MITSUBISHI

Mitsubishi Safety Programmable Controller

MELSEC QS series

QSCPU

User's Manual
(Function Explanation, Program Fundamentals)

QS001CPU

●SAFETY PRECAUTIONS●

(Always read these instructions before using this equipment.)

Before using this product, please read this manual, the relevant manuals introduced in this manual, standard PLC manuals, and the safety standards carefully and pay full attention to safety to handle the product correctly.
In this manual, the safety instructions are ranked as "DANGER" and "CAUTION".

DANGER	Indicates that incorrect handling may cause hazardous conditions, resulting in death or severe injury.
CAUTION	Indicates that incorrect handling may cause hazardous conditions, resulting in medium or slight personal injury or physical damage.

Note that the CAUTION level may lead to a serious consequence according to the circumstances. Always follow the instructions of both levels because they are important to personal safety.

Please save this manual to make it accessible when required and always forward it to the end user.

[Design Precautions]

DANGER

- When a safety PLC detects an error in an external power supply or a failure in PLC main module, it turns off all the outputs.
  Create an external circuit to securely stop the power of hazard by turning off the outputs. Incorrect configuration may result in an accident.

- Create short current protection for a safety relay, and a protection circuit such as a fuse, and breaker, outside a safety PLC.

- When data/program change, or status control is performed from a PC to a running safety PLC, create an interlock circuit outside the sequence program and safety PLC to ensure that the whole system always operates safely.
  For the operations to a safety PLC, pay full attention to safety by reading the relevant manuals carefully, and establishing the operating procedure.
  Furthermore, for the online operations performed from a PC to a safety CPU module, the corrective actions against a communication error due to a cable connection fault, etc. should be predetermined as a system.

- All output signals from a safety CPU module to the CC-Link Safety system master module are prohibited to use.
  These signals can be found in the CC-Link Safety System Master Module User's Manual.
  Do not turn ON or OFF these signals by sequence program, since turning ON/OFF these output signals of the PLC system may cause malfunctions and safety operation cannot be guaranteed.

- When a safety remote I/O module has detected a CC-Link Safety error, it turns off all the outputs. Note that the outputs in a sequence program are not automatically turned off.
  If a CC-Link Safety error has been detected, create a sequence program that turns off the outputs in the program.
  If the CC-Link Safety is restored with the outputs on, it may suddenly operate and result in an accident.

- To inhibit restart without manual operation after safety functions was performed and outputs were turned OFF, create an interlock program which uses a reset button for restart.

CAUTION

- Do not bunch the wires of external devices or communication cables together with the main circuit or power lines, or install them close to each other. They should be installed 100 mm (3.94 inch) or more from each other. Not doing so could result in noise that would cause erroneous operation.

[Installation Precautions]

⚠ CAUTION

- Use a safety PLC in the environment that meets the general specifications described in this manual. Using this PLC in an environment outside the range of the general specifications could result in electric shock, fire, erroneous operation, and damage to or deterioration of the product.

- While pressing the installation lever located at the bottom of module, insert the module fixing tab into the fixing hole in the base unit until it stops. Then, securely mount the module with the fixing hole as a supporting point.
  Incorrect loading of the module can cause a failure or drop.
  Secure the module to the base unit with screws.
  Tighten the screw in the specified torque range.
  If the screws are too loose, it may cause a drop of the screw or module.
  Over tightening may cause a drop due to the damage of the screw or module.

- Completely turn off the externally supplied power used in the system before mounting or removingthe module.
  Not doing so could result in damage to the product.

- Do not directly touch the module's conductive parts or electronic components.
  Doing so may cause malfunctions or a failure.

[Wiring Precautions]

⚠ DANGER

- Be sure to shut off all phases of the external supply power used by the system before wiring.
  Not completely turning off all power could result in electric shock or damage to the product.

- When energizing or operating the module after installation or wiring, be sure to close the attached terminal cover.
  Not doing so may result in electric shock.

[Wiring Precautions]

⚠CAUTION

- Be sure to ground the FG terminals and LG terminals to the protective ground conductor.
  Not doing so could result in electric shock or erroneous operation.

- Use a solderless terminal with insulation sleeve for wiring of a terminal block.
  Use up to two solderless terminals for a single terminal.

- Use applicable solderless terminals and tighten them with the specified torque.
  If any solderlessspade terminal is used, it may be disconnected when the terminal screw comes loose, resultingin failure.

- Wire the module correctly after confirming the rated voltage and terminal layout.
  Connecting a power supply of a different rated voltage or incorrect wiring may cause a fire or failure.

- Tighten a terminal block mounting screw, terminal screw, and module mounting screw within the specified torque range.
  If the terminal block mounting screw or terminal screw is too loose, it may cause a short circuit, fire, or malfunctions.
  If too tight, it may damage the screw and/or the module, resulting in a drop of the screw or module, a short circuit or malfunctions.
  If the module mounting screw is too loose, it may cause a drop of the screw or module.
  Over tightening the screw may cause a drop due to the damage of the screw or module.

- Be sure there are no foreign substances such as sawdust or wiring debris inside the module.
  Such debris could cause a fire, failure, or erroneous operation.

- The module has an ingress prevention label on its top to prevent foreign matter, such as wire offcuts, from entering the module during wiring.
  Do not peel this label during wiring. Before starting system operation, be sure to peel this label because of heat dissipation.

- Install our PLC in a control panel for use.
  Wire the main power supply to the power supply module installed in a control panel through a distribution terminal block.
  Furthermore, the wiring and replacement of a power supply module have to be performed by a maintenance worker who acquainted with shock protection.
  (For the wiring methods, refer to the QSCPU User's Manual (Hardware Design, Maintenance and Inspection))

[Startup and Maintenance precautions]

⚠DANGER

- Do not touch the terminals while power is on.
  Doing so could cause shock or erroneous operation.

- Correctly connect the battery. Also, do not charge, disassemble, heat, place in fire, short circuit, or solder the battery.
  Mishandling of battery can cause overheating or cracks which could result in injury and fires.

- Turn off all phases of the external supply power used in the system when cleaning the module or retightening the terminal block mounting screws, terminal screws, or module mounting screws.
  Not doing so could result in electric shock. Tighten a terminal block mounting screw, terminal screw, and module mounting screw within the specified torque range.
  If the terminal block mounting screw or terminal screw is too loose, it may cause a short circuit, fire, or malfunctions.
  If too tight, it may damage the screw and/or the module, resulting in a drop of the screw or module, a short circuit or malfunctions.
  If the module mounting screw is too loose, it may cause a drop of the screw or module.
  Over tightening the screw may cause a drop due to the damage of the screw or module.

[Startup and Maintenance precautions]

⚠CAUTION

- The online operations performed from a PC to a running safety PLC (Program change when a safety CPU is RUN, device test, and operating status change such as RUN-STOP switching) have to be executed after the manual has been carefully read and the safety has been ensured.
  Following the operating procedure predetermined at designing, the operation has to be performed by an instructed person.
  When changing a program while a safety CPU is RUN (Write during RUN), it may cause a program breakdown in some operating conditions.
  Fully understand the precautions described in the GX Developer's manual before use.

- Do not disassemble or modify the modules.
  Doing so could cause a failure, erroneous operation, injury, or fire.
  If the product is repaired or remodeled by other than the specified FA centers or us, the warranty is not covered.

- Use any radio communication device such as a cellular phone or a PHS phone more than 25cm(9.85 inch) away in all directions of the PLC.
  Not doing so can cause a malfunction.

- Completely turn off the externally supplied power used in the system before mounting or removingthe module.
  Not doing so could result in damage to the product.

- Restrict the mounting/removal of a module, base unit, and terminal block up to 50 times (IEC61131-2-compliant), after the first use of the product.
  Failure to do so may cause the module to malfunction due to poor contact of connector.

- Do not drop or give an impact to the battery mounted to the module.
  Doing so may damage the battery, causing the battery fluid to leak inside the battery.
  If the battery is dropped or given an impact, dispose of it without using.

- Before touching the module, always touch grounded metal, etc. to discharge static electricity fromhuman body, etc.
  Not doing so can cause the module to fail or malfunction

[Disposal Precautions]

⚠CAUTION

- When disposing of this product, treat it as industrial waste.
  When disposing of batteries, separate them from other wastes according to the local regulations. (For details of the battery directive in EU member states, refer to QSCPU User's Manual (HardwareDesign, Maintenance and Inspection).

[Transportation Precautions]

⚠CAUTION

- When transporting lithium batteries, make sure to treat them based on the transport regulations.
  (For details of the controlled models, refer to QSCPU User's Manual (Hardware Design, Maintenance and Inspection).

REVISIONS

The manual number is given on the bottom left of the back cover.

Print Date	Manual Number	Revision
Sep., 2006	SH(NA)-080627ENG-A	First edition
Jun.,2007	SH(NA)-080627ENG-B	Partial correction Section 3.7.1, 3.7.2, 3.7.3, 4.2.2, 5.3.3, 6.10, 9.1, 9.2, 9.2.4, 9.2.8, 9.5
Apr.,2008	SH(NA)-080627ENG-C	Partial correction ABOUT MANUALS, GENERIC TERMS AND ABBREVIATIONS, Section 1.1, 2.2, Chapter 3, Section 3.3.1, 3.3.2, 3.4, 4.1, 4.2.1, 4.2.2, 4.3.1, 4.3.2, 4.3.3, 5.3.3, 6.1, 6.2.1, 6.2.4, 6.7, 7.2, Chapter 8, Section 8.1, 8.2, 9.2.1, 9.2.6, 9.2.7, 9.2.11, 9.2.12, 10.1.1, 10.1.2, Appendix 1, Appendix 2, Appendix3, Appendix 5 Addition 6.16, 7.3, 7.4, 8.3, Appendix 4, Appendix 6, Appendix 7, Appendix 7.1, Appendix 7.2, Appendix 8, Appendix 9
Sep.,2008	SH(NA)-080627ENG-D	Partial correction SAFETY PRECAUTIONS, Appendix 6 deletion Appendix 10

Japanese Manual Version SH-080608-D

INTRODUCTION

Thank you for choosing the Mitsubishi MELSEC-QS Series of Safety Programmable Controllers.
Before using the equipment, please read this manual carefully to develop full familiarity with the functions and performance of the QS series PLC you have purchased, so as to ensure correct use.

CONTENTS

(Related manual)..... QSCPU User's Manual (Hardware Design, Maintenance and Inspection)

CONTENTS

ABOUT MANUALS

Introduction Manual

Before constructing or designing the safety-related system, be sure to read the following manual.

Manual Name	Manual No. (Model Code)
Safety Application Guide Explains the overview, construction method, laying and wiring examples, and application programs of the safety-related system. (Sold separately)	SH-080613ENG (13JR90)

The following manuals are also related to this product.
In necessary, order them by quoting the details in the tables below.

Related Manuals

Manual Name	Manual Number (Model Code)
QSCPU User's Manual (Hardware Design, Maintenance and Inspection) Explains the specifications of the QSCPU, safety power supply modules, safety base unit and other. (Sold separately)	SH-080626ENG (13JR92)
QSCPU Programming Manual (Common Instructions) Explains how to use the sequence instructions, basic instructions, application instructions, and QSCPU dedicated instructions. (Sold separately)	SH-080628ENG (13JW01)
CC-Link Safety System Master Module User's Manual Explains the specifications, procedures and settings before system operation, parameter setting, and troubleshooting of the QS0J61BT12 CC-Link Safety system master module. (Sold separately)	SH-080600ENG (13JR88)
CC-Link Safety System Remote I/O Module User's Manual Explains the specifications, procedures and settings before system operation, parameter setting, and troubleshooting of the CC-Link Safety system remote I/O module. (Sold separately)	SH-080612ENG (13JR89)
CC-Link IE Controller Network Reference Manual Explains the specifications, procedures and settings before system operation, parameter setting, programming, and troubleshooting of a CC-Link IE controller network. (Sold separately)	SH-080668ENG (13JV16)
Q Corresponding MELSECNET/H Network System Reference Manual (PLC to PLC network) Explains the specifications, procedures and settings before system operation, parameter setting, programming, and troubleshooting of a MELSECNET/H network system for PLC to PLC network. (Sold separately)	SH-080049 (13JF92)
Q Corresponding Ethernet Interface Module User's Manual (Basic) Explains the specifications, procedures for data communication with external devices, line connection (open/close), fixed buffer communication, random access buffer communication, and troubleshooting of the Ethernet module. (Sold separately)	SH-080009 (13JL88)
Q Corresponding Ethernet Interface Module User's Manual (Application) Explains the e-mail function, programmable controller CPU status monitoring function, communication function via CC-Link IE controller network, MELSECNET/H or MELSECNET/10, communication function using the data link instructions, file transfer function (FTP server) of the Ethernet module. (Sold separately)	SH-080010 (13JL89)

Manual Name	Manual Number (Model Code)
Q Corresponding MELSEC Communication Protocol Reference Manual Explains the communication methods and control procedures using the MC protocol, which is used by external devices to read and write data of the programmable controller CPU via the serial communication module or Ethernet module. (Sold separately)	SH-080008 (13JF89)
GX Developer Version 8 Operating Manual Explains the online functions of GX Developer, such as the programming, printout, monitoring, and debugging methods. (Sold separately)	SH-080373E (13JU41)
GX Developer Version 8 Operating Manual (Safety Programmable Controller) Explains the GX Developer functions added and modified for the compatibility with the safety programmable controller. (Sold separately)	SH-080576ENG (13JU53)

Remark

Printed materials are separately available for single item purchase. Order the manual by quoting the manual number on the table above (Model code).

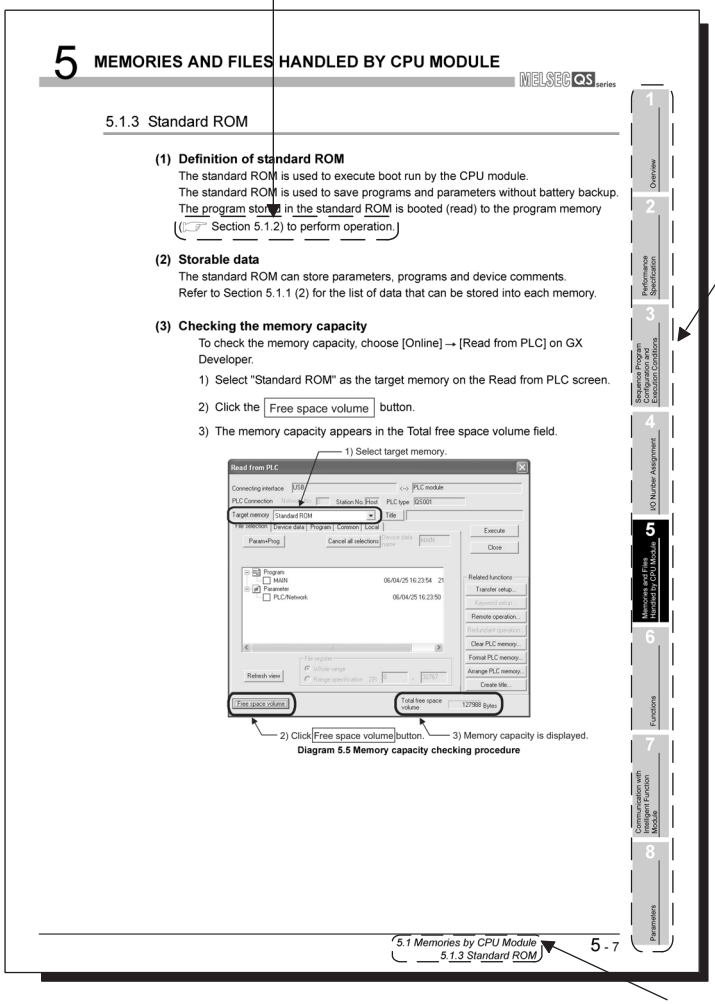
HOW TO SEE THIS MANUAL IS ORGANIZED

Reference destination

A reference destination or reference manual is marked ☞.

Chapter heading

The index on the right side of the page shows the chapter of the open page at a glance.



5 MEMORIES AND FILES HANDLED BY CPU MODULE

MELSEC QS series

5.1.3 Standard ROM

(1) Definition of standard ROM

The standard ROM is used to execute boot run by the CPU module.
The standard ROM is used to save programs and parameters without battery backup.
The program stored in the standard ROM is booted (read) to the program memory (☞ Section 5.1.2) to perform operation.

(2) Storable data

The standard ROM can store parameters, programs and device comments.
Refer to Section 5.1.1 (2) for the list of data that can be stored into each memory.

(3) Checking the memory capacity

To check the memory capacity, choose [Online] → [Read from PLC] on GX Developer.

1) Select "Standard ROM" as the target memory on the Read from PLC screen.

2) Click the Free space volume button.

3) The memory capacity appears in the Total free space volume field.

Diagram 5.5 Memory capacity checking procedure

1 Overview
2 Performance Specification
3 Sequence Program Configuration and Execution Conditions
4 I/O Number Assignment
5 Memories and Files Handled by CPU Module
6 Functions
7 Communication with Intelligent Function Module
8 Parameters

5.1 Memories by CPU Module
5.1.3 Standard ROM
5 - 7

Section title

The section of the open page is shown at a glance.

In addition, this manual provides the following explanations.

POINT

Explains the matters to be especially noted, the functions and others related to the description.

Remark

Provides the reference destination related to the description on that page and the convenient information.

HOW TO USE THIS MANUAL

This manual is prepared for users to understand memory map, functions, programs and devices of the CPU module when you use QS Series PLCs.

The manual is classified roughly into three sections as shown below.

1) Chapters 1	Describe the outline of the CPU module.
2) Chapters 2 to 5	Describe the performance specifications, executable program, I/O No. and memory of the CPU module.
3) Chapter 6	Describes the functions of the CPU modules.
4) Chapter 7	Describes communication with intelligent function modules.
5) Chapters 8 and 9	Describe parameters and devices used in the CPU modules.
6) Chapter 10	Describes the CPU module processing time.
7) Chapter 11	Describes the procedure for writing parameters and programs created at the GX Developer to the CPU module.

Remark

This manual does not explain the functions of power supply modules, base units, extension cables, memory cards and batteries of CPU module.
For these details, refer to the manual shown below.

☞ QSCPU User's Manual (Hardware Design, Maintenance and Inspection)

GENERIC TERMS AND ABBREVIATIONS

Unless otherwise specified, this manual uses the following generic terms and abbreviations to explain the QS series CPU modules.

Generic Term/Abbreviation	Description
Safety PLC	Generic term for safety CPU module, safety power supply module, safety main base unit, CC-Link safety master module and CC-Link safety remote I/O module
Standard PLC	Generic term of each module for MELSEC-Q series, MELSEC-QnA series, MELSEC-A series and MELSEC-FX series (Used for distinction from safety PLC.)
QS series	Abbreviation for Mitsubishi safety PLC MELSEC-QS series
QS001CPU	Abbreviation for the QS001CPU type safety CPU module
CPU module	Other name for the QS001CPU
GX Developer	General product name for the models SW8D5C-GPPW-E, SW8D5C-GPPW-EA, SW8D5C-GPPW-EV and SW8D5C-GPPW-EVA
QS034B	Abbreviation for the QS034B type safety main base unit
Base unit	Other name for the QS034B
QS061P	Abbreviation for the QS061P-A1 and QS061P-A2 type safety power supply modules
Power supply module	Other name for the QS061P
QS0J61BT12	Abbreviation for the QS0J61BT12 type CC-Link Safety system master module
CC-Link Safety	Abbreviation for the CC-Link Safety system
CC-Link Safety master module	Other name for the QS061BT12
CC-Link IE controller network module	Abbreviation for the QJ71GP21-SX and QJ71GP21S-SX CC-Link IE controller network module
MELSECNET/H	Abbreviation for the MELSECNET/H network system
MELSECNET/H module	Abbreviation for the QJ71LP21-25, QJ71LP21S-25, QJ71LP21G, QJ71BR11 MELSECNET/H network module
Ethernet	Abbreviation for the Ethernet network system
Ethernet module	Abbreviation for the QJ71E71-100, QJ71E71-B5, QJ71E71-B2 Ethernet interface module
Intelligent function module	Generic term for the CC-Link Safety master module, CC-Link IE controller network module, MELSECNET/H module, and Ethernet module
QS0J65BTS2-8D	Abbreviation for the QS0J65BTS2-8D CC-Link Safety remote I/O module
QS0J65BTS2-4T	Abbreviation for the QS0J65BTS2-4T CC-Link Safety remote I/O module
QS0J65BTB2-12DT	Abbreviation for the QS0J65BTB2-12DT type CC-Link Safety remote I/O module
CC-Link Safety remote I/O module	Generic term for the QS0J65BTS2-8D, QS0J65BTS2-4T, QS0J65BTB2-12DT
Q series CPU module	Generic term for the Q00JCPU, Q00CPU, Q01CPU, Q02CPU, Q02HCPU, Q06HCPU, Q12HCPU, Q25HCPU, Q12PHCPU, Q25PHCPU, Q12PRHCPU and Q25PRHCPU modules
Standard CPU module	Other name for the Q series CPU module (Used for distinction from safety CPU modules)
Battery	Abbreviation for the Q6BAT type battery
Blank cover	Abbreviation for the QG60 type blank cover
GOT	Generic term for the Mitsubishi Graphic Operation Terminal GOT-A*** series, GOT-F*** series and GOT1000 series

Memo

CHAPTER1 OVERVIEW

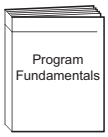
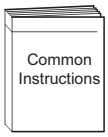
This manual describes the programs, I/O number assignment method, functions and devices of the QS Series CPU Modules (QS001CPU).

For the power supply modules, base units and batteries, refer to the manual below.
☞ QSCPU User's Manual (Hardware Design, Maintenance and Inspection)

(1) List of QS Series CPU Module manuals

The QS series CPU module manuals are as shown below.
For details such as manual numbers, refer to "ABOUT MANUALS" in this manual.

Table1.1 List of manuals of QS Series CPU module

				
Purpose	**QSCPU CPU Module User's Manual (Hardware)**	**QSCPU User's Manual (Hardware Design, Maintenance and inspection)**	**QSCPU User's Manual (Function Explanation, Program Fundamentals)**	**QSCPU Programming Manual (Common Instruction)**
Confirmation of part names and specifications of the CPU module	Outline	Details	Outline	
Confirmation of connection methods for the power supply module, base unit and I/O module	Outline	Details		
Construction of the single CPU system (confirmation of start-up procedure and I/O number assignment)		Details		
Confirmation of the sequence program configuration and memory			Details	
Confirmation of the functions, parameters, and devices of the CPU module			Details	
Confirmation of the troubleshooting and error codes		Details		
Confirmation of usage of sequence instructions, basic instructions, application instructions, etc.				Details

1.1 Features

The QS series CPU module has the following new features:

(1) Safety PLC system can be constructed

The QS series programmable controllers have obtained the highest safety level (IEC61508 SIL3, EN954-1/ISO13849-1 Category 4, IEC62061) applicable to programmable controllers.

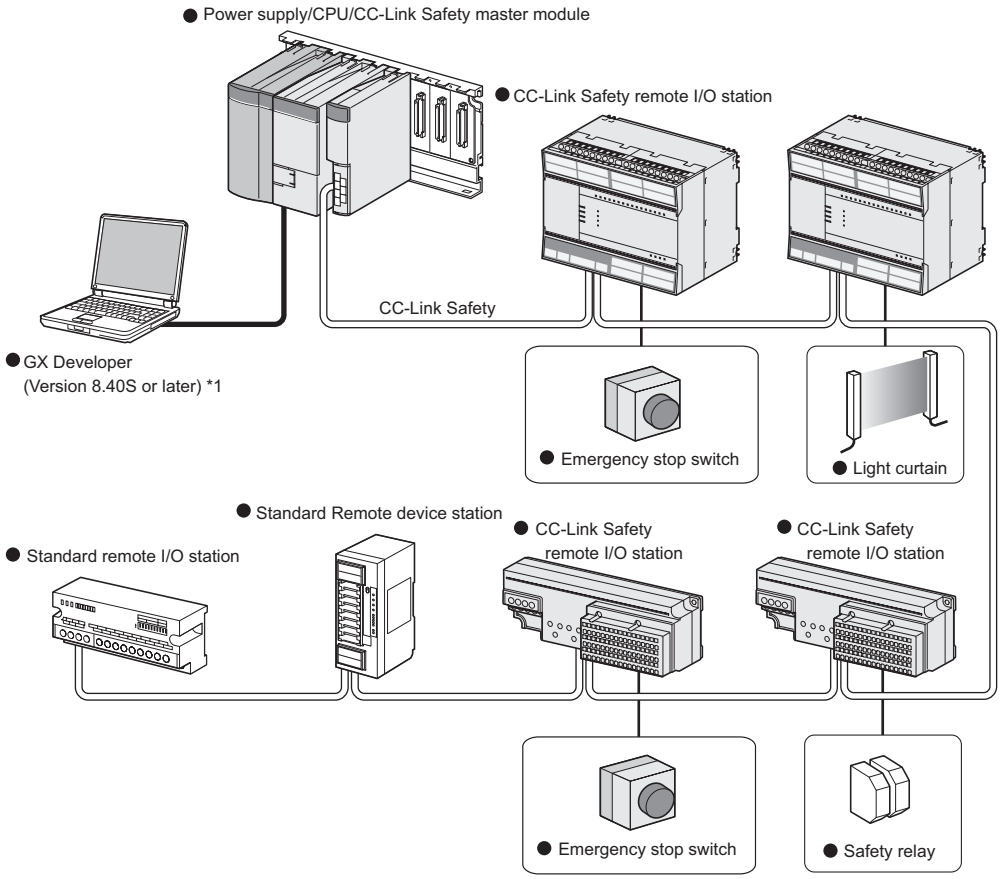


Figure 1.1 Safety PLC system

* 1 : The available functions vary depending on the versions. For details, refer to Appendix 9.

(2) The safety CPU operation mode is equipped for safe system operation

The CPU module is equipped with two safety CPU operation modes. "SAFETY MODE" for safe system operation and "TEST MODE" for system construction and maintenance.

These two modes prevent the user's erroneous operations for safe system operation.

(a) SAFETY MODE

SAFETY MODE is a mode for safe system operation. This mode prohibits the write operation from a programming tool and the device test operation during the system operation.

(b) TEST MODE

TEST MODE is a mode for maintenance. This mode enables the write operation from a programming tool and the device test operation to debug or maintain the sequence program.

(3) Enriched operation history and error history

The CPU module can record a total of 3000 details of the CPU module operation by the user and errors occurred in the CPU module or CC-Link Safety as operation/error history data.

Recording the details of the CPU module operation by the user into the operation/error history clarifies the occurrence order of operations and errors. Troubleshooting becomes easier by confirming the error/operation history.

The contents recorded in the operation/error history are shown in Table1.2.

Table1.2 Recorded contents of operation/error history

Information	Contents	History Information per Entry
Operation history information	User's operations for the CPU module are stored as a history. (Operations which change the CPU module status are recorded.)	• Operation code • Operation message • Operation execution date • Result code • Operation attached information
Error history information	The following errors are stored as a history. • Error/failure detected by self-diagnostics • Hardware error • Error detected by CC-Link Safety	• Error code • Error message • Occurrence date • Error information category (common information/individual information) • Error information (common information/individual information)

(4) Enhanced RAS

(a) Enhanced memory diagnostics
The memory diagnostics equipped with the CPU module are enhanced.

(b) Redundant CPU
The CPU module has two CPUs (CPU A and CPU B). The operation results of CPU A/CPU B are compared, and output only when the results are matched so that incorrect outputs can be prevented. (When the compared results are mismatched, the system stops.)

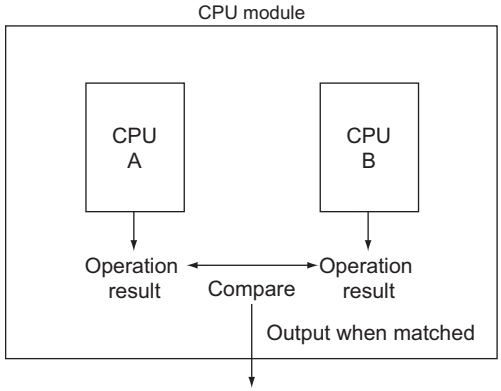


Figure 1.2 Redundant CPU

(c) Enhanced hardware diagnostics by hardware circuit
The diagnostic functions of the Table1.3 prevents incorrect outputs when a hardware error which cannot be detected by the OS occurs.

Table1.3 Hardware diagnostics function added to the QS series CPU module

Diagnostics	Diagnosis Contents
Overvoltage/ undervoltage detection	Overvoltage or undervoltage is detected for the power supply voltage provided from the power supply module to the CPU module.
Clock stop detection	The input clock stop to the CPU module internal circuit is detected.

(5) USB interface is equipped

The CPU module is equipped with the USB interface to communicate with a programming tool.

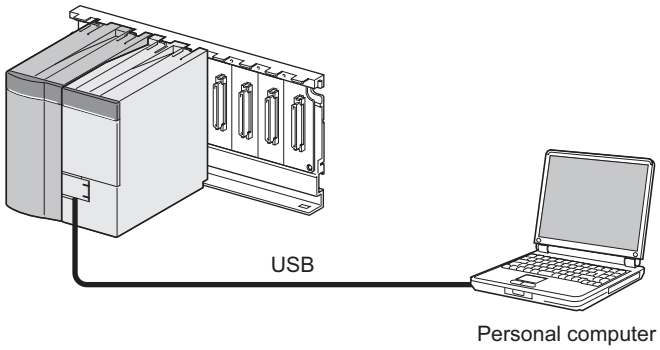


Figure 1.3 Connection to a personal computer using USB

(6) Connectable with personal computers and standard programmable controllers*1

The CPU module can read data from the MELSOFT products installed in the personal computer and also can communicate data between safety programmable controller and standard programmable controller using dedicated instructions via CC-Link IE controller network, MELSECNET/H, and/or Ethernet*2.

Besides, the data of ladder monitor, device monitor, and operation/error history in the safety programmable controller can be read using GOT.

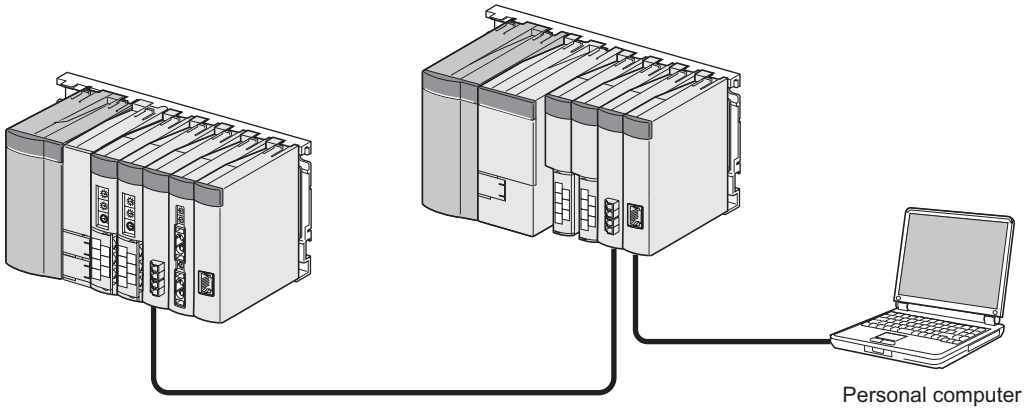


Figure 1.4 Connection with personal computer and standard programmable controller

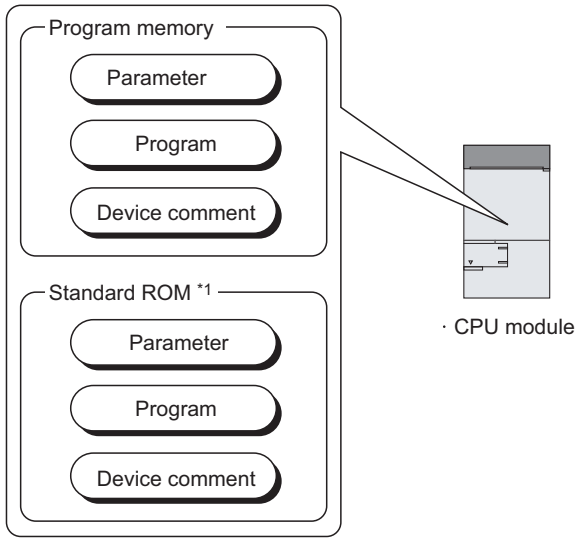
* 1: For an access range from GX Developer and a GOT to a safety CPU module, refer to Appendix 8.
* 2: An access to the CPU module can be restricted by using the remote password function.

1.2 Program Storage and Operation

(1) Program storage

(a) Storage of program created by GX Developer

The program created by GX Developer can be stored into the program memory or standard ROM of the CPU module.



* 1 : The standard ROM is used to ROM the program memory.

Diagram 1.5 Memory configuration and storage destinations

(b) Program execution

The CPU module operates the program stored in the program memory.

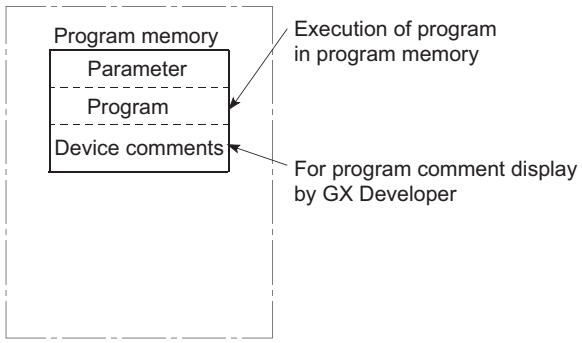


Diagram 1.6 Execution of stored program

(c) Execution of program stored in standard ROM

Programs and data can also be stored into the standard ROM.
The programs stored in the standard ROM can be booted (read) to the program memory and executed when the PLC is powered ON or the CPU module is reset.

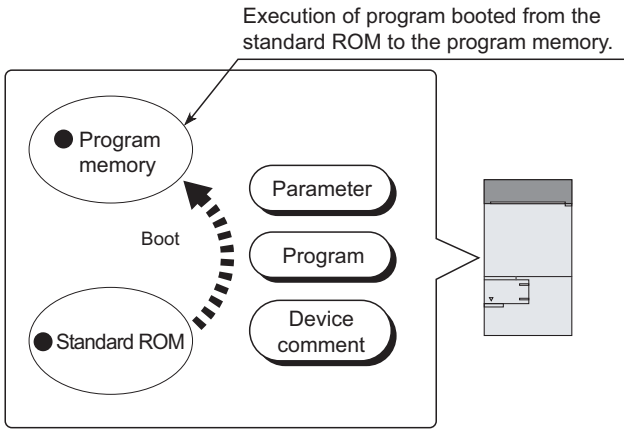


Diagram 1.7 Boot run

1.3 Devices and Instructions Convenient for Programming

The CPU module has devices and instructions convenient for program creation.
The main devices and instructions are outlined below.

(1) Flexible device designation

CPU modules allow devices to be specified flexibly.

(a) Word device bits are handled as contacts/coils

By specifying the bit of the word device, each bit of the word device can be handled as a contact/coil.

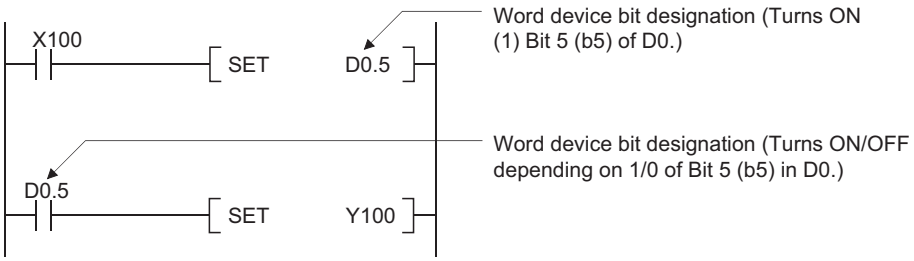


Diagram 1.8 Designation of word device bit

(b) Input need not be pulsed by use of differential contact

An input need not be pulsed by use of a differential contact(/).

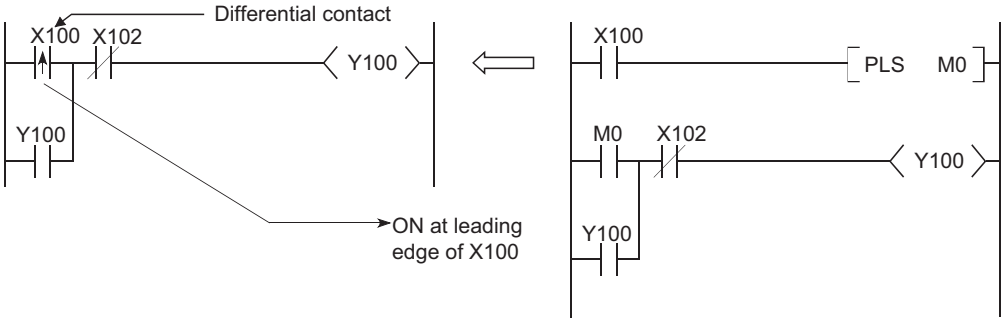


Diagram 1.9 Use of differential contact

1.4 How to Check the Serial No. and Function Version

The serial No. and function version of the CPU module can be checked on the rating plate or in the system monitor of GX Developer.

(1) Checking on rating plate

The rating plate is on the side face of the CPU module.

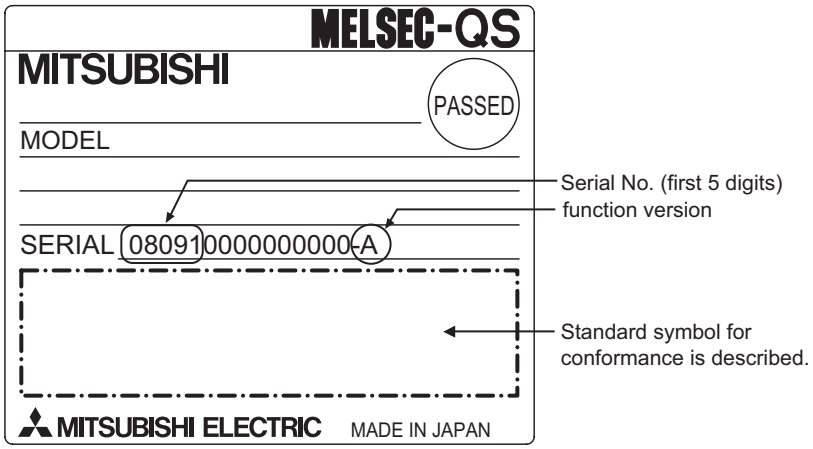


Diagram 1.10 Rating plate

(2) Checking on the front of the module

The serial number written on the rating plate is displayed on the front (at the bottom) of the module.

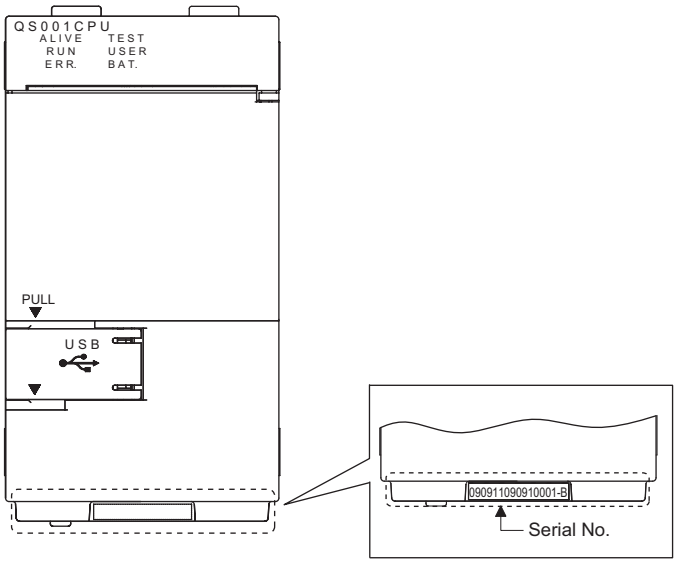


Diagram 1.11 CPU module front display

Remark

The serial number is displayed on the front of the module from March 2008 production.
Products manufactured during switching period may not have the serial number on the front of the module.

(3) Confirming the serial No. on the system monitor (Product Information List)

To display the System monitor screen, select [Diagnostics] → [System monitor] and click the Product Information List button in GX Developer.
On the system monitor, the serial No. and function version of the intelligent function module can also be confirmed.

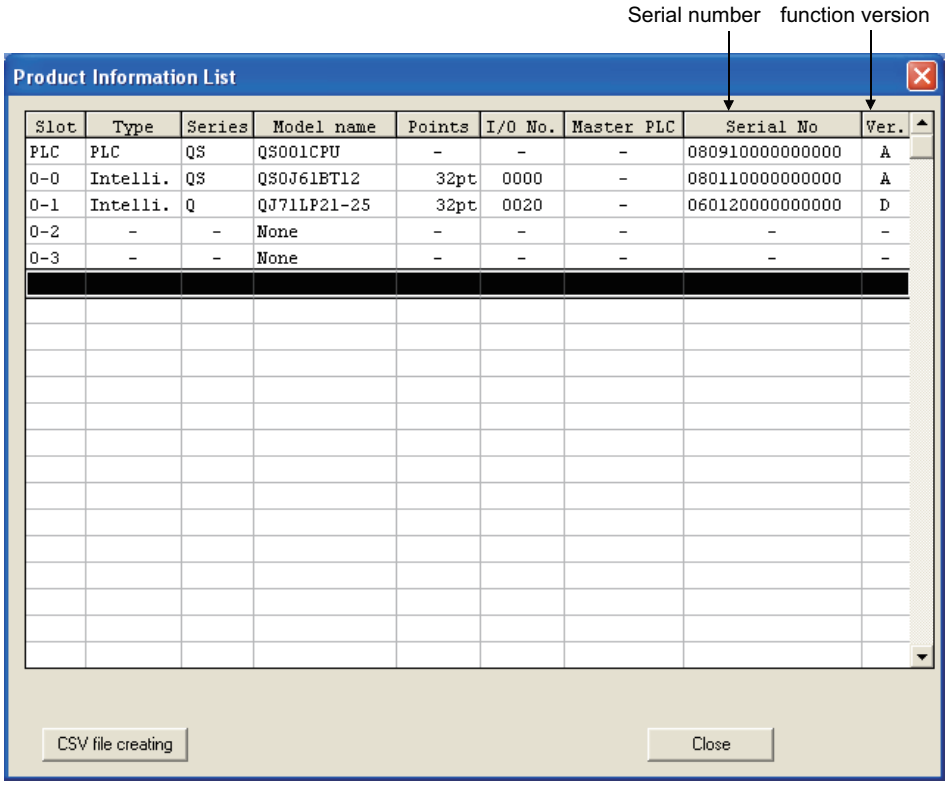


Diagram 1.12 System monitor

POINT

The serial number displayed on the Product information list screen of GX Developer may differ from that on the rating plate and on the front of the module.

- The serial No. on the rated plate describes the management information of the product.
- The serial No. displayed on the product information of GX Developer describes the function information of the product.
  The function information of the product is updated when adding functions.

CHAPTER2 PERFORMANCE SPECIFICATION

Table2.1 shows the performance specifications of the CPU module.

Table2.1 Performance Specifications

Item		QS001CPU	Remarks
Control method		Repetitive operation of stored program	----
I/O control mode		Refresh mode*3	----
Program language	Sequence control language	Relay symbol language, function block.	----
Processing speed (sequence instruction)	LD X0	0.10μs	----
	MOV D0 D1	0.35μs	----
Constant scan (Function for keeping regular scan time)		1 to 2000ms (Setting available in1ms unit.)	Setting by parameters.
Program capacity*1		14k steps (56k bytes)	☞ Section 5.1.1 Section 5.1.2
Memory capacity*1	Program memory (drive 0)	128k bytes	☞ Section 5.1.2
	Standard ROM (drive 4)	128k bytes	☞ Section 5.1.3
Max. number of files stored	Program memory	3*2	☞ Section 5.1.2
	Standard ROM	3*2	☞ Section 5.1.3
No. of times of writing data into the standard ROM		Max.100000 times	----
No. of I/O device points		6144 points(X/Y0 to 17FF)	No. of points usable on program
No. of I/O points		1024 points(X/Y0 to 3FF)	No. of points accessible to the actual I/O module

*1 : The maximum number of executable sequence steps is as shown below.
(Program capacity) - (File heade size (default: 34 steps))

☞ Refer to CHAPTER 5 for details of the program capacity and file.

*2 : Each of parameter, sequence program, SFC program, and device comment files can be stored.

*3 : The refresh mode batch-accesses I/O modules before start of sequence program operation.

Table2.1 Performance Specifications (Continue)

Item			QS001CPU	Remarks
No. of device points	Internal relay [M]		6144 points by default (M0-6143) (changeable)	The number of points can be changed within the setting range. ☞ Section 9.2
	Link relay [B]		2048 points by default (B0 to 7FF) (changeable)	
	Timer [T]		512 points by default (T0 to 511) (changeable) (Sharing of low- and high-speed timers)	
			The low- and high-speed timers are specified by the instructions. The measurement unit of the low- and high-speed timers is 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]		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 unit of the low- and high-speed retentive timers is 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]		• Normal counter: 512 points by default (C0 to 511) (changeable)	
	Data register [D]		6144 points by default (D0 to 6143) (changeable)	
	Link register [W]		2048 points by default (W0 to 7FF) (changeable)	
	Annunciator [F]		1024 points by default (F0 to 1023) (changeable)	
	Edge relay [V]		1024 points by default (V0 to 1023) (changeable)	
	Link special relay [SB]		1536 points (SB0 to 5FF)	The number of device points is fixed.
	Link special register [SW]		1536 points (SW0 to 5FF)	
	Special relay [SM]		5120 points (SM0 to 5119)	
	Special register [SD]		5120 points (SD0 to 5119)	
RUN/PAUSE contact			One contact can be set up in X0 to 17FF for each of RUN. No PAUSE contact.	Setting by parameters.
Timer function			Year, month, date, hour, minute, second and day-of-week (leap year automatically identified) Accuracy: -3.18 to +5.25s (TYP. +2.14s) / d at 0℃ Accuracy: -3.18 to +2.59s (TYP. +2.07s) / d at 25℃ Accuracy: -12.97 to +3.63s (TYP. -3.16s) / d at 55℃	☞ Section 6.11
Allowable instantaneous power failure period			Varies depending on the power supply module	----
5VDC internal current consumption			0.43A	----
External dimensions		H	98mm	----
		W	55.2mm	----
		D	115mm	----
Weight			0.29kg	----
Protection of degree			IP2X	----

Remark

Refer to the following manual for the general specifications.

☞ QSCPU User's Manual (Hardware Design, Maintenance and Inspection)

CHAPTER3 SEQUENCE PROGRAM EXECUTION

The CPU module executes a program in the following order

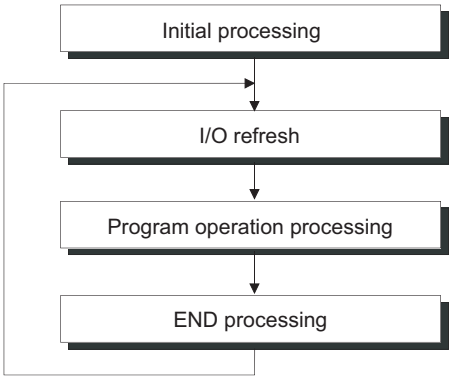


Diagram 3.1 Program execution order

3.1 Sequence Program

A sequence program is created using the sequence instructions, basic instructions, application instructions, etc.

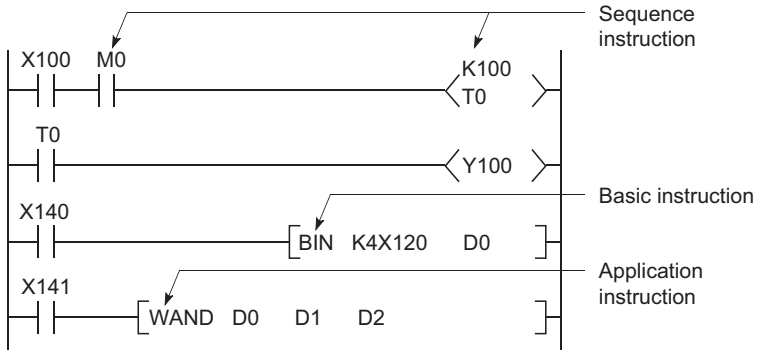


Diagram 3.2 Sequence program

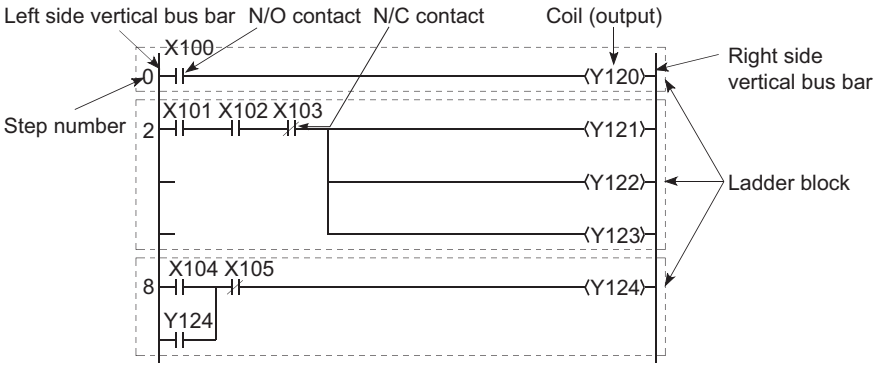
Remark

Refer to the following manual for the sequence instructions, basic instructions and application instructions.

☞ QSCPU Programming Manual (Common Instructions)

3.1.1 Sequence program description method

The sequence program is created with the ladder mode of GX Developer.
The ladder mode is based on the concept of a sequence circuit of relay control. It enables programming in representation close to a sequence circuit.
In the ladder mode, programming is performed in ladder block units.
A ladder block is the minimum unit for performing sequence program operation, which starts from the left side vertical bus bar and ends at the right side vertical bus bar.



X100 to 105 indicate inputs.
Y120 to 124 indicates outputs.

Diagram 3.3 Ladder mode

3.1.2 Sequence program operation

The CPU module calculates in order from the left to the right side vertical bus and from top to bottom.

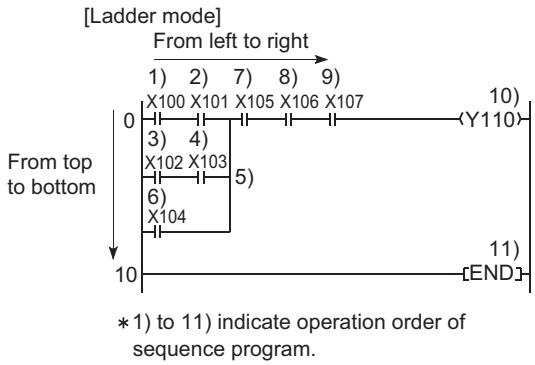


Diagram 3.4 Comparison between ladder mode and list mode

(1) Execution operation of sequence program

The sequence program is executed from Step 0 to the END instruction, where END processing is performed.

After the END processing, the program restarts operation from Step 0.

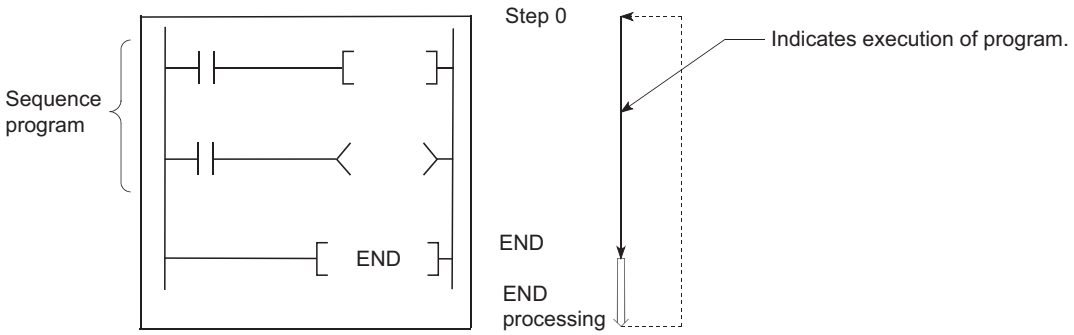


Diagram 3.5 Sequence program

3.2 Concept of Scan Time

(1) Scan time

Scan time is a period from the time when the CPU module starts the sequence program operation from Step 0 until it executes Step 0 of the same sequence program again.

The scan time consists of the sequence program execution time and the END processing time.

(a) Scan time storage location

The CPU module measures the current value and minimum and maximum values of the scan time and stores them into the special registers (SD520, SD521, SD524 to 527).

The scan time can be checked by monitoring SD520, SD521 and SD524 to 527.

Diagram 3.6 Scan time storage location

When SD520 is 3 and SD521 is 400, the scan time is 3.4ms.

(b) Accuracy and measurement of scan time

The accuracy of each scan time stored into the special registers is ±0.1ms.

(c) Scan time watch

The CPU module has scan time watch timers (watchdog timers). (☞ (2) in this section)

(2) WDT (Watchdog timer)

The watchdog timer (hereafter abbreviated to the WDT) watches the scan time.
The default value is 200ms.

(a) WDT error

A WDT error is 10ms.
When the WDT (t) is set to 10ms, a "WDT ERROR" occurs within a scan time range of 10ms<t<20ms.

(b) WDT Setting

The WDT setting can be changed within a range of 10ms to 2000ms in the PLC RAS of the PLC parameter dialog box. (Setting unit: 10ms)

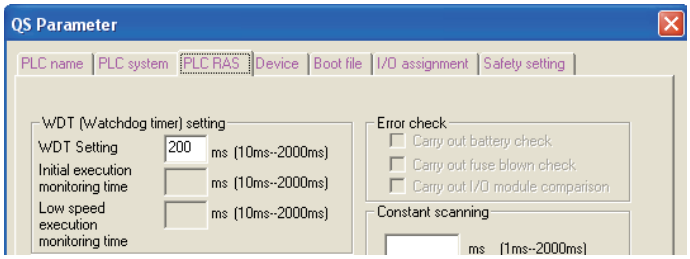


Diagram 3.7 PLC RAS (WDT Setting)

(3) Function that repeats program at fixed intervals

The constant scan function (☞ Section 6.9) allows a program to be executed repeatedly at fixed intervals.
When the constant scan is set, a program is executed at intervals of the preset constant scan time.

3.3 Operation Processing

This section explains the operation processing of the CPU module.

3.3.1 Initial processing

Initial processing is a preprocessing for execution of the sequence program operation. When the PLC is power-on or the CPU module reset is canceled, the following processing is executed only once.

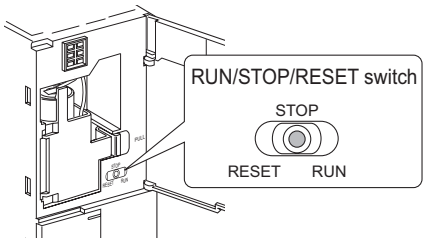
- System setting
- Boot from the standard ROM*
- Safety CPU operation mode setting
- Self-diagnostics
- CC-Link Safety network information setting
- CC-Link IE controller network information setting
- MELSECNET/H network information setting
- Ethernet information setting
- CPU operation status determination

When the initial processing is completed, the CPU module is placed in the operation status set by the RUN/STOP/RESET switch. (☞ Section 3.4)

*: In SAFETY MODE, booting is executed from the standard ROM regardless of the PLC parameter boot file settings.
In TEST MODE, booting is executed from the standard ROM if booting from the standard ROM is set at the PLC parameter boot file setting.

POINT

1. The CPU module's RUN/STOP/RESET switche is shown in the figure below.



2. When a parameter or program has been changed in the STOP status, reset the CPU with the RUN/STOP/RESET switch.

3.3.2 I/O refresh

I/O data between CC-Link Safety master module and network module are refreshed by I/O refresh.
The I/O refresh is executed before the sequence program operation starts.

3.3.3 END processing

This is a post-processing to return the sequence program execution to step 0 after completing the whole sequence program operation processing once.
The END processing includes the following.

- Self-diagnostic processing (☞ Section 6.7)
- Communication with external device such as GX Developer
- Processing of instructions dedicated to intelligent function modules
- Network refresh processing
- CC-Link Safety refresh processing
- Constant wait processing
- Watchdog timer reset processing (☞ Section 6.15)
- Setting values in the special relays/special registers in the set timing END processing. (☞ Appendix 1, ☞ Appendix 2)

POINT

When the constant scan function (☞ Section 6.9) is set, the result of END processing is retained during the waiting time after the END processing or before the next scan.

3.4 RUN, STOP Operation Processing

CPU module has two types of operation status; RUN and STOP status.
CPU module operation processing is explained below:

(1) RUN Status Operation Processing

RUN status indicate that the sequence program operation is performed from step 0 to END instruction to step 0 repeatedly.

(a) Output status when changing into RUN status

When changing into the RUN status, the CPU module either outputs the output (Y) status saved in the STOP status or outputs the operation result after one scan depending on the STOP → RUN-time output mode setting of the parameter dialog box. (☞ Section 6.10)

(b) Processing time before operation start

The processing time taken from switching STOP to RUN until the operation start of the sequence program varies with the system configuration and parameter settings. (Normally 0.1 s)

(2) STOP Status Operation Processing

The STOP status means that the sequence program operation is stopped by the RUN/STOP/RESET switch or the remote STOP function. (☞ Section 6.12.1)
The CPU module is also placed in the STOP status when a stop error occurs.

(a) Output status when changing into STOP status

When changing into the STOP status, the CPU module saves the output (Y) status and turns all output points OFF.
The device memory of other than the output (Y) is retained.

(3) CPU module operation processing at switch operation

Table3.1 Operation processing at switch operation

RUN/STOP status	CPU module operation processing			
	Sequence program operation processing	External output	Device memory	
			M,T,C,D	Y
RUN→STOP	Executes up to the END instruction and stops.	Saves the output (Y) status immediately before switching to the STOP status, and turns all points OFF.	Saves the device memory status immediately before switching to the STOP status.	Saves the output (Y) status immediately before switching to the STOP status, and turns all points OFF.
STOP→RUN	Starts at step 0.	Determined by the "STOP→RUN-time output mode" in the PLC parameter dialog box.	Uses the device memory status when the CPU module had been set to STOP status.	Determined by the "STOP→RUN-time output mode" in the PLC parameter dialog box. (☞ Section 6.10)

POINT

The CPU module performs the following in any of RUN and STOP status:

- I/O refresh processing
- Refresh processing of network modules
- Self-diagnostic processing
- Communication processing with external devices, such as GX Developer
- Intelligent function module dedicated instruction processing (only completion processing)

Even in the STOP status, the CPU module can perform the following operations:

- I/O monitor and test operation with GX Developer
- Reading data from external devices using the MC protocol
- Communication with other stations via CC-Link IE controller network and MELSECNET/H

3.5 Operation Processing during Momentary Power Failure

When the input voltage supplied to the power supply module drops below the specified range, the CPU module detects a momentary power failure and performs the following operation.

(1) When momentary power failure occurs for a period shorter than the permitted power failure time

The output is maintained when the momentary power failure occurs, and error history are logged. Then the system interrupts the operation processing.
(The timer clock continues.)

(a) When recovered from momentary power failure

When a momentary power failure ends, the operation processing is resumed.

(b) Watchdog timer (WDT) measurement during momentary power failure

Even if the operation is interrupted due to momentary power failure, the watchdog timer (WDT) measurement continues. For example, if the GX Developer PLC parameter mode WDT setting is set at 200 ms, when a momentary power failure of 15 ms occurs at scan time 190 ms, the watchdog timer error is set.

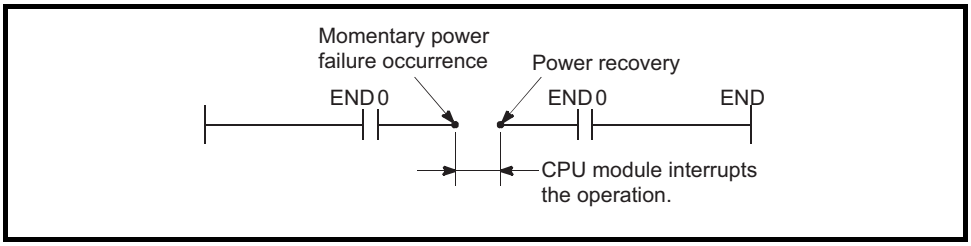


Diagram 3.8 Operation during momentary power failure

(2) When momentary power failure occurs for a period longer than the permitted power failure time

CPU module starts initially.
The same operation processing as that after the following operation occurs.

- Power ON
- Resetting using RUN/STOP/RESET switch.
- Remote setting using GX Developer

3.6 Data Clear Processing

This section explains how to clear CPU module data

(1) Data clear methods

There are the following six ways to clear CPU module data.

(a) Reset with the RUN/STOP/RESET switch, GX Developer.

(b) Restarting the PLC System

(c) PLC memory clear using GX Developer

(d) PLC memory format using GX Developer

(e) PLC memory initialization using GX Developer

(f) History clear using GX Developer (operation and error history clear)

(2) Data That Can and Cannot Be Cleared with Each Data Clearing Method.

Table3.2 shows which data can and cannot be cleared by the methods shown in (1) (a) to (f).

Table3.2 That Can and Cannot Be Cleared with Each Data Clearing Method

Data item	Data clear methods					
	Reset operation	Power restart	PLC memory clear	PLC memory format	PLC memory initialization	Clear history
Program memory data	×	×	×	○	○	×
Standard ROM data*1	×	×	×	×	○	×
Device data	○	○	○	×	○	×
Safety CPU operation mode	×	×	×	×	○*2	×
CPU access password	×	×	×	×	○	×
Clock data	×	×	×	×	○	×
Operation and error history	×	×	×	×	○*3	○*4
ROM write count	×	×	×	×	×	×

○ : Data cleared × : Data not cleared

* 1 : When the program memory is copied into ROM using GX Developer, the standard ROM data is first cleared, then the program memory is written into standard ROM
* 2 : When PLC memory initialization is executed, the safety CPU operation mode becomes TEST MODE.
* 3 : After the history is erased, the following PLC memory initialization operation and error history is recorded.
  - OP005 : FSYSTEM INITIALIZE PLC MEMORY
  - OP100 : POWER ON
  - 2200 : MISSING PARAMETER
* 4 : After the operation and error history is erased, the following operation history is recorded.
  - OP200 : CLEAR OPERATION/ERROR LOG

Remark

For details on GX Developer operation methods, refer to the following manual.

☞ GX Developer Version 8 Operating Manual

☞ GX Developer Version 8 Operating manual (Safety PLC)

3.7 Numeric Values which can be Used in Sequence Programs

Numeric and alphabetic data are expressed by "0" (OFF) and "1" (ON) numerals in the CPU module.
This expression form is called "binary code" (BIN).
The hexadecimal (HEX) expression form in which BIN data are expressed in 4-bit units, and the BCD (binary coded decimal) expression form are applicable to the CPU module.
Table3.3 shows the numeric expressions of BIN, HEX, BCD and DEC (decimal).

Table3.3 BIN, HEX, BCD, and Decimal Numeric Expressions

DEC (Decimal)	HEX (Hexadecimal)	BIN (Binary)				BCD(Binary Coded Decimal)			
0	0				0				0
1	1				1				1
2	2				10				10
3	3				11				11
•	•				•				•
•	•				•				•
•	•				•				•
9	9				1001				1001
10	A				1010			1	0000
11	B				1011			1	0001
12	C				1100			1	0010
13	D				1101			1	0011
14	E				1110			1	0100
15	F				1111			1	0101
16	10			1	0000			1	0110
17	11			1	0001			1	0111
•	•				•				•
•	•				•				•
•	•				•				•
47	2F			10	1111			100	0111
•	•								
•	•								
•	•								
32766	7FFE	0111	1111	1111	1110		--		
32767	7FFF	0111	1111	1111	1111		--		
-32768	8000	1000	0000	0000	0000	1000	0000	0000	0000
-32767	8001	1000	0000	0000	0001	1000	0000	0000	0001
•	•								
•	•								
•	•								
-2	FFFE	1111	1111	1111	1110		--		
-1	FFFF	1111	1111	1111	1111		--		

(1) Numeric value input from outside to CPU module

When setting a numeric value from an external digital switch or similar device to the CPU module, BCD (binary coded decimal) can be used as the same setting in DEC (decimal) by the method given in (b).

(a) Numeric values handled in CPU module

The CPU module performs operation in BIN (binary).
If the value set in BCD is used as-is, the CPU module recognizes the set value as a BIN and performs operation.
Hence, operation is performed using the value different from the set value.
(☞ (b) below)

(b) How to enter numeric value without taking into account BIN notation

Use the BIN instruction to convert the data set in BCD into BIN used in the CPU module.
Using the BIN instruction allows users to set numeric value data from the outside without taking into account BIN notation.

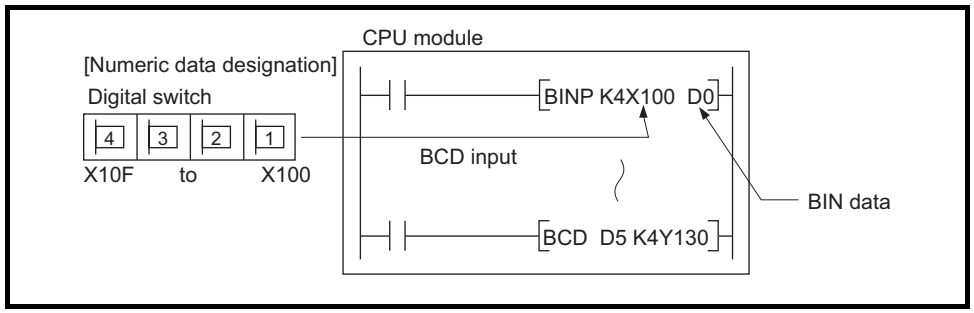


Diagram 3.9 Import of data from digital switch to CPU module

Remark

Refer to the following manual for details of the BIN instruction.
☞ QSCPU Programming Manual (Common Instructions)

(2) Numeric value output from CPU module to outside

A digital display or similar device is available to externally display the numeric value operated by the CPU module.

(a) How to output numeric value

The CPU module performs operation in BIN.
If binary values used in the CPU module are output as they are to a digital display, they will not displayed correctly.
Therefore, the BCD instruction is used to convert the data operated in BIN into BCD used by the external display or similar device.
Using the BCD instruction allows the same display as in DEC (decimal) to be provided on the external display or similar device.

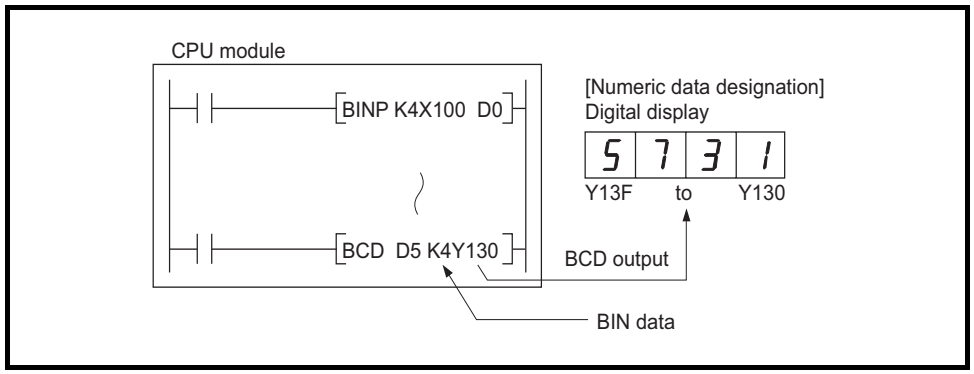


Diagram 3.10 Display of CPU module operation data by digital display

Remark

Refer to the following manual for details of the BCD instruction.
☞ QSCPU Programming Manual (Common Instructions)

3.7.1 BIN (Binary Code)

(1) Binary code

Binary date is represented by 0 (OFF) and 1 (ON).
Decimal notation uses the numerals 0 through 9. When counting beyond 9, a 1 is placed in the 10s column and a 0 is placed in the 1s column to make the number 10.
In binary notation, the numerals 0 and 1 are used. A carry occurs after 1 and the number becomes 10 (decimal 2).
Table3.4 shows the numerical notation by BIN and DEC.

Table3.4 Comparison between Binary and Decimal Notations

DEC (Decimal)	BIN (Binary)	
0	0000	
1	0001	
2	0010	Carry
3	0011	
4	0100	Carry
5	0101	
6	0110	
7	0111	
8	1000	Carry
9	1001	
10	1010	
11	1011	

(2) Binary numeric expression

(a) Bit configuration in BIN notation used in CPU module

Each CPU module register (data registers, link registers, etc.) consists of 16 bits.

(b) Numeric data available for CPU module

Each CPU module register can store numeric values of -32768 to 32767.
Diagram 3.11 shows the numeric notation for CPU module registers.

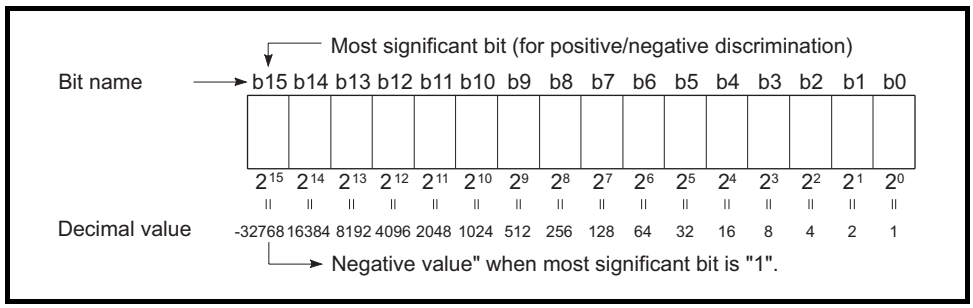


Diagram 3.11 Numeric Expressions for CPU module Registers

POINT

To each bit of each register, a 2^n value is assigned.
Note that the most significant bit is used for distinction of sign (positive or negative).
1) When most significant bit is "0"...Positive
2) When most significant bit is "1"...Negative

3.7.2 HEX (Hexadecimal)

(1) Hexadecimal notation

In hexadecimal notation, 4 binary bits are expressed in 1 digit.
If 4 binary bits are used in binary notation, 16 different values from 0 to 15 can be represented.
Since hexadecimal notation represents 0 to 15 in 1 digit, letters A_H to F_H are used to represent the numbers 10 to 15.
Then, a carry occurs after F_H.
Table3.5 shows the numeric expressions of BIN, HEX and DEC (decimal).

Table3.5 Comparison of BIN, HEX, and DEC Numeric Expressions

DEC (Decimal)	HEX (Hexadecimal)	BIN (Binary)	
0	0		0
1	1		1
2	2		10
3	3		11
•	•		•
•	•		•
•	•		•
9	9		1001
10	A		1010
11	B		1011
12	C		1100
13	D		1101
14	E		1110
15	F		1111
16	10	1	0000
17	11	1	0001
•	•		•
•	•		•
•	•		•
47	2F	10	1111

Carry

(2) Hexadecimal numeric expression

CPU module registers (data registers, link registers, etc.) consist of 16 bits.
For 16 bits, 0 to $FFFF_H$ can be specified in hexadecimal.

POINT

The CPU module regards data stored in HEX as BIN.
For example, if $FFFF_H$ is stored into a register in HEX, the CPU module performs operation, regarding the value of a register as -1.

3.7.3 BCD (Binary Coded Decimal)

(1) BCD notation

BCD (binary coded decimal) is a numbering system in which one digit of DEC (decimal) is expressed in BIN (binary).

Though it uses 4-bit representation like hexadecimal notation, it dose not use letters A_H to F_H.

Table3.6 shows the numeric expressions of BIN, BCD and DEC.

Table3.6 Comparison of BIN, BCD, and DEC Numeric Expressions

DEC (Decimal)	BIN (Binary)	BCD (Binary Coded Decimal)	
0	0000		0
1	0001		1
2	0010		10
3	0011		11
4	0100		100
5	0101		101
6	0110		110
7	0111		111
8	1000		1000
9	1001		1001
10	1010	1	0000
11	1011	1	0001
12	1100	1	0010

Carry

(2) BCD numeric expression

CPU module registers (data registers, link registers, etc.) consist of 16 bits.

In case of 16 bits, 0 to 9999 can be specified in BCD.

POINT

The CPU module regards value stored in BCD as BIN.

For example, if 8000 is stored in BCD, the CPU module performs operation, regarding the value as -32768.

When performing arithmetic operation between values stored in BCD and any values in the CPU module, use the operation instruction of the BCD.

CHAPTER4 I/O NUMBER ASSIGNMENT

This chapter explains the I/O number assignment required for the CPU module to communicate data with I/O modules and/or intelligent function modules.

4.1 Definition of I/O Number

I/O numbers indicate the addresses used in a sequence program to input or output ON/OFF data between the CPU module and other modules.

(1) Input and output of ON/OFF data

Input (X) is used to input ON/OFF data to the CPU module, and output (Y) is used to output ON/OFF data from the CPU module.

(2) I/O number expressions

I/O numbers are expressed as hexadecimal.

4.2 Concept of I/O Number Assignment

4.2.1 I/O numbers of base unit

The CPU module assigns I/O numbers when the programmable controller is powered ON or the reset operation of the CPU module is performed.
I/O numbers are assigned automatically from the right side of the CPU module of the main base unit.

When two CC-Link Safety master modules and one CC-Link IE controller module are mounted on the main base unit, the I/O numbers are assigned as shown in Figure 4.1.

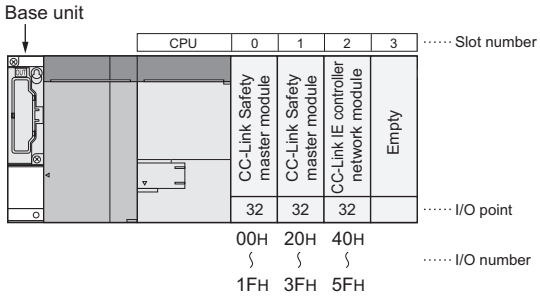


Diagram 4.1 I/O number assignment example

For the empty slot where no CC-Link Safety master module or CC-Link IE controller network module is mounted on the main base unit, the points set on the PLC system setting tab of PLC parameter in GX Developer are assigned. (Default: 16 points)

Remark

The start I/O number can be changed for each slot on the I/O assignment setting tab of PLC parameter in GX Developer.

4.2.2 I/O numbers of remote station

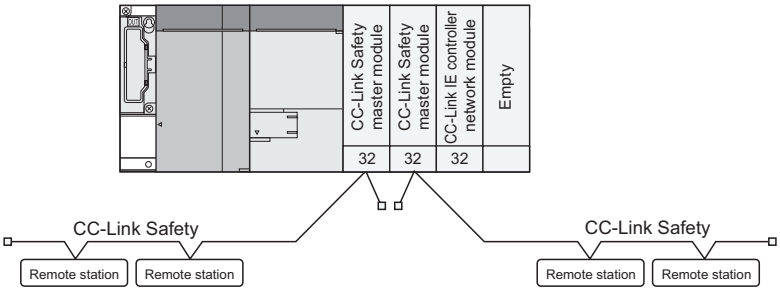
It is possible to assign input (X) and output (Y) of the CPU module to the remote station I/O modules and control the modules in the CC-Link Safety.

(1) CPU module I/O numbers that can be used at remote stations

When two CC-Link Safety master modules and one CC-Link IE controller module are mounted on the main base unit, the CPU module uses X/Y0 to X/Y5F.

When using CPU module input (X) and output (Y) for remote station I/O numbers, use X/Y60 or later.

[System configuration]



[I/O number assignment]

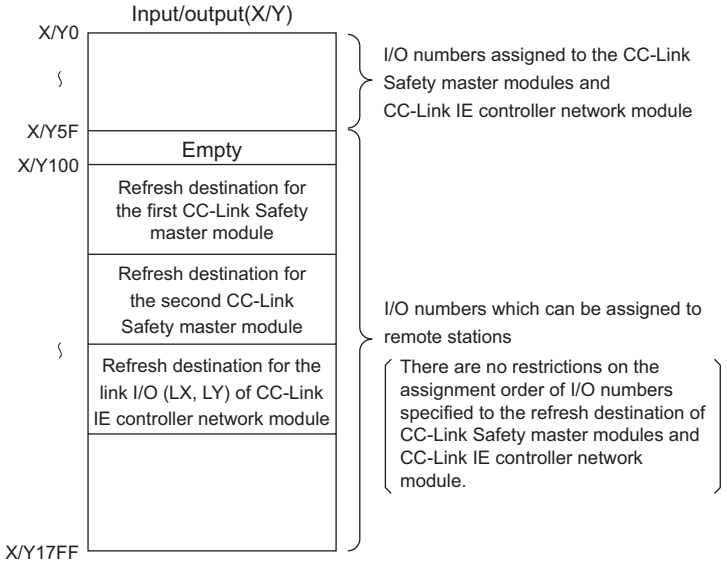


Diagram 4.2 Remote station I/O number assignment

Remark

"Empty" can be assigned in the following areas.

- Area between the first and the second CC-Link Safety master module refreshes
- Area between the second CC-Link Safety master module refresh and the CC-Link IE controller network module refresh

POINT

1. Input (X) and output (Y) can be used as refresh destination (devices on the CPU module side) for the CC-Link IE controller network module link I/O (LX, LY).
2. When using multiple CC-Link Safety master modules, make sure that refresh destination I/O numbers do not overlap.
3. When using CC-Link Safety master modules and CC-Link IE controller network modules together, make sure that refresh destination I/O numbers do not overlap.

4.3 I/O Assignment by GX Developer

This section describes the I/O assignment using GX Developer.

4.3.1 Purpose of I/O assignment by GX Developer

Perform I/O assignment setting by GX Developer in the following cases.

(1) Preventing I/O numbers from changing when converting modules
You can avoid the change in the intelligent function module is removed due to a malfunction.

(2) Changing the I/O numbers to those used in the program
When the designed program's I/O numbers are different from the actual system I/O numbers, each module's I/O number of base units can be set to program-I/O number.

POINT

1. The I/O assignment setting becomes valid when the PLC is powered OFF and then ON or the CPU module is reset.
2. If an intelligent function module breaks down without making I/O assignment settings using GX Developer, it may lead to malfunction of the module, changing I/O numbers of the modules after the broken one.
   Therefore, it is recommended to make I/O assignment setting using GX Developer.

4.3.2 Concept of I/O assignment using GX Developer

In I/O assignment, the "Type (module type)", "Points (I/O points)" and "Start XY" (starting I/O number) can be set for each slot of the base units.
For example, to change the number of occupied I/O points of the designated slot, only the number of occupied I/O points can be designated.
The items other than designated are set to the status where the base unit is installed.

(1) I/O assignment

The I/O assignment is conducted at the "I/O assignment" tab screen in the "(PLC) Parameter" dialog box.

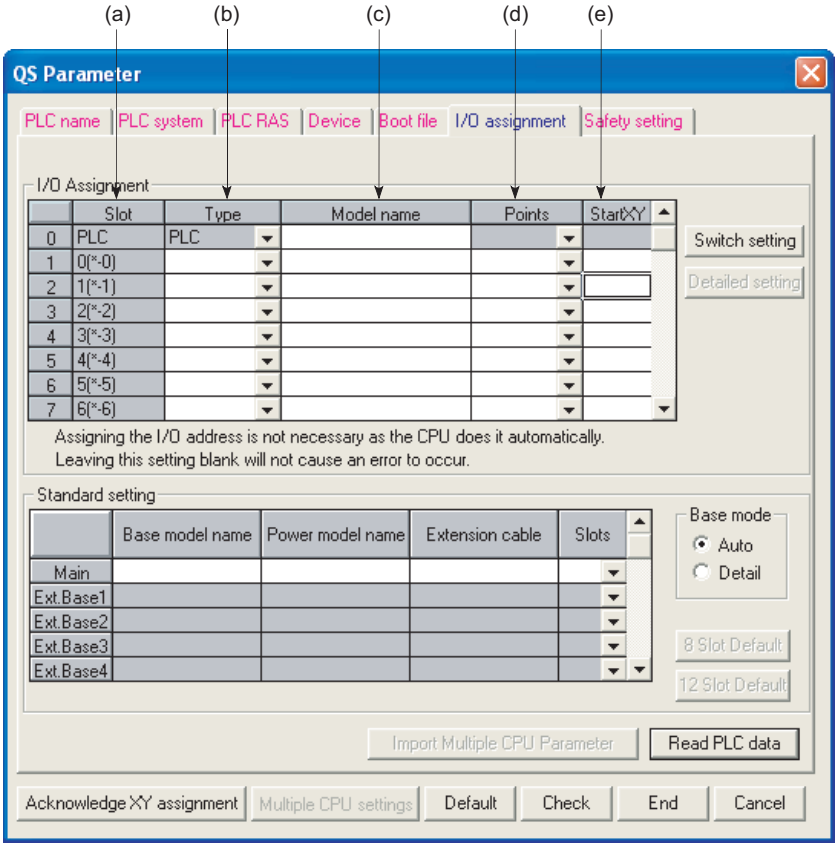


Diagram 4.3 I/O assignment

(a) Slot

The slot number and what number of the main base unit the slot is are displayed.
What number of the main base unit the slot is means the number of slots from 0 slot of the main base unit.

(b) Type

Select "Intelli." for a slot where the CC-Link Safety master module, CC-Link IE controller network module, MELSECNET/H module or Ethernet module is mounted.
Select "Empty" for an empty slot.
If the type is not selected, the type of the module actually mounted is used.

(c) Model name

Set the mounted module model name within 16 characters.
The specified model name is not used for the CPU module. (It is used as a user's memo.)

(d) Points

To change the number of occupied I/O points of each slot, select it from the followings:

• 0 point	• 16 points	• 32 points
• 48 points	• 64 points	• 128 points
• 256 points	• 512 points	• 1024 points

If the number of occupied I/O points is not designated for a slot, the one of the actually mounted module is used.

(e) Start XY

When the I/O number of each slot is changed, you should designate the head I/O number according to the change.
If Start XY is not designated for a slot, the I/O number continuing from the last number of the currently designated slot is assigned.

(2) Precautions for I/O assignment

(a) Slot status after I/O assignment

When I/O assignment setting has been made to a slot, that setting has precedence over the mounted module.

1) When the preset number of points is less than the number of mounted intelligent function module points

"MODULE LAYOUT ERROR" occurs.

2) Mounted module and I/O assigned module type

The mounted module type and the set type in the I/O assignment setting must be the same.
If not, normal operation will not be performed.
For the intelligent function module, make sure that the numbers of I/O points are the same.
Table4.1 describes the operations performed when the mounted module type differs from the one in the I/O assignment setting.

Table4.1 List of operations performed when mounted module differs from I/O assignment

Mounted module	I/O assignment setting	Result
Empty slot	Intelli.	Empty slot
All modules	Empty	Empty slot

3) Last I/O number

In I/O assignment, set the last I/O number not to exceed the maximum value (☞ CHAPTER 2) of the I/O points.
An error ("MODULE LAYOUT ERROR") will occur if the last I/O number exceeds the maximum value of the I/O points. (System monitor of GX Developer shows "***" as an I/O address.)

(b) Precautions for automatic start XY assignment by CPU module

When the start XY is not yet entered, the CPU module automatically assigns it. In the case of 1) or 2) below, therefore, the start XY setting of each slot may overlap the one assigned by the CPU module.

1) Settings of I/O numbers were exchanged in the start XY
2) There are slots with start XY setting and those without start XY setting (automatically assigned slot)

The following example Diagram 4.4 shows overlapping start XY.

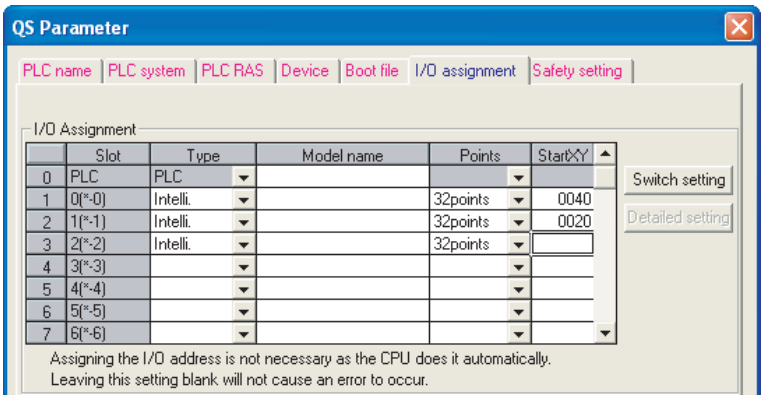


Diagram 4.4 I/O assignment with overlapping start XY

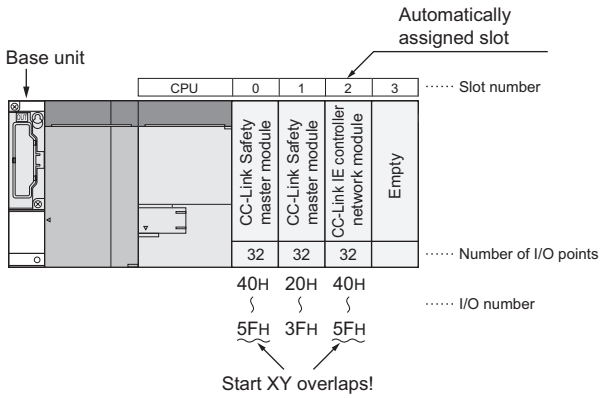


Diagram 4.5 Start XY set by above I/O assignment

Be extremely careful not to overlap the start XY of each slot.
Overlapping start XY will result in an error ("MODULE LAYOUT ERROR").

4.3.3 Examples of I/O Number Assignment

This section shows an I/O number assignment example when I/O assignment is set in GX Developer.

(1) When setting the number of I/O points for mounted modules

Set 32 points for the slots where CC-Link Safety master module or CC-Link IE controller network module is mounted so that the I/O numbers do not change even when the module is removed due to the breakdown of CC-Link Safety master module or CC-Link IE controller network module.

(a) System configuration and I/O number assignment

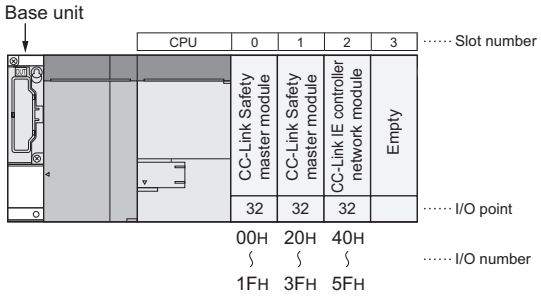


Diagram 4.6 System configuration and I/O number assignment

(b) I/O assignment setting with GX Developer

Set "32points" to the slot No.0 to 2 on the I/O assignment setting tab of PLC parameter in GX Developer.

Select 32 points. (When the type is not selected, the type of the installed module will be selected.)

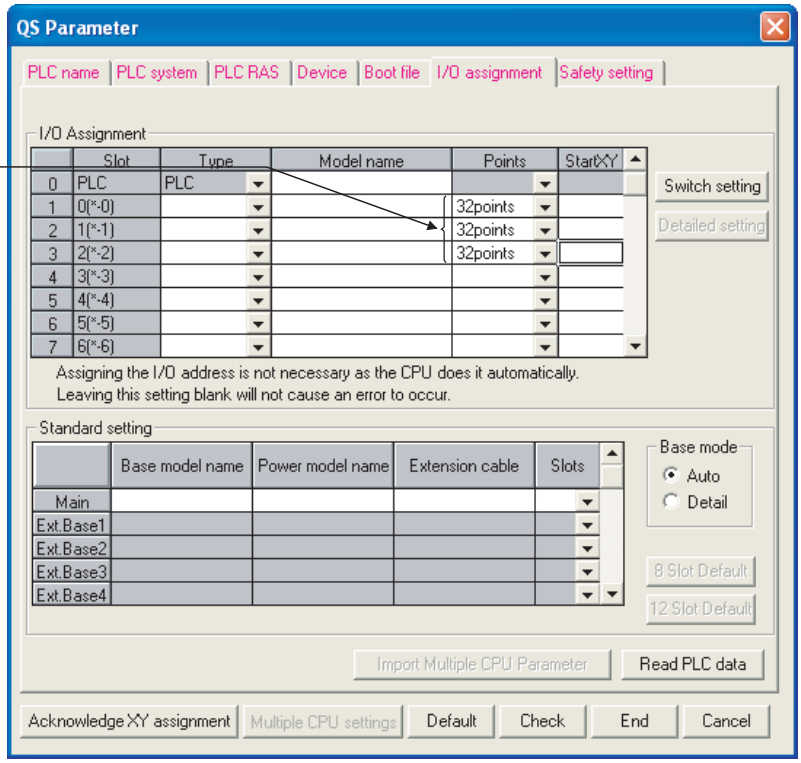


Diagram 4.7 I/O assignment

4.4 Checking the I/O Numbers

The modules mounted on the main base unit and their I/O numbers can be checked using the GX Developer system monitor. (☞ Section 6.17)

CHAPTER5 MEMORIES AND FILES HANDLED BY CPU MODULE

5.1 Memories by CPU Module

5.1.1 Memory configuration and storable data

This section explains the memories handled by the CPU module and the data that can be stored into the memories.

(1) Memory configuration

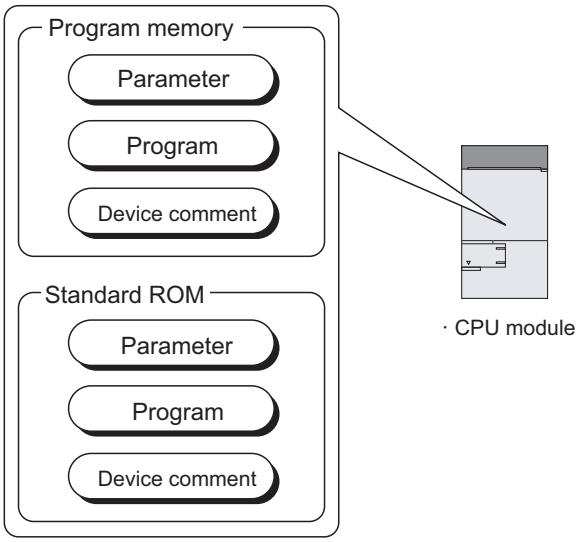


Diagram 5.1 Data handled by CPU module

(a) Program memory (☞ Section 5.1.2)
The program memory stores the program used by the CPU module to perform operation.

(b) Standard ROM (☞ Section 5.1.3)
The standard ROM is used to execute boot run by the CPU module.

(2) Data that can be stored into memories

Table5.1 indicates the data that can be stored into the program memory, standard RAM and standard ROM and the corresponding drive Nos.

Table5.1 Storable data and storage locations

Drive No.	CPU module built-in memories		File name and extension
	Program memory	Standard ROM	
	0	4	
Parameter	◎	○	PARAM.QPA
Sequence program	◎	○	MAIN.QPG
Device comment	○	○	MAIN.QCD
User setting system area*1	○	×	--

◎ : Necessary data, ○ : Storable data, × : Unstorable data

* 1 : Set the area used by the system. (☞ Section 5.1.2(3) (b))

(3) Memory capacities and formatting necessities

Table5.2 indicates the memory capacity and formatting necessity of each memory.

Table5.2 Formatting necessity

	QS001CPU	Formatting
Program memory	128k byte	Necessary*1
Standard ROM	128k byte	Unnecessary

* 1 : Before use, be sure to format the memory using GX Developer.

5.1.2 Program memory

(1) Definition of program memory

The program memory stores the program used by the CPU module to perform operation.

The program stored in the standard ROM is booted (read) to the program memory to perform operation.

(2) Storable data

The program memory can store parameters, programs, device comments, and user setting system area data.

Refer to Section 5.1.1 (2) for the list of data that can be stored into program memory.

POINT

If the total volume of the data to be stored into the program memory exceeds its capacity, examine reducing the user setting system area data.

(3) Before using the program memory

Before using the program memory, be sure to format it by GX Developer.

(a) Formatting

When formatting, display the PLC memory format screen with GX Developer [Online] → [Format PLC memory]. This is done selecting "Program memory/ Device memory" as the target memory on the PLC memory format screen.

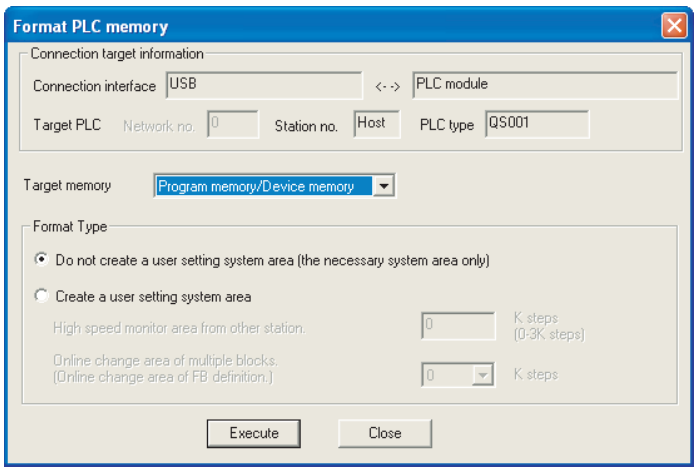


Diagram 5.2 Program memory formatting

(b) Create a user setting system area

When formatting the program memory, set the user setting system area capacity.

1) Do not create a user setting system area

The program memory is formatted without the user setting system area being created.

2) Create a user setting system area

The user setting system area is created during formatting.
There are the following user setting system areas (Table5.3).

Table5.3 User setting system area type

System area type	Description
Online change area of multiple blocks (Online change area of FB definition)	Setting this area enables multiple blocks of data to be changed online. Refer to the following manual for the number of blocks to which online change can be made in this area setting. ☞ GX Developer Operating Manual

POINT

When the user setting system area is created, the available area decreases by the number of created area steps.
The memory capacity can be checked from the Read from PLC screen of GX Developer. (☞ (3) (c) in this section)

(c) Checking the memory capacity after formatting

To check the memory capacity, choose [Online] → [Read from PLC] on GX Developer.

1) Select "Program memory/Device memory" as the target memory on the Read from PLC screen.

2) Click the Free space volume button.

3) The memory capacity appears in the Total free space volume field.

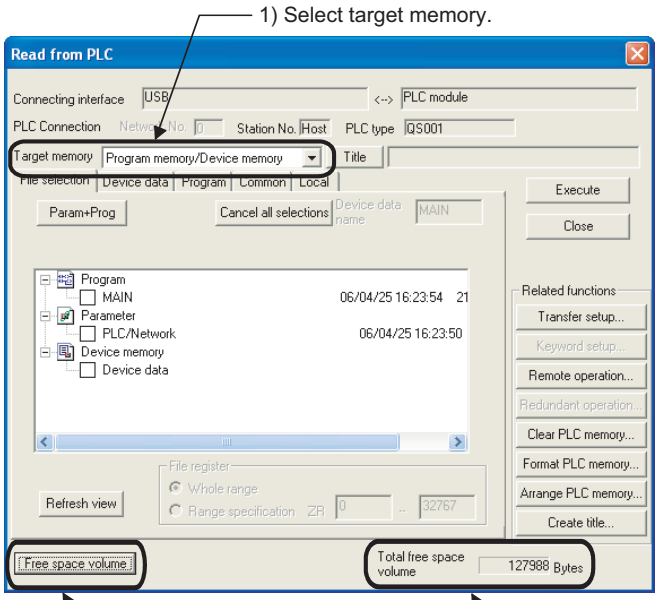


Diagram 5.3 Memory capacity checking procedure

(4) Write to program memory

When writing data to program memory, display the writing to PLC screen with GX Developer [Online] → [Write to PLC].

Select "Program memory/Device memory" as the target memory on the Write to PLC screen and write data to the PLC.

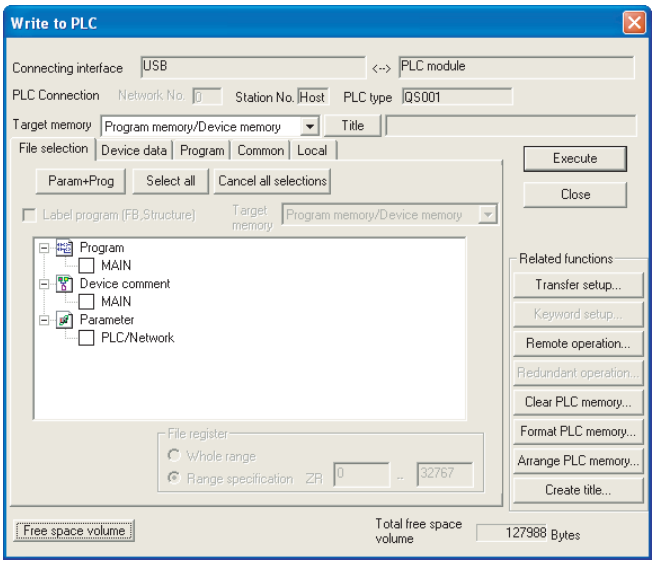


Diagram 5.4 Write to PLC screen

POINT

The file size has the minimum unit. (☞ Section 5.3.4)

The occupied memory capacity may be greater than the actual file size.

5.1.3 Standard ROM

(1) Definition of standard ROM

The standard ROM is used to execute boot run by the CPU module.
The standard ROM is used to save programs and parameters without battery backup.
The program stored in the standard ROM is booted (read) to the program memory (☞ Section 5.1.2) to perform operation.

(2) Storable data

The standard ROM can store parameters, programs and device comments.
Refer to Section 5.1.1 (2) for the list of data that can be stored into each memory.

(3) Checking the memory capacity

To check the memory capacity, choose [Online] → [Read from PLC] on GX Developer.

1) Select "Standard ROM" as the target memory on the Read from PLC screen.

2) Click the Free space volume button.

3) The memory capacity appears in the Total free space volume field.

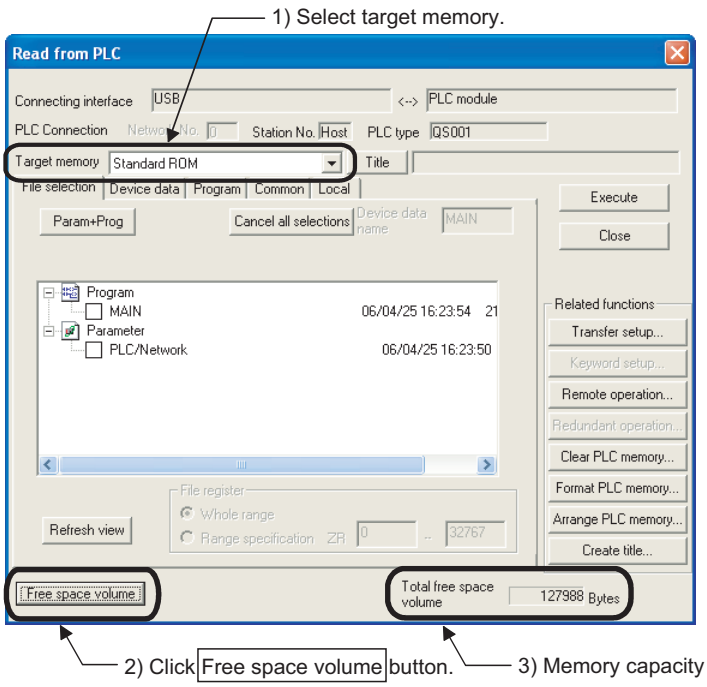


Diagram 5.5 Memory capacity checking procedure

(4) Write to standard ROM

For details on writing to the standard ROM, refer to Section 5.1.4 (3).

POINT

The file size has the minimum unit. (☞ Section 5.3.4)
The occupied memory capacity may be greater than the actual file size.

(5) How to use the program stored in the standard ROM

Since operation cannot be executed by the program stored in the standard ROM, use that program by booting (reading) it to the program memory. (☞ Section 5.1.4)

5.1.4 Standard ROM program execution (boot run) and writing

(1) Standard ROM program execution (boot run)

(a) Standard ROM program execution

The CPU module performs operation of the program stored in the program memory.
It does not operate the program stored in the standard ROM.

The program stored in the standard ROM is booted (read) to the program memory to perform operation.

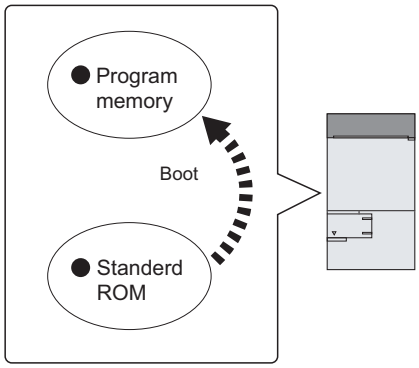


Diagram 5.6 Boot run

1) SAFETY MODE

In SAFETY MODE, boot run is executed regardless of the boot settings made by GX Developer.

2) TEST MODE

Boot run can be executed by setting "Execute boot run" in the boot settings made by GX Developer and writing to the standard ROM.

POINT

In TEST MODE, when debugging was executed with the program memory parameters and program, write to the standard ROM at the time of switching from the TEST MODE to the SAFETY MODE.

(2) Procedure up to boot run and stopping boot run (in TEST MODE)

(a) Procedure for boot run

The following provides the procedure for boot run.

1) **Program creation by GX Developer**
   Create a program for executing boot run.

2) **Boot file by GX Developer**
   Set "Do boot from Standard ROM" in the Boot file of the PLC parameter dialog box.

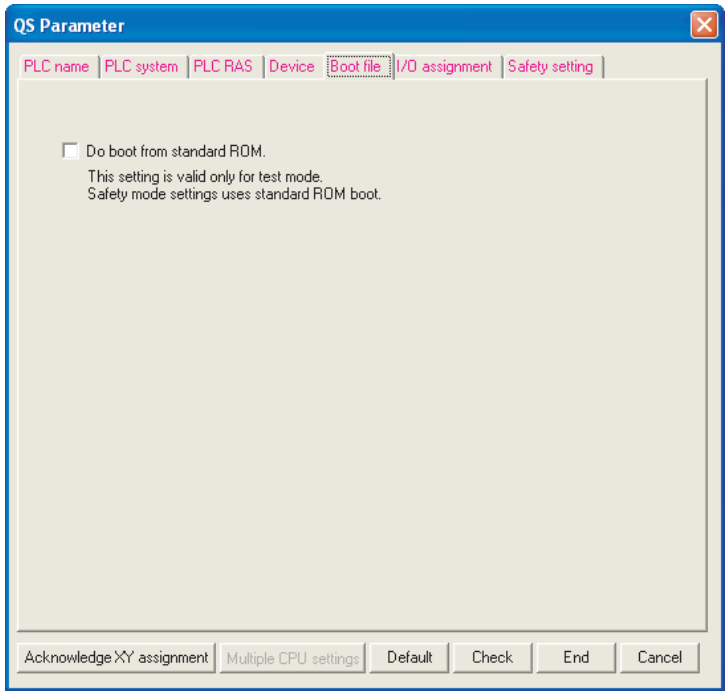


Diagram 5.7 Boot file

3) Write to standard ROM by GX Developer

- Choose [Online] → [Write to PLC] on GX Developer and write the files to the program memory.
- Choose [Online] → [Write to PLC (Flash ROM)] → [Write the program memory to ROM...] on GX Developer, and write to the standard ROM the files written to the program memory. (☞ (3) in this section)

4) Program execution

When you carry out the following operations, the system boots from the standard ROM.

- Restarting the PLC power
- Reset end with the CPU module RUN/STOP/RESET switches.
- Remote reset using GX Developer.

5) Check for normal boot completion

Whether the boot is normally completed or not can be checked by the special relay (SM660) status.
Refer to Appendix 1 for the special relay.

(b) Operation to stop boot run

Perform the following operation using GX Developer to stop boot run and execute operation by the parameter program written to the program memory.

1) Remove the checkmark from "Boot from standard ROM" in the PLC parameter boot file settings.
2) Write parameters and sequence program data to the program memory.
3) Choose [Online] → [Write to PLC (Flash ROM)] → [Write the program memory to ROM...].

(c) Precautions for standard ROM program execution

1) Files stored into standard ROM

Before executing boot run, store the following files into the standard ROM.

- Parameter *1
- Program *1
- Device comment

* 1 : Must be stored into the standard ROM.

2) Online change during boot run

If online change is made to a program in the program memory during boot run from the standard ROM, the change is not updated on the program in the boot source standard ROM.
Hence, write the program to the standard ROM (☞ (3) in this section) when the CPU module is put in a STOP status.

3) When program memory contents change at power OFF → ON or reset

When you write the PLC program into program memory and switch the PLC power OFF → ON or end the CPU module reset, if the contents of the program memory change, it is possible that boot operations are being used.
Refer to "(2)(b) Operation to stop boot run" in this section, and stop the boot run.

(3) Write to standard ROM

The program memory files are written to the standard ROM by batch-copying them to the standard ROM.

(a) Before write

Check the following points before writing the files to the standard ROM.

1) Saving the standard ROM files

When files are written to the standard ROM, all files previously stored in the standard ROM are automatically deleted.
Before writing files to the standard ROM, choose [Online] → [Read from PLC] on GX Developer and save the stored files using GX Developer in advance.

2) Preparation of files to be written

Since all files stored in the standard ROM are automatically deleted when files are to be written to the standard ROM, prepare all files to be stored in advance.

(b) Write procedure

The procedure to write files to the standard ROM will be explained.

1) Choose [Online] → [Write to PLC (Flash ROM)] → [Copy program memory data into ROM] on GX Developer.

2) The Write the program memory to ROM screen appears.

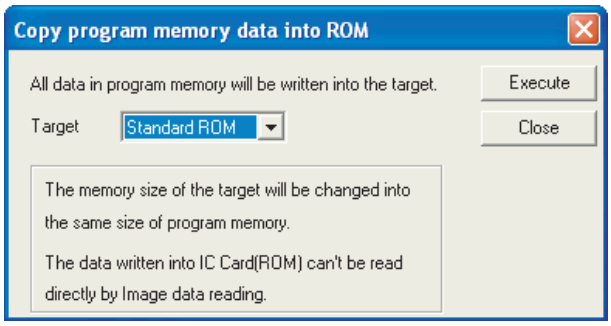


Diagram 5.8 Copy program memory data into ROM screen

3) Select the write destination and copy the program memory files to the standard ROM.

(4) Additions/changes to standard ROM files (in TEST MODE)

Since all files stored in the standard ROM are automatically deleted when files are to be written to the standard ROM, additions/changes to the stored files cannot be made directly.

Observe the following steps.

1) Choose [Online] → [Read from PLC] on GX Developer and read all files from the standard ROM.
2) Make necessary additions/changes to the read files.
3) Write the modified files to the program memory.
4) Choose [Online] → [Write to PLC (Flash ROM)] → [Write the program memory to ROM...], and copy these files to the program memory.

(5) Precautions (in TEST MODE)

(a) Setting of check at communication time of GX Developer

When files are written to the standard ROM with the communication time check time set to 180 seconds or less on GX Developer, they are checked 180 seconds.

5.2 Program File Structure

A program file consists of a file header, execution program and allocate memory for online change.

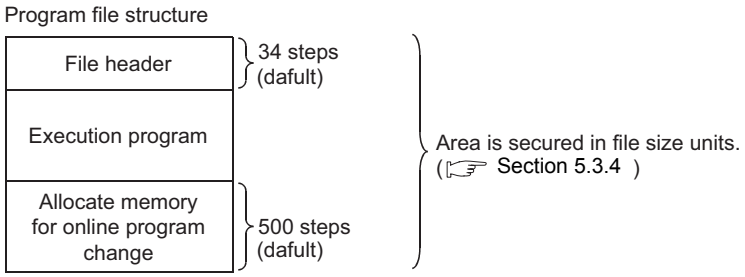


Diagram 5.9 Program file structure

(1) Structure details

The capacity of the program stored in the program memory of the CPU module is the total of the above three areas.

(a) File header

This area stores the file name, size, creation date, etc.
The file header size ranges from 26 to 35 steps (104 to 140 bytes) depending on the device setting of the PLC parameter dialog box.
(Default: 34 steps)

(b) Execution program

This area stores the created program.

(c) Allocate memory for online change

This area is used when online change that increases the number of steps is performed by GX Developer.
When such an online change is performed by GX Developer, the number of remaining allocate memory for online change is displayed.

1) Default number of allocate memory for online change

The default setting is 500 steps (2000 bytes).

2) Changing the number of allocate memory for online change

The number of allocate memory for online change can be changed by GX Developer (by choosing [Online] → [Write to PLC] →<Program>, tab).
When the number of steps is insufficient for online change, it can be set again.
(☞ Section 6.14.1)

(2) Display of program capacity by GX Developer

During programming by GX Developer, the program capacity (sum of the file header capacity and the numbers of steps in the created program) is displayed in terms of the number of steps as shown in Diagram 5.10.
When a program is created, the capacity of the crea.ted program can be confirmed.

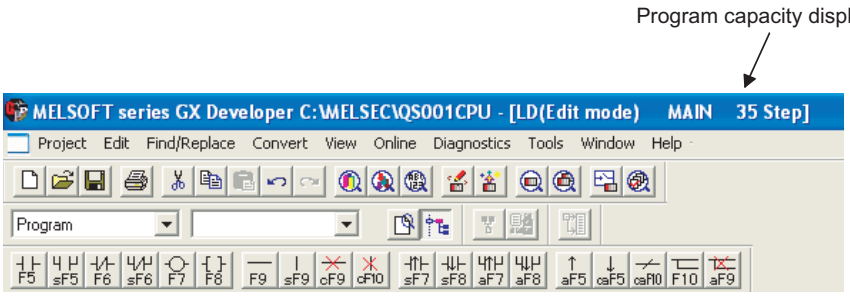
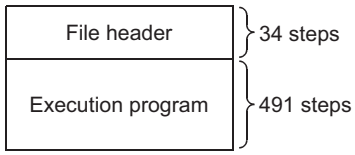


Diagram 5.10 Program capacity display

POINT

1. The program capacity displayed during programming by GX Developer is the capacity of the file header and execution program and does not include the capacity of the allocate memory for online change (500 steps).

   (Example) The capacity of the program having the execution program area of 491 steps is displayed on GX Developer as shown below. (The file header default is 32 steps.)



Display on GX Developer:
34 steps + 491 steps = 525 steps.

Diagram 5.11 File status on GX Developer

2. Since a file is stored in file size units on the program memory, the program capacity displayed during programming by GX Developer may differ from the capacity of the program file on the CPU module. (☞ Section 5.3.4)

5.3 File Operation by GX Developer and Handling Precautions

5.3.1 File operation

The files stored in program memory and the standard ROM can be operated with GX Developer online operations.
However, the file operations that can be executed depend on the safety CPU operation mode and the CPU module RUN/STOP status.
(☞ Refer to Section 6.2.5)

5.3.2 Precautions for handling files

(1) About power-off (including resets) during file operations

When the PLC is power-off or a CPU module is reset during file operations with GX Developer, the files in each memory become uncertain.
During file operations with GX Developer, do not power-off the PLC or reset a CPU module.

5.3.3 Memory capacities of files

When using the program memory or standard ROM, calculate the rough size of each file according to Table5.4.

Table5.4 Memory capacity calculation for files

Function	Rough file capacity (unit: byte)
Drive heading	70
Parameter	Default: 316 (increases depending on the parameter setting) Reference • Boot setting → 100 • CC-Link IE controller network setting made → Max. 326 increased • MELSECNET/H setting made → Max. 226 increased • Ethernet setting made → Max. 896 increased • CC-Link setting made → 22 + 606 × (number of modules of CC-Link Safety) + 76 × (number of safety remote stations) + 4 × (number of safety remote station parameter settings) • Remote password setting made → 70 + 20 + (number of target modules × 10), Max. 170 increased
Sequence program	134*+ (4 × ((number of steps) + (number of allocate memory for online change)))
Device comment	80 + (sum of comment data sizes of devices) • Comment data size of one device = 10 + 10210 × a + 40 × b • a : Quotient of ((device points)/256) • b : Remainder of ((device points)/256)
Multi-block online program change	Value set at formatting (0/1.25k/2.5k)

* : 134 is the default value (It can be increased or decreased by parameter setting.)

5.3.4 File size units

(1) What is file size unit?

The minimum unit for writing a file to a memory area is called as a file size unit.

The CPU module file size unit is 4 bytes.

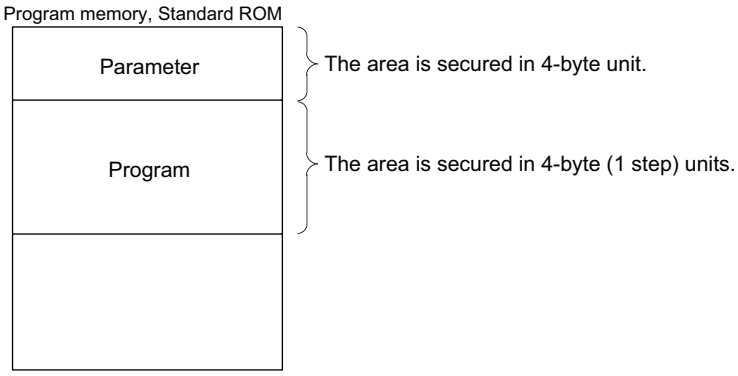


Diagram 5.12 Program memory, standard ROM file size units

CHAPTER6 FUNCTIONS

Function of CPU module is as follows:

6.1 Function List

Functions of CPU module are listed in Table6.1.
The Nos. in the "CPU module" field correspond to the CPU modules as indicated below.

Table6.1 CPU module function list

Item	Description	Safety CPU operation mode		Reference
		SAFETY MODE	TEST MODE	
Safety CPU operation mode	Selects whether to normally operate the CPU module as part of the safety device or to carry out maintenance on the CPU module using program changes and device test functions.	○	○	Section 6.2
CPU access password	Prevents incorrect operations from GX Developer connected by mistake.	○	○	Section 6.3
PLC memory initialization	Erases user data written to the CPU module. When the PLC memory is initialized, data is returned to its factory settings status.	○	○	Section 6.4
Setting for preventing continuous RUN in TEST MODE	Prevents the PLC system from running continuously for long periods in TEST MODE.	×	○	Section 6.5
ROM write count check	Checks the number of writing to ROM.	○	○	Section 6.6
Self-Diagnosis function	Enables the CPU module to check for failures.	○	○	Section 6.7
Operation/error history	Records the the operations that have been executed to the CPU module from the outside and the self-diagnostics errors that have occurred in the CPU module in the past.	○	○	Section 6.8
Constant scan	Executes the program at a constant frequency.	○	○	Section 6.9
Output status selection function for transition from STOP status to RUN status	Selects the output Y status (output before STOP/output after the calculation execution) when the CPU module is set from STOP status to RUN status.	○	○	Section 6.10
Clock function	Executes the CPU module internal clock.	○	○	Section 6.11
Remote RUN/STOP	Stops and starts operating the CPU module.	○	○	Section 6.12.1
Remote RESET	Resets the CPU module when the CPU module is in a STOP status.	○	○	Section 6.12.2
Monitoring function	Monitors the status of programs and devices on the CPU module by operating from the GX Developer.	○	○	Section 6.13
Online change	Writes programs when the CPU module is in the RUN status.	×	○	Section 6.14
Watchdog timer	Monitors operational delays caused by CPU module's hardware and program errors.	○	○	Section 6.15
Remote password	Prevents an illegal access using the Ethernet module.	○	○	Section 6.16
System display	Connects to the GX Developer and monitors system configuration.	○	○	Section 6.17
LED display	Enables the front-mounted LEDs to indicate the operating conditions of the CPU module.	○	○	Section 6.18

○ : Available × : N/A

6.2 Safety CPU Operation Mode

6.2.1 Safety CPU operation mode

The safety CPU operation mode has "SAFETY MODE" and "TEST MODE".
Switch the safety CPU operation mode by operations from GX Developer.

(1) SAFETY MODE

This mode is used for the main operation of the safety-related system.
In SAFETY MODE, to protect this system while it is operating, operations that change safety PLC control, such as writing to PLC and device test, are prohibited.

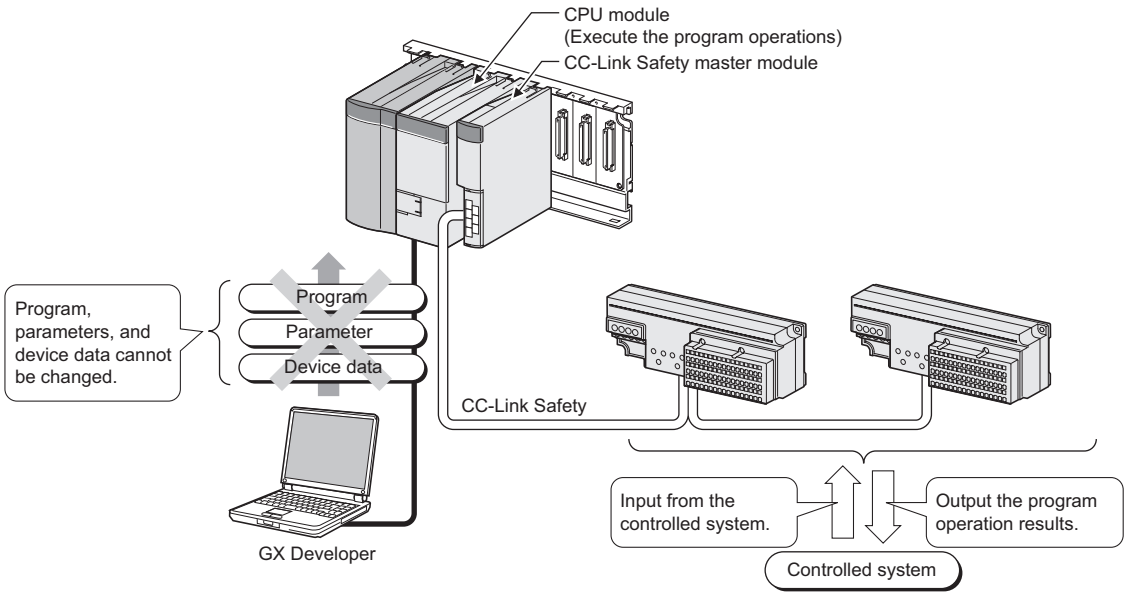


Diagram 6.1 SAFETY MODE operation

(2) TEST MODE

This mode is used for system start-up and maintenance.
In this mode, all the GX Developer functions, such as PLC writing and device testing, can be used.

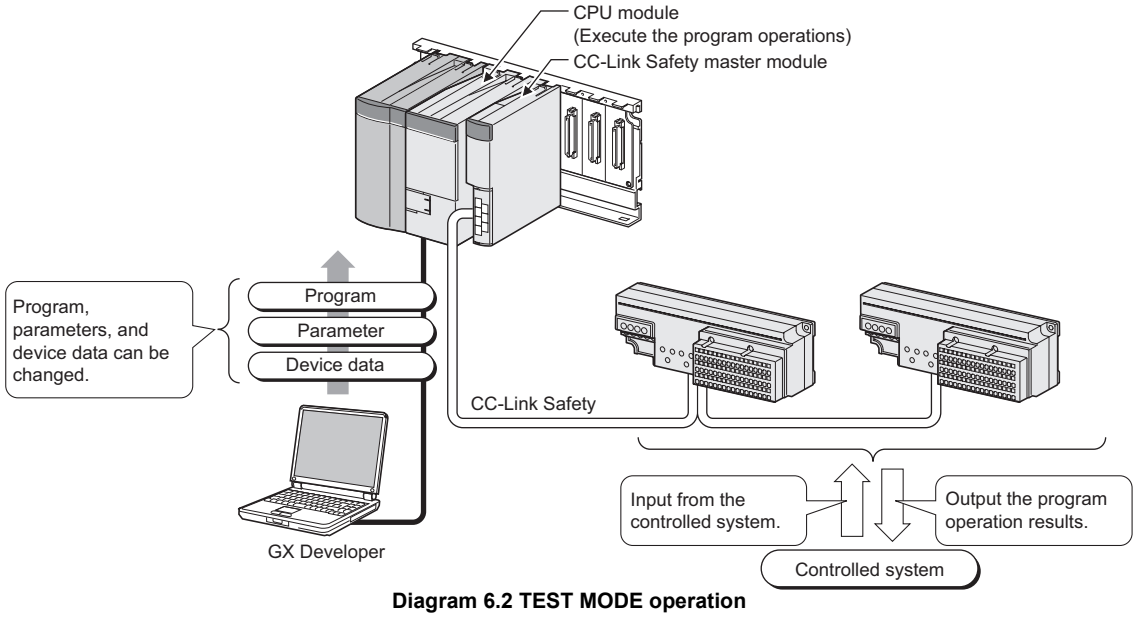


Diagram 6.2 TEST MODE operation

Remark

For details on the GX Developer operations that can be executed in SAFETY MODE and in TEST MODE, refer to the GX Developer Operating Manual (Safety PLC).

(3) Safety CPU operation mode switching

Diagram 6.3 shows the state when the safety CPU operation mode is switched.

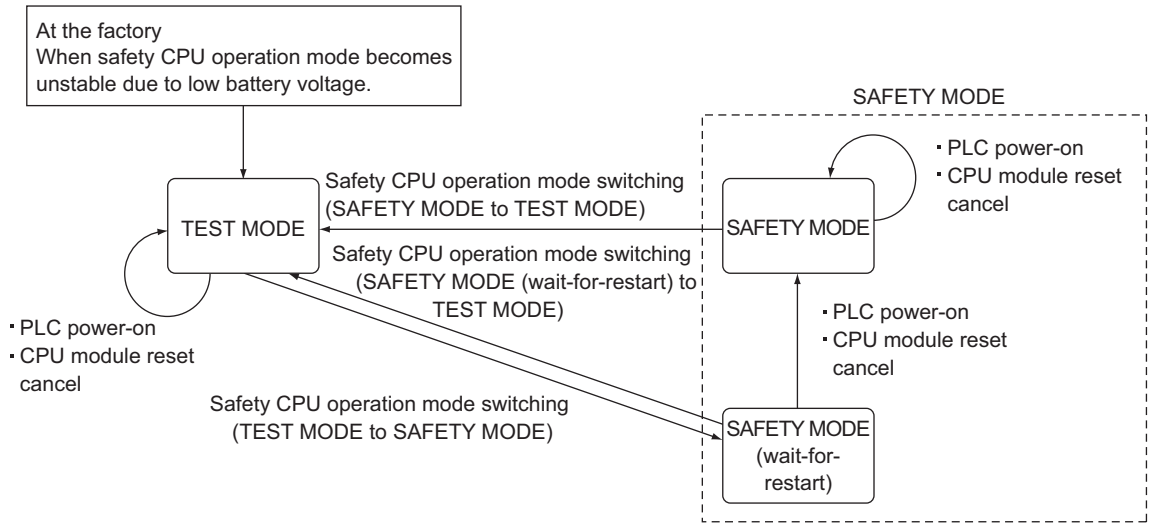


Diagram 6.3 State when the safety CPU operation mode is switched

POINT

1. Safety CPU operation mode information is retained by the CPU module battery.
   When using the CPU module, connect the battery included in the CPU module.
2. Programs cannot be executed in "SAFETY MODE (wait-for-restart)".
   (Even if the RUN/STOP/RESET switch is operated STOP → RUN or a remote RUN is executed from GX Developer, the safety CPU module does not go into the Run status.)
3. In the following cases, the unit starts up in TEST MODE
   - The first power-on after the unit is purchased.
   - When the safety CPU operation mode became unstable due to low battery. (The operation contents "OP001:SYSTEM INITIALIZE OPERATION MODE" are stored in the operation/error history.)

6.2.2 Checking safety CPU operation mode

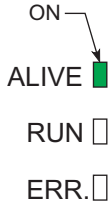
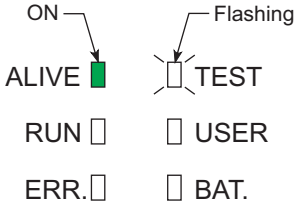
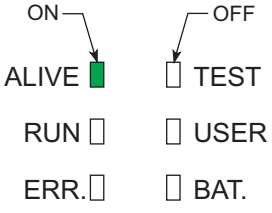
The safety CPU operation mode of the CPU module can be checked with the following methods.

- Checking with the LEDs on the front of the CPU module
- Checking with the GX Developer online operation screen
- Checking with a special relay or a special register

(1) Checking with the LEDs on the front of the CPU module

The current safety CPU operation mode can be checked with the "ALIVE" LED and "TEST" LED on the front of the CPU module.

Table6.2 Checking safety CPU operation mode with the "ALIVE" LED and "TEST" LED

TEST MODE	SAFETY MODE (wait-for-restart)	SAFETY MODE
		

(2) Checking with the GX Developer online operation screen

The current safety CPU operation mode of the CPU module is displayed on the GX Developer online operation screen (PLC diagnostics, remote operation, etc.)
The safety CPU operation mode can be checked when executing remote operations etc. with GX Developer.

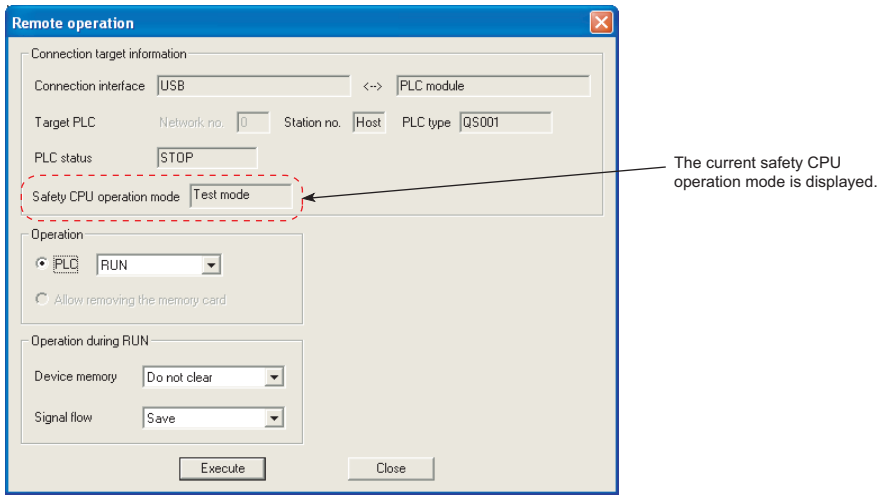


Diagram 6.4 Safety CPU operation mode display using GX Developer

(3) Checking with a special relay or a special register

The current safety CPU operation mode is stored in the special relay SM560 (TEST MODE flag) and special register SD560 (safety CPU operation mode) in the CPU module.

The safety CPU operation mode can be externally displayed using SM560 or SD560 in a program.

The safety CPU operation mode can be also checked by monitoring SM560 or SD560 with GX Developer.

Table6.3 Special relay/special register for confirming safety CPU operation mode

Device name	Name	Description
SM560	TEST MODE flag	Shows whether the current safety CPU operation mode is TEST MODE or not. • OFF: SAFETY MODE or SAFETY MODE (wait-for-restart) • ON: TEST MODE
SD560	Safety CPU operation mode	Shows the current safety CPU operation mode. • 0: SAFETY MODE • 1: TEST MODE • 2 : SAFETY MODE (wait-for-restart)

6.2.3 Safety CPU operation mode switching

To switch the safety CPU operation mode, execute the GX Developer "safety CPU operation mode switching" operation.

(1) Safety CPU operation mode switching conditions

The safety CPU operation mode can be switched in the states shown in Table6.4.

Table6.4 Conditions under which the safety CPU operation mode can be switched

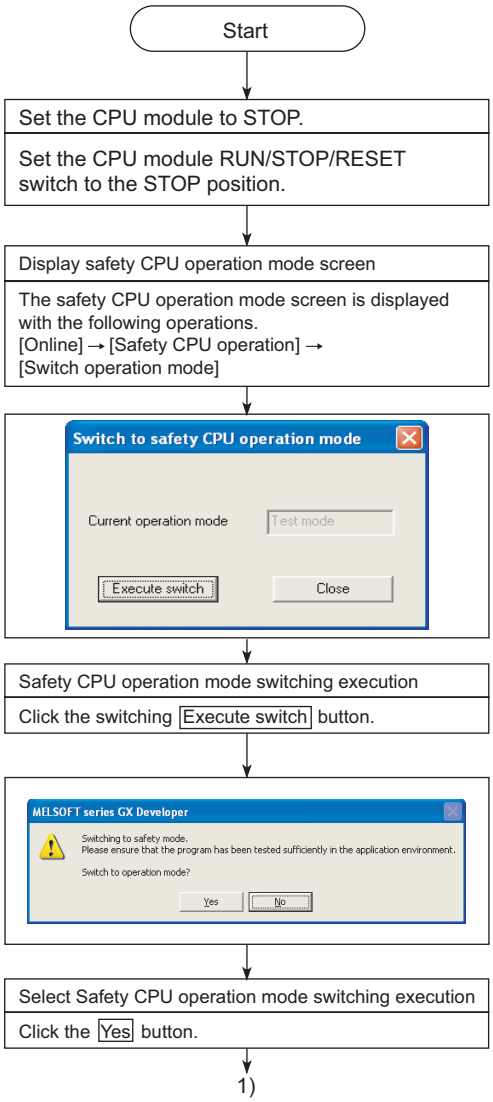
Safety CPU operation mode switching conditions	TEST MODE to SAFETY MODE	SAFETY MODE to TEST MODE
CPU operation status	STOP status (which does not include one due to stop error)	STOP status (which includes one due to stop error)
Program and parameters of GX Developer and program memory:	Should be the same.	-
Other GX Developer operations, such as PLC writing and device testing:	Should not be executed.	-
Other safety CPU operation mode switching operations using GX Developer:	Should not be executed.	Should not be executed.

(2) Safety CPU operation mode switching procedure

This explains the procedure for switching the safety CPU operation mode by operating the GX Developer "safety CPU operation mode switching".

(a) TEST MODE to SAFETY MODE switching

Diagram 6.5 shows the procedure for TEST MODE to SAFETY MODE switching using GX Developer.



Continued to the next page

Diagram 6.5 TEST MODE to SAFETY MODE switching

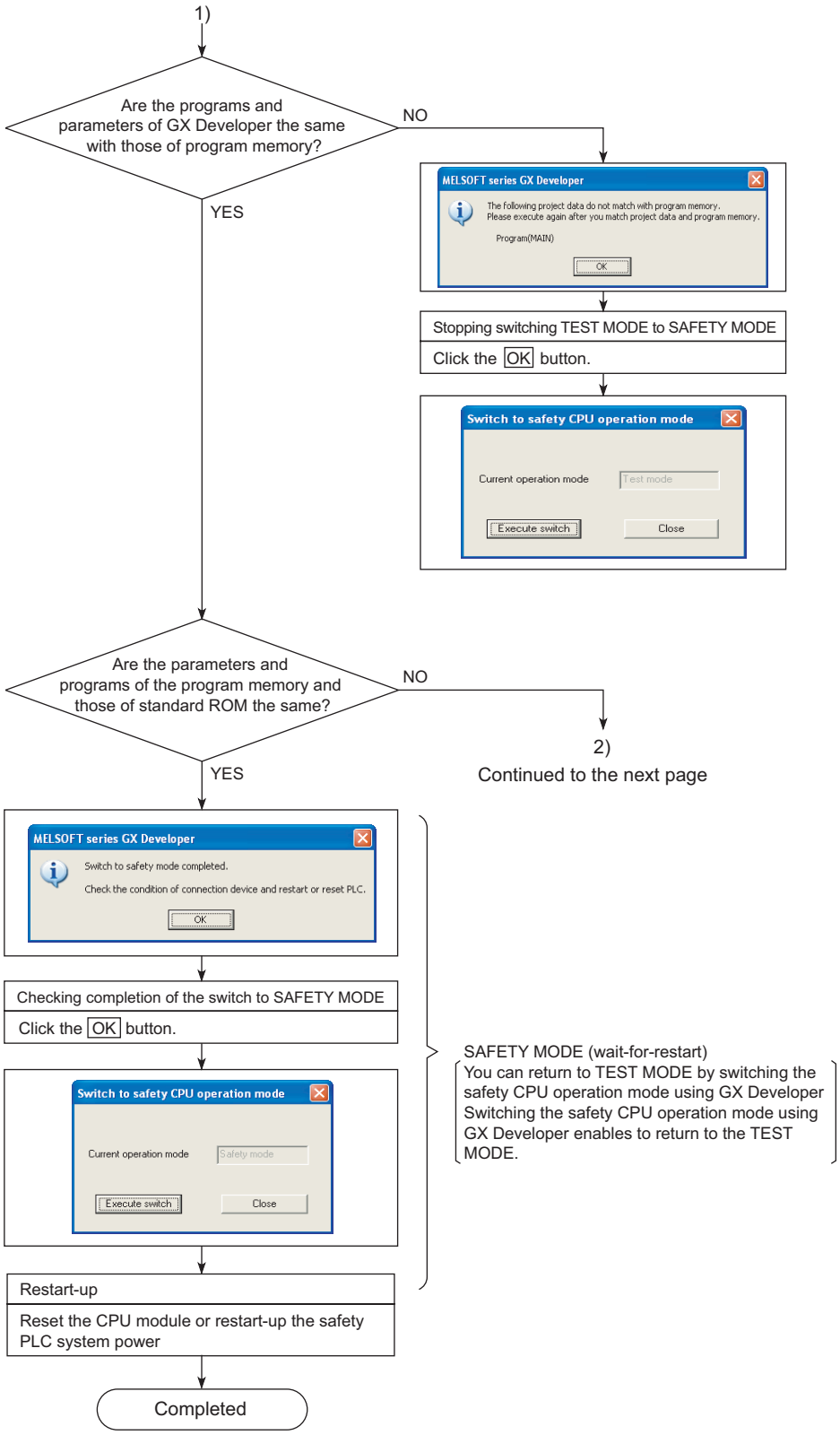


Diagram 6.5 TEST MODE to SAFETY MODE switching (continued)

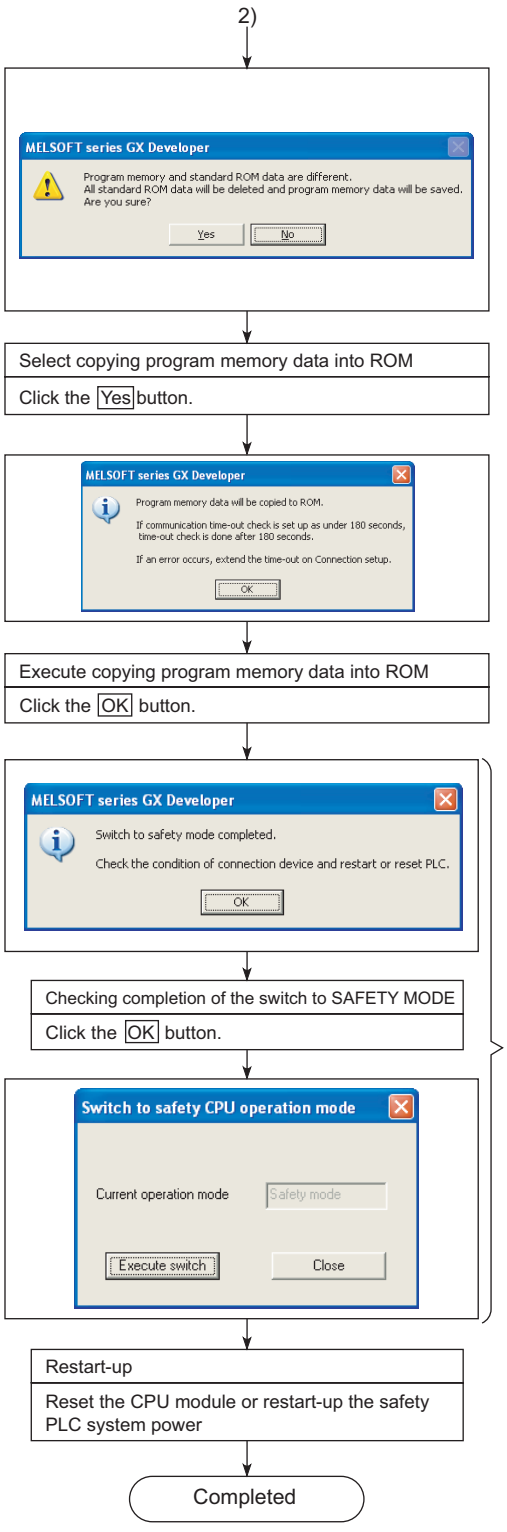


Diagram 6.5 TEST MODE to SAFETY MODE switching (continued)

(b) SAFETY MODE to TEST MODE switching

Diagram 6.6 shows the procedure for SAFETY MODE to TEST MODE switching using GX Developer.

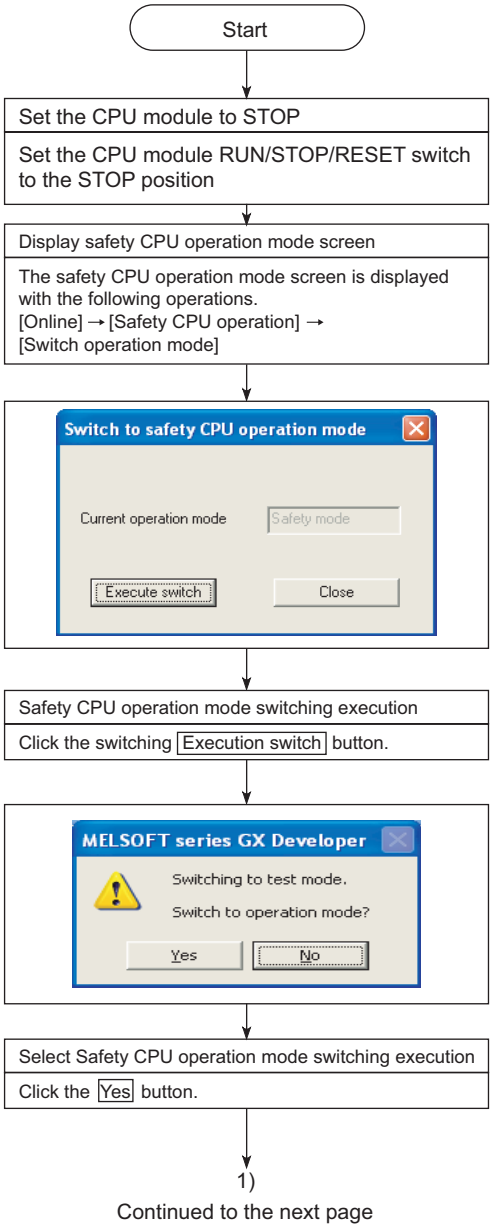


Diagram 6.6 SAFETY MODE to TEST MODE switching

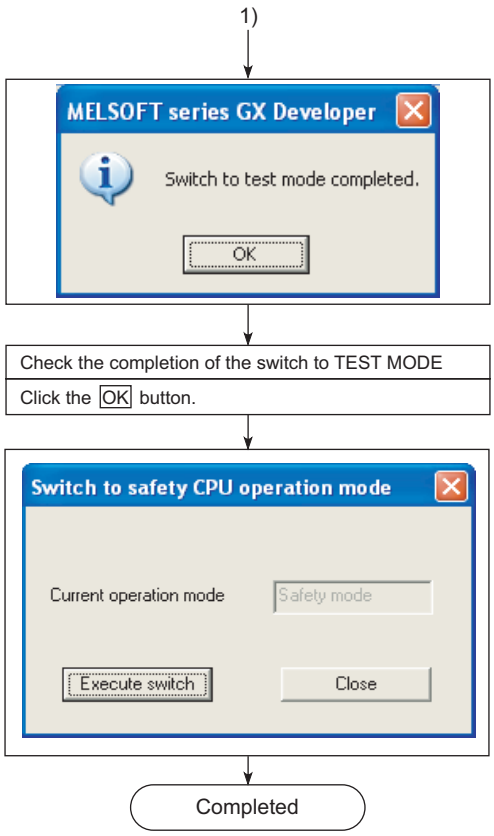


Figure 6.6 SAFETY MODE to TEST MODE switching (continued)

6.2.4 Operation of each function in each safety CPU operation mode and CPU operation status

Table6.5 shows whether each function can be executed or not in each safety CPU operation mode and CPU operation status.

Table6.5 Whether each function can be executed or not in each safety CPU operation mode and CPU operation status

No.	Safety CPU operation mode			Test mode					
	CPU operation status			RUN status	Stop status	Stop error *1	during switching from STOP to RUN	During initial processing	
1	Execution of program			○	×	×	×	×	
2	CC-Link Safety	CPU → CC-Link refresh	RY, RWw	○	○ *2	×	×	×	
			SB, SW	○	○	×	×	×	
		CC-Link → CPU refresh	RX, RWr	○	○	×	×	×	
			SB, SW	○	○	○		×	
		Operation of CC-Link remote I/O station	RY to external output	○	○	○ (OFF output)	○	×	
			external output to RX	○	○	○	○	×	
3	CC-Link IE controller network	CPU → CC-Link IE controller network refresh	B, W	○	○	×	×	×	
			SB, SW	○	○	×	×	×	
		CC-Link IE controller network → CPU refresh	B, W	○	○	×	×	×	
			SB, SW	○	○	○	×	×	
4	MELSECNET/H	CPU → MELSECNET/H refresh	B, W	○	○	×	×	×	
			SB, SW	○	○	×	×	×	
		MELSECNET/H → CPU refresh	B, W	○	○	×	×	×	
			SB, SW	○	○	○	×	×	

○: The function operates. ×: The function does not operate. —: This combination does not exist.

* 1: Indicates the stop error due to moderate errors or major errors.
For details on moderate errors and major errors, refer to the following manual.
☞ QSCPU User's Manual (Hardware Design, Maintenance and Inspection)

* 2: [Case of CPU STOP setting] of CC-Link Safety parameter leads to the following operation.
- When [Clears compulsorily] is selected at [Case of CPU STOP setting]: OFF output
- When [Clears compulsorily] is not selected at [Case of CPU STOP setting]: RY status output

	Safety mode (wait-for-restart)					Safety mode				
	RUN status	STOP status	Stop error *1	during switching from STOP to RUN	During initial processing	RUN status	STOP status	Stop error *1	during switching from STOP to RUN	During initial processing
	—	×	×	—	—	○	×	×	×	×
	—	○ (OFF output)	×	—	—	○	○ (OFF output)	×	×	×
	—	○	×	—	—	○	○	×	×	×
	—	○	×	—	—	○	○	×	×	×
	—	○	○	—	—	○	○	○	×	×
	—	○	○ (OFF output)	—	—	○	○	○ (OFF output)	○	×
	—	○	○	—	—	○	○	○	○	×
	—	○	×	—	—	○	○	×	×	×
	—	○	×	—	—	○	○	×	×	×
	—	○	×	—	—	○	○	×	×	×
	—	○	○	—	—	○	○	○	×	×
	—	○	×	—	—	○	○	×	×	×
	—	○	×	—	—	○	○	×	×	×
	—	○	×	—	—	○	○	×	×	×
	—	○	○	—	—	○	○	○	×	×

○: The function operates. ×: The function does not operate. —: This combination does not exist.

* 1: Indicates the stop error due to moderate error or severe error.
For details on moderate errors and severe errors, refer to the following manual.
☞ QSCPU User's Manual (Hardware Design, Maintenance and Inspection)

6.2.5 Online operations that can be executed on the CPU module from GX Developer

Table6.6 shows the online operations that can be executed on the CPU module from GX Developer.

Table6.6 Online operations that can be executed on the CPU module from GX Developer

No.	Safety CPU operation mode		Test mode					
	CPU operation status		RUN status	STOP status	Stop error *1	during switching from STOP to RUN	During initial processing	
1	File operation	Write to PLC	×	○	○	×	×	
		Read from PLC	○	○	○	×	×	
		Verify with PLC	○	○	○	×	×	
		Delete PLC data	×	○	○	×	×	
2	Drive operation	Arrange PLC memory	×	○	○	×	×	
		Format PLC memory	×	○	○	×	×	
		Drive title registration	×	○	○	×	×	
		Drive title deletion	×	○	○	×	×	
		Write the program memory to ROM	×	○	○	×	×	
3	PLC memory operation	Clear PLC memory	×	○	○	×	×	
4	Proguram change	Writing in Program during CPU Module RUN	○	○	○	×	×	
		Writing in T/C set value during CPU Module RUN	○	○	○	×	×	
5	Monitor	Ladder monitor	○	○	○	×	×	
		Device batch monitor	○	○	○	×	×	
		Entry data monitor	○	○	○	×	×	
		Buffer memory batch	○	○	○	×	×	
		Program monitor list	○	○	○	×	×	
6	Device test		○	○	○	×	×	
7	Remote operation	Remote RUN	○	○	×	×	×	
		Remote STOP	○	○	×	×	×	
		Remote RESET	×	○	○	×	×	
8	Set clock	Reading Time Data	○	○	○	×	×	
		Changing the clock data	○	○	○	×	×	
9	Diagnostics	PLC diagnostics	○	○	○	×	×	
		Operation . error history clear	○	○	○	×	×	
		MELSECNET(II)/10/H diagnostics	○	○	○	×	×	
		CC-Link / CC-Link/LT diagnostics	○	○	○	×	×	
		System monitor	○	○	○	×	×	
10	Safety CPU operation	Test mode to safety mode switching	×	○	×	×	×	
		Safety mode to test mode switching	—	—	—	—	—	
11	CPU Access password	Registering a CPU access password	×	○	○	×	×	
		Changing a CPU access password	×	○	○	×	×	
12	Safety CPU Operation	PLC memory initialization	×	○	○	×	×	

○: The function operates. ×: The function does not operate. -: This combination does not exist.

* 1: Indicates the stop error due to moderate error or severe error.
For details on moderate errors and severe errors, refer to the following manual.
☞ QSCPU User's Manual (Hardware Design, Maintenance and Inspection)

	Safety mode (wait-for-restart)					Safety mode				
	RUN status	STOP status	Stop error *1	during switching from STOP to RUN	During initial processing	RUN status	STOP status	Stop error *1	during switching from STOP to RUN	During initial processing
	—	×	×	—	—	×	×	×	×	×
	—	○	○	—	—	○	○	○	×	×
	—	○	○	—	—	○	○	○	×	×
	—	×	×	—	—	×	×	×	×	×
	—	×	×	—	—	×	×	×	×	×
	—	×	×	—	—	×	×	×	×	×
	—	×	×	—	—	×	×	×	×	×
	—	×	×	—	—	×	×	×	×	×
	—	×	×	—	—	×	×	×	×	×
	—	×	×	—	—	×	×	×	×	×
	—	×	×	—	—	×	×	×	×	×
	—	○	○	—	—	○	○	○	×	×
	—	○	○	—	—	○	○	○	×	×
	—	○	○	—	—	○	○	○	×	×
	—	○	○	—	—	○	○	○	×	×
	—	○	○	—	—	○	○	○	×	×
	—	×	×	—	—	×	×	×	×	×
	—	×	×	—	—	○	○	×	×	×
	—	×	×	—	—	○	○	×	×	×
	—	○	○	—	—	×	○	○	×	×
	—	○	○	—	—	○	○	○	×	×
	—	×	×	—	—	○	○	○	×	×
	—	○	○	—	—	○	○	○	×	×
	—	×	×	—	—	×	×	×	×	×
	—	○	○	—	—	○	○	○	×	×
	—	○	○	—	—	○	○	○	×	×
	—	×	×	—	—	○	○	○	×	×
	—	—	—	—	—	—	—	—	—	×
	—	○	○	—	—	×	○	○	×	×
	—	×	×	—	—	×	×	×	×	×
	—	×	×	—	—	×	×	×	×	×
	×	○	○	×	×	×	○	○	×	×

○: The function operates. ×: The function does not operate. -: This combination does not exist.

* 1: Indicates the stop error due to moderate error or severe error.
For details on moderate errors and severe errors, refer to the following manual.

☞ QSCPU User's Manual (Hardware Design, Maintenance and Inspection)

6.3 CPU access password

(1) What a CPU access password is

To prevent incorrect operations from a GX Developer connected by mistake, the CPU module authenticates access using a password.
This password for authenticating access is called as the CPU access password.

The CPU access password must be set in both the GX Developer project and the CPU module.
When an operation changing control (for example, a program change) is executed from GX Developer, the CPU module compares the GX Developer project and CPU module passwords.
The operation from GX Developer is permitted only when the passwords match.

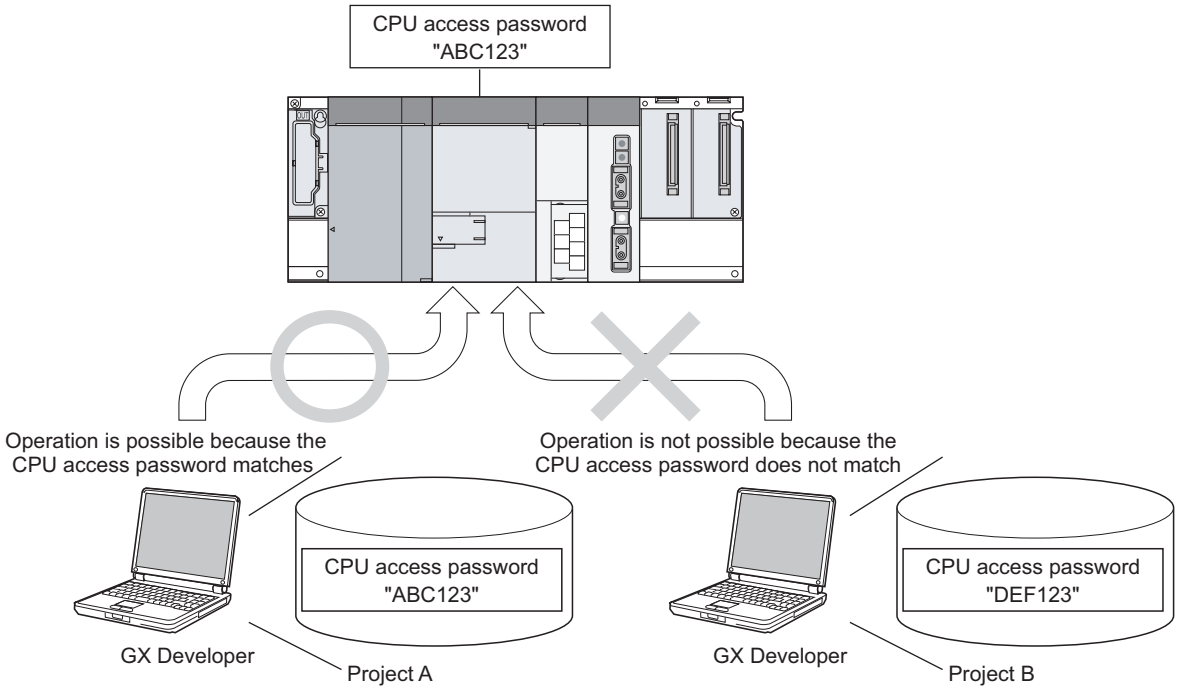


Diagram 6.7 CPU access password

(2) CPU access password setting and characters that can be used

(a) CPU access password setting

The CPU access password is set on the CPU access password registration/change screen of GX Developer.

The CPU access password set is registered in the project.

For details on CPU access password registration/change operations, refer to the GX Developer Manual (Safety PLC).

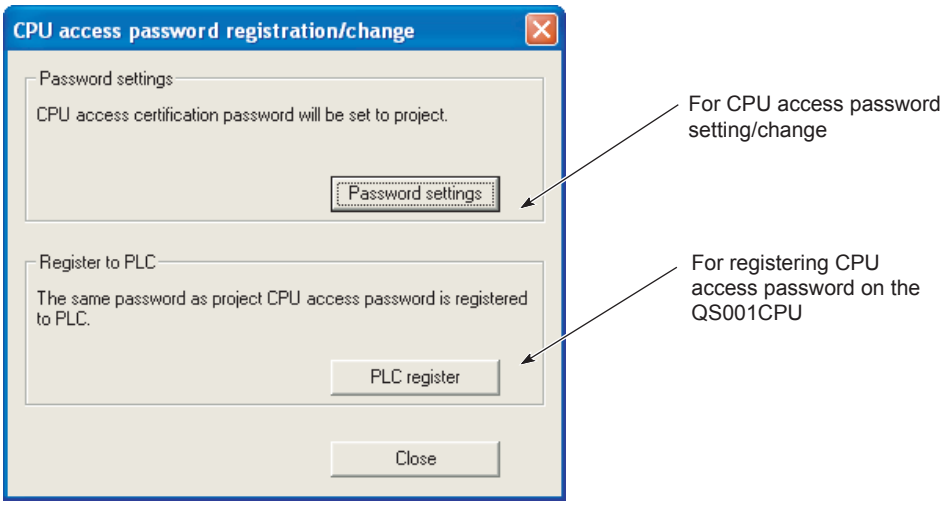


Diagram 6.8 CPU access password registration/change screen

(b) Types and number of characters that can be used for CPU access passwords

Set a CPU access password made up of 6 - 14 single-byte Latin letters, numbers, and symbols (the shaded section of Table6.7).
(Uppercase and lowercase letters are differentiated.)

Table6.7 Characters that can be used for CPU access passwords

LSD	MSD	0	1	2	3	4	5	6	7
		000	001	010	011	100	101	110	111
0	0000	NUL	DLE	(SP)	0	@	P	`	p
1	0001	SOH	DC1	!	1	A	Q	a	q
2	0010	STX	DC2	"	2	B	R	b	r
3	0011	ETX	DC3	#	3	C	S	c	s
4	0100	EOT	DC4	$	4	D	T	d	t
5	0101	ENQ	NAK	%	5	E	U	e	u
6	0110	ACK	SYN	&	6	F	V	f	v
7	0111	BEL	ETB	'	7	G	W	g	w
8	1000	BS	CAN	(	8	H	X	h	x
9	1001	HT	EM	)	9	I	Y	i	y
A	1010	LF	SUB	*	:	J	Z	j	z
B	1011	VT	ESC	+	;	K	[	k	{
C	1100	FF	FS	,	<	L	¥	l	|
D	1101	CR	GS	-	=	M	]	m	}
E	1110	SO	RS	.	>	N	^	n	~
F	1111	SI	US	/	?	O	_	o	DEL

POINT

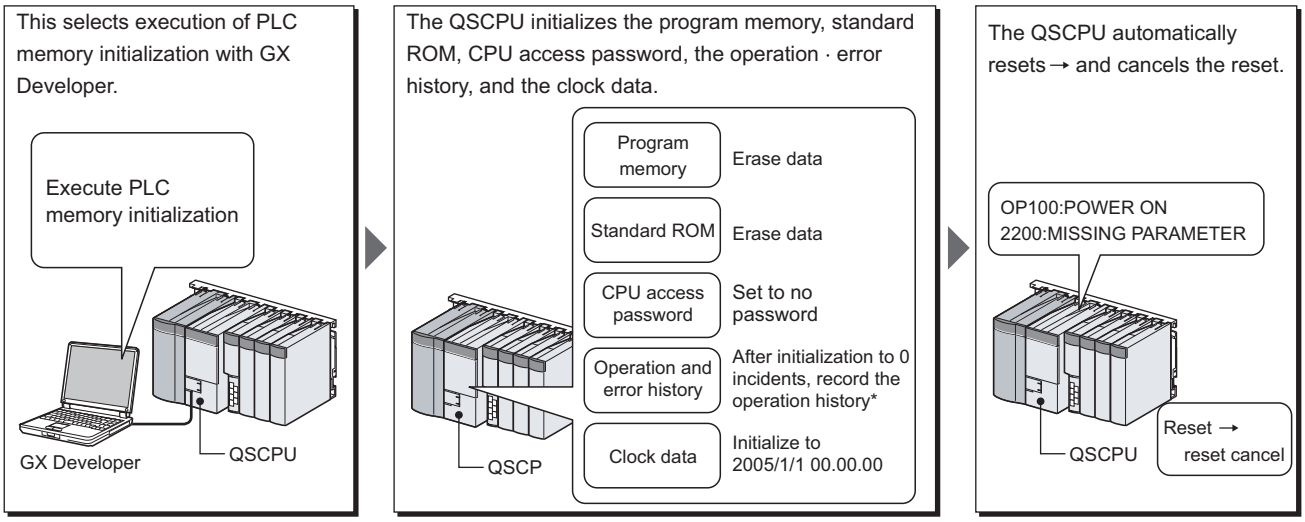
1. At the factory setting, CPU access password is not set in the CPU module. When using the CPU module, set the CPU access password with GX Developer and register it in the CPU module.
   (GX Developer online operation is not possible unless the CPU access password is registered to the CPU module.)
2. The user must manage the CPU access password carefully.
   If a CPU access password has already been set in the CPU module, writing to the PLC is not possible unless that same password is set in the GX Developer project. Also, the set password cannot be changed.
   If you lose the CPU access password, it is necessary to initialize the CPU module by initializing the PLC memory, then write the project to the PLC again.
   For details on how to initialize the PLC memory, refer to Section 6.4.
3. The CPU access password can be registered to the CPU module in the following cases.
   - CPU operation mode: TEST MODE
   - CPU operation status: STOP status
4. Set a different CPU access password for each CPU module.

6.4 PLC memory initialization

(1) What PLC memory initialization is

PLC memory initialization erases user data written in the CPU module.
When you initialize the PLC memory, data is returned to its factory settings.

After PLC memory initialization is executed, the system automatically resets → cancels the reset, then the initialization processing is executed again.



*: OP005:SYSTEM INITIALIZE PLC MEMORY is recorded in the operation · error history.

Diagram 6.9 PLC memory initialization operation overview

(2) Contents of PLC memory initialization processing

Table6.8 shows the contents of PLC memory initialization processing.

Table6.8 Contents of PLC memory initialization processing

Item	Contents of initialization processing
Program memory	The data is erased.(State in which not even one file exists)
Standard ROM	The data is erased.(State in which not even one file exists)
CPU access password	Not registered
Safety CPU operation mode	Enters TEST MODE.
Operation/error history	After the history is erased, the following operation/error history is recorded. • OP005: SYSTEM INITIALIZE PLC MEMORY • OP100: POWER ON • 2200: MISSING PARAMETER
Clock data	Initializes to 2005/01/01 00:00:00.
ROM write count	2 is added

(3) PLC memory initialization execution possible/not possible

PLC memory initialization can be executed in the following cases.

Safety CPU operation mode	SAFETY MODE		SAFETY MODE (wait-for-restart)	TEST MODE	
CPU operation status	RUN	STOP	STOP	RUN	STOP
PLC memory initialization execution possible/not possible	×	○	○	×	○

○: Can be executed, ×: Cannot be executed

(4) PLC memory initialization procedure

Diagram 6.10 shows the PLC memory initialization procedure with GX Developer.

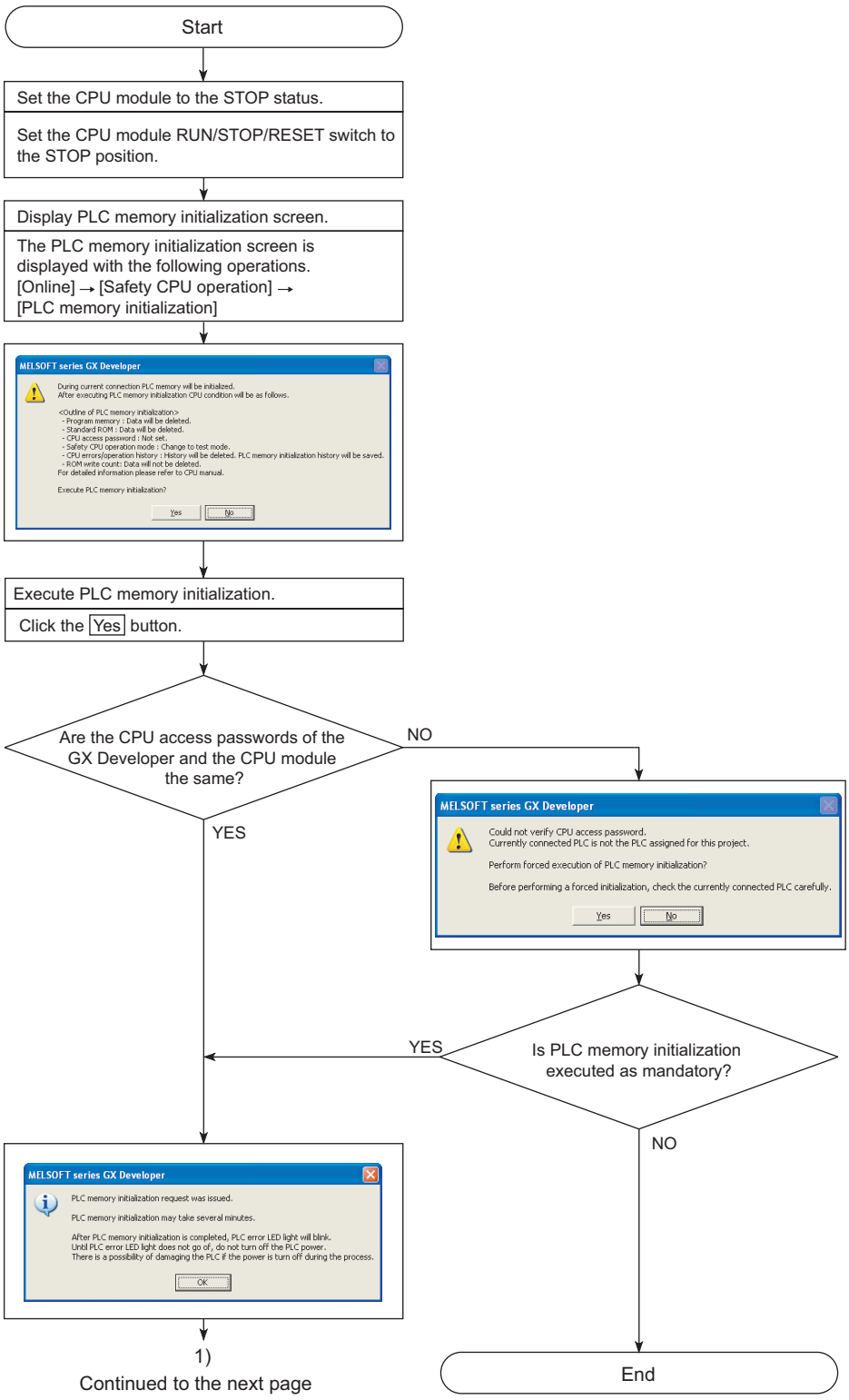


Diagram 6.10 PLC memory initialization procedure

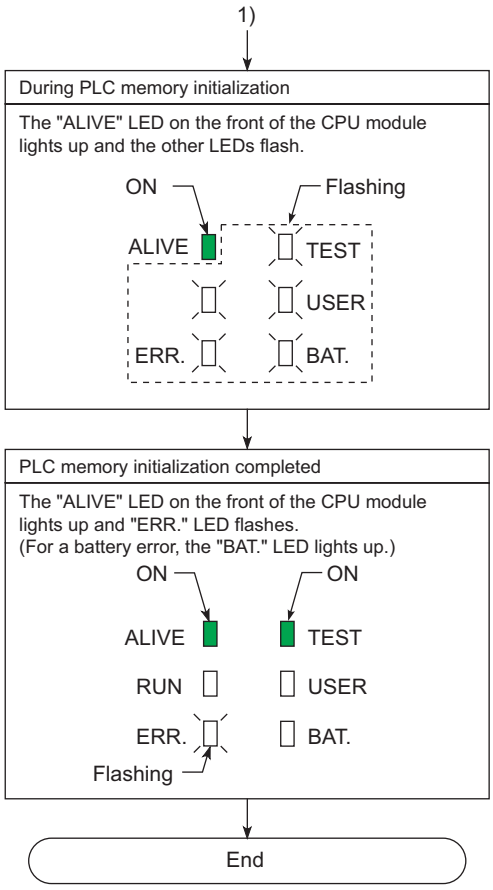


Figure 6.10 PLC memory initialization procedure (continued)

(5) Precautions

(a) PLC memory initialization when the CPU module error occurs

If the PLC memory is initialized when the errors like [INTERNAL CPU COMMUNICATION ERROR] (error code: 8070 to 8074) occur, the communication error may occur at the time of writing from the GX Developer to the CPU module. Initialize the PLC memory after confirming that the above-mentioned error does not occur.

For how to deal with [INTERNAL CPU COMMUNICATION ERROR] (error code: 8070 to 8074), refer to the error code list described in the QSCPU User's Manual (Hardware Design, Maintenance and Inspection).

(b) Communication with GX Developer during PLC memory initialization

Online operation from GX Developer to the CPU module cannot be executed during the PLC memory initialization.

Execute online operation from GX Developer after the PLC memory initialization is completed.

6.5 Setting to prevent continuous RUN in TEST MODE

(1) What the setting to prevent continuous RUN in TEST MODE is

The setting to prevent continuous RUN in TEST MODE is for preventing a continuous RUN for a long time in TEST MODE.

If the RUN state in TEST MODE exceeds the restriction time (continuous RUN tolerance time in TEST MODE), the "TEST MODE TIME EXCEEDED" (error code: 8100) continuation error occurs.

(2) Measuring the continuous RUN operation time in TEST MODE

(a) Measurement start

When the CPU module goes into RUN status in TEST MODE, the measurement of the RUN continuous time in TEST MODE starts.

(b) Measurement stop

When the CPU module goes into the state below, the measurement of the continuous RUN operation time in TEST MODE is stopped and the measurement value is cleared.

- When the CPU module is put into the STOP status
- When the PLC is power-off
- When the CPU module is reset

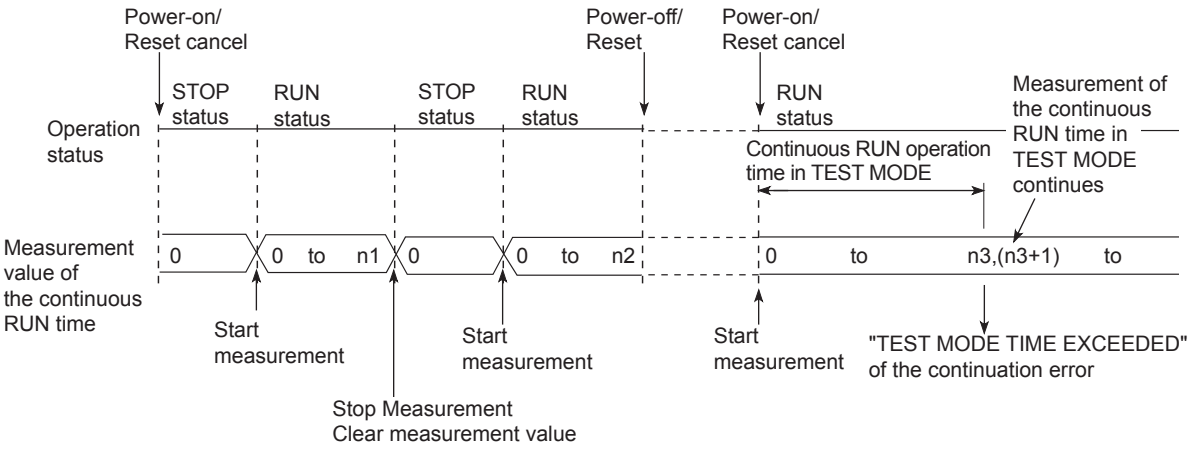


Diagram 6.11 Measurement period for continuous RUN operation time in TEST MODE

Remark

1. The continuous RUN operation time in TEST MODE is not measured during operation in SAFETY MODE.
2. Measurement of the continuous RUN time in TEST MODE continues even if the operating time in TEST MODE exceeds the set continuous RUN tolerance time and the "TEST MODE TIME EXCEEDED" (error code: 8100) continuation error occurs.

(3) Setting the TEST MODE continuous RUN tolerance time

The continuous RUN tolerance time in TEST MODE is set with the PLC parameter safety setting screen.

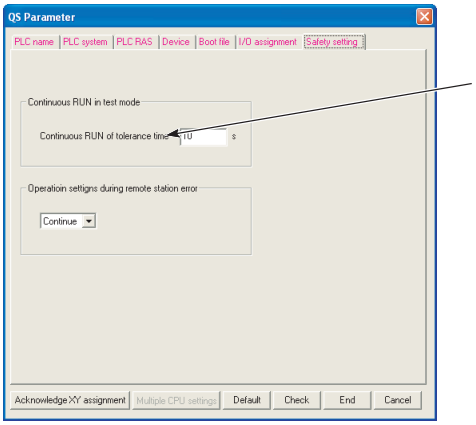


Diagram 6.12 PLC parameter safety setting screen

(4) Checking the continuous RUN operation time in TEST MODE

The continuous RUN operation time in TEST MODE is stored in special registers SD561 and SD562.

The continuous RUN operation time in TEST MODE can be checked by monitoring special registers SD561 and SD562.

Also, if the "TEST MODE TIME EXCEEDED" continuation error occurs, special relay SM561 turns ON.

Table6.9 Special relay and special registers storing the results of measuring the TEST MODE continuous RUN time

Special relay, special register number	Description	Remark
SM561	• Turns ON when the continuous RUN operation time in TEST MODE exceeds the continuous RUN tolerance time that has been set.	• Updated when changed. • When the error is canceled, SM561 is turned OFF.
SD561	• The continuous RUN operation time in TEST MODE is stored as a binary value.(in seconds) • The data is stored in the range 1 to 2147483647. • When the measured value is cleared, SD561 and SD562 are also cleared.	• Updated in the processing for the end of each scan • Continues storing of the measured values into memory even if the "TEST MODE TIME EXCEEDED" continuation error occurs. • When the error is canceled, SD561 and SD562 are cleared.
SD562		

6.6 Checking the ROM write count

The ROM write count is up to 100,000.
When the ROM write count exceeds 100,000, the continuation error "EXCEED MAX FLASH ROM REWRIT. ERR." (error code: 1610) occurs.
When the [EXCEED MAX FLASH ROM REWRIT. ERR.] (error code: 1610) occurs, the CPU may not write to the ROM, which needs to replace the CPU module.

(1) Method for checking the ROM write count

The ROM write count is stored in special registers SD232 and SD233.
The current ROM write count can be checked by monitoring special registers SD232 and SD233.
Also, if the ROM write count exceeds 100,000, special relay SM232 turns ON.

Table6.10 ROMwrite count check special relay and special registers

Special relay, special register number	Description	Remark
SM232	Turns ON if the ROM write count exceeds 100,000.	-
SD232	The ROM write count is stored as a binary value.	The ROM write count continues to be stored even if it exceeds 100,000.
SD233		

(2) Operation counted as ROM writes

Below are the operations counted as a ROM write.

(a) Writing parameters or program to the standard ROM

There are two types of writing parameters and programs to ROM
- Writing program memory to ROM using GX Developer
- Writing program memory to ROM when switching from TEST MODE to SAFETY MODE

(b) Registering the CPU access password from GX Developer

(c) PLC memory initialization

POINT

1. The following shows the count value at the time of writing to ROM.
   - Writing the program memory to ROM:6
   - Registration/change of the CPU access password from GX developer :2
   - PLC memory initialization:2
2. At the factory, the OS etc. are written to the ROM of the safety CPU module. Therefore, the ROM write count is increased by the number of ROM writes at the factory.

6.7 Self-diagnostics Function

(1) What the self-diagnostics function is

The self-diagnostics function diagnoses presence or absence of an error in the CPU module by itself.

The objectives of the self-diagnostics function are the prevention of malfunction of the CPU module and preventive maintenance.

(2) Self-diagnostics timing

If an error occurs when the CPU module is power on or while the CPU module is running, the self-diagnostics function detects and displays the error, and executes the CPU module operations stop etc.

(3) Checking an error

(a) LEDlit

When the CPU module detects an error, it lights up the "ERR." LED.

(b) The storage destination and checking of the error definition

If the CPU module detects an error, it turns ON special relays (SM0 and SM1) and stores the error definition (error code)in a special register (SD0).

If the CPU module detects multiple errors, it stores the error code of the latest error into SD0.

Use the special relay and the special register in a program to establish the PLC or mechanical system interlock.

(4) Checking the operation/error history

The CPU module records 3000 incidents of the operation/error history.

(☞ Section 6.8)

The operation/error history can be checked by using GX Developer [Diagnostics] → [PLC diagnostics].

The operation/error history is backed up by battery even if the PLC is power-off.

(5) CPU module operation when an error is detected (Stop error/ continuation error)

When an error is detected by the self-diagnostics, the CPU module has the following two types of operations.

(a) When an error that stops CPU module operations is detected

At the point when the CPUmodule detects the error, it stops operations and turns all external output OFF. (Device memory output (Y) is held.)

The error which stops operation is referred to as a stop error.

(b) When an error that allows CPU module operations to continue is detected

Even when the CPUmodule detects the error, it continues to execute the program.

The error which continues operation is referred to as a continuation error.

(6) List of self-diagnostics

The error messages in the "Error message" column in the table can be checked on the screen displayed by selecting [Diagnostics] → [PLC Diagnostics] in GX Developer.

Table6.11 List of self-diagnostics

No.	Detailed item/ Diagnostics subject	Diagnostics description	Diagnostics timing	Error occurring when error is detected	
				Error code	Error message
1	RAM diagnostics	Checks that the CPU module internal memory is not corrupted.?	• At power ON • At reset	1131,1132,1133, 1136,1137	RAM ERROR
			• Always	1141,1142,1143, 1146	
2	F/W diagnostics	Checks that the firmware stored in the ROM is not corrupted?	• At power ON • At reset • During execution of the END instruction	8060	INCORRECT FIRMWARE
3	Operation circuit diagnostics	Checks that the operation circuit, which performs sequence program operations, operates correctly?	• At power ON • At reset • During execution of the END instruction	1210	OPERATION CIRCUIT ERROR
4	Program verify	Checks that files stored in the program memory are not corrupted?	• At power ON • At reset	8031	INCORRECT FILE
			• During execution of the END instruction	8032	
5	Output data verify	Checks that the operation results output from the CPU A and B match?	• During execution of the END instruction	8050	SAFETY OUTPUT VERIFY ERROR
6	Time monitoring	Checks that the CPU A and B have the same OS execution status?	• Always	8020	CPU A & B CAN'T BE SYNCHRONIZED
			• During execution of the END instruction	8021	
7	Microcomputer diagnostics	Checks that registers used in the CPU module operate correctly.	• At power ON • At reset • During execution of the END instruction	8000	INTERNAL REGISTER ERROR
				8010	INTERNAL BUS ERROR
8	Power supply voltage monitoring	Checks that the CPU module operates at a voltage within the operation guaranteed range.	• Always	8080	POWER SUPPLY ERROR
9	Power supply voltage monitoring circuit diagnostics	Checks that the power supply voltage monitoring circuit operates correctly?	• During execution of the END instruction	8090	VOLTAGE DIAGNOSIS ERROR
10	Clock stop detection	Checks that clock input to the CPU module internal circuit is not stopped?	• Always	8120	WDT CLOCK CHECK ERROR
11	CPU module OS	Checks that the main CPU operates normally without detecting runaway?	• Always	1000, 1006	MAIN CPU DOWN
12	CPU module hardware	Checks that the following hardware of the CPU module operates correctly? • Main CPU • Clock element • RUN/STOP/RESET switch	• Always	1001, 1002, 1003, 1004	MAIN CPU DOWN
13	Power supply module	Checks that the power supply module operates normally?	• Always	1009	MAIN CPU DOWN
14	Program	Checks that the END instruction is executed at the end of the user program?	• During execution of the END instruction	1010	END NOT EXECUTE
15	CPU module, base unit, CC-Link Safety master module, network module	Checks that no invalid interrupt occurs within the CC-Link Safety master module, network module, base unit or CPU module?	• At interrupt occurrence	1311	I/O INTERRUPT ERROR

(Continued to the next page)

Table 6.11 Self-diagnostics list (continued)

No.	Detailed item/ Diagnostics subject	Diagnostics description	Diagnostics timing	Error occurring when error is detected	
				Error code	Error message
16	Module state during operation	Checks that the CC-Link Safety master module and network module operate normally.	• At power ON • At rese • When accessing to intelligent function module	1401	INTELLIGENT FUNCTION MODULE DOWN
			• During execution of the END instruction	1403	
17	Communication route with CC-Link Safety master module and network module	• Checks that communication with the CC-Link Safety master module and network module is performed normally? • Checks that the base unit operates normally?	• At power ON • At reset	1411	CONTROL-BUS ERROR
			• Always	1413	
			• During execution of the END instruction	1414, 1415	
18	Input power supply to power supply module	• Checks that input power supply is supplied normally to the power supply module? • Checks that no momentary power failure occurs in the input power supply?	• Always	1500	AC/DC DOWN
19	Battery	Checks that the voltage of the battery installed to the CPU module satisfies the standard value?	• Always	1600	BATTERY ERROR
20	ROM write count	Checks that the ROM write count is within the guaranteed count (100,000)?	• During execution of the END instruction	1610	EXCEED MAX FLASH ROM REWRIT. ERR.
21	Module mounting state during operation	Checks that the mounting status of the CC-Link Safety master module and network module has not been changed since power-ON or reset operation?	• During execution of the END instruction	2000	MODULE VERIFY ERROR
22	Module configuration	• Checks that the CC-Link Safety master module and network module are mounted according to the I/O assignment setting of PLC parameter? • Checks that the number of mounted CC-Link Safety master modules and network modules are within the setting range? • Checks that the start I/O numbers of CC-Link Safety master module and network module are not overlapping?	• At power ON • At rese	2100, 2106, 2107	MODULE LAYOUT ERROR
		Checks that no module is mounted exceeding the I/O points can be used actually?	• At power ON • At reset	2124	MODULE LAYOUT ERROR
		Checks that a module that can not be used (such as I/O module, intelligent function module, GOT) is mounted?	• At power ON • At reset	2125	MODULE LAYOUT ERROR
23	Parameter configuration	Checks that parameters exist in the CPU module?	• At power ON • At rese	2200	MISSING PARAMETER
24	Parameter setting	Checks that the setting in PLC parameter meets the specifications?	• At power ON • At reset • When CC-Link Safety remote station returned.	3000, 3001, 3003, 3004, 3008	PARAMETER ERROR
		Checks that the setting in Network parameter for the network module meets the specifications?	• At power ON • At reset	3100, 3101, 3102, 3103, 3104	NETWORK PARAMETER ERROR
		Checks that the setting in CC-Link Safety parameter meets the specifications?	• At power ON • At reset	3105, 3106, 3107	CC-LINK PARAMETER ERROR
		Checks that the setting of Remote password meets the specifications.	• At power ON • At reset	3400, 3401	REMOTE PASSWORD ERROR

(Continued to the next page)

Table 6.11 Self-diagnostics list (continued)

No.	Detailed item/ Diagnostics subject	Diagnostics description	Diagnostics timing	Error occurring when error is detected	
				Error code	Error message
25	Program	Checks that the start I/O number or network number specified by the intelligent function module dedicated instruction is correct?	• During execution of the instruction	2112	INTELLIGENT FUNCTION MODULE ERR.
		Checks that the instruction code in the program is correct (is not corrupted)?	• At power ON • At reset • At status change from STOP to RUN	4000	INSTRUCTION CODE ERROR
		Checks that the extension dedicated instruction format in the program is correct.	• At power ON • At reset • At status change from STOP to RUN	4002, 4003, 4004	INSTRUCTION CODE ERROR
		Checks that an END instruction exist in the program?	• At power ON • At reset • At status change from STOP to RUN	4010	MISSING END INSTRUCTION
		During execution of an instruction, checks that the input data handed over to the instruction meet the instruction specifications?	• During execution of the instruction	4100, 4101, 4102	OPERATION ERROR
26	Scan time	Checks that the scan time is within the WDT setting range?	• Always	5001	WDT ERROR
		When the constant scan time is set, checks that one scan completes within the constant scan time?	• Always	5010	PROGRAM SCAN TIME OVER
27	Operation time in TEST MODE	Checks that the continuous RUN time in TEST MODE is within the setting range?	• During execution of the END instruction	8100	TEST MODE TIME EXCEEDED

6.7.1 LED display for error

When an error occurs, the LEDs on the front of the CPU module light up and flash.
(☞ Section 6.18)

6.7.2 Cancel the error

The CPU module can carry out the operations canceling errors in programs as long as the error allows the program operations to continue.
The occurring continuation error can be checked by the bit which is turned "1" of SD81 (error factor). Error factor/continuation error corresponding to the bit number of SD81 is shown in Table6.12.

Table6.12 Error factor/error code corresponding to bit number of SD81

Bit number of SD81/error factor corresponding to continuation error		Continuation error corresponding to bit number of SD81	
Bit number	**Error factor**	**Error code**	**Error message**
0	Instantaneous power failure	1500	AC/DC DOWN
1	Battery low	1600	BATTERY ERROR
2	Standard ROM write count excess	1610	EXCEED MAX FLASH ROM REWRIT.ERR.
3	Test mode continuous RUN tolerance timeout	8100	TEST MODE TIME EXCEEDED
4	Scan timeout	5010	PROGRAM SCAN TIME OVER
5	Annunciator ON	9000	F**** (**** indicates the annunciator number.)
6	Safety remote station detection error	8300	CC-LINK REMOTE DETECTION ERROR
7	Safety remote station product information mismatch	8310	CC-LINK PRODUCT INFO. MISMATCH
8	Initial monitoring timeout error Safety monitoring timeout Error menitoring timeout error	8320 8321 8322	CC-LINK DATA RECEPTION TIMEOUT
9	Safety remote station command error Safety remote station data split error Safety remote station link ID error Safety remote station running number error Safety remote station reception data error	8330 8331 8332 8333 8334	CC-LINK RECEIVED DATA ERROR

(1) Error canceling procedure

Cancel an error with the following procedure.

1) Read out SD81 with GX Developer and check the cause of the current continuation error occurring in the CPU module.
2) Eliminate the cause of the error.
3) Store the canceling error code in special register SD50.
4) Turn special relay SM50 OFF → ON.
5) Again read out SD81 with GX Developer and check that the bit corresponding to the current continuation error canceled is OFF.

6) Turn special relay SM50 OFF.

(a) Error canceling procedure for multiple errors

Because the description of the error information special relays/registers (SM0, SM1, SM5, SM16, SD0 to 26) are cleared when the last error to occur (the error stored in special register SD0) is canceled, the information on errors that have not been canceled cannot be obtained from the special relays/registers.
Cancel errors that have not been canceled by obtaining errors that have occurred in the past from the error history (☞ Section 6.8).

(2) State after error canceled

If the CPU module is recovered by canceling the error, the special relays, special registers, and LEDs related to errors return to the pre-error states.
The error history does not change.
If the same error occurs again after it has been canceled, it is recorded into the error history again.

(3) Canceling annunciator

When canceling multiple detected annunciators, only the F number first detected is canceled.

(4) Canceling errors when multiple erros occur

When multiple continuation errors occur and an error is canceled, the CPU module LED display and error information are as follows.

Error canceling state	LED display Âñ1 (ERR. LED, BAT.LED, USER LED)	Error information (SM0, SM15, SM16, SD0 - 26)
Before error canceled	ON	The error information for the continuation error that occurred last is stored.
↓		
The continuation error that occurred last is canceled. (There are continuation errors remaining that have not been canceled.)	ON	Returns to the no-error state.
A continuation error other than the last one is canceled. (There are continuation errors remaining that have not been canceled.)	ON	No change (The error information for the continuation error that occurred last is retained.)
↓		
All the continuation errors are canceled.	OFF	No error

* 1: (1) When error code: 1600("BATTERY ERROR") occurs, only the "BAT." LED lights up.
When error code: 1600 is canceled, the "BAT." LED goes out.
(2) When error code: 9000(F****) occurs, only the "USER" LED lights up.
When error code: 9000 is canceled, the "USER" LED goes out.

POINT

1. When the error code for the error to be canceled is stored in SD50 and the error is canceled, the bottom 1-digit code number is ignored.
   (Example)
   If error code 2100 or 2106 occurred, when error code 2100 is canceled, error code 2106 is canceled too.
   If error code 2100 or 2125 occurred, even when error code 2100 is canceled, error code 2125 is not canceled.
2. If an error occurred due to a cause other than the CPU module, even if the error is canceled using a special relay (SM50) and special register (SD50), the cause of the error cannot be eliminated.
   (Example)
   For "INTELLIGENT FUNCTION MODULE DOWN", because this error occurred in the base unit, intelligent module, or the like, even if the error is canceled using a special relay (SM50) and special register (SD50), the cause of the error cannot be eliminated.
   Refer to the error code list in the QSCPU User's Manual (Hardware Design, Maintenance and Inspection) and eliminate the cause of the error.

6.8 Recording the operation contents and self-diagnostics error occurrence contents (operation/error history function)

(1) What the operation/error history function is

The operation/error history function records the operations that have been executed to the CPU module from the outside and the self-diagnostics errors that have occurred in the CPU module in the past. The objective of this function is to make troubleshooting easier.

(2) Data stored in the operation/error history area

The CPU module stores the operations that have been executed to the CPU module from the outside and the self-diagnostics errors in the operation/error history area.

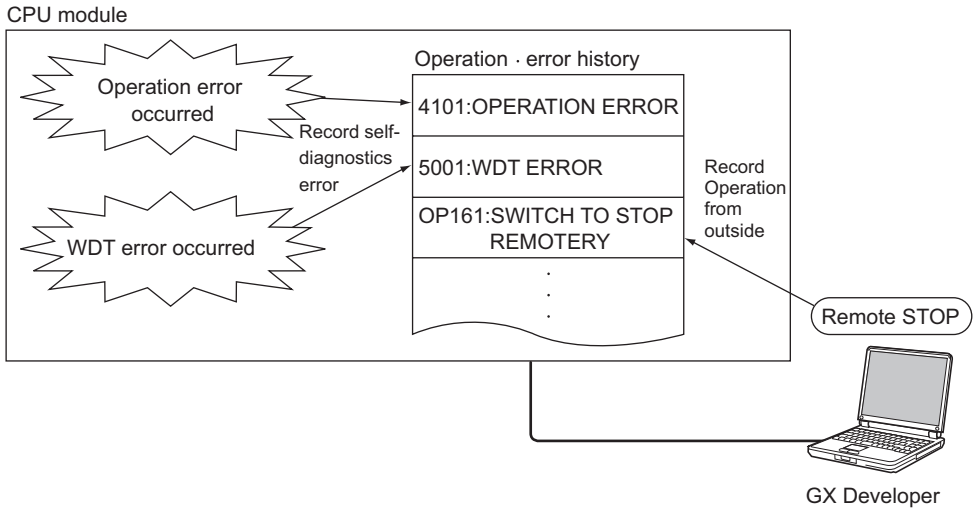


Diagram 6.13 Recording the operation/error history to the CPU module

(a) Operations executed to the CPU module from the outside

The following are stored as operations executed to the CPU module from the outside.

- Online operations from GX Developer
- Operations with the CPU module RUN/STOP/RESET
- Input power supply ON/OFF

Table6.13 shows the operations stored in the operation/error history.

Table6.13 Operations stored in the operation/error history

Classification	Operation code	Operation message	Operation description
System	OP001	SYSTEM INITIALIZE OPERATION MODE	Because the safety CPU operation mode is not retained correctly, the CPU module initialized the safety CPU operation mode in TEST MODE.
	OP002	SYSTEM INITIALIZE PROGRAM MEMORY	Because the program memory contents are not retained correctly, the CPU module formatted the program memory.
	OP003	SYSTEM INITIALIZE OPE./ERROR LOG	Because the operation/error history contents are not retained correctly, the operation/error history was initialized into 0 incidents.
	OP004	SYSTEM INITIALIZE SYSTEM CLOCK	Because the system clock data is not correct, the CPU module initialized the system clock data.
	OP005	SYSTEM INITIALIZE PLC MEMORY	The CPU module executed the PLC memory initialization function.
	OP006	SYSTEM INITIALIZE ROM WRITE INF.	Because the write to ROM information is not retained correctly, the CPU module initialized the ROM information.
System (CPU operation status)	OP010	SYSTEM SWITCH TO RUN	The CPU operation status of the CPU module switched to the RUN state.
	OP011	SYSTEM SWITCH TO STOP	The CPU operation status of the CPU module switched to the STOP state.
Power supply operation	OP100	POWER ON	The PLC was power-on.Or the CPU module reset was canceled.
Drive operation	OP144	WRITE PRGRAM MEMORY TO ROM	The write to ROM of program memory data → standard ROM was executed.
Remote operation	OP160	SWITCH TO RUN REMOTELY	The remote RUN operation was executed.
	OP161	SWITCH TO STOP REMOTELY	The remote STOP operation was executed.
Safety CPU operation mode operation	OP180	SWITCH SAFETY PC OPERATION MODE	The safety CPU operation mode was switched.
History operation	OP200	CLEAR OPERATION/ERROR LOG	The operation/error history in the CPU module was cleared.
Clock operation	OP210	ADJUST SYSTEM CLOCK	The CPU module clock was set.
CPUaccess password operation	OP220	MODIFY ACCESS PASSWORD	In the CPU module, the CPU access password was set.

(b) Self-diagnostics error

The contents of the self-diagnostics error detected by the CPU module are stored.
For details on self-diagnostics errors, refer to the following manual.

☞ QSCPU User's Manual (Hardware Design · Maintenance and Inspection)

(3) Operation · history capacity

The contents of 3000 operations and errors can be stored in the operation/error history of the CPU module.
When the total number of operations and errors exceeds 3000, the oldest content is overwritten with the latest one in order.

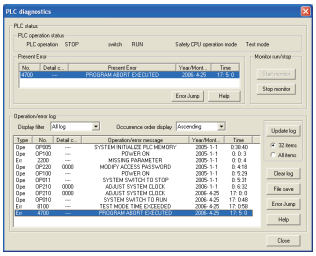
(4) Displaying operation/error history using GX Developer

The contents of the operation/error history can be displayed on the GX Developer PLC diagnostics screen.

(a) PLC diagnostics screen display

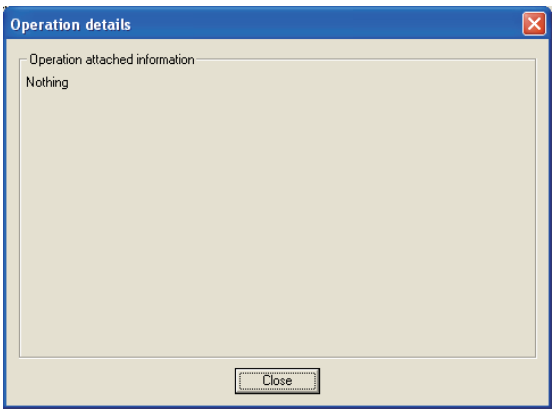
Table6.14 shows the display of the operation/error history on the GX Developer PLC diagnostics screen.

Table6.14 Contents of the PLC diagnostics screen and the operation/error history item

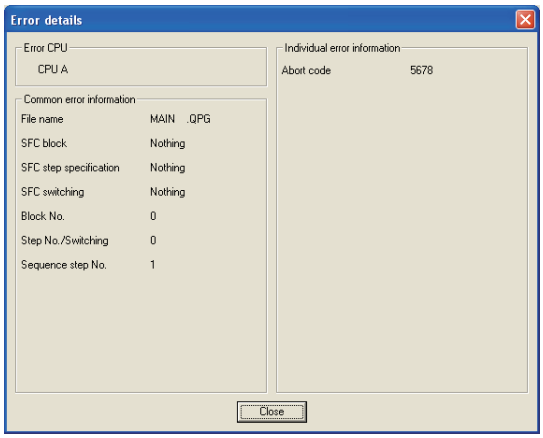
PLC diagnostics screen	Description of PLC diagnostics screen	
	Item	Description
	Type	The history type is displayed. Ope: Operation history Err: Error history
	No.	The operation/error number is displayed.
	Detailed code	The 4-digit code corresponding to the operation history and the CC-Link Safety remote I/O unit error history is displayed. If there is no detailed code, ---- is displayed.
	Present error/Error Message	The operation content · error message recorded in the operation/error history is displayed. If the history is damaged, "BROKEN OPERATION/ERROR LOG" is displayed.

(b) Operation/error history details screen

When double-clicking a history in the history list or an error currently occurring on the PLC diagnostics screen, the detailed information in Diagram 6.14 can be displayed.



(a) Operation history



(b) Error history

Diagram 6.14 Operation history/Error history details screen

(5) Operation/error history clear

The operation/error history of the CPU module can be cleared by pressing the "Clear log" button on the GX Developer PLC Diagnostics screen.

The operation/error history clear operation is only valid when the CPU module safety CPU operation mode is TEST MODE. When the operation/error history is cleared, the CPU module stores the operation contents OP200 : "CLEAR OPERATION/ERROR LOG" in the operation/error history.

POINT

The operation/error history is retained by the CPU module battery.

At the power-on or the reset cancel, the CPU module checks if the operation/error history has not been lost or damaged.

When the CPU module detects that the operation/error history has been lost or damaged due to battery low etc., the CPU module initializes the operation/error history.

When the CPU module initializes the operation/error history, operation contents OP003 : "SYSTEM INITIALIZE OPE./ERROR LOG" is stored in the operation/error history.

6.9 Constant scan

(1) Definition of Constant Scan

The scan time differs because the processing time differs depending on whether the instruction, which is used in the sequence program, is executed or not.
Constant scan is a function to execute the sequence program repeatedly while maintaining the scan time at a constant time.

(2) Applications of constant scan

I/O refresh is performed before sequence program execution.
Using the constant scan function, the I/O refresh intervals can be made constant if the sequence program execution time varies.

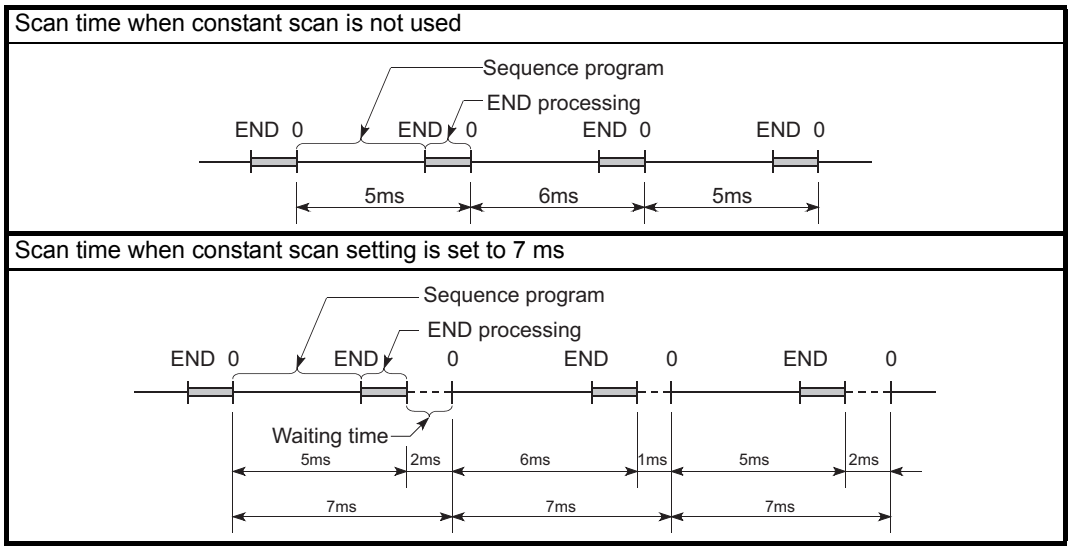


Diagram 6.15 Constant scan operation

(3) Setting the constant scanning time

The constant scanning time is set at the "PLC RAS" tab screen in the "(PLC) Parameter" dialog box.
The constant scan time can be set in the range of 1 to 2000 ms (in units of 1 ms).

When executing constant scanning, set the constant scanning time.
When not executing a constant scanning, leave the constant scanning time blank.

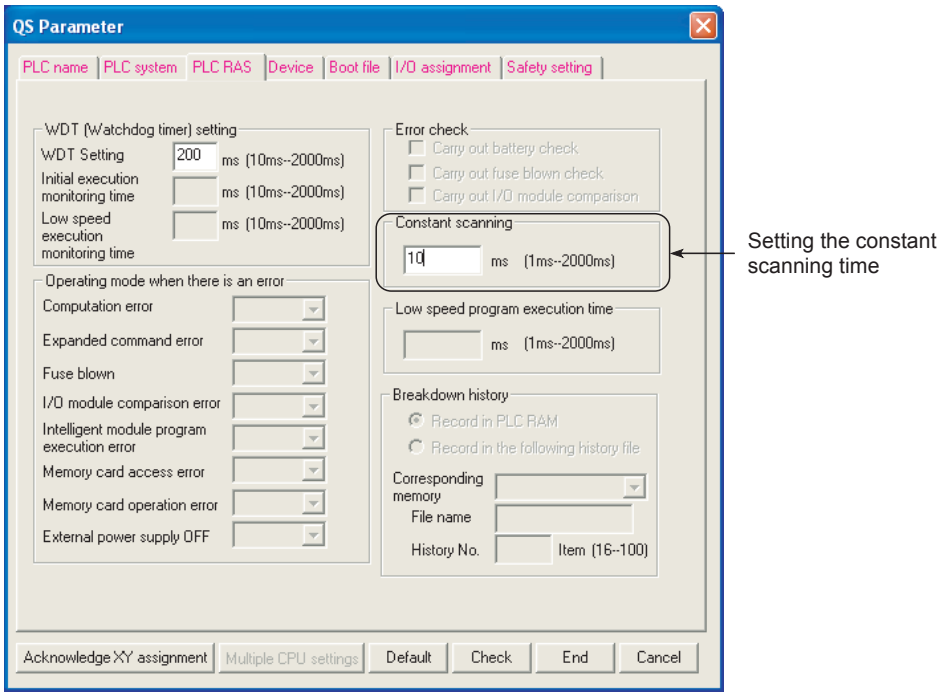


Diagram 6.16 When constant scanning time is set to 10ms

(a) Setting time condition

As the constant scan time, set a value that satisfies the following relational expression.

(WDT Set Time) > (Constant Scan Set Time) > (Sequence Program maximum Scan Time)

If the sequence program scan time is longer than the constant scan setting time, the CPU module detects "PROGRAM SCAN TIME OVER" (error code: 5010). In this case, the constant scan setting is ignored and the sequence program is executed based on its scan time.

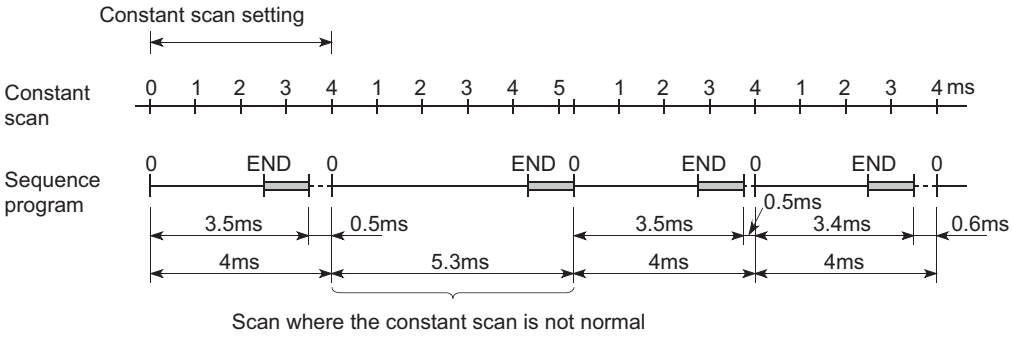


Diagram 6.17 Operation when the Scan Time is longer than the Constant Scan setting time

If the sequence program scan time is longer than the WDT setting time, the CPU module detects a WDT error.
In this case, the program execution is stopped.

(4) Waiting time from when END processing is executed until next scan starts

Sequence program processing is stopped during the waiting time from when the END processing of a sequence program is executed until the next scan starts.

(5) Constant scan accuracy

Refer to CHAPTER 10 for the constant scan accuracy.

6.10 Setting of Output (Y) Status when Changing between STOP and RUN

(1) Definition

When changed from the RUN status to the STOP status, the CPU module stores the output (Y) in the RUN status into the PLC and turns all outputs (Y) OFF.
Status when changing from STOP to RUN can be selected from the following two options with parameters in GX Developer.

- The output (Y) status prior to STOP is output.
- The output (Y) is cleared.

(2) Setting applications

Using a holding circuit or similar, it is possible to select whether the output is resumed from the previous status or not when the STOP status is changed to the RUN status.

Diagram 6.18 Holding circuit

- When the output (Y) status prior to STOP is set to output

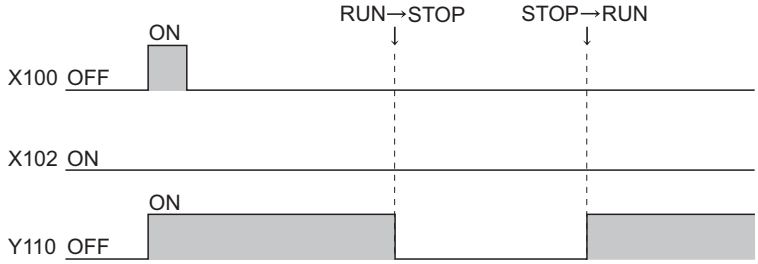


Diagram 6.19 Timing chart when output (Y) status prior to STOP is set to output

- When output (Y) is set to clear

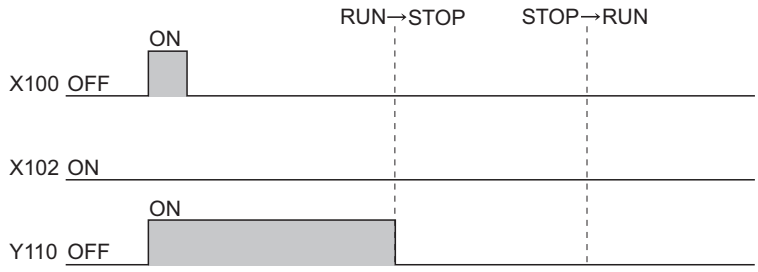


Diagram 6.20 Timing chart when output (Y) is set to clear

(3) Operation switching from STOP status to RUN status

(a) Output (Y) status prior to STOP is output (Default)

After the output (Y) status before the STOP status is output, the sequence program calculations are performed.

(b) Output is cleared

The output becomes OFF status.
The output (Y) is output after the operation of sequence program.
Refer to (5) for the operation when performing forced ON of output(Y) at STOP status.

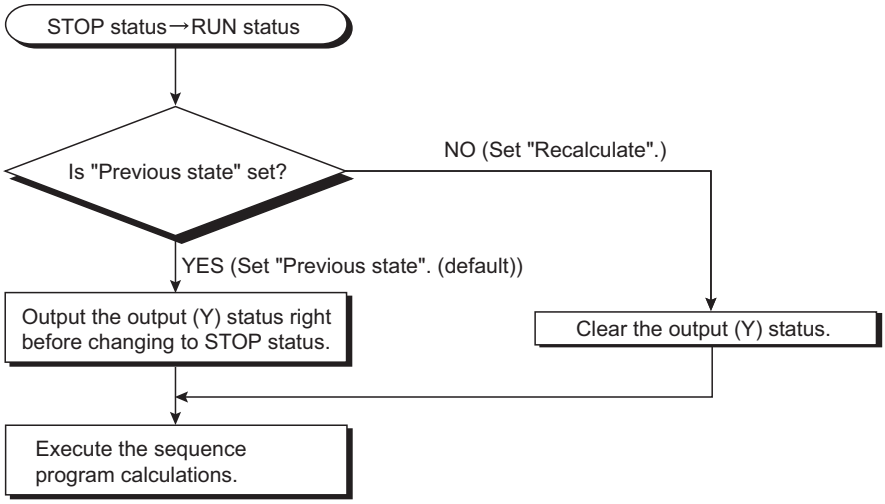


Diagram 6.21 Processing when Change from STOP Status to RUN Status

(4) Setting the Output (Y) Status when Changing from STOP Status to RUN Status

Set the output (Y) status when changing from the STOP status to the RUN status in the PLC system of the PLC parameter dialog box.

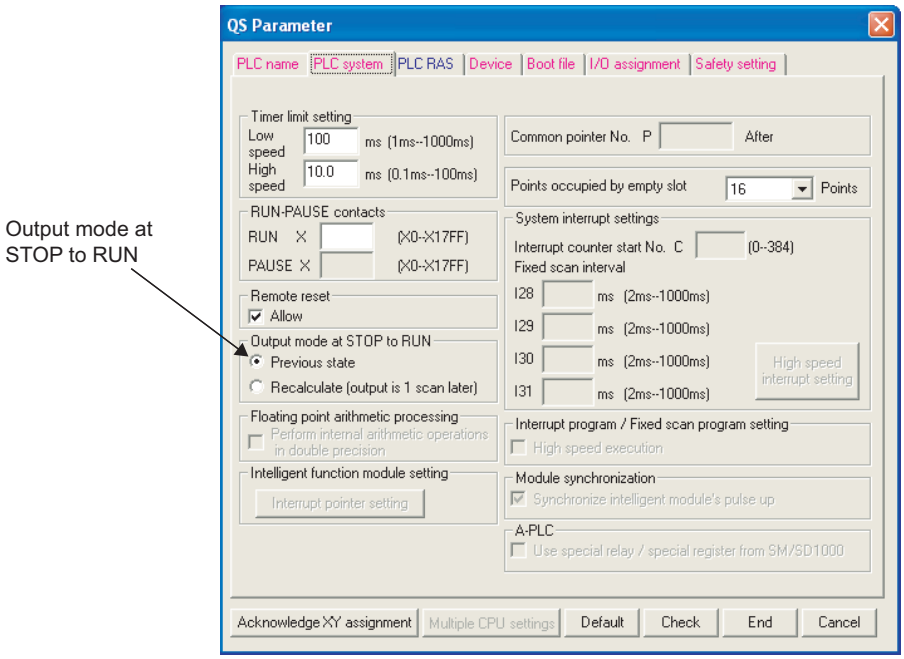


Diagram 6.22 PLC system screen

(5) Precaution

When performing forced ON at STOP status of the CPU module, the output at switching from STOP status to RUN status is as shown in Table6.15.

.

Table6.15 Output at switching from STOP status to RUN status after performing forced ON to output (Y)

Output mode at switching from STOP to RUN	Output at switching from STOP status to RUN status
Output (Y) status prior to STOP is output	Output the status before STOP If the output (Y) is OFF before STOP, ON status is not maintained
Outputs (Y) is cleared.	Maintain ON status

6.11 Clock Function

(1) Definition of Clock Function

The clock function reads the internal clock data of the CPU module to use it for time management.

The clock data is used by the CPU module system to perform time management, e.g. storage of date into the operation/error history.

(2) Clock operation at power OFF and momentary power failure

Clock operation is continued by the internal battery of the CPU module during power OFF of the PLC or when a power failure longer than the permissible momentary power failure time occurs.

(3) Clock Data

Clock data is used in the CPU module and includes the data indicated in Table6.16.

Table6.16 Clock data details

Data Name	Contents	
Year	Four digits in AD (Countable from 1980 to 2079)	
Month	1 to 12	
Day	1 to 31 (Automatic leap year calculation)	
Hour	0 to 23 (24 hours)	
Minute	0 to 59	
Second	0 to 59	
Day of the week	0	Sunday
	1	Monday
	2	Tuesday
	3	Wednesday
	4	Thursday
	5	Friday
	6	Saturday

(4) Changing and reading the clock data

(a) Changing clock data

The clock data can be changed by either GX Developer or the special relay and special registers.

1) Changing data using GX Developer

Display the Set time screen by selecting [Online] → [Set clock] in GX Developer and change the clock data of the CPU module.

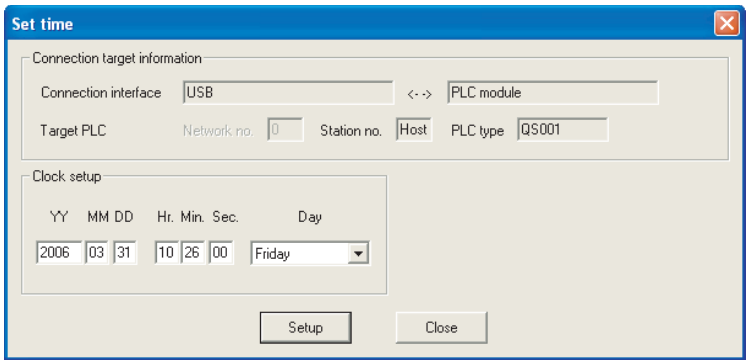


Diagram 6.23 Clock data write from GX Developer

POINT

When the CPU module clock data is changed using GX Developer, the CPU module records OP210: "ADJUST SYSTEM CLOCK" in the operation/error history.

2) Changing data using special relay and special registers

The clock data can be written using the special relay (SM210) and special registers (SD210 to SD213).

For details on the special relay, refer to Appendix 1. For details on the special registers, refer to Appendix 2.

(b) Reading clock data

The clock data can be read using the special relay (SM213) and special registers (SD210 to 213).

For details on the special relay, refer to Appendix 1; for details on the special registers, refer to Appendix 2.

(5) Precautions

(a) Initial clock data setting

The clock data is not factory-set.
The clock data is used by the CPU module system for error · operation history, etc.
When using the CPU module for the first time, be sure to set the precise time.

(b) Clock data when battery is low

The CPU measures the time even if the power fails module, using a battery mounted on the CPU module.
Therefore, if the CPU module's battery capacity falls, the clock data value may become inaccurate.
When the PLC power-on or the CPU module reset is canceled, the CPU module checks if the clock data value is within the range shown in this Section (3).
If the clock data value is incorrect, the clock data value is initialized to January 1, 2005, 00:00:00.
At this time, the CPU module records OP004: "SYSTEM INITIALIZE SYSTEM CLOCK" in the operation/error history.
(The time recorded in the operation/error history is the value of the clock data after the clock data was initialized.)

(6) Accuracy of Clock Data

The accuracy of the clock function differs with the ambient temperature, as shown below:

Table6.17 Accuracy of clock data

Ambient Temperature (℃)	Accuracy (Day difference, S)
0	- 3.18 to + 5.25(TYP.+ 2.14)
+ 25	- 3.18 to + 5.29(TYP.+ 2.07)
+ 55	- 12.97 to + 3.63(TYP.-3.16)

6.12 Remote Operation

Remote operation changes the operating status of the CPU module by the operation performed from outside (e.g. GX Developer, remote contact).

The following two options are available for remote operations:

- Remote RUN/STOP : ☞ Section 6.12.1
- Remote RESET : ☞ Section 6.12.2

6.12.1 Remote RUN/STOP

(1) Definition of Remote RUN/STOP

The remote RUN/STOP performs RUN/STOP of the CPU module externally with the CPU module RUN/STOP/RESET switch at RUN.

(2) Applications of remote RUN/STOP

Using remote RUN/STOP for the following remote operations are useful:

- When the CPU module is at a position out of reach
- When performing RUN/STOP of the control board CPU module externally

(3) Calculations during Remote RUN/STOP

The program calculation that performs remote RUN/STOP is as follows:

(a) Remote STOP

Executes the program to the END instruction and enters the STOP status.

(b) Remote RUN

When remote RUN is performed while in the STOP status using remote STOP, the status changes to RUN and executes the program from step 0.

(4) Method with Remote RUN/STOP

Remote RUN/STOP operation can be performed either by the RUN contact or by GX Developer.

(a) Method with RUN contact

The RUN contact is set at the PLC system tab screen in the (PLC) Parameter dialog box of GX Developer.

The range of devices that can be set is input X0 to 17FF.

By turning the set RUN contact ON/OFF, the remote RUN/STOP can be performed.

- When the RUN contact is OFF, the CPU module enters the RUN status.
- When the RUN contact is ON, the CPU module enters the STOP status.

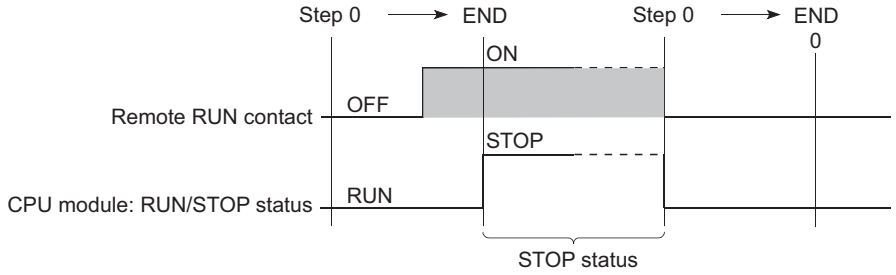


Diagram 6.24 Time Chart for RUN/STOP with RUN Contact

(b) Method by GX Developer

RUN/STOP of the CPU module can be executed by performing remote RUN/STOP operation with GX Developer.

Operate GX Developer by choosing [Online] → [Remote operation].

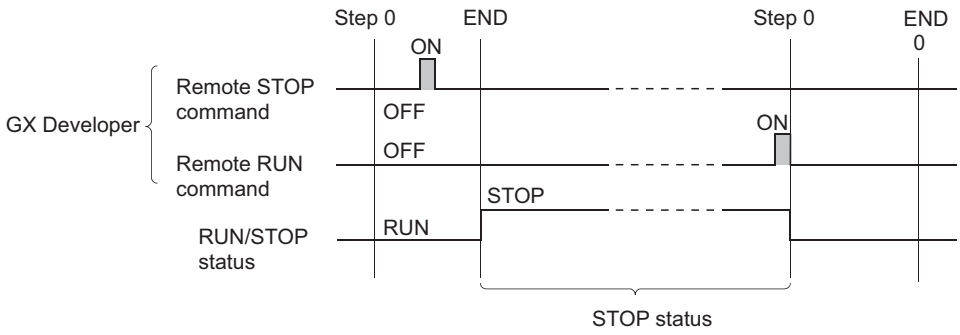


Diagram 6.25 Remote RUN/STOP by GX Developer

(5) Precautions

Take note of the following, because STOP has priority in CPU module:

(a) Timing of changing to STOP status

The CPU module is put in the STOP status when remote STOP is executed from any of the followings: RUN contact, GX Developer.

(b) To put CPU module in RUN status again after remote STOP

When placing the CPU module in the RUN status again after putting it in the STOP status by remote STOP, perform remote RUN in the order that remote STOP was executed first.

POINT

1 . The RUN/STOP status is described below:

- RUN Status.....Status in which the calculations are repeatedly executed from step 0 to the END/FEND instruction in the sequence program.
- STOP Status.....Status in which the sequence program calculations are stopped and the output (Y) is all OFF.

2 . After being reset, the CPU module is put to RUN/STOP status according to the RUN/STOP/RESET switch setting.

6.12.2 Remote RESET

(1) Definition of Remote RESET

A remote reset is an operation that resets the CPU module using GX Developer when the CPU module is in the STOP status.
Even if RUN/STOP/RESET switch is in RUN, the reset can be performed when the CPU module is stopped and an error that can be detected by the self-diagnosis function occurs.

(2) Applications of remote RESET

A remote reset can reset the CPU module using GX Developer when an error that is beyond the reach of the CPU module occurs.

(3) Remote RESET method

Remote RESET operation can be performed by only GX Developer.
To perform the remote RESET, follow the following steps:

- When the CPU module is in RUN status, use remote STOP to arrange the STOP status.
- Reset CPU module by the remote RESET operation.
  For the GX Developer, this is performed by [Online] →[Remote operation.]

(4) Precautions

(a) Remote RESET in RUN status

Remote RESET cannot be performed when the CPU module is in RUN status.
Perform remote RESET after placing the CPU module in the STOP status by performing remote STOP or similar operation.

(b) Status after reset processing completion

After the reset processing is complete, the CPU module will enter operation status set by the RUN/STOP/RESET switch.

- With the RUN/STOP/RESET switch in the STOP position, the CPU module enters into the STOP status.
- With the RUN/STOP/RESET switch in the RUN position, the CPU module enters into the RUN status.

(c) When error occurs due to noise

Take care that Remote RESET does not reset CPU module if an error occurs in the CPU module due to noise.
When the CPU module cannot be reset by the remote reset, either reset with the RUN/STOP/RESET switch or restart-up the PLC.

POINT

1. If remote RESET is performed with the CPU module stopping due to an error, note that the CPU module is placed in the operation status set by the RUN/STOP/RESET switch upon completion of the reset processing.
2. Remote processing in GX Developer can be completed without setting Remote reset to "Allow" in the PLC system setting screen of PLC parameter. However, the reset processing is not performed to the CPU module, accordingly the CPU module will not be reset.
   When the CPU module status does not change with Remote reset in GX Developer, check if the Remote reset on the "PLC system" setting screen is set to "Allow".

6.12.3 Relationship of remote operation and CPU's RUN/STOP status

(1) Relationship of the Remote Operation and CPU module Switch

The CPU module operation status is as shown in Table6.18 with the combination of remote operations to RUN/STOP switch.

Table6.18 Relation between RUN/STOP status and remote operation

RUN/STOP status	Remote operation		
	RUN *1	STOP	RESET
RUN	RUN	STOP	Cannot operate *2
STOP	STOP	STOP	RESET *3

* 1 : When performing the operation with RUN contact, "RUN-PAUSE contact" must be set at the "PLC system" tab screen in the "(PLC) Parameter" dialog box.
* 2 : RESET can be performed if the CPU module changed to the STOP status by a remote operation.
* 3 : This includes a situation where the CPU module is stopped due to error.

(2) Remote Operations from the Same GX Developers

When remote operations are performed from the same GX Developer, the status of the remote operation that is executed last will be effective.

6.13 Monitor Function

(1) Definition of Monitoring Function

This is a function to read the program, device and intellignet function module status of the CPU module by using GX Developer.

The monitor functions that can be executed are shown below.

- Ladder monitor
- Device/buffer memory batch monitor
- Device registration monitor
- Device test
- Program monitor list
- Ladder registration monitor

For details on GX Developer monitor functions, refer to the following manual.

- GX Developer Operating Manual

(2) Monitor request processing timing and displayed data

The CPU module performs the END processing to handle monitor requests from GX Developer.

The results of CPU module END processing are displayed on the GX Developer side.

6.14 Writing in Program during CPU Module RUN

With the CPU module, writing during RUN is possible in ladder mode.

6.14.1 Online change in ladder mode

(1) Writing data in the circuit mode during RUN Status

Writing data in the circuit mode during RUN is a function to write a program during the CPU module RUN status.

Writing data in the circuit mode during RUN can be executed only at TEST MODE.

The program can be changed without stopping the process in CPU module program by performing writing data in the circuit mode during RUN status.

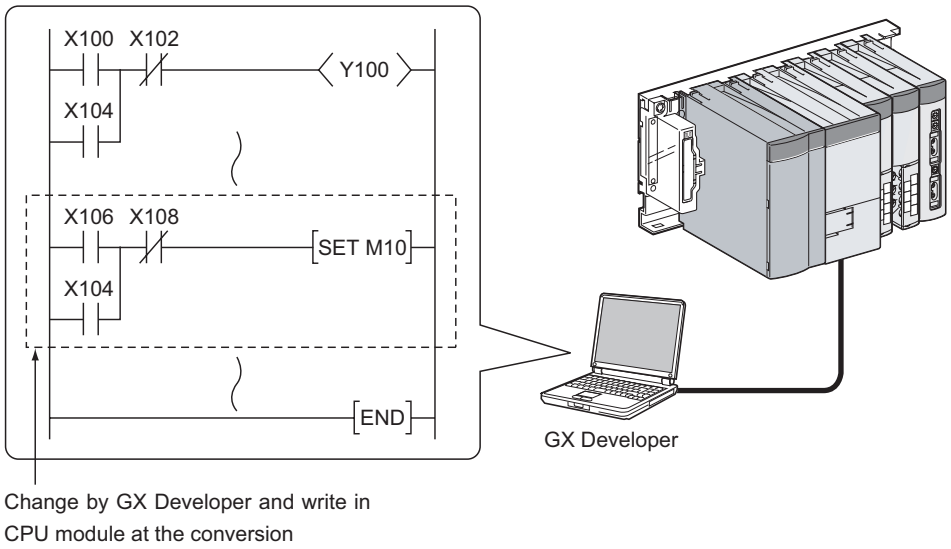


Diagram 6.26 Outline of online change in ladder mode

(2) Precautions

Take a note of the following when online change is performed:

(a) Memory enabled for online change

The memory that can be written during RUN is only program memory.

(b) Online change performed during boot run

When writing during RUN is executed, the boot source program is not changed.

Write the contents of program memory to standard ROM before the PLC power-off or the CPU module reset after writing during RUN.

(c) Number of steps enabled for online change at once

A maximum of 512 steps can be written at once during RUN.

(d) Changing the "allocate memory for online change" for online change

The following explains the precautions for changing the "allocate memory for online change" for online change.

1) The allocate memory for online change

A program file has steps secured for online change to support online change that changes the program file capacity.
The program file capacity is the sum of the created program capacity and "allocate memory for online change".

2) When program file capacity increases from the secured capacity

If the capacity secured for the program file capacity (capacity including the allocate memory for online change) is exceeded at the time of online change, the allocate memory for online change can be re-set for online change.
Hence, online change can be executed when the user memory area has a free area.

3) Scan time increased when allocate memory for online change are set again

The scan time increases, when the online change reserve step is re-set in online change.
For increased scan time, refer to Section 10.1.3.

(e) Instructions do not operate normally at online change

When online change is performed, the following instructions do not operate normally.

- Trailing edge instruction
- Leading edge instruction

1) Trailing edge instruction

The trailing edge instruction is executed when the instruction is in a writing range even the execution condition(ON → OFF) is not established at the completion of online change.

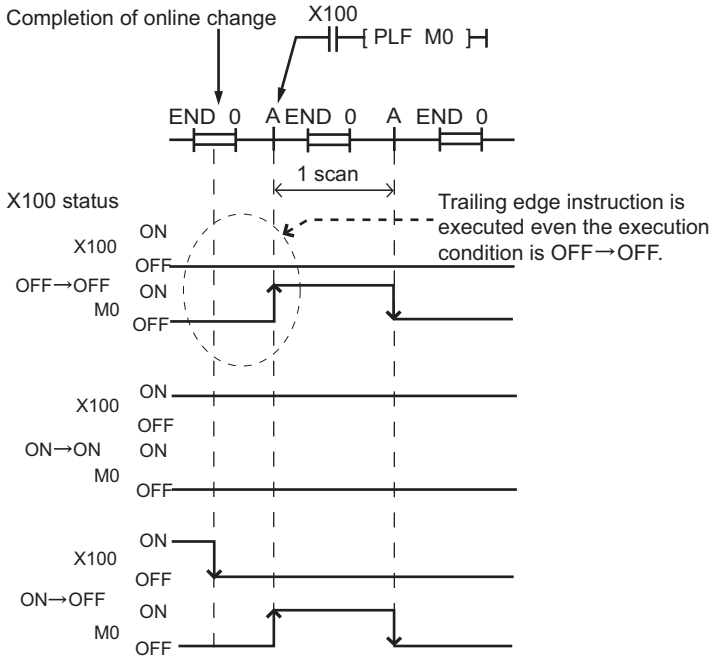


Diagram 6.27 Trailing edge instruction operation

The corresponding instructions are LDF,ANDF,ORF,MEF,PLF.

2) Leading edge instruction

The leading edge instruction is not executed when the instruction is in a writing range even the execution condition(OFF → ON) is established at the completion of online.

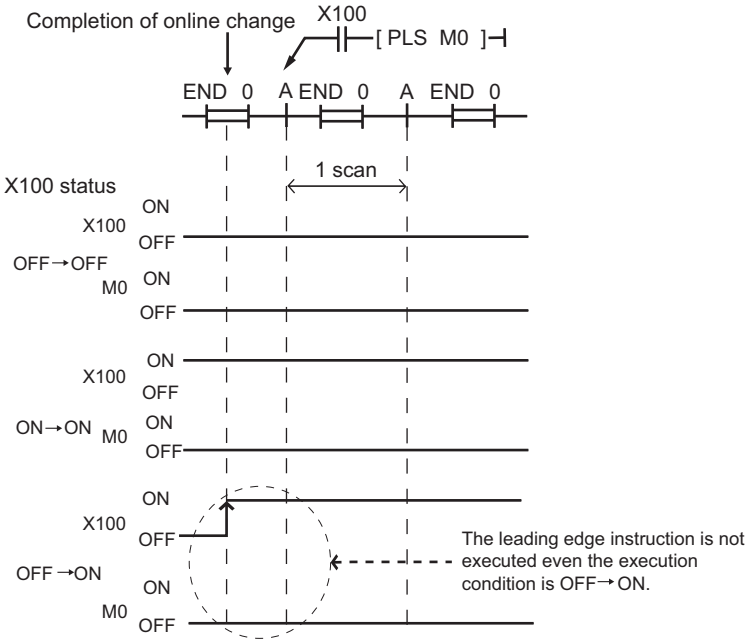


Diagram 6.28 Leading edge instruction operation

The corresponding instructions are PLS,□P.

6.15 Watchdog Timer (WDT)

(1) Definition of Watchdog Timer (WDT)

The watchdog timer is an internal sequence timer to detect CPU module hardware and sequence program error.

(2) Watchdog Timer Setting and Reset

(a) Watchdog timer setting

The watchdog timer setting can be changed at the "PLC RAS" tab screen in the "(PLC) Parameter" dialog box.
The default value of the watchdog timer is 200 ms.
The setting range is 10 to 2000 ms (in 10ms units).

(b) Watchdog timer resetting

CPU module resets the watchdog timer during the END processing.

- When the END instruction is executed within the set value of the watchdog timer in the sequence program and the CPU module is operating correctly, the watchdog timer does not time out.
- When the scan time of a sequence program is extended due to the CPU module hardware error, and END instruction cannot be executed within the set watchdog timer value, the watchdog timer times out.

(3) When watchdog timer expires

When the watchdog timer expires, a watchdog timer error occurs.
The CPU module responds to the watchdog timer error as follows:

1) The CPU module turns off all outputs.
2) The front-mounted "RUN" LED turned off, and the "ERR." LED starts flicking.
3) SM0, SM1 turns ON and the error code 5001 ("WDT ERROR") is stored into SD0.

(4) Precautions

(a) Watchdog timer error

An error of 0 to 10 ms occurs in the measurement time of the watchdog timer. Set the watchdog timer for a desired value by taking such an error into account.

POINT

1. The scan time is the time taken for the execution of the sequence program, starting from step 0 and ending at step 0.
   The scan time is not the same for each scan, which differs according to the execution or non-execution of the instructions used in the program.
2. To execute at the same scan time at every scan, use the constant scan function. (☞ Section 6.9)

6.16 Remote password

(1) Definition

Remote password is a function to prevent an illegal access to the CPU module by users in remote locations.

If a remote password is set, a remote password check is performed when the CPU module is accessed by users in remote locations.

(2) Flow from remote password setting to reflection

Set a remote password using GX Developer and then write it to the CPU module. (☞ (6) in this section)

The remote password is transferred to the modules that accept remote password setting (☞ (3) in this section) when the programmable controller is powered OFF→ON (at power ON) or the reset operation of the CPU module is performed (at reset).

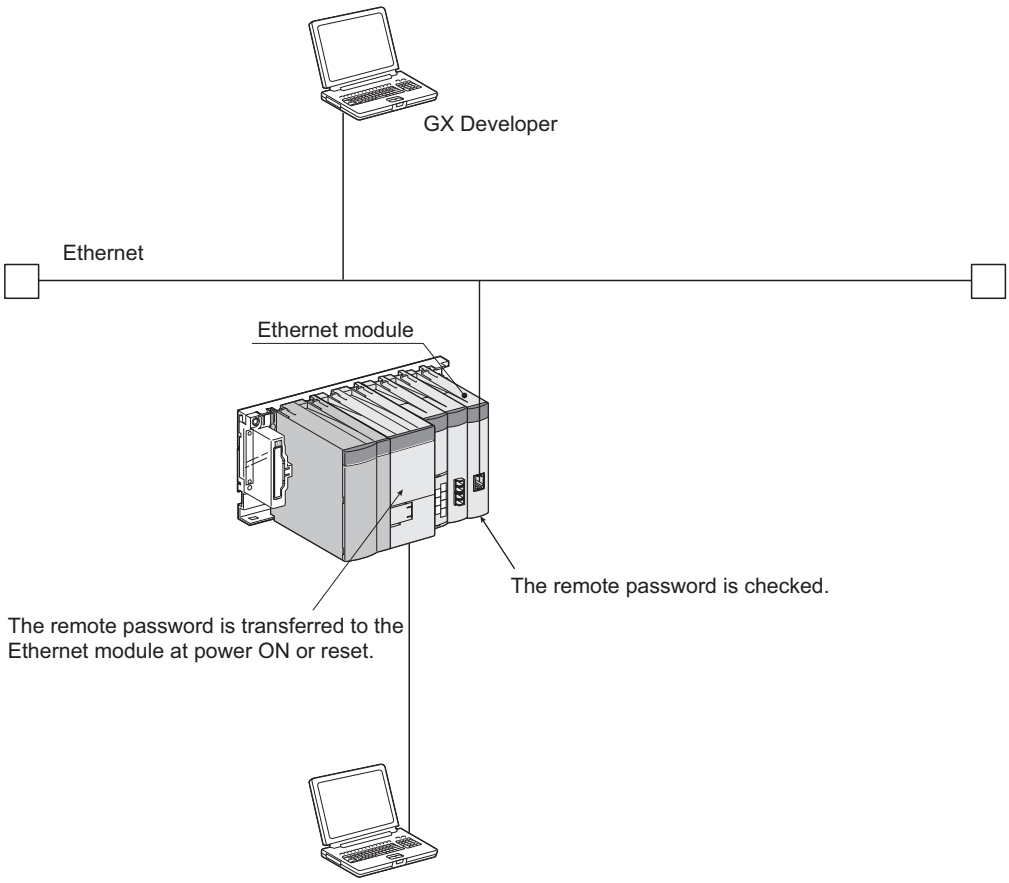


Diagram 6.29 Overview of remote password

(3) Modules that support remote password setting

The module that support remote password setting is Ethernet module only.

(4) Remote password lock/unlock processing

The remote password set for the Ethernet mSodule can be unlocked via Ethernet. When the remote password is matched, an access to the CPU module is enabled.

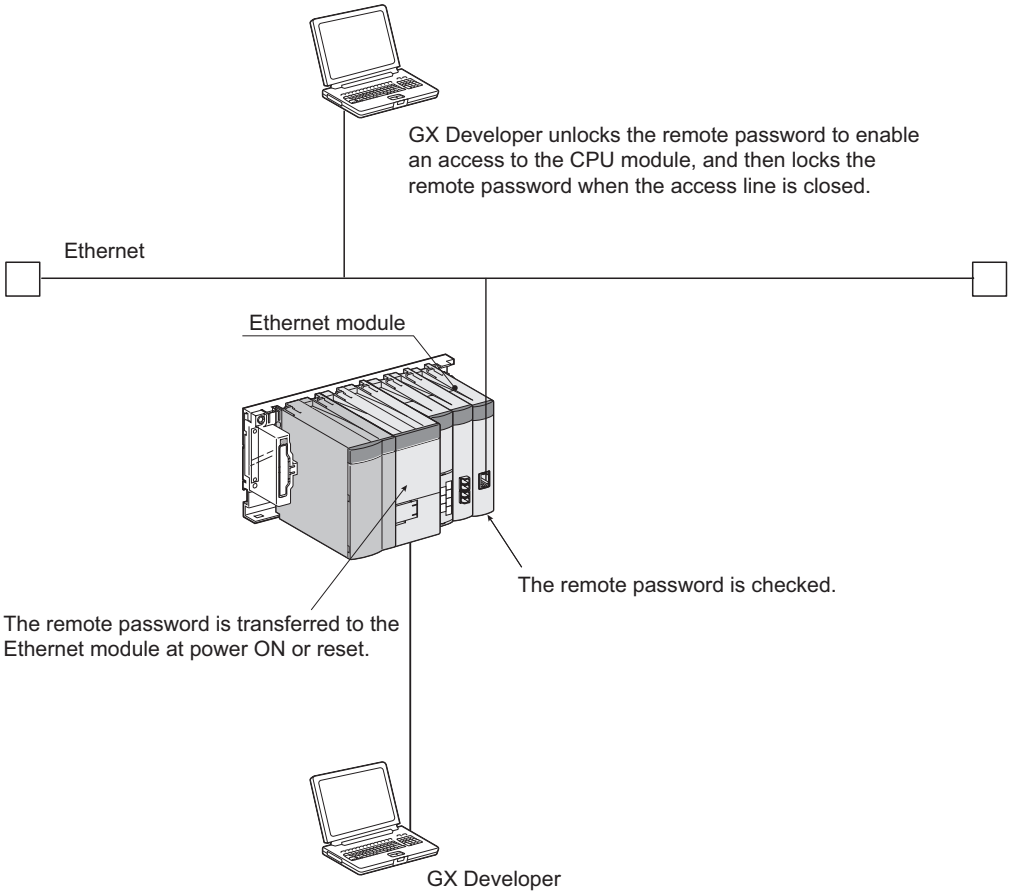


Diagram 6.30 Outline of remote password lock/unlock processing performed for Ethernet module

(5) Number of remote password-set modules

The number of remote password-set modules is only one.

(6) Remote password setting, changing, and deleting procedures

(a) Setting the remote password

- In the Project data list tree of GX Developer, select [Parameter] → [Remote password] to display the Remote password setting screen.
  Set the remote password.

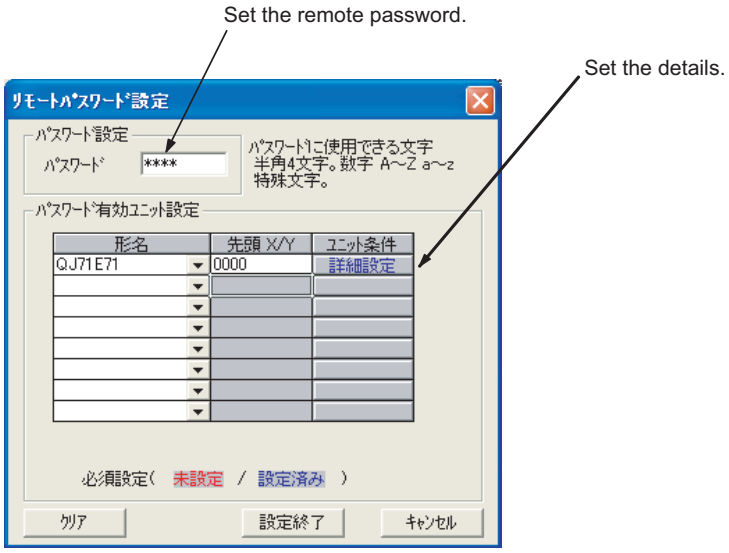


Diagram 6.31 Remote password setting screen

Table6.19 Setting items on Remote password setting screen

Item			Description	Setting range
Password settings			Enter the remote password.	Within 4 characters (alphabets, numerals, symbols)
Password active module settings		Model name	Select the module model.	QJ71E71
		Start XY	Set the start address of the module.	0000_H to $03E0_H$
Detail			------	------
	User connection No.		Set the user connection number.	Connection 1 to 16
	System connection	Auto open UDP port	Specify the remote password valid port.	------
		GX Developer transmission port (TCP/IP)		
		GX Developer transmission port (UDP/IP)		

- Connect GX Developer to the CPU module.
  Write the set remote password to the CPU module.
- The remote password becomes valid for the module when the programmable controller is powered OFF → ON (at power ON) or the reset operation of the CPU module is performed (at reset).

(7) Changing the remote password

- Change the password and write the new password to the CPU module.
- Deleting the remote password.

(8) Click the Clear button to delete the set password.

- In the Project data list tree of GX Developer, select [Parameter] → [Remote password] to display the Remote password setting screen.
- Click the Clear button to delete the set password.
- Write the remote password using GX Developer.

6.17 CPU Module System Display by GX Developer

After GX Developer is connected to the CPU module, the following items can be checked in the system monitor.

- Installed status
- Parameter status
- Module's detailed information
- Product information

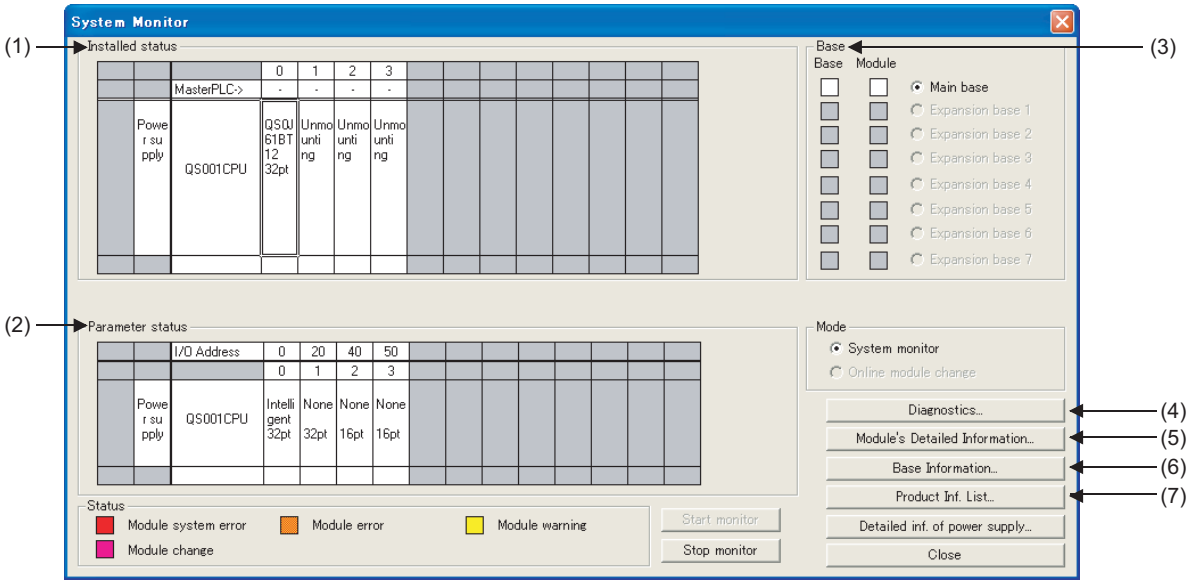


Diagram 6.32 System monitor screen

(1) Installed status

The names and number of modules mounted on the base unit can be checked.
"Not mounted" is displayed for slots in which no module is mounted.
For slots for which "empty" is set in the PLC parameter I/O assignment, even if a module is mounted, the module name is not displayed.

(2) Parameter status

The I/O numbers, module type, and points for the each slot of the base unit can be checked.
If an assignment error or empty 0 is displayed for the operation status, the PLC parameter I/O assignment is different from the loading status.
Match the PLC parameter I/O assignments to the loading status.

(3) Base

The state of the mounted modules and the base unit can be checked.
When even one error module exists, the module column becomes the state color for that module.

(4) Diagnostics

This function is used to confirm the status of the CPU module and errors.

(5) Module's detailed information

This is used to check detailed information on the selected module.
For detailed information on intelligent function modules, refer to the manual for each intelligent function module.

(6) Base information

Enables the "Overall Information" and "Base Information" to be confirmed.

(a) Overall information

Enables the number of base units in use and the number of modules mounted on the base units to be confirmed.

(b) Base information

Enables the base name, the number of slots, the base type and the number of modules mounted onto the base for the selected base unit to be confirmed.

(7) Product Information List

Enables the individual information for mounted CPU modules and intelligent function modules to be confirmed (type, series, model, number, head I/O, control PLC, serial No., function version.)

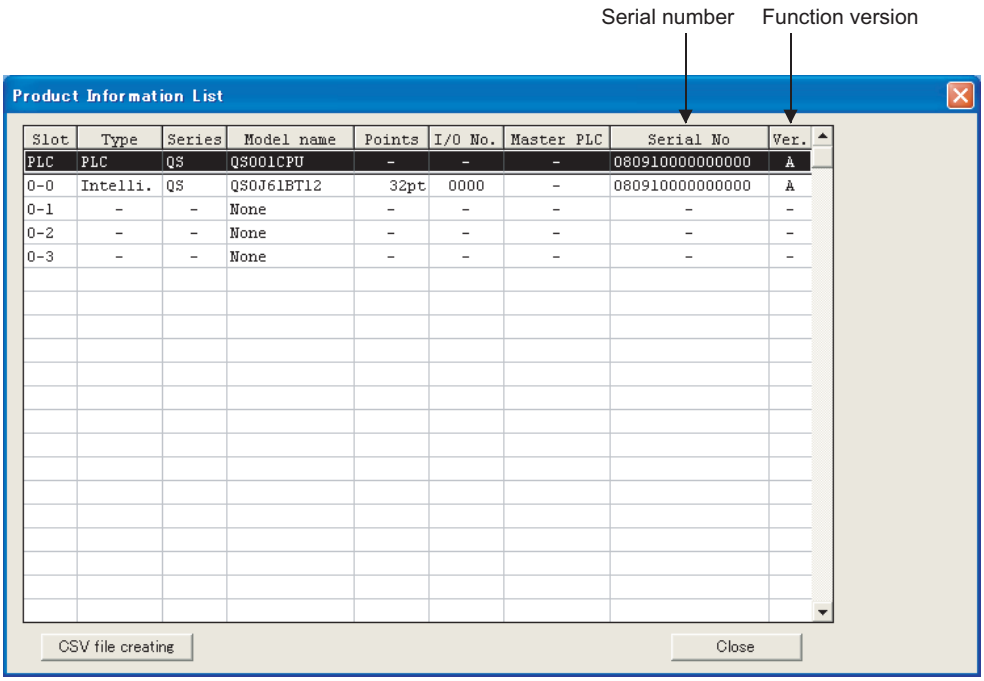


Diagram 6.33 Product information list

Remark

Refer to the following manual for details of the system monitor of GX Developer.
☞GX Developer Operating Manual

6.18 LED Display

The LEDs on the front of the CPU module show the CPU module operation status.

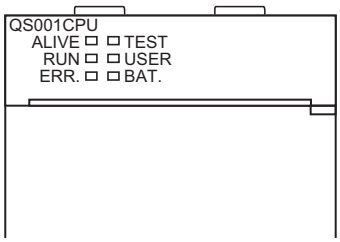


Diagram 6.34 LED on CPU module front

Remark

Refer to the following manual for details of the LED indications.

☞QSCPU User's Manual (Hardware Design, Maintenance and Inspection)

6.18.1 Method to turn off the LED

The LED that is on can be turned off by the following operation. (Except for the reset operation.)

Table6.20 LED turning off method

Method to Turn LED Off	Applicable LED			
	ERR.	USER	BAT.	BOOT
After the cause of error is resolved, cancel the error by operating the special relay SM50 and special register SD50. (Only for the operation continue errors.) *1	○	○	○	×

○ : Valid × : Invalid

* 1 : Special relay and special register contents

SM50•••When switch from OFF to ON, the error is canceled for the error code stored in the SD50.

SD50•••The error code for the error to be canceled is stored.

Refer to the following manual for the error codes.

☞QSCPU User's Manual (Hardware Design/Maintenance and Inspection)

CHAPTER7 COMMUNICATION WITH INTELLIGENT FUNCTION MODULE

7.1 Communication with CC-Link Safety master module

Communication between the CPU modules and the CC-Link Safety master module is executed by auto refresh.
To execute link refresh, the refresh parameters need to be set on the Ethernet/CC IE/MELSECNET setting of Network parameter in GX Developer.
For details on the Ethernet/CC IE/MELSECNET setting items, refer to Section 8.2.

Remark

For details on the Ethernet/CC IE/MELSECNET setting items of Network parameter, refer to the following manuals.
☞ CC-Link Safety System Master Module User's Manual

7.2 Communication with CC-Link IE Controller Network Module or MELSECNET/H Module

Communication between the CPU module and the CC-Link IE controller network module or MELSECNET/H module is performed by link refresh.
To execute link refresh, the refresh parameters need to be set on the *** of Network parameter in GX Developer.
For details on the network parameter setting items, refer to Section 8.2.

POINT

When a CC-Link IE controller network module or MELSECNET/H module is used with a safety CPU module, the functions that can be used are restricted.
For details on restrictions, refer to Appendix 4 and 5.

Remark

For details on the *** of Network parameter, refer to the following manuals.

☞ CC-Link IE Controller Network Reference Manual

☞ Q Corresponding MELSECNET/H Network System Reference Manual (PLC to PLC Networks)

7.3 Communication with Ethernet Module

Communication between the CPU module and the Ethernet module is performed by dedicated instructions. For details on the dedicated instructions, refer to Appendix 7.

POINT

When an Ethernet module is used with a safety CPU module, the functions that can be used are restricted.
For details on the restrictions, refer to Appendix 6.

7.4 Communication using intelligent function module dedicated instructions

(1) Definition

Intelligent function module dedicated instruction is an instruction for realizing easy programming to use the functions of intelligent function modules.

(2) Processing of intelligent function module dedicated instructions

Some intelligent function module dedicated instructions can specify a completion device.

The completion device turns ON for one scan after the instruction execution is completed.

If multiple intelligent function module dedicated instructions are used for the same intelligent function module, create a program so that dedicated instructions are executed one by one, following the completion device of each instruction tuning ON.

(3) Precautions

(a) Changing the operation status before the completion device turns ON

f the operation status of the CPU module is switched from RUN to STOP before the completion device turns ON after an intelligent function module dedicated instruction execution, the completion device turns ON after the status is switched to RUN again and the operation is performed for one scan.

(b) Supported instructions

For instructions supported in the safety CPU module, refer to Appendix 7.

Remark

For details on intelligent function module dedicated instructions and completion devices, refer to the manual of an intelligent function module used.

CHAPTER8 PARAMETERS

This chapter explains the parameters need to be set when the programmable controller system is configured.

(1) Parameter types

There are three types of parameters for the CPU module.

- PLC parameters (☞ Section 8.1)
  This parameter is set when the programmable controller is used stand-alone.
- Network parameters (☞ Section 8.2)
  This parameter is set when the CC-Link Safety master module, CC-Link IE controller network module, MELSECNET/H module or Ethernet module is used in the programmable controller system.
- Remote password
  This parameter is set when the remote password function of the Ethernet module is used.

(2) Parameter setting method

Set the parameters by GX Developer.
Refer to the following manual for the setting operation on GX Developer.
For details on basic operations using GX Developer, refer to the following manual.
☞ GX Developer Operating Manual

POINT

In GX Developer, since the functions are not available to the CPU module being used, it is not necessary to set the setting items displayed in gray (cannot be selected) that are not explained in this section.

Remark

- When an error occurs in the parameter setting, the corresponding parameter No. indicated in the tables of this chapter is stored into the special register (SD16 to 26).
  Refer to Appendix 3 for the list of the parameter No.
- Refer to CHAPTER 11 for the parameter reflection procedure.

8.1 PLC Parameters

This section shows the list of PLC parameters and explains the details of each parameter setting item.

(1) PLC name

Set the label and comment of the used CPU module.
Setting the label and comment in the PLC name does not affect the actual operation.

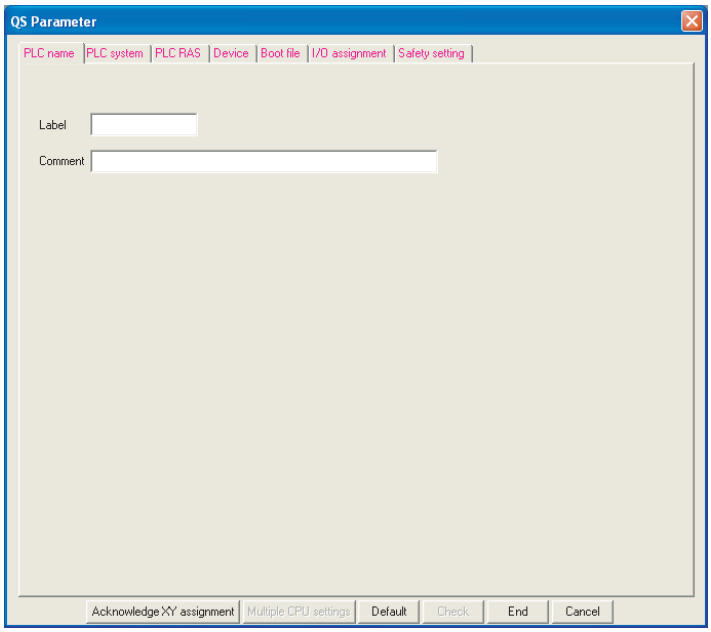


Diagram 8.1 PLC name

Table8.1 PLC name list

Item	Parameter No.	Description	Setting range	Default value	Reference
Label	0000H	Set the label (name, application) of the CPU module.	Max. 10 characters	No setting	----
Comment	0001H	Set the comment of the CPU module label.	Max. 64 characters	No setting	----

(2) PLC system

Make the settings necessary to use the CPU module.
The parameters may be the default values to perform control.

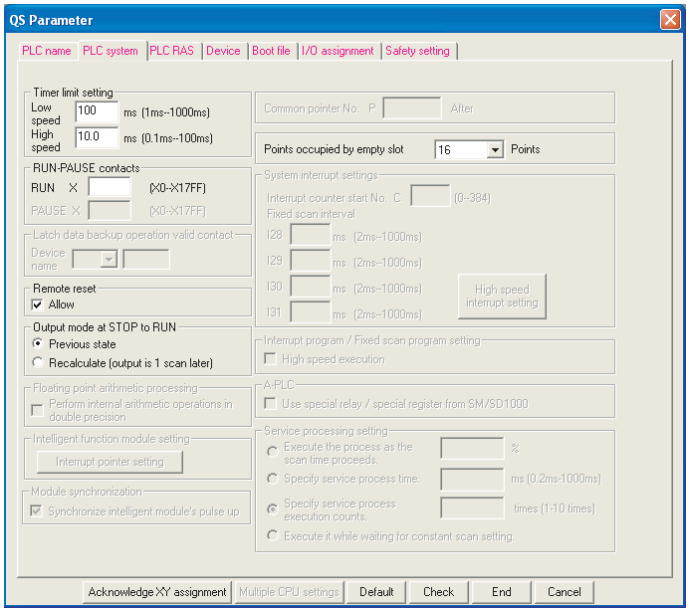


Diagram 8.2 PLC system

Table8.2 PLC system setting list

Item		Parameter No.	Description	Setting range	Default value	Reference
Timer limit setting	Low speed	1000H	Set the time limit of the low speed timer/high speed timer.	1ms to 1000ms (1ms unit)	100ms	Section 9.2.8
	High speed			0.1ms to 100.0ms (0.1ms unit)	10.0ms	Section 9.2.8
RUN-PAUSE contact		1001H	Set the contact that controls RUN of the CPU module.	X0 to 17FF	No setting	Section 6.12.1
Remote reset		1002H	Set enable/disable of remote reset operation from GX Developer.	Enable/Disable	Enable	Section 6.12.2
Output mode at STOP to Run		1003H	Set the output (Y) status when the STOP status is switched to the RUN status.	Provide output (Y) status before STOP/Clear output (Y) (output one scan later)	Provide output (Y) status before STOP	Section 6.10
Points occupied by empty slot		1007H	Set the number of empty slots on the main base unit.	0 points/16 points/32 points/64 points/128 points/256 points/512 points/1024 points	16 points	Section 4.2.1

(Continued on next page)

(3) PLC RAS

Make the various settings for the RAS function.

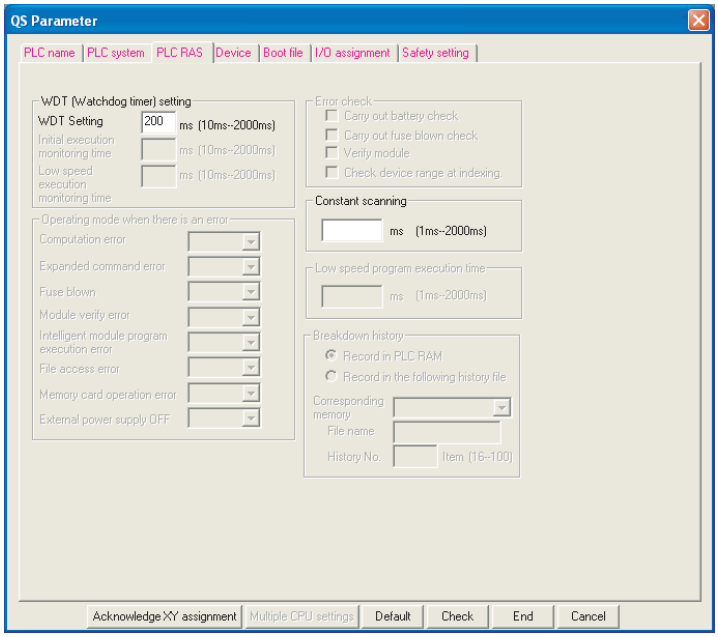


Diagram 8.3 PLC RAS

Table8.3 PLC RAS list

Item		Parameter No.	Description	Setting range	Default value	Reference
WDT (watchdog timer) setting	WDT setting	3000H	Set the watchdog timer value of the CPU module.	10ms to 2000ms (10ms unit)	200ms	Section 3.2
Constant scanning		3003H	Set the constant scan time.	1ms to 2000ms (1ms unit)	No setting	Section 6.9

(4) Device

Set the number of used points and latch range for each device.

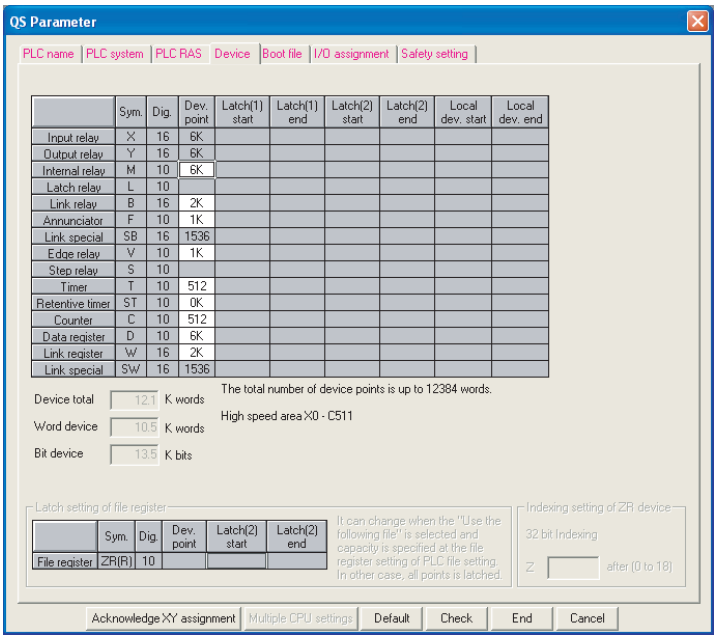


Diagram 8.4 Device

Table8.4 Device list

Item	Parameter No.	Description	Setting range	Default value	Reference
Device points	2000H	Set the number of used device points according to the system.	X (6k points), Y (6k points), 1536, SB (1536 points) and SW (1536 points) are fixed. Can be set within the range of total 12384 words, including the above number of points (2400 words). • 1 device: Max. 32k points	X : 6k points Y : 6k points M : 6k points B : 2k points F : 1k points SB : 1536 points V : 1k points T : 512 points ST : 0k points C : 512 points D : 6k points W : 2k points SW : 1536 points	Section 9.1

(5) Boot file

Set whether a boot from the standard ROM will be executed or not.

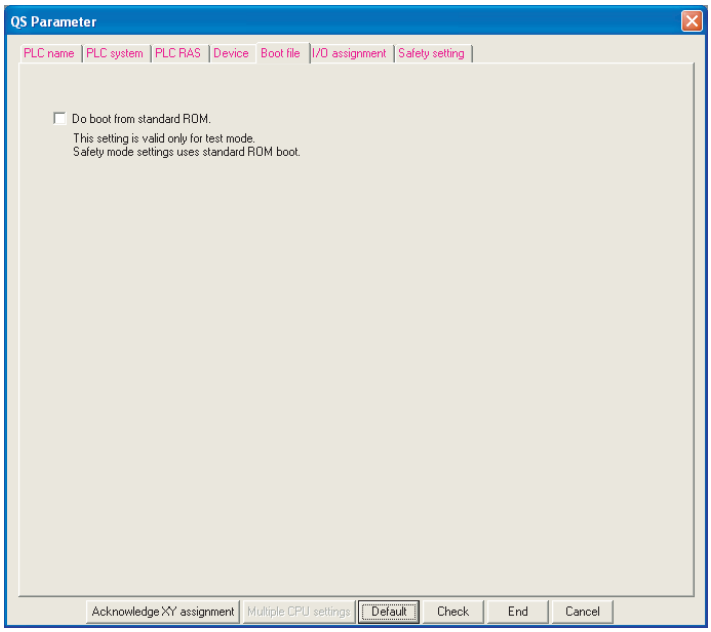


Diagram 8.5 Boot file

Table8.5 Boot file list

Item	Parameter No.	Description	Setting range	Default value	Reference
Boot file	7000H	At TEST MODE, set whether to boot from the standard ROM or not.	Do not execute boot/Execute boot	Do not execute boot	Section 5.1.4

POINT

In SAFETY MODE, boot operation is executed regardless of the boot file settings.

(6) I/O assignment

Set the mounting status of each module in the system.

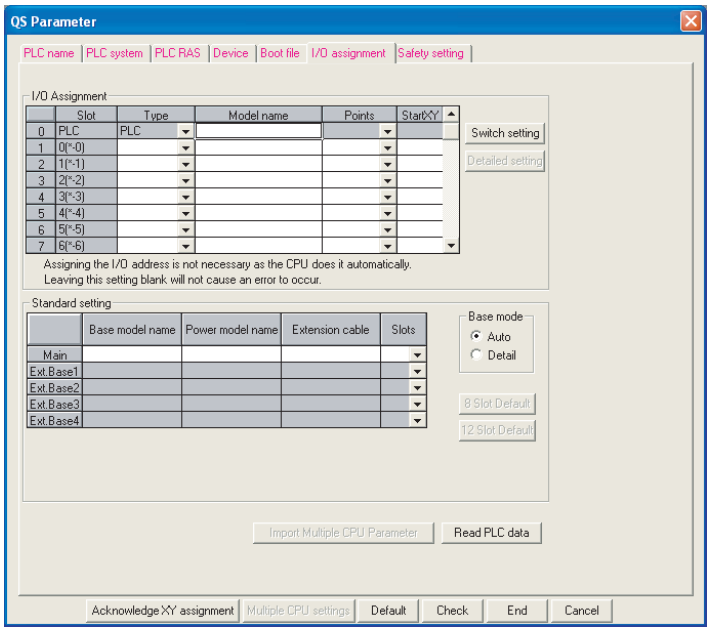


Diagram 8.6 I/O assignment

Table8.6 I/O assignment list

Item		Parameter No.	Description	Setting range	Default value	Reference
I/O assignment	Type	0400H	Set the type of the mounted module.	Empty/intelli.	No setting	Section 4.3
	Model name		Set the model name of the mounted module. (User memo. Not used for the CPU module.)	16 characters	No setting	
	points		Set the number of points of each slot.	0 points/16 points/32 points/ 48 points/64 points/ 128 points/256 points/ 512 points/1024 points	No setting	
	Start XY (Start I/O No.)		Set the start I/O number of each slot.	0H to 3F0H	No setting	
Standard setting	Base model name	0401H	Set the model name of the used main base unit. (User memo. Not used for the CPU module.)	16 characters	No setting	Section 4.4
	Power model name		Set the model name of the power supply module mounted on the main base unit. (User memo. Not used for the CPU module.)	16 characters	No setting	
	Extension cable		Set the extension cable model name. (User memo. Not used for the CPU module.)	16 characters	No setting	
	Slots		Set the number of slots of the main base unit.	4	No setting	
Switch setting		0407H	Unusable	Unusable	----	----

(7) X/Y assignment

Check the data set on the I/O assignment tab, Ethernet/CC IE/MELSECNET setting, and CC-Link setting.

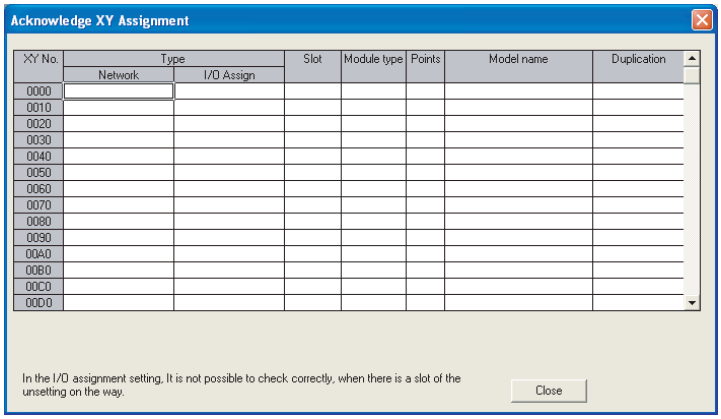


Diagram 8.7 X/Y assignment

Table8.7 X/Y assignment list

Item	Parameter No.	Description	Setting range	Default value	Reference
X/Y assignment	----	The data set in the I/O assignment tab, Ethernet/CC IE/ MELSECNET setting, and CC-Link setting can be checked.	----	----	----

(8) Safety settings

Set the operation settings in continuous RUN in test mode and for remote station error status.

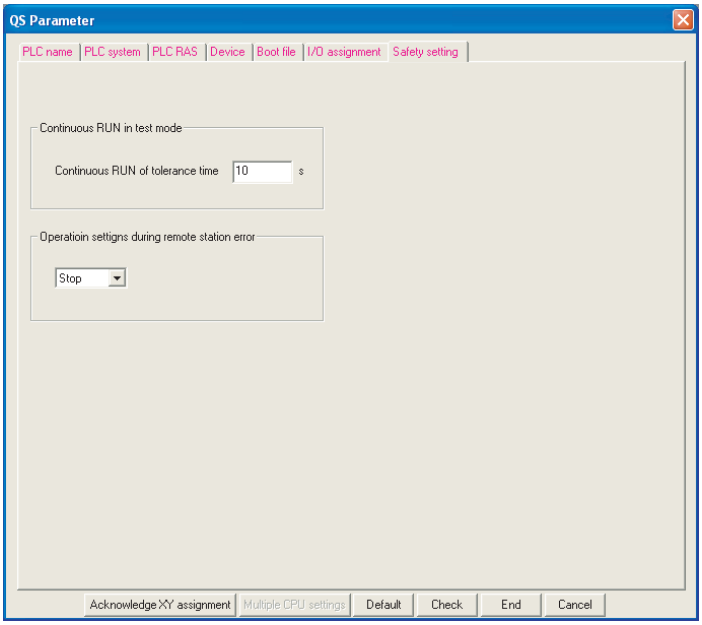


Diagram 8.8 Safety settings

Table8.8 Safety settings

Item	Parameter No.	Description	Setting range	Default value	Reference
Continuous RUN in test mode	6000H	Set the continuous RUN tolerance time in TEST MODE.	1 second to 86400 seconds	10 seconds	Section 6.5
Operation settings during remote station error status		Set the operation settings for remote station errors	Stop/Continue	Stop	----

8.2 Network Parameters

This section shows the list of network parameters and explains the details of each parameter setting item.

■ **Definition of mn, M, N in the "Parameter No." column**

mn, M, N in the "Parameter No." column in this section indicate the following.

mn : Indicates a "start I/O No. ÷ 16" value.
N : Indicates the module number.
M : Indicates the network type.

Table8.9 Network type for CC-Link IE controller network and MELSECNET/H setting (☞ (1) (2) in this section)

M	Network type
2_H	CC IE Control (Normal station), MELSECNET/10 mode (Normal station), MELSECNET/H mode (Normal station), MELSECNET/H. Extended mode (Normal station)

Table8.10 Network type for CC-Link setting (☞ (3) in this section)

M	Network type
0_H	Master station

(1) CC-Link IE controller network, MELSECNET/H setting

The network parameters for the CC-Link IE controller network and MELSECNET/H are set.

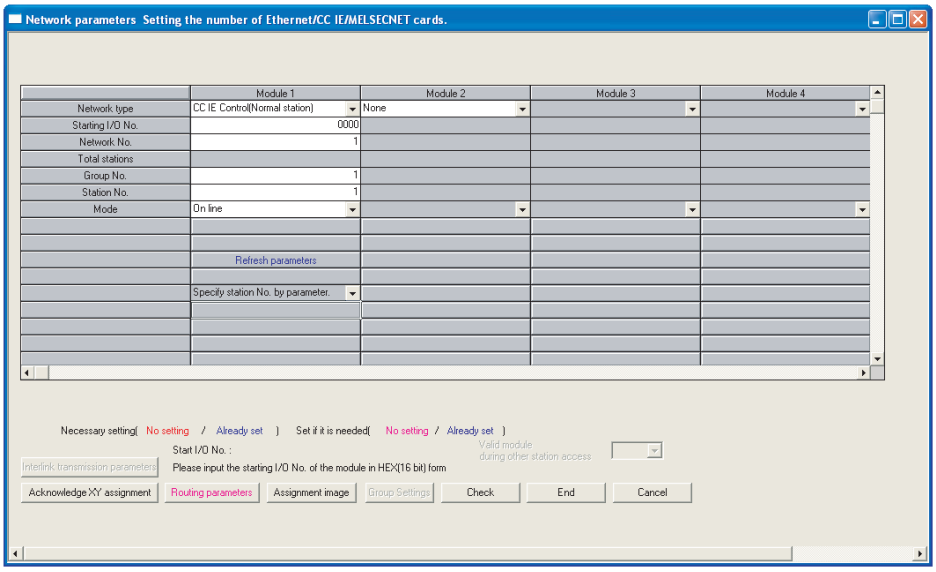


Diagram 8.9 Setting the number of Ethernet/CC IE/MELSECNET screen (for CC-Link IE controller network setting)

Table8.11 List of CC-Link IE controller network, MELSECNET/H setting items

Item	Parameter No.	Description	Setting range	Default value	Reference
Nunber of MELSECNET	5000H	Sets the network parameters for the CC-Link IE controller network and MELSECNET/H.	Refer to the manuals of the CC-Link IE controller network and MELSECNET/H.	----	----
Starting I/O No.	5NM0H				
Network No.					
Group No.	05mnH				
Station No. *1	5NM0H				
Mode	5NM0H				
Refresh parameters	5NM1H				
Routing parameters	5003H				

* 1: Settable only for the CC-Link IE controller network.

(2) Ethernet setting

The network parameters for the Ethernet are set.

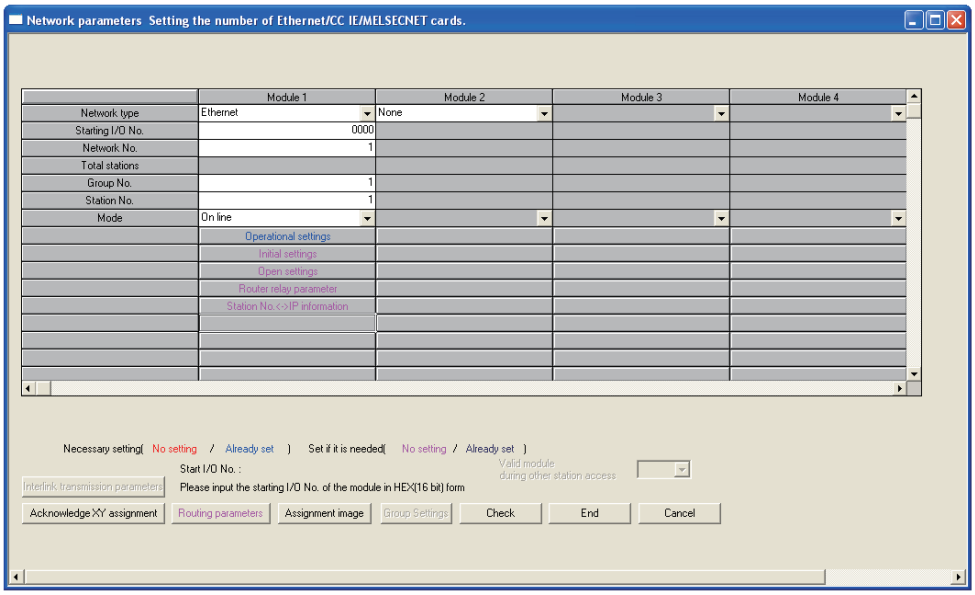


Diagram 8.10 Setting the number of Ethernet/CC IE/MELSECNET screen (for Ethernet setting)

Table8.12 List of Ethernet setting items

Item	Parameter No.	Description	Setting range	Default value	Reference
Number of Ethernet	9000H	Sets the network parameters for the Ethernet.	Refer to the Ethernet manual.	----	----
Starting I/O No.	9N00H				
Network No.					
Group No.	09mnH				
Station No.	9N00H				
Mode					
Operational settings					
Initial settings	9N01H				
Open settings	9N02H				
Router relay parameter	9N03H				
Station No.<->IP information	9N05H				
Routing parameters	9N04H				

(3) CC-Link setting

Set the CC-Link parameters.

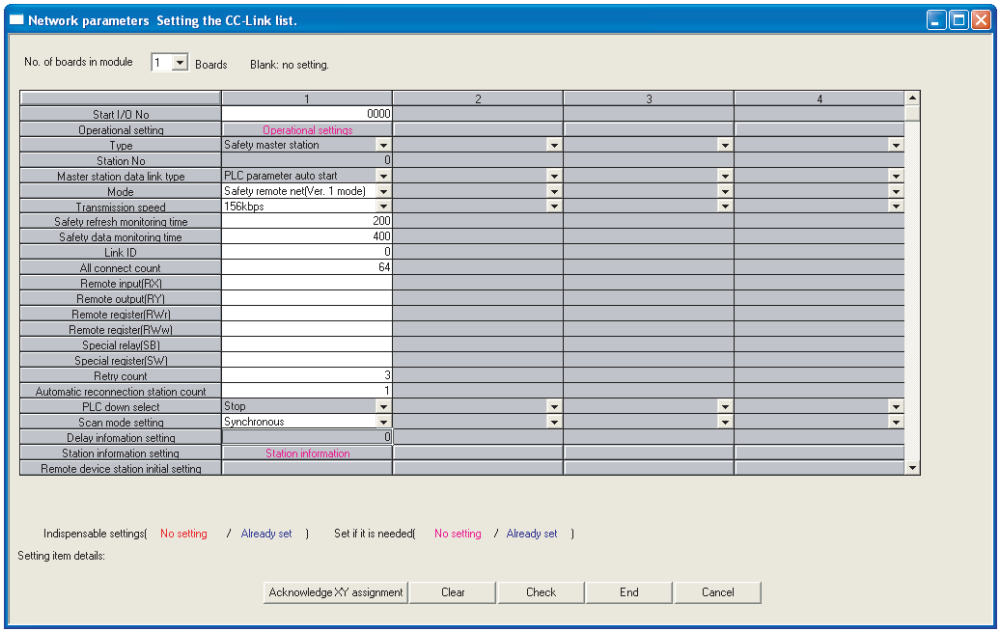


Diagram 8.11 Network parameters Setting the CC-Link list

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Table8.13 Network parameters Setting the CC-Link list

Item	Parameter No.	Description	Setting range	Default value	Reference
Number of CC-Link	C000H	Set the CC-Link safety parameters.	Refer to the CC-Link safety Manual.	----	----
Starting I/O No.	CNM2H				
Operational settings					
Mode setting					
Transmission settings					
Safety refresh monitoring time					
Safety data monitoring time					
Link ID					
All connect count					
Remote input (RX)	CNM1H				
Remote output (RY)					
Remote register (RWr)					
Remote register (RWw)					
Special relay (SB)					
Special register (SW)					
Retry count	CNM2H				
Automatic reconnection station count					
Scan mode setting					
Station information setting					

8.3 Remote Password

This section shows the list of remote password-related parameters and explains the details of each parameter setting item.

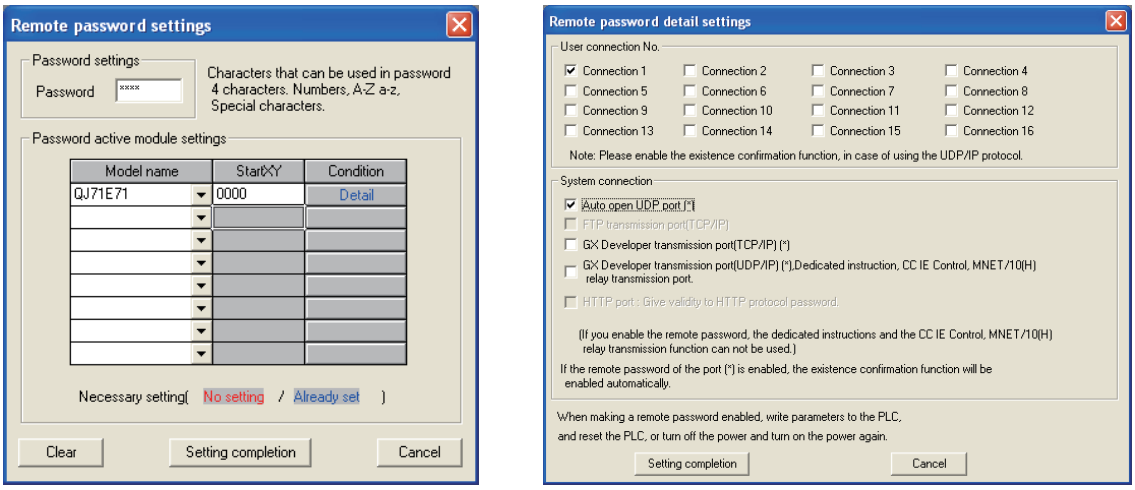


Diagram 8.12 Remote password setting screens

The remote password for the Ethernet module is set.

Table8.14 List of remote password setting items

Item		Parameter No.	Description	Setting range	Default value	Reference
Password settings		----	Enter the remote password.	Within 4 characters (alphabets, numerals, symbols)	----	Refer to the Ethernet manual.
Password active module settings	Model name	----	Select the module model of the remote password check target.	QJ71E71	----	
	Start XY	----	Set the start address of the module targeted for the remote password check.	0000_H to $03E0_H$	----	
Remote password detail settings		----	Set the remote password details in the QJ71E71.	----	----	
	User connection No.	----	Set the user connection number.	Connection 1 to 16	----	
	System connection	----	Specify the remote password valid port of the system connection.	Specify the remote password valid port. • Auto open UDP port • GX Developer transmission port (TCP/IP) • GX Developer transmission port (UDP/IP), Dedicated instruction, CC IE Control, MELSECNET/10(H) relay transmission port	----	

CHAPTER9 DEVICE EXPLANATION

This chapter describes all devices that can be used in the CPU module.

9.1 Device List

The names and data ranges of devices which can be used in the CPU module are shown in Table9.1.

Table9.1 Device List

Class	Type	Device Name	Default Values			Parameter Designated Setting Range	Reference Section
			Number of Points	Range Used			
Internal user devices	Bit devices	Input	6144 points	X0 to 17FF	Hexadecimal	Changeable within 12384 words.*2	Section 9.2.1
		Output	6144 points	Y0 to 17FF	Hexadecimal		Section 9.2.2
		Internal relay	6144 points	M0 to 6143	Decimal		Section 9.2.3
		Annunciator	1024 points	F0 to 1023	Decimal		Section 9.2.4
		Edge relay	1024 points	V0 to 1023	Decimal		Section 9.2.5
		Link relay	2048 points	B0 to 7FF	Hexadecimal		Section 9.2.6
		Special link relay	1536 points	SB0 to 5FF	Hexadecimal		Section 9.2.7
	Word devices	Timer*1	512 points	T0 to 511	Decimal		Section 9.2.8
		Retentive timer*1	0 points	--	Decimal		
		Counter*1	512 points	C0 to 511	Decimal		Section 9.2.9
		Data register	6144 points	D0 to 6143	Decimal		Section 9.2.10
		Link register	2048 points	W0 to 7FF	Hexadecimal		Section 9.2.11
		Link special register	1536 points	SW0 to 5FF	Hexadecimal		Section 9.2.12
Internal system devices	Bit devices	Special relay	5120 points	SM0 to 5119	Decimal	Unchangeable	Section 9.3.1
	Word devices	Special register	5120 points	SD0 to 5119	Decimal		Section 9.3.2
Nesting	--	Nesting	15 points	N0 to 14	Decimal	Unchangeable	Section 9.4
Constants	--	Decimal constants	K-2147483648 to 2147483647				Section 9.5.1
		Hexadecimal constants	H0 to FFFFFFFF				Section 9.5.2

* 1 : For the timers, retentive timers and counters, their contacts and coils are bit devices and their current values are word devices.
* 2 : Can be changed in the PLC parameter dialog box of GX Developer. (Except the input, output, step relay, link special relay and link special register.) (☞ Section 9.2)

9.2 Internal User Devices

(1) Definition

Internal user devices can be used for various user applications.
The "number of usable points" setting is designated in advance (default value) for internal user devices.
However, this setting can be changed at the "Device" tab screen in the "(PLC) Parameter" dialog box.

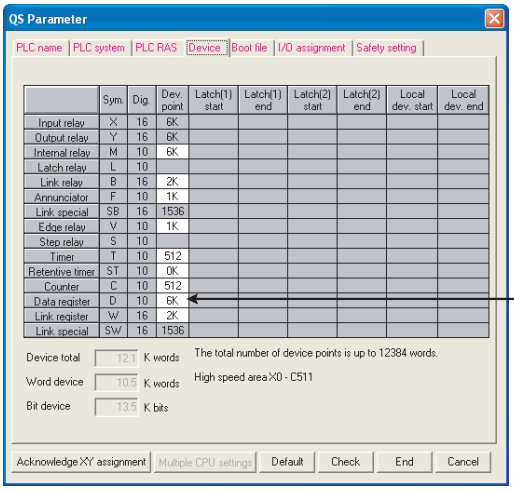


Diagram 9.1 Device in PLC parameter dialog box

(2) Internal user device setting range

The number of used points of internal user devices other than CPU module input (X), output (Y), link special relay (SB), or link special register (SW) can be changed within the range of 9.75k words with the PLC parameter device settings.
The following gires more information.

(a) Setting range

The number of device points is designated in 16-point units.
A maximum of 32 k points can be designated for one device.
1 point is calculated as 2 points (1 for coil, 1 for contact) for the timer, retentive timer, and counter.

(3) Memory capacity

Use the following expression to obtain the memory capacity of an internal user device.

(Bit device capacity) + (Word device capacity) + (Timer, retentive timer and counter capacity) $\leq$ 12384 words

(a) For bit devices:

For bit devices, 16 points are calculated as 1 word.

$$\text{(Bit device capacity)} = \frac{\text{(Total number of points of X, Y, M, B, F, SB, V)}}{16} \text{ (words)}$$

(b) For timer (T) retentive timer (ST), and Counter (C):

For the timer, retentive timer, and counter, 16 points are calculated as 18 words.

$$\text{(Timer, retentive, counter capacity)} = \frac{\text{(Total number of points of T, ST, C)}}{16} \times 18 \text{ (words)}$$

(c) For word devices:

For data registers (D), link registers (W), and special register(SD), 16 points are calculated as 16 words.

$$\text{(Word device capacity)} = \frac{\text{(Total number of points of D, W, SD)}}{16} \times 16 \text{ (words)}$$

POINT

When the number of used points of internal user devices is changed with the PLC parameters, any sequence program created with the pre-change parameters cannot be used as it is.
When the number of used points of internal user devices is changed, write the parameters and sequence program to the CPU module.

(4) Device point assignment example

A device point assignment example is shown in Table9.2.

Table9.2 Device point assignment example

Device name	Symbol	Numeric notation	Number of device points*1*2		Restriction check			
			Number of points	Number	Capacity (Word)*3		Number of bit points*2	
Input relay	X	16	6k (6144) points	X0000 to 17FF	÷ 16	384 words	× 1	6144 points
Output relay	Y	16	6k (6144) points	Y0000 to 17FF	÷ 16	384 words	× 1	6144 points
Internal relay	M	10	8k (8192) points	M0 to 8191	÷ 16	512 words	× 1	8192 points
Link relay	B	16	1k (1024) points	B0000 to 03FF	÷ 16	64 words	× 1	1024 points
Annunciator	F	10	1k (1024) points	F0 to 1023	÷ 16	64 words	× 1	1024 points
Link special relay	SB	16	1.5k (1536) points	SB0000 to 05FF	÷ 16	96 words	× 1	1536 points
Edge relay	V	10	1k (1024) points	V0 to 1023	÷ 16	64 words	× 1	1024 points
Timer	T	10	1k (1024) points	T0 to 1023	$\times \frac{18}{16}$	1152 words	× 2	2048 points
Retentive timer	ST	10	1k (1024) points	ST0 to 1023	$\times \frac{18}{16}$	1152 words	× 2	2048 points
Counter	C	10	1k (1024) points	C0 to 1023	$\times \frac{18}{16}$	1152 words	× 2	2048 points
Data register	D	10	4k (4096) points	D0 to 4095	× 1	4096 words	--	
Link register	W	16	1k (1024) points	W0000 to 03FF	× 1	1024 words	--	
Link special register	SW	16	1.5k (1536) points	SW0000 to 05FF	× 1	1536 words	--	
Device total						11680 words (12384 words or less)		31232 points

* 1 : The hatched number of points is fixed. (Unchangeable)
* 2 : The maximum number of points of one device is 32k points.
* 3 : Enter the value that is obtained by multiplying (or dividing) the number of device points by the numeral indicated in the capacity (Word) field.

9.2.1 Input (X)

(1) Definition

Inputs transmit commands or data to the CPU module from an external device such as push-button switches, selector switches, limit switches, digital switches.

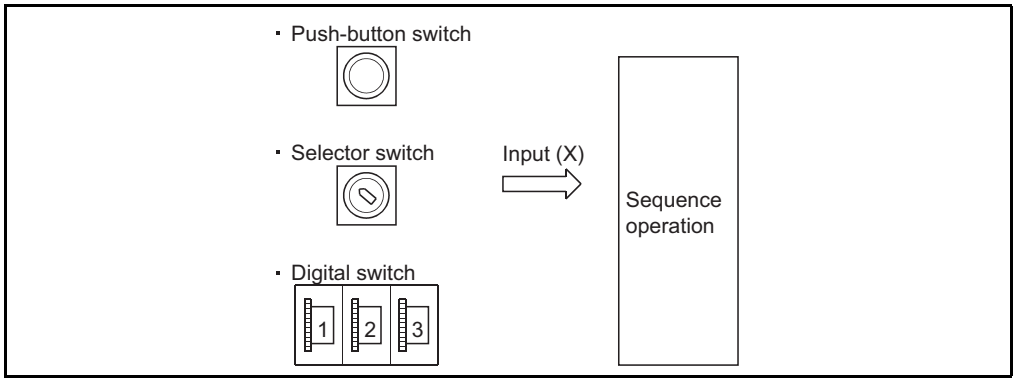


Diagram 9.2 Commands from external devices to CPU module

(2) Concept of input (X)

If the input point is the Xn virtual relay inside the CPU module, the program uses the Xn's N/O contact or N/C contact.

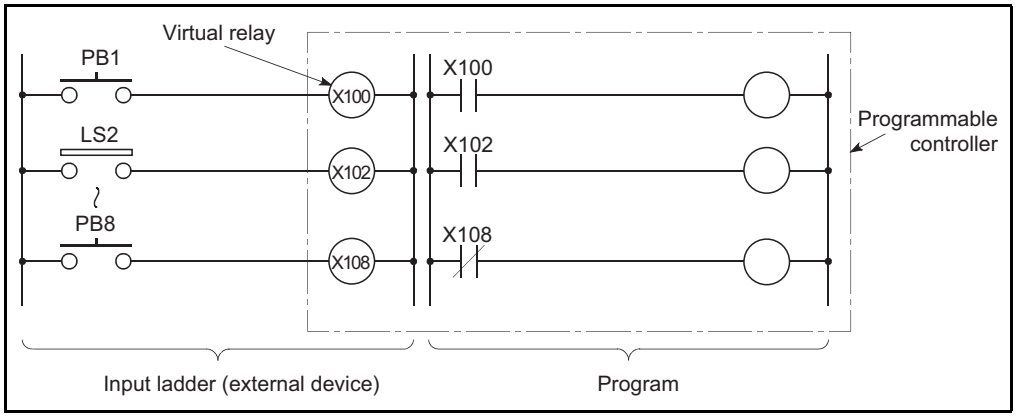


Diagram 9.3 Inputs(X)

(3) Number of used N/O and N/C contacts

There are no restrictions on the number of Xn N/O contacts and N/C contacts used in a program, provided the program capacity is not exceeded.

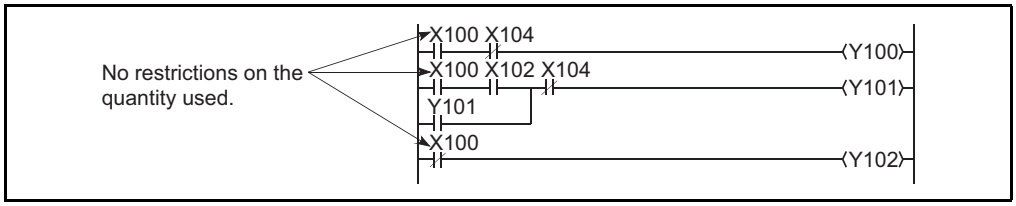


Diagram 9.4 Input(X) Used in Program

POINT

1. When debugging a program, an input (X) can be turned ON/OFF by the following methods.

   - GX Developer test operation
   - OUT Xn instruction

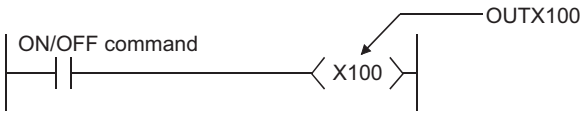


Diagram 9.5 Input(X) ON/OFF by the OUT Xn instruction

2. Input (X) can also be used as following devices:
   - Destination device (on the CPU module side) of CC-Link Safety remote input (RX) refresh
   - Destination device (on the CPU module side) of CC-Link IE controller network or MELSECNET/H refresh

9.2.2 Output (Y)

(1) Definition

Outputs give out the program control results to the external devices such as solenoid, electromagnetic switch, signal lamp and digital display.
Outputs give out the result equivalent to one N/O contact.

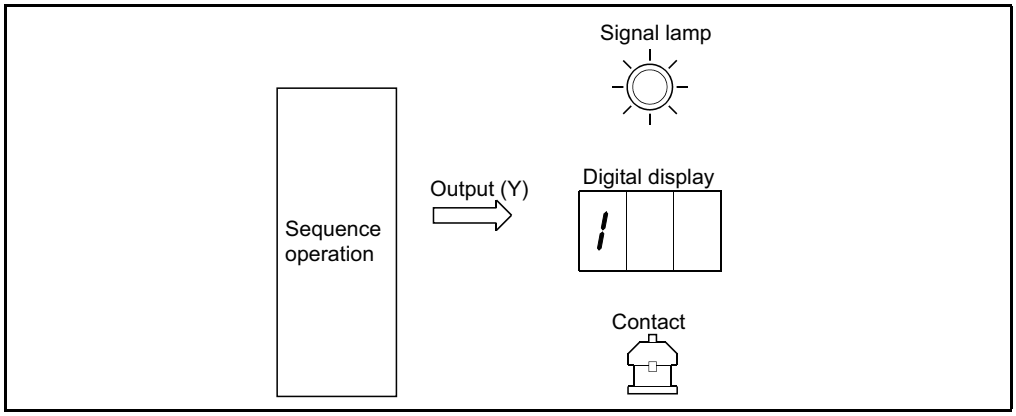


Diagram 9.6 Output from CPU module to external devices

(2) Number of used N/O and N/C contacts

There are no restrictions on the number of output Yn N/O contacts and N/C contacts used in a program, provided the program capacity is not exceeded.

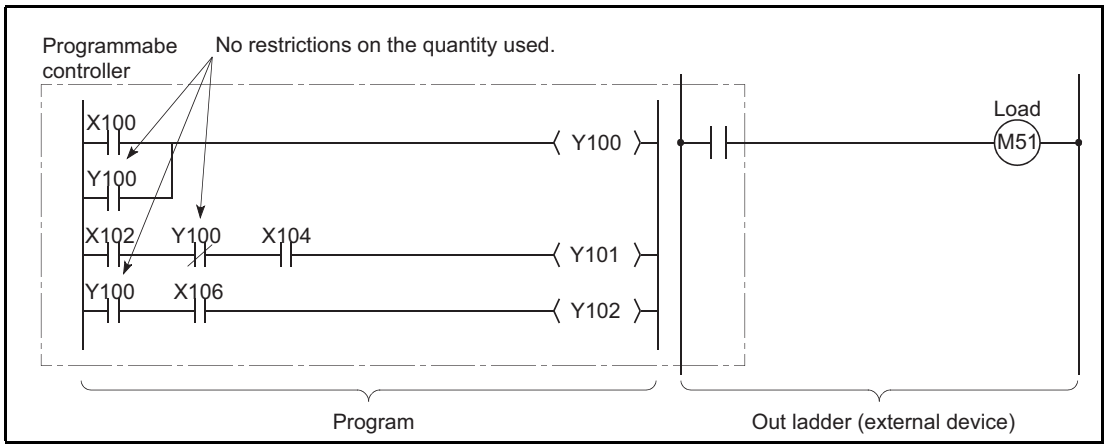


Diagram 9.7 Use of output (Y) in program

(3) Using outputs as internal relays (M)

An output (Y) corresponding to a region with no module mounted can be used in place of an internal relay (M).

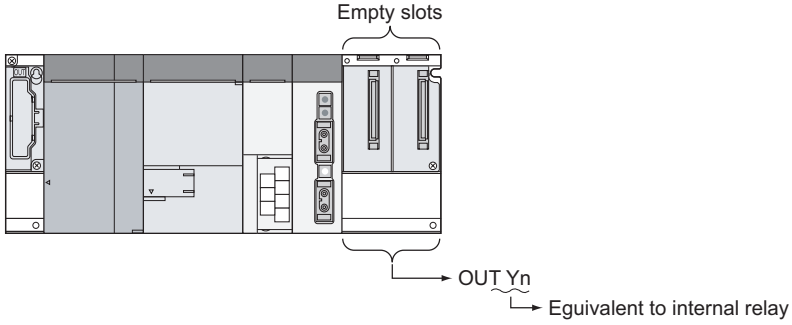


Diagram 9.8 Substitute for internal relay

9.2.3 Internal relay (M)

(1) Definition

Internal relays are auxiliary relays used in the CPU module.
All internal relays are switched OFF at the following times:

- When the PLC is powered OFF and then ON
- When the CPU module is reset

(2) Number of used N/O and N/C contacts

There are no restrictions on the number of contacts (N/O contacts, N/C contacts) used in the program, provided the program capacity is not exceded.

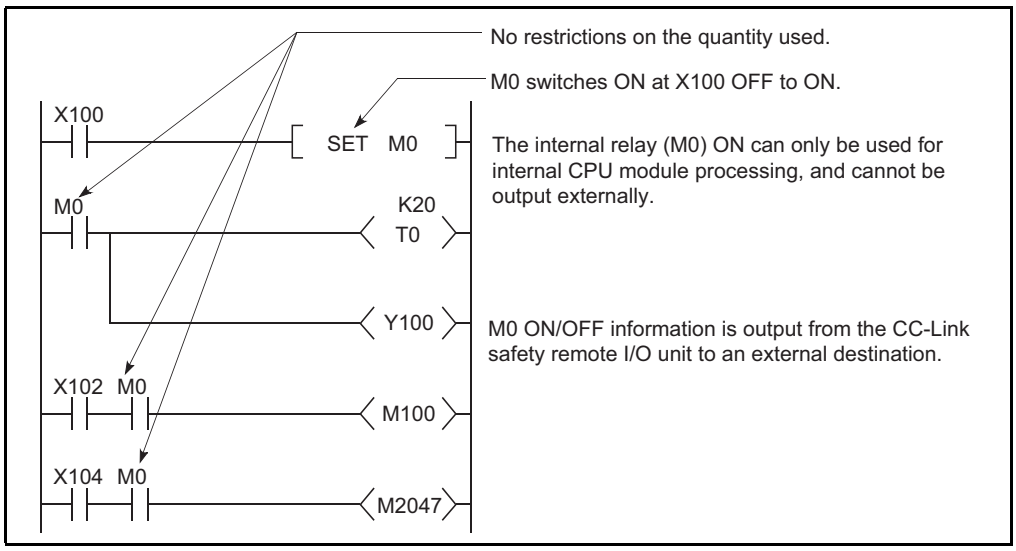


Diagram 9.9 Use of internal relays in program

(3) Procedure for external outputs

Outputs (Y) are used to output sequence program operation results to an external destination.

9.2.4 Annunciator (F)

(1) Definition

Annunciators are internal relays used for fault detection programs created by the user.

(2) Special relay and special registers at annunciator ON

When annunciators switch ON, a special relay (SM62) switches ON, and the Nos. and quantity of the annunciators which switched ON are stored at the special registers (SD62 to 79).

• Special relay	: SM62	• • • • •	Switches ON if even one annunciator switches ON.
• Special register	: SD62	• • • • •	No. of first annunciator which switched ON is stored here.
	SD63	• • • • •	The number (quantity) of annunciators which are ON is stored here.
	SD64 to 79	• • •	Annunciator Nos. are stored in the order in which they switched ON. (The same annunciator No. is stored at SD62 and SD64.)

Annunciator numbers stored in SD62 are also recorded in the operation • error history storage area.

POINT

Even if multiple annunciators are switched ON while the PLC is power-on, only one annunciator number is stored in the operation • error history storage area. When an error is ended on a CPU module, the other annunciator numbers that are ON can be stored in the error history storage area.

(3) Applications of annunciators

Using annunciators for a fault detection program, an equipment fault or fault presence/absence (annunciator number) can be checked by monitoring the special register (SD62 to 79) when the special relay (SM62) switches ON.

Example

The program which outputs the No. of the ON annunciator (F5).

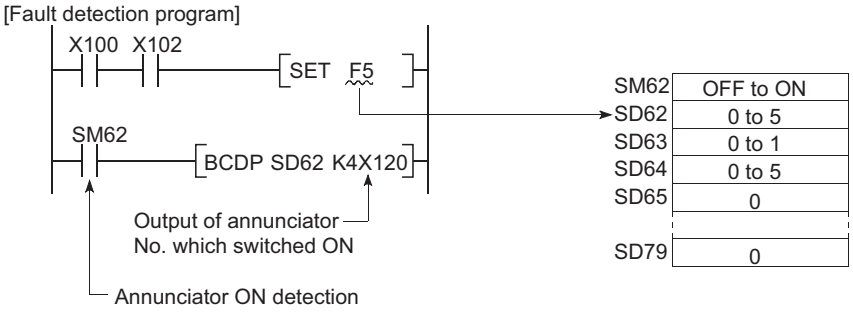


Diagram 9.10 Detection and storage of annunciator ON

(4) Number of used N/O and N/C contacts

There are no restrictions on the number of contacts (N/O contacts, NC contacts) used in the program, provided the program capacity is not exceeded.

(5) Annunciator ON procedure

(a) Annunciator ON procedure

The annunciator can be turned ON by either of the following instructions.

1) SET F□ instruction

The SET F□ instruction turns ON the annunciator only on the leading edge (OFF to ON) of the input condition.
If the input condition turns OFF, the annunciator is held ON.
The scan time can be reduced by using many annuciators, compared with the OUT F□ instruction.

2) OUT F□ instruction

Basic

Note9.1

The annunciator can be turned ON/OFF by the OUT F□ instruction, but it takes longer time than the SET F□ instruction since it performs processing every scan.
If the annunciator is turned OFF by the OUT F□ instruction, the RST F□ instruction must be executed. For these reasons, use the SET F□ instruction to turn ON the annunciator.

POINT

If switched ON by any method other than the SET F□ and OUT F□ instructions, the annunciator functions in the same way as the internal relay.
Does not switch ON at SM62, and annunciator Nos. are not stored at SD62, SD64 to 79.

(b) Processing at annunciator ON

1) Data stored at special registers (SD62 to 79)

- Nos. of annunciators which switched ON are stored in order at SD64 to 79.
- The annunciator No. which was stored at SD64 is stored at SD62.
- "1" is added to the SD63 value.

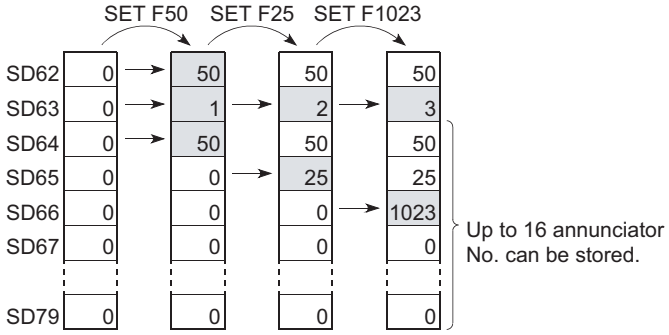


Diagram 9.11 Processing at annunciator ON

2) Processing at CPU

The "USER" LED on the module front turns ON.

(6) Annunciator OFF procedure and processing content

(a) Annunciator OFF procedure

The annunciator can be turned OFF by any of the following instructions.

1) RST F□ instruction

The RST F□ instruction turns OFF an annunciator at leading eggs (OFF to ON) of the input condition.

If an annunciator is turned OFF by the RST F□ instruction, processing at annunciator OFF shown in 9.2.4(6)(b) will be performed.

2) OUT F□ instruction

Although an annunciator can be turned ON/OFF by OUT F□ instruction, it takes time longer than when using the RST F□ instruction since every scan is processed.

However, if an annunciator is switched OFF by the OUT F□ instruction, the "processing at annunciator OFF" ((6)(b) in this section) is not performed.

Execute the RST F□ instruction after the annunciator has been switched OFF by the OUT F□ instruction.

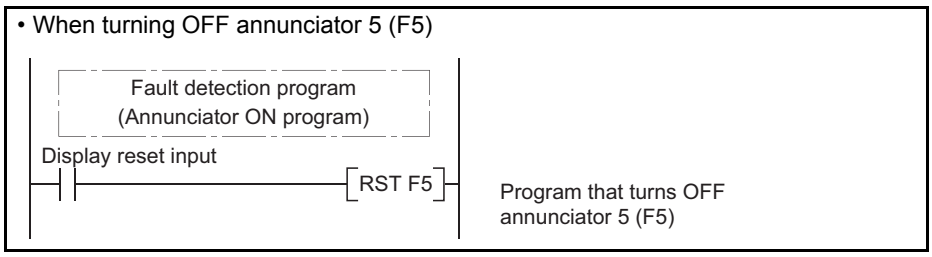


Diagram 9.12 Example of turning OFF the annunciators

Remark

Refer to the following manual for details of each instruction.

☞ QSCPU Programming Manual (Common Instructions)

(b) Processing at annunciator OFF

1) Special register (SD62 to 79) data operation when annunciator is tunred OFF by executing the RST F□ instruction

- The annunciator No. specified by the RST instruction is deleted, and the stored annunciator Nos. after the deleted annunciator No. are shifted up.
- If the annunciator No. stored at SD64 was switched OFF, the new annunciator No. which is stored at SD64 is stored at SD62.
- 1 is subtracted from the SD63 value.
- If the SD63 value is "0", SM62 is switched OFF.

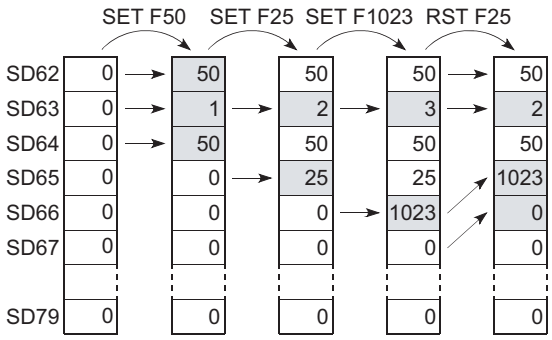


Diagram 9.13 Processing at annunciator OFF (when RST F□ instruction is executed)

2) LED indication

When the annunciator Nos. in SD64 to 79 all turn OFF, the "USER" LED, which was turned ON as the annunciator turned ON, turns OFF.

9.2.5 Edge relay (V)

(1) Definition

An edge relay is a device which stores the operation results (ON/OFF information) from the beginning of the ladder block.

Edge relays can only be used at contacts, and cannot be used as coils.

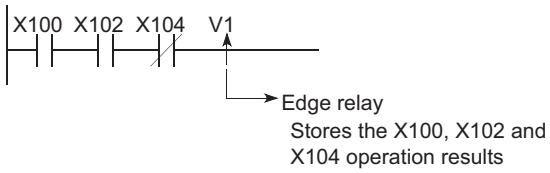


Diagram 9.14 Edge relay

(2) Precautions

The edge relay of the same No. cannot be set in multiple steps of a program.

9.2.6 Link relay (B)

(1) Definition

Link relay is a CPU module side relay used when refreshing the link relay (LB) data of the CC-Link IE controller network module or MELSECNET/H module to the CPU module, or when refreshing the CPU module data to the link relays (LB) of the CC-Link IE controller network module or MELSECNET/H module.

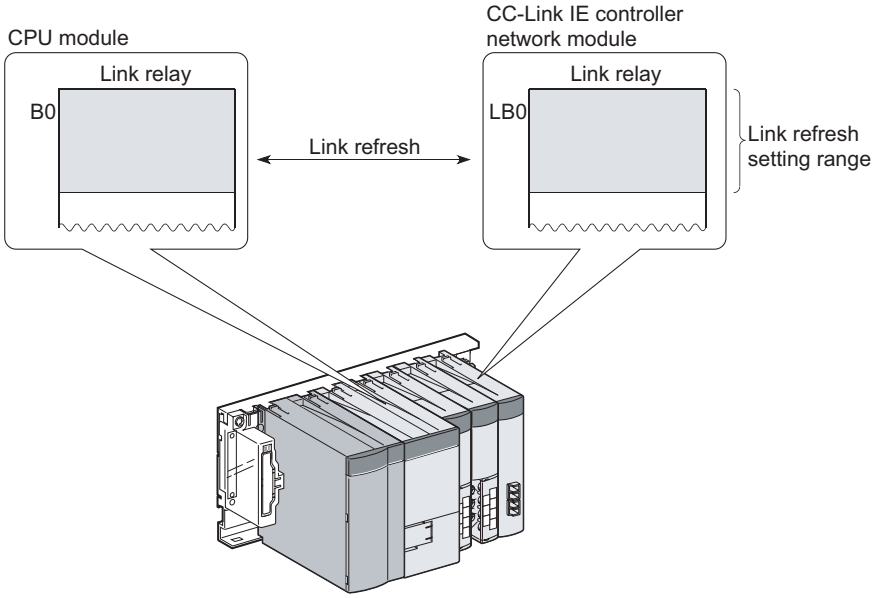


Diagram 9.15 Link refresh

(2) Number of used N/O and N/C contacts

There are no restrictions on the number of contacts (N/O contacts, N/C contacts) used in the program.

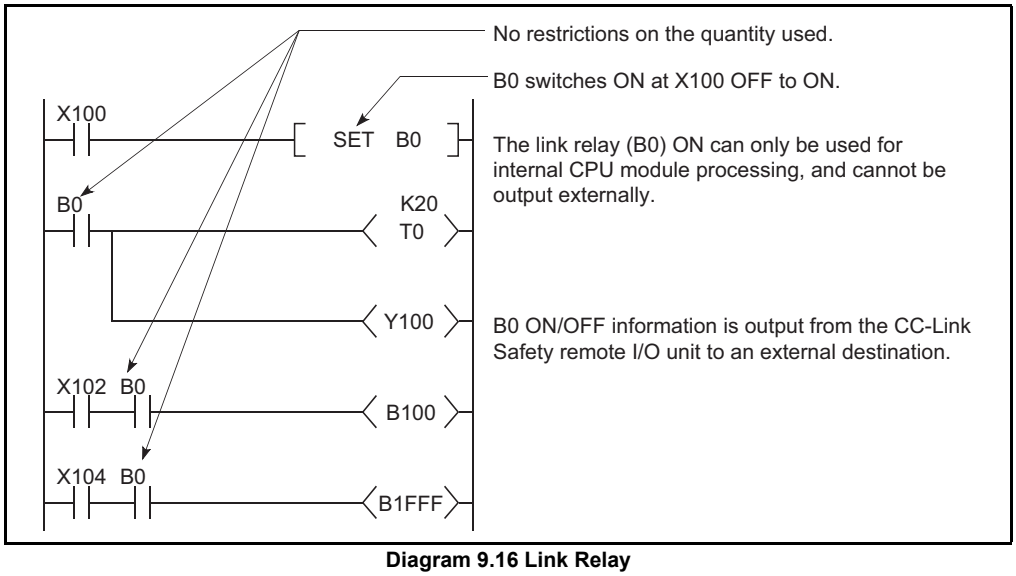


Diagram 9.16 Link Relay

(3) Using link relays in the network system

In order to use link relays in the network system, a network parameter setting is required.

Link relays in the range where network parameters have not been set (not used by the CC-Link IE controller network or MELSECNET/H) can be used as internal relays.

POINT

The number of device points for link relays is 16384 in the CC-Link IE controller network module and MELSECNET/H module, but 2048 in the CPU module by default.

To use link relays exceeding the device point range described above, change the number of device points for link relays on the Device setting tab of PLC parameter in GX Developer.

Remark

For the network parameters, refer to the following manuals.

☞ CC-Link IE Controller Network Reference Manual

☞ Q Corresponding MELSECNET/H Network System Reference Manual (PLC to PLC network)

9.2.7 Link special relay (SB)

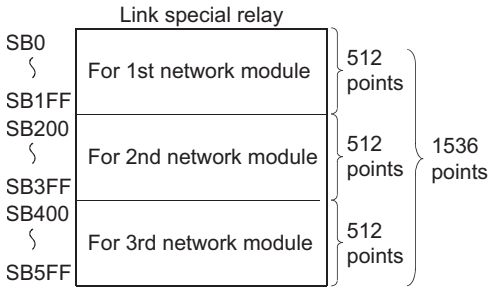
(1) Definition

Link special relay is a relay used to indicate the communication status and error detection of the CC-Link Safety master module, CC-Link IE controller network module, and MELSECNET/H module.
ON/OFF of the link special relays are controlled by various causes that occur during data link.
By monitoring the link special relays, the communication status, error status and others of data link can be grasped.

(2) Number of link special relay points

The number of link special relay points is as described in Table9.3.

Table9.3 Number of link special relay points of each CPU module

CPU module	Number of link special relay points
Safety CPU	1536 points (SB0 to 5FF). The number of device points for link special relays is 512 in the CC-Link Safety master module, CC-Link IE controller network module, and MELSECNET/H module. The link special relays can be assigned as shown below. 

Remark

For details on the link special relay, refer to the following manuals.

☞ CC-Link IE Controller Network Reference Manual

☞ Q Corresponding MELSECNET/H Network System Reference Manual (PLC to PLC network)

9.2.8 Timer (T)

(1) Definition

A timer (T) is a device that starts counting when its coil turns ON, and times-out and turns ON its contact when the current value reaches or exceeds the set value.
The timer is of an up-counting type.
The current value matches the set value when a "time-out" occurs.

(2) Timer types

There are two types of timers: a low/high speed that allows the current value to return to "0" when a timer coil switches OFF, and a retentive timer that retains the current value even when a timer coil switches OFF.

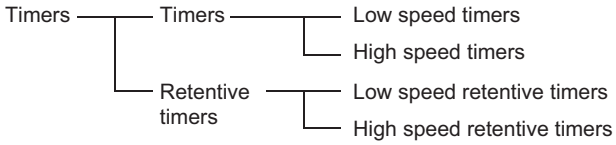


Diagram 9.17 Timer types

(3) How to use timers

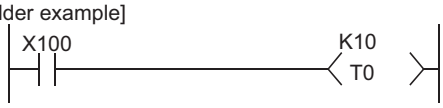
With a timer setting (instruction format), a device is assigned for a low speed timer or high speed timer. The OUT T0 instruction is used to assign a device for a low -speed timer. The OUTH T0 instruction is used to assign a device for a high speed timer.
With a timer setting (instruction format), a device is assigned for a low speed retentive timer or high speed retentive timer. The OUT T0 instruction is used to assign a device for a low speed retentive timer. The OUTH T0 instruction is used to assign a device for a high speed retentive timer.

(4) Low-speed timers

(a) Definition

Low-speed timers perform counting in 1 to 1000ms units.
The timer is valid only while its coil is ON.
The time measurement begins when the timer's coil switches ON, and the contact switches ON when a "time-out" occurs. When the timer's coil switches OFF, the current value becomes "0", and the contact switches OFF.

[Ladder example]



When X100 switches ON, the T0 coil switches ON, and the contact switches ON 1 second later. (The low-speed timer measures time in 100 ms units.)

[Time chart]

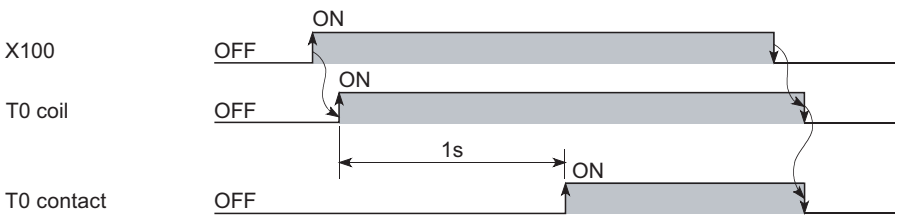


Diagram 9.18 Ladder example and timing chart of low-speed timer

(b) Measurement units

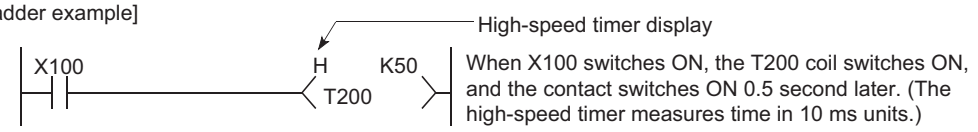
The default time measurement units setting for low speed timers is 100 ms.
The time measurement units setting can be designated in 1 ms units within a 1 ms to 1000 ms range.
This setting is designated at the "PLC system" tab screen in the "(PLC) Parameter" dialog box.

(5) High-speed timers

(a) Definition

High-speed timers performs counting in 0.1 to 100ms units.
The timer is valid only while its coil is ON, and has a symbol "H".
The time measurement begins when the timer's coil switches ON, and the contact switches ON when the time elapses. When the timer's coil switches OFF, the current value becomes "0", and the contact switches OFF.

[Ladder example]



[Time chart]

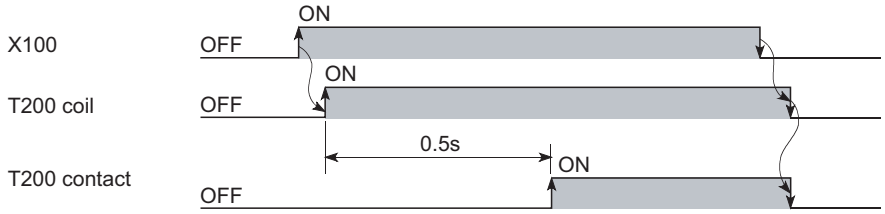


Diagram 9.19 Ladder example and timing chart of high-speed timer

(b) Measurement units

The default time measurement units setting for high speed timers is 10 ms.
The time measurement units setting can be designated in 0.1ms units within a 0.1 ms to 100 ms range.
This setting is designated at the "PLC system" tab screen in the "(PLC) Parameter" dialog box.

(6) Retentive timers

(a) Definition

Retentive timers measure the "coil ON" time.
The measurement begins when the timer coil switches ON, and the contact switches ON when a time-out (coil OFF) occurs.
Even when the timer coil is OFF, the current value and the contact ON/OFF status are saved. When the coil is switched ON again, the time measurement resumes from the current value which was saved.

(b) Retentive timer types

There are 2 retentive timer types: low speed retentive timer, and high speed retentive timer.

(c) Retentive timer clear

The RST ST□ instruction is used to clear (reset) the current value and switch the contact OFF.

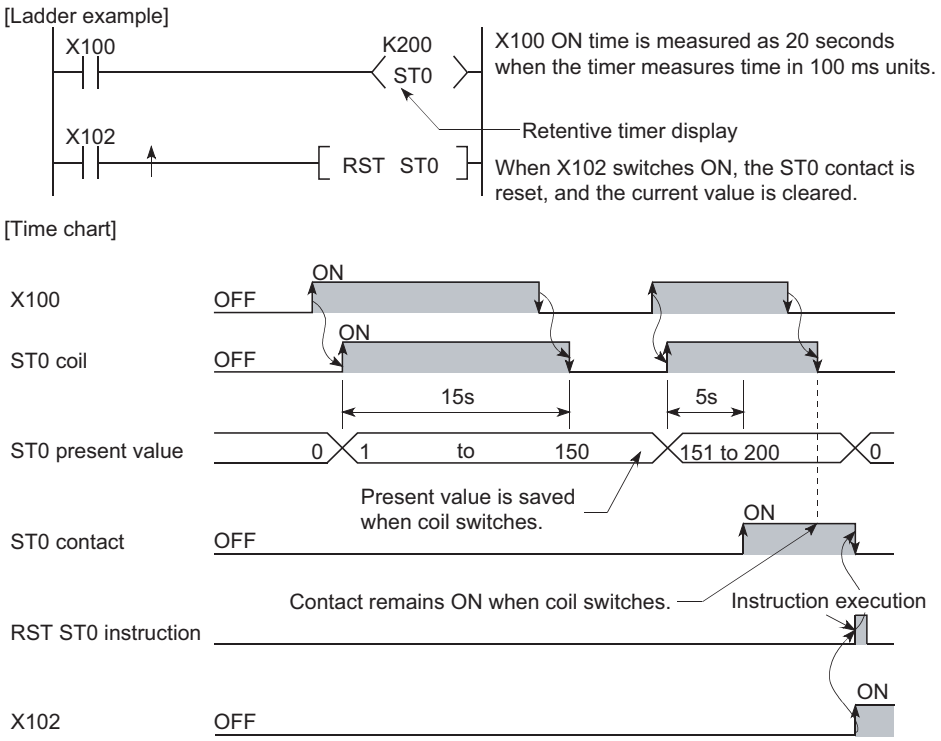


Diagram 9.20 Ladder example and timing chart of retentive timer

(d) Measurement units

The measurement units settings for retentive timers are the same as those for low speed timers and high speed timers.

- Low speed retentive timer : Same as low speed timer
- High speed retentive timer : Same as high speed timer

POINT

In order to use retentive timers, a retentive timer "number of points used" setting must be designated at the "Device" tab screen in the "(PLC) Parameter" dialog box.

(7) Timer Processing and accuracy

(a) Processing method

When an OUT T□ instruction is executed, the following is processed: timer coil ON/OFF, current value update and contact ON/OFF processing. Timer current value update and contact ON/OFF processing are not performed at END processing.

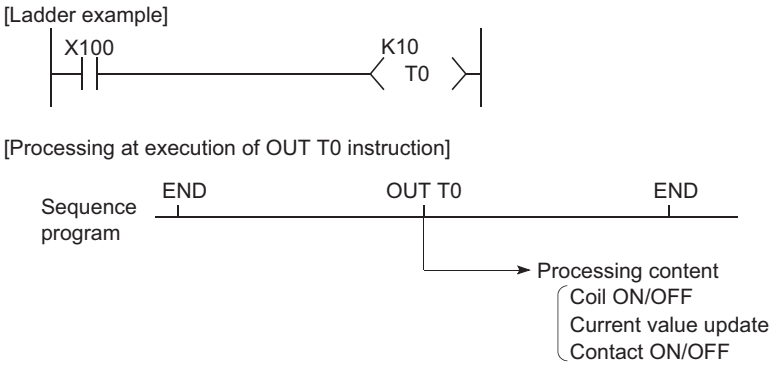


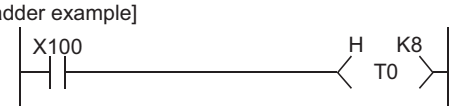
Diagram 9.21 Processing at execution of OUT TO instruction

(b) Accuracy

Measured value at END instruction is added to the current value when the OUT T□ instruction is executed.

If the timer coil is OFF when the OUT T□ instruction is executed, the current value is not updated.

[Ladder example]



[Current value update timing]

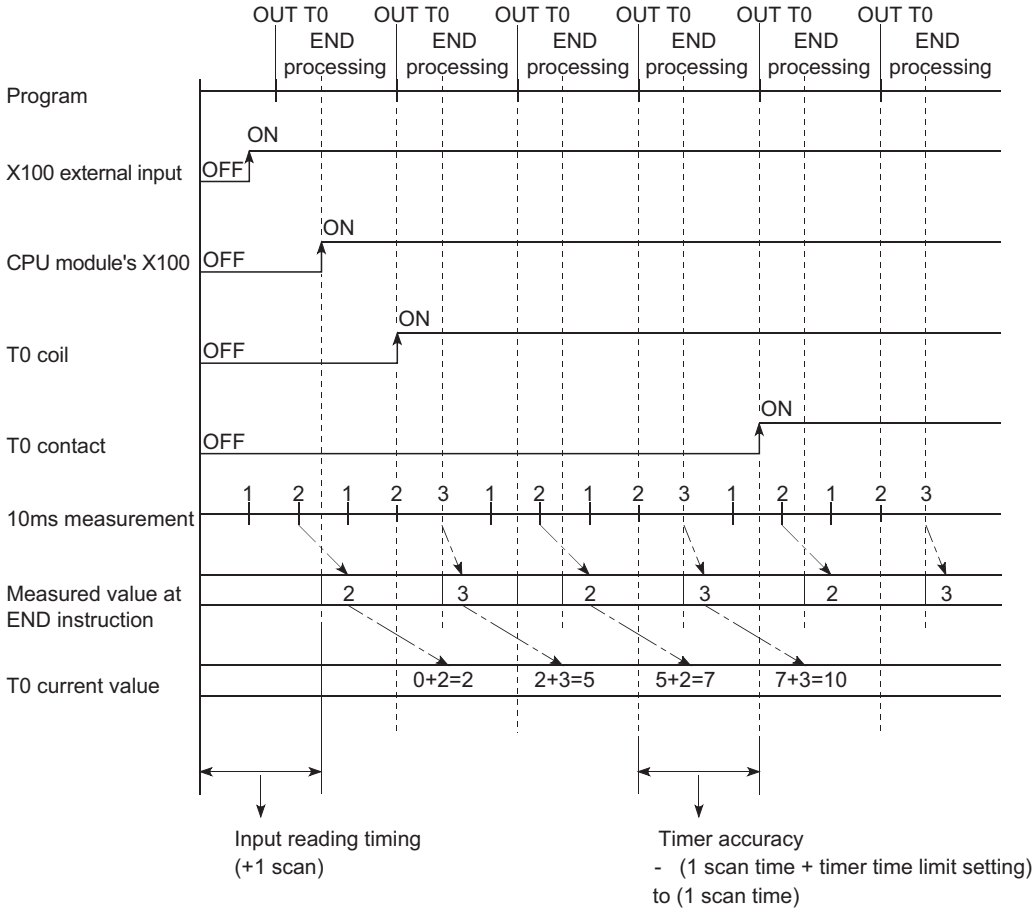


Diagram 9.22 Timer accuracy (For 10ms)

The timer response accuracy from when reading input (X), until when outputing it is + (2-scan time + timer time limit setting).

(8) Precautions for using timers

The following are a few precautions regarding timer use:

(a) Use of the same timer

A given timer cannot be designated (by OUT T□) more than once in a single scan.

This designation results in measurement, since the timer current value is updated at execution of each OUT T□ instruction.

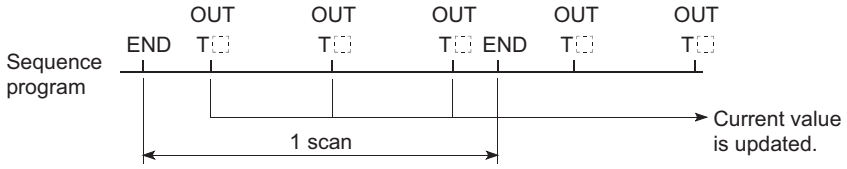


Diagram 9.23 When the same timer is used

(b) When set value is 0

If the timer set value is "0", the contact turnes ON when the OUT T□ instruction is executed.

(c) When set value is changed after time-out

If the set value changes to a value which is higher than the current value following a timer "time-out", the "time-out" status will remain in effect, and timer operation will not be performed.

9.2.9 Counter (C)

(1) Definition

A counter is a device which counts the number of input condition leading edges in sequence programs.
When the count value matches the set value, the counter counts up and its contact turns ON.
The counter is of an up-counting type.

(2) Count processing

(a) When OUT C□ instruction is executed

When and OUT C□ instruction is executed, the following counter processing occurs: coil ON/OFF, current value update (count value + 1), and contact ON/OFF. Counter current value update and contact ON/OFF processing are not performed at END processing.

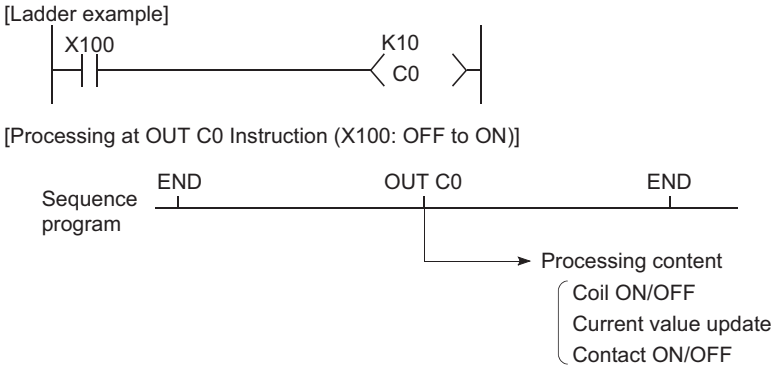


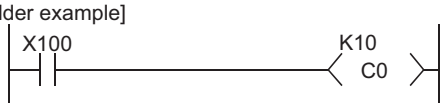
Diagram 9.24 Execution and processing of OUT C□ instruction

(b) Current value update (count value + 1)

The current value update (count value + 1) is performed at the leading edge (OFF to ON) of the OUT C□ instruction.

The current value is not updated in the following OUT C□ instruction statuses: OFF, ON to ON, ON to OFF

[Ladder example]



[Current value update timing]

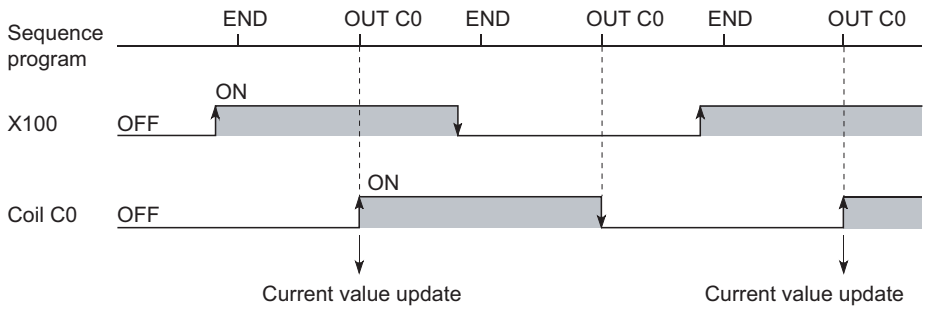


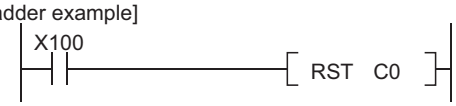
Diagram 9.25 Current value update timing

(c) Resetting the counter

Counter current values are not cleared even if the OUT C□ instruction switches OFF. Use the RST C□ instruction to clear the counter's current value and switch the contact OFF.

The count value is cleared and the contact is switched OFF at execution of when the RST C□ instruction.

[Ladder example]



[Counter reset timing]

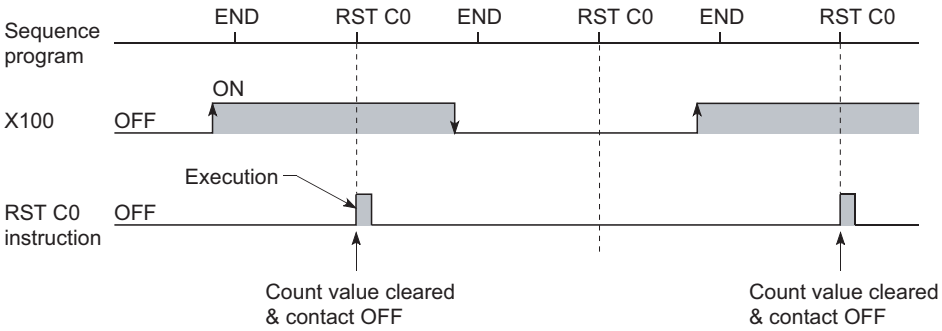


Diagram 9.26 Counter resetting

1) Precautions for resetting the counter

When the RST C□ instruction is executed, the coil of C□ also turns OFF.

If the execution condition of the OUT C□ instruction is still ON after execution of the RST C□ instruction, the coil of C□ is turned ON at the execution of the OUT C□ instruction to update the current value (increment the count value by 1).

[Ladder example]

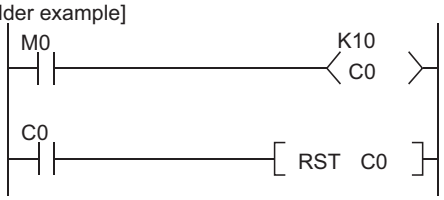


Diagram 9.27 Counter resetting ladder example

In the above ladder example, when M0 turns from OFF to ON, the coil of C0 turns ON, updating the current value. When C0 reaches the preset value finally, the contact of C0 turns ON, and the execution of the RST C0 instruction clears the current value of C0. At this time, the coil of C0 also turns OFF. When M0 is still ON in the next scan, the current value is updated since the coil of C0 turns from OFF to ON at the execution of the OUT C0 instruction. (The current value turns to 1.)

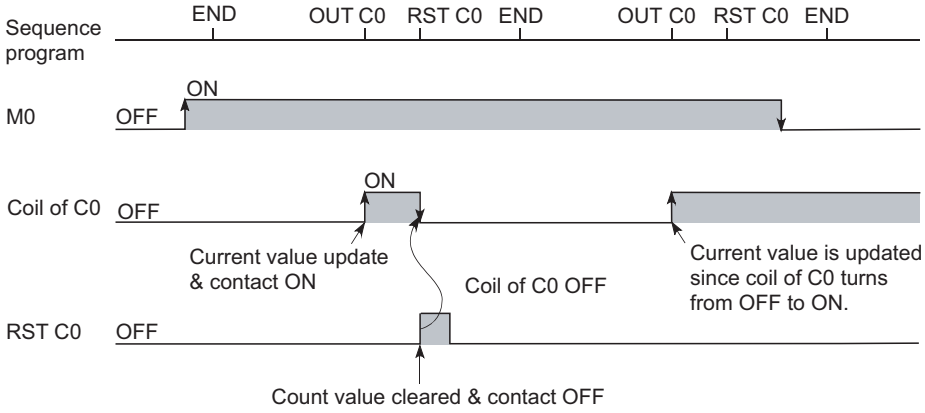


Diagram 9.28 Current value update timing

To prevent the above, it is recommended to insert the N/C contact of the OUT C0 instruction as the execution condition of the RST C0 instruction so that the coil of C0 does not turn OFF while the execution condition (M0) of the OUT C0 instruction is ON.

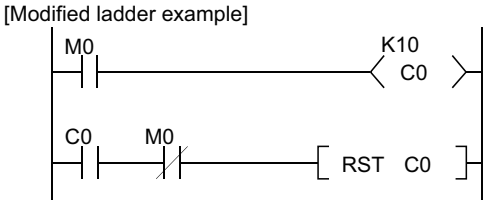


Diagram 9.29 Counter resetting ladder example (recommended example)

(d) Maximum counting speed

The counter can count only when the input condition ON/OFF time is longer than the execution interval of the corresponding OUT C□ instruction.
The maximum counting speed is calculated by the following expression:

$$\text{Maximum counting speed (Cmax)} = \frac{n}{100} \times \frac{1}{T} \text{ [times/s]}$$

n: Duty(%)*1

T: Execution interval of the OUT C□ instruction (sec)

* 1 : The "duty" is the count input signal's ON-OFF time ratio expressed as a percentage value.

- When $T1 \geqq T2$, $n = \frac{T2}{T1+T2} \times 100\%$
- When $T1 < T2$, $n = \frac{T1}{T1+T2} \times 100\%$

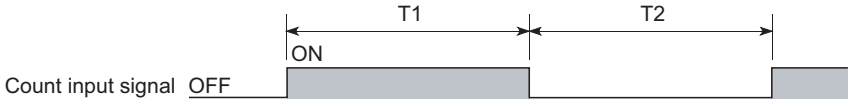


Diagram 9.30 Duty ratio

9.2.10 Data register (D)

(1) Definition

Data registers are memory devices which store numeric data (-32768 to 32767, or 0000H to FFFFH).

(2) Bit configuration of data register

(a) Bit configuration and read and write units

Data registers, which consist of 16 bits per point, read and write data in 16-bit units.

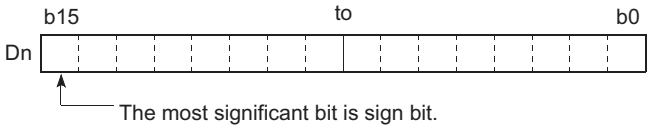


Diagram 9.31 Bit configuration of data register

POINT

Data register data are handled as signed data.
For HEX (hexadecimal), 0000H to FFFFH can be stored. However, since the most significant bit is a sign bit, the range of a value that can be specified is -32768 to 32767.

(b) When data register is used for 32-bit instruction

If the data registers are used for 32-bit instructions, the data will be stored in registers Dn and Dn + 1. The lower 16 bits of data are stored at the data register No. (Dn) designated in the sequence program, and the higher 16 bits of data are stored in the designated register No. + 1 (Dn + 1). For example, if register D12 is designated in the DMOV instruction, the lower 16 bits are stored in D12, and the upper 16 bits are stored in D13.

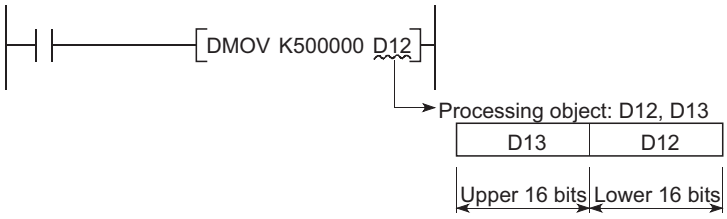


Diagram 9.32 Data transfer by 32-bit instruction and storage destination

Two data registers can store a range of numeric data from -2147483648 to 2147483647 or from 0H to FFFFFFFFH. (The most significant bit in a 32-bit configuration is a sign bit.)

(3) Holding of stored data

The data stored in the data register is held until the other data is stored.
The data stored in the data register is initialized when the PLC is powered OFF or the CPU module is reset.

9.2.11 Link register (W)

(1) Definition

Link register is a CPU module side memory used when refreshing the link register (LW) data of the CC-Link IE controller network module or MELSECNET/H module to the CPU module.

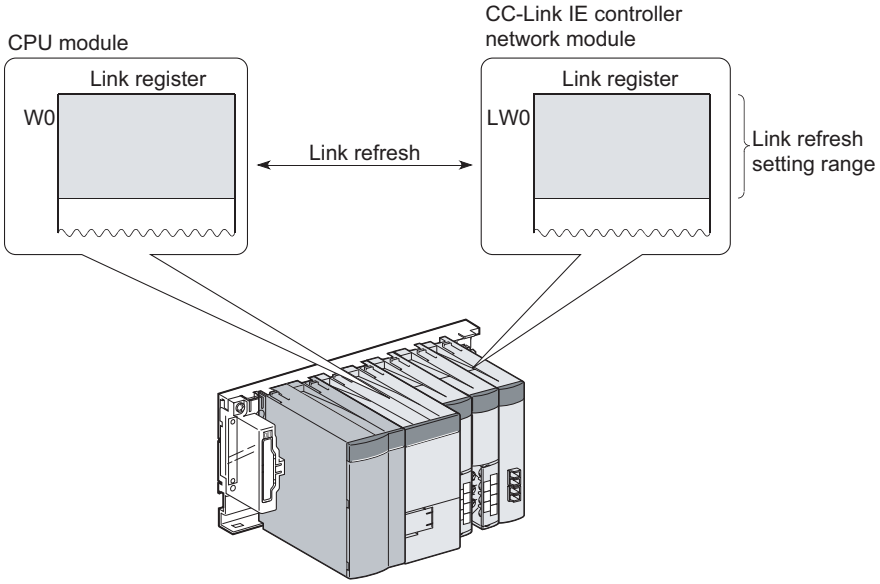


Diagram 9.33 Link refresh

Link register can store numerical data (-32768 to 32767, or 0000H to FFFFH).

(2) Bit configuration of link register

(a) Bit configuration and read and write units

Link registers, which consist of 16 bits per point, read and write data in 16 bit units.

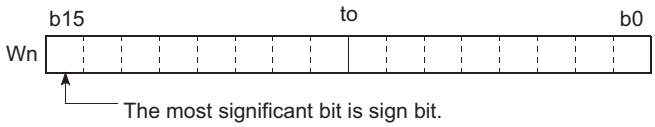


Diagram 9.34 Bit configuration of link register

POINT

1. Link register data are handled as signed data.
   For HEX (hexadecimal), 0000H to FFFFH can be stored. However, since the most significant bit is a sign bit, the range of a value that can be specified is -32768 to 32767.
2. Link registers in the range where not used in the CC-Link IE controller network module or MELSECNET/H module can be used as substitution of data registers.

(b) When link register is used for 32-bit instruction

If the link registers are used for 32-bit instructions, the data is stored in registers Wn and Wn + 1. The lower 16 bits of data are stored in the link register No. (Wn) designated in the sequence program, and the higher 16 bits of data are stored in the designated register No. + 1 (Wn + 1).

For example, if link register W12 is designated in the DMOV instruction, the lower 16 bits are stored in W12, and the upper 16 bits are stored in W13.

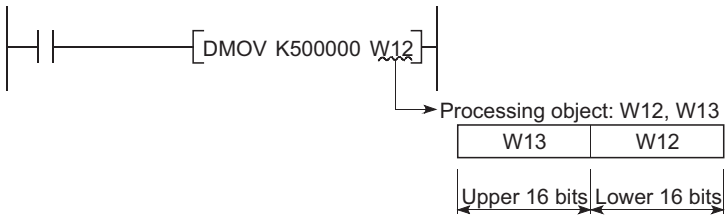


Diagram 9.35 Data transfer by 32-bit instruction and storage destination

Two link registers can store a range of numeric data from -2147483648 to 2147483647 or from 0H to FFFFFFFFH. (The most significant bit in a 32-bit configuration is a sign bit.)

(3) Holding of stored data

Data stored by the link register is maintained until another data is save.

The data stored in the link register is initialized when the PLC is powered OFF or the CPU module is reset.

POINT

The number of device points for link registers is 16384 in the CC-Link IE controller network module and MELSECNET/H module, but 2048 in the CPU module by default.

To use link registers exceeding the device point range described above, change the number of device points for link registers on the Device setting tab of PLC parameter in GX Developer.

(4) Using link registers in a network system

In order to use link registers in the network system, network parameter settings must be made.

Link registers not set in the network parameter settings can be used as data registers.

Remark

For the network parameters, refer to the following manuals.

☞ CC-Link IE Controller Network Reference Manual

☞ Q Corresponding MELSECNET/H Network System Reference Manual (PLC to PLC network)

9.2.12 Link special register (SW)

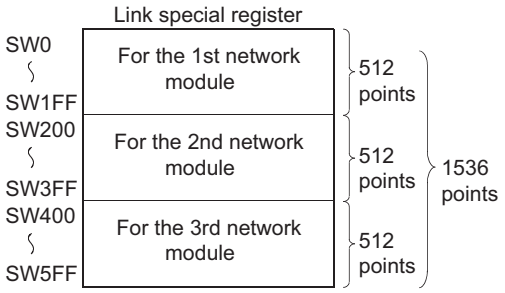
(1) Definition

Link special register is a register used to store the communication status and error contents of the CC-Link Safety master module, CC-Link IE controller network module, and MELSECNET/H module.Since link special registers store the data link information as numerical data, the error locations and error causes can be identified by monitoring link special registers.

(2) Number of link special register points

The number of link special register points is as described in Table9.4.

Table9.4 Number of link special register points of each CPU module

CPU module	Number of link special relay points
Safety CPU	1536 points (SW0 to 5FF). The number of device points for link special relays is 512 in the CC-Link Safety master module, CC-Link IE controller network module, and MELSECNET/H module. The link special registers can be assigned as shown below. 

Remark

For details on the link special register, refer to the following manuals.

☞ CC-Link Safety Master Module User's Manual

☞ CC-Link IE Controller Network Reference Manual

☞ Q Corresponding MELSECNET/H Network System Reference Manual (PLC to PLC network)

9.3 Internal System Devices

Internal system devices are used for system operations.
The allocations and sizes of internal system devices are fixed, and cannot be changed by the user.

9.3.1 Special relay (SM)

(1) Definition

Special relay stores the CPU module states (error diagnostics, system information, etc.).

(2) Special relay classifications

Special relays are classified according to their applications, as shown in Table9.5.

Table9.5 Special relay classification list

Classification	Special relay
Diagnostics information	SM0 to 99
System information	SM200 to 399
System clock/system counter	SM400 to 499
Safety CPU	SM560 to 599
Boot	SM600 to 699
Instruction related	SM700 to 799
CC-Link Safety	SM1000 to 1299

(3) Special relay that can be used in the program that achieves the safety function

In the program that achieves the safety function, only SM1000 to SM1299 can be used.

Remark

For details on special relays which can be used by the CPU module, refer to Appendix 1.

9.3.2 Special register (SD)

(1) Definition

A special register is used to store CPU module status data (error diagnostics and system information).

(2) Special register classifications

Special registers are classified according to their applications, as shown in Table9.6.

Table9.6 Special register classification list

Classification	Special register
Diagnostics information	SD0 to 99
System information	SD200 to 399
System clock/system counter	SD400 to 499
Scan information	SD500 to 559
Safety CPU	SD560 to 599
Memory	SD600 to 699
CC-Link Safety	SD1000 to 1299

(3) Special register that can be used in the program that achieves the safety function

In the program that achieves the safety function, only SD1000 to SD1299 can be used.

Remark

For details on special relays refer to Appendix 2.

9.4 Nesting (N)

(1) Definition

Nesting is a device used in the master control instruction (MC instruction, MCR instruction) to program operation conditions in a nesting structure.

(2) Specifying method in master control instruction

The master control instruction opens/closes a common ladder bus to create a sequence program of efficient ladder switching.

Specify nesting in ascending order (in order of N0 to N14), starting from the outside of the nesting structure.

Refer to the following manual for how to use nesting.

☞QSCPU Programming Manual (Common Instructions)

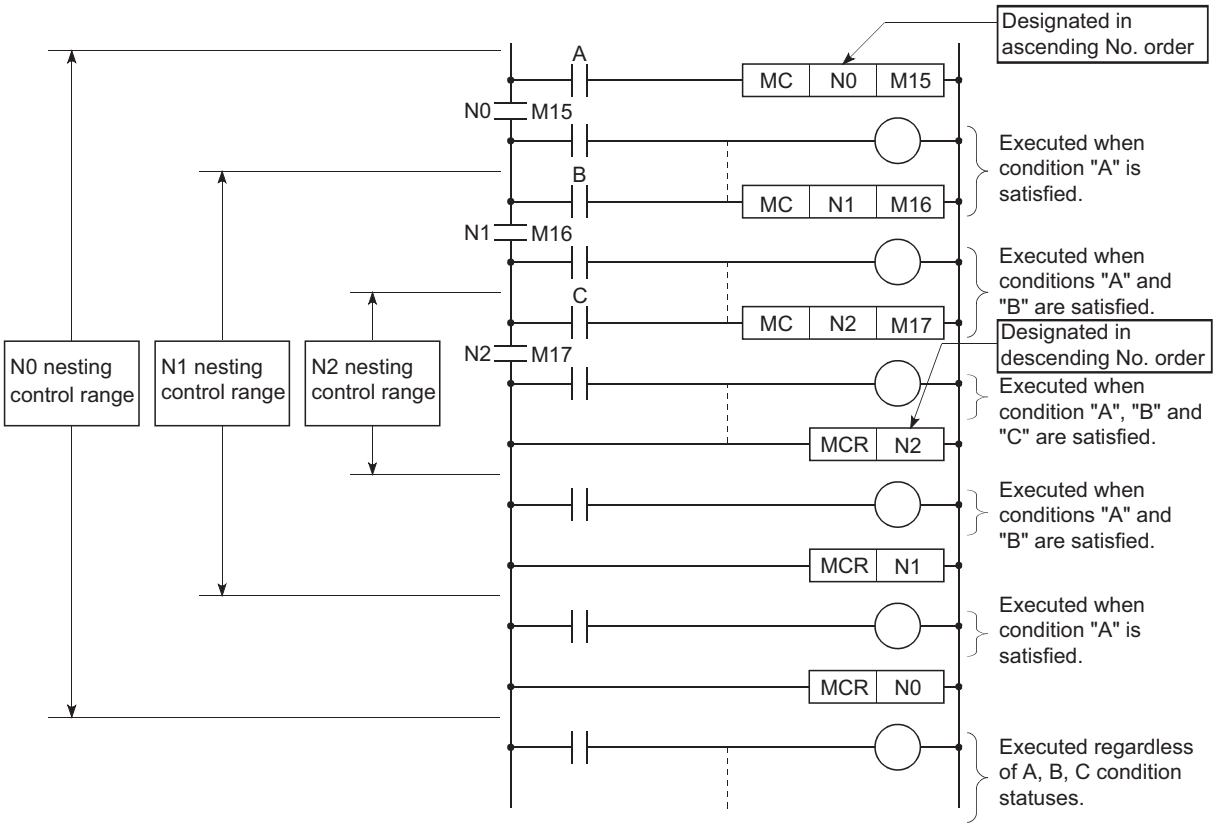


Diagram 9.36 Program example using nesting

9.5 Constants

9.5.1 Decimal constant (K)

(1) Definition

Decimal constants are devices that designate decimal data in sequence programs.

Specify it as K□ (example: K1234) in a sequence program.

It is stored in binary (BIN) into the CPU module. (☞ Section 3.7.1)

(2) Designation range

The designation ranges for decimal constants are as follows:

- For word data (16 bits)••••••••••••••••••••••••••K-32768 to 32767
- For 2-word data (32 bits) ••••••••••••••••••••••K-2147483648 to 2147483647

POINT

The most significant bit is a sign bit.

9.5.2 Hexadecimal constant (H)

(1) Definition

Hexadecimal constants are devices which designate hexadecimal or BCD data in sequence programs.

(For BCD data designations, 0 to 9 digit designations are used.)

Hexadecimal constants are designated as "H□ " settings (e.g. H1234).

(☞ Section 3.7.2)

(2) Designation range

The setting ranges for hexadecimal constants are as follows:

- For word data (16 bits)••••••••••••••••••••••••••H0 to FFFF
  (H0 to 9999 for BCD)
- For 2-word data (32 bits) ••••••••••••••••••••••H0 to FFFFFFFF
  (H0 to 99999999 for BCD)

CHAPTER10 CPU MODULE PROCESSING TIME

This chapter explains the CPU module processing time.

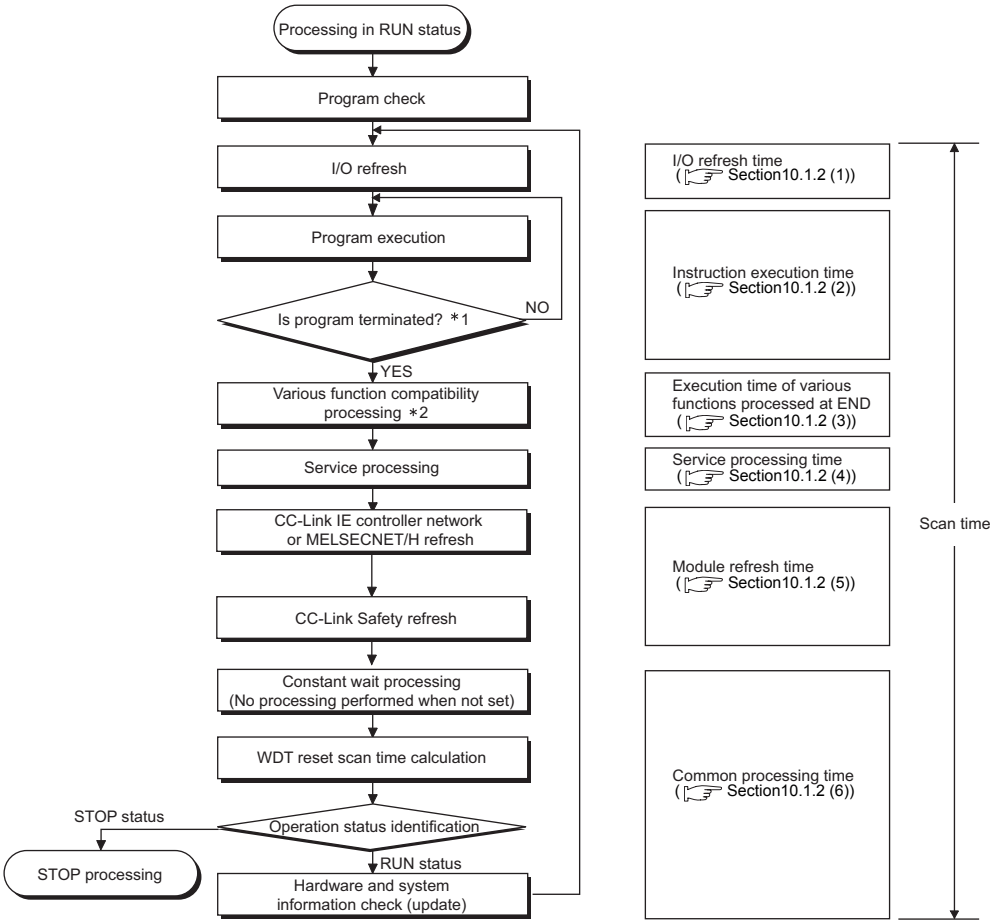
10.1 Scan Time

This section explains the scan time structures and CPU module processing time.

10.1.1 structure and calculation of scan time

(1) Scan time structure

The CPU module scan time consists of the followings processings.
The CPU module performs the following processings cyclically in the RUN status.



* 1 : Program end indicates the timing when the END, S.QS ABORT instruction is executed.
* 2 : Indicates a calendar update or error clear.

Diagram 10.1 Scan time structure Safety CPU

(2) Calculation of scan time

The scan time is calculated from the following formula.

SM = Tru + Tio + Tie + Tend + Ts + Tc (ms)

- SM :Scan time
- Tru :Module refresh time
- Tio :I/O refresh time
- Tie :Instruction execution time
- Tend:Execution time for each function processed by the END
- Ts :Service processing time
- Tc :Common processing time

10.1.2 Time required for each processing included in scan time

This section explains how to calculate the processing and execution times shown in Section 10.1.1.

(1) I/O refresh time

I/O refresh time is the refresh time for I/O data between the CC-Link Safety master module, CC-Link IE controller network module or MELSECNET/H module and the CPU module.

The I/O refresh time (Tio) will be calculated with the following formula:

Tio = (number I/O points) × 0.224 + 310 (μs)

(2) Instruction execution time

Instruction execution time is the total processing time of instructions used in the program to be executed in the CPU module.

For the processing time of each instruction, refer to the following manual.

☞ QSCPU Programming Manual (Common Instructions)

(3) Execution time of various functions processed at END

The execution time of various functions processed at END is the sum of times required for calendar update, and error clear.

(a) Calendar update processing time

This indicates the time taken to change/read the clock data at END processing when the clock data set request (SM210 changes from OFF to ON) or the clock data read request (SM213 turns ON) is issued.

Table10.1 Calendar update processing time

CPU module	END processing time	
	When clock data set request is issued	When clock data read request is issued
QS001CPU	0.10ms	0.02ms

(b) Error clear processing

This indicates the time taken to clear the continuation error stored in SD50 when SM50 (error clear) rises (changes from OFF to ON).

Table10.2 Error clear processing time

CPU module	Error clear processing time
QS001CPU	0.13ms

(4) Service processing time

Service processing is the processing for communication with GX Developer and external devices.

- Monitoring by GX Developer

  Processing times required for monitoring by GX Developer are shown below.

Table10.3 Monitor processing time by GX Developer

Function	QS001CPU
Read of program from PLC*1	5.6ms
Device monitor*2	3.0ms
Online change*3	6.4ms
Operation/error history display*4	6.1ms

* 1 : Time taken to read an 8k-step program from the program memory.
* 2 : Time taken when 32 points have been set in registration monitor.
* 3 : Time taken when a 100-step ladder is added.
* 4 : Time taken to update the display, specifying [All log].

- Communication with Ethernet module

  For details of the time required for communication with the Ethernet module, refer to the following manual.

  ☞ Q Corresponding Ethernet Interface Module User's Manual (Basic)

(5) Module refresh time

Module refresh time is the total time for the link refresh of CC-Link IE controller network or MELSECNET/H and the auto refresh of CC-Link Safety set in the network parameters.

(a) CC-Link IE controller network refresh time

This is the time required to refresh data between the link devices of the CC-Link IE controller network module and the devices of the CPU module.

The CC-Link IE controller network refresh time (Tmnet) will be calculated with the following formula:

Tmnet = 1.85 × (number of words to be refreshed) + 1000 (μs)

For the number of words to be refreshed, refer to the following manual.

☞ CC-Link IE Controller Network Reference Manual

(b) MELSECNET/H refresh time

This is the time required to refresh data between the link devices of the MELSECNET/H module and the devices of the CPU module.

The MELSECNET/H refresh time (Tmnet) will be calculated with the following formula:

Tmnet = 1.85 × (number of words to be refreshed) + 1000 (μs)

For the number of words to be refreshed, refer to the following manual.

☞ Q Corresponding MELSECNET/H Network System Reference Manual (PLC to PLC network)

(c) CC-Link Safety auto refresh time

This is the time required to refresh data between the CC-Link Safety master module and the CPU module.

For the CC-Link Safety auto refresh time, refer to the following manual.

☞ CC-Link Safety System Master Module User's Manual

(6) Common processing time

This indicates the processing time common to the CPU modules.

Table10.4 shows the common processing time for each CPU module model.

Table10.4 Common processing time

CPU module	Common processing time
QS001CPU	6.2 to 10.0ms

10.1.3 Factors that increase the scan time

When the following functions or operations are performed, this will increase the scan time of the CPU module.
When executing any of them, make sure to allow for the processing time (the value given in this section to the value calculated in Section 10.1.2).

(1) Online change executed in ladder mode

The scan time increases by the value indicated in Table10.5 after online change.

Table10.5 Increased time when online change is in ladder mode

CPU module model name	Allocate memory for online change	
	No change	Re-setting
QS001CPU	Max. 1.7ms	Max. 36ms

(2) Functions that increase scan time

The scan time also increases by use of the following functions.

- System monitor
- General data processing

10.2 Other Processing Times

This section explains the processing times other than those described in Section 10.1.

(1) Constant scan accuracy

Table10.6 indicates the constant scan accuracy.

Table10.6 Constant scan accuracy

CPU module	Constant scan accuracy
QS001CPU	2ms

With monitor : Indicates the status in which monitor is being executed with GX Developer connected.

Without monitor : Indicates the status in which monitor is not executed by GX Developer.

CHAPTER11 PROCEDURE FOR WRITING PROGRAM TO CPU MODULE

This chapter describes the procedure for writing program created at the GX Developer to the CPU module.
The CPU module startup procedure is not described in this manual.
Refer to the following manuals for the CPU module startup procedure.
☞ QSCPU User's Manual (Hardware Design, Maintenance and Inspection)

11.1 Items to be examined for program creation

To create a program with the CPU module, the program capacity, the number of device points used, etc. must be determined in advance.

(1) Program size considerations
Consider whether a program can be stored within the program capacity that can be executed with CPU modules (14 k steps) or not. (☞ Section 5.3.3)

(2) Applications of devices and setting of their numbers of points
Consider the applications of the devices used in a program and their number of points. (☞ CHAPTER 9)

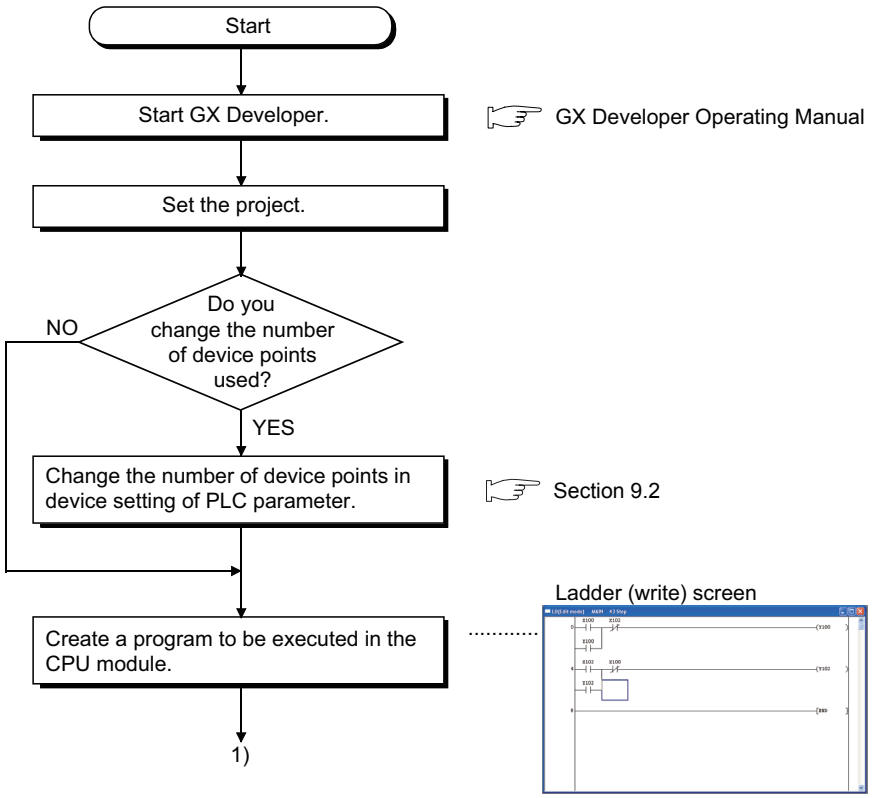
(3) Boot operation considerations
When boot operation is executed in TEST MODE, set the PLC parameter boot file settings.
(In SAFETY MODE, execute boot run regardless of the PLC parameter boot file settings.)
(☞ Section 5.1.4, ☞ Section 11.3)

11.2 Procedure for writing program

This section explains the procedure for writing the parameters and program created by GX Developer to the CPU module.

This section explains the procedure for writing a program to the program memory (☞ Section 5.1.2).
When storing a program in standard ROM and booting in TEST MODE, execute the procedure in 11.3 after executing the procedure in this item.

Procedural steps shown in ▭ boxes are performed at the GX Developer, and those shown in ▭ boxes are performed in the CPU module.



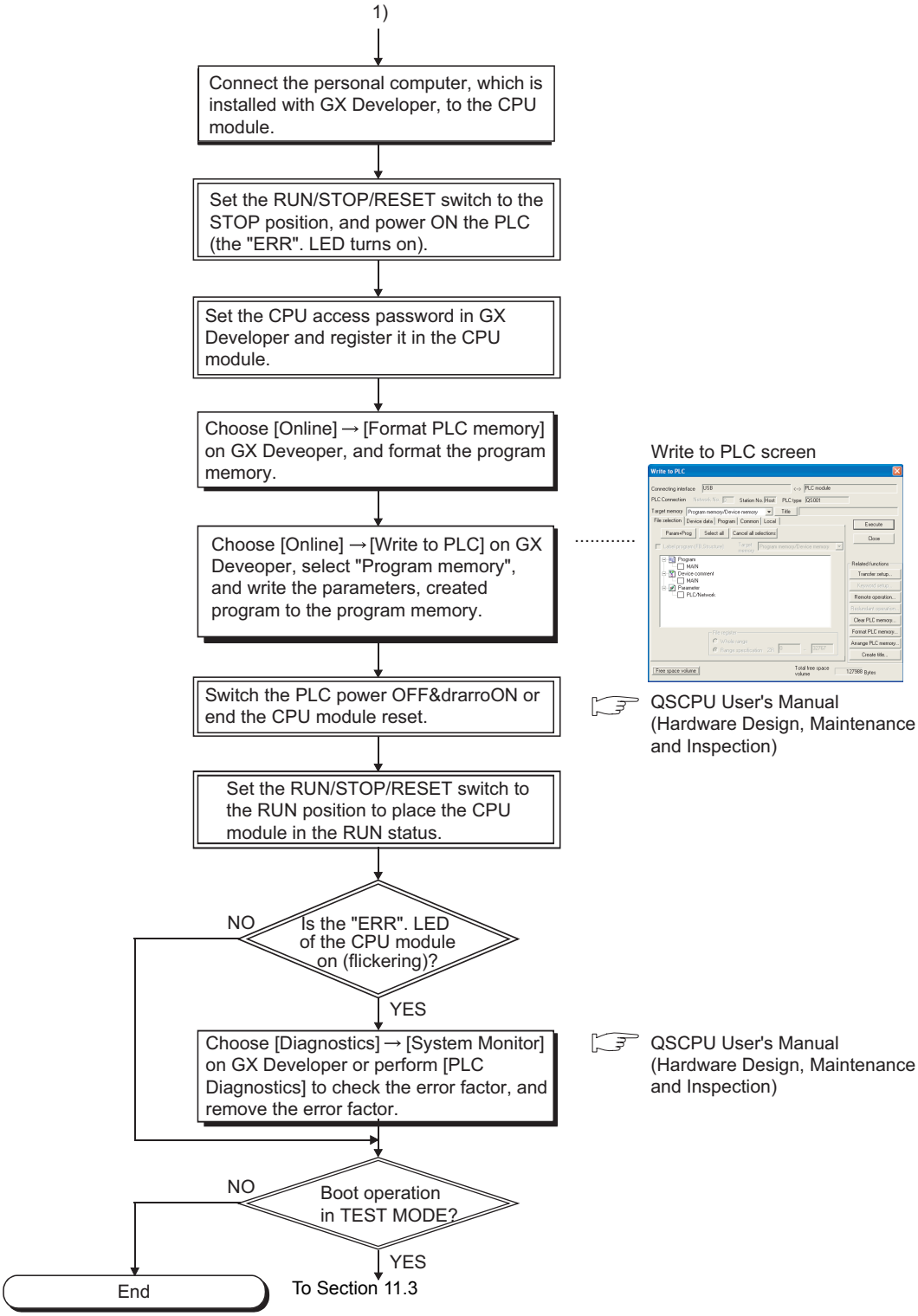


Diagram 11.1 Flowchart for writing program

11.3 Boot run procedure

This section explains a boot run procedure.

In the following procedure, ▭ indicates the operation on the GX Developer side, and ▭ indicates that on the CPU module side.

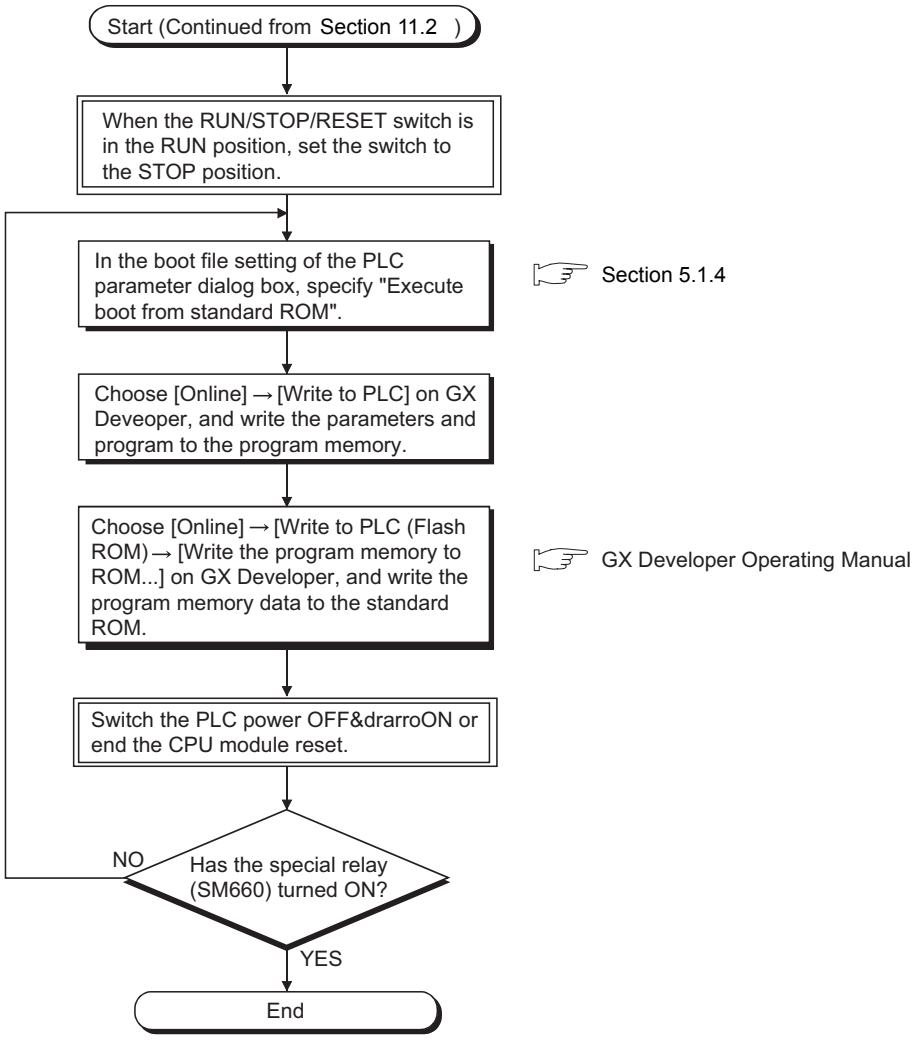


Diagram 11.2 Boot run flowchart

APPENDICES

Appendix 1 Special Relay List

Special relays, SM, are internal relays whose applications are fixed in the PLC.
For this reason, they cannot be used by sequence programs in the same way as the normal internal relays.
However, they can be turned ON or OFF as needed in order to control the CPU module and remote I/O modules.
The heading descriptions in the following special relay lists are shown in TableApp.1.

TableApp.1 Descriptions of the special relay lists headings

Item	Function of Item
Number	• Indicates special register number
Name	• Indicates name of special register
Meaning	• Indicates contents of special register
Explanation	• Discusses contents of special register in more detail
Set by (When set)	• Indicates whether the relay is set by the system or user, and, if it is set by the system, when setting is performed. <Set by> S : Set by system U : Set by user (sequence programs or test operations from GX Developer) S/U : Set by both system and user <When set> Indicated only for registers set by system Every END : Set during every END processing Initial : Set only during initial processing (when power supply is turned ON, or when going from STOP to RUN) Status change : Set only when there is a change in status Error : Set when error occurs Instruction execution : Set when instruction is executed Request : Set only when there is a user request (through SM, etc.)

For details on the following items, refer to the following manuals:
• Networks → Manuals of each network module

POINT

In the program that achieves the safety function, only SM1000 to SM1299 can be used.
Special relay other than SM1000 to SM1299 cannot be used in the program that achieves the safety function.

(1) Diagnostic Information

TableApp.2 Descriptions of the special relay headings

Number	Name	Meaning	Explanation	Set by (When Set)	Corresponding CPU
SM0	Diagnostic errors	OFF : No error ON : Error	• Turns ON when an error is detected by diagnostics (Includes when an annunciator is ON) • Remains ON if the condition is restored to normal thereafter.	S (Error)	QS
SM1	Self-diagnosis error	OFF : No self-diagnosis errors ON : Self-diagnosis	• Turns ON when an error is detected by self-diagnostics (Does not include when an annunciator is ON) • Remains ON if the condition is restored to normal thereafter.	S (Error)	
SM5	Error common information	OFF : No error common information ON : Error common information	• When SM0 is ON, ON if there is error common information	S (Error)	
SM16	Error individual information	OFF : No error individual information ON : Error individual information	• When SM0 is ON, ON if there is error individual information	S (Error)	
SM50	Error reset	OFF→ON: Error reset	• Conducts error reset operation	U	
SM51	Battery low latch	OFF : Normal ON : Battery low	• ON if battery voltage at CPU module or memory card drops below rated value. • Remains ON if the battery voltage returns to normal thereafter. • Synchronous with BAT. LED	S (Error)	
SM52	Battery low	OFF : Normal ON : Battery low	• Same as SM51, but goes OFF subsequently when battery voltage returns to normal.	S (Error)	
SM53	AC DOWN detection	OFF : AC DOWN not detected ON : AC DOWN detected	• Turns ON if an instantaneous power failure of within 20ms occurs during use of the AC power supply module. Reset when the power supply is switched OFF, then ON.	S (Error)	
SM56	Operation error	OFF : Normal ON : Operation error	• ON when operation error is generated • Remains ON if the condition is restored to normal thereafter.	S (Error)	
SM61	I/O module verify error	OFF : Normal ON : Error	• Turns ON if the I/O module differs from the status registered at power on. • Remains ON if the condition is restored to normal thereafter.	S (Error)	
SM62	Annunciator detection	OFF : Not detected ON : Detected	• Goes ON if even one annunciator F goes ON.	S (Instruction execution)	

(2) System information

TableApp.3 Special relay

Number	Name	Meaning	Explanation	Set by (When Set)	Corresponding CPU
SM203	STOP contact	STOP status	• Turns ON when the CPU is in STOP status.	S (Status change)	QS
SM210	Clock data set request	OFF : Ignored ON : Set request	• Writes clock data stored in SD210 to SD213 to the CPU module after the END instruction of the scan where the relay changes OFF to ON has been executed.	U	
SM211	Clock data error	OFF : No error ON : Error	• Turns ON when an error is detected in the clock data (SD210 to SD213) and turns OFF if no error is detected.	S (Request)	
SM213	Clock data read request	OFF : Ignored ON : Read request	• Reads clock data to SD210 to SD213 in BCD value when the relay is ON.	U	
SM232	Number of writes to ROM	OFF : Within the number of writes ON : Over the number of writes	• Turns ON when the number of writes to ROM exceeds 100,000.	S (Error)	

(3) System clocks/counters

TableApp.4 Special relay

Number	Name	Meaning	Explanation	Set by (When Set)	Corresponding CPU
SM400	Always ON	ON OFF	• Normally is ON	S (Every END)	QS
SM401	Always OFF	ON OFF	• Normally is OFF	S (Every END)	
SM402	After RUN, ON for 1 scan only	ON / OFF, 1 scan	• After RUN, ON for 1 scan only.	S (Every END)	
SM403	After RUN, OFF for 1 scan only	ON / OFF, 1 scan	• After RUN, OFF for 1 scan only.	S (Every END)	
SM410	0.1 second clock	0.05s / 0.05s	• Repeatedly changes between ON and OFF at each designated time interval. • When PLC power supply is turned OFF or a CPU module reset is performed, goes from OFF to start.	S (Status change)	
SM411	0.2 second clock	0.1s / 0.1s			
SM412	1 second clock	0.5s / 0.5s			
SM413	2 second clock	1s / 1s			
SM414	2n second clock	ns / ns	• This relay alternates between ON and OFF at intervals of the time (unit: s) specified in SD414. • When PLC power supply is turned OFF or a CPU module reset is performed, goes from OFF to start.	S (Status change)	

(4) Safety CPU

TableApp.5 Special relay

Number	Name	Meaning	Explanation	Set by (When Set)	Corresponding CPU
SM560	TEST MODE flag	OFF : Other than TEST MODE ON : TEST MODE	• Turns ON when operating on the TEST MODE. • Turns OFF when operating on the other mode (SAFETY MODE, SAFETY MODE (wait-for-restart)).	S (Status change)	QS
SM561	Continuous RUN of tolerance time setting for the TEST MODE	OFF : Within the setting time ON : Over the setting time	• Turns ON when the continuous RUN of tolerance time set for the TEST MODE in the parameter is exceeded.	S (Error)	

(5) Boot operation

TableApp.6 Special relay

Number	Name	Meaning	Explanation	Set by (When Set)	Corresponding CPU
SM660	Boot operation	OFF : Program memory execution ON : During boot operation	(On the TEST MODE) • Turns ON during the boot operation from standard ROM. • Turns OFF when the boot operation from standard ROM is not run. (On the SAFETY MODE) • Always ON	S (Initial)	QS

(6) Instruction-Related Special Relays

TableApp.7 Special relay

Number	Name	Meaning	Explanation	Set by (When Set)	Corresponding CPU
SM722	BIN/DBIN instruction error disabling flag	OFF : Error detection performed ON : Error detection not performed	• Turned ON when "OPERATION ERROR" is suppressed for BIN or DBIN instruction.	U	QS

(7) CC-Link Safety

TableApp.8 Special relay

Number	Name	Meaning	Explanation	Set by (When Set)	Corresponding CPU
SM1004	Safety station refresh communication status (Safety master module 1)	OFF : Nomal ON : Communication error	The safety station refresh communication atatus is stored. (The status of each station are stored in SD1004 to SD1007.)	S (Status change)	QS
SM1204	Safety station refresh communication status (Safety master module 2)	OFF : Nomal ON : Communication error	The safety station refresh communication status is stored. (The status of each station are stored in SD1204 to SD1207.)	S (Status change)	

Appendix 2 Special Register List

The special registers, SD, are internal registers with fixed applications in the PLC.
For this reason, it is not possible to use these registers in sequence programs in the same way that normal registers are used.
However, data can be written as needed in order to control the CPU modules and remote I/O modules.
Data stored in the special registers are stored as BIN values if no special designation has been made to the contrary.

The heading descriptions in the following special register lists are shown in TableApp.9.

TableApp.9 Descriptions of the special register list headings

Item	Function of Item
Number	• Indicates special register number
Name	• Indicates name of special register
Meaning	• Indicates contents of special register
Explanation	• Discusses contents of special register in more detail
Set by (When set)	• Indicates whether the relay is set by the system or user, and, if it is set by the system, when setting is performed. <Set by> S : Set by system U : Set by user (sequence programs or test operations from GX Developer) S/U : Set by both system and user <When set> Indicated only for registers set by system Every END : Set during every END processing Initial : Set only during initial processing (when power supply is turned ON, or when going from STOP to RUN) Status change : Set only when there is a change in status Error : Set when error occurs Instruction execution : Set when instruction is executed Request : Set only when there is a user request (through SM, etc.) Writing to ROM : Set when writing to ROM

For details on the following items, refer to the following manuals:
• Networks → Manuals of each network module

POINT

In the program that achieves the safety function, only SD1000 to SD1299 can be used.
Special register other than SD1000 to SD1299 cannot be used in the program that achieves the safety function.

(1) Diagnostic Information

TableApp.10 Special register

Number	Name	Meaning	Explanation	Set by (When set)	Corresponding CPU
SD0	Diagnostic errors	Diagnosis error code	• Error codes for errors detected by diagnostics are stored as BIN data. • Contents identical to latest fault history information.	S (Error)	QS
SD1	Clock time for diagnosis error occurrence	Clock time for diagnosis error occurrence	• Stores the year (last two digits) and month when SD0 data was updated as BCD 2-digit code. b15 to b8 b7 to b0 Year (0 to 99) | Month (1 to 12) (Example) September, 2006 H0609	S (Error)	
SD2			• Stores the day and hour when SD0 data was updated as BCD 2-digit code. b15 to b8 b7 to b0 Day (1 to 31) | Hour (0 to 23) (Example) 10 a.m. on 25th H2510		
SD3			• Stores the minute and second when SD0 data was updated as BCD 2-digit code. b15 to b8 b7 to b0 Minutes (0 to 59) | Seconds (0 to 59) (Example) 35 min. 48 sec. H3548		
SD4	Error information categories	Error information category code	Category codes to identify what type of error information is stored in the common information (SD5 to SD15) or in the individual information (SD16 to SD26). b15 to b8 b7 to b0 Individual information category codes | Common information category codes • The common information category codes store the following codes: 0 : No error 1: Module No./Base No. 2: File name/Drive name 3: Time (value set) 4: Program error location 9: CC-Link Safety information 10: Module No./Station No. • The individual information category codes store the following codes: 0: No error 2: File name/Drive name 3: Time (value actually measured) 4: Program error location 5: Parameter number 6: Annunciator (F) number 9: Error information 10: CC-Link Safety information 11: Program abort information 12: File diagnostics information	S (Error)	

TableApp.10 Special register

<table>
<tr><th>Number</th><th>Name</th><th>Meaning</th><th>Explanation</th><th>Set by (When set)</th><th>Corresponding CPU</th></tr>
<tr><td>SD5
SD6
SD7
SD8
SD9
SD10
SD11
SD12
SD13
SD14
SD15</td><td>Error common information</td><td>Error common information</td><td>• Common information corresponding to the error codes (SD0) is stored here.
• The following six types of information are stored here:
1) Module No./Base No.
<table><tr><th>Number</th><th>Meaning</th></tr><tr><td>SD5</td><td>Slot No./Base No. *1</td></tr><tr><td>SD6</td><td>I/O No. *2</td></tr><tr><td>SD7
SD8
SD9
SD10
SD11
SD12
SD13
SD14
SD15</td><td>(Empty)</td></tr></table>*1: The storing value "255" in SD5 (Slot No.) indicates that the slot number for a module specified by an instruction cannot be identified. When storing the base number to SD5, store 0 (main base unit).
*2: The storing value "FFFFH" in SD6 (I/O No.) indicates that the I/O number cannot be identified on the I/O assignment setting tab of PLC parameter due to overlapping of I/O numbers or that the I/O number cannot be identified from the network number specified by an instruction. In this case, the error location can be identified in SD5.
2) File name/Drive name
<table><tr><th>Number</th><th colspan="2">Meaning</th></tr><tr><td>SD5</td><td colspan="2">Drive</td></tr><tr><td>SD6
SD7
SD8
SD9</td><td colspan="2">File name
(ASCII code: 8 characters)</td></tr><tr><td>SD10</td><td>Extension *3</td><td>2EH(.)</td></tr><tr><td>SD11</td><td colspan="2">(ASCII code: 3 characters)</td></tr><tr><td>SD12
SD13
SD14
SD15</td><td colspan="2">(Empty)</td></tr></table>(Example) File name = MAIN.QPG
<table><tr><th>b15 to b8</th><th>b7 to b0</th></tr><tr><td>41H(A)</td><td>40H(M)</td></tr><tr><td>43H(N)</td><td>49H(I)</td></tr><tr><td>20H(SP)</td><td>20X(SP)</td></tr><tr><td>20H(SP)</td><td>20H(SP)</td></tr><tr><td>51H(Q)</td><td>2EH(.)</td></tr><tr><td>47H(G)</td><td>50H(P)</td></tr></table></td><td>S (Error)</td><td>QS</td></tr>
</table>

Remark

*3 : Extensions are shown in TableApp.11.

TableApp.11 Extension name

SDn	SDn+1		Extension name	File type
Higher 8 bits	Lower 8 bits	Higher 8 bits		
51H	50H	41H	QPA	Parameters
51H	50H	47H	QPG	Sequence program
51H	43H	44H	QCD	Device comment

TableApp.10 Special register

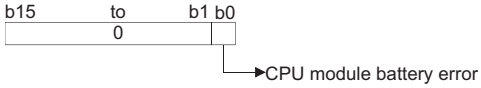
<table>
<tr><th>Number</th><th>Name</th><th>Meaning</th><th>Explanation</th><th>Set by (When set)</th><th>Corresponding CPU</th></tr>
<tr><td>SD5
SD6
SD7
SD8
SD9
SD10
SD11
SD12
SD13
SD14
SD15</td><td>Error common information</td><td>Error common information</td><td>3) Time (value set)
<table><tr><th>Number</th><th>Meaning</th></tr><tr><td>SD5</td><td>Time : 1μs units (0 to 999μs)</td></tr><tr><td>SD6</td><td>Time : 1ms units (0 to 65535ms)</td></tr><tr><td>SD7
SD8
SD9
SD10
SD11
SD12
SD13
SD14
SD15</td><td>(Empty)</td></tr></table>4) Program error location
<table><tr><th>Number</th><th>Meaning</th></tr><tr><td>SD5
SD6
SD7
SD8</td><td>File name
(ASCII code: 8 characters)</td></tr><tr><td>SD9</td><td>Extension ∗3 | 2EH(.)</td></tr><tr><td>SD10</td><td>(ASCII code: 3 characters)</td></tr><tr><td>SD11</td><td>(Empty)</td></tr><tr><td>SD12</td><td>Block No.∗4</td></tr><tr><td>SD13</td><td>Step No. ∗4</td></tr><tr><td>SD14</td><td>Sequence step No. (L)</td></tr><tr><td>SD15</td><td>Sequence step No. (H)</td></tr></table>*4: "0" is stored to the block number and the step number.
9) CC-Link Safety information
<table><tr><th>Number</th><th>Meaning</th></tr><tr><td>SD5</td><td>Error classification∗5</td></tr><tr><td>SD6</td><td>Error item∗5</td></tr><tr><td>SD7</td><td>Link ID</td></tr><tr><td>SD8</td><td>Station No.</td></tr><tr><td>SD9</td><td>System area 1</td></tr><tr><td>SD10</td><td>System area 2</td></tr><tr><td>SD11</td><td>System area 3</td></tr><tr><td>SD12</td><td>System area 4</td></tr><tr><td>SD13</td><td>System area 5</td></tr><tr><td>SD14</td><td>System area 6</td></tr><tr><td>SD15</td><td>System area 7</td></tr><tr><td>SD16</td><td>System area 8</td></tr></table>*5: The error classification and error item are stored only when the error code is 8300 (CC-LINK REMOTE DETECTION ERROR).
0 is stored when the error coad is other than 8300.
10) Module No./Station No.
<table><tr><th>Number</th><th>Meaning</th></tr><tr><td>SD5</td><td>Slot No.</td></tr><tr><td>SD6</td><td>I/O No.</td></tr><tr><td>SD7</td><td>Station No.</td></tr><tr><td>SD8
SD9
SD10
SD11
SD12
SD13
SD14
SD15</td><td>(Empty)</td></tr></table></td><td>S (Error)</td><td>QS</td></tr>
</table>

TableApp.10 Special register

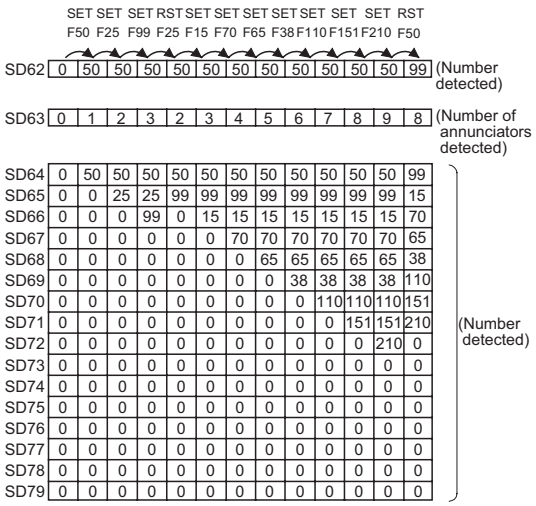
<table>
<tr><th>Number</th><th>Name</th><th>Meaning</th><th>Explanation</th><th>Set by (When set)</th><th>Corresponding CPU</th></tr>
<tr><td>SD16
SD17
SD18
SD19
SD20
SD21
SD22
SD23
SD24
SD25
SD26</td><td>Error individual information</td><td>Error individual information</td><td>
• Individual information corresponding to error codes (SD0) is stored here.
• There are the following nine different types of information are stored.

2) File name/Drive name
<table>
<tr><th>Number</th><th>Meaning</th></tr>
<tr><td>SD16</td><td>Drive</td></tr>
<tr><td>SD17</td><td rowspan="5">File name
(ASCII code: 8 characters)</td></tr>
<tr><td>SD18</td></tr>
<tr><td>SD19</td></tr>
<tr><td>SD20</td></tr>
<tr><td>SD21</td><td>Extension *3 2EH(.)</td></tr>
<tr><td>SD22</td><td>(ASCII code: 3 characters)</td></tr>
<tr><td>SD23</td><td rowspan="4">(Empty)</td></tr>
<tr><td>SD24</td></tr>
<tr><td>SD25</td></tr>
<tr><td>SD26</td></tr>
</table>
(Example) File name = MAIN.QPG
<table>
<tr><th>b15 to b8</th><th>b7 to b0</th></tr>
<tr><td>41H(A)</td><td>40H(M)</td></tr>
<tr><td>43H(N)</td><td>49H(I)</td></tr>
<tr><td>20H(SP)</td><td>20x(SP)</td></tr>
<tr><td>20H(SP)</td><td>20H(SP)</td></tr>
<tr><td>51H(Q)</td><td>2EH(.)</td></tr>
<tr><td>47H(G)</td><td>50H(P)</td></tr>
</table>
3) Time (value Actually measured)
<table>
<tr><th>Number</th><th>Meaning</th></tr>
<tr><td>SD16</td><td>Time : 1μs units (0 to 999μs)</td></tr>
<tr><td>SD17</td><td>Time : 1ms units (0 to 65535ms)</td></tr>
<tr><td>SD18
SD19
SD20
SD21
SD22
SD23
SD24
SD25
SD26</td><td>(Empty)</td></tr>
</table>
4) Program error location
<table>
<tr><th>Number</th><th>Meaning</th></tr>
<tr><td>SD16
SD17
SD18
SD19</td><td>File name
(ASCII code: 8 characters)</td></tr>
<tr><td>SD20</td><td>Extension *3 2EH(.)</td></tr>
<tr><td>SD21</td><td>(ASCII code: 3 characters)</td></tr>
<tr><td>SD22</td><td>(Empty)</td></tr>
<tr><td>SD23</td><td>Block No. *6</td></tr>
<tr><td>SD24</td><td>Step No. *6</td></tr>
<tr><td>SD25</td><td>Sequence step No. (L)</td></tr>
<tr><td>SD26</td><td>Sequence step No. (H)</td></tr>
</table>
*6: "0" is stored to the block number and the step number.
5) Parameter No.
<table>
<tr><th>Number</th><th>Meaning</th></tr>
<tr><td>SD16</td><td>Parameter No.</td></tr>
<tr><td>SD17
SD18
SD19
SD20
SD21
SD22
SD23
SD24
SD25
SD26</td><td>(Empty)</td></tr>
</table>
6) Annunciator number
<table>
<tr><th>Number</th><th>Meaning</th></tr>
<tr><td>SD16</td><td>No.</td></tr>
<tr><td>SD17
SD18
SD19
SD20
SD21
SD22
SD23
SD24
SD25
SD26</td><td>(Empty)</td></tr>
</table>
9) Error information
<table>
<tr><th>Number</th><th>Meaning</th></tr>
<tr><td>SD16</td><td>Error information 1</td></tr>
<tr><td>SD17</td><td>Error information 2</td></tr>
<tr><td>SD18</td><td>Error information 3</td></tr>
<tr><td>SD19</td><td>Error information 4</td></tr>
<tr><td>SD20</td><td>Error information 5</td></tr>
<tr><td>SD21</td><td>Error information 6</td></tr>
<tr><td>SD22</td><td>Error information 7</td></tr>
<tr><td>SD23</td><td>Error information 8</td></tr>
<tr><td>SD24</td><td>Error information 9</td></tr>
<tr><td>SD25</td><td>Error information 10</td></tr>
<tr><td>SD26</td><td>Error information 11</td></tr>
</table>
</td><td>S (Error)</td><td>QS</td></tr>
</table>

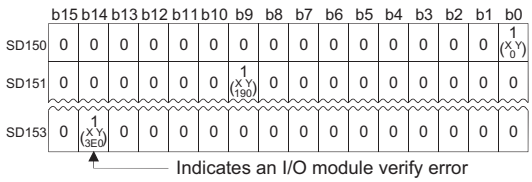
TableApp.10 Special register

<table>
<tr><th>Number</th><th>Name</th><th>Meaning</th><th>Explanation</th><th>Set by (When set)</th><th>Corresponding CPU</th></tr>
<tr><td>SD16
SD17
SD18
SD19
SD20
SD21
SD22
SD23
SD24
SD25
SD26</td><td>Error individual information</td><td>Error individual information</td><td>10) CC-Link Safety information
<table><tr><th>Number</th><th>Meaning</th></tr><tr><td>SD16</td><td>Number of items for individual information</td></tr><tr><td>SD17</td><td>individual information 1</td></tr><tr><td>SD18</td><td>individual information 2</td></tr><tr><td>SD19</td><td>individual information 3</td></tr><tr><td>SD20</td><td>individual information 4</td></tr><tr><td>SD21</td><td>individual information 5</td></tr><tr><td>SD22</td><td>individual information 6</td></tr><tr><td>SD23</td><td>individual information 7</td></tr><tr><td>SD24</td><td>individual information 8</td></tr><tr><td>SD25</td><td>individual information 9</td></tr><tr><td>SD26</td><td>individual information 10</td></tr></table>11) Program abort information
<table><tr><th>Number</th><th>Meaning</th></tr><tr><td>SD16</td><td>Abort code ∗5</td></tr><tr><td>SD17
SD18
SD19
SD20
SD21
SD22
SD23
SD24
SD25
SD26</td><td>(Empty)</td></tr></table>*5 : The specified abort code is stored by the S.QSABORT instruction.
12) File diagostics information
<table><tr><th>Number</th><th colspan="2">Meaning</th></tr><tr><td>SD16</td><td>Error information</td><td>Drive No.</td></tr><tr><td>SD17
SD18
SD19
SD20</td><td colspan="2">File name (ASCII code: 8 characters)</td></tr><tr><td>SD21</td><td>Extension ∗3</td><td>2EH(.)</td></tr><tr><td>SD22</td><td colspan="2">(ASCII code: 3 characters)</td></tr><tr><td>SD23
SD24</td><td colspan="2">Error information 2</td></tr><tr><td>SD25
SD26</td><td colspan="2">Error information 3</td></tr></table>(Example) File name = MAIN.QPG
<table><tr><th>b15 to b8</th><th>b7 to b0</th></tr><tr><td>41H(A)</td><td>40H(M)</td></tr><tr><td>43H(N)</td><td>49H(I)</td></tr><tr><td>20H(SP)</td><td>20H(SP)</td></tr><tr><td>20H(SP)</td><td>20H(SP)</td></tr><tr><td>51H(Q)</td><td>2EH(.)</td></tr><tr><td>47H(G)</td><td>50H(P)</td></tr></table></td><td>S (Error)</td><td rowspan="7">QS</td></tr>
<tr><td>SD27</td><td>Diagnostics error CPU identifier</td><td>CPU identifier (CPU A/CPU B)</td><td>• The CPU identifier which the CPU issues diagnostics error SD0 to SD26 is stored
0001H : CPU A
0002H : CPU B</td><td>S (Error)</td></tr>
<tr><td>SD50</td><td>Error reset</td><td>Error number that performs error reset</td><td>• Stores error number that performs error reset</td><td>U</td></tr>
<tr><td>SD51</td><td>Battery low latch</td><td>Bit pattern indicating where battery voltage drop occurred</td><td>• All corresponding bits go 1(ON) when battery voltage drops.
• Subsequently, these remain 1(ON) even after battery voltage has been returned to normal.
  </td><td>S (Error)</td></tr>
<tr><td>SD52</td><td>Battery low</td><td>Bit pattern indicating where battery voltage drop occurred</td><td>• Same configuration as SD51 above
• Turns to 0 (OFF) when the battery voltage returns to normal thereafter.</td><td>S (Error)</td></tr>
<tr><td>SD53</td><td>AC DOWN detection</td><td>Number of times for AC DOWN detection</td><td>• Every time the input voltage falls to or below 85% (AC power) of the rating during calculation of the CPU module, the value is incremented by 1 and stored in BIN code.</td><td>S (Error)</td></tr>
</table>

TableApp.10 Special register

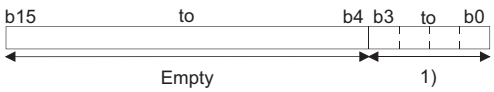
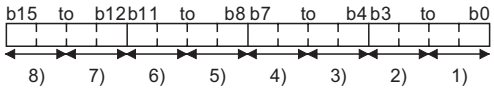
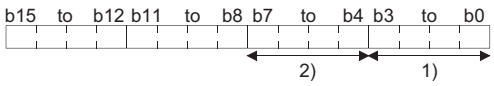
<table>
<tr><th>Number</th><th>Name</th><th>Meaning</th><th>Explanation</th><th>Set by (When set)</th><th>Corresponding CPU</th></tr>
<tr><td>SD61</td><td>I/O module verify error number</td><td>I/O module verify error module number</td><td>• The lowest I/O number of the module where the I/O module verification number took place.</td><td>S (Error)</td><td rowspan="20">QS</td></tr>
<tr><td>SD62</td><td>Annunciator number</td><td>Annunciator number</td><td>• The first annunciator number (F number) to be detected is stored here.</td><td>S (Instruction execution)</td></tr>
<tr><td>SD63</td><td>Number of annunciators</td><td>Number of annunciators</td><td>• Stores the number of annunciators searched.</td><td>S (Instruction execution)</td></tr>
<tr><td>SD64
SD65
SD66
SD67
SD68
SD69
SD70
SD71
SD72
SD73
SD74
SD75
SD76
SD77
SD78
SD79</td><td>Table of detected annunciator numbers</td><td>Annunciator detection number</td><td>• When F goes ON due to OUT F or SET F, the F numbers which go progressively ON from SD64 through SD79 are registered.
• The F numbers turned OFF by RST F are deleted from SD64 - SD79, and the F numbers stored after the deleted F numbers are shifted to the preceding registers.
After 16 annunciators have been detected, detection of the 17th will not be stored from SD64 through SD79.
 
</td><td>S (Instruction execution)</td></tr>
<tr><td>SD81</td><td>Cause of error</td><td>Cause of error</td><td>• When a continuation error occurs, the corresponding bits are all set to ON.
• Canceling the error, starting up the safety PLC power or canceling the safety CPU module reset after eliminating the cause of the error makes the bits go OFF.
<table><tr><th>Bit No.</th><th>Name of the cause</th></tr><tr><td>0</td><td>Instantaneous power failure</td></tr><tr><td>1</td><td>Battery low</td></tr><tr><td>2</td><td>Standard ROM write count excess</td></tr><tr><td>3</td><td>TEST MODE continuous RUN tolerance timeout</td></tr><tr><td>4</td><td>Scan timeout</td></tr><tr><td>5</td><td>Annunciator ON</td></tr><tr><td>6</td><td>Safety remote station detection error</td></tr><tr><td>7</td><td>Safety remote station product information mismatch</td></tr><tr><td>8</td><td>Initial monitoring timeout error
Safety monitoring timeout error
Error monitoring timeout error</td></tr><tr><td>9</td><td>Safety remote station data split error
Safety remote command error
Safety remote station link ID error
Safety remote station running number error
Safety remote station reception data error</td></tr><tr><td>10 to 15</td><td>Empty (fixed to 0)</td></tr></table></td><td>S (Error)</td></tr>
</table>

TableApp.10 Special register

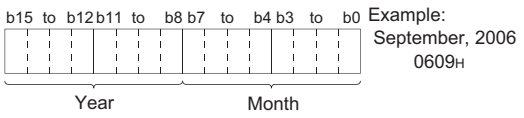
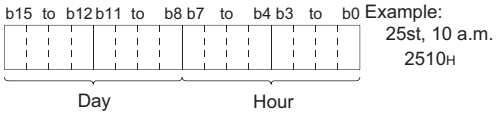
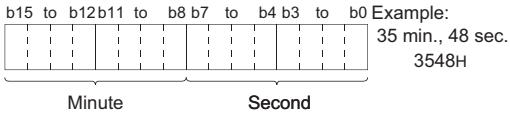
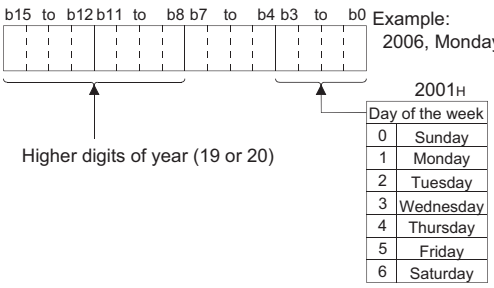
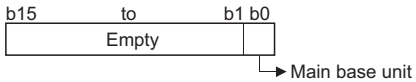
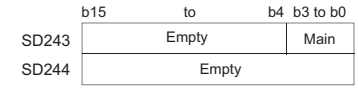
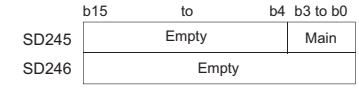
Number	Name	Meaning	Explanation	Set by (When set)	Corresponding CPU
SD150 SD151 SD152 SD153	I/O module verify error	Bit pattern, in units of 16 points, indicating the modules with verify errors. 0: No I/O verify errors 1: I/O verify error present	• When I/O modules, of which data are different from those entered at power-on, have been detected, the I/O module numbers (in units of 16 points) are entered in bit pattern. (Preset I/O module numbers set in parmeters when parameter setting has been performed.)  • Not cleared even if the blown fuse is replaced with a new one. This flag is cleared by error resetting operation.	S (Error)	QS

(2) System information

TableApp.12 Special register

Number	Name	Meaning	Explanation	Set by (When set)	Corresponding CPU
SD200	Status of switch	Status of CPU switch	• The CPU switch status is stored in the following format.  1): CPU switch status 0: RUN 1: STOP 2: RESET	S (Every END)	QS
SD201	LED status	Status of CPU-LED	• The following bit patterns are used to store the statuses of the LEDs on the CPU module: • 0 is off, 1 is on, and 2 is flicker.  1): RUN 5): Empty 2): ERR. 6): Empty 3): USER 7): TEST 4): BAT. 8): Empty	S (Status change)	
SD203	Operating status of CPU	Operating status of CPU	• The CPU operating status is stored as indicated in the following figure:  1): Operating status of CPU 0: RUN 2: STOP 2): STOP cause 0: Instruction in remote operation program from RUN/STOP/RESET switch 1: Remote contact 2: Remote operation from GX Developer/ serial communication, etc. 4: Error Note stores the above-mentioned factors from the smallest number in priority to the largest one. However, "4:error" is treated as the highest priority.	S (Every END)	

TableApp.12 Special register

Number	Name	Meaning	Explanation	Set by (When set)	Corresponding CPU
SD210	Clock data	Clock data (year, month)	• The year (last two digits) and month are stored as BCD code at SD210 as shown below: 	S (Request)/U	QS
SD211	Clock data	Clock data (day, hour)	• The day and hour are stored as BCD code at SD211 as shown below: 		
SD212	Clock data	Clock data (minute, second)	• The minutes and seconds (after the hour) are stored as BCD code at SD212 as shown below: 		
SD213	Clock data	Clock data (later digits of year, day of week)	• Stores the year (two digits) and the day of the week in SD213 in the BCD code format as shown below. 		
SD232 SD233	ROM write count	ROM write count up to now	• Store the ROM write count up to now.	S (Writing to ROM)	
SD240	Base mode	0: Automatic mode	• Stores the base mode.(0 fixed)	S (Initial)	
SD241	Extension stage number	0: Main base only	• Stores the maximum number of the extension bases being installed. (0 fixed)	S (Initial)	
SD242	Installed Q base presence/ absence	Base type differentiation 0: Base not installed 1: QS**B is installed		S (Initial)	
SD243 SD244	No. of base slots (Operation status)	No. of base slots	 • As shown above, each area stores the number of slots being installed. (Number of set slots when parameter setting has been made)	S (Initial)	
SD245 SD246	No. of base slots (Mounting status)	No. of base slots	 • As shown above, each area stores the numbers of module-mounted slots of the base unit (actual number of slots of the installed base unit).	S (Initial)	

TableApp.12 Special register

Number	Name	Meaning	Explanation	Set by (When set)	Corresponding CPU
SD250	Loaded maximum I/O	Loaded maximum I/O No.	• The upper 2 digits of the final I/O number plus 1 of the modules loaded are stored as BIN values.	S (Initial)	QS
SD254	CC-Link IE controller network, MELSECNET /H information	Number of modules mounted	• Indicates the number of mounted CC-Link IE controller network or MELSECNET/H modules.	S (Initial)	
SD255		I/O number	• Indicates the I/O number of mounted CC-Link IE controller network or MELSECNET/H module.		
SD256		Network number	• Indicates the network number of mounted CC-Link IE controller network or MELSECNET/H module.		
SD257		Group number	• Indicates the group number of mounted CC-Link IE controller network or MELSECNET/H module.		
SD258		Station number	• Indicates the station number of mounted CC-Link IE controller network or MELSECNET/H module.		
SD290	Device assignment (Same as the parameter setting)	Number of points assigned for X	• Stores the number of points currently set for X devices	S (Initial)	
SD291		Number of points assigned for Y	• Stores the number of points currently set for Y devices		
SD292		Number of points assigned for M	• Stores the number of points currently set for M devices		
SD294		Number of points assigned for B	• Stores the number of points currently set for B devices		
SD295		Number of points assigned for F	• Stores the number of points currently set for F devices		
SD296		Number of points assigned for SB	• Stores the number of points currently set for SB devices		
SD297		Number of points assigned for V	• Stores the number of points currently set for V devices		
SD299		Number of points assigned for T	• Stores the number of points currently set for T devices		
SD300		Number of points assigned for ST	• Stores the number of points currently set for ST devices		
SD301		Number of points assigned for C	• Stores the number of points currently set for C devices		
SD302		Number of points assigned for D	• Stores the number of points currently set for D devices		
SD303		Number of points assigned for W	• Stores the number of points currently set for W devices		
SD304		Number of points assigned for SW	• Stores the number of points currently set for SW devices		
SD340	Ethernet information	Number of modules mounted	• Indicates the number of mounted Ethernet modules.	S (Initial)	
SD341		I/O number	• Indicates the I/O number of mounted Ethernet module.		
SD342		Network number	• Indicates the network number of mounted Ethernet module.		
SD343		Group number	• Indicates the group number of mounted Ethernet module.		
SD344		Station number	• Indicates the station number of mounted Ethernet module.		

(3) System clocks/counters

TableApp.13 Special register

Number	Name	Meaning	Explanation	Set by (When set)	Corresponding CPU
SD412	1 second counter	Number of counts in 1-second units	• Following programmable controller CPU module RUN, 1 is added each second • Count repeats from 0 to 32767 to -32768 to 0	S (Status change)	QS
SD414	2n second clock setting	2n second clock units	• Stores value n of 2n second clock (Default is 30) • Setting can be made between 1 to 32767	U	
SD420	Scan counter	Number of counts in each scan	• Incremented by 1 for each scan execution after the CPU module is set to RUN. • Count repeats from 0 to 32767 to -32768 to 0	S (Every END)	

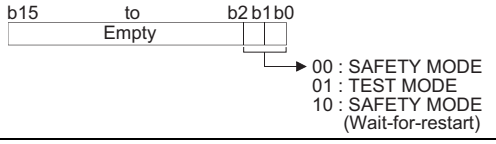
(4) Scan information

TableApp.14 Special register

Number	Name	Meaning	Explanation	Set by (When set)	Corresponding CPU
SD520	Current scan time	Current scan time (in 1 ms units)	• The current scan time is stored into SD520 and SD521. (Measurement is made in 100 μs units.) SD520: Stores the value of ms. (Storage range: 0 to 6553) SD521: Stores the value of μs. (Storage range: 0 to 900) (Example) When the current scan time is 23.6ms, the following values are stored. SD520 = 23 SD521 = 600 • The accuracy of processing time of scantime is ±0.1ms.	S (Every END)	QS
SD521		Current scan time (in 100 μs units)			
SD524	Minimum scan time	Minimum scan time (in 1 ms units)	• Stores the minimum value of the scan time into SD524 and SD525. (Measurement is made in 100 μs units.) SD524: Stores the ms place. (Storage range: 0 to 6553) SD525: Stores the μs place. (Storage range: 0 to 900) • The accuracy of processing time of scantime is ±0.1ms.	S (Every END)	
SD525		Minimum scan time (in 100 μs units)			
SD526	Maximum scan time	Maximum scan time (in 1 ms units)	• Stores the maximum value of the scan time into SD526 and SD527. (Measurement is made in 100 μs units.) SD526: Stores the ms place. (Storage range: 0 to 6553) SD527: Stores the μs place. (Storage range: 0 to 900) • The accuracy of processing time of scantime is ±0.1ms.	S (Every END)	
SD527		Maximum scan time (in 100 μs units)			
SD540	END processing time	END processing time (in 1 ms units)	• Stores the time from when the scan program ends until the next scan starts into SD540 and SD541. (Measurement is made in 100 μs units.) SD540: Stores the ms place. (Storage range: 0 to 6553) SD541: Stores the μs place. (Storage range: 0 to 900) • The accuracy of NED processing time is ±0.1ms.	S (Every END)	
SD541		END processing time (in 100 μs units)			
SD542	Constant scan wait time	Constant scan wait time (in 1 ms units)	• Stores the wait time for constant scan setting into SD542 and SD543. (Measurement is made in 100 μs units.) SD542: Stores the ms place. (Storage range: 0 to 6553) SD543: Stores the μs place. (Storage range: 0 to 900) • The accuracy of constant scan wait time is ±0.1ms.	S (Every END)	
SD543		Constant scan wait time (in 100 μs units)			
SD548	Scan program execution time	Scan program execution time (in 1 ms units)	• Stores the execution time of a scan program during one scan into SD548 and SD549. (Measurement is made in 100 μs units.) SD548: Stores the ms place. (Storage range: 0 to 6553) SD549: Stores the μs place. (Storage range: 0 to 900) • Stored every scan. • The accuracy of scan program execution time is ±0.1ms.	S (Every END)	
SD549		Scan program execution time (in 100 μs units)			

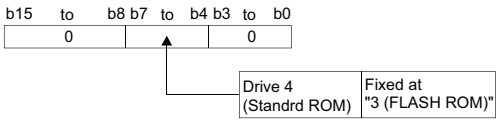
(5) Safety CPU

TableApp.15 Special register

Number	Name	Meaning	Explanation	Set by (When set)	Corresponding CPU
SD560	Safety CPU operation mode	Safety CPU operation mode	• Stores the safety CPU operation mode. 	S (Status change)	QS
SD561 SD562	TEST MODE continuous RUN time	TEST MODE continuous RUN time (seconds)	• Stores the TEST MODE continuous RUN time. (Measured in seconds) (RUN time in TEST MODE. Start measurement when STOP & RUN (Time when operation is STOP is not included.) • Stores the measurment valve with the range of 1 to 2147483647.	S (Every END)	

(6) Memory

TableApp.16 Special register

Number	Name	Meaning	Explanation	Set by (When set)	Corresponding CPU
SD620	Memory type	Memory type	• Indicates the type of built-in memory. 	S (Initial)	QS
SD623	Drive 4 (ROM) capacity	Drive 4 capacity	• Drive 4 capacity is stored in 1 kbyte units.	S (Initial)	

(7) CC-Link Safety

TableApp.17 Special register

<table>
<tr><th>Number</th><th>Name</th><th>Meaning</th><th>Explanation</th><th>Set by (When set)</th><th>Corresponding CPU</th></tr>
<tr><td>SD1000 to SD1003</td><td>Safety remote station specification (CC-Link Safety master module 1)</td><td>0: No safety remote station specification
1: Safety remote station specification</td><td>• The specified status of safety remote station is stored.
• "0" is stored for the standard remote station.
<table><tr><td></td><td>b15</td><td>b14</td><td>-</td><td>b1</td><td>b0</td></tr><tr><td>SD1000</td><td>16</td><td>15</td><td>to</td><td>2</td><td>1</td></tr><tr><td>SD1001</td><td>32</td><td>31</td><td>to</td><td>18</td><td>17</td></tr><tr><td>SD1002</td><td>48</td><td>47</td><td>to</td><td>34</td><td>33</td></tr><tr><td>SD1003</td><td>64</td><td>63</td><td>to</td><td>50</td><td>49</td></tr></table>1 to 64 in the table indicate station numbers.</td><td>S (Initial)</td><td rowspan="4">QS</td></tr>
<tr><td>SD1004 to SD1007</td><td>Safety station refresh communication status (CC-Link Safety master module 1)</td><td>0: Normal, Reserved station specified, Unused, Standard remote station
1: Safety station communication error</td><td>• The refresh communication status of safety remote station is stored.
• "0" is stored for the standard remote station.
<table><tr><td></td><td>b15</td><td>b14</td><td>-</td><td>b1</td><td>b0</td></tr><tr><td>SD1004</td><td>16</td><td>15</td><td>to</td><td>2</td><td>1</td></tr><tr><td>SD1005</td><td>32</td><td>31</td><td>to</td><td>18</td><td>17</td></tr><tr><td>SD1006</td><td>48</td><td>47</td><td>to</td><td>34</td><td>33</td></tr><tr><td>SD1007</td><td>64</td><td>63</td><td>to</td><td>50</td><td>49</td></tr></table>1 to 64 in the table indicate station numbers.</td><td>S (Status changel)</td></tr>
<tr><td>SD1008 to SD1071</td><td>Safety station communication status (CC-Link Safety master module 1)</td><td>The status of communication with safety station is stored.</td><td>• The status of communication with each safety remote station is stored.
• SD1008: Station number 1 to SD1071: Station number 64 (0 fixed in the case of standard remote station, reserved station specified, or without connection)
0: At normal communication
10: At initial
20: During internal information access
30: Link error
8300: The safety communications - Safety remote station detection error
8310: The safety communications - Product information mismatch
8320: The safety communications - Initial monitor timeout
8321: The safety communications - Safety monitor timeout
8322: The safety communications - Error monitor timeout
8330: The safety communications - Command error
8331: The safety communications - Data numbering error
8332: The safety communications - Link ID error
8333: The safety communications - Running number error
8334: The safety communications - Received data error</td><td>S (Status changel)</td></tr>
<tr><td>SD1072 to SD1075</td><td>Safety station interlock status (CC-Link Safety master module 1)</td><td>0: Interlock is not executed
1: During interlock</td><td>Bit corresponding to the station number turns 1 when the master station goes to the interlock status after the error was detected at the master station.
<table><tr><td></td><td>b15</td><td>b14</td><td>-</td><td>b1</td><td>b0</td></tr><tr><td>SD1072</td><td>16</td><td>15</td><td>to</td><td>2</td><td>1</td></tr><tr><td>SD1073</td><td>32</td><td>31</td><td>to</td><td>18</td><td>17</td></tr><tr><td>SD1074</td><td>48</td><td>47</td><td>to</td><td>34</td><td>33</td></tr><tr><td>SD1075</td><td>64</td><td>63</td><td>to</td><td>50</td><td>49</td></tr></table>1 to 64 in the table indicate station numbers.</td><td>S (Status changel)</td></tr>
</table>

TableApp.17 Special register

<table>
<tr><th>Number</th><th>Name</th><th>Meaning</th><th>Explanation</th><th>Set by (When set)</th><th>Corresponding CPU</th></tr>
<tr><td>SD1076 to SD1079</td><td>Safety station interlock cancel request (CC-Link Safety master module 1)</td><td>0: Not cancel the I/O interlock of safety station
1: Cancel the I/O interlock of safety station</td><td>Cancel the I/O interlock of safety station by changing the bit of register from 0 to 1.
<table><tr><td></td><td>b15</td><td>b14</td><td>-</td><td>b1</td><td>b0</td></tr><tr><td>SD1076</td><td>16</td><td>15</td><td>to</td><td>2</td><td>1</td></tr><tr><td>SD1077</td><td>32</td><td>31</td><td>to</td><td>18</td><td>17</td></tr><tr><td>SD1078</td><td>48</td><td>47</td><td>to</td><td>34</td><td>33</td></tr><tr><td>SD1079</td><td>64</td><td>63</td><td>to</td><td>50</td><td>49</td></tr></table>1 to 64 in the table indicate station numbers.</td><td>U (Request)</td><td rowspan="4">QS</td></tr>
<tr><td>SD1200 to SD1203</td><td>Safety remote station specification (CC-Link Safety master module 2)</td><td>0: No safety remote station specification
1: Safety remote station specification</td><td>• The specified status of safety remote station is stored.
• "0" is stored for the standard remote station.
<table><tr><td></td><td>b15</td><td>b14</td><td>-</td><td>b1</td><td>b0</td></tr><tr><td>SD1000</td><td>16</td><td>15</td><td>to</td><td>2</td><td>1</td></tr><tr><td>SD1001</td><td>32</td><td>31</td><td>to</td><td>18</td><td>17</td></tr><tr><td>SD1002</td><td>48</td><td>47</td><td>to</td><td>34</td><td>33</td></tr><tr><td>SD1003</td><td>64</td><td>63</td><td>to</td><td>50</td><td>49</td></tr></table>1 to 64 in the table indicate station numbers.</td><td>S (Initial)</td></tr>
<tr><td>SD1204 to SD1207</td><td>Safety station refresh communication status (CC-Link Safety master module 2)</td><td>0: Normal, Reserved station specified, Unused, Standard remote station
1: Safety station communication error</td><td>• The refresh communication status of safety remote station is stored.
• "0" is stored for the standard remote station.
<table><tr><td></td><td>b15</td><td>b14</td><td>-</td><td>b1</td><td>b0</td></tr><tr><td>SD1204</td><td>16</td><td>15</td><td>to</td><td>2</td><td>1</td></tr><tr><td>SD1205</td><td>32</td><td>31</td><td>to</td><td>18</td><td>17</td></tr><tr><td>SD1206</td><td>48</td><td>47</td><td>to</td><td>34</td><td>33</td></tr><tr><td>SD1207</td><td>64</td><td>63</td><td>to</td><td>50</td><td>49</td></tr></table>1 to 64 in the table indicate station numbers.</td><td>S (Status changel)</td></tr>
<tr><td>SD1208 to SD1271</td><td>Safety station communication status (CC-Link Safety master module 2)</td><td>The status of communication with safety station is stored.</td><td>• The status of communication with each safety remote station is stored.
• SD1208: Station number 1 to SD1271: Station number 64 (0 fixed in the case of standard remote station, reserved station specified, or without connection)
0: At normal communication
10: At initial
20: During internal information access
30: Link error
8300: The safety communications - Safety remote station detection error
8310: The safety communications - Product information mismatch
8320: The safety communications - Initial monitor timeout
8321: The safety communications - Safety monitor timeout
8322: The safety communications - Error monitor timeout
8330: The safety communications - Command error
8331: The safety communications - Data numbering error
8332: The safety communications - Link ID error
8333: The safety communications - Running number error
8334: The safety communications - Received data error</td><td>S (Status changel)</td></tr>
</table>

TableApp.17 Special register

<table>
<tr><th>Number</th><th>Name</th><th>Meaning</th><th>Explanation</th><th>Set by (When set)</th><th>Corresponding CPU</th></tr>
<tr><td>SD1272 to SD1275</td><td>Safety station interlock status (CC-Link Safety master module 2)</td><td>0: Interlock is not executed
1: During interlock</td><td>Bit corresponding to the station number turns 1 when the master station goes to the interlock status after the error was detected at the master station.
<table><tr><td></td><td>b15</td><td>b14</td><td>-</td><td>b1</td><td>b0</td></tr><tr><td>SD1272</td><td>16</td><td>15</td><td>to</td><td>2</td><td>1</td></tr><tr><td>SD1273</td><td>32</td><td>31</td><td>to</td><td>18</td><td>17</td></tr><tr><td>SD1274</td><td>48</td><td>47</td><td>to</td><td>34</td><td>33</td></tr><tr><td>SD1275</td><td>64</td><td>63</td><td>to</td><td>50</td><td>49</td></tr></table>1 to 64 in the table indicate station numbers.</td><td>S (Status changel)</td><td rowspan="2">QS</td></tr>
<tr><td>SD1276 to SD1279</td><td>Safety station interlock cancel request (CC-Link Safety master module 2)</td><td>0: Not cancel the I/O interlock of safety station
1: Cancel the I/O interlock of safety station</td><td>Cancel the I/O interlock of safety station by changing the bit of register from 0 to 1.
<table><tr><td></td><td>b15</td><td>b14</td><td>-</td><td>b1</td><td>b0</td></tr><tr><td>SD1276</td><td>16</td><td>15</td><td>to</td><td>2</td><td>1</td></tr><tr><td>SD1277</td><td>32</td><td>31</td><td>to</td><td>18</td><td>17</td></tr><tr><td>SD1278</td><td>48</td><td>47</td><td>to</td><td>34</td><td>33</td></tr><tr><td>SD1279</td><td>64</td><td>63</td><td>to</td><td>50</td><td>49</td></tr></table>1 to 64 in the table indicate station numbers.</td><td>S (Request)</td></tr>
</table>

Appendix 3 Parameter Number List

The parameter number is stored into the special register (SD16 to 26) when an error occurs in the parameter settings.
This section describes the parameter number and the corresponding parameter setting area (item) in the list.

TableApp.18 Parameter number list

Item		Parameter No.	Referance
Label		0000H	Section 8.1(1)
Comment		0001H	
I/O assignment	Type	0400H	Section 4.3 Section 8.1(6)
	Model name		
	points		
	Start XY (Start I/O No.)		
Basic setting	Base model name	0401H	Section 8.1(6)
	Power model name		
	Extension cable		
	Slots		
Group No.		05mnH	Section 8.2(1)
		09mnH	Section 8.2(2)
Switch setting		0407H	Section 8.1(6)
Timer limit setting	Low speed	1000H	Section 8.1(2) Section 9.2.8
	High speed		
RUN-PAUSE contact		1001H	Section 6.12.1 Section 8.1(2)
Remote reset		1002H	Section 6.12.2 Section 8.1(2)
Output mode at STOP to RUN		1003H	Section 6.10 Section 8.1(2)
Points occupied by empty slot		1007H	Section 4.2.1 Section 8.1(2)
Device points		2000H	Section 8.1(4) Section 9.1 Section 9.2
WDT (watchdog timer) setting		3000H	Section 3.2 Section 8.1(3)

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TableApp.18 Parameter number list (continued)

Item		Parameter No.	Referance
Constant scanning		3003H	Section 6.9 Section 8.1(3)
CC-Link IE controller network, MELSECNET/H setting	Setting the number of MELSECNET	5000H	Section 8.2(1)
	Starting I/O No.	5NM0H	
	Network No.		
	Mode	5NM0H	
	Refresh parameters	5NM1H	
Station No		5NM0H	
Routing parameters		5003H	
Continuous RUN in test mode		6000H	Section 6.5 Section 8.1(8)
Operation mode at the time of a remote station error			
Boot file setting		7000H	Section 5.1.4 Section 8.1(5)
Ethernet setting	Setting the number of Ethernet	9000H	Section 8.2(2)
	Starting I/O No.	9NM0H	
	Network No.		
	Station No.		
	Operational settings		
	Initial settings	9NM1H	
	Open settings	9NM2H	
	Router relay parameter	9NM3H	
	Routing parameters	9NM4H	
	Station No.<->IP information	9NM5H	
CC-Link setting	Number of CC-Link	C000H	Section 8.2(2)
	Remote input (RX)	CNM1H	
	Remote output (RY)		
	Remote register (RWr)		
	Remote register (RWw)		
	Special relay (SB)		
	Special register (SW)		
	Operational settings	CNM2H	
	Mode setting		
	Transmission settings		
	Safety refresh monitoring time		
	Safety data monitoring time		
	Link ID		
	All connect count		
	Retry count		
	Automatic reconnection station count		
	Scan mode setting		
	Station information setting		

Appendix 4 Restrictions on Using CC-Link IE Controller Network Module with Safety CPU Module

(1) Network parameters which can be set in the safety CPU module

TableApp.19 lists the network parameters for CC-Link IE controller network and their setting availability with GX Developer when the CC-Link IE controller network is used with the safety CPU module.

TableApp.19 List of network parameters and their setting availability with GX Developer

Item		Setting availability
Network type	CC IE Control (control station)	×
	CC IE Control (Normal station)	○
Starting I/O No.		○
Network No.		○
Total stations		×
Group No.		○
Station No.		○
Mode		○
Network range assignment (common parameters)		×
Refresh parameters		○
Interrupt settings		×
Interlink transmission parameters		×
Routing parameters		○
Valid module during other station access		×
Station number specification method		×

○ : Available, × : Not available

Remark

For details on the CC-Link IE controller network, refer to the following manual.

☞ CC-Link IE Controller Network Reference Manual

(2) CC-Link IE controller network functions which can be used in the safety CPU module

TableApp.20 lists the functions of CC-Link IE controller network and their availability in the safety CPU module.

TableApp.20 List of CC-Link IE controller network functions and their availability in safety CPU module

Function			Availability
Cyclic transmission function	Communication by LB/LW		○
	Communication by LX/LY		○
	Link refresh		○
	Direct access to link devices		×
	Assurance of cyclic data integrity		○
	Cyclic transmission punctuality assurance		○
	Constant link scan		○
	Reserved station specification		○
	Interlink data transfer function		×
	Cyclic transmission stop/restart		○
Transient transmission function	Reading/writing data from/to word device on another station (READ/SREAD/WRITE/SWRITE)		○ *1
	Transient request to another station (REQ)	Clock data read/write	○ *1
		Remote RUN/STOP	○ *1
	Sending/receiving data (SEND/RECV)		×
	Receiving data on another station (for interrupt program) (RECVS)		×
	Reading/writing data from/to word device on another station (ZNRD/ZNWR)		×
	Remote RUN/STOP (RRUN/RSTOP)		×
	Reading/writing clock data from/to the CPU module on another station (RTMRD/RTMWR)		○ *1
	GX Developer access to other stations		○
	Changing number of transient transmissions		×
	Group function		○
	Routing function		○
	Time setting from GX Developer		○
RAS function	Control station switching function		×
	Loopback function (optical loop system)		○
	Automatic return function		○
	Cable fault detection function		○
	Cable insertion error detection function		○
	Duplicated control station or station No. detection function		○
	Transient transmission error detection time check		○
	Transient transmission enabled even at CPU module error		○

(To the next page)

TableApp.20 List of CC-Link IE controller network functions and their availability in safety CPU module (continued)

Function		Availability
Diagnostic function	Hardware test	○
	Self-loopback test	○
	Line test	○
	Station-to-station test	○
	Network test	○
	Communication test	○
Interrupt request to CPU module		×
Station No. setting by sequence program		×

○ : Available, × : Not available

* 1: Data cannot be written to the safety CPU module from the CPU module on another station. (☞ Appendix 7.1)

Appendix 5 Restrictions on Using MELSECNET/H Module with Safety CPU Module

(1) Network parameters which can be set in the safety CPU module

TableApp.21 lists the network parameters for MELSECNET/H and their setting availability with GX Developer when the MELSECNET/H module is used with the safety CPU module.

TableApp.21 List of network parameters and their setting availability with GX Developer

Item		Setting availability
Network type	MNET/H mode (control station), MNET/H EX (control station)	×
	MNET/H mode (normal station), MNET/H EX (normal station)	○
	MNET/10 mode (control station)	×
	MNET/10 mode (normal station)	○
	MNET/H standby station	×
Starting I/O No.		○
Network No.		○
Total number of (slave) stations		×
Group No.		○
Mode		○
Network range assignment (common parameters)		×
Station inherent parameters		×
Refresh parameters		○
Interrupt setting		×
Control station return setting		×
Standby station compatible module		×
Redundant setting		×
Inter-link data transfer		×
Routing parameters		○
Valid unit in access to another station		×

○ : Available, × : Not available

Remark

For details on the MELSECNET/H, refer to the following manual.

☞Q Corresponding MELSECNET/H Network System Reference Manual (PLC to PLC network)

(2) MELSECNET/H network system functions which can be used in the safety CPU module

TableApp.22 lists the functions of MELSECNET/H and their availability in the safety CPU module.

TableApp.22 List of MELSECNET/H functions and their availability in safety CPU module

Function			Availability
Cyclic transmission function	Communication by LB/LW		○
	Communication by LX/LY		○
	MELSECNET/H extended mode		○
	Refresh parameter		○
	Common parameter		○
	Station inherent parameter		×
	Interlink data transfer function		×
	Reserved station specification		○
	Low-speed cyclic transmission function		○
	Redundant system function		×
Transient transmission function	Communication function		○
	Routing function		○
	Group function		○
	Message sending function using logical channel numbers		×
	Sending/receiving data (SEND/RECV)		×
	Receiving data on another station (for interrupt program) (RECVS)		×
	Reading/writing data from/to word device on another station (READ/SREAD/WRITE/SWRITE)		○ *1
	Transient request to another station (REQ)	Clock data read/write	○ *1
		Remote RUN/STOP	× *1
	Reading/writing data from/to word device on another station (ZNRD/ZNWR)		×
	Remote RUN/STOP (RRUN/RSTOP)		×
	Reading/writing clock data from/to the CPU module on another station (RTMRD/RTMWR)		○ *1
RAS function	Automatic return function		○
	Control station switching function		×
	Control station return control function		×
	Loopback function (optical loop system)		○
	Prevention of station failure by using external power supply (optical loop system)		○
	Station detach function (coaxial bus system)		○
	Transient transmission enabled even at CPU module error		○
	Transient transmission error detection time check		○
	Diagnostic function		○

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TableApp.22 List of CC-Link IE controller network functions and their availability in safety CPU module (continued)

Function	Availability
Direct access to link devices	×
Interrupt sequence program startup	×
Multiplex transmission function (optical loop system)	○
Simple dual-structured network function	×
Cyclic transmission stop/restart and link refresh stop (network test)	○
Increasing number of send points by installing multiple module with the same network number	×
Multiple CPU system support	×
Remote I/O system	×
Redundant system support	×
Network diagnostics (line monitor)	○

○ : Available, × : Not available

* 1: Data cannot be written to the safety CPU module from the CPU module on another station. (☞ Appendix 7.1)

Appendix 6 Restrictions on Using Ethernet Module with Safety CPU Module

(1) Network parameters which can be set in the safety CPU module

TableApp.23 lists the network parameters for Ethernet and their setting availability with GX Developer when the Ethernet module is used with the safety CPU module.

TableApp.23 List of network parameters and their setting availability with GX Developer

Item		Setting availability
Network type	Ethernet	○
Starting I/O No.		○
Network No.		○
Group No.		○
Station No.		○
Mode		○
Operational settings		○
Initial settings		○
Open settings		○
Router relay parameter		○
Station No.<->IP information		○
FTP parameters		×
E-mail settings		×
Interrupt settings		×
Redundant settings		×
Valid module during other station access		×
Routing parameters		○

○ : Available, × : Not available

Remark

For details on the Ethernet, refer to the following manual.

☞ Q Corresponding Ethernet Interface Module User's Manual (Basic)

☞ Q Corresponding Ethernet Interface Module User's Manual (Application)

(2) Ethernet functions which can be used in the safety CPU module

TableApp.24 lists the functions of Ethernet and their availability in the safety CPU module.

TableApp.24 List of Ethernet functions and their availability in the safety CPU module

Function			Availability
Communication using the MC protocol	Using 4E frame		○ *1
	Using QnA-compatible 3E frame		○
	Using A-compatible 1E frame		○
Communication using the fixed buffer (Procedure exist)			○
Communication using the fixed buffers (No procedure)			○
Communication using the random access buffer			×
Sending/receiving e-mail			×
Communication using dedicated instructions	Establishing/disconnecting a connection with an external device of which data communication is performed (OPEN/CLOSE)		○
	Reading receive data/writing send data using fixed buffer communication (BUFRCV/BUFSND)		○
	Reading receive data using fixed buffer communication (for interrupt programs) (BUFRCVS)		×
	Clearing/reading error information of the Ethernet module (ERRCLR/ERRRD)		○
	Reinitializaton of the Ethernet module (UINI)		○
	Reading/sending e-mails from/to other stations (MRECV/MSEND)		×
	Reading/writing data from/to word device on another station (READ/SREAD/WRITE/SWRITE)		○ *2
	Reading/writing data from/to word device on another station (ZNRD/ZNWR)		×
	Sending/receiving data (SEND/RECV)		×
	Receiving data on another station (for interrupt program) (RECVS)		×
	Transient request to another station (REQ)	Clock data read/write	○ *2
		Remote RUN/STOP	× *1
File transfer (FTP server function)			×
Communication using the Web function			×
CC-Link IE controller network, MELSECNET/H, MELSECNET/10 relay communication			×
Router relay communication (Router relay function)			○
Existence check of external device			○
Communication using the pairing open method			○
Remote password check			○
Simultaneous broadcast			○
Communication with MELSOFT products using dedicated connections	TCP/IP		○
	UDP/IP		○
Hardware test			○
Self-loopback test			○
Communication error storage			○
Ethernet diagnostics function using GX Developer			○

○ : Available, × : Not available

* 1: Available only for the Ethernet module whose serial number (first five digits) is "07082" or higher.
* 2: Data cannot be written to the safety CPU module from the CPU module on another station. (☞ Appendix 7.1)

(3) MC protocol which can be used in the safety CPU module

TableApp.25 and TableApp.26 list the data communication functions using the MC protocol and their availability in the safety CPU module.

(a) 4E frame and QnA-compatible 3E frame

TableApp.25 List of MC protocol functions (4E frame and QnA-compatible 3E frame) and their availability in the safety CPU module

Function		Type	Command (Subcommand)	Availability
Device memory	Batch read	Bit	0401(00*1)	○
		Word	0401(00*0)	○
	Batch write	Bit	1401(00*1)	×
		Word	1401(00*0)	×
	Random read	Word	0403(00*0)	○
	Test (Random write)	Bit	1402(00*1)	×
		Word	1402(00*0)	×
	Monitor data registration	Bit	0801(00*0)	×
	Monitor	Word	0802(0000)	× *1 *2
	Multiple block batch read	Word	0406(00*0)	○
	Multiple block batch write	Word	1406(00*0)	×
Buffer memory	Batch read	----	0613(0000)	○ *1
	Batch write	----	1613(0000)	○ *1
Intelligent function module	Batch read	----	0601(0000)	○
	Batch write	----	1601(0000)	×
Programmable controller CPU	Remote RUN	----	1001(0000)	×
	Remote STOP	----	1002(0000)	×
	Remote PAUSE	----	1003(0000)	×
	Remote latch clear	----	1005(0000)	×
	Remote RESET	----	1006(0000)	×
	CPU model name read	----	0101(0000)	○
Drive memory	Memory usage status read	----	0205(0000)	×
	Memory defragmentation	----	1207(0000)	×
File	File information table read	Without header statement	0201(0000)	×
		With header statement	0202(0000)	×
		File No. usage status	0204(0000)	×
	File information modification	Modification of last update	1204(0000)	×
		File name/size modification	1204(0001)	×
		Batch modification	1204(0002)	×
	File search	----	0203(0000)	×
	File data read	----	0206(0000)	×
	New registration (File name registration)	----	1202(0000)	×
	File data write	Arbitrary data	1203(0000)	×
		Same data	1203(0001)	×
	File lock registration/cancel	----	0808(000*)	×
	File copy	----	1206(0000)	×
	File delete	----	1205(0000)	×

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TableApp.25 List of MC protocol functions (4E frame and QnA-compatible 3E frame) and their availability in the safety CPU module (continued)

Function		Type	Command (Subcommand)	Availability
File	Directory/file information read	----	1810(0000)	○
	Directory/file information search	----	1811(0000)	○
	New file creation	----	1820(0000)	×
	File delete	----	1822(0000)	×
	File copy	----	1824(0000)	×
	File attribute modification	----	1825(0000)	×
	File creation data modification	----	1826(0000)	×
	File open	----	1827(0000)	○
	File read	----	1828(0000)	○
	File write	----	1829(0000)	×
	File close	----	182A(0000)	○
LED off, Error code initialization		----	1617(000*)	○ *1
Loopback test		----	0619(0000)	○ *1
Programmable controller CPU monitoring	Registration	----	0630(0000)	○
	Cancel	----	0631(0000)	○
Remote password	Unlock	----	1630(0000)	○ *1
	Lock	----	1631(0000)	○ *1

○ : Available, × : Not available

* 1: The function which is supported on the Ethernet module side.
* 2: Since the safety CPU module does not support the monitor data registration, data is not updated even when the module operates normally.

(b) A-compatible 1E frame

TableApp.26 List of MC protocol functions (4E frame and QnA-compatible 3E frame) and their availability in the safety CPU module

Function		Type	Command (Subcommand)	Availability
File	Batch read	Bit	00_H	○
		Word	01_H	○
	Batch write	Bit	02_H	×
		Word	03_H	×
	Test (Random write)	Bit	04_H	×
		Word	05_H	×
	Monitor data registration	Bit	06_H	× *1
		Word	07_H	× *1
	Monitor	Bit	08_H	×
		Word	09_H	×

○ : Available, × : Not available

* 1: Since the function is supported on the Ethernet module side, no error occurs as long as the specified device has no errors.

Remark

For details on the MC protocol, refer to the following manuals.

☞ Q Corresponding MELSEC Communication Protocol Reference Manual

☞ Q Corresponding Ethernet Interface Module User's Manual (Basic)

☞ Q Corresponding Ethernet Interface Module User's Manual (Application)

Appendix 7 Dedicated Instructions which can be used in Safety CPU Module

Appendix 7.1 List of dedicated instructions

(1) Dedicated instructions which can be used in the safety CPU module

TableApp.27 lists the dedicated instructions which can be used in the safety CPU module.

TableApp.27 List of available dedicated instructions

Application	Dedicated instruction	Function description	Supported network		
			CC-Link IE controller network	MELSECNET /H	Ethernet
For opening and closing connections	OPEN*1	Establishes a connection.	×	×	○
	CLOSE*1	Disconnects a connection.	×	×	○
For fixed buffer communication	BUFRCV*1	Reads received data. (for main program)	×	×	○
	BUFSND*1	Sends data.	×	×	○
For reading and clearing error information	ERRCLR	Clears error information.	×	×	○
	ERRRD	Reads error information.	×	×	○
For reinitialization	UINI	Reinitializes the Ethernet module.	×	×	○
For communication with programmable controller CPU on another station (Data link instruction)	READ	Reads data from word devices of the CPU module on another station.	○	○	○
	SREAD	Reads data from word devices of the CPU module on another station. (with completion devices)	○	○	○
	WRITE	Writes data to word devices of the CPU module on another station.	○	○	○
	SWRITE	Writes data to word devices of the CPU module on another station. (with completion devices)	○	○	○
	REQ*2	• Reads clock data from the CPU module on another station. • Writes clock data to the CPU module on another station.	○	○	○
	RTMRD	Reads clock data from the CPU module on another station.	○	○	×
	RTMWR	Writes clock data to the CPU module on another station.	○	○	×

* 1: Only connection No.1 to No.8 can be specified. If the specified connection is out of the range, an OPERATION ERROR (error code: 4101) occurs.

* 2: The REQ instruction only reads and writes clock data. If other operations are requested, an OPERATION ERROR (error code: 4001) occurs.

(2) Dedicated instructions which can be used from the CPU module on another station to the safety CPU module

TableApp.28 lists the dedicated instructions which can be used from the CPU module on another station to the safety CPU module.

TableApp.28 List of available dedicated instructions

Application	Dedicated instruction	Function description	Supported network		
			CC-Link IE controller network	MELSECNET /H	Ethernet
For communication with programmable controller CPU on another station (Data link instruction)	READ	Reads data from word devices of the CPU module on another station.	○	○	○
	SREAD	Reads data from word devices of the CPU module on another station. (with completion devices)	○	○	○
	REQ*1	Reads clock data from the CPU module on another station.	○	○	○
	RTMRD	Reads clock data from the CPU module on another station.	○	○	×

* 1: The REQ instruction only reads and writes clock data. If other operations are requested, an OPERATION ERROR (error code: 4001) occurs.

Remark

For details on each dedicated instruction, refer to the following manuals.

☞ Manuals of each network module

Appendix 7.2 Programming using dedicated instructions

Since the safety CPU module does not support the intelligent function module device (U□ G□) and the FROM/TO instructions, data stored in the buffer memory of the intelligent function module cannot be used in the sequence program of the safety CPU module.
To use data stored in the buffer memory of the intelligent function module in the sequence program of the safety CPU module, use I/O signals, which correspond to the buffer memory, of the intelligent function module.

In order to use dedicated instructions listed in TableApp.29, replace the programs using the FROM/TO instructions with the programs using the I/O signals.

TableApp.29 List of targeted dedicated instructions

Dedicated instruction	Function description	Reference
OPEN	Establishes a connection.	(1) in this section
CLOSE	Disconnects a connection.	(2) in this section
BUFRCV	Reads received data. (for main program)	(3) in this section
BUFSND	Sends data.	(4) in this section
UINI	Reinitializes the Ethernet module.	(5) in this section

Sample programs where the intelligent function module device (U□ G□) and the FROM/TO instructions are replaced with I/O signals are described below.

(1) OPEN instruction

Fig.App.1 shows a program example where buffer memory addresses are replaced with I/O signals in the program for Active-opening the connection No.1 for TCP/IP communication.

TableApp.30 Buffer memory address - I/O signal correspondence

Buffer memory address in hexadecimal (decimal)	I/O signal
5000_H (20480): Open completion signal	X10: Connection 1 open completion
5002_H (20482): Open request signal	Y8: Connection 1 open request (This corresponding signal cannot be used since the signal does not turn ON/OFF by the OPEN instruction.)

When the I/O signals of the Ethernet module are X/Y00 to X/Y1F

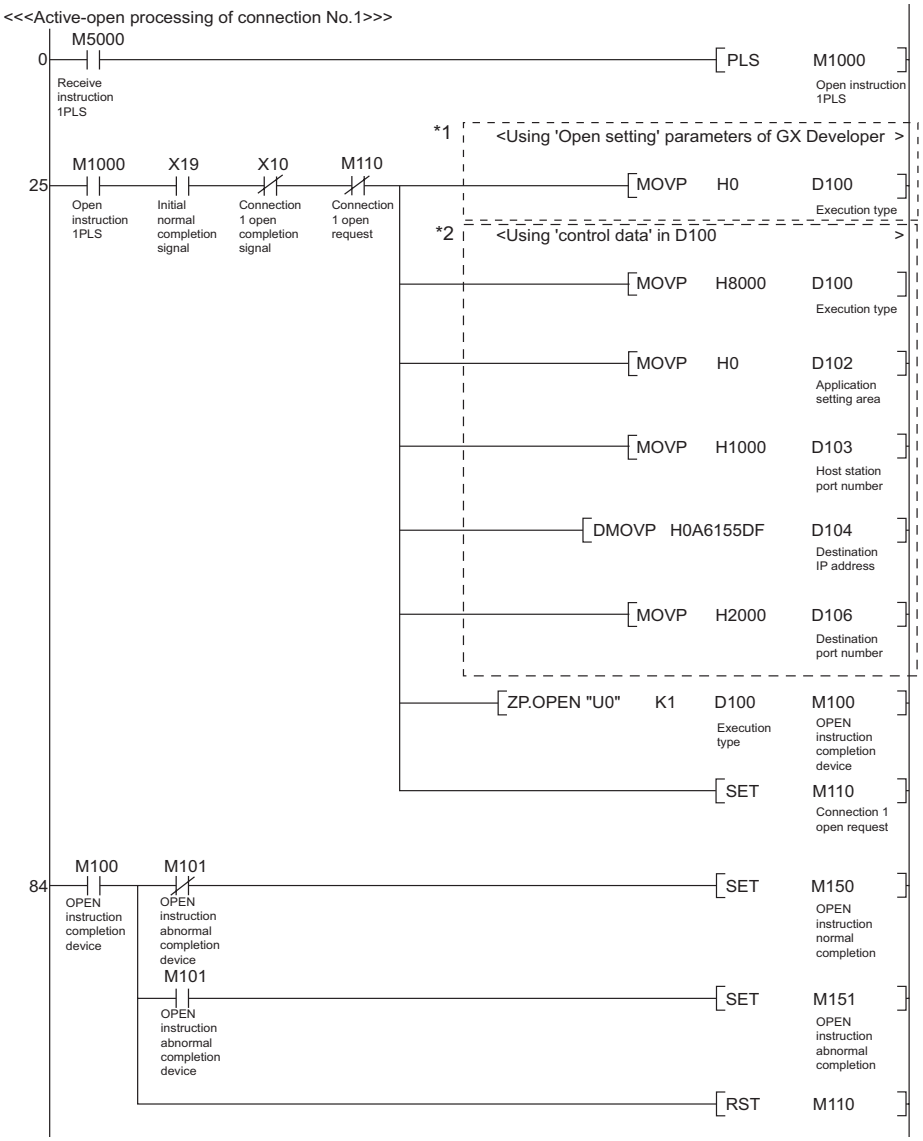

Fig.App.1 Program example using I/O signals

* 1: Required when using "Open setting" parameters of GX Developer.
* 2: Required when not using "Open setting" parameters of GX Developer.

(2) CLOSE instruction

Fig.App.2 shows a program example where buffer memory addresses are replaced with I/O signals in the program for closing the connection No.1.

TableApp.31 Buffer memory address - I/O signal correspondence

Buffer memory address in hexadecimal (decimal)	I/O signal
5000_H (20480): Open completion signal	X10: Connection 1 open completion

When the I/O signals of the Ethernet module are X/Y00 to X/Y1F

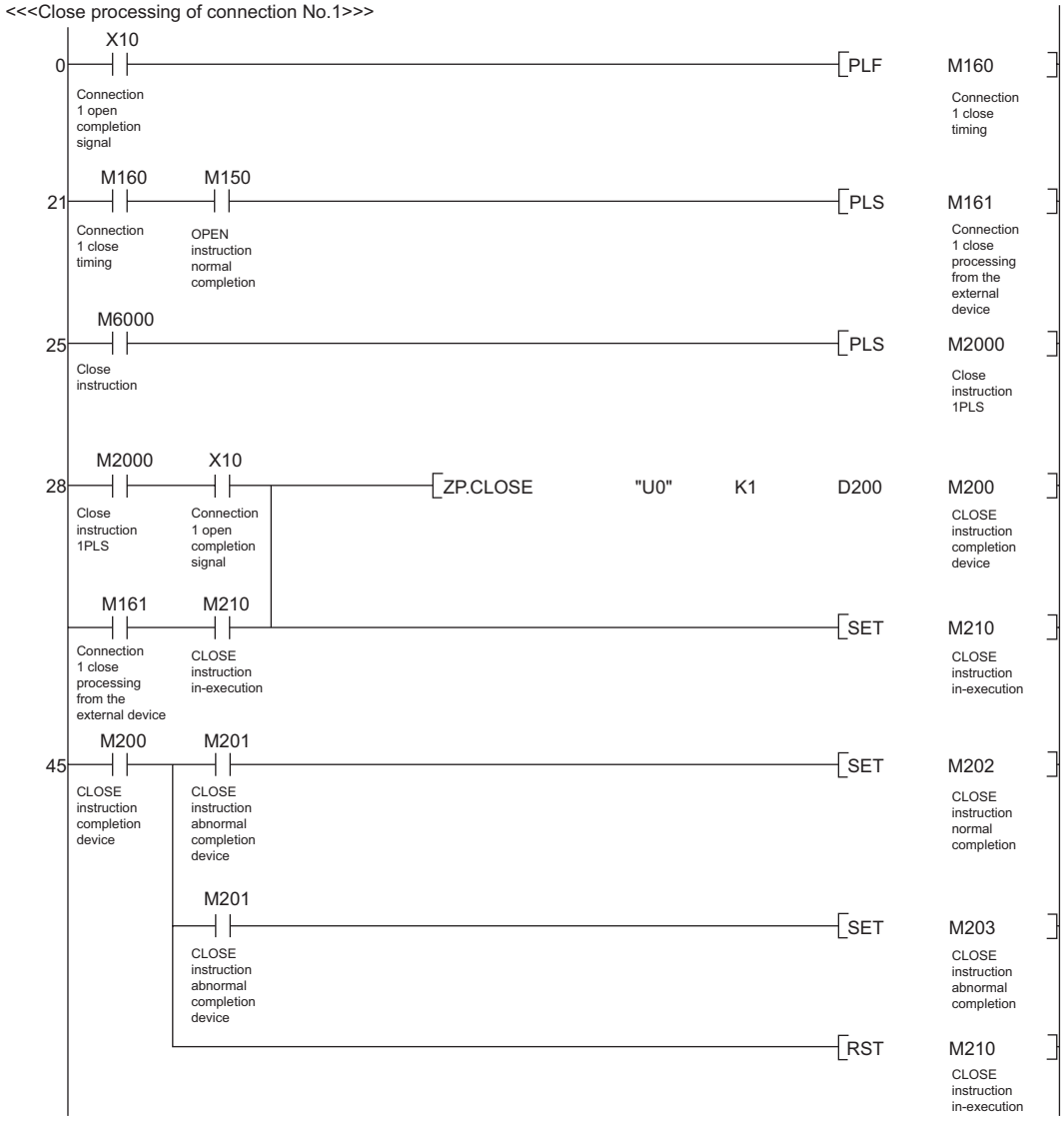

Fig.App.2 Program example using I/O signals

(3) BUFRCV instruction

Fig.App.3 shows a program example where buffer memory addresses are replaced with I/O signals in the program for reading received data from the fixed buffer of the connection No.1.

TableApp.32 Buffer memory address - I/O signal correspondence

Buffer memory address in hexadecimal (decimal)	I/O signal
5000_H (20480): Open completion signal	X10: Connection 1 open completion
5002_H (20482): Open request signal	Y8: Connection 1 open request (This corresponding signal cannot be used since the signal does not turn ON/OFF by the OPEN instruction.)
5005_H (20485): Fix buffer receive status signal	X10: Connection 1 open completion

When the I/O signals of the Ethernet module are X/Y00 to X/Y1F

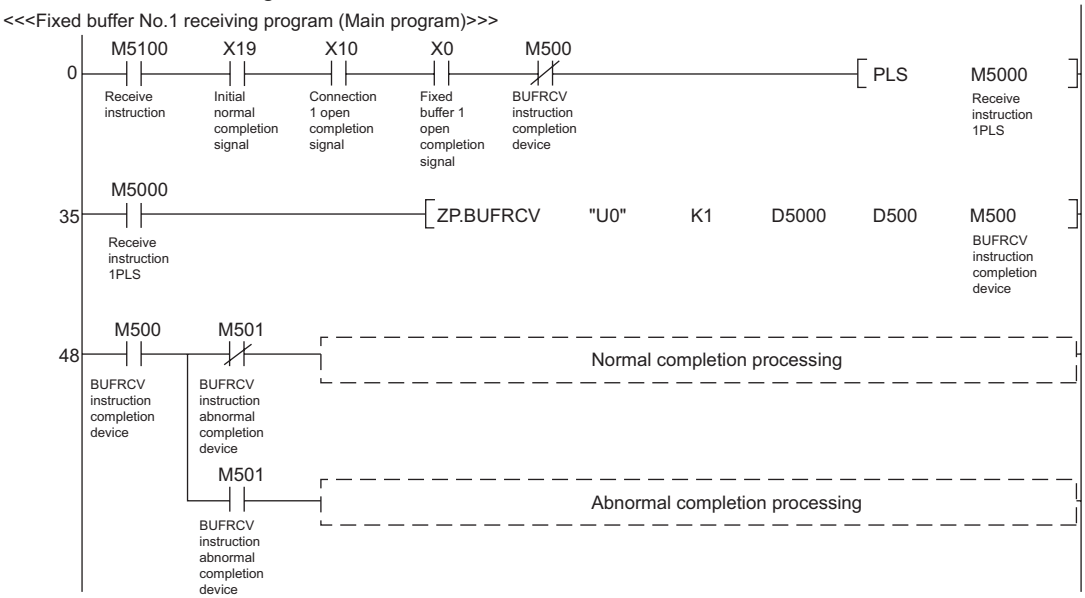

Fig.App.3 Program example using I/O signals

(4) BUFSND instruction

Fig.App.4 shows a program example where buffer memory addresses are replaced with I/O signals in the program for sending data from the fixed buffer of the connection No.1.

TableApp.33 Buffer memory address - I/O signal correspondence

Buffer memory address in hexadecimal (decimal)	I/O signal
5000_H (20480): Open completion signal	X10: Connection 1 open completion

When the I/O signals of the Ethernet module are X/Y00 to X/Y1F

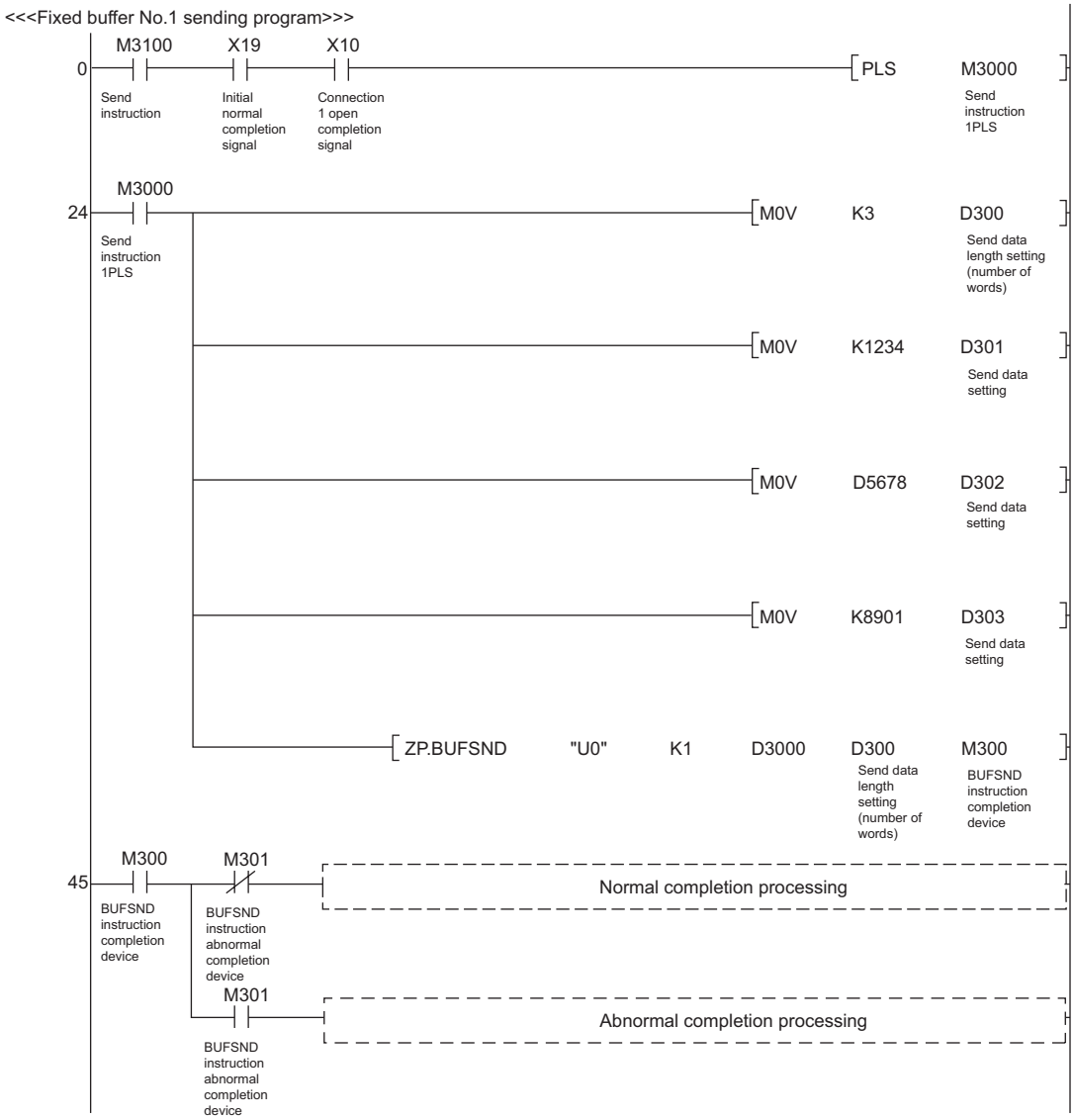

Fig.App.4 Program example using I/O signals

(5) UINI instruction

Fig.App.5 shows a program example where buffer memory addresses are replaced with I/O signals in the program for reinitialize the Ethernet module.*1

TableApp.34 Buffer memory address - I/O signal correspondence

Buffer memory address in hexadecimal (decimal)	I/O signal
5000_H (20480): Open completion signal	X10: Connection 1 open completion

When the I/O signals of the Ethernet module are X/Y00 to X/Y1F

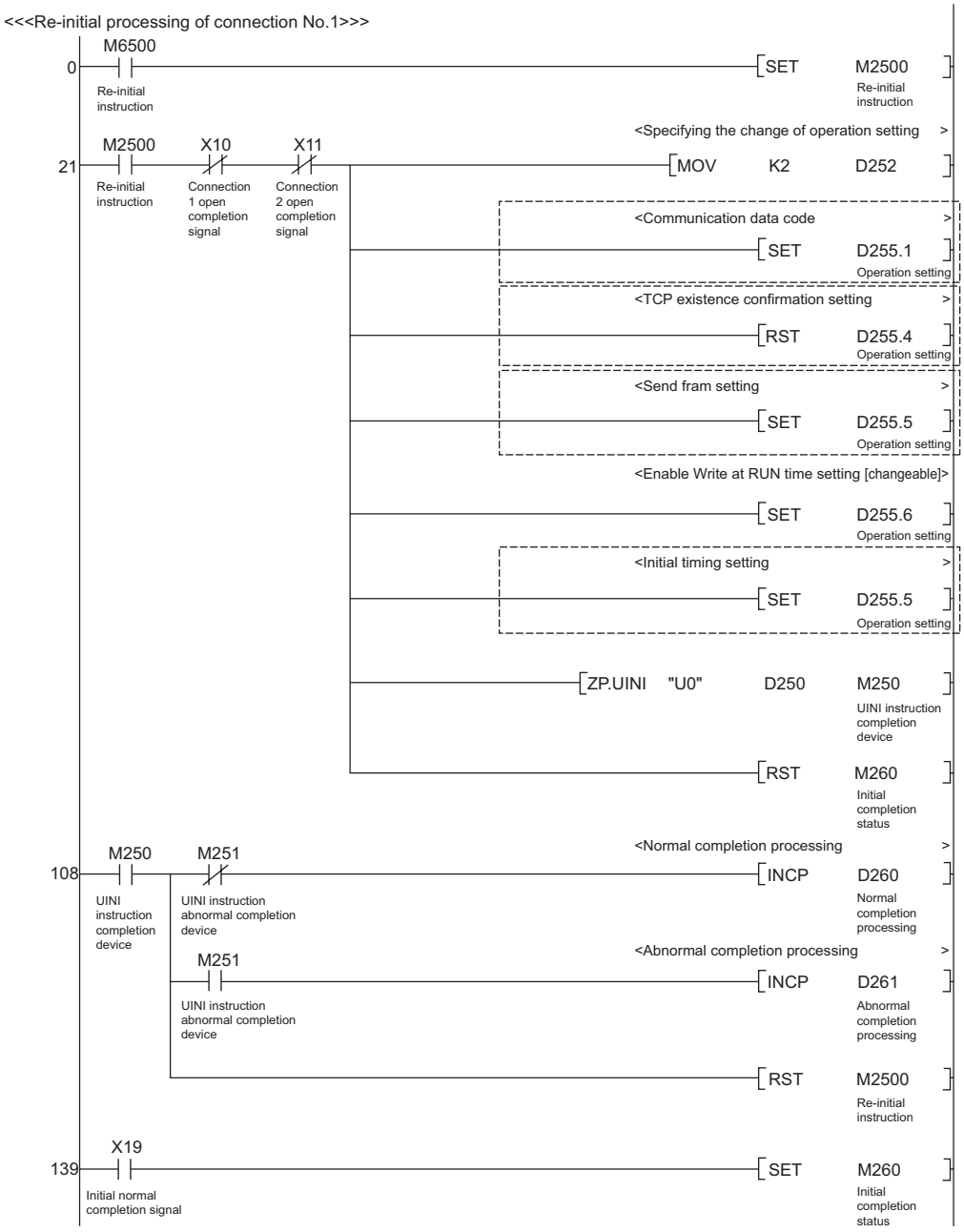

Fig.App.5 Program example using I/O signals

* 1: The safety CPU module cannot read the current operation setting. Therefore, all operation setting items need to be specified. When specifying these items, do not change the current setting for the items in the dashed line.

Appendix 8 Access Range for Safety CPU Module

The following shows an access range and accessibility from GX Developer and a GOT to a safety CPU module.
The safety CPU module does not perform routing between Ethernet and CC-Link IE controller network or between Ethernet and MELSECNET/H.

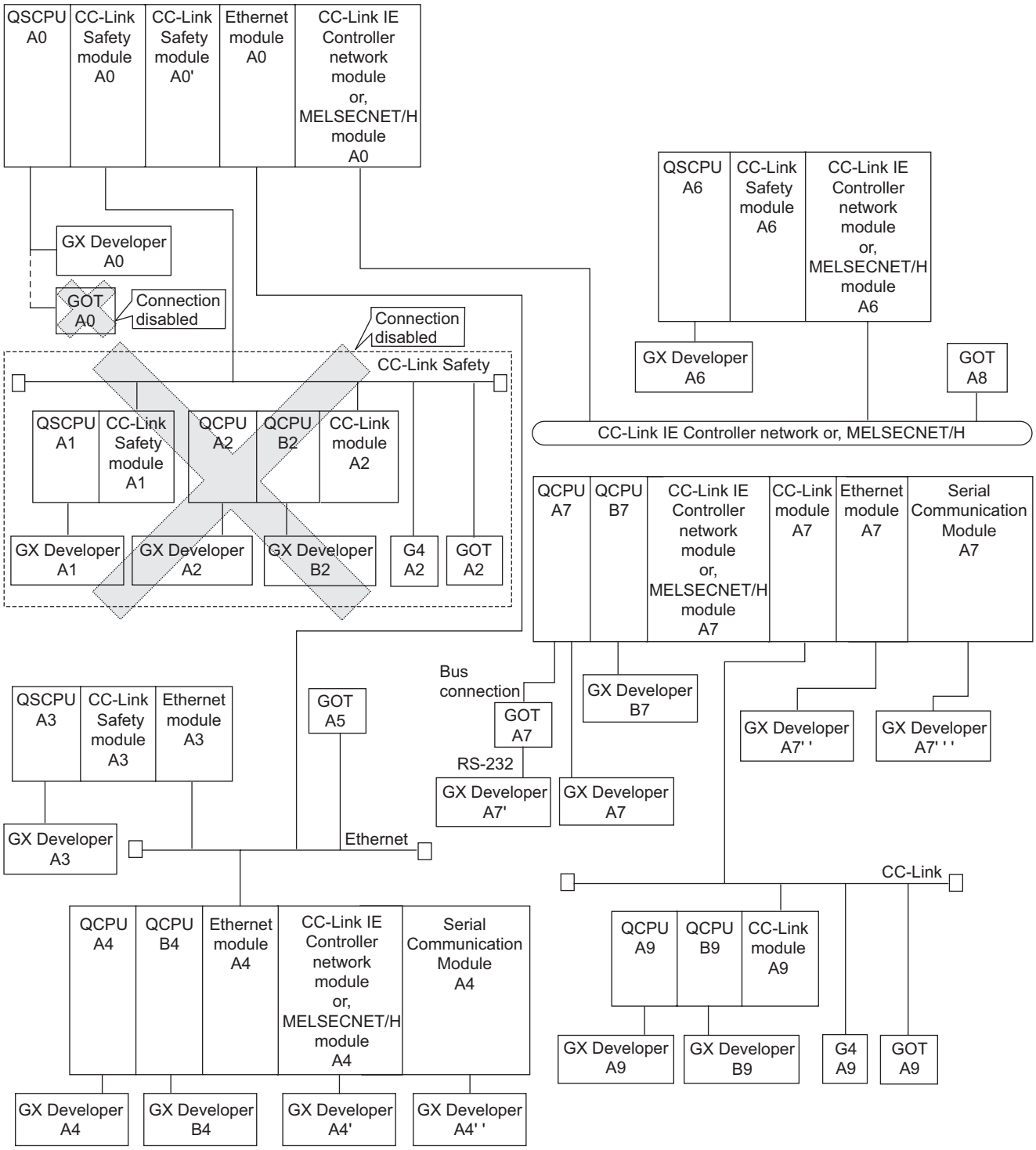

Fig.App.6 Access range

TableApp.35 Accessibility

Access source	Access target											
	QSCPU A0	QSCPU A1	QCPU A2	QCPU B2	QSCPU A3	QCPU A4	QCPU B4	QSCPU A6	QCPU A7	QCPU B7	QCPU A9	QCPU B9
GX Developer A0	○	×	×	×	×	×	×	×	×	×	×	×
GOT A0	×	×	×	×	×	×	×	×	×	×	×	×
GX Developer A1	×	○	×	×	×	×	×	×	×	×	×	×
GX Developer A2	×	×	○	○	×	×	×	×	×	×	×	×
GX Developer B2	×	×	○	○	×	×	×	×	×	×	×	×
G4 A2	×	×	×	×	×	×	×	×	×	×	×	×
GOT A2	×	×	×	×	×	×	×	×	×	×	×	×
GX Developer A3	×	×	×	×	○	×	×	×	×	×	×	×
GX Developer A4	○	×	×	×	○	○	○	×	×	×	×	×
GX Developer A4'	△ (A4)	×	×	×	△ (A4)	○	○	×	×	×	×	×
GX Developer A4"	○	×	×	×	○	○	○	×	×	×	×	×
GX Developer B4	○	×	×	×	○	○	○	×	×	×	×	×
GOT A5	○	×	×	×	○	○	○	×	×	×	×	×
GX Developer A6	×	×	×	×	×	×	×	○	×	×	×	×
GX Developer A7	○	×	×	×	×	×	×	○	○	○	○	○
GX Developer A7'	×	×	×	×	×	×	×	×	○	○	○	○
GX Developer A7"	△ (A7)	×	×	×	×	×	×	△ (A7)	○	○	○	○
GX Developer A7"'	○	×	×	×	×	×	×	○	○	○	○	○
GOT A7	○	×	×	×	×	×	×	○	○	○	×	×
GX Developer B7	○	×	×	×	×	×	×	○	○	○	○	○
GOT A8	○	×	×	×	×	×	×	○	○	○	×	×
GX Developer A9	○	×	×	×	×	×	×	○	○	○	○	○
GX Developer B9	○	×	×	×	×	×	×	○	○	○	○	○
G4 A9	○	×	×	×	×	×	×	○	○	○	○	○
GOT A9	×	×	×	×	×	×	×	×	○	○	○	○

○ : Available,

△ : Available (by setting the routing parameter to the QCPU or remote station shown in the parentheses),

× : Not available

Remark

For GOT accessible to the safety CPU module, refer to the following manual.

☞ GT Designer2 Version2 Screen Design Manual

Appendix 9 Safety CPU Module Upgrade

(1) Additional functions and availability of the functions according to the version of GX Developer

TableApp.36 Additional functions and availability of the functions according to the version of GX Developer

New function	Compatible function version	Compatible serial No.	Compatible GX Developer
Response performance enhancement(☞ CC-Link Safety System Master Module User's Manual	A	10032 or later	Version 8.65T or later
CC-Link IE controller network compatibility (☞ CC-Link IE Controller Network Reference Manual)			
MELSECNET/H transient transmission function (☞ Q Corresponding MELSECNET/H Network System Reference Manual (PLC to PLC network))			
Ethernet compatibility(☞ Q Corresponding Ethernet Interface Module User's Manual (Basic)), (☞ Q Corresponding Ethernet Interface Module User's Manual (Application))			
Dedicated instruction compatibility (☞ QSCPU User's Manual (Function Explanation, Program Fundamentals)), (☞ CC-Link IE Controller Network Reference Manual), (☞ Q Corresponding MELSECNET/H Network System Reference Manual (PLC to PLC network)), (☞ Q Corresponding Ethernet Interface Module User's Manual (Basic)), (☞ Q Corresponding Ethernet Interface Module User's Manual (Application))			
MC protocol(☞ Q Corresponding MELSEC Communication Protocol Reference Manual)			
Clock data change function using special relay and special registers (☞ QSCPU User's Manual (Function Explanation, Program Fundamentals))			
Remote password setting function (☞ QSCPU User's Manual (Function Explanation, Program Fundamentals))			

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Memo

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(2) Customer shall cooperate with MELCO and MELCO's representatives in MELCO's investigation of the warranty claim, including preserving evidence of the claim and its causes, meaningfully responding to MELCO's questions and investigation of the problem, grant MELCO access to witnesses, personnel, documents, physical evidence and records concerning the warranty problem, and allow MELCO to examine and test the Products in question offsite or at the premises where they are installed or used; and

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SH(NA)-080627ENG-D

Mitsubishi Safety
Programmable Controller MELSEC QS series

QSCPU
User's Manual
(Function Explanation, Program Fundamentals)

MODEL	QSCPU-U-KP-E
MODEL CODE	13JR93
SH(NA)-080627ENG-D(0809)MEE	

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