10H,11H, ch2:31H,32H) of buffer memory in signed 32-bit binary.
2	At the rising edge of the voltage inputted to an outer input terminal(From off to on), the currently counted value of buffer memory is set up as the preset value of buffer memory. The value is preset irrelevantly to the enabling to count(Y04(Y0C)).

Point

- If "flag detecting request for outer presetting(X04(X0b))" is on, even the voltage is inputted to an outer preset terminal or "requesting to preset(Y01(Y09))" is set, a currently counted value is not preset. In this case, to preset, "requesting to reset detecting outer presetting(Y05(Y0d))" is to be set and flag detecting request for outer presetting is to be off.

- Even though outer presetting input is set while requesting to reset detecting outer

presetting(Y05(Y0d)), a value is not preset.

6.9.7 Counting Functions

Disabling to count, sampling counting, latch counting and periodic pulse counting are can be used.

If the following data are written in buffer memory(ch1:1AH ch2:3AH) and starting to count is given (Y06(Y0E) is on by an outer input or a user program), one among the four counting functions can be used.

Counting Function	Set Value	Note
Disabling to Count	0	In case that start to count is on while enabling to count(Y04(Y0c)) is turning on, counting is stopped.
Latch Counting	1	A currently counted value is stored for a certain time.
Sampling Counting	2	The pulses inputted during a set time are counted.
Periodic Pulse Counting	3	A currently and a previously counted value are stored for set periodic time.

Point

Counting functions can be changed while starting to count is off.

If the value in the range from 1 to 65535 is inputted to buffer memory(ch1:1B , ch2:3B), set sampling/periodic time can be changed.
The unit is 10ms. If 10 are inputted, it will be 10*10ms = 100ms.

List :

- Reading the Counted value for Counting Functions
- Disabling to Count
- Latch Counting
- Sampling Counting
- Periodic Pulse Counting

6.9.7.1 Reading the Counted value for Counting Functions

When a selected counting function is operated, the counted value for the function is stored in the following buffer memory.

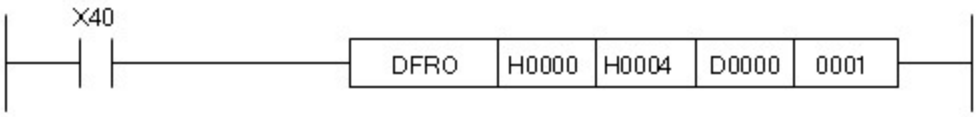
	Current Value	Counted Value			
		Latch-counted Value	Sampling-counted Value	Previous Periodic-pulse-counted Value	Current Periodic-pulse-counted Value
CH1	0H, 1H	04H, 05H	06H, 07H	08H, 09H	0AH, 0BH
CH2	20H, 21H	24H, 25H	26H, 27H	28H, 29H	2AH, 2BH

A currently counted value is stored in buffer memory in signed 32-bit value. The value is automatically revised according to counting form.

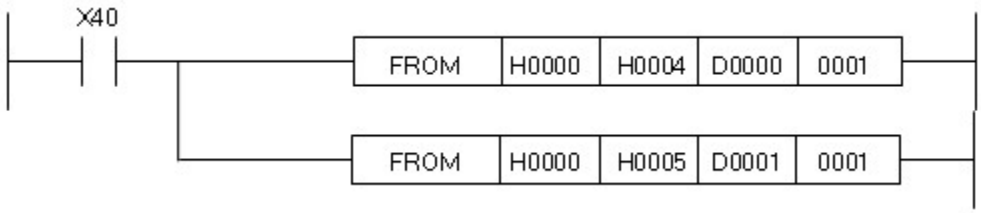
Point

The counted value in buffer memory is to be read in two words by DFRO command. If the value is read one word by one word while it is being revised, the value of the upper word and the lower word may be wrong.

Ex 1. Right

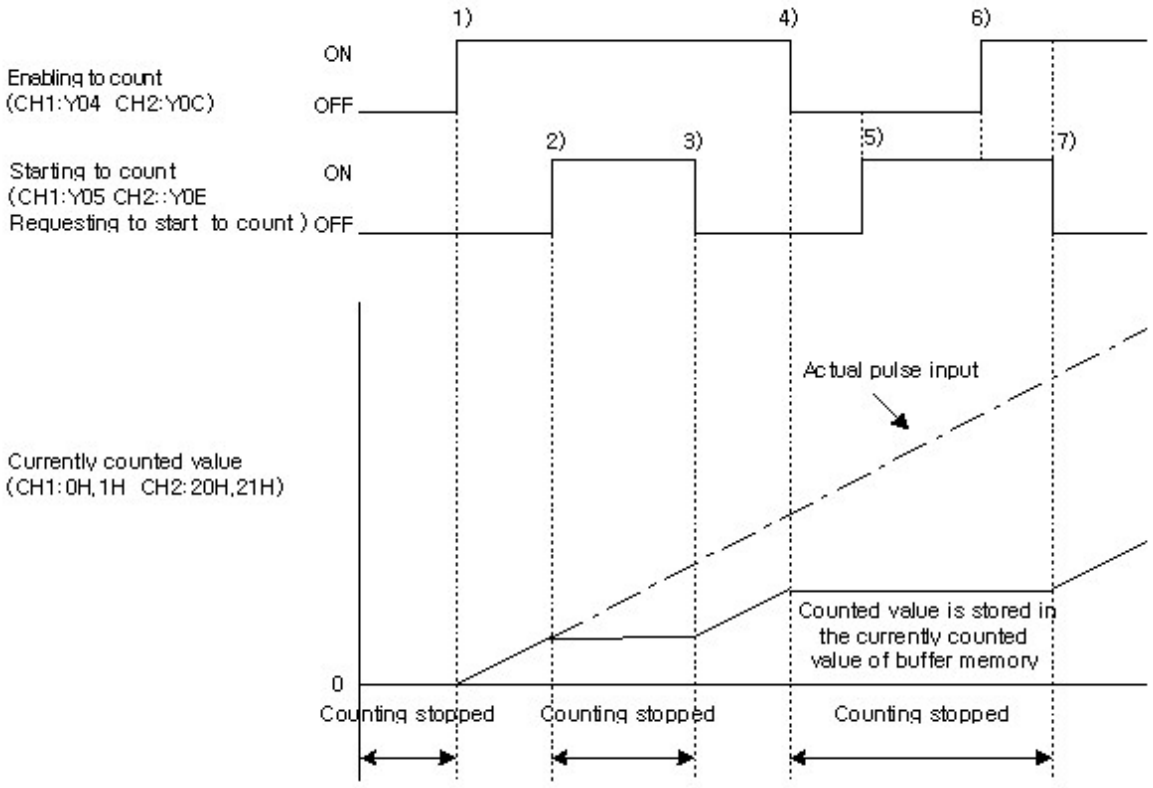


Ex 2. Wrong



6.9.7.2 Disabling to Count

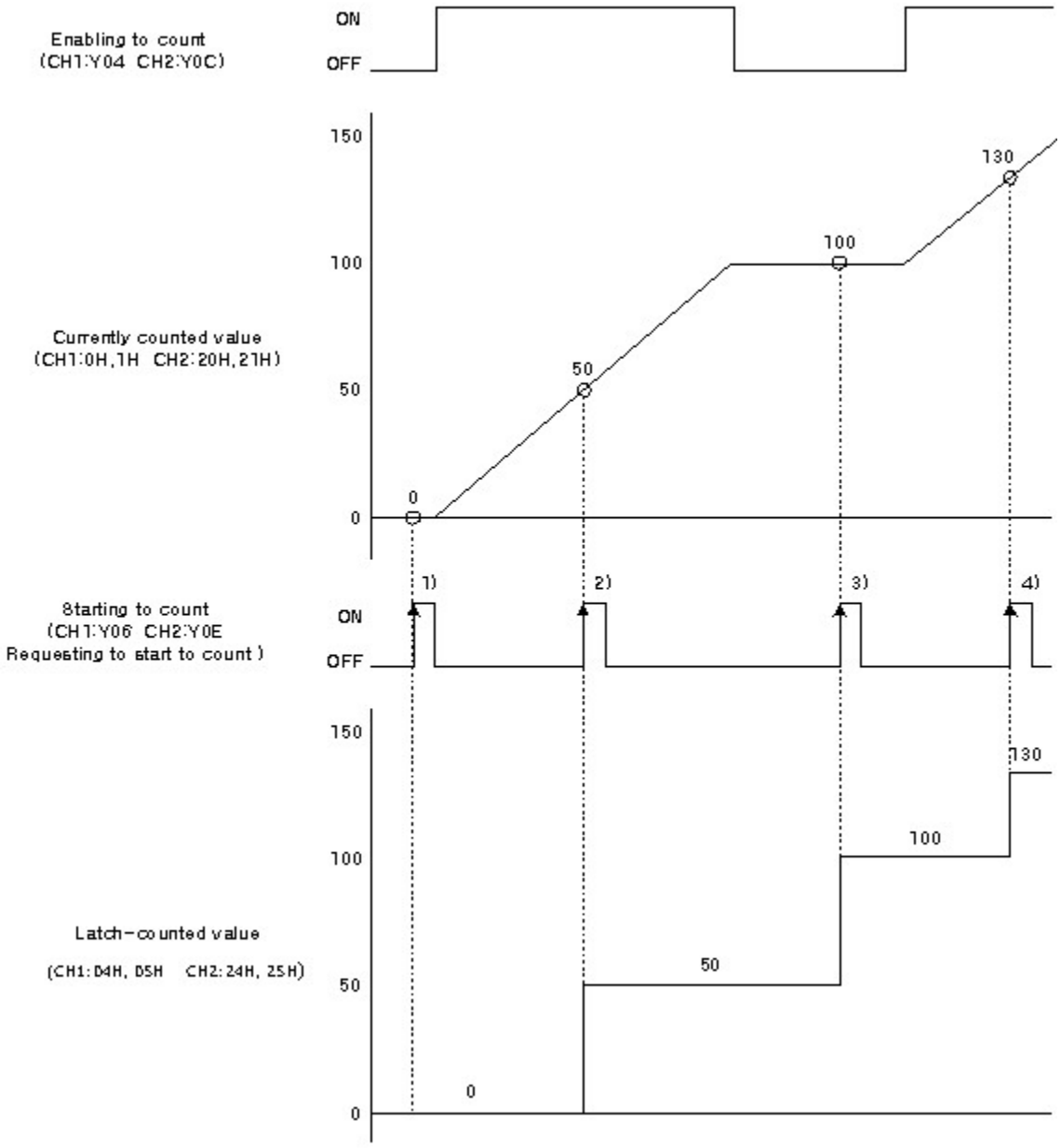
Disabling to count is used to stop counting when enabling to count is on.



No	Description
1	Input pulses are counted by enabling to count(Y04(Y0C))".
2	Input pulses are not counted if starting to count(Y06(Y0E)) or input terminal to start to count is on.
3	If starting to count is off, input pulses will be counted again.
4	If enabling to count is off, input pulses will be not counted.
5	If enabling to count is off, input pulses will not be counted irrelevantly to starting to count.
6	As starting to count is on, even though enabling to count is on, input pulses are not counted.
7	If starting to count is off, input pulses will be counted again.

6.9.7.3 Latch Counting

If starting to count is on, a currently counted value is stored at rising edges.

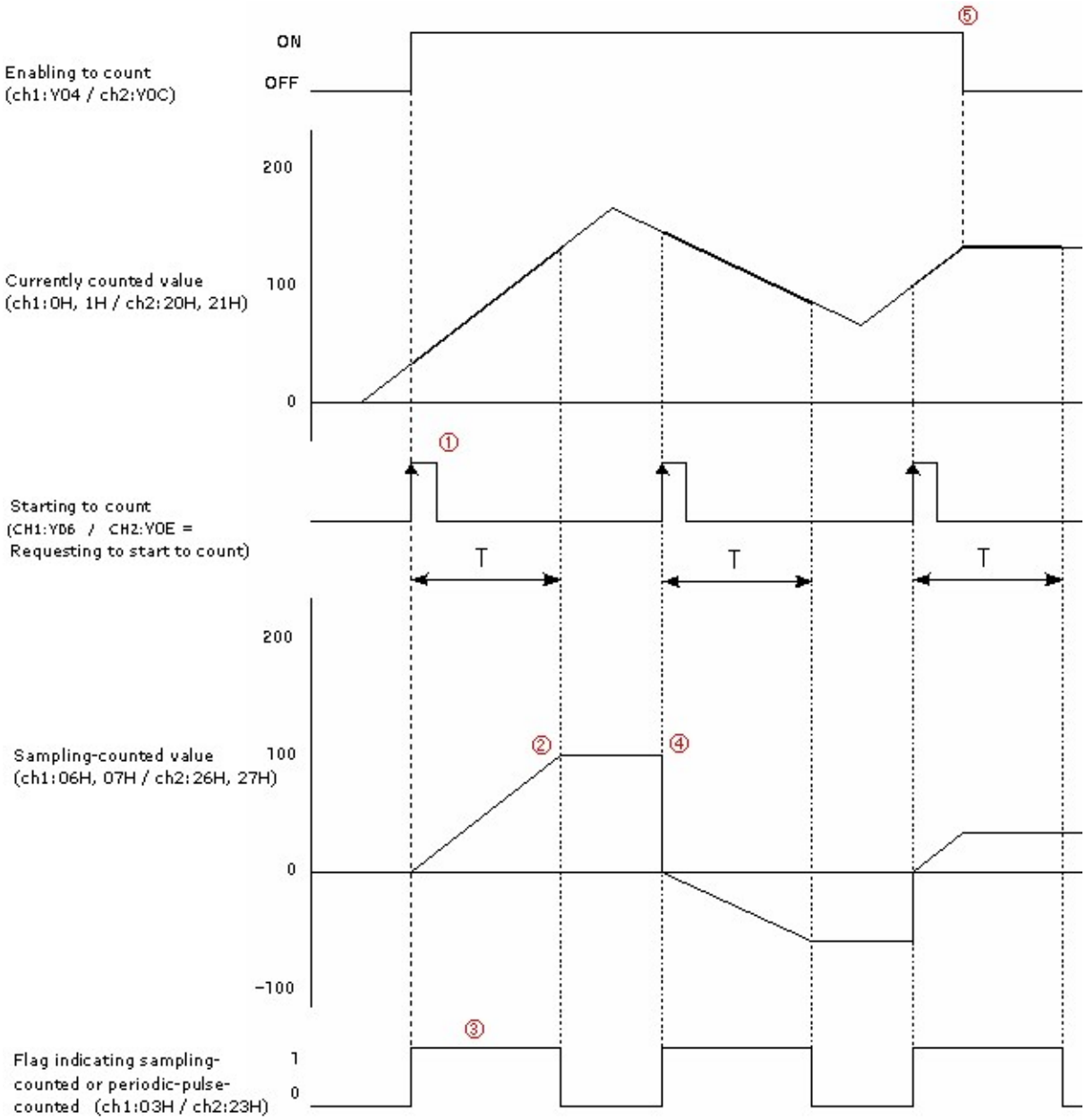


Input pulses are latch-counted at the rising edge of starting to count.

Pulses are latch-counted irrelevantly to enabling to count(Y04(Y0C)).

6.9.7.4 Sampling Counting

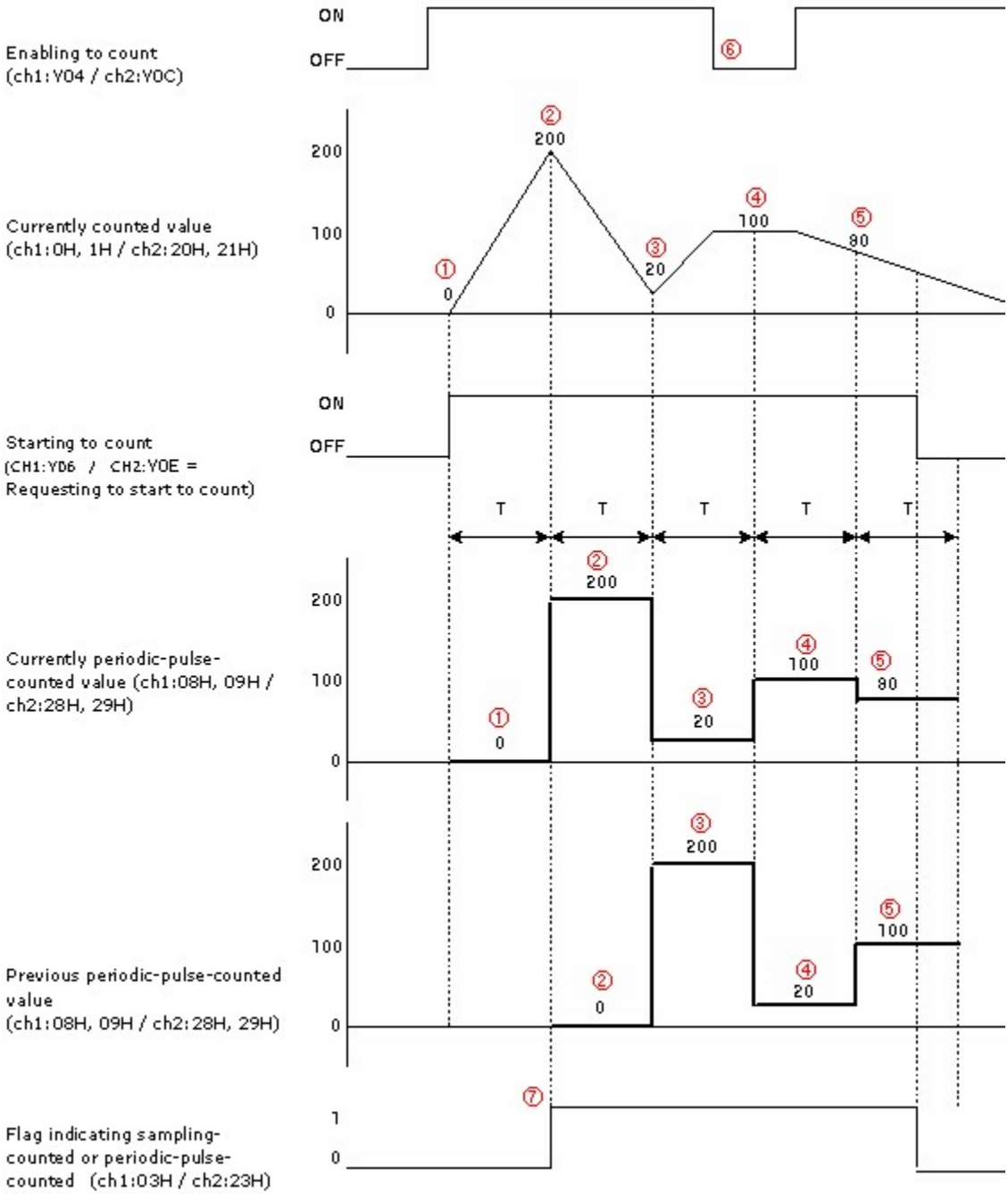
Input pulses are counted for set periodic time.



No	Description
1	At the rising edges when starting to count(Y06(Y0E)) or input terminal to count is on, the numbers of pulses are counted from
2	If set periodic time is passed, pulses are not counted.
3	When input pulses are sampling-counted, 1 is stored in flag Indicating Sampling-counted or Periodic-pulse-counted(ch1:03H ch2:23H).
4	After input pulses are sampling-counted, the value is stored in buffer memory.
5	Input pulses are sampling-counted irrelevantly to enabling to count(Y04(Y0C)).

6.9.7.5 Periodic Pulse Counting

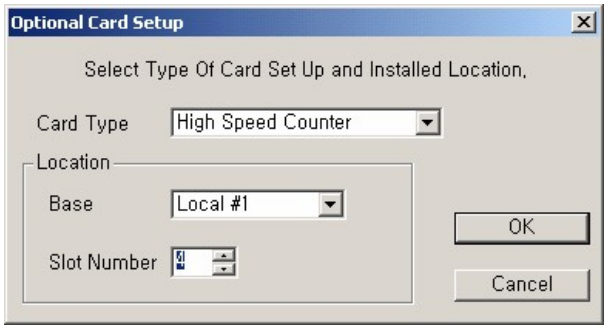
A current value and a previous value are stored at set periodic times.



No	Description
1	A currently counted value(0) is stored in a current periodic-pulse-counted value (ch1:0AH,0BH ch2:2AH,2BH) of buffer memory.
2	A currently counted value(200) is stored in the current periodic-pulse-counted value of buffer memory. The "0" stored in the current periodic-pulse-counted value of buffer memory is stored in the previous periodic-pulse-counted value(ch1:08H,09H ch2:28H,29H) of buffer memory.
3	A currently counted value(20) is stored in the current periodic-pulse-counted value of buffer memory. The "200" stored in the current periodic-pulse-counted value of buffer memory is stored in the previous periodic-pulse-counted value of buffer memory.
4	A currently counted value(100) is stored in the current periodic-pulse-counted value of buffer memory. The "20" stored in the current periodic-pulse-counted value of buffer memory is stored in the previous periodic-pulse-counted value of buffer memory.
5	A currently counted value(80) is stored in the current periodic-pulse-counted value of buffer memory. The "100" stored in the current periodic-pulse-counted value of buffer memory is stored in the previous periodic-pulse-counted value of buffer memory.
6	Input pulses are periodic-pulse-counted irrelevantly to enabling to count(Y04(Y0C)).
7	When input pulses are periodic-pulse-counted, "1" is stored in flag Indicating Sampling-counted or Periodic-pulse-counted(ch1:03H ch2:23H).

6.9.8 CICON - Setting up HSC Card

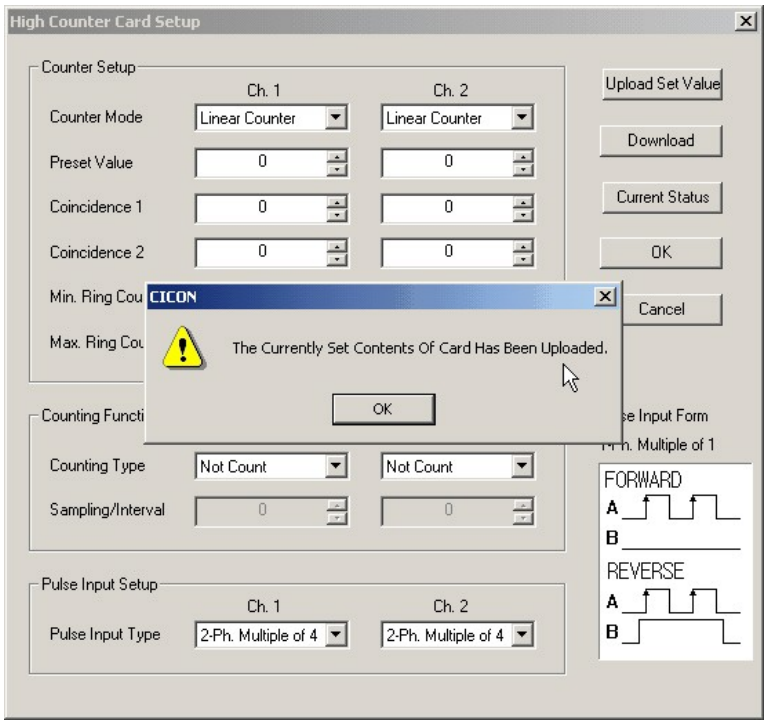
If you select the Optional Card Setup in the Tools, an optional card setup dialog box will appear as follows.

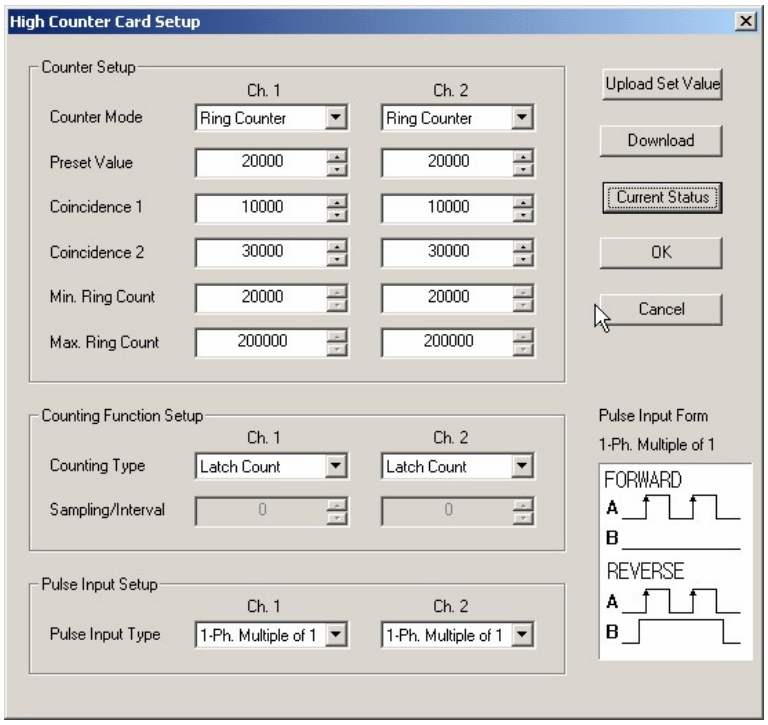


Click :

6.9.8.1 Set up HSC

If you select the HSC in the above dialog box, the mounted slot and the OK, a HSC setup dialog box will appear and the values currently set up to a HSC card will be automatically uploaded.





Counting Setup

- **Counting Mode :** This is used to select ring counting or linear counting.
- **Preset Value :** This is used to set up a preset value.
- **Coincidence Comparison Value 1, 2 :** This is used to set up Coincidence Comparison Value 1 & 2.
- **Min. ring-counted value :** This is used to set up the minimum value when ring counting is used.
- **Max. ring-counted value :** This is used to set up the maximum value when ring counting is used.

Counting Function Setup

- **Counting Type :** Disabling to count, latch counting, sampling counting, periodic pulse counting

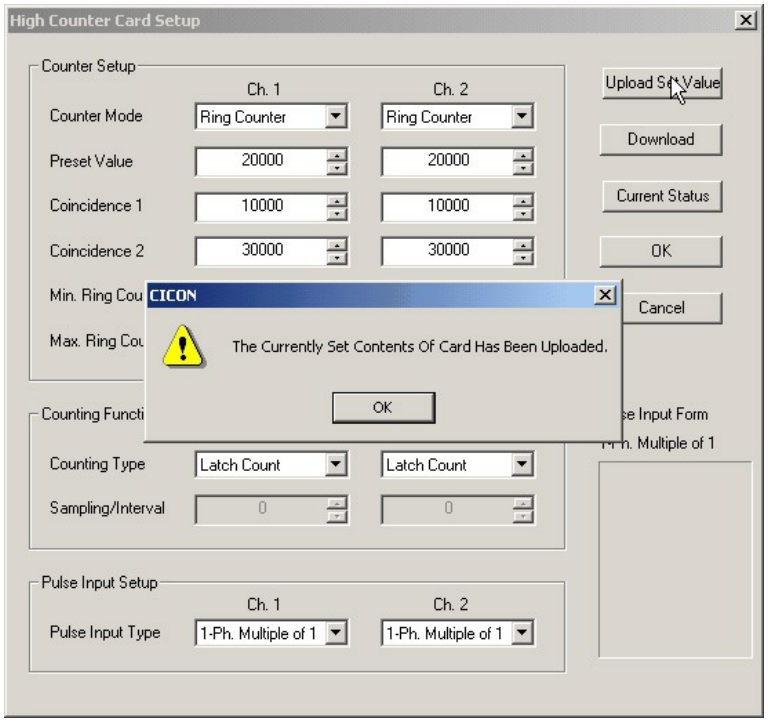
- **Sampling/Interval(ms) :** This is used to set up the time and the interval of sampling when sampling counting or periodic pulse counting is used.

Pulse Input Setup

- **Pulse Input Type :** 1-ph 1-multiple, 1-ph 2-multiple, CW/CCW, 2-ph 1-multiple, 2-ph 2-multiple, 2-ph 4-multiple

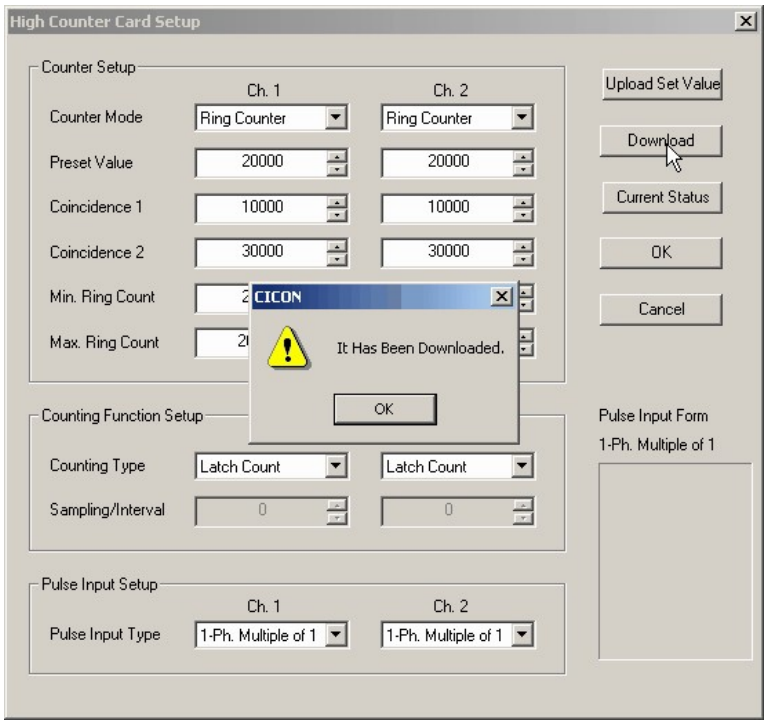
6.9.8.2 Upload

If you press the upload button, the values currently set up to a HSC will be uploaded.



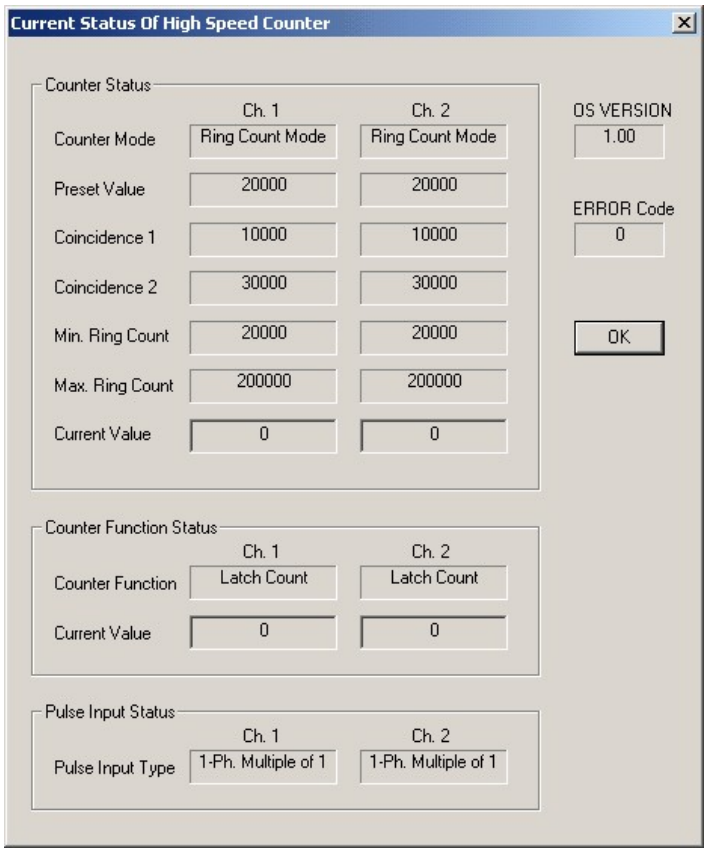
6.9.8.3 Download

If you press the download button, the currently set values will be downloaded to a HSC.



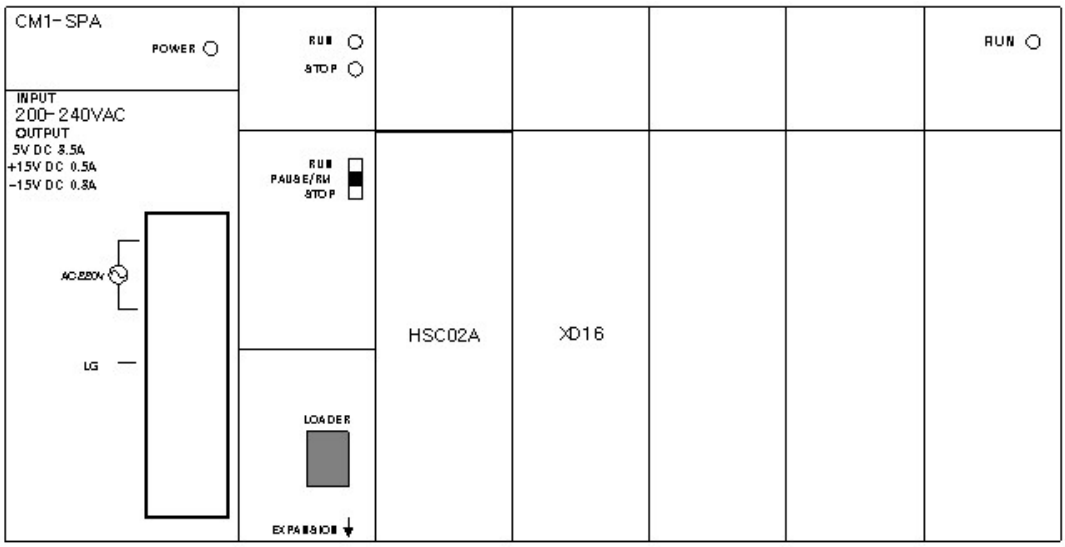
6.9.8.4 Current Status

If you press the current status button, the current status of a HSC can be shown.



6.9.8.5 Application Programs (Using the CICON)

Configuration ,



Initial Setup and Using Card ,

Set Values in the CICON

Item	Set Value
Channel Used	1
Preset Value	2500
Mode of Counting	Ring Counting
Coincidence Comparison Value 1	1000
Coincidence Comparison Value 2	-
Min. Ring-counted Value	-5000
Max. Ring-counted Value	5000
Counting Function	Optional
Sampling/Interval(10mS)	1000
Pulse Input	2-phase 1-multiple

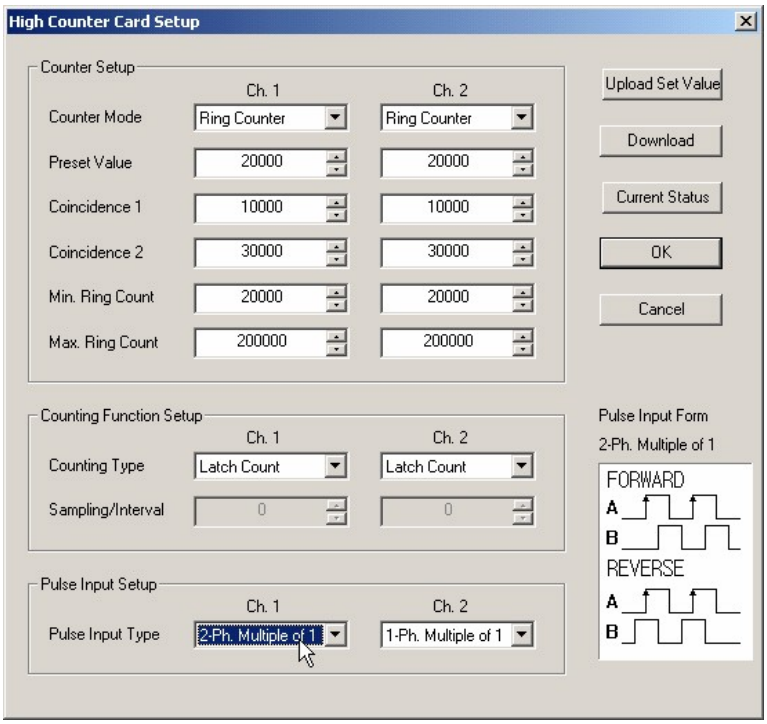
Input Card

Description	Contact	Contact
Enabling to Count	X10	X18
Enabling Coincidence Output	X11	X19
Resetting Coincidence Output	X12	X1A
Presetting	X13	X1B
Starting to Count	X14	X1C
Starting to Latch-count	X15	X1D
Starting to Sampling-count	X16	X1E

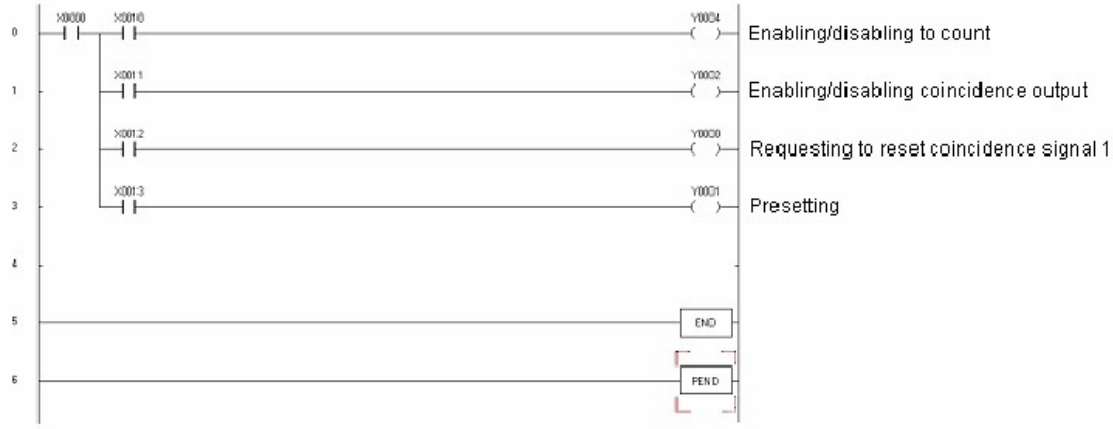
Starting to Periodic-pulse-count	X17	X1F

Setup in the CICON ,

Use the CICON to set up as follows and to download set values.



Example of program ,



The following program can be inserted according to the counting function used.

Disabling to count

Latch counting

Sampling counting

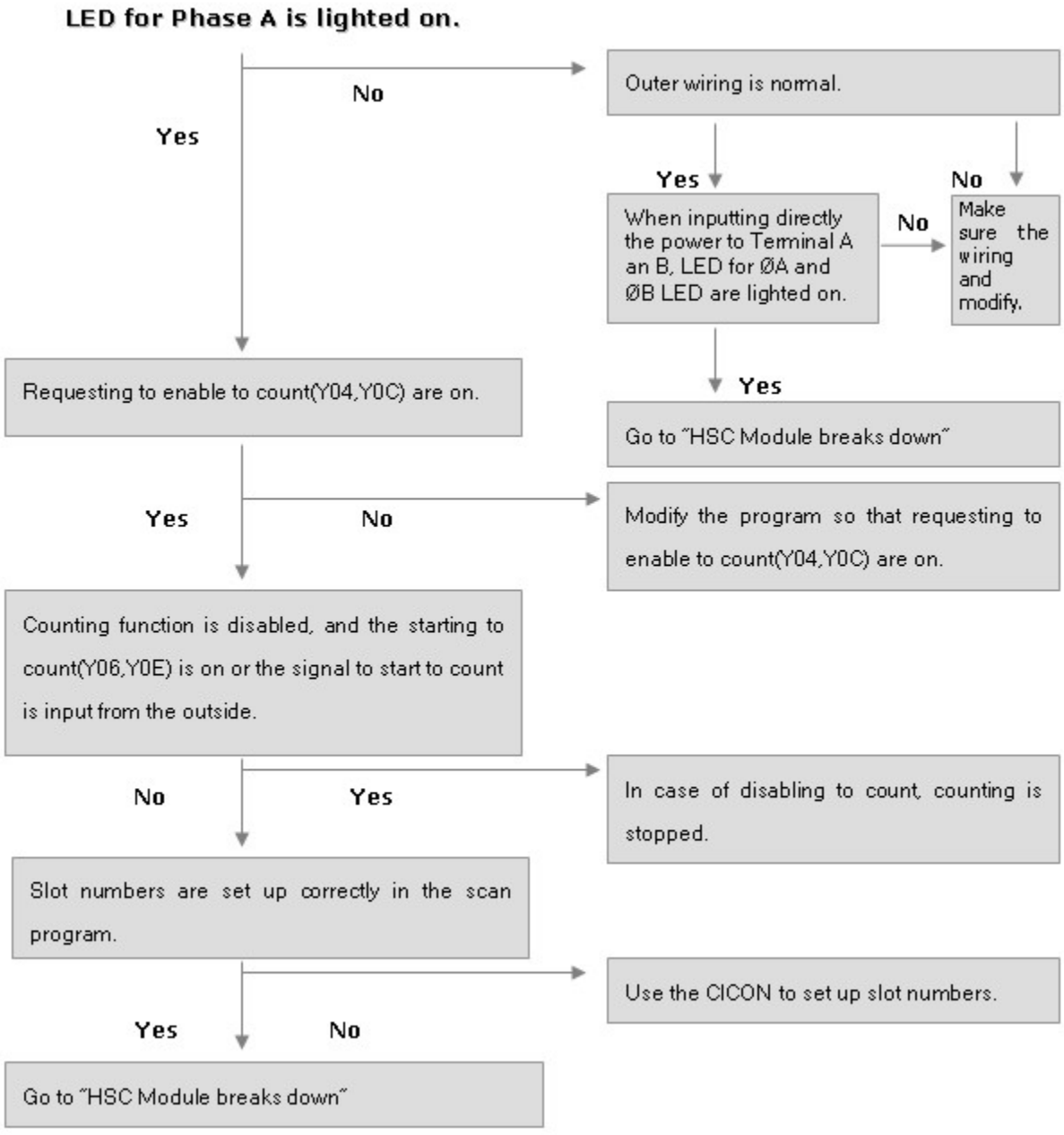
Periodic pulse counting

6.9.9 Trouble Shooting

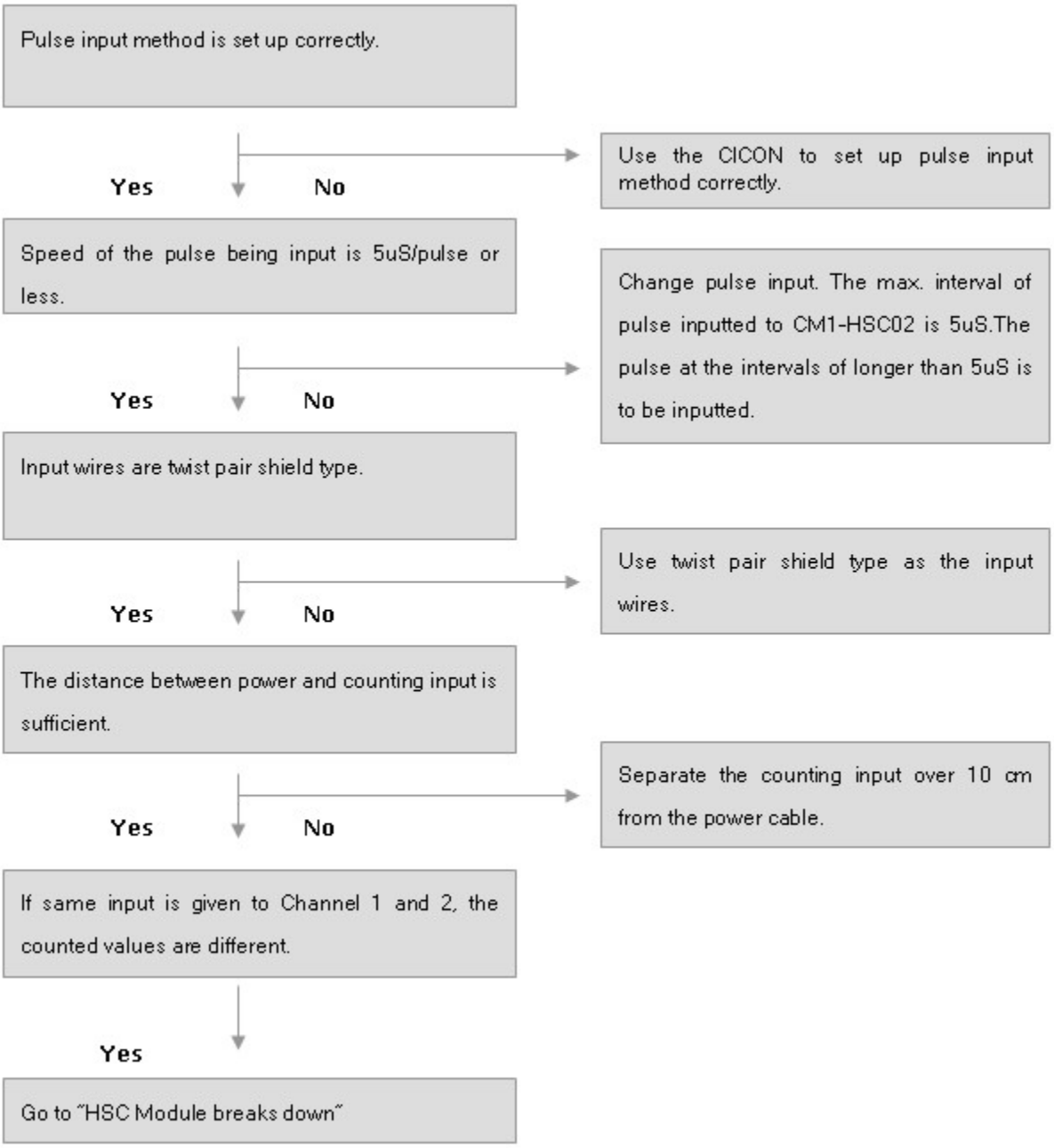
Trouble Shooting :

- Error in Counting
- Error in Counted Value
- Error in Output

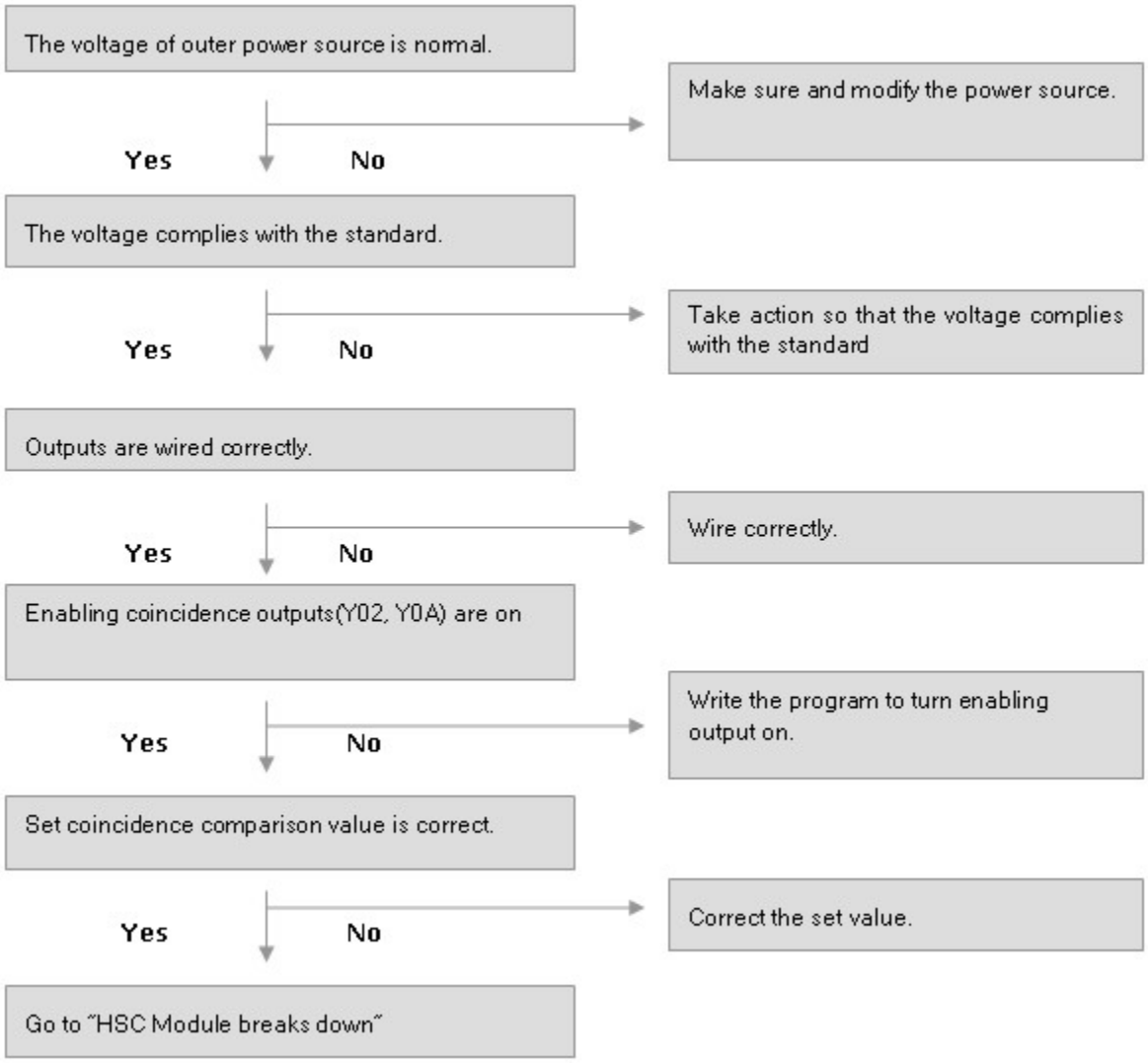
6.9.9.1 Error in Counting



6.9.9.2 Error in Counted Value



6.9.9.3 Error in Output



6.10 Positioning

CM1-PSnnX module is a pulse output modules for CP and XP series of CIMON PLCs. PS02A type supports differential driver system pulse output. PSnnX is capable of driving not only servo motor but also stepping motor

Features :

- **Control Axis :** CM1-PS02A provides 2 axis pulse outputs and supports linear/circular interpolation.

- **Dedicated Instructions :** CP and XP series of CIMON PLCs are embedding several dedicated instructions for PSnnX module. These instructions provide easy and powerful control functions.
- **Manual Operation :** PSnnX module supports various kinds of manual operations, such as jog operation, inching operation. And this module supports external connection of MPG (manual pulse generator).
- **PLC compatibility :** CP and XP CPUs of CIMON PLC supporting PSnnX module.

Contents :

6.10.1 Specifications

See :

- Technical Data
- General Specifications
- Input Signal Specifications
- Output Signal Specification
- Dimensions

6.10.1.1 Technical Data

LED Display

LED	Description	Cause
LED ON LED OFF LED TOGGLE	LED Status Symbol	-

	Normal	-
	Axis Running	-
	Axis Error	Check error code with CICON. The error can be cleared by setting 1 to the ‘ Error Reset’ area in control memory.
	System Error	Check error code with CICON. The error can be cleared by setting 1 to the ‘ Error Reset’ area of axis 1 in control memory.
	Fatal Defect	Check the mounting condition of module on backplane.

Connector Pin Description

Signal	Pin		Description
	A1	A2	
FP+	12	11	Pulse output
FP-	10	9	
RP+	8	7	
RP-	8	5	
LMT U	40	39	Upper Limit Input
LMT L	38	37	Lower Limit Input
DOG	36	35	Near Point DOG Input
STOP	34	33	External STOP Input
ECMD	32	31	External Command Input
COM1	30 28	29 27	COMMON (LMT U, LMT L, DOG, STOP, ECMD)
RDY	20	19	Ready Signal Input from Driver

COM2	18	17	COMMON (RDY)
ZERO24	26	25	Zero Signal Input (+24V)
ZERO05	24	23	Zero Signal Input (+5V)
COM3	22	21	COMMON (ZERO24, ZERO05)
CLEAR	16	15	Deviation Counter Clear Output
COM4	14	13	COMMON (CLEAR)
MPG A+	3		MPG/ENCODER A+ Input
MPG A-	1		MPG/ENCODER A- Input
MPG B+	4		MPG/ENCODER B+ Input
MPG B-	2		MPG/ENCODER B- Input

Deviation counter clear is an output signal of PSnnX module.

6.10.1.2 General Specification

<table>
<tr><th>Item</th><th colspan="6">Specification</th></tr>
<tr><td>Operating Temperature</td><td colspan="6">-10 ~ 65ºC</td></tr>
<tr><td>Storage Temperature</td><td colspan="6">-25 ~ 80ºC</td></tr>
<tr><td>Operating Humidity</td><td colspan="6">5 ~ 95%RH, Not condensed.</td></tr>
<tr><td>Storage Humidity</td><td colspan="6">5 ~ 95%RH, Not condensed.</td></tr>
<tr><td rowspan="6">Vibration</td><td colspan="6">In case of intermittent vibration</td></tr>
<tr><td>Frequency</td><td colspan="2">Acceleration</td><td>Amplitude</td><td colspan="2">Sweep</td></tr>
<tr><td>10 ≦ f< 57Hz</td><td colspan="2">-</td><td>0.075mm</td><td colspan="2" rowspan="2">10 times in each direction (X,Y,Z)</td></tr>
<tr><td>57 ≦ f < 150 Hz</td><td colspan="2">9.8m/s2 {1G}</td><td>-</td></tr>
<tr><td colspan="6">In case of continuous vibration</td></tr>
<tr><td>Frequency</td><td colspan="2">Acceleration</td><td>Amplitude</td><td colspan="2">Sweep</td></tr>
<tr><td>10 ≦ f < 57Hz</td><td colspan="2">-</td><td>0.035mm</td><td colspan="2" rowspan="2">10 times in each direction (X,Y,Z)</td></tr>
<tr><td>57 ≦ f < 150 Hz</td><td colspan="2">4.9m/s2 {1G}</td><td>-</td></tr>
<tr><td>Shock</td><td colspan="6">• Max. Shock Acc. : 147 m/s2 {15G}
• Time : 11㎳(3 times in X, Y, Z)
• Pulse Wave : Half sine wave pulse</td></tr>
<tr><td rowspan="4">Noise</td><td>Square wave impulse noise</td><td colspan="5">±2000V</td></tr>
<tr><td>Electrostatic discharge</td><td colspan="5">Voltage: 4 kV(Contact discharge)</td></tr>
<tr><td>Radiated electro-magnetic field</td><td colspan="5">27 ~ 500 MHz. 10 V/m</td></tr>
<tr><td>Fast Transient Bust Noise</td><td>Item</td><td>Power Modul</td><td>Digital I/O (24V or more)</td><td colspan="2">Digital I/O(Less than 24V) Analog I/O Comm.</td></tr>
</table>

			e		interface
		Voltage	2KV	1KV	0.25KV
Environment	No corrosive gas and no dust.				
Altitude	2,000m or less				
Pollution	Less than 2				
Cooling	Natural Air cooling				

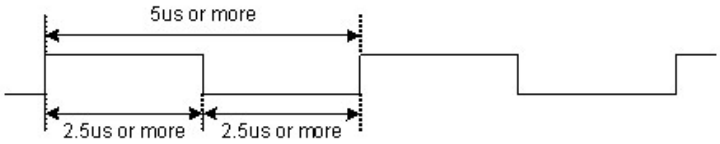
6.10.1.3 Module Specification

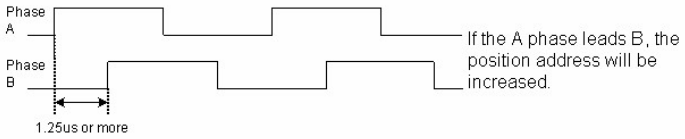
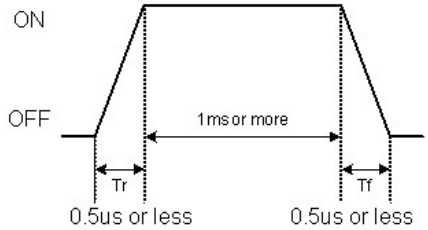
Module Name		CM1-PS02A
I/O Occupation		16 Points
Axis		2 Axis
Interpolation		2 Axis Linear/Circular Interpolation
Control Functions		Point to Point, Path, Speed
Control Unit		Pulse, mm, inch, degree
Position Data		600 / Axis
Coordinate		Absolute / Incremental
Backup		Flash Rom Backup (Parameters, Position Data, Block Data, Condition Data)
Positioning	Control Type	Position Control – Absolute Coordinate / Incremental Coordinate Path Control - Absolute Coordinate / Incremental Coordinate
	Coordinate	• Absolute Coordinate -214748364.8 ~ 214748364.7 ㎛ -21474.83648 ~ 21474.83647 inch 0 ~ 359.9999 degree -2147483648 ~ 2147483647 pulse • Incremental Coordinate -214748364.8 ~ 214748364.7 ㎛ -21474.83648 ~ 21474.83647 inch -21474.83648 ~ 21474.83647 degree -2147483648 ~ 2147483647 pulse
	Speed	0.1 ~ 20,000,000.00 (㎜/min) 0.001 ~ 2,000,000.000 (inch/min) 0.001 ~ 2,000,000.000 (degree/min) 1 ~ 1,000,000 (pulse/sec)
	Acc/Dec Type	Trapezoidal / S-Pattern
	Acc/Dec Time	0 ~ 65,535 ms
	Sudden Stop Dec. Time	0 ~ 65,535 ms
External Cabling		40pin Connector
Max. Pulse Output		1 MPPS (Line Driver Pulse Output)
Max. Distance		10 m

Power Consume	240 mA / 5V
Flash ROM Write Count	Max. 100,000 times
Dimension (mm)	32(W) * 109(H) * 93.3(D)
Weight (g)	168

6.10.1.4 Input Signal Specifications

<table>
<tr><th>Signal</th><th>Rated input voltage / current</th><th>Working voltage Range</th><th>ON Voltage / Current</th><th>OFF Voltage / Current</th><th>Input Resistance</th><th>Response Time</th></tr>
<tr><td>Near Point DOG
Upper Limit (LMTU)
Lower Limit (LMTL)
Stop (STOP)
External Command (ECMD)</td><td>24Vdc / 5mA</td><td>19.2 ~ 26.4 Vdc</td><td>19Vdc / 4mA or more</td><td>11Vdc / 1mA</td><td>2.7kΩ</td><td></td></tr>
<tr><td rowspan="2">MPG
Phase A
(MPG A+, MPG A-)

Phase B
(MPG B+, MPG B-)</td><td>5Vdc / 7ma</td><td>5Vdc / 7ma</td><td>2.5Vdc / 3mA or more</td><td>1Vdc / 1mA or less</td><td>940Ω</td><td></td></tr>
<tr><td colspan="6">①Pulse Width
 

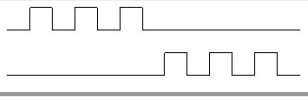
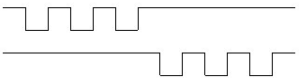
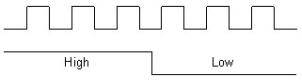
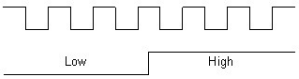
② Phase
 
</td></tr>
<tr><td>Driver unit ready input (RDY)</td><td>24Vdc / 5mA</td><td>19.2 ~ 26.4 Vdc</td><td>19Vdc / 4mA or more</td><td>11Vdc / 1mA</td><td>2.8kΩ</td><td></td></tr>
<tr><td rowspan="2">Zero Input
(Encoder Z Phase)
(ZERO 5)
(ZERO 24)</td><td>5Vdc / 7ma</td><td>4.25 ~ 5.5Vdc</td><td>2.5Vdc / 3mA or more</td><td>1Vdc / 1mA or less</td><td>600Ω</td><td></td></tr>
<tr><td>24Vdc / 5mA</td><td>19.2 ~ 26.4Vdc</td><td>19Vdc / 4mA or more</td><td>11Vdc / 1mA</td><td>2.7kΩ</td><td></td></tr>
<tr><td colspan="6"> 
</td></tr>
</table>

6.10.1.5 Output Signal Specification

<table>
<tr><th>Signal</th><th>Rated Voltage</th><th>Working Voltage</th><th>Max. Current / Inrush Current</th><th>Voltage Drop at ON</th><th>Leakage Current at OFF</th></tr>
<tr><td>Pulse Output (CW/PULSE)

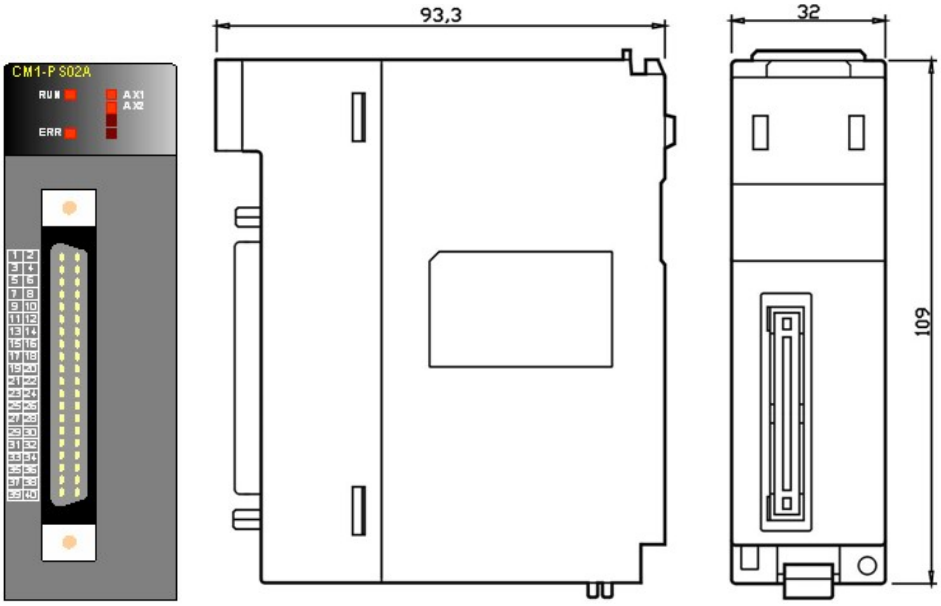
Pulse Sign (CCW/SIGN)</td><td>5 ~ 24 Vdc</td><td>4.75 ~ 26.4 Vdc</td><td>50mA (1 point) / 0.2A (10ms or less)</td><td>0.5Vdc</td><td>0.1mA or less</td></tr>
<tr><td colspan="5">? Differential driver equivalent to AM26C31

? The type of output pulse(CW / CCW, Pulse/Sign) is selected by basic parameter settings

<table>
<tr><td rowspan="2">Pulse Output Mode</td><td colspan="4">Output Signal Level</td></tr>
<tr><td colspan="2">Positive Logic</td><td colspan="2">Negative Logic</td></tr>
<tr><td>Forward</td><td>Reverse</td><td>Forward</td><td>Reverse</td></tr>
<tr><td>CW
CCW</td><td colspan="2">  </td><td colspan="2">  </td></tr>
<tr><td>Pulse
Sign</td><td colspan="2"> 
</td><td colspan="2"> 
</td></tr>
</table>
</td></tr>
<tr><td>Deviation Counter Clear (CLEAR)</td><td>5 ~ 24Vdc</td><td>4.75 ~ 26.4Vdc</td><td>0.1A (1 point) / 0.4A (10ms or less)</td><td>1 Vdc</td><td>0.1mA or less</td></tr>
</table>

6.10.1.6 Dimensions

Unit : mm



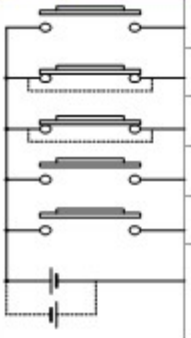
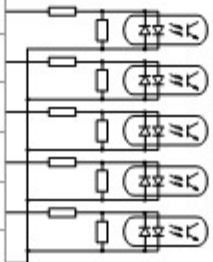
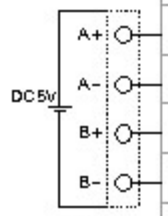
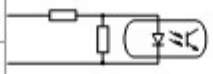
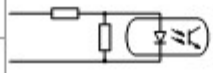
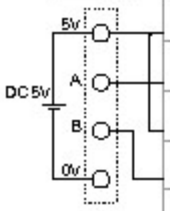
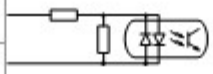
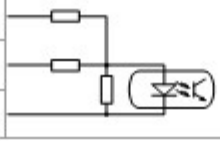
Pin	Function	Pin	Function
1	MPG A-	2	MPG A+
3	MPG B-	4	MPG B+

5	AXIS 2	RP-	6	AXIS 1	RP-
7		RP+	8		RP+
9		FP-	10		FP-
11		FP+	12		FP+
13		CLR COM	14		CLR COM
15		CLR	16		CLR
17		RDY COM	18		RDY COM
19		RDY	20		RDY
21		ZERO COM	22		ZERO COM
23		ZERO 5	24		ZERO 5
25		ZERO 24	26		ZERO 24
27		Y COM	28		X COM
29		Y COM	30		X COM
31		ECMD	32		ECMD
33		STOP	34		STOP
35		DOG	36		DOG
37		LMT L	38		LMT L
39		LMT U	40		LMT U

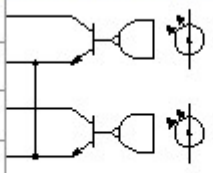
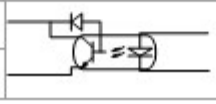
6.10.2 Wiring

Contents :

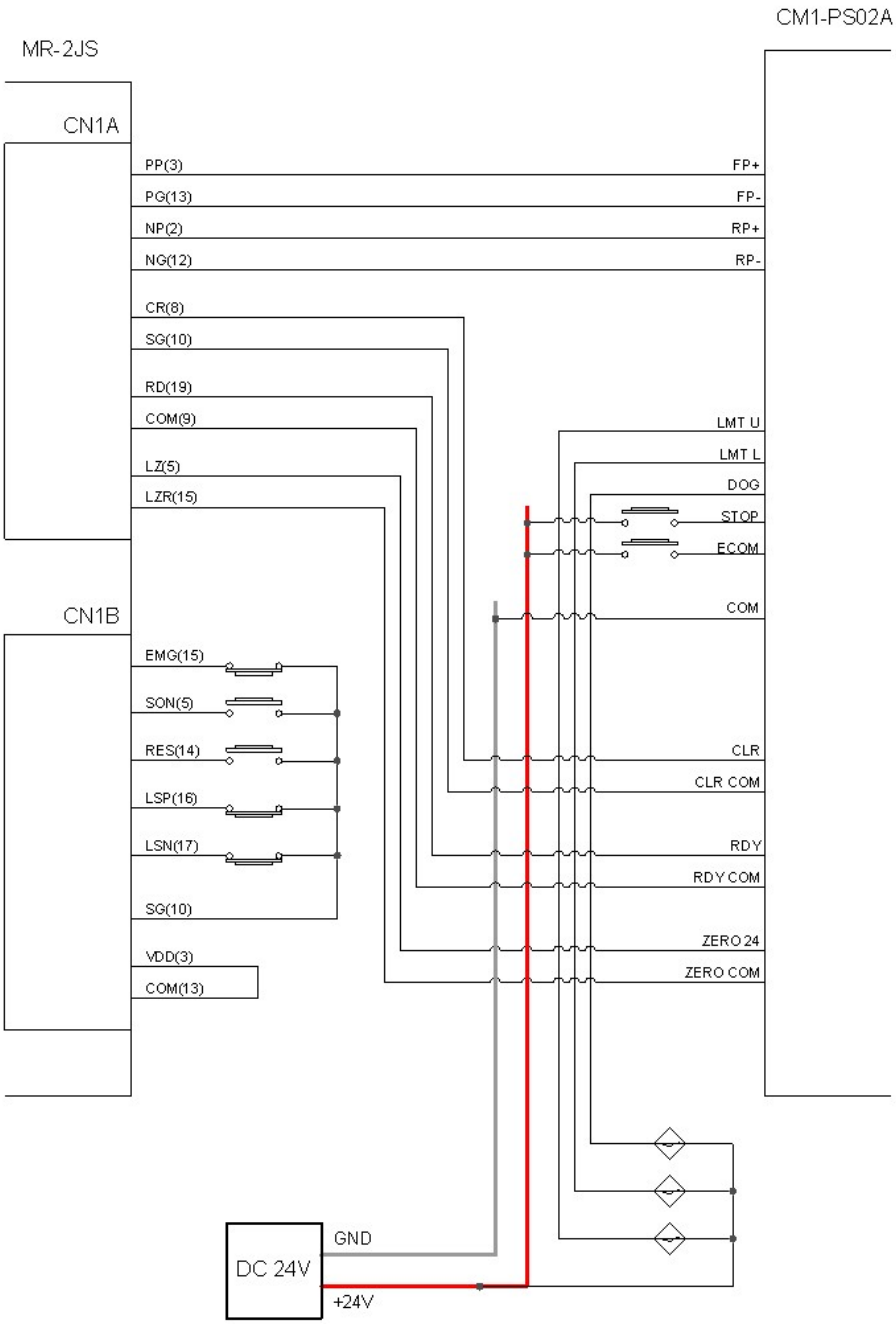
6.10.2.1 Input Signal

Wiring	Pin	Internal Circuit	Signal Name	Remark
	35(36)		DOG	
	39(40)		LMT U	
	37(38)		LMT L	
	33(34)		STOP	
	31(32)		ECMD	
	27,29 (28,30)		COM1	
	4		MPG A+	
	3		MPG A-	
	2		MPG B+	
	1		MPG B-	
	4		MPG A+	
	3		MPG A-	
	2		MPG B+	
	1		MPG B-	
	19(20)		RDY	
	17(18)		COM2	
	25(26)		ZERO24	
	23(24)		ZERO05	
	21(22)		COM3	

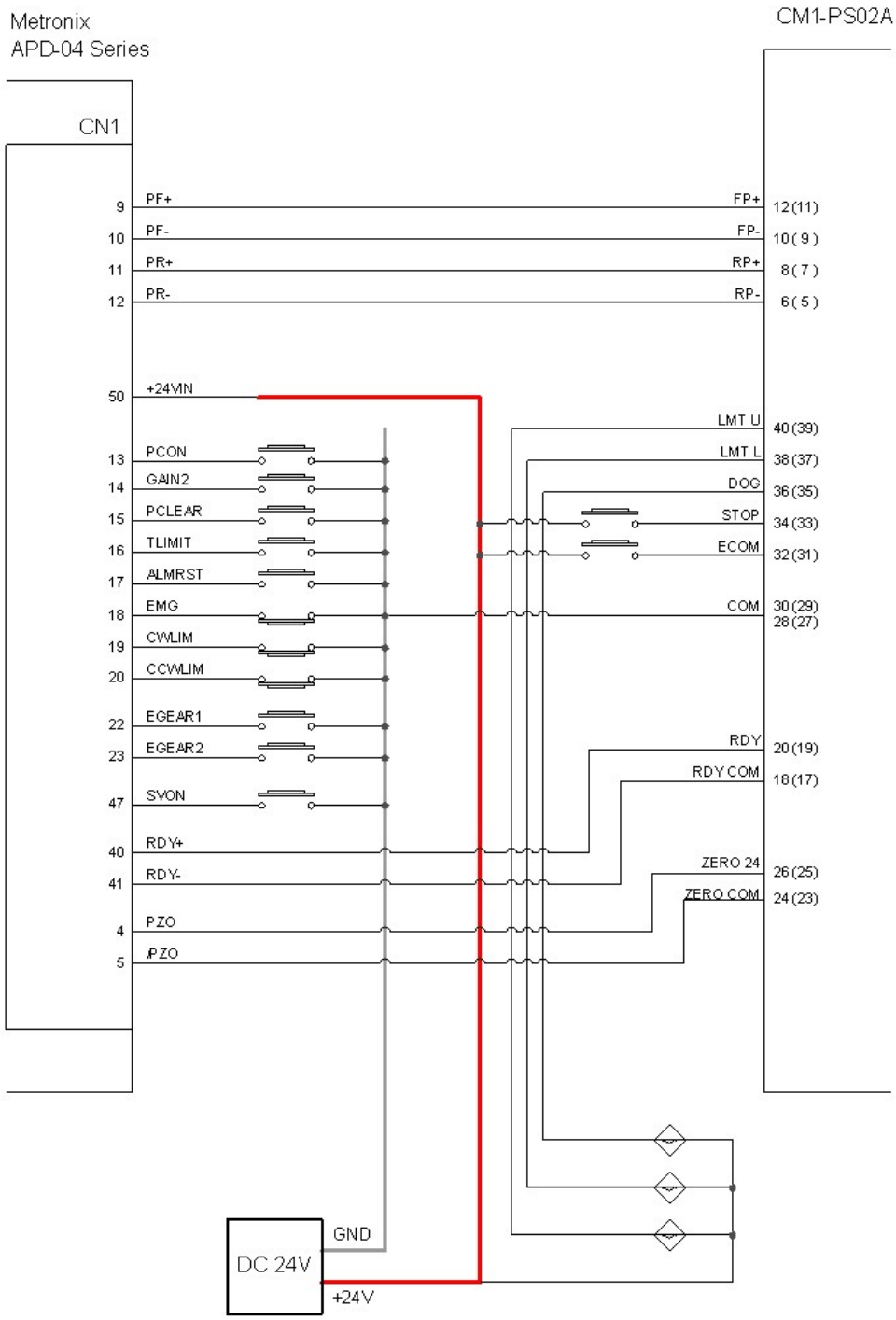
6.10.2.2 Output Signal

Output Signal	Pin	Internal Circuit	Signal Name	Remark
Pulse Output	11(12)		FP+	
	9(10)		FP-	
	7(8)		RP+	
	5(6)		RP-	
Others	15(16)		CLEAR	
	13(14)		COM4	

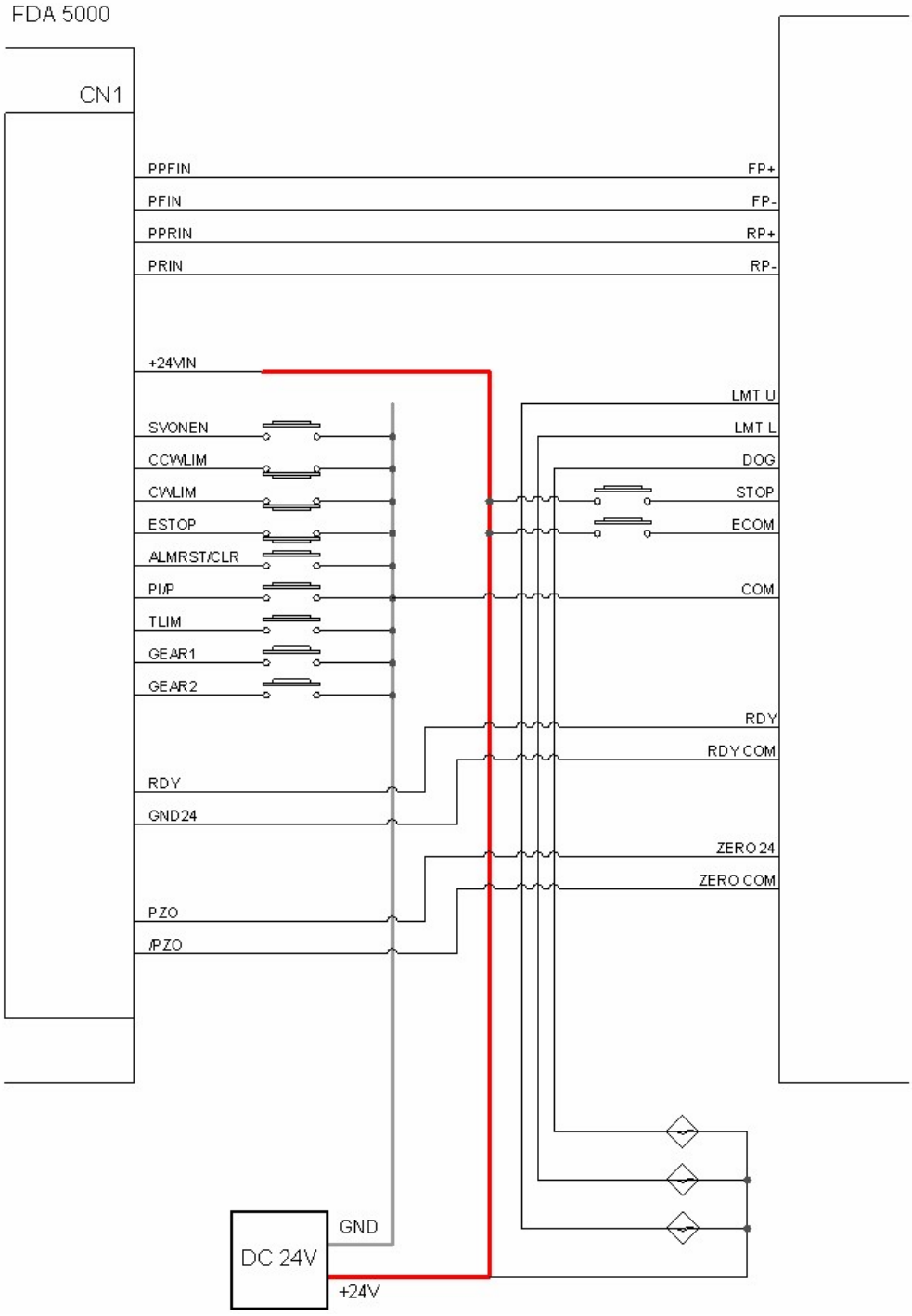
6.10.2.3 Wiring Example "MR-J2S Seres (Mitsubishi)"



6.10.2.4 Wiring Example "APD-VS Series (Metronix)"



6.10.2.5 Wiring Exmaple "FDA5000 Series (LG Otis)"



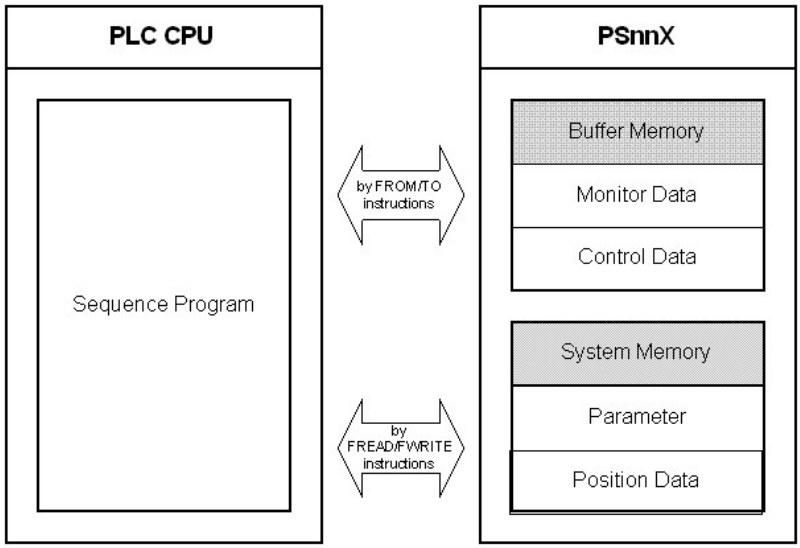
6.10.3 Internal I/O and Shared Memory

PSnnX module occupies 16 points in PLC I/O space. These I/O points are used for data exchange with CPU module. Direction of input signal is from PSnnX to CPU, and output signal is from CPU to PSnnX.

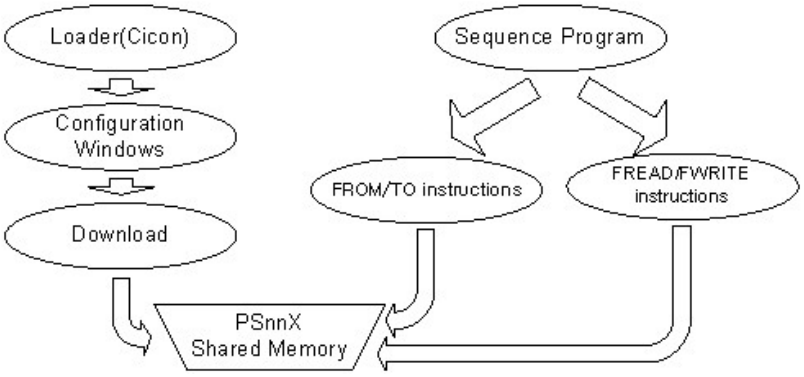
Direction : CPU?PSnnX		Direction : CPU?PSnnX	
Input	Signal Description	Output	Signal Description
X00	Module Ready	Y00	CPU Ready
X01	Module Error	Y01	
X02		Y02	
X03		Y03	
X04	Command Ack (Axis 1)	Y04	Positioning Start (Axis 1)
X05	Busy (Axis 1)	Y05	MPG Run (Axis 1)
X06	Error (Axis 1)	Y06	Forward JOG (Axis 1)
X07	Positioning Done (Axis 1)	Y07	Reverse JOG (Axis 1)
X08	M code ON (Axis 1)	Y08	Stop (Axis 1)
X09		Y09	
X0A	Command Ack (Axis 2)	Y0A	Positioning Start (Axis 2)
X0B	Busy (Axis 2)	Y0B	MPG Run (Axis 2)
X0C	Error (Axis 2)	Y0C	Forward JOG (Axis 2)
X0D	Positioning Done (Axis 2)	Y0D	Reverse JOG (Axis 2)
X0E	M code ON (Axis 2)	Y0E	Stop (Axis 2)
X0F		Y0F	

6.10.4 Shared Memory Area

PSnnX provides two types of shared memory area. One is buffer memory area and the other is system memory area. These memory areas can be read or written by sequence program of CPU or CICON. Following shows the block diagram of these shared memories.



Accessing the Shared Memory of PSnnX



Contents :

6.10.4.1 Control Data Memory Area

System Memory

The configuration data and position data are stored in this memory. For access this area, the FREAD/ FWRITE instructions must be used in sequence program.

System memory is backed-up by flash memory. Current data of system memory is stored in flash memory by issuing a command with instruction. The number of flash memory writing is restricted to 25 times at every power ON. This restriction is putted for protecting flash memory from the sequence program mistake. The overall lifetime of flash memory is 100,000 times of writing.

Buffer Memory

All the special purposed modules of CIMON PLC have buffer memory. Sequence program of CPU can get or control the module' s useful information through this memory. For this data exchange the FROM/TO instructions are used for data exchange between CPU and the module.
PSnnX provides two kinds of data through the buffer memory. One is a monitor data, and the other is a control data. These two data are explained more precisely as follows.

Monitor Data

Monitor data provides some useful information about the running status of PSnnX module. These data are read-only. Following table shows the data can be monitored.

OFFSET				Description
Axis 1	Axis 2	Axis 3	Axis 4	
0	15	30	45	M Code
1	16	31	46	External Input Status
2	17	32	47	Running Status 1
3	18	33	48	Running Status 2
4	19	34	49	Destination Position Address (Low word)
5	20	35	50	Destination Position Address (High word)
6	21	36	51	Current Position Address (Low word)
7	22	37	52	Current Position Address (High word)
8	23	38	53	Machine Address (Low word)
9	24	39	54	Machine Address (High word)
10	25	40	55	Target Speed (Low word)
11	26	41	56	Target Speed (High word)
12	27	42	57	Current Speed (Low word)
13	28	43	58	Current Speed (High word)
14	29	44	59	Position Data Number
60				Flash Write Counter
61				Reserved
62				Reserved
63				OS Version
64	66	68	70	Warn Code
65	67	69	71	Error Code

Control Data

This memory area is used for controlling the PSnnX module. Before issuing a instruction, the related data have to be set properly.

OFFSET				Description
Axis 1	Axis 2	Axis 3	Axis 4	
72	117	162	207	Position Data Number (1 – 600)
73	118	163	208	Reserved
74	119	164	209	Axis Error Reset
75	120	165	210	Resume Request
76	121	166	211	M code OFF Request
77	122	167	212	External Signal Enable(1) / Disable(0)
78	123	168	213	New Position Address (Low word)
79	124	169	214	New Position Address (High word)
80	125	170	215	Reserved
81	126	171	216	Reserved
82	127	172	217	Reserved
83	128	173	218	Reserved
84	129	174	219	Reserved
85	130	175	220	Reserved
86	131	176	221	New Speed (Low word)
87	132	177	222	New Speed (High word)
88	133	178	223	Speed Change Request (1)
89	134	179	224	Inching Movement Amount
90	135	180	225	JOG Speed (Low word)
91	136	181	226	JOG Speed (High word)
92	137	182	227	OPR Request Flag Reset
93	138	183	228	MPG Multiplier
94	139	184	229	MPG Operation Enable (1) / Disable (0)
95	140	185	230	Reserved
96	141	186	231	Reserved
97	142	187	232	Reserved
98	143	188	233	Reserved
99	144	189	234	Reserved
100	145	190	235	Reserved
101	146	191	236	Target Position Address (Low word)
102	147	192	237	Target Position Address (High word)
103	148	193	238	Target Speed (Low word)
104	149	194	239	Target Speed (High word)
105	150	195	240	Target Address Change Request (1)
106	151	196	241	Simultaneous Start Position Data Number (Axis 1)

107	152	197	242	Simultaneous Start Position Data Number (Axis 2)
108	153	198	243	Simultaneous Start Position Data Number (Axis 3)
109	154	199	244	Simultaneous Start Position Data Number (Axis 4)
110	155	200	245	Step Operation Method
111	156	201	246	Step Operation Enable (1) / Disable (0)
112	157	202	247	Step Operation Command
113	158	203	248	Skip Request (1)
114	159	204	249	Teaching Data
115	160	205	250	Teaching Position Data Number
116	161	206	251	ABS Direction (only for unit of degree)
252				Reserved
253				Reserved
254				Flash Write Request (1)
255				Initialize to Factory Default (1)

6.10.5 Parameter

The parameters must be configured appropriately according to the machine, applicable motors etc.

- Basic Parameters
- Expanded Parameters
- OPR Parameters
- Common Parameters

Basic Parameters

Axis				Description	Initial Value	Remark
1	2	3	4			
0	50	100	150	Speed limit (low word)	200,000	mm [x10-2mm/min] : 1~2,000,000,000 inch [x10-3inch/min] : 1~2,000,000,000 degree [x10-3deg/min] : 1~2,000,000,000 pulse [pulse/sec] : 1~1,000,000
1	51	101	151	Speed limit (high word)		
2	52	102	152	Bias speed (low word)	1	
3	53	103	153	Bias speed (high word)		
4	54	104	154	Acceleration/Deceleration time #0	1,000	0 ~ 65,535 ms
5	55	105	155	Acceleration/Deceleration time #1	1,000	0 ~ 65,535 ms
6	56	106	156	Acceleration/Deceleration time	1,000	0 ~ 65,535 ms

				#2		
7	57	107	157	Acceleration/Deceleration time #3	1,000	0 ~ 65,535 ms
8	58	108	158	Number of pulses per rotation	20,000	1 ~ 65,535 pulse
9	59	109	159	Movement amount per rotation	20,000	1 ~ 65,535 [x10-1 ㎛ x10-5 inch, x10-5 degree, pulse]
10	60	110	160	Pulse Output Mode (Bit 0~ 1)	01	00 = PLS/DIR mode 01 = CW/CCW mode
				Unit setting (Bit 2~ 3)	00	00 = pulse 01 = mm 10 = inch 11 = degree
				Unit magnification (Bit 4~ 5)	00	00 = x 1 01 = x 10 10 = x 100 11 = x 1000
				Rotation direction setting (Bit 6)	0	0 = Increase address at forward rotate 1 = Increase address at reverse rotate

Expanded Parameters

Axis				Description	Initial Value	Remark
1	2	3	4			
11	61	111	161	Software stroke limit upper limit (low word)	2147483647	-2,147,483,648 ~ 2,147,483,647 [x10-1 ㎛ x10-5 inch, x10-5 degree, pulse]
12	62	112	162	Software stroke limit upper limit (high word)		
13	63	113	163	Software stroke limit lower limit (low word)	-2147483647	
14	64	114	164	Software stroke limit lower limit (high word)		
15	65	115	165	Backlash compensation amount	0	0 ~ 65,535 [x10-1 ㎛ x10-5 inch, x10-5 degree, pulse]
16	66	116	166	Positioning complete signal output time	300	0 ~ 65,535 ms
17	67	117	167	S-pattern ratio	100	1 ~ 100 %
18	68	118	168	External command function selection	0	0 = Start 1 = Speed/Position switching 3 = Skip
19	69	119	169	Sudden stop deceleration time	1000	0 ~ 65,535 ms
20	70	120	170	Acceleration/Deceleration pattern (Bit 0)	0	0 = Trapezoidal, 1 = S-Pattern
				M Code ON timing (Bit 1)	0	0 = WITH mode 1 = AFTER mode
				Current feed value during speed control (Bit 2~ 3)	00	00 = Do not update 01 = Update 10 = Update after clear
				Software limit detection during	0	JOG, Inching, MPG

				manual operation (Bit 4)		0 = allow, 1 = forbid
				Software limit coordination (Bit 5)	0	0 = Current Address. 1 = Machine Address
				Speed/Position switching method (Bit 6)	0	0 = by Incremental Coord. 1 = by Absolute Coord.
				Use External command (Bit 7)	0	0 = Not used 1 = Used
				Use External STOP (Bit 8)	0	0 = Not used 1 = Used
				Sudden stop group #1 (Bit 9)	0	0 = Normal Stop 1 = Sudden Stop
				Sudden stop group #2 (Bit 10)	0	
				Sudden stop group #3 (Bit 11)	0	
21	71	121	171	Logical Input selection	Bit 00 : LMT U	0	0 = Low Active 1 = High Active
					Bit 01 : LMT L	0	
					Bit 02 : DOG	0	
					Bit 03 : STOP	0	
					Bit 04 : ECMD	0	
					Bit 05 : RDY	0	
22	72	122	172	JOG speed limit value (low word)		20000	mm [x10-2mm/min] : 1~2,000,000,000 inch [x10-3inch/min] : 1~2,000,000,000 degree [x10-3deg/min] : 1~2,000,000,000 pulse [pulse/sec] : 1~1,000,000
23	73	123	173	JOG speed limit value (high word)			
24	74	124	174	JOG Operation acceleration time selection		0	0 – 3 (Acc/Dec number)
25	75	125	175	JOG Operation deceleration time selection		0	0 – 3 (Acc/Dec number)

OPR Parameters

Axis				Description	Initial Value	Remark
1	2	3	4			
30	80	130	180	OP address (low word)	0	-2,147,483,648 ~ 2,147,483,647 [x10-1 ㎛ x10-5 inch, x10-5 degree, pulse]
31	81	131	181	OP address (high word)		
32	82	132	182	OPR speed (low word)	20,000	mm [x10-2mm/min] : 1~2,000,000,000 inch [x10-3inch/min] : 1~2,000,000,000 degree [x10-3deg/min] : 1~2,000,000,000 pulse [pulse/sec] : 1~1,000,000
33	83	133	183	OPR speed (high word)		
34	84	134	184	Creep speed (low word)	2,000	
35	85	135	185	Creep speed (high word)		
36	86	136	186	OPR method (Bit 0~ 2)	000	0(000) Detect zero after DOG OFF 1(001) Detect zero after deceleration when DOG ON

						2(010) Detect limit and zero signal 3(011) Detect DOG
				OPR direction (Bit 3)	0	0 = forward 1 = reverse
37	87	137	187	OPR Acc/Dec number	0	0 ~ 3 (Acc/Dec number)
38	88	138	188	OPR dwell time	0	0 ~ 65,535 ms
39	89	139	189	OPR compensation (low word)	0	-2,147,483,648 ~ 2,147,483,647 [x10-1 ㎛ x10-5 inch, x10-5 degree, pulse]
40	90	140	190	OPR compensation (high word)		
41	91	141	191	Deviation counter clear signal time	50	1 ~ 65,535 ms

Common Parameters

Axis				Description	Initial Value	Remark
1	2	3	4			
200				Pulse output Logic	0	0 = High Active 1 = Low Active

6.10.5.1 Basic Parameters

IN THIS TOPIC :

Speed Limit

Designate the applicable maximum speed. All the speed in sequence program or position data must be lower than this parameter. Otherwise, the axis error will be issued.

PSnnX module has different speed resolution according to the configuration of this parameter.

Speed Limit	Resolution (pulse)
1 ~ 8,000	1
8,001 ~ 16,000	2
16,001 ~ 40,000	5
40,001 ~ 80,000	10
80,001 ~ 160,000	20

160,001 ~ 400,000	50
400,001 ~ 800,000	100
800,001 ~ 1,000,000	200

This resolution table is applied to all speed data, such as bias speed, positioning command in sequence program, OPR speeds and so on. Speed data must be multiple of resolution value of above table. If the speed value used is not multiple of resolution value, PSnnX will choose automatically the near most value among the multiple of resolution. But, if the selected speed is lower than bias speed, the bias speed will be selected.

Bias Speed

This parameter designates the initial speed of pulse output. The bias speed has to be defined to allow the motor to start smoothly especially when a stepping motor is used. A stepping motor will not start smoothly if a low rotation speed is instructed at the beginning. This speed cannot be set higher than speed limit.

Acceleration / Deceleration Time (0~3)

Acceleration time specifies the time for the speed to increase from zero to the speed limit value. And deceleration time specifies the time for the speed to decrease from the speed limit value to zero. In normal case, the positioning speed is lower than the speed limit value, thus the actual acceleration/deceleration time will be relatively short. The actual time for acceleration/deceleration can be calculated by following formula.

T = V x Ts / Vmax

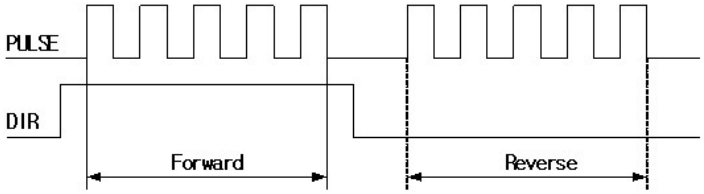
- V : Destination Speed,
- Ts : Acc/Dec time in parameter
- Vmax : Speed limit in parameter

Pulse Output Mode

Set the pulse output mode to match the servo amplifier being used. Pulse output signal is specified by the ‘ pulse output logic’ parameter setting also. Followings are based on ‘ high active’ setting of ‘ pulse output logic’ parameter.

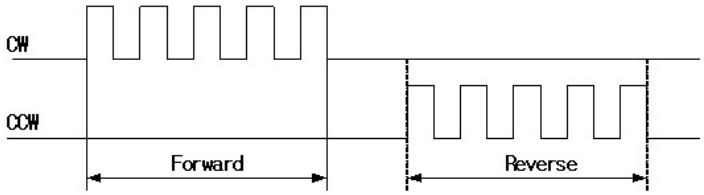
PLS/DIR mode

Forward run and reverse run are controlled with the ON/OFF of the direction sign (SIGN).



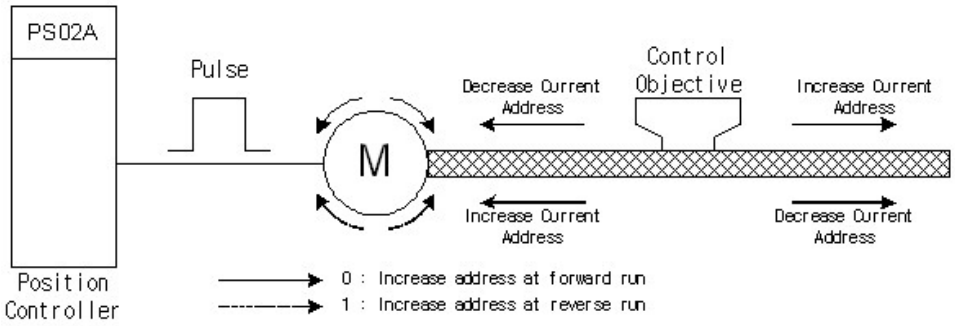
CW/CCW

During forward run, the forward run feed pulse (CW) will be output.
During reverse run, the reverse run feed pulse (CCW) will be output.



Rotation direction setting

Set the relation of the motor rotation direction and current address increment/decrement.

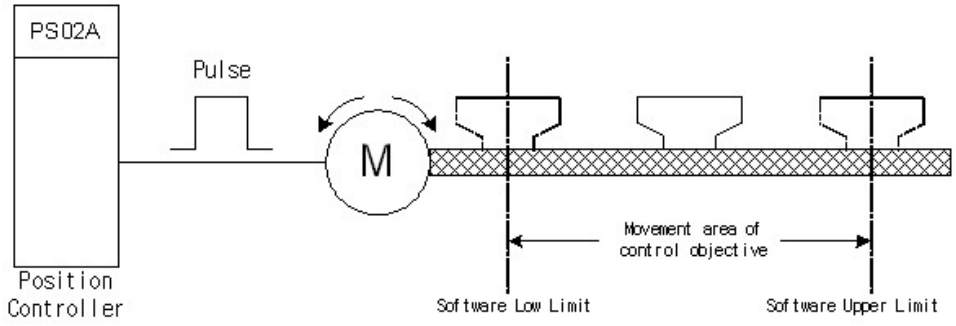


6.10.5.2 Expaned Parameters

IN THIS TOPIC :

Sudden Stop Group (#1 ~ #3)
Logical Input Selection

Software Limits



Set the lower/upper limit for the machine' s movement range during positioning control. The software limit is verified all the time during system running except for following special cases :

- When the unit is ' degree' , the software limit check is invalid during speed control or during manual control.
- During manual operation, software limit checking is performed according to the setting of ' Software limit detection during manual operation'
- To invalidate the software limit, set the setting value to ' upper limit value = lower limit value' . (The setting value can be anything.)

Software limit is verified when the positioning instruction is issued and during running. With the control unit set to ' degree' , the software upper and lower limit values are 0 to 359.99999. To validate the software limit checking, set the lower and the upper limit value in a clockwise direction.

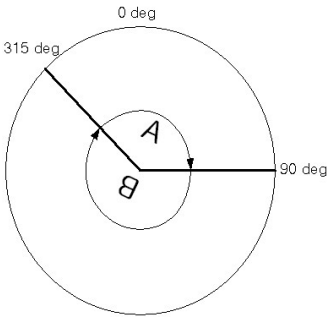
Example

To set the movement range A :

lower limit : 315 upper limit : 90

To set the movement range B :

lower limit : 90 upper limit : 315

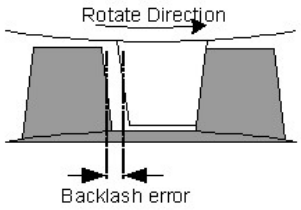


In absolute positioning system with unit of ‘ degree’ , software limit setting influences the actual movement :

- When the software limit checking is allowed : The positioning is carried out in a clockwise/ counterclockwise direction depending on the software limit range setting method. Because of this, positioning with ‘ shortcut control’ may not be possible.
- When the software limit checking is forbidden : Positioning is carried out in the nearest direction to the designated address, using the current value as a reference. This is called ‘ shortcut control’ .

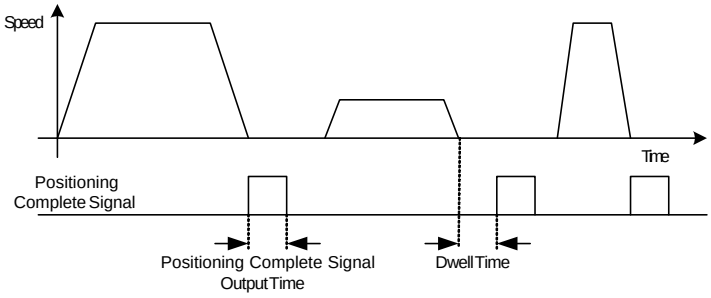
Backlash compensation amount

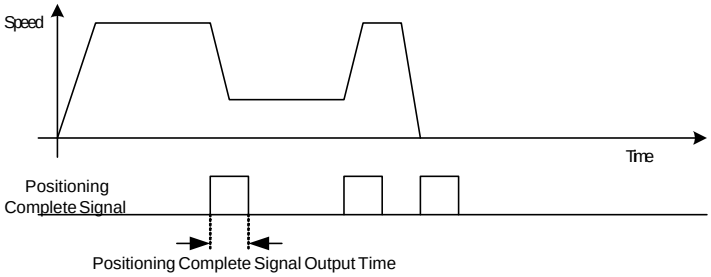
The error that occurs due to backlash when moving the machine via gears can be compensated. When the Backlash compensation amount amount is set, pulses equivalent to the compensation amount will be output each time the direction changes during positioning.



Positioning Complete Signal Output Time

Set the output time of the positioning complete signal output from PSnnX. A positioning completes when the specified dwell time has passed after the PSnnX terminated the output.



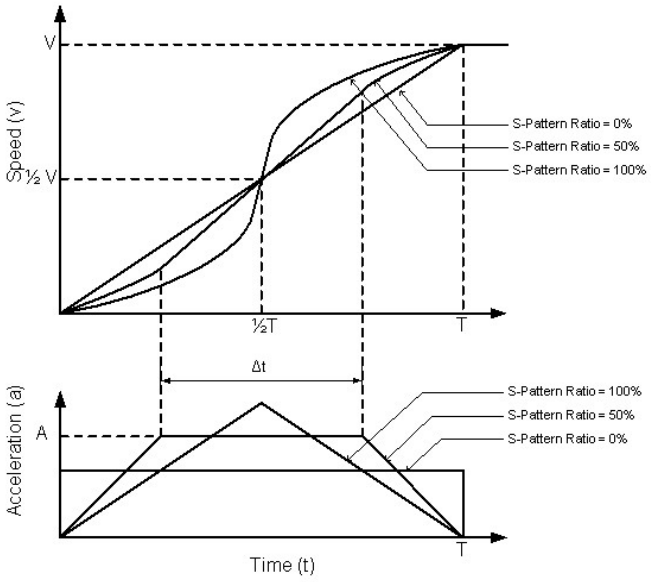


S-Pattern Ratio

This parameter is effective when the ' Acc/Dec pattern' is configured as S-Pattern (1). S-Pattern reduces the burden of motor during starting and stopping. This is a method in which acceleration/deceleration is carried out gradually, based on the acceleration time, deceleration time, speed limit value, and S-Pattern ratio set by the user.

When the stepping motor is used, the S-Pattern acceleration/deceleration processing method cannot be carried out. When using this processing method, ensure to use a servo motor.

Followings explain the concept of S-Pattern ratio. S-Pattern acceleration/deceleration is composed with 3 different acceleration/deceleration stages.



- 1st Stage : Increase the acceleration/deceleration value
- 2nd Stage : retain a constant acceleration/deceleration value
- 3rd Stage : decrease the acceleration/deceleration value

S-Pattern ratio is a time ratio of 2nd stage compared to the total acceleration/deceleration time (T). It can be presented as a following formula.

S-Pattern Ratio (%) = ((T – Δt) / T) x 100

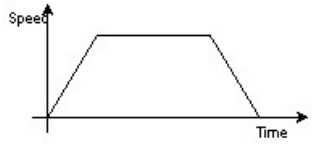
When Δt is ' 0' , the S-Pattern ratio will be 100%. In that case, the 2nd stage will be skipped and as a result, the variation of speed will be large most. When Δt is T, the S-Pattern ratio will be 0%. As a result, the S-Pattern acceleration/deceleration will be the same pattern with the trapezoidal.

Acceleration / Deceleration Pattern

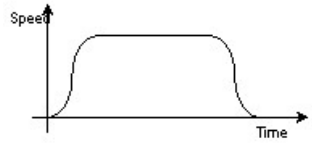
Set whether to use automatic trapezoid acceleration/deceleration or S-Pattern acceleration/deceleration for the acceleration/deceleration process.

Trapezoidal

The acceleration and deceleration are linear.



The acceleration and deceleration follow a sine curve



M Code ON Timing

This parameter sets the M code ON signal output timing. Choose either WITH mode or AFTER mode as the M code ON signal output timing.

- With Mode : An M code is output and the M code ON signal is turned ON when a positioning operation starts.
- After Mode : An M code is output and the M code ON signal is turned ON when a positioning operation completes.

If the M code is set as zero, the M code ON signal will not be issued.

Sudden Stop Group (#1~#3)

Set the method to stop when the stop causes in the following stop groups occur.

- Stop Group 1 : Stop with hardware stroke limit
- Stop Group 2 : PLC Ready Signal OFF
- Stop Group 3 : External stop signal, Stop signal from PLC CPU, Error occurrence such as software limit,

Stop made when the near point DOG signal turns ON in OPR.

Logical Input selection

Set the I/O signal logic that matches the signaling specification of the connected external device. A mismatch in the signal logic will disable normal operation. Be careful of this when you change from the default value.

6.10.5.3 OPR Parameters

OPR is used to return a machine system at any position other than the OP to the OP. For normal operation of OPR, the parameters in this section will be configured properly.

IN THIS TOPIC :

OP Address

Set the address used as the reference point for positioning control. When the machine OPR is completed, the stop position address is changed to this address.

OPR Speed

Set the speed to be used in ‘ Fast OPR’ stage. This speed must be less than ‘ Speed Limit’ value and faster than the ‘ Creep speed’ .

Creep Speed

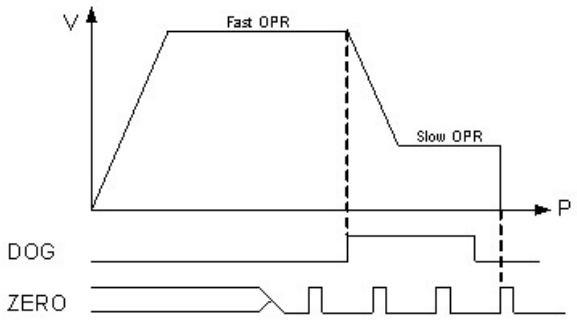
Set the speed to be used in ‘ Creep speed’ stage. This speed must be equal to or faster than the ‘ Bias

Speed' .

OPR Method

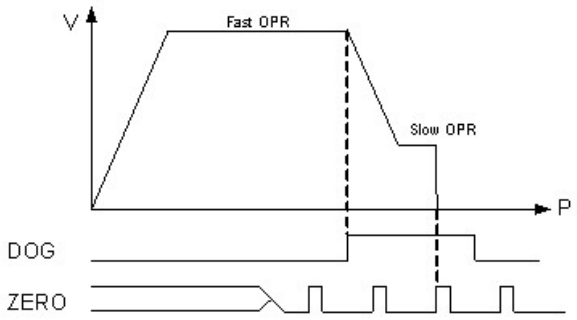
CM1-PSnnX supports 4 types of OPR.

[ZERO Detect after DOG OFF]



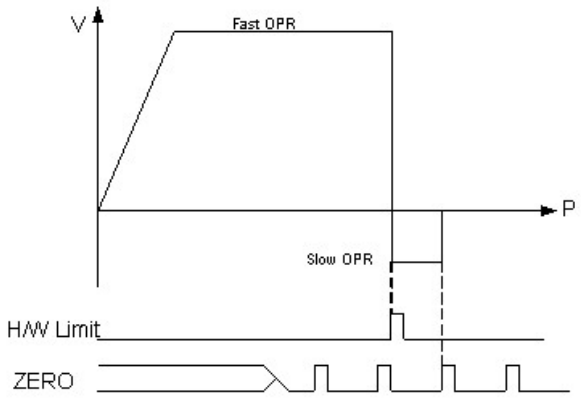
When the OPR instruction is issued, PSnnX performs a fast OPR with the designated direction in ' OPR direction' . When the DOG signal is detected as ON, PSnnX switches the speed to the ' Creep speed' . The ' Creep speed' will be continued until when the first ZERO signal detected after DOG signal OFF.

[ZERO Detect while DOG ON]



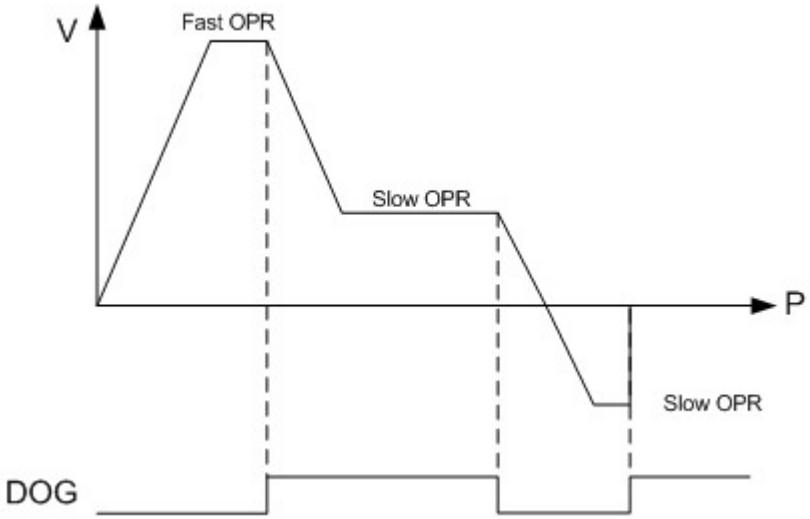
When the OPR instruction is issued, PSnnX performs a fast OPR with the designated direction in ' OPR direction' . When the DOG signal is detected as ON, PSnnX switches the speed to the ' Creep speed' . The ' Creep speed' will be continued until when the first ZERO signal detected while DOG signal is ON.

[ZERO Detect after Hardware Limit Signal]



When the OPR instruction is issued, PSnnX performs a fast OPR with the designated direction in ' OPR direction' . When one of the hardware limit signal is detected as ON, PSnnX changes the direction and move backward with Creep speed. This backward movement will be continued until when the first ZERO signal is detected.

[Only with DOG Signal]



When the OPR instruction is issued, PSnnX performs a fast OPR with the designated direction in 'OPR direction'. When the DOG signal is detected as ON, PSnnX will change the speed to 'Creep Speed'. Forward movement will be continued until when the DOG signal changes from ON to OFF. After the detection of DOG signal OFF, PSnnX will change the movement direction to backward. And this movement will be continued until the DOG signal ON again.

OPR Direction

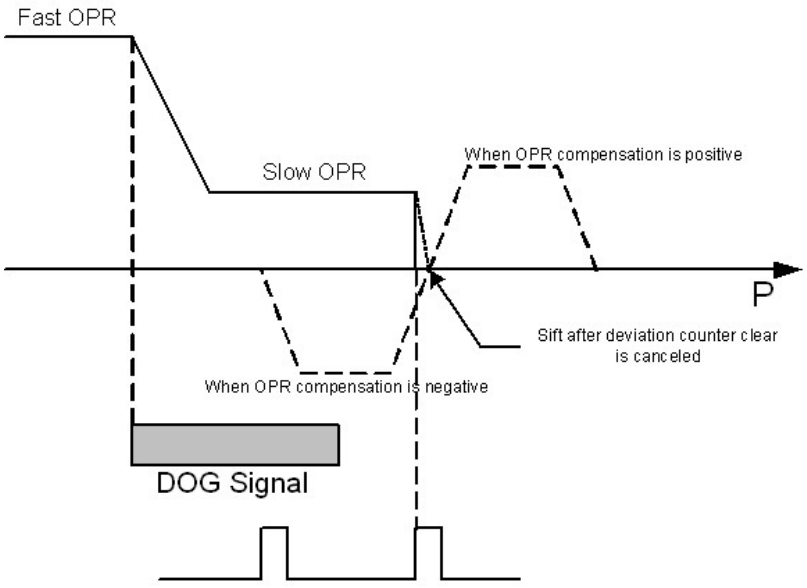
Set the direction to start movement when starting machine OPR.

OPR Dwell Time

This setting is used when the OPR movement is completed. After this time the ‘ OPR complete’ signal will be issued.

OPR Compensation

After returning to the machine OP, this function compensates the position by the designated distance from the machine OP position and sets that position as the OP address. If there is a physical limit to the OP position, such as the near-point dog installation position, use this function to compensate the OP to an optimum position.



6.10.5.4 Common Parameters

Pulse Output Logic

Set the logic of the driver pulse output.

0 : High Active

1 : Low Active

6.10.6 Position Data

What is Position Data

Position data can be defined up to 600 for each axis. Each position data stores the position address, moving method/speed/time and other information about a position control. A position data occupies 10 words of internal flash memory.

Details of Position Data

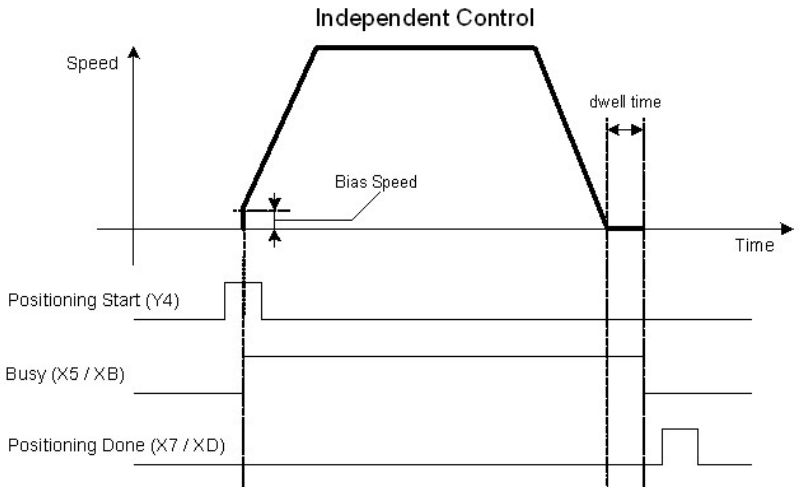
Memory Offset (Axis)				Description	Initial Value	Remark	
1	2	3	4				
500	6500	12500	18500	Control Type (bit 0 ~ 1)	00	00 : Independent 01 : Continuous	Position Data #1
				Interpolation Axes (bit 2 ~ 3)	00	0 : Not interpolation 1 : X 2 : Y	
				Acceleration Number (bit 4 ~ 5)	00	00 : Acc/Dec #1 01 : Acc/Dec #2 10 : Acc/Dec #3 11 : Acc/Dec #4	
				Deceleration Number (bit 6 ~ 7)	00		
				Control Instruction (bit 8 ~ 15)	00	01h : ABS 02h : ABS2 03h : ABS3 04h : ABS4 05h : INC 06h : INC2 07h : INC3 08h : INC4 09h : FEED 0Ah : FEED2 0Bh : FEED3 0Ch : FEED4 0Dh : ACIS 0Eh : ICIS 0Fh : ACW 10h : ICW 11h : ACCW	

						12h : ICCW 13h : FSC 14h : FSC2 15h : FSC3 16h : FSC4 17h : RSC 18h : RSC2 19h : RSC3 1Ah : RSC4 80h : NOP 81h : JUMP 82h : LOOP 83h : LEND 84h : POS	
501	6501	12501	18501	M code	0	0 ~ 65535	
502	6502	12502	18502	Dwell time	0	0 ~ 65535 mS	
503	6503	12503	18503	Reserved	0		
504	6504	12504	18504	Speed (Low word)	0	mm [x10-2mm/min] : 1~2,000,000,000 inch [x10-3inch/min] : 1~2,000,000,000 degree [x10-3deg/min] : 1~2,000,000,000 pulse [pulse/sec] : 1~1,000,000	
505	6505	12505	18505	Speed (High word)			
506	6506	12506	18506	Destination Address or Movement Amount (Low word)	0	-2,147,483,648 ~ 2,147,483,647 [x10-1 ㎛ x10-5 inch, x10-5 degree, pulse]	
507	6507	12507	18507	Destination Address or Movement Amount (High word)			
508	6508	12508	18508	Circular Interpolation Address (Low word)	0	-2,147,483,648 ~ 2,147,483,647 [x10-1 ㎛ x10-5 inch, x10-5 degree, pulse]	
509	6509	12509	18509	Circular Interpolation Address (High word)			
. . .							
6490 - 6499	12490 - 12499	18490 - 18499	24490 - 24499				Position Data #600

6.10.6.1 Control Type

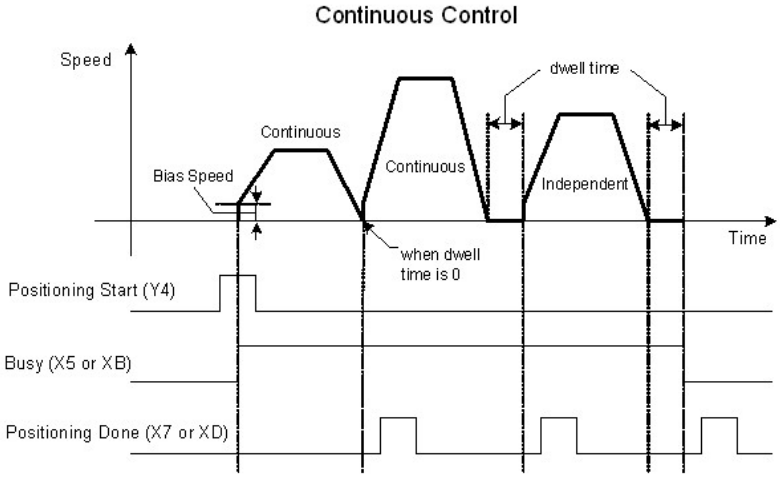
Independent

This control is set when executing only one designated data item of positioning. If a dwell time is designated, the positioning will complete after the designated time expires.
Or if this control is used at the end of positioning data list, this data becomes the end of block data when carrying out block positioning. The positioning will stop after this data.



Continuous

This control is used when a series of positioning control is needed. The last position data of this chain must be designated as independent control type to finish the positioning. The machine always automatically decelerates each time the positioning is completed. Acceleration is then carried out after the speed reaches 0 to carry out the next positioning data operation. If a dwell time is designated, the acceleration is carried out after the designated time expires. In operation by continuous positioning control, the next positioning number is automatically executed.



6.10.6.2 Interpolation Area

Set the axes that is interpolated with current axes. Current axes treated as main axes. This setting is valid only when interpolation instruction is used. If the instruction is non-interpolation type, this setting has no meaning. But when the interpolation instruction is used, this setting must designate the sub axes.

- **Not Interpolation (00) :** Use this setting on non-interpolated control.
- **X (01) :** Use this setting when the Y axis is the main axis and the X axis is sub-axis.
- **Y (10) :** Use this setting when the Y axis is the main axis and the X axis is sub-axis.

6.10.6.3 Acceleration/Deceleration Number

Designate the number of acceleration/deceleration time in basic parameter to be applied.

6.10.6.4 Control Instruction

Control Instruction :

- ABS
- INC
- FEED
- ACIS (absolute address) / ICIS (incremental address)
- ACW (absolute address) / ICW (incremental address)
- ACCW (absolute address) / ICCW (incremental address)
- FSC (forward) / RSC (reverse)
- NOP
- JUMP
- LOOP / LEND
- POS

ABS

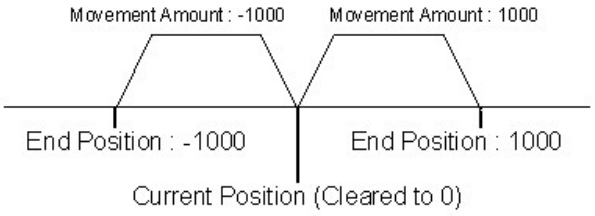
Positioning is carried out from the current stop position to the designated address. The destination positioning address must be absolute address.
All the addresses are based on the address established by machine OPR. The moving direction is decided automatically by comparing the current and the destination position address.

INC

Positioning is carried out from the current stop position by the designated amount of movement. The direction is determined by the sign of the movement amount. If the movement amount is negative value, the direction will be reverse. All the addresses are based on the address established by machine OPR.

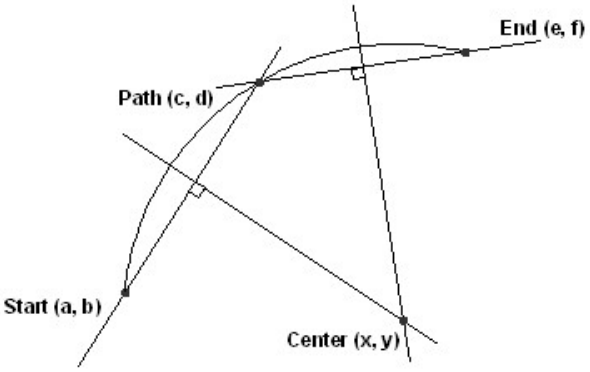
FEED

The address of the current stop position (start point address) is set to ‘ 0’ . Positioning is then carried out to a position designated by movement amount.



ACIS (absolute address) / ICIS (incremental address)

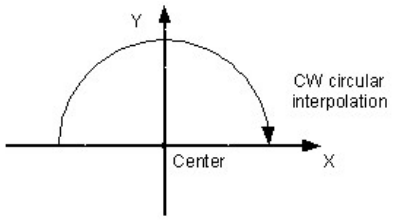
One of the circular interpolation instruction. This instruction needs a point which is located in the path of movement.



For using this circular interpolation instruction, the path point must be defined in ‘ Circular Interpolation Address’ field. The resulting control path is an arc having as its center the intersection point of perpendicular bisectors of a straight line between the start point address and sub point address, and a straight line between the sub point address and end point address.

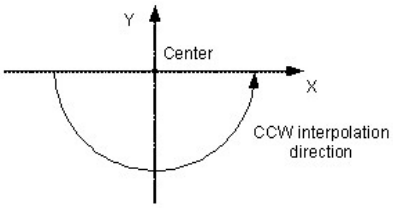
ACW (absolute address) / ICW (incremental address)

This instruction is a kind of circular interpolation, and two motors are used to carry out position control in an arc path having a designated center point, while carrying out interpolation for the direction of clock-wise. The center point must be designated in ‘ Circular Interpolation Address’ field.



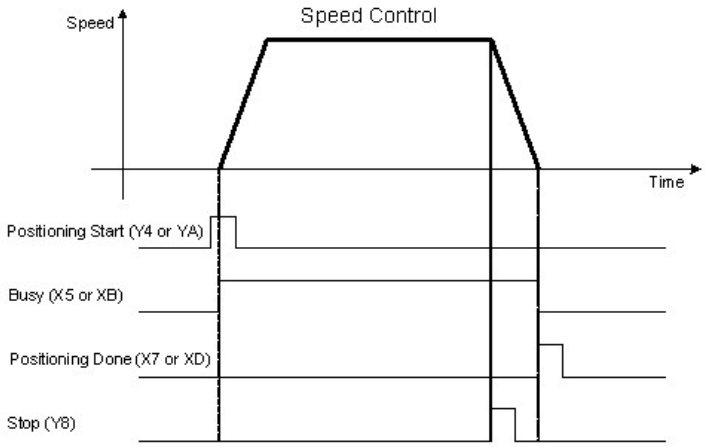
ACCW (absolute address) / ICCW (incremental address)

This instruction is a kind of circular interpolation, and two motors are used to carry out position control in an arc path having a designated center point, while carrying out interpolation for the direction of counter-clockwise. The center point must be designated in ‘ Circular Interpolation Address’ field.



FSC (forward) / RSC (reverse)

This instruction controls the speed. After issuing of this instruction, PSnnX outputs pulse with designated speed until axis stop signal from Y8 or YE. The speed must be designated in the ‘ Speed’ field. During the speed control, current address value update is dependent on the setting of ‘ Current feed value during speed control’ in extended parameter.



NOP

No operation.

JUMP

This instruction is used to change the next positioning data to execute. In continuous control the next number of position data is automatically executed. But, this instruction changes the next position data to execute. The number of position data must be designated in ‘ dwell time’ field.

LOOP / LEND

This instruction is used to execute position data repeatedly. Position data between LOOP and LEND are executed repeatedly for designated times in ‘ M code’ field.

POS

This instruction is used to change the current position address to the designated address in ‘ Destination Address’ field. The machine position address does not affected by this instruction.

6.10.6.5 M Code

Set this item when carrying out sub work (clamp and drill stops, tool replacement, etc.) corresponding to the code number related to the positioning data execution. X8 or XF point is turned ON depending on the configuration of expended parameter ‘ M code ON timing’ . There are two modes for M code ON. During the M code is ON, the next positioning data is not executed. M code can be cleared by sequence program in PLC CPU.

6.10.6.6 Dwewll Time

Set the time the machine dwells after the positioning stop to the output of the positioning done signal.

6.10.6.7 Speed

Set the speed for speed control function.

6.10.6.8 Destination Address / Movement Amount

Set the destination position address (absolute) or movement amount (incremental). In speed control instruction, this setting is ignored.

6.10.6.9 Circular Interpolation Address

Set the path point address or center point address for circular interpolation. This setting is effective only in circular interpolation functions.

6.10.7 Dedicated Instructions for Positioning

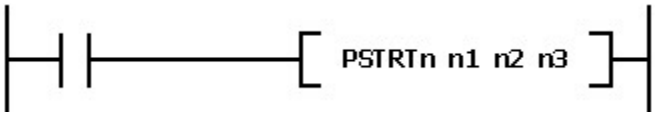
Dedicated Instructions for Positioning :

- PSTRT1 , PSTRT2

- PFWRT
- PINIT
- POSCTRL

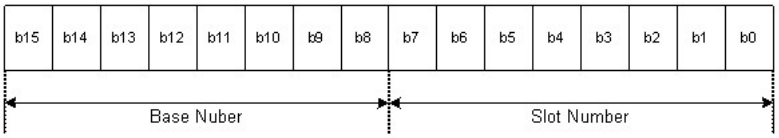
6.10.7.1 PSTRT1, PSTRT2

This instruction starts the positioning control of the designated axis of the PSnnX.



n1 : Base and slot number

This parameter specifies which module the instruction to be issued.



- High Byte : Base Number (00h ~ 10h, 00h : local base)
- Low Byte : Slot Number (00h ~ 0Bh)

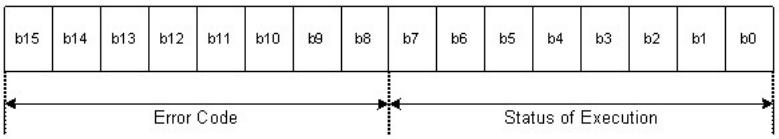
n2 : Number of position data

n2 parameter specifies the position number to be executed. The position data specified by this number must be stored in flash memory of PSnnX.

- 1~600 : Position data number
- 9001 : Machine OPR
- 9002 : Fast OPR
- 9003 : Change the current position address
- 9004 : Multiple axis simultaneous start

n3 : Device memory where the result flags to be stored

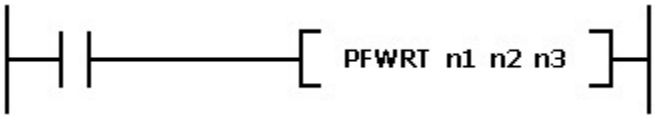
The device memory must be a word. M, L, K, D area can be used with this instruction. After issuing the instruction, the result of execution is stored in this memory as following :



- High Byte : Error code will be stored
- Low Byte : Flags representing execution status are stored.
  a. Bit 0 : Processing the instruction.
  b. Bit 1 : The execution of the instruction is completed.
  c. Bit 2 : Error on execution of the instruction (this flag is set with bit 1)
  d. Bit 3~7 : Reserved

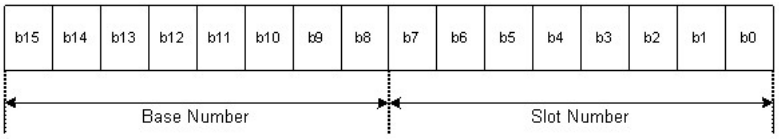
6.10.7.2 PFWRT

This instruction is used to write the PSnnX parameters, positioning data and block data to the flash memory. The flash memory of PSnnX can be rewritten up to 100,000 times. But, PSnnX limits this to 25 times after every power ON. This limitation is for the purpose of protecting the flash memory damage from sequence program mistake.



n1 : Base and slot number

This parameter specifies which module the instruction to be issued.



- High Byte : Base Number (00h ~ 10h, 00h : local base)
- Low Byte : Slot Number (00h ~ 0Bh)

n2 : Data type to be stored

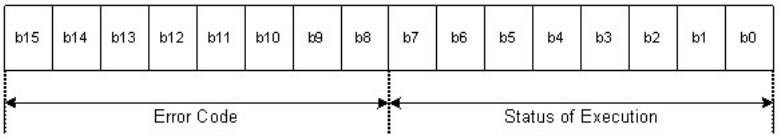
Use one of following codes according to the data type to store

- 0 : All data (parameters, position data)

- 1 : Parameters
- 2 : Position Data

n3 : Device memory where the result flags to be stored

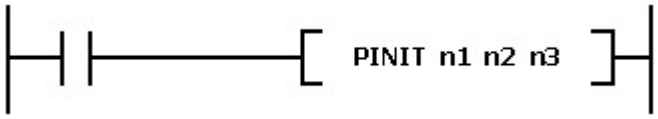
The device memory must be a word. M, L, K, D area can be used with this instruction. After issuing the instruction, the result of execution is stored in this memory as following :



- High Byte : Error code will be stored
- Low Byte : Flags representing execution status are stored.
  a. Bit 0 : Processing the instruction.
  b. Bit 1 : The execution of the instruction is completed.
  c. Bit 2 : Error on execution of the instruction (this flag is set with bit 1)
  d. Bit 3~7 : Reserved

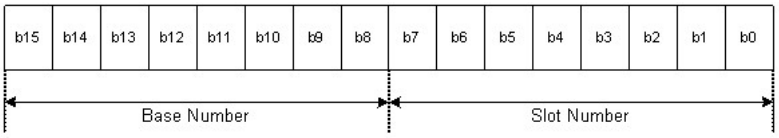
6.10.7.3 PINIT

This instruction is used to initialize the setting data to the factory default. After issuing this instruction, all data in flash memory is cleared to the default.



n1 : Base and slot number

This parameter specifies which module the instruction to be issued.



- High Byte : Base Number (00h ~ 10h, 00h : local base)

- Low Byte : Slot Number (00h ~ 0Bh)

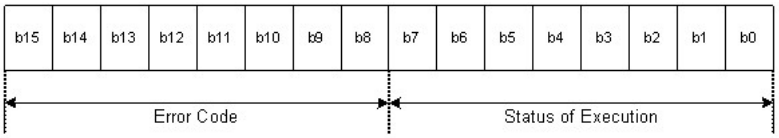
n2 : Data type to be initialized

Use one of following codes according to the data type to initialize

- 0 : All data (parameters, position data)
- 1 : Parameters
- 2 : Position Data

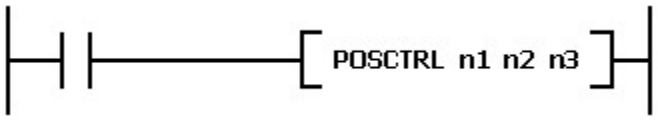
n3 : Device memory where the result flags to be stored

The device memory must be a word. M, L, K, D area can be used with this instruction. After issuing the instruction, the result of execution is stored in this memory as following format.



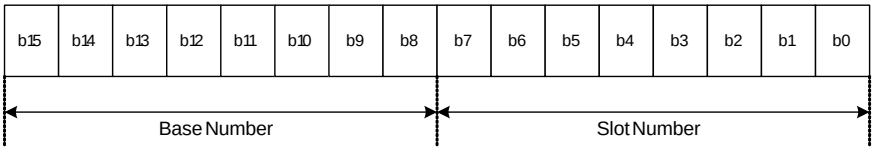
- High Byte : Error code will be stored
- Low Byte : Flags representing execution status are stored.
  a. Bit 0 : Processing the instruction.
  b. Bit 1 : The execution of the instruction is completed.
  c. Bit 2 : Error on execution of the instruction (this flag is set with bit 1)
  d. Bit 3~7 : Reserved

6.10.7.4 POSCTRL



n1 : Base and slot number

This parameter specifies which module the instruction to be issued.



High Byte : Base Number (00h ~ 10h, 00h : local base)
Low Byte : Slot Number (00h ~ 0Bh)

n2 : Control Data

This must be designated with a block of word device. M, L, K, D area can be used as this block. The designated device is the first device memory of 12 or 4 words sized continuous memory block. The precise data for control are stored in this memory block.
A control code is included in this memory block. According to this control code, two different sized memory blocks are used. One is 4 words and the other is 12 words sized block. The 4 words sized block is used at 3 simple controls such as changing position address or speed. The 12 words sized block is used for more complicated control. Following tables show the structures of these two differently sized blocks.

(N2)	Axis Number
(N2+1)	Control Code
(N2+2)	Control Data (Low Word)
(N2+3)	Control Data (High Word)

When the 'Control Code' is other values than 10

(N2)	Axis Number
(N2+1)	Control Code (10)
(N2+2)	Control Command
(N2+3)	M Code
(N2+4)	Dwell Time
(N2+5)	Reserved (0)
(N2+6)	Speed (Low Word)
(N2+7)	Speed (High Word)
(N2+8)	Destination Address (Low)
(N2+9)	Destination Address (High)
(N2+10)	Circular Interpolation Data (Low)
(N2+11)	Circular Interpolation Data (High)

When the 'Control Code' is 10 (Positioning Data)

Axis Number (N2)

Assign the number of axes to control.

- 1 : Axis 1
- 2 : Axis 2

Control Code (N2+1)

Assign one of following codes.

- 1 : Change the current position address. 2 more words must be followed for new position address.
- 2 : Change the current speed. 2 more words must be followed for new speed.
- 6 : Change the destination position address. 2 more words must be followed for new destination position address.
- 9 : Clear the error code. 2 more words must be followed. Each word must be set as 1 and 0.
- 10 : Issue a control by position data. 10 more words must be followed for position data.

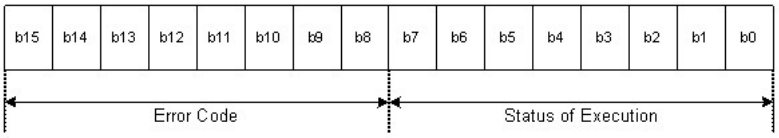
Control Data ([N2+2] ~ [N2+11])

According to the control code, 2 or 10 more words are needed. The detail information of these words are explained as below.

- Control Code 1 : New position address (2 words)
- Control Code 2 : New speed (2 words)
- Control Code 6 : New destination position address (2 words)
- Control Code 9 : The first word must be set as 1 and the second word as 0 (2 words)
- Control Code 10 : 10 more words follow. These words have the same format as position data. The detail information of the position data are described in former section. Refer to that section.

n3 : Device memory where the result flags to be stored

The device memory must be a word. M, L, K, D area can be used with this instruction. After issuing the instruction, the result of execution is stored in this memory as following format.



- High Byte : Error code will be stored
- Low Byte : Flags representing execution status are stored.
  a. Bit 0 : Processing the instruction.
  b. Bit 1 : The execution of the instruction is completed.
  c. Bit 2 : Error on execution of the instruction (this flag is set with bit 1)
  d. Bit 3~7 : Reserved

6.10.8 CICON-The configuration Tool

"CICON" :

- Provides convenient interface to edit program easily.
- Supports link function of various types by using CPU Loader, RS232C/422/485 and Ethernet.
- Enables to diagnose program errors and system by using debug functions easily.

CICON - The configuration Tool :

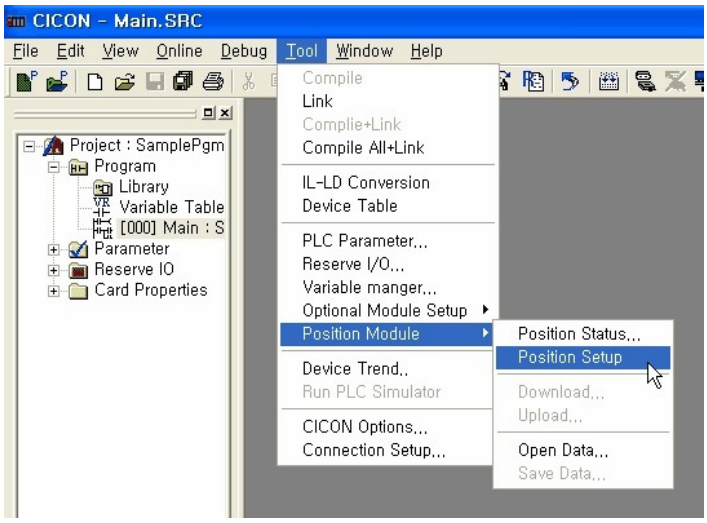
- Open / Create a Configuration Data
- Save a Configuration Data
- Parameter Configuration
- Position data configuration
- Upload from module
- Download module

6.10.8.1 Open / Create a Configuration Data

Create a new configuration data

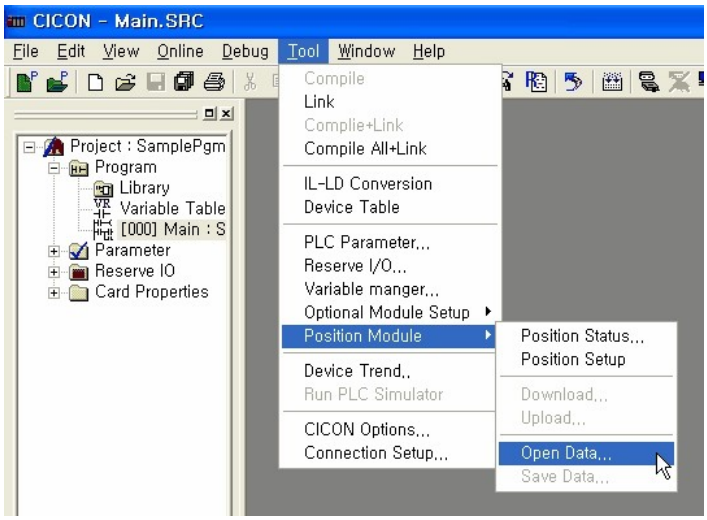
Select the menu ' Tool' - ' Position Module' – ' Position Setup'

A new window will be created and all the configuration can be performed on this window.



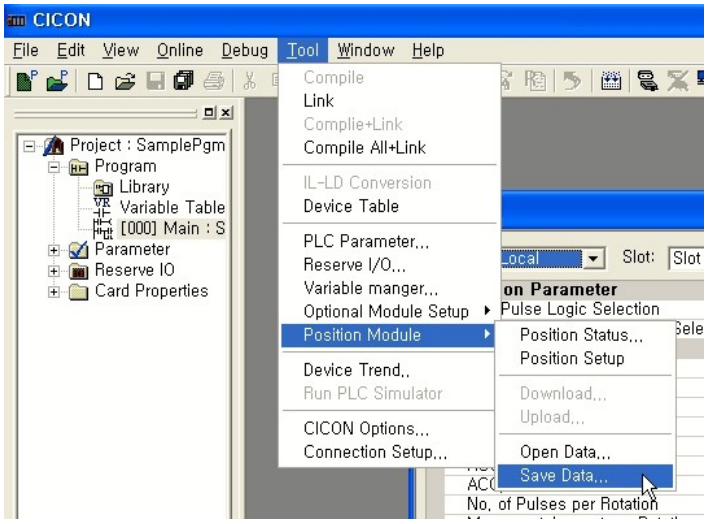
Open a configuration file

The configuration data of position module can be stored as a file. To open the configuration file, select the menu as ‘ Tool’ –‘ Position Module’ –‘ Open Data’ .



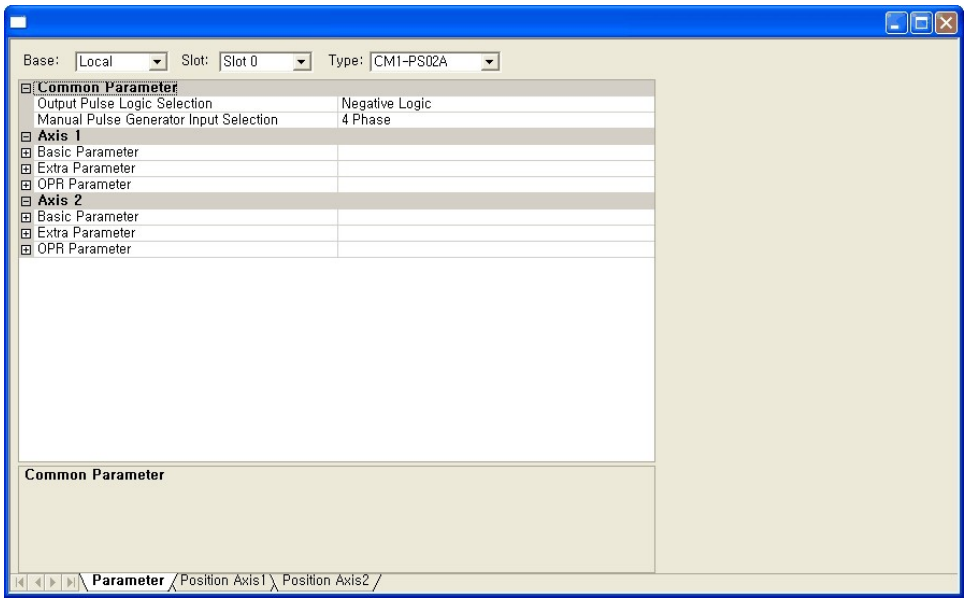
6.10.8.2 Save a Configuration Data

The configuration data can be stored as a file. To save the configuration data, select the menu as ‘ Tool’ – ‘ Position Module’ –‘ Save Data’ .



6.10.8.3 Parameter Configuration

The configuration window has three tab-windows. All parameters can be configured in ‘ Parameter’ tab.



After the configuration, the data can be downloaded to the position module or stored in a file. Use the menu ‘ Tool’ –‘ Position Module’ –‘ Download’ to download the configuration.

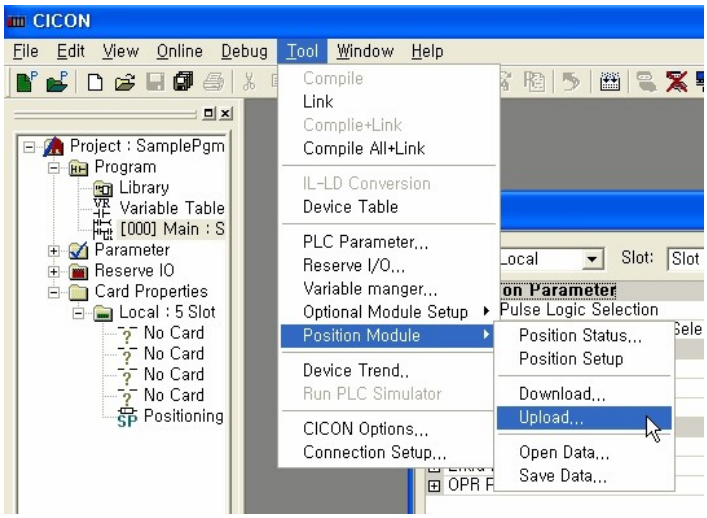
6.10.8.4 Position data configuration

Position data for each axis can be configured at ‘ Position Axis1’ and ‘ Position Axis2’ tab.

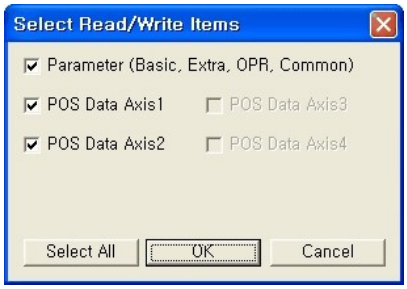
POS Data No.	Operation Pattern	Axis to be Interpolated	ACC Time No.	DEC Time No.	Control System	M code	Dwell time (msec)	Command Speed	Positioning Address	Arc Address	Description
1											
2											
3											
4											
5											
6											
7											
8											
9											
10											
11											
12											
13											
14											
15											

6.10.8.5 Upload from module

All configuration data can be uploaded from the PSnnX module. Use the menu ‘ Tool’ –‘ Position Module’ –‘ Upload’ . For this operation, CICON must be in on-line status with PLC.

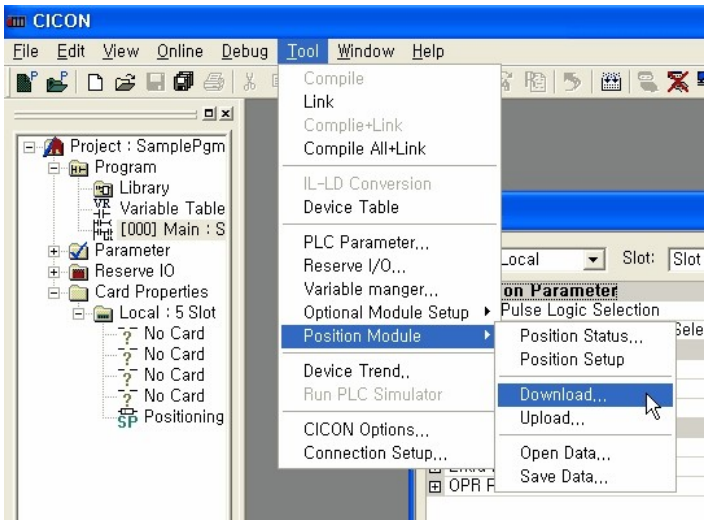


When the upload menu is activated, following dialog box quires about the type of configuration data to be uploaded. Some of configuration data can be skipped to upload by un-checking the item.

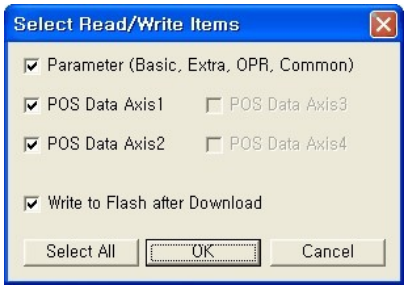


6.10.8.6 Download module

All configuration data in configuration window can be downloaded to the PSnnX module. Use the menu ‘ Tool’ – ‘ Position Module’ – ‘ Download’ . For this operation, CICON must be in on-line status.



When the download menu is activated, following dialog box quires about the type of configuration data to be downloaded. Some of configuration data can be skipped to download by un-checking the item.



Check the ' Write to flash memory after download' item to save the configuration data in flash memory of PSnnX. If the data is downloaded without checking this item, the data is stored in RAM only. In that case, all the configuration data will be returned to the original data stored in flash memory after power off and on. It is useful when a number of trials are needed without affecting original configuration data.

6.10.9 Programming Examples

Variable Name	Device
Axis1_Err_Rst	X10
Axis1_For_InchingCmd	X11
Axis1_Rev_InchingCmd	X12
Axis1_ForwardJOG_Cmd	X13
Axis1_ReverseJOG_Cmd	X14
Axis1_OPR_Cmd	X15
Axis1_PosSingle_Cmd	X16
Axis1_PosCont_Cmd	X17
Axis1_Stop_Cmd	X18
Axis1_Restart_Cmd	X19
Axis1_Spd_Chg_Cmd	X1A
Axis1_ForSpdCtrl_Cmd	X1B
Axis1_RevSpdCtrl_Cmd	X1C
Axis1_PosWithMCode	X1D
Axis1_MCodeOff_Req	X1E
Axis1_POSCTRL_Cmd	X1F

The example program in this section assumes that the PLC is equipped with " CPU + PSnnX + XD16A + YR16A" . All input signals are defined as variables as Left :

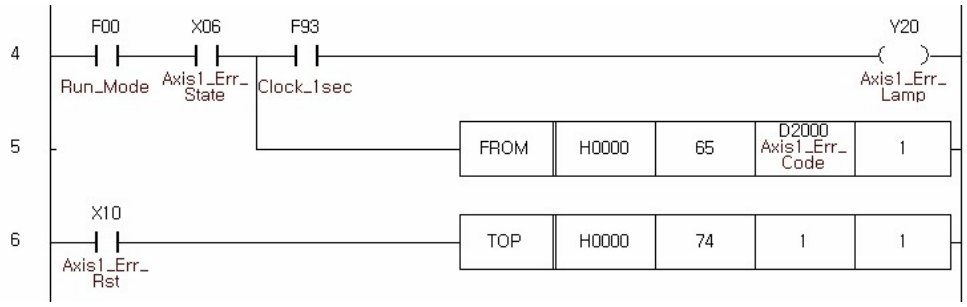
Contents :

6.10.9.1 Making the Module ready

First of all, for proper operation of PSnnX module, the PLC CPU Ready (Y0) signal must be turned ON. After the PSnnX module detects this signal, the module ready signal (X0) of PSnnX is turned ON.

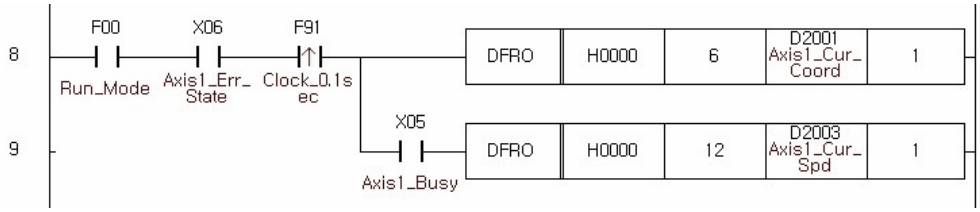
6.10.9.2 Reading the error code and reset

When there is a error in PSnnX module, the error code must be reset for further operation. Following sample program shows how to read the error code and reset it.



6.10.9.3 Reading the current position address

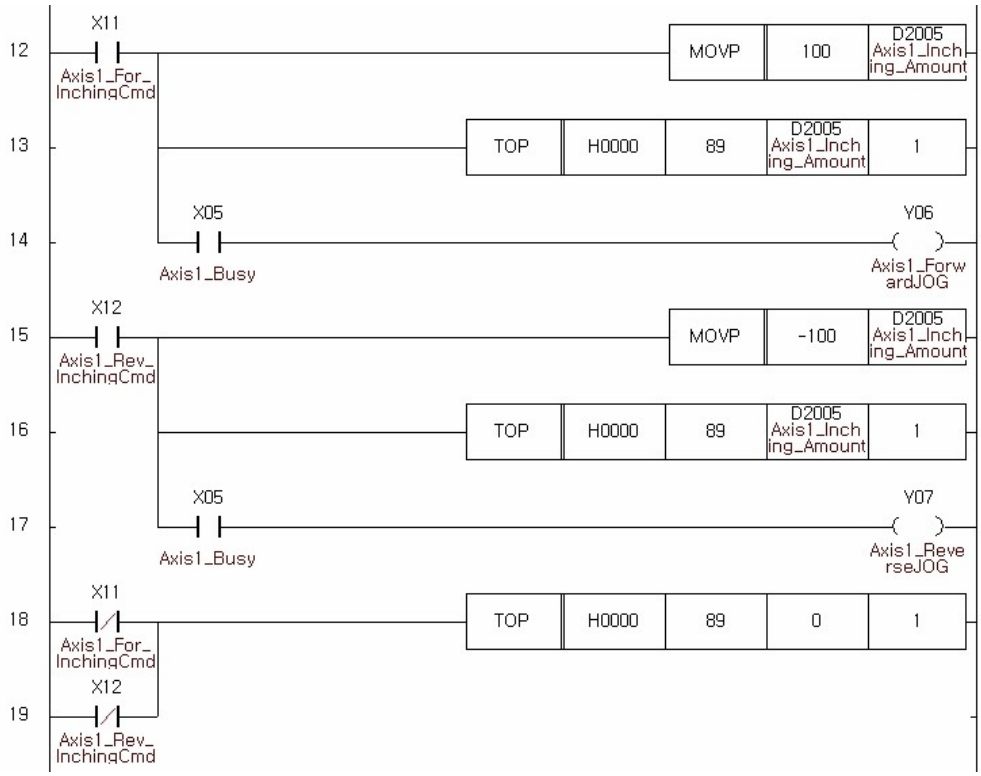
Following example shows how to read the current position address and speed from the monitor data area of PSnnX.



6.10.9.4 Inching/JOG

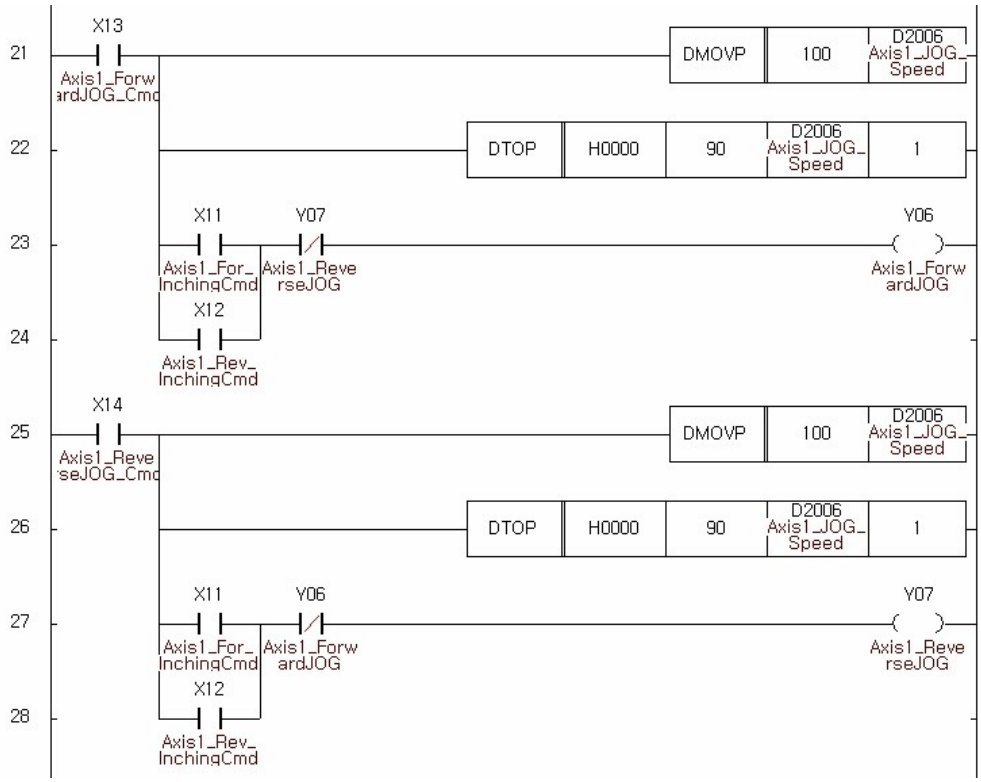
Inching

Following example shows how to set the inching operation. The inching movement amount must be set before JOG output. The movement amount must be cleared to zero when the inching operation does not needed.



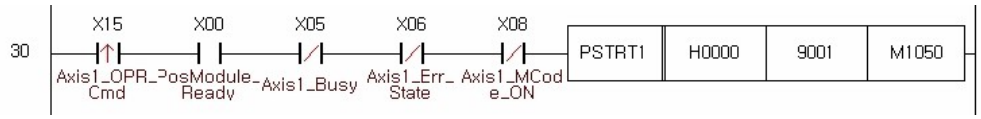
JOG

Following example shows hot to set the JOG operation. JOG speed must be set and the inching movement amount must be cleared to zero before the JOG output. Notice that if the movement amount is not zero, the JOG output performs the inching operation regardless of JOG speed setting.



6.10.9.5 OPR

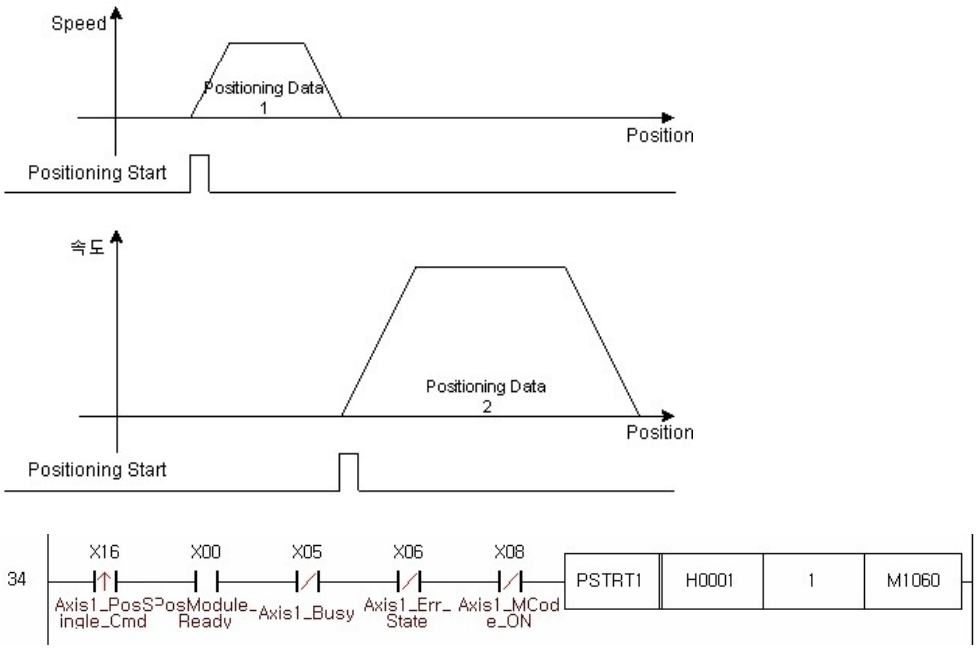
Following example shows how to issue the OPR. This example uses the PSTRT1 instruction for OPR. Ensure that the OPR parameters are configured properly before running this example program.



6.10.9.6 Issuing the control with position data

This example performs the positioning with PSTRT1 instruction. PSTRT1 instruction needs the number of position data. The number can be a range of 1 to 600. This example assumes that a position data is configured on No. 1 as following figure.

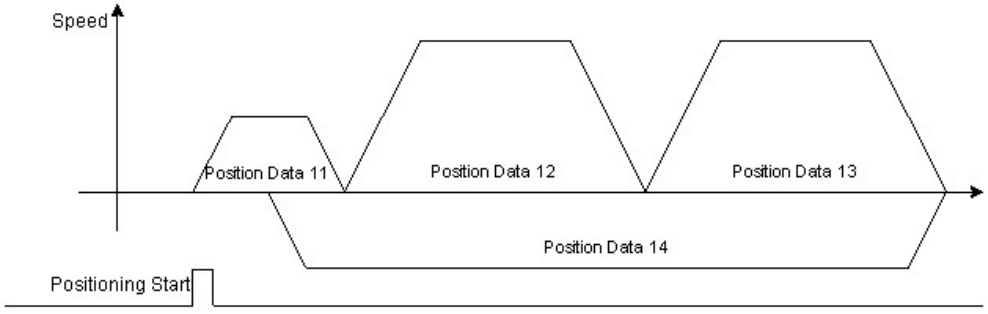
POS Data No.	Operation Pattern	Axis to be Interpolated	ACC Time No.	DEC Time No.	Control System	M code	Dwell time (msec)	Command Speed	Positioning Address	Arc Address
1	POS STOP	No Interpol...	No.1	No.1	ABS	0	0	500	1000	
2	POS STOP	No Interpol...	No.1	No.1	ABS	0	0	1000	3000	



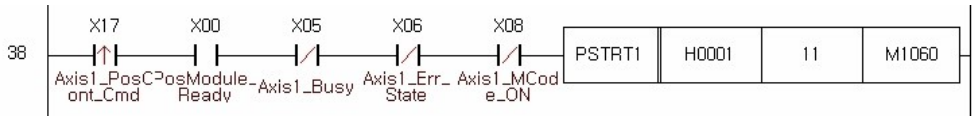
6.10.9.7 Continuous positioning with position data list

This example shows the continuous positioning with multiple position data. A PSTRT1 instruction is used for that operation. This example assumes that the position data is defined as following figure.

POS Data No.	Operation Pattern	Axis to be Interpolated	ACC Time No.	DEC Time No.	Control System	M code	Dwell time (msec)	Command Speed	Positioning Address	Arc Address
11	POS CON	No Interpol...	No.1	No.1	ABS	0	0	500	1000	
12	POS CON	No Interpol...	No.1	No.1	ABS	0	0	1000	3000	
13	POS CON	No Interpol...	No.1	No.1	ABS	0	0	1000	5000	
14	POS STOP	No Interpol...	No.1	No.1	ABS	0	0	500	500	



With only one PSTRT1 instruction, all the above position data are executed automatically. Notice that the control type of leading three position data is configured as continuous and the last one is configured as independent type.

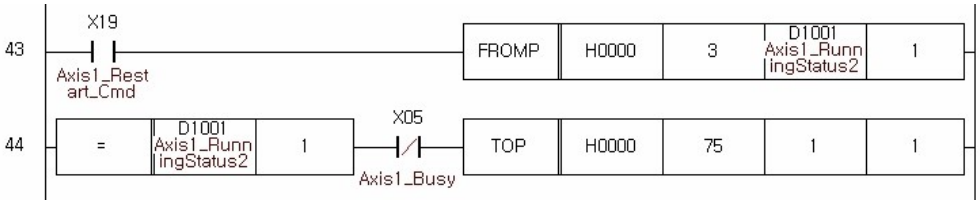


6.10.9.8 Positioning Stop

During the positioning operation, sequence program can issue a forced stop.

6.10.9.9 Resume Positioning

Resume operation is able to issue only when the module is in stopped state. The current state of module can be known from ‘ running status 2’ of monitor data. This example uses TO/TOP instruction. This instruction writes 1 to the ‘ Resume Request’ of control data area for resume operation. Notice that the resume operation cannot be used when the state of module is standby state.

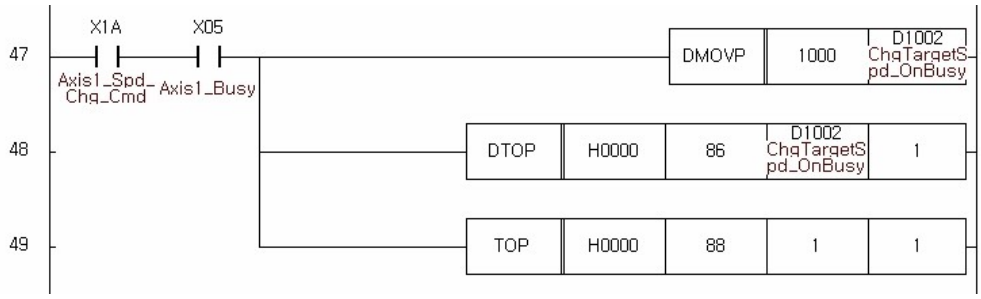


6.10.9.10 Speed Changing

There is two different way to change the current speed of positioning. The choice is dependent on user’ s favorite.

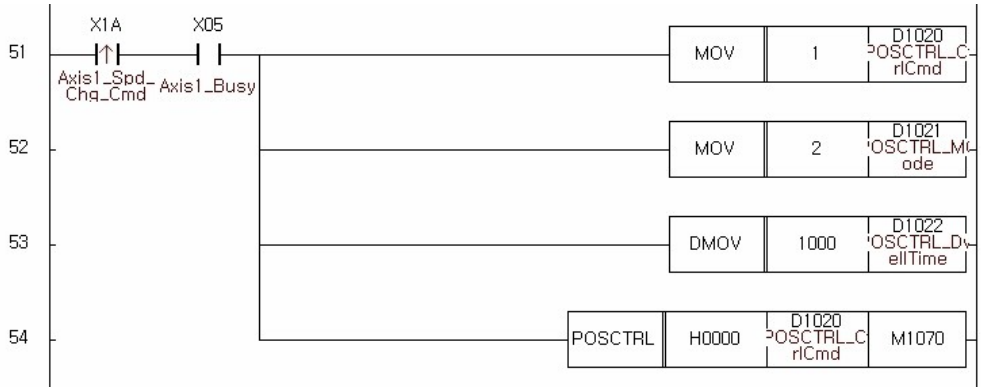
By setting the control data area

Set the ‘ New speed’ and ‘ Speed change request’ fields of PSnnX’ s control data memory. The new speed must be written to the ‘ New speed’ field, and then set the ‘ Speed change request’ field as following example program.



By dedicated instruction

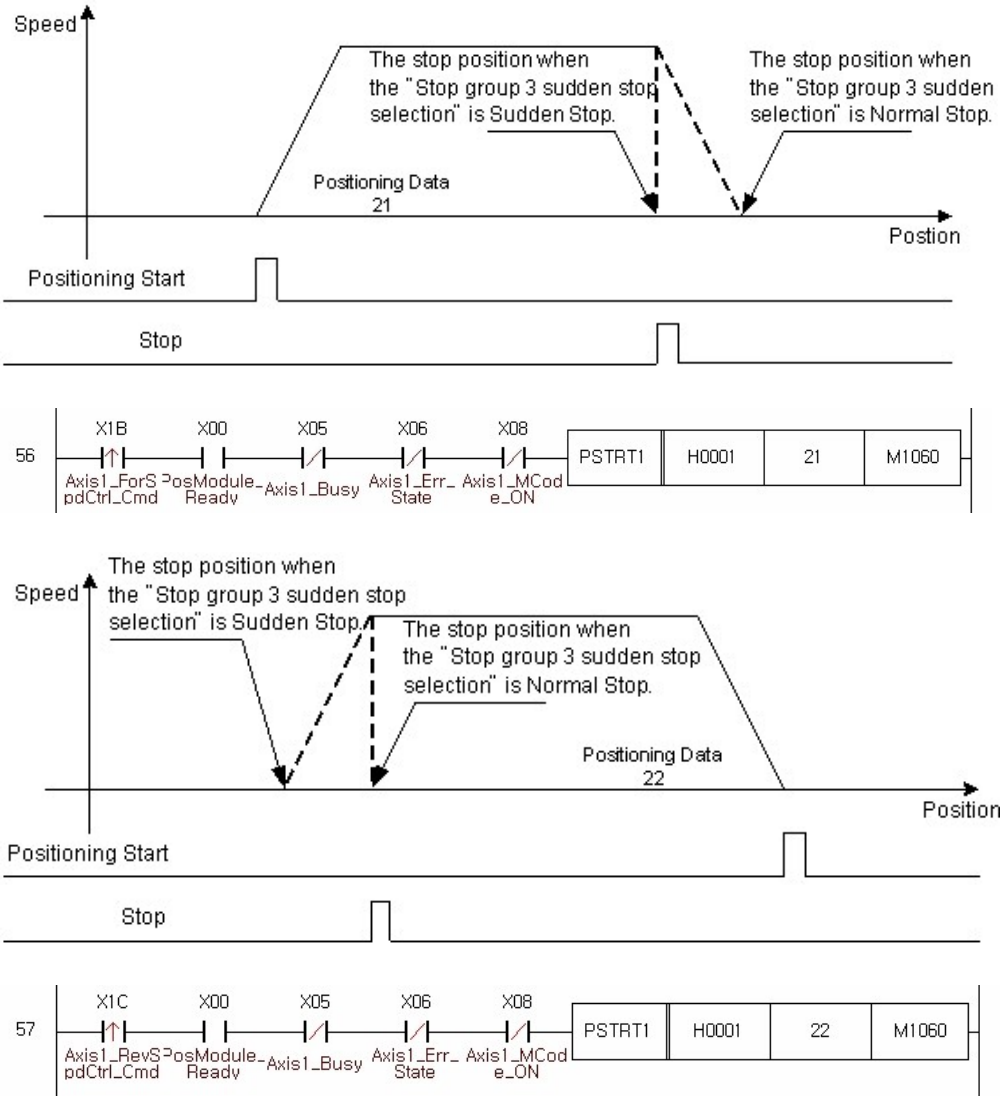
Use the POSCTRL instruction. POSCTRL instruction needs 4 words sized memory which is storing the control code and it' s parameters are designated. For speed change control, use control code 2 as following example.



6.10.9.11 Speed Control

The instruction PSTRT1 can be used for speed control. The position data must be configured in advance. For terminating speed control ' Positioning Stop' signal is used. This is presented at previous example.
Following shows two speed control examples. Each position data was defined as number of 20 and 21. Each speed control will output pulse continuously until the positioning stop signal input.
Notice that the way of stop at stop signal is according to the setting of ' Stop Group 3 Sudden stop selection' . It can be a normal deceleration stop or sudden stop.

POS Data No.	Operation Pattern	Axis to be Interpolated	ACC Time No.	DEC Time No.	Control System	M code	Dwell time (msec)	Command Speed	Positioning Address	Arc Address
21	POS STOP	No Interpol...	No.1	No.1	FSC	0	0	2000		
22	POS STOP	No Interpol...	No.1	No.1	FSC	0	0	2000		



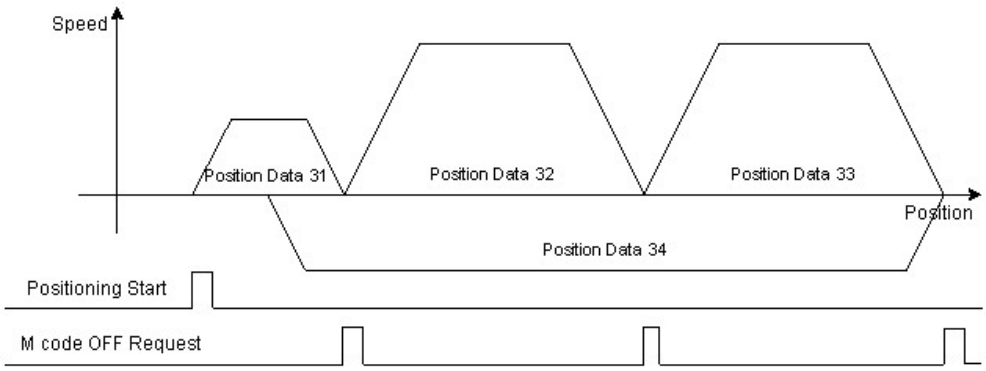
6.10.9.12 Positioning with M Code

This example shows how to use M code in positioning control. Assume following four position data of 31 to 34.

POS Data No.	Operation Pattern	Axis to be Interpolated	ACC Time No.	DEC Time No.	Control System	M code	Dwell time (msec)	Command Speed	Positioning Address	Arc Address
31	POS CON	No Interpol...	No.1	No.1	ABS	1	0	500	1000	
32	POS CON	No Interpol...	No.1	No.1	ABS	2	0	1000	3000	
33	POS CON	No Interpol...	No.1	No.1	ABS	3	0	1000	5000	
34	POS STOP	No Interpol...	No.1	No.1	ABS	4	0	500	500	

The above position data is configured as 4 steps continuous position. Assume that the M code ON timing is ' After' mode. It that case, the M code will be issued at the end of each positioning, and the next positioning will not be started until the M code is cleared. The M code OFF request control must be issued for clearing M code.

Following chart shows that the entire positioning path with proper M code clear request.

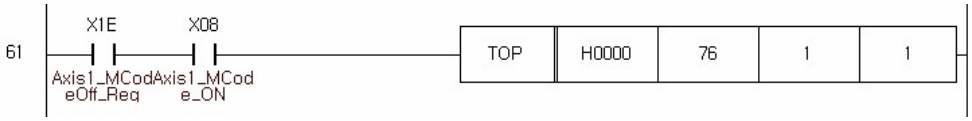


The M code ON state can be read by X8 point of PSnnX module. The continuous positioning control needs only one positioning start signal for the first position data. The other position data are started automatically after M code clear. The following figure shows the start of positioning.

Positioning start

M code Clear

If M code is designated non-zero value, the M code signal is turned on at each positioning control according to the configuration of ' M code ON timing' . The next position data can be started after the preceding M code signal is cleared. For clearing the M code signal ' M code clear request' control must be issued. Following figure shows the example of the clearing the M code signal.

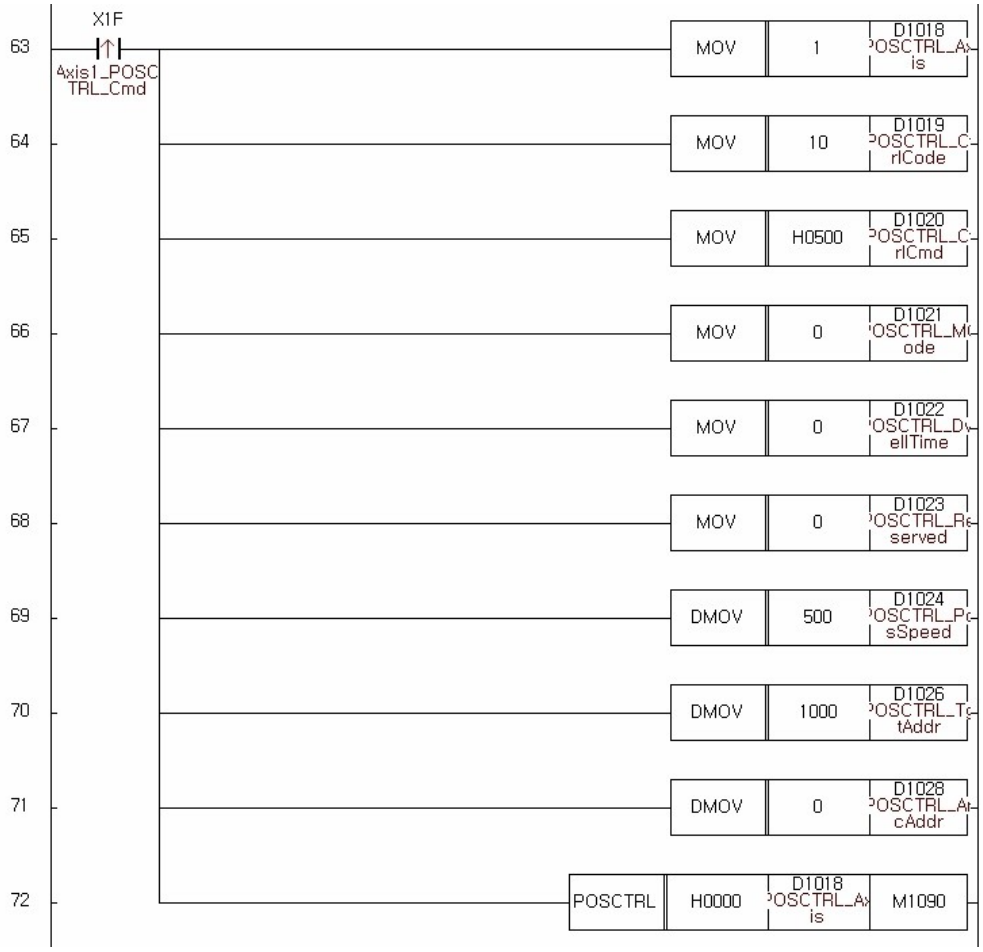


6.10.9.13 Positioning control without position data

All previous examples use the position data for positioning control. The position data was defined in table and the number of position data in table is used in control instructions.

This example shows how to issue a positioning control without position data. The POSCTRL instruction is used.

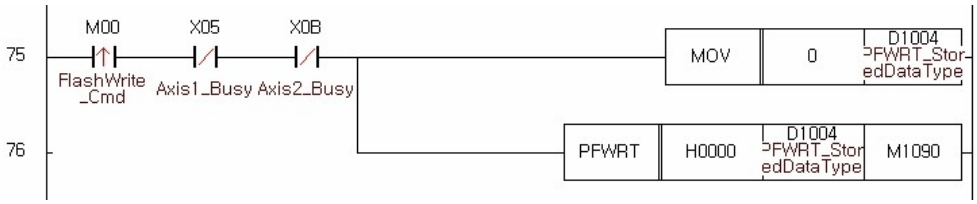
The precise explanation of POSCTRL instruction was described in previous section. This example performs the same positioning control that was used in section "Issuing the control with position data list". Following figure shows the program.



6.10.9.14 Flash Write

This example shows how to store the parameter and position data to the flash memory of PSnnX module. The PFWRT instruction is used. This instruction requires a code which defines the memory type to be stored. There are two kinds of data which can be stored. One is the parameter and the other is position data table. One or all of them can be selectively stored to flash memory. More detailed information about that was described in previous section.

The data stored in flash memory are retained until the next power off and on. PSnnX module limits the number of repeated writing at each power on. It is limited to 25 times. This limitation is settled for protecting the flash memory from the sequence program mistake.



6.10.10 Trouble Shooting

- Error and Warn
- Error Code Details
- Warning Code Details

6.10.10.1 Error and Warn

If PSnnX module has an error, it cannot perform any kind of operation until the error is cleared. But the warn state does not put any restriction on the operation of PSnnX. The error state is visualized by LED.
For clearing the error, the error code must be verified and the trouble source that caused the error must be removed. For clearing the error code of PSnnX, refer to the section "Reading the error code and reset" .

Error on the parameter configuration

PSnnX module checks the parameter when the PLC Ready signal is turned on. If any kinds of error is found such as configuration range overflow, the error will be issued.

Error on the instruction issuing

Error can be occurred when issue the control of positioning, JOG, Inching. Check the related configurations of parameter or the signal from the mechanical part.

Error Classifications

Error Code Range	Description
001 ~ 009	Fatal error
100 ~ 199	Common error
200 ~ 299	Errors on OPR
300 ~ 399	Errors on JOG, Inching
500 ~ 599	Errors on positioning control
800 ~ 899	Errors on external signal interface
900 ~ 999	Errors on parameter configuration

Warnings

The warnings can be issued when invalid set value is found on the control data and position data area. The warning code is cleared by the same method used in error code clearing.

Warning Classifications

Warning Code Range	Description
100 ~ 199	Common Warning
300 ~ 399	Warning on JOG operation
400 ~ 499	Warning on MPG operation
500 ~ 599	Warning on Positioning control

6.10.10.2 Error Code Details

Class	Code	Error Name	Description
-	0	No Error	Normal status
Fatal	1	DPRAM Initialize Error	Troubles in shared memory Check with the CPU module
	2	DPRAM Access Error	
	3	CPU Not Found	
Common	RES	-	
	101	PLC READY OFF	PLC Ready signal (Y0) is turned OFF Turn on the Y0 signal by sequence program or CICON
	102	DRIVER READY OFF	No ready signal from motor driver. Check the cable and the driver.
	RES	-	
	104	Hardware Upper Limit	Hardware limit signal is detected.
	105	Hardware Lower Limit	
	RES	-	
	154	Software stroke limit upper limit	Software limit is detected.
	155	Software stroke limit lower limit	
	RES	-	
OPR	RES	-	
	203	No DOG Signal	DOG signal is not detected during OPR operation. Check the wiring.
	RES	-	
	207	OPR Required	OP is un-known when the OPR operation is issued.

	RES	-	
Manual Operation	300	MPG Error	Check the parameter for JOG, Inching or MPG Operation
	RES	-	
Positioning	RES	-	
	503	Invalid Speed	When the speed is not designated or designated as invalid value
	RES	-	
	516	Path Control Error	Invalid position data for path control.
	RES	-	
	519	Interpolation Axis Busy	The axis for interpolation is busy. Check the timing of the positioning data
	RES	-	
	521	Invalid Interpolation Axis	Not supported axis was assigned as a interpolation
	RES	-	
	525	Invalid Path Point	Designated path point is invalid for circular interpolation
	526	Invalid End Point	Designated end point is invalid for circular interpolation
	RES	-	
	536	Positioning started during M CODE ON	M code by previous positioning control must be cleared.
	537	CPU READY OFF	CPU READY signal (Y0) is not turned on. Check the sequence program
	538	Module READY OFF	Module READY signal (X0) is not turned ON
	RES	-	
	543	Invalid Position Number	Check the position number. Valid range : 1~600, 7000~7004, 9001~9004
	544	Invalid Angle	When the unit is ‘ degree’ , the range must be in 0~359.9999
	545	Invalid Loop Counter	Error on the repeat counter of LOOP instruction
	RES	-	
	547	Nested Loop Error	Nest LOOP is permitted up to 8 levels
	548	Internal Loop Error	Internal error was occurred during the processing loop. Try to change some value of position data.
	549	Unsupported Instruction	Invalid instruction was used in position data
	RES	-	
I/F	RES	-	
	805	Too Many FLASH Writing	Up to 25 times of flash memory writing is permitted at each power on.
	RES	-	
Parameter	900	Invalid Unit	Invalid unit code was assigned. The valid range of unit code is 0 to 3.
	901	Invalid Number of Pulse Per Rotationo	Number of pulse per rotation can be a range of 1~65535
	902	Invalid Movement Amount per Rotation	Movement amount per rotation can be a range of 1~65535.
	903	Invalid Unit Magnification	Unit Magnification can be a range of 0 to 3
	904	Invalid Pulse Output	Pulse output mode can be a 0 or 1

		Mode	
	905	Invalid Rotation Direction	Rotation direction can be a value of 0 or 1
	906	Invalid Bias Speed	Invalid value was assigned to the bias speed configuration.
	RES	-	
	910	Invalid Speed Limit	Invalid value was assigned to the speed limit configuration.
	911	Invalid Acc/Dec time 1	The Acc/Dec time can be a range of 0~65535ms
	912	Invalid Acc/Dec time 2	
	913	Invalid Acc/Dec time 3	
	914	Invalid Acc/Dec time 4	
	RES	-	
	920	Invalid Backlash	The backlash can be a range of 0~65535
	921	Invalid Software stroke limit upper limit	Invalid value was assigned to the software stroke limit upper limit configuration.
	922	Invalid Software stroke limit lower limit	Invalid value was assigned to the software stroke limit lower limit configuration.
	RES	-	
	927	Invalid M Code ON Timing	M code on timing can be a value of 0 or 1
	RES	-	
	956	Invalid JOG Speed Limit	Invalid value was assigned to JOG speed limit value
	957	Invalid JOG Acc/Dec Time	The JOG acc/dec time can be a range of 0~3
	RES	-	
	960	Invalid S-Pattern Ratio	The S-Pattern ratio can be a range of 0~100
	RES	-	
	967	Invalid External command function selection	External command function selection can be 0, 1 or 3
	RES	-	
	980	Invalid OPR method	The OPR method can be a range of 0~3
	981	Invalid OPR Direction	OPR direction can be 0 or 1
	982	Invalid OP Address	Invalid value was assigned to OP address.

6.10.10.3 Warning Code Details

Class	Code	Name	Description
-	0	No Warning	Normal Operation
Common	100	Start Command on Busy	A start command was issued during the operation of a axes. A start command must be issued when the BUSY signal is off.
	RES	-	
	102	Deviation Counter Clear Request on Busy	A deviation counter clear request was issued during the axis busy. The request is ignored.
	RES	-	

	104	Resume Ignored	A resume request was issued when the axes was still in busy or in standby state.
	RES	-	
	109	Teaching Ignored	A teaching command was issued when the axes was still in operation.
	RES	-	
	114	Below Bias Speed	The designated speed is below the bias speed. Actual operation speed is the bias speed.
	RES	-	
	150	Invalid External Command	External command signal is denied according to the expended parameter configuration. This warning can be issued when the ' Use External command' is set as 0 (Not Used).
	RES	-	
JOG	300	Speed change request during deceleration	The speed change request will be ignored when the request is issued during deceleration of continuous positioning control.
	301	JOG Speed Limit Warn	This warning will be issued when the JOG operation is started with above the JOG speed limit value. The actual JOG speed will be the JOG speed limit value.
	RES	-	
Positioning	500	Invalid Bias Speed	Bias speed configuration of basic parameter was assigned invalid value.
	501	Speed Limit Exceeded	When the requested speed during positioning is above the speed limit, this warning will be issued. The actual speed will be the speed limit in basic parameter.
	RES	-	
	503	M Code Signal ON	This warning is issued when the positioning start command is issued during the M code is ON. The positioning start command will be ignored.
	RES	-	
	505	Block Operation Terminated	On block program operation, if all the block is defined as continuous then this warning will be issued at the end of block.
	RES	-	
	509	Insufficient Remaining Distance.	This warning will be issued when there is not enough distance remained to accelerate the speed to the new requested speed. The speed change request will be ignored.
	RES	-	
	512	Illegal External Function	This warning will be issued when the undefined external signal command is turned on. This external command will be ignored.
	513	Insufficient Movement Amount	Remained movement amount is not sufficient to deceleration. When the destination position is reached during the deceleration, the positioning will be stopped by sudden stop.
	514	Out Of Speed Limit	This warning will be issued when the requested speed is above the speed limit configuration. The positioning control will be performed by speed limit in basic parameter.
	RES	-	

	516	Illegal Teaching Data Number	This warning will be issued when the data number for teaching is invalid. The teaching operation will be ignored.
	RES	-	
	518	Impossible to change the Target	If it is impossible to change the target position address, then this warning will be issued. The request for changing target will be ignored.
	RES	-	

Top Level Intro

This page is printed before a new
top-level chapter starts

Part

7 BP Series(CM2, Block Type)

Block Type PLC (BP Series) :

- High performance CPU (200 nsec / step)
- CPU embedded PID function (max. 32 loops)
- High compatibility between CPU series : uses the same programming tool (CICON)
- Provides the programming tool (CICON) free.

Contents :

7.1 Brochure

Features of BP Series :

- Series BP is suitable for a small-sized control system.
- Series BP furnishes many functions with various instructions as high-speed process to apply control sites.
- Series BP allows Any user to expand I/O Points easily for analog control or communication.
- Integrates power module, CPU and I/O module :Separation modules are not necessary.
- Process High-speed operation with a built-in high-speed MPU : Process speed (200ns/step)
- Several Hundreds of instruction : Sequence (62 Instructions) / Application (308 Instructions)

BP32M

- Abundant program capacity - 8,000 Step
- Device range :
  Internal Relay : 4,096 Points
  Data Memory : 5,000 Words
- Easy expansion : Max. 3 block expansion

BP16M

- Abundant program capacity - 4,000 Step
- Device range :
  Assistant Relay : 4,000 Points
  Data Memory : 1,000 Words
- Not-expansible

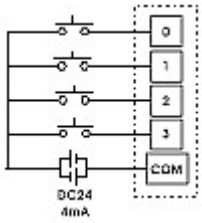
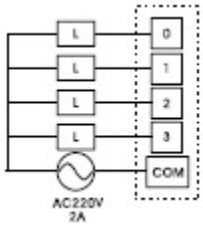
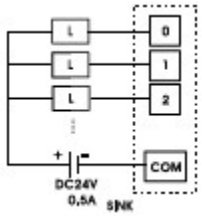
- **Technical Specifications**

Item		Specification	
		CM2-BP32M	CM2-BP16M
Program Control Type		Stored Program, Cyclic Operation, Time Driven Interrupt	
I/O Control Type		Indirect, Direct by Instructions	
Program Language		IL(Instruction List) , LD(Ladder Diagram)	
Instructions	Sequence	62 Instruction	
	Application	308 Instruction	
Processing Rate		200ns/Step	
Program Memory Capacity		8K Step	

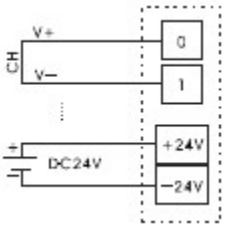
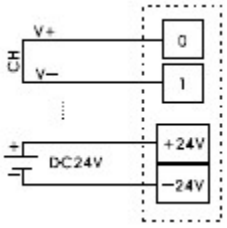
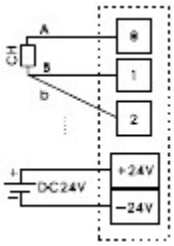
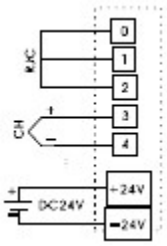
Expansion Option		AD/DA/AD+DA/RTD/TC/IO (Max. 3steps)	Not-Expandable
I/O Point	X	128	8
	Y	128	7
	M	4,096	
	K	1,024	
	L	1,024	
	F	2,048	
	T	256	
	C	256	
	S	100 Card * 100 Step	
	D	5,000 Word	
	Z	1,024 Word	
Timer	Type	On Delay, Off Delay, Integration, Monostable, Retriggerable	
	range	0.01 ~ 655.35 second(10ms), 0.1 ~ 6553.5 second(100ms)	
Counter	Type	Up Counter , Down Counter , Up-Down Counter, Ring Counter	
	range	-32,768 ~ +32,767	
Operation Mode		RUN , STOP , PAUSE , DEBUG	
Self diagnostic function		Operation Delay Monitoring	Stops PLC Operation in case the detected time is over the set time.
		Error in Memory	Detects errors in flash memory in a CPU or DPRAM of each specialty card
		Power Trouble	Detects temporary breakdown in case input voltage is lower
CPU Built-in		HSC	1-phase 16kPPS, 2-phase 8kPPS
		PID Auto Tuning	Executes automatic PID Operation
		Password	Programs can be protected
		DC 24V Output	Allows controlling sensors, switches and etc

- **I/O Specifications**

Item		DC Input	Relay Output	Transistor Output
Rated I/O Voltage		DC 24V	AC 220V / DC 24V	DC 12 / 24V
Rated I/O Current		4mA	1 Point, 2A / COM 5A	1 Point, 0.2A / COM 2A
On Voltage / On Current		DC 19V / 4mA	-	-
Off Voltage / Off Current		DC 11V / 1mA	-	-
Response Time	Off -> On	5ms or less	10 ms or less	1ms or less
	On -> Off	5ms or less	5ms or less	1ms or less
Common Type		4 points	4 Points	8 Points

Operation Indication	LED	LED	LED
Insulation Type	Photo Coupler	Relay	Photo Coupler
Input Type	SINK / SRC	-	-
Circuit			

- **Analog Expansion Block Specifications**

Item	Specification			
Power Source	DC 24V External Input			
Type	A/D	D/A	RTD	TC
Digital Data	Signed 16-Bit Binary Value (Data : 14 Bit)			
Precision	Within 0.3%			
Max. Conversion Speed	5ms / 1Ch	10ms / 1Ch	50ms / 1Ch	50ms / 1Ch
Absolute Max. I/O	± 12V / +21mA	± 12V / +21mA	-	-
Insulation Type	Photo Coupler			
Circuit				

➢ Analog blocks can be expansion max.2 blocks

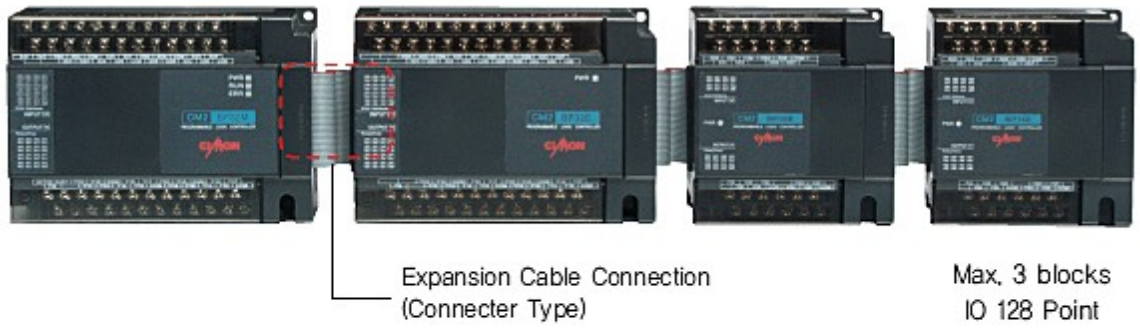
- **Built-in Communication Block Specifications**

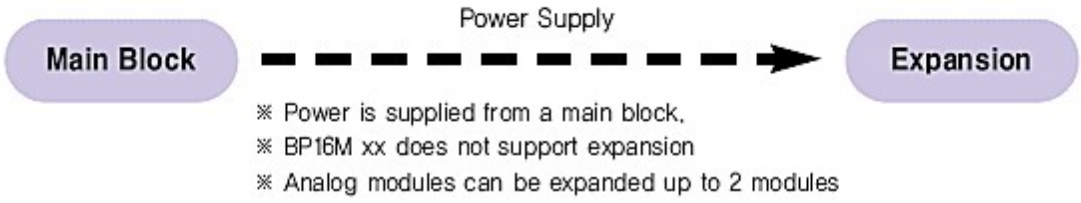
Item		RS232C	RS422/485	RS422/485 2Ch	RS232C 1Ch
Model		*R	*S	*U	*T
Power Source		Supplied from CPU			
Comm. Mode	Exclusive	HMI Protocol(1 : n)			
	Loader	X	X	Communication to link with CICON	
	User	X	X	Protocol program	
Data Type	Data Bit	7 or 8 Bits			

	Stop Bit	1 or 2 Bits
	Parity	Even / Odd / None
Synchronous Type		Asynchronous
Baud Rate		300 / 600 / 1200 / 2400 / 4800 / 9600 / 19200 / 38400
Modem Connection Function		Communication with an external modem unit

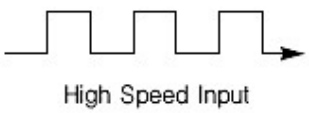
Item	Ethernet
Model	*E
Power Source	Supplied form a CPU Module
Type	10 Base-T
Baud Rate	10Mbps
Max. Segment Length	100m (Node - Hub)
No. of Max. Nodes	Enables to link with 4-line Hub
Max. Protocol Size	1500Byte
Access Type	CSMA / CD

- **Expansion**





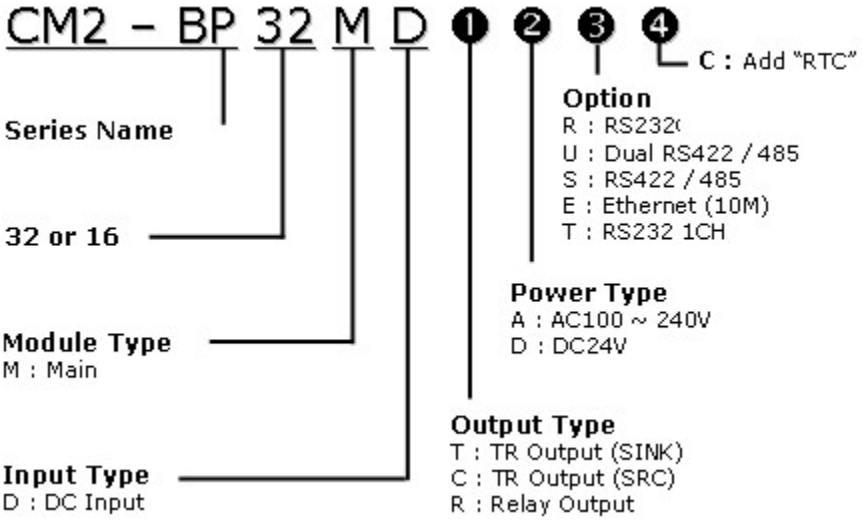
- **Built-in High Speed Counter**



- 8 Pulse Input types
- Linear, Ring Counting Mode
- Coincidence Comparison Function
- Max.3kPPS

Product Line :

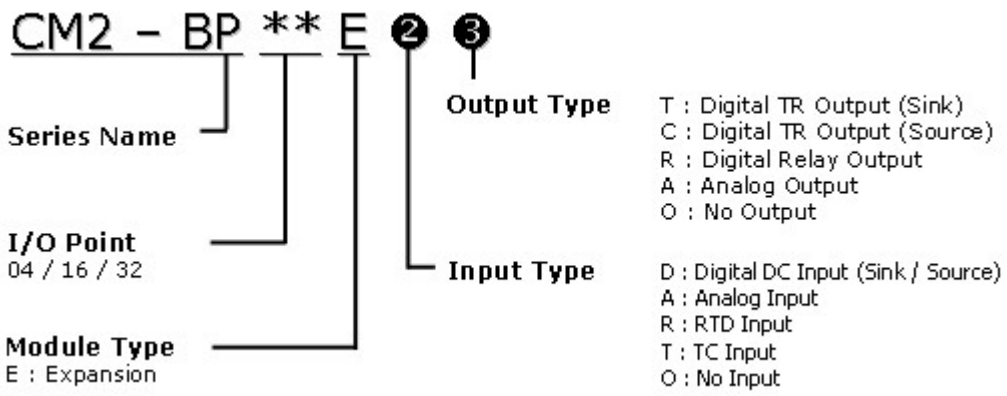
- **Main Block Model Name**



Model	Power Source	Input		Output		Remarks
CM2-BP32MDTA*	AC 90 ~ 240V	16	DC 24V	16	TR (Sink)	[Indicates]
CM2-BP32MDCA*					TR (Source)	R : RS232C
CM2-BP32MDRA*					RELAY	S : RS422 / 485
CM2-BP32MDTD*	DC 24V				TR (Sink)	E : Ethernet (10M)
CM2-BP32MDCD*					TR (Source)	U : RS422 / 485 2ch
CM2-BP32MDRD*					RELAY	T : RS232 1ch
CM2-BP16MDTA*	AC 90 ~ 240V	8	DC 24V	7	TR (Sink)	[Indicates]
CM2-BP16MDCA*					TR (Source)	R : RS232C
CM2-BP16MDRA*					RELAY	S : RS422 / 485
CM2-BP16MDTD*	DC 24V				TR (Sink)	

CM2-BP16MDCD*					TR (Source)	
CM2-BP16MDRD*					RELAY	

- **Expansion Block Model Name**



❖ BP16M is not expandable

- **I/O Expansion Unit**

Model	Input		Output		Remarks
CM2-BP16EDT	8	DC 24V	8	TR (Sink)	**Power Source :** Supplied from a main unit.
CM2-BP16EDC				TR (Source)	
CM2-BP16EDR				RELAY	
CM2-BP32EDT	16		16	TR (Sink)	
CM2-BP32EDC				TR (Source)	
CM2-BP32EDR				RELAY	
CM2-BP16EDO	16		0	-	
CM2-BP16EOR	0	-	16	RELAY	-
CM2-BP16EOT				TR (Sink)	
CM2-BP16EOC				TR (Source)	

- **Analog Expansion Unit**

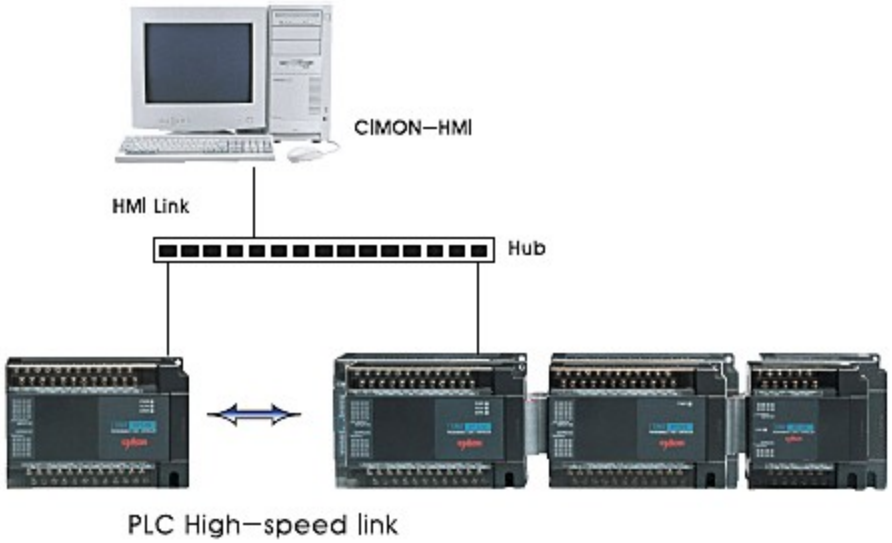
Model	Input		Output		Remarks
CM2-BP04EAO	4	AD V/I Input	0		**Power Source :** 24V External Power source
CM2-BP04EAA	2		2	DA V/I Output	
CM2-BP04EOA	0	-	4		
CM2-BP04ERO	4	RTD Input	0		

CM2-BP04ETO	4	TC Input	0		

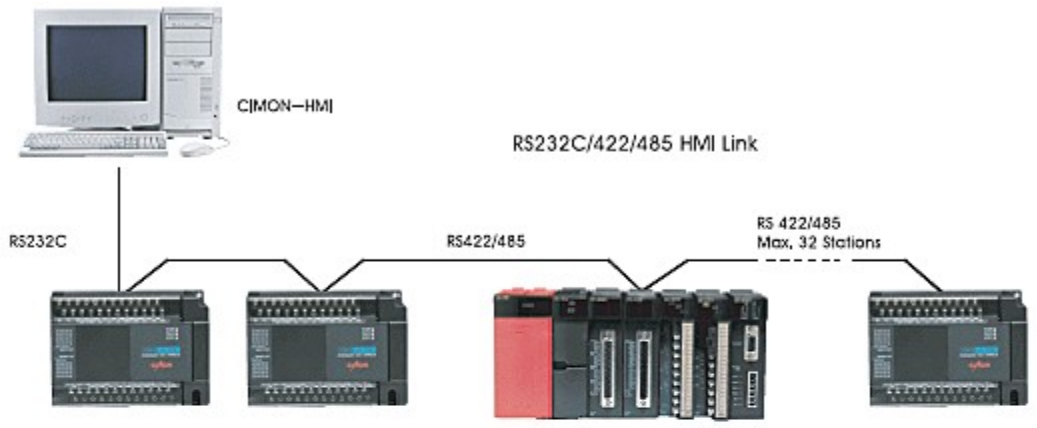
❖ Max 2. analog blocks can be expanded with a main block

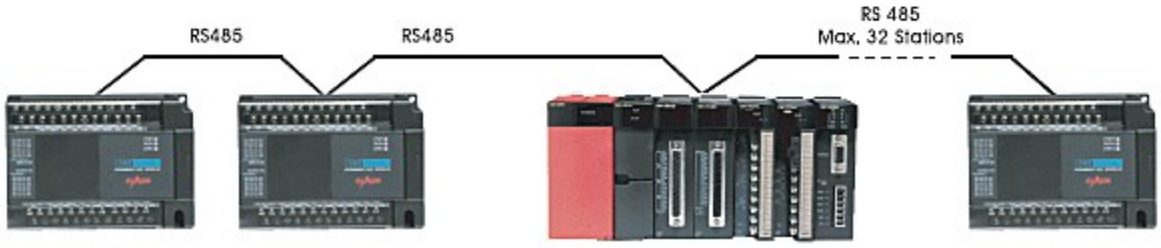
Communication :

- **Ethernet**



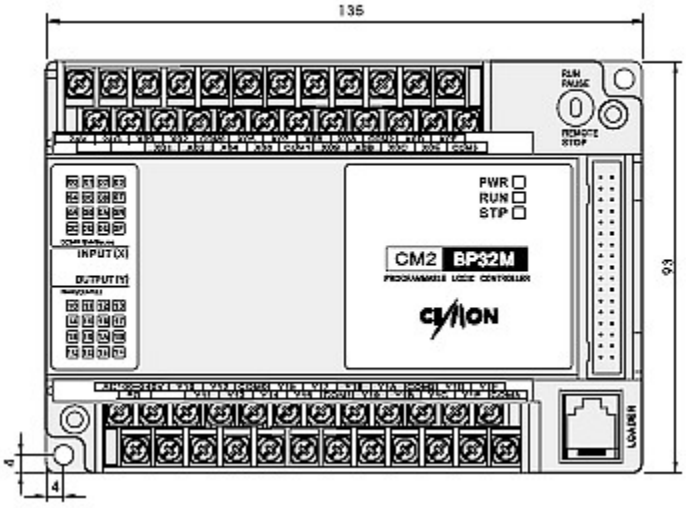
- **Serial Communication**

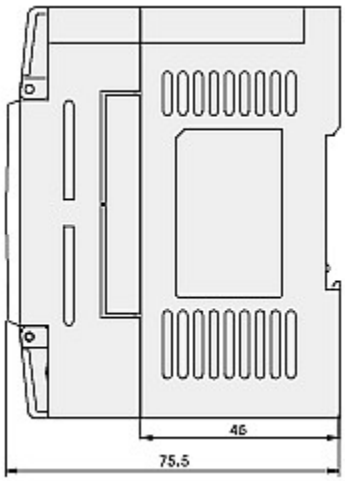




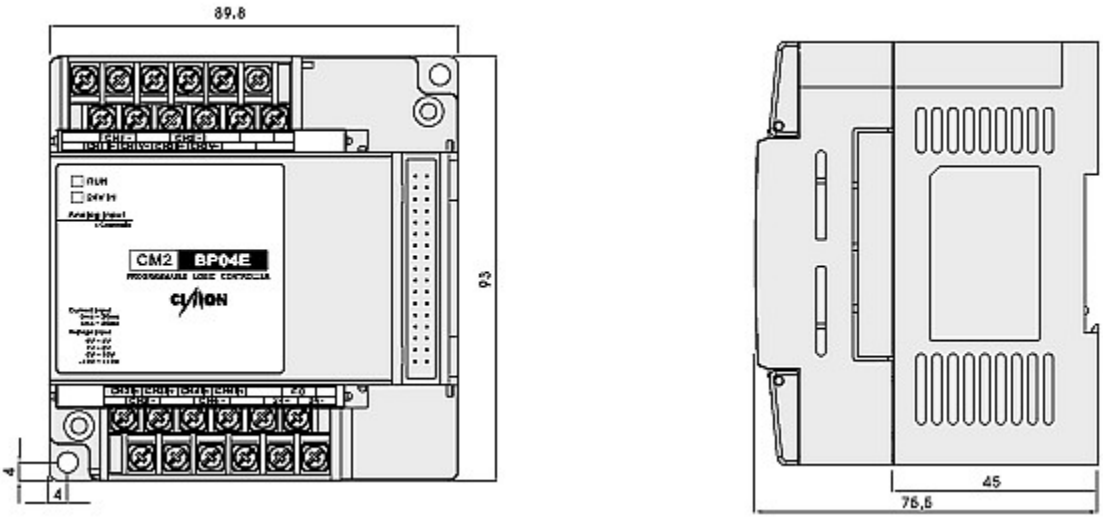
Dimensions :

- **Min Block, 32-point Expansion Block**





- **Min Block(BP16M), 32-point Expansion Block, Analog Block**



7.2 Specification

- Series BP is suitable for a small-sized control system.
- Series BP furnishes many functions with various instructions as high-speed process to apply control sites.
- Series BP allows Any user to expand I/O Points easily for analog control or communication.
- Integrates power module, CPU and I/O module :Separation modules are not necessary.
- Process High-speed operation with a built-in high-speed MPU : Process speed (200ns/step)
- Several Hundreds of instruction : Sequence (62 Instructions) / Application (308 Instructions)

BP32M :

1. Abundant program capacity - 8,000 Step
2. Device range :
   - Internal Relay : 4,096 Points
   - Data Memory : 5,000 Words
3. Easy expansion
   - Max. 3 block expansion

BP16M :

1. Abundant program capacity - 4,000 Step
2. Device range :
   - Assistant Relay : 4,000 Points
   - Data Memory : 1,000 Words
3. Not-expansible

Item		BP32M	BP16M
Power		AC220V / DC24V **(20W)**	AC220V / DC24V **(10W)**
Input		DC24V	
Out		Relay / TR SINK / TR SOURCE	
Expansion Option		AD / DA / AD+DA / RTD / TC / IO (Max.3steps)	Not-Expansible
Standard I/O		Input : 16 / Output : 16	Input : 8 / Output : 7
Program Control Type		Stored Program, Cyclic operation, Time Driven Interrupt	
I/O Control Type		Indirect, Direct by Instructions	
Program Language		IL (Instruction List), LD (Ladder Diagram)	
Instruction	Sequence	62 Instruction	
	Application	308 Instruction	
Processing Rate		200 nsec / step (Sequence Instruction)	

List :

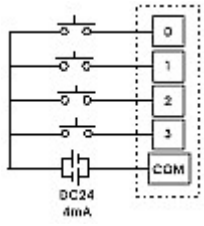
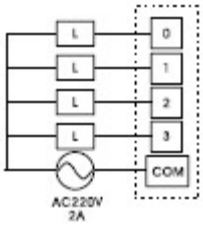
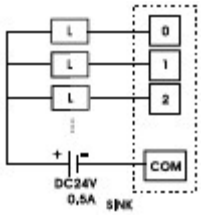
I/O Point

	X	Y	M	L	K	F	T	C	S	D	Z
BP32M	128	128	4096	1024	1024	2048	256	256	100*100	5000	1024
BP16M	8	7	4096	1024	1024	2048	256	256	100*100	5000	1024

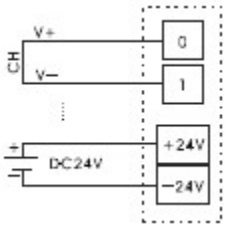
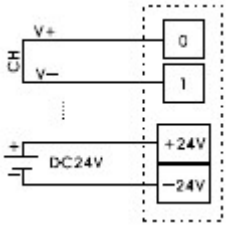
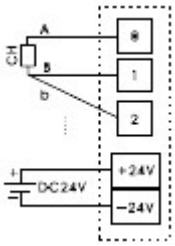
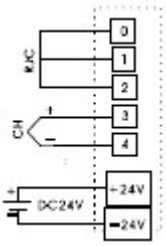
Self-diagnosis and Built-in Function

Function	Description	
Self-diagnosis	Operation Delay Monitoring	Stops PLC operation in case the detected time is over the set time.
	Error in Memory	Detects errors in flash memory in a CPU or DPRAM of each specialty card.
	Power Trouble	Detects temporary breakdown in case input voltage is lower.
CPU Built-in	HSC	3kPPS
	PID Auto Tuning	Executes automatic RID operation. (Max. 32 Loops)
	Password	Programs can be protected.
	DC 24V Output	Allows controlling sensors, switches and etc (300mA)

I/O Specifications

Item		DC Input	Relay Output	Transistor Output
Rated I/O Voltage		DC 24V	AC 220V / DC 24V	DC 12 / 24V
Rated I/O Current		4mA	1 Point, 2A / COM 5A	1 Point, 0.2A / COM 2A
On Voltage / On Current		DC 19V / 4mA	-	-
Off Voltage / Off Current		DC 11V / 1mA	-	-
Response Time	Off -> On	5ms or less	10 ms or less	1ms or less
	On -> Off	5ms or less	5ms or less	1ms or less
Common Type		4 points	4 Points	8 Points
Operation Indication		LED	LED	LED
Insulation Type		Photo Coupler	Relay	Photo Coupler
Input Type		SINK / SRC	-	-
Circuit				

Analog Expansion Block Specifications

Item	Specification			
Power Source	DC 24V External Input			
Type	A/D	D/A	RTD	TC
Digital Data	Signed 16-Bit Binary Value (Data : 14 Bit)			
Precision	Within ± 0.3%			
Max. Conversion Speed	5ms / 1Ch	10ms / 1Ch	50ms / 1Ch	50ms / 1Ch
Absolute Max. I/O	± 12V / +21mA	± 12V / +21mA	-	-
Insulation Type	Photo Coupler			
Circuit				

Built - in Communication Block Specifications

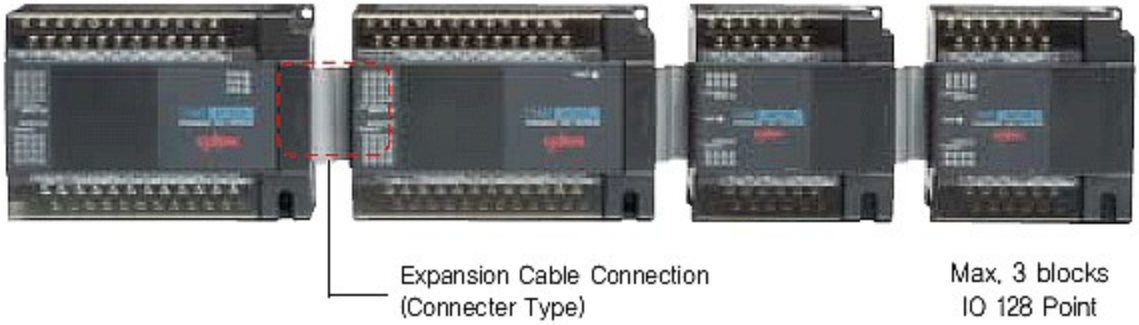
Item		RS232C	RS422/485	RS422/485 2Ch	RS232C 1Ch
Model		*R	*S	*U	*T
Power Source		Supplied from CPU			
Comm. Mode	Exclusive	HMI Protocol(1 : n)			
	Loader	X	X	Communication to link with CICON	
	User	X	X	Protocol program	
Data Type	Data Bit	7 or 8 Bits			
	Stop Bit	1 or 2 Bits			
	Parity	Even / Odd / None			
Synchronous Type		Asynchronous			
Baud Rate		300 / 600 / 1200 / 2400 / 4800 / 9600 / 19200 / 38400			
Modem Connection Function		Communication with an external modem unit			

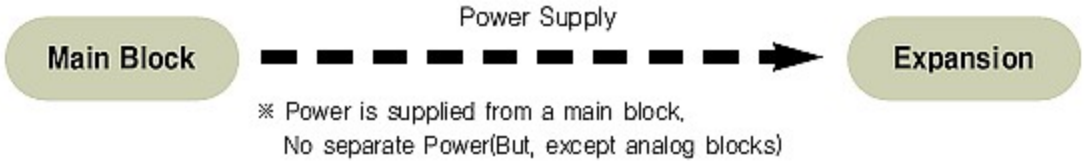
Item	Ethernet
Model	*E
Power Source	Supplied form a CPU Module
Type	10 Base-T
Baud Rate	10Mbps
Max. Segment Length	100m (Node - Hub)
No. of Max. Nodes	Enables to link with 4-line Hub
Max. Protocol Size	1500Byte

Access Type	CSMA / CD

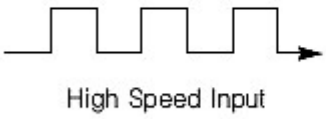
7.3 Functions

Expansion





Built-in High Speed Counter



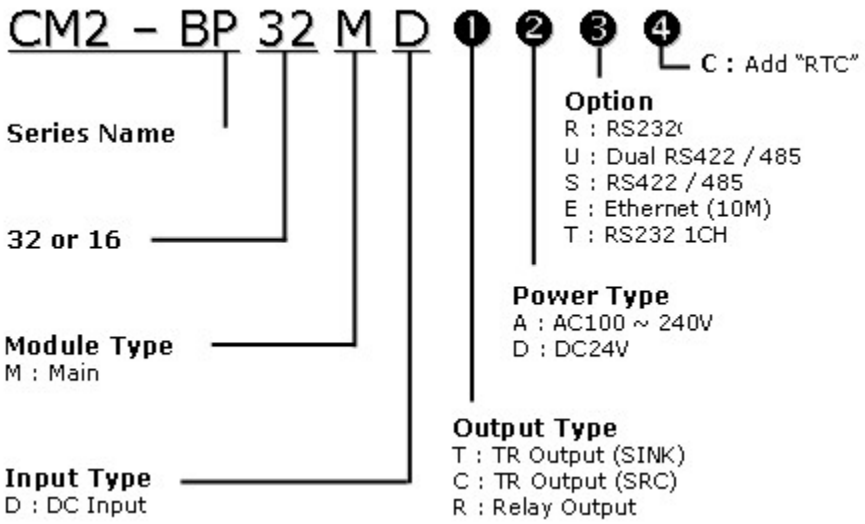
8 Pulse Input Types
Linear, Ring Counting Mode
Coincidence Comparison Function
Max 3kPPS

7.4 Product Line

Click :

- Main Block Model Name
- Expansion Block Model Name
- I/O Expansion Unit
- Analog Expansion Unit

Main Block Model Name,



Model	Power Source	Input		Output		Remarks
CM2-BP32MDTA*	AC 90 ~ 240V	16	DC 24V	16	TR (Sink)	**[Indicates]** R : RS232C S : RS422 / 485 E : Ethernet (10M) U : RS422 / 485 2ch T : RS232 1ch
CM2-BP32MDCA*					TR (Source)	
CM2-BP32MDRA*					RELAY	
CM2-BP32MDTD*	DC 24V				TR (Sink)	
CM2-BP32MDCD*					TR (Source)	
CM2-BP32MDRD*					RELAY	
CM2-BP16MDTA*	AC 90 ~ 240V	8	DC 24V	7	TR (Sink)	**[Indicates]** R : RS232C S : RS422 / 485
CM2-BP16MDCA*					TR (Source)	
CM2-BP16MDRA*					RELAY	
CM2-BP16MDTD*	DC 24V				TR (Sink)	
CM2-BP16MDCD*					TR (Source)	
CM2-BP16MDRD*					RELAY	

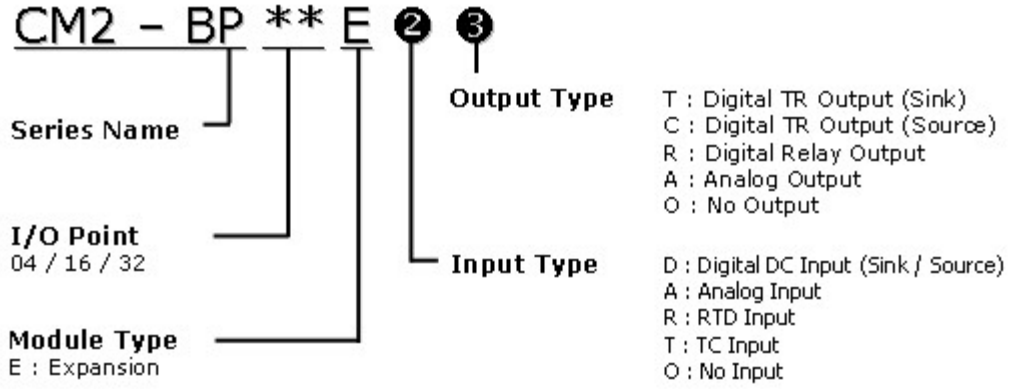

Main Block (BP32M)


Main Block (BP16M)


Expansion (DIO)


Expansion (Analog)

Expansion Block Model Name ,



**** BP16M is not expandable**

I/O Expansion Unit ,

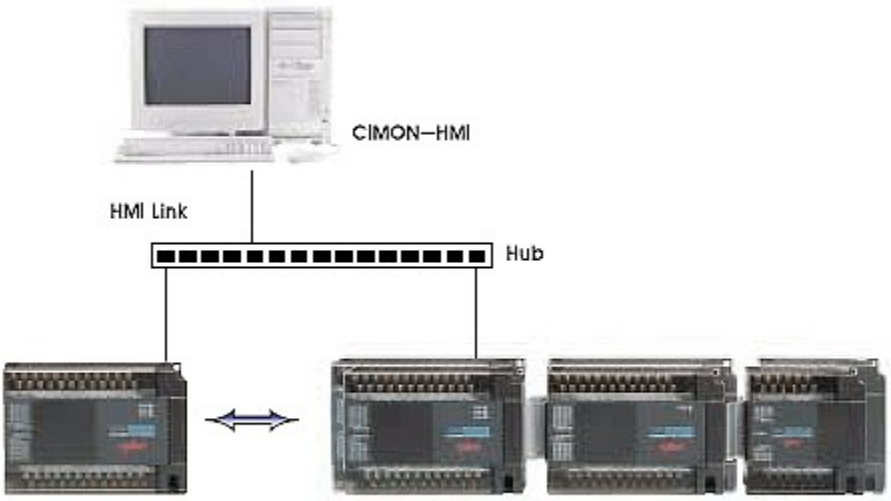
Model	Input		Output		Remarks
CM2-BP16EDT	8	DC 24V	8	TR (Sink)	**Power Source :** Supplied from a main unit.
CM2-BP16EDC				TR (Source)	
CM2-BP16EDR				RELAY	
CM2-BP32EDT	16		16	TR (Sink)	
CM2-BP32EDC				TR (Source)	
CM2-BP32EDR				RELAY	
CM2-BP16EDO	16		0	-	
CM2-BP16EOR	0	-	16	RELAY	-
CM2-BP16EOT				TR (Sink)	
CM2-BP16EOC				TR (Source)	

Analog Expansion Unit ,

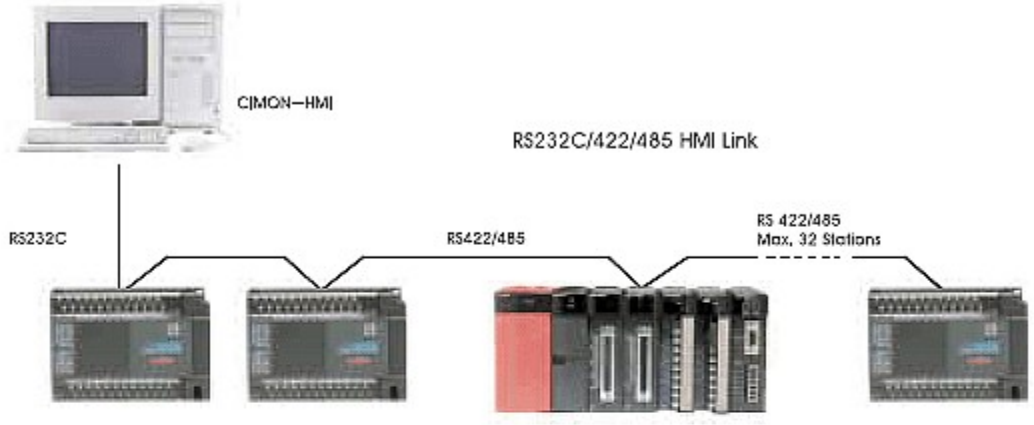
Model	Input		Output		Remarks
CM2-BP04EAO	4	AD V/I Input	0		**Power Source :** 24V External Power source
CM2-BP04EAA	2		2	DA V/I Output	
CM2-BP04EOA	0	-	4		
CM2-BP04ERO	4	RTD Input	0		
CM2-BP04ETO	4	TC Input	0		

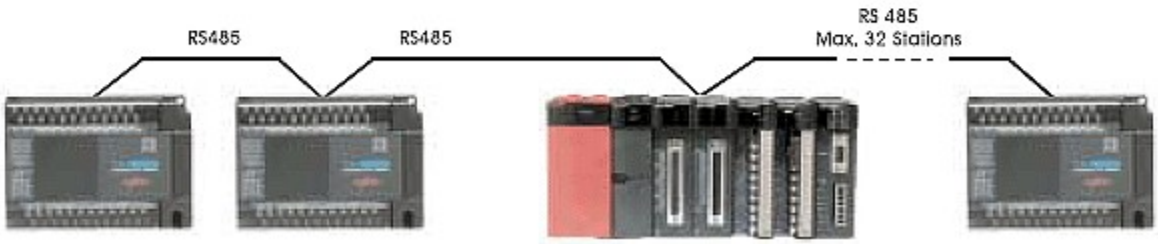
7.5 Data Link

Ethernet ,



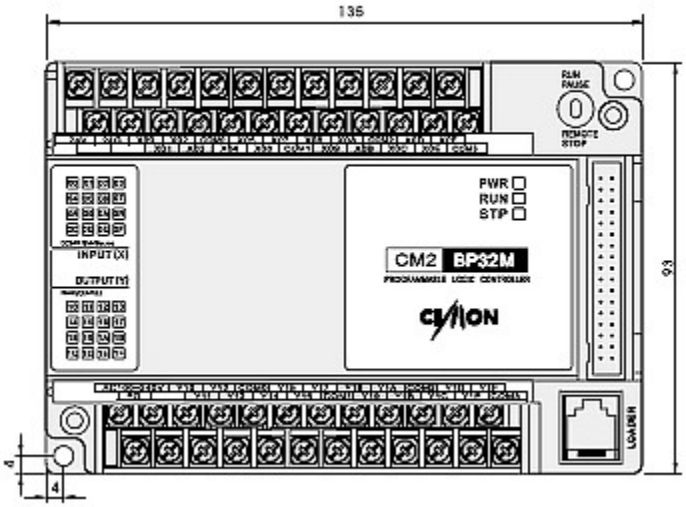
Serial Communication,

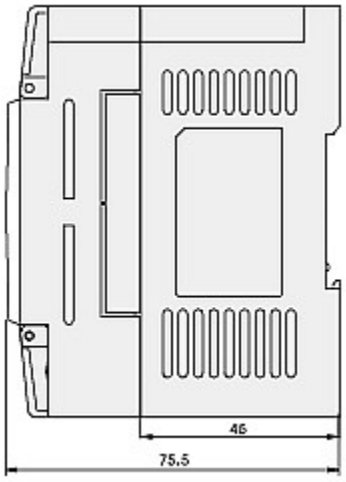




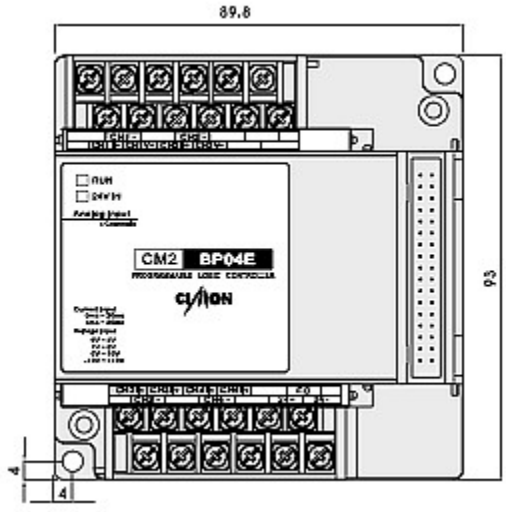
7.6 Dimensions

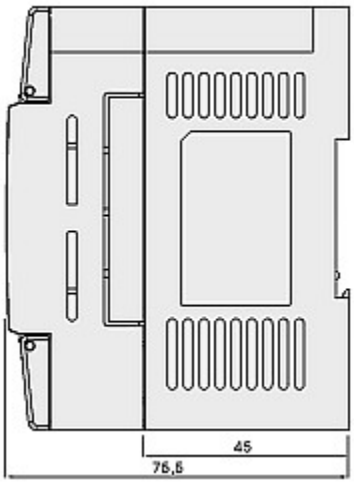
Main Block, 32-point Expansion Block





Main Block(BP 16M), 16-point Expansion Block, Analog Block



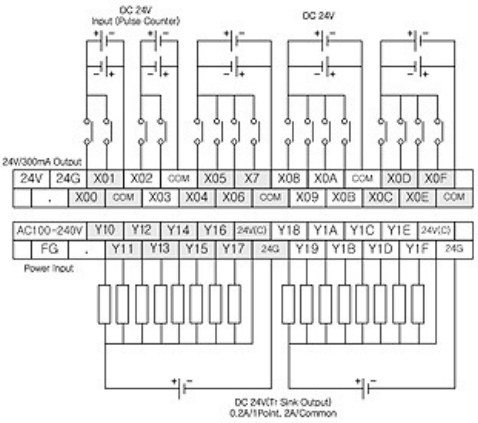


7.7 BP Main Module

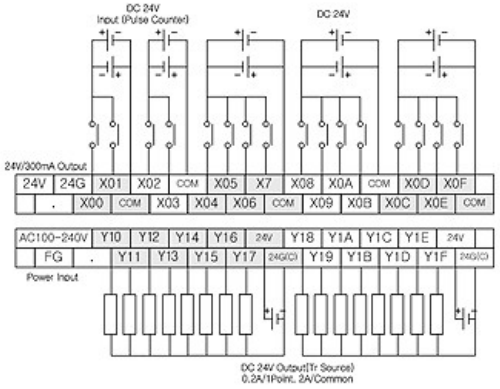
7.7.1 External Wiring

BP **EXTERNAL WIRING**

▶ **CM2-BP32MDTA□**

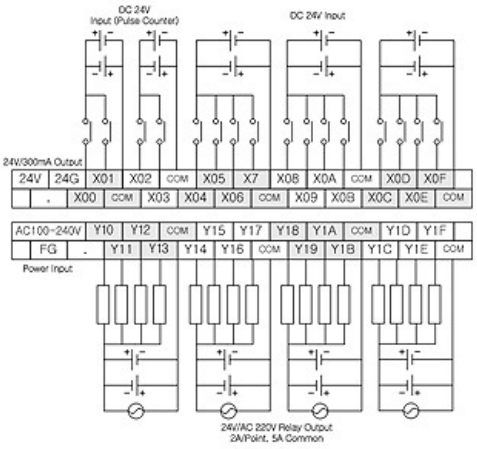


▶ **CM2-BP32MDCA□**

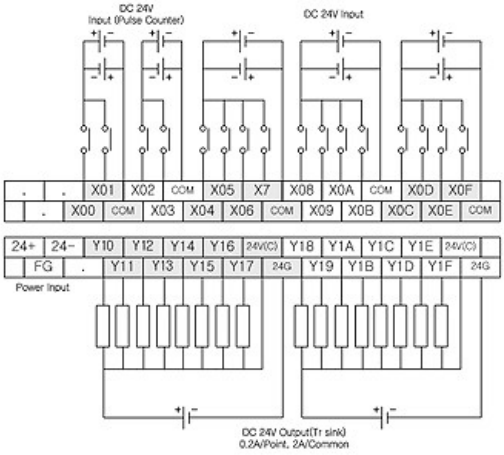


▶ **CM2-BP32MDRA□**

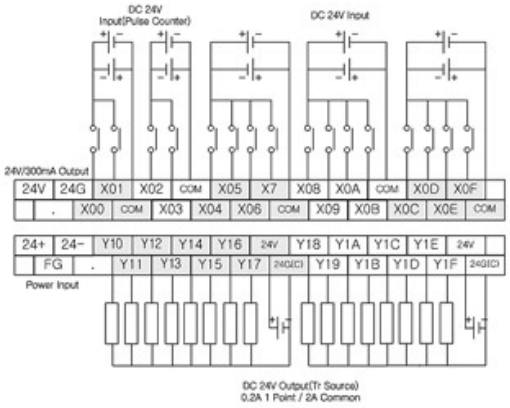
▶ **CM2-BP32MDTD□**



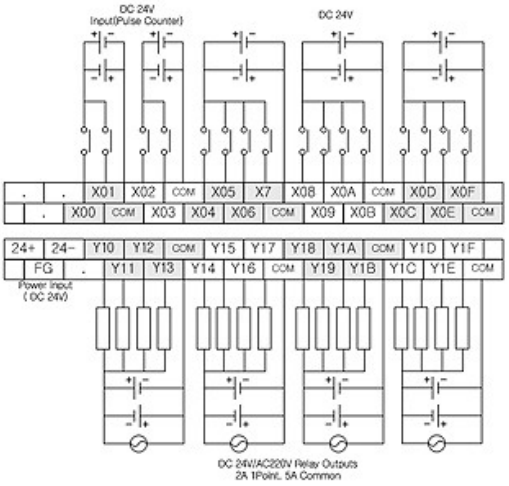
▶ **CM2-BP32MDCD□**



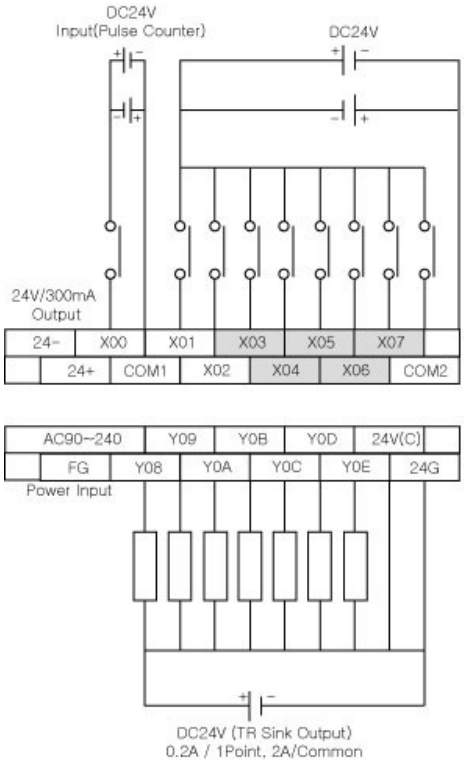
▶ **CM2-BP32MDRD□**



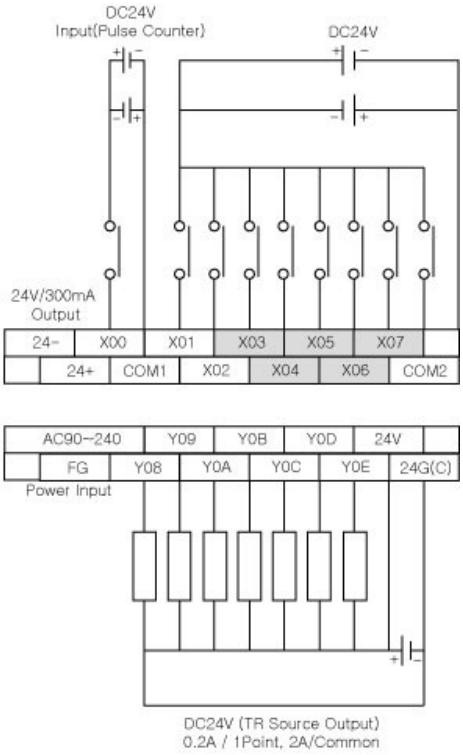
▶ **CM2-BP16MDTA□**



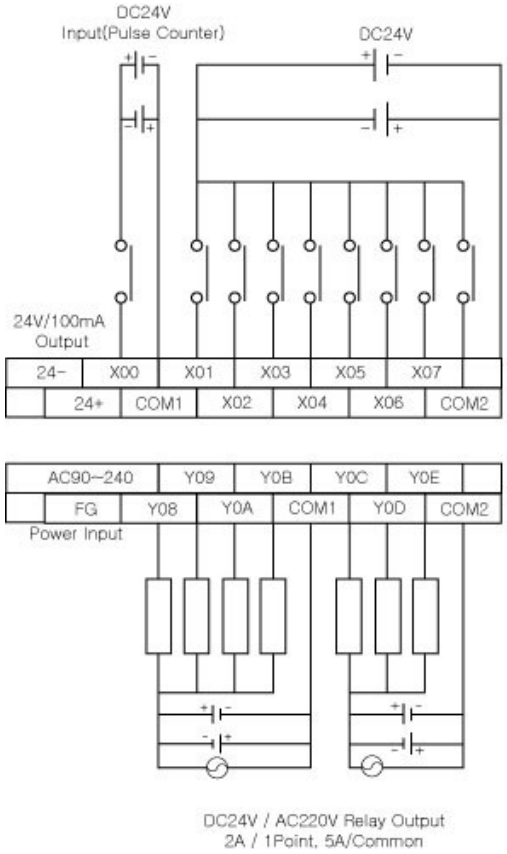
▶ **CM2-BP16MDCA□**



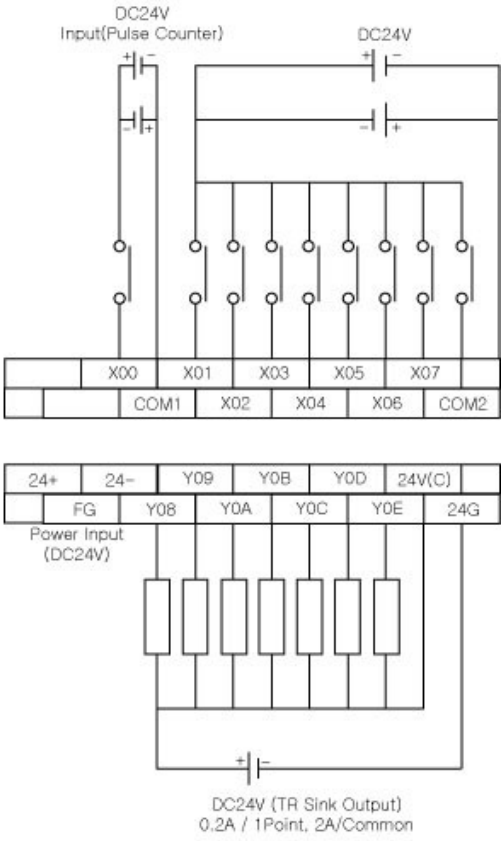
▶ **CM2-BP16MDRA□**



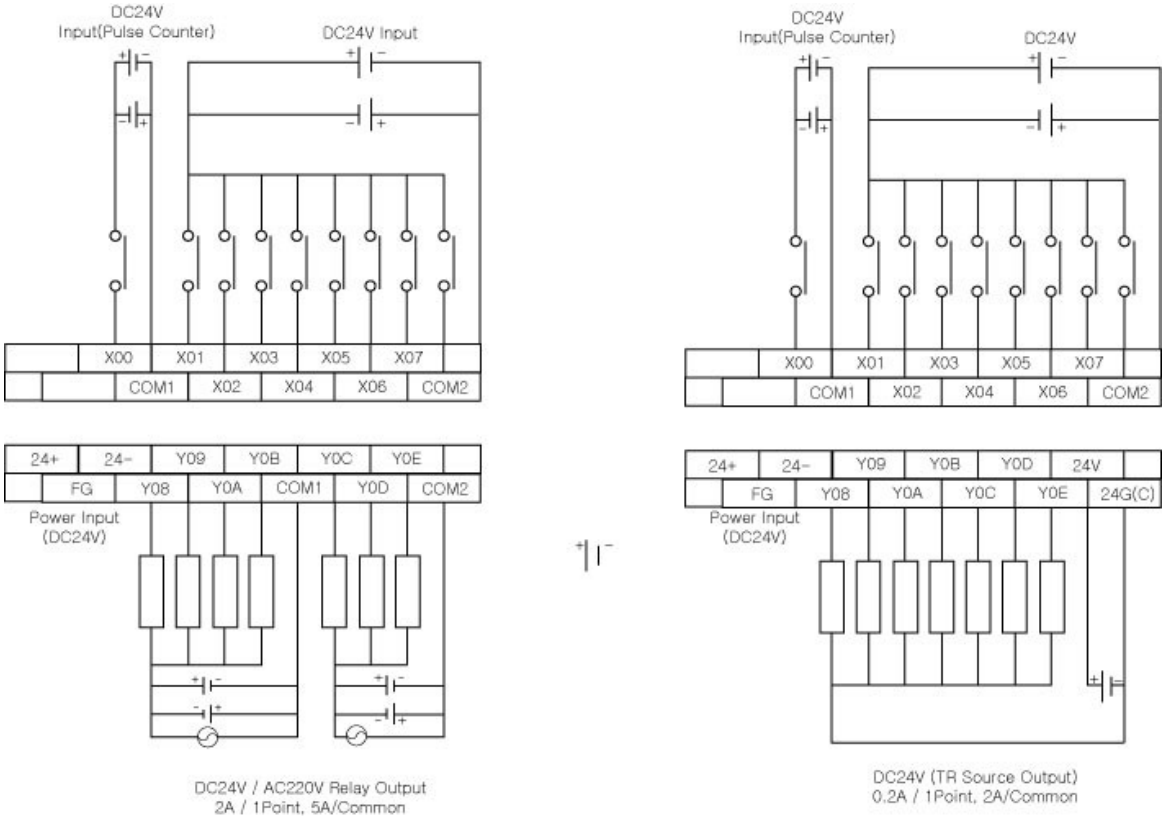
▶ **CM2-BP16MDTD□**



▶ **CM2-BP16MDRD□**



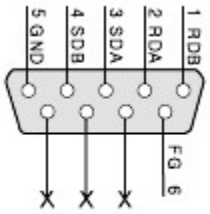
▶ **CM2-BP16MDCD□**



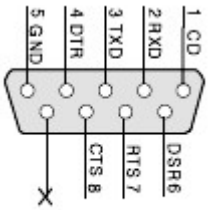
7.7.2 Communication Option Module Setting

Option Type	Communication Type	Modules that can be applied	
		CM2-BP32M	CM2-BP16M
- R	RS232C(HMI Protocol Only)	OK	OK
- S	RS422/485 1Ch(HMI Protocol Only)	OK	OK
- U	RS422/485 2Ch	OK	-
- T	RS232C	OK	-
- E	Ethernet (10Mbps)	OK	-

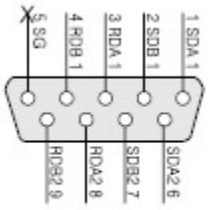
CM2-BP32M Communication Option Connector Pin



RS422/485(S)

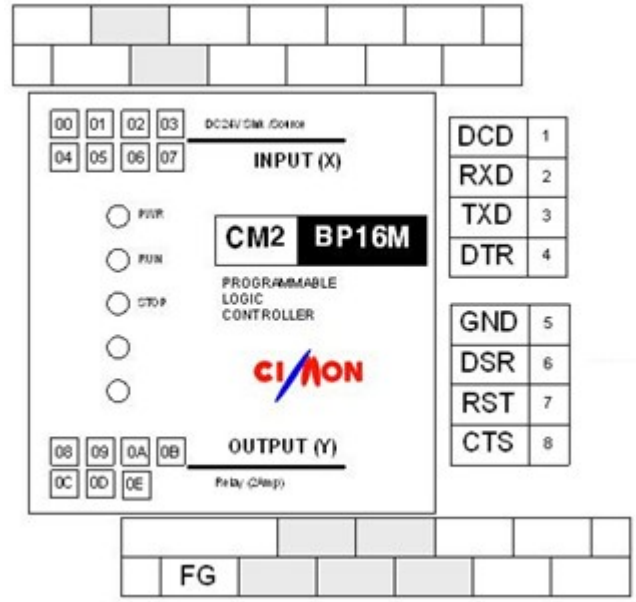


RS232C(R, T)

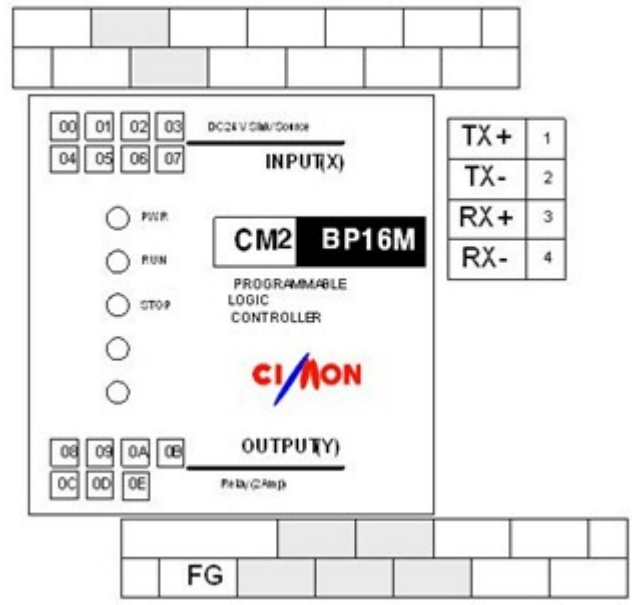


RS422/485 2채널(U)

CM2-BP16M Communication Option Connector Pin



RS-232C



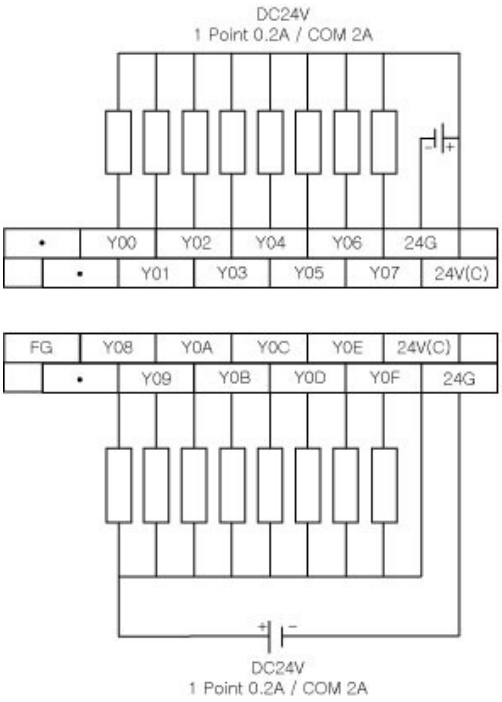
RS422-485

7.8 BP I/O Module

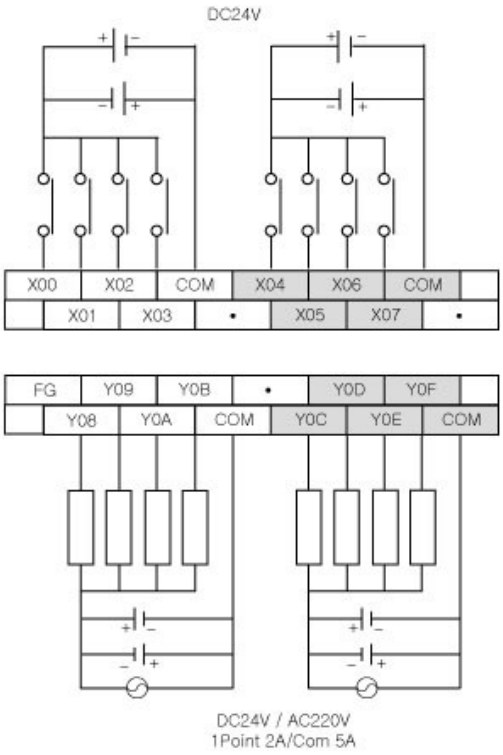
7.8.1 External Wiring

BP **EXTERNAL WIRING**

▶ **CM2-BP16EOT□**

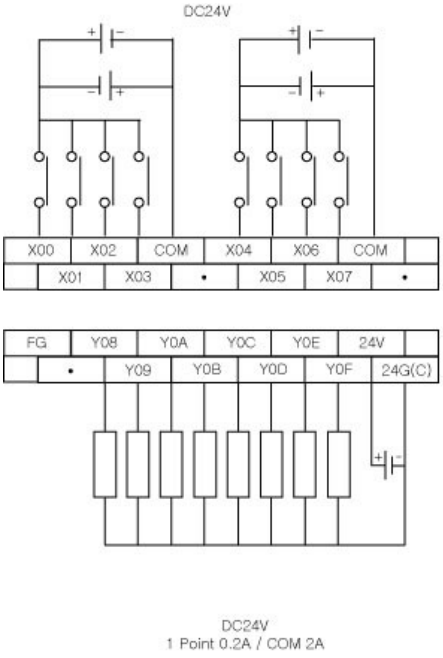


▶ **CM2-BP16EDR□**

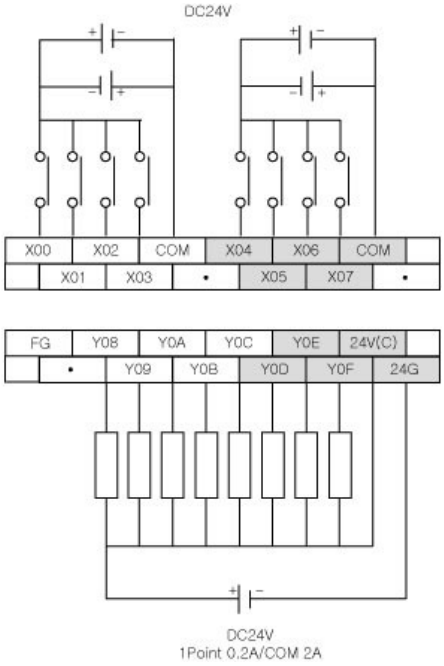


▶ **CM2-BP16EDC□**

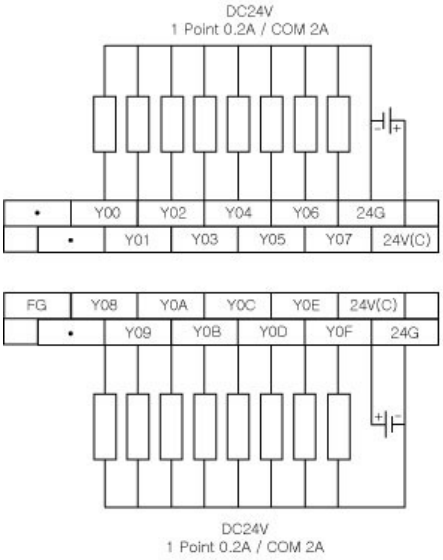
▶ **CM2-BP16EDT□**

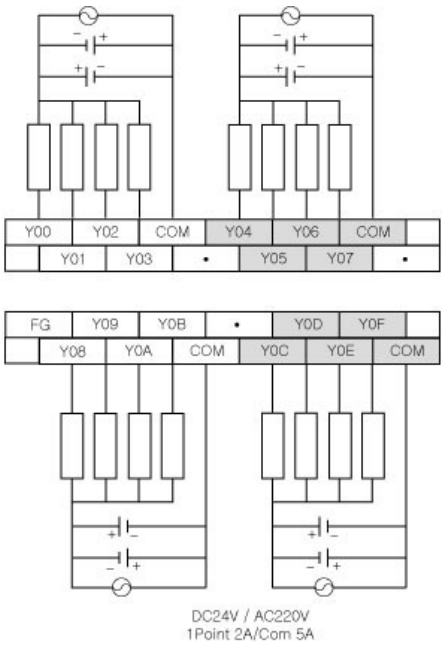


▶ **CM2-BP16EOC□**

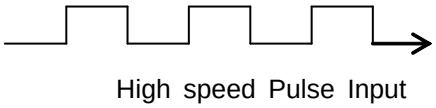


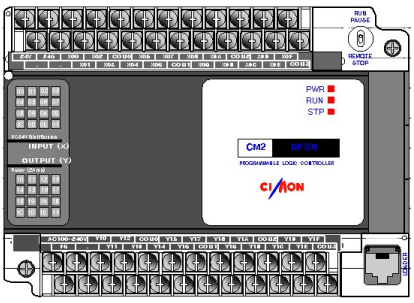
▶ **CM2-BP16EOR□**





7.9 Built-In High Speed Counter



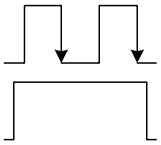
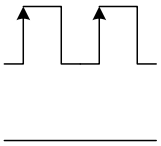
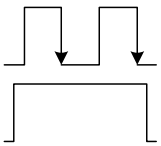
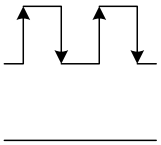
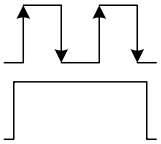
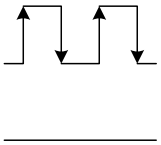
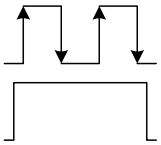
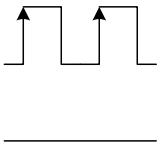
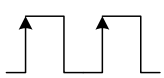


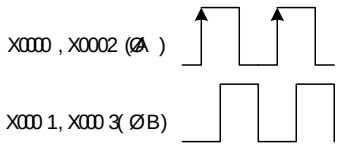
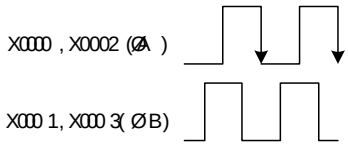
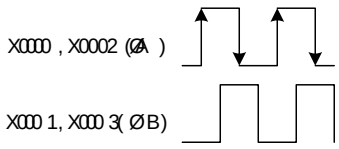
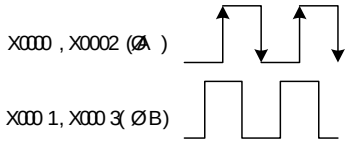
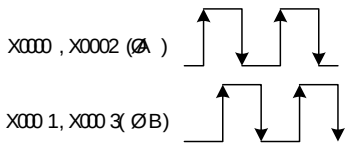
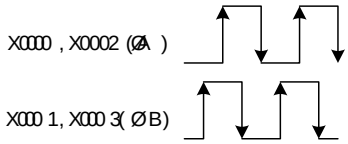
Contents :

7.9.1 Features

1. The built-in high speed counter of the block type PLC uses four switchable input terminals (X0000 ~ X0003). Those input terminals can be used as general inputs or exclusively for the high speed counter inputs.
2. Pulse input of the high-speed counter requires rated load voltage of DC24V and digital input automatically changes to high speed counter input according to the high speed counter settings from PLC parameter.
3. Counted values are saved as 32bit binary values with positive/negative signs (-2147484658 ~ 2147483647).
4. For CM2-BP32M Series, when 1-Phase 1-Multiple is selected, maximum of 4 channels and when 2-Phase 2-Multiple is selected, maximum 2 channels can be used. (CM2-BP16M Series:1Phase 1Multiple - Max. 2 channels, 2Phase 2Multiple - Max. 1 channel)
5. The speed of the maximum input pulse is 3Kpps.
6. Supports 8 different pulse input types.

Pulse Input Type	Count Timing			Channel in Use
1-Phase 1-Multiple	Counting	X0000 , X0002 (ØA) X0001, X0003 (ØB)	Counts at the rising edges of A when B is OFF	CH1 CH3

	Counting Down	X0000 , X0002 (ØA) X0001, X0003 (ØB) 	Counts at the falling edges of A when B is ON	CH1 CH3
1-Phase 1-Multiple B Switch Function Input	Counting	X0000 , X0001 X0002, X0003 (ØA) HSCSW "U/D" (ØB) 	Counts at the rising edges of A when the input of HSCSW U/D is OFF	CH1 CH2 CH3 CH4
	Counting Down	X0000 , X0001 X0002, X0003 (ØA) HSCSW "U/D" (ØB) 	Counts at the falling edges of A when the input of HSCSW U/D is ON	CH1 CH2 CH3 CH4
1-Phase 2-Multiple	Counting	X0000 , X0002 (ØA) X0001, X0003 (ØB) 	Counts at the rising and falling edges of A when B is OFF	CH1 CH3
	Counting Down	X0000 , X0002 (ØA) X0001, X0003 (ØB) 	Counts at the rising and falling edges of A when B is ON	CH1 CH3
1-Phase 2-Multiple B Switch Function Input	Counting	X0000 , X0001 X0002, X0003 (ØA) HSCSW "U/D" (ØB) 	Counts at the rising edges of A when the input of HSCSW U/D is OFF	CH1 CH2 CH3 CH4
	Counting Down	X0000 , X0001 X0002, X0003 (ØA) HSCSW "U/D" (ØB) 	Counts at the falling edges of A when the input of HSCSW U/D is ON	CH1 CH2 CH3 CH4
CW/CCW	Counting	X0000 , X0002 (ØA) X0001, X0003 (ØB) 	Counts at the rising edges of A when B is OFF	CH1 CH3
	Counting Down	X0000 , X0002 (ØA) X0001, X0003 (ØB) 	Counts at the rising and falling edges of B when A is OFF	CH1 CH3

2-Phase 1-Multiple	Counting		Counts at the rising edges of A when B is OFF	CH1 CH3
	Counting Down		Counts at the falling edges of A when B is OFF	CH1 CH3
2-Phase 2-Multiple	Counting		Counts at the rising edges of A when B is OFF Counts at the falling edges of A when B is ON	CH1 CH3
	Counting Down		Counts at the rising edges of A when B is ON Counts at the falling edges of A when B is OFF	CH1 CH3
2-Phase 4-Multiple	Counting		Counts at the rising edges of A when B is OFF Counts at the falling edges of A when B is ON Counts at the rising edges of B when A is ON Counts at the falling edges of B when A is OFF	CH1 CH3
	Counting Down		Counts at the rising edges of A when B is ON Counts at the falling edges of A when B is OFF Counts at the rising edges of B when A is OFF Counts at the falling edges of B when A is ON	CH1 CH3

7. There are 2 different counter modes as follows:

> Linear Counter

Can be counted within the range of -2147483648~2147483647. When the value goes out of this range, the computation terminates and the internal overflow bit is set.

By executing preset command, internal overflow bit automatically resets.

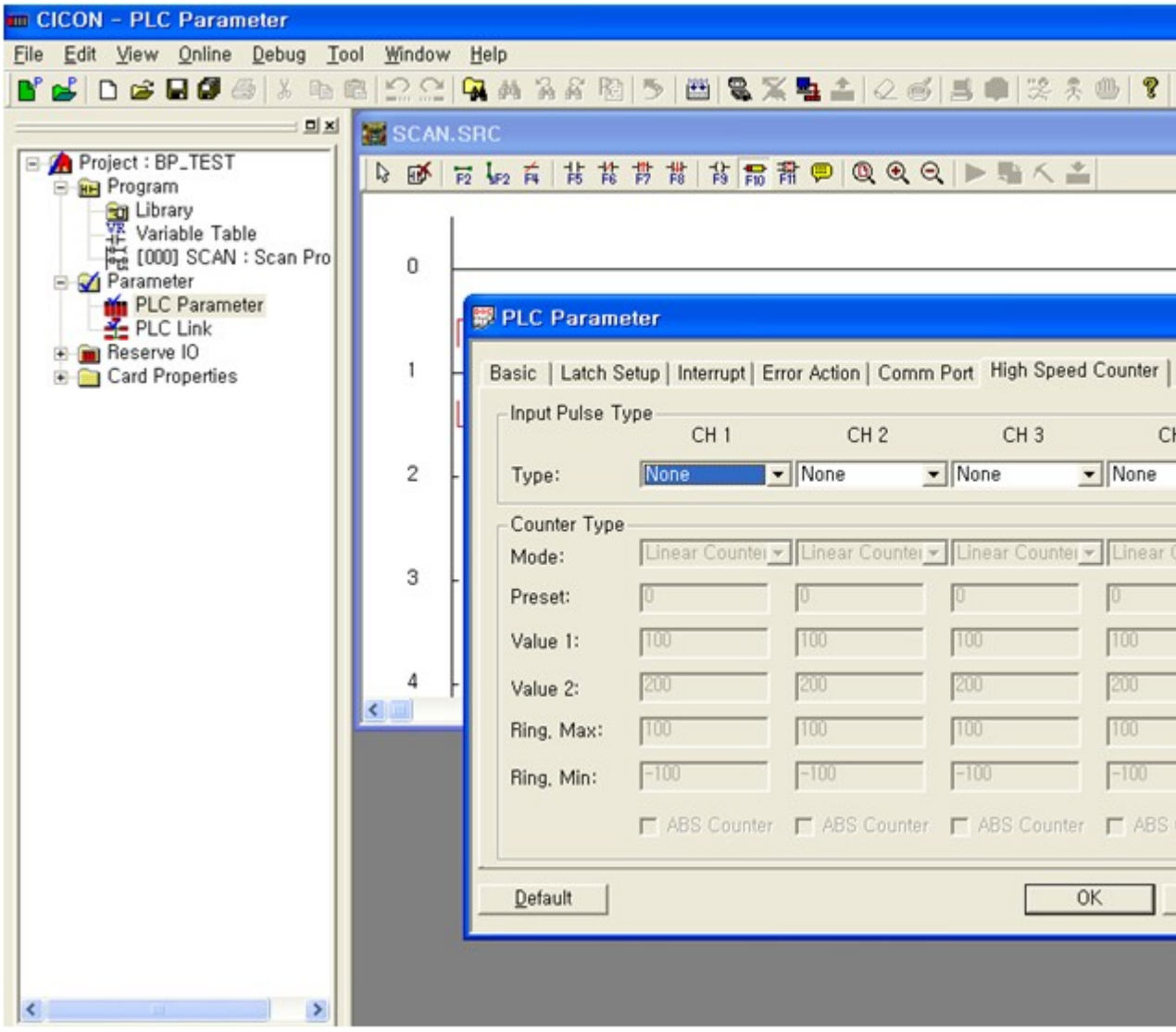
> Ring Counter

Counts repeatedly between the maximum and minimum set values of the ring counter.

8. Coincidence output signal can be sent by comparing the present value and the already-set coincidence value. The coincidence signal is not an actual output but SET/RESET of exclusive Flag(F0370~F038F).
9. During RUN Mode, modifying the following items is not authorized: Pulse Input Type, Preset Value, Coincidence, Max. Ring Count, Min. Ring Count, and Counter Mode.

7.9.2 Setting Up

In the Project workspace on the left-hand side in CICON(Graphic Loader), double click on "PLC Parameter" under "Parameter". When PLC Parameter window opens, click on "High Speed Counter" tab on the top tab menu to get the same screen as follows:

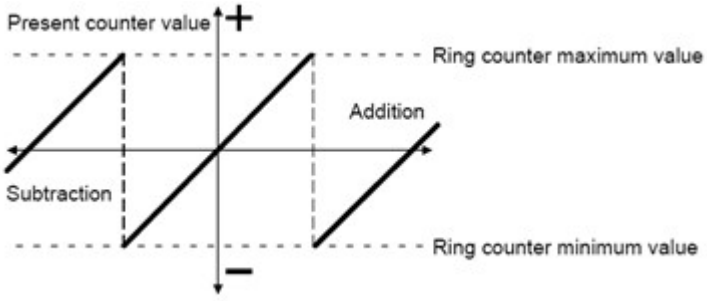


Change the settings properly according to the consisted system and use command HSC or command HSCSW in the scan program to compute input pulse.

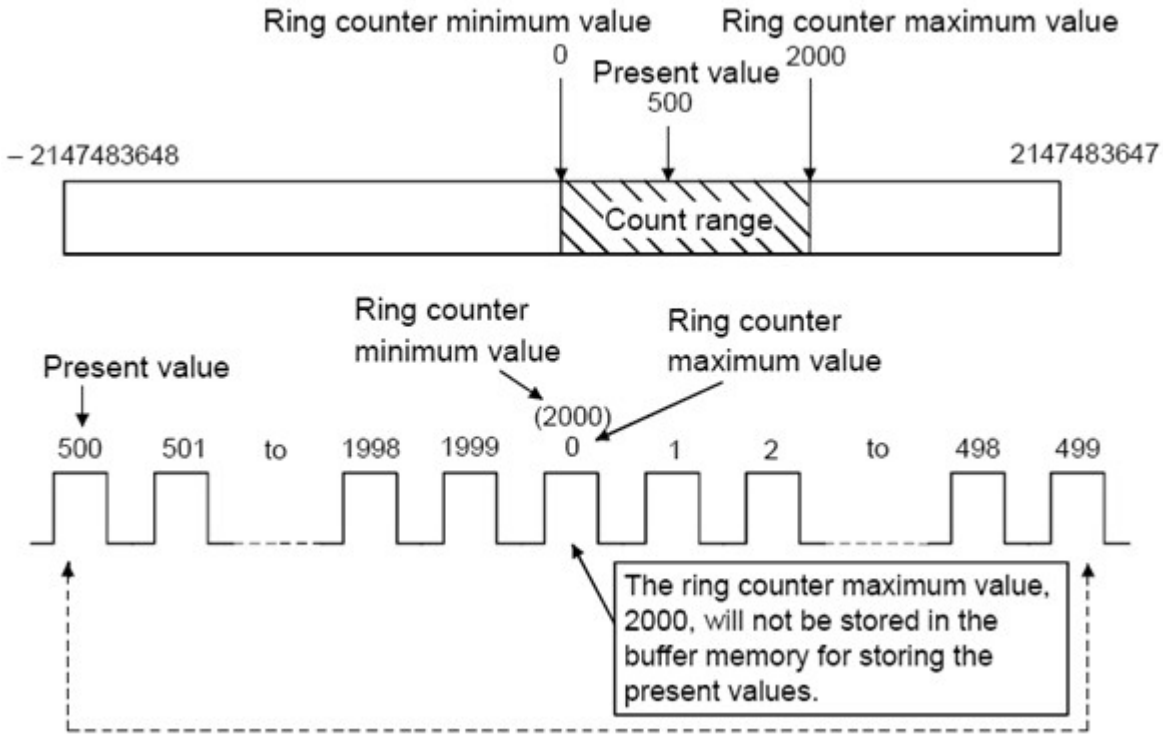
1. CH1, CH3 Setting Options
   Disable
   1-Phase 1-Multiple
   1-Phase 1-Multiple (B switch)
   1-Phase 2-Multiple
   1-Phase 2-Multiple (B switch)
   CW/CCW
   2-Phase 1-Multiple
   2-Phase 2-Multiple
   2-Phase 4-Multiple
2. CH2, CH4 Setting Options
   Disable
   1-Phase 1-Multiple (ØB switch)
   1-Phase 2-Multiple (B switch)

3. When "ØB switch" is selected from CH1 and CH3, the user can choose from either Up or Down count operation by using HSCSW command.
4. From Counter Setup for each channel, set each items of the active channels in order according to the already-selected pulse input type (Counter Mode, Preset Value, Coincidence 1, Coincidence 2, Max. Ring Count, Min. Ring Count).
5. There are two options for counter mode which are linear counter and ring counter. When ring counter is selected and the max, and the min values are set, counting values goes back forth between the min value and the max value. The overflow error does not occur for ring counter.

Operation of Ring Counter



Order of Ring Counting



6. While setting Preset values, when the preset terminal of HSC and HSCSW commands receives input signal, the counted value changes to the preset value.

7. Up to 2 coincidence values can be set for each channel and set/reset the exclusive Flag(F0370~F038f) by comparing the present value and the defined coincidence value.

7.9.3 Coincidence Output Flag and Overflow Bit

1. CH1, CH2 coincidence output Flag and Overflow Bit (F0370)

CH	CH2								CH1							
No.	Coincidence No.2				Coincidence No.1				Coincidence No.2				Coincidence No.1			
FLAG	F37F	F37E	F37D	F37C	F37B	F37A	F379	F378	F377	F376	F375	F374	F373	F372	F371	F370
SET	★	>	=	<		>	=	<	★	>	=	<		>	=	<

2. CH3, CH4 coincidence output Flag and Overflow Bit (F0380)

CH	CH4								CH3							
No.	Coincidence No.2				Coincidence No.1				Coincidence No.2				Coincidence No.1			
FLAG	F38F	F38E	F38D	F38C	F38B	F38A	F389	F388	F387	F386	F385	F384	F383	F382	F381	F380
SET	★	>	=	<		>	=	<	★	>	=	<		>	=	<

3. Overfolw Bit

When counter mode is set to linear counter, counting range is 2147483648~2147483647 and when the value is out of the range, the computation terminates and sets internal overflow bit. Set overflow bit for each channel is marked as★ above.

7.9.4 Exclusive Commands for Built-In High Speed Counter

These commands are used exclusively for the built-in high speed counter of the block type PLC. The following description only describes basic functions of the commands. Please refer to "CPU Command" manual for more detailed descriptions and examples.

1. HSC

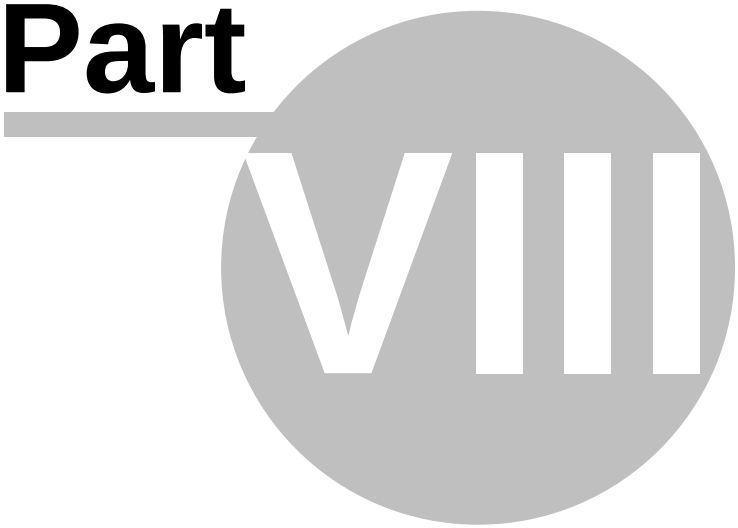
Receives an input of channel Enable and Preset signal of the high speed counter to start counting and to use preset function of counting value. This command is used only when B-Phase switch function is not selected.

2. HSCSW

This command is used only when pulse input type is selected to 1-Phase 1-Multiple B-Phase switch or 1-Phase 2-Multiple B-Phase switch. Like the command "HSC", it receives an input of channel Enable,Preset, and B-Phase switch signal of the high speed counter to start counting and to use preset, up/down function o f counting value.

Top Level Intro

This page is printed before a new
top-level chapter starts



8 PLC-S(CM3)

PLC-S Brochure
PLC-S Program Setting
PLC-S Communication
PLC-S AD Module : SP04EAO
PLC-S DA Module : SP04EOAx
PLC-S AD DA Module : SP04EAA
PLC-S RTD Module : SP04ERO
PLC-S TC Module : SP04ETO
PLC_S AD MUX Module : SP 04EAM
PLC-S High-Speed Counter
PLC-S Positioning
PLC-S Parameter Settings

8.1 PLCS Brochure

Main Unit

Specification	
Max. Expansion	11
Program Capacity	10k Steps
Operation Rate	200nsec/step
I/O points	Max. 384 points
High speed counter	2 Phase 2Ch.
Pulse Output	Max. 100Kpps, 2 Axis, Linear interpolation
Programming Tool	USB (CICON)
PID	32 Channels, Auto-Tuning
RTC	Built-In (Battery : CR2032)
ETC.	Floating point arithmetic, Online Edit
Power	DC24V
Size & Weight	30 X 90 X 61mm /120g

COMMUNICATION PROTOCOL	
Ethernet	MODBUS/TCP, CICON(Loader)
	CIMON-HMI (TCP,UDP)
RS232C/485	MODBUS/RTU Master,
	MODBUS/RTU Slave,
	CICON(Loader), CIMON-HMI

Built-in Functions

High-speed counter

Counter Input signal	Voltage Input (Open Collector)
Max. counting speed	20kpps
Number of channels	2 channels (10kpps)
Counting range	Signed 32Bit
	(-2,147,483,648 ~ 2,147,483,647)

Positioning

No. of control axis	2 axis
Interpolation	2 axis linear interp
Pulse output Type	Open Collector (D
Pulse output	Pulse + Direction
Control Mode	Position control, S
	Speed/Position sw
	Position/Speed sw
Max. output speed	100kpps

MAIN UNITS

CM3-SP32MDT	DI16/DO16, USB Loader, RS232C 1ch
CM3-SP32MDT-SD	DI16/DO16, USB Loader, RS232C 1ch, SD/MMC
CM3-SP32MDTV	DI16/DO16, USB Loader, RS232C 1ch, 422/485 1ch
CM3-SP32MDTV-SD	DI16/DO16, USB Loader, RS232C 1ch, 422/485 1ch, SD/MMC
CM3-SP32MDTE	DI16/DO16, USB Loader, RS232C 1ch, Ethernet 1ch
CM3-SP32MDTE-SD	DI16/DO16, USB Loader, RS232C 1ch, Ethernet 1ch, SD/MMC
CM3-SP32MDTF	DI16/DO16, USB Loader, RS232C 1ch, 422/485 1ch, Ethernet 1ch
CM3-SP32MDTF-SD	DI16/DO16, USB Loader, RS232C 1ch, 422/485 1ch, Ethernet 1ch, SD/MMC
CM3-SP16MDR	DI8/DO8 (Relay), USB Loader, RS232 1ch
CM3-SP16MDRV	DI8/DO8 (Relay), USB Loader, RS232 1ch, RS485 1ch
CM3-SP16MDRE	DI8/DO6 (Relay), USB Loader, RS232 1ch, Ethernet 1ch
CM3-SP16MDRF	DI8/DO6 (Relay), USB Loader, RS232 1ch, Ethernet 1ch, RS485 1ch

EXPANSION / DIGITAL

Item	Description	Specification
CM3-SP32EDO	DI-32	32 points DC24V Input
CM3-SP32EOT	DO-32	32 points TR(Sink) Output
CM3-SP32EDT	DI-16/DO-16	16 points DC24V Input/16 points TR
CM3-SP16EOR	DO-16	16 points Relay Output

EXPANSION / ANALOG

Item	Description	Specification
CM3-SP04EAO	Analog Input	AI 4CH V/I, 12 bit
CM3-SP04EAA	Analog I/O	AI 2CH V/I, AO 2CH V/I, 16/14 bi
CM3-SP04EOAI	Analog Output (Current)	AO 4CH Current, 14 bit
CM3-SP04EOAV	Analog Output (Voltage)	AO 4CH Voltage, 14 bit
CM3-SP04ERO	Temperature measurement	4CH RTD(PT100/JPT100/PT1000)
CM3-SP04ETO		4CH TC(K,J,E,T,B,R,S,W)

EXPANSION / COMMUNICATION

Item	Specification
CM3-SP02ERS	RS232C 1ch, RS485 1ch
CM3-SP01EET	Ethernet 1ch, 100Mbps

ACCESSORIES

Item	Specification
CM0-TB32M	Multi-Terminal Unit
CM0-SCB15M	Main Block 1.5m Cable
CM0-SCB15E	I/O 32 points 1.5m Cable

8.2 PLCS Program Setting

Contents :

8.2.1 Frimware Download

Please check CICON Build version and USB DRIVER installed.
(CICON version must be 2.29 or more. There is USB DRIVER in CICON folder.)

Contents :

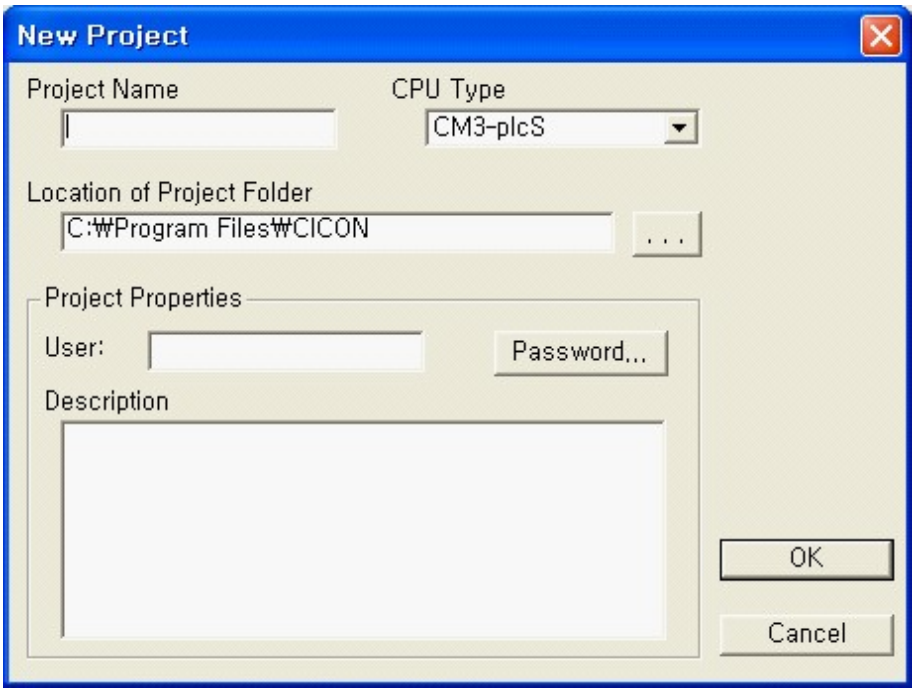
8.2.1.1 How to upgrade PLC-S CPU firmware

1. Turn PLC-S Power On (DC 24V) and connect USB connector with PC.

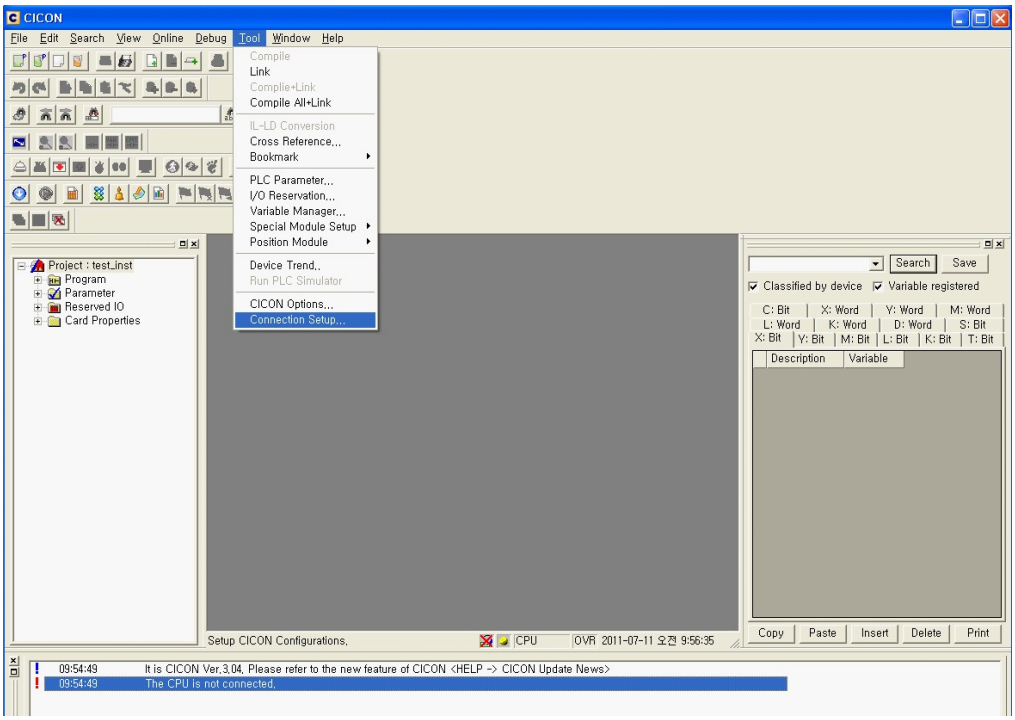
2. Put MODE SWITCH to STOP and check STOP LED On.

3. Execute CICON

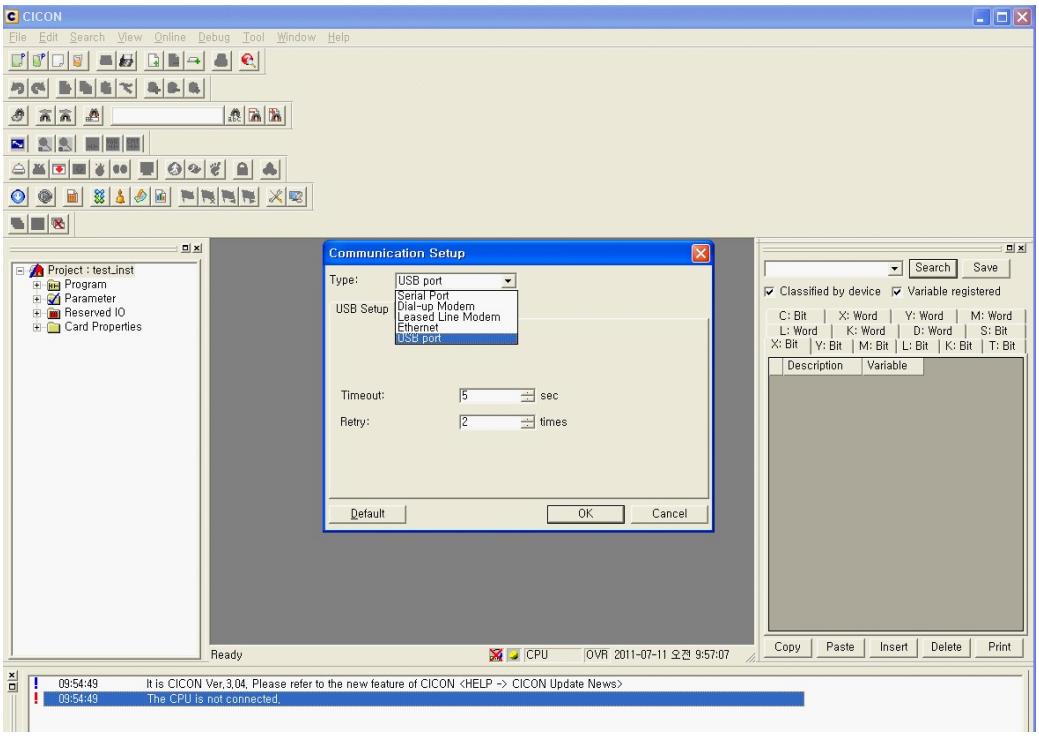
4. Select CM3-plcS at CPU Type



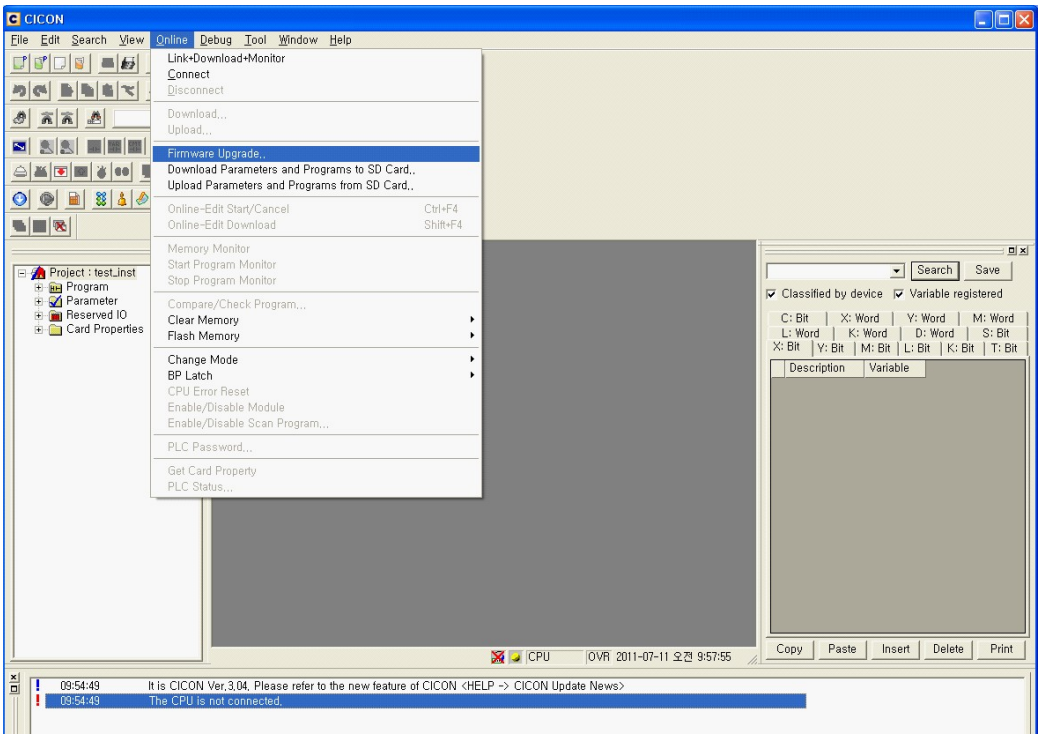
5. Select [Tool] -> [Connection Setup]



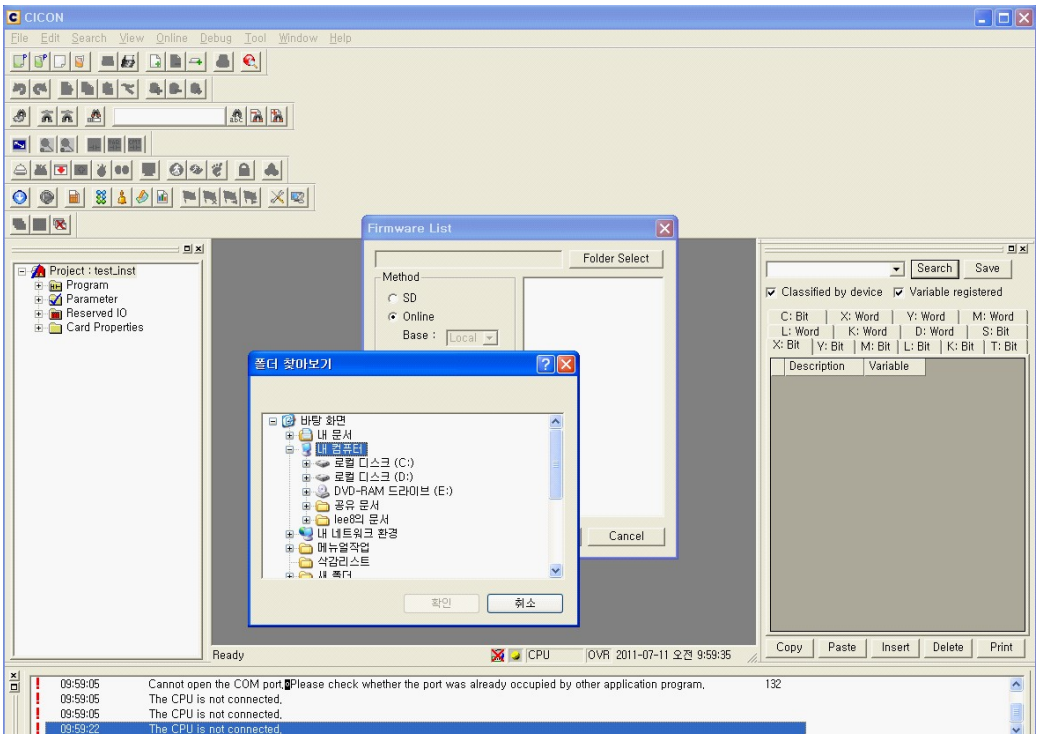
6. Select USB Port at Type.(Timeout should be more than 5 sec.)



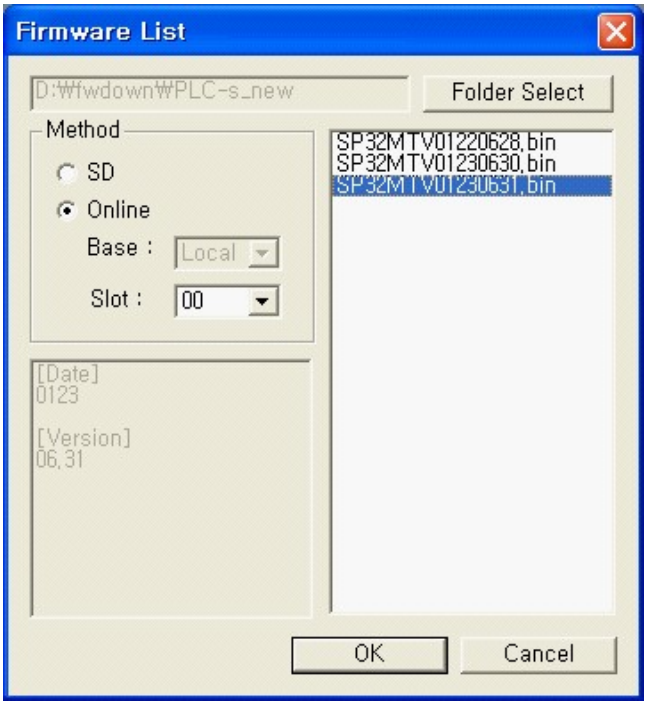
7. Select [Online] -> [Connect] and [Online] -> [Firmware Upgrade]



8. Check Online and select the folder where firmware file is in.

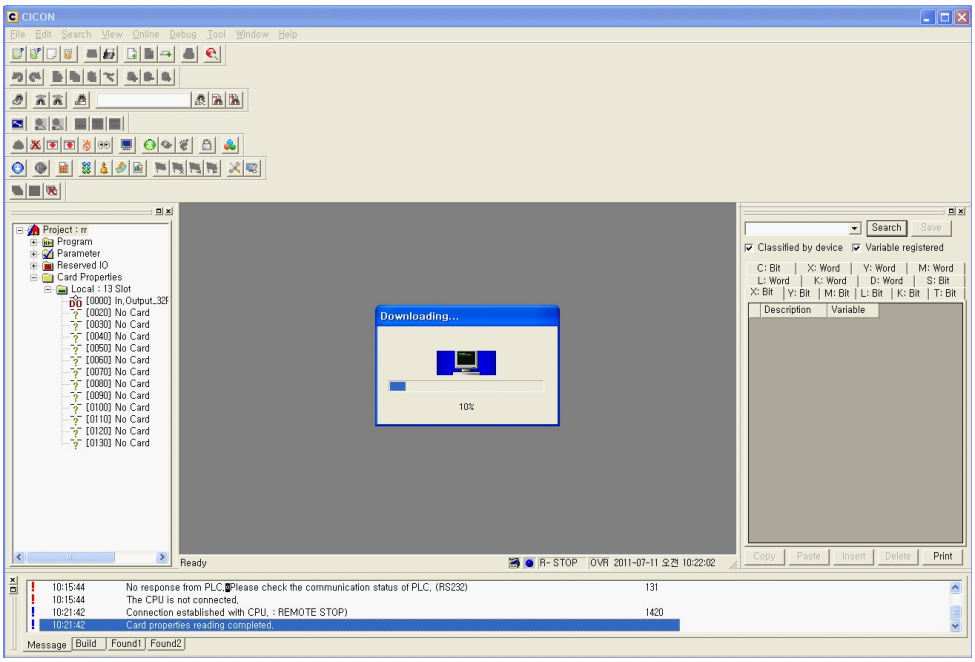


9. Check firmware file name and click [OK] button.

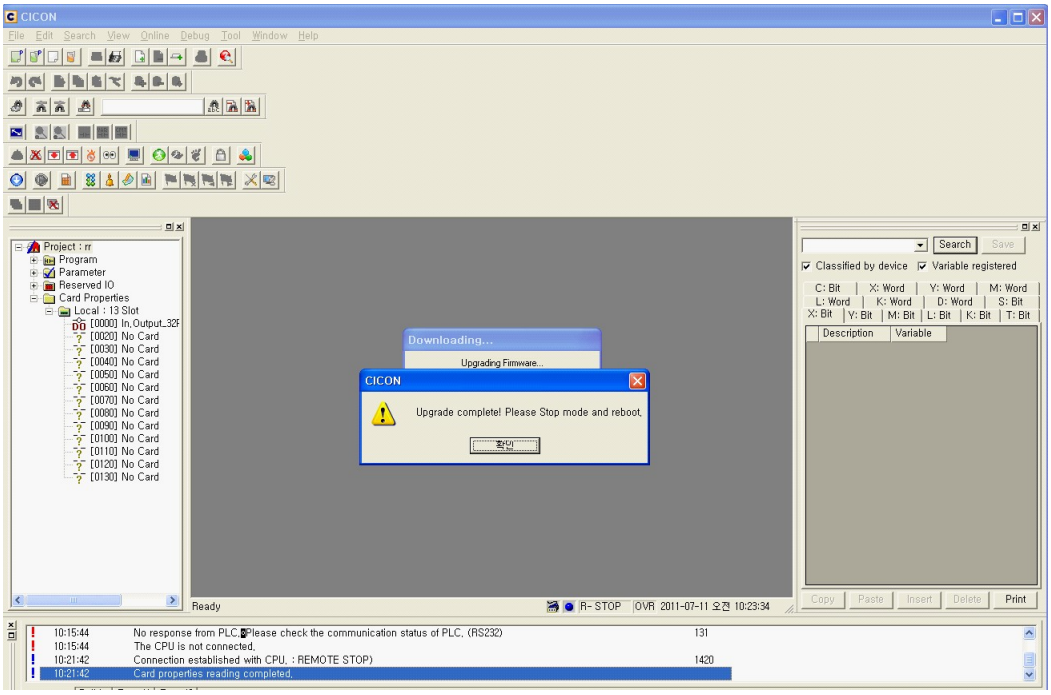


10.Start firmware upgrade.

(Do not remove USB connection from PC or PLC-S until firmware is completely finished)



11.When firmware is finished in order, the message box will be appeared as follow. In case of PLC-S, only Power LED is ON and others are blinking.



12.If you want to make other PLC-S firmware upgraded, start from No.8 again.

13.SD memory card type Module has the same upgrade process.

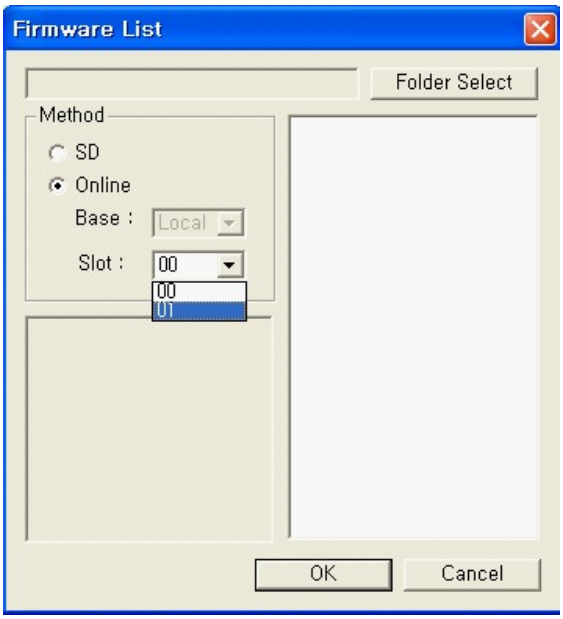
8.2.1.2 PLC-S Expansion module Firmware Upgrade

1. Turn CPU Power ON(DC 24V) after connect expansion module to CPU.

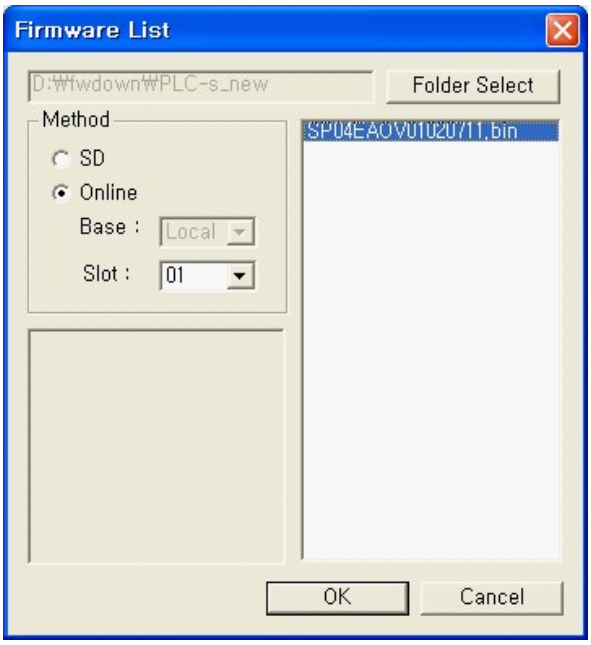
2. Check Power LED of expansion module is ON.

3. Follow instruction from No.1 to No.8.

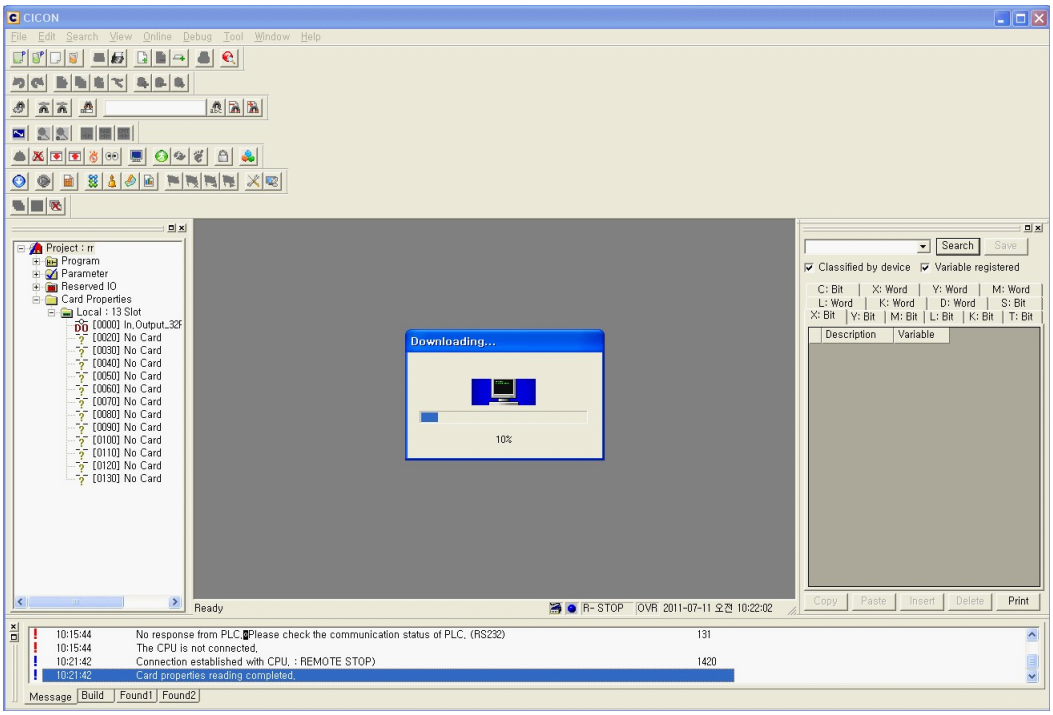
4. Check “01” at Slot in [Firmware List]



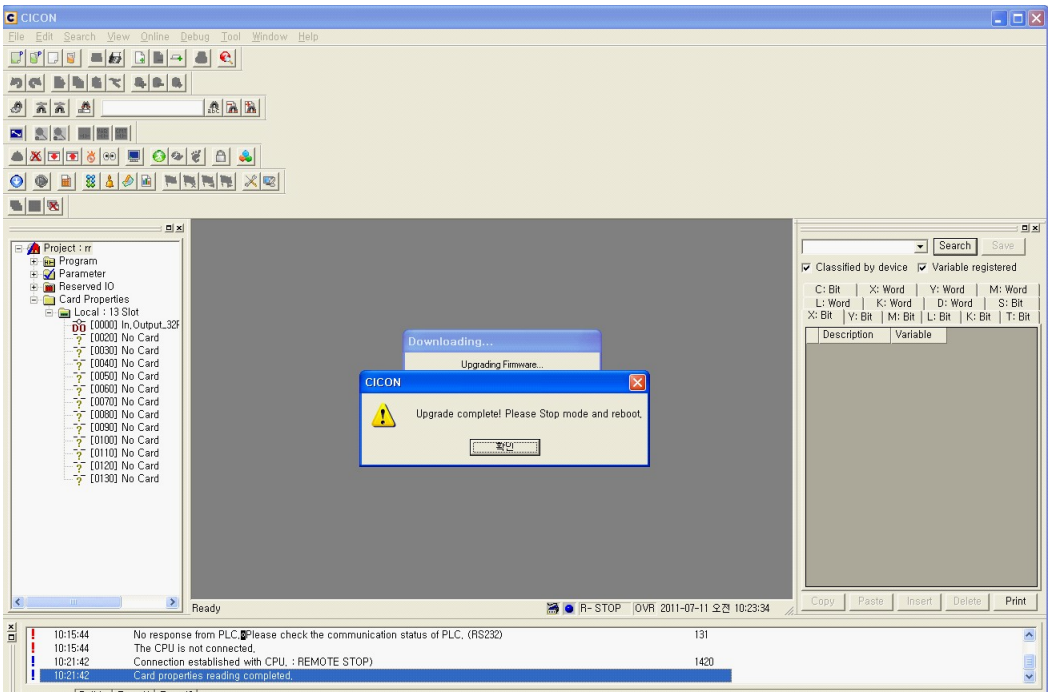
5. Check firmware file name and click [OK] button.



6. Start firmware upgrade.
(Do not remove USB connection from PC or PLC-S until firmware is completely finished.)



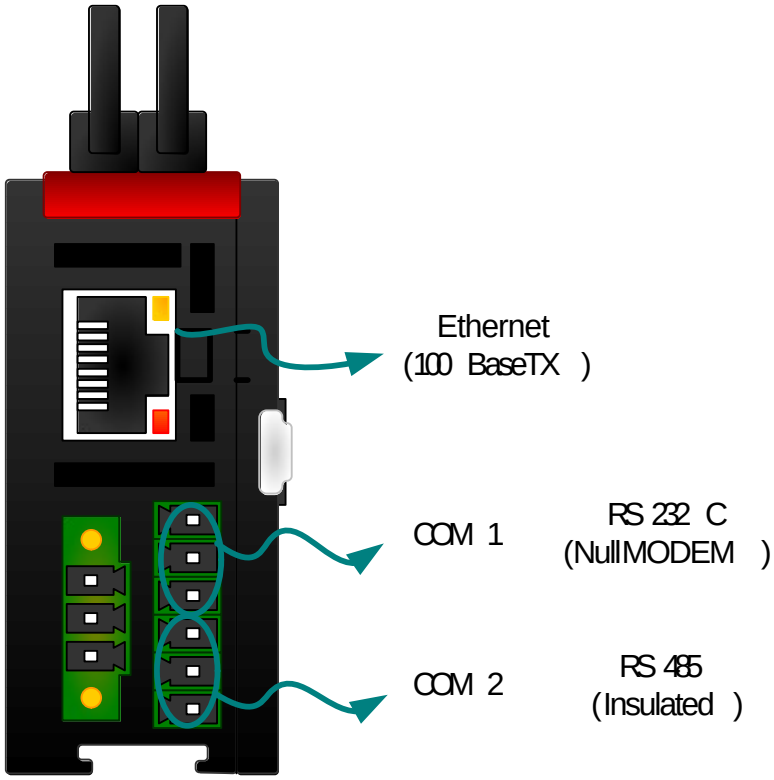
7. When firmware is finished in order, the message box will be appeared as follow. In case of expansion module, Power LED is blinking quickly.



8.3 PLCS Communication

Contents :

8.3.1 Outline



Port	Spec.	Protocol	Features
Ethernet	100Base-TX 10Base-T	CIMON HMI Protocol (TCP/IP, UDP/IP) MODBUS/TCP (Slave) High Speed PLC Link Programming Tool Connection (CICON)	Programming Tool Bridge DHCP + CIMON DDNS
COM1	RS232C NULL MODEM	CIMON HMI Protocol MODBUS/RTU (Master) MODBUS/RTU (Slave) Protocol Program Programming Tool Connection (CICON)	Protocol Auto Detection
COM2	RS485	CIMON HMI Protocol MODBUS/RTU (Master) MODBUS/RTU (Slave) Protocol Program Programming Tool Connection (CICON)	Protocol Auto Detection Insulated

8.3.2 Ethernet

- Network Capacity

PLCS supports Max.5 clients at once. TCP/IP supports Max.2 clients at once.

If more than Max. number clients access network at once, network will be malfunction.

- Network Speed

  Network speed(10Mbps, 100Mbps) will be set up automatically.

2.1 CIMON HMI Protocol (TCP/IP, UDP/IP)

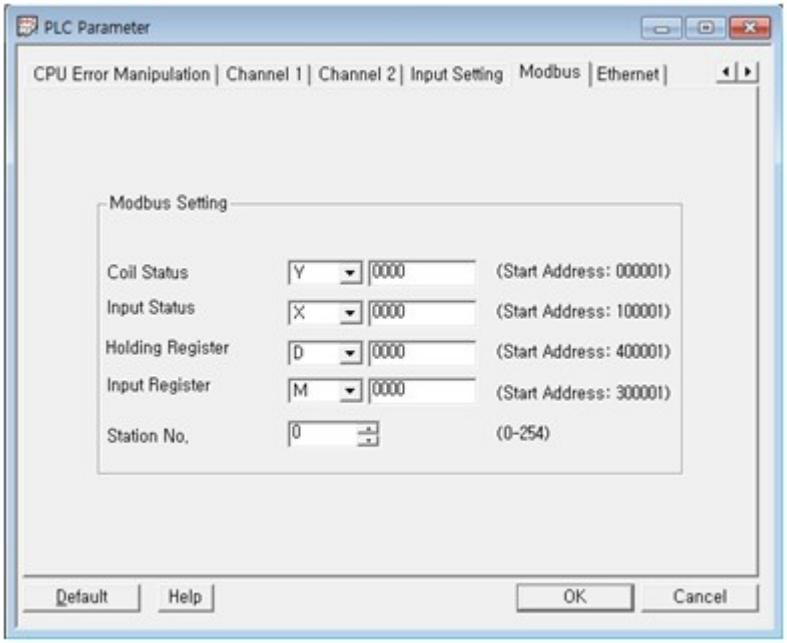
1) PLCS supports "CIMON HMI Protocol" which all CIMON PLC have.

2) Comm. Port number : UDP/IP=10262, TCP/IP=10260

3) TCP/IP or UDP/IP are selected by Client(HMI device)

4) PLCS supports Max.5 clients at once. TCP/IP supports Max.2 clients at once.

2.2 MODBUS/TCP (Slave)



1) User can see MODBUS Memory map in “PLC Parameter”

2) This function enables user to choose and assign internal memory as MODBUS Memory.

3) This MODBUS Memory Map will be operated as same as COM1 and COM2 MODBUS/RTU Protocol.

4) Comm. Port Number : TCP/IP 502

2.3 High Speed PLC Link

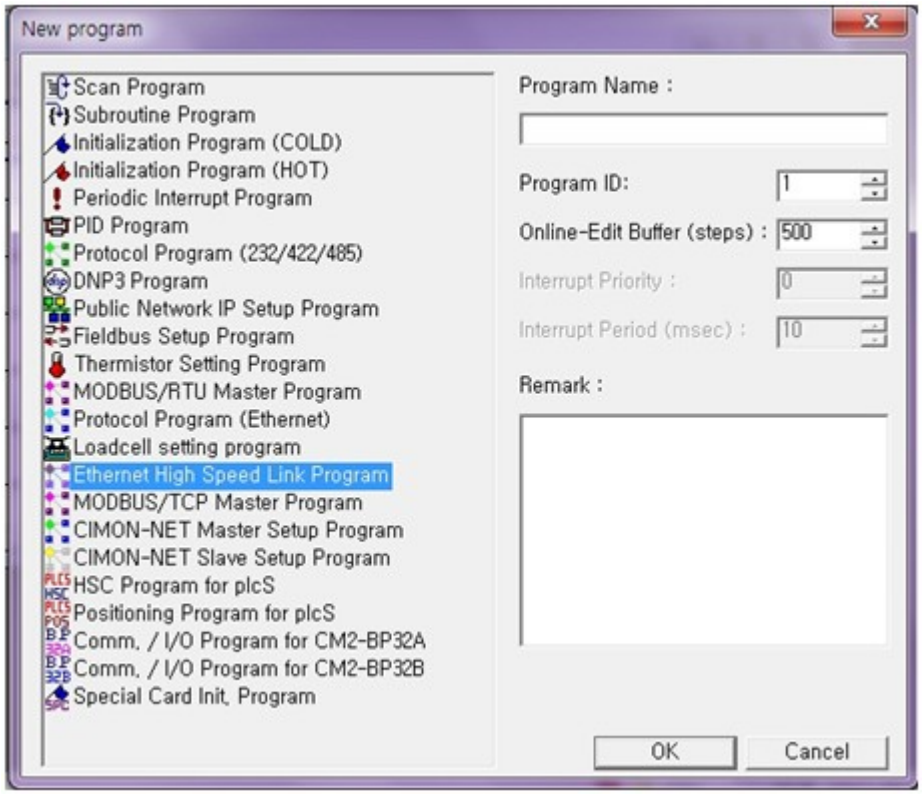
1) This function will be used when fast communication between CIMON PLCs is needed.

2) It is possible to communicate among Max. 64stations.

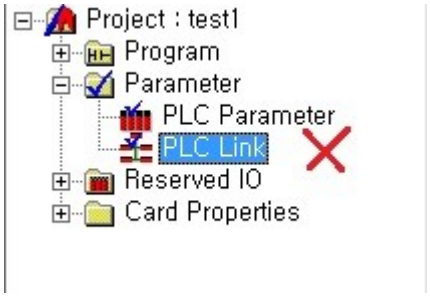
3) Each PLC can send and receive data of Max. 64stations. Sending stations are limited upto 32stations.

4) There can be Max. 64words executive data in a station.

5) In order to activate this function, [Ethernet High Speed Link Program] is selected.



6) Note : [PLC Link] in [Parameter] does not support High support PLC Link to PLC-S. Only [Ethernet High Speed Link Program] in Special program supports this function.



7) Compatible Comm. Modules are as following

- PLC-S : All CPU module which has Ethernet Option
- PLC-S : CM3-SP01EET (Ethernet Expansion module)
- CP/XP Series PLC : CM1-EC10A, CM1-EC10B
- Note : CM1-EC01A of CP/XP series is not compatible with Ethernet option of CM2-BP series.
-

8) In order to enjoy the best performance, it should be separated with other networks. If it works with other networks, its network speed should be damaged. Its network is UDP/IP Broadcast type. Therefore, network Hub does not need to be

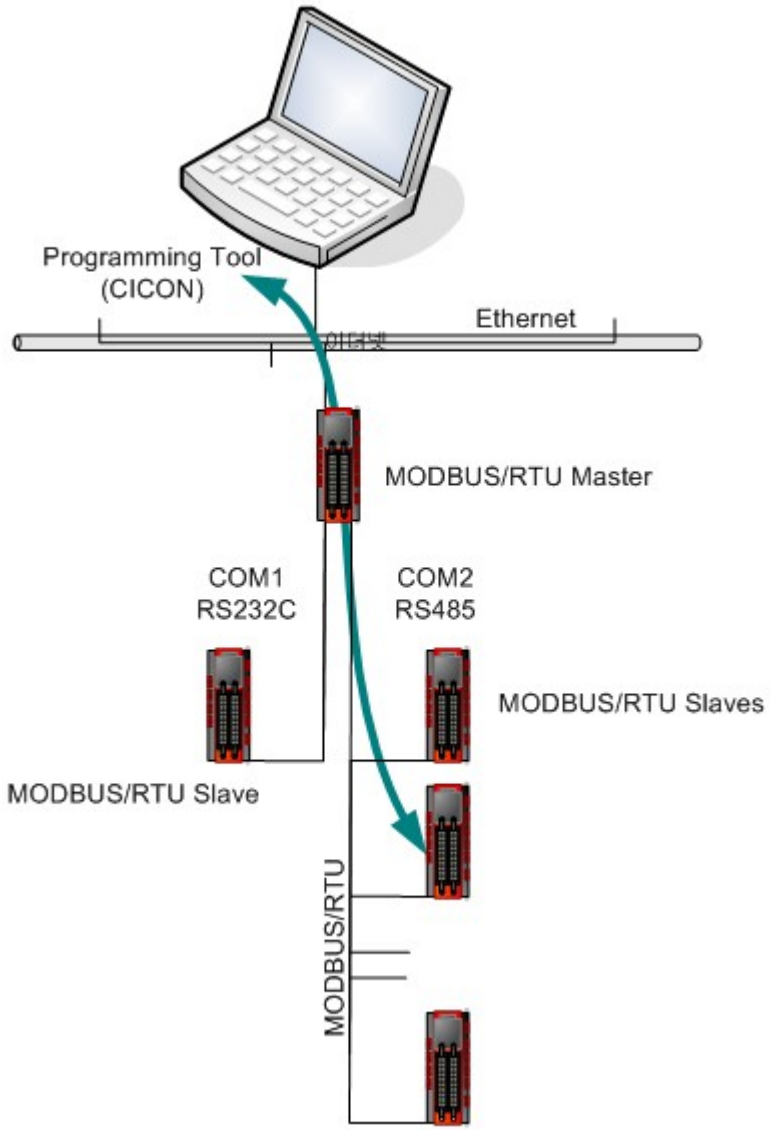
9) switching Hub.

10) Comm. Port Number : UDP/IP 10264

2.4 Programming Tool Connection (CICON)

1) CPU can connect to CICON through Ethernet.
2) UDP/IP is used and Port Number is 10266.
3) Programming Tool Bridge supported.

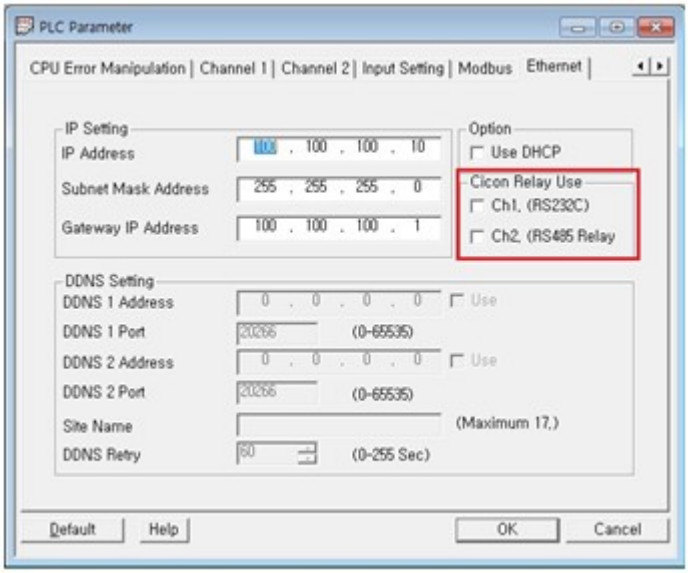
This function enable to make CICON communication from CPU to other CPU by port COM1 or COM2.



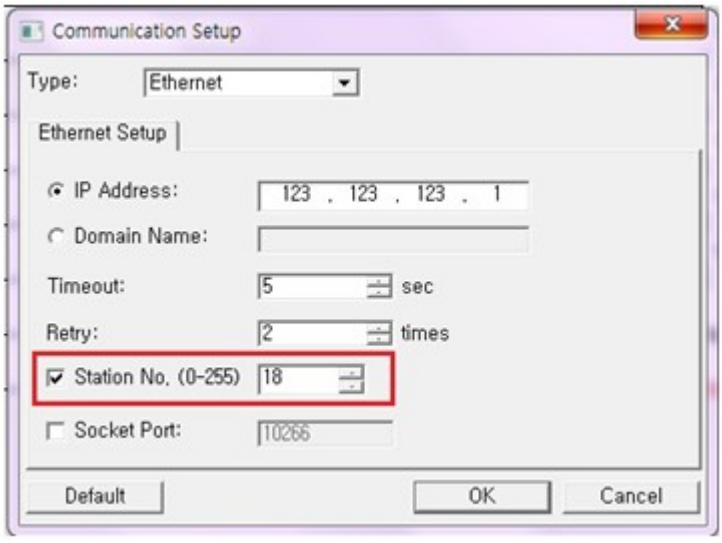
4) Example of Programming Tool Bridge

- The above configuration is the one of examples of Programming Tool Bridge.
- Generally PLC-S communicates with other PLC-S by MODBUS/RTU Master-Slave. (Master PLC-S has Ethernet Option)

- To operate this function, [Cicon Relay Use] of Master PLC Parameter must be selected.

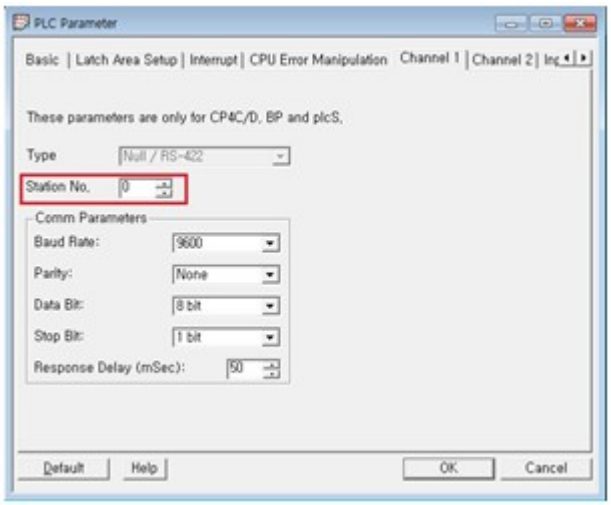


- As 2 serial ports are supported, 2 MODBUS/RTU networks can be set up.
- If 2 Channels are used, IP address should be set up as below
  Slave PLC with Channel 1 : Station No. 0~127
  Slave PLC with Channel 2 : Station No. 128~254.
  (Master PLC can use any Station No.)
- After setup, connect Master PLC to CICON through Ethernet to operate Slave PLC.



- Assign [Station No.] that you want to connect Slave PLC. Then Master PLC stops network and connects CICON to Serial port.
  (MODBUS/RTU Master Communication mode is changed to Stop mode at that time)

- Mater PLC will use assigned Station number of Ch1 or Ch2 in [PLC Parameter]
  In case that both channels are selected by [Cicon Relay Use], any Station No. which is matched with Master PLC will be connected.



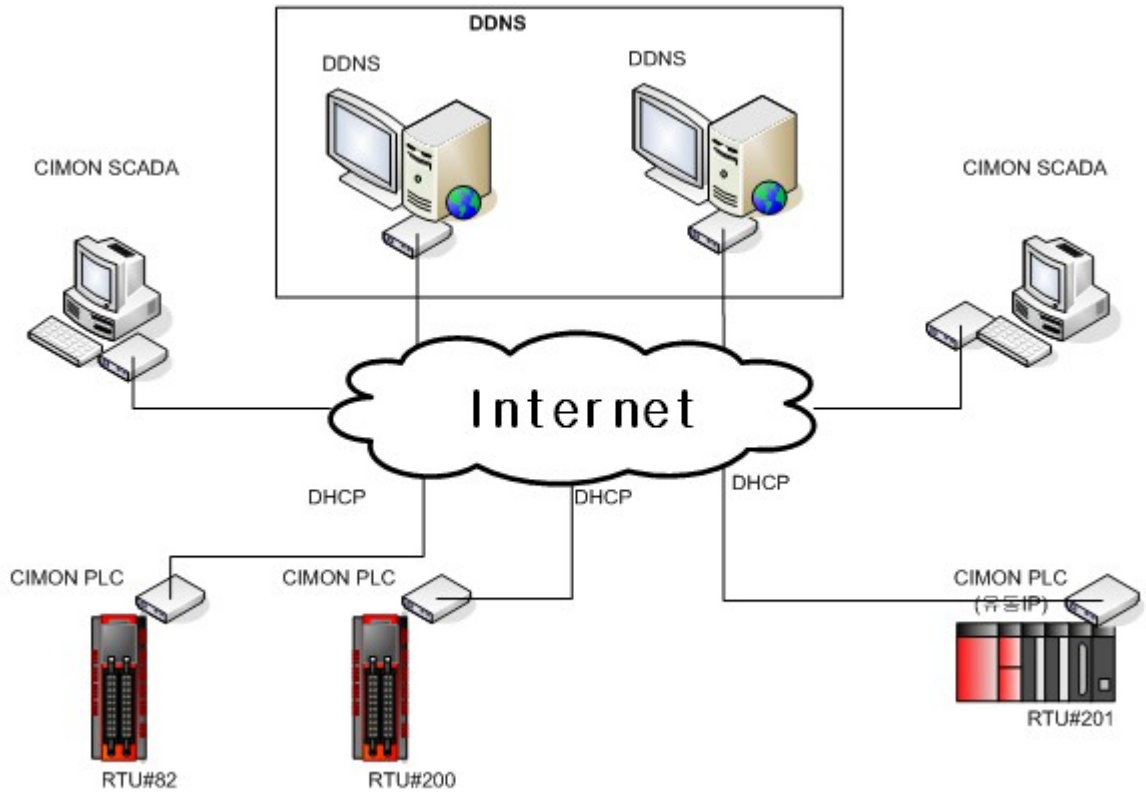
- Without serial port setup, PLC-S can recognize Comm. protocol automatically. With this function, Slave PLC changes MODBUS/RTU mode to CICON Comm. mode automatically.
- While program task is operating with Slave PLC, other PLCs will be on standby because serial port cannot have several comm. protocols.
- After programming finished, Ethernet connection between Master PLC and CICON will be cut. If Master PLC does not receive message from CICON in 5 sec. it changes to previous comm. mode automatically. In this case, it will become MODBUS/RTU Master comm.
- Master PLC which is changed to MODBUS/RTU Master comm. will restart communication with Slave PLC. Slave PLC search MODBUS/RTU protocol automatically and send respond when Station number is correct.

2.5 DHCP

(1) Outline

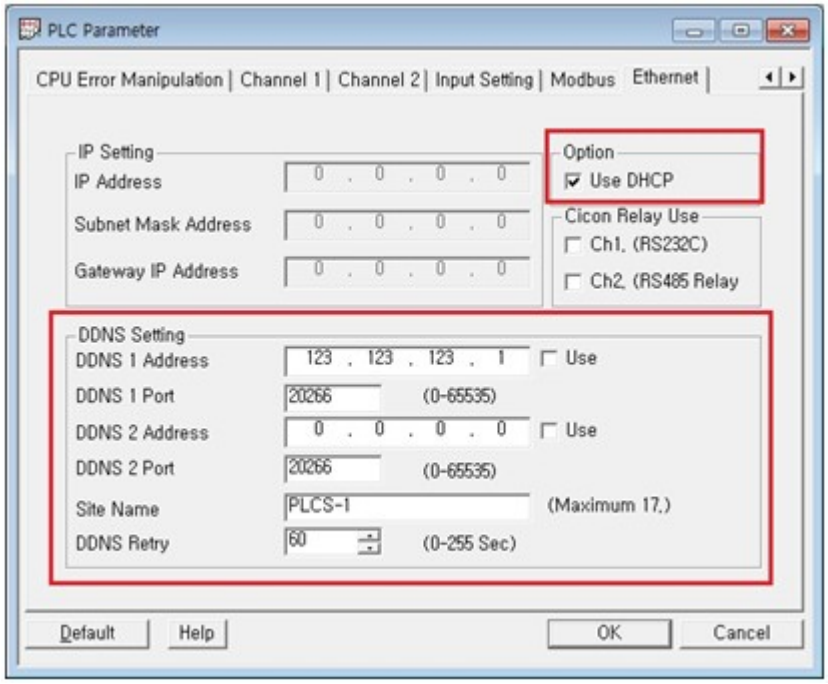
PLC-S supports DHCP that is operated with dynamic IP network. However, as HMI does not recognize dynamic IP, PLC-S provides method to operate private DDNS with CIMON SCADA.

(2) CIMON Private DDNS



The Private DDNS is the software which is provided with CIMON SCADA. It has function that operates PLC-S with CIMON SCADA through dynamic IP. CIMON SCADA can gain IP address of PLC-S if user install software in computer which has fixed IP and register PLC name and IP.

(3) PLC-S Setting (PLC Parameter -> Ethernet)



Above picture shows DHCP and DDNS setting parameter.

- DDNS address : write IP address which is assigned to DDNS. DDNS redundancy is possible.
- Site Name : Write PLC name. CIMON SCADA will search PLC IP address based on this Site Name.
- DDNS Retry : PLC will send IP address to DDNS regularly. This function is used to register IP address to DDNS in case that IP address is changed and show that PLC is connected with network and works fine. Less than 1 minute is recommended.

(4) Etc.

- The network address assigned from DHCP can be checked at below F device address.

Items	Device address	Remarks
IP Address	F0670	a.b.c.d 중 a.b
	F0680	a.b.c.d 중 c.d
Network Mask	F0690	a.b.c.d 중 a.b
	F0700	a.b.c.d 중 c.d
Gateway	F0710	a.b.c.d 중 a.b
	F0720	a.b.c.d 중 c.d
MAC Address	F0730	a:b:c:d:e:f 중 a:b
	F0740	a:b:c:d:e:f 중 c:d
	F0750	a:b:c:d:e:f 중 e:f

- DDNS Connection Port : UDP/IP, 20266

8.3.3 Serial(COM1 / COM2)

3.1 Features

(1) Protocol Auto Scan

- PLC-S scans below protocol for HMI automatically without protocol setting. (Baud rate and basic parameter should be setup for matching with HMI)
  1. CIMON HMI Protocol
  2. MODBUS/RTU Slave
  3. Programming Tool Connection (CICON)
- If Special program below is registered, Protocol Auto Scan is not operated with RUN Mode.
  1. MODBUS/RTU Master
  2. Protocol Program

(2) Communication insulation(COM2)

- COM2 Port is only for RS485
- COM2 Port has insulation and is effective as following:
  1. Protect Comm. quality and electric shock from electric potential difference.
  2. Protect Comm. quality from Noise and Surge.

(3) Comm. port independent.

- COM1 and COM2 works independently that makes flexible network.
- Two different protocols work with COM1 and COM2 simultaneously.
- Special programs works with COM1 and COM2 independently.
  Ex) two protocols from each Comm. Port can work independently without interrupt.

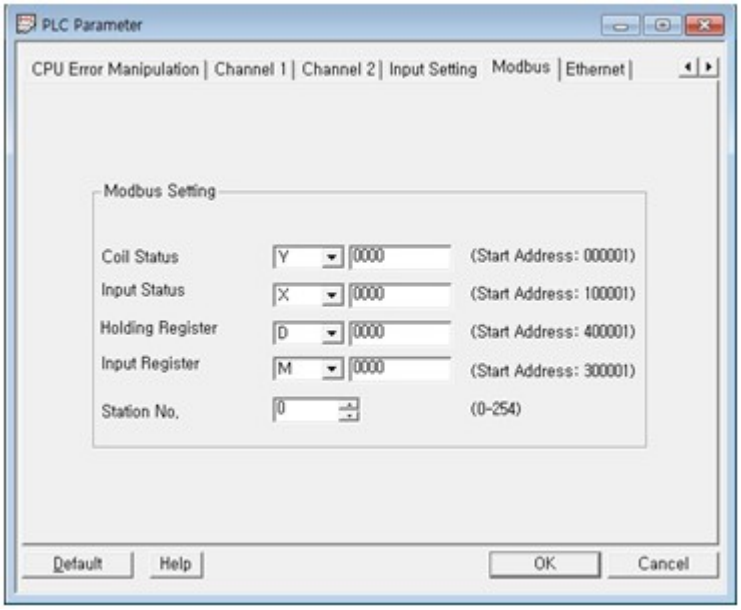
(4) Programming Tool Bridge (CICON)

- Connect to CICON through Ethernet port.
- Please refer to PLC-S Ethernet Communication manual.

3.2 CIMON HMI Protocol

(1)CIMON HMI Protocol supported.

3.3 MODBUS/TCP MODBUS/RTU (Slave)

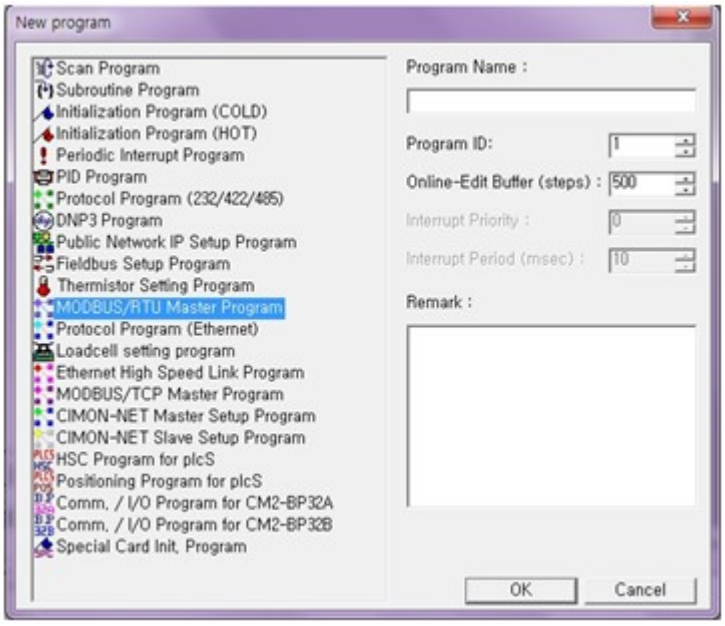


(1) MODBUS Memory mapping function is supported in [PLC Parameter]

(2) This function is used to assign some parts of internal memory to MODBUS Memory.

(3) The MODBUS Memory Map is used the same with MODBUS/TCP supported from Ethernet.

3.4 MODBUS/RTU Master

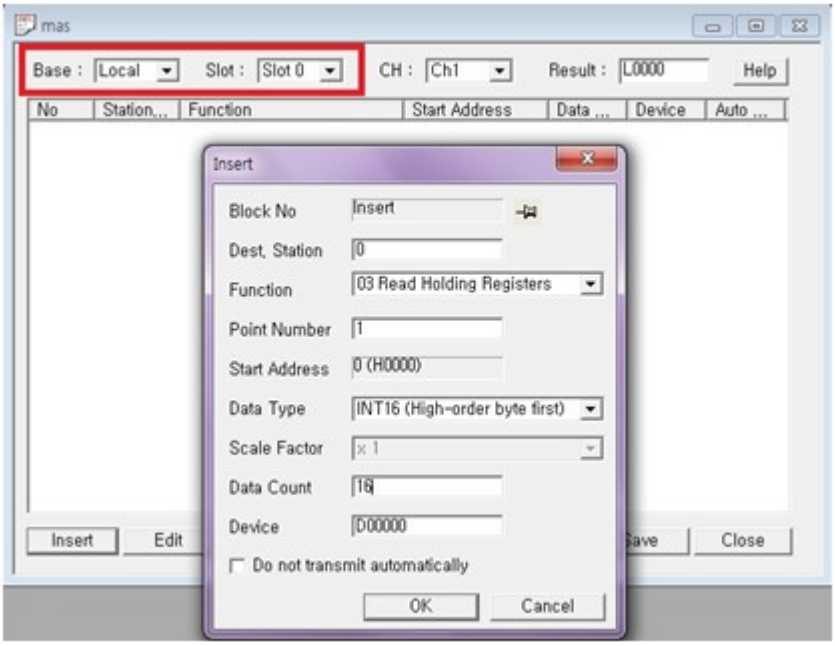


(1)"MODBUS/RTU Master Program" is selected to use this function.

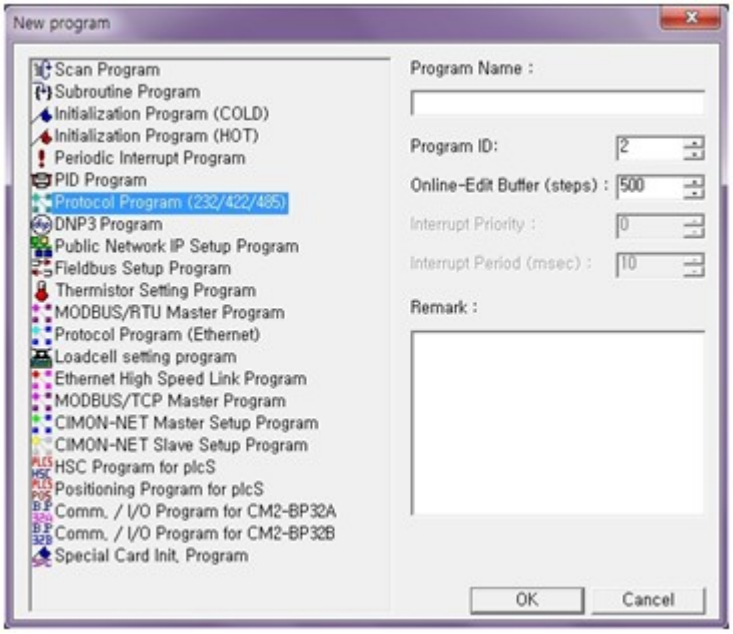
(2)The Base and Slot must be Local and Slot0 each. Slot 0 means CPU in PLC-S.
(Special program which is used in Expansion module starts with ‘Slot 1’)

(3)Channel Mode

Mode	Port	Remark
Ch1	COM1	RS232C
Ch2	COM2	RS485



3.5 Protocol Program



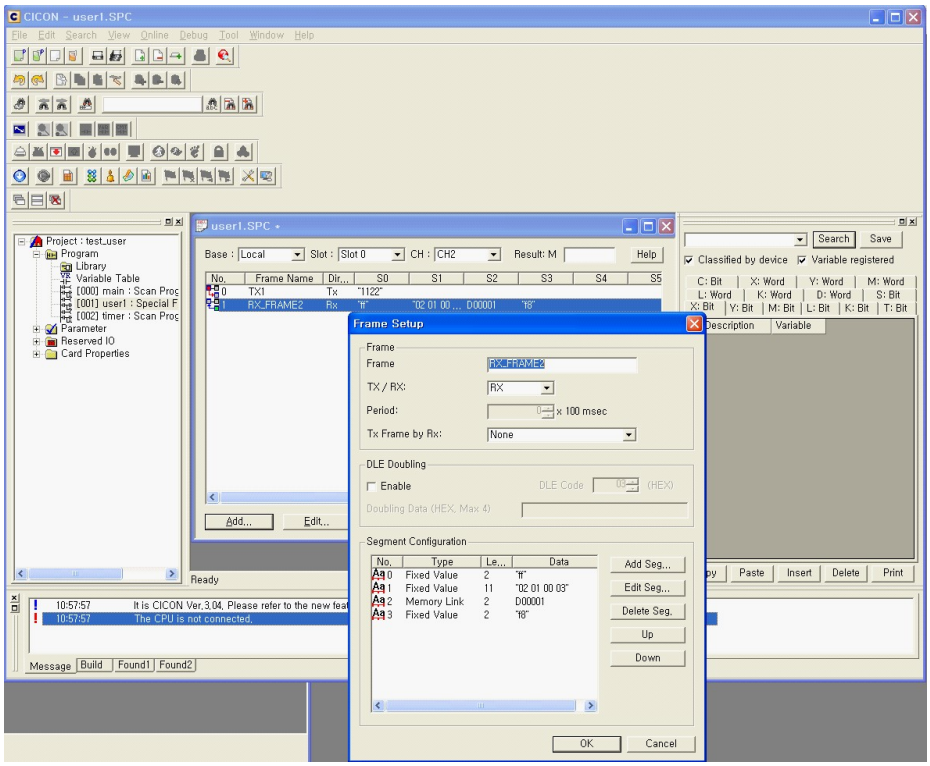
(1) "Protocol Program" is selected to use this function.

(2)The Base and Slot must be Local and Slot0 each. Slot 0 means CPU in PLC-S.

(Special program which is used in Expansion module starts with ‘Slot 1’)

(3)Channel Mode

Mode	Port	Remark
Ch1	COM1	RS232C
Ch2	COM2	RS485



8.4 PLCS AD Module : SP04EAO

CM3-SP04EAO is analog input module that converts analog input signal (Voltage or Current) to 16bit binary digital value.

Contents :

8.4.1 Features

- CM3-SP04EAO is Analog input module which has 4 channels analog input (current/voltage).
- The input range is 0~20mA, 4~20mA, 0~5V, 1~5V, -10~10V, 0~10V.
- In order to have Max resolution, you can select 0~16000 or -8000~8000.

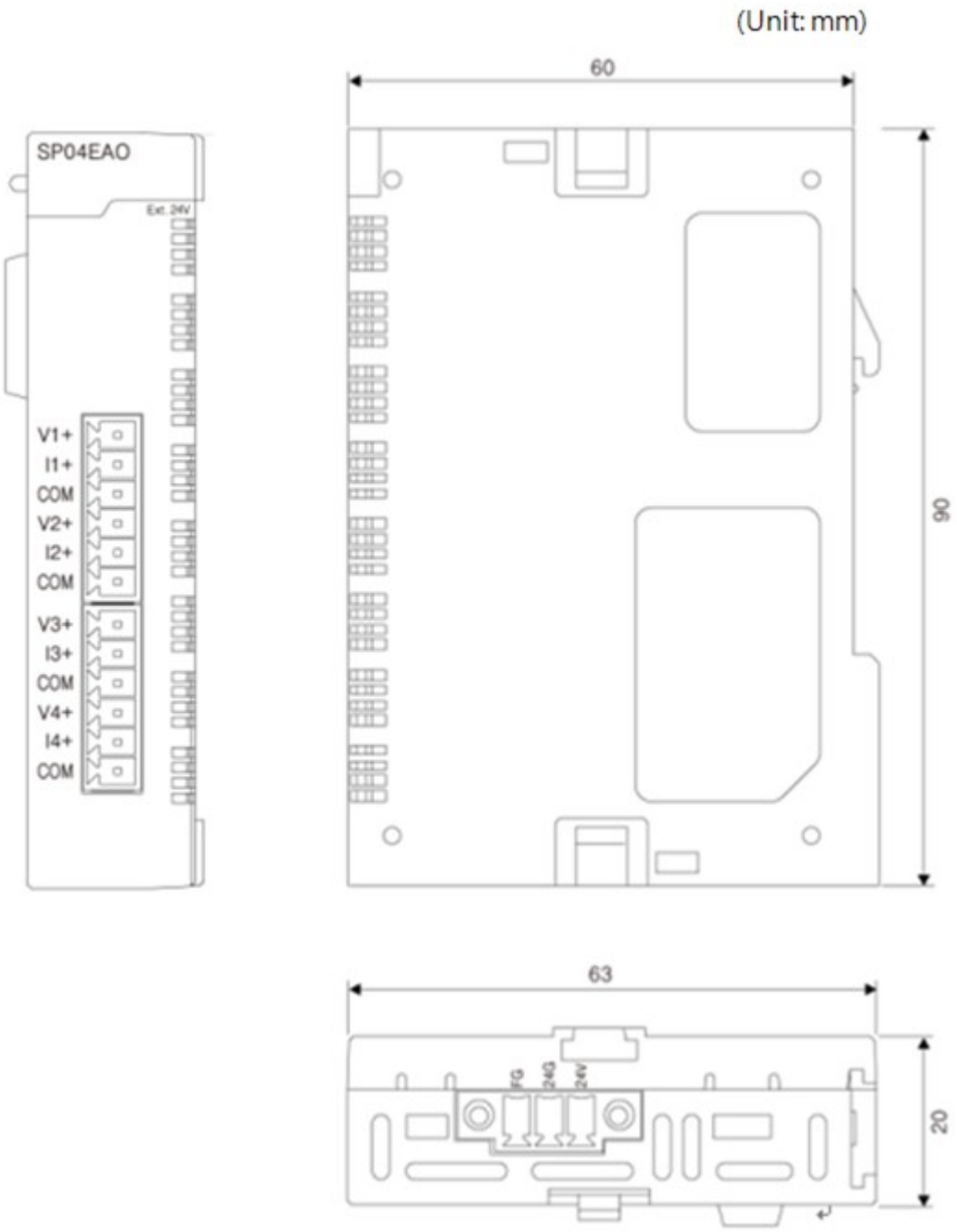
- User can have accuracy value because of digital filter inside.
- User can select Average processing (Time average / Count average) or Sampling processing.
- There is no quantity limitation to use in a system.
- (Maximum Expansion with one CPU is 11 modules except CPU)
- There is led indicator to check module status.

8.4.2 Specification of Analog input module

<table>
<tr><th>Item</th><th colspan="5">CM3-SP04EAO</th></tr>
<tr><td>Analog input</td><td colspan="5">4 Channel</td></tr>
<tr><td>Analog input</td><td colspan="5">0 ~ +5V(0 ~ 20mA)
1 ~ +5V(4 ~ 20mA)
0 ~ +10V
-10V ~ +10V</td></tr>
<tr><td rowspan="8">Digital output</td><td colspan="5">➢ Voltage</td></tr>
<tr><td></td><td>0~5V</td><td>1~5V</td><td>0~10V</td><td>-10~10V</td></tr>
<tr><td>Signed value</td><td colspan="4">-8000 ~ 8000</td></tr>
<tr><td>Precise value</td><td>0~5000</td><td>1000~5000</td><td>0~10000</td><td>-10000~10000</td></tr>
<tr><td>Percentile value</td><td colspan="4">0 ~ 10000</td></tr>
<tr><td colspan="5">➢ Current</td></tr>
<tr><td></td><td colspan="2">0~20mA</td><td colspan="2">4~20mA</td></tr>
<tr><td>Signed value</td><td colspan="4">-8000 ~ 8000</td></tr>
<tr><td>Precise value</td><td colspan="2">0~20000</td><td colspan="2">4000~20000</td></tr>
<tr><td>Percentile value</td><td colspan="4">0 ~ 10000</td></tr>
<tr><td rowspan="5">Max. resolution</td><td rowspan="4">Voltage</td><td>0 ~ +5 V</td><td colspan="3">312.5 mV</td></tr>
<tr><td>1 ~ +5 V</td><td colspan="3">250 mV</td></tr>
<tr><td>0 ~ +10 V</td><td colspan="3">625 mV</td></tr>
<tr><td>-10V ~ +10 V</td><td colspan="3">1.25 mV</td></tr>
<tr><td>Current</td><td>0 ~ 20 mA</td><td colspan="3">1.25 nA</td></tr>
<tr><td>Accuracy</td><td colspan="5">+- 0.1% (Full Scale)</td></tr>
<tr><td>Max. Conversion speed</td><td colspan="5">2.1ms / 4Ch</td></tr>
</table>

Absolute max. input	Voltage: +-15V, Current: +- 30mA
Insulation method	Photo-coupler insulation : between input terminal and PLC (No insulation between channels)
IO Points	16 points
Connection Terminal	18-point terminal block
Consumption current	430 mA
Weight	187 g .

8.4.3 Dimension



8.4.4 Conversion Characteristic according to Analog input voltage

No.	Analog input voltage	Offset	Gain	Digital output	Max. resolution
①	1 ~ 5V	1V	5V	0 ~ 16000 (-8000~8000)	312.5 mV
②	0 ~ 5V	0V	5V		250 mV
③	0 ~ 10V	0V	10V		625 mV

④	-10 ~ 10V	-10V	10V		1250 mV

8.4.5 Conversion Characteristic according to Analog input current

No.	Analog input current	Offset	Gain	Digital output	Max. resolution
①	0 ~ 20mA	0mA	20mA	0 ~ 16000 (-8000~8000)	1.25 nA
②	4 ~ 20mA	4mA	20mA		1 nA

8.4.6 Functions of Analog Input Module

- A/D Conversion methods
- Digital output value setting
- Precise value
- Percentile value

8.4.6.1 A/D Conversion methods

Sampling processing

It converts analog input sign to digital through general A/D conversion processing and save digital value to Buffer memory. The required time for Sampling processing is 2.1ms interval regardless of the number of channels used.

Average processing

It is used to execute A/D conversion of the channel designated for average account or times and save the average of the accumulated sum on buffer memory. If setting value of time average is specified, it does not read A/D conversion value but receives A/D conversion value gained by time interval and use it for Count average process.

The after decimal point of A/D conversion is ignored.

Setting range of Count average process: 1~255 (times)

Setting range of Time average process: 0~255(x10)ms.

If setting value of Time average processing is 0, only Count average processing is executed.

- If Count average process is 10 times

  It receives sampling data (2.1ms) 10 times and execute average processing. In other words, the average value of input signal during 2.1ms outputs AD conversion value. In this case, interval time is 2.1ms.

- If Count average process is 10times and Time average process is 5(50ms)

  Sampling data is done by every 50ms and it executes average processing with those sampling value which is received 10 times. As a result, the average input signal value in 500ms will output as A/D conversion value. In this case, interval time is 50ms.

8.4.6.2 Digital output value setting

When Digital output value is saved to Buffer memory, you can select signed value 14 bit data (-8000~8000) or unsigned value 14 bit data (0~16000).

8.4.6.3 Precise value

It indicates digital output value separately with analog input signal to each channels so that you can see precise value without additional data processing. You can check Precise value for each analog input range.

Analog input	Precise value
4 ~ 20 mA	4,000 ~ 20,000
0 ~ 20 mA	0 ~ 20,000
1 ~ 5 V	1,000 ~ 5,000
0 ~ 5 V	0 ~ 5,000
-10 ~ 10 V	-10,000 ~ 10,000
0 ~ 10 V	0 ~ 10,000

8.4.6.4 Percentile value

A/D conversion value for each channels indicates percentage (0~10000) compared with input signal range.

8.4.7 Internal I/O Table

Direction of Signal(CPU? A/D Module)		Direction of Signal(CPU? A/D Module)	
Input	Name of Signal	Output	Name of Signal
X00	A/D Module Ready	Y00	Not Use
X01	Reserved	Y01	
X02	Flag indicating the operation condition set up	Y02	Requesting to set up an operation condition
X03	Reserved	Y03	ReserVed
X04		Y04	
X05		Y05	
X06		Y06	
X07	CH.1 Maximum alarm value	Y07	
X08	CH.2 Maximum alarm value	Y08	
X09	CH.3 Maximum alarm value	Y09	
X0A	CH.4 Maximum alarm value	Y0A	
X0B	CH.1 Alarm in Minimum	Y0B	
X0C	CH.2 Alarm in Minimum	Y0C	
X0D	CH.3 Alarm in Minimum	Y0D	
X0E	CH.4 Alarm in Minimum	Y0E	
X0F	A/D module Error flag	Y0F	Flag to request error clear

8.4.8 Buffer Memory

Memory address		Details	Default	R/W
Hex.	Dec.			
0H	0	CH.1 Digital conversion value	-	R
1H	1	CH.2 Digital conversion value	-	R
2H	2	CH.3 Digital conversion value	-	R
3H	3	CH.4 Digital conversion value	-	R
4H	4	CH.1 Precise value	-	R
5H	5	CH.2 Precise value	-	R
6H	6	CH.3 Precise value	-	R
7H	7	CH.4 Precise value	-	R
8H	8	CH.1 Percentile value	-	R
9H	9	CH.2 Percentile value	-	R
AH	10	CH.3 Percentile value	-	R
BH	11	CH.4 Percentile value	-	R
CH	12	CH.1 Setup input signal range	0	R/W
DH	13	CH.2 Setup input signal range	0	R/W
EH	14	CH.3 Setup input signal range	0	R/W
FH	15	CH.4 Setup input signal range	0	R/W
10H	16	Setup Raw Value digital output	0	R/W
11H	17	Reserved	-	-
12H	18	CH.1 Average processing setting value	2000h	R/W
13H	19	CH.2 Average processing setting value	2000h	R/W
14H	20	CH.3 Average processing setting value	2000h	R/W
15H	21	CH.4 Average processing setting value	2000h	R/W
16H	22	CH.1 Maximum alarm setting value	0	R/W
17H	23	CH.2 Maximum alarm setting value	0	R/W
18H	24	CH.3 Maximum alarm setting value	0	R/W
19H	25	CH.4 Maximum alarm setting value	0	R/W
1AH	26	CH.1 Minimum alarm setting value	0	R/W
1BH	27	CH.2 Minimum alarm setting value	0	R/W
1CH	28	CH.3 Minimum alarm setting value	0	R/W
1DH	39	CH.4 Minimum alarm setting value	0	R/W
1EH	30	Maximum alarm status	-	R
1FH	31	Minimum alarm status	-	R
20H	32	CH.1 Digital Filter Constant	30	R/W
21H	33	CH.2 Digital Filter Constant	30	R/W
22H	34	CH.3 Digital Filter Constant	30	R/W
23H	35	CH.4 Digital Filter Constant	30	R/W
24H	36	Calibration Code	-	R/W
25H	37	Error Code	-	R
26H	38	OS Version	-	R

*** Buffer memory is located inside of AD module. It converts analog input signal to digital value and setting values are saved in.**

*** It saves AD conversion value in buffer memory 0 ~ 3 to CPU memory through FROM instruction to use program.**

*** R/W is to denote Read/Write if available from PLC program.**

R: Read W: Write

8.4.8.1 Digital conversion value

It is used to save A/D conversion digital output value.

The digital conversion value indicates 0 ~ 64,000 (or -32,000 ~ 32,000) by 16bit.

If digital conversion value is over this range, its value is fixed with -384 / 64,383 (or -32,384 / 32,383)

8.4.8.2 Precise value

It is used to convert A/D conversion value to Precise value.

Please see the Analog input range with Precise value as below.

Analog input	Precise value
4 ~ 20 mA	4,000 ~ 20,000
0 ~ 20 mA	0 ~ 20,000
1 ~ 5 V	1,000 ~ 5,000
0 ~ 5 V	0 ~ 5,000
-10 ~ 10 V	-10,000 ~ 10,000
0 ~ 10 V	0 ~ 10,000

8.4.8.3 Percentile value

is used to save analog input value for each channel as percentile value compared with input signal range.

The conversion value is 0 ~ 10,000(0% ~ 100.00%)

8.4.8.4 Setting Input signal range

It is used to setup analog input range for each channel.

Input signal range	Setting value
4 ~ 20 mA	0
0 ~ 20 mA	1

1 ~ 5 V	2
0 ~ 5 V	3
-10 ~ 10 V	4
0 ~ 10 V	5

8.4.8.5 Setting Raw Value digital output

Setup range of digital conversion value to output Raw value. 2 bit for each channel is assigned.

[Bit Mapping: 16 bits]

MSB LSB

0	0	0	0	0	0	0	0	CH4	CH3	CH2	CH1

Code	Normal input range	Full Range
00 (0)	-8000 ~ +8000	-8191 ~ +8192
01 (1)	-8000 ~ +8000	-8000 ~ +8000
10 (2)	-192 ~ 16191	-192 ~ 16191
11 (3)	0 ~ 64000	0 ~ 64000

Full Range: It is used for Exceeding of normal input range.

8.4.8.6 Average processing setting value

It is used to specify average processing methods.

- Upper 1 byte: Count average: 1~256
- Lower 1 byte: Time average: 0~256 (*10ms)

8.4.8.7 Maximum alarm setting value

It is used to set maximum setting value. The alarm occurs when A/D conversion value exceeds maximum alarm setting value.

8.4.8.8 Minimum alarm setting value

It is used to set minimum setting value. The alarm occurs when A/D conversion value is lower than minimum alarm setting value.

8.4.8.9 Maximum alarm status

If A/D conversion value exceeds Maximum alarm setting value, related channel's bit is ON.

0	0	0	0	0	0	0	0	CH8	CH7	CH6	CH5	CH4	CH3	CH2	CH1

You can also Maximum alarm status of CH1 ~ CH4 at I/O area.

8.4.8.10 Minimum alarm status

If A/D conversion value is lower than Minimum alarm setting value, related channel's bit is ON.

0	0	0	0	0	0	0	0	CH8	CH7	CH6	CH5	CH4	CH3	CH2	CH1

You can also Maximum alarm status of CH1 ~ CH4 at I/O area.

8.4.8.11 Error Code

If error occurs, error code indicates

Error Code	details
0	No error
1	System error (A/S needed)
2	Calibration fault for AD conversion value

8.4.8.12 OS Version

It is used to indicate Firmware version of module.

8.4.9 Wiring

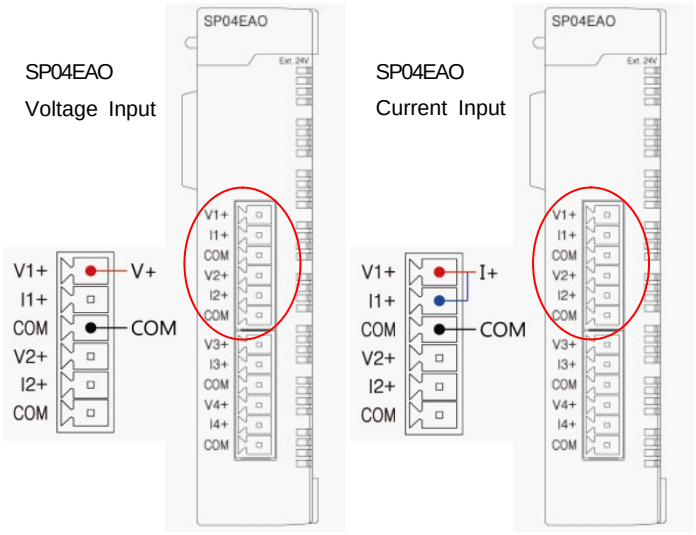
[In case of voltage input]

	+ Terminal	- Terminal
Ch 1	Terminal 1	Terminal 3
Ch 2	Terminal 4	Terminal 6
Ch 3	Terminal 7	Terminal 9
Ch 4	Terminal 10	Terminal 12
24V External	Connection : bottom of module	

[In case of current input]

	+Terminal	- Terminal	Action
Ch 1	Terminal 1	Terminal 3	Connect 1-2
Ch 2	Terminal 4	Terminal 6	Connect 4-5
Ch 3	Terminal 7	Terminal 9	Connect 7-8
Ch 4	Terminal 10	Terminal 12	Connect 10-11
24V External	Connection : bottom of module		

[Wiring Input Method]



8.5 PLCS DA Module : SP04EOAx

CM3-SP04EOA* is the analog output module that converts 16bit binary digital input value to analog output signal(Voltage or Current).

Contents :

8.5.1 Features

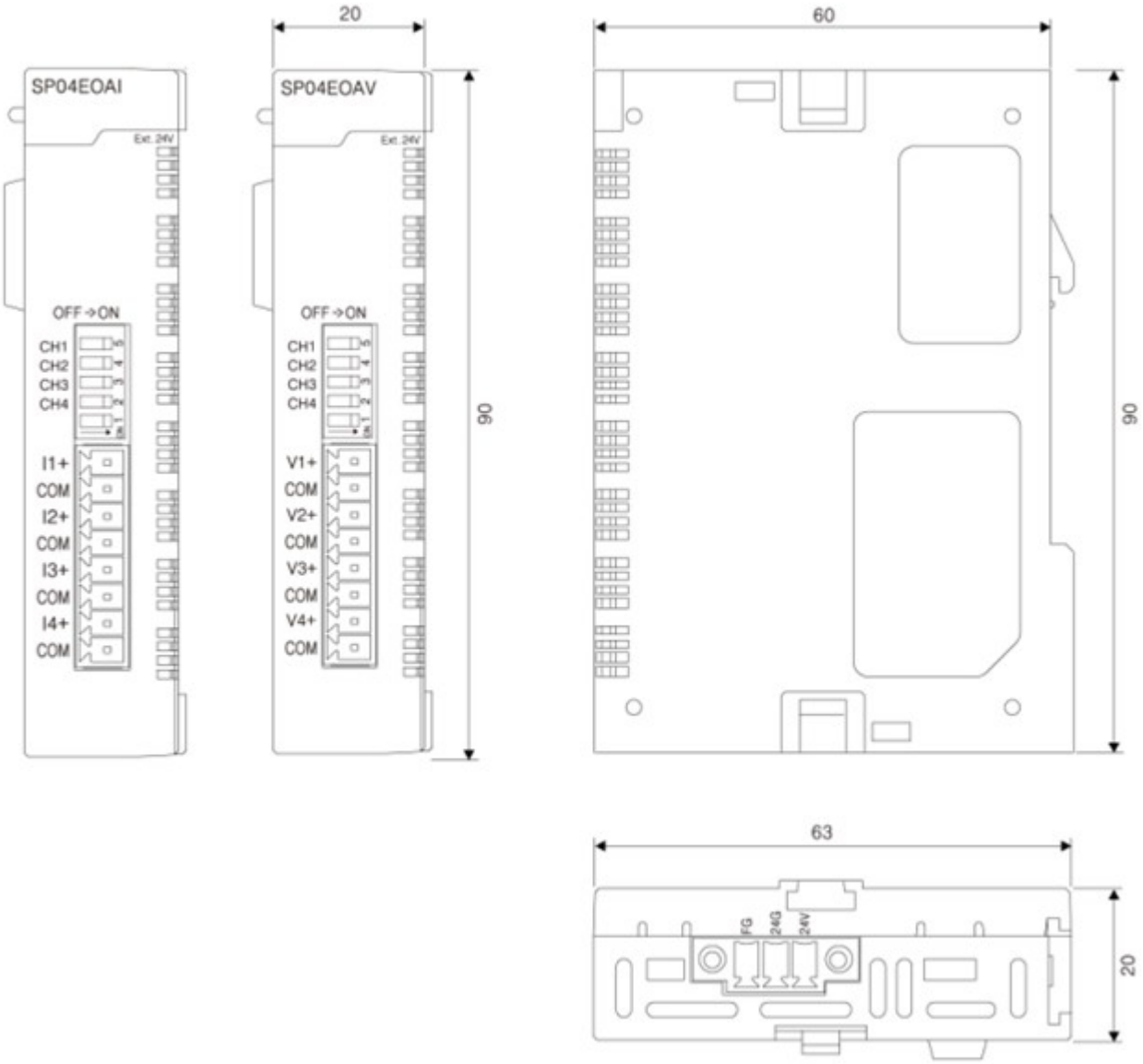
- CM3-SP04EOAV is a D/A module which has 4channels voltage output (-10~10V, 0~10V).
- CM3-SP04EOAI is a D/A module which has 4channels current output (4~20mA).
- DA conversion module converts digital value, 16bit binary data (data: 14bit) from PLC CPU, into analog output signal (voltage or current output). It converts digital value (0~16000, -8000~8000) to analog value (4~20mA, -10~10V, 0V~10V).
- Through “Hold/Clear” function, DA module can output offset value (4mA, -10V) when Error or RUN mode changes to STOP mode, or maintain output value being with RUN mode.
- User can choose the basic output of the channel that converting is prohibited
- Max. 11 analog modules can be installed in one station.
- Normal status: LED On, Error status: LED blinking by 0.5sec interval.

8.5.2 Specification of Analog output module (CM3-SP04EOAI, CM3-SP04EOAV)

Item		CM3-SP04EOAI	CM3-SP04EOAV
Analog output CH.		4 Channel	4 Channel
Analog output		-10V ~ 10V / 0 ~ 10V (DIP S/W)	4 ~ 20mA
Digital input		-0 ~ 16000 (-8000 ~ 8000)	
Resolution		1.25 mV or less	1.25 μA or less
Accuracy		± 0.1%	
Conversion speed		10ms	
Absolute max, input		Voltage: ±15V	Current: ±24mA
Insulation method		Photo-coupler insulation : between input terminal and PLC (No insulation between channels)	
Power supply		External DC +24V	
IO Points		16 points	
Connection Terminal		12-point terminal block	
Consumption (mA)	+5V		
	24V		
Weight			

8.5.3 Dimension

(Unit: mm)



8.5.4 Conversion Characteristic according to Analog output voltage

Analog output voltage	Offset	Gain	Digital input	Max. resolution
-10 ~ 10V	-10V	10V	0~16000	1.35mV

8.5.5 Conversion Characteristic according to Analog output current

Analog output current	Offset	Gain	Digital input	Max. resolution
4 ~ 20mA	4mA	20mA	0~16000 (-8000~8000)	1.25mA

8.5.6 Functions of Analog Output Module

- **D/A conversion Enable/Disable settings**

  It is used to set D/A conversion Enable/Disable for each output channel.

  If disused channel is set as Disable, it outputs offset value (4mA or –10V)

  The conversion speed is at constant regardless of conversion Enable/Disable settings.

- **Analog output Clear/Hold settings**

  It is used to hold or clear out analog value when PLC status is Stop mode or Error.

  (User can select it in " Stop mode output")

- **Offset/Gain settings**

  When digital input value is 0~16000, -8000~8000, analog output can be calibrated to 4~20mA or –10~10V.

- **Digital output settings**

  When digital input value is saved to Buffer memory, the range 0~16000 or –8000~8000 can be selected.

- **D/A Channel output Enable/Disable settings (Set output)**

  It is used to select output D/A conversion value or offset value to each output channel.

  The conversion speed is at constant regardless of Output Enable/Disable settings.

  *** Although D/A conversion is enabled but if Channel output is Disabled, D/A conversion value does not output but output only Offset value (4mA or -10V). As D/A conversion Enable/Disable settings are not saved, select Output Enable through using "TO" command at the first scan in order to use channel.**

8.5.7 Internal I/O Table

Sign direction (CPU ? D/A)		Sign direction (CPU ?D/A)	
Input	Signal	Output	Signal
X20	D/A module Ready	Y20	Reserved
X21	Reserved	Y21	
X22	Finishing operating condition setting	Y22	Requesting operating condition setting
X23	DA CH1 Output Enable (status)	Y23	DA CH1 Output Enable (control command)
X24	DA CH2 Output Enable (status)	Y24	DA CH2 Output Enable (control command)
X25	DA CH3 Output Enable (status)	Y25	DA CH3 Output Enable (control command)
X26	DA CH4 Output Enable (status)	Y26	DA CH4 Output Enable (control command)

X27	Reserved	Y27	Reserved
X28		Y28	
X29		Y29	
X2A		Y2A	
X2B		Y2B	
X2C		Y2C	
X2D		Y2D	
X2E		Y2E	
X2F	D/A module Error flag	Y2F	request error clear

(I/O signal number appears as above when D/A conversion module is installed at the 1st slot)

*** Finishing operating condition setting / Requesting operating condition setting**

It is used to save operating condition in Buffer memory into flash memory of module permanently. When DA module recognizes this signal, it saves data from buffer memory into flash memory and sets Flag of "finishing operating condition setting".

*** Output Enable**

It is used to output DA conversion signal of assigned channels.

8.5.8 Shared Memory

Address		Details	Default	R/W
Hex.	Dec.			
00H	0	DA conversion Enable/Disable setup	0	R/W
01H	1	CH.1 Digital output value	0	R/W
02H	2	CH.2 Digital output value	0	R/W
03H	3	CH.3 Digital output value	0	R/W
04H	4	CH.4 Digital output value	0	R/W
05H	5	CH.1 Range of digital value	0	R/W
06H	6	CH.2 Range of digital value	0	R/W
07H	7	CH.3 Range of digital value	0	R/W
08H	8	CH.4 Range of digital value	0	R/W
09H	9	CH.1 Channel Hold / Clear	0	R/W
0AH	10	CH.2 Channel Hold / Clear	0	R/W
0BH	11	CH.3 Channel Hold / Clear	0	R/W
0CH	12	CH.4 Channel Hold / Clear	0	R/W
0DH	13	CH.1 Setup output range for channel (DIP S/W setting needed)	0	R/W
0EH	14	CH.2 Setup output range for channel (DIP S/W setting needed)	0	R/W
0FH	15	CH.3 Setup output range for channel (DIP S/W setting needed)	0	R/W
10H	16	CH.4 Setup output range for channel (DIP S/W setting needed)	0	R/W
11H	17	CH.1 Status	0	R
12H	18	CH.2 Status	0	R
13H	19	CH.3 Status	0	R
14H	20	CH.4 Status	0	R
15H	21	Error Code	0	R
16H	22	OS Version	0	R
17H	23	Enable DA output	0	R/W

**** Each data is Word type.**

**** R/W is to denote Read/Write if available from PLC program.**

R: Read W: Write

8.5.8.1 DA conversion Enable/Disable setup

It is used to specify Analog output Enable or Disable.

b15															b0
0	0	0	0	0	0	0	0	0	0	0	0	ch 4	ch 3	ch 2	ch 1

0 = Forbidden, 1 = Allowed

8.5.8.2 Digital output value

It is used to convert specified digital value to analog signal. The range of digital value is specified from "Range of digital value".

8.5.8.3 Range of digital value.

It is used to set range of digital value that sequence program specifies. Maximum 14bit resolution digital output is used.

Code	Range
0	0.. 16000
1	-8000... +8000
2	Voltage/Current value (Current: 0 ... 20000, Voltage: -10000 ... +10000)
3	Percentage (0 .. 10000)

8.5.8.4 Channel Hold / Clear

It is used to specify status of analog output signal when PLC run mode becomes stop mode.

Hold / Clear	Stop mode output
0 (0000b)	Clear (Minimum output)
1 (0001b)	Hold (Maintain last output)
2 (0010b)	Half level (Medium output)
3 (0011b)	Max. level (Maximum output)

8.5.8.5 Setup output range for channel (DIP S/W setting needed)

Code	Range
0	0 ~ 10V
1	-10V ~ 10V

In order to operate it properly, software setting and hardware setting (DIP S/W) must be the same.

EX) CH1 software : 0 ~ 10V , DIP S/W : CH1 OFF
CH2 software : -10V ~ 10V , DIP S/W : CH2 ON

8.5.8.6 Error Code

It displays error codes

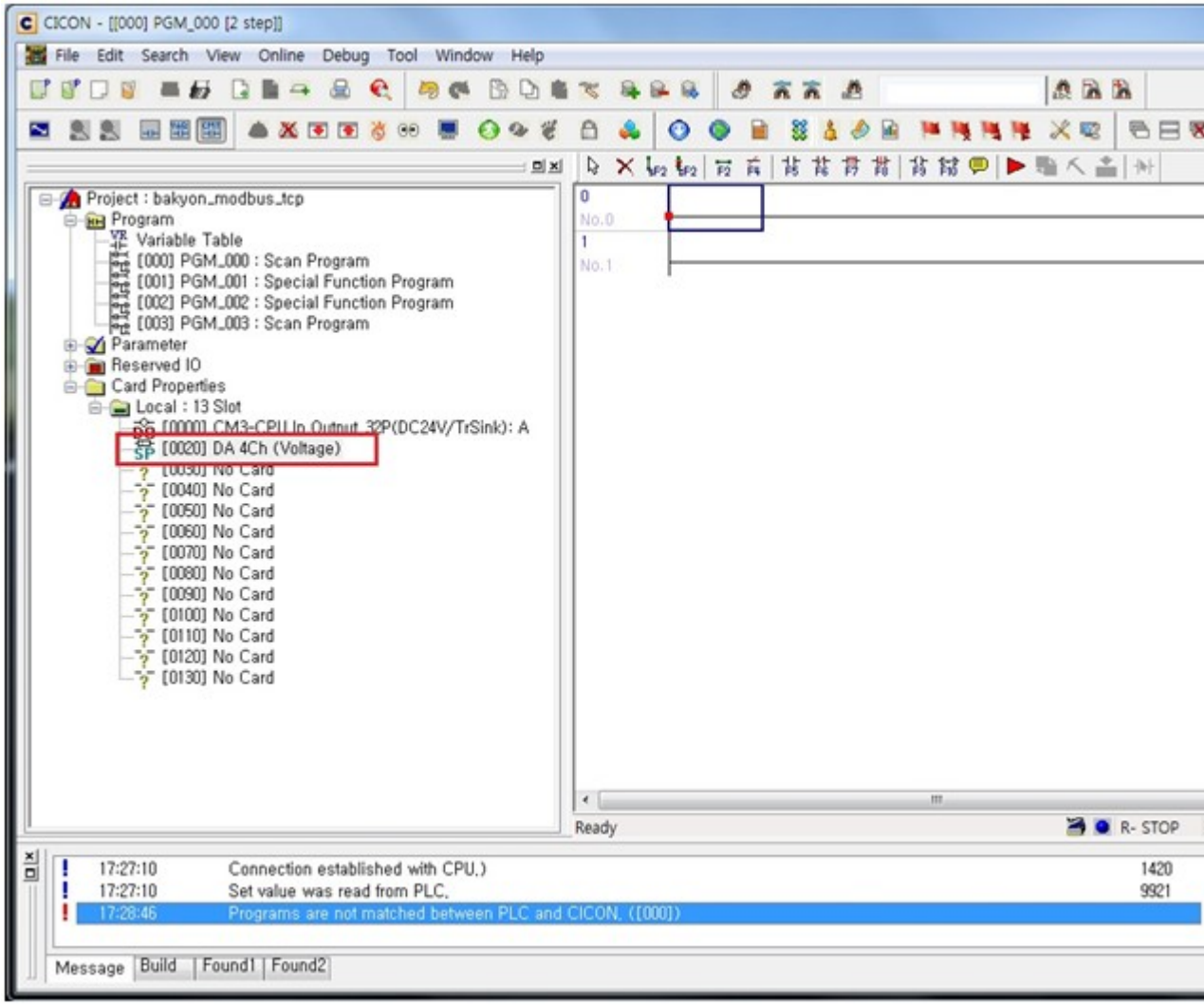
Error Code	Details
0	No error
1	System error (considered A/S)
2	No external DC 24V power

8.5.8.7 OS Version

It displays Firmware version of module.

8.5.9 Calibration setting (Voltage output / Current output)

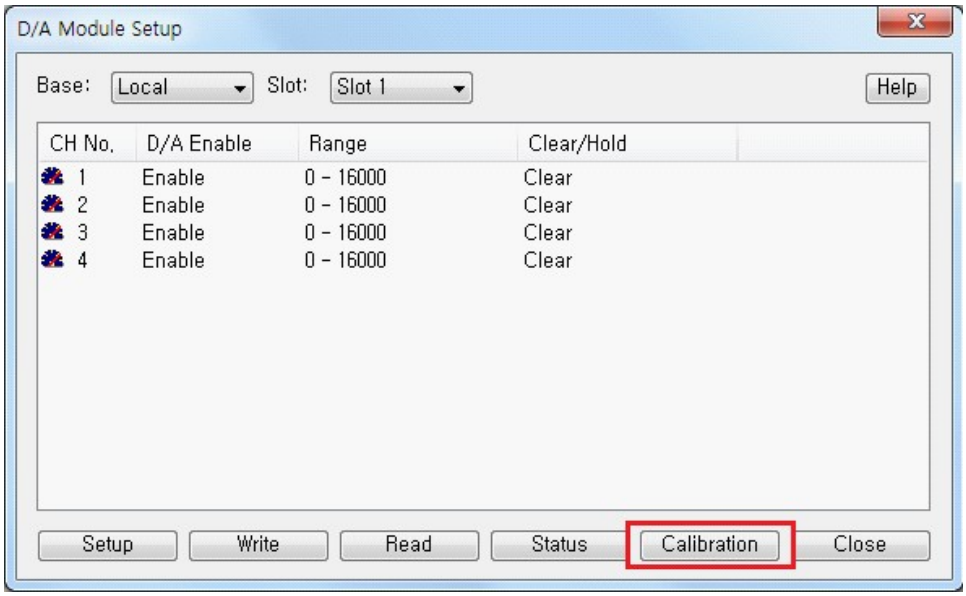
Double click DA 4Ch.



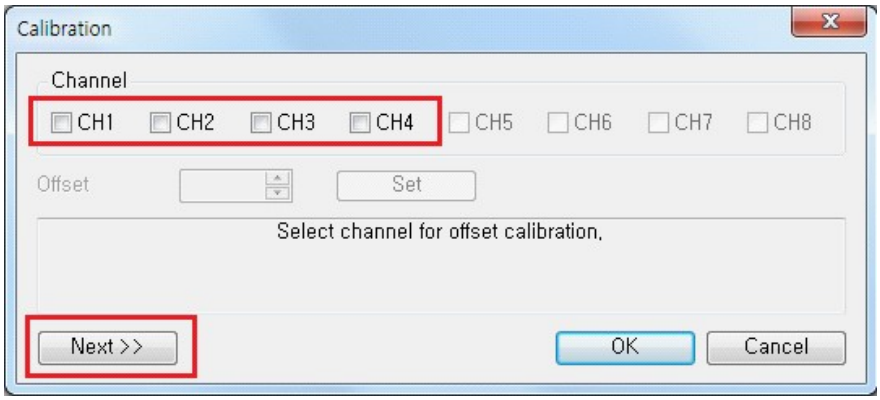
Click “Calibration”

In case of Voltage output, check software setting and DIP S/W setting before calibration. Calibrate both settings.

* DIP SWITCH OFF: 0~10V, ON: -10 ~ 10V



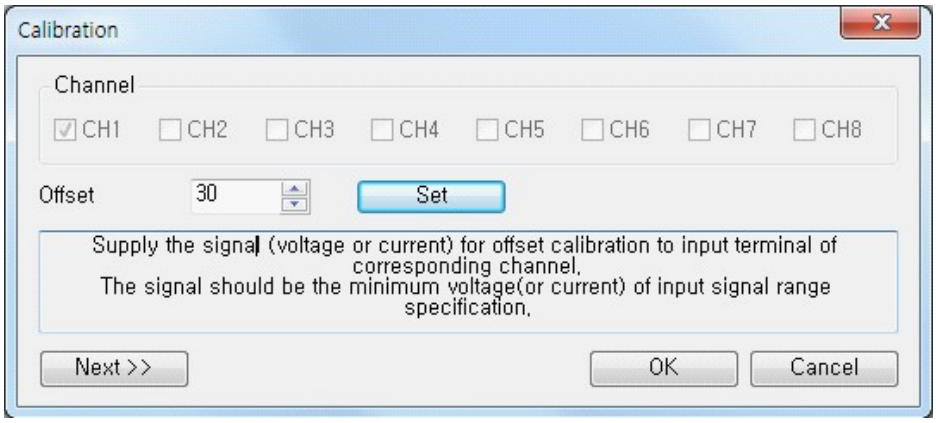
Select channel and click “Next”



When you measure output after click “Set”, minimum output value will be (4mA, 0V).

Write Offset value (+9999 ~ -9999)

If you write 30, it does not mean that it will increase 30mV. It calculates again and increase by 30. In case of current output, measure output again after 5 seconds.



If measurement is ok, click “Next”

If you read output value by measurement device after click “set”, maximum value will be (20mA, 10V).

Keep doing this process until measurement is ok.

Click “OK” to finish Calibration.

* Calibration is not possible when the range of voltage output is 0~15mV.

8.5.10 Wiring

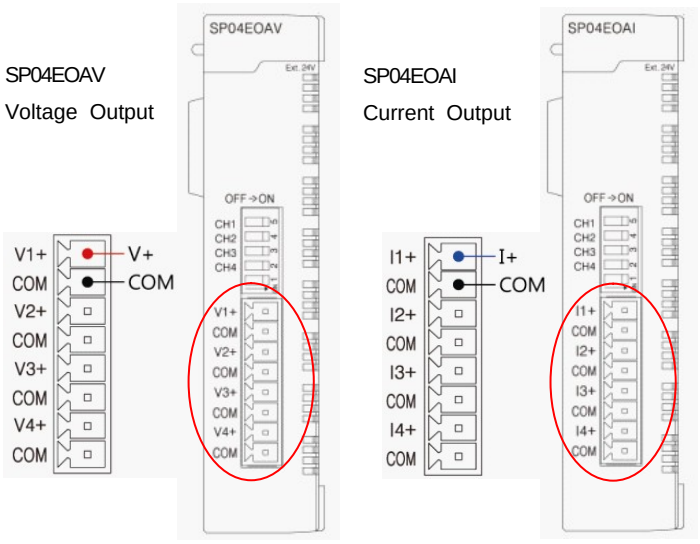
[CM3-SP04EOAV : In case of voltage output]

Channel	+ Terminal	- Terminal
Ch 1	Terminal 1	Terminal 3
Ch 2	Terminal 3	Terminal 7
Ch 3	Terminal 5	Terminal 11
Ch 4	Terminal 13	Terminal 15
24V External	Connection : bottom of module	

[CM3-SP04EOAI : In case of current output]

Channel	+ Terminal	- Terminal
Ch 1	Terminal 1	Terminal 2
Ch 2	Terminal 3	Terminal 4
Ch 3	Terminal 5	Terminal 6
Ch 4	Terminal 7	Terminal 8
24V External	Connection : bottom of module	

[Wiring Output Method]



8.6 PLCS AD DA Module : SP04EAA

Contents :

8.6.1 Overview

A/D and D/A mixed module CM3-SP04EAA, which is used by combining CPU for CIMON PLC-S series, is a module that receives external analogue signals (DC voltage or current) and converts it into 16 bit binary digital value and then converts signed 16 bit binary value into analogue signal (DC voltage or DC current)

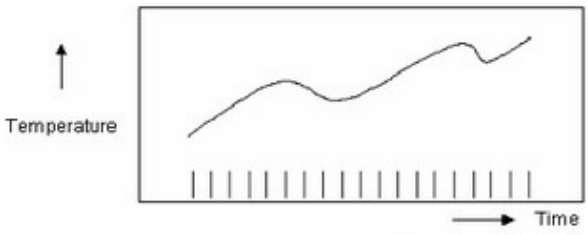
8.6.1.1 Characteristics

1. CM3-SP04EAA is able to perform A/D conversion and D/A conversion for each 2 channels.
2. It can convert input signals with 0~20mA, 4~20mA, 0~5V, 1~5V, -10~10V and 0~10V into 0~64000 or -32000~32000 of digital values.
3. This module can output digital values of 0~64000 or -32000~32000 into signals with ranges of analog

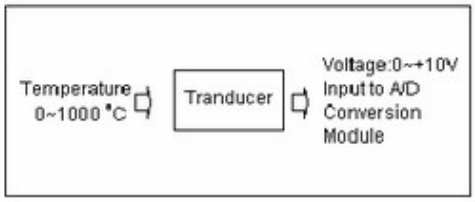
values 0~20mA, 4~20mA, 0~5V, 1~5V, -10~10V and 0~10V

4. It can acquire precise measurement value thanks to digital filter.
5. This module can process average time and numbers of times
6. This module can acquire digital value of high resolution as its digital resolution can be set to 1/32000.
7. There is no limitation for the number of one system.

8.6.1.2 Understanding concept

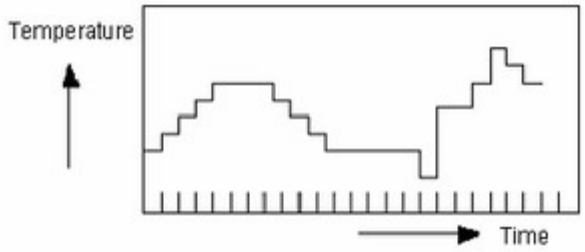


[Figure 1.1] Analog Value

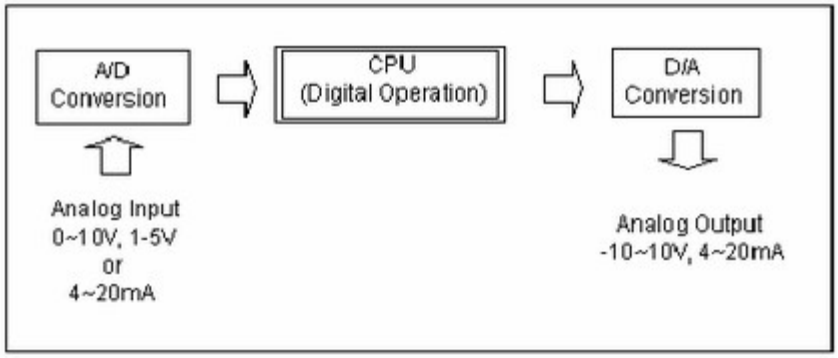


[Figure 1.2] Example of Tranducer

A consecutively changing amount such as voltage, current, temperature, velocity, pressure and flow rate is called analog amount. Temperature, for an example, is consecutively changing with time as shown in Fig 1.1 However, as this changing temperature is directly inputted into PLC, its equivalent analog amount of DC voltage, 0 ~+10V or DC current 4~20㎃is inputted into PLC via transducer.



[Figure 1.3] Digital value



[Figure 1.4] Process in a PLC

Non-consecutively changing numbers such as 0, 1, 2 or 3 is called digital amount. On and Off signal is expressed by digital amount of 0 and 1. BCD value and binary value is also digital amount. CPU module is unable to directly input analogue amount to calculate it as digital amount. Therefore, the system converts analog amount into digital amount and then input the digital amount into CPU as shown in 1.4. In addition, it' s necessary to convert digital amount of CPU into the amount of analog in order to output analog amount to external side.

8.6.2 Specifications

Enter topic text here.

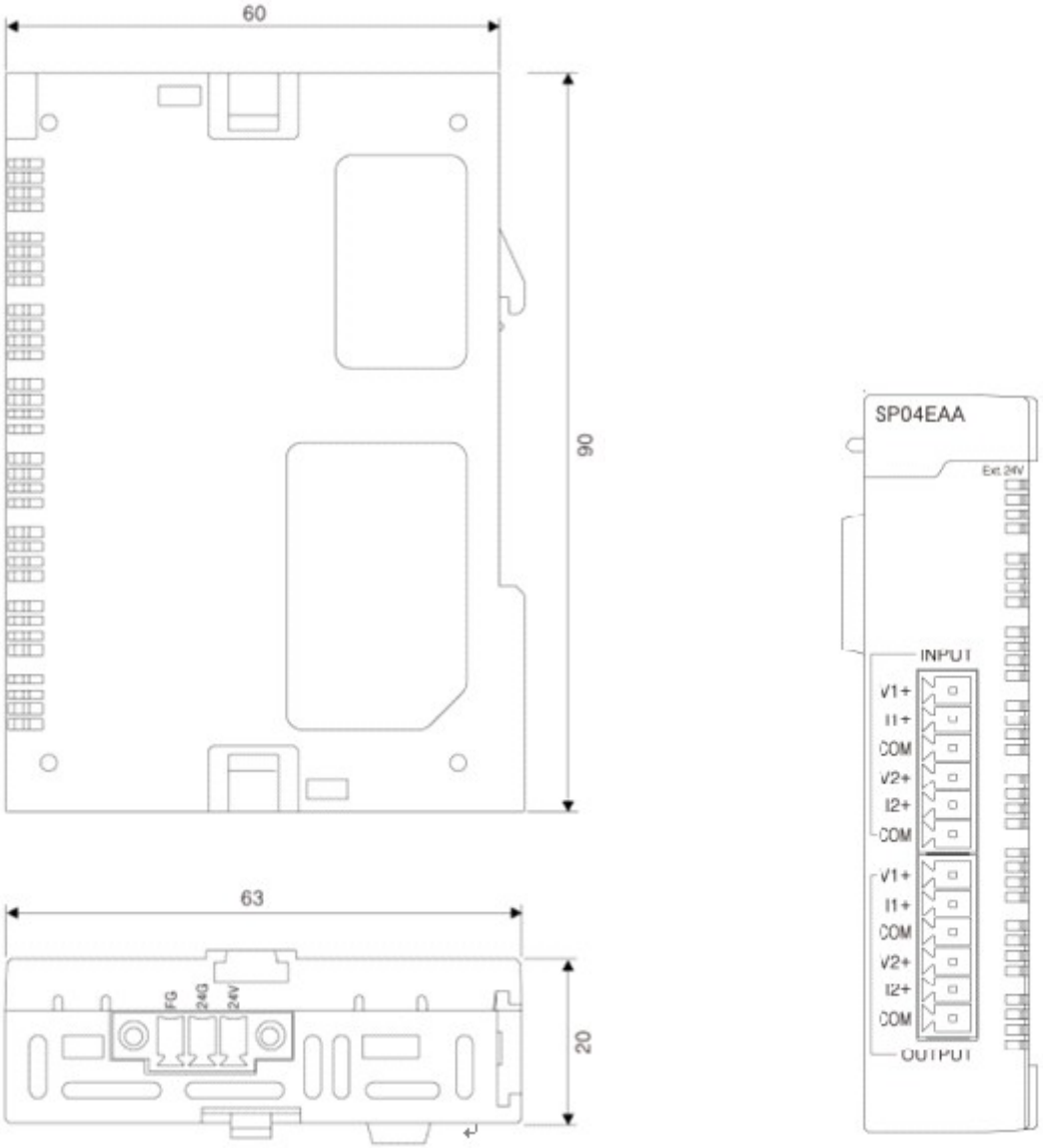
8.6.2.1 Specification of AD/DA module

<table>
<tr><th>Item</th><th colspan="5">CM3-SP04EAA</th></tr>
<tr><td>Analog I/O</td><td colspan="5">Input : 2 CH, Output : 2CH</td></tr>
<tr><td>Analog Input</td><td colspan="5">0 ~ +5V(0 ~ 20mA)
1 ~ +5V(4 ~ 20mA)
0 ~ +10V
-10V ~ +10V</td></tr>
<tr><td rowspan="8">Digital output</td><td colspan="5">➢ Voltage</td></tr>
<tr><td></td><td>0~5V</td><td>1~5V</td><td>0~10V</td><td>-10~10V</td></tr>
<tr><td>Signed value</td><td colspan="4">-32000 ~ 32000</td></tr>
<tr><td>Precise value</td><td>0~5000</td><td>1000~5000</td><td>0~10000</td><td>-10000~10000</td></tr>
<tr><td>Percentile value</td><td colspan="4">0 ~ 10000</td></tr>
<tr><td colspan="5">➢ Current</td></tr>
<tr><td></td><td colspan="2">0~20mA</td><td colspan="2">4~20mA</td></tr>
<tr><td>Signed value</td><td colspan="4">-32000 ~ 32000</td></tr>
<tr><td>Precise value</td><td colspan="2">0~20000</td><td colspan="2">4000~20000</td></tr>
<tr><td>Percentil value</td><td colspan="4">0 ~ 10000</td></tr>
<tr><td rowspan="5">Max. resolution</td><td rowspan="4">Voltage</td><td>0 ~ +5 V</td><td colspan="3">78.1 mV</td></tr>
<tr><td>1 ~ +5 V</td><td colspan="3">62.5 mV</td></tr>
<tr><td>0 ~ +10 V</td><td colspan="3">156.3 mV</td></tr>
<tr><td>-10V ~ +10 V</td><td colspan="3">312.5 mV</td></tr>
<tr><td>current</td><td>0 ~ 20 A</td><td colspan="3">312.5 nA</td></tr>
<tr><td>Accuracy</td><td colspan="5">±0.05% (Full Scale)</td></tr>
<tr><td>Conversion speed</td><td colspan="5">2.1ms / 4Ch</td></tr>
<tr><td>Absolute max. input</td><td colspan="5">Voltage: ±15V, Current: ±30mA</td></tr>
<tr><td>Insulation method</td><td colspan="5">Photo-coupler insulation : between input terminal and PLC (No insulation</td></tr>
</table>

	between channels)
IO Points	16 points
Connection Terminal	18-point terminal block
Consumption current	430 mA
Weight	187 g

8.6.2.2 Dimension

(Unit:mm)



8.6.3 Characteristic of I/O conversion

1. A/D conversion method

- Sampling process

This process makes it possible to sequentially convert analog values to digital value by A/S conversion and store it in buffer memory. Sampling process is performed with a frequency of 2.1 ms regardless of the number of channels in use.

- Averaging process

This process calculates average value from sum of sampled AD converted values by the number of average processing times and then stores it into buffer memory. In this case, if average processing time is already set, the system converts AD converted values inputted based on set frequency not directly taking AD converted value and uses it to calculate averaging for the number of times. Digits after decimal occurred from AD conversion will be discarded. Set range for average calculation is 1~ 255 times for number and 0~255(X10) ms for average time. And if the value for time average is set to '0', the system performs only number of times for sampling data.

- In the event that average value for number of time is set to 10 times,

The system calculates average by receiving sampling process data (2.1ms) 10 times. In other words, average value for signals which is inputted for 21ms is outputted as AD converted value. In this case, the frequency for updating data is 2.1ms which is sampling processing time.

- In the event that average processing for number of times is set to 10 times and that of time is set to 5(50ms).

Average processing is performed in a way that data is sampled every 50 ms and the system receives this value 10 times. In other words, average value for signal which is inputted for 500 ms is outputted as AD converted value. In this case, the frequency of updating data is 50ms which is average processing time.

30 X (4 X 5) = 600(ms)

2. Digital output value setting

When Digital output value is saved into Buffer memory, you can select signed value 16 bit data (-32000~32000) or unsigned value 16 bit data (0~16000)

3.Precise value

The system displays analogue signals coming to each channel separately from digital output value. The measured value can be checked without additional data processing. Displaying range for the measured value for each input signal is referred as following.

Analog input	Precise value
4 ~ 20 mA	4,000 ~ 20,000
0 ~ 20 mA	0 ~ 20,000
1 ~ 5 V	1,000 ~ 5,000
0 ~ 5 V	0 ~ 5,000
-10 ~ 10 V	-10,000 ~ 10,000
0 ~ 10 V	0 ~ 10,000

4.Percentile value

Converted input value for each channel is displayed by percentage (0~10000) compared to whole input signal range.

5.D/A conversion Enable /Disable settings

1. It is used to set D/A conversion Enable/Disable for each output channel.
2. If unused channel is set to be Disable for switching channel, offset value is outputted.(4mA or –10V)
3. The conversion speed is at constant regardless of conversion Enable/Disable settings

6.Analog output Clear/Hold settings

It is used to hold or clear out analog value when PLC status is Stop mode or Error.

7.Offset/Gain settings

When digital input value is 0~16000 or -8000~8000, analog output can be calibrated to 4~20mA or -10~10V.

8.Digital output settings

When digital input value is saved to Buffer memory, the range 0~16000 or –8000~8000 can be selected..

9.D/A output Enable/Disable

1. It is used to select output D/A conversion value or offset value to each output channel.
2. The conversion speed is at constant regardless of Output Enable/Disable settings.

* Note) When D/A output is set to be Disabled although D/A conversion is set to Enable for each channel, D/A converted value is not normally outputted, instead the offset value (4mA or -10V) value is outputted. Because D/A output Enable/Disable is not saved, make sure to set corresponding channel for each Enable/Disable (User Program Memory address 23) to Enable (1) using TO command in the first scan to use channels.

8.6.4 I/O signal for CPU

Sign direction(CPU ? A/D,D/A)		Sign direction(CPU ? A/D,D/A)	
Input	Signal	Output	Signal
X00	A/D module Ready	Y10	Reserved
X01	Reserved	Y11	
X02	Finishing operating condition setting	Y12	Requesting operating condition setting
X03	CH.1 High Alarm value	Y13	DA CH1 output Enable
X04	CH.2 High Alarm value	Y14	DA CH2 output Enable
X05	CH.1 Low Alarm value	Y15	Reserved
X06	CH.2 Low Alarm value	Y16	
X07	Reserved	Y17	
X08		Y18	
X09		Y19	

X0A		Y1A	
X0B		Y1B	
X0C		Y1C	
X0D		Y1D	
X0E		Y1E	
X0F	Module Error flag	Y1F	Flag to request error clear

Refer to A/D module in Chapter 7 and D/A module in Chapter 8 for more detailed description for input / output signals.

8.6.5 Buffer Memory

Address		Details	Default	R/W
Hex.	Dec.			
0H	0	CH.1 Digital conversion value (AD)	-	R
1H	1	CH.2 Digital conversion value (AD)	-	R
2H	2	CH.1 Precise value (AD)	-	R
3H	3	CH.2 Precise value (AD)	-	R
4H	4	CH.1 Percentile value (AD)	-	R
5H	5	CH.2 Percentile value (AD)	-	R
6H	6	High alarm status (AD)	-	R
7H	7	Low alarm status (AD)	-	R
8H	8	CH.1 Setup input signal range (AD)	0	R/W
9H	9	CH.2 Setup input signal range (AD)	0	R/W
AH	10	Setup Raw Value digital output (AD)	0	R/W
BH	11	CH.1 Average processing setting value (AD)	2000h	R/W
CH	12	CH.2 Average processing setting value (AD)	2000h	R/W
DH	13	CH.1 Maximum alarm setting value (AD)	0	R/W
EH	14	CH.2 Maximum alarm setting value (AD)	0	R/W
FH	15	CH.1 Minimum alarm setting value (AD)	0	R/W
10H	16	CH.2 Minimum alarm setting value (AD)	0	R/W
11H	17	CH.1 Digital Filter Constant (AD)	30	R/W
12H	18	CH.2 Digital Filter Constant (AD)	30	R/W
13H	19	DA Enable/Disable setup (DA conversion)	0	R/W
14H	20	CH.1 DA output type (Current 2types, Voltage 4types)	0	R/W
15H	21	CH.2 DA output type (Current 2types, Voltage 4types)	0	R/W
16H	22	CH.1 DA Range of digital value	0	R/W
17H	23	CH.2 DA Range of digital value	0	R/W
18H	24	CH.1 DA Channel Hold/Clear	0	R/W
19H	25	CH.2 DA Channel Hold/Clear	0	R/W
1AH	26	CH.1 digital output value (DA)	0	R/W
1BH	27	CH.2 digital output value (DA)	0	R/W
1CH	28	AD / DA Resolution setting	0	R/W
1DH	29	Error Code	-	R
1EH	30	OS Version	-	R

Buffer memory, which is a memory in AD module, stores digital signals converted by AD module and also records set values in currently operating module. AD conversion values which is stored in buffer memory 0 ~ 1 are stored into CPU memory to be used for program using FROM command.
R/W indicates whether or not reading / writing is available from PLC.

8.6.5.1 Digital conversion value

It is used to save A/D conversion digital output value.
Data in other areas is displayed depending on resolution setting for AD/DA (Offset 28)

[16 bit Resolution]

Digital conversion value is expressed by 1 bit data of 0 ~ 64,000 (or -32,000 ~ 32,000) and of the value is off the range, it is fixed into -384 / 64,383 (or -32,384 / 32,383)

[14 bit Resolution]

Digital conversion value is displayed by 14bit data with 0 ~ 16,000 (or -8,000 ~ 8,000) and if the value is off the range, it is fixed into -192 / 16,191 (or -8,192 / 8,191)

8.6.5.2 Precise value

A/D conversion value is converted into Precise value.
Refer to following table for the range for converted value depending on setting input range.

Analog input	Precise value
4 ~ 20 mA	4,000 ~ 20,000
0 ~ 20 mA	0 ~ 20,000
1 ~ 5 V	1,000 ~ 5,000
0 ~ 5 V	0 ~ 5,000
-10 ~ 10 V	-10,000 ~ 10,000
0 ~ 10 V	0 ~ 10,000

8.6.5.3 Percentile value

Analog signal entering channel is converted to percentage based on setting input range and then saved.
The converted values are 0 ~ 10,000(0% ~ 100.00%)

8.6.5.4 Setting Input signal range

This sets range for inputting analog signal to each channel
Refer to following table for set values depending on input range.

Input signal range	Setting value
4 ~ 20 mA	0
0 ~ 20 mA	1
1 ~ 5 V	2
0 ~ 5 V	3

-10 ~ 10 V	4
0 ~ 10 V	5

8.6.5.5 Setting Raw Value digital output

This sets range of digital conversion to be outputted as Raw Value
This is set to 2 bit per channel. Refer to following table

[Bit Mapping : 16 bits]

MSB LSB

0	0	0	0	0	0	0	0	CH4	CH3	CH2	CH1

[16 Bit Resolution]

Code	Normal input range	Full Range
00 (0)	-32000 ~ +32000	-32767 ~ +32768
01 (1)	-32000 ~ +32000	-32000 ~ +32000
10 (2)	500 ~ 64500	0 ~ 65000
11 (3)	0 ~ 64000	0 ~ 64000

[14 Bit Resolution]

Code	Normal input range	Full Range
00 (0)	-8000 ~ +8000	-8192 ~ +8191
01 (1)	-8000 ~ +8000	-8000 ~ +8000
10 (2)	0 ~ 16000	-192 ~ 16191
11 (3)	0 ~ 16000	0 ~ 16000

Full Range : It is range for conversion for input signal which is off the normal range.

8.6.5.6 Average processing setting value

It is used to specify average processing methods.

- Upper 1 byte: Count average: 1~256
- Lower 1 byte: Time average: 0~256 (*10ms)

8.6.5.7 Maximum alarm setting value

When you want to use the function to detect Maximum alarm setting value by comparing A/D conversion value, you set High conversion value as raw value standard.

8.6.5.8 Minimum alarm setting value

When you want to use the function to detect Minimum alarm setting value by comparing A/D conversion value, you set Minimum alarm setting value as raw value standard.

8.6.5.9 Maximum alarm status

If A/D conversion value exceeds Maximum alarm setting value, related channel's bit is ON.

0	0	0	0	0	0	0	0	CH8	CH7	CH6	CH5	CH4	CH3	CH2	CH1

You can also check Maximum alarm status of CH1 ~ CH4 at I/O area.

8.6.5.10 Minimum alarm status

If A/D conversion value is lower than Minimum alarm setting value, related channel's bit is ON.

0	0	0	0	0	0	0	0	CH8	CH7	CH6	CH5	CH4	CH3	CH2	CH1

You can also Maximum alarm status of CH1 ~ CH4 at I/O area.

8.6.5.11 Digital output value

The system performs DA conversion for digital value designated by this area and outputs analog signals. Range for set values is set from 'Range for digital value'

8.6.5.12 DA Out Enable/Disable

It is used to set Enable or Disable analog signal output.

b0 = Ch1 Out Enable(1) or Out Disable(0)

b1 = Ch2 Out Enable(1) or Out Disable(0)

8.6.5.13 DA Output type

It designate types of analog signal which is converted by DA.

Following table shows summary of codes for various analog signals

Code	Output type	Remark
0 (0000b)	4 .. 20 mA	
1 (0001b)	0 .. 20 mA	
2 (0010b)	1 .. 5 V	
3 (0011b)	0 .. 5 V	
4 (0100b)	-10 .. +10 V	
5 (0101b)	0 .. 10 V	

8.6.5.14 DA Range of digital value

This sets the range of digital value designated by sequence program.

[16 Bit Resolution]

Code	Range
0	0 .. 64000
1	-32000 .. +32000
2	Voltage/Current value (Current : 0 .. 20000, Voltage : -10000 .. +10000)
3	Percentile (0 .. 10000)

[14 Bit Resolution]

Code	Range
0	0 .. 16000
1	-8000 .. +8000
2	Voltage/Current value (Current : 0 .. 20000, Voltage : -10000 .. +10000)
3	Percentile (0 .. 10000)

8.6.5.15 DA Channel Hold/Clear

This sets status of output signals for DA analog when PLC Run mode is switched to STOP mode. 4 operation statuses could be designated as shown at following table.

Hold/Clear	STOP mode output
0 (0000b)	Clear
1 (0001b)	Hold
2 (0010b)	Half Level
3 (0011b)	Max. Level

8.6.5.16 AD / DA Resolution setting

This function enables to set one of 16bit and 14bit of resolution for DA output value. Since most of functions related to analog such as PID provided by CPU are configured based on 14 bit of resolution, there is no additional task to convert the measured value once 14 bit of resolution is maintained.

MSB LSB

DA Resolution				AD Resolution			
CH4	CH3	CH2	CH1	CH4	CH3	CH2	CH1

Resolution Code	Details
0	14 bit
1	16 bit
2	N.A
3	N.A

8.6.5.17 Error Code

If any error occurs in module, this displays error code.

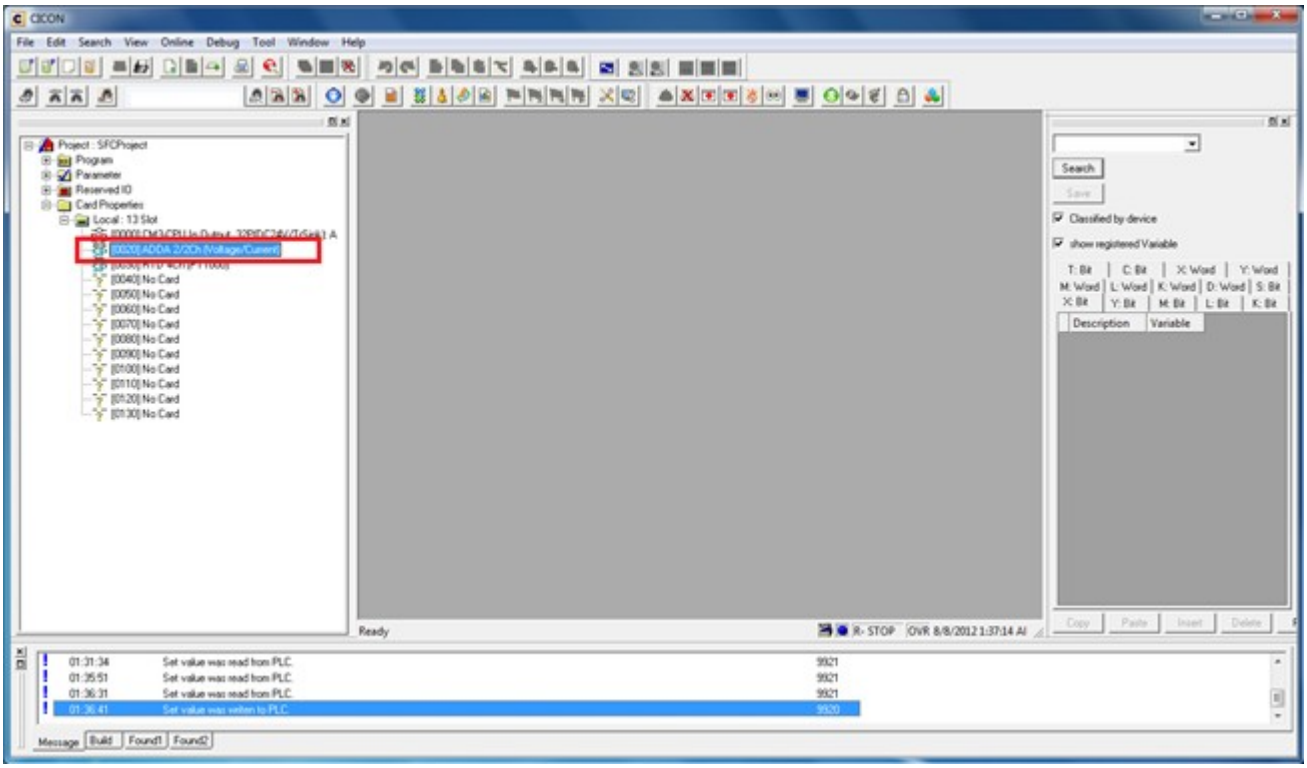
Error Code	Details
0	No error
1	System error (A/S considered)
2	Calibration fail for AD conversion value

8.6.5.18 OS Version

This shows version of Firmware version for module.

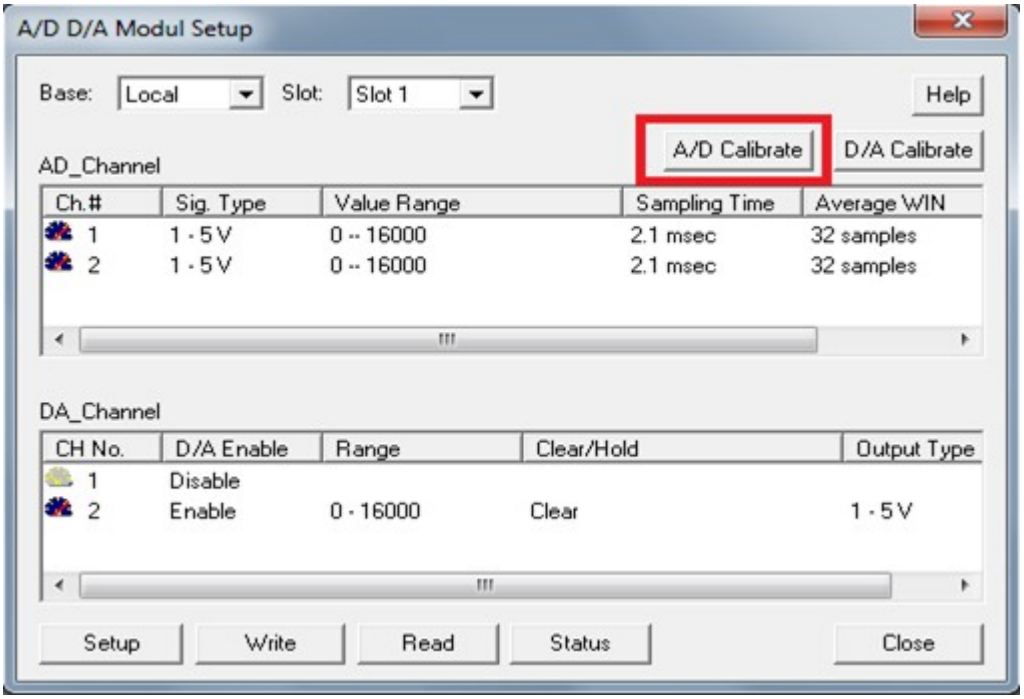
8.6.6 Calibration setting for A/D

Double click AD/DA 2/2Ch at workplace.

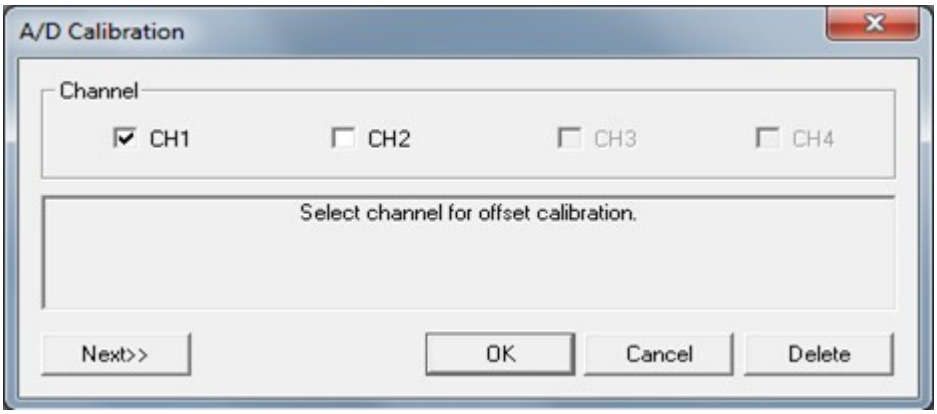


Click “ A/D Calibrate”

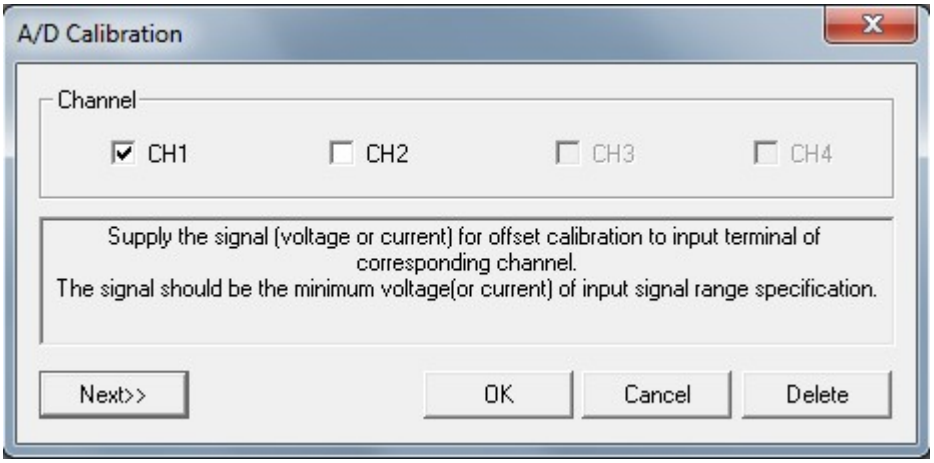
In case of voltage input, 0~20mA will be a base provided that current input is -10~10V. If input is fixed by a single value, its degree of precision becomes highest. Set resolution for 14bit and 16bit respectively and then click “ A/D Calibrate” .



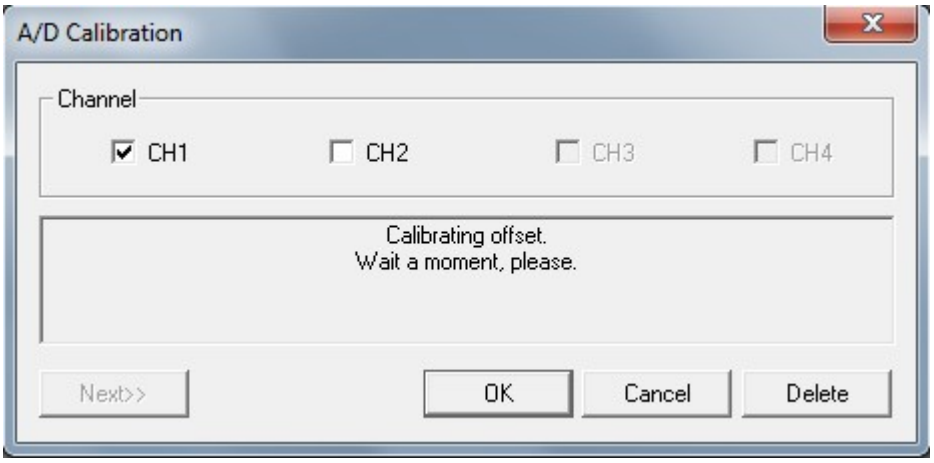
Select channel and click “ Next”



Input -10V and 4mA if setting is -10 ~ 10V and 4 ~ 20mA. Click “ Next”



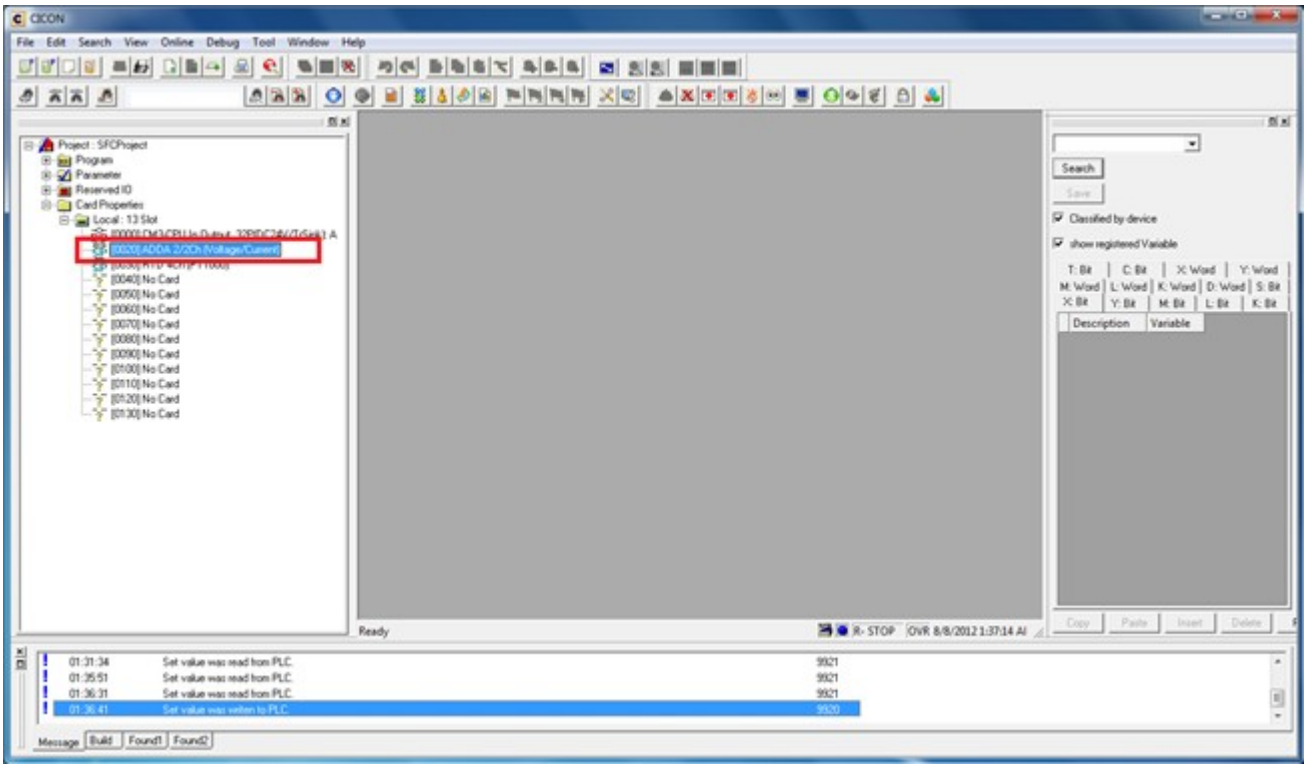
Input maximum value for each setting input.



Complete this procedure by performing same methods mentioned above for each channel.

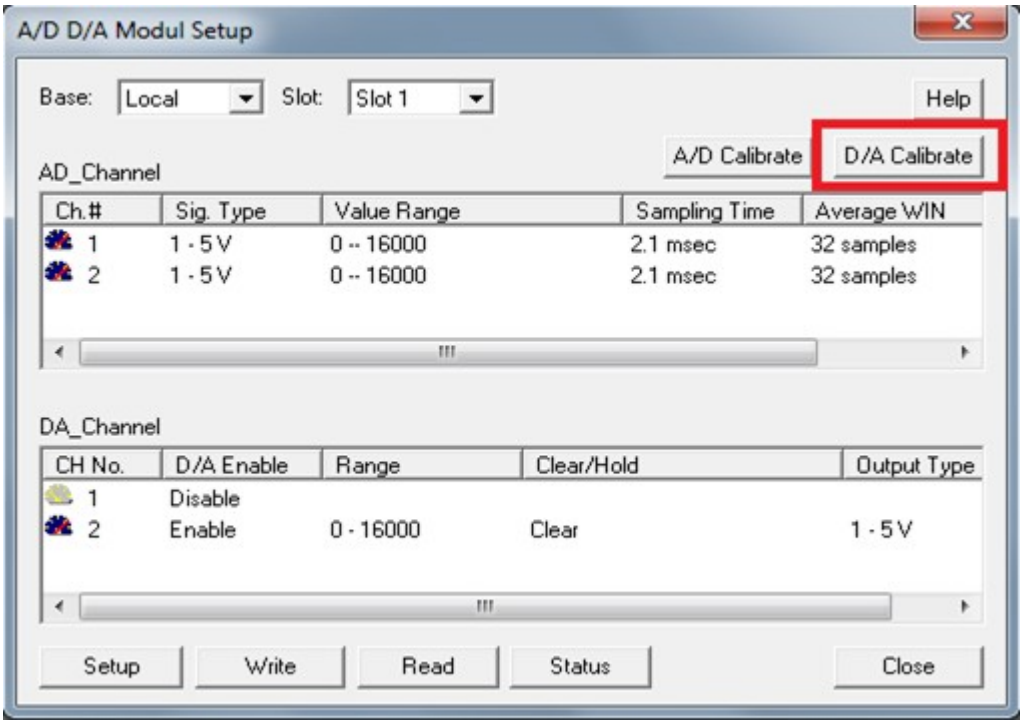
8.6.7 Calibration setting for D/A

Double click AD/DA 2/2Ch at workplace.

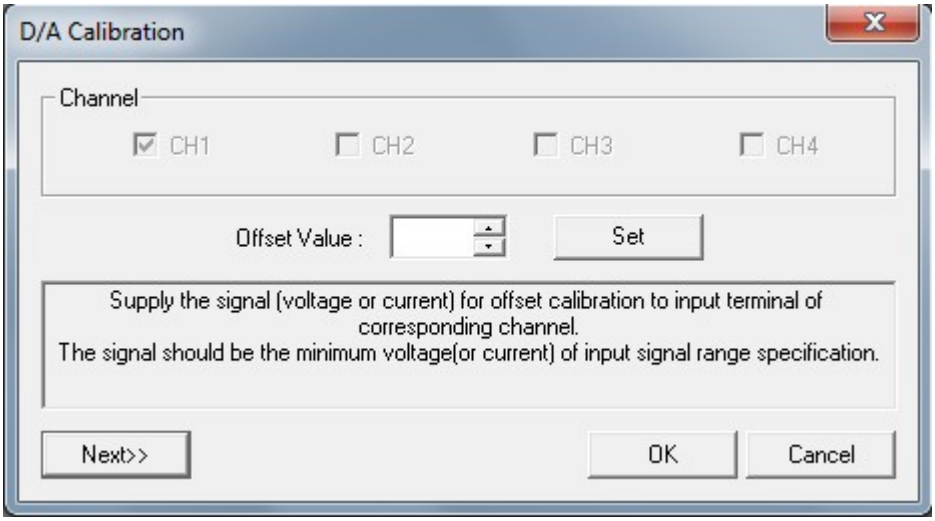


Click " D/A Calibrate"

In case of voltage output, 0~20mA will be a base provided that current input is -10~10V. If input is fixed by a single value, its degree of precision becomes highest. For resolution, once calibration is performed only at 14bit, the same condition will be applied for 16 bit as well.



Select channel and click " Next"



The minimum value (4mA, 0V) is outputted by calibrator or measuring instruments

Input value into the offset field (between +9999 and -9999) In this case, input value of 30 doesn't mean rising by 30mV but increase by 30 by calculated number.

If measurement is ok, click "Next"

The maximum value (20mA, 10V) is outputted by calibrator or measuring instruments

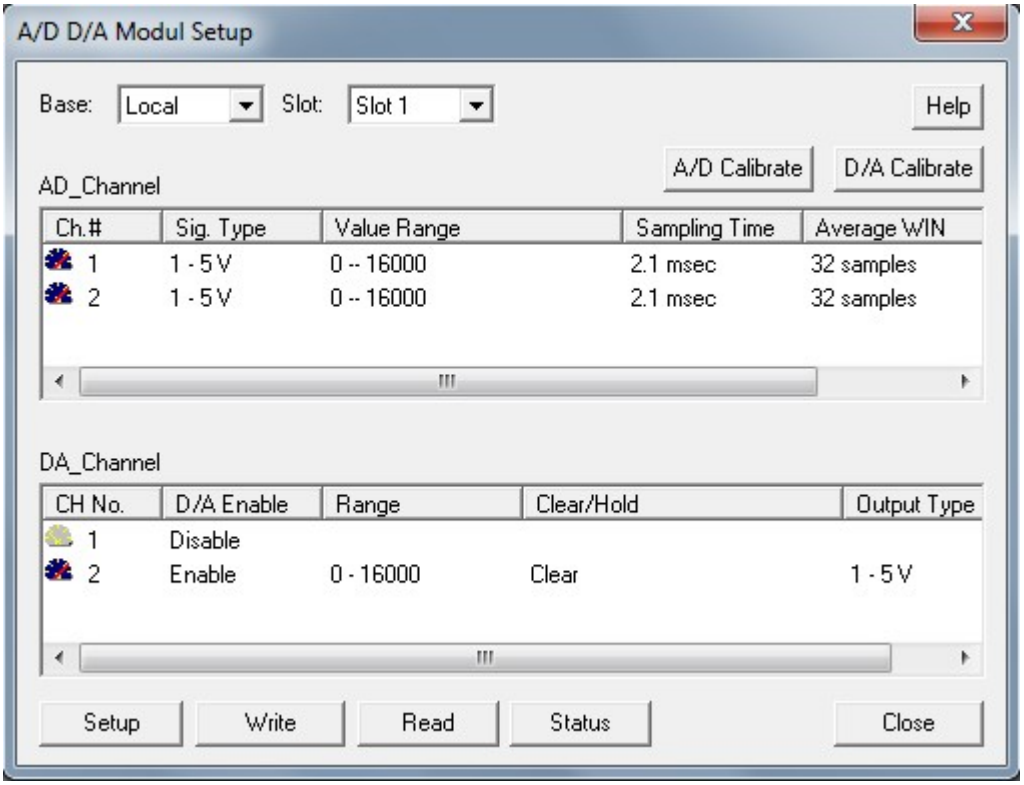
Complete this procedure by performing same methods mentioned above for each channel and click " OK"

* In case of calibration, correct calibration is possible without Calibrator or devices in use.

8.6.8 A/D D/A Module setup in CICON

If you select [Tool]?Special Module Setup]?AD/DA Module], the “A/D D/A Module Setup” window appears. It displays Slot number where AD/DA module is installed. You can also see “A/D D/A Module Setup” window when you double click AD/DA card at workspace.

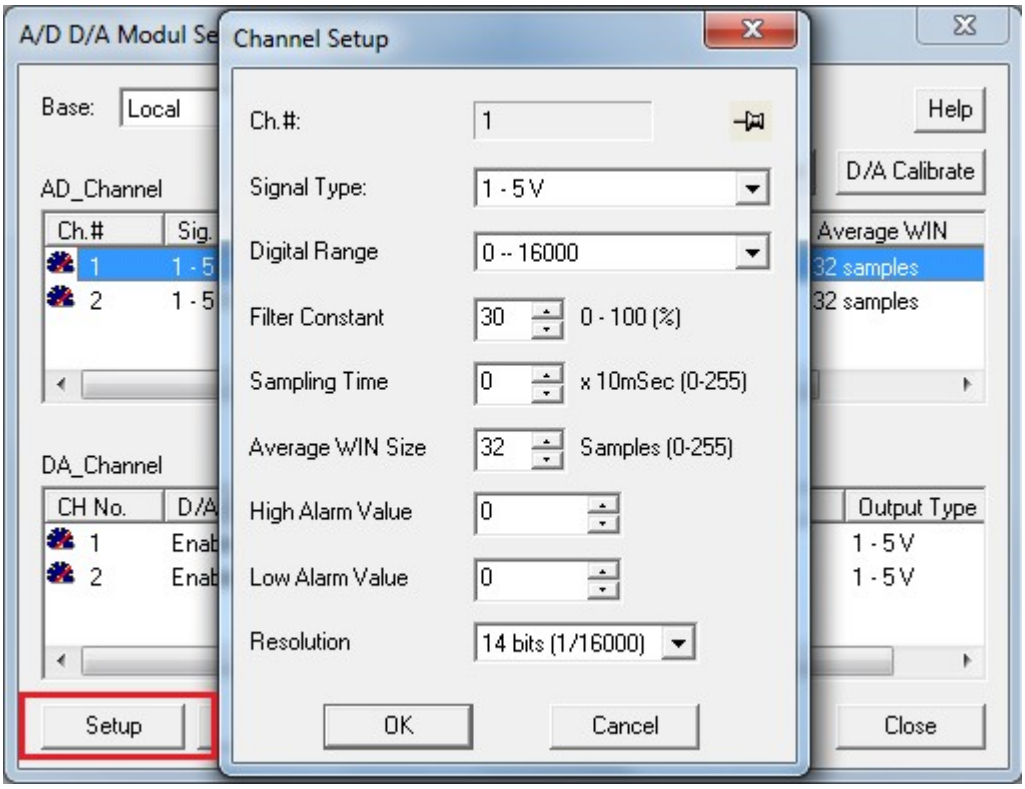
“A/D D/A Module Setup” window shows current card information.



- AD Channel Setting
- DA Channel Setting
- A/D D/A module Status

8.6.8.1 AD Channel Setting

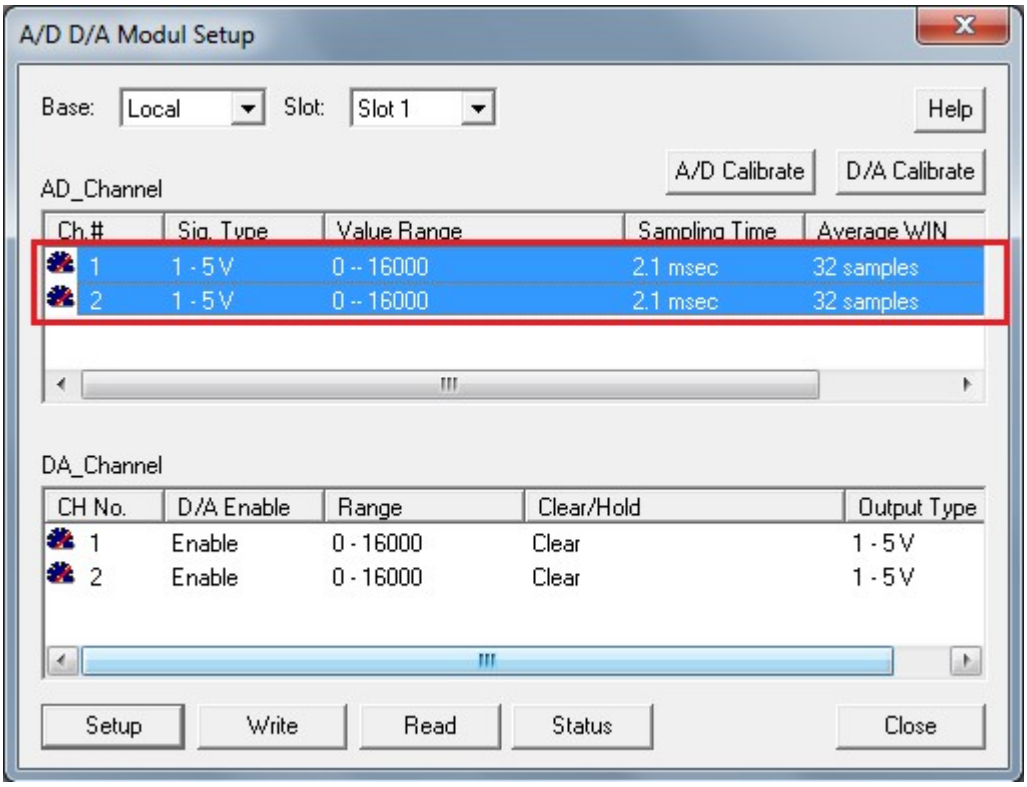
If you double click one of AD channel or click “Setup”, “Channel Setup” window pops up.



- Signal Type : 4 ~ 20mA, 0 ~ 20mA, 1 ~ 5V, 0 ~ 5V, -10 ~ 10V, 0 ~ 10V
- Digital Range : -32768 ~ 32767, -32000 ~ 32000, 500 ~ 64500,0 ~ 64000
- Filter Constant : 0 ~ 100%
- Sampling Time : 0 ~ 2550mSec
- Average WIN Size : 0 ~ 255 Samples
- High Alarm Value : within range of digital conversion value
- Low Alarm Value : within range of digital conversion value

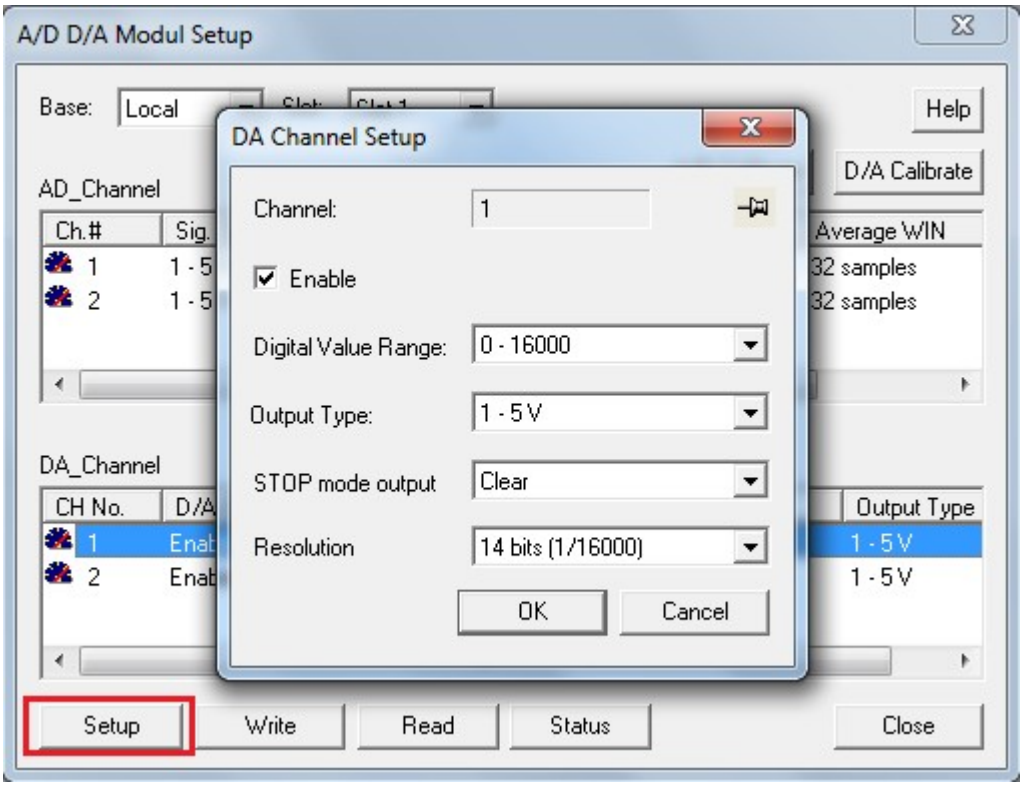
- Click “ OK” after channel setting

- If you select whole channels by mouse as below and click “ Setup” , you can set all channels in once.



8.6.8.2 DA Channel Setting

If you double click one of DA channel or click " Setup" , " DA Channel Setup" window pops up.

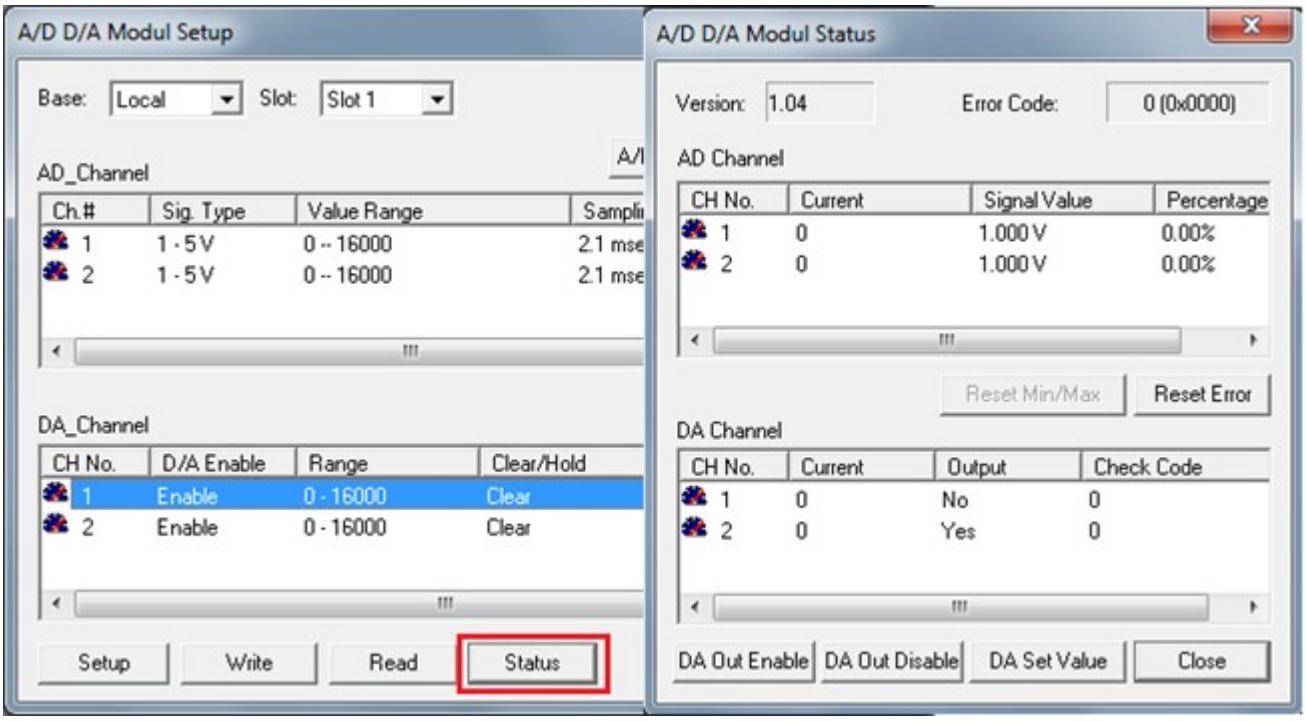


- Digital Value Range : 0 ~ 16000, - 8000 ~ 8000
- Output Type : 4 ~ 20mA, 0 ~ 20mA, 1 ~ 5V, 0 ~ 5V, -10 ~ 10V, 0 ~ 10V
- STOP mode output : HOLD, CLEAR, Half Level, Max. Level
- Resolution : 14bits (1/16000), 16bits (1/64000)

In order to run CA by set value, click “Write”. The message “Set value was written to PLC” is displayed. Set values are recorded at EEPROM. Therefore, conversion is carried out by current set values even power is On/Off. If you click “Read”, it reads current set value from DA card.

8.6.8.3 A/D D/A Module Status

You can check firmware version of AD/DA module and Error code at A/D D/A Module Status if you click “Status”



- DA Out Enable / DA Out Disable : It is used to make output current value or minimum value
  (If power of PLC is turned Off, setting becomes DA Out Disable. Thus Y23 and Y24 should be always on in ladder program. Please check I/O signal Table.)
- DA Set Value : adjust current value.
- Reset Error : Clear error codes when there is any arror or any digital value out of 0 ~ 16000(-8000 ~ 8000) is inputted.

In order to make DA Out Enable properly, the bit of DA Out Enable/Disable(Buffer memory No.23) must be set 1. If it is DA Out Disable, the minimum value (4mA, -10V, 0V) outs regardless of digital input value. You can see the " Yes" or " No" as Enable / Disable status at the above picture.
Although you setup DA Out Enable, it will become DA Out Disable when power of PLC is turned OFF and ON.

8.6.9 Installation and Wiring

- Installation
- Wiring

8.6.9.1 Installation

Installation environment

Environmental conditions

Install the module in control panel which is water proof and anti-vibration

Install the module where there is no persistent shock and vibration.
Install the module where it is not exposed to direct sun ray
Install this module where there is no condensation due to rapid temperature
Install this module where surrounding temperature is maintained at -10 ~ +65℃.

Installation procedure

Make sure that residues from machining screw hole or wiring are not inserted into PLC
Install the module where operation is easy to be performed.
Do not install the module in devices with high voltage and same panel.
Keep more than 50 mm of gap from duct and surrounding module.
Put to earth where surrounding noise environment is good.

Cautions for handing

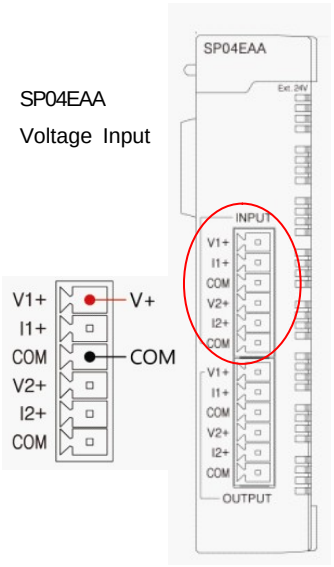
- Do not drop it or put strong shock on it.
- Do not separate PCB from case. Otherwise it may cause malfunction.
- Make sure that foreign substance such as residue from wiring is not inserted into upper areas of module. If foreign substance is found there, remove it.
- Do not mount or dismount module while power is turned on.

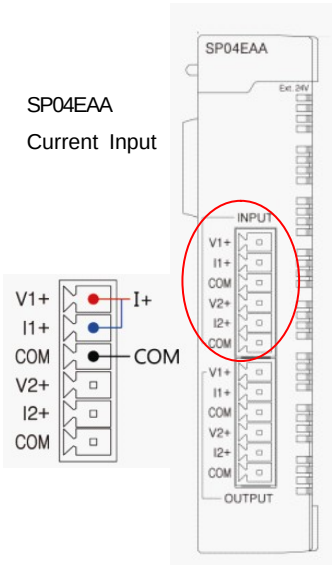
8.6.9.2 Wiring

[In case of current input]

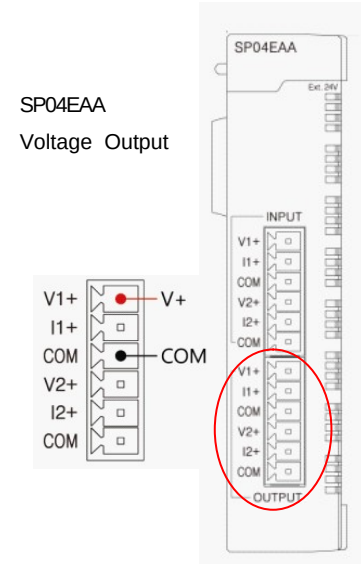
Channel	+ Terminal	- Terminal	Action
AD Ch 1	Terminal 1	Terminal 3	Connect 1-2
AD Ch 2	Terminal 4	Terminal 6	Connect 4-5
DA Ch 1	Terminal 8	Terminal 9	
DA Ch 2	Terminal 11	Terminal 12	
24V External	Connection : bottom of module		

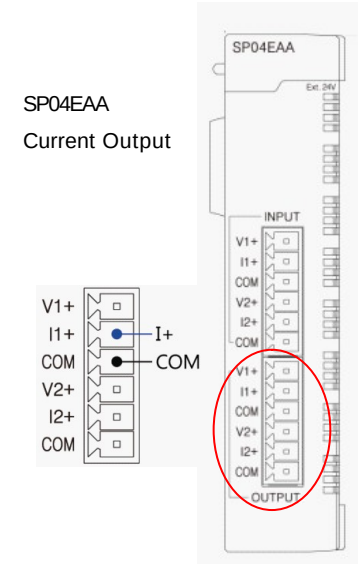
[Wiring Input Method]





[Wiring Output Method]





8.7 PLCS RTD Module : SP04ERO

Contents :

- RTD module setting in CICON
- Trouble shooting

8.7.1 Analog input 4 channel RTD

RTD conversion module is a module that measures temperature by input from thermo resistor (Pt100, JPt100, Pt1000, Ni1000) and converts it into temperature(℃, ℉) and signed 14 bit of digital value.

- Features
- Understanding concept

8.7.1.1 Features

1. RTD module displays the temperature converted by platinum thermo resistor, Pt100 or JPt100 as℃ or ℉ and the temperature can be handled as digital value with the first decimal place.

2. RTD conversion module converts temperature data into 16bit binary data for digital value.

3. It converts -200℃ ~600℃(-50℃~160 ℃) into 0~16000(-8000~8000).

4. The range of temperature is -200℃ ~ 600℃(-50 ℃~ 160)℃and range of digital value is -192 ~ 16191.

5. If user set minimum temp. value and maximum temp. value, RDT conversion module set minimum value 0(-8000) and maximum value 16000(8000).

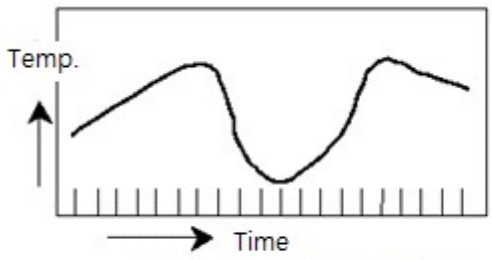
6. RTD conversion module has functions to detect thermo resistor, short circuit of cable and exceeding of measurement range for each channel.

7. This module can connect 4 types of thermo resistor (except Pt100) for maximum 4 points.

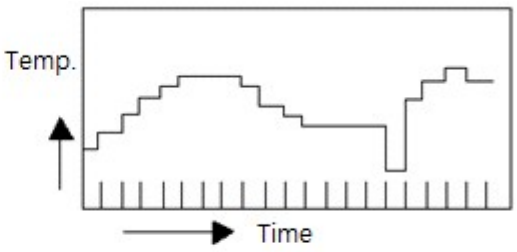
8. EXP LED is turned On for normal operation but it blinks every 0.3second for error.

9. Power LED blinks every 0.5second when RDT conversion module has communication error with CPU module.

8.7.1.2 Understanding concept



[Fig. 1-1] Analog amount



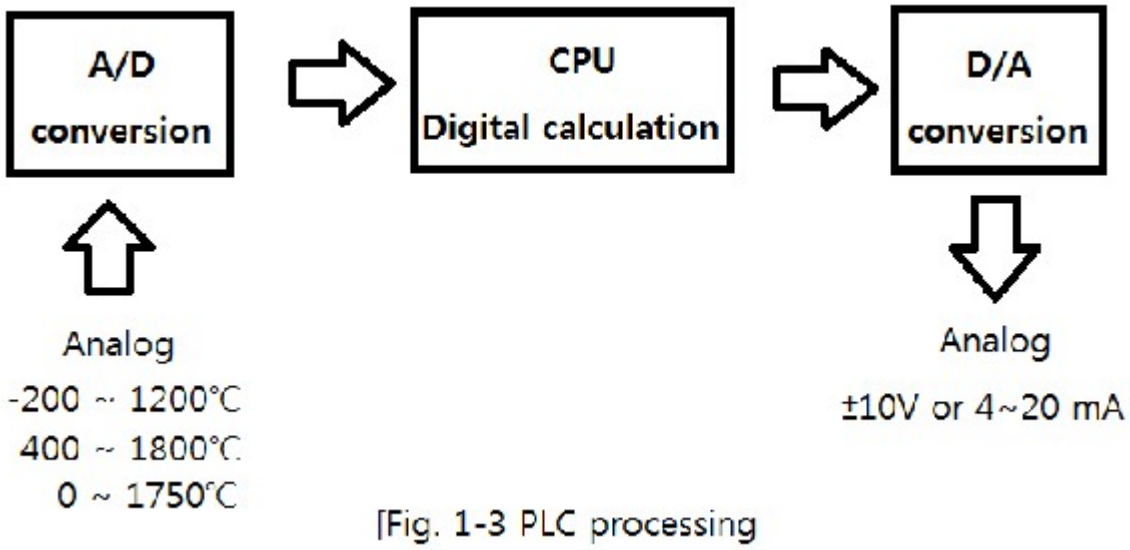
[Fig. 1-2] Digital amount

Analog Value - A

Consecutively changing amounts such as voltage, current, temperature, speed, pressure and flow rate are called Analog amount. Temperature, for example, is consecutively changing by time as shown in Figure 1-1. However, because this consecutively changing amount can't be directly inputted to PLC, thermocouple input module makes it possible to convert temperature into digital amount for PLC.

Digital Value - D

Non-consecutively changing amount like numbers such as 0, 1, 2 and 3 is called Digital amount. The signal ON and OFF is expressed by digital amount of 0 and 1. BCD value and binary value are also Digital amount.



[Fig. 1-3 PLC processing

CPU module cannot input analog value directly to calculate digital amount. Therefore, analog value should be converted digital value to be inputted to CPU as Figure 1-3. In addition, digital value in CPU needs to be converted into analog value in order to output analog value.

Platinum and nickel thermo resistor

This is a sensor to detect temperature as a resistance..

A platinum thermo resistor, Pt100 and jPt100 display 100.00 ? of output for a temperature of 0℃

A platinum thermo resistor, Pt1000 displays 1000.00 ? of output for a temperature of 0℃.

A nickel thermo resistor, Ni1000 displays 1000.00 ? of output for a temperature of 0℃

8.7.2 Specification

- General Specification
- Performance Specification
- Dimension

8.7.2.1 General Specification

<table>
<tr><th>NO</th><th>Items</th><th colspan="6">Specification</th><th>Related standards</th></tr>
<tr><td>1</td><td>Operating temp.</td><td colspan="6">-10 ~ +65℃</td><td></td></tr>
<tr><td>2</td><td>Storage temp</td><td colspan="6">-25 ~ +80℃</td><td></td></tr>
<tr><td>3</td><td>Operating humidity</td><td colspan="6">5 ~ 95%RH, Non-condensing</td><td></td></tr>
<tr><td>4</td><td>Storage humidity</td><td colspan="6">5 ~ 95%RH, Non-condensing</td><td></td></tr>
<tr><td rowspan="8">5</td><td rowspan="8">Vibration</td><td colspan="6">For discontinuous vibration</td><td></td></tr>
<tr><td>Frequency</td><td>Acceleration</td><td colspan="2">Amplitude</td><td colspan="2">Numbers</td><td rowspan="7">IEC61131-2</td></tr>
<tr><td>10=f < 57Hz</td><td>-</td><td colspan="2">0.075mm</td><td colspan="2" rowspan="5">Each 10 times in X,Y,Z directions</td></tr>
<tr><td>57= f < 150 Hz</td><td>9.8m/s2 {1G}</td><td colspan="2">-</td></tr>
<tr><td colspan="3">For continuous vibration</td></tr>
<tr><td>Frequency</td><td>Acceleration</td><td colspan="2">Amplitude</td></tr>
<tr><td>10=f < 57Hz</td><td>-</td><td colspan="2">0.035mm</td></tr>
<tr><td>57= f < 150 Hz</td><td>4.9m/s2 {1G}</td><td colspan="2">-</td></tr>
<tr><td>6</td><td>Shocks</td><td colspan="6">-Max. impact acceleration : 147 m/s2 {15G}
- Authorized time : 11ms
- Pulse wave : Sign half-wave pulse (Each 3 times in X,Y,Z directions)</td><td>IEC61131-2</td></tr>
<tr><td rowspan="5">7</td><td rowspan="5">Noise</td><td>Square wave impulse noise</td><td colspan="5">±2000V</td><td>KDT standard</td></tr>
<tr><td>Electrostatic discharging</td><td colspan="5">Voltage : 4KV(contact discharging)</td><td>IEC61131-2
IEC1000-4-2</td></tr>
<tr><td>Radiated electromagnetic field noise</td><td colspan="5">27 ~ 500 MHz. 10 V/m</td><td>IEC1131-2
IEC1000-4-3</td></tr>
<tr><td rowspan="2">Fast transient / Burst noise</td><td>Class</td><td>Power module</td><td>Digital I/O (24V or more)</td><td>Digital I/O (24V or less) Analog I/O communication interface</td><td>IEC1131-2
IEC1000-4-4</td></tr>
<tr><td>Voltage</td><td>2KV</td><td>1KV</td><td>0.25KV</td><td></td></tr>
<tr><td>8</td><td>Ambient conditions</td><td colspan="6">No corrosive gas or dust</td><td></td></tr>
<tr><td>9</td><td>Operating height</td><td colspan="6">2,000m or less</td><td></td></tr>
</table>

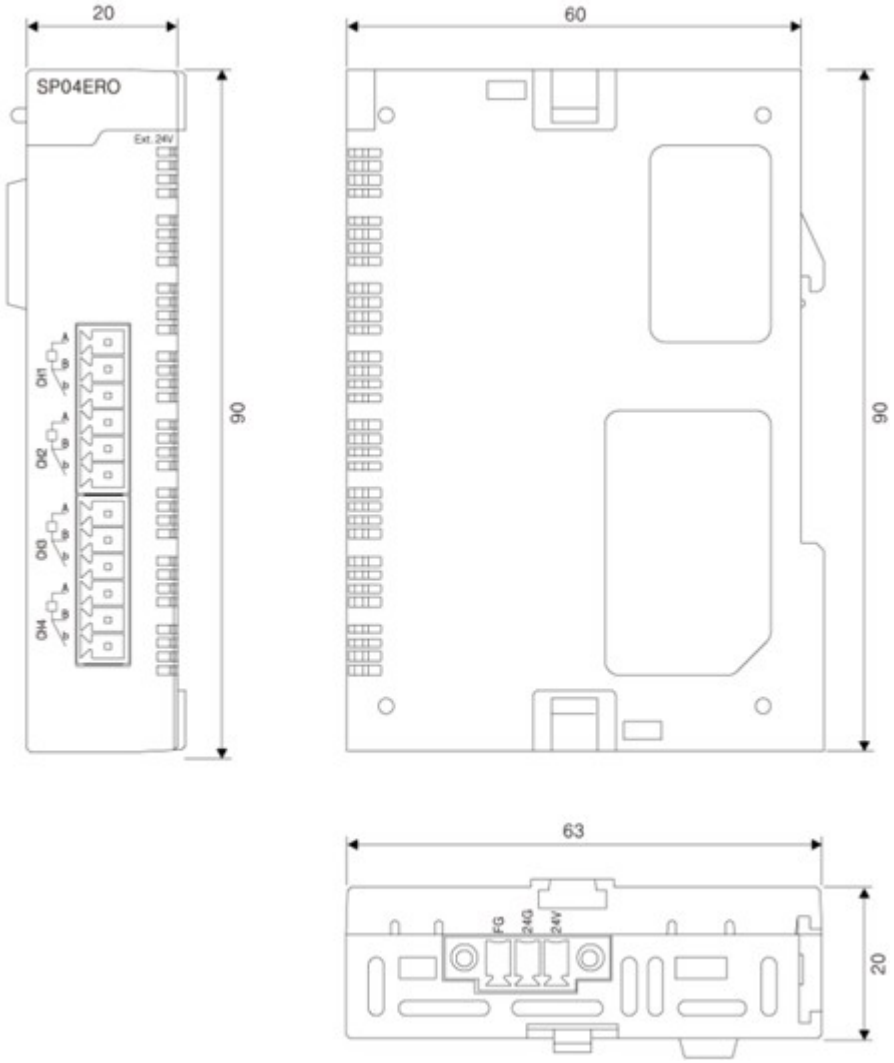
10	Pollution	2 or less	
11	Cooling type	Natural air cooling	

8.7.2.2 Performance Specification

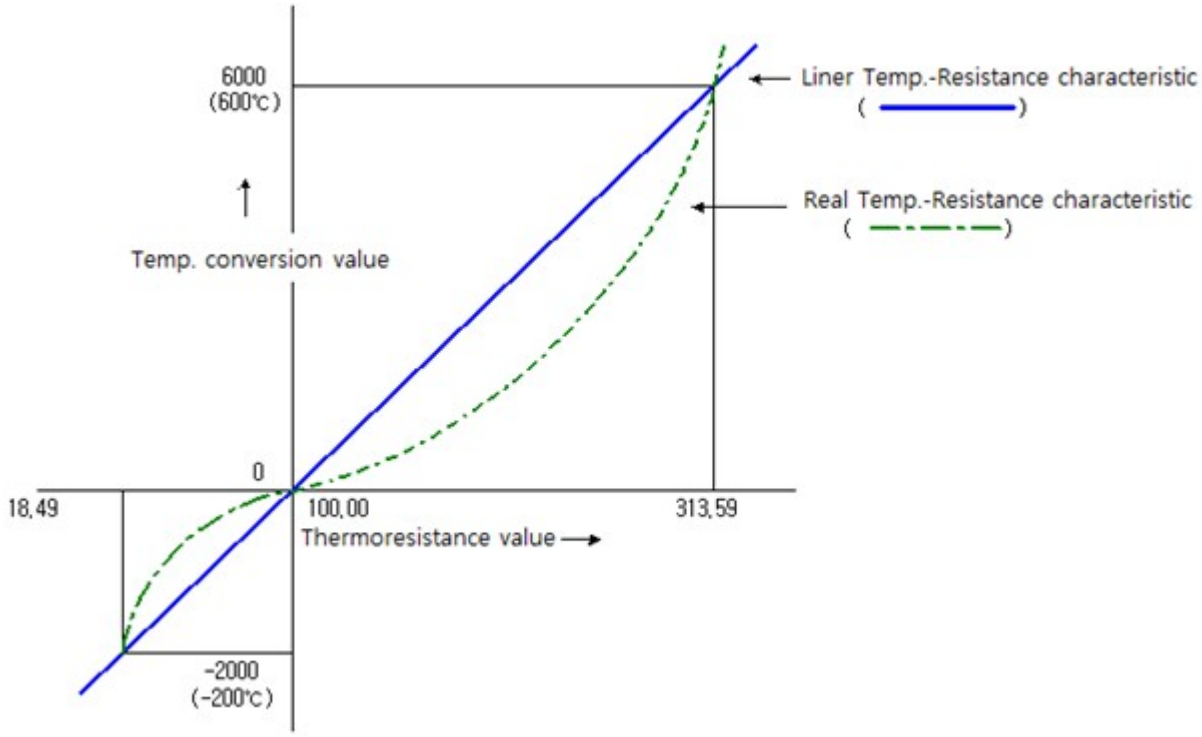
Item		Specification
RTD type		Pt100 (JIS C1640-1989, DIN 43760-1980) JPt100 (KS C1603-1991, JIS C1604-1981) Pt1000 (DIN EN 60751) Ni1000 (DIN 43760) Ni1000 (TCR 5000)
Range of input temperature		Pt100 : -200.0□ C to 600□ C (18.48 to 313.59□) JPt100 : -200.0□ C to 600□ C (17.14 to 317.28□) Pt1000 : -200.0□ C to 600□ C (184.8 to 3135.9□) Ni1000 (DIN 43760): -50.0□ C to 160□ C (742.6 to 2065.9□) Ni1000 (TCR 5000): -50.0□ C to 160□ C (790.9 to 1863.6□)
Digital/Temp. Output		Digital conversion value : 0 ~ 16,000(-8000~8000) Temp. : -2000 ~ 6000 or -500 ~ 1600 (floating point X 10)
Disconnection detection		3 points indication for each channel
Accuracy		±0.1 %(Full Scale)
Max. conversion speed		120ms
Number of Input channels		4Channel / 1 Module
Insulation Method		Photo-coupler insulation : between input terminal and PLC (No insulation between channels)
Connection Terminal		12 points
Consumption current	+ 5V	60 mA
	+ 24V	30 mA

8.7.2.3 Dimension

(Unit: mm)



8.7.3 Characteristic of Temperature conversion



1. Resistance of Pt100 sensor is varying depending on changes in surrounding temperature.
2. RDT input module performs linearization for resistance input of RTD which is non-linear as shown in above picture.
3. The temperature is stored in internal memory of TC input module as a converted temperature.
4. It uses converted temperature or digital converted value stored in buffer memory in the module using FROM command in scan program.

8.7.4 Functions

RTD conversion Enable / Disable

1. User can set RTD conversion Enable or Disable for each input channel.
2. User can make conversion time short by setting Disable to unused channels.

Temperature detection value

1. It saves a converted Celsius and Fahrenheit into memory. (down to one decimal point X 10)
2. It converts the converted temperature into 0~16000, -192 ~ 16191, -8000 ~ 8000, -8192 ~ 8191.

Information for operation channels

1. Information for channels under normal temperature conversion is displayed for each channel.
2. If there is any disconnection error in RTD conversion Enable channel, its bit becomes 0.
3. The bit for Disable channel is 0.

Disconnection detection function

1. It has a function to detect the disconnection of thermocouple and cable for each channel.
2. If disconnection is detected, RTD module holds temperature value before disconnection without further conversion. In this case, error code is displayed while LED flickers every 0.3 second.

Digital output setting

User can select 0~16000, -192 ~ 16191, -8000 ~ 8000 and -8192 ~ 8191 as a range for saving digital output value to buffer memory.

Maximum/Minimum temperature setting

1. RTD conversion module converts -200 ~600℃(-50℉~160)℃into digital value 0(-8000)~16000(8000). This maximum and minimum value could be set by user.
2. If a user inputs maximum and minimum value, RTD module converts the minimum value into 0(-8000) and maximum value into 16000(8000).

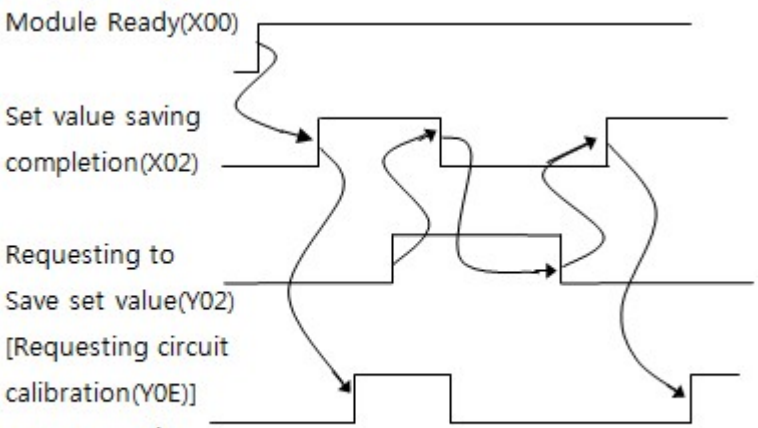
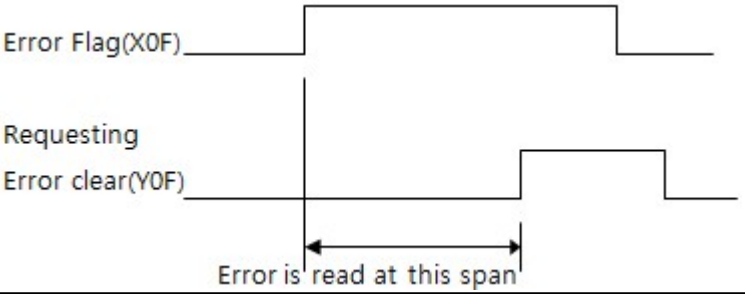
8.7.5 I/O signal for CPU

Signal direction(CPU <- RTD)		Signal direction(CPU -> RTD)	
Input	Signal	Output	Signal
X00	RTD module Ready	Y00	Reserved
X01	RTD conversion completion flag	Y01	
X02	Set value saving completion flag	Y02	Requesting to save set value
X03	Reserved	Y03	Reserved
X04		Y04	
X05		Y05	
X06		Y06	
X07		Y07	
X08		Y08	
X09		Y09	
X0A		Y0A	
X0B		Y0B	
X0C		Y0C	
X0D		Y0D	
X0E		Y0E	Requesting circuit calibration
X0F	RTD module error flag	Y0F	Requesting error clear

** (I/O signal number appears as above when RTD module is installed at the 1st slot)

- Input Signal
- Output Signal

8.7.5.1 Input Signal

Device NO.	Name of Signals	Description
X00	RTD module Ready	(1) This signal is turned On at the time RTD conversion is completely ready when CPU power is on. RTD conversion is performed.
X01	RTD conversion completion flag	(1) If any conversion Enable channel is not converted more than 1 time while PLC power is turned on and its initialization is completed, this flag is OFF (in case that the conversion value is not stored at buffer). If all conversion Enable channel finished to be converted more than 1 time, this flag is On. (2) If set value is changed, this flag is cleared.
X02	Set value saving completion flag	(1) This flag is used for interlock to turn ON/OFF " Requesting to save set value" (Y02) when RTD conversion Enable/Disable is changed. (2) If " Set value saving completion flag" is OFF, RTD conversion process is not performed. (in case " Requesting to save set value" (Y02) is ON) 
X0F	RTD module error flag	(1) This flag is turned ON when error occurs in module. (2) Error code clear turns " Requesting error clear" (Y0F) ON. Execute Error clear in CICON 

8.7.5.2 Output signal

Device NO.	Name of signal	Description
Y02	Request to save set value	(1) This signal is turned ON when RTD conversion Enable/Disable, Designating RTD SET data and Maximum and Minimum temp. set value are stored. (2) Refer to X02(Set value saving completion) for timing of ON/OFF
Y0E	Requesting circuit calibration	(1) This signal is turned ON when circuit calibration is requested. (2) Refer to X02(Set value saving completion) for timing of ON/OFF
Y0F	Requesting error clear	(1) This signal is turned ON when error flag(X0F) is cleared. (2) Refer to X0F(RTD module error flag) for timing of ON/OFF.

8.7.6 Buffer Memory

Address		Details	R/W	Address		Details	R/W
Hex	Dec			Hex	Dec		
0H	0	RTD conversion Enable/Disable	R/W	1EH	30	Designate Average Process	R/W
1H	1	CH.1 Temp detection value(°C)	R	1FH	31	CH.1 Error code	R
2H	2	CH.2 Temp detection value(°C)	R	20H	32	CH.2 Error code	R
3H	3	CH.3 Temp detection value(°C)	R	21	33	CH.3 Error code	R
4H	4	CH.4 Temp detection value(°C)	R	22	34	CH.4 Error code	R
5H	5	CH.5 Temp detection value(°C)	R	23	35	CH.5 Error code	R
6H	6	CH.6 Temp detection value(°C)	R	24	36	CH.6 Error code	R
7H	7	CH.7 Temp detection value(°C)	R	25	37	CH.7 Error code	R
8H	8	CH.8 Temp detection value(°C)	R	26	38	CH.8 Error code	R
9H	9	Designate RTD type	R/W	27	39	Reserved	-
AH	10	Digital output setting 1	R/W	28	40	Requesting data for calibration	R/W
BH	11	CH.1 Temp detection value (°F)	R	29	41	CH.1 Max. temp input value	R/W
CH	12	CH.2 Temp detection value (°F)	R	2A	42	CH.2 Max. temp input value	R/W
DH	13	CH.3 Temp detection value (°F)	R	2B	43	CH.3 Max. temp input value	R/W
EH	14	CH.4 Temp detection value (°F)	R	2C	44	CH.4 Max. temp input value	R/W
FH	15	CH.5 Temp detection value (°F)	R	2D	45	CH.5 Max. temp input value	R/W
10H	16	CH.6 Temp detection value (°F)	R	2E	46	CH.6 Max. temp input value	R/W
11H	17	CH.7 Temp detection value (°F)	R	2F	47	CH.7 Max. temp input value	R/W
12H	18	CH.8 Temp detection value (°F)	R	30	48	CH.8 Max. temp input value	R/W
13H	19	Information for operation channel	R	31	49	Max. & Min. Scale setting data	R/W
14H	20	Designate RTD type	-	32	50	Max. and Min. set error	R

15H	21	CH.1 Digital conversion value	R	33	51	CH.1 Min. temp input value	R/W
16H	22	CH.2 Digital conversion value	R	34	52	CH.2 Min. temp input value	R/W
17H	23	CH.3 Digital conversion value	R	35	53	CH.3 Min. temp input value	R/W
18H	24	CH.4 Digital conversion value	R	36	54	CH.4 Min. temp input value	R/W
19H	25	CH.5 Digital conversion value	R	37	55	CH.5 Min. temp input value	R/W
1AH	26	CH.6 Digital conversion value	R	38	56	CH.6 Min. temp input value	R/W
1BH	27	CH.7 Digital conversion value	R	39	57	CH.7 Min. temp input value	R/W
1CH	28	CH.8 Digital conversion value	R	3A	58	CH.8 Min. temp input value	R/W
1DH	29	Digital output setting 2	R/W	3B-3E	59-62	CH1-CH4 average time/filter coefficient setting	R/W

** Buffer memory, which is a memory in module, stores digital values that are converted from input signal of RTD and records current operations for the module.

** Temperature conversion value or digital conversion value is stored to CPU memory using FROM command and they are used for programs.

** Each data is 2 byte of data.

** 4 channel modules do not use buffer memory of CH.5 ~ CH.8

** R/W indicates whether or not read/write is possible from PLC

R: read W: write

8.7.6.1 RTD conversion Enable/Disable setting(Buffer memory address "0")

1) Set up RTD conversion Enable or Disable for each channel.

2) The initial value is TC conversion Disable.

3) In order to save set value to module, " requesting to save set value (Y02) must be ON/OFF.

4) Set value is stored in EEPROM and is operated by previous set value when power is turned ON/OFF

b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
0	0	0	0	0	0	0	0	0	0	0	0	CH.4	CH.3	CH.2	CH.1

1: RTD conversion Enable

0: RTD conversion Disable

b8 ~ b15 of CM3-SP04ERO is fixed at "0"

8.7.6.2 Temperature detection value ℃(Buffer memory address "1"~"8")

1. This stores temperature value which is detected by RTD conversion.
   The value stored in the memory is actual temperature (first decimal digit) x 10
2. The range of Temperature Conversion is -200℃ ~ 600℃ and if it is out of this range, -250 ~ 650℃ is measured. If the value is out of this range -250 ~ 650 , -250℃ ~ 650℃ is fixed.

8.7.6.3 Designate RTD type (Buffer memory address "9")

1) Initial value is Pt100.

2) In order to save set value to module, " requesting to save set value (Y02) must be ON/OFF.

3) Set value is stored in EEPROM and is operated by previous set value when power is turned ON/OFF.

MSB LSB

Ch4				Ch3				Ch2				Ch1			
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

PLC-S only uses Buffer memory address " 9" . If you set 4 bit for each 4 channels, RTD will be used as below table.

Address 9	RTD type
0 (0000b)	Pt100
1 (0001b)	jPt100
2 (0010b)	Pt1000
3 (0011b)	Ni1000 (DIN43760)
4 (0100b)	Ni1000 (TCR5000)

8.7.6.4 Temperature detection value, °F (Buffer memory address "11" ~ "18")

1. Temperature in Fahrenheit converted by RTD module is stored. In this case, actual temperature (the first decimal digit) * 10 is stored to memory.
2. The range of Temperature conversion is -392~1112°F and if it is out of this range, -482~1202°F is measured. It the value is out of this range -482~1202°F, -482~1202°F is fixed.

8.7.6.5 Information for operation channel (Buffer memory address "19")

1. Information for channel under normal conversion among conversion Enable channels (Buffer memory address" 1") is displayed.
2. Bit for disconnected channel among conversion Enable channels is 0 while bit for channel under conversion is 1.
3. Bit for conversion Disable channel stores 0.

8.7.6.6 Digital conversion value (Buffer memory address "21"~"28")

1. If the temperature measured by RTD is -200℃, it is stored as digital value 0(-8000). If it is 600℃, it is stored as digital value 16000(8000).
2. If user input Maximum and minimum value and minimum temperature is measured, 0(-8000) will be stored. If maximum temperature is measured, 16000(8000) will be stored.

8.7.6.7 Digital output setting (Buffer memory address "10,29")

1) Select 0~16000,-8000~8000,-192~16191,-8192~8191 as digital output value. If -192 ~ 16191 or -8192 ~

8191 is selected, the module displays minimum and maximum measured temperature for each thermocouple by 0~16000 or -8000~8000 and if input values exceed this range, it displays -192 ~ 16191, -8192 ~ 8191

2) Initial value is set to -192 ~ 16191.

3) In order to save set value to module, " requesting to save set value (Y02) must be ON/OFF.

4) Set value is stored in EEPROM and is operated by previous set value when power is turned ON/OFF.

Buffer memory address"10"	0	0	0	0	0	0	0	0	CH .8	CH 7	CH 6	CH 5	CH 4	CH 3	CH 2	CH 1
Buffer memory address"29"	0	0	0	0	0	0	0	0	CH 8	CH .7	CH .6	CH .5	CH 4	CH .3	CH .2	CH .1

Address 10	Address 29	Digital output value
0	0	-192 ~ 16191
0	1	-8192 ~ 8191
1	0	0 ~ 16000
1	1	-8000 ~ 8000

8.7.6.8 Assigning average process (Buffer memory address "30")

1) Set average process of RTD module Enable/disable.

2) The initial value is RTD average process Disable for whole channels.

3) In order to save set value to module, " requesting to save set value (Y02) must be ON/OFF.

4) Set value is stored in EEPROM and is operated by previous set value when power is turned ON/OFF.

b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
0	0	0	0	0	0	0	0	0	0	0	0	CH. 4	CH. 3	CH. 2	CH. 1

1: Average process Enable

0: Average process Disable

8.7.6.9 Error code (Buffer memory address "31"~"38")

1) Error code detected by RTD module is stored.

2) *indicates 1~3.

3) Error is maintained before it is cleared or power is turned OFF. If another error occurs before previous error is not cleared, newly generated error is ignored.

4) Error code is decimal number.

01	If A and B are short circuited

02	If A or B is short circuited.
03	If b or A and B is short circuited
04	If the measured temperature exceeded maximum or minimum temperature range.
10*	System error (A/S) or 24V is not supplied to RDT module

8.7.6.10 Maximum and Minimum Temperature input value (Buffer memory address "41"~"48", "51"~"58")

1) Input maximum and minimum temperature that user wants.
2) In order for maximum or minimum set value to be effective, make sure to set corresponding bit for temperature SET data (Address "49") for set channel to 1 and turn the request (Y02) for storing set value ON/OFF.
3) For Maximum and Minimum setting Error, if minimum value inputted by user is larger than maximum value, bit for corresponding channel becomes 1.
4) Set value is stored in EEPROM and is operated by previous set value when power is turned ON/OFF.
5) If maximum value is smaller than minimum value, error occurs.

8.7.6.11 Maximum and Minimum Scale setting data (buffer memory address "49")

0	0	0	0	0	0	0	0	0	0	0	0	CH .4	CH .3	CH .2	CH .1

1: Setting Enable
0: Setting Disable

1. In case that Scale temperature unit is Disable, the Scale values of PT100, JPT100 and PT1000 are set as 200℃ ~ 600℃.
2. In case that Scale temperature unit is Disable, the Scale values of NI1000_DIN and NI1000_TCR are set as -50℃ ~ 160℃.

8.7.6.12 Maximum and Minimum Set error (buffer memory address "50")

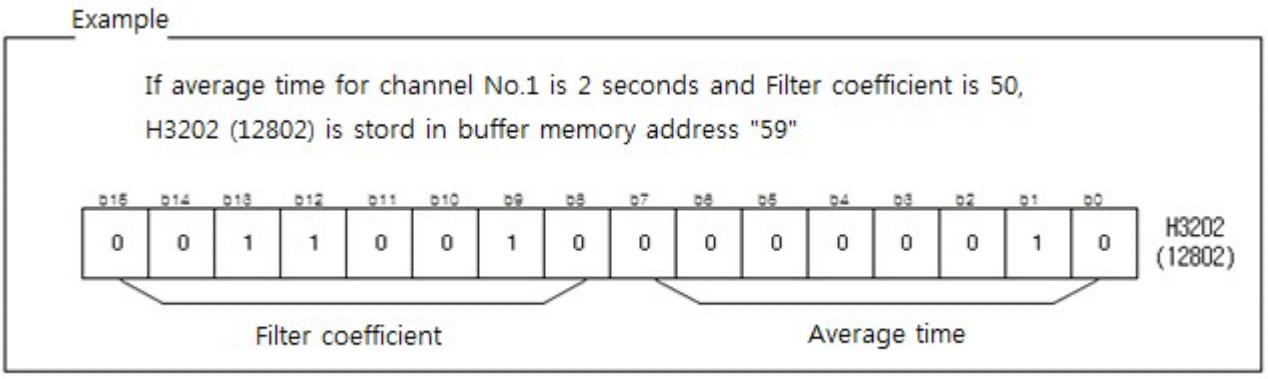
0	0	0	0	0	0	0	0	0	0	0	0	CH .4	CH .3	CH .2	CH .1

1: Setting error
0: No error

1. If maximum value is smaller than minimum value, error occurs.
2. In case of PT100, JPT100 and PT1000, error occurs if Minimum value is over -200 or Maximum value is over 600.
3. In case of NI1000_DIN and NI1000_TCR, error occurs if Minimum value is over -50 or Maximum value is over 160.

8.7.6.13 CH1-CH4 average time / filter coefficient (buffer memory address "59"~"62")

1) It stores filter coefficient set value and average time set value.
2) Average time set value for 1 BYTE below 1 WORD: 1~255 (sec.)
3) Filter coefficient set value for upper 1BYTE: 0~70%
4) When filter function is not used, set the value to 0



If converted temperature has severe variations due to external noise, set this.
Width for variations for converted temperature is limited before it is stored in buffer memory.
Range of setting value: 0 ~ 70 %

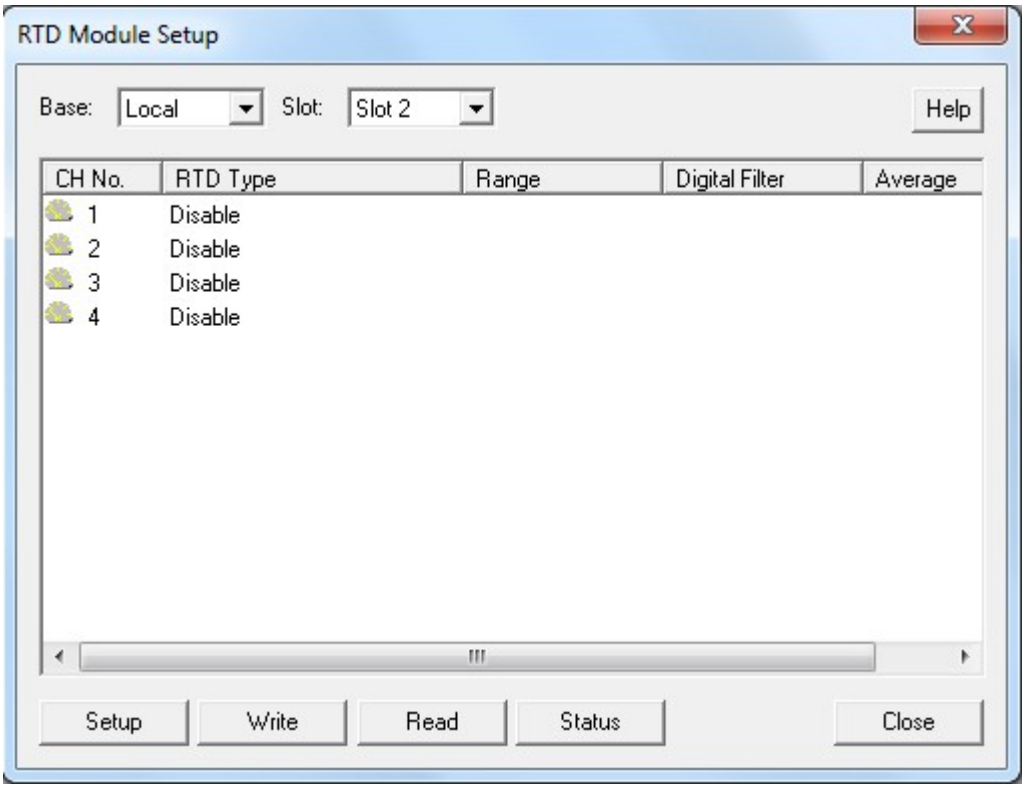
Example) If temperature is changed as shown in following figure, it is a value that is actually stored in buffer memory.

Conversion temp. value Digital filter value	10	15	13	9	14	12	9	5	15
10 %	-	14.5	13.2	9.4	13.5	12.2	9.3	5.4	14.0
70 %	-	11.5	12	11.1	12.0	12.0	11.1	9.3	11.0

Current value = current value + (previous value – current value) * filter coefficient (%) / 100

8.7.7 RTD module setting in CICON

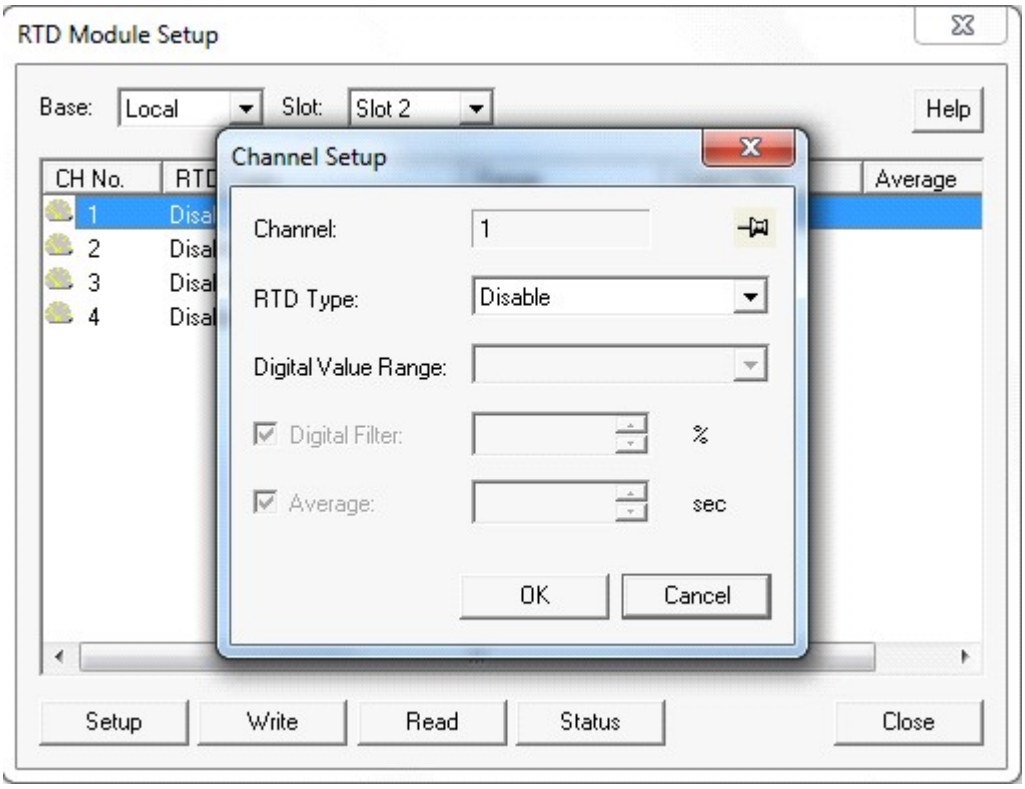
If you click [Tool] -> [Special module Setup] -> [RTD Module] in CICON, [RTD Module Setup] window appears as below.
This automatically displays the base and slot where RTD card is installed in the connected PLC. You can also double click corresponding RTD card after you read card information from project window to display following set window.



- Channel Setup
- RTD Module Status

8.7.7.1 Channel Setup

If you double click channel or click “ Setup” , you can see “ Channel Setup” as below picture



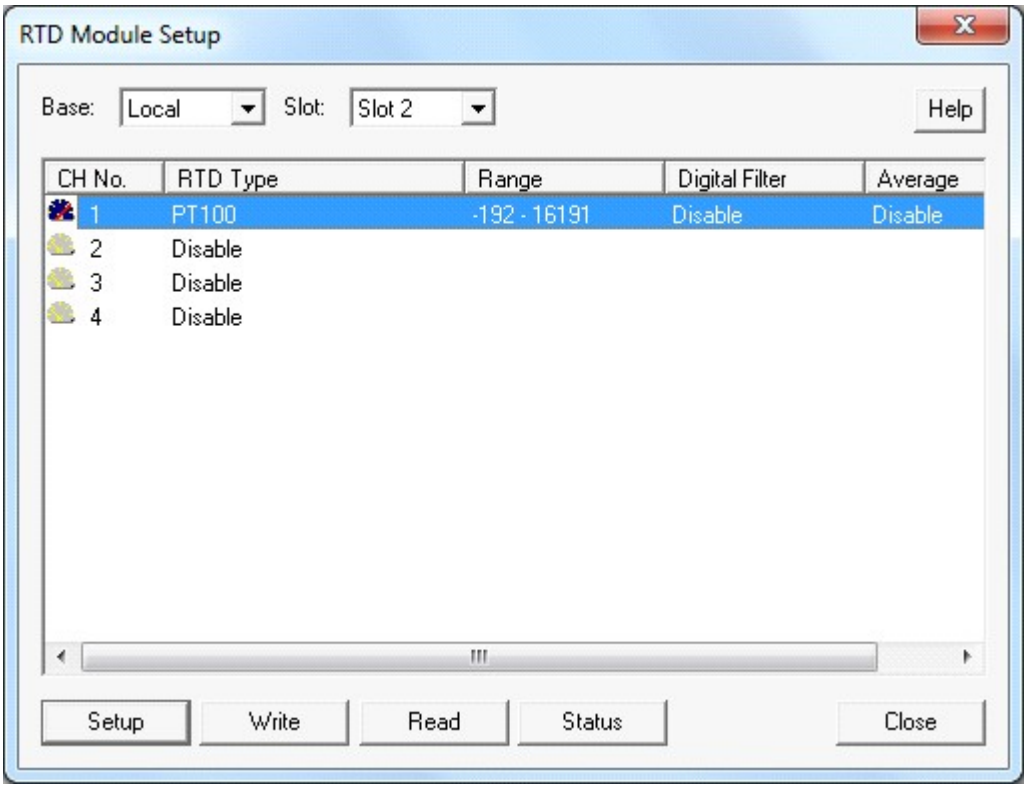
1 RTD Type : PT100, JPT100, PT1000, NI1000

2 Digital Value Range : -192~16191, -8192~8191, 0~16000, -8000~8000

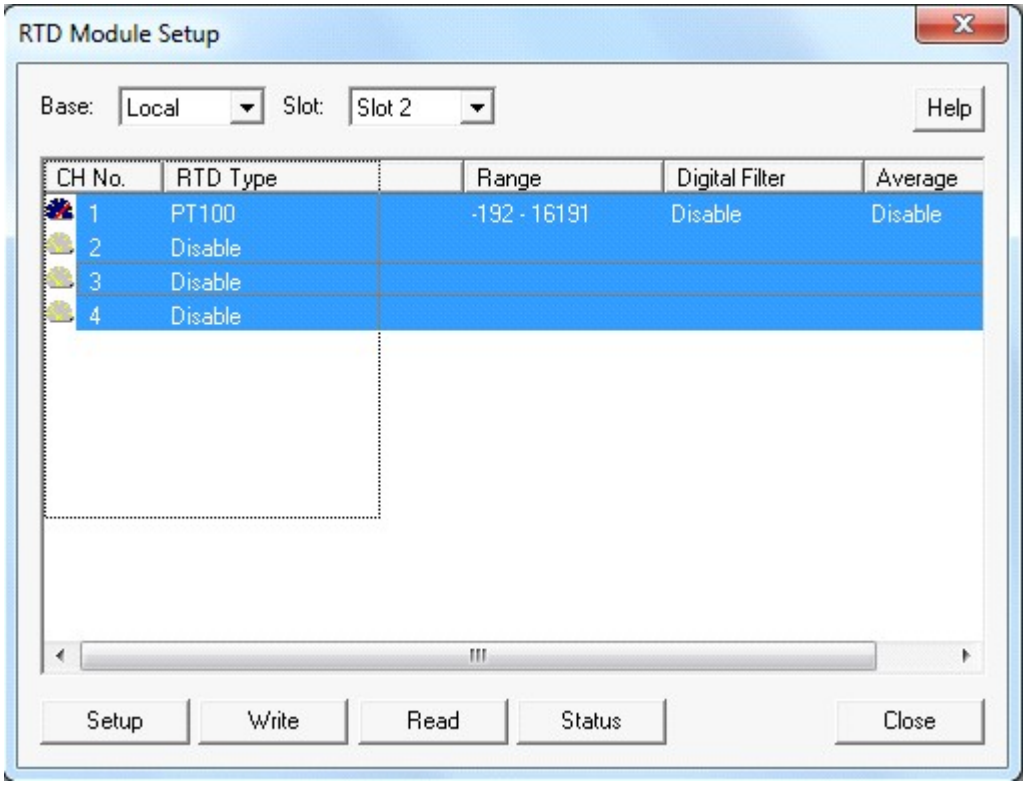
3 Digital Filter : 0~70%

4 Average: 1~255 sec.

- After setting, click "OK" to save setting value.



- If you select whole channels by mouse as below and click “ Setup” , you can set all channels at once



In order to run RTD module with setting value, click “Write”

“Set value is written to PLC.” appears on the screen.

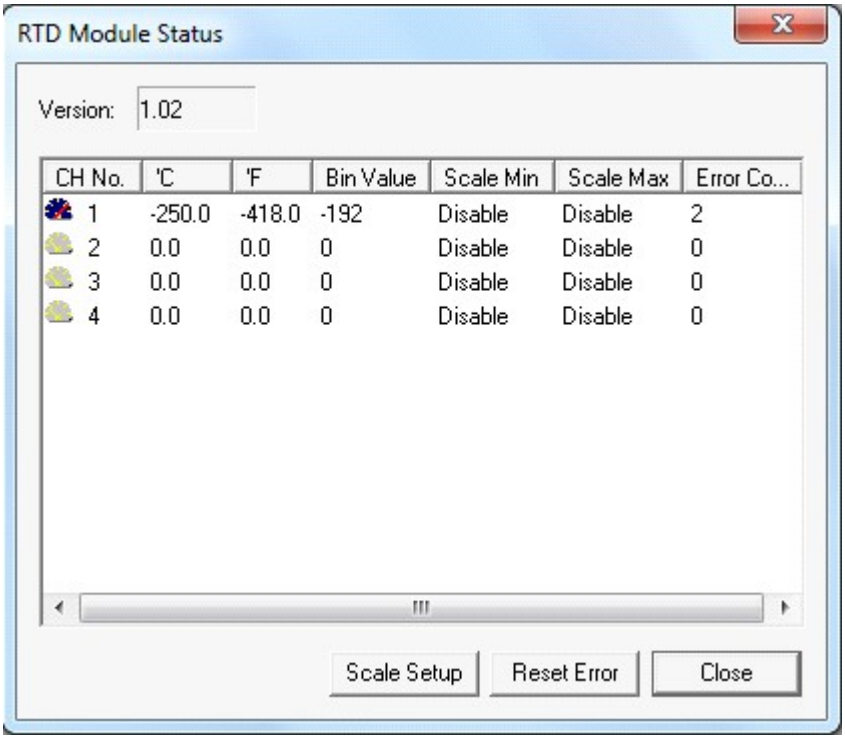
Set values are recorded at EEPROM. Therefore, conversion is carried out by current set values even power is On/Off

If you click “Read”, CICON reads setting value from RTD module.

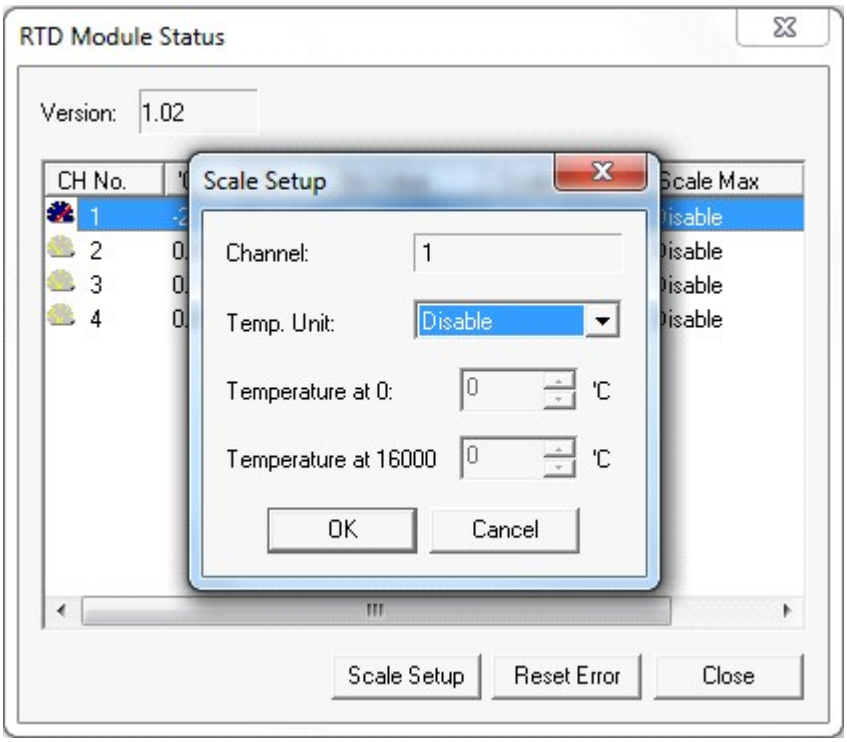
8.7.7.2 RTD Module Status

You can check firmware version of RTD module, Error code and Scale if you click “Status”

If Scale Min. and Scale Max. are set as Disable, the setting is basic standard which converts -200℃~ 600℃ to digital conversion value 0(-8000) ~16000(8000).



1 If you click “Scale Setup” after selecting channel, below windows appears



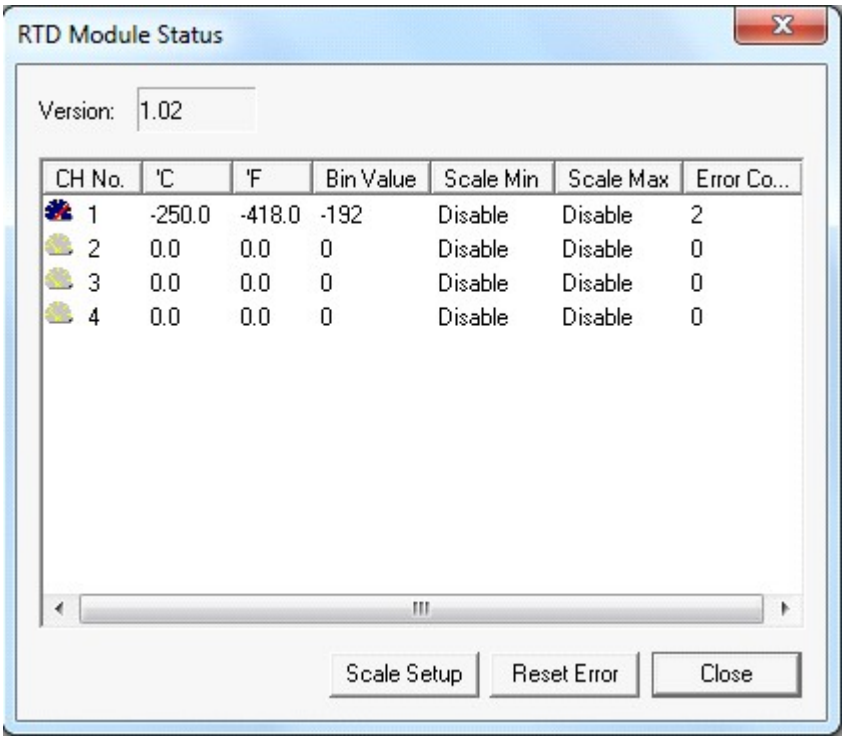
If you want to change maximum and minimum temperatures, select scaling and set temperature when digital value is 0 and 16000. Scale set value is stored at EEPROM. Therefore, this module keeps previous value even if power is turned OFF/ON.

8.7.8 Trouble shooting

RUN LED is blinking every 0.3 second
RUN LED is blinking every 0.5 second and temperature value is not changed
LED is blinking every 0.3 second temperature is stopped at around -250 (or -500)

8.7.8.1 RUN LED is blinking every 0.3 second

Check error code in RTD module status window from CICON.
If there is short circuit (error code: 1) or temperature exceeds measurement temperature range (error code 4), error code is generated. Following picture indicates a case that No.1 channel is under short circuit of A and B.



Refer to 10.6.2 (9) Error code.

8.7.8.2 RUN LED is blinking every 0.5 second and temperature value is not changed

RTD module is corrected for its measurement circuit before it is delivered from factory. In this case, the module uses Y***5. Check if Y***5 bit for the module is set in CICON memory monitor and if it is already set, then check if this bit is used through scan program or communication..

8.7.8.3 LED is blinking every 0.3 second temperature is stopped at around -250 (or -50℃)

If RDT module is not connected with power 24V, this error occurs.
Connect 24V power at the bottom of RTD module to solve this problem.

8.8 PLCS TC Module : SP04ETO

TC conversion module is a module that measure temperature from thermocouple (K, J, E, T, B, R, S, and N) and converts it into temperature value and signed 14 bit of digital value.

Contents :

- TC module setting in CICON
- Trouble shooting
- Thermistor Calibration
- Installation and Wiring

8.8.1 Overview

- Features
- Understanding concept

8.8.1.1 Features

1) CM3-SP04ETO is a TC module which directly connects 8 thermocouples (K, J, E, T, B, R, S, and N) to thermocouple input module and converts temperature (℃, ℉) by the first decimal digit and outputs digital values of 0~16000

2) CM3-SP04ETO is used to convert temperature data into singed 14bit of binary data for digital value. This module converts minimum and maximum value into 0~16000(-8000~8000)

3) Temperatures indicate minimum -50℃ and maximum +50 ℃ and digital value is expressed as -192~16191(-8192~8191)

4) If a user set minimum and maximum temperature, this module converts the minimum value to 0(-8000) and the maximum value to 16000(8000)

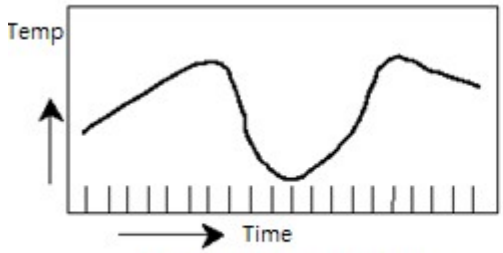
5) This module has a function to detect thermocouple, short circuit in cable and exceeding of measurement range for each channel.

6) This module has 4 channels to connect thermocouples.

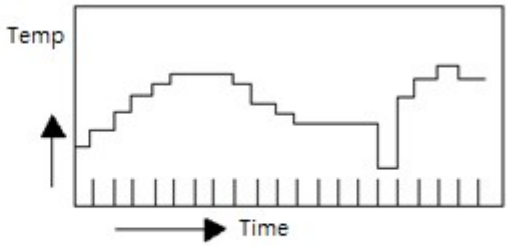
7) There is no limitation for number of TC modules in one base.

8) Reference Junction Compensation (RJC) is automatically performed by temperature sensor attached to terminal.

8.8.1.2 Understanding concept



[Pic 1.1] Analog amount



[Pic 1.2] Digital amount

Analog Amount - A

Consecutively changing amounts such as voltage, current, temperature, speed, pressure and flow rate are called Analog amount. Temperature, for example, is consecutively changing by time as shown in Picture 1.1. However, because this consecutively changing amount can't be directly inputted to PLC, thermocouple input module makes it possible to convert temperature into digital amount for PLC.

Digital Amount - D

Non-consecutively changing amount like numbers such as 0, 1, 2 and 3 is called Digital amount. The signal ON and OFF is expressed by digital amount of 0 and 1. BCD value and binary value are also Digital amount.

Compensating cable

This is a cable to compensate deviation (temperature variations) due to distance for thermocouple input module: This shows almost the same thermo-electrical characteristics in temperature of -20~90℃ for G Type and 0~150℃ for H Type.

Thermocouple

It is a temperature sensor consisting of 2 different metals attached and uses thermoelectric effect which makes thermoelectricity flow by generating electromotive force due to difference of temperature between both contact points. The strength of electromotive force is determined by types of attached metals and temperature for both contact points but it is not affected by shape, dimension and temperature variation of metals.

Temperature conversion characteristic

Temperature conversion to thermocouple input has non-linear characteristics.
This module converts the thermocouple input with non-linear characteristics into A/D and outputs the temperature conversion that is linearly treated.

Disconnection detection function

When Disconnection occurs between a thermocouple/parts of compensating cable and module, internal disconnection detection circuit detects short circuit by identifying larger voltage than measurement range.

RJC (Reference Junction Compensation)

Because sensors for various types of thermocouple output voltage corresponding to differences in temperature between both ends, actual temperature is measured in a way that a temperature from sensor is added to current temperature in PLC.
Currently, SP04ETO module performs reference junction compensation (RJC) using by Thermistor.

8.8.2 Specification

- General specification
- Performance Specification
- Dimension

8.8.2.1 General specification

NO	Items	Specification				Related standards
1	Operating temp.	-10 ~ +65℃				
2	Storage temp.	-25 ~ +80℃				
3	Operating humidity	5 ~ 95%RH, Non-condensing				
4	Storage humidity	5 ~ 95%RH, Non-condensing				
5	Vibration	For discontinuous vibration				
		Frequency	Acceleration	Amplitude	Numbers	IEC61131-2
		10=f < 57Hz	-	0.075mm	Each 10 times in X,Y,Z	

		57= f < 150 Hz	9.8m/s2 {1G}	-	directions	
		For continuous vibration				
		Frequency	Acceleration	Amplitude		
		10=f < 57Hz	-	0.035mm		
		57= f < 150 Hz	4.9m/s2 {1G}	-		
6	Shocks	-Max. impact acceleration : 147 m/s2 {15G} - Authorized time : 11ms - Pulse wave : Sign half-wave pulse (Each 3 times in X,Y,Z directions)				IEC61131-2
7	Noise	Square wave impulse noise	±2000V			KDT standard
		Electrostatic discharging	Voltage : 4KV(contact discharging)			IEC61131-2 IEC1000-4-2
		Radiated electromagnetic field noise	27 ~ 500 MHz. 10 V/m			IEC1131-2 IEC1000-4-3
		Fast transient / Burst noise	Class	Power module	Digital I/O (24V or more)	Digital I/O (24V or less) Analog I/O communication interface	IEC1131-2 IEC1000-4-4
			Voltage	2KV	1KV	0.25KV	
8	Ambient conditions	No corrosive gas or dust					
9	Operating height	2,000m or less					
10	Pollution	2 or less					
11	Cooling type	Natural air cooling					

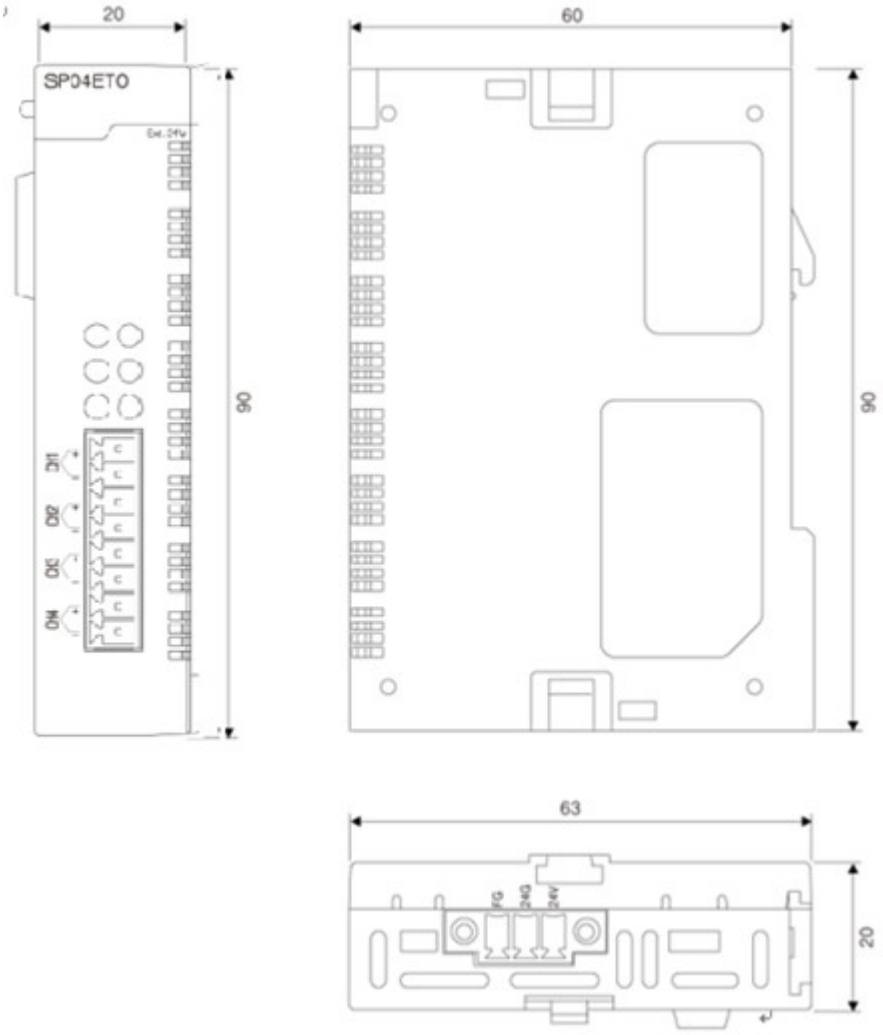
8.8.2.2 Performance Specification

	Items
Type of input sensors	Thermocouple K, J, E, T, B, R, S, N type
Digital output	Digital conversion value : 0 ~ 16000(-8000~8000), Temp. conversion value :measured temp. range of thermocouple(down to one decimal place X 10)

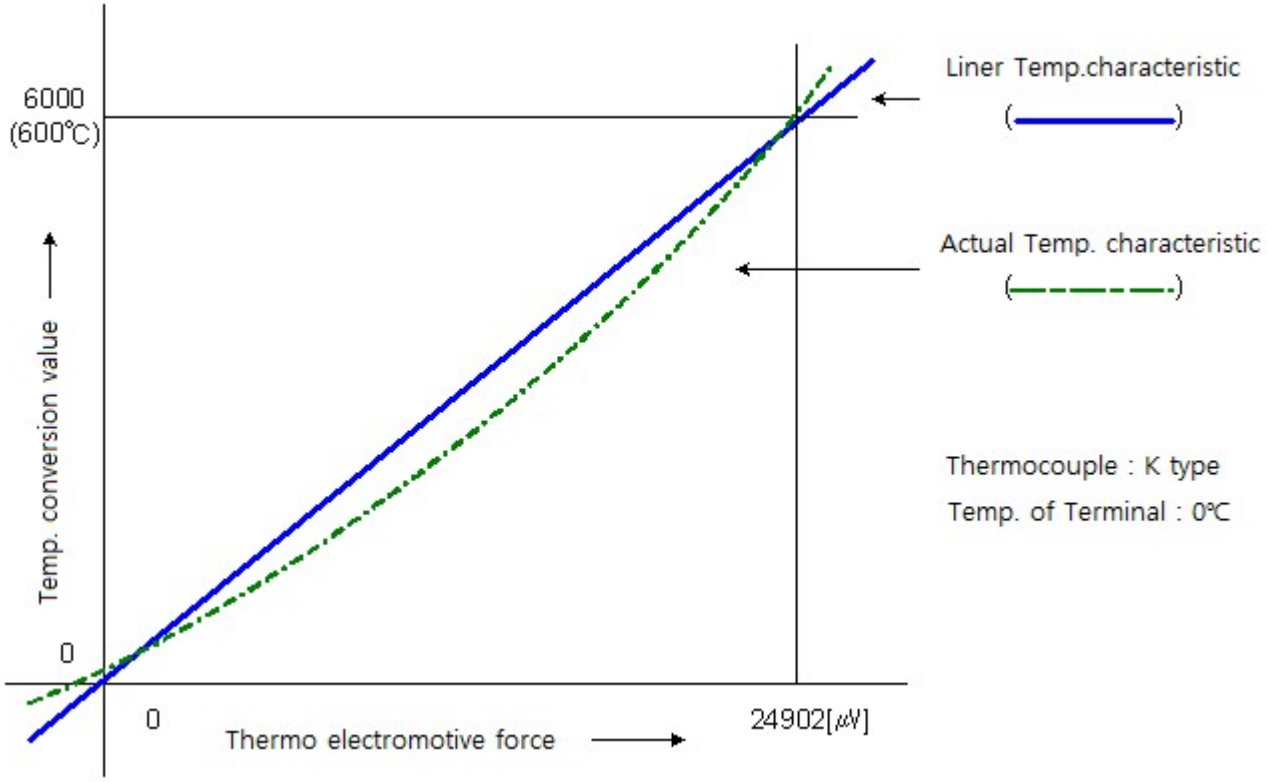
<table>
<tr><td colspan="2">Range of input temperature</td><td>
<table>
<tr><th>Thermocouple</th><th>standards</th><th>Range of measured Temperature(°C)</th><th>Range of measured Voltage(μV)</th></tr>
<tr><td>K</td><td rowspan="8">ITS-90</td><td>-200.0~1200.0</td><td>-5891~48828</td></tr>
<tr><td>J</td><td>-200.0~800.0</td><td>-7890~45498</td></tr>
<tr><td>E</td><td>-200.0~600.0</td><td>-8824~45085</td></tr>
<tr><td>T</td><td>-200.0~400.0</td><td>-5602~20869</td></tr>
<tr><td>B</td><td>400.0~1800.0</td><td>786~13585</td></tr>
<tr><td>R</td><td>0.0~1750.0</td><td>0~21006</td></tr>
<tr><td>S</td><td>0.0~1750.0</td><td>0~18612</td></tr>
<tr><td>N</td><td>-200.0~1250.0</td><td>-3990~43846</td></tr>
</table>
</td></tr>
<tr><td colspan="2">RJC</td><td>Auto compensation by RJC</td></tr>
<tr><td colspan="2">Disconnection detection</td><td>Detection for each channel</td></tr>
<tr><td colspan="2">Accuracy</td><td>±[(Full Scale)x0.3%+1°C(RJC tolerance)]</td></tr>
<tr><td colspan="2">Max. conversion speed</td><td>100ms / 1 channel</td></tr>
<tr><td colspan="2">Input channel No.</td><td>4Channel / Module</td></tr>
<tr><td colspan="2">Insulation</td><td>Photo-coupler insulation : between input terminal and PLC (No insulation between channels)</td></tr>
<tr><td colspan="2">Connection Terminal</td><td>8-point terminal block</td></tr>
<tr><td rowspan="3">Consumption current</td><td>+5V</td><td>60 mA</td></tr>
<tr><td>+15V</td><td>30 mA</td></tr>
<tr><td>-15V</td><td>10 mA</td></tr>
</table>

8.8.2.3 Dimension

(Unit: mm)



8.8.3 Characteristic of thermocouple temperature conversion



1. Electromotive force in thermocouple is varying depending on changes in temperature near both ends of each thermocouple.
2. TC input module performs linearization for electromotive force input from thermocouple which is non-linear as shown in above figure.
3. The temperature is stored in internal memory of TC input module as a converted temperature.
4. It uses converted temperature or digital converted value stored in buffer memory in the module using FROM command in scan program.

8.8.4 Functions

TC conversion Enable / Disable

1. User can set TC conversion Enable or Disable for each input channel.
2. User can make conversion time short by setting Disable to unused channels.

Temperature detection value

1. It saves a converted Celsius and Fahrenheit into memory. (down to one decimal point X 10)
2. It converts the converted temperature into 0~16000, -192 ~ 16191, -8000 ~ 8000, -8192 ~ 8191.

Information for operation channels

1. Information for channels under normal temperature conversion is displayed for each channel.

2. If there is any disconnection error in TC conversion Enable channel, its bit becomes 0.
3. The bit for Disable channel is 0.

Disconnection detection function

1. It has a function to detect the disconnection of thermocouple and cable for each channel.
2. If disconnection is detected, TC module holds temperature value before disconnection without further conversion. In this case, error code is displayed while LED flickers every 0.2 second.

Digital output setting

User can select 0~16000, -192 ~ 16191, -8000 ~ 8000 and -8192 ~ 8191 as a range for saving digital output value to buffer memory.

Maximum/Minimum temperature setting

TC module converts allowable temperature for each thermocouple into digital value of 0(-8000)~16000(8000). This maximum and minimum value could be set by user. If a user inputs maximum and minimum value, TC module convert the minimum value into 0(-8000) and maximum value into 16000(8000).

Maximum Sample Temperature setting

This function is used to detects wrong temperature if previous sample temperature and current sample temperature are higher than a set temperature. User can set range of temperature from 3 to 1000.
If temperature is not updated under an environment with rapidly changing temperature, user should set higher temperature than current set value.

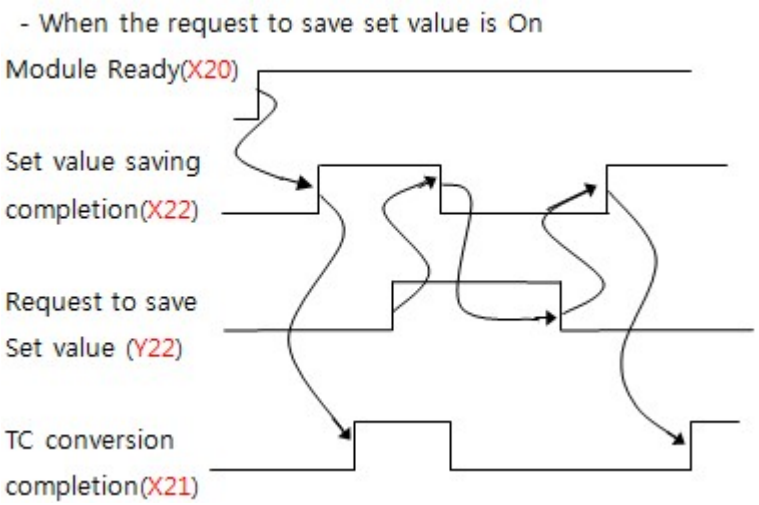
8.8.5 I/O signal for CPU

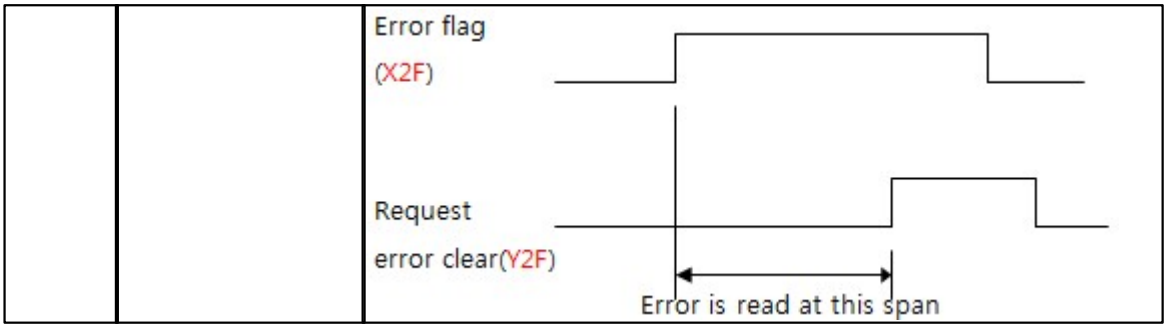
Signal direction(CPU <- TC)		Signal direction(CPU -> TC)	
Input	**Signal**	**Output**	**Signal**
X20	TC module Ready	Y20	Reserved
X21	TC conversion completion flag	Y21	
X22	Set value saving completion flag	Y22	Requesting to save set value
X23	Reserved	Y23	Reserved
X24		Y24	
X25		Y25	
X26		Y26	
X27		Y27	
X28		Y28	
X29		Y29	
X2A		Y2A	
X2B		Y2B	
X2C		Y2C	
X2D		Y2D	
X2E		Y2E	
X2F	TC module Error flag	Y2F	Request error clear

* (I/O signal number appears as above when TC module is installed at the 1st slot)

- Input Signal
- Output Signal

8.8.5.1 Input Signal

Device NO.	Name of Signals	Description
X20	TC Module Ready	(1) This signal is turned On at the time TC conversion is completely ready when CPU power is on. TC conversion is performed.
X21	TC conversion completion flag	(1) If any conversion Enable channel is not converted more than 1 time while PLC power is turned on and its initialization is completed, this flag is OFF (in case that the conversion value is not stored at buffer). If all conversion Enable channel finished to be converted more than 1 time, this flag is On. (2) If set value is changed, this flag is cleared.
X22	Set value saving completion flag	(1) This flag is used for interlock to turn ON/OFF request of strong set value when TC conversion Enable/Disable is changed. (2) If set value storing completion flag is OFF, TC conversion process is not performed. - When the request to save set value is On 
X2F	TC module error flag	(1) This flag is turned On when error occurs in module. (2) Error code clear turns the request error clear ON(Y2F)



8.8.5.2 Output signal

device NO.	Name of signal	Descriptions
Y22	Request to save set value	(1) This signal is turned ON when TC conversion Enable/Disable, TC type and etc. are stored (2) Refer to Y22(Requesting to save set value) for timing of ON/OFF

8.8.6 Buffer Memory

Address		Details	R/W	Address		Details	R/W
Hex.	Dec.			Hex.	Dec.		
0H	0	TC conversion Enable/Disable	R/W	23H	35	CH.5 Error code	R
1H	1	CH.1 Temp detection value(°C)	R	24H	36	CH.6 Error code	R
2H	2	CH.2 Temp detection value(°C)	R	25H	37	CH.7 Error code	R
3H	3	CH.3 Temp detection value(°C)	R	26H	38	CH.8 Error code	R
4H	4	CH.4 Temp detection value(°C)	R	27H	39	Reserved	-
5H	5	CH.5 Temp detection value(°C)	R	28H	40	Request calibration	R/W
6H	6	CH.6 Temp detection value(°C)	R	29H	41	CH.1 Max. temp input value	R/W
7H	7	CH.7 Temp detection value(°C)	R	2AH	42	CH.2 Max. temp input value	R/W
8H	8	CH.8 Temp detection value(°C)	R	2BH	43	CH.3 Max. temp input value	R/W
9H	9	CH.1~CH.4thermocouple type setting	R/W	2CH	44	CH.4 Max. temp input value	R/W
AH	10	Digital output setting 1	R/W	2DH	45	CH.5 Max. temp input value	R/W
BH	11	CH.1 Temp detection value (°F)	R	2EH	46	CH.6 Max. temp input value	R/W
CH	12	CH.2 Temp detection value (°F)	R	2FH	47	CH.7 Max. temp input value	R/W
DH	13	CH.3 Temp detection value (°F)	R	30H	48	CH.8 Max. temp input value	R/W
EH	14	CH.4 Temp detection value (°F)	R	31H	49	Assigning temp. setting data	R/W

FH	15	CH.5 Temp detection value (°F)	R	32H	50	Error in Temp. setting	R
10H	16	CH.6 Temp detection value (°F)	R	33H	51	CH.1 Min. temp input value	R/W
11H	17	CH.7 Temp detection value (°F)	R	34H	52	CH.2 Min. temp input value	R/W
12H	18	CH.8 Temp detection value (°F)	R	35H	53	CH.3 Min. temp input value	R/W
13H	19	Information for operation Channel	R	36H	54	CH.4 Min. temp input value	R/W
14H	20	Assigning type setup data	R/W	37H	55	CH.5 Min. temp input value	R/W
15H	21	CH.1 Digital conversion value	R	38H	56	CH.6 Min. temp input value	R/W
16H	22	CH.2 Digital conversion value	R	39H	57	CH.7 Min. temp input value	R/W
17H	23	CH.3 Digital conversion value	R	3AH	58	CH.8 Min. temp input value	R/W
18H	24	CH.4 Digital conversion value	R	3B-3E	59-62	CH1-CH4 average time/filter coefficient setting	R/W
19H	25	CH.5 Digital conversion value	R	3FH	63	OS Version	R
1AH	26	CH.6 Digital conversion value	R	40H	64	CH.1 Max. Temp. in changing	R/W
1BH	27	CH.7 Digital conversion value	R	41H	65	CH.2 Max. Temp. in changing	R/W
1CH	28	CH.8 Digital conversion value	R	42H	66	CH.3 Max. Temp. in changing	R/W
1DH	29	Digital output setting 2	R/W	43H	67	CH.4 Max. Temp. in changing	R/W
1EH	30	Assigning Average Process	R/W	44H	68	CH.5 Max. Temp. in changing	R/W
1FH	31	CH.1 Error code	R	45H	69	CH.6 Max. Temp. in changing	R/W
20H	32	CH.2 Error code	R	46H	70	CH.7 Max. Temp. in changing	R/W
21H	33	CH.3 Error code	R	47H	71	CH.8 Max. Temp. in changing	R/W
22H	34	CH.4 Error code	R				

** Buffer memory, which is a memory in module, stores digital values that are converted from input signal of thermocouple and records current operations for the module

Temperature conversion value or digital conversion value is stored to CPU memory using FROM command and they are used for programs.

** Each data is 2 byte of data.

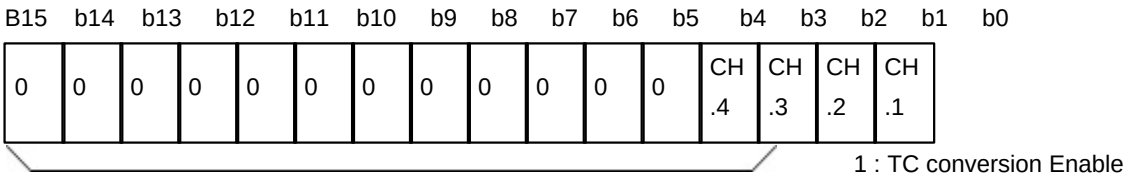
** 4 channel modules do not use buffer memory of CH.5 ~ CH.8

** R/W indicates whether or not read/write is possible from PLC

R : read W : write

8.8.6.1 TC conversion Enable/Disable setting(Buffer memory address "0")

1) Set up TC conversion Enable or Disable for each channel.
2) The initial value is TC conversion Disable.
3) In order to save set value to module, "requesting to save set value(Y02) must be ON/OFF.
4) Set value is stored in EEPROM and is operated by previous set value when power is turned ON/OFF



8.8.6.2 Temperature detection value ℃(Buffer memory address "1"~"8")

1) This stores temperature value which is detected by TC conversion
The value stored in the memory is actual temperature(first decimal digit) x 10

2) Range of temperature conversion

Thermocouple	Measured temp. range (°C)	Max. range of measured temperature(°C)
K	-200.0~1200.0	-250.0~1250.0
J	-200.0~800.0	-250.0~850.0
E	-200.0~600.0	-250.0~650.0
T	-200.0~400.0	-250.0~450.0
B	400.0~1800.0	350.0~1850.0
R	0.0~1750.0	-50.0~1800.0
S	0.0~1750.0	-50.0~1800.0
N	-200.0~1250.0	-250.0~1300.0

3) If value is out of range, it is measured by minimum -50℃ and maximum +500℃.

8.8.6.3 TC type setting (Buffer memory address "9")

1. In order to make set types of TC available, make sure to set the bit for "Assigning type setup data (Buffer memory "20") to 1 and make "requesting to save set value (Y02)" ON/OFF.
2. Initial value is set to "K" type.
3. In order to save set value to module, "requesting to save set value (Y02) must be ON/OFF.
4. Set value is stored in EEPROM and is operated by previous set value when power is turned ON/OFF

- Set value for each thermocouple type

TC type	K	J	E	T	R	S	B	N
Set value	0	1	2	3	4	5	6	7

b15 ~ b12 b11 ~ b8 b7 ~ b4 b3 ~ b0

Buffer memory address "9"	CH.4	CH.3	CH.2	CH.1

8.8.6.4 Temperature detection value, °F (Buffer memory address "11" ~ "18")

1. Temperature in Fahrenheit converted by TC module is stored.
2. In this case, actual temperature (the first decimal digit) * 10 is stored.

8.8.6.5 Information for operation channel (Buffer memory address "19")

1. Information for channel under normal conversion among conversion Enable channels (Buffer memory address" 1") is displayed.
2. Bit for disconnected channel among conversion Enable channels is 0 while bit for channel under conversion is 1.
3. Bit for conversion Disable channel stores 0.

8.8.6.6 Digital conversion value (Buffer memory address "21"~"28")

1. The temperature measured by TC is stored as digital value of 0(-8000) and 16000(8000). If the temperature is out of this range, it is stored as maximum -192(-8192) ~ 16191(8191)
2. If user input Maximum and minimum value and minimum temperature is measured, 0(-8000) will be stored. If maximum temperature is measured, 16000(8000) will be stored.

8.8.6.7 Digital output setting (Buffer memory address "10,29")

1. Select 0~16000,-8000~8000,-192~16191,-8192~8191 as digital output value.
   If -192 ~ 16191 or -8192 ~ 8191 is selected, the module displays minimum and maximum measured temperature for each thermocouple by 0~16000 or -8000~8000 and if input values exceed this range, it displays -192 ~ 16191, -8192 ~ 8191.

2. Initial value is set to -192 ~ 16191

3. In order to save set value to module, " requesting to save set value (Y02) must be ON/OFF.

4. Set value is stored in EEPROM and is operated by previous set value when power is turned ON/OFF

Buffer memory	0	0	0	0	0	0	0	0	CH	CH	CH	CH	CH	CH	CH	CH

address"10"									.8	7	6	5	4	3	2	1
Buffer memory address"29"	0	0	0	0	0	0	0	0	CH 8	CH .7	CH .6	CH .5	CH 4	CH .3	CH .2	CH .1

Address 10	Address 29	Digital output value
0	0	-192 ~ 16191
0	1	-8192 ~ 8191
1	0	0 ~ 16000
1	1	-8000 ~ 8000

8.8.6.8 Assigning average process (Buffer memory address "30")

1. Set average process of TC module Enable/disable.
2. The initial value is TC average process Disable for whole channels.
3. In order to save set value to module, “ requesting to save set value (Y02) must be ON/OFF.
4. Set value is stored in EEPROM and is operated by previous set value when power is turned ON/OFF

b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
0	0	0	0	0	0	0	0	0	0	0	0	CH .4	CH .3	CH .2	CH .1

1 : Average process Enable

0 : Average process Disable

8.8.6.9 Error code (Buffer memory address "31~38")

1. Error code detected by TC module is stored
2. Error code is maintained until a user clear it or power is turned OFF.
3. Error is maintained before it is cleared or power is turned OFF. If another error occurs before previous error is not cleared, newly generated error is ignored
4. ♦indicates 1~3
5. Error code is decimal number.

01	disconnection
02	RJC error
03	in case that wrong TC type is selected
04	Measured temperature is out of maximum or minimum temperature range.
10♦	System error (A/S needed)

8.8.6.10 Maximum Temperature input value (Buffer memory address "41~48")

Maximum and Minimum temperature SET data (Buffer memory address "49")
Maximum and Minimum setting Error (Buffer memory address "50")
Minimum temperature input value (Buffer memory address "51"~"58")

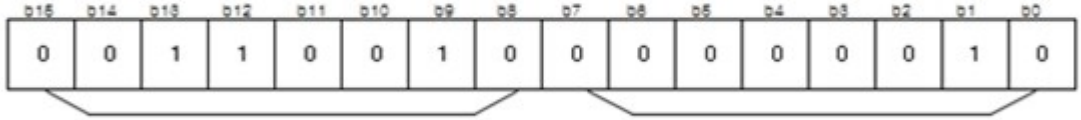
1. Input maximum and minimum temperature that user wants.
2. In order for maximum or minimum set value to be effective, make sure to set corresponding bit for temperature SET data (Address "49") for set channel to 1 and turn the request (Y02) for storing set value ON/OFF.
3. For Maximum and Minimum setting Error, if minimum value inputted by user is larger than maximum value, bit for corresponding channel becomes 1
4. Initial value is set to maximum and minimum value for temperature measurement range.
5. Because maximum and minimum variations that are inputted by user is stored in EEPROM, the module is operated by previous set value even after power is turned ON and then OFF
6. If maximum value is smaller than minimum value, error occurs.

8.8.6.11 CH1-CH4 average time / filter coefficient (buffer memory address "49~52")

1) It stores filter coefficient set value and average time set value.
2) Average time set value for 1 BYTE below 1 WORD: 1~255
   Filter coefficient set value for upper 1BYTE: % 0~70
   When filter function is not used, set the value to 0

Example

If average time for channel No.1 is 2 seconds and Filter coefficient is 50,
H3202 (12802) is stord in buffer memory address "59"



If converted temperature has severe variations due to external noise, set this.
Width for variations for converted temperature is limited before it is stored in buffer memory.

Range of setting value : 0 ~ 70 %

Example) If temperature is changed as shown in following figure, it is a value that is actually stored in buffer memory.

Conversion temp. value Digital filter value	10	15	13	9	14	12	9	5	15
10 %	-	14.5	13.2	9.4	13.5	12.2	9.3	5.4	14.0
70 %	-	11.5	12	11.1	12.0	12.0	11.1	9.3	11.0

Current value = current value + (previous value – current value) * filter coefficient (%) / 100

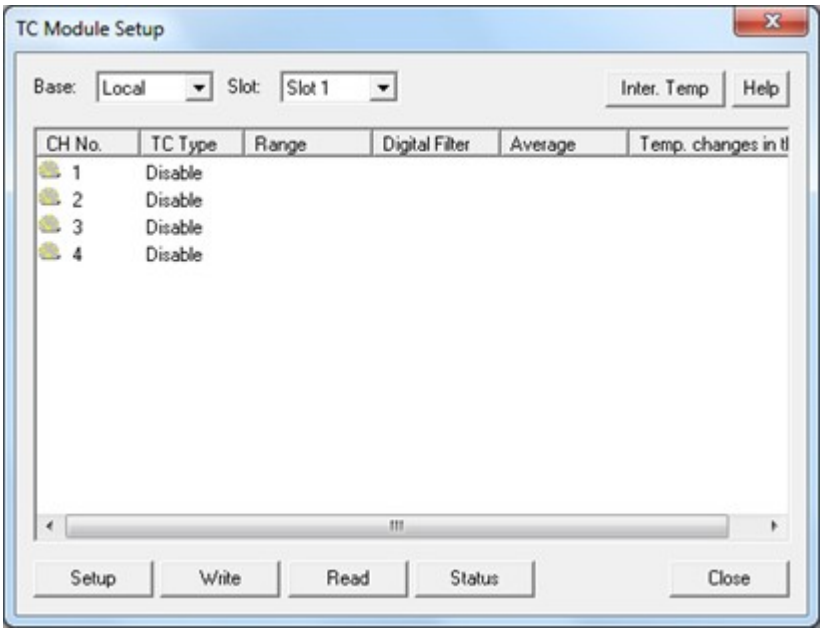
8.8.6.12 Max. Temp. in changing (Buffer memory address "64~71")

1. This sets difference between previous measurement and current measurement for each channel and stores them.
2. It sets up to 3~1000 (Initial value: 10)
3. Low set value may cause slow response but stability is high. Contrary to this, high set value gives rapid response but its stability may be low.
4. If temperature is not updated under rapidly changing temperature, use higher temperature than current set value.

8.8.7 TC module setting in CICON

If you click "Tool" -> "Special module Setup -> "TC Module" in CICON, "TC Module Setup" window appears as below.

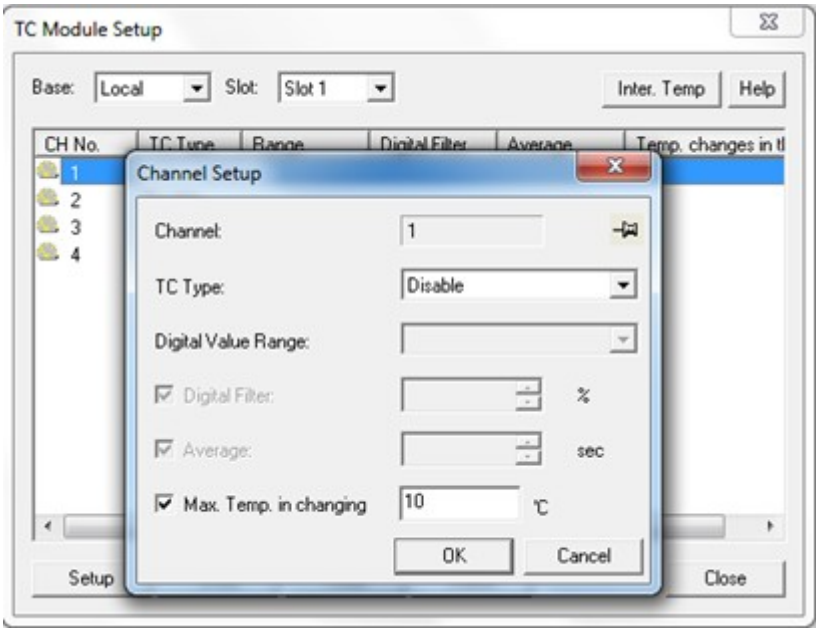
This automatically displays the base and slot where TC card is installed in the connected PLC. You can also double click corresponding TC card after you read card information from project window to display following set window.



- Channel Setup
- TC Module Status

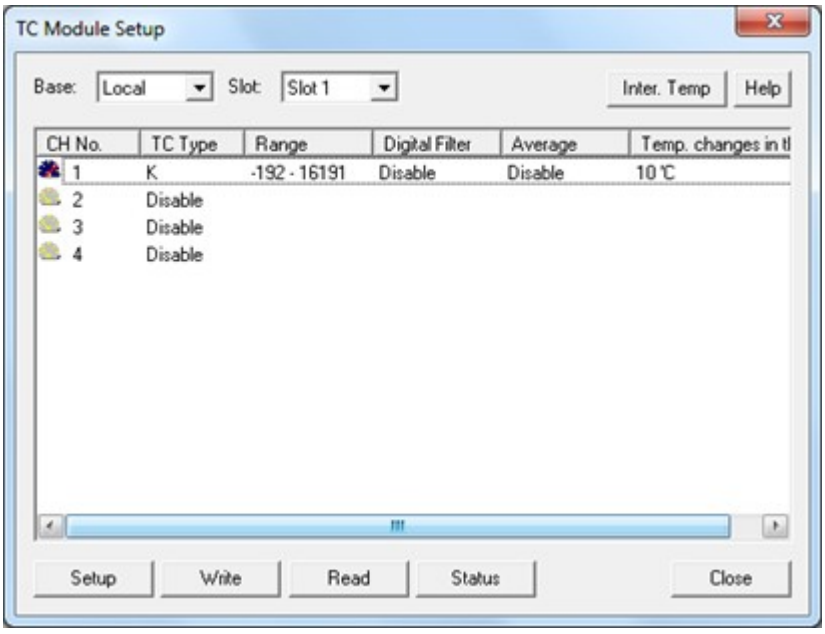
8.8.7.1 Channel Setup

If you double click channel or click “ Setup” , you can see “ Channel Setup” as below picture.

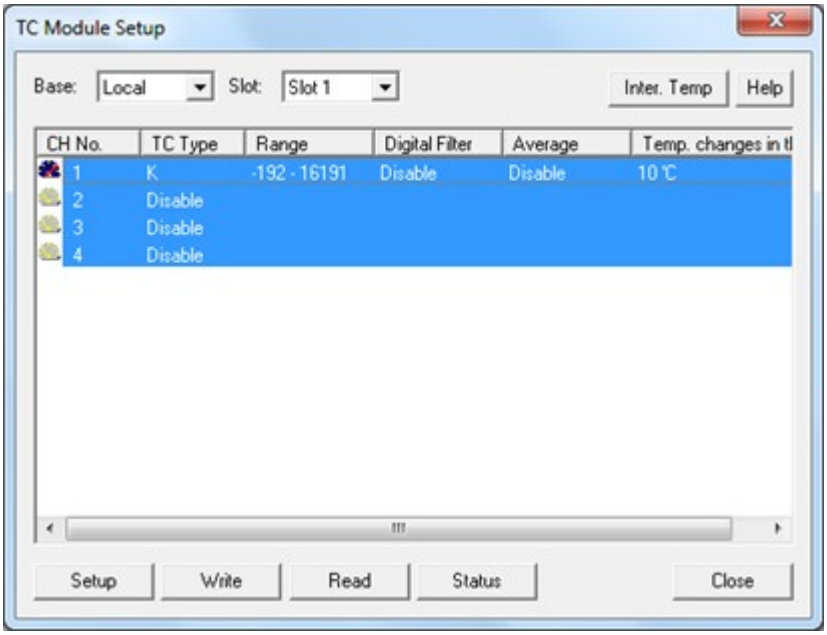


1. TC Type : K, J, E, T, R, S, B, N
2. Digital value range : -192~16191, -8192~8191, 0~16000, -8000~8000
3. Digital Filter : 0~70%
4. Average : 1~255초

After setting, click “OK” to save setting value.



If you select whole channels by mouse as below and click “Setup”, you can set all channels at once



In order to run TC module with setting value, click “Write”

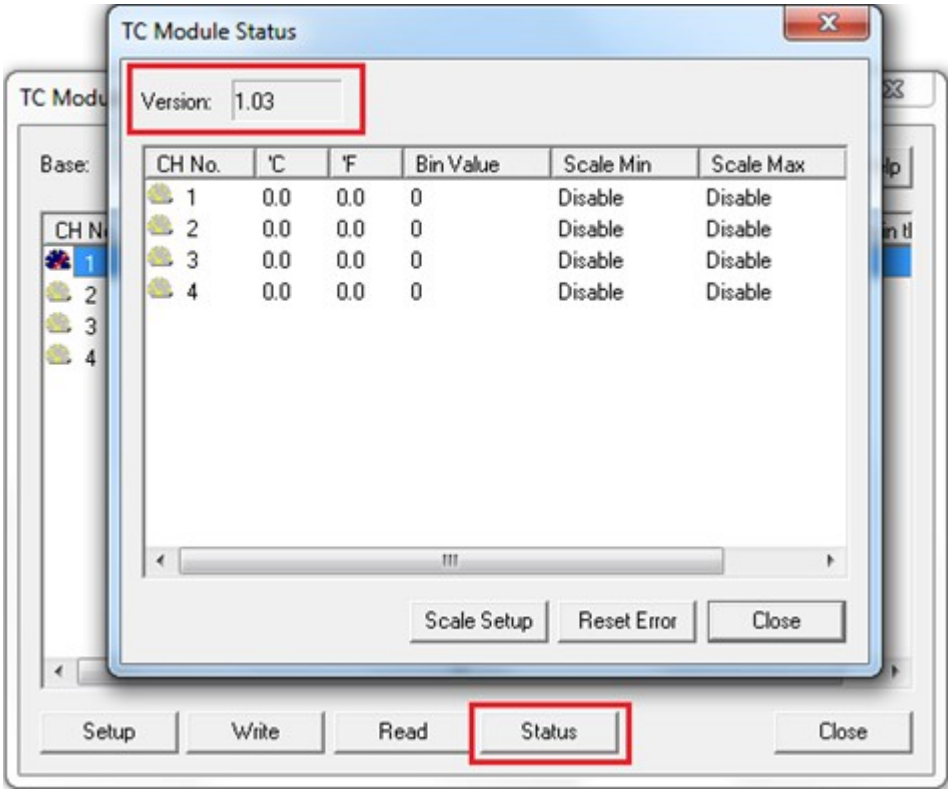
“Set value is written to PLC.” Appears on the screen.

Set values are recorded at EEPROM. Therefore, conversion is carried out by current set values even power is On/Off

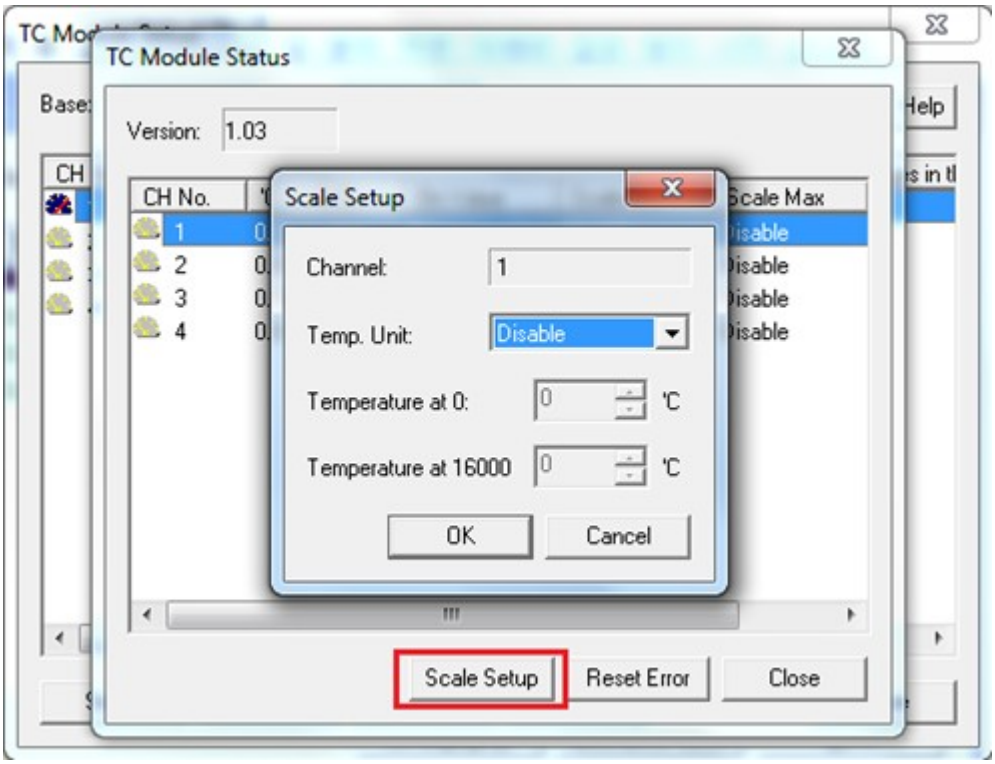
If you click “Read”, CICON reads setting value from TC module.

8.8.7.2 TC Module Status

You can check firmware version of TC module and Error code if you click “ Status”



If you click “ Scale Setup” after selecting channel, below windows appears



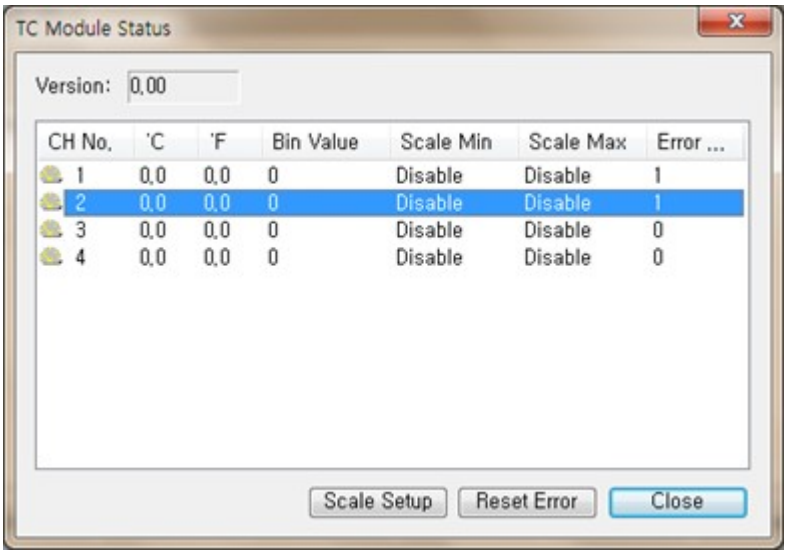
If digital scale is not set, this module converts maximum and minimum temperature for each thermocouple into 0(-8000) ~16000(8000). If you want to change maximum and minimum temperatures, select scaling and set temperature when digital value is 0 and 1600. Scale set value is stored at EEPROM. Therefore, this module keeps previous value even if power is turned OFF/ON.

8.8.8 Trouble shooting

- RUN LED is blinking every 0.2 second.
- RUN LED is blinking every 0.2 second and Error code No.2 is displayed.

8.8.8.1 RUN LED is blinking every 0.2 second.

Check error code in TC module status window from CICON
If there is short circuit (error code: 1) or temperature exceeds measurement temperature range (error code 4), error code is generated. Following picture indicates a case that No.1 channel is under short circuit.



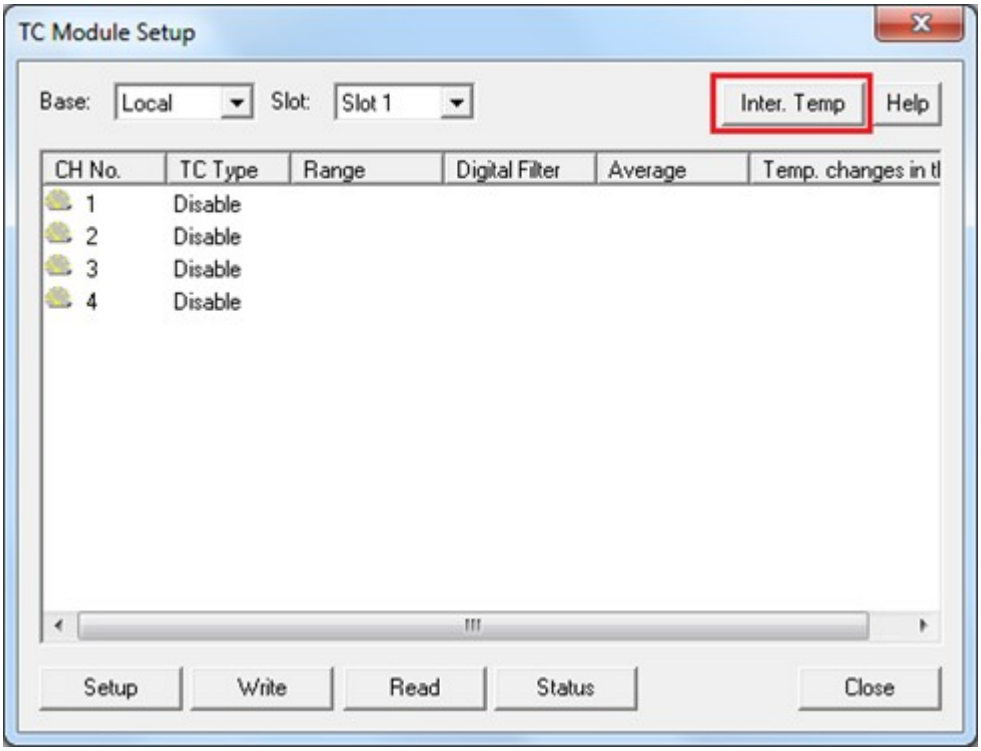
Refer to Error code

8.8.8.2 RUN LED is blinking every 0.2 second and Error code No.2 is displayed.

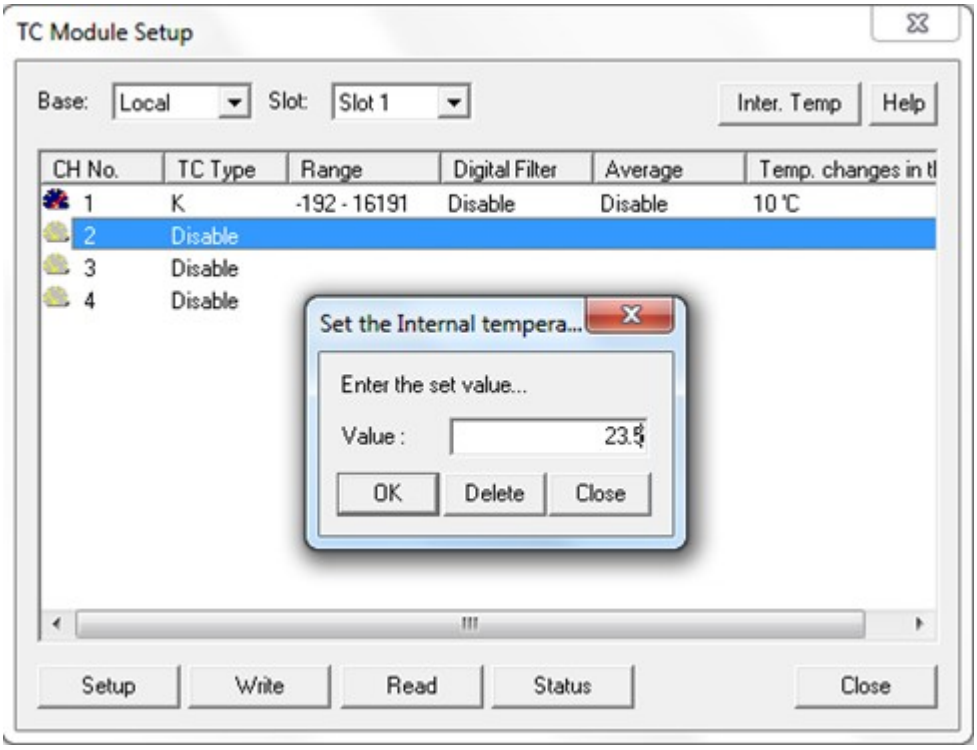
TC module uses ±15V in analog calculation area. If voltage is not imposed on this module, this error occurs.

8.8.9 Thermistor Calibration

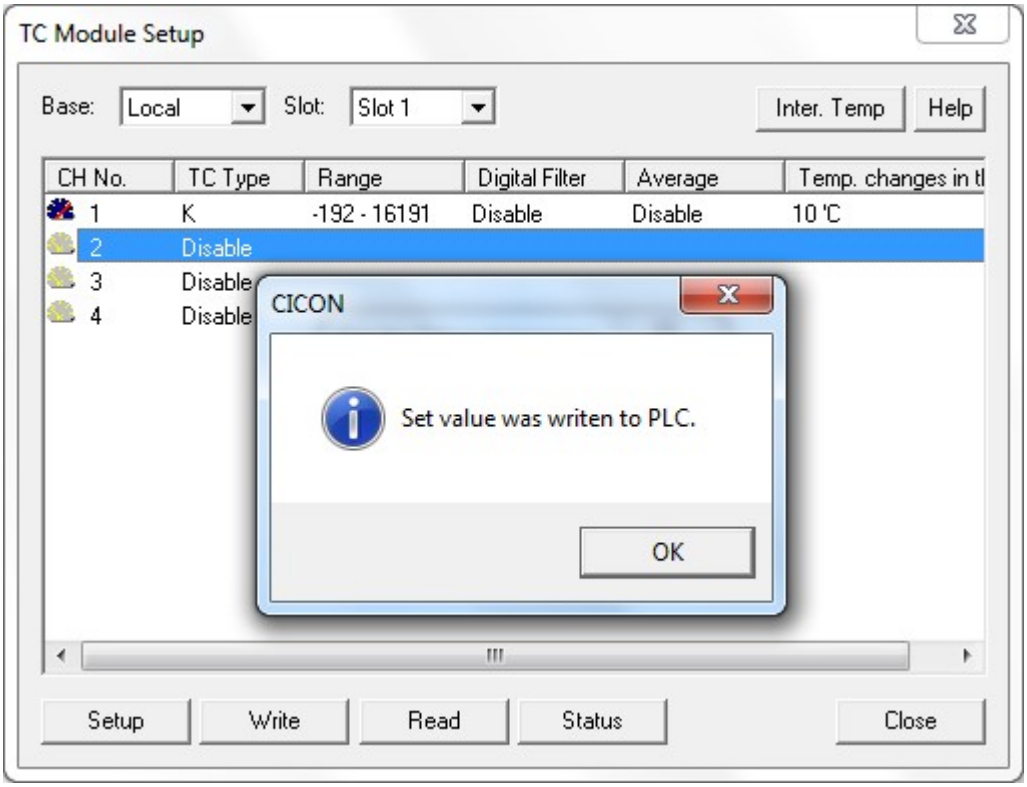
Click " Inter. Temp."



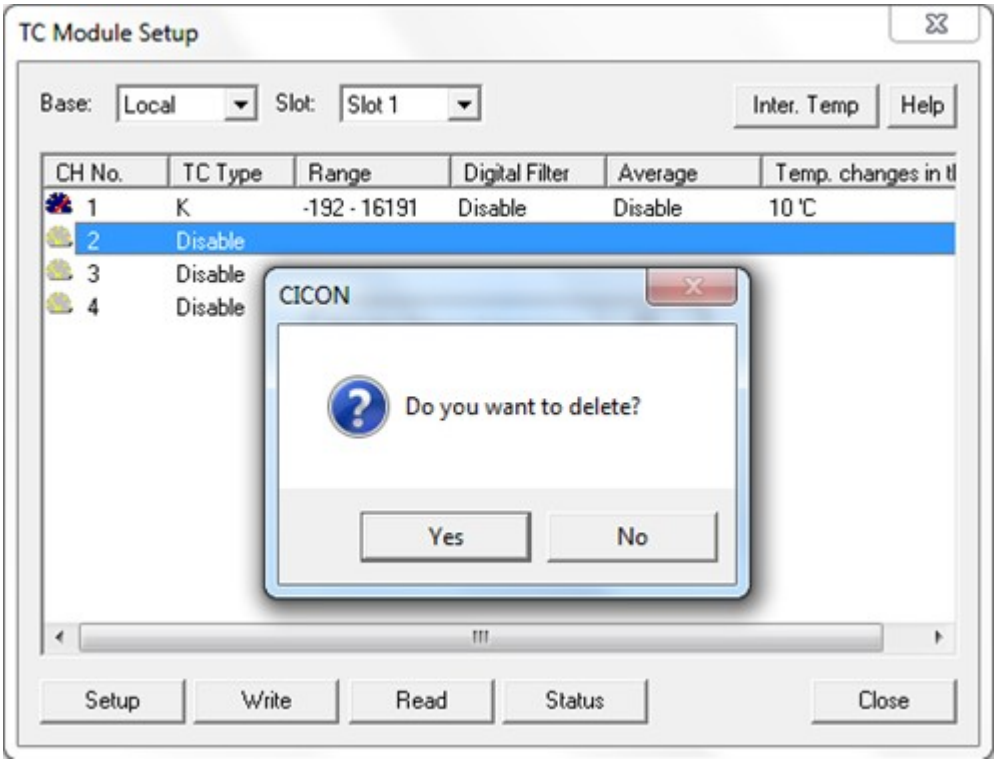
Write internal temperature



Click " OK" to save set value and apply it



If user wants to delete the set value and apply other temperature value, click “ Delete”



*Cautions

- If user set internal temperature value, temperature of inner thermistor is changed which means exact TC temperature will not be shown. Therefore, do not use this function except test. Once internal temperature function is used, user has to delete its value so that function of thermistor works properly.

8.8.10 Installation and Wiring

- Installation
- Wiring

8.8.10.1 Installation

Installation environment

Environmental conditions

Install the module in control panel which is water proof and anti-vibration
Install the module where there is no persistent shock and vibration.
Install the module where it is not exposed to direct sun ray
Install this module where there is no condensation due to rapid temperature
Install this module where surrounding temperature is maintained at -10 ~ +65℃.

Installation procedure

Make sure that residues from machining screw hole or wiring are not inserted into PLC
Install the module where operation is easy to be performed.
Do not install the module in devices with high voltage and same panel.
Keep more than 50 mm of gap from duct and surrounding module.
Put to earth where surrounding noise environment is good.

Cautions for handing

- Do not drop it or put strong shock on it.
- Do not separate PCB from case. Otherwise it may cause malfunction.
- Make sure that foreign substance such as residue from wiring is not inserted into upper areas of module. If foreign substance is found there, remove it.
- Do not mount or dismount module while power is turned on.

8.8.10.2 Wiring

Channel	A Terminal	B Terminal
Ch 1	Terminal 1	Terminal 2
Ch 2	Terminal 3	Terminal 4
Ch 3	Terminal 5	Terminal 6
Ch 4	Terminal 7	Terminal 8

8.9 PLCS AD MUX Module : SP04EAM

Contents :

8.9.1 Summary

Analog Mux module receives analog values from 4 channels and outputs the same values to one port at a time.

1) Desired channels can be selected to be enabled or disabled and get operation status.
2) Different relay ON time can be set by each channel from 0.1 to 1000.0 seconds range.
3) Relay count values can be checked for life expectancy.
4) Easy control with Auto/Manual mode.
5) Power LED blinks by 0.5 second interval when there's an error with CPU communication.
6) It is not suitable for current signal use since this module switches analog signals repeatedly.

8.9.2 Performance Specifications

Performance Specifications :

- General Standards
- Performance Specifications
- Appearance and Dimensions

8.9.2.1 General Standards

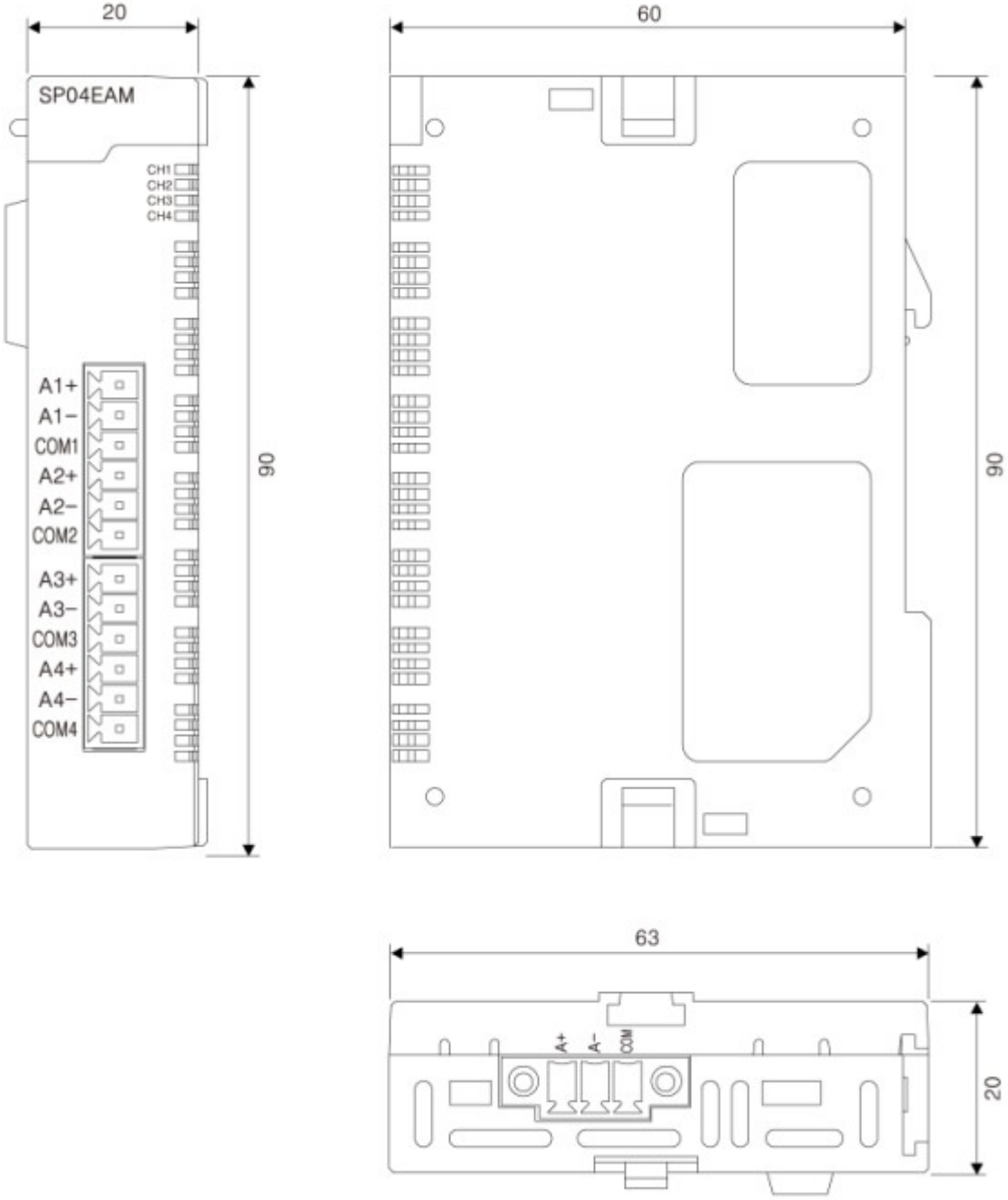
<table>
<tr><th>Item</th><th colspan="4">Specification</th><th>Related Standard</th></tr>
<tr><td>Operating Temp.</td><td colspan="4">-10 ~ +65℃</td><td></td></tr>
<tr><td>Storage Temp.</td><td colspan="4">-25 ~ +80℃</td><td></td></tr>
<tr><td>Operating Humidity</td><td colspan="4">5 ~ 95%RH (Non-condensing)</td><td></td></tr>
<tr><td>Storage Humidity</td><td colspan="4">5 ~ 95%RH (Non-condensing)</td><td></td></tr>
<tr><td rowspan="9">Vibration</td><td colspan="4">For Intermittent Vibrations</td><td></td></tr>
<tr><td>Frequency</td><td>Acceleration</td><td>Amplitude</td><td>Number</td><td rowspan="8">IEC61131-2</td></tr>
<tr><td>10= f <57Hz</td><td>-</td><td>0.075mm</td><td rowspan="7">20 times each in X,Y,Z</td></tr>
<tr><td>57= f <150 Hz</td><td>9.8m/s2 {1G}</td><td>-</td></tr>
<tr><td colspan="3">For Continuous Vibrations</td></tr>
<tr><td>Frequency</td><td>Acceleration</td><td>Amplitude</td></tr>
<tr><td>10=f < 57Hz</td><td>-</td><td>0.035mm</td></tr>
<tr><td>57= f < 150 Hz</td><td>4.9m/s2 {1G}</td><td>-</td></tr>
<tr><td>Shock</td><td colspan="4">- Maximum Impact Acceleration : 147 m/s2 {15G}
- Duration Time: 11ms
- Pulse Wave : Sign Half-Wave Pulse (3 times each in X,Y,Z)</td><td>IEC61131-2</td></tr>
</table>

Noise	Square Wave Impulse Noise	±2000V			KDT Standard
	Electrostatic Discharging	Voltage : 4KV (Contact discharging)			IEC61131-2 IEC1000-4-2
	Radiated Electromagnetic Field Noise	27 ~ 500 MHz. 10 V/m			IEC1131-2 IEC1000-4-3
	Fast Transient/ Burst Noise	Power Module	Digital I/O (24V or more)	Digital I/O, (24V or less) Analog I/O, Comm. Interface	IEC1131-2 IEC1000-4-4
	Voltage	2KV	1KV	0.25KV	
Environment	Corrosive Gas Free and Excessive Dust Free Environment				
Altitude	Less than 2,000m				
Pollution Degree	Less than level 2				
Cooling Type	Natural Air Cooling				

8.9.2.2 Performance Specifications

Item	Standard
Connectable Analog Inputs	Voltage, TC and RTD sensor
Max/Min ON time	0.1 sec / 1000.0 sec
Analog Input Pts	4 channels / 1 module
Insulation Method	Relay
Number of Ports	Input: 12 pts, Ouput: 3 pts
Relay Life Expectancy	Number of Operation of 10^{8}

8.9.2.3 Appearance and Dimensions



8.9.3 Function

Channel Enable / Disable

1. The user can select enable or disable for each channel .
2. Channel conversion time can be reduced by disabling non-used channels.

Relay ON Time Settings

1. Possible to set-up different relay ON time for each channel.
2. Anywhere from 0.1 to 1000.0 sec range can be set.

Operation Status

1. Indicates currently used channel information.
2. Bit for disabled channels shows as 0.

Relay Count Values

1. Relay count values are shown for each channel.
2. By looking at relay count values, the user can check the life expectancy of the relay.
3. Relay count information can be reset.

Auto/Manual Mode

1. Auto/Manual mode set-up for flexible settings of channel conversion time.

Error Detection

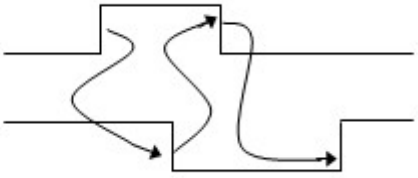
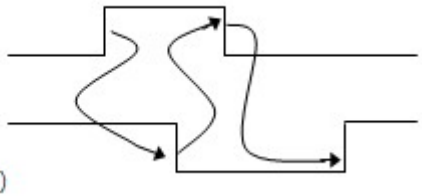
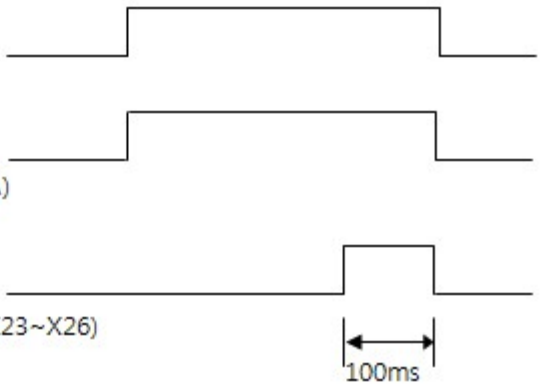
1. Error detecting function to monitor any problems in the module.
2. The error code can be reset.

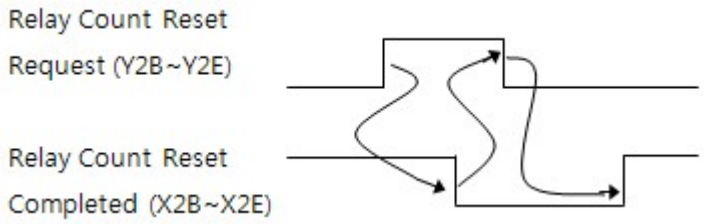
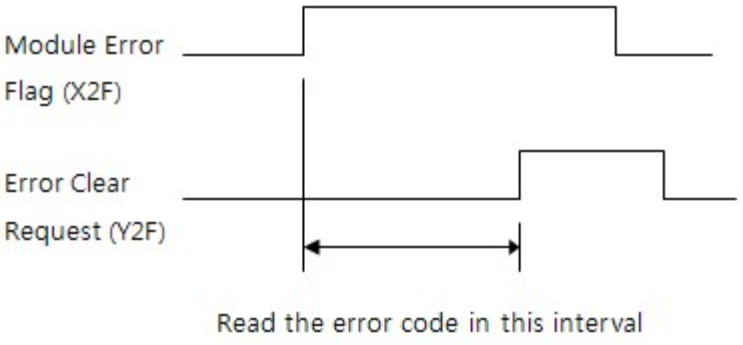
8.9.4 Input and Output Flags for the CPU

Flag Direction (CPU ? MUX Module)		Flag Direction (CPU ? MUX Module)	
Input	Flag	Output	Flag
X20		Y20	
X21	MUX Channel Change Completed	Y21	Mux Channel Change Request
X22	Settings Save Completed	Y22	Settings Save Request
X23	1CH Relay Open Predict	Y23	1CH stoppage Request
X24	2CH Relay Open Predict	Y24	2CH stoppage Request
X25	3CH Relay Open Predict	Y25	3CH stoppage Request
X26	4CH Relay Open Predict	Y26	4CH stoppage Request
X27	1CH Relay Activate	Y27	
X28	2CH Relay Activate	Y28	
X29	3CH Relay Activate	Y29	
X2A	4CH Relay Activate	Y2A	
X2B	1CH Relay Count Reset Completed	Y2B	1CH Relay Count Reset Request
X2C	2CH Relay Count Reset Completed	Y2C	2CH Relay Count Reset Request
X2D	3CH Relay Count Reset Completed	Y2D	3CH Relay Count Reset Request
X2E	4CH Relay Count Reset Completed	Y2E	4CH Relay Count Reset Request
X2F	Module Error	Y2F	Error Clear Request

** Note that I/O flags shown above are applied when the MUX module is installed in the first slot

8.9.4.1 Input Flag

Device NO.	Flag	Contents
X21	MUX Channel Change Completed Flag	(1) When in manual mode to ON/OFF the channel change request (Y21) Channel Change Request (Y21) Channel Change Completed (X21) 
X22	MUX Settings Save Completed Flag	(1) When enabling/disabling a channel and ON/OFF the settings save request (Y22) (2) When settings save completed flag is OFF, MUX conversion process is not activated (In case of settings save request (Y22) is ON) Settings Save Request (Y22) Settings Save Completed (X22) 
X23~X26	Relay Open Predict Flag	(1) The flag get SET 100ms before the relay opens (2) When the relay opens, it RESETS Active Relay Relay Active Flag (X27~X2A) Relay Open Predict Flag (X23~X26) 100ms 
X27~X2A	Relay Active Flag	(1) ON when the relay closes. (2) Signal timing is X23~X26 (Refer to Relay OFF Predict Flag)

X2B~X2E	Relay Count Reset Completed Flag	(1) Used when relay count reset request (Y2B~Y2E) is ON/OFF 
X2F	Module Error Flag	(1) ON when there's an error. (2) To clear an error, error clear request (Y2F) should be ON. Clear an error from CICON 

8.9.4.2 Output Flag

Device NO.	Flag	Contents
Y21	MUX Channel Change Request	(1) When in MANUAL mode (Buffer memory "9") Turn ON when channel change is needed (2) Refer to X21 (Channel Change Completed) for flag timing
Y22	Settings Save Request	(1) Turn ON to save all the settings on the buffer memory. (2) Refer to X22(Settings Save Completed) for flag timing.
Y23~Y26	Stoppage Request	(1) Turn ON when stoppage is required for enabled channels (buffer memory"0") (2) In OFF state, it is switched back to operating status.
Y2B~Y2E	Relay Count Reset Request	(1) Turn ON when Relay count reset is required (2) Refer to X0B~X0E(Count Reset Completed) for flag timing
Y2F	Error Clear Request	(1) Turn ON when Error clear is needed (2) Refer to X0F (Error Flag) for flag timing

8.9.5 Buffer Memory

Address		Contents	R/W
Hex	Dec		
0H	0	MUX Channel Enable / Disable	R/W
1H	1	CH.1 Relay Count High	R
2H	2	CH.1 Relay Count Low	R
3H	3	CH.2 Relay Count High	R
4H	4	CH.2 Relay Count Low	R
5H	5	CH.3 Relay Count High	R
6H	6	CH.3 Relay Count Low	R
7H	7	CH.4 Relay Count High	R
8H	8	CH.4 Relay Count Low	R
9H	9	Auto/Manual Mode	R/W
AH	10	Operation Status	R
BH	11	CH.1 ON time setting value	R/W
CH	12	CH.2 ON time setting value	R/W
DH	13	CH.3 ON time setting value	R/W
EH	14	CH.4 ON time setting value	R/W
FH	15	Error Code	R
10H	16		-
11H	17		-
12H	18		-
13H	19		-
14H	20	OS Version	R

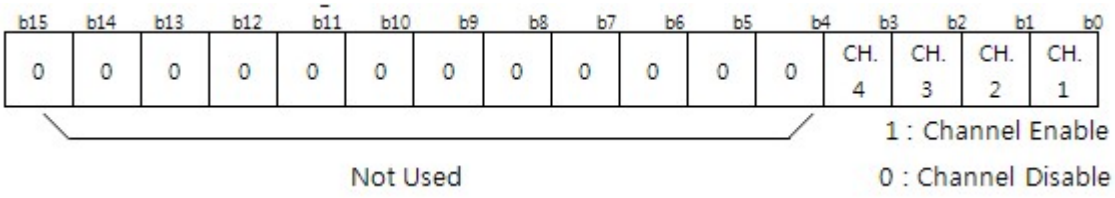
** Each data is 2 bytes.

** R/W shows whether it's readable or writable from the PLC

R : Readable W : Writable

8.9.5.1 Channel enable / disable setting (Buffer memory address "0")

1. Enable or disable by each channel
2. Initial setting is set to disable all the channels.
3. Settings save request flag (Y22) should be ON and then OFF to save the settings on the module.
4. Set values get saved on a flash memory of the module so when the power restarts, it contains the latest saved settings.

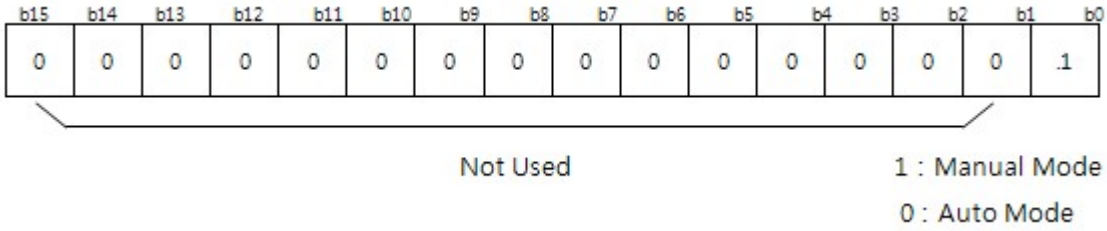


8.9.5.2 Relay Count Value (Buffer memory address "1"~"8")

1. Display the relay's number of operation by each channel.
2. Life expectancy of a relay is 10^8 operations.

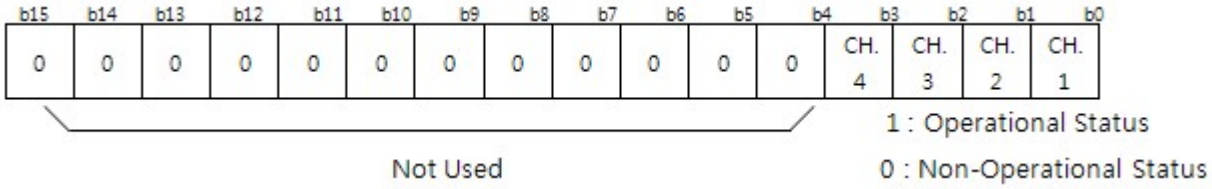
8.9.5.3 Auto/Manual Mode Settings (Buffer memory address "9")

1. Initial setting is set to Auto Mode.
2. Settings save request flag (Y22) should be ON and then OFF to save the settings on the module.
3. Set values get saved on a flash memory of the module so when the power restarts, it contains the latest saved settings.
4. Only the lowest bit (b0) is used.



8.9.5.4 Operation Status (Buffer memory address "10")

1. When the stoppage request flag (Y23 ~ Y26) is activated for an enabled channel, the bit for the channel turns to 0.
2. The bit for Disabled channel (buffer memory address " 0") gets displayed as 0.



8.9.5.5 Relay ON Time Settings (Buffer memory address "11"~"14")

1. Relay ON Time can be set by each channel (1~10000 : 0.1~1000.0 seconds)
2. The unit is 100ms.
   Ex) When 3 is inputted, Relay ON Time becomes 3 X 100ms = 300ms

8.9.5.6 Error Code (Buffer memory address "15")

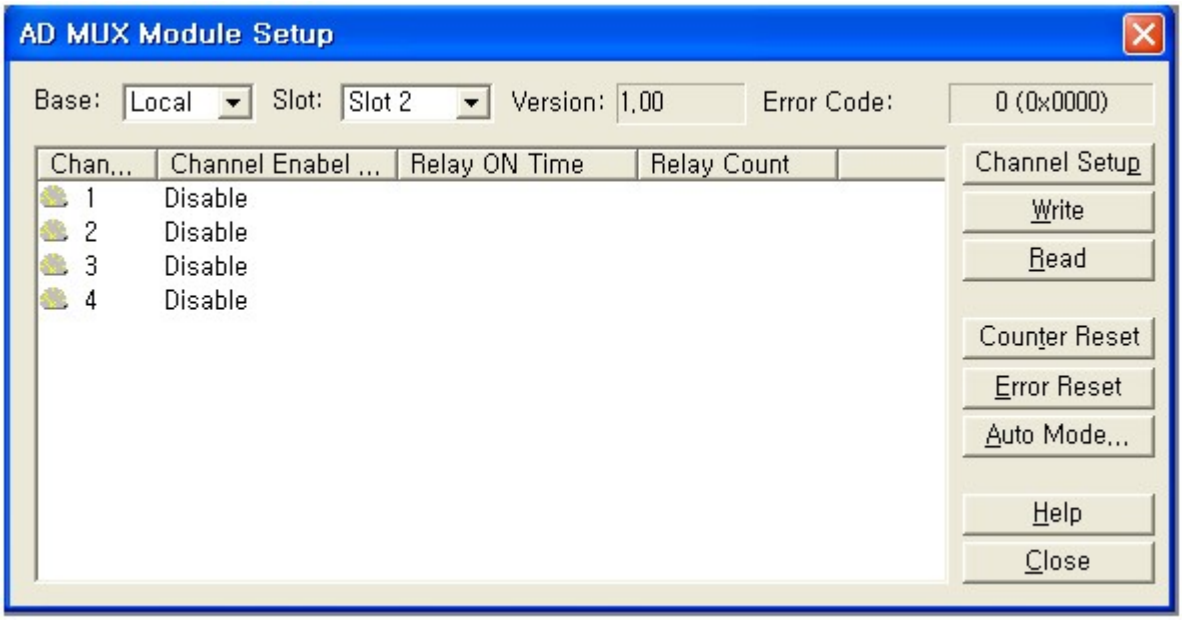
1. Error code that has been detected from the Mux module gets saved.
2. High byte is for channel number, and low byte is for error code.
3. The error remains until the power is off or the user clears the error. When there's an another error addition to the error that hasn't been cleared, the new error gets ignored.
4. The error code is in decimal notation.
5. Error code 5 will occur when the relay count exceed the amount of Double Word (10^8).

Ex) when channel 1 counter exceed error occurs, the error code 0x0105 (256) occurs

8.9.6 MUX Module Settings in CICON

By selecting “ Analog Mux Card” of “ Special Module Setup” in "Tools" menu OR by double clicking Mux Card in the project window, a setup window pops up as below. It shows installed base/slot information automatically.

Current setting information about the mux module shows as below

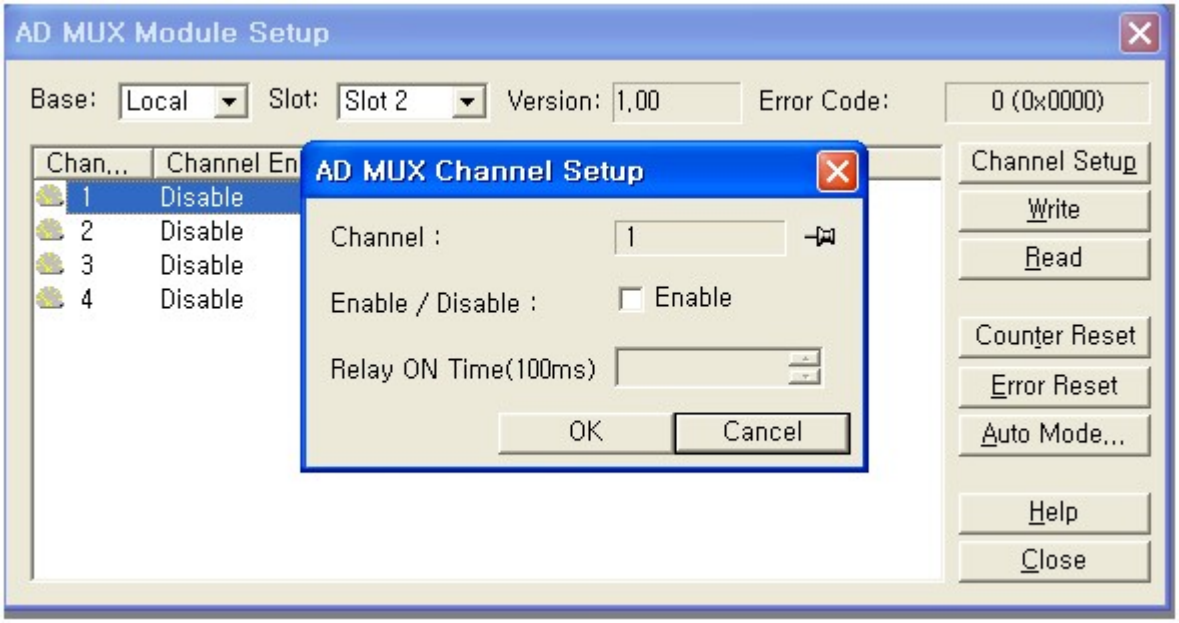


- Channel Settings

8.9.6.1 Channel Settings

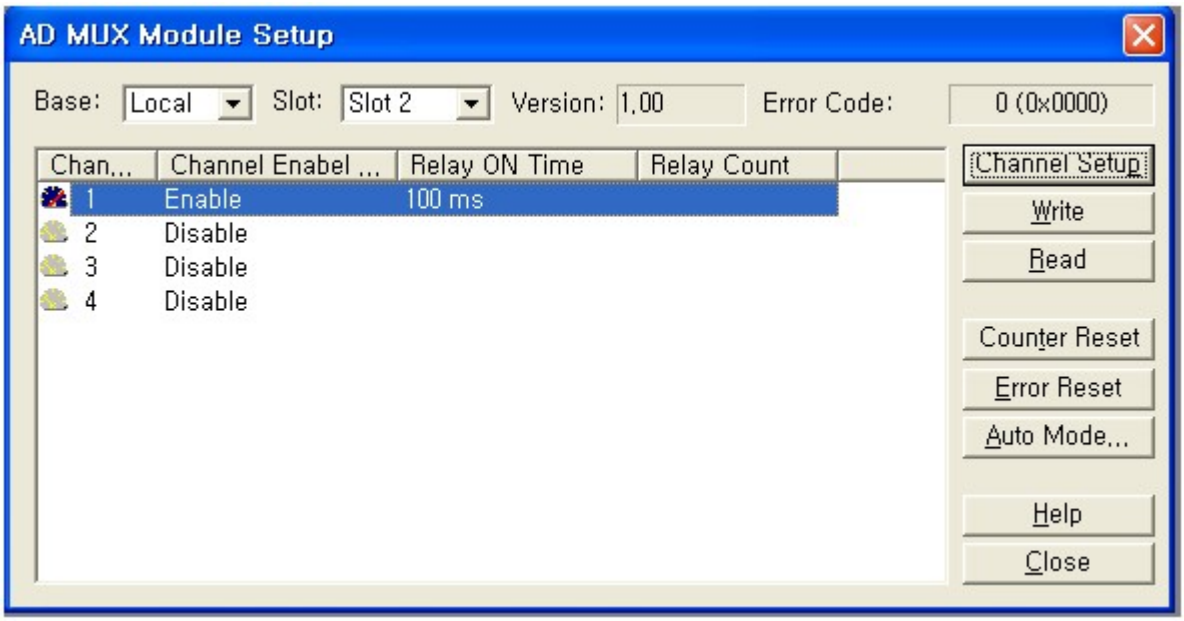
If the user double clicks the channel or after selecting the channel and clicking 

in the module setup window, AD MUX Channel Setup pops up as below.

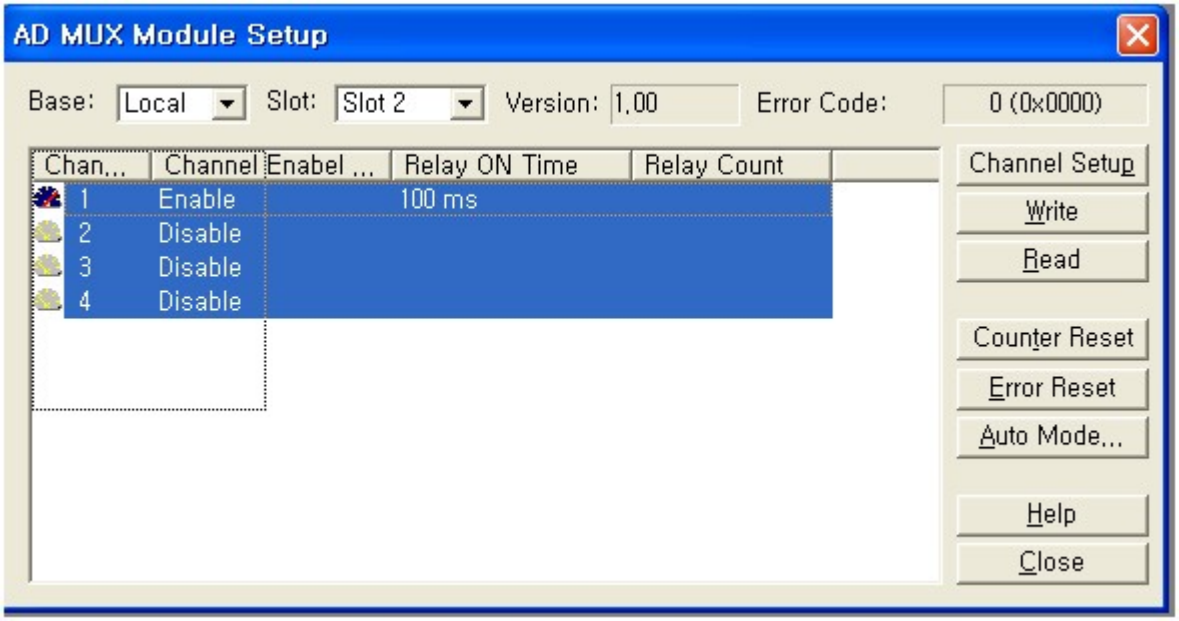


1. Channel Enable/Disable: Select the check box to Enable the channel and deselect to disable.
2. Relay On time settings : 0~10000 (0.1 ~ 1000 seconds)

- Click "OK" after the set-up is complete



- Select the entire channels as below and then click  to configure the settings all at once.

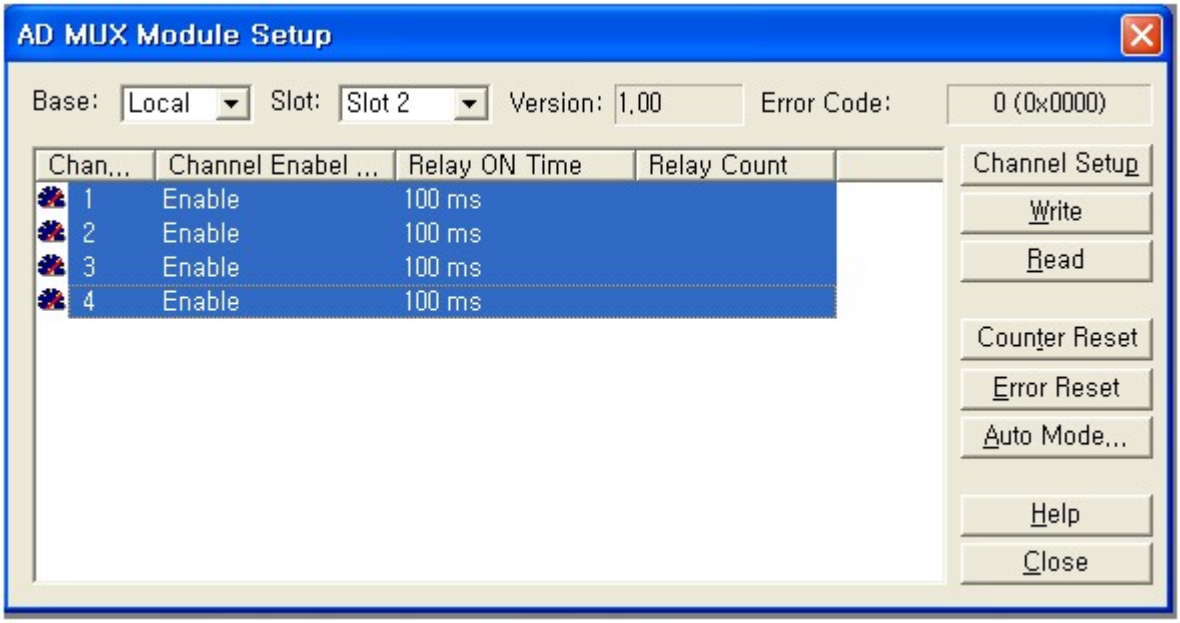


Click 

for the Mux module to be able to operate by the configured settings.
A message " Set value was written to PLC" shows up in the message display window.
Configured values get saved in the flash memory so that even when the power restarts, the saved settings don't get changed.

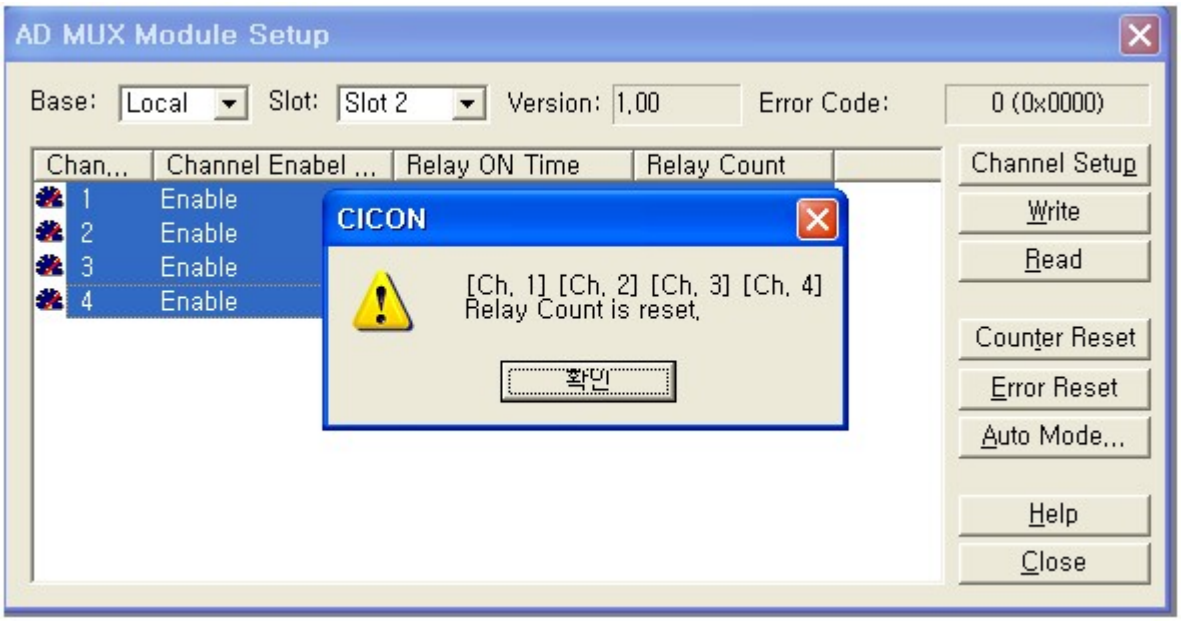
Button reads the current values that has been set from the Mux module.

- Save after enabling the entire channels



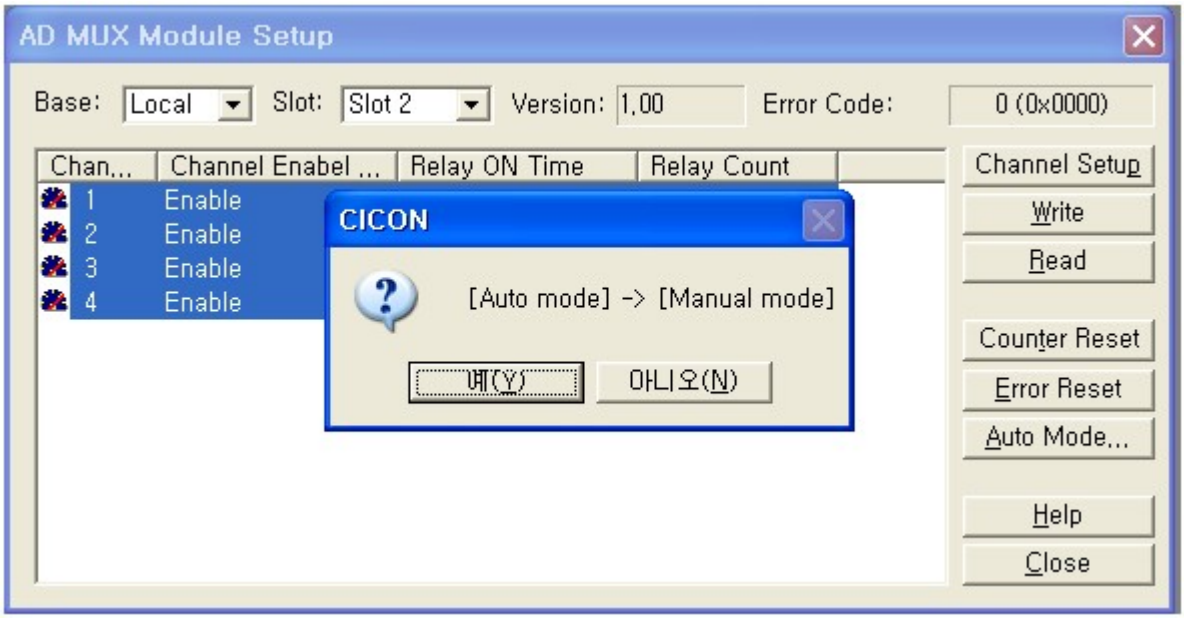
- Select the entire channels and click 

to reset the counter.

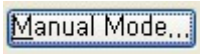


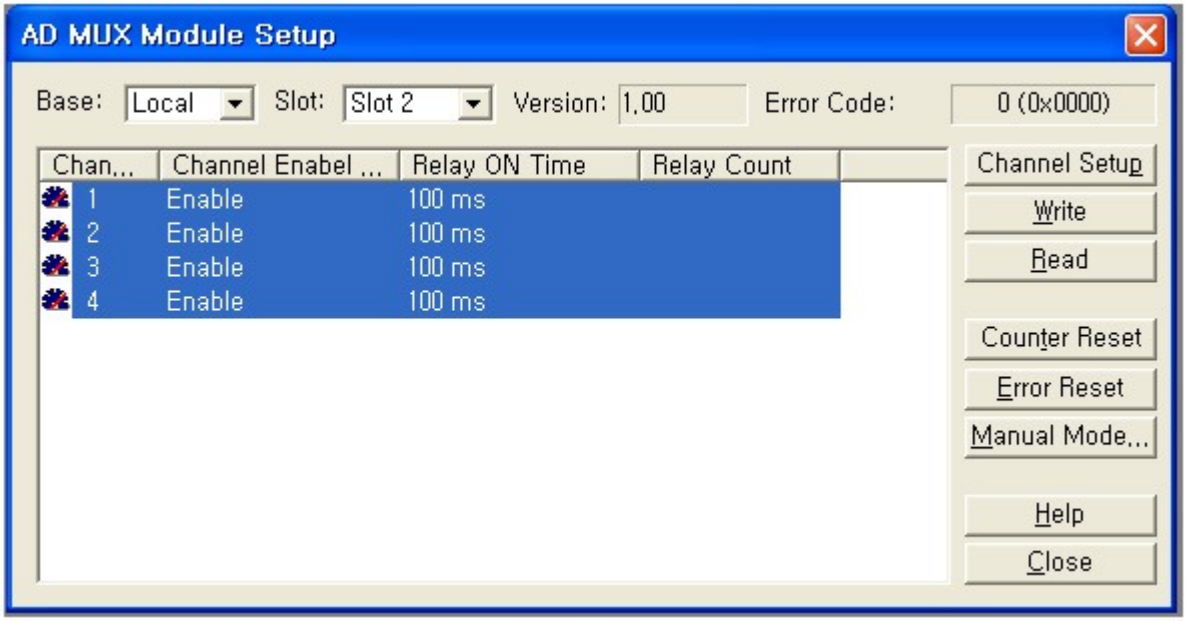
- Click 

on the settings windows to have a pop-up window as follows



Select " Yes" button to change to the manual mode and the button on the right hand side changes to



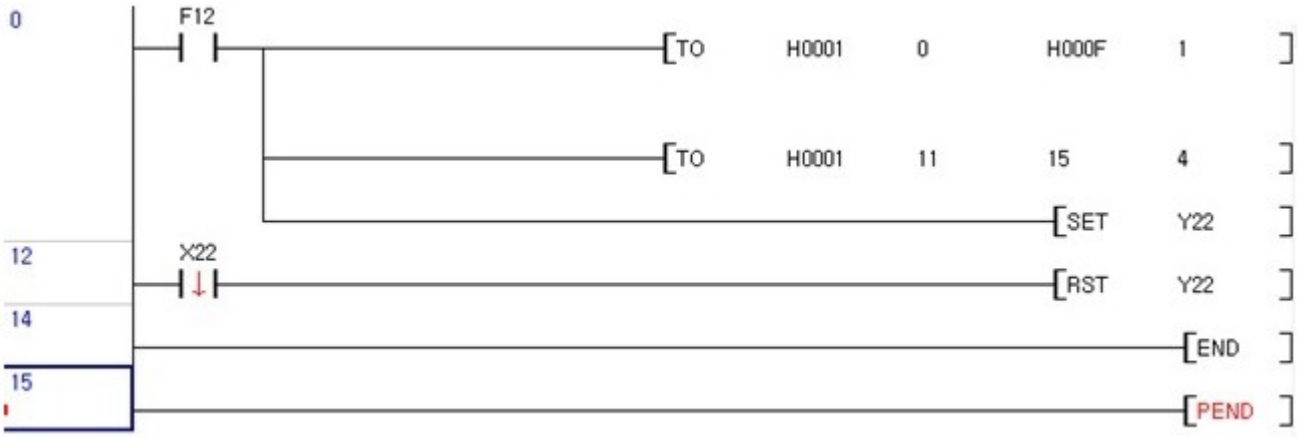


8.9.7 Application Program and Example

To use a Mux module, the desired channels should be enabled and the relay ON time should be set. There are two ways for configuring the module settings.

- When configuring the settings on the RTD settings window of CICON (refer to page 6), there's no need to use scan program as below. However, when the modules get swapped, the settings need to be reconfigured.
- Module settings configuration can be done by using scan program as below.

Whichever method the user chooses, the settings get saved on the internal memory and it stays even when the power restarts.



Row 0: channels 1,2,3,4 of SP04EAM module get enabled
Row 1: channels 1,2,3,4 Relay ON time get set to 1.5 seconds
Row 2: the settings save request (Y22) gets SET
Row 3: when the settings save completed flag (X22) is SET, the settings save request (Y22) resets
-> Settings Saved

- Initialization

8.9.7.1 Initialization

Configuration

- Mount CM3-SP32MDT, CM3-SP04ETO, CM3-SP04EAM in order.

Initial Settings

- CM3-SP04ETO

Channel Used	Channel 1
TC Sensor Type	K TYPE
Digital Output Type	0~16000
Maximum Temperature Input Value	1000℃
Minimum Temperature Input Value	0℃

- CM3-SP04EAM

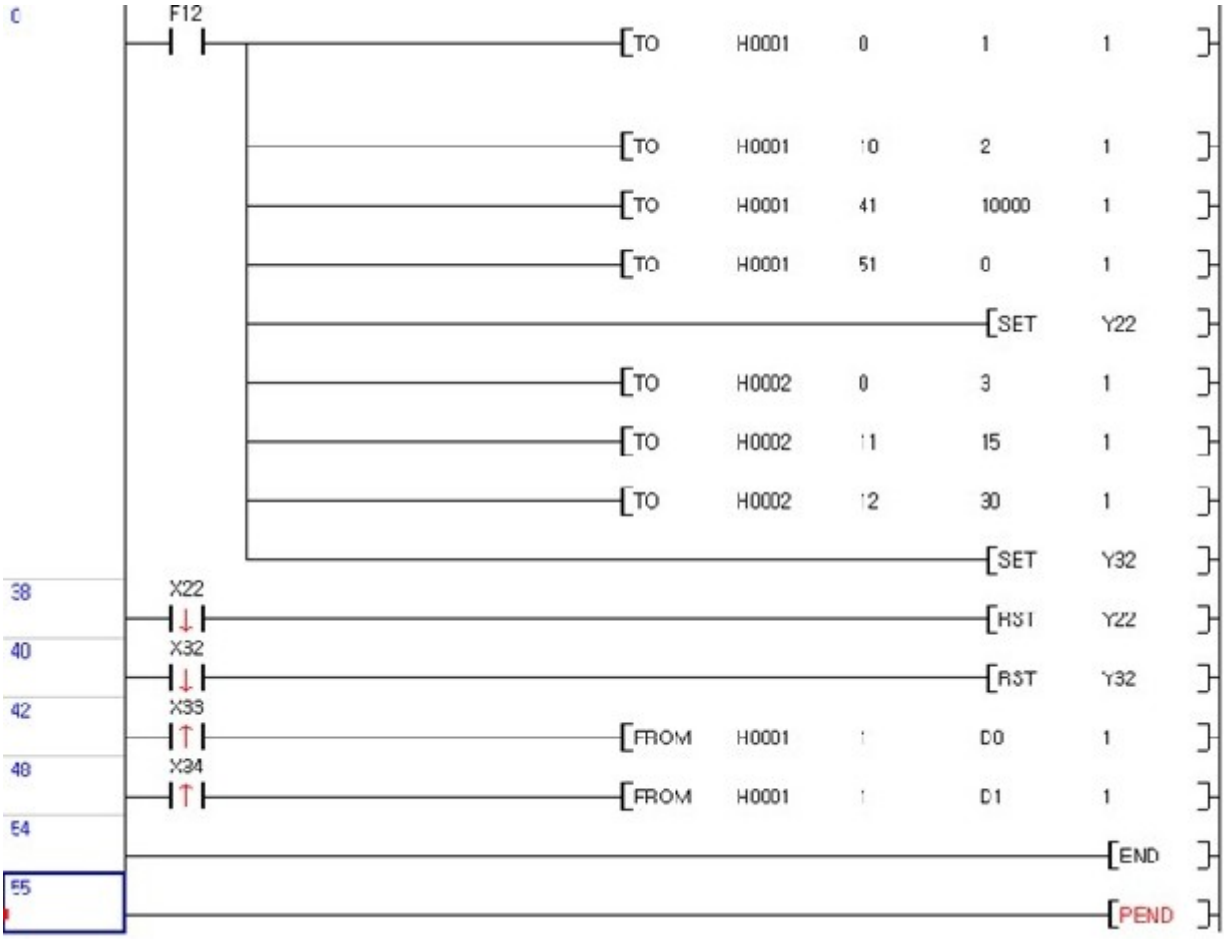
Channel Used	Channel 1	Channel 2
Relay ON Time	15 (x100ms)	30 (x100ms)

Program Description

1. Save the settings on the buffer memory by using TO command
2. Minimum and maximum temperature range for CM3-SP04ETO channel 1 will be 0~1000℃
   (Minimum/Maximum value converts to digital value of 0~16000 range)
3. Set the relay ON time to 1.5 seconds for channel 1 and 3 seconds for channel 2 of CM3-SP04EAM
4. Set Settings Save Request Flag to be ON for CM3-SP04ETO, CM3-SP04EAM
5. After checking that Settings Save Completed flag is 0 for CM3-SP04ETO, CM3-SP04EAM, then turn OFF Settings Save Request flag

* Modules operate by the values that are inputted by TO command in the buffer memory when turning on, off the setting save request flag.
If the settings save request flag don't get turned on and off, the modules operate by the previous values.
* Initial setting of the module can be done by going to " Special Module Setup" in CICON

Program



Row 0: permit SP04ETO module channel 1 conversion
Row 1: channel 1: 0~16000 digital conversion set
Row 2: channel 1: maximum temperature input value -> 1000℃
Row 3: channel 1: minimum temperature input value -> 0℃
Row 4: SP04ETO settings save request (Y22) SET
Row 5: enable SP04EAM module channel 1 and channel 2
Row 6: channel 1 RELAY ON TIME set to 1.5 seconds
Row 7: channel 2 RELAY ON TIME set to 3 seconds
Row 9: SP04EAM settings save request (Y32) SET
Row 10: SP04ETO settings save completed(X22) during falling edge, settings save request(Y22) RESET
-> TC module settings save complete

Row 11 : SP04EAM settings save complete (X32) during rising edge, settings save request (Y32) RESET
-> Mux module settings save complete
Row 12 : when channel 1 relay open signal (X33) is ON 0.1 second before channel 1 conversion, save the TC sensor value
Row 13 : when channel 2 relay open signal (X34) is ON 0.1 second before channel 1 conversion, save the TC sensor value
Row 14 : end

8.9.8 Installation and Wiring

Installation and Wiring :

- Installation
- Wiring

8.9.8.1 Installation

Installation Environment

- Environmental Conditions

- Please install in a dust-proof and water-proof control panel.
- Please install it where there is without any continuous shock or vibration.
- Please avoid locations that are exposed to direct sunlight.
- Please avoid locations with rapid temperature change and condensing environment.
- Please install it where the ambient temperature is -10 ~ +65℃.

- Installation

- Please be careful not to let any wire scraps into the PLC during drilling or wiring.
- Please Install the PLC in an ideal position to operate
- Please do not install in the same panel as the high voltage equipment
- The distance between the duct and any other modules should be at least 50mm.
- Ground it in a location where there's a decent ambient noise level.

Handling Precautions

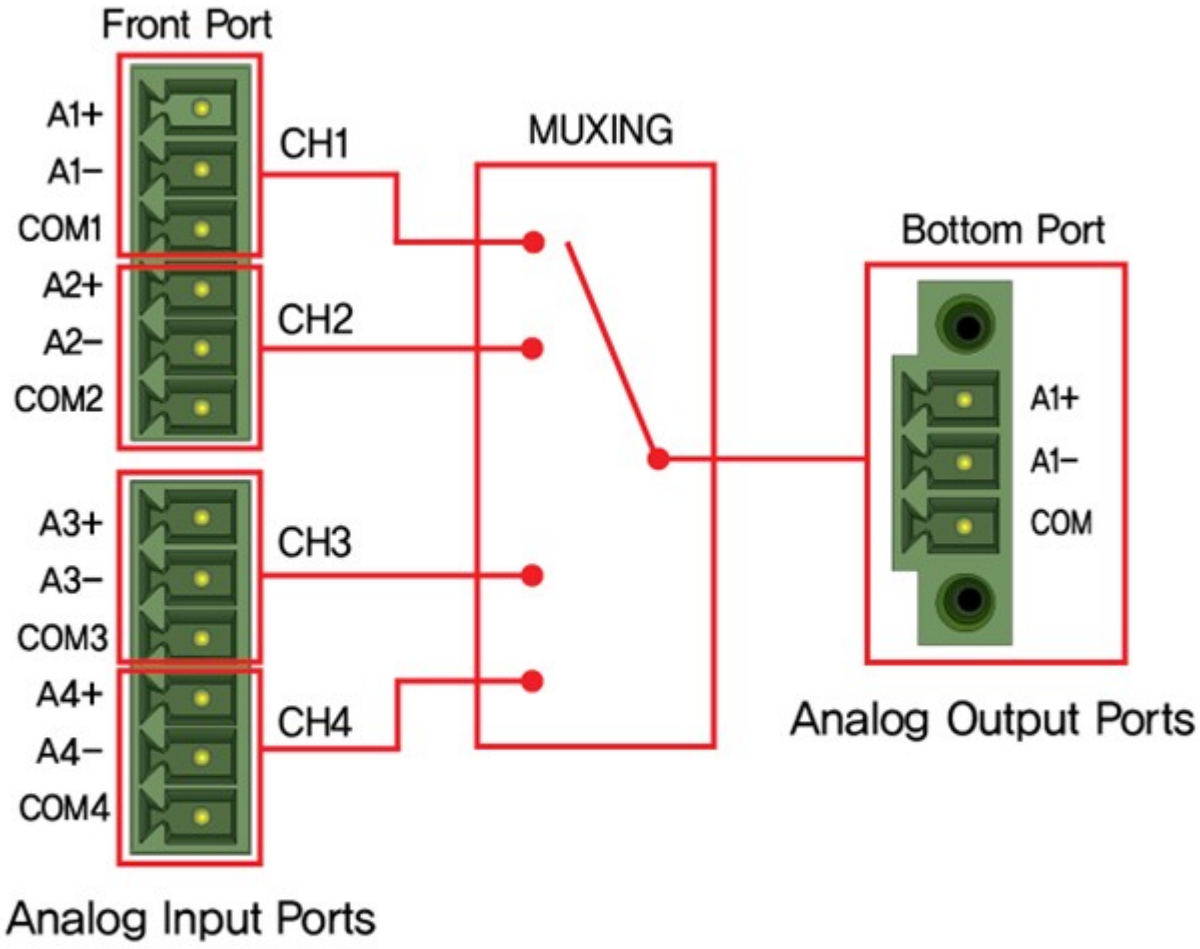
- Please do not let it drop or give strong impact.
- Please do not remove the PCB from the case since it may cause a malfunction
- Please be careful not to let wire scraps to enter the module during wiring.
- Please refrain from detaching the module while the power is ON

8.9.8.2 Wiring

Caution for Wiring

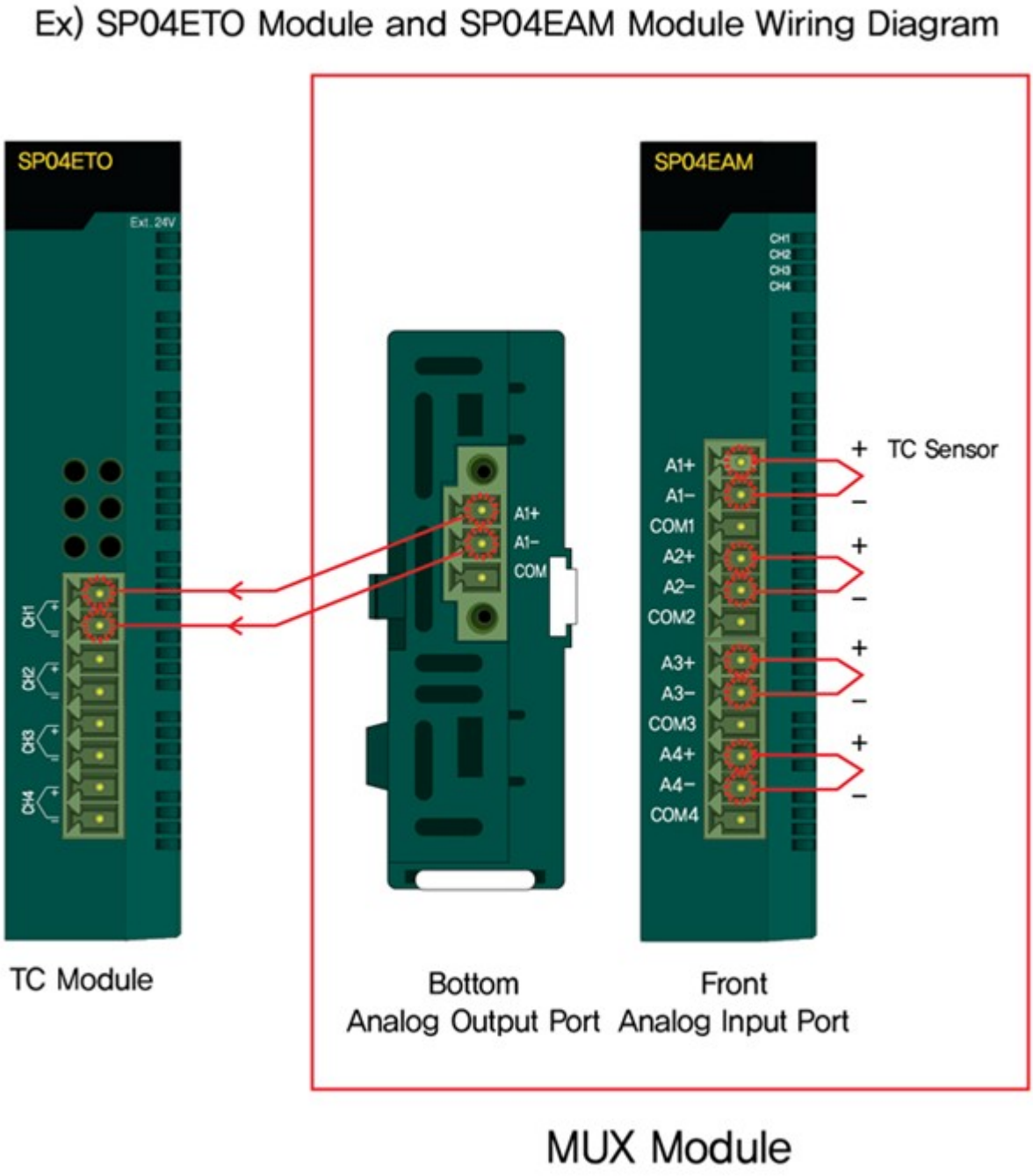
- Please don’t let the AC surge or induction noise to effect the module by connecting a separate cable between the module’s external input signal and the alternate current.
- The wire should be selected considering the ambient temperature and the current used. The minimum thickness of the wire should be AWG22 (0.3 mm2).
- When wiring, if the wire is in direct contact with oil, hazardous substances or devices that generate high temperatures, it might cause a damage or malfunction.
- Please verify the polarity before applying analog input to the terminal.
- When wiring with high voltage line or power line, the malfunction or failure may cause by induced failure.
- It is not suitable for current signal use since this module switches analog signals repeatedly.

Concept Diagram



〈SP04EAM Concept Diagram〉

Wiring Example



8.10 PLCS High-Speed Counter

Contents :

8.10.1 General Specification

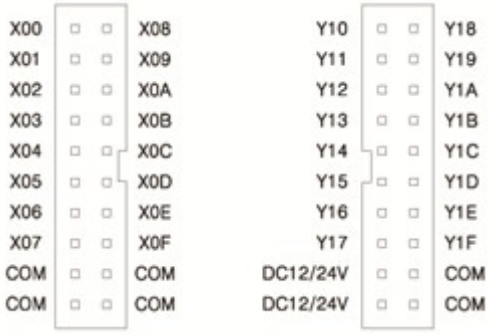
Item		Specification
Counter Input Signal	Phase	2 Phase (Phase A + Phase B) / Channel
	Type	Voltage Input (Open Collector)
	Level	DC24V
Max. Input Speed		20kpps
Channel		2 Channels
Count Range		Signed 32 Bit (-2,147,483,648 ~ 2,147,483,647)
Counter Mode		Linear Count (with Carry/Borrow Flag)
		Ring Count
Input Signal Mode (configurable)		1 Phase Low Active Input(PLS/DIR)
		1 Phase High Active Input(PLC/DIR)
		2 Phase 2Multiplication
		2 Phase 4Multiplication
Signal Type		Voltage
Input Signal	Function	Preset Input
	Level	DC24V
	Type	Voltage
Output Signal	Point	1 Point / Channel
	Function	Compare Output (7 Compare Modes)
	Type	Relay or Open Collector
Preset Function		External Input Signal or Program
Other Functions		Counter Value Latch Pulse Speed Measuring (time unit configurable) RPM / PPS Measuring

8.10.2 Counter / Preset Input Specification

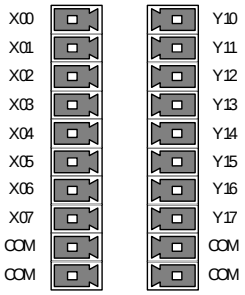
Item	Specification
Input Voltage	24V DC (20.4V ~ 28.8V)
Input Current	4 mA
On Min. Voltage	20.4V
Off Max. Voltage	6V

8.10.3 I/O Signal Connection

Allocation of I/O Signal for CM3-SP32MDT



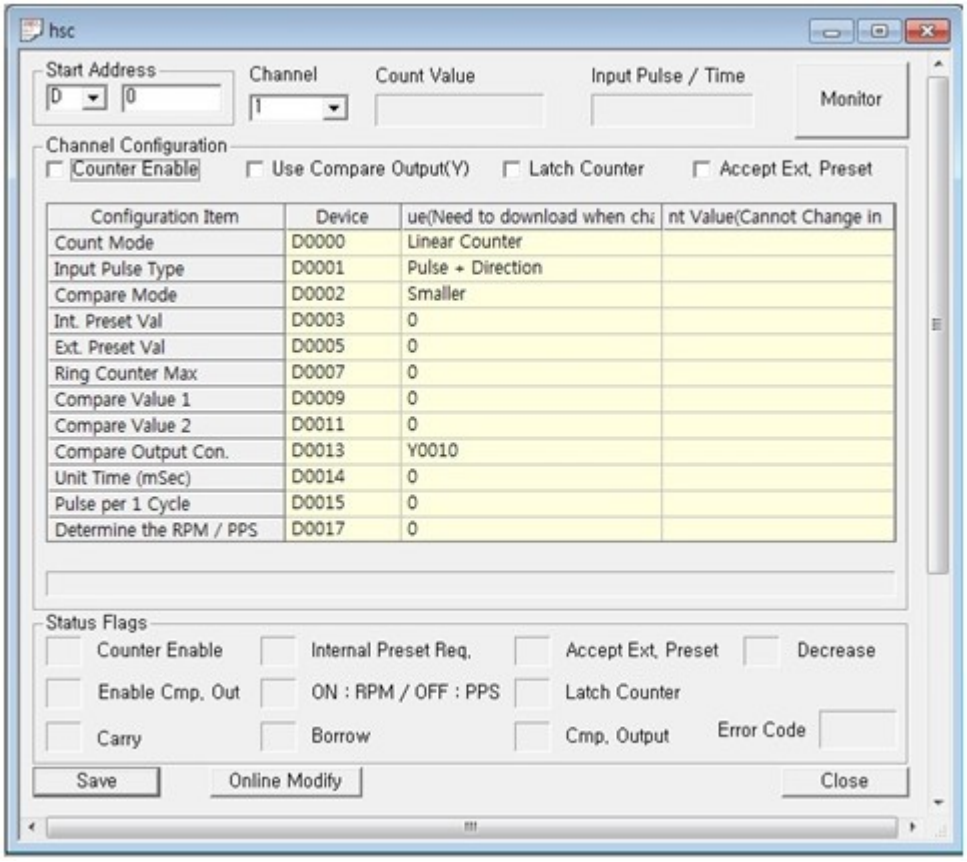
Allocation of I/O Signal for CM3-SP16MDR



I/O Signal

Pin	Input Signal (1)	Output Signal (3)	Pin
X000	Ch1 Phase A	Compare Output(3)	Y010
X001	Ch1 Phase B		Y011
X002	Ch2 Phase A		Y012
X003	Ch2 Phase B		Y013
X004	Ch1 Preset Input (2)		Y014
X005			Y015
X006	Ch2 Preset Input		Y016
X007			Y017
COM	Input Common	External Power Iput (+)	DC24V
COM	Input Common	Power Input Common (-)	COM

◆base on CM3-SP32MDT



1. HSC I/O signal is activated when [Counter Enable] is selected in Special program [HSC Program for plcS]. If [Counter Enable] is not selected, general I/O signal is activated.
2. Preset Input signal is activated when [Accept Ext. Preset] is selected in Special program [HSC Program for plcS]. If [Accept Ext. Preset] is not selected, general Input signal is activated.
3. You can assign output from Y10 to Y17 as Compare Output. Compare Output is activated when [Use Compare Output(Y)]is selected and one of output is assigned at [Compare Output Con.]

8.10.4 Major Function

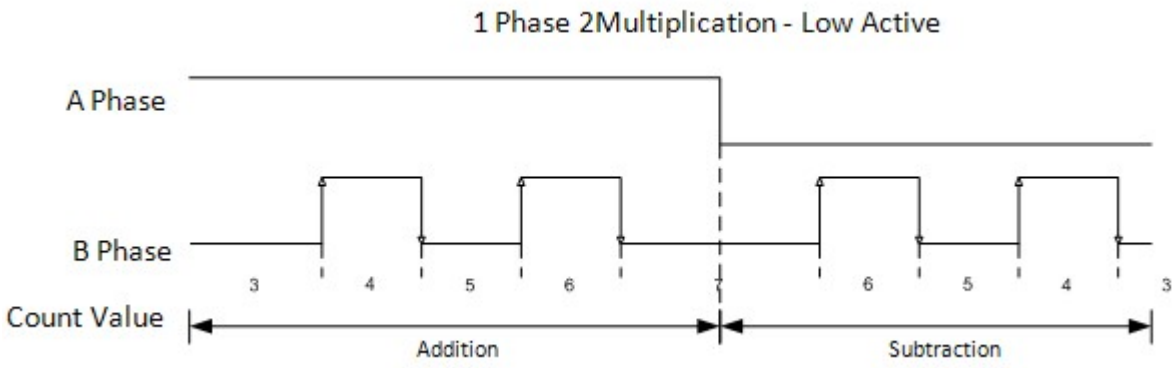
Contents :

8.10.4.1 Counter Input mode

Counter Input mode

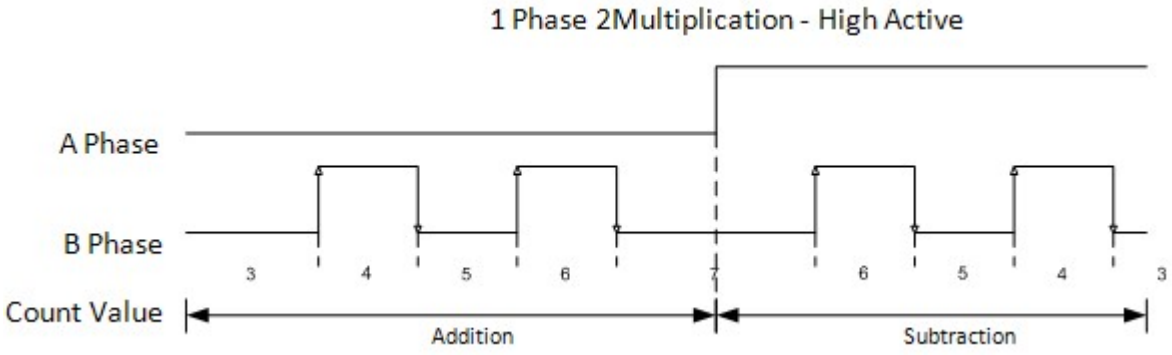
Group	A phase Input	B phase Input	Up/Down
1Ph. 2Multi.	Direction Input (Low Active)	Pulse Input	When A is high : Up Count When A is low : Down Count
1Ph. 2Multi.	Direction Input (High Active)	Pulse Input	When A is low : Up Count When A is high : Down Count
2Ph. 2Multi.	A. Pulse Input	B. Pulse Input	When A is antecedent to B : Up Count When B is antecedent to A : Down Count
2Ph. 4Multi.	A. Pulse Input	B. Pulse Input	When A is antecedent to B : Up Count When B is antecedent to A : Down Count

1. 1Phase 2Multiplication(Low Active)



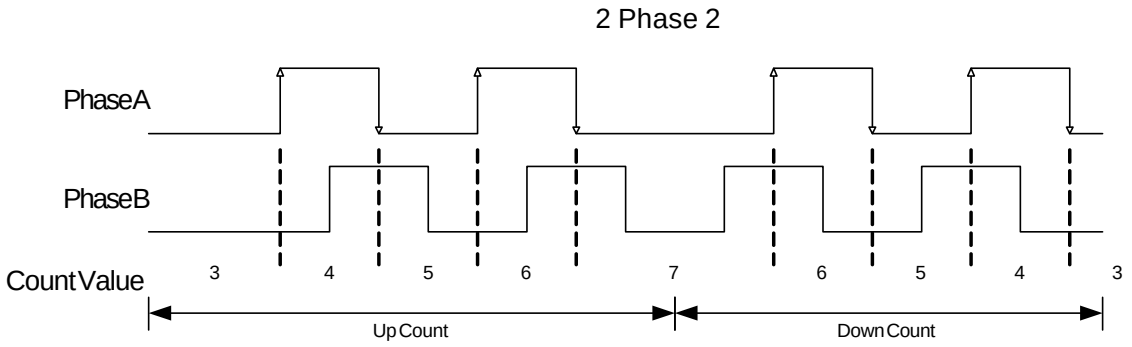
Up Count and Down Count direction are made by A Ph. Input status. In case direction is changed frequently, Count should be made by A Ph. Therefore, if you need precise measurement, 2Ph. 2Multi or 2Ph. 4Multi will be used.

2. 1Phase 2Multiplication(High Active)

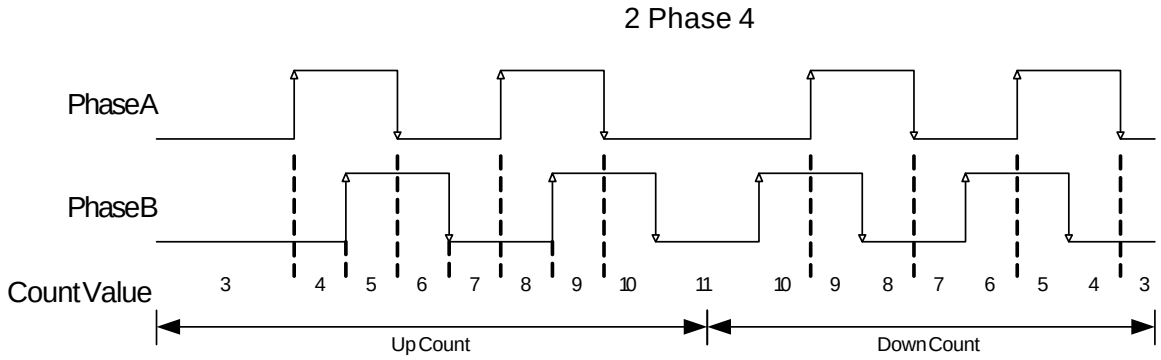


Up Count and Down Count direction are made by A Ph. Input status. In case direction is changed frequently, Count should be made by A Ph. Therefore, if you need precise measurement, 2Ph. 2Multi or 2Ph. 4Multi will be used.

3. 2Phase 2Multiplication

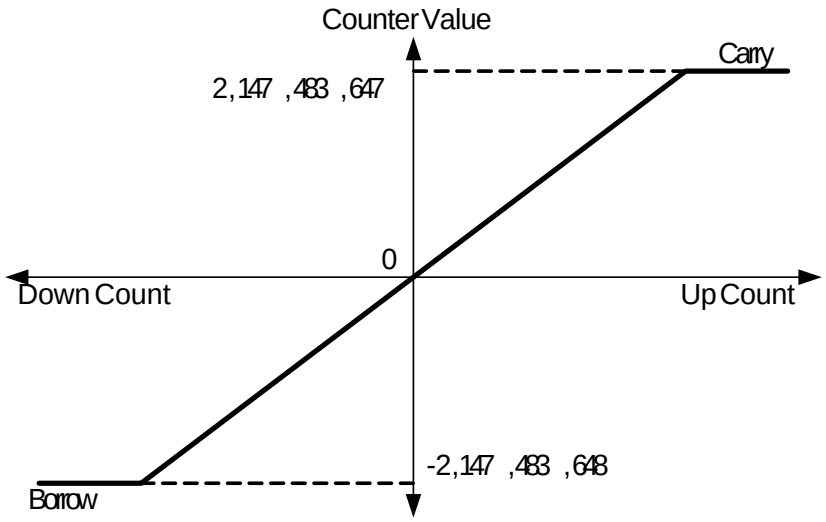


4. 2Phase 4Multiplication



8.10.4.2 Counter Types

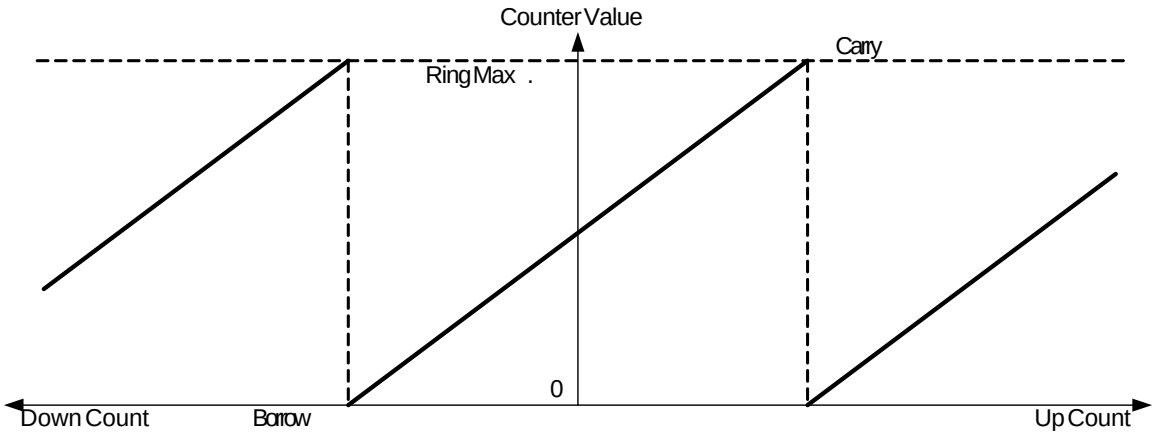
1. Linear Counter



- Linear Count range : -2,147,483,648 ~ 2,147,483,647

- If count values reaches the Max. value while increased, Carry will occur and if count value reaches the Min. value while decreased, Borrow will occur.
- If Carry occurs, count stops and increasing is not available but decreasing is available.
- If Borrow occurs, count stops and decreasing is not available but increasing is available.

2. Ring Count



- Ring Count range : from 0 to user-defined maximum value
- If count values exceeds user-defined maximum value during Up Count, Carry only occurs and count operation will be continued from 0. Carry flag will be maintained until reverse pulse input.
- If count value reaches 0 during Down Count, Borrow occurs and count operation will be continued from user0defined maximum value. Borrow flag will be maintained until reverse pulse input.
- If present count value exceeds user-defined range when setting Ring Count, Error is occurred and it operates Linear Counter.

8.10.4.3 Compared Output

- Available compared outputs are 2 for 1 channel which can be used separately.
- In order to make actual comparison enabled after compared output condition set, [Use Compare Output(Y)]is selected.
- In order to make external output, one of the compared equivalent output signal Y010~Y017 must be set.

Value	Compared output condition
0	Present value < Compared value
1	Present value <= Compared value
2	Present value = Compared value
3	Present value >= Compared value
4	Present value > Compared value
5	Compared value 1 <= Present value <= Compared value 2 (include)
6	Present value <= Compared value 1, Present value >= Compared value 2 (Exclude)

8.10.4.4 Counter Latch

Count Latch is activated when [Latch Count] is selected in Special program [HSC Program for plcS]. Counter value is not cleared when power supply Off -> On and mode change, it is counted from previous value.

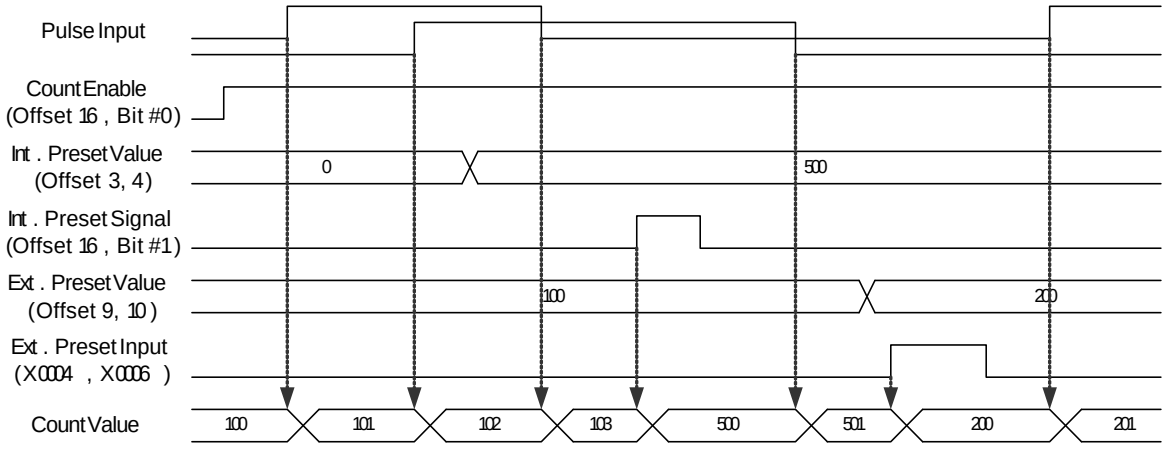
8.10.4.5 Revolution / Unit time

This function counts the number of input pulses for a specified time. In order to use this function, [Unit time] must be set bigger than 0. The displayed umber of pulses updated for a specified time.

- If 0 second is indicated, Revolution/Unit time cannot be operated as well as RPM/PPS.
- Pulse per 1Cycle : In order to indicate by Revolutions per minute(RPM), the operation is executed in program. Write the number of pulse per 1 cycle. If parameter is indicated as 0, RPM is not operated. Counter works by PPS regardless of other parameters.

Built-in HSC of PLCS counts input pulse speed through above parameters. Unit time, PPS(Pulse/Sec) or RPM(Rotate/Minute) can be selected.

8.10.4.6 Preset Function



It changes the current value into preset value.

There are internal preset and external preset. External preset is fixed as input contact point.

External signal : Ch1 ->X0004, Ch2 -> X0006

8.10.5 High-Speed Counter

Contents :

- Parameter Setting

8.10.5.1 Parameter Memory

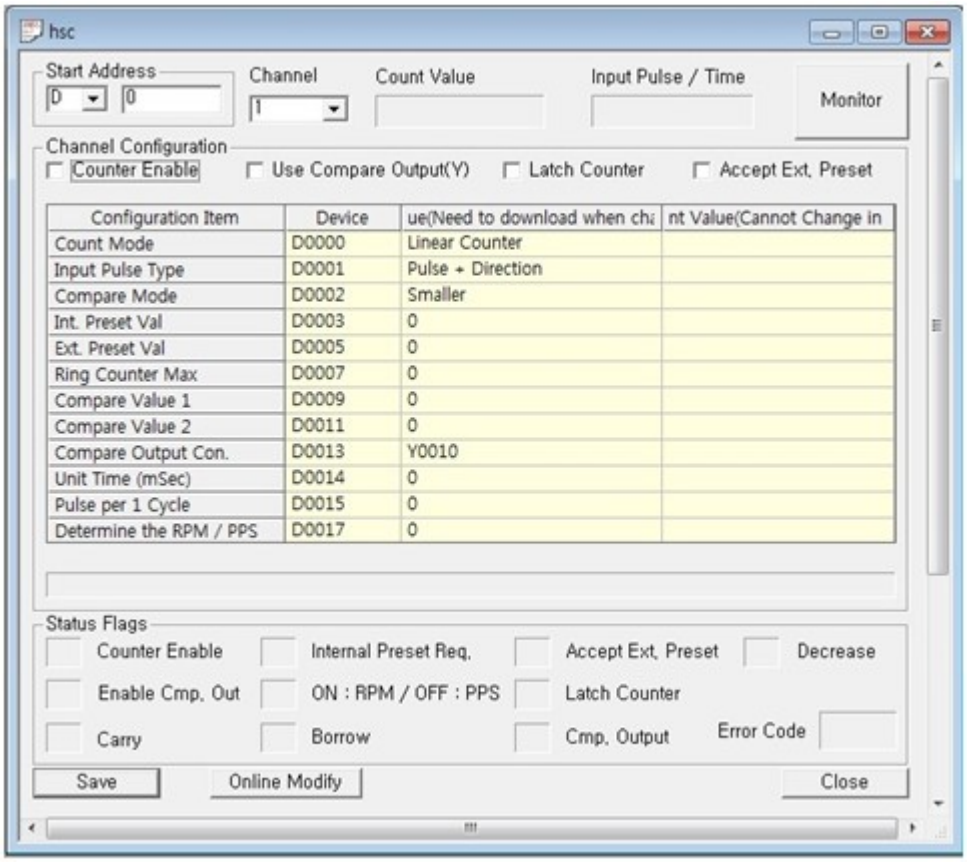
Parameter setting of HSC takes 26 word memories. User can assign among M/L/K/D in Special program [HSC program for plcS]

8.10.5.2 Parameter Memory Setting

Oft	Group	Description	Setting		Memory	Remark
			Value	Setting		
+0	Parameter	Count Mode	H0000	Linear Counter	Word	
			H0001	Ring Counter		
+1		Input Pulse Type	H0000	2 Phase, 2Input, 2Multi.	Word	
			H0001	2 Phase, 2Input, 4Multi.		
			H0002			
			H0003			
+2		Compare Mode	H0000	<	Word	
			H0001	<=		
			H0002	=		
			H0003	>=		
			H0004	>		
			H0005	< >		
			H0006	> <		
+3		Int. Preset Value	-2,147,483,648 ~ 2,147,483,647		Dword	Low
+4						High
+5		Ext. Preset Value	-2,147,483,648 ~ 2,147,483,647		Dword	Low
+6						High
+7		Ring Max. Value	-2,147,483,648 ~ 2,147,483,647		Dword	Low
+8						High
+9		Compare Max.	-2,147,483,648 ~ 2,147,483,647		Dword	Low
+10						High
+11		Compare Min.	-2,147,483,648 ~ 2,147,483,647		Dword	Low
+12						High
+13		Compare Output	HFFFF	N/A	Word	Read Only
			H0000	Y0010		
			H0001	Y0011		
			H0002	Y0012		
			H0003	Y0013		
			H0004	Y0014		
			H0005	Y0015		
			H0006	Y0016		
			H0007	Y0017		
+14		Unit Time	1~60,000 mSec		Word	
+15		Pulse / Rotation	1~60,000 Pulse		Word	
+16	Control	Counter Enable	Bit 0	SET = Enable	Word	
		Int. Preset	Bit 1	SET = Preset		
		Ext. Preset Enable	Bit 2	SET = Enable		
		Down Counting	Bit 3	SET = Down		Read Only
		Compare Output Enable	Bit 4	SET = Enable		
		RPM / PPS Select	Bit 5	RPM(1), PPM(0)		
		Count Latch	Bit 6	SET = Enable		
			Bit 7..F			
+17	Monitor	RPM/PPS Measured Value	-2,147,483,648 ~ 2,147,483,647		Dword	Low Word
+18						High Word
+19						

+20		Carry	Bit 0	SET = Carry	Word	Read Only
		Borrow	Bit 1	SET = Borrow		Read Only
		Compare Result	Bit 2	SET = Result		Read Only
			Bit 3..F			
+21		Current Count Value	-2,147,483,648 ~ 2,147,483,647		Dword	Low Word
+22						High Word
+23		Input Pulse per Unit Time	-2,147,483,648 ~ 2,147,483,647		Dword	Low Word
+24						High Word
+25		Error Code	Refer Error Code Table		Word	

8.10.5.3 Parameter Setting



(1) Count Mode (Offset 0)

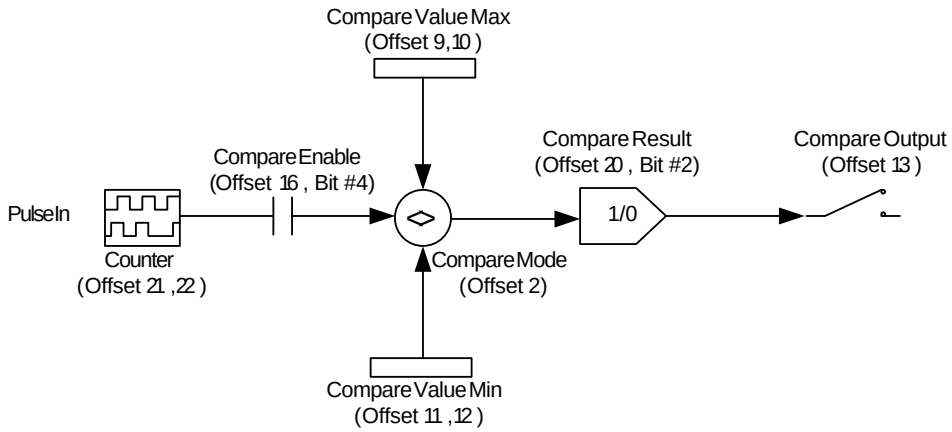
You can choose Ring Counter or Linear Counter. If you change counter mode during operation, you should make reset [Counter Enable] and set again. Before [Counter Enable] is reset, it is operated as Count mode. If it is changed to Ring Count and current value exceeds range, Linear Counter will be operated.

(2) Input Pulse type (Offset 1)

PLC-S supports 2phase encoder input signal. Multiplication is selected. Please refer to 4.1 Counter Input mode.

(3) Compare mode (Offset 2)

It is only operated when [Compare mode] (Offset 16 – Bit #4) is selected. You should set up [Compare value1] and [Compare value2] Offset 9 – 12.



(4) Internal Preset value (Offset 3, 4)

When Internal preset(Offset 16, Bit #1) is changed from Reset to Set, current value is changed to designated value.

(5) External Preset value (Offset 5, 6)

When External Preset Input signal(Ch1 : X0004, Ch2 : X0006) is changed from OFF to ON, current count value is changed to designated value.

(6) Ring Counter Max. (Offset 7, 8)

When [Count mode] is Ring count, [Ring Counter Max] is set up here. Ring Count range : from 0 to user-defined maximum value

(7) Compare value Max. (Offset 9, 10), Compare value Min. (Offset 11, 12)

Both compare values are used when [Compare Enable] is SET. According to [Compare mode], use can use compare value Min. only or both Max. and Min. values together.

(8) Compare Output (Offset 13)

Compare result(Offset 20, Bit #2) can be used internal flag as well as external output signal. In order to use this function, one of Output from Y0010 ~Y0017 can be selected.

(9) Unit time (Offset 14)

Unit time must be set in order to use RPM or PPS. If unit time is set as 0, RPM and PPS are not operated.

(10) Pulse per 1 cycle (Offset 15)

In order to use RPM, value must be set except 0. If '0' set up here, PPS will be operated and Error(101) occur regardless of RPM/PPS (Offset 16, Bit #5).

(11) Status Flags(Offset 16)

(a) Counter Enable (Bit #0)

HSC I/O signal is activated when [Counter Enable] is selected.

(b) Internal Preset Request. (Bit #1)

When current value must set up as designated value, this Bit should be SET in sequence program. When Bit is set, current count value(Offset 21, 22) will be changed as written value of internal preset value(Offset 3, 4).

(c) Accept External preset (Bit #2)

When it is SET, current count value is changed to designated value by force through external signal. External signal is assigned X0004(Ch1) and X0006(Ch2).

(d) Decrease (Bit #3)

According to Input signal direction, current count value becomes Up Count or Down Count. If current count value is decreased, it will be SET. (In case of increasing, it will be RESET)

(e) Enable Compare Out (Bit #4)

When it is RESET, Compare Out is not operated.

(f)On RPM/Off PPS (Bit #5)

In order to use RPM, value(Offset 15) must be set except 0. If '0' set up here, PPS will be operated regardless flag status.

(g) Latch Counter (Bit #6)

Even if power is off, present count value is maintained in memory safely.

(12) Determine the RPM / PPS (Offset 17, 18)

According to choice of RPM/PPS status(Offset 16, Bit #5), values of RPM or PPS will be saved here.

$$PPS = \frac{[\text{Input Pulse per Unit Time}] \times 1000}{[\text{Unit Time}]}$$

$$[\text{PPS Offset } 17, 18] = \frac{[\text{Offset } 23, 24] \times 1000}{[\text{Offset } 14]}$$

$$RPM = \frac{[\text{Input Pulse per Unit Time}] \times 1000 \times 60}{[\text{Unit Time}] \times [\text{Pulse per Rotation}]}$$

$$[\text{RPM Offset } 17, 18] = \frac{[\text{Offset } 23, 24] \times 1000 \times 60}{[\text{Offset } 14] \times [\text{Offset } 15]}$$

(13) Monitor Flag (Offset 20)

(14) Current count value (Offset 21, 22)

(15) Purse per 1 cycle/ Unit time (Offset 23, 24)

(16) Error Code (Offset 25)

Code	Error name	Description
0	No Error	Normal operation mode
100	Exceed Ring count range	Current count value exceeds Ring Count Range
101	RPM operation error	In case pulse per 1 cycle is set '0'

8.11 PLCS Positioning

Contents :

8.11.1 General Specification

Item	Specification
No. of control axis	2 Axes
Interpolation	2 Axes linear interpolation
Pulse output signal	Open collector (DC24V)
Pulse output type	Pulse + Direction
Control type	Position control, speed control, speed/position switching, position/speed switching
Control unit	Pulse
Position data	30 position data per axis (operation step no. : 1 .. 30)
Position data set	CICON special program (permanent auto preservation)
Positioning monitor	Dedicated monitoring window provided by CICON
Back-Up	Parameter, operation data ?Flash memory
Position Method	Absolute / Incremental
Position Address Range	-2,147,483,648 ~ 2,147,483,647 (Pulse)

Speed Range	1 ~ 100,000 pps (1 pps unit)
Acceleration/deceleration type	Trapezoid-shaped
Acceleration/deceleration time	0 ~ 100,000 mSec. (selectable from 4 types of acceleration/deceleration patterns)
Max. output pulse	100kpps
Max. connection distance	2m

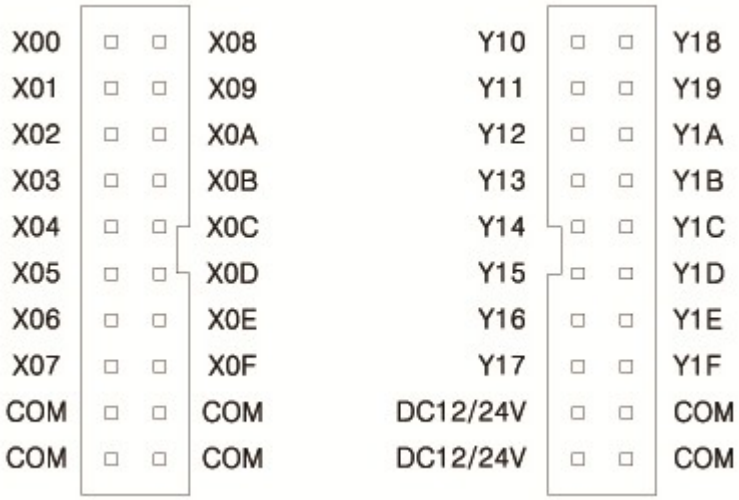
8.11.2 Input Signal Specification

Item	Specification
Rated input voltage	24V DC (20.4V ~ 28.8V)
Rated input current	About 7 mA / 24V
Insulation type	Photo-coupler
Input Impedence	About 3.3kΩ
On voltage (Min.)	20.4V
Off voltage (Max.)	6V
Response time	0.5mSec or less (Used for positioning)
Min. input width	100 us
Ext. Upper Limit Input	X0007 (X axis) / X000A (Y axis), B contact
Ext. Lower Limit Input	X0008 (X axis) / X000B (Y axis), B contact
DOG Input	X000C (X axis) / X000E (Y axis), A contact
Zero Input	X000D (X axis) / X000F (Y axis), A contact

8.11.3 Output Signal Specification

Item	Specification
Rated load voltage	DC5 ~ 24V (DC4.75 ~ 26.4V)
Max. load current	0.1A / 1 point or below
Insulation	Photo-coupler
Inrush current	1A / 10ms or below
On voltage drop	DC 0.3V or below
OFF leakage current	0.1mA or below
Response time	0.1ms or below (rated load, resistor load)

8.11.4 Ex. Signal Wiring

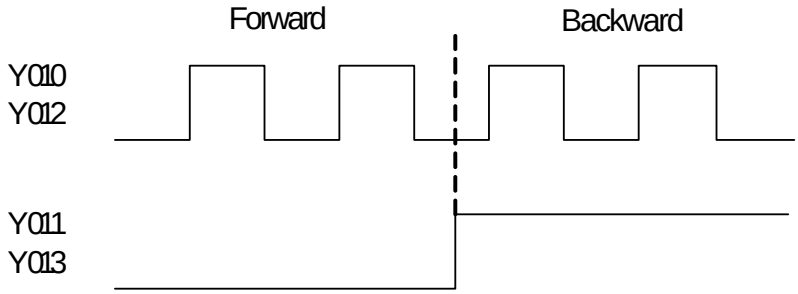


Pin	Input	
	Axis X	Axis Y
X007	Ext. Lower Limit (B contact)	
X008	Ext. Upper Limit (B contact)	
X009	N/A	
X00A		Ext. Lower Limit (B contact)
X00B		Ext. Upper Limit (B contact)
X00C	DOG (A contact)	
X00D	Zero (A contact)	
X00E		DOG (A contact)
X00F		Zero (A contact)
COM	Input Common	Input Common

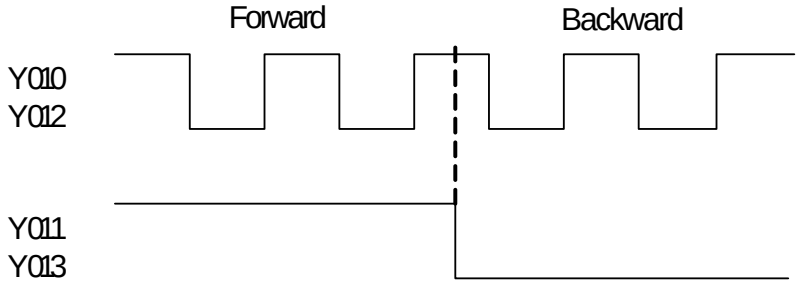
Pin	Output	
	Axis X	Axis Y
Y010	Pulse Output	
Y011	Direction Output	
Y012		Pulse Output
Y013		Direction Output
DC24V	Output Common (+)	
COM	Output Common (-)	

8.11.5 Output Pulse Level

[High Active Mode]

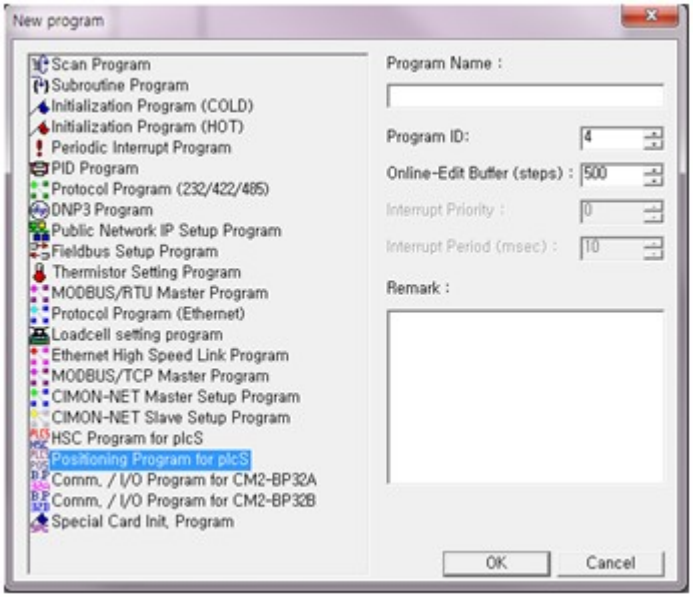


[Low Active Mode]



8.11.6 Parameter

All parameters can be configured by "Positioning Program for plcS" in CICON.



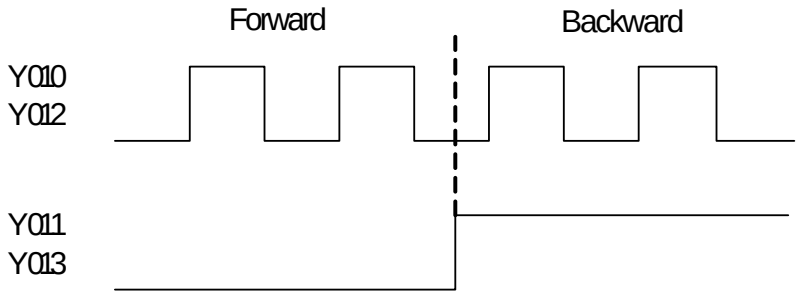
Ofs	Item	Configuration Details		R/W	Remark
		Default	Function		
0	Pulse Output Select	0	0=Not Used 1=High Active 2=Low Active	W	
1 2	Bais Speed	1	1 ~ 100,000 PPS	DW	Low High
3 4	Speed Limit	50,000	1 ~ 100,000 PPS	DW	Low High
5	Acc/Dec Time 1	1,000	1 ~ 65,535 mSec	W	
6	Acc/Dec Time 2	1,000	1 ~ 65,535 mSec	W	
7	Acc/Dec Time 3	1,000	1 ~ 65,535 mSec	W	
8	Acc/Dec Time 4	1,000	1 ~ 65,535 mSec	W	
9 10	S/W Upper Limit	2,147,483,647	-2,147,483,648 ~ 2,147,483,647	DW	Low High
11 12	S/W Lower Limit	-2,147,483,648	-2,147,483,648 ~ 2,147,483,647	DW	Low High
13	Position address under speed control	0	0=Do not update 1=Update 2=Clear and update	W	
14	Backlash Compensation	0	0 ~ 65,535 Pulse	W	
15	External Upper/Lower Limit Signal	0	0=Not Used 1=Wired (Used)	W	
16 17	Jog Speed Limit	20,000	1 ~ 100,000 PPS (Bias Speed<Jog Speed<Speed Limit)	DW	Low High
18	Jog Acc/Dec Time	0	No. of Acc/Dec Time (0~3)	W	
19	Inching Speed	100	0 ~ 65,535 PPS	W	
20	Complete Output Signal Duration	1000	0 ~ 65,535 mSec	W	

21	OPR Method	0	0=DOG / Zero OFF 1=DOG / Zero ON 2=DOG	W	
22	ORP Direction	0	0=Forward 1=Backward	W	
23 24	Origin Address	0	-2,147,483,648 ~ 2,147,483,647	DW	Low High
25 26	OPR High Speed	50,000	1 ~ 100,000 PPS	DW	Low High
27 28	OPR Low Speed	1,000	1 ~ 100,000 PPS	DW	Low High
29	OPR Acc/Dec Time	0	No. of Acc/Dec Time (0~3)	W	
30	DWELL Time	0	0 ~ 50,000 mSec.	W	

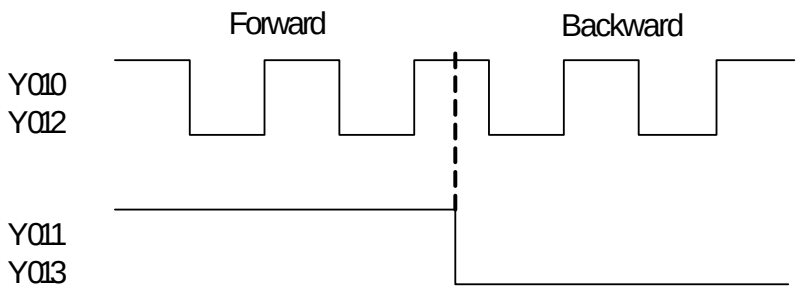
8.11.6.1 Pulse Output Select

- Determine whether to use positioning function
- If non-zero value is assigned, pulse signal output is enabled and the signal type (low active, high active)can be selected:
- If zero value is assigned, pulse signal output is disabled for the specific axis.

[1 : High Active Mode]



[2: Low Active Mode]

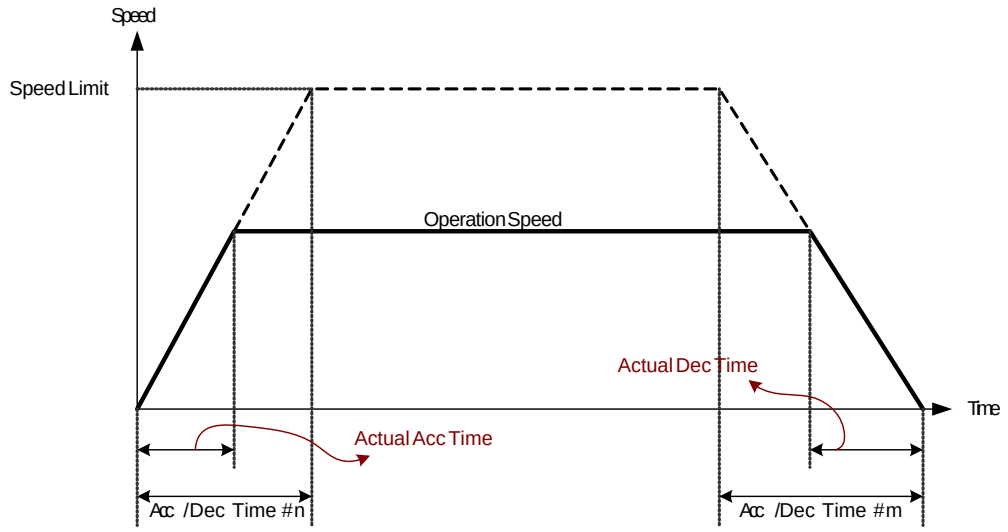


8.11.6.2 Bais Speed

Considering that torque of stepping motor is unstable when its initial speed is almost at 0, the initial speed (bias speed)has to be set during early operation in order to facilitate motor's rotation and to save positioning time. Bias speed shouldn't be over the selected speed limit value.

8.11.6.3 Speed Limit

Speed limit refers to the allowable maximum speed of positioning operation. Also, it is used for calculating the actual acc/dec time. The operating speed value shouldn't be over the set speed limit value.



8.11.6.4 Acc/Dec Time (1~4)

Acc and Dec time is defined as shown below :

(a) Acc Time : a duration required to reach from "0 (stop)" speed to the speed limit set in parameter. Using bias would be a time consumed to reach from bias speed to the speed limit set in parameter.

(b) Dec Time : a duration required to reach from the speed limit set in parameter down to "0 (stop)" speed. Using bias would be a time consumed to reach to bias speed set in parameter. The actual acc/dec time can be calculated by formula below

T = V x Ta / (Vmax – Vbias)

(T : Actual acc/dec time, V : speed change, Ta : acc/dec time set, Vmax : speed limit, Vbais : bias speed)

8.11.6.5 S/W Upper/Lower Limit

- The range of a machine's position is called 'stroke limit', and it sets the upper/lower limits of stroke into software upper limit and software lower limit and does not execute positioning if it operates out of ranges set in the above.
- Range of software upper limit and lower limit is checked before starting positioning and while operation is in progress.
- Pulse output stops when an error (error code 154, 155) is detected.

- S/W limit checking function is disabled when identical values are assigned to upper and lower limits.

8.11.6.6 Position address under speed control

Specify whether you want to enable or disable the update of Current Position Address? while operations are performed under the speed control.

Set Value	Position Address
0	No update
1	Update
2	Clear and update

8.11.6.7 Backlash Compensation

- An error that occurs due to backlash when moving the machine via gears can be compensated.
- When the backlash compensation amount is set, the pulse equivalent to the compensation amount will output each time the direction changes during positioning.

8.11.6.8 External Upper/Lower Limit Signal

- To use external upper/lower limit signals during operation, it should be set as '1'.Otherwise, it does not detect upper/lower limits and the terminals are available for general input contact.

Signal		Terminal	Signal Detection	Logic
Lower Limit	X axis	X07	Rising edge	B contact
	Y axis	X0A		
Upper Limit	X axis	X08		
	Y axis	X0B		

8.11.6.9 Jog Speed Limit

Set the maximum speed for JOG operation.

8.11.6.10 Jog Acc/Dec Time

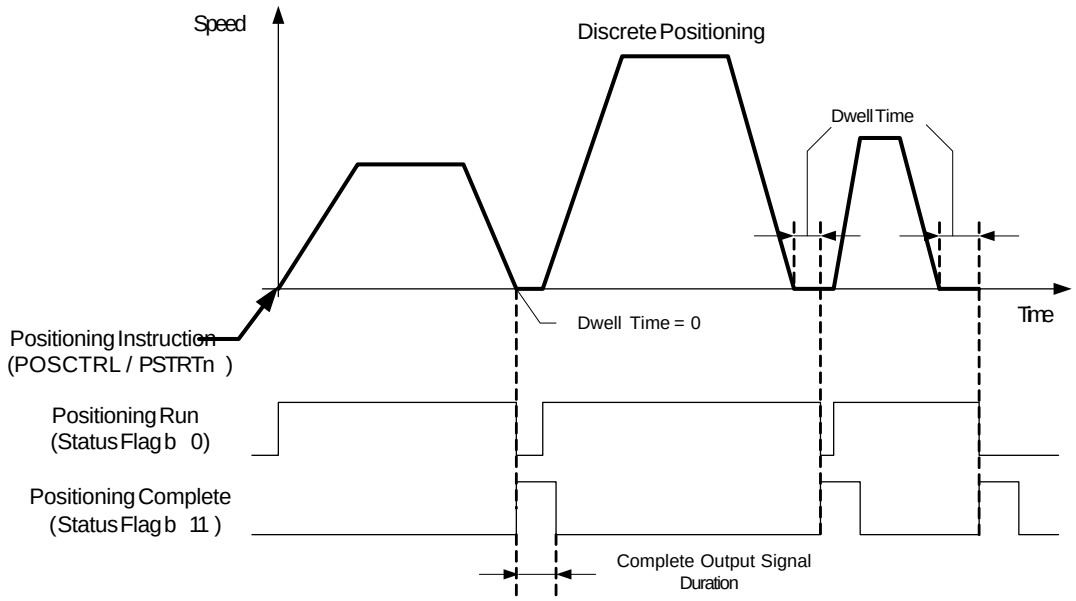
Set which of "Acc/Dec Time 1 to 4" to use for the acceleration time during JOG operation.

8.11.6.11 Inching Speed

Set the speed of inching operation.

8.11.6.12 Complete Output Signal Duration.

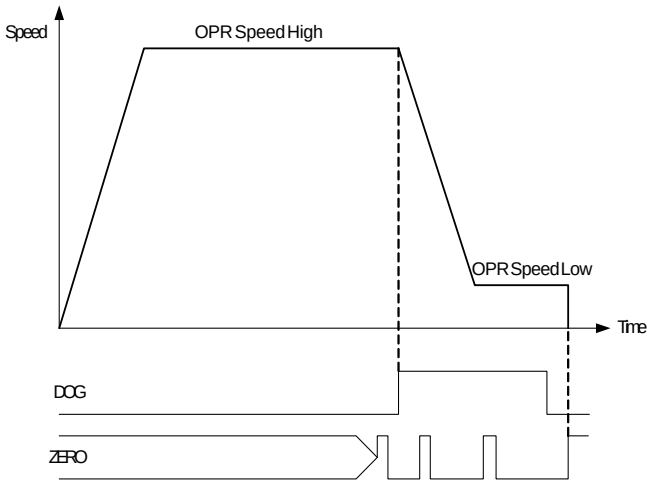
Set the output time of the positioning complete signal in "Status Flag" (Bit 11). Positioning completes when the specified dwell time has passed after the pulse output terminates.



8.11.6.13 OPR Method

PLC-S provides 3 different OPR methods.

DOG / Zero OFF



(1) Start OPR : Start movement at the "OPR Speed High" in the direction of "OPR Direction" set in parameter.

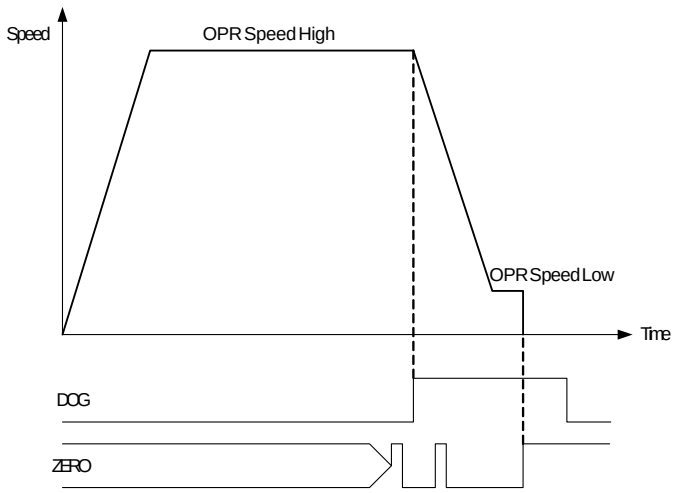
(2) Detects the near-point DOG ON, and start deceleration.

(3) Decelerate to "OPR Speed Low", and move with the "OPR Speed Low". At this time, the near-point DOG must be ON. If the near-point DOG is OFF, the axis will decelerate to a stop.

(4) At the first zero signal (one pulse output at one motor revolution) after the near-point DOG OFF, the

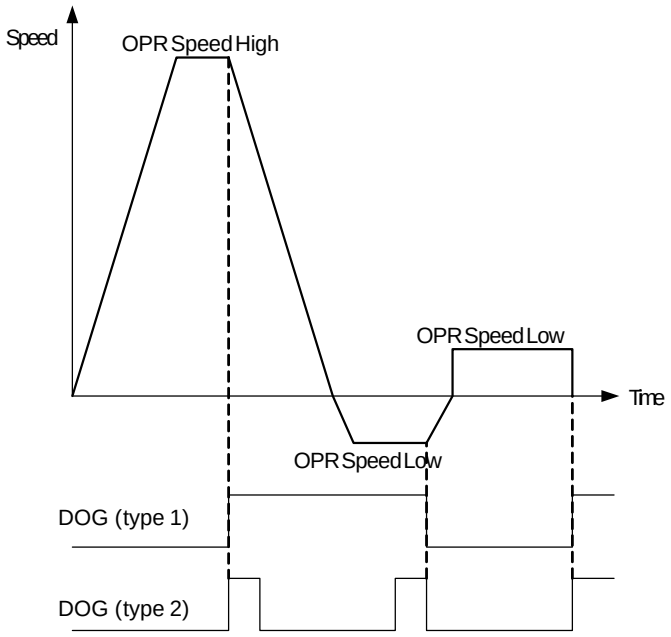
pulse output stops, and the OPR is completed.

DOG / ZERO ON



(1) Start OPR : Starts movement at the speed of "OPR Speed High" in the direction of "OPR Direction" set in parameter.
(2) Detects the near-point DOG ON, and starts deceleration.
(3) Decelerate to the speed of "OPR Speed Low", and move with the speed of "OPR Speed Low". At this time, the near-point DOG must be ON. If the near-point DOG is OFF, the axis will decelerate to a stop.
(4) While DOG ON and after the deceleration, at the first zero signal (one pulse output at one motor revolution), the pulse output stops and OPR is completed.

DOG



(1) Start OPR : Starts movement at the speed of "OPR Speed High" in the direction of "OPR Direction" set in parameter.
(2) Detects (rising edge) the near-point DOG ON, and starts deceleration.
(3) Decelerate to a speed of 0, and accelerate to the speed of "OPR Speed Low" in the direction of backward.
(4) Detects (falling edge) the near-point DOG OFF, and starts deceleration again.
(5) Decelerate to a speed of 0, and move with the speed of "OPR Speed Low" in the direction of forward. At this time, the near-point DOG is OFF.
(6) Detects (rising edge) the near-point DOG ON. At the rising edge of DOG signal, the pulse output stops, and OPR is completed.

8.11.6.14 OPR Direction

Set the direction of OPR.

8.11.6.15 Origin Address

Set the address used as a reference point for positioning control (ABS system).When OPR is completed, the stop position address is changed to this address. At the same time, ‘Origin Address’ is stored in "Current Pos. Address"

8.11.6.16 OPR High Speed

Set the speed for OPR. This speed is set within the following range :
Bias Speed = OPR Low Speed <= **Opr High Speed** <= Speed Limit.

8.11.6.17 OPR Low Speed

Set the creep speed after near-point DOG ON. The low speed just before stopping after decelerating from the OPR High Speed. This speed is set within the following range :
Bias Speed <= **OPR Low Speed** <= Opr High Speed = Speed Limit.

8.11.6.18 OPR Acc/Dec Time

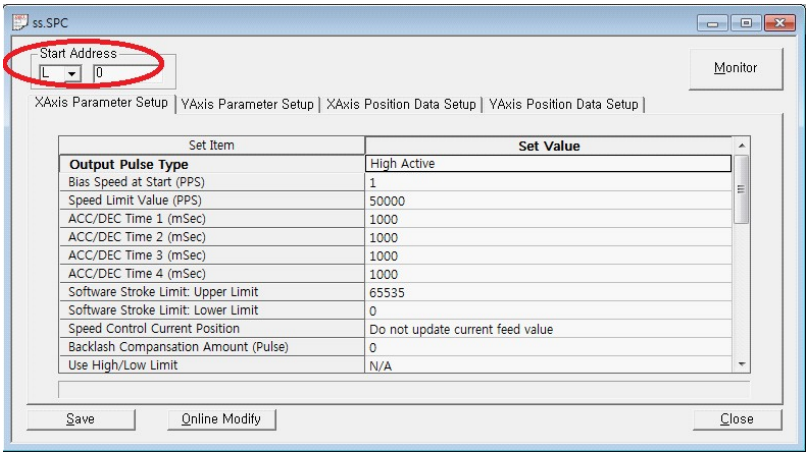
Set which of "Acc/Dec Time 1 to 4" to use for the acceleration and deceleration time during OPR.

8.11.6.19 DWELL Time

Set the time that machine dwells after the positioning stop (pulse output stop) to the output of the positioning complete signal.

8.11.7 Operation Data

When the PLC goes into RUN mode, positioning function allocates a memory area for storing runtime information. The start address of memory area is designated in the "Positioning Program for plcS" special program as shown in the following picture.



The operation data occupies 20 words space (10 words for each axis). The information details are listed in the table below. By using this memory area, you can monitor and control the positioning functions.

Ofs	Axis	Item	Description		Rem
			Bit	Data Details	
0	X	Control Flag	0	Axis Enable (1) / Disable (0)	
			1	Decelerate Stop Req. (activated on rising edge, and auto reset)	
			2	Emergency Stop Req. (activated on rising edge)	
			3	Forward JOG/Inching ON(1) / OFF(0)	
			4	Backward JOG/Inching ON(1) / OFF(0)	

			5		
			6		
			7		
			8		
			9		
			A		
			B		
			C		
			D		
			E		
			F	Error Clear Req. (activated on rising edge, and auto reset)	
1		Status Flag	0	Run (0=Stopped, 1=Running)	
			1	Under position control	
			2	Under speed control	
			3	Under linear interpolation	
			4	Under OPR	
			5	Reserved (0)	
			6	Reserved (0)	
			7	Under acceleration	
			8	Under steady speed running	
			9	Under deceleration	
			A	Under dwell	
			B	Positioning Completed	
			C	OPR Completed	
			D	Direction : Forward(0)/Backward(1)	
			E	Pulse Output Disabled	
			F	Error	
2		Current Pos. Address	L	-2,147,483,648 ~ 2,147,483,647	Pulse
3			H		
4		Current Speed	L	1 ~ 100,000	PPS
5			H		
6		Current Step		Current position program step number (1 ~ 30)	
7		Next Step.		Next position program step number (1 ~ 30)	
8		Inching Movement		Inching distance (0 – 65535)	Pulse
9		Error Code		[refer to the error code table]	
10	Y axis	Control Flag	0	Axis Enable (1) / Disable (0)	
			1	Decelerate Stop Req. (activated on rising edge, and auto reset)	
			2	Emergency Stop Req. (activated on rising edge)	
			3	Forward JOG/Inching ON(1) / OFF(0)	
			4	Backward JOG/Inching ON(1) / OFF(0)	
			5		
			6		

			7		
			8		
			9		
			A		
			B		
			C		
			D		
			E		
			F	Error Clear Req. (activated on rising edge, and auto reset)	
11		Status Flag	0	Run (0=Stopped, 1=Running)	
			1	Under position control	
			2	Under speed control	
			3	Under linear interpolation	
			4	Under OPR	
			5	Reserved (0)	
			6	Reserved (0)	
			7	Under acceleration	
			8	Under steady speed running	
			9	Under deceleration	
			A	Under dwell	
			B	Positioning Completed	
			C	OPR Completed	
			D	Direction : Forward(0)/Backward(1)	
			E	Pulse Output Disabled	
			F	Error	
12		Current Pos. Address	L	-2,147,483,648 ~ 2,147,483,647	Pulse
13			H		
14		Current Speed	L	1 ~ 100,000	PPS
15			H		
16		Current Step		Current position program step number (1 ~ 30)	
17		Next Step		Next position program step number (1 ~ 30)	
18		Inching Movement		Inching distance (0 - 65535)	Pulse
19		Error Code		[refer to the error code table]	

8.11.7.1 Axis Enable/Disable

When the bit is reset (0), all the positioning functions get disabled and when the bit is set (1), all the positioning functions get enabled.

8.11.7.2 Decelerate Stop Req

Request of decelerating stop is issued by setting this flag. Various stop reasons and reactions are listed in the table below.

Cause		Positioning	OPR	JOG	Error Code
S/W Limit	Upper	Immediate Stop	Ignore	Immediate Stop	154
	Lower	Immediate Stop	Ignore	Immediate Stop	155
Sequence CICON	Deceleration Stop Req.	Deceleration Stop	Deceleration Stop	Ignore (Error Code 553)	
	Emergency Stop Req.	Immediate Stop	Immediate Stop	Immediate Stop	102
Ext. Limit Signal	Upper	Immediate Stop	Immediate Stop	Immediate Stop	104
	Lower	Immediate Stop	Immediate Stop	Immediate Stop	105

8.11.7.3 Emergency Stop Req

It stops axis operation immediately without any deceleration step.

8.11.7.4 Forward/Backward JOG/Inching ON/OFF

- JOG Operation: if ‘Inching Movement’ was set as 0, then ‘JOG/Inching ON’activates JOG operation. It outputs pulses to the drive unit from PLC-S while the signal is ON. ‘JOG Speed Limit’ and ‘Jog Acc/Dec Time’ set in parameter are used in JOG operation.

- Inching Operation: if ‘Inching Movement’ was set as non-zero value, then ‘JOG/Inching ON’ activates ‘ inching’ operation. It outputs predefined number of pulses ("Inching Movement") to the drive unit from PLC-S when the signal is changed from OFF to ON. "Inching Speed" set in parameter is applied here.

8.11.7.5 Positioning Completed Flag

Positioning Completed Flag turns ON when a positioning operation is completed. Duration can be configured by setting "Complete Output Signal Duration" in parameter.

8.11.7.6 OPR Completed Flag

OPR Completed Flag turns ON at the end of dwell time after OPR. Reset (OFF) condition is listed as following :

- CPU mode changes to STOP
- A new OPR operation starts
- Axes gets disabled

8.11.7.7 Direction Flag

Direction Flag indicates the direction of axis. (0=Forward, 1=Backward)

8.11.7.8 Pulse Output Disabled Flag

When an error occurs, error code gets written in the memory offset 19. At the same time, ‘error’ and this flag is set automatically. Pulse output is stopped while the ‘Pulse Output Disabled’ flag is set.

To enable the pulse output, the source of the error should be removed and the error code has to be cleared by setting the 'Error Clear Req.' in the control flag.

8.11.7.9 Error Flag

'Error Flag' indicates current status of error on axis. 'Error Code' gives information of the error. This flag can be cleared by setting the 'Error Clear Req.' in control flag after removal of the error source.

8.11.8 Position Data

The basic controls such as position control and speed control are executed by setting the required items in this 'position data', and the starting that position data. The special program named "Positioning Program for plcS" provides a tool for this 'position data' configuration. Maximum 30 'position data' can be defined for each axis, and a 'position data' occupies 8 word sized memory. The same structure of 8 word memory is applied to 'POSCTRL' instruction .

'Control code'must be 0 at the end of 'position data' list.

While in operation, if the control code is zero, PLC-S terminates the series of positioning control and doesn't go onto the next item on the list.

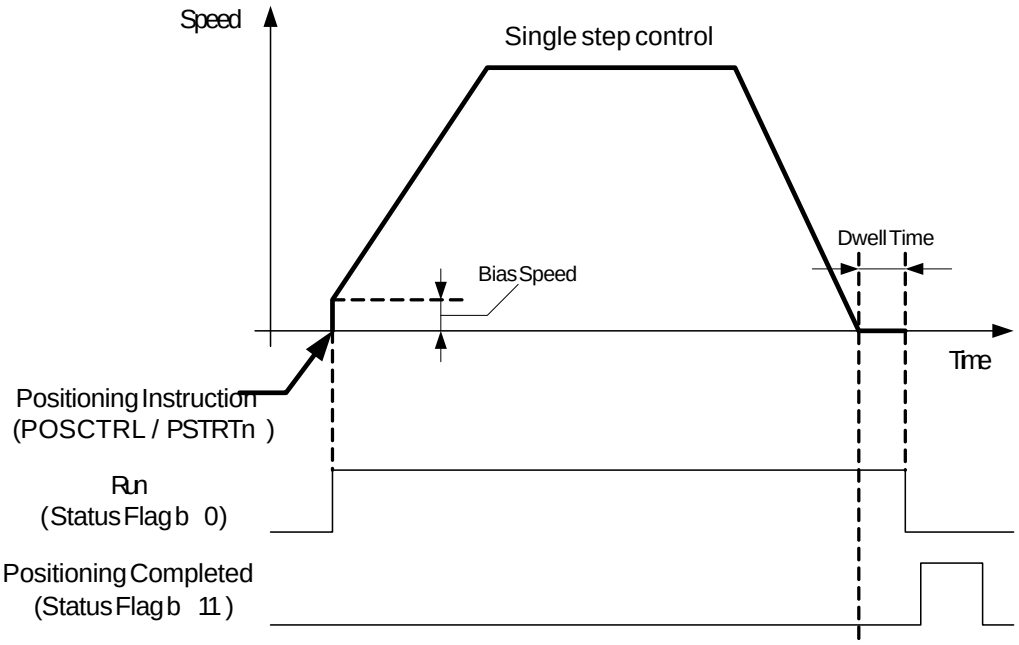
Ofs	Item	Bit	Description	Unit
0	Control Pattern	0	00 = Single step control 01 = Continuous control	
		1		
	Interpolation	2	00 = Non-Interpolation 01 = Main Axis : Y (Linear Interpolation) 10 = Main Axis : X (Linear Interpolation)	
		3		
	Acc Time	4	Acc/Dec No. (0 ~ 3)	
		5		
	Dec Time	6	Acc/Dec No. (0 ~ 3)	
		7		
	Control Code	8..F	See 'Control Code' table	
1				
2	Dwell Time	0 ~ 65,535 or indirect data (device memory)		mSec
3				
4	Speed	L	1 ~ 100,000 or indirect data (device memory)	PPS
5		H		
6	Target Position Addr.	L	-2,147,483,648 ~ 2,147,483,647 or indirect data (device memory)	Pulse

8.11.8.1 Control Pattern

Single Step Control

This type of control executes only one step position data. If a dwell time was defined, 'positioning completed'

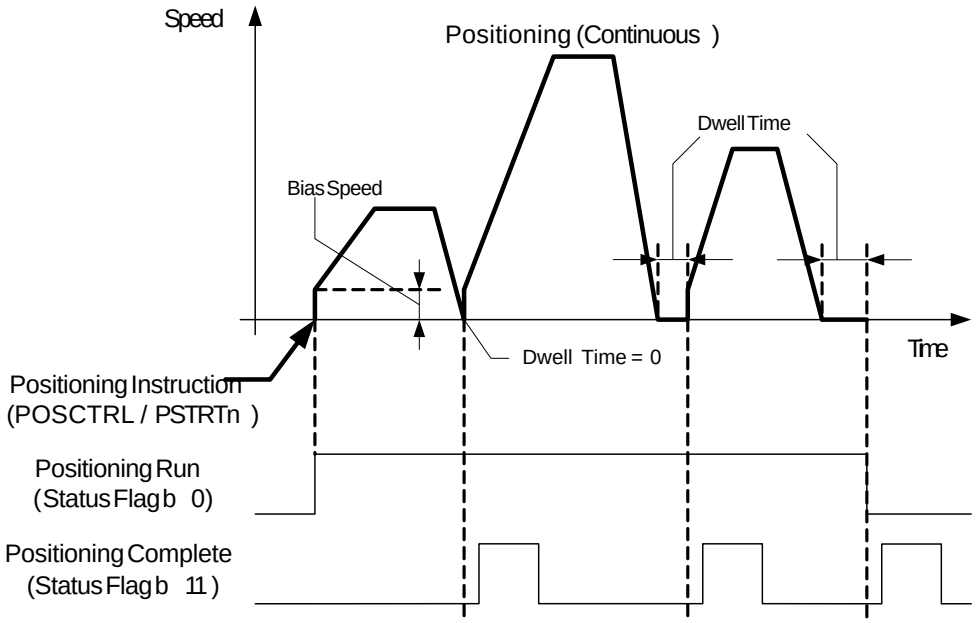
flag is set after the dwell time has passed.



Continuous Control

This type of control is used when several positioning controls need to be executed continuously. PLC-S always automatically decelerates each time the positioning is completed. Acceleration is then carried out after the positioning speed reaches 0 to carry out the next positioning data operation. If a dwell time is designated, the acceleration is carried out after the designated time elapses.

In operation by continuous positioning control, the next positioning No. is automatically executed. **Always** set operation pattern as "Single Step" in the last positioning data to terminate the continuous positioning. If the operation pattern is set to "Continuous", the operation will continue until operation pattern "Single Step" is found. If the operation pattern "Single Step" cannot be found, the operation may be carried out until the positioning data No. 30 and terminates the operation automatically.



8.11.8.2 Interpolation

Set the main and target axis (sub/partner axis) for operations under the 2-axes interpolation control.

1 No-Interpolation
Normal single axis positioning control.
2 Main Axis Y
X is target axis (sub/partner axis).
3 Main Axis X
Y is target axis (sub/partner axis).

(1) If the main axis settings between X and Y position data are not matched, the system will choose main axis automatically. It is based on the moving distance: the axis which has longer moving distance becomes the main.

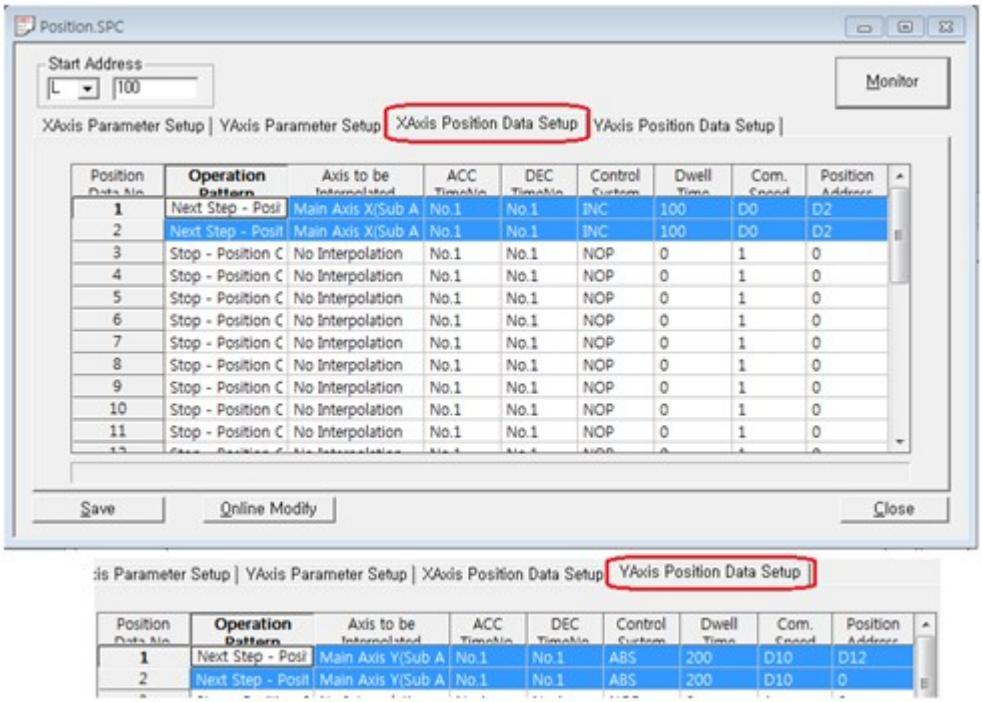
(2) In continuous control, an interpolation axis waits until the other (partner) axis proceeds to the interpolation step. In this case, there is no limit on the waiting time. To escape from the waiting status, use the 긴mergency Stop Req.?control
flag.

(3) In interpolation operation, set values such as speed, dwell time and acc/dec time are taken from the main axis position data set. Only the target position address is effective set in position data of sub axis.

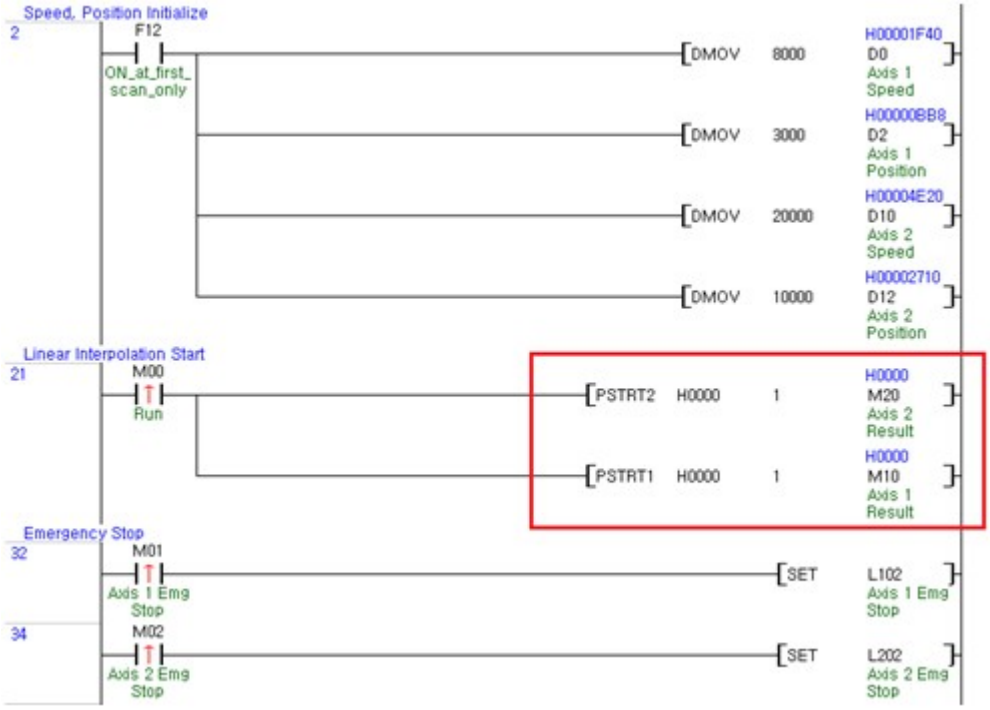
(4) Speed control command is not applicable in interpolation operation. Commands for interpolation operation are restricted to ABS and INC.

(5) Example of Interpolation control:

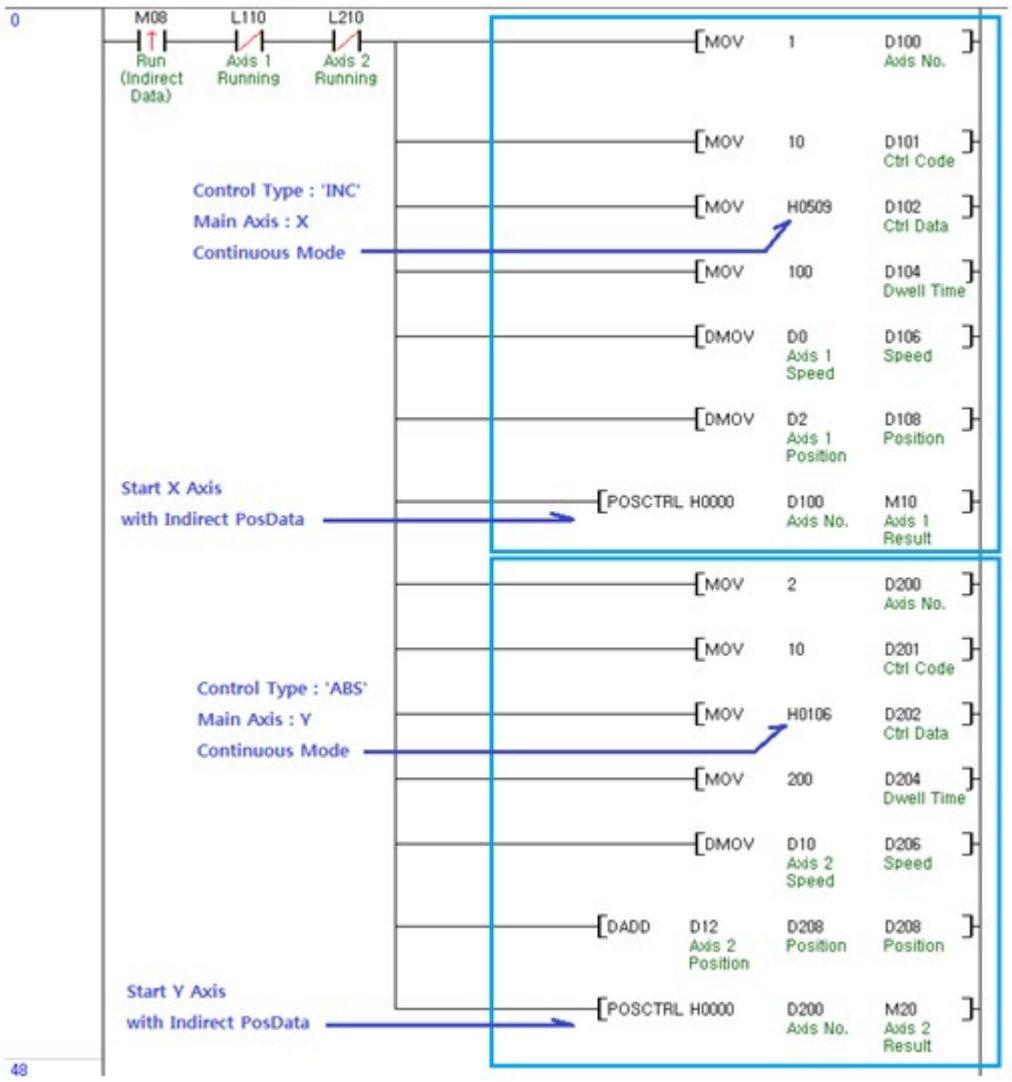
This example uses ‘position data’ table and PSTRTn instructions for interpolation control.



The picture above shows ‘position data’ of X and Y axes. The first and second position data of each axis are configured for interpolation control under continuous mode. PSTRTn instructions are used for triggering those ‘position data’ for interpolation control as shown in the following sequence. Be aware that actual control does not launch until both axes are ready for interpolation. Preceding axis (Y axis in this example) waits until the partner axis (X axis in this example) is ready.



(6) Here is another example which doesn't use the 'position data' but use the indirect table. POSCTRL instruction is used in this case.



8.11.8.3 Acc/Dec Time

Select one of 4 Acc/Dec Time sets in parameter.

8.11.8.4 Control Code (Command)

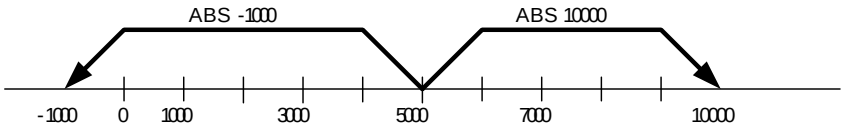
Code		Sym	Function	Remark
Hex	Dec			
00H	0	-	End of position data	Terminates continuous control
01H	1	ABS	Absolute position control	
05H	5	INC	Incremental position control	
09H	9	FEED	Incremental position control after address reset	
13H	19	FSC	Speed control (Forward)	
17H	23	RSC	Speed control (Backward)	

80H	128	NOP	No operation	
81H	129	JUMP	Force to change next step No.	Next step set value is stored in 'target position address'
82H	130	LOOP	The first step of loop	Loop count is stored in 'target position address'
83H	131	LEND	The last step of loop	
84H	132	POS	Force to change the current position address	New address is stored in 'target position address'

8.11.8.4.1 ABS

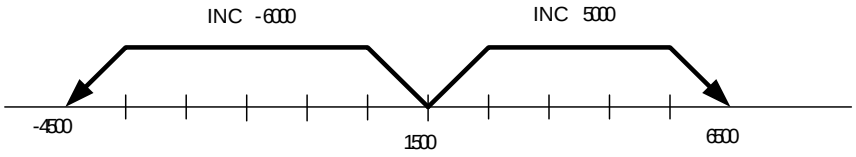
Object moves from start address to target address.
Position control is performed, based on the address designated in home address. Direction is determined by start address and target address.This command is using absolute coordinate which means the target address number is counted from the origin point of coordinate (zero position).

- Start address < target address : forward positioning
- Start address > target address : backward positioning



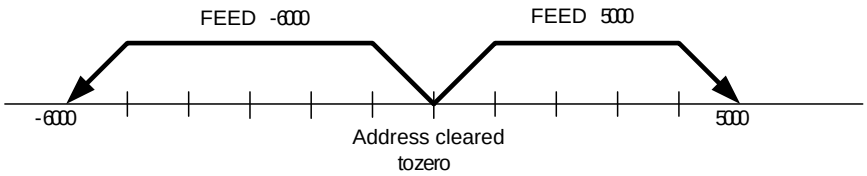
8.11.8.4.2 INC

Object moves from current position as long as the address set in operation data. At this time, target address is based on start address. Direction is determined by sign (+, -).This command is used when the target address. This command is using a relative coordinate which means the target address number is counted from the starting address (present position before operating this command).
- In case address is positive number : forward positioning (direction increasing address)
- In case address is negative number : backward positioning (direction decreasing address)



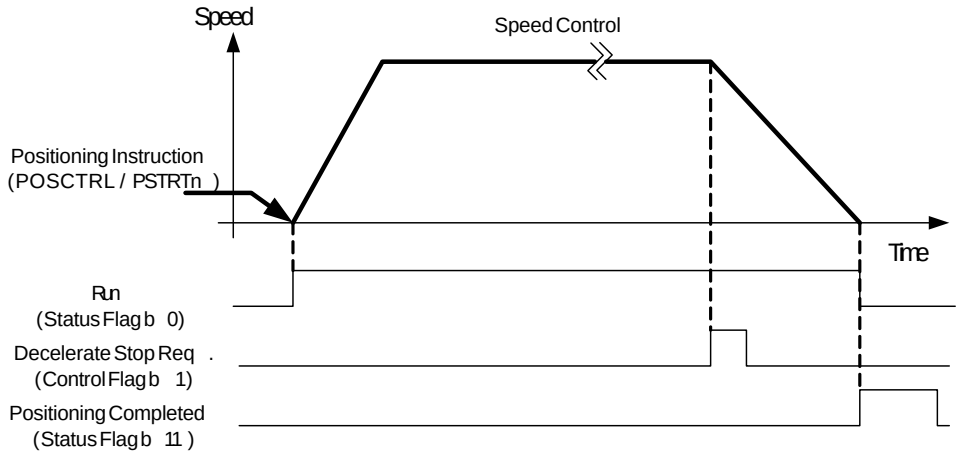
8.11.8.4.3 FEED

Object moves from current position as long as the address set in operation data. Before executing the command, current position address is cleared to zero.



8.11.8.4.4 FSC/RSC

Performs speed control. Speed control outputs designated speed of pulse until the raising of stop request (bit 1, control flag). According to the 'position address under speed control' set in parameter, current position address is cleared/updated or fixed during speed control.



8.11.8.4.5 NOP

No operation is performed.

8.11.8.4.6 JUMP

The JUMP command is used to control the operation so it jumps to a positioning data No. set in the positioning data during 'continuous control'. Using the JUMP command enables repeating of the same positioning control.

8.11.8.4.7 LOOP/LEND

The LOOP command is used for loop control by the repetition of LOOP to LEND. Nesting loop is allowed and LOOP/LEND have to be set as 'continuous control' type.

8.11.8.4.8 POS

Force to change the current position address to a new address. The new address has to be designated in ' target address' field.

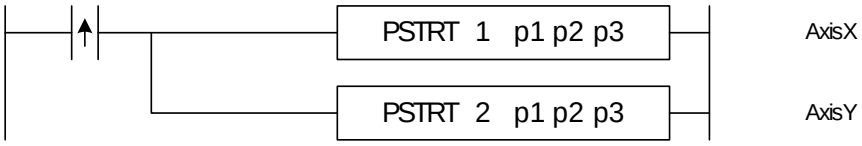
8.11.9 Positioning Instruction

Contents :

- POSCTRL
- TEACHn (n=1 ~ 2)

8.11.9.1 PSTRTn (n=1 ~ 2)

Start the positioning of the designated axis and position data No.



1) p1

Fixed value (0) in case of PLC-S since the CPU is in the 0th slot.

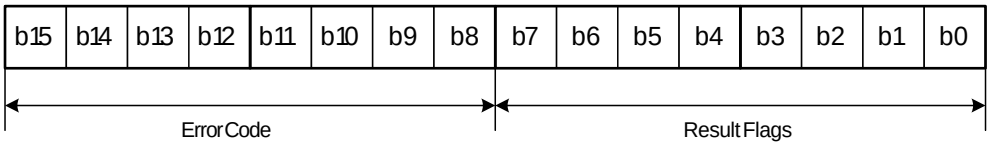
2) p2 (Positioning Data No.)

Positioning data No. to execute.

1. 1~30 : Position data No.
2. 9001 : OPR
3. 9002 : Fast OPR (The axis returns to the zero position address at the OPR high speed without detecting DOG)

3) p3 (Result Flag)

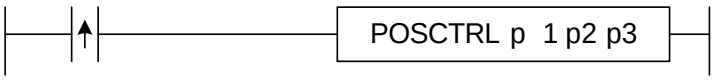
Head address (device memory) where error code (if exist) and result flags to be written. (it must be a word device, for example, M0100)



1. Upper Nibble : Error Code
2. Lower Nibble : Result Flag
   - Bit #0 : Instruction process pending
   - Bit #1 : Completed
   - Bit #2 : Error Occurred (set simultaneously with bit #1)
   - Bit #3~7 : Reserved (0)

8.11.9.2 POSCTRL

Issues positioning commands such as change speed, change target address, etc.



1) p1

Fixed value (0) in case of PLC-S since the CPU is in the 0th slot.

2) p2 (control parameter)

Head address (device memory) where parameters such as axis, command and control parameter are stored.

(p2)	Axis (1. 2)
(p2+1)	Command Code (1, 2, 3, 6)
(p2+2)	Parameter (Lowerword)
(p2+3)	Parameter (Upperword)

Case : command code(p2+1) is not 10

(p2)	Axis (1. 2)
(p2+1)	Command Code (10)
(p2+2) - (p2+9)	Position data (8 words)

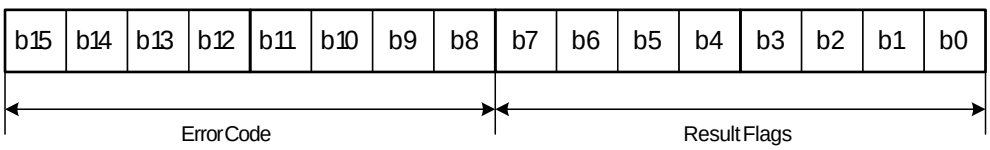
Case : command code(p2+1) is 10

p2 : Axis to control (1..2)
p2+1 : Command Code
p2+2 ~ p2+9 : Parameter

Command		Description
Code	Name	
1	Change current position address	Parameter : a new position address (DWORD) OPR completed flag will be set after this command.
2	Change speed	Parameter : a new speed
3	Inching	Parameter : inching movement (distance), if a negative value was designated, the axis moves backward direction.
6	Change target address	Parameter : a new target address
10	Indirect position data	Parameter : a position data block (8 word size) This data block has the same format with 'Position Data' as described in section 8.

3) p3 (Result Flag)

Head address (device memory) where error code (if exist) and result flags to be written. (it must be a word device, for example, M0100)



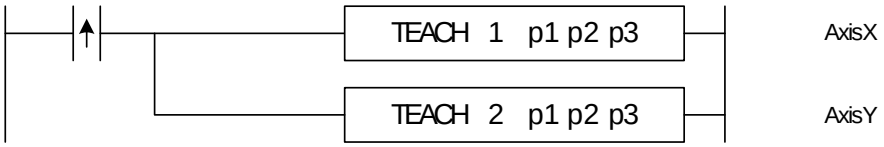
1. Upper Nibble : Error Code

2. Lower Nibble : Result Flag

- Bit #0 : Instruction process pending
- Bit #1 : Completed
- Bit #2 : Error Occurred (set simultaneously with bit #1)
- Bit #3~7 : Reserved (0)

8.11.9.3 TEACHn (n=1 ~ 2)

Change a parameter of position data already defined.

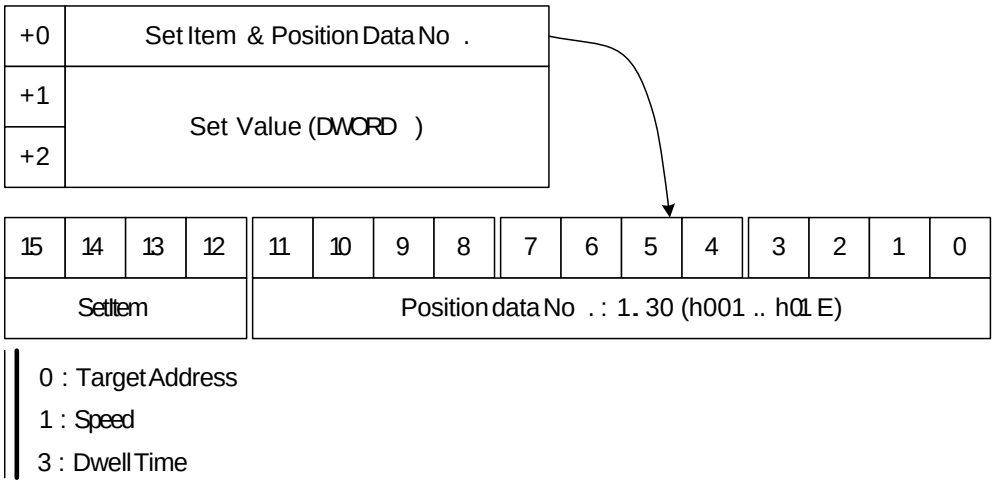


1) p1

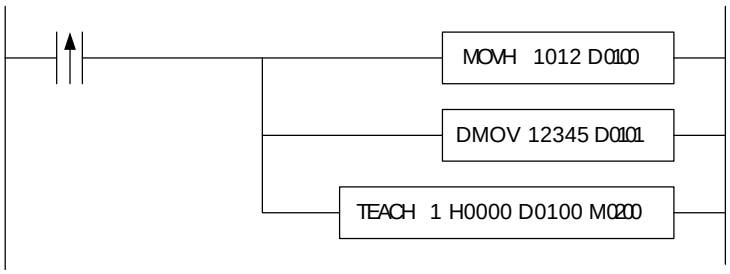
Fixed value (0) in case of PLC-S since the CPU is in the 0th slot.

2) p2

Head address of device memory block with format of as following :



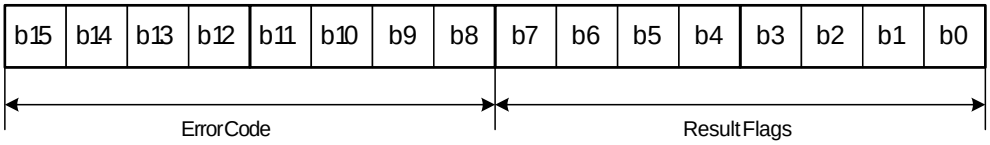
(example) Change the speed set value to 12345 of axis X position data No. 18.



3) p3 (Result Flag)

Head address (device memory) where error code (if exist) and result flags to be written. (it must be a

word device, for example, M0200)



1. Upper Nibble : Error Code
2. Lower Nibble : Result Flag
   - Bit #0 : Instruction process pending
   - Bit #1 : Completed
   - Bit #2 : Error Occurred (set simultaneously with bit #1)
   - Bit #3~7 : Reserved (0)

8.11.10 Error Code

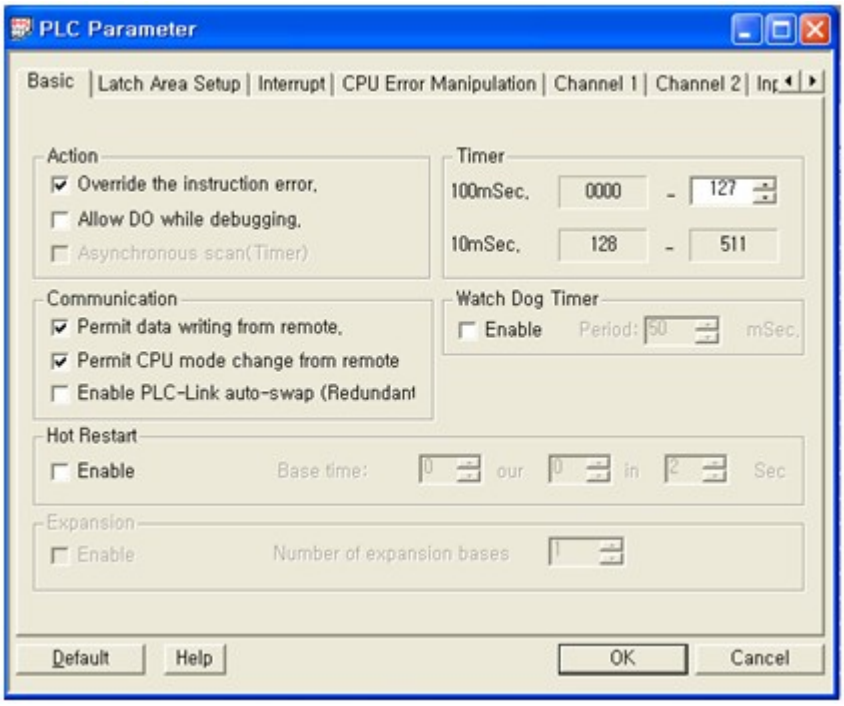
Category	Code	Error Name	Description
-	0	No error	Normal operation status
Common	104	H/W upper limit	Exceeds position limit (H/W upper limit signal detected)
	105	H/W lower limit	Exceeds position limit (H/W lower limit signal detected)
	154	S/W upper limit	Exceeds S/W position upper limit
	155	S/W lower limit	Exceeds S/W position lower limit
	156	Emergency Stop	Positioning control is denied.(Emergency stop signal is ON.)
OPR	202	OPR required	Home position is not decided. Cannot execute positioning control.
	203	No DOG signal	Exceeds DOG signal input time limit (30 seconds) during OPR operation.
Manual	300	JOG/Inching fault	JOG/Inching command/input is executed while other positioning control is under operation.
Positioning	519	Interpolation fault	Partner axis is busy with non-interpolation operation.
	550	Position address change fault	A command to change current position address is issued while the axis is under operation.
	551	Speed change fault	A command to change current speed is issued while the axis in stop or dwell.
	552	Target address change fault	A command to change target address is issued while the axis in stop or dwell.
	553	Duplicated position control	Another position control command is issued while the axis is under operation.
	554	Online edit fault	Online program edit/modify is performed while axis are under operation.

8.12 PLCS Parameter Settings

Contents :

8.12.1 Basic Settings

On the project window, [Parameter] ->double click [PLC Parameter]



1.Action

- Override the instruction error : If this option is selected, PLC will run normally although arithmetic overflow or arithmetic error occurs. (Basic setting : used)
- Allow DO while debugging :It is used to decide to output data to output module with debugging or just change inner data without output. (basic setting : not used)

2.Timer

This option is for setting up time range when timer instruction used.
If user sets up timer as above, timer device of T0000~T0127 will be 100ms and T0127~T0511 will be 10ms.
If 100ms area set up 0~-1, whole timer area will be 10ms.
Once 100ms sets up, 10ms will be automatically set up rest area except 100ms area.

3.Communication

This option is for comm. Set up if PLC is connected with other device through Comm. Module.

- Permit data writing from remote : This option is used to change device value of CPU memory through communication connection. If this option is not selected, only reading device data is available. (Basic setting : used)
- Permit CPU mode change from remote : This option is used to change mode of CPU(RUN/STOP) (Basic setting : used)
- Enable PLC-Link auto-swap(Redundant) : This option is for only Redundancy configuration. In case that communication is disconnected with current PLC, another PLC will be connected automatically. (Basic setting : not used)

4.Watch Dog Timer

This option is used to specify the time value (from 10ms up to 60,000ms by 10ms) of the scan watch-dog timer to keep PLC from stopping due to program error.
In case that scan time becomes longer than fixed WDT value, CPU will be reset. (Basic setting : not used)

5.Hot Restart

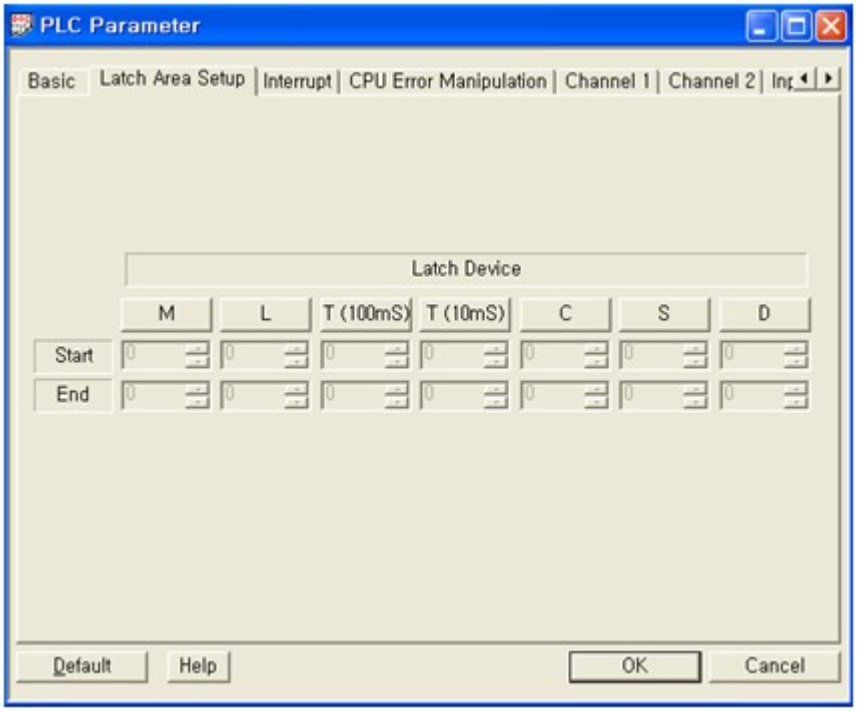
When power is supplied again in fixed time, this option makes Hot Restart initial program run after that, main scan program run. (Basic setting : not used)

6.Expanstion (PLC-S is exception)

This option is used to specify expansion.
When expansion is used, user can decide number of expansion bases. (Basic setting : not used)

8.12.2 Latch Area Setup

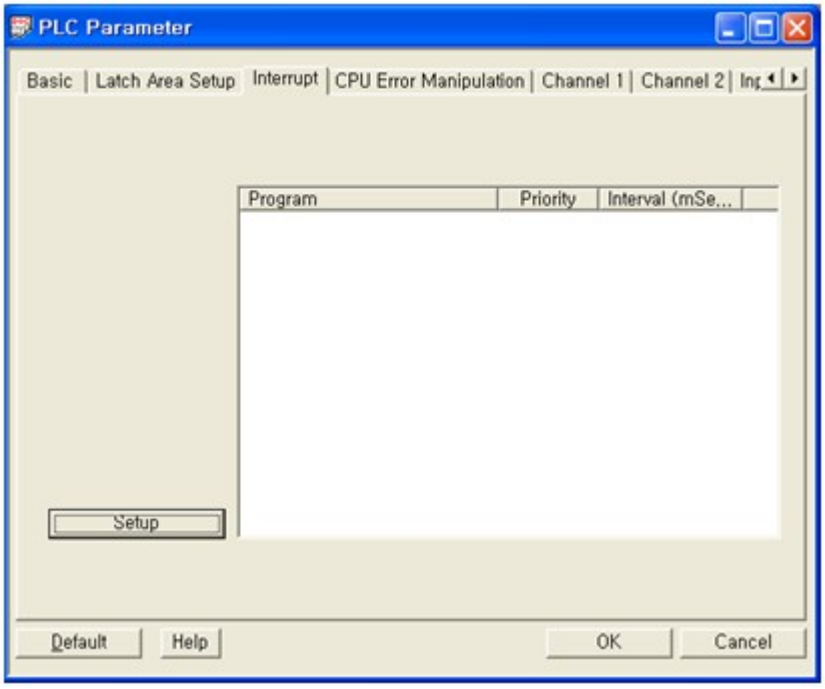
On the project window, [Parameter] ->double click [PLC Parameter] -> [Latch Area Setup]



- It is used to specify the fixed area to preserve current device data although power is off or mode is changed (Stop -> Run, Run -> Stop)
- Once latch area set up, data is maintained as last status when power on again.
- The range of Latch area depends on CPU types.
- The users can set up whole device memory as latch area.
- "K" device area provides latch area basically.
- Click to use the respective device and to select the area.

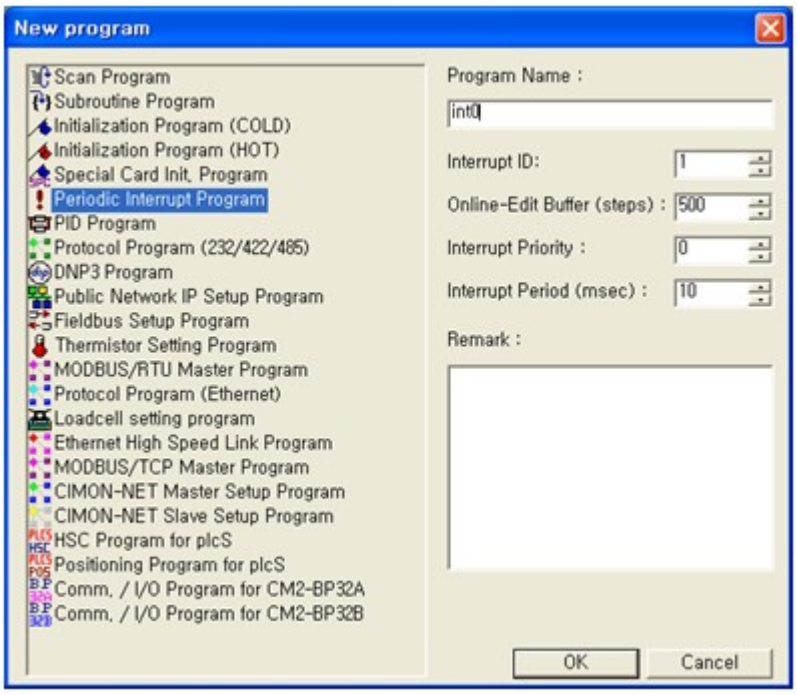
8.12.3 Interrupt

On the project window, [Parameter] ->double click [PLC Parameter] -> [Interrupt]



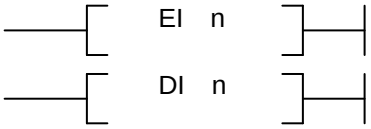
This option is used to decide Priority through fixed interval interrupt.

***This interrupt function can be used by adding the [Periodic Interrupt Program] in New Program.**



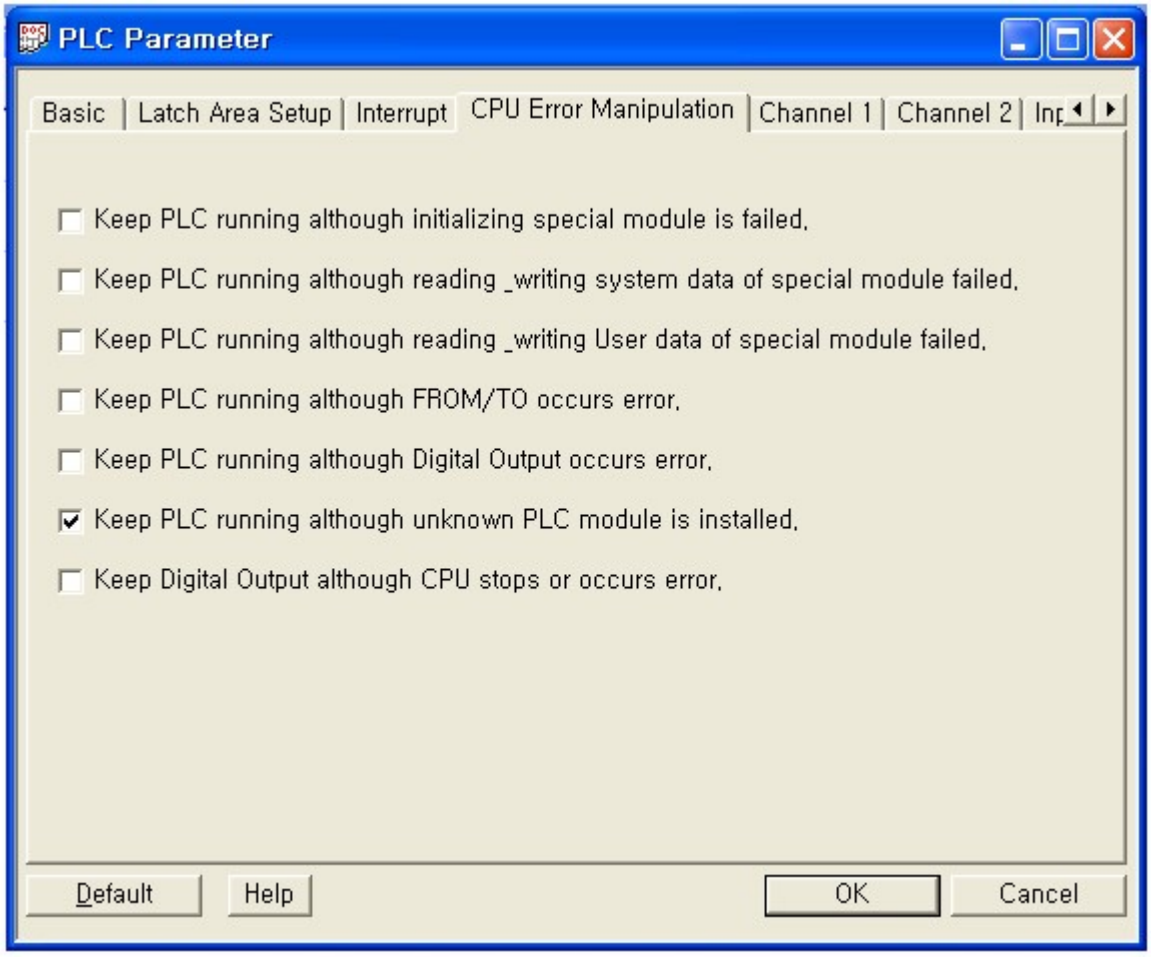
- Interrupt program is operated based on fixed interval.
- No.0 higher in the list has the highest priority.
- Setting range 10ms ~ 655,350ms

Interrupt instruction.

Instruction	Symbol	Function
EI DI		Allow interrupt (by channel) Allow interrupt (by channel)
GEI GDI		Allow interrupt (by channel) Allow interrupt (by channel)
IRET		Terminate Interrupt program

8.12.4 CPU Error Manipulation

On the project window, [Parameter] ->double click [PLC Parameter] -> [CPU Error Manipulation]



1.Keep PLC running although initializing special module is failed

This option is used to decide to continue the PLC operation when initializing special module is failed.
Initialization : it refers to process which reads settings automatically to be normal status when power on.
Initialization lead-time : in 2 sec.
When initialization is failed, LED will be blinking and normal operation is not possible.
(Basic setting : not used)

2.Keep PLC running although reading & writing system data of special module failed.

This option is used to decide to continue the PLC operation when reading and writing system data of special module are failed.
System Data : It refers to I/O area which designates settings and functions of special module.
(Basic setting : not used)

3.Keep PLC running although reading & writing User data of special module failed.

This option is used to decide to continue the PLC operation when reading and writing user data of special module are failed.

User Data : it refers to measured data or will be measured data area by special module.
Measured data can be read through user data.
(Basic setting : not used)

4.Keep PLC running although FROM/TO occurs error.

This option is used to decide to continue the PLC operation when FROM/TO of special module occurs error.
FROM/TO : it refers to instruction which reads(FROM) and writes(TO) value of special module.
(Basic setting : not used)

5.Keep PLC running although Digital Output occurs error.

This option is used to decide to continue the PLC operation when Digital Output occurs error.
DO : Digital Output
There are Relay, SSR and TR output and 8, 16 and 32 points modules
(Basic setting : not used)

6.Keep PLC running although unknown PLC module is installed.

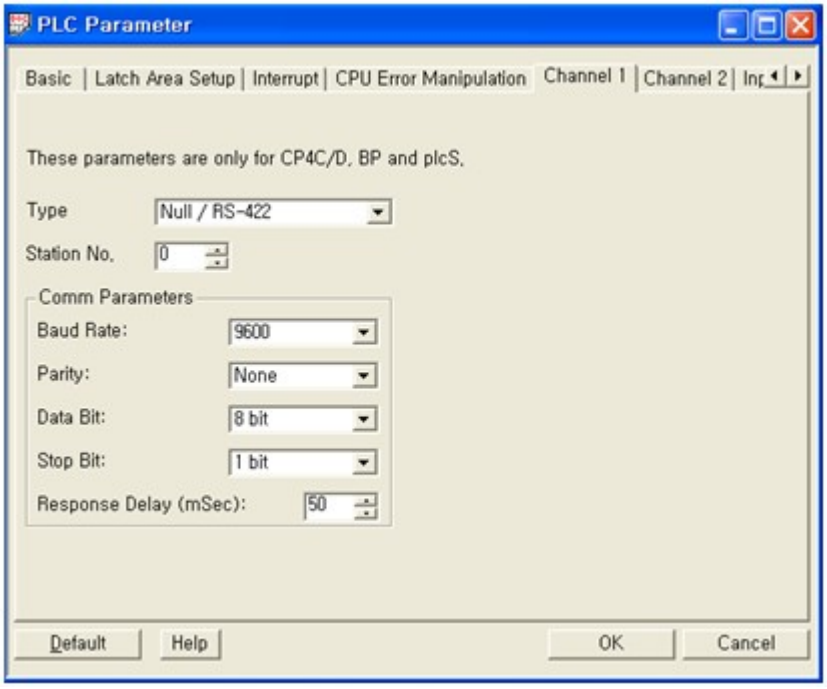
This option is used to decide to continue the PLC operation when unknown PLC module is installed.
Unknown PLC module : it refers to PLC which CPU does not recognize.
In this case, CPU module needs to be firmware (OS) upgraded.
(Basic setting : used)

7.Keep Digital Output although CPU stops or occurs error.

This option is used to decide to continue Digital Output when CPU stops or occurs error.
If this option is selected, final Digital Output status will be maintained although CPU stops or occurs error.
(Basic setting : not used)

8.12.5 Communication

On the project window, [Parameter] ->double click [PLC Parameter] -> [Channel 1]



Basically, PLCS CPU module has RS232C. (Option Comm. Port : RS485, Ethernet)
1Channel : RS232C, 2Channel : RS485C

CICON LOADER PROTOCOL
HMI PROTOCOL
MODBUS RTU SLAVE PROTOCOL
MODBUS RTU MASTER PROTOCOL(Special program)
User Protocol (Special program) (only MDT-P model).

Communication Setting.

CICON LOADER PROTOCOL

supports RS232C(Ch1), RS485(Ch2), Ethernet communication and USB port.
Ch1 & Ch2 : if the value of Baud rate, parity, Data Bit and Stop Bit are the same with other devices, it will communicate as SLAVE Model.
Ethernet : IP setting must be the same with other devices.
USB Port : USB device (2.0)driver has to be installed. You can find out USB Driver in USB DRIVER folder in CICON.

HMI PROTOCOL

HMI PROTOCOL supports Ch1, Ch2 and Ethernet communication.
Ch1 & Ch2 : if the value of Baud rate, parity, Data Bit and Stop Bit are the same with other devices, it will communicate as SLAVE Model.

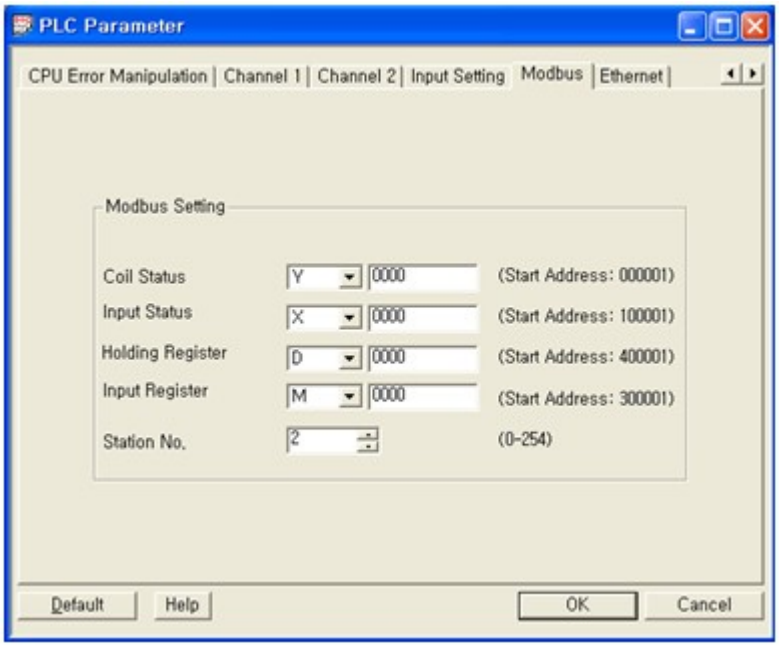
Ethernet : IP setting must be the same with other devices.

MODBUS RTU SLAVE PROTOCOL

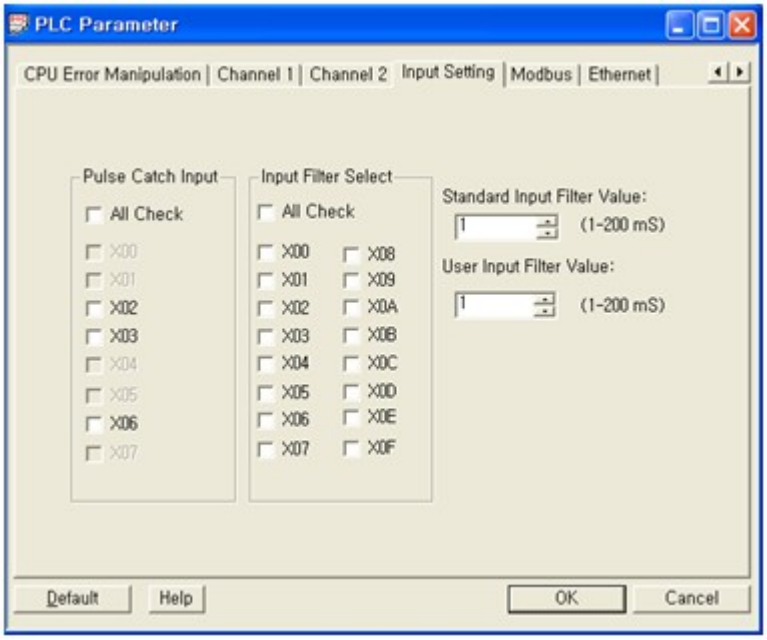
MODBIS RTU SLAVE PROTOCOL supports Ch1, Ch2 and Ethernet communication when MODBUS RTU MASTER in connected with.

Ch1 & Ch2 : if the value of Baud rate, parity, Data Bit and Stop Bit are the same with other devices, it will communicate as SLAVE Model.

Ethernet : IP setting must be the same with other devices.



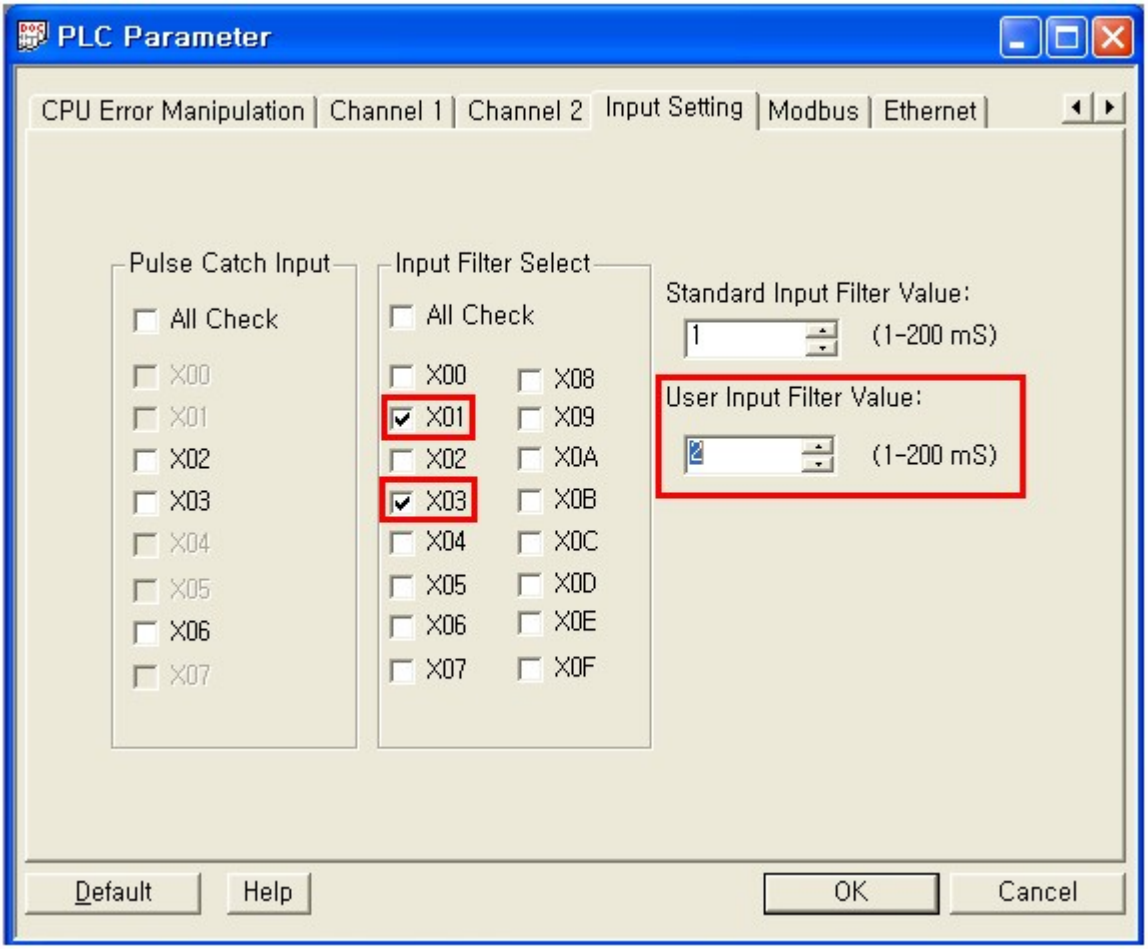
8.12.6 Input Setting



1. Pulse Catch Input : Select Input point that will be High Speed Counter.
2. Input Filter Select : Digital Input Filter value settings.

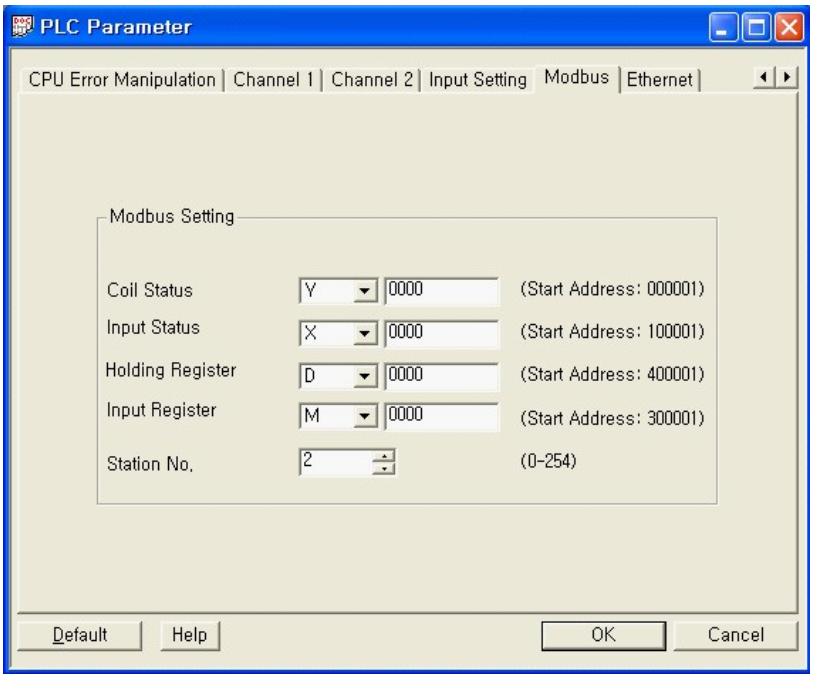
   You can set up User Input Filter Value through selecting input points as below:

   Other inputs which are not selected will be setup by Standard Input Filter Value.



8.12.7 Modbus

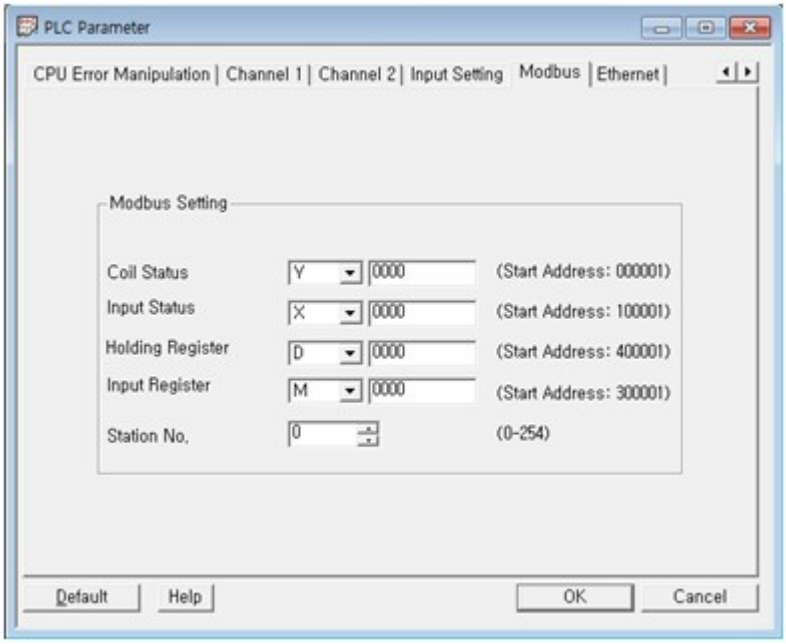
On the project window, [Parameter] -> double click [PLC Parameter]



1. Coli Status : Select starting address of Coil Status(Bit Type)
2. Input Status : Select starting address of Input Status(Bit Type / Read Only)
3. Holding Register : Select starting address of Holding Register(Word Type)
4. Input Register : Select starting address of Input Register (Word Type)
5. Station No. : Select Station Address which will be in Comm. protocol.

8.12.8 Ethernet Settings

For details see "**Click**"



8.12.9 PLC Link

1. Summary

The PLC Link function is used to exchange high baud rate and large capacity data between CIMON-PLCs through Ethernet Comm. module. Device address, word size, periods and etc. are setup by PLC Link parameter.

- Features
  1. Max. 64 Blocks(Send 32 / Receive 32) can be set up for each Comm. modules.

Link Points

Max. Comm. Points	Max. Sending Points	Max. Block Points	Max. Points per Block
4,096	2,048	64(0~63)	64

Max. 64words for Block can be sent.

2. Interval period can be set up in the range from 50ms to 3sec.
3. Device address and word size can be set up to send and receive data.

2. PLC Link (Send / Receive)

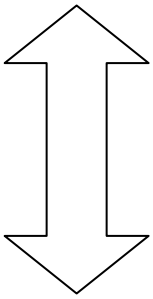
Example of Data process in case of Send and Receive

- Send: Interval period, device address and word size should be set up.
- Receive: Station number and Block number should be set up.

Ex) Station"0" send 10 words from D00000 and Station "1" receive D00000 and save it to Y0000.

Sender (Station : 0)

Type	Block No.	Period	Address	Size
Sender	0	100ms	D0000	10 Word



Receiver (Station : 1)

Type	Station No.	Block No.	Address	Size
Receiver	0	0	Y0000	4 Word

The Station number and Block number of each Station 1 and 2 are set up as the same number. In this case, Station 1 PLC can receive data from Station0 PLC by 100ms. Station0 PLC send 10 words but Station1 PLC will receive only 4 words. (Receiver's word size must be the same with sender's or less than sender's.

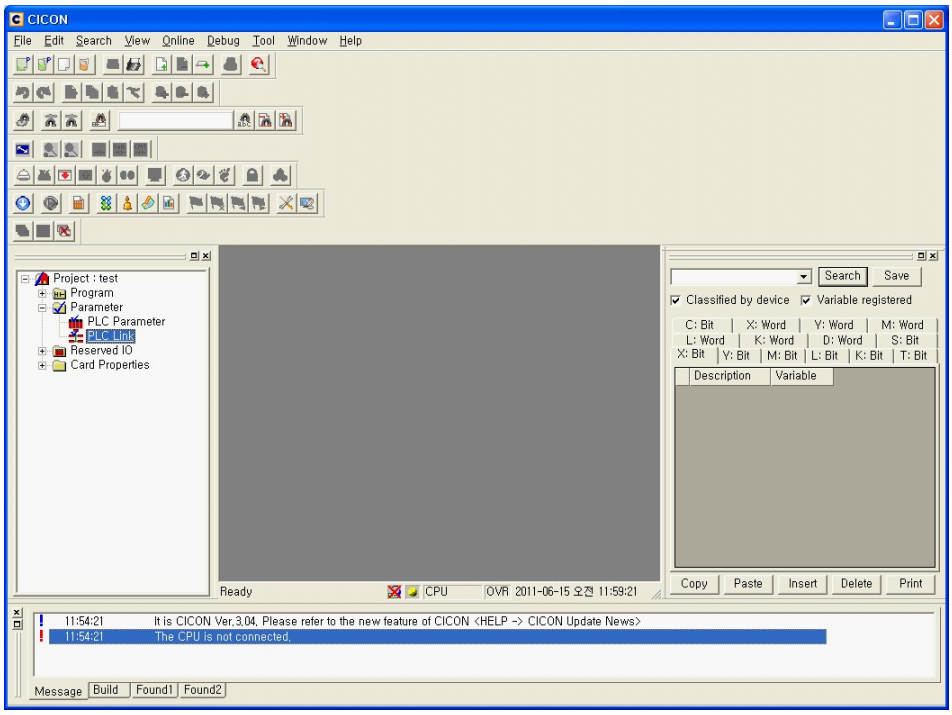
3. PLC Link Parameter

- **Parameter settings for PLC Link**

  In order to exchange data between Comm. modules, [PLC Link] is executed first to setup parameter.

  1.Open Project

  Open project



[Parameter] -> [PLC Link]

- **Parameter Settings for PLC Link**

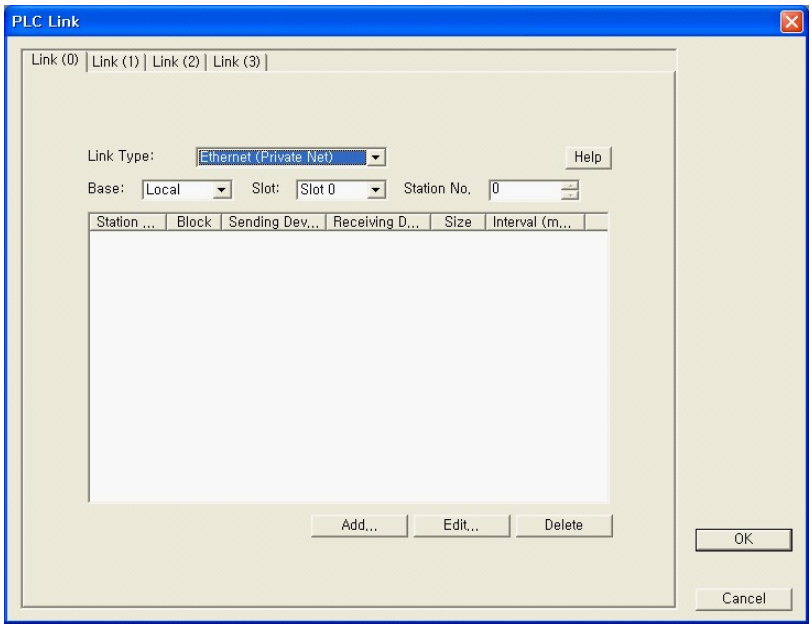
1. PLC Link :

Max. 4 Comm. Module can be installed at CPU module for PLC Link. In order to use PLC Link, each Link will be setup as below Picture 6-2.

2.PLC Link Type settings :

There are 4 basic settings such as Link Type, Base, Slot and Station No.

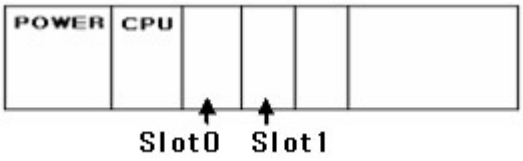
- Link Type : Select Comm. module for PLC Link. If you do not want to use PLC Link, select "Not Used".



- **Base** : Select the Base where Comm. module is installed for PLC Link. If Comm. module is installed with CPU base, select "Local" Otherwise, select expansion Number where Comm. module is installed.

Location where Comm. module installed	Base
CPU Base	Local
Expansion 1 Base(Expansion Switch 0)	Expansion 1
Expansion 15 Base(Expansion Switch 15)	Expansion 16

- Slot : Select slot number where Comm. module is installed.

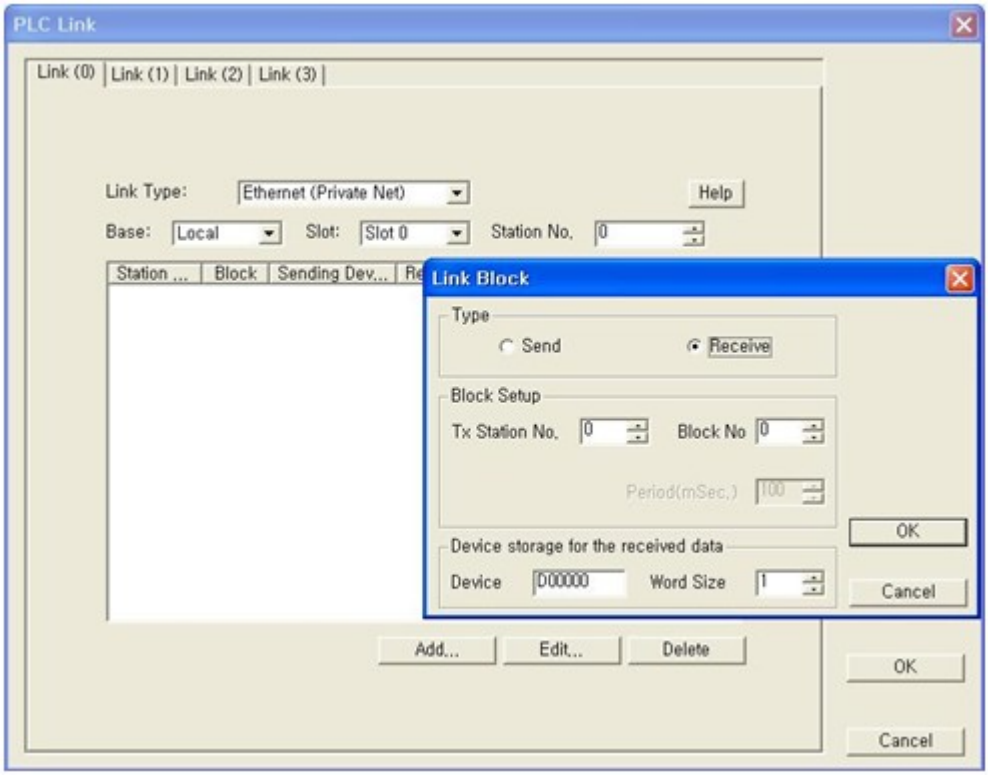


3. PLC Link Block Settings :

This function is used to set up information of sender and receiver's real data.

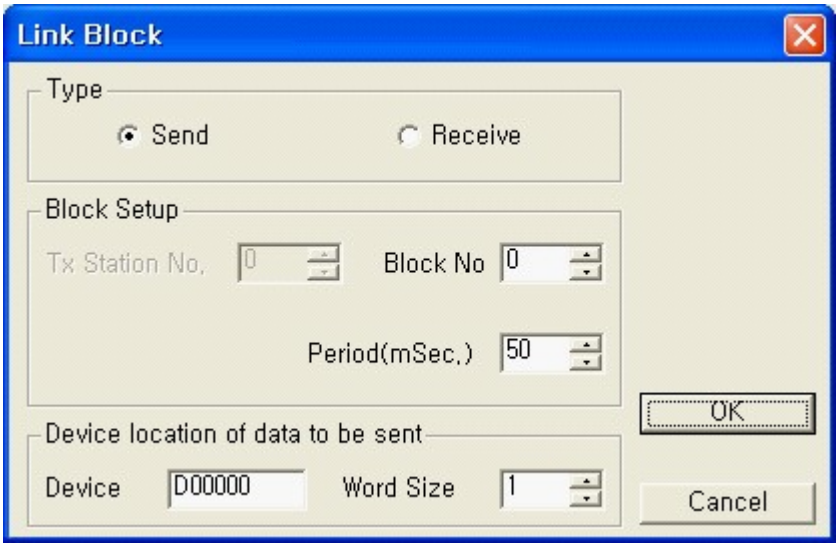
[PLC Link] -> [Link Type : Ethernet(Private Net)] -> [Add] -> [Link Block]

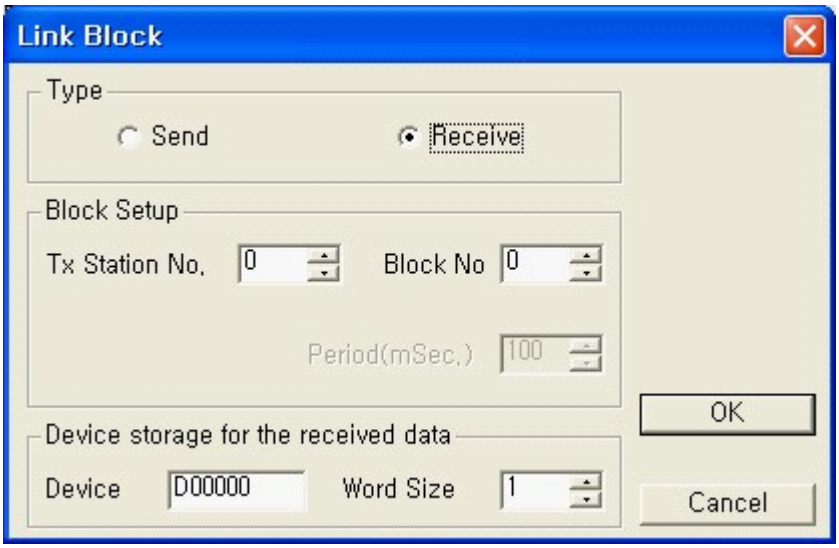
Link Block will be appeared as Picture.



Type -> Send : It is used to send chosen block.

Type -> Receive : It is used to receive chosen block.





- Tx Station No.

In case of Send Type : No need to set up

In case of Receive Type: Select Station Number to be received from 0 to 63.

- Block No. : In order to make a communication between PLCs, Block number (from 0 to 31) must be setup and each Block number of Send and Receive must be the same.

- Period : This function is used to set up interval period for sending data. It can be set up from 50msec to 3sec. if interval period is set up as 50msec, PLC will send data by every 50msec.

- Device Address :

1. Send: Select device address where data will be sent.
2. Receive: Select device address where data will be saved.

- Size : Size refers to data size and it can be set up from 1 to 64words. Sender's data size must be the same with Receiver's size or bigger than Receiver's size.

Size of Sender and Receiver	Size to be saved
Sender > Receiver	Saved as Receiver's size
Sender < Receiver	Saved as Sender's size

Ex) Station1 sends Block 0,1,2 and 3 and receive Block 4,5,6 and 7.

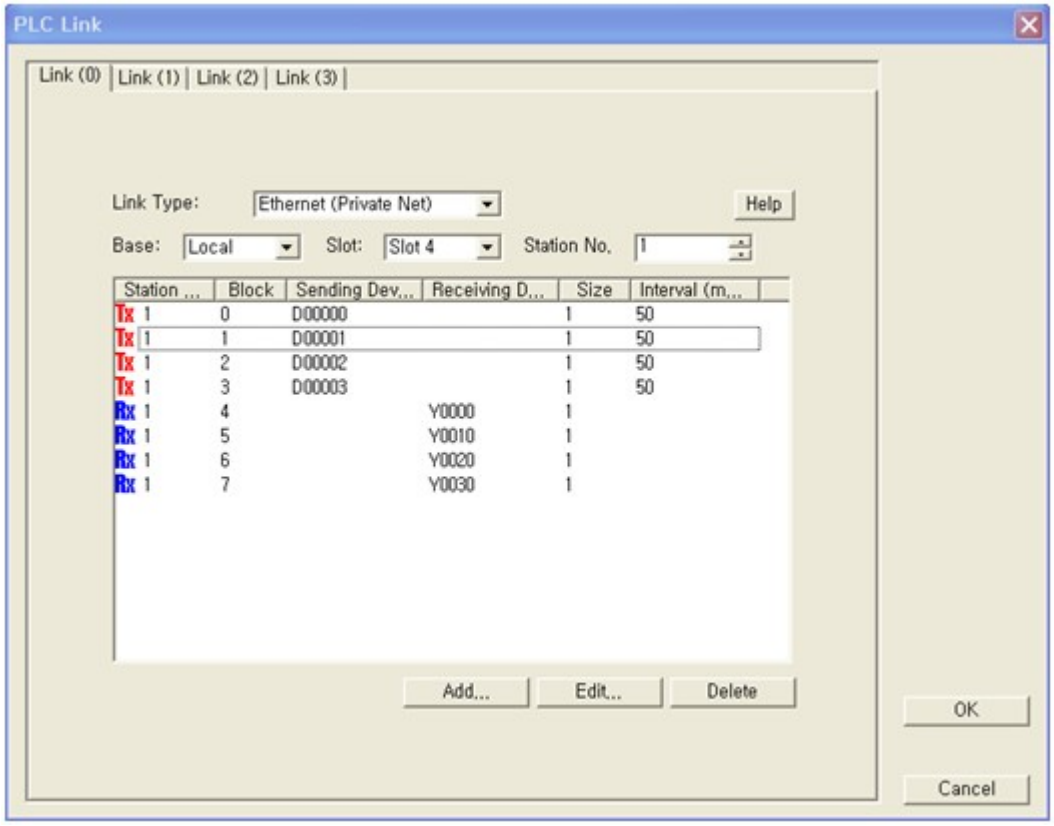
Station 2 sends 4,5,6 and 7 and receive 0,1,2 and 3.

Ethernet module is installed at Slot 4.

Each data size is 1 Word and period is 50msec each.

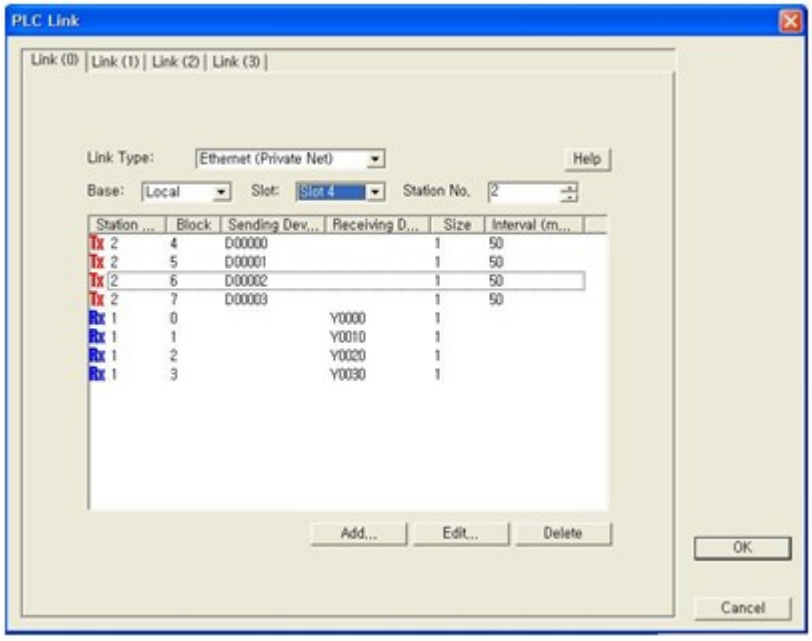
Here is the sample parameter.

1. Station 1.



Station 1 send D00000~D00003 by 1word. If Station and Block number of Receiver is matched with Sender's one, Y0000~Y0030 will be saved.

2. Station 2



Station 2 sends Block 4,5,6 and 7 and Station 1 will compare Station and Block number and receive data. Station 2 receives Y0000~Y0030 after comparing Station and Block number.

Top Level Intro

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top-level chapter starts

Part

9 Remote I/O(Rio)

- Real time integrated input / output control
- Various I/O type supports - DC input 16/32 points, TR output 16/32 points, and relay output 16 points
- Enable to cannot up to 99 station
- Help to reduce installation and maintenance cost
- Compatible with other Manufacture's master with CIMON remote-IO
- International standard communication protocol (Profibus DP) selected open network intended use.
- Provide various system structure convenient system maintenance and system repair.
- To be able to select country code with hardware, system setup is processed more conveniently.
- Simple structure & simple to use due to its unify body - CPU, POWER, Input / Output, and communication ability unified into one module
- Monitoring far distanced module's communication status with monitor.
- Supports high speed communication (Max 12 Mbps)
- Master speed governs speed of other units.

Module Name	Type	Specification
RP-XD16A	Profibus DP	DC24V 16 points : Photo coupler insulation
RP-XD32A		DC24V 32 points : Photo coupler insulation
RP-YR16A		Relay 16 points.
RP-YT16A		Transistor SINK Output 16 points : 0.5Amp : Photo coupler Insulation
RP-YT32A		Transistor SINK Output 32 points : 0.5Amp : Photo coupler Insulation
RP-XY32DT		I/O Hybrid (DC24V 16 Points : TR output 16 points)

Communication Specification

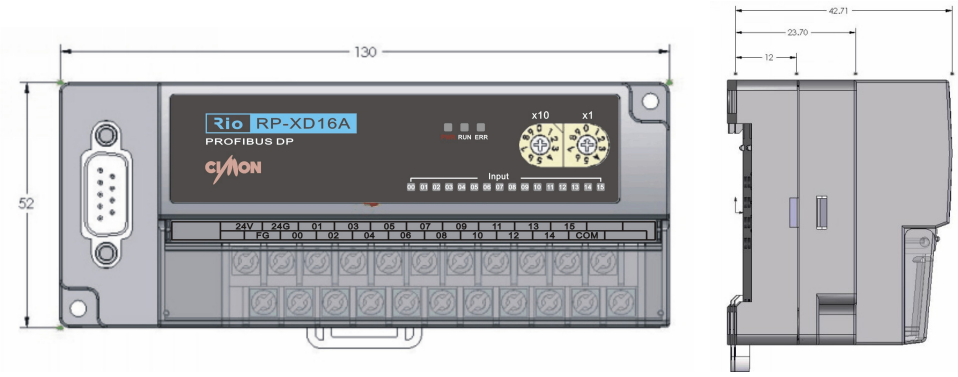
Network	Profibus - DP
Media Access	Logical Token Ring
Communication Method	RS-485 (Electric)
Topology	BUS

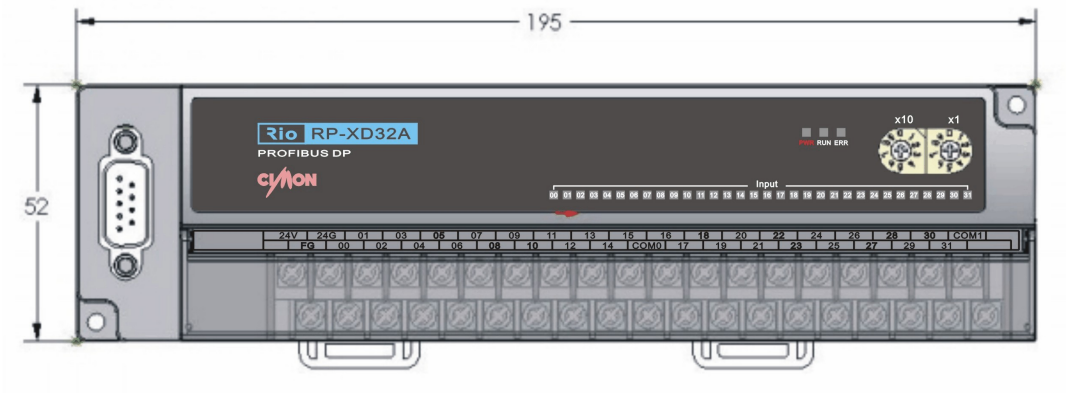
Modulation Method	NRZ
Communication Cable	Shielded Twisted Pair
Transmission distance	1200m(9.6K ~ 187 Kbps)
	400m(500Kbps)
	200m(1.5Mbps)
	100m(3M ~ 12Mbps)
No. of Nodes / Network	99 Station
No. of Nodes / Segment	32 Station

General Specification

Model		Input		Output			Input / Output	
		DC (Sink/Source)		Transistor (Sink)		Relay	DC (Sink/Source)	Transistor (Sink)
Point		16	32	16	32	16	16	16
Rated Input (Load Voltage)		DC24V		DC24V		DC24V/ AC110V/220V	DC24V	DC24V
Rated Input (Load Current)		7mA		0.5A/4A		2A/5A	7mA	0.5A/4A
Respons e Time	Off->On	3ms or less		2ms or less		10ms or less	3ms or less	2ms or less
	On->Off	3ms or less		2ms or less		5ms or less	3ms or less	2ms or less
Common		16points/Com		16 Points/Com		8 Points/Com	16 Points/Com	

Dimensions





Top Level Intro

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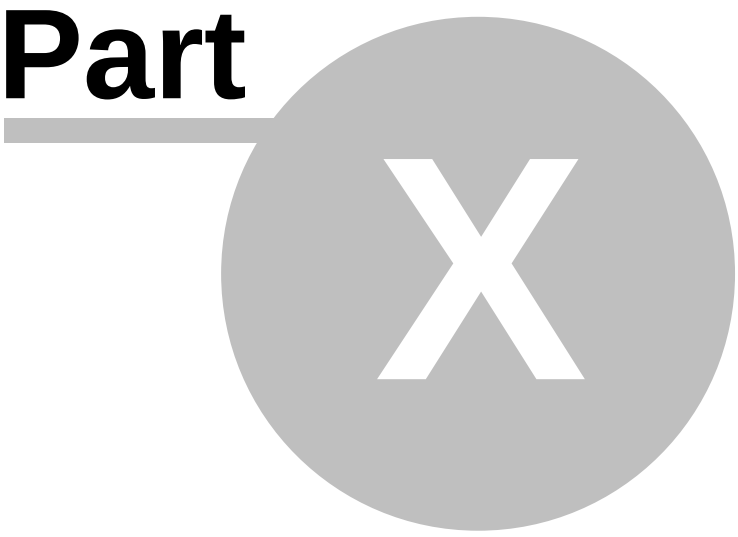


10 Training Kit

Contents :

10.1 PEK - 308

Contents :

10.1.1 Summary

Contents :

10.1.1.1 Training Objectives

1. To understand the basic knowledge and applications of PLC
2. To practice PLC operations with an user interface(XPANEL)
3. To improve a field of use for trainees
4. To learn about Data Link System between PLC<->PLC
5. To master PLC application command skills
6. To improve Xpanel designing skills
7. To be able to configure a combined controlling system
8. To acquire controlling ability of analog signals
9. To understand RS 232C/RS 422/RS 485 configurations
10. To master the capability to configure fields surveillance controlling and acquire management ability

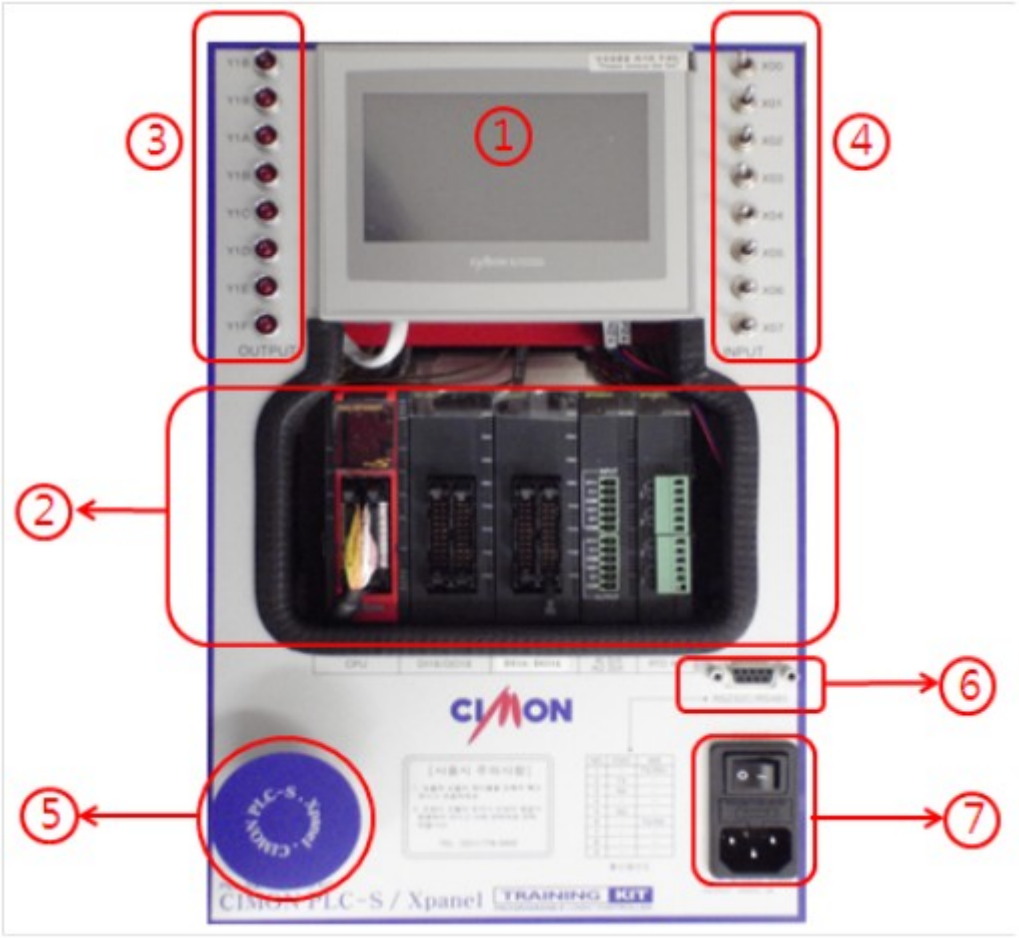
10.1.1.2 PEK - 308 Training Kit Features

1. This is a multi-functional module type PLC training kit.
2. With CICON (loader program), practicing many different types of advanced command is possible: modify

while running, force input/output, reset program and etc.

3. By using Xpanel, users can learn about connections between PLC and MMI.
4. Toggle switches are included for program simulations using LED output lamps and a display device.
5. PID control is possible by using analog module
6. Positioning control exercise is possible by using an already-installed servo driver and a stepping motor
7. Easy connection to a HMI device for a remote controlling and monitoring.
8. Since the system is built with an optimal I/O point with different module types in mind, the user can easily improve adaptive programming skills used in various fields

10.1.2 Overview



1. XPANEL : XT04CB
2. PLCS : CM3-SP32MDT, SP32EDT, SP32EDT, SP04EAA, SP04ERO
3. LED Lamp Outputs Y0010 ~ Y001F
4. Digital S/W Inputs X0000 ~ X000F
5. STEPPING MOTOR
6. Serial Port
    - RS232 1port : HMI Protocol, 19200, N, 8, 1

- RS485 1port : HMI Protocol, 19200, N, 8, 1

7. (90~240V) Power Input

10.1.3 Features and Specifications

Contents :

10.1.3.1 PLCS

Contents :

10.1.3.1.1 PLCS Specifications

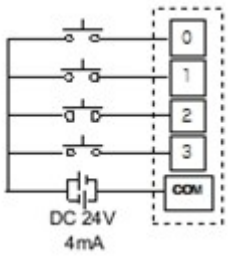
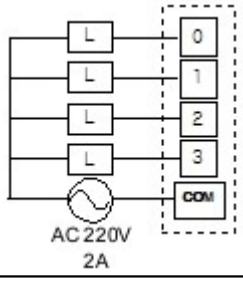
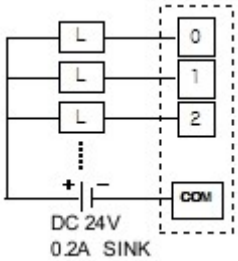
Contents :

10.1.3.1.1.1 CPU : CM3-SP32MDTF

Contents		Specifications
Power		DC24V
Program Control Type		Stored Program, Iterative Operation, Time Driven Interrupt
I/O Control Type		Indirect Type, Direct Type by instructions
Programming Language		IL(Instruction List), LD(Ladder Diagram)
Data Process		32 Bit
Instructions	Sequence	55 Instruction
	Application	389 Instruction
Processing Rate		200ns / Step
Program Memory Capacity		10K Step
Maximum I/O/ Maximum Expansion		384 pts / 1 main Block + Max. 11 Block
Drive Mode		Run, Stop, Remote Run, Remote Stop
Data during Power Outage		Variable data can be Retained
Number of Program Blocks		128
Program Type	Scan	127 (number of program blocks that are used in a task)
	Period	16
	Special	126
	Initial	2 (_INIT,_H_INIT)
	Sub Routine	126
Self-diagnosis Function		Operation Delay Monitoring ,Memory Error, I/O Error ,Battery/Power Error
Restart Function		Cold/Hot Restart
Device Memory Capacity	X	1024 pts (X0000 – X063F)
	Y	1024 pts (Y0000 – Y063F)
	M	8192 pts (M0000 – M511F)
	L	4096 pts (L0000 – L255F)
	K	4096 pts (K0000 – K255F)
	F	2048 pts (F0000 – F127F)
	T	512 pts (T0000 – T0511)
	C	512 pts (C0000 – C0511)
	S	100 states x 100 set (00.00 - 99.99)

	D	10000 words (D0000 - D9999)
	Z	1024 words (Call Stack : Z0000 - Z0063, Z1000 - Z1063)
	R	16 pts (Index)
High Speed Counter		20Kpps, 2 Phase 2Ch.
Position Determination		Max. 100Kpps, 2 Axis, Linear interpolation
PID		32 Channels, Auto-Tuning
RTC		Embedded (Battery CR2032 Backup)
Networking Channel		Standard : USB Loader, Serial 1(RS232C) Optional : Serial 1Ch(RS485), Ethernet 1Ch
Etc.		Minimum 3years of life expectancy

10.1.3.1.1.2 Digital Input Expansion Module : CM3-SP32EDT

Type	DC Input CM3-SP32EDT	Relay Output CM3-SP16EOR	Transistor Output CM3-SP32EDT
Rated I/O Voltage	DC 24V	AC 220V / DC 24V	DC 12V / 24V
Rated I/O Current	4mA	1pt 2A / COM 5A	1pt 0.2A, COM 2A
On Voltage/Current	DC19V / 3mA	N/A	N/A
Off Voltage/Current	DC6V / 1mA	N/A	N/A
Response Time	Less than 3ms	Less than 10ms	Less than 1ms
Indication Lamp	LED Turns On When ON	LED Turns On when ON	ON시 LED 점등
Insulation Method	Photo coupler insulation	Relay insulation	Photo coupler insulation
Input Method	SINK/SRC compatible	N/A	N/A
Output Method	N/A	Relay	Sink
Circuits			

10.1.3.1.1.3 Analog I/O Expansion Module : CM3-SP04EAA

Analog Input

Contents	Spec
Analog Input Points	2pts
Analog Input	Electric Voltage: 0V ~ +5V, 1V ~ +5V, 0V ~ +10V. -10V ~ +10V

		Electric Current : 0~20mA, 4~20mA
Input Resolution		14bit, 0~16000 16bit, 0~64000 Configure by Software
Accuracy		± 0.1% (Full Scale)
Conversion Speed		2.1ms / 1ch
Max Input		±12V ±25mA
Insulation Method		Input Circuit: Photo Coupler insulation Each Channel : non-insulation
Occupation Method		16pts
External Power Supply		DC 24V
Connection Terminal		12pts Terminal
Current consumption (mA)	Internal	@DC24V, 15mA
	External	@DC24V, 70mA

Analog Output

Contents		Spec
Analog Output Points		2Pts
Analog Output		Electric Voltage: 0V ~ +5V, 1V ~ +5V, 0V ~ +10V. -10V ~ +10V Electric Current: 0~20mA, 4~20mA
Output Configuration Method		Software Configuration
Digital Input		14bit, 0~16000 16bit, 0~64000 Software Configuration
Accuracy		± 0.1% (Full Scale)
Conversion Speed		10ms
Max Output		±12V 24mA
Insulation Method		Input Circuit: Photo Coupler Insulation
External Power Supply		DC 24V
Occupation Method		16pts
Connection Terminal		12pts Terminal
Internal current consumption (mA)	Internal	@DC24V, 15mA
	External	@DC24V, 70mA

10.1.3.1.1.4 RTD Thermometer Module : CM3-SP04ERO

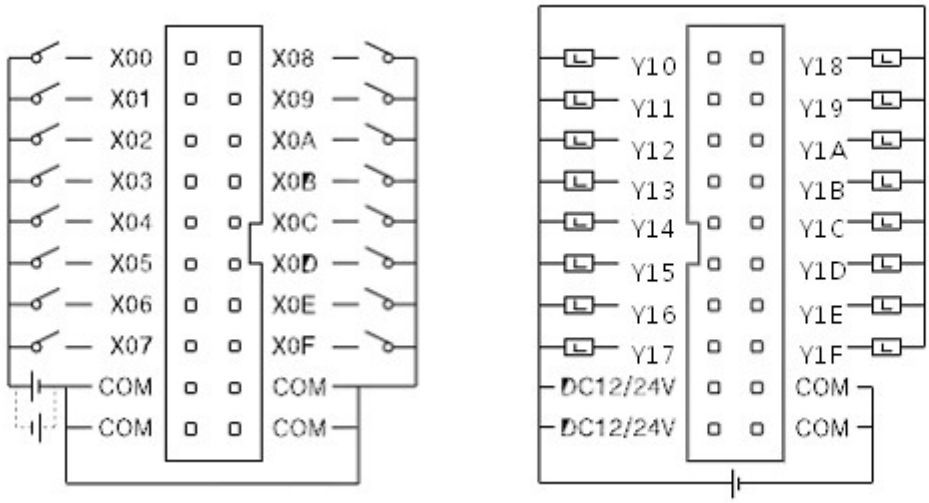
		Spec
Thermoresistor		PT100,JPT100,PT1000, NI1000 (DIN 43760), NI1000 (TCR 5000)
Range of Temp.		PT100 : -200.0ºC to 600ºC (18.48 to 313.59W) JPT100 : -200.0ºC to 600ºC (17.14 to 317.28W) PT1000 : -200.0ºC to 600ºC (184.8 to 3135.9W) NI1000 (DIN 43760): -50.0ºC to 160ºC (742.6 to 1986.3W) NI1000 (TCR 5000): -50.0ºC to 160ºC (790.9 to 1799.3W)
Digital/Temp Output		Digital Value : 0 ~ 16,000(-8000~8000) Temp : -2000~6000 (floating point X 10)
Disconnection Detection		3pts Indication for Each Channel
Precision		± 0.1 %(Full Scale)
Max Conversion Rate		50ms / 4 Channels
No. of Input Channels		4 Channels / 1 Module
Insulation Method		Input Terminal <->PLC Power Photo Coupler Insulation (Between Channels Non-insulation)
Connection Terminal		12pts Terminal
Internal current consumption (mA)	+5V	50
	+15V	30
	-15V	10

10.1.3.1.2 PLCS module connection diagrams

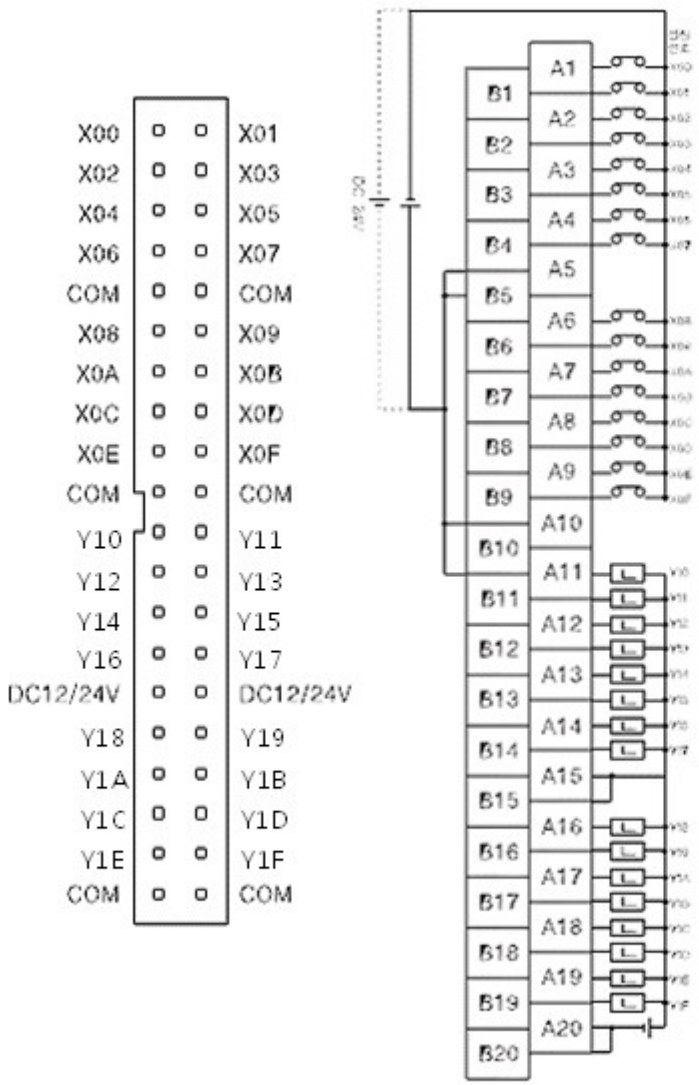
Contents :

10.1.3.1.2.1 SP32MDTV

Main Module I/O Connection Diagram

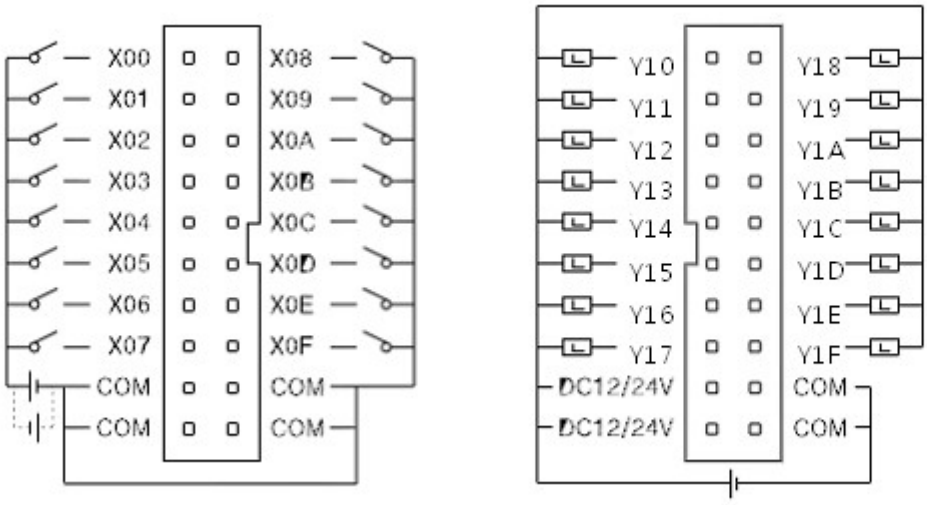


Terminal Block (CM0-TB32M) Connection Diagram



CM0-TB32M	CM3-SP32MDT
A1	X00
B1	X01
A2	X02
B2	X03
A3	X04
B3	X05
A4	X06
B4	X07
A5	COM
B5	COM
A6	X08
B6	X09
A7	X0A
B7	X0B
A8	X0C
B8	X0D
A9	X0E
B9	X0F
A10	COM
B10	COM
A11	Y10
B11	Y11
A12	Y12
B12	Y13
A13	Y14
B13	Y15
A14	Y16
B14	Y17
A15	DC12/24V
B15	DC12/24V
A16	Y18
B16	Y19
A17	Y1A
B17	Y1B
A18	Y1C
B18	Y1D
A19	Y1E
B19	Y1F
A20	COM
B20	COM

10.1.3.1.2.2 SP32EDT(Input Module Connection Diagram)



10.1.3.1.2.3 SP32EAA(Analog I/O Module)

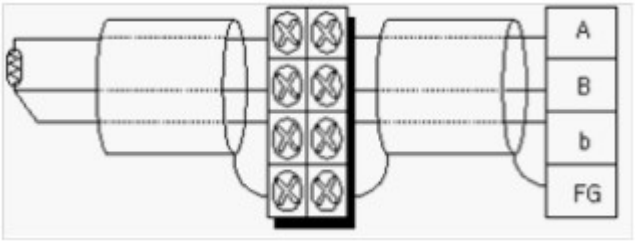
I/O Electric Voltage Signal

Channel	+ Terminal	- Terminal
AD 1 CH	V1+	COM
AD 2 CH	V2+	COM
DA 1 CH	V1+	COM
DA 2 CH	V2+	COM

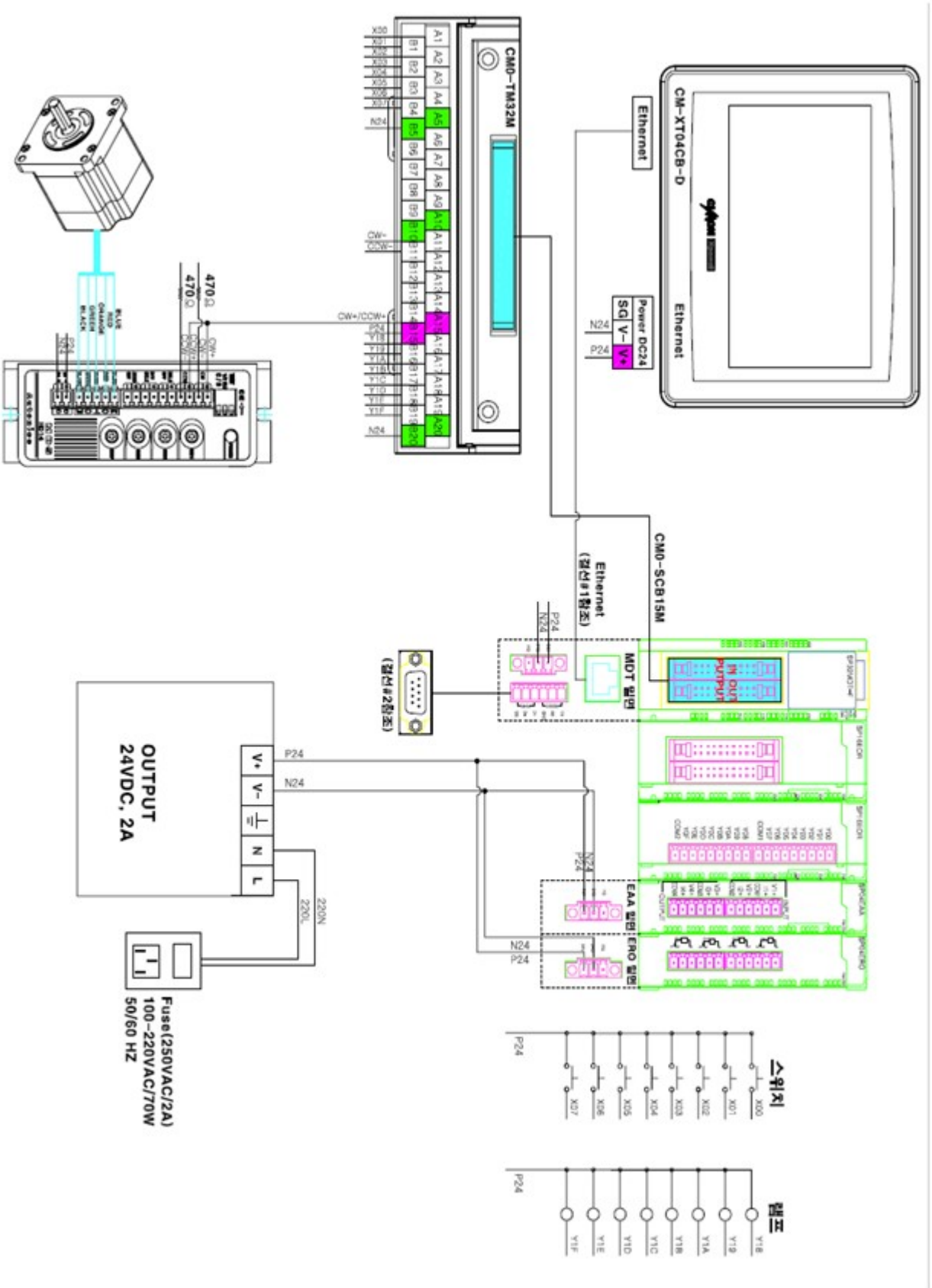
I/O Electric Current Signal

Channel	+ Terminal	- Terminal	Instruction
AD 1 CH	I1+	COM	Connect V1+ - I1+
AD 2 CH	I2+	COM	Connect V1+ - I1+
DA 1 CH	I1+	COM	N/A
DA 2 CH	I2+	COM	N/A

10.1.3.1.2.4 SP32ERO(RTD Temperature Measuring Module)



10.1.3.1.3 Training Kit connection diagrams



10.1.3.1.4 I/O signal & buffer memory expansion module

Contents :

10.1.3.1.4.1 SP32EAA

I/O signal

Direction of Signal(CPU<-A/D, D/A Module)		Direction of Signal(CPU->A/D, D/A Module)	
Input	**Name of Signal**	**Output**	**Name of Signal**
X00	A/D Module Ready	Y00	N/A
X01	N/A	Y01	N/A
X02	Flag Indicating the Operation Condition Settings	Y02	Requesting to Set Up an Operation Condition
X03	CH 1 – Indicating Alarm in Max	Y03	D/A CH 1 Output Enable (Control Command)
X04	CH 2 – Indicating Alarm in Max	Y04	D/A CH 2 Output Enable (Control Command)
X05	CH 3 – Indicating Alarm in Max	Y05	N/A
X06	CH 4 – Indicating Alarm in Max	Y06	N/A
X07	N/A	Y07	N/A
X08	N/A	Y08	N/A
X09	N/A	Y09	N/A
X0A	N/A	Y0A	N/A
X0B	N/A	Y0B	N/A
X0C	N/A	Y0C	N/A
X0D	N/A	Y0D	N/A
X0E	N/A	Y0E	N/A
X0F	D/A Error Indication Flag	Y0F	Requesting to Clear the Error

Buffer Memory

Address		Description	Default Value	R/W
Hexa	**Deci**			
0H	0	Digital Converted Value of CH.1 (AD)	-	R
1H	1	Digital Converted Value of CH.2 (AD)	-	R
2H	2	Input Signal Value of CH.1 (AD)	-	R
3H	3	Input Signal Value of CH.2 (AD)	-	R
4H	4	Percentage Value of CH.1 (AD)	-	R
5H	5	Percentage Value of CH.2 (AD)	-	R

6H	6	Alarm in Max Status (AD)	-	R
7H	7	Alarm in Min Status (AD)	-	R
8H	8	Setting Up Input Range of CH.1 (AD)	0	R/W
9H	9	Setting Up Input Range of CH.2 (AD)	0	R/W
AH	10	Raw Value Digital Output Set (AD)	0	R/W
BH	11	Average Process Set Value of CH.1 (AD)	2000h	R/W
CH	12	Average Process Set Value of CH.2 (AD)	2000h	R/W
DH	13	Max Alarm Set Value of CH.1 (AD)	0	R/W
EH	14	Max Alarm Set Value of CH.2 (AD)	0	R/W
FH	15	Min. Alarm Set Value of CH.1 (AD)	0	R/W
10H	16	Min. Alarm Set Value of CH.2 (AD)	0	R/W
11H	17	CH.1 Digital Filter Constant (AD)	30	R/W
12H	18	CH.2 Digital Filter Constant (AD)	30	R/W
13H	19	DA Conversion Enable/Disable Settings	0	R/W
14H	20	CH.1 DA Output Type (Current 2 types, Voltage 4types)	0	R/W
15H	21	CH.2 DA Output Type (Current 2 types, Voltage 4types)	0	R/W
16H	22	CH.1 DA Set Range	0	R/W
17H	23	CH.2 DA Set Range	0	R/W
18H	24	CH.1 DA Channel Hold/Clear	0	R/W
19H	25	CH.2 DA Channel Hold/Clear	0	R/W
1AH	26	Digital Output Value of CH.1 (DA)	0	R/W
1BH	27	Digital Output Value of CH.2(DA)	0	R/W
1CH	28	AD / DA Resolution Set	0	R/W
1DH	29	Error Code	-	R
1EH	30	OS Version	-	R

10.1.3.1.4.2 SP32ERO

I/O signal

Direction of Signal(RTD Module->CPU)		Direction of Signal(CPU<-RTD Module)	
Input	**Name of Signal**	**Output**	**Name of Signal**
X00	RTD Module Ready	Y00	N/A
X01	RTD Conversion complete flag	Y01	N/A
X02	Flag Indicating the Operation Condition Set Up	Y02	Requesting to Set Up an Operation Condition
X03	N/A	Y03	N/A
X04		Y04	

X05		Y05	
X06		Y06	
X07		Y07	
X08		Y08	
X09		Y09	
X0A		Y0A	
X0B		Y0B	
X0C		Y0C	
X0D		Y0D	
X0E		Y0E	
X0F	RTD Error Indication Flag	Y0F	Requesting to Clear the Error

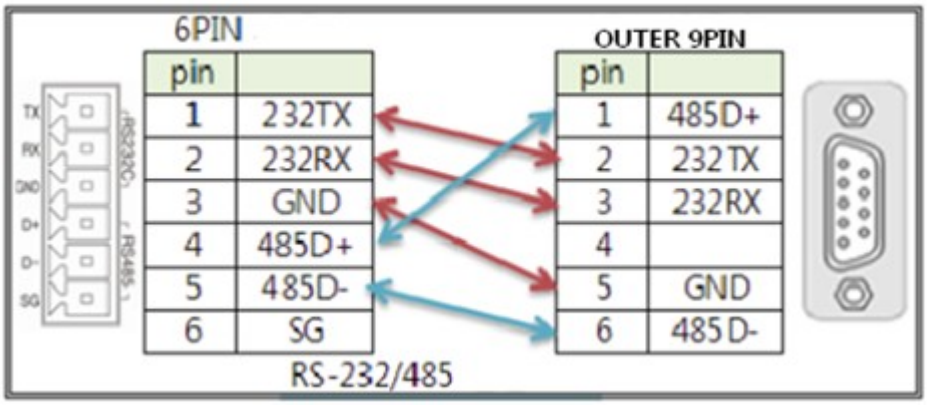
Buffer Memory

Adress		Description	R/W
Hexadec.	Decimal		
0H	0	RTD Conversion Enable/Disable Settings	R/W
1H	1	Detected Temperature Value of CH1(℃)	R
2H	2	Detected Temperature Value of CH2(℃)	R
3H	3	Detected Temperature Value of CH3(℃)	R
4H	4	Detected Temperature Value of CH4(℃)	R
5H	5	Detected Temperature Value of CH5(℃)	R
6H	6	Detected Temperature Value of CH6(℃)	R
7H	7	Detected Temperature Value of CH7(℃)	R
8H	8	Detected Temperature Value of CH8(℃)	R
9H	9	RTD Type Assign	R/W
AH	10	N/A	-
BH	11	Detected Temperature Value of CH1(°F)	R
CH	12	Detected Temperature Value of CH2(°F)	R
DH	13	Detected Temperature Value of CH3(°F)	R
EH	14	Detected Temperature Value of CH4(°F)	R
FH	15	Detected Temperature Value of CH5(°F)	R
10H	16	Detected Temperature Value of CH6(°F)	R
11H	17	Detected Temperature Value of CH7(°F)	R
12H	18	Detected Temperature Value of CH8°F)	R
13H	19	Operating Channels Information	R
14H	20	N/A	R
15H	21	Digital Conversion Value of CH1	R
16H	22	Digital Conversion Value of CH2	R
17H	23	Digital Conversion Value of CH3	R

18H	24	Digital Conversion Value of CH4	R
19H	25	Digital Conversion Value of CH5	R
1AH	26	Digital Conversion Value of CH6	R
1BH	27	Digital Conversion Value of CH7	R
1CH	28	Digital Conversion Value of CH8	R
1DH	29	Digital Output Settings #2	R/W
1EH	30	Average Process Assign	R/W
1FH	31	Error Code Value of CH1	R
20H	32	Error Code Value of CH2	R
21H	33	Error Code Value of CH3	R
22H	34	Error Code Value of CH4	R
23H	35	Error Code Value of CH5	R
24H	36	Error Code Value of CH6	R
25H	37	Error Code Value of CH7	R
26H	38	Error Code Value of CH8	R
27H	39	N/A	-
28H	40		
29H	41	Max Temperature Input Value of CH1	R/W
2AH	42	Max Temperature Input Value of CH2	R/W
2BH	43	Max Temperature Input Value of CH3	R/W
2CH	44	Max Temperature Input Value of CH4	R/W
2DH	45	Max Temperature Input Value of CH5	R/W
2EH	46	Max Temperature Input Value of CH6	R/W
2FH	47	Max Temperature Input Value of CH7	R/W
30H	48	Max Temperature Input Value of CH8	R/W
31H	49	Max/Min Temperature Settings Data	R/W
32H	50	Error in Max/Min Setup	R
33H	51	Min Temperature Input Value of CH1	R/W
34H	52	Min Temperature Input Value of CH2	R/W
35H	53	Min Temperature Input Value of CH3	R/W
36H	54	Min Temperature Input Value of CH4	R/W
37H	55	Min Temperature Input Value of CH5	R/W
38H	56	Min Temperature Input Value of CH6	R/W
39H	57	Min Temperature Input Value of CH7	R/W
3AH	58	Min Temperature Input Value of CH8	R/W

3B-3E	59-62	Average Time/Filter Coefficient Settings for CH1-4	R/W

10.1.3.1.5 Serial port(DSUB-9) network connection diagram



*6PIN connector is a communication port which is included with PLCS main module (SP32MDTF).

10.1.3.2 XPANEL

Contents :

10.1.3.2.1 Xpanel Specifications

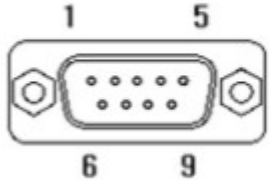
Contents :

10.1.3.2.1.1 XT04CB-D Spec.

Model	CM1 - XT04CB-D
LCD Size	4.3 inch wide
LCD Type	TFE Color
Colors	16.7M Colors
Resolution	WQVGA 480x272
Backlight	LED 300

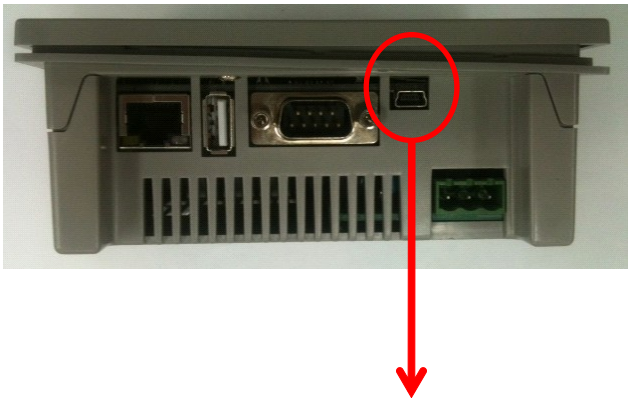
Luminance	300 cd/m2
Touch Panel	4 wire registive
Memory	64MB SDRAM
Storage	32MB Flash
COM1	RS-232
COM2	RS-422/485
Ethernet	+LAN option:10/100 BaseT
USB Host	1 Port
Tool Port	1 USB device
SD Card	None
Audio	None
Rated Voltage	DC24V
Power Consumption	4W
OS	Windows CE 5.0
Dimension(mm)	128x102x50
Panel Cut(mm)	120x94

10.1.3.2.1.2 Serial Port Connection Diagram



Connector	Pin No	Name	Description	Port
	1	SDA	Send Data A	COM2
	2	RD	Receive Data	COM1
	3	TD	Transmit Data	COM1
	4	RDA	Receive Data A	COM2
	5	SG	Signal Ground	COM1/COM2
	6	SDB	Send Data B	COM2
	7	RTS	Request To Send	COM1
	8	CTS	Clear To Send	COM1
	9	RDB	Receive Data B	COM2

10.1.3.2.1.3 Instructions on Project Download



USB Loader Port

USB Loader Cable

1. Download the following synchronization program from Microsoft website and install it:
   - Windows7 : Mobile Device Center
   - XP : ActiveSync
2. Connect USB Mini cable to a loader port
3. Open Xpanel Designer and click on [Online] on the top menu and click on [Write to Xpanel]
4. A selected project downloads onto Xpanel

10.1.4 Accessories

Accessories included with PEK-308 Training Kit:

1. Power Cable (rated current of 7A 250V)
2. USB Loader Cable
3. PLC-S terminal block CM0-TB32M
4. Terminal block cable CM0-SCB15M
5. Installation CD (CICON, Xpanel Designer, Sample Program)
6. Instruction manual

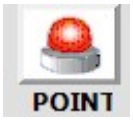
10.1.5 Getting Started

Contents :

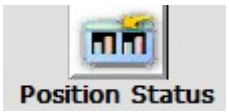
10.1.5.1 Basic Operating Instructions

Contents :

10.1.5.1.1 Main Page



Moves to a page where the user can test point of contact control.

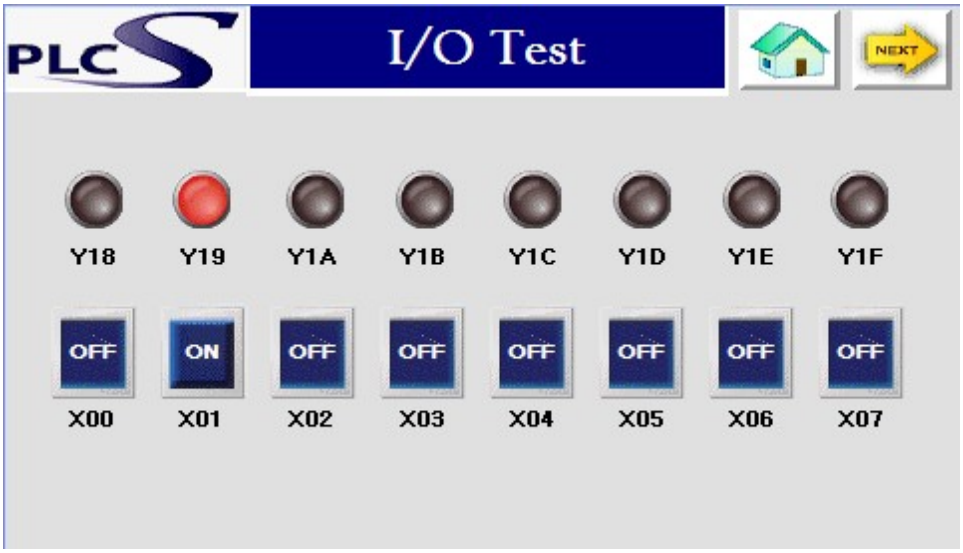


Moves to a page where the user can check the positioning control status

Moves to a page where the user can change positioning control settings and actually control it

Moves to a page where the user can input/output analog signals and check RTD Temperature measurement

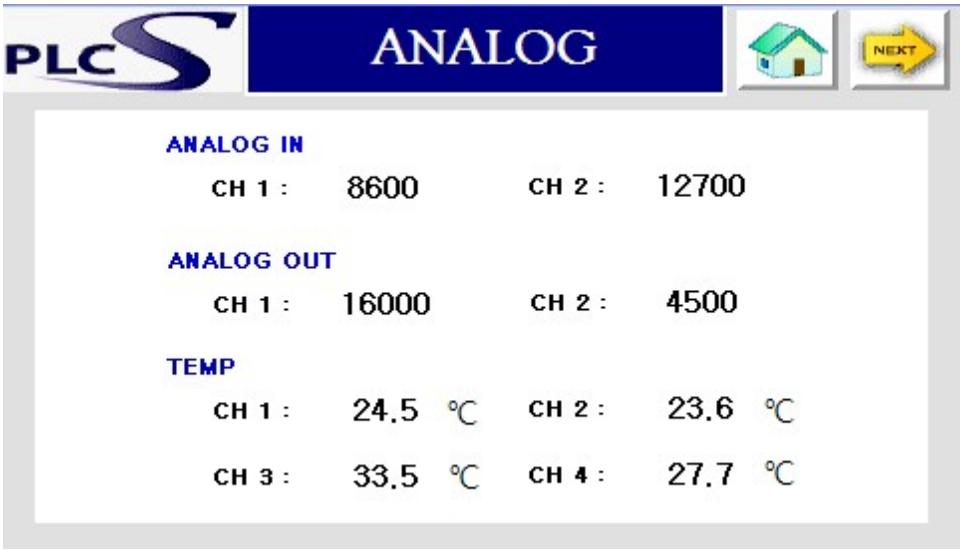
10.1.5.1.2 I/O POINT Page



The user can turn the display lamp (on the screen) on by pressing input button or using the toggle switch

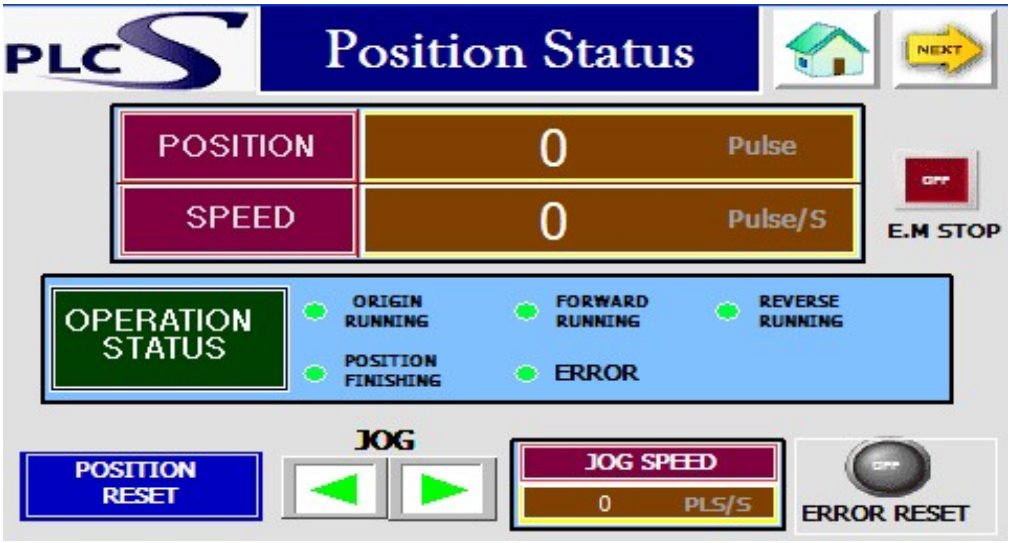
The user should check if the LED lamp is also On/Off

10.1.5.1.3 Analog Page



This page displays the analog input/output signal values from each channel of SP04EAA module and also displays the measured temperature data from SP04ERO module.

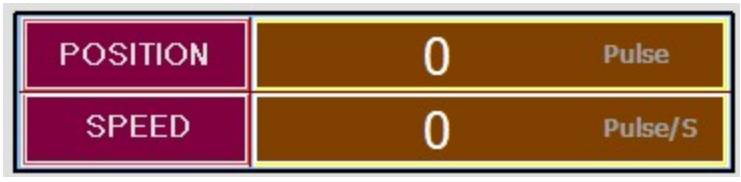
10.1.5.1.4 Position Status Page



In this page, the user can practice monitoring, controlling JOG driver motion, resetting the current driver error status and other functions

Forward direction or backward direction movement can be achieved with JOG function

Monitoring of the current status of motion control can be achieved here. Red lamp means it's operating.



The current position and speed of the Servo can be monitored

Performs emergency stop and stops immediately.

In case of Servo Error, it makes the Servo to reset

Set the current position as an original/zero point

10.1.5.1.5 Positioning Page

The user can set preferred values and control positioning functions in this page

This shows a position of the Servo

This shows a current speed of the Servo

The user can set a preferred position of the Servo

The user can set a preferred speed of the Servo

Set the current position as an original/zero point

Makes the Servo to run

Makes the Servo to stop

Returns the Servo to the original/zero point

]

The lamp turns ON in an error state

Reset the error state

Performs emergency stop and stops immediately.

10.1.5.2 Creating a Sample Project

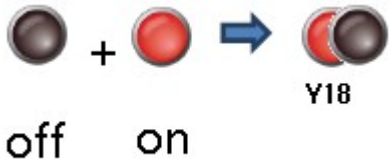
Contents :

1. Lamp On/Off Control Exercise

2. Analog Input / Output Exercise
3. Using RTD Thermometer
4. Using Positioning Control

10.1.5.2.1 Lamp On/Off Control Exercise

To control a lamp with a toggle switch, a ladder, as above, has to be created in CICON.
When an input signal is generated from X00, Y18 LED lamp turns on or off. Since X00 and M20 are connected with an OR logic, the user can also control Y18 LED lamp on MMI instead with a toggle switch by generating ON/OFF signal for M20.



To display the lamp on Xpanel, the user needs to create two images of a lamp for both ON and OFF and then check on visible property. After that, make the two images overlap to each other so that the lamp on Xpanel will turn on/off depending on the LED lamp Y18.

X00 status can be reversed by using a toggle switch.

10.1.5.2.2 Analog Input / Output Exercise

To receive analog signals, a logic that communicates with a special card needs to be created. The command for receiving signals is “FROM” and the command for sending signals is TO.
By using “FROM” and “TO” command, the user can read the input or output values from AD/DA card.

Receiving Analog Input

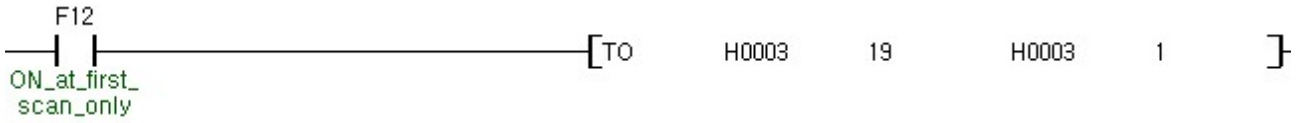
FROM command is used to receive a data from a buffer memory. FROM command is used as follows:

FROM (n1) (n2) (D) (n3)
N1 : Slot number
N2 : Buffer memory
D : Memory address for storing input value
N3 : Data number for reading from a buffer memory

[FROM H0003 0 D3004 2] : This command reads two data (Digitally converted values of CH1 and CH2) from the 0th buffer memory of the special module (SP04EAA) and stores them in D3004.

Analog Input Value is shown on the page using tag value on Xpanel

Sending Analog Output

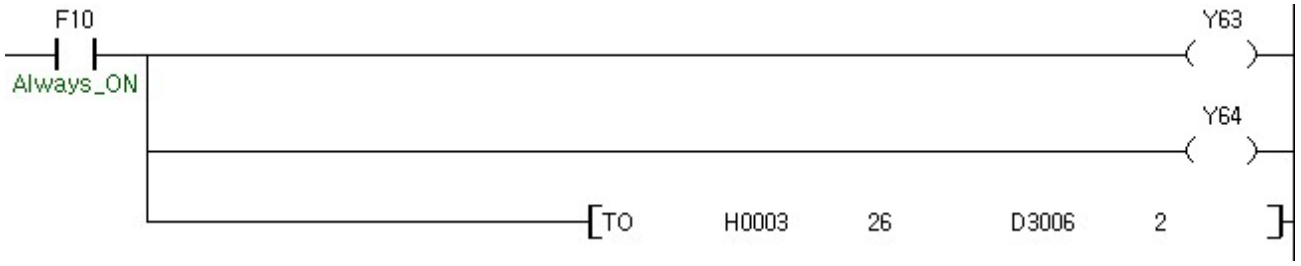


To send an analog output signal, the user must authorize DA conversion on the buffer memory of the analog output module (SP04EAA)
“TO” command is used to write a data to a buffer memory of a special card. “TO” command is used as follows:

TO n1 n2 S n3
N1 : Slot Number
N2 : Buffer Memory
S : Input Data
N3 : Data Number

[TO H0003 19 H0003 1] : This command writes value of 3 on the 19th buffer memory of the special module (SP04EAA) which is positioned on the 3rd slot. When the value 3 writes on the memory, it automatically authorize DA conversion for CH1 and CH2 Slot번에 위치한special module(SP04EAA) .

After authorizing DA conversion of an analog output channel, the user need to send an actual output

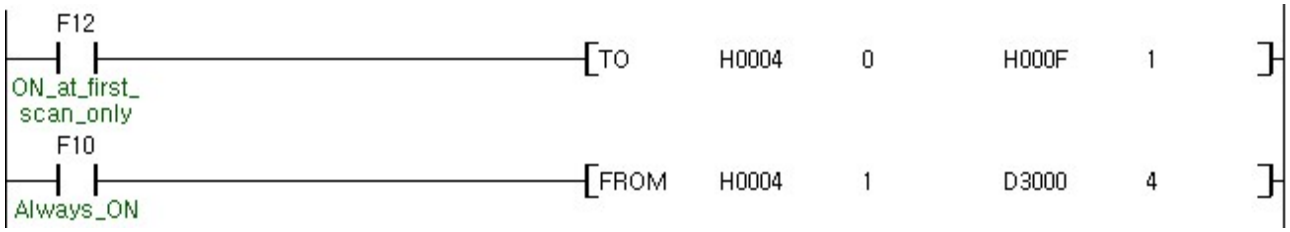


The logic to send out an actual output is as above.

To send the output signal, first the user always need to send the enable I/O signal and then use TO command to send the real data.
Y03, Y04 are the enable I/O signals
[TO H0003 26 D3006 20] : This command stores the data from D3006 and D3007 in the 26th buffer memory and then outputs to CH1 and CH2 respectively

10.1.5.2.3 Using RTD Thermometer

The way to use RTD temperature module is very similar to that of Analog Input module. Similarly, it uses " FROM" command to receive the measured temperature values.



First, it uses "TO" command to store the value in the 0th buffer memory.
The 0th memory is the RTD conversion authorization buffer memory. The structure of this memory is shown below:

b15	b14	b13	b12	b11	b10	b9	b8	b7	b6	b5	b4	b3	b2	b1	b0
0	0	0	0	0	0	0	0	0	0	0	0	CH4	CH3	CH2	CH1

Bits number 0~4 represent each channels' current authorization status and to authorization for the entire channel, H000F should be used.

[FROM H0004 1 D3000 4] : This command stores the temeprature data from each channel in D3000 ~D3003 which were in the 1st~4th buffer memory.

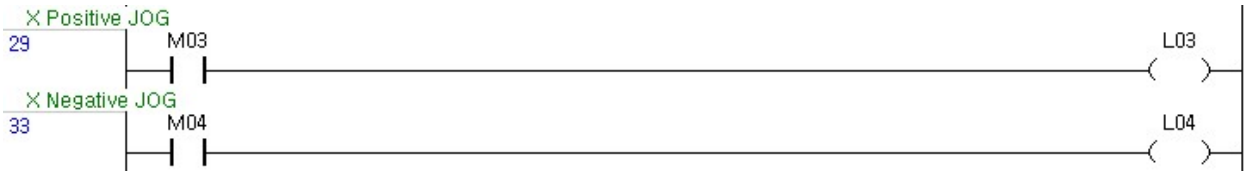
TEMP

CH 1 : ###.# ℃ CH 2 : ###.# ℃

CH 3 : ###.# ℃ CH 4 : ###.# ℃

10.1.5.2.4 Using Positioning Control

Operating JOG Mode

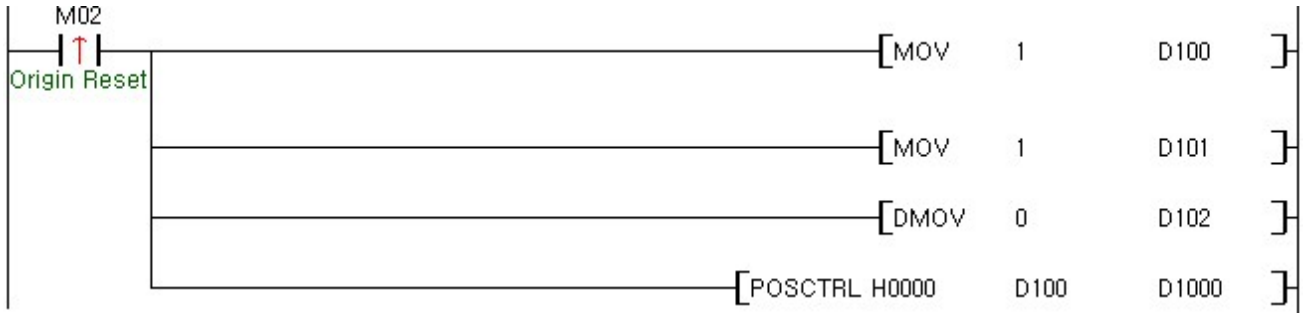


If the starting address of the positioning control program is registered from L0, the user can control L03 and L04 to control forward and backward JOG motion.

Using POSCTRL Command

POSCTRL is a special command for positioning control. This command controls the positioning control module.

A. Setting the Starting Point



The following command is for setting the current position the starting point:

[POSCTRL n1 n2 n3]

N1 : (BASE/Slot) number

N2 : Control parameter

N3 : Result FLAG

The sample program above substitues (1,1,0,0) in the control parameter. Therefore, it sets the current X-coordinate to 0.

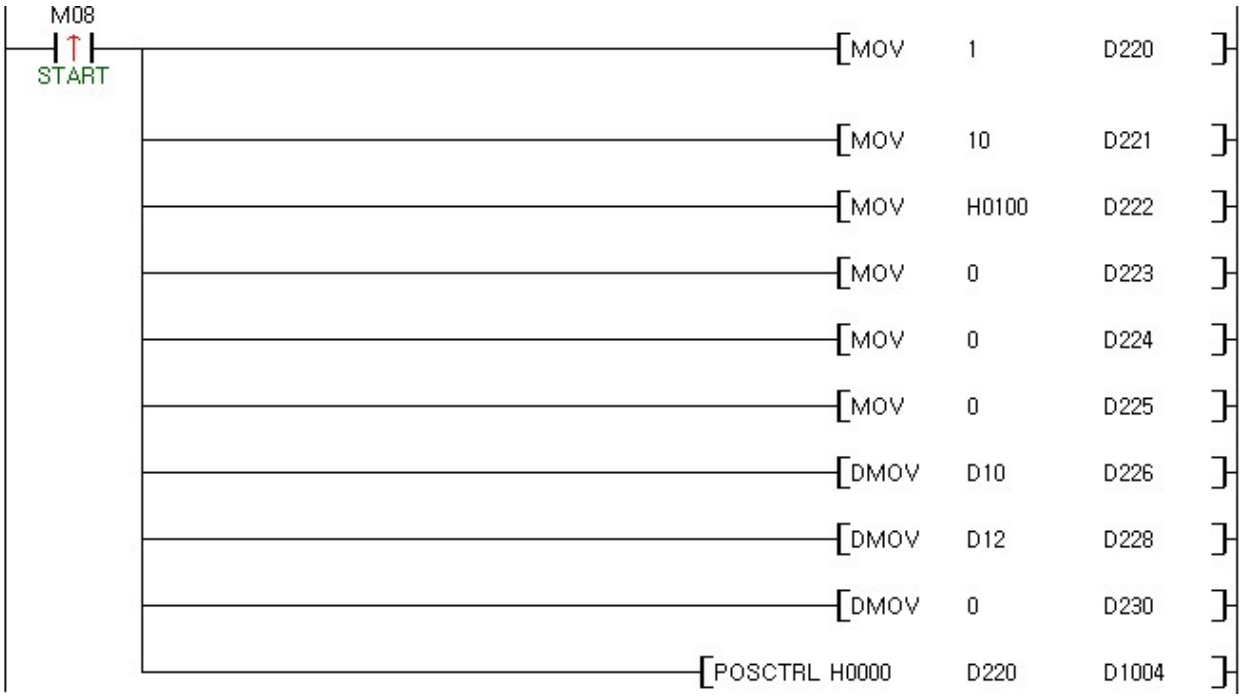
Control Parameter (when the control code(N2+1) is not 10)

N2	Axis (1, 2)
N2 + 1	Command Code
N2 + 2	Parameter (low)
N2 + 3	Parameter (high)

Control Code

1	Change Position
2	Change Speed
6	Change Target Address
9	Error Clear
10	Indirect Position Data

B. Indirect Driving by using POSCTRL



This exmaple is for setting an X axis indirectly and driving

By using MOV command to substitue the data that correspond to the control bit as shown below

Control Parameter (when the control code(N2+1) is 10)

N2	Axis	1
N2 + 1	Control Code (10)	10
N2 + 2	Control Command	H0100 ※Positon Data
N2 + 3	M Code	0
N2 + 4	Dwell Time	0
N2 + 5	Reserved(0)	0
N2 + 6	Speed (Low Word)	D10
N2 + 7	Speed (High Word)	
N2 + 8	Destination Address (Low)	D12
N2 + 9	Destination Address (High)	
N2 + 10	Circular Interpolation (Low)	0
N2 + 11	Circular Interpolation (High)	0

Each parameter data sets as above. Therefore, it operates according to the speed from D10 and the position from D12

Position Data

OFF SET	Content	Bit	Function		
0	Control Pattern	0	00 : Single step control		
		1	01 : Continuous control		
	Interpolation	2	00 : Non-interpolation 01 : Main Axis = Y (Linear interpolation)		
		3	10 : Main Axis = X (Linear interpolation)		
	Acceleration Time	4	Acc/Dec No. (0 – 3)		
		5			
	Decceleration Time	6	Acc/Dec No. ((0 – 3)		
		7			
	Control Code	8 ~ 15	00 H		End of position data
			01 H	ABS	Absolute position control
			05	INC	Incremental position control

			H		
			09H	FEED	Incremental position control ater Address reset
			13H	FSC	Speed control (Forward)
			17H	RSC	Speed control (Backward)
			80H	NOP	No operation
			81H	JUMP	Force to change next step No
			82H	LOOP	The first step of loop
			83H	LEND	The last step of loop
			84H	POS	Force to change the current positon address
1					
2	Dwell Time	0 ~ 65,535 or indirect data (device memory)			
3	N/A	N/A			
4	Speed	L	1 ~ 100,000 or indirect data (device memory)		
5		H			
6	Target Position Address	L	-2,147,483,648 ~ 2,147,483,647 or indirect data (device memory)		
7		H			

Operation Data

Axis	Item	Description		Comment
		Bit	Data Details	
X	Control Flag	0	Axis Enable(1)/Disable(0)	
		1	Deccelerate stop requirement (activated on rising edge, and auto reset)	
		2	Emergency stop requirement (activated on rising edge)	
		3	Forward JOG/Inching ON(1) / OFF(0)	
		4	Backward JOG/Inching ON(1) / OFF(0)	
		5	N/A	
		6	N/A	
		7	N/A	
		8	N/A	
		9	N/A	
		A	N/A	
		B	N/A	
		C	N/A	

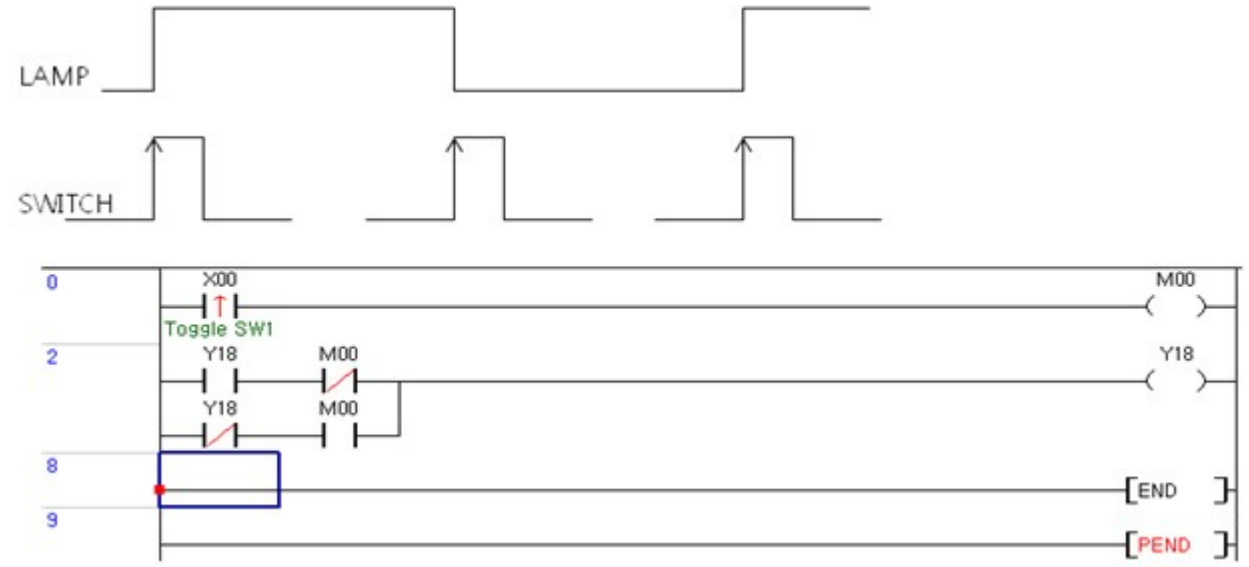
		D	N/A	
		E	N/A	
		F	Error clear (activated on rising edge and auto reset)	
	Status Flag	0	Run (0=stopped , 1=running)	
		1	Under position control	
		2	Under speed control	
		3	Under linear interpolation	
		4	Under OPR	
		5	Reserved (0)	
		6	Reserved (0)	
		7	Under acceleration	
		8	Under constant speed running	
		9	Under decceleration	
		A	Under dwell	
		B	Positioning Completed	
		C	OPR Completed	
		D	Direction Forward(0) / Backward (1)	
		E	Pulse output disabled	
		F	Error	
	Current Pos. Address	L H	-2,146,483,648 – 2,147,483,647	Pulse
	Current Speed	L H	1 – 100,000	PPS
	Current Step		Position program step number (1-30)	
	Next Step		Position program step number (1-30)	
	Inching Mov		(0-65535)	Pulse
	Error Code		[See error code table]	
Y	Contorl Flag	0	Enable(1)/Disable(0	
		1	Deccelerate stop requirement (activated on rising edge, and auto reset)	
		2	Emergency stop requirement (activated on rising edge)	
		3	Forward JOG/Inching ON(1) / OFF(0)	
		4	Backward JOG/Inching ON(1) / OFF(0)	
		5	N/A	
		6	N/A	
		7	N/A	
		8	N/A	
		9	N/A	
		A	N/A	
		B	N/A	

		C	N/A	
		D	N/A	
		E	N/A	
		F	Error clear (activated on rising edge and auto reset)	
	Status Flag	0	Run (0=stopped , 1=running)	
		1	Under position control	
		2	Under speed control	
		3	Under linear interpolation	
		4	Under OPR	
		5	Reserved (0)	
		6	Reserved (0)	
		7	Under acceleration	
		8	Under constant speed running	
		9	Under decceleration	
		A	Under dwell	
		B	Positioning Completed	
		C	OPR Completed	
		D	Direction Forward(0) / Backward (1)	
		E	Pulse output disabled	
		F	Error	
	Cur. Pos. Address		-2,146,483,648 – 2,147,483,647	
	Current Speed		1 – 100,000	
	Current Step		Position program step number (1-30)	
	Next Step		Position program step number (1-30)	
	Inching Mov		(0-65535)	
	Error Code		[See error code table]	

10.1.6 Appendix

Contents :

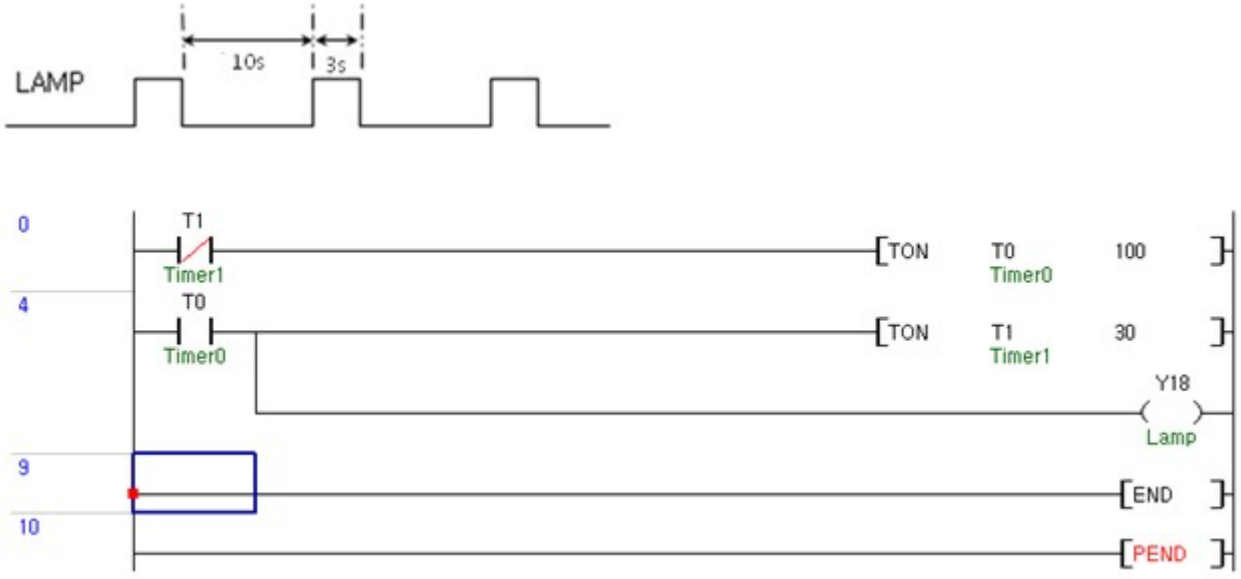
10.1.6.1 Toggle Switch



Whenever the input switch X0000 is selected, the Lamp Y0010 turns ON-OFF.

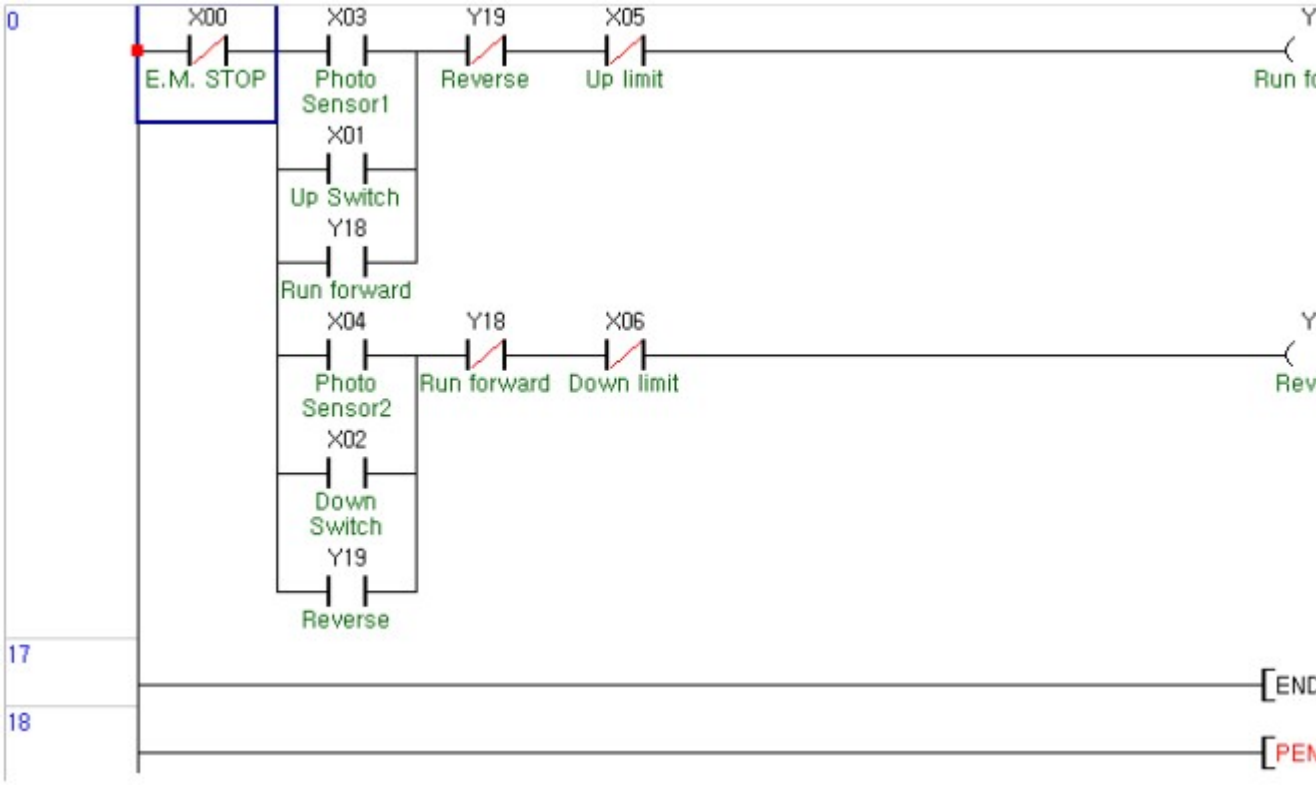
When the lamp is ON and the switch X0000 is selected, the lamp turns off and it stays like that even when the switch is unselected. When the lamp is OFF and the switch X0000 is selected the lamp turns on and it stays on even when the switch is unselected.

10.1.6.2 ON-OFF Control by Using Timers



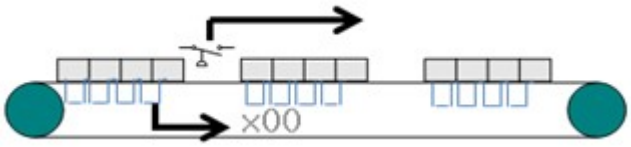
Using 100ms timers to turn the lamp off for 10 seconds and turn it on for 3 seconds.

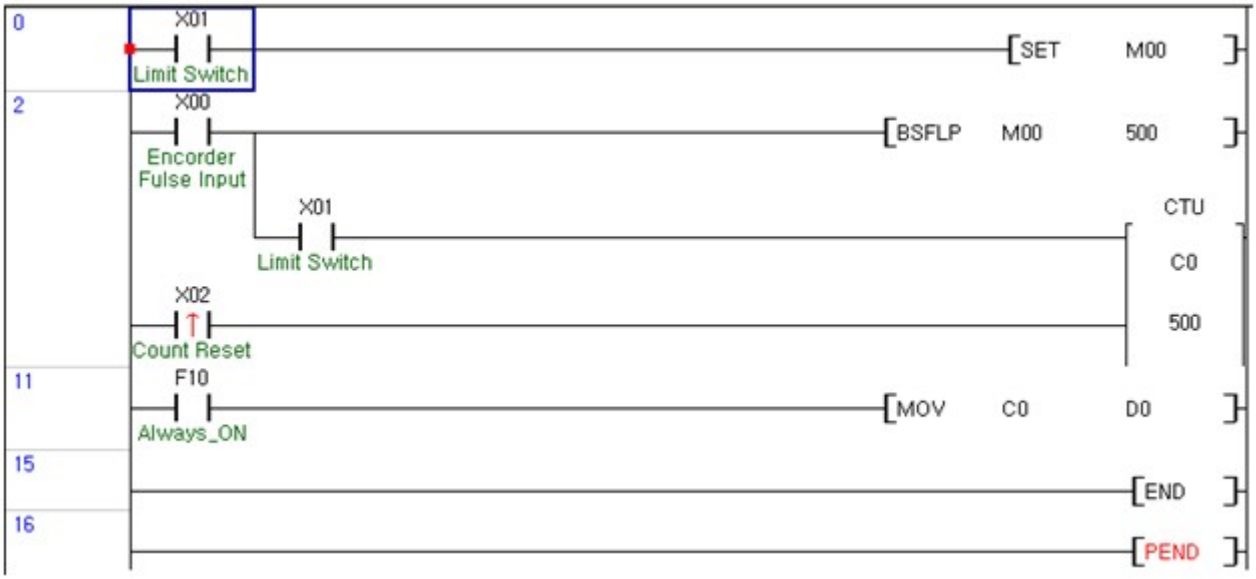
10.1.6.3 Controlling Garage Door



When a car stops in front of the door, Photo sensor 1 senses the car and opens the door, and then when the car goes inside the garage, Photo sensor 2 senses the car in the garage and closes the door. The user can also control the door by up/down switch without using the sensors

10.1.6.4 Measuring the Length of Items by Using Limit SW and Encoder

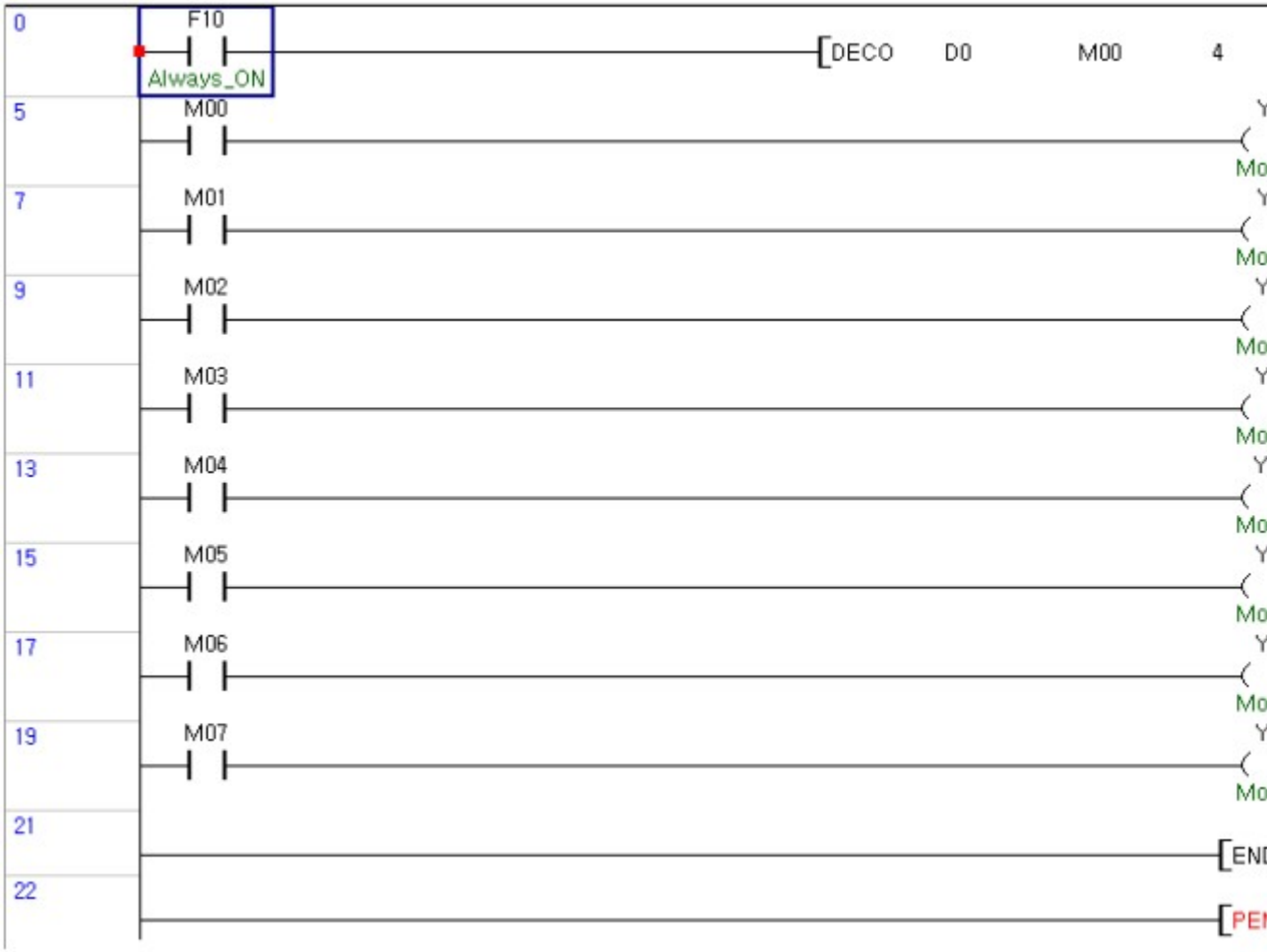




This program measures the length of items. The items are on a conveyor which is powered by a motor that moves 1cm per 1pulse.

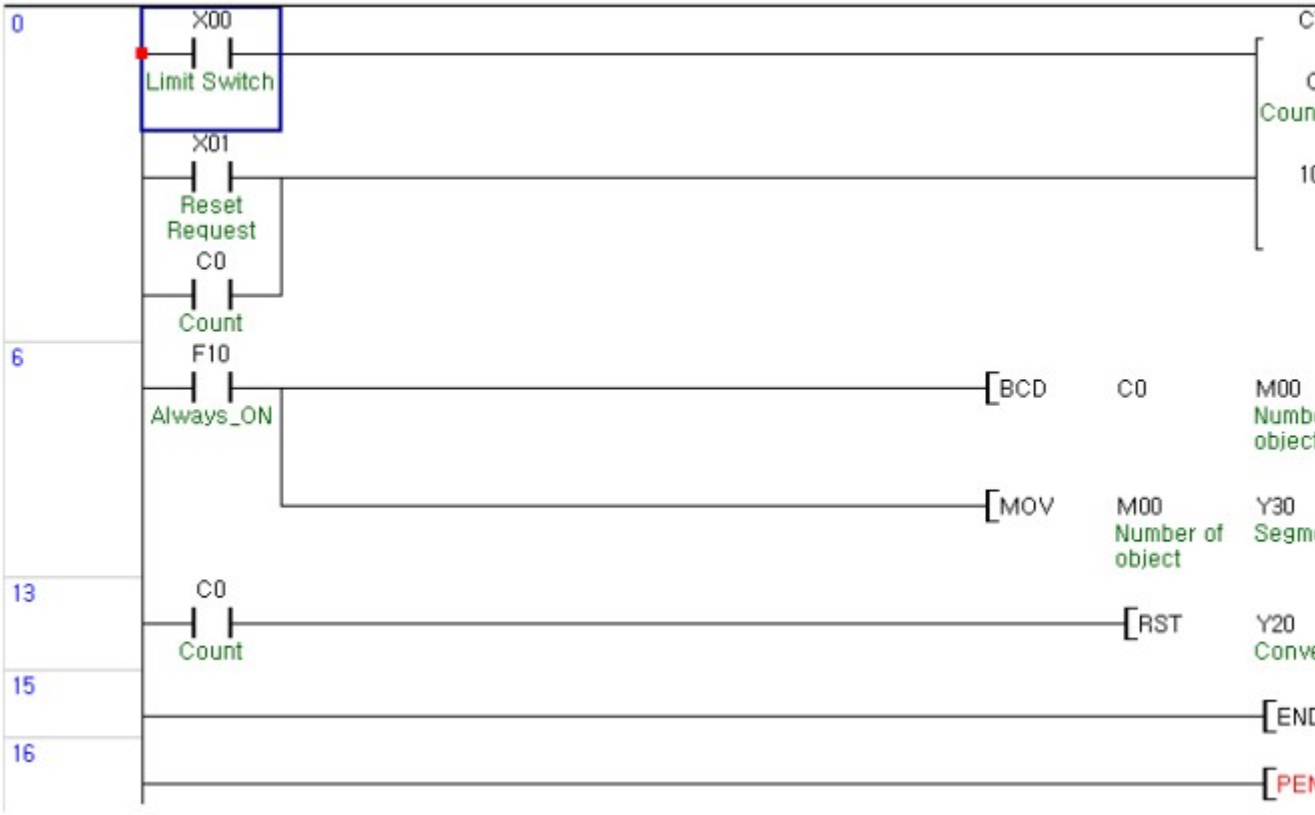
By using limit switches, the program measures the starting point of the item and the end point to calculate the total length.

10.1.6.5 Decoding



This program analyzes M0000 input data and then controls only one motor out of 8 depending on the inputted data.

10.1.6.6 Counting the Number of Items



This program counts the number of items passing through the sensor (limit switch) and displays the number on the segment display. When 1000 items are passed, the program stops the conveyor belt and resets the display to 0.

10.2 PEK - 408

- To Study basic knowledge and applications on PLC
- To improve applicable capability of trainees at site
- To master the capability to use PLC application instructions
- To master the capability to control analog signals
- To understand how to configure RS232C/422/485
- To master the capability to configure and operate a site monitoring & operation system

Features of Training Kit :

- Compose of high-performance module type PLC components.

- Enables to practice the advanced functions of various types like on-line editing, forced input/output, initialization program by using an exclusive loader program (CICON)
- Enable to perform PLC training without connection with other devices.
- Equipped with toggle switches, push buttons and so on to use output lamps and an display for a simulation load.
- Equipped with an analog input signal generator and a level meter to make sure analog output signals.
- Enable to practice PID control by using analog converters.
- Equipped with a photo sensor and an encoder to detect easily the number of revolutions by using.
- Enables computer link in series communication type through computer exclusive terminal of CPU
- Enables remote control and monitoring in connection with HMI S/W
- Composed of a system with very suitable input/output points in module type to improve the capability of programming for site situation.
- Composed of attachable-detachable type to switch input, output and optional modules freely, if necessary.
- Enables training from basic to application

Click :

- Structure
- Module Specifications
- Assigning Input/Output Addresses
- Internal Connection Diagram
- Programming and Operating
- Exmaple of PLC Application

10.2.1 Structure

Structure :

Accessories :

- Power Cable (Rated 7A 250V)
- CM0-CBL15 . 1.5m Loader Cable
- Users Manual
- RS-232C cable
- CD including CICON, application program samples & CIMON HMI S/W Demo

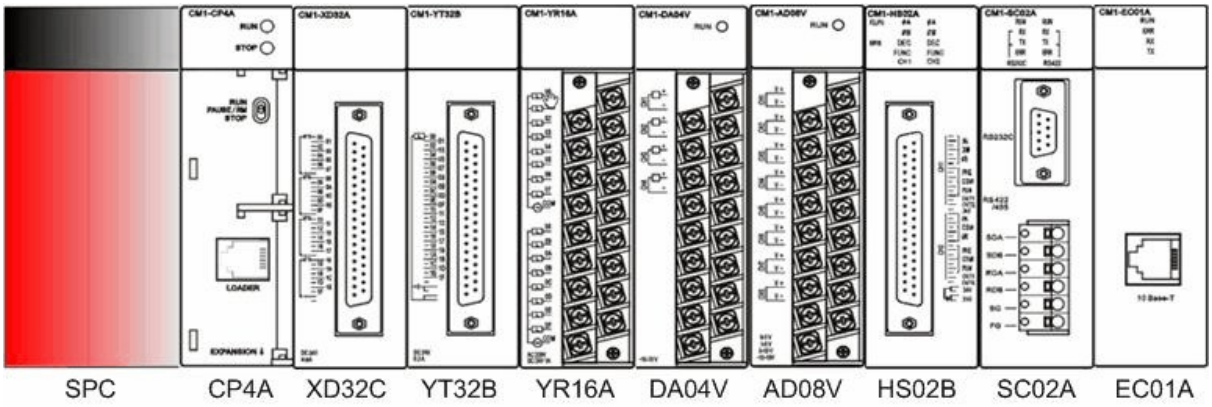
PLC Module Composition :

Module Name	Type	Specification
CM1-CP4A	CPU	16K step program memory capacity
CM1-SPC	Power	Voltage output 5 / 24 / +15 / -15 V
CM1-BS08A	Base	8-slot Base

CM1-XD32C	Digital input	32 point input module
CM1-YT32B	Digital output	32 point source output module
CM1-YR16A		16 point relay output module
CM1-AD08V	Analog input	14 bit 8ch voltage Analog Input
CM1-DA04V	Analog output	14 bit 4ch voltage Analog Output
CM1-SC02A	Communication	RS232C / 422 / 485
CM1-EC01A		10 Mbps Ethernet
CM1-HS02A	HSC	200 kpps 2 Ch high speed Counter

10.2.2 Module Specifications

Standard Module Composition :



❖ **The modules can be changed according to user's training use.**

Click

- CM1-SPC
- CM1-CP4A
- CM1-XD32C
- CM1-YT32B
- CM1-YR16A
- CM1-DA04V
- CM1-AD08V
- CM1-HS02B
- CM1-SC02A
- CM1-EC01A

CM1-SPC ,

This is used to receive the power of AC 220V, supplying the power of DC +5V, +24V, ±15V to each part of a PLC.

Model		CM1-SPC
Input	Input Voltage	AC220V, 50/60Hz
	Input Current	0.25A MAX For 220VAC

	Inrush Current	30A or less
	Efficiency	70% or more(Rated Input/Load)
	Allowed Breakdown	20㎳or less
Output	Output voltage / Output Current	+5V (3.5A), +24V (0.5A), +15V (0.5A), -15V (0.3A)
Voltage Status Indication		LED is turned on in case output voltage is normal.

CM1-CP4A,

The CM1-CP4A processes fast by high-speed MPU and Fractionizes the error codes in self-diagnosis by contents to find the reasons of them.

Model		Specification
		CM1-CP4A
Type of Program Control		Stored Program, Repeat Operation, Time Driven Interrupt
Type of I/O Control		Indirect, Direct by Instructions
Program Language		IL(Instruction List) , LD(Ladder Diagram)
Instruction	Sequence	54 Instructions
	Application	264 Instructions
Baud Rate(Sequence)		200㎱/ Step
Capacity of Memory		16K Steps
Base Expansion		Not Available
Capacity of Data Memory	X	384
	Y	384
	M	8,192
	K	2,048
	L	2,048
	F	2,048
	T	1024(Select 10 ms or 100 ms at user's option)
	C	1,024
	S	100Card * 100Step
	D	5,000
	Z	2048
Timer	Type	On Delay, Off Delay, Accumulation, Monostable, Retriggerable
	Range	0.01 sec ~ 655.35 sec
Counter	Type	Up Counter , Down Counter , Up-Down Counter, Ring Counter
	Range	-32,768 ~ +32,767
Operation Mode		RUN , STOP , PAUSE , DEBUG
Self-dignosis		Watch-dog Timer, Memory Check-sum, I/O Card, Battery, Power
Type of Standard Base		3 slots, 5 slots, 8 slots, 12 slots
Built-in Function		• Computer Link(RS232C) • PID Control • I/O Reservation

	• On-line Editing

CM1-XD32C,

Model		CM1-XD32C
No. of Input Points		32 Points SINK/SRC Input
Rated Input Voltage		DC24V
Rated Input Current		4mA
On Voltage/On Current		DC19V/4mA
Off Voltage/Off Current		DC11V/1mA
Response Time	Off -> On	5mSec or less
	On -> Off	5mSec or less
Type of Common		8 Points
Operation Indication		LED is turned on incase input is turned on.
Type of Insulation		Photo coupler insulation

CM1-YT32B

Model		CM1-YT32B
No. of Output Points		32 Points SRC
Rated Load Voltage		DC12 ~ 24V
Rated Load Current	1 Point	0.2A
	1Com	4A
Response Time	Off -> On	1mSec or less
	On -> Off	1mSec or less
Type of Common		32 Points
Operation Indication		LED is turned on incase input is turned on.
Type of Insulation		Photo coupler

CM1-YR16A,

Model		CM1-YR16A
No. of Output Points		16 Points
Rated Load Voltage		DC12/24V AC220V
Rated Load Current	1 Point	2A
	1Com	5A
Response Time	Off -> On	10mSec or less
	On -> Off	5mSec or less

Type of Common	8 Points
Operation Indication	LED is turned on incase input is turned on.
Type of Insulation	Relay

CM1-DA04V,

Model	DA14Bit / 4CH / Voltage Output
	CM1-DA04V
No. of Input Channels	4 Channels
Digital Input	Signed 16 Bit Binary Value(Data: 14 Bits)
Analog Output	-10 ~ 10V
Max. Resolution	1.25mV
Precision	Within ±0.3%
Max. Conversion Rate	10mSec
Absolute Max. Output	±15V
Type of Insulation	Photo Coupler between input terminal and PLC

CM1-AD08V,

Model		AD14Bit / 8CH / Voltage Input
		CM1-AD08V
No. of Analog Input Channels		8 Channels
Analog Input		0 ~ 5V, 1 ~ 5V, 0 ~ 10V, -10 ~ +10V
Digital Output		Signed 16 Bit Binary Value(Data: 14 Bits)
Max. Resolution	0 ~ 5V	0.3125mV
	1 ~ 5V	0.25mV
	0 ~ 10V	0.625mV
	-10 ~ 10V	1.25mV
	0 ~ 20mA	1.25mA
	4 ~ 20mA	1.0mA
Precision		Within ±0.3%
Max. Conversion Rate		5mSec/1ch
Absolute Max. Input	Voltage	±12V
	Current	±25mA
Type of Insulation		Photo Coupler between input terminal and PLC

CM1-HS02B,

Model		CM1-HS02B
Channel		2 Channels
Counting Input Signal	Signal	1-phase Input/2-phase Input
	Level of Signal	DC5 / 12 / 24V, 2 ~ 5mA
Range of Counting		32Bit (-2,147,483,648 ~ 2,147,483,647)
Counting Rate		200kPPS
Form		Up-down Preset Counting + Ring Counting
External Output	Type	Comparative Output (> , = , <)
	Form of Signal	Open Collector Output

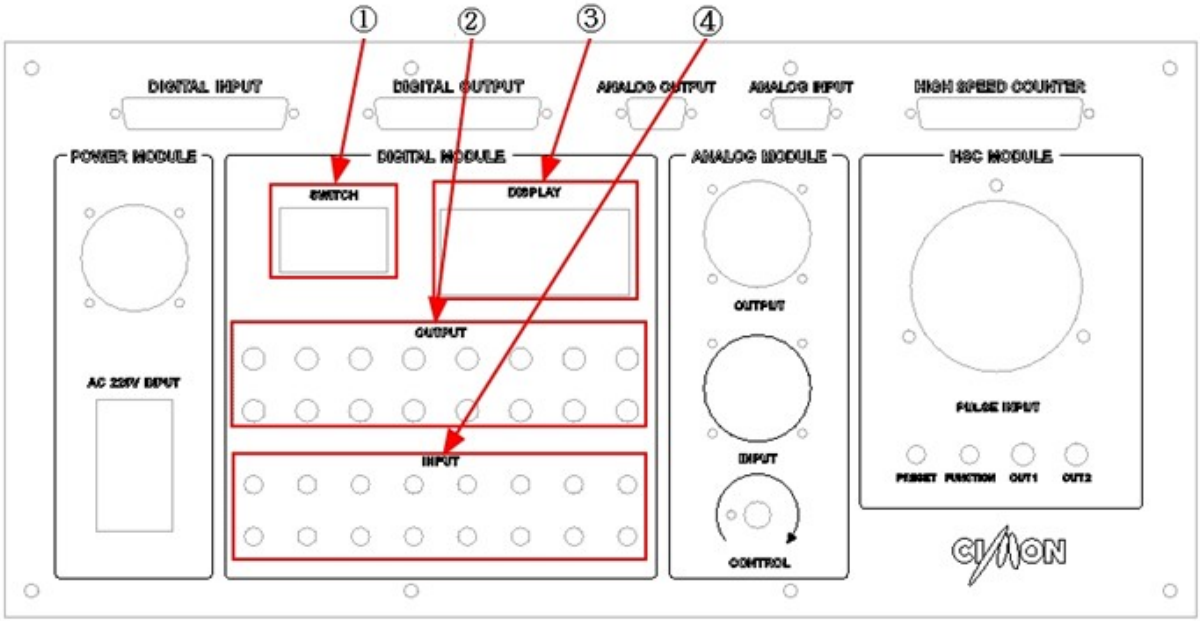
CM1-SC02A,

Model		CM1-SC02A
Interface		RS232C / RS422 / RS485
Comm. Mode	Exclusive	KDT's Exclusive Protocol(Supports 1 : n Communication)
	Graphic Loader	Graphic Loader Link Communication
	User	User Protocol
Form of Data	Data Bit	7 or 8 Bits
	Stop Bit	1 or 2 Bits
	Parity	Even / Odd / None
Form of synchronism		Non-synchronous
Baud Rate		300 / 600 / 1200 / 2400 / 4800 / 9600 / 19200 / 38400 / 76800
Modem Link		Long-distance communication by linking with a modem unit

CM1-EC01A,

Model	CM1-EC01A
Type of Cable	10BASE-T
Baud Rate	10 Mbps
Type of Transmission	Base Band
Max. Length of Segment	100m (Node to Hub)
Max. Number of Nodes	Hub 4 Steps
Max. Size of Protocol	1500 Byte
Type of Network Access	CSMA / CD

10.2.3 Assigning Input/Output Addresses



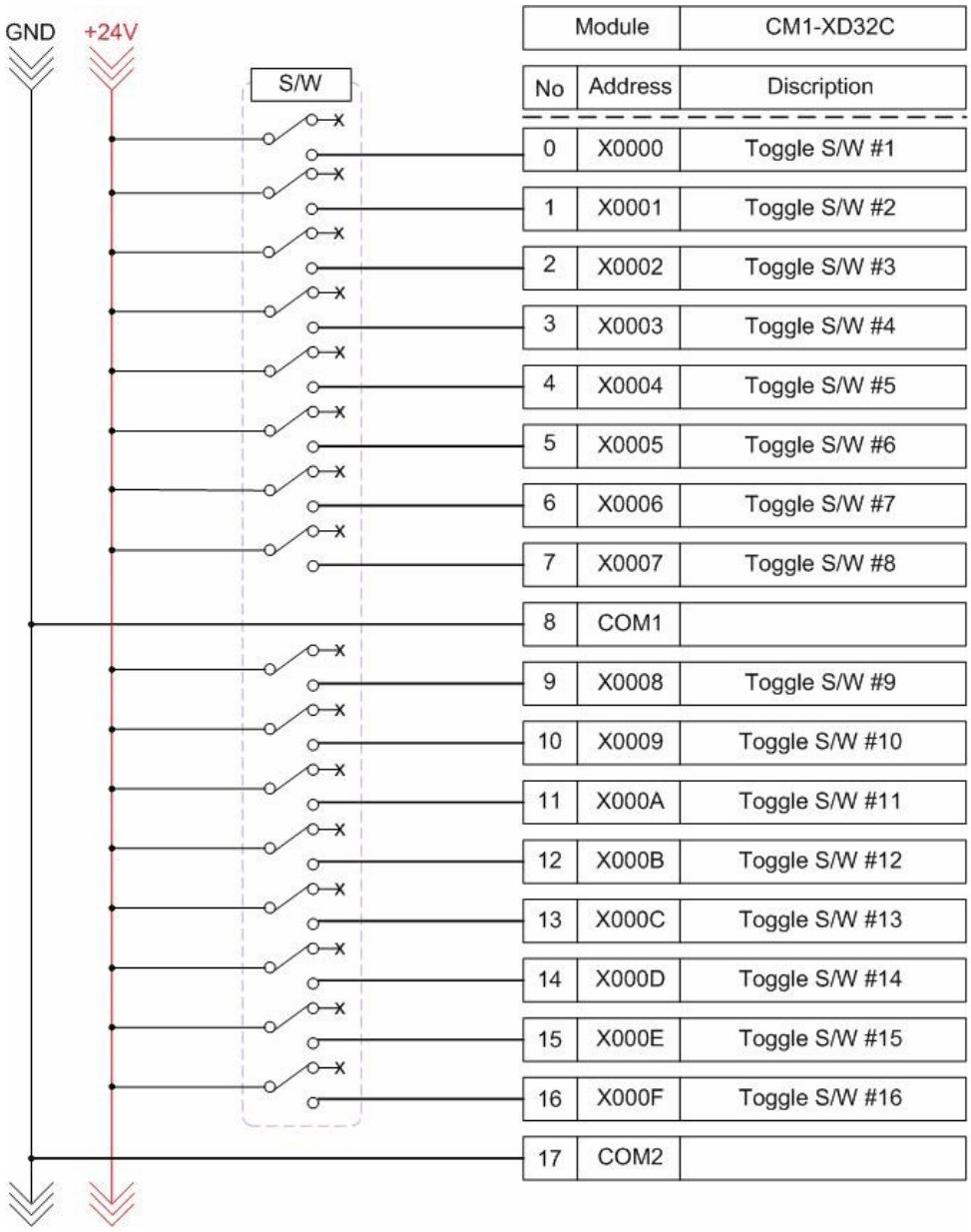
1. DIGIT Switch Input X0000 ~ X0007
2. LED Lamp Output Y0020 ~ Y002F
3. DISPLAY(BCD) UnIt Output Y0030 ~ Y003F
4. Toggle switch input X0000 ~ X000F

10.2.4 Internal Connection Diagram

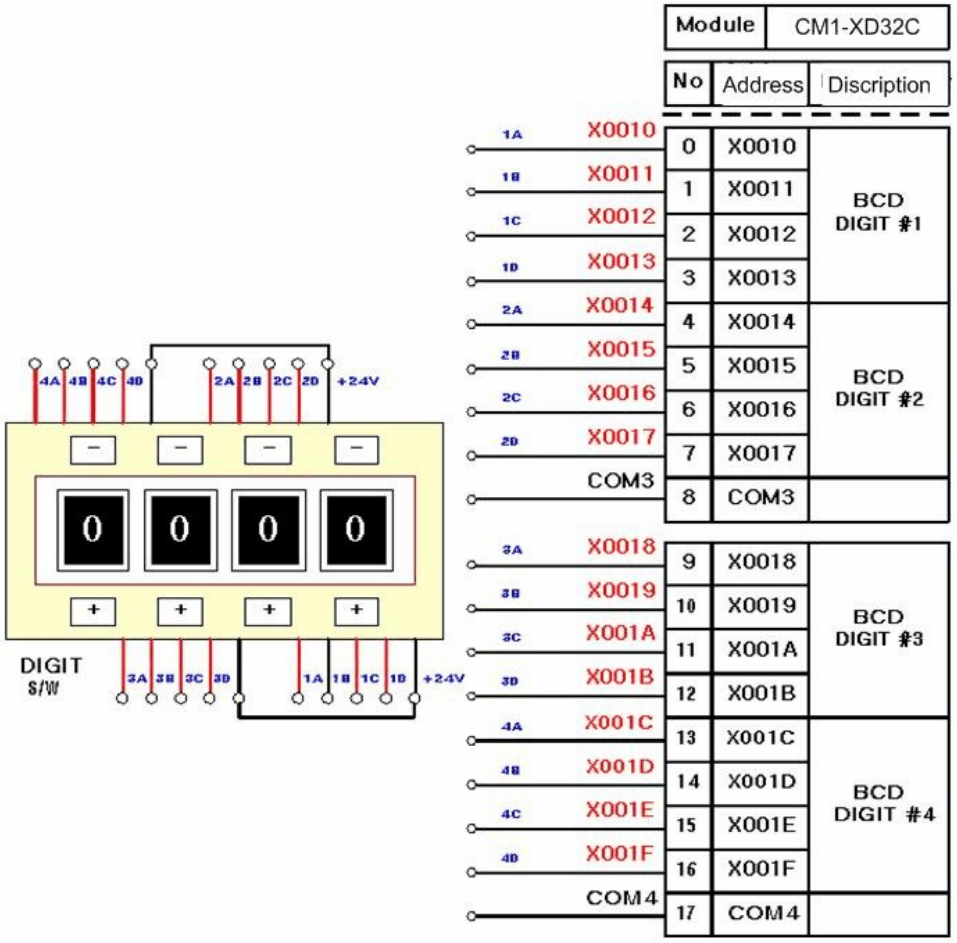
Detailed Module Connection Diagram :

- CM1-XD32C
- CM1-YT32B
- CM1-DA04V / AD08V
- CM1-HS02B

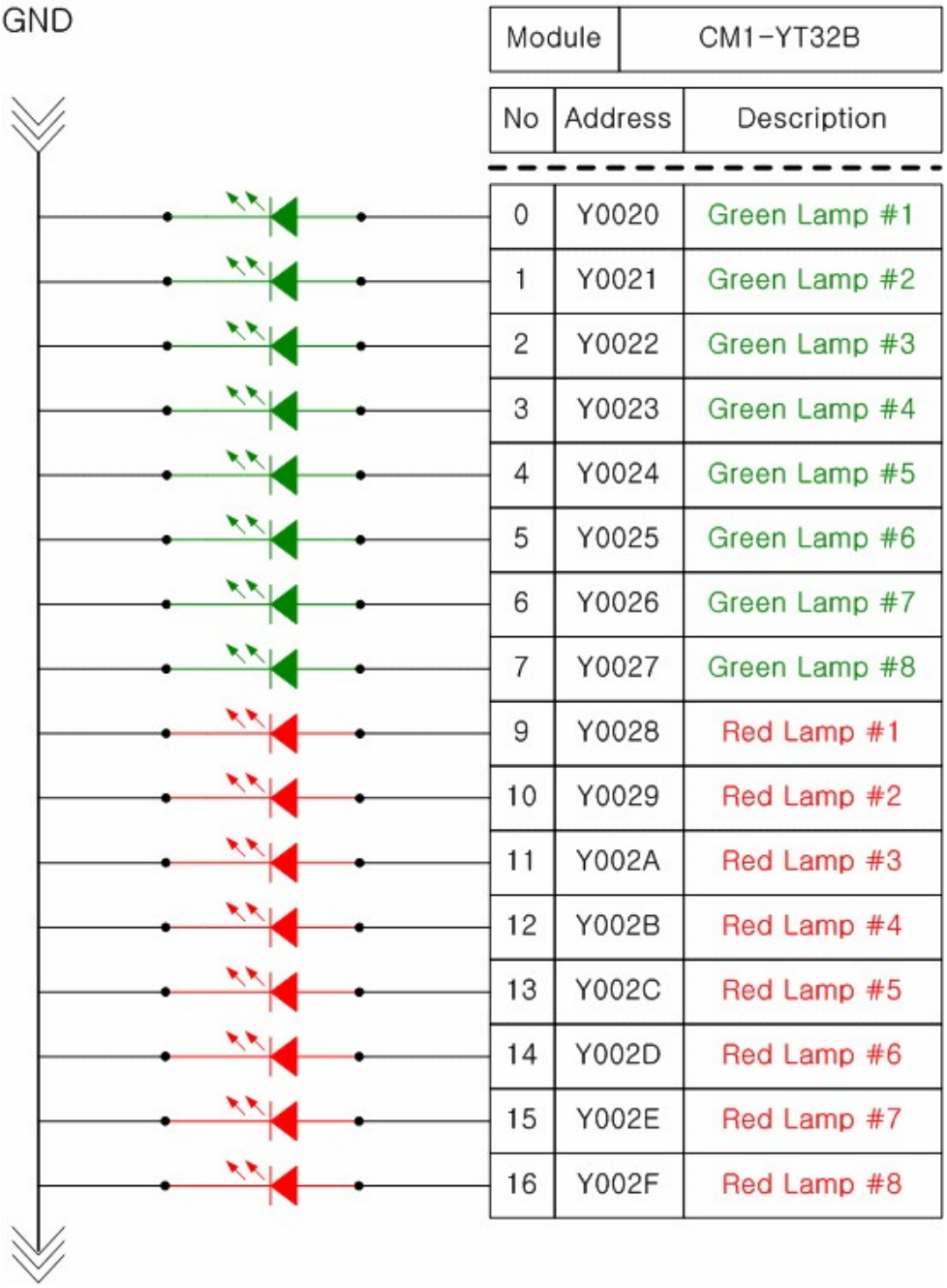
10.2.4.1 CM1-XD32C



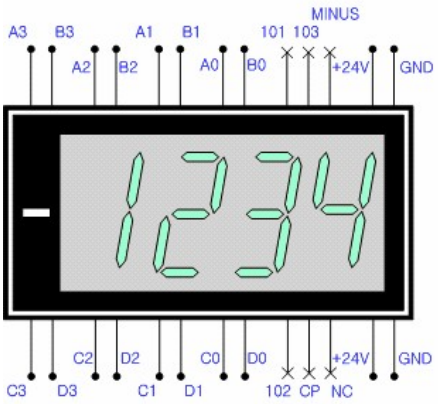
Module		CM1-XD32C
No	Address	Discription
0	X0000	Toggle S/W #1
1	X0001	Toggle S/W #2
2	X0002	Toggle S/W #3
3	X0003	Toggle S/W #4
4	X0004	Toggle S/W #5
5	X0005	Toggle S/W #6
6	X0006	Toggle S/W #7
7	X0007	Toggle S/W #8
8	COM1	
9	X0008	Toggle S/W #9
10	X0009	Toggle S/W #10
11	X000A	Toggle S/W #11
12	X000B	Toggle S/W #12
13	X000C	Toggle S/W #13
14	X000D	Toggle S/W #14
15	X000E	Toggle S/W #15
16	X000F	Toggle S/W #16
17	COM2	



10.2.4.2 CM1-YT32B



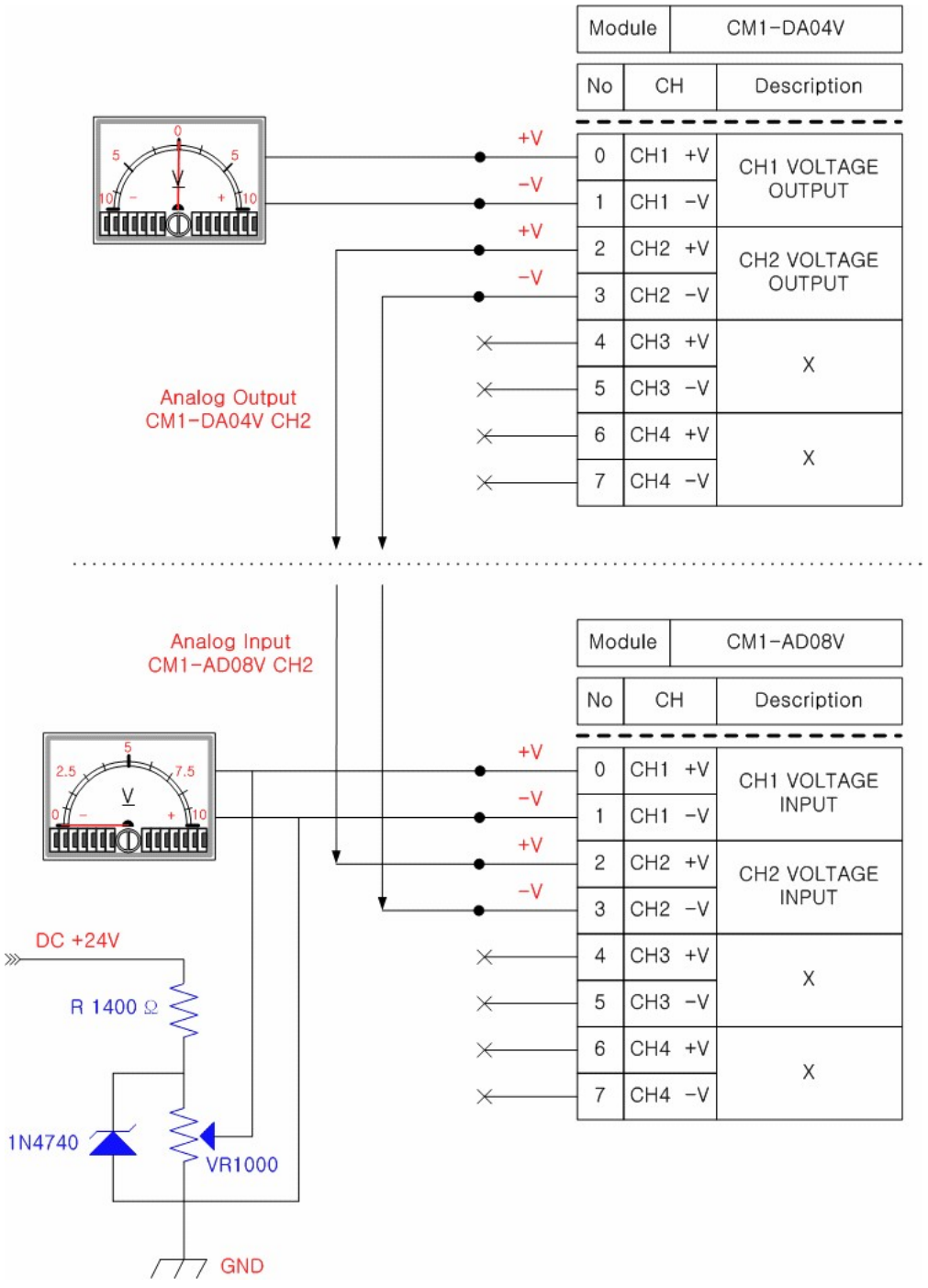
Module	CM1-YT32B	
No	Address	Description
0	Y0020	Green Lamp #1
1	Y0021	Green Lamp #2
2	Y0022	Green Lamp #3
3	Y0023	Green Lamp #4
4	Y0024	Green Lamp #5
5	Y0025	Green Lamp #6
6	Y0026	Green Lamp #7
7	Y0027	Green Lamp #8
9	Y0028	Red Lamp #1
10	Y0029	Red Lamp #2
11	Y002A	Red Lamp #3
12	Y002B	Red Lamp #4
13	Y002C	Red Lamp #5
14	Y002D	Red Lamp #6
15	Y002E	Red Lamp #7
16	Y002F	Red Lamp #8



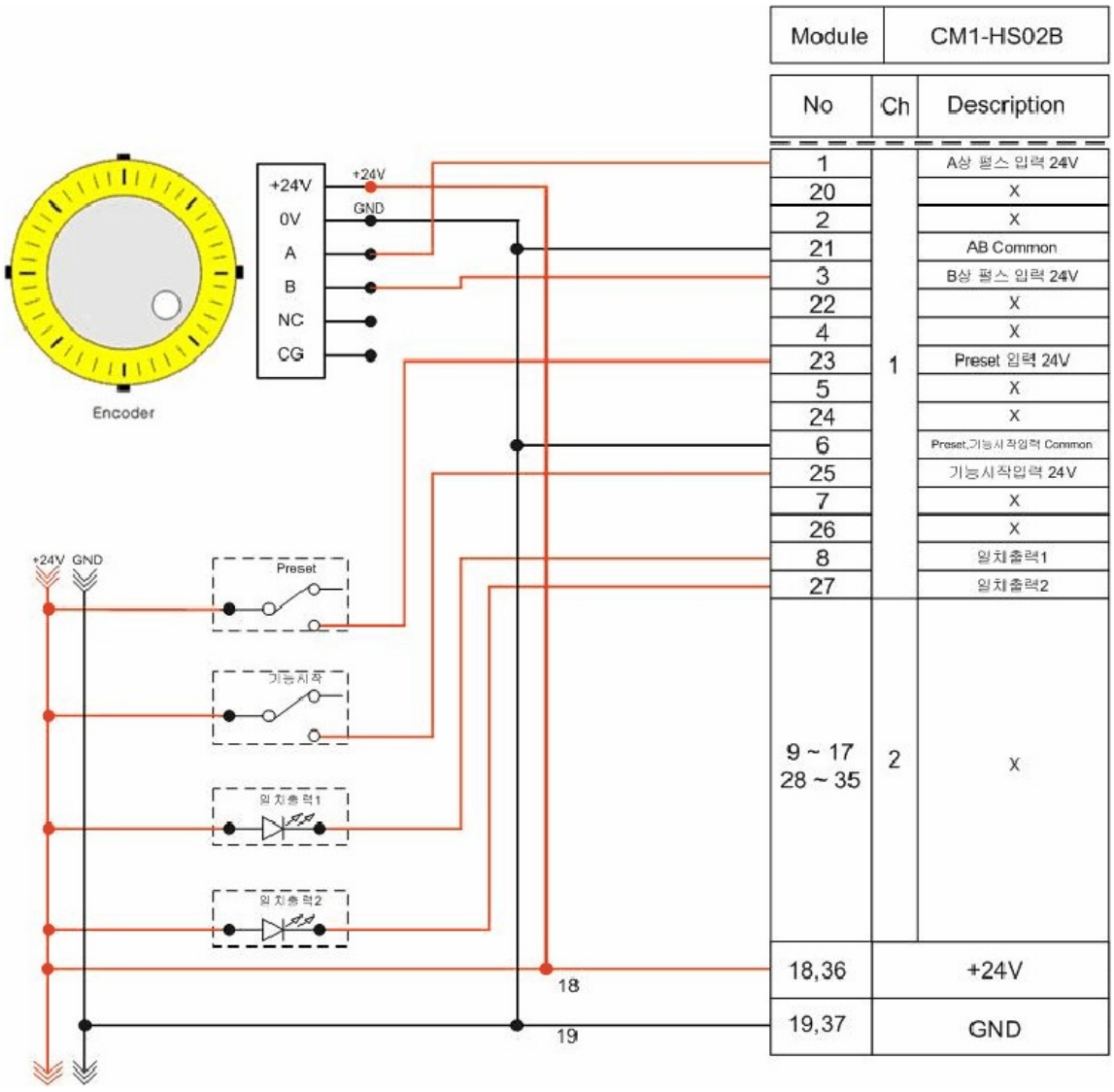
SIGNAL	A	B	C	D	표시
H	L	L	L	L	0
H	H	L	L	L	1
H	L	H	L	L	2
H	H	H	L	L	3
H	L	L	H	L	4
H	H	L	H	L	5
H	L	H	H	L	6
H	H	H	H	L	7
H	L	L	L	H	8
H	H	L	L	H	9
H	X	X	X	X	Blank

Module	CM1-YT32B	
No	Address	Description
0	Y0030	10^0 DIGIT
1	Y0031	
2	Y0032	
3	Y0033	
4	Y0034	10^1 DIGIT
5	Y0035	
6	Y0036	
7	Y0037	
9	Y0038	10^2 DIGIT
10	Y0039	
11	Y003A	
12	Y003B	
13	Y003C	10^3 DIGIT
14	Y003D	
15	Y003E	
16	Y003F	
17	+24V	
18	GND	

10.2.4.3 CM1-DA04V / AD08V



10.2.4.4 CM1-HS02B



10.2.5 Programming and Operating

Programming and Operating,

- Operating PLC
- Writing Device Addresses
- Example of PLC Program
- Linking with HMI S/W CIMON in RS232C Type

10.2.5.1 Operating PLC

1. Install the CICON software in a computer.
2. Select the menu to open the new program in the new project and to write a program.
3. After you finish writing the program and select the menu to compile it, make sure whether there is an error in the compiled one.
4. Connect the COM Port of a computer to the Loader Port of a CPU with a loader cable.
5. Select the menu to set up special cards.
6. Put the CPU on the 'Stop' mode and select the menu to download the program.
7. Put the mode switch on 'Run' mode.

10.2.5.2 Writing Device Addresses

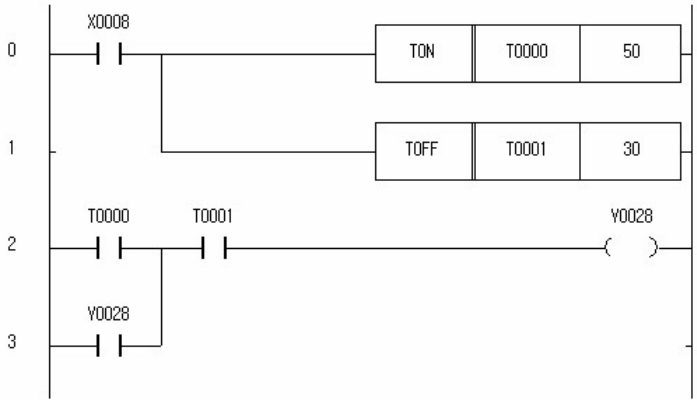
Type	Bit Data	Word Data	Timer, Counter Output Contact	Step Controller Contact	Bit Device in Words
Type of Device	[Device Symbol] + [Card No.] + [Bit No.]	[Device Symbol] + [Card No.]	[Device Symbol] + [Bit No.]	[Device Symbol] + [Card No.] + [.] + [Bit No.]	[Device Symbol] + [Card No.] + [0]
Usable Device	X, Y, M, K, L, F	D, Z, T, C	T, C	S	X, Y, M, K, L, F
Card No.	Decimal 3 Character	Decimal 4 Character	Decimal 4 Character	Decimal 2 Character	Decimal 3 Character
Bit No.	Hexadecimal 1 Character	-	-	Decimal 2 Character	-
Example	X000E Y0012 M034F K0120 L023C F0093	D1234 Z0001 T0011 C1023	T0003 C0567	S00.00 S12.78	X0110 Y0330 M0440 K0000 L0040 F0130

10.2.5.3 Example of PLC Program

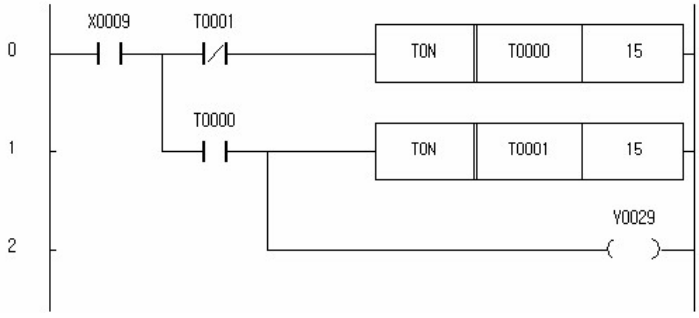
1. If the input signal(X0000) comes, the LED lamp for the output(Y0020) is turned on.

2. If the input signal(X0001) comes, the LED lamp for the output(Y0021) is turned on even the switch is turned off. If another input signal(X0002) comes, the output is turned off.

3. If the input signal(X0008) comes, the LED lamp for the output(Y0028) is turned on in 5 seconds. If the switch is turned off, the LED lamp for the output(Y0028) is turned off in 3 seconds.

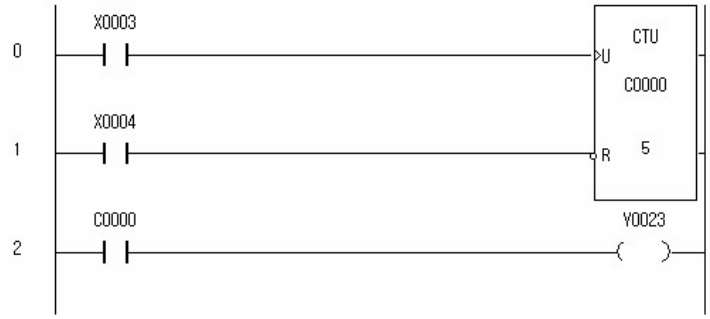


4. While the input signal(X0009) is turning on, the LED lamp for the output(Y0029) blinks at the intervals of 3 seconds.

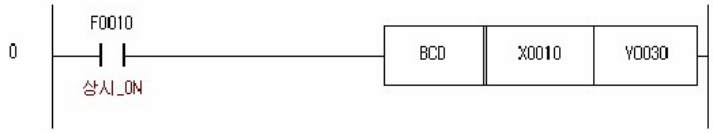


5. If the input signal(X0003) comes at five times, the LED Lamp for the output(Y0023) is turned

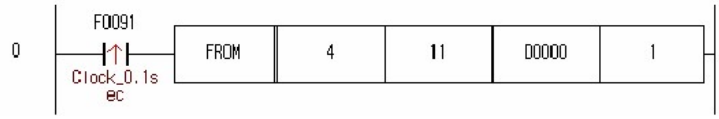
on. If an input signal(X0004) comes, the output and counting are reset.



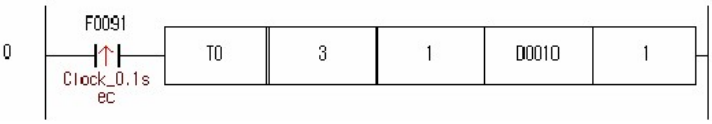
6. The numerals indicated as DIGIT S/W X0010 ~ X001F are output in DISPLAY UNIT(Y0030 ~ Y003F).



7. The voltage input from CM1-AD08V is converted to digital value and the result is stored in D0000.



8. The digital value stored in D0010 is voltage-output through CM1-DA04V.

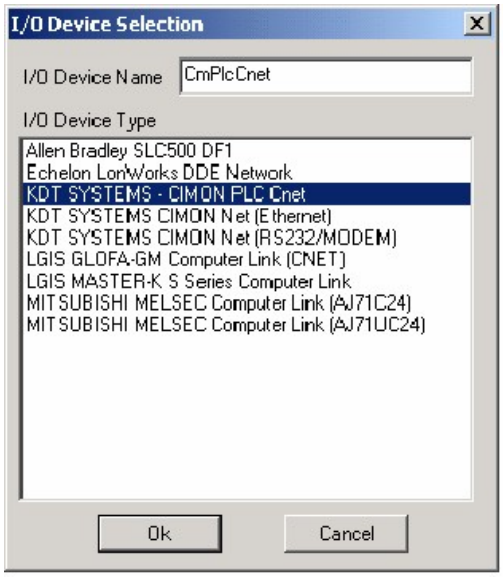


10.2.5.4 Linking with HMI S/W CIMON in RS232C Type

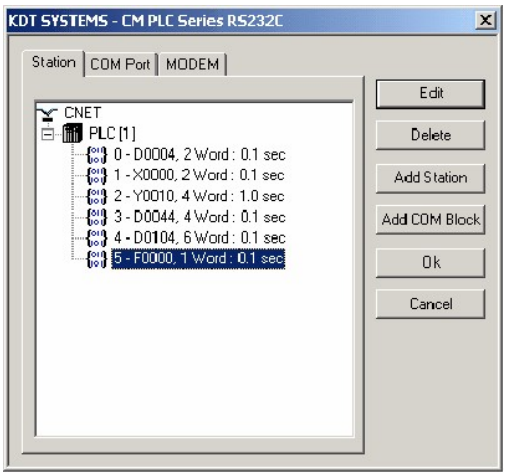
To understand easily, a written CIMON program is explained.

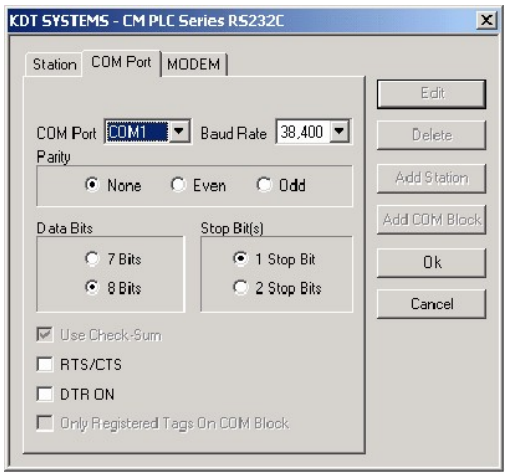
1. Setting up Communication

Connect the COM Port1 of a computer with Module CM1-SC02A in RS-232C Type.
In the I/O device setup, select the KDT Systems CIMON-PLC RS232C/422/485 after entering the name as follows.

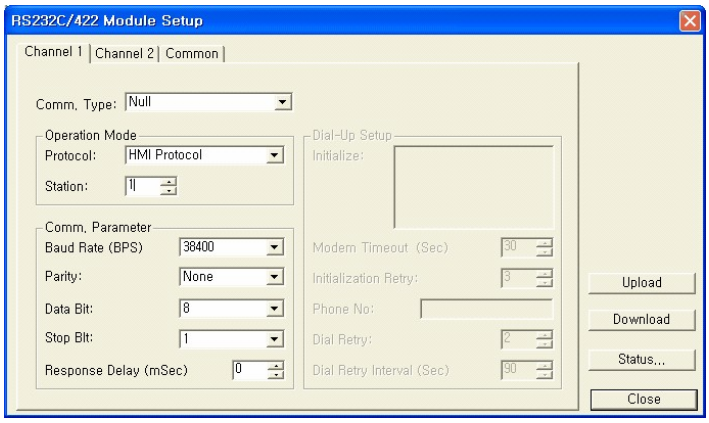


Select the menu to set up the communication block and the environment for actual communication.



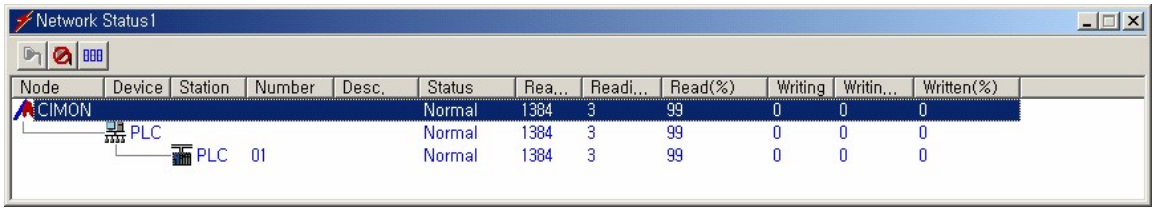


In the CICON, select the menu to set up Module CM1-SC02A as follows.



Make sure whether they are actually communicated when selecting the menu to run after setup as the above.

The communication status should be normal as follows.

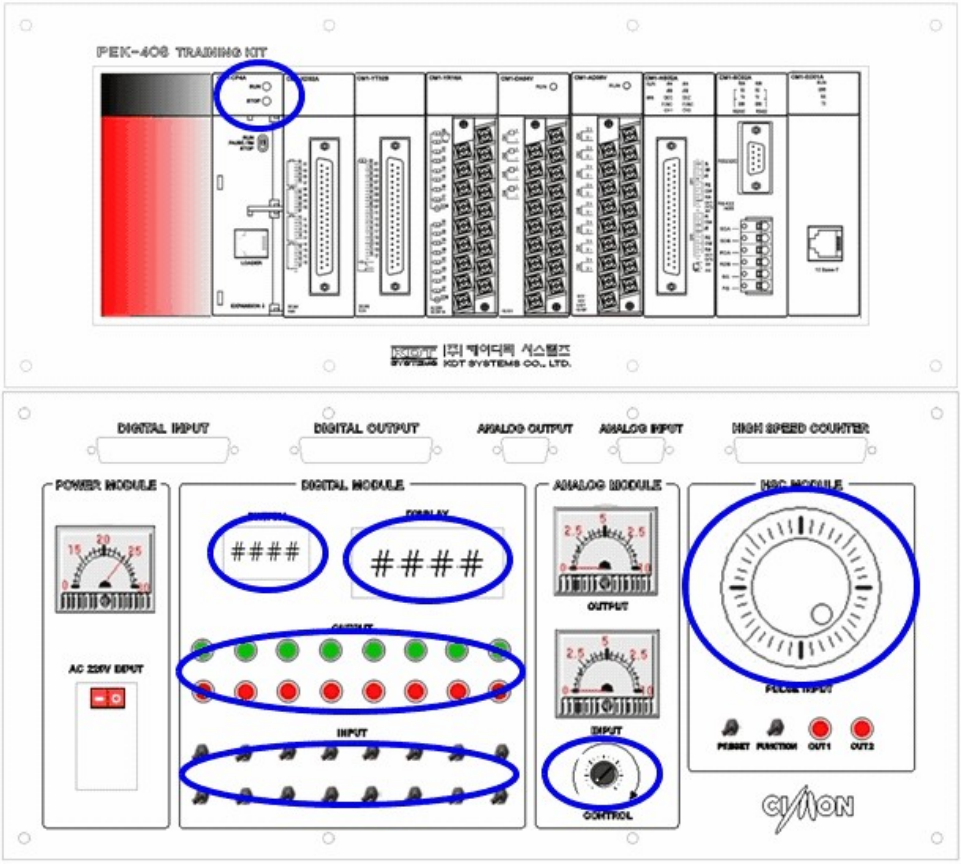


2. Address Map

Address	Data	Tag	Device	Name of Tag
F0000	Digital	Real Tag	PLC.PLC	F0
X0010	Analog	Real Tag	PLC.PLC	DIGITSW (BCD16)
Y0030	Analog	Real Tag	PLC.PLC	DISPLAY (BCD16)
Y0020 ~ Y003F	Digital	Real Tag	PLC.PLC	OUTPUT.Y20 ~ OUTPUT.Y3F
X0000 ~ X001F	Digital	Real Tag	PLC.PLC	INPUT.X0 ~ INPUT.X1F
D0000	Analog	Real Tag	PLC.PLC	AD.CH1
D0044	Analog	Real Tag	PLC.PLC	HSC.CH1
-	Digital	Virtual Tag		HC_CH1_CHANGED

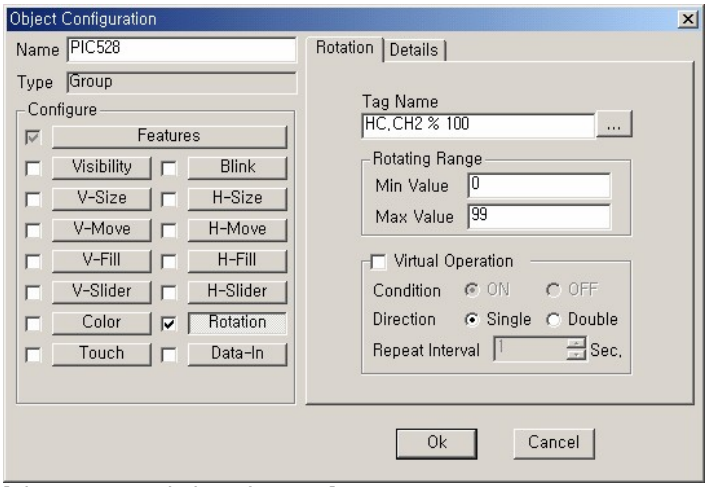
3. Window Configuration

Main Window



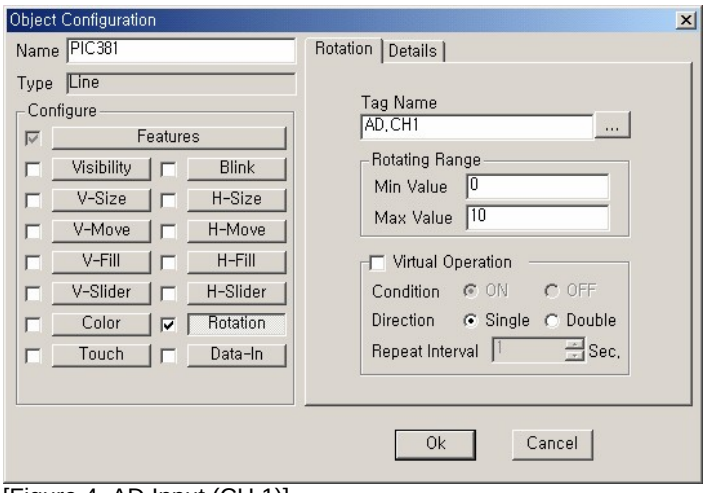
[Figure 1 Main Window]

HSC1



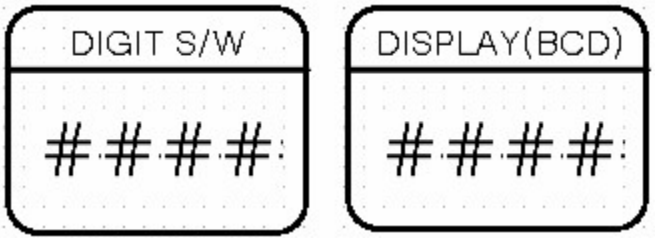
[Figure 2 Revolution of HSC 2]

AD Input



[Figure 4 AD Input (CH 1)]

Indicating BCD Value



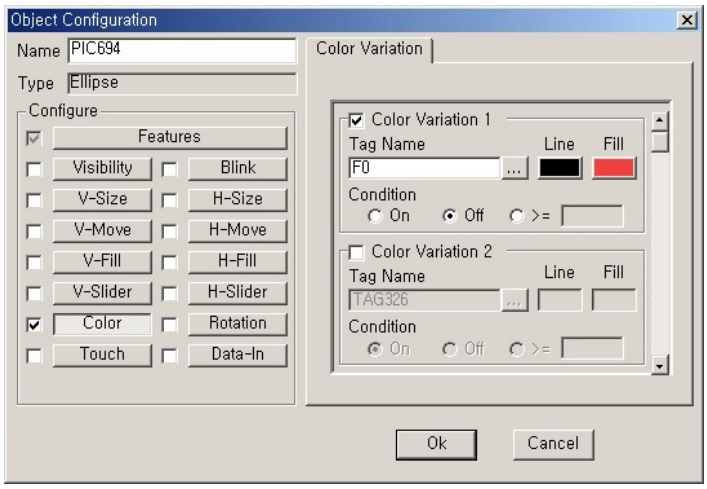
DIGIT S/W

- Tag Name : DIGITSW
- Data Type : BCD

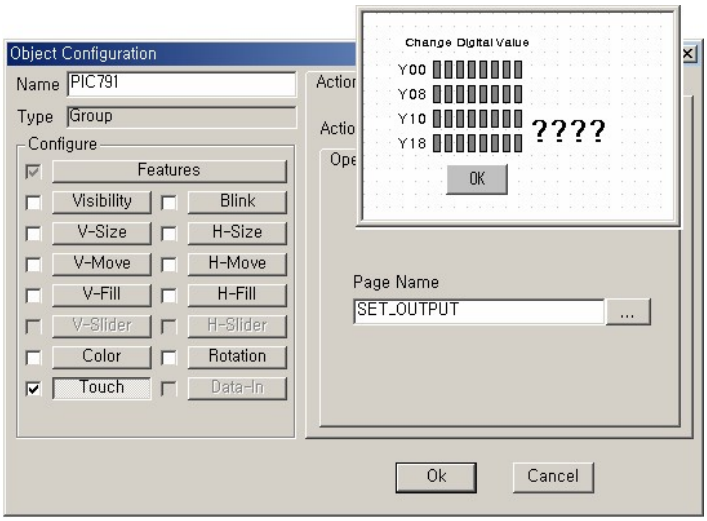
DISPLAY BCD

- Tag Name : DISPLAY
- Data Type : BCD

Lamp Indicating RUN/STOP Status

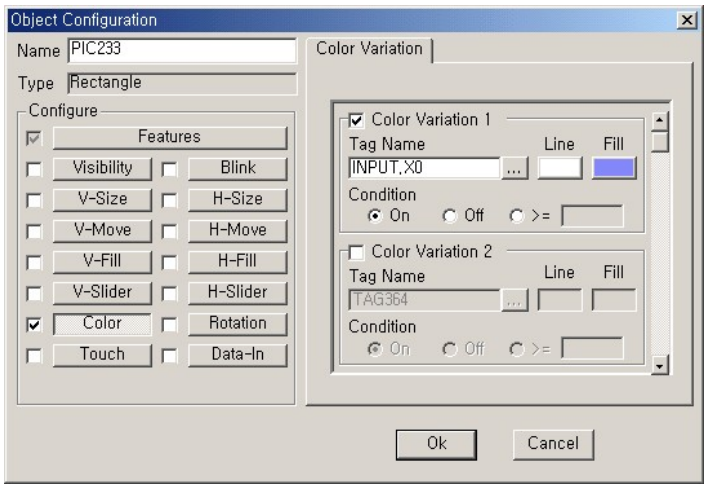


Opening the dialog box to set up Device Y

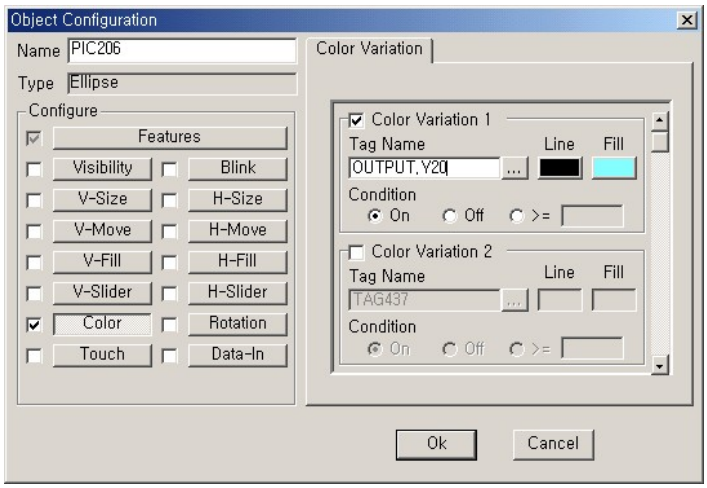


[Dialog box to open a page and set digital value]

Color Variation of Input(Device X)



Color Variation of Output(Device Y)



10.2.6 Exmaple of PLC Application

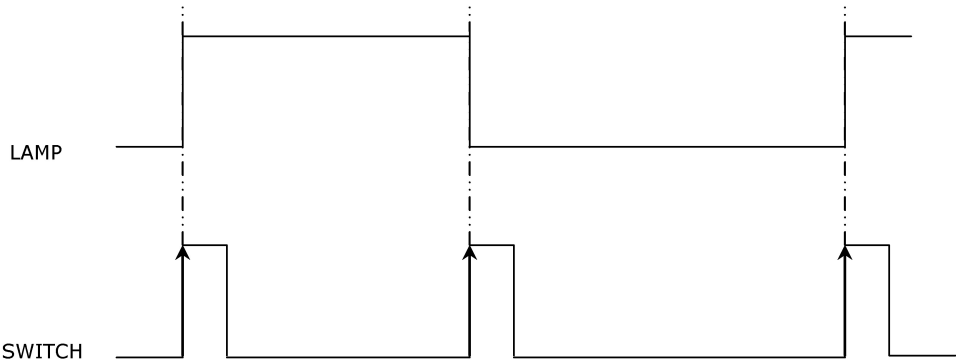
List :

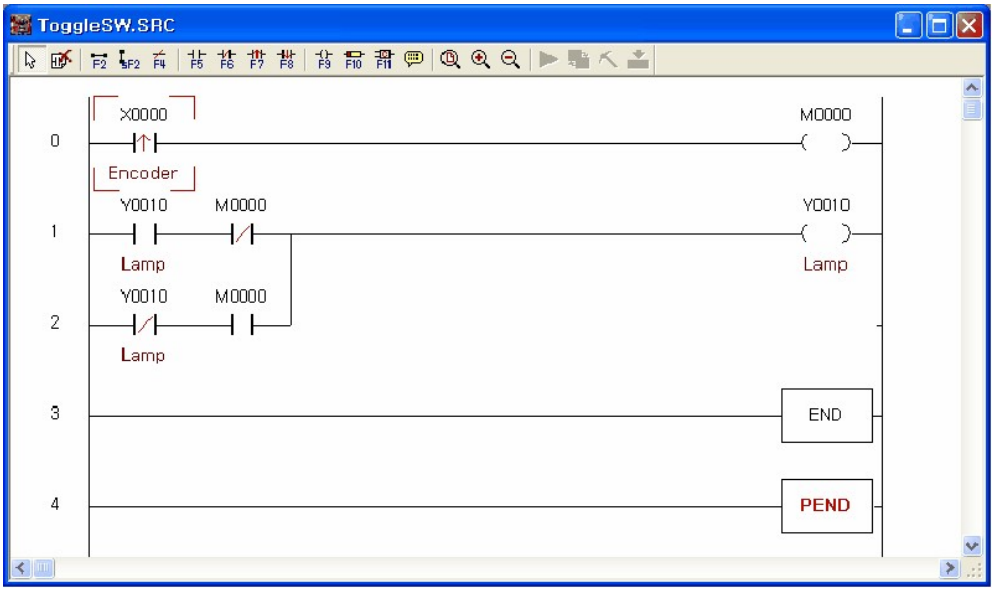
- Toggling Output Contact by Using Input Contact
- Controlling On-Off by Using a Timer
- Controlling Garage Shutter
- Measuring the Length of an Object by Using Limit S/W and Encoder
- Decoding
- Using a Cam Switch
- Counting the Number of Moving Objects

- Keeping the Counted Value
- Network

10.2.6.1 Toggling Output Contact by Using Input Contact

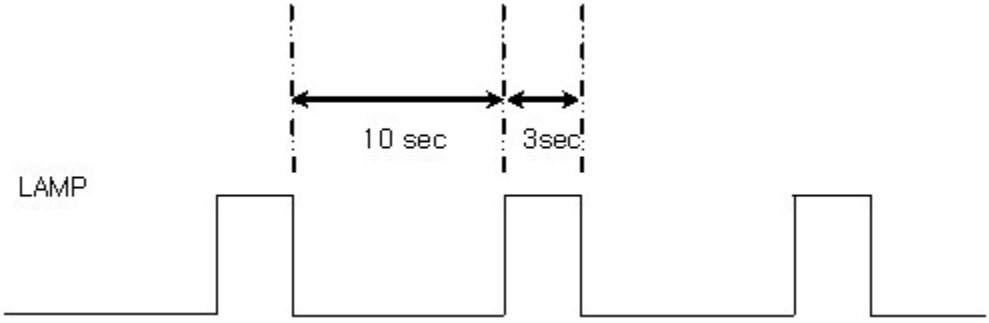
[Operation] Lamp(Y0010) is turned on and off whenever the input switch(X0000) is turned on.
If Switch X0000 is turned on in the status that the current lamp is turned on, the lamp is turned off. If Switch X0000 is turned on in the status that the current lamp is turned off, the lamp is turned on.

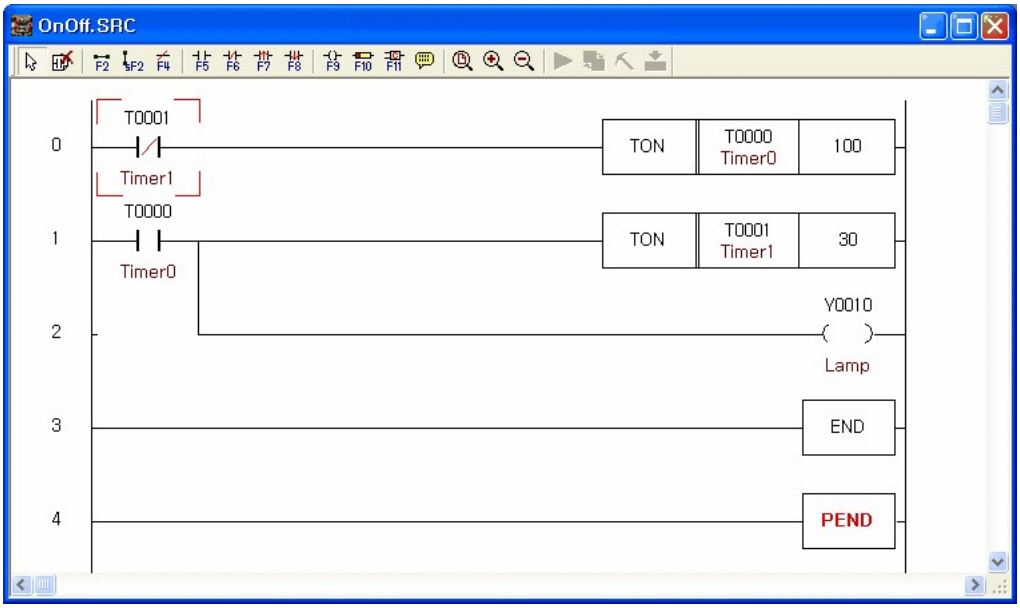




10.2.6.2 Controlling On-Off by Using a Timer

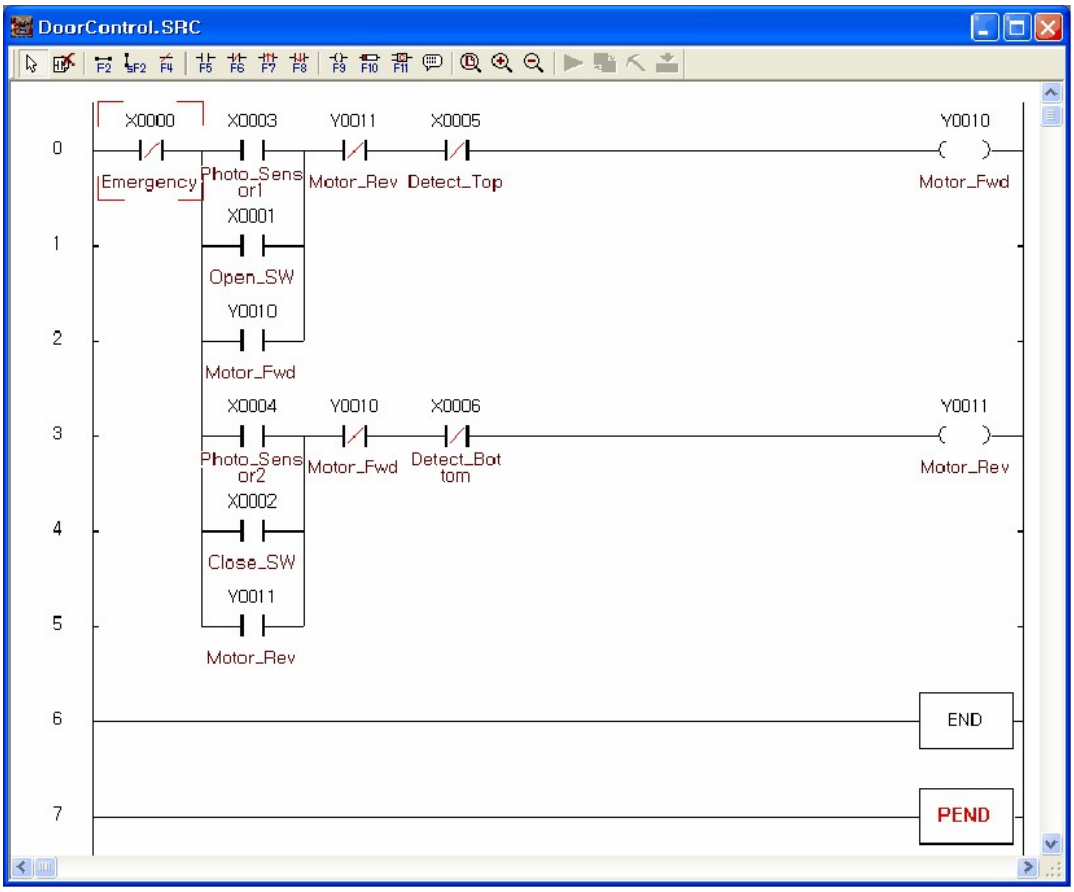
[Operation] The lamp is turned off for 10 seconds and on for 3 seconds by using a 100ms timer.





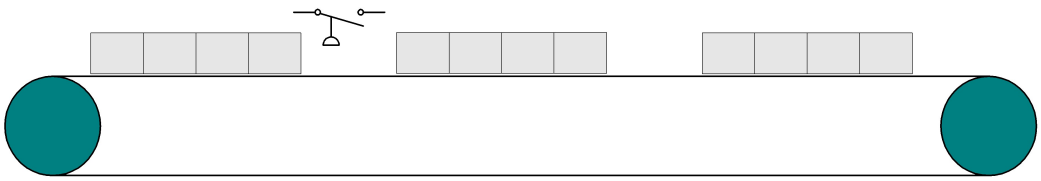
10.2.6.3 Controlling Garage Shutter

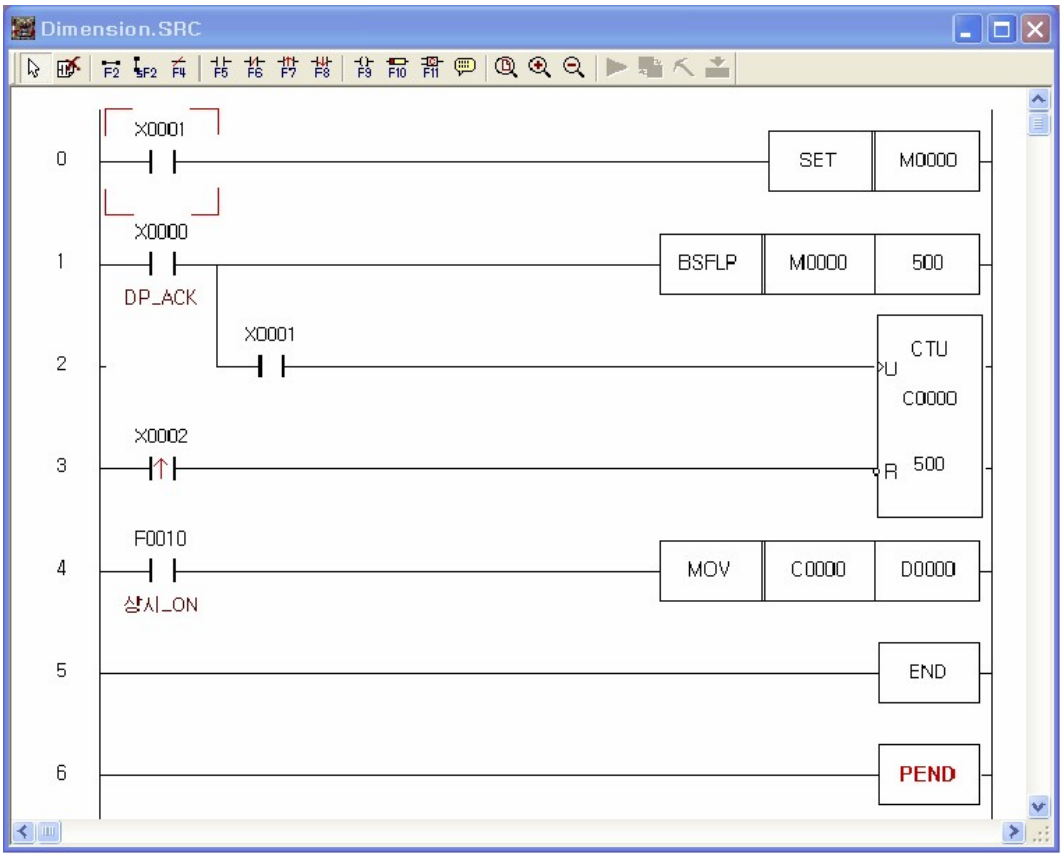
[Operation] If a car arrives in front of the garage, Photo Sensor 1 detects it to open the door. And if the car comes in, Photo Sensor 2 detects it to close the door. But the door can be controlled by up, down, emergency switch without the operation of the sensors, too.



10.2.6.4 Measuring the Length of an Object by Using Limit S/W and Encoder

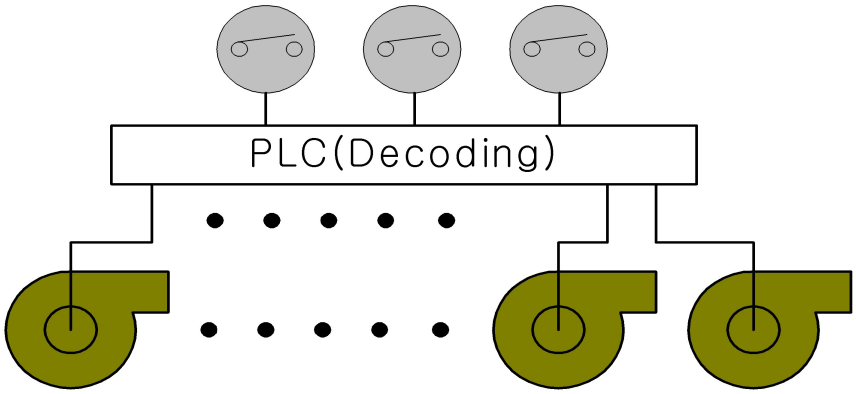
[Operation] The length of an object is measured through the conveyor in which a motor moving as much as 1 cm for 1 pulse is installed. The following is a PLC program to measure the length of the currently passing object by detecting the front and rear of the object passing on a conveyor with a limit switch.

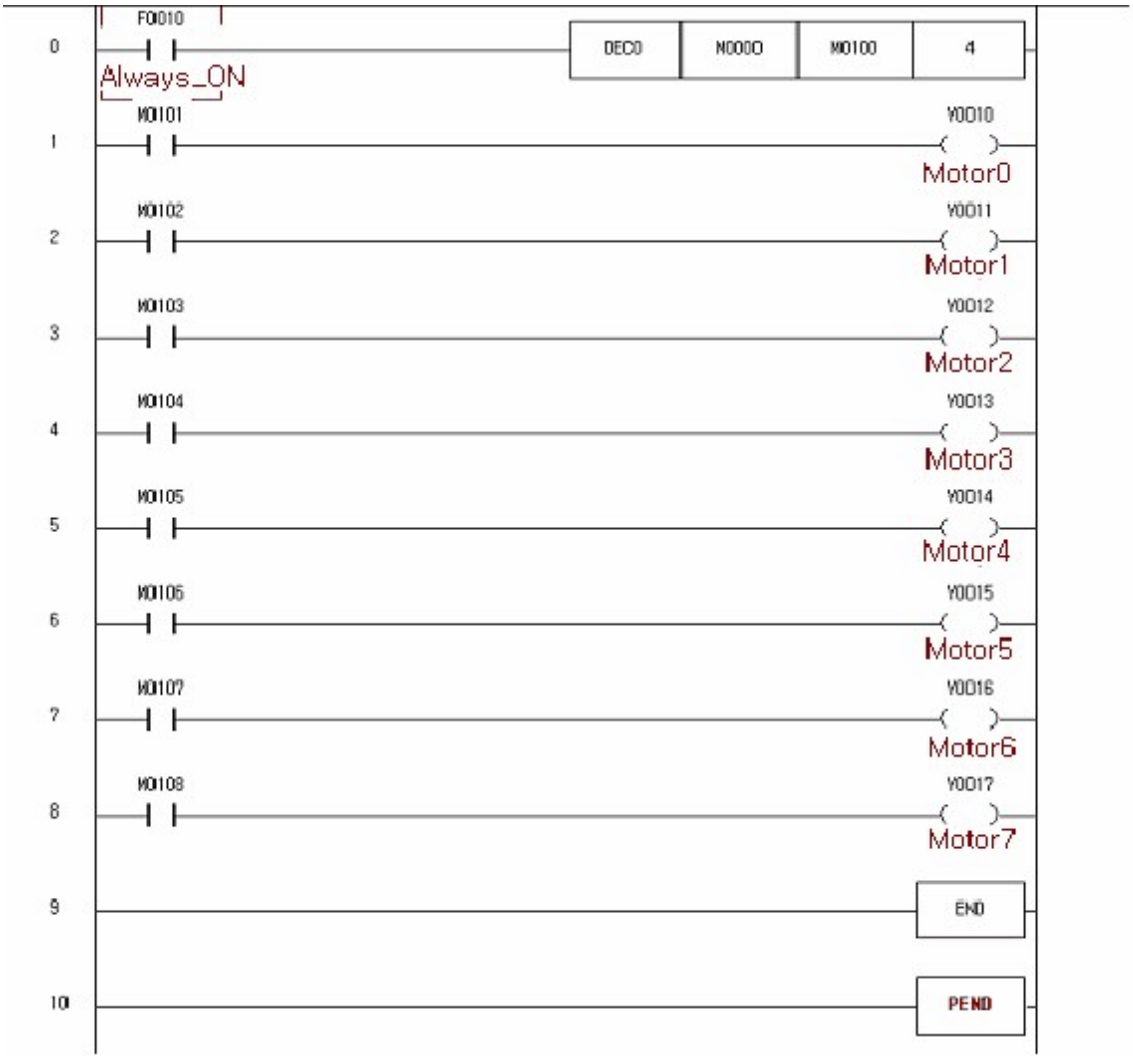




10.2.6.5 Decoding

[Operation] The following is a PLC program to analyze Input Data M0000 and operate the motor of the input number among 8 motors.

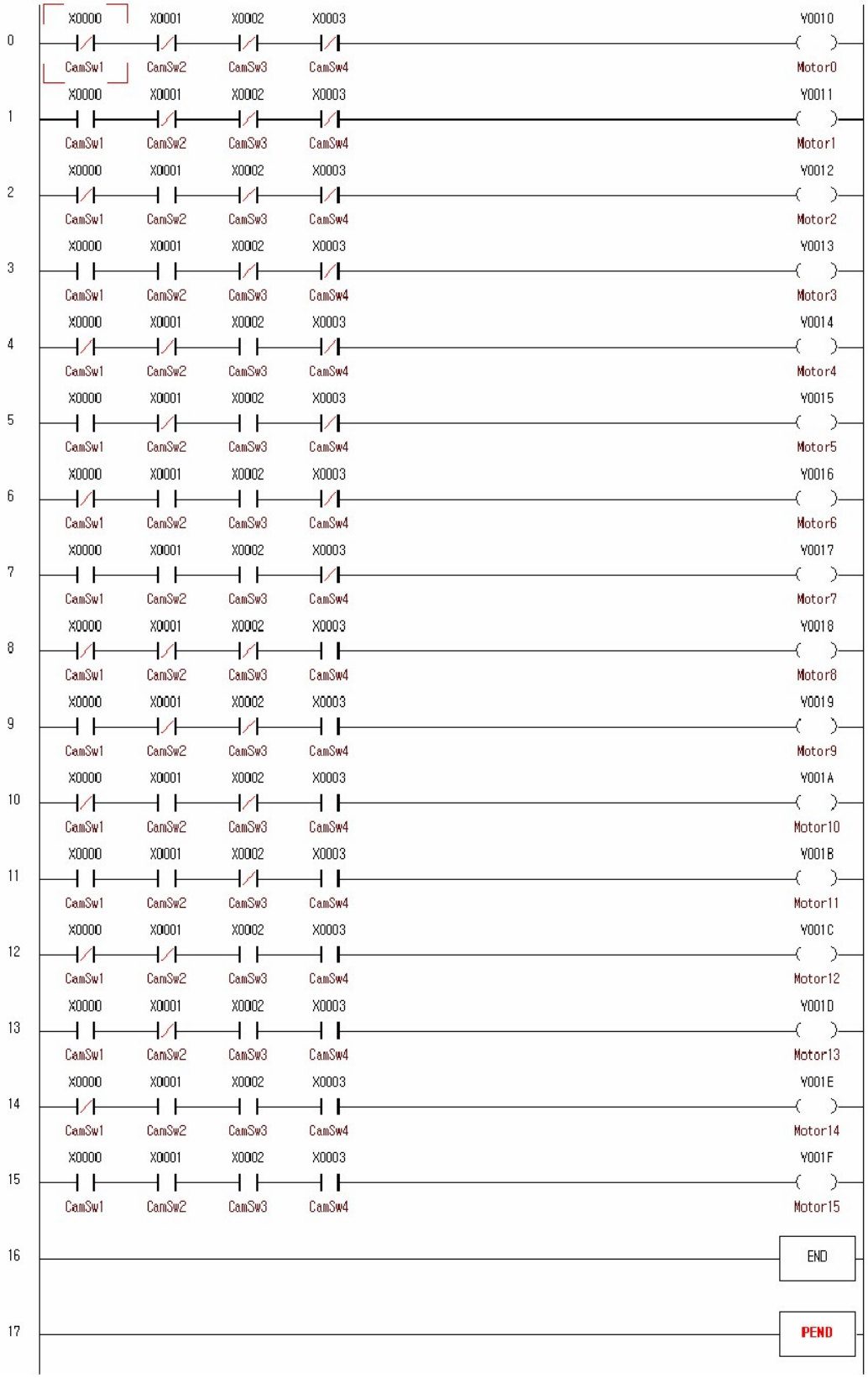




10.2.6.6 Using a Cam Switch

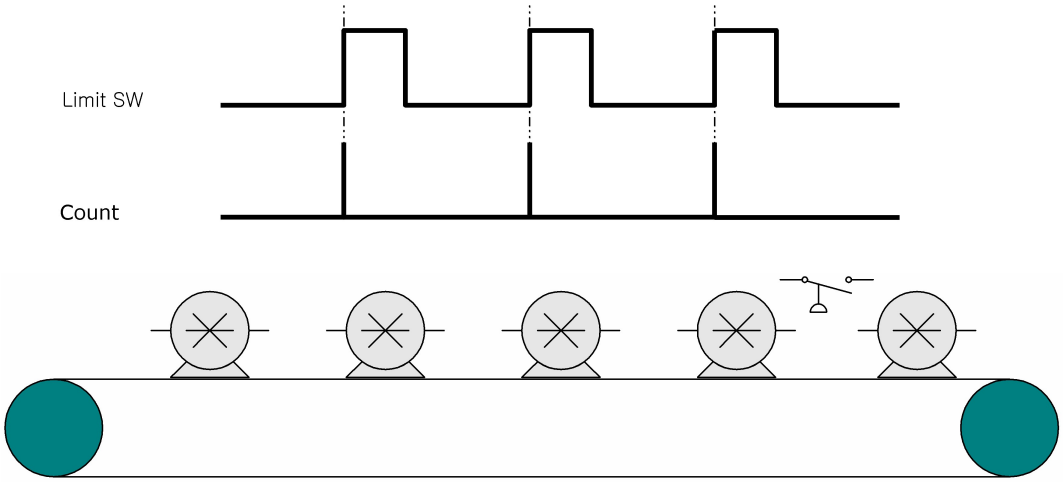
[Operation] The following is a PLC program to output bit data to 16 terminals as maximum by using the cam switch with 4 input terminals.

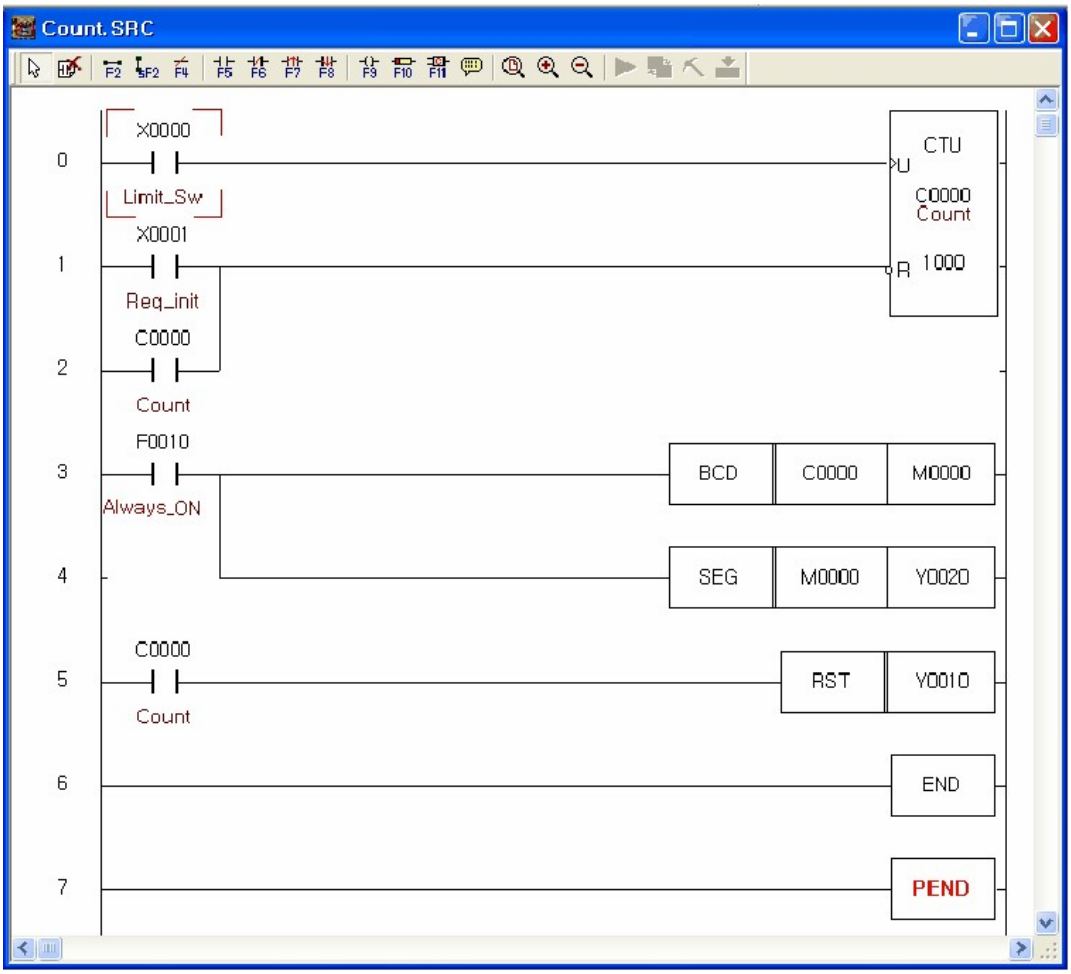
- Input terminal(Cam switch) : X0000 ~ X0003
- Output terminal(Motor) : Y0010 ~ Y001F



10.2.6.7 Counting the Number of Moving Objects

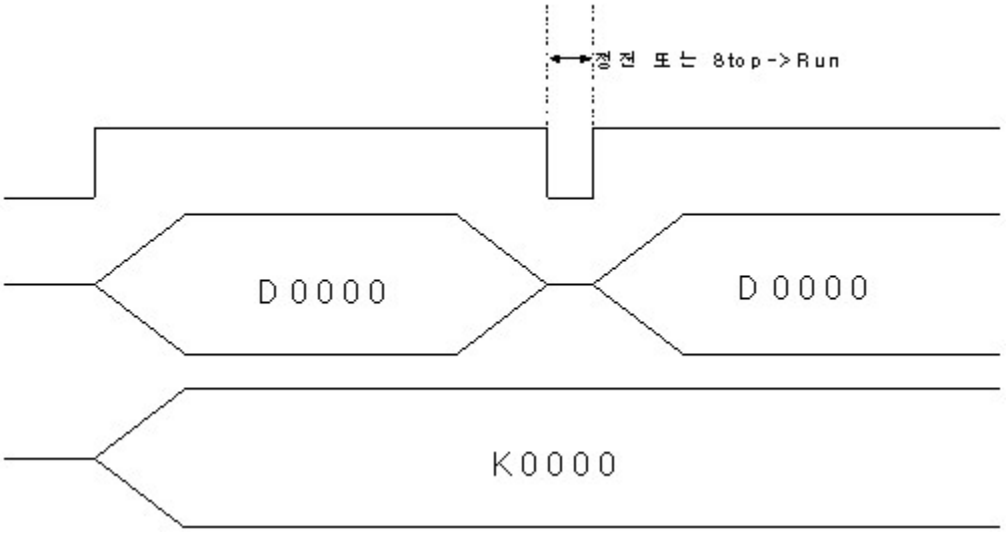
[Operation] The following is a PLC program to count the number of the objects passing on a conveyor belt and show the number on a segment indicator, and to stop the conveyor belt and clear the number on the segment indicator, if the number of the objects having passed on the conveyor belt is 1000.

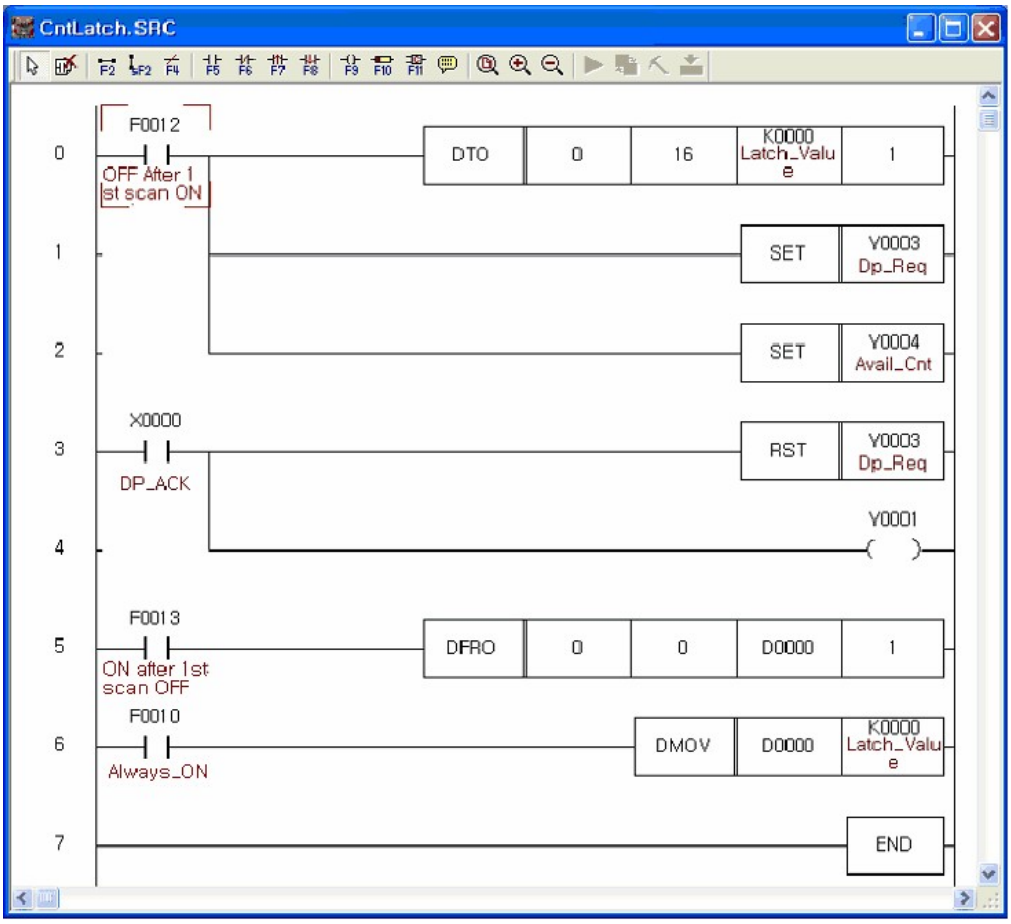




10.2.6.8 Keeping the Counted Value

[Operation] In case the power is off while counting pulses by using a HSC module or CPU status is switched from Stop to Run, the counted value is cleared. The following is a PLC program to keep the counted value as it is even though such situation occurs. (The counted value is always stored in the latched device(K0000) by MOV. The value is preset in case of running again.)



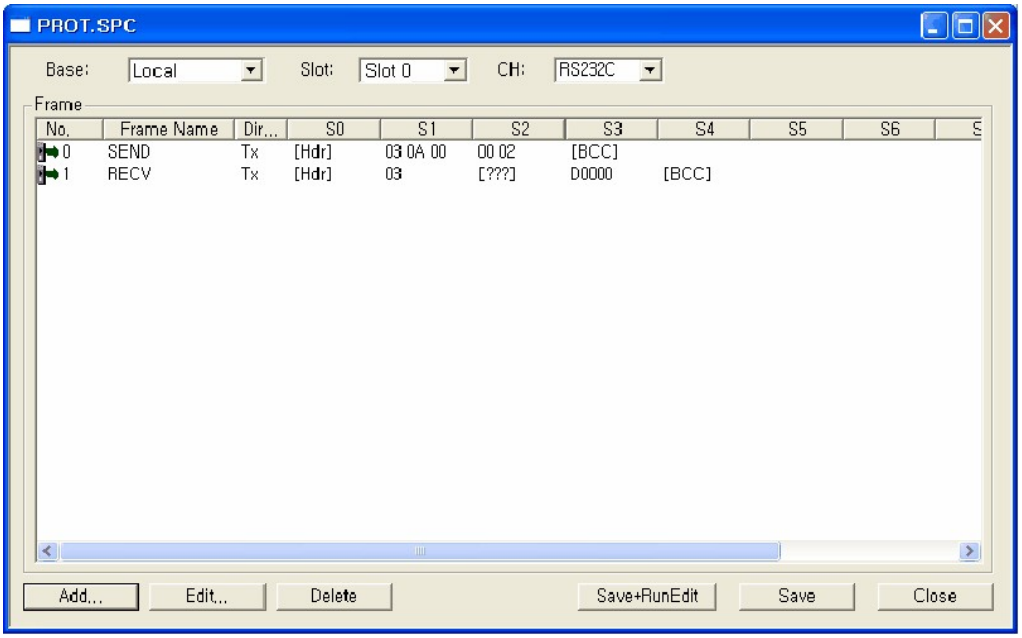


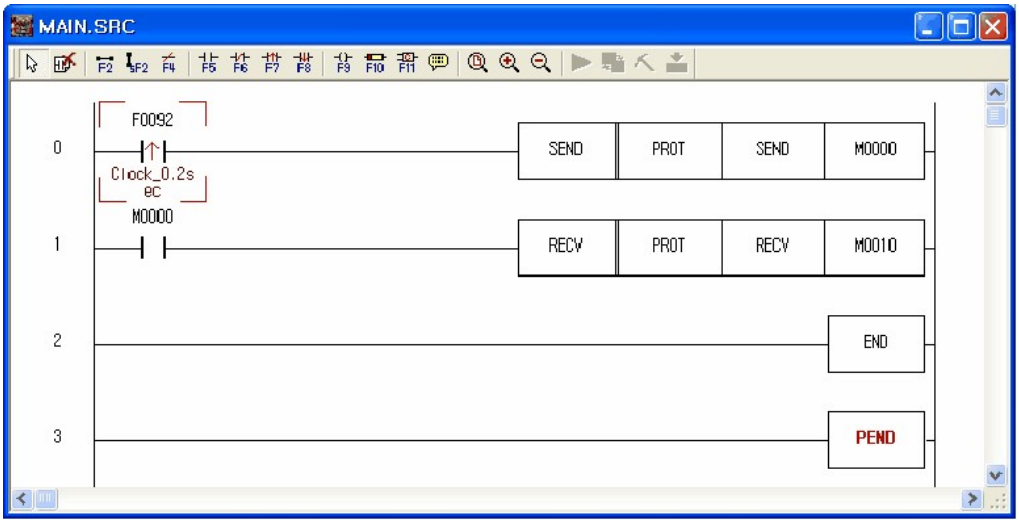
10.2.6.9 Network

[Operation] A CIMON-PLC can communicate with an other manufacturers' PLC using Modicon(Modbus) Protocol. The following is a PLC program to read 2-byte data of an other manufacturers' PLC from a CIMON-PLC

by using Modbus Protocol and store the data in the memory of the CIMON-PLC.(But, data are read every 200ms.)

- Other manufacturer's PLC: Internal Memory(Address: 402561)
- CIMON-PLC: Data Memory(Address: 403073 -> D0000)

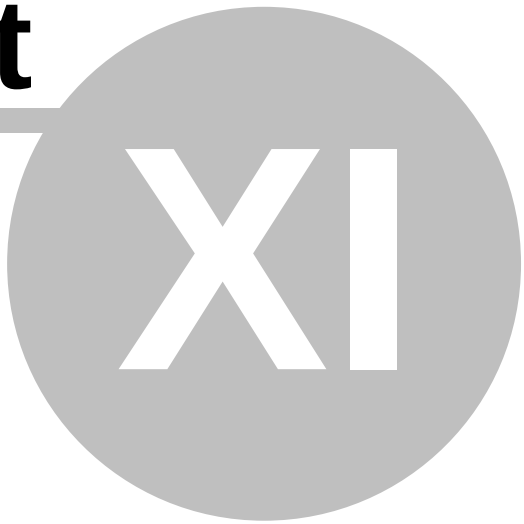




Top Level Intro

This page is printed before a new top-level chapter starts

Part

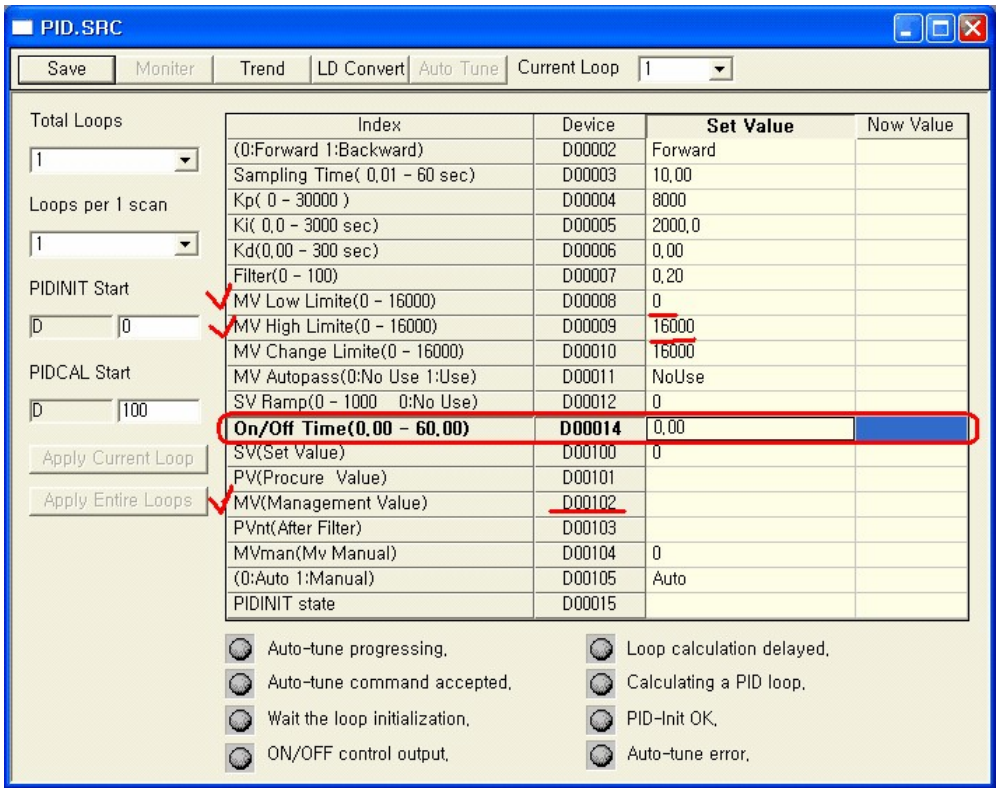


11 FAQ

Is there any question about CIMON - PLC ? See our FAQs.

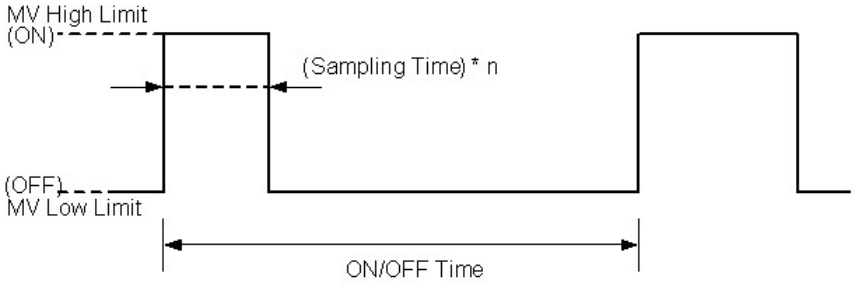
11.1 How can I program an ON-Off (digital) PID control loop with CIMON PLC?

CICON (The programming tool for CIMON PLC series) provides an easy dialog based PID programming environment as shown in the following picture.



There is no need to write a sequence program with this tool. It is enough for programming a PID loop that fill-in some PID parameters and download with other sequence programs. One of topics in CICON help describes well how to program a standard PID loop which has an analog control signal output. Try to find the topic with "PID" keyword in help window of CICON.

This document describes a PID loop which has a digital control output - ON/OFF controlled PID. Although the ON/OFF controlled PID does not have an analog output, the basic concept and parameters are exactly the same as the standard one (the analog output PID control). All parameters in the above dialog box have the same meanings. Only one parameter needed to consider for a digital output PID is the ***"On/Off Time"***. Normally this parameter is configured as zero in an analog output PID. If this item was configured as any non-zero value, the configured PID loop will perform a digital output control. the ***"On/Off Time"*** parameter decides the duty cycle of digital output as shown in the following picture..



During the ON/Off PID control mode, the PLC CPU controls the ON duration within the boundary of defined ***"On/***

Off Time". and the output signal state (ON or OFF) is decided at every sampling time period. Because of that, the ***"On/Off Time"*** duration is recommended to be configured as at least ten times of the ***"Sampling Time"***.
As previously described, the final control output (MV : Management Value, **D00102** in the above example PID) will have just two possible output values. One is ***"MV Low Limit"*** which imply the OFF output state (**D00008** in the above example PID), and the other is ***"MV High Limit"*** which imply the ON output state (**D00009** in the above example PID). However, since the actual control output is a digital output, the programmer has to add a line of sequence program which convert the MV to a digital output signal, as shown in the following picture.

This one sequence program line can be inserted to anywhere of normal scan program type sequence program. In this example, the output actuator assumed to be allocated on the Y0030 point, and there is just one comparison. If the calculated MV has the same value as predefined ***"MV High Limit"***, then turn on the control output. Otherwise, turn off the control output.

[Summary]
1. Set the **"On/Off Time"** parameter as a non-zero value. (the unit of second)
2. The value of **"On/Off Time"** parameter has to be designated as **ten times or more** of the **"Sampling Time"** vlaue.
3. Add a sequence program which checks the control output value (MV) as describe in the following line :
   - If the MV output was the same value of **"MV High Limit"** than make the digital output point as ON. Otherwise, put the digital output point as OFF.

11.2 How can I send the initialize commands to my dial-up MODEM which is connected with CM1-SC01A?

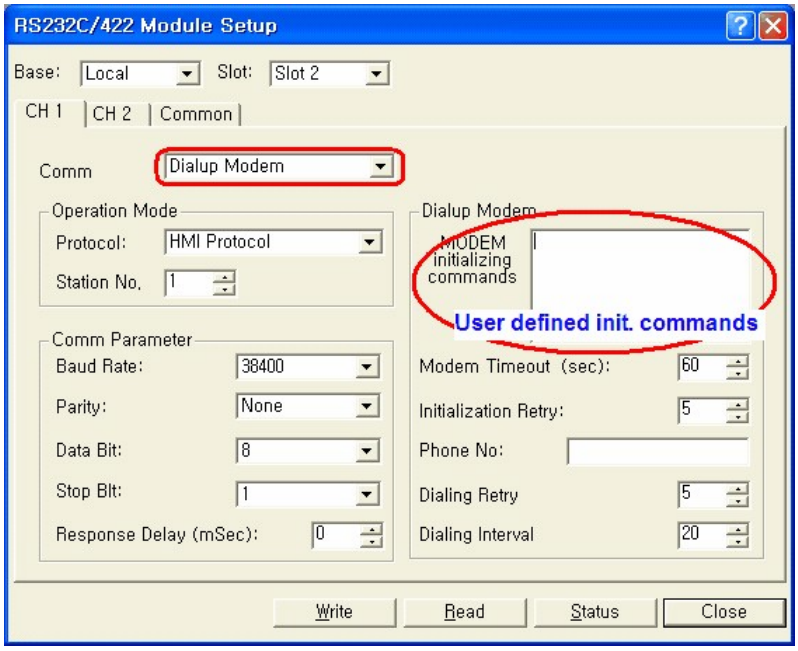
This topic can be applied to the CM1-SC02A and "T" option of CM2-BP series PLC too.

CIMON PLC provides default MODEM initializing commands as shown in the following text box :

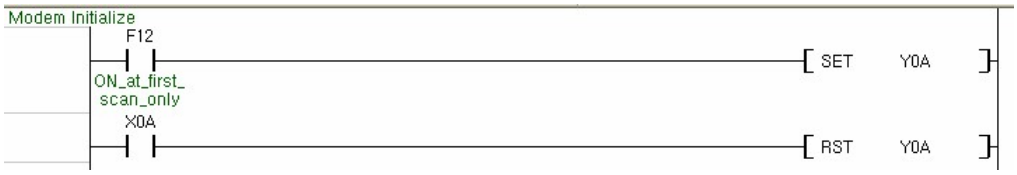
```
ATZ
ATE0
[User defined init. Commands]
ATS0=1
```

And also, user defined commands can be added to the above sequence. Following dialog box of CICON shows the configuration window of serial communication module of CIMON PLC. You can see the command input field

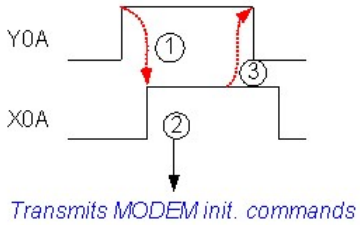
in this picture.



A simple sequence program is needed to transmit the MODEM initialization commands configured as above.



Above sequence program sends the initializing commands to the dial-up MODEM which is connected with PLC. This example assumes that the SCnnA module was installed in the first slot of local base. That is, Y0000 - Y000F and X0000 - X000F I/O memory area was allocated to the SCnnA module.
This example program can be explained by using the following timing chart.



This situation is triggered by Y0A signal which is pulled up by the sequence program.

1) SCnnA/B module detects the Y0A signal and responds with setting X0A signal up.
2) SCnnA/B module transmits the MODEM initialize commands which are registered already by CICON.
3) The X0A signal is detected by the sequence program. The sequence program pull the Y0A signal down.

Following table shows the I/O memory map of SCnnA/B module. You can see the Y0A and X0A signal descriptions in this table.

Device	Description For Signal	Device	Description For Signal
X0000	Error in module	Y0000	Clear error
X0001	Initialized (Card Ready)	Y0001	
X0002		Y0002	
X0003		Y0003	
X0004	Rx Data Existing(Ch1)	Y0004	Clear Rx Buffer (Ch1)
X0005	Tx Buffer Empty(Ch1)	Y0005	Clear Tx Buffer (Ch1)
X0006	Rx Data Existing(Ch2)	Y0006	Clear Rx Buffer (Ch2)
X0007	Tx Buffer Empty(Ch2)	Y0007	Clear Tx Buffer (Ch2)
X0008		Y0008	
X0009		Y0009	
X000A	**Modem Initialized**	Y000A	**Modem Initialization Request**
X000B	Dialing	Y000B	Dialing Request(Line Connection)
X000C	Detect DCD Signal	Y000C	Connection Release Request
X000D	Detect DSR Signal	Y000D	
X000E		Y000E	
X000F	Parameter Applied	Y000F	Parameter Setup Request

11.3 Is there any protocol over serial network to share data between two different PLC System? Especially for the PLC model that does not support the "PLC Link" such as BP16Mxx.

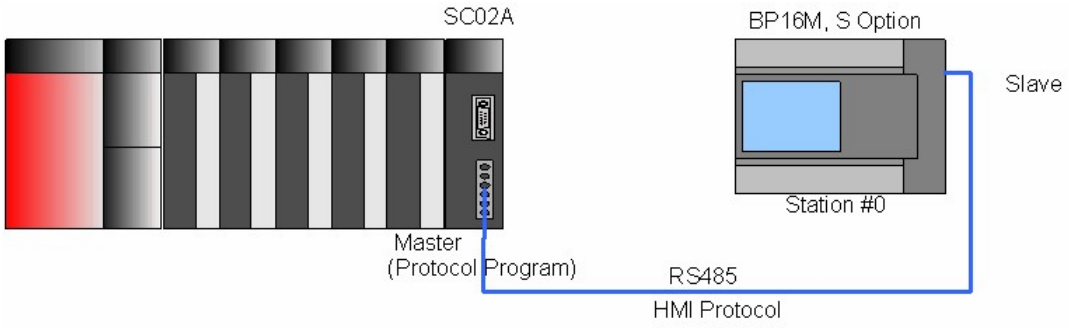
The CIMON PLC provides a network protocol, the PLC Link, for sharing data between PLC systems. However not all communication options support the PLC Link functions. The table below shows the entire serial communication modules and options of CIMON PLCs and their supported functions.

Series	Modular Type PLC (CP/XP Series)							BP32M/A/B					BP16M	
Module Name Or Option Code	CP4C	CP4D	CP4U	SC01A	SC01B	SC02A	SC01DNP	BP32A/B	Option R	Option S	Option T	Option U	Option R	Option S
RS232C	O			O		O	O		O		O		O	
RS422/485		O	O		O	O		O		O		O		O
HMI Protocol	O	O	O	O	O	O		O	O	O	O	O	O	O
MODBUS Master				O	O	O					O	O		
MODBUS Slave				O	O	O					O	O		
Protocol Program				O	O	O					O	O		
PLC Link				O	O	O					O	O		
DNP3.0							O							
Programming Mode (Loader)	O	O	O	O	O	O					O	O		
Dial-Up Modem Support				O		O	O				O			

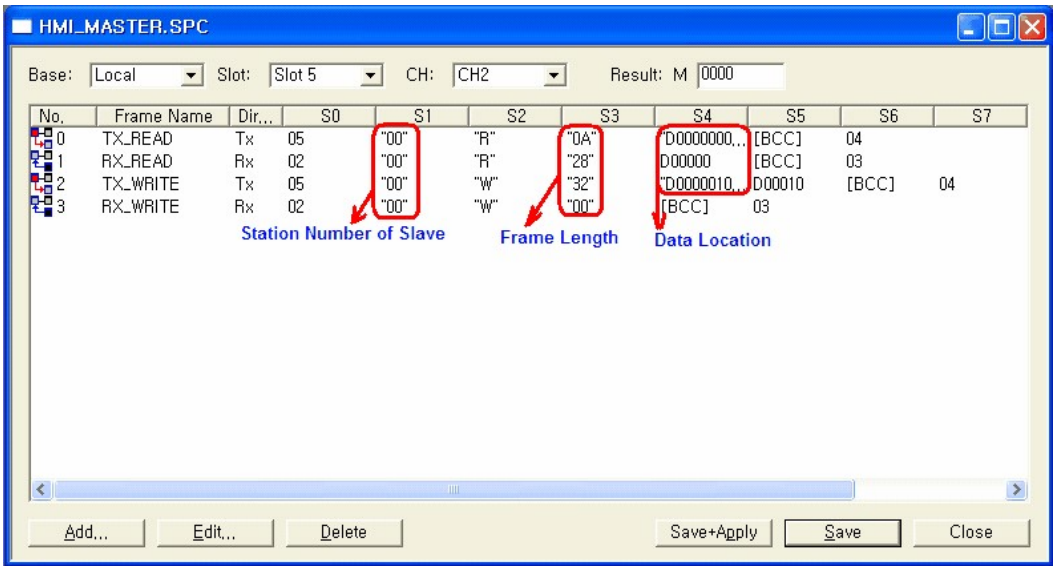
If all communication modules(options) in system configuration support the "PLC Link", there is no problem to share data between CPUs. This report is valuable to consider for the system configuration when one or several modules (or options) which do not support the "PLC Link" function are included in system configuration. However, please notice that this report assumes that at lease one module (or option) in system configuration support the **"Protocol Program"** function. Otherwise, they cannot share data directly. If there is no "Protocol Program" supporting module or option, a master system (such as CIMON SCADA or Xpanel) should relay data between slaves. This is another topic and this report does not cover that configuration.

For sharing data with a module which does not support the "PLC Link", this report recommends to use the "Protocol Program" function. Since the "HMI Protocol" is supported in almost all modules (options) of CIMON PLC, this is the most reasonable solution.

Following sample program assumes the configuration as 1:1 network.



This picture below shows a sample of "Protocol Program". (The sample program can be downloaded from internet. Seethe last page of this document.)

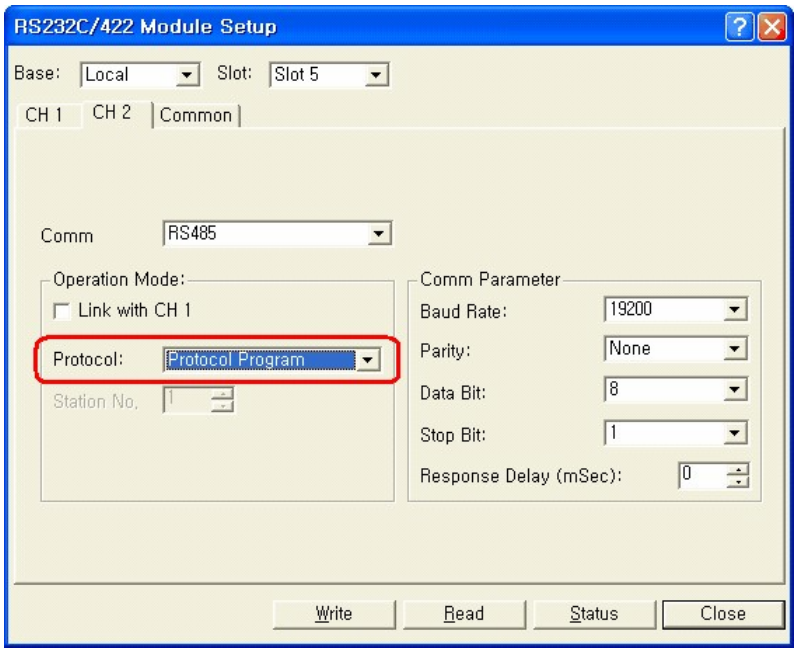


This program plays a role of "HMI Protocol" master in a network. It automatically reads 10 words of data from slave (station #0) and sends 10 words of data to slave at every 200msec as shown in the following table.

Master	Direction	Slave
D0000-D0009, 10 Words	←	D0000-D0009, 10 Words
D0010-D0019, 10 Words	→	D0010-D0019, 10 Words

Already published FAQ, "How can I create a serial protocol program?", explains about the protocol programming. The MODBUS Protocol was explained in that document, but it still can be helpful for understanding the protocol program function.

The master module which runs above protocol program should have been configured as following sample picture. Note that the "Protocol" option should be checked as "Protocol Program".



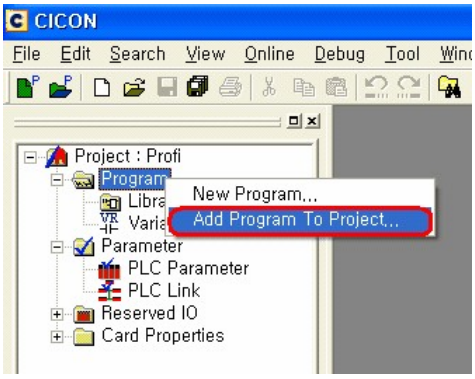
[Registering the sample program]

[STEP1] This sample program can be downloaded from following URL.

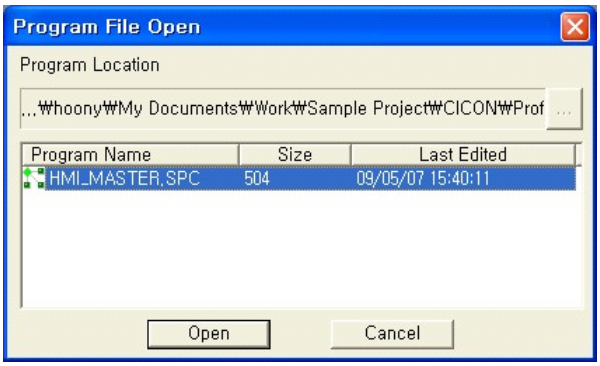
http://www.kdtsys.com/UseFiles/bbs/HMI_MASTER.ZIP

The "HMI_MASTER.SPC" file is zipped in the above file. Unzip and copy this file to your project folder.

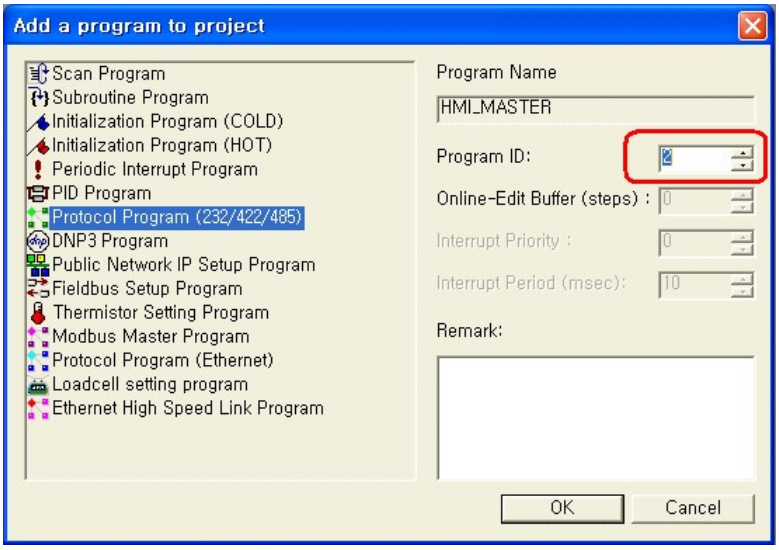
[STEP2] Register the program to your CICON project as shown in the following example picture.



[STEP3] Select the "HMI_MASTER.SPC" program file and click the "Open" button.

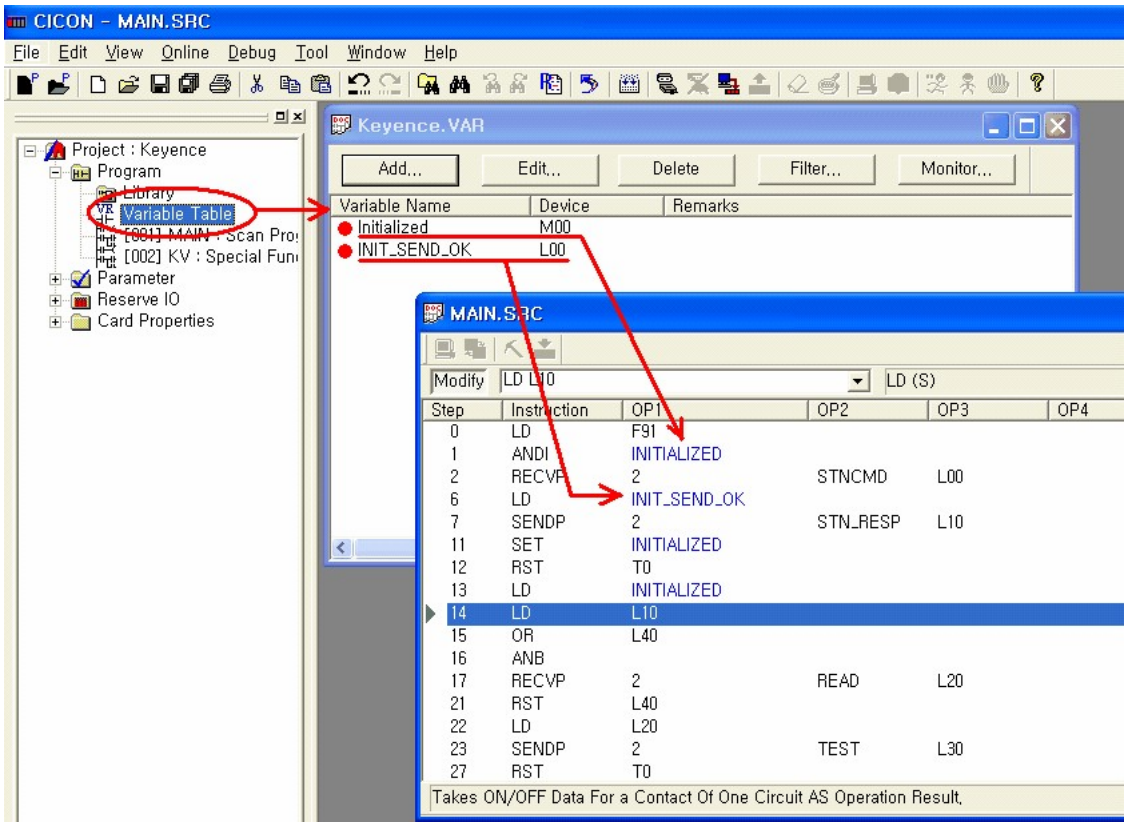


[STEP4] Configure the "Program ID". This ID should not be duplicated with other programs which are already registered in your project.



11.4 How can I use the variable name in mnemonic (IL, instruction list) program?

The programming software, CICON, supports it by the same way that of ladder programming. Following sample picture shows the overall concept of using variable name in IL window.



CICON provides the way to use variable name in programming window instead of using memory device name. First of all, for using the service, the programmer must define a variable in the 'Variable Table' window. in this window, the programmer can define their own variables according to the device type, data type and address. After all the wanted variables have been defined in the 'Variable Table', the programmer can use both of the device address and variable in IL programming window. The variable name will be displayed in blue colored text as shown in the above picture.

Notice that the word and bit variables should be defined separately even if they have the same address form. That is, for example, 'M0000' can be a bit address as well as a word address. If 'M0000' is used for both of bit and word, two different variables must be defined in the 'Variable Table', one for bit and the other for word type data.

11.5 How can I read(write) data from(to) special modules?

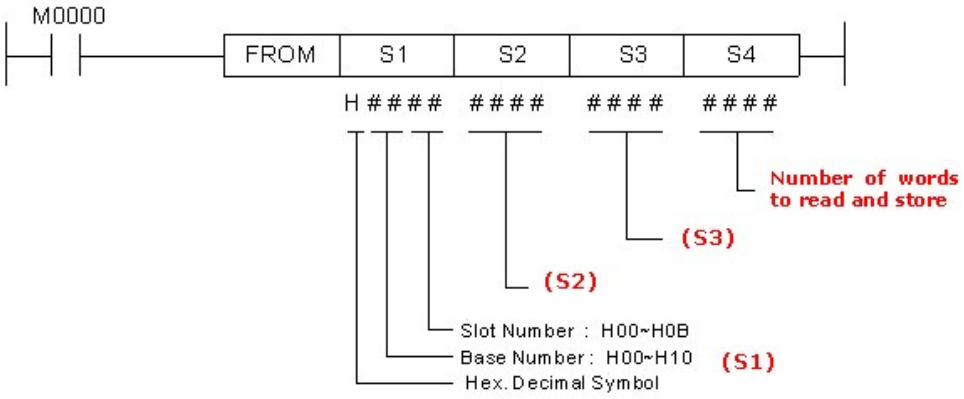
CIMON PLC has many kinds of special modules such as AD, DA, High Speed Counter, etc. All these special modules have a shared memory in their hardware for data exchange with CPU module. The CPU module can send various operation commands, and receive data through this shared memory. On the same way, a sequence program can read from and write to shared memories of special module by using dedicated instructions to this purpose, FROM and TO.

To use FROM/TO instructions appropriately, a programmer must know the memory map of the target special

module. Every special module which have a shared memory were documented the map of the memory in their manuals. CIMON PLC system calls this shared memory as “User Program Memory”.

FROM

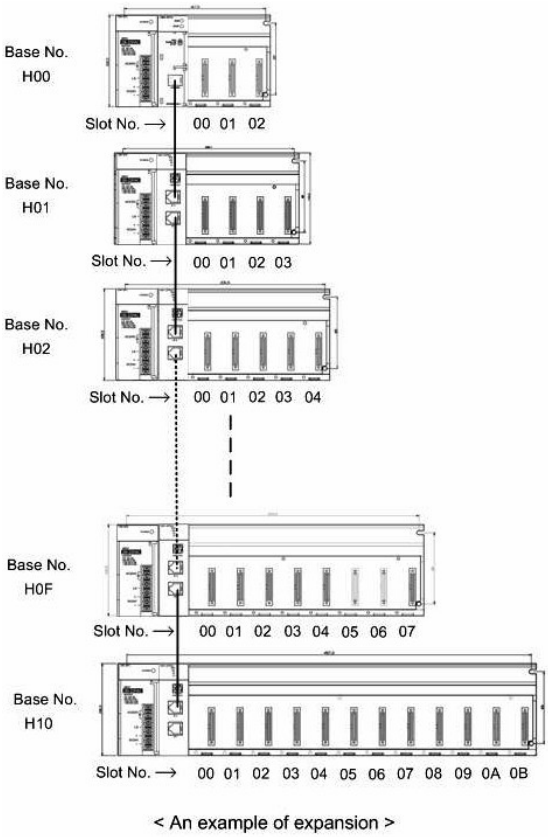
‘ FROM’ instruction reads word data from shared memory of special module, and stores them to the internal device of CPU. Sequence program of CPU can read and process the word data of special module. For example, the converted value of AD module, the temperature value of RTD or TC module etc.
The typical usage of the instruction can be represented by following LD.



S1	Base and Slot number where the special module is installed
S2	Start address of user program memory
S3	Start device address where read data are stored
S4	Number of words to read

S1 (base and slot number) :

CIMON PLC can be expanded up to 16 bases. Following is a sample drawing of 16 bases expansion.



< An example of expansion >

The first operand of FROM instruction should be base and slot number. It can be understood easily with hexa-decimal notation, because the most significant byte is assigned as base number and the least significant byte is assigned as slot number. Keep in mind that base and slot numbers are ‘ 0’ based. That is the number of local base and the first slot are zero.

S2 (Start address of user program memory) :

Designate the start address of user program memory to read. Refer to the manual or quick-reference guide of objective module.

S3 (Start address of device) :

Designate the start address of word device where read values will be stored. Y/M/L/K/D/Z devices is possible.

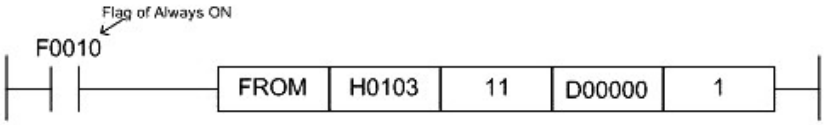
Number of words to read and store :

Designate the number of words to read and store.

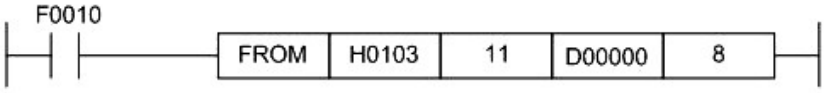
[Programming Example]

Following is an example program which reads one word and eight words. It assumes the special module is CM1-ADxxxx and installed in forth slot of the first expanded base.

Address		Descriptions
Hex	Dec	
0H	0	Channel Enable/Disable
1H	1	CH1 Avr. Const (time/count)
2H	2	CH2 Avr. Const (time/count)
3H	3	CH3 Avr. Const (time/count)
4H	4	CH4 Avr. Const (time/count)
5H	5	CH5 Avr. Const (time/count)
6H	6	CH6 Avr. Const (time/count)
7H	7	CH7 Avr. Const (time/count)
8H	8	CH8 Avr. Const (time/count)
9H	9	Avr. Mode Select
AH	10	A/D Conv. Completed Flags
BH	11	CH1 Measured Value
CH	12	CH2 Measured Value
DH	13	CH3 Measured Value
EH	14	CH4 Measured Value
FH	15	CH5 Measured Value
10H	16	CH6 Measured Value
11H	17	CH7 Measured Value
12H	18	CH8 Measured Value
13H	19	Error Code
14H	20	Ranges of Value (CH.1 ~ CH.4)



Reads a measured value of CH1. and stores it in D00000

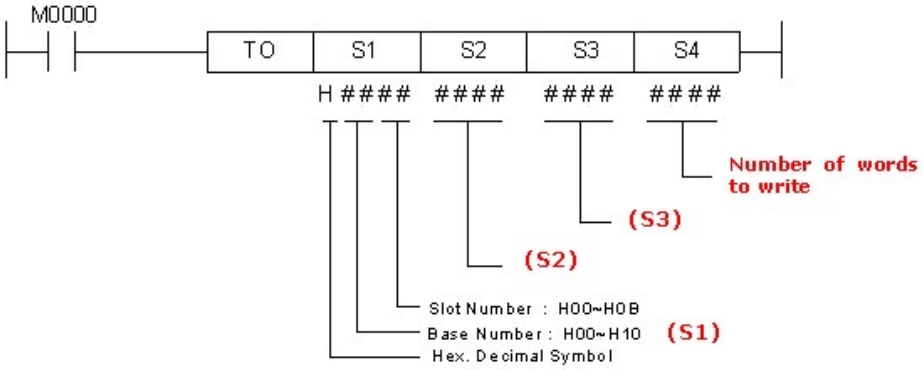


Reads 8 measured values (CH1 to CH8) and stores them in D00000 – D00007

< An example sequence program of FROM >

TO

‘ TO’ instruction writes word data to shared memory of special module such as DA modules. The typical usage of the instruction can be represented by following LD.



S1	Base and Slot number where the special module is installed
S2	Start address of user program memory where to write
S3	Constant Value or start device address which is storing values to write
S4	Number of words to write

S1 (base and slot number) :

Refer to ' FROM' instruction.

S2 (Start address of user program memory) :

Designate the start address of user program memory where to write. Refer to the manual or quick-reference guide of objective module.

S3 (Constant value or start address of device) :

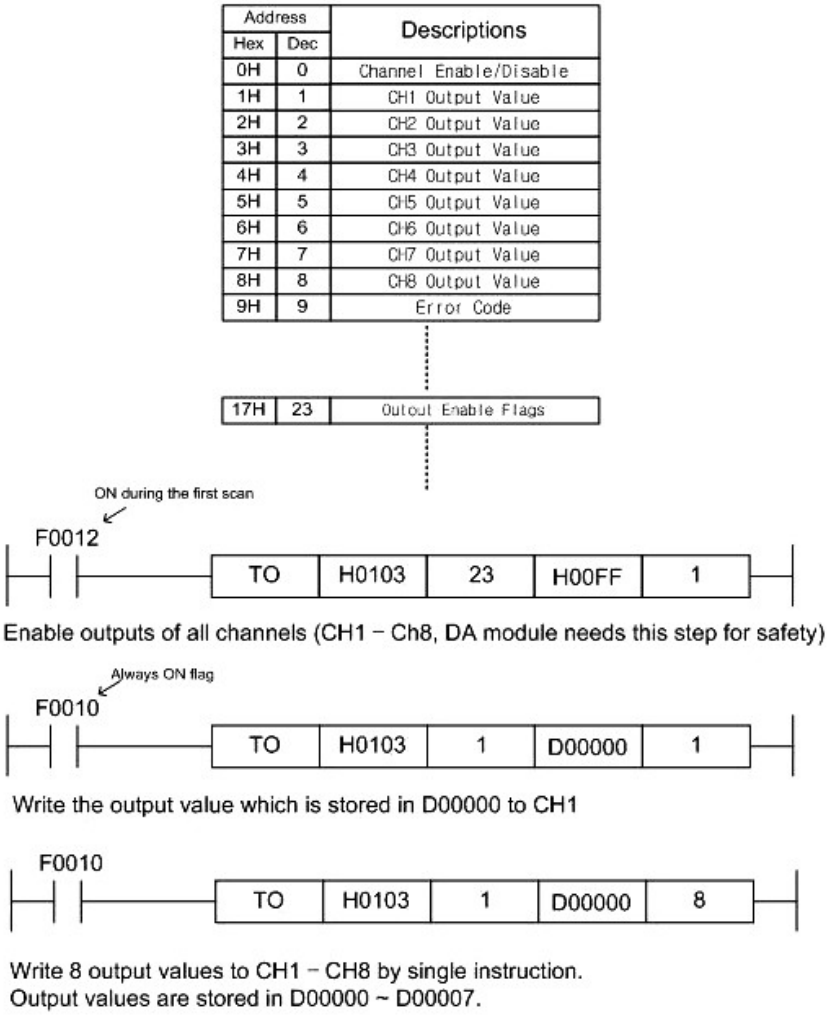
Designate the start address of word device which is storing value to write. X/Y/M/L/K/F/D/Z devices is possible. This operand can be designated with constant value to write. In this case, only one value can be written to user program memory at once.

Number of words to write :

Designate the number of words to write.

[Programming Example]

Following is an example program which writes one word and eight words. It assumes the special module is CM1-DAxxxx and installed in forth slot of the first expanded base.



< An Example Program of TO Instruction >

11.6 Device Memories of CIMON-PLC

CIMON PLC has 11 differently named devices. Each device has it' s own symbol which is denoted by a capital character.

X (Input)

' X' device is a digital input device. It can be ether real physical input signal or various status input from special module. Every special modules have their own I/O map and it was described in it' s manual and quick reference guide.

Y (Output)

‘ Y’ device is a digital output device. It can be ether real physical output or various control output to special module. Every special modules have their own I/O map and it was described in it’ s manual and quick reference guide.

M (General Purpose Relay)

‘ M’ device is an Internal input/output digital device. It can be used in various applications such as intermediate data storage, virtual I/O, word data storage etc.

L (General Purpose Relay)

The usage of ‘ K’ device is very similar to ‘ M’ device. The difference between them is only symbol character.

K (Latch Relay)

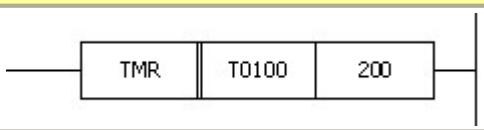
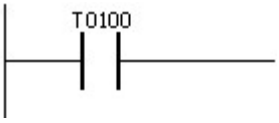
The usage of ‘ K’ device is very similar to ‘ M’ device. But, it has additional functionality of latch. All data in this device are retained even while power off or CPU stopped status. There is no need to configure as latch area.

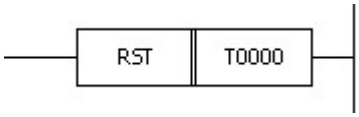
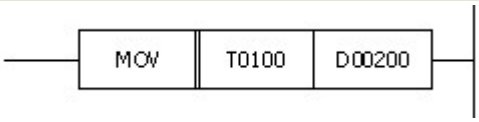
F (Flags)

‘ F’ device is an Input (read) only device. This device provides various useful flags such as one scan on/off, always on, periodic on/off, etc. Refer to CPU’ s ‘ Flags’ section for more detailed descriptions about ‘ F’ relay

T (Timer)

‘ T’ device is a timer device. This device is somewhat different with other devices in that it has both features of bit and word device. It is determined by instruction type which feature will be processed. Following table describes the features for each instruction types.

Device ‘ T’ In Sequence Program		
Features	Instructions	Example
Configuration and Operation	TMR, TON, TOFF, TMON, TRTG	
Get Timer Output	LOAD (LD, LDI etc.)	

Reset Timer	RST	
Read/Modify Tick Count	WORD operations (MOV, INC, > etc.)	

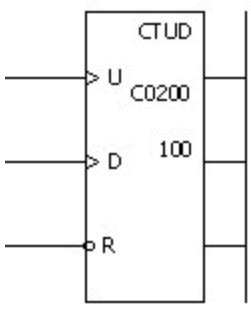
As shown in above table, timer has three data types, one for bit data and two for word data. Bit data type represents timer output status in LOAD instructions and timer reset output for RST instruction. Word data types are set and tick values. The set value can be written only by TIMER instructions (TRM, TON, TOFF, TMON, TRIG). The tick value can be modified or verified by various word instructions such as MOV, INC, comparative instructions and so on.

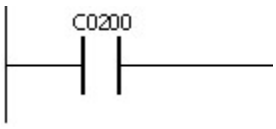
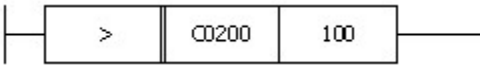
Symbol character of all these device is ‘ T’ in sequence programming point of view. But in monitoring point of view, two more symbol characters are used. ‘ T’ represents just the output status of timer, ‘ TC’ represents the tick counter of timer and ‘ TS’ represents set value of timer. These two new symbols of word are utilized in device memory monitoring window of CICON and in communication protocols for HMI

Device ‘ T’ In Monitoring		
Symbols	Data Types	Descriptions
T	Bit	The status of timer output
TC	Word	The tick count of timer (0 ~ 65,535)
TS	Word	The set value of timer (0 ~ 65,535)

C (Counter)

‘ C’ device is a counter device. As ‘ T’ device, this device is somewhat different with other devices in that it has both features of bit and word device. It is determined by instruction type which feature will be processed. Features of ‘ C’ device on each instruction types are described in following table.

Device ‘ C’ In Sequence Program		
Features	Instructions	Example
Configuration and Operation	CTU, CTD, CTUD, CTR	

Get Counter Output	LOAD (LD, LDI etc.)	
Read/Modify Counted Value	WORD operations (MOV, INC, > etc.)	

As shown in above table, counter has three data types, one for bit data and two for word data. Bit data type represents counter output status in LOAD instructions. Word data types are set and count values. The set value can be written only by COUNTER instructions (CTU, CTD, CTUD, CTR). The count value can be modified or verified by various word instructions such as MOV, INC, comparative instructions and so on. Symbol character of all these device is ' C' in sequence programming point of view. But in monitoring point of view, two more symbol characters are used. ' C' represents just the output status of counter, ' CC' represents the counted value of counter and ' CS' represents set value of counter. These two new symbols of word are utilized in device memory monitoring window of CICON and in communication protocols for HMI

Device ' C' In Monitoring		
Symbols	Data Types	Descriptions
C	Bit	The status of counter output
CC	Word	The counting value of counter (-32,768 ~ 32,767)
CS	Word	The set value of counter (-32,768 ~ 32,767)

S (Step Controller)

' S' device is a special purpose relay for control algorithm which proceeds step by step. CIMON PLC supports up to 100 cards of step controller (S00.nn ~ S99.nn). Each step controller has 100 differently numbered state, and only one can be active among these state (Sxx.00 ~ Sxx.99).

' S' device can be manipulated with ' OUT' or ' SET' instruction. ' OUT' instruction sets (activates) one designated state and there is no restrictions on operation. ' SET' instruction also sets one designated state (assume the state number is ' n') but there is a restriction that the previous state (state number ' n-1') must be active state. If the instruction was executed successfully, previous state will be reset (deactivated) automatically. That is, there is no need to reset previous state.

For verifying a state is activated or not, ' LOAD' instructions can be applicable.

10. D (General Purpose Word Data)

' D' device is a word device. The data in this device is processed as signed value. The range of a word value is -32,768 ~ +32,767. If it was needed to manipulate an unsigned value, specify the value as hex notation(H0000 to HFFFF) in LD program.

In case of storing a double-word data, the word ordering is shown by following example.

DMOV H12345678 D00100		
Device	Data	Storage
D00100	H5678	Least significant word

D00101	H1234	Most significant word

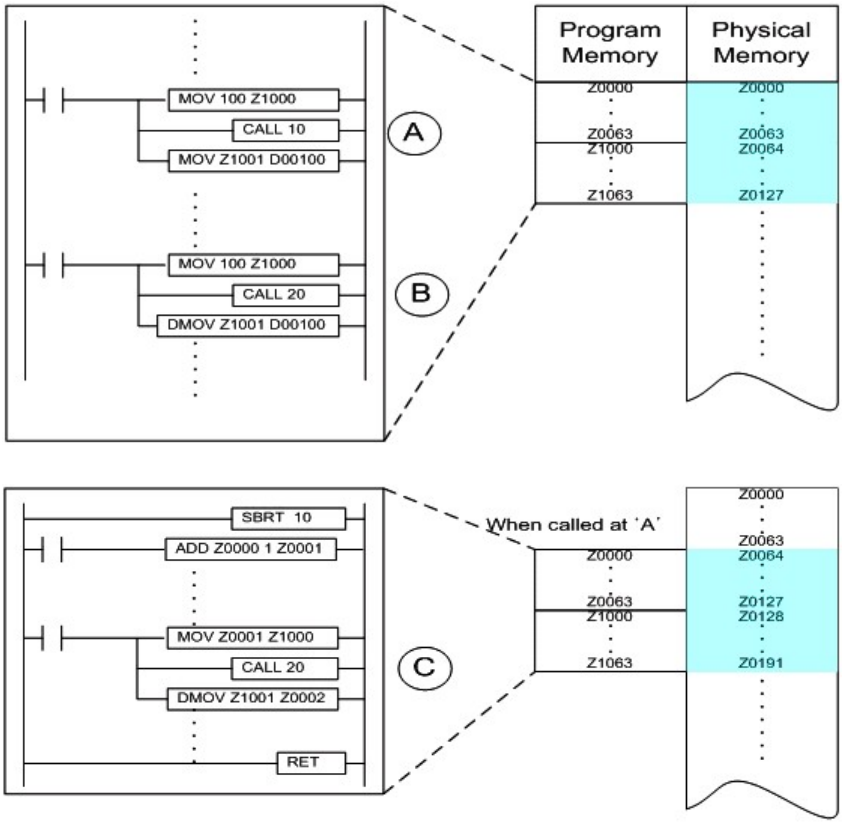
The range of a double word value is -2,147,483,648 ~ +2,147,483,647.

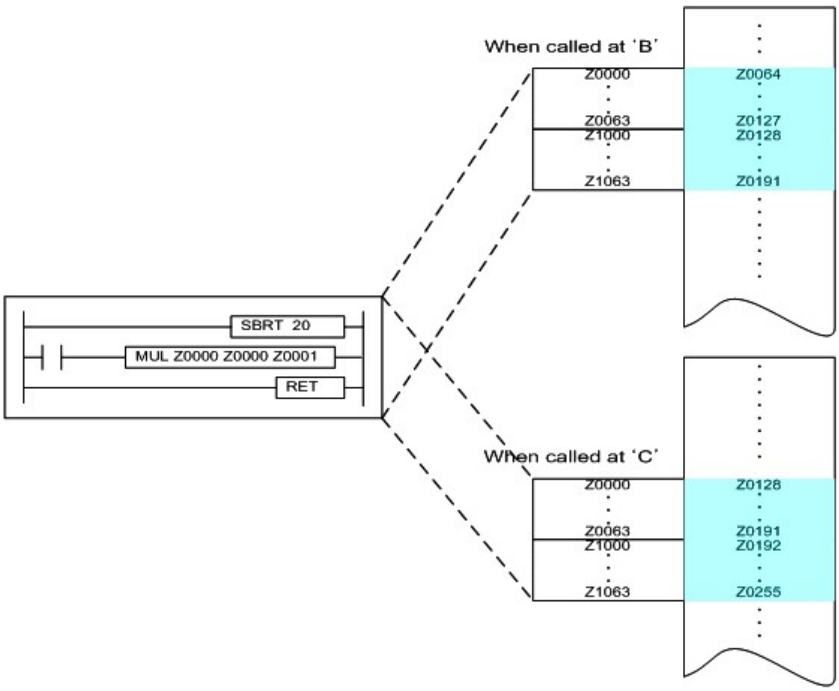
Z (Call Stack)

‘ Z’ device is a word device. It is used for data exchange with subroutine. Every running scan program has two 64 words of ‘ Z’ memory area. One is for it’ s own and the other is for subroutine. It’ s own memory area can be accessed with ‘ Z0000’ to ‘ Z0063’ , and subroutine’ s memory can be accessed with ‘ Z1000’ to ‘ Z1063’ .

If there is some data to transfer to subroutine, just stores them in ‘ Z1000’ to ‘ Z1063’ and next call the subroutine. Then, the called subroutine can read and process the data and store the result with the address of‘ Z0000’ to‘ Z0063’ .

At any time a sequence program can access two 64 words blocks of ‘ Z’ memory. And the total size of physical ‘ Z’ device is 1024 words, that is the reason of why maximum call level is restricted to 16. The relationship between physical memory and programming address of ‘ Z’ device at different call level was explained more precisely in following drawing.





11.7 How can I create a serial protocol program?

CIMON PLC provides a function of programmable protocol. This report provides an example of the protocol program with the CM1-SC02A module or its families. The example is described with following condition and assumptions.

Protocol

- MODBUS RTU Protocol (Master, Binary Mode)

Assumptions

- A MODBUS slave device is connected with the RS485 channel of CM1-SC02A
- The station number of slave device : 20 (decimal)
- The Reader of this document is familiar with the MODBUS/RTU protocol

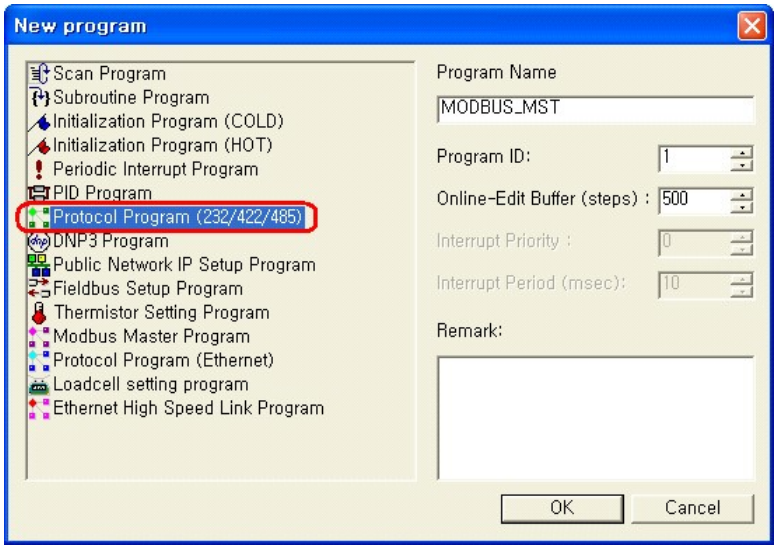
Objectives

- Read 10 holding registers (403073-403082) of slave and store them to the momory of CIMON PLC (D0100-D0109) at every 200ms
- Send (write) 10 words to the slave address area stated from 403083 at every 200ms. The data to send are stored in the memory area of CIMON PLC started from D0110.

In order to describe the simple and easy example, the MODBUS/RTU protocol was chosen.

Because, the MODBUS/RTU protocol is one of the most well known protocols and this protocol includes almost every functions which provided by CIMON PLC's protocol program.
But, note that the communication modules of CIMON PLC (CM1-SC01A / SC01B / SC02A) supports master as well as slave mode. So, there will be no needs to use the protocol programming of MODBUS in actual situation with CIMON PLCs.

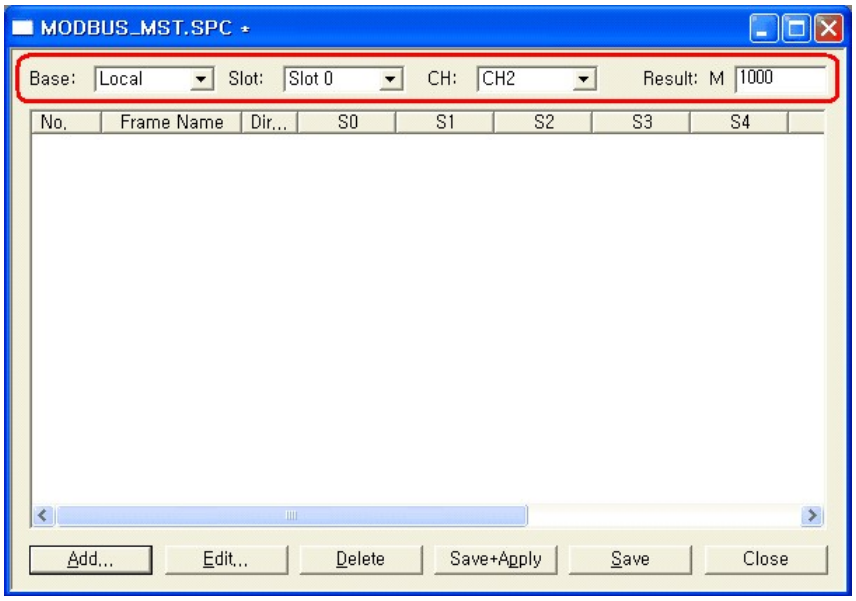
[Step 1] Create a new program block



1. Use the menu of 'File' - 'New Program...' to open the above dialog box
2. Choose the 'Protocol Program (232/422/485)' program type
3. Give a name to the new protocol program ('MODBUS_MST' in this example)

[Step 2] Configure the basic parameters

After pressing the 'OK' button of the 'New Program' dialog box, the main protocol programming window will be shown as following picture.



First of all, the basic parameters should be configured in this dialog box.

Base Designate the base location of communication module where the protocol program is executed

Slot Designate the base location of communication module where the protocol program is executed

CH Choose one of two channels of communication module. CH1 is the RS232C port, and CH2 is RS422/485 port in case of CM1-SC02A

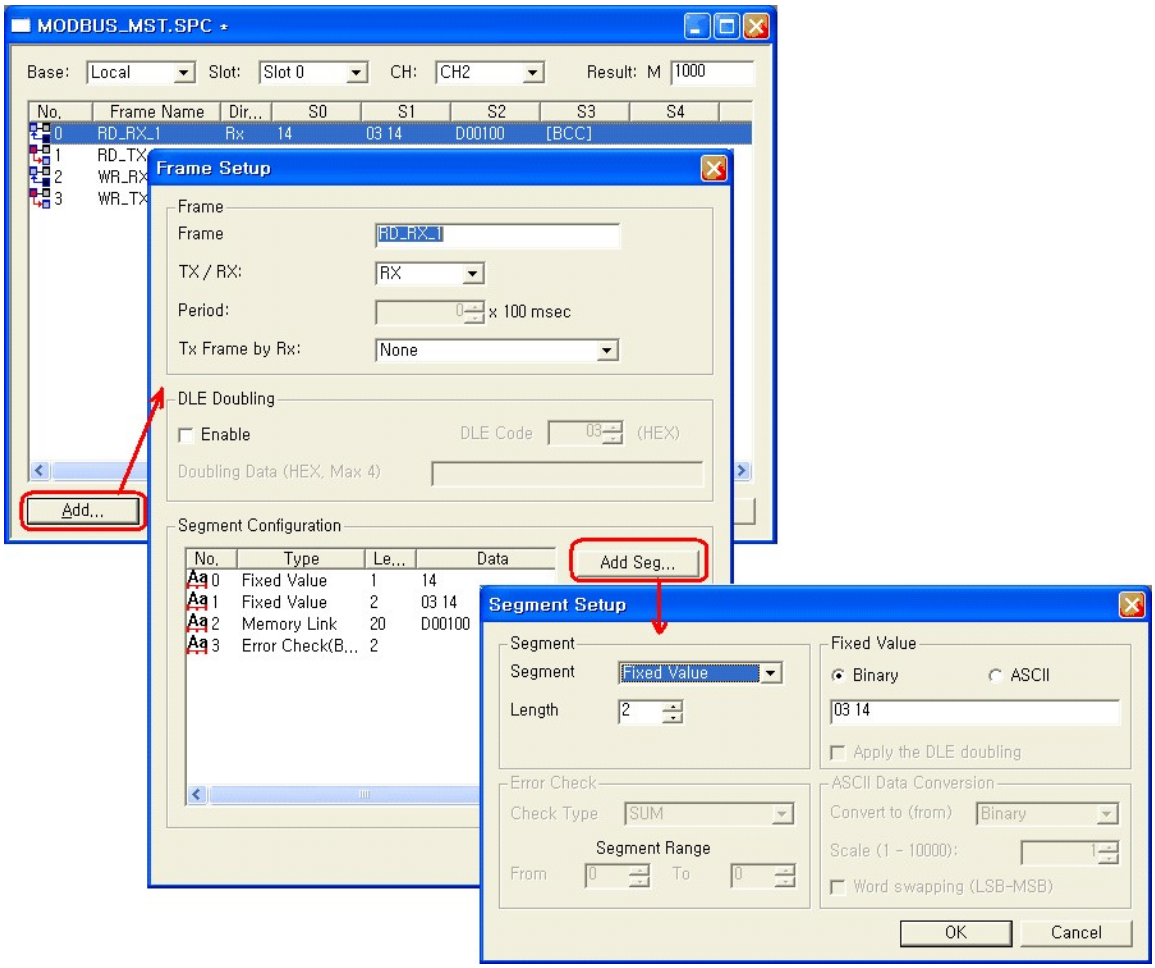
Result Designate the first word address of 4 continuous word memories of M area. These memories have its meaning when the periodical TX frame was activated. The communication module updates these word memories at every communication transaction. This 4 word memories include the success/error flags of all frame registered. For more information, refer to the communication manual.

Note)

These 4 word memory areas are automatically updated by communication module. Please ensure that these memory areas are not used as other purpose in sequence program

Word Memory	Meaning of SET (1)
M word offset + 0	Success flags for frame number 0 to 15
M word offset + 1	Success flags for frame number 16 to 31
M word offset + 2	Error flags for frame number 0 to 15
M word offset + 3	Error flags for frame number 16 to 31

[Step 3] Define the received data frame format



1. Frame Setup

When the 'Add...' button in main configuration window is chosen, the 'Frame Setup' dialog box will be displayed. Following items have to be configured in this dialog box for defining a data frame to be received from a MODBUS slave device.

Name of the frame Give a name to the frame. This name can be used instead of the frame number in sequence program. This name is the 'RD-RX_1' in this example

Note)

Maximum 32 frames can be defined in a protocol program. The frame number of each frame is automatically assigned when it is created. Do not use the frame number directly in other program blocks. the frame number can be changed at any time especially when one or more frames are removed from the original list. Use the **frame name** instead of the frame number.

TX / RX Define the direction of frame. The direction of the data frame sent from other device is **'RX'**

Period This field has meaning only in the frame of TX direction

Tx Frame by Rx If there should be a response frame transmission after receiving the data frame, this field has to be filled with other frame name to be transferred. However, the MODBUS/ RTU protocol does not require the response frame transmission after receiving data. Leave it as 'None'

DLE Doubling This technique is used in some protocols such as SIEMENS 3964R. It is a kind of frame construction technique. If an already defined special code was included in a constructed frame, the code must be appeared twice in the actual transfer frame. However, the MODBUS/RTU protocol does not use this technique. Leave it as unchecked

2. Define the frame with segments

In order to define a communication frame, CIMON PLC uses the **segment** concept as a primitive unit of continuous data block. 4 different segment types are provided as shown in the following table.

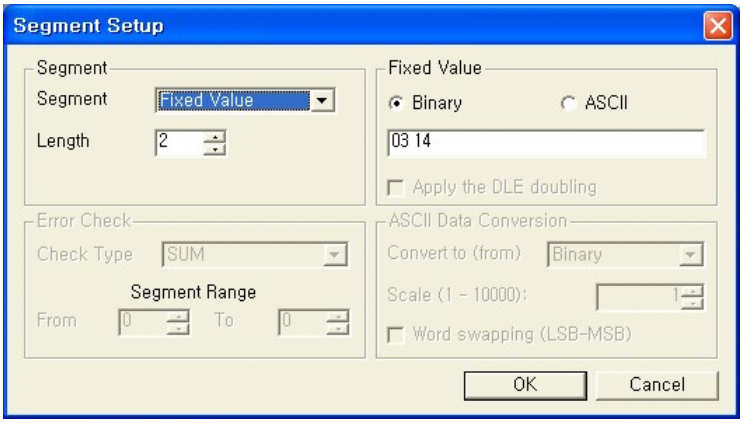
Segment Type	Description
Fixed Value	A part of frame which composed with fixed (static) data.
Ignore	A part of frame which has no meaning. The data in this segment is ignored at frame analysis
Memory Link	A part of frame which should be moved to the memory of PLC CPU for further data manipulation
Error Check	A part of frame which has error check codes such as BCC

As shown in the previous picture, a segment can be configured by filling in the segment type and length field. Other configuration fields need to be filled up according to the each segment type. In this example, the data frame from slave device was defined as following 4 segments.

Stn No.	Cmd	Length	Data (20 bytes)	CRC
14h	03h	14h	??h ??h ... ... ??h	??h ??h
Fixed	**Fixed**		**Memory Link**	**Error Check**

3. Defining a fixed type segment

The fixed value segment is constructed with one or more static data. Following dialog box shows the configuration fields for fixed value segment type.



Length Designate the size of fixed data in byte

Value in Binary Specify the fixed value list in hexa-decimal format. Each value represents an 8 bits value and should be separated with each other by 'space' character

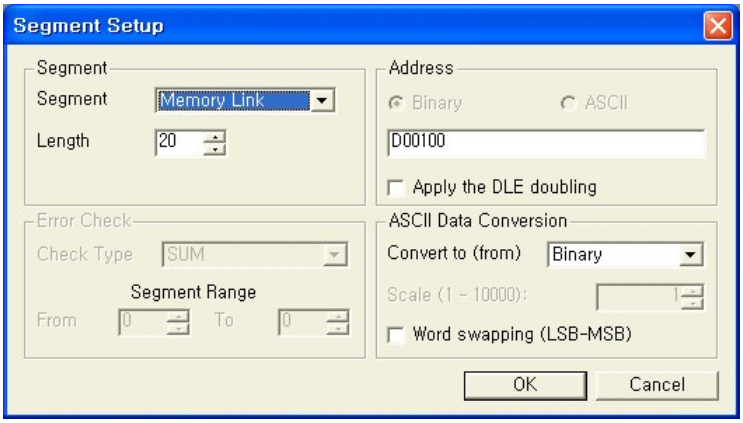
Value in ASCII Specify the fixed value in ASCII

In this example, there are two fixed value segments. One of them is 1 byte sized segment which is a header of the frame. And the other is two byte sized segment which includes a command code and data size of the frame.

4. Defining a memory link type segment

The memory link segment moves the designated size of data between PLC's memory and communication frame. If the frame direction is RX frame, the configured portion of data in received frame will be moved to the PLC memory. Otherwise TX frame, the data stored in PLC memory will be moved to the transmission frame.

And also, the data conversion process can be applied to the data during their movement according to the configuration.



Length Designate the size of fixed data in byte

Address Designate the memory address of PLC

ASCII data Conversion If the data in frame are coded in ASCII, the data in PLC memory have to be converted to or from ASCII code. Following options are provided for this conversion

Converting Option	Description
Binary	The data in frame are coded in binary. No conversion needed. If this option was chosen, the word swapping function can be utilized for the device which uses different byte ordering system with CIMON PLC.
HEX	The data in frame are coded in ASCII, and in hexa-decimal number representation.
DEC	The data in frame are coded in ASCII, and in decimal number representation.
Float	The data in frame are coded in ASCII, and in decimal floating point number representation. If this option was chosen, the scale factor should be designated also. This factor is needed for the PLC CPUs which does not support the floating point data format.

In this example, the third segment is defined as a **'memory link'** type segment. The **'length'** of this segment was designated as 20 bytes. That means, 20 bytes portion of frame data include the 10 word sized read data and these data will be moved to the memory of PLC. The ASCII data conversion option was chosen as **'binary'**. That is, there is no need to convert data during data movement. The MODBUS/ RTU protocol of our example does not use ASCII coded data.

The protocol program is base on the following byte alignment condition for a word data. If the actual byte order was not matched with this, the "Word swapping (LSB-MSB)" option has to be checked for the normal data conversion.

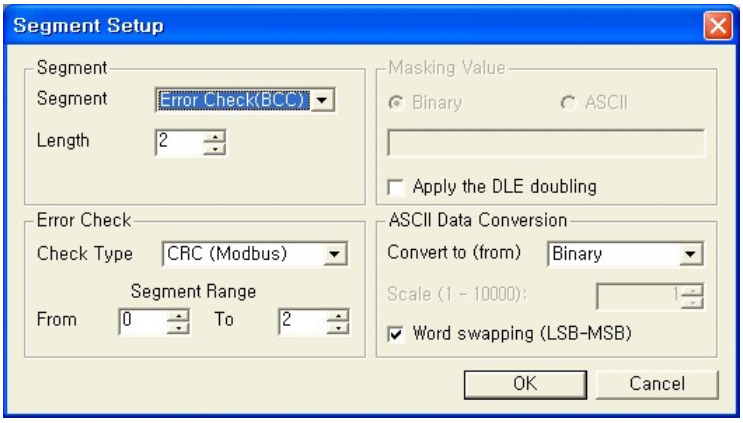
Transmit offset + 0	Transmit offset + 0
High byte	Low byte
1 Word Data	

5. Defining a error check segment

Some of protocol put the error check codes in their frame format. The **'Error Check(BCC)'** type segment is provided for that kind of protocols. CIMON PLC supports several well-known error checking algorithms as shown in the following table.

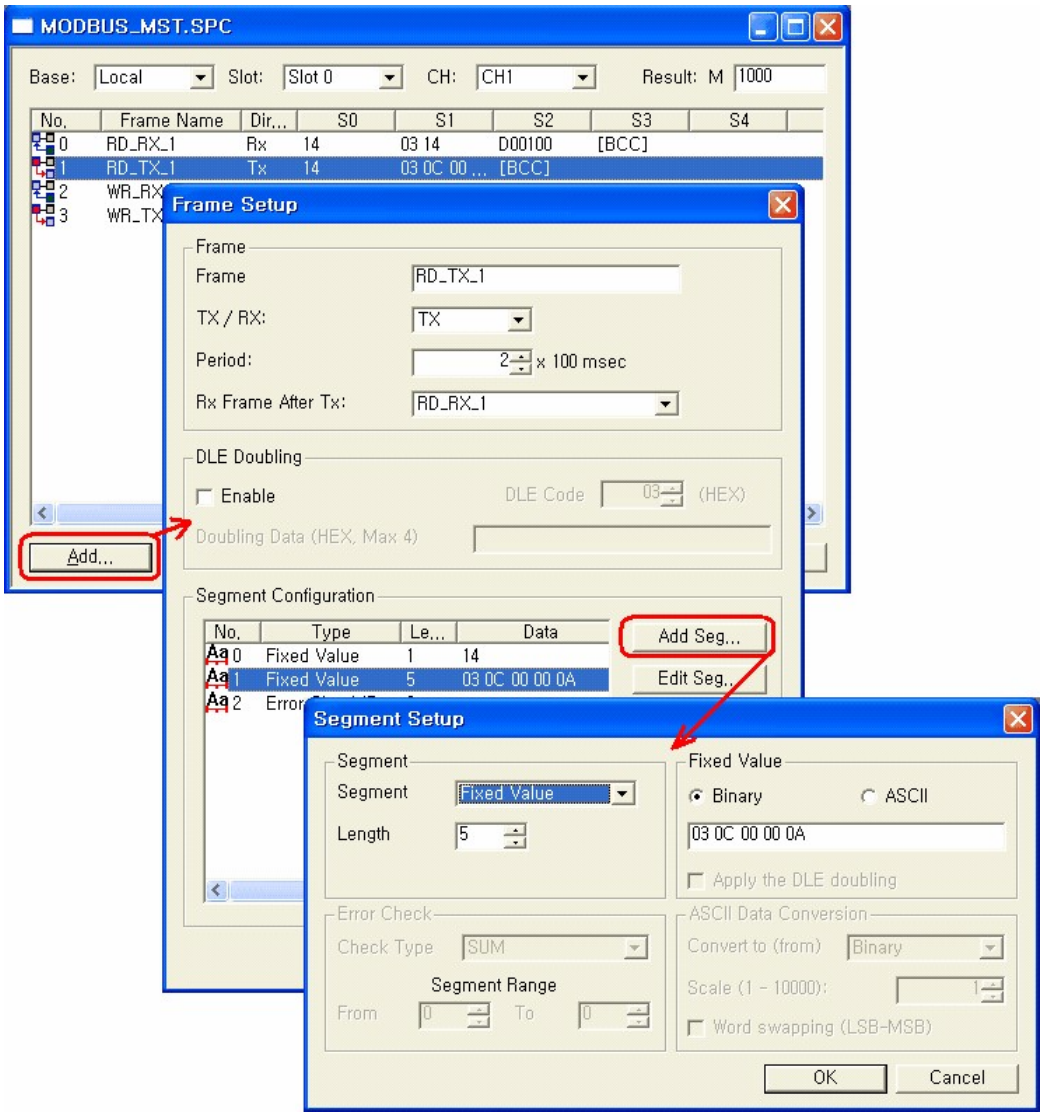
Error Check	Description	Remark
SUM	Add all byte data within designated segments	
SUM + Mask	1. Add all byte data within designated segments 2. Bitwise AND operation with masking value	The masking value should be declared
XOR	Take exclusive-or for all byte data within designated segment	
XOR + Mask	1. Take exclusive-or for all byte data within designated segment 2. Bitwise AND operation with masking value	The masking value should be declared
MUL	Take multiplication for all byte data within designated segments	
MUL + Mask	1. Take multiplication for all byte data within designated segments 2. Bitwise AND operation with masking value	The masking value should be declared
CRC (Modbus)	16bits CRC for MODBUS	
CRC16	16bits CRC	
SUM + 1's complement	1. Add all byte data within designated segment 2. Take the 1's complement of SUM	
SUM + 2's complement	1. Add all byte data within designated segment 2. Take the 2's complement of SUM	

CRC (FT3/DNP3)	16bits CRC for DNP3	



In this example, the **"CRC (Modbus)"** type was chosen for the segment 0, 1 and 2. Note that the 'Word swapping (LSB-MSB)' option should be checked for the MODBUS RTU protocol as shown in the above picture. MODBUS RTU protocol transmits low order byte of CRC first.

[Step 4] Define the data read command frame format



The precise configuration method and background knowledge was not described in this step. Please refer to the previous section, [Step 3], for the more detailed explanations. Only the topic related with the current example, MODBUS/RTU protocol programming, is described in this section.

1. Frame Setup

Name of the frame	"RD_TX_1"
TX / RX	"TX"
Period	"2". This configuration means the frame is automatically transmitted at every 200msec.
Rx Frame After Tx	"RD_RX_1". This configuration make the communication module wait the RX frame "RD_RX_1" immediately after transmitting current frame.
DLE Doubling	Not used.

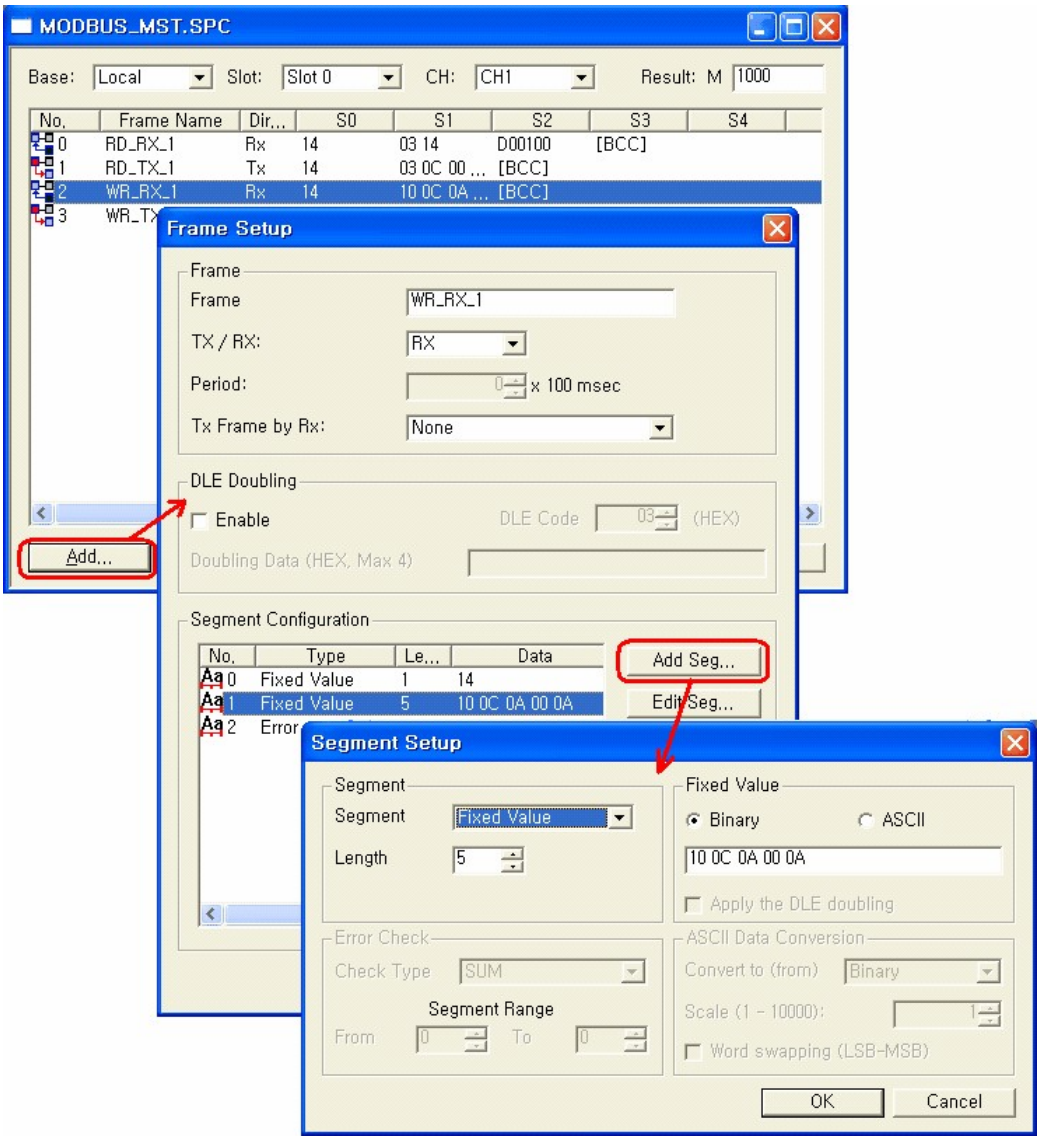
2. Define the frame with segments

The read command frame which will be sent to the slave device was defined as following 3 segments (2 fixed segments and 1 error check segment).

Stn No.	Cmd	Address		No. of Reg		CRC
14h	03h	0Ch	00h	00h	0Ah	??h ??h
Fixed	**Fixed**					**Error Check**

According to the MODBUS/RTU protocol document, the command code of reading holding registers in '03h'. And our example assumes that the communication module read 10 holding registers from 403073 to 403082. So, the start address of holding registers which will be transmitted in the TX frame is 3072 (0C00h). Note that the memory address on the frame is one less than actual address in the MODBUS protocol (3073 - 1 = 3072). And then, the number of register to read is coded at the end of the second fixed frame in word data. The read size of this example is 10 (000Ah).

[Step 5] Define the format of write response frame



The precise configuration method and background knowledge was not described in this step. Please refer to the previous section, [Step 3], for more detailed explanations. Only the topic related with the current example, MODBUS/RTU protocol programming, is described in this section.

1. Frame Setup

Name of the frame	"WR_RX_1"
TX / RX	"RX"
Period	Not used.
Rx Frame After Tx	None.
DLE Doubling	Not used.

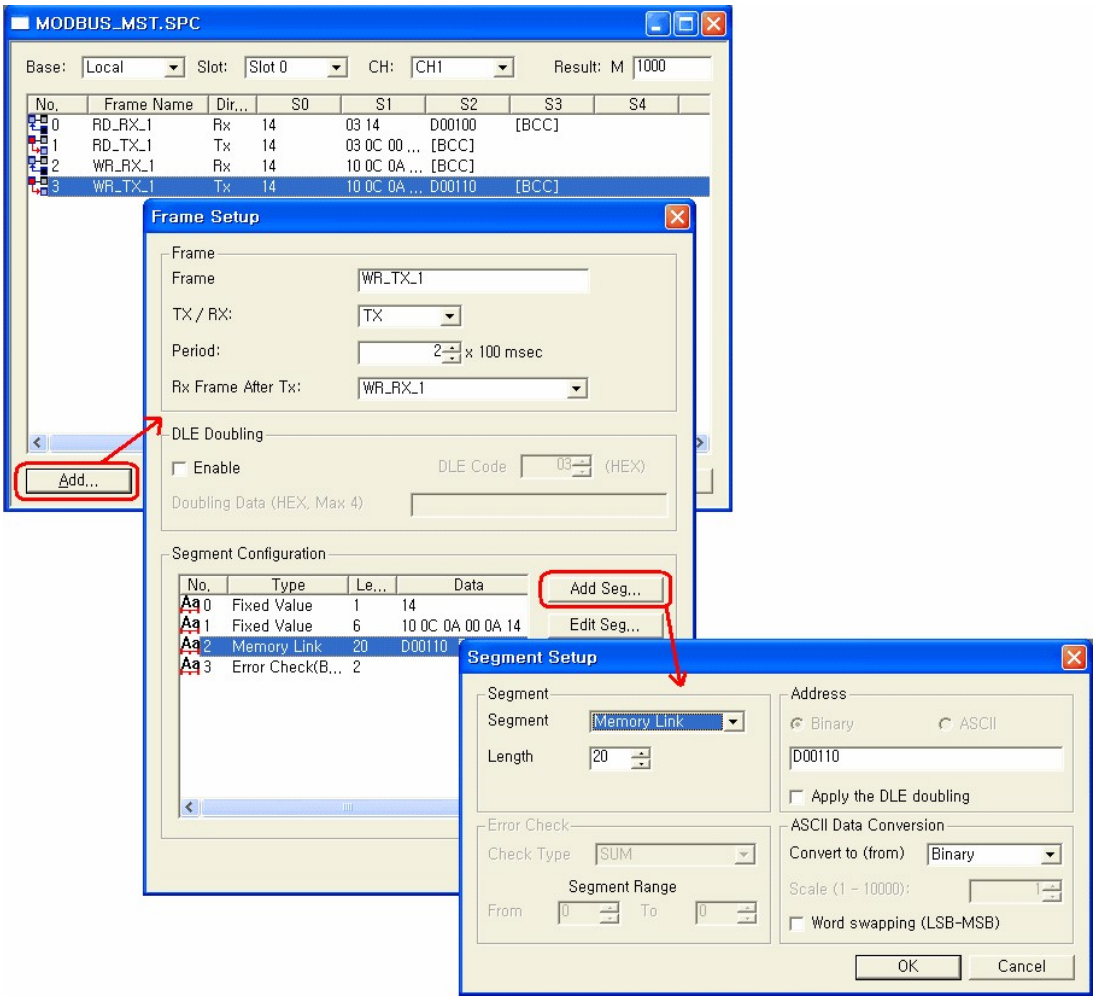
2. Define the frame with segments

The response frame for write command was defined as following 3 segments (2 fixed segments and 1 error check segment).

Stn No.	Cmd	Address		No. of Reg		CRC
14h	10h	0Ch	0Ah	00h	0Ah	??h ??h
Fixed	**Fixed**					**Error Check**

According to the MODBUS/RTU protocol document, the command code of writing holding registers is '10h'. And our example assumes that the communication module writes 10 continuous holding registers from 403083 to 403092. So, the start address of written memory area is 3082 (0C0Ah). Note that the memory address on the frame is one less than actual address in the MODBUS protocol (3083 - 1 = 3082). And then, the number of written registers is coded at the end of the second fixed frame in word data. The written size of this example is 10 (000Ah).

[Step 6] Define the write command frame



The precise configuration method and background knowledge was not described in this step. Please refer to the previous section, [Step 3], for the more detailed explanations. Only the topic related with the current example, MODBUS/RTU protocol programming, is described in this section.

1. Frame Setup

Name of the frame	"WR_TX_1"
TX / RX	"TX"
Period	2. This configuration means the frame is automatically transmitted at every 200msec.
Rx Frame After Tx	"WR_RX_1". This configuration make the communication module wait the RX frame "WR_RX_1" immediately after transmitting current frame.
DLE Doubling	Not used.

2. Define the frame with segment

The response frame for write command was defined as following 4 segments (2 fixed segments, 1 memory link segment and 1 error check segment).

Stn No.	Cmd	Address		No. of Reg		Byte Count	Data to be Written	CRC
14h	10h	0Ch	0Ah	00h	0Ah	14h	data in D0110 - D0119 (20 bytes)	??h ??h
Fixed	**Fixed**						**Memory Link**	**Error Check**

According to the MODBUS/RTU protocol document, the command code of writing multiple holding register is '10h'. And our example assumes that the communication module writes 10 continuous words of holding register form 403083 to 403092. So, the start address of memory area to be written is 3082 (0C0Ah). Note that the memory address on the frame is one less than actual address in the MODBUS protocol (3083 - 1 = 3082). And next, the number of writing registers is coded with the number of 10 (000Ah). The second fixed segment is ended with the byte size of followed writing data, 20 bytes (14h). The data to be written are defined as a memory link segment in this example.

[Step 7] Programming is completed. Download it

If all the programming jobs described above were successfully completed, the only remaining job is **"Tool" - "Compile All + Link"** menu. During the communication, the communication status will be provided by M memory area which was designated at [Step 2].

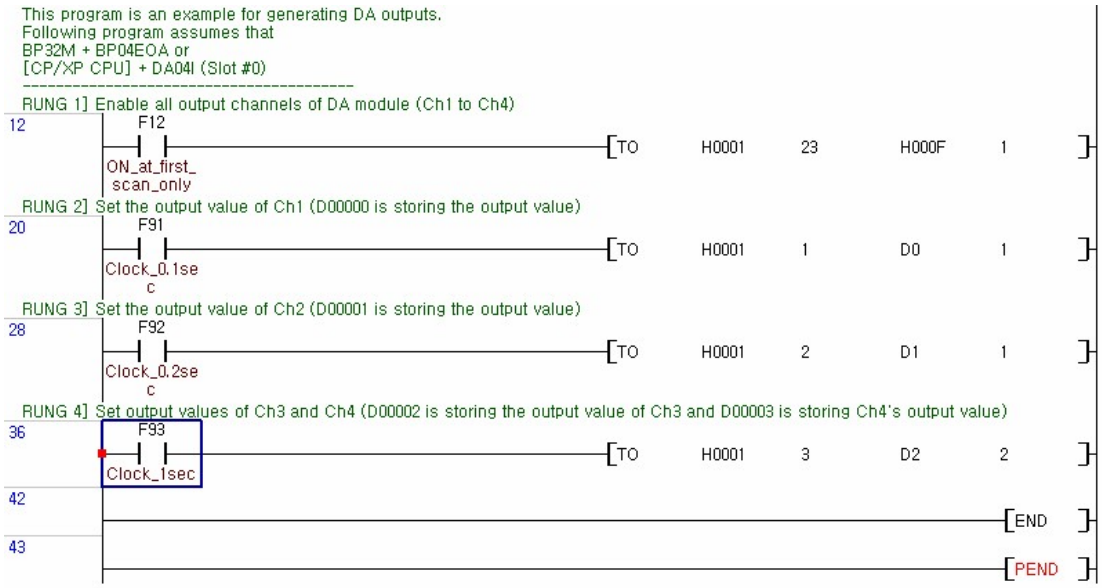
The Sample program can be downloaded from following URL.

- File name : MODBUS_MST.SPC
- URL : http://www.kdtsys.com/file_bdG/upload_file/MODBUS_MST.SPC

1. Copy the downloaded program file to your project folder.
2. Add the program to your project by using "File"-"Add a Program" menu.

11.8 How can I make a sequence program to generate analog outputs from my DA module?

Here is an example for that.



➢ Rung 1

For safety purpose, the module doesn't output D/A signal without definite command from sequence program or CICON. This rung sends signal output enable command to DA module by TO instruction.

The first operand 'H0001' means the first expanded block. If there was another block between CPU and DA, this operand should be 'H0002'.

The second operand 23 means the address of this enable command buffer in 'User Program Memory'. (Refer to the MAP)

The third operand 'H000F' means enabling all outputs (CH1 to CH4). Each channel is bitwise allocated. If you want to enable only CH3, this value should be 'H0004'.

The fourth operand '1' means 1 WORD writing to 'User Program Memory'.

➢ Rung 2

Writes the output value of CH1 on every 0.1 second with a TO instruction. The second operand '1' means the address of 'User Program Memory' where the output value should be written to for CH1. (Refer to the MAP)

The third operand 'D00000' means the device which is storing the digital value for signal output.

The last operand '1' means 1 WORD writing.

➢ Rung 3

Shows another example of one channel output. This rung is for CH2 and the output value is stored in D00001.

➢ Rung 4

Shows a simultaneous output example of multi-channel. This rung output signals to CH3 and CH4 simultaneously. The digital values are stored in D00002 and D00003 for each channel.

Generally, for unburden CPU's scan speed, it's better to output all channel simultaneously than outputs one by one channel. Following example instruction shows this method.

To H0001 1 D0000 4

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Endnotes 2... (after index)

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