MITSUBISHI

Changes for the Better

Mitsubishi Programmable Controller

Training Manual

Q-series advanced course (for GX Works2)

● SAFETY PRECAUTION ●

(Always read these instructions before using the products.)

When designing the system, always read the relevant manuals and give sufficient consideration to safety.
During the exercise, pay full attention to the following points and handle the product correctly.

[EXERCISE PRECAUTIONS]

⚠ WARNING

- Do not touch the terminals while the power is on to prevent electric shock.
- Before opening the safety cover, make sure to turn off the power or ensure the safety.
- Do not touch the movable portion.

⚠ CAUTION

- Follow the instructor's direction during the exercise.
- Do not remove the module of the demonstration machine or change wirings without permission.
  Doing so may cause failures, malfunctions, personal injuries and/or a fire.
- Turn off the power before installing or removing the module.
  Failure to do so may result in malfunctions of the module or electric shock.
- When the demonstration machine (such as X/Y table) emits abnormal odor/sound, press "Power switch" or "Emergency switch" to turn off.
- When a problem occurs, notify the instructor as soon as possible.

REVISIONS

*The textbook number is written at the bottom left of the back cover.

Print date	*Textbook number	Revision
Oct., 2012	SH-081124ENG-A	First edition

CONTENTS

APPENDIX App.- 1 to App.-58

INTRODUCTION

This textbook explains the programmable controller, the program editing methods with GX Works2, the sequence instructions and the application instructions for understanding the MELSEC-Q series programming.

The related manuals are shown below.

(1) QCPU User's Manual (Hardware Design, Maintenance and Inspection)
..... SH-(NA)080483ENG
Explains the hardware.

(2) QnUCPU User's Manual (Function Explanation, Program Fundamentals)
..... SH(NA)-080807ENG
Explains the functions and programming method.

(3) MELSEC-Q/L Programming Manual (Common Instruction)
..... SH(NA)-080809ENG
Explains details of each instruction.

(4) GX Works2 Beginner's Manual (Simple Project)
..... SH(NA)-080787ENG

(5) GX Works2 Version 1 Operating Manual (Common)
..... SH(NA)-080779ENG

(6) GX Works2 Version 1 Operating Manual (Simple Project)
..... SH(NA)-080780ENG

(7) Before Using the Product
..... BCN-P5782

(8) Digital-Analog Converter Module User's Manual
..... SH(NA)-080054

(9) Before Using the Product
..... BCN-P5781

(10) Analog-Digital Converter Module User's Manual
..... SH(NA)-080055

(11) MELSEC-Q/L Programming Manual (Structured Text)
..... SH(NA)-080366

MEMO

CHAPTER 1 OVERVIEW OF QCPU

The Universal model QCPU is used for a training in this textbook, therefore, "QCPU" indicates "Universal model QCPU" unless otherwise noted.

QCPU has the following features.

(1) Large number of I/O points can be controlled
The Q-Series CPU module supports the following number of actual I/O points which are accessible to the I/O modules mounted on the base unit.

(a) Basic model QCPU
- Q00JCPU: 256 points (X/Y0 to FF)
- Q00CPU, Q01CPU: 1024 points (X/Y0 to 3FF)

Up to 2048 points (X/Y0 to 7FF) are supported as the I/O device points available for refreshing the remote I/O of CC-Link and link I/O (LX, LY) of the MELSECNET/H.

(b) High Performance model QCPU
One module supports 4096 points (X/Y0 to FFF).
Up to 8192 points (X/Y0 to 1FFF) are supported as the I/O device points available for the remote I/O stations in the MELSECNET/H remote I/O network and CC-Link data link.

(c) Process CPU and redundant CPU
One module supports 4096 points (X/Y0 to FFF).
Up to 8192 points (X/Y0 to 1FFF) are supported as the I/O device points available for the remote I/O stations in the MELSECNET/H remote I/O network and CC-Link data link.

(d) Universal model QCPU
- Q00UJCPU: 256 points (X/Y0 to FF)
- Q00UCPU, Q01UCPU: 1024 points (X/Y0 to 3FF)
- Q02UCPU: 2048 points (X/Y0 to 7FF)
- Q03UD(E)CPU, Q04UD(E)HCPU, Q06UD(E)HCPU, Q10UD(E)HCPU, Q13UD(E)HCPU, Q20UD(E)HCPU, Q26UD(E)HCPU: 4096 points (X/Y0 to FFF)

Up to 8192 points (X/Y0 to 1FFF) are supported as the I/O device points available for the remote I/O stations in the MELSECNET/H remote I/O network and CC-Link data link.

(2) Lineup corresponding to the program capacity
The following table lists the lineup of CPU available for various program capacity.

CPU module type		Program capacity
Basic model QCPU	Q00(J)CPU	8K steps
	Q01CPU	14K steps
High Performance model QCPU	Q02(H)CPU	28K steps
	Q06HCPU	60K steps
	Q12HCPU	124K steps
	Q25HCPU	252K steps
Process CPU	Q02PHCPU	28K steps
	Q06PHCPU	60K steps
	Q12PHCPU	124K steps
	Q25PHCPU	252K steps
Redundant CPU	Q12PRHCPU	124K steps
	Q25PRHCPU	252K steps
Universal model QCPU	Q00U(J)CPU	10K steps
	Q01UCPU	15K steps
	Q02UCPU	20K steps
	Q03UD(E)CPU	30K steps
	Q04UD(E)HCPU	40K steps
	Q06UD(E)HCPU	60K steps
	Q10UD(E)HCPU	100K steps
	Q13UD(E)HCPU	130K steps
	Q20UD(E)HCPU	200K steps
	Q26UD(E)HCPU	260K steps

(3) High speed processing
High speed processing has been achieved. (Example: LD instruction)

CPU module type		LD instruction processing speed
Basic model QCPU	Q00JCPU	200ns
	Q00CPU	160ns
	Q01CPU	100ns
High Performance model QCPU	Q02CPU	79ns
	Q02HCPU, Q06HCPU, Q12HCPU, Q25HCPU	34ns
Process CPU	Q02PHCPU, Q06PHCPU, Q12PHCPU, Q25PHCPU	
Redundant CPU	Q12PRHCPU, Q25PRHCPU	
Universal model QCPU	Q00UJCPU	120ns
	Q00UCPU	80ns
	Q01UCPU	60ns
	Q02UCPU	40ns
	Q03UD(E)CPU	20ns
	Q04UD(E)HCPU, Q06UD(E)HCPU, Q10UD(E)HCPU, Q13UD(E)HCPU, Q20UD(E)HCPU, Q26UD(E)HCPU	9.5ns

The high-speed system bus for the MELSEC-Q series base unit has achieved faster access to an intelligent function module and link refresh with a network module.

(a) Basic model QCPU
MELSECNET/H link refreshing: 2.2ms/2K words[*1]
*1: The Q01CPU is used without SB and SW, and the MELSECNET/H network module is mounted on the main base unit.

(b) High Performance model QCPU, Process CPU, Redundant CPU or Universal model QCPU

Access to the intelligent function module: 20μs/word (approximately 7 times[*2])

MELSECNET/H link refreshing: 4.6ms/8K words (approximately 4.3 times[*2])

*2: These are the values resulted from the following comparison:

- Comparing Q02HCPU with Q2ASHCPU-S1
- Comparing Q25PHCPU with Q4ARCPU
- Comparing Q25PRHCPU with Q4ARCPU

(4) Increased debugging efficiency through high-speed communication with GX Works2

High-speed communications at maximum 115.2Kbps are available by RS-232 and the time required for writing and reading of programs and monitoring are reduced. Also, the communication time efficiency of debugging is increased. In addition, High Performance model QCPUs (except for the Q02CPU), Process CPUs, Redundant CPUs, and Universal model QCPUs support USB, which enables high-speed communications at 12Mbps.

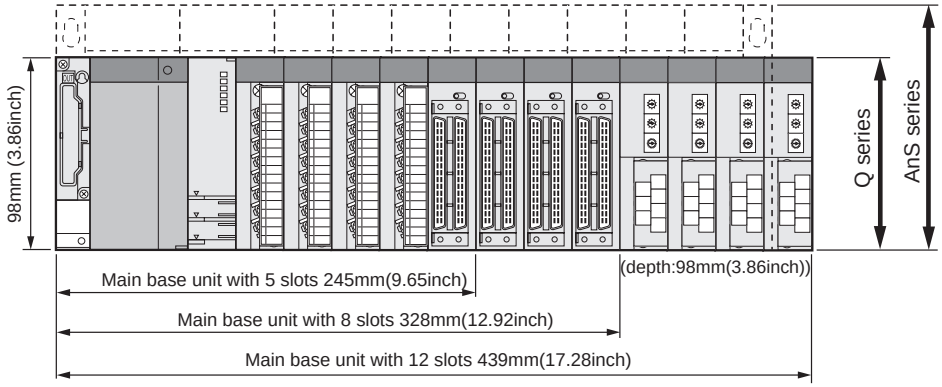
(5) AnS/A series I/O modules and special function modules are available

The AnS/A series compatible extension base units (QA1S6□B, QA6□B, and QA6ADP+A5□B/A6□B) enable High Performance model QCPU to use the AnS/A series I/O modules and special function modules.

* The extension base unit for the A series cannot be used for the Universal model QCPU.

(6) Saved space by downsizing

The installation space for the Q series is reduced by approximately 60% compared with the AnS series.



(7) Connection of up to 7 extension base units

Up to seven extension base units can be connected to the Q series CPU module.

The whole extension cable length is 13.2m, which enables flexible layout of base units.

(8) Memory extension by memory card[*3]

The QCPU equips the memory card installing connector so that a memory card with the capacity of up to 32M byte can be connected. (The 32M-byte memory card can be connected only when an ATA card is used.)
Installing large-capacity memory cards enables large-capacity files to be managed, which allows for the comment setting to all data devices and saving old programs in a memory as correction data.

*3: The Basic model QCPU, Q00(J)CPU, and Q01UCPU do not support memory cards.

POINT
For the High Performance model QCPU, available file register points differs depending on the function version and serial number. For details, refer to the QCPU User's Manual Hardware Design, Maintenance and Inspection.

(9) Automatic writing to standard ROM[*4,*5]

Parameters and programs of the memory cards can be written to the standard ROM of the CPU module without GX Works2.

*4: The Basic model QCPU does not support the following functions.
Automatic writing to standard ROM

*5: The Universal model QCPU does not support the following function.
Automatic writing to standard ROM

(10) Forced on and off of external I/O[*6]

Even when the CPU module is running, forced on and off of external input and output is available with GX Works2 regardless of the program execution status. Also, the wiring and operation tests can be conducted without stopping the CPU module by forcibly turning on or off the I/O.

*6: The Basic model QCPU does not support the following functions.
Forced on and off of external I/O

(11) Remote password setting

When the built-in Ethernet port QCPU, Ethernet module, or serial communication module is externally accessed, an access to the CPU module can be controlled by the remote password.

(12) Remote I/O network of MELSECNET/H[*7]

A MELSECNET/H remote I/O system can be configured by installing a MELSECNET/H remote master station.

*7: The Basic model QCPU does not support the following functions.
Remote I/O network of MELSECNET/H

POINT

- The remote password can be set when the built-in Ethernet port QCPU, Ethernet module, or serial communication module of function version B or later is used.
- The MELSECNET/H remote I/O network can be implemented when the MELSECNET/H network module of function version B or later is used.

(13) Supporting the multiple CPU system

The Q series CPU module supports the multiple CPU system.
Multiple CPU system can be configured in combination with CPU modules, motion CPUs, PC CPU modules, and C Controller module.
For details of the multiple CPU system, refer to the QCPU User's Manual (Multiple CPU System).

(14) Supporting the redundant power supply system

The redundant power supply system can be configured with a redundant base unit and redundant power supply modules.
The system can continue operation even when one of the power supply modules fails, since the other supplies the power.

(15) Direct connection to Ethernet[*8]

The Built-in Ethernet port QCPU module allows for direct connections to Ethernet.
For details of the functions, refer to the QnUCPU User's Manual Communication via Built-in Ethernet Port.

*8: Applicable only to the built-in Ethernet port QCPU.

MEMO

CHAPTER 2 SYSTEM CONFIGURATION

2.1 Basic System Configuration

2.1.1 Device configuration

The following figure shows an actual programmable controller configuration.

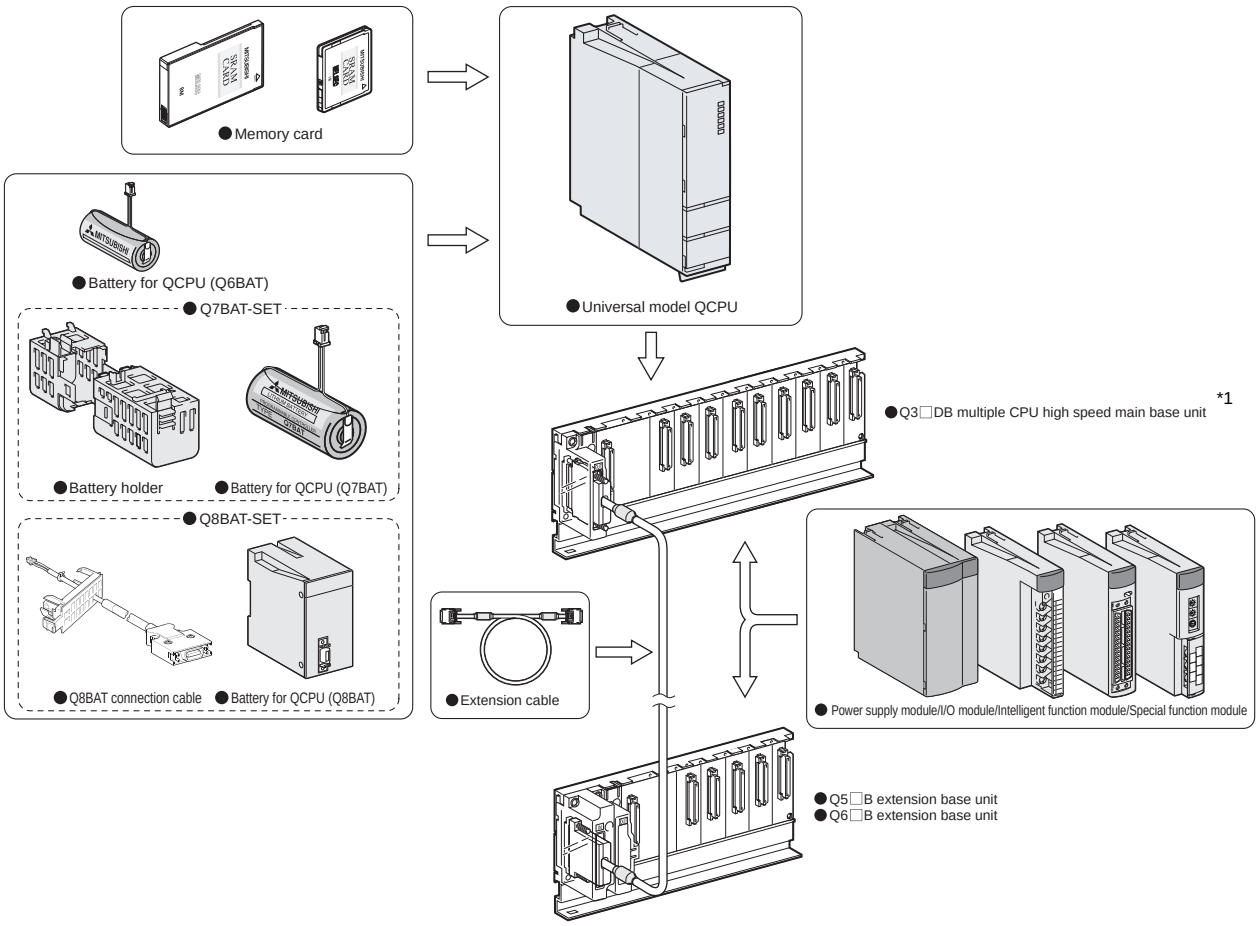
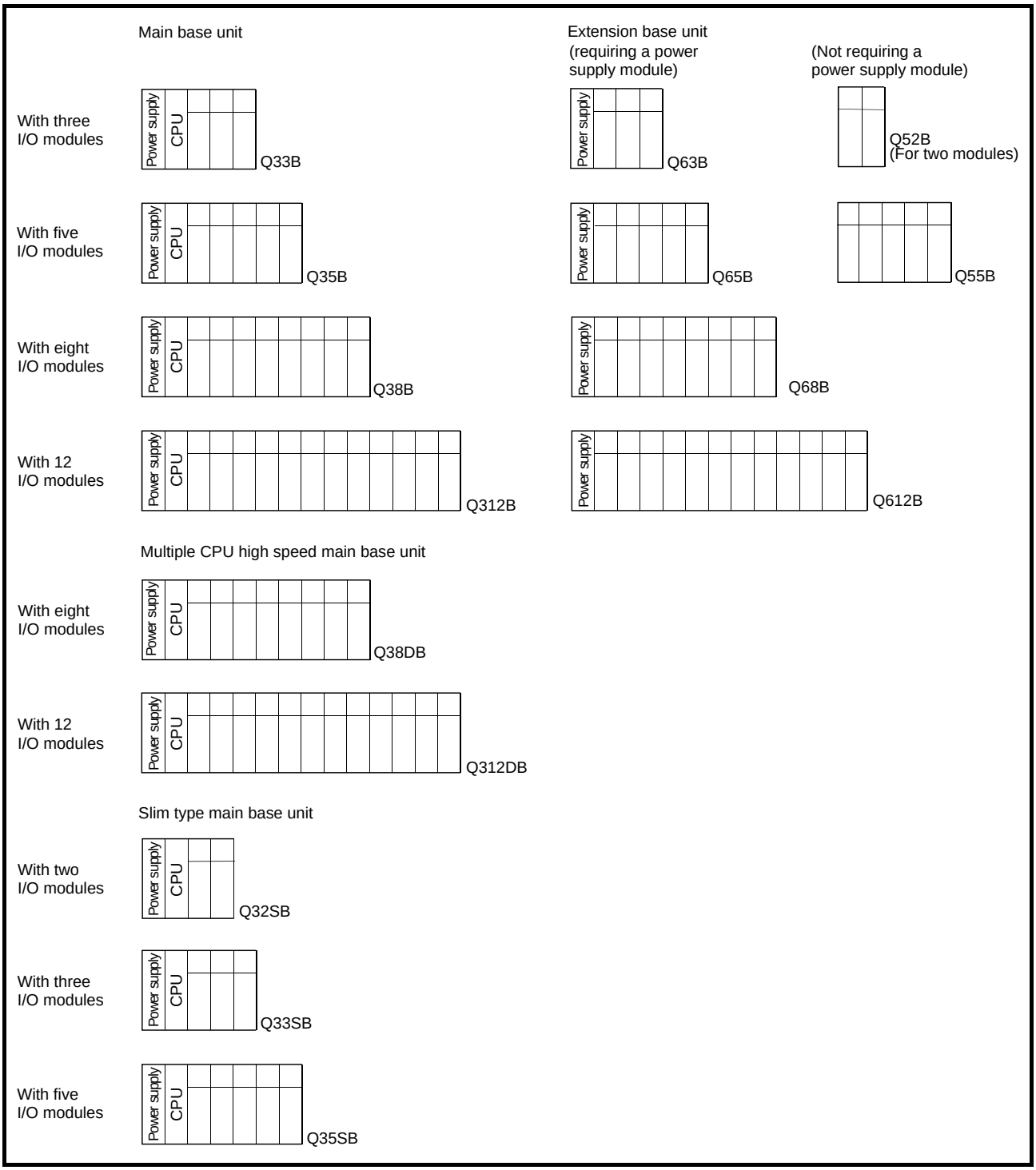


Figure 2.1 Universal model QCPU module configuration (When Q3□DB is used)

*1: The following bases are also available for the Universal model QCPU:

- Q3□B type main base unit
- Q3□RB type redundant power main base unit
- Q3□SB type slim type main base unit

Base Unit



The main roles of the base unit are; fixing the power supply module, CPU module, and I/O modules, supplying 5VDC power from the power supply module to the CPU module and I/O modules, and transmitting the control signals to each module.

Power Supply Module

Module name	Input	Output
Q61P	100V to 240VAC	5VDC 6A
Q62P	100V to 240VAC	5VDC 3A, 24VDC 0.6A
Q63P	24VDC	5VDC 6A
Q64PN	100V to 240VAC	5VDC 8.5A
Q61P-D	100V to 240VAC	5VDC 6A
Q61SP	100V to 240VAC	5VDC 2A

CPU Module

CPU type	Program capacity (maximum)	Basic instruction processing speed	Maximum I/O points for connecting to a programmable controller
Q00UJCPU	10K steps	120ns	256 points
Q00UCPU	10K steps	80ns	1024 points
Q01UCPU	15K steps	60ns	1024 points
Q02UCPU	20K steps	40ns	2048 points
Q03UD(E)CPU	30K steps	20ns	4096 points
Q04UD(E)HCPU	40K steps	9.5ns	
Q06UD(E)HCPU	60K steps		
Q10UD(E)HCPU	100K steps		
Q13UD(E)HCPU	130K steps		
Q20UD(E)HCPU	200K steps		
Q26UD(E)HCPU	260K steps		

I/O Module

Format \ I/O points		8 points	16 points	32 points	64 points
Input module	120VAC	-	○	-	-
	240VAC	○	-	-	-
	24VDC (positive common)	-	○	○	○
	24VDC (high-speed input)	○	-	-	-
	24VDC (negative common)	-	○	○	-
	5/12VDC	-	○	○	○
Output module	Contact output	-	○	-	-
	Independent contact output	○	-	-	-
	Triac output	-	○	-	-
	Transistor output (sink)	○	○	○	○
	Transistor output (source)	-	○	○	-
I/O mixed		○	-	○	-

2.1.2 Precautions for system configuration

This section explains restrictions for configuring the system with the Q-series CPU module.

(1) Number of mountable modules

(a) The number of mountable modules and supported functions are restricted depending on the module type.

[When the Universal model QCPU is used]

Product name	Model name	Maximum number of modules/units per system
CC-Link IE controller network module*1	• QJ71GP21-SX • QJ71GP21S-SX	Up to 4 modules*2, *3
MELSECNET/H network module	• QJ71LP21 • QJ71BR11 • QJ71LP21-25 • QJ71LP21S-25 • QJ71LP21G • QJ71NT11B	
Q series Ethernet interface module	• QJ71E71 • QJ71E71-B2 • QJ71E71-B5 • QJ71E71-100	Up to 4 modules*3
Q series CC-Link system master/local module	• QJ61BT11 • QJ61BT11N	No restriction*4, *5
Interrupt module	• QI60	Only 1 module*6
GOT (Graphic Operation Terminal)	GOT1000 Series (for bus connection only)*7	Up to 5 units

*1: Only the CC-Link IE controller network module with the serial number (first five digits) of "09042" or later can be used.

*2: The number is a total of the CC-Link IE controller network module and MELSECNET/H network module.

*3: One module is mountable to the one system of the Q00UJCPU, Q00UCPU, and the Q01UCPU, and two modules for the Q02UCPU.

*4: Available in modules with function version B or later.

*5: One CPU module can control the following number of modules by setting CC-Link network parameters in GX Works2.
- Q00UJCPU, Q00UCPU, Q01UCPU: up to 2 modules
- Q02UCPU: up to 4 modules
- Q03UD(E)CPU, Q04UD(E)HCPU, Q06UD(E)HCPU, Q10UD(E)HCPU, Q13UD(E)HCPU, Q20UD(E)HCPU, Q26UD(E)HCPU: up to 8 modules

There is no restriction on the number of modules when the parameters are set with the CC-Link dedicated instructions.
For the CC-Link system master/local modules whose parameters can be set by the dedicated instructions, refer to the CC-Link System Master/Local Module User's Manual.

*6: This number indicates the number of interrupt modules with no interrupt pointer setting. There is no restriction on the number of modules for the interrupt modules with the interrupt pointer setting.

*7: For the available GOT models, refer to the GOT1000 Series Connection Manual.

(b) For the GOTs, the GOT1000 series are available (however, Q-mode-compatible operating system and communication driver must be installed).
The Q series bus connection interface module is required for the bus connection.
The GOT800 series, A77GOT, and A64GOT cannot be used.
The GOT900 series do not support the Universal model QCPU.

2.2 Connection with GX Works2

2.2.1 Interface and connection channel

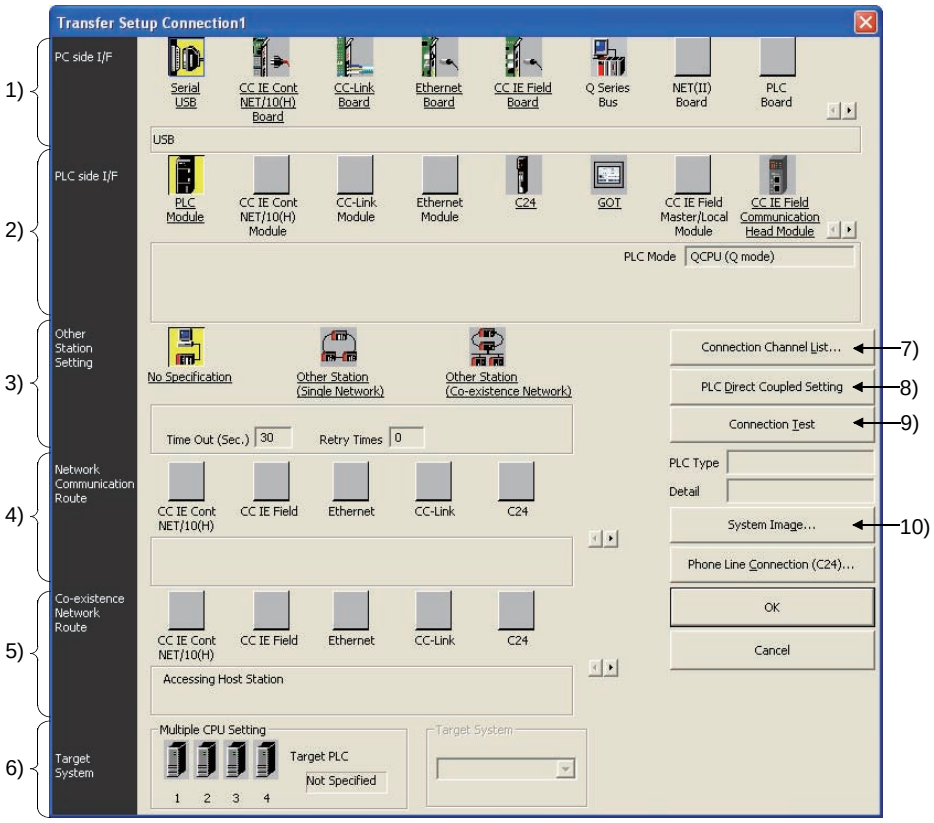
In the Q series, flexible and wide methods are available for connecting the CPU and GX Works2.
For details, refer to the GX Works2 Operating Manual.

GX Works2 has the following two items about the "connection destination".

(1) Specification of I/F
PC side I/F or PLC side I/F

(2) Other station setting and network route
Other Station Setting, Network Communication Route, Co-existence Network Route

The following explains each item of the Transfer Setup screen.



1) PC side I/F
Select the type of the interface on the personal computer side.
Double-click each interface to set the details.

2) PLC side I/F
Select the module on the programmable controller side to be connected with the peripheral device.
Double-click each module to set the details.

3) Other Station Setting
Specify the host station or other station.
Double-click each icon to set the details.
- No Specification
  Select this to access the programmable controller CPU which is directly connected to a personal computer.
- Other Station (Single Network)
  Select this to access the programmable controller CPU on other station via only one type of network (including a multi-tier system) such as CC-Link, MELSECNET/10(H), CC-Link IE controller network, Q series C24 module and Ethernet.
  Since Ethernet is recognized as equivalent to CC-Link IE controller network and MELSECNET/10(H), select "Single Network" for a mixed system in which Ethernet, CC-Link IE controller network, and MELSECNET/10(H) are configured.
- Other Station (Co-existence Network)
  Select this to access the programmable controller CPU on other station via two types of network.
  This means the system which consists of two different networks, such as from MELSECNET/10(H) to CC-Link module or from Q series C24 module to MELSECNET/10(H).

4) Network Communication Route
Select the network type, network number, station number, and the start I/O number of the network that is routed at an access to the programmable controller CPU on other station. The setting items differ according to the selected network type.

5) Co-existence Network Route
Select the network type, network number, station number, and the start I/O number of the network to be accessed. The setting items differ according to the selected network type.

6) Target System
In the multiple CPU system, specify the CPU number to be accessed.

7) Connection Channel List button
Displays a list of the types of the connection destination.
The connection route can be selected from the list.

8) PLC Direct Coupled Setting button
This function is useful to change the station specification from "Other Station" to "No Specification".

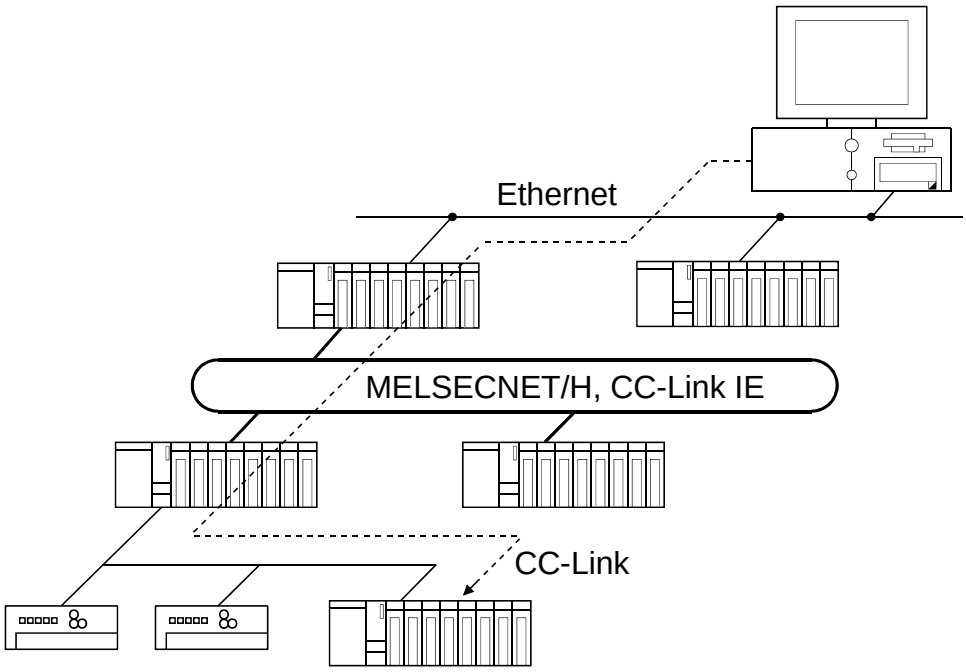
9) Connection Test button
Tests if the target programmable controller CPU set on the Transfer Setup screen can be accessed properly.
If the test is successful, the model of the target programmable controller CPU module is displayed in the PLC Type column.

10) System Image button

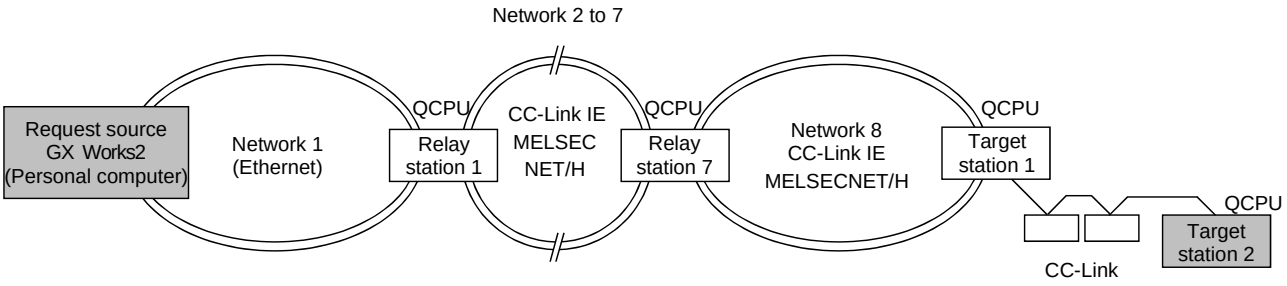
Displays the connection route in an illustration.

2.2.2 Access range from GX Works2

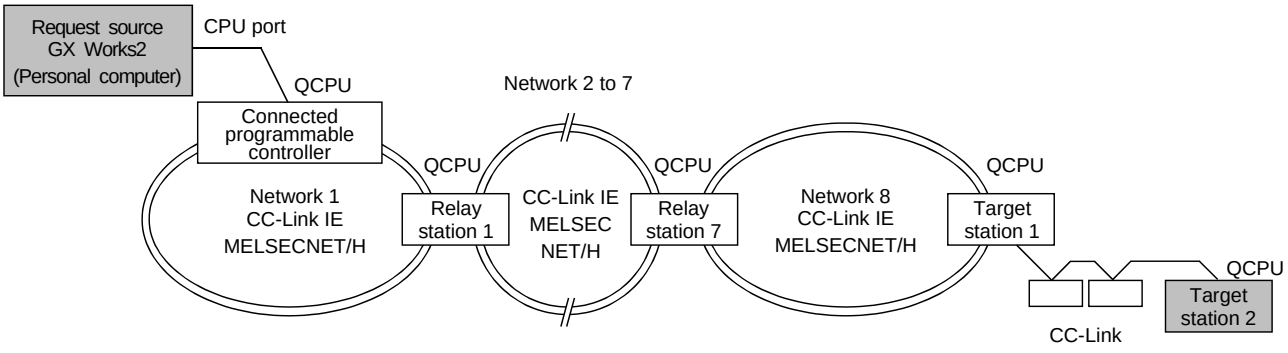
The seamless communication is established among CC-Link IE, Ethernet, MELSECNET/H, and CC-Link of the Q series.
GX Works2 can access a programmable controller via various networks.



(1) Access example via Ethernet, CC-Link IE, MELSECNET/H, and CC-Link
The request source GX Works2 can access up to two target stations.

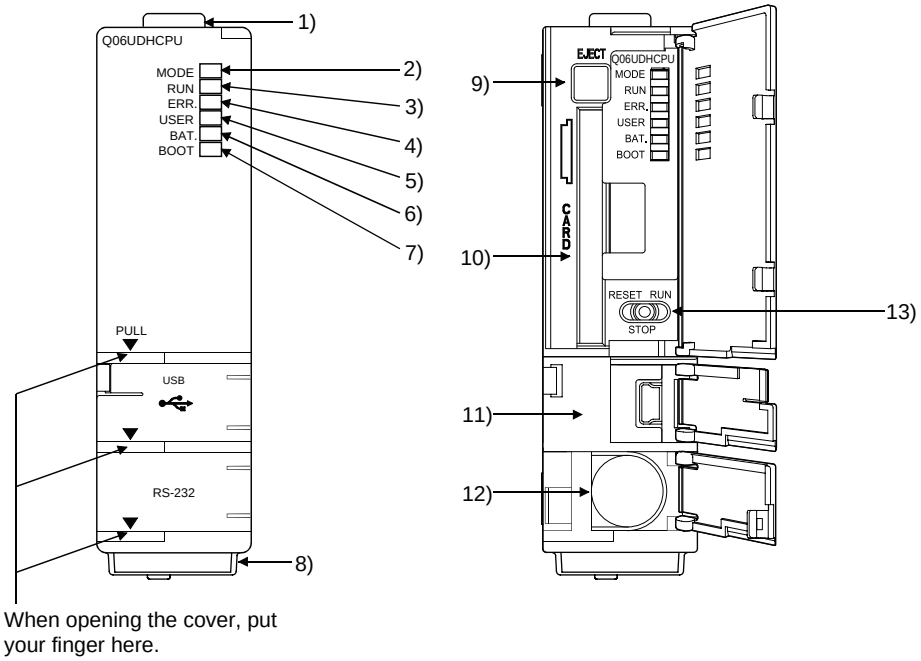


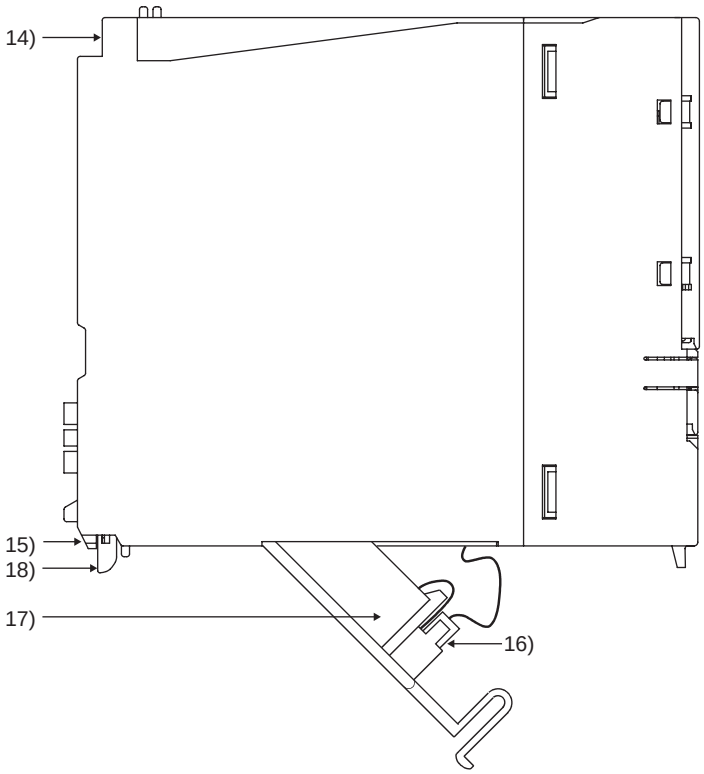
(2) Access example via CC-Link IE, MELSECNET/H, and CC-Link
The request source GX Works2 can access up to two target stations.



2.3 Name and Appearance of CPU

This section explains part names and setting of the module.

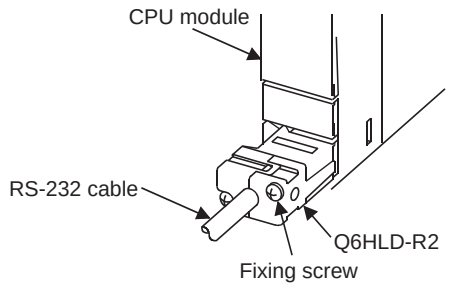




No.	Name	Application
1)	Module fixing hook	Hook used to fix the module to the base unit (Single-operation installation)
2)	MODE LED	Indicates the mode of the CPU module On : Q mode Flash : Device test with conditions is in process. Forced on and off function for external I/O is in process. CPU module change function with memory card is in process.
3)	RUN LED	Indicates the operation status of the CPU module On : During operation with the RUN/STOP/RESET switch set to "RUN" Off : During stop with the RUN/STOP/RESET switch set to "STOP" When an error which stops operation is detected Flash : Parameters or programs are written when the RUN/STOP/RESET switch is set to "STOP", then the RUN/STOP/RESET switch is set from "STOP" to "RUN" To turn on the RUN LED after writing the program, perform the following operations. • Set the RUN/STOP/RESET switch "RUN" → "STOP" → "RUN". • Reset the CPU module with the RUN/STOP/RESET switch. • Power on the programmable controller again. To turn on the RUN LED after writing the parameters, perform the following operations. • Reset the CPU module with the RUN/STOP/RESET switch. • Power on the programmable controller again. (When the RUN/STOP/RESET switch is set to "RUN" → "STOP" → "RUN" after the parameters are changed, network parameters and intelligent function module parameters are not updated.)
4)	ERR. LED	On : When a self-diagnosis error which does not stop the operation except a battery error is detected (When operation is set to be continued at an error detection in the parameter setting) Off : Normal Flash : When an error which stops operation is detected When the reset operation becomes valid with the RUN/STOP/RESET switch
5)	USER LED	On : When the annunciator is (F) turned on Off : Normal
6)	BAT. LED	On (yellow) : When a battery error occurs due to a battery voltage drop of the memory card Flash (yellow) : When a battery error occurs due to a voltage drop of the CPU module battery On (green) : Turns on for five seconds when the restoration of the data backed up to the standard ROM by the latch data backup is completed. Flash (green) : Flashes when the backup of the data to the standard ROM by the latch data backup is completed. Off : Normal
7)	BOOT LED	On : When the boot operation is started Off : When the boot operation is not being performed
8)	Serial number display	Displays the serial number printed on the rating plate.
9)	Memory card EJECT button	Used to eject the memory card from the CPU module
10)	Memory card installing connector	Connector used to install a memory card to the CPU module

No.	Name	Application
11)	USB connector*1	Connector for connection with a USB-compatible peripheral device (Connector type miniB) Can be connected with a USB-dedicated cable.
12)	RS-232 connector*1	Connector for connection with a peripheral device Can be connected with a RS-232 connection cable (QC30R2).
13)	RUN/STOP/RESET switch*2	RUN : Executes sequence program operation. STOP : Stops sequence program operation. RESET : Executes hardware reset, operation error reset, and operation initialization etc.
14)	Module fixing screw hole	Hole for the fixing screw to the base unit (M3 × 12 screw)
15)	Module fixing projection	Projection used to secure the module to the base unit
16)	Battery connector pin	Pins used to connect battery lead wires (Lead wires are disconnected from the connector at the shipping to prevent the battery from consuming.)
17)	Battery	Backup battery for the standard RAM and back-up power function
18)	Module mounting lever	Lever used to mount the module to the base unit

*1: When connecting a cable to the RS-232 connector or USB connector at all times, clamp the cable to prevent a poor connection, moving, and disconnection by unintentional pulling.
The Q6HLD-R2 type connector disconnection prevention holder is provided as a clamp for the RS-232 connector.

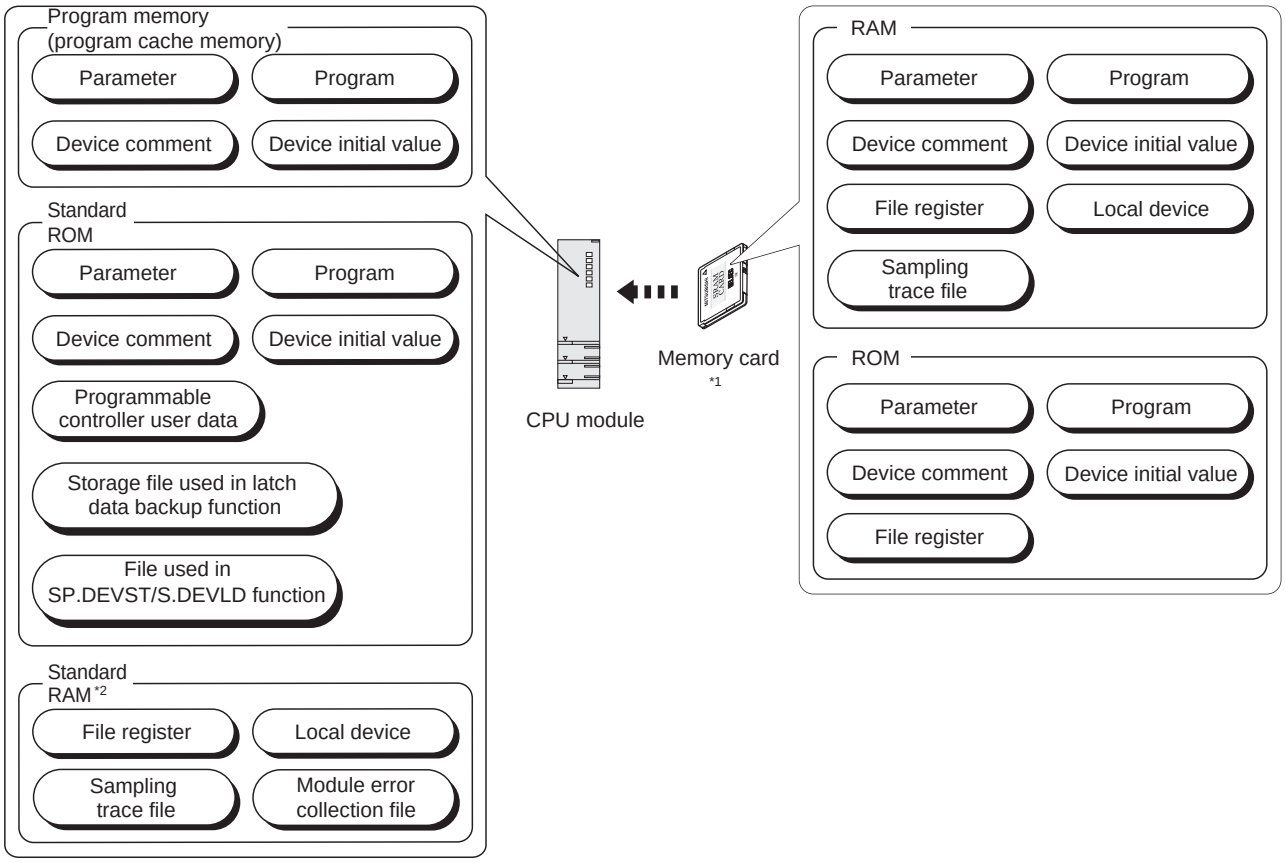


*2: Operate the RUN/STOP/RESET switch with a fingertip.
To prevent the switch from damage, do not use any tool such as screw driver.

2.4 Memory System Configuration

2.4.1 Universal model QCPU module memory configuration

The memory of universal model QCPU consists of the following block configurations.



*1: A memory card cannot be used for Q00UJCPU, Q00UCPU, and Q01UCPU.
*2: Q00UJCPU has no standard RAM.

- Program memory: A memory for storing programs and parameters for CPU module operation
  A program operation is executed by transferring a program stored in the program memory to the program cache memory.
- Program cache memory: A memory for operating programs
  A program operation is executed by transferring a program stored in the program memory to the program cache memory.
- Standard RAM: A memory for using file registers, local devices, and sampling trace files without a memory card
  Using the standard RAM as the file registers enables the high-speed access as well as data registers.
  The standard RAM is also used for storing the module error collection file.
- Standard ROM: A memory for storing data such as parameters and programs
- Memory card (RAM): A card for storing the file register, local device, device initial value, sampling trace file, and device comments with the parameters and program
- Memory card (ROM): A Flash card for storing parameters, programs, and file registers.
  An ATA card stores parameters, programs, and the programmable controller user data (general-purpose files).

POINT

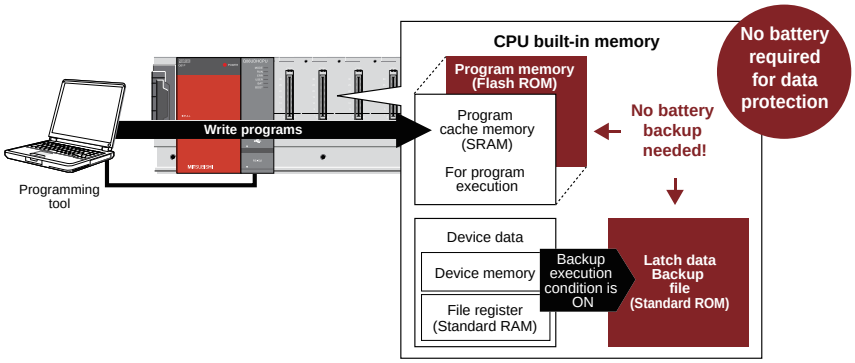
Secure backup by long-term storage

Programs and parameter files are automatically backed up to the program memory (Flash ROM) which does not require a battery backup. This prevents a loss of the program and parameter data due to the flat battery.

The battery backup time is also reduced significantly.

In addition, the important data (such as device data) can be backed up to the standard ROM to prevent a loss of the data due to the flat battery in case of consecutive holidays.

The backup data is restored automatically when the power is turned on next time.



2.4.2 Memory card application

A QCPU equips a built-in memory as standard for storing parameters and programs, therefore, the programs can be executed without a memory card.
The memory cards are required for the situations in the table below.

*: A memory card cannot be used for Q00UJCPU, Q00UCPU, Q01UCPU.

(1) SRAM card
File registers in the SRAM card can be written or read by the sequence program.
The SRAM card is used when:

- the number of file registers exceeds the standard RAM capacity, or
- the sampling trace function is used.

When file registers are stored to the SRAM card, they can be written or read by the sequence program up to 4086K points.

(2) Flash card
Write data with GX Works2 and read it by the sequence program. (Data can only be read by the sequence program.)
Use the Flash card when changing the data is unnecessary.
File registers can be stored up to 2039K points.

(3) ATA card
An ATA card is used for programmable controller user data (general-purpose data).
Programmable controller user data of an ATA card can be accessed by the file access instruction (such as the SP.FWRITE instruction) in a sequence program through a CSV format or binary format.

2.4.3 Handling the memory card

The specifications of the memory card which are available for the QCPU module conform to those of the JEIDA/PCMCIA small programmable controller card.
Only one memory card can be installed to the QCPU.

(1) Memory card specifications

(a) SRAM card

Item		Type			
		Q2MEM-1MBS	Q2MEM-2MBS	Q3MEM-4MBS	Q3MEM-8MBS
Memory capacity after format		1011.5K byte	2034K byte	4078K byte	8172K byte
Storable number of files		255	287	319	
Number of insertions and removals		5000 times			
External dimensions	H	45mm		74mm	
	W	42.8mm			
	D	3.3mm		8.1mm	
Weight		15g		30g	31g

(b) Flash card

Item		Type	
		Q2MEM-2MBF	Q2MEM-4MBF
Memory capacity		2035K byte	4079K byte
Storable number of files		288	
Number of insertions and removals		5000 times	
Number of writings		100000 times	
External dimensions	H	45mm	
	W	42.8mm	
	D	3.3mm	
Weight		15g	

(c) ATA card

Item		Type		
		Q2MEM-8MBA	Q2MEM-16MBA*2	Q2MEM-32MBA
Memory capacity after format		7982K byte*1	15982K byte*1	31854K byte
Storable number of files		512*2		
Number of insertions and removals		5000 times		
Number of writings		1000000 times		
External dimensions	H	45mm		
	W	42.8mm		
	D	3.3mm		
Weight		15g		

*1: The capacity of the ATA cards with the manufacturer control number E or earlier after formatting is as follows.
Manufacturer control number E: Q2MEM-8MBA: 7948K byte, Q2MEM-16MBA: 15948K byte
Manufacturer control number E or earlier: Q2MEM-8MBA: 7940k byte, Q2MEM-16MBA: 15932K byte

*2: Up to 511 files can be stored in the Universal model QCPU.

(2) When using the memory card in the purchased status

(a) Install the enclosed battery.

• SRAM card battery

Item \ Type	Q2MEM-BAT	Q3MEM-BAT
Classification	Graphite fluoride lithium primary battery	Manganese dioxide lithium primary battery
Initial voltage (V)	3.0	3.0
Nominal current (mAh)	48	550
Battery life when stored	Actually 5 years (room temperature)	
Battery life when used	Refer to the QCPU User's Manual Hardware Design, Maintenance and Inspection	
Application	Power failure backup for SRAM card For Q2MEM-1MBS/Q2MEM-2MBS	Power failure backup for SRAM card For Q3MEM-4MBS/Q3MEM-8MBS

(b) Since the memory card is not formatted in the initial setting, use the card after formatting in GX Works2.
Formatting is unnecessary for Flash cards.

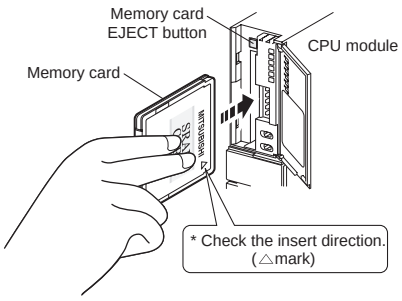
(3) Installing and removing a memory card

(a) For Q2MEM type memory card

1) To install the memory card

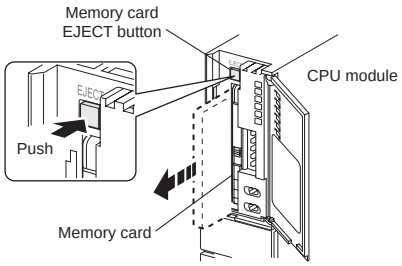
Pay attention to the direction of the memory card when installing it to the CPU module.

Insert the memory card securely into the connector until the projection of the memory card EJECT button appears.



2) To remove the memory card

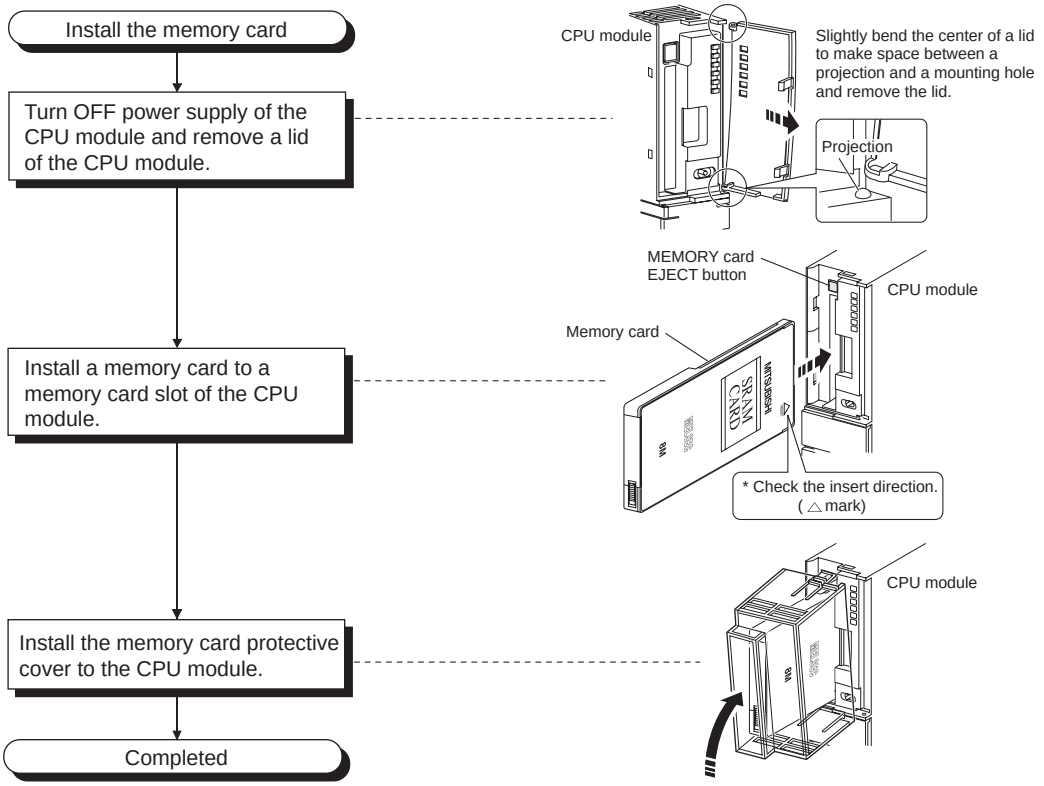
When removing the memory card from the CPU module, press the memory card EJECT button and pull out the memory card.



(b) For Q3MEM type memory card

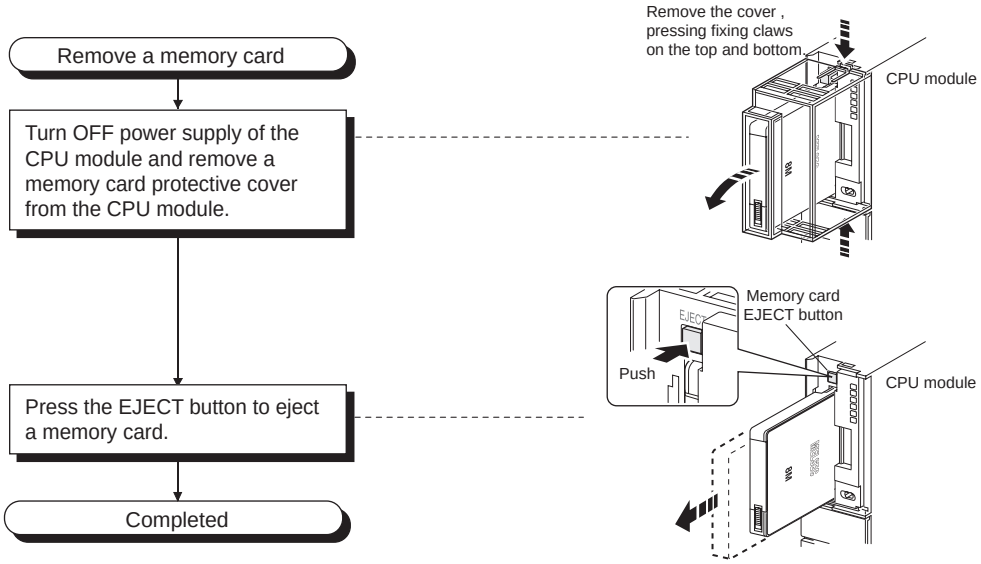
1) To install the memory card

When installing a memory card to the CPU module, follow the following procedures and pay attention to the direction of the memory card.



2) To remove the memory card

When removing the memory card from the CPU module, remove the memory card protective cover and press the EJECT button and pull out the memory card.



(c) To remove the memory card while the power is on

When removing the memory card, confirm that special relays "SM604" and "SM605" are off.

- The memory card cannot be removed when "SM604" is on because the CPU module is using the card.
- Turn off "SM605" when it is on.

  When both "SM604" and "SM605" are off, remove the memory card according to the following procedure.

1) Turn on the special relay "SM609" with the sequence program or the device test of GX Works2.
2) Use the monitor function of GX Works2 to check that the special relay "SM600" is turned off.
3) Remove the memory card.

   SM600 (Memory card can be used): The system is turned on when the memory card is ready to be used.

   SM604 (memory card is being used): The system is turned on when the CPU module is using the memory card.

   SM605 (memory card installation/removal prohibited): Turned on by the user to disable a installation/removal of the memory card.

(d) To install the memory card while the power is on

1) Install the memory card.
2) Use the monitor function of GX Works2 to check that the special relay "SM600" is turned on.

CHAPTER 3 PERFORMANCE SPECIFICATIONS

3.1 Performance Specifications

The following table lists the performance specifications of the Universal model QCPU.

(1) Q00UJCPU, Q00UCPU, Q01UCPU, Q02UCPU, Q03UD(E)CPU

<table>
<tr><th colspan="3" rowspan="2">Item</th><th colspan="5">Universal model QCPU</th></tr>
<tr><th>Q00UJCPU</th><th>Q00UCPU</th><th>Q01UCPU</th><th>Q02UCPU</th><th>Q03UDCPU
Q03UDECPU</th></tr>
<tr><td colspan="3">Control method</td><td colspan="5">Stored program repeat operation</td></tr>
<tr><td colspan="3">I/O control mode</td><td colspan="5">Refresh mode
(Direct access I/O is available by specifying direct access I/O (DX□, DY□).)</td></tr>
<tr><td rowspan="2">Program language</td><td colspan="2">Sequence control language</td><td colspan="5">Relay symbol language, logic symbolic language, MELSAP3 (SFC), MELSAP-L, function block, and structured text (ST)</td></tr>
<tr><td colspan="2">Process control language</td><td colspan="5">-</td></tr>
<tr><td rowspan="2">Processing speed (sequence instruction)</td><td>LD X0</td><td></td><td>120ns</td><td>80ns</td><td>60ns</td><td>40ns</td><td>20ns</td></tr>
<tr><td>MOV D0 D1</td><td></td><td>240ns</td><td>160ns</td><td>120ns</td><td>80ns</td><td>40ns</td></tr>
<tr><td>Processing speed (redundant function)</td><td colspan="2">Tracking execution time (increased scan time)</td><td colspan="5">-</td></tr>
<tr><td colspan="3">Constant scanning
(function for keeping regular scan time)</td><td colspan="5">0.5 to 2000ms (setting available in 0.5ms unit) (setting by parameters)</td></tr>
<tr><td colspan="3">Program capacity*1 *2</td><td colspan="2">10K steps
(40K byte)</td><td>15K steps
(60K byte)</td><td>20K steps
(80K byte)</td><td>30K steps
(120K byte)</td></tr>
<tr><td rowspan="7">Memory capacity*1</td><td colspan="2">Program memory
(drive 0)</td><td colspan="2">40K byte</td><td>60K byte</td><td>80K byte</td><td>120K byte</td></tr>
<tr><td colspan="2">Memory card (RAM)
(drive 1)</td><td colspan="3">-</td><td>Capacity of the installed memory card (8M byte max.)</td></tr>
<tr><td colspan="2">Memory card (ROM)
(drive 2)</td><td colspan="3">-</td><td>Capacity of the installed memory card
(Flash card: 4M byte max.,
ATA card: 32M byte max.)</td></tr>
<tr><td colspan="2">Standard RAM
(drive 3)</td><td>-</td><td colspan="3">128K byte</td><td>192K byte</td></tr>
<tr><td colspan="2">Standard ROM
(drive 4)</td><td>256K byte</td><td colspan="3">512K byte</td><td>1024K byte</td></tr>
<tr><td rowspan="2">CPU shared memory*3</td><td>QCPU standard memory</td><td>-</td><td colspan="4">8K byte</td></tr>
<tr><td>Multiple CPU high speed transmission area</td><td colspan="4">-</td><td>32K byte</td></tr>
</table>

*1: The size unit of the files stored in the memory area differs depending on the CPU module.
For details, refer to the QnUCPU User's Manual (Function Explanation, Program Fundamentals).

*2: The maximum number of executable sequence steps is obtained by the following formula.
(Program capacity) - (File header size (Default: 34 steps))
For details of the program capacity and files, refer to the QnUCPU User's Manual (Function Explanation, Program Fundamentals).

*3: Data in the CPU shared memory is not latched.
Data in the CPU shared memory is cleared when the programmable controller is powered on or the CPU module is reset.

<table>
<tr><td colspan="3" rowspan="2">Item</td><td colspan="5">Universal model QCPU</td></tr>
<tr><td>Q00UJCPU</td><td>Q00UCPU</td><td>Q01UCPU</td><td>Q02UCPU</td><td>Q03UDCPU
Q03UDECPU</td></tr>
<tr><td rowspan="5">Max. number of files stored</td><td colspan="2">Program memory</td><td colspan="3">32</td><td>64</td><td>124</td></tr>
<tr><td colspan="2">Memory card (RAM)</td><td colspan="3">-</td><td colspan="2">319 (when the Q3MEM-8MBS is used)</td></tr>
<tr><td rowspan="2">Memory card (ROM)</td><td>Flash card</td><td colspan="3">-</td><td colspan="2">288</td></tr>
<tr><td>ATA card</td><td colspan="3">-</td><td colspan="2">511</td></tr>
<tr><td colspan="2">Standard RAM</td><td>-</td><td colspan="4">3 files (each one of the following files: file register file, local device file, and sampling trace file)</td></tr>
<tr><td colspan="2">Standard ROM</td><td colspan="4">128</td><td>256</td></tr>
<tr><td colspan="3">Number of times of writing data into the program memory</td><td colspan="5">Max. 100000 times*4</td></tr>
<tr><td colspan="3">Number of times of writing data into the standard ROM</td><td colspan="5">Max. 100000 times*5</td></tr>
<tr><td colspan="3">Number of I/O device points (number of usable points on program)</td><td colspan="5">8192 points (X/Y0 to 1FFF)</td></tr>
<tr><td colspan="3">Number of I/O points (number of points accessible to the actual I/O module)</td><td>256 points (X/Y0 to FF)</td><td colspan="2">1024 points (X/Y0 to 3FF)</td><td>2048 points (X/Y0 to 7FF)</td><td>4096 points (X/Y0 to FFF)</td></tr>
<tr><td rowspan="16">Number of device points</td><td colspan="2">Internal relay [M]*6</td><td colspan="5">8192 points by default (M0 to 8191) (changeable)</td></tr>
<tr><td colspan="2">Latch relay [L]*6</td><td colspan="5">8192 points by default (L0 to 8191) (changeable)</td></tr>
<tr><td colspan="2">Link relay [B]*6</td><td colspan="5">8192 points by default (B0 to 1FFF) (changeable)</td></tr>
<tr><td colspan="2">Timer [T]*6</td><td colspan="5">2048 points by default (T0 to 2047) (changeable) (sharing of low- and high-speed timers)
The low- and high-speed timers are specified by the instructions.
The measurement units of the low- and high-speed timers are set up by parameters.
(Low-speed timer: 1 to 1000ms, 1ms unit, 100ms by default)
(High-speed timer: 0.1 to 100ms, 0.1ms unit, 10ms by default)</td></tr>
<tr><td colspan="2">Retentive timer [ST]*6</td><td colspan="5">0 point by default (sharing of the low- and high-speed retentive timers) (changeable)
The low- and high-speed retentive timers are specified by the instructions.
The measurement units of the low- and high-speed retentive timers are set up by parameters.
(Low-speed retentive timer: 1 to 1000ms, 1ms unit, 100ms by default)
(High-speed retentive timer: 0.1 to 100ms, 0.1ms unit, 10ms by default)</td></tr>
<tr><td colspan="2">Counter [C]*6</td><td colspan="5">Normal counter, 1024 points by default (C0 to 1023) (changeable)</td></tr>
<tr><td colspan="2">Data register [D]*6</td><td colspan="5">12288 points by default (D0 to 12287) (changeable)</td></tr>
<tr><td colspan="2">Extended data register [D]</td><td>-</td><td colspan="4">0 point by default (changeable)</td></tr>
<tr><td colspan="2">Link register [W]*6</td><td colspan="5">8192 points by default (W0 to 1FFF) (changeable)</td></tr>
<tr><td colspan="2">Extended link register [W]</td><td>-</td><td colspan="4">0 point by default (changeable)</td></tr>
<tr><td colspan="2">Annunciator [F]*6</td><td colspan="5">2048 points by default (F0 to 2047) (changeable)</td></tr>
<tr><td colspan="2">Edge relay [V]*6</td><td colspan="5">2048 points by default (V0 to 2047) (changeable)</td></tr>
<tr><td colspan="2">Link special relay [SB]*6</td><td colspan="5">2048 points by default (SB0 to 7FF) (changeable)</td></tr>
<tr><td colspan="2">Link special register [SW]*6</td><td colspan="5">2048 points by default (SW0 to 7FF) (changeable)</td></tr>
</table>

*4: A single writing operation may not be counted as one.
The number of writing into the program memory can be checked with the special register (SD682 and SD683).

*5: A single writing operation may not be counted as one.
The number of writing into the standard ROM can be checked with the special register (SD687 and SD688).

*6: The number of points can be changed within the setting range.

Item				Universal model QCPU				
				Q00UJCPU	Q00UCPU	Q01UCPU	Q02UCPU	Q03UDCPU Q03UDECPU
Number of device points	File register *7	[R]	Standard RAM	-	32768 points (R0 to 32767) Max. 65536 points by block switching			32768 points (R0 to 32767) Max. 98304 points by block switching
			SRAM card (1M byte)	-			Max. 517120 points by block switching in units of 32768 points (R0 to 32767)	
			SRAM card (2M byte)	-			Max. 1041408 points by block switching in units of 32768 points (R0 to 32767)	
			SRAM card (4M byte)	-			Max. 2087936 points by block switching in units of 32768 points (R0 to 32767)	
			SRAM card (8M byte)	-			Max. 4184064 points by block switching in units of 32768 points (R0 to 32767)	
			Flash card (2M byte)	-			Max. 1041408 points by block switching in units of 32768 points (R0 to 32767)	
			Flash card (4M byte)	-			Max. 2087936 points by block switching in units of 32768 points (R0 to 32767)	
		[ZR]	Standard RAM	-	65536 points (ZR0 to 65535) Block switching not required			98304 points (ZR0 to 98303) Block switching not required
			SRAM card (1M byte)	-			517120 points (ZR0 to 517119), Block switching not required	
			SRAM card (2M byte)	-			1041408 points (ZR0 to 1041407), Block switching not required	
			SRAM card (4M byte)	-			2087936 points (ZR0 to 2087935), Block switching not required	
			SRAM card (8M byte)	-			4184064 points (ZR0 to 4184063), Block switching not required	
			Flash card (2M byte)	-			1041408 points (ZR0 to 1041407), Block switching not required	
			Flash card (4M byte)	-			2087936 points (ZR0 to 2087935), Block switching not required	

*7: When a Flash card is used, only reading is possible. ATA cards cannot be used.

Item			Universal model QCPU				
			Q00UJCPU	Q00UCPU	Q01UCPU	Q02UCPU	Q03UDCPU Q03UDECPU
Number of device points	Step relay [S]*8		8192 points (S0 to 8191) (the number of device points is fixed.)*9				
	Index register/ Standard devise register [Z]		Max. 20 points (Z0 to 19)				
	Index register [Z] (32-bit indexing specification of ZR device)		-	Max. 10 points (Z0 to 18) (Index register (Z) is used in double words.)			
	Pointer [P]		512 points (P0 to 511), The available ranges of the local pointers and common pointers can be set by parameters.			4096 points (P0 to 4095), The available ranges of the local pointers and common pointers can be set by parameters.	
	Interrupt pointer [I]		128 points (I0 to 127) The constant cyclic interval of system interrupt pointers I28 to 31 can be set by parameters. (0.5 to 1000ms, 0.5ms unit) Default value I28: 100ms, I29: 40ms, I30: 20ms, I31: 10ms			256 points (I0 to 255) The constant cyclic interval of system interrupt pointers I28 to 31 can be set by parameters. (0.5 to 1000ms, 0.5ms unit) Default value I28: 100ms, I29: 40ms, I30: 20ms, I31: 10ms	
	Special relay [SM]		2048 points (SM0 to 2047) (the number of device points is fixed.)				
	Special register [SD]		2048 points (SD0 to 2047) (the number of device points is fixed.)				
	Function input [FX]		16 points (FX0 to F) (the number of device points is fixed.)				
	Function output [FY]		16 points (FY0 to F) (the number of device points is fixed.)				
	Function register [FD]		5 points (FD0 to 4) (the number of device points is fixed.)				
Number of device tracking words			-				
Link direct device			Device for accessing the link device directly Dedicated to CC-Link IE controller network and MELSECNET/H Specified form: J□\X□, J□\Y□, J□\W□, J□\B□, J□\SW□, J□\SB□				
Intelligent function module device			Device for accessing the buffer memory of the intelligent function module directly Specified form: U□\G□				
Specifications of built-in Ethernet port CPU module*10	Data transmission speed		-				100/10Mbps
	Communication mode		-				Full-duplex/Half-duplex
	Transmission method		-				Base band
	Max. distance between hub and node		-				100m
	Max. number of connectable nodes	10BASE-T	-				Cascade connection: Max. four nodes
		10BASE-T	-				Cascade connection: Max. two nodes
	Number of connections*11		-				16 in total for socket communication, MELSOFT connection, and MC protocol, 1 for FTP

*8: The step relay is a device for the SFC function.

*9: For the Universal model QCPU whose serial number (first five digits) is "10042" or later, the number of device points can be changed to zero.

*10: For the Built-in Ethernet port QCPU

*11: The number is a total of TCP/IP and UDP/IP.

Item		Universal model QCPU				
		Q00UJCPU	Q00UCPU	Q01UCPU	Q02UCPU	Q03UDCPU Q03UDECPU
Latch range		L0 to 8191 (8192 points by default) (Latch range can be set for B, F, V, T, ST, C, D, and W) (setting by parameters)				
RUN/PAUSE contact		One contact can be set up in X0 to 1FFF for each of RUN and PAUSE (setting by parameters)				
Clock function		Year, month, date, hour, minute, second, and day of the week (automatic leap year detection) Accuracy: -2.96 to +3.74s (TYP. +1.24s)/d at 0°C Accuracy: -2.34 to +3.74s (TYP. +1.63s)/d at 25°C Accuracy: -11.48 to +2.12s (TYP. -3.03s)/d at 55°C			Year, month, date, hour, minute, second, and day of the week (automatic leap year detection) Accuracy: -2.96 to +3.74s (TYP. +1.42s)/d at 0°C Accuracy: -3.18 to +3.74s (TYP. +1.50s)/d at 25°C Accuracy: -13.20 to +2.12s (TYP. -3.54s)/d at 55°C	
Allowable momentary power failure time		20ms or less (100VAC or more)	Varies depending on the power supply module.			
5VDC internal current consumption		0.37A*12	0.33A		0.23A	0.33A*13
External dimensions	H	98mm	98mm			
	W	245mm*14	27.4mm			
	D	98mm	89.3mm*15			
Weight		0.70kg*14	0.15kg		0.20kg*15	

*12: The value is for the CPU module and base unit together.

*13: The value is 0.46A for the Q03UDECPU.

*14: The value includes the CPU module, power supply module, and base unit.

*15: The following values are applied for the Q03UDECPU.

External dimensions (D) : 115mm

Weight : 0.22kg

(2) Q04UD(E)HCPU, Q06UD(E)HCPU, Q10UD(E)HCPU, Q13UD(E)HCPU, Q20UD(E)HCPU, Q26UD(E)HCPU

<table>
<tr><td colspan="3" rowspan="3">Item</td><td colspan="6">Universal model QCPU</td></tr>
<tr><td>Q04UDHCPU</td><td>Q06UDHCPU</td><td>Q10UDHCPU</td><td>Q13UDHCPU</td><td>Q20UDHCPU</td><td>Q26UDHCPU</td></tr>
<tr><td>Q04UDEHCPU</td><td>Q06UDEHCPU</td><td>Q10UDEHCPU</td><td>Q13UDEHCPU</td><td>Q20UDEHCPU</td><td>Q26UDEHCPU</td></tr>
<tr><td colspan="3">Control method</td><td colspan="6">Stored program repeat operation</td></tr>
<tr><td colspan="3">I/O control mode</td><td colspan="6">Refresh mode
(Direct access I/O is available by specifying direct access I/O (DX□, DY□).)</td></tr>
<tr><td rowspan="2">Program language</td><td colspan="2">Sequence control language</td><td colspan="6">Relay symbol language, logic symbolic language, MELSAP3 (SFC), MELSAP-L, function block and structured text (ST)</td></tr>
<tr><td colspan="2">Process control language</td><td colspan="6">-</td></tr>
<tr><td rowspan="2">Processing speed (sequence instruction)</td><td colspan="2">LD X0</td><td colspan="6">9.5ns</td></tr>
<tr><td colspan="2">MOV D0 D1</td><td colspan="6">19ns</td></tr>
<tr><td>Processing speed (redundant function)</td><td colspan="2">Tracking execution time (increased scan time)</td><td colspan="6">-</td></tr>
<tr><td colspan="3">Constant scanning (function for keeping regular scan time)</td><td colspan="6">0.5 to 2000ms (setting available in 0.5ms unit) (setting by parameters)</td></tr>
<tr><td colspan="3">Program capacity*1 *2</td><td>40K steps (160K byte)</td><td>60K steps (240K byte)</td><td>100K steps (400K byte)</td><td>130K steps (520K byte)</td><td>200K steps (800K byte)</td><td>260K steps (1040K byte)</td></tr>
<tr><td rowspan="7">Memory capacity*1</td><td colspan="2">Program memory (drive 0)</td><td>160K byte</td><td>240K byte</td><td>400K byte</td><td>520K byte</td><td>800K byte</td><td>1040K byte</td></tr>
<tr><td colspan="2">Memory card (RAM) (drive 1)</td><td colspan="6">Capacity of the installed memory card (8M byte max.)</td></tr>
<tr><td colspan="2">Memory card (ROM) (drive 2)</td><td colspan="6">Capacity of the installed memory card (Flash card: 4M byte max., ATA card: 32M byte max.)</td></tr>
<tr><td colspan="2">Standard RAM (drive 3)</td><td>256K byte</td><td>768K byte</td><td colspan="2">1024K byte</td><td colspan="2">1280K byte</td></tr>
<tr><td colspan="2">Standard ROM (drive 4)</td><td colspan="2">1024K byte</td><td colspan="2">2048K byte</td><td colspan="2">4096K byte</td></tr>
<tr><td rowspan="2">CPU shared memory*3</td><td>QCPU standard memory</td><td colspan="6">8K byte</td></tr>
<tr><td>Multiple CPU high speed transmission area</td><td colspan="6">32K byte</td></tr>
</table>

*1: The size unit of the files stored in the memory area differs depending on the CPU module.
For details, refer to the QnUCPU User's Manual (Function Explanation, Program Fundamentals).

*2: The maximum number of executable sequence steps is obtained by the following formula.
(Program capacity) - (File header size (Default: 34 steps))
For details of the program capacity and files, refer to the QnUCPU User's Manual (Function Explanation, Program Fundamentals).

*3: Data in the CPU shared memory is not latched.
Data in the CPU shared memory is cleared when the programmable controller is powered on or the CPU module is reset.

Item			Universal model QCPU					
			Q04UDHCPU	Q06UDHCPU	Q10UDHCPU	Q13UDHCPU	Q20UDHCPU	Q26UDHCPU
			Q04UDEHCPU	Q06UDEHCPU	Q10UDEHCPU	Q13UDEHCPU	Q20UDEHCPU	Q26UDEHCPU
Max. number of files stored	Program memory		124		252*4			
	Memory card (RAM)		319 (when the Q3MEM-8MBS is used)					
	Memory card (ROM)	Flash card	288					
		ATA card	511					
	Standard RAM		3 files (each one of the following files: file register file, local device file, and sampling trace file)					
	Standard ROM		256					
Number of times of writing data into the program memory			Max. 100000 times*5					
Number of times of writing data into the standard ROM			Max. 100000 times*5					
Number of I/O device points (number of usable points on program)			8192 points (X/Y0 to 1FFF)					
Number of I/O points (number of points accessible to the actual I/O module)			4096 points (X/Y0 to FFF)					
Number of device points	Internal relay [M]*7		8192 points by default (M0 to 8191) (changeable)					
	Latch relay [L]*7		8192 points by default (L0 to 8191) (changeable)					
	Link relay [B]*7		8192 points by default (B0 to 1FFF) (changeable)					
	Timer [T]*7		2048 points by default (T0 to 2047) (changeable) (sharing of low- and high-speed timers) The low- and high-speed timers are specified by the instructions. The measurement units of the low- and high-speed timers are set up by parameters. (Low-speed timer: 1 to 1000ms, 1ms unit, 100ms by default) (High-speed timer: 0.1 to 100ms, 0.1ms unit, 10ms by default)					
	Retentive timer [ST]*7		0 point by default (sharing of the low- and high-speed retentive timers) (changeable) The low- and high-speed retentive timers are specified by the instructions. The measurement units of the low- and high-speed retentive timers are set up by parameters. (Low-speed retentive timer: 1 to 1000ms, 1ms unit, 100ms by default) (High-speed retentive timer: 0.1 to 100ms, 0.1ms unit, 10ms by default)					
	Counter [C]*7		Normal counter, 1024 points by default (C0 to 1023) (changeable)					
	Data register [D]*7		12288 points by default (D0 to 12287) (changeable)					
	Extended data register [D]		0 point by default (changeable)					
	Link register [W]*7		8192 points by default (W0 to 1FFF) (changeable)					
	Extended link register [W]		0 point by default (changeable)					
	Annunciator [F]*7		2048 points by default (F0 to 2047) (changeable)					
	Edge relay [V]*7		2048 points by default (V0 to 2047) (changeable)					
	Link special relay [SB]*7		2048 points by default (SB0 to 7FF) (changeable)					
	Link special register [SW]*7		2048 points by default (SW0 to 7FF) (changeable)					

*4: Up to 124 programs can be executed in the CPU module. (The CPU module cannot execute 125 or more programs.)

*5: A single writing operation may not be counted as one.
The number of writing into the program memory can be checked with the special register (SD682 and SD683).

*6: A single writing operation may not be counted as one.
The number of writing into the standard ROM can be checked with the special register (SD687 and SD688).

*7: The number of points can be changed within the setting range.

Item				Universal model QCPU					
				Q04UDHCPU	Q06UDHCPU	Q10UDHCPU	Q13UDHCPU	Q20UDHCPU	Q26UDHCPU
				Q04UDEHCPU	Q06UDEHCPU	Q10UDEHCPU	Q13UDEHCPU	Q20UDEHCPU	Q26UDEHCPU
Number of device points	File register*8	[R]	Standard RAM	32768 points (R0 to 32767) Max. 131072 points by block switching	32768 points (R0 to 32767) Max. 393216 points by block switching	32768 points (R0 to 32767) Max. 524288 points by block switching		32768 points (R0 to 32767) Max. 655360 points by block switching	
			SRAM card (1M byte)	Max. 517120 points by block switching in units of 32768 points (R0 to 32767)					
			SRAM card (2M byte)	Max. 1041408 points by block switching in units of 32768 points (R0 to 32767)					
			SRAM card (4M byte)	Max. 2087936 points by block switching in units of 32768 points (R0 to 32767)					
			SRAM card (8M byte)	Max. 4184064 points by block switching in units of 32768 points (R0 to 32767)					
			Flash card (2M byte)	Max. 1041408 points by block switching in units of 32768 points (R0 to 32767)					
			Flash card (4M byte)	Max. 2087936 points by block switching in units of 32768 points (R0 to 32767)					
		[ZR]	Standard RAM	131072 points (ZR0 to 131071) Block switching not required	393216 points (ZR0 to 393215) Block switching not required	524288 points (ZR0 to 524287) Block switching not required		655360 points (ZR0 to 655359) Block switching not required	
			SRAM card (1M byte)	517120 points (ZR0 to 517119), Block switching not required					
			SRAM card (2M byte)	1041408 points (ZR0 to 1041407), Block switching not required					
			SRAM card (4M byte)	2087936 points (ZR0 to 2087935), Block switching not required					
			SRAM card (8M byte)	4184064 points (ZR0 to 4184063), Block switching not required					
			Flash card (2M byte)	1041408 points (ZR0 to 1041407), Block switching not required					
			Flash card (4M byte)	2087936 points (ZR0 to 2087935), Block switching not required					

*8: When a Flash card is used, only reading is possible. ATA cards cannot be used.

Item			Universal model QCPU					
			Q04UDHCPU	Q06UDHCPU	Q10UDHCPU	Q13UDHCPU	Q20UDHCPU	Q26UDHCPU
			Q04UDEHCPU	Q06UDEHCPU	Q10UDEHCPU	Q13UDEHCPU	Q20UDEHCPU	Q26UDEHCPU
Number of device points	Step relay [S]*9		8192 points (S0 to 8191) (the number of device points is fixed.)*10					
	Index register/Standard devise register [Z]		Max. 20 points (Z0 to 19)					
	Index register [Z] (32-bit indexing specification of ZR device)		Max. 10 points (Z0 to 18) (Index register (Z) is used in double words.)					
	Pointer [P]		4096 points (P0 to 4095), The available ranges of the local pointers and common pointers can be set by parameters.					
	Interrupt pointer [I]		256 points (I0 to 255) The constant cyclic interval of system interrupt pointers I28 to 31 can be set by parameters. (0.5 to 1000ms, 0.5ms unit) Default value I28: 100ms, I29: 40ms, I30: 20ms, I31: 10ms					
	Special relay [SM]		2048 points (SM0 to 2047) (the number of device points is fixed.)					
	Special register [SD]		2048 points (SD0 to 2047) (the number of device points is fixed.)					
	Function input [FX]		16 points (FX0 to F) (the number of device points is fixed.)					
	Function output [FY]		16 points (FY0 to F) (the number of device points is fixed.)					
	Function register [FD]		5 points (FD0 to 4) (the number of device points is fixed.)					
Number of device tracking words			-					
Number of device tracking words			Device for accessing the link device directly Dedicated to CC-Link IE controller network and MELSECNET/H Specified form: J□□\X□□, J□□\Y□□, J□□\W□□, J□□\B□□, J□□\SW□□, J□□\SB□□					
Intelligent function module device			Device for accessing the buffer memory of the intelligent function module directly Specified form: U□□\G□□					
Specifications of built-in Ethernet port CPU module*11	Data transmission speed		100/10Mbps					
	Communication mode		Full-duplex/Half-duplex					
	Transmission method		Base band					
	Max. distance between hub and node		100m					
	Max. number of connectable nodes	10BASE-T	Cascade connection: Max. four nodes					
		100BASE-TX	Cascade connection: Max. two nodes					
	Number of connections*12		16 in total for socket communication, MELSOFT connection, and MC protocol, 1 for FTP					

*9: The step relay is a device for the SFC function.

*10: For the Universal model QCPU whose serial number (first five digits) is "10042" or later, the number of device points can be changed to zero.

*11: For the Built-in Ethernet port QCPU

*12: The number is a total of TCP/IP and UDP/IP.

Item		Universal model QCPU					
		Q04UDHCPU	Q06UDHCPU	Q10UDHCPU	Q13UDHCPU	Q20UDHCPU	Q26UDHCPU
		Q04UDEHCPU	Q06UDEHCPU	Q10UDEHCPU	Q13UDEHCPU	Q20UDEHCPU	Q26UDEHCPU
Latch range		L0 to 8191 (8192 points by default) (Latch range can be set for B, F, V, T, ST, C, D, and W) (setting by parameters)					
RUN/PAUSE contact		One contact can be set up in X0 to 1FFF for each of RUN and PAUSE (setting by parameters)					
Clock function		Year, month, date, hour, minute, second, and day of the week (automatic leap year detection) Accuracy: -2.96 to +3.74s (TYP. +1.42s)/d at 0°C Accuracy: -3.18 to +3.74s (TYP. +1.50s)/d at 25°C Accuracy: -13.20 to +2.12s (TYP. -3.54s)/d at 55°C					
Allowable momentary power failure time		Varies depending on the power supply module.					
5VDC internal current consumption		0.39A*13					
External dimensions	H	98mm					
	W	27.4mm					
	D	89.3mm*14					
Weight		0.20kg*14					

*13: The value is 0.49A for the Q04UDEHCPU, Q06UDEHCPU, Q10UDEHCPU, Q13UDEHCPU, Q20UDEHCPU, and Q26UDEHCPU.

*14: The following values are applied for the Q04UDEHCPU, Q06UDEHCPU, Q10UDEHCPU, Q13UDEHCPU, Q20UDEHCPU, and Q26UDEHCPU.
External dimensions (D): 115mm
Weight: 0.22kg

3.2 Device

The following table lists the devices used in QCPU and applicable ranges.

Table 3.1 Device list

Classification	Type	Device name	Default			Setting range by parameters
			Points	Range		
Internal user device	Bit device	Input	8192	X0 to X1FFF	Hexadecimal	Can be changed within 29K words*3
		Output	8192	Y0 to Y1FFF	Hexadecimal	
		Internal relay	8192	M0 to M8191	Decimal	
		Latch relay	8192	L0 to L8191	Decimal	
		Annunciator	2048	F0 to F2047	Decimal	
		Edge relay	2048	V0 to V2047	Decimal	
		Step relay	8192	S0 to S511/block	Decimal	
		Link relay	8192	B0 to B1FFF	Hexadecimal	
		Link special relay	2048	SB0 to SB7FF	Hexadecimal	
	Word device	Timer*1	2048	T0 to T2047	Decimal	
		Retentive timer*1	0	(ST0 to ST2047)	Decimal	
		Counter*1	1024	C0 to C1023	Decimal	
		Data register	12288	D0 to D12287	Decimal	
		Link register	8192	W0 to W1FFF	Hexadecimal	
		Link special register	2048	SW0 to SW7FF	Hexadecimal	
Internal system device	Bit device	Function input	16	FX0 to FXF	Hexadecimal	Cannot be changed.
		Function output	16	FY0 to FYF	Hexadecimal	
		Special relay	2048	SM0 to SM2047	Decimal	
	Bit device	Function register	5	FD0 to FD4	Decimal	
		Special register	2048	SD0 to SD2047	Decimal	
Link direct device	Bit device	Link input	8192	Jn\X0 to Jn\X1FFF	Hexadecimal	Cannot be changed.
		Link output	8192	n\Y0 to Jn\Y1FFF	Hexadecimal	
		Link relay	16384	Jn\B0 to Jn\B3FFF	Hexadecimal	
		Link special relay	512	Jn\SB0 to Jn\SB1FF	Hexadecimal	
	Word device	Link register	16384	Jn\W0 to Jn\W3FFF	Hexadecimal	
		Link special register	512	Jn\SW0 to Jn\SW1FF	Hexadecimal	
Module access device	Word device	Intelligent function module device	65536	Un\G0 to Un\G65535*2	Decimal	Cannot be changed.
		Multiple CPU shared device*4	14336	U3En\G10000 to U3En\G24335	Decimal	Can be changed.

*1: For the timer, retentive timer, and counter, a bit device is used for contacts and coils, and a word device is used for a current value.

*2: The number of points that can be actually used varies depending on the intelligent function module.
For the number of buffer memory points, refer to the manual for the intelligent function module used.

*3: The number of device points can be changed in the Device tab of the Q Parameter Setting dialog box (the points for input relay, output relay, and step relay cannot be changed). For the Universal model QCPU whose serial number (first five digits) is "10042" or later, the points for step relay can be changed to 0.

*4: Available only in multiple CPU systems.

Classification	Type	Device name	Default			Setting range by parameters
			Points	Range		
Index register/Standard devise register	Word device	Index register/Standard devise register	20	Z0 to Z19	Decimal	Cannot be changed.
File register[*7]	Word device	File register	0	-	-	0 to 4086K points[*6]
Extended data register[*7]	Word device	Extended data register	0	-	-	
Extended link register[*7]	Word device	Extended link register	0	-	-	
Nesting	-	Nesting	15	N0 to N14	Decimal	Cannot be changed.
Pointer	-	Pointer	4096[*8]	P0 to P4095[*9]	Decimal	Cannot be changed.
		Interrupt pointer	256[*10]	I0 to I255[*11]	Decimal	
Other	Bit device	SFC block device	256[*10]	BL0 to BL319[*12]	Decimal	Cannot be changed.
	-	Network No. specification device	255	J1 to J255	Decimal	
		I/O No. specification device	-	U0 to UFF, U3E0 to U3E3[*13]	Hexadecimal	
		Macro instruction argument device	-	VD0 to VD□	Hexadecimal	
Constant	-	Decimal constant	K-2147483648 to K2147483647			
		Hexadecimal constant	H0 to HFFFFFFFF			
		Real number constant	Single-precision floating point data: E ± 1.17549435 - 38 to E ± 3.40282347 + 38			
			Double-precision floating point data[*5]: E ± 2.2250738585072014 - 308 to E ± 1.7976931348623157 + 308			
		Character string constant	"ABC", "123"			

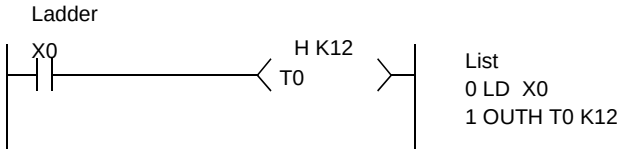
*5: Up to 15 digits can be entered in GX Works2.
*6: Indicates the total number of points for the file register, extended data register (D), and extended link register (W).
*7: Not available for the Q00UJCPU.
*8: The points are 512 points for the Q00UJCPU, Q00UCPU, and Q01UCPU.
*9: The range is from P0 to P511 for the Q00UJCPU, Q00UCPU, and Q01UCPU.
*10: The points are 128 points for the Q00UJCPU, Q00UCPU, and Q01UCPU.
*11: The range is from I0 to I127 for the Q00UJCPU, Q00UCPU, and Q01UCPU.
*12: The range is from BL0 to BL127 for the Q00UJCPU, Q00UCPU, and Q01UCPU.
*13: The range is from U0 to UF for the Q00UJCPU, from U0 to U3F or from U3E0 to U3E2 for the Q00UCPU and Q01UCPU, and from U0 to U7F or from U3E0 to U3E2 for the Q02UCPU.

Since device types are the same as those of the MELSEC-QnA series, the advantage of easy program creation is succeeded.
The following explains devices which are unique to the MELSEC-Q series.

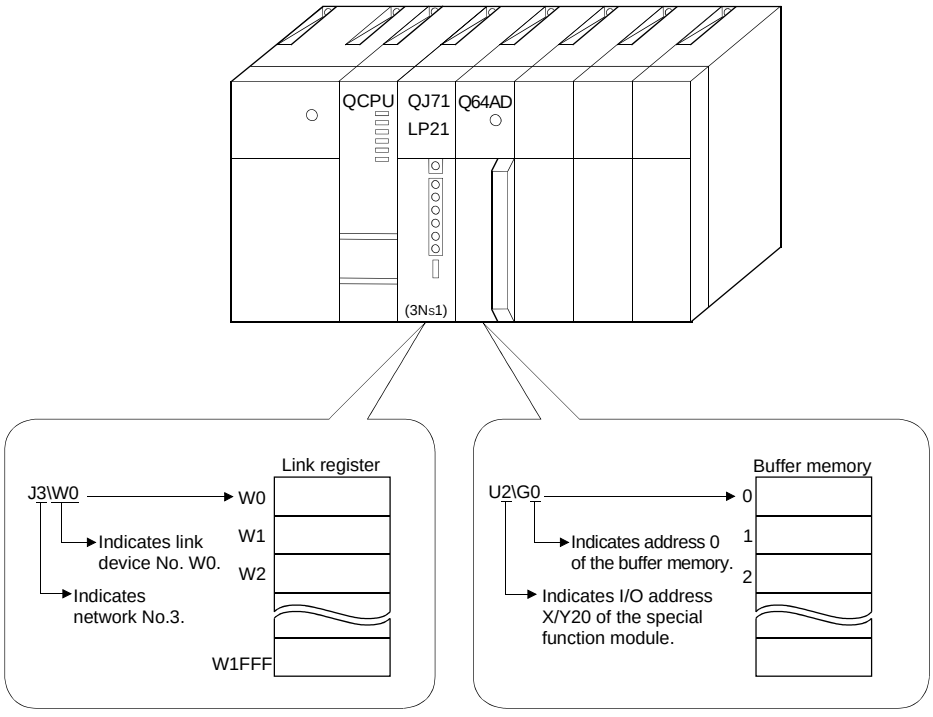
(1) Special relay/Special register (SM/SD)
The special relay and special register are used for writing or reading data between the QCPU and user program.
The special relay/special register (SM/SD) include the following:
SM1: Self-diagnostic error
SM52: Battery low

(2) Retentive timer (ST)
The device name is expressed as ST to be distinguished from the normal timer.
<Example> OUT ST100 K500

(3) Low-speed timer/High-speed timer (T)
The measurement unit can be changed. To change the setting, use the parameter.
In addition, the low-speed timer and the high-speed timer can be distinguished in a program.
<Example> Low-speed timer: OUT T200 K12
High-speed timer: OUTH T200 K12



(4) Intelligent function module device (U□\G□)
The intelligent function module device of the intelligent function module or special function module can be accessed directly from the QCPU as a data register.



(5) File register (R/ZR)

The file register is for extending the data register. For the file register, use the standard RAM or the memory card (SRAM, Flash card).

The following explains the maximum capacity of the file register.

When using the standard RAM

The following table shows the maximum points of the file register data that can be stored in the standard RAM.

However, if the standard RAM is used for an application other than file registers, available points are decreased.

CPU module	Points
Q00UCPU, Q01UCPU, Q02UCPU	64K
Q03UDCPU, Q03UDECPU	96K
Q04UDHCPU, Q04UDEHCPU	128K
Q06UDHCPU, Q06UDEHCPU	384K
Q10UDHCPU, Q10UDEHCPU, Q13UDHCPU, Q13UDEHCPU	512K
Q20UDHCPU, Q20UDEHCPU, Q26UDHCPU, Q26UDEHCPU	640K

When using an SRAM card

Up to 4086K points can be stored in one file.

Since one block consists of 32K words, up to 128 blocks can be stored.

Note that the number of points or blocks that can be added depends on the capacity of the programs and device comments stored in the memory card.

When using a Flash card

Up to 2039K points can be stored in one file.

Since one block consists of 32K words, up to 64 blocks can be stored.

Note that the number of points or blocks that can be added depends on the memory card capacity and the capacity of the programs and device comments stored in the memory card.

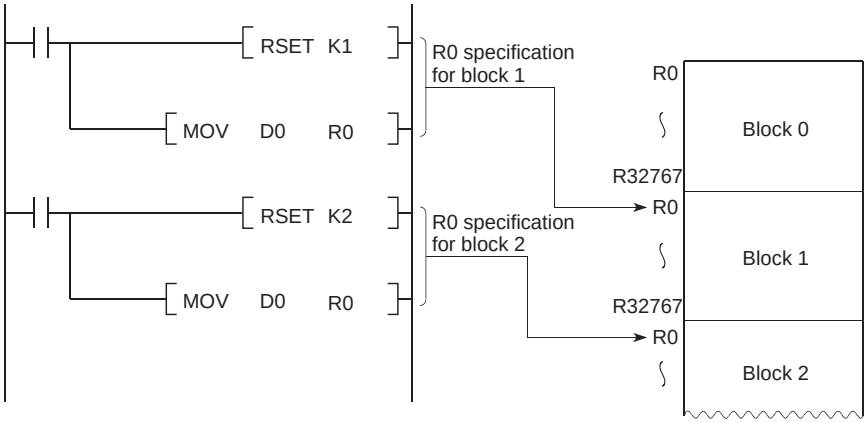
The large-capacity data can be accessed with a block unit of 32K words or the whole file register in series.

(a) Block switching method

The used file register points are divided and specified in units of 32K points (R0 to R32767).

When multiple blocks are used, the desired block is specified with the block number in the RSET instruction.

Each block has a specification range of R0 to R32767.

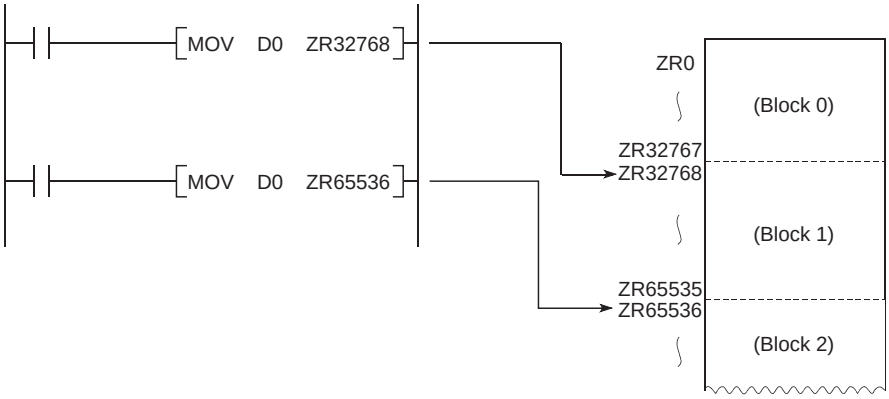


(b) Serial number access method

A file register whose capacity is exceeding 32K points can be specified with consecutive device numbers.

Multiple blocks of a file register can be used as a continuous file register.

This type of the device is expressed as "ZR".



(6) Function devices (FX, FY, FD)

Function devices are used in subroutine programs with argument passing.

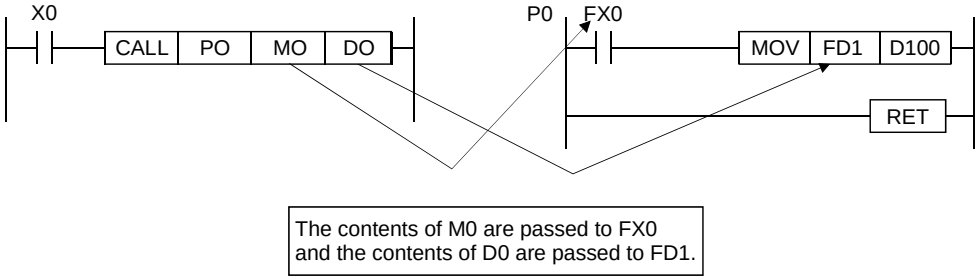
Data are read or written between such subroutine programs and calling programs, using function devices.

- Each device is used as below.

  FX → Bit condition input by a subroutine

  FY → Bit output condition

  FD → I/O data condition



(7) Step relay (S)

This relay is dedicated to SFC for indicating an active status of each step.

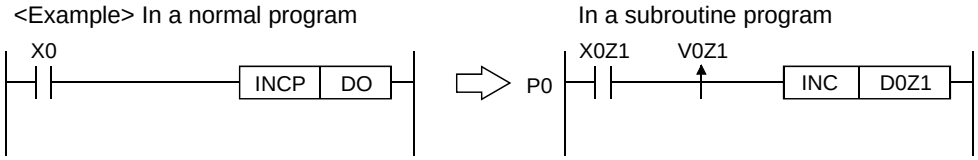
In sequence programs, a step relay can be specified with the block.

(Example) BL2\S1 ... Specifies the step relay 1 of the block No. 2.

(8) Edge relay (V)

The edge relay is for generating pulses in the repeatedly executed programs such as subroutine programs and interrupt programs.

Using this device makes the pulse generation instructions such as a subroutine and the interrupt program easier to be used.



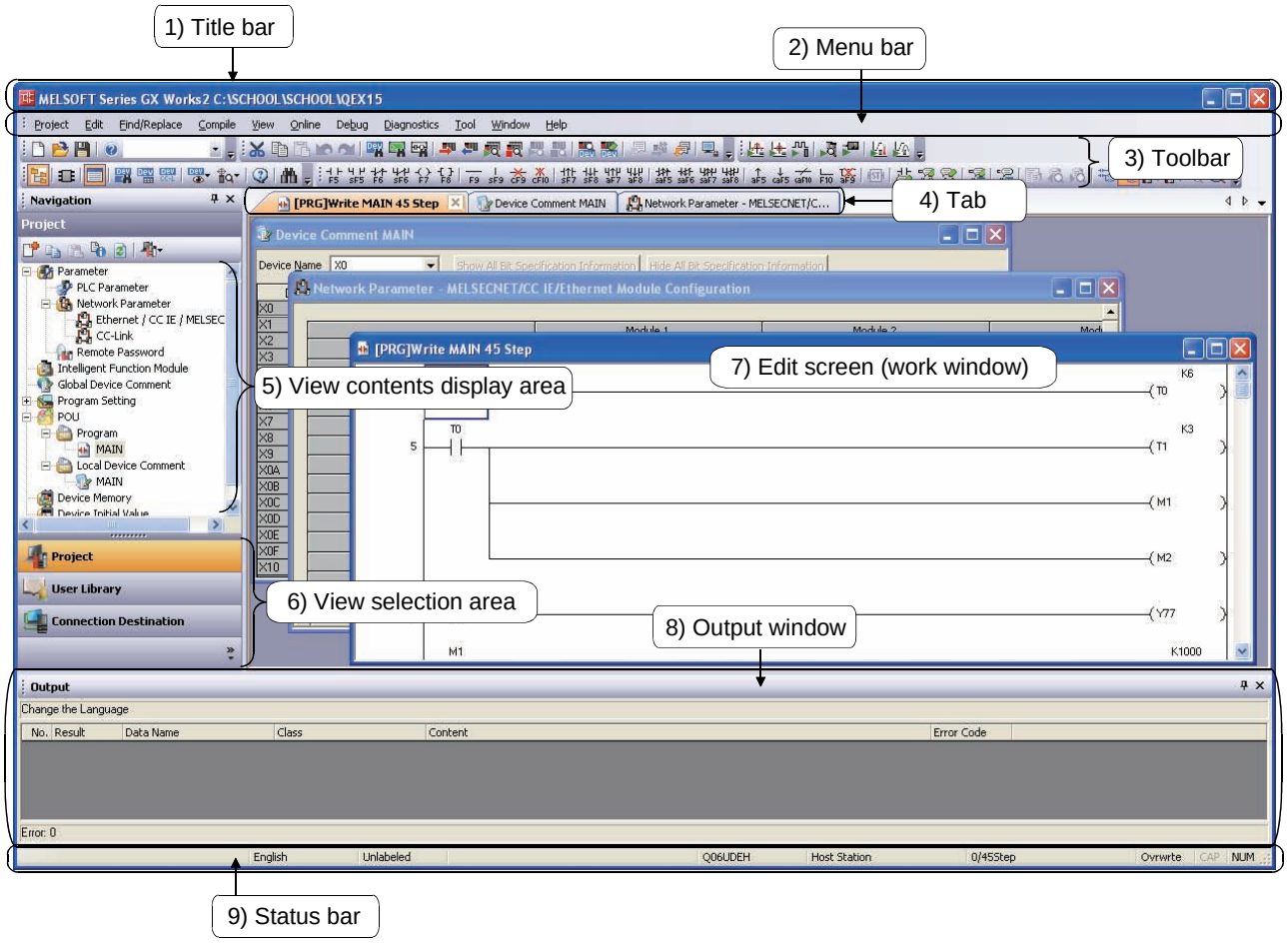
(9) Link direct device (J□\□)

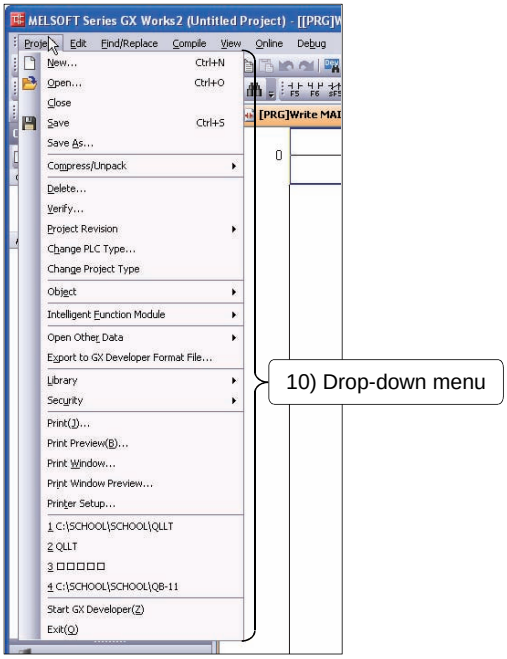
The link direct device is for the direct access to the link device in a CC-Link IE Controller Network module or MELSECNET/H module.

Using this device shortens the transmission time of the link device. Also, the link range which is not set by the network refresh parameter is accessible.

CHAPTER 4 BASIC KNOWLEDGE REQUIRED FOR OPERATING GX Works2

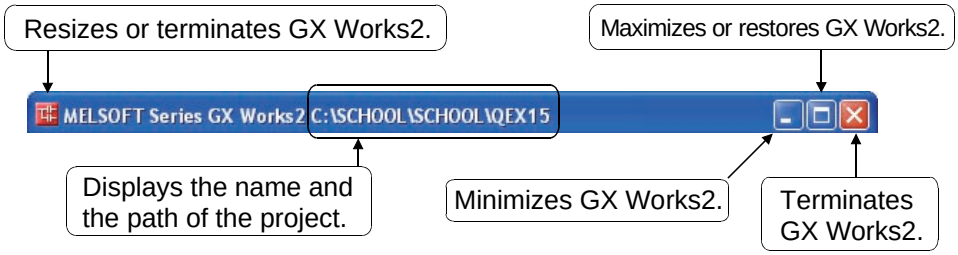
4.1 Screen Configuration in GX Works2





1) Title bar

Title bar displays the name of the active project.



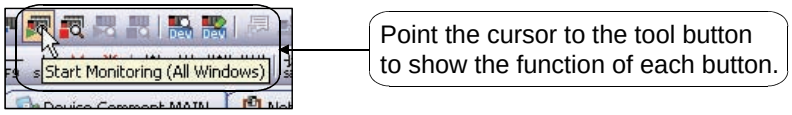
2) Menu bar

Menu bar is a most frequently used item to operate GX Works2.

Click the menu bar to select a variety of functions from the drop-down menu.

3) Toolbar

Toolbar equips buttons to easily access the commonly-used functions. This enables a quicker operation.



4) Tab

When multiple work windows are open, they are displayed in the tab browser format. Clicking a tab activates the corresponding work window.

5) View contents display area

View contents display area displays the contents of the currently selected view.

6) View selection area

View selection area allows selection of the view to be displayed.

7) Edit screen (work window)

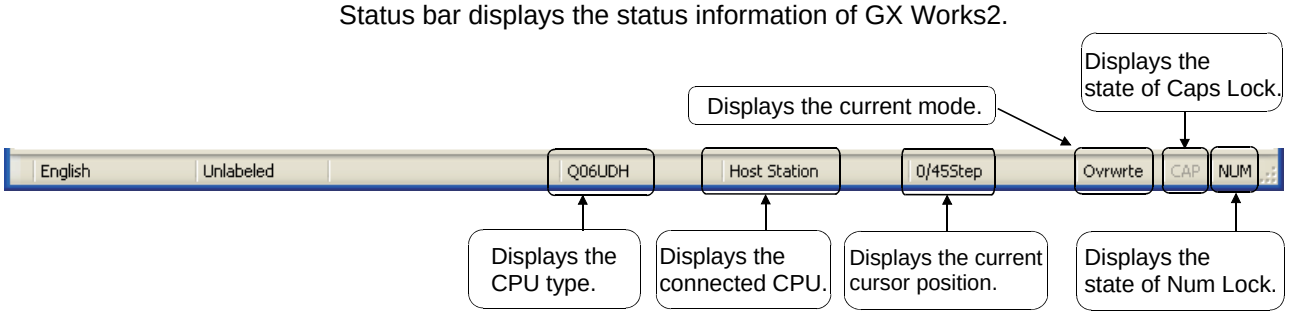
Edit screen displays various screens such as ladder program creation screen and comment creation screen for editing ladder diagrams, comments, and parameters.

8) Output window

Output window displays compilation and check results (such as errors and warnings).

9) Status bar

Status bar displays the status information of GX Works2.

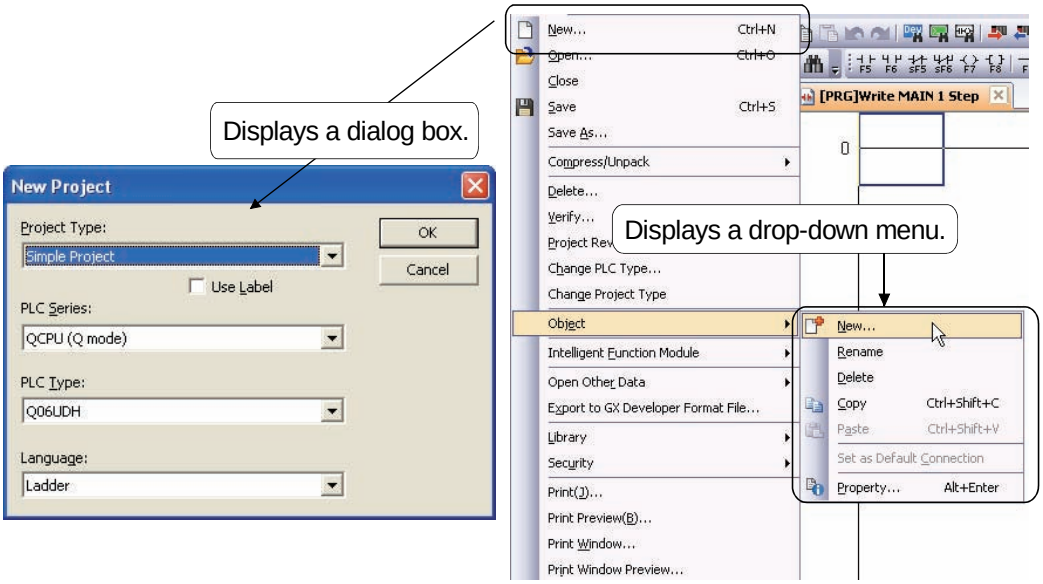


10) Drop-down menu

Drop-down menu displays the names of the available functions in GX Works2.

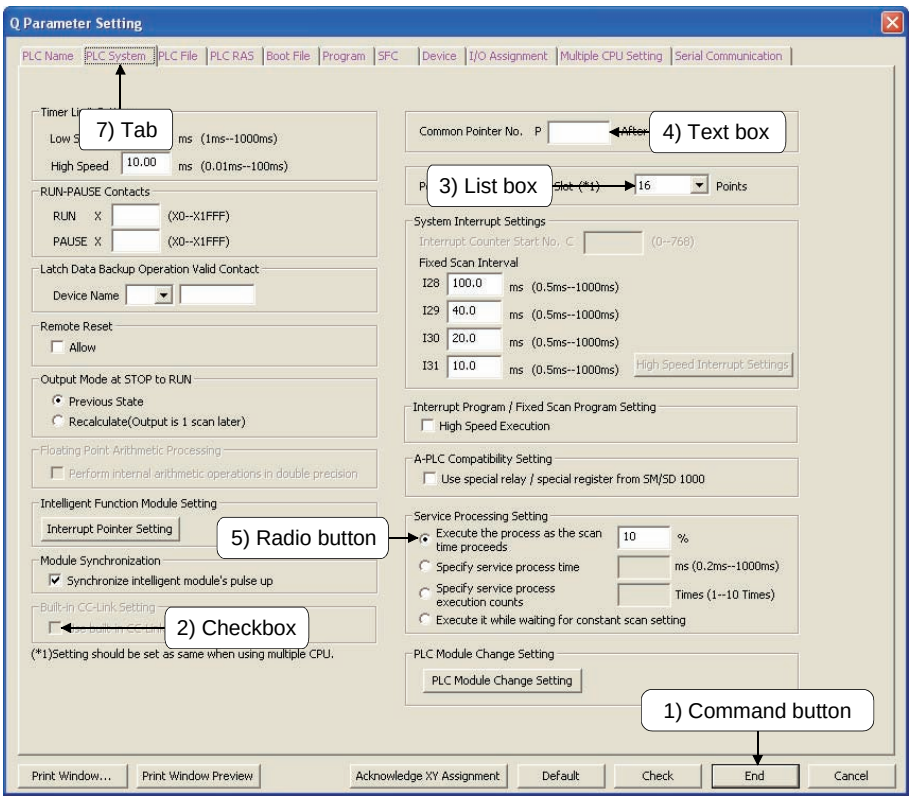
Selecting the function with "▶" on the right end displays the related drop-down menu.

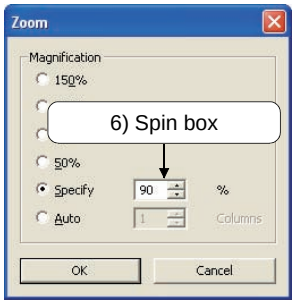
Clicking the function with "...." after the name displays the setting dialog box.



4.2 Basic Operations of Dialog Box

This section explains the screen configuration of the dialog box.





1) Command button
Command buttons include [OK] and [Cancel] Click each button to execute its operation.

2) Checkbox
Click ☐ to put ☑ in the box to execute the operation.

3) List box
After the selection list is displayed by clicking  , click an item to select.

4) Text box
Enter letters in a text box with the keyboard.
Only numbers can be entered depending on the text box type.

5) Radio button
Click ○ of an item to select.

6) Spin box
Values can be entered directly or changed by the  button.
To enter a value directly in a spin box, click  , then enter the value with the keyboard.
When changing a value by clicking the  button,  increases the value.
Clicking decreases the value.

7) Tab
Clicking  switches the screens in which setting items are displayed.

4.3 Ladder Program Creation Method

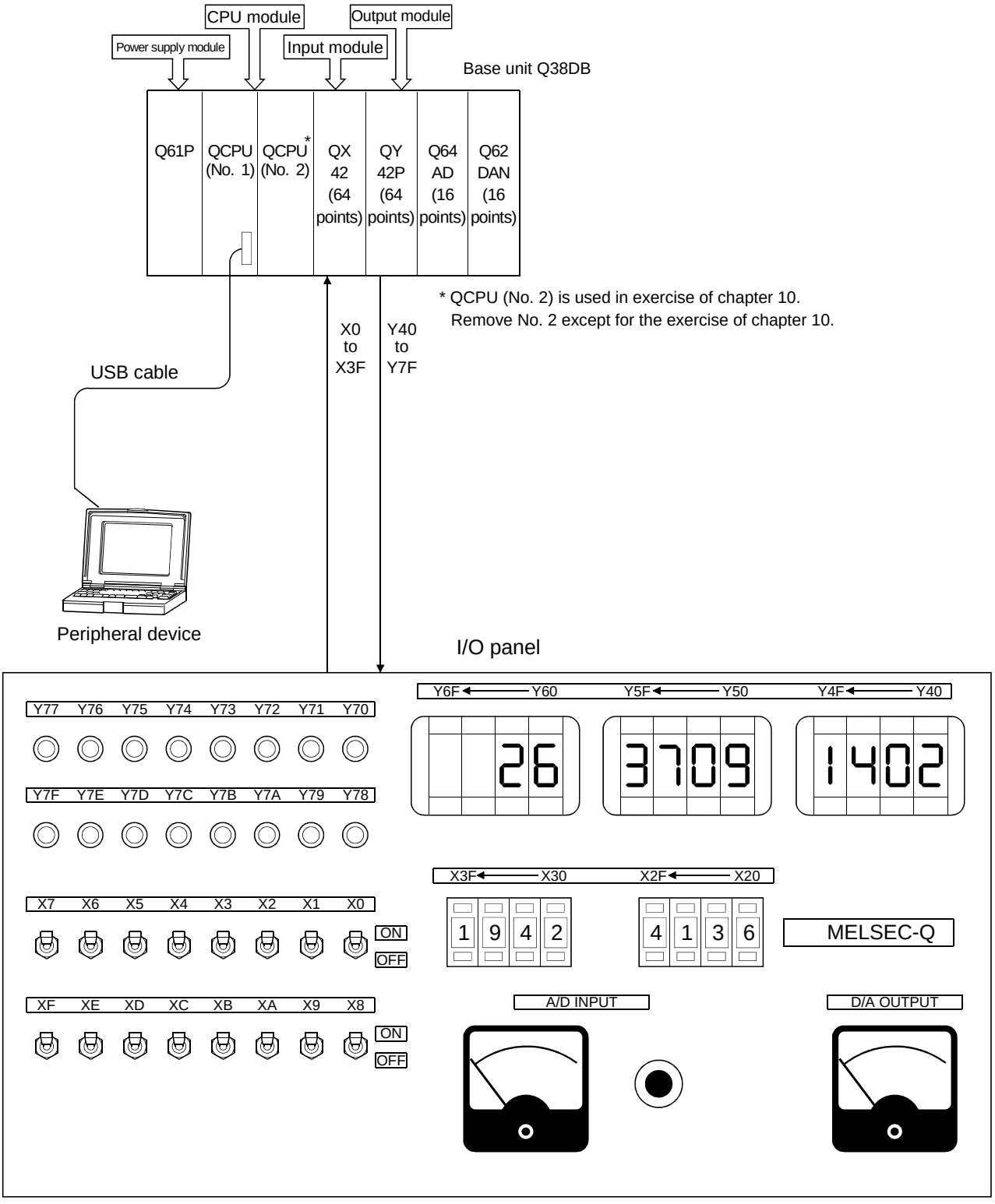
Refer to appendix 2 about the ladder program creation method in GX Works2.

MEMO

CHAPTER 5 GX Works2 BASIC OPERATIONS (PART 1: SINGLE PROGRAM)

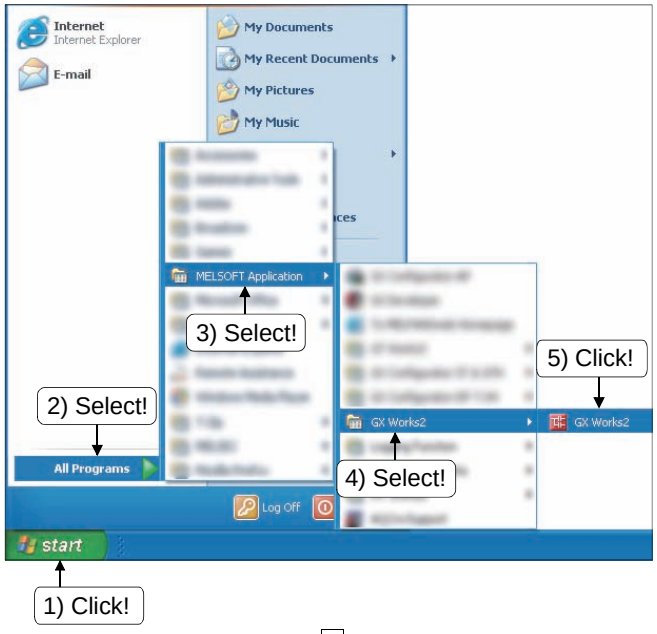
5.1 System Configuration of Demonstration Machine

The following figure shows the system configuration to be used in the exercise.



5.2 Basic Operation 1 (Operation Before Creating Ladder Programs)

5.2.1 Starting up GX Works2



1) Click the start button.

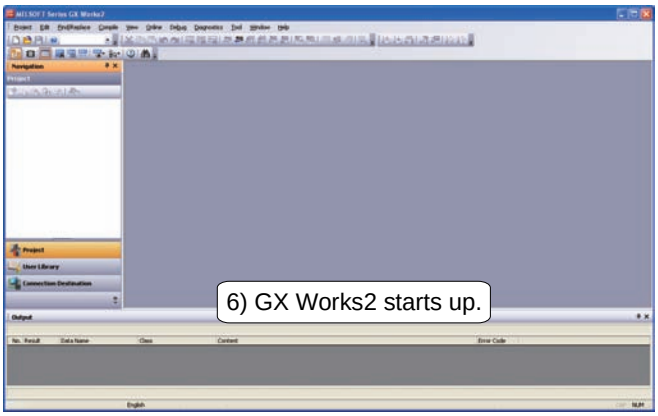
2) Select [All Programs].

3) Select [MELSOFT Application].

4) Select [GX Works2].

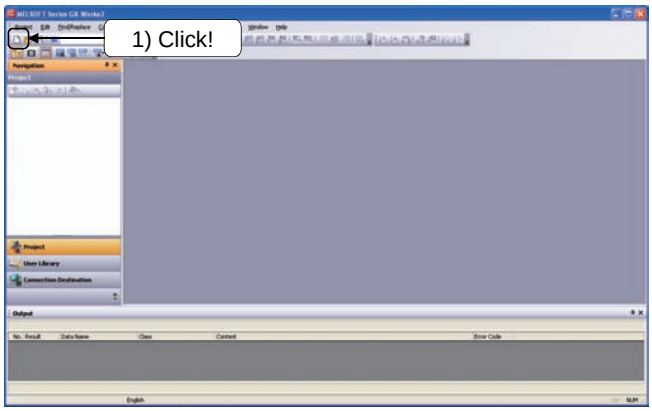
Put the mouse cursor over the items to select the menu.
(Clicking or double-clicking the mouse is not required.)

5) Click [GX Works2].

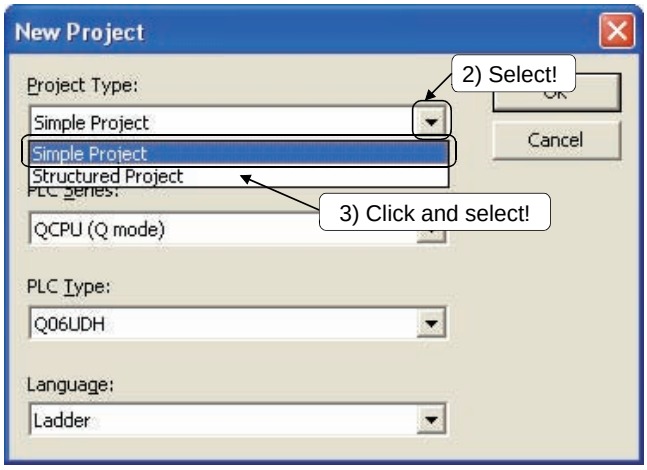


6) GX Works2 starts up.

5.2.2 Selecting programmable controller type and project type (creating a new project)



1) Click on the toolbar or select [Project] → [New Project] (Ctrl +N).

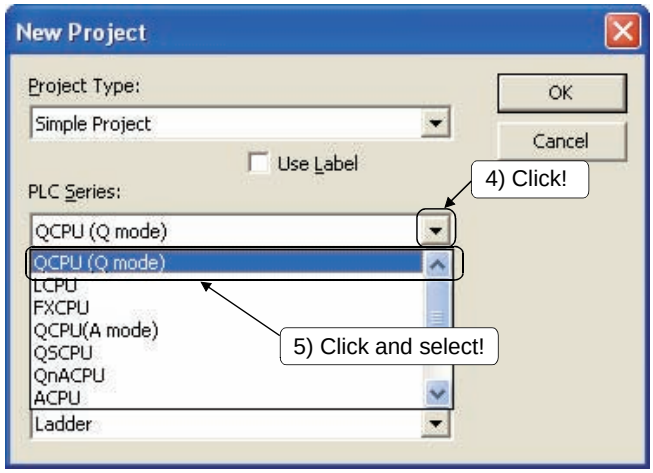


2) Click the "Project Type" list button.

3) The "Project Type" list is displayed. Select "Simple Project".

Simple project:
The Simple project creates sequence programs using instructions for Mitsubishi programmable controller CPU.

Structured project:
The structured project creates programs with a structured programming.



4) Click the "PLC Series" list button.

5) The "PLC Series" list is displayed. Select "QCPU (Q mode)".

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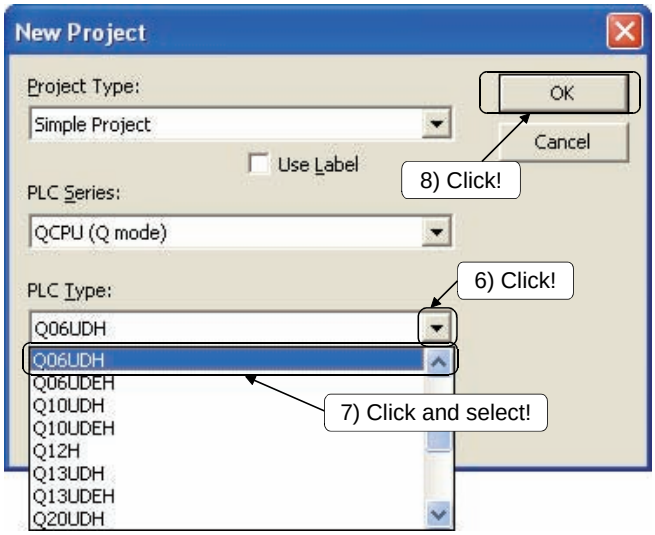
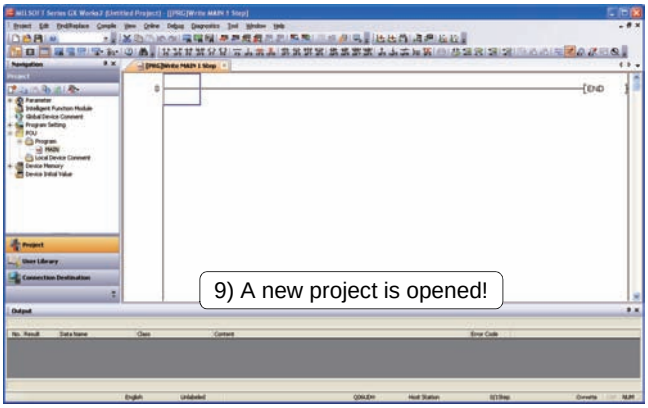


6) Click the "PLC Type" list button.

7) The "PLC Type" list is displayed. Select "Q06UDH".

8) Click the OK button.



9) A new project is opened.

5.2.3 Creating a program

Create a program.

(1) A program to be created

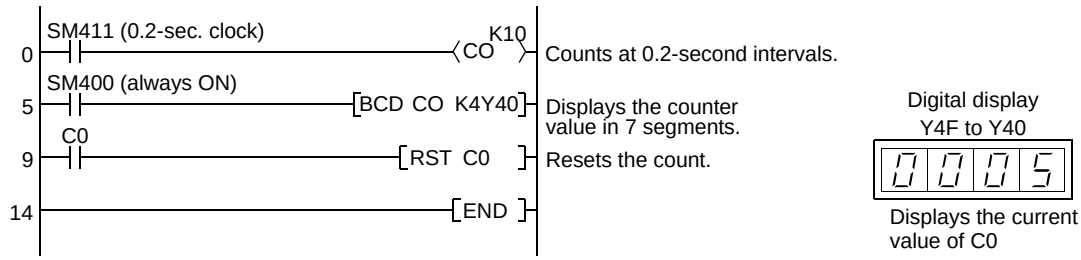
Create a program which displays a counter value counted by a special relay SM411 (0.2-sec. clock) of a programmable controller CPU on the LED of the demonstration machine.

(2) Devices to be used

- Y40 to Y4F ... For displaying the counter value

(3) Program

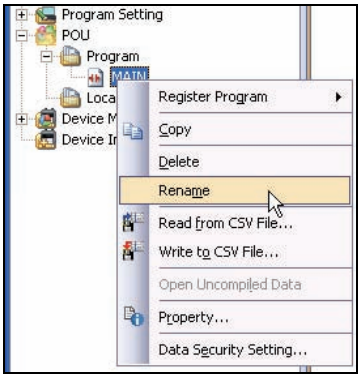
Project name	Applied 1
Program name	PR1



(4) Changing a program name

Change a program name.

1) Right-click "MAIN" in the project data list.



2) Click [Rename].

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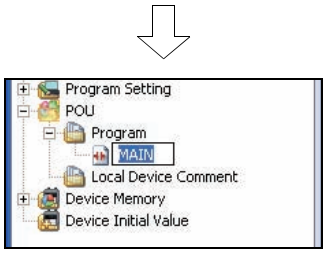


3) Enter "PR1" as the data name.

4) The program name is changed from "MAIN" to "PR1".

(5) Creating procedure for the program

Create a sequence program with ladder symbols.

This section explains the creation procedure using the tool buttons.

REMARK

- Right-clicking on the ladder creation screen displays a menu for various editing or searching operation.
- Useful operations

  Insert row: Shift + Insert Delete row: Shift + Delete

  Insert column: Ctrl + Insert Delete column: Ctrl + Delete

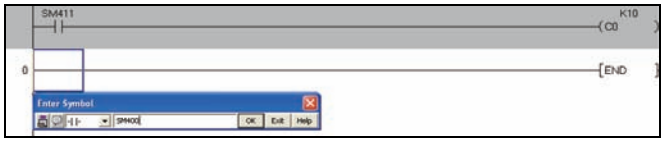
1) Click F5 on the toolbar to open the Enter Symbol window. Enter "SM411".
   If any other button is pressed by mistake, click the Exit button.

2) Click the OK button to confirm the entry.

3) The entered symbol (SM411) is displayed.

4) Click the F7 button on the toolbar, and enter "C0 K10".

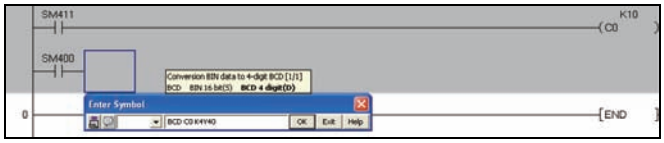
5) Click the OK button.



6) The entered symbol (C0 K10) is displayed.

7) Click the F5 button on the toolbar, and enter "SM400".

8) Click the OK button.



9) The entered symbol (SM400) is displayed.

10) Enter "BCD C0 K4Y40".

11) Click the OK button.

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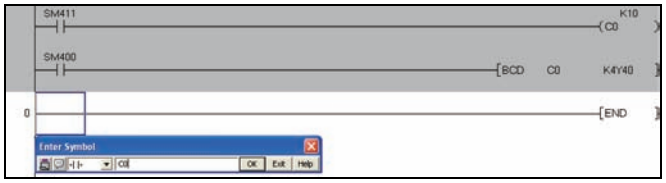
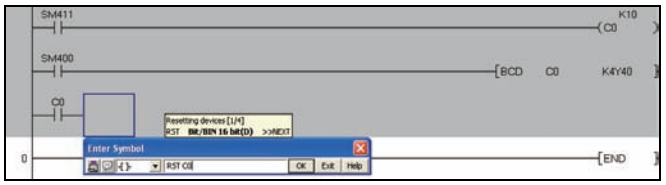


12) The entered symbol (⊣[BCD CO K4Y40]⊢) is displayed.

13) Click the F5 button on the toolbar, and enter "C0".

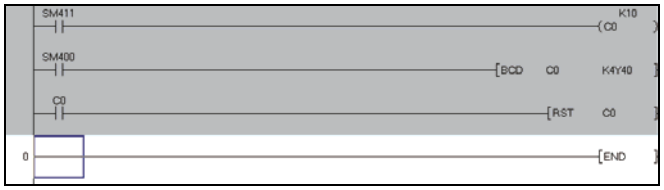
14) Click the OK button.



15) The entered symbol (⊣ C0 ⊢) is displayed.

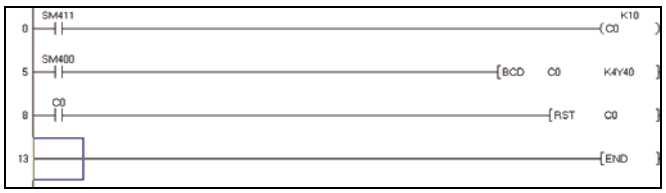
16) Click the F8 button on the toolbar, and enter "RST C0".

17) Click the OK button.



18) The procedure is finished.

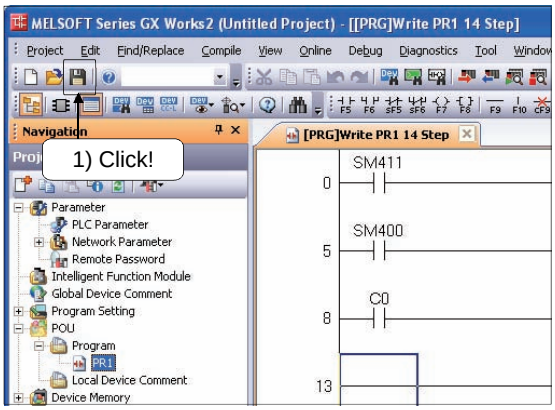
19) Click the button on the toolbar to convert the symbol.



20) The symbol is converted.

5.2.4 Saving a project

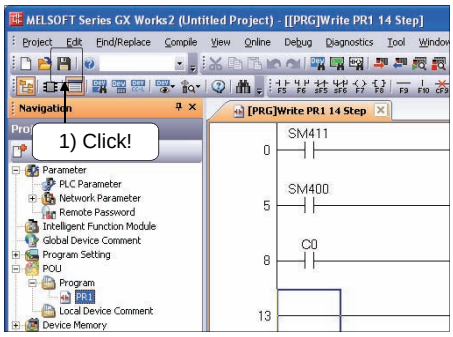
(1) Modified project



1) Click  on the toolbar or select [Project] → [Save] (Ctrl + S).

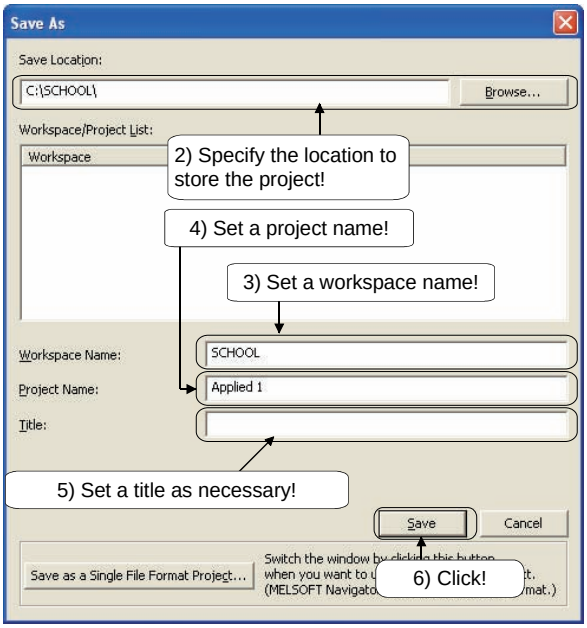
POINT
Save destination of the project data Before saving the created project, create a folder of "SCHOOL" directly in C drive.

(2) New project



1) Click  on the toolbar or select [Project] → [Save] (Ctrl + S).

(Only when a newly-created project is saved)



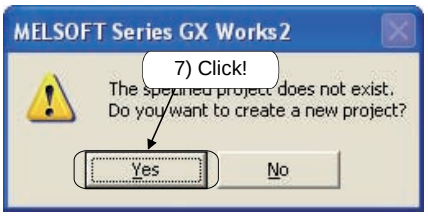
2) Specify the location to store the project.

3) Set a workspace name.
(Set the name to "SCHOOL".)

4) Set a project name.
(Set the name to "Applied 1".)

5) Set a title as necessary.

6) Click the Save button to accept the entry.

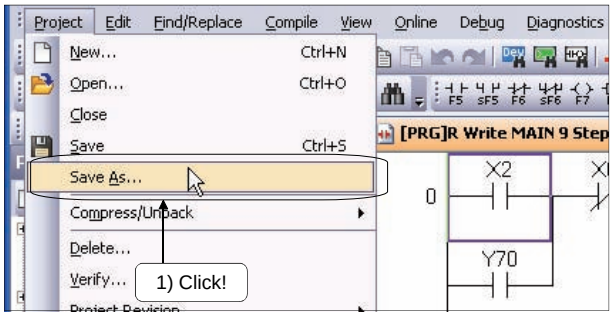


7) Click the Yes button.
The new project is saved.

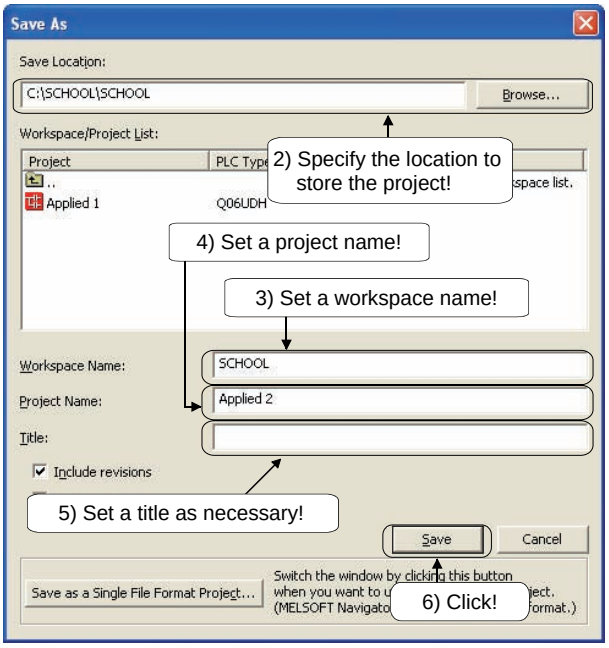
POINT

- Workspace
  Workspace enables GX Works2 to manage several projects with one name.
- When the save destination exists
  When the save destination (workspace and project) exists, the folder where the workspace is saved can be specified in "Workspace/Project List".
- Number of the characters for a workspace name, project name, and title
  Specify a workspace name, project name, and title within 128 characters each.
  However, the total number of the characters of the save destination path name + workspace name + project name must be within 150.

5.2.5 Saving a project with another name



1) Click [Project] → [Save as].



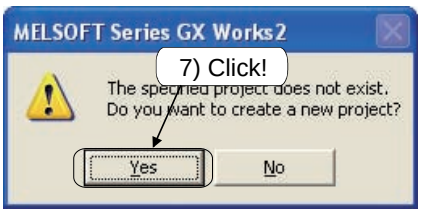
2) Specify the location to store the project.

3) Set a workspace name.
(Set the name to "SCHOOL".)

4) Set a project name.
(Set the name to "Applied 2".)

5) Set a title as necessary.

6) Click the Save button to accept the entry.



7) Click the Yes button.
The new project is saved.

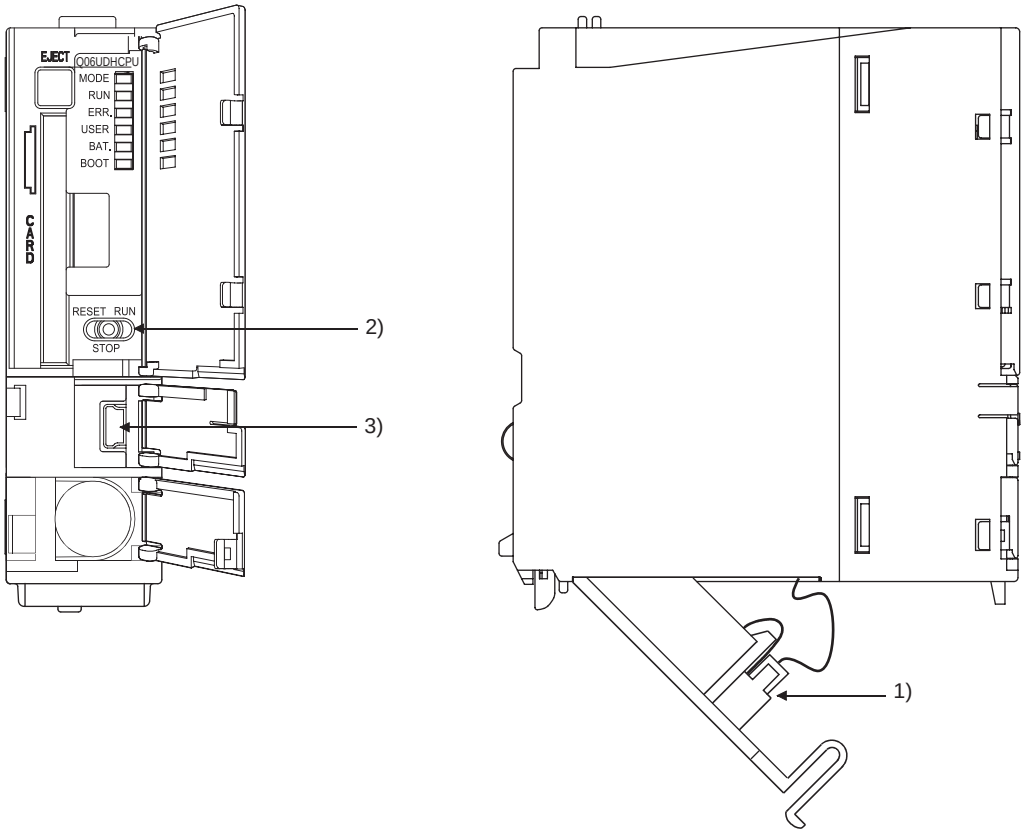
5.3 Basic Operation 2 (Preparation for CPU Operation)

Write the program created in section 5.2.3 to the CPU after the preparation of setting switches and internal clock. Operate the program after writing to monitor and test.

5.3.1 Preparations for starting up CPU

Setting switches and formatting the built-in memory are required before writing a program to the CPU.

Connect or set the connectors and the switches of (1) to (3) shown below.
(The figures below are example of Q06UDHCPU.)



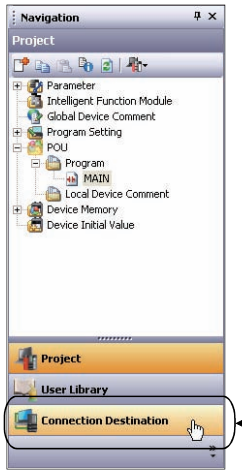
(1) Connecting a battery
Connect the battery since the lead wire of the battery connector is disconnected at the factory shipment.

(2) Setting the switches
Set the RUN/STOP/RESET switch to the STOP position.

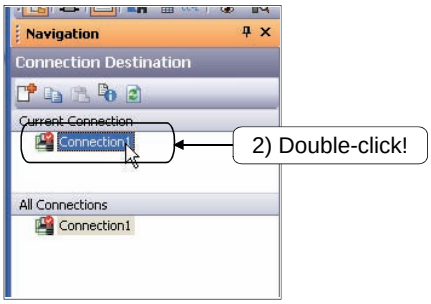
(3) Connecting the USB cable

(4) Setting the connection destination

This section explains how to set the connection destination for accessing the programmable controller CPU.

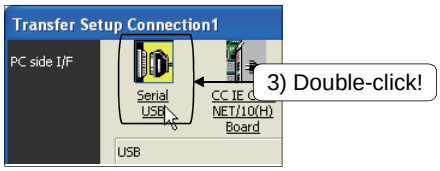


1) Click "Connection Destination" in the view selection area on the navigation window.

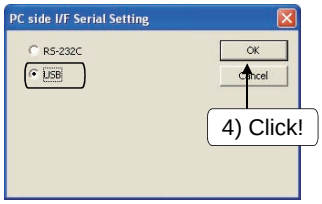


2) The Connection Destination view is displayed. Double-click "Connection1" in Current Connection.

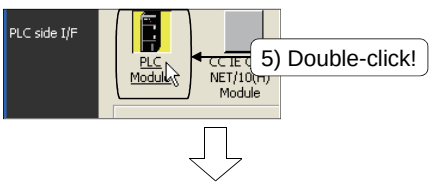
The Transfer Setup dialog box is displayed.



3) Double-click "Serial USB" of PC side I/F.



4) The PC side I/F Serial Setting dialog box is displayed. Check "USB" and click the OK button.



5) Double-click "PLC Module" of PLC side I/F.

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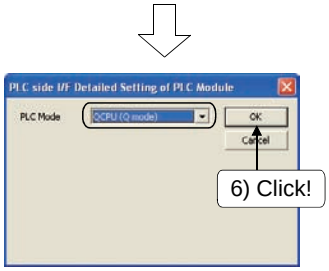
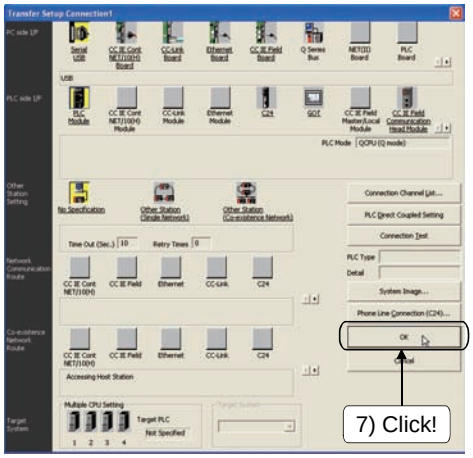


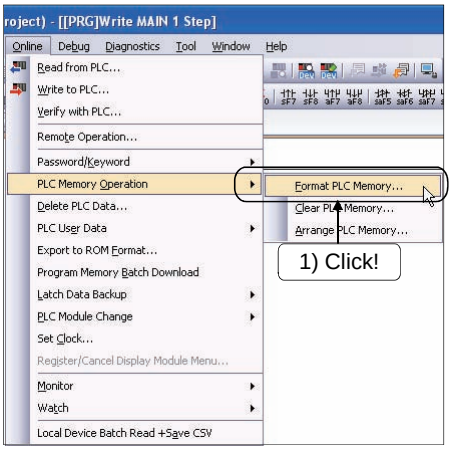
6) The PLC side I/F Detailed Setting of PLC Module dialog box is displayed. Select "QCPU (Q mode) " and click the OK button.



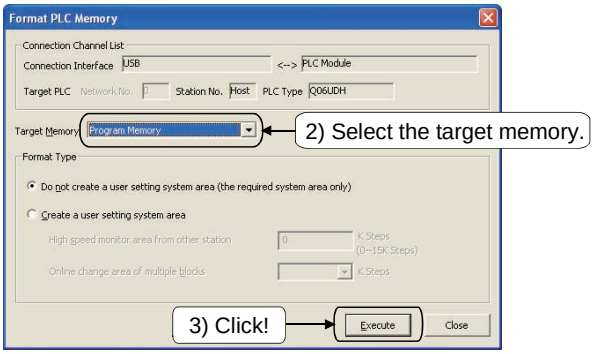
7) Click the OK button.

(5) Formatting the built-in memory of the CPU

This section explains how to format the program memory of the QCPU.

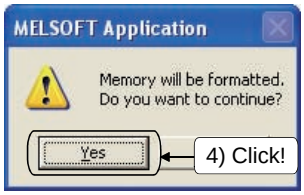


1) Click [Online] → [PLC Memory Operation] → [Format PLC Memory].

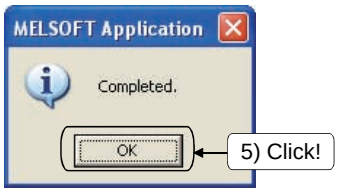


2) The Format PLC Memory dialog box is displayed. Select "Program Memory" from the Target Memory drop-down menu.

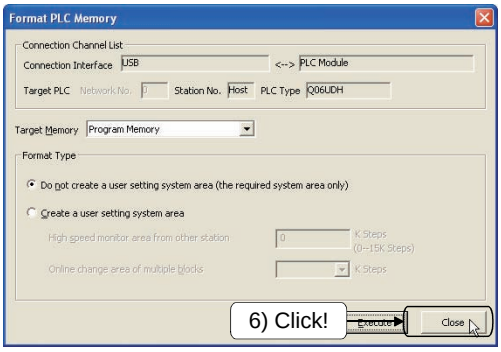
3) Click the Execute button.



4) Click the Yes button to start formatting.



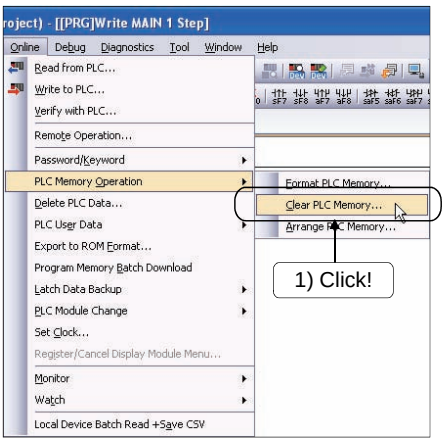
5) When format is completed, the dialog box on the left is displayed. Click the OK button.



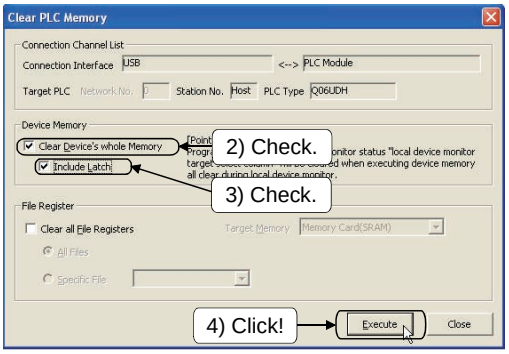
6) Click the Close button to close the dialog box.

(6) Clearing all the device memory from the CPU

This section explains how to clear the device memory of the QCPU.



1) Click [Online] → [PLC Memory Operation] → [Clear PLC Memory].

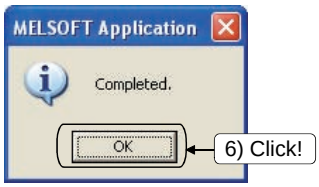


2) The Clear PLC Memory dialog box is displayed. Check that "Clear Device's whole Memory" is checked.

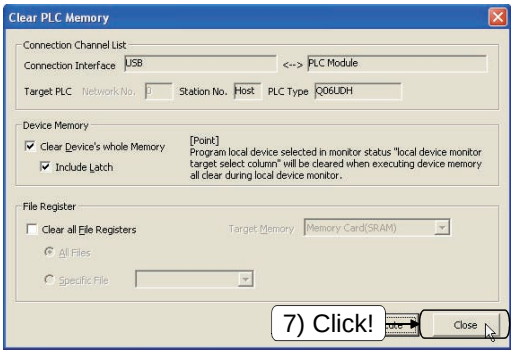
3) Check "Include Latch".

4) Click the Execute button.

5) Click the Yes button to clear the latch device.



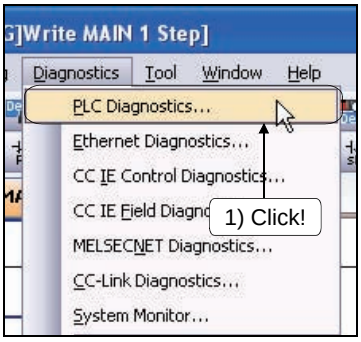
6) When the clearing the latch device is completed, the dialog box on the left is displayed. Click the OK button.



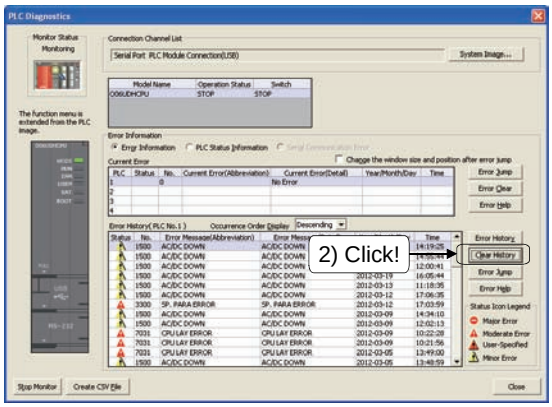
7) Click the Close button to close the dialog box.

(7) Clearing the error history in the CPU

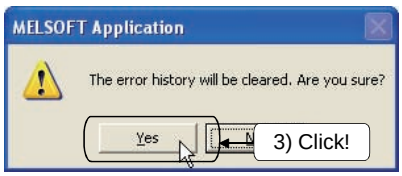
This section explains how to clear the error history data stored in the QCPU.



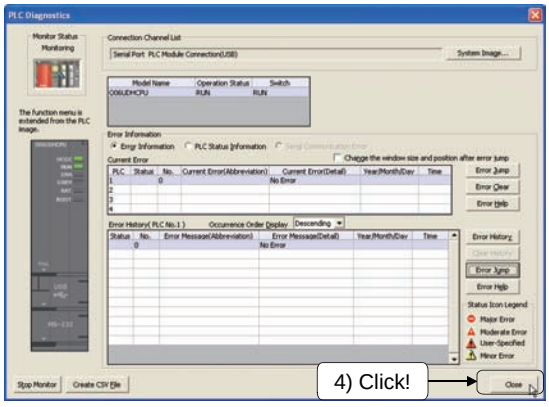
1) Click [Diagnostics] → [PLC Diagnostics].



2) The PLC Diagnostics dialog box is displayed. Click the Clear History button.



3) The confirmation dialog box is displayed. Click the Yes button.



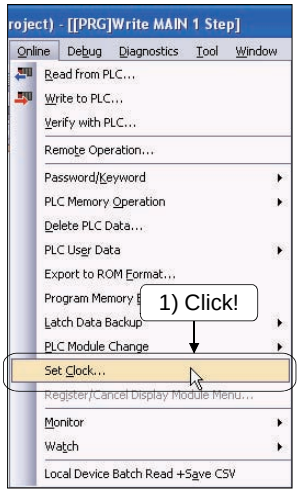
4) Click the Close button to close the dialog box.

(8) Setting the clock on the programmable controller CPU

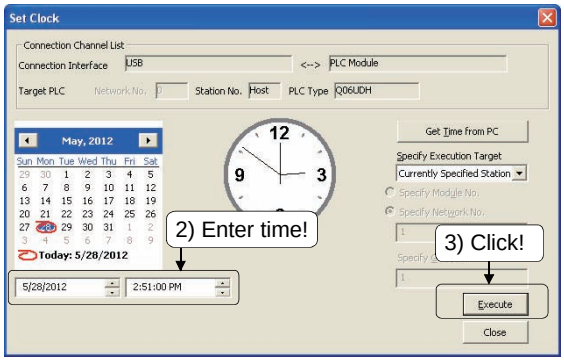
Setting a year, month, date, time, minute, second, and day of the week to the clock on the programmable controller CPU is available.

To use the clock function, use GX Works2 or a sequence program.

Set or read the clock data in GX Works2.



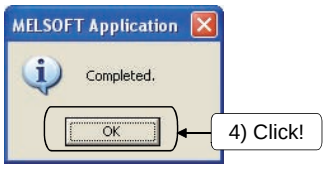
1) Click [Online] → [Set Clock] to display the Set Clock dialog box.



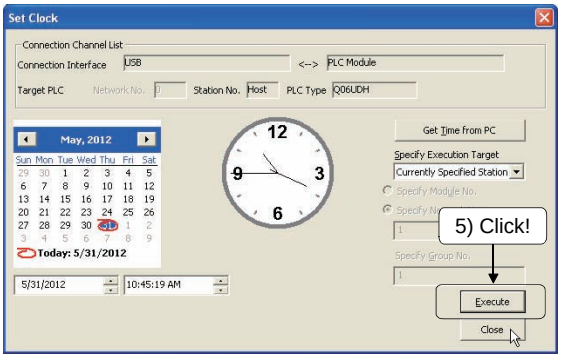
2) Enter a year, month, date, time, minute, second, and day of the week in the Set Clock dialog box.

3) Click the Execute button.

When the time in the personal computer is correct, clock can be set easily by clicking the Get Time from PC button.



4) The dialog box on the left is displayed. Click the OK button.

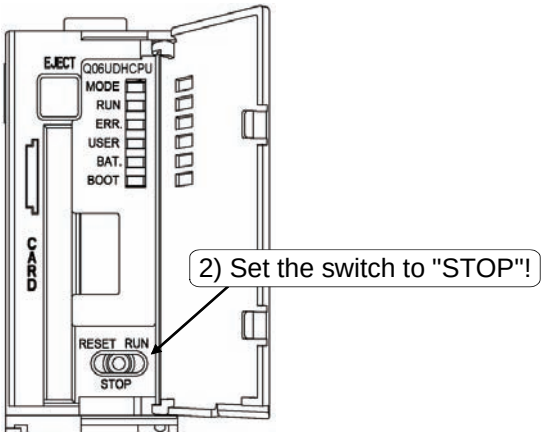


5) Click the Close button to close the dialog box.

5.4 Basic Operation 3 (Writing Data to Programmable Controller, Monitoring, Modifying Program)

5.4.1 Writing data to the CPU

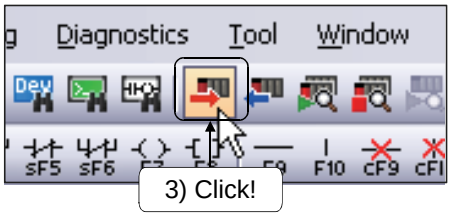
Write the sequence program created in section 5.2.3 to QCPU.

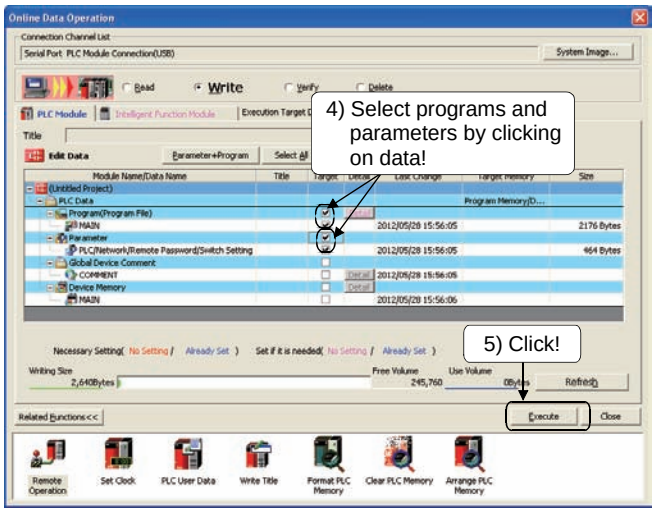


1) Suppose that the ladder program (sequence program) has been created in section 5.2.3 with GX Works2 to proceed to the next step.

2) Set the RUN/STOP/RESET switch on the CPU to STOP.

3) Click on the toolbar or click [Online] → [Write to PLC].





4) From the "PLC Module" tab, click to select the program and parameter to write to the CPU. Or click Parameter + Program to select the target program and parameter.

5) Click Execute to accept the selection.

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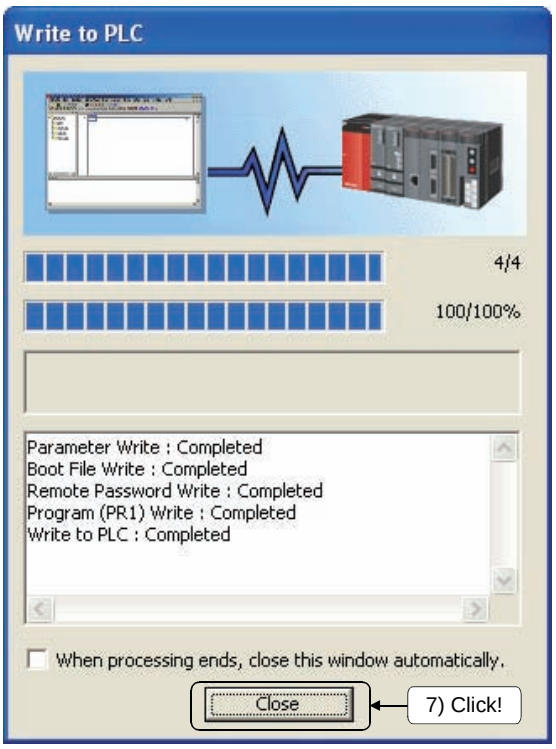
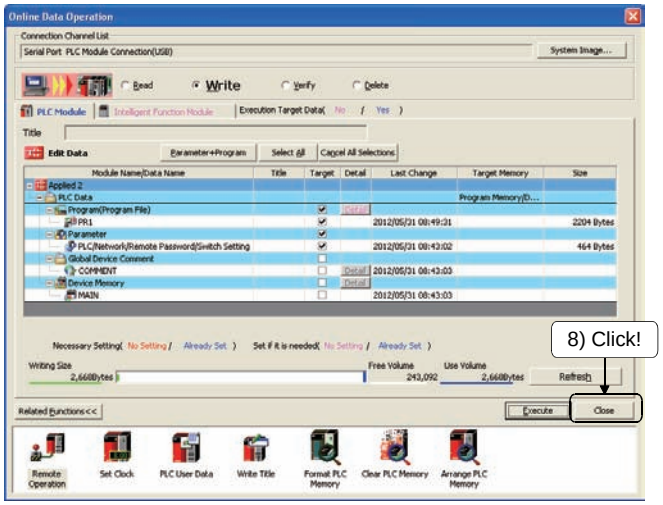


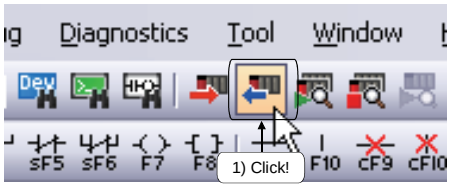
6) The progress dialog box is displayed.

7) The message "Completed" is displayed when the writing is completed. Click Close.

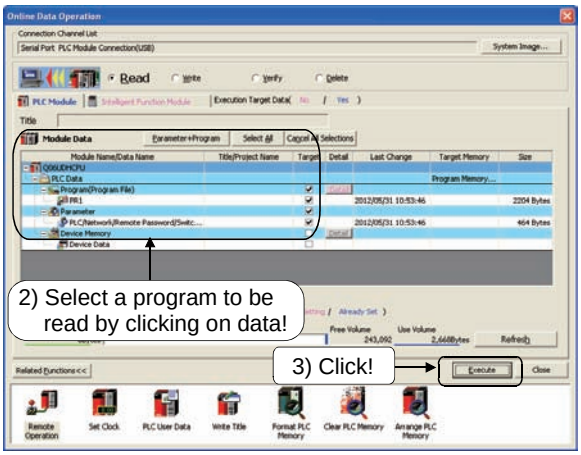


8) Click the Close button to close the dialog box.

5.4.2 Reading data from the CPU

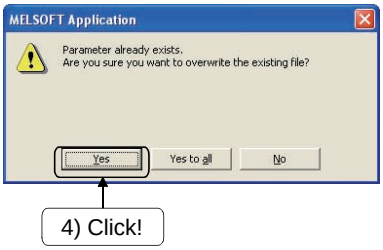


1) Click on the toolbar or click [Online] → [Read from PLC].

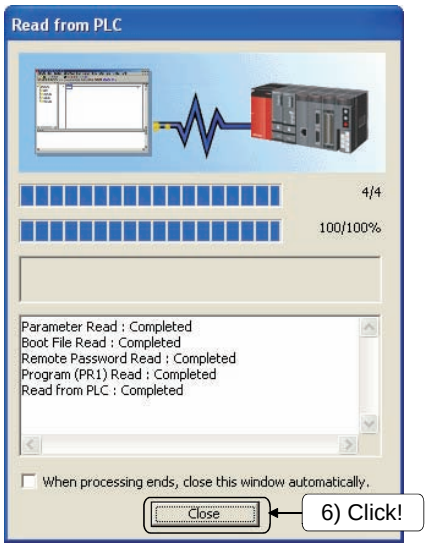


2) From the "PLC Module" tab, click to select the program and parameter to read from the CPU. Or click [Parameter + Program] to select the target program and parameter.

3) Click [Execute] to accept the selection.



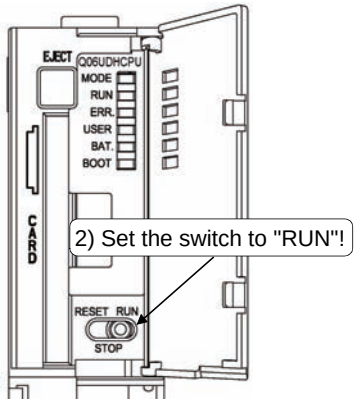
4) If a parameter or program exits, the confirmation dialog box for overwriting the data is displayed. Click [Yes].



5) The progress dialog box is displayed.

6) The message "Completed" is displayed when the reading is completed. Click [Close].

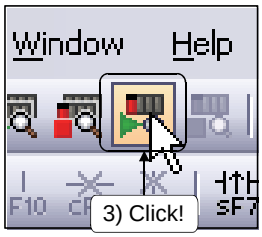
5.4.3 Monitoring



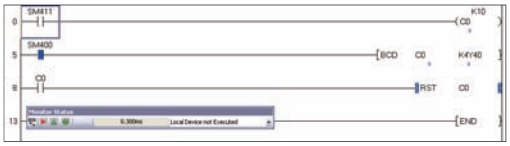
1) Suppose that the ladder program (sequence program) has been written into the programmable controller CPU to proceed to the next step.

2) Perform the reset operation with the RUN/STOP/RESET switch of the CPU and set the switch to RUN.

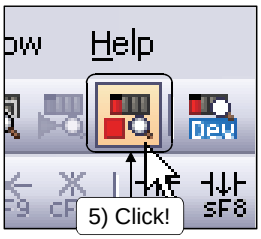
   * For the reset operation, refer to POINT in the next page.



3) Click  on the toolbar or click [Online] → [Monitor] →[Start Monitoring].



4) The Monitor Status dialog box is displayed and the ladder monitor is started.

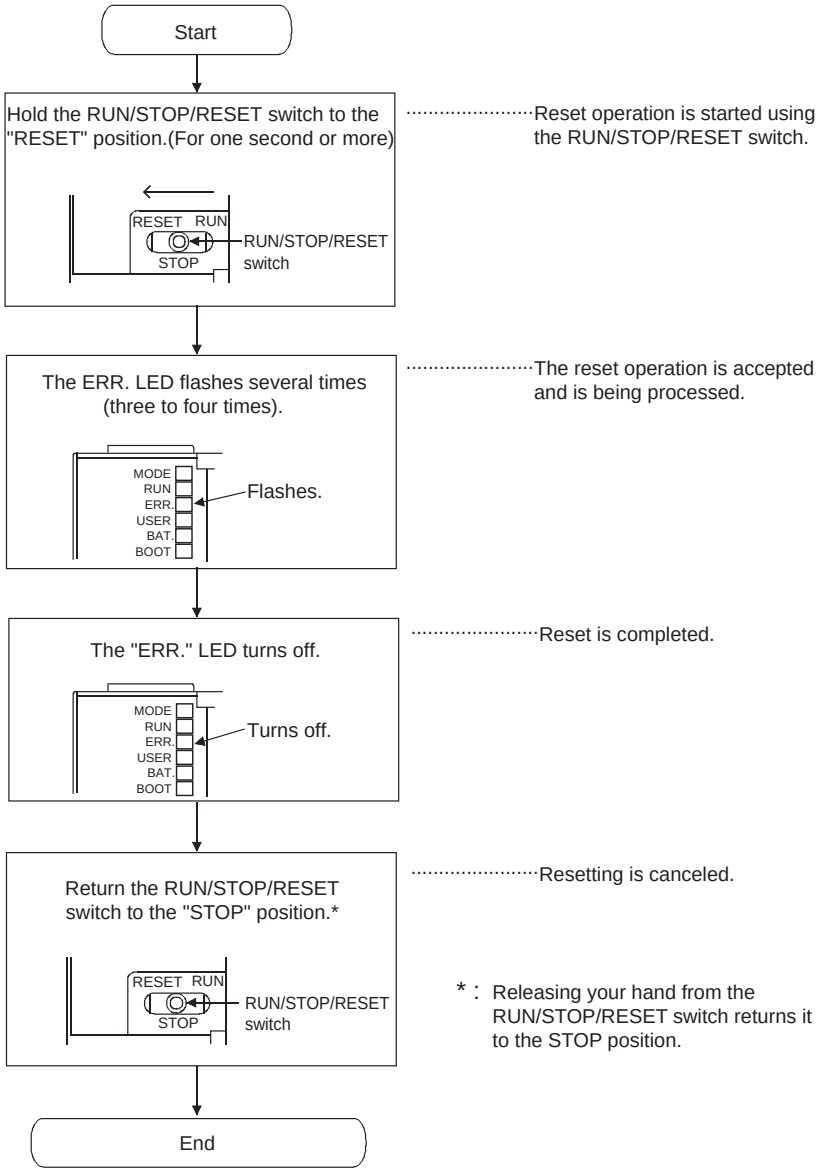


5) To stop the ladder monitor, click  on the toolbar or click [Online] → [Monitor] → [Stop Monitoring].

POINT

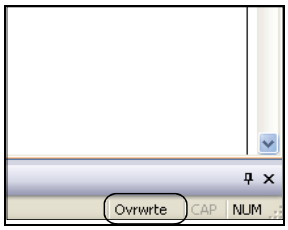
Reset operation for the Universal model QCPU

For the reset operation of the RUN/STOP/RESET switch, follow the procedures shown below.



5.4.4 Modifying a program

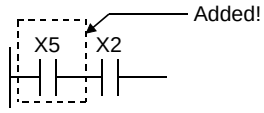
Modify the program written to the programmable controller CPU in section 5.4.1 while the programmable controller is running.
Modify the setting value K10 to K100 as an example.



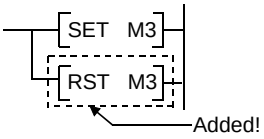
1) Confirm that "Ovrwrte" is shown at the lower-right portion of the screen.

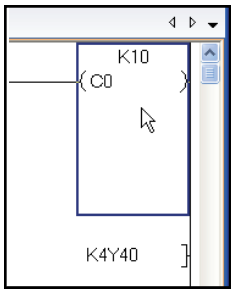
If "Insert" is shown on the screen, press the [Ins] key to change the display to "Ovrwrte".
If "Insert" is shown on the screen, contacts or coils are added to the diagram.

<When correcting X2 to X5>



<When correcting SET to RST>

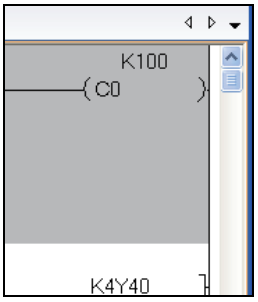




2) Move the cursor to the place shown on the left and double-click.

3) The Enter Symbol window is displayed. Change the value to "C0 K100".

4) Click the [OK] button.



5) The ladder program has been changed.

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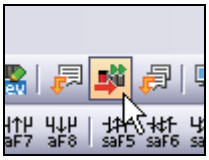
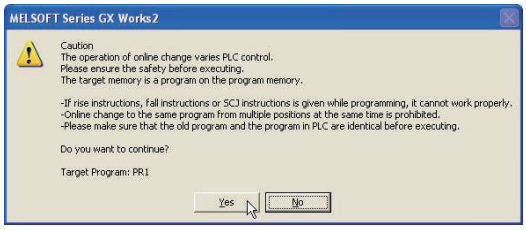
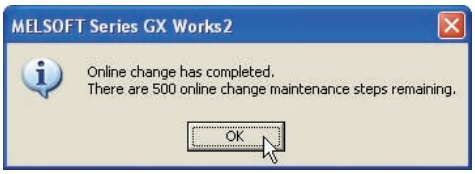


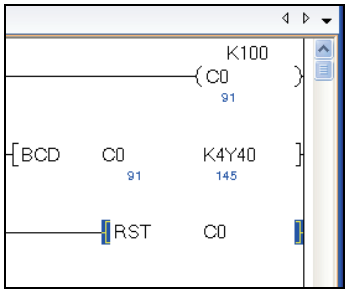
6) Click the button on the toolbar.



7) The dialog box on the left is displayed. Click the Yes button to execute the online program change.



8) Click the OK button.



9) C0 is counted from 0 to 99.
The BCD display of the demonstration machine is also counted from 0 to 99.

10) Monitor the program.

MEMO

CHAPTER 6 FILE-BASED MANAGEMENT AND PROGRAM EXECUTION MANAGEMENT

6.1 File-Based Management

In the ACPU, all processes are developed in one program. In the QCPU, a program is composed of several files, which enables the program development divided by functions and processes for several developers.

(1) Advantages of file-based management

(a) Programs can be stored to a memory in file basis. Therefore, even when a file is added or changed corresponding to a partial change of a program, other files are not affected.

(b) Names and time can be added to programs and data for management.

(c) Each file can be write-protected.

(2) File type and the data to be stored

The following table shows the types of data which can be stored in each memory.

Item	CPU module built-in memory			Memory card (RAM)	Memory card (ROM)		File name and extension	Remarks
	Program memory	Standard RAM	Standard ROM	SRAM card	Flash card	ATA card		
	Drive 0 *1	Drive 3 *1	Drive 4 *1	Drive 1 *1	Drive 2 *1			
Parameter	○	×	○	○	○	○	PARAM.QPA	1 data/drive
Intelligent function module parameter *2	○	×	○	○	○	○	IPARAM.QPA	1 data/drive
Program	◉	×	○*3	○*4	○*4	○*4	***.QPG	-
Device comment	○*5	×	○*6	○*6	○*6	○*6	***.QCD	-
Device initial value	○	×	○	○	○	○	***.QDI	-
Device data	×	×	○	×	×	×	***.QST	-
File register	×	○*7*8	×	○	○*9	×	***.QDR	-
Local device	×	○*7	×	○	×	×	***.QDL	1 data/CPU module
Sampling trace file	×	○*7	×	○	×	×	***.QTD	-
Error history data	×	×	×	×	×	×	***.QFD	-
Device data storage file	×	×	○	×	×	×	DEVSTORE.QST	-
Module error collection file	×	○	×	×	×	×	IERRLOG.QIE	-
Backup data file	×	×	×	○	○	○	MEMBKUP0.QBP	-
Programmable controller user data	×	×	○	×	×	○*10	***.***	-
User setting system area *11	○	×	×	×	×	×	-	-

◉: Required, ○: Storable, ×: Not storable

*1: A drive number is used to specify a memory to be written/read by the external device using a sequence program or MC protocol. Since the memory name is used to specify the target memory in GX Works2, the drive number needs not to be considered.

*2: Store the intelligent function module parameters in the same drive with the parameters. When they are stored in different drives, the intelligent function module parameters do not become valid.

*3: A program stored in the standard ROM cannot be executed. Store the program to the program memory before execution.

*4: To execute a program stored in the memory card, make the setting in the Boot File tab of the PLC parameter.

*5: The device comments cannot be read by instructions in a sequence program.

*6: Reading from a sequence program requires several scans.

*7: Only each one of file register, one local device, and sampling trace file can be stored in the standard RAM.

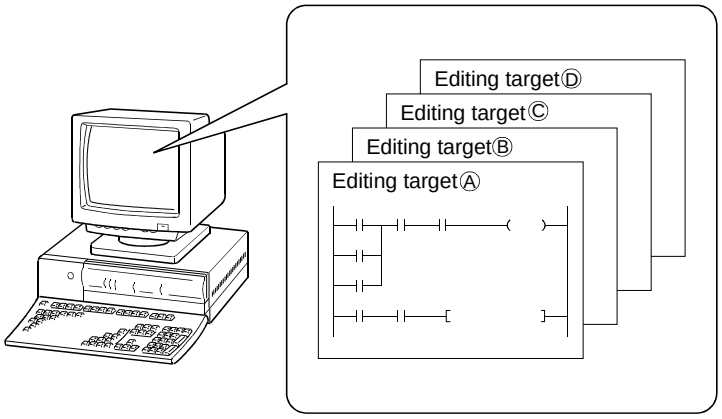
*8: For the number of storable file registers, refer to QnUCPU User's Manual Function Explanation, Program Fundamentals.

*9: A sequence program allows reading only. No data can be written from the sequence program.

*10: Data can be written or read with the following instructions.
- SP.FREAD (batch-reads data from the specified file in the memory card.)
- SP.FWRITE (batch-writes data to the specified file in the memory card.)

*11: Set an area used by the system.

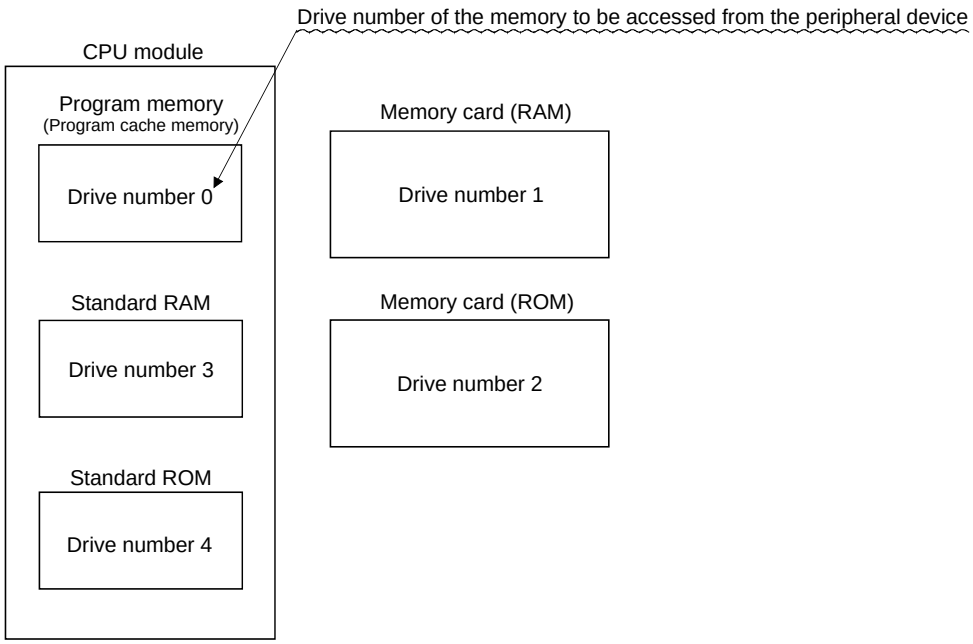
(3) Editing multiple programs at the same time
In GX Works2, multiple programs can be edited at the same time.



Multiple programs can be edited at the same time.

6.1.1 Built-in memory and IC memory card

Memories to store files include the following two types; built-in memory of the QCPU and memory card.
The built-in memories include the following three types; program memory, standard RAM, and standard ROM.
Memory cards include the following three types; SRAM card, Flash card, and ATA card.



The tables on the next page list the memory capacities and necessity of formatting of each memory in the QCPU.

		Q00UJCPU	Q00UCPU	Q01UCPU	Q02UCPU	Q03UD(E)CPU	Formatting
Program memory		10K steps (40K byte)		15K steps (60K byte)	20K steps (80K byte)	30K steps (120K byte)	*1
Standard ROM		256K byte	512K byte			1024K byte	Unnecessary
Standard RAM		-	128K byte			192K byte	*1
Memory card	SRAM card	-			Q2MEM-1MBS: 1M byte Q2MEM-2MBF: 2M byte Q3MEM-4MBS: 4M byte Q3MEM-8MBS: 8M byte		Necessary (use GX Works2.)
	Flash card	-			Q2MEM-2MBF: 2M byte Q2MEM-4MBF: 4M byte		Unnecessary
	ATA card	-			Q2MEM-8MBA: 8M byte Q2MEM-16MBA: 16M byte Q2MEM-32MBA: 32M byte		Necessary (use GX Works2.)

		Q04UD(E) HCPU	Q06UD(E) HCPU	Q010UD(E) HCPU	Q13UD(E) HCPU	Q20UD(E) HCPU	Q26UD(E) HCPU	Formatting
Program memory		40K steps (160K byte)	60K steps (240K byte)	100K steps (400K byte)	130K steps (520K byte)	200K steps (800K byte)	260K steps (1040K byte)	*1
Standard ROM		1024K byte		2048K byte		4096K byte		Unnecessary
Standard RAM		256K byte	768K byte	1024K byte		1280K byte		*1
Memory card	SRAM card	Q2MEM-1MBS: 1M byte Q2MEM-2MBS: 2M byte Q3MEM-4MBS: 4M byte Q3MEM-8MBS: 8M byte						Necessary (use GX Works2.)
	Flash card	Q2MEM-2MBF: 2M byte Q2MEM-4MBF: 4M byte						Unnecessary
	ATA card	Q2MEM-8MBA: 8M byte Q2MEM-16MBA: 16M byte Q2MEM-32MBA: 32M byte						Necessary (use GX Works2.)

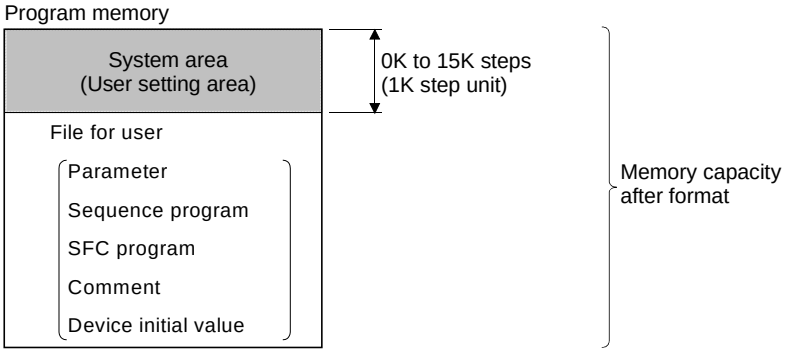
*1: When the memory contents become indefinite in the initial status or due to the end of battery life, the memory is automatically formatted after the programmable controller is powered off and then on or is reset. Make sure to format the memory in GX Works2 before using.

(1) Built-in memory

This section explains a memory map of the program memory built in a QCPU and capacities of the built-in memories (program memory, standard RAM, and standard ROM).

- Memory map

  The program memory stores files as follows.



  Use the user setting area of a system file for a communication with serial communication modules and for monitoring from other station on the network.

  Registering the user area enables a high-speed monitoring from other station on the network through the serial communication. (Refer to section 8.1.3 (2))

POINT
(1) When using a QCPU for the first time after purchase, format the program memory and standard RAM.
(2) A program is stored in units of file which is equivalent to a step consisting of 4 bytes.
(3) Up to 124 programs can be executed in a QCPU.

- Capacities and the number of storable files of the program memory, standard RAM, and standard ROM

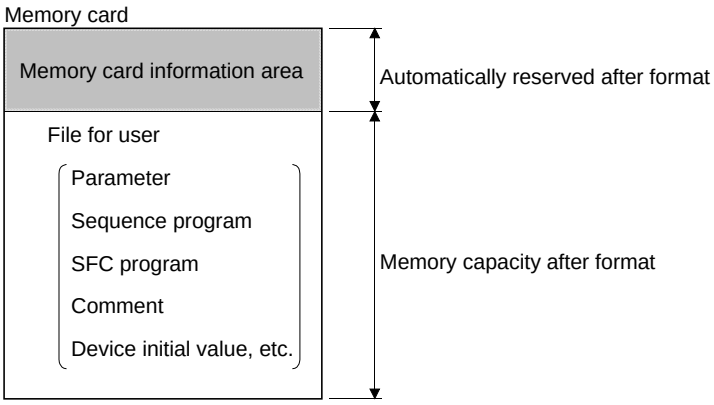
  Refer to section 3.1.

(2) Memory card

This section explains a memory map and capacity of memory cards for a QCPU.

- Memory map

  A memory card stores files as follows.



POINT

(1) When using a memory card (SRAM, ATA) for the first time after purchase, format it with a peripheral device.

(2) A program is stored to the IC memory card in units of file which is equivalent to 128 steps individually consisting of 512 bytes.

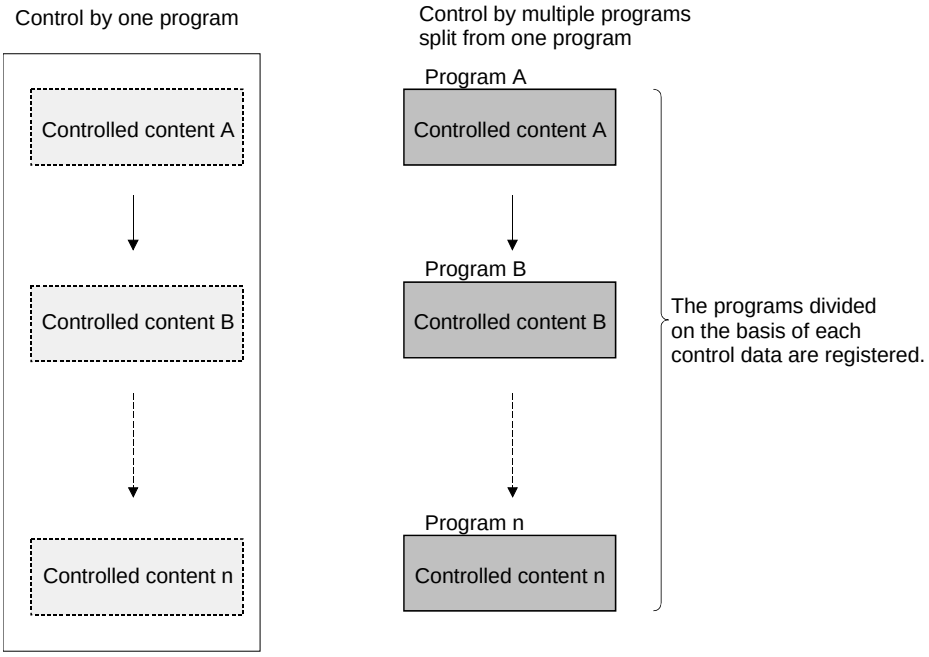
- Capacities and the number of storable files of memory cards

Memory card model name	Memory capacity	Number of storable files
Q2MEM-1MBS	1011.5K byte	255
Q2MEM-2MBS	2034K byte	287
Q3MEM-4MBS	4078K byte	319
Q3MEM-8MBS	8172K byte	319
Q2MEM-2MBF	2035K byte	288
Q2MEM-4MBF	4079K byte	288
Q2MEM-8MBA	7982K byte	512
Q2MEM-16MBA	15982K byte	512
Q2MEM-32MBA	31854K byte	512

6.2 Program Execution Management

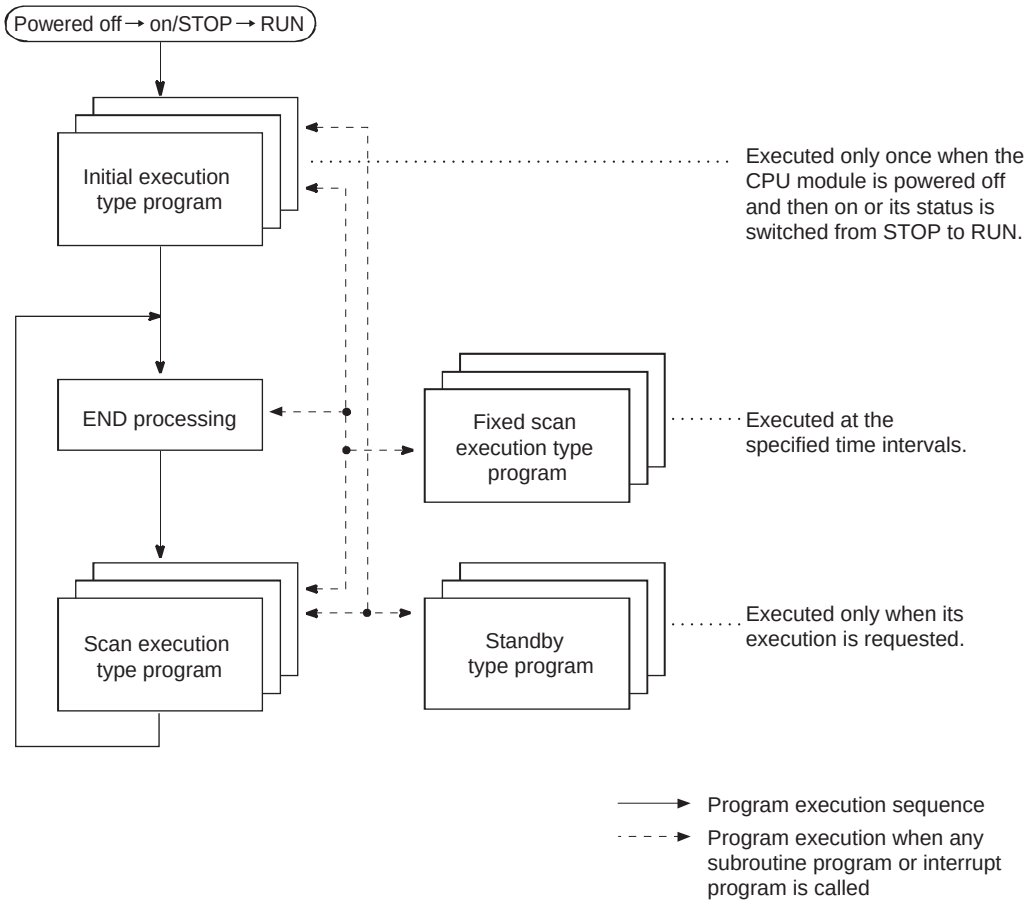
6.2.1 Description of program execution type

The program execution in the QCPU can be managed in two methods; by integrating controlled contents into one program (conventional method) and by dividing a program into multiple programs by controlled contents.
When dividing a program into multiple programs, set "execution type" in the program setting of the PLC parameter setting in GX Works2 to specify the execution mode for each divided program.



The QCPU executes each divided program according to each execution type; "Initial execution type", "Scan execution type", "Standby type", and "Fixed scan execution type" set by parameters.

The following figure shows the program sequence after the QCPU is powered on or its status is changed from STOP to RUN.



POINT
Use the initial execution type program, standby type program, and the fixed scan execution type program as necessary.

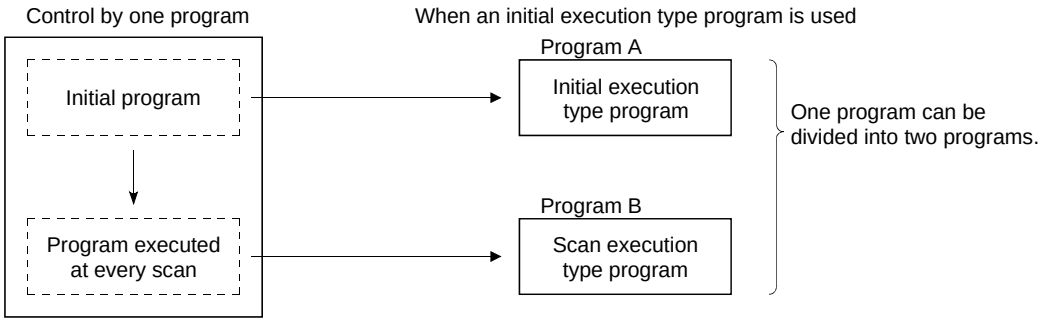
6.2.2 Initial execution type program

(1) Initial execution type program

(a) Initial execution type program is executed only once when the CPU is powered on or its operating status is changed from STOP to RUN.

(b) Set the execution type to "Initial" in the program setting of the PLC parameter.

(c) Initial execution type program is available for the program which is not necessary to be executed from the next scan after executed once.

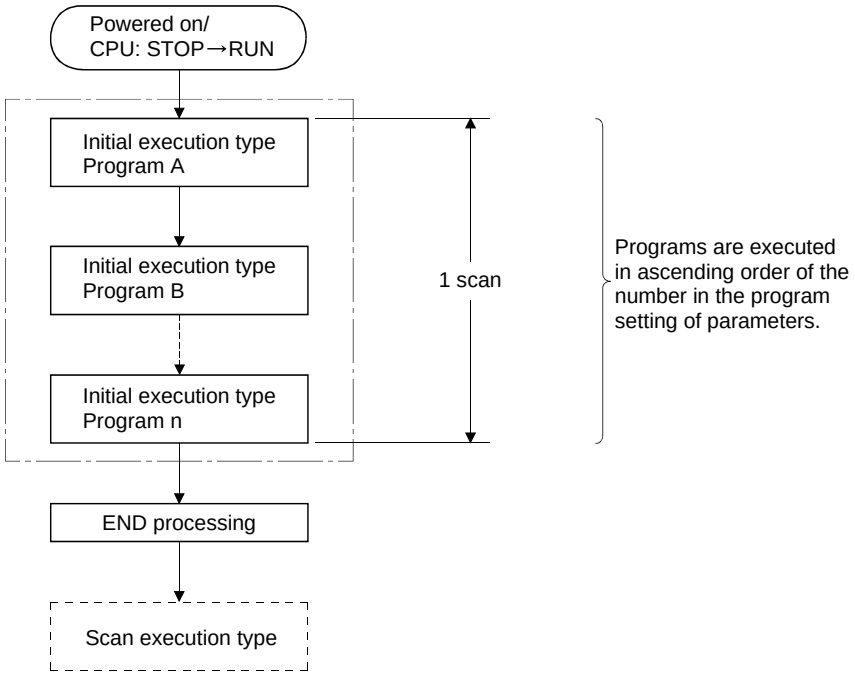


(2) Execution of multiple initial execution type programs

When two or more initial execution type programs exist, the programs are executed in ascending order of the numbers in the program setting of the PLC parameter.

(3) END Processing

After all initial execution type programs are executed, the END processing is executed. In the next scan or later, "scan execution type program" is executed.



6.2.3 Scan execution type program

(1) Scan execution type program

(a) Scan execution type program is executed once for every scan after the scan in which the initial execution type program is executed.

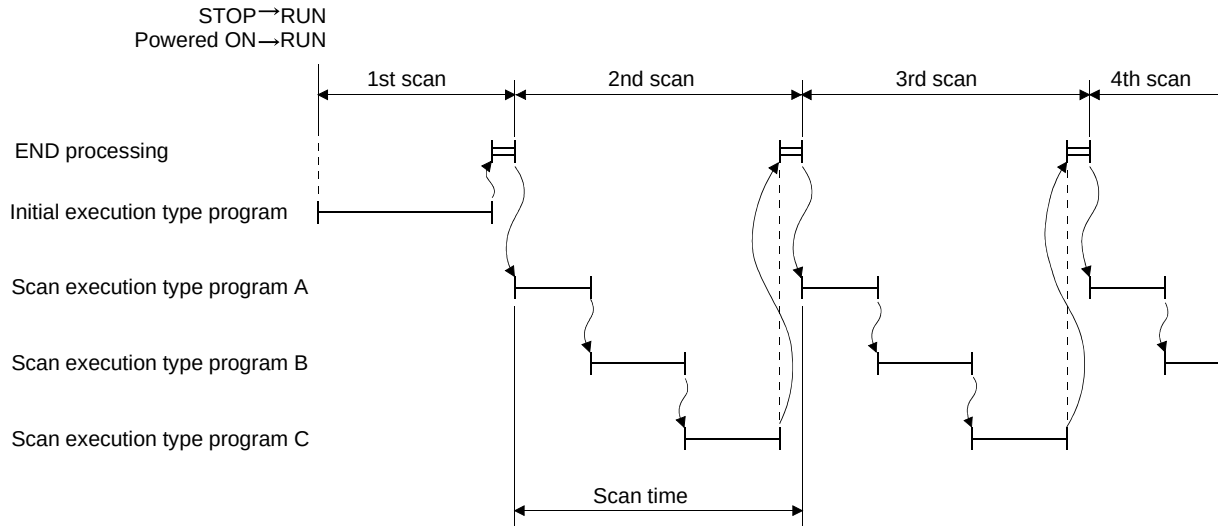
(b) Set the execution type to "Scan" in the program setting of the PLC parameter.

(2) Execution of multiple scan execution type programs

When two or more scan execution type programs exist, the programs are executed in ascending order of the numbers in the program setting of the PLC parameter.

(3) END Processing

After all scan execution type programs are executed, the END processing is executed and the first scan execution type program is executed again.



(4) When constant scanning is set

When the constant scanning is set, the scan execution type programs are executed according to the set constant scan time.

(Refer to section 8.3.1)

6.2.4 Standby type program

(1) Standby type program

(a) Standby type program is executed only when its execution is requested.

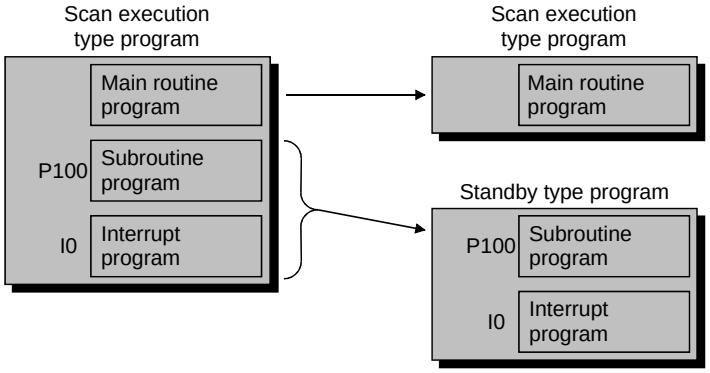
(b) Standby type program has the following applications.

1) Program library

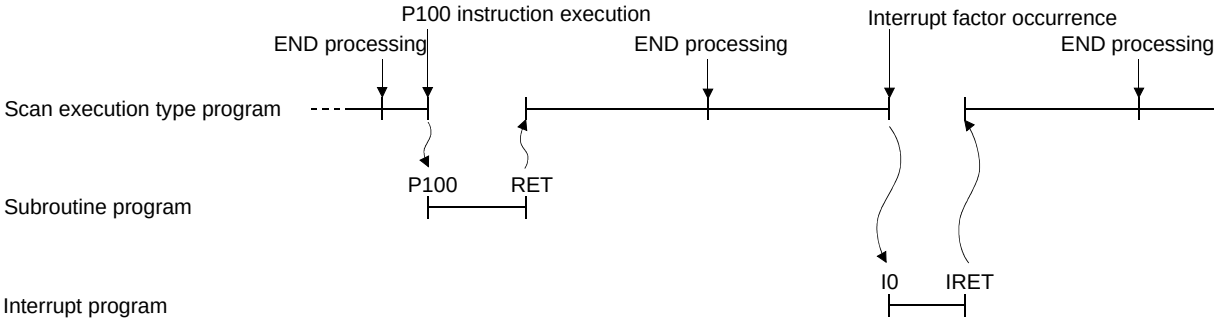
2) Program type change

(2) Program library

(a) Standby type program is used for managing subroutine programs and interrupt programs separately from a main routine program.
Multiple subroutine programs and interrupt programs can be created and managed in a single standby type program.



(b) After the execution of a standby type program, the CPU module re-executes the program that called a program in the standby type program.
The following figure shows the operation when the subroutine and interrupt programs in the standby type program are executed.



(3) Program type change

Standby type program is used to create and store programs available in all systems. Only required programs will be executed.
A program set as a standby type program in the PLC parameter can be changed to a scan execution type program and executed in the sequence program.
Use the PSCAN, PSTOP, and POFF instructions to change a program execution type in the QCPU.

6.2.5 Fixed scan execution type program

(1) Fixed scan execution type program

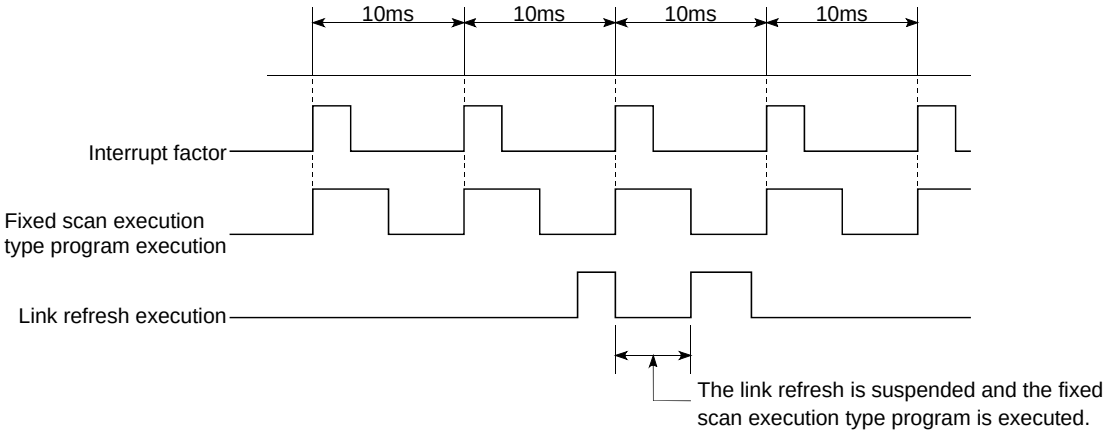
(a) Fixed scan execution type program is an interrupt program executed at specified time intervals.
Interrupts in units of files are available without interrupt pointers or the IRET instruction.

(2) Execution of fixed scan execution type program

(a) When two or more fixed scan execution type programs exist, a fixed scan execution type program which reaches the specified time is executed.
When two or more fixed scan execution type programs reach the specified time at the same timing, the programs are executed in ascending order of the numbers in the program setting of the PLC parameter.

(b) When a fixed scan execution type program and an interrupt program (I28 to I31) reach the specified time at the same timing, the interrupt program is executed first.

(c) When the execution condition is established during the network refresh, the network refresh is interrupted and an interrupt program is executed.
Therefore, note that even though the "Block data assurance per station" setting is set in the CC-Link IE or MELSECNET/H network, this setting is invalid when a device set as a refresh target is used in the fixed scan execution type program.



(d) Execution during END processing
When the execution condition is established during the constant scan execution or the waiting time of the END instruction, a fixed scan execution type program is executed.

(3) High-speed execution setting and overhead time of fixed scan execution type program

When fixed scan execution type programs are executed, the following processes are executed.

・ Saving and restoring the index register data

・ Saving and restoring block numbers of the file register in use

Selecting "High Speed Execution" of Interrupt Program / Fixed Scan Program Setting in the PLC system setting of the PLC parameter does not execute the processes above.

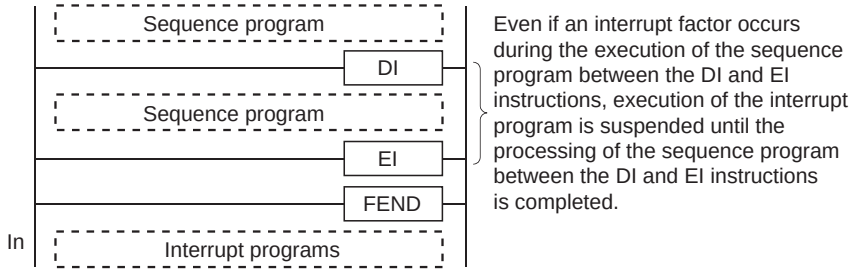
Therefore, the overhead time of the fixed scan execution type programs can be shortened.

For details, refer to the QnUCPU User's Manual (Function Explanation, Program Fundamentals).

6.2.6 Executing EI

The EI instruction is used to clear the interrupt disable state resulting from the execution of the DI instruction, and to create a state in which the interrupt program specified by the interrupt pointer number certified by the IMASK instruction can be executed.

When the IMASK instruction is not executed, I32 to I47 are disabled.



POINT

Terms

(1) DI
- The DI instruction disables the execution of an interrupt program until the EI instruction has been executed, even if a start cause for the interrupt program occurs.
- The program enters a DI state when the power is turned on or the CPU module is reset.

(2) MASK
The IMASK instruction enables or disables the execution of the interrupt program marked by the specified interrupt pointer by using the bit pattern of 16 points from the device specified by the start number (BIN 16 bits) of the device where the interrupt mask data is stored.
- 1 (ON) ... Interrupt program execution enabled
- 0 (OFF) ... Interrupt program execution disabled

Refer to the MELSEC-Q/L Programming Manual Common Instruction for more details.

CHAPTER 7　GX Works2 BASIC OPERATIONS (PART 2: MULTIPLE PROGRAMS)

7.1　Multiple Programs

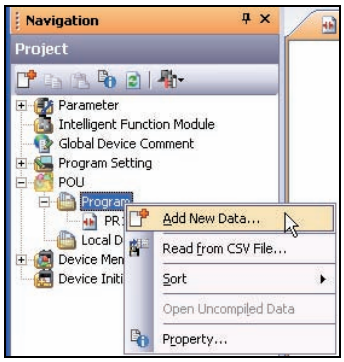
Execute the sequence program created by separate files according to the order set by parameters.

7.1.1　Creating multiple programs

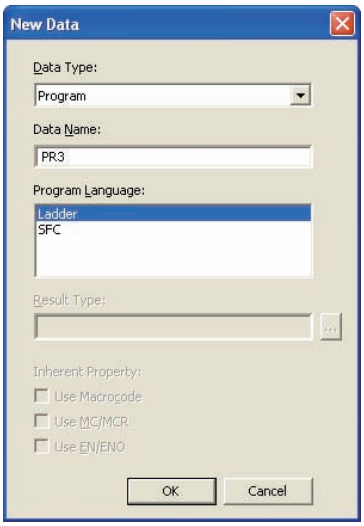
Create multiple programs in the ladder mode.

(1) Procedure for adding program
Add a new program in the project.

1) Right-click "Program" in the project data list.



2) Click [Add New Data].



3) The dialog box on the left is displayed. Enter "PR3" as a data name.

4) Click the OK button.

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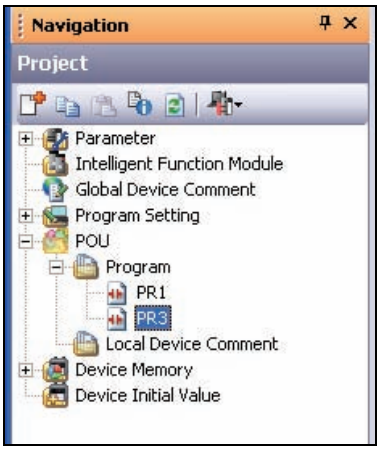


5) The program "PR3" is newly created.

(2) Creating a fixed scan execution type program

(a) A program to be created

Create a program which counts the number of its executions and displays the count value on the 7-segment display.

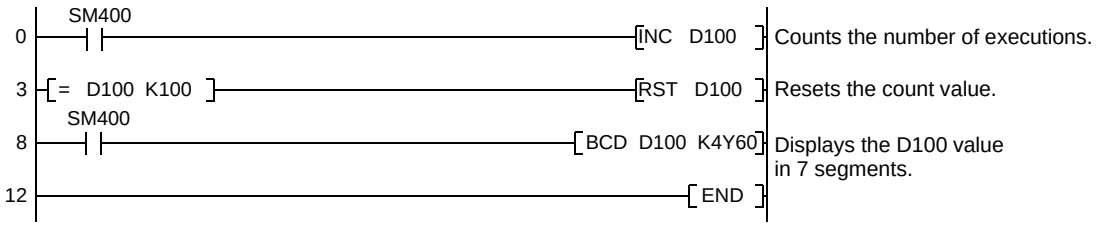
(b) Devices to be used

- D100 ..... Register for counting the number of program executions
- Y60 to Y6F .... 7-segment display of the D100 value

(c) Program

For the creating procedure of a program, refer to section 5.2.3.

Project name	Applied 2
Program name	PR3



(3) Creating an initial execution type program

(a) A program to be created

Create a program which initializes the register used for PR2 and PR3.

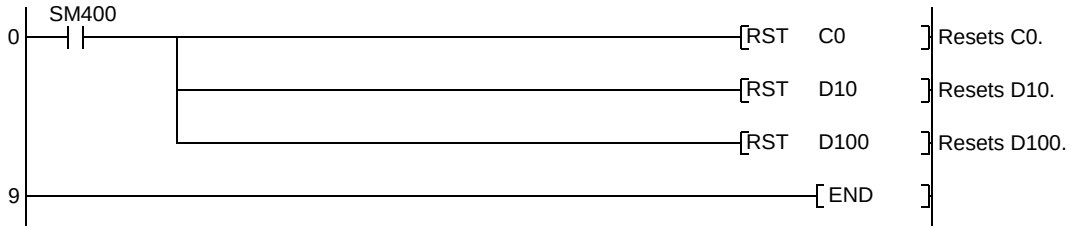
(b) Devices to be used

・ C0, D10, and D100 ... Targets to be initialized

(c) Program

For the creating procedure of a program, refer to section 5.2.3.

Project name	Applied 2
Program name	INITIAL



(4) Creating a standby type program 1)

(a) A program to be created

Create a program which sets the setting value of the counter C0 and the data register D1 of the program PR1.

(b) Devices to be used

・ X6 and X7…… Switches which import the setting value of digital switches when the program is changed from the standby type to the scan execution type

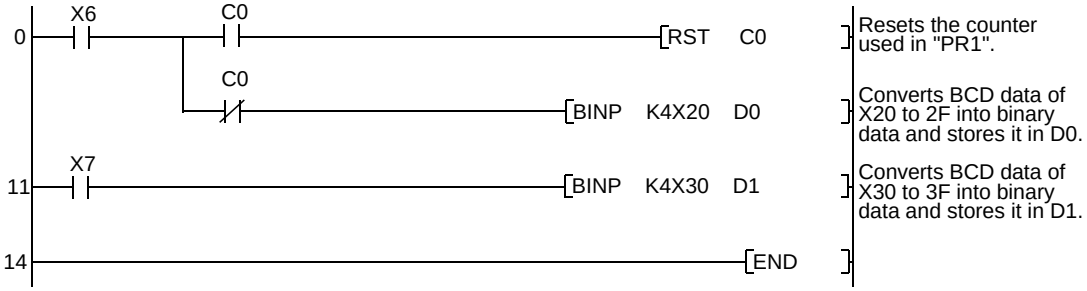
・ C0…… Resets the counter used in "PR1"

・ D0 and D1 …… Registers for storing binary data

(c) Program

For the creating procedure of a program, refer to section 5.2.3.

Project name	Applied 2
Program name	SUB



(5) Creating a stand by type program 2)

(a) A program to be created

Create a program which counts the number of its executions.

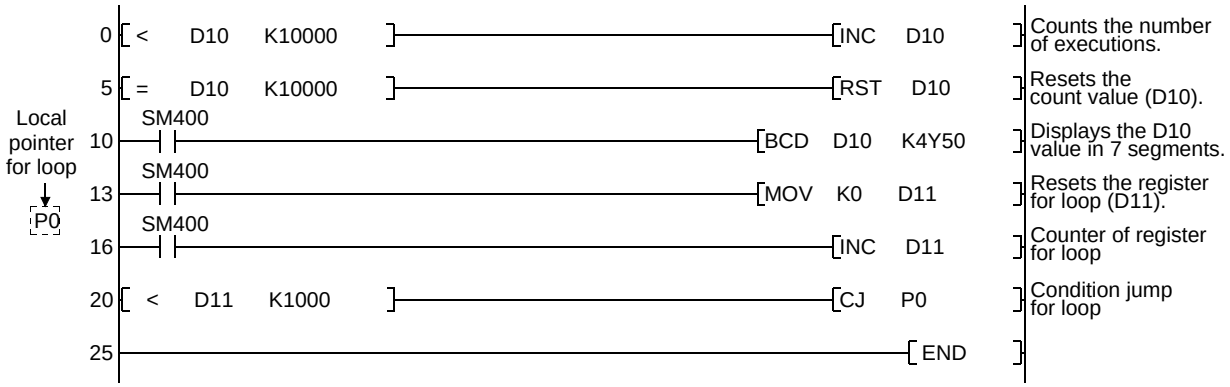
(b) Devices to be used

- D0 ····· Register for counting the number of program executions
- Y50 to Y5F ···· 7-segment display of the D10 value
- P0 ····· Pointer for loop

(c) Program

For the creating procedure of a program, refer to section 5.2.3.

Project name	Applied 2
Program name	PR2



(6) Creating a scan execution type program

(a) A program to be created

Create a program which changes the standby type program "SUB" to a scan execution type.

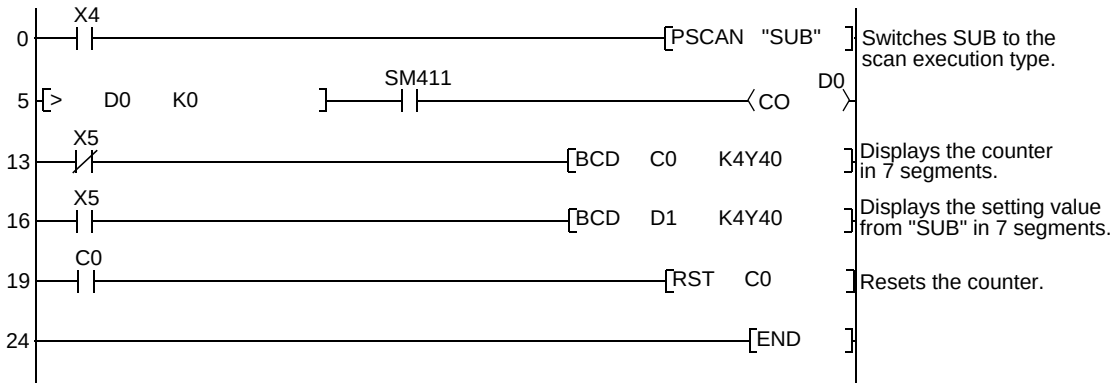
(b) Devices to be used

- X4 ····· Switch which shifts the program type to the scan execution type
- X5 ····· Switch which shifts the 7-segment display (for 4 digits from Y40)

(c) Program

For the creating procedure of a program, refer to section 5.2.3.

Project name	Applied 2
Program name	PR1



7.1.2 Creating programs for control

Create programs which control the operating status of the programs created in previous pages.

(1) Program control instructions

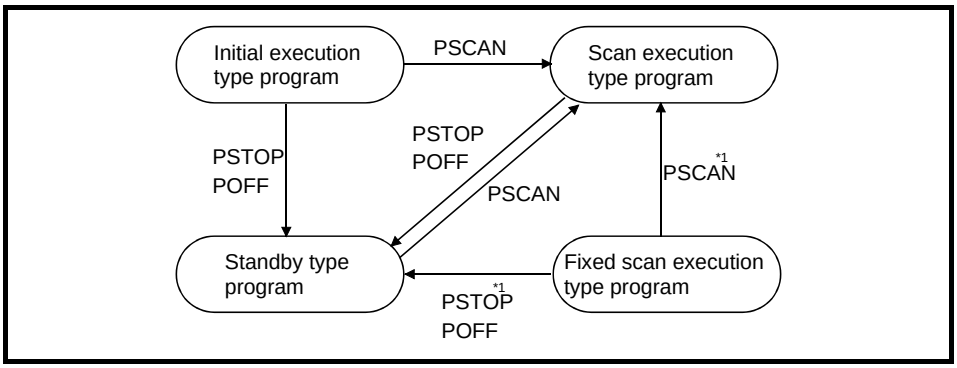
Program control instructions change the execution type of the programs while a programmable controller CPU is running.

Program control instructions are the following three types.

・PSCAN instruction

・POFF instruction

・PSTOP instruction



*1: Once the fixed scan execution type program is changed to other execution type, it cannot be returned to the fixed scan execution type.

The POFF instruction is used to securely turn off the external output (Y) when the program is changed to the standby type.

POINT
Program execution type changes by program control instructions are executed to the program which is read in the program memory. The program execution type of the program which is not read in the program memory from the memory card cannot be changed.

(2) Programs for control

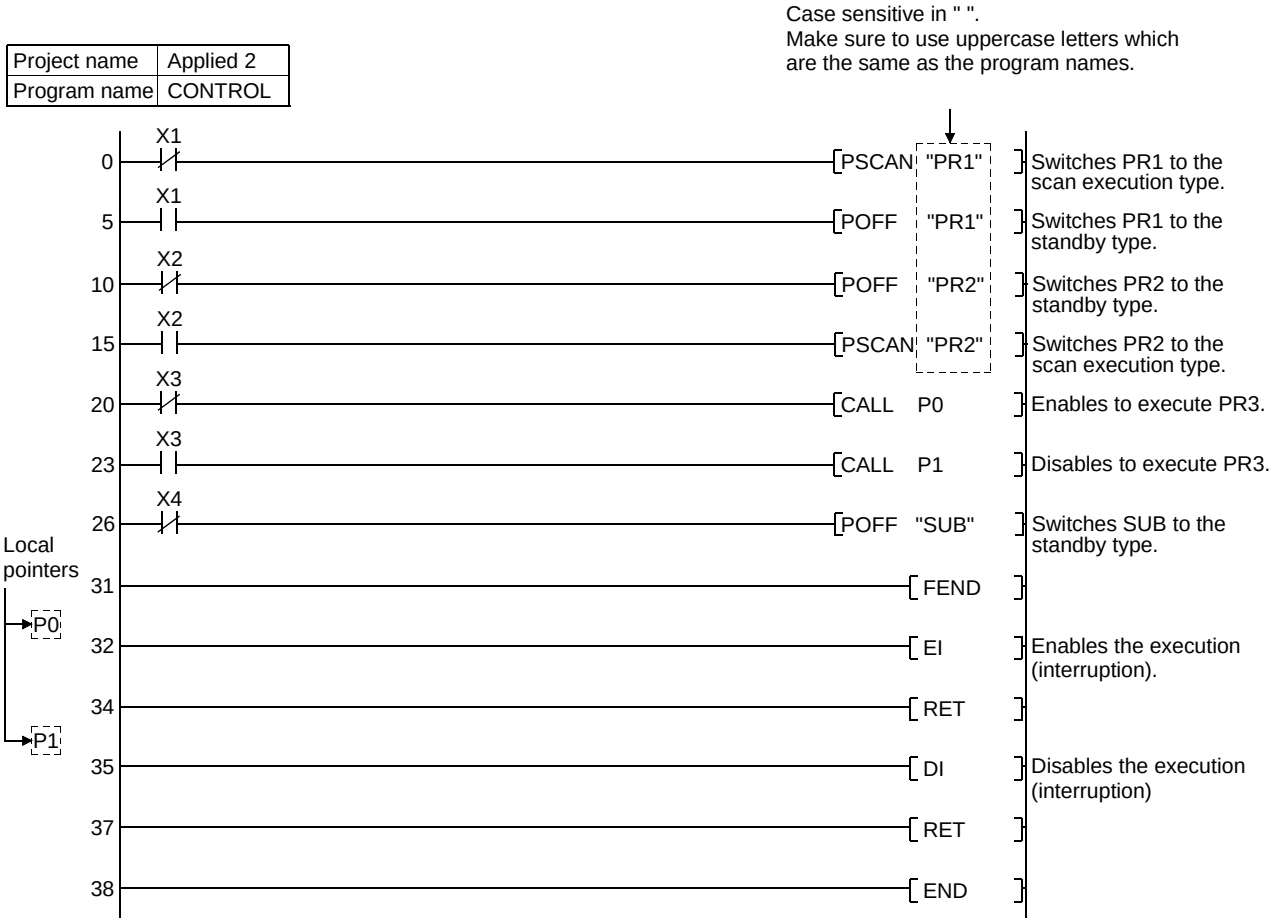
(a) A program to be created

1) Turning on the switch X1 switches PR1 from the scan execution type to the standby type.
2) Turning on the switch X2 switches PR2 from the standby type to the scan execution type.
3) Turning on the switch X3 disables the PR3 execution. (The EI instruction must be executed first to execute the fixed scan execution type program.)
4) Turning on the switch X4 switches SUB from the standby type to the scan execution type.

(b) Devices to be used

- X1 (ON)..... Switches PR1 to the standby type
  (OFF)..... Switches PR1 to the scan execution type
- X2 (ON)..... Switches PR2 to the scan execution type
  (OFF)..... Switches PR2 to the standby type
- X3 (ON)..... Disables PR3 execution
  (OFF)..... Enables PR3 execution
- X4 (ON)..... Switches SUB to the scan execution type
  (OFF)..... Switches SUB to the standby type
- P0 and P1..... Local pointers

(c) Program



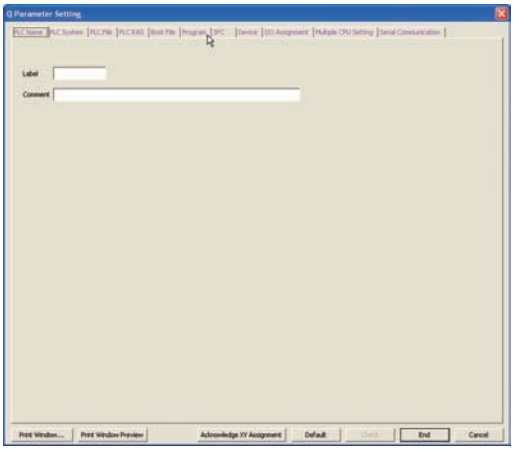
7.1.3 Setting parameters

Set parameters which control the created sequence programs and write them with the programs to the programmable controller CPU.

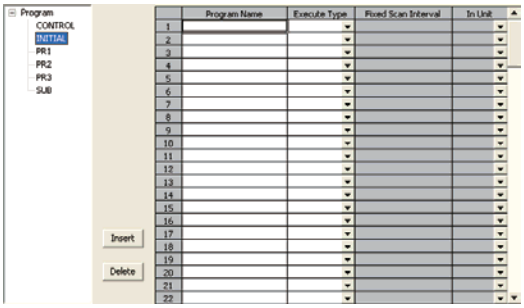
(1) Program setting

1) Double-click "Parameter" in the project list.

2) Double-click "PLC Parameter".



3) The Q Parameter Setting dialog box is displayed. Click the "Program" tab.



4) Click "INITIAL".

5) Click the Insert button.

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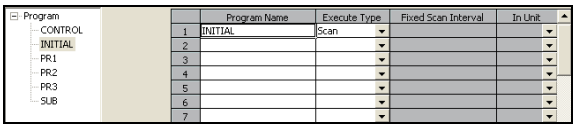
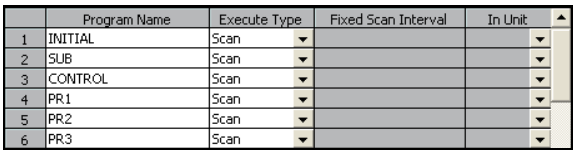


6) Click the second cell of the Program Name column.

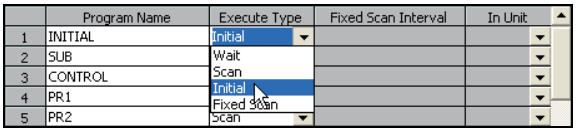
7) Click "SUB".

8) Click the Insert button.



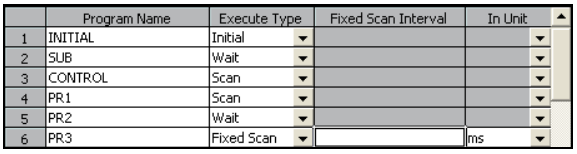
	Program Name	Execute Type	Fixed Scan Interval	In Unit
1	INITIAL	Scan		
2	SUB	Scan		
3	CONTROL	Scan		
4	PR1	Scan		
5	PR2	Scan		
6	PR3	Scan		

9) Perform the step 6) to 8) repeatedly to set the following contents.
   a) The third cell → "CONTROL"
   b) The forth cell → "PR1"
   c) The fifth cell → "PR2"
   d) The sixth cell → "PR3"



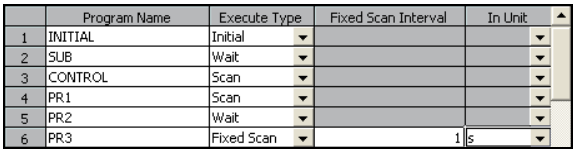
	Program Name	Execute Type	Fixed Scan Interval	In Unit
1	INITIAL	Initial		
2	SUB	Wait		
3	CONTROL	Scan		
4	PR1	Initial		
5	PR2	Fixed Scan		

10) Click ▼ of Execution Type of "INITIAL" and select "Initial".



	Program Name	Execute Type	Fixed Scan Interval	In Unit
1	INITIAL	Initial		
2	SUB	Wait		
3	CONTROL	Scan		
4	PR1	Scan		
5	PR2	Wait		
6	PR3	Fixed Scan		ms

11) Set the following contents with procedure 10).
   a) "SUB" and "PR2" → "Wait"
   b) "PR3" → "Fixed Scan"

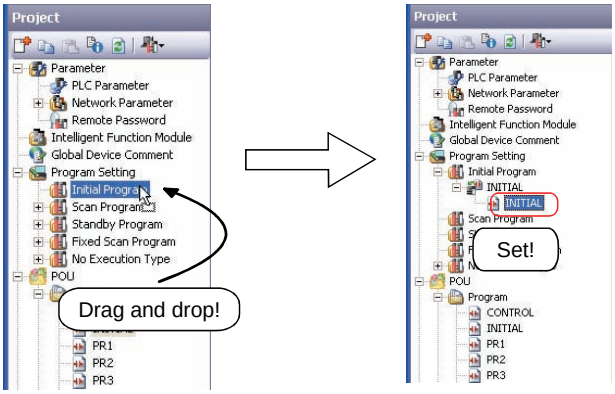


	Program Name	Execute Type	Fixed Scan Interval	In Unit
1	INITIAL	Initial		
2	SUB	Wait		
3	CONTROL	Scan		
4	PR1	Scan		
5	PR2	Wait		
6	PR3	Fixed Scan	1	s

12) Enter "1" to "Fixed Scan Interval" of "PR3" and click ▼ of "In Unit" column to set "s".

POINT

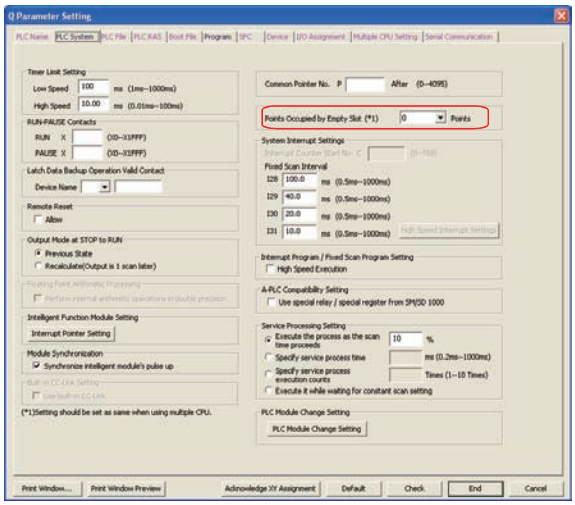
Program setting can be done by dragging and dropping items on the navigation window.



(2) PLC system setting

Click the "PLC System" tab on the Q Parameter Setting dialog box.

Set "0" to Points Occupied by Empty Slot.



After the setting of (1) and (2), click the End button and click [Project] → [Save] to save the contents.

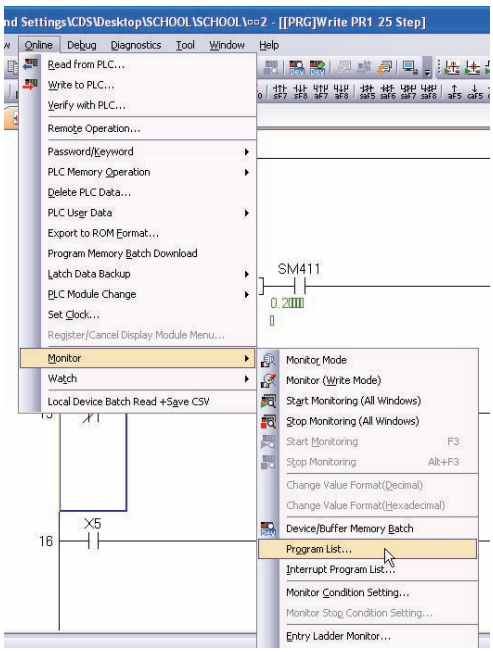
(3) Writing the data to the programmable controller CPU

Write the created programs (PR1, PR2, PR3, INITIAL, SUB, and CONTROL) and parameters to the programmable controller CPU. (Refer to section 5.4.1)

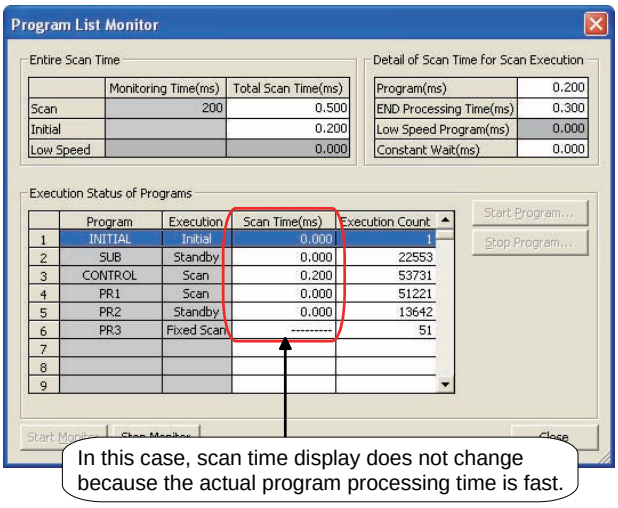
7.2 Monitor

7.2.1 Program list monitor

Monitor the execution condition of the multiple programs ("Applied 2") created in section 7.1.
Before monitoring, reset and run the CPU.



1) Click [Online] → [Monitor] → [Program List].



2) The Program List Monitor dialog box is displayed. Turn on or off the switches X1, X2, X3, and X4 to check that the execution statuses change.

- The change of execution status

X1 : OFF Switches PR1 to the scan execution type
: ON Switches PR1 to the standby type
X2 : OFF Switches PR2 to the standby type
: ON Switches PR2 to the scan execution type
X3 : OFF Enables PR3 execution
: ON Disables PR3 execution
X4 : OFF Switches SUB to the standby type
: ON Switches SUB to the scan execution type

(1) "Entire Scan Time"
Displays the total scan time of each program type and monitoring time set in the "PLC RAS" tab of the PLC parameter in the project data list.

(a) "Monitoring Time"
Displays each monitoring time of the scan program and initial program.
When the scan time exceeds these time, a watchdog timer error is displayed on the CPU.

(b) "Total Scan Time"
Displays the total time of the scan program and initial program each. For the scan program, the END processing time is included.

(2) "Detail of Scan Time for Scan Execution"
Displays the detail of the scan time.

(a) "Program"
Displays the total execution time of scan programs.

(b) "END Processing Time"
Displays the END processing time.

(c) "Constant Wait"
Displays the waiting time at a constant scan execution.

(3) "Execution Status of Programs"
Displays the execution status of programs specified in the "Program" tab of the PLC parameter in the project data list.

(a) "Program"
Displays the program names in the input order in the PLC parameter.

(b) "Execution"
Displays the execution type of the programs specified in the PLC parameter.

(c) "Scan Time"
Displays the actual scan time (current value). The display is "0.000ms" in the program stop (standby) status.
* The scan time display does not change when the actual program processing time is short.

(d) "Execution Count"
Displays the number of executions, counted from 0 at the point of starting count. (After reaching 65536, the count returns to 0.) The execution count is stored even after the program stops.

7.2.2 Monitor function

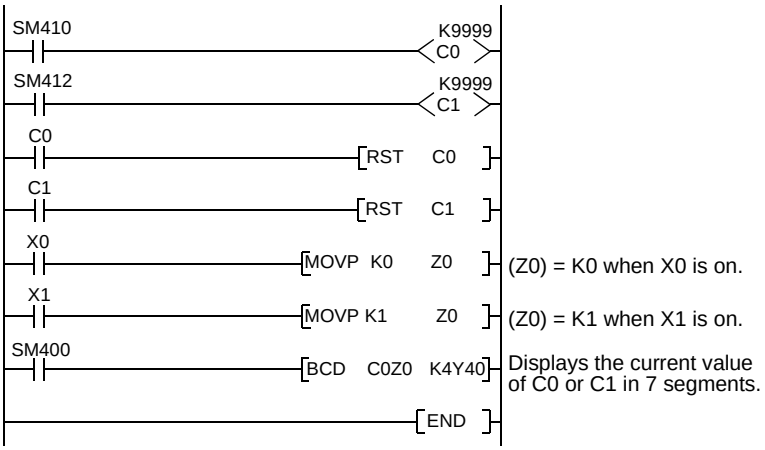
The monitor function reads the statuses of programs and devices in a CPU from GX Works2.

Operation Check with an Example

(1) Monitoring of indexing devices and comparison instructions

<Program>

Project name	Applied 3
Program name	INDEXMOD

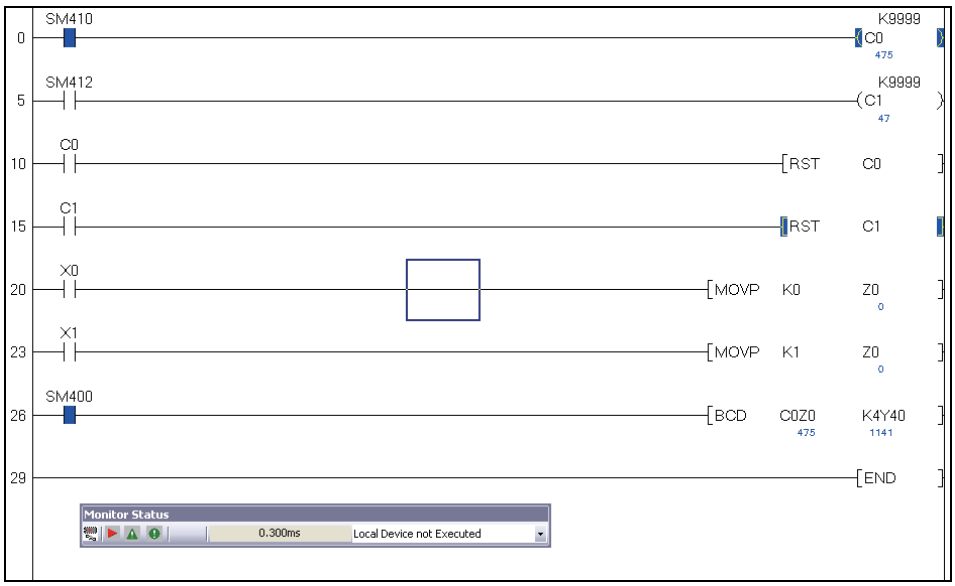


<Operation>

- Read the program above and write it with parameters to the programmable controller.
- Reset and run the CPU.
- Click  to monitor the program.

<Description>

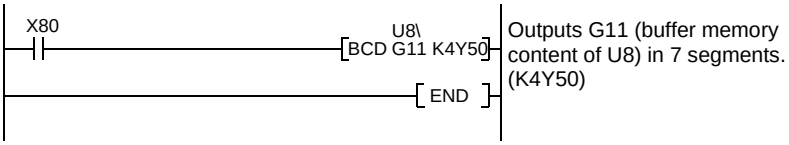
When X0 is turned on, indexing is performed as C0Z0 = C (0 + 0) = C0.
When X1 is turned on, indexing is performed as C0Z0 = C (0 + 1) = C1.
The condition establishment of the comparison instruction can be monitored.



(2) Buffer memory monitor of the intelligent function module

<Program>

Project name	Applied 4
Program name	BUFMEM



<Operation>

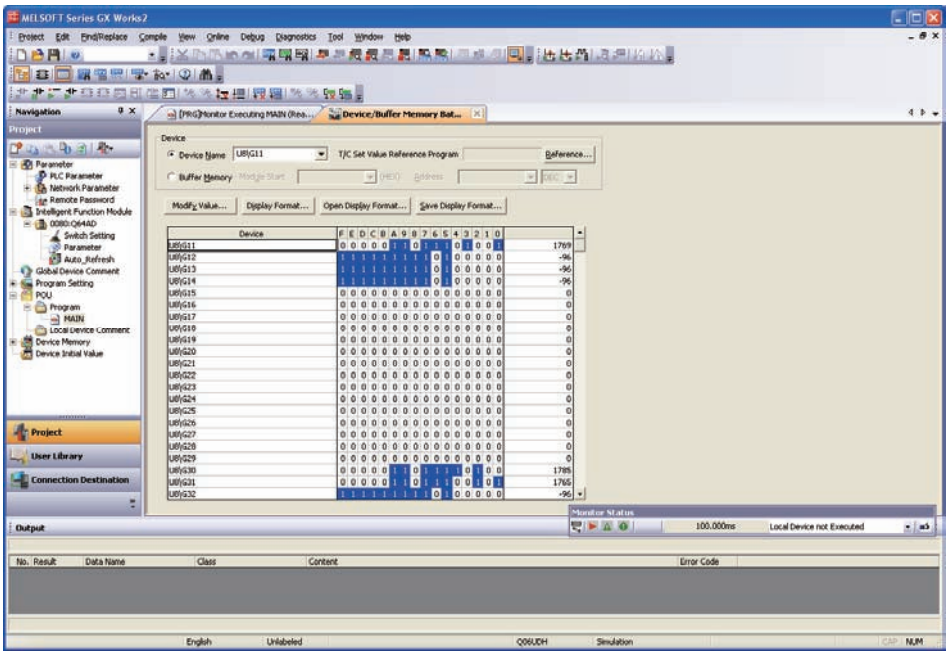
- Read the program above and write it with parameters to the programmable controller.
- Reset and run the CPU.
- Click  to monitor the program.
- Click [Online] → [Monitor] → [Change Value Format(Hexadecimal)] to change the display format to the hexadecimal notation.
- Click [Online] → [Monitor] → [Device/Buffer Memory Batch].
  Set the contents as "Device Name: U8¥G11", "Monitor Format: Bit and Word", "Display: 16bit Integer" and "Value: DEC" then click [OK].
  (Monitoring is also available in [Watch].)

<Description>

Turn on the READY signal X80 of Q64AD to display the content of the buffer memory address 11 (the value after the A/D conversion) on the 7-segment display with the program and to check that the buffer memory monitor is available with GX Works2.

<Note>

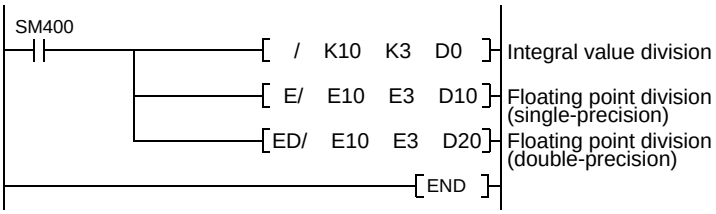
When the A/D conversion value is negative, an operation error occurs by the BCD instruction execution. As the prevention method, adjust the offset value of the A/D converter module.



(3) Monitoring real number (floating decimal point) data

<Program>

Project name	Applied 5
Program name	FLOATING



<Operation>

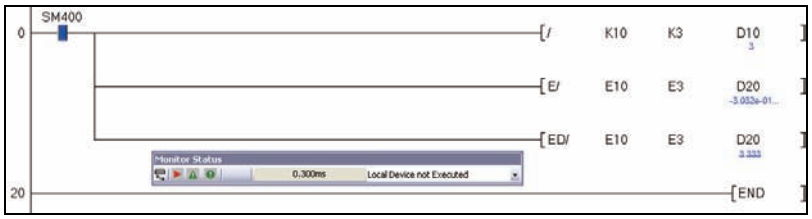
- Read the program above and write it with parameters to the programmable controller.
- Reset and run the CPU.
- Click  to monitor the program.

<Description>

Check that the results of the division are different.

In integral numbers: 10/3 = 3 remainder 1. In floating decimal points: 10/3 = 3.33333···.

The data in floating decimal point format can be monitored directly with GX Works2.



Selecting [Online] → [Monitor] → [Device/Buffer Memory Batch] displays the following display.

Display: 16bit Integer

D0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	3
D1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1

Display: Real Number (32Bit)

D10	0	1	0	1	0	1	0	1	0	1	0	1	0	1	1	3.3333333
D11	0	1	0	0	0	0	0	0	1	0	1	0	1	0	1	

Display: Real Number (64Bit)

D20	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	1	3.333333333333334
D21	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	
D22	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	
D23	0	1	0	0	0	0	0	0	0	0	0	0	1	0	1	0	

POINT

The real number data includes the single-precision floating-point data and double-precision floating-point data.

1) Two word devices are used for the real number data of the single-precision floating point data.
2) Four word devices are used for the real number data of double-precision floating point data.

For how to use the real number data, refer to appendix 9.

CHAPTER 8 FUNCTIONS OF QCPU

8.1 Maintenance and Debug Functions

Maintenance function list

The QCPU has useful functions for system maintenance.
The following table lists the maintenance functions.

Item	Description
Watchdog timer function	Monitors operation delays caused by program error or hardware failure of the CPU.
Self-diagnostic function	Self-diagnoses the CPU module to see whether an error exists or not.
Error history function	Stores the result of self-diagnostics to the memory as error history data.
System display function	Displays the names of the CPU, I/O modules, and intelligent function module and the system configuration of the I/O address from GX Works2.
System protection function	Allows or prohibits writing/reading data to/from each file in the QCPU module.
Password registration function	Restricts operations from the peripheral device to the memory in the CPU.
Remote password function	Selects the restrictions for the external access via Ethernet or serial communication.
LED and LED indicator	Displays operating status of the CPU module with the LEDs on the front of the CPU module or with the LED indicator.
Display of LED	Indicates whether the CPU operation is normal or not.
Display of LED indicator	Displays messages at an error.
Latch data backup to standard ROM function	Backs up latch data such as device data and error history to the standard ROM without a battery.
CPU module change function with memory card	Backs up data in the CPU module to a memory card and restores the backup data to another CPU module.
Module error collection function	Collects errors caused in the intelligent function modules in the CPU module.

For the details on the functions which require the operation of a peripheral device, refer to the GX Works2 Operating Manual.

Debug function list

The QCPU has useful debug functions.
The following table lists the debug function.

Item	Description
Monitor function	Reads the status of programs and devices of the CPU from a peripheral device.
Online change function	Writes programs when the CPU module is in the RUN status.
Execution time measurement function	Displays the processing time of the program which is being executed.
Program monitor list	Displays the processing time of the program which is being executed.
Interrupt program monitor list	Displays the number of executions of interrupt programs.
Sampling trace function	Continuously collects the specified device data with the QCPU at a preset timing.
Device test function	Forcibly changes the current value of a word device or the on/off status of a bit device in a program.
Debug function from multiple peripheral tools	Enables simultaneous debugging by multiple peripheral devices.

For the details on the operation method of each function, refer to the GX Works2 Operating Manual.

8.1.1 Self-diagnostic function

This function allows the CPU module to diagnose itself to check for errors.

(1) This function aims to provide preventive measures and will prevent malfunction of the CPU module.
When an error occurs at power-on or during the RUN status of the programmable controller, the self-diagnostic function detects and displays the error to stop the programmable controller operation.

(2) The QCPU stores the detected error as an error code to a special register SD0 and illuminates the ERR.LED.
When multiple errors occur, the error code of the latest error is stored to SD0.

(3) Up to 100 of the latest errors are backed up with a battery-backup even when the power is turned off.
Error history can be checked by clicking [Diagnostics] → [PLC Diagnostics] in GX Works2.

(4) When an error is detected by the self-diagnostic function, select one of the following two CPU operations.
- Mode that stops CPU module operation
  When an error is detected, the CPU module stops all external outputs of the module for which "Error Time Output Mode" is set to "Clear" in "Detailed Setting" of the I/O assignment setting of the PLC parameter. (Outputs (Y) in the device memory are held).
  Note that the external outputs of the module for which "Error Time Output Mode" is set to "Hold" are held. (Outputs (Y) in the device memory are held).
- Mode that continues CPU module operation
  When an error is detected, the CPU module operation executes programs other than the one (instruction) where an error occurred.

Whether to continue or stop an operation can be selected in "Operation Mode When There Is an Error" of the "PLC RAS" tab of the PLC parameter in the project data list.

1) Computation Error
2) Expanded Command Error
3) Fuse Blown
4) Module Verify Error
5) Intelligent Module Program Execution Error
6) File Access Error
7) Memory Card Operation Error
8) External Power Supply OFF

(In the initial setting, "Stop" is set for all errors.)

As an example, when "Module Verify Error" is set to "Continue", the operation is continued from the I/O address before the error.

Error whether to continue or stop an operation can be selected in "Detailed Setting" in the I/O assignment setting of the PLC parameter
- Intelligent function module error

(5) For error items which can be set to "Stop" or "Continue" in the "PLC RAS" tab of the PLC parameter in the project data list, an error for which "Continue" is set does not stop the operation even when the corresponding error occurs.

(6) For the following errors, whether to execute an error check can be selected in the "PLC RAS" tab of the PLC parameter in the project data list.
    1) Carry Out Battery Check
    2) Carry Out Fuse Blown Check
    3) Verify Module
    4) Check Device Range at Indexing
    5) Diagnose Redundant Power Supply System
    (In the initial setting, all the items set to execute the error check.)

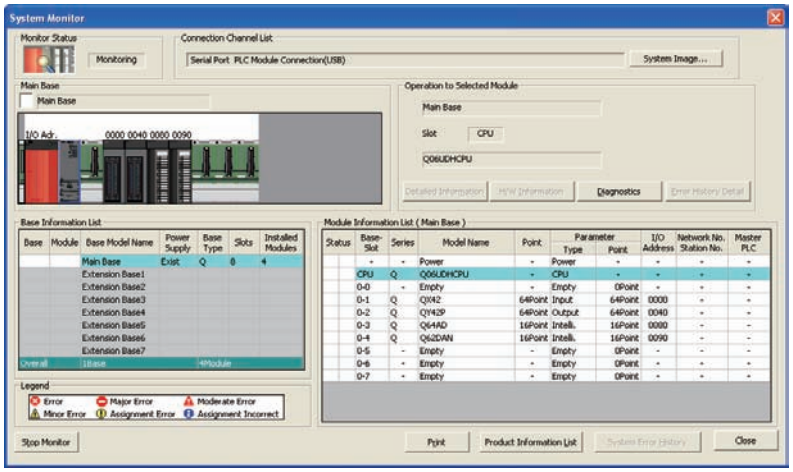
    Without the error check, errors are not detected. Therefore, the processing time of the END instruction can be shortened.

8.1.2 System display function

The system configuration (module name, number of I/O occupied points, and I/O address) of the connected host station can be checked from the peripheral device with the system monitor function.

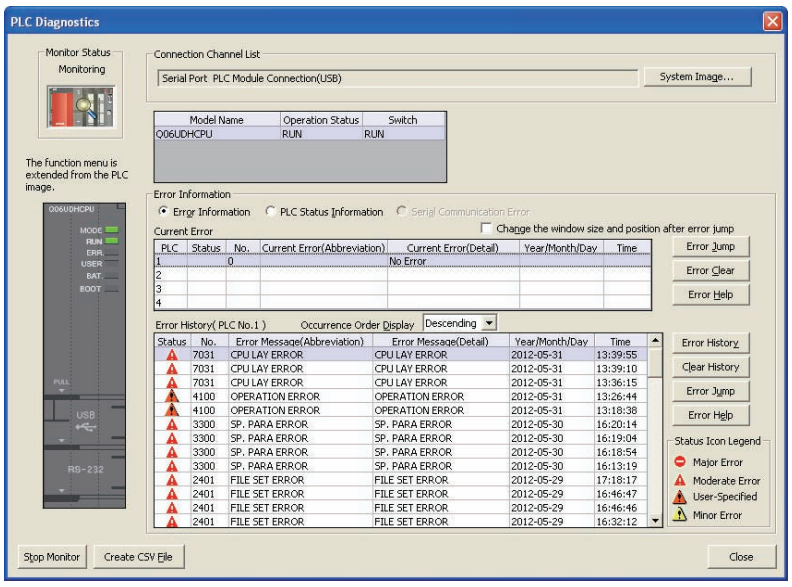
(1) Starting up the system monitor

Click [Diagnostics] → [System Monitor].



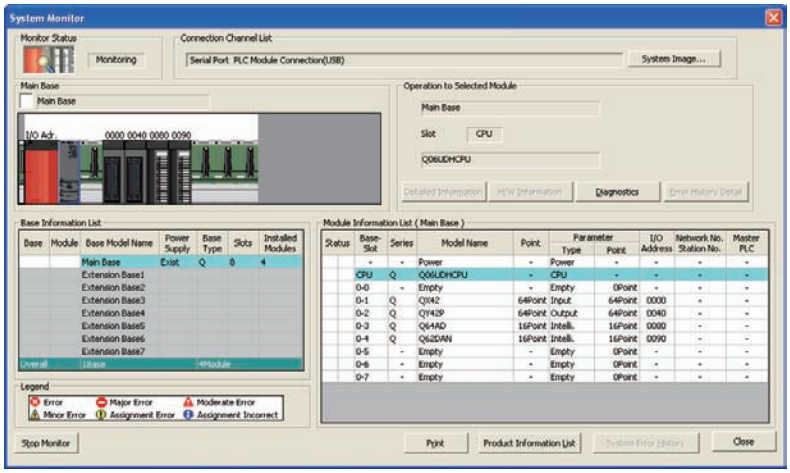
(2) PLC Diagnostics

Selecting a CPU and clicking the Diagnostics button displays the execution status of the CPU and error history.

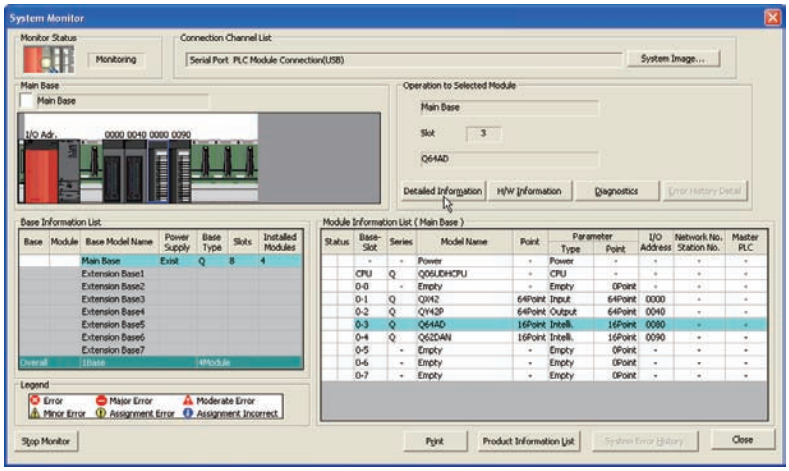


(3) Detailed information of modules

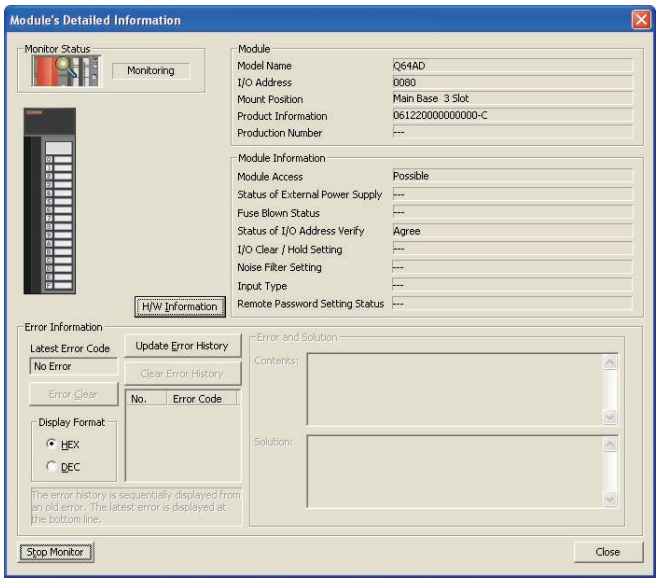
Select a module to check the detailed information.



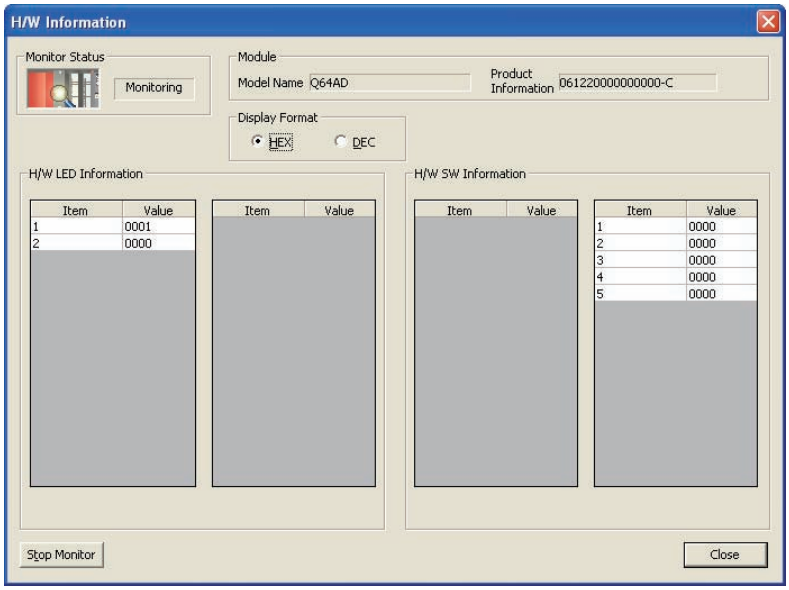
Click the Detailed Information button.



The following dialog box is displayed.

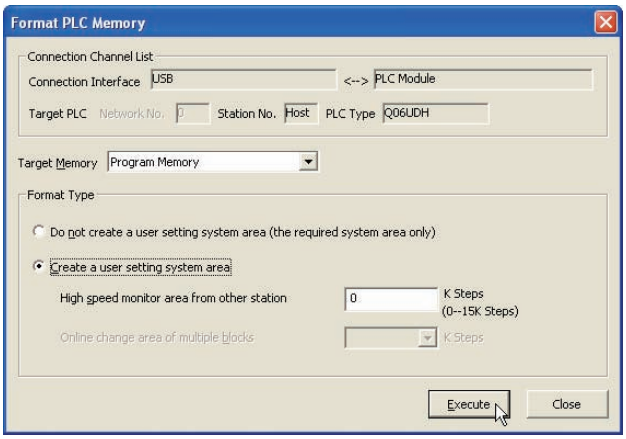


The status of the module LEDs and switch setting can be displayed by clicking the H/W Information button.



(4) Operation practice

This section explains how to check the cause of the error which is caused intentionally here with the PLC diagnostics function from the system monitor.

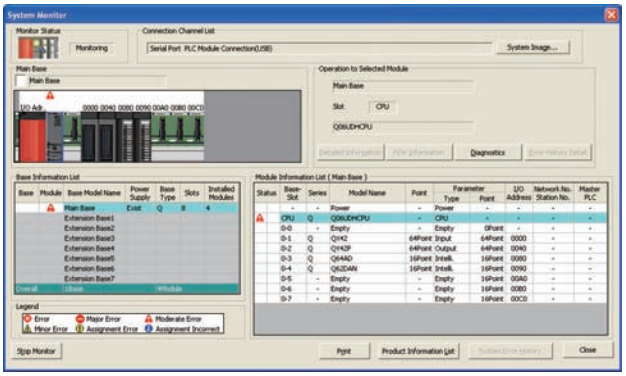


1) Stop the CPU.

2) Click [Online] → [PLC Memory Operation] → [Format PLC Memory] to format the program memory. (Refer to section 5.3.1 (5))

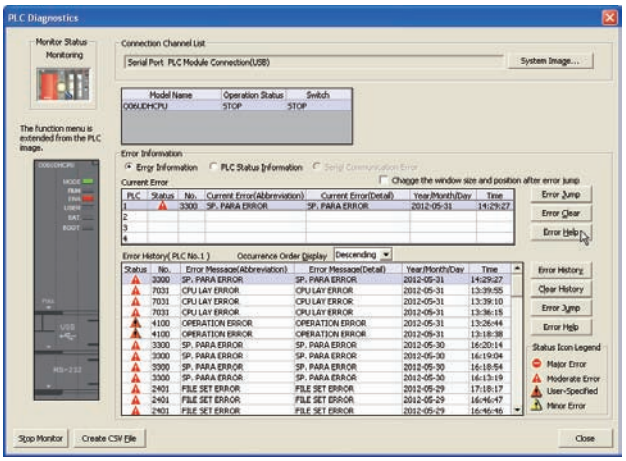
3) Reset the CPU.

   Error occurs.



4) Click [Diagnostics] → [System Monitor] and check the module where the error occurs in the System Monitor dialog box.

5) After checking the error in the CPU, select "Q06UDH" and click the Diagnostics button.



6) After checking "3300 SP.PARA ERROR" in "Current Error", click the Error Help button.

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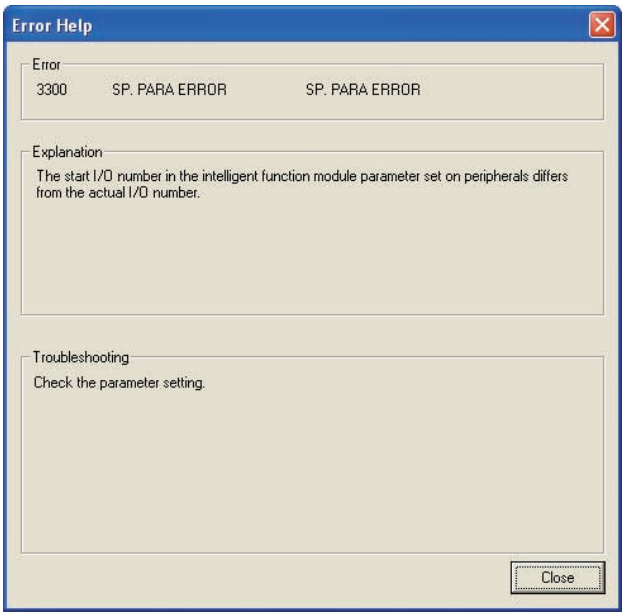


7) The detail of the error code is displayed. Check the cause and the solution.

8.1.3 System protection function

The QCPU has protection functions (system protection) to prevent programs from being modified by a user other than the designer.

Protection target	File to be protected	Description	Method	Remark
In units of memory cards	All files	Prohibits writing to a memory card.	Turn on the write protect switch of a memory card.	-
In units of files	Program Device comment Device initial value	Changes the attribute for each file to either of the following. Read/write prohibition Write prohibition	Change the attribute for each file in the password registration.	-

Control instruction, read/write, and writing in the table above indicates the following contents.

Item	Description
Control instruction	Operation instruction for the CPU by the remote operation (such as remote RUN and remote STOP)
Read/write	Operations of reading or writing programs
Write	Operations regarding writing programs

8.1.4 Password registration function

A password prohibits reading and writing (overwriting) data such as programs and comments in the QCPU module using a peripheral device.
The password can be registered in units of files of the specified memory (program memory, standard ROM, memory card (RAM), and memory card (ROM)). The following two operations can be prohibited.

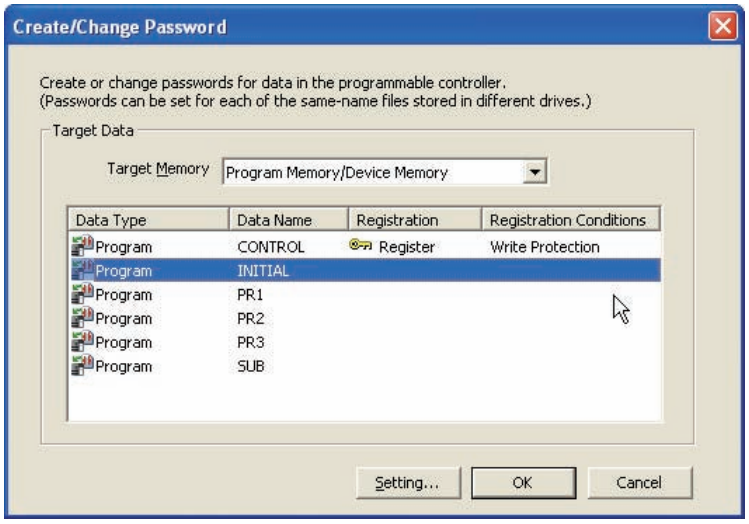
- Reading and writing a file
- Writing a file (Reading is available.)

When a password is registered to a file, the file cannot be operated from the peripheral device unless the password is canceled.
To cancel the password, click [Online] → [Password/Keyword] → [Disable].
Or cancel the password when executing the limited operation.

(1) Registering a password

Click [Online] → [Password/Keyword] → [New] in GX Works2.

For the details of the operation method of each function, refer to the GX Works2 Operating Manual.



Each item is explained as follows.

(a) Target Memory

Set a memory of a file with which a password is registered.

(b) Data Type

Displays the data types of the files with which passwords can be registered.

(c) Data Name

Displays the data name of the files with which passwords can be registered.

(d) Registration

Displays the password registration status of the files written in the CPU.

"🔑" is displayed to the file with which a password is registered.

(e) Registration Conditions

Set conditions of the files with which passwords are registered.

- Read/Write Protection

  Reading or writing is unavailable unless the password is canceled.
- Write Protection

  Writing (overwriting) is unavailable unless the password is canceled. Reading is available.

POINT
(1) Passwords can be registered only for programs, device comments, and device initial values. (2) The passwords registered in the CPU cannot be read by the peripheral device. (3) To cancel the password registration, click [Online] → [Password/Keyword] → [Delete].

8.2 Other Functions

Function list

The following table lists other functions.

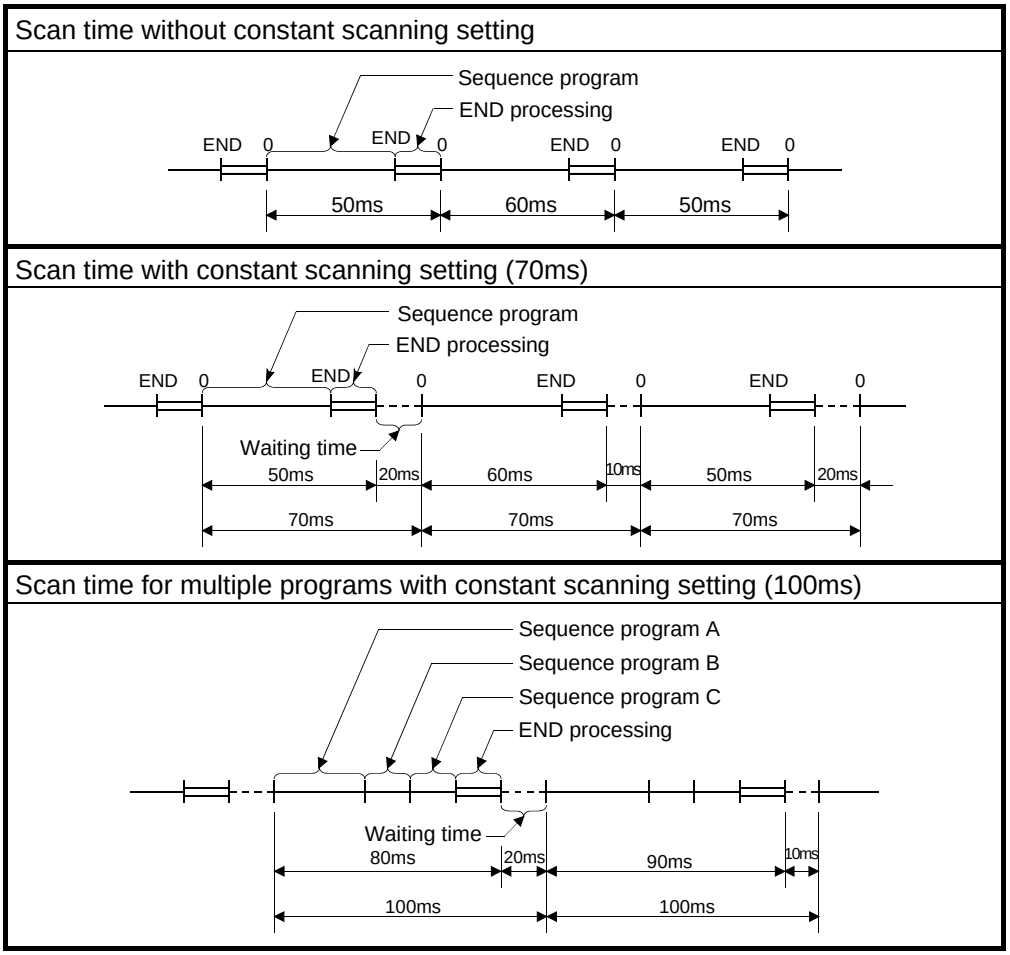
Item		Description
Constant scan function		Executes a program in a set time interval regardless of its scan time.
Latch function		Holds the device data even at power-off or reset.
Battery life-prolonging function		Extends the life of a battery by holding only clock data.
Output status setting function when the status changed from STOP to RUN		Sets the output (Y) status (outputting the same status prior to STOP or clearing the status) when the operating status of the CPU module is switched from STOP to RUN.
Clock function		Executes the internal clock of the CPU.
Remote operation function		Operates the QCPU externally.
	Remote RUN/STOP	Runs or stops the CPU.
	Remote STEP-RUN	Executes the CPU in step execution.
	Remote PAUSE	Stops the CPU temporarily.
	Remote RESET	Resets the CPU.
	Remote latch clear	Clears the latch data in the CPU.
	Relationship between remote operation and CPU	The relationship between the RUN/STOP switch setting for the CPU and the remote operation is explained.
Service processing setting		Specifies the service processing count or time to be executed in the END processing.
Switch setting for the intelligent function module supporting QCPU		Configures settings for intelligent function modules. (Refer to manuals of intelligent function modules for setting details.) → Refer to section 9.2.3.
Response time change for the input module supporting QCPU		Changes the response time of the input module supporting QCPU to 1ms, 5ms, 10ms, 20ms, or 70ms. (Default: 10ms) → Refer to section 10.7

For the details on the functions which require the operation of a peripheral device, refer to the GX Works2 Operating Manual.

8.2.1 Constant scan function

(1) Constant scan

The scan time of the QCPU varies since the processing time differs depending on the execution status of instructions used in the sequence program.
The constant scan function repeatedly executes sequence programs keeping their scan time constant.



Constant scanning operation

For details, refer to the QnUCPU User's Manual (Function Explanation, Program Fundamentals).

POINT

Set a constant scanning time in the "PLC RAS" tab of the PLC parameter in the project data list in GX Works2.
Set the constant scanning time within the following range.

(WDT setting time) > (Constant scanning setting time) > (CPU maximum scan time)

8.2.2 Latch function

The latch function holds data in each device of the CPU module when:

- the CPU module is powered off and then on,
- the CPU module is reset, or
- power failure occurs exceeding the allowable momentary power failure time.

Data in each device of the CPU module is cleared and back to its default (bit device: off, word device: 0) without the latch function.

Program operation is the same, regardless of the latch status.

(1) Application

This function can be used to hold the data, such as the number of manufactured products, the number of fault products, and address, and to continue the control even when a power failure exceeding the allowable momentary power failure time occurs during the sequential control.

(2) Devices that can be latched

(a) The following devices can be latched.

- Latch relay
- Link relay
- Annunciator
- Edge relay
- Timer
- Retentive timer
- Counter
- Data register
- Link register

POINT
When the battery life-prolonging function is set, the latch relay cannot be latched. Battery life-prolonging function This function extends the battery life installed in the CPU module by setting the data to be held to only the clock data. All data other than the clock data are initialized when the CPU module is powered off or is reset. For details of the battery life-prolonging function, refer to the QnUCPU User's Manual (Function Explanation, Program Fundamentals).

(b) Set the latch range in the "PLC RAS" tab of the PLC parameter in the project data list in GX Works2.

The latch range setting has the range where the latch clear key becomes valid and the range where the key becomes invalid.

For the latch range of each device, refer to the QnUCPU User's Manual (Function Explanation, Program Fundamentals).

8.2.3 Remote operation function

The remote operation can change the operating status of the CPU module externally (with GX Works2, external devices with the MC protocol, link dedicated instructions of CC-Link IE controller network modules or MELSECNET/H module, or remote contacts).

The remote operations as follows can be executed with the QCPU.

Remote operation / RUN/STOP status	RUN	STOP	PAUSE	RESET	Latch clear
RUN	RUN	STOP	PAUSE	Operation disabled	Operation disabled
STOP	STOP	STOP	STOP	RESET	Latch clear

(1) Remote RUN/STOP

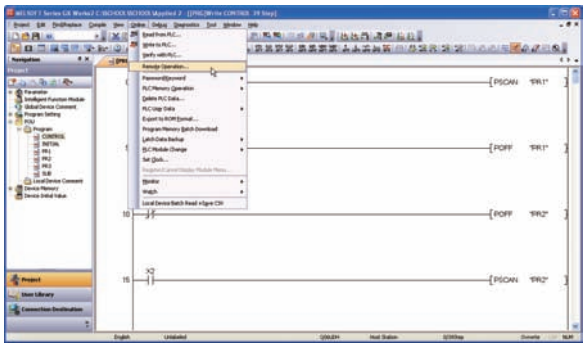
Set the RUN/STOP switch to RUN when executing the remote RUN/STOP.

The remote RUN/STOP has two methods for the execution.

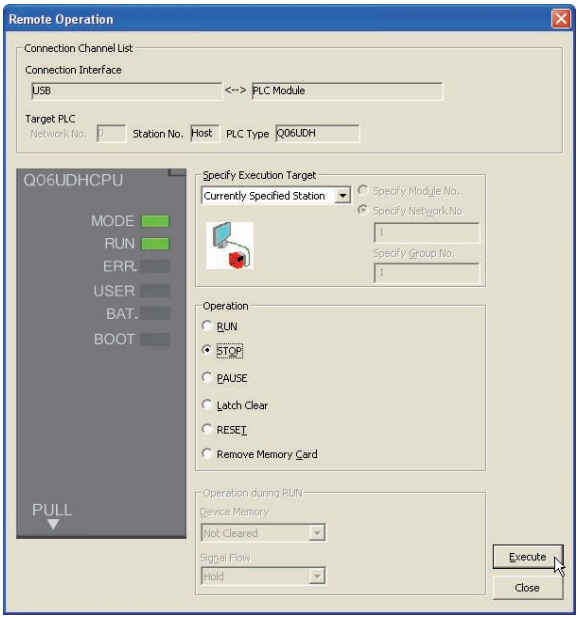
(a) Operation from GX Works2

Use the remote RUN/STOP command from GX Works2.

Execute the remote STOP, then execute the remote RUN.

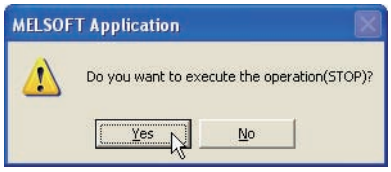


1) Click [Online] → [Remote Operation].



2) The dialog box is displayed. Select "STOP" in "Operation".

3) Click the Execute button.



4) The confirmation dialog box is displayed. Click the Yes button.

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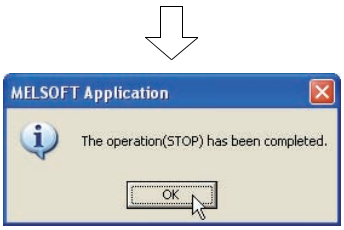
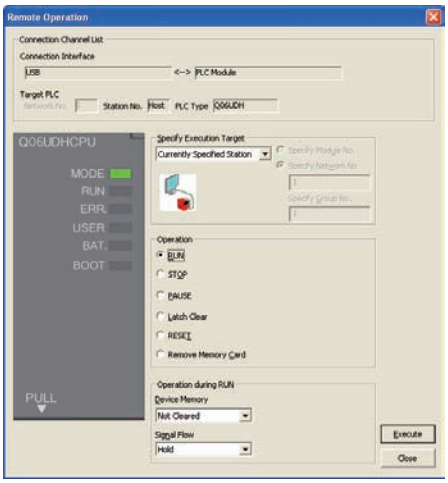
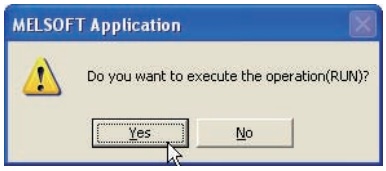


5) When the remote STOP is completed, the dialog box is displayed. Click the OK button.

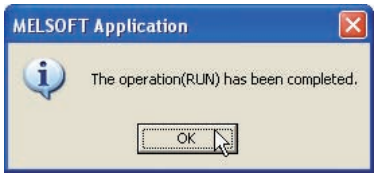


6) Select "RUN" in "Operation".

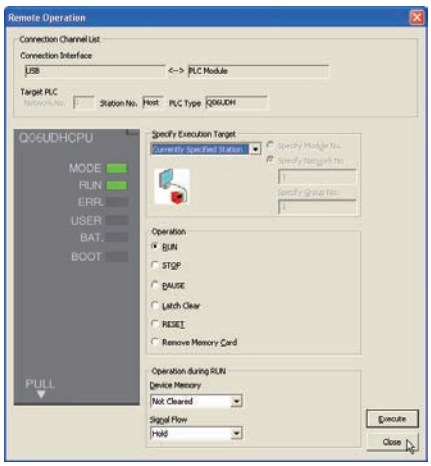
7) Click the Execute button.



8) The confirmation dialog box is displayed. Click the Yes button.



9) When the remote RUN is completed, the dialog box is displayed. Click the OK button.
Confirm that the CPU is running with the demonstration machine.



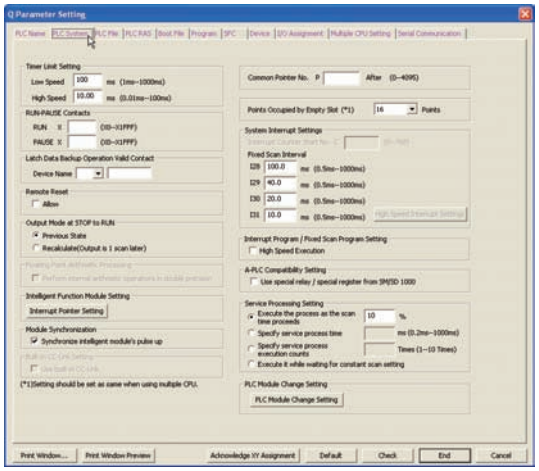
10) Click the Close button to close the dialog box.

(b) Method with the remote RUN contact

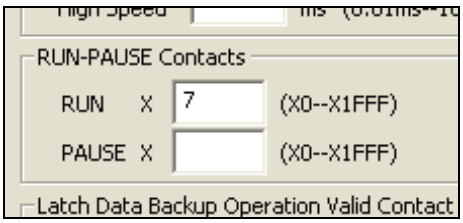
Set the remote RUN contact (X) with a parameter. Turning on the contact turns the operation status of the CPU to STOP (turning off runs the CPU).

1) Double-click "Parameter" in the project list.

2) Double-click "PLC Parameter".



3) The Q Parameter Setting dialog box is displayed. Click the "PLC System" tab.



4) To set the RUN contact to X7, enter "7" in the RUN column of RUN-PAUSE Contacts.

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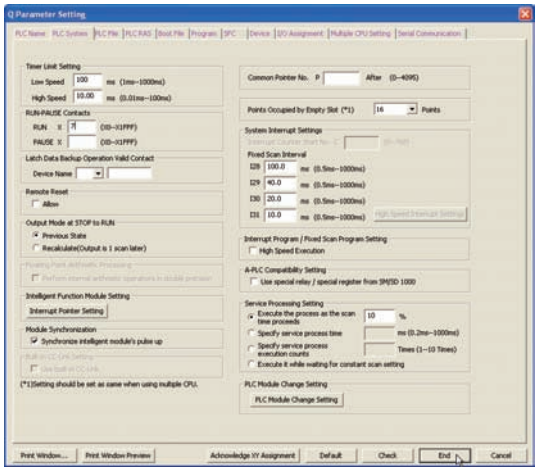
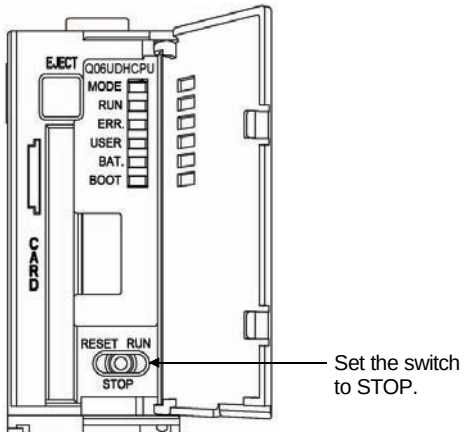
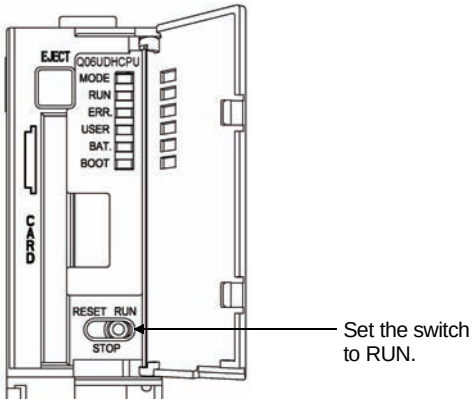


5) Click the End button to complete the setting.



6) Set the RUN/STOP/RESET switch on the CPU to "STOP".

7) Select only Parameter "PLC/Network/Remote Password/Switch Setting" and write it to the CPU. (Refer to section 5.4.1)



8) Set the RUN/STOP/RESET switch to "RUN" after resetting the CPU.
Then, confirm the operation of the CPU by turning on/off X7.

(2) Remote PAUSE, RESET, latch clear

The operation of the remote PAUSE is the same as the remote RUN/STOP described before.

For the remote RESET and remote latch clear, the CPU module is needed to be set in the STOP status by the remote STOP operation.

* Before the remote RESET is executed, the remote RESET is needed to be allowed in the PLC parameter setting.

8.2.4 Service processing setting

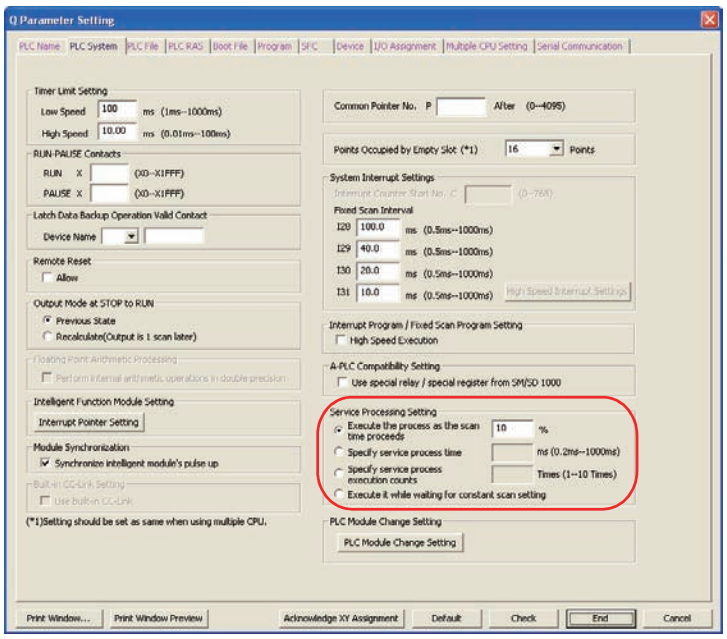
This function can set the number of times and time of the service processing executed in the END processing by parameters.
This function also improves the response of communication with a peripheral device and restrains the increase of the scan time due to the service processing.
This enables the configuration of optimal service processing environment for the system.

> POINT
>
> The service processing indicates the communication service processing with the peripheral device (such as GX Works2) and intelligent function module. However, the link refreshing processing, such as with the CC-Link IE controller network module, MELSECNET/H module, and CC-Link system master local module, are not included.

Using the COM instruction enables the same service processing as the END processing even during the program execution.
Therefore, the high-speed service processing response is available even when the scan time is long.

(1) Parameter setting

Set the parameters in the PLC system setting of the PLC parameter.



To execute the service processing, select any of the parameter items in the following table.

The setting value of deselected parameter cannot be entered. (Default: Execute the process as the scan time proceeds = 10%)

Item	Description	Setting range	Remark
Execute the process as the scan time proceeds	Set the percentage of service processing for one scan.	• Range: 1 to 99% • Unit: 1%	Default when selected = 10%
Specify service process time	Set the time of service processing for one scan.	• Range: 0.2 to 1000ms • Unit: 0.1ms	Default when selected = 0.2ms
Specify service process execution counts	Set the number of times for service processing for one scan.	• Range: 1 to 10 times • Unit: 1 time	Default when selected = 1 time
Execute it while waiting for constant scan setting	Set whether to execute service processing during a waiting time for constant scanning setting.	-	Even when the waiting time is 0.2ms or less, the service processing time (0.2ms) is added to the scan time at the service processing execution.

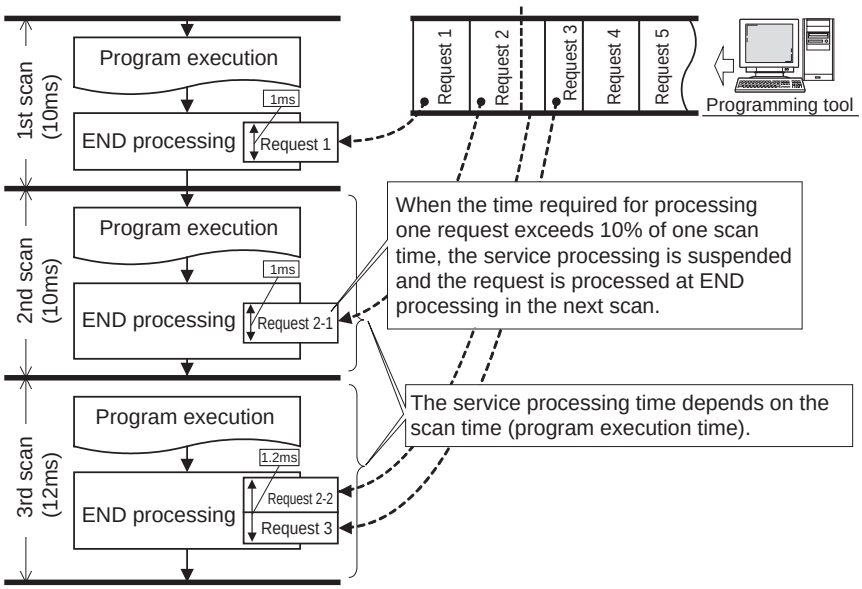
(2) Operations for service processing setting

Operations for each service processing setting is described below.

The operation of "Execute the process as the scan time proceeds" is described here.

For other operations, refer to the QnUCPU User's Manual (Function Explanation, Program Fundamentals).

(a) Operation when 10% is set



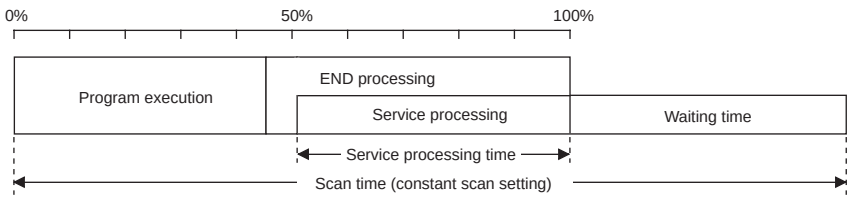
POINT

When no request data for service processing exists, the END processing becomes faster for the request processing time. (The CPU module does not wait for requests.)

(b) Operation for constant scanning setting

The percentage calculation is executed for the time in which the waiting time for the constant scanning is subtracted from the scan time, not executed for the scan time.

Ex. Operation of when "percentage of service processing = 50%"



(3) Precautions

The following explains precautions for the service processing setting.

(a) For the following functions, scan time exceeds the specified time during service processing even if the service processing time specification is set.
- Online program change
- Change T/C setting
- Local device monitor
- Program memory backup
- Writing/reading data to/from a file register (The scan time is increased when the write or read size is large.)
- Writing/reading data to/from the buffer memory of the intelligent function module (The scan time is increased when the write or read size is large.)
- Access to a network module
  1) Diagnostic functions (CC IE Control diagnostics, MELSECNET diagnostics, Ethernet diagnostics, CC-Link/ CC-Link/LT diagnostics)
  2) Monitor function (Module access device, Link direct device)

(b) Note that the scan time may be increased much longer if the CPU module receives multiple requests simultaneously while the many service processing count specifications are set.

(c) When the service processing time is set much shorter than the scan time, the response performance of the service processing decreases significantly.
Set the service processing time considering the time-out time of the peripheral device.

(d) An error of -20μs to +30μs occurs between the actual processing time and the set service processing time.

8.3 Comments Storage Function

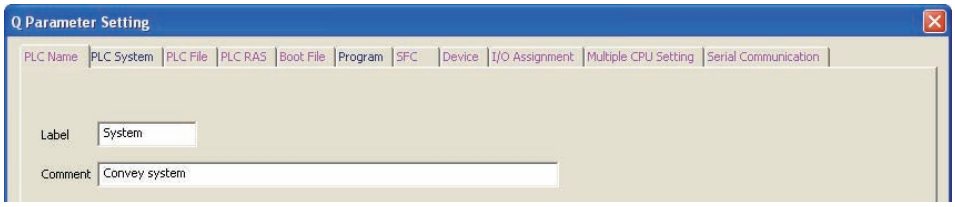
The QCPU can store various types of comments. This improves the operability of the CPU and makes the program easier to be read for users other than the program designer.
The following table lists each type of the comment which can be stored to the QCPU.

Item	Function
PLC name	Give a name for the CPU to be used.
Title	Give a title for each project.
Data name	Change the data name of the opened project.
Property	Give a title or comment for each data.
Device comment	Gives a comment or label to the device to be used in a program.
Statement/note	Give a statement/note for each step number, P or I pointer.
Device initial value comment	Gives a comment for the device initial value file.

For the details on the setting method of each function, refer to the GX Works2 Operating Manual.

(1) PLC name

Giving a comment to a CPU enables easy confirmation of the target CPU when GX Works2 accesses the QCPU.
Set a label and comment as a PLC name. Set a PLC name in the "PLC Name" tab of the PLC parameter in the project data list.



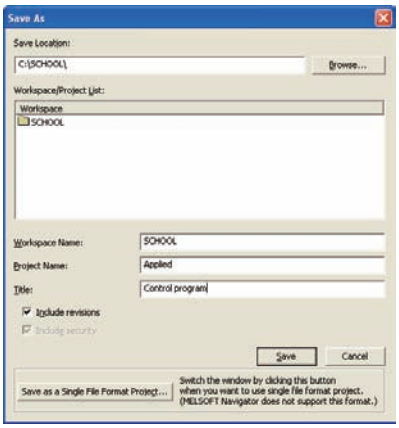
The following table lists the setting contents.

Item	Description	Setting range	Default
Label	Set a label for the CPU.	Up to 10 characters	Blank
Comment	Set a comment for the CPU.	Up to 64 characters	

(2) Title (project index)

Give a title to a project to identify its contents.

Set a title when saving a project with a different name, and the title is stored in the created project.



POINT
Specify a workspace name, project name, and title within 128 characters each. However, the total number of the characters of the save destination path name + workspace name + project name must be within 150.

(3) Data name

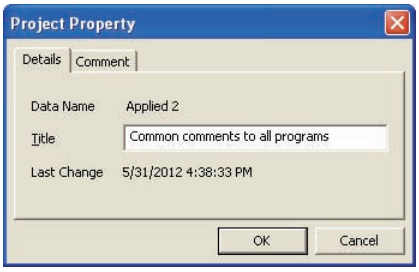
On the opened project window, select the data name to change.

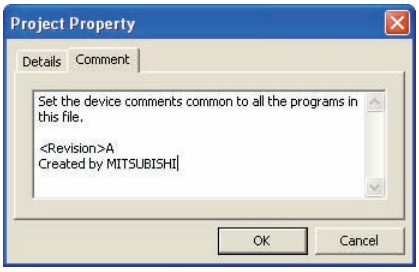
Right-click and click [Rename] to change the data name.

(4) Property

The properties for a folder, parameter, and program are displayed.

Also, giving titles and comments for each data is available.





[How to display screen]

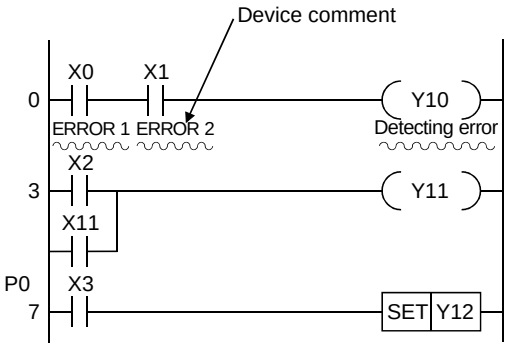
[Project] → [Object] → [Property]

[Screen items]

Item	Description
Data Name	Displays the data name.
Title	Set a title (index) for the data. (Up to 128 characters are applicable for a project, and 32 for other data.)
Last Change	Displays the date when the data was updated.
Comment	Set a comment for the data. (Up to 5120 characters are applicable.)

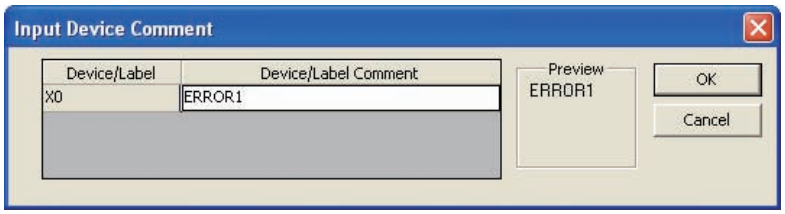
(5) Device comment

A device can be displayed with comments, to make the program easier to be read.



(a) Set the device comments on the ladder creation screen.

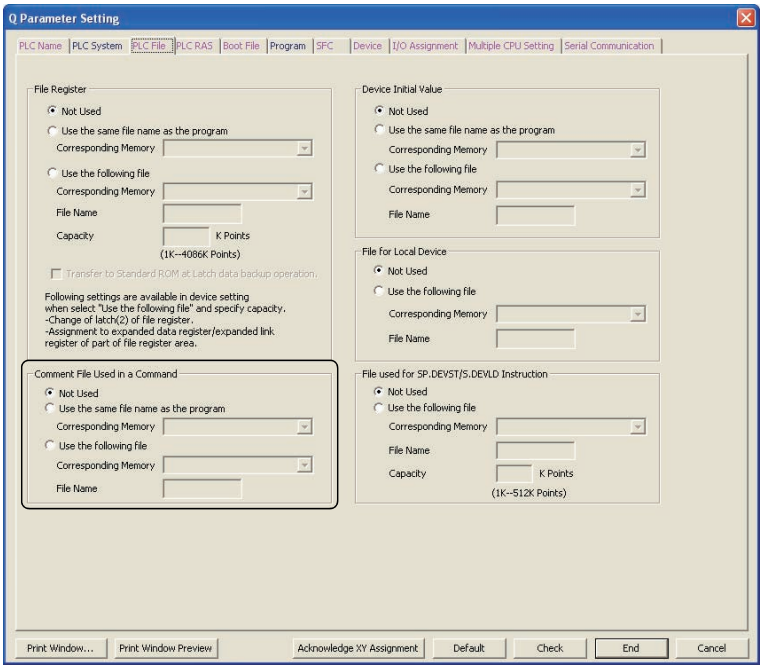
Click and double-click at the position where to set the device comments.



- The devices for which a comment can be given are shown below.

  Device name: X, Y, M, L, F, SM, B, SB, V, T (current value), C (current value), ST (current value), D, SD, W, SW, R, ZR, P, I, U□\G□, J□\X, J□\Y, J□\B, J□\SB, J□\W, J□\SW, BL□\S, BL□\TR (when the comments for P and I are used as pointers for a subroutine program and interrupt program, the comments are not displayed. To display the comment, use a pointer statement. (Refer to (6))

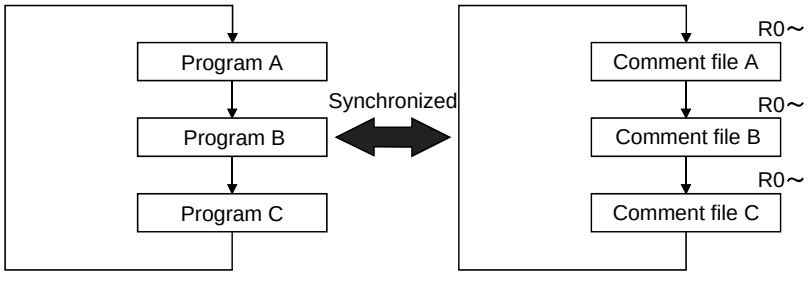
(b) When device comment files are written in the CPU, select a valid device comment file with the parameter to use the comment with the application instruction (COMRD).
Set the setting in the "PLC File" tab of the PLC parameter in the project data list.



The following lists the setting contents.

1) Not Used
No file register is set by the parameter.
Set this when using a sequence program to specify the comment file to use.
Use the QCDSET instruction to specify the comment file to use.
(For details of the QCDSET instruction, refer to the MELSEC-Q/L Programming Manual Common Instruction.)

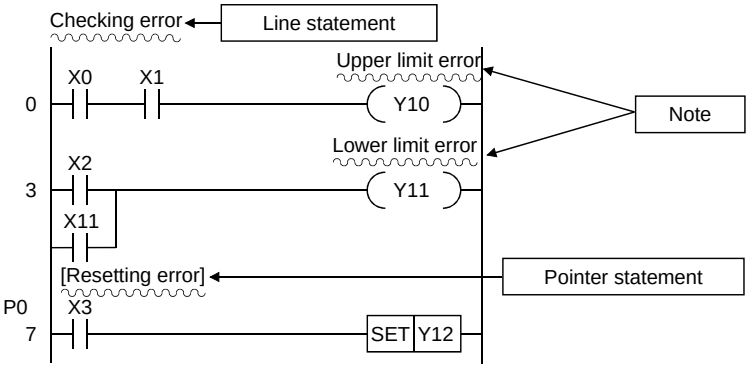
2) Use the same file name as the program
Specify the drive of the memory card.
Every time an execution program is changed, the valid comment file is also changed.



3) Use the following file
Only the comment file specified with the drive and file name is valid.

(6) Statement/note

The statement/note is given for each program step, P, or I pointer to make the program easier to be read.



(a) Set the statement/note on the ladder creation screen.

Click / and double-click at the position where to set the statement/note.

(b) Applications of each comment are as follows.

- Line statement

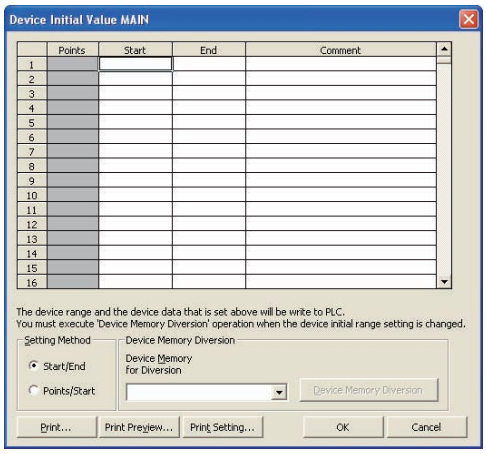
  Describes the meaning and application of a ladder block organized by each function.
- Pointer statement

  Describes the meaning and application of each program corresponding to the pointer set to the start of the subroutine program and interrupt program.
- Note

  Describes the meaning and application of each ladder block.

(7) Device initial value comment

Give a comment for a device initial value file to identify its content. The device initial value comment is stored in the device initial value file. Configure the setting on the Device Initial Value screen in the project data list.

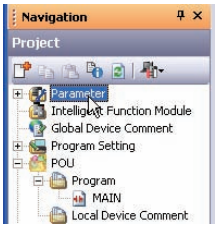


8.4 Appropriate Assignment of Device Points

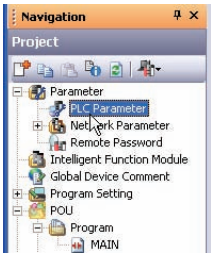
In the ACPU, the device points are fixed.
In the QCPU, the device points to be used can be assigned according to a system appropriately. The following table lists the description.

Item	Description	Setting range	Default value
Number of device points	Set the number of each internal device points.	Up to 32K points for one device can be set within the range of 29K words in total (except for the devices X, Y, S, SB, and SW).	X : 8K points (Fixed) Y : 8K points (Fixed) M : 8K points L : 8K points B : 8K points F : 2K points SB : 2K points V : 2K points S : 8K points T : 2K points ST : 0K points C : 1K points D : 12K points W : 8K points SW : 2K points
Latch range (1) (Latch clear operation enable range)	Set a latch range where the data can be cleared by the latch clear operation.	Only one range can be set for each device.	Blank
Latch range (2) (Latch clear operation disable range)	Set a latch range where the data cannot be cleared by the latch clear operation.	Only one range can be set for each device.	Blank

(1) The following explains how to change the internal relay M to 10K points and the data register D to 1K points (D0 to D500: latch clear operation enable range, D501 to D1023: latch clear operation disable range).



1) Double-click "Parameter" in the project list.



2) Double-click "PLC Parameter".

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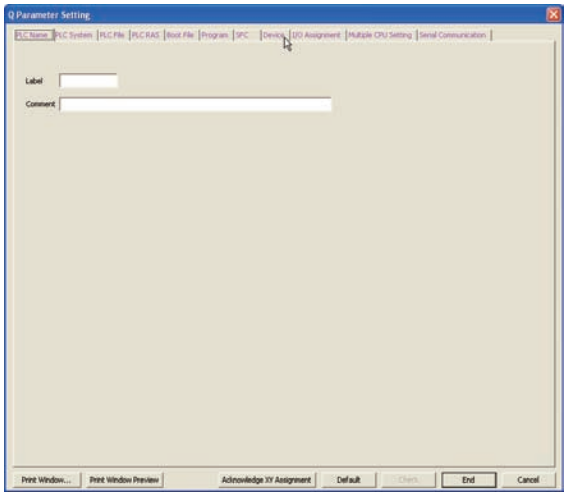

3) The Q Parameter Setting dialog box is displayed. Click the "Device" tab.

	Sym.	Dig.	Device Points	Latch (1) Start	Latch (1) End
Input Relay	X	16	8K		
Output Relay	Y	16	8K		
Internal Relay	M	10	8K		
Latch Relay	L	10	8K		
Link Relay	B	16	8K		
Annunciator	F	10	2K		
Link Special	SB	16	2K		
Edge Relay	V	10	2K		

4) The screen is switched. Click the Internal relay (M) column of Device Points to move the cursor to the column.

	Sym.	Dig.	Device Points	Latch (1) Start	Latch (1) End
Input Relay	X	16	8K		
Output Relay	Y	16	8K		
Internal Relay	M	10	10K		
Latch Relay	L	10	8K		
Link Relay	B	16	8K		
Annunciator	F	10	2K		
Link Special	SB	16	2K		
Edge Relay	V	10	2K		

5) Enter "10K" and press the Enter key.

Step Relay	S	10	8K		
Timer	T	10	2K		
Retentive Timer	ST	10	0K		
Counter	C	10	1K		
Data Register	D	10	12K		
Link Register	W	16	8K		
Link Special	SW	16	2K		
Index	Z	10	20		
Device Total	28.9	K Words	The total number of		

6) Click the Data Register (D) column of Device Points to move the cursor to the column.

Step Relay	S	10	8K		
Timer	T	10	2K		
Retentive Timer	ST	10	0K		
Counter	C	10	1K		
Data Register	D	10	1K		
Link Register	W	16	8K		
Link Special	SW	16	2K		
Index	Z	10	20		
Device Total	17.9	K Words	The total number of Latch(1) : Able to cl		

7) Enter "1K" and press the Enter key.

Step Relay	S	10	8K		
Timer	T	10	2K		
Retentive Timer	ST	10	0K		
Counter	C	10	1K		
Data Register	D	10	1K	0	
Link Register	W	16	8K		
Link Special	SW	16	2K		
Index	Z	10	20		
Device Total	17.9	K Words	The total number of		

8) The cursor is moved to the Data Register column of Latch (1) Start. Enter "0" and press the Enter key.

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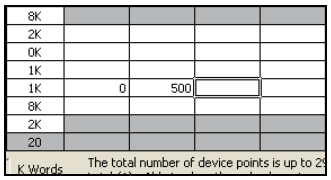
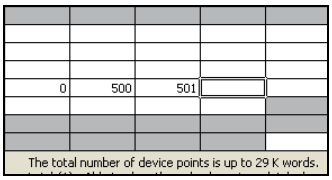
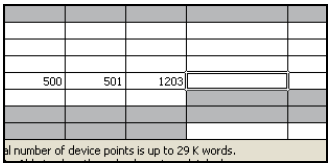


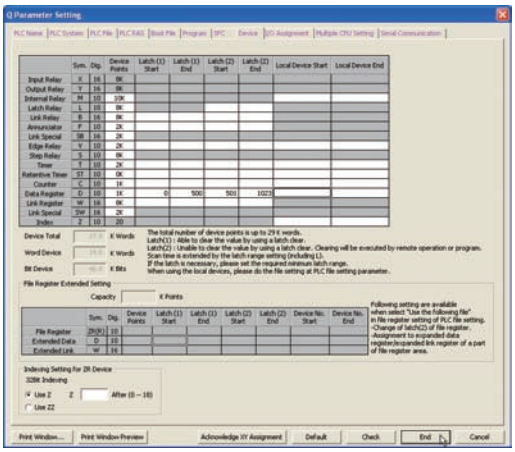
9) Enter "500" and press the Enter key to set the end address.



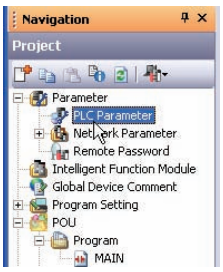
10) Enter "501" and press the Enter key to set the start address of the latch clear operation disable range.



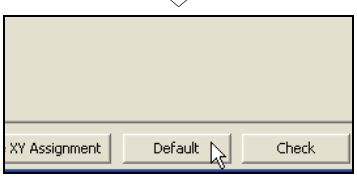
11) Enter "1023" and press the Enter key to set the end address.



12) Click the End button to accept the setting.
The device points are set.



13) The parameter must be initialized not to affect other exercises.
Double-click "PLC Parameter" in the project list.



14) The Q Parameter Setting dialog box is displayed.
Click the Default button after checking the "Device" tab is activated.

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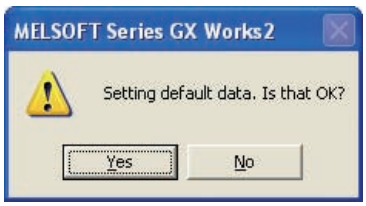
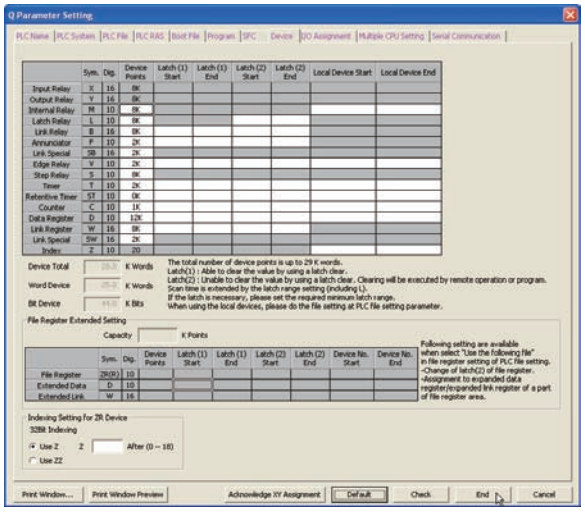


15) Click the Yes button.



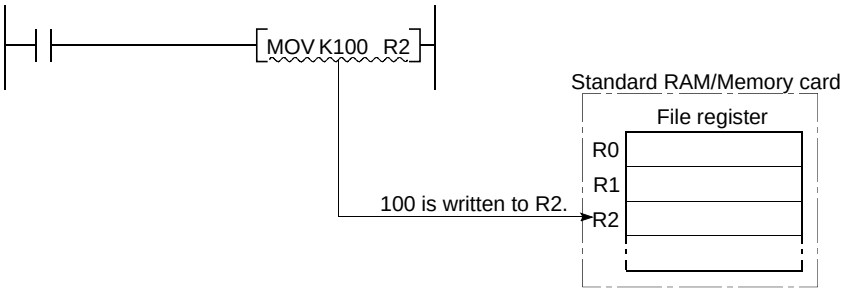
10) Click the End button.
The device setting is returned to the default.

POINT
(Internal user) When the device assignment range is changed, the sequence program created with the parameter before the change cannot be used as it is. After the change, the sequence program and parameter must be written to the CPU again.

8.5 Using File Register

The file register is a register extended from the data register (D).
Normally, the file register is used with the standard RAM or memory card.

The file register is stored in the standard RAM of the QCPU or a memory card installed on the QCPU in a file format.



Accesses available for the file register vary for each memory.

Access method		Standard RAM	SRAM card	Flash card
Writing program		○	○	×
Reading program		○	○	○
Writing device memory to programmable controller		○	○	×
Reading device memory from programmable controller		○	○	○
Data modification	Online test operation from GX Works2	○	○	×
	Writing data to programmable controller with GX Works2	○	○	×
	Writing data to programmable controller with GX Works2 (flash ROM)	×	×	○
	Batch-writing with a serial communication module	○	○	×
	Writing data with GOT1000 series	○	○	×
	Random write command from GOT1000 series	○	○	×

8.5.1 Preparation for using file register

(1) Selecting the file register

Set the file register to be used in a memory card in the sequence program in the "PLC File" tab of the PLC parameter in GX Works2.

(a) When selecting "Not Used"

Set this when using a sequence program to specify the file register to use. Use the QDRSET instruction to specify the comment file to use.

(b) When selecting "Use the same file name as the program"

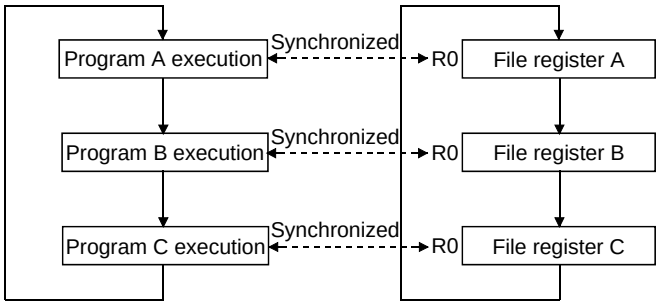
Set this when using the file register with the same file name as the sequence program independently. When the program is switched, the name of the file register is automatically changed to the same name as the program.

This is useful when the file register is used for one program as a local device independently.

Ex.

When each of file registers A to C has the same name with the corresponding one of the programs A to C, the operation is as described below.

- During execution of program A · · · · · Accessing file register A
- During execution of program B · · · · · Accessing file register B
- During execution of program C · · · · · Accessing file register C

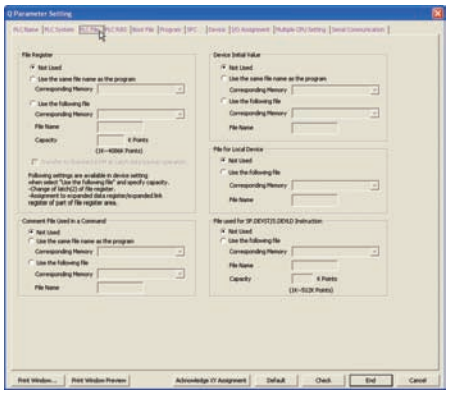


(c) When selecting "Use the following file"

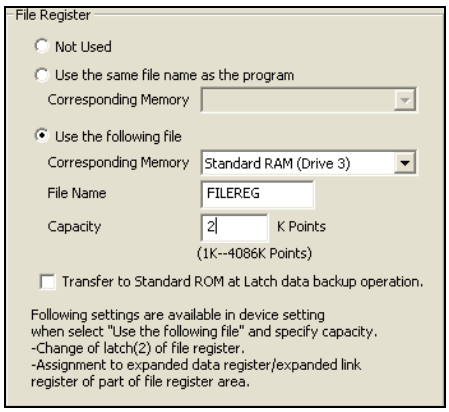
Set this when one file register is to be shared by all programs.

With "Corresponding Memory", "File Name", and "Capacity" set corresponding to the file register to be used, a file of the file register specified by the parameter is created when the QCPU starts to run.

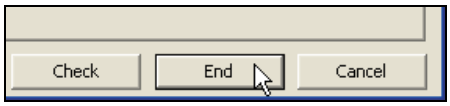
In this exercise, set the file register in the standard RAM.



1) Click the "PLC File" tab on the Q Parameter Setting dialog box.



2) Select "Use the following file" of "File Register" and set the following items.
Corresponding Memory: "Standard RAM (Drive 3)"
File Name: "FILEREG" (Example)
Capacity: "2" (Example)



3) Click the End button.

(2) Registration to the QCPU

(a) When "Not Used" or "Use the same file name as the program" is selected in the "PLC File" tab of the PLC parameter setting in GX Works2, the file register files are required to be registered to the QCPU.
The registration is not required when "Use the following file" is selected.

(b) To register the file register files to the QCPU, set the file name and file register size in the "PLC File" tab of the PLC parameter in GX Works2 and write it to the QCPU.
Set the file register size is from ZR0 in units of 1K points (1024 points).

POINT

Precautions for when the file register is unregistered or exceeds the registered size

(1) When the file of the file register is not registered
Writing/reading data to/from the file register causes the "OPERATION ERROR" (error code: 4101).

(2) Writing/reading data to/from the file register exceeding the registered size (points)
Writing/reading data causes the "OPERATION ERROR" (error code: 4101).

(3) Register size check

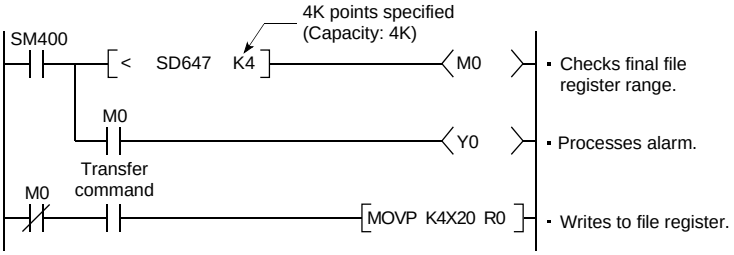
(a) When writing/reading data to/from the file register, check the file register size so that data can be written or read within the size (points) set for the CPU module.

(b) The available file register size can be checked in the File register capacity area (SD647).
The file register size in units of 1K points is stored in SD647.
(The points 1K or less are rounded off.)

(c) File register size checking procedure
1) Check the file register size to be used.
2) Check that the total file register size set in SD647 on the sequence program is sufficient for the points to be used.

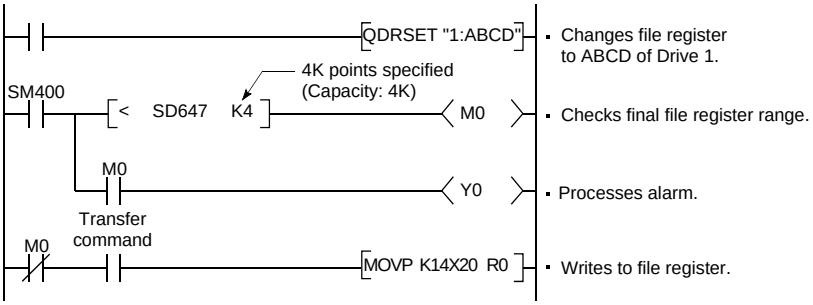
[Program example 1]

When checking the file register range used at the beginning of each program



[Program example 2]

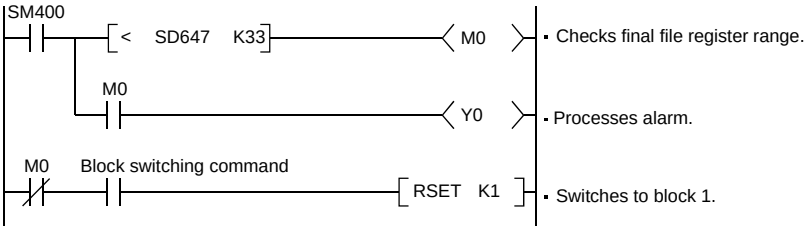
When checking the file register range used after execution of the QDRSET instruction



*: When a file of the file register is switched, the file register size of the currently selected file is stored in SD647.

[Program example 3]

When switching a block

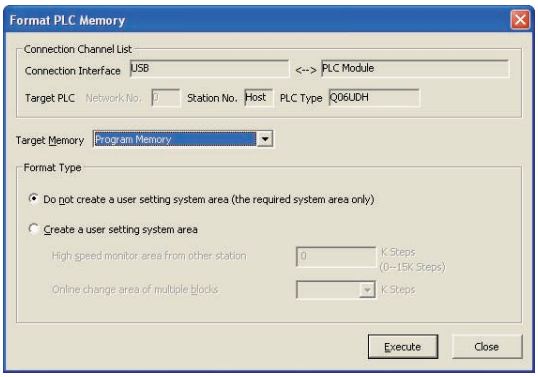


*: Before switching the file register block with the RSET instruction, confirm that the block after the switching has the size of 1K points or more.

(File register size) > [32K points × (Switching block No.) + 1K points]

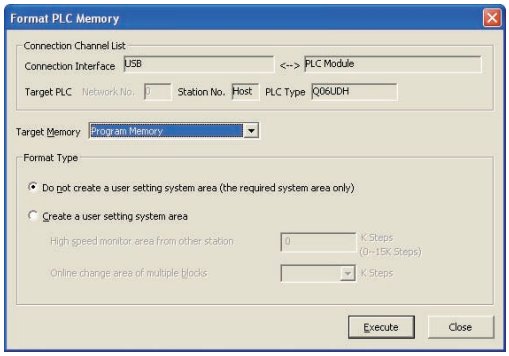
(4) Memory card format

In this exercise, store the file register in the standard RAM.
Therefore, format the standard RAM as preparation.



1) Click [Online] → [PLC Memory Operation] → [Format PLC Memory] of GX Works2, and select "Standard RAM" for "Target Memory" and click the Execute button.

2) Click the Yes button.



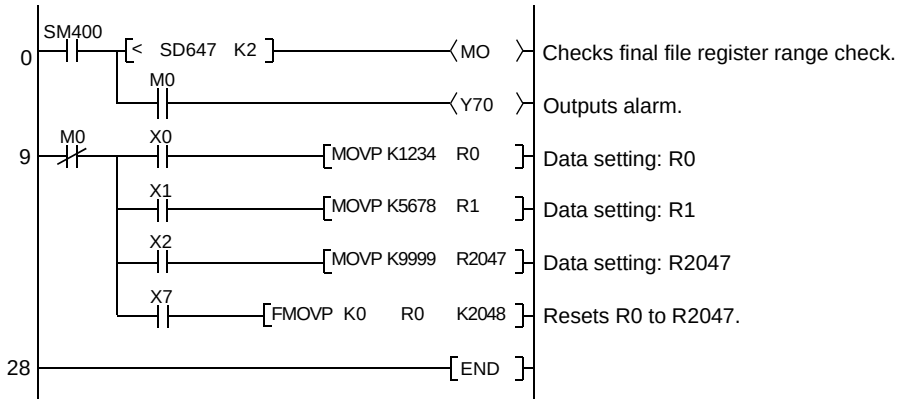
3) Click the Close button.

8.5.2 Operation check

(1) Creating a program for operation check

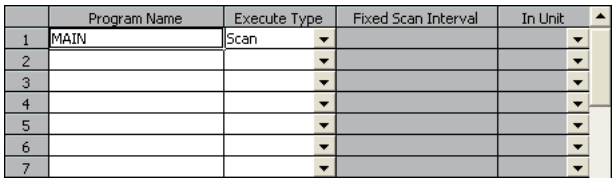
Create the following program to check the operation easily.

Project name	Applied 6
Program name	FILEREG



(2) Program setting

Configure the setting as shown below in the "Program" tab of the PLC parameter in the project data list.



(3) Writing data to the programmable controller

Write the program (MAIN) and parameter to the CPU.

> POINT
>
> Select "Program Memory" for the target memory when writing the program and parameter to the programmable controller.

(4) Operation check

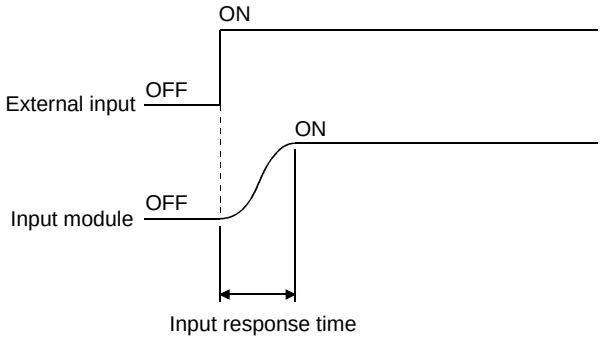
Run the CPU to check the operation on the ladder monitor.

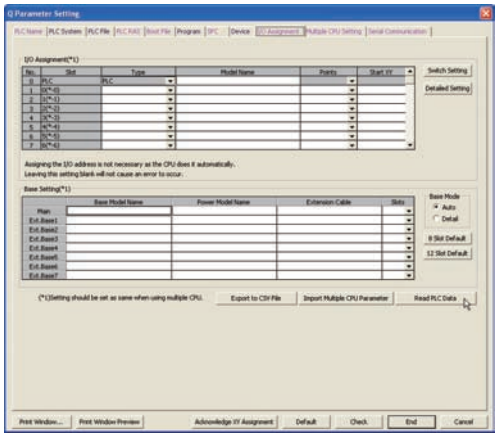
- The register R is set when X0, X1, and X2 are turned on.
- The register R is reset when X7 is turned on.

In addition, check the value set when X0, X1, and X2 are turned on is not cleared by the reset or latch clear of the CPU.

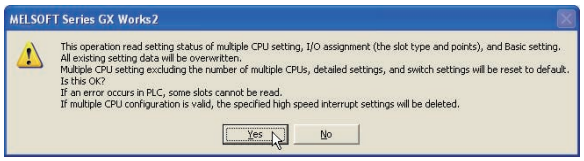
8.6 Input Response Speed Change

For the input, high-speed input, and I/O combined module, the input response speed can be set individually with the parameter setting of GX Works2.
The input module imports external inputs in the set input response time.

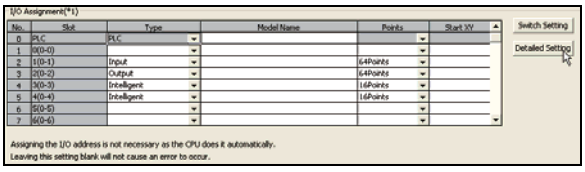




1) Click the "I/O Assignment" tab of the Q Parameter Setting dialog box.
Read the mounting status of the programmable controller.
Click the Read PLC Data button.



2) Click the Yes button.



3) Click the Detailed Setting button.

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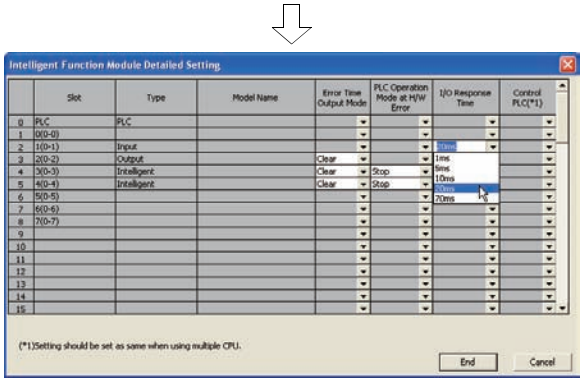
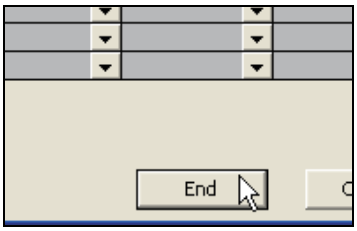
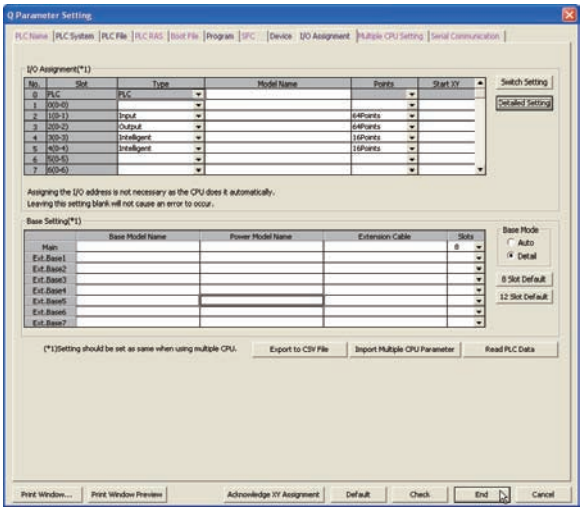


4) Select I/O Response Time.
Select 20ms.



5) Click the End button.



6) Click the End button of the Q Parameter Setting dialog box.

Write the PLC parameter set above with the program to the CPU.

CHAPTER 9 PROGRAMMING INTELLIGENT FUNCTION MODULE

On QCPUs, some functions are not supported or are limited in use. Intelligent function modules support those functions instead of QCPUs.
Therefore users need to select an intelligent function module that is appropriate for the purpose involved.
QCPUs are compatible with QCPU-compatible intelligent function modules.
The following table shows examples of the intelligent function modules.

Table 9.1 Example of intelligent function module

Name	Number of I/O occupied points	Function	Module current consumption
Analog-digital converter module (Q64AD)	16 points	Input module that converts; 0 to 20mA → 0 to 4000 (in standard resolution mode), 0 to ±10V → 0 to ±4000 (in standard resolution mode)	5VDC 0.63A
Digital-analog converter module (Q62DAN)	16 points	Output module that converts; 0 to 4000 → 0 to 20mA (in standard resolution mode), 0 to ±4000 → 0 to ±10V (in standard resolution mode)	5VDC 0.33A 24VDC 0.12A

9.1 Communication with Intelligent Function Module

The following table shows the communication methods between a QCPU and an intelligent function module.

Table 9.2 Communication method with intelligent function modules

Communication method	Function	Setting method
Initial setting, Auto refresh setting	Performs initial settings and auto refresh settings of intelligent function modules. These settings allow writing/reading data to/from intelligent function modules regardless of communication program creation or buffer memory address. Ex.) When A/D converter module Q64AD is used • Initial setting : • A/D conversion enable/disable setting • Sampling/averaging processing specification, • Time average/number of times average specification, • Average time/average number of times specification (Set data in auto refresh settings is stored to the intelligent function module parameter on a QCPU.) • Auto refresh setting : Set a device on a QCPU to store the following data to. • Digital output from Q64AD • Maximum and minimum values of Q64AD • Error code (Set data in auto refresh settings is stored to the intelligent function module parameter on a QCPU.)	Use GX Works2.
Device initial value	Writes set data in device initial settings of intelligent function modules to the intelligent function modules at the following timings. • At power-on of a QCPU • At reset • At switching from STOP to RUN	Use GX Works2 to specify the range for intelligent function module devices (U□\G□).
FROM/TO instruction	Read or write data from or to the buffer memory on an intelligent function module.	Use this instruction in a sequence program.
Intelligent function module device (U□\G□)	Directly handles the buffer memory on an intelligent function module as a device of a QCPU. Unlike "FROM/TO instruction", this requires only one instruction for processing data that is read from an intelligent function module.	Specify this device as a device in a sequence program.
Intelligent function module dedicated instruction	Used to simplify programming for using the functions of intelligent function modules.	Use this instruction in a sequence program.

9.1.1 Various settings with GX Works2

(1) Switch setting, parameter setting, and auto refresh setting of the intelligent function module

Configuring the switch setting, parameter setting, and auto refresh setting of the intelligent function module enables writing or reading data without creating a communication program which communicates with the intelligent function module.

Also, various settings are available regardless of the buffer memory address of the intelligent function module.

(2) Setting with GX Works2

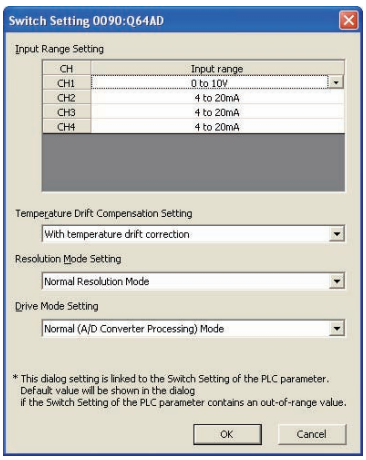
The following explains the switch setting, parameter setting, and auto refresh setting of the A/D converter module Q64AD.

(a) Switch setting

Configure the switch setting of the intelligent function module.

This setting is reflected in the I/O assignment setting of the PLC parameter.

[Switch setting screen]



The set switch setting data is stored in the intelligent function module.

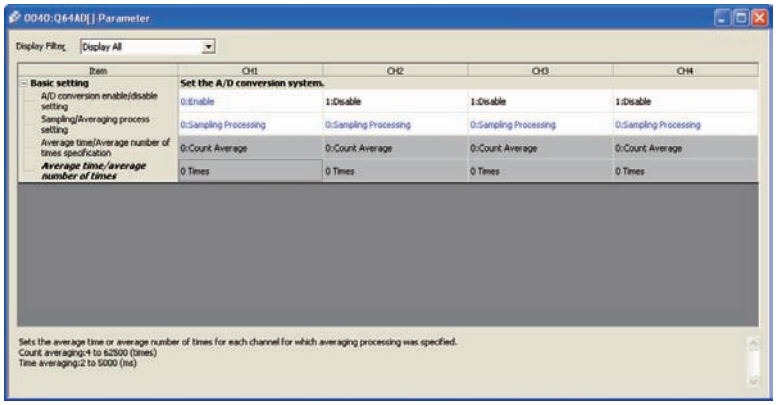
(b) Parameter setting

The initial setting of Q64AD includes the following four types.

- A/D conversion enable/disable setting
- Sampling/averaging processing specification
- Time average/number of times average specification
- Average time/average number of times specification

Configure the initial setting of Q64AD in the following screen.

[Initial setting screen]



The set parameter setting data is stored in the intelligent function module.

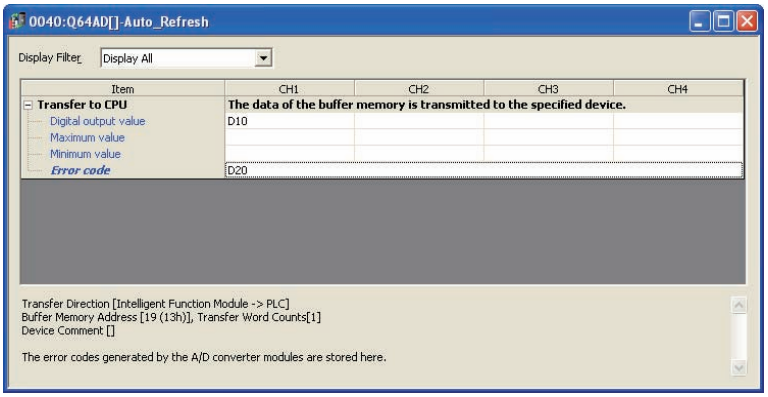
(c) Auto refresh setting

In the auto refresh setting, set the QCPU-side device for storing the following data.

- Digital output from Q64AD
- Maximum and minimum values of Q64AD
- Error code

Configure the auto refresh setting of Q64AD in the following screen.

[Auto refresh setting screen]



The set auto refresh setting data is stored in the intelligent function module.

9.1.2 Communications by the intelligent function module device

(1) Intelligent function module device (U□\G□)

The intelligent function module device represents the buffer memory of the intelligent function module as one of the QCPU module devices.

Both of the following are available; directly reading the data stored in the buffer memory of the intelligent function module and writing data to the buffer memory.

(2) Difference from the FROM/TO instruction

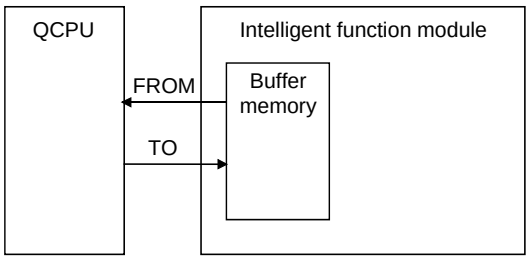
Since the intelligent function module device can be recognized as a device of the QCPU, reading data from the intelligent function module can be processed with one instruction.

The processing speed is the total of the instruction execution time and the access time with the intelligent function module.

(3) FROM/TO instruction

The FROM instruction stores data read from the buffer memory of the intelligent function module to the specified device.

The TO instruction writes data stored in the specified device to the buffer memory of the intelligent function module.



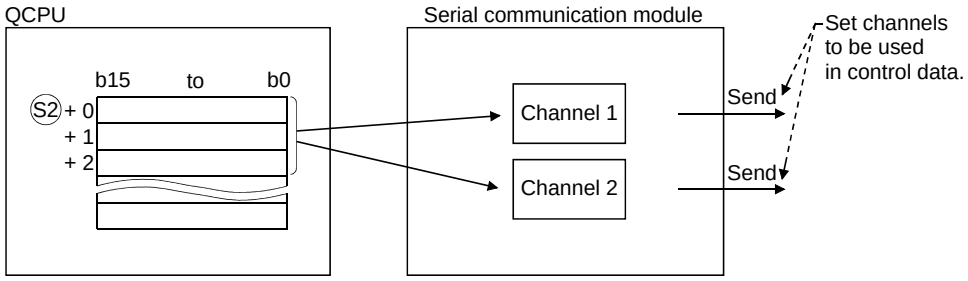
POINT

When reading the data of the intelligent function module for several times in a program, use the FROM instruction at one place and store the data to the data register instead of using the intelligent function module device for every time.
The reason is that the intelligent function module accesses the intelligent function module every instruction execution, which extends the scan time of the program.

9.1.3 Communications with the intelligent function module dedicated instruction

This instruction enables easy programming for using functions of the intelligent function module.

For example, the serial communication module dedicated instruction (OUTPUT instruction) allows a data communication in a user-optional message format by nonprocedural protocol.



For the intelligent function module dedicated instruction and the completion device, refer to the user's manual of the intelligent function module to be used.

REMARK

The following table lists the communication timings in the communication methods mentioned above.

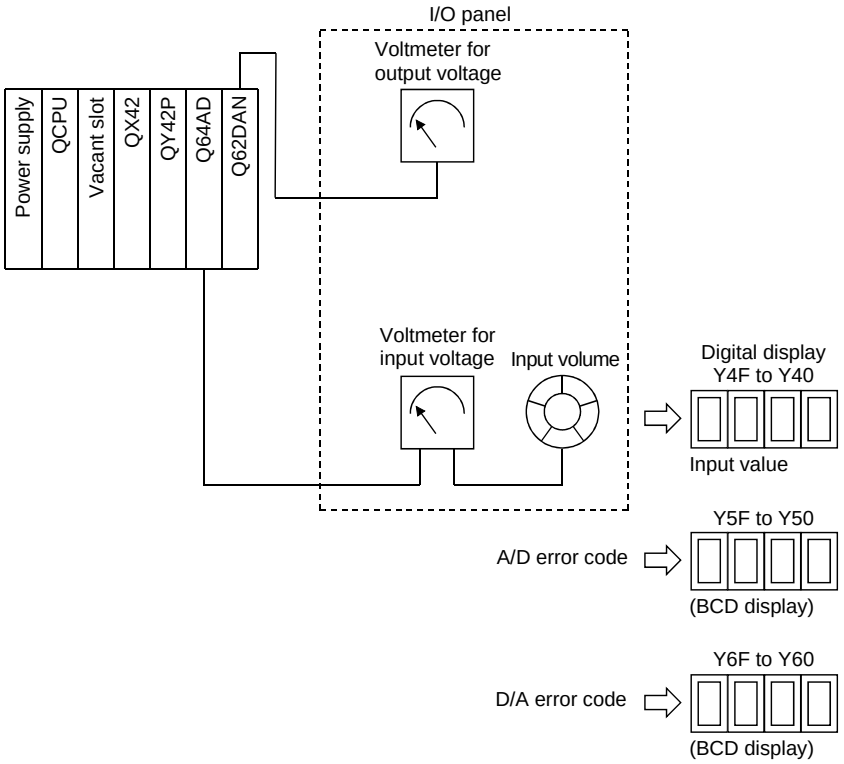
Communication methods with the intelligent function module	Communication timing				
	Power on	QCPU reset	STOP → RUN	Instruction execution	END processing
Initial setting	○	○	○	--	--
Auto refresh setting	--	--	--	--	○
Device initial value	○	○	○	--	--
Program created with the FROM/TO instruction	--	--	--	○	--
Program created with the intelligent function module device	--	--	--	○	--
Program created with the intelligent function module dedicated instruction	--	--	--	○	--

9.2 Intelligent Function Module System in Demonstration Machine

9.2.1 Creating an exercise program

System configuration of exercise machine

(1) Configuration



(2) Program conditions

<A/D conversion>

The Q64AD executes a sampling processing on analog voltages through CH1, and converts the analog values to digital values.

When the A/D error occurs, the error code is output to the 7-segment display.

(a) Initial setting

- A/D conversion enable channel : CH1

(b) Devices used by users

- A/D error code reset signal : X0
- Digital conversion value input from CH1 of the A/D converter module : D10, Y40 to Y4F
- A/D error code display : D20, Y50 to Y5F

<D/A conversion>

The Q62DAN reduces the digital conversion value of the Q64AD to half and outputs the value from CH1.

When the D/A error occurs, the error code is output to the 7-segment display.

(a) Initial setting

- D/A analog output enable channel : CH1

(b) Devices used by users

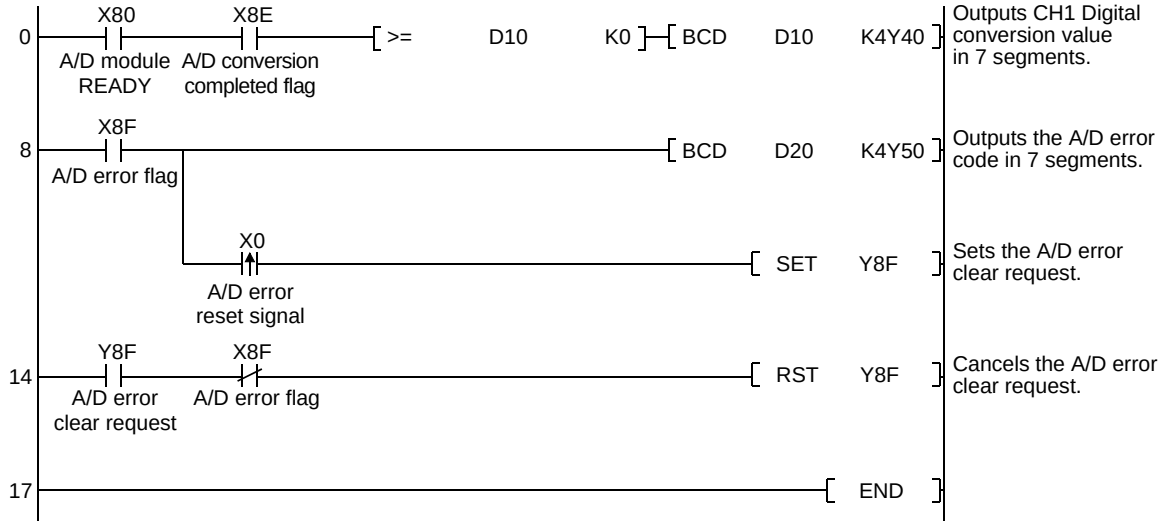
- D/A error code reset signal : X1
- Digital output enable signa : X8
- Digital value output from CH1 of the D/A converter module : D30
- D/A error code display : D40, Y60 to Y6F

(3) A program to be created

Create the following programs to check operation easily.

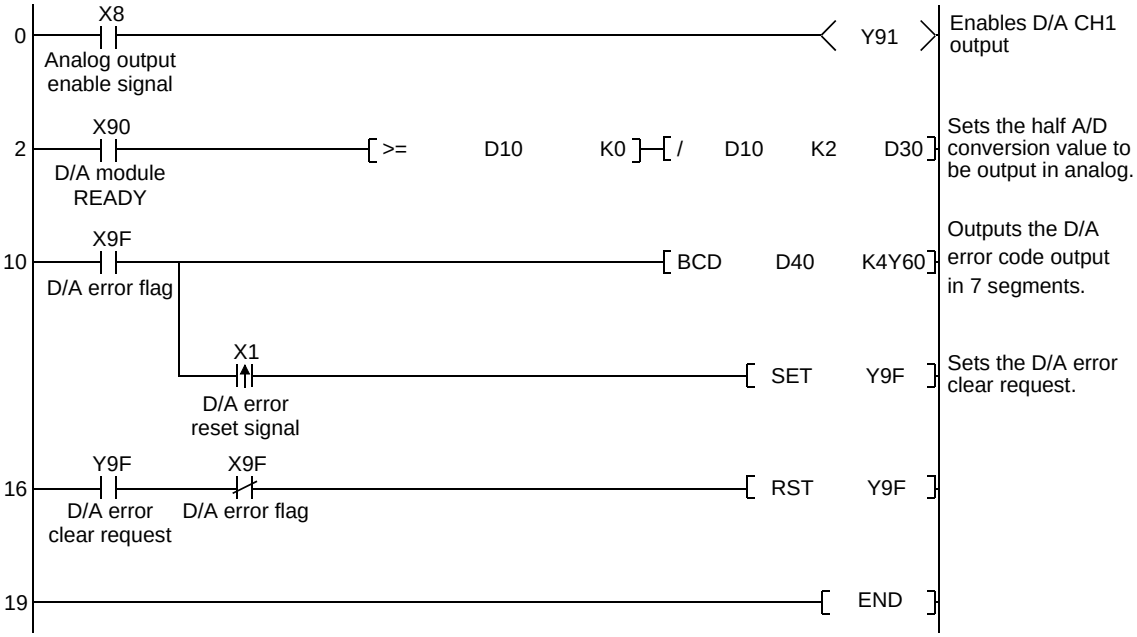
<For A/D conversion>

Project name	Applied 7
Program name	AD



<For D/A conversion>

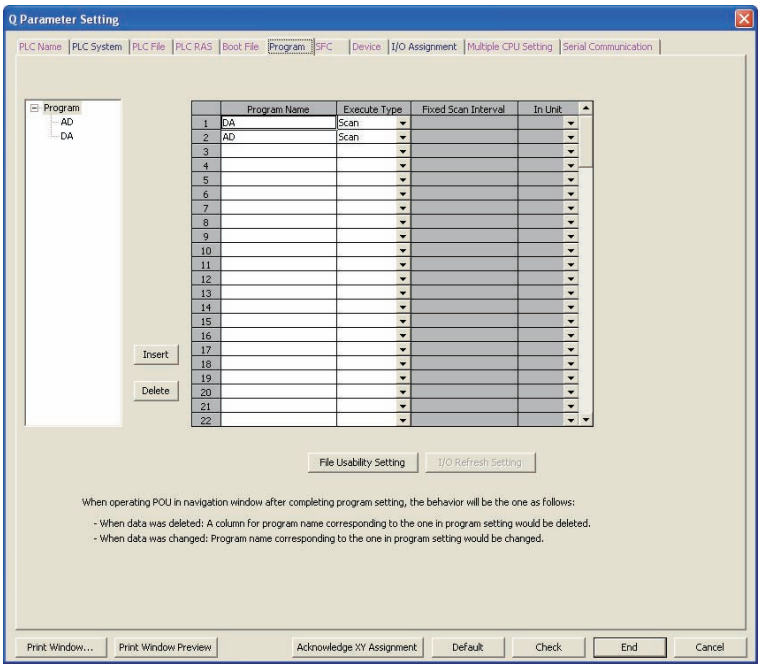
Project name	Applied 7
Program name	DA



REMARK
When the A/D conversion value is negative, an operation error occurs at the BCD instruction execution. (Refer to section 8.1.1 (2))

(4) Program setting

Configure the setting as shown below in the "Program" tab of the PLC parameter in the project data list.



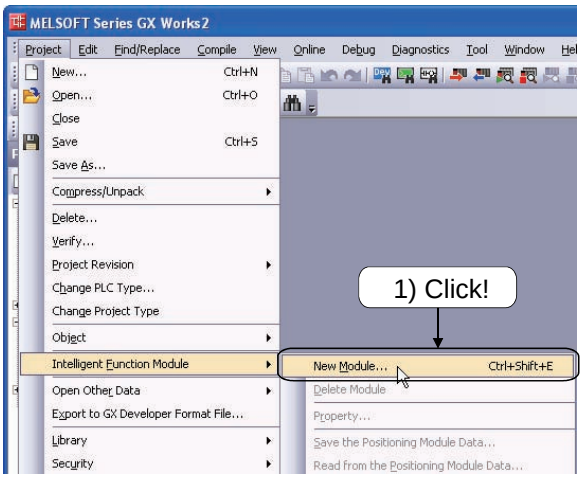
9.2.2 Switch setting, parameter setting, and auto refresh setting for the intelligent function module

For Q series, the switch setting for the intelligent function module is configured in the I/O assignment settings of GX Works2.
The intelligent function module switches consist of switches 1 to 5 and are set with 16-bit data.
All the default settings of the switches 1 to 5 are 0.

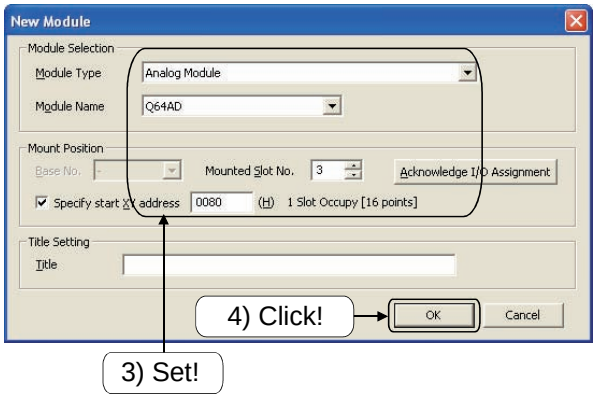
(1) Adding and setting the intelligent function module data

This section explains how to set the intelligent function module data.
After an intelligent function module is added to a project, the data settings (parameters and switch settings) of the intelligent function module can be set.

(a) Adding and setting method for Q64AD



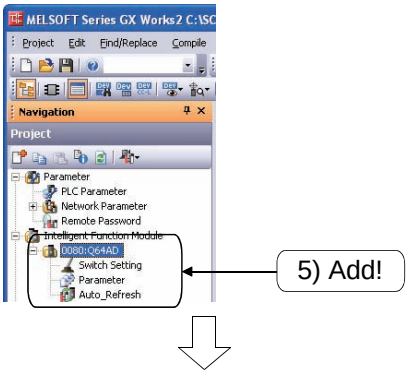
1) Click [Project] → [Intelligent Function Module] → [New Module].



2) The New Module dialog box is displayed.

3) Set the A/D converter module setting as follows.
Module Type : Analog Module
Module Name : Q64AD
Mounted Slot No. : 3
(Specify start XY address: 0080)

4) Click the OK button.



5) The specified intelligent function module data are added to the Project window.

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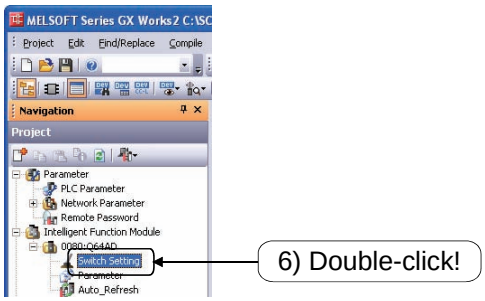
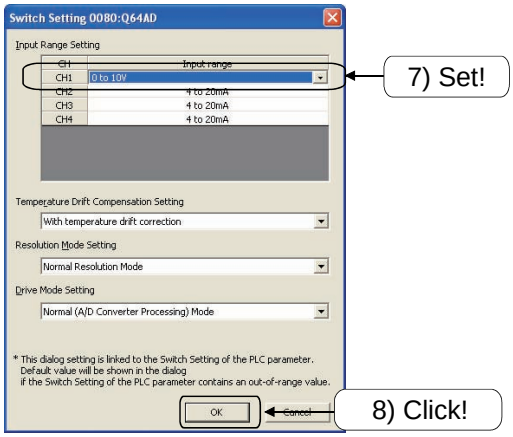
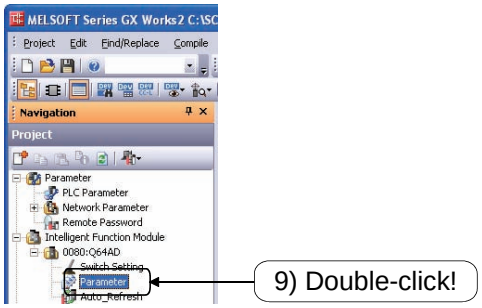


6) Double-click Switch Setting.

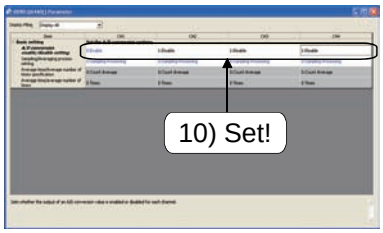


7) The Switch Setting screen is displayed.
Set Input range for CH1 to "0 to 10V".

8) Click the OK button.



9) Double-click Parameter.



10) The Parameter screen is displayed.
Set "A/D conversion enable/disable setting" for CH2 to CH4 to "1:Disable". (Only CH1 is used.)

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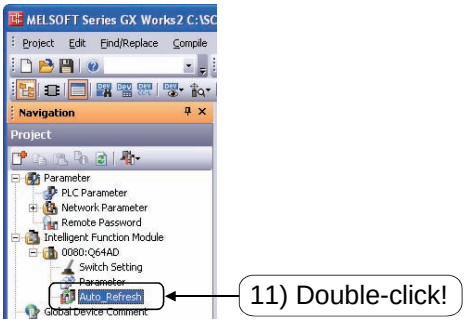
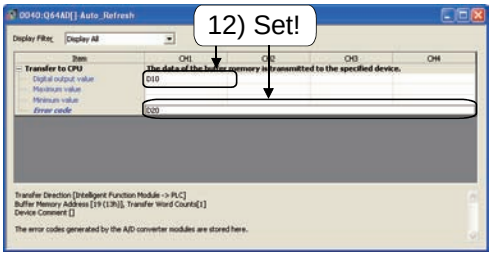
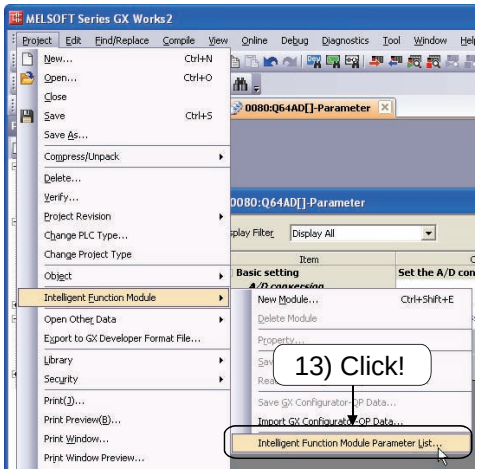


11) Double-click Auto_Refresh.



12) The Auto_Refresh screen is displayed.
Set Digital output value for CH1 to "D10" and Error code for CH1 to "D20".



13) Click [Project] → [Intelligent Function Module] → [Intelligent Function Module Parameter List].

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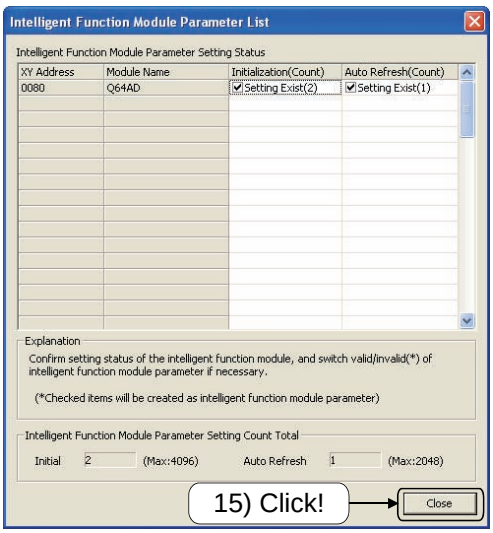
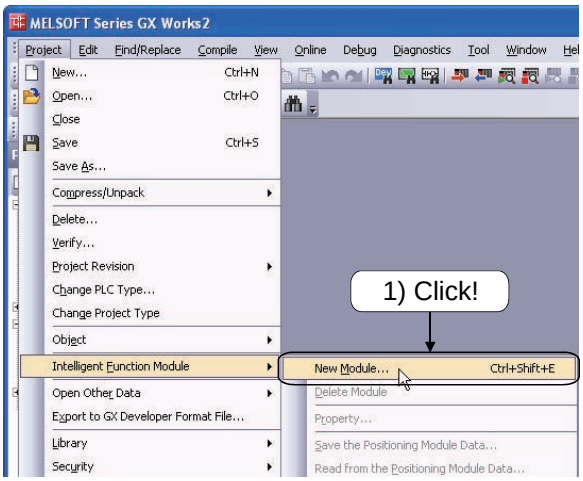


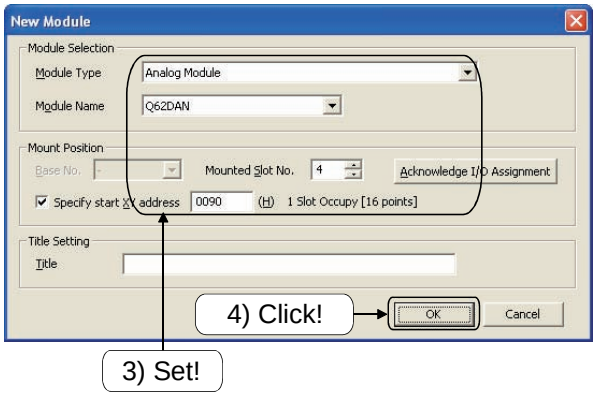
14) Check that "Setting Exist" is checked in Initialization (Count) and Auto Refresh (Count) for Q64AD in the Intelligent Function Module Parameter List dialog box.

15) Click the Close button.

(b) Adding and setting method for Q62DAN



1) Click [Project] → [Intelligent Function Module] → [New Module].



2) The New Module dialog box is displayed.

3) Set the A/D converter module setting as follows.
Module Type : Analog Module
Module Name : Q62DAN
Mounted Slot No. : 4
(Specify start XY address: 0090)

4) Click the OK button.

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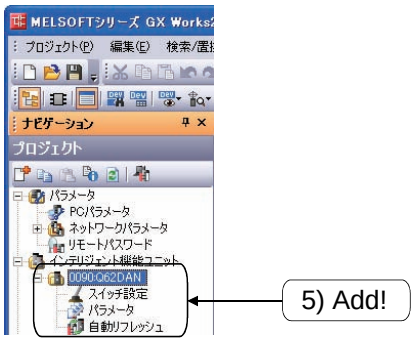
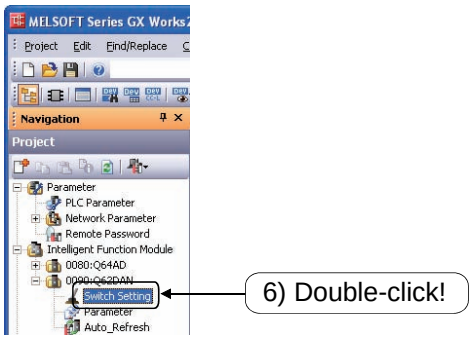
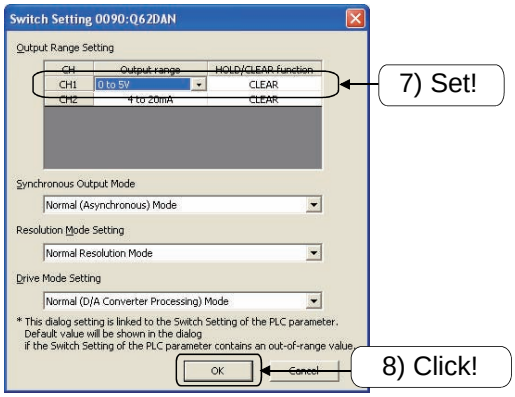


5) The specified intelligent function module data are added to the Project window.

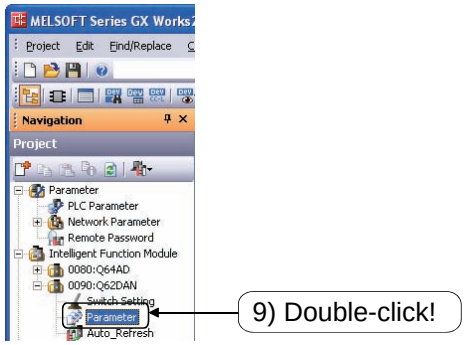


6) Double-click Switch Setting.



7) The Switch Setting screen is displayed.
Set Output range for CH1 to "0 to 5V".

8) Click the OK button.



9) Double-click Parameter.

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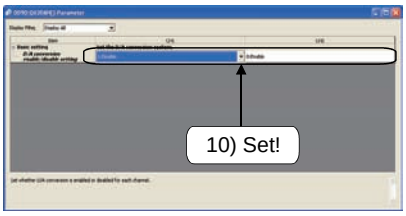
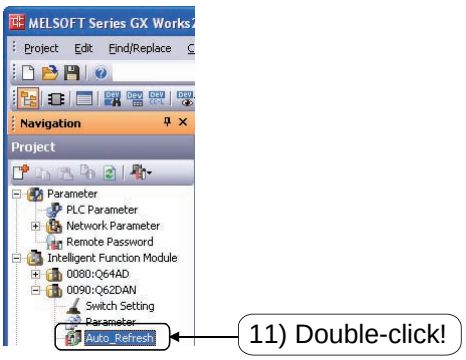
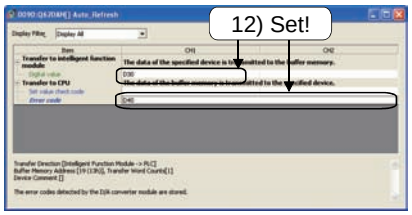


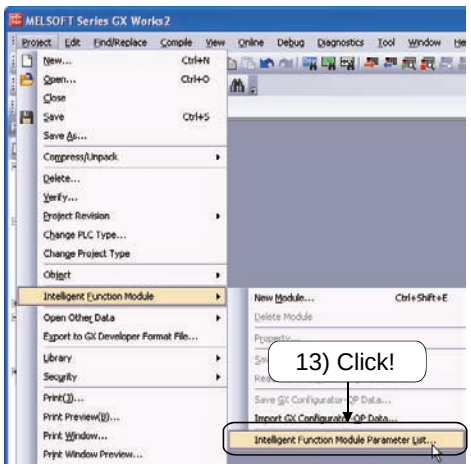
10) The Parameter screen is displayed.
Set "D/A conversion enable/disable setting" for CH1 to "0:Enable". (Only CH1 is used.)



11) Double-click Auto_Refresh.



12) The Auto_Refresh screen is displayed.
Set Digital value for CH1 to "D30" and Error code for CH1 to "D40".



13) Click [Project] → [Intelligent Function Module] → [Intelligent Function Module Parameter List].

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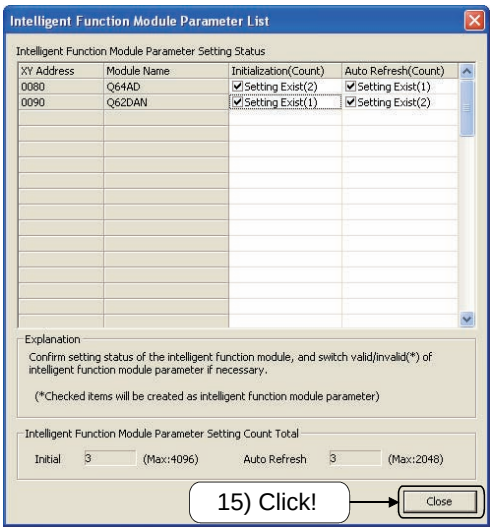


14) Check that "Setting Exist" is checked in Initialization (Count) and Auto Refresh (Count) for Q62DAN in the Intelligent Function Module Parameter List dialog box.

15) Click the Close button.

NOTE

Number of parameter settings for intelligent function modules

The number of parameter settings for intelligent function modules (initial setting and auto refresh) is limited according to the programmable controller CPUs and intelligent function modules to be used. Be sure to set the total number of parameter settings of the intelligent function modules within the maximum number of parameter settings of the programmable controller CPUs.

- Limit for the number of parameter settings of the programmable controller CPUs
  The following table lists the available number of parameter settings for the initial setting and auto refresh that can be set on the programmable controller CPUs.

Application target of intelligent function module		Max. number of parameter settings	
		Initial setting	Auto refresh
Universal model QCPU	Q00UJ, Q00U, Q01U, Q02U	2048	1024
	Q03UD, Q03UDE, Q04UDH, Q04UDEH, Q06UDH, Q06UDEH, Q10UDH, Q10UDEH, Q13UDH, Q13UDEH, Q20UDH, Q20UDEH, Q26UDH, Q26UDEH	4096	2048

- Limit for the number of parameter settings of the intelligent function modules
  The following table lists the available number of parameter settings for the initial setting and auto refresh that can be set on the intelligent function modules.

CPU	Module type	Module model name	Initial setting (fixed)	Auto refresh (max. number of auto refreshes)
QCPU (Q mode)	Analog module	Q64AD	2	13
		Q64DAN	1	5

For details, refer to the GX Works2 Version 1 Operating Manual (Intelligent Function Module).

REMARK

Module switch setting item

Module switch setting item for Q64AD

<table>
<tr><td></td><td colspan="2">Setting item</td></tr>
<tr><td>Switch 1</td><td>Input range setting
□□□□ H
CH4 CH3 CH2 CH1</td><td rowspan="2"><table><tr><th>Analog input range</th><th>Input range setting value</th></tr><tr><td>4 to 20mA</td><td>0H</td></tr><tr><td>0 to 20mA</td><td>1H</td></tr><tr><td>1 to 5V</td><td>2H</td></tr><tr><td>0 to 5V</td><td>3H</td></tr><tr><td>-10 to 10V</td><td>4H</td></tr><tr><td>0 to 10V</td><td>5H</td></tr><tr><td>User range setting</td><td>FH</td></tr></table></td></tr>
<tr><td>Switch 2</td><td>Input range setting
□□□□ H
CH8 CH7 CH6 CH5</td></tr>
<tr><td>Switch 3</td><td colspan="2">Not used</td></tr>
<tr><td>Switch 4</td><td colspan="2">□□□□ H
00H : With temperature drift correction
01 to FFH : Without temperature drift correction
0H : Normal resolution mode
1 to FH : High resolution mode
0H : Normal mode (A/D conversion processing)
1 to FH : Offset/gain setting mode</td></tr>
<tr><td>Switch 5</td><td colspan="2">0: Fixed</td></tr>
</table>

Module switch setting item for Q62DAN

<table>
<tr><td></td><td colspan="2">Setting item</td></tr>
<tr><td>Switch 1</td><td>Output range setting
□□□□ H
CH4 CH3 CH2 CH1</td><td rowspan="2"><table><tr><th>Analog output range</th><th>Output range setting value</th></tr><tr><td>4 to 20mA</td><td>0H</td></tr><tr><td>0 to 20mA</td><td>1H</td></tr><tr><td>1 to 5V</td><td>2H</td></tr><tr><td>0 to 5V</td><td>3H</td></tr><tr><td>-10 to 10V</td><td>4H</td></tr><tr><td>User range setting</td><td>FH</td></tr></table></td></tr>
<tr><td>Switch 2</td><td>Output range setting
□□□□ H
CH8 CH7 CH6 CH5</td></tr>
<tr><td>Switch 3</td><td colspan="2">□□□□ H
CH4 CH3 CH2 CH1
HOLD/CLEAR function setting
0H : CLEAR
1 to FH : HOLD</td></tr>
<tr><td>Switch 4</td><td colspan="2">□□□□ H
00H : Normal mode (non-synchronized)
01 to FFH: Synchronized output mode
0H : Normal resolution mode
1 to FH : High resolution mode
0H : Normal mode (D/A conversion processing)
1 to FH : Offset/gain setting mode</td></tr>
<tr><td>Switch 5</td><td colspan="2">0: Fixed</td></tr>
</table>

9.2.3 Operation check and monitor test

(1) Operation check

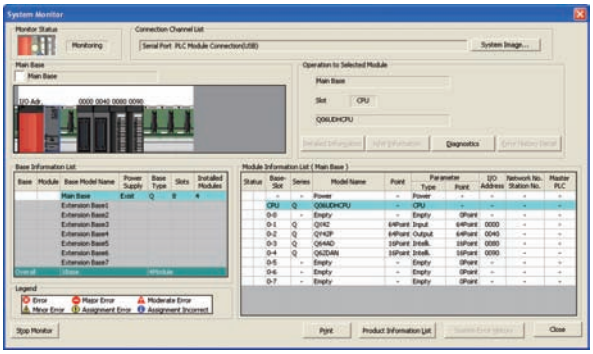
Run the CPU after resetting to validate the written parameters, then check the operation. (Keep the switch of the CPU No. 2 to STOP.)

- Change input voltages for the A/D converter module with the volume on the demonstration machine.
  The digital conversion value is displayed in the 7-segment display (Y40 to Y4F).
- When X8 is turned on, the D/A OUTPUT voltmeter displays the voltage value that the D/A converter module outputs.
  The displayed value is quarter of that of the A/D INPUT voltmeter since the A/D input range is 0 to 10V and the D/A output range is 0 to 5V, and the digital conversion value is operated to half in the CPU.
- When an error occurs, find the cause following (2) Monitor/test described below to solve the error.

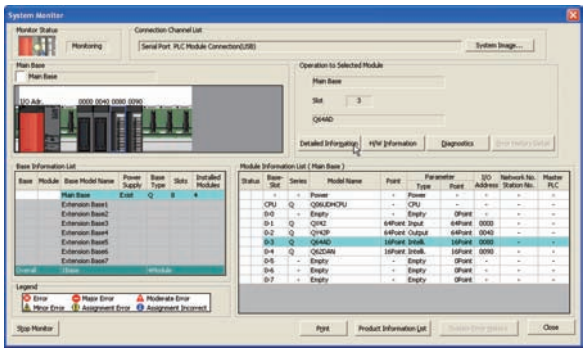
(2) Monitor/test

This section explains how to check the status of the A/D converter module.

(a) Checking method with GX Works2 system monitor



1) Click [Diagnostics] → [System Monitor].



2) Select "Q64AD" of the slot 3 and click the Detailed Information button.
(Or double-click "Q64AD".)

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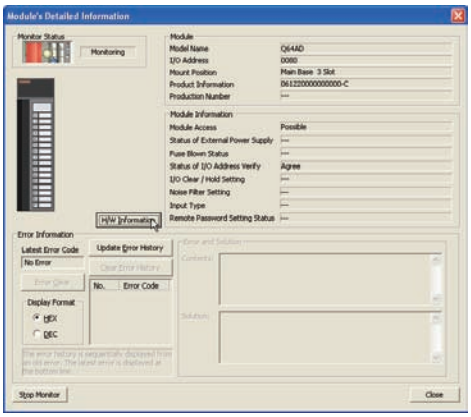
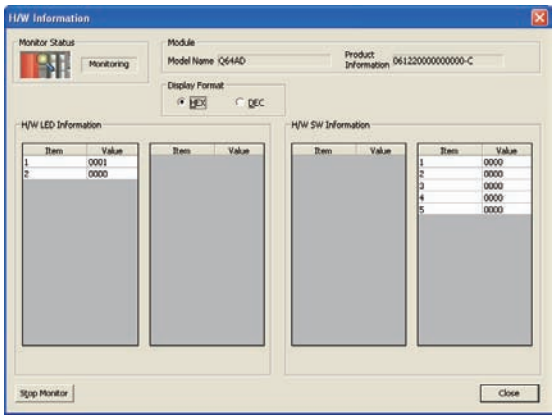


3) The information of the selected module (information of Q64AD here) is displayed.

Click the H/W Information button.



4) The LED status is displayed.

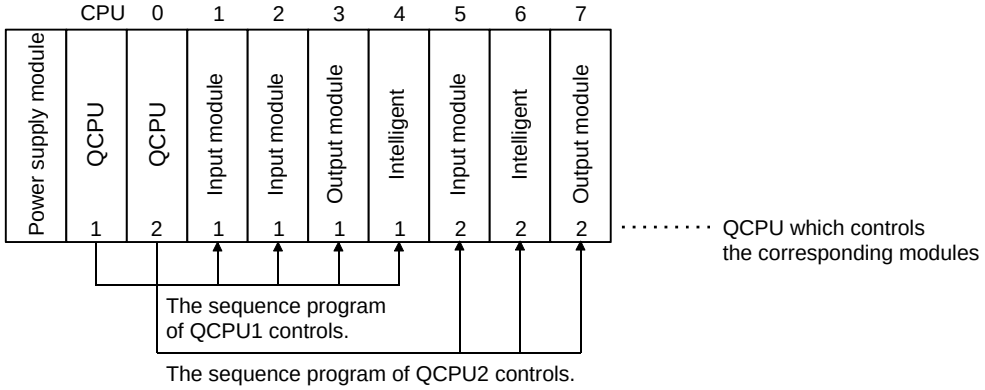
No.	LED name	Status
1	RUN LED	0000H : Off
2	ERROR LED	0001H : On

MEMO

CHAPTER 10 HOW TO USE MULTIPLE CPU SYSTEM

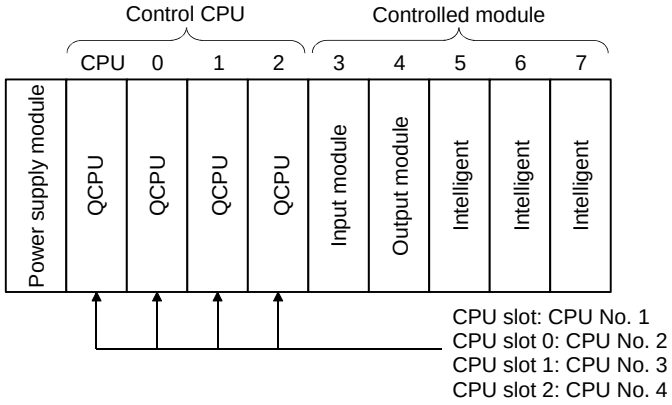
10.1 Overview of Multiple CPU System

A multiple CPU system consists of more than one QCPU/motion CPU (up to 4 modules) which is mounted on a main base unit in order to control I/O modules and intelligent function modules separately.
Using more than one QCPU/motion CPU can distribute load produced by the high-load processing and each processing.



Set each module as follows in the multiple CPU system.

Control CPU	:	QCPU which controls I/O modules and intelligent function modules
Controlled modules	:	I/O modules and intelligent function modules controlled by the control CPU
Non-controlled modules	:	Modules controlled by other CPUs
CPU number	:	Number for identifying multiple QCPUs/motion CPUs mounted on the main base unit. The number 1 is allocated to the CPU slot, and the numbers 2, 3, and 4 are allocated in series.



POINT

- All I/O modules can be used in the multiple CPU system.
- Use the intelligent function module with the function version B in the multiple CPU system.
  Intelligent function modules with the function version A can be used in the multiple CPU system when the CPU No. 1 is set as the control CPU.

10.2 Difference from Single CPU System

This section explains the differences between the single CPU system and the multiple CPU system.

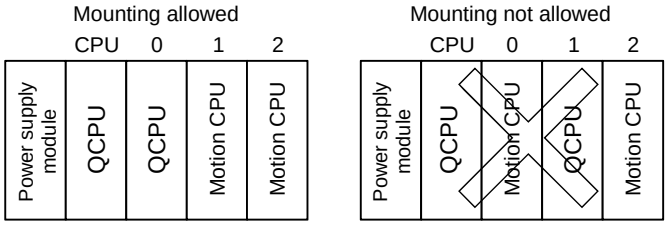
10.2.1 Mounting position of QCPU/motion CPU

(1) Up to four QCPUs can be sequentially mounted from the CPU slot (the right-side slot of the power supply module) to the slot No. 2 of the main base unit.

(2) Motion CPUs (Q17n and Q17nH) can be mounted together on the right-side slots of the QCPU.

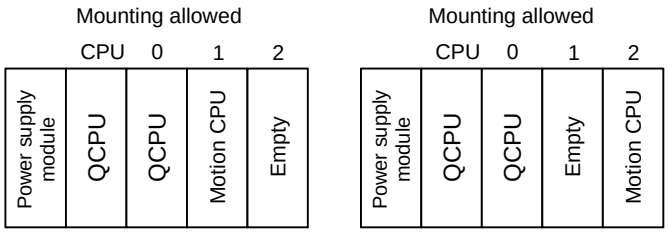
a) Note that the mountable motion CPUs differ according to the model of the Universal model QCPU. For details, refer to chapter 3 of the QCPU User's Manual (Multiple CPU System).

b) The High Performance Model QCPUs or Process CPUs cannot be mounted on the right-side slot of the motion CPUs.



(3) Empty slots can be reserved for future addition of a QCPU/motion CPU (Q17nD). Select the number of CPU modules including an empty slot and set the type of the right-end slot to "PLC (Empty)" in the I/O assignment setting of the PLC parameter.

For the Universal model QCPU (QnUCPU), "PLC (Empty)" can be set between the CPU modules.
Therefore, when a CPU module is added to the system, the CPU No. is not changed, and changing the program is unnecessary.



10.2.2 I/O number assignment of the multiple CPU system

The multiple CPU system is different from the single CPU system in the position (slot) of I/O number 0H.
However, the concept of the order of allocating I/O numbers for the extension base unit, I/O numbers for each slot and empty slots is the same for both types.

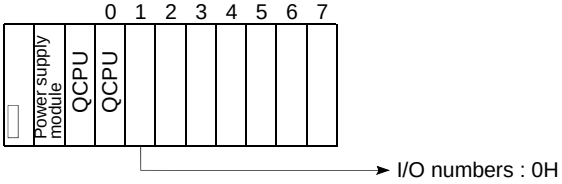
(1) Position of I/O number "0H"

(a) The number of slots set with the multiple CPU setting of the PLC parameter are occupied by QCPU/motion CPU in the multiple CPU system.

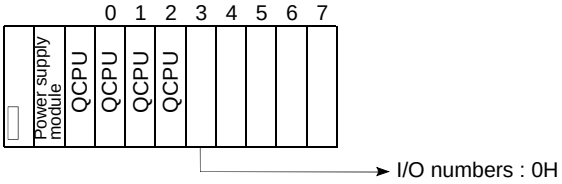
(b) I/O modules and intelligent function modules are mounted from the right of the slots occupied by QCPU/motion CPU modules.

(c) The I/O number for an I/O module or intelligent function module mounted to the next slot to the slot occupied by QCPU/motion CPU is set as "0H" and consecutive numbers are allocated sequentially to the right.

1) QCPU: Two CPU modules are mounted



2) QCPU: Four CPU modules are mounted



10.2.3 Communication between QCPUs and modules

(1) Communication to controlled module/non-controlled modules

The I/O module and intelligent function module controlled by the host CPU can be controlled as well as the single CPU system.
The following table shows the accessibilities to the controlled/non-controlled module.

Access target		Controlled CPU	Non-controlled CPU	
			Disabled	Enabled
Input (X)		○	×	○
Output (Y)	Read	○	×	○*1
	Write	○	×	×
Buffer memory	Read	○	○*1	○*1
	Write	○	×	×

The accessibilities for motion CPUs are different from programmable controller CPU, and *1 in the table applies to them.
For details, refer to section 2.1.3 of the MOTION CONTROLLER Programming Manual (COMMON) [Q173D(S)CPU/Q172D(S)CPU] (IB-0300134).

(2) Communication among each QCPU

In the multiple CPU system, the following communications are available among each QCPU.

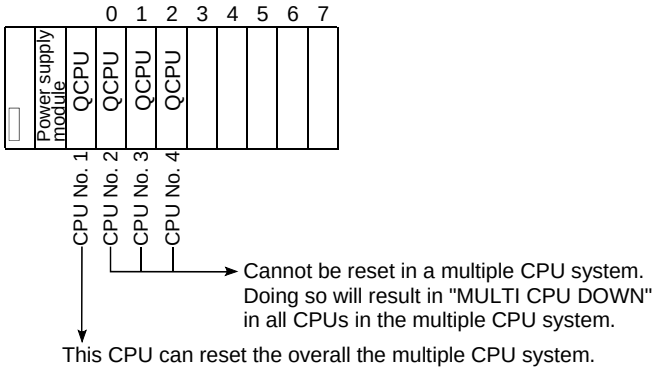
- Auto refresh of the device data between each QCPU/motion CPU with the parameter setting for the multiple CPU system
- Data transfer between QCPUs/motion CPUs with multiple CPU dedicated instructions
- Control instruction from a QCPU to a motion CPU with motion dedicated instructions
- Writing/reading of device data from a QCPU to a motion CPU with the multiple CPU transmission dedicated instruction

10.2.4 Reset and operation for errors

(1) How to reset a system

The entire multiple CPU system can be reset by resetting the QCPU No. 1.
Resetting QCPU No. 1 resets all QCPUs, I/O modules, and intelligent function modules.

If a stop error occurs in any of the QCPU on the multiple CPU system, reset QCPU No. 1 or restart the programmable controller (power supply ON → OFF → ON) for recovery.
(Recovery is impossible by resetting the QCPUs/motion CPUs No. 2 to 4 with the stop error.)



POINT

(1) It is impossible to reset the QCPUs/motion CPUs of No. 2 to 4 individually in the multiple CPU system.
If any of QCPUs/motion CPUs is reset during operation of the multiple CPU system, a "MULTI CPU DOWN" (error code: 7000) error occurs in other CPUs, and the entire multiple CPU system stops.
However, depending on the timing when any of QCPUs/motion CPUs of No. 2 to 4 is reset, an error other than the "MULTI CPU DOWN" may stop other QCPUs.

(2) A "MULTI CPU DOWN" (error code: 7000) error occurs if QCPUs No. 2 to 4 are reset, regardless of the setting of the operation mode (All station stop by stop error of PLC2 to 4) in the multiple CPU setting of the PLC parameter.

(2) Operation for errors

The entire system behaves differently depending whether a stop error occurs in CPU No. 1 or any of CPU No. 2 to 4 in the multiple CPU system.

(a) When a stop error occurs at QCPU No. 1

When a stop error occurs at CPU No. 1, a "MULTI CPU DOWN" (error code: 7000) error occurs at the other QCPUs/motion CPUs No. 2 to 4 and the multiple CPU system is stopped.

Follow the procedures below to restore the system.

1) Confirm the error cause with the PLC diagnostics.
2) Remove the error cause.
3) Reset the QCPU No.1 or restart the power of the programmable controller.
   All QCPUs on the entire multiple CPU system are reset and are restored when the QCPU No. 1 is reset or the power of the CPU is reapplied.

(b) When a stop error occurs at QCPUs No. 2 to 4

Set whether to stop the entire system or not in the event of a stop error at the QCPU No. 2 to 4 in "Operation Mode" in the multiple CPU setting of GX Works2.

Follow the procedures below to restore the system.

1) Confirm the error-detected CPU No. and error cause in the PLC diagnostics.
2) Remove the error cause.
3) Reset the QCPU No. 1 or restart the power of the programmable controller.
   All QCPUs on the entire multiple CPU system are reset and are restored when the QCPU No. 1 is reset or the power of the CPU is reapplied.

10.3 Communication among each QCPU/Motion CPU in Multiple CPU System

In the multiple CPU system, the following is available;

- Data transfer among each CPU module by the auto refresh of the CPU shared memory
- Reading the CPU shared memory between QCPUs, and the motion CPU shared memory from the QCPU with the multiple CPU dedicated instructions
- Control instruction from a QCPU to a motion CPU with the motion dedicated instructions
- Writing/reading of device data from a QCPU to a motion CPU with the multiple CPU transmission dedicated instructions

10.3.1 CPU shared memory

The CPU shared memory is for transferring data between QCPUs and its capacity is 24336 words of 0H to 5F0FH.

The CPU shared memory consists of five areas; "Host CPU operation information area", "Restricted system area", "Auto refresh area", "User setting area", and "Multiple CPU high speed transmission area".
Configuring the auto refresh setting for the CPU shared memory allows for using the area from 800H to the end point for auto refresh as the auto refresh area.
The start address of the user setting area is next to the end address in the auto refresh area.
When the points for auto refresh is 18 (11H), the auto refresh area is 800H to 811H and the user setting area is 812H or later.

The following figure shows the CPU shared memory configuration and the accessibility in the sequence program.

CPU shared memory				Host CPU		Other CPUs	
				Write	Read	Write	Read
(0H) to (1FFH)	G0 to G511	QCPU standard area	Host CPU operation information area	×	○	×	○
(200H) to (7FFH)	G512 to G2047		System area	×	×	×	○
(800H)	G2048		Auto refresh area	×	×	×	×
to (FFFH)	to G4095		User setting area	○	○	×	○
(1000H) to (270FH)	G4096 to G9999	Use-prohibited area*1		×	×	×	×
(2710H) to (5F0FH)	G10000 to Max. G24335	Multiple CPU high speed transmission area*1		○	○	×	○

○: Communication allowed, ×: Communication not allowed

*1: The Q00UCPU, Q01UCPU, and Q02UCPU do not have the use-prohibited area and the multiple CPU high speed transmission area.

(1) Host CPU operation information area

(a) Information stored in the host CPU operation information area

The following information is stored in the host CPU operation information area in the multiple CPU system.*1

They all remain as 0 and do not change in the single CPU system.

*1: For the motion CPU, 5H to 1CH of the host CPU operation information area are not used. When 5H to 1CH of the host CPU operation information area is read from the motion CPU, they are read as "0."

List of host CPU operation information areas

CPU shared memory address	Name	Description	Explanation	Corresponding special register
0H	Information availability	Information availability flag	The area to confirm if information is stored in the host CPU's operation information area (1H to 1FH) or not. ・0: Information is not stored in the host CPU's operation information area. ・1: Information is stored in the host CPU's operation information area.	-
1H	Diagnostic error	Diagnostic error number	Stores an error number identified during diagnostics in binary.	SD0
2H	Time the diagnosis error occurred	Time the diagnosis error occurred	Stores the year and month that the error number was stored in the CPU shared memory's 1H address with two digits of the BCD code.	SD1
3H			Stores the day and time that the error number was stored in the CPU shared memory's 1H address with two digits of the BCD code.	SD2
4H			Stores the minutes and seconds that the error number was stored in the CPU shared memory's 1H address with two digits of the BCD code.	SD3
5H	Error information identification code	Error information identification code	Stores an identification code to determine what error information has been stored in the common error information and individual error information.	SD4
6H to 10H	Common error information	Common error information	Stores the common information corresponding to the error number identified during diagnostic.	SD5 to SD15
11H to 1BH	Individual error information	Individual error information	Stores the individual information corresponding to the error number identified during diagnostic.	SD16 to SD26
1CH	Empty	-	Cannot be used	-
1DH	Switch status	CPU switch status	Stores the CPU module switch status	SD200
1EH	LED status	CPU-LED status	Stores the CPU module's LED bit pattern.	SD201
1FH	CPU operation status	CPU operation status	Stores the CPU module's operation status	SD203

(b) Reading of host CPU operation information area

Other QCPU can use the FROM instruction or multiple CPU area device (U3En\G) to read data from the host CPU operation information area of the host CPU.

However, because there is a delay in data updating, use the read data for monitoring purposes.

(2) Restricted system area

This area is used by the system of the QCPU (OS).

The OS uses this area when the multiple CPU transmission dedicated instruction is executed.

(3) Auto refresh area

This area is used when the multiple CPU system is automatically refreshed.

The points from the address next to the last address in the restricted system area are used for auto refresh.

(4) User setting area

This area is for communication between CPU modules.

The points after the ones used for the auto refresh area are used.

(An area including the auto refresh area can be used as the user setting area when auto refresh is not executed.)

(5) QCPU standard area

This area is for the Universal model QCPU to communicate with other CPUs (High Performance QCPU or Process CPU) in a multiple CPU system.

This area includes "Host CPU operation information area", "System area", "Auto refresh area", and "User setting area".

For each area, refer to (1) to (4).

(6) Multiple CPU high speed transmission area

This area is for communication with other CPU modules in the multiple CPU system using the Universal model QCPU.

The Multiple CPU high speed transmission area includes "auto refresh area" and "user setting area."

(a) Auto refresh area

The area is used when the multiple CPU system is automatically refreshed.

(b) User setting area

This area is for storing data to be sent to other CPU modules by the program.

Address for CPU shared memory is 10000H or later.

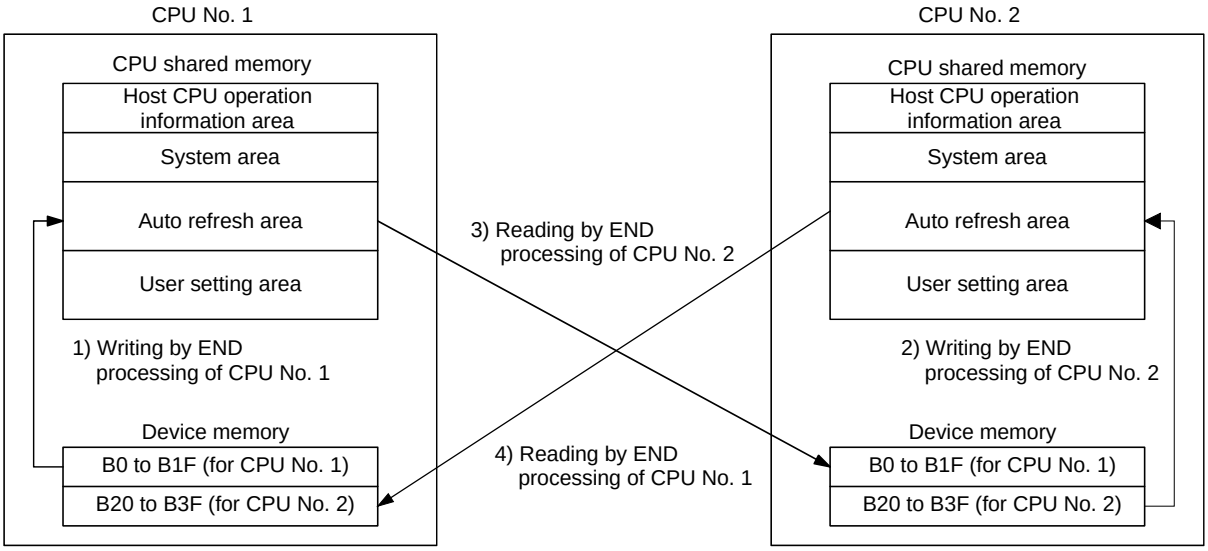
10.3.2 Communication by auto refresh using CPU shared memory

(1) Communication using auto refresh

The auto refresh of the CPU shared memory is executed automatically at the QCPU/motion CPU END processing for the data transfer between each CPU in the multiple CPU system.

As device memory data of other CPUs are automatically read by the auto refresh function, the host CPU can use those device data.

Example) Operation when CPU No. 1 executes auto refresh of 32 points for B0 to B1F, and when CPU No. 2 executes auto refresh of 32 points for B20 to B3F



The processes performed during CPU No. 1 END process

1): Transfers B0 to B1F transmission device data for CPU No. 1 to the host CPU shared memory's auto refresh area.

4): Transfers data in the CPU No. 2 CPU shared memory's auto refresh area to B20 to B3F in the host CPU.

The processes performed during CPU No. 2 END process

2): Transfers B20 to B3F transmission device data of CPU No. 2 to the CPU shared memory's auto refresh area.

3): Transfers data in CPU No. 1 CPU shared memory's auto refresh area to B0 to B1F in CPU No. 2.

(2) Executing auto refresh

Auto refresh is executed when the QCPU/motion CPU is in the RUN, STOP or PAUSE status.

Auto refresh cannot be executed when a stop error has been triggered in the QCPU/motion CPU.

If a stop error occurs on one module, the other modules without any error save the data prior to the stop error being triggered

For example, if a stop error occurs in CPU No. 2 when B20 is on, the B20 in CPU No. 1 remains on as shown in Example) in (1).

(3) Settings for auto refresh

The setting for the points to be transmitted by each CPU and the device in which the data is to be stored (the device that executes auto refresh) is configured in the multiple CPU setting of the PLC parameter in GX Works2.

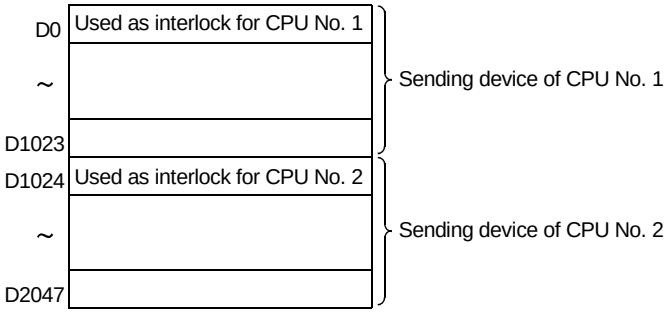
(4) Interlock method for communication by auto refresh

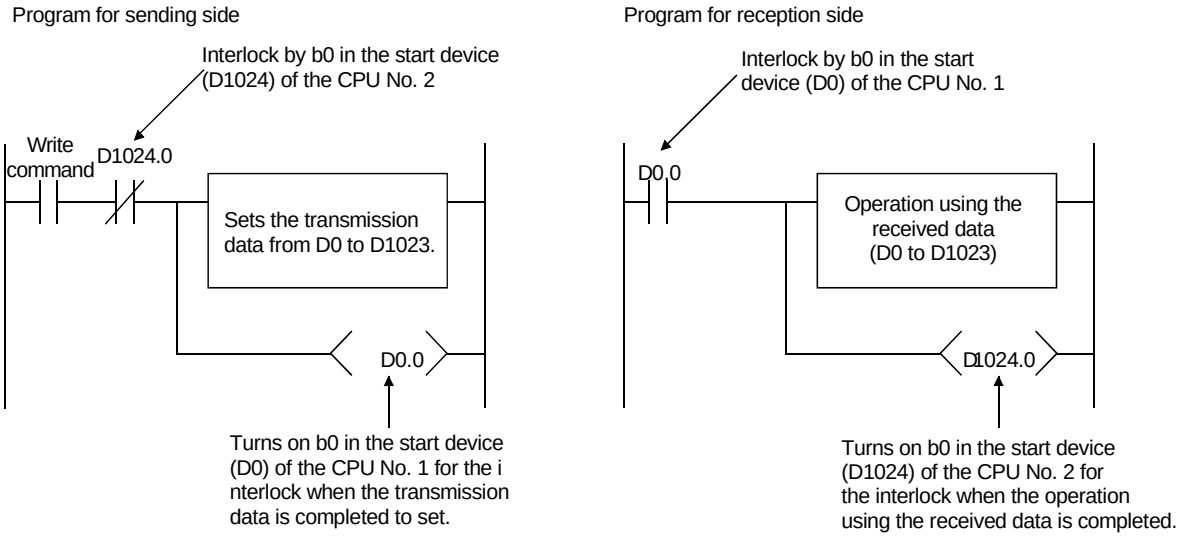
The old data and the new data may be mixed in each CPU due to the timing of a refresh for the host CPU and of reading data from the other CPU.

To execute auto refresh, create an interlock program which uses the start device of devices to be refreshed of each CPU as shown in the following figures. In addition, be careful not to use the data stored in the other CPU when the old data and the new data is mixed.

For example, the following figure shows the program example for the QCPU when the auto refresh setting in the multiple CPU setting is made as follows.

- PLC Side Device : D0
- Send points of CPU No. 1 : 1024 points (D0 to D1023)
- Send points for CPU No. 2 : 1024 points (D1024 to D2047)





10.3.3 Communication by auto refresh using multiple CPU high speed transmission area

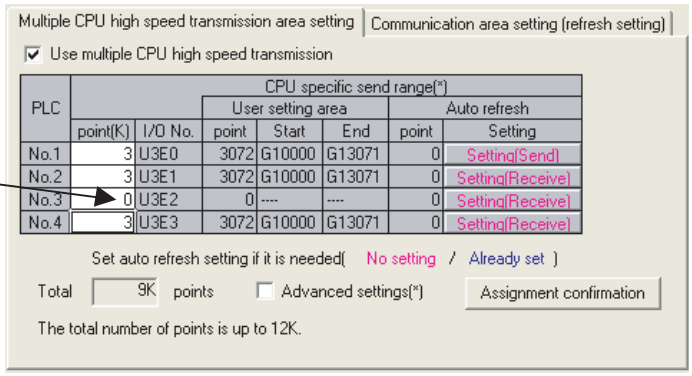
The communication by auto refresh using the multiple CPU high speed transmission area can be executed only when the following conditions are all met.

- The multiple CPU high speed main base unit (Q38DB or Q312DB) is used.
- The Universal model QCPU (except the Q00UCPU, Q01UCPU, Q02UCPU) is used as the CPU No. 1.
- At least two of Universal model QCPUs (except the Q00UCPU, Q01UCPU, and Q02UCPU) and/or motion CPUs (Q172DCPU or Q173DCPU) are used.
- C Controller module (Q12DCCPU-V) is used.

Communication using the multiple CPU high speed transmission area by auto refresh cannot be made with CPU modules other than Universal model QCPUs (except the Q00UCPU, Q01UCPU, and Q02UCPU), C Controller module (Q12DCCPU-V), and Motion CPUs (Q172DCPU and Q173DCPU) mounted on the multiple CPU high speed main base unit.

When any of these modules is mounted on the multiple CPU high speed main base unit, set 0 to the relevant CPU by the "point" field in "CPU specific send range" of "Multiple CPU high speed communication area setting".

Set 0 for the CPU modules except for the Universal model QCPU (except for Q00UCPU, Q01UCPU, Q02UCPU), motion CPU (Q172DCPU, Q173DCPU), and C Controller (Q12DCCPU-V).



(1) Overview of auto refresh

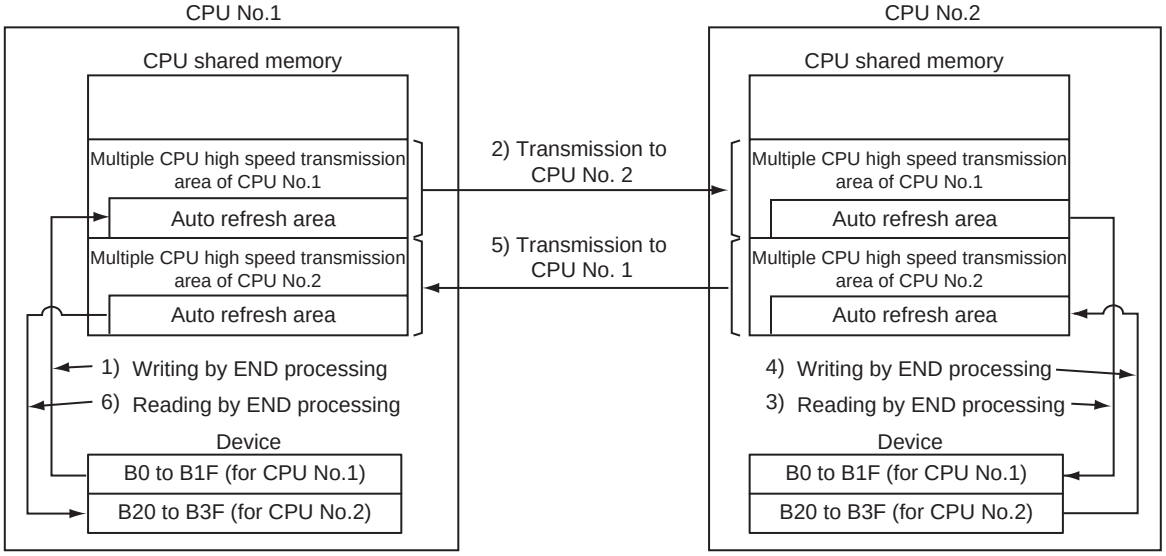
The auto refresh is a communication method using the auto refresh area of the multiple CPU high speed transmission area in the CPU shared memory.

The data written to the auto refresh area of the multiple CPU high speed transmission area is sent to that of the other CPUs in a certain cycle (multiple CPU high speed transmission cycle).

Setting the multiple CPU setting in the PLC parameter allows to automatically read/ write data among all CPUs in the multiple CPU system.

Since device data of other CPUs can be automatically read by the auto refresh function, the host CPU can also use them as those of host CPU.

The following figure shows an overview of operations when CPU No. 1 executes auto refresh of 32 points for B0 to B1F, and when CPU No. 2 executes auto refresh of 32 points for B20 to B3F.



Procedure for the CPU No. 2 to read device data of the CPU No. 1

1): Transfers data in B0 to B1F to the auto refresh area of the host CPU at END processing of a CPU No. 1.
2): Sends data in the multiple CPU high speed transmission area of CPU No. 1 to CPU No. 2.
3): Transfers the received data to B0 to B1F at END processing of CPU No. 2.

Procedure for the CPU No. 1 to read device data of the CPU No. 2

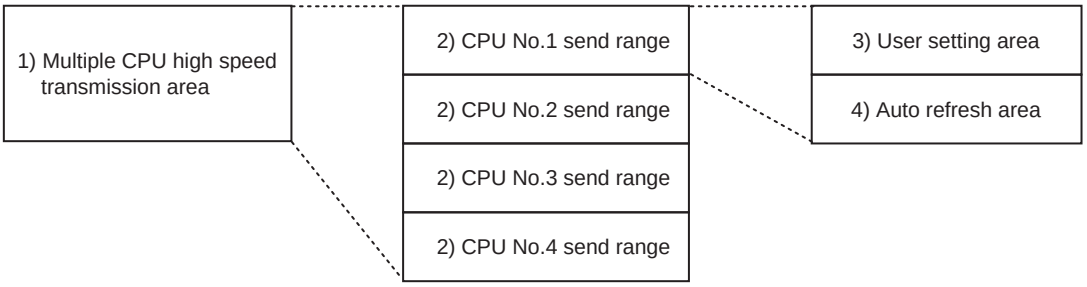
4): Transfers data in B20 to B3F to the auto refresh area of the host CPU at END processing of CPU No. 2.
5): Sends data in the multiple CPU high speed transmission area of CPU No. 2 to CPU No. 1.
6): Transfers the received data to B20 to B3F at END processing of CPU No. 1.

(2) Executing auto refresh

Auto refresh is executed when the QCPU is in the RUN, STOP or PAUSE status.

(3) Memory configuration of the multiple CPU high speed transmission area

The following explains the memory configuration of the multiple CPU high speed transmission area of the CPU shared memory that is used in the multiple CPU high speed transmission function.



No.	Name	Description	Size	
			Setting range	Setting unit
1)	Multiple CPU high speed transmission area	・Area for data transmission between each CPU modules in the multiple CPU system ・The area up to 14K word is divided by each CPU module that constitutes the multiple CPU system	0 to 14K words	1K word
2)	CPU No. n send area n (n = 1 to 4)	・Area to store the send data of the each CPU module ・Sends the data stored in the send area of the host CPU to the other CPUs. ・Other CPU send area stores the data received from the other CPUs.	0 to 14K words	1K word
3)	User setting area	・Area for data communication with other CPUs using the multiple CPU area device. ・Can be accessed by the user program using the multiple CPU area device.	0 to 14K words	2 words
4)	Auto refresh area	・Area for communicating device data with other CPUs by the communication using auto refresh	0 to 14K words	2 words

POINT

When the COM instruction is used in the sequence program, auto refresh can be executed automatically at the execution of the COM instruction.
However, the scan time is prolonged due to the processing time for auto refresh.
For details of the COM instruction, refer to the MELSEC-Q/L Programming Manual Common Instruction.

(4) Settings required for auto refresh

To execute auto refresh, setting the number of points to be sent from each CPU module and a device for storing data (device for executing auto refresh) in the multiple CPU setting of the PLC parameter is required.

10.3.4 Communications by the multiple CPU instruction and motion dedicated instruction

(1) Communications by the multiple CPU instruction/intelligent function module device

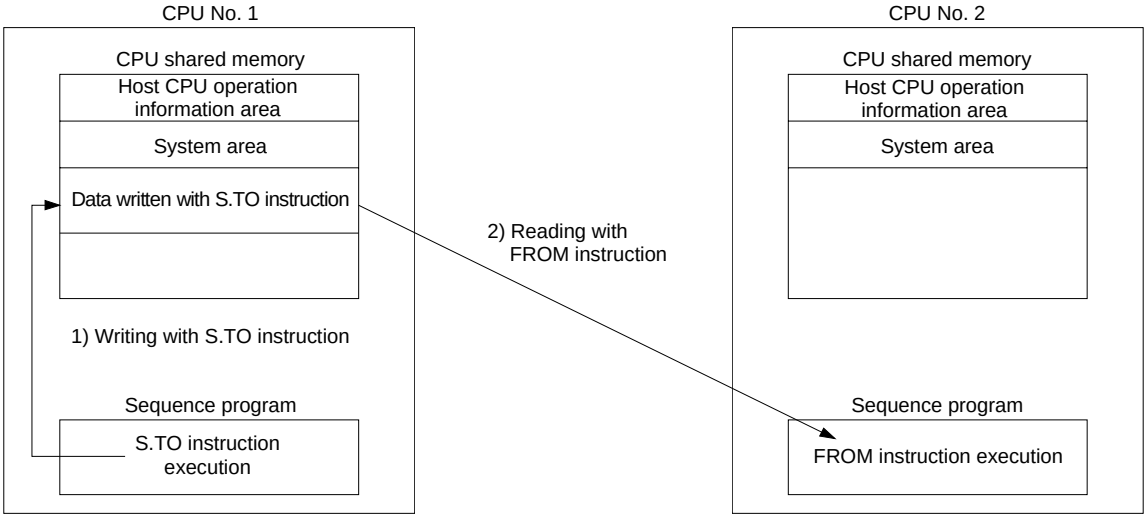
The QCPU in the multiple CPU system can access the CPU shared memory of QCPU/motion CPU with the S.TO/FROM instruction.

Also, the Universal model QCPU can write/read device data to/from another Universal model QCPU with the multiple CPU high-speed transmission dedicated instruction.

The S.TO instruction is used to write data of the host CPU to the CPU shared memory and the FROM instruction of other CPU is used to read the data.

Unlike auto refresh of the CPU shared memory, directly reading the data at instruction execution is available.

Example) When the data written with the S.TO instruction to the CPU shared memory of QCPU No. 1 is read to QCPU No. 2 with the FROM instruction



The processes of QCPU No. 1

1) Writes data in the user setting area of QCPU No. 1 with the S.TO instruction.

The processes of QCPU No. 2

2) Reads the data stored in the user setting area of QCPU No. 1 to the specified device with the FROM instruction.

For details of the S.TO instruction/FROM instruction, refer to the following manual:

MELSEC-Q/L Programming Manual Common Instruction

POINT
Since motion CPUs do not have the S.TO instruction, FROM instruction, and intelligent function module, these instructions are not used for communication between QCPUs and motion CPUs. For communication between QCPUs and motion CPUs, use auto refresh of the CPU shared memory and the multiple CPU transmission dedicated instruction.

(2) Communication by the motion dedicated instruction

The multiple CPU transmission dedicated instruction and multiple CPU high-speed transmission dedicated instruction allows writing data to motion CPUs and reading data via a QCPU.

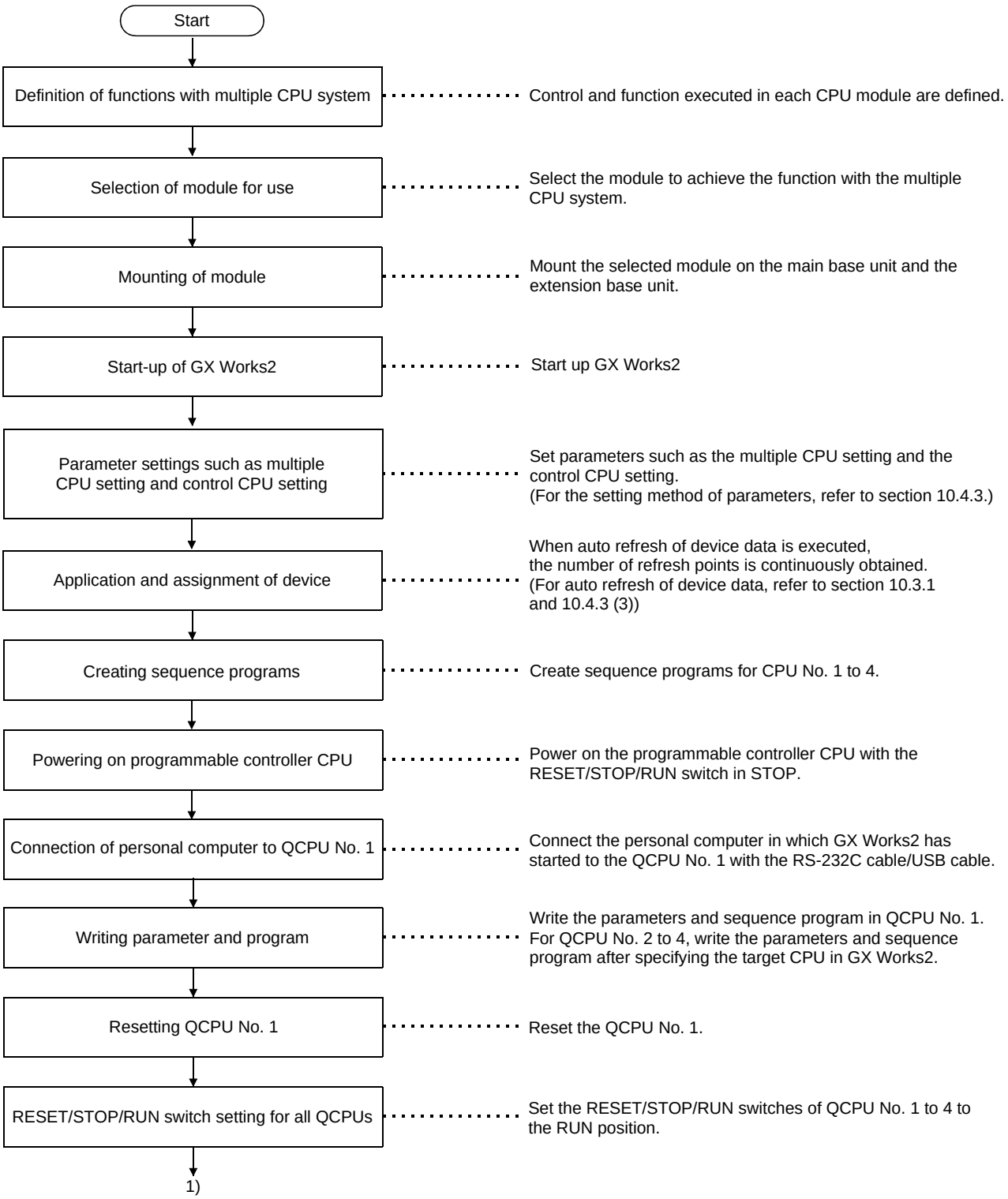
For details and the use of the motion dedicated instruction and multiple CPU transmission dedicated instruction, refer to the Motion CPU Programming Manual.

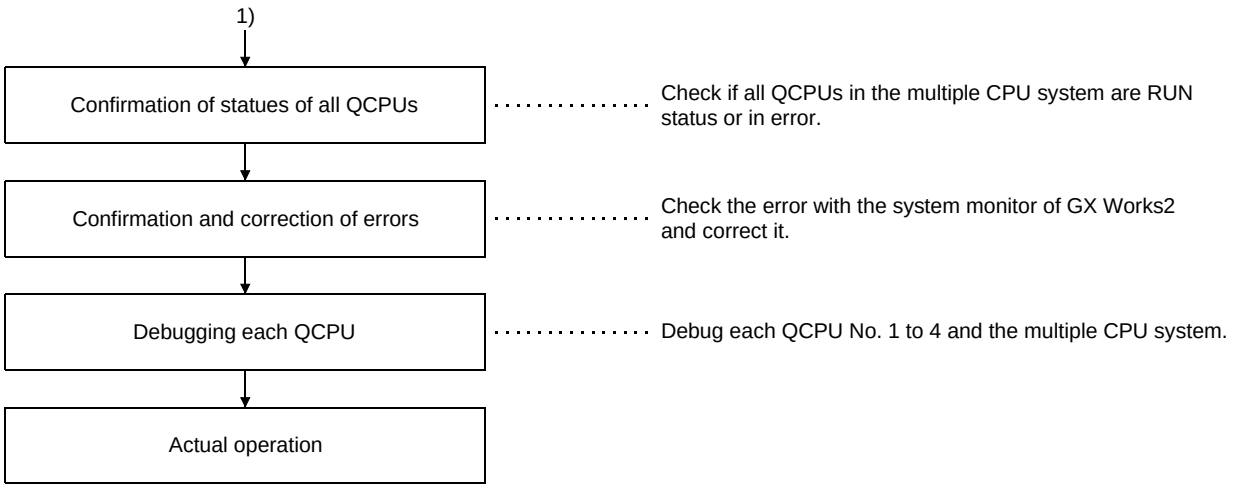
POINT
・ Control instructions from a motion CPU to other motion CPU is not allowed. ・ Data transfers with the multiple CPU transmission dedicated instruction between QCPUs, motion CPU and QCPU, and motion CPUs are not allowed.

10.4 Starting up Multiple CPU System

This Chapter explains the standard start-up procedures for the multiple CPU system.

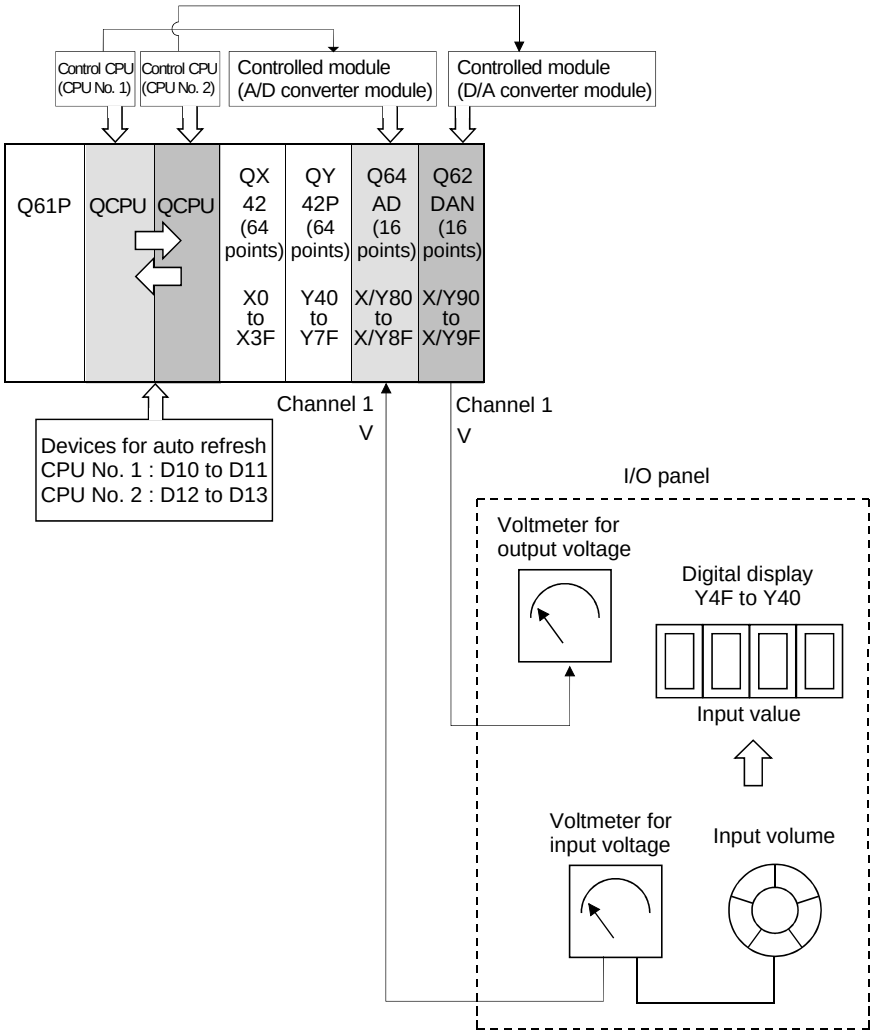
10.4.1 Procedure for starting up the multiple CPU system




1)
Confirmation of statues of all QCPUs
Check if all QCPUs in the multiple CPU system are RUN status or in error.
Confirmation and correction of errors
Check the error with the system monitor of GX Works2 and correct it.
Debugging each QCPU
Debug each QCPU No. 1 to 4 and the multiple CPU system.
Actual operation

10.4.2 System configuration of the demonstration machine

In order to explain the operation overview of the multiple CPU system, a simple example is used for an exercise.
The following figure shows a system in which the multiple CPUs (CPU No. 1 and No. 2) control different intelligent function modules (A/D and D/A converter module) and transfer the data in the intelligent function modules between the two CPUs.



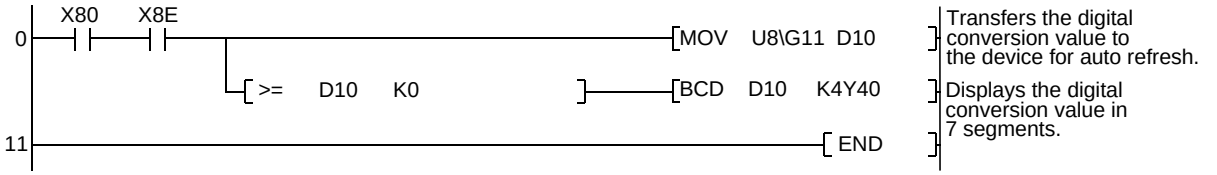
10.4.3 Creating a program for CPU No. 1

Create a program for checking the operation of the multiple CPU.
Generally, in the multiple CPU system using the auto refresh setting (between CPUs), the old data and the new data may be mixed when multiple data is communicated between CPUs.
The interlock shown in 10.3.1(4) is required to solve the problem.
In this exercise, the simple program as below is used since the communication data is 1 word which requires no interlock.

Sequence program for QCPU No. 1

The sequence program executes a sampling processing on analog voltages input through CH1 of Q64AD, and then converts the analog values to digital values.
The converted digital value is stored in the device for auto refresh (D10).

Project name	Applied 8
Program name	MULTI1



X80 (X0): Module READY
X8E (XE): A/D conversion completed flag
U8\G11 (Un\G11): Digital output value from CH1

10.4.4 Parameter setting for CPU No. 1

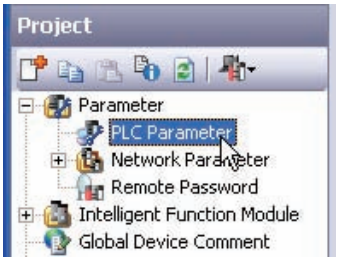
The multiple CPU system requires the following setting, which is unnecessary for the single CPU system, in the PLC parameter.

- No. of PLC: Set the number of QCPUs in the multiple CPU system mounted on the main base unit.
- Control PLC: Set the CPU which controls the mounted module.
- Refresh setting: Set the points sent by each CPU and the device for storing data for auto refresh for the device data.
  (When auto refresh is not executed, this setting is not required.)

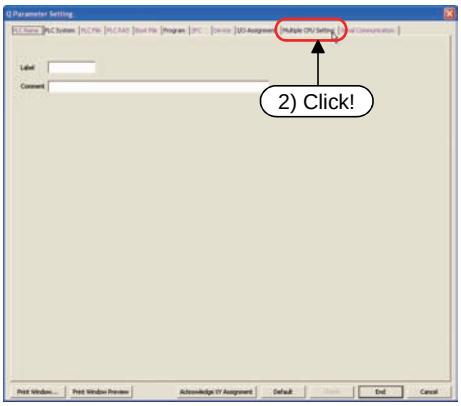
POINT

- The parameter (multiple CPU setting, PLC system (No. of empty slot), and I/O assignment) written into the CPU needs to be the same in all the QCPUs/motion CPUs used in the multiple CPU system.

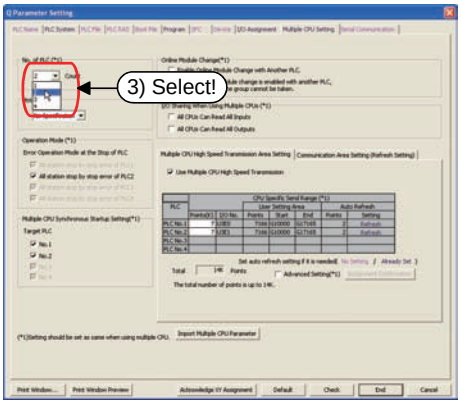
(1) Number of CPUs setting



1) Double-click "PLC Parameter" in the project list of GX Works2.

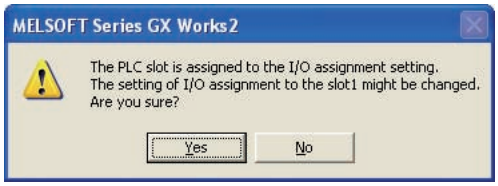


2) The Q parameter Setting dialog box is displayed. Click the "Multiple CPU Setting" tab.

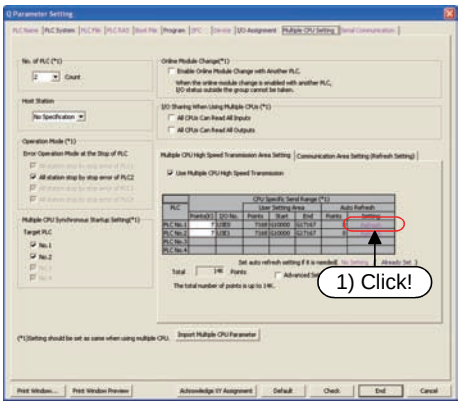


3) Set "No. of PLC" to "2".

4) The message below is displayed. Click the Yes button.

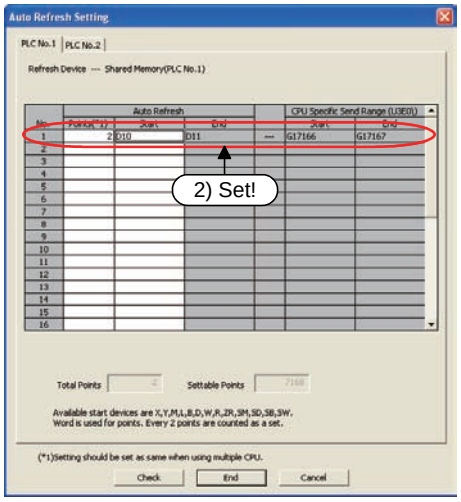


(2) Auto refresh setting



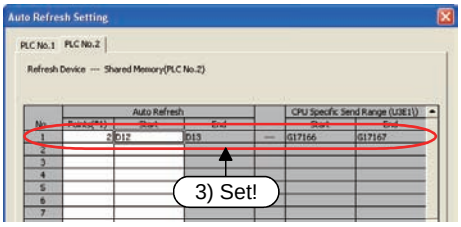
1) Specify the device to be used in the CPU shared memory.

Click the Refresh button in the row of PLC No. 1 in the Multiple CPU High Speed Transmission Area Setting tab.



2) Set the device for storing the data transmitted from CPU No. 1 to the other CPU as follows.

Setting No.1: 2 points, D10



3) Click the PLC No.2 tab and set the device for storing the data which CPU No. 1 receives from CPU No. 2 as follows.

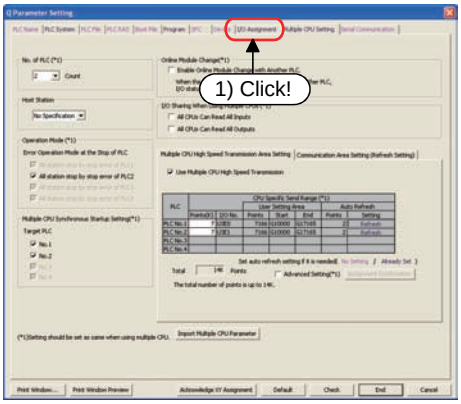
Setting No.1: 2 points, D12

POINT

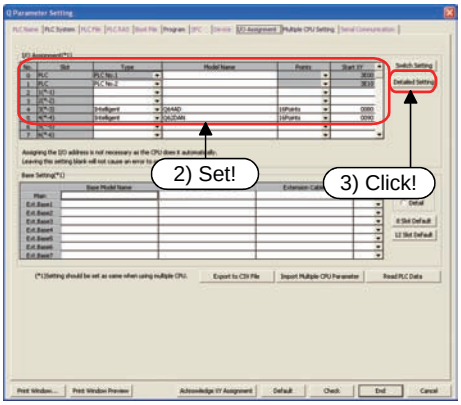
For auto refresh, the following devices can be used.

- Device available for send range: X, Y, M, L, B, D, W, R, ZR, SM, SD, SB, SW
- Device available for receive range: X, Y, M, L, B, D, W, R, ZR

(3) Control CPU settings



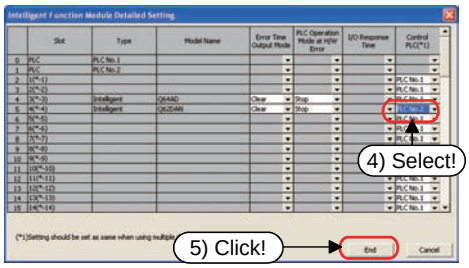
1) Click the "I/O Assignment tab" on the Q Parameter Setting dialog box.



2) Set the I/O assignment to the slots which mount Q62AD and Q62DAN.

Slot	Type	Model Name	Points	Start XY
3(*-3)	Intelligent	Q64AD	16Points	0080 (Hex.)
4(*-4)	Intelligent	Q62DAN	16Points	0090 (Hex.)

3) Click the Detailed Setting button to close the parameter setting screen.

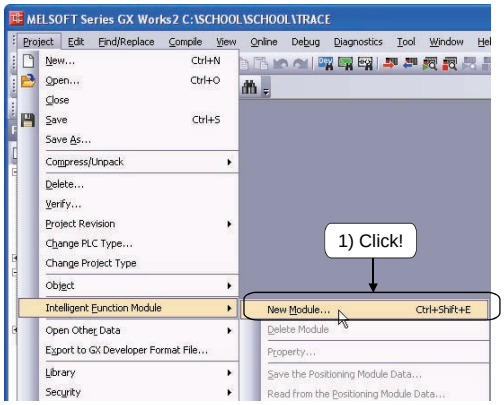


4) The Intelligent Function Module Detailed Setting dialog box is displayed. Set "Control PLC" for Q62DAN of the slot "4(*-4)" to "PLC No.2"

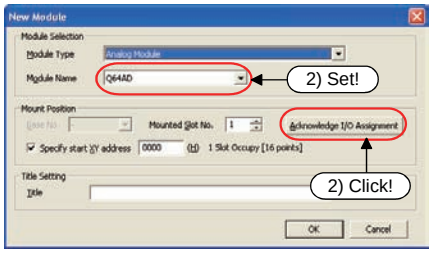
5) Click the End button to close the parameter setting screen.

(4) Intelligent function module data setting

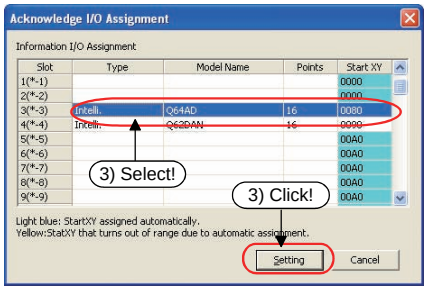
Set the analog module as described in chapter 9. In this section, set Q64AD which is the controlled module for CPU No. 1.



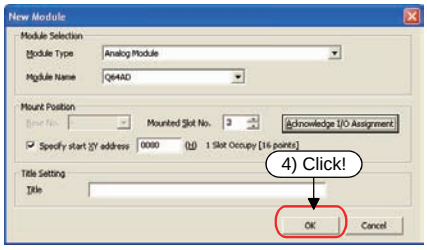
1) Click [Project] → [Intelligent Function Module] → [New Module].



2) Select "Q64AD" for Module Name. Click the Acknowledge I/O Assignment button.



3) The Acknowledge I/O Assignment dialog box is displayed. Select "Q64AD" and click the Setting button.



4) The New Module dialog box is displayed again. Click the OK button.

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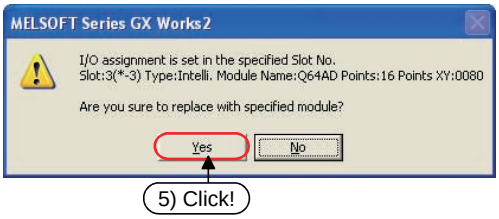
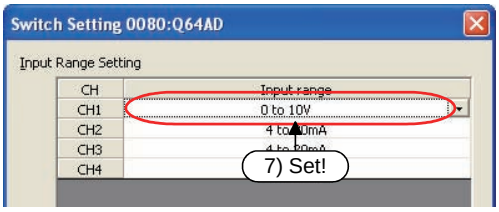
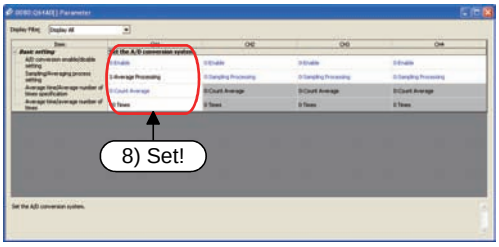


5) The message on the left is displayed. Click the Yes button.



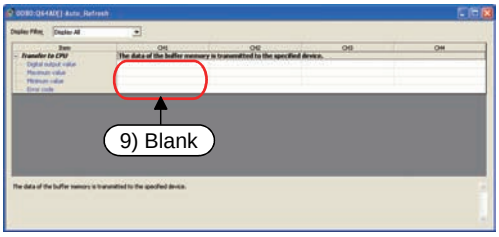
6) Set the switch setting, parameter, and the auto refresh setting as described in chapter 9.

7) In the Switch Setting screen, set Input range for CH1 to "0 to 10V".



8) In the Parameter screen, set CH1 as follows.

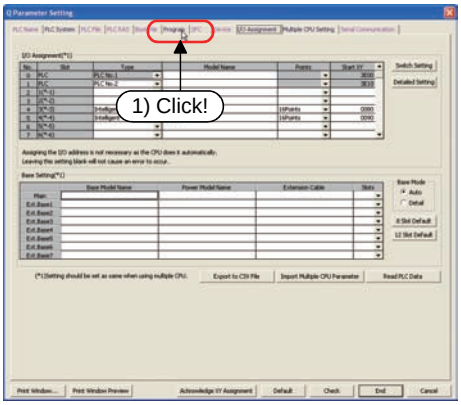
Sampling/Averaging process setting:
1:Average processing
Average time/Average number of times:
40 Times



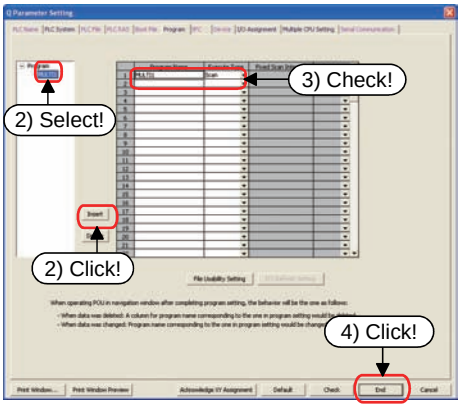
9) In the Auto_Refresh screen, set nothing.

(5) Program setting

Set the created program as an execution program to prevent a CPU parameter error when multiple programs are included in the same CPU (this setting is optional).



1) Click the "Program" tab on the Q Parameter Setting dialog box.



2) Select the program "MULTI1" and click the Insert button.

3) Check the program "MULTI1" is set to Scan in Execute Type.

4) Click the End button.

Save the created and set program/parameter above.

Project name	Applied 8
Program name	MULTI1

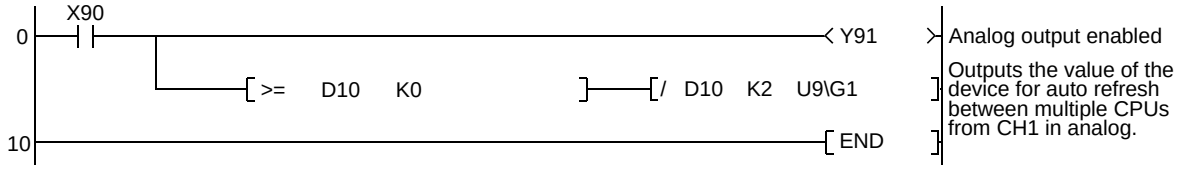
10.4.5 Creating a program for CPU No. 2

Create a program for QCPU No. 2 in the similar way for QCPU No. 1.
In this exercise, the simple program as below is used since the communication data is 1 word which requires no interlock.
In addition, attach the program to be created here to a different project from the project of the QCPU No. 1.

Sequence program for QCPU No. 2

The sequence program reduces the digital conversion value stored in the device of the QCPU (No. 1) for auto refresh (D10) to half and converts the value into the analog signal from CH1 of Q62DAN.

Project name	Applied 9
Program name	MULTI2



X90 (X0): Module READY
U9\G1 (Un\G1): CH1 Digital value
Y91 (Y1): CH1 Output enable/disable flag

10.4.6 Parameter setting for CPU No. 2

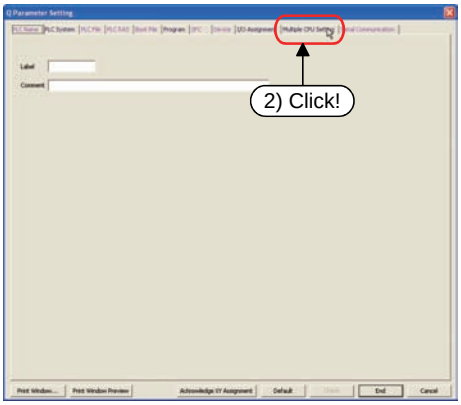
The related items to the multiple CPU system set for CPU No. 1 can be used for the CPU No. 2 with "Import Multiple CPU Parameter" in GX Works2 without re-entering.

POINT

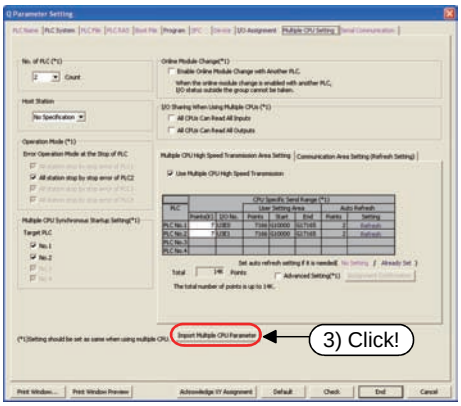
- The parameter (multiple CPU setting, PLC system (No. of empty slot), and I/O assignment) written into the CPU needs to be the same in all the QCPUs/motion CPUs used in the multiple CPU system.

(1) Parameter import

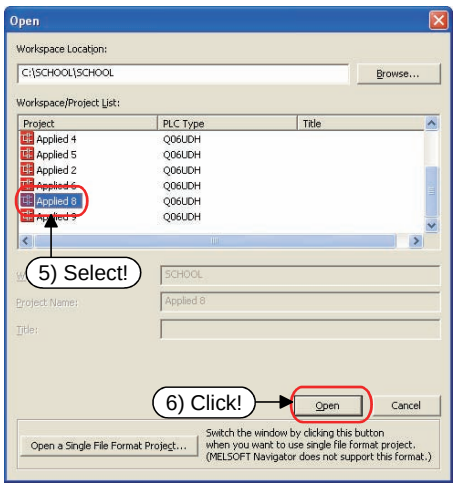
1) Double-click "PLC Parameter" in the project list of GX Works2.



2) The Q parameter Setting dialog box is displayed. Click the "Multiple CPU Setting" tab.



3) Click the Import Multiple CPU Parameter button.

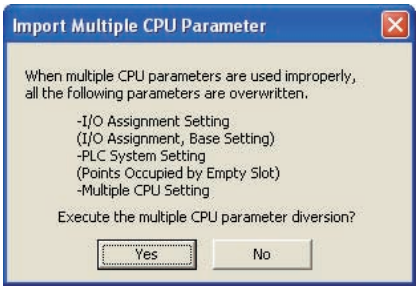


4) The "Open" dialog box is displayed.

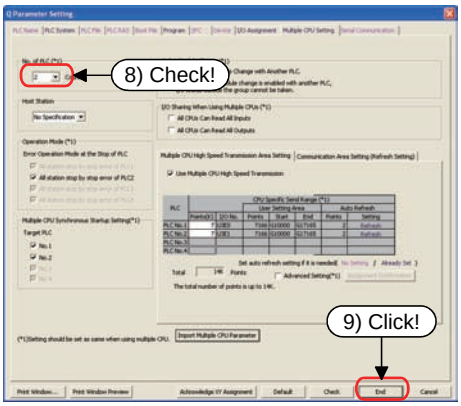
5) Select the project to import multiple CPU parameters from.

   Work space name : SCHOOL
   Project name : Applied 8

6) Click the Open button.

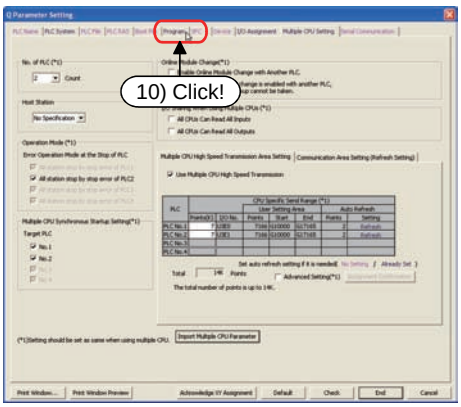


7) The Import Multiple CPU Parameter dialog box is displayed. Click the Yes (import execution) button.

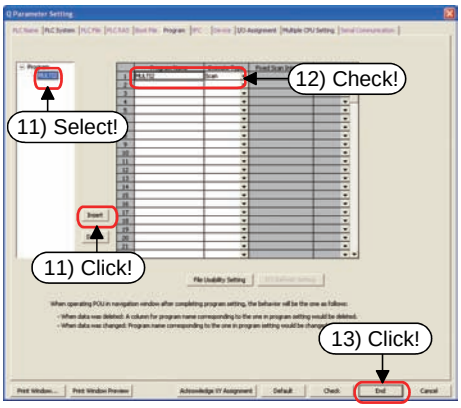


8) The Q Parameter Setting dialog box is displayed again.
   Check No. of PLC is changed from 1 set in the operation procedure 3) to 2.

9) Click the End button.



10) Click "Program" tab on the Q Parameter Setting dialog box. (Although this procedure is optional, it prevents a CPU error.)



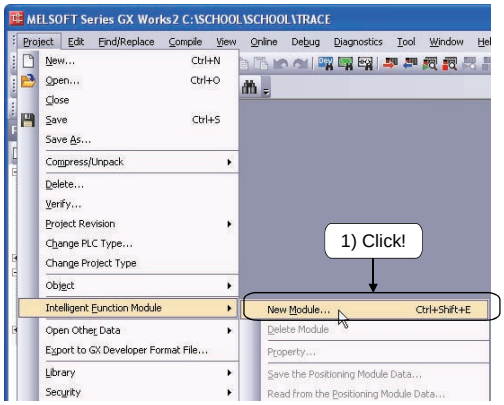
11) Select the program "MULTI2" and click the Insert button.

12) Check the program "MULTI2" is set to Scan in Execute Type.

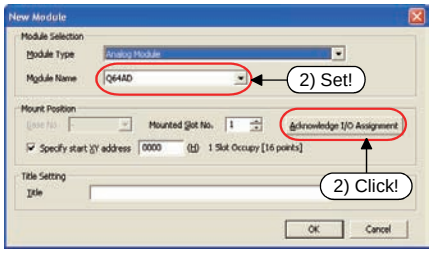
13) Click the End button.

(2) Intelligent function module data setting

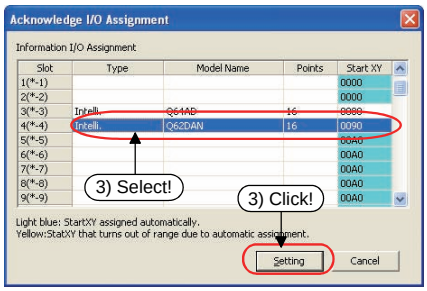
Set the analog module as described in chapter 9. In this section, set Q62DAN.



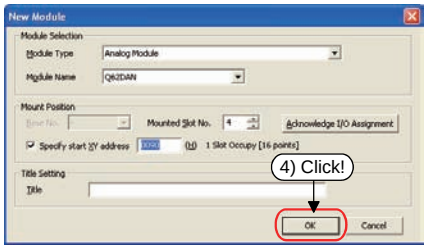
1) Click [Project] → [Intelligent Function Module] → [New Module].



2) Select "Q64DAN" for Module Name. Click the Acknowledge I/O Assignment button.



3) The Acknowledge I/O Assignment dialog box is displayed. Select "Q64DAN" and click the Setting button.



4) The New Module dialog box is displayed again. Click the OK button.

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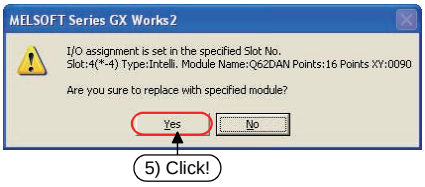
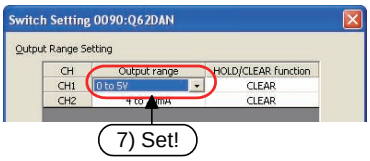
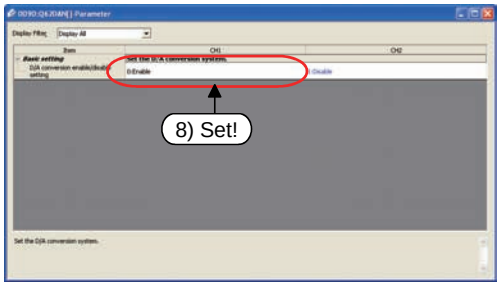


5) The message on the left is displayed. Click the Yes button.



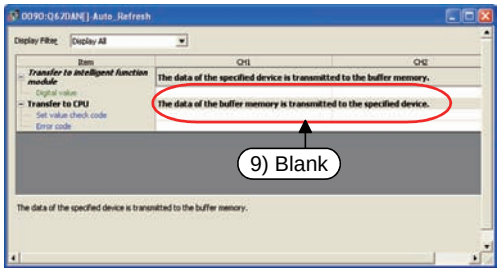
6) Set the switch setting, parameter, and the auto refresh setting as described in chapter 9.

7) In the Switch Setting screen, set Input range for CH1 to "0 to 5V".



8) In the Parameter screen, set CH1 as follows.

D/A conversion enable/disable setting: 0:Enable



9) In the Auto_Refresh screen, set nothing.

Save the created and set program/parameter above.

Project name	Applied 9
Program name	MULTI2

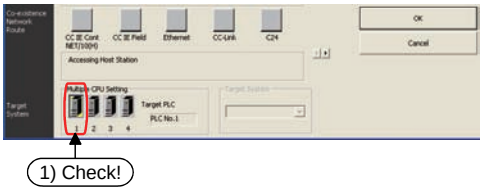
10.4.7 Writing data to the CPU

Write the created sequence program and parameter setting in each QCPU.

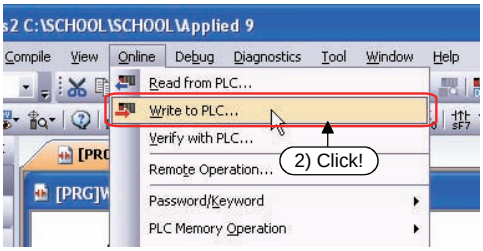
Set the RUN/STOP/RESET switches of CPUs (both No. 1 and No. 2) to "STOP".

(1) Writing data to QCPU No. 1

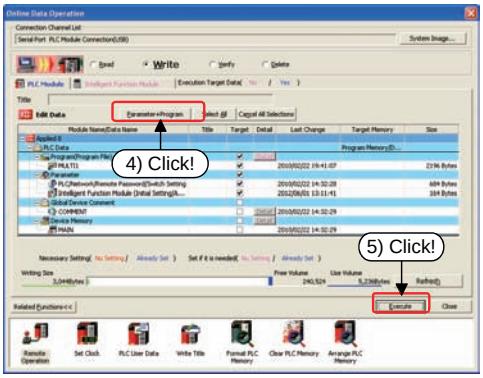
Write the created program for QCPU No. 1 with GX Works2.
(Project name) Applied 8, (Program name) MULTI1



1) Check Target System is "PLC No.1" in the Transfer Setup screen.



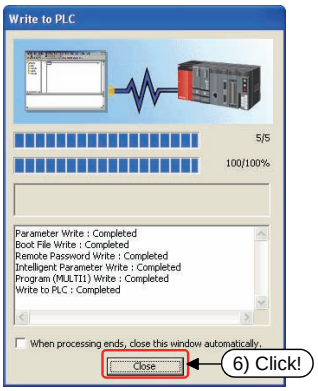
2) Click [Online] → [Write to PLC].



3) The Online Data Operation dialog box is displayed.

4) Click the Parameter + Program button.

5) Click the Execute button.

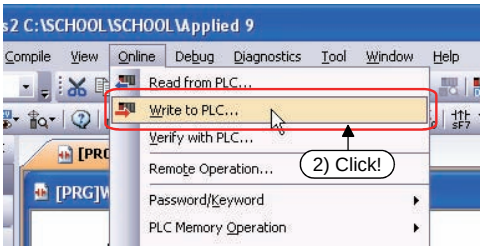


6) When the writing to QCPU No. 1 is completed, the dialog box on the left is displayed. Click the Close button.

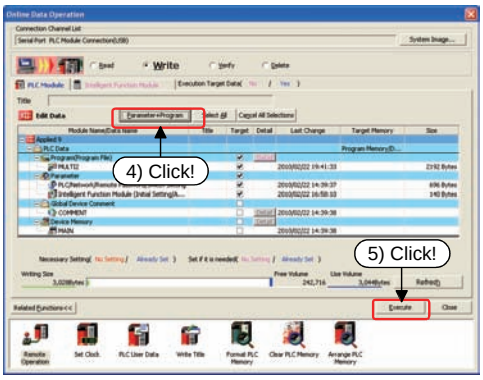
(2) Writing data into QCPU No. 2

Write the created program for QCPU No. 2 with GX Works2.
(Project name) Applied 9, (Program name) MULTI2

1) Check Target System is "PLC No.2" in the Transfer Setup screen.



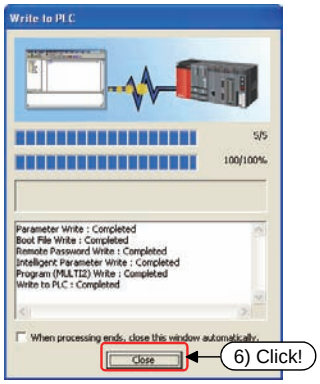
2) Click [Online] → [Write to PLC].



3) The Online Data Operation dialog box is displayed.

4) Click the Parameter + Program button.

5) Click the Execute button.



6) When the writing to QCPU No. 2 is completed, the dialog box on the left is displayed. Click the Close button.

10.4.8 Operation check

Check the operation with the following procedure.

(1) Reset of the multiple CPU
  1) Reset the QCPU No. 1.
  2) Set RUN/STOP/RESET switches of QCPUs No. 1 and No. 2 to RUN.

(2) Operation check
  1) Change input voltages for the A/D converter module with the volume on the demonstration machine.
     The digital conversion value is displayed in the 7-segment display (Y40 to Y4F).
  2) The D/A OUTPUT voltmeter displays the voltage value that the D/A conversion module outputs.
     The displayed value is quarter of that of the A/D INPUT voltmeter since the A/D input range is 0 to 10V and the D/A output range is 0 to 5V, and the digital conversion value is operated to half in the CPU.

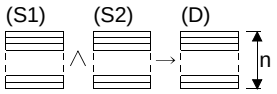
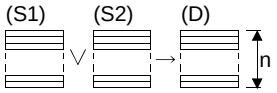
MEMO

APPENDIX

Appendix 1 Instruction Tables

For instructions related to SFC, refer to the MELSEC-Q/L/QnA Programming Manual (SFC) SH-080041.

(1) Logical operation instructions

Category	Instruction symbol	Symbol	Processing details	Execution condition	Number of basic steps	Subset
Logical AND operation	WAND	WAND S D	· (D)∧(S)→(D)		3	●
	WANDP	WANDP S D				
	WAND	WAND S1 S2 D	· (S1)∧(S2)→(D)		4	● *2
	WANDP	WANDP S1 S2 D				
	DAND	DAND S D	· (D+1,D)∧(S+1,S)→(D+1,D)		*1	●
	DANDP	DANDP S D				
	DAND	DAND S1 S2 D	· (S1+1,S1)∧(S2+1,S2)→(D+1,D)		*1	● *2
	DANDP	DANDP S1 S2 D				
	BKAND	BKAND S1 S2 D n			5	
	BKANDP	BKANDP S1 S2 D n				
Logical OR operation	WOR	WOR S D	· (D)∨(S)→(D)		3	●
	WORP	WORP S D				
	WOR	WOR S1 S2 D	· (S1)∨(S2)→(D)		4	● *2
	WORP	WORP S1 S2 D				
	DOR	DOR S D	· (D+1,D)∨(S+1,S)→(D+1,D)		*1	●
	DORP	DORP S D				
	DOR	DOR S1 S2 D	· (S1+1,S1)∨(S2+1,S2)→(D+1,D)		*1	● *2
	DORP	DORP S1 S2 D				
	BKOR	BKOR S1 S2 D n			5	
	BKORP	BKORP S1 S2 D n				

REMARK

*1: The number of steps varies depending the device and CPU type to be used.

Device	Number of steps	
	QCPU	QnACPU
・Word device: Internal device (except for the file register ZR) ・Bit device: Devices whose device Nos. are multiples of 16, whose digit designation is K8, and which use no Indexing ・Constant: No limitations	6	6
Devices other than above	4	

*2: Only QCPU supports the subset.

Category	Instruction symbol	Symbol	Processing details	Execution condition	Number of basic steps	Subset
Exclusive OR	WXOR	WXOR S D	· (D) ⩛ (S) → (D)		3	●
	WXORP	WXORP S D				
	WXOR	WXOR S1 S2 D	· (S1) ⩛ (S2) → (D)		4	● *2
	WXORP	WXORP S1 S2 D				
	DXOR	DXOR S D	· (D+1,D) ⩛ (S+1,S) → (D+1,D)		*1	●
	DXORP	DXORP S D				
	DXOR	DXOR S1 S2 D	· (S1+1,S1) ⩛ (S2+1,S2) → (D+1,D)		*1	● *2
	DXORP	DXORP S1 S2 D				
	BKXOR	BKXOR S1 S2 D n	(S1) (S2) (D) n		5	
	BKXORP	BKXORP S1 S2 D n				
NON exclusive logical sum	WXNR	WXNR S D	· $\overline{(D) \veebar (S)}$ → (D)		3	●
	WXNRP	WXNRP S D				
	WXNR	WXNR S1 S2 D	· $\overline{(S1) \veebar (S2)}$ → (D)		4	● *2
	WXNRP	WXNRP S1 S2 D				
	DXNR	DXNR S D	· $\overline{(D+1,D) \veebar (S+1,S)}$ → (D+1,D)		*1	●
	DXNRP	DXNRP S D				
	DXNR	DXNR S1 S2 D	· $\overline{(S1+1,S1) \veebar (S2+1,S2)}$ → (D+1,D)		*1	● *2
	DXNRP	DXNRP S1 S2 D				
	BKXNOR	BKXNOR S1 S2 D n	$\overline{(S1)}$ $\overline{(S2)}$ (D) n		5	
	BKXNORP	BKXNORP S1 S2 D n				

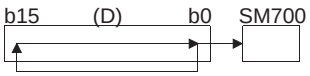
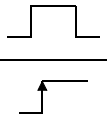
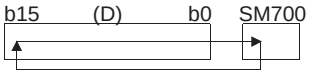
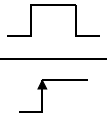
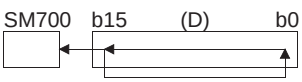
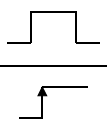
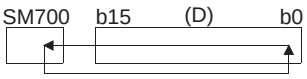
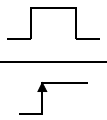
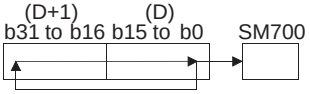
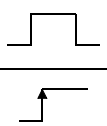
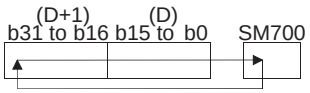
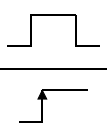
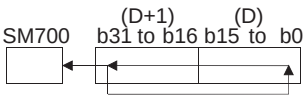
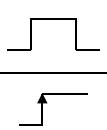
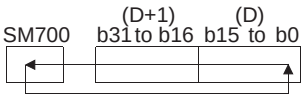
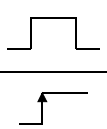
REMARK

*1: The number of steps varies depending the device and CPU type to be used.

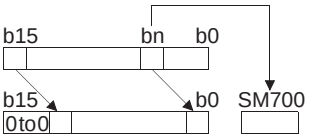
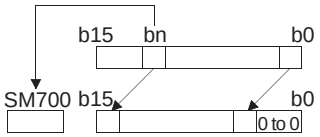
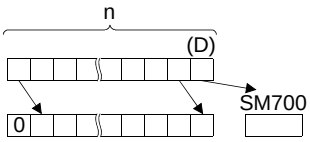
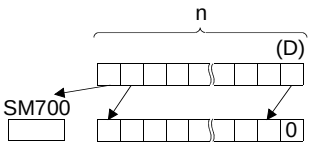
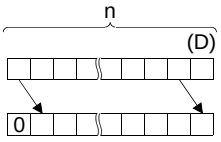
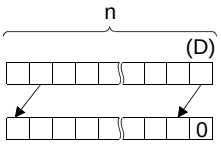
Device	Number of steps	
	QCPU	QnACPU
・Word device: Internal device (except for the file register ZR) ・Bit device: Devices whose device Nos. are multiples of 16, whose digit designation is K8, and which use no Indexing ・Constant: No limitations	6	6
Devices other than above	4	

*2: Only QCPU supports the subset.

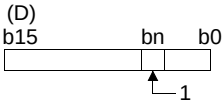
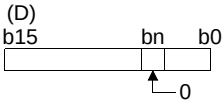
(2) Rotation instructions

Category	Instruction symbol	Symbol	Processing details	Execution condition	Number of basic steps	Subset
Right rotation	ROR	ROR D n	 Right rotation (n bit)		3	●
	RORP	RORP D n				
	RCR	RCR D n	 Right rotation (n bit)		3	●
	RCRP	RCRP D n				
Left rotation	ROL	ROL D n	 Left rotation (n bit)		3	●
	ROLP	ROLP D n				
	RCL	RCL D n	 Left rotation (n bit)		3	●
	RCLP	RCLP D n				
Right rotation	DROR	DROR D n	 Right rotation (n bit)		3	●
	DRORP	DRORP D n				
	DRCR	DRCR D n	 Right rotation (n bit)		3	●
	DRCRP	DRCRP D n				
Left rotation	DROL	DROL D n	 Left rotation (n bit)		3	●
	DROLP	DROLP D n				
	DRCL	DRCL D n	 Left rotation (n bit)		3	●
	DRCLP	DRCLP D n				

(3) Shift instructions

Category	Instruction symbol	Symbol	Processing details	Execution condition	Number of basic steps	Subset
n-bit shift	SFR	SFR D n			3	●
	SFRP	SFRP D n				
	SFL	SFL D n			3	●
	SFLP	SFLP D n				
1-bit shift	BSFR	BSFR D n			3	
	BSFRP	BSFRP D n				
	BSFL	BSFL D n			3	
	BSFLP	BSFLP D n				
1-word shift	DSFR	DSFR D n			3	●
	DSFRP	DSFRP D n				
	DSFL	DSFL D n			3	●
	DSFLP	DSFLP D n				

(4) Bit processing instructions

Category	Instruction symbol	Symbol	Processing details	Execution condition	Number of basic steps	Subset
Bit set/reset	BSET	BSET D n			3	●
	BSETP	BSETP D n				
	BRST	BRST D n			3	●
	BRSTP	BRSTP D n				

Category	Instruction symbol	Symbol	Processing details	Execution condition	Number of basic steps	Subset
Bit tests	TEST	TEST S1 S2 D	(S1) b15 to b0 (D) Bit specified by (S2)		4	
	TESTP	TESTP S1 S2 D				
	DTEST	DTEST S1 S2 D	(S1) b31 to b0 (D) Bit specified by (S2)		4	
	DTESTP	DTESTP S1 S2 D				
Batch reset of bit devices	BKRST	BKRST S n	(S) ON OFF Reset (S) OFF OFF n ON ON OFF OFF		3	
	BKRSTP	BKRSTP S n				

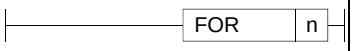
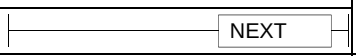
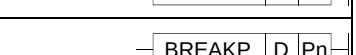
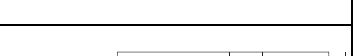
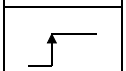
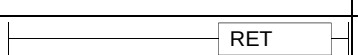
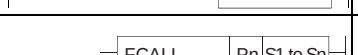
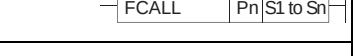
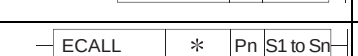
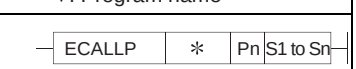
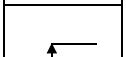
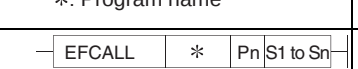
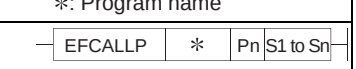
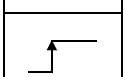
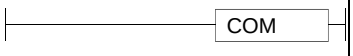
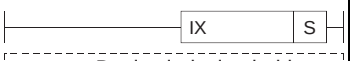
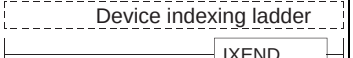
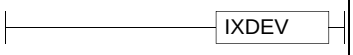
(5) Data processing instructions

Category	Instruction symbol	Symbol	Processing details	Execution condition	Number of basic steps	Subset
Data searches	SER	SER S1 S2 D n	(S1) (S2) n (D) : Position of match (D+1) : Number of matches		5	
	SERP	SERP S1 S2 D n				
	DSER	DSER S1 S2 D n	32 bits (S1) (S2) n (D) : Position of match (D+1) : Number of matches		5	
	DSERP	DSERP S1 S2 D n				
Bit checks	SUM	SUM S D	(S) b15 b0 (D) : Number of bits where 1 is set		3	●
	SUMP	SUMP S D				
	DSUM	DSUM S D	(S+1) (S) (D) : Number of bits where 1 is set		3	●
	DSUMP	DSUMP S D				
Decode	DECO	DECO S D n	8→256 decode (S) Decode (D) n 2^nbit		4	
	DECOP	DECOP S D n				
Encode	ENCO	ENCO S D n	256→8 decode (S) 2^nbit Encode (D) n		4	
	ENCOP	ENCOP S D n				

Category	Instruction symbol	Symbol	Processing details	Execution condition	Number of basic steps	Subset
7-segment decode	SEG	SEG S D	b3 to bO (S) (D) 7SEG		3	●
	SEGP	SEGP S D				
Separating and linking	DIS	DIS S D n	・ Separates 16-bit data specified by (S) into 4-bit units, and stores it at the lower 4 bits of n points from (D). (n ≤ 4)		4	
	DISP	DISP S D n				
	UNI	UNI S D n	・ Links the lower 4 bits of n points from the device specified by (S) and stores it at the device specified by (D). (n ≤ 4)		4	
	UNIP	UNIP S D n				
	NDIS	NDIS S1 D S2	・ Separates the data in the devices specified by (S1) into bits specified by the devices from (S2), and stores them to the devices following the device specified by (D).		4	
	NDISP	NDISP S1 D S2				
	NUNI	NUNI S1 D S2	・ Links the data in the devices following the device specified by (S1) with bits specified by the devices from (S2), and stores them to the devices following the device specified by (D).			
	NUNIP	NUNIP S1 D S2				
	WTOB	WTOB S D n	・ Breaks n points of 16-bit data from the device specified by (S) into 8-bit units, and stores them to the device specified by (D).		4	
	WTOBP	WTOBP S D n				
	BTOW	BTOW S D n	・ Links the lower 8 bits of 16-bit data of n points from the device specified by (S) into 16-bit units, and stores them to the device BTOWP specified by (D).			
	BTOWP	BTOWP S D n				
Search	MAX	MAX S D n	・ Searches for the data of n points from the device specified by (S) in 16-bit units, and stores the maximum value to the device specified by (D).		4	
	MAXP	MAXP S D n				
	MIN	MIN S D n	・ Searches for the data of n points from the device specified by (S) in 16-bit units, and stores the minimum value to the device specified by (D).			
	MINP	MINP S D n				
	DMAX	DMAX S D n	・ Searches for the data of 2 × n points from the device specified by (S) in 32-bit units, and stores the maximum value to the device specified by (D).		4	
	DMAXP	DMAXP S D n				
	DMIN	DMIN S D n	・ Searches for the data of 2 × n points from the device specified by (S) in 32-bit units, and stores the minimum value to the device specified by (D).			
	DMINP	DMINP S D n				

Category	Instruction symbol	Symbol	Processing details	Execution condition	Number of basic steps	Subset
Sort	SORT	SORT S1 n S2 D1 D2 ・S2 : Number of comparisons for single run ・D1 : Device to be turned on at completion of sort ・D2 : For system use	・Sorts data of n points from device specified by (S1) in 16-bit units. (n × (n-1)/2 scans are required)		6	
	DSORT	DSORT S1 n S2 D1 D2 ・S2 : Number of comparisons for single run ・D1 : Device to be turned on at completion of sort ・D2 : For system use	・Sorts data of 2 × n points from device specified by (S1) in 32-bit units. (n × (n-1)/2 scans are required)			
Total value calculations	WSUM	WSUM S D n	・Adds 16-bit BIN data of n points from the device specified by (S), and stores it to the device specified by (D).		4	
	WSUMP	WSUMP S D n				
	DWSUM	DWSUM S D n	・Adds 32-bit BIN data of n points from the device specified by (S), and stores it to the device specified by (D).			
	DWSUMP	DWSUMP S D n				

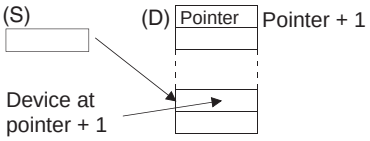
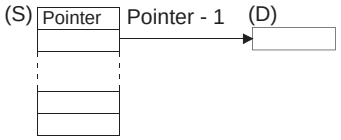
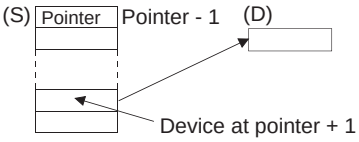
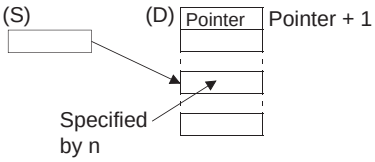
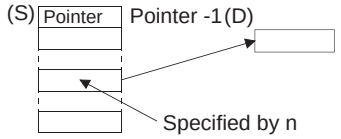
(6) Structure creation instructions

Category	Instruction symbol	Symbol	Processing details	Execution condition	Number of basic steps	Subset
Number of repeats	FOR		・ Executes n times between the FOR and NEXT.		2	
	NEXT				1	
	BREAK		・ Forcibly ends the execution of the FOR to NEXT cycle and jumps pointer Pn.		3	
	BREAKP					
Subroutine program calls	CALL		・ Executes subroutine program Pn when the input condition is met. (S1 to Sn are arguments sent to subroutine program. 0 ≤ n ≤ 5)		*1 2+n	
	CALLP					
	RET		・ Returns from the subroutine program		1	
	FCALL		・ Executes non-execution processing of the subroutine program of Pn when input conditions have not been met.		*1 2+n	
	FCALLP					
	ECALL		・ Executes subroutine program Pn in the specified program name when the input condition is met. (S1 to Sn are arguments sent to subroutine program. 0 ≤ n ≤ 5)		*2 3+n	
	ECALLP					
	EFCALL		・ Executes non-execution processing of subroutine program Pn in the specified program name when input conditions have not been not met.		*2 3+n	
	EFCALLP					
	COM		・ Executes link refreshing and general data processing.		1	
Fixed indexing	IX		・ Executes indexing for individual devices used in the device indexing ladder.		2	
	IXEND				1	
	IXDEV		・ Stores the indexing value used for indexing executed between the IX and IXEND to the device specified by D or later.		1	
	IXSET				3	

*1: n indicates number of arguments for the subroutine program.

*2: n indicates the total number of arguments used in the subroutine program and program name steps.
The number of program name steps is calculated as "number of characters in the program/2" (decimal fraction is rounded up).

(7) Table operation instructions

Category	Instruction symbol	Symbol	Processing details	Execution condition	Number of basic steps	Subset
Table processing	FIFW	FIFW S D			3	
	FIFWP	FIFWP S D				
	FIFR	FIFR S D			3	
	FIFRP	FIFRP S D				
	FPOP	FPOP S D			3	
	FPOPP	FPOPP S D				
	FINS	FINS S D n			4	
	FINSP	FINS S D n				
	FDEL	FDEL S D n			4	
	FDELP	FDELP S D n				

(8) Buffer memory access instructions

Category	Instruction symbol	Symbol	Processing details	Execution condition	Number of basic steps	Subset
Data read	FROM	FROM n1 n2 D n3	・ Reads data in 16-bit units from a special function module.		5	
	FROMP	FROMP n1 n2 D n3				
	DFRO	DFRO n1 n2 D n3	・ Reads data in 32-bit units from a special function module.		5	
	DFROP	DFROP n1 n2 D n3				
Data write	TO	TO n1 n2 S n3	・ Writes data in 16-bit units to a special function module.		5	
	TOP	TOP n1 n2 S n3				
	DTO	DTO n1 n2 S n3	・ Writes data in 32-bit units to a special function module.		5	
	DTOP	DTOP n1 n2 S n3				

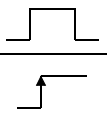
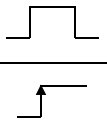
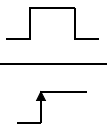
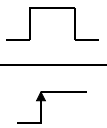
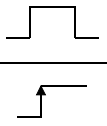
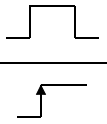
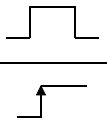
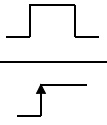
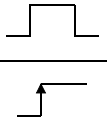
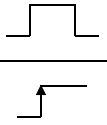
(9) Display instructions

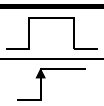
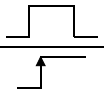
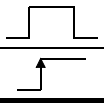
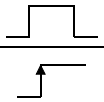
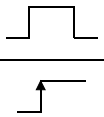
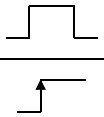
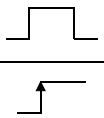
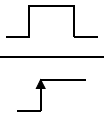
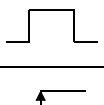
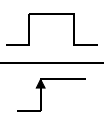
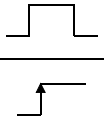
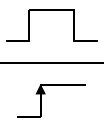
Category	Instruction symbol	Symbol	Processing details	Execution condition	Number of basic steps	Subset
ASCII print	PR	＊SM701: OFF PR S D	・ Outputs ASCII code of 8 points (16 characters) from the device specified by (S) to the output module.		3	
	PR	＊SM701: ON PR S D	・ Outputs ASCII code from device specified by (S) to 00H to the output module.			
	PRC	PRC S D	・ Converts comments of the device specified by (S) into ASCII code and outputs them to the output module.			
Display	LED	LED S	・ Outputs ASCII code of 8 points (16 characters) from the device specified by (S) to the LED indicator at the front of the CPU.		2	
	LEDC	LEDC S	・ Outputs the comment from the device specified by (S) to the LED indicator at the front of the CPU.			
Reset	LEDR	LEDR	・ Resets the annunciator and LED indicator display.		1	

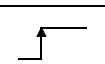
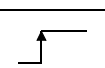
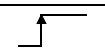
(10) Debugging and failure diagnosis instructions

Category	Instruction symbol	Symbol	Processing details	Execution condition	Number of basic steps	Subset
Checks	CHKST	CHKST	・ The CHK instruction is executed when CHKST is executed. ・ Jumps the execution to the step following the CHK instruction when CHKST is not executed.		1	
	CHK	CHK Check condition	・ During normal conditions → SM80: OFF, SD80: 0 ・ During abnormal conditions → SM80: ON, SD80: Failure No.			
	CHKCIR	CHKCIR	・ Starts update in ladder pattern to be checked with the CHK instruction.		1	
	CHKEND	CHKEND	・ Ends update in ladder pattern to be checked with the CHK instruction.			
Status latch	SLT	SLT	・ Executes the status latch.	↑	1	
	SLTR	SLTR	・ Resets the status latch to enable the re-execution.			
Sampling trace	STRA	STRA	・ Sets a trigger for the sampling trace.	↑	1	
	STRAR	STRAR	・ Resets the sampling trace to enable the re-execution.			
Program trace	PTRA	PTRA	・ Sets a trigger for the program trace.	↑	1	
	PTRAR	PTRAR	・ Resets the program trace to enable the re-execution.			
	PTRAEXE	PTRAEXE	・ Executes the program trace.	⊓	1	
	PTRAEXEP	PTRAEXEP		↑		

(11) Character string processing instructions

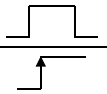
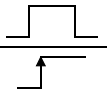
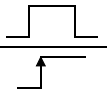
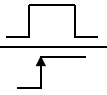
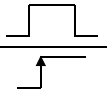
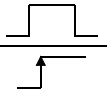
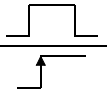
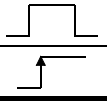
Category	Instruction symbol	Symbol	Processing details	Execution condition	Number of basic steps	Subset
BIN ↓ Decimal ASCII	BINDA	BINDA S D	・ Converts a 1-word BIN value specified by (S) into a 5-digit decimal ASCII value, and stores it to the word device specified by (D).		3	
	BINDAP	BINDAP S D				
	DBINDA	DBINDA S D	・ Converts a 2-word BIN value specified by (S) into a 10-digit decimal ASCII value, and stores it to word devices following the word device specified by (D).		3	
	DBINDAP	DBINDAP S D				
BIN ↓ Hexadecimal ASCII	BINHA	BINHA S D	・ Converts a 1-word BIN value specified by (S) into a 4-digit hexadecimal ASCII value, and stores it to word devices following the word device specified by (D).		3	
	BINHAP	BINHAP S D				
	DBINHA	DBINHA S D	・ Converts a 2-word BIN value specified by (S) into an 8-digit hexadecimal ASCII value, and stores it to word devices following the word device specified by (D).		3	
	DBINHAP	DBINHAP S D				
BCD ↓ Decimal ASCII	BCDDA	BCDDA S D	・ Converts a 1-word BCD value specified by (S) to a 4-digit decimal ASCII value, and stores it to word devices following the word device specified by (D).		3	
	BCDDAP	BCDDAP S D				
	DBCDDA	DBCDDA S D	・ Converts a 2-word BCD value specified by (S) to an 8-digit decimal ASCII value, and stores it to word devices following the word device specified by (D).		3	
	DBCDDAP	DBCDDAP S D				
Decimal ASCII ↓ BIN	DABIN	DABIN S D	・ Converts a 5-digit decimal ASCII value specified by (S) into a 1-word BIN value, and stores it to a word device specified by (D).		3	
	DABINP	DABINP S D				
	DDABIN	DDABIN S D	・ Converts a 10-digit decimal ASCII value specified by (S) into a 2-word BIN value, and stores it to a word device specified by (D).		3	
	DDABINP	DDABINP S D				
Hexadecimal ASCII ↓ BIN	HABIN	HABIN S D	・ Converts a 4-digit hexadecimal ASCII value specified by (S) into a 1-word BIN value, and stores it to a word device specified by (D).		3	
	HABINP	HABINP S D				
	DHABIN	DHABIN S D	・ Converts an 8-digit hexadecimal ASCII value specified by (S) into a 2-word BIN value, and stores it to a word device specified by (D).		3	
	DHABINP	DHABINP S D				

Category	Instruction symbol	Symbol	Processing details	Execution condition	Number of basic steps	Subset
Decimal ASCII ↓ BCD	DABCD	DABCD S D	・ Converts a 4-digit decimal ASCII value specified by (S) into a 1-word BCD value, and stores it to a word device specified by (D).		3	
	DABCDP	DABCDP S D				
	DDABCD	DDABCD S D	・ Converts an 8-digit decimal ASCII value specified by (S) into a 2-word BCD value, and stores it to a word device specified by (D).		3	
	DDABCDP	DDABCDP S D				
Device comment read operation	COMRD	COMRD S D	・ Stores a comment of the device specified by (S) to a device specified by (D).		3	
	COMRDP	COMRDP S D				
Character string length detection	LEN	LEN S D	・ Stores the data length (number of characters) of character string in the device specified by (S) to a device specified by (D).		3	
	LENP	LENP S D				
BIN ↓ Decimal character string	STR	STR S1 S2 D	・ Converts a 1-word BIN value specified by (S2) into a decimal character string with the total number of digits and the number of decimal fraction digits specified by (S1) and stores them to a device specified by (D).		4	
	STRP	STRP S1 S2 D				
	DSTR	DSTR S1 S2 D	・ Converts a 2-word BIN value specified by (S2) into a decimal character string with the total number of digits and the number of decimal fraction digits specified by (S1) and stores them to a device specified by (D).		4	
	DSTRP	DSTRP S1 S2 D				
Decimal character string ↓ BIN	VAL	VAL S D1 D2	・ Converts a character string including decimal point specified by (S) into a 1-word BIN value and the number of decimal fraction digits, and stores them to devices specified by (D1) and (D2).		4	
	VALP	VALP S D1 D2				
	DVAL	DVAL S D1 D2	・ Converts a character string including decimal point specified by (S) into a 2-word BIN value and the number of decimal fraction digits, and stores them to devices specified by (D1) and (D2).		4	
	DVALP	DVALP S D1 D2				
Floating decimal point ↓ Character string	ESTR	ESTR S1 S2 D	・ Converts the floating decimal point data specified by (S) into a character string, and stores it to devices specified by (D).		4	
	ESTRP	ESTRP S1 S2 D				
Character string ↓ Floating decimal point	EVAL	EVAL S D	・ Converts the character string specified by (S) to floating decimal point data, and stores it in devices specified by (D).		3	
	EVALP	EVALP S D				
Hexadecimal BIN ↓ ASCII	ASC	ASC S D n	・ Converts 1-word BIN values of the devices following the device specified by (S) into hexadecimal ASCII, and stores n characters of them to word devices following the device specified by (D).		4	
	ASCP	ASCP S D n				
ASCII ↓ Hexadecimal BIN	HEX	HEX S D n	・ Converts n hexadecimal ASCII characters of the devices following the device specified by (S) into BIN values, and stores them to the devices following the device specified by (D).		4	
	HEXP	HEXP S D n				

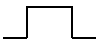
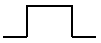
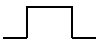
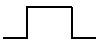
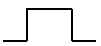
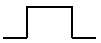
Category	Instruction symbol	Symbol	Processing details	Execution condition	Number of basic steps	Subset
Character string	RIGHT	RIGHT S D n	・Stores n characters from the end of a character string specified by (S) to the device specified by (D).		4	
	RIGHTP	RIGHTP S D n				
	LEFT	LEFT S D n	・Stores n characters from the start character string specified by (S) to the device specified by (D)			
	LEFTP	LEFTP S D n				
	MIDR	MIDR S1 D S2	・Stores the specified number of characters specified by (S1) from the position specified by (S2) to the device specified by (D).		4	
	MIDRP	MIDRP S1 D S2				
	MIDW	MIDW S1 D S2	・Stores the specified number of character string specified by (S1) from the position specified by the device (S2) specified by (D).			
	MIDWP	MIDWP S1 D S2				
	INSTR	INSTR S1 S2 D n	・Searches for character string (S1) from the nth character of character string (S2), and stores matched positions to (D).		5	
	INSTRP	INSTRP S1 S2 D n				
Floating decimal point ↓ BCD	EMOD	EMOD S1 S2 D	・Converts the floating decimal point data of (S1) into BCD data with the number of decimal fraction digits specified by (S2) , and stores them to the device specified by (D).		4	
	EMODP	EMODP S1 S2 D				
BCD ↓ Floating decimal point	EREXP	EREXP S1 S2 D	・Converts BCD data of (S1) into the floating decimal point data with the number of decimal fraction digits specified by (S2), and stores them to the device specified by (D).		4	
	EREXPP	EREXPP S1 S2 D				

(12) Special function instructions

Category	Instruction symbol	Symbol	Processing details	Execution condition	Number of basic steps	Subset
Trigonometric functions (floating decimal point data)	SIN	SIN S D	· Sin(S+1,S) ⟶ (D+1,D)		3	
	SINP	SINP S D				
	COS	COS S D	· Cos(S+1,S) ⟶ (D+1,D)		3	
	COSP	COSP S D				
	TAN	TAN S D	· Tan(S+1,S) ⟶ (D+1,D)		3	
	TANP	TANP S D				
	ASIN	ASIN S D	· Sin^{-1}(S+1,S) ⟶ (D+1,D)		3	
	ASINP	ASINP S D				
	ACOS	ACOS S D	· Cos^{-1}(S+1,S) ⟶ (D+1,D)		3	
	ACOSP	ACOSP S D				
	ATAN	ATAN S D	· Tan^{-1}(S+1,S) ⟶ (D+1,D)		3	
	ATANP	ATANP S D				
Angles ↔ Radians conversion	RAD	RAD S D	· (S+1, S) ⟶ (D+1, D) Conversion from angle to radian		3	
	RADP	RADP S D				
	DEG	DEG S D	· (S+1, S) ⟶ (D+1, D) Conversion from radian to angle		3	
	DEGP	DEGP S D				
Square root	SQR	SQR S D	· $\sqrt{(S+1,S)}$ ⟶ (D+1,D)		3	
	SQRP	SQRP S D				
Exponential operations	EXP	EXP S D	· $e^{(S+1,S)}$ ⟶ (D+1,D)		3	
	EXPP	EXPP S D				
Natural logarithms	LOG	LOG S D	· Log e(S+1,S) ⟶ (D+1,D)		3	
	LOGP	LOGP S D				
Random number generation	RND	RND D	· Generates a random number (from 0 to less than 32767) and stores it to the device specified by (D).		2	
	RNDP	RNDP D				
Random number series update	SRND	SRND D	· Updates random number series according to the 16-bit BIN data stored in the device specified by (S).			
	SRNDP	SRNDP D				

Category	Instruction symbol	Symbol	Processing details	Execution condition	Number of basic steps	Subset
Square root	BSQR	BSQR S D	· $\sqrt{(S)}$ → (D) +0 Integral part +1 Decimal part		3	
	BSQRP	BSQRP S D				
	BDSQR	BDSQR S D	· $\sqrt{(S+1,S)}$ → (D) +0 Integral part +1 Decimal part		3	
	BDSQRP	BDSQRP S D				
Trigonometric functions	BSIN	BSIN S D	· Sin(S) → (D) +0 Sign +1 Integral part +2 Decimal part		3	
	BSINP	BSINP S D				
	BCOS	BCOS S D	· Cos(S) → (D) +0 Sign +1 Integral part +2 Decimal part		3	
	BCOSP	BCOSP S D				
	BTAN	BTAN S D	· Tan(S) → (D) +0 Sign +1 Integral part +2 Decimal part		3	
	BTANP	BTANP S D				
	BASIN	BASIN S D	· $Sin^{-1}(S)$ → (D) +0 Sign +1 Integral part +2 Decimal part		3	
	BASINP	BASINP S D				
	BACOS	BACOS S D	· $Cos^{-1}(S)$ → (D) +0 Sign +1 Integral part +2 Decimal part		3	
	BACOSP	BACOSP S D				
	BATAN	BATAN S D	· $Tan^{-1}(S)$ → (D) +0 Sign +1 Integral part +2 Decimal part		3	
	BATANP	BATANP S D				

(13) Data control instructions

Category	Instruction symbol	Symbol	Processing details	Execution condition	Number of basic steps	Subset
Upper and lower limit controls	LIMIT	LIMIT S1 S2 S3 D	・ When (S3) < (S1) ... Stores value of (S1) to (D) ・ When (S1) ≤ (S3) ≤ (S2) ... Stores value of (S3) to (D) ・ When (S2) < (S3) ... Stores value of (S2) to (D)		5	
	LIMITP	LIMITP S1 S2 S3 D				
	DLIMIT	DLIMIT S1 S2 S3 D	・ When ((S3) + 1, (S3)) < ((S1) + 1, S1) ... Stores value of ((S1) + 1, (S1)) to ((D) + 1, (D)) ・ When ((S1) + 1, (S1)) ≤ ((S3) + 1, (S3)) < (S2 + 1, S2) ... Stores value of ((S3) + 1, (S3)) to ((D) + 1, (D)) ・ When ((S2), (S2) + 1) < ((S3), (S3) + 1) ... Stores value of ((S2) + 1, (S2)) to ((D) + 1, (D))		5	
	DLIMITP	DLIMITP S1 S2 S3 D				
Dead band controls	BAND	BAND S1 S2 S3 D	・ When (S1) ≤ (S3) ≤ (S2)... 0 → (D) ・ When (S3) < (S1)... (S3) - (S1) → (D) ・ When (S2) < (S3)... (S3) - (S2) → (D)		5	
	BANDP	BANDP S1 S2 S3 D				
	DBAND	DBAND S1 S2 S3 D	・ When ((S1) + 1, (S1)) ≤ ((S3) + 1, (S3)) ≤ (S2 + 1, S2) ... 0 → ((D) + 1, (D)) ・ When ((S3) + 1, (S3)) < ((S1) + 1, (S1)) ... ((S3) + 1, (S3)) - ((S1) + 1, (S1)) → ((D) + 1, (D)) ・ When ((S2) + 1, (S2)) < ((S3) + 1, (S3)) ... ((S3) + 1, (S3)) - ((S2) + 1, (S2)) → ((D) + 1, (D))		5	
	DBANDP	DBANDP S1 S2 S3 D				
Zone controls	ZONE	ZONE S1 S2 S3 D	・ When (S3) = 0... 0 → (D) ・ When (S3) > 0... (S3) + (S2) → (D) ・ When (S3) > 0... (S3) (S1) → (D)		5	
	ZONEP	ZONEP S1 S2 S3 D				
	DZONE	DZONE S1 S2 S3 D	・ When ((S3) + 1, (S3)) = 0 ... 0 → ((D) + 1, (D)) ・ When ((S3) + 1, (S3)) > 0 ... ((S3) + 1, (S3)) + ((S2) + 1, (S2)) →((D) + 1, (D)) ・ When ((S3) + 1, (S3)) < 0 ... ((S3) + 1, (S3)) + ((S1) + 1, (S1)) →((D) + 1, (D))		5	
	DZONEP	DZONEP S1 S2 S3 D				

(14) Switching instructions

Category	Instruction symbol	Symbol	Processing details	Execution condition	Number of basic steps	Subset
Block number switching	RSET	RSET S	・ Changes the extension file register block number to the number specified by (S).		2	
	RSETP	RSETP S				
File set	QDRSET	QDRSET File name	・ Sets file names to be used as file registers.		* 2+n	
	QDRSETP	QDRSETP File name				
	QCDSET	QCDSET File name	・ Sets file names to be used as comment files.		* 2+n	
	QCDSETP	QCDSETP File name				

*: n ([number of file name characters]/2) indicates a step (decimal fraction is rounded up)

(15) Clock instructions

Category	Instruction symbol	Symbol	Processing details	Execution condition	Number of basic steps	Subset
Read/write clock data	DATERD	DATERD D	・(Clock element) →(D)+0 Year, +1 Month, +2 Day, +3 Hour, +4 Minute, +5 Second, +6 Day of week		2	
	DATERDP	DATERDP D				
	DATEWR	DATEWR S	・(D)+0 Year, +1 Month, +2 Day, +3 Hour, +4 Minute, +5 Second, +6 Day of week →(Clock element)		2	
	DATEWRP	DATEWRP S				
Clock data addition/subtraction	DATE+	DATE+ S1 S2 D	(S1) Hour, Minute, Second + (S2) Hour, Minute, Second → (D) Hour, Minute, Second		4	
	DATE+P	DATE+P S1 S2 D				
	DATE-	DATE− S1 S2 D	(S1) Hour, Minute, Second − (S2) Hour, Minute, Second → (D) Hour, Minute, Second		4	
	DATE-P	DATE−P S1 S2 D				
Clock data translation	SECOND	SECOND S D	(S) Hour, Minute, Second → (D) Second (lower), Second (upper)		3	
	SECONDP	SECONDP S D				
	HOUR	HOUR S D	(S) Second (lower), Second (upper) → (D) Hour, Minute, Second			
	HOURP	HOURP S D				

(16) Peripheral device instructions

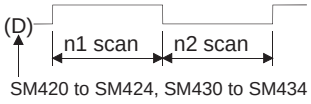
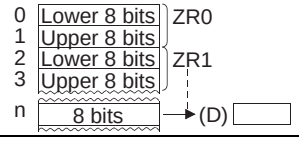
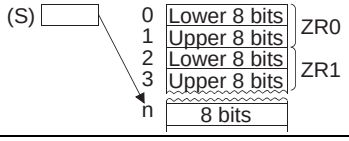
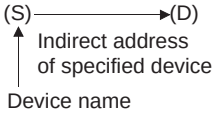
Category	Instruction symbol	Symbol	Processing details	Execution condition	Number of basic steps	Subset
Input/output to peripheral device	MSG	MSG S	・ Stores the message specified by (S) to the QnACPU. This message is displayed on the peripheral device.		2	
	PKEY	PKEY D	・ Stores the data input from the peripheral device to the device specified by (D).		2	

(17) Program instructions

Category	Instruction symbol	Symbol	Processing details	Execution condition	Number of basic steps	Subset
	PSTOP	PSTOP Program name	・ Sets the specified program to the standby status.		*	
	PSTOPP	PSTOPP Program name			2+n	
	POFF	POFF Program name	・ Turns off the coil of the OUT instruction of the specified program, and sets the program to the standby status.		*	
	POFFP	POFFP Program name			2+n	
	PSCAN	PSCAN Program name	・ Registers the specified program as a scan execution type.		*	
	PSCANP	PSCANP Program name			2+n	
	PLOW	PLOW Program name	・ Registers the specified program as a low-speed execution type.		*	
	PLOWP	PLOWP Program name			2+n	

*: n ([number of file name characters]/2) indicates a step (decimal fraction is rounded up).

(18) Other instructions

Category	Instruction symbol	Symbol	Processing details	Execution condition	Number of basic steps	Subset
WDT reset	WDT	WDT	・ Resets the watchdog timer during the execution of the sequence program.		1	
	WDTP	WDTP				
Timing clock	DUTY	DUTY n1 n2 D			4	
Direct read/write operations in 1-byte units	ZRRDB	ZRRDB n D			3	
	ZRRDBP	ZRRDBP n D				
	ZRWRB	ZRWRB n S			3	
	ZRWRBP	ZRWRBP n S				
	ADRSET	ADRSET S D			3	
	ADRSET	ADRSETP S D				
Numerical key input from keyboard	KEY	KEY S n D1 D2	・ Imports ASCII data to 8 points of input unit specified by (S), converts it into hexadecimal value, and stores it to devices following the device specified by (D1).		5	
Batch save of index register	ZPUSH	ZPUSH D	・ Saves the contents of index registers Z0 to Z15 to devices following the device specified by (D).		2	
	ZPUSHP	ZPUSHP D				
Batch recovery of index register	ZPOP	ZPOP D	・ Reads the data stored in the devices following the device specified by (D) to the index registers Z0 to Z15.			
	ZPOPP	ZPOPP D				
Batch write to file register of E^2PROM	EROMWR	EROMWR S D1 n D2	・ Writes data to the file register of E^2PROM in batch.		5	
	EROMWRP	EROMWRP S D1 n D2				

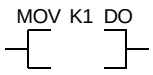
Category	Instruction symbol	Symbol	Processing details	Execution condition	Number of basic steps	Subset
Reading module information	UNIRD	UNIRD n1 D n2	・ Reads the module information stored in the device starting from the I/O number specified by (n) by the points specified by (n2), and stores it to devices following the device specified by (D).	⌐¬	4	
	UNIRDP	UNIRDP n1 D n2		⌐		
Trace set	TRACE	TRACE	・ Stores the trace data set with the peripheral device of the number of set times set when SM800, SM801, and SM802 are turned on to the trace file of the IC memory card.	⌐	1	
Trace reset	TRACER	TRACER	・ Resets the data set with the TRACE instruction.	⌐	1	
Writing data to the specified file	SP.FWRITE	SP.FWRITE U0 S0 D0 S1 S2 D1	・ Writes data to the specified file.	⌐	11	
Reading data from specified file	SP.FREAD	SP.FREAD U0 S0 D0 S1 S2 D1	・ Reads data from the specified file.	⌐	11	
Loading program from memory	PLOADP	PLOADP S D	・ Transfers the program stored in a memory card or standard memory (other than drive 0) to drive 0 and sets the program to the standby status.	⌐	3	
Unloading program from program memory	PUNLOADP	PUNLOADP S D	・ Deletes the standby program stored in the standard memory (drive 0).	⌐	3	
Load + Unload	PSWAPP	PSWAPP S1 S2 D	・ Deletes the standby program stored in the standard memory (drive 0) specified by (S1). Then, transfers the program stored in a memory card or standard memory (other than drive 0) specified by (S2) to drive 0 and sets it to the standby status.	⌐	4	
High-speed block transfer of file register	RBMOV	RBMOV S D n	・ Transfers n points of 16-bit data from the device specified by (S) to n points of the devices starting from the device specified by (D).	⌐¬	4	
	RBMOVP	RBMOVP S D n		⌐		
Writing to host CPU shared memory	S.TO	S.TO n1 n2 n3 n4 D	・ Writes device data of the host station to the host CPU shared memory area.	⌐¬	5	
	S.TOP	S.TOP n1 n2 n3 n4 D		⌐		
Reading from other CPU shared memory	FROM	FROM n1 n2 D n3	・ Reads the device data from the other CPU shared memories, and stores the data in the host station.	⌐¬	5	
	FROMP	FROMP n1 n2 D n3		⌐		
CPU shared memory auto refresh	COM	COM	・ Executes the auto refreshing of the intelligent function module, general data, and multiple CPU shared memory.		1	

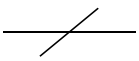
Appendix 2 How to Create Ladder Programs with GX Works2

Ladder program creation methods include the following five methods.

1. Inputting list expressions (mnemonic language) with the keyboard on the ladder program creation screen
2. Using the tool buttons on the toolbar
3. Using the function keys
4. Using the items of the menu bar
5. Directly inputting devices (only for I/O devices)

The following table shows the operations of each method.

Ex.	List expression	Tool button	Function	Menu bar
	LD X1 → Enter	Click F5 → "X1" in the device instruction input field → Click the OK button.	F5 → "X1" in the device instruction input field → Enter	[Edit] → [Ladder Symbol] → [Open Contact] → "X1" in the device instruction input field → Enter
	LDI X1 → Enter	Click SF5 → "X1" in the device instruction input field → Click the OK button.	Shift + F5 → "X1" in the device instruction input field → Enter	[Edit] → [Ladder Symbol] → [Close Contact] → "X1" in the device instruction input field → Enter
	OR X1 → Enter	Click F6 → "X1" in the device instruction input field → Click the OK button.	F6 → "X1" in the device instruction input field → Enter	[Edit] → [Ladder Symbol] → [Open Branch] → "X1" in the device instruction input field → Enter
	ORI X1 → Enter	Click SF6 → "X1" in the device instruction input field → Click the OK button.	Shift + F6 → "X1" in the device instruction input field →Enter	[Edit] → [Ladder Symbol] → [Close Branch] → "X1" in the device instruction input field → Enter
	OUT Y1 → Enter	Click F7 → "Y1" in the device instruction input field → Click the OK button.	F7 → "Y1" in the device instruction input field → Enter	[Edit] → [Ladder Symbol] → [Coil] → "Y1" in the device instruction input field → Enter
	MOV K1 D0 → Enter	Click F8 → "MOV K1 D0" in the device instruction input field → Click the OK button.	F8 → "MOV K1 D0" in the device instruction input field → Enter	[Edit] → [Ladder Symbol] → [Application Instruction] → "Y1" in the device instruction input field → Enter
	LDP X1 → Enter	Click SF7 → "X1" in the device instruction input field → Click the OK button.	Shift + F7 → "X1" in the device instruction input field →Enter	[Edit] → [Ladder Symbol] → [Pulse Contact Symbol] → [Rising Pulse] → "X1" in the device instruction input field → Enter
	LDPI X1 → Enter	Click saF5 → "X1" in the device instruction input field → Click the OK button.	Shift + Alt + F5 → "X1" in the device instruction input field → Enter	[Edit] → [Ladder Symbol] → [Pulse Contact Symbol] → [Rising Pulse Close] → "X1" in the device instruction input field → Enter

Ex.	List expression	Tool button	Function	Menu bar
	LDF X1 → Enter	Click → "X1" in the device instruction input field → Click the OK button.	Shift + F8 → "X1" in the device instruction input field →Enter	[Edit] → [Ladder Symbol] → [Pulse Contact Symbol] → [Falling Pulse] → "X1" in the device instruction input field → Enter
	LDFI X1 → Enter	Click → "X1" in the device instruction input field → Click the OK button.	Shift + Alt + F6 → "X1" in the device instruction input field → Enter	[Edit] → [Ladder Symbol] → [Pulse Contact Symbol] → [Falling Pulse Close] → "X1" in the device instruction input field → Enter
	ORP X1 → Enter	Click → "X1" in the device instruction input field → Click the OK button.	Alt + F7 → "X1" in the device instruction input field → Enter	[Edit] → [Ladder Symbol] → [Pulse Contact Symbol] → [Rising Pulse Branch] → "X1" in the device instruction input field → Enter
	ORPI X1 → Enter	Click → "X1" in the device instruction input field → Click the OK button.	Shift + Alt + F7 → "X1" in the device instruction input field → Enter	[Edit] → [Ladder Symbol] → [Pulse Contact Symbol] → [Rising Pulse Close Branch] → "X1" in the device instruction input field → Enter
	ORF X1 → Enter	Click → "X1" in the device instruction input field → Click the OK button.	Alt + F8 → "X1" in the device instruction input field →Enter	[Edit] → [Ladder Symbol] → [Pulse Contact Symbol] → [Falling Pulse Branch] → "X1" in the device instruction input field → Enter
	ORFI X1 → Enter	Click → "X1" in the device instruction input field → Click the OK button.	Shift + Alt + F8 → "X1" in the device instruction input field → Enter	[Edit] → [Ladder Symbol] → [Pulse Contact Symbol] → [Falling Pulse Close Branch] → "X1" in the device instruction input field → Enter
	EGP V0 → Enter	Click → "V0" in the device instruction input field → Click the OK button.	Alt + F5 → "V0" in the device instruction input field → Enter	[Edit] → [Ladder Symbol] → [Operation Result Rising Pulse] → "V0" in the device instruction input field → Enter
	EGF V0 → Enter	Click → "V0" in the device instruction input field → Click the OK button.	Ctrl + Alt + F5 → "V0" in the device instruction input field → Enter	[Edit] → [Ladder Symbol] → [Operation Result Falling Pulse] → "V0" in the device instruction input field → Enter
	INV → Enter	Click → Click the OK button.	Ctrl + Alt + F10 → Enter	[Edit] → [Ladder Symbol] → [Invert Operation Results] → Enter

Ex.	List expression	Tool button	Function	Menu bar
Horizontal line	-	Click F9 → Input the number of lines to be written in the device instruction input field. → Click the OK button.	F9 → Input the number of lines to be written in the device instruction input field. → Enter	[Edit] → [Ladder Symbol] → [Horizontal Line] → Input the number of lines to be written in the device instruction input field. → Enter
Vertical line	-	Click F10 → Input the number of lines to be written in the device instruction input field. → Click the OK button.	F10 → Input the number of lines to be written in the device instruction input field. → Enter	[Edit] → [Ladder Symbol] → [Vertical Line] → Input the number of lines to be written in the device instruction input field. → Enter
Rule line	-	Click aF10 → Move the cursor to the position where a line is to be written and drag the cursor.	Alt + F10 → Move the cursor to the position where a line is to be written and drag the cursor.	[Edit] → [Edit Line] → Move the cursor to the position where a line is written and drag the cursor.
Delete vertical line	-	Click cF9 → Input the number of lines to be deleted in the device instruction input field. → Click the OK button.	Ctrl + F9 → Input the number of lines to be deleted in the device instruction input field. → Enter	[Edit] → [Ladder Symbol] → [Delete Horizontal Line] → Input the number of lines to be deleted in the device instruction input field. → Enter
Delete rule line	-	Click cF10 → Input the number of lines to be deleted in the device instruction input field. → Click the OK button.	Ctrl + F10 → Input the number of lines to be deleted in the device instruction input field. → Enter	[Edit] → [Ladder Symbol] → [Delete Vertical Line] → Input the number of lines to be deleted in the device instruction input field. → Enter
Delete horizontal line	-	Click aF9 → Move the cursor to the position where lines are to be deleted and drag the cursor.	Alt + F9 → Move the cursor to the position where lines are to be deleted and drag the cursor.	[Edit] → [Delete Line] → Move the cursor to the position where lines are to be deleted and drag the cursor.

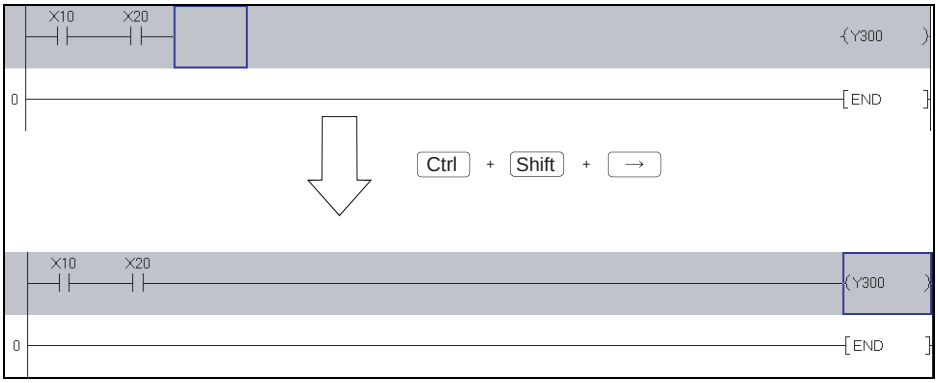
POINT

Input and deletion of lines

Other than the methods above, lines can also be input and deleted with Ctrl + an arrow key.

Continuous input of horizontal lines

Horizontal lines can be input continuously from the cursor position with Ctrl + Shift + an arrow key (←/→). (Deletion is available by the same method.)



The following shows how to input the instructions for the low-speed timer, high-speed timer, retentive timer, and edge relay.

(1) Low-speed timer

(2) High-speed timer

(3) High-speed retentive timer

(4) Edge relay

To input the retentive timer, set the device points on the device setting screen of the PLC parameter.

Appendix 3 Offset/Gain Setting

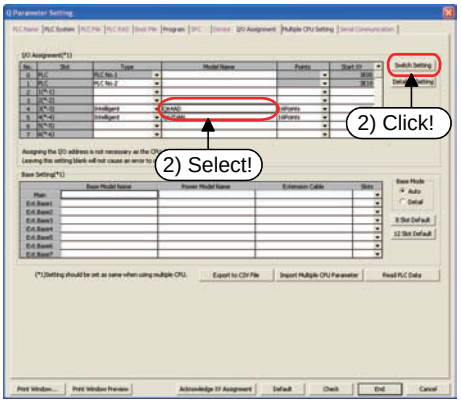
In the A/D and D/A converter modules which handle analog signals, adjust the offset/gain to secure the signal accuracy as necessary. (For the offset/gain, refer to appendix. 3.2.)
In the A/D or D/A converter modules of Q-series, the offset/gain settings can be executed in the GX Works2.

The A/D converter module (Q64AD) is used as an example in the following.
The setting procedure is the same for the D/A converter module (Q62DAN).
For details, refer to the following manuals.

- Analog-Digital Converter Module User's Manual SH-080055
- Digital-Analog Converter Module User's Manual SH-080054

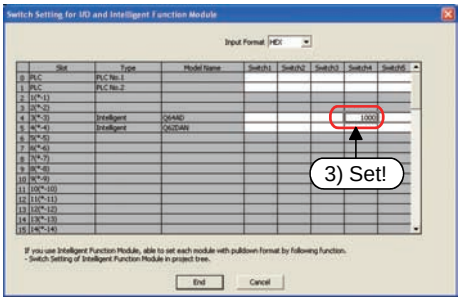
Appendix 3.1 Offset/gain setting with GX Works2

(1) Switching the mode to the offset/gain setting mode



1) Click the "I/O Assignment" tab of the PLC parameter.

2) Select "Q64AD" and click the Switch Setting button.



3) Set the bit 4 of the switch 4 to a value except "0".

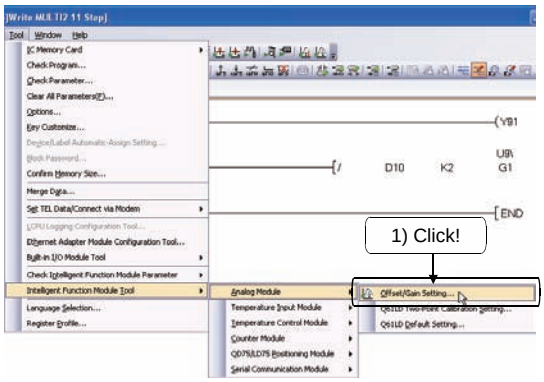
In this example, set the switch 4 to "1000".

Write the PLC parameter set above to the CPU and reset the CPU.

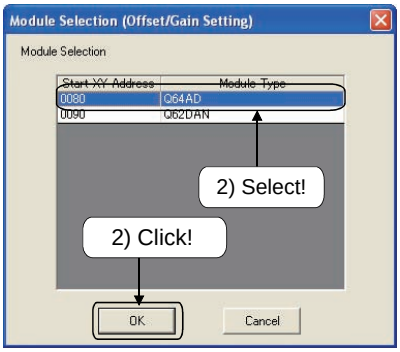
Write the parameters with the following procedure to the second CPU installed to the demonstration machine.
(When only one CPU is used, the following procedure is not needed.)
1) Change the connection destination to the second CPU. (Refer to section 10.4.5 (1).)
2) Write the parameter setting to the QCPU.
3) After completion of the writing, set the connection destination to the first CPU again. (Refer to section 10.4.5 (1).)

Resetting switches the mode to the offset/gain setting mode, and the RUN LED on Q64AD flashes.

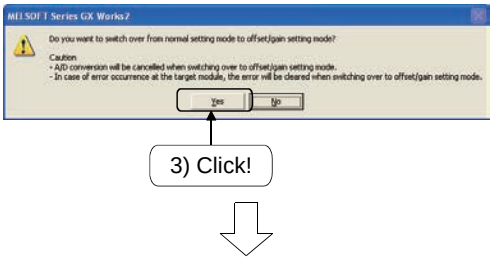
(2) Switching the screen to the Offset/Gain Setting screen



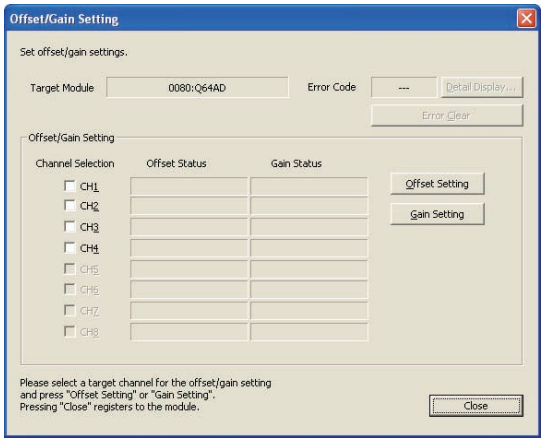
1) Click [Tool] → [Intelligent Function Module Tool] → [Analog Module] → [Offset/Gain Setting].



2) The Module Selection (Offset/Gain Setting) screen is displayed. Select "Q64AD (0080)" and click the OK button.



3) The message on the left is displayed. Click the Yes button.



4) The Offset/Gain Setting screen is displayed.

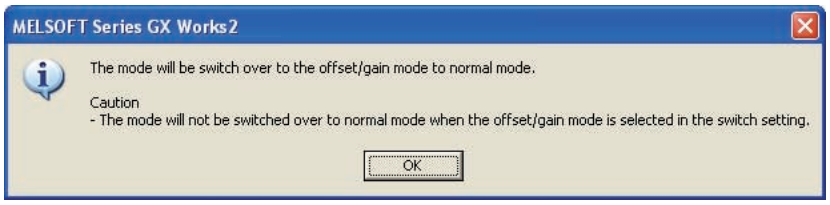
Adjust the offset values and the gain values on the screen.

(3) Specifying channels
Select the check box on the "Channel Selection" column to specify channels for which the offset or gain is set.

(4) Applying current or voltage
Apply current or voltage to the module.

(5) Executing the offset/gain setting
For each of the channels specified in (3), click the [Offset Setting] button when executing the offset setting, or click the [Gain Setting] button when executing the gain setting.

(6) Switching the mode to the normal mode
After completion of the setting, click the [OK] button. The following message is displayed.



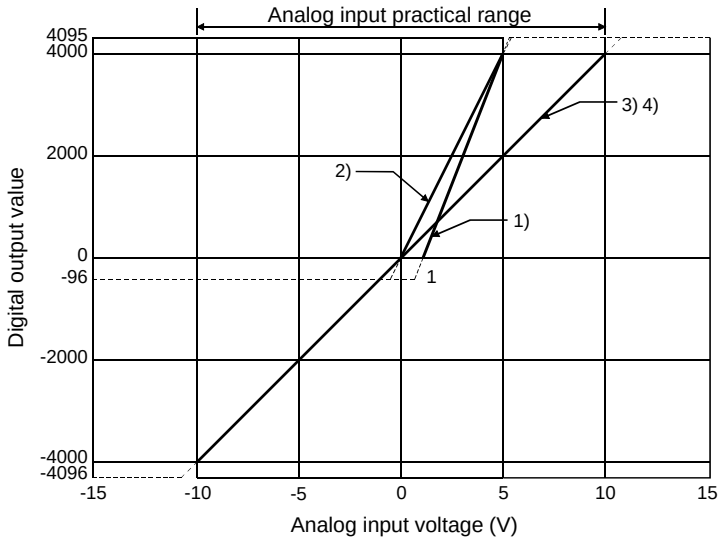
POINT

When an error code is displayed in the setting, the error detail and the solution can be confirmed by clicking the [...] button on the right of the error code display area. Error codes can be cleared by clicking the [Error Clear] button.

Appendix 3.2 Offset value and gain value

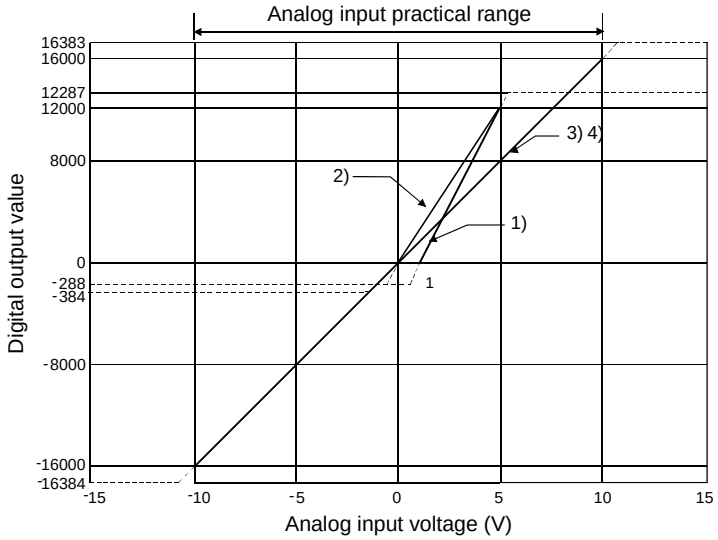
(1) I/O characteristic of the A/D conversion

Offset value	Analog input value (voltage or current) that corresponds with the digital output value "0"
Gain value	Analog input value (voltage or current) that corresponds with the digital output value "4000/12000/16000"*1



No.	Analog input range setting	Offset value	Gain value	Digital output value*2	Maximum resolution
1)	1 to 5V	1V	5V	0 to 4000	1.0mV
2)	0 to 5V	0V	5V		1.25mV
3)	-10 to 10V	0V	10V	-4000 to 4000	2.5mV
4)	0 to 10V	0V	10V	0 to 4000	2.5mV
-	User range setting	*1	*1	-4000 to 4000	0.375mV

Voltage input characteristic in standard resolution mode



No.	Analog input range setting	Offset value	Gain value	Digital output value*2	Maximum resolution
1)	1 to 5V	1V	5V	0 to 12000	0.333mV
2)	0 to 5V	0V	5V		0.416mV
3)	-10 to 10V	0V	10V	-16000 to 16000	0.625mV
4)	0 to 10V	0V	10V	0 to 16000	0.625mV
-	User range setting	*1	*1	-12000 to 12000	0.333mV

Voltage input characteristic in high resolution mode

POINT

(1) Do not input an analog voltage out of the range between -15 to 15V. The elements may be damaged.

(2) Set the offset/gain values for the user range setting *1 within a range in which the following conditions are met.
{ (Gain value) - (Offset value) } > A

<Value A>

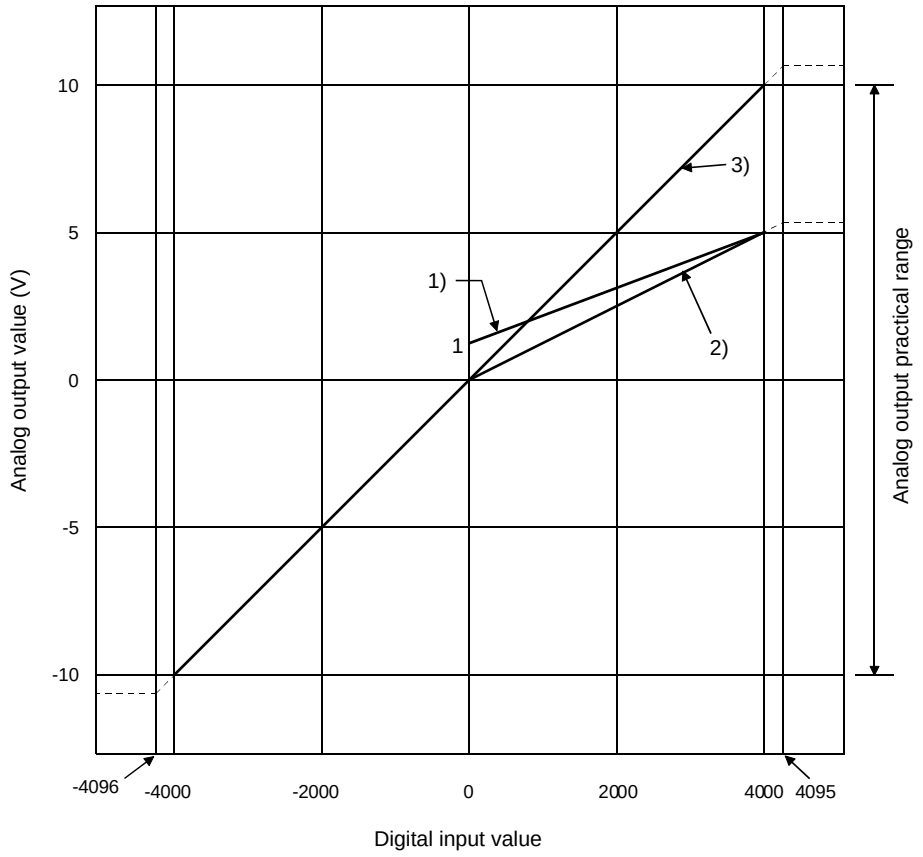
Standard resolution mode	High resolution mode
1.5V	4.0V

(3) When an analog value that exceeds the range for the digital output value *2 is input, the digital output value will be fixed at the maximum or minimum value.

Analog input range setting	Standard resolution mode		High resolution mode	
	Minimum	Maximum	Minimum	Maximum
1 to 5V	-96	4095	-288	12287
0 to 5V				
-10 to 10V	-4096		-16384	16383
0 to 10V	-96		-384	
User range setting	-4096		-12288	12287

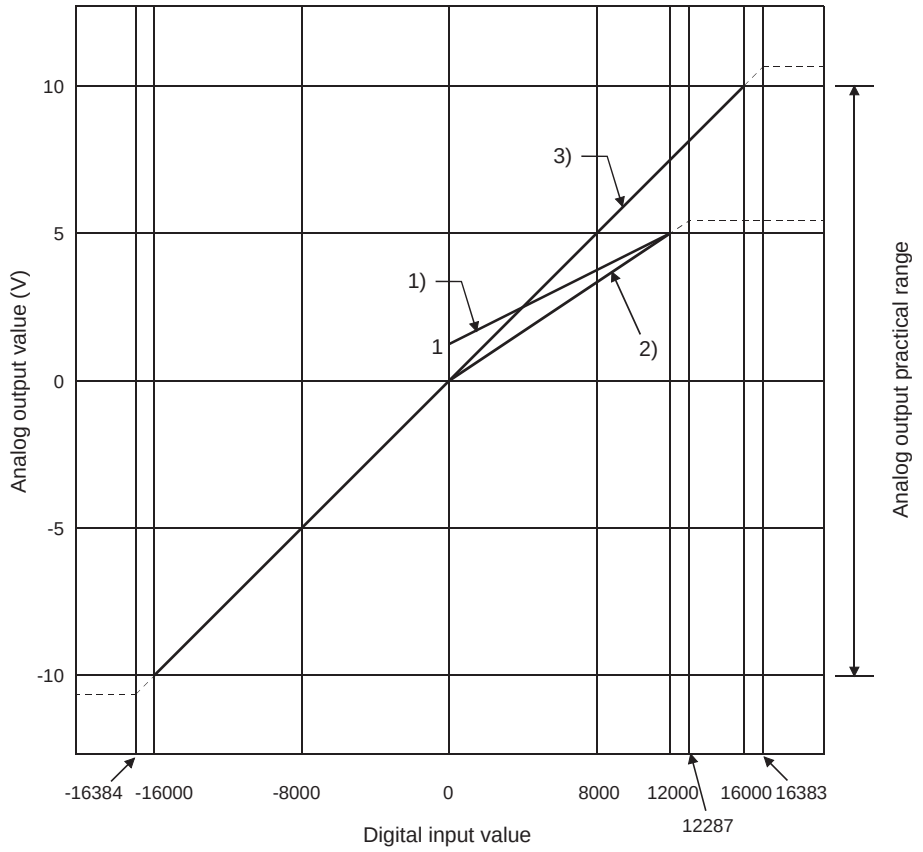
(2) I/O characteristic of the D/A conversion

Offset value	Analog output value (voltage or current) that corresponds with the digital input value "0"
Gain value	Analog output value (voltage or current) that corresponds with the digital input value "4000/12000/16000"



No.	Output range setting	Offset value	Gain value	Digital input value	Maximum resolution
1)	1 to 5V	1V	5V	0 to 4000	1.0mV
2)	0 to 5V	0V	5V		1.25mV
3)	-10 to 10V	0V	10V	-4000 to 4000	2.5mV
-	User range setting	*1	*1	-4000 to 4000	0.75mV

Voltage output characteristic in standard resolution mode



No.	Output range setting	Offset value	Gain value	Digital input value	Maximum resolution
1)	1 to 5V	1V	5V	0 to 12000	0.333mV
2)	0 to 5V	0V	5V		0.416mV
3)	-10 to 10V	0V	10V	-16000 to 16000	0.625mV
-	User range setting	*1	*1	-12000 to 12000	0.333mV

Voltage output characteristic in high resolution mode

POINT

Set the offset/gain values for the user range setting *1 within a range in which the following conditions are met.
(a) The setting range is -10 to 10V.
(b) { (Gain value) - (Offset value) } > A

<Value A>

Standard resolution mode	High resolution mode
3.0V	4.0V

Appendix 4 Specifications of the A/D and D/A Converter Modules

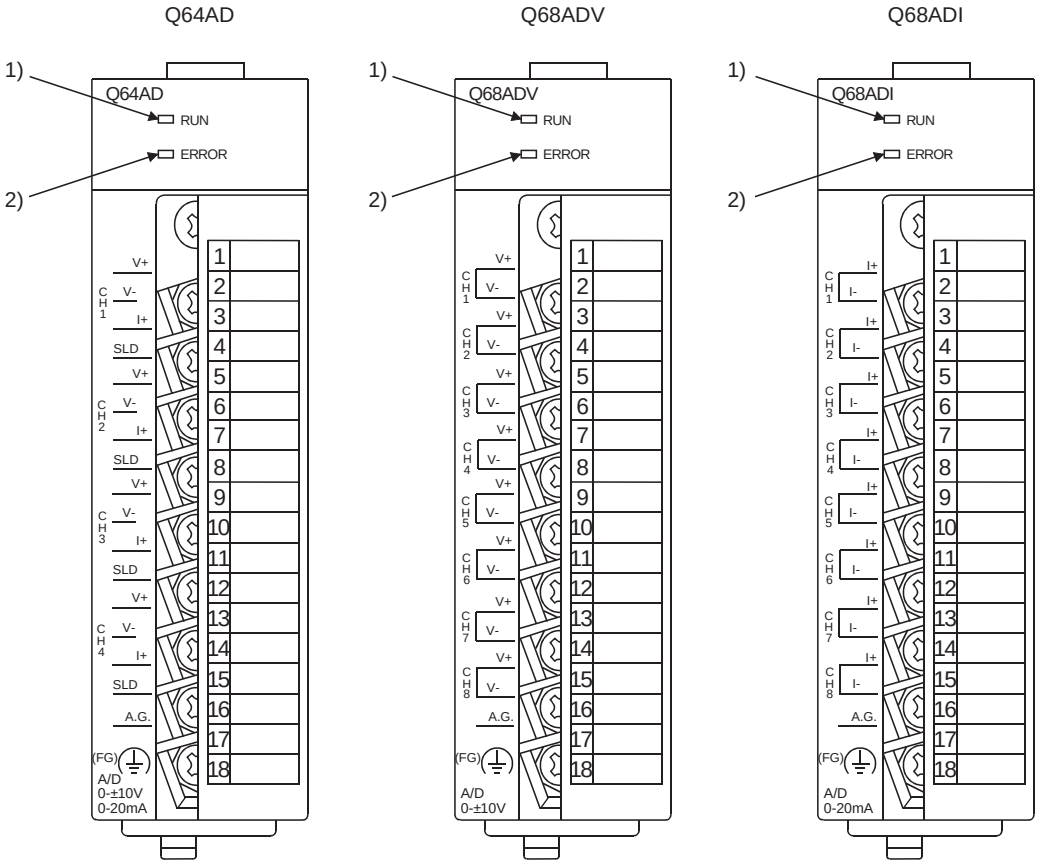
Appendix 4.1 A/D converter module

For details, refer to the Analog-Digital Converter Module User's Manual SH-080055.

(1) Performance specifications

<table>
<tr><td colspan="3">Item \ Model name</td><td>Q64AD</td><td>Q68ADV</td><td>Q68ADI</td></tr>
<tr><td colspan="3">Analog input points</td><td>4 points (4 channels)</td><td>8 points (8 channels)</td><td>8 points (8 channels)</td></tr>
<tr><td rowspan="2">Analog input</td><td>Voltage</td><td></td><td colspan="2">-10 to 10VDC (Input resistance value 1MΩ)</td><td>-</td></tr>
<tr><td>Current</td><td></td><td>0 to 20mADC (Input resistance value 250Ω)</td><td>-</td><td>0 to 20mADC (Input resistance value 250Ω)</td></tr>
<tr><td colspan="3">Digital output</td><td colspan="3">16-bit signed binary
(standard resolution mode: -4096 to 4095, high resolution mode: -12288 to 12287, -16384 to 16383)</td></tr>
<tr><td colspan="3">I/O characteristics, Maximum resolution</td><td colspan="3">
<table>
<tr><td colspan="2" rowspan="2">Analog input range</td><td colspan="2">Standard resolution mode</td><td colspan="2">High resolution mode</td></tr>
<tr><td>Digital output value</td><td>Maximum resolution</td><td>Digital output value</td><td>Maximum resolution</td></tr>
<tr><td rowspan="5">Voltage</td><td>0 to 10V</td><td rowspan="3">0 to 4000</td><td>2.5mV</td><td>0 to 16000</td><td>0.625mV</td></tr>
<tr><td>0 to 5V</td><td>1.25mV</td><td rowspan="2">0 to 12000</td><td>0.416mV</td></tr>
<tr><td>1 to 5V</td><td>1.0mV</td><td>0.333mV</td></tr>
<tr><td>-10 to 10V</td><td rowspan="2">-4000 to 4000</td><td>2.5mV</td><td>-16000 to 16000</td><td>0.625mV</td></tr>
<tr><td>User range setting</td><td>0.375mV</td><td>-12000 to 12000</td><td>0.333mV</td></tr>
<tr><td rowspan="3">Current</td><td>0 to 20mA</td><td rowspan="2">0 to 4000</td><td>5μA</td><td rowspan="2">0 to 12000</td><td>1.66μA</td></tr>
<tr><td>4 to 20mA</td><td>4μA</td><td>1.33μA</td></tr>
<tr><td>User range setting</td><td>-4000 to 4000</td><td>1.37μA</td><td>-12000 to 12000</td><td>1.33μA</td></tr>
</table>
</td></tr>
<tr><td colspan="3">Accuracy
(Accuracy for maximum digital output value)</td><td colspan="3">
<table>
<tr><td colspan="2" rowspan="3">Analog Input range</td><td colspan="3">Standard resolution mode</td><td colspan="3">High resolution mode</td></tr>
<tr><td colspan="2">Ambient temperature 0 to 55°C</td><td rowspan="2">Ambient temperature 25±5°C</td><td colspan="2">Ambient temperature 0 to 55°C</td><td rowspan="2">Ambient temperature 25±5°C</td></tr>
<tr><td>With temperature drift compensation</td><td>Without temperature drift compensation</td><td>With temperature drift compensation</td><td>Without temperature drift compensation</td></tr>
<tr><td rowspan="5">Voltage</td><td>0 to 10V</td><td rowspan="8">±0.3% (±12 digit*)</td><td rowspan="8">±0.4% (±16 digit*)</td><td rowspan="8">±0.1% (±4 digit*)</td><td>±0.3% (±48 digit*)</td><td>±0.4% (±64 digit*)</td><td>±0.1% (±16 digit*)</td></tr>
<tr><td>-10 to 10V</td></tr>
<tr><td>0 to 5V</td><td rowspan="6">±0.3% (±36 digit*)</td><td rowspan="6">±0.4% (±48 digit*)</td><td rowspan="6">±0.1% (±12 digit*)</td></tr>
<tr><td>1 to 5V</td></tr>
<tr><td>User range setting</td></tr>
<tr><td rowspan="3">Current</td><td>0 to 20mA</td></tr>
<tr><td>4 to 20mA</td></tr>
<tr><td>User range setting</td></tr>
</table>
* Digit indicates a digital value.
</td></tr>
<tr><td colspan="3">Conversion speed</td><td colspan="3">80μs/channel
(When the temperature drift compensation function is used, the time calculated by adding 160μs will be used regardless of the number of channels used.)</td></tr>
<tr><td colspan="3">Absolute maximum input</td><td colspan="3">Voltage: ±15V Current: ±30mA</td></tr>
<tr><td colspan="3">Insulation method</td><td colspan="3">Between the I/O terminal and programmable controller power supply: Photocoupler insulation
Between channels: Non-insulated</td></tr>
<tr><td colspan="3">Occupied points</td><td colspan="3">16 points</td></tr>
<tr><td colspan="3">Connection terminal</td><td colspan="3">18-point terminal block</td></tr>
<tr><td colspan="3">Applicable wire size</td><td colspan="3">0.3 to 0.75mm^2</td></tr>
<tr><td colspan="3">Applicable solderless terminal</td><td colspan="3">R1.25-3 (A solderless terminal with sleeve cannot be used.)</td></tr>
<tr><td colspan="3">Internal current consumption (5VDC)</td><td>0.63A</td><td>0.64A</td><td>0.64A</td></tr>
<tr><td colspan="3">Weight</td><td>0.18kg</td><td>0.19kg</td><td>0.19kg</td></tr>
</table>

(2) Names of parts



No.	Name and appearance	Description
1)	RUN LED	Indicates the operation status of the A/D converter module. ON : In normal operation Flicker : In offset/gain setting mode OFF : 5V power failure or watchdog timer error occurred
2)	ERROR LED	Indicates errors and the status of the A/D converter module. ON : Error occurred OFF : In normal operation Flicker : Switch setting error occurred Values other than 0 have been set to the switch 5 on the intelligent function module.

(3) List of I/O signals

List of I/O signals of the A/D converter module

Signal direction: CPU ← A/D converter module		Signal direction: CPU → A/D converter module	
Device No. (input)	Signal name	Device No. (output)	Signal name
X0	Module READY	Y0	Use prohibited*1
X1	Temperature drift compensation flag	Y1	
X2	Use prohibited*1	Y2	
X3		Y3	
X4		Y4	
X5		Y5	
X6		Y6	
X7		Y7	
X8	High resolution mode status flag	Y8	
X9	Operating condition setting completed flag	Y9	Operating condition setting request
XA	Offset/gain setting mode flag	YA	User range writing request
XB	Channel change completed flag	YB	Channel change request
XC	Use prohibited*1	YC	Use prohibited*1
XD	Maximum value/minimum value reset completed flag	YD	Maximum value/minimum value reset request
XE	A/D conversion completed flag	YE	Use prohibited*1
XF	Error flag	YF	Error clear request

POINT

*1: These signals cannot be used by the user since they are for system use only. If these are turned on/off by the sequence program, the functioning of the A/D converter module cannot be guaranteed.

(4) Buffer memory

The following explanation is mentioned based on the Q68ADV and Q68ADI with 8-channel analog input (CH1 to CH8).

Buffer memory assignment of the A/D converter module

Address		Description	R/W*2	Address		Description	
Hexadecimal	Decimal			Hexadecimal	Decimal		
0H	0	A/D conversion enable/disable setting	R/W	18H	24	System area	
1H	1	CH1 Average time/average number of times	R/W	19H	25		
2H	2	CH2 Average time/average number of times	R/W	1AH	26		
3H	3	CH3 Average time/average number of times	R/W	1BH	27		
4H	4	CH4 Average time/average number of times	R/W	1CH	28		
5H	5	CH5 Average time/average number of times*1	R/W	1DH	29		
6H	6	CH6 Average time/average number of times*1	R/W	1EH	30	CH1 Maximum value	R/W
7H	7	CH7 Average time/average number of times*1	R/W	1FH	31	CH1 Minimum value	R/W
8H	8	CH8 Average time/average number of times*1	R/W	20H	32	CH2 Maximum value	R/W
9H	9	Averaging process setting	R/W	21H	33	CH2 Minimum value	R/W
AH	10	A/D conversion completed flag	R	22H	34	CH3 Maximum value	R/W
BH	11	CH1 Digital output value	R	23H	35	CH3 Minimum value	R/W
CH	12	CH2 Digital output value	R	24H	36	CH4 Maximum value	R/W
DH	13	CH3 Digital output value	R	25H	37	CH4 Minimum value	R/W
EH	14	CH4 Digital output value	R	26H	38	CH5 Maximum value*1	R/W
FH	15	CH5 Digital output value*1	R	27H	39	CH5 Minimum value*1	R/W
10H	16	CH6 Digital output value*1	R	28H	40	CH6 Maximum value*1	R/W
11H	17	CH7 Digital output value*1	R	29H	41	CH6 Minimum value*1	R/W
12H	18	CH8 Digital output value*1	R	2AH	42	CH7 Maximum value*1	R/W
13H	19	Error code	R/W	2BH	43	CH7 Minimum value*1	R/W
14H	20	Setting range (CH1 to CH4)	R	2CH	44	CH8 Maximum value*1	R/W
15H	21	Setting range (CH5 to CH8)*1	R	2DH	45	CH8 Minimum value*1	R/W
16H	22	Offset/gain setting mode Offset specification	R/W				
17H	23	Offset/gain setting mode Gain specification	R/W				

*1: For Q64AD, the buffer memory areas for CH5 to CH8 are system areas.

*2: Indicates whether reading from and writing to a sequence program are enabled.

R : Read enabled

W : Write enabled

Appendix 4.2 D/A converter module

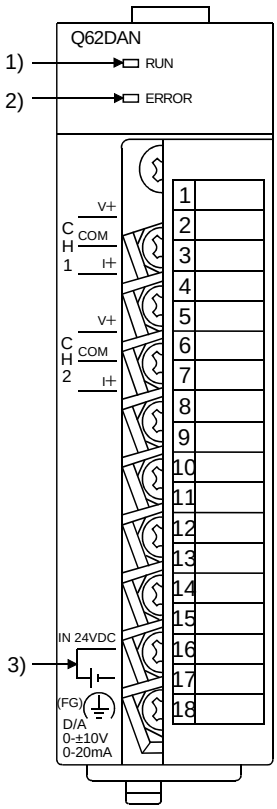
For the details, refer to the Digital-Analog Converter Module User's Manual SH-080054.

(1) Performance specifications

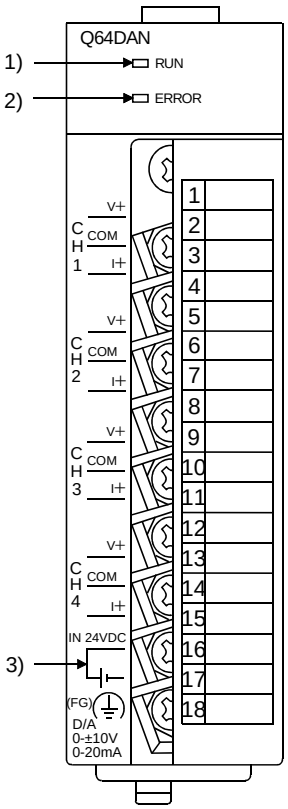
<table>
<tr><th colspan="3">Item \ Model name</th><th>Q62DAN</th><th>Q64DAN</th><th>Q68DAVN</th><th>Q68DAIN</th></tr>
<tr><td colspan="3">Analog output points</td><td>2 points (2 channels)</td><td>4 points (4 channels)</td><td colspan="2">8 points (8 channels)</td></tr>
<tr><td colspan="3">Digital input</td><td colspan="4">16-bit signed binary
(standard resolution mode: -4096 to 4095, high resolution mode: -12288 to 12287, -16384 to 16383)</td></tr>
<tr><td rowspan="2">Analog output</td><td>Voltage</td><td></td><td colspan="2">-10 to 10VDC (External load resistance value: 1kΩ to 1MΩ)</td><td colspan="2">-</td></tr>
<tr><td>Current</td><td></td><td colspan="2">0 to 20mADC (External load resistance value: 0Ω to 600Ω)</td><td>-</td><td>0 to 20mADC (External load resistance value: 0Ω to 600Ω)</td></tr>
<tr><td colspan="3">I/O characteristics, Maximum resolution</td><td colspan="4"><table>
<tr><th colspan="2" rowspan="2">Analog output range</th><th colspan="2">Standard resolution mode</th><th colspan="2">High resolution mode</th></tr>
<tr><th>Digital input value</th><th>Maximum resolution</th><th>Digital input value</th><th>Maximum resolution</th></tr>
<tr><td rowspan="4">Voltage</td><td>0 to 5V</td><td rowspan="2">0 to 4000</td><td>1.25mV</td><td rowspan="2">0 to 12000</td><td>0.416mV</td></tr>
<tr><td>1 to 5V</td><td>1.0mV</td><td>0.333mV</td></tr>
<tr><td>-10 to 10V</td><td rowspan="2">-4000 to 4000</td><td>2.5mV</td><td>-16000 to 16000</td><td>0.625mV</td></tr>
<tr><td>User range setting</td><td>0.75mV</td><td>-12000 to 12000</td><td>0.333mV</td></tr>
<tr><td rowspan="3">Current</td><td>0 to 20mA</td><td rowspan="2">0 to 4000</td><td>5μA</td><td rowspan="2">0 to 12000</td><td>1.66μA</td></tr>
<tr><td>4 to 20mA</td><td>4μA</td><td>1.33μA</td></tr>
<tr><td>User range setting</td><td>-4000 to 4000</td><td>1.5μA</td><td>-12000 to 12000</td><td>0.83μA</td></tr>
</table></td></tr>
<tr><td rowspan="2">Accuracy (Accuracy for maximum analog output value)</td><td>Ambient temperature 25±5°C</td><td colspan="4">Within ±0.1 % (Voltage: ±10mV, Current: ±20μA)</td></tr>
<tr><td>Ambient temperature 0 to 55°C</td><td colspan="4">Within ±0.3% (Voltage: ±30mV, Current: ±60μA)</td></tr>
<tr><td colspan="3">Conversion speed</td><td colspan="4">80μs/channel</td></tr>
<tr><td rowspan="2">Absolute maximum output</td><td>Voltage</td><td></td><td colspan="3">±12V</td><td>-</td></tr>
<tr><td>Current</td><td></td><td colspan="2">21mA</td><td>-</td><td>21mA</td></tr>
<tr><td colspan="3">Output short circuit protection</td><td colspan="4">Available</td></tr>
<tr><td colspan="3">Insulation method</td><td colspan="4">Between the I/O terminal and programmable controller power supply : Photocoupler insulation
Between output channels : No insulation
Between external supply power and analog output : Transformer insulation</td></tr>
<tr><td colspan="3">Occupied points</td><td colspan="4">16 points</td></tr>
<tr><td colspan="3">Connection terminal</td><td colspan="4">18-point terminal block</td></tr>
<tr><td colspan="3">Applicable wire size</td><td colspan="4">0.3 to 0.75mm^2</td></tr>
<tr><td colspan="3">Applicable solderless terminal</td><td colspan="2">R1.25-3 (A solderless terminal with sleeve cannot be used.)</td><td colspan="2">FG terminal : R1.25-3, 1.25-YS3, RAV1.25-3, V1.25-YS3A
Other terminals than FG : R1.25-3 (A solderless terminal with sleeve cannot be used.)</td></tr>
<tr><td rowspan="4" colspan="3">External supply power</td><td colspan="4">24VDC +20%, -15%</td></tr>
<tr><td colspan="4">Ripple, spike 500mVP-P or less</td></tr>
<tr><td>Inrush current: 2.5A, within 250μs</td><td>Inrush current: 2.5A, within 260μs</td><td>Inrush current: 2.5A, within 230μs</td><td>Inrush current: 2.5A, within 230μs</td></tr>
<tr><td>0.15A</td><td>0.24A</td><td>0.20A</td><td>0.27A</td></tr>
<tr><td colspan="3">Internal current consumption (5VDC)</td><td>0.33A</td><td>0.34A</td><td>0.38A</td><td>0.38A</td></tr>
<tr><td colspan="3">Weight</td><td>0.19kg</td><td>0.20kg</td><td>0.20kg</td><td>0.20kg</td></tr>
</table>

(2) Names of parts

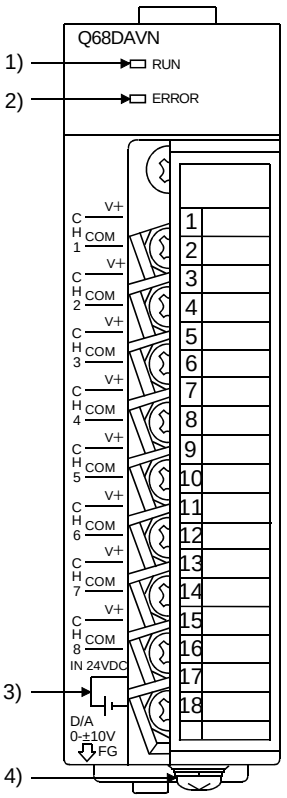
Q62DAN



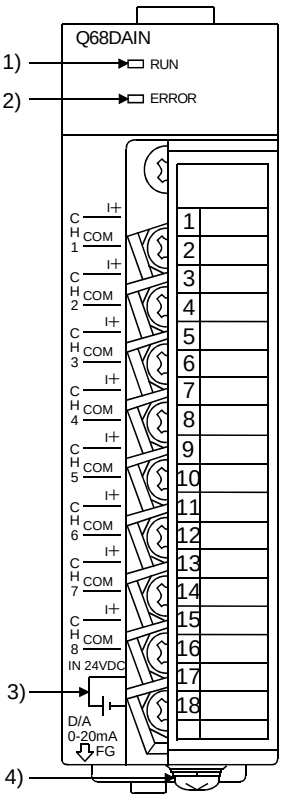
Q64DAN



Q68DAVN



Q68DAIN



No.	Name and appearance	Description
1)	RUN LED	Indicates the operation status of the D/A converter module. ON : In normal operation Flicker : In offset/gain setting mode OFF : 5V power failure or watchdog timer error occurred
2)	ERROR LED	Indicates the operation status of the D/A converter module. ON : Error occurred OFF : In normal operation Flicker : Switch settings error occurred Values other than 0 has been set to the switch 5 on the intelligent function module.
3)	External power supply terminal	Terminal for connecting a 24VDC external power supply
4)	FG terminal	Frame ground terminal

(3) List of I/O signals

List of I/O signals of the D/A converter module

Signal direction	D/A converter module → CPU module	Signal direction	CPU module → D/A converter module
Device No.	Signal name	Device No.	Signal name
X0	Module READY	Y0	Use prohibited*1
X1	Use prohibited*1	Y1	CH1 Output enable/disable flag
X2		Y2	CH2 Output enable/disable flag
X3		Y3*2	CH3 Output enable/disable flag
X4		Y4*2	CH4 Output enable/disable flag
X5		Y5	CH5 Output enable/disable flag
X6		Y6	CH6 Output enable/disable flag
X7		Y7	CH7 Output enable/disable flag
X8	High resolution mode status flag	Y8	CH8 Output enable/disable flag
X9	Operating condition setting completed flag	Y9	Operating condition setting request
XA	Offset/gain setting mode flag	YA	User range writing request
XB	Channel change completed flag	YB	Channel change request
XC	Set value change completed flag	YC	Set value change request
XD	Synchronous output mode flag	YD	Synchronous output request
XE	Use prohibited*1	YE	Use prohibited*1
XF	Error flag	YF	Error clear request

POINT

*1: These signals cannot be used by the user since they are for system use only. If these are turned on/off by the sequence program, the functioning of the D/A converter module cannot be guaranteed.

*2: For the Q62DAN and Q62DA, the use of Y3 to Y8 is prohibited.
For the Q64DAN and Q64DA, the use of Y5 to Y8 is prohibited.

(4) Buffer memory

The following explanation is mentioned based on the Q64DAN with 4-channel analog output (CH1 to CH4).

Buffer memory assignment of the D/A converter module

Address		Name	Default*2	Read/write*3
Hexadecimal	Decimal			
0H	0	D/A conversion enable/disable	Q62DAN : 3H Q64DAN : FH	R/W
1H	1	CH1 Digital value	0	R/W
2H	2	CH2 Digital value	0	
3H	3	CH3 Digital value*1	0	R/W
4H	4	CH4 Digital value*1	0	R/W
5H	5	System area	-	-
6H	6		-	-
7H	7		-	-
8H	8		-	-
9H	9		-	-
AH	10		-	-
BH	11	CH1 Set value check code	0	R
CH	12	CH2 Set value check code	0	R
DH	13	CH3 Set value check code*1	0	R
EH	14	CH4 Set value check code*1	0	R
FH	15	System area	-	-
10H	16		-	-
11H	17		-	-
12H	18		-	-
13H	19	Error code	0	R/W
14H	20	Setting range	0	R
15H	21	System area	-	-
16H	22	Offset/gain setting mode Offset specification	0	R/W
17H	23	Offset/gain setting mode Gain specification	0	R/W
18H	24	Offset/gain adjustment value specification	0	R/W

*1: For Q62DAN, the buffer memory areas for CH3 and CH4 are system areas.

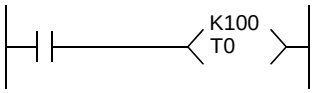
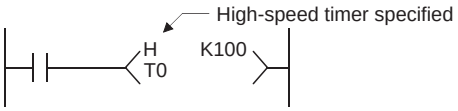
*2: This is the initial value set after the power is turned on or the programmable controller CPU is reset.

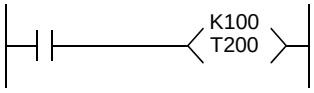
*3: Indicates whether reading from and writing to a sequence program are enabled.
R: Read enabled
W: Write enabled

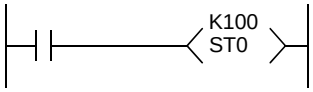
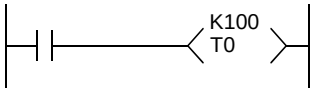
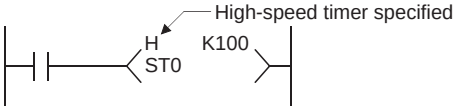
Appendix 5 Comparison of Timers and Counters

Appendix 5.1 Comparison of timers and counters

Comparison of timers

<table>
<tr><th colspan="2">Function</th><th>QCPU/QnACPU</th><th>AnUCPU</th><th>AnACPU</th><th>AnNCPU</th></tr>
<tr><td rowspan="2">Low-speed timer</td><td>Measurement unit</td><td>• 100ms (default value)
Can be changed in the range of 1 to 100ms (parameter)</td><td colspan="3">• Fixed at 100ms</td></tr>
<tr><td>Specification method</td><td></td><td colspan="3"> 
</td></tr>
<tr><td rowspan="2">High-speed timer</td><td>Measurement unit</td><td>• 10ms (default value)
Can be changed in the range of 1 to 100ms (parameter)</td><td colspan="3">• Fixed at 10ms</td></tr>
<tr><td>Specification method</td><td> 

* High-speed timer setting: Conducted by sequence program.</td><td colspan="3"> 

* High-speed timer setting: Conducted at parameters.</td></tr>
<tr><td rowspan="2">Retentive timer</td><td>Measurement unit</td><td>• Same measurement unit as the low-speed timer</td><td colspan="3">• Fixed at 10ms</td></tr>
<tr><td>Specification method</td><td> 
</td><td colspan="3"> 
</td></tr>
<tr><td rowspan="2">High-speed retentive timer</td><td>Measurement unit</td><td>• Same measurement unit as the high-speed timer</td><td colspan="3" rowspan="2">• None</td></tr>
<tr><td>Specification method</td><td> 

* High-speed timer setting: Conducted by sequence program.</td></tr>
<tr><td>Setting range for set values</td><td></td><td>• 1 to 32767</td><td colspan="3">• 1 to 32767</td></tr>
<tr><td>Processing for set value 0</td><td></td><td>• Momentarily ON</td><td colspan="3">• Infinity (does not time out)</td></tr>
<tr><td rowspan="4">Indexing</td><td>Contact</td><td>• Enabled (only Z0 and Z1 are usable)</td><td>• Enabled</td><td colspan="2">• Disabled</td></tr>
<tr><td>Coil</td><td>• Enabled (only Z0 and Z1 are usable)</td><td>• Disabled</td><td colspan="2">• Disabled</td></tr>
<tr><td>Set value</td><td>• Disabled</td><td>• Disabled</td><td colspan="2">• Disabled</td></tr>
<tr><td>Current value</td><td>• Enabled (Z0 to Z15 are usable)</td><td>• Enabled</td><td colspan="2">• Enabled</td></tr>
<tr><td colspan="2">Update processing for current value</td><td rowspan="2">• When OUT Tn instruction is executed</td><td colspan="3" rowspan="2">• When END processing is executed</td></tr>
<tr><td colspan="2">Contact ON/OFF processing</td></tr>
</table>

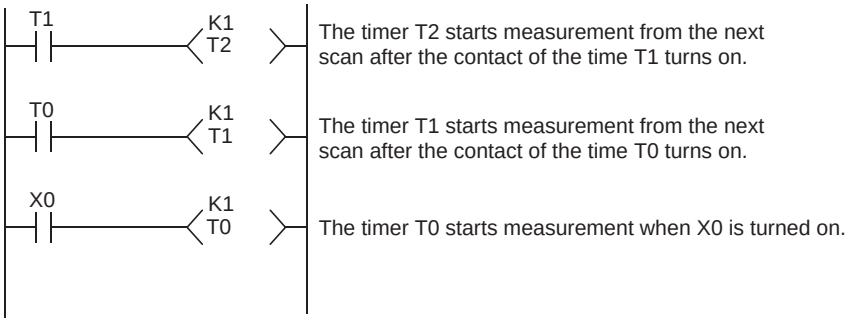
(1) Cautions on using timers

Q/QnACPU updates the current value of timers and turns on or off the contacts of them at the execution of the OUT T□ instruction.
Therefore, if (Current value) ≧ (Set value) when the timer coil is turned on, the contact of that timer is turned on.

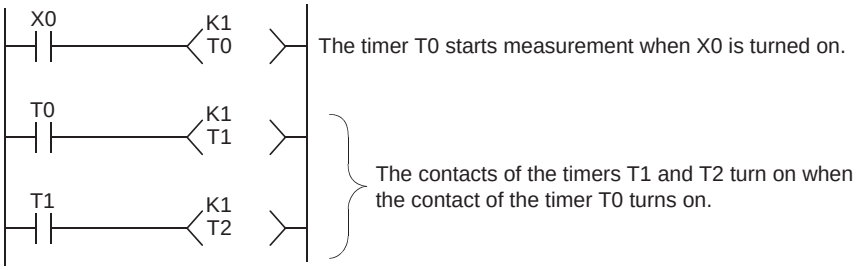
When creating a program in which the operation of the timer contact triggers the operation of another timer, set the timer that operates later first.
In the following cases, all the timers turns on at the same scan if the program is created in the order the timers operates.
• When the set value is smaller than a scan time with high-speed timers
• When the set value is "1" with low-speed timers

Example

- For timers T0 to T2, the program is created in the order the timer operates later.

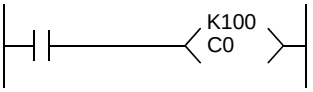
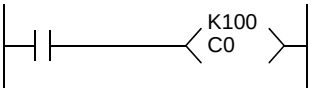


- For timers T0 to T2, the program is created in the order of timer operation.



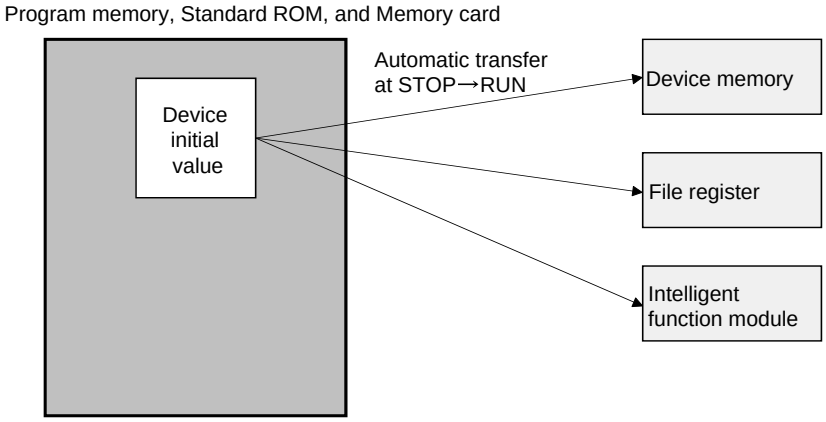
Appendix 5.2 Comparison of counters

Comparison of counters

Function		QCPU/QnACPU	AnUCPU	AnACPU	AnNCPU
Specification method					
Indexing	Contact	• Enabled (only Z0 and Z1 are usable)	• Enabled		• Disabled
	Coil	• Enabled (only Z0 and Z1 are usable)	• Enabled		• Disabled
	Set value	• Disabled	• Disabled		• Disabled
	Current value	• Enabled (Z0 to Z15 are usable)	• Enabled		• Enabled
Update processing for current value		• When OUT Tn instruction is executed	• When END processing is executed		
Contact ON/OFF processing					

Appendix 6 Setting device initial values

The device initial value set in the peripheral device beforehand can be automatically transferred to the device memory, file register, and the intelligent function module when the status changed from STOP to RUN. When the device initial values are set, the initial setting program is unnecessary.



Required Setting

To use the setting function of the device initial values, set "Device Memory" and "Device Initial Value" in the project data list.
The device initial value file reflecting the setting needs to be written to be stored in the program memory, the standard ROM, or the memory card.

Devices Where the Initial Values can be Set

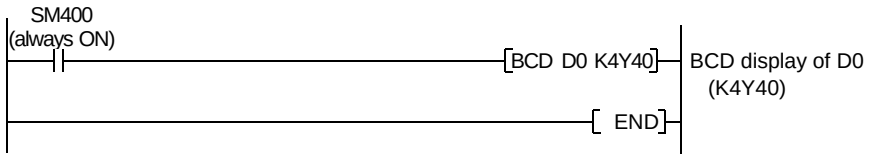
The following table shows the list of devices where the device initial values can be set.

Device name	Applicability	Device name	Applicability	Device name	Applicability	Device name	Applicability	Device name	Applicability
X	×	T (Contact)	×	FD	×	SZ	×	U□\G	○
Y	×	T (Coil)	×	B	×	S	×	J□\X	×
M	×	T (Current value)	○	SB	×	TR	×	J□\Y	×
L	×	C (Contact)	×	W	○	BL	×	J□\B	×
F	×	C (Coil)	×	SW	○	U	×	J□\SB	×
SM	×	C (Current value)	○	G	×	J	×	J□\W	○
FX	×	ST (Contact)	×	R	○	ZR	○	J□\SW	○
FY	×	ST (Coil)	×	P	×			BL□\S	×
V	×	ST (Current value)	○	I	×			BL□\TR	×
DX	×	D	○	N	×				
DY	×	SD	○	Z	×				

Preparations for the Initial Value Setting Operation Check

(1) Create the following program to check operation easily.

Project name	Applied 10
Program name	DEVINT

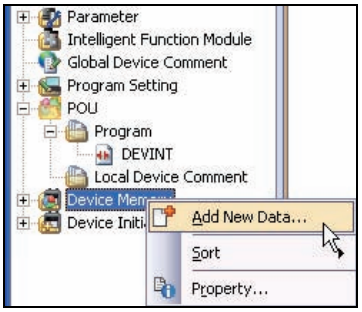


(2) Configure the setting in the "Program" tab of the PLC parameter in the project data list as shown below.

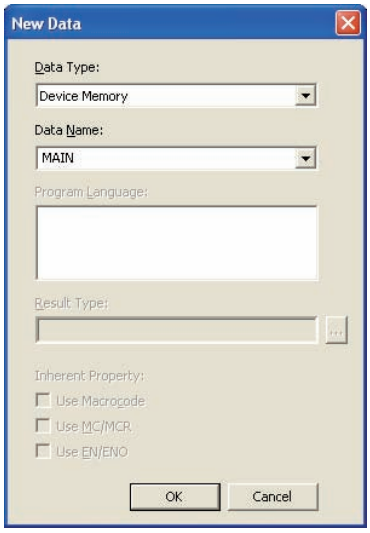
	Program Name	Execute Type	Fixed Scan Interval	In Unit
1	DEVINT	Scan		
2				
3				
4				
5				
6				
7				

Appendix 6.1 Setting device memories

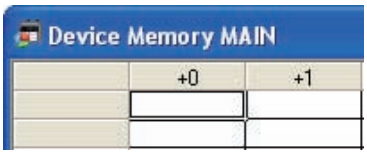
(1) Set device initial value to a device memory.
Set D0 to "1234" in the following procedure.



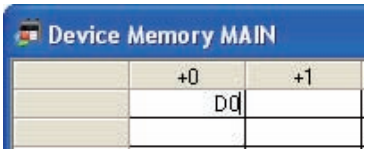
1) Right-click "Device Memory" in the project data list and click [Add New Data].



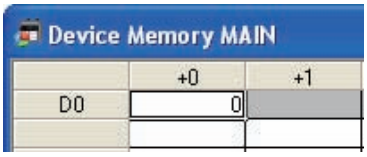
2) The dialog box on the left is displayed. Click the OK button.
In this example, set "MAIN" as Data Name.



3) Select a cell where a device value is set.



4) Enter "D0" to the cell.



5) Press the Enter key.
The device "D0" is set in the device number display area.

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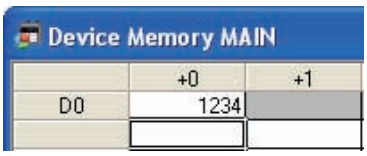
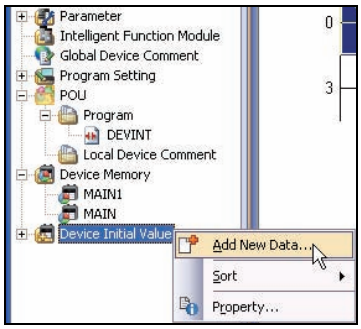
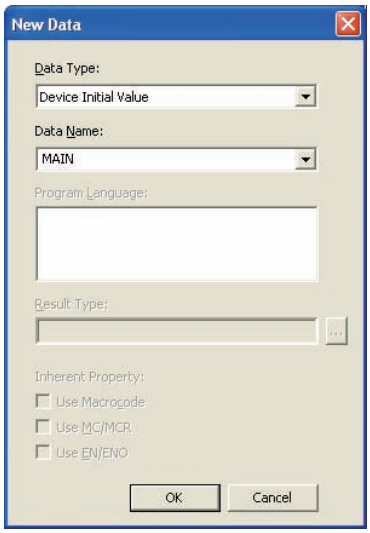


6) Click the cell D0 and enter "1234". Press the Enter key.
The initial value is set to D0.

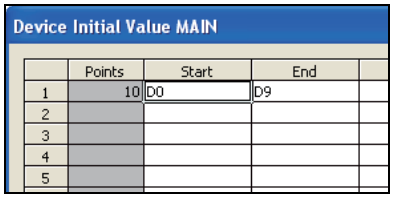
(2) Set a device range of the device initial value.
In this example, set D0 to D9 as the device initial value.



1) Right-click "Device Initial Value" and click [Add New Data].



2) The dialog box on the left is displayed. Click the OK button.
In this example, set "MAIN" as Data Name.



3) The dialog box on the left is displayed. Enter "D0" for Start, and "D9" for End.

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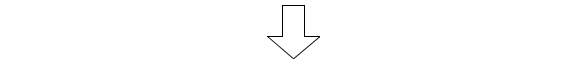
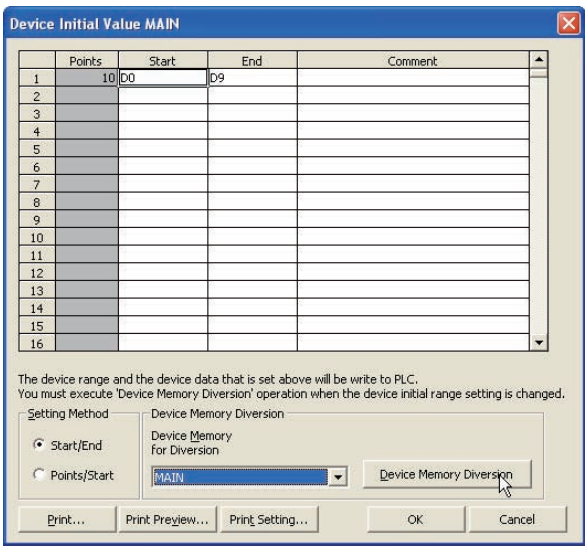
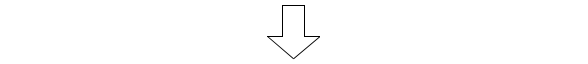
(From the previous page)

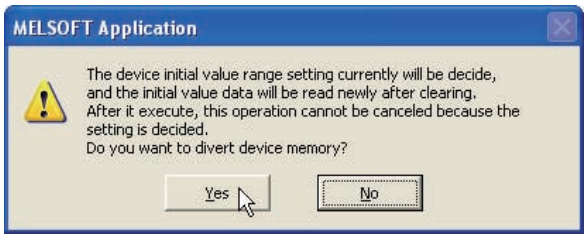




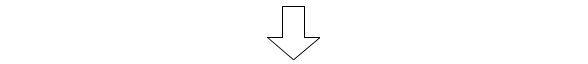
4) Select the device memory "MAIN", where the device initial value is set.

5) Click the Device Memory Diversion button.

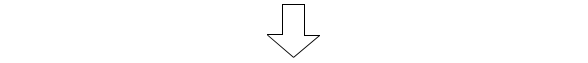


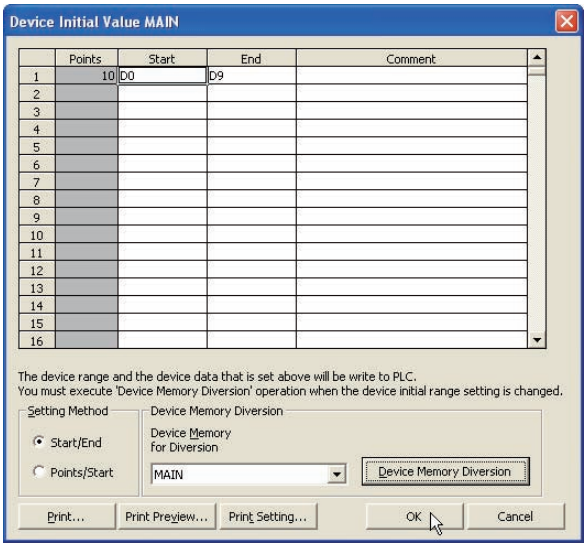


6) The dialog box on the left is displayed. Click the OK button.



7) Click the OK button.

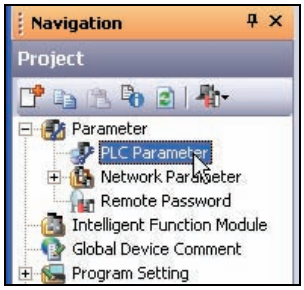




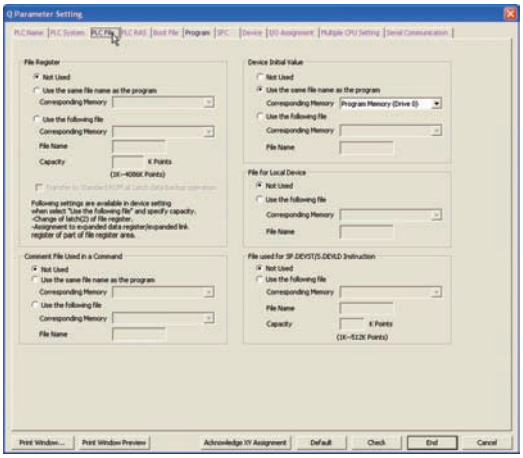
8) Click the OK button to close the dialog box.

Appendix 6.2 Specifying file names for device initial value

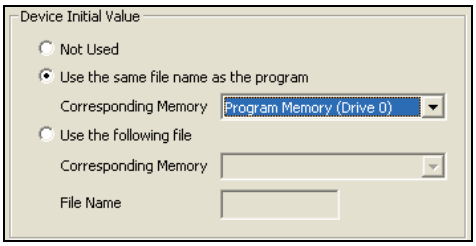
Set a file to be used as a device initial value file in the "PLC File" tab of the PLC parameter in the project data list.



1) Double-click "PLC Parameter" in the project data list.

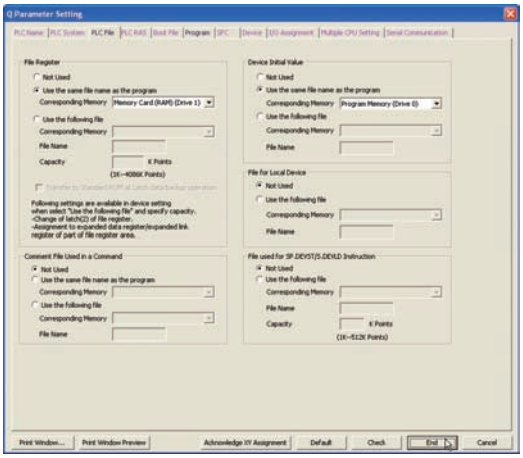


2) The Q Parameter Setting dialog box is displayed. Click the "PLC File" tab.



3) The screen is switched. Click "Use the same file as the program" in "Device Initial Value".

4) Confirm that "Program Memory (Drive 0)" is displayed.

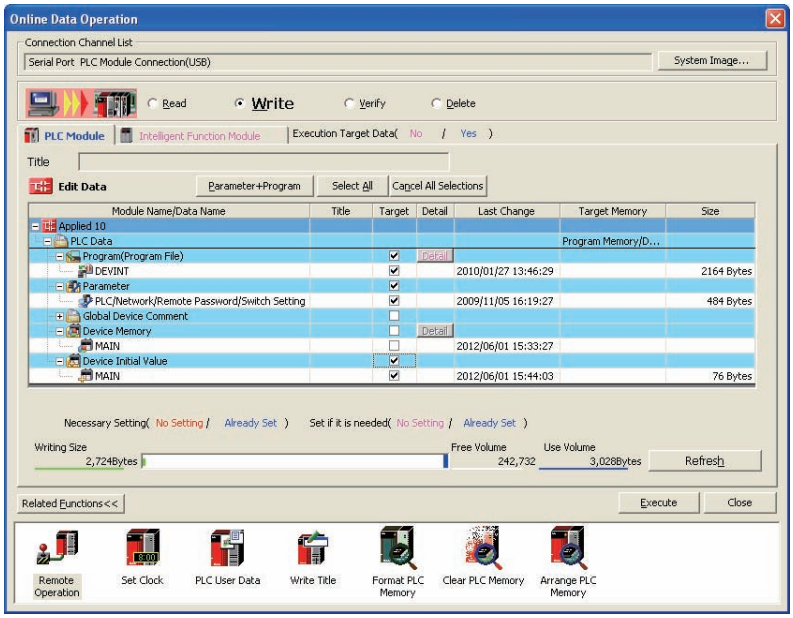


5) Click the End button to accept the setting.

Appendix 6.3 Checking the operation of device initial values

(1) Writing data to the CPU

Write programs, parameters and device initial values to the CPU.



POINT
In this section, the device initial value setting file also can be written to the CPU simultaneously with the parameters and programs. Reason: The device initial value setting file uses the same target memory area. (In this section, the program memory is used for all.) Generally, the target memory area for the device initial value setting file is different from the one for parameter and program files. Each of them can be written into each target memory separately.

(2) Operation check

When the RUN/STOP/RESET switch on the CPU is switched from STOP to RUN, or at the timing of the power-on, the values of the device initial value setting file are transferred to the CPU device.

In this section, the initial set value of the register D0, "1234" is displayed on the LED (K4Y40) of the demonstration machine.

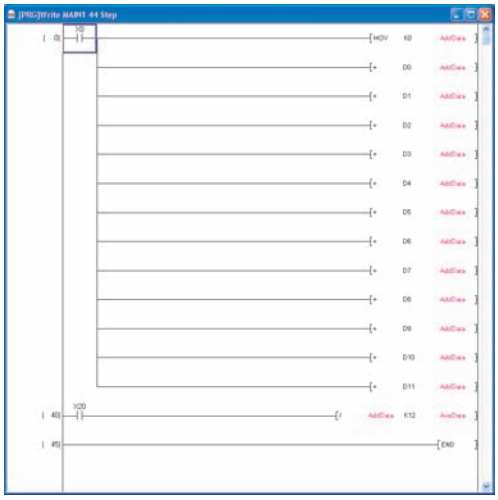
POINT
When the latch range overlaps with the device initial value, the device initial value is given priority.

Appendix 7 Inline Structured Text

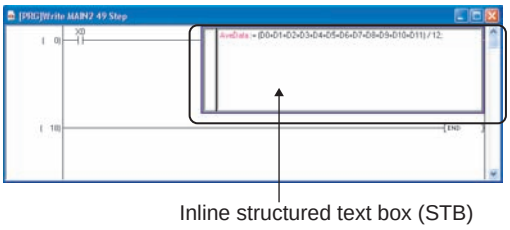
Inline structured text is a function to edit/monitor a program by creating an inline structured text box that displays an ST program at the coil instruction area on the ladder editor of the project with labels.
With this function, a numeric value operation or a character string process can be easily created in the ladder program.

Select "Enable function block call 'from ladder to Structured Ladder/FBD or ST' and 'from Structured Ladder/FBD or ST to ladder'" under [Tool] → [Options] → [Compile] → [Basic Setting] to use the inline structured text function.

< Using ladder >



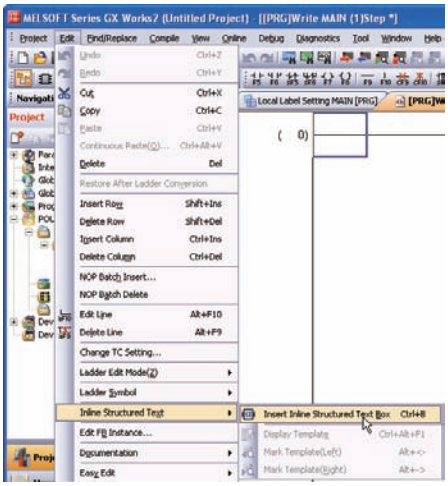
< Using Inline structured text >



Inline structured text box (STB)

Appendix 7.1 Editing inline structured text

(1) Inserting an inline structured text box

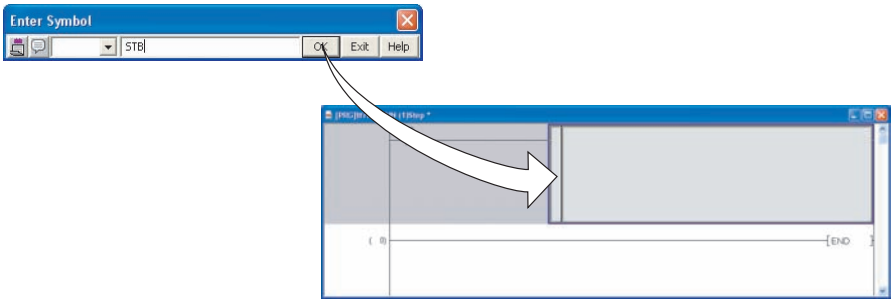


1) Click [Edit] → [Inline Structured Text] → [Insert Inline Structured Text Box].

2) An inline structured text box is inserted.

POINT

- Inserting an inline structured text box
  - An inline structured text box can be also inserted by entering "STB" on the Enter Symbol screen.



  - The maximum number of inline structured text boxes that can be inserted is 100 per program, and 400 per project.

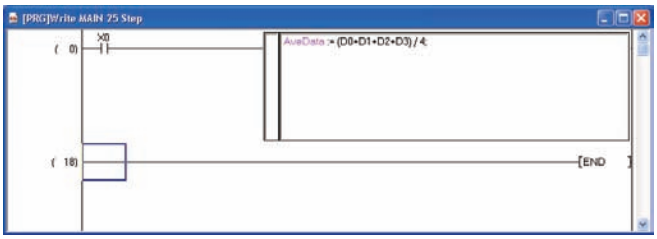
(2) Editing an inline structured text program

Double-click the inline structured text box.

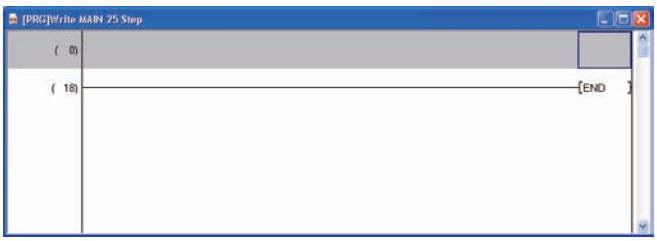
The editing method of the inline structured text is the same as that of the ST language.

For editing programs in the ST language, refer to the GX Works2 Version 1 Operating Manual Structured Project and MELSEC-Q/L/F Structured Programming Manual (Fundamentals).

(3) Deleting an inline structured text box



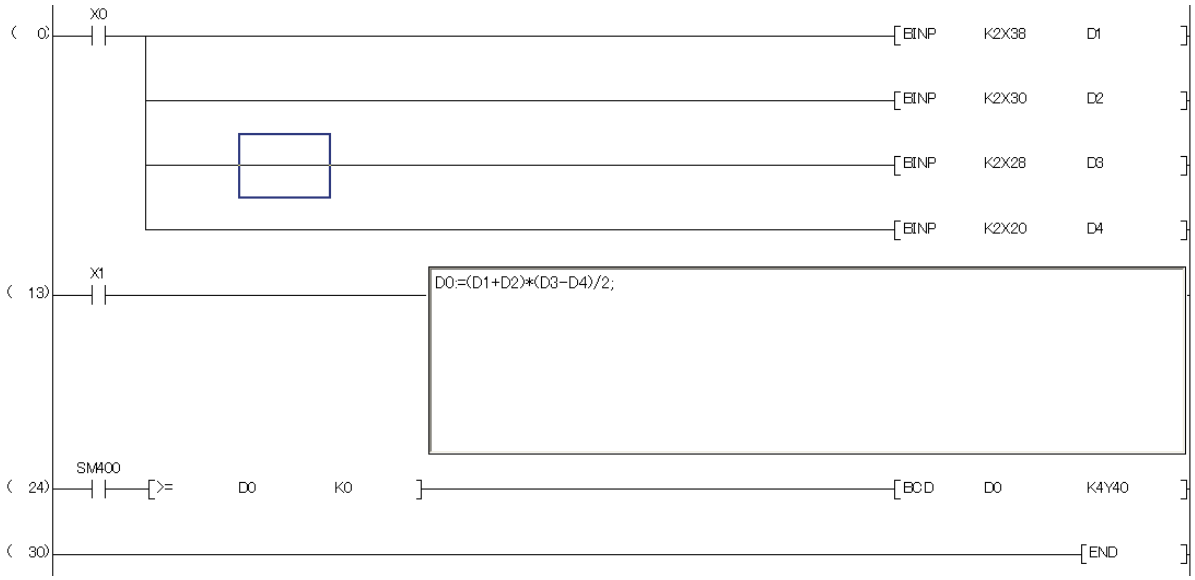
1) Select an inline structured text box to be deleted.



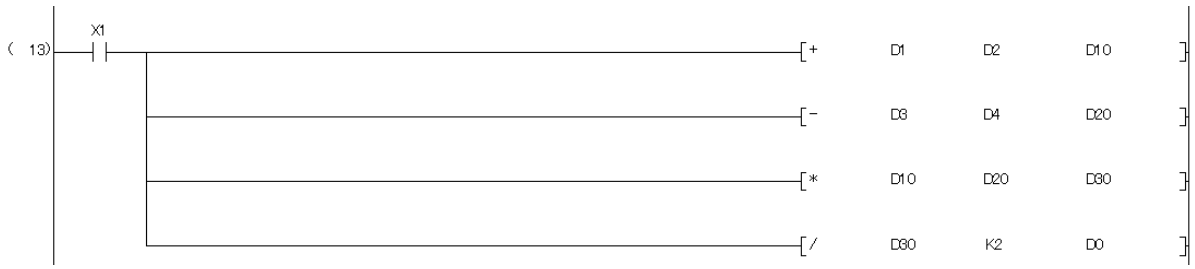
2) Click [Edit] → [Delete].

One ladder block containing the inline structured text box is deleted.

(4) Program example of the inline structured text



* Program example without the inline structured text



Appendix 7.2 Precautions on using the inline structured text

(1) Precautions on creating ladder programs
- One inline structured text box can be created for one ladder block.
- Both an FB and an inline structured text box cannot be used in a ladder block.
- When the creation of an inline structured text box is attempted at the contact instruction area, an inline structured text box is created at the coil instruction area.
- A ladder program cannot be edited if an unconverted inline structured text program exists on the ladder editor. Edit a program after converting it.

(2) Precautions on editing in an inline structured text box
- A maximum number of characters that can be entered is 2048.
- Up to 23 local labels can be used in an inline structured text box. (Excluding constants)
- The following data type labels cannot be used.
  - Counter
  - Timer
  - Retentive timer
  - Pointer
  - Structure
  - Array
  - Function block
- Lower-case device names cannot be used as labels regardless of the option setting.
- Instructions cannot be entered using the Selection window.
- The template function of the ST program cannot be used.
- Label candidates are not displayed.
- The editing status cannot be recovered to the previous status by the operation such as clicking [Edit] → [Undo].

(3) Verifying a program containing an inline structured text

When a project or project revision is verified with "Program" selected, an inline structured text is not the verification target. When verifying a program containing an inline structured text, select "Program File" to verify.

(4) Finding or replacing a program containing an inline structured text

The inside of an inline structured text box are not the target of the following Find/Replace functions.
- Replace String
- Find Device/Replace Device
- Find Instruction/Replace Instruction
- Find Contact or Coil
- Change Open/Close Contact
- Device Batch Replace

When searching the inside of an inline structured text box, use Cross Reference or Device List.

For Cross Reference and Device List, refer to the GX Works2 Version 1 Operating Manual Common.

(5) Copying an inline structured text box

When copying an inline structured text box, select a ladder block including the left side of the left power rail. Contacts of a ladder block containing an inline structured text box only or an inline structured text box only cannot be copied.
A ladder block containing an unconverted inline structured text box also cannot be copied. Copy a ladder block after converting the program.

(6) Jumping to an inline structured text box during monitoring

At search during monitoring or verification for an inline structured text box, the cursor is moved to the target position, but the range is not selected.

Appendix 8 Battery

Install a battery (Q6BAT, Q7BAT, or Q8BAT) in the CPU module to hold data in the program memory, standard RAM, and latch devices even if power failure occurs.

The following table shows the specifications of the batteries used for the CPU module.

Item	Type		
	Q6BAT	Q7BAT	Q8BAT
Classification	Manganese dioxide lithium primary battery		Manganese dioxide lithium primary battery (assembled battery)
Initial voltage	3.0V		
Nominal current	1800mAh	5000mAh	18000mAh (1800mAh × 10 pieces)
Battery life when stored	Actually 5 years (room temperature)		
Battery life when used	Refer to the QCPU User's Manual Hardware Design, Maintenance and Inspection.		
Lithium content	0.49kg	1.52kg	4.9kg
Application	For data retention of the program memory, standard RAM, and latch device during power failure		
Accessory	-	Battery holder*1	Q8BAT connection cable*2

*1: Included only when the Q7BAT-SET is purchased.

*2: Included only when the Q8BAT-SET is purchased.

The real number data includes the single-precision floating-point data and double-precision floating-point data.

(1) Single-precision floating-point data

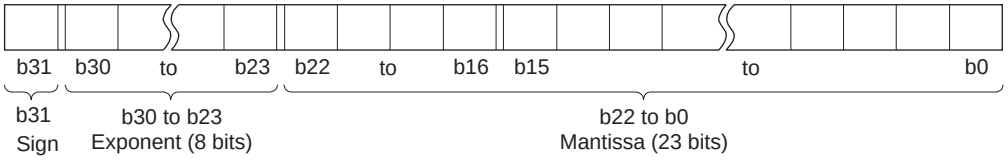
(a) Internal representation of real numbers

Internal representation of real numbers used in the CPU module is shown below.

Real number data can be represented as follows, using two word devices.

[Sign] 1. [Mantissa] $\times$ $2^{[Exponent]}$

The bit configuration and the meaning of each bit are described below.



1) Sign...The most significant bit, b31, is the sign bit.
0: Positive, 1: Negative

2) Exponent
The 8 bits, b23 to b30, represent the exponent n of 2^n.
The following shows the exponent n according to the binary values in b23 to b30.

b23 to b30	FF$_H$	FE$_H$	FD$_H$		81$_H$	80$_H$	7F$_H$	7E$_H$		02$_H$	01$_H$	00$_H$
n	Not used	127	126		2	1	0	-1		-125	-126	Not used

3) Mantissa
Each of the 23 bits, b0 to b22, represents the "XXXXXX..." portion when the data is represented in binary, "1.XXXXXX...".

(b) Calculation example

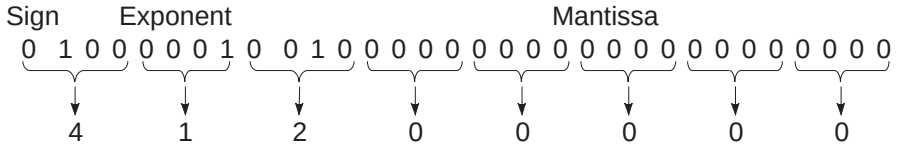
The following shows the calculation examples. (The "X" in (nnnnnn)X indicates the numeral system used.)

1) When "10" is stored

$(10)_{10} \rightarrow (1010)_2 \rightarrow (1.010000..... \times 2^3)_2$

Sign: Positive $\rightarrow$ 0
Exponent: 3 $\rightarrow$ 82$_H$ $\rightarrow$ $(10000010)_2$
Mantissa: $(010\ 00000\ 00000\ 00000\ 00000)_2$

In this case, the value will be encoded as 41200000$_H$.

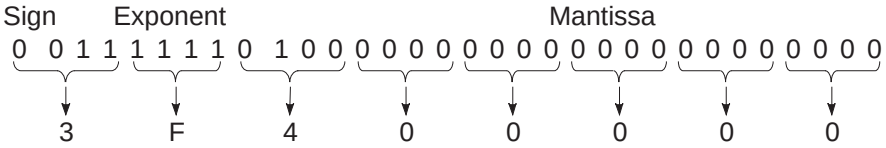


2) When "0.75" is stored

$(0.75)_{10} \rightarrow (0.11)_2 \rightarrow (1.100..... \times 2^{-1})_2$

Sign: Positive → 0
Exponent: -1 → 7EH → $(01111110)_2$
Mantissa: $(100\ 00000\ 00000\ 00000\ 00000)_2$

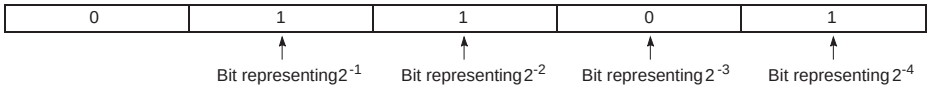
In this case, the value will be encoded as 3F400000H.



POINT

Values after the decimal point (in binary) are calculated as follows.

Ex.) $(0.1101)_2$



$(0.1101)_2 = 2^{-1} + 2^{-2} + 2^{-4} = 0.5 + 0.25 + 0.0625 = (0.8125)_{10}$

(2) Double-precision floating-point data

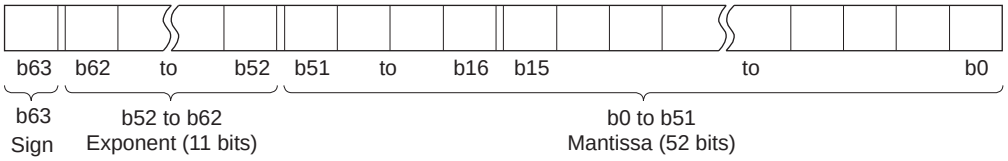
(a) Internal representation of real numbers

Internal representation of real numbers used in the CPU module is shown below.

Real number data can be represented as follows, using four word devices.

[Sign] 1. [Mantissa] $\times 2^{[Exponent]}$

The bit configuration and the meaning of each bit are described below.



1) Sign ... The most significant bit, b63, is the sign bit.
0: Positive, 1: Negative

2) Exponent
The 11 bits, b52 to b62, represent the exponent n of 2^n.
The following shows the exponent according to the binary values in b52 to b62.

b52 to b62	7FFH	7FEH	7FDH			400H	3FFH	3FEH	3FDH	3FCH			02H	01H	00H
n	Not used	1023	1022			1	0	-1	-2	-3			-1021	-1022	Not used

3) Mantissa
Each of the 52 bits, b0 to b51, represents the "XXXXXX..." portion when the data is represented in binary, "1.XXXXXX...".

(b) Calculation example

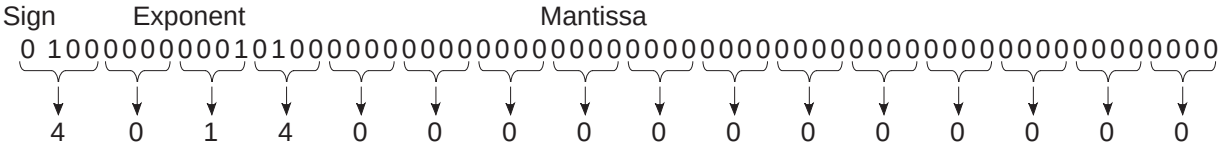
The following shows the calculation examples. (The "X" in (nnnnnn)X indicates the numeral system used.)

1) When "10" is stored

$(10)_{10} \rightarrow (1010)_2 \rightarrow (1.010000..... \times 2^3)_2$

Sign: Positive → 0
Exponent: $3 \rightarrow 401_H \rightarrow (100\ 0000\ 0001)_2$
Mantissa:
$(0100\ 0000\ 0000\ 0000\ 0000\ 0000\ 0000\ 0000\ 0000\ 0000\ 0000\ 0000\ 0000)_2$

In this case, the value will be encoded as 4014000000000000_H.

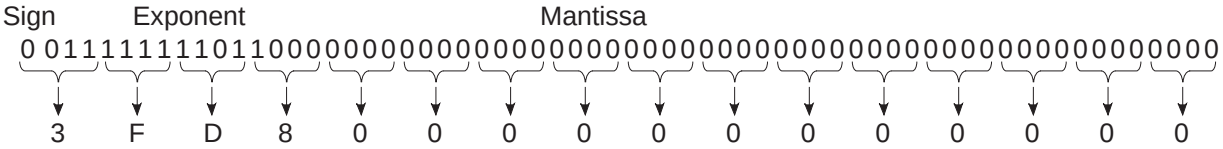


2) When "0.75" is stored

$(0.75)_{10} \rightarrow (0.11)_2 \rightarrow (1.100.....\times 2^{-1})_2$

Sign: Positive → 0
Exponent: $-1 \rightarrow 3FD_H \rightarrow (011\ 1111\ 1101)_2$
Mantissa:
$(1000\ 0000\ 0000\ 0000\ 0000\ 0000\ 0000\ 0000\ 0000\ 0000\ 0000\ 0000\ 0000)_2$

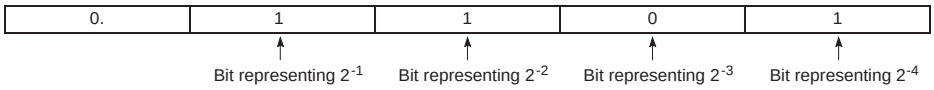
In this case, the value will be encoded as $3FD8000000000000_H$.



POINT

Values after the decimal point (in binary) are calculated as follows.

Ex.) $(0.1101)_2$



$(0.1101)_2 = 2^{-1} + 2^{-2} + 2^{-4} = 0.5 + 0.25 + 0.0625 = (0.8125)_{10}$

Mitsubishi Programmable Controller Training Manual
Q-series advanced course (for GX Works2)

MODEL	SCHOOL-APPLI-GXW2-E
MODEL CODE	13JW56
SH(NA)-081124ENG-A(1210)MEE	

MITSUBISHI ELECTRIC CORPORATION

HEAD OFFICE : TOKYO BUILDING, 2-7-3 MARUNOUCHI, CHIYODA-KU, TOKYO 100-8310, JAPAN
NAGOYA WORKS : 1-14 , YADA-MINAMI 5-CHOME , HIGASHI-KU, NAGOYA , JAPAN