

Programmable Controller



QnPRHCPU User's Manual (Redundant System)

-Q12PRHCPU -Q25PRHCPU



SAFETY PRECAUTIONS

(Read these precautions before using this product.)

Before using this product, please read this manual and the relevant manuals carefully and pay full attention to safety to handle the product correctly.

In this manual, the safety precautions are classified into two levels: " / WARNING" and " / CAUTION".



Under some circumstances, failure to observe the precautions given under " A CAUTION" may lead to serious consequences.

Observe the precautions of both levels because they are important for personal and system safety. Make sure that the end users read this manual and then keep the manual in a safe place for future reference.

[Design Precautions]

- Configure safety circuits external to the programmable controller to ensure that the entire system operates safely even when a fault occurs in the external power supply or the programmable controller. Failure to do so may result in an accident due to an incorrect output or malfunction.
 - (1) Configure external safety circuits, such as an emergency stop circuit, protection circuit, and protective interlock circuit for forward/reverse operation or upper/lower limit positioning.
 - (2) The programmable controller stops its operation upon detection of the following status, and the output status of the system will be as shown below.

Status	Output	
Overcurrent or overvoltage protection of the power supply module is activated.	All outputs are turned off.	
The CPU module detects an error such as a watchdog timer error by the self-diagnostic function.	All outputs are held or turned off according to the parameter setting.	

All outputs may turn on when an error occurs in the part, such as I/O control part, where the CPU module cannot detect any error. To ensure safety operation in such a case, provide a safety mechanism or a fail-safe circuit external to the programmable controller. For a fail-safe circuit example, refer to General Safety Requirements in the QCPU User's Manual (Hardware Design, Maintenance and Inspection).

(3) Outputs may remain on or off due to a failure of an output module relay or transistor. Configure an external circuit for monitoring output signals that could cause a serious accident.

[Design Precautions]



When a device such as a lamp, heater, or solenoid valve is controlled through an output module, a large current (approximately ten times greater than normal) may flow when the output is turned from off to on.

Take measures such as replacing the module with one having a sufficient current rating.

After the CPU module is powered on or is reset, the time taken to enter the RUN status varies depending on the system configuration, parameter settings, and/or program size. Design circuits so that the entire system will always operate safely, regardless of the time.

[Security Precautions]

To maintain the security (confidentiality, integrity, and availability) of the programmable controller and the system against unauthorized access, denial-of-service (DoS) attacks, computer viruses, and other cyberattacks from external devices via the network, take appropriate measures such as firewalls, virtual private networks (VPNs), and antivirus solutions.

[Installation Precautions]

 Use the programmable controller in an environment that meets the general specifications in the QCPU User's Manual (Hardware Design, Maintenance and Inspection). Failure to do so may result in electric shock, fire, malfunction, or damage to or deterioration of the product. 			
 To mount the module, while pressing the module mounting lever located in the lower part of the module, fully insert the module fixing projection(s) into the hole(s) in the base unit and press the module until it snaps into place. Incorrect mounting may cause malfunction, failure or drop of the module. When using the programmable controller in an environment of frequent vibrations, fix the module with a screw. Tighten the screw within the specified torque range. Undertightening can cause drop of the screw, short circuit or malfunction. Overtightening can damage the screw and/or module, resulting in drop, short circuit, or malfunction. 			
 When using an extension cable, connect it to the extension cable connector of the base unit securely. Check the connection for looseness. Poor contact may cause incorrect input or output. 			
 When using a memory card, fully insert it into the memory card slot. Check that it is inserted completely. Poor contact may cause malfunction. 			
 Shut off the external power supply (all phases) used in the system before mounting or removing the module. Failure to do so may result in damage to the product. A module can be replaced online (while power is on) on any MELSECNET/H remote I/O station or in the system where Redundant CPUs are used. Note that there are restrictions on the modules that can be replaced online, and each module has its predetermined replacement procedure. For details, refer to Section 2.4. 			
 Do not directly touch any conductive part of the module. Doing so can cause malfunction or failure of the module. 			
 When using a Motion CPU module and modules designed for motion control, check that the combinations of these modules are correct before applying power. The modules may be damaged if the combination is incorrect. For details, refer to the user's manual for the Motion CPU module. 			

[Wiring Precautions]

🕂 WARNING

- Shut off the external power supply for the system in all phases before wiring. Failure to do so may result in electric shock or damage to the product.
- After wiring, attach the included terminal cover to the module before turning it on for operation.
 Failure to do so may result in electric shock.

Individually ground the FG and LG terminals of the programmable controller with a ground resistance of 100Ω or less. Failure to do so may result in electric shock or malfunction.
Use applicable solderless terminals and tighten them within the specified torque range. If any spade solderless terminal is used, it may be disconnected when the terminal screw comes loose, resulting in failure.
Check the rated voltage and terminal layout before wiring to the module, and connect the cables correctly.

Connecting a power supply with a different voltage rating or incorrect wiring may cause a fire or failure.

- Connectors for external connection must be crimped or pressed with the tool specified by the manufacturer, or must be correctly soldered. Incomplete connections could result in short circuit, fire, or malfunction.
- Tighten the terminal screw within the specified torque range.
 Undertightening can cause short circuit, fire, or malfunction.
 Overtightening can damage the screw and/or module, resulting in drop, short circuit, or malfunction.
- Prevent foreign matter such as dust or wire chips from entering the module.
 Such foreign matter can cause a fire, failure, or malfunction.

[Wiring Precautions]

- When a protective film is attached to the top of the module, remove it before system operation. If not, inadequate heat dissipation of the module may cause a fire, failure, or malfunction.
- Mitsubishi Electric programmable controllers must be installed in control panels.
 Connect the main power supply to the power supply module in the control panel through a relay terminal block.
 Wiring and replacement of a power supply module must be performed by maintenance personnel

who is familiar with protection against electric shock. (For wiring methods, refer to the QCPU User's Manual (Hardware Design, Maintenance and Inspection)).

[Startup and Maintenance Precautions]

Do not touch any terminal while power is on.
Doing so will cause electric shock.
Correctly connect the battery connector.
Do not charge, disassemble, heat, short-circuit, solder, or throw the battery into the fire.
Doing so will cause the battery to produce heat, explode, or ignite, resulting in injury and fire.
Shut off the external power supply (all phases) used in the system before cleaning the module or retightening the terminal screws or module fixing screws.
Failure to do so may result in electric shock.
Undertightening the terminal screws can cause short circuit or malfunction.
Overtightening can damage the screw and/or module, resulting in drop, short circuit, or malfunction.

[Startup and Maintenance Precautions]



[Disposal Precautions]

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 the QCPU User's Manual (Hardware Design, Maintenance and Inspection).)

[Transportation Precautions]

 When transporting lithium batteries, follow the transportation regulations. (For details of the regulated models, refer to the QCPU User's Manual (Hardware Design, Maintenance and Inspection).)

CONDITIONS OF USE FOR THE PRODUCT

(1) MELSEC programmable controller ("the PRODUCT") shall be used in conditions;

i) where any problem, fault or failure occurring in the PRODUCT, if any, shall not lead to any major or serious accident; and

ii) where the backup and fail-safe function are systematically or automatically provided outside of the PRODUCT for the case of any problem, fault or failure occurring in the PRODUCT.

(2) The PRODUCT has been designed and manufactured for the purpose of being used in general industries. MITSUBISHI ELECTRIC SHALL HAVE NO RESPONSIBILITY OR LIABILITY (INCLUDING, BUT NOT LIMITED TO ANY AND ALL RESPONSIBILITY OR LIABILITY BASED ON CONTRACT, WARRANTY, TORT, PRODUCT LIABILITY) FOR ANY INJURY OR DEATH TO PERSONS OR LOSS OR DAMAGE TO PROPERTY CAUSED BY the PRODUCT THAT ARE OPERATED OR USED IN APPLICATION NOT INTENDED OR EXCLUDED BY INSTRUCTIONS, PRECAUTIONS, OR WARNING CONTAINED IN MITSUBISHI ELECTRIC USER'S, INSTRUCTION AND/OR SAFETY MANUALS, TECHNICAL BULLETINS AND GUIDELINES FOR the PRODUCT. ("Prohibited Application")

Prohibited Applications include, but not limited to, the use of the PRODUCT in;

- Nuclear Power Plants and any other power plants operated by Power companies, and/or any other cases in which the public could be affected if any problem or fault occurs in the PRODUCT.
- Railway companies or Public service purposes, and/or any other cases in which establishment of a special quality assurance system is required by the Purchaser or End User.
- Aircraft or Aerospace, Medical applications, Train equipment, transport equipment such as Elevator and Escalator, Incineration and Fuel devices, Vehicles, Manned transportation, Equipment for Recreation and Amusement, and Safety devices, handling of Nuclear or Hazardous Materials or Chemicals, Mining and Drilling, and/or other applications where there is a significant risk of injury to the public or property.

Notwithstanding the above restrictions, Mitsubishi Electric may in its sole discretion, authorize use of the PRODUCT in one or more of the Prohibited Applications, provided that the usage of the PRODUCT is limited only for the specific applications agreed to by Mitsubishi Electric and provided further that no special quality assurance or fail-safe, redundant or other safety features which exceed the general specifications of the PRODUCTs are required. For details, please contact the Mitsubishi Electric representative in your region.

(3) Mitsubishi Electric shall have no responsibility or liability for any problems involving programmable controller trouble and system trouble caused by DoS attacks, unauthorized access, computer viruses, and other cyberattacks.

REVISIONS

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

Print Date	Manual Number	Revision
Jun., 2004	SH(NA)-080486ENG-A	First edition
Jun., 2005	SH(NA)-080486ENG-B	Partial correction
		GENERIC TERMS AND ABBREVIATIONS, Chapter 1, Section 2.3, 6.2.2, 8.1.1,
		8.3.3, 9.1, 9.2
Aug., 2005	SH(NA)-080486ENG-C	Partial correction
		GENERIC TERMS AND ABBREVIATIONS, Section 2.1, 2.3, Chapter 4,
		Section 5.1.3, 5.1.4, 5.3.1, 5.4, 5.5.1, 5.5.3, 5.5.6, 5.5.7, 5.6.2, 5.7, 5.9, 6.2.1,
		7.1, 8.3.3, 9.2, Appendix 1, 4
Mar., 2006	SH(NA)-080486ENG-D	Partial correction
		GENERIC TERMS AND ABBREVIATIONS, Section 2.1, 2.3, 4.2, 5.3.5, 6.2.2,
		Appendix 4.3, 4.5
Jun., 2006	SH(NA)-080486ENG-E	Model addition
		QJ71PB92V
		Addition
		Section 6.2.6
		Partial correction
		ABOUT MANUALS, Section 1.2, 2.1, 2.3, 5.3.1, 5.3.4, 6.2, 7.1, 9.2
Jun., 2006	SH(NA)-080486ENG-F	Partial correction
		SAFETY PRECAUTIONS, Section 2.3, 2.4, Appendix 4.3, 4.5
Dec., 2006	SH(NA)-080486ENG-G	Partial correction
		SAFETY PRECAUTIONS, Section 4.2, 5.5.3, 7.1, 7.3, 8.2, Appendix 4.5, 5
Apr., 2007	SH(NA)-080486ENG-H	Revision involving Redundant CPU serial No.09012
		Model addition
		Q65WRB
		Partial correction
		SAFETY PRECAUTIONS, Section 1.1, 1.2, 2.1, 2.3, 2.4, Chapter 4, Section 4.1,
		4.2, 4.4, 5.1.3, 5.1.4, 5.1.5, 5.3.1, 5.2, 5.4, 5.5.1, 5.6.1, 5.8, 5.10.1, 5.10.2, 6.1.3,
		6.2, 6.2.1, 6.2.2, 6.2.3, 6.2.4, 6.2.5, 6.3, 6.3.1, 6.3.2, 6.3.3, 6.3.4, 7.1, 7.2,
		Chapter 8, Section 8.1.2, 8.1.4, 8.1.5, 8.3.4, 8.3.6, 9.2, Appendix 1, 2, 3
		Section 8.1.9, 8.1.10, 8.1.11, 8.3.8, 8.3.10, Chapter 6, Section 6.1, 6.2, 6.3, 6.4,
		Chapter number correction
		Section 8.3.8 → 8.3.9
Sep., 2007	SH(NA)-080486ENG-I	Partial correction
		GENERIC TERMS AND ABBREVIATIONS, Section 1.1, 1.2, 2.1, 2.3, 2.4, 3.3,
		5.1.4, 5.1.5, 5.2, 5.4, 5.3.4, 5.3.6, 5.5.1, 5.5.4, 5.5.5, 5.6.2, 5.9, 5.10.1, 5.10.2,
		0.1.3, 0.2, 0.2.2, 0.2.4, 0.2.3, 0.3, 0.3.2, 0.3.3, 0.3.4, 0.4, 1.1, 1.2, 0.1, 0.2, 3.2,
Nov 2007	SH(NA)-080486ENG-1	Revision due to a support of Redundant CPU having serial number 09102 and
1107., 2007		overall review

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

Print Date	Manual Number	Revision
May, 2008	SH(NA)-080486ENG-K	Revision due to a support of Redundant CPU having serial number 10042,
		This manual has been revised wholly because of integration of existing
		MELSECNET/G network modules into CC-Link IE Controller Network module.
		Partial correction
		GENERIC TERMS AND ABBREVIATIONS, Section 1.1, 1.2, 2.1, 2.3, 2.4, 4.2,
		5.1, 5.1.1, 5.3.3, 5.3.4, 5.4, 5.6.1, 5.6.2, 5.7, 5.9, 5.10.1, 5.10.2, 6.1.1, 6.1.3,
		6.3.2, 6.2, 6.2.1, 6.2.2, 6.2.3, 6.2.4, 6.2.5, 6.3, 6.3.1, 6.3.2, 6.3.3, 6.3.4, 6.4, 7.1,
		7.3, 8.1.7, 8.1.16, 8.3.1, 8.3.2, 8.3.3, 8.3.4, 8.3.5, 8.3.6, 8.3.9, 9.2, Appendix 1, 2,
		3, 4.1, 5
		Addition
		Section 8.1.12, 8.1.13, 8.1.14, 8.1.15
Mar., 2009	SH(NA)-080486ENG-L	Partial correction
		Section 2.4, 7.1
Jul., 2009	SH(NA)-080486ENG-M	Partial correction
		SAFETY PRECAUTIONS, GENERIC TERMS AND ABBREVIATIONS
Apr., 2010	SH(NA)-080486ENG-N	Partial correction
		SAFETY PRECAUTIONS, Section 2.3, 5.5.1, 6.3, Appendix 4.4
		Addition
		CONDITIONS OF USE FOR THE PRODUCT
Jun., 2011	SH(NA)-080486ENG-O	Partial correction
		INTRODUCTION, Section 2.3, Appendix 4.4, 4.5
Jul., 2012	SH(NA)-080486ENG-P	Partial correction
		HOW TO USE THIS MANUAL, GENERIC TERMS AND ABBREVIATIONS,
		Section 2.3, 2.4, 5.3.3, 6.1.3, 7.5, 8.2, Appendix 1, 2, 3, 4.3, 4.5
Jan., 2013	SH(NA)-080486ENG-Q	Partial correction
		GENERIC TERMS AND ABBREVIATIONS, Section 2.1, 2.3, 4.2, 5.3.3, 6.2
		Addition
		Section 6.2.5, Appendix 5
Jan., 2014	SH(NA)-080486ENG-R	Revision due to a support of Redundant CPU having serial number 16021
		Partial correction
		MANUALS, GENERIC TERMS AND ABBREVIATIONS, Chapter 1, Section 2.3,
		4.2, 5.3.4, 5.5.3, 5.11, 9.1, 9.2

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Print Date	Manual Number	Revision
Oct., 2014	SH(NA)-080486ENG-S	Revision due to a support for redundant system of the MODBUS/TCP module and the model addition of the Redundant power supply module
		Q64RPN
		Partial correction MANUALS, GENERIC TERMS AND ABBREVIATIONS, Section 1.2, 2.1, 2.3, 4.2, 5.3.1, 5.3.3, 6.2, Appendix 7
		Addition Section 6.2.4
		Chapter number correction Section 6.2.4 \rightarrow 6.2.5, Section 6.2.5 \rightarrow 6.2.6, Section 6.2.6 \rightarrow 6.2.7
Mar., 2015	SH(NA)-080486ENG-T	Partial correction MANUALS, GENERIC TERMS AND ABBREVIATIONS, Section 1.2, 2.1, 2.3, 5.3.1, 5.5.3, 5.5.4, 5.5.5, 5.9, 6.2.1, 6.2.2, 6.2.7, 6.3.1, 8.1.6, 8.1.16, 8.3.4, Appendix 1, 2, 3, 4.3, 4.4, 4.5, 8
Dec., 2015	SH(NA)-080486ENG-U	Partial correction Section 2.2, 5.1.4, WARRANTY
Dec., 2017	SH(NA)-080486ENG-V	Partial correction Section 5.3.3, 7.5, Appendix 4.5
Sep., 2018	SH(NA)-080486ENG-W	Partial correction GENERIC TERMS AND ABBREVIATIONS
Apr., 2019	SH(NA)-080486ENG-X	Partial correction GENERIC TERMS AND ABBREVIATIONS, Section 2.3, 4.2, 9.1, 9.2
Dec., 2019	SH(NA)-080486ENG-Y	Partial correction Appendix 6
Sep., 2022	SH(NA)-080486ENG-Z	Partial correction SAFETY PRECAUTIONS, CONDITIONS OF USE FOR THE PRODUCT, Section 6.2
Jun., 2024	SH(NA)-080486ENG-AA	Partial correction Section 5.4

Japanese Manual Version SH-080474-AB

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INTRODUCTION

Thank you for purchasing the Mitsubishi Electric MELSEC-Q series programmable controllers. Before using this product, please read this manual carefully and develop familiarity with the functions and performance of the MELSEC-Q series programmable controller to handle the product correctly. When applying the program examples introduced in this manual to the actual system, ensure the applicability and confirm that it will not cause system control problems.

Note that the menu names and operating procedures may differ depending on an operating system in use and its version. When reading this manual, replace the names and procedures with the applicable ones as necessary.

Please make sure that the end users read this manual.

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Appendix 7	.7	OUTPUT Instruction	App - 60

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MANUALS

The manuals related to this product are listed below. Order each manual as needed, referring to the following list.

Related Manuals

Manual Name	Manual Number (Model Code)
QCPU User's Manual (Hardware Design, Maintenance and Inspection)	
Specifications of the hardware (CPU modules, power supply modules, base units, extension cable	es, and SH-080483ENG
memory cards), system maintenance and inspection, troubleshooting, and error codes	(13JR73)
(Sold s	separately)
Qn(H)/QnPH/QnPRHCPU User's Manual (Function Explanation, Program Fundamentals)	SH-080808ENG
Functions, methods, and devices for programming	(13JZ28)
(Sold s	separately)
	SH-080809ENG
How to use sequence instructions, basic instructions, and application instructions (Sold s	separately) (13JW10)
MELSEC-Q/L/QnA Programming Manual (PID Control Instructions)	SH-080040
Dedicated instructions for PID control (Sold s	separately) (13JF59)
MELSEC-Q/L/QnA Programming Manual (SFC)	
System configuration, performance specifications, functions, programming, debugging, and error co (MELSAP3) programs	codes for SFC SH-080041 (13JF60)
(Sold s	separately)
MELSEC-Q/L Programming Manual (MELSAP-L)	SH-080076
Programming methods, specifications, and functions for SFC (MELSAP-L) programs (Sold s	separately) (13JF61)
MELSEC-Q Programming/Structured Programming Manual (Process Control Instructions)	
Dedicated instructions for process control	SH-000310E
(Sold s	separately) (13JF07)
MELSEC-Q/L Programming Manual (Structured Text)	SH-080366
Programming methods using structured text language	(13 IE68)
(Sold s	separately)
MELSEC-Q CC-Link IE Controller Network Reference Manual	011 0000007110
Specifications, procedures and settings before system operation, parameter setting, programming	g, and SH-080668ENG
troubleshooting of the CC-Link IE Controller Network module	(13JV16)
(Sold s	separately)
Consponding MELSECINE I/H Network System Reference Manual (Remote I/O network	SH-080124
specifications, procedures and settings before system operation, parameter setting, programming troubleshooting of a MELSECNET/H network system (remote I/O network)	(13.IF96)
(Sold s	separately)
Type MELSECNET/10 Network system (PLC to PLC network) Reference Manual	1)/
Specifications, procedures and settings before system operation, parameter setting, programming	g, and IB-66440
troubleshooting of a MELSECNET/H network system (PLC to PLC network)	(13JE33)
(Sold s	separately)

Related Manuals

Manual Name	Manual Number (Model Code)
Q Corresponding Serial Communication Module User's Manual (Basic)	
Overview, system configuration, specifications, procedures before operation, basic data communication method	SH-080006
with external devices, maintenance and inspection, and troubleshooting for using the serial communication	(13JL86)
module	()
MELSEC O/L Social Communication Module User's Manual (Application)	
Special functions (specifications, usage, and sattings) and data communication method with external devices of	SH-080007
the serial communication module	(13, 11, 87)
(Sold separately)	(100201)
Q Corresponding Ethernet Interface Module User's Manual (Basic)	
Specifications, procedures for data communication with external devices, line connection (open/close), fixed	SH-080009
buffer communication, random access buffer communication, and troubleshooting of the Ethernet module	(13JL88)
(Sold separately)	
MELSEC-Q/L Ethernet Interface Module User's Manual (Application)	
E-mail function, programmable controller CPU status monitoring function, communication via CC-Link IE	SH-080010
Controller Network, CC-Link IE Field Network, MELSECNE I/H, or MELSECNE I/10, communication using the	(13JL89)
data link instructions, and hie transfer function (FTF server) of the Ethernet module (Sold separately)	
MELSEC Communication Protocol Reference Manual	
Communication methods and control procedures through the MC protocol for the external devices to read and	SH-080008
write data from/to the CPU module using the serial communication module/Ethernet module	(13JF89)
(Sold separately)	
MELSEC-Q CC-Link System Master/Local Module User's Manual	
System configuration, performance specifications, functions, handling, wiring, and troubleshooting of the	SH-080394
QJ61BT11N	(13JR64)
(Sold separately)	
NODBOS Interface Module Oser's Manual	SH-080578ENG
System configuration, specifications, functions, procedures and settings before system operation, programming,	(13 IR86)
(Sold separately)	(1331(00)
MODBUS/TCP Interface Module User's Manual	
System configuration, specifications, functions, procedures and settings before system operation, programming,	SH-080446ENG
dedicated instructions, and troubleshooting of the QJ71MT91.	(13JR71)
(Sold separately)	
PROFIBUS-DP Master Module User's Manual	
System configuration, performance specifications, functions, handling, wiring, and troubleshooting of the	SH-080572ENG
QJ71PB92V	(13JR84)
(Sold separately)	

HOW TO USE THIS MANUAL

This manual explains the redundant system configuration, functions, communication with external devices and troubleshooting.

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

1) Chapter 1 and 2	Explains the redundant system overview and system configuration	
2) Chapter 3	Explains the tracking cable specifications, part names and connection method.	
3) Chapter 4	Explains starting up the redundant system.	
4) Chapter 5	Explains the redundant system functions.	
5) Chapter 6	Explains the communication between a redundant system and each network, GOT and GX Developer.	
6) Chapter 7	Explains the precautions for programming in a redundant system.	
7) Chapter 8	Explains the troubleshooting methods and module replacement in a redundant system.	
8) Chapter 9	Explains the processing time of a redundant system.	
Remark ••••••		
 (1) 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. 		

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

- (2) This manual does not explain the functions of the CPU module.
 For these functions, refer to the manual shown below.
 CF Qn(H)/QnPH/QnPRHCPU User's Manual (Function Explanation, Program Fundamentals)
- (3) Operating procedures are explained using GX Developer. The procedures are the same as those for when using GX Works2.

HOW THIS MANUAL IS ORGANIZED



In addition, this manual provides the following explanations.



GENERIC TERMS AND ABBREVIATIONS

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

Generic Term/Abbreviation	Description	
Basic model QCPU	A generic term for the Q00JCPU, Q00CPU, and Q01CPU	
High Performance model QCPU	A generic term for the Q02CPU, Q02HCPU, Q06HCPU, Q12HCPU, and Q25HCPU	
Process CPU	A generic term for the Q02PHCPU, Q06PHCPU, Q12PHCPU, and Q25PHCPU	
Redundant CPU	A generic term for the Q12PRHCPU and Q25PRHCPU	
	A generic term for the Q00UJCPU, Q00UCPU, Q01UCPU, Q02UCPU, Q03UDCPU,	
	Q03UDVCPU, Q03UDECPU, Q04UDHCPU, Q04UDVCPU, Q04UDPVCPU,	
Universal model OCDU	Q04UDEHCPU, Q06UDHCPU, Q06UDVCPU, Q06UDPVCPU, Q06UDEHCPU,	
Universal model QCPU	Q10UDHCPU, Q10UDEHCPU, Q13UDHCPU, Q13UDVCPU, Q13UDPVCPU,	
	Q13UDEHCPU, Q20UDHCPU, Q20UDEHCPU, Q26UDHCPU, Q26UDVCPU,	
	Q26UDPVCPU, Q26UDEHCPU, Q50UDEHCPU, and Q100UDEHCPU	
OCDU	A generic term for the Basic model QCPU, High performance model QCPU, Process	
QCFU	CPU Redundant CPU, and Universal model QCPU	
QnCPU	Another term for the Q02CPU	
QnHCPU	A generic term for the Q02HCPU, Q06HCPU, Q12HCPU, and Q25HCPU	
QnPHCPU	A generic term for the Q02PHCPU, Q06PHCPU, Q12PHCPU, and Q25PHCPU	
QnPRHCPU	A generic term for the Q12PRHCPU and Q25PRHCPU	
	A generic term for the Q00UJCPU, Q00UCPU, Q01UCPU, Q02UCPU, Q03UDCPU,	
	Q03UDVCPU, Q03UDECPU, Q04UDHCPU, Q04UDVCPU, Q04UDPVCPU,	
	Q04UDEHCPU, Q06UDHCPU, Q06UDVCPU, Q06UDPVCPU, Q06UDEHCPU,	
QIUCPU	Q10UDHCPU, Q10UDEHCPU, Q13UDHCPU, Q13UDVCPU, Q13UDPVCPU,	
	Q13UDEHCPU, Q20UDHCPU, Q20UDEHCPU, Q26UDHCPU, Q26UDVCPU,	
	Q26UDPVCPU, Q26UDEHCPU, Q50UDEHCPU, and Q100UDEHCPU	
Q Series	An abbreviation for the Mitsubishi Electric MELSEC-Q series programmable controller	
GX Works2	The product name of the software package for the MELSEC programmable controllers	
GX Developer	The product name of the software package for the MELSEC programmable controllers	
OPS	An abbreviation for the operation system that includes MELSOFT and EZSocket partner	
	products	
CC-Link IE Controller Network	A generic term for the QJ71GP21-SX and QJ71GP21S-SX CC-Link IE Controller	
module	Network modules	
MELSECNET/H	An abbreviation for the MELSECNET/H network system	
MELSECNET/H module	A generic term for the QJ71LP21, QJ71LP21-25, QJ71LP21S-25, QJ71LP21G,	
	QJ71LP21GE, and QJ71BR11 MELSECNET/H network modules	
MELSECNET/10	An abbreviation for the MELSECNET/10 network system	
Ethernet	An abbreviation for the Ethernet network system	
Ethernet module	A generic term for the QJ71E71-100, QJ71E71-B5, and QJ71E71-B2 Ethernet interface	
	modules	
CC-Link master module	An abbreviation for the CC-Link system master/local module	
MODBUS module	An abbreviation for the QJ71MB91 MODBUS interface module	
MODBUS/TCP module	An abbreviation for the QJ71MT91 MODBUS/TCP interface module	
Q3□B	A generic term for the Q33B, Q35B, Q38B, and Q312B main base units	
Q3□SB	A generic term for the Q32SB, Q33SB, and Q35SB slim type main base units	
Q3□RB	Another term for the Q38RB main base unit for redundant power supply system	
Q5□B	A generic term for the Q52B and Q55B extension base units	
Q6□B	A generic term for the Q63B, Q65B, Q68B, and Q612B extension base units	

Generic Term/Abbreviation	Description
Q6□RB	Another term for the Q68RB extension base unit for redundant power supply system
Q6□WRB	Another term for the Q65WRB extension base unit for redundant system
Main base unit	A generic term for the Q3_B, Q3_SB, and Q3_RB
Extension base unit	A generic term for the Q5_B, Q6_B, Q6_RB, and Q6_WRB
Slim type main base unit	Another term for the Q3 SB
Redundant power main base unit	Another term for the Q3 RB
Redundant power extension base unit	Another term for the Q6□RB
Redundant type extension base unit	Another term for the Q6 WRB
	A generic term for the main base unit, extension base unit, slim type main base unit,
Base unit	type extension base unit, redundant power extension base unit, and redundant
Eutonaian achla	A generic term for the QC05B, QC06B, QC12B, QC30B, QC50B, and QC100B
Extension cable	extension cables
Tracking cable	A generic term for the QC10TR and QC30TR tracking cables for the Redundant CPU
O series nower supply module	A generic term for the Q61P-A1, Q61P-A2, Q61P, Q61P-D, Q62P, Q63P, Q64P, and
a series power supply module	Q64PN power supply modules
Slim type power supply module	An abbreviation for the Q61SP slim type power supply module
Redundant power supply module	A generic term for the Q63RP, Q64RPN, and Q64RP redundant power supply modules
Power supply module	A generic term for the Q series power supply modules and redundant power supply modules
Detter	A generic term for the Q6BAT, Q7BATN, Q7BAT, and Q8BAT CPU module batteries,
Battery	Q2MEM-BAT SRAM card battery
	A generic term for the Q2MEM-1MBSN, Q2MEM-1MBS, Q2MEM-2MBSN,
SRAM card	Q2MEM-2MBS, and Q3MEM-4MBS SRAM cards
Flash card	A generic term for the Q2MEM-2MBF and Q2MEM-4MBF Flash cards
ATA card	A generic term for the Q2MEM-8MBA, Q2MEM-16MBA, and Q2MEM-32MBA ATA cards
Memory card	A generic term for the SRAM card, Flash card, and ATA card

RELEVANT TERMS

Relevant Term	Description
System A	The system to which the system A connector of tracking cable is connected
System B	The system to which the system B connector of tracking cable is connected
Host system	The system where the currently mentioned Redundant CPU module is mounted
	The system connected to the host system via the tracking cable
Other system	If system A is the host system, system B is the other system; if system B is the host
	system, system A is the other system
Control avetom	The basic system that is controlling the redundant system and performing network
Control system	communication
Standby system	The basic system for backup that consists of the redundant system
Now control system	The system that has switched to control system from standby system after system
New control system	switching
New standby system	The system that has switched to standby system from control system after system
New standby system	switching
	The slot that is located on the right side of the power supply module mounted on the
CDU alat	main base unit
	In the case of redundant power supply base unit, it indicates the slot that is located on
	the right side of a pair of power supply modules

CHAPTER1 OVERVIEW

This manual describes the configuration and functions of the redundant system using the Redundant CPUs.

For common specifications, performance, and functions of the QCPUs, refer to the following.

(1) Specifications and handling of Q series products, such as QCPUs, power supply modules, base units, memory cards

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

(2) Common functions, programs, and devices of QCPUs
 CP Qn(H)/QnPH/QnPRHCPU User's Manual (Function Explanation, Program Fundamentals)

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OVERVIEW

(3) List of Redundant CPU manuals

Redundant CPU manuals are listed below.

For details such as manual numbers, refer to "MANUALS" in this manual.

Table1.1 List of User's Manuals for Redundant CPU

	Maintenance and Inspection	Program Fundamentals	Multi CPU System	Redundant system	STEM
Purpose	QCPU User's Manual (Hardware Design, Maintenance and inspection)	Qn(H)/QnPH/ QnPRHCPU User's Manual (Function Explanation, Program Fundamentals)	QCPU User's Manual (Multiple CPU System)	QnPRHCPU User's Manual (Redundant System)	E CCC
Part names and specifications of the CPU module	Details	Outline			TRACKING CABL
Connecting methods of power supply modules, base units, and I/O modules	Details				A STEM
Construction of redundant system (including start-up procedure and I/O number assignment)				Details	PROCEDURE FC STARTING UP A REDUNDANT SY
Sequence programs and memory devices		Details			STEM 2
Functions, parameters, and devices of the CPU module		Details			REDUNDANT S
Troubleshooting				Details	SYSTEM 0
Error codes	Details				REDUNDANT S NETWORKS

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TROUBLESHOOTING

Table1.2 List of Programming Manuals for Redundant CPU

	Common Instructions	PID control Instructions	Process control Instruction	SFC	MELSAP-L	Structured Text
Purpose	MELSEC-Q/L Programming Manual (Common Instruction)	MELSEC-Q/L/ QnA Programming Manual (PID Control Instructions)	MELSEC-Q Programming/ Structured Programming Manual (Process Control Instructions)	MELSEC-Q/L/ QnA Programming Manual (SFC)	MELSEC-Q/L Programming Manual (MELSAP-L)	MELSEC-Q/L Programming Manual (Structured Text)
Usage of instructions, such as sequence instructions, basic instructions, and application instructions	Details					
Dedicated instructions for PID controls		Details				
Dedicated instructions for process control			Details			
System configuration, performance specifications, functions, programming, debugging, and error codes for SFC (MELSAP3) programs				Details		
Programming methods, specifications, and functions for SFC (MELSAP-L) programs					Details	
Programming methods using structured text language						Details

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TRACKING CABLE

PROCEDURE FOR STARTING UP A REDUNDANT SYSTEM

> REDUNDANT SYSTEM FUNCTIONS

> REDUNDANT SYSTEM NETWORKS

1.1 Redundant System Overview

A redundant system offers improved system reliability, as it consists of two basic systems,

each of which includes the CPU module, power supply module, network module *3 and others, so that even if a module error occurs in one basic system, the other one continues the system control.

To configure a redundant system, prepare two sets of systems, i.e., two redundant main base units on which the abovementioned modules are mounted. Then, connect the CPU modules of both systems with a tracking cable.

I/O module(s) and intelligent function module(s) are installed to MELSECNET/H remote I/O station(s) or extension base unit(s) in redundant systems.

Power supply redundancy is also available by using redundant power main base units or redundant power extension base units.



Diagram 1.1 Configuration Example of Redundant System

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- * 1: The control system indicates the system that actually controls the redundant system. ($\boxed{=}$ Section 5.1.2)
- * 2: The standby system indicates the backup system within a redundant system. (\square Section 5.1.2)
 - If an error occurs in the control system, the standby system takes over the control of the redundant system.
- * 3: Refer to Section 2.3, for details of network modules compatible for redundant system.



The redundant system described in this manual does not guarantee continuous operation of the system depending on the failure status. Also, when system switching occurs due to an extension base unit error or a module error on the extension base unit, the standby system also detects the error and the CPUs on both systems will stop. Therefore, create a safety circuit externally so that the overall system safety can be ensured even in these cases.

1.2 Features

Features of redundant system are indicated below.

(1) Redundant Configuration of Basic System

As a redundant system consists two basic systems, i.e., two sets of CPU modules, power supply modules, main base units, network module^{*3}, etc., one of the basic systems controls the whole system, while the other one performs backup. Data of the CPU module performing control is transmitted to the backup CPU module in order to make the data consistent. This enables the backup system to take over the redundant system control after the control system goes down and system switching occurs.



Diagram 1.2 Redundant Configuration of Basic System

- * 1: The control system indicates the system that actually controls the a redundant system. ($\boxed{27}$ Section 5.1.2)
- * 2: The standby system indicates the backup system within a redundant system. ($\bigcap_{\mathcal{F}}$ Section 5.1.2)

If an error occurs in the control system, the standby system takes over the control of the redundant system.

* 3: Refer to Section 2.3, for details of network modules compatible for redundant system.

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(2) Connection of Extension Base Unit

In the redundant system where the Redundant CPU whose first 5 digits of serial No. is "09012" or later is used in both systems, the extension base unit can be connected.^{*1} Since communication can be made not by network but via bus, communication with the I/O module and the intelligent function module can be made in high speed.



Diagram 1.3 System Configuration when Connecting Extension Base Unit

* 1: For the precautions of the system configuration when connecting the extension base unit, refer to Section 2.4.

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In the case of CC-Link IE Controller Network, MELSECNET/H PLC to PLC network, Ethernet, and MODBUS/TCP, control/standby system switching occurs and system control and network communication is continued even when a network module fails or when network cable disconnection is detected.





* 1: For restrictions of the CC-Link IE Controller Network interface board, refer to the following manual.

(b) MELSECNET/H Remote I/O Network

MELSECNET/H remote I/O stations can continue the operation even when control/standby system switching occurs. (\Box Section 6.2.2)



Diagram 1.5 System Configuration for MELSECNET/H Remote I/O Network
(c) PROFIBUS-DP

When the PROFIBUS-DP master module detects a fault or communication failure with slave stations, the both systems are switched so that the communications can be continued.



(4) Redundant system settings using parameters.

Redundant system settings such as tracking settings, network pairing settings, etc. can be made easily in the parameter settings of GX Developer.

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(5) Writing parameters and programs to control system and standby system without the need to identify each system

Parameters and programs can be written into both of control system and standby system using GX Developer. There is no need to identify each system.



Diagram 1.7 Writing Data to the CPU Modules in the Control System and Standby System

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(6) Copy of parameters and programs from control system to standby system

After the CPU module is replaced in standby system, parameters and programs can be copied from the CPU module of control system to the new CPU module by executing the transfer command from GX Developer. This operation can also be done via special relays and special registers.

(C Section 5.7)



Diagram 1.8 Copy of Parameters and Programs when CPU Module is Replaced

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(7) Access to redundant system from host network

When accessing to a redundant system, the host OPS can automatically identify and directly access to the control system, if it has been specified as destination in advance.



Diagram 1.9 System Configuration for Ethernet

(8) Compatible with Q series modules

Q series modules such as the I/O module, intelligent function module, and network module can be applied to a redundant system without making any modifications. (Some models are irrelevant) ($\Box = 3$ Section 2.3)

Therefore, equipments within factories can be utilized, maintenance costs can be reduced, and the system can be expanded.

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(9) Online module change (hot swapping)

The I/O module mounted on a main base unit with a redundant CPU module and the module mounted on a remote I/O station can be replaced online (hot swapping) using GX Developer. (S Section 2.4 (6))

The module can be replaced without stopping the system, when it fails.

Note that a module mounted to the main base unit cannot be replaced online when the extension base unit is connected.



Diagram 1.10 Online Module Change (Hot Swapping) of Remote I/O Stations

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(10)System status can be monitored.

The operation status of the whole redundant system can be monitored using the System Monitor of GX Developer.



Diagram 1.12 System Monitor of GX Developer

(11)Compact Redundant System

The space of control panel can be saved, as Q series modules (other than the CPU module, redundant power supply module, and tracking cable) are applicable.

(12)Flexible layout

The layout can be changed flexibly because the main base unit is divided into two units for the control system and standby system.



Diagram 1.13 Horizontal Arrangement of Control System and Standby System



Diagram 1.14 Vertical Arrangement of Control System and Standby System

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CHAPTER2 SYSTEM CONFIGURATION

This chapter describes the redundant system configuration.

2.1 System Configuration

An example of redundant system configuration is illustrated in Diagram 2.1.



- * 1: In a coaxial bus system, use double shielded coaxial cables. Refer to the following manual for the double shielded coaxial cables.
 - G Corresponding MELSECNET/H Network System Reference Manual (Remote I/O Network)
- * 2: For the extension base units and network modules compatible with the redundant system, refer to Section 2.3 and Section 2.4.

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CONFIGURATION

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STARTING UP A REDUNDANT SYSTEM

REDUNDANT SYSTEM FUNCTIONS

REDUNDANT SYSTEM NETWORKS

SYSTEM

(1) Redundant System

(a) System Configuration

A redundant system consists of two sets of power supply modules, CPU modules, main base units, and network modules.

To configure a redundant system, prepare two sets of systems, i.e., mount the same model of power supply module, CPU module, and network module on each main base unit, then connect the CPU modules of both systems with a tracking cable.

The connection direction (connectors) of the tracking cable determines which one is system A or B.

(Section 5.1.1)

If system A and system B are started up simultaneously, system A becomes the control system.

If one of the systems is started up before the other, the system started up first becomes the control system.^{*1} (\bigcirc Section 5.1.2)



Diagram 2.2 Redundant System Configuration

The extension base unit cannot be connected to the main base unit where the Redundant CPU whose first 5 digits of serial No. is "09011" or earlier is mounted. If connected, a stop error "BASE LAY ERROR (error code: 2010)" occurs. When connecting the extension base unit, use the Redundant CPU whose first 5 digits of serial No. is "09012" or later.

* 1 : If system A and system B are started up within three seconds of one another, system A becomes the control system.

(b) Backup of Power Supply Module

The power supply module of each system can be backed up. By adding backup power supply modules to system A and system B, even if an error occurs in the power supply system connected to one power supply module, or if the power supply module fails, the other power supply module can continue the operation.

This enables the faulty power supply system to be restored, and the faulty power supply module can be replaced while the system is running.

The power supply module can also be replaced for preventive maintenance while the system is running.



(c) Module which can be mounted to main base unit or extension base unit For the module which can be mounted to the main base unit or extension base unit, refer to Section 2.3.

(d) Redundant System Operations

Refer to Section 5.1, for redundant system operations.

The extension base unit cannot be connected to the main base unit where the Redundant CPU whose first 5 digits of serial No. is "09011" or earlier is mounted. If connected, a stop error "BASE LAY ERROR (error code: 2010)" occurs. When connecting the extension base unit, use the Redundant CPU whose first 5 digits of serial No. is "09012" or later.

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(2) Communication with a Host OPS or personal computer

(a) Communications over Ethernet

Communications between a host OPS or personal computer and Redundant CPUs are performed over Ethernet.



Diagram 2.4 Connection of Redundant System to Ethernet

(b) Ethernet Modules applicable to Redundant System Refer to Section 2.3, for Ethernet modules applicable to a redundant system.

(c) Ethernet Communication Methods and Operations during System Switching For an overview of communication methods between the OPS or personal computer connected to the Ethernet network and CPU modules in a redundant system, and operations during system switching, refer to Section 6.2.3.

For details, refer to the Q Corresponding Ethernet Interface Module User's Manual (Basic).

(3) Communication via CC-Link IE Controller Network or MELSECNET/H PLC to PLC Network

 (a) Connecting Redundant System to CC-Link IE Controller Network, MELSECNET/H, and MELSECNET/10 PLC to PLC Network
A redundant system can communicate with Q series CPU modules connected to CC-Link IE Controller Network or MELSECNET/H PLC to PLC network.
The system can also connect to MELSECNET/10 PLC to PLC network and communicate with Q series, QnA series, and A series CPU modules.

(b) Pairing Settings and Relevant CPU Modules

Pairing settings must be made using the control station network parameters when connecting a redundant system to CC-Link IE Controller Network, MELSECNET/ H, or MELSECNET/10.

The following CPU modules include the network parameters for pairing settings.

- Redundant CPU *1
- High Performance model QCPU *1
- Process CPU ^{*1}
- Basic model QCPU ^{*1}
- Universal model QCPU *1
- Q4ARCPUs *1 *2 *3

When connecting a redundant system to a network, set any of the above CPU modules as the control station.

CPU modules other than above can be set as the normal station only. Refer to the following manuals, for details on pairing settings for CC-Link IE Controller Network, MELSECNET/H, and MELSECNET/10 PLC to PLC networks.

- MELSEC-Q CC-Link IE Controller Network Reference Manual
- Q Corresponding MELSECNET/H Network System Reference Manual (PLC to PLC network)
- CP QnA/Q4AR Corresponding MELSECNET/10 Network System Reference Manual

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Normal station Normal station Normal station Normal station lletu Dutput module Intelli QNACPU Output module Intelli QJ71E7 Input module Input module Input module module modu Input modul Input modul QJ71LP2 AJ71QLP2 Input module Q4ARCP A.17101 P2 QNHCF Input modu QNPHCF supply mod supply supply supply 0 0 0 0 Input nput Input Dutput MELSECNET/H (MELSECNET/10 Mode) PLC to PLC network (communication with other stations) Normal station Control station Normal station Normal station System A -Control System System B -Standby Syst System B System A Control System Standby Sy A61RP A61RP QJ71GP21-SX QJ61BT11N QJ71GP21-SX QJ61BT11N Q4ARCPU Q4ARCPU QJ71LP21 QJ71E71 QJ71E71 10LP21 **AS92R** IQLP21 QNPRHCPL QJ71LP2 AGRAF **QnPRHCPI** supply supply Tracking cal Pairing setting is required Pairing setting is required

Diagram 2.5 Connection of Redundant System to MELSECNET/H PLC to PLC Network

- * 1: Before making the pairing settings, check the GX Developer version. (Section 2.3)
- * 2: The Q4ARCPU makes pairing settings using the "J.PAIRSET" instruction.
- * 3: The pairing settings cannot be made with the Q4ARCPU in the CC-Link IE Controller Network.



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(4) Communication via MELSECNET/H Remote I/O Network

(a) Controlling External Devices

A redundant system controls external devices using I/O modules and intelligent function modules that are installed to remote I/O stations on the MELSECNET/H remote I/O network.

Communications with external devices are also available by installing a communication module to a remote I/O station, when it cannot be mounted on the main base unit of the redundant system.

(b) Backup of Power Supply Module

The power supply module for each remote I/O station can be backed up. By adding a backup power supply module to a remote I/O station, the remote I/O station can continue to operate, even if an error occurs in either power supply system, or if the power supply module fails.

This enables the faulty power supply system to be restored and power supply modules that have failed can be replaced, even when the remote I/O station power supply is on.

The power supply module can also be replaced for preventive maintenance, etc. when the remote I/O station power supply is on.

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(c) Online Module Change (Hot Swapping) Using GX Developer

The I/O module mounted on a remote I/O station (including analog module of function version C) can be replaced online (hot swapping) using GX Developer. Refer to Section 2.4 (6), for modules on a remote I/O station that can be replaced online (hot swapping) using GX Developer.



Diagram 2.6 MELSECNET/H Remote I/O Network Configuration

(d) Reference Manual

Refer to the following manual, for modules that can be mounted on a remote I/O station and parameter settings.

C Corresponding MELSECNET/H Network System Reference Manual (Remote I/O network)

(5) Communications through MODBUS/TCP

Mounting MODBUS/TCP modules in a redundant system enables data communications with MODBUS/TCP devices.

(a) When MODBUS/TCP modules are mounted on main base units

- Transmission lines can be redundant.
- The slave function can be used. (The modules work as slave stations.)

(b) When MODBUS/TCP modules are mounted on extension base units

Both the master and slave functions can be used. (The modules work as master or slave stations.)

1) Redundant transmission lines

Transmission lines cannot be redundant when the MODBUS/TCP modules are mounted on an extension base unit.

2) Dedicated instructions

Dedicated instructions cannot be used.

Use the automatic communication function instead of the MBRW instruction. For details of the automatic communication function, refer to the following manual.

STMODBUS/TCP Interface Module User's Manual

3) GX Configurator-MB

When accessing the Redundant CPUs from GX Developer via an intelligent function module on an extension base unit, GX Configurator-MB cannot be used.

Connect GX Configurator-MB to the Redundant CPUs in either of the following ways.



(Through Ethernet module, MELSECNET/H module, or CC-Link module) Diagram 2.7 Communication Route for GX Configurator-MB

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(6) Communication via CC-Link

(a) Controlling External Devices

A redundant system controls external devices using remote I/O stations, remote device stations, and intelligent device stations connected to CC-Link.

(b) CC-Link master module setting

Set the CC-Link master modules as follows.

1) When mounting to the main base unit

- System A: master station
- System B: standby master station

If A system is standby master station and B system is master station, data link cannot be made.

Also, start the system so that A system can be the control system.

(Section 5.1.2)

If B system starts as the control system, CC-Link communication cannot be made since CC-Link master station does not exist.

For the standby master station function, refer to the following manual.

CF MELSEC-Q CC-Link System Master/Local Module User's Manual

2) When mounting to the extension base unit

Set [Master station (Extension base)].

(c) System start-up

1) When using the QJ61BT11N whose first 5 digits of serial No. is 07112 or later

When using the CC-Link, control using the CC-Link can be made starting up from either system A or system B.

2) When using the QJ61BT11N whose first 5 digits of serial No. is 07111 or earlier

When using the CC-Link, start up the system so that system A will be the control system.

If starting up the system B as the control system, CC-Link cannot make communication since the master station of the CC-Link does not exist.



Diagram 2.8 Connection of Redundant System to CC-Link

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(7) Communications through MODBUS

Mounting MODBUS modules in a redundant system enables data communications with MODBUS devices.

(a) When MODBUS modules are mounted on main base units

- Transmission lines can be redundant.
- The slave function can be used. (The modules work as slave stations.)
- (b) When MODBUS modules are mounted on extension base units

Both the master and slave functions can be used. (The modules work as master or slave stations.)

1) Redundant transmission lines

Transmission lines cannot be redundant when the MODBUS modules are mounted on an extension base unit.

2) Dedicated instructions

Dedicated instructions cannot be used.

Use the automatic communication function instead of the MBRW instruction. For details of the automatic communication function, refer to the following manual.

MODBUS Interface Module User's Manual

3) GX Configurator-MB

When accessing the Redundant CPUs from GX Developer via an intelligent function module on an extension base unit, GX Configurator-MB cannot be used.

Connect GX Configurator-MB to the Redundant CPUs in either of the following ways.



Diagram 2.9 Communication Route for GX Configurator-MB

(8) Communications through the PROFIBUS-DP

(a) I/O data exchange

The PROFIBUS-DP master module exchanges I/O data with slave stations connected to the PROFIBUS-DP.

(b) Communication method and operation at system switching of the PROFIBUS-DP

For the method of communications with slave stations connected to the PROFIBUS-DP and operation overview at system switching, refer to Section 6.2.8.

For the method of communications with slave stations connected to the PROFIBUS-DP and operation details at system switching, refer to the following manual.



PROFIBUS-DP Master Module User's Manual

Diagram 2.10 Connection of Redundant System to PROFIBUS-DP

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2.2 Peripheral Device Configuration



- * 1: Do not format ATA cards for using other than GX Developer.
 - CPU User's Manual (Hardware Design, Maintenance and Inspection)
- * 2: Refer to the following manual, for details on writing to memory card and USB cable.
 - GX Developer Version 8 Operating Manual
- * 3: Refer to Section 2.3, for versions of GX Developer, PX Developer and GX Simulator applicable to redundant CPU.

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2.3 Applicable Devices and Software

This section describes modules and software packages that can be used to configure a redundant system.

(1) List of system configuration devices

Item	Description		
Applicable main base unit	Main base unit	Q33B, Q35B, Q38B, Q312B	
	Redundant power main base unit	Q38RB	
	Redundant type extension base unit (first level)	Q65WRB	
Applicable extension base unit	Redundant power extension base unit (second	O68RB	
	level and later)		
Number of connectable extension base units	7 extension base units maximum		
Number of mountable modules	Main base unit	11 modules (11 slots) maximum	
	Extension base unit	53 modules (53 slots) maximum	
Extension cable	QC05B, QC06B, QC12B, QC30B, QC50B, QC100B		
Total length of extension cables	13.2m		
	SPAM cord	Q2MEM-1MBSN, Q2MEM-1MBS, Q2MEM-	
Applicable memory card		2MBSN, Q2MEM-2MBS, Q3MEM-4MBS ^{*1}	
	Flash card	Q2MEM-2MBF, Q2MEM-4MBF	
	ATA cord	Q2MEM-8MBA, Q2MEM-16MBA, Q2MEM-	
		32MBA	
Applicable battery	Q6BAT, Q7BATN, Q7BAT, Q8BAT		

Table2.1 List of System Configuration Devices

* 1: The CPU module whose serial number (first five digits) is "16021" or later supports this SRAM card.

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(2) Modules that can be used in the redundant system

Modules listed in Table2.2 are mountable to a main base unit where a redundant CPU is mounted. For any other module, mount it to a MELSECNET/H remote I/O station or an extension base unit. Note that, however, some modules cannot be mounted to MELSECNET/H remote I/O stations and extension base units.

([] (2)) in this section, (b), (c))

(a) Modules mountable to main base unit where redundant CPU is mounted Table2.2 lists the modules mountable to a main base unit where a redundant CPU is mounted.

Module Name	Model	Checking Method	
	• Q61P-A1		
	• Q61P-A2		
	• Q61P		
Devuer eventy medule *1	• Q61P-D		
Power supply module	• Q62P	-	
	• Q63P		
	• Q64P		
	• Q64PN		
	• Q63RP		
Redundant power supply module *2 *7	• Q64RPN	-	
	• Q64RP		
CC Link IE Controller Network module ^{*6} *8	• QJ71GP21-SX		
CC-LINK IE CONTIONEL METWORK MODULE	• QJ71GP21S-SX		
	• QJ71LP21-25		
	• QJ71LP21S-25		
MELSECNET/H module *6	• QJ71LP21G	Function version: D^{*5}	
	• QJ71LP21GE		
	• QJ71BR11		
	• QJ71E71-B2		
Ethernet module ^{*6 *7}	• QJ71E71-B5		
	• QJ71E71-100		
CC-Link master module *4 *6 *7	• QJ61BT11N	Serial No. (first 5 digits): "06052" or later ^{*5}	
MODBUS module *7 *9	• QJ71MB91	-	
MODBUS/TCP module *7 *9	• QJ71MT91	Function version: D ^{*5}	
PROFIBUS-DP master module	• QJ71PB92V	Function version: D ^{*5}	
Input module *7	• QX 🗌 🗌 *3	-	
Output module *7	• QY *3	-	
I/O combined module *7	• QH42 • QX48Y57	-	

Table2.2 Modules Mountable to Main Base Unit Where Redundant CPU is Mounted

* 1: Mountable only when the Q33B, Q35B, Q38B. or Q312B is used.

* 2: Mountable only when the Q38RB is used.

* 3: indicates the type of the input module or output module.

- * 4: The QJ61BT11 cannot be mounted on a main base unit where a redundant CPU is mounted.
- * 5: For checking of the serial No. and function version, refer to (3) in this section.
- * 6: For restrictions on the number of modules that can be mounted to a main base unit in a redundant system, refer to Section 2.4.
- * 7: Mountable to extension base units.
- * 8: Use the Redundant CPUs whose first five digits of serial number is "10042" or later in both systems.
- * 9: Only the slave function can be set.

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- (b) Modules that cannot be mounted to MELSECNET/H remote I/O stations Refer to the following manual for the modules that cannot be mounted to MELSECNET/H remote I/O stations.
 - CF Q Corresponding MELSECNET/H Network System Reference Manual (Remote I/O Network)
- (c) Modules that cannot be mounted to extension base units
 - The following modules cannot be mounted to extension base units.
 - CC-Link IE Controller Network module
 - MELSECNET/H module
 - Ethernet module (function version: B or earlier)
 - Web server module (first 5 digits of serial No.: "09011" or earlier.)
 - MES interface module (first 5 digits of serial No.: "09011" or earlier.)
 - Interrupt module
 - DeviceNet master module
 - DeviceNet slave module

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(3) Confirming the serial No. and function version of the CPU module

(a) On the rated plate

The serial No. and function version of the CPU module can be confirmed on the rated plate.



(b) 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 2.13 CPU module front display

(c) Confirming the serial No. on the system monitor (Product Information List) To display the System monitor window, 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.

							Serial number	Functio	on v
roduci	Informati	on List						5	ิ
			-						
Slot	Туре	Series	Model name	Points	I/O No.	Master PLC	Serial No	Ver.	
PLC	PLC	Q	Q25PRH	-	-	-	060510000000000	D	
0-0	-	-	(PLC)	-	-	-	-	-	
0-1	Intelli.	Q	QJ71LP21-25	32pt	0000	-	060510000000000	D	
0-2	-	-	None	-	-	_	-	-	

Diagram 2.14 System Monitor (Product Information List)

The serial No. displayed on the "Product Information List" window 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 and on the front of the module describes the management information of the product.
- The serial No. displayed on the "Product Information List" window of GX Developer describes the function information of the product. The function information of the product is updated when a function is added.

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(4) Available software packages

(a) Available GX Works2, GX Developer, and PX Developer versions

Table2.3 lists the versions of software packages supporting a redundant system.

Table2.3 Versions of available software packages

Product Name	Model	Version
GX Works?	SW1DND-GXW2-E,	Vor 1 87P or lator
GA WORSZ	SW1DNC-GXW2-E	
GX Developer	SW8D5C-GPPW-E	Ver.8.18U or later ^{*1 *3}
PX Developer	SW1D5C-FBDQ-E	Ver.1.05F or later ^{*2 *4}
GX Simulator	SW6D5C-LLT-E	Ver.6.20W or later

* 1: Use version 8.45X or later when using extension base unit.

* 2: Use version 1.14Q or later when using extension base unit.

* 3: Use version 8.68W or later when using CC-Link IE Controller Network module.

* 4: Use version 1.18U or later when using CC-Link IE Controller Network module.

(b) Available GX Configurator versions

Table2.4 lists GX Configurator versions supporting redundant system.

Table2.4 Available GX Configurator versions

Product Name	Model	Version
GX Configurator-CC	SW D5C-J61P-E	Ver.1.10L or later ^{*1}
GX Configurator-AD	SW D5C-QADU-E	Ver.1.15R or later
GX Configurator-DA	SW D5C-QDAU-E	Ver.1.15R or later
GX Configurator-SC	SW D5C-QSCU-E	Ver.1.14Q or later
GX Configurator-CT	SW D5C-QCTU-E	Ver.1.16S or later
GX Configurator-TC	SW D5C-QTCU-E	Ver.1.14Q or later
GX Configurator-TI	SW D5C-QTIU-E	Ver.1.14Q or later
GX Configurator-FL	SW D5C-QFLU-E	Ver.1.14Q or later
GX Configurator-PT	SW D5C-QPTU-E	Ver.1.14Q or later
GX Configurator-AS	SW D5C-QASU-E	Ver.1.16S or later
GX Configurator-QP	SW D5C-QD75P-E	Ver.2.14Q or later
GX Configurator-MB	SW D5C-QMBU	Ver.1.00A or later

* 1: Use version 1.16S or later when mounting CC-Link master module on extension base unit.

2.4 System Configuration Cautions

(1) Extension base unit

The extension base unit cannot be connected to the main base unit where the Redundant CPU whose first 5 digits of serial No. is "09011" or earlier is mounted. If connected, a stop error "BASE LAY ERROR (error code: 2010)" occurs.

When connecting the extension base unit, there are following restrictions.

- Use Redundant CPUs whose first 5 digits of serial No. are "09012" or later for both systems.
- Connect a redundant type extension base unit as the first extension stage. As the second and later stages, redundant power extension base units only can be used.
- Only one redundant type extension base unit can be used per system.
- Connect IN connector (IN1 and IN2) of the redundant type extension base unit to OUT connector of the main base unit.
- Connect OUT connector of the redundant type extension base unit to IN connector of the redundant power extension base unit.
- Use the same main base unit models in systems A and B.
- Configuration of multiple CPU system is not allowed.
- Do not power OFF or reset the control system in Separate mode.
- Do not perform boot operation of a Redundant CPU whose first 5 digits of serial No. is "09011" or earlier, using a memory card storing network parameters for Ethernet and CC-Link configurations on an extension base unit.
- Do not disconnect the extension cable while the power supply module mounted on the main base unit is ON.
- Any dedicated instructions cannot be used to intelligent function modules on extension base units. (S Section 7.1 (8))
- Any interrupt pointer caused by an interrupt from an intelligent function module on an extension base unit cannot be used. (S Section 7.5 (4))
- Connect extension cables so that an overall cable distance^{*1} does not exceed 13.2 m.
- * 1: To calculate an overall cable distance, use the longer length for the two extension cables connecting between the system A or B main base unit and the redundant type extension base unit



- To communicate via a module mounted on the extension base unit by using MC protocol, use QnA-compatible 2C/3C/4C frame, QnA-compatible 3E frame, or 4E frame for the access.
- MELSOFT products connectable to a module mounted on the extension base unit are GX Works2, GX Developer, and PX Developer. However, there are restrictions on applicable functions. For details, refer to the following manuals.
 - GX Works2 Version 1 Operating Manual (Common)
 - GX Developer Version 8 Operating Manual
 - PX Developer Version 1 Operating Manual (Programming Tool)

Only the control system can access modules on the extension base units. If accessing the standby system while the system monitor function of GX Developer is in execution, the extension base units and modules on them are not displayed.

Using GX Developer with specifying "Control system" at [Target system] in the [Transfer Setup] window is preferable.

(2) Modules that can be mounted on a main base unit

The I/O modules used independently by the network module and System A or System B CPU module can be mounted on the same main base unit as a redundant CPU is mounted.

I/O modules and intelligent function modules used to control a redundant system must be mounted on MELSECNET/H remote I/O station or extension base unit.

Remote I/O station, remote device station, and intelligent device station can be used by mounting CC-Link master module on a main base unit or extension base unit.

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(3) Modules where the number of mountable modules is restricted

The module where the number of mountable modules is restricted when the redundant CPU is used is listed in Table2.5.

Table2.5 Number of modules loaded

Applicable Module	Туре	Limitation on the nu modules pe	umber of mountable er system ^{*1}
CC-Link IE Controller Network module *2	• QJ71GP21-SX • QJ71GP21S-SX	Up to 2	
MELSECNET/H module *2	• QJ71LP21-25 • QJ71LP21S-25 • QJ71LP21G • QJ71LP21GE • QJ71BR11	Up to 4 in total of PLC to PLC network and remote I/O network modules	Up to 4 in total
Ethernet module	• QJ71E71-B2 • QJ71E71-B5 • QJ71E71-100	Up to 4	
CC-Link master module	• QJ61BT11N	Up to 8 *3	

* 1: The number of mountable modules per system indicates the number of modules that can be mounted on main base unit or extension base unit. Or, it indicates the number of modules that can be mounted on either one of the systems when they are mounted on main base unit.

* 2: CC-Link IE Controller Network module or MELSECNET/H module cannot be mounted to the extension base unit.

* 3: This applies to the following combinations only.

• Redundant CPU: The serial number (first five digits) of 09102 or later

• GX Works2 with the version of 1.87R or later or GX Developer with the version of 8.58L or later Up to four modules can be mounted per system for a combination other than those listed above.

If setting 5 or more at "No. of boards in module" in CC-Link network parameter of GX Developer version 8.55H or earlier, the following error dialog box appears.



In this case, set 4 or less at "No. of boards in module".

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(4) System A/System B configuration

Set up system A and system B so that they will be configured the same. If they are configured differently, a stop error will occur, and they will not start up as a system.

(In some cases, they may start up as a system, even when configured differently. Refer to Section 5.1.4 for details.)

(5) Number of Slots Occupied by a Redundant CPU

A redundant CPU occupies two slots.

Main base unit slot 0 is set as follows, type: redundant, points: 0 points.

The I/O number for slot 1, in which modules are mounted, is X/YO_{H} .



Diagram 2.15 Number of Slots Occupied by Redundant CPU and I/O Numbers of Main Base Units

(6) Restrictions on online module change (Hot Swapping)

The online module change (hot swapping) using GX Developer can be performed to the main base unit, extension base unit, and MELSECNET/H remote I/O station where the Redundant CPU is mounted.

The target modules of online module change are listed in Table2.6.

		Mounting position			
Module	Function version	Main base unit where Redundant CPU is mounted	Extension base unit	MELSECNET/H Remote I/O station	
Input module	_	○ ^{*1}	0	0	
Output module	-	○ ^{*1}	0	0	
I/O combined module	-	○ ^{*1}	0	0	
Analog input module	С	×	0	0	
Analog output module	С	×	0	0	
Temperature input module	С	×	0	0	
Temperature adjustment module	С	×	\bigcirc	\bigcirc	
Pulse input module	C	×	0	\bigcirc	

Table2.6 Target Modules of Online Module Change (Hot Swapping)

* 1: When the extension base unit is connected, online module change (hot swapping) cannot be performed to modules mounted on the main base unit.

- O:Online Module Change (Hot Swapping) Possible
- × :Online Module Change (Hot Swapping) not Possible (because cannot be mounted on a main base unit.)

Refer to the following manuals, for online module change (hot swapping) of input modules, output modules, and I/O combined modules.

(a) Main base unit where Redundant CPU is mounted

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

(b) Extension base unit

Corresponding MELSECNET/H Network System Reference Manual (Remote I/O network)

Refer to the manual of each module, for online module change (hot swapping) of analog input module, analog output module, temperature adjustment module, and pulse input module.

(7) Cables applicable to coaxial bus system of MELSECNET/H Remote I/O Network

In a coaxial bus system, use double shielded coaxial cables.

Refer to the following manual for the double shielded coaxial cables.

C Corresponding MELSECNET/H Network System Reference Manual (Remote I/O network)

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CHAPTER3 TRACKING CABLE

This chapter provides the tracking cable specifications and part names, and explains connecting/disconnecting the cable to/from the CPU module.

3.1 Specifications

The tracking cable specifications are listed in Table3.1.

Table3.1	Tracking	Cable	Specifications

Itom	Name			
item	QC10TR	QC30TR		
Cable Length	1.0 m	3.0 m		
Purpose	Connecting the CPU modules of a redundant system			
Mass	0.15 kg	0.28 kg		
Tightening Torque	29.4N•cm			

3.2 Part Names

Tracking cable part names are indicated here.



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3.3 Connecting and Disconnecting a Tracking Cable

(1) Cautions when Connecting a Tracking Cable

- Be careful not to step on the tracking cable.
- When laying tracking cables, secure a minimum bending radius of 27.6 mm or more.
- If the bending radius is less than 27.6 mm, a malfunction may occur due to characteristic deterioration, wire breakage, etc.



Diagram 3.1 Minimum Bending Radius of a Tracking Cable

- 1. Always power OFF the standby system or set the RESET/L.CLR switch of the standby system CPU module to RESET before connecting or disconnecting the tracking cable.
- 2. To connect or disconnect the tracking cable, hold it by the cable connector.

(2) Connecting a Tracking Cable

(a) Make sure that you are using the correct tracking cable connector for System A or System B.

Refer to Section 3.2 and Section 5.1.1, for confirming System A and System B.

(b) Hold the tracking cable connector, and align it with the CPU module TRACKING connector.



Diagram 3.2 Checking the Connection Orientation of the Tracking Connector

(c) Connect the tracking cable connector to the CPU module TRACKING connector.



Diagram 3.3 Connecting the Tracking cable Connector

(d) Tighten the connector fixing screws and fix the connector to the CPU module.



Diagram 3.4 Fixing the Tracking cable Connector

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- (3) Disconnecting a Tracking Cable
 - (a) Loosen the connector fixing screws.



Diagram 3.5 How to Loosen the Connector Fixing Screws

(b) When disconnecting the tracking cable, hold the tracking cable connector, and then remove it.



Diagram 3.6 Disconnecting the Tracking Cable
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(1) Procedure for starting up in the backup mode

The standard procedure for starting up system A as the control system and system B as the standby system of a redundant system in the backup mode is described below. Explanation of program and parameter creation is not provided here.



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Connecting to a Personal Computer in which GX Developer is Installed ...Refer to Section 4.6 Start up GX Developer in a personal computer. (1)(2) Connect the personal computer to the system A CPU module. Writing Parameters and Programs to the CPU Module ..Refer to Section 4.7 Write the parameters and programs created with GX Developer to the CPU modules of System A and System B. ...Refer to Restarting System A and System B^{*3} Section 4.8 (1) Power off system A and system B, or toggle RESET/L.CLR switch of CPU module. (2) Simultaneously power on system A and system B, or simultaneously set the RESET/L.CLR switches of both CPU modules to reset switch neutral position. Error Check ...Refer to Section 4.9 Check if the "ERR." LEDs of system A and system B CPU modules are OFF. If the "ERR." LEDs are ON/flashing, check the error cause using the System Monitor or diagnostics*4 of GX Developer, and eliminate it. ...Refer to Checking the Control System/Standby System Section 4.10 Check the control system/standby system by the "CONTROL" LED status of each CPU module. Running Standby System (System B) CPU Module ...Refer to Section 4.11 (1) Set the RUN/STOP switch of standby system CPU module (the "CONTROL" LED is OFF) to the RUN position, and confirm that the "RUN" LED of CPU module is OFF. (2) Confirm that the "ERR." LED of standby system CPU module is ON. Confirm that the error cause is "OPE.MODE DIFF. (error code: 6010)" *⁵ using the System Monitor or diagnostics^{*4} of GX Developer. If the error is caused by the parameter or programs related to other than "OPE.MODE DIFF.", correct the parameters or programs of system A and system B.

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When switching power on again, switch power on more than 5 seconds after switching power off. Failure to do so may disable a normal start of the redundant system because an inrush current of higher than the specified value may flow or the tracking communication circuit in the CPU module may not be initialized.

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(2) Procedure for starting up in the debug mode

The standard procedure for starting up either system in the debug mode is described below.

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Explanation of program and parameter creation is not provided here.



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Restarting System	Refer to
Power off the system and then power on again, or set the RESET/L.CLR switch of the CPU module to the RESET position and then set it to the reset switch neutral position.	Section 4.8
\downarrow	
Error Check	Refer to
Check if the "ERR." LED of the CPU module is OFF. If the "ERR" LED is ON/flashing, check the error cause using the System Monitor or diagnostics of GX Developer, and eliminate it.	Section 4.9
Ļ	

When switching power on again, switch power on more than five seconds after switching power off. Failure to do so may cause an inrush current of higher than the specified value to flow.



For details, refer to each network manual.

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4.1 Mounting Modules

(1) Procedure for Mounting Modules

Mount a module to the main base unit and the extension base unit in the following procedures.

- (a) Insert the module fixing latch, into the module fixing cutout firmly so that the module fixing latch may not come off the module fixing cutout.
- (b) Using the module fixing hole as a support, install the module onto the base unit by pushing it in the direction of arrow.



Diagram 4.3 Procedure for Mounting Modules

- (2) Handling Cautions
 - (a) Do not drop the module case or subject it to strong impact, as it is made of resin.
 - (b) The module can be fixed to the base unit easily by the upper hook. However, it is recommended that the module be fixed using the module fixing screw, if installed in a location exposed to strong vibration or impact. In such cases, tighten the module fixing screw within the following range. Module fixing screw (M3×12 screw): Tightening torque range: 36-48 N•cm

4 - 6 *4.1 Mounting Modules*

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4.2 Wiring

Line A Line B

This section explains wiring to the power supply module necessary for starting up a redundant system, connection of the Q6BAT battery connectors, tracking cable connection.

Install the wiring to a network module by referring to the corresponding manual, as the wiring method differs according to model.

Install the wiring to an I/O module by referring to the following manual, as the wiring method differs according to the model.

I/O Module Type Building Block User's Manual

(1) Wiring to a Power Supply Module

Connect a power cable and ground cable to the power supply module on a main base unit by referring to the wiring example shown in Diagram 4.5.





Diagram 4.4 Example of Wiring to a Power Supply Module

* 1: Operation of an ERR terminal is as follows:

<When mounting power supply module to main base unit>

The ERR terminal is OFF (open) when AC power is not turned ON, when the CPU module stop error (including an error at the time of reset) occurs, or when fuse of the power supply module is blown

<When mounting redundant power supply module to redundant type extension base unit> The ERR terminal is OFF (open) when AC power is not turned ON, when fuse of the redundant power supply module is blown, or when the redundant power supply module breaks down.

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* 1: Operation of an ERR terminal is as follows:

<When mounting power supply module to main base unit>

The ERR terminal is OFF (open) when AC power is not turned ON, when the CPU module stop error (including an error at the time of reset) occurs, or when fuse of the power supply module is blown.

<When mounting redundant power supply module to redundant type extension base unit> The ERR terminal is OFF (open) when AC power is not turned ON, when fuse of the redundant power supply module is blown, or when the redundant power supply module breaks down.

1. Use the thickest possible (max. 2 mm² (14 AWG) wires for the 100/200VAC and 24VDC power cables. Be sure to twist these wires starting at the connection terminals.

For wiring a terminal block, be sure to use a solderless terminal.

To prevent short-circuit due to loosening screws, use the solderless terminals with insulation sleeves of 0.8 mm or less.

Also, only two solderless terminals can be connected per terminal block.



- 2. Supply power to two redundant power supply modules individually (redundant power supply module).
- 3. When two redundant power supply modules (Q64RPN, Q64RP) are placed together and operated as a redundant power supply system, it is recommended to use one of them as an AC power input and connect the other to an uninterruptible power supply.
- When LG and FG terminals are connected, ground the wires.
 If not, the programmable controller may become susceptible to noise.
 The potential of the LG terminal is a half of the input voltage.
- 5. When the redundant power main base unit is used in the system, and the redundant power modules mounted on the redundant power main base unit and redundant power extension base unit are powered on simultaneously, on-timing (short circuit) of the ERR terminals differs between the modules. (The ERR terminal on-timing of the CPU module on the redundant power main base unit delays by the time required for the initial processing.)

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(2) Connecting the Q6BAT Battery Connectors

The CPU module Q6BAT batteries are shipped with the battery connectors disconnected.

Connect the battery connectors according to the following procedure prior to use.

(a) Confirming Battery Installation Status

Open the CPU module bottom cover, and confirm that the battery is installed properly.

(b) Connecting the Battery Connectors

Align the connector mounted in the case with battery connector pin and insert it.



Diagram 4.6 Connecting the Case Connector and Battery Connector Pin



Refer to the following manual, for installation of Q7BATN, Q7BAT, and SRAM card batteries applicable to CPU modules.

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

(3) Connecting a Tracking Cable

Connect a tracking cable to CPU module tracking connectors according to the following procedure.

- (a) Confirming System A/System B Connectors Confirm each connector of system A/system B.
- (b) Connecting a Tracking Cable Connector Align the tracking cable connector with the CPU module TRACKING connector, and then connect them.

For details, refer to Section 3.3.

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(4) Connecting extension cables

When using the redundant type extension base unit, connect extension cables by the following procedures.

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Diagram 4.7 Connection method for extension cables when using the redundant type extension base unit

(a) Connecting the main base unit to the redundant type extension base unit

- System A extension cable → Connect to IN connector (IN1) on the redundant type extension base unit.
- System B extension cable → Connect to IN connector (IN2) on the redundant type extension base unit.
- (b) Connecting the redundant type extension base unit to the redundant power extension base unit

Connect extension cable from OUT connector on the redundant type extension base unit to IN connector on the redundant power extension base unit.



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4.3 Module Initial Settings

Make the switch settings for the CPU module and network module. Refer to the manual for the network module used, as the settings vary according to the model.

(1) CPU Module RUN/STOP Switch Settings

Set the RUN/STOP switch of CPU module to the STOP position.

(2) CPU Module RESET/L.CLR Switch Settings

Set the RESET/L.CLR switch of CPU module to the reset switch neutral position.



Diagram 4.8 CPU Module Switch Positions and Settings

* 1: Make sure to operate the RUN/STOP switch and the RESET/L.CLR switch by hand to make the settings

If these switches are operated by the screw driver or other tool, this can result in damage.

4.4 Confirming that the Power Supply is ON

(1) Powering on the system

Check the power line and power supply voltage of the power supplies of the power supply modules of the main base units and extension base units in systems A and B, and turn ON power supplies simultaneously.

(2) Confirming the Power Supply Module "POWER" LED

After turning ON power supplies of the power supply modules of the main base units and extension base units in systems A and B, check that "POWER" LED is turned ON (green).*1



Diagram 4.9 Confirm that the "POWER" LED of power supply module is ON

* 1: The LED turns on on either system in the debug mode.

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4.5 Confirming System A/System B

Identify system A and system B by checking the "System A" and "System B" LEDs of CPU modules.

Table4.1 Identify system A and system B by checking the "SYSTEM A" and "SYSTEM B" LEDs

CPU Module LEDs	System	A and System	B LEDs
Q12PRHCPU MODE BACKUP CONTROL ERR SYSTEM A USER BAT BOOT	LED Name SYSTEM A SYSTEM B	System A ON OFF	System B OFF ON

Refer to the following manual, for details on the CPU module LED.

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

4.6 Starting up/Connecting GX Developer

(1) Starting up GX Developer

Power on the personal computer and start up GX Developer.

(2) Connecting GX Developer

Connect the computer in which GX Developer has been installed and the System A CPU module with a cable.

Refer to the following manual for applicable cables.

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



(GX Developer)

Diagram 4.10 Connecting GX Developer and System A CPU Module

4.7 Writing Parameters and Programs to CPU

Write parameters and programs to the CPU modules (one CPU module in the debug mode) of System A and System B according to the following procedures.

(1) Display of Write to PLC Window

Select [Online] to [Write to PLC] from the menu bar to display the "Write to PLC" window.



Diagram 4.11 Write to PLC Window

(2) Selection of Write Data

Click the "Parameters and Programs" button, and select parameters and programs as Write Data.

(3) Execution of Write to PLC

Click the "Execute" button.

As the following confirmation dialog box appears, click "Yes".

MELSOF	T series GX Developer	
⚠	Do you want to execute writing to both s	ystems?
	Yes No	
	E. J.	

Diagram 4.12 Execution of Write to PLC Confirmation Window

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4.8 Restarting System A and System B

Power on system A and system B again, or set the reset switches of system A/system B CPU modules to neutral position, in order to restart the redundant system.

(1) Powering supply ON again

Power off system A and system B, and then simultaneously power on the both systems. $^{\ast 1}$

(2) Setting the Reset Switches of CPU modules to Neutral Position

Set the RESET/L.CLR switches of system A and system B CPU modules to the RESET position, and then simultaneously set the switches to neutral position. $*2 *^3$



Diagram 4.13 Setting the CPU Module RESET Switch to Neutral Position

- * 1: Power on one system within three seconds after powering on the other system.
- * 2: Set the reset switch of one CPU module to neutral position within three seconds after making the same settings for the other CPU module.
- * 3: The LED turns on on either system in the debug mode.

When switching power on again, switch power on more than 5 seconds after switching power off. Failure to do so may disable a normal start of the redundant system because an inrush current of higher than the specified value may flow or the tracking communication circuit in the CPU module may not be initialized.

4.9 Error Check

Table4.2 Checking the "ERR." LED to Check for Errors CPU Module LED LED (common to System A and System B) Error^{*1} LED Name Normal Q12PRHCPU BACKUP MODE RUN ERR. OFF ON/Flashing ERR. USER BAT. BOOT

Confirm that no error has occurred in the CPU module by checking the "ERR." LED.

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* 1: If any error has occurred in the CPU module, check the details by using the PLC diagnostics of GX Developer.

Refer to the following manual, for details on CPU module LEDs.

CF QCPU User's Manual (Hardware Design, Maintenance and Inspection)

4.10 Confirming the Control System/Standby System

Identify the control system/standby system by checking the "CONTROL" LEDs.

Table4.3 Checking the "CONTROL" LED to Identify Control System and Standby System

CPU Module LED	LED (common to System A/System B, i.e., Contro System/Standby System)		em B, i.e., Control stem)
Q12PRHCPU MODE RUN ERR. USER BAT. BOOT	LED Name CONTROL	Control System (System A) ON	Standby System (System B) OFF

4.11 Running CPU Modules

Set the RUN/STOP switch to the RUN position in this order: standby system (System B) CPU module \rightarrow control system (System A) CPU module.



Diagram 4.14 CPU Module RUN/STOP Switch Position and Setting

CHAPTER5 REDUNDANT SYSTEM FUNCTIONS

This chapter explains the redundant system functions.

5.1 Basic Concept of Redundant System

A redundant system consists of two basic systems, each of which includes a power supply module, CPU module, main base unit and network module.

To configure a redundant system, connect the basic systems on which above modules are mounted with a tracking cable.

(Please refer to Section 2.1 for system configuration.)



Diagram 5.1 Redundant System Configuration

(1) Determination of System A and System B

In a redundant system, one basic system is called "System A", and the other, "System B", to identify each of the two systems connected with a tracking cable. Please refer to Section 5.1.1 for determination of system A and system B.

(2) Control System and Standby System

In a redundant system, the CPU module of either system performs operations and controls the redundant system.

The other system, which is for backup, does not perform operations.

The controlling system is referred to as "Control system", and the backup system, "Standby system".

Please refer to Section 5.1.2 for details on the control system and standby system.

(3) Switching Between the Control System and Standby System

If a fault occurs in the control system, the backup system takes over the system control and continues the operation.

Please refer to Section 5.3 for switching between the control system and standby system.

(4) Consistency Check between Control System and Standby System

A redundant system conducts "Consistency check between Systems A and B" to check if the control system and standby system are consistent so that control continues without the system going down when system switching occurs. Refer to Section 5.1.4, for consistency check between systems A and B.

(5) Operation Mode

The redundant system operates in the following three modes.

(a) Backup mode

The backup mode is for normal operation of redundant system. If a fault or failure occurs in the control system, the standby system takes over the control and continues the system control.

(b) Separate mode

The separate mode is for maintenance without stopping control. In the separate mode, different programs can be run in the control system and standby system CPU modules. While continuing the system control in the control system, program of standby system can be corrected and operation of program can be checked by using the data tracked from the control system. However, in the separate mode, system switching is not executed even if a fault or failure occurs in the control system. (System switching can be manually carried out.)

(c) Debug mode

The debug mode is for debugging with a system configuration of only either system prior to the system operation. In a redundant system, two Redundant CPUs are normally required; however, debugging can be executed with only one CPU.

In the debug mode, the CPU module uses the parameters for system A to operate. Therefore, the station set as system B in the network parameters becomes absent station (disconnected station).

Check the system switching operation in the backup mode prior to the system operation because the system switching cannot be checked in the debug mode. On the programming at system switching, refer to CHAPTER 7 "PROGRAMMING CAUTIONS".

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5.1.1 Determination of System A/System B

In a redundant system, one of the systems connected with a tracking cable is referred to as "System A", and the other, "System B".

System A and System B are determined by the direction of the tracking cable, i.e., connectors.

(1) Determination of System A/System B

The system that includes the CPU module connected with the tracking cable system A connector will be "System A" and the other one with the system B connector will be "System B".

(a) When the System A connector is connected to the left system

When the system A connector is connected to the CPU module of the left system, system A/B will be determined as shown in Diagram 5.2.



Diagram 5.2 System A and System B when System A Connector Is Connected to Left System

(b) When the System A connector is connected to the right system

When the system A connector is connected to the CPU module of the right system, system A/B will be determined as shown in Diagram 5.3.



Diagram 5.3 System A and System B when System A Connector Is Connected to Right System

Refer to CHAPTER 3, for tracking cable specifications and connection.

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(2) Confirming system A/System B *1

Identify system A and system B by checking the "SYSTEM A" and "SYSTEM B" LEDs of CPU modules.

Table5.1 Identify system A and system B by checking the "SYSTEM A" and "SYSTEM B" LEDs

CPU Module LED	LED Statuses	
Q12PRHCPU MODE BACKUP RUN CONTROL ERR. SYSTEM A USER SYSTEM B BAT. BOOT	LED NameSystem ASystem BSYSTEM AONOFFSYSTEM BOFFON	

Refer to the following manual, for details on the CPU module LED.

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

* 1: System A and System B can be identified by checking whether the special relays "System A discriminating flag (SM1511)" and "System B discriminating flag (SM1512)" are ON or OFF.

Table5.2 Confirming SM1511 and SM1512 to Identify System A and System B

	SM1511	SM1512
System A	ON	OFF
System B	OFF	ON

(3) Precautions

When using the redundant system in the backup mode, connect the tracking cable to the control system and the standby system CPU modules.

If both systems are powered on without the tracking cable connected to the CPU models, the "TRK.CABLE ERR. (error code: 6120)" stop error will occur and the system cannot run.

If "TRK. CABLE ERR." occurs at power-on, power off System A and System B, then connect the tracking cable to the CPU modules, and power the systems on again.

When starting up a single basic system, use the debug mode. Refer to Section 5.1.3, for the debug mode.

5.1.2 Determination of Control System and Standby System

In a redundant system, either system CPU module runs the programs, controls the system and communicates with the network.

The system that includes the CPU module running the programs is referred to as the "Control system".

The other system serves as a backup for continuing the system operation in the case the module on the control system fails or develops an error.

This backup system is referred to as the "standby system".

The standby system CPU module does not run the programs. (The same status as the STOP status.)

The control system and standby system are determined by which system starts up first, or which RESET/L.CLR switch of the CPU module is set to the neutral position first.

(1) When One of the Systems Starts Up Before the Other One *1 *2

If either system A or system B starts up before the other one, the system that starts up first will be the "Control system", and the other one will be the "Standby system". ^{*3} When both CPU modules of the system A and system B are reset, the system with the CPU module of which RESET/L.CLR switch is set to the neutral position first will be the "Control system", and the other one will be the "Standby system". ^{*3}

(a) When system A starts up first



Diagram 5.4 Control System and Standby System when System A Starts Up First

- * 1: Refer to Section 5.1.1 for determination of system A and system B.
- * 2: Indicates the case where one system starts up within 3 seconds after the other system.
- * 3: If the second system does not start up within 3 seconds of the first one, the "STANDBY SYS.DOWN(error code: 6300)" continuation error will occur in the control system CPU module. By disabling "Check standby system malfunction," at the standby System Monitor settings in the redundant parameter operation mode settings with GX Developer, the control system will not detect the "STANDBY SYS. DOWN" continuation error.

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(b) When system B starts up first



Diagram 5.5 Control System and Standby System when System B Starts Up First

(2) When System A and System B Start Up Simultaneously *⁴ *⁵

If system A and system B start up simultaneously, system A will be the "Control system", and system B will be the "Standby system".

If the system A and system B CPU modules are reset (RESET/L.CLR switch is set to the RESET position) and unreset (RESET/L.CLR switch is set to the neutral position) simultaneously, system A will be the "Control system", and system B will be the "Standby system".



Power on both systems simultaneously.

Diagram 5.6 Control System and Standby System when System A and System B Start Up Simultaneously

- * 4: Refer to Section 5.1.1 for determination of system A and system B.
- * 5: This indicates the following cases:
 - •One system starts up and the other starts up within 3 seconds.
 - •When one CPU module is unreset (RESET/L.CLR switch is set to the neutral position) within 3 seconds of the other.

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(3) When Only One System Starts Up

Whichever system that starts up first will be the "Control system".^{*6} Also, if the control system is already on, the other system will be the "Standby" system when it starts up.



Diagram 5.7 Control System when Only One System Starts Up

* 6: The "STANDBY SYS. DOWN (error code: 6300) continuation error will occur in the control system CPU module.

By disabling "Check standby system malfunction," at the standby System Monitor settings in the redundant parameter operation mode settings with GX Developer, the control system will not detect the "STANDBY SYS. DOWN" continuation error.

(4) Confirming the Control System/Standby System^{*7}

Identify the control system and standby system by checking the "CONTROL" LEDs. of CPU modules.

Table5.3 Confirming the control system and	standby system by checking the "	'CONTROL" LEDs
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CPU module LED		LED status		
Q12PRHCPU MODE RUN ERR. USER BAT. BOOT	LED Name CONTROL	Control System ON	Standby System OFF]

Refer to the following manual, for details on the CPU module LED :

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

* 7: The control system and standby system can be identified by checking the status in the special relay "Control system judgement flag" (SM1515) and "Standby system judgement flag" (SM1516).

Table5.4 Confirming SM1515 and SM1516 to Identify Control system and Standby system

	SM1515	SM1516
Control system	ON	OFF
Standby system	OFF	ON

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(5) Precautions

When using the redundant system in the backup mode, connect the tracking cable to the control system and the standby system CPU modules.

If both systems are powered on without the tracking cable connected to the CPU models, the "TRK.CABLE ERR. (error code: 6120)" stop error will occur and the system cannot run.

If "TRK. CABLE ERR." occurs at power-on, power off System A and System B, then connect the tracking cable to the CPU modules, and power the systems on again.

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5.1.3 Operation Mode

The operation mode determines the redundant system operation methods. Following three operation modes are available.

- Backup Mode
- Separate Mode
- Debug mode

Use GX Developer to switch between the backup mode and separate mode. Refer to Section 5.3 for switching between the backup mode and separate mode. Switch the operation mode to the debug mode in the redundant parameter settings.

(1) Backup Mode

The backup mode is for normal operation of redundant system.

If a fault or failure occurs in the control system, the standby system takes over the control and continues the system operation.

To enable the standby system to continue the system operation when the control system goes down, the data of the control system must be continuously transferred to the standby system through the tracking cable.

Refer to Section 5.5, for details on the tracking function.



Diagram 5.8 System Switching Operation in Backup Mode

(a) Confirming Backup Mode

Confirm that the redundant system is running in the backup mode by checking the "BACKUP" LEDs of CPU modules.

Table5.5 Checking the	"BACKUP"	LED to	Confirm	the Backup Mode

CPU Module LED		LED status	
Q12PRHCPU MODE BACKUP CONTROL ERR. CONTROL USER SYSTEM A BAT. BOOT	LED Name BACKUP	Control System ON (green)	Standby System ON (green)

Refer to the following manual, for details on the CPU module LED:

CF QCPU User's Manual (Hardware Design, Maintenance and Inspection)

(b) Precautions

- When the system A and system B CPU modules are reset simultaneously (RESET/L.CLR switch is set to the RESET position), or unreset (RESET/ L.CLR switch is set to the neutral position) simultaneously, the operation mode will automatically change to the backup mode. (This applies to only when the debug mode has not been specified in the redundant parameter settings.) If the above operation is performed when the operation mode has been set to the separate mode with GX Developer while the system is running, this also will change the operation mode to the backup mode.
- 2) In the backup mode, make system A and system B parameters and programs consistent.

If inconsistent, the "FILE DIFF. (error code: 6000)" stop error will be detected by the consistency check between systems A and B.

Refer to Section 5.1.4, for consistency check between systems A and B.



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(2) Separate Mode

The separate mode is for maintenance without stopping control. In the separate mode, different programs can be run in the control system and standby system CPU modules. While continuing the system control in the control system, program of standby system can be corrected and operation of program can be checked by using the data tracked from the control system.

(a) Enabling/Disabling the Tracking Function

In the separate mode, it is possible to select whether the tracking function is enabled or not, in order to perform the tracking. Refer to Section 5.5 for the tracking function.

(b) Confirming the Separate Mode

Confirm that the redundant system is running in the backup mode by checking the "BACKUP" LEDs of CPU modules.

CPU Module LED	LED Status
Q12PRHCPU MODE BACKUP CONTROL RUN SYSTEMA USER SYSTEMA BAT. BOOT	LED NameControlStandbySystemSystemSystemBACKUPONON(amber)(amber)

Table5.6 Checking the "BACKUP" LED to Confirm the Separate Mode

Refer to the following manual, for details on the CPU module LED:

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

(c) Precautions

- When the operation mode is changed with GX Developer while the redundant system is running, the operation mode will automatically change to the separate mode. (Refer to Section 5.4, for details on changing Operating Mode.)
- If either system is powered on again or either CPU module is unreset (RESET/ L.CLR switch is set to the neutral position) in the separate mode, system switching will not occur.
 - If the control system is powered on again or unreset (RESET/L.CLR switch is set to the neutral position), it will start up as the control system, again.
 - If the standby system is powered on again or unreset (RESET/L.CLR switch is set to the neutral position), it will start up as the standby system, again.

System switching will not occur even when the control system is powered on again or unreset (RESET/L.CLR switch is set to the neutral position). However, system switching can be manually carried out. Refer to Section 5.3, for details on system switching.

- Do not turn OFF the power supply of the control system or perform reset operation in the separate mode when the extension base unit is connected. (If doing so, turn ON both systems simultaneously or cancel the reset.)
- Internal device tracking can be done in the separate mode. Internal devices are tracked even when the operation mode is changed from the backup mode to separate mode.

To interrupt internal device tracking, turn the tracking trigger off. (537) Section 5.5.5)

- 1. When the system A and system B are powered on simultaneously or unreset (RESET/L.CLR switch is set to the neutral position) simultaneously, the operation mode will change to the backup mode.
- Make sure the tracking cable is connected to the system A and system B CPU modules before powering on the either system again in the separate mode. Failure to do so may cause the "TRK. CABLE ERR (error code: 6120)" stop error in the CPU module of that system.

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(3) Debug Mode^{*1}

The debug mode is for debugging with a system configuration of only either system prior to the system operation. In a redundant system, two Redundant CPUs are normally required; however, debugging can be executed with only one CPU. (An error will not occur even if the tracking cable is not connected.)

In the debug mode, the CPU module is fixed to "system A" and "control system", and uses the parameters for system A to operate.

Therefore, the station set as system B in the network parameters becomes absent station (disconnected station).

Confirm that the redundant system is running in the debug mode by checking the relevant LEDs of the CPU module.

CPU module LED	LED Status		
Q12PRHCPU MODE BACKUP CONTROL ERR SYSTEMA BAT. BOOT	LED NameLED StatusBACKUPOFFCONTROLONSYSTEM AONSYSTEM BOFF		

Table5.7 Checking the "BACKUP" LED to Confirm the Debug Mode

Refer to the following manual, for details on the CPU module LED:

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

 * 1 : When CC-Link IE Controller Network modules are mounted, do not connect the CC-Link IE Controller Network module on both systems to the network at the same time.
 In the debug mode, the system B CPU module uses the same parameters for the system A CPU module for operation. Therefore, control station overlap and station number overlap occur when connecting to the network at the same time.

(a) Setting and Canceling the Debug Mode

The debug mode must be specified in the redundant parameter settings with GX Developer to operate the system in the debug mode.

 Write the redundant parameter in which "Start with Debug mode" is set into the CPU module, and power on the system again or set the RESET/L.CLR switch of the CPU module to reset switch neutral position. Then, the system will start up in the debug mode.



Diagram 5.9 Setting of Debug Mode on Redundant Parameter Window

2) Write the redundant parameter in which "Do not start with Debug mode" is set into the CPU module, and power on the system again or set the RESET/L.CLR switch of the CPU module to reset switch neutral position. Then, the system will start up in the operation mode other than debug mode.



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(b) Precautions

- 1) The following redundant system functions cannot be executed in the debug mode, as the systems do not operate as a redundant system even when they are connected with the tracking cable.
 - · System switching (including manual system switching)
 - Memory copy from control system to standby system.
 - Tracking
- The debug mode cannot be changed to the backup mode or separate mode with GX Developer, as it is set by the redundant parameter. Cancel the debug mode if the dialog box (Diagram 5.10) appears on GX Developer:

MELSOF	T series GX Developer 🛛 🕅
(j)	Cannot execute this function when the PLC status is debug mode.
	OK]

Diagram 5.10 Error Dialog Box Displayed on GX Developer

Change the redundant parameter to cancel the debug mode.

3) When mounting the MELSECNET/H remote master station on the main base unit, set the station No. to 0 (master station).

If the station No. is set to a value other than 0, the "LINK PARA. ERROR (error code: 3101)" stop error will occur.

4) When the CPU modules connected with the tracking cable are running in the different modes (backup mode/separate mode and debug mode), each of them operate as listed in Table5.8.

Table5.8 Operation of CPU Module Connected to CPU Module Running in Debug Mode by Tracking Cable

OPERATION MODE	CPU MODULE OPERATIONS					
BACKUP MODE	CONTROL	The CPU module develops the "STANDBY SYS. DOWN				
	SYSTEM	(error code: 6300)" stop error.				
	STANDBY	The CPU module develops the "CONTROL SYS. DOWN				
	SYSTEM	(error code: 6310)" stop error.				
SEPARATE MODE	CONTROL	The CPU module ignores the CPU module in the debug				
	SYSTEM	medo				
	STANDBY	(Daga net dataet env errer.)				
	SYSTEM	(Does not detect any enot.)				

Cancel the debug mode in the redundant parameter when using the redundancy system in the backup mode.

5) In the debug mode, the CPU module uses the parameters for system A to operate. Therefore, the station set as system B in the network parameters becomes absent station (disconnected station). Check the system switching operation in the backup mode prior to the system operation because the system switching cannot be checked in the debug mode. On the programming at system switching, refer to CHAPTER 7 "PROGRAMMING CAUTIONS".

5.1.4 System Consistency Check

In order to continue the redundant system control after system switching, the system configurations, parameters and programs of the control system and standby system must be consistent.

In the backup mode, the standby system CPU module checks if the system configurations, parameters and programs of both systems are consistent. The redundant system operates as listed below according to the check results.^{*1}

If the control system and standby system are consistent in the system configuration, parameters and programs, the redundant system operates normally.

- If the control system and standby system are inconsistent in the system configuration, parameters and programs, an error will occur in the standby system CPU module.
 - * 1: This check is referred to as "Consistency Check Between Systems A and B".

The consistency check is executed in the following cases:

- · When both systems are powered on simultaneously
- When both system CPU modules are unreset (RESET/L.CLR switch is set to the neutral position) simultaneously.
- During END processing by the control system CPU module
- When the tracking cable is reconnected

Table5.9 lists consistency check points, and Table5.10 lists execution conditions.



Diagram 5.11 Consistency Check Points Between Systems A and B

Table5.9 Consistency Check Points Between Systems A and B

	Check Points	Description
(1) File Contents	Parameters, programs, and initial device values are checked. The memory	
	File Contents	capacity of the area for online change of multiple blocks is also checked.
(2)	Operating Status	The operating status (RUN/STOP/PAUSE) of each CPU module is checked.
(3) Basic System Configuration	The mounting status of each CPU module, I/O module, and network module	
	mounted on the main base units is checked.	
(4) Memory Card Setting	The status of each memory card inserted (SRAM, Flash, or ATA cards) is	
	Memory Card Setting	checked.
(5)	Parameter Valid Drive Settings	The parameter-valid drive settings (dip switches SW2 and SW3) are checked.

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Conditions *1			Description					
Execution Timing	Operation Mode	Standby System Operating Status	Control System Operating Status	File	Operating Status	Basic System Configuration	Memory Card Settings	Parameter Valid Drive Settings
Execution Timing	Operation Mode	Standby System Operating Status	Control System Operating Status	File	Operating Status	Basic System Configuration	Memory Card Settings	Parameter Valid Drive Settings
Both systems powered on simultaneously	Backup Mode	_	-	0	0	0	0	0
Both systems Unreset ^{*3} simultaneously	Backup Mode	-	-	0	0	0	0	0
			RUN	⊖ * ¹	0	-	-	-
	Backup Mode	RUN	STOP PAUSE	-	0	-	-	-
			STOP→RUN	0	0	-	-	-
END processing		STOP PAUSE	RUN STOP PAUSE	-	0	-	-	-
			STOP→RUN	-	0	-	-	-
		STOP→ RUN	RUN	0	0	-	-	_
			STOP PAUSE	Ι	0	_	-	-
		Power ON Unreset ^{*3}	RUN	0	0	0	-	0
			STOP PAUSE	-	0	0	-	0
	Changing from Separate Mode to Backup Mode	RUN	RUN	0	0	0	-	0
		STOP→ RUN Power ON Unreset ^{*3}	STOP PAUSE	-	0	0	_	0
Tracking cable reconnected Ba		RUN	RUN	0	0	0	-	0
	Backup Mode	STOP PAUSE	RUN STOP PAUSE	_	0	0	_	0

Table5.10 Consistency Check Execution Conditions between System A and System B

○ Consistency Check Target, – Out of Consistency Check Target

. . . .

. . . .

* 1 The consistency check is executed only in the following cases:

 After online program change is completed (the consistency check is executed only for the program files.)

•At system switching

(The consistency check is executed under the above conditions only.)

* 2 The consistency check is not executed under any other conditions not listed in the table.

* 3 "Unreset" indicates that the RESET/L.CLR switch is set to the neutral position.

Remark •

The consistency check will not be executed during the following:

Memory copy from control system to standby system

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(1) File Consistency Check

(a) Check points

The file consistency check means checking the following files at system switching as listed in Table5.11.

Table5.11 Target Files and Check Contents

Target Files	Details	
	Checks the parameters stored in the drive set as parameter valid drive	
Deremetere	(PLC parameters, redundant parameters, network parameters) and	
Parameters	the intelligent function module parameters set with GX Configurator.	
	Checks the remote password stored in the program memory.	
Programs	• Checks the program file set in the PLC parameters program settings.	
	 The password set in the password registration is irrelevant. 	
	Checks the initial device value file set in the PLC parameter PLC file	
Initial Device Values	settings.	
	 The password set in the password registration is irrelevant. 	
Area for Online Change of	Checks the memory capacity of the area for online change of multiple	
Multiple-Block Write	blocks set during formatting. ^{*1}	

- * 1 If the memory capacities of the area for online change of multiple blocks are different in both systems, carry out the following operations:
 - •Using memory copy from control system to standby system function, copy the program memory contents of the control system to the standby system.
 - •Format program memories of both system CPU modules. (The memory capacities of the area for online change of multiple blocks will be the same.)

(b) Inconsistency Errors

Table5.12 lists the file inconsistency errors occurred when the target files are inconsistent.

Table5.12 File	Inconsistency	Errors
----------------	---------------	--------

Execution Conditions	Error Description
 When both systems are powered ON simultaneously. When both system CPU modules are unreset (RESET/L.CLR switch is set to the neutral position) simultaneously. When one system starts up after the other. When the separate mode is changed to the backup mode 	The following stop error will occur in the standby system CPU module only: "FILE DIFF. (error code: 6000)". ^{*2}

If the "FILE DIFF." occurs in the standby system, execute the PLC verify by either of the methods described below to confirm the differences between the files of both system, correct the problem file, and perform write to PLC again.

- · After reading the system A programs and parameters using GX Developer or PX Developer, compare them with the System B programs and parameters.
- · Verify the GX Developer and PX Developer programs and parameters saved in the offline environment with the those written to both system CPU modules.
- * 2 If a stop error occurs in the standby CPU module, the "STANDBY SYS. DOWN (error code: 6300)" continuation error will occur in the control system CPU module.

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(2) Operating Status Consistency Check

(a) Check points

The operating status consistency check means checking the CPU module operating status (RUN / STOP / PAUSE).



Diagram 5.12 Operating Status Consistency Check

(b) Inconsistency Errors

Table5.13 lists inconsistency errors that occur when the operating statuses are inconsistent.

Table5.13 Inconsistency Errors

Execution Conditions	Error Description
 When both systems are powered ON simultaneously. When both system CPU modules are unreset (RESET/L.CLR switch is set to the neutral position) simultaneously. 	The following stop error will occur in the control system and standby system CPU modules: "OPE.MODE DIFF. (error code: 6020)".
 When one system starts up after the other. 	
During normal operation.	The following continuation error will occur in
• When the separate mode is changed to the backup mode.	the standby system CPU module only: "OPE.MODE DIFF. (error code: 6010)".
 When reconnecting the tracking cable. 	

If the "OPE.MODE DIFF." error occurs in the control and standby systems, or in the standby system only, check and correct the following so that they will be consistent in both systems.

- CPU module RUN/STOP switch position
- GX Developer remote operation
- Remote contact ON/OFF status
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(c) Operating Status Consistency Check Settings

- In order that no error will be detected when the operating status is changed during normal operation, uncheck "Check operating status consistency" at backup mode settings in the redundant parameter settings. Then, write the parameter to the CPU module, reset it, and the parameter setting will take effect.
- 2) When "Check operating status consistency" is unchecked, the CPU module will not detect an error even when writing the parameters with GX Developer to change the CPU operating status.
- 3) When powering on both systems simultaneously, even if the backup mode redundant parameters are set not to check the "Check operating status consistency" has been unchecked at the backup mode settings of operation mode settings in the redundant parameter settings, it will execute a consistency check.

Tracking settings
· Indoking sokings
ing
Initial start mode
e Hot-start mode during system switching.
n watch setting
e error in Standby system
etting
art with Debug mode
Debug mode
setting
arriting status consistency.
eraung status consistency
Default Check End Cancel
e n n s it

Diagram 5.13 Operation setting Window

(3) Basic System Configuration Consistency Check

(a) Check points

The following items are checked in the basic system configuration consistency check.

(If the number of slots of the main base unit has been set in the PLC parameter I/ O assignment, only the specified number of slots will be checked.)

- CPU module model
- · Model and type of modules mounted on each slot in the main base unit
- Network module mode settings



Diagram 5.14 Basic system Configuration Consistency Check

On the other hand, the following items are not checked.

- Model of battery set in the CPU module
- · Main base unit model and number of available slots
- · Serial Nos. of modules mounted in the main base unit
- Number of power supply modules mounted in the main base unit
- · Model of power supply modules mounted in the main base unit
- · Slots set to "Open" in the PLC parameter I/O assignment
- Modules being replaced online
- Modules mounted on slots after the number of those in the PLC parameter I/O assignment

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(b) Inconsistency Errors

Table5.14 lists inconsistency errors that occur when the basic system configurations are inconsistent.

Execution Conditions	Error Description
When both systems are powered ON simultaneously	The following stop error will occur in the control
When both system CPU modules are unreset (RESET/L.CLR switch is set to the neutral position) simultaneously	system and standby system CPU modules: "UNIT LAY. DIFF. (error code: 6030 or 6035)".
 When one system starts up after the other. When the separate mode is changed to the backup mode When reconnecting the tracking cable 	The following stop error will occur in the standby system CPU module only: "UNIT LAY. DIFF. (error code: 6030 or 6035)". ^{*1}

If the "UNIT LAY. DIFF." error occurs in the standby system, check and correct the following so that they will be consistent in both systems.

- Model and type of modules mounted in the control system and standby system main base units
- Network module mode settings
- * 1: If a stop error occurs in the standby system CPU module, the following continuation error will occur in the control system CPU module: "STANDBY SYS. DOWN (ERROR CODE: 6300)".

(4) System configuration check when using extension base unit

When the extension base unit is used, there are following restrictions. The error description for the case where the system configuration does not meet the following conditions is listed in Table5.15.

- Connect the redundant type extension base unit to the first extension stage.
- Only one redundant type extension base unit is applicable per system.
- Connect IN connector (IN1 and IN2) of the redundant type extension base unit to OUT connector of the main base unit.
- Connect OUT connector of the redundant type extension base unit to IN connector of the redundant power extension base unit.
- The main base units used in systems A and B should be the same model.

Table5.15 Error description when extension base unit does not meet use condition

Use condition	Error description	
Connect the redundant type extension base		
unit to the first extension stage		
 Properly connect the redundant type 	BASE LAY ERROR (error code: 2012 of 2013) occu	
extension base unit and the main base unit		
Only one redundant type extension base unit is	"EXT.CABLE ERR. (error code: 2020)" occurs.	
applicable per system		
The main base units used in systems A and B		
should be the same model	DASE LAT ERROR (enoi code: 2012) occurs.	

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(5) Memory Card Setting Status Consistency Check

(a) Check points

The memory card setting consistency check means checking if a memory card is set and the type.

Table5.16 Me	mory Card Se	etting Status	Check Points
--------------	--------------	---------------	--------------

Check Points	Description
Memory Card Setting	Checks if a memory card is set or not.
Memory Card Type	Checks if type of memory cards set in the control system and standby
	system (SRAM card, Flash card, ATA card) are the same.



Diagram 5.15 Memory Card Setting Status Consistency Check

(b) Inconsistency Errors

Table5.17 lists the inconsistency errors that occur when the card setting statuses are inconsistent.

Table5.17 Memory Card Setting	g status Inconsistency Errors
-------------------------------	-------------------------------

Execution Conditions	Error Description
 When both systems are powered ON 	
simultaneously.	The following stop error occurs in the control
When both system CPU modules are unreset	system and standby system CPU modules:
(RESET/L.CLR switch is set to the neutral	"CARD TYPE DIFF. (error code: 6040 or 6041)".
position) simultaneously.	

If the "CARD TYPE DIFF." error occurs in the control system and standby system CPU modules, set the same memory card in each system.

- The memory card setting status consistency check does not include the memory card capacity check.
 When using memory cards of different capacities, check the capacity required for the actual control.
- 2. If the special relay "Card removal/setting enable flag (SM609) is turned on and the memory card is changed during redundant system operation, an error does not occur since a memory card setting status consistency check is not performed.

However, a memory card setting status consistency check is executed if both systems are powered on simultaneously or unreset (RESET/L.CLR switch is set to the neutral position) simultaneously.

When changing the memory card during redundant system operation, set the memory card of the same type in each system.

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(6) Parameter Valid Drive Settings Consistency Check

(a) Check points

The parameter-valid drive settings (dip switches SW2 and SW3) in the control system and standby system are checked.

An error occurs because the dip switch (SW3) setting is incorrect



Diagram 5.16 Parameter Valid Drive Settings Consistency Check

(b) Inconsistency Errors

Table5.18 displays the consistency errors that occurred when the parameter valid drive settings are inconsistent.

Table5.18 Parameter Va	alid Drive Settings	Inconsistency Errors
------------------------	---------------------	----------------------

Execution Conditions	Error Description
 When both systems are powered ON 	
simultaneously	The following stop error occurs in the control system
 When both system CPU modules are 	and standby system CPU modules: "FILE DIFF.
unreset (RESET/L.CLR switch is set to the	(error code: 6001)".
neutral position) simultaneously	
When one system starts up after the other	
• When the separate mode is changed to the	The following stop error occurs in the standby system
backup mode	CPU module only: "FILE DIFF. (error code: 6001)".*1
When reconnecting the tracking cable	

If the "FILE DIFF." occurs in the standby CPU module, Use the dip switches SW2, SW3 of the control system and standby system CPU modules so that the settings will be consistent.

* 1: If a stop error occurs in the standby CPU module, the following continuation error will occur in the control system CPU module: "STANDBY SYS. DOWN (error code: 6300)".

(1) Self Diagnostics Function

The self diagnostics function means that the redundant CPU checks for its own error, in order to prevent malfunction as well as to perform preventive maintenance. If an error occurs when the redundant system is powered on or while the redundant CPU is running, the redundant CPU detects the error and displays it and performs system switching, etc.

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(2) Error Detection Processing

(a) Error detection processing

When detecting an error, the redundant CPU will perform the following process:

- 1) Turning the ERR.LED etc. on
- 2) Turning the special relays (SM0, SM1) on
- 3) Storing the error information (error code) into the special resistor (SD0) When detecting multiple errors, the redundant CPU will store only the latest error code into the SD0.

Use the special relay and special register in a program to make a programmable controller or machine system interlock.

(b) Error history confirmation

The redundant CPU records the 16 latest error codes as error history. The error history can be checked in the PLC diagnostics of GX Developer. The error history is backed up by the battery even if the programmable controller is powered off.

(3) Redundant CPU Operation upon an error detection

(a) Operation Mode when detecting an error

When detecting an error through the self diagnostics, the redundant CPU operates in the following two ways:

1) Stop of redundant CPU operation

Upon an error detection, the redundant CPU stops the operation and performs system switching.

The redundant CPU holds all outputs (Y) that have not been assigned to the main base unit, while it processes the outputs (Y) that have been assigned to the main base unit according to "Output Mode on Error Detection" of the PLC parameters I/O assignment settings as listed below:

- Turns off all output of modules set to "Clear Output" (default). (Device memory output (Y) is held.)
- Output of modules set to "Maintain output" is held. (Device memory output (Y) is maintained.)

2) Continuation of redundant CPU operation

Upon an error detection, the redundant CPU executes all programs other than the program (instruction) where the error occurred.

(b) Errors that allow selection of operation

For the following errors, the operation can be selected to "continue" or "stop" in the PLC parameter's PLC RAS settings.

(In the parameter default settings, all errors are set to "stop".)

- 1) Operation error (including SFC program)
- 2) Extension instruction error (setting for extension in future)
- 3) Blown fuse
- 4) Module verify error
- 5) Intelligent program execution error
- 6) File access error
- 7) Memory card operation error
- 8) External power supply OFF (setting for extension in future)

As the module verify error is preset to "stop", when the error occurs, a stop error is detected in the control system, resulting in system switching.

However, since the new control system also detects the module verify error and stops its operation, the redundant system stops the control.

When the module verify error is set to "continue", even if the error occurs, the system switching does not occur and the operation continues with I/O numbers used before the error occurrence.

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(4) Self Diagnostic at Startup of Redundant CPU

The redundant CPU diagnoses the system based on the points described in Table5.19 when the redundant system is powered on or the CPU modules are unreset (RESET/L.CLR switch is set to the neutral position). When detecting an error, the redundant CPU develops a stop error.

Priority ^{*1}		Diagnostics Description	Detected Error		
		Diagnostics Description	Error Message	Error Code	
1		CPU module hardware check	MAIN CPU DOWN *2	1000 to 1009	
2	Redundant CPU	RAM check	RAM ERROR	1101 to 1109	
3		Operation circuit check	OPE.CIRCUIT ERR.	1200 to 1202	
4		Tracking cable connection check	TRK.CABLE ERR.	6120	
5		Tracking communication (system status) check	TRK.INIT.ERROR	6140	
6		Extension base unit mounting check	BASE LAY-ERROR	2010 to 2013	
7		For unsupported module being mounted check	SP.UNIT VER.ERR.	2151	
8		Main base unit bus check	0017001 0110 500 *2	1411	
9		Extension base unit bus check	CONTROL-BUS ERR. 2	1418	
10		Extension base unit mounting status	EXT.CABLE ERR.	2020	
11		Base assignment check	SP.UNIT LAY ERR.	2122, 2125	
12		Booting check	BOOT ERROR	2210, 2211	
13		For parameters check	MISSING PARA.	2200	
14		Parameters and system configuration check	SP.UNIT LAY ERR.	2100, 2103, 2106, 2107, 2124, 2125, 2128	
15		Intelligent Function Module check	SP.UNIT DOWN *3	1401, 1403	
16		RUN/STOP switch status check	OPE.MODE DIFF.	6020	
17	Redundant System	Control system and standby system configuration check	UNIT LAY.DIFF.	6030	
18		Control system and standby system CPU module models check	UNIT LAY.DIFF.	6035	
19	Check	For control system and standby system memory card settings check	CARD TYPE DIFF.	6040, 6041	
20		Parameter settings check	PARAMETER ERROR	3000 to 3004, 3007, 3040, 3041, 3042	
21		File storage to program memory check	FILE SET ERROR	2400, 2401	
22	1	Program files check	CAN'T EXE.PRG.	2500 to 2504	
23		Instruction codes check	INSTRCT. CODE ERR.	4000 to 4004	
24		Pointer (P) check	CAN'T SET(P)	4020, 4021	
25	-	Pointer (I) check	CAN'T SET(I)	4030	
26		END instruction check	MISSING END INS.	4010	
27	1	Link parameter error	LINK PARA.ERROR	3100 to 3107	
28		Remote password check	REMOTE PASS.ERR.	3400, 3401	
29	1	Intelligent parameters check	SP.PARA.ERROR	3300 to 3302	
30	1	File consistency check	FILE DIFF.	6000	
31	1	Parameter valid drive settings consistency check	FILE DIFF.	6001	
32	1	Tracking setting parameter check	TRK.PARA.ERROR	6500, 6501	

Table5.19 Self Diagnostic at CPU Module Startup

* 1 Indicates the priority of the order in which errors are detected when the both systems are powered on or the CPU modules are unreset (RESET/L.CLR switch is set to the neutral position).

* 2 The errors may be detected regardless the priority.

* 3 Can be changed to "continue" in the PLC parameters settings of GX Developer.

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5.1.6 Start Mode

The start mode is the mode that determines device status at system startup or unreset (RESET/L.CLR switch is set to the neutral position).

Two types of start modes are available: Initial start mode and Hot-start mode. (Initial start mode is set by default.)

Select the start mode at backup mode settings in the redundant parameter settings of GX Developer.

/	/ Select Initial start mode / Hot-start mo
Redundant parameter	X
Operation settings Tracking settings Start mode setting Mode It will become Hot-start mode during system switching. Standby system watch setting It will become Hot-start mode during system switching. Check the error in Standby system Debug mode setting It open at start with Debug mode Backup mode setting It open at start with Debug mode Check operating status consistency	
Default	Check End Cancel

Diagram 5.17 Operation setting Window

(1) Initial start mode (Default)

This mode is for clearing all devices except the file register and the latch range settings device (word device: 0; bit device: OFF) before performing the operation.



Diagram 5.18 Initial Start Mode Operation

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After system switching, the new control system will start up in the Hot-start mode regardless of the start mode settings.

(2) Hot-start mode

This mode is for performing the operation from when holding the device. (Some devices such as the step relay and the index register will be cleared.) As holding the devices even when the redundant system goes down due to power OFF or CPU module reset, the system can continue the operation when it is powered on or the CPU modules are unreset (RESET/L.CLR switch is set to the neutral position).



Diagram 5.19 Hot-Start Mode Operation

(3) Differences Between Initial Start Mode and Hot-start Mode

Table5.20 lists the differences between Initial start mode and Hot-start Mode.

			Initial Start Mode	Hot Start Mode
	All Other Than Index Register	Not held in power OFF	Cleared	Held ^{*1}
	and Step Relay	Held in power OFF	Held	
Device Memory	Index Register and Step Relay		Cleared	
	Special Relay and Special Register		Initial value is set	
	Initial Device Value Setting Range		Initial value is set	
	Local Device		Clea	red
	File Register		Held	
	Initial Execution Type Program		Executed only one time during STOP→RUN	
Program	Program Interrupt Permitted / Not Permitted Execution SM402 (After RUN, ON for 1 scan) SM403 (After RUN, OFF for 1 scan)		Set to not permit interrupt	
Execution			Turned ON 1 scan during STOP→RUN	
			Turned OFF 1 scan during STOP→RUN	
Program Execution Type (Initial / Scan / Standby)			Based on the PLC parameter settings	
File Register Settings			Based on the PLC parameter settings	
Comment File Settings			Based on the PLC parameter settings	
SFC Program Startup Mode			Based on the PLC parameter settings	
Boot from Memory Card / Standard ROM			Based on the PLC parameter settings	
Intelligent Module Parameter Initial Settings			The intelligent module parameters are reflected	

Table5.20 Differences Between Initial Start Mode and Hot-start Mode

* 1: Clear device data by latch clear.

The redundant system functions are listed in Table5.21

Please refer to the following manual, for functions other than the redundant system functions.

CF Qn(H)/QnPH/QnPRHCPU User's Manual (Function Explanation, Program Fundamentals)

Table5.21 Function List

Description	Reference
This function switches the control system and the standby system. (It changes	
the control system to the standby system, and the standby system to the	Section 5.2
control system.)	Section 5.5
There are 2 types: automatic system switching and manual system switching.	
This function switches the operation mode between the separate mode and	
backup mode	3601011 3.4
This function transfers the operation control data to the standby system to	
ensure continuous system operation when a control system failure or fault	
occurs.	Section 5.5
Control can be continued with the same data even if a control system failure or	
fault occurs and the systems switching occurs.	
This function transfers the data, such as programs (including those written	
online) and parameters written to the control system CPU from the standby	Section 5.6
system.	
This function copies program memory contents from the control system to the	
standby system.	
(When exchanging the standby system CPU module, use of this function can	
make the control system and standby system program memories consistent.)	Section 5.7
This function can be executed by using GX Developer, or by using the special	
relay and special register.	
Allows replacement of an I/O module mounted on the main base unit where	
the Redundant CPU is mounted while power supply is ON. (Not applicable	
when any extension base unit is connected.)	
• Allows replacement of an I/O module or intelligent function module *1	
mounted on an extension base unit while power supply is ON.	Section 5.8
Allows replacement of an I/O module or intelligent function module *1	
mounted on a MELSECNET/H remote I/O station while power supply is ON	
Allows replacement of a power supply module while the system is operating	
when the system uses the redundant power main base unit.	
	Description This function switches the control system and the standby system. (It changes the control system to the standby system, and the standby system to the control system.) There are 2 types: automatic system switching and manual system switching. This function switches the operation mode between the separate mode and backup mode This function transfers the operation control data to the standby system to ensure continuous system operation when a control system failure or fault occurs. Control can be continued with the same data even if a control system failure or fault occurs and the systems switching occurs. This function transfers the data, such as programs (including those written online) and parameters written to the control system CPU from the standby system. This function copies program memory contents from the control system to the standby system. (When exchanging the standby system CPU module, use of this function can make the control system and standby system program memories consistent.) This function can be executed by using GX Developer, or by using the special relay and special register. • Allows replacement of an I/O module mounted on the main base unit where the Redundant CPU is mounted while power supply is ON. (Not applicable when any extension base unit is connected.) • Allows replacement of an I/O module or intelligent function module *1 mounted on an extension base unit while power supply is ON. • Allows replacement of an I/O module or intelligent function module *1 mounted on a MELSECNET/H remote I/O station while power supply is ON.

* 1: Intelligent function module that supports online module change. (S Section 2.4 (6))

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5.3 System Switching (Between Control System and Standby System) Function

This section describes how to switch the system during RUN, execution timings, execution possibilities, operations of the CPU modules in both (control and standby) systems after system switching, and relevant precautions.

5.3.1 System Switching Method

2 methods of system switching are available: automatic system switching and manual system switching that is performed by the user.

Whether the system switching can be executed automatically or manually depends on the operation mode. (Refer to Section 5.1.3 for details on operation mode.) Table5.22 indicates the system switching methods and applicable operation modes.

Table 5.22 System Switching Method and the Applicable Operation Modes

System Switching Method	Description	Operation Modes
Automatia avatam	System switching when a fault occurs in the control system	
Automatic system	 System switching by the system switching request issued from 	Backup Mode
switching	the network module	
Manual System	System switching using GX Developer *1	Backup Mode
Switching	System switching by system switching instruction	Separate Mode

* 1: System switching can be done from the OPS (application using EZ Socket), too.

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If system switching is performed in the backup mode, the following error codes will be stored into the error history of the new control system and new standby system CPU modules.

In this case, the ERR. LED will remain off. (The ERR. LED does not turn on or flash.)

- New control system: "CONTROL EXE. (error code: 6200)"
- New standby system: "STANDBY (error code: 6210)" It is possible to confirm if the system switching has been executed or not in the PLC

diagnostics (Error log) of GX Developer. *2

PLC operati Connective	on RUN system : Control	switch RUN system, System B, Backup	Tracking c mode Manual swi	onnecting tching : Enable	
resent Error PLC Module System A System B	No. 0	Present Error No error No error	Year/Month/Day	Time	Monitor run/stop
		Parity error	Clear Diagnostics	Error Jump	

PLC status					
PLC operation st PLC opera	atus tion RUN	switch RUN	Tracking co	onnecting	
Connective	e system : Stand	by system, System A, Backup m	node Manual swi	tching : Enable	
Present Error					- Monitor run/sto
PLC Module	No.	Present Error	Year/Month/Day	Time	
System A System B	0	No error No error			Start monitor
					Stop monitor
- Coriol communi					
				Error Jump	
			1		
		O	ar Diagnostics	Help	
Error log				_	
	Error log	Clear log Occurrence ord	er Ascending	•	
	Error mess	age Year/Month/	Day Time	File save	
No.	OTAMONY	2008- 3-18	3 16:19:41		
No. 6210	STANUBT				
No. 6210	STANUBT			Error Jump	Close

Diagram 5.20 PLC Diagnostics Window of the New Control System

Diagram 5.21 PLC Diagnostics Window of the New Standby System

* 2: If the "WTD error" occurs in the new standby system, PLC diagnostics cannot be done via the tracking cable.

Connect an RS-232 cable or USB cable to the system to be diagnosed (new control system/new standby system) and execute the PLC diagnostics.

Fror details Individual error information Individual error Inditor Error Individual error <t

The reason for system switching can be confirmed on the Error details window.

Diagram 5.22 Error details window

(1) Automatic System Switching

In automatic system switching, the redundant CPU determines if a system switching is necessary and automatically switches the control system and standby system. 2 types of automatic system switching are available: automatic system switching when a fault occurs in the control system, and system switching requested by the network module.

(a) System switching when a fault occurs in the control system

In the redundant system, the standby system CPU module monitors the control system operating status.

When the control system is in any of the following status and is not able to continue the redundant system control, the standby system CPU module switches to the control system and continues the redundant system control.

- · A stop error occurs in the control system CPU module
- The control system is powered OFF
- The control system CPU module is reset

If a continuation error occurs in the control system CPU module, system switching will not occur.

Diagram 5.23 shows the processes that take place if a stop error occurs in the control system CPU module:



Diagram 5.23 System switching operations when a control system error occurs

(b) System switching requested by the network module

 When the control system CC-Link IE Controller Network module, MELSECNET/H module, Ethernet module, or the MODBUS/TCP module detects a communication error or wire break^{*1}, the module requests system switching to the CPU module. (The standby system CC-Link IE Controller Network module, MELSECNET/H module, Ethernet module, or the MODBUS/TCP module does not request system switching, even if the

module detects a communication error or wire break^{*1}.)

 When the PROFIBUS-DP master module detects a module fault or communication failure with DP-Slaves, the module requests system switching to the CPU module. (The standby system PROFIBUS-DP master module does not request system switching, even if the module detects a module fault or communication failure with DP-Slaves.)

When receiving the system switching request from the network module, the control system CPU module will perform a system switching at END processing.

Diagram 5.24 shows the processes that take place when the system switching request is received from the network module.





* 1: For the Ethernet interface modules, only the QJ71E71-100 can detect wire break.

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- The network module system switching can only be requested from a redundant system-compatible CC-Link IE Controller Network module, MELSECNET/H module, Ethernet module, MODBUS/TCP module, and PROFIBUS-DP master module. Refer to Section 2.3 for details on serial Nos. of these redundant systemcompatible modules.
- 2. When the Ethernet module is mounted on the extension base unit, the system switching request cannot be issued.

(The CC-Link IE Controller Network module and MELSECNET/H module cannot be mounted on the extension base unit.)

If the network module cable is disconnected, the system switching may not be performed depending on the timing when the control system and standby system detects the fault.

Example: The following diagram shows the processes that take place when the redundant system is connected to the MELSECNET/H.

- If the control system detects the cable disconnection first, the system switching will be performed.
- If the standby system detects the cable disconnection first, the system switching will not be performed.
- In this case, the "CAN'T SWITCH (error code: 6220)" continuation error will occur in the control system CPU module.



Diagram 5.25 System Switching Operation at Cable Disconnection

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(2) Manual System Switching

Manual system switching means the system switching that is done manually by the user while the system is running.

2 types of manual system switching are available: system switching using GX Developer and that by the system switching instruction (SP.CONTSW instruction).

The manual system switching is performed for the control system CPU module.

(a) System switching using GX Developer

When executing the system switching in the control system CPU module using GX Developer, the system switching operation is done at END processing.

- 1) System switching using GX Developer is done in the following procedure:
 - Turn on the "Enable/disable user system switching" flag (SM1592) in the control system CPU module.
 - ţ
 - The system switching request is issued to the control system CPU module by the redundant operation of GX Developer.



Diagram 5.26 System Switching Operation by GX Developer

 If SM1592 is not turned ON at the time of system switching executed from GX Developer, the error dialog box as Diagram 5.27 appears.

If the error dialog box as Diagram 5.27 has appeared, turn ON SM1592 and then execute system switching again from GX Developer.

MELS	OFT application		
Þ	The system switching is not allowed. Please switch the system again after turning ON the manual change permission flag (SM1592). <es:0104 24b=""></es:0104>		
	ОК		
Diagram 5 27 Error Dialog Box Displayed on GX Developer			

(b) System switching by the system switching instruction (SP. CONTSW instruction) ^{*1}

When the system switching instruction is executed in the control system CPU module, the system switching is performed at END processing after instruction execution.

1) The system switching by system switching instruction is done in the following procedure:

•Turn on the "Enable/disable user system switching" flag (SM1592) in the control system CPU module.

Ļ

•Turn on the system switching instruction condition in the control system CPU module and execute the instruction.



Diagram 5.28 System Switching Operation by System Switching Instruction

* 1: Refer to the following manual for details on the system switching instruction.

1. Precautions When Executing the System Switching Instruction (SP.CONTSW instruction)

As the control system and standby system CPU module programs and device data are consistent, when the system switching instruction is executed in the control system CPU module, the system switching may be executed in the new control system CPU module, too.

When executing the system switching instruction, it is required to use the special relay "Standby system to control system switching status flag (SM1518)" as illustrated in Diagram 5.29, and modify the program so that the instruction will not be executed in the new control system CPU module again.

Standby system to control system switching status flag		
SM1518	SET M0]-	
system switching command M1000 M0 ───┤ ├────_ SP.CONTSW K	1 M10 ^{*1}]-	
Cancel Signal M1001 ——— I	RST MO]-	*1 : When the SP.CONTSW instruction cannot perform a system switch, the error completion device (M10) is set to ON.

Diagram 5.29 Program That Does Not Execute System Switching Instruction Again in New Control System CPU Module

- The error completion device for the system switching instruction can be used to check whether system switching is executed by the system switching instruction or not.
 - When the error completion device is OFF . .System switching is executed
 - When the error completion device is ON . . . System switching is not executed

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2) Reasons for system switching can be set as system switching instruction parameter.



Argument (Reason for system switching, etc.)

Diagram 5.30 Example of System Switching Instruction programming The system switching instruction parameter value can be confirmed in the system switching instruction error details window, which can be displayed from

the PLC Diagnostics window. The system switching instruction parameter value can be used in

troubleshooting.

Error details		X
Common error information		Individual error information
Reason(s) for system switching	16	Nothing
Reason(s) for system switching failure	1	
		920

Diagram 5.31 Error details window

In addition, this parameter value is also stored in the special register SD6 (error common information) and SD1602 (system switching dedicated instruction parameter).

(3) System Switching Priority

The system switching priorities are listed in Table5.23.

Priority Reasons for System Switching		Reasons for System Switching
Hiah	1	Control system powered off
riigii	1	Control system CPU module reset
1	2	Stop error in control system CPU module
÷	3	Execution of system switching instruction
4 • Sy		 System switching operation using GX Developer
LOW	5	System switching request by network module

(a) System switching processing when multiple system switching requests are issued simultaneously

When multiple system switching requests are issued simultaneously, system switching is performed according to the priority (from high to low) of reasons for system switching.

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(b) Error message displayed on GX Developer

If the system switching is actually executed due to another reason for system switching when an attempt of system switching has been made using GX Developer, the error message (Diagram 5.32) will appear on GX Developer.

MELSOFT application			
(j)	System switching was previously executed by one factor. Please confirm the system.		
	<e5:010a424f></e5:010a424f>		
	ОК		

Diagram 5.32 Error Dialog Box Displayed on GX Developer

(4) Operations When System Switching is Executed in the Standby System CPU Module

If the manual system switching request is issued to the standby system CPU module, the system switching will not be executed.

Table5.24 indicates the operations performed when a system switching request is issued to the standby system CPU module.

Table5.24 Operations When a System Switching Request is issued to the standby system CPU Module

System Switching	Operation Mode		
Request	Backup Mode	Separate Mode	
System Switching by		The following stop error will occur upon	
System Switching	Not performed	instruction execution: "OPERATION ERROR	
Instruction		(error code: 4121)".	
	The following error message will be displayed on the GX Developer that was used to perform the system switching	The following error message will be displayed on the GX Developer that was used to perform the system switching	
System Switching Using GX Developer	MELSOFT series GX Developer	MELSOFT series GX Developer	

5.3.2 System Switching Execution Timing

Table5.25 indicates the system switching execution timing when a system switching condition occurs.

System Switching Method	Reasons for System Switching in Control System	Execution Timing		
	Stop error	System switching is executed when the reason for system		
Automatic System Switching	Power off	switching occurs		
	Reset			
	System switching request by network			
	module			
	System switching using GX	System switching is executed at END processing of the sca		
Manual Switching	Developer	where the reason for system switching occurred. *1		
Manual Switching	System switching by system			
	switching instruction			

Table5.25 System Switching Execution Timing

* 1: Even if the COM instruction is executed after a reason for system switching occurs, system switching will not be executed by END processing.

Refer to the following manual for details on the COM instruction.

MELSEC-Q/L Programming Manual (Common Instruction)

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5.3.3 System Switching Execution Possibility

(1) In Backup Mode

System switching execution possibility in Backup Mode is listed in Table5.26.

		Control System Switching Condition									
Standby System Operating Status *1			Automa	Manual System Switching							
		Power Off Reset	Hardware Failure	Watchdog Timer Error *3	Stop Error Other Than Watchdog Timer Error	System Switching requested by the Network Module	System Switching by System Switching Instruction	System Switching using GX Developer			
Normal		0	0	0	0	0	0	0			
Continuati	on ERROR	0	0	0	0	0	0	0			
Tracking C	able Disconnection	×	⊖ ^{*4}	O ^{*4}	×	×	×	×			
Power OF	F ^{*2}										
Resetting	*2	×	⊖ ^{*4}	O *4	×	×	×	×			
Hardware	Failure ^{*2}										
CPUston	Watchdog Timer Error ^{*2 *3}	0	0	0	×	×	×	×			
error	Stop Error Other Than Watchdog Timer Error ^{*2}	0	0	0	0	×	×	×			
At network	fault detection	0	0	0	0	×	×	×			
Memory C System to	opy from Control Standby System	0	0	0	0	×	×	×			
During On	line Program Change	0	0	0	0	×	×	×			
Operating Status Inconsistency		0	0	0	0	×	×	×			
Preparing for Tracking		×	0	0	×	×	×	Х			
System Sv Timeout	vitching Request	×	0	0	×	×	×	×			
Executing	System Switching	0	0	0	0	0	×	Х			

Table5.26 System Switching Execution Capability

 \bigcirc System switching enabled, imes System switching disabled

* 1: Standby System Operating Status is displayed in Table5.27.

* 2: When the reasons for system switching failure such as standby system power off/being reset, standby system stop error, tracking cable disconnection, are removed, the system switching may occur. (

- * 3: Watchdog timer error corresponds to the "WDT ERROR (error code: 5000 or 5001)".
- * 4: The control system switches to the standby system, but the standby system status does not change.

Operating Status	Description					
Normal	The CPU module is in the RUN, STOP or PAUSE status, where no error such as a continuation error or stop					
Noma	error has occurred.					
Continuation Error	The CPU module is in the RUN, STOP and PAUSE status, where a continuation error has occurred.					
Stop Error	The CPU module has stopped, as a stop error has occurred.					
Power Off	The system power is OFF.					
Resetting	The CPU module is being reset.					
	A fault has been detected by at least one module of standby system network modules (CC-Link IE					
At network fault detection	Controller Network module, MELSECNET/H module, Ethernet module, MODBUS/TCP module,					
	PROFIBUS-DP master module).					
Preparing for Tracking	The communication is not made between the control system and standby system via tracking cable.					
System Switching Request	The system switching has not been completed, as a data error occurred due to noise, etc., in the					
Timeout	communication between the control system and standby system during system switching processing.					
Executing System Switching	System switching cannot be executed since the control system or standby system is executing system					
Executing System Switching	switching due to the previous system switching condition.					

Table 5.27 Operating Status and Details

⊠POINT —

 Make sure to set "CPU Operation Mode" to "STOP (default)" on the details settings of the PLC parameters I/O Assignment settings.
 If set to "Continue", system switching cannot be executed when the "SP. UNIT DOWN" error occurs due to a network module hardware failure.

Hardware Failure									
System Switching Method	Control System Switching Condition	System Status Before System Switching		System Status After System Switching Condition		Operation After B System Power ON → OFF or unresetting the CPU module (RESET/L.CLR switch is se			
		System A	System B	System A	System B	to the neutral position)			
	Stop Error Other Than Watchdog Timer Error	Control System	Standby System	Control System	Standby System	Startup as standby system			
Automatic	Watchdog Timer Error	Control System	Standby System	Standby System	Standby System	Startup as control system			
	Hardware Failure	Control System	Standby System	Control System	Standby System	Startup as control system			
System Switching	Power OFF	Control System	Standby System	Control System	Standby System	Startup as control system			
	Resetting	Control System	Standby System	Control System	Standby System	Startup as control system			
	System Switching Request by Network Module	Control System	Standby System	Control System	Standby System	System switching will causes system B to become control system			
Manual	System Switching Using GX Developer	Control System	Standby System	Control System	Standby System	Startup as standby system			
System Switching	System Switching by System Switching Instruction	Control System	Standby System	Control System	Standby System	Startup as standby system			

Table5.28 Operations When System Switching Cannot Be Executed Due to Standby System Power Off, Resetting or

Table5.29 Operations When System Switching Cannot Be Executed Due to Error Other Than Stop Error in the Standby System

System Switching Method	Control System Switching Condition	Status Before System Switching		System Status After System Switching Condition		Operation After System B Power OFF → ON	
mounou		System A	System B	System A	System B		
	Stop Error Other Than	Control	Standby	Standby	Control	Startup as control system	
	Watchdog Timer Errors	System	System	System	System	Startup as control system	
	Watchdog Timor	Control	Standby	Standby	Standby	Startup as control system	
	Watchdog Timer	System	System	System	System	Startup as control system	
	Hardwara Eailura	Control	Standby	Standby	Control	Startup as control system	
Automatic	Hardware Failure	System	System	System	System	Startup as control system	
System	Power OFF	Control	Standby	Standby	Control	Startup as control system	
Switching		System	System	System	System		
	Resetting	Control	Standby	Standby	Control	Startun as control system	
		System	System	System	System	Startup as control system	
	System Switching	Control	Standby	Control	Standby	System switching will cause system B to	
	Request by Network	System	System	System	System	become control system	
	System Switching	Control	Standby	Control	Standby	Startun as standby system	
Manual	Using GX Developer	System	System	System	System	Startup as startuby system	
System Switching	System Switching by System Switching Instruction	Control System	Standby System	Control System	Standby System	Startup as standby system	

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System Switching Method	Control System Switching Condition	Before System Switching		System Status After System Switching Condition		Operation After Tracking Cable Disconnection	
Method		System A	System B	System A	System B		
	Stop Error Other Than	Control	Standby	Control	Standby	System switching will not be executed	
	Watchdog Timer Errors	System	System	System	System	System switching will not be executed.	
	Watchdog Timor Error	Control	Standby	Standby	Standby	System switching will not be executed	
	Watchdog Timer Enor	System	System	System	System	System switching will not be executed.	
	Hardwara Eailura	Control	Standby	Control	Standby	System switching will not be executed	
Automatic	Hardware Failure	System	System	System	System	System switching will not be executed.	
System	Power OFF	Control	Standby	Control	Standby	System switching will not be executed.	
Switching		System	System	System	System		
	Depatting	Control	Standby	Control	Standby	System switching will not be executed	
	Resetting	System	System	System	System	System switching will not be executed.	
	System Switching	Control	Standby	Control	Standby		
	Request by Network	System	System	System	System	System switching will not be executed.	
	System Switching	Control	Standby	Control	Standby		
Manual	Using GX Developer	System	System	System	System	System switching will not be executed.	
System Switching	System Switching by System Switching Instruction	Control System	Standby System	Control System	Standby System	System switching will not be executed.	

Table5.30 Operations When System Switching Cannot Be Executed Due to Tracking Cable Disconnection

Table5.31 When System Switching Cannot Be Executed Due to Network Error of Standby System

System Switching Method	Control System Switching Condition	System Status Before System Switching		System Status After System Switching Condition		Operation After B System Power OFF → ON	
Method		System A	System B	System A	System B		
	Stop Error Other Than	Control	Standby	Standby	Control	Startup as control system	
	Watchdog Timer Error	System	System	System	System	Statup as control system	
	Watabdag Timor Error	Control	Standby	Standby	Standby	Startup on control system	
	Watchuog Timer Error	System	System	System	System	Statup as control system	
	Hardwara Eailura	Control	Standby	Standby	Control	Startup as control system	
Automatic	Hardware Failure	System	System	System	System	Startup as control system	
System	Power OFF	Control	Standby	Standby	Control	Startup as control system	
Switching		System	System	System	System		
	Resetting	Control	Standby	Standby	Control	Startup as control system	
		System	System	System	System	Startup as control system	
	System Switching	Control	Standby	Control	Standby		
	Request by Network	System	System	System	System	Startup as standby system	
	Module	Oystern	Oystem	Oystem	Oystern		
	System Switching	Control	Standby	Control	Standby	Startun as standby system	
Manual	Using GX Developer	System	System	System	System	Startap to startaby system	
System	System Switching by	Control	Standby	Control	Standby		
Switching	System Switching	System	System	System	System	Startup as standby system	
	Instruction	Cystom	Cystom	Cystom	Cystom		

System Switching Method	Control System Switching Condition	Status Before System Switching		System Status After System Switching Condition		Operation After System B Power OFF → ON
lilictrica		System A	System B	System A	System B	
	Stop Error Other Than	Control	Standby	Standby	Control	Startun as standhy system
	Watchdog Timer Errors	System	System	System	System	Startup as standby system
	Watabdag Timor	Control	Standby	Standby	Standby	Startup as control system
	watchuog miller	System	System	System	System	Startup as control system
	Hardwara Eailura	Control	Standby	Standby	Control	Startup as control system
Automatic System	Hardware Failure	System	System	System	System	Startup as control system
	Power OFF	Control	Standby	Standby	Control	Startup as control system
Switching		System	System	System	System	Startup as control system
	Resetting	Control	Standby	Standby	Control	Startun an antral quatam
		System	System	System	System	Startup as control system
	System Switching	Control	Standby	Control	Standby	System switching will cause system B to
	Request by Network	System	System	System	System	become control system
	Module	oyotom	eyetein	oyotom	oyetem	
	System Switching	Control	Standby	Control	Standby	Startun as standby system
Manual	Using GX Developer	System	System	System	System	
System	System Switching by	Control	Standby	Control	Standby	
Switching	System Switching	System	System	System	System	Startup as standby system
	Instruction	Gystein	Oystern	Oystein	Oystein	

Table5.32 When System Switching Cannot Be Executed Due to Watchdog Timer Error of Standby System

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(2) In Separate Mode

System switching execution possibility in Separate Mode is listed in Table5.33.

	Control System Switching Condition								
		Automa	Manual System Switching ^{*2}						
Standby System Operating Status ^{*1}	Stop Error Other Than Watchdog Timer Errors	Watchdog Timer Error *3	Hardware Failure	Power OFF Reset	System Switching requested by the Network Module	System Switching Using GX Developer	System Switching with System Switching Instruction		
Normal	×	×	×	×	×	0	0		
Continuation Error	×	×	×	×	×	0	0		
Power OFF Resetting Hardware Failure	×	×	×	×	×	×	×		
Watchdog Timer Error *3	×	×	×	×	×	×	×		
Stop Error Other Than Watchdog Timer Errors	×	×	×	×	×	×	×		
At network fault detection	×	×	×	×	×	0	0		
Copying memory from Control System to Standby System	×	×	×	×	×	×	×		
During Online Program Change	×	×	×	×	×	0	0		
Operating Status Inconsistency	×	×	×	×	×	0	0		
Tracking Cable Disconnection	×	×	×	×	×	×	×		
Preparing for Tracking	×	×	×	×	×	×	×		
System Switching Request Timeout	×	×	×	×	×	×	×		
Executing System Switching	×	×	×	×	×	×	×		

Table 5.33 System Switching Execution Capability

 \bigcirc Indicates system switching possible, imes Indicates system switching not possible

* 1: For details of the standby system operating status, refer to Table5.34.

* 2: On the condition that an extension base unit is used, if the system switching timing matches the interrupt timing of the internal timer (I28 to I31), the interrupt interval of the internal timer may become longer in the standby system CPU module.

* 3: Watchdog timer error corresponds to "WDT ERROR (error code: 5000 or 5001)".

Table5.34 Operating Status and Details

Operating Status	Description					
Normal	The CPU module is in the RUN, STOP or PAUSE status, where no error such as a continuation error or stop					
Normai	error has occurred.					
Continuation Error	The CPU module is in the RUN, STOP and PAUSE status, where a continuation error has occurred.					
Stop Error	The CPU module has stopped, as a stop error has occurred.					
Power Off	The system power is OFF.					
Resetting	The CPU module is being reset.					
	A fault has been detected by at least one module of standby system network modules (CC-Link IE Controller					
At network fault detection	Network module, MELSECNET/H module, Ethernet module, MODBUS/TCP module, PROFIBUS-DP master					
	module).					
Preparing for Tracking	The communication is not made between the control system and standby system via tracking cable.					
System Switching	The system switching has not been completed, as a data error occurred due to noise, etc., in the					
Request Timeout	communication between the control system and standby system during system switching processing.					
Executing System	System switching cannot be executed since the control system or standby system is executing system					
Switching	switching due to the previous system switching condition.					

Table5.35 Operations When System Switching Cannot Be Executed Due to Operation mode, i.e., Separate Mode

System Switching Method	Control System Switching Condition	Before System Switching		System Status After System Switching Condition		Operation After Changing From Separate Mode to Backup Mode	
Method		System A	System B	System A	System B		
	Stop Error Other Than	Control	Standby	Control	Standby	System switching will not be executed	
	Watchdog Timer Errors	System	System	System	System	Cystem switching win her be excedited.	
	Watchdog Timer Error	Control	Standby	Control	Standby	System switching will not be executed	
	Watchdog Timer Enor	System	System	System	System	System switching will not be executed.	
		Control	Standby	Control	Standby	Cannot change from Separate Mode to	
	Hardware Failure	System	System	System	System	Backup Mode due to a control system	
Automatic		eyetein	eyetein	oyotom	oyotom	hardware failure.	
System	Power OFF	Control	Standby	Control	Standby	Cannot change from Separate Mode to	
Switching		System	n System System		System	Backup Mode due to control system	
					- ,	power OFF.	
		Control	Standby	Control	Standby	Cannot change from Separate Mode to	
	Resetting	System	System	System	System	Backup Mode due to control system	
		,	,	,	, ,	reset status.	
	System Switching	Control	Standby	Control	Standby		
	Request by Network	System	System	System	System	System switching will not be executed.	
	Module	-	-	-	-		
	System Switching	Control	Standby	Standby	Control	System switching will not be executed.	
Manual	Using GX Developer	System	System	System	System	, , , , , , , , , , , , , , , , , , , ,	
System	System Switching by	Control	Standby	Standby	Control		
Switching	System Switching	System	System	System	System	System switching will not be executed.	
	Instruction	-, otoin	,	Cystonii	,		

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5.3.4 Operation in Both Systems After Switched

Table5.36 and Table5.37 list the operation of the CPU modules and network modules in the control and standby systems after they are switched.

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(1) Operation of CPU modules

Table5.36 Operation of CPU Modules After the Systems are Switched

Item		New Control System CPU Module	New Standby System CPU Module			
	Initial Execution Type Program	Does not execute the program. However, executes the initial execution type program from the 0 step again, if it was not completed in the previous control system at the time of system switching.				
Deserves	Scan Execution Type Program	Executes scan execution type program based on the tracked device data from step 0.				
Execution ^{*1}	Fixed Scan Execution Type Program	Starts counting the interrupt interval time from 0. (Refer to Section 7.2)	Stops program execution.			
	Standby Type Program	Not executed.				
	Interrupt Program	Executes when the interrupt factor is established. (Refer to Section 7.2)				
Tracking		Starts tracking to the new standby system.	Starts reception of tracking data. However, stops the reception of tracking data if a stop error has occurred.			
Online Program	m Change	Continues the write operation after system switching.	Continues the write operation after system switching.			
Writing files in	RUN	Continues the write operation after system switching.	Continues the write operation after system switching.			
General Data	Processing	Executes the request received after system switching.	Executes the request received at time of system switching. However, a communication error may occur if a system switching is executed during general data processing.			
Device Memory		Holds the data.	Holds the data. Sets the received tracking data to specified device.			
Signal Flow Memory		Holds the tracked data. Turns ON signal flow memory in all steps if has not been tracked. Stores the execution results in the signal flow memory, after program execution.	Holds the data Sets the received tracking data in the signal flow memory.			
Initial Device \	/alue Setting	Does not set the value.	Does not process it.			
Special Relays and Special Registers		Holds the data. However, stores the statuses of control system and standby system after system switching in SM1515 and SM1516.	Holds the data. However, stores the statuses of control system and standby system after system switching in SM1515 and SM1516. Sets the received tracking data in the corresponding special relay and special register.			
Output (Y)		Holds the output. Outputs program execution results. ^{*2}	Turns OFF the output (Y) from modules mounted on the main base unit. Holds the output (Y) from modules other than above.			
Local Device S	Settings	Sets devices according to parameter settings.	Does not process it.			
File Register S	Settings	Holds the file register settings prior to system switching.	Not processed.			
Direct Input (D	X)	Inputs data when an instruction using the direct input is executed after the systems are switched. ^{*2}	Not processed.			
Direct Output (DY) *3		Inputs data when an instruction using the direct input is executed after the systems are switched.	Not processed.			
Intelligent Function Module Dedicated Instruction		Executes the instruction in a program after system switching if the corresponding execution condition has been satisfied, and does not execute it if it has not been satisfied.	Not processed.			
FROM/TO Inst	truction	Executes the instruction in a program after system switching if the corresponding execution condition has been satisfied, and does not execute if it has not been satisfied.	Not processed.			
Access Reque	st from Intelligent	Ignores the access request.	Not processed.			

* 1: The Redundant CPU cannot execute low-speed execution type programs.

- * 2: In the redundant system where the modules are mounted on the execusion base unit, if the systems are switched because of an extension cable failure, data are not input to the modules on the extension base unit in the new control system.
- * 3: The direct output cannot be used to mounted modules on the extension base unit. (

(2) Operation of network modules

Table5.37 Operation of Network Modules After the Systems are Switched

Item	New Control System Network Module	New Standby System Network Module	
CC Link IE Controller Network	Starts cyclic transmission.	Continues cyclic transmission.	
CC-LINK IE CONTIONEL NETWORK		However does not perform output.	
MELSECNET/H PLC to PLC	Starts cyclic transmission.	Continues cyclic transmission.	
network		However does not perform output.	
MELSECNET/H Remote I/O	Starts cyclic transmission.	Continues cyclic transmission as sub-master station.	
network	Operates as master station.	However, does not perform output.	
	Communicates with the control system when it is specified by	Communicates with the standby system when it is specified	
Ethernet	external device.	by external device.	
	Transfers a message to the standby system when it is	Transfers message to the control system when it is	
	specified by external device.	specified by external device.	
PROFIBUS-DP	Continues PROFIBUS-DP communications.	Stands by and prepares for system switching.	

For more details, refer to the manual for the network module used.

5.3.5 Special Relays/Registers For System Switching

(1) Special Relays For System Switching

Special relays for system switching are listed in Table5.38.

Device No.	Name		Setting at Time of System Switching	
		Description	New Control System CPU Module	New Standby System CPU Module
SM1590	System switching enable/disable flag from network module	This flag turns on when a system switching request is issued from a network module. The number of a module that issued a system switching request can be checked in SD1590. This flag turns off when all the bits of SD1590 are off.	0	0
SM1591	Standby system error detection disable flag at system switching	 This flag is used to determine whether to detect "STANDBY" (error code: 6210) in the new standby system after the system is switched due to the causes listed later in this column. ON: An error is not detected in the new standby system upon system switching. OFF: An error is detected in the new standby system upon system switching. [Reason(s) for system switching] System switching with GX Developer System switching using the dedicated instruction System switching request from a network module 	_	0

⊖Set, – Not set

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(2) Special Registers For System Switching

Special registers for system switching are listed in Table5.39.

Table5.39 Special Registers For System Switching

Device No.	Name	Description	Setting at Time of System Switching	
			New Control System	New Standby
			CPU Module	System CPU Module
SD5	Error common information	This register stores the system switching condition that occurred in the control		
		system prior to system switching only when "5 (System switching condition)" is		
		saved to the error common information category code for SD4.		
		0: No system switching condition (default)		
		1: Power-off, reset, H/W failure, watchdog timer error	0	0
		2: CPU stop error (except a watchdog timer error)		
		System switching request from a network module		
		16: Control system switching instruction		
		17: Control system switching request from GX Developer		

Table5.38 Special Relays For System Switching

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Dovice	Name	Description	Setting at Time of System Switching	
No.			New Control System	New Standby
			CPU Module	System CPU Module
	Individual error information	(System switching condition)" is saved to the individual error information		
		category code for SD4.		
		0: Switch successfully completed (default)		
		1: Tracking cable malfunction (cable disconnection, cable malfunction,		
		internal circuit malfunction, or hardware malfunction)		
		 H/W failure, power-oπ, reset, or watchdog timer error occurring in the standby system 		
		3: H/W failure, power-off, reset, or watchdog timer error occurring in the		
SD16		control system		_
3010		4: Preparing for tracking communications	0	_
		5: Timeout		
		6: Stop error (except a watchdog timer error)		
		 Different operations between the two systems (detected only in the backup mode) 		
		8: Copying memory from the control system to the standby system		
		9: Writing during RUN		
		10: Error detection by a standby system network module		
		11: Executing system switching		
		12: Online module change		

 \bigcirc Set, – Not set
Dovico			Setting at Time of System Switching		8
No.	Name	Description	New Control System CPU Module	New Standby System CPU Module	/ERVIE/
SD1588	Reason(s) for system switching	 This register stores the reason(s) for system switching in the own system. A system switching condition is stored even when the system cannot be switched due to causes system switching is disabled. This register is initialized with zero (0) stored when the system is powered on from off or is reset. 0: Initial value (The control system has never been switched.) 1: H/W failure, watchdog timer error 2: CPU stop error (except a watchdog timer error) 3: System switching request from a network module 16: System switching request from GX Developer 	_	0	SYSTEM CONFIGURATION C
SD1589	Reason(s) for system switching failure conditions	 If a system switching fails, one of the following values is stored in this register. 0: System switching complete (default) 1: Tracking cable malfunction (cable disconnection, cable malfunction, or internal circuit malfunction) 2: H/W failure, power-off, reset, watchdog timer error in the standby system 3: H/W failure, power-off, reset, watchdog timer error in the control system 4: Preparing for tracking communications 5: Communication timeout 6: Stop error in the standby system (except a watchdog timer error) 7: Different operations between the two systems (detected only in the back up mode) 8: During memory copy from the control system to the standby system 9: Performing online program change 10: Detecting an error of the network module in the standby system 11: The system is being switched. This register is initialized with zero (0) stored when the own system is powered on. Zero is stored in this register upon normal completion of system switching. 	-	_	PROCEDURE FOR STARTING UP A REDUNDANT SYSTEM
SD1590	Network module head address, which requested system switching	 When system switching is requested from the network module in the own system, the bit corresponding to the module that received the request turns on. D1500 b11 to b1 b0 0: OFF 0: OFF 1: ON Module 0: Disabled because the CPU module occupies 2 slots. Module 11: The module farthest to the right of the CPU module farthest to the right on a 12-slot base unit (Q312B) The system turns off the bit after the error is removed by a user. For the number of a module that issued a system switching request from the network module in another system, refer to SD1690. 	0	0	ANT SYSTEM ON REDUNDANT SYSTEM G

Table5.39 Special Registers For System Switching (Continued)

⊖Set, -Not set

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Dovico			Setting at Time of System Switching	
No.	Name	Description	New Control System	New Standby
			CPU Module	System CPU Module
SD1600	System error information	 If an error is detected by the error check for a redundant system, the corresponding bit shown below turns on. That bit turns off when the error is cleared after that. Each bit SD1600 0 Fixed 0 Fixed	0	0
SD1601	System switching results	 In the debug mode, b0, b1, b2, and b15 are all off. This register stores the reason(s) for system switching. When a system is switched, the reason for system switching is stored in SD1601 of both systems. This register is initialized with zero (0) stored when the system is powered on from off or is reset. The following lists the values stored in this register. Initial value (The control system has never been switched.) Power-off, reset, H/W failure, or watchdog timer error*1 Stop error (except a watchdog timer error) A system switching request from a network module Control system switching instruction System switching request from GX Developer 	0	0
SD1602	System switching dedicated instruction parameter	 This register stores the argument to the instruction when a system is switched by the SP.CONTSW instruction. (The argument for the SP.CONTSW instruction is stored in SD1602 of both systems upon system switching.) SD1602 is only valid when "16 (Control system switching instruction)" is stored in SD1601. SD1602 is updated only when a system is switched by Control system switching instruction. 	0	0
SD1610	Other system diagnostic error	This register stores an error code for the error occurred in another system.The value in SD0 of the CPU module in another system is reflected.	0	-

Table5.39 Special Registers For System Switching (Continued)

⊖Set, -Not set

* 1 : When the system is switched upon the power-off or reset of the control system, "1" is not stored in SD1601 of the new standby system.

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5.3.6 System Switching Precautions

(1) System Switching Failure

The control system may disappear and the redundant system may not function in any of the following cases:

- (a) A tracking cable error (including tracking cable disconnection) has occurred during system switching (due to hardware failure, power off, or CPU module reset).
- (b) A communication error has occurred between the CPU modules during system switching due to a user instruction or a stop error.
- (c) During system switching due to a user instruction or a stop error, a tracking cable error (including tracking cable disconnection) has occurred concurrently with any of the following standby system conditions:
 - The standby system is powered off or its CPU module is reset.
 - A stop error occurs in the standby CPU module.
 - Control system and standby system CPU module operating statuses are different.
 - A standby system network module failure

Operations when the system switching fails due to one of (a) to (c) are listed in the Table5.40 below.

Function		System A and System B CPU Module Operation	
CPU Module Operating Status		Standby System Operation	
	PACKUD	Red light ON (in Backup Mode)	
LED Indication	DACKUP	Amber light ON (in Separate Mode)	
	CONTROL	Light OFF	
Special Polov	SM1516	ON (Standby system)	
Special Relay	(Operation System Status)	JN (Stalluby System)	
	System Switching Request	Cannot execute system switching (ignores system switching request)	
	from Network Module	Carnot execute system switching (ignores system switching request)	
System Switching	System Switching Instruction	Cannot execute system switching (instruction cannot be executed due to	
Request	System Switching Instruction	standby system operation)	
	System Switching Request	Cannot execute system switching	
	from GX Developer, etc.	Returns error code 4240H on startup (Can't execute on standby system).	
Communication from GX	Communication specified by	Communication error	
Developer, etc.	control system CPU module	Returns error code 4248H on startup (inconsistency).	

Table5.40 System A and B CPU Module Operations When the System Switching Fails

If the system switching has failed, power OFF the system A and B, connect a perfect cable to the CPU module, and then power ON the both systems simultaneously. With this operation, the system A will operates as the control system.

(2) Monitoring the Watchdog Timer During System Switching

The redundant system suspends the watchdog timer from being monitored during system switching.

Therefore, the "WDT ERROR (error code: 5001)" will not occur in the system switching scan even if the scan time exceeds the monitoring time set in the scan time watchdog timer.

(3) Enabling System Switching During Online Program Change

System switching is disabled during online program change.

In order to prevent system switching during online program change, the redundant system disables the redundant CPU module from performing system switching prior to online program change, and enables it to perform system switching upon completion of online program change.

If the communication is interrupted between the redundant CPU module and GX Developer due to cable disconnection or other reason during online program change, the redundant system CPU module cannot complete the online program change and may remain to be disabled from performing system switching. As long as the redundant CPU module is in this status, either of manual system switching or system switching by network module system switching request cannot be performed.

In this case, enable the system switching by performing the following operation, in order to enable the manual system switching or system switching by network module system switching request.

- Turn on the control system CPU module special relay "Disable prohibition of system switching during Online program change" (SM1709).
- Perform online program change again to complete it.

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5.4 Operation Mode Change Function

2 types of redundant system operation mode change are available.

- Change from the backup mode to separate mode
- Change from the separate mode to backup mode

Refer to Section 5.1.3 for details on the backup mode and separate mode.

(1) Operation Mode Change Procedure

The operation mode change is performed in the control system CPU module by the redundant operation of GX Developer.

(a) Changing from the Backup Mode to Separate Mode

- 1) Connect GX Developer to the control system CPU module.
- 2) Select "Online" "Redundant operation" from the menu bar of GX Developer to open the "Redundant operation" window.
- 3) Open the GX Developer online Redundancy Procedure window. Check the "Change operation mode" at the redundant operation area, and then select "Separate mode" from the list.
- 4) Click the Execute button.
- 5) Set the RUN/STOP switch of the standby system CPU module to RUN→STOP→RUN, or use GX Developer to change from remote STOP to remote RUN. With this setting, the CPU module starts running and executes.^{*1}



* 1: When changing from the backup mode to the separate mode, the RUN LED of the standby system CPU module will flash and will be in a stop status.

(b) Changing From Separate Mode to Backup Mode *1

- 1) Connect GX Developer to the control system CPU module.
- 2) Select "Online" "Redundant operation" from the menu bar of GX Developer to open the "Redundant operation" window.
- Open the GX Developer online Redundancy Procedure window. Check the "Change operation mode" at the redundant operation area, than select "Backup mode" from the list.
- 4) Click on the Execute button.



Diagram 5.34 Operation when Changing from Separate Mode to Backup Mode

- * 1: The operation mode can be changed from the separate mode to backup mode by either of the following methods:
 - •Powering on system A and system B simultaneously
 - •Setting the RESET/L.CLR switches of both CPU modules to reset switch neutral position simultaneously.
- (c) Precautions
 - After the operation mode is changed from the separate mode to backup mode, the standby system CPU module resumes the Consistency Check Between Systems A and B.

When returning to the backup mode, make sure to make the settings so that the control system and standby system will be consistent in advance. Refer to Section 5.1.4 for details on the Consistency Check Between Systems A and B. When different GX Developer is used to change the operation mode back to backup mode, the error dialog box (Diagram 5.35) appears.

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If the error dialog box appears, change GX Developer to the one used to change the mode to separate mode or reset the control system CPU module.



Diagram 5.35 Error Dialog Box Displayed on GX Developer

- 3) The operation mode cannot be changed from separate mode to backup mode using GX Developer when the control system CPU module operation is stopped (the "RUN" LED of the CPU module is flashing).
- 4) Operation mode cannot be changed in the following situations:
 - When standby system is powered off or the standby system CPU module is being reset.

If the error dialog box (Diagram 5.36) appears on GX Developer, turn the standby system on again or clear reset on the CPU module and then change the operation mode.



Diagram 5.36 Error Dialog Box Displayed on GX Developer

• When the communication with the standby system is disabled due to tracking cable disconnection.

If the error dialog box (Diagram 5.37) appears on GX Developer, check the tracking cable connection and change the operation mode.

MELS	MELSOFT application				
Ų	The tracking cable has a communication problem. Please execute it again after confirming the state of the tracking cable.				
	<e5:010a4242></e5:010a4242>				
	(OK)				

Diagram 5.37 Error Dialog Box Displayed on GX Developer

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• When the operation mode change request is issued to the standby system CPU module

(If the system switching is executed in the separate mode, the operation mode change request is issued to the new control system CPU module.) If the error dialog box (Diagram 5.38) appears on GX Developer, specify the control system CPU module and make the operation mode change request.

MELSOFT series GX Developer				
Cannot execute this function when the PLC is not control system.				
	<u>OK</u>			

Diagram 5.38 Error Dialog Box Displayed on GX Developer

- When the operation mode change request and the system switching request are issued simultaneously
 - The operation mode will not be changed even after the system switching is completed.

If the error dialog box (Diagram 5.39) appears on GX Developer, after the system switching, repeat the operation mode change.

MELSOFT application		
Operation mode(separates/backup) are switched or the System switching (control) Please execute it again after completing the switch.	standby system) is running cannot execute this function.	
<e5:010a4246></e5:010a4246>		

Diagram 5.39 Error Dialog Box Displayed on GX Developer

• When the operation mode change request is issued to the CPU module in the debug mode

If the error dialog box (Diagram 5.40) appears, cancel Debug Mode in the redundancy parameters. (

Cannot execute this function when the PLC status is debug mode		
ОК		

Diagram 5.40 Error Dialog Box Displayed on GX Developer

• When a hardware failure or watchdog timer error has occurred in the control system CPU module

If the error dialog box (Diagram 5.41) appears on GX Developer, cancel the specified control system CPU error and change the operating mode.

MELS	MELSOFT application				
Ū,	Cannot communicate with PLC for one of the following reasons. Communications timeout Cable error Specified transmission speed not supported for connected PLC Monitor conditions set status is read by device The project PLC and the connected PLC are different. <e5:0160040b></e5:0160040b>				
	OK				

Diagram 5.41 Error Dialog Box Displayed on GX Developer

• During online program change

If the error dialog box (Diagram 5.42) appears on GX Developer, wait for RUN write to complete and then change the operation mode.



Diagram 5.42 Error Dialog Box Displayed on GX Developer

• During memory copy from control system to standby system If the error dialog box (Diagram 5.43) appears on GX Developer, wait for memory copy from the control system to the standby system to complete and then change the operation mode.

MELS	MELSOFT application				
(j)	The memory copy function is being executed. Please execute it again for a while after time.				
	<es:010a4247></es:010a4247>				

Diagram 5.43 Error Dialog Box Displayed on GX Developer

• When a stop error occurs in the control system CPU module (the "RUN" LED: flashing)

If the error dialog box (Diagram 5.44) appears on GX Developer, cancel the control system CPU error and change the operation mode.

MELS	MELSOFT application				
Ū,	Operation mode is being changed (from backup to separates). Please change RUN-LED blink PLC from STOP status to RUN status. After it, Please execute the change of Operation mode again.				
	<es:010a4258></es:010a4258>				
	<u> </u>				

Diagram 5.44 Error Dialog Box Displayed on GX Developer

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(2) Operations When Changing Operation Mode

The CPU module operations after operation mode change and the input/output processing to the remote station are listed in Table5.41. Refer to Table5.41 for operations during operation in the corresponding operation mode.

Function				From Backup Mode to Separate Mode		
Function				Control system	Standby system	
	Operation	Operation statu		Continues execution.	Stops. (Starts operation when the RUN/STOP switch is operated from RUN to STOP to RUN.)	
	Dragrama		IS. STOP, PAUSE, Stop elloi	Stops (continues).	Stops (continues).	
Program	Program execution type				Takes over the current setting.	
execution				Takes over the current setting.	Takes over the current setting.	
	IMASK setting			Takes over the current setting.	Takes over the current setting.	
	DUTY sett	ing		lakes over the current setting.	lakes over the current setting.	
	File registe	er setting		Takes over the current setting.	Takes over the current setting.	
	Instruction instruction	executed over s)	everal scans (dedicated	Continues the instruction execution.	- (since operation was not executed before operation mode change.)	
Device mem	nory (includir	ig special relays	and special registers)	Takes over the current status.	Takes over the current status.	
Signal flow			With tracking setting	Takes over the current status.	Takes over the current status.	
Olghai now			Without tracking setting	Takes over the current status.	Clears.	
	"RUN"	Operation status: RUN		Turns on (continues).	Turns off and then flashing. (Turns on when the RUN/STOP switch is operated from RUN to STOP to RUN.)	
LED		Operation status: STOP, PAUSE, stop error		Turns off (continues).	Turns off (continues).	
	"BACKUP"			ON (green) and then ON (orange).	ON (green) and then ON (orange).	
	Other than "RUN" and "BACKUP"		CKUP"	Takes over the current status.	Takes over the current status.	
	I/O from/to main base unit		Input	Continues execution.	Continues execution.	
			Output	Continues execution.	Starts output.	
	I/O from/to extension base unit		Input	Continues execution.	Does not execute input.	
			Output	Continues execution.	Does not execute output.	
	CC-Link IE Controller Network		Link to CPU	Continues execution.	Continues execution.	
			CPU to link	Continues execution.	Does not execute refresh. (No change from before operation mode change)	
	MELSECNET/H PLC to PLC network		Link to CPU	Continues execution.	Continues execution.	
			CPU to link	Continues execution.	Does not execute refresh. (No change from before operation mode change)	
I/O			Link to CPU	Continues execution.	Continues execution.	
	MELSECNET/H remote I/O network		CPU to link	Continues execution.	Does not execute refresh. (No change from before operation mode change)	
	Auto refres	sh to network	Intelligent module to CPU	Continues execution.	Continues execution.	
	module on	main base unit	CPU to intelligent module	Continues execution.	Continues execution.	
	Auto refres	sh of network	Intelligent module to CPU	Continues execution.	Does not execute auto refresh.	
	module on unit	extension base	CPU to intelligent module	Continues execution.	Does not execute auto refresh.	
	SB/SW ref	resh (CC-Link	Link to CPU	Continues execution.	Continues execution.	[
	IE Controller Network, MELSECNET/H, CC-Link)		CPU to link	Continues execution.	Does not execute refresh. (No change from before operation mode change)	

Table5.41 Operations When Changing Operation Mode

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From Separate Mode to Backup Mode			
Control system	Standby system		
Continues execution.	Stops.		
Stops (continues).	Stops (continues).		
Takes over the current setting.	Takes over the current setting.		
Takes over the current setting.	Changes to the DI status (interrupt disable).		
Takes over the current setting.	Takes over the current setting.		
Takes over the current setting.	Takes over the current setting.		
Takes over the current setting.	Takes over the current setting.		
Continues the instruction execution.	Continues the instruction execution.		
Takes over the current setting.	Takes over the current setting.		
Takes over the current setting.	Takes over the current setting.		
Takes over the current setting.	Takes over the current setting.		
Turns on (continues).	Turns on, flickers and then turns off.		
Turns off (continues).	Turns off (continues).		
Lit orange and then lit green.	Lit orange and then lit green.		
Takes over the current setting.	Takes over the current setting.		
Continues execution.	Continues execution.		
Continues execution.	Stops output.		
Continues execution.	Does not execute input.		
Continues execution.	Does not execute output.		
Continues execution.	Continues execution.		
Continues execution.	Does not execute refresh. (No change from before operation mode change)		
Continues execution.	Continues execution.		
Continues execution.	Does not execute refresh. (No change from before operation mode change)		
Continues execution.	Continues execution.		
Continues execution.	Does not execute refresh. (No change from before operation mode change)		
Continues execution.	Continues execution.		
Continues execution.	Continues execution.		
Continues execution.	Does not execute auto refresh.		
Continues execution.	Does not execute auto refresh.		
Continues execution.	Continues execution.		
Continues execution.	Does not execute refresh. (No change from before operation mode change)		

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Function		From Ba			
		Control system	Standby system		
		Device memory		Continues execution.	
		SM/SD (system dependent)		Stops tracking.	
Data tracking ([] Section 5.5.3) Redundant function Consistency check betwee ([] Section 5.1.4)	Data tracking	SFC information			
	([Section 5.5.3)	PID control instruction information	Stops tracking.		
		Signal flow (with tracking setting)		Stops tracking.	
	Consistency check between System A & B (There are no items to be Stops operation stat	e checked when operation mode change is made. us consistency check between System A & B.	

Table 5.41 Operations When Changing Operation Mode (Continue)

From Se	eparate Mode to Backup Mode
Control system	Standby system
	Continues execution.
	Starts tracking.
Makes consistency chec	k between System A & B for the following items.
When an error is detected, a	a self-diagnostic error occurs in the standby system.
	• File
	Operation status
• N	lain base mounting status
	Parameter valid drive

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(a) Operations When Changing from Backup Mode to Separate Mode

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Diagram 5.45 Operations When Changing from Backup Mode to Separate Mode



(b) Operations When Changing from Separate Mode to Backup Mode

Diagram 5.46 Operations When Changing from Separate Mode to Backup Mode

5	REDUNDANT SYSTEM FUNCTIONS	
Mem	0	
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		<u> </u>
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		TEM
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		3
		BLE
		TRACI
		4
		OR YSTEM
		PROCEI
		5
		STEM
		NT SYS
		¥
		IT SYST
		NDAN
		7
		0 Z
		IONS
		PROG
		8
		ESHOC
	Ed Operation Made Charge Functi	
	5.4 Operation Mode Change Functi	

(3) Processing After Operation Mode Change

Table5.42 indicates the redundant system operations after operation mode change.

In Backup Mode							
		Control System	Standby System				
Item	During Normal RUN and During Continuation Error	During Stop	During Stop Error	During Normal RUN and During Continuation Error	During Stop	During Stop Error	
Program Execution	Executes the program	Does not execute the program					
Signal Flow Memory	Reflects the operation result of the control system.	Holds.		When the setting is "Enable tracking of signal flow memory": Renews the old data into the signal memory flow data tracked from the control system CPU module. When the setting is "No tracking": Holds the current status.			
RUN LED	ON	OFF			OFF		
END Processing	Execu	ites it.		Executes it.			
Consistency Check Between Systems A and B	Does not exec	cute the check	te the check		Executes it. Executes it. Executes the check while the control system is running. Does not execute it when the control system is in STOP status or has developed a stop.		
Tracking	Executes the function			Executes the function		Does not execute the function.	
Program Change in Ladder Mode During RUN	Executable			Executes the online Does not exe	ine program change in the control system. xecute it in the standby system only.		
Writing files in RUN	Executable		Executes system	Executes the function when control system rewritten. Executes system Standby system rewrite only is not pos		system has been not possible	
Input from Input Module on Main Base Unit	Inpu	ıts it	switching	Inputs it			
Output to Output Module on Main Base Unit	on Main Outputs it.			Turns OFF output (Y) during system switching Does not execute output (Y) in the standby system.		Does not output it	
Input from input module on extension base unit	Inpu	ıts it	Does not execute input		ut		
Output to Output module on extension base unit	Outp	uts it.		D	oes not execute outp	out	
Automatic Refresh to Network Module on Main Base Unit (CPU module→ network module)	Executes the function			Executes the function Does not exect output it Executes the function		Does not execute output it	
Automatic Refresh from network Module on Main Base Unit (Network Module→CPU Module)	Executes the function					1	
Auto refresh to network module on extension base unit (CPU module→ network module)	Executes a	uto refresh		Does	s not execute auto re	fresh	
Auto refresh from network module on extension base unit (Network Module→ CPU Module)	Executes a	uto refresh		Does	s not execute auto re	fresh	

Tables 42	Onorationa	After O	norotion	Mada	Change
120165.42	Operations	After U	peration	woae	Change

	MELSEC	Q	series
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In Separate Mode							
	Control System			Standby System			
During Normal RUN and During Resume Error	During Stop	During Stop Error	During Normal RUN and During Resume Error	During Stop	During Stop Error		
Executes the program	Does not exect	ute the program	Executes the program *3	Does not exect	ute the program		
Reflects the operation result of the control system.			Reflects the operation result of the standby system.	Но	lds.		
ON	O	FF	ON	OFF			
	Executes it			Executes it			
Doe	es not execute the ch	leck	Does not execute the check				
E	Executes the functior	١	Executes the function Does not executes the function				
Executes the che	ck on the specified (CPU module only.	Executes only on specified CPU module				
Executes	only on specified CP	rU module	Executes only on specified CPU module				
	Input it		Input it				
Output it		Does not output it	Output it		Does not output it		
	Executes input		Does not execute input				
	Executes output		Does not execute output				
Executes the function		Does not perform output it	Executes the function		Does not perform output it		
Executes the function			Executes the function				
E	Executes auto refrest	'n	Does not execute auto refresh				
E	Executes auto refrest	n	Does not execute auto refresh				

Table 5.42 Operations After Operation mode change (Continue)
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	In Backup Mode						
		Control System		Standby System			
Item	During Normal RUN and During Continuation Error	During Stop	During Stop Error	During Normal RUN and During Continuation Error	During Stop	During Stop Error	
Refresh between CC-Link IE Controller Network CPU Module ↔ Network Module	Executes t	he function	nction		Executes a refresh from the network module to the CPU module. Does not execute a refresh from the CPU module to the network module		
Transient Requested from Other Station in CC-Link IE Controller Network	Executes the function			Executes the function			
Refresh between MELSECNET/H PLC to PLC Network CPU Module ↔ Network Module	Executes the function		F	Executes a refresh from the network module to the CPU module. Executes the function Does not execute a refresh from the CPU module to the network module function switching Executes the function		Executes the function	
Transient Requested from Other Station in MELSECNET/H PLC to PLC Network	Executes the function		switching			1	
Input from MELSECNET/H Remote I/O network (Input Refresh from Network Module to CPU Module)	Inputs it			Inputs it D		Does not input it	
Output to MELSECNET/H Remote I/O net (Output Refresh From CPU Module to Network Module) *1	Outputs it Turns OFF output (Y)			Does not output it			
SB/SW Refresh from Network Module to CPU Module *2	Executes t	he function		Executes the function		ı	
SB/SW Refresh from CPU Module to Network Module *2	Executes t	he function		Executes the	ne function	Does not execute the function	

* 1: When a stop error occurs in both system CPU modules, all output (Y) to the remote I/O station is turned off.

Remote I/O station output can be held when a stop error occurs in both system CPU modules. Please refer to the following manuals for information on how to hold remote I/O station output.

Corresponding MELSECNET/H Network System Reference Manual (Remote I/O network)

MELSEC-Q CC-Link System Master/Local Module User's Manual

* 2: Indicates refresh of SB (Link special relay)/SW (Link special register used for) CC-Link IE Controller Network, MELSECNET/H PLC to PLC network, MELSECNET/H Remote I/O network, and CC-Link.

		In Separa	rate Mode			
	Control System		Standby System			
During Normal RUN and During Resume During Stop Error		During Stop Error	During Normal RUN and During Resume During Stop Error		During Stop Error	
Executes t	ne function	Does not execute the function	Executes refresh from r mod Does not execute refres network	Does not execute the function		
	Executes the function		Executes the function			
Executes t	ne function	Does not execute the function	Executes refresh from r mod Does not execute refres network	Does not execute the function		
Executes the function			Executes the function			
Inputs it		Inputs it	Inputs it		Inputs it	
Outputs it Turns OFF output (Y)		Does not output it	Does not output it			
Executes the function			Executes the function			
Executes th	ne function	Does not execute the function	Executes t	he function	Does not execute the function	

* 3: When changing from the backup mode to separate mode, the RUN LED will flash and programs will not be executed.

Set the RUN/STOP switch of the standby system CPU module to RUN \rightarrow STOP \rightarrow RUN, or use GX Developer to change from remote STOP to remote RUN. With this setting, the CPU module starts running and executes programs

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5.5 Tracking Function

5.5.1 Tracking Function Overview

(1) Tracking Function

The tracking function maintains the data of the control system and standby systems consistent so that the redundant system can continue to operate with the standby system in case the control system goes down.

As the tracking data settings have been made by the default in the redundant CPU,

tracking can be done without changing the tracking settings. *1

Tracking can be done in either backup mode or separate mode. *2



Diagram 5.47 Data Transfer by Tracking Function

- * 1: Following tracking data are set by default:
 - Internal devices
 - SFC data
 - PID control instruction data
 - Refer to Section 5.3 for the tracking data setting.
- * 2: Please refer to Section 5.5.3, for data tracking in the backup mode and separate mode.
- * 3: If the data for tracking is changed, data after the change will be tracked.

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(2) Tracking Data

There are 2 types of tracking data: tracking data based on the range set by the user and tracking data regardless of the settings, i.e., automatic tracking data.

(a) Tracking Data Range Setting by User

The tracking data range and tracking timing can be set by the user. As the tracking data range has been set by default in the redundant CPU, tracking will be executed even without the user making the tracking settings.

(b) Automatic Tracking Data

The data will be automatically tracked regardless of the tracking settings. The automatic tracking data range cannot be changed by the user.

Refer to Section 5.5.3 for details on the tracking data settings.

(3) Changing Tracking Data Settings

The tracking data range settings can be changed in the following cases:

- To shorten the tracking time
- To add to the tracking data (file register, etc.)
- To change the tracking timing in a program
- To track signal flow memory

Change the tracking data setting at the tracking settings in the redundant parameter settings of GX Developer.

Refer to Section 5.5.4 for details on changing the tracking data settings.

Remark, When changing the tracking data settings at the tracking settings in the redundant parameter settings, the data can be divided into blocks (tracking block). Each block can be set to be tracked or not for each scan with the special relay for data tracking execution (Data tracking block specification trigger: SM1520 to SM1583).

Refer to Section 5.5.5, for details on tracking blocks and tracking triggers.

(4) Precautions

Tracking transfer cannot be performed in the following cases. Scan time will shorten by the tracking transfer time.

(a) The tracking cable is disconnected or is a failure. (TRK. DISCONNECT (error code: 6130))

Make sure the tracking cable is connected or change the cable.

(b) If the following malfunctions occur on the standby system:

- Standby system power is off
- A stop error occurs on the standby system CPU module
- The standby system CPU module is resetting

(Tracking can be performed if reset is cleared.)

When tracking device setting is not made, the program is executed with the values before refresh at first scan after system switching. Set the following devices as tracking devices.

- Device that makes auto refresh setting to the intelligent function module on the extension base unit with GX Configurator
- Device that makes auto refresh setting to the CC-Link master module on the extension base unit

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5.5.2 Tracking Execution Procedure



The procedure for executing tracking in Diagram 5.48.

5.5.3 Tracking Data

Tracking data are listed in Table5.43.

			Auto	Setting	Operating Mode ^{*3}	
	Туре	Description	Tracking ^{*1}	Change by User ^{*2}	Backup Mode	Separate Mode
Internal Device		Data of input (X), output (Y), internal relay (M) and others used in programs	○ ^{*4}	0	0	0
Device S Data S R	Special Relay	Data turned ON or OFF by user or system	0	\times *5	0	0
	Special Register	Data stored by user or system ([Table5.47)	0	\times *5	0	0
Signal Flo	w Memory	Data that determines whether the rise and fall instructions will be executed or not in sequence programs	×	0	0	×
SFC data		Data used to execute SFC	0	×	0	×
PID Contro data	ol Instruction	PID control data specified by PIDINIT and S.PIDINIT instructions	0	×	0	×

Table5.43 Tracking Data

* 1: \bigcirc Auto tracking enabled, \times Auto tracking disabled

* 2: \bigcirc Setting change enabled, \times Setting change disabled

* 3: \bigcirc Tracking enabled, \times Tracking disabled

* 4: The device range set by default will be transferred.

* 5: The control system and standby system use different special relay and special register areas (SM/SD) for storing some information, such as system information. If data in these areas are transferred from the control system to the standby system, the system does not operate properly. Do not transfer data in these areas.

(1) Tracking Data Range Setting by User

The tracking data range and tracking timing can be set by the user.

This applies to the internal devices and signal flow memory. (Set whether the signal flow memory will be tracked or not.)

Up to 100K words of internal devices and signal flow memory can be transferred for each tracking.

(a) Internal devices

Internal devices are data of input (X), output (Y), internal relay (M) and others used in programs.

Table5.44 lists the internal devices that can be tracked.

1) Internal Device Default Setting Range

The default tracking range is set to the internal devices as listed in Table5.44. When changing the number of the device points to be used in the PLC parameter device setting using GX Developer, the number after change will be the tracking range.

By default, all device points in the tracking range are to be tracked.

Device	Default Tracking Range	Tracking Range Set by User
Input	X0 to X1FFF	X0 to X1FFF
Output	Y0 to Y1FFF	Y0 to Y1FFF
Internal relay ^{*1}	M0 to M8191	M0 to M8191
Latch Relay ^{*1}	L0 to L8191	L0 to L8191
Step Relay	S0 to S8191	S0 to S8191
Annunciator *1	-	F0 to F2047 *7
Edge Relay ^{*1}	V0 to V2047	V0 to V2047
Link Relay ^{*1}	B0 to B1FFF	B0 to B1FFF
Link Special Relay	-	SB0 to SB7FF *6
Timer (Contact Points and Current Value) ^{*1}	T0 to T2047	T0 to T2047
Retentive Timer (Contact Points and Current Value)	*2	*2
Counter (Contact Points and Current Value) ^{*1}	C0 to C1023	C0 to C1023
Data Register *1	D0 to D12287	D0 to D12287
Link Register *1	W0 to W1FFF	W0 to W1FFF
Link Special Register	-	SW0 to SW7FF *6
Index Register	Z0 to Z15	Z0 to Z15
Special Relay	*3	*5
Special Register	*4	*5
File Register	-	ZR0 to ZR1042431

Table5.44 Internal Devices That Can Be Tracked

- : Indicates data that is set to be not tracked by default.

* 1: The number of device points to be used can be changed in the PLC parameter device settings using GX Developer.

If the number of points to be used is changed, the number after change will be the "default tracking range" or the "tracking range set by user."

* 2: The number of retentive timer points is 0 by default. When setting the number of retentive timer points to be used in the PLC parameter device settings of GX Developer, the set number will be the "default tracking range" or the "tracking range set by user."

- * 3: For the special relays, the data in the range listed in Table5.46 will be automatically tracked:
- *4: For the special registers, the data in the range listed in Table5.47 will be automatically tracked:
- * 5: Special relays and special registers used in the redundant system are transferred automatically. The tracking transfer range cannot be set by the user.
- * 6: Do not perform the tracking transfer to the link special relay (SB) and link special register (SW) used in the network module system since they are the data inherent to stations.
- * 7: Refer to Section 7.3 for the processing to be performed when the annunciator is tracked.



Please use the following settings when changing the internal device settings:

- Bit devices (including timer, retentive timer, counter) Multiples of 16 of the beginning device number Transfer range is set in 16 point units
- Word device
- Set in 1 point units

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2) Changing the Internal Device Settings

Internal device settings are changed in the following cases:

Objective	Tracking Setting
To shorten tracking time	 Change the settings so that only the devices actually used will be tracked. Divide the tracking data range into multiple blocks and change the tracking timing for each block.
To add file register or annunciator	Set the file register or annunciator to tracking blocks No. 1 to 64.
Program tracking timing to any time.	 Change the settings so that the tracking trigger of tracking block No. 1 will be turned on and off manually. Divide the tracking data range into multiple blocks and turn the tracking trigger of each block on and off in the program.

Table5.45 Internal Device Settings Change

(b) Signal Flow Memory

Signal flow memory records the operation execution result of each sequence program step, i.e., whether each sequence program step was executed or not. The signal flow memory information determines whether the rise, fall and SCJ instructions will be executed or not.

1) Default Tracking Settings

By default, signal flow memory is set to be not tracked.

2) Changing the Tracking Setting

When signal flow memory has not been tracked, the rise, fall and SCJ instructions may not function normally in the new control system after system switching.

In order to ensure these instructions function even if system switching occurs, change the settings so that signal flow memory will be tracked.

This setting reduces the number of internal device points that can be tracked at a time by 16K words.

- 1. Precautions when disabling signal flow memory from being tracked
 - Rise instruction (PLS, P, SP.)
 Even if the execution condition is changed from off to on during system switching, the rise instruction will not be executed after system switching.
 - Fall instruction (LDF, ANDF, ORF, MEF, PLF)
 If the execution condition is off during system switching, the fall instruction will be executed after system switching.
 - SCJ instruction If the execution condition is on during system switching, the SCJ instruction will jump to the specified pointer without waiting 1 scan.
- 2. Signal flow memory tracking capacity Signal flow memory as much as program capacity will be tracked.

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(2) Automatic Tracking Data

Automatic tracking data is the data that the redundant CPU tracks regardless of the redundant parameter tracking settings.

The data settings cannot be changed by changing the redundant parameter tracking settings.

This applies to the SFC data, PID control instruction data, and some special relays and special registers.

(a) SFC data

SFC data is necessary for continuing the SFC program. SFC data is tracked when using the SFC program in the backup Mode.

(b) PID control instruction data

PID control instruction data to be automatically tracked is the data that is specified for PID control by the PIDINIT and S.PIDINIT instructions.

The PID control data is tracked when executing the PIDINIT and S.PIDINIT instructions in the backup mode.

(c) Special Relay

Table5.46 lists the automatically transferred special relay areas. Data in the special relay are transferred only in Backup Mode. Do not transfer data in the special relay areas other than those listed in Table5.46.

Table5 46 Automatically	Transferred S	Special Rela	v Areas
Tables. to Automatical	y manalemed c		y Alcus

Number	Name	Number	Name		
SM00 to SM00	Startup watchdog timer for step transition	SM701	Number of output characters selection		
310190 10 310199	(Enabled only when SFC program exists)	3101701			
SM202	LED OFF command	SM702	Search method		
SM206	PAUSE enable coil	SM703	Sort order		
SM210	Clock data set request	SM710	CHK instruction priority ranking flag		
SM213	Clock data read request	SM715	El flag		
SM250	Max. loaded I/O read	SM722	BIN/DBIN instruction error disabling flag		
SM254	All stations refresh command	SM774	PID bumpless processing (for complete		
51012.54		311/14	derivative)		
SM255 to SM257	MELSECNET/H module 1 information	SM775	Selection of link refresh processing during COM		
510255 10 510257		510175	instruction execution		
SM260 to SM262	MELSECNET/H module 2 information	SM776	Enable/disable local device at CALL		
SM265 to SM267	MELSECNET/H module 3 information	SM777	Enable/disable local device in interrupt program		
SM270 to SM272	MELSECNET/H module 4 information	SM794	PID bumpless processing (for incomplete		
5101270 10 5101272			derivative)		
SM321	Startup/stop SEC program	SM1500	Hold mode (SIN SOUT instruction)		
0101021		SM1501			
SM322	SEC program start status	SM1520 to	Data tracking block specification trigger		
010022	or o program start status	SM1583			
SM323	Presence/absence of continuous transition for	SM1591	Standby system error detection disable flag at		
011020	entire blocks	Cimitos i	system switching		
SM325	Output mode at block stop	SM1592	Enable/disable user system switching		
SM326	SEC device clear mode	SM1598	Copy contents of standard ROM during memory		
01020		0111000	сору		
SM327	Output during end step execution	SM1649	Standby system cancel error flag		
SM402	After RUN, ON for 1 scan only	SM1700	Disable prohibition of system switching during		
OM-TOZ		CMITIOS	online program change		
SM403	After RUN, OFF for 1 scan only	SM1710	Transfer tracking data during online program		
SM551	M551 Reads module service interval		change enable flag		

(d) Special register

Table5.47 lists the automatically transferred special register areas. Data in the special register are transferred only in Backup Mode. Do not transfer data in the special register areas other than those listed in Table5.47.

Table5.47 Automatically Transferred Special Register Areas

Number	Name
SD90 to SD99	Step transition monitoring timer setting value (Enabled only when SFC program exists)
SD207 to SD209	LED display priority ranking
SD210 to SD213	Clock data
SD250	Loaded maximum I/O
SD315	Time reserved for communication processing
SD414	2n second clock setting
SD415	2nms clock setting
SD550	Service interval measurement module
SD774 to SD775	PID limit setting (for complete derivative)
SD778	Refresh processing selection when the COM/CCOM instruction is executed
SD794 to SD795	PID limit setting (for incomplete derivative)
SD1500 to SD1501	Basic period
SD1649	Standby system error cancel command
SD1710	Waiting time for online program change (standby system)

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5.5.4 Tracking Data Settings

Make the tracking data settings at Tracking settings in Redundant parameter in GX Developer.

If no tracking settings are made by the user, Tracking device settings will be set to "Internal device block setting" (default) and tracking will be executed based on "Default Tracking Range" in Table 5.44 in Section 5.5.3 (1).



Diagram 5.49 Tracking setting Window

ltem			Range	Default	Reference
1	Tracking device setting		Internal device block setting	Internal device block patting	Section
			Device detail settings	Internal device block setting	5.5.3
2	Signal flow memory trackin	a setting	No tracking	No tracking	Section
2		g setting	 Enable tracking of signal flow memory 	No liacking	5.5.3
3	Tracking block No		• 1 to 64	1	Section
5	Tracking block No.			I	5.5.5
		Device		Table5 44 Default Tracking	Section
4	Device range Settings ^{*1}	Points / Start	Table5.44 Tracking Range Set by User	Range	553
		Start / End		Tange	5.5.5
5	Tracking characteristics setting		Synchronized tracking mode	Synchronized tracking mode	Section
5			 Program priority mode 	Synchronized tracking mode	5.5.7
6	Do auto forward Tracking h	lock No. 1	Do auto forward Tracking block No. 1	Do auto forward Tracking	Section
0	Do auto forward fracking block No. 1		Do not auto forward Tracking block No. 1	block No. 1	5.5.5
		Target	Memory card (SRAM)		
		memory	Standard RAM		_
7	File register		Sets tracking file register file name		
	file settings *2	File name	 Up to 8 half-width characters 	-	_
			Cannot include the following characters:		
			\ /:;*?<> +=[].,		

- * 1: The following is the setting range in the detailed device settings:
 - •1 to 2048 devices can be set for one block
 - The total of the number of devices for all blocks is 2048 (maximum).
 - •The device range settings for the timer, retentive timer and counter device will be doubled.
 - •Tracking device capacity per block is up to 100K words, including single flow memory tracking capacity (16K words).
 - •Tracking device points per range are:
 - Bit device: 0 to 32767 (set in 16 point units)
 - Timer, retentive timer and counter: 0 to 32767 (set in 16 point units)
 - Word device: 0 to 32767 (set in 1 point units)
- * 2: The file register file can be set in each tracking block.
- * 3: 16 device points of timer, retentive timer and counter is equivalent to 18 words.

- The same device No. cannot be set in 2 ranges for 1 tracking block. If the same device No. is set in 2 ranges in the tracking settings of GX Developer, an error will occur in GX Developer.
- As 100K words can be set in one block and up to 64 blocks can be set, up to 6,400K words can be set as a total at the tracking settings in the redundant parameter settings of GX Developer.

However, up to 100K words can be tracked for each scan. When setting tracking data to multiple tracking blocks, make sure that tracking capacity is within 100K words for each scan. OVERVIEW

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5.5.5 Tracking Block And Tracking Trigger

(1) Tracking Blocks

(a) Tracking Block Overview

The internal device tracking range can be divided into multiple blocks, i.e., tracking blocks (tracking block No. 1 to 64) at the tracking settings in the redundant parameter settings of GX Developer.

(b) Tracking the Tracking Blocks

Set whether the tracking block will be tracked or not with the data tracking block specification trigger (SM1520 to SM1583) that corresponds to the target tracking block.

When the data tracking block specification trigger is turned ON, the device data set to the corresponding tracking block No. will be tracked.

[Program Example]





Diagram 5.50 Tracking Operation Timing by Tracking Trigger

(c) Default Tracking Block Setting

When the tracking settings are not made (default settings), devices will be set to tracking block No.1, based on the Default Tracking Range in Table5.44.



Table 5.42 "Default Transfer Range" is set.



(d) Caution When Dividing Into Multiple Blocks

1) When tracking multiple blocks at a time, make sure that the tracking capacity is within 100K words.

If the tracking capacity exceeds 100K words, the continuation error "TRK. SIZE ERROR (error code: 6110) will occur and tracking cannot be performed.

2) When multiple blocks are set for tracking, they will be tracked in the setting order starting from the one of lowest No.

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(2) Tracking Trigger

(a) Tracking Trigger Overview

A tracking block trigger is a special relay that determines whether to track the multiple blocks of internal device data.

Tracking block triggers are assigned to each tracking block. (FF Table5.49.) When executing tracking, turn on the tracking trigger that corresponds to each tracking No. to execute tracking in the program.

(b) Setting Tracking Trigger for Tracking Block No. 1

It is possible to make the settings at the tracking settings in the redundant parameter settings, so that the data tracking trigger (SM1520) for tracking block No. 1 will turn on automatically when power is turned on.

(By default, the tracking trigger for tracking block No. 1 turns on automatically and automatically tracks the device data in tracking block No. 1.)

Number	Name	Description	Default	Set By User or System
SM1520	Tracking Block No. 1 Tracking Trigger	OFF: No trigger ON: Trigger	 When setting batch of internal devices at the tracking: Turns on at the time of power ON/ reset/STOP to RUN. When the detailed device settings are made at the tracking settings: The trigger turns on at the time of power ON/ reset/STOP to RUN, if tracking block No. 1 is set to be tracked in the automatic tracking parameter. Turn off if tracking block No. 1 is set to not to be tracked in the automatic tracking parameter. 	System / User
SM1521	Tracking Block No. 2 Tracking Trigger			
SM1522	Tracking Block No. 3 Tracking Trigger			
SM1523	Tracking Block No. 4 Tracking Trigger			
SM1524	Tracking Block No. 5 Tracking Trigger]		
SM1525	Tracking Block No. 6 Tracking Trigger]		
SM1526	Tracking Block No. 7 Tracking Trigger]		
SM1527	Tracking Block No. 8 Tracking Trigger			
SM1528	Tracking Block No. 9 Tracking Trigger			
SM1529	Tracking Block No. 10 Tracking Trigger			
SM1530	Tracking Block No. 11 Tracking Trigger	OFF: No trigger	OFF	User
SM1531	Tracking Block No. 12 Tracking Trigger	ON: Trigger		0001
SM1532	Tracking Block No. 13 Tracking Trigger			
SM1533	Tracking Block No. 14 Tracking Trigger			
SM1534	Tracking Block No. 15 Tracking Trigger			
SM1535	Tracking Block No. 16 Tracking Trigger			
SM1536	Tracking Block No. 17 Tracking Trigger			
SM1537	Tracking Block No. 18 Tracking Trigger			
SM1538	Tracking Block No. 19 Tracking Trigger			
SM1539	Tracking Block No. 20 Tracking Trigger			
SM1540	Tracking Block No. 21 Tracking Trigger			

Table 5.49 Tracking Triggers

Table5.49 Tracking Triggers (Continued)

Number	Name	Description	Default	Set By User or System	EW
SM1541	Tracking Block No. 22 Tracking Trigger				ERVI
SM1542	Tracking Block No. 23 Tracking Trigger				20
SM1543	Tracking Block No. 24 Tracking Trigger				2
SM1544	Tracking Block No. 25 Tracking Trigger				
SM1545	Tracking Block No. 26 Tracking Trigger				
SM1546	Tracking Block No. 27 Tracking Trigger				NO
SM1547	Tracking Block No. 28 Tracking Trigger				IRAT
SM1548	Tracking Block No. 29 Tracking Trigger				FIGL
SM1549	Tracking Block No. 30 Tracking Trigger				LSYS1
SM1550	Tracking Block No. 31 Tracking Trigger				
SM1551	Tracking Block No. 32 Tracking Trigger				3
SM1552	Tracking Block No. 33 Tracking Trigger				
SM1553	Tracking Block No. 34 Tracking Trigger				Щ
SM1554	Tracking Block No. 35 Tracking Trigger				CAB
SM1555	Tracking Block No. 36 Tracking Trigger				UNG
SM1556	Tracking Block No. 37 Tracking Trigger				ACK ZACK
SM1557	Tracking Block No. 38 Tracking Trigger				Ë
SM1558	Tracking Block No. 39 Tracking Trigger				Δ
SM1559	Tracking Block No. 40 Tracking Trigger				-
SM1560	Tracking Block No. 41 Tracking Trigger				R
SM1561	Tracking Block No. 42 Tracking Trigger				P A P
SM1562	Tracking Block No. 43 Tracking Trigger	OFF: No trigger	OFF	User	
SM1563	Tracking Block No. 44 Tracking Trigger	ON: Higger			RTIN
SM1564	Tracking Block No. 45 Tracking Trigger				STA STA
SM1565	Tracking Block No. 46 Tracking Trigger				
SM1566	Tracking Block No. 47 Tracking Trigger				Ð
SM1567	Tracking Block No. 48 Tracking Trigger				LEM
SM1568	Tracking Block No. 49 Tracking Trigger				SYSI
SM1569	Tracking Block No. 50 Tracking Trigger				NT (
SM1570	Tracking Block No. 51 Tracking Trigger				
SM1571	Tracking Block No. 52 Tracking Trigger				LINC
SM1572	Tracking Block No. 53 Tracking Trigger				ССL
SM1573	Tracking Block No. 54 Tracking Trigger				6
SM1574	Tracking Block No. 55 Tracking Trigger				Σ
SM1575	Tracking Block No. 56 Tracking Trigger				STE
SM1576	Tracking Block No. 57 Tracking Trigger				T S/
SM1577	Tracking Block No. 58 Tracking Trigger				DAN
SM1578	Tracking Block No. 59 Tracking Trigger				
SM1579	Tracking Block No. 60 Tracking Trigger				R N N N
SM1580	Tracking Block No. 61 Tracking Trigger	1			7
SM1581	Tracking Block No. 62 Tracking Trigger	1			
SM1582	Tracking Block No. 63 Tracking Trigger	1			
SM1583	Tracking Block No. 64 Tracking Trigger				MING

5.5.6 Tracking Execution

When a tracking trigger is turned on, device data of the tracking block No. that corresponds to the tracking trigger will be tracked.

Tracking target data is different depending on the operation mode and the operating statuses of both systems.

(1) In Backup Mode

The tracking target data in backup mode are listed in Table5.50 according to the operating status in both systems.

Table5.50 Tracking Target Data According to Operating Statuses of Both Systems

Operating Status		Tracking Data				
	Standby System	Device Data ^{*1}				
Control System		Internal Device	Special Relay and Special Register	Signal Flow	SFC Data	PID Control Instruction Data
RUN	RUN	0	0	0	0	0
	STOP PAUSE	0	0	0	0	0
	Stop Error	×	×	×	×	×
STOP PAUSE	RUN	0	0	0	0	0
	STOP PAUSE	0	0	0	0	0
	Stop Error	×	×	×	×	×

 \bigcirc :Tracked, \times :Not tracked

* 1: Device data

•Indicates the internal devices set at the tracking settings in the redundant parameter settings.

(Section 5.5.3)

 $\ensuremath{\cdot}$ Indicates the special relays and special registers that will be automatically tracked.

(Section 5.5.3)
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(2) In Separate Mode

The tracking target data in separate mode are listed in Table5.51 according to the operating status in both systems.

Operating Status		Tracking Data					
		Device Data ^{*1}					
Control System	Standby System	Internal Device	Special Relay and Special Register	Signal Flow	SFC Data	PID Control Instruction Data	
	RUN	0	×	×	×	×	
RUN	STOP PAUSE	0	×	×	×	×	
	Stop Error	×	×	×	×	×	
	RUN	0	×	×	×	×	
STOP PAUSE	STOP PAUSE	0	×	×	×	×	
	Stop Error	×	×	×	×	×	
Stop Error	RUN	×	×	×	×	×	
	STOP PAUSE	×	×	×	×	×	
	Stop Error	×	×	×	×	×	

Table5.51 Tracking Data By System Operating Status

 \bigcirc :Performs tracking , $~\times$:Does not perform tracking

* 1: Device data:

•Internal device refers to device set in the redundancy parameters tracking setting.

(Section 5.5.3)

•Special relays and special registers refers to the automatically tracked special relay and special register.

(Section 5.5.3)

5.5.7 Tracking Mode

Tracking mode determines processing when a new tracking request occurs before the previous tracking processing is completed.

(If the previous tracking has been completed while the control system CPU module is executing the END processing, the next tracking will be initiated.)

There are 2 types of tracking modes:

- Synchronous tracking mode
- Asynchronous tracking mode
- (1) Tracking Mode For Each Operation Mode and System Operating Status Tracking mode is determined by the operation mode and system operating status as listed in Table5.52.

Operating Status		Operation Mode				
Control System	Standby System	Backup Mode	Separate Mode	Backup Mode to Separate Mode	Separate Mode to Backup Mode	
	RUN	Synchronous tracking mode ^{*3}		Synchronous to asynchronous tracking mode ^{*1}	Asynchronous to synchronous tracking mode ^{*2}	
RUN	STOP PAUSE Stop Error				A	
STOP PAUSE	RUN STOP PAUSE Stop Error	tracking mode	Asynchronous tracking mode	tracking mode	tracking mode	
Stop Error	RUN STOP PAUSE Stop Error	-		_	-	

Table5.52 Tracking Mode by Operation Mode and System Operating Status

* 1: Tracking mode will change to asynchronous mode when the backup mode is changed to separate mode.

* 2: Tracking mode will change to synchronous mode within maximum 150ms after the separate mode is changed to backup mode.

* 3: When the special relay "Device memory tracking during RUN write (SM1710)" is turned on to execute tracking during online program change, tracking during online program change is executed in the asynchronous tracking mode. (Section 5.6.2)

(2) Synchronized Tracking Mode

This method performs tracking to the standby system for each scan while the control system CPU module is executing the END processing.

If the previous tracking is not complete during END processing, the system will wait and perform the next tracking after it has been completed.

2 types of synchronized tracking modes are available: synchronized tracking mode and program priority mode.

The default tracking mode is synchronized tracking mode.

Change the tracking mode settings at the tracking settings in the redundant parameter settings.

(a) Synchronized Tracking Mode

In synchronized tracking mode, the control system CPU stands from tracking start to finish, and executes the scan execution type program upon tracking completion.

For this reason, when system switching occurs, the new control system CPU starts operation based on the scan tracking data of up to 1 scan before However, scan time increases by the amount of tracking time.





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(b) Program Priority Mode

In program priority mode, the control system CPU module executes the scan execution type program as soon as tracking starts.

If tracking time is longer than program execution time, the next tracking cannot start until the current tracking is completed.

In this mode, the scan time can be made shorter than in synchronized tracking mode.

However, if system switching occurs, the new control system CPU starts operation based on the tracking data of up to 2 scans before.



1) tracking when program run time \geq tracking time

Device data for new control system CPO module



2) Tracking when program run time < tracking time



Diagram 5.54 Tracking Operation Timing When Program Execution Time < Tracking Processing Time

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(3) Asynchronous Tracking Mode

In this mode, the control system CPU prioritizes program operation over tracking processing.

If the previous tracking has not been completed before the END processing, the control system CPU module suspends the next tracking and performs the program operation.

(a) Tracking when Control System is in RUN, Standby System is in STOP and System is in Backup Mode



1) tracking when program run time \geq tracking time

Diagram 5.55 Tracking Operation Timing When Program Execution Time ≥ Tracking Processing Time

2) Tracking when program run time < tracking time



Diagram 5.56 Tracking Operation Timing When Program Execution Time < Tracking Processing Time

Scan time Prepare Tracking data 3) Prepare Tracking Prepare Tracking data 1) data 2) program 3) END/0 Run 0 Run Control system 0 Run program 4) Run END/0^{Run} program 5) program 6) Run Run END END 0 CPU module program 1) program 2) Ŷ New Standby system CPU module Send Send Send Tracking Tracking Tracking ₽ ┛ _ processing 1) processing 2) processing 3) Receive Receive Receive END/0 I Run program 2) END END 0 0 Run program 1) Run program 3) Run program 4) Standby system CPU module Adjust Tracking Adjust Tracking data 1) data 2)

MELSEC Q series

(b) Tracking in Separate Mode

Diagram 5.57 Tracking Operation Timing in Separate Mode

5.5.8 Device Data Used By The New Control System

When the tracking from the control system CPU module is complete, the standby system CPU stores the received tracking data into the specified devices sequentially. When system switching occurs, the new control system CPU begins operation based on the received tracking data, which varies depending on the reception condition at the time of system switching.

Table5.53 lists the device data used by the new control system CPU module depending on the tracking data reception condition.

	Tracking Data Not Received	Tracking Data Received		
System Switching Timing		Popolying Tracking Data	Reception of Tracking Data	
		Receiving fracking Data	Completed *1	
Device in which Initial Value is	CPU Module Device Data	CPI I Module Device Data	Received Tracking Data	
not set				
Device in which Initial Device	Preset Initial Device Data	CPU Modulo Dovico Data	Received Tracking Data	
Value is set				

[Tracking in Program Synchronized Mode]

Table5.53 Device Data Used by New Control System CPU Module

* 1: If received tracking data is not stored in the specified device, the CPU module will begin operation after storing tracking data in the specified device.



Diagram 5.58 Tracking Operation Timing in Program Synchronized Mode

REDUNDANT SYSTEM **5** REDUNDANT SYSTEM **5** REDUNDANT SYSTEM

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5.6 Online Program Change for Redundancy

In the backup mode, GX Developer writes the same program to the control system and standby system CPU modules to keep them consistent.

Write to the control system and standby system is executed in the following conditions:

- Writing to the CPU module that is in STOP status (Section 5.6.1)
- Writing to the CPU module that is running (Section 5.6.2)

5.6.1 Writing to the CPU Module in STOP Status

(1) Operation Outline

When writing the parameters and programs either system CPU module, GX Developer will write the same parameters and programs to the other system as well.

(2) Write Order

GX Developer writes to the control system first and then the standby system, regardless of connection route, i.e., the system to which GX Developer is connected. The following diagram shows the writing operation on the assumption that GX Developer is connected to the standby system. (Write of program B to the control system and standby system is executed in the order (1) and (2).)



Diagram 5.59 Write Order

(3) Precautions

(a) If programs cannot be written to the standby system CPU module

In the following cases, the data will be written into only the CPU module to which GX Developer is connected:

- · Either or both powers on control system/standby system are OFF
- · Either or both CPU modules on control system/standby system are in RESET
- Either or both systems have a hardware failure
- Either or both CPU modules on control system/standby system have "Watchdog timer error (error code: 5000 or 5001)"
- Tracking cable disconnection or malfunction

In these cases, the error dialog box in Diagram 5.60 will appear on GX Developer.

MELS	OFT application
Ų	Connected system has a communication problem. Please execute it again after confirming the state of connected system and the state of the tracking cable.
	<e5:010a4245></e5:010a4245>
	OK]

Diagram 5.60 Error Dialog Box Displayed on GX Developer

(b) Operations prohibited during online program change

Do not perform the following operations in either control system or standby system during online program change:

- System power OFF
- CPU module reset
- Tracking cable connection or disconnection

If any of the above operations is performed, "Consistency check between system A and B" may cause the "FILE DIFF. (error code: 6000) stop error in the standby system CPU module.

In addition, the error dialog box in Diagram 5.61 will appear on GX Developer that wrote the program.

MELSOFT application				
(į)	Connected system has a communication problem. Please execute it again after confirming the state of connected system and the state of the tracking cable.			
	<e5:010a4245></e5:010a4245>			
	ОК			

Diagram 5.61 Error Dialog Box Displayed on GX Developer

If the dialog box appears, eliminate the error cause displayed in the dialog box, and write the program to the CPU modules again.

(c) Writing a program via module mounted to extension base unit Writing a program via a module mounted to the extension base unit is disabled. REDUNDANT SYSTEM NETWORKS

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(d) Access to files being written

The files being written by GX Developer cannot be accessed by other GX Developer.

If you access the files being written, the error dialog box in Diagram 5.62 will appear:

MELSOFT application				
į)	Processing is in progress from another peripheral device. Please wait until the other processing is completed, then execute again. <es:010a4025></es:010a4025>			
	ОК]			

Diagram 5.62 Error Dialog Box Displayed on GX Developer

Access the files again after the writing operation has been completed.

(e) Write to files being accessed by another GX Developer

If data is tried to be written to the files being accessed by another GX Developer, the error dialog box in Diagram 5.63 will appear.

MELSOFT application					
į,	Processing is in progress from another peripheral device. Please wait until the other processing is completed, then execute again. <e5:010a4025></e5:010a4025>				
	OK				

Diagram 5.63 Error Dialog Box Displayed on GX Developer

After the current processing ends, write the data to the CPU module again.

(f) Write Processing in Separate Mode

In the separate mode, GX Developer writes to the CPU module of the system that is specified in the connection target settings.

GX Developer will not write to the CPU module of the system that is not specified in the connection target settings

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(g) Writing of CC-Link parameter setting

If writing to the programmable controller with setting 5 or more at "No. of boards in module" in CC-Link network parameter while the following conditions are met, the error dialog box in Diagram 5.63 appears.

- The first five digits of serial number for the Redundant CPUs is "09101" or lower.
- GX Developer version is 8.58L or later.

MELSOFT series GX Developer				
(Process will be interrupted, because there are no corresponding parameters for connected PLC. The following causes are expected.			
	5 or more is set in the No. of boards in modules in the CC-Link parameters.			
	<u>OK</u>			

Diagram 5.64 Error dialog box appearing on GX Developer

Clicking the OK button displays the following error dialog box. Replace the Redundant CPU by the one whose first five digits of serial number is "09102" or higher.

MELSOF	T series GX Developer 🛛 🛛 🔀				
(j)	Some error has occurred while processing. Please check the status.				
v	[system A] Parameter NG				
(COK					

Diagram §	5.65 First five digits of serial number for	the Di	a
F	Redundant CPU on system A is "09101'	or lower.	

MELSOF	T series GX Develop	er 🔀
(j)	Some error has occurred Please check the status	d while processing. :.
V	[system A] Parameter Program	ОК ОК
	[system B] Parameter	NG
	OK)	

Diagram 5.66 First five digits of serial number for the Redundant CPU on system A is "09102" or higher and that for the Redundant CPU on system B is "09101" or lower.

5.6.2 Program Change While CPU is Running

Data are written to both systems while CPU is running, in the following cases:

- Online program change
- Writing files in RUN
- T/C set value change

Refer to the following manual for details on the above operations.

CF Qn(H)/QnPH/QnPRHCPU User's Manual (Function Explanation, Program Fundamentals)

(1) Operations When Changing Programs While CPU is running

When changing the program of the control system CPU module during RUN in the backup mode, the same program will be written to the standby system CPU module. Even if a stop error occurs in the control system during the online program change and system switching occurs, the online program change to both systems will continue.

(2) Procedure for Writing to the Control System and Standby System

When performing the online program change to the control system CPU module by GX Developer, regardless of the connection route.

When the online program change is performed to the control system CPU module, data will be written to the control system and standby system CPU modules.

Diagram 5.65 shows the operation in the case of program change in ladder mode during RUN.

(The program change in ladder mode during RUN is executed in the order (1) and (2).)



Diagram 5.65 Procedure for Writing to Control System and Standby System When Program Is Changed during CPU RUN

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(3) Tracking Execution During Online Program Change

Use the special relay "SM1710" (Transfer tracking data during online program change enable flag) to enable or disable the tracking execution of the following control data during online program change.

- Internal device (Table5.44)
- Special relay (Table5.46)
- Special register (Table5.47)
- SFC data (Section 5.5.3 (2))
- PID control instruction data (Section 5.5.3 (2))

Make sure to set SM1710 to on or off (whether or not to execute tracking) before executing online program change.

If the special relay is turned on during online program change, tracking will not be executed.

(a) When SM1710 is OFF (Default)

When SM1710 is off, tracking will be suspended until online program change is complete.

If a system switching occurs during online program change, the new control system CPU module may output old data.

For example, if output (Y) is turned on in the control system during online program change, the output (Y) on information will not be tracked to the standby system CPU module since tracking has not been performed.

If system switching occurs under these conditions, output will turn on and off at the time of the system switching.



Diagram 5.66 Operation When System Switching Occurs during Online Program Change

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(b) When SM1710 is ON

When SM1710 is on, if a system switching occurs, old data will not be output because tracking is performed also during online program change. (Refer to Section 5.5.4 for tracking data settings.)



Diagram 5.67 Operation When System Switching Occurs during Online Program Change

However, even if the program of the new control system CPU module has not been changed due to the system switching timing, the data calculated in the previous control system after system switching may be tracked.



Diagram 5.68 Program and Device Data due to System Switching Timing

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(4) System Switching During Online Program Change

Table5.54 lists the operation when the reason for system switching occurs during online program change.

Table5.54 System Switching During RUN Write Redundancy Compliance Execution

Туре	System Switching Condition	System Switching Execution During RUN Write
	Stop error	0
Automatic System	System switching request by network module	× *1
Switching	System power OFF	0
Ownorming	CPU module reset	0
	CPU module hardware malfunction	0
Manual System	System switching instruction	× *1
Switching	System switching request from GX Developer	imes *2

 \bigcirc Yes, $\times No$

* 1: The "CAN'T SWITCH (error code: 6220)" continuation error occurs in control system CPU module that executed the system switching instruction.

"System switching has failed due to online program change" is set in the detailed information special relay.

* 2: The error dialog box in Diagram 5.69 will appear on the GX Developer which requested the system switching:

MELS	OFT application
(This peripheral device or another peripheral device are operating online change function. Please execute it again after it completed online change function.
	<e5:010a424c></e5:010a424c>
	K

Diagram 5.69 Error Dialog Box Displayed on GX Developer

(5) Waiting Time Check for Online Program Change to Standby System The waiting time check for online program change to the standby system abnormally completes the online program change and enables the online program change again when a communication error accurs between CX Developer and the control aveter.

when a communication error occurs between GX Developer and the control system/ standby system CPU module.

When the time from when the online program change to the control system is completed until the online program change to the standby system starts falls outside the SD1710 setting range, this function judges it as a communication error and abnormally completes the online program change.

SD1710 defaults to 90 seconds and can be set within the range 90 to 3600 seconds.

(6) Special Relays And Special Registers For Online Program Change

(a) Special Relays For Online Program change

Special relays for online program change are listed in Table5.55.

Table5.55 Special Relays For Online Program change

Number	Name	Explanation
SM1709	Manual system switching disable/enable setting during online program change redundant tracking	 This relay is turned from off to on to enable the user to switch a system during online program change for redundancy. After the manual system switching disable status is canceled, the system automatically turns off SM1709. A system can be switched even an online program change for redundancy is being performed and regardless of the status of this relay, if the reason for the switching is any of the following: Power-off Reset Hardware failure CPU stop error The system switching disable status can also be canceled by this relay during the following states. Multiple-block online program change redundant tracking execution status File batch online program change redundant tracking execution status
SM1710	Transfer tracking data during online program change enable flag	 This relay specifies whether to execute a tracking transfer for the following control data during online program change for redundancy. Device memory (including the SM and SD areas transferred automatically) PIDINIT information, S.PIDINIT information, SFC information SM1710 can be also used to specify whether to enable a tracking transfer during multiple-block online program change redundant tracking execution and file batch online program change redundant tracking execution. Data in SM1710 are transferred from the control system to the standby system by tracking transfer.

(b) Special Registers For Online Program Change

Special registers for online program change are listed in Table5.56.

Table5.56 Special Registers For Online Program Change

Number	Name	Explanation
SD1710	Waiting time for online program change (standby system)	 This register stores the waiting time required for starting the online program change in the standby system after completion of that in the control system. The value is specified in units of seconds. If online program change is not requested within the set time even after it is completed in the control system, the CPU modules in both systems determine that it is a failure of an online program change for redundancy. In this case, the CPU modules in both systems resume the consistency check for the systems that have been on hold during the online program change for redundancy. When both systems are powered on, 90 seconds are set to SD1710 as the default value. Set the value within the range 90 to 3600 seconds. When the setting is 0 to 89 seconds, it is regarded as 90 seconds for operation. If the setting is outside the allowed range, it is regarded other than 0 to 3600 seconds for operation. The waiting time for a start of online program change to the standby system CPU module is checked according to the SD1710 setting during online change of multiple blocks and online change of batch of files for redundancy.

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(7) Precautions

(a) When program memory space is insufficient for writing files in RUN

To write files to the program memory in RUN, a working memory area (free area) as large as the size of the files is required.

If a sufficient working memory area is not reserved in the program memory, writing files in RUN is not executable.

However, if the necessary space is available in a memory card (SRAM card or ATA card), a batch of files can be written into the card during RUN.

(b) Memory used for writing files in RUN

When writing files in RUN, the same kind of memory is used for the control and standby system CPU modules.

If different memories are reserved for them, writing files in RUN is not executed.

Table5.57 Memories for Control System and Standby System CPU Modules and Executability of Writing Files in RUN

Memory available for control	y available for control Memory available for standby system	
system	Program memory	Memory card
Program memory	0	×
Memory card	Х	0

When writing files in RUN fails the error dialog box in Diagram 5.70 appears.

MELS	OFT application 🛛 📉
(f)	Exceeds specified memory range. Check and retry.
4	<es:0180204a></es:0180204a>
	OK

Diagram 5.70 Error Dialog Box Displayed on GX Developer

(c) Operations disabled during online program change

Do not perform the following operation during online program change:

- System power OFF
- CPU module reset
- Tracking cable connection or disconnection

Executing any of the above operations may corrupt the contents of program memory.

(d) Processing when the target programs are different between the control system and standby system CPU modules

If the target programs are different between the control system and standby system CPU modules, it will be written to the control system CPU module only. If this happens, the error dialog box in Diagram 5.71 will appear on GX Developer:

MELSOF	T series GX Developer
(į)	Write during RUN will be cancelled because FILE DIFF. (6000) has occurred in the standby system.
	СК

Diagram 5.71 Error Dialog Box Displayed on GX Developer

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(e) Access to programs being changed online

The programs being changed online cannot be accessed by GX Developer. If programs in RUN write by GX Developer are accessed, the error dialog box in Diagram 5.72 will appear on GX Developer:

MELS	OFT application
(į)	This peripheral device or another peripheral device are operating online change function. Please execute it again after it completed online change function.
	<es:010a424c></es:010a424c>
	<u> </u>

Diagram 5.72 Error Dialog Box Displayed on GX Developer

Access the programs again after the online program change is complete.

(f) When online program change cannot be executed to either control system or standby system

In the following cases, online program change cannot be executed to either control system or standby system:

- 1) Online program change when a fault has occurred in the standby system The error dialog box illustrated below will appear if online program change is executed during the following:
 - Standby system power is OFF
 - Standby system CPU is resetting
 - WDT error occurring on the standby system CPU
 - Tracking cable not connected or malfunctioning

MELSOF	T series GX Developer
(j)	This will cancel the process because there is no communication with the standby system.
	<u> </u>

Diagram 5.73 Error Dialog Box Displayed on GX Developer

2) Changing programs being accessed by the other GX Developer online The error dialog box Diagram 5.74 will appear if online program change is executed to programs being accessed by the other GX Developer:

MELS	OFT application
Ų	Processing is in progress from another peripheral device. Please wait until the other processing is completed, then execute again. <e5:010a4025></e5:010a4025>
	СК
Jiagu	ram 5.74 Error Dialog Box Displayed on GX Dovelone

Diagram 5.74 Error Dialog Box Displayed on GX Developer

3) Changing programs being accessed by the other GX Developer online The error dialog box in Diagram 5.75 will appear if online program change is executed to the CPU module during system switching or operation mode change:

MELS	OFT application
(j)	Communication trouble or system switching was generated while executing Online function to the control system PLC.
	<e5:010a4253></e5:010a4253>
	OK

Diagram 5.75 Error Dialog Box Displayed on GX Developer

4) Online program change to CPU module during system switching or operation mode change

The error dialog box in Diagram 5.76 will appear if online program change is executed during memory copy from the control system to the standby system:



Diagram 5.76 Error Dialog Box Displayed on GX Developer

(g) Online program change in Separate Mode

In the separate mode, online program change is executed only to the system that specified in the target connection settings.

Online program change is not executed to the CPU module of the system that is not specified in the target connection settings.

(h) Extension of scan time due to online program change

If online program change is executed, the control system CPU module scan time will extended.

Refer to the following manual for information on control system CPU module scan time extension:

CF Qn(H)/QnPH/QnPRHCPU User's Manual (Function Explanation, Program Fundamentals)

(i) Signal Flow Processing

The signal flow in the changed steps or program turns on. Therefore, if a running program is changed online, the rise, fall and SCJ instructions will do the following:

Rise instruction (PLS instruction, □P instruction, SP.□ instruction) Even if the execution condition changes from off to on when online program change is complete, the rise instruction will not be executed.

It will be executed when the execution condition is turned off and on again.

2) Fall instruction (LDF, ANDF, ORF, MEF, PLF)

If the execution condition is off when online program change is complete, the fall instruction will be executed again.

3) SCJ instruction

If the execution condition is on when online program change is complete, a jump to the specified pointer will be executed without waiting 1 scan.

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(j) Consistency check between both systems during online program change

1) File Consistency Check

The file consistency check cannot be performed during online program change.

Therefore, during online program change, an error will not occur even if the programs of the control system and standby system CPU modules are temporarily different.

However, if any of the following operations is performed, an error may occur during the file consistency check even though the online program change is completed successfully.

- Either control system or standby system CPU module is changed from STOP (PAUSE) to RUN
- Either control system or standby system CPU module is reset, then unreset (RESET/L.CLR switch is set to the neutral position)
- Either control system or standby system is powered OFF and then ON
- The tracking cable is disconnected and then connected

2) Operating Status Consistency Check

The operation status consistency check cannot be performed during online program change.

3) Main base unit configuration

The main base unit configuration check cannot be performed during online program change.

However, if one of the following conditions occurs during online program change, it will be performed.

- Standby system CPU module is reset and then unreset (RESET/L.CLR switch is set to the neutral position)
- Standby system is powered OFF and ON
- Tracking cable is disconnected and connected

4) Parameter valid drive settings consistency check

The parameter valid drive settings consistency check cannot be performed during online program change.

However, if one of the following conditions occurs during online program change, it will be performed.

- Standby system CPU module resets and clears reset
- Standby system power is turned OFF and ON
- Tracking cable is disconnected and connected

5) Memory Card Setting Status Consistency Check

The memory card setting status consistency check cannot be performed during online program change.

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5.7 Memory Copy From Control System To Standby System

(1) Overview of Memory Copy From Control System To Standby System **Function**

Memory copy form control system to standby system function transfers the parameters, programs, file register and other data from the control system CPU module to the standby system CPU module to make the standby system and control system consistent.

The applicable memory is standard RAM, standard ROM and program memory. (Memory cards are irrelevant.)

This function is used to make the memory contents of the control system and standby system CPU modules consistent when replacing the standby system CPU module, etc.



- (a) Executing memory copy
 - Memory copy can be executed by using either of the following.
 - · GX Developer
 - · Special relays and special registers

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(b) Special Relays and Special Registers for Memory Copy

Table5.58 lists the special relays and special registers for the memory copy function.

Туре	Number	Description	Set by User or System	Remarks
		Turn on this relay to start memory copy after storing		Specific to control
	3D1 _H into SD1595.		User	system CPU module
	SM1596	This relay is on during memory copy from the control system to the standby system. This relay turns off when memory copy is complete. ^{*1}	System	Applicable to both control system and standby system CPU modules
Special Relays	SM1597	This relay turns on after memory copy. ^{*1} Turn off this relay when starting memory copy. In the case of memory copy by GX Developer, GX Developer will turn off this relay before starting memory copy.	System / User	Applicable to both control system and standby system CPU modules
	SM1598	If set to on by user, the standard ROM data is not copied to the other system while memory copy is executing. Default: Off (Execution of standard ROM memory copy)	User	Specific to control system CPU module
Special Registers	SD952	 This register stores a value indicating the completion status of the latest memory data copy from the control system to the standby system. The value same as the SD1596 value is stored at completion or abend of the memory data copy from the control system to the standby system. Since data have been backed up in case of power failure, this register holds the value indicating the latest memory data copy status from the control system to the standby system. This register is cleared to 0 by latch clear. 	System	Applicable to both control system and standby system CPU modules
	SD1595	Before SM1595 is turned from off to on, the I/O No. of the memory copy destination (Standby system CPU module: 3D1 _H) is stored in this register.	User	Specific to control system CPU module
	SD1596	Stores the execution result of Memory copy function. (0: Memory copy is complete)	System.	Applicable to control system and standby system CPU modules

Table5.58 Special Relays and Special Registers for Memory Copy

* 1: If any of the following occurs during memory copy from control system to standby system, the memory copy will be stopped.

In this case, SM1596 (Memory copy to other system status flag) turns off and SM1597 (Memory copy to other system completion flag) turns on.

- •Standby system power OFF
- •Standby system CPU module reset

•Tracking cable disconnection or malfunction

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(c) Memory Copy Precautions

1) Before memory copy, the standby system CPU memory will be automatically formatted.

Then, the "PRG. MEM. CLEAR (error code: 6400)" stop error will occur in the standby system CPU module.

However, if a stop error has occurred before memory copy, the "PRG. MEM CLEAR" is not detected.

2) Memory copy is stopped when any of the following operations is performed during memory copy.

At this time, the memory contents of the standby system CPU module will be illegal.

Perform any of the following operations after confirming that memory copy is completed.

- Power off the control system or standby system.
- Reset the control system or standby system CPU module.
- Disconnect the tracking cable.

If the following error occurs during memory copy, the memory copy is also stopped with the memory contents of the standby system CPU module being illegal.

Tracking cable fault

(d) How to confirm memory copy completion

Completion of memory copy can be confirmed by the special relays and GX Developer.

1) Confirmation by special relays

When memory copy is completed, the special relay "Memory copy to other system status flag (SM1596)" turns off and "Memory copy to other system completion flag (SM1597)" turns on.

Check whether SM1596 and SM1597 are ON or OFF to confirm memory copy completion.

Also, whether memory copy is normally completed or abnormally completed can be checked by the special register "Memory copy completion status (SD1596)".

- When memory copy is normally completed: SD1596: 0
- When memory copy is abnormally completed: SD1596: other than 0 (error code)

2) Confirmation by GX Developer

Whether memory copy is normally completed or abnormally completed can be checked on the "Redundant operation" window of GX Developer.

edundant operatio				
Connection target info	rmation			
Connection interface	COM1	<>	PLC module	
Target PLC	Network no. 0	Station no. Host	PLC type Q25PRH	
PLC status	RUN			
System type	Control system	Operation mode	Backup mode	
Remote operation C System switching		Mem	ory copy progress status	-
C Change operation	mode Backup mode	<u> </u>		
Memory copy				
			Execute	Close

Diagram 5.77 Redundant Operation Window Showing Normal Completion

Redundant operatio	n			×
Connection target info	mation			
Connection interface	COM1	<>	PLC module	
Target PLC	Network no. 0	Station no. Host	PLC type Q25PRH	
PLC status	RUN			
System type	Control system	Operation mode	Backup mode	
Remote operation		Memor	y copy progress status -	
C System switching			Memory copy failure.	
C Change operation	mode Backup mode	~		
Memory copy				
			Execute	Close

Diagram 5.78 Redundant Operation Window Showing Abnormal Completion

(2) Memory Copy from Control System to Standby System Using GX Developer

The following provides the procedure for executing memory copy function using GX Developer and the relevant operations.

(a) Procedure

1) Connect the control system and standby system CPU modules with a tracking cable and power on the standby system.



Diagram 5.79 LED Indications When Tracking Cable Is Connected

- * 2: If the standby system CPU module is replaced and the parameters are not stored in the new CPU module, the "MISSING PARA. (error code: 2200)" stop error will occur.
- Connect GX Developer to the control system CPU module. Identify the control system CPU module with the "CONTROL" LED or in the special relay (SM1515 (Control system judgement flag): ON, SM1516 (Standby system judgement flag): OFF).

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 Select "Memory copy" on the Redundant operation window of the Online dialog box on GX Developer, and click the Execute button.

Redundant operatio	n 	-		×	
Connection target info	rmation				
Connection interface	СОМ1	<>	PLC module		
Target PLC	Network no. 0 Station no.	Host	PLC type Q25PRH		
PLC status	RUN				
System type	Control system Operation	node	Backup mode		
Remote operation	n mode Backup mode 💌	Memo	ry copy progress status		 Memory copy progress is displayed in %.
			Execute Close		

Select "Memory copy".

Diagram 5.80 Redundant Operation Window

4) When the memory copy confirmation dialog box appears, click the "Yes" button.

This transfers the control system data to the standby system.



Diagram 5.81 Confirmation Dialog Box Displayed on GX Developer

Then, the "BACKUP" LED of the standby system CPU module will flash (red).



Diagram 5.82 LED Indications during Memory Copy

- * 3: When memory copy begins, the "MEM. COPY EXE. (error code: 6410)" continuation error will occur in the control system CPU module, and then the "STANDBY SYS. DOWN (error code: 6300)" continuation error will occur.
- * 4: When memory copy begins, the "PRG. MEM. CLEAR (error code: 6400)" stop error will occur in the standby system CPU module.

5) When memory copy is complete, the "BACKUP" LED of the standby system CPU module will turn on (red).



Diagram 5.83 LED Indications at Memory Copy Completion

6) When memory copy is complete, restart the standby system or reset the standby system CPU module. It will operate as the standby system CPU module.

Then, the "BACKUP" LED of the standby system CPU module will turn on (green).



Diagram 5.84 LED Indications during Standby System CPU Module Operation

[Specify memory copy]



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(b) Operations when executing Memory Copy

The operation at memory copy execution is shown in Diagram 5.85.

[Perform memory copy]



GX Developer

Diagram 5.85 shows the operation performed when memory copy is executed.

(3) Memory Copy From Control System to Standby System Using Special Relays and Special Registers

The following provides the procedure for executing memory copy function using the special relays and special registers and the relevant operations

- (a) Steps
 - 1) Connect the control system and the standby system with the tracking cable, and turn the standby system power ON.



* 1: If the standby system CPU module is replaced and the parameters are not stored in the new CPU

- module, the "MISSING PARA. (error code: 2200)" stop error will occur.
- Make sure SM1596 and SM1597 are turned OFF. If SM1596 or SM1597 is ON, turn it OFF.



3) When 3D1H is stored in the special register (SD1595) and the special relay (SM1595) is turned ON, the contents of control system memory will be copied to the standby system.

Then, the "BACKUP" LED of the standby system CPU module will turn ON (red).



- * 2: When memory copy begins, the "MEM. COPY EXE. (error code: 6410)" continuation error will occur in the control system CPU module, and then a "STANDBY SYS. DOWN (error code: 6300)" resume error will occur.
- * 3: When memory copy begins, the "PRG. MEM. CLEAR (error code: 6400)" stop error will occur in the standby system CPU module.
- 4) When memory copy is complete, SM1597 will turn ON.

Then, the "BACKUP" LED of the standby system CPU module will turn ON (red).



Diagram 5.88 LED Indications at Memory Copy Completion

5) After completing memory copy to the other system, restart the standby system or reset the standby system CPU module. It will operate as the standby system CPU module.

Then, the "BACKUP" LED of the standby system CPU module will turn ON (green).



Diagram 5.89 LED Indications during Standby System CPU Module Operation





- If this happens, the "Memory copy to other system status" flag (SM1596) will turn OFF, and the "Memory copy to other system completion" flag (SM1597) will turn ON.
- Standby system power OFF
- Standby system CPU reset •Tracking cable disconnection or malfunction

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- When the special relay "Memory copy to other system status executed" flag (SM1596) or the "Memory copy to other system completion" flag (SM1597) is ON, memory copy will not be to other system status executed even if the "Memory copy to other system start" flag (SM1595) is turned ON. In this case, no error code will not be stored in "Memory copy target I/O No." (SD1596) in the special register. Turn OFF SM1596 or SM1597 if either of them is ON, then execute memory copy again.
- 2. When a transfer target I/O No. other than the standby CPU module $(3D1_H)$ is set to "Memory copy target I/O No." (SD1595) and memory copy is executed, the "Unsupported transfer target I/O No. (error code: 4248_H) will be stored in SD1596.

In this case, memory copy will not be executed.

(4) Error Occurrence During Memory Copy

If any of errors listed in Table5.59 occurs during memory copy, the contents of standby system memory will be corrupted.

In this case, memory copy is not complete, but the special relay "Memory copy in process" flag (SM1596) will turn OFF and the "Memory copy complete" flag (SM1597) will turn ON.

Remove the cause of the error and execute memory copy again.

Cause	Memory Copy Using GX Developer	Memory Copy Using Special Relays and Special Registers
Control system power OFFControl system CPU reset	The following error dialog box will appear: MELSOFT application Carnot communicate with the PLC. Execute again after checking the connections with the PLC. CES:01808201> CK	-
 Standby system power OFF Standby system CPU reset 	The following error dialog box will appear: MELSOFT application Unable to communicate with PLC. The following reasons may be responsible. The power supply of the standby system was turned off. reset status. User WOT error status. PLC has a FW problem. <es:01084241></es:01084241>	4241 _H will be stored in SD1596 of the control system CPU module.
 Tracking cable disconnection Tracking cable failure 	The following error dialog box will appear: MELSOFT application The tracking cable has a communication problem. Please execute it again after confirming the state of the tracking cable. <es:0104242> CK</es:0104242>	4242 _H will be stored in SD1596 of the control system CPU module.
 USB cable disconnection RS-232 cable disconnection 	The following error dialog box will appear: MELSOFT application Cannot communicate with the PLC. Execute again after checking the connections with the PLC. CES:01808201> CES:01808201> CES:01808201>	-

Table5.59 Error Occurrence During Memory Copy

(5) Precautions

(a) GX Developer Functions Disabled During Memory Copy

The GX Developer cannot perform the following operations on either the control system or the standby system during memory copy:

- 1) PLC memory format
- 2) Program memory to ROM
- 3) Write to PLC (Flash ROM)
- 4) Online change
- 5) System switching
- 6) Operation mode change

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(b) Restrictions on Memory Copy

Memory copy cannot be done using either GX Developer or the special relays and special registers under the conditions listed in Table5.60.

	Memory Copy Operation				
Execution Conditions	Memory Copy Using GX Developer	Memory Copy Using Special Relays and Special Registers			
	The following error dialog box will appear:				
Memory copy executed to the standby system CPU module	MELSOFT series GX Developer Image: Cannot execute this function when the PLC is not control system. Image: Cannot execute this function when the PLC is not control system.	-			
Memory copy executed in Debug Mode	The following error dialog box will appear: MELSOFT series GX Developer Cannot execute this function when the PLC status is debug mode.	424D _H will be stored in SD1596 of the control system CPU.			
Memory copy re-executed during memory copy	The following error dialog box will appear:	4247 _H will be stored in SD1596 of the control system CPU.			
	The following error dialog box will appear:				
During online program change or similar operation to the control system CPU module	MELSOFT application K MELSOFT application C C C C C C C C C C C C C	424C _H will be stored in SD1596 of the control system CPU.			
Memory copy target I/O No. (SD1595) is any value other than 3D1H	-	4248 _H will be stored in SD1596 of the control system CPU.			
Standby system power OFF Standby system CPU module reset	The following error dialog box will appear: MELSOFT application Multiple to communicate with PLC. The following reasons may be responsible. The power supply of the standby system was turned off. User WDT error status. More WDT error status. Sec VDT error status. CES:0104241> COK	4241 _H will be stored in SD1596 of the control system CPU.			
Tracking cable disconnection	The following error dialog box will appear: MELSOFT application The tracking cable has a communication problem. Please execute it again after confirming the state of the tracking cable. <es:010a4242> OK</es:010a4242>	4242 _H will be stored in SD1596 of the control system CPU.			

Table 5.60 Restrictions on Memory Copy

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5.8 Online Module Change (Hot Swapping)

In the redundant system, following modules can be replaced online.

- Module mounted to the extension base unit (I/O module, analog module etc.)
- Module mounted to the remote I/O station in the MELSECNET/H Remote I/O network (I/O module, analog module etc.)
- · Power supply module when the power supply modules are duplicated
- I/O module mounted on the main base unit where the Redundant CPU is mounted (Only when the extension base unit is not connected)

The network module mounted on the control system main base unit cannot be replaced online (while the system power is ON).

When replacing the network module mounted on the control system main base unit, make sure to switch it to the standby system using GX Developer or the system switching instruction (SP. CONTSW instruction).

The standby system is not actually controlling. Therefore, there will be no effect on the redundant system control if the standby system is powered off.

When powering the standby system OFF, the "STANDBY SYS. DOWN (error code: 6300)" continuation error will occur in the control system CPU module.

(1) Module mounted to the extension base unit

The online module change (hot swapping) is applicable for a module mounted to the extension base unit.

However, there are restrictions on the module where the online module change is applicable.

(For modules that can be replaced online, refer to Section 2.4)

For replacing modules where the extension base unit is connected online, refer to the following manual.

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

(2) Module mounted on the MELSECNET/H remote I/O station

The MELSECNET/H remote I/O station supports online module change. If a module mounted on the MELSECNET/H remote I/O station has a failure, the module can be replaced without stopping system control.

However, the target module of online module change is restricted.

(Refer to Section 2.4 (4) for details.)

Refer to the following manual for information on online change of the module mounted on the MELSECNET/H remote I/O station.

CFRQ Corresponding MELSECNET/H Network System Reference Manual

(Remote I/O network)

SP User's Manual of the corresponding module

(3) Redundant Power Supply Module

When a pair of redundant power supply modules is used in each system of the redundant system, one redundant power supply module can be replaced at a time after powering off the module.

As another redundant power supply module supplies power to the modules mounted on the same base unit, the redundant system control can be continued during the replacement.

Refer to Section 8.3.3, for details.

(4) I/O module mounted to main base unit where Redundant CPU is mounted

The I/O modules mounted on the control system and standby system main base units can be replaced online.

If an error occurs in an I/O module mounted on the control system or standby system main base unit, the module can be replaced without stopping system control. Note that a module mounted to the main base unit cannot be replaced online when the extension base unit is connected.

Refer to the following manual, for details.

CPU User's Manual (Hardware Design, Maintenance and Inspection)
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5.9 Network Module Redundant Group Settings

(1) Network Module Redundant Group Settings

When a pair of Ethernet modules is used in each system of the redundant system, by making the network module redundant group settings of the Ethernet modules, system switching can be disabled even if an error occurs in one network. However, if a communication error occurs in both Ethernet modules, system switching will occur.

[Example:]

Diagram 5.92 and Diagram 5.93 show the operations when an error occurs in the communication between the control system and standby system via the Ethernet.

• Diagram 5.92 shows the processes that take place when a malfunction occurs on one of the networks with network module redundant group settings.



Diagram 5.92 Operation When Error Occurs on One of the Networks

• Diagram 5.93 shows the processes that take place when a malfunction occurs on both networks with network module redundant group settings.



Diagram 5.93 Operation When Error Occurs on Both Networks

(2) Redundant Group Settings

Redundant group settings are made in the network parameter group settings using GX Developer.

Set "Group" or leave it block in the network module set to the lower I/O No.

Network module re	dundant group set	×			
Module No. Star 1 2 3 0040 4 0060 5 6 6 7 8 9 10 11	tt I/O No. Ne Ethernet (Ma Ethernet (Ma	twork type in base) in base) End	Group settings Group Group Cancel		When module No. 3 is set in "Group", module No. 3 becomes grouped with module No.4.

Diagram 5.94 Network module redundant group setting Window

(3) Confirming a System Switching Request by a Network Module

If a network module requests a system switching, the SD1590 bit for the module No. will change to "1". *1



•Module No. 2...Slot 2 • • • •Module No. 11...Slot 11

(4) When a non-redundant network module is set in the redundant group settings

If redundant group settings are made for a network module that does not support redundant systems, a stop error, "PARAMETER ERROR (error code: 3000)" will occur.

In this case, check the network parameter group settings.

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5.10 Redundant CPU Functions Restricted in Redundant System

This section explains the following Redundant CPU functions that are restricted in a redundant system.

- Enforced ON/OFF of external I/O
- Remote operation

Refer to the following manual for details of each function.

CF Qn(H)/QnPH/QnPRHCPU User's Manual (Function Explanation, Program Fundamentals)

5.10.1 Enforced ON/OFF of external I/O

The Redundant CPU can forcibly turn ON/OFF the enforced ON/OFF of external I/O operation from GX Developer.

The registered ON/OFF information can be cleared by GX Developer operation.

(1) CPU modules that can be forcibly turned ON/OFF

The enforced ON/OFF of the external I/O can be executed for only the control system CPU module. (It cannot be executed for the standby system CPU.) If registration/change/clear of the forced I/O ON/OFF status is made to the standby system CPU, the error dialog box (in Diagram 5.96) will appear on GX Developer. In this case, change the connection target of GX Developer to the "control system".

MELS	SOFT application	ME	LSOFT application	
()	The executed function is not supported in standby system. Please check the manual and other documentation.	į,	This function cannot execute with control system of transfer setting or standby system of Please change transfer setting, and execute it again.	transfer settin
	<e5:010a4240></e5:010a4240>		<e5:010a424a></e5:010a424a>	
	OK)		СОК	

Diagram 5.96 Error Dialog Box That Appears When Forced ON/OFF/Cancel Is Executed in Standby System

(2) Tracking of Registered Forced ON/OFF Information from Control System to Standby System

The forced ON/OFF information registered in the control system CPU module is tracked to the standby system CPU module.

(Track the registered forced ON/OFF information from the control system CPU module to the standby system CPU module in the "backup mode" or "separate mode".)

Hence, if system switching occurs, the external I/O forced ON/OFF can be continued according to the forced ON/OFF information registered by GX Developer before system switching.



Diagram 5.97 Input/Output by Forced ON/OFF of External I/O at System Switching Occurrence

(3) Operation of Input/Output of which forced ON/OFF information has been registered at Operation Mode Change

If the operation mode is changed, the forced ON/OFF information before operation mode change remains.

Hence, if the operation mode is changed, the external I/O forced ON/OFF can be continued according to the forced ON/OFF information before operation mode change.

If the operation mode is in the separate mode, the external I/O forced ON/OFF by GX Developer can be executed for only the control system CPU module. If in the separate mode, the external I/O forced ON/OFF registration cannot be executed individually for the control system and standby system CPU modules.

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(4) Operation When Control System/Standby System Is Powered Off and Then On/CPU Module Is Reset and Then its RESET Switch Is Set to Neutral Position

- (a) In the backup mode
 - 1) Operation when control system is powered off and then on/control system CPU module is reset and then its RESET switch is set to neutral position

System switching occurs when the control system is powered off/the control system CPU module is reset.

The input/output of which forced ON/OFF has been registered remains the ON/OFF status according to the forced ON/OFF information of the new control system CPU module.

Table5.61 Operation When Control System Is Powered Off and Then On/Control System CPU Module Is Reset and Then its RESET Switch Is Set to Neutral Position

Item	Module mounted on main base unit including Redundant CPU Module mounted on remote I/O station					
Input	Device X remains ON/OFF according to the forced ON/OFF information.					
Output	External output ON/OFF is continued according to the forced ON/OFF information.					
	 2) Operation when standby system is powered off and then on/standby system CPU module is reset and then its RESET switch is set to neutral position If the standby system is powered off/the standby system CPU module is reset, the forced ON/OFF information of the control system CPU module does not change. The input/output of which forced ON/OFF has been registered continues the ON/OFF status according to the forced ON/OFF information of the control system CPU module. 					
	Table5.62 Operation When Standby System Is Powered Off and Then On/Standby System CPU Module Is Reset and Then					
	its RESET Switch Is Set to Neutral Position					

Item	Module mounted on main base unit including Redundant CPU	Module mounted on remote I/O station
Input	Device X remains ON/OFF according to t	he forced ON/OFF information.
Output	External output ON/OFF is continued according to the forced ON/OFF information.	

(b) In the separate mode

1) Operation when control system is powered off and then on/control system CPU module is reset and then its RESET switch is set to neutral position

When the control system is powered off/the control system CPU module is reset, the forced ON/OFF information is all cleared.

The input/output of which forced ON/OFF has been registered all return to the status before the forced ON/OFF registration.

However, when the control system is powered off/the control system CPU module is reset, the master station on the MELSECNET/H remote I/O network changes to the sub master station. Therefore, the output to the remote I/O station holds the status when the control system was powered off/the control system CPU module was reset.

Table5.63 Operation When Control System Is Powered Off and Then On/Control System CPU Module Is Reset and Then its RESET Switch Is Set to Neutral Position

Item	Module mounted on main base unit including Redundant CPU	Module mounted on remote I/O station	
		[After power is switched on/RESET switch is set to neutral	
Input	Device X changes according to the external input.	position]	
		Device X changes according to the external input.	
		[When power is switched off/CPU is reset]	
	The external output changes according to device V	The output status when the control system is powered off/	
Output		the control system CPU module is reset is held.	
Output	The external output changes according to device 1.	[After power is switched on/RESET switch is set to neutral	
		position]	
		The external output changes according to device Y.	

2) Operation when standby system is powered off and then on/standby system CPU module is reset and then its RESET switch is set to neutral position

If the standby system is powered off/the standby system CPU module is reset, the forced ON/OFF information of the control system CPU module does not change.

The input/output of which forced ON/OFF has been registered remains the ON/OFF status according to the forced ON/OFF information of the control system CPU module.

Table5.64 Operation When Standby System Is Powered Off and Then On/Standby System CPU Module Is Reset and Then its RESET

Switch Is Set to Neutral Position

Item	Module mounted on main base unit including Redundant CPU	Module mounted on remote I/O station
Input	Device X remains ON/OFF according to t	the forced ON/OFF information.
Output	External output ON/OFF is continued according to the forced ON/OFF information.	

3) Turning power supply OFF or reset operation when the extension base unit is connected

Do not turn OFF the power supply of the control system or perform reset operation in the separate mode when the extension base unit is connected. (If doing so, turn ON both systems simultaneously or cancel the reset.) In the redundant system, the following remote operations can be performed by GX Developer or other means.

(The remote operation for the Redundant CPU can be executed regardless of the communication route.)

- Remote RUN
- Remote STOP
- Remote PAUSE
- Remote latch clear
- Remote reset

The remote operation for the Redundant CPU can be executed in any of the following methods.

- Remote operation from GX Developer
- CC-Link IE Controller Network module, MELSECNET/H module dedicated instruction
- Remote operation by MC protocol
- Remote operation function from OPS using EZSocket

(1) Target CPU modules of remote operation

(a) In the backup mode

- Remote RUN, remote STOP, remote PAUSE or remote latch clear can change the operation status of the CPU module(s) in the system or both systems specified in the Connection Setup of GX Developer or other means.
- Remote reset can be executed for only the control system CPU module. Performing remote reset for the control system CPU module resets both systems.

(b) In the separate mode

Remote operation can be performed for only the CPU module of the system specified in the Connection Setup of GX Developer or other means.

(2) Target Specification for Remote Operation

As the target CPU module of remote RUN, remote STOP, remote PAUSE or remote latch clear, select the CPU module of either system or the CPU modules of both systems in the Connection Setup of GX Developer.

Remote operation	
Connection target information	
Connection interface COM1 <-> PLC module	_
Target PLC Network no. 0 Station no. Host PLC type Q25PRH	
PLC status RUN	
Sustem time Control sustem Operation mode Backup mode	
Operation Specify execution destination	
PLC STOP	
C Extract memory card	
Operation during RUN, STEP-RUN Both systems (A & B)	
Specify execution unit	
Signal flow Save 💌 Board no. 1	
Liose	

Diagram 5.98 Remote Operation Window

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(a) Remote operation for the system specified in the Connection Setup of GX Developer

When "Currently specified station" is selected at the execution destination area on the Remote operation window of GX Developer, remote operation is performed for only the system specified in the Connection Setup, which can be selected from [Online] from the menu bar of GX Developer.

(The current station can be selected in the "backup mode" and "separate mode".) For example, when remote STOP is executed after the "control system" is specified on the Connection Setup window, remote STOP is executed for the current control system CPU module.



Diagram 5.99 Remote STOP Operation When Current Station Is Specified

(b) Remote operation for both systems

When "Both systems (A & B)" is selected at the execution destination area on the Remote operation window of GX Developer, remote operation is performed for the control system and standby system.

Remote operation for "Both systems" can be selected in the backup mode only. (In the separate mode, "Both systems" cannot be selected at the execution destination area on the Remote operation window of GX Developer.) When "Both systems (A & B)" is selected, GX Developer executes remote operation in order of the "standby system CPU module" and "control system CPU



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(3) Remote reset operation

(a) In the backup mode

In the backup mode, performing remote reset operation for the control system resets both systems.

(Both systems are reset also when "Currently specified station" is selected at the execution destination area on the Remote operation window of GX Developer.)



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Remote reset operation cannot be performed for the standby system. If remote reset operation is performed for the standby system by GX Developer, the error dialog box in Diagram 5.102 will appear.

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Ū,	Cannot execute this function when the PLC is not control system.

Diagram 5.102 Error Dialog Box Displayed on GX Developer

(b) In the separate mode or debug mode

In the separate mode or debug mode, remote reset can be executed for only the system specified in the Connection setup of GX Developer. The operation status of the unspecified system does not change.





(c) Precautions when executing remote reset operation

The following describes the precautions to be taken when performing remote reset for both systems in the backup mode.

1) Remote reset when control system CPU module is in the STOP status and standby system CPU module is in the RUN status

System switching will occur when remote reset operation is performed for the control system CPU module when the control system CPU module is in the STOP status and the standby system CPU module is in the RUN status. To disable system switching at the time of remote reset, change the operation statuses of the control system and standby system CPU modules to the STOP status, and then perform remote reset.



Diagram 5.104 Remote Reset Operation When Control System CPU Module Is in STOP Status and Standby System CPU Module Is in RUN Status

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2) When watchdog timer error has occurred in the standby system CPU module

When a watchdog timer error has occurred in the standby system CPU module, only the control system CPU module is reset and the standby system CPU module is not reset.

When performing remote reset for the standby system CPU module in which a watchdog timer error has occurred, set the communication route where the tracking cable is not relayed.



Diagram 5.105 Remote Reset Operation When Watchdog Timer Error Has Occurred in Standby System CPU Module

3) Remote reset after execution of remote operation for control system or standby system CPU module from other route

When remote operation is being performed for the control system or standby system CPU module from GX Developer in the other route, the standby system CPU module is not reset if remote operation is performed for the control system CPU module.^{*1}

When performing remote reset for the control system or standby system CPU module, cancel the remote operation for the standby system CPU module from GX Developer or other means that executed the remote operation for the standby system CPU module.



Diagram 5.106 Remote Reset Operation after Execution of Remote STOP for Control System or Standby System CPU Module from Other Route

* 1: How to confirm remote operation execution

Whether remote operation has been executed or not can be checked by the special register "CPU operation status (SD203)".

When the CPU operation status is changed by remote operation, "2 (remote operation from GX Developer/serial communication module)" is stored into b4 to b7 of SD203.

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5.11 Access to Module Mounted on Extension Base Unit

Table5.65 lists the access to a module mounted on the extension base unit when accessing from the control system and when accessing from the standby system.

Itom		Execution	Nomo	Access from control system		Access from standby system	
Ite		timing	Name	Backup mode	Separate mode	Backup mode	Separate mode
I/O access	Refresh	At END	Input from input module	Execute	Execute	_ ^{*5}	_ ^{*5}
		processing	Output from output module	Execute	Execute	Not execute	Not execute
			Direct access of input device (DX)	Executable	Executable	Inexecutable	Inexecutable
	Instruction	execution	Direct access of output device (DY)	Inexecutable	Inexecutable	Inexecutable	Inexecutable
			I/O refresh instruction	Executable	Executable	Inexecutable	Inexecutable
			Refresh of intelligent function module	Executable	Executable	Inexecutable	Inexecutable
			Refresh of CC-Link IE Controller Network module	Inexecutable ^{*1}	Inexecutable ^{*1}	Inexecutable ^{*1}	Inexecutable ^{*1}
	Refresh	At END processing	Refresh of MELSECNET/H module	Inexecutable ^{*1}	Inexecutable ^{*1}	Inexecutable ^{*1}	Inexecutable ^{*1}
			Refresh of CC-Link master module	Executable	Executable	Inexecutable	Inexecutable
			Device initial value of link direct device $(J \Box \setminus \Box)$	Inexecutable ^{*1}	Inexecutable ^{*1}	Inexecutable ^{*1}	Inexecutable ^{*1}
Access to buffer			Device initial value of intelligent function module (U□\G□)	Executable	Executable	Inexecutable	Inexecutable
memory			Data link instruction	Executable	Executable	Inexecutable	Inexecutable
			Refresh instruction	Executable	Executable	Inexecutable	Inexecutable
	Instruction	ion At instruction execution	Read/write from/to intelligent function module/ special function module	Executable	Executable	Inexecutable	• SM1593=ON: Inexecutable (An error does
			Link direct device $(J \square \setminus \square)$	Inexecutable ^{*1}	Inexecutable ^{*1}	Inexecutable ^{*1}	not occur)
			Intelligent function module (U_\G_)	Executable	Executable	Inexecutable	• SM1593=OFF: Stop error
	Monitor	At END processing	Buffer memory batch monitor/device batch monitor	Executable ^{*2}	Executable ^{*2}	Inexecutable ^{*4}	Inexecutable ^{*4}

Table5.65 Access to Module Mounted on Extension Base Unit

(To the next page)

Itom		Execution	Nomo	Access from control system Access from standby system			
116		timing	Name	Backup mode	Separate mode	Backup mode	Separate mode
Dedicated	Dedicated	At instruction	Intelligent function module	*3	*3	*3	*3
instruction	instruction	execution	(U□\G□)	Inexecutable °	Inexecutable °	Inexecutable °	Inexecutable °

Table5.65 Access to Module Mounted on Extension Base Unit (Continued)

* 1: CC-Link IE Controller Network, MELSECNET/H module cannot be mounted to the extension base unit.

- * 2: An error code (4248_H) is returned to the request source when system switching occurs during monitoring.
- * 3: An error (OPERATION ERROR: 4122) occurs.
- * 4: Accessing to a module mounted on the extension base unit from the standby system is disabled. When buffer memory batch monitor or device batch monitor is executed from GX Developer, the following message box is displayed.

1) When executing buffer memory batch monitor



* 5: Input (X) from the input module on the extension base unit will be an undefined value.

In the redundant system where the modules are mounted on the extension base unit, if the systems are switched because of an extension cable failure, data are not output/input from/to the modules on the extension base unit in the new control system.

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CHAPTER6 REDUNDANT SYSTEM NETWORKS

This chapter explains the redundant system networks on the assumption that the operation mode has been set to the backup mode.

6.1 Communication with GX Developer and PX Developer

6.1.1 Communication Methods with GX Developer

The communication between GX Developer and redundant CPU module can be made through the following three paths.

- CPU module direct connection
- Routing a network module
- Routing an intelligent function module

In the case of GX Developer, select [Online] - [Specify Connection] from the menu bar, and specify the connection path on the displayed dialog box.

And, specify the communication target system from the following: "Not specified" (default), "Control system", "Standby system", "System A" and "System B". (



Diagram 6.1 Connection Setup Window

System Specification		Communication Path
Not specified (Default)	Select this option to communicate with only the CPU module connected to GX Developer.	System not specified (default) GX Developer
Control System	 Select this option to communicate with the control system CPU module using GX Developer. If system switching occurs, communication is done with the new control system CPU module. If the CPU module connected to GX Developer is the control system, communication is done with that CPU module. If the CPU module connected to GX Developer is the standby system, communication is done with the other system (the control system) via the tracking cable. 	System A - Control System B - Standby System Control system GX Developer Control system GX Developer System A - Control System CPU module Control system GX Developer Control system Control system
Standby System	 Select this option to communicate with the standby system CPU module using GX Developer. If system switching occurs, communication is done with the new standby system CPU module. If the CPU module connected to GX Developer is the standby system, communication is done with that CPU module. If the CPU module connected to GX Developer is the control system, communication is done with the other system (the standby system) via the tracking cable. 	System A - Control System System B - Standby System Standby system GX Developer GX Developer GX Developer GX Developer GX Developer GX Developer Communicate with the standby system CPU module Standby system GX Developer Communicate with the standby system CPU module Communicate with the standby system CPU module
System A	 Select this option to communicate with system A CPU module using GX Developer. If system switching occurs, communication continues with the new system A CPU module. If the CPU module connected to GX Developer is system A, communication is done with that CPU module. If the CPU module connected to GX Developer is system B, communication is done with the other system B, communication is done with the other system (system A) via the tracking cable. 	System A - Control System B - Standby System System A - Control System B - Standby System Tracking cable Communicate with the System A's CPU module System A - Control System System B - Standby System (Communicate with the System A's CPU module) System A - Control System System B - Standby System (Communicate with the System A's CPU module) (Communicate with the System A's CPU mod
System B	 Select this option to communicate with system B CPU module using GX Developer. If system switching occurs, communication continues with the new system B CPU module. If the CPU module connected to GX Developer is system B, communication is done with that CPU module. If the CPU module connected to GX Developer is system A, communication is done with the other system (system B) via the tracking cable. 	System A - Control System B - Standby System System B GX Developer Communicate with the System B's CPU module System A - Control System Tracking cable Tracking cable Communicate with the System B - Standby System System B - Stand

Table6.1 GX Developer System Specification and Communication Paths

6.1.2 Confirming the Connection Target on GX Developer

The current communication target CPU module and the connection path can be confirmed on the following GX Developer window.

Display information for the connected system in monitor status (control system/standby system and System A/System B).



Display information for the system specified in connection settings (control system/standby system and System A/System B).

Diagram 6.2 GX Developer Ladder Monitor Window

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6.1.3 Cautions on Access from GX Developer and PX Developer

This section describes cautions on access from GX Developer and PX Developer.

(1) Cautions when the System Connected to GX Developer/PX Developer and the Specified System are Different

(a) Communicating with a CPU Module via a Tracking Cable

When the system for the CPU module to which GX Developer/PX Developer is connected is different from the specified system, communication is done with the CPU module of the other system (specified system) via the tracking cable. ([] = Table6.1)



Diagram 6.3 Communication with CPU Module via Tracking Cable

(b) Accessing a Network Module via a Tracking Cable

Communication with a network module on the other system via a tracking cable is not available for GX Developer and PX Developer.

To communicate with a network module on the other system (e.g., network diagnosis of the other system), reconnect the GX Developer and PX Developer to the CPU module on the other system.



Diagram 6.4 Access to Network Module via Tracking Cable

(2) Corrective Action when a Line Down Occurs during Access via a Network

(a) In the case of other than monitoring

A communication error occurs when accessing to a module mounted on the extension base unit via the network using the function other than [Monitor] of GX Developer or PX Developer.

As for functions other than [Monitor] of GX Developer or PX Developer, change the connection destination at [Transfer setup] and retry the communication. For MC protocol commands that can be used for communications made via a module on an extension base unit, refer to Appendix 8.

MELSOFT products connectable to a module mounted on the extension base unit are GX Works2, GX Developer, and PX Developer. However, there are restrictions on applicable functions. For details, refer to the following manuals.

- GX Works2 Version 1 Operating Manual (Common)
- GX Developer Version 8 Operating Manual
- PX Developer Version 1 Operating Manual (Programming Tool)

(b) In the case of monitoring

When a line down occurs during access via a network using PX Developer (monitoring tool), take the corrective action according to the system specified in the connection setup.

1) When "Not Specified" is Specified

A communication error occurs when "Not Specified" has been specified as the connection target using GX Developer or PX Developer (monitoring tool). Change the connection target in the connection set up of GX Developer or PX Developer (monitoring tool), and restart communication.

 When "Control System", "Standby System", "System A", or "System B" is Specified

When "Control System", "Standby System", "System A", or "System B" has been specified as the connection target using GX Developer or PX Developer (monitoring tool), switch the connection path, and, communication will continue with the specified system. OVERVIEW

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[Example]

If a line down occurs in system A during access when PX Developer (monitoring tools) is connected to that system, and the connection target is specified as system A, communication is continued with system A via system B.



Diagram 6.5 Communication continuation through system switching

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Communication via a tracking cable is carried out when the route system's power supply is on, and the tracking cable is connected properly.

Communication via a tracking cable is not carried out in the following cases.

- · When the route system's power supply is off
- When the route CPU module is reset
- When a watchdog timer error occurs in the route CPU module
- · When the connected system's power supply is off
- When the connected CPU module is reset
- When a watchdog timer error occurs in the connected CPU module
- When the tracking cable is not connected or broken.

6.2 Redundant System Network Overview

The following networks can be redundant.

(Network modules must be mounted on the main base units.)

- CC-Link IE Controller Network
- MELSECNET/H PLC to PLC network
- MELSECNET/H Remote I/O network
- MELSECNET/10 PLC to PLC network ^{*1}
- Ethernet
- MODBUS/TCP
- CC-Link
- MODBUS
- PROFIBUS-DP
- * 1: When connecting to MELSECNET/10 PLC to PLC network in redundant system, set MELSECNET/H to MELSECNET/10 mode. For details, refer to the following manual.
 I I I O Corresponding MELSECNET/H Network System Reference Manual (PLC to PLC network)

The above networks can continue the data link and communication with external devices, even when an error occurs in the control system.

However, the system is not switched when a communication error occurs in CC-Link and MODBUS. To switch the system, use the system switching instruction. For details of each network, refer to the manual for the network used.

The network modules for networks other than the abovementioned and serial

communication modules, etc., cannot be mounted on a main base unit for redundant system.

Mount them to the remote I/O station or extension base unit in the MELSECNET/H Remote I/O network.

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Diagram 6.6 Redundant System Network

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6.2.1 CC-Link IE Controller Network or MELSECNET/H PLC to PLC network

In a redundant system, the data link is continued through system switching even when an error occurs in the control system or control system network.

(1) Overview of Communication between Control System and Standby System Network Modules

In a redundant system, the control system network module carries out cyclic data communication, as the control system and standby system form one system. The standby system network module receives cyclic data from the other station in order to continue control even when system switching occurs.



Diagram 6.7 Communication between Control System and Standby System Network Modules

(2) Redundant System Operation at System Switching due to Control System Error

When system switching occurs due to a control system error, the data link is continued by the network module mounted on the new control system.

[Example]

Diagram 6.8 shows the redundant system operation when a stop error occurs in the control system CPU module, on the assumption that the control system network module is the control station of station No. 1, and the standby system network module is the normal station of station No. 2.



Diagram 6.8 Operation When System Switching Occurs Due to Control System Error

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(3) Redundant System Operation when a Communication Error Occurs in CC-Link IE Controller Network or MELSECNET/H PLC to PLC Network

(a) Continuation of Data Link via System Switching

When a communication error occurs in CC-Link IE Controller Network or MELSECNET/H PLC to PLC network, system switching is performed according to the following procedure so that the data link will be continued.

- 1) When detecting a communication error, the control system network module issues a system switching request to the control system CPU module.
- 2) When receiving the system switching request from the network module, the control CPU module performs END processing. Through the processing, system switching is performed.
- 3) After system switching is completed, the new control system network module continues the data link.

The standby system network module does not issue a system switching request even when a communication error occurs in CC-Link IE Controller Network or MELSECNET/H PLC to PLC network.

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[Example]

Diagram 6.9 shows the redundant system operation when the control system network module detects a communication error, on the assumption that the control system network module is the control station of station No.1, and the standby system network module is the normal station of station No. 2.



Diagram 6.9 Continuation of Data Link via System Switching

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(b) Operation of New Standby System Network Module

The new standby system network module that has developed a communication error is cut off from the network.

When the network communication error is cleared, the new standby system network module is returned to the network as the normal station.

(4) Station No. Settings for the Network Module

Set the station Nos. for network modules mounted on system A and system B of a redundant system with consecutive numbers.

[Example]

If station No. 3 is set for system A network module, system B network module can be set as station No. 2 or station No. 4.



Diagram 6.10 Station No. settings for the network module

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(5) Network Parameter Settings

The "host transmission ranges" of the network modules of system A and system B must be identical by making the pairing settings, as the systems form a redundant system.

For the control stations of network systems connected to a redundant system, make sure to make the pairing settings for the station Nos. of the network modules of system A and system B in the network parameter settings.^{*1}

Network parame	Network parameters Assignment the CC IE Control network range. Module No.: 1.																		
Setup common parameters.																			
System switching [2000] ms																			
Assignment method		Data link monitoring	time 20	100 ms	ms Parameter name														
Start/End Total slave stations					S	witch scre	ens LB/LW settings (1)												
			LB/LW se	ettings (1)										^		/	^J Set	station	No. 3
Station No.		LB			LW					_	-		Pairing				or	1 nairing	
1	Points	Start	End	Points	Start	End	Points	Start	End	Points	Start	End	Disable				101	+ pairing	
2	256	0100	00FF	256	00100	000FF							Disable	÷			L		
3	256	0200	02FF	256	00200	002FF							Enable	-					
4	256	0200	02FF	256	00200	002FF							Enable	•					
5	256	0300	03FF	256	00300	003FF							Disable	* *					
														•					
Specify I/O master station	Specif	y reserved	station	Equal assignment as		Iden ass	ical point gnment	256	Points	Help - se	Help - Network setting								
Supplementary setting	Supplementary setting				Clear		heck		End	Ca	Cancel								
4															F				

Diagram 6.11 Network Parameter Settings

* 1 : In the debug mode, the CPU module uses the parameters for system A to operate. Therefore, the station set as system B in the network parameters becomes absent station (disconnected station).

Refer to the following manual, for network parameters.

MELSEC-Q CC-Link IE Controller Network Reference Manual

Cresponding MELSECNET/H Network System Reference Manual

(PLC to PLC Network)

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Pairing settings can be made for the following CPU modules that can work as the control station.

- Redundant CPU ^{*1}
- High performance model QCPU ^{*1}
- Process CPU ^{*1}
- Basic model QCPU ^{*1}
- Universal model QCPU ^{*1}
- Q4ARCPU ^{*1 *2}

When connecting a redundant system to the network that includes the CPU module other than above, for which control station network parameters have been set, change the system A or system B of the redundant system to the control station.



Diagram 6.12 Changing the Control Station When Adding Redundant System

- * 1 : Refer to Section 2.3, for GX Developer that supports a redundant system (including pairing settings).
- * 2 : The pairing settings cannot be made with the Q4ARCPU in the CC-Link IE Controller Network.

(6) Startup Order of System A and System B

No restrictions apply to the startup order of system A and system B when connected to the CC-Link IE Controller Network or MELSECNET/H PLC to PLC network. After starting up system A and system B, the control system and standby system are determined, and then the data link is continued.

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(7) Precautions for Using Redundant System in CC-Link IE Controller Network or MELSECNET/H PLC to PLC Network

(a) Programming of CC-Link IE Controller Network or MELSECNET/H CC-Link IE Controller Network or MELSECNET/H network detects a temporary communication error depending on conditions such as power supply ON/OFF or cable and noise.

Create the program using CC-Link IE Controller Network or MELSECNET/H so that it will not stop controlling even when the temporary communication error is detected.

(b) Error detection by turning ON/OFF other station (including standby system) When turning ON/OFF power supply of the other station (including standby system) CPU module or booting and shutting down the personal computer where CC-Link IE Controller Network interface board or MELSECNET/H board is mounted, CC-Link IE Controller Network module or MELSECNET/H module of the control system may issue a system switching request, detecting a temporary communication error.

When the above-mentioned system switching request is issued before the standby system is started up, a continuation error "CAN'T SWITCH" may be detected in the control system CPU module. In this case, control can be continued normally. Therefore, create the program so that control will not be stopped due to error detection.

For canceling the error "CAN'T SWITCH", refer to Section 8.1.16. For details of CC-Link IE Controller Network or MELSECNET/H, refer to the following manual.

SMELSEC-Q CC-Link IE Controller Network Reference Manual

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

(c) Usage in debug mode when CC-Link IE Controller Network modules are mounted

When CC-Link IE Controller Network modules are mounted, do not connect CC-Link IE Controller Network module on both systems to the network at the same time.

In the debug mode, the system B CPU module uses the same parameters for the system A CPU module for operation. Therefore, control station overlap and station number overlap occur when connecting to the network at the same time.

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6.2.2 MELSECNET/H Remote I/O network

A redundant system uses a multiplexed remote I/O system of MELSECNET/H remote I/O network to continue the control of remote I/O stations even when system switching occurs. The multiplexed remote I/O network system consists of "multiplexed remote master station" that controls remote I/O stations, and "multiplexed remote sub-master stations" that is for backup of multiplexed remote master station.

In a redundant system, make sure to set system A as the multiplexed remote master station, and system B as the multiplexed remote sub-master station.

(1) Overview of Remote I/O Stations

The control system network module (multiplexed remote master station) performs data control with remote I/O station by data transmission, and data transmission with the multiplexed remote sub-master station.

The standby system network module (multiplexed remote sub-master station) receives data from remote I/O stations and sends/receives data to/from the multiplexed remote master station in order to take over the control of remote I/O stations even when system switching occurs.



Diagram 6.13 Overview of Remote I/O Station

control system CPU module.

(2) Redundant System Operation at System Switching

When system switching occurs, the new control system network module operates as the master station, and takes over the control of remote I/O stations. Diagram 6.14 shows a redundant system operation when a stop error occurs in the

Multiplexed Remote Master Multiplexed Remote Sub-master Station (station No. 0) Station (station No. 1) Control system Standby system 0.0[] • [] 0.0[] • [@ @ 000000000 00 ſ, Tracking cable MELSECNET/H Remote I/O network Remote I/O station Remote I/O station (station No. 2) (station No. 3) Multiplexed Remote Master Multiplexed Remote Sub-master Master Station (station No. 0) Station (station No. 1) station Standby Standby Control Control system system System 0 0 0 0 0 1) Stop Error has 0.01.010 2) Pe occurred Ē E. EF Tracking cable MELSECNET/H Remote I/O network Remote I/O station (station No. 2) Output is preserved during system switching Remote I/O station (station No. 3) Output is preserved during system switching

Diagram 6.14 Redundant System Operation at System Switching

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(3) Redundant System Operation when a Communication Error Occurs in the MELSECNET/H Remote I/O Network

(a) System Switching Procedure

When a communication error occurs in the MELSECNET/H remote I/O network, system switching is performed according to the following procedure, so that the data link will be continued.

- 1) When a communication error occurs in the MELSECNET/H remote I/O network, the control system network module issues a system switching request to the control system CPU module.
- 2) When receiving the system switching request from the network module, the control system CPU module performs END processing. Through the processing, system switching is performed.
- 3) After system switching is completed, the new control system network module continues the data link.

(b) Output Status during System Switching

The remote I/O station's output is held during system switching.

[Example]

Diagram 6.15 shows the redundant system when the control system network module detects a communication error, on the assumption that the control system network module is the master station, and the standby system network module is the sub-master station.



Diagram 6.15 Output Status during System Switching

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(4) Network Module Station No. Settings

Set station No. 0 (multiplexed remote master station) for the network module which is mounted on system A.

Set any of station No. 1 to 64 for the network module that is mounted on system B. If the network module mounted on system B is set to station No. 0, the "LINK PARA.ERROR (error code: 3101)" stop error will occur.



MELSECNET/H Remote I/O network

(5) Network Parameter Settings

In the network parameters for system A and system B, set the network type identically as "MNET/H (multiplexed remote master)".^{*1}



Diagram 6.17 Network parameter Setting the number of Ethernet/CC IE/MELSECNET cards

* 1 : In the debug mode, the CPU module uses the parameters for system A to operate. Therefore, the station set as system B in the network parameters becomes absent station (disconnected station).

Refer to the following manual for network parameters.

C Compatible MELSECNET/H Network System Reference Manual

(Remote I/O Network)

Diagram 6.16 Network Module Station No. Settings

(6) Startup Order of System A and System B

No restrictions apply to the startup order of system A and system B when connected to the MELSECNET/H remote I/O network.

After starting up system A and system B, the control system and standby system are determined, and then the data link is started.

(7) Checking the Standby System Operating Status

After power-ON, the status of a MELSECNET/H module on the standby system can be checked with the following link special relays (SB) on the control system CPU module side.

- SB75: Remote master station cyclic transmission status
- SB76: Remote sub-master station cyclic transmission status

When both of the above link special relays (SB) are OFF, the MELSECNET/H module on the standby system is running normally.

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(8) Detecting Configuration Mismatch for the Remote I/O Station in the Master Station and Sub-master Station

When a disconnection occurs in the system connected to the MELSECNET/H multiplexed remote I/O network, the accessible remote I/O stations might be different between the control system (master station) and standby system (sub-master station). In this case, as control cannot be continued after system switching, the "UNIT LAY. DIFF. (error code: 6036)" stop error (specific to the standby system in the backup mode) occurs in order to prevent system switching.

The abovementioned operation, i.e., checking whether the accessible remote I/O stations for the master station and sub-master station are identical, is called the "network separation check".

The "UNIT LAY. DIFF" occurs in the MELSECNET/H multiplexed remote I/O network that uses optical cables, when a disconnection occurs simultaneously at the following locations.

- · Between the master station and sub-master station
- Other than above location

In the diagram below, the "UNIT LAY. DIFF" occurs when a disconnection occurs simultaneously at point A and any of point B to D.



Diagram 6.18 Error Detection at Cable Disconnection

Table6.2 lists the transmission possibilities when a disconnection occurs at Point A only and when a disconnection occurs simultaneously at Point A and Point C.

					-		
Table6 2	Transmission	Possibilities	when	Disconnection	Occurs	at Point A	A and Point C
	manomooron			Bioooninoononi	000010	at i oniti	

	At Point	t A Only	At Points A and C			
	System A CPU	System B CPU	System A CPU	System B CPU		
	Module	Module	Module	Module		
1 Station	0	0	×	0		
2 Stations	0	0	0	×		
3 Stations	0	0	×	0		

 \bigcirc :Possible, \times :Not Possible

(9) Operation Mode Setting for Error Occurrence

For Redundant CPUs and MELSECNET/H remote I/O stations, the operation mode for occurrence of "fuse blown" and "module verify error" can be preset in PLC RAS settings in PLC parameter.^{*2}

Q parameter setting	MINE 171 UPI Remote 170 station parameter
PLC name PLC system PLC file PLC RAS(1) PLC RAS(2) Device Program Boot file SFC	I/O assignment PLC system PLC RAS Operational settings (I/O assignment)
WDT (Watchdog timer) setting Error check WDT Setting 200 ms (10ms-2000ms) Initial execution ms (10ms-2000ms) Corry out the blown check Verify module Low speed ms (10ms-2000ms) Import Check Cerry out the blown check monitoring time ms (10ms-2000ms) Import Check Cerry out the blown check monitoring time ms (10ms-2000ms) Constant counting Constant counting	- WDT (Watchdog time) setting Enor check. WDT Setting 200 ms (Toms-2000ms) Iridia execution monitoring time ms (Toms-2000ms) Low speed execution monitoring time ms (Toms-2000ms)
Operating mode when there is an error Computation error Stop	Operating mode when there is an error Computation error Stop
Expanded command error Stop Fue blown Stop Module verify error Stop Trelegent module program Stop Fle access error Stop Memory card operation error Stop External power supply OFF Stop Fle access Heritory No. Hern (16-100) Hern (16-100)<	Expanded command error Stop Fue blown Stop Module verify error Stop Irrellighert module program execution error Stop File access error Stop Memory card operation error Stop External power supply OFF Stop History No Item (16-100)
Acknowledge XY assignment Multiple CPU settings Default Check End	Cancel Acknowledge XY assignment Default Check End Cancel

Diagram 6.19 In the case of Redundant CPU

Diagram 6.20 In the case of Remote I/O Station

Different error-time operation modes can be set to the Redundant CPU (remote master station) and remote I/O station.

When an error (fuse blown or module verify error) occurs in a Redundant CPU (remote master station) and a remote I/O station, the data link and output of the remote I/O station is determined by the combination of the error-time operation mode settings of the Redundant CPU (remote master station) and remote I/O station. The following describes the data link and output status of the remote I/O station determined by the combination of the parameter settings.

(a) Operation when error occurs in Redundant CPU (remote master station)

Table6.3 Operation When Error Occurs in Redundant CPU (Remote Master Station)

Settings of operation mode for			Data link operation of	Output operation from remote			
error occurrence		Redundant CPU	MELSECNET/H remote I/O				
Redundant	Remote I/O	control status	metseche I/A remote I/O	I/O station			
CPU	station		Tietwork				
	Stop			Depends on the output mode			
Stop	Continue	Stops control.	All stations stop data link.	hold/clear settings for error			
		(Stop error)		occurrence.*3			
Continue	Stop Continues control.		All station continue data link	All stations output normally			
Continue	Continue	(Continue error)	All station continue data link.	All stations output normally.			

* 2 : Refer to the following manual for details of the PLC RAS setting.

CF Qn(H)/QnPH/QnPRHCPU User's Manual (Function Explanation, Program Fundamentals)

* 3 : Set the output mode for error occurrence in the I/O assignment detailed setting of the PLC parameter dialog box.

Refer to the following manual for details of the I/O assignment detailed setting.

CF Qn(H)/QnPH/QnPRHCPU User's Manual (Function Explanation, Program Fundamentals)

Settings of operation mode for error occurrenceRedundantRemote I/OCPUstation		Redundant CPU control status	Data link operation of MELSECNET/H remote I/O network	Output operation from remote I/O station		
	Stop	Stone control		Depends on the output mode		
Stop	Continue	(Stops control.	All stations stop data link.	hold/clear settings for error		
				occurrence.*4		
				The output of the faulty station		
	Stop	Continues control.		follows the hold/clear setting in		
Continue			All stations continue data link.	the error-time output mode. ^{*4}		
		(Continue error)		All stations output normally.		
	Continue			All stations output normally.		

Table6.4 Operation When Error Occurs in remote I/O station

* 4 : Set the output mode for error occurrence in the I/O assignment detailed setting of the PLC parameter dialog box.

Refer to the following manual for details of the I/O assignment detailed setting.

CF Qn(H)/QnPH/QnPRHCPU User's Manual (Function Explanation, Program Fundamentals)

(10)Precautions for Using Redundant System in MELSECNET/H Remote I/O Network

(a) Programming of MELSECNET/H

The MELSECNET/H network detects a temporary communication error depending on conditions such as power supply ON/OFF or cable and noise. Create the program using the MELSECNET/H so that it will not stop controlling even when the temporary communication error is detected.

(b) Error detection by turning ON/OFF other station (including standby system)

When turning ON/OFF power supply of the other station (including standby system) CPU module or booting and shutting down the personal computer where the MELSECNET/H board is mounted, the MELSECNET/H module of the control system may issue a system switching request, detecting a temporary communication error.

When the above-mentioned system switching request is issued before the standby system is started up, a continuation error "CAN'T SWITCH" may be detected in the control system CPU module. In this case, control can be continued normally. Therefore, create the program so that control will not be stopped due to error detection.

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6.2.3 Ethernet

External devices use MC protocol, fixed buffers, random access buffers, data link instructions, etc. to communicate with the CPU modules of a redundant system. Partner products including EZ Socket^{*1} can also communicate with them through OPS

Refer to the following manual below for details.

CPQ-Corresponding Ethernet Interface Module User's Manual (Basic)

* 1: Indicates the FA communication middleware for programmable controllers, servos, robots, NC, etc. made by Mitsubishi Electric, which consists of the Windows[®] API (Application Programming Interface). By using EZ Socket, each partner company can easily develop FA-related application software using FA devices made by Mitsubishi Electric, which operate on Windows[®] personal computers.

connection.

Ethernet module can be mounted to the main base unit or extension base unit. Note that dedicated instructions cannot be used when it is mounted to the extension base unit. When using dedicated instructions, mount it to the main base unit. The control system Ethernet module can issue a system switching request to the control system CPU module when it detects a communication error or disconnection*².

System switching is carried out when the control system CPU module receives the system switching request from that Ethernet module.

The system switching request can be set to be issued or not in the network parameters, as indicated in (3).



Diagram 6.21 Operation when a communication error or disconnection is detected

* 1: Only the QJ71E71-100 can detect disconnection.

Remark A system switching request is not issued when Ethernet interface module is mounted to the extension base unit. 6

(1) Overview of Communication with External Devices

(a) Communication by MC Protocol, and Data Link Instructions For MC protocol, external devices can communicate with the specified system, i.e., control system, standby system, system A, or system B.

(b) Communication by Fixed Buffers and Random Access Buffers For fixed buffers and random access buffers, external devices can communicate with the control system Ethernet module only, as processing via sequence programs is necessary.

(2) External Device Operation at System Switching

When system switching occurs in a redundant system, external devices operate differently according to the communication method.

(a) In the case of OPS connection

When system switching occurs in a redundant system, the OPS automatically switches the connection path, and continues the communication.

[Example]

Diagram 6.22 shows the external device operation when the control system Ethernet module detects a communication error.



Diagram 6.22 Operation at Communication Error Detection

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(b) Communication with the Control System/Standby System by MC Protocol or Data Link Instructions

Even when system switching occurs in a redundant system, communication can be continued if the communication path is normal.

When the communication cannot be continued the external device develops a communication error. In this case, review the communication path and restart the communication.

(c) Communication other than above

When system switching occurs in a redundant system, the external device develops a communication error occurs.

In this case, review the communication path and restart the communication.

(3) Network Parameter Settings

IP address, station No., and mode of Ethernet are set in [Redundant settings] of the network parameter in the redundant system.

(a) When mounting to the main base unit

When mounting to the main base unit, set [Network type] as [Ethernet (Main base)].

(b) When mounting to the extension base unit

When mounting to the extension base unit, set [Network type] as [Ethernet (Extension base)].

Write the set network parameters to the CPU modules of System A and System B.^{*1} Refer to the following manual, for network parameters.

Crresponding Ethernet Interface Module User's Manual (Basic)

Redundant settings										×	
System B settings Station number and mode setting (System A) Station number Mode Online	Issu Cable Issu System s	e system e disconr e system witching	switch in (nection tim switch in (settings wł	Cab eou com nen	le disconnection timeout t setting 2.0 se munication error communication error oc	ec (C curs).Osec - 30.	.Osec	5)		
Station number and mode setting (System B)		Setting	Protoco	ol	Open system		Fixed bu	ffer	Fixed buffer communication procedure	1	
Station number 2	1	V	TCP	Ŧ	Active	Ŧ	Send	Ŧ	Procedure exist	-	
	2	Ľ	TCP	۳	Active	Ŧ	Receive	Ŧ	Procedure exist	•	
Mode Online 💌	3			•		•		•		•	I
	4		TCP	* *	Active	Ť	Send		Procedure evist	-	
IP address settings	6		10	*	Moure	-	Jona	-	T TOCODORC CAISE	• •	
Input format DEC.		Enable a	uto open l	UDF	° port(*)					•	I I
System A	Г	Enable (aX Develo	per	UDP communication por	t(*)					
	Г	Enable (aX Develo	Der	TCP communication port						
192 0 1 1								1			
System B		Chable I	TT COMIN	on IIC	adon por						
		Enable H	ITTP com	mur	nication port						
192 0 1 2		It is nec setting	essary to s during com	set t imui	he remote password if th nication error is enabled i	e sy n (*)	stem switcl	n			
					Check E	nd		(Cancel		-

Diagram 6.23 Network Parameter Setting Window

* 1 : In the debug mode, the CPU module uses the parameters for system A to operate. Therefore, the station set as system B in the network parameters becomes absent station (disconnected station).

(4) System Startup Order

No restrictions apply to the startup order of system A and system B when connected to the Ethernet.

6.2.4 MODBUS/TCP

The transmission lines can be redundant by mounting MODBUS/TCP modules (slave function) on the main base units where the Redundant CPUs are mounded. When the lines do not need to be redundant or using MODBUS/TCP modules as master stations, mount them on an extension base unit.

When any of following is occurred, a system switching request is issued.

- Ethernet cable disconnection detection
- Communication error with the MODBUS/TCP device
- Communication error with GX Developer



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(1) System switching request to the control system CPU module

This function issues a system switching request to the control system CPU module if the QJ71MT91 mounted on the main base unit in a redundant system detects a communication error or disconnection.



MODBUS/TCP master device

MODBUS/TCP slave

Diagram 6.25 System Switching Request to the Control System CPU Module

(2) Conditions under which a system switching request is issued

The QJ71MT91 issues a system switching request when the following conditions are satisfied.

Condition	Description		
Communication error with the	KoonAlivo timoout	After communications started, the existence of the	
MODBUS/TCP device ^{*1}	ReepAnve lineout	target device cannot be confirmed.	
Communication error with GX	LIL P timoout	An ACK response is not returned from the target	
Developer		device within the TCP ULP timer time.	
	The cable connected to the QJ71MT91 is		
Ethernet cable disconnecti	disconnected, or the connection target device is		
		powered off.	

Table6.5 System Switching Request Issuing Conditions

* 1: Applicable only when the slave function (automatic response function) is used.

- When the standby system has already been in error status, a system switching is not performed even if the QJ71MT91 issues a system switching request.
- Conditions under which a system switching request is issued are set using switch 5 (redundant settings) of the intelligent function module switch setting.

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(3) System switching request operation due to communication error

The QJ71MT91 monitors communications with the target device for an error using a KeepAlive and TCP ULP timer.

(a) System switching timing when a KeepAlive is used

When the QJ71MT91 has not communicated with the target device where a TCP connection is open for a certain period of time, it sends a KeepAlive ACK message. If a response message is not returned from the target device, the QJ71MT91 detects a communication error and issues a system switching request to the control system CPU module. [Example]

When KeepAlive resent count is two.



For the setting method of KeepAlive, refer to the following.

GMODBUS/TCP Interface Module User's Manual

(b) System switching timing when a ULP timeout is used

When ACK is not returned from the target device after the data has been sent from the QJ71MT91, data will be resent according to the setting value of the TCP resend timer until after time of the TCP ULP timer value has passed. If ACK is not returned from the target device within the TCP ULP timer time, the QJ71MT91 detects a communication error and issues a system switching request to the control system CPU module.



Diagram 6.27 System Switching Timing When a ULP Timeout is Used

For the setting method of TCP ULP timer and TCP resend timer value, refer to the following.

MODBUS/TCP Interface Module User's Manual

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(4) System switching request operation upon disconnection detection The QJ71MT91 mounted on the control system CPU module monitors the connection status of the Ethernet cable connected to the QJ71MT91, and on detection of

disconnection, it issues a system switching request to the control system CPU module.

(a) Conditions upon disconnection detection

Disconnection is detected in the following cases.

- Disconnection between the QJ71MT91 and a hub
- Ethernet cable removal from the hub side connector
- Hub power-off
- Ethernet cable removal from the QJ71MT91 side connector
- (b) Disconnection detection timing

The QJ71MT91 starts disconnection detection after initial processing completion. On detection of disconnection, the QJ71MT91 performs a disconnection status time check, and when the disconnected status exceeds the disconnection detection time set using the switch 5 (redundant settings) of the intelligent function module switch setting, the QJ71MT91 issues a system switching request to the control system CPU module. When the disconnected status returns to normal within the disconnection detection time, the QJ71MT91 does not issue a system switching request.





- Disconnection is not detected when linkup has not yet been performed after system startup. (Disconnection is detected only when normal status turns to abnormal.)
- Disconnection of the Ethernet cable that is not directly connected to QJ71MT91 cannot be detected.
- Set the disconnection detection time from a few seconds to several tens of seconds. If the setting value of the disconnection detection time is too small, the system switching may occur even by noise or other factors.

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(5) Redundant system operation at system switching

When system switching occurs in a redundant system, the MODBUS/TCP module operates differently according to the mode set using the switch 5 (redundant settings) of the intelligent function module switch setting.

Two modes are available: fixed IP mode and redundant IP mode.

(a) Fixed IP mode

Fixed IP addresses are assigned to system A and system B. Even if a system switching occurs, the IP addresses are not switched.

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Processing of judging the current control system and switching the communication destination (system A or system B) on the MODBUS/TCP master side are required.

The MODBUS/TCP master can identify whether the target CPU module is the control system or standby system by reading SM1515 (Control system judgement flag) and SM1516 (Standby system judgement flag) of the CPU module.

(When the default settings are used for device assignment parameters: SM1515 = coil 21995, SM1516 = coil 21996)

(b) Redundant IP mode

IP addresses are assigned to the control system and standby system. If a system switching occurs, the IP addresses are also switched.

When the systems are switched, the access destination IP address needs not to be modified.

Use the fixed IP mode for communication specifying system A and system B.

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• When system switching occurs, the TCP connection of the previously used is disconnected.

Reconnect to a network from the MODBUS/TCP master and reopen the TCP connection.

- In the redundant IP mode, the IP addresses after a system switching are notified by issuing the Gratuitous ARP from the QJ71MT91 when system switching occurs. Use the fixed IP mode when using a MODBUS/TCP master device which does not support the Gratuitous ARP or disabling the Gratuitous ARP in a security software setting on the MODBUS/TCP master side.
- Use the fixed IP mode when using the QJ71MT91 as the MODBUS/TCP master. (The redundant IP mode cannot be used.)

(6) Intelligent function module switch setting

For the intelligent function module switch setting, refer to the following manual. The redundant system operates using the switch 5 (redundant settings) of the intelligent function module switch setting.

STMODBUS/TCP Interface Module User's Manual

(7) Parameters

Set the same parameters for both MODBUS/TCP modules in the control system and the standby system.

Set the parameters for the MODBUS/TCP modules using GX Developer. Do not change the parameters using I/O signals (such as Basic parameter setting request, MODBUS device assignment parameter setting request). If parameters are changed using I/O signals, the consistency of parameters for both the control system and the standby system may not be maintained.

(8) Communication procedure for access to the control system CPU module in a redundant system

The following shows a communication procedure example.

(a) For fixed IP mode

Communications can be continued by judging the current control system and switching the communication destination (system A or system B) on the MODBUS/TCP master side.

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Diagram 6.31 Communication Example for Fixed IP Mode

(b) For redundant IP mode

Communications continue because the MODBUS/TCP master accesses to the IP address of the control system.



Diagram 6.32 Communication Example for Redundant IP Mode

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6.2.5 CC-Link

A redundant system can continue the CC-Link control by CC-Link standby master function, even when system switching occurs.

When using this function, set the system A as "master station" that controls the data link, and system B as "standby master station" for backup of "master station".

Refer to the following manual, for CC-Link standby master function.

CFMELSEC-Q CC-Link System Master/Local Module User's Manual



Diagram 6.33 CC-Link Operation at System Switching

Auto refresh can be made when mounting the CC-Link master module to the extension base unit. Set the tracking device setting to the device where the auto refresh is performed.

When using the auto refresh, set [Refresh settings] of the network parameter. Set the tracking device setting to the device where the auto refresh is set.

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(1) Overview of Remote Stations

In a redundant system, the control system master station controls remote stations and sends/receives data to/from standby system master station.

The standby system standby master station receives data from the remote stations and sends/receives data to/from the master station, in order to continue the CC-Link control even when system switching occurs.



Diagram 6.34 Control of and Data Communication with Remote Stations

(2) Redundant system Operation at the time of System Switching

(a) When System Switching Occurs due to Control System Error

When an error occurs in the control system and system switching occurs, the new control system standby master station starts to operate as the master station and takes over the control of the remote stations.

Diagram 6.35 shows the redundant system operation when a stop error occurs in the control system CPU module.



Diagram 6.35 Operation at System Switching due to Control System Error

(b) When System Switching Occurs due to Communication Error in Network other than CC-Link

When a communication error occurs in a network other than CC-Link, system switching occurs and the new control system takes over the control of the redundant system.

However, the new standby system master station does not switch to the standby master station, as it can communicate with remote stations.

Also, the new control system standby master station remains as the standby master station, and cannot control remote stations as the master station. As a result, the new control system is unable to control the CC-Link.

Make sure to switch the data link control from the standby master station to the master station using the new control system's program.

Refer to Appendix 4 for program details.



Diagram 6.36 Operation at System Switching due to Communication Error of Network other than CC-Link

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(c) When System Switching is Manually Carried Out

When system switching is manually carried out, the new control system takes over the control of the redundant system.

However, the new standby system master station does not switch to the standby master station, as it can communicate with remote stations.

Also, the new standby system master station remains as the standby station and cannot control remote stations as the master station.

As a result, the new control system is unable to control the CC-Link.

Make sure to switch the data link control from the standby master station to the master station using the new control system's program.



Refer to Appendix 4 for program details.

Diagram 6.37 Operation When System Switching Is Manually Carried Out

(3) Programs for Switching the Standby Master Station that Controls CC-Link

Refer to Appendix 4 for programs that switches the standby master station that controls the CC-Link from the previous control system standby master station to the new one when system switching occurs.

(4) Network Parameter Setting

Set [Type] (station type) of network parameter as follows:

- (a) When mounting to the main base unit Set station type as [Master station (Duplex function)].
- (b) When mounting to the extension base unit Set station type as [Master station (Extension base)].

Refer to Appendix 4 for network parameter settings.

(5) System Start-up

- (a) The QJ61BT11N whose first 5 digits of serial No. is "07112" or later When using the CC-Link, control by the CC-Link is enabled when starting up either system A or system B.
- (b) The QJ61BT11N whose first 5 digits of serial No. is "07111" or earlier When the redundant system is connected to CC-Link, start up the system so that system A will be the control system. Control via CC-Link cannot be performed when system B only is started up.

(6) Checking the operating status of standby system

After power-ON, the status of CC-Link master module on the standby system can be checked with the link special register (SW80) of the control system CPU module. If the normal data link status of the standby master station (the bit corresponding to the standby master station is OFF in SW80) stays ON for two seconds or more, the CC-Link master module on the standby system has started normally.

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(a) Station number setting

Set CC-Link master module station number so that station number 0 is assigned to system A (master station), and other than station number 0 (standby master station) is assigned to system B.

(b) Tracking device setting

Set a device that makes auto refresh setting to the CC-Link master module on the extension base unit as a tracking device.

Do not set the link special relay (SB) and link special register (SW) as tracking transfer device to the CC-Link master module mounted on the main base unit.

(c) When using CC-Link

When the CC-Link master module is mounted on main base unit, the redundant system cannot start with the previous control system. (F Appendix 5)

(d) Parameters in the debug mode

In the debug mode, the CPU module uses the parameters for system A to operate. Therefore, the station set as system B in the network parameters becomes absent station (disconnected station).

(8) Output Holding Time of Remote Station at System Switching

When system switching occurs, the remote station output is held until system switching is completed. (The remote station cannot be controlled from when system switching occurs until it is completed.)

Use the expression listed in Table6.6 to calculate the remote station output holding time (output holding time) at system switching occurrence.

Reasons for System Switching	Output Holding Time Calculation Expression (ms)
Control system power off	•When (3 $ imes$ LS) > 100ms
Control system CPU module reset	(Output holding time) = (error detection processing time*1) + 100 + 6 \times LS + SS + (I/O
Control system CPU module stop error	response time)
	•When 100ms > (3 $ imes$ LS)
Control system CPU module hardware fault	(Output holding time) = (error detection processing time*1) + 200 + 3 \times LS + SS + (I/O
	response time)
System switching by GX Developer	•When (3 $ imes$ LS) > 100ms
System switching by system switching	(Output holding time) = (error detection processing time*1) + 300 + 6 \times LS + 2 \times SS + (I/O
instruction	response time)
• · · · · · · · · · · · · · · · · · · ·	•When 100ms > (3 $ imes$ LS)
System switching by system switching	(Output holding time) = (error detection processing time*1) + 400 + 3 \times LS + 2 \times SS + (I/O
request from network module	response time)

Table6.6 Remote Station Output Holding Time

LS : Link scan time

Refer to the following manual for the link scan time calculation method.

MELSEC-Q CC-Link System Master/Local Module User's Manual

SS : Sequence program scan time

* 1 : Use the value in Table6.7 as the error detection processing time.

Table6.7 Error Detection Processing Time

Transmission speed	Error detection processing time
10Mbps	5ms
5Mbps	8ms
2.5Mbps	15ms
625kbps	50ms
156kbps	400ms

6.2.6 MODBUS

The transmission lines can be redundant by mounting MODBUS modules (slave function) on the main base units where the Redundant CPUs are mounded.

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When the lines do not need to be redundant or using MODBUS modules as master stations, mount them on an extension base unit.



(1) Mounting the modules on the main base units (Configuring redundant transmission lines)

To configure redundant transmission lines, mount the MODBUS modules on the main base units. (Only the slave function can be used.)

With a backup line, data communications with the master device (or station) can be continued even when a MODBUS communication error occurs.

Note, however, that when a communication error occurs in MODBUS, the system will not be switched automatically. The system needs to be switched using a program. For details of programming, refer to Appendix 5.

(a) Parameter settings

Set the same parameters for both communication-target master devices that communicate with the MODBUS modules.

Also, set the same parameters for both MODBUS modules in the control system and the standby system.

(b) MODBUS device assignment parameter settings

To change the MODBUS device assignment parameters from their default settings, use GX Configurator-MB.

Store the parameter settings in GX Configurator-MB, and terminate the GX Configurator. Then, execute the write to PLC function using GX Developer and write the setting data to the CPU modules in the control system and the standby system.

(c) Turning off the ERR. LED

An error in the MODBUS module of the standby system cannot be cleared using GX Configurator-MB, GX Works2, nor sequence programs.

To turn off the ERR. LED, issue a request message for clearing an error from the master station.

For details, refer to the following manual.

CF MODBUS Interface Module User's Manual

(2) Mounting the modules on an extension base unit

When mounting the modules on an extension base unit, refer to Section 2.1 (7).

6.2.7 Serial Communication Modules

Mount the serial communication module on the MELSECNET/H remote I/O station or extension base unit. (The serial communication module cannot be mounted to the main base unit where the Redundant CPU module is mounted.)

Communication from the serial communication module to external devices can be made by MC protocol, nonprocedural protocol, and bidirectional protocol.

For MC protocol, external devices can communicate with the specified system, i.e., control system, standby system, system A, or system B.

Refer to the following manual for MC protocol.

MELSEC Communication Protocol Reference Manual

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When a serial communication module is mounted on an extension base unit, dedicated instructions cannot be used; therefore, create a program using the FROM/TO instructions.

For the sample program using the FROM/TO instruction, refer to Appendix 7.

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(1) Communication between External Devices and Control System CPU Module

- (a) Communication by MC Protocol
 - 1) When mounting to the extension base unit

There are restrictions on the connection destination depending on the command from the external device to MC protocol. (1 + 2 + 2)

(Appendix 7 (1))

In addition, when system switching occurs, the communication timeout will occur since both old system and new system cannot respond. Therefore,

perform retry processing by MC protocol.



Diagram 6.39 Operation for Communication with Control System CPU Module by MC Protocol

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2) When mounting to the main base unit

Specify the "control system" by MC protocol on each eternal device, and perform the communication with the control system CPU module. If the "control system" is specified by MC protocol, communication with the new control system CPU module can be performed, even when system switching occurs.



Diagram 6.40 Operation for Communication with Control System CPU Module by MC Protocol

(b) Communication by Nonprocedural Protocol/Bidirectional Protocol For nonprocedural protocol/bidirectional protocol, communication with external

devices can be performed using the control system CPU module's programs.

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(2) Communication between External Devices and the Standby System CPU Module

(a) Communication by MC Protocol

Specify the "standby system" by MC protocol on each external device, and perform the communication with the control system CPU module. If the "standby system" is specified by MC protocol, communication with the new standby system CPU module can be performed, even when system switching occurs. Communication can be performed by MC protocol only.



Diagram 6.41 Operation for Communication with Standby System CPU Module by MC Protocol

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(3) Communication between External Devices and System A/System B

(a) Communication by MC Protocol

In order to perform the communication with the system A/system B CPU module, specify "System A" or "System B" on each external device by MC protocol. If "System A" or "System B" is specified by MC protocol, communication with the specified system CPU module can be performed even when system switching occurs.

This communication can be performed by MC protocol only.



Diagram 6.42 Communication with System A CPU Module by MC Protocol

6.2 Redundant System Network Overview

6.2.7 Serial Communication Modules

6.2.8 PROFIBUS-DP

(1) Communication overview of the PROFIBUS-DP

In redundant system, when the PROFIBUS-DP master module detects a fault or communication failure with DP-Slaves, the standby system master module is switched to new control system master module and inherits the PROFIBUS communications.

(2) Operation at system switching

The PROFIBUS-DP master modules switch each system on the following cases.

- When the PROFIBUS-DP master module detects a fault
- When a communication failure with DP-Slaves is detected



Diagram 6.43 Operation of the PROFIBUS-DP Master Module at System Switching
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(3) Line redundant system

The line redundant system allows the system configuration using 2 lines, and either of the lines is used for slave station control. When an error occurs at the controlling line, the control is inherited to another line.

(4) Station number setting

Set the station number of the PROFIBUS-DP master module with GX Developer and GX Configurator-DP.

For details of setting method, refer to the following manual.

PROFIBUS-DP Master Module User's Manual

(5) Startup order of system A and system B

When using the PROFIBUS-DP master module, startup order of system A and system B is unrestricted.

After the both system is started up and assigned their system (Control system/ standby system), data link is started.

(6) Precautions when using the PROFIBUS-DP master modules in redundant system

- (a) Function version of the PROFIBUS-DP master modules Use the PROFIBUS-DP master modules of function version D or later.
- (b) GX Developer version Use GX Developer version 8.18U or later.
- (c) At redundant system startup
 - Check for an error of the PROFIBUS-DP master module at local station error information area (Un\G23071).
 - For local station error information area, refer to the following manual.

PROFIBUS-DP Master Module User's Manual

• When there is an error, clear the error to perform system switching.

(d) Continuing each function of the PROFIBUS-DP master module For precautions to continue each function of the PROFIBUS-DP master module, refer to the following manual.

PROFIBUS-DP Master Module User's Manual

6.3 Communication between the Both Systems CPU Module and GOTs

When the GOT communicates with the standby system/control system CPU module, the communication target can be specified by the station No.

(The GOT cannot specify the system (control system, standby system, system A, or system B.))

Table6.8 lists the connection method and connectability when the GOT is used in the redundant system. For the restrictions when the GOT is used in the redundant system, refer to the following manual.

GOT1000 Series Connection Manual (Mitsubishi Products)

Connectior	n method	Connectability	Remarks
			Not connectable since the stop error EXTEND BASE ERR. (error
	Bus connection	×	code: 2010) ^{*1} occurs to the CPU module.
	CPU direct connection	0	
	Computer link		Not connectable since the serial communication module cannot be
		×	mounted to the main base unit where the Redundant CPU is
Main base unit where	connection		mounted.
Redundant CPU is	Ethernet connection	0	
mounted	CC-Link IE Controller	\sim	
	Network	0	
	MELSECNET/H PLC to	\bigcirc	
	PLC network	0	
	MELSECNET/10 PLC	\bigcirc	
	to PLC network	\bigcirc	
	CC-Link connection	0	
	Bus connection	×	Not connectable (No error occurs to the CPU module.)
	Computer link	\bigcirc	
	connection	0	
	Ethernet connection	\bigcirc	
	CC-Link IE Controller	~	Not connectable since CC-Link IE Controller Network module
Extension base unit	Network	^	cannot be mounted to the extension base unit.
	MELSECNET/H PLC to	×	Not connectable since MELSECNET/H module cannot be mounted
	PLC network	~	to the extension base unit.
	MELSECNET/10 PLC	×	Not connectable since MELSECNET/H module cannot be mounted
	to PLC network		to the extension base unit.
	CC-Link connection	0	
	Bus Connection	×	
MELSECNET/H remote	CPU Direct Connection	0	
I/O station	Computer Link	\bigcirc	
	Connection	0	
	Ethernet connection	0	
	Bus Connection	×	
MELSECNET/10 remote	CPU Direct Connection	×	Not connectable since MELSECNET/10 is not compatible with the
I/O station	Computer Link	~	Redundant CPU.
	Connection	X	

Table6.8 Connection Method of GOT and its Connectability in Redundant System

 \bigcirc : Applicable, \times : N/A

* 1: EXTEND BASE ERR. (error code: 2012) occurs to the CPU module whose first 5 digits of serial No. is "09012" or later.



Diagram 6.44 GOT Connection Method Applicable to a Redundant System

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6.3.1 When connecting GOTs to MELSECNET/H remote I/O station

For MELSECNET/H network connection, connect GOTs to a remote I/O module or serial communication module mounted on a MELSECNET/H remote I/O network remote I/O station.

The GOT cannot be connected to the base unit of a remote I/O station (bus connection). When connected to the base unit of a remote I/O station, the GOT will result in a communication error.

(1) GOT connection methods

Make sure to connect GOTs to a remote I/O station via "CPU direct connection" or "computer link connection".

For CPU direct connection, connect the GOT to the remote I/O module mounted on the remote I/O station via the RS-232 port.

For computer link connection, connect the GOT to a serial communication module mounted on a remote I/O station via the RS-232 port.



Diagram 6.45 GOT Connection Method

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(2) Communication method

The GOT communicates with the control system CPU module since the remote I/O module communicates with the network module which operates as the master station by specifying station No. 0 in the GOT.

Even when system switching occurs, the remote I/O module communicates with the network module which operates as the master station in the new control system. Therefore, the GOT communicates with the new control system CPU module. For details, refer to the following manual.

GOT1000 Series Connection Manual (Mitsubishi Products)

6.3.2 When Connecting GOTs to CC-Link

As for the GOT, connect it to the CC-Link on the main base unit or CC-Link on the extension base unit, or connect it to the CC-Link communication module (AJ65BT-G4-S3) connected to the CC-Link.

The GOTs will work as intelligent device stations or a remote device stations, depending on the CC-Link communication module used.



Diagram 6.46 System When Connecting GOTs to CC-Link

(1) GOT connection methods

The connection method for connecting GOTs to the CC-Link is referred to as "CC-Link connection".

In this method, mount a CC-Link communication unit (GOT-dedicated product) to a GOT, and then connect it to the CC-Link.

(2) Communication method

The GOT communicates with the control system CPU module of the master station by specifying station No. 0 in the GOT.

Even when system switching occurs, the network module of the new control system operates as the master station. Therefore, the GOT communicates with the new control system CPU module. (When connection is made via the extension base unit, the GOT always monitors the control system.)

For details, refer to the following manual.

GT1000 Series Connection Manual (Mitsubishi Products)

6.3.3 Communication when the GOT is Connected to CC-Link IE Controller Network, MELSECNET/H, or MELSECNET/10 PLC to PLC Network

Connect GOTs to a CC-Link IE Controller Network, MELSECNET/H, or MELSECNET/10 PLC to PLC network.

(1) GOT connection type

The following are connection types of the GOT.

- "CC-Link IE Controller Network connection" *1
- "MELSECNET/H connection (PLC to PLC network)"
- "MELSECNET/10 connection (PLC to PLC network)"



Diagram 6.47 GOT Connection Method (CC-Link IE Controller Network)

* 1: GOT-A900 series cannot be used in the CC-Link IE Controller Network connection.

(2) Communication method

(a) GOT1000 series

The GOT can monitor the control system of the redundant system by setting the Q redundant setting.

The monitoring target can be changed automatically even when system switching occurs.

For the function to enable this automatic changing of the monitoring target at the GOT, refer to the following manual.

GOT1000 Series Connection Manual (Mitsubishi Products)

(b) GOT-A900 series

The GOT specifies the target communication station connected to the MELSECNET/10 PLC to PLC network by the network No. and station No. It is necessary to create a window to switch station No. of systems A and B to monitor when system switching occurs.

For details, refer to the following manual.

GOT-A900 Series User's Manual (GT Works2 Version2/GT Designer2 Version2 compatible Connection System Manual) OVERVIEW

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6.3.4 When Connecting GOTs to a Ethernet

The GOT is connected to Ethernet module mounted on the main base unit or Ethernet module mounted on the extension base unit.

(1) GOT Connection Methods

Connect GOTs to a Ethernet via "Ethernet connection".







Diagram 6.49 GOT Connection Type (when Mounting to Extension Base Unit)

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(2) Communication method

(a) GOT1000 series

The GOT can monitor the control system of the redundant system by setting the Q redundant setting.

The monitoring target can be changed automatically even when system switching occurs. (When connecting via the extension base unit, the control system is always monitored.)

For the function to enable this automatic changing of the monitoring target at the GOT, refer to the following manual.

GT1000 Series Connection Manual (Mitsubishi Products)

(b) GOT-A900 series

The GOT specifies the target communication station connected to Ethernet by the network No. and station No.

It is necessary to specify the station No. of systems A and B when communicating with the redundant system in the GOT. It is also necessary to create a window to switch station No. of systems A and B to monitor when system switching occurs in the redundant system.

For details, refer to the following manual.

GOT-A900 Series User's Manual (GT Works2 Version2/GT Designer2 Version2 compatible Connection System Manual)

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6.4 Precautions for Accessing Redundant CPU from Other Networks

In a system using CC-Link IE Controller Network, MELSECNET/H, MELSECNET/10 or Ethernet, use of GX Developer or MC protocol allows communication with a redundant CPU by specifying "control system", "standby system", "System A" or "System B". Note that when accessing a redundant CPU from another network (network of different network No.), there are the following restrictions on the CPU modules that can be used as relay stations. (

Table6.9 CPU Modules Applicable to Relay Stations for Communication with Redundant CPU from Other Networks

Serial No. of CPU module		06051 or earlier				06052 or later					
System sr	pecification	Not	Control	Standby	System	System	Not	Control	Standby	System	System
e yetein ep		specified	system	system	Α	В	specified	system	system	Α	В
	Q00JCPU										
	Q00CPU										
	Q01CPU										
Q02CPU CPU module Q02HCPU	Q02CPU										
	\sim	~		X	~	\sim	\sim	\sim	\sim	\sim	
model name	odel name Q06HCPU	0	~	~	~	~	0	0	0	0	0
	Q12HCPU										
	Q25HCPU										
	Q12PHCPU										
	Q25PHCPU										

 \bigcirc : Applicable, \times : Inapplicable

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[Example]

Diagram 6.50 shows a system configuration example for making communication by specifying the "control system" of a redundant system by GX Developer and MC protocol of other networks.



Diagram 6.50 System Configuration for Communication from Other Networks with "Control System" Specified

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6.5 Precautions for Writing Device Data from Other Station

(1) Operation When System Switching Occurs Until Tracking Is Completed

When the devices of the control system CPU module where data have been written are set to within the tracking range, the device data written in the control system CPU module are also tracked to the standby system CPU module.

However, if system switching occurs due to any of the following reasons from when write of device data to the control system CPU module is completed until tracking is completed, the device data written in the control system CPU module are not tracked to the standby system CPU module.

- · Control system power off
- Control system CPU module reset
- · Control system hardware fault
- Control system CPU module stop error

At this time, the new control system CPU module after system switching uses the old device data for control.

(2) Checking for system switching after device data write

After writing device data to the control system CPU module by GX Developer or other means, check for system switching occurrence.

System switching can be checked by either of the following methods.

(a) Checking for system switching by verifying written device data

After write of device data to the control system CPU module is completed, read the written device data from the control system CPU module to check whether system switching occurred or not.





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(b) Checking for system switching by system A and system B identification flags

Whether system switching occurred or not can be confirmed by checking the system A and system B identification flags before and after write of device data.



Diagram 6.52 Flowchart for Checking for System Switching with the system A and system B identification Flags

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CHAPTER7 PROGRAMMING CAUTIONS

This chapter provides the programming cautions (restrictions on instructions, and fixedscan clocks and fixed scan execution type programs).

7.1 Instructions Restricted in Use for Redundant System

Some instructions are restricted in use to a redundant system as indicated below.

(1) Instructions Requiring a Certain Number of Scans

(a) Instruction Operations

Some instructions require a certain number of scans from start to completion of the execution. If system switching conditions are satisfied while this kind of instruction is being executed, the CPU stops the execution and the relevant processing will not be completed.

In this case, it is necessary to use the user program to execute that instruction again after system switching.

Instru	ction Classification	Instruction Symbol	Execution Completion Signal	
Data-processing	Cort	• SORT	Present	
Instructions	Soft	• DSORT		
Character String	Read	COMPD	Present	
Processing	i teau	COMIND	Tresent	
Other Convenient	Write data to specified file	SP.FWRITE	Present	
Instructions	Read data to specified file	SP.FREAD	Present	
Instructions Dedicated	to Intelligent Function Modules *1	_	Present	

Tahla7 1	Instructions	Requiring a	Cortain	Number	of Scane
	manucuona	itequiling a	Certain	Number	JI Ocalis

* 1: Refer to the manual of the intelligent function module used, for the instructions dedicated to intelligent function modules.

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(b) Countermeasures

 The instruction that includes the complete signal can be executed again by the new control system CPU module, if it has been suspended due to system switching.^{*2}

However, note that the same instruction might be executed twice.

[Example]

In the following program example, when system switching occurs during execution of the REMFR instruction (M201 : ON) in an MELSECNET/H remote I/O system, the REMFR instruction is re-executed by the new control system CPU module.

System configuration

Diagram 7.1 shows the system configuration for the example of the REMFR instruction programming.



Relevant devices

Table7.2 indicates the devices used in the program example for the REMFR instruction.

Table7.2 Devices Used for Execution of REMFR Instruction

Device No.	Name	Remarks
SB20	Module status	Refer to the following manual for details of
SB47	Baton pass status of host	the link special relays (SB) and link special
SB48	Status of host	registers (SW).
SB49	Data link status of host	Q Corresponding MELSECNET/H
SW70.9	Baton pass status of each station (10th station)	Network System Reference Manual
SW74.9	Data link status of each station (10th station)	(Remote I/O Network)
SM1518	Standby system to control system switching	
5101510	status flag	
M200	Read request flag	
M201	REMFR instruction execution flag	
M202	System switching-triggered REMFR instruction	Change the device number according to the
11/202	re-request flag	system.
M203	REMFR instruction completed flag	
M204	REMFR instruction abnormally completed flag	

* 2: The complete signal is not tracked even it is set for tracking.

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• Program example

Diagram 7.2 shows a program that reads data from the intelligent function module on the remote I/O station by the REMFR instruction.



Diagram 7.2 Example of REMFR instruction programming

 The instruction that includes no execution completion signal or write instruction needs to be executed again, as it is difficult to determine if its execution is completed or not.

However, note that the same instruction might be executed twice.

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(2) Rise Instruction

If signal flow memory has not been tracked, after system switching, the rise instruction is processed as explained below.

(a) Processing

When the systems are switched, the new control system CPU module turns on data in the signal flow memory.

For this reason, the CPU module does not execute the rise instruction even though the rise instruction execution condition is satisfied before the systems are switched.

(b) Relevant Instructions

- LDP, ANDP, ORP
- MEP
- PLS
- P (Examples: MOVP, INCP, etc.)
- SP.□, GP.□, ZP.□, JP.□ (Intelligent function module dedicated instructions)
- FF, LEDR, DUTY, TRACE, TRACER

(3) Fall Instruction

If signal flow memory has not been tracked, after system switching, the fall instruction is processed as explained below.

(a) Processing

When the systems are switched, the new control system CPU module turns on data in the signal flow memory.

For this reason, the CPU module executes the fall instruction again if the fall instruction execution condition is turned off before the systems are switched.

(b) Relevant Instructions

- LDF, ANDF, ORF
- MEF
- PLF

(4) SCJ Instruction

Note that jump processing for the specified pointer (P) varies with whether tracking signal flow memory has been tracked or not, if the SCJ instruction contact turns ON during system switching processing.

(a) When signal flow memory has not been tracked

Jumping is executed from the first scan after system switching.

(b) When signal flow memory has been tracked

Jumping is executed from the second scan or later after system switching.

(When Signal flow memory is not tracking)



(When Signal flow memory is tracking)



Diagram 7.3 ON/OFF Operation of SCJ Instruction When Signal Flow Has Been Tracked

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(5) Instructions that Change CPU Status

When the instruction listed in Table7.3 is executed and the control system CPU module status changes, the information of the changed status will not be sent to the standby system CPU module.

Therefore, if system switching occurs, it is necessary to use the user program to execute that instruction in the new control system CPU, as necessary.

Instruction	Instruction Symbol	
	Disable Interrupt	DI
Program Execution Control	Enable Interrupt	El
	Interrupt Disable/Enable Setting	IMASK
	File Register Block No. Change	RSET
Change Instruction	File Register File Set	QDRSET
	Comment File Set	QCDSET
Application Instruction	Timing Clock	DUTY

Table7.3 Instructions that Change CPU Status

(6) Restrictions when Using Special Relay (SM1518) "Standby System to Control System Switching Status Flag"

This section explains how the rise instruction, for which SM1518 has been set as its execution condition, is processed after system switching, on the assumption that signal flow memory has not been tracked.

(a) Processing

When system switching occurs, the control system CPU module turns on signal flow memory in all steps.

Therefore, the rise instruction, for which SM1518 has been set as its execution condition, cannot be executed after system switching.



Diagram 7.4 Program for DUTY Instruction Using SM1518

Create a program to be executed at the time of SM1518 shutdown using shutdown pulse operation contact as shown in the diagram below when startup execution instructions with SM1518 execution conditions are executed. The instruction is executed at the second scan after system switching, in order that the fall instruction will be executed upon SM1518 fall.





(b) Relevant Instructions

- PLS
- P(Examples: MOVP,INCP, etc.)
- SP. , GP. , ZP. , JP. (Intelligent Function Module Dedicated Instructions)

(7) Restrictions on Use of COM and ZCOM Instructions

The COM and ZCOM instructions execute refresh between the Redundant CPU and network module during program execution.

In a redundant system, there are restrictions on the selection of the refresh items by the COM and ZCOM instructions.

Table7.4 lists the refresh items by the COM and ZCOM instructions and whether they can be selected or not in the redundant system.

Instruction symbol	Refresh item ^{*3}	Selection in redundant system
	I/O refresh	\bigcirc
	Network module refresh	× * ¹
СОМ	Auto refresh of intelligent function module	× *2
	Auto refresh of CPU shared memory	×
	General data processing	\bigcirc
ZCOM	Network module refresh	× *1
200101	Auto refresh of intelligent function module	× *2

Table7.4 Refresh Items by COM and ZCOM Instructions and Whether They Can Be Selected or Not in Redundant System

 \bigcirc : Selectable, \times : Not selectable

* 1: Tracking is not executed when the COM or ZCOM instruction is executed. If system switching occurs due to any of reasons for system switching indicated in No. 1 of Table7.5 from when the COM instruction or ZCOM instruction is executed until tracking is completed, system switching is done without tracking being performed. Hence, any change made to the output to the network module by the COM/ZOM instruction in the control system CPU module will not be reflected on the standby system CPU module. Since the new control system CPU module provides the old output to the network module after system switching, the output from the network module may change.

Table7.5 Reasons for System Switching and Output Changes at System Switching

No.	Reasons for System switching	Output change when COM/ ZCOM instruction is used
	Control system power off	Since system switching is
1	 Control system CPU module reset 	executed without tracking, the
1	 Control system hardware fault 	output may change at the time
	 Control system CPU module stop error 	of system switching.
	System switching request from network module	Since system switching is done
2	 System switching instruction execution 	after tracking, the output does
	System switching request from GX Developer or OPS	not change at system switching.

* 2: Not selectable since an intelligent function module cannot be mounted on the main base unit in the redundant system.

* 3: For the COM instruction, select the refresh item with the special relay "Link refresh selection during COM instruction execution (SM775)" and special register "Link refresh selection during COM instruction execution (SD778)".



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7.2 Cautions on Fixed-Scan Clocks and Fixed Scan Execution Type Programs

(1) Fixed-scan Clocks (SM409 to SM415)

When system switching occurs, fixed-scan clock measurement is suspended until system switching is complete.

When system switching is complete, the new control system CPU module starts all fixed-scan clocks from OFF.

Therefore, the OFF time is extended (T+t') as shown in Diagram 7.6. The maximum value of the extension time when t=t' is (T+t).



Diagram 7.6 Operations of Fixed-scan Clocks at System Switching

(2) Fixed-scan Clocks (SM420 to SM424)

When system switching is complete, SM420 to SM424 remain OFF in the new control system CPU module.

Execute the DUTY instruction in the new control system CPU module to make SM420 to SM424 usable in the new control system CPU module.

[Example]

A program starting an SM420 timing clock (1 scan: ON, 3 scan: OFF) by executing the DUTY instruction in the new control system CPU module.



Diagram 7.7 Program That Executes Fixed-scan Clock (SM420) after System Switching

* 1 : This is the contact point for 1 scan: ON in the new control system after SM1518 system switching.

If DUTY instructions are executed for SM1518 shutdown, the DUTY instructions are executed on the second scan following system switching.

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(3) Fixed scan execution type Program

When system switching occurs, the execution of fixed scan execution type programs is suspended until system switching is complete.

When system switching is complete, the new control system CPU module starts counting the fixed-scan interval time from 0.

Therefore, the fixed scan execution interval time is increased (T+ α ') as shown in Diagram 7.8.

The maximum value for the extension time is $(T + \alpha)$ when $\alpha = \alpha'$.



Diagram 7.8 Operations of Fixed Scan Execution Type Programs at System Switching

(4) Interrupt by the Internal Timer (I28 to I31)

When system switching occurs, execution of interrupt is suspended until system switching is complete.

Also, interrupt from the module mounted on the extension base unit cannot be made. When system switching occurs, the new control system CPU module starts counting the interrupt interval time from 0.

Therefore, the fixed scan execution interval is increased (T+ α ') as shown in Diagram 7.9.



The maximum value for the extension time is $(T + \alpha)$ when $\alpha = \alpha'$.

Diagram 7.9 Operations of Interrupts by Internal Timers at System Switching

(5) Interrupt from Network module

Execution of the interrupt program that corresponds to the interrupt factor sent from a network module varies according to the following conditions.

(a) When the Operation Mode is Backup Mode

1) When System Switching Occurs before Execution of the Interrupt Program

The control system CPU module holds the received interrupt factor, even when it becomes the standby system CPU module through system switching before the interrupted program is executed.

When switching is done again and the standby system CPU module returns to the control system CPU module, it executes the interrupt program for the held interrupt factor.

Since the interrupt factor accepted by the control system CPU module is not taken over by the new control system CPU module, the new control system CPU module does not execute the interrupt program of the interrupt factor accepted by the control system CPU module.

2) When the Standby System CPU Module receives an interrupt

The standby system CPU module holds the interrupt factor received from an intelligent function module.

When the standby system CPU module becomes the new control system CPU module through system switching, it executes the interrupt program for the held interrupt factor.

The interrupt program corresponding to the held interrupt factor is executed when the standby system CPU module becomes the control system CPU module through system switching.

If multiple interrupt factors are held in the standby system CPU module, the scan time is widely extended.

(b) When the Operation Mode is Separate Mode

Both control system CPU module and standby system CPU module execute interrupt programs for the interrupt factors sent from a network module.

(c) When the Operation Mode is Debug Mode

The control system CPU module executes an interrupt program for the interrupt factor sent from a network module.

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(6) Interrupt during Tracking Processing

If interrupt is enabled (EI status) during END processing, when an interrupt is issued during tracking processing, the CPU will stop the tracking processing and execute the interrupt program.

Therefore, both data of before and after interrupt program execution might be tracked.

[Example]

The operations for interrupted (I31) execution via an internal timer are shown in Diagram 7.10.



Diagram 7.10 Operations When Interrupt Is Executed by Internal Timer

When execution of programs interrupted during tracking processing is not done, execute DI instructions, then execute EI instructions at step 0 before executing END instructions, as shown in the program in the Diagram 7.11.

As interrupt is disabled during END processing (including tracking processing), the CPU will not execute the interrupt program.



Diagram 7.11 Program Example That Disables Interrupts during END Processing

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7.3 Precautions for Using Annunciator (F) in Redundant System

The annunciator defaults to no tracking.

In the tracking setting of the Redundant parameter dialog box, the annunciator can be set to within the tracking range.

Table7.6 provides an operation example of the control system and standby system CPU modules when the annunciator is set to within the tracking range and the annunciator (F10) is turned ON in the control system CPU module.

Table7.6 Operations of Control System and Standby System CPU Modules When F10 Is Turned ON in Control System CPU Module

	ltem	Control System CPU Module	Standby System CPU Module
F10	Annunciator	ON	ON
SM62	Annunciator detection	ON	OFF
SD62	Annunciator No.	The annunciator No. turned on is stored.	No change
SD63	No. of annunciators	Number of annunciators turned on is	No change
0000		stored.	
SD64 to number table			
		The annunciator No. turned on is stored.	No change
SD79			
"USER" LED		On	Off

If system switching occurs when the annunciator (F10) turns on in the control system CPU module, whether the annunciator is on or not cannot be checked by the USER LED since the USER LED is off in the new control system CPU module.



Diagram 7.12 Operation of USER LED When Annunciator (F10) Turns On

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Create the following program to turn on the "USER" LED of the new control system CPU module at occurrence of system switching.

(1) When turning on another annunciator at system switching to turn on the "USER" LED

When tracking the annunciator, create the following program to also turn on the "USER" LED of the new control system CPU module.

[Program example]

When any of the used 32 annunciators F0 to F31 is on in the new control system CPU module, the "USER" LED is turned on.

To turn off the "USER" LED, turn on the "USER" LED off command (M100).





(2) When turning on the annunciators in the new control system CPU module at system switching

By turning on the annunciators in the new control system, the "USER" LED can be turned on.

(a) When turning on the annunciators by the "OUT" instruction

By tracking the "OUT" instruction execution condition, the annunciators can also be turned on in the new control system CPU module at system switching.



Diagram 7.14 Program That Turns on the Annunciators by the OUT Instruction after System Switching

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(b) When turning on the annunciators by the "SET" instruction

By creating the following program and tracking the "SET" instruction execution condition, the annunciators can also be turned on in the new control system CPU module at system switching.



Diagram 7.15 Program That Turns on the Annunciators by the SET Instruction after System Switching

* 1: SM1518 is a contact that turns on in the new control at occurrence of system switching and remains ON for one scan.

7.4 Precautions at System Switching Occurrence

(1) Precautions regarding access to intelligent function module and external device

Depending on timing of system switching occurrence such as turning power supply OFF, tracking transfer processing may be discontinued, and the device data may not be reflected to the new control system CPU module after switching systems. In this case, the data output and the device data of the new control system CPU module may mismatch.

When the CPU module communicates with the intelligent function module or external device using the output (Y) and the buffer memory, a program may not operate properly due to device data mismatch after switching systems.

Diagram 7.17 shows operations when the system switching occurs before the tracking transfer processing is completed after outputting the output (Y).





When outputting the command output (e.g., output (Y), start-up by writing to buffer memory, clear etc.), consider time required for transferring conditions to the standby system CPU module from the control system CPU module.

Diagrams 7.18 and 7.19 show a program example which delays the output by one scan from the command output condition establishment.

(a) Input is returned corresponding to output



[Program example]

(Before measures)

мо —	X10 //	Y10 ↓/	[SET	Y10]
M10	X10 ──	Y10 ──	[RST	Y10]

(After measures)



Diagram 7.17 Program Example when there is Response (Input) to Output



Diagram 7.18 Program Example when there is Response (Output) to External Input

Set [Do tracking] of [Signal flow memory tracking setting] at [Tracking settings] of [Redundant parameter].

(2) Precautions regarding timer

Pay attention to the following points regarding timer at the time of system switching occurrence.

- 1) The present value of timer at the first scan of the new control system CPU module at the time of system switching occurrence.
- 2) Depending on timing of system switching occurrence such as turning power supply OFF, tracking transfer processing may be discontinued, and the device data may not be reflected to the new control system CPU module after switching systems.

In this case, the timer whose time is up before switching systems may not be recognized even after the first scan after system switching.

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3) When output (output (Y), writing to buffer memory) is performed from the timer contact, the timer goes into the above-mentioned 2) status, which leads to chattering of the output.

When the CPU module communicates with the module or external device using the output (Y) and buffer memory, the program may not operate normally due to chattering of the output after system switching.

The operation for the case where the system switching occurs before the tracking transfer processing is completed after outputting the output (Y) from the timer contact is shown in Diagram 7.19.



Diagram 7.19 Chattering Occurs to Output by Timer Contact

When outputting the output (Y) or writing buffer memory to a module or external device, consider time required for tracking transfer from the control system CPU module to the standby system CPU module.

The program example to output, delaying one scan from the time up of the timer, is shown in Diagram 7.20.

[Program example]



Diagram 7.20 Program Example when Outputting by timer contact

Set [Do tracking] at [Signal flow memory tracking setting] on [Tracking settings] in redundant parameter.

(3) Precautions regarding writing data from the GOT and external device etc.

Pay attention to the following points regarding writing data from the GOT and external device etc.

1) The tracking data may not be reflected to the new control system CPU module depending on the timing of the system switching occurrence such as turning power supply OFF.

In this case, data written immediately before switching systems by the GOT or external device may disappear. Rewrite data after switching systems.

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7.5 Precautions of Programming when Connecting Extension Base Unit

This section describes the precautions of programming when connecting the extension base unit.

(1) Precautions for using PX Developer

As for the following functions, use the dedicated instructions. Do not use them to Ethernet module mounted to the extension base unit.

- Communication control FB (SEND, RECV)
- Event notification

(2) Functions applicable in GX Works2, GX Developer, and PX Developer

MELSOFT products connectable to a module mounted on the extension base unit are GX Works2, GX Developer, and PX Developer. However, there are restrictions on applicable functions.

For details, refer to the following manuals.

- GX Works2 Version 1 Operating Manual (Common)
- GX Developer Version 8 Operating Manual
- PX Developer Version 1 Operating Manual (Programming Tool)

(3) Tracking device setting

When tracking device setting is not set, the program is executed using the value before refresh is performed at the first scan after switching systems Set the following devices at the tracking device setting.

- Device which performs auto refresh setting to the intelligent function module mounted on the extension base unit by GX Configurator
- Device that makes auto refresh setting to the CC-Link master module on the extension base unit

(4) Prohibition of using an interrupt pointer

When interrupting from the intelligent function module mounted to the extension base unit, an interrupt pointer cannot be used.

If set, "CAN'T EXECUTE(I)" (error code: 4225) occurs at the time of start-up.

(5) Prohibition using of direct output (DY)

Do not use direct output (DY) to mounted modules on extension base unit. When data are output to modules with direct output (DY), other 15 bits in 1 word may be off once at the first scan after the system switching. [Example]

When DY13 turns on, Y10 to Y12 and Y14 to Y1F may turn off.


CHAPTER8 TROUBLESHOOTING

This chapter provides troubleshooting methods of redundant system.

Error codes, special relays, and special registers of redundant CPU are not covered in this manual. Refer to the following manual, for error codes, special relays, and special registers of redundant CPU.

CPU User's Manual (Hardware Design, Maintenance and Inspection) The CPU module status can be confirmed by the LEDs, which are situated on the front face of the CPU module. The CPU module LEDs necessary for troubleshooting of redundant system are explained here.



No. Name Explanation Indicates the CPU module mode. MODE LED On (Green) : Q Mode. 1) Flashing (Green) : External I/O Forced ON/OFF has been registered. Indicates the CPU module operation status. : The CPU is Running. The RUN/STOP switch: RUN position. On Off : The CPU has Stopped. The RUN/STOP switch: STOP position. The standby system CPU module in backup mode. (The RUN/STOP switch: RUN position.) 2) RUN LED An error that stops operation has been detected. Flashing : The RUN/STOP switch is set to the STOP position to write parameters/ programs into CPU, and then the switch is returned from the STOP to RUN position. The standby system CPU module for which the operation mode is switched from backup mode to separate mode. On : The self diagnostics error that does not stop the operation (other than battery error) is detected. (The settings have been made by the parameter so that the operation is continued when an error is detected.) 3) ERR.LED Off : Normal. Flashing : An error that stops operations has been detected. Automatic write to the standard ROM is completed (BOOT LED is also flashing.)

Table8.1 LED Names and Explanations

No.	Name	Explanation		
4)	USER LED	On : An error has been detected with the CHK instruction, or annunciator F		
		turns on.		
		Off : Normal.		
		Flashing : Latch clear is executed.		
5)		On : A battery error has occurred due to battery voltage drop in the CPU		
	BAT.LED	module or memory card.		
		Off : Normal.		
6)	BOOT LED	On : Boot operation has started.		
		Off : Boot operation has not been executed.		
		Flashing : Automatic write to the standard ROM is completed. (The ERR.LED is also		
		flashing.)		
	BACKUP LED	Indicates the operation mode, i.e., backup mode or separate mode.		
		On (Green) :Backup mode.		
		On (Red) : Unable to continue the control (RUN) because of system switching.		
		On (Amber) : Separate mode.		
		Off : Debug mode.		
		Indicates as shown below, when the memory copy from control system to standby		
7)		system is being executed.		
		Back up mode operation Separate mode operation		
		Control system Standby system Control system Standby system		
		Executing memory conv. Lit (Ped) Elashing (Ped) Lit (Amber) Flashing		
		Memory copy successfully the trace to the tr		
		completed Lit (Red) Lit (Red) Lit (Amber) Lit (Amber)		
8)	CONTROL LED	Indicates the system of the CPU module, i.e., control system or standby system.		
		On : Control system (System switching is possible, as the standby system is		
		normal.)Debug mode.		
		Off : Standby system.		
	SYSTEM A LED	Indicates the system A CPU module status.		
9)		On : Operating as system A		
		Debug mode		
		Flashing : The tracking cable has been disconnected while the CPU module is		
		normally operating as system A		
		(Flashing until the system A connector of the tracking cable is		
		connected.)		
		Off : Not operating as system A, i.e., operating as system B. (The SYSTEM B		
		LED is On.)		
10)	SYSTEM B LED	Indicates the system B CPU module status.		
		On : Operating as system B		
		Flashing : The tracking cable has been disconnected while the CPU module is		
		normally operating as system B.		
		(Flashing until the system B connector of the tracking cable is		
		connected.)		
		Off : Not operating as system B, i.e., operating as system A. (The SYSTEM A		
		LED is On.)		
		Debug mode.		

Table8.1 LED Names and Explanations (Continued)

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8.1 Troubleshooting Flow



Diagram 8.2 Troubleshooting Flow

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8.1.1 Flow for the Case where the "MODE" LED is not ON

Diagram 8.3 is for the case where the "MODE" LED does not turn on when the programmable controller is powered on.





* 1 : Relevant to the redundant power supply module.

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8.1.2 When the CPU Module "BACKUP" LED is ON (Red)

The following flow (Diagram 8.4) is for the case where the "BACKUP" LED of the CPU module is on (red) while the redundant system is running.

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Diagram 8.4 Flow for the Case where the CPU Module BACKUP LED is ON (Lit Red)

- * 1: The control system, of which CPU module has been replaced, might start up as the standby system.
 - Make sure to check the control system BACKUP LED after replacing the CPU module.
- * 2: When using the CPU module whose first 5 digits of serial No. is "09012" or later, refer to Sections 8.1.9 and 8.1.10 for the description of error detected by the standby system.

8.1.3 When the "SYSTEM A/B" LED is flashing

The following flow (Diagram 8.5) is for the case where the control system CPU module "SYSTEM A/B" LED is flashing while the redundant system is running.



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Diagram 8.5 Flow for the Case where the SYSTEM A/B LED is Flashing

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8.1.4 When the System A/System B CPU module "RUN" LED is not ON

The "RUN" LED does not light up NO Is the running mode (Separate mode)*3 set to backup mode? *1 YES(Backup mode) Is the control system NO Normal (the standby system CPU CPU module "RUN" LED module "RUN" LED is not ON) not lighting up? * YES NO (Flashing) Reset with the CPU module's Is the "RUN" LED ON? **RESET/L.CLR** switch YES (not ON) Is the RUN / STOP NO Return the RUN / STOP switch to the switch set to the **RUN** position RUN position YES 1)

The following flow (Diagram 8.6) is for the case where the System A/System B CPU module "RUN" LED is not on.

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- * 1: The operation mode can be confirmed by the "BACKUP" LED. (
- * 2: The control system CPU module can be identified by the "CONTROL" LED. (
- * 3: When the "RUN" LED of the standby system CPU module is flashing in the separate mode, set the RUN/STOP switch of the standby system CPU module from RUN to STOP to RUN.
- * 4: When using the CPU module whose first 5 digits of serial No. is "09012" or later, refer to Sections 8.1.9 and 8.1.10 for the description of error detected by the standby system after switching systems.

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Diagram 8.6 Flow for the Case where the System A/System B CPU Module "RUN" LED is not ON

8.1.5 When System Switching has Occurred

The following flow (Diagram 8.7) is for the case where system switching has occurred while the redundant system is running.



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Diagram 8.7 Flow for the Case where System Switching Occurred

* 1: When using the CPU module whose first 5 digits of serial No. is "09012" or later, refer to Sections 8.1.9 and 8.1.10 for the description of error detected by the standby system after switching systems.

8.1.6 When System Switching has failed

The following flow (Diagram 8.8) is for the case where system switching has failed, even though a system switching condition was satisfied while the redundant system was running.

(1) In the Case of System Switching by GX Developer



Diagram 8.8 Flow for the Case where System Switching Has Failed

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(2) In the Case of System Switching due to Control System Error or System Switching Instruction Execution



* 1 : The ERR. LED of the CPU module flashes when a stop error has occurred.





Diagram 8.9 Flow in the Case of System Switching due to Control System Error or System Switching Instruction Execution

8.1.7 When "TRK. INIT. ERROR (error code: 6140)" Occurred at Redundant System Startup

(1) "TRK. INIT. ERROR" occurrence conditions

- (a) This error occurs when either of the following operations is performed during starting the redundant system and before the "BACKUP" LED turns green.
 - Either system was powered off.
 - The CPU module in either system was reset.
- (b) This error may occur in the system using the redundant type extension base unit if extension cables are not connected and the system is not powered on as the procedures described in CHAPTER 4.

(2) Corrective action for "TRK. INIT. ERROR"

If "TRK. INIT. ERROR" has occurred during a startup of the redundant system, restart the system by performing either of the following operations.

(a) Power on System A and System B again

- 1) When System A/System B has been powered off, power on System A and System B again simultaneously.
- 2) The System A CPU module starts as a control system and the System B CPU module as a standby system.
- (b) Set the RESET switches of System A and System B CPU modules to the neutral position simultaneously
 - When the System A/System B CPU module has been reset, reset the System A and System B CPU modules and then set their RESET switches to the neutral position simultaneously.
 - 2) The System A CPU module starts as a control system and the System B CPU module as a standby system.

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8.1.8 When "CONTROL SYS. DOWN (error code: 6310 to 6312)" Occurred at Redundant System Startup

(1) "CONTROL SYS. DOWN" occurrence conditions

"CONTROL SYS. DOWN" occurs when either of the following operations is performed until the BACKUP LED is lit green during a startup of the redundant system.

- Either system was powered off.
- The CPU module in either system was reset and then its RESET switch was set to the neutral position.

(2) Corrective action for "CONTROL SYS. DOWN"

If "CONTROL SYS. DOWN " has occurred during a startup of the redundant system, restart the system by performing either of the following operations.

(a) Power on System A and System B again

- 1) Power on System A and System B again simultaneously.
- 2) The System A CPU module starts as a control system and the System B CPU module as a standby system.
- (b) Set the RESET switches of System A and System B CPU modules to the neutral position simultaneously
 - 1) Reset the System A and System B CPU modules and then set their RESET switches to the neutral position simultaneously.
 - 2) The System A CPU module starts as a control system and the System B CPU module as a standby system.

8.1.9 When "ETX.CABLE ERR." Occurs

The following shows the flowchart for when "EXT.CABLE ERR." occurs during operation of the redundant system.



Diagram 8.10 Flowchart for when "EXT.CABLE ERR." occurs

* 1 : As for IN1 connector and IN2 connector of the redundant type extension base unit, connect one to the control system and connect the other to the standby system.

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8.1.10 When "BASE LAY ERROR" Occurs

The following shows the flowchart for when "BASE LAY ERROR" occurs during operation of the redundant system.



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Diagram 8.11 Flowchart for when "BASE LAY ERROR" Occurs

8.1.11 When "UNIT LAY. DIFF." Occurs

The following shows the flowchart for when "UNIT LAY. DIFF." occurs during operation of the redundant system.





8.1.12 When "SP. UNIT DOWN" Occurs

The following shows the flowchart for when "SP. UNIT DOWN" occurs during operation of the redundant system.

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Diagram 8.13 Flowchart for when "SP. UNIT DOWN" Occurs

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8.1.13 When "SP. UNIT LAY ERROR" Occurs

The following shows the flowchart for when "SP. UNIT LAY ERROR" occurs during operation of the redundant system.





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8.1.14 When "LINK PARA. ERROR" Occurs

The following shows the flowchart for when "LINK PARA. ERROR" occurs during operation of the redundant system.



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Diagram 8.15 Flowchart for when "LINK PARA. ERROR" Occurs

8.1.15 When "SP. UNIT VER. ERR." Occurs





Diagram 8.16 Flowchart for when "SP. UNIT VER. ERR." Occurs



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8.1.16 When "CAN'T SWITCH" Occurs to Control System CPU Module due to Communication Error when Turning ON/OFF Power Supply of CPU Module or Booting and Shutting Down Personal Computer in CC-Link IE Controller Network or MELSECNET/H

(1) Cause of "CAN'T SWITCH" occurrence

In the redundant system where CC-Link IE Controller Network or MELSECNET/H is used, CC-Link IE Controller Network or MELSECNET/H module of the control system may issue a switching request, detecting a communication error due to turning power supply ON/OFF of the other station (including the standby system) CPU module or booting and shutting down the personal computer where CC-Link IE Controller Network interface board or MELSECNET/H board is mounted.

For details of function requesting to switch system to the control system CPU module, refer to the following manuals.

- ST MELSEC-Q CC-Link IE Controller Network Reference Manual
- CF Q Corresponding MELSECNET/H Network System Reference Manual (PLC to PLC network)
- C Corresponding MELSECNET/H Network System Reference Manual (Remote I/O network)

Note that "CAN'T SWITCH" may be detected in the control system CPU module when the above-mentioned system switching is requested before the control system of the redundant system is started up. Although the control system operates normally even in this case, how to cancel "CAN'T SWITCH" is shown below.

(2) How to cancel "CAN'T SWITCH"

Cancel "CAN'T SWITCH" detected by the control system CPU module after checking that the standby system and the CC-Link IE Controller Network module or MELSENET/H module operate normally by the special register.

A sample program to cancel an error by the error cancel command (M100) at the time of "CAN'T SWITCH" occurrence is shown in Diagram 8.17.

In this sample program, when "CAN'T SWITCH" occurs to the control system CPU module due to system switching request from the network module, an error "CAN'T SWITCH" can be cancelled by turning ON the error cancel command (M100) after checking that the standby system CPU module, CC-Link IE Controller Network module, or MELSECNET/H module operate normally.

However, when systems cannot be switched by "other than system switching request", "CAN'T SWITCH" cannot be cancelled in this sample program.

[Program example]



Diagram 8.17 Sample Program to Cancel an Error "CAN'T SWITCH"

When executing the error cancel command automatically, change error cancel command (M100) in Diagram 8.17 to be always ON (SM400).

(3) Programming of CC-Link IE Controller Network or MELSECNET/H

CC-Link IE Controller Network or MELSECNET/H network detects a temporary communication error depending on conditions such as power supply ON/OFF or cable and noise. Create the program using CC-Link IE Controller Network or MELSECNET/ H so that it will not stop control even when the temporary communication error is detected.

For details, refer to the following manuals.

- MELSEC-Q CC-Link IE Controller Network Reference Manual
- Corresponding MELSECNET/H Network System Reference Manual (PLC to PLC network)
- Corresponding MELSECNET/H Network System Reference Manual (Remote I/O network)

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8.2 Error Clear

In a redundant system, the errors that continue the CPU module operation can be cleared.

The following methods for error clear are available in a redundant system.

- · Clearing the host CPU module error
- Clearing the standby system CPU module error by the control system CPU module

(This includes clearing the standby system CPU module error by GX Developer connected to the control system CPU module.)

(1) Clearing Host CPU Module Error

The host CPU module error can be cleared using a special relay (SM50) and a special register (SD50).

(a) Procedure

Error clear is performed according to the following procedure.

- 1) Remove the cause of target error.
- 2) Store the corresponding error code into a special register (SD50).
- 3) Turn special relay SM50 from OFF to ON.
- 4) The target error is cleared.

If the error is cleared and the CPU module returns to normal, the relevant special relay, special register and LED return to the previous statuses.

If the same error occurs again after that, it will be re-registered in the error history.

(b) Cautions

1) When the corresponding error code is stored in SD50 and error clear is performed, the last digit of the code No. will be ignored.

When multiple errors, of which codes are different in the last digit only, occur, the errors can be simultaneously cleared.

[Example]

If errors that correspond to error codes 2100 and 2101 occur, both of them will be simultaneously cleared when either one is cleared.

In the case of errors that correspond to error codes 2100 and 2111, both of them will not be simultaneously cleared even when either one is cleared.

- 2) If an error has occurred due to a problem other than that of the CPU module it will not be removed even when clearing the error is attempted using SM50 and SD50.
 - [Example]

The cause of the SP. UNIT DOWN error cannot be removed by performing error clear operation using SM50 and SD50, as the error could have occurred in a base unit (including extension cables), intelligent function module, etc.

Remove the cause of the error by referring to the error code list.

3) If the cause of the error is not removed after error clear has been performed, the same error will be detected.

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- 4) Error clear processing is performed by END processing. Therefore, an error cannot be cleared unless the END instruction is executed with SM50 ON.
- (2) Clearing the Standby System CPU Module Error by the Control System **CPU Module**

A standby system CPU module error is cleared with the user program of the control system CPU module, using SM1649 and SD1649.

When using GX Developer connected to the control system CPU module to clear a standby system CPU module error, SM1649 and SD1649 are also used.

(a) Procedure

Error clear is performed according to the following procedure.

- 1) Remove the cause of the target error from the standby system.
- 2) Store the corresponding error code into SD1649 in the control system CPU module.
- 3) Turn SM1649 in the control system CPU module from OFF to ON.
- 4) The target error is cleared from the standby system.

(b) Cautions

1) Error clear using SM1649 and SD1649 is enabled in the control system CPU module only.

If this method is executed in the standby system CPU module, the standby system error will not be cleared.

The operation modes applicable to this error clear method are listed in Table8.2.

Table8.2 Operation Modes Applicable to Clearing the Standby System Error using SM1649 and SD1649

Operation Made	CPU Module Performing Error Clear		
Operation mode	Control System CPU Module	Standby System CPU Module	
Backup Mode	0	×	
Separate Mode	×	×	
Debug Mode	-	-	

○: Standby System Error Clear Enabled, ×: Standby System Error Clear Disabled, -: Irrelevant as Standby System Does not Exist

2) When the corresponding error code is stored in SD1649 and error clear is performed, the last digit of the code No. will be ignored.

When multiple errors, of which codes are different in the last digit only, occur, the errors can be simultaneously cleared.

[Example]

- If errors that correspond to error codes 2100 and 2101 occur, both of them will be simultaneously cleared even when either one is cleared.
- In the case of errors that correspond to error codes 2100 and 2111, both of them will not be simultaneously cleared even when either one is cleared.

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 If an error has occurred due to a problem other than that of the CPU module, it will not be removed even when clearing the error is attempted using SM1649 and SD1649.

[Example]

The cause of the SP. UNIT DOWN error cannot be removed by performing error clear operation using SM1649 and SD1649, as the error could have occurred in a base unit (including extension cables), network module, etc. Remove the cause of the error by referring to the error code list.

- 4) If the cause of the error is not removed after error clear has been performed, the same error will be detected.
- Error clear processing is performed by END processing. Therefore, an error cannot be cleared unless the END instruction is executed with SM1649 ON.

(c) Sample Program for Clearing Standby System CPU Module Error

The following shows a sample program for clearing the standby system error by the control system CPU module.

[Sample Program]

A continuation error currently occurring in the standby system is cleared when the error clear command (M100) turns ON.

(Create the control system's program that enables the ON/OFF status of SM1649 to be held for one scan or longer so that the standby system will detect the SM1649 change, i.e., SM1649 turns from OFF to ON or OFF to ON.)



Diagram 8.18 Sample Program for Clearing Standby System CPU Module Error

(3) Corrective Actions When LEDs Do not Return to Status Prior to Error Occurrence

If error clear is performed but LEDs do not return to the status prior to the error occurrence, this might indicate that multiple continuation errors have occurred simultaneously or multiple annunciators are ON.

The following explains the methods of checking whether multiple continuation errors have occurred simultaneously or whether multiple annunciators are ON, and the method of clearing the errors.

(a) Continuation Errors other than Annunciator (F) ON (error code: 9000) The error code of the latest continuation error is stored in a special register (SD0/ SD1610).

If the LEDs do not return to the status prior to the error occurrence even when error clear operation has been performed for the error, which corresponds to the error code stored in special register (SD0/SD1610), check the error history

information in the online PLC diagnostics of GX Developer.*1

Clear the latest errors and any errors that occurred simultaneously in the error history.

 * 1: When error clear operation is performed and the error is cleared, the SD0/SD1610 information shows "No Errors".
Therefore, the errors that occurred simultaneously with the latest one cannot be confirmed by SD0/ SD1610.

(b) Annunciator (F) ON (error code: 9000)

Whether Annunciator (F) is ON (error occurrence is detected) and the number of annunciators that detected errors can be checked using the special relay and special register below.

- SM62 (Detection of annunciator ON)
- SD63 (Number of annunciators ON)

Perform error clear operation repeatedly until SM62 will be off, or SD63 will be 0, then turn all annunciators from ON to OFF.

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8.3 Replacing Module in Redundant System

8.3.1 CPU Module Replacement

(1) CPU Module Replacement

The control system CPU module cannot be replaced while redundant systems are running.

When replacing the control system CPU module, use GX Developer to switch its system to the standby system, then, start the replacement operation.



Diagram 8.19 System where Control System CPU Module is Replaced

Replace the standby system CPU module after powering off the standby system. The standby system can be powered off even while the redundant system is running.



Diagram 8.20 System where Standby System CPU Module is Replaced

(2) Replacement Procedure

The procedure for replacing the CPU module is shown in Diagram 8.21.


Disconnecting the Tracking Cable Disconnect the tracking cable from the standby system CPU module. →Refer to Section 3.3, for disconnecting the tracking cable. Replacing the Standby System CPU Module Remove the standby system CPU module from the main base unit. 1) 2) Mount an alternative CPU module (the same model as the control system CPU module) to the main base unit. 3) Connect the CPU module battery connector to the battery connector pin. → Refer to the QCPU User's Manual (Hardware Design, Maintenance and Inspection), for removing/mounting the CPU module and battery connection. Connecting the Tracking Cable Connect the tracking cable connector to the standby system CPU module. → Refer to Section 3.3, for connecting the tracking cable. Power ON the Standby System Set the RUN/STOP switch of the standby system CPU module to the STOP position. 1) Set the RESET/L.CLR switch of the standby system CPU module to the central position (reset 2) switch neutral position). 3) Power on the standby system. Confirming the POWER LED of the Power Supply Module Confirm that the POWER LED of the power supply module is ON (lit green) and the module is being properly powered Executing the Memory Copy from Control System to Standby System Perform the memory copy from control system to standby system using the GX Developer connected to the control system CPU module, and write the memory content from the control system CPU module to the standby system CPU module. Resetting the Standby System CPU Module Set the RESET/L.CLR switch of the standby system CPU module to the RESET position. Setting the Switch of the Standby System CPU Module to That of the Control System Set the RUN/STOP switch of the standby system CPU module to the same position of that of the control system CPU module. Setting the Reset Switch of the Standby System CPU Module to Neutral Position Set the RESET/L.CLR switch of the standby system CPU module from the RESET position to the central position (reset switch neutral position).

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Diagram 8.21 CPU Module Replacement Procedure

When the standby system is powered OFF, the control system CPU module develops STANDBY SYS.DOWN (error code: 6300) continuation error. After the replacement of the standby system CPU module is complete, clear the error in the control system CPU module as necessary. Refer to Section 8.2 for the error resetting method. OVERVIEW

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8.3.2 Power Supply Module Replacement Procedure

(1) Power Supply Module Replacement^{*1}

The control system power supply module cannot be replaced while redundant systems are running.

When replacing the control system power supply module, switch its system to the standby system by GX Developer, then, start the replacement operation.



Diagram 8.22 System where Control System Power Supply Module is Replaced

Replace the power supply module for the standby system after turning the power supply for the standby system OFF.

The standby system power supply can be turned off even when the redundant system is active.



Diagram 8.23 System where Standby System Power Supply Module is Replaced

* 1: When a pair of redundant power supply modules is used in each system, one redundant power supply module can be replaced at a time while the redundant system is running.
 ([] F Section 8.3.3)

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(2) Replacement Procedure

The procedure for replacing the power supply modules is shown in Diagram 8.24.



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Diagram 8.24 Power Supply Module Replacement Procedure

POINT

When the standby system is powered OFF, the control system CPU module develops in a STANDBY SYS.DOWN (error code: 6300) continuation error. After the replacement of the standby system CPU module is complete, reset errors in the control system CPU module as necessary.

Refer to Section 8.2 for the error resetting method.

When a pair of redundant power supply modules is used in each system, one redundant power supply module can be replaced at a time after powering off the module, while the redundant system is running. This operation can be performed in both systems. System control can be continued while the power supply module is being replaced, because another power supply module supplies power to the modules mounted on the same base unit.

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Replace the redundant power supply module.

(1) Procedure for Replacing Redundant Power Supply Modules

The procedure for replacing redundant power supply modules is shown in the Diagram 8.25.



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8.3.4 I/O Module Replacement Procedure

(1) Module Replacement during Power OFF

When replacing the control system I/O module, switch its system to standby system, power off the standby system, and then start the replacement operation. System switching is not necessary when replacing the standby system I/O module. Make sure to power off the standby system before replacing the I/O module. The standby system can be powered off while the redundant system is running.



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(2) Module Replacement during Power ON

By using the online module change of GX Developer, the I/O module can be replaced while the redundant system is running, regardless of its system, i.e., control system or standby system.





POINT

The I/O modules of control system and standby system cannot perform online module change (hot swapping) using GX Developer when connecting the extension base unit to the CPU module whose first 5 digits of serial No. is 09012 or later.

When replacing modules online using GX Developer in other than above cases, refer to the following manual.

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

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(3) Replacement Procedure during Power OFF

The I/O module replacement procedure is shown in Diagram 8.28.



Refer to Section 8.2 for the error resetting method.

(1) Network Module Replacement

The control system network module cannot be replaced while the redundant system is running.

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In this case, switch its system to the standby system, then, start the replacement operation.



Diagram 8.29 System where Control System Network Module Is Replaced

Perform replacement of the standby system's network module after switching the standby system's power supply OFF.

The power supplies of standby systems can be turned OFF even when the redundant system is active.





(2) Replacement Procedure

The replacement procedure for network modules is indicated in Diagram 8.31.



Ļ
Disconnecting the Cable
Disconnect the network cable from the target network module.
ightarrow Refer to the manual of the network module, for disconnecting the network cable.
Ļ
Replacing the Standby System's Network Module
1) Disconnect the network module from the main base unit.
2) Attach the replacement network module (a network module of the same type as the control
system network module).
For removal and installation of the network module, refer to the manual of the used netwo
module.
\downarrow
Wiring
Connect the network cable to the network module.
ightarrow Refer to the manual of the network module, for connecting the network cable.
↓
Turn on the Standby System's Power Supply
1) Match the position of the standby system CPU module's RUN/STOP switch with that of the
control system.
2) Set the control system CPU module's RESET/L.CLR switch to the central position
3) Turn the standby system power supply ON.
\downarrow
Confirm the Power Supply Module's POWER LED
Confirm that the power supply module's POWER LED is ON (green), and that power is being
supplied properly.
Confirming the Network Module Status
Confirm that the new network module has not developed an error by using the System Monitor
GX Developer.

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(Start standby system) Diagram 8.31 Network Module Replacement Procedure

When the standby system is powered OFF, the control system CPU module develops in a STANDBY SYS.DOWN (error code: 6300) continuation error. After the replacement of the standby system CPU module is complete, reset errors in the control system CPU module as necessary. Refer to Section 8.2 for the error resetting method.

8.3.6 Main Base Unit Replacement Procedure

(1) Main Base Unit Replacement

The control system main base unit cannot be replaced while the redundant system is running.

In this case, switching its system to the standby system, then replace that main base unit.



Diagram 8.32 System where Control System's Main Base Unit Is Replaced Perform replacement of the standby system's main base unit after turning the standby

system's power supply OFF.

The power supply for the standby system can be turned OFF even when the redundant system is active.



Diagram 8.33 System where Standby System's Main Base Unit Is Replaced

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(2) Replacement Procedure

The replacement procedure for the main base unit is indicated in Diagram 8.34.

(Start)
Confirming the Main Base Unit Targeted for Replacement
Confirm that the main base unit to be replaced is for the standby system (CONTROL LED is
off). When replacing the control system's power supply module, switch it to be the standby system
using GX Developer's system switching.
→ Refer to Section 5.2 regarding system switching via GX Developer.
Turn the Standby System's Power Supply OFF
Disconnect the Cable
1) Disconnect the tracking cable from the standby system CPU module.
\rightarrow Refer to Section 3.3 for disconnecting the tracking cable
2) Disconnect the power supply cable from the standby system power supply module
3) Disconnect the network cable from the network module
\rightarrow Refer to the manual of the network module, for disconnecting the network cable
4) Remove the connector/terminal block from the I/O module
5) Disconnect the extension cable for mounting the main base unit of the standby system
Removing Modules
Remove the modules from the main base unit
\rightarrow Refer to the OCPULLser's Manual (Hardware Design Maintenance and Inspection) for
removing modules
+ Replacing the Main Base Unit
1) Remove the main base unit from the control nanel, etc.
2) Mount an alternative main base unit to the control panel, etc.
Mounting Modules
Mount the module that was removed from the previous base unit to the new one
Mount the modules to the main base unit so that they will be located the same as those of the
control system)
Defente the OCDUULE and Manual (Llandware Design Maintenance and Inspection) for
→ Relef to the QCPO user's Manual (Hardware Design, Maintenance and Inspection), for mounting modulos
↓ Wiring
1) Connect the tracking cable to the standby system CPU module
\rightarrow Defer to Section 2.3 for connecting the tracking cable
2) Connect the power supply cable to the power supply module
3) Connect the network cable to the network module
Pofer to the manual of the natural module. for connecting the natural code
→ Never to the manual of the network module, for connecting the network cable. A) Mount the terminal block/connector to the I/O module.
5) Connect the extension cable for mounting to the main base unit of the standby system
\downarrow



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Diagram 8.34 Main Base Unit Replacement Procedure

When the standby system is powered OFF, the control system CPU module develops in a STANDBY SYS.DOWN (error code: 6300) continuation error. After the replacement of the standby system CPU module is complete, reset errors in the control system CPU module as necessary. Refer to Section 8.2 for the error resetting method.

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8.3.7 Procedure for Replacing Module mounted on the I/O Station of Redundant System

By using the online module change of GX Developer, the module mounted on the MELSECNET/H remote I/O network remote I/O station can be replaced while the redundant system is running .

Following modules can be replaced by using this method.

- I/O Module ^{*1}
- Intelligent Function Module *2

(Analog module, temperature input module, temperature control module, pulse input module)

* 1: Refer to the following manual, for module replacement by using online module change of GX Developer.

Q-Corresponding MELSECNET/H Network System Reference Manual (Remote I/O network)

* 2: Refer to the manual of the intelligent function module, for module replacement by using online module change of GX Developer.

Intelligent function modules other than the above cannot be replaced online using GX Developer.

When replacing these intelligent function modules, power off the remote I/O station in advance.

8.3.8 Replacement of Modules Mounted to Extension Base Unit

A module mounted to the extension base unit can be replaced online using GX Developer during operation of the system.

The following are the modules where online module change (hot swapping) can be performed using GX Developer.

- I/O module ^{*1}
- Intelligent function module ^{*2} (Analog module, temperature input module, temperature regulating module, and pulse input module)
- * 1: For changing modules online (hot swapping) using GX Developer, refer to the following manual.
- * 2: For changing modules online (hot swapping) using GX Developer, refer to the manual for the intelligent function module used.

- 1. When connecting the extension base unit, use the Redundant CPU whose first 5 digits of serial No. is "09012" or later in both systems. In addition, connect the redundant type extension base unit to the first extension stage.
- 2. The intelligent function module other than the analog module, temperature input module, temperature regulating module, and pulse input module are not compatible with online module change (hot swapping) using GX Developer. For the intelligent function module which is not compatible with online module change (hot swapping) using GX Developer, turn OFF power supply of the power supply module before replacing modules.

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8.3.9 Tracking Cable Replacement

(1) Tracking Cable Replacement

The tacking cable cannot be replaced while both systems are running. After powering off the standby system (or keeping the standby system CPU module reset), replace the tracking cable.

The standby system can be powered off or reset while the redundant system is running.



Diagram 8.35 System where Tracking Cable Replacement

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(2) Replacement Procedure

The procedure of replacing the tracking cable is shown in the Diagram 8.36.



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Diagram 8.36 Tracking Cable Replacement

Make sure to replace the tracking cable after powering off the standby system (or setting the RESET/L.CLR switch to the RESET position (reset)).

If the tracking cable is connected or disconnected while both systems are running, it may result in either of the following.

- The scan time is extended and the "WDT ERROR (ERROR CODE: 5000, 5001) occurs.
- The "TRK.CIR.ERROR (ERROR CODE: 1112, 1113, 1116)" occurs and the redundant CPU operation stops.

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8.3.10 Replacement Procedures of Extension Cable

(1) Replacement of extension cable

An extension cable which connects the main base unit and the redundant type extension base unit of the control system cannot be replaced during operation of the redundant system.

Before replacing the extension cable, always switch the control system to the standby system by GX Developer.

(2) Replacement procedures

The replacement procedure of the extension cable is shown in Diagram 8.37.



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Diagram 8.37 Replacement Procedures of Extension Cable

CHAPTER9 PROCESSING TIME IN REDUNDANT SYSTEM

The scan time of the control system CPU module in the redundant system is the total of I/O refresh time, instruction execution time, END processing time, and tracking time.

For the I/O refresh time, instruction execution time, and END processing of the control system CPU module (Redundant CPU), refer to the following.

Fundamentals)

This chapter describes the tracking time calculation method and the time required for system switching.

9.1 Increase in Scan Time due to Tracking

Calculate an increase in scan time of the control system CPU module due to tracking, referring to Table9.1.



Table9 1 I	ncrease	in	Scam	Time	due	to	Tracking

Ts: Increase in scan time	Condition	α (ms)
Tra: Tracking data setup time	Both systems are operating normally.	Max. 4
Trb: Tracking processing time	A momentary power failure or power	Momentary power
Tp: Program execution time	supply shut-off has occurred in the	failure time to max.
α_{i} Overhead time for tracking (refer to the table on the right)	standby system.	40
	Data communications are being	May 20
	performed via the tracking cable.	Max. 50

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(1) Tracking data setup time (Tra)

Use the following expression to calculate the tracking data setup time.

Tra = 1 + Tra1 + Tra2 + Tra3 + Tra4 (ms)

Tra: Tracking data setup time Tra1 to Tra4: Processing time of the transfer data listed in Table9.2

Table9.2	Processing	Times	of	Tra1	to	Tra4
100100.2	riocessing	111163	U.	man	ιU	II a -

	Trans	Processing Time (ms)		
Tra1 Signal flow memory		Time set in the tracking setting	4.0.42×10-3 7	
		of redundant parameter	1+0.13X10 * X Z	
Tra2	SFC information	SFC program execution time	1 (Fixed)	
		PIDINIT instruction execution	0.5 (Fixed)	
Tra3	PID control instruction	time		
information		S.PIDINIT instruction	0.5 (Eixed)	
		execution time		
Tra4	Device data	_	X1+X2+X3 ^{*1}	

Z: Number of steps in the program

* 1: X1 to X3 are calculated as follows.

•X1: Processing time according to the number of device points in the tracking setting $X1=(D1 \times K1) + (D2 \times K2) + (D3 \times K3) + (D4 \times K4)$ [ms]

•X2: Processing time according to the number of device ranges in the tracking setting $X2=(E1 \times K5) + (E2 \times K6) + (E3 \times K7) + (E4 \times K8) \text{ [ms]}$

•X3: Processing time according to the number of tracking blocks in the tracking setting $X3=(F1 \times K9) + (F2 \times K10) + (F3 \times K11)$ [ms]

D1 to D4, E1 to E4, F1 to F3, and K1 to K11 are values used in Table9.3.

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Symbol	Description	System Number Symbol	Counting Value
D1	Number of tracking device points of the devices other than the index register	K1	0.09×10 ⁻³
D2	Number of tracking device points of the index register	K2	0.15×10^{-3}
D3	Number of tracking device points of the file register stored in the Standard RAM	K3	0.09×10 ⁻³
D4	Number of tracking device points of the file register stored in the SRAM card	K4	0.42×10^{-3}
E1	Number of tracking device ranges of the devices other than the index register	K5	4×10^{-3}
E2	Number of tracking device ranges of the index register	K6	5×10 ⁻³
E3	Number of tracking device ranges of the file register stored in the Standard RAM	K7	5×10^{-3}
E4	Number of tracking device ranges of the file register stored in the SRAM card	K8	5×10 ⁻³
F1	Number of blocks not including the file register	K9	1 × 10 ⁻³
F2	Number of blocks including the file register stored in the Standard RAM	K10	$25 imes 10^{-3}$
F3	Number of blocks including the file register stored in the SRAM card	K11	*2

Table9.3 Counting Value of D1 to D4, E1 to E4, F1 to F3, and K1 to K11

* 2: The value of K11 differs depending on the serial number of the QnPRHCPU used.

•QnPRHCPU whose serial number (first five digits) is "06081" or earlier: $(120+3 \times G^{*3}) \times 10^{-3}$ •QnPRHCPU whose serial number (first five digits) is "06082" or later: 120×10^{-3}

* 3: G is the number of clusters of the specified file register. Calculate it using the following expression.

G = (file register capacity)/(size of one cluster)

Round up the fractional portion of G calculated by the above expression.

Use the following value as the size of one cluster.

•Q2MEM-1MBSN, Q2MEM-1MBS: 256 words (512 bytes)

•Q2MEM-2MBSN, Q2MEM-2MBS, Q3MEM-4MBS: 512 words (1024 bytes)

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(2) Tracking processing time (Trb)

Use the following expression to calculate the tracking processing time.

 $Trb = 0.26 \times 10^{-3} \times (N1 + N2 + N3 + N4) (ms)$

Trb: Tracking processing time N1 to N4: Processing time of the transfer data listed in Table9.4 (unit: word)

	Transfer Data		Number of Data Transferred (Words)
N1	Signal flow memory	Time set in the tracking setting	Σ (Number of steps in each
N2	SFC information	SFC program execution time	13312 (13k) (Fixed)
N2	PID control instruction	PIDINIT instruction execution time	1024 (1k) (Fixed)
N3 information	S.PIDINIT instruction execution time	1024 (1k) (Fixed)	
N4	Device data	_	4+D1+D2+D3+D4 D1: Inside device (except the index register) D2: Index register D3: File register (in the Standard RAM) D4: File register (in the SRAM card)

* 1: Fractions are rounded up.

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9.2 System Switching Time

System switching time is the time required from detecting a switching factor in the control system to starting an operation in the new control system.

Use the following expression to calculate the system switching time.

 Tsw = α + T α m + Trc (ms)

 Tsw : System switching time*3

 Trc : Time required for the standby system CPU module to reflect the tracking data

 T α m: CC-Link IE Controller Network, MELSECNET/H, CC-Link, PROFIBUS-DP automatic refresh time (Refer to the manual for the network module used.)

 α : When an extension base unit is connected

 • Signal flow memory is not transferred: 31.5ms

 • Signal flow memory is transferred: 12.5ms

 When no extension base unit is connected

- Signal flow memory is not transferred: 20.5ms
- Signal flow memory is transferred: 1.5ms



Diagram 9.1 System Switching Timing

- * 1: This is the time when the signal flow memory is set to "No tracking" in the tracking setting of redundant parameter.
- * 2: The time is 0ms before the tracking processing completes.
- * 3: This is the maximum time required for system switching.

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MELSEC Q series

(1) Tracking data reflection time (Trc)

Use the following expression to calculate the tracking data reflection time.

rc = 1 + Trc1 + Trc2 + Trc3 + Trc4 (ms)					
Trc	: Tracking data reflection time				
Trc1 to Trc4	: Processing time of the transfer data listed in				
	Table9.5				

Table9 5	Processing	Times	of	Tra1	to	Tra4
100163.5	Frocessing	1111163	U.	IIai	ιU	II a 4

	Trans	Processing Time (ms)	
Tro1	Signal flow momony	Time set in the tracking setting	4 + 0 4 0 + 4 0 - 3 + 7
пст	Signal now memory	of redundant parameter	1+0.13 × 10 ° × Z
Trc2	SFC information	SFC program execution time	1 (Fixed)
		PIDINIT instruction execution	0.5 (Fixed)
Tro?	PID control instruction	time	0.5 (FIXed)
information		S.PIDINIT instruction	0.5 (Fixed)
		execution time	0.5 (FIXed)
Trc4	Device data	-	X1 + X2 + X3 ^{*1}

Z: Number of steps in the program

* 1: X1 to X3 are calculated as follows.

•X1: Processing time according to the number of device points in the tracking setting $X1=(D1 \times K1) + (D2 \times K2) + (D3 \times K3) + (D4 \times K4)$ [ms]

•X2: Processing time according to the number of device ranges in the tracking setting $X2=(E1 \times K5) + (E2 \times K6) + (E3 \times K7) + (E4 \times K8) \text{ [ms]}$

•X3: Processing time according to the number of tracking blocks in the tracking setting X3=(F1 \times K9) + (F2 \times K10) + (F3 \times K11) [ms]

D1 to D4, E1 to E4, F1 to F3, and K1 to K11 are values used in Table9.6.

FROCESSING TIME FOR REDUNDANT

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Symbol	Description	System Number Symbol	Counting Value
D1	Number of tracking device points of the devices other than the index register	K1	0.09 × 10 ⁻³
D2	Number of tracking device points of the index register	K2	$0.15 imes 10^{-3}$
D3	Number of tracking device points of the file register stored in the Standard RAM	K3	0.09 × 10 ⁻³
D4	Number of tracking device points of the file register stored in the SRAM card	K4	0.42×10^{-3}
E1	Number of tracking device ranges of the devices other than the index register	K5	4×10 ⁻³
E2	Number of tracking device ranges of the index register	K6	5×10^{-3}
E3	Number of tracking device ranges of the file register stored in the Standard RAM	K7	5×10 ⁻³
E4	Number of tracking device ranges of the file register stored in the SRAM card	K8	5×10 ⁻³
F1	Number of blocks not including the file register	K9	1 × 10 ⁻³
F2	Number of blocks including the file register stored in the Standard RAM	K10	$25 imes 10^{-3}$
F3	Number of blocks including the file register stored in the SRAM card	K11	*2

Table9.6 Counting Value of D1 to D4, E1 to E4, F1 to F3, and K1 to K11

* 2: The value of K11 differs depending on the serial number of the QnPRHCPU used.

•QnPRHCPU whose serial number (first five digits) is "06081" or earlier: $(120+3 \times G^{*3}) \times 10^{-3}$ •QnPRHCPU whose serial number (first five digits) is "06082" or later: 120×10^{-3}

* 3: G is the number of clusters of the specified file register. Calculate it using the following expression.

G = (file register capacity)/(size of one cluster)

Round up the fractional portion of G calculated by the above expression.

Use the following value as the size of one cluster.

•Q2MEM-1MBSN, Q2MEM-1MBS: 256 words (512 bytes)

•Q2MEM-2MBSN, Q2MEM-2MBS, Q3MEM-4MBS: 512 words (1024 bytes)

APPENDICES

Appendix 1 Comparison of Q4ARCPU and QnPRHCPU

A comparison of Q4ARCPU and QnPRHCPU redundant systems is listed in Table App.1.

Item		QnPRHCPU Redundant System		Q4ARCPU Redundant System	
		ternal device 48K Word Setting Time	Int	ernal device 48K Word Setting Time	
Trocking Time		Synchronized Tracking Mode: 41 ms ^{*1}		-	
		-		Batch Transfer Mode: 68.4 ms	
		Program Priority Mode: 21 ms ^{*1}		• Repeat Mode: 34.2 ms ^{*1}	
System Switching Time	Ts	w=21 + T + Trc (Refer to Section 9.2)	30	0ms	
A Series Modules	N/	'A	Ap	plicable	
QnA Series Modules	N/	A	Applicable		
CC-Link Auto Refresh	Applieghte (Meximum 4 Medules)		N/A (Performed using FROM/TO		
Setting	7	Applicable (Maximum 4 Modules)		instruction)	
Maximum Number of Modules Mounted on Main/ Extension Base Unit	<< 11 → ∪µ	First 5 digits of serial No. is "09011" or earlier>> modules (Main base unit only) Modules which are not duplicated are mounted to MELSECNET/H remote I/O station (Number of mountable modules on remote I/O station: 64 modules per station) First 5 digits of serial No. is "09012" or later>> to to 63 modules	58 ba	Modules (main base unit + extension se unit : 7 stages)	
	Item Tracking Time System Switching Time A Series Modules QnA Series Modules CC-Link Auto Refresh Setting Maximum Number of Modules Mounted on Main/ Extension Base Unit	Item In Tracking Time In System Switching Time Ts A Series Modules N/ QnA Series Modules N/ CC-Link Auto Refresh Setting Ap Maximum Number of Modules Mounted on Main// Extension Base Unit <	ItemQnPRHCPU Redundant SystemInternal device 48K Word Setting TimeSynchronized Tracking Mode: 41 ms *1-Program Priority Mode: 21 ms *1System Switching TimeTsw=21 + T + Trc (Refer to Section 9.2)A Series ModulesN/AQnA Series ModulesN/ACC-Link Auto Refresh SettingApplicable (Maximum 4 Modules)System Switching Time<< <first "09011"="" 5="" digits="" earlier="" is="" no.="" of="" or="" serial="">> 11 modules (Main base unit only)Modules which are not duplicated are mounted to MELSECNET/H remote I/O station (Number of mountable modules on remote I/O station: 64 modules per station)<<first "09012"="" 5="" digits="" is="" later="" no.="" of="" or="" serial="">> Up to 63 modules (Main base unit + extension base unit: 7 stages)</first></first>	ItemQnPRHCPU Redundant SystemTracking TimeInternal device 48K Word Setting TimeInternal device 48K Word Setting TimeSynchronized Tracking Mode: 41 ms *1-Program Priority Mode: 21 ms *1-System Switching TimeTsw=21 + T + Trc (Refer to Section 9.2)30A Series ModulesN/AApQnA Series ModulesN/AApCC-Link Auto Refresh SettingApplicable (Maximum 4 Modules)N// insKaximum Number of Modules Mounted on Main/ Extension Base Unit<	

* 1: Q4ARCPU repeat mode results in program priority mode on QnPRHCPU.

PROCESSING TIME FOR REDUNDANT SYSTEMS

	Item	QnPRHCPU Redundant System	Q4ARCPU Redundant System
System	System Extension via	< <first "09011"="" 5="" digits="" earlier="" is="" no.="" of="" or="" serial="">> N/A → Modules for the expanded system are mounted to MELSECNET/H remote I/O station. [Restrictions on Mounting Modules on Remote I/O Stations] • FROM/TO instructions and intelligent function module devices (U□\G□) are inapplicable. Use REMFR/REMTO for accessing. Or, in GX Configurator, configure the settings for intelligent function modules on remote I/O stations.^{*2} • The following modules cannot be mounted to remote I/O stations: CC-Link IE Controller Network module, MELSECNET/H module, interrupt module, Web server module, MES interface module, PROFIBUS-DP master module, PROFIBUS-DP slave module, PROFIBUS-DP interface module, DeviceNet master module. • For Ethernet modules, dedicated instructions, interrupt pointers, e-mail function, web server function is not usable. For intelligent function modules other than the above, dedicated instructions and interrupt pointers are not usable. Sinters 5 digits of serial No. is "09012" or later>> Applicable (Extension base units: Up to 7) • The following modules cannot be mounted: Interrupt module, CC-Link IE Controller Network module, MELSECNET/H module, Ethernet module (function version: B or earlier), Web server function is not usable. For intelligent function modules other than the above, dedicated instructions and interrupt pointers are not usable. For Fist 5 digits of serial No. is "09012" or later>> Applicable (Extension base units: Up to 7) • The following modules cannot be mounted: Interrupt module, CC-Link IE Controller Network module, MELSECNET/H module, Ethernet module (function version: B or earlier), Web server module (first 5 digits of serial No.: "09011" or earlier), PROFIBUS-DP master module, PROFIBUS-DP slave module, PROFIBUS-DP interface module, DeviceNet master module, and DeviceNet slave module. For intelligent function modules, dedicated instructions and interrupt pointers are not usable.</first>	Applicable (Extension base units:
Configuration	Extension Base Unit		Maximum 7 stages)

Table App.1 Comparison of Q4ARCPU and QnPRHCPU Redundant Systems (Continued)

MELSEG Q series

* 2: MELSECNET/H remote I/O stations have a limit for the maximum number of parameters that can be set with GX Configurator as intelligent function modules.

•The maximum number of parameter settings for initialization settings: 512

•The maximum number of parameter settings for automatic refresh settings: 256

APPENDICES

	ltem		QnPRHCPU Redundant System	Q4ARCPU Redundant System
		Bus		
		Connection	N/A	Applicable
		CPU Direct	Applicable (Communication with the CPU module	Annlinghla
		Connection	connected to the GOT only.)	Applicable
		Computer Link	N1/A	Applicable
		Connection	N/A	Applicable
		MELSECNET/		
	OOT	H Remote I/O	Applicable (N/A for extension base unit)	N/A
	GOT	Station		
	Туре	Connection		
		CC-Link	Applicable	Applicable
		Connection		
		MELSECNET/		
		H PLC to PLC	Applicable (N/A for extension base unit)	N/A
Svstem		Network		
Configuration		Connection		
		Connection	Applicable	Applicable
		Connection	Disabled (Slot 1 becomes I/O number "0")	
	Mounting I/O module or network module on slot 0		Mount I/O modules and natural modules an elete	Enabled
			1 and later	
	16 character I FD display			
	(auto diagnostics		N/A	
	information and comments		\rightarrow Auto diagnostics error information and comments,	Available
	are displayed.)		etc. can be confirmed using GX Developer.	
	Manual System Switching		System switching by the system switching	System switching using switches of bus
			instructions or redundant operation of GX Developer	switching module (A6RAF)
	Manual ope	erational mode	Operation mode change by redundant operation of	Operation mode change using switches
	switching		GX Developer	of bus switching module (A6RAF)
	CPU modu	le damage	Power supply module error contact output	System management module (AS92R)
	external ou	tput		CPU/ALRAM/WDT contact point output
Programming Tool	Q6PU		N/A	Applicable
	SW IVD-GPPQ		N/A	Applicable
	GX Developer		Version 8.18U or later is applicable.	SW0D5C-GPPW or later is applicable.
	GX Works2		Version 1.87R or later is applicable.	N/A
	MX Links		N/A	
	MX Monitor		\rightarrow Substituted with MX Component. (An application	Applicable
	MX Chart		program on the personal computer side needs	, .hb
			to be corrected.)	
	Connection Port		RS-232 USB	RS422 (RS-232/RS-422 converter)

Table App.1 Comparison of Q4ARCPU and QnPRHCPU Redundant Systems (Continued)

MELSEG **Q** series



Item			QnPRHCPU Redundant System	Q4ARCPU Redundant System	
	Instruction Restrictions		Instructions listed in Table App.2 are inapplicable.	-	
	Special Re	lay	Some special relays are different. ^{*3}	-	
	Special Re	gister	Some special registers are different. *3 -		
	A composit	de Cresiel	N/A		
	A-compatit	ne Special	\rightarrow Must be changed to a special relay applicable for	Applicable	
Program	Relay (Sivi	1000 and later)	QnPRHCPU. ^{*3}		
5	A-compatib	ole Special	N/A		
	Registers (SD1000 and		\rightarrow Must be changed to a special register applicable	Applicable	
	later)		for QnPRHCPU. *3		
Debug Function	Number of Steps		Number of steps for some instructions are different.	-	
	Low-speed Execution Type		N/A	Applicable	
	Program				
	Status Latch		N/A	Applicable	
	Program Trace		N/A	Applicable	
	Simulation		N/A	Applicable	
			\rightarrow Substituted with GX Simulator	Applicable	
		Sequence	N/A		
	Step Execution	Program	→ Substituted with GX Simulator	Applicable	
		SFC Program	N/A		

Table App.1 Comparison of Q4ARCPU and QnPRHCPU Redundant Systems (Continued)

* 3: For details, refer to the following.

CPU User's Manual (Hardware Settings, Maintenance and Inspection)

Table App.2 Instructions Inapplicable for QnPRHCPU

Instruction symbol	Instruction Name	Instruction symbol	Instruction Name	
LED	LED Display of ASCII code	PR	Print ASCII code	
LEDC	LED display of Comments	PRC	Print Comments	
SLT	Status Latch Set	KEY	Numerical Key Input	
SLTR	Status Latch Reset	UDCNT1	1-phase Input Up/Down Counter	
STRA	Sampling Trace Set	UDCNT2	2-phase Input Up/Down Counter	
STRAR	Sampling Trace Reset	TTMR	Teaching Timer	
PTRAEXE(P)	Program Trace Execution	STMR	Special Function Timer	
PTRA	Program Trace Set	ROTC	Rotary Table Near Path Rotation Control	
PTRAR	Program Trace Reset	RAMP	Ramp Signal	
MSG	Message Displayed on Peripheral Devices	SPD	Pulse Density Measurement	
PKEY	Peripheral Device Keyboard Input	PLSY	Pulse Output	
RFRF	Read From Remote I/O Station Special Function		Pulse Width Medulation	
	Module			
PTOP	Write To Remote I/O Station Special Function	MTD	Matrix Innut	
RIOP	Module	WITK		

MELSEC Q series

Appendix 2 Comparison of Qn(H)CPU and QnPRHCPU

A Comparison of Qn(H)CPU and QnPRHCPU is listed in Table App.3.

Table App.3 Comparison of Qn(H)CPU and QnPRHCPU

	Item	QnPRHCPU	QnHCPU
Performance	Scan Time	Scan time is increased by the tracking time. Inside device 48K word setting time • Synchronized tracking mode: 41 ms • Program priority mode: 21 ms	-
	A Series Module	N/A	Applicable
System Configuration	Maximum Number of Modules Mounted on Main/Extension Base Unit	< <first "09011"="" 5="" digits="" earlier="" is="" no.="" of="" or="" serial="">> 11 modules (Main base unit only) → Modules which are not duplicated are mounted to MELSECNET/H remote I/O station (Number of mountable modules on remote I/O station: 64 modules per station) <<first "09012"="" 5="" digits="" is="" later="" no.="" of="" or="" serial="">> Up to 63 modules (Main base unit + extension base unit: 7 stages)</first></first>	64 Slots (Main base unit + Extension base unit: 7 stages)

MELSEC Q se	eries
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System System Expansion via Configuration System Expansion via Configuration System Expansion via Configuration System Expansion via Configuration System Expansion via P The following modules cannot be mounted: Por Ethernet Interrupt module, PROFIBUS-DP System System Expansion via Configuration For Ethernet interface module, PROFIBUS-DP System System Expansion via		Item	QnPRHCPU	QnHCPU
For intelligent function modules, dedicated	System Configuration	Item System Expansion via Extension Base Unit	 CNPRHCPU <<first "09011"="" 5="" digits="" earlier="" is="" no.="" of="" or="" serial="">> N/A</first> → Modules for the expanded system are mounted to MELSECNET/H remote I/O station. [Restrictions on Mounting Modules on Remote I/O Stations] FROM/TO instructions and intelligent function module devices (U_\G_) are inapplicable. Use REMFR/REMTO for accessing. Or, in GX Configurator, configure the settings for intelligent function modules on remote I/O stations.^{*1} The following modules cannot be mounted to remote I/O stations: CC-Link IE Controller Network module, MELSECNET/H network module, interrupt module, Web server module, MES interface module, PROFIBUS-DP master module, PROFIBUS-DP slave module, PROFIBUS-DP interface module, DeviceNet master module. For Ethernet interface modules, dedicated instructions, interrupt pointers, e-mail function, communication by the fixed buffer, FTP server function, web server function is not usable. For intelligent function modules cannot be mounted: Interrupt module, CC-Link IE Controller Network module, ad AS-i master module. For Ethernet interface modules, dedicated instructions, interrupt pointers, e-mail function, communication by the fixed buffer, FTP server function, web server function is not usable. For intelligent function modules other than the above, dedicated instructions and interrupt pointers are not usable. First 5 digits of serial No. is "09012" or later>> Applicable (Extension base units: Up to 7) The following modules cannot be mounted: Interrupt module, CC-Link IE Controller Network module, MELSECNET/H network module, PROFIBUS-DP slave module (first 5 digits of serial No.: "09011" or earlier), PROFIBUS-DP master module, PROFIBUS-DP slave module, PROFIBUS-DP interface module, PROFIBUS-DP slave module, PROFIBUS	Applicable (Extension base units: maximum 7 levels)

Table App.3 Comparison of Qn(H)CPU and QnPRHCPU (Continuation)

* 1: MELSECNET/H network system remote I/O stations have a limit for the maximum number of parameters that can be set with GX Configurator as intelligent function modules.

• The maximum number of parameter settings for initialization settings: 512

• The maximum number of parameter settings for automatic refresh settings: 256

APPENDICES

	ltom		OnPRHCPU	OnHCPU
	Multi CPU S	vstem	N/A	Applicable
	Single CPLL System		Applicable (Debug mode only)	Applicable
	enigie ei e	Bus Connection	N/A	Applicable
		CPU Direct Connection	Applicable (Communication with the CPU module connected to the GOT only)	Applicable
		Computer Link Connection	N/A	Applicable
		Ethernet Connection	Applicable	Applicable
	GOT Connection	CC-Link IE Controller Network Connection	Applicable (N/A for extension base unit)	Applicable
System Configuration	Туре	MELSECNET/ H PLC to PLC Network Connection	Applicable (N/A for extension base unit)	Applicable
		CC-Link Connection	Applicable	Applicable
		MELSECNET/H Remote I/O Station Connection	Applicable (N/A for extension base unit)	Applicable
	Mounting I/O module or network module on slot 0		Disabled (Slot 1 becomes I/O number "0") → Mount I/O modules and network modules on slots 1 and later.	Enabled
	Restriction on the applicable intelligent function modules		Applied → The Ethernet modules and MELSECNET/H modules of serial No. "06052" or later are applicable.	Not applied
Programming	GX Developer		Version 8.18U or later is applicable.	Version 4 or later is applicable.
Tool	GX Works2		Version 1.87R or later is applicable.	Version 1.15R or later is applicable.
Program	Instruction restriction		 Instructions listed in Table App.4 cannot be used. Instructions listed in Table App.5 can be used under restrictions. 	-
			Only internal operation processing with single precision. (Internal operation processing precision level (single/ double) is not selectable.)	Internal operation processing precision level (single/double) is selectable.
	High-speed	interrupt (I49)	N/A	Applicable
	Slow-speed execution-type program		N/A	Applicable

Table App.3 Comparison of Qn(H)CPU and QnPRHCPU (Continuation)

MELSEC **Q** series

Instruction symbol	Instruction Name	Instruction symbol	Instruction Name	
PLOADP	Program Load from Memory Card	PLSY	Pulse Output	
PUNLOADP	Program Unload from Memory Card	PWM	Pulse Width Modulation	
PSWAP	Load + Unload	MTR	Matrix input	
PR	Print ASCII code	S.TO	Write To Host Station CPU Shared Memory	
PRC	Print Comments	S(P).SFCF	Request of Motion SFC Program Startup	
KEY	Numerical Key Input	S(P).SVST	Request of Servo Program Startup	
UDCNT1	1-phase Input Up/Down Counter	D(P).CHGV	Axis Speed Change during Positioning and JOG	
OBOINT			operation	
UDCNT2	2-phase Input Up/Down Counter	D(P).CHGT	Torque Control Value Change during Operation and	
0001112			Suspension in Real Mode	
TTMR	Teaching Timer		Current value Change of Halted Axis/Synchronized	
		B(1).0110/1	Encoder/Cam axis	
STMR	Special Timer	D(P).DDWR	Write Other CPU Device Data into Host CPU	
ROTC	Rotary Table Near Path Rotation Control	D(P).DDRD	Reads other CPU device data into the host CPU	
RAMP	Ramp Signal	D(P) GINT	Request of Other CPU Interrupt Program Startup.	
SPD	Pulse Density Measurement	D(I).CINT		

Table App.4 Instructions Inapplicable for QnPRHCPU

Table App.5 Instructions Restricted for QnPRHCPU

Instruction Symbol	Instruction Name	Remark	
COM	Selection Refresh	For restrictions on COM and ZCOM, refer to Section 7.1.(7)	
ZCOM	Refresh of Specified Module		

MELSEC Q series

Appendix 3 Comparison of QnPHCPU and QnPRHCPU

A comparison of QnPHCPU and QnPRHCPU is listed in Table App.6.

Table App.6 Comparison of QnPHCPU and QnPRHCPU

	Item	QnPRHCPU	QnPHCPU
Performance	Scan Time	Scan time is increased by the tracking time. Internal device 48K word setting time • Synchronized tracking mode: 41 ms • Program priority mode: 21 ms	-
System Configuration	Maximum Number of Modules Mounted on Main/ Extension Base Unit	< <first "09011"="" 5="" digits="" earlier="" is="" no.="" of="" or="" serial="">> 11 modules (Main base unit only) → Modules which are not duplicated are mounted to MELSECNET/H remote I/O station (Number of mountable modules on remote I/O station: 64 modules per station) <<first "09012"="" 5="" digits="" is="" later="" no.="" of="" or="" serial="">> Up to 63 modules (Main base unit + extension base unit: 7 stages)</first></first>	64 Slots (Main base unit + Extension base unit: 7 stages)



	Item	QnPRHCPU	QnPHCPU
System Configuration	System expansion using extension base units	< <first "09011"="" 5="" digits="" earlier="" is="" no.="" of="" or="" serial="">> N/A → Modules for the expanded system are mounted to MELSECNET/H remote I/O station. [Restrictions on Mounting Modules on Remote I/O Stations] • FROM/TO instructions and intelligent function module devices (U□\G□) are inapplicable. Use REMFR/REMTO for accessing. Or, in GX Configurator, configure the settings for intelligent function modules on remote I/O stations.^{*1} • The following modules cannot be mounted to remote I/O stations: CC-Link IE Controller Network module, MELSECNET/H module, interrupt module, Web server module, MES interface module, PROFIBUS-DP master module, PROFIBUS-DP slave module, PROFIBUS-DP interface module, DeviceNet master module. • For Ethernet modules, dedicated instructions, interrupt pointers, e-mail function, communication by the fixed buffer, FTP server function, web server function is not usable. For intelligent function modules other than the above, dedicated instructions and interrupt pointers are not usable. <first "09012"="" 5="" digits="" is="" later="" no.="" of="" or="" serial="">> Applicable (Extension base units: Up to 7) • The following modules cannot be mounted: Interrupt module, CC-Link IE Controller Network module, MELSECNET/H module, Ethernet module (function version: B or earlier), Web server module (first 5 digits of serial No.: "09011" or earlier), PROFIBUS-DP master module, PROFIBUS-DP slave module, PROFIBUS-DP interface module, first 5 digits of serial No.: "09011" or earlier), PROFIBUS-DP master module, PROFIBUS-DP slave module, PROFIBUS-DP interface module (first 5 digits of serial No.: "09011" or earlier), PROFIBUS-DP master module, PROFIBUS-DP slave module, PROFIBUS-DP interface module (first 5 digits of serial No.: "09011" or earlier), PROFIBUS-DP master module, PROFIBUS-DP slave module, PROFIBUS-DP interface module, DeviceNet master module, and DeviceNet slave module.</first></first>	Applicable (Extension base units: maximum 7 levels)

Table App.6 Comparison of QnPHCPU and QnPRHCPU (Continued)

* 1: MELSECNET/H remote I/O stations have a limit for the maximum number of parameters that can be set with GX Configurator as intelligent function modules.

• The maximum number of parameter settings for initialization settings: 512

The maximum number of parameter settings for automatic refresh settings: 256

APPENDICES

	ltem		QnPRHCPU	QnPHCPU
	Multi CPU System		N/A	Applicable
System Configuration	Single CPU System		Applicable (Debug mode only)	Applicable
	GOT Connection Type	Bus Connection	N/A	Applicable
		CPU Direct Connection	Applicable (Communication with the CPU module connected to the GOT only)	Applicable
		Computer Link Connection	N/A	Applicable
		Ethernet Connection	Applicable	Applicable
		CC-Link IE Controller Network Connection	Applicable (N/A for extension base unit)	Applicable
		MELSECNET/ H PLC to PLC Network Connection	Applicable (N/A for extension base unit)	Applicable
		CC-Link Connection	Applicable	Applicable
		MELSECNET/ H Remote I/O Station Connection	Applicable (N/A for extension base unit)	Applicable
	Mounting I/O module or network module on slot 0		Disabled (Slot 1 becomes I/O number "0".) → Mount I/O modules and network modules on slots 1 and later.	Enabled
	Restriction on the		Applied	
	applicable intelligent		\rightarrow The Ethernet modules and MELSECNET/H	Not applied
	function modules		module of serial No. "06052" or later are applicable.	
Programming	GX Developer		Version 8.18U or later is applicable.	Version / or later is applicable.
Tool	GX Works2		Version 1.8/R or later is applicable.	Version 1.8/R or later is applicable.
	PX Developer		version 1.06G or later is applicable.	version 1.00A or later is applicable.
Drogram			instructions listed in Table App.7 are inapplicable.	-
Program Low-speed Program			N/A	Applicable

Table App.6 Comparison of QnPHCPU and QnPRHCPU (Continued)

MELSEC **Q** series

Instruction	Instruction Namo	Instruction	Instruction Name	
Symbol	Instruction Name	Symbol		
PLOADP	Program Load from Memory Card	PLSY	Pulse Output	
PUNLOADP	Program Unload from Memory Card	PWM	Pulse Width Modulation	
PSWAP	Load + Unload	MTR	Matrix Input	
PR	Print ASCII code	S.TO	Write To Host Station CPU Shared Memory	
PRC	Print Comments	D(P).SFCF	Request of Motion SFC Program Startup	
KEY	Numerical Key Input	D(P).SVST	Request of Servo Program Startup	
UDCNT1	1-phase Input Up/Down Counter	D(P).CHGV	Axis Speed Change during Positioning and JOG	
			operation	
UDCNT2	2-phase Input Up/Down Counter	D(P).CHGT	Torque Control Value Change during Operation and	
ODCIVIZ			Suspension in Real Mode	
TTMR	Teaching Timer	D(P).CHGA	Current value Change of Halted Axis/Synchronized	
			Encoder/Cam axis	
STMR	Special Timer	D(P).DDWR	Write Host CPU Device Data into Other CPU	
			devices	
ROTC	Rotary Table Near Path Rotation Control	D(P).DDRD	Read Other CPU Device Data into Host CPU.	
RAMP	Ramp Signal		Deguast of Other CDL Interrunt Dreamon Startun	
SPD	Pulse Density Measurement	D(1 ⁻).01111	request of other of o interrupt rogram startup.	

Table App.7 Instructions Inapplicable for QnPRHCPU

Table App.8 Instructions Restricted for PRHCPU

Instruction Symbol	Instruction Name	Remark
COM	Selection Refresh	For restrictions on COM and ZCOM, refer to Section 7.1.(7)
ZCOM	Refresh of Specified Module	
Appendix 4 Sample Programs When CC-Link is Used

This section provides sample programs that continue the control of CC-Link network after the system is switched in a redundant system.

When CC-Link is used in a redundant system, create the sample programs provided in Appendix 4.5.

Appendix 4.1 System Configuration

Diagram App.1 shows the system configuration for creating sample programs and setting CC-Link network parameters.

In the diagram, the I/O numbers assigned to the CC-Link master module will be X/Y40 to X/Y5F. (\Box Section 2.4)

If the system being used is different from the diagram (Diagram App.1), change the settings for the sample program device Nos., and for CC-Link network parameters.



Diagram App.1 System Configuration

Appendix 4.2 Sample Program Names

The sample program names are listed in Table App.9.

Change the program names to match the system used.

Accordingly, change the program name in the Program tab of the PLC parameter setting as well.

Table App.9 Sample Program Name	Table /	App.9	Sample	Program	Names
---------------------------------	---------	-------	--------	---------	-------

Program Name	Execution Type	Processing Content
CHANGE	Scan	A processing program that makes QJ61BT11N usable with redundant system CPUs Make the program settings in the PLC settings so that "MAIN" will be executed after "CHANGE".
MAIN	Scan	A CC-Link control processing program

Appendix 4.3 Devices Used in Programs

(1) Devices in a CPU module

Table App.10 and Table App.11 list device numbers used in sample programs and their applications.

Device Number	Application	Remarks
SM400	Always ON	-
SM402	ON for 1 scan only after RUN	-
SM1515	Control system judgment flag	Control system: SM1515: ON, SM15165: OFF
SM1516	Standby system judgment flag	Standby system: SM1515: OFF, SM1516: ON
SM1518	Standby system to control system switching status flag	-
SM1592	Enable manual system switching flag	OFF :Manual switching prohibited ON :Manual system switching enabled
M100	Enable control program execution flag	OFF : Control program execution not possible ON : Control program execution possible
M101	System switching execution flag	OFF : System switching must not be executed ON : System switching executed
M102	System B first startup system switching flag	OFF : System switching must not be executed ON : System switching executed
M103	Scan waiting completion after saving the link devices at master switching	OFF : Scan waiting not completed ON : Scan waiting completed
M202	SP.CONTSW instruction error flag	OFF : Normal ON : Error
M4531	During data link execution	OFF : Not executed data link ON : During data link execution
D0	Number of scans after saving the link devices at master switching	After saving the link devices at master switching, the value is incremented by one for each scan until the return processing is executed.
D100 to D107	Interrupt enable or interrupt disable (IMASK instruction)	0: interrupt prohibited 1: interrupt enabled
W1200 to W1209	Device to back up data in remote output (RY)	-
W1300 to W1309	Device to back up data in remote input (RX)	-
W1400 to W1413	Device to back up data in remote register (RWw)	-
W1500 to W1513	Device to back up data in remote register (RWr)	-
SD1601	System switching condition	16: system switching instruction
SD1602	System switching instruction argument	Argument specified by SP.CONTSW instructions
141	Pointer performed at STANDBY error	Switches the stand-by master station in CC-Link to the master station

Table App.10 Devices in a CPU Module

(2) Devices in a CC-Link master module

Device Number *1	Application	Remarks				
X40	Module error	OFF : Module normal				
740		ON : Module error				
X41	Host data link status	OFF : Data link is stopped				
7.41		ON : Data linking in progress				
X4F	Module ready	OFF : Operation not possible				
7.41	would ready	ON : Operation possible				
SB40C	Forced master switching	OFF : Not requested				
02100		ON : Requested				
SB401	Refresh instruction at standby master switching	OFF : Not instructed				
00101	Renoon methodion at etallaby matter ownering	ON : Instructed				
SB442	Refresh instruction acknowledgment status at	OFF : Not executed				
00112	standby master switching	ON : instruction acknowledged				
SB443	Refresh instruction complete status at standby	OFF : Not executed				
00110	master switching	ON : Switching complete				
SB45A	Master switching request acknowledgment	OFF : Not acknowledged				
0040/	Master switching request addressed and	ON : Request acknowledged				
SB45B	Master switching request complete	OFF : Not complete				
00-00	Musici switching request complete	ON : Complete				
SW/443	Refresh instruction at standby master switching	0: Normal				
01110	result	Other than 0: Stores an error code				

* 1: Indicates the device number on CPU side in (3) of this Section.

(3) Refresh Devices

In redundant systems, refresh of remote inputs (RX), remote outputs (RY) and remote registers (RWr, RWw) are set with the program.

Refresh settings of special relays (SB) and special registers (SW) are configured with network parameters.

The CC-Link refresh devices and refresh ranges for the system in Appendix 4.1 (using 5 stations) are listed in Table App.12.

Change the transfer range on the CC-Link side, and the device range on the CPU side to match them with the number of stations and module types on the system used.

	CPU Side				
Desise News	Turnefen Denne	Buffer Memory Head	Number of Data	Davies Hand	
Device Name	Transfer Range	Address	Transferred (Words) ^{*1}	Device Used	
Remote Input (RX)	RX0-RX9F	224(E0н)	10	X1000-X109F	
Remote Output (RY)	RY0-RY9F	352(160н)	10	Y1000-Y109F	
Remote Register (RWr)	RWr0-RWr20	736(2E0н)	20	W1000-W1013	
Remote Register (RWw)	RWw0-RWw20	480(1E0н)	20	W1100-W1113	
Special Relay (SB)	SB0-SB1FF	-	-	SB400-SB5FF	
Special Register (SW)	SW0-SW1FF	-	-	SW400-SW5FF	

Table App.12 Refresh Devices

* 1: Indicates the number of transferred data that is specified in the BMOV instruction.

Appendix 4.4 Parameter Settings

The PLC parameters and network parameters for using the sample program are shown here.

(1) Program settings

The program settings of the PLC parameter settings are shown in Diagram App.2. Set "MAIN" as a number lower than "CHANGE" in program settings.

Q	Q parameter setting														
ſ	PLC name PLC sys	tem PLC file	PLC	RAS(1) PLC RAS(2	2) Device	Pr	ogram Boot	file	SF	c I	/O assi	ignment	1		
	1 1											-			
						_	F 1	_	_	_					
	- Program	-		Program name	Execute ty	pe	interval	ln u	nit	-					
	MAIN		1	KIRIKAE	Scan	-			Ŧ						
	- KIRIKAE		2	MAIN	Scan	-			•						
			3]	•			•						
			4			-			•						
			5			•		_	•						
			7			-		-	-						
			8			÷			+						
			9			-			-						
			10			-			-						
			11			-			•						
			12			•			Ŧ						
			13			-			•						
			14			•			•						
			15			•			•						
			15			-			•						
		Insert	10			÷			Ť						
			19			÷			÷						
		Delate	20			-			-						
		Delote	21			-			-						
			22			-			•	-					
				la usabilitu sattira - [1/0	aak	cotting 1								
			-	ie usability setting	1/U rem	esh	setting								
-		Acknowledge :	XY assi	gnment Multiple CF	PU settings	[Default	Chec	:k		nd	Can	icel		

Diagram App.2 Program Setting Window

(2) Tracking settings

Set the tracking settings as shown in Diagram App.3.



Diagram App.3 Tracking Setting Window

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(3) CC-Link network parameter settings

(a) Setting example

An example of CC-Link network parameter settings is shown in Diagram App.4. Refer to (b) for the station information setting.

	1	2	3	4 🔺					
Start I/O No	0040								
Operational setting	Operational settings								
Туре	Master station(Duplex function) 👻	•	•	•					
Master station data link type	PLC parameter auto start 🛛 👻	*	-	•					
Mode	Remote net(Ver.1 mode) 🔹 👻	•	-	•					
All connect count	4								
Remote input(RX)									
Remote output(RY)									
Remote register(RWr)									
Remote register(RWw)									
Ver.2 Remote input(RX)									
Ver.2 Remote output(RY)									
Ver.2 Remote register(RWr)									
Ver.2 Remote register(RWw)									
Special relay(SB)	SB400								
Special register(SW)	SW400								
Retry count	3								
Automatic reconnection station count	1								
Stand by master station No.	5								
PLC down select	Stop 👻	•	-						
Scan mode setting	Asynchronous 👻	•	-	•					
Delay information setting	0								
Station information setting	Station information								
Remote device station initial setting	Initial settings								
Interrupt setting	Interrupt settings			•					
Indispensable settings(No setting / Already set) Set if it is needed(No setting / Already set) ing item details: Acknowledge XY assignment Clear Check End Cancel									

Diagram App.4 CC-Link Network Parameter Setting Window

(b) Station information setting

Set the station information as shown in Diagram App.5

CC-Link s	CC-Link station information. Module 1											
			Expanded	Exclusive station	Remote station		Reserve/inval	id	Intelligent	buffer sele	ct(word)	
Station No	. Station type		cyclic setting	g count	points		station select		Send	Receive	Automatic	
1/1	Remote I/O station	Ŧ	single 📃	 Exclusive station 1 - 	32 points	•	No setting	•				
2/2	Remote I/O station	Ŧ	single 🗖	 Exclusive station 1 - 	32 points	-	No setting	Ŧ				
3/3	Remote device station	Ŧ	single 🗖	 Exclusive station 2 - 	64 points	-	No setting	-				
4/5	Intelligent device station	Ŧ	single 🗖	 Exclusive station 1 - 	32 points	-	No setting	-	64	64	128	-
	Default			Check B	End Cance	el						

Diagram App.5 CC-Link Station Information Setting

MELSEC Q series

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Appendix 4.5 Sample Program



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2) Sample program

* 1: After saving the link devices, wait a fixed number of scans and execute the processing which sets the link devices saved at master switching and Refresh instruction at standby master switching (SB401).

For details, refer to the following.

MELSEC-Q CC-Link System Master/Local Module User's Manual

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Diagram App.7 Sample Program: CHANGE

PROCESSING TIME FOR REDUNDANT SYSTEMS

(b) Sample program name: MAIN

1) General flow



Diagram App.8 General Flow

2) Sample program



5 11 1

Control the CC-Link control program operation of when the master station or the standby master station is oprating with the CJ instruction as this example program.

When the program is controlled with the MC instruction, output may turn off at the system switching.



- (a) Sample program name: CHANGE
 - 1) General flow



Diagram App.10 General Flow



2) Sample program

* 1: After saving the link devices, wait a fixed number of scans and execute the processing which sets the link devices saved at master switching and Refresh instruction at standby master switching (SB401).

For details, refer to the following.

MELSEC-Q CC-Link System Master/Local Module User's Manual

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Diagram App.11 Sample Program: CHANGE

PROCESSING TIME FOR REDUNDANT SYSTEMS

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(b) Sample program name: MAIN

1) General flow



Diagram App.12 General Flow

2) Sample program



Diagram App.13 Sample Program: MAIN

Control the CC-Link control program operation of when the master station or the standby master station is oprating with the CJ instruction as this example program.

When the program is controlled with the MC instruction, output may turn off at the system switching.



Appendix 5 Sample Programs When MODBUS is Used

This section provides sample programs that switch the system when a communication error occurs in a MODBUS module mounted on the main base unit in the control system. If a slave station (connected to the CPU module in the control system) cannot receive the alive check data that has been sent by the master station for a specified period, the system will be switched.

When configuring redundant transmission lines for MODBUS modules, create the sample programs provided in this section.

Appendix 5.1 System Configuration

Diagram App.14 shows the system configuration for creating sample programs and setting parameters. In the sample programs, the QJ71MB91s are used as master stations.



Diagram App.14 System Configuration I/O numbers of each MODBUS module will be as follows:

Master station 1: X/Y0 to X/Y1F

Master station 2: X/Y20 to X/Y3F

Slave stations (in the control system and standby system): X/Y0 to X/Y1F

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Appendix 5.2 Sample Programs for Master Stations

This section describes parameter settings and sample programs for master stations. When redundant transmission lines are configured, a program that sequentially performs the following communications needs to be created.

- 1) Read data of SM1515 (Control system judgement flag) and SM1516 (Standby system judgement flag).
- 2) Send the alive check data.
- 3) Communicate with slave stations.

Sample programs provided in this section perform the communications above (1) to 3)) every five seconds.

To perform the communications (1) to 3)) at a constant frequency, set the total response monitoring timer value of the MBRW instruction used in each program not to exceed the total communication time.

(The response monitoring timer value of the MBRW instruction in each program is set to one second in the sample programs.)

In the sample programs, the default settings are used for the MODBUS device assignment parameters for slave stations. If the parameters need to be changed, set the corresponding device number to the MODBUS device head number.

(1) Parameter settings

(a) Intelligent function module switch setting

Set the intelligent function module switches for the MODBUS modules used as a master station 1 and 2 as shown in Diagram App.15.

Switch setting for I/O and intelligent function module											
					loout	format	HEY	-			
[Slot	Туре	Model name	Switch 1	Switch 2	Switch 3	Switch 4	Switch 5		
	0	PLC	PLC								
	1	0(*-0)	Intelli.	QJ71MB91	0000	0000	0000	0070	0000		
	2	1(*-1)	Intelli.	QJ71MB91	0000	0000	0000	0700	0000		

Diagram App.15 Intelligent Function Module Switch Setting

(2) Devices used in the sample programs

Table App.13 lists devices used in the sample programs.

	idble Applie Bet							
Devic	e Number	Application						
Master Station 1	Master Station 2	Appreation						
X0	X20	Module ready						
X10	X30	Intelligent function module switch change status						
M8172	M8182	MBRW instruction execution trigger (for reading data of SM1515 and SM1516)						
M8173	M8183	MBRW instruction execution signal (for reading data of SM1515 and SM1516)						
M8174	M8184	MBRW instruction completion signal (for reading data of SM1515 and SM1516)						
M8175	M8185	MBRW instruction completion monitoring flag (for reading data of SM1515 and SM1516)						
M8176	M8186	MBRW instruction interlock signal (for sending the alive check data)						
M8177	M8187	MBRW instruction execution trigger (for sending the alive check data)						
M8178	M8188	MBRW instruction execution signal (for sending the alive check data)						
M8179	M8189	MBRW instruction completion signal (for sending the alive check data)						
M8180	M8190	MBRW instruction completion monitoring flag (for sending the alive check data)						
D12130 to D12146	D12210 to D12226	MBRW instruction control data (for reading data of SM1515 and SM1516)						
D12150	D12230	Read data storage device (for reading data of SM1515 and SM1516)						
D12160	D12240	Write data storage device (for reading data of SM1515 and SM1516)						
D12170 to D12186	D12250 to D12266	MBRW instruction control data (for sending the alive check data)						
D12190	D12270	Read data storage device (for sending the alive check data)						
D12200	D12280	Write data storage device (for sending the alive check data)						
T2044	T2046	Initial start-up wait						
T2045	T2047	MBRW instruction execution interval timer						

Table App.13 Devices Used in the Sample Programs

(3) Sample program for the master station 1

This program reads the data in the special relay (SM1515, SM1516) and sends the alive check data.

(a) General flow





0	X0	X10					K50 .	The wait time to start up the slave station
6	T2044	T2045					K50 (T2045	Perform a set of communications (reading the data in the special relay (SM1515, SM1516), sending the alive check data, and communicating with slave
12	T2045					-[PLS	M8172	stations) every five seconds. Turn on the MBRW instruction execution trigger.
15	M8172				-[моv	H0	D12130	Fixed to 0
					-[моv	H0	D12131	Clear the completion status to 0.
					—[мо∨	H0	D12132	Clear MODBUS exception code to 0.
					—[моv	K2	D12133	Specify the target channel.
					—[мо∨	H0	D12134	Fixed to 0
					—[мо∨	K1	D12135	The target station number (station No.1)
					-[моv	H0	D12136	Fixed to 0
					—[мо∨	K100	D12137	Response monitoring timer value (1 second)
					—[моv	H100	D12138	Type specification of the target MODBUS device (100н: Read coils)
					-[моv	К0	D12139	Target file number
					-[моv	H55EB	D12140	Target MODBUS device head number (Specify the coil 021996 and read the data in SM1515 and SM1516.)
					-[моv	K2	D12141	Access points (2 points)
					-[моv	K1	D12142	Read data storage area (1 point)
					—[моv	K1	D12146	Write data storage area size (dummy)
		[[Z.ME	3RW ″U0″	D12130	D12150	D12160	M8173	Execute the dedicated instruction.
						-[rst	M8172	Turn off the MBRW instruction execution trigger.
55	M8173	M8174				-[set	M8175	A process upon normal completion (M8173: ON, M8174: OFF)
		M8174				-[RST	M8175	A process upon abnormal end (M8173: ON, M8174: ON)
						-[SET	M8176	Turn on the interlock trigger for the MBRW instruction.
64	SM402				—[моv	K1	D12200	Store the initial value of alive check data.
67	M8176					-[PLS	M8177	Turn on the MBRW instruction execution trigger.

(b) Sample program

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70	M8177				—[моv	H0	D12170	Fixed to 0
					—[моv	H0	D12171	Clear the completion status to 0.
					—[моv	H0	D12172	Clear MODBUS exception code to 0.
					—[моv	K2	D12173	Specify the target channel.
					—[моv	H0	D12174	Fixed to 0
					—[моv	К1	D12175	The target station number (station No.1)
					—[моv	H0	D12176	Fixed to 0
					—[моv	K100	D12177	Response monitoring timer value (1 second)
					—[моv	H5	D12178	Type specification of the target MODBUS device (5н: Write holding registers)
					—[моv	К0	D12183	Target file number
					—[моv	H2FFF	D12184	Target MODBUS device head number (Specify the holding register 412288 and write the data to D12287.)
					—[моv	K1	D12185	Access points (1 point)
					—[моv	K1	D12186	Write data storage area size (1 point)
			[Z.MBRW "U0"	D12170	D12190	D12200	M8178	Execute the dedicated instruction.
						-[RST	M8176	Turn off the MBRW instruction execution trigger.
108	M8178	M8179				-[SET	M8180	A process upon normal completion (M8178: ON, M8179: OFF)
		M8179				-[RST	M8180	A process upon abnormal end (M8178: ON, M8179: ON)
						-[inc	D12200	Increment the alive check data.
118	M8175	M8180 D12150.0 D12150.1			Perfori	m commu	nications.	Perform communications with the slave station connected to the control system.
						-[RST	M8175	
						-[RST	M8180	
		D12150.0 D12150.1				-[RST	M8175	Do not perform communications with the slave station connected to the standby system.
						-[RST	M8180	
132							[END]	

Diagram App.17 Sample Program for the Master Station 1



This program performs the same operations as the master station 1.

(a) General flow

Refer to Appendix 5.3 (3).

(b) Sample program

0	X20	X30		К50 (Т2046)	The wait time to start up the slave station (5 seconds)
	T2046	T20 <u>4</u> 7		K50	Perform a set of communications (reading the data in the special relay (SM1515, SM1516), sending the
6	T2047			(12047)	alive check data, and communicating with slave stations) every five seconds.
12			-[PLS	M8182	Turn on the MBRW instruction execution trigger.
15	M8182	Емоч	H0	D12210	Fixed to 0
		Емоч	H0	D12211	Clear the completion status to 0.
		Емоч	H0	D12212	Clear MODBUS exception code to 0.
		Емоч	К2	D12213	Specify the target channel.
		Емоч	H0	D12214	Fixed to 0
		Емоч	К1	D12215	The target station number (station No.1)
		Емоч	H0	D12216	Fixed to 0
		[mov	K100	D12217	Response monitoring timer value (1 second)
		[моч	H100	D12218	Type specification of the target MODBUS device (100н: Read coils)
		[mov	К0	D12219	Target file number
		[моч	H55EB	D12220	Target MODBUS device head number (Specify the coil 021996 and read the data in SM1515 and SM1516.)
		Емоч	K2	D12221	Access points (2 points)
		Емоч	К1	D12222]	Read data storage area (1 point)
		Емоч	К1	D12226	Write data storage area size (dummy)
		[Z.MBRW ″U2″ D12210 D12230	D12240	M8183	Execute the dedicated instruction.
			-[rst	M8182	Turn off the MBRW instruction execution trigger.
55	M8183	M8184	-[set	M8185	A process upon normal completion (M8183: ON. M8184: OFF)
		M8184	-[rst	M8185	A process upon abnormal end (M8183: ON, M8184: ON)
			-[set	M8186	Turn on the interlock trigger for the MBRW instruction.
64	SM402	Емоч	К1	D12280	Store the initial value of alive check data.
67	M8186		-[PLS	M8187	Turn on the MBRW instruction execution trigger.

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70	M8187				—[моv	H0	D12250]	Fixed to 0
					—[моv	H0	D12251]	Clear the completion status to 0.
					-Емоу	H0	D12252]	Clear MODBUS exception code to 0.
					-[моv	K2	D12253]	Specify the target channel.
					—[моv	H0	D12254]	Fixed to 0
					—[моv	К1	D12255]	The target station number (station No.1)
					—[моv	H0	D12256]	Fixed to 0
					-[моv	K100	D12257]	Response monitoring timer value (1 second)
					-[моv	H5	D12258]	Type specification of the target MODBUS device (5н: Write holding registers)
					—[моv	К0	D12263]	Target file number
					-[моv	H2FFF	D12264]	Target MODBUS device head number (Specify the holding register 412288 and write the data to D12287)
					-[моv	K1	D12265]	Access points (1 point)
					—[моv	К1	D12266]	Write data storage area size (1 point)
			[z.mbrw ″u2″	D12250	D12270	D12280	M8188]	Execute the dedicated instruction.
						-[RST	M8186]	Turn off the MBRW instruction execution trigger.
108	M8188	M8189				-[SET	M8190]	A process upon normal completion (M8188: ON, M8189: OFF)
		M8189				-[RST	M8190]	A process upon abnormal end (M8188: ON, M8189: ON)
						-[INC	D12280]	Increment the alive check data.
118	M8185	M8190 D12230.0 D12230.1			Perfor	m commu	inications.	Perform communications with the slave station connected to the control system.
						-[rst	M8185]	
						-[RST	M8190]	
		D12230.0 D12230.1				-[RST	M8185]	Do not perform communications with the slave station connected to the standby system.
						-[RST	M8190]	
132							-[end]	

Diagram App.18 Sample Program for the Master Station 2

Appendix 5.3 Sample Programs for Slave Stations

This section describes parameter settings and a sample program for slave stations. The sample program switches the system if a slave station cannot receive the alive check data for 10 seconds.

(1) Parameter settings

(a) Redundant parameter

Select "Do tracking (Device total increases 16K word.)" for "Signal flow memory tracking setting" in the Tracking settings parameter.

Redundant parameter					
Operation settings Tracking settings					
Tracking device settings					
Signal flow memory tracking setting C No tracking C Do tracking (Device total increases 16K word.)	All tracking device capacity K word				

Diagram App.19 Redundant Parameter

(b) Intelligent function module switch setting

Set the intelligent function module switches for the MODBUS modules used as a slave station as shown in Diagram App.20.

Switch setting for I/O and intelligent function module								×		
					<i>,</i> .	LIEU	_			
	Input format									
	Slot	Tune	Model name	Switch 1	Switch 2	Switch 3	Switch 4	Switch 5	•	
0	PLC	PLC								
1	0(*-0)	(PLC)								
2	1(*-1)	Intelli.	QJ71MB91	0000	0000	0001	0740	0000		

Diagram App.20 Intelligent Function Module Switch Setting

(c) MODBUS device assignment parameter

Default settings are used in the sample program. No settings are required.

PROCESSING TIME FOR REDUNDANT SYSTEMS

(2) Devices used in the sample program

Table App.14 lists devices used in the sample program.

	Table App.14 Devices	Used in the	Sample	Program
--	----------------------	-------------	--------	---------

Device Number	Application
SM400	Always ON
SM1515	Control system judgement flag
SM1516	Standby system judgement flag
SM1518	Standby system to control system switching status flag
SM1592	Enable/disable user system switching
M8190	First data receive signal
M8191	Status when the SP.CONTSW instruction is completed
D12286	Alive check data storage device (last value)
D12287	Alive check data storage device (received value)
T2047	Data reception monitoring timer

(3) Sample program

(a) General flow



Diagram App.21 General Flow



Appendix 6 Method for Starting up the Previous Control System

When both systems are simultaneously powered on, or when the reset switches of both system CPU modules are simultaneously set to neutral position in a redundant system, the redundant system will start up with system A as the control system.

Even when the power supplies for both systems go off temporarily due to a power failure while system B is operating as the control system, system A will start up as the control system when the power supplies of both systems are turned ON.

In order to start up with the previous control system, i.e., system B as the control system in this condition, create the following program (Diagram App.23) that uses the special relay, "Previous control system identification flag" (SM1519).

However, when mounting a network module on the main base unit or extension base unit, create an interlock circuit as shown on the programs in Diagram App.29 and Diagram App.31 before executing the SP.CONTSW instruction.

If battery error occurs in either system and device data cannot be held, the operation cannot be guaranteed.

(1) When network module is not mounted

The following program shows an operation when the previous control system starts with no network module mounted.

(a) Program Example



Diagram App.23 A program example

(b) Operation Image

1) System B is operating as the control system.



Diagram App.24 The system when System B is operating as the control system

2) Power supplies of both systems are temporarily OFF because of a power failure, etc.



Diagram App.25 The system when power supplies of both systems are temporarily OFF

3) System A starts as the control system when both systems are simultaneously powered ON.

(The SM1519 is ON for one scan after the system A CPU module has run.)



Diagram App.26 The system when both systems are simultaneously powered ON

* 1: After turning on one of the power supply modules, turn the other one on within 3 seconds.

 Switching System B to the control system through a system switching instruction



Diagram App.27 The system when System B is switched to the control system through a system switching instruction

Create a system switching program while paying attention to the following points.

- Turn on the special relay, "Manual System Switching Enabled Flag" (SM1592) by executing SP.CONTSW instruction.
 An "OPERATION ERROR (error code: 4120)" will occur if the SP.CONTSW instruction is executed while SM1592 is OFF.
- Set any value other than 0 as the parameter for SP.CONTSW instruction. If the SP.CONTSW instruction is executed with the parameter set as 0, the "OPERATION ERROR (error code: 4100)" will occur.

(2) When network module is mounted

Make sure that the network module has started up, and then create a program that executes the SP.CONTSW instruction.

(a) CC-Link IE Controller Network module, MELSECNET/H module or Ethernet module is mounted on the main base unit.

[System Configuration]



Diagram App.28 System configuration when CC-Link IE Controller Network module, MELSECNET/H module or Ethernet module is mounted on the main base unit

APPENDICES



[Program Example]



Diagram App.29 A program example

- (0) Saves the ON/OFF status of SM1519 (Previous Control System Identification Flag) to M8191 (System B restart flag) since SM1519 is on during only one scan after the operating status of the CPU module has changed to RUN.
- (2) Makes the subroutine program (P100) execute while M8191 (System B restart flag) is on.
- Jumps the processing to the END instruction not to execute the user program while M8191 is on.
- (39) Ends the main routine program.
- (55) Starts measuring the timeout time (ten seconds (Timer Limit Setting: 100ms)) for the startup of previous control system. Checks the following before executing the SP.CONTSW instruction: one of the device area from SW0070 to SW0073 for checking that the data link status of the network modules in the system B is normal (the device area and bit vary depending on the network modules and the station number in the system B); SD1690 (Network module head address, which requested system switching on host (control) system) for checking that system switching requests are not received from the network modules in the system B. Sets SM1592 (Enable/disable user system switching) after the network module communications in the system B have been established successfully. (The manual system switching function is enabled.) Executes the SP.CONTSW instruction.

Executes the SP.CONTSW Instruction.

Turns off M8191 (System B restart flag).

Turns off M8191 as well when the timeout time (ten seconds) has elapsed, because system switching is not performed and the CPU module proceeds to the next scan to execute the user program while the system A remains as the control system. (The timeout time (ten seconds) needs to be adjusted depending on the system configuration and environment.)

(79) Ends the subroutine program.

(b) CC-Link master module is mounted on the extension base unit. [System Configuration]



Diagram App.30 System configuration when CC-Link master module is mounted on the extension base unit

[Program Example]

(The I/O number assigned to CC-Link master module is from X100 to 11F.)





- If CC-Link system master/local modules are mounted on the main base unit, system B cannot be started up as the control system.
 Start up system A as the control system.
- 2. If all stations are faulty in CC-Link network system, system A will be control system since Xn1 does not turn on. To start with the previous control system, power on the programmable controller CPU after powering on the CC-Link remote I/O stations.
- 3. In the user program, SM402 (After RUN, ON for 1 scan only) and SM403 (After RUN, OFF for 1 scan only) cannot be used because the system switching instruction (SP.CONTSW) takes several scans to complete the processing. Use other devices instead. For example, use an alternative device to SM402 to turn it ON on the rising edge of SM1519 (Previous Control System Identification Flag) and make it turn off after the first execution of the user program. Make an alternative device to SM403 to turn on at the head of the next scan following the falling edge of the alternative device to SM402.
- 4. To use the Rise/Fall execution instruction in a program of system B after system switching, set [Do tracking] at [Signal flow memory tracking setting] on [Tracking settings] in redundant parameter.

Appendix 7 Precautions for Using Serial Communication Module

The dedicated instructions of the serial communication module for the module mounted to the extension base unit cannot be used in the redundant system.

For the functions to communicate using the dedicated instructions, create programs by using the FROM/TO instruction.

The dedicated instruction applicable in the serial communication module and the changeability by the FROM/TO instruction are listed in Table App.15.

Instruction name	Function overview	Changeability by FROM/TO instruction	Reference section
	Sets initial setting of the unit (word/byte) of the number of send/receive data and the send/receive area size.	Applicable	Appendix 7.1
CSET	Registers/cancels programmable controller CPU monitoring to use the programmable controller CPU monitoring function.	N/A	-
	Clears receive data without stopping the send processing in the nonprocedural protocol.	Applicable	Appendix 7.1
UINI	Switches mode, transmission specifications, and host station number.	Applicable ^{*1}	Appendix 7.2
BUFRCVS	Receives data in the interrupt program by the nonprocedural or bidirectional protocol communication.	N/A	-
SPBUSY	Reads send/receive status of data by dedicated instructions.	N/A	-
INPUT	Receives data by user arbitrary transmission format in the nonprocedural protocol.	Applicable	Appendix 7.3
PUTE	Registers user registration frame.	Applicable	Appendix 7.4
GETE	Reads user registration frame.	Applicable	Appendix 7.5
ONDEMAND	Sends data by the on-demand function of MC protocol.	Applicable	Appendix 7.6
OUTPUT	Sends data as much as specified by the nonprocedural protocol communication.	Applicable	Appendix 7.7
PRR	Sends data by user registration frame according to specification at user registration frame specification area for sending in the nonprocedural protocol communication.	Applicable	Appendix 7.8
BIDOUT	Sends data as much as specified by the bidirectional protocol communication.	Applicable	Appendix 7.9
BIDIN	Reads data received by the bidirectional protocol communication.	Applicable	Appendix 7.10

Table App.15 Serial Communication Module Dedicated Instruction List

* 1: Station number or operating status (independent/linked) cannot be changed.

A sample program of the serial communication module where dedicated instructions are changed to the FROM/TO instruction is described in the next section or later. For the precautions at system switching, refer to Section 7.4.

Appendix 7.1 CSET Instruction

(1) When setting initial setting of the unit (word/byte) of the number of send/ receive data and the send/receive area size

(a) Setting the unit of send/receive data length

The following tables list the devices and buffer memory area used in the sample program of the send/receive data length unit setting.

1) I/O signal

Table App.16	List of	I/O Signal
--------------	---------	------------

I/O s	ignal	Signal namo	Description of signal	
CH1 side	CH2 side	Signal name	Description of signal	
X(n+1)E		Q series C24 ready	ON: Accessible	
X(n+1)F		Watabdag timor arror	ON : Module error occurred	
			OFF: Module being normally	
			operated	

2) Buffer memory

Write 0 (word unit) or 1 (byte unit) to the following address.

Table App.17 List of Buffer Memory

Buffer memory address	hexadecimal (decimal)	Buffer memory name	
CH1 side	CH2 side	Burler memory name	
96 _H (150)	136 _H (310)	Word/byte units designation	

Set the send/receive data length unit setting before communication. In addition, change the setting when the ready signal X(n+1)E of a module is ON.

The program example of send/receive data length unit setting is shown in Diagram App.32. (For the I/O signal is X/Y80 to X/Y9F)



Diagram App.32 Program Example

(b) Specification of buffer memory head address and buffer memory size used in on-demand function

For the specification, refer to Appendix 7.6.

(c) Specification of head address/area size of send area/receive area

The following tables list the devices and buffer memory areas used in the sample program of specifying the head address and area size.

1) I/O signal

Table App.18 List of I/O Signal

I/O signal		Signal name	Description
CH1 side	CH2 side	Signal name	Description
X(n+1)E		Q series C24 ready	ON: Accessible
X(n+1)F		Watchdog timer error (WDT error)	ON : Module error occurred
			OFF: Module being normally
			operated

2) Buffer memory

Table App.19 List of Buffer Memory

Buffer memory address	Hexadecimal (decimal)	Puffor momory nomo	
CH1 side	CH2 side	Buller memory name	
A2(162)	142 _H (322)	Transmission buffer memory head	
A2H(102)		address designation	
A3(163)	1/12(202)	Transmission buffer memory length	
A3H(103)	140H(020)	designation	
A6. (166)	146(326)	Receive buffer memory head address	
70H(100)	140H(320)	designation	
A7. (167)	147 _H (327)	Receive buffer memory length	
Αιθ(101)		designation	

When using the following functions simultaneously, be careful not to duplicate the assignment of buffer memory which stores send data and receive data dealt with the function to be used.

- On-demand function of MC protocol
- Send/receive function of nonprocedural protocol
- Send/receive function of bidirectional protocol

X9E

X9E

+

X9F

-1/

X9F

1/

H0D00 D0] Sets D0 to head address D00_H. H300 D1] Sets D1 to buffer memory length 300_H.

] Writes receive area setting value.

Sets D0 to head address C00_H.

Writes send area setting value.

Sets D1 to buffer memory length 100_H.

Diagram App.34 Program Example

D0

K2

The program example of specifying the send area head address and the send

H0C00

H100

D0

Diagram App.33 Program Example

The program example of specifying the receive area head address and the

D0

D1

K2

MOVP

MOVP

H0A2

-MOVP

MOVP

H0A6

area size is shown in Diagram App.33. (For the I/O signal is X/Y80 to X/Y9F)

-Гтор

H8

receive area size is shown in Diagram App.34.

H8

(For the I/O signal is X/Y80 to X/Y9F)

-TOP

(2) When clearing receive data without stopping the send processing in nonprocedural protocol

The following tables list the devices and buffer memory area used in the sample program of clearing receive data.

(a) Device of programmable controller CPU

Table App.20 Device Used in the Program

Device No.	Application	Remarks
X23	Receive data clear request command	ON: Receive data clear request
M11	Receive processing	ON: Executing, OFF: Not executed
M12	Send processing	ON: Executing, OFF: Not executed
M15	Receive data clear request pulse	ON: Receive data clear request
M16	Receive data clear request	ON: Receive data clear request
WITO	acceptance flag	acceptance
M17	Receive data clear request completion	ON: Receive data clear request
IVI I 7	flag	completion
M18	Communication disable	ON: Communication disable
M19	Communication enable	ON: Communication enable

(b) I/O signal

Table App.21 List of I/O Signal

I/O signal		Signal namo	Description
CH1 side	CH2 side	Signa halle	Description
Xn3	XnA	Reception data read request	ON: Requesting read
Xn4	XnB	Reception abnormal detection	ON: Abnormal detection
Yn1	Yn8	Reception data read completion	ON: Data read completed

(c) Buffer memory

When all of the receive processing, send processing, and receive data clear processing are not executed, write 1 to the following address.

Table App.22 List of Buffer Memory

Buffer memory address	Hexadecimal (decimal)	Buffer memory name
CH1 side	CH2 side	
A8 _H (168)	148 _H (328)	Receive data clear request

- 1. When using the Q series C24 (function version A), restart the data communication when 100ms has passed after the buffer memory address $A8_{\rm H}$ (for CH1)/148_H (for CH2) was changed from 1 to 0.
- 2. Do not execute clear request of receive data during communicating data with the external device, since data communication is discontinued when clear request is performed to the receive data.


The program example of clearing receive data is shown in Diagram App.35. (For the I/O signal is X/Y80 to X/Y9F)

Diagram App.35 Program Example

 * 1: When using the Q series C24 (function version A), add the dotted line to the sequence program.

* 2: Communicate data when M19 is ON

MELSEG Q series

Appendix 7.2 UINI Instruction

The following tables list the devices and buffer memory areas used in the sample program for mode switching.

(1) Device of programmable controller CPU

Table App.23 Device Used in the Program

Device No.	Application	Remarks
X52	Mode switching request clear command	ON: Mode switching request clear
X60	Mode switching command	ON: Mode switching
M11	Receive processing	ON: Executing, OFF: Not executed
M12	Send processing	ON: Executing, OFF: Not executed
M50	Mode switching completion flag	ON: Mode switching completion

(2) I/O signal

Table App.24 List of I/O Signal

	I/O si	ignal	Signal name	Devic turned	e to be ON/OFF	Timing
I	CH1 side	CH2 side		CPU	C24	
	Xn6	XnD	Mode switching	-	0	- Completed
	Yn2	Yn9	Mode switching request	0	-	(Switching in execution)

Table App.25 List of I/O Signal

I/O signal		Signal name	Description	
CH1 side	CH2 side	Signal hame	Description	
Xn3	XnA	Reception data read request	ON: Requesting read	
Xn4 XnB		Reception abnormal detection	ON: Abnormal detection	
XnE		CH1 ERR. occurrence	ON: Error occurring	
XnF		CH2 ERR. occurrence	ON: Error occurring	
X(n+1)E		Q series C24 ready ON: Accessible		
X(n+1)F		Watchdog timer error ON : Module error occurred		
		(WDT error)	OFF: Module being normally operated	

(3) Buffer memory

When all of the receive processing, send processing, and receive data clear processing are not executed, write 1 to the following address.

Buffer memory address Hexadecimal (decimal) CH1 side CH2 side		Na	me	Setting value Stored value
90 _H (144)	130 _H (304)	For mode switching	Switching mode No. specification (Refer to (a))	 0001_H: MC protocol (Format 1) 0007_H: Bidirectional protocol 00FF_H: GX Developer connection
91 _H (145)	131 _H (305)	specification	Transmission specification after switching (Refer to (b))	 0000_H: Set the same setting as the setting of GX Developer 8000_H to 8FFF_H: Set the setting the same as this area setting
203 _H	(515)	For switching setting and mode switching confirmation	Switch setting error, mode switching error status	 0: No error Other than 0: Switch setting error, mode switching error

Table App.26 List of Buffer Memory

(a) Switching mode No. specification area (Address: 90_{H} , 130_{H})

The mode No. after switching $(0001_{\text{H}} \text{ to } 0007_{\text{H}}, 00\text{FF}_{\text{H}})$ is written to this area.



* 1: When specifying GX Developer connection mode in Switch setting of GX Developer, specify [00_H] to the communication protocol.

(b) Transmission specification area after switching (Address: 91_H, 131_H)

- 1) Specify the transmission specification after mode switching. *2
- 2) Write [0000_H] when initializing settings set by GX Developer.
- When setting the arbitrary transmission specifications (transmission specifications other than set in GX Developer), write the value corresponding to ON/OFF of the relevant bit shown below. Specification of 1(ON)/0(OFF) of the relevant bit is the same as that of transmission setting of GX Developer.



- * 2: Specify [8000_H] when selecting "GX Developer connection" for the switching mode No. specification.
- * 3: The following table lists the specified values of the communication speed.

Communication speed	Bit position	Communication speed	Bit position
(Unit: bps)	b14 to b8	(Unit: bps)	b14 to b8
50	0F _H	14400	06 _H
300	00 _H	19200	07 _H
600	01 _H	28800	08 _H
1200	02 _H	38400	09 _H
2400	03 _H	57600	0A _H
4800	04 _H	115200	0B _H
9600	05 _H	230400	0C _H

- 230400bps is applicable for the CH1 side of the QJ71C24N(-R2/R4) only.
- When connecting external devices to two interfaces (CH1 and CH2), the total of communication speed of two interfaces should be within 115200bps (230400bps for the QJ71C24N(-R2/R4)).

When connecting an external device to either interface (CH1 or CH2), the communication speed can be set up to 115200bps (230400bps for the CH1 side of the QJ71C24N(-R2/R4)). In this case, the communication speed of the interface where the external device is not connected should be 300bps.

• Set [00_H] to the interface side where "GX Developer connection" is set in the communication protocol setting. The serial communication module can operate at speed set for GX Developer side.



The program example for mode switching is shown in Diagram App.36. (For the I/O signal is X/Y80 to X/Y9F)

MELSEG Q series

Diagram App.36 Program Example

- 1. Stop all data communication before mode switching. Data communication will be stopped when mode switching is performed during data communication.
- 2. Note that station No. setting change and switching to linked operation/ switching from linked operation to independent mode cannot be made.

Appendix 7.3 INPUT Instruction

The following tables list the devices and buffer memory areas used in the sample program of receiving data by the nonprocedural protocol communication.

(1) I/O signal

Table	App.27	List	of I/O	Signa

I/O signal		Signal name	Description	
CH1 side	CH2 side	Signar name	Description	
Xn3	XnA	Reception data read request	ON: Requesting read	
Xn4	XnB	Reception abnormal detection	ON: Abnormal detection	
X(n+1)F		Watchdog timer error	ON : Module error occurred	
		(WDT error)	OFF: Module being normally operated	
Yn1	Yn8	Reception data read completion	ON: Data read completed	

(2) Buffer memory

Table App.28 List of Buffer Memory

Buffer memory address Hexadecimal (decimal)		Name	Stored value
CH1 side	CH2 side		
258 _H (600)	268 _H (616)	Data reception result	0 : Normal completion 1 or more: Abnormal completion (error code)
600 _H (1536)	A00 _H (2560)	Receive data count (Number of data for which read is requested)	0: No receive data 1 or later: Number of receive data
601 _H to 7FF _H (1537 to 2047)	A01 _H to BFF _H (2561 to 3071)	Receive data	Data received from an external device

The following shows the program example of receiving data by the nonprocedural protocol communication is shown in Diagram App.37. (For the I/O signal is X/Y80 to X/Y9F)



Diagram App.37 Program Example

Appendix 7.4 PUTE Instruction

The following tables list the devices and buffer memory areas used in the sample program of registering the user registration frame.

(1) Device of programmable controller CPU

Table App.29 Device Used in the Program

Device No.	Application	Remarks
X50	Register request command	ON: Register request
M1	Flash ROM write request flag	ON: Flash ROM write request start
M50	Register request set	ON: Registering

(2) I/O signal

Table App.30 List of I/O Signal

I/O signal		Signal name	Description
CH1 side	CH2 side	Signal name	Description
X(n-	+1)8	Flash ROM write completion	ON: Completed
Y(n-	+1)8	Flash ROM write request	ON: Requesting

(3) Buffer memory

Table App.31 List of Buffer Memory			
Buffer memory add (deci	dress Hexadecimal mal)	Name	Stored value
CH1 side	CH2 side		
			0: No request
2	(2)	Register/read/delete	1: Registration request
44 4	(2)	instructions	2: Read request
			3: Deletion request
3	(2)		0: No designation
3 _H (3)		Frame No. direction	Other than 0: Frame No.
		Pagiatration/road/dalata	0: Normal completion
4 _H (4)			Other than 0: Abnormal
		result storage	completion
			0 : No designation
5	(5)	Number of data bytes	Other than 0: Number of
5 _H (5)		registered designation	data bytes registered
			(maximum 80 bytes)
			0 : No designation
6 _H to 2D _H (6 to 45)		User frame	Other than 0: Registered
			data (maximum 80 bytes)
2000	(8102)	Flash ROM write allow/	0: Write prohibited
2000H	2000 _H (8192)		1: Write allowed

X50

-||

M50

-| |

0

3

Diagram App.36.

(For the I/O signal is X/Y80 to X/Y9F)

Sets the number of data byte Гмоч K10 D3 to be registered -Гмоv H3946 D4 -[mov H3030 D5 Sets registered data of a frame -Гмоv H3030 D6 to be registered to D4 to D8 Гмо∨ H4646 D7 -Гмоv H3030 D8 -[то H8 H2000 K1 K1 Sets the write permission to the flash ROM. Гто H8 H2 D0 K2 Registers user registration frame Гто H8 H5 D3 K6 SET M1 Sets the flash ROM write request flag. M1 X98 36 -|| -1/ SET Y98 Writes data to the flash ROM. X98 Reads registration result when write completion is turned ON ┥┟ FROM H8 H4 D2 K1 Executes error processing when D2 is other than 0 -RST Y98 Resets the flash ROM write request flag. -RST M1

The program example of registering the user registration frame No.3E8H is shown in

M50

D0

D1

Requests registration

Sets registration request

Sets frame No. to be registered

- PLS

K1

H3E8

-Гмоv

-MOV



Appendix 7.5 GETE Instruction

The following tables list the devices and buffer memory areas used in the sample program of reading the user registration frame.

(1) Device of programmable controller CPU

Table App.32 Device Used in the Program

Device No.	Application	Remarks
X50	Read command	ON: Read command
MO	Read command acceptance	ON: Read command acceptance
M1	Read flag	ON: Reading

(2) I/O signal

Table App.33 List of I/O Signal

I/O signal		Signal namo	Description
CH1 side	CH2 side	Signal name	Description
X(n+	-1)7	Flash ROM read completion	ON: Completed
Y(n+	+1)7	Flash ROM read request	ON: Requesting
X(n+1)E		Q series C24 ready	ON: Accessible
		Watchdog timer error	ON : Module error occurred
X(n+1)F		(WDT error)	OFF: Module being normally
		(,	operated

(3) Buffer memory

Table App.34 List of Buffer Memory

Buffer memory address Hexadecimal (decimal)		Name	Stored value
CH1 side	CH2 side		
			0: No request
2	(2)	Register/read/delete	1: Registration request
-H	(2)	instructions	2: Read request
			3: Deletion request
3	(3)	Frame No. direction	0: No designation
3H(3)		Frame No. direction	Other than 0: Frame No.
		Registration/read/delete	0: Normal completion
4 _H	(4)		Other than 0: Abnormal
		lesuit storage	completion
			0 : No designation
5	(5)	Number of data bytes	Other than 0: Number of
5H(3)		registered designation	data bytes registered
			(maximum 80 bytes)
6 _H to 2D _H (6 to 45)			0 : No designation
		User frame	Other than 0: Registered
			data (maximum 80 bytes)

X50 M1 +/{ PLS 0 ┥┟ M0 Pulse-outputs read command M0 +Гмоч K2 D0 Sets the read request - MOV H3EB D1 Sets the frame No. to be read X9E X9F +1/-Гто H8 H2 D0 K2 Writes read command etc. SET M1 Sets read flag X97 M1 Turns ON the read 17 +-1/--SET Y97 request signal. X97 Reads result of read if read FROM ┥┝ H8 H4 D2 K1 completion signal is turned ON RST Y97 H Turns OFF the read request signal. Reads the number of user FROM **||** = D2 K0 H8 H5 D3 K1 registration frames. Converts the number of bytes -[/ D50 D3 K2 into the number of words. Add 1 to the number of read -[+ D50 D51 Z0 words for the odd data. FROM H8 K070 H6 D4 Reads the user registration frame. RST M1 Resets the read flag.

The program example of reading the user registration frame is shown in Diagram App.39. (For the I/O signal is X/Y80 to X/Y9F)

Diagram App.39 Program Example

MELSEG **Q** series

Appendix 7.6 ONDEMAND Instruction

The following tables list the devices and buffer memory areas used in the sample program of sending data by the on-demand function.

(1) Device of programmable controller CPU

Table App.35 Device Used in the Program

Device No.	Application	Remarks
X50	Transmission command	ON: Transmission completion
X60	Error reset command	ON: Error reset
Y20	For checking normal completion	ON: Normal completion
Y21	For checking abnormal completion	ON: Abnormal completion
MO	Transmission data set	ON: Transmission data set
M1	On-demand data set	ON: On-demand data set

(2) I/O signal

Table App.36 List of I/O Signal

I/O signal		Signal name	Description
CH1 side	CH2 side	Signal name	Description
Xn0	Xn7	Transmission normal completion	ON: Normal completion
Xn1	Xn8	Transmission abnormal completion	ON: Abnormal completion
Xn2	Xn9	Transmission processing	Transmission in progress
XnE	XnF	ERR. occurrence	ON: Error occurring
X(n-	+1)E	Q series C24 ready	ON: Accessible
X(n·	+1)F	Watchdog timer error (WDT error)	ON : Module error occurred OFF: Module being normally operated
Yn0	Yn7	Transmission request	ON: Requesting transmission

(3) Buffer memory

Table App.37 List of Buffer Memory

Buffer memory address Hexadecimal			
(deci	mal)	Name	Stored value
CH1 side	CH2 side		
0(0)	1(1)	Communication error clear	0: OFF, No initialization request
0H(0)	'H(')	request and to turn LED off	1: OFF, Initialization requested
96. (150)	136. (310)	Word/byte units designation	0: Word units
30H(130)	30H(130) 130H(310)		1: Byte units
AQ (160)	140 (220)	Buffer memory head	400 _H to 1AFF _H
A0H(100)	140 _H (320)	address for on-demand	2600 _H to 3FFF _H
A1 _H (161)	141 _H (321)	On-demand data length	0000 _H to 3400 _H
201	(513)	LED ON status and	0: Turned off/OFF, no error
201 _H (313)		communication error status	1: Turned on/ON, error
256. (598)	266. (614)	On domand oxocution result	0: Completed normally
230H(390)	200H(014)	On-demand execution result	1 or later: Error code
C00 _H to 1AFF _H		Lisor frog area	
(3072 to 6911)			

X9F

-1/4

X9E

-11

X50

┥┟ M0

0

8

1

31

42

59

62



PROCESSING TIME FOR REDUNDANT SYSTEMS

head address data length. Turns ON the on-demand data set flag. Resets output signal for checking operator Starts up the on-demand (send request). Turns OFF the on-demand data set flag.

Writing is not required when send

data is set in units of bytes/words

Sets the buffer memory head address where the send data

is stored and the data length Program -[MOV K2 D3]-

when send data is set

Pulse-outputs send command

Sets send data

Reads LED status and on-demand execution result, and checks the cause of error completion Address 256_H

Requests turning OFF error LED

Resets stored value of on-demand



The program example of sending data by the on-demand function is shown in Diagram

K1

PLS

-MOV H1234

-MOV H5678

МОХ НОСОО

MOV K4

H0C00 D0

K1

M0

D0

D1

K2

D2

D3

Initial setting program for Q series C24(N)

TOP H8 H96

-Гто

H8

App.40. (For the I/O signal is X/Y80 to X/Y9F)

Appendix 7.7 OUTPUT Instruction

The following tables list the devices and buffer memory areas used in the sample program of sending data by the nonprocedural protocol communication.

(1) Device of programmable controller CPU

Table App.38 Device Used in the Program

Device No.	Application	Remarks
X50	Transmission command	ON: Transmission completion
X60	Error reset command	ON: Error reset

(2) I/O signal

Table App.39 List of I/O Signal			
I/O s	ignal	Signal namo	Description
CH1 side	CH2 side	Signarhame	Description
Xn0	Xn7	Transmission normal completion	ON: Normal completion
Xn1	Xn8	Transmission abnormal completion	ON: Abnormal completion
Xn2	Xn9	Transmission processing	Transmission in progress
XnE	XnF	ERR. occurrence	ON: Error occurring
X(n-	+1)E	Q series C24 ready	ON: Accessible
X(n·	+1)F	Watchdog timer error (WDT error)	ON : Module error occurred OFF: Module being normally operated
Yn0	Yn7	Transmission request	ON: Requesting transmission

(3) Buffer memory

Table App.40 List of Buffer Memory

Buffer memory address Hexadecimal			
(decimal)		Name	Stored value
CH1 side	CH2 side		
			0 : Normal completion
257 _H (599) 267 _H	267 _H (615)	Data transmission result	1 or more: Abnormal completion
			(error code)
400(1024)	800(2048)	Transmission data count	0: No designation
400H(1024)	000 _H (20+0)	designation	1 or more: Number of send data
401 _H to 5FF _H	801 _H to 9FF _H	Transmission data	Data to be sent to an external
(1025 to 1535)	(2049 to 2559)	designation	device



The program example of sending data by the nonprocedural protocol communication is shown in Diagram App.41.





Diagram App.41 Program Example

Appendix 7.8 PRR Instruction

The following tables list the devices and buffer memory areas used in the sample program of sending data by the user registration frame of the nonprocedural protocol communication.

(1) Device of programmable controller CPU

Table App.41 Device Used in the Program

Device No.	Application	Remarks
X50	Transmission command	ON: Transmission completion
X60	Transmission command pulse	ON: Read completion

(2) I/O signal

I/O signal		Signal name	Description
CH1 side	CH2 side	Signarhame	Description
Xn0	Xn7	Transmission normal completion	ON: Normal completion
Xn1	Xn8	Transmission abnormal completion	ON: Abnormal completion
Xn2	Xn9	Transmission processing	Transmission in progress
XnE	XnF	ERR. occurrence	ON: Error occurring
X(n+	⊦1)E	Q series C24 ready	ON: Accessible
X(n-	+1)F	Watchdog timer error (WDT error)	ON : Module error occurred OFF: Module being normally operated
Yn0	Yn7	Transmission request	ON: Requesting transmission

Table App.42 List of I/O Signal

(3) Buffer memory

Table App.43 List of Buffer Memory

Buffer memory add	dress Hexadecimal		
(deci	imal)	Name	Stored value
CH1 side	CH2 side		
			CR/LF output designation
B7 _H (183)	157 _H (343)		0: Do not send
			1: Send.
			Output head pointer designation
B8 _H (184)	158 _H (344)		0: No designation
		For user frame	1 to 100: Send from nth
		being transmitted	Output count designation
B9 _H (185)	159 _H (345)	designation	0: No designation
			1 to 100: Output n
			Output frame No. designation (A
BA _H to 11D _H	15A _H to 1BD _H		maximum of 100 can be specified)
(186 to 285)	(346 to 445)		0: No designation
			1 or more: Output frame No.
			0 : Normal completion
257 _H (599)	267 _H (615)	Data transmission result	1 or more: Abnormal completion
			(error code)
400(1024)	800(2048)	Transmission data count	0: No designation
+00H(102+)	300H (2040)	designation	1 or more: Number of send data
401 _H to 5FF _H	801 _H to 9FF _H	Transmission data	Data to be sent to an external
(1025 to 1535)	(2049 to 2559)	designation	device

App - 62

X50 - PLS M50 0 \dashv \vdash M50 X9E X9F X80 X81 Y80 ┥┝╼┤┝═┤┟╧═┟╱╧╶┟┟ -MOV K4 D0 MOV H1234 D1 Sets the send data and the number of send data. MOV H56AB D2 ГМОУ НО D10 MOV H1 D11 MOV H5 D12 MOV H3F2 D13 Sets the data to be written to the schedule specification area of the buffer memory. D14 MOV H3F3 MOV H8001 D15 MOV H8000 D16 MOV H41B D17 Гмоч но D18 Writes each data of CR/LF output specification to output -Гто H8 H0B7 D10 K9 frame No. specification to the schedule specification area. √то H8 H400 D0 K3 Sets the number of send data. SET Y80 Turns ON the send request signal. X80 Turns OFF the send request signal if the send RST Y80 42 ┥┟ completion signal is turned ON. X81 Reads the error code and turns OFF the send request 44 FROMP H8 H257 D20 K1 ┥┟ signal if the send error complete signal is turned ON. Turns OFF the send request signal if the send -RST Y80 completion signal is turned ON.

The program example of sending data by the user registration frame of the nonprocedural protocol communication is shown in Diagram App.42. (For the I/O signal is X/Y80 to X/Y9F)

Diagram App.42 Program Example

MELSEG Q series

Appendix 7.9 BIDOUT Instruction

The following tables list the devices and buffer memory areas used in the sample program of sending data by the bidirectional protocol communication.

(1) Device of programmable controller CPU

Table App.44 Device Used in the Program

Device No.	Application	Remarks
X50	Transmission command	ON: Transmission completion
X60	Clear command	ON: Clear completion

(2) I/O signal

Table App.45 List of I/O Signal				
I/O s	ignal	Signal namo	Description	
CH1 side	CH2 side	Signarhame	Description	
Xn0	Xn7	Transmission normal completion	ON: Normal completion	
Xn1	Xn8	Transmission abnormal completion	ON: Abnormal completion	
Xn2	Xn9	Transmission processing	Transmission in progress	
XnE	XnF	ERR. occurrence	ON: Error occurring	
X(n+1)E		Q series C24 ready	ON: Accessible	
X(n+1)F		Watchdog timer error (WDT error)	ON : Module error occurred OFF: Module being normally operated	
Yn0	Yn7	Transmission request	ON: Requesting transmission	

(3) Buffer memory

Table App.46 List of Buffer Memory

Buffer memory address Hexadecimal (decimal)		Name	Stored value	
CH1 side	CH2 side			
			0 : Normal completion	
257 _H (599)	267 _H (615)	Data transmission result	1 or more: Abnormal completion	
			(error code)	
400 _H (1024) 800 _H (2048)		Transmission data count	0: No designation	
		designation	1 or more: Number of send data	
401 _H to 5FF _H	801 _H to 9FF _H	Transmission data	Data to be sent to an external	
(1025 to 1535)	(2049 to 2559)	designation	device	



Diagram App.43 Program Example

MELSEG Q _{series}

Appendix 7.10 BIDIN Instruction

The following tables list the devices and buffer memory areas used in the sample program of receiving data by the bidirectional protocol communication.

(1) Device of programmable controller CPU

Yn8

Table App.47 Device Used in the Program

Device No.	Application	Remarks
X30	Error code read command	ON: Error code read
X60	Clear command	ON: Clear completion

(2) I/O signal

	Table App.48 List of I/O Signal					
	I/O s	ignal	Signal name	Description		
	CH1 side CH2 side		Signal name	Description		
	Xn3	XnA	Reception data read request	ON: Requesting read		
	X(n+1)F		Watchdog timer error	ON : Module error occurred		
			(WDT error)	OFF. Module being normally operated		

Reception data read completion

(3) Buffer memory

Yn1

Table App.49 List of Buffer Memory

ON: Data read completed

Buffer memory address Hexadecimal (decimal)		Name	Stored value	
CH1 side	CH2 side			
			0 : Normal completion	
258 _H (600)	268 _H (616)	Data reception result	1 or more: Abnormal completion	
			(error code)	
		Receive data count	0: No roccivo data	
600 _H (1536)	A00 _H (2560)	(Number of data for which		
		read is requested)	1 or more: Number of receive data	
601 _H to 7FF _H	A01 _H to BFF _H	Pocoivo data	Data received from an external	
(1537 to 2047)	(2561 to 3071)	Nevelve uaid	device	

The program example of receiving data by the bidirectional protocol communication is shown in Diagram App.44.

(For the I/O signal is X/Y80 to X/Y9F)



Diagram App.44 Program Example

Appendix 8 Cautions on Communications Made via Module on Extension Base Unit

(1) MC protocol frames available for communications

Use QnA-compatible 2C/3C/4C frame, QnA-compatible 3E frame, or 4E frame for the access.

(2) MC protocol commands available for communications

Table App.50 lists whether each access target can be specified for each MC protocol command or not when communications are made via a module on an extension base unit.

Table App.50 Applicability of connection destination specification of each command from request source

Function		Connection destination specification				
Target	Command name	Control system	Standby system	No system specification	System A	System B
	Batch read	0	0	0	0	0
	Batch write	0	0	0	0	0
	Random read	0	0	0	0	0
	Test (Random write)	0	0	0	0	0
Device memory	Monitor data registration	×	×	×	0	0
	Monitor	×	×	×	0	0
	Multiple block batch read	0	0	0	0	0
	Multiple block batch write	0	0	0	0	0
Intelligent function module	Batch read	0	0	0	0	0
	Batch write	0	0	0	0	0
	Remote RUN	0	0	0	0	0
	Remote STOP	0	0	0	0	0
Programmable controller CPU	Remote PAUSE	0	\bigcirc	0	0	0
	Remote latch clear	0	\bigcirc	0	0	0
	Remote RESET	0	\bigcirc	0	0	0
	CPU model name read	0	0	0	0	0
	Directory/file information read	×	×	×	0	0
	Directory/file information search	×	×	×	0	0
	New file creation	×	×	×	0	0
	File deletion	×	×	×	0	0
File	File copy	×	×	×	0	0
File	File attribute change	×	×	×	0	0
	File creation data change	×	×	×	0	0
	File open	×	×	×	0	0
	File read	×	×	×	0	0
	File write	×	×	×	0	0
	File close	×	×	×	0	0



For details of each command, refer to the following manual

.

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MELSEC Communication Protocol Reference Manual

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(3) System switching during communication made via a module on an extension base unit

If system switching occurs during communication made via a module on an extension base unit by MC protocol or a dedicated instruction, both the old and new control systems may not be able to respond, and this may cause a communication timeout.

MEL	SEG	Q	sorio
		-	serie

Memo	TIME ANT
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WARRANTY

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