

Programmable Controller

MELSEC iQ-R
series

MELSEC iQ-R PROFINET IO Device Module User's Manual (Startup)

-RJ71PN93

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.

The precautions given in this manual are concerned with this product only. For the safety precautions of the programmable controller system, refer to the user's manual for the CPU module used.

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

 WARNING	Indicates that incorrect handling may cause hazardous conditions, resulting in death or severe injury.
 CAUTION	Indicates that incorrect handling may cause hazardous conditions, resulting in minor or moderate injury or property damage.

Under some circumstances, failure to observe the precautions given under "⚠️ 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]

WARNING

- 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) Emergency stop circuits, protection circuits, and protective interlock circuits for conflicting operations (such as forward/reverse rotations or upper/lower limit positioning) must be configured external to the programmable controller.
 - (2) When the programmable controller detects an abnormal condition, it stops the operation and all outputs are:
 - Turned off if the overcurrent or overvoltage protection of the power supply module is activated.
 - Held or turned off according to the parameter setting if the self-diagnostic function of the CPU module detects an error such as a watchdog timer error.
 - (3) All outputs may be turned on if an error occurs in a part, such as an 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 MELSEC iQ-R Module Configuration Manual.
 - (4) Outputs may remain on or off due to a failure of a component such as a relay and transistor in an output circuit. Configure an external circuit for monitoring output signals that could cause a serious accident.
 - In an output circuit, when a load current exceeding the rated current or an overcurrent caused by a load short-circuit flows for a long time, it may cause smoke and fire. To prevent this, configure an external safety circuit, such as a fuse.
 - Configure a circuit so that the programmable controller is turned on first and then the external power supply. If the external power supply is turned on first, an accident may occur due to an incorrect output or malfunction.
 - Configure a circuit so that the external power supply is turned off first and then the programmable controller. If the programmable controller is turned off first, an accident may occur due to an incorrect output or malfunction.
 - For the operating status of each station after a communication failure, refer to manuals for the network used. For the manuals, please consult your local Mitsubishi representative. Incorrect output or malfunction due to a communication failure may result in an accident.
 - When connecting an external device with a CPU module or intelligent function module to modify data of a running programmable controller, configure an interlock circuit in the program to ensure that the entire system will always operate safely. For other forms of control (such as program modification, parameter change, forced output, or operating status change) of a running programmable controller, read the relevant manuals carefully and ensure that the operation is safe before proceeding. Improper operation may damage machines or cause accidents. When a Safety CPU is used, data cannot be modified while the Safety CPU is in SAFETY MODE.
-

[Design Precautions]

WARNING

- Especially, when a remote programmable controller is controlled by an external device, immediate action cannot be taken if a problem occurs in the programmable controller due to a communication failure. To prevent this, configure an interlock circuit in the program, and determine corrective actions to be taken between the external device and CPU module in case of a communication failure.
 - Do not write any data to the "system area" and "write-protect area" of the buffer memory in the module. Also, do not use any "use prohibited" signals as an output signal from the CPU module to each module. Doing so may cause malfunction of the programmable controller system. For the "system area", "write-protect area", and the "use prohibited" signals, refer to the user's manual for the module used. For areas used for safety communications, they are protected from being written by users, and thus safety communications failure caused by data writing does not occur.
 - If a communication cable is disconnected, the network may be unstable, resulting in a communication failure of multiple stations. Configure an interlock circuit in the program to ensure that the entire system will always operate safely even if communications fail. Incorrect output or malfunction due to a communication failure may result in an accident. When safety communications are used, an interlock by the safety station interlock function protects the system from an incorrect output or malfunction.
 - If data exchanges of a PROFINET IO device module are disabled, the module sends input data (0) to a PROFINET IO controller module. The PROFINET IO device module holds output data (at the time when the data exchanges stopped) received from the PROFINET IO controller module in 'IO data receive area' (Un\G0 to Un\G511) of the buffer memory.
Configure an interlock circuit (with 'IO data exchanging' (X1) and 'IO data receive error' (X2)) in the program to ensure that the entire system will always operate safely even if communications fail.
-

[Security Precautions]

WARNING

- 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]

WARNING

- 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 electric shock or cause the module to fail or malfunction.
-

[Installation Precautions]

CAUTION

- Use the programmable controller in an environment that meets the general specifications in the Safety Guidelines included with the base unit. Failure to do so may result in electric shock, fire, malfunction, or damage to or deterioration of the product.
 - To mount a module, place the concave part(s) located at the bottom onto the guide(s) of the base unit, and push in the module until the hook(s) located at the top snaps into place. Incorrect interconnection may cause malfunction, failure, or drop of the module.
 - To mount a module with no module fixing hook, place the concave part(s) located at the bottom onto the guide(s) of the base unit, push in the module, and fix it with screw(s). Incorrect interconnection 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 screws within the specified torque range. Undertightening can cause drop of the component or wire, short circuit, or malfunction. Overtightening can damage the screw and/or module, resulting in drop, short circuit, or malfunction. For the specified torque range, refer to the MELSEC iQ-R Module Configuration Manual.
 - 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 malfunction.
 - When using an SD memory card, fully insert it into the SD memory card slot. Check that it is inserted completely. Poor contact may cause malfunction.
 - Securely insert an extended SRAM cassette or a battery-less option cassette into the cassette connector of the CPU module. After insertion, close the cassette cover and check that the cassette is inserted completely. Poor contact may cause malfunction.
 - Do not directly touch any conductive parts and electronic components of the module, SD memory card, extended SRAM cassette, battery-less option cassette, or connector. Doing so can cause malfunction or failure of the module.
-

[Wiring Precautions]

WARNING

- Shut off the external power supply (all phases) used in the system before installation and wiring. Failure to do so may result in electric shock or cause the module to fail or malfunction.
 - After installation and wiring, attach a blank cover module (RG60) to each empty slot and an included extension connector protective cover to the unused extension cable connector before powering on the system for operation. Failure to do so may result in electric shock.
-

[Wiring Precautions]

CAUTION

- Individually ground the FG and LG terminals of the programmable controller with a ground resistance of 100 ohms 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 signal 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 fire or failure.
 - Connectors for external devices must be crimped or pressed with the tool specified by the manufacturer, or must be correctly soldered. Incomplete connections may cause short circuit, fire, or malfunction.
 - Securely connect the connector to the module. Poor contact may cause malfunction.
 - Do not install the control lines or communication cables together with the main circuit lines or power cables. Doing so may result in malfunction due to noise. Keep a distance of 100mm or more between those cables.
 - Place the cables in a duct or clamp them. If not, dangling cables may swing or inadvertently be pulled, resulting in malfunction or damage to modules or cables.
In addition, the weight of the cables may put stress on modules in an environment of strong vibrations and shocks.
Do not clamp the extension cables with the jacket stripped. Doing so may change the characteristics of the cables, resulting in malfunction.
 - Check the interface type and correctly connect the cable. Incorrect wiring (connecting the cable to an incorrect interface) may cause failure of the module and external device.
 - Tighten the terminal screws or connector screws within the specified torque range. Undertightening can cause drop of the screw, short circuit, fire, or malfunction. Overtightening can damage the screw and/or module, resulting in drop, short circuit, fire, or malfunction.
 - When disconnecting the cable from the module, do not pull the cable by the cable part. For the cable with connector, hold the connector part of the cable. For the cable connected to the terminal block, loosen the terminal screw. Pulling the cable connected to the module may result in malfunction or damage to the module or cable.
 - Prevent foreign matter such as dust or wire chips from entering the module. Such foreign matter can cause a fire, failure, or malfunction.
 - A protective film is attached to the top of the module to prevent foreign matter, such as wire chips, from entering the module during wiring. Do not remove the film during wiring. Remove it for heat dissipation before system operation.
 - 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 qualified maintenance personnel with knowledge of protection against electric shock. For wiring, refer to the MELSEC iQ-R Module Configuration Manual.
 - For Ethernet cables to be used in the system, select the ones that meet the specifications in the user's manual for the module used. If not, normal data transmission is not guaranteed.
-

[Startup and Maintenance Precautions]

WARNING

- Do not touch any terminal while power is on. Doing so will cause electric shock or malfunction.
 - Correctly connect the battery connector. Do not charge, disassemble, heat, short-circuit, solder, or throw the battery into the fire. Also, do not expose it to liquid or strong shock. Doing so will cause the battery to produce heat, explode, ignite, or leak, 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, connector screws, or module fixing screws. Failure to do so may result in electric shock.
-

[Startup and Maintenance Precautions]

CAUTION

- When connecting an external device with a CPU module or intelligent function module to modify data of a running programmable controller, configure an interlock circuit in the program to ensure that the entire system will always operate safely. For other forms of control (such as program modification, parameter change, forced output, or operating status change) of a running programmable controller, read the relevant manuals carefully and ensure that the operation is safe before proceeding. Improper operation may damage machines or cause accidents.
 - Especially, when a remote programmable controller is controlled by an external device, immediate action cannot be taken if a problem occurs in the programmable controller due to a communication failure. To prevent this, configure an interlock circuit in the program, and determine corrective actions to be taken between the external device and CPU module in case of a communication failure.
 - Do not disassemble or modify the modules. Doing so may cause failure, malfunction, injury, or a fire.
 - Use any radio communication device such as a cellular phone or PHS (Personal Handy-phone System) more than 25cm away in all directions from the programmable controller. Failure to do so 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 cause the module to fail or malfunction.
 - Tighten the screws within the specified torque range. Undertightening can cause drop of the component or wire, short circuit, or malfunction. Overtightening can damage the screw and/or module, resulting in drop, short circuit, or malfunction.
 - After the first use of the product, do not perform each of the following operations more than 50 times (IEC 61131-2/JIS B 3502 compliant).
Exceeding the limit may cause malfunction.
 - Mounting/removing the module to/from the base unit
 - Inserting/removing the extended SRAM cassette or battery-less option cassette to/from the CPU module
 - Mounting/removing the terminal block to/from the module
 - After the first use of the product, do not insert/remove the SD memory card to/from the CPU module more than 500 times. Exceeding the limit may cause malfunction.
 - Do not touch the metal terminals on the back side of the SD memory card. Doing so may cause malfunction or failure of the module.
 - Do not touch the integrated circuits on the circuit board of an extended SRAM cassette or a battery-less option cassette. Doing so may cause malfunction or failure of the module.
 - Do not drop or apply shock to the battery to be installed in the module. Doing so may damage the battery, causing the battery fluid to leak inside the battery. If the battery is dropped or any shock is applied to it, dispose of it without using.
 - Startup and maintenance of a control panel must be performed by qualified maintenance personnel with knowledge of protection against electric shock. Lock the control panel so that only qualified maintenance personnel can operate it.
 - Before handling the module, touch a conducting object such as a grounded metal to discharge the static electricity from the human body. Failure to do so may cause the module to fail or malfunction.
-

[Operating Precautions]

CAUTION

- When changing data and operating status, and modifying program of the running programmable controller from an external device such as a personal computer connected to an intelligent function module, read relevant manuals carefully and ensure the safety before operation. Incorrect change or modification may cause system malfunction, damage to the machines, or accidents.
 - Do not power off the programmable controller or reset the CPU module while the setting values in the buffer memory are being written to the flash ROM in the module. Doing so will make the data in the flash ROM and SD memory card undefined. The values need to be set in the buffer memory and written to the flash ROM and SD memory card again. Doing so can cause malfunction or failure of the module.
-

[Disposal Precautions]

CAUTION

- When disposing of this product, treat it as industrial waste.
 - When disposing of batteries, separate them from other wastes according to the local regulations. For details on battery regulations in EU member states, refer to the MELSEC iQ-R Module Configuration Manual.
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[Transportation Precautions]

CAUTION

- When transporting lithium batteries, follow the transportation regulations. For details on the regulated models, refer to the MELSEC iQ-R Module Configuration Manual.
 - The halogens (such as fluorine, chlorine, bromine, and iodine), which are contained in a fumigant used for disinfection and pest control of wood packaging materials, may cause failure of the product. Prevent the entry of fumigant residues into the product or consider other methods (such as heat treatment) instead of fumigation. The disinfection and pest control measures must be applied to unprocessed raw wood.
-

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.

INTRODUCTION

Thank you for purchasing the Mitsubishi Electric MELSEC iQ-R series programmable controllers.

This manual describes the procedures, system configuration, and wiring of the relevant product listed below.

Before using this product, please read this manual and the relevant manuals carefully and develop familiarity with the functions and performance of the MELSEC iQ-R series programmable controller to handle the product correctly.

When applying the program examples provided in this manual to an actual system, ensure the applicability and confirm that it will not cause system control problems.

Please make sure that the end users read this manual.

Relevant product

RJ71PN93

COMPLIANCE WITH EMC AND LOW VOLTAGE DIRECTIVES

Method of ensuring compliance

To ensure that Mitsubishi programmable controllers maintain EMC and Low Voltage Directives when incorporated into other machinery or equipment, certain measures may be necessary. Please refer to one of the following manuals.

- MELSEC iQ-R Module Configuration Manual
- Safety Guidelines (This manual is included with the base unit.)

Additional measures

To ensure that this product maintains EMC and Low Voltage Directives, please refer to one of the following manuals.

- Page 29 Maintaining EMC Directive in this manual
- Before Using the Product (This manual is included with this product.)

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RELEVANT MANUALS

Manual name [manual number]	Description	Available form
MELSEC iQ-R PROFINET IO Device Module User's Manual (Startup) [SH-082364ENG] (this manual)	Specifications, procedures before operation, system configuration, wiring, and communication examples of the PROFINET IO device module	Print book e-Manual PDF
MELSEC iQ-R Module Configuration Manual [SH-081262ENG]	The combination of the MELSEC iQ-R series modules, common information on the installation/wiring in the system, and specifications of the power supply module, base unit, SD memory card, and battery	Print book e-Manual PDF
MELSEC iQ-R PROFINET IO Device Module User's Manual (Application) [SH-082366ENG]	Functions, parameter settings, troubleshooting, I/O signals, and buffer memory of the PROFINET IO device module	Print book e-Manual PDF
GX Works3 Operating Manual [SH-081215ENG]	System configuration, parameter settings, and online operations of GX Works3	e-Manual PDF

This manual does not include detailed information on the following:

- General specifications
- Installation

For details, refer to the following.

 MELSEC iQ-R Module Configuration Manual

Point

e-Manual refers to the Mitsubishi Electric FA electronic book manuals that can be browsed using a dedicated tool.

e-Manual has the following features:

- Required information can be cross-searched in multiple manuals.
- Other manuals can be accessed from the links in the manual.
- The hardware specifications of each part can be found from the product figures.
- Pages that users often browse can be bookmarked.
- Sample programs can be copied to an engineering tool.

TERMS

Unless otherwise specified, this manual uses the following terms.

Term	Description
Buffer memory	Memory in an intelligent function module to store data such as setting values and monitor values. For CPU modules, it refers to memory to store data such as setting values and monitor values of the Ethernet function, or data used for data communication of the multiple CPU system function.
Device	A memory of a CPU module to store data. Devices such as X, Y, M, D, and others are provided depending on the intended use.
Engineering tool	A tool used for setting up programmable controllers, programming, debugging, and maintenance
Global label	A label that is valid for all the program data when multiple program data are created in the project. There are two types of global label: a module specific label (module label), which is generated automatically by GX Works3, and an optional label, which can be created for any specified device.
GSDML file	A file based on XML for PROFINET. The file contains information required for PROFINET configuration, such as an IO device attribute, module types, setting data of modules, and error messages.
Intelligent function module	A module that has functions other than an input or output, such as an A/D converter module and D/A converter module
Module label	A label that represents one of memory areas (I/O signals and buffer memory areas) specific to each module in a given character string. For the module used, GX Works3 automatically generates this label, which can be used as a global label.
Multiple CPU system	A system where two to four CPU modules separately control I/O modules and intelligent function modules
Safety program	A program that performs safety control

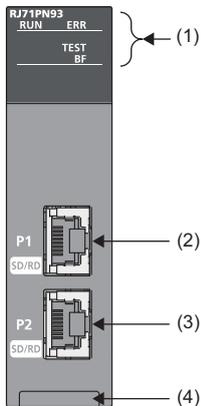
GENERIC TERMS AND ABBREVIATIONS

Unless otherwise specified, this manual uses the following generic terms and abbreviations.

Generic term/abbreviation	Description
CPU module	An abbreviation for the MELSEC iQ-R series CPU module
IO controller	An abbreviation for the PROFINET IO controller
IO device	An abbreviation for PROFINET IO devices. These devices include the RJ71PN93.
MRC	An abbreviation for the Media Redundancy Client. A device that operates according to the ring topology settings of the MRM among PROFINET IO devices with two or more ports.
MRM	An abbreviation for the Media Redundancy Manager A device that can manage the ring topology among PROFINET IO devices with two or more ports.
MRP	An abbreviation for the Media Redundancy Protocol
PROFINET configuration tool	A generic term for the configuration tool used for PROFINET configuration with the IO controller
Remote head module	An abbreviation for the RJ72GF15-T2 CC-Link IE Field Network remote head module

1 PART NAMES

This chapter describes the names of each part of the RJ71PN93.



No.	Name	Description
(1)	RUN LED	Indicates the operating status. On: Normal operation Off: Error (MELSEC iQ-R PROFINET IO Device Module User's Manual (Application))
	ERR LED	Indicates the error status of the RJ71PN93. On, flashing: Error (MELSEC iQ-R PROFINET IO Device Module User's Manual (Application)) Off: Normal operation
	TEST LED	Indicates the receive status of the Blink command.*1 Flashing: Blink command received from an external device Off: Blink command not received
	BF LED	Indicates the communication status with the IO controller. On: I/O data exchanges stopped Off: I/O data exchanging*2
(2)	Ethernet port (P1)	A connector for PROFINET connection. Connect an Ethernet cable. For wiring methods and wiring precautions, refer to the following. Page 29 WIRING
	SD/RD LED	Indicates the data sending/receiving status. On, flashing: Data being sent or received Off: Data not sent nor received
(3)	Ethernet port (P2)	Same as Ethernet port (P1)
	SD/RD LED	
(4)	Production information marking	Indicates the production information (16 digits) of the RJ71PN93.

*1 The Blink command remotely flashes the LED on the target device. This command shows the physical location of the target device selected on the PROFINET configuration tool. (Manual of the IO controller or PROFINET configuration tool used)

*2 The BF LED is turned off during exchanging I/O data regardless of the 'IO data receive error' (X2) status.

Point

The LED indication when operation mode is the automatic hardware test, refer to the following.
MELSEC iQ-R PROFINET IO Device Module User's Manual (Application)

2 SPECIFICATIONS

2.1 Performance Specifications

This section describes the performance specifications of the RJ71PN93.

Item	Description	
PROFINET communication specifications	Conformance Class B	
Data exchange	Maximum I/O data length	1024 bytes (Total size of the I/O data) ^{*1}
	Cycle time	512ms maximum 2ms minimum
MRP	MRC ^{*2}	
Transmission specifications	Type ^{*3}	100BASE-TX/10BASE-T
	Data transmission speed ^{*3}	100Mbps/10Mbps
	Communication mode	Full-duplex (half-duplex is not supported. ^{*4})
	Interface	RJ45 connector (Auto-negotiation, Auto MDI/MDI-X)
	Transmission method	Base band
	Maximum segment length	100m (length between a hub and a node) ^{*5}
	Number of cascade connections	Consult the manufacturer of the switching hub used.
	IP version	IPv4
Number of occupied I/O points	32	
Internal current consumption (5VDC)	0.43A	
External dimensions	Height	106mm (Base unit mounting side: 98mm)
	Width	27.8mm
	Depth	110mm
Weight	0.14kg	

*1 For details on I/O data, refer to the following.

 MELSEC iQ-R PROFINET IO Device Module User's Manual (Application)

*2 The RJ71PN93 can operate as an MRC in a ring topology. To perform communications in the ring topology, a device in the ring topology has to operate as the MRM.

*3 Data communications at 100Mbps is recommended.

*4 When a half-duplex hub is used to connect the RJ71PN93 to the IO controller, a connection error occurs in the IO controller.

*5 For the maximum segment length (length between hubs), consult the manufacturer of the switching hub used.

3 FUNCTION LIST

The following tables list the functions of the RJ71PN93. For details on the functions, refer to the following.

📖 MELSEC iQ-R PROFINET IO Device Module User's Manual (Application)

Data communications

Function	Description
Data exchange	Exchanges data between the RJ71PN93 and the IO controller at a specified cycle.
Data consistency function	Prevents data inconsistency between the buffer memory in the RJ71PN93 and the devices in the CPU module in I/O data exchanges.

Diagnostics

Function	Description
Automatic hardware test	Tests whether the ROM, RAM, or 2-port RAM of the RJ71PN93 has an error.

4 PROCEDURES BEFORE OPERATION

This chapter describes the procedures before operation.

1. Network construction

Configure the system and set the parameters which are required for start-up.

- Wiring (👉 Page 29 WIRING)
- Parameter setting (📖 MELSEC iQ-R PROFINET IO Device Module User's Manual (Application))

For details on parameters for the IO controller, refer to the following.

📖 Manual of the IO controller or PROFINET configuration tool used

2. Network diagnostics

Check that communications are performed normally.

For the status of LEDs and input signals of the RJ71PN93 when communications are performed normally, refer to the following.

👉 Page 36 Checking the network status

3. Programming

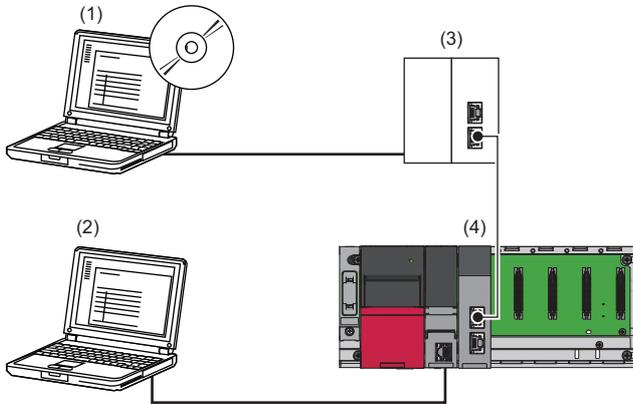
Create a program. For details, refer to the following.

👉 Page 31 COMMUNICATION EXAMPLE

5 SYSTEM CONFIGURATION

5.1 PROFINET Configuration

This chapter describes the PROFINET configuration using an IO controller and the RJ71PN93s.



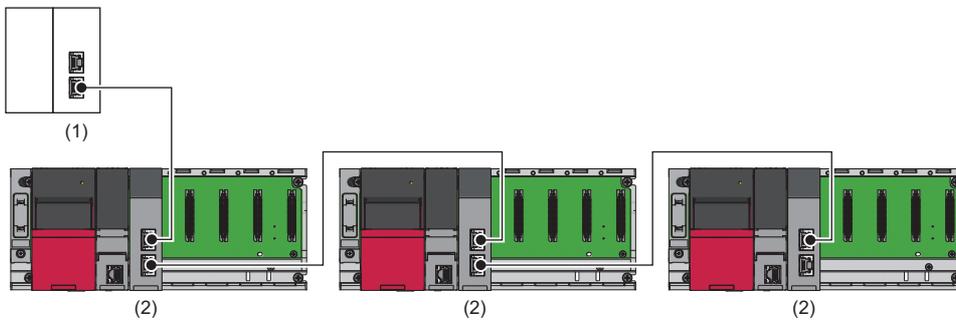
- (1) PROFINET configuration tool
- (2) Engineering tool
- (3) IO controller
- (4) RJ71PN93

Point

In PROFINET, other PROFINET IO controllers or external devices that perform TCP/IP communications can be used on the same network.

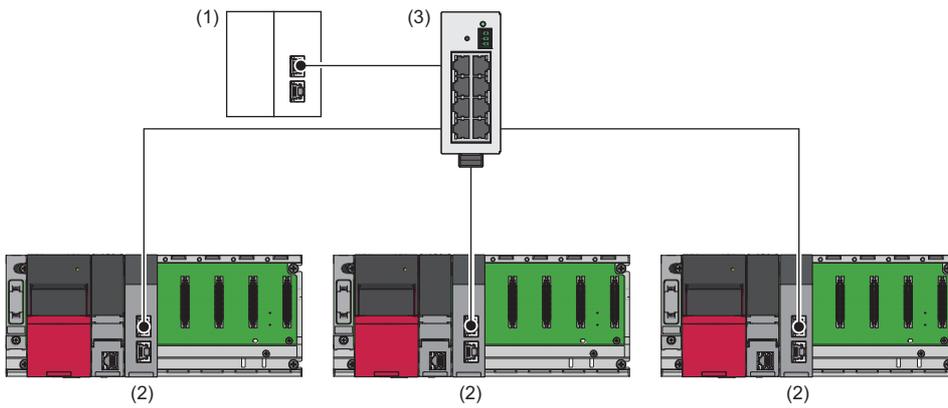
Line topology

In a line topology, connect the RJ71PN93s (2) to the IO controller (1) as follows.



Star topology

In a star topology, connect the RJ71PN93s (2) to the IO controller via a switching hub (3) as follows.

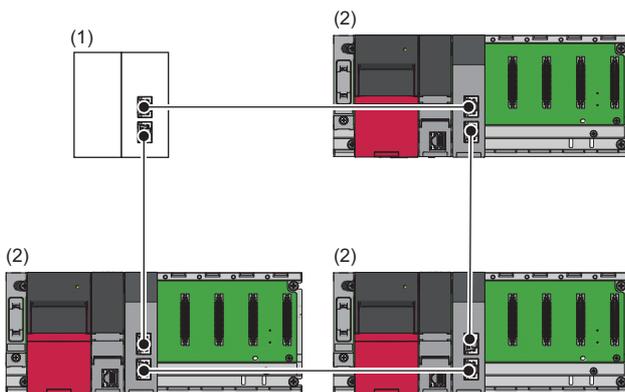


Ring topology

The RJ71PN93 can operate as an MRC in a ring topology.

When a ring topology is used, check the following.

- The ring topology includes a device to be operated as the MRM.
- The communication timeout is set to 200ms or longer.



(1) Device to be operated as the MRM

(2) Devices (RJ71PN93s) to be operated as MRCs

5.2 Applicable CPU Modules

The following table shows the availability of the RJ71PN93 when each CPU module or remote head module is used.

The CPU modules and remote head modules are indicated by symbols as follows.

- Rn: RnCPU
- RnEN: RnENCPU
- RnP(P): Process CPU (process mode)
- RnP(R)(M): Process CPU (redundant mode) (main base unit)
- RnP(R)(E): Process CPU (redundant mode) (extension base unit in the redundant system with redundant extension base unit)
- RnMT: Motion CPU
- RnNC: NCCPU
- RnRT: Robot CPU
- RnC: C Controller module
- RnPSF: SIL2 Process CPU
- RnSF: Safety CPU
- Rem: Remote head module
- Rem(R): Remote head module (redundant system)

○: Available, ×: Not available

Model	Rn	RnEN	RnP(P)	RnP(R)(M)	RnP(R)(E)	RnMT	RnNC	RnRT	RnC	RnPSF	RnSF	Rem	Rem(R)
RJ71PN93	○*1	○*1	○*1	×	×	×	×	×	×	×	○*1*2*3	×	×

*1 When the refresh target of "IO Data Send Area" and "IO Data Receive Area" under "Refresh Settings" is set, use the following firmware version of the CPU module. Failure to do so results in a parameter error (error code: 2200H).

- Rn: 28 or later
- RnEN: 28 or later
- RnP(P): 12 or later
- RnSF: 14 or later

*2 PROFIsafe communications cannot be used. Only standard PROFINET communications can be used.

*3 The module does not support a safety program.

Point

The number of mountable RJ71PN93s depends on the specifications of the CPU module used.

For the number of mountable RJ71PN93s, refer to the following.

 MELSEC iQ-R Module Configuration Manual

Precautions

For the RnP(R)(M), RnP(R)(E), RnMT, RnNC, RnRT, RnC, RnPSF, Rem, and Rem(R), an error cannot be detected in the following cases.

- When the RJ71PN93s are mounted with unsupported CPU modules and remote head modules
- When the number of mountable RJ71PN93s is exceeded

Multiple CPU system

The RJ71PN93 supports the multiple CPU system. For details on the multiple CPU system, refer to the following.

 MELSEC iQ-R Module Configuration Manual

5.3 Applicable Base Units

The following table shows the availability of the RJ71PN93 when each base unit is used.

○: Available, ×: Not available

Product		Model	Availability
Main base unit	Main base unit	R33B, R35B, R38B, R312B	○
	Extended temperature range main base unit	R310B-HT	○
	Redundant power supply main base unit	R310RB	○
	Extended temperature range redundant power supply main base unit	R38RB-HT	○
Extension base unit	Extension base unit	R65B, R68B, R612B	○
	Extended temperature range extension base unit	R610B-HT	○
	Redundant power supply extension base unit	R610RB	○
	Extended temperature range redundant power supply extension base unit	R68RB-HT	○
	Redundant extension base unit	R68WRB	×
	Extended temperature range redundant extension base unit	R66WRB-HT	×
	RQ extension base unit	RQ65B, RQ68B, RQ612B	×

5.4 Available Software Packages

The engineering tool is required for setting the RJ71PN93.

Software	Supported version
GX Works3	Version 1.072A or later

Profile and GSDML file

■How to obtain

Please consult your local Mitsubishi representative.

■Importing the GSDML file

How to import the GSDML file of the RJ71PN93, refer to the manual of the IO controller or PROFINET configuration tool used.

6 WIRING

This chapter describes the wiring for the RJ71PN93.

6.1 Wiring Methods

This section describes connection and disconnection of the Ethernet cable.

Connecting the cable

1. Push the Ethernet cable connector into the RJ71PN93 until it clicks. Pay attention to the connector's direction.
2. Lightly pull it to check that it is securely connected.
3. Check that the SD/RD LED of the port connected with an Ethernet cable is on.*¹

*¹ The time between the cable connection and the SD/RD LED turning on may vary. The SD/RD LED usually turns on in a few seconds. Note, however, that the time may be extended further if the link-up processing is repeated depending on the status of the device on the line. Check whether the cables are connected properly if the SD/RD LED does not turn on. (MELSEC iQ-R PROFINET IO Device Module User's Manual (Application))

Disconnecting the cable

1. Press the latch down and unplug the Ethernet cable.

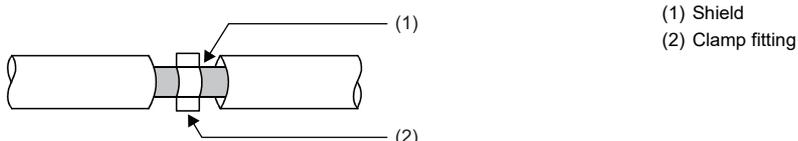
Precautions

- Place the Ethernet cable in a duct or clamp it. If not, dangling cable may swing or inadvertently be pulled, resulting in damage to the module or the cable or malfunction due to poor contact.
- Do not touch the core of the cable-side or module-side connector, and protect it from dirt or dust. If oil from your hand, dirt or dust is attached to the core, this can increase transmission loss, causing a problem in communications.
- Check that the Ethernet cable is not disconnected or not shorted and there is no problem with the connector connection.
- Do not use Ethernet cables with broken latches. Doing so may cause the cables to unplug or malfunction.
- Hold the connector part when connecting and disconnecting the Ethernet cable. Pulling the cable connected to the module may result in damage to the module or the cable or malfunction due to poor contact.
- To prevent dust and dirt from getting in, attach an included connector cover to a connector to which an Ethernet cable is not connected.
- For an Ethernet cable between nodes, the maximum cable length is 100m. However, the length may be shorter depending on the environment where the cable is used. For details, contact the cable manufacturer.
- The bending radius of the Ethernet cable is limited. For details, check the specifications of the Ethernet cable to be used.
- Do not connect the PROFINET network to other networks such as LANs for general-purpose. Otherwise, a network failure due to overload or malfunction may occur.
- Do not disconnect the Ethernet cable during operation. Doing so may cause malfunction of the module as normal data transmission is not guaranteed.

Maintaining EMC Directive

To ensure that this product maintains EMC Directive, take the following measure.

- Use a shielded twisted pair cable to connect the Ethernet cable. Strip a part of the jacket of the shielded twisted pair cable as shown below and ground the exposed shield with the contact surface as large as possible.



6.2 Wiring Products

This section describes the devices used for PROFINET.

PROFINET devices

Ethernet cables must be prepared by users. For details on Ethernet cables, refer to the following.

- PI: www.profibus.com

Point

A communication error may occur due to high-frequency noise from devices other than a programmable controller in a given connection environment. The following describes countermeasures to avoid high-frequency noise influence.

Wiring

- Do not install cables together with the main circuit lines or power cables.
 - Place cables in a duct.
-

Switching hub

Use switching hubs that support the transmission speed of communication when using switching hubs in PROFINET.

When the industrial managed switch (NZ2MHG-T8F2) is used, use the industrial managed switch (NZ2MHG-T8F2) with the production information (first six digits) of 7104AV or later.

7 COMMUNICATION EXAMPLE

Precautions for programming

Turn on 'IO data send area refresh directive' (Y0) and start data sending in 'IO data send area' (Un\G640 to Un\G1151).
Configure an interlock with the following input signals when creating a program.

- 'IO data exchanging' (X1)
- 'IO data receive error' (X2)

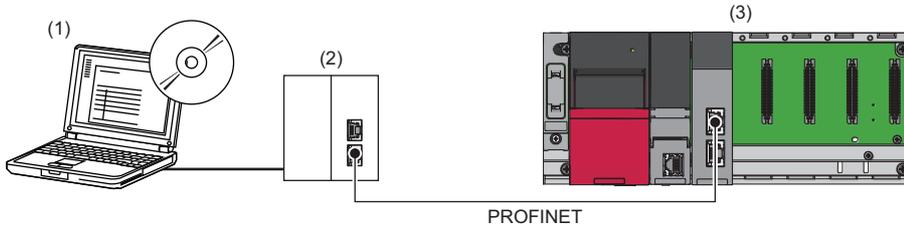
7.1 Example of I/O Data Exchanges

This section describes an example of I/O data exchanges between the RJ71PN93 and an IO controller.

System configuration example

The following system configuration is used in this example.

System configuration



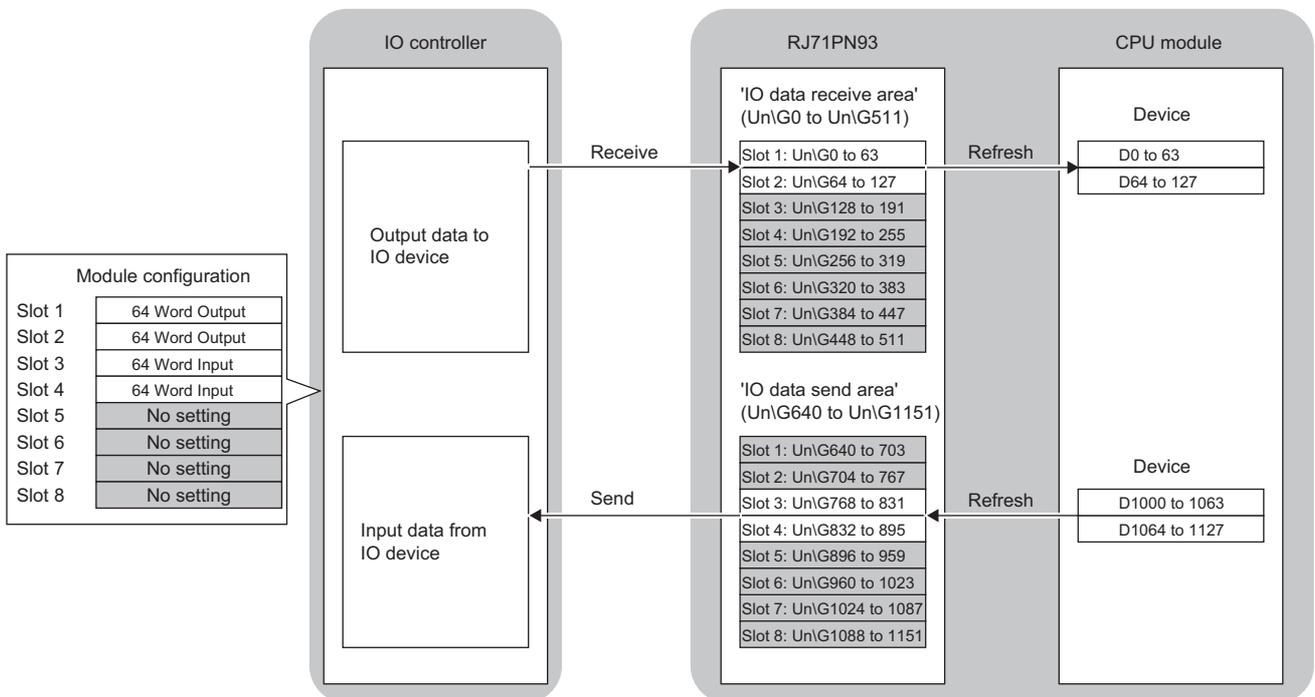
- (1) PROFINET configuration tool
- (2) IO controller side
 - IO controller: SIMATIC S7-1200 (CPU 1215C)*1
- (3) IO device side
 - Power supply module: R61P
 - CPU module: R04CPU
 - IO device: RJ71PN93 (start I/O number: 0000H to 001FH)

*1 The device is manufactured by Siemens AG.

Device assignment

The following figure shows the send/receive device assignment for I/O data exchanges.

The data size of I/O data exchanges is 128 words each for send data and receive data.



Setting parameters

IO controller settings

Perform the following settings for the IO controller. For details, refer to the manual of the IO controller or PROFINET configuration tool used.

■Importing the GSDML file

Import the GSDML file of the RJ71PN93 to the PROFINET configuration tool connected to the IO controller.

■Setting parameters

Write the RJ71PN93 information to the PROFINET configuration tool connected to the IO controller.

- Network overview

Item	Setting details	
IO controller (SIMATIC S7-1200)	Device name	plc_1
	IP address	192.168.3.130
IO device (RJ71PN93)	Device name	rj71pn93
	IP address	192.168.3.5

- Device overview

Module	Slot	I address	Q address
64 Word Output_1	1	—	68...195
64 Word Output_2	2	—	196...323
64 Word Input_1	3	68...195	—
64 Word Input_2	4	196...323	—

- PLC tags

Name	Data type	Address	Comment
recv_area_word	Word	%IW68	Receive area (slot 3, unit: word)
recv_area_dword	DWord	%ID196	Receive area (slot 4, unit: double-word)
send_area_word	Word	%QW68	Send area (slot 1, unit: word)
send_area_dword	DWord	%QD196	Send area (slot 2, unit: double-word)
RefreshReq	Bool	%M0.0	Refresh request

■Program example

Refer to the following.

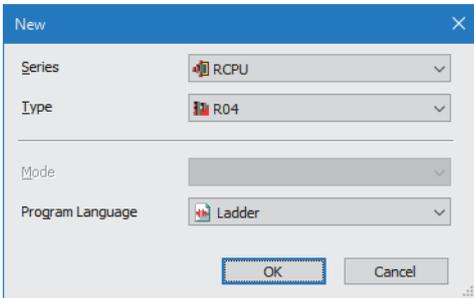
 Page 37 Program examples of IO controller

IO device settings

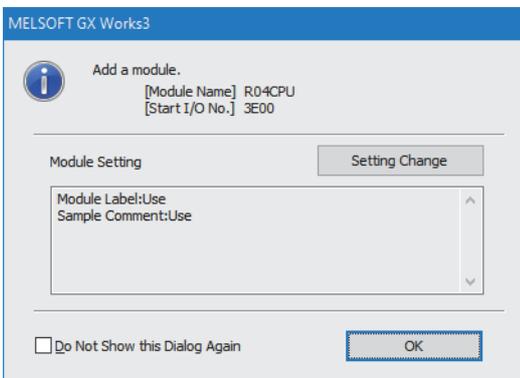
Connect the engineering tool to the CPU module and set the parameters.

1. Set the CPU module as follows.

 [Project] ⇒ [New]

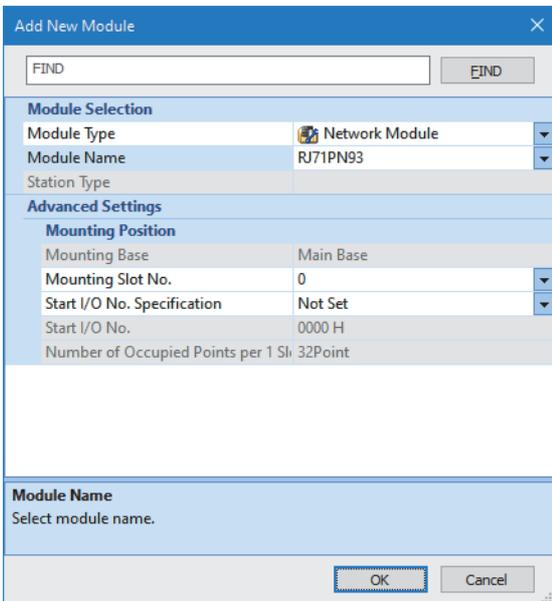


2. Click the [Setting Change] button and set "Use Module Label" to "Yes".

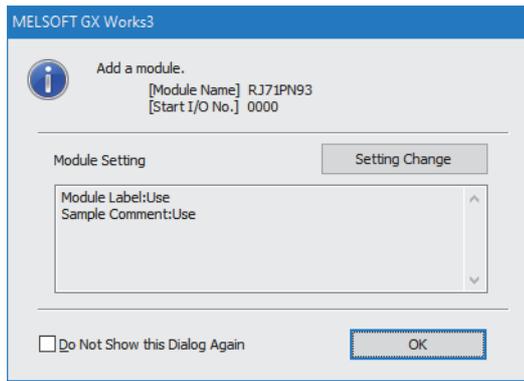


3. Set the RJ71PN93 as follows.

 [Navigation window] ⇒ [Parameter] ⇒ [Module Information] ⇒ Right-click ⇒ [Add New Module]



- Click the [OK] button to add the module labels of the RJ71PN93.



- Set the items in "Basic Setting" as follows.

[Navigation window] ⇒ [Parameter] ⇒ [Module Information] ⇒ [RJ71PN93] ⇒ [Basic Setting]

Item	Setting Value
Various Operations Settings	
Mode Settings	Online(Use parameter set by GX Works 3)
Own Node Setting	Set the information of the own node such as IP address.
IP Address Setting	Set the IP address, subnet mask, and default gateway for the own node.
IP Address	192.168.3.5
Subnet Mask	255.255.255.0
Default Gateway	
Device Name	Set the Device Name.
Name	rj71pn93
Data Consistency Setting	
Data Consistency	Disable

- In "Refresh Setting", set "Target" to "Device", and set devices to be refreshed as follows.

[Navigation window] ⇒ [Parameter] ⇒ [Module Information] ⇒ [RJ71PN93] ⇒ [Refresh Setting]

Item	Setting Value
Transfer to intelligent module	Transfers the data of the specified device to the buffer memory.
IO Data Send Area	Refresh setting of IO data send area
Slot1 (0th to 63rd words)	
Slot2 (64th to 127th words)	
Slot3 (128th to 191st words)	D1000
Slot4 (192nd to 255th words)	D1064
Slot5 (256th to 319th words)	
Slot6 (320th to 383rd words)	
Slot7 (384th to 447th words)	
Slot8 (448th to 511th words)	
Transfer to CPU	Transfer the buffer memory data to the specified device.
IO Data Receive Area	Refresh setting of IO data receive area
Slot1 (0th to 63rd words)	D0
Slot2 (64th to 127th words)	D64
Slot3 (128th to 191st words)	
Slot4 (192nd to 255th words)	
Slot5 (256th to 319th words)	
Slot6 (320th to 383rd words)	
Slot7 (384th to 447th words)	
Slot8 (448th to 511th words)	
Refresh Timing	Set refresh timing.
Refresh Timing	At the Execution Time of END Instruction
Refresh Group [n](n: 1-64)	1
Refresh Timing (I/O)	Specify the timing which transfers the I/O device data.
Refresh Timing	Based on Refresh Timing (Buffer Memory)

- Write the set parameters to the CPU module, and reset the CPU module or power off and on the system.

[Online] ⇒ [Write to PLC]

Point

In the program example, default settings are used for parameters other than the above. For details on parameters, refer to the following.

📖 MELSEC iQ-R PROFINET IO Device Module User's Manual (Application)

Checking the network status

Check whether the IO controller and the RJ71PN93 communicate with each other normally.

Communications are being performed normally when the LEDs and input signals of the RJ71PN93 are in the following status after execution of the program.

For the program, refer to the following.

☞ Page 37 Program examples

- LEDs of the RJ71PN93

Name	Status
RUN LED	On
ERR LED	Off
BF LED	Off
SD/RD LED (The Ethernet port in use.)	On, flashing
SD/RD LED (The Ethernet port not in use.)	Off

- Input signals

Name	Status
'Module watchdog timer error' (X0)	Off
'IO data exchanging' (X1)	On
'IO data receive error' (X2)	Off
'Module error' (X3)	Off
'Module READY' (X1D)	On

Precautions

Since the RJ71PN93 sends invalid data to the IO controller while 'IO data send area refresh directive' (Y0) is off, the IO controller may detect an error. In this case, turn on 'IO data send area refresh directive' (Y0) and check that the error has been cleared.

Program examples

The IO controller (SIMATIC S7-1200) uses the big-endian byte order and the RJ71PN93 uses the little-endian byte order. When the I/O data is exchanged between them, the byte order needs to be swapped by either the IO controller or the RJ71PN93 to convert the endianness.

For the programs in this section, use the following:

- IO controller programs Page 37 When endianness is not converted
- IO device program Page 40 Program example of IO device

Program examples of IO controller

The following shows program examples of the IO controller (SIMATIC S7-1200).

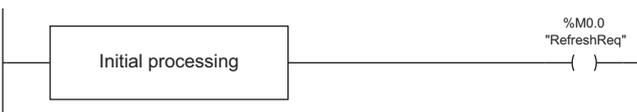
Define tags as shown below.

Name	Data type	Comment
recv_word_data	Array[0..63] of Word	Receive data (unit: word)
recv_dword_data	Array[0..31] of DWord	Receive data (unit: double-word)
send_word_data	Array[0..63] of Word	Send data (unit: word)
send_dword_data	Array[0..31] of DWord	Send data (unit: double-word)

When endianness is not converted

Network 1

Initial processing

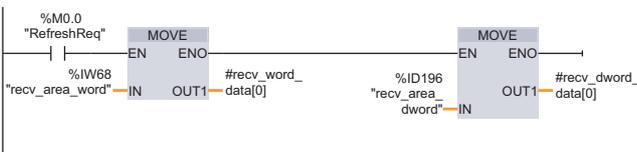


Initial processing

Execute initial processing with the program (Network 1).

Network 2

Receiving I/O data



Receive data processing

Transfer data as follows by executing the program (Network 2): The first data stored in the IO data receive area (slot 3, unit: word) tag is transferred to the first area of the receive data (unit: word) tag in "local". The first data stored in the IO data receive area (slot 4, unit: double-word) tag is transferred to the first area of the receive data (unit: double-word) tag in "local".

Network 3

Receive data processing



Execute receive data processing with the program (Network 3).

Network 4

Send data processing

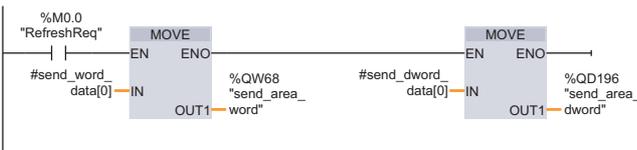


Send data processing

Execute send data processing with the program (Network 4).

Network 5

Sending I/O data



Transfer data as follows by executing the program (Network 5): The first data stored in the receive data (unit: word) tag in "local" is transferred to the first area of the IO data send area (slot 1, unit: word) tag. The first data stored in the receive data (unit: double-word) tag in "local" is transferred to the first area of the IO data send area (slot 2, unit: double-word) tag.

Point

The above programs are for when the IO controller sends/receives I/O data. Swap the byte order of the I/O data to convert the endianness using the IO device program.

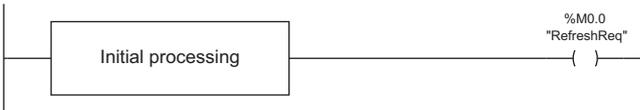
Page 40 Program example of IO device

■When endianness is converted in units of words

The following program examples show when endianness is converted (in units of words) in the IO controller program.

Network 1

Initial processing

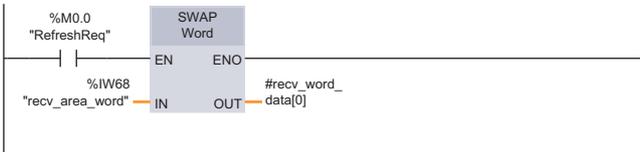


■Initial processing

Execute initial processing with the program (Network 1).

Network 2

Receiving I/O data (endianness conversion in units of words)



■Receive data processing

With the program (Network 2), perform byte order swapping in one word of the receive data in the receive area (slot 3, unit: word) tag, and transfer the data to the receive data (unit: word) tag in "local".

Network 3

Receive data processing



Execute receive data processing with the program (Network 3).

Network 4

Send data processing

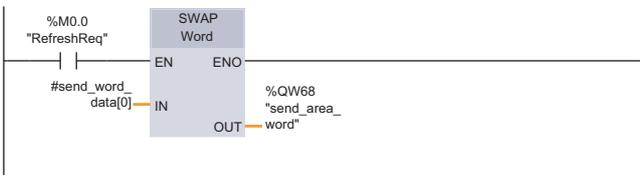


■Send data processing

Execute send data processing with the program (Network 4).

Network 5

Sending I/O data (endianness conversion in units of words)



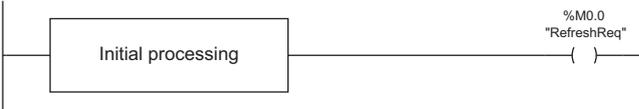
With the program (Network 5), perform byte order swapping in one word of the send data in the send data (unit: word) tag in "local", and transfer the data to the send area (slot 1, unit: word) tag.

■When endianness is converted in units of double-words

The following program examples show when endianness is converted (in units of double-words) in the IO controller program.

Network 1

Initial processing

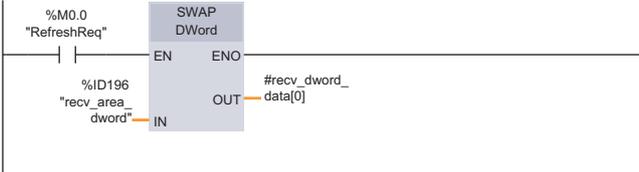


■Initial processing

Execute initial processing with the program (Network 1).

Network 2

Receiving I/O data (endianness conversion in units of double-words)



■Receive data processing

With the program (Network 2), perform byte order swapping in one double-word of the receive data in the receive area (slot 4, unit: double-word) tag, and transfer the data to the receive data (unit: double-word) tag in "local".

Network 3

Receive data processing



Execute receive data processing with the program (Network 3).

Network 4

Send data processing

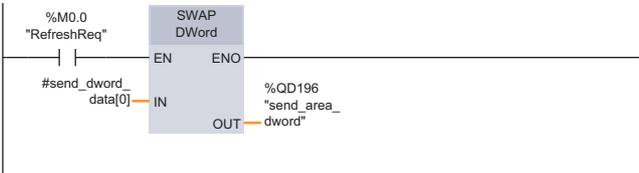


■Send data processing

Execute send data processing with the program (Network 4).

Network 5

Sending I/O data (endianness conversion in units of double-words)

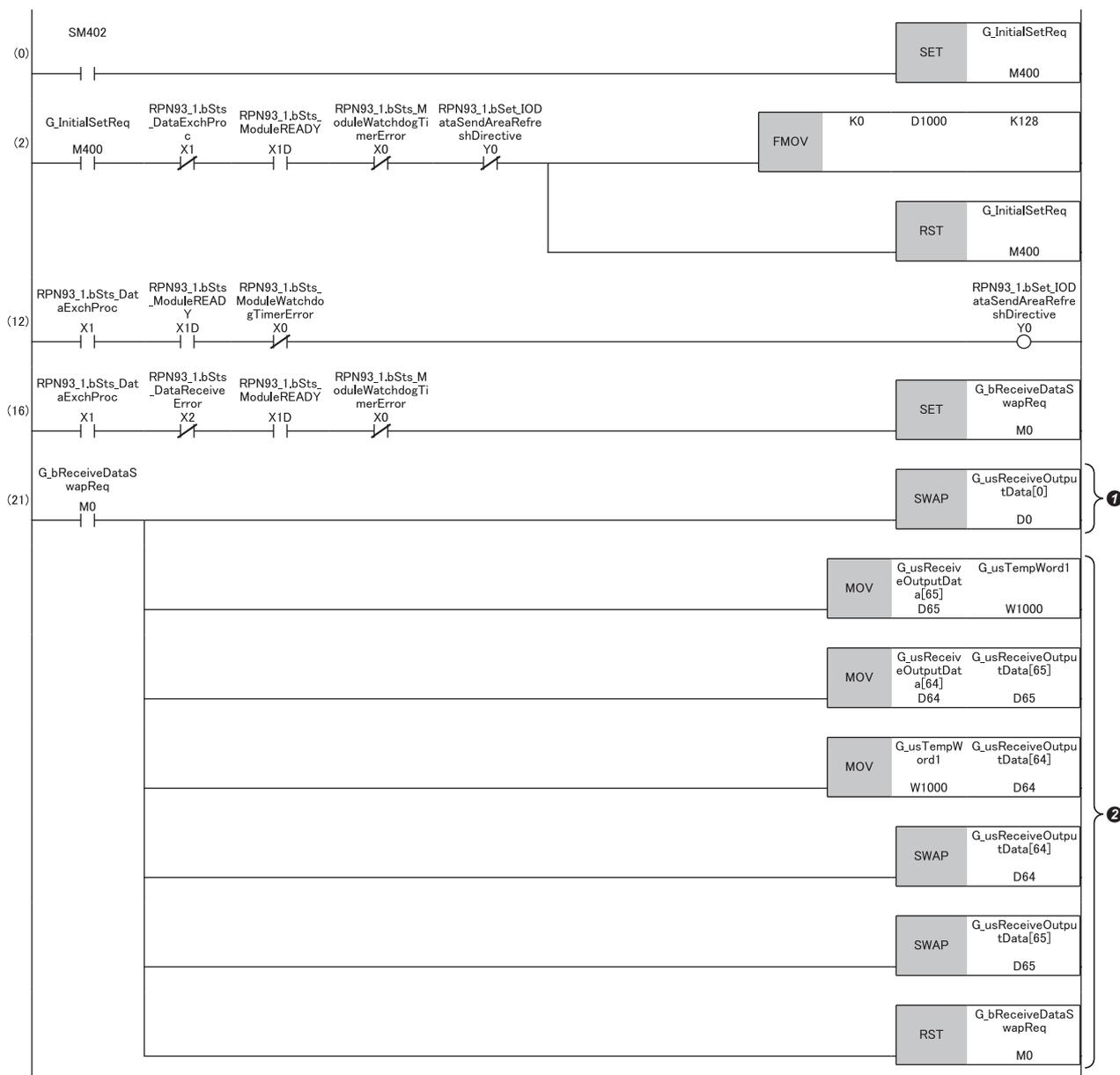


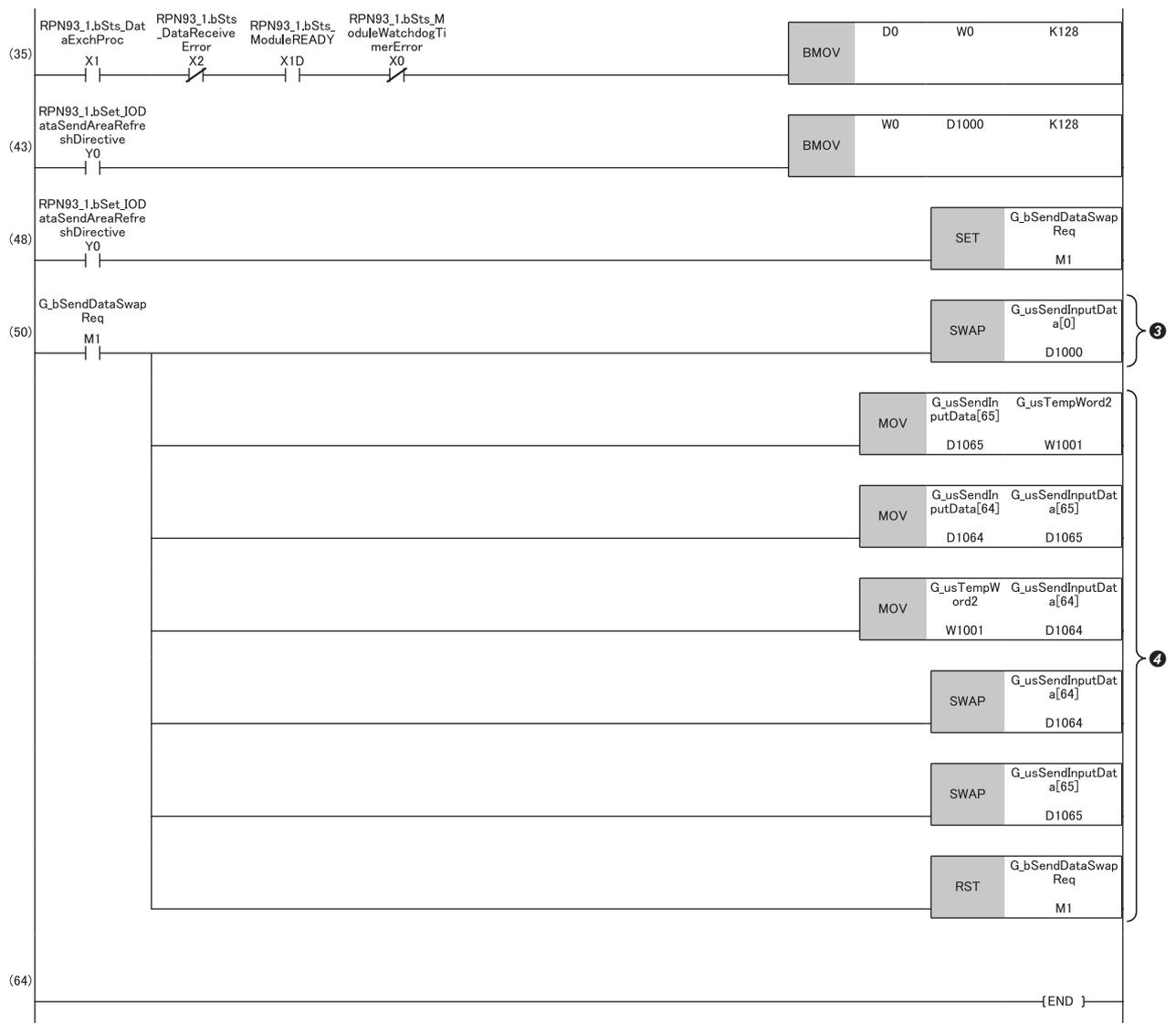
With the program (Network 5), perform byte order swapping in one double-word of the send data in the send data (unit: double-word) tag in "local", and transfer the data to the send area (slot 2, unit: double-word) tag.

Program example of IO device

Write the following program into the CPU module on the IO device side.

Classification	Label name	Description	Device																																								
Module label	RPN93_1.bSts_ModuleWatchdogTimerError	Module watchdog timer error	X0																																								
	RPN93_1.bSts_DataExchProc	IO data exchanging	X1																																								
	RPN93_1.bSts_DataReceiveError	IO data receive error	X2																																								
	RPN93_1.bSts_ModuleReady	Module READY	X1D																																								
	RPN93_1.bSet_IODataSendAreaRefreshDirective	IO data send area refresh directive	Y0																																								
Label to be defined	Define the global labels as shown below.																																										
	<table border="1"> <thead> <tr> <th></th> <th>Label Name</th> <th>Data Type</th> <th>Class</th> <th>Assign (Device/Label)</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>G_usReceiveOutputData</td> <td>Word [Unsigned]/Bit String [16-bit](0..127)</td> <td>VAR_GLOBAL</td> <td>D0</td> </tr> <tr> <td>2</td> <td>G_usSendInputData</td> <td>Word [Unsigned]/Bit String [16-bit](0..127)</td> <td>VAR_GLOBAL</td> <td>D1000</td> </tr> <tr> <td>3</td> <td>G_InitialSetReq</td> <td>Bit</td> <td>VAR_GLOBAL</td> <td>M400</td> </tr> <tr> <td>4</td> <td>G_bReceiveDataSwapReq</td> <td>Bit</td> <td>VAR_GLOBAL</td> <td>M0</td> </tr> <tr> <td>5</td> <td>G_bSendDataSwapReq</td> <td>Bit</td> <td>VAR_GLOBAL</td> <td>M1</td> </tr> <tr> <td>6</td> <td>G_usTempWord1</td> <td>Word [Unsigned]/Bit String [16-bit]</td> <td>VAR_GLOBAL</td> <td>W1000</td> </tr> <tr> <td>7</td> <td>G_usTempWord2</td> <td>Word [Unsigned]/Bit String [16-bit]</td> <td>VAR_GLOBAL</td> <td>W1001</td> </tr> </tbody> </table>				Label Name	Data Type	Class	Assign (Device/Label)	1	G_usReceiveOutputData	Word [Unsigned]/Bit String [16-bit](0..127)	VAR_GLOBAL	D0	2	G_usSendInputData	Word [Unsigned]/Bit String [16-bit](0..127)	VAR_GLOBAL	D1000	3	G_InitialSetReq	Bit	VAR_GLOBAL	M400	4	G_bReceiveDataSwapReq	Bit	VAR_GLOBAL	M0	5	G_bSendDataSwapReq	Bit	VAR_GLOBAL	M1	6	G_usTempWord1	Word [Unsigned]/Bit String [16-bit]	VAR_GLOBAL	W1000	7	G_usTempWord2	Word [Unsigned]/Bit String [16-bit]	VAR_GLOBAL	W1001
	Label Name	Data Type	Class	Assign (Device/Label)																																							
1	G_usReceiveOutputData	Word [Unsigned]/Bit String [16-bit](0..127)	VAR_GLOBAL	D0																																							
2	G_usSendInputData	Word [Unsigned]/Bit String [16-bit](0..127)	VAR_GLOBAL	D1000																																							
3	G_InitialSetReq	Bit	VAR_GLOBAL	M400																																							
4	G_bReceiveDataSwapReq	Bit	VAR_GLOBAL	M0																																							
5	G_bSendDataSwapReq	Bit	VAR_GLOBAL	M1																																							
6	G_usTempWord1	Word [Unsigned]/Bit String [16-bit]	VAR_GLOBAL	W1000																																							
7	G_usTempWord2	Word [Unsigned]/Bit String [16-bit]	VAR_GLOBAL	W1001																																							



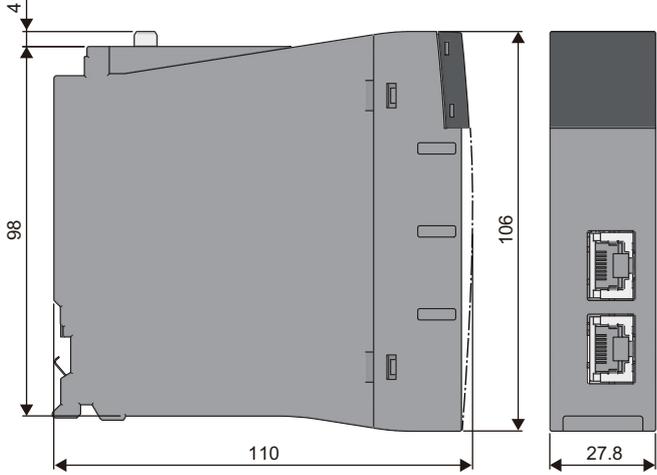


- (0) Initial setting request
- (2) Initial setting processing
- (12) Start of refresh in the IO data send area (turn on 'IO data send area refresh directive' (Y0))
- (16) Byte order swapping request for output receive data
- (21) Byte order swap processing for output receive data
- ① Byte order swap processing in units of words
- ② Byte order swap processing in units of double words
- (35) Output receive data processing (data for acquiring information)
- (43) Input send data processing (data for acquiring information)
- (48) Byte order swapping request for input send data
- (50) Byte order swap processing for input send data
- ③ Byte order swap processing in units of words
- ④ Byte order swap processing in units of double words

APPENDIX

Appendix 1 External Dimensions

This section describes the external dimensions of the RJ71PN93.



(Unit: mm)

MEMO

A

INDEX

A

Automatic hardware test 20

B

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REVISIONS

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

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WARRANTY

Please confirm the following product warranty details before using this product.

1. Gratis Warranty Term and Gratis Warranty Range

If any faults or defects (hereinafter "Failure") found to be the responsibility of Mitsubishi occurs during use of the product within the gratis warranty term, the product shall be repaired at no cost via the sales representative or Mitsubishi Service Company.

However, if repairs are required onsite at domestic or overseas location, expenses to send an engineer will be solely at the customer's discretion. Mitsubishi shall not be held responsible for any re-commissioning, maintenance, or testing on-site that involves replacement of the failed module.

[Gratis Warranty Term]

The gratis warranty term of the product shall be for one year after the date of purchase or delivery to a designated place. Note that after manufacture and shipment from Mitsubishi, the maximum distribution period shall be six (6) months, and the longest gratis warranty term after manufacturing shall be eighteen (18) months. The gratis warranty term of repair parts shall not exceed the gratis warranty term before repairs.

[Gratis Warranty Range]

- (1) The range shall be limited to normal use within the usage state, usage methods and usage environment, etc., which follow the conditions and precautions, etc., given in the instruction manual, user's manual and caution labels on the product.
- (2) Even within the gratis warranty term, repairs shall be charged for in the following cases.
 1. Failure occurring from inappropriate storage or handling, carelessness or negligence by the user. Failure caused by the user's hardware or software design.
 2. Failure caused by unapproved modifications, etc., to the product by the user.
 3. When the Mitsubishi product is assembled into a user's device, Failure that could have been avoided if functions or structures, judged as necessary in the legal safety measures the user's device is subject to or as necessary by industry standards, had been provided.
 4. Failure that could have been avoided if consumable parts (battery, backlight, fuse, etc.) designated in the instruction manual had been correctly serviced or replaced.
 5. Failure caused by external irresistible forces such as fires or abnormal voltages, and Failure caused by force majeure such as earthquakes, lightning, wind and water damage.
 6. Failure caused by reasons unpredictable by scientific technology standards at time of shipment from Mitsubishi.
 7. Any other failure found not to be the responsibility of Mitsubishi or that admitted not to be so by the user.

2. Onerous repair term after discontinuation of production

- (1) Mitsubishi shall accept onerous product repairs for seven (7) years after production of the product is discontinued. Discontinuation of production shall be notified with Mitsubishi Technical Bulletins, etc.
- (2) Product supply (including repair parts) is not available after production is discontinued.

3. Overseas service

Overseas, repairs shall be accepted by Mitsubishi's local overseas FA Center. Note that the repair conditions at each FA Center may differ.

4. Exclusion of loss in opportunity and secondary loss from warranty liability

Regardless of the gratis warranty term, Mitsubishi shall not be liable for compensation to:

- (1) Damages caused by any cause found not to be the responsibility of Mitsubishi.
- (2) Loss in opportunity, lost profits incurred to the user by Failures of Mitsubishi products.
- (3) Special damages and secondary damages whether foreseeable or not, compensation for accidents, and compensation for damages to products other than Mitsubishi products.
- (4) Replacement by the user, maintenance of on-site equipment, start-up test run and other tasks.

5. Changes in product specifications

The specifications given in the catalogs, manuals or technical documents are subject to change without prior notice.

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