OMRON

Environment-resistive Remote Terminal

NXR-series

IO-Link Master Unit
for EtherNet/IP™

User's Manual

NXR-ILM08C-EIT

IO-Link Master Unit for EtherNet/IP

Introduction

Thank you for purchasing an NXR-series IO-Link Master Unit for EtherNet/IP.

This manual contains information that is necessary to use the NXR-series IO-Link Master Unit for EtherNet/IP. Please read this manual and make sure you understand the functionality and performance of the NXR-series IO-Link Master Unit for EtherNet/IP before you attempt to build an IO-Link System.

Keep this manual in a safe place where it will be available for reference during operation.

Intended Audience

This manual is intended for the following personnel, who must also have knowledge of electrical systems (an electrical engineer or the equivalent).

- Personnel in charge of introducing FA systems.
- Personnel in charge of designing FA systems.
- Personnel in charge of installing and maintaining FA systems.
- Personnel in charge of managing FA systems and facilities.

For programming, this manual is intended for personnel who understand the programming language specifications in international standard IEC 61131-3 or Japanese standard JIS B 3503.
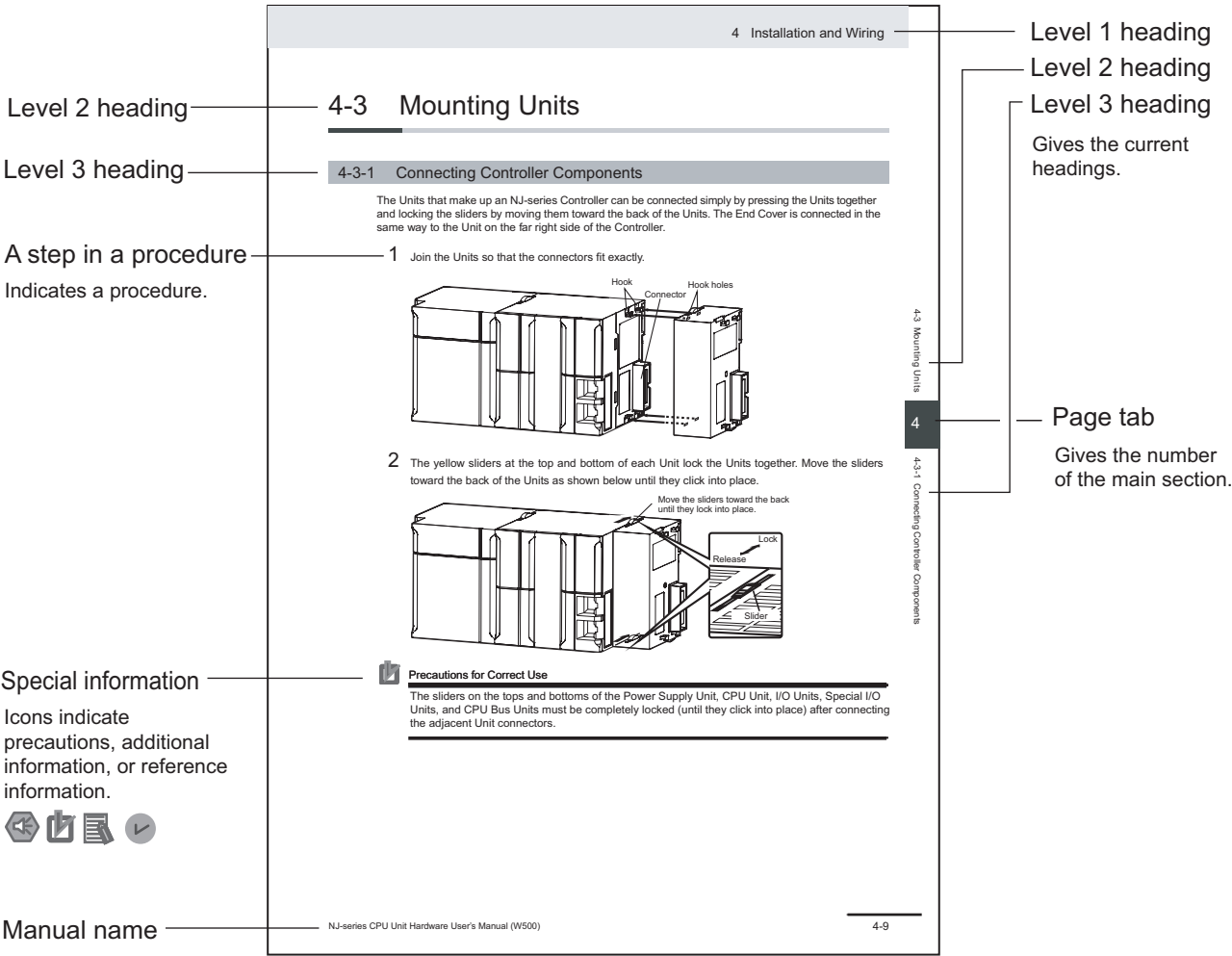
Applicable Products

This manual covers the following product.

- NXR-series IO-Link Master Unit for EtherNet/IP
  NXR-ILM08C-EIT

Manual Structure

Page Structure

The following page structure is used in this manual.

Level 2 heading

Level 3 heading

A step in a procedure
Indicates a procedure.

Special information
Icons indicate
precautions, additional
information, or reference
information.

Manual name

Level 1 heading

Level 2 heading

Level 3 heading
Gives the current
headings.

Page tab
Gives the number
of the main section.

4   Installation and Wiring

4-3   Mounting Units

4-3-1   Connecting Controller Components

The Units that make up an NJ-series Controller can be connected simply by pressing the Units together and locking the sliders by moving them toward the back of the Units. The End Cover is connected in the same way to the Unit on the far right side of the Controller.

1   Join the Units so that the connectors fit exactly.

Hook   Hook holes
Connector

2   The yellow sliders at the top and bottom of each Unit lock the Units together. Move the sliders toward the back of the Units as shown below until they click into place.

Move the sliders toward the back until they lock into place.

Lock
Release
Slider

4-3 Mounting Units

4

4-3-1 Connecting Controller Components

Precautions for Correct Use

The sliders on the tops and bottoms of the Power Supply Unit, CPU Unit, I/O Units, Special I/O Units, and CPU Bus Units must be completely locked (until they click into place) after connecting the adjacent Unit connectors.

NJ-series CPU Unit Hardware User's Manual (W500)   4-9

This illustration is provided only as a sample. It may not literally appear in this manual.

Special Information

Special information in this manual is classified as follows:

Precautions for Safe Use

Precautions on what to do and what not to do to ensure safe usage of the product.

Precautions for Correct Use

Precautions on what to do and what not to do to ensure proper operation and performance.

Additional Information

Additional information to read as required.
This information is provided to increase understanding or make operation easier.
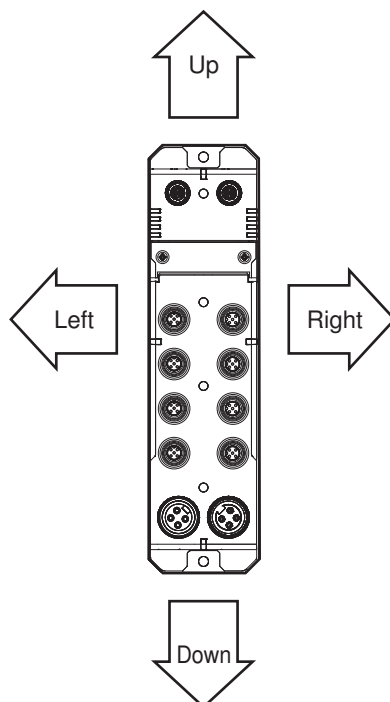
Version Information

Information on differences in specifications and functionality for Controllers with different unit versions and for different versions of the Support Software is given.

Precaution on Terminology

- In this manual, "download" refers to transferring data from the Support Software to a physical device and "upload" refers to transferring data from a physical device to the Support Software.
- In this manual, the directions in relation to the Units are given in the following figure, which shows upright installation.

Sections in this Manual

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Section 1   Features and System Configuration

Section 2 Specifications and Application Procedures

Section 3 Part Names and Functions

Section 4 Designing the Power Supply System

Section 5 Installation and Wiring

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Section 7   Setting Up IO-Link Master Unit

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Warranty, Limitations of Liability

Warranties

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Data presented in Omron Company websites, catalogs and other materials is provided as a guide for the user in determining suitability and does not constitute a warranty. It may represent the result of Omron's test conditions, and the user must correlate it to actual application requirements. Actual performance is subject to the Omron's Warranty and Limitations of Liability.

Change in Specifications

Product specifications and accessories may be changed at any time based on improvements and other reasons. It is our practice to change part numbers when published ratings or features are changed, or when significant construction changes are made. However, some specifications of the Product may

be changed without any notice. When in doubt, special part numbers may be assigned to fix or establish key specifications for your application. Please consult with your Omron's representative at any time to confirm actual specifications of purchased Product.

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OMRON SHALL NOT BE RESPONSIBLE AND/OR LIABLE FOR ANY LOSS, DAMAGE, OR EXPENSES DIRECTLY OR INDIRECTLY RESULTING FROM THE INFECTION OF OMRON PRODUCTS, ANY SOFTWARE INSTALLED THEREON OR ANY COMPUTER EQUIPMENT, COMPUTER PROGRAMS, NETWORKS, DATABASES OR OTHER PROPRIETARY MATERIAL CONNECTED THERETO BY DISTRIBUTED DENIAL OF SERVICE ATTACK, COMPUTER VIRUSES, OTHER TECHNOLOGICALLY HARMFUL MATERIAL AND/OR UNAUTHORIZED ACCESS.

It shall be the users sole responsibility to determine and use adequate measures and checkpoints to satisfy the users particular requirements for (i) antivirus protection, (ii) data input and output, (iii) maintaining a means for reconstruction of lost data, (iv) preventing Omron Products and/or software installed thereon from being infected with computer viruses and (v) protecting Omron Products from unauthorized access.

Safety Precautions

Definition of Precautionary Information

The following notation is used in this manual to provide precautions required to ensure safe usage of the NXR-series IO-Link Master Unit for EtherNet/IP.
The safety precautions that are provided are extremely important to safety. Always read and heed the information provided in all safety precautions.
The following notation is used.

⚠ WARNING	Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury. Additionally, there may be severe property damage.
⚠ Caution	Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury, or property damage.

Symbols

🚫	The circle and slash symbol indicates operations that you must not do. The specific operation is shown in the circle and explained in text. This example indicates prohibiting disassembly.
⚠	The triangle symbol indicates precautions (including warnings). The specific operation is shown in the triangle and explained in text. This example indicates a precaution for electric shock.
⚠	The triangle symbol indicates precautions (including warnings). The specific operation is shown in the triangle and explained in text. This example indicates a general precaution.
❗	The filled circle symbol indicates operations that you must do. The specific operation is shown in the circle and explained in text. This example shows a general precaution for something that you must do.

Warnings

⚠ WARNING

During Power Supply

Do not touch the terminal section while power is ON.
Electric shock may occur.

Do not attempt to take any Unit apart.
In particular, high-voltage parts are present in Units that supply power while power is supplied or immediately after power is turned OFF. Touching any of these parts may result in electric shock. There are sharp parts inside the Unit that may cause injury.

Fail-safe Measures

Provide safety measures in external circuits to ensure safety in the system if an abnormality occurs due to malfunction of the CPU Unit, other Units, or slaves or due to other external factors affecting operation.
Not doing so may result in serious accidents due to incorrect operation.

Emergency stop circuits, interlock circuits, limit circuits, and similar safety measures must be provided in external control circuits.

The outputs may remain ON or OFF due to deposition or burning of the output relays or destruction of the output transistors. As a countermeasure for such problems, external safety measures must be provided to ensure safe operation of the system.

The CPU Unit will turn OFF all outputs from Basic Output Units in the following cases.
The remote I/O slaves will operate according to the settings in the slaves.
• If a power supply error occurs.
• If the power supply connection becomes faulty.
• If a CPU watchdog timer error or CPU reset occurs.
• If a Controller error in the major fault level occurs.
• While the CPU Unit is on standby until RUN mode is entered after the power is turned ON
External safety measures must be provided to ensure safe operation of the system in such cases.

You must take fail-safe measures to ensure safety in the event of incorrect, missing, or abnormal signals caused by broken signal lines, momentary power interruptions, or other causes.
Not doing so may result in serious accidents due to incorrect operation.

Voltage and Current Inputs

Make sure that the voltages and currents that are input to the Units and slaves are within the specified ranges.
Inputting voltages or currents that are outside of the specified ranges may cause accidents or fire.

Power Supply Design

Follow the instructions in this manual to correctly perform power supply design and wiring. Inputting voltages or currents that are outside of the specified ranges, as well as incorrect wiring, may cause failure or fire.

Wiring

Make sure that the grounds (0 V) of the Unit/input power supply and the output power supply are at the same potential.

Cautions

⚠ Caution

Getting an IP Address

If you get an IP address from a DHCP server, make sure that the DHCP server is set as follows. Otherwise, the control system may operate unexpectedly.
- IP address allocation method: Static allocation
- Lease period: Infinite

Precautions for Safe Use

▌ Transporting

- When transporting any Unit, use the special packing box for it.
  Also, do not subject the Unit to excessive vibration or shock during transportation.
- Do not drop any Unit or subject it to abnormal vibration or shock.
  Doing so may result in Unit failure or malfunction.

▌ Installation

- Before touching a Unit, be sure to first touch a grounded metallic object in order to discharge any static build-up.
- Make sure that all Master Unit mounting screws and switch cover screws are tightened to the torque specified in this manual.

▌ Mounting

- Be sure that the terminal blocks, communications cables, and other items with locking devices are properly locked into place.

▌ Wiring

- Use cables, connectors, and waterproof covers that are specified in this manual.
- Make sure that all cable connector screws and waterproof cover screws are tightened to the torque specified in this manual.
- Double-check all switches and other settings and double-check all wiring to make sure that they are correct before turning ON the power supply. Use the correct wiring parts and tools when you wire the system.
- Do not pull on the cables or bend the cables beyond their natural limit.
- Do not place heavy objects or step on top of the cables.
- If the Unit is used in more than one system, be sure to keep a clearance of at least 5 mm between cables to prevent unstable operation due to interference. Do not bundle the cables together.
- Observe the following precautions when wiring the communications cable.
  Keep the communications cables away from power lines and high-voltage lines.
  Always lay communications cable inside ducts.
  Use the recommended communications cables that are specified in this manual.
  Connect both ends of communications cable shielded wires to the connector hoods.

▌ Power Supply Design

- Use the power supply voltage that is specified in this manual.

- The maximum power supply current is 9 A, which is the sum of the Unit/input power supply current and the output power supply current. Do not use the Unit beyond the maximum power supply current. Otherwise, an excess current flows through the power supply cable, and it may cause fire.
- The maximum port current is 4 A/port. Do not use the Unit beyond the maximum current. Otherwise, an excess current flows through the I/O connectors, and it may cause failure or fire.
- Inrush current may flow in the Unit/input power supply and output power supply in the following cases.
  When power is turned ON.
  When power supply to IO-Link devices is started.
  When connected external devices are turned ON and OFF.

  In addition, overcurrent may flow until the protection is activated when there is a short-circuit in I/O cables. Consider these currents and select power supplies with sufficient extra capacity. The inrush current may prevent the power supply from operating correctly, or cause the power supply to turn OFF.

Setting Up the IO-Link Master Unit

- When you connect an external device, check the port settings for pin 4 and pin 2.
- Do not connect a non-IO-Link actuator to pin 4 that is set to IO-Link Mode. Depending on the operation to establish IO-Link communications, the actuator may unexpectedly and repeatedly turn ON and OFF in a short cycle.

EtherNet/IP Communications

- Make sure that the communications distance, number of nodes connected, and method of connection for EtherNet/IP are within specifications.
- EtherNet/IP communications are not always established immediately after the power supply is turned ON. Use the CPU Unit system-defined variables or status in the user program to confirm that communications are established before attempting control operations.

Actual Operation

- Check the user program, data, and parameter settings for proper execution before you use them for actual operation.
- Take appropriate measures to ensure that the specified power with the rated voltage and frequency is supplied in places where the power supply is unstable.

Turning OFF the Power Supply

- Turn OFF the external power supply to the Units and the power supply to the devices to communicate with the Unit before you wire the communication cables.
- Always turn OFF the external power supply to the Units before attempting any of the following.
  Assembling Units including the connected devices
  Setting the rotary switches
  Connecting or wiring cables

Attaching or removing terminal blocks or connectors

Operation

- Confirm that the controlled system will not be adversely affected before you perform any of the following operations.
  Changing the operating mode of the CPU Unit (including changing the setting of the Operating Mode at Startup)
  Changing the user program or settings
  Changing set values or present values
  Forced refreshing
- The CPU Unit refreshes I/O even when the program is stopped (i.e., even in *PROGRAM* mode).
  Confirm safety thoroughly in advance before changing the status of any part of memory allocated to I/O Units, Special I/O Units, or CPU Bus Units. Any changes to the data allocated to any Unit specifically the Special I/O Units/CPU Bus Units may result in unexpected operation of the loads connected to the Unit.
  Transferring I/O memory data to the CPU Unit with a Programming Device (PC tool).
  Changing present values in memory with a Programming Device.
  Force-setting/-resetting bits with a Programming Device.
  Transferring I/O memory files from a memory card or EM file memory to the CPU Unit.
  Transferring I/O memory from a host computer or from another PLC on a network.

Maintenance

- Do not use paint thinner when cleaning. Use commercially available alcohol.
- Do not use high-pressure cleaning.

Disposal

- Dispose of the product according to local ordinances as they apply.

Precautions for Correct Use

Storage, Mounting, and Wiring

- Do not operate or store the Units in the following locations. Doing so may result in malfunction or in operation stopping.
  Locations subject to direct sunlight
  Locations subject to temperatures or humidity outside the range specified in the specifications
  Locations subject to condensation as the result of severe changes in temperature
  Locations subject to corrosive or flammable gases
  Locations subject to dust (especially iron dust) or salts
  Locations subject to exposure to acid, oil, or chemicals
  Locations subject to shock or vibration
  Locations close to power lines
- Take appropriate and sufficient countermeasures during installation in the following locations.
  Locations subject to static electricity or other forms of noise
  Locations subject to strong electromagnetic fields
  Locations subject to possible exposure to radioactivity
  Locations close to power supply lines
- Wire all connections correctly according to instructions in this manual.
- When you attach the switch cover, make sure that the packing is not twisted. Also confirm that there is no foreign matter adhering to the case and packing.
- Do not use the Unit continuously submerged in water.

Power Supply Design

Always use separate power supplies for the Unit/input power supply and the output power supply. If you supply power from the same power supply, load variations in output devices may cause malfunctions.

EtherNet/IP Communications

Do not disconnect the EtherNet/IP communications cables during operation. The outputs will become unstable.

Executing a Communication Cable Diagnosis

The communications are interrupted for the port that is during a communications cable diagnosis, and all connections (tag data links) and message communications via the port are stopped temporarily. Confirm that the system will not be adversely affected before you execute a communications cable diagnosis.

Regulations and Standards

Conformance to EU Directives

Applicable Directives

- EMC Directives
- Low Voltage Directive

Concepts

● EMC Directives

OMRON devices that comply with EU Directives also conform to the related EMC standards so that they can be more easily built into other devices or the overall machine. The actual products have been checked for conformity to EMC standards.*1

Whether the products conform to the standards in the system used by the customer, however, must be checked by the customer. EMC-related performance of the OMRON devices that comply with EU Directives will vary depending on the configuration, wiring, and other conditions of the equipment or control panel on which the OMRON devices are installed. The customer must, therefore, perform the final check to confirm that devices and the overall machine conform to EMC standards.

*1. Applicable EMC (Electromagnetic Compatibility) standards are as follows: EMS (Electromagnetic Susceptibility): EN 61131-2, EMI (Electromagnetic Interference): EN 61131-2 (Radiated emission: 10-m regulations).

● Low Voltage Directive

Always ensure that devices operating at voltages of 50 to 1,000 VAC and 75 to 1,500 VDC meet the required safety standards. The applicable directive is EN 61010-2-201.

● Conformance to EU Directives

The NXR-series products comply with EU Directives. To ensure that the machine or device in which the NXR-series products are used complies with EU Directives, the following precautions must be observed.

- You must use SELV power supply for the DC power supplies that are connected as the Unit/input power supplies and output power supplies for the NXR-series products.
  We recommend that you use the OMRON S8VK-S-series Power Supplies. EMC standard compliance was confirmed for the recommended Power Supplies.
- NXR-series products that comply with EU Directives also conform to the Common Emission Standard. Radiated emission characteristics (10-m regulations) may vary depending on the configuration of the control panel used, other devices connected to the control panel, wiring, and other conditions.
  You must therefore confirm that the overall machine or equipment in which the NXR-series products are used complies with EU Directives.
- You must use power supplies with an output hold time of 10 ms or longer for the DC power supplies that are connected as the Unit/input power supplies and output power supplies for the NXR-series products.

- This is a Class A product (for industrial environments). In a residential environment, it may cause radio interference. If radio interference occurs, the user may be required to take appropriate measures.
- Conformance to EU Directives was confirmed using power supply cables and I/O cables with a cable length of 30 m or shorter.

Conformance to UL and CSA Standards

Some NXR-series products comply with UL and CSA standards.

If you use a product that complies with UL or CSA standards and must apply those standards to your machinery or devices, refer to the *Instruction Sheet* that is provided with the product. The *Instruction Sheet* provides the application conditions for complying with the standards.

Conformance to Shipbuilding Standards

This product does not comply with any shipbuilding standards.

Conformance to KC Certification

When you use this product in South Korea, observe the following precautions.

사 용 자 안 내 문
이 기기는 업무용 환경에서 사용할 목적으로 적합성평가를 받은 기기로서 가정용 환경에서 사용하는 경우 전파간섭의 우려가 있습니다.

This product meets the electromagnetic compatibility requirements for business use. There is a risk of radio interference when this product is used in home.

Software Licenses and Copyrights

This product incorporates certain third party software. The license and copyright information associated with this software is available at http://www.fa.omron.co.jp/nj_info_e/ and http://www.fa.omron.co.jp/nx_info_e/.

Unit Versions

Unit Versions

A "unit version" has been introduced to manage the Units in the NXR Series according to differences in functionality accompanying Unit upgrades.

Notation of Unit Versions on Products

The *unit version* is given with the Unit specifications on the side of the Unit.

Unit model number

Lot number

Unit version

MAC address
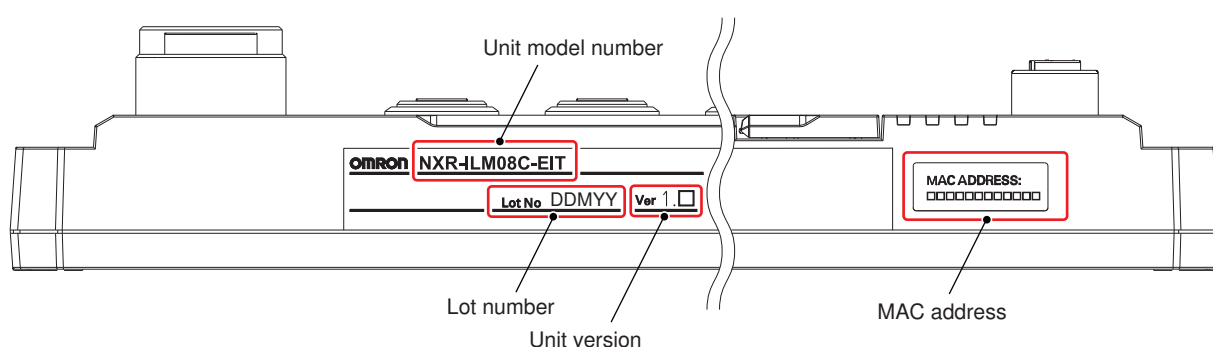
The following information is provided in the Unit specifications on the Unit.

Name	Function
Unit model number	Gives the model of the Unit.
Unit version	Gives the unit version of the Unit.
Lot number	Gives the lot number of the Unit. DDMYY "M" gives the month (1 to 9: January to September, X: October, Y: November, Z: December)
MAC address	Shows the MAC addresses of the EtherNet/IP ports on the Unit.

Unit Versions and Support Software Versions

The functions that are supported depend on the unit version of the Unit. The version of Support Software that supports the functions that were added for an upgrade is required to use those functions. Refer to *A-5 Version Information* on page A-67 for the functions that are supported by each unit version.

Related Manuals

The following table shows related manuals. Use these manuals for reference.

Manual name	Cat. No.	Models	Application	Contents
NXR-series IO-Link Master Unit for EtherNet/IP™ User's Manual	W619	NXR-ILM08C-EIT	Learning how to use an NXR-series IO-Link Master Unit for EtherNet/IP.	The hardware, setup methods, and functions of the NXR-series IO-Link Master Unit for EtherNet/IP are described.
NXR-series IO-Link I/O Hub User's Manual	W620	NXR-□□□□□□-IL□	Learning how to use an NXR-series IO-Link I/O Hub.	The hardware, setup methods, and functions of the NXR-series IO-Link I/O Hub, which is an IO-Link device, are described.
NJ/NX-series CPU Unit Built-in EtherNet/IP™ Port User's Manual	W506	NX701-□□□□ NX502-□□□□ NX102-□□□□ NX1P2-□□□□ NJ501-□□□□ NJ301-□□□□ NJ101-□□□□	Using the built-in EtherNet/IP port on an NJ/NX-series CPU Unit.	Information on the built-in EtherNet/IP port is provided. Information is provided on the basic setup, tag data links, and other features.
CS and CJ Series EtherNet/IP™ Units Operation Manual	W465	CS1W-EIP21 CJ1W-EIP21 CJ2H-CPU6□-EIP CJ2M-CPU3□	Learning how to use an EtherNet/IP Unit.	Information on using an EtherNet/IP Unit that is connected to a CS/CJ-series CPU Unit is provided. Information is provided on the basic setup, tag data links, and FINS communications.
Sysmac Studio Version 1 Operation Manual	W504	SYSMAC-SE2□□□	Learning about the operating procedures and functions of the Sysmac Studio.	Describes the operating procedures of the Sysmac Studio.
NJ/NX-series Instructions Reference Manual	W502	NX701-□□□□ NX502-□□□□ NX102-□□□□ NX1P2-□□□□ NJ501-□□□□ NJ301-□□□□ NJ101-□□□□	Learning detailed specifications on the basic instructions of an NJ/NX-series CPU Unit.	The instructions in the instruction set (IEC 61131-3 specifications) are described.
IO-Link Sensor Index List	9541795-1	E3Z-□8□-IL□	Learning the vendor IDs, device IDs, I/O data (process data), and objects (service data).	The following information is provided on OMRON IO-Link sensors, which are IO-Link devices. • IO-Link physical layer • Device IDs • Process data • Service data • Event function
	9540292-0	E2E(Q)-□-IL□		
	9539397-1	E3S-DCP21-IL□		

Terminology

Term	Abbreviation	Description
Beacon	---	A frame name used in DLR.
Common Industrial Protocol	CIP	The CIP (Common Industrial Protocol) is a shared industrial protocol used in networks such as EtherNet/IP and DeviceNet.
Device Level Ring	DLR	A data-link layer protocol that provides single-fault tolerance defined by EtherNet/IP standards.
Electronic Data Sheet	EDS	A text file that contains setting information for an EtherNet/IP adapter.
EtherNet/IP scanner	---	A device that monitors the status of the connections with EtherNet/IP adapters and exchanges I/O data with EtherNet/IP slaves through the EtherNet/IP network. Furthermore, it refers to the *originator* when opening a connection. OMRON EtherNet/IP scanners include EtherNet/IP Units such as CJ1W-EIP21 and CS1W-EIP21 as well as the built-in EtherNet/IP ports of NJ/NX/CJ-series CPU Units.
EtherNet/IP adapter	---	A device that outputs the data that is received from the EtherNet/IP scanner through the EtherNet/IP network to a connected external device, and sends the data that is input from a connected external device to the EtherNet/IP scanner through the EtherNet/IP network. Furthermore, it refers to the *target* when opening a connection.
FCS error	---	FCS is an acronym for frame check sequence. It refers to a data error that occurs in the middle of communications.
IO-Link	---	A standard interface for 1:1 (point-to-point) connections with sensors, actuators, or other devices as defined in international standard IEC 61131-9.
IO-Link event code	---	A code for an error detected by an IO-Link device.
IO-Link communications	---	Communications that use the IO-Link protocol.
IO-Link device	---	A device with a sensor or actuator that can perform IO-Link communications with the IO-Link master. IO-Link devices are simply referred to as "devices" in IO-Link specifications, but in this manual "IO-Link" is added to distinguish these devices from other communications devices.
IO-Link Device Configuration Settings	---	The setting information to verify the configuration when IO-Link devices are connected.
IO-Link Device Information Area	---	Information on the connection configuration of the IO-Link devices that are actually connected to the IO-Link Master Unit.
non-IO-Link connected external device	---	A device such as a sensor or actuator that cannot perform IO-Link communications. It exchanges signals with the IO-Link master in SIO (DI) Mode or SIO (DO) Mode. In this manual, this term may also be described as "non-IO-Link external device".
non-IO-Link input device	---	A device such as a sensor that cannot perform IO-Link communications.
non-IO-Link output device	---	A device such as an actuator that cannot perform IO-Link communications.
IO-Link master	---	A device that communicates with the IO-Link devices in the IO-Link System and simultaneously communicates with the Controller through the network. "IO-Link Master Unit" is used to refer to a specific Unit.
IO-Link Mode	---	One of the communications mode settings. In this communications mode, IO-Link communications are performed with the IO-Link devices.

Term	Abbre-viation	Description
QuickConnect	---	A device mode that enables the EtherNet/IP target device to quickly start up and accept a TCP connection.
SIO	---	An acronym for standard input/output. A general term for the communications modes to input and output digital signals (ON/OFF signals).
SIO (DI) Mode	---	One of the communications mode settings. A communications mode to input digital signals (ON/OFF signals) from input devices.
SIO (DO) Mode	---	One of the communications mode settings. A communications mode to output digital signals (ON/OFF signals) to output devices.
octet	---	8-bit units of data.
object	---	An abstract representation of a particular component within a device, which consists of data, parameters, and methods.
originator	---	The node that sends a request to open a connection at the time of opening a tag data link connection.
controller	---	An OMRON CPU Unit connected to the IO-Link Master Unit through EtherNet/IP or a controller from another company.
target	---	The node that receives a request to open a connection at the time of opening a tag data link connection.
tag data link	---	A function that enables cyclic tag data exchanges in an EtherNet/IP network between a scanner and adapters.
scanner from another manufacturer	---	An EtherNet/IP scanner from another manufacturer.
device event	---	Events that are reported from the IO-Link devices to the IO-Link master with the IO-Link event reporting function. The following two types of events are allocated as I/O data. • Error-level device event • Warning-level device event
error-level device event	---	An event that is reported to the IO-Link Master Unit when an error is detected for which an IO-Link device cannot continue operation.
warning-level device event	---	An event that is reported to the IO-Link Master Unit when an error is detected for which an IO-Link device can continue operation.
Network configuration information	---	The EtherNet/IP network configuration information held by the Ether-Net/IP scanner.
process output data	---	Output data sent from the IO-Link master to the IO-Link devices in IO-Link communications.
process data	---	I/O data in the IO-Link devices. You can allocate a maximum of 32 bytes of process data in the IO-Link master. A generic term for the IO-Link process input data and IO-Link process output data in IO-Link devices.
process input data	---	Input data received from an IO-Link device to the IO-Link master in IO-Link communications.
port	---	An I/O connection port of the IO-Link master. An IO-Link device or non-IO-Link external device is connected to a port.
ring supervisor	---	The ring supervisor is responsible for verifying the integrity of the ring; reconfiguring the ring to recover from faults and collecting diagnostic information for the ring.
ring node	---	Joins the DLR network to implement the ring topology. Notifies the ring supervisor of the fault. It also handles the Beacon frame to determine the state of the ring topology from the ring supervisor.

Revision History

A manual revision code appears as a suffix to the catalog number on the front and back covers of the manual.

Cat. No. | W619-E1-06

Revision code

Revision code	Date	Revised content
01	April 2020	Original production
02	July 2020	Corrected mistakes.
03	November 2020	• Made changes accompanying the upgrade of the IO-Link Master Units version to version 1.1. • Made changes accompanying the acquisition of UL and CSA standards certification.
04	June 2022	Corrected mistakes.
05	July 2023	Made changes accompanying the upgrade of the CX-ConfiguratorFDT version 3.0.
06	December 2024	Corrected mistakes.

1

Features and System Configuration

This section describes the features and system configuration of the NXR-series IO-Link Master Unit for EtherNet/IP.

1-1　Introduction to the IO-Link Master Unit

The NXR-series IO-Link Master Unit for EtherNet/IP is an EtherNet/IP adapter that provides IO-Link master functions with an environmental resistance of IP67.

An NXR-series IO-Link Master Unit for EtherNet/IP receives data from the EtherNet/IP scanner through the EtherNet/IP network and outputs the data to connected external devices. It also sends the data that is input from connected external devices to the EtherNet/IP scanner through the EtherNet/IP network.

You can connect the following external devices to the ports of the IO-Link Master Unit.

- IO-Link devices
- External devices such as non-IO-Link sensors or actuators

The IO-Link Master Unit exchanges data with IO-Link devices through IO-Link communications.
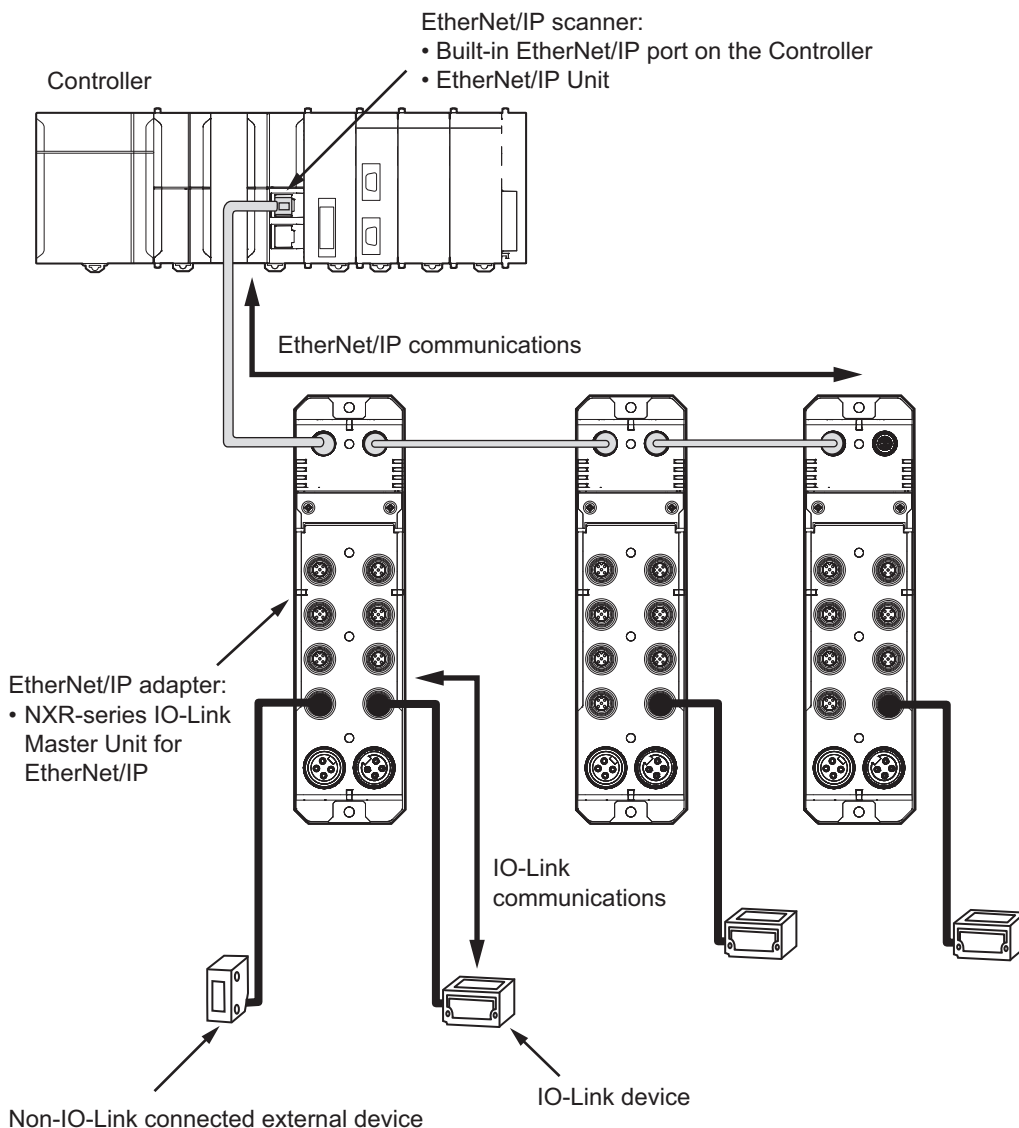
1-1-1   Introduction to EtherNet/IP

EtherNet/IP is an industrial multi-vendor network that uses Ethernet. The EtherNet/IP specifications are open standards managed by the ODVA (Open DeviceNet Vendor Association), just like DeviceNet. EtherNet/IP is not just a network between Controllers. It is also used as a field network. Because EtherNet/IP uses standard Ethernet technology, various general-purpose Ethernet devices can be used in the network.

1-1-2   Introduction to IO-Link

IO-Link is a standard interface for 1:1 (point-to-point) connections with sensors, actuators, or other devices as defined in international standard IEC 61131-9.
Devices that previously could not exchange digital I/O signals can now exchange information such as detected amounts.
Data exchange is possible using the following two types of communications.
- Cyclic communications to exchange specified data in a specific cycle with devices
- Message communications to access user-specified data in devices when required

You can also connect external devices such as non-IO-Link sensors or actuators that support only ON/OFF signals.

1-1-3   Functions of Port Pins and Connected External Devices

An NXR-series IO-Link Master Unit for EtherNet/IP has eight ports. You can connect the following external devices:
- IO-Link devices
- External devices such as non-IO-Link sensors or actuators

For pin 4 and pin 2 of each port, you can set a communications mode that is suitable for the connected external device. This enables the IO-Link Master Unit to exchange data with these connected external devices. The functions of these port pins and the connected external devices are given below. Refer to *10-2 Communications Mode Settings* on page 10-5 for details on the communications mode settings for pin 4 and pin 2.
Note that each port has pins that are numbered 1 to 4. They are called pin 1, pin 2, pin 3, and pin 4.

8 ports

Enlarged view of port

Pin 1
Pin 2
Pin 4
Pin 3

Non-IO-Link connected
external device
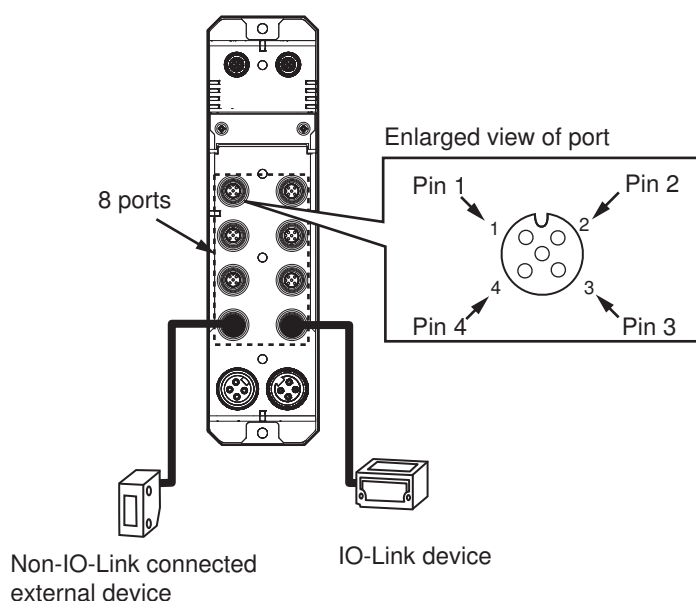
IO-Link device

Communications mode of port pin	Pin name	Function of port pin
IO-Link Mode	Pin 4	IO-Link communications function. Communicates with an IO-Link device.
	Pin 2	Pin 2 cannot be set to IO-Link Mode.
SIO (DI) Mode	Pin 4	Digital input function. Inputs the ON/OFF signals from the following input device. • Non-IO-Link input device
	Pin 2	Digital input function. Inputs the ON/OFF signals from the following input devices. • IO-Link device with digital outputs for pin 2 • Non-IO-Link input device
SIO (DO) Mode	Pin 4	Digital output function. Outputs the ON/OFF signals to the following output device. • Non-IO-Link output device
	Pin 2	Digital output function. Outputs the ON/OFF signals to the following output devices. • IO-Link device with digital inputs for pin 2 • Non-IO-Link output device

Pin1 and pin3 are used to device power supply + and device power supply -, respectively. Refer to *3-4-3 I/O Connectors* on page 3-10 for details on I/O connectors. Refer to *5-4-4 Wiring Examples* on page 5-23 for details on wiring with connected external devices.

1-2 Features of the IO-Link Master Unit

This section describes the following features of the NXR-series IO-Link Master Unit for EtherNet/IP.
- Features as an EtherNet/IP adapter
- Features as an IO-Link master

1-2-1 Features as an EtherNet/IP Adapter

The features of the NXR-series IO-Link Master Unit for EtherNet/IP as an EtherNet/IP adapter are described below.

● High-speed and High-capacity Data Exchange through Tag Data Links (Cyclic Communications)

The IO-Link Master Unit supports implicit communications and can perform cyclic communications with an EtherNet/IP scanner. In this manual, these cyclic communications are called tag data links. Large volumes of data can be sent to and from the EtherNet/IP scanner at high speed.
(Refer to *6-1 EtherNet/IP Communications* on page 6-2 and *9-8 Tag Data Links* on page 9-22.)

● Cyclic Communications at a Specified Cycle

Tag data links operate at the cyclic period specified for each connection, regardless of the number of nodes. Data is exchanged over the network at the refresh cycle set for each connection, so the communications refresh cycle will not increase even if the number of nodes is increased. Also, the concurrency of the connection's data is maintained. Since the refresh cycle can be set for each connection, each application can communicate at its ideal refresh cycle. For example, inter-process interlocks can be transferred at high speed, while the production commands and the status monitor information are transferred at low speed.
(Refer to *6-1 EtherNet/IP Communications* on page 6-2 and *9-8 Tag Data Links* on page 9-22.)

Note The communications load to the nodes must be within the Units' allowed communication bandwidth.

● Flexible Network Topology

Line, star, tree, and ring topologies are possible with the dual communications port configuration of the IO-Link Master Unit.
(Refer to *1-3-2 EtherNet/IP Topologies* on page 1-11.)

● DLR (Device Level Ring)

The IO-Link Master Unit is a Beacon-based ring node that supports DLR, which is a data-link layer protocol that provides single-fault tolerance. It allows for continuous communications even if a wire break occurs in a DLR network, which consists of a combination of a ring supervisor and IO-Link Master Units.
(Refer to *9-6 DLR (Device Level Ring)* on page 9-19.)

● Communications Cable Error Diagnosis

If one of the following errors occurs in a node, the IO-Link Master Unit can determine if the error cause is the communications cable. It also allows you to estimate where in the communications cable a break or short-circuit occurred.
- Connection timeout or connection open process timeout

- DLR Disconnection

This makes it easy to narrow down the error cause.

(Refer to *9-3 Communications Cable Diagnosis* on page 9-5.)

● **EtherNet/IP Communications Quality Check**

The IO-Link Master Unit records the total FCS error reception count in EtherNet/IP communications. You can use this total value to check the quality of EtherNet/IP communications.

(Refer to *9-4 Network Statistical Information Acquisition* on page 9-14.)

● **Unit Replacement without the Support Software**

You can replace the IO-Link Master Unit without the Support Software. Back up the device parameter settings in advance, replace it with a new Unit, and then use a user program to write the backed up settings to it.

The IO-Link Master Unit provides a CIP object that allows for setting the device parameters of an IO-Link Master Unit. To set an IO-Link Master Unit, send an explicit message from the user program in the Controller to access the object .

(Refer to *Replacing the IO-Link Master Unit without the Support Software* on page 13-5.)

1-2-2　Features as an IO-Link Master

The features of the NXR-series IO-Link Master Unit for EtherNet/IP as an IO-Link master are described below.

● **Reading Various Information from IO-Link Devices**

The IO-Link Master Unit exchanges data with IO-Link devices through IO-Link communications. This allows for reading various types of information. For example, the following information can be read.

- Input signals and status from IO-Link devices[1]
- Wire break, short-circuit, power ON status, and other information between the IO-Link Master Unit and IO-Link devices
- Analog data from IO-Link devices, such as the amount of incident light

Because the IO-Link Master Unit can cyclically read analog data such as the amount of incident light, it can be used for predictive maintenance based on detection of such things as decreases in the amount of light.

*1. Examples for photoelectric sensors: Instability detection, sensor error, etc.

● **Reading and Writing User-specified Data in IO-Link Devices**

You can read and write user-specified data in the IO-Link devices by sending an explicit message from the Controller or Network Configurator. This allows you to change IO-Link device parameter settings, monitor status, and perform operations, as needed.

(Refer to *6-2-2 Message Communications for IO-Link Communications* on page 6-10.)

● **Combining IO-Link Devices with Non-IO-Link Sensors or Actuators**

For each port of the IO-Link Master Unit, pin 4 and pin 2 support the following functions.

- Pin 4: IO-Link communications, digital inputs, and digital outputs
- Pin 2: Digital inputs and digital outputs

Therefore, you can connect to combine IO-Link devices with non-IO-Link sensors or actuators. When you change from an existing system to an IO-Link Master Unit system, you can use existing non-IO-Link sensors or actuators.
(Refer to *1-1-3 Functions of Port Pins and Connected External Devices* on page 1-3.)

● **Checking for Incorrect Connections of IO-Link Devices When IO-Link Communications Start**

You can register in advance configuration settings information on the IO-Link devices that you connect to the IO-Link Master Unit to enable verifying the connections of the IO-Link devices when IO-Link communications start. This allows you to reduce commissioning and maintenance work.
(Refer to *10-7 IO-Link Device Verification* on page 10-15.)

● **Checking the Quality of IO-Link Communications**

The IO-Link Master Unit records the total number of lost frames in IO-Link communications. You can use this value to check the quality of IO-Link communications.
(Refer to *10-12 IO-Link Total Communications Lost Frames* on page 10-27.)

● **Identifying the Short-circuit Location in Connected External Devices**

The IO-Link Master Unit provides short-circuit detection and protection for connections with the IO-Link devices or non-IO-Link connected external devices that are connected to the IO-Link Master Unit. This makes it easy to identify the short-circuit location.
(Refer to *10-8 I/O Cable Short-circuit Detection* on page 10-18.)

● **Power Supply Voltage Monitoring**

You can monitor the voltage of the following power supplies to the IO-Link Master Unit.
• Unit/input power supply
• Output power supply
This allows you to easily determine whether power is suppled correctly to the IO-Link Master Unit.
(Refer to *10-9 Monitoring Unit/Input Power Supply Voltage* on page 10-20 and *10-10 Monitoring Output Power Supply Voltage* on page 10-23.)

● **Easy Replacement of IO-Link Devices**

The IO-Link Master Unit supports the backup/restore function specified by the IO-Link standard. Therefore, you can back up the parameter settings of IO-Link devices to the IO-Link Master Unit. When you replace the IO-Link device, the backed up settings are automatically restored to the new IO-Link device.
This allows you to replace IO-Link devices without the Support Software.
(Refer to *10-13 Backing Up and Restoring IO-Link Device Parameters* on page 10-31 and *13-2-3 Replacing IO-Link Devices* on page 13-6.)

1-3 System Configuration

This section describes the system configuration of the NXR-series IO-Link Master Unit for EtherNet/IP and the topologies of EtherNet/IP.

1-3-1 System Configuration of the IO-Link Master Unit

An example of a system configuration for an NXR-series IO-Link Master Unit for EtherNet/IP is shown below.

(A) Controller

(B) EtherNet/IP scanner

(N) Support Software for the Controller

EtherNet/IP port

(I) Communications cable
Ethernet/IP cable

(L) Network Configurator

(M) EDS files

(C) EtherNet/IP adapter:
NXR-series IO-Link Master Unit
for EtherNet/IP

(H) Ethernet switch

(J) CX-ConfiguratorFDT

(K) IODD files

(G) Non-IO-Link connected external device

Through-wiring for power supplies

(D) Unit/input
power supply

(E) Output
power supply

(F) IO-Link device:

NXR-series IO-Link I/O Hub

(G) Non-IO-Link connected external device

The description of each item is given below.

Let-ter	Item	Description
(A)	Controller	This is an OMRON CPU Unit or a controller from another company, connected to the IO-Link Master Unit through an EtherNet/IP adapter. It exchanges I/O data with the IO-Link Master Unit and executes a user program through EtherNet/IP. The following OMRON Controllers can be connected to the IO-Link Master Unit.[1] • NJ/NX-series CPU Unit • CJ/CP/CS-series PLC
(B)	EtherNet/IP scanner	The EtherNet/IP scanner monitors the status of the connections with EtherNet/IP adapters and exchanges I/O data with EtherNet/IP adapters through the EtherNet/IP network. It refers to the *originator* when opening a connection. The following OMRON EtherNet/IP scanners are available.[1] • EtherNet/IP Units, such as CJ1W-EIP21 and CS1W-EIP21 • Built-in EtherNet/IP port on an NJ/NX/CJ-series CPU Unit
(C)	EtherNet/IP adapter: NXR-series IO-Link Master Unit for Ether-Net/IP	The EtherNet/IP adapter outputs the data received from the EtherNet/IP scanner to a connected external device and sends the data input from a connected external device to the EtherNet/IP scanner through the EtherNet/IP network. It refers to the *target* when opening a connection. The NXR-series IO-Link Master Unit for EtherNet/IP is an EtherNet/IP adapter that provides IO-Link master functions. You can connect IO-Link devices and non-IO-Link connected external devices to the NXR-series IO-Link Master Unit for EtherNet/IP. It exchanges data with IO-Link devices through IO-Link communications.
(D)	Unit/input pow-er supply	The Unit/input power supply provides power to the IO-Link Master Unit for operation and interface with input devices. Connect an external power supply to the power sup-ply connector (input).[2]
(E)	Output power supply	The output power supply provides power for interface with output devices. Connect an external power supply to the power supply connector (input).[2]
(F)	IO-Link device: NXR-series IO-Link I/O Hub	The IO-Link device is a sensor, actuator, or other device that performs IO-Link com-munications with the IO-Link master.[3] The NXR-series IO-Link I/O Hub is an OMRON IO-Link device. It exchanges data with the NXR-series IO-Link Master Unit for EtherNet/IP in IO-Link communications. You can connect non-IO-Link connected external devices to the NXR-series IO-Link I/O Hub.
(G)	Non-IO-Link connected ex-ternal device	The non-IO-Link connected external device is a sensor, actuator, or other device that handles ON/OFF signals that are not supported by IO-Link.[3]
(H)	Ethernet switch	This is a relay device that connects multiple nodes. To prevent the increase of network traffic due to multicast packets, it is recommended to use an Ethernet switch with multicast filtering capability. To give priority to the trans-fer of tag data link packets when tag data links and message communications are executed on the same network, an Ethernet switch that enables QoS (Quality of Serv-ice) is required. Refer to the user's manual for your EtherNet/IP scanner for informa-tion on recommended Ethernet switches. Note that an Ethernet switch that supports the ring supervisor is required to configure a ring topology with an Ethernet switch.
(I)	Communica-tions cable	Use a double-shielded cable with aluminum tape and braiding of category 5 (100BASE-TX) or higher, and use straight wiring.
(J)	CX-Configura-torFDT[4]	The CX-ConfiguratorFDT is the Support Software to configure and monitor IO-Link de-vices that are connected to the IO-Link Master Unit. The above is an example of con-necting the CX-ConfiguratorFDT to IO-Link Master Units via Ethernet. Refer to *11-2-10 Going Online* on page 11-10 for other connection methods.

Let-ter	Item	Description
(K)	IODD files	These files contain IO-Link device definitions. The IODD files for OMRON's IO-Link devices are automatically installed when you install the CX-ConfiguratorFDT. OMRON IO-Link device files are available for download from the OMRON website.
(L)	Network Con-figurator*4	The Network Configurator is the Support Software to configure an EtherNet/IP net-work. For the IO-Link Master Unit, it is used for the following purposes. • Setting the device parameters of the IO-Link Master Unit • Setting the connection between the EtherNet/IP scanner and the IO-Link Master Unit The above is an example of connecting Network Configurator to IO-Link Master Units via Ethernet. Refer to *7-3-1 Going Online* on page 7-9 for other connection meth-ods.
(M)	EDS files	The EDS files contain information that is unique to the IO-Link Master Unit. You can load EDS files into the Network Configurator or other Support Software for EtherNet/IP network setup to easily allocate data and view or change settings. The EDS files for IO-Link Master Units are already installed in the Sysmac Studio or Network Configurator. You can obtain the EDS files for the latest models through the automatic update function.
(N)	Support Soft-ware for the Controller*4	The Support Software is used to configure the Controller and EtherNet/IP scanner, create user programs, and perform monitoring, and troubleshooting. The Support Software depends on the Controller that you use.

*1. Refer to *A-5 Version Information* on page A-67 for information on the unit versions of the OMRON Control-lers and EtherNet/IP scanners that can be connected to the IO-Link Master Unit.

*2. You can use through-wiring to supply power from the Unit/input power supply and output power supply to other IO-Link Master Units. It is also possible to supply power directly to each Unit. Refer to *Section 4 Designing the Power Supply System* on page 4-1 for details on the power supply system. Refer to *5-3 Connecting the Power Supplies* on page 5-11 for details on power supply cables.

*3. Refer to *5-4 Connecting I/O Cables* on page 5-19 for details on I/O cables for connecting the IO-Link Mas-ter Unit to IO-Link devices and non-IO-Link connected external devices.

*4. Refer to *1-4 Support Software* on page 1-15 for details on the Support Software used for systems with IO-Link Master Units.

1-3-2 EtherNet/IP Topologies

Line, star, and tree topologies are possible with the dual communications port configuration of the IO-Link Master Unit. Additionally, it is a Beacon-based ring node that supports DLR, and can be combined with the ring supervisor to configure a ring topology.

● Line

A topology that consists of more than one IO-Link Master Unit connected each other.
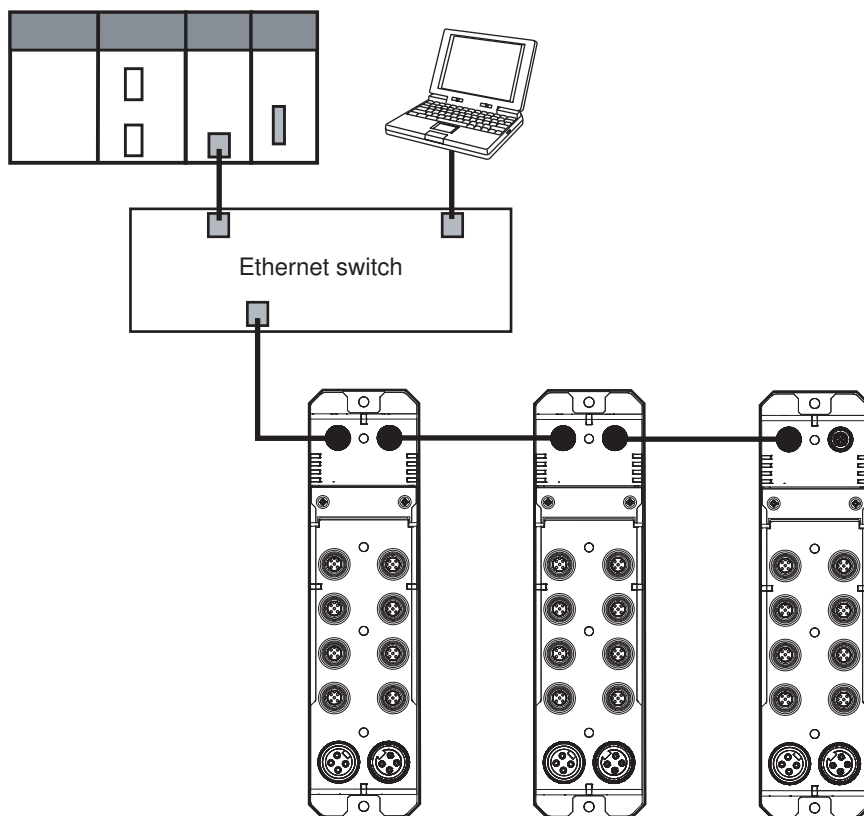
● **Star**

A topology that consists of more than one IO-Link Master Unit connected to an Ethernet switch.
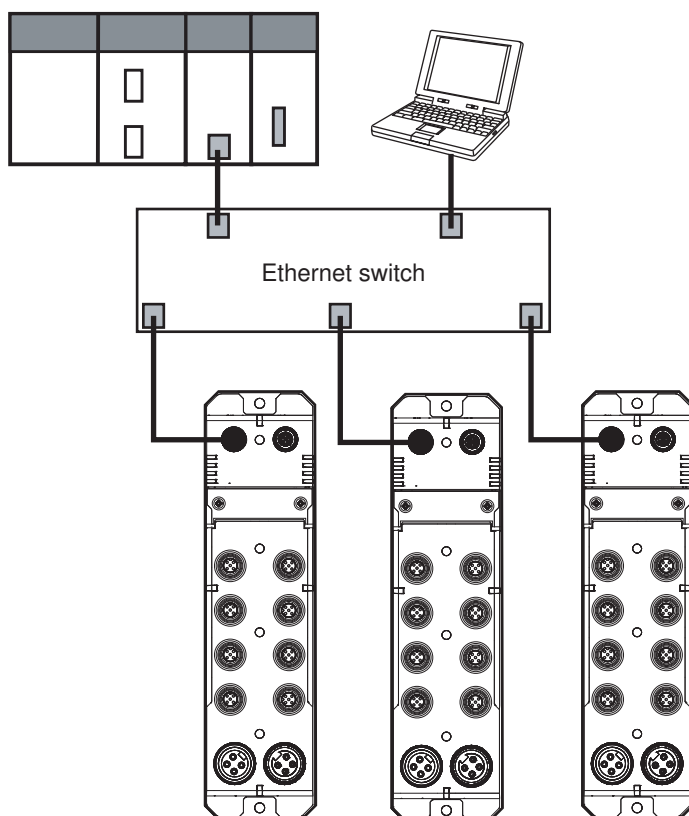
● **Tree**

A topology that consists of a combination of star and line topologies.
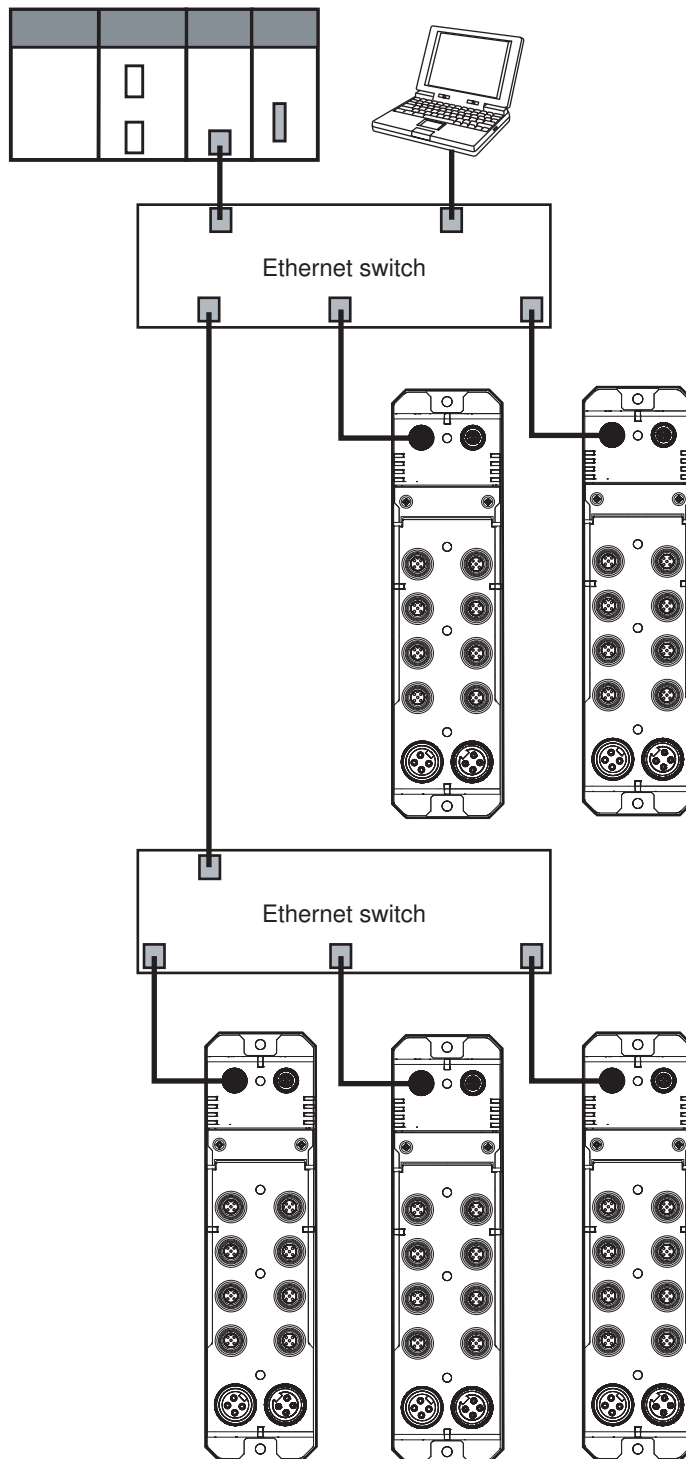
● **Ring**

A ring topology that consists of a combination of one ring supervisor and more than one IO-Link Master Unit. Refer to *9-6 DLR (Device Level Ring)* on page 9-19 for details on the ring topology.

Ring supervisor

NXR-series IO-Link Master Unit for EtherNet/IP User's Manual (W619)
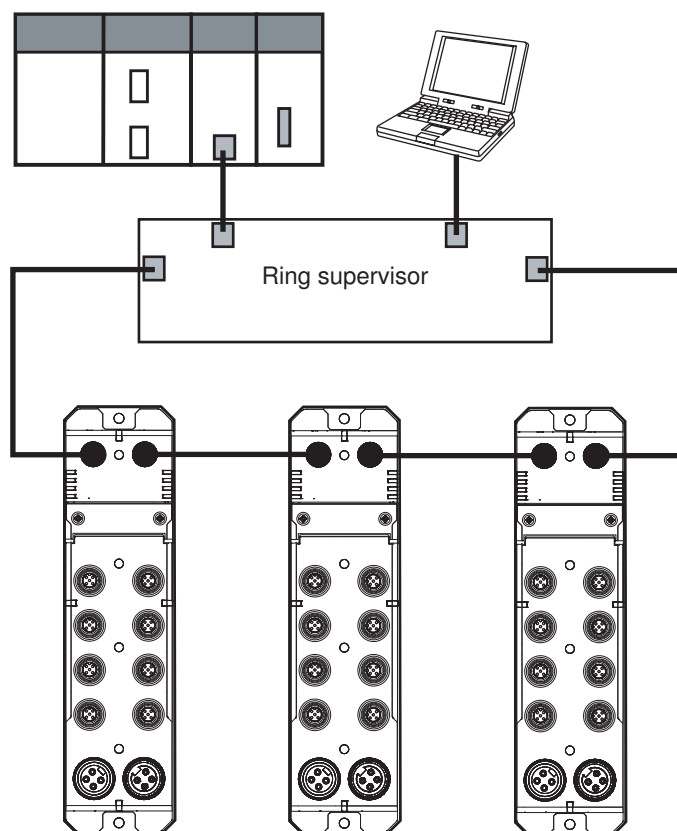
1-4 Support Software

The following table shows the Support Software that you can use to configure a system of the NXR-series IO-Link Master Unit for EtherNet/IP. Refer to *A-5 Version Information* on page A-67 for information on the Support Software versions.

Destination to which IO-Link Master Unit is connected		Applications and applicable Support Software			
Controller	EtherNet/IP scanner	Creating the user program	Setting connections	Setting the device parameters of the IO-Link Master Unit	Setting and monitoring IO-Link devices
NJ/NX-series CPU Unit	Built-in EtherNet/IP port on NJ/NX-series CPU Unit, or CJ1W-EIP21	Sysmac Studio	Sysmac Studio or Network Configurator	Network Configurator	CX-ConfiguratorFDT
CJ/CP/CS-series PLC	• EtherNet/IP Unit CJ1W-EIP21 or CS1W-EIP21 • Built-in EtherNet/IP port on CJ-series CPU Unit	CX-Programmer	Network Configurator		
Controller from another company	EtherNet/IP scanner from another manufacturer	Software from another manufacturer	Software from another manufacturer		

1-5 Functions of the IO-Link Master Unit

Refer to the following sections for details on the functions of the NXR-series IO-Link Master Unit for EtherNet/IP.

- *Section 9 Functions as an EtherNet/IP Adapter* on page 9-1
- *Section 10 Functions as an IO-Link Master* on page 10-1

2

Specifications and Application Procedures

This section describes the specifications and application procedures for the IO-Link Master Unit.

2-1 Specifications

This section describes the following specifications of the IO-Link Master Unit.

- General specifications
- EtherNet/IP communications specifications
- Unit specifications

2-1-1 General Specifications

Item		Specification
Degree of protection		IP67
Operating environment	Ambient operating temperature	-10 to 55°C
	Ambient operating humidity	25% to 85% (with no condensation)
	Atmosphere	Must be free from corrosive gases.
	Storage temperature	-25 to 65°C
	Storage humidity	25% to 85% (with no condensation)
	Altitude	2,000 m max.
	Pollution degree	3 or less: Conforms to IEC 61010-2-201.
	Noise immunity	2 kV on power supply line (Conforms to IEC 61000-4-4.)
	Overvoltage category	Category II: Conforms to IEC 61010-2-201.
	EMC immunity level	Zone B
	Vibration resistance	10 to 60 Hz with amplitude of 0.35 mm, 60 to 150 Hz and 50 m/s^2 80 min each in X, Y, and Z directions
	Shock resistance	150 m/s^2, 3 times each in 6 directions along X, Y, and Z axes
	Dielectric strength	600 VAC (between isolated circuits)
	Insulation resistance	20 MΩ min. (between isolated circuits)
Applicable standards		cULus: Listed (UL61010-2-201) EU: EN 61131-2, RCM KC: KC Registration EAC IO-Link conformance EtherNet/IP conformance

Note Refer to the OMRON website (www.ia.omron.com) or ask your OMRON representative for the most recent applicable standards.

2-1-2 EtherNet/IP Communications Specifications

Item	Specification
Communications protocols	EtherNet/IP protocol • Implicit messages (Class1) • Explicit messages (Class 3, UCMM)
Modulation	Baseband
Link speed	10 Mbps or 100 Mbps
Ethernet physical layer	100BASE-TX or 10BASE-T (100BASE-TX is recommended.)[*1]
Ethernet switch	Layer-2 switch

Item		Specification
Transmission media		Category 5 or higher twisted-pair cable (Recommended cable: double-shielded cable with aluminum tape and braiding)
Transmission distance		100 m or less (Distance between nodes and between hub and node)
Topology		Line, Star, Tree, Ring
Number of connected Units		• Line, Star No restrictions • Tree There is no restrictions in the number of cascade connections when an Ethernet switch is used. • Ring Dependent on the ring supervisor specifications.
EtherNet/IP tag data links	Number of connections	5[2]
	Packet interval (RPI)	1 to 10,000 ms
	Allowed communications bandwidth per Unit	4,000 pps
Explicit messages	Class 3 (number of connections)	5[2] However, the maximum number of connections per originator is 2
	UCMM (unconnected)	Supported[2]
EtherNet/IP I/O connection size		Input: 296 bytes max. (including input data, status, and unused areas) Output: 258 bytes max. (including output data and unused areas)
Support functions	Supported services	Tag data link, CIP message communications, automatic clock adjustment (NTP/SNTP client), BOOTP client, DHCP client
	IP address duplication detection	Provided
	Run/Idle header	Supported[3]
	QuickConnect	Supported
	DLR	Ring nodes supported

*1.　If tag data links are used, use 100BASE-TX.

*2.　The maximum number of connections is 10 when tag data links (Class 1), Class 3, and UCMM are used simultaneously.

*3.　You can configure output retention, clear, and other settings during Idle. Refer to *10-4 Output Settings during Communications Errors/Idle with EtherNet/IP Scanner* on page 10-8 for details.

2-1-3　Unit Specifications

Item	Specification
Unit name	IO-Link Master Unit
Model	NXR-ILM08C-EIT

Item		Specification
IO-Link specifications	IO-Link connector type	Class A
	Communications protocol	IO-Link protocol
	Number of ports	8
	Baud rate	COM1: 4.8 kbps COM2: 38.4 kbps COM3: 230.4 kbps
	Topology	1:1
	Compliant standards	• IO-Link Interface and System Specification Version1.1.2[1] • IO-Link Test Specification Version1.1.2
	Cable specifications	• Cable type: Unshielded • Cable length: 20 m max. • Electrostatic capacity between lines: 3 nF max. • Loop resistance: 6 Ω max.
Unit/input power supply voltage		24 VDC (20.4 to 26.4 VDC)
Output power supply voltage		24 VDC (20.4 to 26.4 VDC)
Maximum power supply current		9 A Sum of Unit/input power supply current and output power supply current
Number of connected Units when supplying power with through-wiring		No restrictions if power supply specifications are met.
Mounting method		Mounting with M5 screws
Mounting strength		100 N
Installation orientation and restrictions		Installation orientation: 6 possible orientations Restrictions: No restrictions
Connector types		• EtherNet/IP communications connectors: M12 (D-coding, female) × 2 • Power supply connectors: 7/8 inch (male) × 1, 7/8 inch (female) × 1 • I/O connectors: M12 (A-coding, female) × 8
Connector strength		30 N Applicable to all connectors
Screw tightening torque		• EtherNet/IP communications connectors and I/O connectors (M12 screw): 0.5 to 0.6 N·m • Power supply connectors (7/8 inch screw): 1.5 to 1.7 N·m • Unit mounting (M5 screw): 1.47 to 1.96 N·m • Rotary switch cover (M3 screw): 0.4 to 0.6 N·m • Waterproof covers for EtherNet/IP communications connectors (M12 screw): 0.5 to 0.6 N·m • Waterproof covers for power supply connectors (7/8 inch screw): 1.5 to 1.7 N·m
Maximum port current		4 A/port Total available current between pin 1 and pin 4
Device power supply[2] in IO-Link Mode or SIO (DI) Mode	Power supply used	Unit/input power supply
	Rated voltage	24 VDC (20.4 to 26.4 VDC)
	Maximum load current	2 A/pin
	Short-circuit protection	Provided[3]
	Short-circuit detection	Provided[3]

Item		Specification
Digital inputs for pin 4 or digital inputs for pin 2 (in SIO (DI) Mode)	Power supply used	Unit/input power supply
	Rated voltage	24 VDC (20.4 to 26.4 VDC)
	Internal I/O common	PNP
	Input current	• Digital inputs for pin 2: 3.0 mA (at 24 VDC) • Digital inputs for pin 4: 6.3 mA (at 24 VDC)
	ON voltage/ON current	• Digital inputs for pin 2: 15 VDC min, 2 mA min. • Digital inputs for pin 4: 15 VDC min, 3 mA min.
	OFF voltage/OFF current	5 VDC max, 1 mA max.
	ON/OFF response time	1.0 ms max.
	Input filter time	No filter, 0.25 ms, 0.5 ms, 1 ms (default), 2 ms, 4 ms, 8 ms, 16 ms, 32 ms, 64 ms, 128 ms, 256 ms
	Short-circuit protection	Provided[*3]
	Short-circuit detection	Provided[*3]
Digital outputs for pin 4 or digital outputs for pin 2 (in SIO (DO) Mode)	Power supply used	Output power supply
	Internal I/O common	PNP
	Output type	Open-drain
	Rated voltage	24 VDC (20.4 to 26.4 VDC)
	Maximum load current	2 A/pin
	Leakage current	0.1 mA max.
	Residual voltage	1.5 V max.
	ON/OFF response time	1.0 ms max.
	Short-circuit protection	Provided[*4]
	Short-circuit detection	Provided[*4]
Current consumption	Unit/input power supply	50 mA
	Output power supply	100 mA
Weight		440 g
Dimensions		240 × 24.2 × 62 mm (W×H×D) (The height is 38 mm when the connectors are included.)
Isolation method		No isolation

2-1 Specifications

2

2-1-3 Unit Specifications

Item	Specification
Circuit layout	
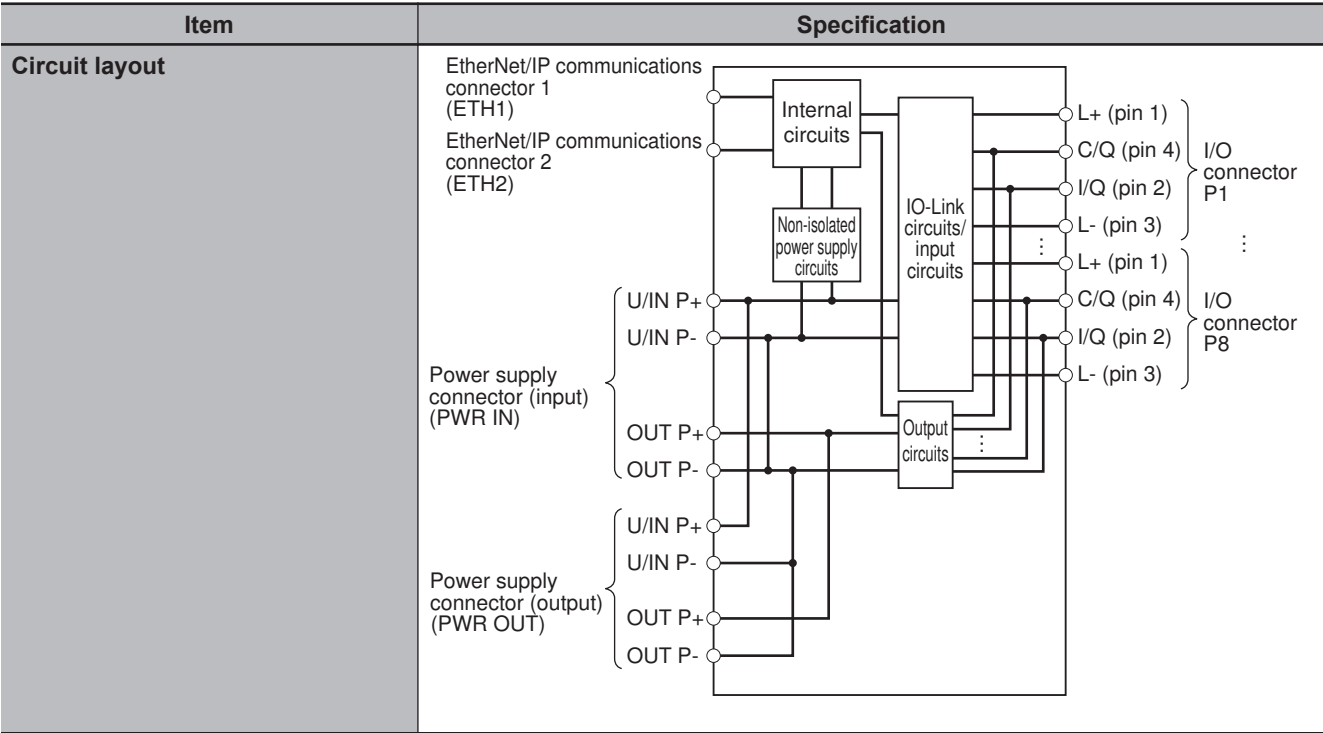
*1. This product does not support the IO-Link preoperate state.

*2. Used as a power supply for IO-Link devices or non-IO-Link input devices. Supplies power from the Unit/input power supply of the IO-Link Master Unit to external devices through I/O connectors.

*3. Detects a short-circuit that occurred between pin 1 and pin 3 to protect the IO-Link Master Unit.

*4. Detects a short-circuit that occurred between pin 2 and pin 3 and between pin 4 and pin 3 to protect the IO-Link Master Unit.

2-2   Application Procedures

This section describes the basic application procedures for the IO-Link Master Unit.

Step	Item		Description	Reference
1	Preparing for Work	Confirming Suitability of Specifications	Confirm that the following restrictions for the IO-Link Master Unit are met. • Design conditions for the Unit/input power supply and output power supply	*Section 4 Designing the Power Supply System* on page 4-1
2	Making Hardware Settings and Installing and Wiring the IO-Link Master Unit	IP Address Settings	Remove the rotary switch cover. Directly set the IP address with the hardware rotary switches. You can also use following methods to set the IP address. • Make software settings with the Network Configurator. • Get the IP address from the BOOTP server with hardware switches. • Get the IP address from the DHCP server with hardware switches To use any of the above methods, specify the setting method with rotary switches. After setting the IP address, install the rotary switch cover.	• *Installing the Rotary Switch Cover* on page 5-3 • *3-3 Rotary Switches* on page 3-8 • *7-3-2 IP Address Settings* on page 7-10
		Installation	Mount the IO-Link Master Unit with M5 screws.	*5-1-3 Installation Method* on page 5-2
		Wiring	Wire the IO-Link Master Unit. • Connect the communications cables. • Connect the power supply cables. • Connect the I/O cables.	• *5-2 EtherNet/IP Network Wiring* on page 5-4 • *5-3 Connecting the Power Supplies* on page 5-11 • *5-4 Connecting I/O Cables* on page 5-19
3	Turning ON the Power Supplies		Turn ON the Unit/input power supply and output power supply to the IO-Link Master Unit.	---
4	Setting TCP/IP and Automatic Clock Adjustment Settings for the IO-Link Master Unit		Create an EtherNet/IP network configuration with the Network Configurator. Make the TCP IP settings for the IO-Link Master Unit. If you perform software settings, set the IP address with the Network Configurator. Make the LINK Settings as necessary. Set the automatic clock adjustment with the Network Configurator.	• *7-3 Setting TCP/IP* on page 7-9 • *7-4 Setting the Automatic Clock Adjustment* on page 7-23
5	Setting the Device Parameters of the IO-Link Master Unit		Set the device parameters of the IO-Link Master Unit with the Network Configurator.	*7-5 Setting Device Parameters* on page 7-28
6	Downloading and Verifying the Device Parameters of the IO-Link Master Unit		Connect the Network Configurator online with the IO-Link Master Unit, and download the device parameters. Verify the parameters after downloading.	

Step	Item		Description	Reference
7	Setting and Transferring the IO-Link Device Parameters		Start the CX-ConfiguratorFDT, create a Network View, and set the IO-Link device parameters. Go online with the IO-Link devices through the IO-Link Master Unit, and transfer the parameters to the IO-link device.	*Section 11 Setting Up IO-Link Devices* on page 11-1
8	Setting Tag Data Links	Determining the Tag Sets for the IO-Link Master Unit	The IO-Link Master Unit provides input and output tag sets with different data size and contents. You must determine the tag sets to use depending on the I/O device that you connect to the port. If you connect an IO-Link device to a port, you must determine the tag sets by considering the data size. Check the maximum size of the process input data and process output data for the IO-Link device. Then, use input and output tag sets that can handle larger IO-Link data than the maximum size.	*7-7 Setting Tag Data Links* on page 7-62
		Creating Network Variables	Use the Support Software depending on the Controller that you connect, and create network variables corresponding to the tags required for the device to participate in tag data links. [1]	
		Setting the Tags, Tag Sets, and Connections	Create tags and tag sets for the EtherNet/IP scanner (originator) with the Network Configurator, and establish a connection with the IO-Link Master Unit. At this time, select the input tag set and output tag set that you determined at the beginning of this step.	
9	Downloading the Tag Data Link Parameters		Download the tags, tag sets, and connections that you set in step 8 into the EtherNet/IP scanner (originator). After they are downloaded, the tag data links start automatically.	
10	Checking Operation	Checking the Indicators	Check the indicators on the Controller, EtherNet/IP scanner, IO-Link Master Unit, and IO-Link devices to confirm that there is no error.	• User's manual for the CPU Unit that you use • User's manual for the EtherNet/IP scanner that you use • User's manuals for the IO-Link devices
		Checking the Wiring	Use the Support Software depending on the Controller that you connect. In Watch Tab Page, etc., read input data from and write output data to the IO-Link Master Unit to confirm that the wiring is completed correctly.	• Operation manual for the Support Software that you use
11	Creating the User Program		Create the user program with network variables. At this time, write the program so that it uses valid I/O data to make tag data links. Refer to *A-2-1 Tag Data Links with Valid I/O Data* on page A-38 for details on the sample programming.	• User's manual for the CPU Unit that you use • Operation manual for the Support Software that you use • *A-2-1 Tag Data Links with Valid I/O Data* on page A-38

*1. Create network variables only when the Controller that can handle network variables is used. For example, some models of the NJ/NX-series CPU Unit or CJ-series CPU Unit (CJ2H-CPU6□-EIP21 and CJ2M-CPU3□ only) are available. For Controllers that cannot handle network variables, use the I/O memory addresses of the CPU Unit for tags.

3

Part Names and Functions

This section describes the names and functions of the parts of the IO-Link Master Unit.

3-1   Parts and Names

This section gives the names of the parts of the IO-Link Master Unit.

Letter	Name	Function
(A)	EtherNet/IP communications connector 1	The connector for EtherNet/IP port 1. • M12 connector (D-coding, female) Connect a communications cable.
(B)	EtherNet/IP communications connector 2	The connector for EtherNet/IP port 2. • M12 connector (D-coding, female) Connect a communications cable.
(C)	I/O connectors	The connectors for connecting IO-Link devices or non-IO-Link connected external devices. They are called "ports." • M12 connectors (A-coding, female) Connect I/O cables.
(D)	Power supply connector (input)	The connector for supplying Unit/input power and output power. • 7/8 inch connector (male) Connect the power supply cable to an external power supply.
(E)	Power supply connector (output)	The connector for supplying Unit/input power and output power from the local node to another node. Use this connector when the power supply method is power supply with through-wiring. • 7/8 inch connector (female) Connect the power supply cable to an additional IO-Link Master Unit.
(F)	I/O indicators	The indicators that show the I/O status of pin 4/pin 1 and pin 2 for each port.

Letter	Name	Function
(G)	Cover mounting holes	The screw holes for mounting the rotary switch cover. They are provided in two locations. The above figure shows the holes when the cover is mounted with screws.
(H)	Rotary switches	The switches for setting the IP address.
(I)	Status indicators	The indicators that show the current operating status of the Unit.
(J)	Unit mounting hole	The holes for mounting the Unit. They are provided in two locations. Mount the Unit with M5 screws.

3-2 Indicators

The IO-Link Master Unit has the following indicators. These indicators are described below.

- Status indicators
- I/O indicators

3-2-1 Status Indicators
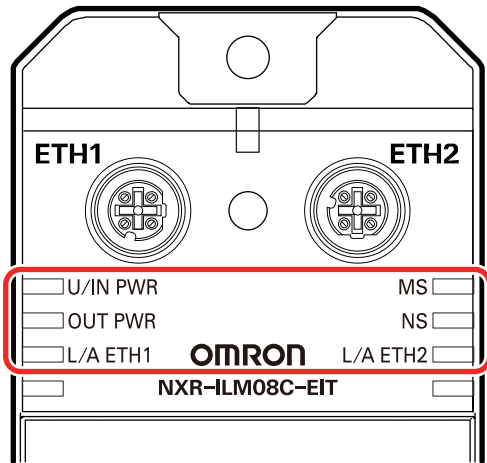
MS Indicator

The module status indicator. This indicator shows the operating status of the Unit.

Color	Status		Description
Green		Lit	The Unit is operating normally.
		Flashing	• The Unit is starting or restarting. • BOOTP/DHCP Server Connection Error • The Unit stopped operating due to the rotary switch setting FFFF (hex).
Red		Lit	One of the following unrecoverable errors was detected. • Non-volatile Memory Hardware Error • Unit Processing Error • Hardware failure
		Flashing	One of the following nonfatal errors was detected. • Non-volatile Memory Checksum Error • IP Address Duplication • TCP/IP Setting Error (Local IP Address) • Automatic Clock Adjustment Setting Error • NTP/SNTP Server Connection Error
Green/Red		Flashing	Initializing
---		Not lit	The Unit/input power is not supplied.

NS Indicator

The network status indicator. This indicator shows the status of the EtherNet/IP network.

Color		Status	Description
Green		Lit	Tag data link communications or explicit message communications (Class 3) is established and normal communications are in progress.[*1]
		Flashing	Tag data link communications or explicit message communications (Class3) is not established.[*2]
Red		Lit	IP Address Duplication
		Flashing	The Exclusive Owner connection timed out.
Green/Red		Flashing	Initializing
---		Not lit	• The Unit/input power is not supplied. • The IP address is not set. • The Unit stopped operating due to the rotary switch setting FFFF (hex).

*1. A state in which there are one or more established connections with the IP address obtained.
*2. A state in which there are no established connections and no occurrences of timeout in Exclusive Owner connections with the IP address obtained.

L/A ETH1 Indicator

The Link/Activity indicator for EtherNet/IP port 1. This indicator shows the linked status and communications status of EtherNet/IP port 1.

Color		Status	Description
Green		Lit	Link established
		Flashing	Link established and communications are active.
---		Not lit	No link established

L/A ETH2 Indicator

The Link/Activity indicator for EtherNet/IP port 2. This indicator shows the linked status and communications status of EtherNet/IP port 2.

Color		Status	Description
Green		Lit	Link established
		Flashing	Link established and communications are active.

Color	Status		Description
---	☐	Not lit	No link established

U/IN PWR Indicator

This indicator shows the status of the Unit/input power supply.

Color	Status		Description
Green	🟩	Lit	The Unit/input power is supplied.
---	☐	Not lit	The Unit/input power is not supplied.

OUT PWR Indicator

This indicator shows the status of the output power supply.

Color	Status		Description
Green	🟩	Lit	The output power is supplied.
---	☐	Not lit	The output power is not supplied.

3-2-2   I/O Indicators

These indicators show the I/O status of the ports.
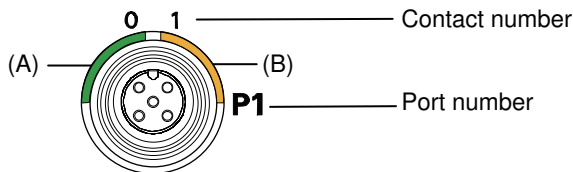
Example: I/O indicator for port 1

Letter	Name	Description
(A)	Pin 4/Pin 1 status indicator	This indicator shows the status of pin 4/pin 1 for each port. For each port, the contact numbers for digital input or digital output are given. Details are given below.[1] P1: 0, P2: 2, P3: 4, P4: 6, P5: 8, P6: 10, P7: 12, P8: 14
(B)	Pin 2 status indicator	This indicator shows the status of pin 2 for each port. For each port, the contact numbers for digital input or digital output are given. Details are given below.[1] P1: 1, P2: 3, P3: 5, P4: 7, P5: 9, P6: 11, P7: 13, P8: 15

[1]. Refer to *Pin 4/Pin 2 Digital Input Data* on page 7-52 in *7-6-3 Details on Input Assembly Data* on page 7-47 for details on I/O data during digital input. Refer to *Pin 4/Pin 2 Digital Output Data* on page 7-57 in *7-6-4 Details on Output Assembly Data* on page 7-57 for details on I/O data during digital output.

The details of each indicator are given below.

Pin 4/Pin 1 Status Indicator

This indicator shows the IO-Link communications status or digital I/O status for pin 4.

Color	Status		Description[1]			
			IO-Link Mode	**SIO (DI) Mode**	**SIO (DO) Mode**	**Disabled**
Green		Lit	IO-Link communications are in progress.	---	---	---
Yellow		Lit	---	The input is ON	The output is ON	---
Red		Flashing	One of the following occurred: • IO-Link Communications Error • Device Configuration Verification Error • Error-level Device Event • I/O Port Short-circuit Error Short-circuit between pin 1 and pin 3 or between pin 4 and pin 3	• I/O Port Short-circuit Error Short-circuit between pin 1 and pin 3	• I/O Port Short-circuit Error Short-circuit between pin 1 and pin 3 or between pin 4 and pin 3	• I/O Port Short-circuit Error Short-circuit between pin 1 and pin 3
---		Not lit	IO-Link communications are stopped.	The input is OFF	The output is OFF	No error occurred

*1.　--- means that the status is not defined.

Pin 2 Status Indicator

This indicator shows the digital I/O status for pin 2.

Color	Status		Description[1]		
			SIO (DI) Mode	**SIO (DO) Mode**	**Disabled**
Yellow		Lit	The input is ON	The output is ON	---
Red		Flashing	---	• I/O Port Short-circuit Error Short-circuit between pin 2 and pin 3	---
---		Not lit	The input is OFF	The output is OFF	The indicator is always not lit.

*1.　--- means that the status is not defined.

3-3 Rotary Switches

Use the rotary switches to set the IP address of the IO-Link Master Unit.

The pair of the third octet switches represents the first two hexadecimal digits, while the pair of the fourth octet switches represents the last two hexadecimal digits.

The setting range of the third and fourth octets are 00 to FF hex, and the default setting is 00 hex.

$x16^1$ $x16^0$ $x16^1$ $x16^0$

Third octet switches   Fourth octet switches
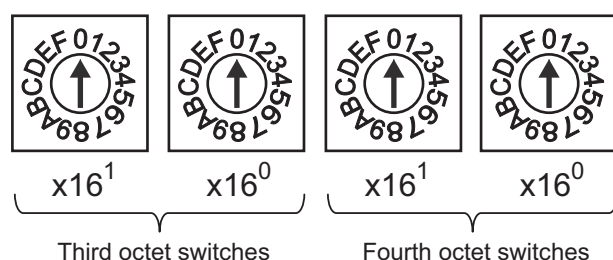
The meaning of the set value is as follows:

Set value (hex)		Description	Remarks
Third octet	Fourth octet		
00 to FF	00	Set the IP address with the Network Configurator. Select one of the following setting methods. • Directly set the IP address with the Network Configurator. • Get the IP address from the BOOTP server with the Network Configurator. • Get the IP address from the DHCP server with the Network Configurator.	By default, the IO-Link Master Unit operates with the following IP address: IP address: 192.168.250.1 Subnet mask: 255.255.255.0 Default gateway: 0.0.0.0
00 to FF	01 to FE	Directly set the IP Address with hardware switches.	---
00	FF	Get the IP address from the BOOTP server with hardware switches.	---
01	FF	Get the IP address from the DHCP server with hardware switches.	---
FF	FF	The IO-Link Master Unit does not operate even if you turn ON the Unit/input power supply. The IP address is set as follows. IP address: 192.168.250.1 Subnet mask: 255.255.255.0 Default gateway: 0.0.0.0	If you set this value, change the set value and cycle the Unit/input power supply.

3-4 Connectors

The IO-Link Master Unit has the following connectors. These connectors are described below.
- EtherNet/IP communications connectors
- Power supply connectors
- I/O connectors

3-4-1 EtherNet/IP Communications Connectors

The EtherNet/IP communications connectors are used for EtherNet/IP communications. In this manual, they are sometimes referred to as "communications connectors."
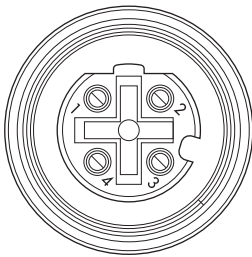
The specifications are as follows:
- Electrical specifications
  Conform to IEEE 802.3 standards.
- Connector structure
  M12 connector (D-coding, female, shielded) x 2
- Pin arrangement

Pin No.	Signal name	Description
1	TD+	Send data +
2	RD+	Receive data +
3	TD-	Send data -
4	RD-	Receive data -

3-4-2 Power Supply Connectors

The power supply connectors are used for supplying power to the IO-Link Master Unit.

PWR IN

Power supply connector
(input)

PWR OUT

Power supply connector
(output)
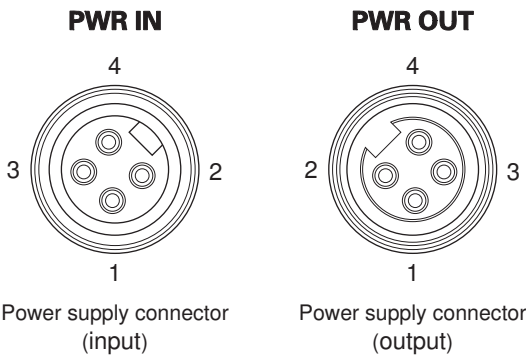
● **Power Supply Connector (Input)**

The connector for supplying the following power. Connect the power supply cable to an external power supply.

- Unit/input power supply
- Output power supply

● **Power Supply Connector (Output)**

The connector for supplying Unit/input power and output power from the local node to another node of the IO-Link Master Unit. Use this connector to supply power with through-wiring. Connect the power supply cable between IO-Link Master Units.

● **Specifications**

The specifications are as follows:

a. Connector structure

Power supply connector (input): 7/8 inch connector (male)

Power supply connector (output): 7/8 inch connector (female)

b. Pin arrangement

Both the power supply connector (input) and power supply connector (output) have the following pin arrangement.

Pin No.	Signal name	Description
1	OUT P+	Output power supply +
2	U/IN P+	Unit/input power supply +
3	U/IN P-	Unit/input power supply -[1]
4	OUT P-	Output power supply -[1]

*1. These signals are internally connected inside the Unit.

Precautions for Safe Use

The maximum power supply current is 9 A, which is the sum of the Unit/input power supply current and the output power supply current. Do not use the Unit beyond the maximum power supply current. Otherwise, an excess current flows through the power supply cable, and it may cause fire.

Precautions for Correct Use

Always use separate power supplies for the Unit/input power supply and the output power supply. If you supply power from the same power supply, load variations in output devices may cause malfunctions.

3-4-3 I/O Connectors

The I/O connectors are used for connecting IO-Link devices or non-IO-Link external devices.
They are called "ports".
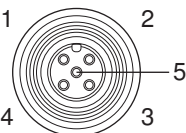
The specifications are as follows:

- Connector structure

  M12 connector (A-coding, female) × 8

- Pin arrangement

Pin No.	Pin name	Signal name	Description
1	Pin 1	L+	Device power supply +[1]

2	Pin 2	I/Q	One of the following functions is set depending on the communications mode setting.
			• Disable
			  Does not function. It is not used.
			• SIO (DI) Mode
			  Inputs digital signals (ON/OFF signals) from an input device.
			• SIO (DO) Mode
			  Outputs digital signals (ON/OFF signals) to an output device.

3	Pin 3	L-	Device power supply -[1]

4	Pin 4	C/Q	One of the following functions is set depending on the communications mode setting.
			• Disable
			  Does not function. It is not used.
			• IO-Link Mode
			  Performs IO-Link communications.
			• SIO (DI) Mode
			  Inputs digital signals (ON/OFF signals) from an input device.
			• SIO (DO) Mode
			  Outputs digital signals (ON/OFF signals) to an output device.

5	---	NC	Not used

[1]. It is used as a power supply for IO-Link devices or non-IO-Link input devices. The power is supplied from the Unit/input power supply of the IO-Link Master Unit to connected external devices through I/O connectors.

Precautions for Safe Use

The maximum port current is 4 A/port. Do not use the Unit beyond the maximum current. Otherwise, an excess current flows through the I/O connectors, and it may cause failure or fire.

4

Designing the Power Supply System

This section describes how to design the power supply system for the IO-Link Master Unit.

4-1 Power Supply Types and Power Supply System

This section describes the power suppl types and applications and the power supply system for the IO-Link Master Unit.

4-1-1 Power Supply Types and Applications

This section describes the power supply types and applications for the IO-Link Master Unit.

Power Supply Types

There are the following two types of power supplies that supply power to the IO-Link Master Unit.
- Unit/input power supply
- Output power supply

Power Supply Applications

The applications of the power supplies are given below.
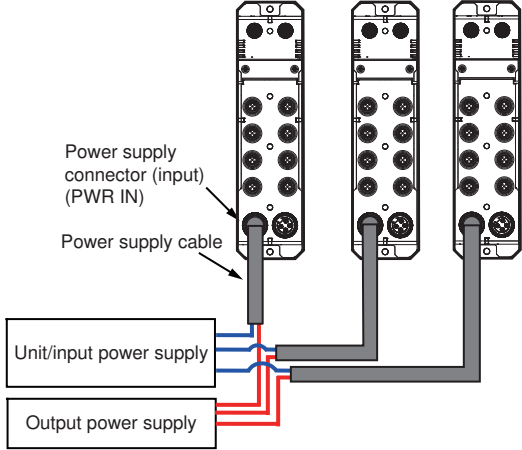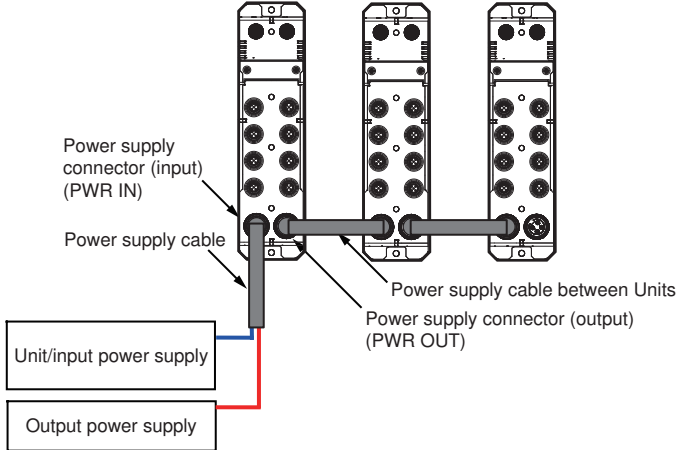
Type	Applications
Unit/input power supply	The Unit/input power supply provides power to the IO-Link Master Unit for operation and interface with input devices. The following are applications. • Operation of the internal circuits and input circuits of the IO-Link Master Unit • Power supply to IO-Link devices or non-IO-Link devices[1] • Input current from IO-Link devices with digital outputs for pin 2 • Input current from non-IO-Link input devices
Output power supply	The output power supply provides power for interface with output devices. The following are applications. • Operation of the output circuits of the IO-Link Master Unit • Load current to IO-Link devices with digital inputs for pin 2[2] • Load current to non-IO-Link output devices

*1. This is device power supply.
*2. Depending on the IO-Link device, load current may be used as the output power supply for IO-Link devices. For example, the Digital I/O Variable Hub of the NXR-series IO-Link I/O Hub (NXR-CD166C-IL2) uses load current for its output power supply. For applications of the load current for IO-Link devices, confirm the specifications of IO-Link device that you use.

4-1-2 Power Supply System

There are two methods to supply power to IO-Link Master Units as shown below.

Method	Description	Feature
Direct power supply	Connect the external power supplies to the power supply connector (input) of each IO-Link Master Unit. The power supply connector (output) is not used. Power supply connector (input) (PWR IN) Power supply cable Unit/input power supply Output power supply	This method does not cause voltage drop in through-wiring cables or due to connection through IO-Link Master Units.
Power supply with through-wiring	Connect the external power supplies to the power supply connector (input) of one IO-Link Master Unit. Then, connect the power supply connector (output) of the Unit to the power supply connector (input) of another IO-Link Master Unit with a power supply cable. In this way, supply power with through-wiring between the subsequent Units with power supply cables. The power supply connector (output) is used. Power supply connector (input) (PWR IN) Power supply cable Power supply cable between Units Power supply connector (output) (PWR OUT) Unit/input power supply Output power supply	Through-wiring can reduce the overall length of the power supply cables used in the system.

The details of system configuration are shown below.

● **System Configuration for Direct Power Supply**

An example is shown below. Connect the external power supplies to the power supply connector (input) of each IO-Link Master Unit.

You can also include Units that are connected to different external power supplies in the same EtherNet/IP network as shown below.

☑ **Precautions for Correct Use**

- Always use separate power supplies for the Unit/input power supply and the output power supply. If you supply power from the same power supply, load variations in output devices may cause malfunctions.
- If a short-circuit occurs in a Unit/input power supply or output power supply, the Unit/input power supply and output power supply to the IO-Link Master Unit may be turned OFF.

● **Power Supply System with Through-wiring**

An example is shown below. Connect the external power supplies to the power supply connector (input) of one IO-Link Master Unit. Then, connect the power supply connector (output) of the Unit to the power supply connector (input) of another IO-Link Master Unit with a power supply cable. In this way, connect a power supply cable between the subsequent Units with through-wiring one after another.
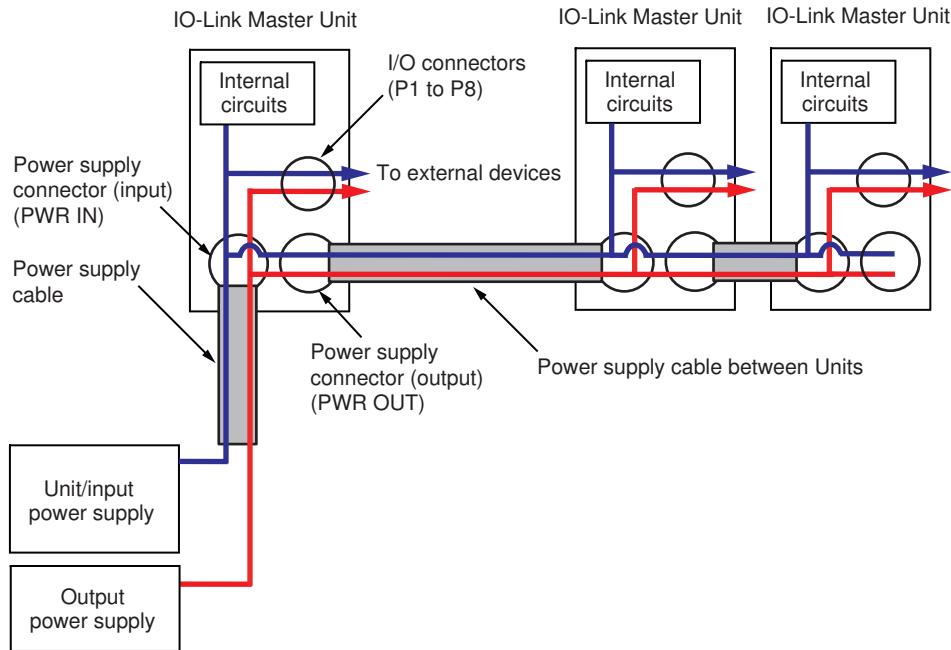
You can also include Units that are connected to different external power supplies in the same EtherNet/IP network as shown below.

Precautions for Correct Use

- Always use separate power supplies for the Unit/input power supply and the output power supply. If you supply power from the same power supply, load variations in output devices may cause malfunctions.
- If a short-circuit occurs in a Unit/input power supply or output power supply, the Unit/input power supply and output power supply to the IO-Link Master Unit may be turned OFF.

4-2   Designing the Power Supply System

This section describes how to design the power supply system for the IO-Link Master Unit.

> ## ⚠ WARNING
>
> Follow the instructions in this manual to correctly perform power supply design and wiring. Inputting voltages or currents that are outside of the specified ranges, as well as incorrect wiring, may cause failure or fire.

4-2-1   Procedure for Designing the Power Supply System

The overall procedure for designing the power supply system for the IO-Link Master Unit is as follows.

Step	Description	Reference
1. Determining the Power Supply Method	Determine the power supply method. There are the following two power supply methods. • Direct power supply • Power supply with through-wiring	*4-1-2 Power Supply System* on page 4-2
2. Designing the Power Supply System	Depending on the power supply method, perform the following design operations and then confirm that they meet the design conditions. • Designing the Unit/input power supply • Designing the output power supply	• For direct power supply *4-2-2 Design Method for Direct Power Supply* on page 4-7 • For power supply with through-wiring *4-2-3 Design Method for Power Supply System with Through-wiring* on page 4-13
3. Selecting External Power Supplies and Protective Devices	Calculate the power supply capacity from the current consumption calculated in step 2, and select external power supplies accordingly. In addition, select protective devices (e.g., breakers and fuses) to protect against short circuits and overcurrents in external circuits.	*4-3 Selecting Power Supplies and Protective Devices* on page 4-20

4-2-2   Design Method for Direct Power Supply

This section describes how to design the power supply system when the power supply method is direct power supply.

Design Procedure for Direct Power Supply

Confirm that the power supplies meet the following design conditions (a) to (c). Refer to the reference sections for the confirmation method.

Design condition	Reference for confirmation method
(a) The sum of the total current consumption from the Unit/input power supply and output power supply must not exceed the maximum power supply current of the IO-Link Master Unit.[*1]	*Calculating the Total Current Consumption in Direct Power Supply* on page 4-8
(b) The input circuit specifications of IO-Link Master Unit and the voltage specifications of connected external devices are met even if the Unit/input power supply voltage drops.[*2]	*Calculating the Voltage Drop in Direct Power Supply* on page 4-12
(c) The output circuit specifications of the IO-Link Master Unit and the voltage specifications of connected external devices are met even if the output power supply voltage drops.[*3]	

*1. The maximum power supply current is 9 A. Do not exceed 9 A.
*2. For example, for the IO-Link Master Unit, confirm that the Unit/input power supply voltage is 20.4 to 26.4 VDC.
*3. For example, for the IO-Link Master Unit, confirm that the output power supply voltage is 20.4 to 26.4 VDC.

Calculating the Total Current Consumption in Direct Power Supply

When the power supply method is direct power supply, power is supplied to each IO-Link Master Unit. Therefore, calculate the total current consumption of each Unit from each power supply. Design the system so that the sum of the total current consumption from each power supply is less than the maximum power supply current of the IO-Link Master Unit.

The calculation methods for the total current consumption of the IO-Link Master Unit from the Unit/input power supply and output power supply are given below.

● Total Current Consumption from Unit/Input Power Supply

= (Current consumption from Unit/input power supply)
   + (Current consumed between IO-Link Master Unit and IO-Link devices)
   + (Current consumed between IO-Link Master Unit and non-IO-Link input devices)

The items of the formula are described below.

Item	Description
Current consumption from Unit/input power supply	The current consumed by the IO-Link Master Unit. Use the *Unit/input power supply* value of *Current consumption* in *2-1-3 Unit Specifications* on page 2-3.
Current consumed between IO-Link Master Unit and IO-Link devices[*1]	Use the following formula to calculate this value. (Current consumption from power supplies of IO-Link devices) + (Input current[*2*3] × Number of inputs used)
Current consumed between IO-Link Master Unit and non-IO-Link input devices[*1]	Use the following formula to calculate this value. (Current consumption from power supplies of non-IO-Link input devices) + (Input current[*3] × Number of inputs used)

*1. Do not exceed the maximum load current of device power supply (2 A/pin) and the maximum port current (4 A/port).
*2. This is the input current from IO-Link devices with digital outputs for pin 2.
*3. This corresponds to *Input current* of *Digital inputs for pin 4 or digital inputs for pin 2 (in SIO (DI) Mode)* specified in *2-1-3 Unit Specifications* on page 2-3.

● **Total Current Consumption from Output Power Supply**

= (Current consumption from output power supply)

+ (Current consumed between IO-Link Master Unit and IO-Link devices)

+ (Current consumed between IO-Link Master Unit and non-IO-Link output devices)

The items of the formula are described below.

Item	Description
Current consumption from output power supply	The current consumed by the IO-Link Master Unit. Use the *Output power supply* value of *Current consumption* in *2-1-3 Unit Specifications* on page 2-3.
Current consumed between IO-Link Master Unit and IO-Link devices[1]	Use the following formula to calculate this value. (Load current[2] × Number of outputs used)
Current consumed between IO-Link Master Unit and non-IO-Link output devices[1]	Use the following formula to calculate this value. (Load current × Number of outputs used)

[1]. Do not exceed the maximum load current of the digital outputs for pin 2 and digital outputs for pin 4 (2 A/pin) and the maximum port current (4 A/port).

[2]. This is load current to IO-Link devices with digital inputs for pin 2.

Calculation Example for the Total Current Consumption in Direct Power Supply

The following shows how to calculate the total current consumption from the Unit/input power supply and output power supply for a given configuration and application conditions as an example.

● **Configuration Example**

Assume that there are three IO-Link Master Units: ILM1, ILM2, and ILM3 from the left.

Power supply connector (input) (PWR IN)

Power supply cable

Unit/input power supply

Output power supply
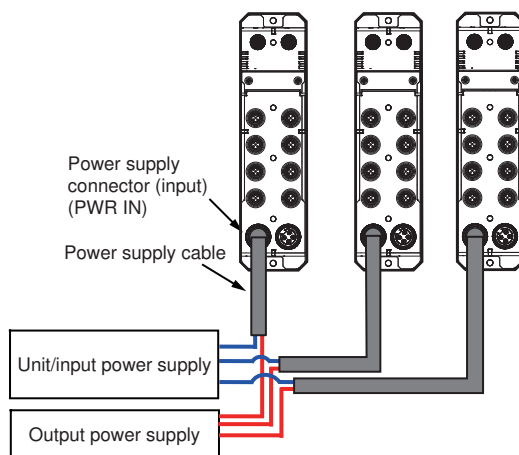
● **Application Conditions for Connected External Devices**

Assume that the following conditions are used for each IO-Link Master Unit. The conditions for ILM2 and ILM3 are the same.

Conditions for IO-Link Master Unit				Conditions for connected external device	
Unit name	Port setting			Product name	Specification
	Port name	Pin name	Communications mode		
ILM1	Port 1	Pin 4	IO-Link Mode	IO-Link device (with digital outputs for pin 2)	Current consumption: 50 mA
		Pin 2	SIO (DI) Mode (Input current: 3.0 mA)		
	Port 2	Pin 4	IO-Link Mode	IO-Link device (with digital inputs for pin 2)	• Current consumption: 50 mA • Load current for pin 2: 2 A
		Pin 2	SIO (DO) Mode		
	Port 3	Pin 4	SIO (DI) Mode (Input current: 6.3 mA)	Three-wire sensor	Current consumption: 30 mA
		Pin 2	SIO (DO) Mode	Solenoid valve	Load current: 1 A
	Ports 4 to 8	Pin 4	Disable setting	Not used	---
		Pin 2			
ILM2 and ILM3	Port 1	Pin 4	SIO (DI) Mode (Input current: 6.3 mA)	Three-wire sensor	Current consumption: 30 mA
		Pin 2	SIO (DI) Mode (Input current: 3.0 mA)		Current consumption: 30 mA
	Port 2	Pin 4	SIO (DO) Mode	Solenoid valve	Load current: 1 A
		Pin 2	SIO (DO) Mode		Load current: 1 A
	Ports 3 to 8	Pin 4	Disable setting	Not used	---
		Pin 2		Not used	---

● **Calculating the Total Current Consumption**

The items to calculate for the total current consumption of each IO-Link Master Unit from the Unit/input power supply and output power supply are as follows.

Unit name	Power supply type	Item to calculate for total current consumption	Calculation result
ILM1	Unit/input power supply	Current consumption from Unit/input power supply	50 mA according to the specifications of the IO-Link Master Unit
		Current consumed between IO-Link Master Unit and IO-Link devices	Ports 1 and 2 are calculated. (Current consumption from power supplies of IO-Link devices) + (Input current × Number of inputs used) = (50 mA + 50 mA) + (3.0 mA × 1 point) = 103.0 mA
		Current consumed between IO-Link Master Unit and non-IO-Link input devices	Port 3 is calculated. (Current consumption from power supplies of non-IO-Link input devices) + (Input current × Number of inputs used) = 30 mA + (6.3 mA × 1 point) = 36.3 mA

Unit name	Power supply type	Item to calculate for total current consumption	Calculation result
ILM2 and ILM3	Output power supply	Current consumption from output power supply	100 mA according to the specifications of the IO-Link Master Unit
		Current consumed between IO-Link Master Unit and IO-Link devices	Port 2 is calculated. (Load current × Number of outputs used) = 2 A × 1 point = 2 A
		Current consumed between IO-Link Master Unit and non-IO-Link output devices	Port 3 is calculated. (Load current × Number of outputs used) = 1 A × 1 point = 1 A
	Unit/input power supply	Current consumption from Unit/input power supply	50 mA according to the specifications of the IO-Link Master Unit
		Current consumed between IO-Link Master Unit and IO-Link devices	There is no port to calculate.
		Current consumed between IO-Link Master Unit and non-IO-Link input devices	Port 1 is calculated. (Current consumption from power supplies of non-IO-Link input devices) + (Input current × Number of inputs used) = (30 mA +30 mA) + (6.3 mA × 1 point + 3.0 mA × 1 point) = 69.3 mA
	Output power supply	Current consumption from output power supply	100 mA according to the specifications of the IO-Link Master Unit
		Current consumed between IO-Link Master Unit and IO-Link devices	There is no port to calculate.
		Current consumed between IO-Link Master Unit and non-IO-Link output devices	Port 2 is calculated. (Load current × Number of outputs used) = 1 A × 2 points = 2 A

From the above calculation results, the sum of the total current consumption of each IO-Link Master Unit is calculated as follows.

a. Sum of the total current consumption of ILM1
    (Total current consumption of ILM1 from Unit/input power supply) + (Total current consumption of ILM1 from output power supply)
    = (50 mA + 103.0 mA + 36.3 mA) + (100 mA + 2 A + 1 A)
    ≈ 3.29 A

b. Sum of the total current consumption of ILM2
    (Total current consumption of ILM2 from Unit/input power supply) + (Total current consumption of ILM2 from output power supply)
    = (50 mA + 69.3 mA) + (100 mA + 2 A)
    ≈ 2.22 A

c. Sum of the total current consumption of ILM3

The formula is the same as that of ILM2.

(Total current consumption of ILM3 from Unit/input power supply) + (Total current consumption of ILM3 from output power supply)

≈ 2.22 A

This example is acceptable because the sum of the total current consumption for each Unit is below 9 A, the maximum power supply current of the IO-Link Master Unit.

Calculating the Voltage Drop in Direct Power Supply

A power supply cable causes voltage drop.

Voltage drop in a power supply cable is calculated as a sum of the total current consumption from the Unit/input power supply and output power supply, which is shown in the following table.

Sum of Total current consumption from Unit/input power supply and output power supply (A)	Voltage drop for each power supply cable length (V)			
	1 m	3 m	5 m	10 m
9	0.90	1.53	2.07	3.60
8	0.80	1.36	1.84	3.20
6	0.60	1.02	1.38	2.40
4	0.40	0.68	0.92	1.60
3	0.30	0.51	0.69	1.20
2	0.20	0.34	0.46	0.80
1	0.10	0.17	0.23	0.40

Design the system so that the voltage specifications of the IO-Link Master Units and connected external devices are met even if the voltage of the Unit/input power supply and output power supply drops. The following shows an example of calculation. Follow the procedure described in this example to calculate voltage drop.

● Calculation Example for Voltage Drop

The following example explains how to calculate voltage drop under the following conditions.

Item	Conditions
Configuration	Use the conditions specified in *Calculation Example for the Total Current Consumption in Direct Power Supply* on page 4-9.
Application conditions for connected external devices	The conditions lead to the sum of total current consumption from each power supply by each Unit below: • ILM1: 3.29 A • ILM2: 2.22 A • ILM3: 2.22 A
Power supply cable length	• Power supply cable connected to ILM1: 1 m • Power supply cable connected to ILM2: 3 m • Power supply cable connected to ILM3: 5 m
Voltage at power supply terminal of external power supply	• Unit/input power supply: 24.0 VDC • Output power supply: 24.0 VDC

According to the table of voltage drop in power supply cables, the voltage drop for each Unit from each power supply is determined as follows.

Unit name	Voltage drop
ILM1	0.40 V (4 A is used because the cable length is 1 m and the total current consumption is 3.29 A.)
ILM2	0.51 V (3 A is used because the cable length is 3 m and the total current consumption is 2.22 A.)
ILM3	0.69 V (3 A is used because the cable length is 5 m and the total current consumption is 2.22 A.)

From the above results, the voltage of each input power supply to each Unit is calculated as follows.

a. Voltage of each input power supply to ILM1

Voltage of each power supply = 24.0 V - Voltage drop in power supply cables = 24.0 V - 0.40 V = 23.60 V

b. Voltage of each input power supply to ILM2

Voltage of each power supply = 24.0 V - Voltage drop in power supply cables = 24.0 V - 0.51 V = 23.49 V

c. Voltage of each input power supply to ILM3

Voltage of each power supply = 24.0 V - Voltage drop in power supply cables = 24.0 V - 0.69 V = 23.31 V

The above voltage values are acceptable because they meet the voltage specifications of each power supply.

Also, confirm that the voltage values meet the voltage specifications of the connected IO-Link devices or non-IO-Link external devices. However, this confirmation is omitted in this example.

If the voltage specifications are not met, review the length of power supply cable and the connected external devices.

4-2-3 Design Method for Power Supply System with Through-wiring

This section describes how to design the power supply system when the power supply method is power supply with through-wiring.

Procedure for Designing a Power Supply System with Through-wiring

Confirm that the power supplies meet the following design conditions (a) to (c). Refer to the reference sections for the confirmation method.

Design condition	Reference for confirmation method
(a) The sum of the total current consumption from the Unit/input power supply and output power supply must not exceed the maximum power supply current of the IO-Link Master Unit.[1]	*Calculating the Total Current Consumption in Power Supply with Through-wiring* on page 4-14

Design condition	Reference for confirmation method
(b) The input circuit specifications of IO-Link Master Unit and the voltage specifications of connected external devices are met even if the Unit/input power supply voltage drops.[*2]	*Calculating the Voltage Drop in Power Supply with Through-wiring* on page 4-17
(c) The output circuit specifications of the IO-Link Master Unit and the voltage specifications of connected external devices are met even if the output power supply voltage drops.[*3]	

*1. The maximum power supply current is 9 A. Do not exceed 9 A.
*2. For example, for the IO-Link Master Unit, confirm that the Unit/input power supply voltage is 20.4 to 26.4 VDC.
*3. For example, for the IO-Link Master Unit, confirm that the output power supply voltage is 20.4 to 26.4 VDC.

Calculating the Total Current Consumption in Power Supply with Through-wiring

When the power supply method is power supply with through-wiring, unlike the case of direct power supply, the current to be consumed by other IO-Link Master Units to which power is supplied flows through the IO-Link Master Unit connected to external power supplies. Therefore, confirm that the sum of the current consumption of the Units supplied from external power supplies does not exceed the maximum power supply current of the IO-Link Master Unit. The following is an example.
In this example, confirm that the following condition is met.

$(Iui1 + Iui2 + Iui3 + Io1 + Io2 + Io3) <$ (Maximum power supply current of ILM1[*1])
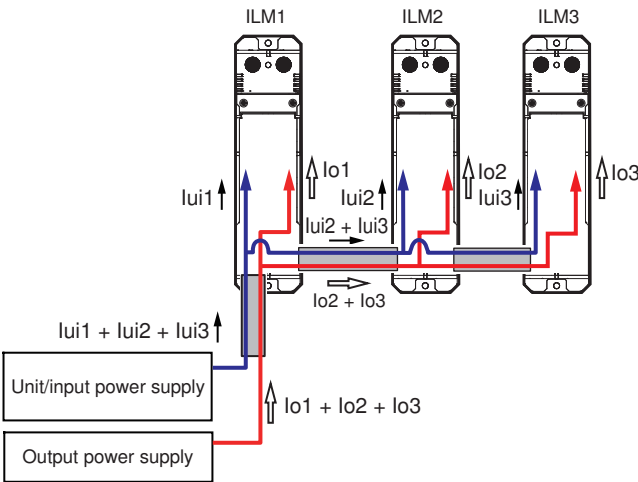
Iui1: Total current consumption of ILM1 from Unit/input power supply
Iui2: Total current consumption of ILM2 from Unit/input power supply
Iui3: Total current consumption of ILM3 from Unit/input power supply
Io1: Total current consumption of ILM1 from output power supply
Io2: Total current consumption of ILM2 from output power supply
Io3: Total current consumption of ILM3 from output power supply

*1. If the maximum power supply current of ILM1 is not exceeded, then that of ILM2 and ILM3 is not exceeded.

The calculation method for the total current consumption of each Unit from the Unit/input power supply or output power supply is the same as that for direct power supply. Refer to *Calculating the Total Current Consumption in Direct Power Supply* on page 4-8.

If the calculated value does not meet the specified condition, add external power supplies so that the condition is met.

Example: A system with additional external power supplies
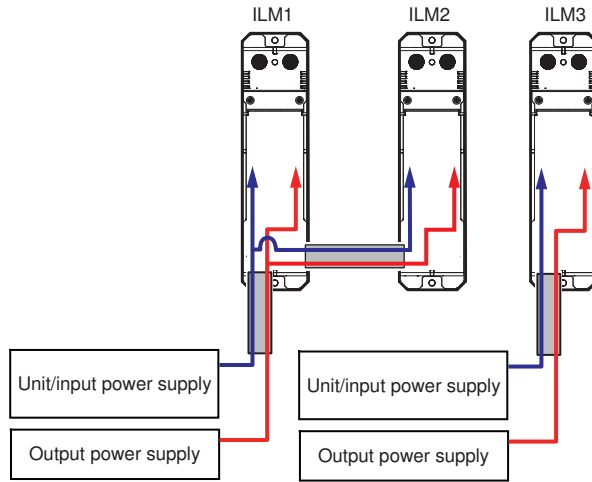
 **Precautions for Correct Use**

Be sure to add a set of Unit/input power supply and output power supply as shown below. It is not allowed to add either one of them.

NG
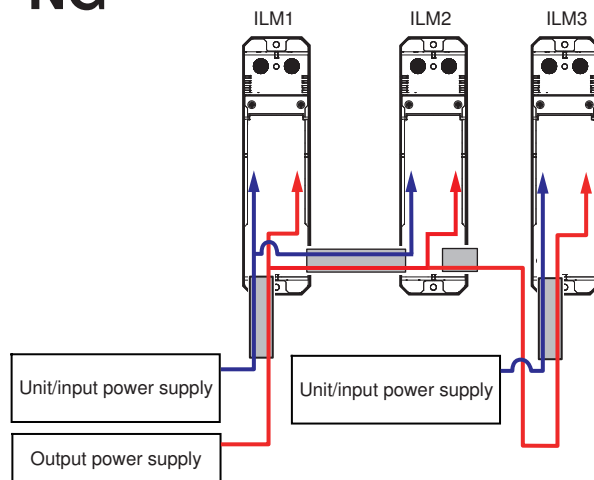
Calculation Example for the Total Current Consumption in Power Supply with Through-wiring

The following shows how to calculate the total current consumption when the power supply method is power supply with through-wiring for a given configuration and application conditions as an example.

● **Configuration Example**

Iui1: Total current consumption of ILM1 from Unit/input power supply
Iui2: Total current consumption of ILM2 from Unit/input power supply
Iui3: Total current consumption of ILM3 from Unit/input power supply
Io1: Total current consumption of ILM1 from output power supply
Io2: Total current consumption of ILM2 from output power supply
Io3: Total current consumption of ILM3 from output power supply

● **Application Conditions for Connected External Devices**

The conditions are the same as those in *Calculation Example for the Total Current Consumption in Direct Power Supply* on page 4-9.

● **Calculating the Total Current Consumption**

The total current consumption of each Unit is calculated as follows, according to *Calculation Example for the Total Current Consumption in Direct Power Supply* on page 4-9.

a. Sum of the total current consumption of ILM1
    (Total current consumption of ILM1 from Unit/input power supply) + (Total current consumption of ILM1 from output power supply)
    = (Iui1) + (Io1)
    = (50 mA + 103.0 mA + 36.3 mA) + (100 mA + 2 A + 1 A)
    ≈ 3.29 A

b. Sum of the total current consumption of ILM2
    (Total current consumption of ILM2 from Unit/input power supply) + (Total current consumption of ILM2 from output power supply)
    = (Iui2) + (Io2)
    = (50 mA + 69.3 mA) + (100 mA + 2 A)
    ≈ 2.22 A

c. Sum of the total current consumption of ILM3
    The formula is the same as that of ILM2.
    (Total current consumption of ILM3 from Unit/input power supply) + (Total current consumption of ILM3 from output power supply)

$$= (Iui3) + (Io3)$$

$$\approx 2.22 \text{ A}$$

The sum of the current consumption of each Unit supplied from external power supplies is calculated as follows.

(Iui1 + Iui2 + Iui3 + Io1 + Io2 + Io3)

= (3.29 A + 2.22 A + 2.22 A)

= 7.73 A

This example is acceptable because the calculation result is below 9 A, the maximum power supply current of the IO-Link Master Unit ILM1.

Calculating the Voltage Drop in Power Supply with Through-wiring

When the power supply method is power supply with through-wiring, voltage drop occurs due to the following elements.

- Internal circuits of IO-Link Master Units
- Power supply cables

When the power supply method is power supply with through-wiring, the current to be consumed by other IO-Link Master Units flows through each IO-Link Master Unit, which causes voltage drop in the internal circuits of the Units.
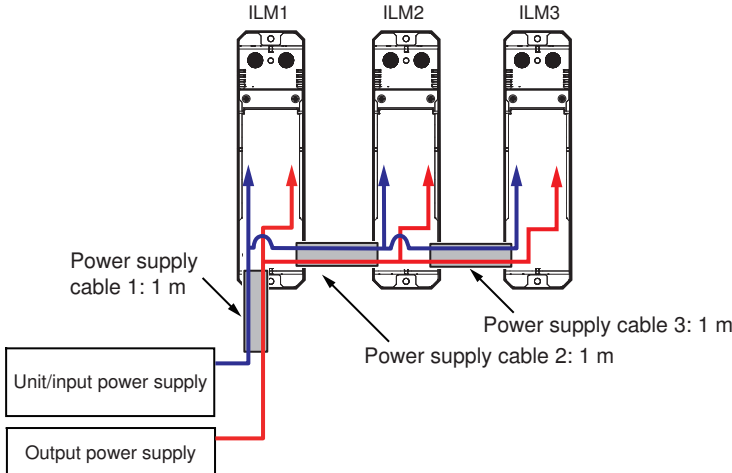
Voltage drop in the internal circuits of IO-Link Master Units and power supply cables is calculated as a sum of the total current consumption from the Unit/input power supply and output power supply, as shown in the table below.

Sum of Total current consumption from Unit/input power supply and output power supply (A)	Voltage drop in the internal circuits of Unit (V)	Voltage drop for each power supply cable length (V)			
		1 m	3 m	5 m	10 m
9	0.54	0.90	1.53	2.07	3.60
8	0.48	0.80	1.36	1.84	3.20
6	0.36	0.60	1.02	1.38	2.40
4	0.24	0.40	0.68	0.92	1.60
3	0.18	0.30	0.51	0.69	1.20
2	0.12	0.20	0.34	0.46	0.80
1	0.06	0.10	0.17	0.23	0.40

● Calculation Example for Voltage Drop

The following example explains how to calculate voltage drop under the following conditions.

Item	Conditions
Configuration	Use the conditions specified in *Calculation Example for the Total Current Consumption in Power Supply with Through-wiring* on page 4-15.
Application conditions for connected external devices	

Item	Conditions
Power supply cable length	The cable length is as follows. ILM1　ILM2　ILM3 Power supply cable 1: 1 m Power supply cable 3: 1 m Power supply cable 2: 1 m Unit/input power supply Output power supply
Voltage at power supply terminal of external power supply	• Unit/input power supply: 24.0 VDC • Output power supply: 24.0 VDC

According to the table of voltage drop in the internal circuits of IO-Link Master Units and power supply cables, the voltage drop for each Unit from each power supply is determined as follows.

Unit name	Voltage drop in internal circuits of Unit	Voltage drop in power supply cables	Remarks
ILM1	---	• Voltage drop in power supply cable 1: 0.80 V	Use the voltage drop at 8 A because the sum of the current consumption of each unit from external power supplies is 7.73 A.
ILM2	Voltage drop in internal circuits of ILM1: 0.36 V	• Voltage drop in power supply cable 1: 0.80 V • Voltage drop in power supply cable 2: 0.60 V	For the voltage drop in power supply cable 1, use the value of ILM1. For the voltage drop in power supply cable 2 and internal circuits of ILM1, use the current value calculated as follows. (Sum of current consumption of each Unit from external power supplies) - (Sum of total current consumption of ILM1) = 7.73 A - 3.29 A = 4.44 A Therefore, use the value at 6 A.
ILM3	• Voltage drop in internal circuits of ILM1: 0.36 V • Voltage drop in internal circuits of ILM2: 0.18 V	• Voltage drop in power supply cable 1: 0.80 V • Voltage drop in power supply cable 2: 0.60 V • Voltage drop in power supply cable 3: 0.30 V	For the voltage drop in power supply cable 1 and power supply cable 2, and voltage drop in the internal circuits of ILM1, use the values of ILM1 and ILM2. For the voltage drop in power supply cable 3 and internal circuits of ILM2, use the current value calculated as follows. (Sum of current consumption of each Unit from external power supplies) - (Sum of total current consumption of ILM1 and ILM2) = 7.73 A - 3.29 A - 2.22 A = 2.22 A Therefore, use the value at 3 A.

From the above results, the voltage of each input power supply to each Unit is calculated as follows.

a. Voltage of each input power supply to ILM1

Voltage of each power supply = 24.0 V - Voltage drop in power supply cable 1 = 24.0 V - 0.80 V
= 23.20 V

b. Voltage of each input power supply to ILM2

Voltage of each power supply

= 24.0 V - (Voltage drop in power supply cable 1 + Voltage drop in the internal circuits of ILM1 + Voltage drop in power supply cable 2)

= 24.0 V - (0.80V + 0.36 V + 0.60 V)

= 22.24 V

c. Voltage of each input power supply to ILM3

Voltage of each power supply

= 24.0 V - (Voltage drop in power supply cable 1 + Voltage drop in the internal circuits of ILM1 + Voltage drop in power supply cable 2 + Voltage drop in the internal circuits of ILM2 + Voltage drop in power supply cable 3)

= 24.0 V - (0.80 V + 0.36 V + 0.60 V + 0.18 V + 0.30 V)

= 21.76 V

The above voltage values are acceptable because they meet the voltage specifications of each power supply.

Also, confirm that the voltage values meet the voltage specifications of the connected IO-Link devices or non-IO-Link external devices. However, this confirmation is omitted in this example.

If the voltage specifications are not met, review the length of power supply cable and the connected external devices.

4-3 Selecting Power Supplies and Protective Devices

This section describes how to select the external power supplies, i.e., Unit/input power supply and output power supplies, and protective devices for the IO-Link Master Unit.

4-3-1 Selecting External Power Supplies

The following describes how to select the recommended power supplies for external power supplies and their power supply capacity.

Recommended Power Supplies

Use an SELV power supply that meets the following conditions for the Unit/input power supply and output power supply of the IO-Link Master Unit.
• Has overcurrent protection.
• Has double or reinforced insulation between the input and output.
• Has an output voltage of 24 VDC (20.4 to 26.4 VDC).

Recommended power supplies: S8VK-S Series (manufactured by OMRON)

Power Supply Capacity

Calculate the total current consumptions from the Unit/input power supply and output power supply of the IO-Link Master Unit and the power supply capacity of each power supply according to the calculation methods described in the following sections.
• *4-2-2 Design Method for Direct Power Supply* on page 4-7
• *4-2-3 Design Method for Power Supply System with Through-wiring* on page 4-13

Precautions for Safe Use

Inrush current may flow in the Unit/input power supply and output power supply in the following cases.
When power is turned ON.
When power supply to IO-Link devices is started.
When connected external devices are turned ON and OFF.

In addition, overcurrent may flow until the protection is activated when there is a short-circuit in I/O cables. Consider these currents and select power supplies with sufficient extra capacity. The inrush current may prevent the power supply from operating correctly, or cause the power supply to turn OFF.

4-3-2 Selecting Protective Devices

This section describes how to select protective devices (e.g., breakers and fuses) to protect against short circuits and overcurrents in external circuits.

Overcurrent is the current that flows when an excessive load is connected and one of the following ratings is exceeded.
- For the Unit/input power supply and output power supply (common), maximum power supply current and maximum port current
- For the Unit/input power supply, maximum load current from device power supplies to connected external devices
- For the output power supply, maximum load current of digital outputs for pin 2 or pin 4

Refer to *2-1-3 Unit Specifications* on page 2-3 for the above rated values.

Selecting Protective Devices

Consider the following items when you select protective devices.
- Protective device specifications (breaking/fusing, detection characteristics, steady current value, etc.)
- Inrush current when power is turned ON
- Inrush current when connected external devices are turned ON and OFF
- Inrush current when power supply to IO-Link devices is started

Installation Locations for Protective Devices

Install protective devices for each of the Unit/input power supply and output power supply as shown in the following figure.

5
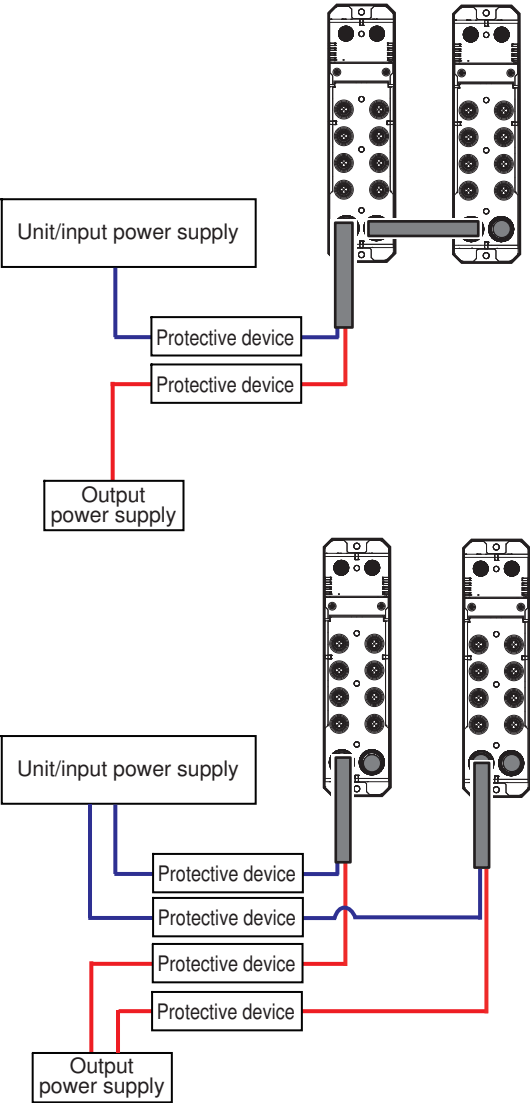
Installation and Wiring

This section describes how to install and wire the IO-Link Master Unit.

5

5-1 Installing Units

This section describes how to install the IO-Link Master Unit.

5-1-1 Installation Precautions

To increase the reliability of the IO-Link Master Unit and take complete advantage of its functionality, observe the following precautions.

Do not install the IO-Link Master Unit in the following locations.
- Locations subject to direct sunlight
- Locations subject to ambient temperatures or humidity outside the range specified in the specifications of the Unit
- Locations subject to condensation as the result of severe changes in temperature
- Locations subject to corrosive or flammable gases
- Locations subject to dust (especially iron dust) or salts
- Locations subject to exposure to acid, oil, or chemicals
- Locations subject to shock or vibration
- Locations close to power lines

Take appropriate and sufficient countermeasures during installation in the following locations.
- Locations subject to static electricity or other forms of noise
- Locations subject to strong electromagnetic fields
- Locations subject to possible exposure to radioactivity
- Locations close to power supply lines

5-1-2 Installation Orientations

The IO-Link Master Unit can be installed in any of the following six orientations.
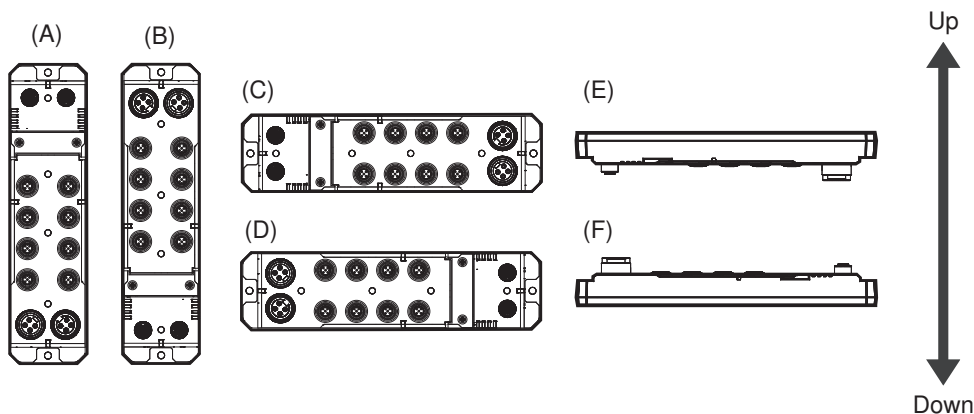
5-1-3 Installation Method

This section describes the following installation methods for the IO-Link Master Unit.
- Installing the rotary switch cover

• Installing the Unit

Installing the Rotary Switch Cover

Use the two cover mounting holes to install the rotary switch cover.

Cover mounting holes
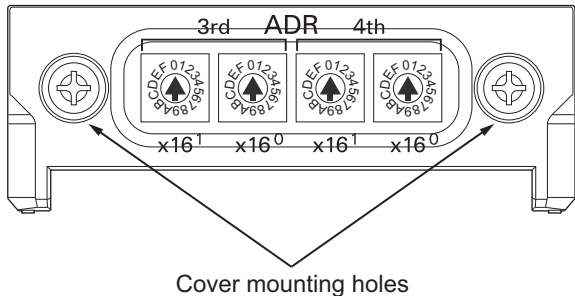
Tighten the M3 screws to the following torque. You can maintain the IP67 protective structure when the screws are tightened to the specified tightening torque.

Tightening location	Screw size	Tightening torque
Rotary switch cover mounting holes	M3	0.4 to 0.6 N·m

Precautions for Correct Use

• Do not allow oil to adhere to the screws. Oil adhesion may damage the screws.
• Tighten the screws with an appropriate screwdriver. Tightening a screw with an inappropriate screwdriver may damage the screw.

Additional Information

The cover is installed in the default settings.

Installing the Unit

Use the two Unit mounting holes with screws to install the IO-Link Master Unit.
The mounting holes are located near the upper and lower sides of the Unit. Refer to *A-4 Dimensions* on page A-66 for details on the installation dimensions.
Tighten the M5 screws to the following torque.

Tightening location	Screw size	Tightening torque
Unit mounting holes	M5	1.47 to 1.96 N·m

Precautions for Correct Use

• Install the Unit properly. The Unit may be affected by vibration if it is not installed properly, which may cause failure.
• Do not allow oil to adhere to the screws. Oil adhesion may damage the screws.
• Tighten the screws with an appropriate screwdriver. Tightening a screw with an inappropriate screwdriver may damage the screw.

5-2 EtherNet/IP Network Wiring

This section describes how to install the EtherNet/IP network for the IO-Link Master Unit. Refer to the user's manual for EtherNet/IP scanner that you use for how to wire an EtherNet/IP scanner.

5-2-1 Installation Precautions

Basic precautions for the installation of an EtherNet/IP network for the IO-Link Master Unit are provided below.

Precautions when Installing a Network

• When you install an EtherNet/IP network, take sufficient safety precautions and perform the installation according to all applicable standards and specifications.
  An expert well versed in safety measures and the standards and specifications should be asked to perform the installation.
• Do not install EtherNet/IP network equipment near sources of noise. If the network must be installed in an area with noise, take steps to address the noise, such as placing equipment in metal cases.

Precautions when Installing Communications Cables

• To maintain the IP67 protective structure of the IO-Link Master Unit, use communications cables with screw connectors shown in *5-5 Connected Devices* on page 5-32 and tighten the connectors to the specified tightening torque.
• To maintain the IP67 protective structure of the IO-Link Master Unit, tighten waterproof covers shown in *5-5 Connected Devices* on page 5-32 to the specified tightening torque to any unused communications connectors.
• Check the following items on the communications cables that are used in the network.
  Are there any breaks?
  Are there any shorts?
  Are there any connector problems?
• When you connect a communication cable to one of the communications connectors of the IO-Link Master Unit, tighten the screw connectors of the cable with a correct wiring tool.
• When you connect a communications cable to a device with RJ45 Modular Connectors, firmly insert the communications cable connector until it locks in place.
• Do not lay the communications cables together with high-voltage lines.
• Do not lay the communications cable near devices that generate noise.
• Do not lay the communications cables in locations subject to high temperatures or high humidity.
• Do not lay the communications cables in locations subject to excessive dust, oil mist, or other contaminants.
• There are limitations on the bending radius of communications cables. Check the specifications of the communications cable for the bending radius.
• Using a communications cable whose cable shield is not connected to the connector hoods at both ends may decrease noise immunity. For communications cables, use EtherNet/IP cables shown in

the Connected Devices section. These communications cables have a cable shield that is connected to the connector hoods at both ends.
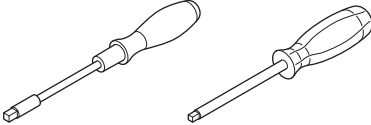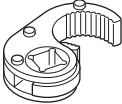
5-2-2 Preparing for Wiring

● Preparing Communication Cables

For communications cables, use the EtherNet/IP communications cables shown in *5-5 Connected Devices* on page 5-32.
Refer to *5-5-1 EtherNet/IP Cables* on page 5-32 for details.

● Preparing Tightening Tools

Use the following tools to tighten the M12 screw connectors of EtherNet/IP cables to a specified torque.

Name and appearance	Manufacturer	Model
• M12 torque handle Product, setting aid for torque • M12 attachment	Weidmuller	Screwty-M12-DM

5-2-3 Connecting Communications Cables

Cable connections can be made freely in EtherNet/IP networks.
The following example shows line topology.
Connect the communications cable from the EtherNet/IP scanner to one of the communications connectors on the first IO-Link Master Unit. Then, connect another communications cable from the other communications connector on the first Unit to one of the communications connectors on the next EtherNet/IP Slave Terminal.

Controller
Built-in EtherNet/IP port
(EtherNet/IP scanner)

EtherNet/IP communications connector 2 (ETH2)
Communications cable

Communications cable

EtherNet/IP communications
connector 1
(ETH1)

IO-Link Master Units
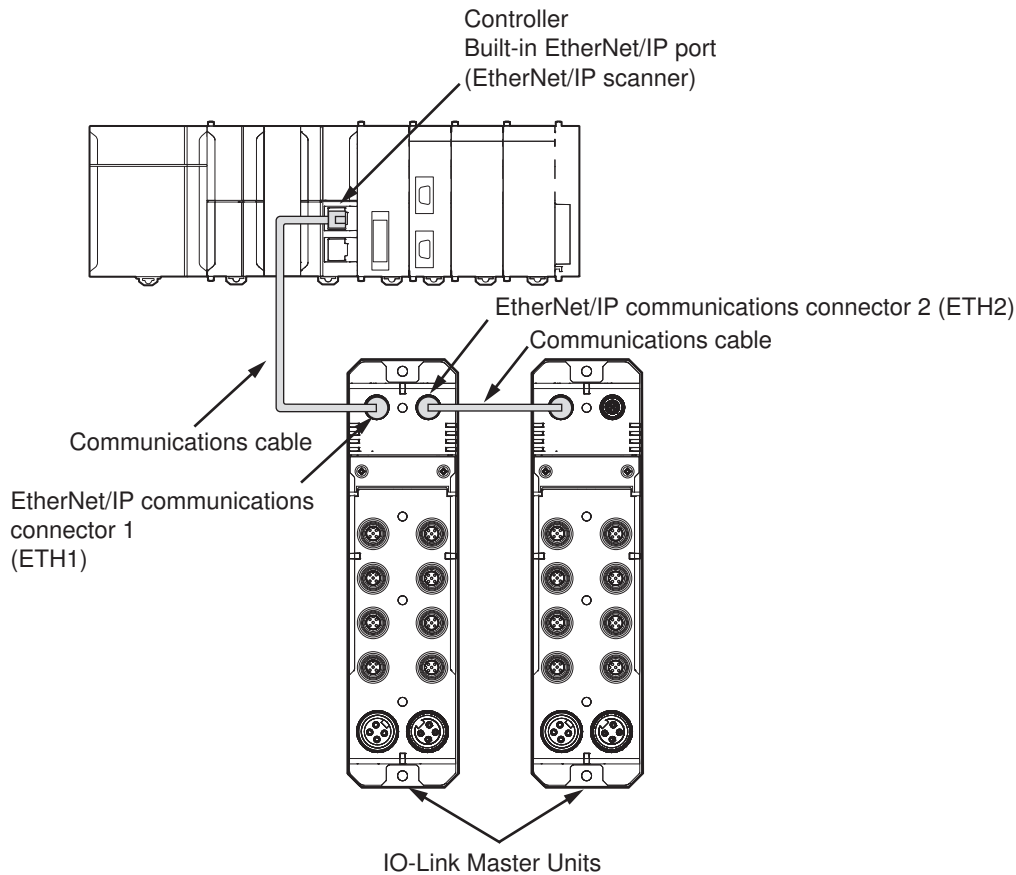
- There is no need to distinguish between the communications connectors, i.e., ETH1 and ETH2. To establish a star connection that uses only one connector, you can connect the communications cable to either ETH1 or ETH2.

Precautions for Correct Use

For the EtherNet/IP ports on the IO-Link Master Unit, configure the Link Settings as follows according to the QuickConnect Setting.

If QuickConnect Setting is Disable (Default):
Use Auto (default setting). If the devices to communicate with the IO-Link Master Unit use one of the following settings, the link will be unstable and prevent normal communications.
- 10 Mbps (fixed), Full Duplex
- 100 Mbps (fixed), Full Duplex
Therefore, connect the Unit to a device that supports the following communications modes. We recommend to set to Auto.
- Auto
- 10 Mbps (fixed), Half Duplex
- 100 Mbps (fixed), Half Duplex

If QuickConnect Setting is Enable:
Use the set values that are needed to obtain the starting characteristics of QuickConnect. Refer to *9-5 QuickConnect* on page 9-16 for details on the set values.

Refer to *7-3-3 Link Settings* on page 7-19 for details on the Link Settings for the IO-Link Master Unit.

The following describes the communications cable connection procedure, tightening torque, and waterproof covers.

Connection Procedure

Use the following procedures to connect a communications cable. Turn OFF the Unit/input power supply and output power supply to the IO-Link Master Unit and the external power supply to the devices to communicate with the IO-Link Master Unit before you connect a communication cable.

1 Push the M12 plug (male) of the EtherNet/IP cable into the communications connector (female) of the IO-Link Master Unit. At this time, be careful of the orientation of the communications connector.
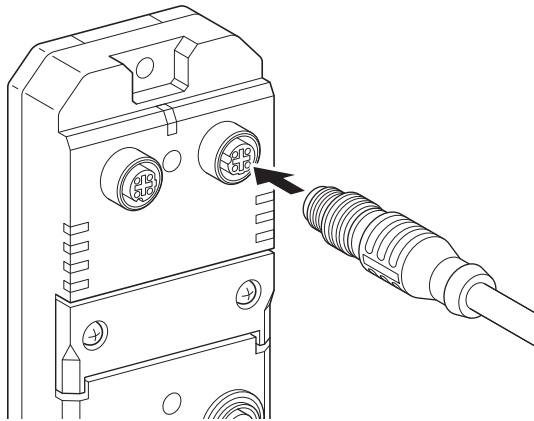
2 Rotate the M12 screw connector of the EtherNet/IP cable in the direction shown in the following figure to tighten it. Tighten the connector before tightening it to the specified torque.

M12 screw connector

3 Set the M12 torque handle to the specified torque. Then, insert the torque handle into the tightening hole of the M12 attachment. When you tighten the connector, place the M12 attachment in the orientation shown in the following figure and insert the torque handle.
Refer to *Tightening Torque* on page 5-9 for information on the specified torque.
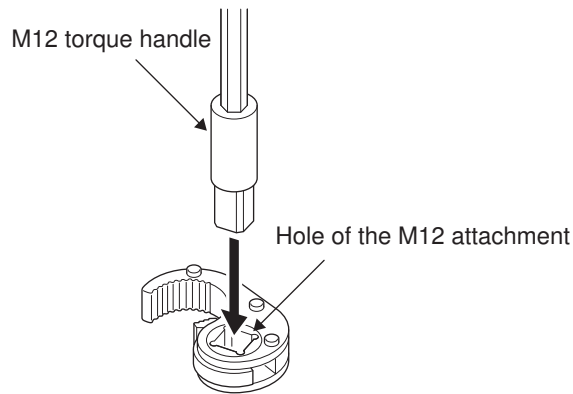
M12 torque handle

Hole of the M12 attachment

4   Mount the M12 attachment on the M12 screw connector of the EtherNet/IP cable. After you mount the M12 attachment, rotate the M12 torque handle in the direction shown in the following figure to tighten the M12 screw connector to the specified torque.

M12 torque handle

M12 attachment

M12 screw connector
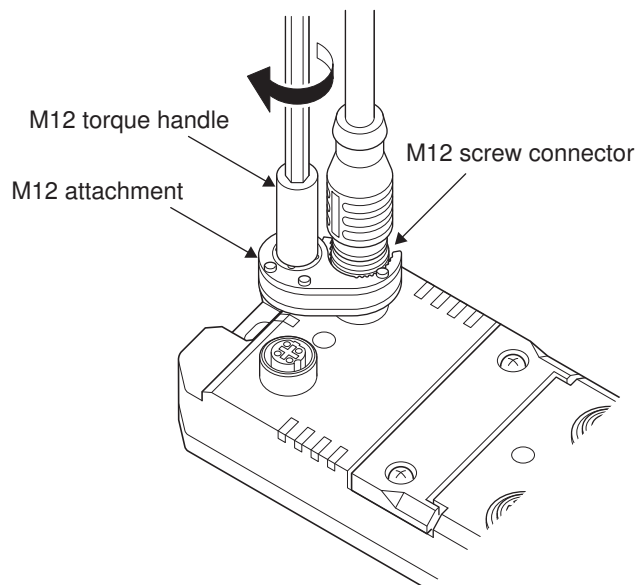
Removal Procedure

Use the following procedures to remove a communications cable. Turn OFF the Unit/input power supply and output power supply to the IO-Link Master Unit and the external power supply to the devices to communicate with the IO-Link Master Unit before you remove a communication cable.

1   Insert the M12 torque handle into the tightening hole of the M12 attachment. When you remove the connector, place the M12 attachment upside down, that is, in the opposite orientation to that for tightening.

M12 torque handle

Hole of the M12 attachment

2 Mount the M12 attachment on the M12 screw connector of the EtherNet/IP cable. After you mount the M12 attachment, rotate the M12 torque handle in the direction shown in the following figure to loosen the M12 screw connector.

M12 screw connector

M12 torque handle

M12 attachment

3 Rotate the M12 screw connector of the EtherNet/IP cable in the direction opposite to the connection direction.

Tightening Torque

Tighten the M12 screw connectors of EtherNet/IP cables to the following torque.
You can maintain the IP67 protective structure when the screw connectors are tightened to a suitable tightening torque.

Tightening location	Screw size	Tightening torque
EtherNet/IP communications connectors	M12	0.5 to 0.6 N·m

Waterproof Covers

Install waterproof covers for EtherNet/IP communications connectors on any unused EtherNet/IP connectors. For waterproof covers, use the M12 waterproof cover shown in *5-5 Connected Devices* on page 5-32. Refer to *5-5-4 Waterproof Covers for Connectors* on page 5-35 for details.
Tighten the waterproof covers to the following torque.
You can maintain the IP67 protective structure when the waterproof covers are tightened to a suitable tightening torque.

Tightening location	Screw size	Tightening torque
Waterproof covers for EtherNet/IP communications connectors (M12 waterproof covers)	M12	0.5 to 0.6 N·m

5-3 Connecting the Power Supplies

This section describes how to wire the Unit/input power supply and output power supply to the IO-Link Master Unit.

⚠ WARNING

- Make sure that the voltages and currents that are input to the Units and slaves are within the specified ranges.
  Inputting voltages or currents that are outside of the specified ranges may cause accidents or fire.
- Follow the instructions in this manual to correctly perform power supply design and wiring. Inputting voltages or currents that are outside of the specified ranges, as well as incorrect wiring, may cause failure or fire.
- Make sure that the grounds (0 V) of the Unit/input power supply and the output power supply are at the same potential.

5-3-1 Installation Precautions

Basic precautions for the installation of power supplies to the IO-Link Master Unit are provided below.

- To maintain the IP67 protective structure of the IO-Link Master Unit, use power supply cables with screw connectors shown in *5-5 Connected Devices* on page 5-32 and tighten the connectors to the specified tightening torque.
- To maintain the IP67 protective structure of the IO-Link Master Unit, tighten waterproof covers shown in *5-5 Connected Devices* on page 5-32 to the specified tightening torque to any unused communications connectors.
- Do not lay the communications cables in locations subject to high temperatures or high humidity.
- Do not lay the communications cables in locations subject to excessive dust, oil mist, or other contaminants.
- There are limitations on the bending radius of power supply cables. Check the specifications of the power supply cables for the bending radius.

5-3-2 Preparing for Wiring
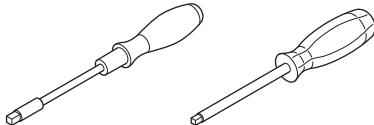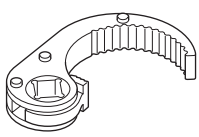
● Preparing Power Supply Cables

For power supply cables, use the power supply cables shown in *5-5 Connected Devices* on page 5-32.
Refer to *5-5-2 Power Supply Cables* on page 5-33 for details.

● Preparing Tightening Tools

Use the following M12 torque handle and M23 attachment to tighten the 7/8 inch screw connectors of power supply cables to a specified torque.

Name and appearance	Manufactur-er	Model	Remarks
M12 torque handle Product, setting aid for torque	Weidmuller	Screwty-M12-DM	The model on the left is a set of an M12 torque handle and an M12 attachment. Use the M12 attachment when you wire communications cables and I/O cables.
M23 attachment	Weidmuller	Screwty M23 LS	---

5-3-3　　Connecting Power Supply Cables to External Power Supplies

For external power supplies, use the power supply cables shown in *5-5 Connected Devices* on page 5-32, and connect the discrete wire end of the cable to external power supplies. Connect the 7/8 inch connector (female) to the power supply connector (input) (male) of the IO-Link Master Unit.

- 72MNf4□□□ or 72MNfL4□□□

The appearance of the model 72MNf4□□□ is shown below.
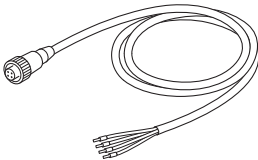
According to the following wiring diagram, connect the discrete wire end of the power supply cable to external power supplies.

PWR IN

Unit/input power supply
+
-

Output power supply
+
-

4
3
2
1
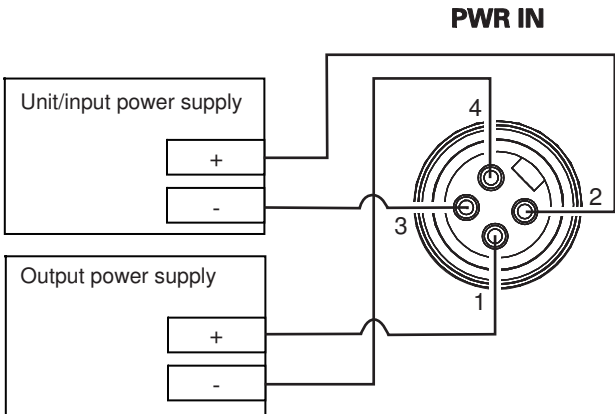
Pin arrangement of power supply connector (input)		External power supply wiring	Color of power supply cable discrete wire
Pin No.	Signal name		
1	OUT P+	Connect the positive (+) side of the output power supply.	Red
2	U/IN P+	Connect the positive (+) side of the Unit/input power supply.	Green
3	U/IN P-	Connect the negative (-) side of the Unit/input power supply.	White
4	OUT P-	Connect the negative (-) side of the output power supply.	Black

5-3-4 Connecting Power Supply Cables

There are two methods to supply external power to IO-Link Master Units as shown below.

- Direct power supply
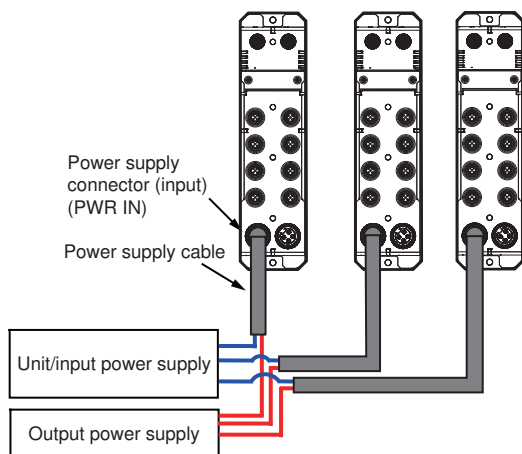
- Power supply with through-wiring
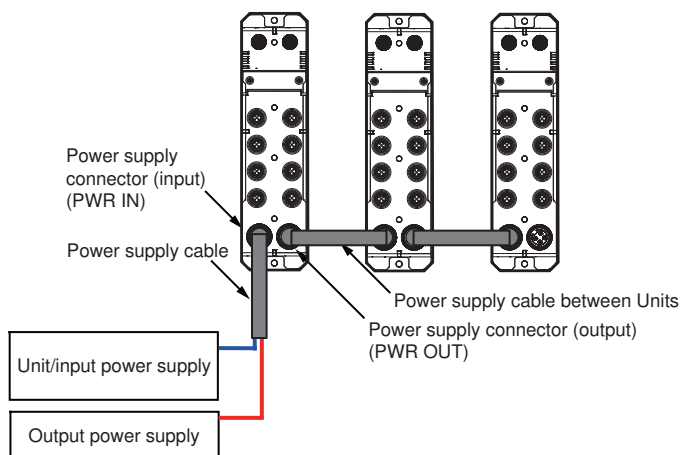
For the direct power supply, the power supply connector (output) of each IO-Link Master Unit is not used.

For the power supply with through-wiring, the power supply connector (output) of each IO-Link Master Unit is used. However, the power supply connector (output) of the last Unit to supply power is not used.

Refer to *4-1-2 Power Supply System* on page 4-2 for details on the power supply method.

Precautions for Safe Use

The maximum power supply current is 9 A, which is the sum of the Unit/input power supply current and the output power supply current. Do not use the Unit beyond the maximum power supply current. Otherwise, an excess current flows through the power supply cable, and it may cause fire.

Precautions for Correct Use

Always use separate power supplies for the Unit/input power supply and the output power supply. If you supply power from the same power supply, load variations in output devices may cause malfunctions.

The following describes the power supply cable connection procedure, tightening torque, and waterproof covers.

Connection Procedure

Use the following procedures to connect a power supply cable. Turn OFF the Unit/input power supply and output power supply before you connect a power supply cable.

1 Push the 7/8 inch connector (female) of the power supply cable into the power supply connector (input) (male) of the IO-Link Master Unit. At this time, be careful of the orientation of the power supply connector.
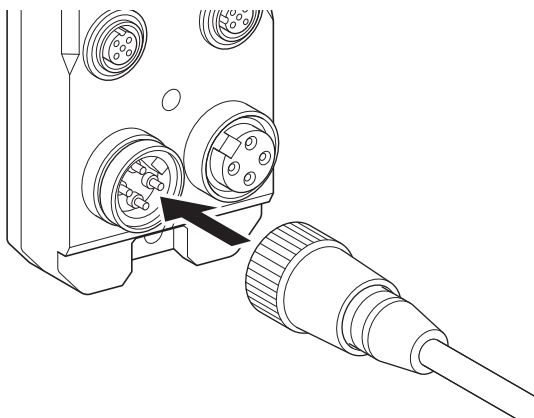
2 Rotate the 7/8 inch screw connector of the power supply cable in the direction shown in the following figure to tighten it. Tighten the connector before tightening it to the specified torque.

7/8 inch screw connector
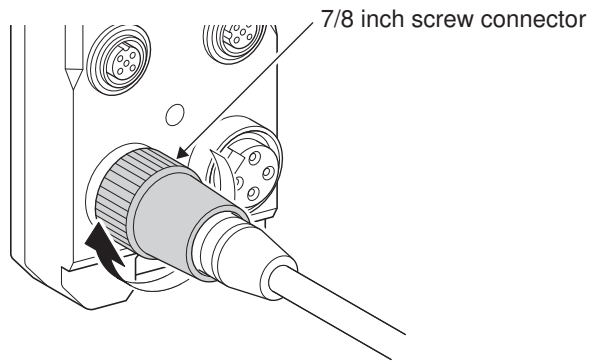
3 Set the M12 torque handle to the specified torque. Then, insert the torque handle into the tightening hole of the M23 attachment. When you tighten the connector, place the M23 attachment in the orientation shown in the following figure and insert the torque handle.
Refer to *Tightening Torque* on page 5-18 for information on the specified torque.
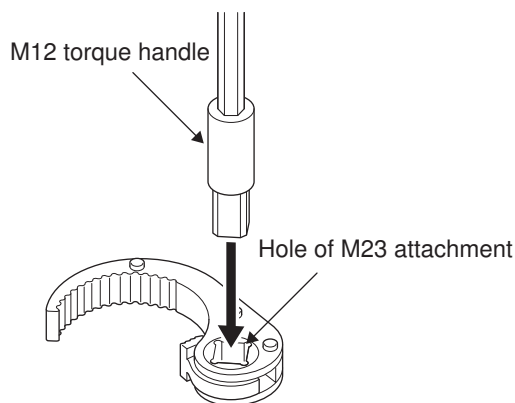
M12 torque handle

Hole of M23 attachment

4 Mount the M23 attachment on the 7/8 inch screw connector of the power supply cable. After you mount the M23 attachment, rotate the M12 torque handle in the direction shown in the following figure to tighten the 7/8 inch screw connector to the specified torque.

M12 torque handle

7/8 inch screw connector

M23 attachment
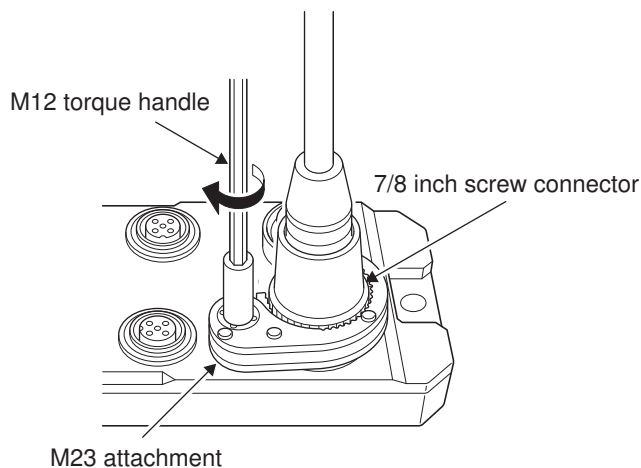
5 When the power is supplied with through-wiring, push the 7/8 inch connector (male) of the power supply cable into the power supply connector (output) (female) of the IO-Link Master Unit. At this time, be careful of the orientation of the power supply connector.

6 Rotate the 7/8 inch screw connector of the power supply cable in the direction shown in the following figure to tighten it. Tighten the connector before tightening it to the specified torque.

7/8 inch screw connector

7 Mount the M23 attachment on the 7/8 inch screw connector of the power supply cable. After you mount the M23 attachment, rotate the M12 torque handle in the direction shown in the following figure to tighten the 7/8 inch screw connector to the specified torque.

M12 torque handle

7/8 inch screw connector

M23 attachment

Removal Procedure
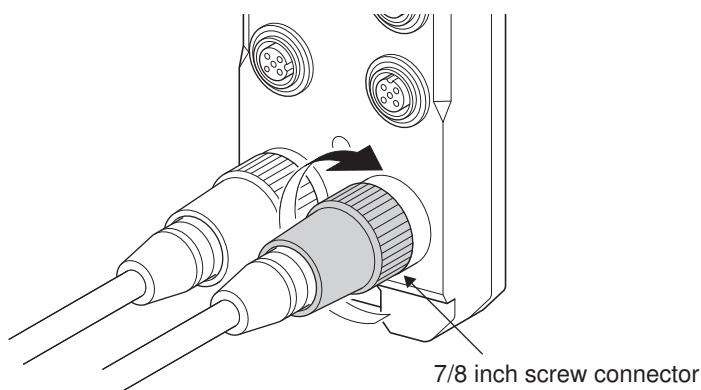
Use the following procedures to remove a power supply cable. Turn OFF the Unit/input power supply and output power supply before you remove a power supply cable.

1 Insert the M12 torque handle into the tightening hole of the M23 attachment. When you remove the connector, place the M23 attachment upside down, that is, in the opposite orientation to that for tightening.

M12 torque handle

Hole of M23 attachment
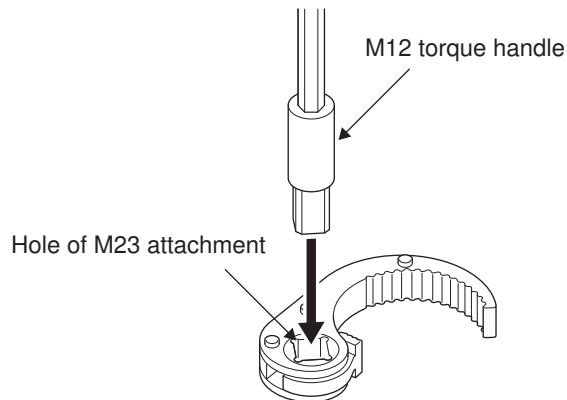
2 Mount the M23 attachment on the 7/8 inch screw connector of the power supply cable. After you mount the M23 attachment, rotate the M12 torque handle in the direction shown in the following figure to loosen the 7/8 inch screw connector.

7/8 inch screw connector   7/8 inch screw connector

M23 attachment

Power supply connector (input)   power supply connector (output)
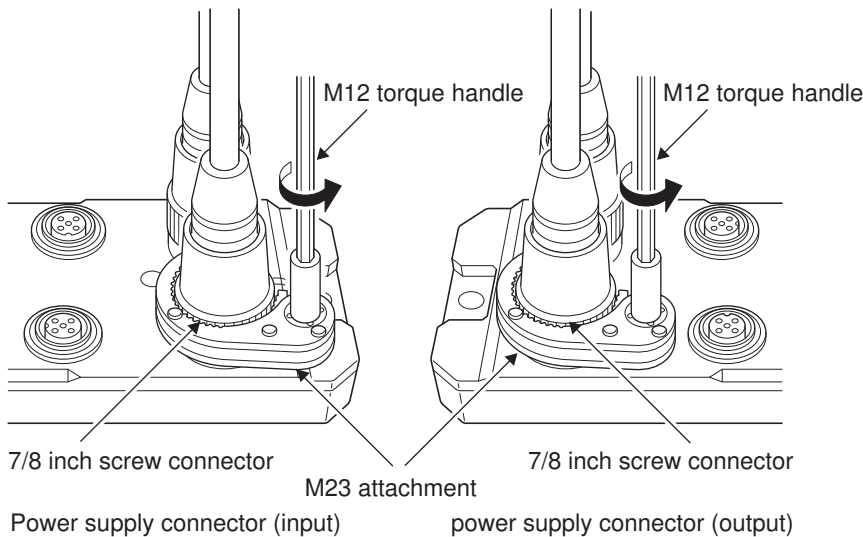
3   Rotate the 7/8 inch screw connector of the power supply cable in the direction opposite to the connection direction.

Tightening Torque

Tighten the 7/8 inch screw connectors of power supply cables to the following torque.
You can maintain the IP67 protective structure when the screw connectors are tightened to a suitable tightening torque.

Tightening location	Screw size	Tightening torque
Power supply connectors	7/8 inch	1.5 to 1.7 N·m

Waterproof Covers

Install waterproof covers for power supply connectors on any unused power supply connectors. For waterproof covers, use the 7/8 inch waterproof cover shown in *5-5 Connected Devices* on page 5-32. Refer to *5-5-4 Waterproof Covers for Connectors* on page 5-35 for details.
Tighten the waterproof covers to the following torque.
You can maintain the IP67 protective structure when the waterproof covers are tightened to a suitable tightening torque.

Tightening location	Screw size	Tightening torque
Waterproof covers for power supply connectors (7/8 inch waterproof covers)	7/8 inch	1.5 to 1.7 N·m

5-4 Connecting I/O Cables

This section describes how to wire I/O cables to IO-Link devices or non-IO-Link external devices.

5-4-1 Installation Precautions

Basic precautions for the installation of I/O cables to the IO-Link Master Unit are provided below.

- To maintain the IP67 protective structure of the IO-Link Master Unit, use I/O cables with screw connectors shown in *5-5 Connected Devices* on page 5-32 and tighten the connectors to the specified tightening torque.
- To maintain the IP67 protective structure of the IO-Link Master Unit, tighten waterproof covers shown in *5-5 Connected Devices* on page 5-32 to the specified tightening torque to any unused communications connectors.
- Do not lay the communications cables in locations subject to high temperatures or high humidity.
- Do not lay the communications cables in locations subject to excessive dust, oil mist, or other contaminants.
- There are limitations on the bending radius of I/O cables. Check the specifications of the I/O cables for the bending radius.
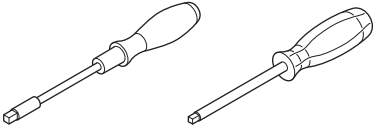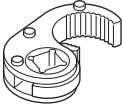
5-4-2 Preparing for Wiring

● Preparing I/O Cables

For I/O cables, use the I/O cables shown in *5-5 Connected Devices* on page 5-32.
Refer to *5-5-3 I/O Cables* on page 5-33 for details.

● Preparing Tightening Tools

Use the following tools to tighten the M12 screw connectors of I/O cables to a specified torque.

Name and appearance	Manufacturer	Model
• M12 torque handle Product, setting aid for torque • M12 attachment	Weidmuller	Screwty-M12-DM

5-4-3 Connecting I/O Cables

This section describes the I/O cable connection procedure, tightening torque, and waterproof covers.

Connection Procedure

Use the following procedures to connect an I/O cable. Turn OFF the Unit/input power supply and output power supply to the IO-Link Master Unit before you connect an I/O cable.

1 Push the M12 plug (male) of the I/O cable into the I/O connector (female) of the IO-Link Master Unit. At this time, be careful of the orientation of the I/O connector.
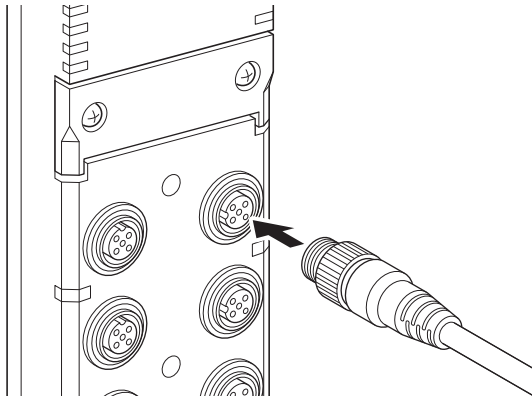
2 Rotate the M12 screw connector of the I/O cable in the direction shown in the following figure to tighten it. Tighten the connector before tightening it to the specified torque.

M12 screw connector
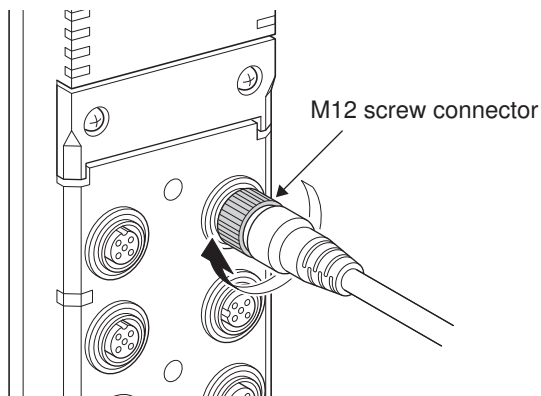
3 Set the M12 torque handle to the specified torque. Then, insert the torque handle into the tightening hole of the M12 attachment. When you tighten the connector, place the M12 attachment in the orientation shown in the following figure and insert the torque handle.
Refer to *Tightening Torque* on page 5-22 for information on the specified torque.
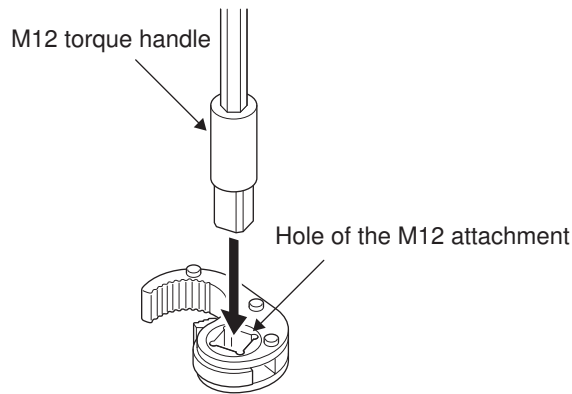
M12 torque handle

Hole of the M12 attachment

4 Mount the M12 attachment on the M12 screw connector of the I/O cable. After you mount the M12 attachment, rotate the M12 torque handle in the direction shown in the following figure to tighten the M12 screw connector to the specified torque.
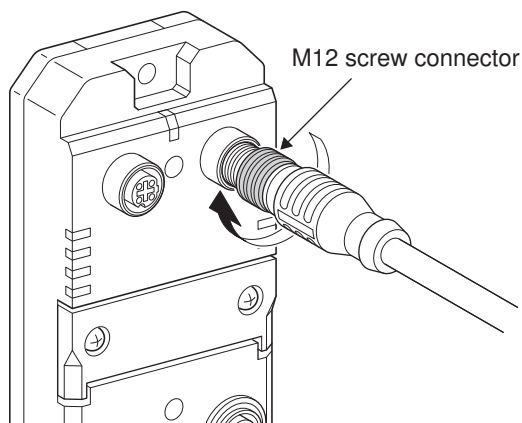

M12 torque handle

M12 screw connector

M12 attachment
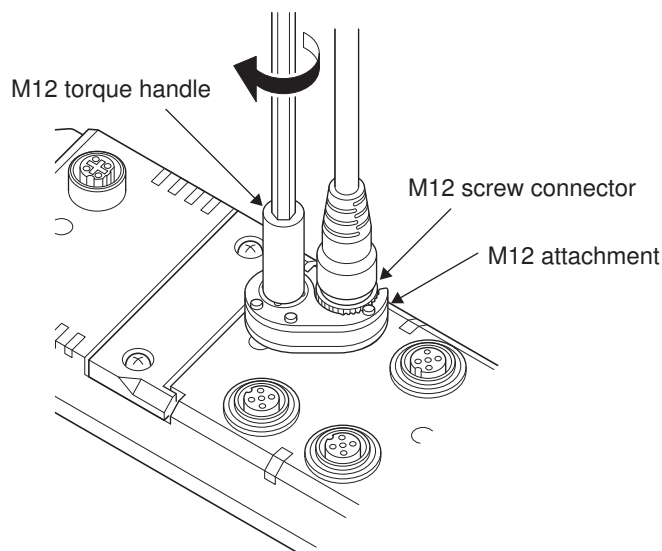
Removal Procedure

Use the following procedures to remove an I/O cable. Turn OFF the Unit/input power supply and output power supply to the IO-Link Master Unit before you remove an I/O cable.

1 Insert the M12 torque handle into the tightening hole of the M12 attachment. When you remove the connector, place the M12 attachment upside down, that is, in the opposite orientation to that for tightening.

M12 torque handle

Hole of the M12 attachment

2 Mount the M12 attachment on the M12 screw connector of the I/O cable. After you mount the M12 attachment, rotate the M12 torque handle in the direction shown in the following figure to loosen the M12 screw connector.

M12 screw connector

M12 torque handle

M12 attachment

3 Rotate the M12 screw connector of the I/O cable in the direction opposite to the connection direction.

Tightening Torque

Tighten the M12 screw connectors of I/O cables to the following torque.
You can maintain the IP67 protective structure when the screw connectors are tightened to a suitable tightening torque.

Tightening location	Screw size	Tightening torque
I/O connectors	M12	0.5 to 0.6 N·m

Waterproof Covers

Install waterproof covers for I/O connectors on any unused I/O connectors. For waterproof covers, use the M12 waterproof cover shown in *5-5 Connected Devices* on page 5-32. Refer to *5-5-4 Waterproof Covers for Connectors* on page 5-35 for details.

Tighten the waterproof covers to the following torque.

You can maintain the IP67 protective structure when the waterproof covers are tightened to a suitable tightening torque.

Tightening location	Screw size	Tightening torque
Waterproof covers for I/O connectors (M12 waterproof covers)	M12	0.5 to 0.6 N·m

5-4-4 Wiring Examples

Wiring examples for connecting the following external devices to the I/O connectors on the IO-Link Master Unit are given below.

- IO-Link device
- Non-IO-Link input device
- Non-IO-Link output device

Wring examples with a branch connector are also shown.

The external devices that you connect to the I/O connectors depend on the communications mode settings for pin 4 and pin 2 of the port on the IO-Link Master Unit. Refer to *10-2 Communications Mode Settings* on page 10-5 for information on the communications mode settings.

Precautions for Correct Use

If you set the following mode to pin 2 and pin 4 of the port for the IO-Link Master Unit and connect the Unit with external devices, use the external devices without protective diodes in the locations shown in the following figure.

• Pin 2: SIO (DO) Mode, pin 4: IO-Link Mode
• Pin 2: SIO (DO) Mode, pin 4: SIO (DI) Mode
• Pin 2: SIO (DI) Mode, pin 4: SIO (DO) Mode

If the connected external devices have protective diodes, change them to those with built-in reverse current prevention diodes as shown in the following figure, or externally install reverse current prevention diodes.
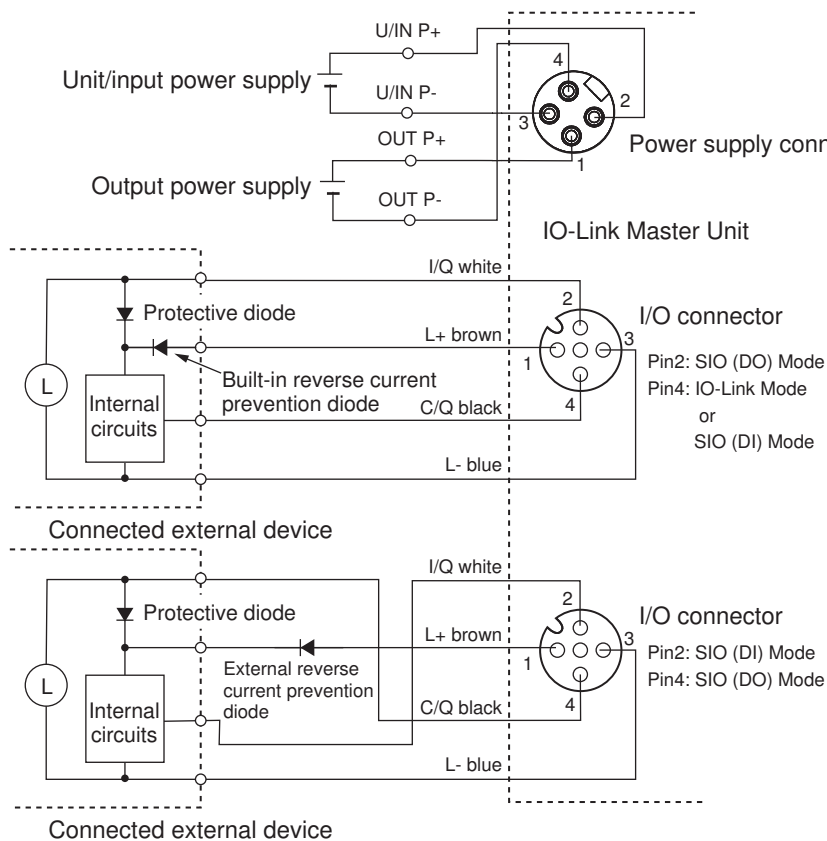
If the connected external devices have protective diodes, reverse current flows due to a difference between the Unit/input power supply and the output power supply as shown in the figure below, which may result in failure or malfunction of the product or connected external devices.

U/IN P+

Unit/input power supply
U/IN P-
Reverse current
OUT P+
Power supply connector (input)
Output power supply
OUT P-
Reverse current

I/Q white
Protective diode
L+ brown
I/O connector
L
Internal
circuits
Reverse current
Pin2: SIO (DO) Mode
Pin4: IO-Link Mode
C/Q black
or
SIO (DI) Mode
L- blue
Connected external device

I/Q white
Protective diode
L+ brown
I/O connector
L
Internal
circuits
Reverse current
Pin2: SIO (DI) Mode
C/Q black
Pin4: SIO (DO) Mode
L- blue
Connected external device
IO-Link Master Unit

Wiring Examples for IO-Link Devices

Wring examples between the IO-Link Master Unit and an IO-Link device are shown below.

● **Wiring Example for IO-Link Devices (with Digital Inputs for Pin 2)**

A wiring example for an IO-Link device with digital inputs for pin 2 is shown below. In this example, the port is used in the following communications modes.

Pin 4: IO-Link Mode, pin 2: SIO (DO) Mode

U/IN P+

Unit/input power supply
U/IN P-
OUT P+
Power supply connector (input)
Output power supply
OUT P-
IO-Link Master Unit
I/Q white
I/O connector
L+ brown
C/Q black
L- blue
IO-Link device
(with digital inputs for pin 2)

● **Wiring Example for IO-Link Devices (with Digital Outputs for Pin 2)**

A wiring example for an IO-Link device with digital outputs for pin 2 is shown below. In this example, the port is used in the following communications modes.

Pin 4: IO-Link Mode, pin 2: SIO (DI) Mode

Unit/input power supply

U/IN P+
U/IN P-

Power supply connector (input)

IO-Link Master Unit

I/Q white
L+ brown
C/Q black
L- blue

I/O connector
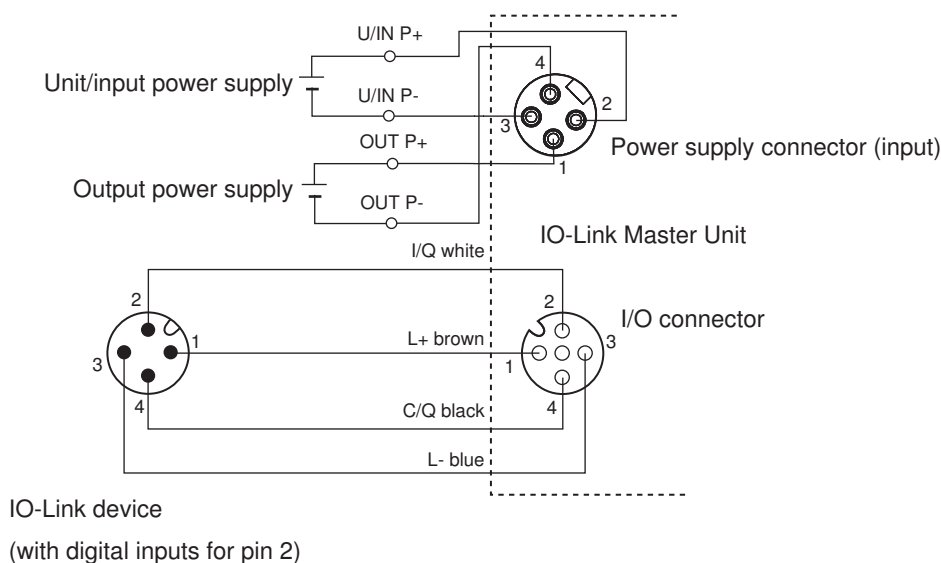
IO-Link device

(with digital outputs for pin 2)
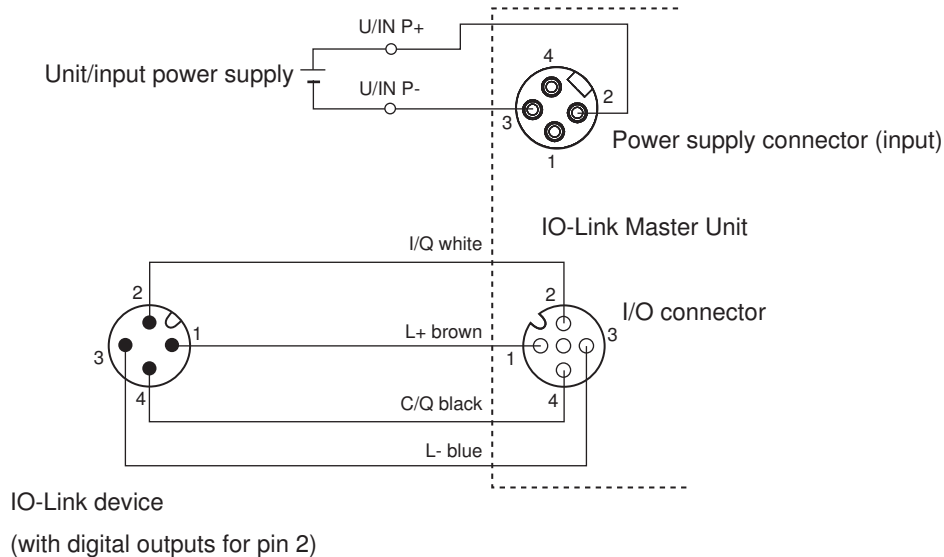
● **Wiring Example for IO-Link Devices (without Digital Inputs and Outputs for Pin 2)**

A wiring example for an IO-Link device without digital inputs and outputs for pin 2 is shown below.

In this example, the port is used in the following communications modes.

Pin 4: IO-Link Mode, pin 2: Disabled

Unit/input power supply

U/IN P+
U/IN P-

Power supply connector (input)

IO-Link Master Unit

I/Q white
L+ brown
C/Q black
L- blue

I/O connector

IO-Link device

(without digital inputs or outputs for pin 2)
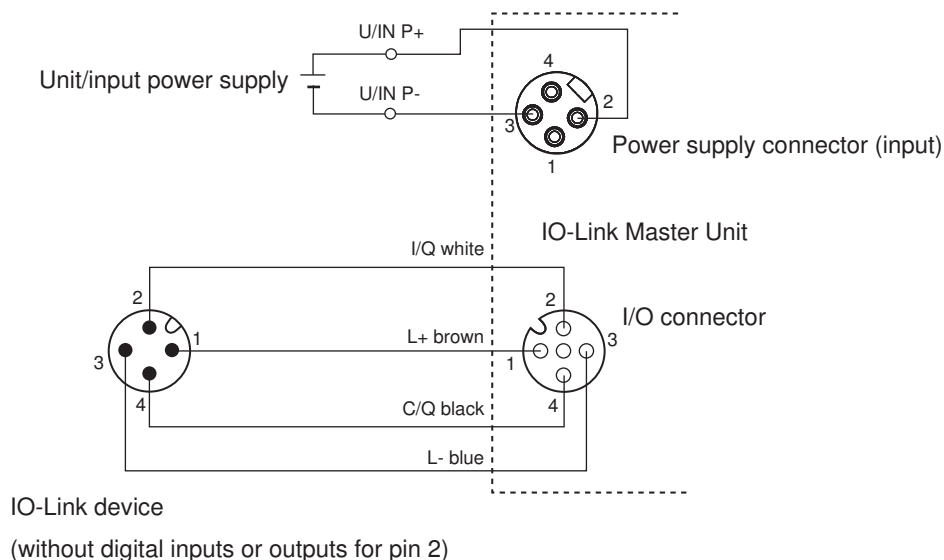
Wiring Examples for Non-IO-Link Input Devices

Wring examples between a sensor, which is a non-IO-Link input device, and the IO-Link Master Unit are shown below.

● **Wiring Example for Three-wire Sensors**

In this example, the port is used in the following communications modes.

Pin 4: SIO (DI) Mode, pin 2: Disabled

Unit/input power supply

U/IN P+

U/IN P-

Power supply connector (input)

IO-Link Master Unit

I/O connector

L+ brown

C/Q black

L- blue

Three-wire sensor
PNP type
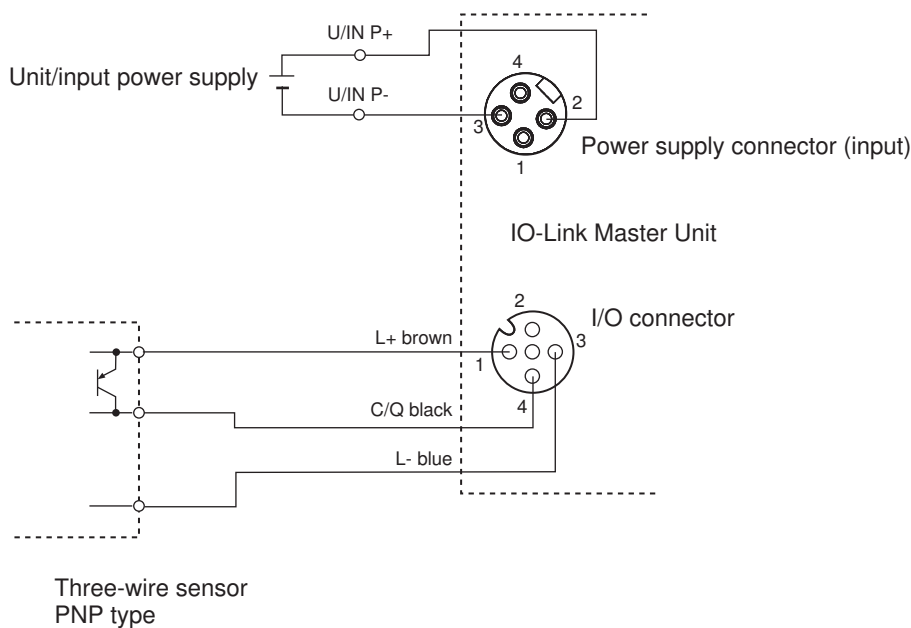
● **Wiring Example for Two-wire Sensors**

In this example, the port is used in the following communications modes.

Pin 4: SIO (DI) Mode, pin 2: Disabled

Unit/input power supply

U/IN P+

U/IN P-

Power supply connector (input)

IO-Link Master Unit

I/O connector

L+ brown

C/Q black

Two-wire sensor
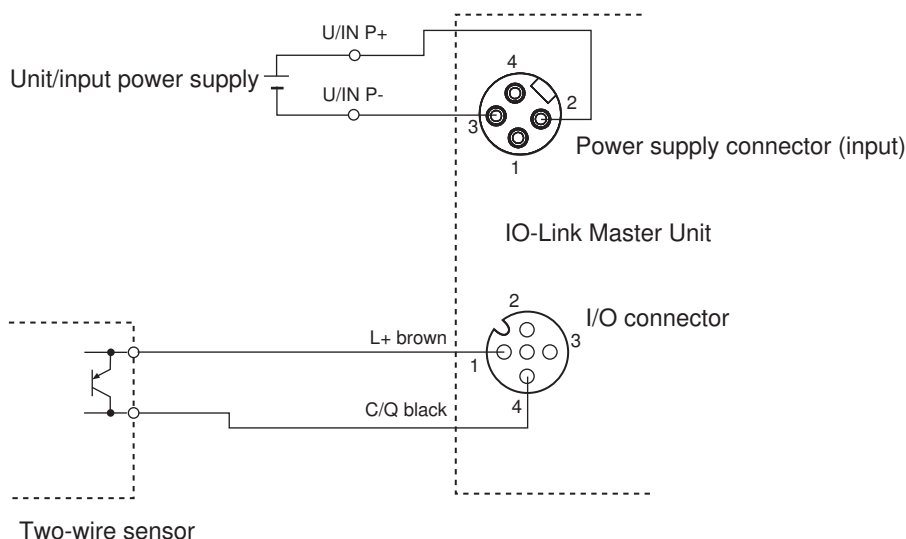
Wiring Example for Non-IO-Link Output Devices

A wiring example between the IO-Link Master Unit and a non-IO-Link output device is shown below.

In this example, the port is used in the following communications modes.

Pin 4: SIO (DO) Mode, pin 2: Disabled
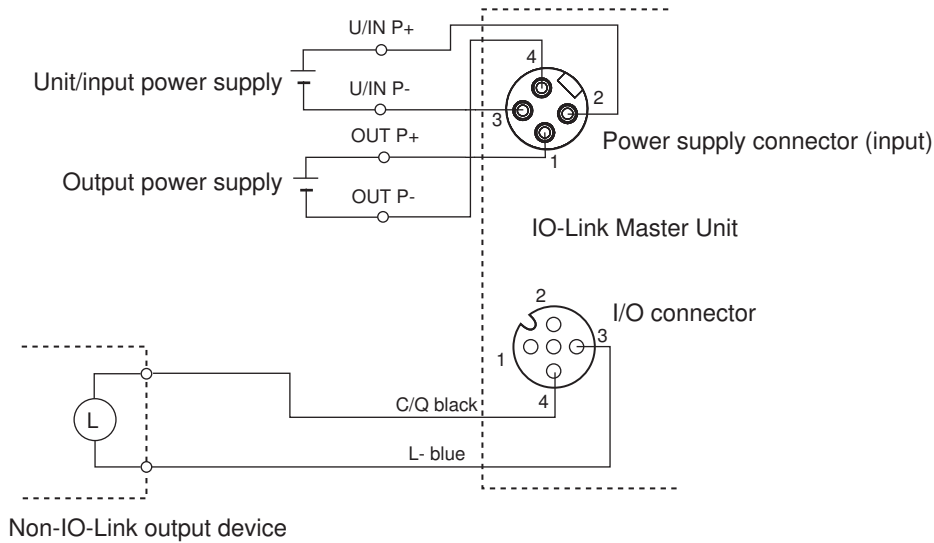
Non-IO-Link output device

> **Precautions for Correct Use**
>
> If you use a inductive load (solenoid valve, etc.), use a device with built-in diodes for absorbing counter-electromotive force, or externally install the diodes. Refer to *5-4-5 Precautions when Wiring External Output Signal Lines* on page 5-30 for details.

Wiring Examples with a Branch Connector

Wiring examples of using a branch connector to connect two or more external devices to a port are shown below.
Use the following branch connector.

- XS5R-D426-1 (OMRON)

Refer to *Branch Connector for I/O Connectors* on page 5-34 for details on the branch connector.

● Wiring Example for Non-IO-Link Input Devices

A wiring example of using a branch connector to connect a two-wire sensor and a three-wire sensor to a port is shown below. In this example, the port is used in the following communications modes.
Pin 4: SIO (DI) Mode, pin 2: SIO (DI) Mode
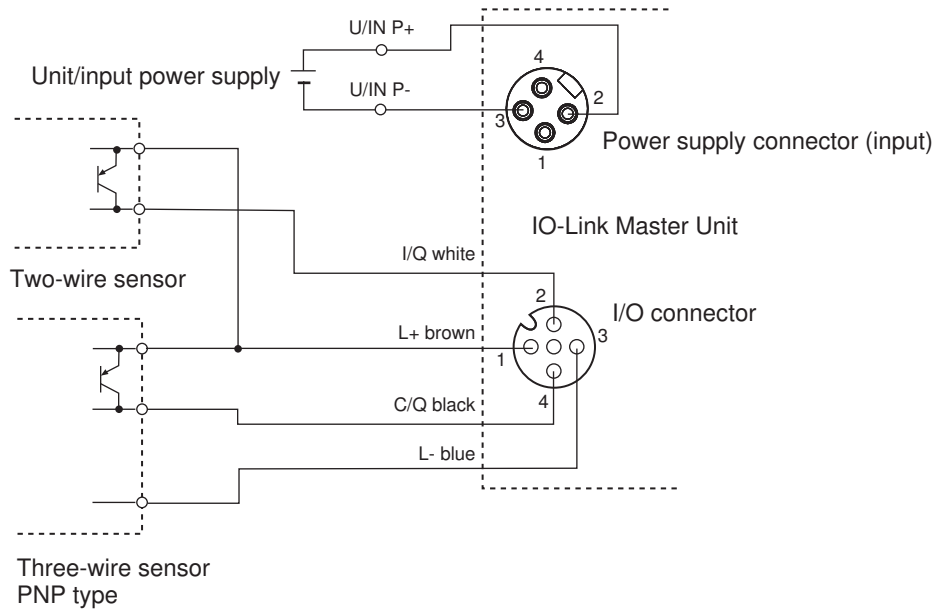
● **Wiring Example for Non-IO-Link Output Devices**

A wiring example of using a branch connector to connect two output devices to a port is shown below. In this example, the port is used in the following communications modes.
Pin 4: SIO (DO) Mode, pin 2: SIO (DO) Mode
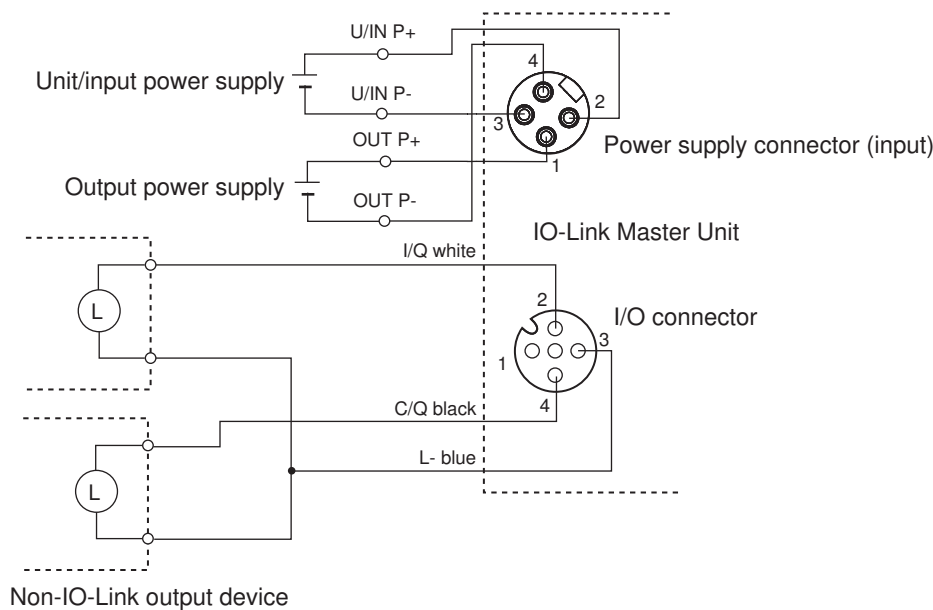
Non-IO-Link output device

┌──┐
│ ✍ │ **Precautions for Correct Use**
└──┘

If you use a inductive load (solenoid valve, etc.), use a device with built-in diodes for absorbing counter-electromotive force, or externally install the diodes. Refer to *5-4-5 Precautions when Wiring External Output Signal Lines* on page 5-30 for details.

● **Wiring Example for Non-IO-Link Input and Output Devices**

A wiring example of using a branch connector to connect a three-wire sensor and an output device to a port is shown below. In this example, the port is used in the following communications modes.

Pin 4: SIO (DO) Mode, pin 2: SIO (DI) Mode
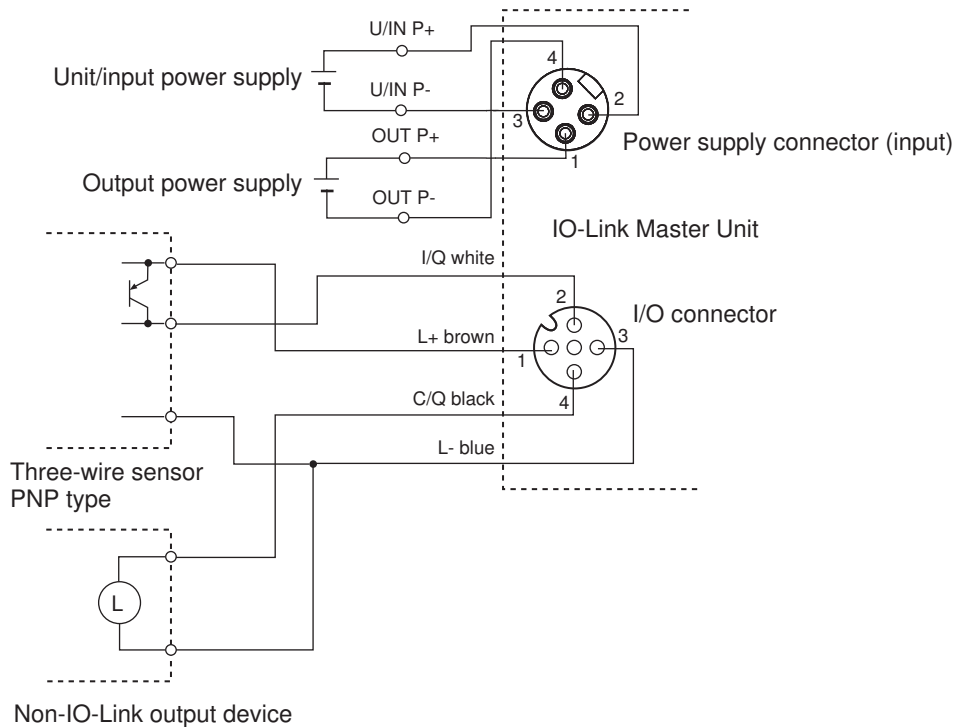
U/IN P+

Unit/input power supply

U/IN P-

OUT P+

Output power supply

OUT P-

4

3   2

1

Power supply connector (input)

IO-Link Master Unit

I/Q white

L+ brown

C/Q black

L- blue

2

1   3

4

I/O connector

Three-wire sensor
PNP type

L

Non-IO-Link output device

✍ **Precautions for Correct Use**

If you use a inductive load (solenoid valve, etc.), use a device with built-in diodes for absorbing counter-electromotive force, or externally install the diodes. Refer to *5-4-5 Precautions when Wiring External Output Signal Lines* on page 5-30 for details.

5-4-5   Precautions when Wiring External Output Signal Lines

Observe the following points when wiring external output signal lines.

• To absorb counter-electromotive force when an inductive load is connected to an output signal, connect a diode near the inductive load.

Example: When pin 4 is used in SIO (DO) Mode

U/IN P+

Unit/input power supply

U/IN P-

OUT P+

Output power supply

OUT P-

4

3

2

1

Power supply connector (input)

IO-Link Master Unit

2

1

3

4

I/O connector

C/Q black

Diode   Inductive load   L- blue
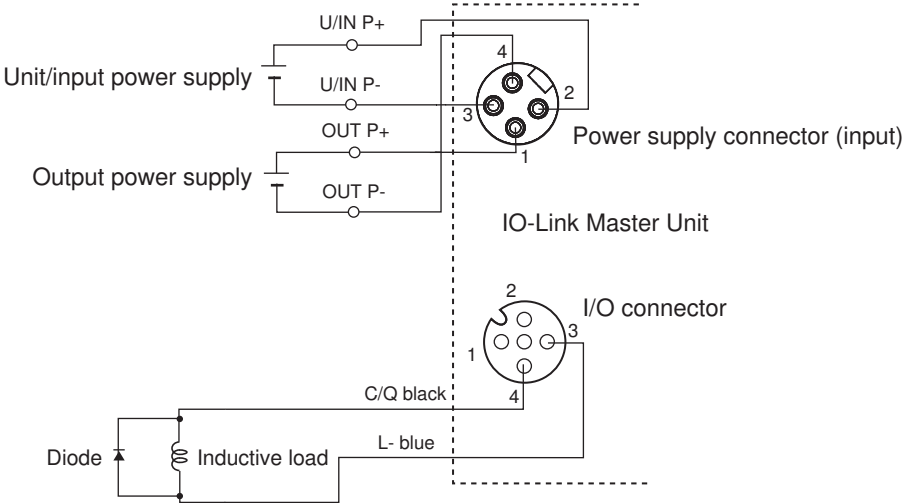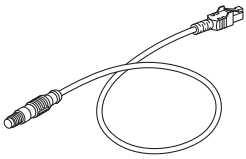
5-5 Connected Devices
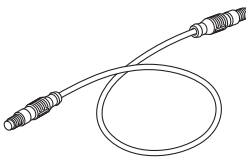
This section describes the connected devices for wiring the IO-Link Master Unit.

5-5-1 EtherNet/IP Cables
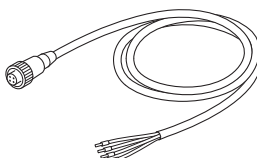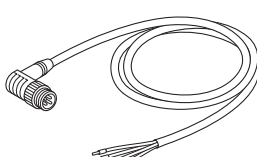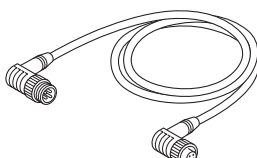
● **Connection Cables between IO-Link Master Unit and EtherNet/IP Scanner with RJ45 Connectors**

Name and appearance	Manu-facturer	Specifica-tion	Num-ber of cable con-duc-tors	Availa-ble con-nectors	Cable connec-tion di-rection	Cable length	Model
Industrial Ethernet Connectors with Cable	HART-ING K.K.	M12 plug (D-coding, male) to RJ45	4	Screw connec-tor	Straight/ straight	0.5 m	72MDm4Rm4005K
						1 m	72MDm4Rm4010K
						2 m	72MDm4Rm4020K
						3 m	72MDm4Rm4030K
						5 m	72MDm4Rm4050K
						10 m	72MDm4Rm4100K

● **Connection Cables between IO-Link Master Units**

Name and appearance	Manu-facturer	Specifica-tion	Num-ber of cable con-duc-tors	Availa-ble con-nectors	Cable connec-tion di-rection	Cable length	Model
Industrial Ethernet Connectors with Cable	HART-ING K.K.	M12 plug (D-coding, male) to M12 plug (D-coding, male)	4	Screw connec-tor	Straight/ straight	0.5 m	72MDm4MDm4005K
						1 m	72MDm4MDm4010K
						2 m	72MDm4MDm4020K
						3 m	72MDm4MDm4030K
						5 m	72MDm4MDm4050K
						10 m	72MDm4MDm4100K

5-5-2   Power Supply Cables

Name and appearance	Manu-facturer	Specification	Number of cable conductors	Available connectors	Cable connection direction	Cable length	Model
Connector with Cable (Socket on One End, Straight)	HARTING K.K.	7/8 inch socket (female) to discrete wire	4	Screw connector	Straight	1 m	72MNf4010
						2 m	72MNf4020
						5 m	72MNf4050
						10 m	72MNf4100
Connector with Cable (Socket on One End, L-shaped)					L-shaped	1 m	72MNfL4010
						2 m	72MNfL4020
						5 m	72MNfL4050
						10 m	72MNfL4100
Connector with Cable (Socket on One End, Plug on Other End, Straight)		7/8 inch socket (female) to 7/8 inch plug (male)	4	Screw connector	Straight	1 m	72MNf4MNm4010
						2 m	72MNf4MNm4020
						5 m	72MNf4MNm4050
						10 m	72MNf4MNm4100
Connector with Cable (Socket on One End, Plug on Other End, L-shaped)					L-shaped	1 m	72MNfL4MNmL4010
						2 m	72MNfL4MNmL4020
						5 m	72MNfL4MNmL4050
						10 m	72MNfL4MNmL4100

5-5-3   I/O Cables

● Conversion Cable

The following cable converts connections from an IO-Link device or non-IO-Link connected external device with an M8 plug.
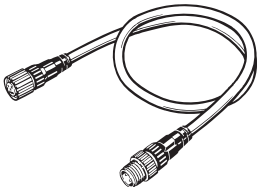
Name and appearance	Manu-facturer	Specification	Number of cable conduc-tors	Available connectors	Cable connec-tion direc-tion	Cable length	Model
XS3W Connector with Cable (M8 socket/M12 plug)	OMRON Corpora-tion	M8 socket (A-coding, fe-male) to M12 plug (A-cod-ing, male), uses DC	4	M8 screw connector, M12 Smart-click con-nector[1]	Straight	0.2 m	XS3W-M42C-4C2-A

*1. Connectors for the IO-Link Master Unit are not Smartclick connectors. Use I/O cable tightening tools to install this ca-ble. The Smartclick connector of the I/O cable also serves as a screw connector.

● **Direct Connection or Extension Cables**
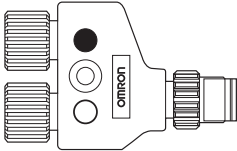
The following cables are used as extension cables from IO-Link devices or non-IO-Link connected external devices with an M12 plug. These cables can also be used for direct connection with IO-Link devices with an M12 plug.

Details are given below.

Name and appearance	Manufac-turer	Specification	Num-ber of cable con-duc-tors	Available connec-tors	Cable connec-tion direc-tion	Cable length	Model
XS2W Connector with Cable (M12 socket/M12 plug)	OMRON Corpora-tion	M12 socket (A-cod-ing, female) to M12 plug (A-cod-ing, male), uses DC	4	Screw connector	Straight/straight	1 m	XS2W-D421-C81-F
						2 m	XS2W-D421-D81-F
						3 m	XS2W-D421-E81-F
						5 m	XS2W-D421-G81-F
						10 m	XS2W-D421-J81-F

● **Branch Connector for I/O Connectors**

This is a branch connector. Details are given below.

Name and appearance	Manufac-turer	Specifi-cation	Number of cable conduc-tors	Available connectors	Cable connec-tion di-rection	Cable length	Model
XS5R Y-Joint Plug/Socket Con-nector	OMRON Corpora-tion	M12	---	Smartclick connector[1]	---	---	XS5R-D426-1
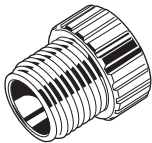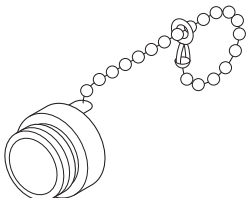
*1. Connectors for the IO-Link Master Unit are not Smartclick connectors. Use I/O cable tightening tools to install this ca-ble. The Smartclick connector of the branch connector also serves as a screw connector.

The wiring diagram is shown below.
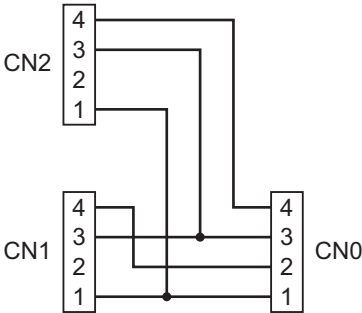
5-5-4 Waterproof Covers for Connectors

These are waterproof covers for unused M12 or 7/8 inch connectors.
When you use these waterproof covers, you can maintain the IP67 protective structure.
The following two types of covers are available.
The M12 waterproof cover can be mounted on a communications connector and I/O connector. The 7/8 inch waterproof cover can be mounted on a power supply connector.

Name and appearance	Manufacturer	Specification	Available connectors	Model
M12 Waterproof Cover	OMRON Corporation	M12	Screw connector	XS2Z-22
7/8 Inch Waterproof Cover	Molex	7/8 inch	Screw connector	1302011110

NXR-series IO-Link Master Unit for EtherNet/IP User's Manual (W619)

6

EtherNet/IP and IO-Link Communications

This section describes the EtherNet/IP communications and the IO-Link Communications of the IO-Link Master Unit.

6

6-1 EtherNet/IP Communications

The IO-Link Master Unit uses implicit and explicit message functions to exchange I/O data with an EtherNet/IP scanner and perform configuration settings.

Connection-based cyclic, class 1, implicit messages are used to exchange I/O information. Connection-based, class 3 explicit messages and connectionless UCMM explicit messages are used for configuration and other non-cyclic communications.
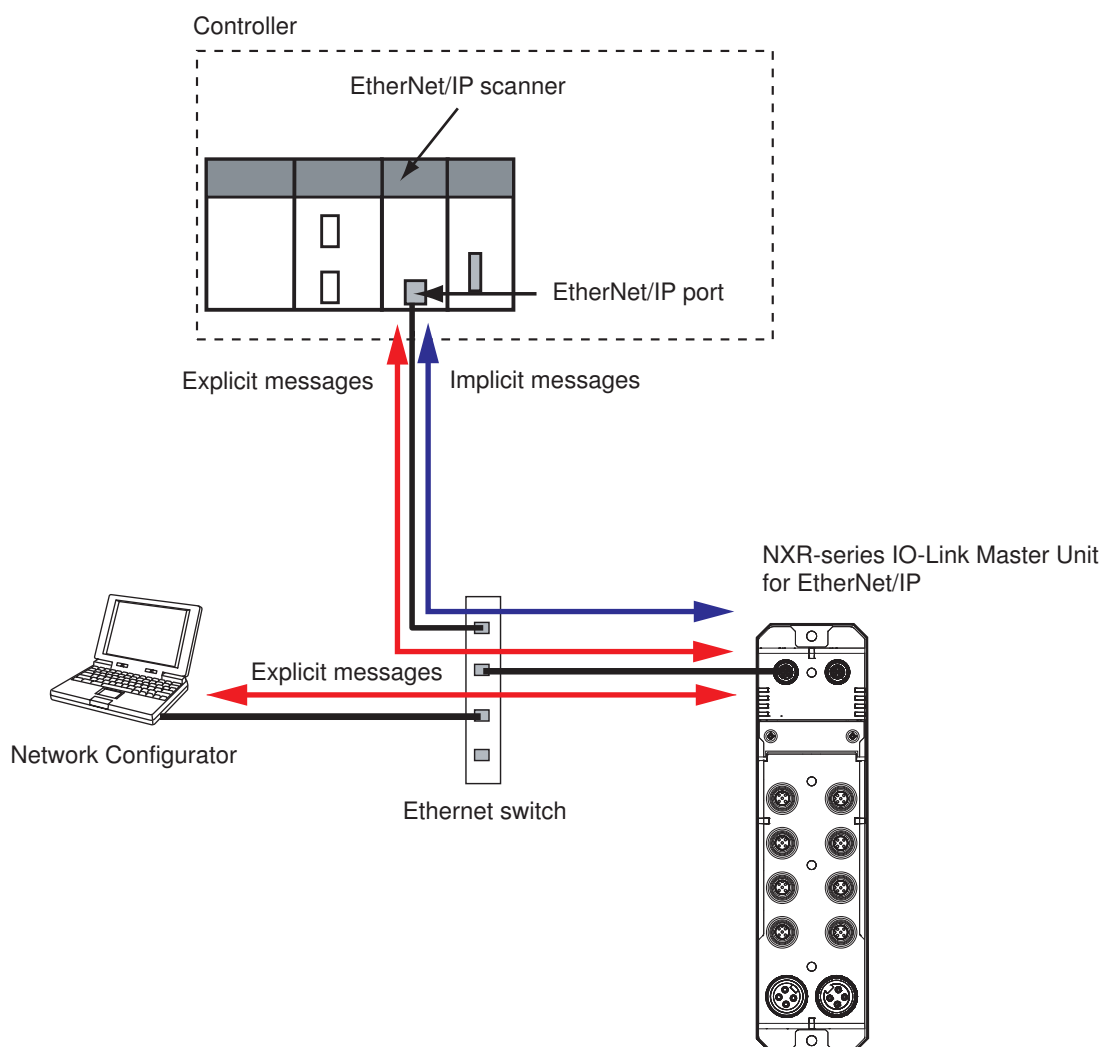
The following sections describe implicit message communications (cyclic communications) and explicit message communications (non-cyclic communications).

6-1-1 Implicit Message Communications

Implicit message communications allow cyclic communications with EtherNet/IP devices. In this manual, this type of cyclic communications is called tag data link communications. Data can be exchanged at high speed between IO-Link Master Units and Controllers using tag sets in EtherNet/IP scanners. Tag data links can operate at the cyclic period specified for each application (RPI), regardless of the number of nodes. Data is exchanged over the network at the refresh cycle set for each connection, so the communications refresh cycle does not increase even if the number of nodes is increased, i.e., the concurrency of the connection's data is maintained.

Since the refresh cycle can be set for each connection, each application can communicate at its ideal refresh cycle. For example, an application's critical interlock information can be transferred at higher speed while the less critical production commands and the status monitor information are transferred at lower speed.

The communications load to the IO-Link Master Units must be within the Units' allowed communications bandwidth.

There are three common types of implicit message connections classified as Exclusive Owner, Input Only connection and Listen Only. Among these types, the IO-Link Master Unit supports the following two types, i.e., Exclusive Owner and Input Only.

Implicit Message Connections

The Exclusive Owner connection and Input Only connection supported by the IO-Link Master Unit are described below.

● Exclusive Owner Connection

An Exclusive Owner connection is used in a bidirectional connection between an EtherNet/IP scanner and an EtherNet/IP adapter that has I/O data, where the EtherNet/IP scanner controls the output data to the EtherNet/IP adapter. You cannot make Exclusive Owner connections from more than one EtherNet/IP scanner. For an IO-Link Master Unit, a connection I/O type of *input/output* is equivalent to an Exclusive Owner connection.
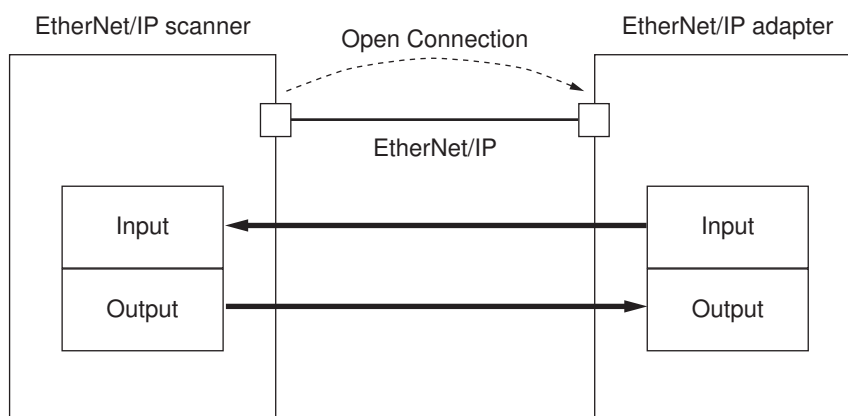
● Input Only Connection

An Input Only connection is used to connect to an EtherNet/IP adapter that has input data so that an EtherNet/IP scanner receives the input data from the EtherNet/IP adapter. You can create Input Only connections from more than one EtherNet/IP scanner. With an Input Only connection, the EtherNet/IP scanner produces only a heartbeat signal to the EtherNet/IP adapter and no output data is present.
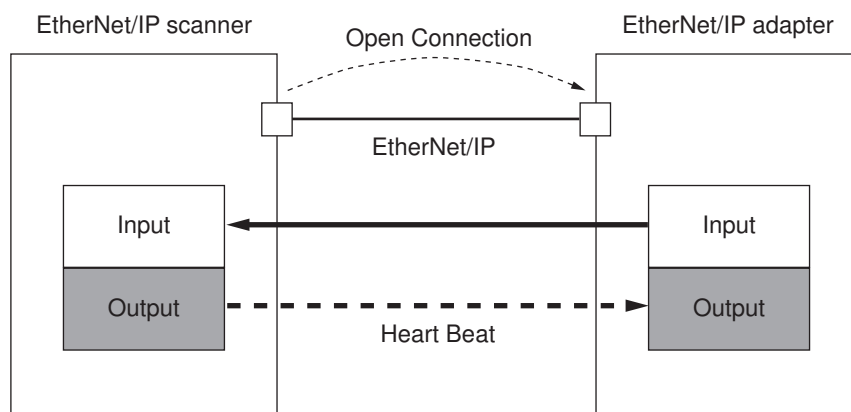
I/O Data Assemblies for IO-Link Master Unit

The IO-Link Master Unit provides I/O data assemblies that you can use for each connection type. Refer to *7-6 Specifications of I/O Data* on page 7-43 for information on the I/O data assemblies for the IO-Link Master Unit.

6-1-2   Explicit Message Communications

The IO-Link Master Unit supports explicit message server functions. This means that you can access CIP objects in the IO-Link Master Unit from a device such as an EtherNet/IP scanner or the Network Configurator. Accessing CIP objects through an explicit message enables the following operations.

- Troubleshooting the IO-Link Master Unit by reading event logs, clearing event logs, etc.
- Configuring the device parameter settings, and the IP address and other communications parameters for the IO-Link Master Unit

Also, if the EtherNet/IP scanner does not support tag data links (i.e., implicit messages), you can use explicit messages as an alternative message means to control I/O for the IO-Link Master Unit.

Refer to *A-1 Supported CIP Objects* on page A-2 for details on CIP objects that are supported by the IO-Link Master Unit.
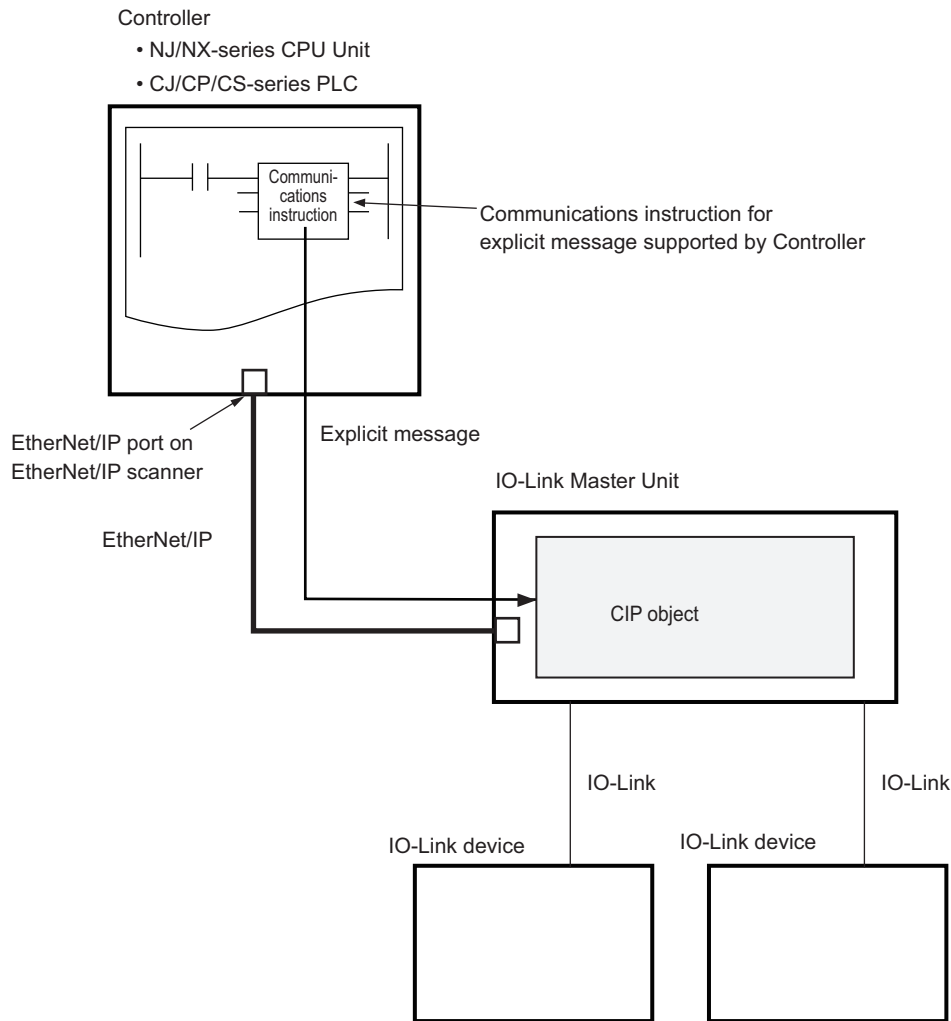
Conditions for Explicit Message Communications

The following conditions must be met.
- Communications must be established between the EtherNet/IP scanner and the IO-Link Master Unit.

Accessing CIP Objects through an Explicit Message

You can use the following methods to access CIP objects in the IO-Link Master Unit through an explicit message.
- Using the special instructions for the Controller to send an explicit message
- Setting general parameters in the Network Configurator to send an explicit message

These are described below.

● Special Instructions for the Controller

Use the following special instructions depending on the Controller.

Controller	Special Instruction
NJ/NX-series CPU Unit	CIPSend (Send Explicit Message) instruction
	CIPUCMMSend (Send Explicit Message) instruction
CJ/CP/CS-series PLC	CMND (EXPLICIT MESSAGE SEND) instruction

For details on the communications instructions for NJ/NX-series CPU Units, refer to the instructions reference manual for the connected CPU Unit.

For details on the communications instructions for CJ/CP/CS-series PLCs, refer to the *CS/CJ/NSJ Series Instructions Reference Manual (Cat. No. W474)* and *CS and CJ Series EtherNet/IP Units Operation Manual (Cat. No. W465)*.

However, the following two restrictions apply if the CIPSend or CIPUCMMSend instruction for NJ/NX-series CPU Units is used for the IO-Link Master Unit. These restrictions are described below.

Restriction 1:

To establish a class 3 connection, use the CIPOpenWithDataSize instruction and specify the data length of input variables (*DataSize*) to 509 or less. The CIPOpen instruction cannot establish a class 3 connection.

Note that a CPU Unit with unit version 1.06 or later and Sysmac Studio version 1.07 or higher are required to use the CIPOpenWithDataSize instruction.

Restriction 2:

For the data type of the request path (*RqPath*), which is a input variable to the CIPSend and CIPUCMMSend instructions, use the structure _sREQUEST_PATH_EX type. For the logical format members of the input variable, specify the following supported values. The structure _sREQUEST_PATH type cannot be used.

Logical format	Supported value
ClassIDLogicalFormat	_8BIT (8 bits) or _16BIT (16 bits)
InstanceIDLogicalFormat	_8BIT (8 bits) or _16BIT (16 bits)
AtrributeIDLogicalFormat	_8BIT (8 bits)

Note that a CPU Unit with unit version 1.11 or later and Sysmac Studio version 1.15 or higher are required to specify _sREQUEST_PATH_EX type.

● **Setting General Parameters in the Network Configurator**

In the Network Configurator, select **Tool** – **Setup Parameters** from the menu.
The **Setup Parameters** dialog box is displayed.
Refer to Help on the Network Configurator for details.

6-2   IO-Link Communications

The IO-Link Master Unit exchanges data with IO-Link devices through IO-Link communications. There are the following two types of IO-Link communications.
- Cyclic communications
- Message communications

The following sections describes the cyclic communications and message communications for IO-Link communications.

6-2-1   Cyclic Communications for IO-Link Communications

The IO-Link Master Unit acts as an IO-Link communications master and shares the I/O data (process data) of the IO-Link devices with the IO-Link devices in a cycle. For the I/O data (process data) of OMRON IO-Link devices, refer to *Index List* or *Process Data* in the manual for each IO-Link device. Details on cyclic communications for IO-Link communications are described below.

Relationship between the Target of Cyclic Communications and EtherNet/IP Communications

The following shows the cyclic communications of the IO-Link Master Unit, including EtherNet/IP communications.

Controller
• NJ/NX-series CPU Unit
• CJ/CP/CS-series PLC

Controller cycle time

EtherNet/IP port on
EtherNet/IP scanner

EtherNet/IP communications
• Implicit message communications

Packet interval (RPI)

IO-Link Master Unit

Data processing cycle

EtherNet/IP port

Port 1 · · · · · · · Port 8
Pin 4 Pin 2 · · · · · · · Pin 4 Pin 2

IO-Link communications
• Cyclic communications

Digital I/O
Digital I/O

Digital I/O

IO-Link
communications
cycle time

I/O data
(Process data)

Non-IO-Link connected external device

IO-Link device

● Target of Cyclic Communications

Cyclic communications for IO-Link communications cover only the following connection among the
connections with IO-Link devices.
• Pin 4 that is set to IO-Link Mode

The exchange of digital input or output data through pin 2, which is performed with IO-Link devices
that have digital inputs or outputs for pin 2, is not covered.
Similarly, the exchange of digital input or output data through pin 4 and pin 2, which is performed
with non-IO-Link connected external devices, is not covered.

● Relationship with EtherNet/IP Communications

Cyclic communications for IO-Link communications are not synchronized with implicit message
communications that are cyclic communications for EtherNet/IP communications.

Start Timing of Cyclic Communications

Cyclic communications for IO-Link communications automatically start concurrently with the start of the communications when the following conditions are met. It does not depend on the status of the EtherNet/IP communications with the EtherNet/IP scanner.

- An IO-Link device is connected.
- The Unit/input power supply to the IO-Link Master Unit is ON.

However, if you are using the IO-Link device verification and the registered configuration settings of the IO-Link devices do not match the actual configuration settings of the IO-Link devices, IO-Link communications for those ports will not start.
Refer to *10-7 IO-Link Device Verification* on page 10-15 for details on the IO-Link device verification.

Programming Cyclic Communications

When you program cyclic communications for IO-Link communications, write the user program so that the input and output of I/O data is processed when *Input Data Enabled* is TRUE for the I/O data in the IO-Link Master Unit.
Refer to *7-6-3 Details on Input Assembly Data* on page 7-47 for details on the specifications of *Input Data Enabled*. Refer to *A-2-1 Tag Data Links with Valid I/O Data* on page A-38 for details on the sample programming.

Precautions for Correct Use

- If an error occurs in IO-Link communications, among the process input data in the IO-Link Master Unit, *IO-Link Input Data* has a value immediately before the occurrence of the error. To prevent malfunctions, write the user program so that IO-Link data processing is not performed when *Input Data Enabled* is FALSE.
- If an error occurs in IO-Link communications, the *IO-Link Output Data* can no longer be sent to the IO-Link devices. In the IO-Link devices, make settings to provide safe output operation in such case to ensure safety in the system.
- *Input Data Enabled* is FALSE when a non-IO-Link external device is connected in IO-Link Mode. Write the user program so that IO-Link data processing is not performed when *Input Data Enabled* is FALSE.
- You must use the TRUE status of *Input Data Enabled* in the I/O data as a condition for processing the *IO-Link Input Data* in IO-Link Mode in the user program.

Stopping Cyclic Communications

You can specify to stop the cyclic communications for IO-Link communications by each port.
Use the following procedure.

1 Set the *Pin 4 Communications Mode Setting* for the port to stop to other than **IO-Link Mode**.

2 Restart the IO-Link Master Unit or cycle the Unit/input power supply.
To restart the IO-Link Master Unit, use the Network Configurator, or send an explicit message to the following CIP object.
- Identity object (class ID: 01 hex), instance ID: 01 hex, service code: 05 hex, restart (00 hex)
Refer to *A-1-1 Identity Object (Class ID: 01 Hex)* on page A-2 for details on the CIP object.

Refer to *Restarting IO-Link Master Unit from the Network Configurator* on page 6-10 for the procedure to restart the IO-Link Master Unit from the Network Configurator.

Restarting IO-Link Master Unit from the Network Configurator

The following shows the procedure to restart the IO-Link Master Unit from the Network Configurator.

1 Connect the Network Configurator online.

2 Right-click the IO-Link Master Unit to restart and select **Reset**.
A confirmation dialog box for restart execution is displayed.

3 Click the **Yes** button.
The IO-Link Master Unit is restarted.

Operation When an IO-Link Device Is Disconnected

If an IO-Link device is disconnected from a port, an *IO-Link Communications Error* occurs and *Input Data Enabled* changes to FALSE. Disconnection from a port means that the IO-Link Master Unit became unable to perform IO-Link communications after the establishment of communications with the IO-Link device due to the following causes:
• The IO-Link device is removed from the port.
• The IO-Link cable is broken.
At this time, *Input Data Enabled* for the IO-Link Master Unit changes to FALSE. The status of the outputs from the IO-Link device depends on the specifications of the IO-Link device.

If an IO-Link device is not connected to a port, *Input Data Enabled* is FALSE, but no *IO-Link Communications Error* occurs. An IO-Link device is not connected to a port means that the IO-Link Master Unit has not performed IO-Link communications even once since the Unit/input power supply was turned ON, because an IO-Link device is not connected to the port. However, if the IO-Link device verification is enabled, an *IO-Link Communications Error* will occur.

6-2-2 Message Communications for IO-Link Communications

Message communications for IO-Link communications refers to communications for accessing IO-Link device objects (service data) as needed. As shown in the figure below, an explicit message is sent from the Controller to the following CIP object in the IO-Link Master Unit, through its EtherNet/IP adapter.
• IO-Link object (class ID: 381 hex), service code: 34 hex (Message for IO-Link device)
Through this CIP object, the Controller accesses objects in the IO-Link device connected to a specified port.
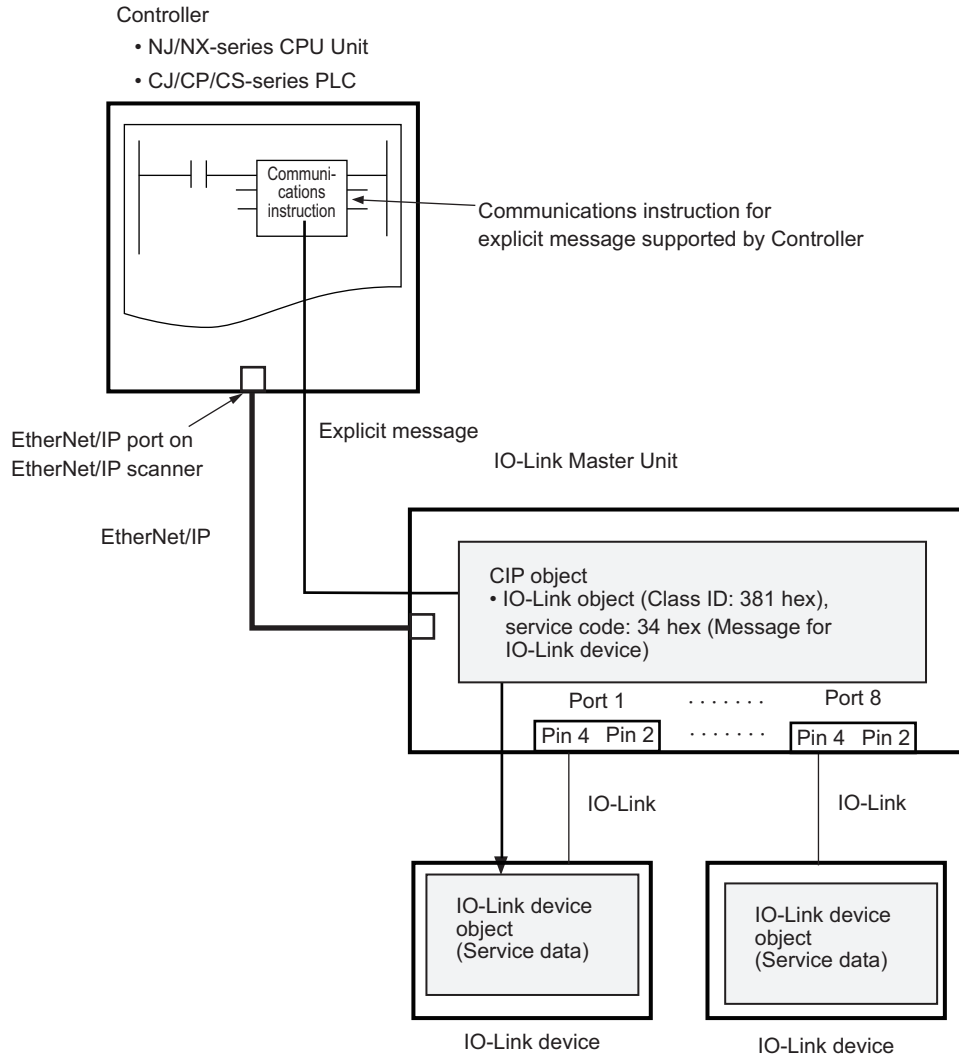
Refer to *A-1-9 IO-Link Object (Class ID: 381 Hex)* on page A-24 for details on the CIP object.
For the objects of OMRON IO-Link devices, refer to *Index List* or *Service Data* in the manual for each IO-Link device.

Conditions for Message Communications

The following conditions must be met.
- Communications must be established between the EtherNet/IP scanner and the IO-Link Master Unit.
- Communications must be established between the IO-Link Master Unit and the IO-Link devices.
- The *Pin 4 Communications Mode Setting* for the IO-Link Master Unit must be **IO-Link Mode**.

If the *Pin 4 Communications Mode Setting* for the port is other than **IO-Link Mode**, a communications instruction error will occur in explicit message communications.

Accessing CIP Objects through an Explicit Message

Refer to *Accessing CIP Objects through an Explicit Message* on page 6-5 in *6-1-2 Explicit Message Communications* on page 6-4 for the methods to access CIP objects in the IO-Link Master Unit through an explicit message.

7

Setting Up IO-Link Master Unit

This section describes how to set up the IO-Link Master Unit.

7-1   Setting Items and Setting Procedures

This section describes the setting items and setting procedures for the IO-Link Master Unit. It gives an example of establishing a connection with the following OMRON Controller and EtherNet/IP scanner to allow access to the IO-Link Master Unit and its I/O data.

Controller	EtherNet/IP scanner
NJ/NX-series CPU Unit	Built-in EtherNet/IP port on NJ/NX-series CPU Unit, or CJ1W-EIP21
CJ/CP/CS-series PLC	• EtherNet/IP Unit CJ1W-EIP21 or CS1W-EIP21 • Built-in EtherNet/IP port on CJ-series CPU Unit

A configuration example is shown below.

Controller
• NJ/NX-series CPU Unit
• CJ/CP/CS-series PLC

Support Software for the Controller

• Creating Network Variables
• Creating the User Program

EtherNet/IP scanner:
• EtherNet/IP Unit
• Built-in EtherNet/IP port

Network Configurator

• Creating the Network Configuration
• Setting the IO-Link Master Unit
  TCP/IP, automatic clock adjustment,
  device parameters
• Setting Tag Data Links

EtherNet/IP adapter:
NXR-series IO-Link
Master Unit for
EtherNet/IP

Ethernet switch

CX-ConfiguratorFDT

• Setting IO-Link Device

Non-IO-Link connected external device   IO-Link device

7-1-1　Setting Items

The following table shows the setting items to allow the EtherNet/IP scanner to access I/O data in the IO-Link Master Unit.

Classification	Item	Description
IO-Link Master Unit Settings	TCP/IP Settings	Set the following as the TCP/IP settings for the IO-Link Master Unit. • IP Address Settings • Link Settings
	Automatic Clock Adjustment Settings	Set the internal clock information for the IO-Link Master Unit.
	Device Parameter Settings	Set the EtherNet/IP and IO-Link master functions.
IO-Link Device Settings	Parameter Settings	Set the IO-Link device parameters.
Settings for Data Exchange between Scanner and IO-Link Master Unit	Tag Data Link Settings	Set the tag data link parameters, such as tags, tag sets and connections. Select the I/O data to use for the IO-Link Master Unit in the connection setting.
	Network Variable Creation[1]	Create variables that are required to access the IO-Link Master Unit with a user program.

*1. Create network variables only when the Controller that can handle network variables is used. Refer to the user's manual for your Controller for information on whether it can handle network variables.

7-1-2　Setting Procedures

The following table shows the setting procedures to allow the EtherNet/IP scanner to access I/O data in the IO-Link Master Unit.

Procedure		Description		Reference
1	Creating the Network Configuration	(1)	Start the Network Configurator	*7-2-1 Starting the Network Configurator* on page 7-6
		(2)	Register devices	*7-2-2 Registering Devices* on page 7-7
2	Setting the TCP/IP Settings for the IO-Link Master Unit	(1)	Go online with the EtherNet/IP network to which the IO-Link Master Unit is connected	*7-3-1 Going Online* on page 7-9
		(2)	Set IP address	*7-3-2 IP Address Settings* on page 7-10
		(3)	Set link	*7-3-3 Link Settings* on page 7-19
3	Setting the Automatic Clock Adjustment Settings for the IO-Link Master Unit	Set the automatic clock adjustment		*7-4 Setting the Automatic Clock Adjustment* on page 7-23
4	Setting the Device Parameters of the IO-Link Master Unit	(1)	Set device parameters	*7-5-2 Setting the Device Parameters of the IO-Link Master Unit* on page 7-30
		(2)	Download device parameters and verify settings	*7-5-4 Downloading and Verifying Device Parameters* on page 7-37

	Procedure		Description	Reference
5	Setting and Transferring the IO-Link Device Parameters		Set and transfer the IO-Link device parameters	*Section 11 Setting Up IO-Link Devices* on page 11-1
6	Setting Tag Data Links	(1)	Determine the tag sets for the IO-Link Master Unit	*7-7-1 Determining the Tag Sets for the IO-Link Master Unit* on page 7-62
		(2)	Create network variables	*7-7-2 Creating Network Variables* on page 7-63
		(3)	Create tags and tag sets	*7-7-3 Creating Tags and Tag Sets* on page 7-64
		(4)	Set the connection	*7-7-4 Setting the Connection* on page 7-68
		(5)	Download tag data link parameters	*7-7-5 Downloading Tag Data Link Parameters* on page 7-73
		(6)	Save the network configuration file	*7-7-8 Saving the Network Configuration File* on page 7-75
7	Creating the User Program		Create the user program with network variables that you created. At this time, write the program so that it uses valid I/O data to make tag data links. Refer to *A-2-1 Tag Data Links with Valid I/O Data* on page A-38 for details on sample programming.	• User's manual for the CPU Unit that you use • User's manual for the EtherNet/IP scanner that you use • Operation manual for the Support Software that you use • *A-2-1 Tag Data Links with Valid I/O Data* on page A-38
8	Checking Operation		Execute the user program and check with indicators or status information that data is exchanged successfully.	• *12-1 Checking for Errors* on page 12-2 • User's manual for the CPU Unit that you use • User's manual for the EtherNet/IP scanner that you use • Operation manual for the Support Software that you use

7-1 Setting Items and Setting Procedures

7

7-1-2 Setting Procedures

7-2   Creating the Network Configuration

Use the Network Configurator and register the EtherNet/IP scanner and IO-Link Master Units to partic-
ipate in tag data links in the network configuration.

7-2-1   Starting the Network Configurator

This section describes the starting method and window structure of the Network Configurator.

Starting Method

● Starting from the Windows Start Menu

If you use the built-in EtherNet/IP port on an NJ/NX-series CPU Unit, select the following to start
the Network Configurator.
OMRON – **Sysmac Studio** – **Network Configurator for EtherNetIP** – **Network Configurator**
To use a CS and CJ Series EtherNet/IP Unit, replace "Sysmac Studio" with "CX-One" in the above
sequence.

When the Network Configurator starts, the following window is displayed.
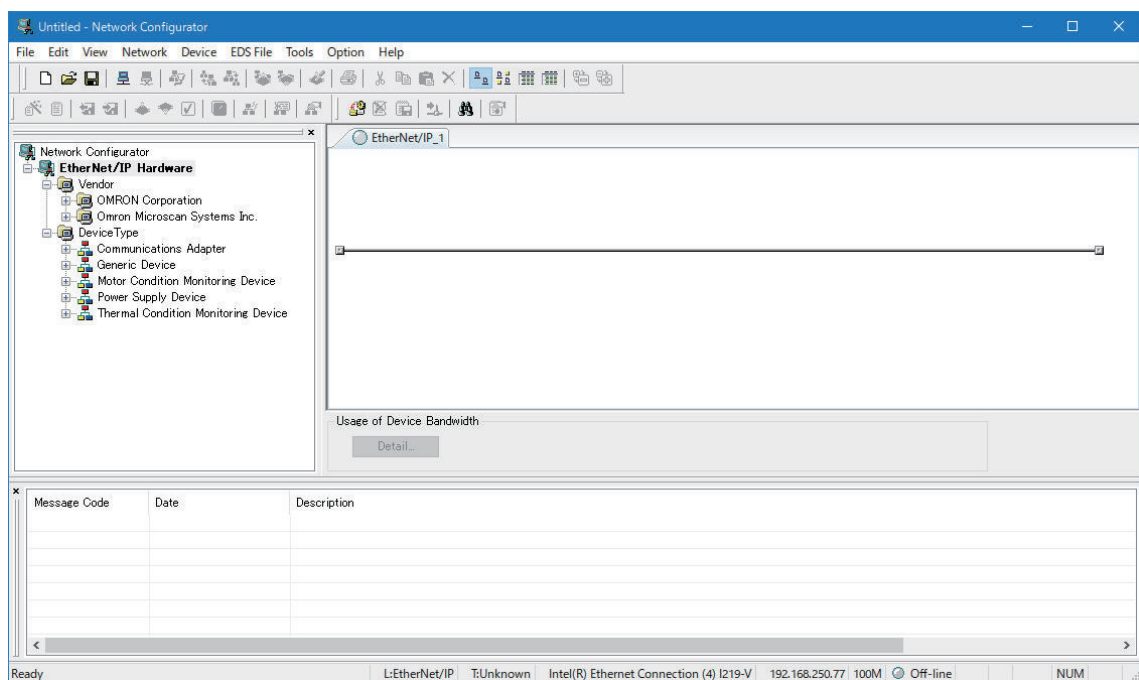
Main Window

The Main Window consists of a Hardware List and a Network Configuration Pane, as shown in the
following diagram.
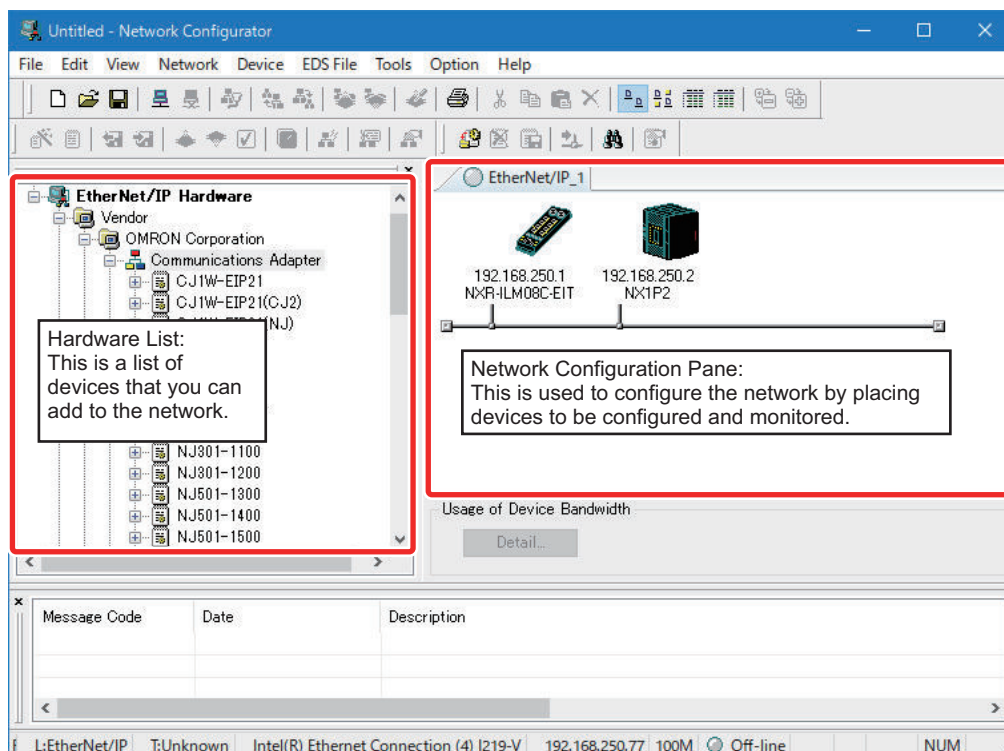
You can manage two or more networks by adding networks.

Refer to *Starting the Network Configurator* in the user's manual for your OMRON EtherNet/IP scanner for how to add a network.

7-2-2   Registering Devices

Register all of the devices required in the equipment (such as EtherNet/IP scanners and IO-Link Master Units to participate in tag data links) in the network configuration.

1   Register the device to participate in the tag data links by dragging it from the Hardware List on the left side of the window to the Network Configuration Pane on the right side.

The icon of the device is displayed in the Network Configuration Pane, as shown in the following diagram.

Be sure to select a device with the same major CIP revision (Rev □).
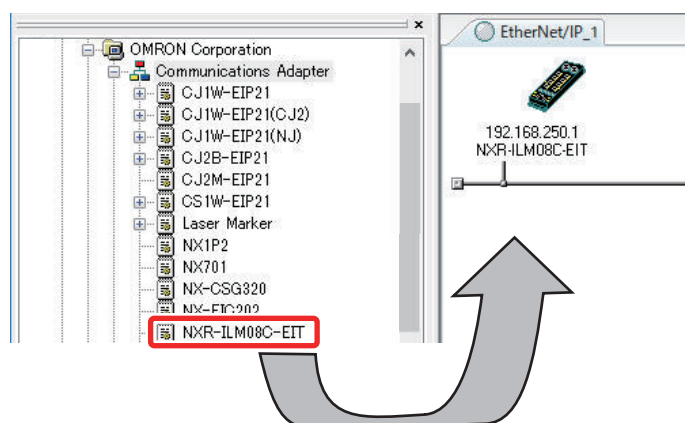
You can also select a device in the Hardware List and press the Enter key to register it.

Precautions for Correct Use

Make sure that the device name and major CIP revision of the device to register match those of the actual device to use. If the device name or major CIP revision is incorrect, the following will occur when you attempt to download tag data link parameters in the Network Configurator.
- If the device name is incorrect
  A **Specified device can not be accessed, or wrong device type** message will be displayed, and the download will fail.
- If the major CIP revision is incorrect
  A **Wrong unit revision** message will be displayed, and the download will fail.

If the download fails, change the device name or major CIP revision of the device to register so that they match those of the actual device to use. Refer to *Changing Devices* in the user's manual for your OMRON EtherNet/IP scanner for how to change devices.

The device will operate in the same manner as above when you upload or verify the tag data link parameters.

2 Right-click the icon of the registered device and select **Change Node Address**.
The **Change IP Address** dialog box is displayed.
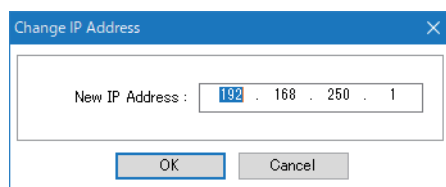
3 Set the IP address of the registered device to match the IP address of the actual device. After you make the setting, click the **OK** button.

If you plan to perform software settings to set the IP address with the Network Configurator, set the IP address on the actual device in advance.

Refer to *7-3-2 IP Address Settings* on page 7-10 for the setting procedure.

4 Repeat steps 1 to 3, and register all devices to which tag data links are made.
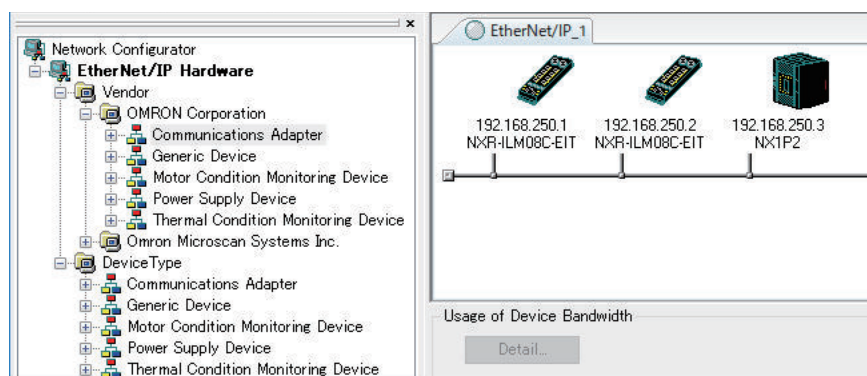
7-3 Setting TCP/IP

This section describes the TCP/IP settings for the IO-Link Master Unit. It also describes the methods to go online with the network, which you need to configure the settings.

7-3-1 Going Online

There are several ways to go online with the EtherNet/IP network from the Network Configurator. The connection method depends on the OMRON EtherNet/IP scanner to connect to. For example, to connect to the built-in EtherNet/IP port on an NJ/NX-series CPU Unit as a scanner, you can use the following connection methods.
- Connecting through Ethernet
- Connecting through CPU Unit's USB port
- Direct Connection to built-in EtherNet/IP port via Ethernet

Here, connecting through Ethernet is described.
Refer to *Connecting the Network Configurator to the Network* in the user's manual for your OMRON EtherNet/IP scanner for other connection methods.

▌Connecting through Ethernet

You can connect the Network Configurator to the IO-Link Master Unit either directly or thorough an Ethernet switch.

> **✓ Precautions for Correct Use**
>
> You need to change the Windows firewall settings when you make the connection for the first time.
> For the procedure, refer to *A-3 Configuring the Windows Firewall* on page A-63.

1 Select **Option** – **Select Interface** – **Ethernet I/F**.

2 Select **Network** – **Connect**.
   If there are multiple Ethernet interfaces on the computer, the **Select Interface** dialog box is displayed. Select the interface to connect, and press the **OK** button.
   The following dialog box is displayed.
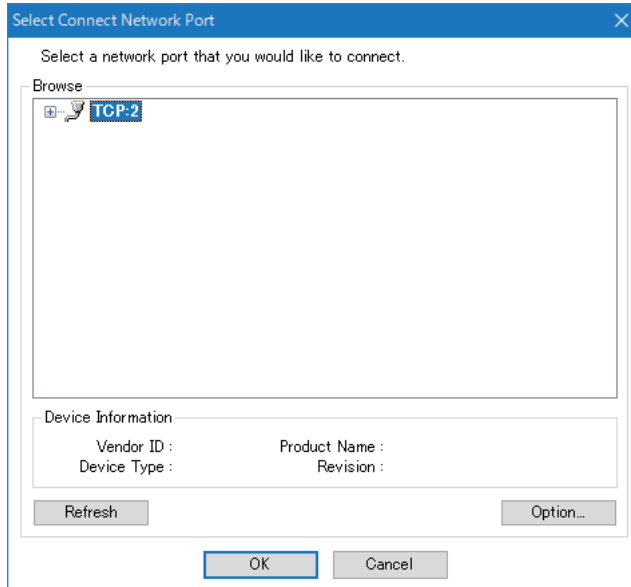
3 Click the **OK** button.

The following dialog box is displayed.
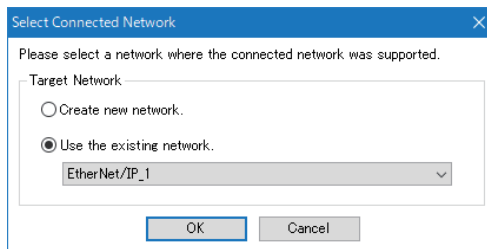
4 Select the network to connect to and click the **OK** button.

The Network Configurator is connected to the EtherNet/IP network.

If the Network Configurator goes online normally, **On-line** is displayed in the status bar at the bottom of the window. The network connection icon is displayed in blue on the Network tab page in which the Network Configurator is connected.

Network connection icon
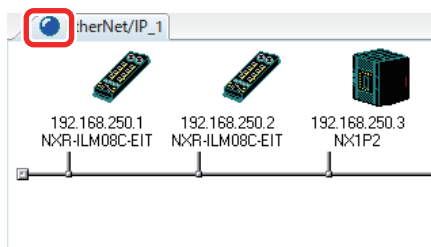
7-3-2 IP Address Settings

There are several ways to set the IP address of the IO-Link Master Unit.

Use the rotary switches on the front panel of the Unit to specify the setting method for the IP address.

Set value (hex)		Setting method	Reference
Third octet	Fourth octet		
00 to FF	00	Directly set the IP address with the Network Configurator.	*Directly Setting the IP Address with the Network Configurator* on page 7-11
		Get the IP address from the BOOTP server with the Network Configurator.	*Getting the IP Address from the BOOTP Server with the Network Configurator* on page 7-13
		Get the IP address from the DHCP server with the Network Configurator.	*Getting the IP Address from the DHCP Server with the Network Configurator* on page 7-15
00 to FF	01 to FE	Directly set the IP address with hardware switches.	*Directly Setting the IP Address with Hardware Switches* on page 7-17
00	FF	Get the IP address from the BOOTP server with hardware switches.	*Getting the IP Address from the BOOTP Server with Hardware Switches* on page 7-18
01	FF	Get the IP address from the DHCP server with hardware switches.	*Getting the IP Address from the DHCP Server with Hardware Switches* on page 7-19
FF	FF	Turning ON the Unit/input power supply does not cause the IO-Link Master Unit to operate. The IP address is set as follows. • IP address: 192.168.250.1 • Subnet mask: 255.255.255.0 • Default gateway: 0.0.0.0 If you set this value, change the set value and cycle the Unit/input power supply.	---

Precautions for Correct Use

By default, the IO-Link Master Unit is set as follows.
• IP address: Fixed to 192.168.250.1
• IP address duplication detection: Enabled
This means that using two or more IO-Link Master Units with the default settings will cause IP address duplication when the Unit/input power is supplied.

Directly Setting the IP Address with the Network Configurator

The following describes how to use the Network Configurator to directly set the IP address.

Precautions for Correct Use

If you have two or more IO-Link Master Units for which to set IP addresses, connect them one at a time, and download the TCP/IP Configuration's IP address parameters with the Network Configurator.
By default, the IO-Link Master Unit is set as follows.
• IP address: Fixed to 192.168.250.1
• IP address duplication detection: Enabled
This means that using two or more IO-Link Master Units with the default settings will cause IP address duplication when the Unit/input power is supplied.

1 Set the rotary switches as follows, and turn ON the Unit/input power supply to the IO-Link Master Unit.
Third octet switches: Any value between 00 to FF hex
Fourth octet switches: 00 hex

2 Go online with the network that includes the IO-Link Master Unit to set up.

3 Select **Tools** – **Setup TCP/IP Configuration** from the menu.
The **Setup TCP/IP Configuration** dialog box is displayed. In the dialog box below, the default settings are shown.

4 In the **Setup TCP/IP Configuration** dialog box, enter the settings for the IO-Link Master Unit.

1) In the **Target IP Address** area, enter the IP address of the IO-Link Master Unit (192.168.250.1 by default).

2) In the **New Configuration** area, select the **Use the following IP address** option, and set the IP address, subnet mask, and default gateway.

> ### Additional Information
>
> Clicking the **Get from the Device** button sets the present settings in the **New Configuration** area. Use this method as necessary.

5 Select the **Not use DNS** option.

6 In the **New Configuration** – **TCP/IP Configuration** area, click the **Set to the Device** button.

The IP address settings that you configured in the **New Configuration** area are downloaded to the IO-Link Master Unit.

The following dialog box is displayed to show that the download was completed. The new settings apply immediately.
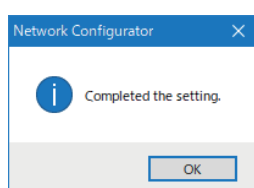
> ### Precautions for Correct Use
>
> • Setting an incorrect target IP address causes connection to an unexpected device, which results in setting incorrect device parameters.
>   Download data only after you confirm the IP address of the connected device.
> • If the ACD Setting is Enable (default) and the set IP address is assigned to another device, IP address duplication will occur.

Getting the IP Address from the BOOTP Server with the Network Configurator

The following describes how to specify the Network Configurator to get the IP address from the BOOTP server.

Precautions for Correct Use

If you have two or more IO-Link Master Units for which to set IP addresses, connect them one at a time, and download the TCP/IP Configuration's IP address parameters with the Network Configurator.
By default, the IO-Link Master Unit is set as follows.
• IP address: Fixed to 192.168.250.1
• IP address duplication detection: Enabled
This means that using two or more IO-Link Master Units with the default settings will cause IP address duplication when the Unit/input power is supplied.

On the BOOTP server, create a pairing table of the MAC addresses of IO-Link Master Units and the IP addresses assigned to the IO-Link Master Units in advance. Refer to the instruction manual for your BOOTP server for how to create a pairing table.

The MAC address of the IO-Link Master Unit is printed on a label attached to the right side of the Unit. Refer to *Notation of Unit Versions on Products* on page 25 in *Unit Versions* on page 25 for the location of the MAC address label.

1   Set the rotary switches as follows, and turn ON the Unit/input power supply to the IO-Link Master Unit.
Third octet switches: Any value between 00 to FF hex
Fourth octet switches: 00 hex

2   Go online with the network that includes the IO-Link Master Unit to set up.

3   Select **Tools** – **Setup TCP/IP Configuration** from the menu.
The **Setup TCP/IP Configuration** dialog box is displayed. In the dialog box below, the default settings are shown.

4   In the **Setup TCP/IP Configuration** dialog box, enter the settings for the IO-Link Master Unit.

1) In the **Target IP Address** area, enter the IP address of the IO-Link Master Unit (192.168.250.1 by default).

2) In the **New Configuration** area, select the **Get the IP address via BOOTP server** option.

5 In the **New Configuration** – **TCP/IP Configuration** area, click the **Set to the Device** button.
The settings that are required to get IP address from the BOOTP server are downloaded to the IO-Link Master Unit.
The following dialog box is displayed to show that the download was completed. The new settings apply immediately.
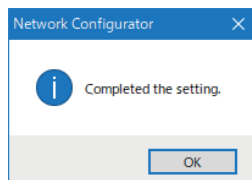
6 Cycle the Unit/input power supply or restart the Unit.
The IO-Link Master Unit gets the IP address from the BOOTP server.

Precautions for Correct Use

The above procedure causes the IO-Link Master Unit to get the IP address only when you reset the device for the first time after the settings are downloaded.
To cause the device to get the IP address from the BOOTP server every time it is reset, get the IP address from the BOOTP server with hardware switches.
Refer to *Getting the IP Address from the BOOTP Server with Hardware Switches* on page 7-18 for information on how to make the settings.

Getting the IP Address from the DHCP Server with the Network Configurator

The following describes how to specify the Network Configurator to get the IP address from the DHCP server.

Precautions for Correct Use

If you have two or more IO-Link Master Units for which to set IP addresses, connect them one at a time, and download the TCP/IP Configuration's IP address parameters with the Network Configurator.

By default, the IO-Link Master Unit is set as follows.
- IP address: Fixed to 192.168.250.1
- IP address duplication detection: Enabled

This means that using two or more IO-Link Master Units with the default settings will cause IP address duplication when the Unit/input power is supplied.

On the DHCP server, create a pairing table of the MAC addresses of IO-Link Master Units and the IP addresses assigned to the IO-Link Master Units in advance. Refer to the instruction manual for your DHCP server for how to create a pairing table.

The MAC address of the IO-Link Master Unit is printed on a label attached to the right side of the Unit. Refer to *Notation of Unit Versions on Products* on page 25 in *Unit Versions* on page 25 for the location of the MAC address label.

1 Set the rotary switches as follows, and turn ON the Unit/input power supply to the IO-Link Master Unit.

Third octet switches: Any value between 00 to FF hex

Fourth octet switches: 00 hex

2 Go online with the network that includes the IO-Link Master Unit to set up.

3 Select **Tools** – **Setup TCP/IP Configuration** from the menu.

The **Setup TCP/IP Configuration** dialog box is displayed. In the dialog box below, the default settings are shown.

4 In the **Setup TCP/IP Configuration** dialog box, enter the settings for the IO-Link Master Unit.

1) In the **Target IP Address** area, enter the IP address of the IO-Link Master Unit (192.168.250.1 by default).

2) In the **New Configuration** area, select the **Get the IP address via DHCP server** option.

5 In the **New Configuration** – **TCP/IP Configuration** area, click the **Set to the Device** button.
The settings that are required to get IP address from the DHCP server are downloaded to the IO-Link Master Unit.
The following dialog box is displayed to show that the download was completed. The new settings apply immediately.
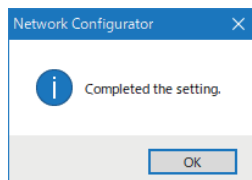
6 Cycle the Unit/input power supply or restart the Unit.
The IO-Link Master Unit gets the IP address from the DHCP server.

Precautions for Correct Use

The above procedure causes the IO-Link Master Unit to get the IP address only when you reset the device for the first time after the settings are downloaded.
To cause the device to get the IP address from the DHCP server every time it is reset, get the IP address from the DHCP server with hardware switches.
Refer to *Getting the IP Address from the DHCP Server with Hardware Switches* on page 7-19 for information on how to make the settings.

Directly Setting the IP Address with Hardware Switches

The following describes how to set the IP Address directly with hardware switches.
Use the third and fourth octet switches to directly set the IP address.
The relationship between the switch settings and the set IP address are as follows.

192.168.☐.☐

Fixed value

Set value of fourth octet switches in decimal

Set value of third octet switches in decimal
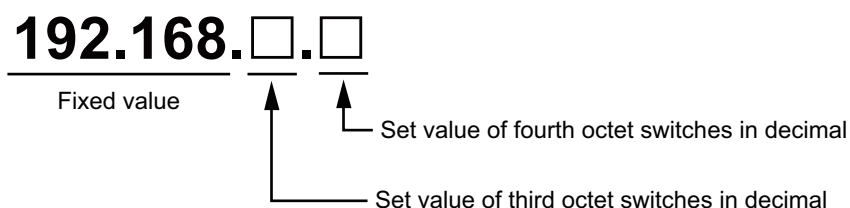
Rotary switches	Setting range (hex)
Third octet switches	00 to FF
Fourth octet switches	01 to FE

For example, when the set values of the rotary switches are as follows, the IP address is 192.168.17.34.

- Set value of third octet switches: 11 hex
- Set value of fourth octet switches: 22 hex

Precautions for Correct Use

- The IO-Link Master Unit gets the set IP address value when the Unit/input power supply is turned ON, or the Unit is restarted.
  This means that the IP address of the IO-Link Master Unit is not changed even if you change the IP address setting while power is supplied.
- If the ACD Setting is Enable (default) and the set IP address is assigned to another device, IP address duplication will occur.

Getting the IP Address from the BOOTP Server with Hardware Switches

The following describes how to get the IP Address from the BOOTP server with hardware switches.

You can set the hardware switches to get the IP address from the BOOTP server.

The switch settings are as follows.

Rotary switches	Set value (hex)
Third octet switches	00
Fourth octet switches	FF

On the BOOTP server, create a pairing table of the MAC addresses of IO-Link Master Units and the IP addresses assigned to the IO-Link Master Units in advance. Refer to the instruction manual for your BOOTP server for how to create a pairing table.

The MAC address of the IO-Link Master Unit is printed on a label attached to the right side of the Unit. Refer to *Notation of Unit Versions on Products* on page 25 in *Unit Versions* on page 25 for the location of the MAC address label.

The IO-Link Master Unit gets the IP address from the BOOTP server to make it its local IP address every time the Unit/input power supply is turned ON, or the Unit is restarted.

Precautions for Correct Use

- If the IO-Link Master Unit cannot get the IP address from the BOOTP server during a period of 60 seconds after the Unit/input power supply is turned ON, or the Unit is restarted, a BOOTP/DHCP Server Connection Error occurs. The Unit will continue to try to get the IP address from the BOOTP server even after the connection error occurs.
- If the Unit gets an illegal address from the BOOTP server, an TCP/IP Setting Error (Local IP Address) occurs. The Unit will continue to try to get an IP address from the BOOTP server even after the setting error occurs.
- To cancel getting the IP address from the BOOTP server, change the rotary switch settings, and then cycle the Unit/input power supply or restart the Unit.

Getting the IP Address from the DHCP Server with Hardware Switches

The following describes how to get the IP Address from the DHCP server with hardware switches.

You can set the hardware switches to get the IP address from the DHCP server.

The switch settings are as follows.

Rotary switches	Set value (hex)
Third octet switches	01
Fourth octet switches	FF

On the DHCP server, create a pairing table of the MAC addresses of IO-Link Master Units and the IP addresses assigned to the IO-Link Master Units in advance. Refer to the instruction manual for your DHCP server for how to create a pairing table.

The MAC address of the IO-Link Master Unit is printed on a label attached to the right side of the Unit. Refer to *Notation of Unit Versions on Products* on page 25 in *Unit Versions* on page 25 for the location of the MAC address label.

The IO-Link Master Unit gets the IP address from the DHCP server to make it its local IP address every time the Unit/input power supply is turned ON, or the Unit is restarted.

Precautions for Correct Use

- If the IO-Link Master Unit cannot get the IP address from the DHCP server during a period of 60 seconds after the Unit/input power supply is turned ON, or the Unit is restarted, a BOOTP/ DHCP Server Connection Error occurs. The Unit will continue to try to get the IP address from the DHCP server even after the connection error occurs.
- If the Unit gets an illegal address from the DHCP server, an TCP/IP Setting Error (Local IP Address) occurs. The Unit will continue to try to get an IP address from the DHCP server even after this error occurs.
- To cancel getting the IP address from the DHCP server, change the rotary switch settings, and then cycle the Unit/input power supply or restart the Unit.

7-3-3 Link Settings

Link Settings are the link speed settings of EtherNet/IP ports on the IO-Link Master Unit. Configure the settings for each EtherNet/IP port on the IO-Link Master Unit. The settings are shown in the following table.

Setting	Description	Default	Setting range	Update timing
Speed & Duplex	Set the link speed for EtherNet/IP ports on the IO-Link Master Unit.	Auto	• Auto • 10 Mbps Half Duplex • 10 Mbps Full Duplex • 100 Mbps Half Duplex • 100 Mbps Full Duplex	Immediately

Precautions for Correct Use

For the EtherNet/IP ports on the IO-Link Master Unit, configure the Link Settings as follows according to the QuickConnect Setting.

If QuickConnect Setting is Disable (Default):
Use Auto (default setting). If the devices to communicate with the IO-Link Master Unit use one of the following settings, the link will be unstable and prevent normal communications.
• 10 Mbps (fixed), Full Duplex
• 100 Mbps (fixed), Full Duplex
Therefore, connect the Unit to a device that supports the following communications modes. We recommend to set to Auto.
• Auto
• 10 Mbps (fixed), Half Duplex
• 100 Mbps (fixed), Half Duplex

If QuickConnect Setting is Enable:
Use the set values that are needed to obtain the starting characteristics of QuickConnect. Refer to *9-5 QuickConnect* on page 9-16 for details on the set values.

Configure the Link Settings with the Network Configurator.
However, the EtherNet/IP ports that you can configure depend on the setup dialog box.

Dialog box name	EtherNet/IP ports that can be configured	Reference
Setup TCP/IP Configuration	EtherNet/IP port 1	*Setting with the **Setup TCP/IP Configuration** Dialog Box* on page 7-20
Speed & Duplex	EtherNet/IP port 1 and EtherNet/IP port 2	*Setting with the **Speed & Duplex** Dialog Box* on page 7-21

Setting with the Setup TCP/IP Configuration Dialog Box

1 Go online with the network that includes the IO-Link Master Unit to set up.

2 Select the IO-Link Master Unit to set up, and then select **Tools** – **Setup TCP/IP Configuration** from the menu.
The **Setup TCP/IP Configuration** dialog box is displayed.

3 Select the link speed from the **Speed & Duplex** drop-down list.

4 Click the **Set to the Device** button. The Link Settings for EtherNet/IP port 1 are downloaded to the IO-Link Master Unit.
After completion of the download, the new settings are immediately reflected on the IO-Link Master Unit.

Setting with the Speed & Duplex Dialog Box

1 Go online with the network that includes the IO-Link Master Unit to set up.

2 Right-click the IO-Link Master Unit to set up and select **Parameter** – **Edit**.
The **Edit Device Parameters** dialog box is displayed.

3 Click the **Speed & Duplex** button.
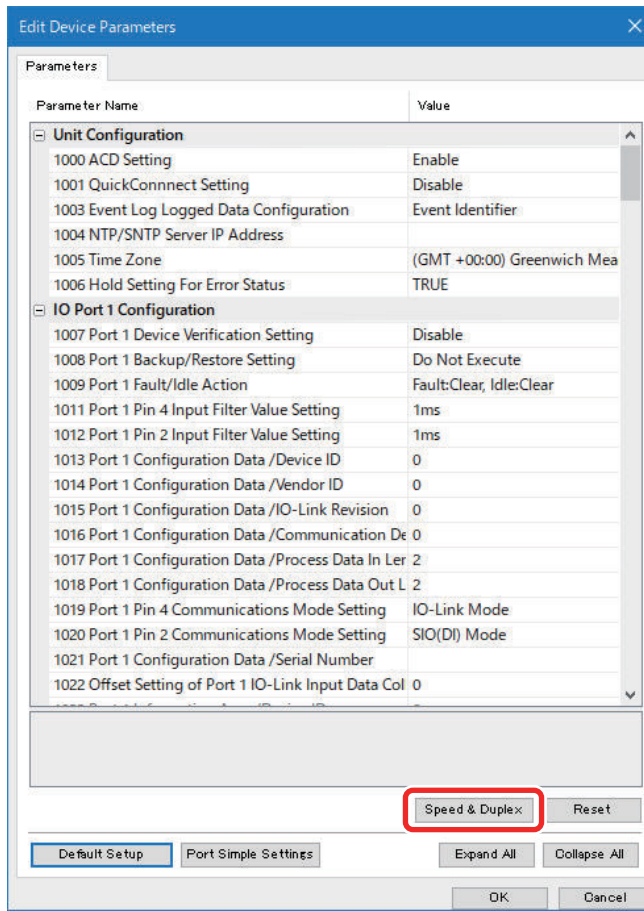
The **Speed & Duplex** dialog box is displayed.
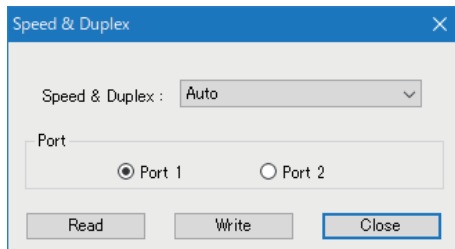
4 Select the port to set in **Port**, and then select the link speed from the **Speed & Duplex** drop-down list.

5 Click the **Write** button.
The Link Settings for EtherNet/IP port 1 and EtherNet/IP port 2 are downloaded to the IO-Link Master Unit.
After completion of the download, the new settings are immediately reflected on the IO-Link Master Unit.

7-4   Setting the Automatic Clock Adjust-ment

Automatic clock adjustment is a function that enables IO-Link Master Units to retrieve clock informa-
tion from the NTP server or SNTP server after the Unit/input power supply is turned ON and update
their internal clock information.
This allows you to synchronize the time of event occurrence in an IO-Link Master Unit with the server's
time, which is useful for error analysis.
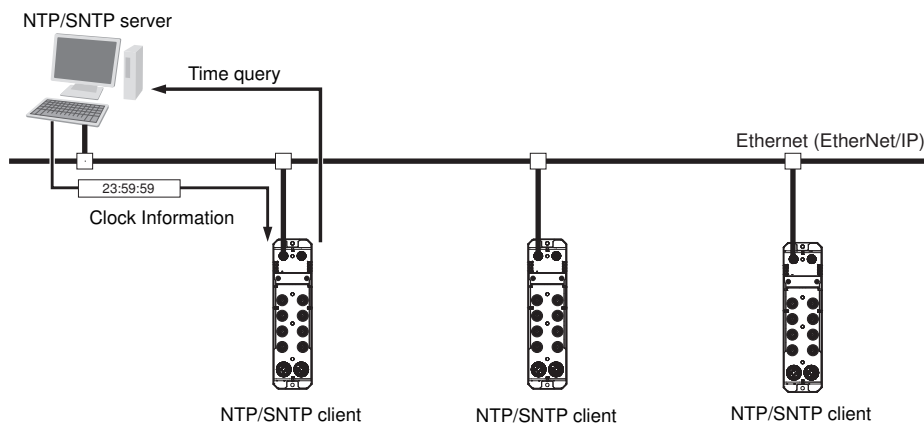
7-4-1   Details on Function

Operation of the IO-Link Master Unit

The table below shows how the IO-Link Master Unit operates when the function is enabled or disa-
bled. The operation depends on the value of Event Log Logged Data Configuration, which is described
later.

Automatic clock adjustment enabled/disabled[1]	Event Log Logged Data Configuration value	Operation of the IO-Link Master Unit
Enabled	Event Identifier +Time Stamp	The time of event occurrence in the IO-Link Master Unit is recorded based on the time information from the clock built in the IO-Link Master Unit, which is retrieved from the NTP server or SNTP server. If the clock information cannot be retrieved from the NTP server or SNTP server, the IO-Link Master Unit's internal clock starts measuring the time at "1972/01/01 00:00:00" after the Unit/input power supply is turned ON. The time of events that occurs before the time is retrieved from the NTP server or SNTP server is also recorded as the time started at "1972/01/01 00:00:00".
	Event Identifier	The time of event occurrence in the IO-Link Master Unit is fixed to "1972/01/01 00:00:00" regardless of when the time information is retrieved from the NTP server or SNTP server.
Disabled	Event Identifier +Time Stamp	The time of event occurrence in the IO-Link Master Unit starts at "1972/01/01 00:00:00" after power is supplied to the Unit/input power supply.
	Event Identifier	The time of event occurrence in the IO-Link Master Unit is fixed to "1972/01/01 00:00:00".

*1. To enable the function, enter the IP address in *NTP/SNTP Server IP Address*. To disable the function, do not enter the value.

Settings

Set the device parameters of the IO-Link Master Unit to use the automatic clock adjustment. Configure the following settings with the Network Configurator.

Setting	Description	Default	Setting range	Update timing
Event Log Logged Data Configuration	Set whether to record in event logs the event name only or the event name with the time of event occurrence. To use the automatic clock adjustment, select **Event Identifier + Time Stamp**.[1]	Event Identifier	• Event Identifier • Event Identifier +Time Stamp	After restart
NTP/SNTP Server IP Address	Set the IP address of the NTP/SNTP server from which to get time information with the automatic clock adjustment. Enter the IP address in the format of □□□. □□□. □□□. □□□. When the setting is left blank, the automatic clock adjustment is disabled.[1]	Function disabled (blank)	IP address in the format specified in the Description column	After restart

Setting	Description	Default	Setting range	Update timing
Time Zone	Set the time zone used with the automatic clock adjustment.	(GMT +00:00)Greenwich Mean Time(UTC)	*2	After restart

*1.　The operation at the time of occurrence of an event log is determined by the combination of the *Event Log Logged Data Configuration* and *NTP/SNTP Server IP Address* settings.
　　Refer to *Operation of the IO-Link Master Unit* on page 7-23 for details.

*2.　The setting range is as follows.

(GMT -12:00) Kwajalein
(GMT -11:00) Midway Island
(GMT -10:00) USA (Hawaii)
(GMT -09:00) USA (Alaska)
(GMT -08:00) Canada, USA (Pacific)
(GMT -07:00) Canada, USA (Mountain)
(GMT -06:00) Canada, USA (Central)
(GMT -05:00) Canada, USA (Eastern)
(GMT -04:00) Canada (Atlantic)
(GMT -03:30) Canada (Newfoundland)
(GMT -03:00) Argentina
(GMT -02:00) Antarctica
(GMT -01:00) Azores
(GMT +00:00) England
(GMT +00:00) United Kingdom, Portugal
(GMT +00:00) Greenwich Mean Time (UTC)
(GMT +01:00) France, Germany, Italy, Spain, Switzerland
(GMT +01:00) Sweden
(GMT +02:00) Bulgaria, Finland, Greece
(GMT +03:00) Russia (Moscow, St.Petersburg)
(GMT +03:30) Iran
(GMT +04:00) Russia (Samara, Izhevsk)
(GMT +04:30) Afghanistan
(GMT +05:00) Russia (Yekaterinburg, Perm)
(GMT +05:30) India
(GMT +05:45) Nepal
(GMT +06:00) Russia (Novosibirsk, Omsk)
(GMT +06:30) Myanmar
(GMT +07:00) Thailand
(GMT +07:00) Vietnam
(GMT +08:00) Australia (Western)
(GMT +08:00) China
(GMT +08:00) Taiwan
(GMT +09:00) Japan
(GMT +09:00) Republic of Korea
(GMT +09:30) Australia (Northern Territory), Australia (South)
(GMT +10:00) Australia (New South Wales/Queensland/Victoria)
(GMT +10:30) Australia (Lord Howe Island)

7-4 Setting the Automatic Clock Adjustment

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7-4-1 Details on Function

(GMT +11:00) New Caledonia
(GMT +11:30) Norfolk Island
(GMT +12:00) New Zealand
(GMT +12:45) Chatham Island
(GMT +13:00) Tonga

> **Additional Information**
>
> Daylight Savings Time is not supported.

7-4-2 Setting Method

This section describes how to set the automatic clock adjustment with the Network Configurator. Refer to *7-5 Setting Device Parameters* on page 7-28 for details on how to display the Edit Device Parameters dialog box and download device parameters.

1 Right-click the IO-Link Master Unit to set up and select **Parameter** – **Edit**.
The **Edit Device Parameters** dialog box is displayed.

2 Under **Unit Configuration**, set the following parameters. After you make all of the settings, click the **OK** button.

1) Select **Event Log Logged Data Configuration**, and then select **Event Identifier +Time Stamp** from the **Value** drop-down list.

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2) Select **NTP/SNTP Server IP Address** and enter the IP address of the NTP or SNTP server in the **Value** field.

3) Select **Time Zone**, and then select the time zone for your time from the **Value** drop-down list.

3 Connect the Network Configurator online.

4 Download the device parameters to the IO-Link Master Unit to set up.
After completion of the download, the IO-Link Master Unit restarts.
The settings are reflected after the IO-Link Master Unit is restarted.

7-5 Setting Device Parameters

This section describes how to set, download, and verify the device parameters of the IO-Link Master Unit.

To set the device parameters of the IO-Link Master Unit, use the Network Configurator or an explicit message.

Here, the setting procedures with the Network Configurator are described. Refer to *A-2-2 Configuring the IO-Link Master Unit with Message Communications* on page A-39 for information on the setting procedures with an explicit message.

7-5-1 List of Settings

The following table shows the setting and description of each IO-Link Master Unit device parameter. Refer to the description of settings in the reference sections for details on the setting range and default.

If you change any parameter whose update timing is "After restart", transfer the setting to the IO-Link Master Unit and then restart the IO-Link Master Unit to apply the change. If you change any parameter whose update timing is "Immediately", transfer the setting to the IO-Link Master Unit to immediately apply the change.

In the Setting column, Port □ represents port number 1 to 8.

Setting	Description	Change	Update timing	Reference
ACD Setting	Enable or disable IP address duplication detection.	Possible	After restart	*9-7 IP Address Duplication Detection* on page 9-20
QuickConnect Setting	Enable or disable QuickConnect.	Possible		*9-5 QuickConnect* on page 9-16
Event Log Logged Data Configuration	Set whether to record in event logs the event name only or the event name with the time of event occurrence.	Possible		*7-4 Setting the Automatic Clock Adjustment* on page 7-23
NTP/SNTP Server IP Address	Set the IP address of the NTP/SNTP server from which to get time information with the automatic clock adjustment.	Possible		
Time Zone	Set the time zone used with the automatic clock adjustment.	Possible		

Setting	Description	Change	Update timing	Reference
Hold Setting For Error Status	Set the behavior of the error status when the error cause is removed.	Possible	After restart	*12-8-2 Hold Setting For Error Status* on page 12-41
Port □ Device Verification Setting	Set the operation of IO-Link device verification.	Possible		*10-7 IO-Link Device Verification* on page 10-15
Port □ Backup/Restore Setting	Set whether to back up or restore the parameter settings of the IO-Link device, or disable the backup/restore function.	Possible		*10-13 Backing Up and Restoring IO-Link Device Parameters* on page 10-31
Port □ Fault/Idle Action	Set output operations during communications errors or Idle.	Possible		*10-4 Output Settings during Communications Errors/Idle with EtherNet/IP Scanner* on page 10-8
Port □ Pin 4 Communications Mode Setting	Set the communications mode for pin 4.	Possible		*10-2 Communications Mode Settings* on page 10-5
Port □ Pin 2 Communications Mode Setting	Set the communications mode for pin 2.	Possible		
Port □ Pin 4 Input Filter Value Setting	Set the input filter value of digital inputs for pin 4.	Possible	After restart	*10-5 Digital Input Filter* on page 10-10
Port □ Pin 2 Input Filter Value Setting	Set the input filter value of digital inputs for pin 2.	Possible		
Port □ Configuration Data /Device ID	Set the device ID of the connected IO-Link device.	Possible		*10-7 IO-Link Device Verification* on page 10-15
Port □ Configuration Data /Vendor ID	Set the vendor ID of the connected IO-Link device.	Possible		
Port □ Configuration Data /IO-Link Revision	Set the IO-Link revision of the connected IO-Link device.	Possible		
Port □ Configuration Data / Communication Delay Time	Set the IO-Link communications delay time.	Possible		*10-15 IO-Link Communications Delay Time Settings* on page 10-42
Port □ Configuration Data /Process Data In Length	Set the size of the process input data from the connected IO-Link device.	Possible	After restart	*A-1-9 IO-Link Object (Class ID: 381 Hex)* on page A-24
Port □ Configuration Data /Process Data Out Length	Set the size of the process output data to the connected IO-Link device.	Possible		
Port □ Configuration Data /Serial Number	Set the serial number of the connected IO-Link device.	Possible		*10-7 IO-Link Device Verification* on page 10-15
Offset Setting of Port □ IO-Link Input Data Collection Port	Specify the position of the bit to extract from IO-Link Input Data.	Possible		*10-6 Digital Input Collection* on page 10-12

7-5 Setting Device Parameters

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7-5-1 List of Settings

Setting	Description	Change	Update timing	Reference
Port □ Information Area /Device ID	The device ID retrieved from the actually connected IO-Link device is displayed.	Not possible	Cannot be changed. Monitoring only.	*A-1-9 IO-Link Object (Class ID: 381 Hex)* on page A-24
Port □ Information Area /Vendor ID	The vendor ID retrieved from the actually connected IO-Link device is displayed.	Not possible		
Port □ Information Area /IO-Link Revision	The IO-Link revision retrieved from the actually connected IO-Link device is displayed.	Not possible		
Port □ Information Area /Cycle Time	The cycle time retrieved from the actually connected IO-Link device is displayed.	Not possible		*A-1-9 IO-Link Object (Class ID: 381 Hex)* on page A-24
Port □ Information Area /Process Data In Length	The process input data size retrieved from the actually connected IO-Link device is displayed.	Not possible		
Port □ Information Area /Process Data Out Length	The process output data size retrieved from the actually connected IO-Link device is displayed.	Not possible		
Port □ Information Area /Serial Number	The serial number retrieved from the actually connected IO-Link device is displayed.	Not possible		*A-1-9 IO-Link Object (Class ID: 381 Hex)* on page A-24
Port □ Product Name of the Last Connected IO-Link Device	The product name retrieved from the last-connected IO-Link device is displayed.	Not possible		
Port □ Vendor Name of the Last Connected IO-Link Device	The vendor name retrieved from the last-connected IO-Link device is displayed.	Not possible		

7-5-2 Setting the Device Parameters of the IO-Link Master Unit

This section describes how to set the device parameters of the IO-Link Master Unit with the Network Configurator.

Among the device parameter settings, the IO-Link Port Simple Settings of the Network Configurator facilitates the configuration of those associated with IO-Link device configuration settings information. Refer to *7-5-3 IO-Link Port Simple Settings* on page 7-32 for information on the setting procedures with the IO-Link Port Simple Settings.

1 Open the Network Configurator file that contains the IO-Link Master Unit.

2 Display the **Edit Device Parameters** dialog box with either of the following methods.
   • Double-click the IO-Link Master Unit in the Network Configuration Pane.
   • Right-click the IO-Link Master Unit in the network and select **Parameter** – **Edit**.

3 Set the device parameters. For each item in the **Parameter Name** column, click the value in the **Value** field to set a value.

📖 **Additional Information**

Some of the items displayed in the **Edit Device Parameters** dialog box are for monitoring only and cannot be edited. You can check whether they are editable or not in *7-5-1 List of Settings* on page 7-28.

4 After you edit all parameters, click **OK** to complete the editing of device parameters.

Adding IO-Link Master Units That Have the Same Settings

With the Network Configurator, you can add new IO-Link Master Units that have the same device parameter settings. The setting procedure is described below.

1 Right-click the IO-Link Master Unit to copy and select **Copy** from the menu.

2 Right-click in the Network Configuration Pane and select **Paste** from the menu.
The copied IO-Link Master Unit is inserted.

> **Additional Information**
>
> Copying and pasting an IO-Link Master Unit creates a copy that has the same settings excluding the IP address. For the IP address, a unique value is automatically set. Change the value as required.

Exporting/Importing Device Parameter Settings

With the Network Configurator, you can export the device parameters of an IO-Link Master Unit as a file. You can then import the exported setting file to another IO-Link Master Unit.
This allows you to create a copy of the IO-Link Master Unit with the same device parameters.
The file extension is ".dvf".

1 Right-click the IO-Link Master Unit from which to export settings and select **Parameter** – **Save as**.
The **Save Device Parameters** dialog box is displayed.

2 Enter a file name, and then click the **Save** button.
The device parameter file is saved.
The file extension is ".dvf".

3 Right-click the IO-Link Master Unit from which to import settings and select **Parameter** – **Open**.
The **Open Device Parameters** dialog box is displayed.

4 Select the file to import and click the **Open** button.
The device parameters of the IO-Link Master Unit are imported.

7-5-3   IO-Link Port Simple Settings

Among the device parameters of the IO-Link Master Unit, those associated with IO-Link device configuration settings information must be configured so as to match the information on the actually connected IO-Link devices. The IO-Link Port Simple Settings of the Network Configurator facilitates the configuration of the IO-Link device configuration settings information to match the information on the actual devices.

The IO-Link Port Simple Settings supports the following two methods to register devices.
• Registering devices offline by selecting from the IO-Link device list
• Registering devices by getting and editing configuration settings from the actual IO-Link devices connected to the IO-Link Master Unit

Registering Devices Offline

1 Right-click the IO-Link Master Unit to set up and select **Parameter** – **Edit**.
The **Edit Device Parameters** dialog box is displayed.
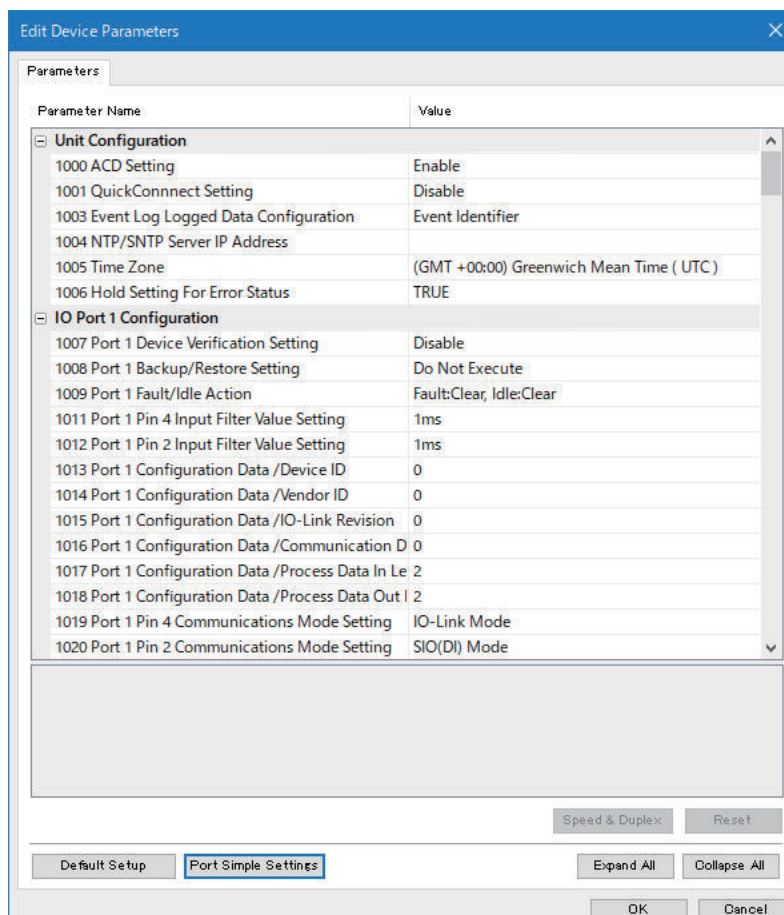
2 Click the **Port Simple Settings** button.

The **IO-Link Port Simple Settings** dialog box is displayed.
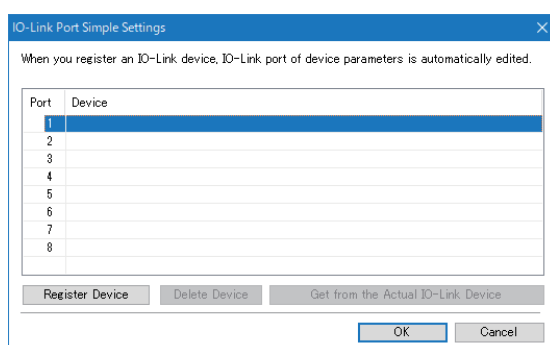
3 Select the port to which to connect the IO-Link device and click the **Register Device** button.

The **Select IO-Link Device** dialog box is displayed.
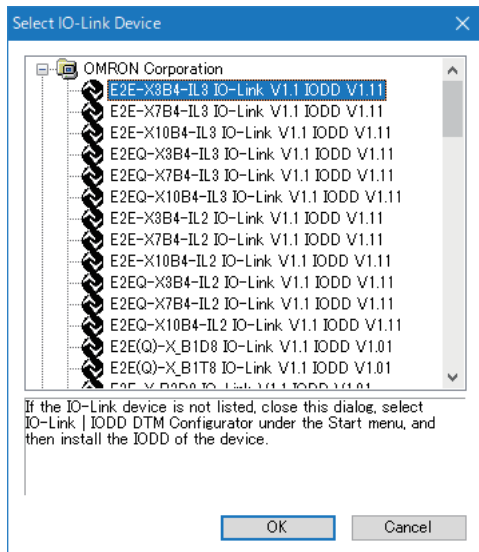
Precautions for Correct Use

IO-Link devices without IODD files are not listed even if they are connected. Refer to *11-2-4 Installing IODD Files for IO-Link Devices from Other Companies in the CX-ConfiguratorFDT* on page 11-5.

4 From the device list in the **Select IO-Link Device** dialog box, select the IO-Link device to use and click the **OK** button.
The device is added to the selected port.
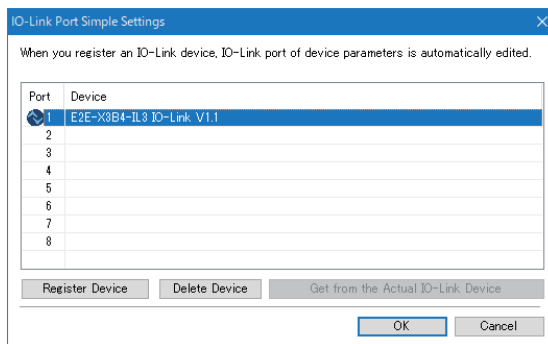
5 Repeat steps 2 to 4 to register IO-Link devices with the port.

6 After you register IO-Link devices, click the **OK** button in the **IO-Link Port Simple Settings** dialog box.
In the **Edit Device Parameters** dialog box, the following items listed under **IO Port ☐ Configuration** are automatically set in the device settings of the registered device.
Port ☐ represents port number 1 to 8.

Port ☐ Configuration Data /Device ID
Port ☐ Configuration Data /Vendor ID
Port ☐ Configuration Data /IO-Link Revision
Port ☐ Configuration Data /Process Data In Length
Port ☐ Configuration Data /Process Data Out Length

Precautions for Correct Use

When you register devices offline with the IO-Link Port Simple Settings, among IO-Link device configuration settings information, the following parameter is not set.

Port □ Configuration Data/Serial Number

Set this parameter in the **Edit Device Parameters** dialog box.

Registering Devices by Getting the Device Settings from the Actual IO-Link Devices

1 Go online with the network that includes the IO-Link Master Unit to set up.

2 Right-click the IO-Link Master Unit to set up and select **Parameter** – **Edit**.
The **Edit Device Parameters** dialog box is displayed.

Edit Device Parameters

Parameters

Parameter Name	Value
Unit Configuration	
1000 ACD Setting	Enable
1001 QuickConnnect Setting	Disable
1003 Event Log Logged Data Configuration	Event Identifier
1004 NTP/SNTP Server IP Address	
1005 Time Zone	(GMT +00:00) Greenwich Mean Time (UTC)
1006 Hold Setting For Error Status	TRUE
IO Port 1 Configuration	
1007 Port 1 Device Verification Setting	Disable
1008 Port 1 Backup/Restore Setting	Do Not Execute
1009 Port 1 Fault/Idle Action	Fault:Clear, Idle:Clear
1011 Port 1 Pin 4 Input Filter Value Setting	1ms
1012 Port 1 Pin 2 Input Filter Value Setting	1ms
1013 Port 1 Configuration Data /Device ID	0
1014 Port 1 Configuration Data /Vendor ID	0
1015 Port 1 Configuration Data /IO-Link Revision	0
1016 Port 1 Configuration Data /Communication D	0
1017 Port 1 Configuration Data /Process Data In Le	2
1018 Port 1 Configuration Data /Process Data Out I	2
1019 Port 1 Pin 4 Communications Mode Setting	IO-Link Mode
1020 Port 1 Pin 2 Communications Mode Setting	SIO(DI) Mode

Speed & Duplex   Reset

Default Setup   Port Simple Settings   Expand All   Collapse All

OK   Cancel

3 Click the **Port Simple Settings** button.
The **IO-Link Port Simple Settings** dialog box is displayed.
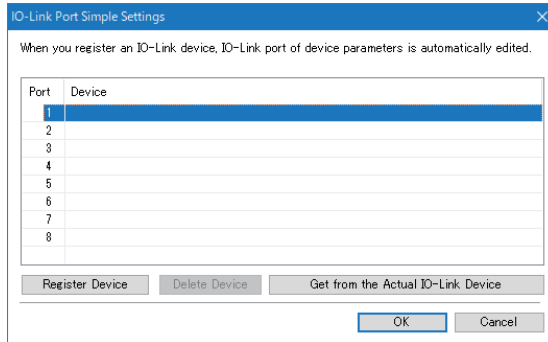
4 Click the **Get from the Actual IO-Link Device** button.
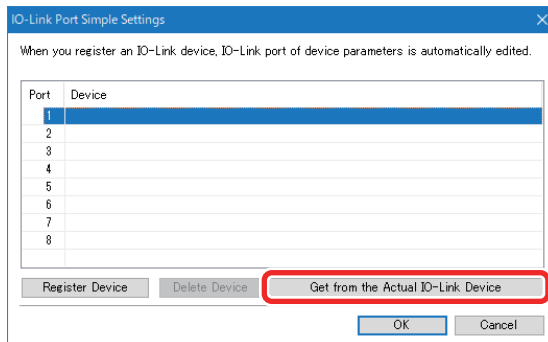
The dialog box now shows IO-Link devices for ports to which the actual IO-Link devices are connected.
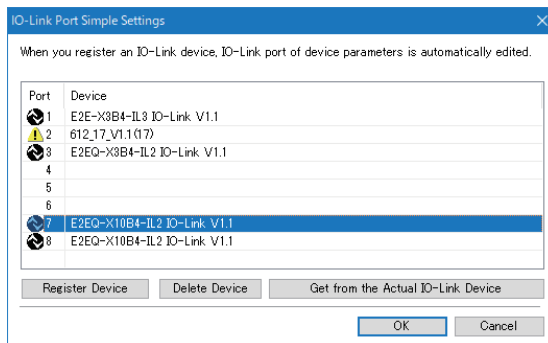
> 📋 **Precautions for Correct Use**
>
> • For any IO-Link device without IODD files, a warning icon (⚠) is shown in the **Port** column.
>   Install IODD files for the IO-Link device. Refer to *11-2-4 Installing IODD Files for IO-Link Devices from Other Companies in the CX-ConfiguratorFDT* on page 11-5 for the installation procedure.
> • When you get device settings from the actual IO-Link devices, the device names written in the IODD files are shown. However, depending on the connected devices, the written device names may be representative model names.
>   Therefore, the displayed model names may differ from the model names of the actually connected devices.
>   In this case, the device settings of the actually connected devices are automatically set for the IO-Link Master Unit.

5 Click the **OK** button in the **IO-Link Port Simple Settings** dialog box.

In the **Edit Device Parameters** dialog box, the following items listed under **IO Port ☐ Configuration** are automatically set in the device settings of the actually connected devices. Port ☐ represents port number 1 to 8.

Port ☐ Configuration Data /Device ID
Port ☐ Configuration Data /Vendor ID
Port ☐ Configuration Data /IO-Link Revision
Port ☐ Configuration Data /Process Data In Length
Port ☐ Configuration Data /Process Data Out Length
Port ☐ Configuration Data/Serial Number

The IO-Link device settings of the actually connected devices are as follows.

Port ☐ Information Area /Device ID
Port ☐ Information Area /Vendor ID
Port ☐ Information Area /IO-Link Revision
Port ☐ Information Area /Process Data In Length
Port ☐ Information Area /Process Data Out Length
Port ☐ Information Area /Serial Number

Configure the IO-Link device settings as required.
Then, download the device parameters to update the IO-Link device configuration settings information with the current information on the actually connected IO-Link devices. Refer to *7-5-4 Downloading and Verifying Device Parameters* on page 7-37 for information on the download procedure.

7-5-4　Downloading and Verifying Device Parameters

This section describes how to download device parameters to the IO-Link Master Unit and verify them with the Network Configurator.
There are two ways to download the parameters.
- Downloading all device parameters in the network
- Downloading individually to particular devices

These are described below.

Downloading All Device Parameters in the Network

Download the parameters of all devices in the network configuration, including IO-Link Master Units.

1 Go online with the network that includes the IO-Link Master Unit to which to download device parameters.

2 Select **Network** – **Download** from the menu.
The following dialog box is displayed.
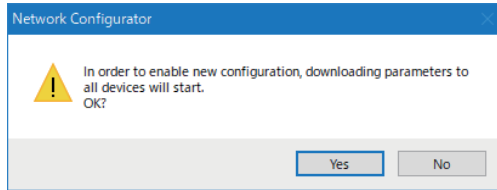
3 Click the **Yes** button to download the parameters of all EtherNet/IP devices including IO-Link Master Units.
The following dialog box is displayed if any of the CPU Units is not in PROGRAM mode.
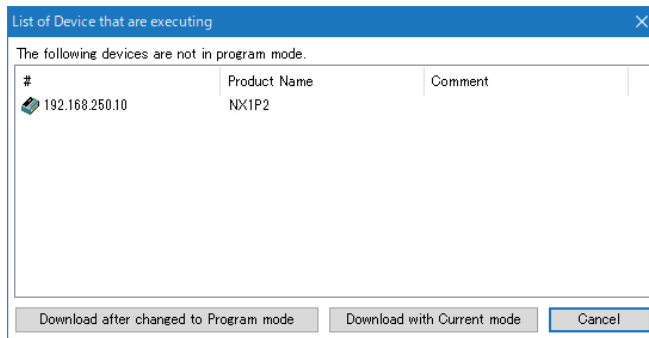
Refer to *Downloading Tag Data Link Parameters* in the user's manual for your OMRON EtherNet/IP scanner for how the CPU Unit operates with buttons provided in this dialog box.

When the download is completed, the following dialog box is displayed.
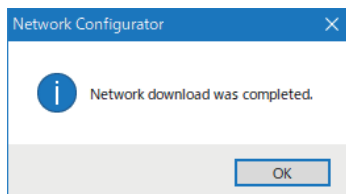
If you download a parameter that does not change until after the Unit is restarted, the IO-Link Master Unit restarts when the download is completed. The settings are reflected after the IO-Link Master Unit is restarted.
If you download a parameter that is updated immediately, the settings are reflected on IO-Link Master Unit immediately when the download is completed.

Downloading Individually to Particular Devices

1 Go online with the network that includes the IO-Link Master Unit to which to download device parameters.

2 Select the IO-Link Master Unit to which to download device parameters.

3 Select **Device** – **Parameters** – **Download** from the menu to start downloading the device parameters.

4 When the download is completed, the following dialog box is displayed.
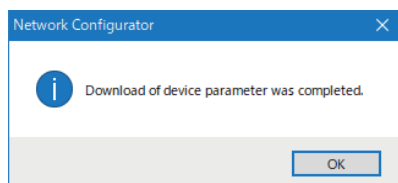
If you download a parameter that does not change until after the Unit is restarted, the IO-Link Master Unit restarts when the download is completed. The settings are reflected after the IO-Link Master Unit is restarted.

If you download a parameter that is updated immediately, the settings are reflected on IO-Link Master Unit immediately when the download is completed.

Verifying Settings

Verify settings by selecting IO-Link Master Units individually.

1 Go online with the network that includes the IO-Link Master Unit for which to verify settings.

2 Select the IO-Link Master Unit for which to verify settings.

3 Select **Device** – **Parameters** – **Verify** from the menu to verify the settings.
The results of the comparison are displayed as shown below.
- When the settings are the same
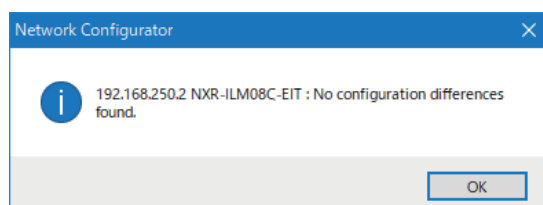
- When the settings are different
The following is an example of when the Port 1 Configuration Data /Device ID is different from the device ID of the actually connected IO-Link device.
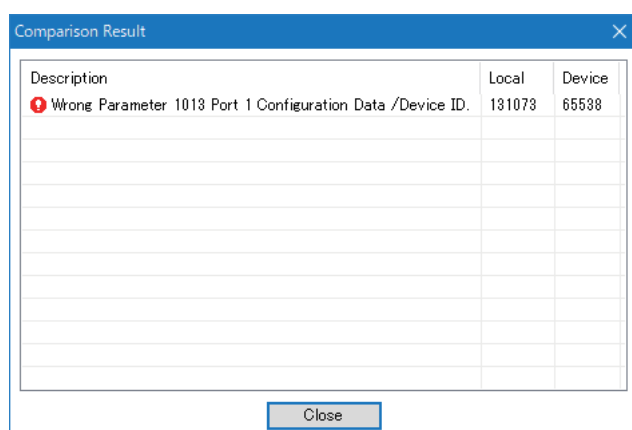
7-5-5   Uploading Device Parameters

With the Network Configurator, you can upload device parameters from the IO-Link Master Unit.
There are two ways to upload the parameters.
- Uploading from all devices in the network
- Uploading individually from particular devices

These are described below.

Uploading from All Devices in the Network

Upload device parameters from all devices in the network configuration, including the IO-Link Master Unit.

1 Go online with the network that includes the IO-Link Master Unit from which to upload device parameters.

2 Select **Network** – **Upload** from the menu.
The following dialog box is displayed.
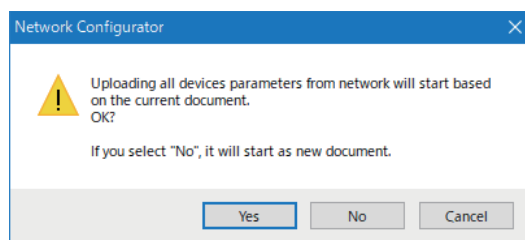
- If you click the **Yes** button
  Go to step 3.
- If you click the **No** button
  Go to step 4.
- If you click the **Cancel** button
  The upload operation is canceled. Device parameters are not uploaded.

3 If you click the **Yes** button in step 2, the following dialog box is displayed.
You are ready to upload device parameters with the current configuration file.
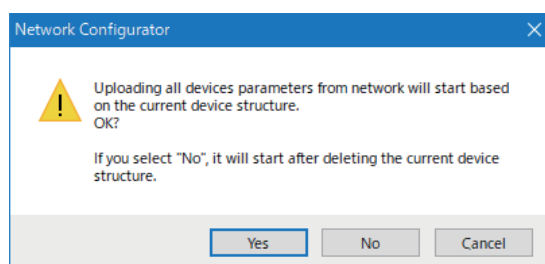
- If you click the **Yes** button
  The upload operation starts. Parameters are uploaded only from the devices registered in the Network Configuration Pane. Parameters are not uploaded from devices that are not registered in the Network Configuration Pane.

When the upload is completed, the following dialog box is displayed.
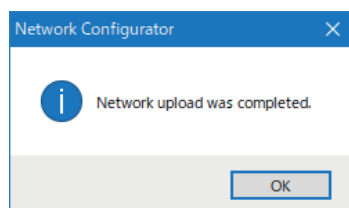
Click the **OK** button.
- If you click the **No** button
  Go to step 4.
- If you click the **Cancel** button
  The upload operation is canceled. Device parameters are not uploaded.

4 If you click the **No** button in step 2 or 3, the following dialog box is displayed.
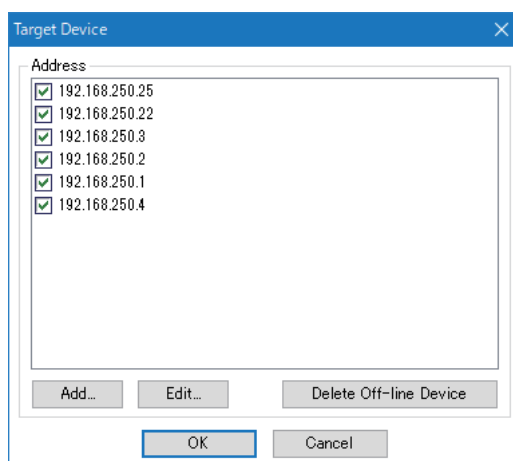
Select the devices from which to upload parameters and click the **OK** button.
A new network configuration file opens and device parameters are uploaded from the selected devices.
The current network configuration information will be lost.
When the upload is completed, the following dialog box is displayed.
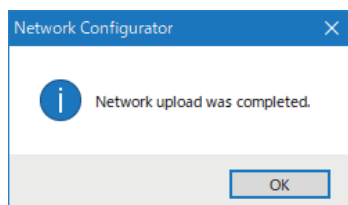
Click the **OK** button.

Uploading Individually from Particular Devices

1 Go online with the network that includes the IO-Link Master Unit from which to upload device parameters.

2 Select the IO-Link Master Unit from which to upload device parameters.
To select multiple nodes, press and hold the **Shift** key or the **Ctrl** key while you select additional icons.
In the following example, two nodes are selected: 192.168.250.1 and 192.168.250.2.
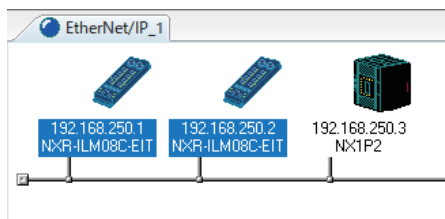
3 Select **Device** – **Parameters** – **Upload** from the menu.
The following dialog box is displayed.
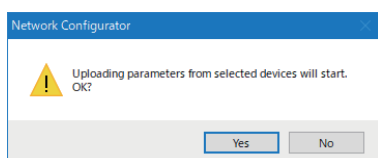
4 Click the **Yes** button.
The upload operation starts. When the upload is completed, the following dialog box is displayed.
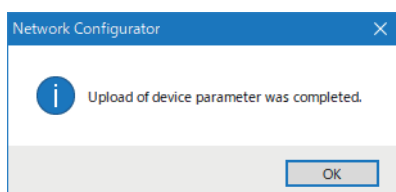
Click the **OK** button.

7-6   Specifications of I/O Data

This section describes the I/O data for an IO-Link Master Unit.

Between an EtherNet/IP scanner and an IO-Link Master Unit, data exchange performs with tag data link communications. This means that the I/O data for an IO-Link Master Unit is defined with input and output tag sets.

Set the I/O data to use for the IO-Link Master Unit in the tag data link connection settings. Refer to *7-7-4 Setting the Connection* on page 7-68 for information on how to make the settings.
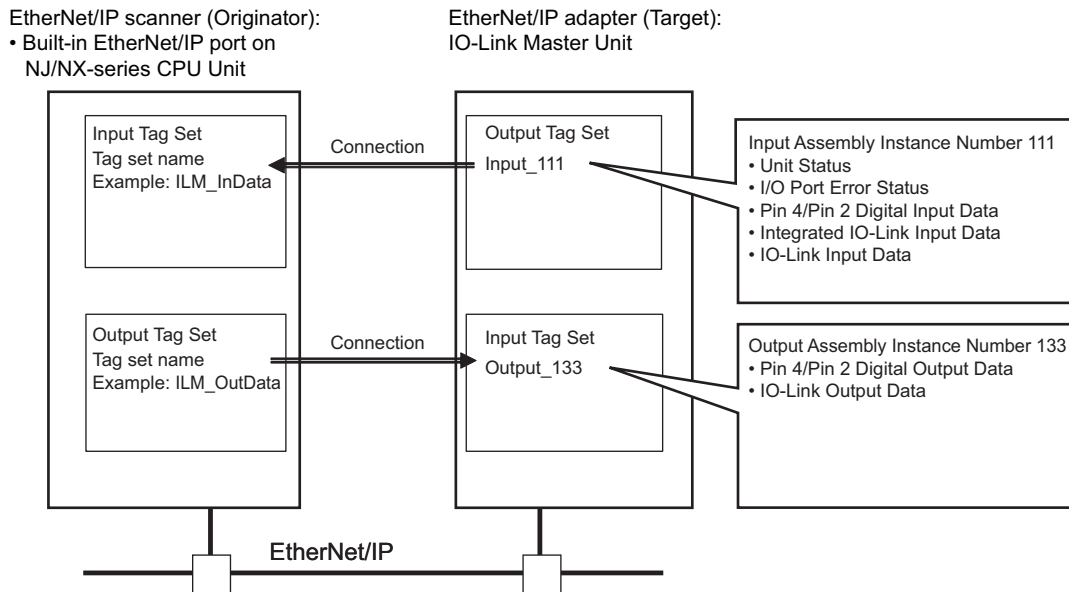
Example: When connection I/O type *EO Digital I/O, IO-Link 8 byte with Status* is selected
  • Output Tag Set: Input Assembly Instance Number 111
  • Input Tag Set: Output Assembly Instance Number 133

The following sections describe the input and output tag sets, and then the data configuration and data details of the input and output assembly instances that make up the input and output tag sets.

7-6-1   List of Input and Output Tag Sets

The input and output tag sets that can be assigned to the IO-Link Master Unit are given below.

Implicit message connections	Connection I/O type	Output Tag Set		Input Tag Set	
		Input Assembly Instance Number	Data size [bytes]	Output Assembly Instance Number	Data size [bytes]
Exclusive Owner	EO Digital I/O with Status	126	30	148	2
	EO Digital I/O, IO-Link 2 byte with Status	110	46	132	18
	EO Digital I/O, IO-Link 8 byte with Status	111	94	133	66
	EO Digital I/O, IO-Link 32 byte with Status	112	286	134	258

Implicit message connections	Connection I/O type	Output Tag Set		Input Tag Set	
		Input Assembly Instance Number	Data size [bytes]	Output Assembly Instance Number	Data size [bytes]
Input Only	IO Digital In with Status	126	30	197	0
	IO Digital In, IO-Link In 2 byte with Status	110	46	197	0
	IO Digital In, IO-Link In 8 byte with Status	111	94	197	0
	IO Digital In, IO-Link In 32 byte with Status	112	286	197	0

Precautions for Correct Use

If you select Input Only for implicit message connections, the NS indicator on the IO-Link Master Unit will not flash red even if a connection timeout occurs.

Additional Information

- If you select Exclusive Owner for implicit message connections, the IO-Link Master Unit will stop sending the output tag set to the EtherNet/IP scanner when a connection timeout occurs.
  Using the output tag set for Exclusive Owner for Multi-cast connection also causes the IO-Link Master Unit to temporarily stop sending data to other EtherNet/IP scanner that uses the same output tag set for Multi-cast connection. To prevent the Unit from temporarily stop sending data, use the output tag set for Exclusive Owner in a Point to Point connection.
- In the Edit Connection dialog box of the Network Configurator, the output and input tag sets for the IO-Link Master Unit, which is the target device, are displayed as follows.
  a) Input_Input Assembly Instance Number - [Data size]
     Example: Input_126 - [30Byte]
  b) Output_Output Assembly Instance Number - [Data size]
     Example: Output_148 - [2Byte]

7-6-2 Types and Data Configuration of Tag Sets

This section describes the types and data configuration of output and input tag sets.

Types of Output Tag Sets (Input Data)

An output tag set is the input data in the IO-Link Master Unit, which is sent to the EtherNet/IP scanner. The type of an output tag set is defined as the type of the Input Assembly that makes up the output tag set. The type of an Input Assembly is distinguished by the instance number.
The following describes the data configuration of the Input Assembly for each Input Assembly Instance Number.

● **Input Assembly Instance Number 110**

Bytes	Data name	Size [bytes]	Total size [bytes]	Reference
0 to 9	Unit Status	10	46	*7-6-3 Details on Input Assembly Data* on page 7-47
10 to 25	I/O Port Error Status	16		
26 to 27	Pin 4/Pin 2 Digital Input Data	2		
28 to 29	Integrated IO-Link Input Data	2		
30 to 45	IO-Link Input Data 2 bytes × 8 ports	16		

● **Input Assembly Instance Number 111**

Bytes	Data name	Size [bytes]	Total size [bytes]	Reference
0 to 9	Unit Status	10	94	*7-6-3 Details on Input Assembly Data* on page 7-47
10 to 25	I/O Port Error Status	16		
26 to 27	Pin 4/Pin 2 Digital Input Data	2		
28 to 29	Integrated IO-Link Input Data	2		
30 to 93	IO-Link Input Data 8 bytes × 8 ports	64		

● **Input Assembly Instance Number 112**

Bytes	Data name	Size [bytes]	Total size [bytes]	Reference
0 to 9	Unit Status	10	286	*7-6-3 Details on Input Assembly Data* on page 7-47
10 to 25	I/O Port Error Status	16		
26 to 27	Pin 4/Pin 2 Digital Input Data	2		
28 to 29	Integrated IO-Link Input Data	2		
30 to 285	IO-Link Input Data 32 bytes × 8 ports	256		

● **Input Assembly Instance Number 126**

Bytes	Data name	Size [bytes]	Total size [bytes]	Reference
0 to 9	Unit Status	10	30	*7-6-3 Details on Input Assembly Data* on page 7-47
10 to 25	I/O Port Error Status	16		
26 to 27	Pin 4/Pin 2 Digital Input Data	2		
28 to 29	Integrated IO-Link Input Data	2		

Types of Input Tag Sets (Output Data)

An input tag set is the output data in the IO-Link Master Unit, which is received from the EtherNet/IP scanner.

The type of an input tag set is defined as the type of the Output Assembly that makes up the input tag set. The type of an Output Assembly is distinguished by the instance number.
The following describes the data configuration of the Output Assembly for each Output Assembly Instance Number.

● Output Assembly Instance Number 132

Bytes	Data name	Size [bytes]	Total size [bytes]	Reference
0 to 1	Pin 4/Pin 2 Digital Output Data	2	18	*7-6-4 Details on Output Assembly Data* on page 7-57
2 to 17	IO-Link Output Data 2 bytes × 8 ports	16		

● Output Assembly Instance Number 133

Bytes	Data name	Size [bytes]	Total size [bytes]	Reference
0 to 1	Pin 4/Pin 2 Digital Output Data	2	66	*7-6-4 Details on Output Assembly Data* on page 7-57
2 to 65	IO-Link Output Data 8 bytes × 8 ports	64		

● Output Assembly Instance Number 134

Bytes	Data name	Size [bytes]	Total size [bytes]	Reference
0 to 1	Pin 4/Pin 2 Digital Output Data	2	258	*7-6-4 Details on Output Assembly Data* on page 7-57
2 to 257	IO-Link Output Data 32 bytes × 8 ports	256		

● Output Assembly Instance Number 148

Bytes	Data name	Size [bytes]	Total size [bytes]	Reference
0 to 1	Pin 4/Pin 2 Digital Output Data	2	2	*7-6-4 Details on Output Assembly Data* on page 7-57

● Output Assembly Instance Number 197

This assembly instance is used when an Input Only is selected for the connection I/O type.
This Assembly Instance Number is used although you cannot select any input tag set for the target device during connection setting.
It is used for heartbeat signals that are sent from the EtherNet/IP scanner to the IO-Link Master Unit. The output data size is 0 byte.

Bytes	Data name	Size [bytes]	Total size [bytes]	Reference
0	Input Only Heart Beat	0	0	---

7-6-3   Details on Input Assembly Data

Details on the Input Assembly data are described below.

Unit Status

Unit Status is data that indicates the operating status of an IO-Link Master Unit.
The data size of the Unit Status is 10 bytes.

	Bit			
Offset	15	08	07	00
m	Unit Error Collection Status			
m+1	(Reserved)		Unit Error Status	
m+2	Port Input Data Enabled		Port Error	
m+3	Unit/input power supply voltage			
m+4	Output Power Supply Voltage			

The function of each bit of the Unit Status is given in the following table.
For bits that are indicated as "(Default: Hold)", when the *Hold Setting For Error Status* is TRUE (default), the bit remains TRUE even after the cause of the error is removed. Execute the Clear Error Status Flag service to change the bit to FALSE. Refer to *12-8 Resetting Errors* on page 12-41 for how to clear the error status.
Change the Hold Setting For Error Status to FALSE to cause the bit to change to FALSE immediately when the cause of the error is removed.

Offset	Bit	Name	Default	Description
m	00 to 15	Unit Error Collection Status	0000 hex	0020 hex: One of the following errors occurred. Check the Unit Error Status or Port Error value in the Unit Status to determine which of the errors occurred. • Unit/Input Power Supply Voltage Drop • Output Power Supply Voltage Drop • Automatic Clock Adjustment Setting Error • NTP/SNTP Server Connection Error • EtherNet/IP Port 1 Link Down • EtherNet/IP Port 2 Link Down • Port Error 0000 hex: Indicates that none of the above errors occurred.

Offset	Bit	Name	Default	Description
m+1	Unit Error Status			
	00	Unit/Input Power Supply Voltage Drop	FALSE	TRUE: (Default: Hold) Indicates that the Unit/input power supply voltage dropped below the lower limit of the rating. FALSE: Indicates that none of the above error occurred.
	01	Output Power Supply Voltage Drop	FALSE	TRUE: (Default: Hold) Indicates that the output power supply voltage dropped below the lower limit of the rating. FALSE: Indicates that none of the above error occurred.
	02	Automatic Clock Adjustment Setting Error	FALSE	TRUE: (Default: Hold) Indicates that an incorrect value is stored in the *NTP/SNTP Server IP Address*. FALSE: Indicates that none of the above error occurred.
	03	NTP/SNTP Server Connection Error	FALSE	TRUE: (Default: Hold) Indicates that an attempt to connect to the NTP/SNTP server failed when automatic clock adjustment is enabled. FALSE: Indicates that none of the above error occurred.
	04	(Reserved)	---	Reserved by the system
	05	(Reserved)	---	Reserved by the system
	06	EtherNet/IP Port 1 Link Down	FALSE	TRUE: (Default: Hold) Indicates that a link down was detected after EtherNet/IP Port 1 was linked up. FALSE: Indicates that no link down occurred after EtherNet/IP Port 1 was linked up.
	07	EtherNet/IP Port 2 Link Down	FALSE	TRUE: (Default: Hold) Indicates that a link down was detected after EtherNet/IP Port 2 was linked up. FALSE: Indicates that no link down occurred after EtherNet/IP Port 2 was linked up.
	08 to 15	(Reserved)	---	Reserved by the system

Offset	Bit	Name	Default	Description
m+2		Port Error		TRUE: (Default: Hold) Indicates that one of the following errors occurred in port □. Check the I/O Port Error Status to determine which of the errors occurred. • Port □ IO-Link Communications Error • Port □ Verification Error • Port □ Device I/O Size Error • Port □ Device Error-level Event • Port □ Device Warning-level Event • Port □ Assembly Error • Port □ Pin 1 Short-circuit Error • Port □ Pin 2 Short-circuit Error • Port □ Pin 4 Short-circuit Error FALSE: Indicates that none of the above errors occurred.
	00	Port 1 Error	FALSE	
	01	Port 2 Error	FALSE	
	02	Port 3 Error	FALSE	
	03	Port 4 Error	FALSE	
	04	Port 5 Error	FALSE	
	05	Port 6 Error	FALSE	
	06	Port 7 Error	FALSE	
	07	Port 8 Error	FALSE	
		Port Input Data Enabled		TRUE: Indicates that the IO-Link Input Data for port □ is enabled. FALSE: Indicates that one of the following occurred in IO-Link Mode and the IO-Link Input Data is disabled. • Port □ IO-Link Communications Error • Port □ Verification Error • Port □ Device I/O Size Error • Port □ Device Error-level Event • Port □ Pin 1 Short-circuit Error • Port □ Pin 2 Short-circuit Error • Port □ Pin 4 Short-circuit Error • A non-IO-Link sensor is connected in IO-Link Mode. Always FALSE in SIO (DI) Mode and SIO (DO) Mode.
	08	Port 1 Input Data Enabled	FALSE	
	09	Port 2 Input Data Enabled	FALSE	
	10	Port 3 Input Data Enabled	FALSE	
	11	Port 4 Input Data Enabled	FALSE	
	12	Port 5 Input Data Enabled	FALSE	
	13	Port 6 Input Data Enabled	FALSE	
	14	Port 7 Input Data Enabled	FALSE	
	15	Port 8 Input Data Enabled	FALSE	
m+3	00 to 15	Unit/input power supply voltage	0000 hex	Indicates the present value of the Unit/input power supply voltage. The unit is 0.1 V. Example: This is 24.1 V when 00F1 hex = 241.
m+4	00 to 15	Output Power Supply Voltage	0000 hex	Indicates the present value of the output power supply voltage. The unit is 0.1 V. Example: This is 24.1 V when 00F1 hex = 241.

I/O Port Error Status

I/O Port Error Status is the data to determine the cause of an error that occurred in port □.

The data size of the I/O Port Error Status is 16 bytes.

Offset	Bit 15	08 07	00
m	Port 1 Error Status		
m+1	Port 2 Error Status		
m+2	Port 3 Error Status		

m+3	Port 4 Error Status
m+4	Port 5 Error Status
m+5	Port 6 Error Status
m+6	Port 7 Error Status
m+7	Port 8 Error Status

The function of each bit of the I/O Port Error Status is given in the following table.

For bits that are indicated as "(Default: Hold)", when the *Hold Setting For Error Status* is TRUE (default), the bit remains TRUE even after the cause of the error is removed. Execute the Clear Error Status Flag service to change the bit to FALSE. Refer to *12-8 Resetting Errors* on page 12-41 for how to clear the error status.

Change the Hold Setting For Error Status to FALSE to cause the bit to change to FALSE immediately when the cause of the error is removed.

Offset	Bit	Name	Default	Description
m		Port 1 Error Status		
	00	Port 1 IO-Link Communications Error	FALSE	TRUE: (Default: Hold) IO-Link communications are not established for port 1. Or, one of the following errors occurred. • The I/O cable is broken. • The IO-Link device is disconnected from the port. • IO-Link communications failed due to noise, etc. • There is an error-level device event in the IO-Link device. • When the Device Verification Setting is enabled, a non-IO-Link external device is connected, or an IO-Link device is not connected. • An IO-Link device has failed. • A communications timeout occurred due to the effect of IO-Link communications delay. FALSE: Indicates that none of the above errors occurred.
	01	Port 1 Verification Error	FALSE	TRUE: (Default: Hold) Indicates that the configuration of the IO-Link device that is actually connected does not match the IO-Link device configuration settings information for port 1. FALSE: Indicates that the IO-Link device configuration settings information matches the configuration of the IO-Link device that is actually connected.
	02	Port 1 Device I/O Size Error	FALSE	TRUE: (Default: Hold) Indicates that one of the following errors occurred. • The process input data size for the actually connected IO-Link device is larger than the *Port 1 Configuration Data /Process Data In Length*. • The process output data size for the actually connected IO-Link device is larger than the *Port 1 Configuration Data /Process Data Out Length*. FALSE: Indicates that none of the above errors occurred.

Offset	Bit	Name	Default	Description
	03	Port 1 Device Error-level Event	FALSE	TRUE: (Default: Hold) An error-level event occurred in the IO-Link device for port 1. FALSE: Indicates that none of the above error occurred.
	04	Port 1 Device Warning-level Event	FALSE	TRUE: (Default: Hold) An warning-level event occurred in the IO-Link device for port 1. FALSE: Indicates that none of the above error occurred.
	05	Port 1 Assembly Error	FALSE	TRUE: (Default: Hold) Indicates that the IO-Link output data size for the Output Assembly selected in connection settings is smaller than the *Port 1 Configuration Data /Process Data Out Length*. [1] FALSE: Indicates that none of the above error occurred.
	06	(Reserved)	---	Reserved by the system
	07	(Reserved)	---	Reserved by the system
	08	Port 1 Pin 1 Short-circuit Error	FALSE	TRUE: (Default: Hold) Indicates that a short-circuit error occurred between pin 1 and pin 3 of port 1. FALSE: Indicates that none of the above error occurred.
	09	Port 1 Pin 2 Short-circuit Error	FALSE	TRUE: (Default: Hold) Indicates that a short-circuit error occurred between pin 2 and pin 3 of port 1. FALSE: Indicates that none of the above error occurred.
	10	Port 1 Pin 4 Short-circuit Error	FALSE	TRUE: (Default: Hold) Indicates that a short-circuit error occurred between pin 4 and pin 3 of port 1. FALSE: Indicates that none of the above error occurred.
	11	(Reserved)	---	Reserved by the system
	12	(Reserved)	---	Reserved by the system
	13	(Reserved)	---	Reserved by the system
	14	(Reserved)	---	Reserved by the system
	15	(Reserved)	---	Reserved by the system
m+1	00 to 15			Error status for port 2. The bit configuration is the same as that for port 1. In the description for port 1, replace the occurrence of port number 1 with port number 2.
---				
m+6	00 to 15			Error status for port 7. The bit configuration is the same as that for port 1. In the description for port 1, replace the occurrence of port number 1 with port number 7.
m+7	00 to 15			Error status for port 8. The bit configuration is the same as that for port 1. In the description for port 1, replace the occurrence of port number 1 with port number 8.

*1. The error cannot be detected or cleared when Idle is reported from the EtherNet/IP scanner.

Pin 4/Pin 2 Digital Input Data

Pin 4/Pin 2 Digital Input Data is data that indicates the input value for pin 4 or pin 2 in SIO (DI) Mode.
The data size of the Pin 4/Pin 2 Digital Input Data is 2 bytes.

The function of each bit of the Pin 4/Pin 2 Digital Input Data is given in the following table.
This is the digital input data for pin 4 or pin 2 of each port in SIO(DI) Mode. In modes other than SIO (DI) Mode, each bit is fixed to FALSE.

Bit	Name	Default	Description
00	Port 1 Pin 4 Digital Input Bit	FALSE	TRUE: The Port 1 Pin 4 Digital Input Bit is ON. FALSE: The Port 1 Pin 4 Digital Input Bit is OFF.
01	Port 1 Pin 2 Digital Input Bit	FALSE	TRUE: The Port 1 Pin 2 Digital Input Bit is ON. FALSE: The Port 1 Pin 2 Digital Input Bit is OFF.
02	Port 2 Pin 4 Digital Input Bit	FALSE	TRUE: The Port 2 Pin 4 Digital Input Bit is ON. FALSE: The Port 2 Pin 4 Digital Input Bit is OFF.
03	Port 2 Pin 2 Digital Input Bit	FALSE	TRUE: The Port 2 Pin 2 Digital Input Bit is ON. FALSE: The Port 2 Pin 2 Digital Input Bit is OFF.
04	Port 3 Pin 4 Digital Input Bit	FALSE	TRUE: The Port 3 Pin 4 Digital Input Bit is ON. FALSE: The Port 3 Pin 4 Digital Input Bit is OFF.
05	Port 3 Pin 2 Digital Input Bit	FALSE	TRUE: The Port 3 Pin 2 Digital Input Bit is ON. FALSE: The Port 3 Pin 2 Digital Input Bit is OFF.
06	Port 4 Pin 4 Digital Input Bit	FALSE	TRUE: The Port 4 Pin 4 Digital Input Bit is ON. FALSE: The Port 4 Pin 4 Digital Input Bit is OFF.
07	Port 4 Pin 2 Digital Input Bit	FALSE	TRUE: The Port 4 Pin 2 Digital Input Bit is ON. FALSE: The Port 4 Pin 2 Digital Input Bit is OFF.
08	Port 5 Pin 4 Digital Input Bit	FALSE	TRUE: The Port 5 Pin 4 Digital Input Bit is ON. FALSE: The Port 5 Pin 4 Digital Input Bit is OFF.
09	Port 5 Pin 2 Digital Input Bit	FALSE	TRUE: The Port 5 Pin 2 Digital Input Bit is ON. FALSE: The Port 5 Pin 2 Digital Input Bit is OFF.

Bit	Name	Default	Description
10	Port 6 Pin 4 Digital Input Bit	FALSE	TRUE: The Port 6 Pin 4 Digital Input Bit is ON. FALSE: The Port 6 Pin 4 Digital Input Bit is OFF.
11	Port 6 Pin 2 Digital Input Bit	FALSE	TRUE: The Port 6 Pin 2 Digital Input Bit is ON. FALSE: The Port 6 Pin 2 Digital Input Bit is OFF.
12	Port 7 Pin 4 Digital Input Bit	FALSE	TRUE: The Port 7 Pin 4 Digital Input Bit is ON. FALSE: The Port 7 Pin 4 Digital Input Bit is OFF.
13	Port 7 Pin 2 Digital Input Bit	FALSE	TRUE: The Port 7 Pin 2 Digital Input Bit is ON. FALSE: The Port 7 Pin 2 Digital Input Bit is OFF.
14	Port 8 Pin 4 Digital Input Bit	FALSE	TRUE: The Port 8 Pin 4 Digital Input Bit is ON. FALSE: The Port 8 Pin 4 Digital Input Bit is OFF.
15	Port 8 Pin 2 Digital Input Bit	FALSE	TRUE: The Port 8 Pin 2 Digital Input Bit is ON. FALSE: The Port 8 Pin 2 Digital Input Bit is OFF.

Integrated IO-Link Input Data

Integrated IO-Link Input Data is data that reflects the value of a specified bit among IO-Link Input Data.
The data size of the input data is 2 bytes.

Refer to *10-6 Digital Input Collection* on page 10-12 for information on the IO-Link Input Data collection.
The function of each bit of the Integrated IO-Link Input Data is given in the following table.

Bit	Name	Default	Description
00	Port 1 Specified Input Bit	FALSE	TRUE: In the Port 1 IO-Link Input Data, the input bit in the specified offset position is ON. FALSE: In the Port 1 IO-Link Input Data, the input bit in the specified offset position is OFF.
01	Port 2 Specified Input Bit	FALSE	TRUE: In the Port 2 IO-Link Input Data, the input bit in the specified offset position is ON. FALSE: In the Port 2 IO-Link Input Data, the input bit in the specified offset position is OFF.

Bit	Name	Default	Description
02	Port 3 Specified Input Bit	FALSE	TRUE: In the Port 3 IO-Link Input Data, the input bit in the specified offset position is ON. FALSE: In the Port 3 IO-Link Input Data, the input bit in the specified offset position is OFF.
03	Port 4 Specified Input Bit	FALSE	TRUE: In the Port 4 IO-Link Input Data, the input bit in the specified offset position is ON. FALSE: In the Port 4 IO-Link Input Data, the input bit in the specified offset position is OFF.
04	Port 5 Specified Input Bit	FALSE	TRUE: In the Port 5 IO-Link Input Data, the input bit in the specified offset position is ON. FALSE: In the Port 5 IO-Link Input Data, the input bit in the specified offset position is OFF.
05	Port 6 Specified Input Bit	FALSE	TRUE: In the Port 6 IO-Link Input Data, the input bit in the specified offset position is ON. FALSE: In the Port 6 IO-Link Input Data, the input bit in the specified offset position is OFF.
06	Port 7 Specified Input Bit	FALSE	TRUE: In the Port 7 IO-Link Input Data, the input bit in the specified offset position is ON. FALSE: In the Port 7 IO-Link Input Data, the input bit in the specified offset position is OFF.
07	Port 8 Specified Input Bit	FALSE	TRUE: In the Port 8 IO-Link Input Data, the input bit in the specified offset position is ON. FALSE: In the Port 8 IO-Link Input Data, the input bit in the specified offset position is OFF.
08 to 15	(Reserved)	---	Reserved by the system

IO-Link Input Data

IO-Link Input Data is data that stores the process input data from the IO-Link device.

There are three types of IO-Link Input Data that differ in data size per port.

- 2 byes × 8 ports (16 bytes in total)
- 8 byes × 8 ports (64 bytes in total)
- 32 byes × 8 ports (256 bytes in total)

Details on the IO-Link Input Data is given below.

● **IO-Link Input Data (2 Bytes × 8 Ports)**

The data configuration of the IO-Link Input Data (2 bytes × 8 ports) is shown below. The total data size is 16 bytes.

		Bit		
Offset	15	08	07	00
m		Port 1 IO-Link Input Data		
m+1		Port 2 IO-Link Input Data		
m+2		Port 3 IO-Link Input Data		
m+3		Port 4 IO-Link Input Data		
m+4		Port 5 IO-Link Input Data		
m+5		Port 6 IO-Link Input Data		
m+6		Port 7 IO-Link Input Data		
m+7		Port 8 IO-Link Input Data		

The bit configuration and the function of each bit of the IO-Link Input Data (2 bytes × 8 ports) are given in the following table. In modes other than IO-Link Mode, each bit is fixed to FALSE.

Offset	Bit	Name	Default	Description
m	00 to 15	Port 1 IO-Link Input Data	0000 hex	This is the process input data from the IO-Link device that is connected to port 1 in IO-Link Mode. The data format is defined by the IO-Link device.
m+1	00 to 15	Port 2 IO-Link Input Data	0000 hex	This is the process input data from the IO-Link device that is connected to port 2 in IO-Link Mode. The data format is defined by the IO-Link device.
---				
m+7	00 to 15	Port 8 IO-Link Input Data	0000 hex	This is the process input data from the IO-Link device that is connected to port 8 in IO-Link Mode. The data format is defined by the IO-Link device.

The PD data for IO-Link devices is stored in the 2 bytes of IO-Link Input Data in the following order.

		Bit		
Offset	15	08	07	00
0		PD1		PD0

● **IO-Link Input Data (8 Bytes × 8 Ports)**

The data configuration of the IO-Link Input Data (8 bytes × 8 ports) is shown below. The total data size is 64 bytes.

		Bit		
Offset	15	08	07	00
m to m+3		Port 1 IO-Link Input Data		
m+4 to m+7		Port 2 IO-Link Input Data		
m+8 to m+11		Port 3 IO-Link Input Data		
m+12 to m+15		Port 4 IO-Link Input Data		
m+16 to m+19		Port 5 IO-Link Input Data		
m+20 to m+23		Port 6 IO-Link Input Data		
m+24 to m+27		Port 7 IO-Link Input Data		
m+28 to m+31		Port 8 IO-Link Input Data		

7-6 Specifications of I/O Data

7

7-6-3 Details on Input Assembly Data

The bit configuration and the function of each bit of the IO-Link Input Data (8 bytes × 8 ports) are given in the following table. In modes other than IO-Link Mode, each bit is fixed to FALSE.

Offset	Bit	Name	Default	Description
m to m+3	00 to 15	Port 1 IO-Link Input Data	00 hex × 8	This is the process input data from the IO-Link device that is connected to port 1 in IO-Link Mode. The data format is defined by the IO-Link device.
m+4 to m+7	00 to 15	Port 2 IO-Link Input Data	00 hex × 8	This is the process input data from the IO-Link device that is connected to port 2 in IO-Link Mode. The data format is defined by the IO-Link device.
---				
m+28 to m+31	00 to 15	Port 8 IO-Link Input Data	00 hex × 8	This is the process input data from the IO-Link device that is connected to port 8 in IO-Link Mode. The data format is defined by the IO-Link device.

The PD data for IO-Link devices is stored in the 8 bytes of IO-Link Input Data in the following order.

	Bit	
Offset	15 08	07 00
0	PD1	PD0
+1	PD3	PD2
+2	PD5	PD4
+3	PD7	PD6

● **IO-Link Input Data (32 Bytes × 8 Ports)**

The data configuration of the IO-Link Input Data (32 bytes × 8 ports) is shown below. The total data size is 256 bytes.

	Bit	
Offset	15 08	07 00
m to m+15	Port 1 IO-Link Input Data	
m+16 to m+31	Port 2 IO-Link Input Data	
m+32 to m+47	Port 3 IO-Link Input Data	
m+48 to m+63	Port 4 IO-Link Input Data	
m+64 to m+79	Port 5 IO-Link Input Data	
m+80 to m+95	Port 6 IO-Link Input Data	
m+96 to m+111	Port 7 IO-Link Input Data	
m+112 to m+127	Port 8 IO-Link Input Data	

The bit configuration and the function of each bit of the IO-Link Input Data (32 bytes × 8 ports) are given in the following table. In modes other than IO-Link Mode, each bit is fixed to FALSE.

Offset	Bit	Name	Default	Descriptions
m to m+15	00 to 15	Port 1 IO-Link Input Data	00 hex × 32	This is the process input data from the IO-Link device that is connected to port 1 in IO-Link Mode. The data format is defined by the IO-Link device.
m+16 to m+31	00 to 15	Port 2 IO-Link Input Data	00 hex × 32	This is the process input data from the IO-Link device that is connected to port 2 in IO-Link Mode. The data format is defined by the IO-Link device.

Offset	Bit	Name	Default	Descriptions
m +112 to m +127	00 to 15	Port 8 IO-Link Input Data	00 hex × 32	This is the process input data from the IO-Link device that is connected to port 8 in IO-Link Mode. The data format is defined by the IO-Link device.

The PD data for IO-Link devices is stored in the 32 bytes of IO-Link Input Data in the following order.

Offset	Bit 15 — 08	07 — 00
0	PD1	PD0
+1	PD3	PD2
---	---	
+15	PD31	PD30

7-6-4 Details on Output Assembly Data

Details on the Output Assembly data is described below.

Pin 4/Pin 2 Digital Output Data

Pin 4/Pin 2 Digital Output Data is data that indicates the output set value for pin 4 or pin 2 in SIO (DO) Mode.
The data size of the Pin 4/Pin 2 Digital Output Data is 2 bytes.

The function of each bit of the Pin 4/Pin 2 Digital Output Data is given in the following table.
In modes other than SIO (DO) Mode, setting a value in Pin 4/Pin 2 Digital Output Data does not produce output.

Bit	Name	Default	Description
00	Port 1 Pin 4 Digital Output Bit	FALSE	TRUE: The Port 1 Pin 4 Digital Output Bit is ON. FALSE: The Port 1 Pin 4 Digital Output Bit is OFF.
01	Port 1 Pin 2 Digital Output Bit	FALSE	TRUE: The Port 1 Pin 2 Digital Output Bit is ON. FALSE: The Port 1 Pin 2 Digital Output Bit is OFF.
02	Port 2 Pin 4 Digital Output Bit	FALSE	TRUE: The Port 2 Pin 4 Digital Output Bit is ON. FALSE: The Port 2 Pin 4 Digital Output Bit is OFF.
03	Port 2 Pin 2 Digital Output Bit	FALSE	TRUE: The Port 2 Pin 2 Digital Output Bit is ON. FALSE: The Port 2 Pin 2 Digital Output Bit is OFF.
04	Port 3 Pin 4 Digital Output Bit	FALSE	TRUE: The Port 3 Pin 4 Digital Output Bit is ON. FALSE: The Port 3 Pin 4 Digital Output Bit is OFF.

Bit	Name	Default	Description
05	Port 3 Pin 2 Digital Output Bit	FALSE	TRUE: The Port 3 Pin 2 Digital Output Bit is ON. FALSE: The Port 3 Pin 2 Digital Output Bit is OFF.
06	Port 4 Pin 4 Digital Output Bit	FALSE	TRUE: The Port 4 Pin 4 Digital Output Bit is ON. FALSE: The Port 4 Pin 4 Digital Output Bit is OFF.
07	Port 4 Pin 2 Digital Output Bit	FALSE	TRUE: The Port 4 Pin 2 Digital Output Bit is ON. FALSE: The Port 4 Pin 2 Digital Output Bit is OFF.
08	Port 5 Pin 4 Digital Output Bit	FALSE	TRUE: The Port 5 Pin 4 Digital Output Bit is ON. FALSE: The Port 5 Pin 4 Digital Output Bit is OFF.
09	Port 5 Pin 2 Digital Output Bit	FALSE	TRUE: The Port 5 Pin 2 Digital Output Bit is ON. FALSE: The Port 5 Pin 2 Digital Output Bit is OFF.
10	Port 6 Pin 4 Digital Output Bit	FALSE	TRUE: The Port 6 Pin 4 Digital Output Bit is ON. FALSE: The Port 6 Pin 4 Digital Output Bit is OFF.
11	Port 6 Pin 2 Digital Output Bit	FALSE	TRUE: The Port 6 Pin 2 Digital Output Bit is ON. FALSE: The Port 6 Pin 2 Digital Output Bit is OFF.
12	Port 7 Pin 4 Digital Output Bit	FALSE	TRUE: The Port 7 Pin 4 Digital Output Bit is ON. FALSE: The Port 7 Pin 4 Digital Output Bit is OFF.
13	Port 7 Pin 2 Digital Output Bit	FALSE	TRUE: The Port 7 Pin 2 Digital Output Bit is ON. FALSE: The Port 7 Pin 2 Digital Output Bit is OFF.
14	Port 8 Pin 4 Digital Output Bit	FALSE	TRUE: The Port 8 Pin 4 Digital Output Bit is ON. FALSE: The Port 8 Pin 4 Digital Output Bit is OFF.
15	Port 8 Pin 2 Digital Output Bit	FALSE	TRUE: The Port 8 Pin 2 Digital Output Bit is ON. FALSE: The Port 8 Pin 2 Digital Output Bit is OFF.

IO-Link Output Data

IO-Link Output Data is data that stores the process output data to the IO-Link device.

There are three types of IO-Link Output Data that differ in data size per port.

• 2 byes × 8 ports (16 bytes in total)
• 8 byes × 8 ports (64 bytes in total)

• 32 byes × 8 ports (256 bytes in total)

Details on the IO-Link Output Data is given below.

● IO-Link Output Data (2 Bytes × 8 Ports)

The data configuration of the IO-Link Output Data (2 bytes × 8 ports) is shown below. The total data size is 16 bytes.

	Bit		
Offset	15	08 07	00
m		Port 1 IO-Link Output Data	
m+1		Port 2 IO-Link Output Data	
m+2		Port 3 IO-Link Output Data	
m+3		Port 4 IO-Link Output Data	
m+4		Port 5 IO-Link Output Data	
m+5		Port 6 IO-Link Output Data	
m+6		Port 7 IO-Link Output Data	
m+7		Port 8 IO-Link Output Data	

The bit configuration and the function of each bit of the IO-Link Output Data (2 bytes × 8 ports) are given in the following table. In modes other than IO-Link Mode, setting a value in IO-Link Output Data does not produce output.

Offset	Bit	Name	Default	Description
m	00 to 15	Port 1 IO-Link Output Data	0000 hex	This is the process output data to the IO-Link device that is connected to port 1 in IO-Link Mode. The data format is defined by the IO-Link device.
m+1	00 to 15	Port 2 IO-Link Output Data	0000 hex	This is the process output data to the IO-Link device that is connected to port 2 in IO-Link Mode. The data format is defined by the IO-Link device.
---				
m+7	00 to 15	Port 8 IO-Link Output Data	0000 hex	This is the process output data to the IO-Link device that is connected to port 8 in IO-Link Mode. The data format is defined by the IO-Link device.

The 2 bytes of IO-Link Output Data is output to the PD data for IO-Link devices in the following order.

	Bit		
Offset	15	08 07	00
0	PD1		PD0

● IO-Link Output Data (8 Bytes × 8 Ports)

The data configuration of the IO-Link Output Data (8 bytes × 8 ports) is shown below. The total data size is 64 bytes.

	Bit		
Offset	15	08 07	00
m to m+3		Port 1 IO-Link Output Data	
m+4 to m+7		Port 2 IO-Link Output Data	
m+8 to m+11		Port 3 IO-Link Output Data	

Offset	
m+12 to m+15	Port 4 IO-Link Output Data
m+16 to m+19	Port 5 IO-Link Output Data
m+20 to m+23	Port 6 IO-Link Output Data
m+24 to m+27	Port 7 IO-Link Output Data
m+28 to m+31	Port 8 IO-Link Output Data

The bit configuration and the function of each bit of the IO-Link Output Data (8 bytes × 8 ports) are given in the following table. In modes other than IO-Link Mode, setting a value in IO-Link Output Data does not produce output.

Offset	Bit	Name	Default	Description
m to m+3	00 to 15	Port 1 IO-Link Output Data	00 hex × 8	This is the process output data to the IO-Link device that is connected to port 1 in IO-Link Mode. The data format is defined by the IO-Link device.
m+4 to m+7	00 to 15	Port 2 IO-Link Output Data	00 hex × 8	This is the process output data to the IO-Link device that is connected to port 2 in IO-Link Mode. The data format is defined by the IO-Link device.
---				
m+28 to m+31	00 to 15	Port 8 IO-Link Output Data	00 hex × 8	This is the process output data to the IO-Link device that is connected to port 8 in IO-Link Mode. The data format is defined by the IO-Link device.

The 8 bytes of IO-Link Output Data is output to the PD data for IO-Link devices in the following order.

Bit

Offset	15	08 07	00
0	PD1	PD0	
+1	PD3	PD2	
+2	PD5	PD4	
+3	PD7	PD6	

● IO-Link Output Data (32 Bytes × 8 Ports)

The data configuration of the IO-Link Output Data (32 bytes × 8 ports) is shown below. The total data size is 256 bytes.

Bit

Offset	15	08 07	00
m to m+15	Port 1 IO-Link Output Data		
m+16 to m+31	Port 2 IO-Link Output Data		
m+32 to m+47	Port 3 IO-Link Output Data		
m+48 to m+63	Port 4 IO-Link Output Data		
m+64 to m+79	Port 5 IO-Link Output Data		
m+80 to m+95	Port 6 IO-Link Output Data		
m+96 to m+111	Port 7 IO-Link Output Data		
m+112 to m+127	Port 8 IO-Link Output Data		

The bit configuration and the function of each bit of the IO-Link Output Data (32 bytes × 8 ports) are given in the following table. In modes other than IO-Link Mode, setting a value in IO-Link Output Data does not produce output.

Offset	Bit	Name	Default	Description
m to m+15	00 to 15	Port 1 IO-Link Output Data	00 hex × 32	This is the process output data to the IO-Link device that is connected to port 1 in IO-Link Mode. The data format is defined by the IO-Link device.
m+16 to m +31	00 to 15	Port 2 IO-Link Output Data	00 hex × 32	This is the process output data to the IO-Link device that is connected to port 2 in IO-Link Mode. The data format is defined by the IO-Link device.
---				
m +112 to m +127	00 to 15	Port 8 IO-Link Output Data	00 hex × 32	This is the process output data to the IO-Link device that is connected to port 8 in IO-Link Mode. The data format is defined by the IO-Link device.

The 32 bytes of IO-Link Output Data is output to the PD data for IO-Link devices in the following order.

Offset	Bit 15 ... 08	07 ... 00
0	PD1	PD0
+1	PD3	PD2
---	---	
+15	PD31	PD30

7-7 Setting Tag Data Links

This section describes the tag data link settings required for an IO-Link Master Unit to exchange data with the EtherNet/IP scanner. To set tag data links, configure the connection settings for the EtherNet/IP scanner that functions as the originator.
Use the following procedures to set tag data links.

	Procedure	Description	Reference
1	Determining the Tag Sets for the IO-Link Master Unit	Determine the input and output tag sets to use depending on the data size of the I/O device to connect to the port.	*7-6 Specifications of I/O Data* on page 7-43 *7-7-1 Determining the Tag Sets for the IO-Link Master Unit* on page 7-62
2	Creating Network Variables for the EtherNet/IP Scanner	Create network variables to assign to the EtherNet/IP scanner.	*7-7-2 Creating Network Variables* on page 7-63
3	Creating Tags and Tag Sets	Create tag sets and member tags that are required to create connections for the EtherNet/IP scanner.	*7-7-3 Creating Tags and Tag Sets* on page 7-64
4	Setting the Connection	Set the connection between the EtherNet/IP scanner and the IO-Link Master Unit.	*7-7-4 Setting the Connection* on page 7-68
5	Downloading Tag Data Link Parameters	Download the set tag data link parameters to the EtherNet/IP scanner.	*7-7-5 Downloading Tag Data Link Parameters* on page 7-73
6	Saving the Network Configuration File	Save the set device parameters and tag data link parameters in a network configuration file.	*7-7-8 Saving the Network Configuration File* on page 7-75

7-7-1 Determining the Tag Sets for the IO-Link Master Unit

The IO-Link Master Unit provides input and output tag sets with varying data size and contents.
You need to determine the tag sets to use depending on the type of the I/O device to connect to the port. If you connect an IO-link device, check the maximum size of the process input data and process output data for the IO-Link device. Then, use input and output tag sets that can handle larger IO-Link data than the maximum size.

For example, assume that the sizes of the process input data and process output data for the IO-Link device to connect to each port are as follows.
• Process input data size: 24 bytes
• Process output data size: 8 bytes
In this case, the maximum size of the process input data and process output data is 24 bytes.
Therefore, select a connection I/O type with input and output tag sets whose data size per port is larger than 24 byes.
Specifically, select the following connection I/O type.
EO Digital I/O, IO-Link 32 byte with Status
• Output Tag Set: Input Assembly Instance Number 112 (IO-Link Input Data size 32 bytes × 8 ports)
• Input Tag Set: Output Assembly Instance Number 134 (IO-Link Output Data size 32 bytes × 8 ports)

Refer to *7-6-2 Types and Data Configuration of Tag Sets* on page 7-44 for details on the input and output tag sets that the IO-Link Master Units can handle.

> ![icon] **Precautions for Correct Use**
>
> Use the input and output tag sets only in the combination specified for the connection I/O type. For example, for *EO Digital I/O, IO-Link 32 byte with Status*, the following is the specified combinations.
> - Output Tag Set: Assembly Instance Number 112 (286 bytes)
> - Input Tag Set: Assembly Instance Number 134 (258 bytes)
>
> You cannot use the tag sets in combination with other Assembly Instance Numbers. Although the Network Configurator allows you to select combinations of input and output tag sets that are different from the combination specified for the connection I/O type, an error will occur when you transfer them.

7-7-2   Creating Network Variables

Use the Support Software corresponding to the Controller to connect to. Create network variables corresponding to the tags required for the device to participate in tag data links. This allows you to exchange data between the Controller and the IO-Link Master Unit with the user program.
Note that the data size of each network variable that you create must be the same as that of the tag set.

> ![icon] **Additional Information**
>
> Network variables may not be used for some Controllers. For Controllers that cannot handle network variables, use the I/O memory addresses of the CPU Unit for tags.
> Refer to the user's manual for your Controller for information on whether it can handle network variables.

An example of creating a network variable for Input Assembly Instance Number 110 with an NJ/NX-series CPU Unit is described below.
- Define a structure data type according to the data configuration of Input Assembly Instance Number 110.
- With the above data type, create a network variable for Input Assembly Instance Number 110. Assume that the variable name is *Inputs1*.
- Use the Sysmac Studio.

Input Assembly Instance Number 110 is made up of 46 bytes of data as shown in the following data configuration table.

Variable name	Size [bytes]	Data name	Description
Inputs1 46 bytes	10	Unit Status: UnitStatus	Created as UnitStatus.
	16	Port 1 Error Status: PortErrorStatus[1]	Created as PortErrorStatus. Data is created as an array so as to be accessible by port.
		Port 2 Error Status: PortErrorStatus[2]	

		Port 8 Error Status: PortErrorStatus[8]	
	2	Pin 4/Pin 2 Digital Input Data: Pin4Pin2DigitalInputData	Created as Pin4Pin2DigitalInputData.
	2	Integrated IO-Link Input Data: IntegratedIOLinkInputData	Created as IntegratedIOLinkInputData.
	16	Port 1 IO-Link Input Data: IOLinkInputData[1]	Created as IOLinkInputData. Data is created as an array so as to be accessible by port.
		Port 2 IO-Link Input Data: IOLinkInputData[2]	

		Port 8 IO-Link Input Data: IOLinkInputData[8]	

Define a structure data type with above data configuration as shown in the following table.

Name	Data type	Offset type	Byte offset	Bit offset
InputAssembly110	STRUCT	User specified		
UnitStatus	Array[1..5] of WORD		0	
PortErrorStatus	Array[1..8] of WORD		10	
Pin4Pin2DigitalInputData	WORD		26	
IntegratedIOLinkInputData	WORD		28	
IOLinkInputData	Array[1..8] of WORD		30	

Inputs1 is a variable that specifies the whole data of Input Assembly Instance Number 110.
For example, to access the Port 1 IO-Link Input Data, specify *IOLinkInputData[1]*, which is a member of *InputAssembly110*.

7-7-3　Creating Tags and Tag Sets

Create tag sets and member tags that are required to create connections for the registered EtherNet/IP scanner. You can set the network variables used in user programs for tags.
Refer to *Creating Tags and Tag Sets* in the user's manual for your OMRON EtherNet/IP scanner for how to change tags and tag sets.
The following shows how to create tags and tag sets with given conditions as an example.

Item	Condition
EtherNet/IP scanner	Built-in EtherNet/IP port on NJ/NX-series CPU Unit
Connection type for IO-Link Master Unit	EO Digital I/O, IO-Link 2 byte with Status • Output Tag set: Input Assembly Instance Number 110 (46 bytes) • Input Tag Set: Output Assembly Instance Number 132 (18 bytes)
Network variables created	• Input Tag Set for scanner: Inputs1 • Output Tag Set for scanner: Outputs1
Applicable Support Software	Network Configurator

1 In the Network Configuration Pane of the Network Configurator, right-click the icon of the Ether-Net/IP scanner with which the IO-Link Master Unit exchange data and select **Parameter** – **Edit**.

The **Edit Device Parameters** dialog box is displayed.

2 Click the **Tag Sets** tab at the top of the **Edit Device Parameters** dialog box.

There are two tabs for tag sets: input (consume) and output (produce).
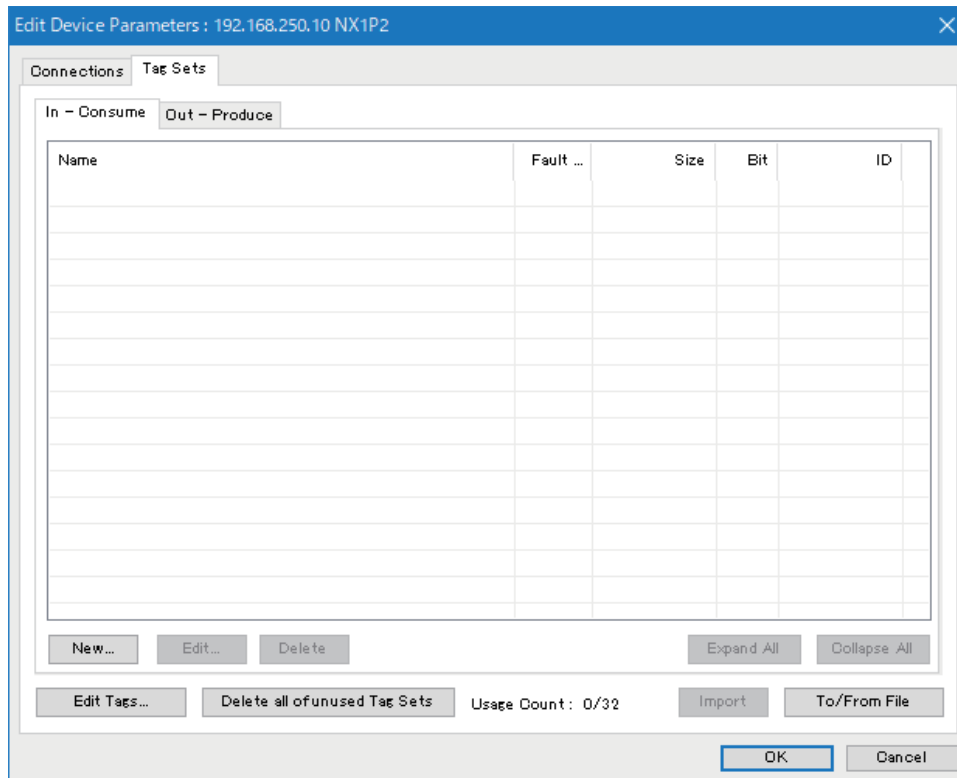
3 Click the **Edit Tags** button.

The **Edit Tags** dialog box is displayed. Register input (consume) tags and output (produce) tags.

In this example, first set the input tags.
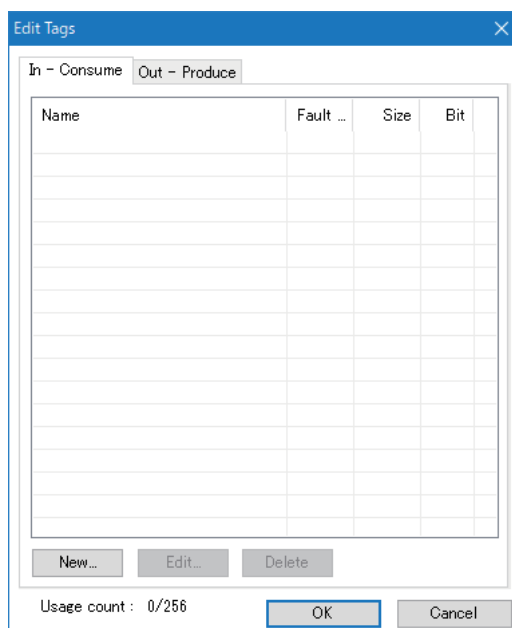
4 Select the **In – Consume** tab, and then click the **New** button.
The **Edit Tag** dialog box is displayed.

5 In the **Name** field, enter the network variable name.
In this example, enter *Inputs1*.

6 In the **Size** field, enter the size of the tag according to the size of the input or output tag set used for the IO-Link Master Unit.
In this example, enter 46 bytes, which is the size of Input Assembly Instance Number 110 that you use.

7 Click the **Regist** button to register the tag.
The **Edit Tag** dialog box is displayed so that you can continue editing the next tag.
Because this is an example of setting only one input tag *Inputs1*, click the **Close** button to complete the editing. To add tags, register all of the tags and then click the **Close** button.

8 Set an output tag. Select the **Out – Produce** tab, and then click the **New** button.
The **Edit Tag** dialog box is displayed.
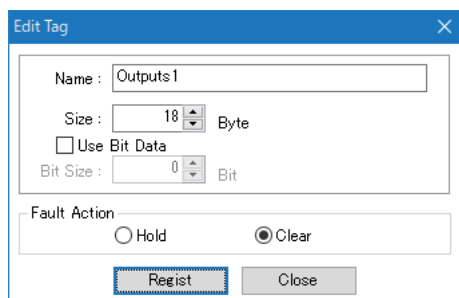
9 In the **Name** field, enter the network variable name.

In this example, enter *Outputs1*.

10 In the **Size** field, enter the size of the tag according to the size of the input or output tag set used for the IO-Link Master Unit.

In this example, enter 18 bytes, which is the size of Output Assembly Instance Number 132 that you use.
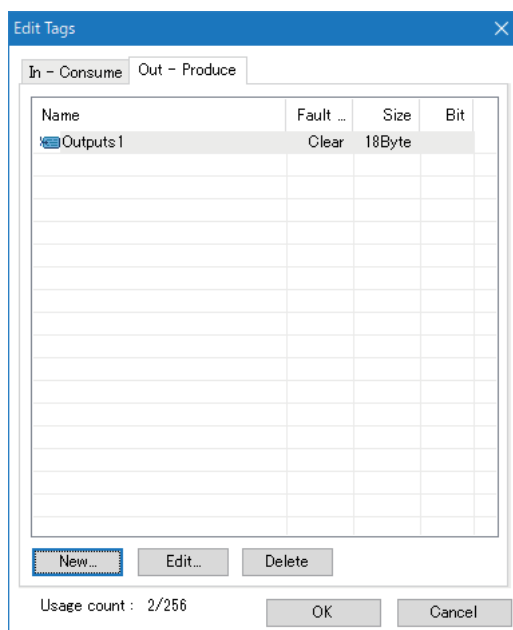
For the output (produce) tag, you need to set the following item.

• NJ/NX-series CPU Unit: **Fault Action**

Refer to the user's manual for your OMRON EtherNet/IP scanner for details on this setting.

11 Click the **OK** button in the **Edit Tags** dialog box.
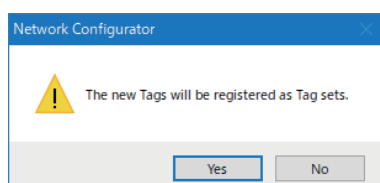
12 At this point, a confirmation dialog box is displayed to check whether the registered tag names are used as the tag set names. Click the **Yes** button.

13 Click the **OK** button in the **Edit Device Parameters** dialog box.

This completes the creation of tags and tag sets.

> **Additional Information**
>
> Refer to *Changing and Registering Tag Sets* in the user's manual for your OMRON EtherNet/IP scanner for how to change and register tag sets, for example, when you set incorrect tag sizes for your input and output tag sets.
> At this time, when **PLC Status** is displayed in the **Edit Tag Set** dialog box, select the **Not Include** option (default). If you select the **Include** option, **I/O data size mismatch detected** is displayed in an error dialog box and you cannot change and register the tag sets.
>
> PLC Status
> ◉ Not Include   ○ Include

7-7-4 Setting the Connection

This section describes how to configure connection settings. Connection settings are required for the EtherNet/IP scanner, which is the originator that creates tag data links to the IO-Link Master Unit (target device).
Set the connection after you create tag sets for all of the devices involved in tag data links.
The following shows how to set the connection with the conditions given in *7-7-3 Creating Tags and Tag Sets* on page 7-64 as an example.

To configure the connection, perform the following two operations in order:

1. Registering devices in the Register Device List

2. Setting the connection

(1) Registering Devices in the Register Device List

Register the IO-Link Master Unit to establish a connection with the EtherNet/IP scanner.

1 In the Network Configuration Pane of the Network Configurator, right-click the icon of the EtherNet/IP scanner with which the IO-Link Master Unit exchange data and select **Parameter** – **Edit**.
The **Edit Device Parameters** dialog box is displayed.

2 Click the **Connections** tab page in the **Edit Device Parameters** dialog box.
Except for the selected EtherNet/IP scanner, all of the devices registered in the network are displayed.
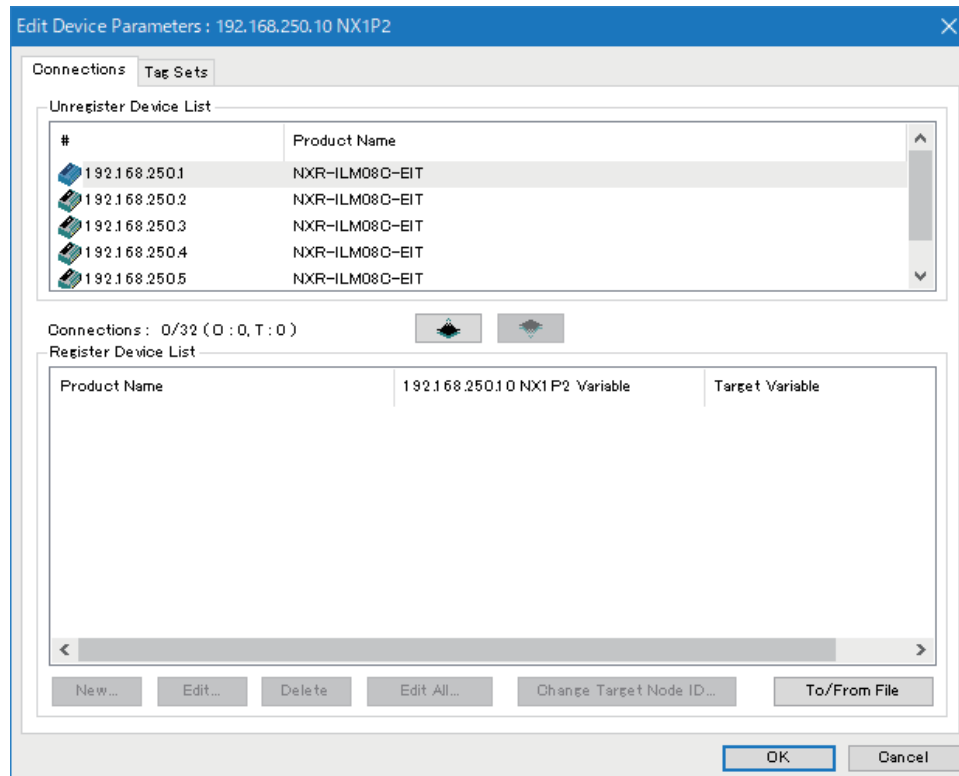
3 In the **Unregister Device List**, click the target device that requires connection settings, and click the downward arrow button ( ).

The selected target device is displayed in the **Register Device List**, as shown below.
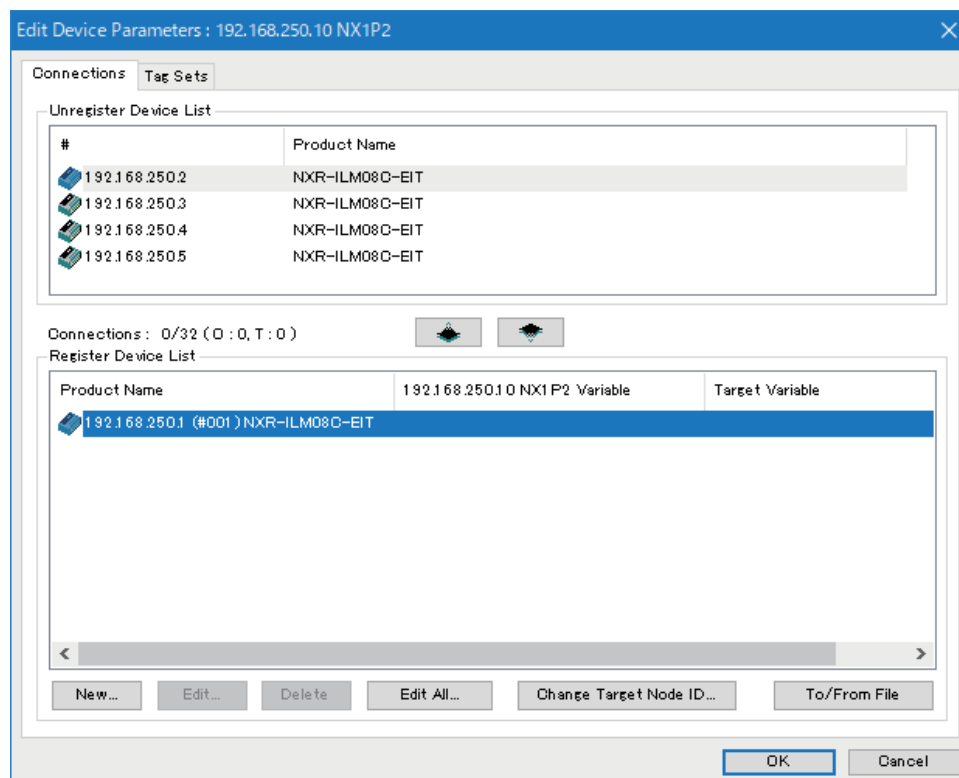
Target node IDs are assigned to the devices that are registered in the **Register Device List**.

Refer to the user's manual for your OMRON EtherNet/IP scanner for details on the target node IDs.

4 Repeat step 3, and register devices to participate in tag data links with the selected EtherNet/IP scanner.

(2) Setting the Connection

For the EtherNet/IP scanner, set the connection to the IO-Link Master Unit that you registered.

1 In the **Register Device List** of the **Connections** tab page, select the IO-Link Master Unit to which to set the connection, and then click the **New** button.
The **Edit Connection** dialog box is displayed.

2 Select the connection from the **Connection I/O Type** drop-down list.
In this example, select **EO Digital I/O, IO-Link 2 byte with Status**.
In the **Target Device** area, the **Output Tag Set** and **Input Tag Set** drop-down lists change as follows. These are input and output tag sets that the selected connection I/O type has.
• Output Tag Set: Input_110 - [46Byte]
• Input Tag Set: Output_132 - [18Byte]

✋ **Precautions for Correct Use**

Use the input and output tag sets only in the combination specified for the connection I/O type. For example, for *EO Digital I/O, IO-Link 32 byte with Status*, the following is the specified combinations.
- Output Tag Set: Assembly Instance Number 112 (286 bytes)
- Input Tag Set: Assembly Instance Number 134 (258 bytes)

You cannot use the tag sets in combination with other Assembly Instance Numbers.
If you select a combination of input and output tag sets that is different from the combination specified for the connection I/O type in the Network Configurator, an error will occur when you transfer them.

3 From the **Input Tag Set** drop-down list in the **Originator Device** area, select the input tag set that you created in the example in *7-7-3 Creating Tags and Tag Sets* on page 7-64.
In this example, select **Inputs1** for the tag set that you created in *7-7-3 Creating Tags and Tag Sets* on page 7-64. The drop-down list contains the name of the tag set that you created in advance.

4 From the **Output Tag Set** drop-down list in the **Originator Device** area, select the output tag set that you created in the example in *7-7-3 Creating Tags and Tag Sets* on page 7-64.
In this example, select **Outputs1** for the tag set that you created in *7-7-3 Creating Tags and Tag Sets* on page 7-64. The drop-down list contains the name of the tag set that you created in advance.

7-7 Setting Tag Data Links

7

7-7-4 Setting the Connection

5 Set the **Connection Type**, **Packet Interval (RPI)**, **Timeout Value**, and **Connection Name**. The settings are described as shown in the following table.

Setting	Description
Connection Type	Select whether the data is sent in multicast or unicast (Point-to-Point) form. The default is Multi-cast connection. • Multi-cast connection: Select this type when the same data is shared by multiple nodes. • Point to Point connection: Select this type when the same data is not shared by multiple nodes. In a unicast connection, other nodes are not burdened with an unnecessary load. For output tag sets, you can select Point to Point connection only.
Packet Interval (RPI)[*1]	Set the data update cycle (i.e., the packet interval) of each connection between the originator and target. • The minimum RPI for the IO-Link Master Unit is 1 ms. • The default setting is 50 ms (i.e., data updated once every 50 ms). • Set the RPI between 1 and 10,000 ms in 0.5-ms increments.
Timeout Value[*1]	Set the time until a connection timeout is detected. The timeout value is set as a multiple of the packet interval (RPI) and can be set to 4, 8, 16, 32, 64, 128, 256, or 512 times the packet interval. The default setting is 4 times the packet interval (RPI).
Connection Name[*1]	Set a name for the connection. This is up to 32 characters in length and can be omitted.

*1. These items and the **Connection Structure** area are not displayed if the **Hide Detail** button is clicked.

6 Click the **Regist** button to register the set connection.

The **Edit Connection** dialog box is displayed so that you can continue setting the next connection.

Because this is an example of creating only one tag set, click the **Close** button to complete the setting.

To add connections, set all of the connections and then click the **Close** button.

7 After you complete the connection setting for all devices, click the **OK** button.

This completes the connecting setting.

Precautions for Correct Use

In tag data links, the data transmission period is set for each connection as the requested packet interval (RPI).
If the sizes of input and output tag sets are large, the IO-Link Master Unit may not send all data within the data transmission period, which causes a Tag Data Link Timeout. If this occurs, adjust the packet interval (RPI) value.
Refer to *Requested Packet Interval (RPI) Settings* in the user's manual for your OMRON EtherNet/IP scanner.

Additional Information

You can edit the connection settings for all of the target devices selected in the Register Device List together in a table. Refer to *Editing Settings for All Connections* in the user's manual for your OMRON EtherNet/IP scanner.

● **Confirming the Connection Settings**

Refer to *Confirming the Connection Settings* in the user's manual for your OMRON EtherNet/IP scanner for how to confirm the connection settings.

7-7-5 Downloading Tag Data Link Parameters

To make tag data links, you must download tag data link parameters, such as tag set settings and connection settings, to the EtherNet/IP scanner.
The following describes the download procedure with the following conditions as an example.
• Use the built-in EtherNet/IP port on an OMRON NJ/NX-series CPU Unit as the EtherNet/IP scanner.
• Download all tag data link parameters with the Network Configurator.

1 Go online with the network that includes the EtherNet/IP scanner and IO-Link Master Unit to which to download tag data link parameters.

2 Select **Network** – **Download** from the menu.
The following dialog box is displayed.
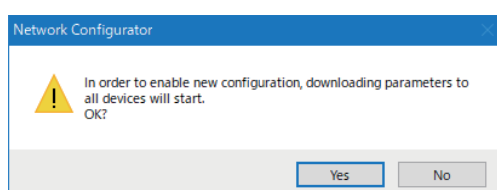
3 Click the **Yes** button to download the tag data link parameter settings to EtherNet/IP devices including the IO-Link Master Unit.
The following dialog box is displayed if any of the CPU Units is not in PROGRAM mode.
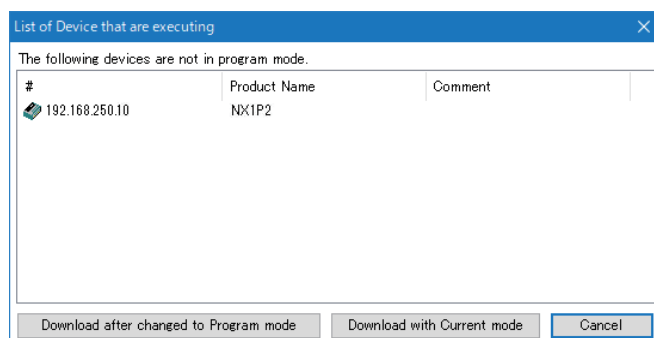
Refer to the following information for how to operate the CPU Unit with buttons provided in this dialog box.

- *Downloading Tag Data Link Parameters* in the *NJ/NX-series CPU Unit Built-in EtherNet/IP Port User's Manual (Cat. No. W506)*

When the download is completed, the following dialog box is displayed.
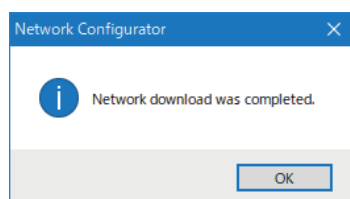
Additional Information

Refer to *Downloading Tag Data Link Parameters* in the user's manual for your OMRON EtherNet/IP scanner for the download procedure with other OMRON EtherNet/IP scanners.

7-7-6   Uploading Tag Data Link Parameters

You can upload tag data link parameters from EtherNet/IP devices in the EtherNet/IP network.
The tag data link parameters refer to information such as tag set information and connection information.
Refer to *Uploading Tag Data Link Parameters* in the user's manual for your OMRON EtherNet/IP scanner for how to upload tag data link parameters.

Additional Information

Refer to *Verifying Tag Data Link Parameters* in the user's manual for your OMRON EtherNet/IP scanner for how to verify tag data link parameters.

7-7-7   Starting and Stopping Tag Data Links

The methods to start and stop tag data links depend on the OMRON EtherNet/IP scanner that you use.

Refer to *Starting and Stopping Tag Data Links* in the user's manual for your OMRON EtherNet/IP scanner.

7-7-8   Saving the Network Configuration File

Save the device parameters and tag data link parameters that you set with the Network Configurator in a network configuration file.

1   Select **File** – **Save As** from the menu.
The following dialog box is displayed.
Untitled is displayed as the default file name.
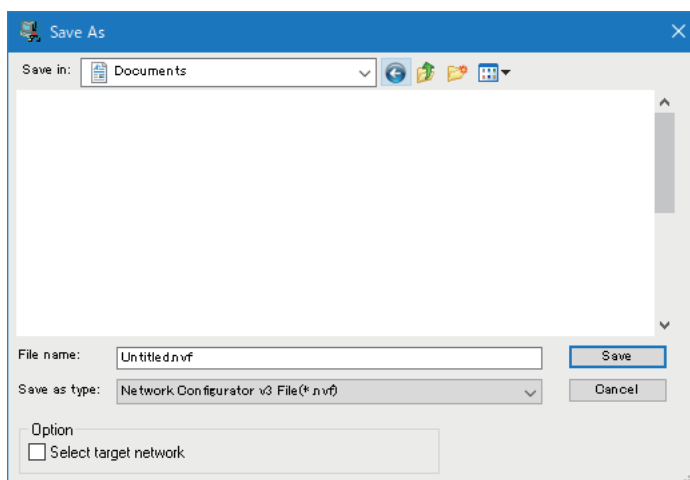
2   Enter the file name, and then click the **Save** button.
The network configuration file is saved.

📓 **Additional Information**

You can select the **Select target network** check box in the **Option** area to select and save only the required network configuration files among the existing multiple files.

7-8 Backing Up and Restoring Settings

This section describes how to back up or restore the settings to allow the EtherNet/IP scanner to access I/O data in IO-Link Master Units.

7-8-1 Target Settings for Backup and Restore

Backup and restore operations are applicable to the following settings.

○: Applicable, ×: Not applicable

Settings		Backup and restore	Reference
Target	Item		
IO-Link Master Unit	TCP/IP Settings	×	*1
	Automatic Clock Adjustment Settings	○	*7-8-2 Backing Up and Restoring Device Parameters* on page 7-76
	Device Parameter Settings	○	
IO-Link device	Parameter Settings	○	*10-13 Backing Up and Restoring IO-Link Device Parameters* on page 10-31
Data exchange between EtherNet/IP scanner and IO-Link Master Unit	Tag Data Link Settings	○	*7-8-5 Backing Up and Restoring Tag Data Link Settings* on page 7-80
	Network Variable	○	User's manuals for the Controller and EtherNet/IP scanner that you use

*1. The TCP/IP settings for IO-Link Master Units are not the target for backup and restore.
Therefore, before you replace an existing IO-Link Master Unit with a new one, you need to configure the TCP/IP settings on the new IO-Link Master Unit.

> **Additional Information**
>
> Refer to the user's manuals for your Controller and EtherNet/IP scanner for how to back up and restore the settings of the EtherNet/IP scanner.

7-8-2 Backing Up and Restoring Device Parameters

The methods to back up and restore device parameters of IO-Link Master Units are given below.
When you replace an existing IO-Link Master Unit with a new one, back up data from the old Unit and restore the data to the new Unit.
Refer to *13-2-2 Replacing the IO-Link Master Unit* on page 13-4 for information on how to replace an IO-Link Master Unit.

Use the following methods to back up and restore device parameters.

Method	Reference
Backing up and restoring with the Network Configurator	*7-8-3 Backing Up and Restoring with the Network Configurator* on page 7-77
Backing up and restoring with message communications	*7-8-4 Backing Up and Restoring with Message Communications* on page 7-79

7-8-3　Backing Up and Restoring with the Network Configurator

To back up device parameters from an IO-Link Master Unit, save the device parameters that you configured with the Network Configurator to a file.
To restore device parameters, open the saved file with the Network Configurator and download the device parameters to the IO-Link Master Unit.

Use the following methods to back up and restore device parameters with the Network Configurator.

Method	Reference
Backing up and restoring from all devices in the network	*Backing Up and Restoring from All Devices in the Network* on page 7-77
Backing up and restoring individually from IO-Link Master Units	*Backing Up and Restoring Individually from IO-Link Master Units* on page 7-78

Backing Up and Restoring from All Devices in the Network

The following describes how to back up and restore device parameters from all devices in the network.

● Backup Method

To back up device parameters from all devices in the network, save them in a network configuration file (extension .nvf).
Refer to *7-7-8 Saving the Network Configuration File* on page 7-75 for the backup procedure.
Use the saved network configuration file to restore the device parameters.

● Restore Method

To restore device parameters, open the network configuration file that you backed up and download the device parameters to the IO-Link Master Unit.
The procedure is described below.

1 In the Network Configurator, select **File** – **Open**.
The following dialog box is displayed.
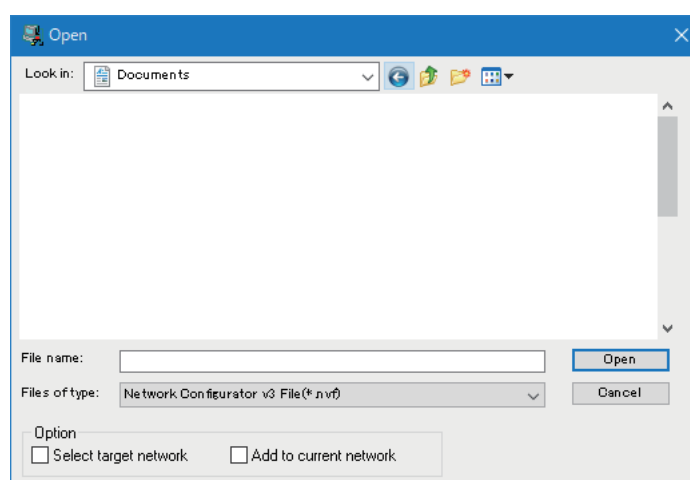
2 Select the network configuration file (extension .nvf) that you saved in advance.

3 Click the **Open** button.

The network configuration file is read into the Network Configurator.

4 Go online with the network corresponding to the read network configuration file.

5 Download the device parameters and tag data link parameters.

Refer to *Downloading All Device Parameters in the Network* on page 7-37 in *7-5-4 Download-ing and Verifying Device Parameters* on page 7-37 for information on downloading device pa-rameters.

Refer to *7-7-5 Downloading Tag Data Link Parameters* on page 7-73 for information on down-loading tag data link parameters.

The restore procedure is completed on completion of the download.

Backing Up and Restoring Individually from IO-Link Master Units

The following describes how to back up and restore device parameters individually from IO-Link Mas-ter Units.

● Backup Method

To back up device parameters from an IO-Link Master Unit, save the device parameter to a device parameter file (extension .dvf).
The procedure is described below.

1 With the Network Configurator, open the network configuration file that includes the IO-Link Master Unit to back up.

2 In the Network Configuration Pane, double-click the IO-Link Master Unit from which to back up device parameters.

3 Select **Device** – **Parameters** – **Save** from the menu.

The following dialog box is displayed.
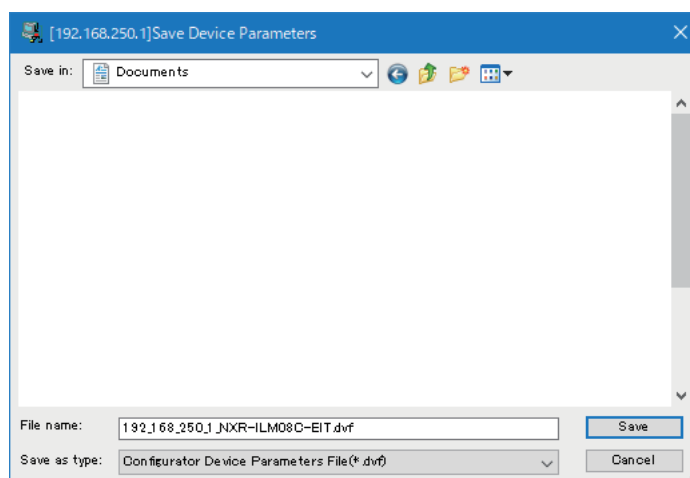
4 Enter the file name, and then click the **Save** button.

The device parameter file is saved with the extension ".dvf".

Use the saved device parameter file to restore the device parameters.

● **Restore Method**

To restore device parameters, open the device parameter file that contains the backed up parameters and download them to the IO-Link Master Unit.
The procedure is described below.

1 In the Network Configuration Pane of the Network Configurator, select the IO-Link Master Unit to which to restore device parameters.

2 Select **Device** – **Parameters** – **Read** from the menu.
The following dialog box is displayed.
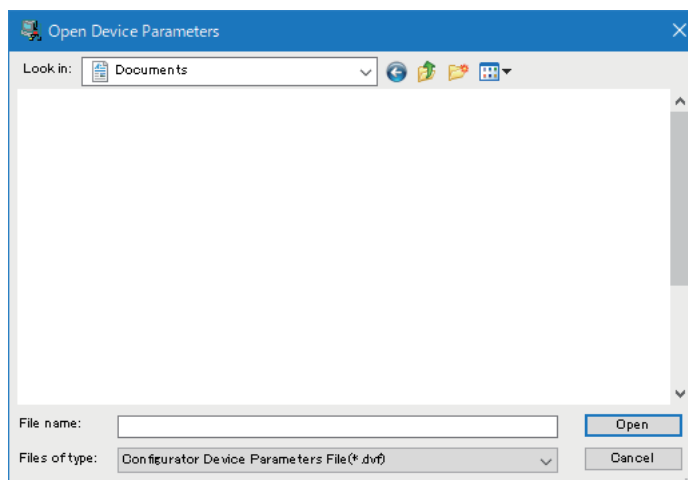
3 Select the device parameter file (extension .dvf) that you saved in advance.

4 Click the **Open** button.
The device parameter file is read into the Network Configurator.

5 Go online with the network that includes the IO-Link Master Unit to which to restore device parameters.

6 Download the device parameters.
Refer to *Downloading Individually to Particular Devices* on page 7-38 in *7-5-4 Downloading and Verifying Device Parameters* on page 7-37 for information on downloading device parameters.
The restore procedure is completed on completion of the download.

7-8-4 Backing Up and Restoring with Message Communications

The IO-Link Master Unit provides a CIP object that allows for setting the device parameters of an IO-Link Master Unit. From the user program in the Controller, you can send an explicit message that specifies the Class ID, Instance ID, and Attribute ID of the relevant object to use the following services for backup or restore.
• Service for backup: Get_Attribute_Single

- Service for restore: Set_Attribute_Single

Refer to *6-1-2 Explicit Message Communications* on page 6-4 for details on sending an explicit message and *A-2-4 Backing Up and Restoring Devices Parameters of IO-Link Master Units* on page A-55 for how to set device parameters through an explicit message.

7-8-5 Backing Up and Restoring Tag Data Link Settings

The methods to back up and restore tag data link settings are given below.
Tag data links are saved in the EtherNet/IP scanner. When you replace an EtherNet/IP scanner, back up data from the old scanner and restore the backed up data to the new scanner.
Refer to the user's manual for your EtherNet/IP scanner for how to replace an EtherNet/IP scanner.

To back up and restore tag data link settings, use the Network Configurator.
The methods are described below.

Backup and Restore Methods

To back up tag data link settings, save the tag data settings to a network configuration file (.nvf) with Network Configurator.
To restore tag data link settings, open the network configuration file that you saved and download the parameters to the EtherNet/IP scanner.
Refer to *Backing Up and Restoring from All Devices in the Network* on page 7-77 in *7-8-3 Backing Up and Restoring with the Network Configurator* on page 7-77 for the procedures.

8

I/O Refreshing

This section describes I/O refreshing of the IO-Link Master Unit.

8

8-1 Introduction to I/O Refreshing

This section provides an introduction to the I/O refreshing of the NXR-series IO-Link Master Unit for EtherNet/IP.

The Controller performs I/O refreshing cyclically for both the IO-Link Master Unit and the IO-Link devices connected to the IO-Link Master Unit through the following communications.

- Implicit message communications for EtherNet/IP communications
- Cyclic communications for IO-Link communications

These communications are asynchronous.

The operation of I/O refreshing between the Controller and the IO-Link Master Unit or between the IO-Link Master Unit and the connected IO-Link devices is affected by the following four cycle elements.

(A) Cycle time of the Controller

(B) Packet Interval (RPI)

(C) Data processing cycle of the IO-Link Master Unit

(D) IO-Link communications cycle time

Controller
• NJ/NX-series CPU Unit
• CJ/CP/CS-series PLC

(A) Controller cycle time

EtherNet/IP port on
EtherNet/IP scanner

EtherNet/IP communications
• Implicit message communications

(B) Packet Interval (RPI)

IO-Link Master Unit

(C) Data processing cycle of IO-Link Master Units

EtherNet/IP port

Port 1 · · · · · · · Port 8
Pin 4 Pin 2 · · · · · · · Pin 4 Pin 2

IO-Link communications
• Cyclic communications

Digital I/O
Digital I/O
Digital I/O

(D) IO-Link communications cycle time

I/O data
(Process data)

Non-IO-Link connected external device

IO-Link device

(D) applies to only pin 4 of each port. For non-IO-Link external devices that are connected to the IO-Link Master Unit, cycle elements (A) to (C) affect the operation of I/O refreshing.

8-2 Communications Performance

This section describes the following I/O response times of the IO-Link Master Unit.
• I/O response time for IO-Link devices
• I/O response time for non-IO-Link connected external devices (sensors or actuators)

8-2-1 I/O Response Time for IO-Link Devices

IO-Link response time here means the time during which input data from an IO-Link device to the IO Link Master Unit is processed by the Controller and the result is output from the IO Link Master Unit to the IO-Link device. This applies to pin 4 of the port that is set to IO-Link Mode.

The I/O response time of an IO-Link device that has digital inputs or outputs for pin 2 and the I/O response time of pin 2 of a port that is set to SIO (DI) Mode or SIO (DO) Mode for ON/OFF signals are the same as the I/O response time for non-IO-Link connected external devices. Refer to *8-2-2 I/O Response Time for Non-IO-Link Connected External Devices* on page 8-6.

Timing Charts and Formulas

The timing charts and formulas for the minimum I/O response time and maximum I/O response time are shown below.
Refer to *Definition of Formula Elements* on page 8-5 for the formula elements.

● Minimum I/O Response Time

$Tmin = T_{in} + (T_{IO-Link} \times$ IO-Link data size (bytes) $\times 2) + ($Data processing cycle $\times 2) + (T_{ETN} \times 2) + T_{controller} + T_{out}$
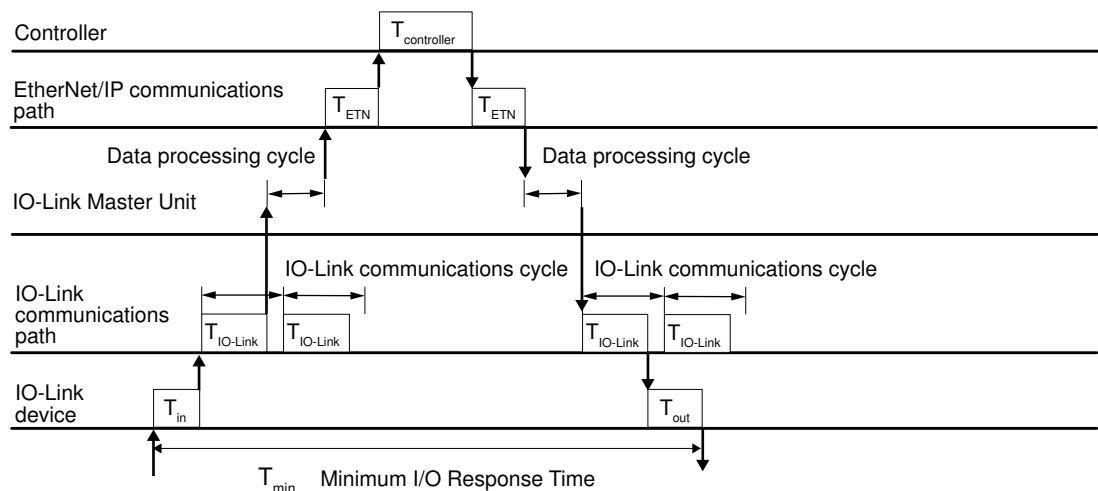
● Maximum I/O Response Time

$Tmax = T_{in} + ($IO-Link communications cycle $\times 4) + ($Data processing cycle $\times 4) + (RPI \times 4) + (T_{controller} \times 2) + T_{out}$

Definition of Formula Elements

The meaning of each element is given below.

Element	Description
T_{in}	This is the input response time of the IO-Link device. Refer to the manual for the IO-Link device for the value.
$T_{IO\text{-}Link}$	This is the IO-Link communications delay. For each baud rate, the communications delay per byte is as follows. • At COM3 (230.4 kbps): 0.0477 ms/byte • At COM2 (38.4 kbps): 0.286 ms/byte • At COM1 (4.8 kbps): 2.29 ms/byte
IO-Link communications cycle	a. When the baud rate is COM3 This is defined as follows, depending on the sum of the *minimum cycle time of the IO-Link device* and the *set value of the IO-Link communications delay time*. • Fixed to 1.1 ms if 1.1 ms or less • Sum if greater than 1.1 ms[1] b. When the baud rate is COM1 or COM2 This is the sum of the *minimum cycle time of the IO-Link device* and the *set value of the IO-Link communications delay time*.[1]
Data processing cycle	This is the data processing cycle of the IO-Link Master Unit. • 0.5 ms
RPI	This is the communications refresh period which can be specified on the Network Configurator. Refer to *7-7-4 Setting the Connection* on page 7-68 for details on the settings.
T_{ETN}	This is the Ethernet communications delay. For each link speed, the communications delay time depending on the data size is as follows. Data size is defined as the size of data exchanged between the EtherNet/IP scanner and the target IO-Link Master Unit. a. At 100 Mbps • 1 to 64 bytes: 0.007 ms • 65 to 1,500 bytes: (Data size (bytes) + 20) × 8 ÷ 100,000,000 × 1,000 b. At 10 Mbps • 1 to 64 bytes: 0.07 ms • 65 to 1,500 bytes: (Data size (bytes) + 20) × 8 ÷ 10,000,000 × 1,000
$T_{controller}$	This is the Controller cycle time. Refer to the user's manual for the connected Controller for the value.

Element	Description
T_{out}	This is the output response time of the IO-Link device. Refer to the manual for the IO-Link device for the value.

*1. The sum is limited to a maximum of 132.8 ms.

8-2-2 I/O Response Time for Non-IO-Link Connected External Devices

I/O response time here means the time during which an input signal from an non-IO-Link input device to the IO Link Master Unit is processed by the Controller and the result is output from the IO Link Master Unit to the non-IO-Link output device.

This applies to pin 2 or pin 4 of a port that is used in SIO (DI) or SIO (DO) Mode.

Timing Charts and Formulas

The timing charts and formulas for the minimum I/O response time and maximum I/O response time are shown below.

Refer to *Definition of Formula Elements* on page 8-7 for the formula elements.

● Minimum I/O Response Time

$Tmin = T_{IND} + (T_{ILM} \times 2) + (\text{Data processing cycle} \times 2) + (T_{ETN} \times 2) + T_{controller} + T_{OUTD}$
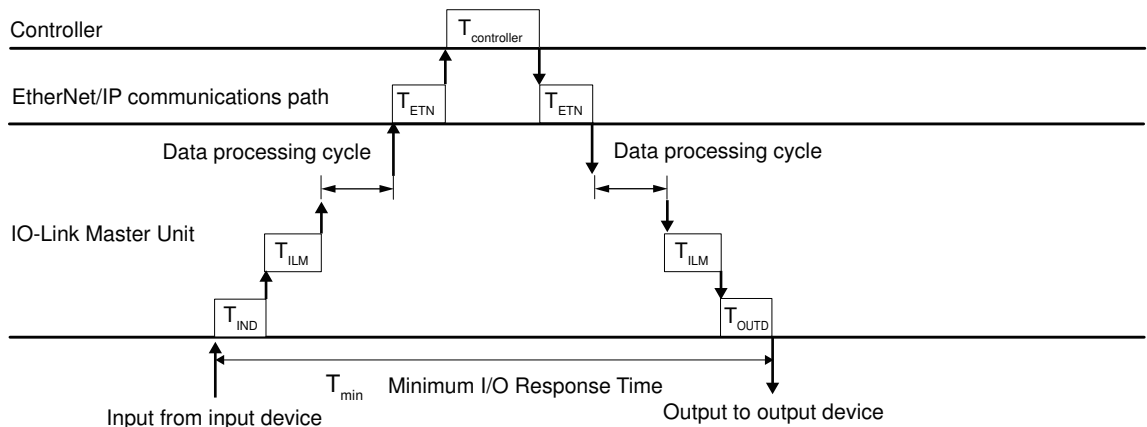
● Maximum I/O Response Time

$Tmax = T_{IND} + (T_{ILM} \times 4) + (\text{Data processing cycle} \times 4) + (RPI \times 4) + (T_{controller} \times 2) + T_{OUTD}$

Definition of Formula Elements

The meaning of each element is given below.

Element	Description
T_{IND}	This is the ON/OFF response time of digital inputs for pin 2 or pin 4 of the IO-Link Master Unit. Refer to *2-1-3 Unit Specifications* on page 2-3 for the value.
T_{ILM}	This is the I/O processing time of the IO-Link Master Unit. • 0.05 ms
Data processing cycle	This is the data processing cycle of the IO-Link Master Unit. • 0.5 ms
RPI	This is the communications refresh period which can be specified on the Network Configurator. Refer to *7-7-4 Setting the Connection* on page 7-68 for details on the settings.
T_{ETN}	This is the Ethernet communications delay. For each link speed, the communications delay time depending on the data size is as follows. Data size is defined as the size of data exchanged between the EtherNet/IP scanner and the target IO-Link Master Unit. a. At 100 Mbps • 1 to 64 bytes: 0.007 ms • 65 to 1,500 bytes: (Data size (bytes) + 20) × 8 ÷ 100,000,000 × 1,000 b. At 10 Mbps • 1 to 64 bytes: 0.07 ms • 65 to 1,500 bytes: (Data size (bytes) + 20) × 8 ÷ 10,000,000 × 1,000
$T_{controller}$	This is the Controller cycle time. Refer to the user's manual for the connected Controller for the value.
T_{OUTD}	This is the ON/OFF response time of digital outputs for pin 2 or pin 4 of the IO-Link Master Unit. Refer to *2-1-3 Unit Specifications* on page 2-3 for the value.

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9

Functions as an EtherNet/IP Adapter

This section describes the functions of the NXR-series IO-Link Master Unit for Ether-Net/IP as an EtherNet/IP adapter.

9

9-1 List of Functions

The following table lists the functions of the NXR-series IO-Link Master Unit for EtherNet/IP as an EtherNet/IP adapter.

Category	Function name	Description	Reference
Ethernet functions	IP address settings	A function that sets the IP address of the IO-Link Master Unit. Use one of the following methods. • Hardware settings • Software settings with the Network Configurator.	*7-3-2 IP Address Settings* on page 7-10
	BOOTP client	A client function that enables the IO-Link Master Unit to get the IP address of the IO-Link Master Unit from the BOOTP server. It cannot be used together with the DHCP client.	
	DHCP client	A client function that enables the IO-Link Master Unit to get the IP address of the IO-Link Master Unit from the DHCP server. It cannot be used together with the BOOTP client.	
	NTP/SNTP client	A client function that enables the IO-Link Master Unit to get the clock information from the NTP/SNTP server with automatic clock adjustment.	*7-4 Setting the Automatic Clock Adjustment* on page 7-23
	ICMP function	The IO-Link Master Unit provides ICMP (Internet Control Message Protocol) that has the following capabilities. • Response to the PING command • Destination Unreachable error response to the sender	*9-2 ICMP Function* on page 9-3
	Communications cable diagnosis	A diagnostic function that determines whether the cause of an error that occurred in a node is the communications cable. It allows you to estimate where in the communications cable a break or short-circuit occurred.	*9-3 Communications Cable Diagnosis* on page 9-5
	Network statistical information acquisition	The IO-Link Master Unit records the total FCS error reception count in EtherNet/IP communications. You can read the recorded total count to check the quality of EtherNet/IP communications. You can also analyze the information obtained from the total count to find the cause of the communications error.	*9-4 Network Statistical Information Acquisition* on page 9-14
EtherNet/IP functions	QuickConnect	The IO-Link Master Unit supports QuickConnect, which is an EtherNet/IP standard. It enables the nodes to quickly start up and participate in an EtherNet/IP network.	*9-5 QuickConnect* on page 9-16
	DLR (Device Level Ring)	The IO-Link Master Unit is a Beacon-based ring node that supports DLR (Device Level Ring) of EtherNet/IP standard. You can use one or more ring supervisors and IO-Link Master Units to configure a ring topology.	*9-6 DLR (Device Level Ring)* on page 9-19
	IP address duplication detection	A function that enables IO-Link Master Units to detect IP address duplication with other nodes in the same EtherNet/IP network.	*9-7 IP Address Duplication Detection* on page 9-20
	Tag data links	A function that enables cyclic tag data exchanges between an EtherNet/IP scanner and IO-Link Master Units in an EtherNet/IP network.	*9-8 Tag Data Links* on page 9-22
	Automatic clock adjustment	A function that enables IO-Link Master Units to retrieve clock information from the NTP or SNTP server after the Unit/input power supply is turned ON and update their internal clock information.	*7-4 Setting the Automatic Clock Adjustment* on page 7-23

9-2 ICMP Function

9-2-1 Overview of Function

The IO-Link Master Unit provides ICMP (Internet Control Message Protocol) that has the following capabilities.

- Response to the PING command
- Destination Unreachable error response to the sender

9-2-2 Details on Function

This section describes the following two functions that you can use.

Response to PING Command

The PING command sends an echo request packet to a remote node and receives an echo response packet to confirm that the remote node communications are normal. The PING command uses the ICMP echo request and response. The echo response packet is automatically returned in the ICMP. The PING command is normally used to check the connections of remote nodes when you set up a network. The IO-Link Master Unit supports the ICMP response function. This enables you to execute the PING command from a computer or the host computer to the IO-Link Master Unit to perform a communications test with the IO-Link Master Unit. If the IO-Link Master Unit returns a normal response to the PING command, then it is physically connected correctly and Ethernet node settings are correct.
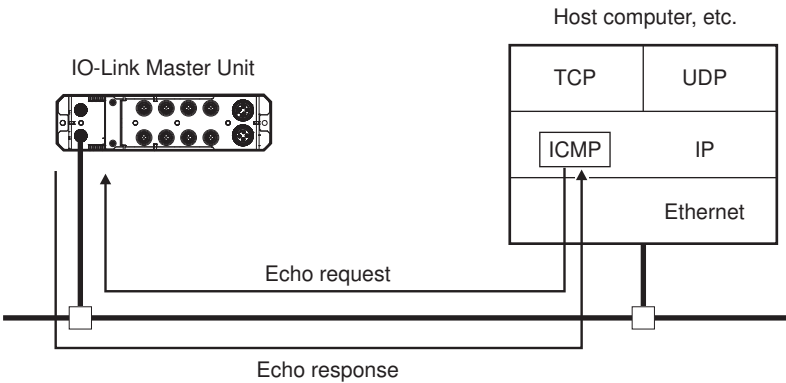
Refer to *Testing Communications* in the user's manual for your OMRON EtherNet/IP scanner for how to use the PING command on the host computer.

Destination Unreachable Error Response to Sender

If the UDP port specified by the sender on the IO-Link Master Unit is not open, the IO-Link Master Unit returns a Destination Unreachable error response to the sender. The IO-Link Master Unit also returns this error response on receipt of the PING command, if the response conditions are met.

9-2-3   Setting Method

No setting is required.

9-3 Communications Cable Diagnosis

9-3-1 Overview of Function

Communications cable diagnosis is a function that determines whether the cause of an error that occurred in a node is the communications cable. It also allows you to estimate where in the communications cable a break or short-circuit occurred.
- Connection timeout or connection open process timeout
- DLR Disconnection

A node in which there is an error.
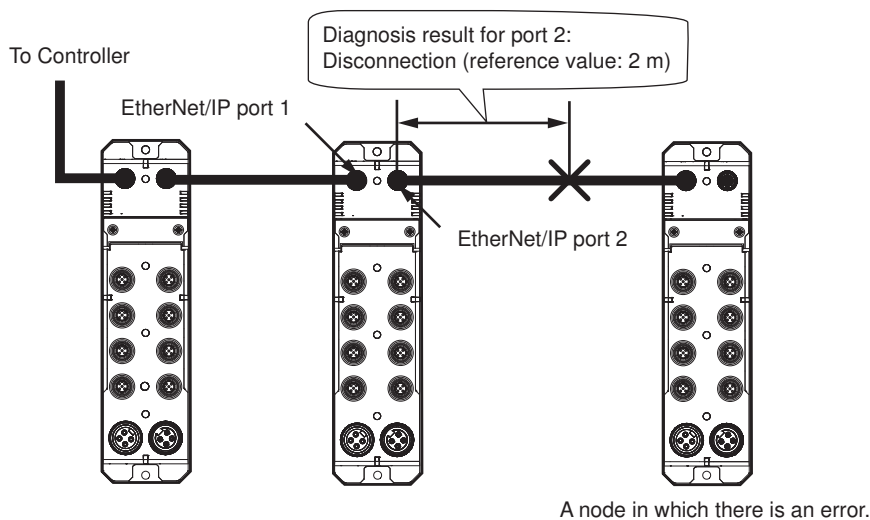
9-3-2 Details on Function

Target of Diagnosis

The target of diagnosis is a communications cable connected to an EtherNet/IP port on the IO-Link Master Unit.
Actually, the diagnosis is executed on EtherNet/IP port 1 or EtherNet/IP port 2 to which the communications cable is connected.

What You Can Check in Diagnosis

The function performs the following checks on a communications cable connected to the IO-Link Master Unit.
- Whether the cable is normal or error (short-circuited or broken)
- Where in the cable an error occurred from the diagnosed EtherNet/IP port (Unit: m)

How to Execute a Diagnosis

You can use any of the following methods to perform a communications cable diagnosis. Identify the node in which an error occurred before you execute a communications cable diagnosis. Refer to *9-3-3 Diagnosis Procedure* on page 9-7 for the procedures.

Execution method		Description
Diagnosis with the Network Configurator		Connect the Network Configurator online and execute a diagnosis in the **Cable Diagnosis** tab page of the Monitor Device dialog box. Refer to *9-3-4 How to Execute Diagnosis with the Network Configurator* on page 9-9 for the diagnosis procedure.
Diagnosis through an explicit message	Sending a message from the user program in the Controller	Access the following CIP object to execute a diagnosis, and then check the *communications cable diagnosis information* for normal response. • Class ID: Diagnosis object (382 hex) • Instance ID: EtherNet/IP port 1 (01 hex) or EtherNet/IP port 2 (02 hex)
	Sending a message from the Network Configurator	• Service code: Exec Cable Diagnosis (3A hex) Refer to *A-1-10 Diagnosis Object (Class ID: 382 Hex)* on page A-32 for details on the diagnosis object.

Precautions for Correct Use

- Diagnosis through an explicit message requires you to use methods of sending the message depending on where in the cable an error occurred. For example, if the Controller cannot communicate with the IO-Link Master Unit, you cannot send an explicit message from the user program. In such a case, send it from the Network Configurator. Refer to *9-3-5 Determining Whether a Diagnosis Can Be Executed from the User Program* on page 9-11 for details on cases where you cannot send an explicit message from the user program.
- The communications are interrupted for the port during execution of a communications cable diagnosis, and all connections (tag data links) and message communications that pass through the port are stopped temporarily. Confirm that the system will not be adversely affected before you execute a communications cable diagnosis.
- If communications cables that are not shown in *5-5 Connected Devices* on page 5-32 are used, the cables may be diagnosed as normal even if they are broken or short-circuited due to differences in the transmission characteristics of the cables. If a connection timeout, connection open process timeout, or DLR Disconnection error occurs even though the diagnosis result is normal, replace the cable and check that the error does not occur.
- The diagnosis result of a communications cable for the EtherNet/IP port in which a link is established is normal even if it is broken or short-circuited.
- Check that power is supplied to the node in which an error occurred. If power is not supplied, the communications cable may be diagnosed as broken even if it is normal.
- The function cannot detect a short-circuit between send data and receive data lines. Details are given below.
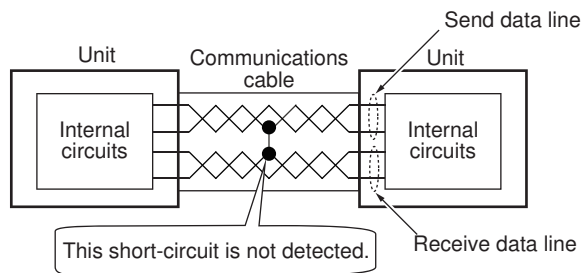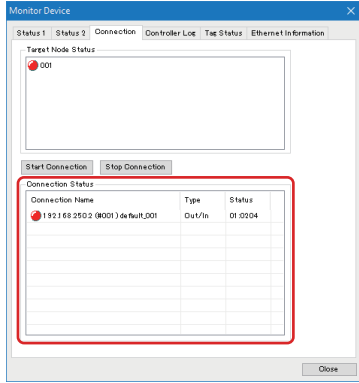
It detects only a short-circuit between send data lines or between receive data lines as shown below.
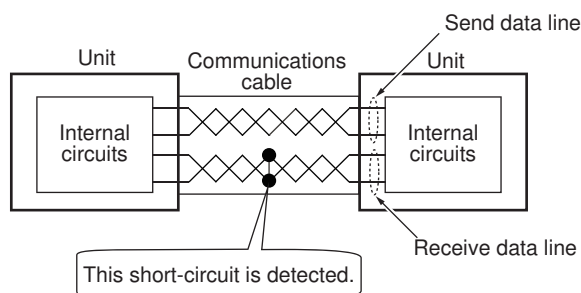
9-3-3 Diagnosis Procedure

Use the following procedure to execute a diagnosis.

1 Depending on the topology, use the method given in the following table to identify the IO-Link Master node in which an error occurred.

Topology	Identification method
Line, tree, and star	Identify the node in which an error occurred in the connection timeout or connection open process timeout, based on the connection timeout detection information in the Controller.[1] To identify the node in which an error occurred, check the network status with the Network Configurator. Place the Network Configurator online, and display the Monitor Device dialog box for the EtherNet/IP scanner to which a connection timeout was reported. In the **Connection** tab page of the Monitor Device dialog box, check the **Connection Status**. Check the node whose **Status** value is *01: 0204* or *01: 0203*. The following figure shows an example of a timeout that occurred in the connection open process. Refer to *12-4-2 Checking the Network Status with the Network Configurator* on page 12-15 for the specific procedure.
Ring	Identify the node in which a DLR Disconnection occurred, based on the ring supervisor's detection information. Refer to the user's manual for your ring supervisor for information on the specifications and check method of the ring supervisor for DLR Disconnection detection.

*1. The method to check the connection timeout detection information in the Controller depends on the EtherNet/IP scanner that you use. For example, if an EtherNet/IP scanner connects to the built-in EtherNet/IP port on an NJ-series CPU Unit, you can check the value of the following system-defined variable.
• _EIP_TDLLinkError (Tag Data Link Communications Error)
Refer to the user's manual for your EtherNet/IP scanner for details on how to check the detection information.

2 Check with the wiring diagram how the communications cables are connected to the node in which an error occurred. Based on the wiring diagram, select the method that you can use to read the Link Down Count in step 3 and execute a communications cable diagnosis in step 5, from the following.
• Using the Monitor Device dialog box in the Network Configurator
• Sending an explicit message from the user program in the Controller
• Sending an explicit message from the Network Configurator
For example, if the Controller cannot communicate with the IO-Link Master Unit that you diagnose, you cannot send an explicit message from the user program. Refer to *9-3-5 Determining Whether a Diagnosis Can Be Executed from the User Program* on page 9-11 for details on cases where you cannot send an explicit message from the user program.

3 Use the method that you selected in step 2 to read the Link Down Count for the EtherNet/IP port on the node in which an error occurred. For a line topology, you can also read the data from the node that is connected to the node in which an error occurred.
Use one of the following methods to read the Link Down Count.

Reading method		Description
Reading with the Network Configurator		Place the Network Configurator online and read the following parameter values in the **Parameters** tab page. • EtherNet/IP Port 1 Link Down Count • EtherNet/IP Port 2 Link Down Count Refer to the *9-3-4 How to Execute Diagnosis with the Network Configurator* on page 9-9 for information on how to display the Monitor Device dialog box.
Reading through an explicit message	Sending a message from the user program in the Controller	Access the following CIP object to read the data. • Class ID: Diagnosis object (382 hex) • Instance ID: EtherNet/IP port 1 (01 hex) or EtherNet/IP port 2 (02 hex) • Attribute ID (Instance): Link Down Counter (01 hex) Refer to *A-1-10 Diagnosis Object (Class ID: 382 Hex)* on page A-32 for details on the diagnosis object.
	Sending a message from the Network Configurator	

4 If the reading result shows that the Link Down Count is counted, the communications cable may be damaged. Stop the tag data links to perform a communications cable diagnosis.
Refer to *7-7-7 Starting and Stopping Tag Data Links* on page 7-74 for information on how to stop tag data links.

5 Execute a communications cable diagnosis for the EtherNet/IP port on the node for which the Link Down Count is counted.
Refer to *How to Execute a Diagnosis* on page 9-6 in *9-3-2 Details on Function* on page 9-5 for details on how to execute a diagnosis.
If the diagnosis result shows that there is a communications cable error, replace the communications cable.

9-3-4 How to Execute Diagnosis with the Network Configurator

This section describes how to execute a communications cable diagnosis in the Monitor Device dialog box in the Network Configurator.

1 Go online with the network that includes the IO-Link Master Unit to execute an diagnosis.
Refer to *7-3-1 Going Online* on page 7-9 for details on how to go online.

2 Select the IO-Link Master Unit to execute an diagnosis and select **Device** – **Monitor** from the menu, or right-click it and select **Monitor**.
The Monitor Device dialog box is displayed.

3 Click the **Cable Diagnosis** tab page of the Monitor Device dialog box.
The Cable Diagnosis tab page is displayed.
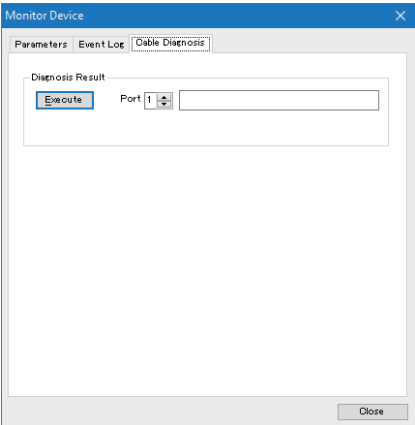
4 Select the EtherNet/IP port number **1** or **2** on which to execute a diagnosis from **Port**.
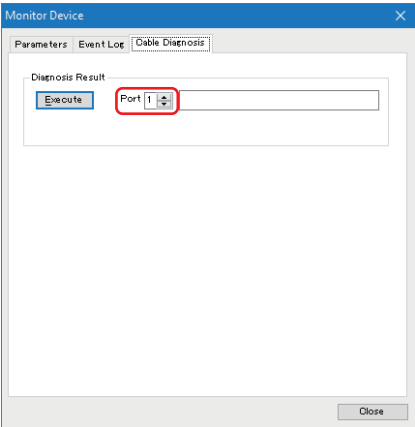
5 Check the diagnosis result.
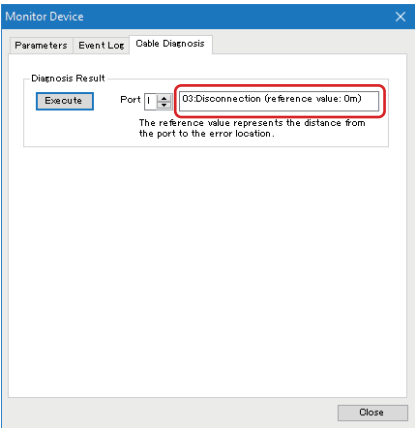
The following table shows the contents of the Diagnosis Result. Click the **Execute** button to update the result.

Diagnosis Result	Description
01: Normal	No error is detected in the communications cable.
02: Short-circuit (reference value: □ m)	There is a short-circuit in the communications cable. The value in parentheses indicates an estimated error occurrence location from the diagnosed port (Unit: m).

Diagnosis Result	Description
03: Disconnection (reference value: □ m)	The communications cable is broken. The value in parentheses indicates an estimated error occurrence location from the diagnosed port (Unit: m).
F1: Already diagnosed	Diagnosed.
F2: Read error	Reading failed.
F3: Other diagnosis error	Diagnosis failed.
No indication	Default setting.

6 Click the **Close** button.

The Monitor Device dialog box is closed.

9-3-5 Determining Whether a Diagnosis Can Be Executed from the User Program

This section provides examples of cases where you can and cannot execute a diagnosis by sending an explicit message from the user program in the Controller. The information provided here also applies to the cases where you use this method to read the Link Down Count described in the diagnosis procedure.

Cases Where You Can Execute a Diagnosis

If any of the following conditions is met, you can execute a diagnosis by sending an explicit message from the user program in the Controller.

• The Controller can communicate with the node in which an error occurred.

• The Controller can communicate with a node connected to the node in which an error occurred.

Two examples are shown below.

Example 1:

This is an example of a connection timeout error that occurred in node #4 in a line topology. In this example, you can send an explicit message to EtherNet/IP port 2 on node #3 because the Controller can communicate with node #3 that is connected to node #4.

Controller

An explicit message can be sent to
EtherNet/IP port 2 on node #3.

#1   #2   #3   #4

A node in which there is an error
for connection timeout.
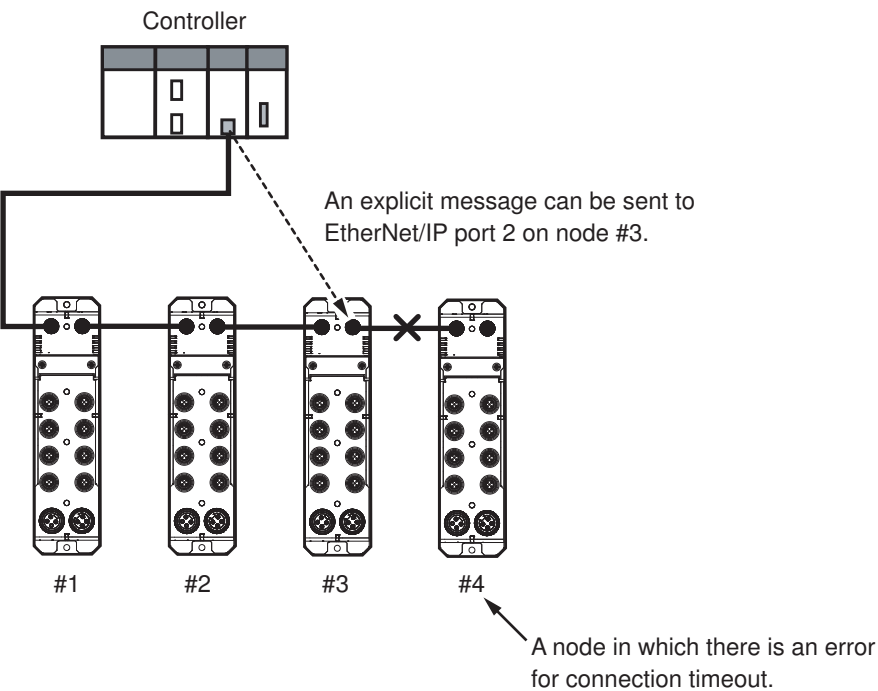
Example 2:

This is an example of a DLR Disconnection error that occurred on node #3 and node #4 in a ring topology.

In this example, you can send an explicit message to EtherNet/IP port 2 on node #3 or EtherNet/IP port 1 on node #4 because the Controller can communicate with node #3 and node #4.

Controller

An explicit message can be sent to the following ports:
• EtherNet/IP port 2 on node #3
• EtherNet/IP port 1 on node #4

Ring supervisor

#1   #2   #3   #4

Nodes in which a DLR Disconnection error occurred
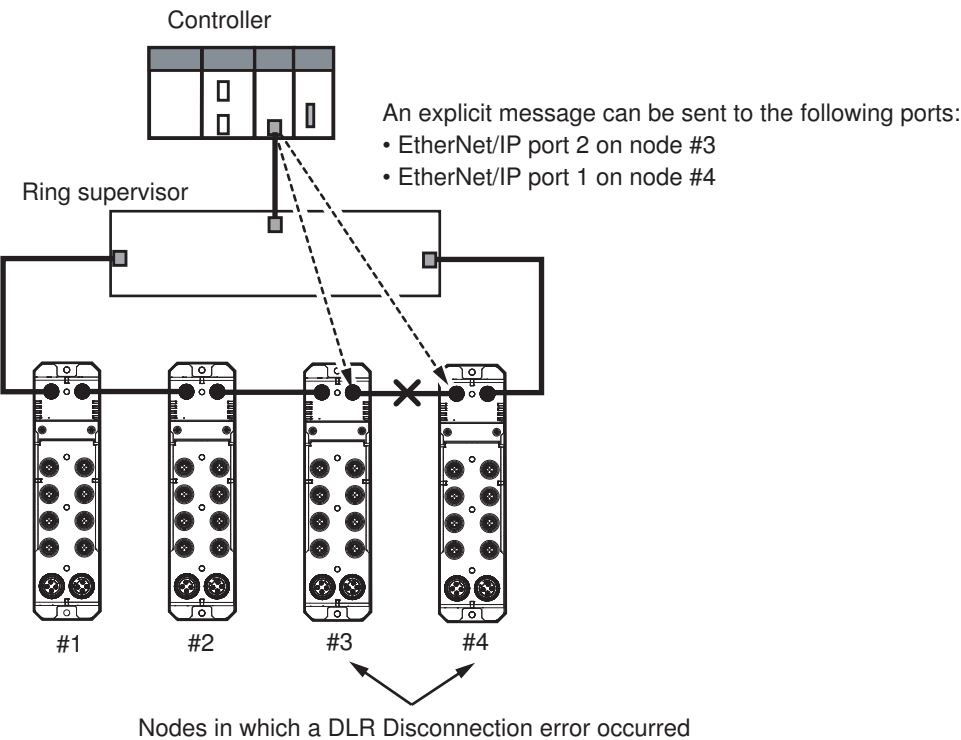
Cases Where You Cannot Execute a Diagnosis

If both of the following conditions are met, you cannot execute a diagnosis by sending an explicit message from the user program in the Controller.

• The Controller cannot communicate with the node in which an error occurred.

• The Controller cannot communicate with a node connected to the node in which an error occurred.

An example is shown below.

This is an example of a connection timeout error that occurred in node #4 in a tree topology. In this example, the Controller cannot communicate with node #4. This means that the Controller cannot send an explicit message to node #4. Therefore, connect the Network Configurator to EtherNet/IP port 2 on node #4 to execute a diagnosis.

Controller

The Controller cannot send an explicit message to node #4.

Ethernet switch

Connect the Network Configurator to EtherNet/IP port 2 on node #4 to execute a diagnosis.

#1   #2   #3   #4

A node in which there is an error for connection timeout.
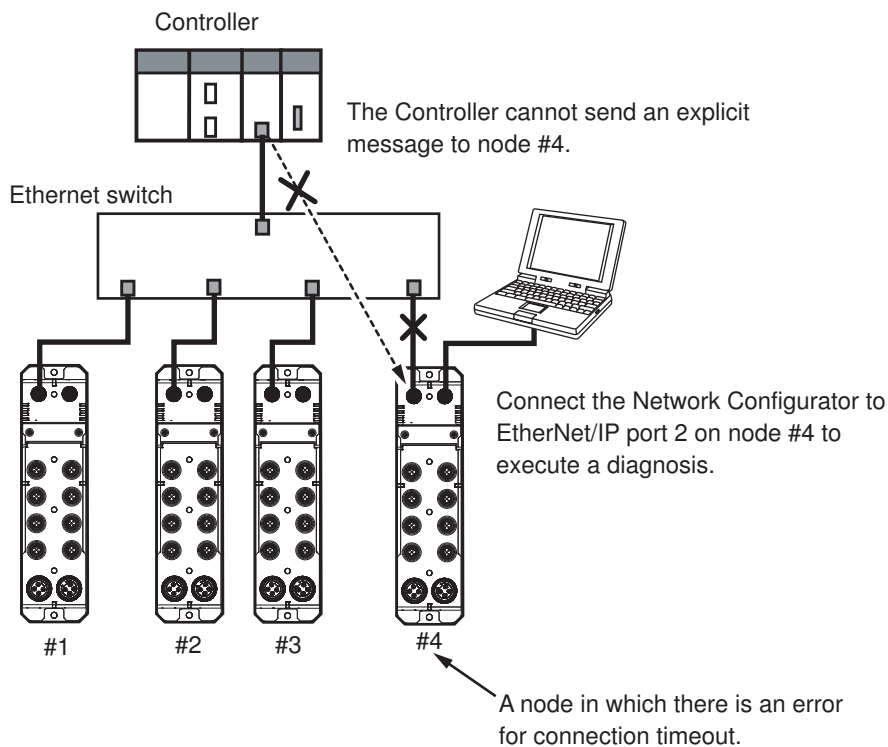
9-4 Network Statistical Information Acquisition

9-4-1 Overview of Function

The IO-Link Master Unit records the total FCS error reception count in EtherNet/IP communications. You can read the recorded total count to check the quality of EtherNet/IP communications. You can also analyze the information obtained from the total count to find the cause of the communications error.

You can use it to diagnose the EtherNet/IP communications line quality for the following:
• Confirming that an EtherNet/IP network was correctly installed
• Finding the causes of communications errors that occur during normal operation

9-4-2 Details on Function

This section describes the specifications of the total FCS error reception count and how to read and clear the total count below.
The causes and corrections for errors that may occur when the IO-Link Master Unit counts the FCS error reception are also described.

● Specifications of Total Error Count

Item	Specification
Range of values	00000000 to FFFFFFFF hex (0 to 4,294,967,295)[1]
Unit	Number of times
Default	00000000 hex

*1. The IO-Link Master Unit stops counting when the maximum value is reached.

● How to Read Total Error Count

Send an explicit message to the following CIP object to read the data.
• Class ID: Ethernet Link object (F6 hex)
• Instance ID: EtherNet/IP port 1 (01 hex) or EtherNet/IP port 2 (02 hex)
• Attribute ID (Instance): Media Counters (05 hex)
Refer to *A-1-4 Ethernet Link Object (Class ID: F6 Hex)* on page A-11 for details on Ethernet Link objects.

● How to Clear Total Error Count

You can use the following two methods to clear the total error count to 0 times.
• Turn OFF the Unit/input power supply to the IO-Link Master Unit.
• Specify the CIP object to access with the service code 4C hex (Get_and_Clear) to read the total count.[1]

*1. The IO-Link Master Unit clears the total count after reading the total count.

● **Causes and Corrections**

The causes and corrections for errors that may occur when the IO-Link Master Unit counts the FCS error reception are described below. If the connection times out, execute a communications cable diagnosis to check that there is no error in the communications cable.

Cause	Correction
The EtherNet/IP cable is disconnected, broken, or a contact failure.	Check that the EtherNet/IP cable connected to the port for which to count the FCS error reception is correctly wired.
Noise is introduced into the EtherNet/IP cable.	Noise may be introduced into the EtherNet/IP cable connected to the port for which to count the FCS error reception. Implement noise countermeasures. Check the increase in the FCS error reception count and analyze it from the following aspects to identify the cause of the noise. • Sporadic noise • Continuous noise • Periodic noise

9-4-3 Setting Method

No setting is required.

9-5 QuickConnect

9-5-1 Overview of Function

The IO-Link Master Unit supports QuickConnect, which is an EtherNet/IP standard. It enables the nodes to quickly start up and participate in an EtherNet/IP network.
QuickConnect is mainly used for the following applications.
• Quickly changing the tool attached to the tip of a robot hand
• Changing over devices in production lines

The following is an example of quickly changing the tool attached to the tip of a robot hand. You can use the IO-Link Master Unit in combination with an EtherNet/IP scanner and a managed switch that support QuickConnect to change the tool quickly.
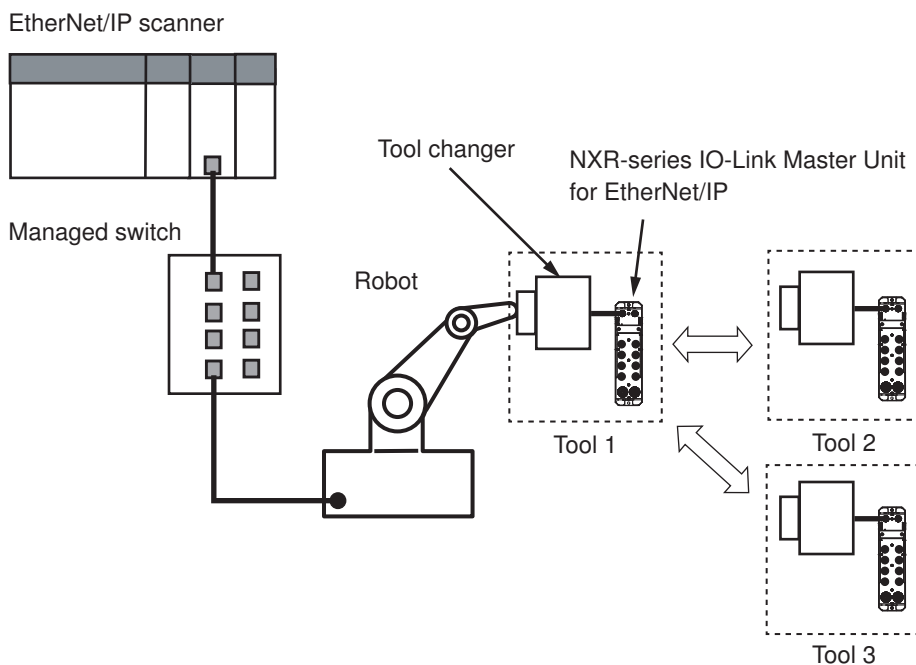
9-5-2 Details on Function

To use this function, use the IO-Link Master Unit in combination with an EtherNet/IP scanner and a managed switch that support QuickConnect. Refer to *EtherNet/IP Scanner and Managed Switch* on page 9-17 in *Precautions When You Use QuickConnect with Enabled* on page 9-17 for recommended EtherNet/IP scanners and managed switches.

Settings

Set the device parameters of the IO-Link Master Unit to set QuickConnect.
QuickConnect is disabled by default. To use QuickConnect, set the following item to **Enable** in the Network Configurator.

Setting	Description	Default	Setting range	Update timing
QuickConnect Setting	Enable or disable QuickConnect.	Disable	• Enable • Disable	After restart

Alternatively, you can send an explicit message to the following CIP object to set the function.
- Class ID: TCP/IP Interface object (F5 hex)
- Instance ID: 01 hex
- Attribute ID (Instance): EtherNet/IP QuickConnect (0C hex)

Refer to *A-1-3 TCP/IP Interface Object (Class ID: F5 Hex)* on page A-8 for details on the TCP/IP Interface object.

Precautions When You Use QuickConnect with Enabled

This section describes precautions when you use QuickConnect with enabled.

● Other Settings

To use QuickConnect with enabled, also set the following items for the IO-Link Master Unit. If they are not set, you cannot obtain the starting characteristics of QuickConnect.

Setting	Description
Speed & Duplex	Set this item to either of the following to fix the Link Settings for EtherNet/IP port 1 and EtherNet/IP port 2 to 100 Mbps Duplex Mode. • 100 Mbps Half Duplex • 100 Mbps Full Duplex The default setting (Auto) is disabled and EtherNet/IP port 1 is fixed to MDI. EtherNet/IP port 2 is fixed to MDI-X.
IP Address Settings	Use any of the following setting methods. Do not get the IP address from the server. • Directly set the IP address with hardware switches. • Directly set the IP address with the Network Configurator.

Refer to *7-3-2 IP Address Settings* on page 7-10 for details on how to set the IP address.
Refer to *7-3-3 Link Settings* on page 7-19 for details on how to set the Link Settings.

● EtherNet/IP Scanner and Managed Switch

Use the IO-Link Master Unit in combination with an EtherNet/IP scanner and a managed switch that support QuickConnect. You cannot obtain the starting characteristics if they do not support QuickConnect.
We recommend that you use a combination of the EtherNet/IP scanners and managed switches listed below.

Type of device	Manufacturer	Product
EtherNet/IP scanner	Rockwell Automation, Inc.	ControlLogix controllers: • ControlLogix 5570 controllers • ControlLogix 5560 controllers GuardLogix controllers: • GuardLogix 5570 controllers • GuardLogix 5560 controllers CompactLogix controllers: • CompactLogix 5370 L3 controllers • CompactLogix 5370 L2 controllers • CompactLogix 5370 L1 controllers Compact GuardLogix Controllers: • Compact GuardLogix 5370 L3 controllers
Managed switch	Rockwell Automation, Inc.	• Stratix 2500 switches • Stratix 5400 switches • Stratix 5410 switches • Stratix 5700 switches • Stratix 8000/8300 switches • Stratix 6000 switches

9-5-3 Setting Method

This section describes the setting procedure with the Network Configurator. Refer to *7-5 Setting Device Parameters* on page 7-28 for details on how to display the Edit Device Parameters dialog box and download device parameters.

1 Display the **Edit Device Parameters** dialog box for the IO-Link Master Unit that you set.

2 Select **QuickConnect Setting** under **Unit Configuration**, and then select **Enable** or **Disable** from the **Value** drop-down list. After you make the setting, click the **OK** button.

3 Connect the Network Configurator online.

4 Download the device parameters to the IO-Link Master Unit that you set.
After completion of the download, the IO-Link Master Unit restarts.
The settings are reflected after the IO-Link Master Unit is restarted.

9-6 DLR (Device Level Ring)

The IO-Link Master Unit is a Beacon-based ring node that supports DLR (Device Level Ring) of Ether-Net/IP standard. You can use one or more ring supervisors and IO-Link Master Units to configure a ring topology.

DLR enables continuous communications even if a wire break occurs in the Ethernet cable on a DLR network ring.

Refer to the user's manuals for your ring supervisor for the specifications of the DLR network. To iden-tify the node in which a DLR Disconnection occurred, use the ring supervisor's detection information. Refer to the user's manual for your ring supervisor for the specifications and check method for the DLR Disconnection detection in the ring supervisor.

Controller
EtherNet/IP scanner
Ring supervisor
NXR-series IO-Link Master Unit for EtherNet/IP
Red double lines: DLR network ring
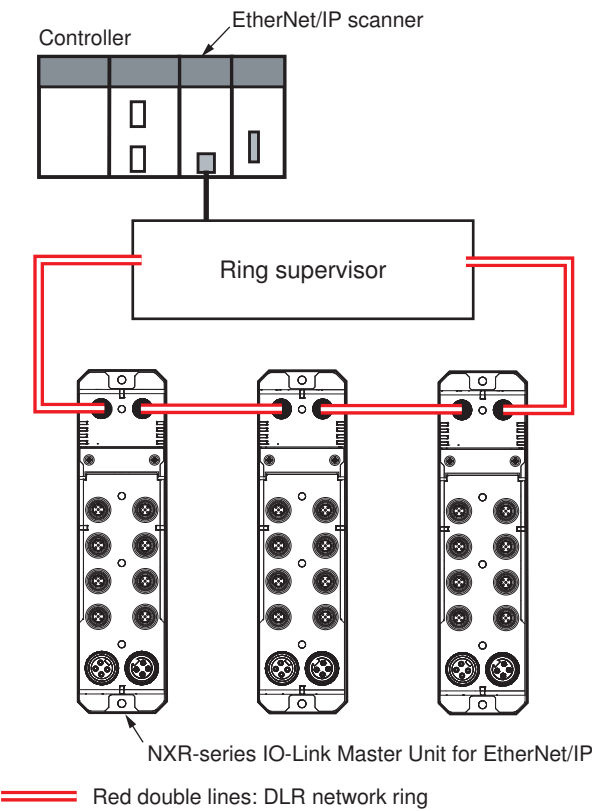
● Recommended Ring Supervisors

For the ring supervisor, the following products are recommended.

Manufacturer	Product
Rockwell Automation, Inc.	Managed switch: • Stratix 5400 switches EtherNet/IP tap: • 1756-EN2TR
PHOENIX CONTACT GmbH & Co. KG	Managed switch: • FL SWITCH 7000 Series

● Setting Method

No setting is required.

9-6 DLR (Device Level Ring)

9

9-7　IP Address Duplication Detection

9-7-1　Overview of Function

A function that enables IO-Link Master Units to detect IP address duplication with other nodes in the same EtherNet/IP network.

9-7-2　Details on Function

- The IO-Link Master Unit detects IP address duplication during startup and during normal communications.
- If the IO-Link Master Unit detects IP address duplication, it stops the EtherNet/IP communications and reports it to you with the MS and NS indicators. Then, an *IP Address Duplication* event occurs.

Refer to *3-2-1 Status Indicators* on page 3-4 for details on the MS and NS indicators.
Refer to *12-5 Checking for Errors and Troubleshooting with the Event Logs of the IO-Link Master Unit* on page 12-26 for details on events.

> **Precautions for Correct Use**
>
> If there is more than one node with the same IP address in the EtherNet/IP network, the IO-Link Master Unit will not detect IP address duplication for the node that participates in the network first because it is connected correctly. However, it will detect IP address duplication for the second and later nodes that attempt to participate in the network.

Settings

Set the device parameters of the IO-Link Master Unit to set the IP address duplication detection function.
IP address duplication detection is enabled by default.
The settings are shown in the following table.

Setting	Description	Default	Setting range	Update timing
ACD Setting	Enable or disable IP address duplication detection.	Enable	• Enable • Disable	After restart

When you do not use this function, set *ACD Setting* to **Disable** in the Network Configurator.

Alternatively, you can send an explicit message to the following CIP object to set the function.
- Class ID: TCP/IP Interface object (F5 hex)
- Instance ID: 01 hex
- Attribute ID (Instance): SelectAcd (0A hex)

Refer to *A-1-3 TCP/IP Interface Object (Class ID: F5 Hex)* on page A-8 for details on the TCP/IP Interface object.

How to Reset an IP Address Duplication Error

There are two methods to reset an IP address duplication error. Refer to *7-3-2 IP Address Settings* on page 7-10 for details on how to set the IP address.

● Method 1

Set the IP addresses again so that the same address is not used by more than one node. When you set the IP addresses again, perform the following processing depending on the setting method. Then, the IP address duplication error will be reset.

IP address setting method	Processing
Directly set the IP address with hardware switches.	Set an IP address that is not used by other nodes with rotary switches. Then, cycle the Unit/input power supply to the node that you reset or restart the node. Then, the new IP address is read.
Directly set the IP address with the Network Configurator.	If there is more than one node with the same IP address in the same network, you cannot directly set the IP address with the Network Configurator. Therefore, remove a node with the same IP address from the network. Connect the Network Configurator to the removed node and set an IP address that is not used by other nodes for it. After you set the IP address, connect the node to the network.

● Method 2

Remove one of the two nodes that have the duplicate IP address from the network. Perform either of the following processing operations on the nodes with the duplicate address in the network.
• Cycle the Unit/input power supply or restart the node.
• Remove the node from the network, and then connect it to the network again.
This resets the IP address duplication error in the node that remains in the network.
If the removed node is necessary for the system, set a different IP address to the node and then connect it to the network again.

9-7-3 Setting Method

This section describes the setting procedure with the Network Configurator. Refer to *7-5 Setting Device Parameters* on page 7-28 for details on how to display the Edit Device Parameters dialog box and download device parameters.

1 Display the **Edit Device Parameters** dialog box for the IO-Link Master Unit that you set.

2 Select **ACD Setting** under **Unit Configuration**, and then select **Enable** or **Disable** from the **Value** drop-down list. After you make the setting, click the **OK** button.

3 Connect the Network Configurator online.

4 Download the device parameters to the IO-Link Master Unit that you set.
After completion of the download, the IO-Link Master Unit restarts.
The settings are reflected after the IO-Link Master Unit is restarted.

9-8 Tag Data Links

9-8-1 Overview of the Function

Tag data links enable cyclic tag data exchanges between an EtherNet/IP scanner and IO-Link Master Units in an EtherNet/IP network.

With a tag data link, one node requests the connection of a communications line to exchange data with another node.
The node that requests the connection is called the originator, and the node that receives the request is called the target.

EtherNet/IP scanner (Originator):
• Built-in EtherNet/IP port on the NJ/NX-series CPU Unit

EtherNet/IP adapter (Target):
IO-Link Master Unit

Input Tag Set
Tag set name
Example: ILM_InData

Connection

Output Tag Set
Input_111

Input Assembly Instance Number 111
• Unit Status
• I/O Port Error Status
• Pin 4/Pin 2 Digital Input Data
• Integrated IO-Link Input Data
• IO-Link Input Data

Output Tag Set
Tag set name
Example: ILM_OutData

Connection

Input Tag Set
Output_133

Output Assembly Instance Number 133
• Pin 4/Pin 2 Digital Output Data
• IO-Link Output Data

EtherNet/IP

Example: When connection I/O type *EO Digital I/O, IO-Link 8 byte with Status* is selected
  • Output Tag Set: Input Assembly Instance Number 111
  • Input Tag Set: Output Assembly Instance Number 133

For communications between an EtherNet/IP scanner and an IO-Link Master Unit, connection information is set in the EtherNet/IP scanner that is the originator.
The output data and input data for each node for which data is exchanged are set in the connection information. These data are called output tag set and input tag set. A tag set in the EtherNet/IP scanner must specify a tag.

The following section describes tags and tag sets that are used in communications between the EtherNet/IP scanner and the IO-Link Master Unit.

9-8-2 Tag Data Link Data Areas

Tags

A tag is a unit that is used to exchange data with tag data links.

For communications between an EtherNet/IP scanner and an IO-Link Master Unit, specify a network variable or I/O memory area of EtherNet/IP scanner for each tag.

Precautions for Correct Use

If you use an NJ/NX-series CPU Unit as the Controller, you must set refreshing tasks to maintain concurrency in the values of network variables that are assigned to tags. Refer to the user's manual for the OMRON EtherNet/IP scanner that you use for details.

Tag Sets

A tag set represents a unit of data that is used to establish a tag data link connection. A tag data link is created by linking one tag set to another with a connection. There are input tag sets and output tag sets.

A connection is used to exchange data as a unit within which data concurrency is maintained. Thus, data concurrency is maintained for all the data exchanged for the tags in one data set.

● Tag Sets for the IO-Link Master Unit

The IO-Link Master Unit provides predefined input and output tag sets with different data size and contents. Select the predefined tag sets depending on the I/O devices connected to a port on the IO-Link Master Unit. Refer to *7-6-1 List of Input and Output Tag Sets* on page 7-43 for details on the input and output tag sets for the IO-Link Master Unit.

● Tag Sets for the EtherNet/IP Scanner

Each tag set in an EtherNet/IP scanner must specify at least one tag. A tag set can contain only input tags or only output tags. The same input tag cannot be included in more than one input tag set.

In communications between an EtherNet/IP scanner and an IO-Link Master Unit, the size of the data for data exchange is the total size of the tags included in the tag set. The data size of tag sets for the EtherNet/IP scanner must match the size of tag sets for the IO-Link Master Unit. Specify the size of each tag so that the size of the tag sets matches as follows.
- Input tag set for the EtherNet/IP scanner and output tag set for the IO-Link Master Unit
- Output tag set for the EtherNet/IP scanner and input tag set for the IO-Link Master Unit

● Setting Tag Set Names

A tag set name must be set for each tag set in the EtherNet/IP scanner. The setting is not required for tag set names for the input and output tag sets provided in the IO-Link Master Unit as they have predefined tag set names.

9-8-3 Connection Type and Packet Interval (RPI)

This section describes the following parameters for connection setting in the tag data link setting procedure.
- Connection type
- Packet interval (RPI)

Connection Type

A multicast connection (Multi-cast connection) or unicast connection (Point to Point connection) can be selected as the connection type in the tag data link connection settings. With a multicast connection, you can send an output tag set in one packet to multiple nodes and make allocations to the input tag sets. If multicast connections are used, however, use an Ethernet switch that has multicast filtering. Otherwise, the tag set is received by all nodes in the network.

A unicast connection separately sends one output tag set to each node, and so it sends the same number of packets as the number of input tag sets. Therefore, using multicast connections can decrease the communications load if one output tag set is sent to multiple nodes.

If an Ethernet switch that does not have multicast filtering is used, the multicast packets will be broadcast to the entire network and packets will be sent to nodes that do not require them, which will cause the communications load on those nodes to increase.

To use a multicast connection and send an output tag set in one packet to multiple nodes, the connection type of the connections that receive the output tag set is multicast, and the output tag set and packet intervals (RPI) are all the same. Note that, if you use a multicast connection, establishing a connection failed when setting a different packet interval (RPI) for more than one connection with the same output tag set. If you set a different packet interval (RPI), set the unicast connection type.

Packet Interval (RPI)

The packet interval is the data I/O refresh cycle in the Ethernet circuit when performing tag data links, and can be set separately for each connection. With EtherNet/IP, data is exchanged on the communications line at the packet interval (RPI) that is set for each connection, regardless of the number of nodes.

The performance of communications devices is limited to some extent by the limitations of each product's specifications. Consequently, there are limits to the packet interval (RPI) settings. Refer to *7-7-4 Setting the Connection* on page 7-68 for the specifications of the IO-Link Master Unit. Refer to the user's manual for the OMRON EtherNet/IP scanner that you use for the specifications of the EtherNet/IP scanner.

● Bandwidth Usage (PPS)

The number of packets transferred by a tag data link in a second is called the used bandwidth or PPS. PPS is an acronym for packet per second.

The PPS is calculated from the RPI and heartbeat for each connection. The PPS must be calculated so that it does not exceed the specification of the allowed communications bandwidth per Unit specified for both the EtherNet/IP scanner and the IO-Link Master Unit. Refer to the user's manual for the OMRON EtherNet/IP scanner that you use for details on the calculation method. Refer to *2-1-2 EtherNet/IP Communications Specifications* on page 2-2 for the specifications of the IO-Link Master Unit. Refer to the user's manual for the OMRON EtherNet/IP scanner that you use for the specifications of the EtherNet/IP scanner.

9-8-4　Setting Method

Refer to *7-7 Setting Tag Data Links* on page 7-62 for details on how to set tag data links.

10

Functions as an IO-Link Master

This section describes the functions of the IO-Link Master Unit as an IO-Link master.

10-1 List of Functions

This section provides an overview and lists the functions of the IO-Link Master Unit as an IO-Link master.

Function name	Description	Reference
Communications mode settings	A function that sets the type of the external device connected to each port. Configure the following pair of settings to set the type of the connected external device. • Pin 2 Communications Mode Setting • Pin 4 Communications Mode Setting	*10-2 Communications Mode Settings* on page 10-5
Automatic baud rate setting for IO-Link communications	A function that enables the IO-Link Master Unit to automatically match the baud rate for IO-Link communications with the IO-Link device connected to each port when the port is set to IO-Link Mode.	*10-3 Automatic Baud Rate Setting for IO-Link Communications* on page 10-7
Output settings during communications errors/Idle with EtherNet/IP scanner	A function that safely controls the output to an IO-Link device or non-IO-Link device if any of the following state occurs. • An error occurred in communications with the EtherNet/IP scanner. • An Idle notification was sent from the EtherNet/IP scanner.	*10-4 Output Settings during Communications Errors/Idle with EtherNet/IP Scanner* on page 10-8
Digital input filter	A function that removes the chattering and noise of the input signal when the port is set to SIO (DI) Mode.	*10-5 Digital Input Filter* on page 10-10
Digital input collection	A function that applies the specified 1-bit value in the IO-Link Input Data for each port to the Integrated IO-Link Input Data when the port is set to IO-Link Mode.	*10-6 Digital Input Collection* on page 10-12
IO-Link device verification	A function that compares the information from the IO-Link device connected to a port with the information on the IO-Link Master Unit that is set by the user and, if they do not match, reports an error without establishing IO-Link communications.	*10-7 IO-Link Device Verification* on page 10-15
I/O cable short-circuit detection	A function that protects the output circuit for each port on the IO-Link Master Unit when a short-circuit occurs in the power supply for a connected external device or load.	*10-8 I/O Cable Short-circuit Detection* on page 10-18
Monitoring Unit/input power supply voltage	A function that monitors the Unit/input power supply voltage and detects if it drops below the minimum value of the rating.	*10-9 Monitoring Unit/Input Power Supply Voltage* on page 10-20
Monitoring output power supply voltage	A function that monitors the output power supply voltage and detects if it drops below the minimum value of the rating.	*10-10 Monitoring Output Power Supply Voltage* on page 10-23
Monitoring total power-ON time	A function that enables the IO-Link Master Unit to record the total power-ON time of the Unit/input power supplied to it.	*10-11 Monitoring Total Power-ON Time* on page 10-25

Function name	Description	Reference
IO-Link total communications lost frames	A function that counts the total number of lost frames for each port during cyclic communications for IO-Link communications when the port is set to IO-Link Mode.	*10-12 IO-Link Total Communications Lost Frames* on page 10-27
Backing up and restoring IO-Link device parameters	A function that is used to replace a connected IO-Link device with a new IO-Link device of the same model without use of the CX-ConfiguratorFDT.	*10-13 Backing Up and Restoring IO-Link Device Parameters* on page 10-31
Recording last-connected device information	A function that supports the replacement work easily by recording the information on the IO-Link devices before replacement in the IO-Link Master Unit when you replace the IO-Link devices.	*10-14 Recording Last-connected Device Information* on page 10-40
IO-Link communications delay time settings	A function that extends the IO-Link communications cycle time when the IO-Link communications delay time is set.	*10-15 IO-Link Communications Delay Time Settings* on page 10-42

10-2 Communications Mode Settings

This section describes the communications mode settings.

10-2-1 Overview of Function

A function that sets the type of the external device connected to each port.
Configure the following pair of settings to set the type of the connected external device.
- Pin 2 Communications Mode Setting
- Pin 4 Communications Mode Setting

10-2-2 Details on Function

Set the type of the external device connected to each port on the IO-Link Master Unit.
You can set *Port □ Pin 4 Communications Mode Setting* and *Port □ Pin 2 Communications Mode Setting* independently. There are no restrictions on the port operations with the combination of these settings.

Settings

Use the Network Configurator or an explicit message to configure the following settings.

Setting	Description	Default	Setting range	Update timing
Port □ Pin 4 Communications Mode Setting	Set the communications mode for pin 4.	IO-Link Mode	• Disable[*1] • SIO(DI) Mode • SIO(DO) Mode • IO-Link Mode	After restart
Port □ Pin 2 Communications Mode Setting	Set the communications mode for pin 2.	SIO(DI) Mode	• Disable[*1] • SIO(DI) Mode • SIO(DO) Mode	After restart

*1. Set to Disable when the port is not used.

Note Port □ represents port number 1 to 8.

📝 **Additional Information**

You can use a branch connector to connect two or more external devices to a port.
At this time, set *Port □ Pin 4 Communications Mode Setting* and *Port □ Pin 2 Communications Mode Setting* individually to SIO (DI) Mode or SIO (DO) Mode.

Refer to *7-5-2 Setting the Device Parameters of the IO-Link Master Unit* on page 7-30 for the setting procedure with the Network Configurator. In the **Edit Device Parameters** dialog box, expand **IO Port □ Configuration** and configure the settings.

Refer to *A-1-9 IO-Link Object (Class ID: 381 Hex)* on page A-24 for information on the CIP object that is set through an explicit message.

Setting Example for Each Connected Device

For each connected external device, set *Port □ Pin 4 Communications Mode Setting* and *Port □ Pin 2 Communications Mode Setting*.
The following is a setting example.

Connected external device	Port □ Pin 4 Communica-tions Mode Setting	Port □ Pin 2 Communica-tions Mode Setting
IO-Link device (without digital inputs and outputs for pin 2)	IO-Link Mode	Disable
IO-Link device (with digital inputs for pin 2)	IO-Link Mode	SIO (DO) Mode
IO-Link device (with digital outputs for pin 2)	IO-Link Mode	SIO (DI) Mode
Digital input device connected to pin 2	Disable	SIO (DI) Mode
Digital input device connected to pin 4	SIO (DI) Mode	Disable
Digital output device connected to pin 2	Disable	SIO (DO) Mode
Digital output device connected to pin 4	SIO (DO) Mode	Disable

10-3 Automatic Baud Rate Setting for IO-Link Communications

A function that enables the IO-Link Master Unit to automatically match the baud rate for IO-Link communications with the IO-Link device connected to each port when the port is set to IO-Link Mode.
This function is applicable to IO-Link devices, so no settings are required by the user.
Refer to *2-1-3 Unit Specifications* on page 2-3 for information on the baud rate.

10-4 Output Settings during Communications Errors/Idle with EtherNet/IP Scanner

This section describes the output settings during errors/Idle in communications with the EtherNet/IP scanner.

10-4-1 Overview of Function

A function that safely controls the output to an IO-Link device or non-IO-Link device if any of the following state occurs.
- An error occurred in communications with the EtherNet/IP scanner.
- An Idle notification was sent from the EtherNet/IP scanner.

This function is applicable to IO-Link devices and non-IO-Link output devices.
This function uses the *Port □ Fault/Idle Action*.

10-4-2 Details on Function

The IO-Link Master Unit performs an output operation depending on the *Port □ Fault/Idle Action* setting, if any of the following state occurs.
- An Exclusive Owner connection with the EtherNet/IP scanner timed out.
- An Idle notification was sent from the EtherNet/IP scanner to the IO-Link Master Unit.

If an IO-Link output device is connected, the IO-Link Master Unit sends an output data invalid notification to it regardless of the setting.
If a non-IO-Link device is connected, the IO-Link Master Unit holds or clears the output value depending on the setting.
This prevents unexpected output operations.
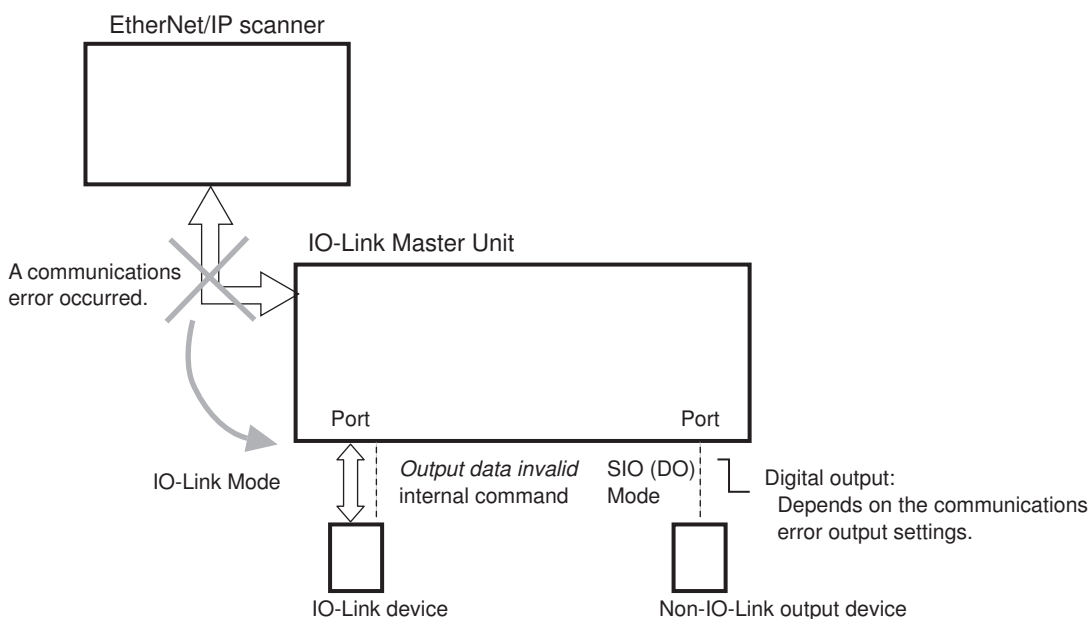
Settings

Use the Network Configurator or an explicit message to configure the following settings.

Setting	Description	Default	Setting range	Update timing
Port □ Fault/Idle Action	Set output operations during communications errors or Idle.	Clear	*1	After re-start

*1. The set values are described as follows:
- IO-Link device

Set value	Description
Clear	Sends an output data invalid notification to the IO-Link device.
Hold	For details on the operations of an IO-Link device that received an output data invalid notification, refer to the manual for the IO-Link device.

- Non-IO-Link output device

Set value	Description
Clear	Clears the output value.
Hold	Holds the output value.

Note Port □ represents port number 1 to 8.

Refer to *7-5-2 Setting the Device Parameters of the IO-Link Master Unit* on page 7-30 for the setting procedure with the Network Configurator. In the **Edit Device Parameters** dialog box, expand **IO Port □ Configuration** and configure the settings.
Refer to *A-1-9 IO-Link Object (Class ID: 381 Hex)* on page A-24 for information on the CIP object that is set through an explicit message.

10-5 Digital Input Filter

This section describes the digital input filter.

10-5-1 Overview of Function

A function that removes the chattering and noise of the input signal when the port is set to SIO (DI) Mode.
When the input data changes without stabilization of the state of the contact point due to chattering and noise, this function prevents changes in data and stabilizes it.
This function uses the *Port □ Pin 4 Input Filter Value Setting* and *Port □ Pin 2 Input Filter Value Setting*.

10-5-2 Details on Function

This function reads the inputs four times at a 1/4 interval of the input filter time that is set in Input Filter Value Setting. When all inputs are ON or OFF, the input values turn ON or OFF.
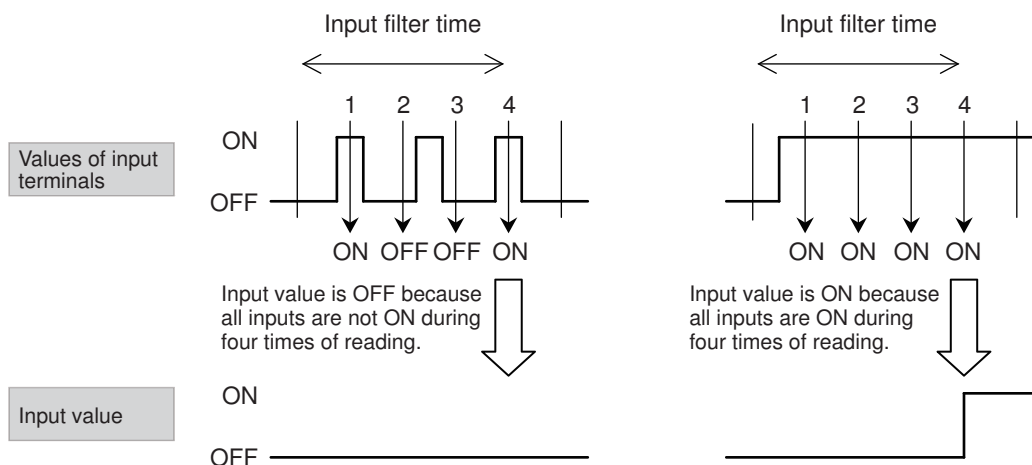
Note that when you use this function, the timing for which the input value actually turns ON or turns OFF is delayed from the initial input to the input terminals until ON delay time or OFF delay time in the following table.

Delay time	Description
ON delay time	ON response time + input filter time
OFF delay time	OFF response time + input filter time

Set the values for pin 4 and pin 2 independently.

Settings

Use the Network Configurator or an explicit message to configure the following settings.

Setting	Description	Default	Setting range	Update timing
Port □ Pin 4 Input Filter Value Setting	Set the input filter value of digital inputs for pin 4.	1 ms	*1	After restart
Port □ Pin 2 Input Filter Value Setting	Set the input filter value of digital inputs for pin 2.	1 ms	*1	After restart

*1.   The set values are as follows:
- No Filter
- 0.25 ms
- 0.5 ms
- 1 ms
- 2 ms
- 4 ms
- 8 ms
- 16 ms
- 32 ms
- 64 ms
- 128 ms
- 256 ms

Note Port □ represents port number 1 to 8.

Refer to *7-5-2 Setting the Device Parameters of the IO-Link Master Unit* on page 7-30 for the setting procedure with the Network Configurator. In the **Edit Device Parameters** dialog box, expand **IO Port □ Configuration** and configure the settings.
Refer to *A-1-9 IO-Link Object (Class ID: 381 Hex)* on page A-24 for information on the CIP object that is set through an explicit message.

10-6 Digital Input Collection

This section describes the digital input collection.

10-6-1 Overview of Function

A function that applies the specified 1-bit value in the IO-Link Input Data for each port to the Integrated IO-Link Input Data when the port is set to IO-Link Mode.
This function uses the *Offset Setting of Port □ IO-Link Input Data Collection Port*.

10-6-2 Details on Function

This function extracts a 1-bit value from the position set in the *Offset Setting of Port □ IO-Link Input Data Collection Port* among the IO-Link Input Data for each port. Refer to (a) in the figure below.
It then places the 1-bit values extracted from all ports in *Integrated IO-Link Input Data* one after the other in the order of port numbers. Refer to (b) in the figure below.
For an offset setting value in *Offset Setting of Port □ IO-Link Input Data Collection Port*, the bit position 00 of the last byte in the IO-Link Input Data serves as the offset position 0.
The size of the IO-Link Input Data is determined by the connection used for the IO-Link Master Unit.
For example, when *Input Assembly Instance Number 111* is selected for the input and output tag sets, the size of the IO-Link Input Data is 8 bytes per port.
Refer to *7-6 Specifications of I/O Data* on page 7-43 for information on connections that you can set.
If the offset value that exceeds the size of the IO-Link Input Data is set, the relevant bit value in the *Integrated IO-Link Input Data* is 0.
For example, when the size of the IO-Link Input Data is 2 bytes, the valid setting range is 0 to 15. If you set 16 at this time, the relevant bit in *Integrated IO-Link Input Data* is 0.

Integrated IO-Link Input Data

Bit position							
07	06	05	04	03	02	01	00
*8	*7	*6	*5	*4	*3	*2	*1

(b)   (b)   (b)

When Input Assembly Instance Number 110 is selected

The input data size is 2 bytes per port for all ports.
An example of Port 2 IO-Link Input Data:
Of the data size in 2 bytes, specify the bit data of offset position 0.

	Bit position							
	07	06	05	04	03	02	01	00
PD0	15	14	13	12	11	10	9	8
PD1	7	6	5	4	3	2	1	0

(a)

When Input Assembly Instance Number 111 is selected

The input data size is 8 bytes per port for all ports.
An example of Port 4 IO-Link Input Data:
Of the data size in 8 bytes, specify the bit data of offset position 33.

	Bit position							
	07	06	05	04	03	02	01	00
PD0	63	62	61	60	59	58	57	56
PD1	55	54	53	52	51	50	49	48
PD2	47	46	45	44	43	42	41	40
PD3	39	38	37	36	35	34	33	32
PD4	31	30	29	28	27	26	25	24
PD5	23	22	21	20	19	18	17	16
PD6	15	14	13	12	11	10	9	8
PD7	7	6	5	4	3	2	1	0

(a)

When Input Assembly Instance Number 112 is selected

The input data size is 32 bytes per port for all ports.
An example of Port 8 IO-Link Input Data:
Of the data size in 32 bytes, specify the bit data of offset position 224.

	Bit position							
	07	06	05	04	03	02	01	00
PD0	255	254	253	252	251	250	249	248
PD1	247	246	245	244	243	242	241	240
PD2	239	238	237	236	235	234	233	232
PD3	231	230	229	228	227	226	225	224
PD4	223	222	221	220	219	218	217	216
PD5	215	214	213	212	211	210	209	208
PD6	207	206	205	204	203	202	201	200
PD7	199	198	197	196	195	194	193	192
PD8	191	190	189	188	187	186	185	184
PD9	183	182	181	180	179	178	177	176
	PD10 to PD27 are omitted.							
PD28	31	30	29	28	27	26	25	24
PD29	23	22	21	20	19	18	17	16
PD30	15	14	13	12	11	10	9	8
PD31	7	6	5	4	3	2	1	0

(a)

*1. Specified bit value for port 1
*2. Specified bit value for port 2
*3. Specified bit value for port 3
*4. Specified bit value for port 4
*5. Specified bit value for port 5
*6. Specified bit value for port 6
*7. Specified bit value for port 7
*8. Specified bit value for port 8

> **Additional Information**
>
> The tag sets for *Input Assembly Instance Number 110*, *Input Assembly Instance Number 111*, and *Input Assembly Instance Number 112* all include the data for port 1 to 8.
> Therefore, you cannot select a different input assembly instance for each port.

Settings

Use the Network Configurator or an explicit message to configure the following settings.

Setting	Description	Default	Setting range	Update timing
Offset Setting of Port □ IO-Link Input Data Collection Port	Specify the position of the bit to extract from IO-Link Input Data.	0	0 to 255	After re-start

Note Port □ represents port number 1 to 8.

Refer to *7-5-2 Setting the Device Parameters of the IO-Link Master Unit* on page 7-30 for the setting procedure with the Network Configurator. In the **Edit Device Parameters** dialog box, expand **IO Port □ Configuration** and configure the settings.
Refer to *A-1-9 IO-Link Object (Class ID: 381 Hex)* on page A-24 for information on the CIP object that is set through an explicit message.

10-7 IO-Link Device Verification

This section describes IO-Link device verification.

10-7-1 Overview of Function

A function that compares the information from the IO-Link device connected to a port with the information on the IO-Link Master Unit that is set by the user and, if they do not match, reports an error without establishing IO-Link communications.
This function is applicable to IO-Link devices.

10-7-2 Details on Function

This function enables the IO-Link Master Unit to registers IO-Link device configuration settings information. The applicable settings are as follows: Refer to (a) in the figure below.
Port □ Configuration Data /Device ID
Port □ Configuration Data /Vendor ID
Port □ Configuration Data /IO-Link Revision
Port □ Configuration Data /Serial Number

Set whether to perform verification and which IO-Link device to verify in *Port □ Device Verification Setting*. You can choose the settings to configure from the following. Refer to (b) in the figure below.
- No check
- Check the vendor ID, device ID, and IO-Link revision.
- Check the vendor ID, device ID, IO-Link revision, and serial number.

Connect the IO-Link device to the port and turn ON the Unit/input power supply. Then, the IO-Link Master Unit verifies the specified settings if the verification setting is enabled. Refer to (c) in the figure below.
If the result is verification match, the IO-Link Master Unit continues the IO-Link communications with the IO-Link device connected to the port.
If the result is verification mismatch, the IO-Link Master Unit stops the IO-Link communications for the port and a Device Configuration Verification Error occurs.
However, if a non-matching IO-Link device is connected, an IO-Link Communications Error occurs for the port, instead of a Device Configuration Verification Error.
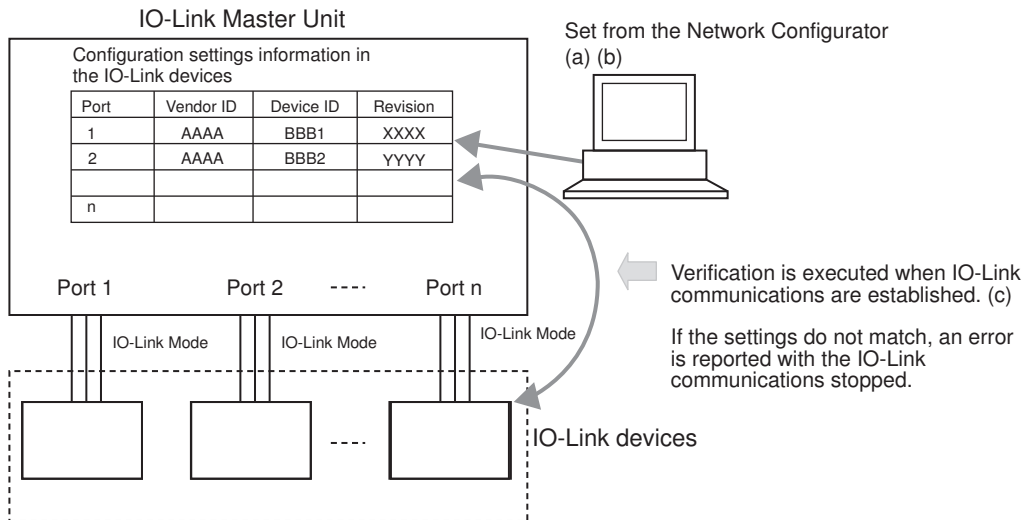
The following table shows the relationship between the setting of *Port □ Device Verification Setting* and the Unit status for different types of connected external devices.

Port □ Device Verification Setting	Connected external device	Port □ IO-Link Communications Error	Port □ Verification Error	Port □ Input Data Enabled
Check	IO-Link device, verification match	FALSE	FALSE	TRUE
	IO-Link device, verification mismatch	FALSE	TRUE	FALSE
	Non-IO-Link device	TRUE	FALSE	FALSE
	No external device connected	TRUE	FALSE	FALSE
No check	IO-Link device	FALSE	FALSE	TRUE
	Non-IO-Link device	FALSE[*1]	FALSE	FALSE
	No external device connected	FALSE[*1*2]	FALSE	FALSE

*1. If the setting is **No check** and a non-IO-Link device or no external device is connected, the status is FALSE because no IO-Link communications occur.

*2. If an IO-Link device is connected and then removed during operation, the status is TRUE.

Note Port □ represents port number 1 to 8.

Settings

Use the Network Configurator or an explicit message to configure the following settings.

Setting	Description	Default	Setting range	Update timing
Port □ Device Verification Setting	Set the operation of IO-Link device verification.	Disable	*1	After re-start
Port □ Configuration Data /Device ID	Set the device ID of the connected IO-Link device.	0	0 to 16,777,215	After re-start
Port □ Configuration Data /Vendor ID	Set the vendor ID of the connected IO-Link device.	0	0 to 65,535	After re-start

Setting	Description	Default	Setting range	Update timing
Port □ Configuration Data /IO-Link Revision	Set the IO-Link revision of the connected IO-Link device.	0	0 to 255	After restart
Port □ Configuration Data /Serial Number	Set the serial number of the connected IO-Link device.	NULL	16 characters	After restart

*1.   The setting range is as follows:

Set value
Disable
VendorID, DeviceID and IO-Link Revision Check
VendorID, DeviceID, IO-Link Revision and SerialNo Check

Note Port □ represents port number 1 to 8.

Refer to *7-5-2 Setting the Device Parameters of the IO-Link Master Unit* on page 7-30 for the setting procedure with the Network Configurator. In the **Edit Device Parameters** dialog box, expand **IO Port □ Configuration** and configure the settings.
Refer to *A-1-9 IO-Link Object (Class ID: 381 Hex)* on page A-24 for information on the CIP object that is set through an explicit message.

10-8 I/O Cable Short-circuit Detection

This section describes I/O cable short-circuit detection.

10-8-1   Overview of Function

A function that protects the output circuit for each port on the IO-Link Master Unit when a short-circuit occurs in the power supply for a connected external device or load.
The IO-Link Master Unit cuts off the relevant output circuit if it detects a short-circuit and reports the occurrence of the event.
This function is enabled regardless of the type of the connected external device, so no settings are required by the user.

10-8-2   Details on Function

If a current that exceeds the maximum load current flows due to a short-circuit between pin 3 and pin 1, between pin 3 and pin 2, or between pin 3 and pin 4 of the port, the function cuts off the output circuit to protect the IO-Link Master Unit.
When the port is short-circuited, the I/O cable short-circuit detection function releases the protection after a certain time. If the short-circuit is not removed, the function sets the protection again. This operation is repeated as long as the port remains in a short-circuit state.
If the short-circuit is removed, the protection remains to be released.

When a short-circuit is detected, the occurrence of the event is reported with the following methods.

Location where short-cut is detected	Notification method
Between pin 1 and pin 3	Port □ Pin 1 Short-circuit Error changes to TRUE.
Between pin 2 and pin 3	Port □ Pin 2 Short-circuit Error changes to TRUE.
Between pin 4 and pin 3	Port □ Pin 4 Short-circuit Error changes to TRUE.

Note Port □ represents port number 1 to 8.

From the user program, etc., access *Port □ Pin 1 Short-circuit Error*, *Port □ Pin 2 Short-circuit Error*, and *Port □ Pin 4 Short-circuit Error* in the Input Assembly of I/O data.
Refer to *7-6-3 Details on Input Assembly Data* on page 7-47 for information on the above data.

The following tables show how the function works with Pin 4 Communications Mode Setting and Pin 2 Communications Mode Setting.
Pin 4

Set value of Port □ Pin 4 Communications Mode Setting	Between pin 1 and pin 3	Between pin 4 and pin 3
IO-Link Mode	Detection and protection enabled	Detection and protection enabled
SIO (DI) Mode		Detection and protection disabled
SIO (DO) Mode		Detection and protection enabled
Disable		Detection and protection disabled

Pin 2

Set value of Port □ Pin 2 Communications Mode Setting	Between pin 1 and pin 3	Between pin 2 and pin 3
IO-Link Mode	(Not supported for IO-Link Mode)	
SIO (DI) Mode	Detection and protection enabled	Detection and protection disabled
SIO (DO) Mode		Detection and protection enabled
Disable		Detection and protection disabled

Precautions for Correct Use

The load short-circuit protection function only protects internal circuits for a short period. Therefore, unless the cause of short-circuit is removed, the I/O cable short-circuit detection function repeats ON/OFF operations in the output.

If the short-circuit is not corrected, output elements deteriorate. If any external load is short-circuited, immediately turn OFF the applicable output and remove the cause of the short-circuit.

10-9 Monitoring Unit/Input Power Supply Voltage

This section describes monitoring Unit/input power supply voltage.

10-9-1 Overview of Function

A function that monitors the Unit/input power supply voltage and detects if it drops below the minimum value of the rating.

This function is used to check if the voltage supplied to the IO-Link Master Unit is within the rated range.

This function is enabled regardless of the type of the connected external device, so no settings are required by the user.

10-9-2 Details on Function

The IO-Link Master Unit has the following information about the Unit/input power supply voltage.

Name	Description
Unit/Input Power Supply Voltage	Indicates the present value of the Unit/input power supply voltage. The unit is 0.1 V.
Maximum Unit/Input Power Supply Voltage	Indicates the maximum value of the Unit/input power supply voltage. The unit is 0.1 V. To reset the value, turn ON the Unit/input power supply.
Minimum Unit/Iuput Power Supply Voltage	Indicates the minimum value of the Unit/input power supply voltage. The unit is 0.1 V. To reset the value, turn ON the Unit/input power supply.
Unit/Input Power Supply Voltage Drop	A status that indicates the Unit/input power supply voltage dropped below the lower limit of the rating. The status changes to TRUE if the voltage drops below the lower limit of the rating. [1]

*1. Refer to *12-8 Resetting Errors* on page 12-41 for conditions under which the status once changes to TRUE and then back to FALSE.

Maximum Unit/Input Power Supply Voltage and *Minimum Unit/Input Power Supply Voltage* are used to check if the result of designing power supply system is acceptable.

If any of these values is out of the rated power supply voltage range of the IO-Link Master Unit, review the design of the power supply system.

Refer to *Section 4 Designing the Power Supply System* on page 4-1 for information on designing the power supply system.

Unit/Input Power Supply Voltage Drop is used to determine if Unit/input power supply to the IO-Link Master Unit is turned OFF.

If this status is TRUE, check that power is correctly supplied from the Unit/input power supply.

The following is the procedure to read the above information.

Reading Parameters into the Network Configurator's Monitor Device Dialog Box

You can use this method to read the values of *Unit/Input Power Supply Voltage*, *Maximum Unit/Input Power Supply Voltage* and *Minimum Unit/Input Power Supply Voltage* among the parameters listed above.

1 Go online with the network that includes the IO-Link Master Unit.
Refer to *7-3-1 Going Online* on page 7-9 for information on how to go online.

2 Select the IO-Link Master Unit and select **Device** – **Monitor** from the menu, or right-click it and select **Monitor**.
The Monitor Device dialog box is displayed.

3 Click the **Parameters** tab page of the Monitor Device dialog box.
The Parameters tab page is displayed.
The information is shown in the Parameters tab page. The display unit is [V].
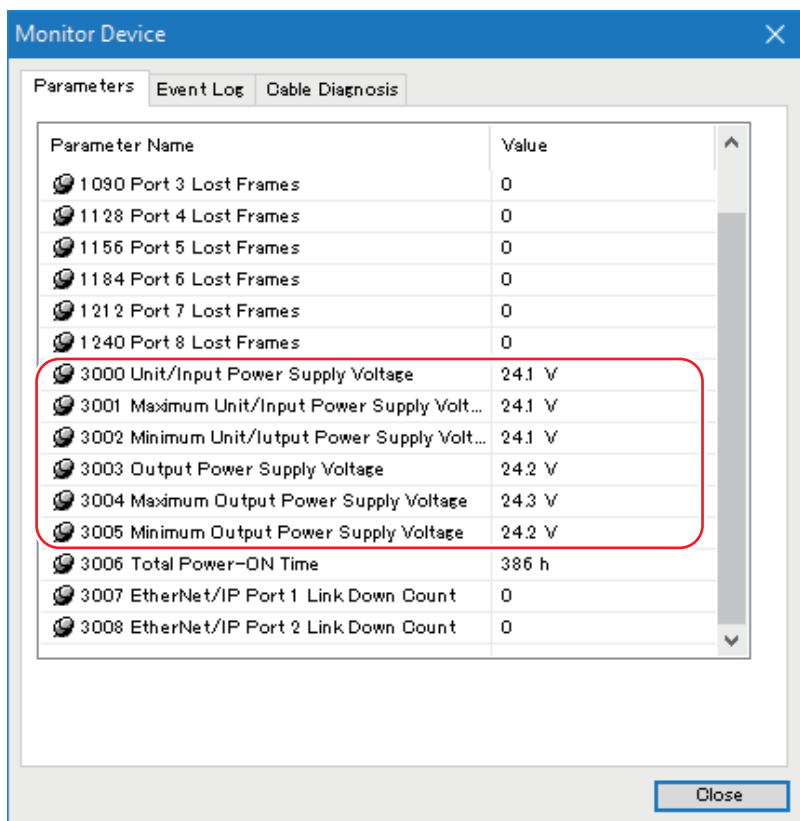
Accessing I/O Data in the IO-Link Master Unit

You can use this method to read the *Unit/Input Power Supply Voltage* and *Unit/Input Power Supply Voltage Drop*.
From the user program, etc., access the *Unit/Input Power Supply Voltage* and *Unit/Input Power Supply Voltage* in the Input Assembly of I/O data.

Refer to *7-6-3 Details on Input Assembly Data* on page 7-47 for information on *Unit/Input Power Supply Voltage* and *Unit/Input Power Supply Voltage*.

Reading Parameters through an Explicit Message

You can use this method to read all of the above information.
Send an explicit message to the following CIP object to read the data.

- *Unit/Input Power Supply Voltage, Maximum Unit/Input Power Supply Voltage, and Minimum Unit/Input Power Supply Voltage*

Class ID	Unit management object (380 hex)
Instance ID	01 hex
Attribute ID (Instance)	• 05 hex Unit/Input Power Supply Voltage • 06 hex Maximum Unit/Input Power Supply Voltage • 07 hex Minimum Unit/Iuput Power Supply Voltage The unit is [0.1 V].

- *Unit/Input Power Supply Voltage Drop*

Class ID	Error status object (383 hex)
Instance ID	01 hex
Attribute ID (Instance)	05 hex Unit/Input Power Supply Voltage Drop

Refer to *A-1-8 Unit Management Object (Class ID: 380 Hex)* on page A-21 and *A-1-11 Error Status Object (Class ID: 383 Hex)* on page A-34 for information on the CIP objects.

10-10 Monitoring Output Power Supply Voltage

This section describes monitoring output power supply voltage.

10-10-1 Overview of Function

A function that monitors the output power supply voltage and detects if it drops below the minimum value of the rating.
This function is used to check if the voltage supplied to the IO-Link Master Unit is within the rated range.
This function is enabled regardless of the type of the connected external device, so no settings are required by the user.

10-10-2 Details on Function

The IO-Link Master Unit has the following information about the output power supply voltage.

Name	Description
Output Power Supply Voltage	Indicates the present value of the output power supply voltage. The unit is 0.1 V.
Maximum Output Power Supply Voltage	Indicates the maximum value of the output power supply voltage. The unit is 0.1 V. To reset the value, turn ON the Unit/input power supply.
Minimum Output Power Supply Voltage	Indicates the minimum value of the output power supply voltage. The unit is 0.1 V. To reset the value, turn ON the Unit/input power supply.
Output Power Supply Voltage Drop	A status that indicates the output power supply voltage dropped below the lower limit of the rating. The status changes to TRUE if the voltage drops below the lower limit of the rating. [1]

*1.   Refer to *12-8 Resetting Errors* on page 12-41 for conditions under which the status once changes to TRUE and then back to FALSE.

Maximum Output Power Supply Voltage and *Minimum Output Power Supply Voltage* are used to check if the result of designing power supply system is acceptable.
If any of these values is out of the rated power supply voltage range of the IO-Link Master Unit, review the design of the power supply system.
Refer to *Section 4 Designing the Power Supply System* on page 4-1 for information on designing the power supply system.

Output Power Supply Voltage Drop is used to determine if output power supply to the IO-Link Master Unit is turned OFF.
If this status is TRUE, check that power is correctly supplied from the output power supply.

The following is the procedure to read the above information.

Reading Parameters into the Network Configurator's Monitor Device Dialog Box

You can use this method to read the *Output Power Supply Voltage*, *Maximum Output Power Supply Voltage*, and *Minimum Output Power Supply Voltage* among the parameters listed above.

For the operating procedure, refer to *Reading Parameters into the Network Configurator's Monitor Device Dialog Box* on page 10-21 in *10-9 Monitoring Unit/Input Power Supply Voltage* on page 10-20.

Accessing I/O Data in the IO-Link Master Unit

You can use this method to read the *Output Power Supply Voltage* and *Output Power Supply Voltage Drop*.

From the user program, etc., access the *Output Power Supply Voltage* and *Output Power Supply Voltage Drop* in the Input Assembly of I/O data.

Refer to *7-6-3 Details on Input Assembly Data* on page 7-47 for information on *Output Power Supply Voltage* and *Output Power Supply Voltage Drop*.

Reading I/O Data through an Explicit Message

You can use this method to read all of the above information.

Send an explicit message to the following CIP object to read the data.

- *Output Power Supply Voltage*, *Maximum Output Power Supply Voltage*, and *Minimum Output Power Supply Voltage*

Class ID	Unit management object (380 hex)
Instance ID	01 hex

Attribute ID (Instance)	• 08 hex
	  Output Power Supply Voltage
	• 09 hex
	  Maximum Output Power Supply Voltage
	• 0A hex
	  Minimum Output Power Supply Voltage
	The unit is [0.1 V].

- *Output Power Supply Voltage Drop*

Class ID	Error status object (383 hex)
Instance ID	01 hex
Attribute ID (instance)	06 hex Output Power Supply Voltage Drop

Refer to *A-1-8 Unit Management Object (Class ID: 380 Hex)* on page A-21 and *A-1-11 Error Status Object (Class ID: 383 Hex)* on page A-34 for information on the CIP objects.

10-11 Monitoring Total Power-ON Time

This section describes monitoring total power-ON time.

10-11-1 Overview of Function

A function that enables the IO-Link Master Unit to record the total power-ON time of the Unit/input power supplied to it.
This function is enabled regardless of the type of the connected external device, so no settings are required by the user.

10-11-2 Details on Function

The IO-Link Master Unit measures and records the total power-ON time of the Unit/input power supplied to it.
When the Unit/input power supply is turned ON, the IO-Link Master Unit starts measuring the time and adds it to the previous total power-ON time.
The IO-Link Master Unit updates the total power-ON time in 1-hour increments.
When the Unit/input power supply is turned OFF, the IO-Link Master Unit truncates the fraction (less-than-one-hour portion) of the current total power-ON time without saving.

Item	Description
Time measurement range	0 to 715,827,882 hours
Display unit	Time
Default	0 hours

The following is the procedure to read the above information.

Reading Parameters into the Network Configurator's Monitor Device Dialog Box

1 Go online with the network that includes the IO-Link Master Unit.
Refer to *7-3-1 Going Online* on page 7-9 for information on how to go online.

2 Select the IO-Link Master Unit and select **Device** – **Monitor** from the menu, or right-click it and select **Monitor**.
The Monitor Device dialog box is displayed.

3 Click the **Parameters** tab page of the Monitor Device dialog box.
The Parameters tab page is displayed.
The information is shown in the Parameters tab page. The display unit is [h].
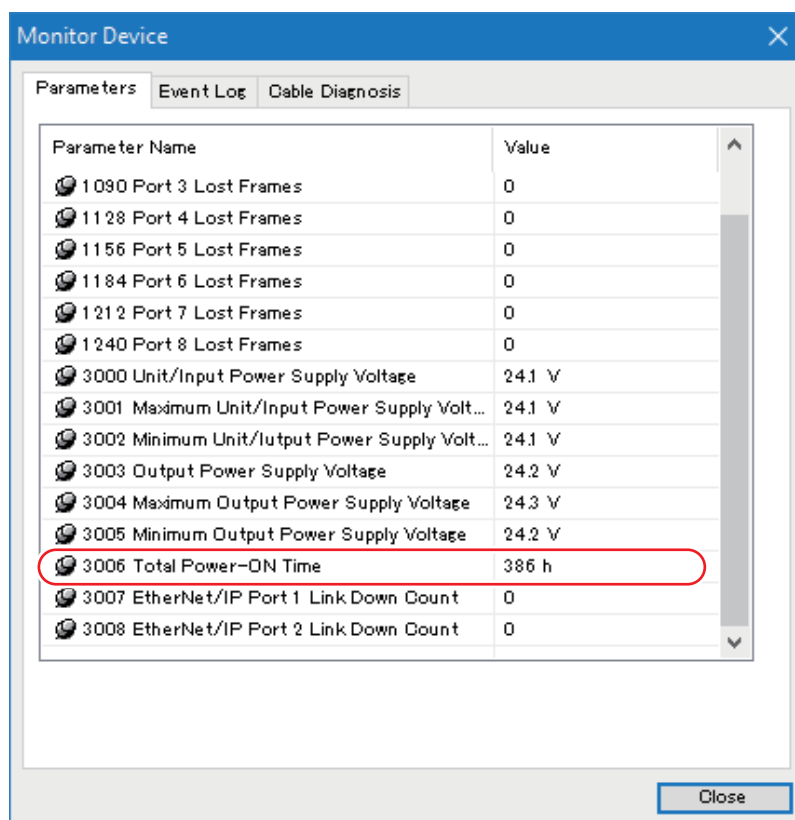
Reading I/O Data through an Explicit Message

Send an explicit message to the following CIP object to read the data.

Class ID	Unit management object (380 hex)
Instance ID	01 hex
Attribute ID (instance)	0B hex Total Power-ON Time The unit is [h].

Refer to *A-1-8 Unit Management Object (Class ID: 380 Hex)* on page A-21 for information on the CIP object.

10-12 IO-Link Total Communications Lost Frames

This section describes the IO-Link total communications lost frames.

10-12-1 Overview of Function

A function that counts the total number of lost frames for each port during cyclic communications for IO-Link communications when the port is set to IO-Link Mode.
The IO-Link total communications lost frames information is used to diagnose the quality of IO-Link communications.
You can use it to diagnose the IO-Link communications line quality for the following:

• Confirming that an IO-Link device was correctly installed
• Finding the causes of communications errors that occur during normal operation

10-12-2 Details on Function

The IO-Link Master Unit counts the total number of lost frames for each port during cyclic communications for IO-Link communications.
The value is stored in *Port □ Lost Frames*. Refer to (a) in the figure below.
The following is the procedure to read the above information. Refer to (b) in the figure below.

Method	Reference
Network Configurator's Monitor Device dialog box	*Reading Parameters into the Network Configurator's Monitor Device Dialog Box* on page 10-28
CX-ConfiguratorFDT's Diagnosis tab page	*Reading Parameters into the CX-ConfiguratorFDT's Diagnosis Tab Page* on page 10-28
Explicit message	*Reading Parameters through an Explicit Message* on page 10-29

Reading methods:
Network Configurator
CX-ConfiguratorFDT
Explicit message
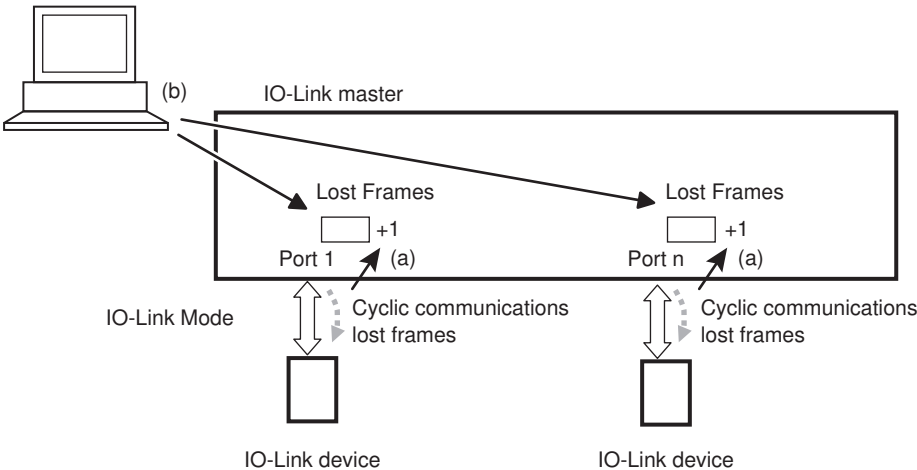
To reset the value, turn ON the Unit/input power supply.

The range of values is 0 to 255 and the IO-Link Master Unit stops counting to 255 when 255 is reached.

Set the *Port □ Lost Frames* value to less than 255 to continue to count from the value.
To change the value, use an explicit message.

Reading Parameter Values

● Reading Parameters into the Network Configurator's Monitor Device Dialog Box

1 Go online with the network that includes the IO-Link Master Unit.
Refer to *7-3-1 Going Online* on page 7-9 for information on how to go online.

2 Select the IO-Link Master Unit and select **Device** – **Monitor** from the menu, or right-click it and select **Monitor**.
The Monitor Device dialog box is displayed.

3 Click the **Parameters** tab page of the Monitor Device dialog box.
The Parameters tab page is displayed.
The information is shown in the Parameters tab page.
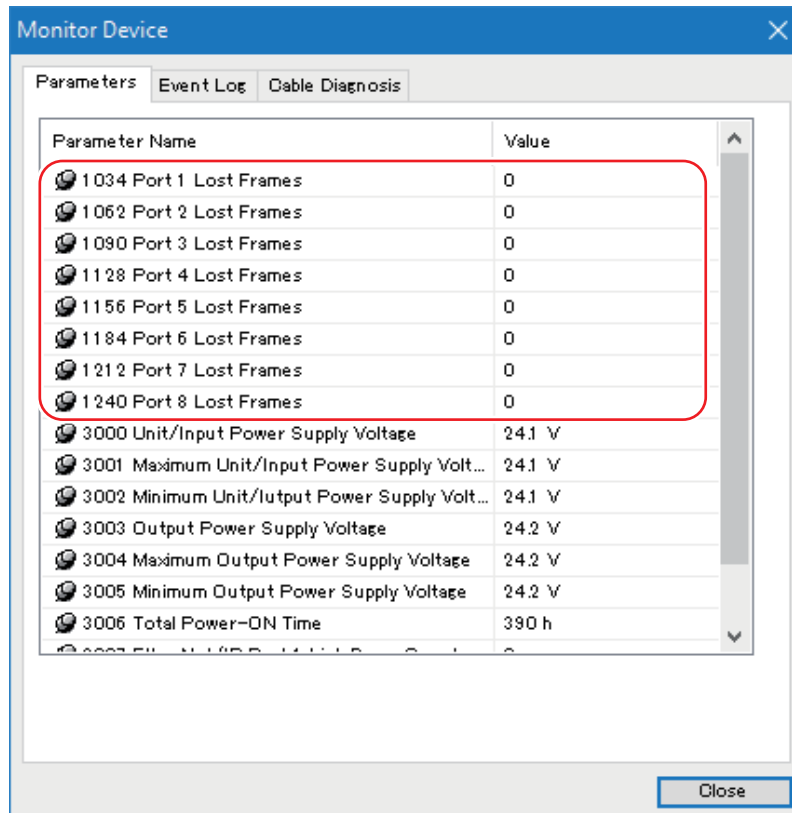
● Reading Parameters into the CX-ConfiguratorFDT's Diagnosis Tab Page

1 Select the DTM for the IO-Link Master Unit and go online with the Unit.
Refer to *11-2 Setting IO-Link Devices with the CX-ConfiguratorFDT* on page 11-3 for infor-
mation on how to go online.

2 Select the DTM for the IO-Link Master Unit and right-click **Diagnosis**.
The Diagnosis tab page is displayed.
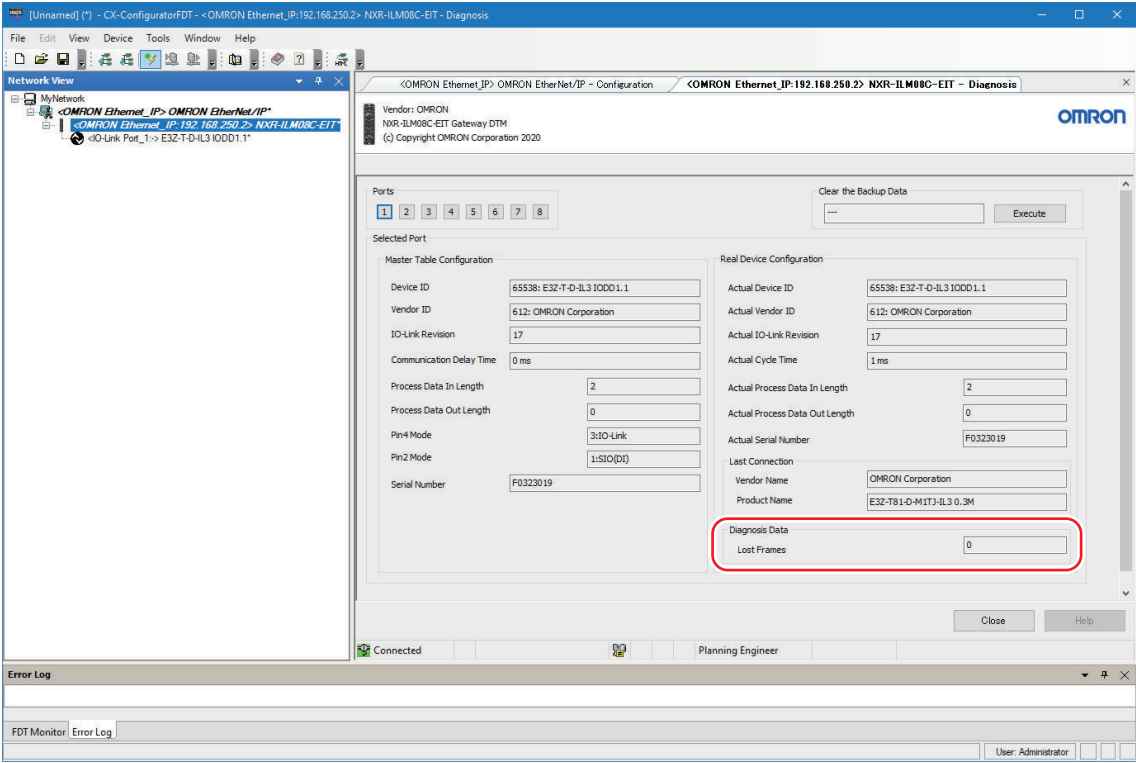
● **Reading Parameters through an Explicit Message**

Send an explicit message to the following CIP object to read the data.

Class ID	IO-Link object (381 hex)
Instance ID	01 to 08 hex (Port number)
Attribute ID (Instance)	1C hex Port □ Lost Frames

Note Port □ represents port number 1 to 8.
Refer to *A-1-9 IO-Link Object (Class ID: 381 Hex)* on page A-24 for information on the CIP ob-
ject.

Writing Parameter Values

● **Writing Parameters through an Explicit Message**

Send an explicit message to the following CIP object to write the data.

Class ID	IO-Link object (381 hex)
Instance ID	01 to 08 hex (Port number)

Attribute ID (Instance)	1C hex
	Port □ Lost Frames

Note Port □ represents port number 1 to 8.

Refer to *A-1-9 IO-Link Object (Class ID: 381 Hex)* on page A-24 for information on the CIP object.

10-13 Backing Up and Restoring IO-Link Device Parameters

This section describes the backup and restoration of parameter settings in IO-Link devices.

10-13-1 Overview of Function

A function that is used to replace a connected IO-Link device with a new IO-Link device of the same model without use of the CX-ConfiguratorFDT.
This function is used to back up the parameter settings from the IO-Link devices to the IO-Link Master Unit and restore them from the IO-Link Master Unit to the IO-Link devices.

Procedure for Backing Up and Restoring IO-Link Device Parameters

1 Back up the parameter settings of the IO-Link device to the IO-Link Master Unit. (Refer to (a) in the figure below.)
Set the device parameters of the IO-Link device according to your application and back up the parameter settings to the IO-Link Master Unit.
For information on how to back up data, refer to *10-13-2 Backing Up IO-Link Device Parameters* on page 10-32.

2 Set the *Port □ Backup/Restore Setting* to **Restore**. (Refer to (b) in the figure below.)
With this setting, when you replace an IO-Link device with another IO-Link device of the same model, you can restore the parameter settings that you backed up from the IO-Link Master Unit to the IO-Link device.

3 Replace the IO-Link device. (Refer to (c) in the figure below.)
When you replace the IO-Link device, the IO-Link Master Unit automatically restores the backed up parameter settings to the new IO-Link device. (Refer to (d) in the figure below.)
Thus, the new IO-Link device operates with the same parameter settings as the old IO-Link device.
Refer to *10-13-3 Restoring IO-Link Device Parameters* on page 10-36 for the restoration procedure.
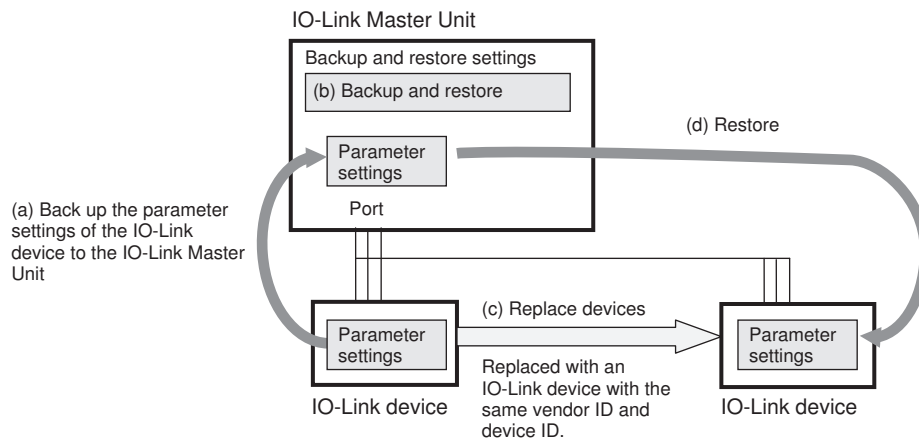
10-13-2 Backing Up IO-Link Device Parameters

The parameter settings that are backed up in the IO-Link Master Unit are called "backup data".

The following backup methods can be used.

a. Automatic backup when IO-Link communications start

b. Backup with a start command with explicit message communications

c. Automatic backup after clearing backup data in the IO-Link Master Unit

d. Automatic backup after transferring parameters to IO-Link devices with the CX-ConfiguratorFDT
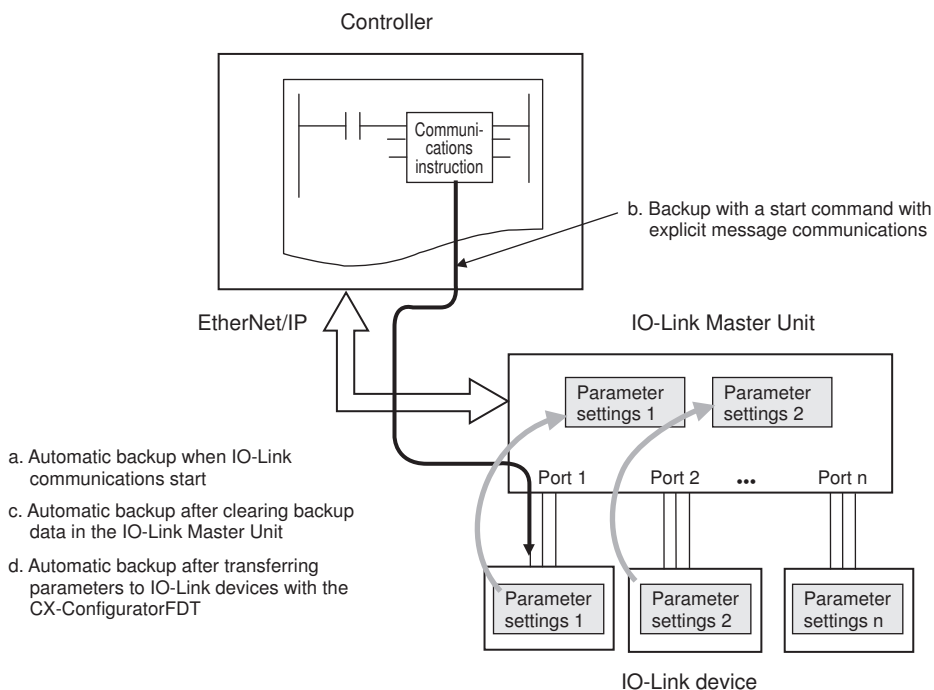
Each of these backup methods is explained below.

Automatic Backup When IO-Link Communications Start

● **When Connecting an IO-Link Device for the First Time**

Backup is executed automatically when IO-Link communications start if the following conditions are met.

- The port settings for the IO-Link Master Unit are as follows.

Setting	Description
Port □ Pin 4 Communications Mode Setting	IO-Link Mode
Port □ Device Verification Setting	Other than **Disable**
Port □ Backup/Restore Setting	Backup

Note Port □ represents port number 1 to 8.

- IO-Link device verification is enabled for the port and the parameter settings match.
- There is no backup data in the IO-Link Master Unit.

Precautions for Correct Use

When you connect an IO-Link device for the first time, the IO-Link Master Unit executes a backup even if the *Port □ Backup/Restore Setting* for the port is **Restore** because it has no backup data for the restore operation.

Additional Information

Backup will fail if you attempt it for an IO-Link device that does not support the backup functions. A Port □ Device Warning-level Event occurs at that time.

● **When Replacing an IO-Link Device with Another IO-Link Device with Different Settings**

This method is used if an IO-Link device is replaced with another IO-Link device with different settings.

Backup is executed automatically when IO-Link communications start if the following conditions are met.

- The port settings for the IO-Link Master Unit are as follows.

Setting	Description
Port □ Pin 4 Communications Mode Setting	IO-Link Mode
Port □ Device Verification Setting	Other than **Disable**
Port □ Backup/Restore Setting	Backup

Note Port □ represents port number 1 to 8.

- IO-Link device verification is enabled for the port and the parameter settings match.
- Backup data already exists in the IO-Link Master Unit and the parameter settings in the connected IO-Link device are different from the backup data.

Additional Information

Backup will fail if you attempt it for an IO-Link device that does not support the backup functions. A Port □ Device Warning-level Event occurs at that time.

Backup with a Start Command with Explicit Message Communications

This method is used to change the settings of IO-Link devices with explicit message communications and back up the settings of the IO-Link devices individually, e.g., when changing over a production line.

By sending a start command over explicit message communications, backup is executed during IO-Link communications if the following conditions are met.

- The port settings for the IO-Link Master Unit are as follows.

Setting	Description
Port □ Pin 4 Communications Mode Setting	IO-Link Mode
Port □ Device Verification Setting	Other than **Disable**
Port □ Backup/Restore Setting	Backup

Note Port □ represents port number 1 to 8.

- The Parameter upload start service data is supported by the IO-Link device.

Index　　　　0002 hex
Write data　　05 hex (Start command)

Refer to *10-13-5 Executing a Start Command for Backup with Explicit Message Communications* on page 10-37 for information on how to execute a start command.

> 📝 **Additional Information**
>
> Backup will fail if you attempt it for an IO-Link device that does not support the backup functions. A Port □ Device Warning-level Event occurs at that time.

Automatic Backup after Clearing Backup Data in the IO-Link Master Unit

By clearing the backup data, the settings of the IO-Link device after change are backed up. This method is used in the following cases.

- When the settings of IO-Link devices are changed by the CX-ConfiguratorFDT or with explicit message communications.
- When the settings of the IO-Link devices are changed with explicit message communications and a backup is performed for one IO-Link master at a time, e.g., when changing over a production line.

If the following condition is met, when you clears the backup data, the IO-Link Master Unit executes a backup.

- The port settings for the IO-Link Master Unit are as follows.

Setting	Description
Port □ Pin 4 Communications Mode Setting	IO-Link Mode
Port □ Device Verification Setting	Other than **Disable**
Port □ Backup/Restore Setting	Backup

Note Port □ represents port number 1 to 8.

For information on how to clear backup data, refer to *10-13-6 Clearing Backup Data* on page 10-37.

Precautions for Correct Use

If the *Port □ Backup/Restore Setting* for the port is **Restore**, when you clears the backup data, the IO-Link Master Unit executes a backup because it has no backup data for the restore operation.

Automatic Backup after Transferring Parameters to IO-Link Devices with the CX-ConfiguratorFDT

This method is used to back up the settings of IO-Link devices by adjusting them with the CX-ConfiguratorFDT at startup.

If the following condition is met, when the parameters are transferred to IO-Link devices with the CX-ConfiguratorFDT, the IO-Link Master Unit executes a backup.

- The port settings for the IO-Link Master Unit are as follows.

Setting	Description
Port □ Pin 4 Communications Mode Setting	IO-Link Mode
Port □ Device Verification Setting	Other than **Disable**
Port □ Backup/Restore Setting	Backup

Note Port □ represents port number 1 to 8.

● Method 1: Transferring Parameters to IO-Link Devices with the CX-ConfiguratorFDT

The following is the procedure to transfer the parameters to individual IO-Link devices.

1 Go online with the IO-Link device.
Refer to *11-2-10 Going Online* on page 11-10 for information on how to go online.

2 Use one of the following methods to transfer the parameters.
  a) Select the DTM for the IO-Link device, right-click the DTM, and select **Store to device**.
  b) Display the Configuration tab page for the IO-Link device and click the **Write to device (download)** or **Write different values to device** button.

● Method 2: Transferring Parameters to IO-Link Devices with the CX-ConfiguratorFDT

The following is the procedure to transfer the parameters to all IO-Link devices for an IO-Link Master Unit at a time.

1 Go online with the IO-Link Master Unit.
Refer to *11-2-10 Going Online* on page 11-10 for information on how to go online.

2 Select the DTM for the IO-Link Master Unit and right-click **Additional functions** – **Store to all devices**.

Precautions for Correct Use

To change the parameters of IO-Link devices with the CX-ConfiguratorFDT, set the *Port □ Backup/Restore Setting* for the port to **Do Not Execute** or **Backup**.
If you set the *Port □ Backup/Restore Setting* for the port to **Restore**, the IO-Link Master Unit automatically executes a restore operation when IO-Link device parameters are transferred with the CX-ConfiguratorFDT. However, the data restored at this time is the data before the transfer. You cannot change the parameter settings for IO-Link devices even if you transfer them with the CX-ConfiguratorFDT.

10-13-3 Restoring IO-Link Device Parameters

After you replace an IO-Link device with another IO-Link device of the same model, you can restore the parameter settings that you backed up from the IO-Link Master Unit to the IO-Link device. Restoration is executed automatically when IO-Link communications start if the following conditions are met.

• The port settings for the IO-Link Master Unit are as follows.

Setting	Description
Port □ Pin 4 Communications Mode Setting	IO-Link Mode
Port □ Device Verification Setting	Other than **Disable**
Port □ Backup/Restore Setting	Restore

Note Port □ represents port number 1 to 8.

• IO-Link device verification is enabled for the port and the parameter settings match.
• Backup data already exists in the IO-Link Master Unit and the parameter settings in the connected IO-Link device are different from the backup data.

10-13-4 Settings and Setting Method

This section describes the settings and setting method for backing up and restoring IO-Link device parameters.
Refer to *10-2 Communications Mode Settings* on page 10-5 for information on *Port □ Pin 4 Communications Mode Setting*. Refer to *10-7 IO-Link Device Verification* on page 10-15 for information on *Port □ Device Verification Setting*.

Settings

Set the device parameters of the IO-Link Master Unit to configure the backup and restore settings for IO-Link devices. Configure the following settings with the Network Configurator.

Setting	Description	Default	Setting range	Update timing
Port □ Backup/ Restore Setting	Set whether to back up or restore the parameter settings of the IO-Link device, or disable the back-up/restore function.	Do Not Execute	• Do Not Execute • Backup • Restore	After re-start

Note Port □ represents port number 1 to 8.

Alternatively, you can send an explicit message to the following CIP object to configure the backup and restore settings for IO-Link devices.

Class ID	IO-Link object (381 hex)
Instance ID	01 to 08 hex (Port number)
Attribute ID (Instance)	03 hex Port □ Backup/Restore Setting

Refer to *A-1-9 IO-Link Object (Class ID: 381 Hex)* on page A-24 for information on the CIP object.

Setting Method

This section describes the setting procedure with the Network Configurator.
Refer to *7-5 Setting Device Parameters* on page 7-28 for details on how to display the Edit Device Parameters dialog box and download device parameters.

1 Display the **Edit Device Parameters** dialog box for the IO-Link Master Unit that you set.

2 Set the **Port □ Backup/Restore Setting** value for the port.
Select **Port □ Backup/Restore Setting** under **IO Port □ Configuration**, and then select **Backup** or **Restore** from the **Value** drop-down list.
After selecting a value, click the **OK** button.

3 Connect the Network Configurator online.

4 Download the device parameters to the IO-Link Master Unit that you set.
After completion of the download, the IO-Link Master Unit restarts.
The settings are reflected after the IO-Link Master Unit is restarted.

10-13-5 Executing a Start Command for Backup with Explicit Message Communications

Send an explicit message to the following CIP object to execute a start command for buckup.

Class ID	IO-Link object (381 hex)
Service code	34 hex Message for IO-Link device
Instance ID	01 to 08 hex (Port number)
Service data	• 0002 hex: Index of the IO-Link device object • 05 hex: Backup start command to the IO-Link device

Refer to *6-1-2 Explicit Message Communications* on page 6-4 for information on the communications instructions to send an explicit message.

10-13-6 Clearing Backup Data

You can clear the backup data from IO-Link devices that is stored in the IO-Link Master Unit.

If the device verification setting is other than **Disable**, the parameter settings are backed up immediately after the backup data is cleared regardless of whether they match or mismatch in IO-Link device verification.

Use either of the following methods to clear backup data.

• Clearing backup data with the CX-ConfiguratorFDT
• Clearing backup data with explicit message communications

With either method, when the backup data is cleared, the backup data of all ports will be cleared.

• Applicable communications modes
  IO-Link Mode, SIO (DI) Mode, SIO (DO) Mode, or Disable Port

Clearing Backup Data with the CX-ConfiguratorFDT

You can use the CX-ConfiguratorFDT to clear the backup data in the IO-Link Master Unit.
Refer to *11-2-5 Starting the CX-ConfiguratorFDT* on page 11-5 for information on how to start the CX-ConfiguratorFDT.

1 Display the **Diagnosis** tab page of the CX-ConfiguratorFDT and click the **Execute** button in the **Clear the Backup Data** area.
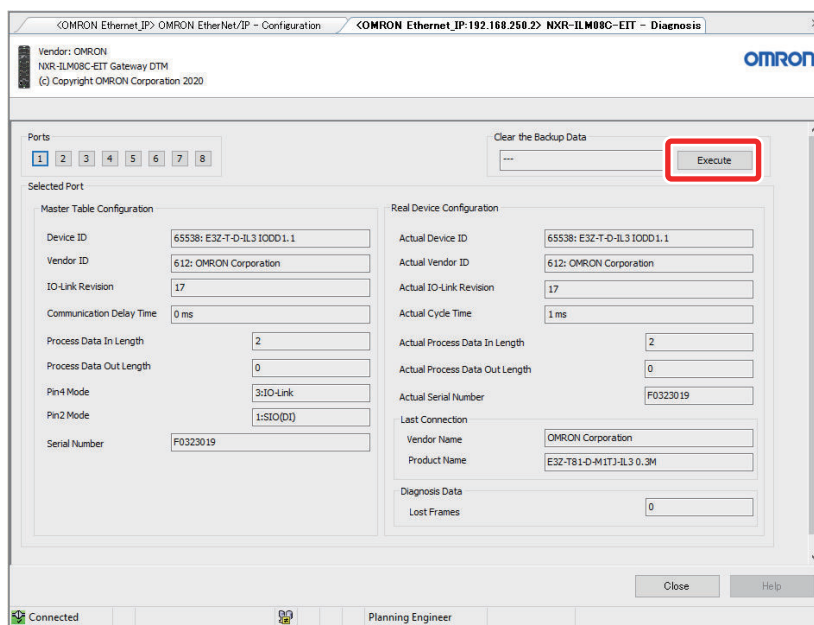
The backup data in the IO-Link Master Unit is cleared.
In addition, the execution result of the clearing operation is displayed. Details are given below.
If the clearing operation is executed normally, **0x00: Success** is displayed.
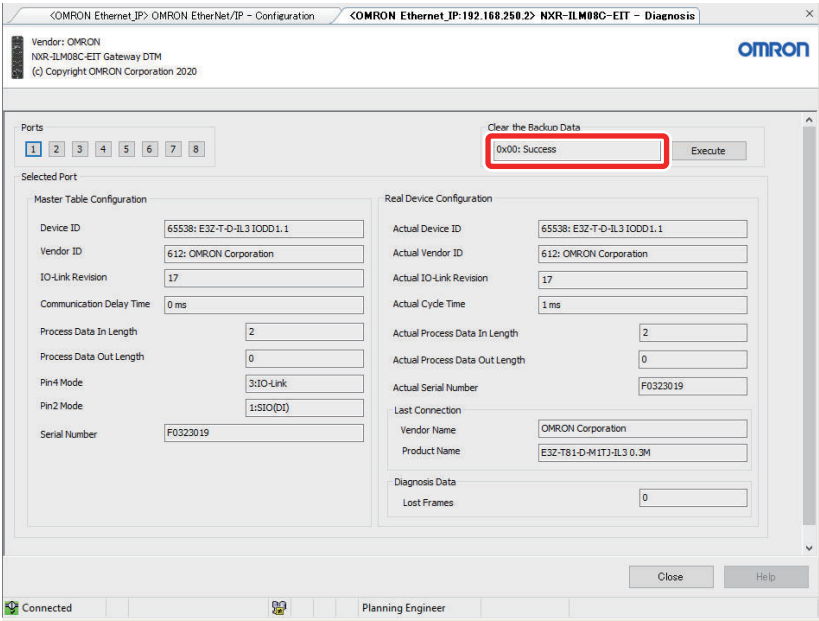
Clearing Backup Data with Explicit Message Communications

Send an explicit message to the following CIP object to clear the backup data.

Class ID	IO-Link object (381 hex)
Service code	33 hex Backup Data Clear
Instance ID	00 hex
Service data	None

Refer to *6-1-2 Explicit Message Communications* on page 6-4 for information on the communications instructions to send an explicit message.

10-14 Recording Last-connected Device Information

This section describes recording last-connected device information.

10-14-1 Overview of Function

A function that supports the replacement work easily by recording the information on the IO-Link devices before replacement in the IO-Link Master Unit when you replace the IO-Link devices.
This function is applicable to IO-Link devices, and no settings are required by the user.

10-14-2 Details on Function

The IO-Link Master Unit registers the vendor name and product name of the connected IO-Link device.

Name	Description
Port □ Vendor Name of the Last Connected IO-Link Device	Records the vendor name of the last-connected IO-Link device as a text string.
Port □ Product Name of the Last Connected IO-Link Device	Records the product name of the last-connected IO-Link device as a text string.

Note Port □ represents port number 1 to 8.

The IO-Link Master Unit updates the above information with information on the connected IO-Link devices when IO-Link communications are started.
This information is retained in the IO-Link Master Unit even if you remove the IO-Link devices. Therefore, you can check the vendor name and product name of the removed IO-Link device even if the IO-Link device is already removed when you replace an IO-Link device.
Thus, you can easily replace the IO-Link devices without error.

The following is the procedure to read the above information.

Reading Parameters into the Network Configurator's Monitor Device Dialog Box

**1** Go online with the network that includes the IO-Link Master Unit.
Refer to *7-3-1 Going Online* on page 7-9 for information on how to go online.

2 Select the IO-Link Master Unit and upload the device parameters.
Refer to *7-5-5 Uploading Device Parameters* on page 7-40 for information on uploading device parameters.

3 Display the Edit Device Parameters dialog box with either of the following methods.
• Select the IO-Link Master Unit and double-click the Unit.
• Select the IO-Link Master Unit, right-click the Unit and select **Parameter** – **Edit**.

Reading I/O Data through an Explicit Message

Send an explicit message to the following CIP object to read the data.

Class ID	IO-Link object (381 hex)
Instance ID	01 to 08 hex (Port number)
Attribute ID (Instance)	18 hex Port □ Vendor Name of the Last Connected IO-Link Device 19 hex Port □ Product Name of the Last Connected IO-Link Device

Note Port □ represents port number 1 to 8.

Refer to *A-1-9 IO-Link Object (Class ID: 381 Hex)* on page A-24 for information on the CIP object.

10-15 IO-Link Communications Delay Time Settings

This section describes the IO-Link communications delay time settings.

10-15-1 Overview of Function

A function that extends the IO-Link communications cycle time when the IO-Link communications delay time is set.

Use this function if an IO-Link Communications Error occurs due to the effect of IO-Link communications delay. For example, during communications with an IO-Link device through a relay device such as an electromagnetic coupler, a communications timeout may occur due to the effect of communications delay in the relay device, which results in an IO-Link Communications Error. You can use this function and extend the IO-Link communications cycle time to eliminate the effect of communications delay.

This function uses the *Port □ Configuration Data /Communication Delay Time*.

10-15-2 Details on Function

This function extends the IO-Link communications cycle time based on the delay time set in *Configuration Data /Communication Delay Time*. However, the extended IO-Link communications cycle time is limited to a maximum of 132.8 ms.

Settings

Use the Network Configurator or an explicit message to configure the following settings.

Setting	Description	Default	Setting range	Update timing
Port □ Configuration Data /Communication Delay Time	Set the IO-Link communications delay time.	0	*1	After restart

*1. The delay time for the set value is as follows:

Set value 0 to 49		Set value 50 to 99		Set value 100 to 149		Set value 150 to 191	
Set value	Delay time (ms)	Set value	Delay time (ms)	Set value	Delay time (ms)	Set value	Delay time (ms)
0	0.0	50	5.0	100	20.8	150	67.2
1	0.1	51	5.1	101	21.2	151	68.8
2	0.2	52	5.2	102	21.6	152	70.4
3	0.3	53	5.3	103	22.0	153	72.0
4	0.4	54	5.4	104	22.4	154	73.6
5	0.5	55	5.5	105	22.8	155	75.2
6	0.6	56	5.6	106	23.2	156	76.8
7	0.7	57	5.7	107	23.6	157	78.4
8	0.8	58	5.8	108	24.0	158	80.0
9	0.9	59	5.9	109	24.4	159	81.6
10	1.0	60	6.0	110	24.8	160	83.2

Set value 0 to 49		Set value 50 to 99		Set value 100 to 149		Set value 150 to 191	
Set value	Delay time (ms)	Set value	Delay time (ms)	Set value	Delay time (ms)	Set value	Delay time (ms)
11	1.1	61	6.1	111	25.2	161	84.8
12	1.2	62	6.2	112	25.6	162	86.4
13	1.3	63	6.3	113	26.0	163	88.0
14	1.4	64	6.4	114	26.4	164	89.6
15	1.5	65	6.8	115	26.8	165	91.2
16	1.6	66	7.2	116	27.2	166	92.8
17	1.7	67	7.6	117	27.6	167	94.4
18	1.8	68	8.0	118	28.0	168	96.0
19	1.9	69	8.4	119	28.4	169	97.6
20	2.0	70	8.8	120	28.8	170	99.2
21	2.1	71	9.2	121	29.2	171	100.8
22	2.2	72	9.6	122	29.6	172	102.4
23	2.3	73	10.0	123	30.0	173	104.0
24	2.4	74	10.4	124	30.4	174	105.6
25	2.5	75	10.8	125	30.8	175	107.2
26	2.6	76	11.2	126	31.2	176	108.8
27	2.7	77	11.6	127	31.6	177	110.4
28	2.8	78	12.0	128	32.0	178	112.0
29	2.9	79	12.4	129	33.6	179	113.6
30	3.0	80	12.8	130	35.2	180	115.2
31	3.1	81	13.2	131	36.8	181	116.8
32	3.2	82	13.6	132	38.4	182	118.4
33	3.3	83	14.0	133	40.0	183	120.0
34	3.4	84	14.4	134	41.6	184	121.6
35	3.5	85	14.8	135	43.2	185	123.2
36	3.6	86	15.2	136	44.8	186	124.8
37	3.7	87	15.6	137	46.4	187	126.4
38	3.8	88	16.0	138	48.0	188	128.0
39	3.9	89	16.4	139	49.6	189	129.6
40	4.0	90	16.8	140	51.2	190	131.2
41	4.1	91	17.2	141	52.8	191	132.8
42	4.2	92	17.6	142	54.4	---	---
43	4.3	93	18.0	143	56.0	---	---
44	4.4	94	18.4	144	57.6	---	---
45	4.5	95	18.8	145	59.2	---	---
46	4.6	96	19.2	146	60.8	---	---
47	4.7	97	19.6	147	62.4	---	---
48	4.8	98	20.0	148	64.0	---	---
49	4.9	99	20.4	149	65.6	---	---

Note Port □ represents port number 1 to 8.

Refer to *7-5-2 Setting the Device Parameters of the IO-Link Master Unit* on page 7-30 for the setting procedure with the Network Configurator. In the **Edit Device Parameters** dialog box, expand **IO Port □ Configuration** and configure the settings.

Refer to *A-1-9 IO-Link Object (Class ID: 381 Hex)* on page A-24 for information on the CIP object that is set through an explicit message.

11

Setting Up IO-Link Devices

This section describes how to set up the IO-Link devices.

11-1 Methods for Setting IO-Link Devices

There are the following two methods to set IO-Link devices with the NXR-series IO-Link Master Unit for EtherNet/IP.

• Setting IO-Link devices with the CX-ConfiguratorFDT
• Setting IO-Link devices with message communications

Refer to the following sections for how to set IO-Link devices with message communications.

• *6-2-2 Message Communications for IO-Link Communications* on page 6-10
• *A-2-3 Configuring IO-Link Devices with Message Communications* on page A-50

The following section covers details on setting IO-Link devices with the CX-ConfiguratorFDT.

11-2 Setting IO-Link Devices with the CX-ConfiguratorFDT

This section describes how to work with the CX-ConfiguratorFDT to set the IO-Link devices connected to the NXR-series IO-Link Master Unit for EtherNet/IP.

11-2-1 Overview of the CX-ConfiguratorFDT

The CX-ConfiguratorFDT is an FDT frame application for setting, diagnosing, and maintaining field devices.
You can make parameter settings for the IO-Link devices with the CX-ConfiguratorFDT.

Functions of the CX-ConfiguratorFDT

- After you create a network configuration, you can set the IO-Link device parameters and then store them in the actual IO-Link devices.
- After you create a network configuration, you can load parameter settings from the actual IO-Link devices.
- You can save the network configuration and IO-Link device settings that you create in a project file.

Network Configuration

Register the following information in the network configuration of the NXR-series IO-Link Master Unit for EtherNet/IP.

Information	Description
Communications DTM	Path from the computer (CX-ConfiguratorFDT) to the IO-Link Master Unit
Gateway DTM	IO-Link Master Unit
Device DTM	IO-Link device connected to each port on the IO-Link Master Unit

CX-ConfiguratorFDT   Network View Configuration

Computer (i.e., CX-ConfiguratorFDT): (My) Network

- Path from the computer (CX-ConfiguratorFDT) to the IO-Link Master Unit

Communications DTM   Connected to the NXR-series IO-Link Master Unit for EtherNet/IP via a CPU Unit or Ethernet "OMRON EtherNet/IP"

IO-Link master

Gateway DTM   NXR-series IO-Link Master Unit for EtherNet/IP "NXR-ILM08C-EIT"

IO-Link devices

Device DTMs   DTMs for the IO-Link devices
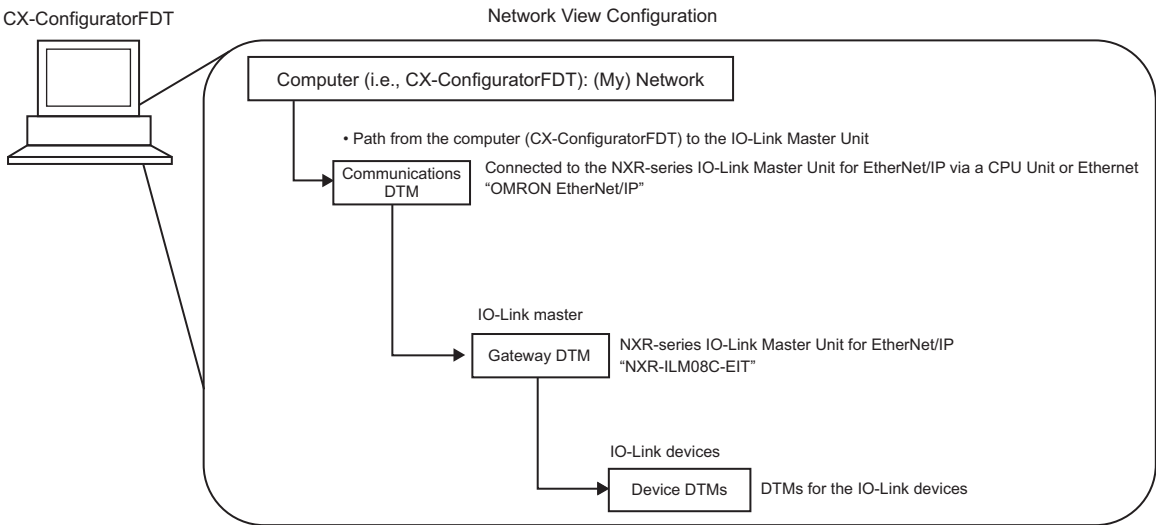
> **✔ Version Information**
>
> You can use the gateway DTM "NXR-ILM08C-EIT" with the CX-ConfiguratorFDT version 2.54 or higher.

11-2-2 Flow of Operations for the CX-ConfiguratorFDT

For the CX-ConfiguratorFDT, use the following flow of operations to set parameters for the IO-Link devices.

Settings

Start the CX-ConfiguratorFDT.

↓

Create the network configuration.

Place the communications DTM (OMRON EtherNet/IP) under (My) Network.

↓

Place the gateway DTM (NXR-series IO-Link Master Unit for EtherNet/IP) under the above communications DTM (OMRON EtherNet/IP).

↓

Place the device DTMs (IO-Link devices) under the above gateway DTM (NXR-series IO-Link Master Unit for EtherNet/IP).[1]

↓

Set the parameters for the device DTMs (IO-Link devices).

↓

Export the network configuration you created to a file.

- -

(Set the parameters in the IO-Link Master Unit with the Network Configurator in advance.)

↓

Downloading

Go online with the CX-ConfiguratorFDT.

↓

Store the parameters in the IO-Link devices.

- -

*1. The maximum number of device DTMs for one communications DTM is 64. If there are more than 64 device DTMs, use more than one communications DTM.

11-2-3 Installing the CX-ConfiguratorFDT in Your Computer

If you install the following Support Software, the CX-ConfiguratorFDT version 2.54 or higher is installed automatically.
The CX-ConfiguratorFDT version 2.54 or higher supports the gateway DTM for the NXR-series IO-Link Master Unit for EtherNet/IP.

Controller used	Support Software	Version
NJ/NX-series CPU Unit	Sysmac Studio	Ver.1.40 or higher
CJ/CP/CS-series PLC	CX-One	Ver.4.52 or higher

11-2-4 Installing IODD Files for IO-Link Devices from Other Companies in the CX-ConfiguratorFDT

If you use IO-Link devices from another company, you must install the IODD files (i.e., XML files) for the IO-Link devices of that company in your computer.

An example of the installation procedure for the Windows 10 operation system is given below.

1 First, obtain the IODD files for the IO-Link devices from the device manufacturer.

2 Select **IO-Link** – **IODD DTM Configurator** from the Windows **Start** menu.

3 The IODDs that are currently installed in your computer are displayed on the **Installed IODDs** tab page.

4 Click the **Add IODD** button, select the IODD files to add, and then click the **Open** button.

The IODDs that you added are displayed on the **Installed IODDs** tab page.

> **Precautions for Correct Use**
>
> You cannot use the IODD DTM Configurator to add or delete individually the IODD files with the same vendor ID, device ID, and IO-Link revision, but different file version.
> Perform the following operations to delete the OMRON IODD files that are already installed.
> - To add IODD files
>   When you add the IODD files with the same vendor ID, device ID, and IO-Link revision, but different file version, IODD files with the installed file version are overwritten.
> - To delete IODD files
>   If several IODD files with the same vendor ID, device ID, and IO-Link revision, but different file version are installed, when you delete individually the relevant IODD files, all of IODD files differ from IODD files with the installed file version are deleted.
> When you made a mistake and deleted different files, select OMRON IOLink IODD Files Setup from **Control Panel** – **Programs and Features**, right-click the OMRON IOLink IODD Files Setup and execute **Repair**, the deleted files can be recovered.

> **Additional Information**
>
> - A set of OMRON IODD files is installed when you install the CX-ConfiguratorFDT.
> - You can install IODD files from other companies. The operation differs depending on the version as follows.
>   a) For the CX-ConfiguratorFDT version lower than 3.0, click the **Install Device Description Files** button in the device catalog.
>   b) For the CX-ConfiguratorFDT version 3.0 or higher, click the **Install Device Description Files** or **IODD Finder** from the **Profile Installation** tab page of the **Device** or **Topology** ribbon.

11-2-5 Starting the CX-ConfiguratorFDT

Use one of the following methods to start the CX-ConfiguratorFDT. Examples of the starting methods for the Windows 10 operation system are given below.

- If the Sysmac Studio is installed

  Select **OMRON** – **Sysmac Studio** – **CX-ConfiguratorFDT** from the Windows **Start** menu.

- If the CX-One is installed

When the CX-One is installed, select **OMRON** – **CX-One** – **CX-ConfiguratorFDT** from the Windows **Start** menu.

The first time you start the CX-ConfiguratorFDT, a dialog box to update the catalog is displayed automatically.

Precautions for Correct Use

- Before you store (download) the settings to IO-Link devices, confirm that the controlled system will not be adversely affected.
- You must update the device catalog after you install the CX-ConfiguratorFDT or after you install new DTMs.
- If DTM reading fails after you update the CX-One or restart the CX-ConfiguratorFDT application, update the device catalog.
- You cannot read and write the "Process data values Output (from PLC)" value, which is displayed for **Process data** under **Menu** in the Configuration tab page for the IO-Link device. An error is not displayed even if you perform one of the following operations for those values.
  - Reading from device (Upload) or writing to device (Download)
  - Enabling cycle read from device for process data
  - Reading comparison values from device or writing different values to device

Additional Information

You can also manually update the catalog. The operation differs depending on the version as follows.
- For the CX-ConfiguratorFDT version lower than 3.0, click the **Update** button on the Device Catalog tab page.
- For the CX-ConfiguratorFDT version 3.0 or higher, click the **Update Catalog** from the **Device** or **Topology** ribbon.

11-2-6 Creating the Network Configuration

To create a network configuration for the NXR-series IO-Link Master Unit for EtherNet/IP, register the following information.

Information	Description
Communications DTM	Path from the computer (CX-ConfiguratorFDT) to the IO-Link Master Unit
Gateway DTM	IO-Link Master Unit
Device DTM	IO-Link device connected to each port on the IO-Link Master Unit

You can create the network configuration either by selecting the configuration devices or by automatically creating it from the devices that are actually connected.

Creating the Network Configuration by Selecting the Configuration Devices

1 Start the CX-ConfiguratorFDT.

2 Right-click **(My) Network** in the Network View and select **Add**.
The **Add** dialog box is displayed.

3 Select the communications DTM for **OMRON EtherNet/IP** and click the **OK** button.
The selected communications DTM is displayed under (My) Network.

4 Right-click **OMRON EtherNet/IP** and select **Add**.
The **Add** dialog box is displayed.

5 Select the gateway DTM for **NXR-ILM08C-EIT** and click the **OK** button.
Under (My) Network, **NXR-ILM08C-EIT** is displayed, which is the NXR-series IO-Link Master Unit for EtherNet/IP.

6 Double-click **NXR-ILM08C-EIT** that is added. Set the IP address and click the **OK** button in the Configuration tab page displayed on the right.

7 Right-click **NXR-ILM08C-EIT** and select **Add**.
The **Add** dialog box is displayed.

8 Select the device DTM for the IO-Link device that you use and click the **OK** button.
The **Select Channel** dialog box is displayed.

9 Select the port on the IO-Link Master Unit to which the IO-Link device is connected.
Select any port from **IO-Link Port_1** to **IO-Link Port_8**.

10 Repeat steps 7 to 9 to register all the IO-Link devices connected to the IO-Link Master Unit.

Automatically Creating the Configuration from the Connected Devices

1 With the DTMs to use selected, select **Set** from the **Device** menu and set the following values in advance.
- **OMRON EtherNet/IP**: Connection method settings
- **NXR-ILM08C-EIT**: IP address setting
Refer to *11-2-10 Going Online* on page 11-10 for details on the connection method settings.

2 Automatically create the network configuration. The operation differs depending on the version as follows.

- For the CX-ConfiguratorFDT version 3.0 or higher, right-click **OMRON EtherNet/IP** and select **Scan** – **Scan and Create**.
- For the CX-ConfiguratorFDT version lower than 3.0, right-click **OMRON EtherNet/IP** and select **Scan** – **Create Network**.

The downstream network configuration is created automatically.

3 Follow the message displayed on the CX-ConfiguratorFDT.

Note You can create the configuration of the NXR-series IO-Link Master Unit for EtherNet/IP connected to EtherNet/IP only. The operation differs depending on the version as follows.

- For the CX-ConfiguratorFDT version 3.0 or higher, right-click **OMRON EtherNet/IP** and select **Scan** – **Scan and Select**.
- For the CX-ConfiguratorFDT version lower than 3.0, right-click **OMRON EtherNet/IP** and select **Scan** – **Life List**.

> **Additional Information**
>
> If the IO-Link device that is detected by an automatic network configuration creation has the IODD files with more than one version, you can click the **Change Device Type** button in the Life List window to change the version of IODD files that are used.
> An example of changing the version of the IODD files used by a detected IO-Link device is shown below.
> Clicking the **OK** button changes the version from V1.11 to V1.011.
>
>
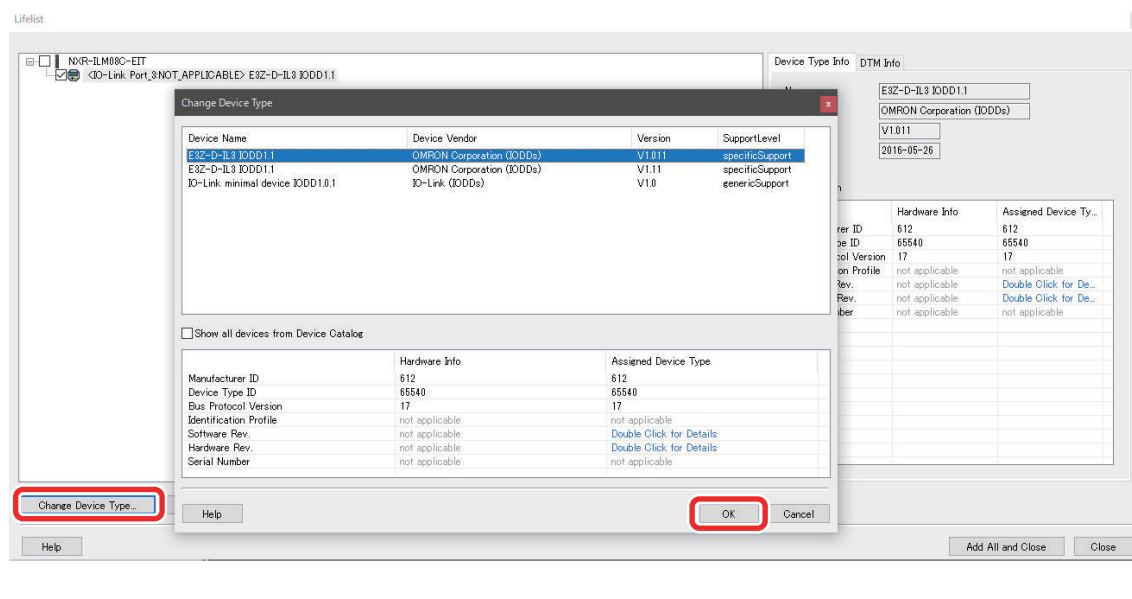
(An example of EtherNet/IP network configuration)

Support Software:
CX-ConfiguratorFDT

EtherNet/IP scanner
NJ/NX-series CPU Unit

Connection to peripheral USB port
on an NJ/NX-series CPU Unit

Built-in EtherNet/IP port

EtherNet/IP

NXR-series IO-Link Master Unit for EtherNet/IP
NXR-ILM08C-EIT

Port 2
IO-Link device
E3Z-series
Photoelectric
Sensor

Port 4
IO-Link device
E2E-series Proximity
Sensor

Port 2
IO-Link device
NXR-series
IO-Link I/O Hub
NXR-CD166C-IL2

For the above system configuration, use the CX-ConfiguratorFDT to create a network configuration as shown below.
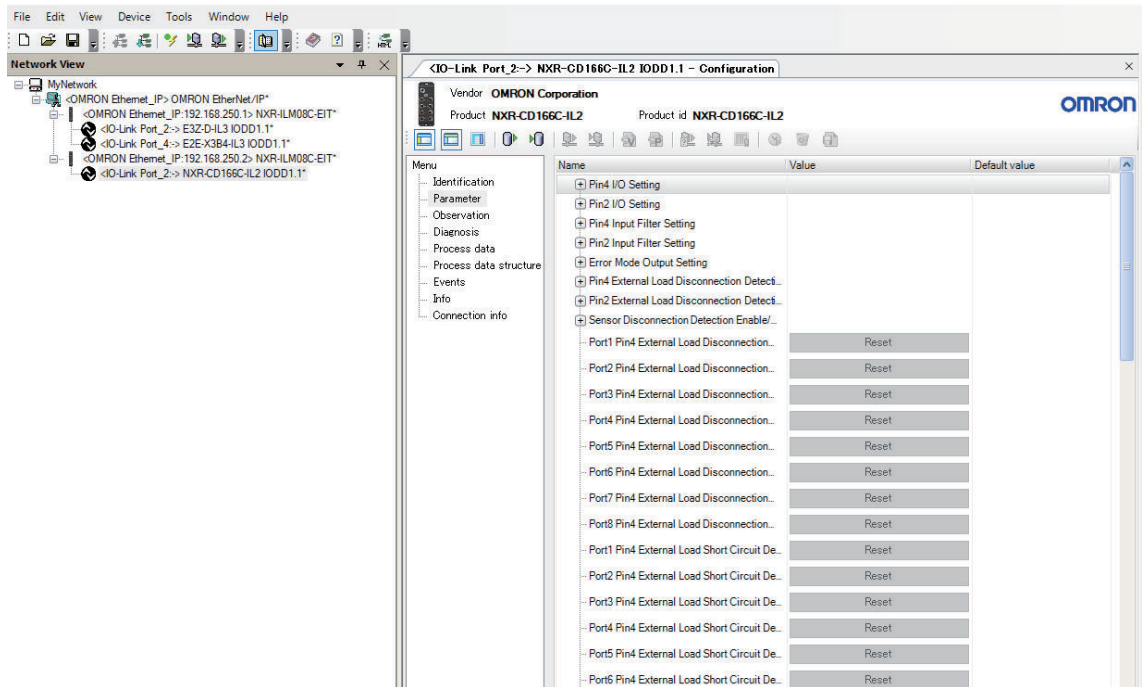
11-2-7 Setting the IO-Link Device Parameters

Use the following procedure to set the IO-Link device parameters.

1 Create the network configuration and register the IO-Link devices.

2 Double-click or right-click the device DTM for the IO-Link device, and select **Configuration**. The Configuration tab page is displayed. In the Configuration tab page, **Menu** is displayed with **Parameter** selected.

3 For the **Value** field for each IO-Link device in the Configuration tab page, select a candidate from the drop-down list or enter a value.

11-2-8 Exporting the Created Network Configuration to a File

You can save the network configuration that you created to an XML file.

1 Export to an XML file. The operation differs depending on the version as follows.
   • For the CX-ConfiguratorFDT version 3.0 or higher, select **Export** – **Export to XML** from **PROJECT**.
   • For the CX-ConfiguratorFDT version lower than 3.0, select **Import/Export** – **Export** from the **File** menu.

2 Enter the file name and click the **Save** button. The network configuration displayed in the current Network View is saved to an XML file.

11-2-9 Importing the Network Configuration from a File

An exported network configuration file (XML file) can be imported.

1 Import an XML file. The operation differs depending on the version as follows.
   • For the CX-ConfiguratorFDT version 3.0 or higher, select **New** – **Import from XML** from **PROJECT**.
   • For the CX-ConfiguratorFDT version lower than 3.0, select **Import/Export** – **Import** from the **File** menu.

2 Select the file name and click the **Open** button. The exported network configuration is displayed in the Network View.

11-2-10 Going Online

This section describes the settings and procedures to go online with the network when the communications DTM is **OMRON EtherNet/IP**.

Select the Connection Method

1 Right-click the communications DTM and select **Configuration**, or select **Configuration** from the **Device** menu.
The **OMRON EtherNet/IP – Configuration** tab page is displayed.
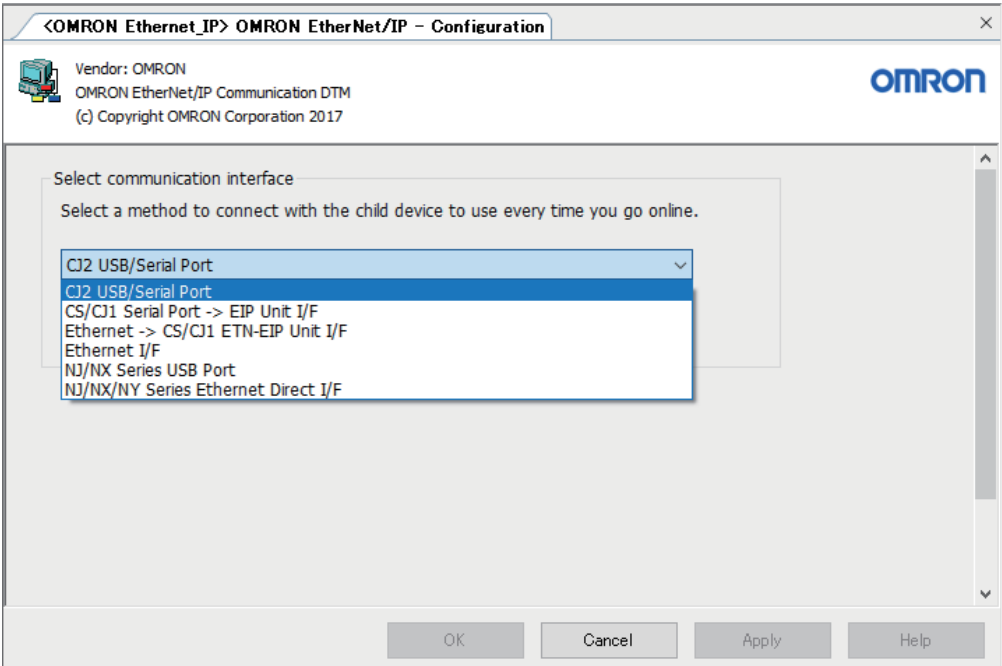
There are the following interface types according to the different connection path.

Interface	Description
CJ2 USB/Serial Port	Connect to the Ethernet port on an EtherNet/IP scanner via the USB port or serial port on a CJ2-series PLC.
CS/CJ1 Serial Port -> EIP Unit I/F	Connect to the Ethernet port on an EtherNet/IP scanner via the peripheral USB port or serial port on a CS/CJ1-series PLC.
Ethernet -> CS/CJ1 ETN-EIP Unit I/F	Connect to the Ethernet port on an EtherNet/IP scanner via the Ethernet Unit or EtherNet/IP scanner mounted on a CS/CJ1-series PLC using an Ethernet interface.
Ethernet I/F	Connect to the Ethernet port on an EtherNet/IP scanner or IO-Link Master Unit via Ethernet.
NJ/NX Series USB Port	Connect to the Ethernet port on an EtherNet/IP scanner via the USB port on an NJ/NX-series CPU Unit.
NJ/NX/NY Series Ethernet Direct I/F[1]	Connect directly from the Ethernet to the built-in EtherNet/IP port. It is not necessary to set the IP address in the computer.

*1. You cannot connect the NXR-series IO-Link Master Unit for EtherNet/IP to an NY-series Industrial PC.

2 Select an interface.

The following gives the procedure to go online with each interface.

CJ2 USB/Serial Port

Connection example
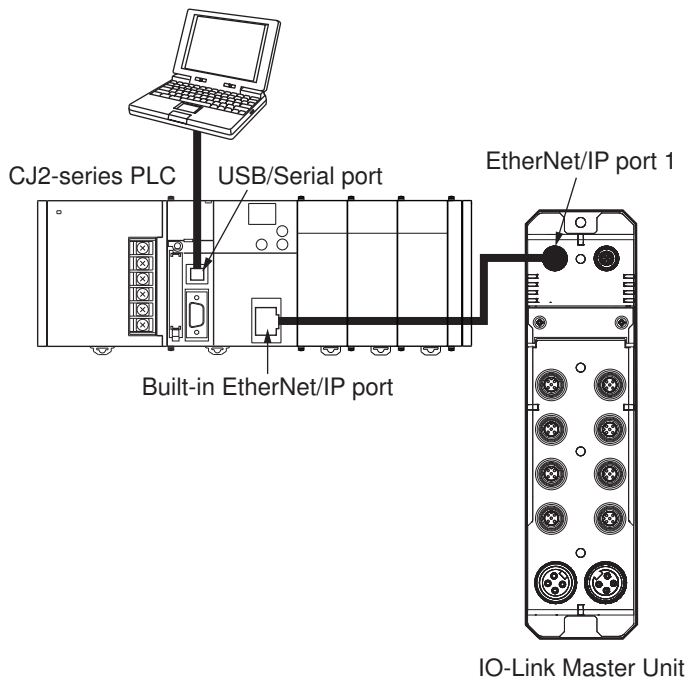
CJ2-series PLC   USB/Serial port   EtherNet/IP port 1

Built-in EtherNet/IP port

IO-Link Master Unit

1   Go online with the Controller. The operation differs depending on the version as follows.
   • For the CX-ConfiguratorFDT version 3.0 or higher, right-click communications DTM in the
     Network View and select **Connect**. Or, select the communications DTM in the Network View,
     and then select **Connect** from the **Device** ribbon.
   • For the CX-ConfiguratorFDT version lower than 3.0, right-click communications DTM in the
     Network View and select **Go online**. Or, select the communications DTM in the Network
     View, and then select **Go online** from the **Device** menu.
   The **Setup Interface** dialog box is displayed.
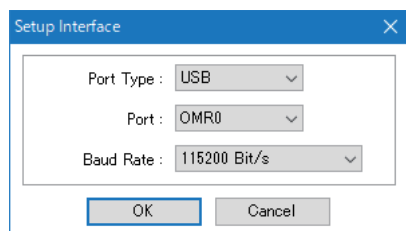
2   Set the **Port Type**, **Port**, and **Baud Rate** to suitable values and then click the **OK** button to
   connect to the CJ2-series PLC.
   If the connection is successful, the **Select Connect Network Port** dialog box is displayed.
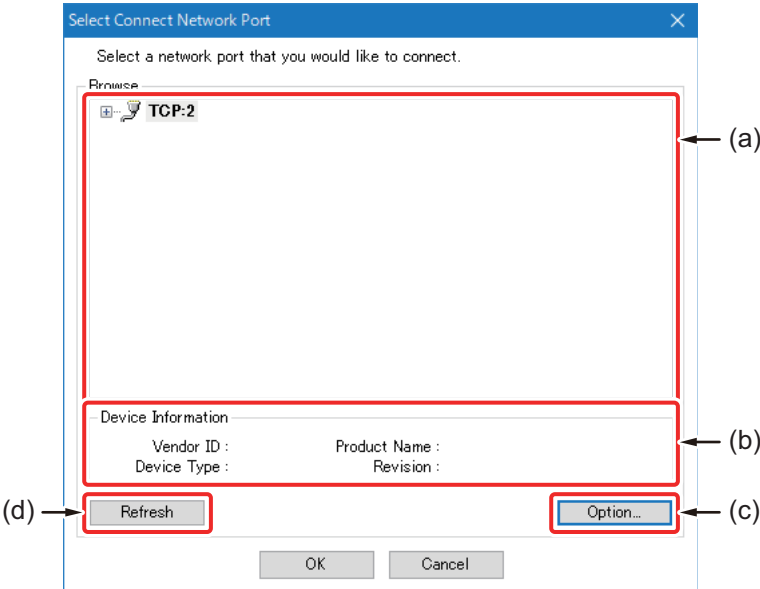
Letter	Item	Description
(a)	Network list	Networks and devices that you can connect to are listed.
(b)	Device Information	Information on the selected device is displayed.
(c)	**Option** button	Set the behavior of the network list display function.
(d)	**Refresh** button	Click this to update the network list.

3 Click the **Option** button.

The **Option** dialog box is displayed.
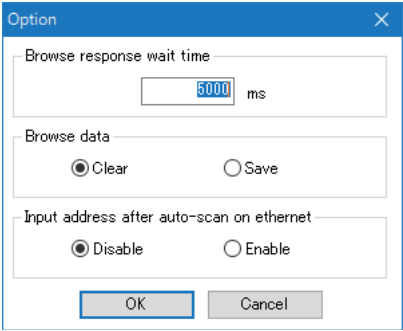
Item	Description
Browse response wait time	Sets the time (in 0.001 s) to monitor the connection timeout when you click the **Refresh** button in the Select Connect Network Port dialog box.
Browse data	Specify whether to retain the network status data that you browse in the Select Connect Network Port dialog box for display in the next connection.
Input address after auto-scan on ethernet	Specify whether to enable IP address entry by the user after automatic network scanning.

4 Set the options as necessary and then click the **OK** button.

You return to the **Select Connect Network Port** dialog box.

5 In the **Network list**, select **BackPlane** and click the **Refresh** button.

The CJ2-series PLC and the Communications Units that are mounted on it are now listed.

6 Select **TCP:2** port on the CJ2-series PLC or TCP:2 port on the Communications Unit and click the **OK** button.
The Support Software goes online.

Precautions for Correct Use

When the computer and communications DTM are connected in the following connection configuration, you cannot select the same communications port in the **Setup Interface** dialog box to go online with more than one communications DTM at the same time.
Doing so causes the later connection attempts to fail.
Connection configuration:
The computer is connected to the serial port on a CJ2-series PLC through a USB-Serial Conversion Cable (CS1W-CIF31) and an online connection is established via the tool bus protocol.

CS/CJ1 Serial Port -> EIP Unit I/F

Connection example

1 Go online with the Controller. The operation differs depending on the version as follows.
- For the CX-ConfiguratorFDT version 3.0 or higher, right-click communications DTM in the Network View and select **Connect**. Or, select the communications DTM in the Network View, and then select **Connect** from the **Device** ribbon.
- For the CX-ConfiguratorFDT version lower than 3.0, right-click communications DTM in the Network View and select **Go online**. Or, select the communications DTM in the Network View, and then select **Go online** from the **Device** menu.

The **Setup Interface** dialog box is displayed.

Item	Description
Interface	Select the serial communications mode for the serial communications port on the CS/CJ-series PLC. You can select **Toolbus** or **Host Link**.
Network Address	Enter the network address of the connected EtherNet/IP scanner. Specify the network address if data passes over the network at a point beyond the serial communications port of the CS/CJ-series PLC. Otherwise, enter *0*.
Node Address	Enter the node address of the connected EtherNet/IP scanner. Specify the network address if data passes over the network at a point beyond the serial communications port of the CS/CJ-series PLC. Otherwise, enter *0*.
Unit No.	Enter the Unit number of the connected EtherNet/IP scanner as a CPU Bus Unit.
COM Port	Select the COM port of the computer that you use for communications.
Baud Rate	Set the baud rate of the serial communications port on the CS/CJ-series PLC.
Data Length	Set the data length for the serial communications port on the CS/CJ-series PLC. The data length setting is valid when the host link interface is selected.
Parity	Set the parity for the serial communications port on the CS/CJ-series PLC. The parity setting is valid when the host link interface is selected.
Stop Bit	Set the stop bit for the serial communications port on the CS/CJ-series PLC. The stop bit setting is valid when the host link interface is selected.

2 Make the settings that are required to connect to the CS/CJ1-series PLC and then click the **OK** button.
If the connection is successful, the **Select Connect Network Port** dialog box is displayed.

3 Set the options as necessary and then click the **Refresh** button.
The PLC and the Communications Units that are mounted on it are now listed.

4 Select **TCP:2** port on the PLC or TCP:2 port on the Communications Unit and click the **OK** button.

The Support Software goes online.

Precautions for Correct Use

When the computer and communications DTM are connected in the following connection configuration, you cannot select the same communications port in the **Setup Interface** dialog box to go online with more than one communications DTM at the same time.
Doing so causes not only the later connection attempts, but also all online operations that you will attempt after that on the communications DTM that is already online to fail.
Also, when other Support Software such as the Network Configurator uses the same communications port to go online with the communications DTM, all online operations from the Support Software will fail. In such cases, once go offline and then go online with the communications DTM again.
Connection configuration:
The computer is connected to the serial port on a CS/CJ1-series PLC through a USB-Serial Conversion Cable (CS1W-CIF31) and an online connection is established via the tool bus protocol.

Ethernet -> CS/CJ1 ETN-EIP Unit I/F

Connection example

1 Go online with the Controller. The operation differs depending on the version as follows.
   • For the CX-ConfiguratorFDT version 3.0 or higher, right-click communications DTM in the Network View and select **Connect**. Or, select the communications DTM in the Network View, and then select **Connect** from the **Device** ribbon.
   • For the CX-ConfiguratorFDT version lower than 3.0, right-click communications DTM in the Network View and select **Go online**. Or, select the communications DTM in the Network View, and then select **Go online** from the **Device** menu.

The **Select Interface** dialog box is displayed if more than one Ethernet adapter is mounted in the computer.

2 Select the adapter to use and click the **OK** button.
The **Setup Interface** dialog box is displayed.
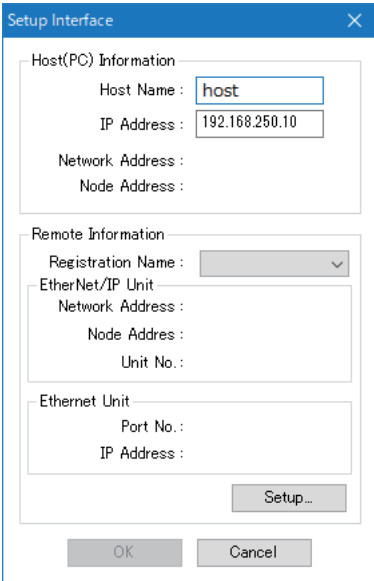
3 Click the **Setup** button.
The **Registration of the connection** dialog box is displayed.
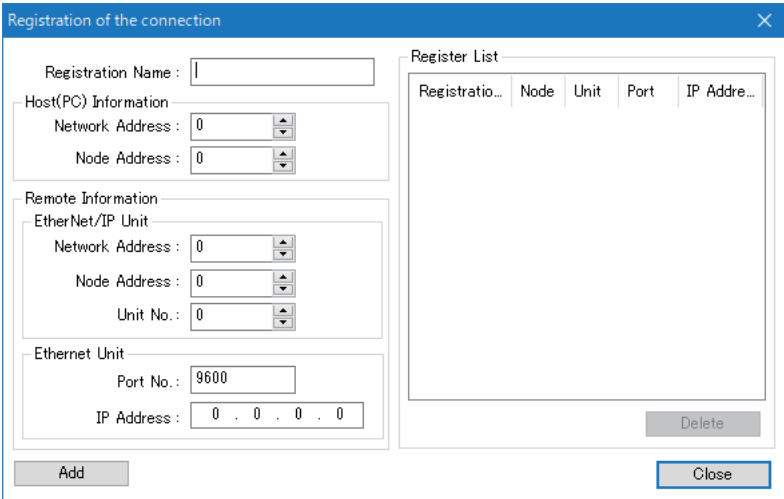
Item	Description
Registration Name	Enter any name.
Host (PC) Information	Enter information on the computer.
Network Address	Enter the same number as the network address of the EtherNet Unit that is mounted on the PLC that serves as a relay node.

Item			Description
	Node Address		Enter the last digit of the IP address of the computer. (Example: 1 if the IP address is 192.168.250.1)
Remote Information			
	EtherNet/IP Unit		Enter information on the EtherNet/IP scanner that is mounted on the PLC that serves as a relay node.
		Network Address	Enter the network address that is set in the routing table.
		Node Address	Enter the last digit of the IP address of the Unit. (Example: 3 if the IP address is 192.168.251.3)
		Unit No.	Enter the unit number of the CPU Bus Unit (EtherNet/IP scanner).
	Ethernet Unit		Enter information on the Ethernet Unit that is mounted on the PLC that serves as a relay node.
		Port No.	Enter the Ethernet port number of the Unit.
		IP Address	Enter the IP address of the Unit.
Register List			This list shows the registered Units to connect to.
Add button			Click this to register the Unit settings that you have entered to the Register List as Registration Name.
Delete button			Click this to delete the Unit with the selected registration name from the Register List.

4 Enter the network information for the Unit to connect to, and then click the **Close** button.
You return to the **Setup Interface** dialog box.

5 Check the registered Unit settings and click the **OK** button.
If the connection is successful, the **Select Connect Network Port** dialog box is displayed.

6 Set the options as necessary, select **TCP:2** and then click the **OK** button.
The Support Software goes online.

Precautions for Correct Use

When the computer and communications DTM are connected in the following connection configuration, you cannot select the same Ethernet adapter in the **Setup Interface** dialog box to go online with more than one communications DTM at the same time.
Doing so causes the later connection attempts to fail.
Connection configuration:
The computer is connected to one of the following ports through an Ethernet cable and an online connection is established.
• Ethernet port on an Ethernet scanner that is connected to a CS/CJ-series PLC
• EtherNet/IP port on an EtherNet/IP scanner that is connected to a CS/CJ-series PLC
• Built-in EtherNet/IP port on the CS/CJ-series PLC

Ethernet I/F

Connection example

EtherNet/IP port 1

Ethernet switch

IO-Link Master Unit

1 Go online with the Controller. The operation differs depending on the version as follows.
- For the CX-ConfiguratorFDT version 3.0 or higher, right-click communications DTM in the Network View and select **Connect**. Or, select the communications DTM in the Network View, and then select **Connect** from the **Device** ribbon.
- For the CX-ConfiguratorFDT version lower than 3.0, right-click communications DTM in the Network View and select **Go online**. Or, select the communications DTM in the Network View, and then select **Go online** from the **Device** menu.

The **Select Interface** dialog box is displayed if more than one Ethernet adapter is mounted in the computer.

2 Select the adapter to use and click the **OK** button.
If the connection is successful, the **Select Connect Network Port** dialog box is displayed.

3 Set the options as necessary, select **TCP:2** and then click the **OK** button.

The Support Software goes online.

Additional Information

You may need to change the Windows firewall settings when you make the connection for the first time.
Refer to *A-3 Configuring the Windows Firewall* on page A-63 for details.

NJ/NX Series USB Port

Connection example

1 Go online with the Controller. The operation differs depending on the version as follows.
- For the CX-ConfiguratorFDT version 3.0 or higher, right-click communications DTM in the Network View and select **Connect**. Or, select the communications DTM in the Network View, and then select **Connect** from the **Device** ribbon.
- For the CX-ConfiguratorFDT version lower than 3.0, right-click communications DTM in the Network View and select **Go online**. Or, select the communications DTM in the Network View, and then select **Go online** from the **Device** menu.

If the connection is successful, the **Select Connect Network Port** dialog box is displayed.

Letter	Item	Description
(a)	Network list	Networks and devices that you can connect to are listed.
(b)	Device Information	Information on the selected device is displayed.
(c)	**Option** button	Set the behavior of the network list display function.
(d)	**Refresh** button	Click this to update the network list.

2 Set the options as necessary, select **TCP:2** and then click the **OK** button.
The Support Software goes online.

> **Additional Information**
>
> You may need to change the Windows firewall settings when you make the connection for the first time.
> Refer to *A-3 Configuring the Windows Firewall* on page A-63 for details.

NJ/NX/NY Series Ethernet Direct I/F

Connection example

NX-series CPU Unit

EtherNet/IP port 1

Built-in EtherNet/IP port

IO-Link Master Unit

1 Go online with the Controller. The operation differs depending on the version as follows.
  - For the CX-ConfiguratorFDT version 3.0 or higher, right-click communications DTM in the Network View and select **Connect**. Or, select the communications DTM in the Network View, and then select **Connect** from the **Device** ribbon.
  - For the CX-ConfiguratorFDT version lower than 3.0, right-click communications DTM in the Network View and select **Go online**. Or, select the communications DTM in the Network View, and then select **Go online** from the **Device** menu.

If the connection is successful, the **Select Connect Network Port** dialog box is displayed.

Letter	Item	Description
(a)	Network list	Networks and devices that you can connect to are listed.
(b)	Device Information	Information on the selected device is displayed.
(c)	**Option** button	Set the behavior of the network list display function.

Letter	Item	Description
(d)	**Refresh** button	Click this to update the network list.

2 Set the options as necessary, select **TCP:2** and then click the **OK** button.

The Support Software goes online.

Precautions for Correct Use

Connection may not be possible if the following settings are made on an NJ/NX-series Controller. If online connection fails, check the following settings. For the details on the settings, refer to *CIP Message Server* and *Packet Filter* in the *NJ/NX-series CPU Unit Built-in EtherNet/IP Port User's Manual (Cat. No. W506)*.
- The **Do not use** Option is selected for the CIP message server.
- The **Use** Option is selected for Packet Filter.

Additional Information

You may need to change the Windows firewall settings when you make the connection for the first time.
Refer to *A-3 Configuring the Windows Firewall* on page A-63 for details.

11-2-11 Precautions When Transferring All of IO-Link Device Settings

The function differs between CX-ConfiguratorFDT version 3.0 or later and earlier versions.

CX-ConfiguratorFDT Version 3.0 or Later

For the CX-ConfiguratorFDT version 3.0 or later, you cannot transfer the settings for each device.
If you transfer the settings for each device, create a project file for each device and use transfer function for each project.

Additional Information

To transfer the settings for each communications device (OMRON EtherNet/IP), you can easily create the project file shown below by following procedure.
- Delete unnecessary devices from a copy of the project file created with the CX-Configura-torFDT version lower than 3.0 and create a project file.
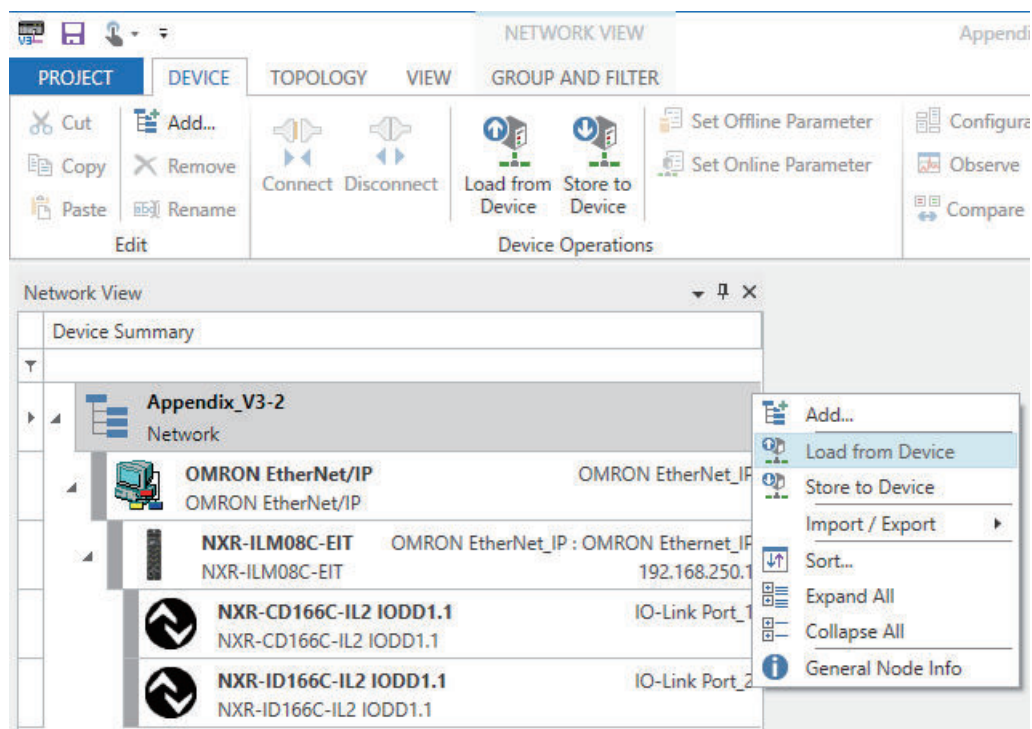
CX-ConfiguratorFDT Version 2.x

For the CX-ConfiguratorFDT version 2.x, you can transfer all of IO-Link device settings for each project (network) or device (communications device or IO-Link master device).

📝 **Additional Information**

To display the **Load from device** and **Store to device** menus for each project, right-click **My Network** in the Network View, and then click from the menu.
To display the **Load from all devices** and **Store to all devices** menus for each device, right-click the device (communications device or IO-Link master device) in the Network View, and then select **Additional functions** from the menu.
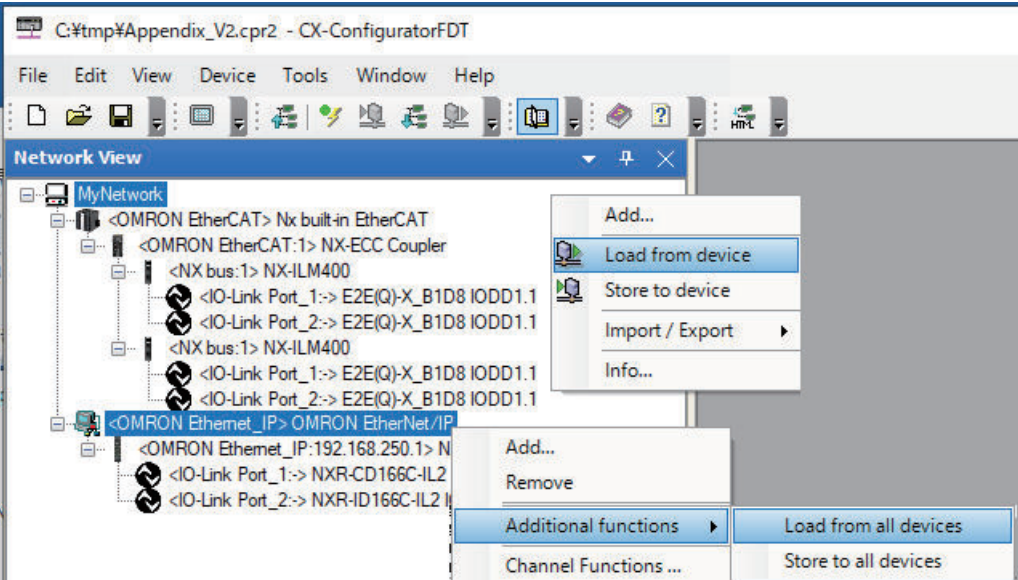
11-2-12 Transferring the IO-Link Device Parameters

This section describes the procedure to transfer the IO-Link device parameters.

Storing the Parameters for an IO-Link Device

✍ **Precautions for Correct Use**

- You cannot store the parameters in the IO-Link device if *Cycle Read* is set to *Enable* for *Dynamic variables* or *Process data* in the Configuration tab page for the IO-Link device. Set *Cycle Read* to *Disable* if you want to store the parameters in the IO-Link device.
- Do not disconnect the cable or turn OFF the power supply to a CPU Unit, Ethernet/IP scanner, or IO-Link Master Unit when you store parameters from the CX-ConfiguratorFDT to an IO-Link device.

1 Go online with the IO-Link device. The operation differs depending on the version as follows.
- For the CX-ConfiguratorFDT version 3.0 or higher, right-click the device DTM for the IO-Link device and select **Connect**.
- For the CX-ConfiguratorFDT version lower than 3.0, right-click the device DTM for the IO-Link device and select **Go online**.

When the Support Software goes online, the following occurs depending on the version.
- For the CX-ConfiguratorFDT version 3.0 or higher, the status bar to the left of the devices in the Network View turns green.

• For the CX-ConfiguratorFDT version lower than 3.0, the devices in the Network View are displayed in bold.

2 Right-click the device DTM again and select **Store to device**.

The parameter settings are stored in the IO-Link device.

Precautions for Correct Use

To change the parameters of IO-Link devices with the CX-ConfiguratorFDT, set the *Port □ Backup/Restore Setting* for the port to **Do Not Execute** or **Backup**.
If you set the *Port □ Backup/Restore Setting* for the port to **Restore**, the IO-Link Master Unit automatically executes a restore operation when IO-Link device parameters are transferred with the CX-ConfiguratorFDT. However, the data restored at this time is the data before the transfer. You cannot change the parameter settings for IO-Link devices even if you transfer them with the CX-ConfiguratorFDT.

Loading Parameter Settings from IO-Link Devices

Precautions for Correct Use

You cannot load the parameters from the IO-Link device if *Cycle Read* is set to *Enable* for *Dynamic variables* or *Process data* in the Configuration tab page for the IO-Link device.
Set *Cycle Read* to *Disable* if you want to load the parameters from the IO-Link device.

1 Go online with the IO-Link device. The operation differs depending on the version as follows.
• For the CX-ConfiguratorFDT version 3.0 or higher, right-click the device DTM for the IO-Link device and select **Connect**.
• For the CX-ConfiguratorFDT version lower than 3.0, right-click the device DTM for the IO-Link device and select **Go online**.

When the Support Software goes online, the following occurs depending on the version.
• For the CX-ConfiguratorFDT version 3.0 or higher, the status bar to the left of the devices in the Network View turns green.
• For the CX-ConfiguratorFDT version lower than 3.0, the devices in the Network View are displayed in bold.

2 Right-click the device DTM again and select **Load from device**.

The parameter settings are uploaded from the IO-Link device.

12

Troubleshooting

This section describes troubleshooting for the IO-Link Master Unit.

12-1 Checking for Errors

This section describes how an error is notified to you, and what and how you should check for errors.

12-1-1 How an Error Is Notified and What Information to Check

The IO-Link Master Unit notifies a detected error by methods shown below.
If an error is notified, check for the error status and perform troubleshooting.

Let ter	Notification method	Checking method	Information to check	Reference
(a)	Notifying IO-Link Master Unit errors by indicators	Visually checking the status of each indicator on the IO-Link Master Unit	Check the indicators on the IO-Link Master Unit. There are two types of indicators, i.e., status indicators and I/O indicators. Status indicators show the status of the IO-Link Master Unit or EtherNet/IP network. I/O indicators show the IO-Link communications status or digital I/O status of each port.	*12-2 Checking for Errors and Troubleshooting with the Indicators* on page 12-5

Let ter	Notification method	Checking method	Information to check	Reference
(b)	Notifying IO-Link Master Unit errors by the status in I/O data	Checking the status in the I/O data in the IO-Link Master Unit by the user program in the Controller or with the Support Software corresponding to the Controller[1]	You can check the occurrence and cause of errors that occurred in the IO-Link Master Unit with the status in the I/O data. Errors in the IO-Link Master Unit are indicated by the following data. • *Unit Error Collection Status* in *Unit Status* • *Unit Error Status* in *Unit Status* • *Port □ Error* in *Unit Status* • *Port □ Error Status* in *I/O Port Error Status* To identify an error, check the I/O data of IO-Link devices, which is stored in the IO-Link Input Data in the IO-Link Master Unit. Refer to the manual for the IO-Link device for the specifications of I/O data of each IO-Link device.	*12-3 Checking for Errors with the Status in I/O Data* on page 12-14
(c)	Notifying the EtherNet/IP communications status and errors by the network status	Checking the network status in the Network Configurator's Monitor Device dialog box	You can check the following information that indicates the EtherNet/IP communications status and errors. • Ethernet Status • Data Link Status • Configuration Error Status • Target Node Status • Target Controller Status • Connection Status • Controller Log • Tag Status • Ethernet Information	*12-4 Checking for Errors and Troubleshooting with the Network Configurator* on page 12-15
(d)	Notifying the occurrences of errors in the IO-Link Master Unit and information on them by event logs	Reading and checking the event logs of the IO-Link Master Unit in the Network Configurator's Monitor Device tab page or through an explicit message	You can check the following information recorded by the IO-Link Master Unit. • Errors that occurred in the IO-Link Master Unit or IO-Link devices • Status changes in the IO-Link Master Unit The above information called events is stored with the time of occurrence in the IO-Link Master Unit. [2]	*12-5 Checking for Errors and Troubleshooting with the Event Logs of the IO-Link Master Unit* on page 12-26
(e)	Notifying the occurrences of errors in IO-Link devices and information on them by device events	Checking the device events of IO-Link devices in the Configuration tab page for the IO-Link device on the CX-ConfiguratorFDT	You can check the error-level or warning-level information recorded by IO-Link devices. [3] This information called device events is stored in the IO-Link devices. Use the information below to check the occurrence of device events. • Read the events recorded by the IO-Link Master Unit. Error-level Device Event, Warning-level Device Event Flag • Read the following I/O data. *Port □ Device Error-level Event* or *Port □ Device Warning-level Event* in *Port □ Error Status* in *I/O Port Error Status*	*12-6 Checking for Device Events and Troubleshooting IO-Link Devices* on page 12-36

*1. You may send an explicit message to a certain CIP object to read the error notification.
Refer to *A-1-11 Error Status Object (Class ID: 383 Hex)* on page A-34 for information on the CIP object.

*2. Some settings are required to record the time of occurrence in event logs. Refer to *12-5-1 Event Logs* on page 12-26 for details.

*3. Applicable only to IO-Link devices that support device events.

Note Port □ represents port number 1 to 8.

12-1-2 How to Check for Errors

The following table shows the basic procedure to check for errors.

Step	Item	Description	Reference
1	Finding the occurrence of an error	Find whether or not an error occurred using the indicator status or the *Unit Error Collection Status* in the I/O data.	*12-2 Checking for Errors and Troubleshooting with the Indicators* on page 12-5 *12-3 Checking for Errors with the Status in I/O Data* on page 12-14
2	Isolating the error cause	If there is an error, perform the following checks to isolate the cause of the error.	---
		Check the status of each indicator according to *12-2 Checking for Errors and Troubleshooting with the Indicators* on page 12-5.	*12-2 Checking for Errors and Troubleshooting with the Indicators* on page 12-5
		Check the status that indicates an error in the I/O data in the IO-Link Master Unit. • *Unit Error Status* in *Unit Status* Indicates the source of the error in the IO-Link Master Unit. • *Port □ Error* in *Unit Status* Indicates whether or not an error occurred for the port. • *Port □ Error Status* in *I/O Port Error Status* Indicates the source of the error for the port.	*12-3 Checking for Errors with the Status in I/O Data* on page 12-14
		Check the network status with the Network Configurator.	*12-4 Checking for Errors and Troubleshooting with the Network Configurator* on page 12-15
		Check the event logs of the IO-Link Master Unit.	*12-5 Checking for Errors and Troubleshooting with the Event Logs of the IO-Link Master Unit* on page 12-26
		Check the device events of IO-Link devices, if any.	*12-6 Checking for Device Events and Troubleshooting IO-Link Devices* on page 12-36
3	Troubleshooting the error	After you isolate the cause of the error, perform troubleshooting.	---

12-2 Checking for Errors and Trouble-shooting with the Indicators

This section describes how to check for errors with the indicators and perform troubleshooting.

12-2-1 Checking for Errors and Troubleshooting with the Status Indicators

Status indicators show the status of the IO-Link Master Unit or EtherNet/IP network.

The status indicators include the following indicators. The checking and troubleshooting methods with each indicators are described below.
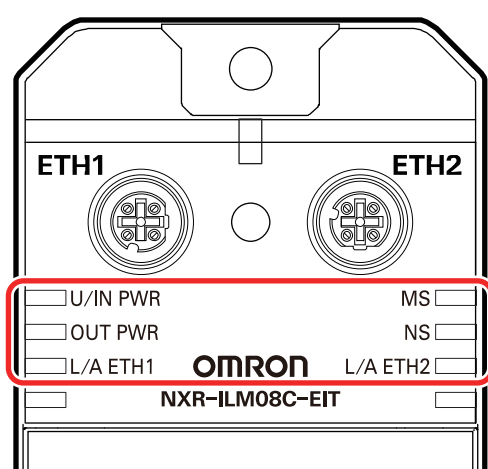
Name	Description	Reference
MS Indicator	The module status indicator. This indicator shows the operating status of the Unit.	*Checking for Primary Errors and Troubleshooting with the MS and NS Indicators* on page 12-6
NS Indicator	The network status indicator. This indicator shows the status of the EtherNet/IP network.	
L/A ETH1 Indicator	The Link/Activity indicator for EtherNet/IP port 1. This indicator shows the linked status and communications status of EtherNet/IP port 1.	*Checking for Primary Errors and Troubleshooting with the L/A ETH1 and L/A ETH2 Indicators* on page 12-8
L/A ETH2 Indicator	The Link/Activity indicator for EtherNet/IP port 2. This indicator shows the linked status and communications status of EtherNet/IP port 2.	
U/IN PWR Indicator	This indicator shows the status of the Unit/input power supply.	*Checking for Errors and Troubleshooting with the U/IN PWR Indicator* on page 12-8
OUT PWR Indicator	This indicator shows the status of the output power supply.	*Checking for Errors and Troubleshooting with the OUT PWR Indicator* on page 12-9

Checking for Primary Errors and Troubleshooting with the MS and NS Indicators

MS	NS	Unit status	Cause	Correction
Not lit	Not lit	No Unit/input power supply.	The Unit/input power er is not supplied.	Check the following items and make sure that power is correctly supplied from the Unit/input power supply. • Make sure that the power supply cable is wired correctly. • Make sure that there are no breaks in the power supply cable. • Make sure that the supply voltage is within the rated range. • Make sure that the power supply has enough capacity. • Make sure that the power supply has not failed. Also check the U/IN PWR indicator status. Refer to *Checking for Errors and Troubleshooting with the U/IN PWR Indicator* on page 12-8.
Lit green	Flashing green	No connection is established for EtherNet/IP communications.	No tag data link connection with the EtherNet/IP scanner and connection message (class 3) connection are established. [*1]	If this status is indicated when tag data link or other connection settings are configured for the EtherNet/IP scanner, the connection settings in the EtherNet/IP scanner may be incorrect. Check the EtherNet/IP scanner for any errors related to connection and then correct the connection settings for the EtherNet/IP scanner.
Lit green	Lit green	The Unit is operating normally.	A tag data link connection with the EtherNet/IP scanner or connection message (class 3) connection is established. [*2]	(This is the normal status.)
Flashing green	Not lit	The Unit stopped operating because the rotary switch setting is FFFF hex.	The rotary switches are set to FFFF hex.	Set the rotary switches to other than FFFF hex and cycle the Unit/input power supply.
		BOOTP/DHCP Server Connection Error	The BOOTP or DHCP server is stopped.	Set the BOOTP or DHCP server to operate normally.
			An error occurred in communications with the BOOTP or DHCP server.	Check the communications path to the BOOTP or DHCP server and take corrective measures if there are any problems.
		Restarting is in progress for the Unit.	The Unit is restarting.	Wait for the Unit to finish initializing.

MS	NS	Unit status	Cause	Correction
Lit red	---	Non-volatile Memory Hardware Error	The non-volatile memory failed.	Cycle the Unit/input power supply. If cycling the Unit/input power supply does not clear the error, replace the Unit.
		Unit Processing Error	An error occurred in the software.	Cycle the Unit/input power supply. If cycling the Unit/input power supply does not clear the error, replace the Unit. If this error occurs again even after you replace the Unit, contact your OMRON representative.
		Hardware failure	A hardware error occurred in the Unit.	Cycle the Unit/input power supply. If cycling the Unit/input power supply does not clear the error, replace the Unit.
Flashing red	---	Non-volatile Memory Checksum Error	The power supply to the Unit was turned OFF while settings were written. Or, Support Software communications were disconnected.	Transfer the settings to the Unit again. Do not turn OFF the power supply to the Unit or disconnect Support Software communications while you transfer the settings to the Unit.
		TCP/IP Setting Error (Local IP Address)	The TCP/IP settings are incorrect.	Correct and transfer the settings again. Then, cycle the Unit/input power supply or restart the Unit.
			The IP address delivered from the BOOTP or DHCP server is incorrect.	Set the IP address correctly in the settings of the BOOTP or DHCP server. Then, cycle the Unit/input power supply or restart the Unit.
		Automatic Clock Adjustment Setting Error	The IP address setting for the NTP/SNTP Server is incorrect.	Correct the IP address of the NTP or SNTP server in *NTP/SNTP Server IP Address* and transfer it again. Then, cycle the Unit/input power supply or restart the Unit.
		NTP/SNTP Server Connection Error	The NTP or SNTP Server IP address is incorrect.	Correct the IP address of the NTP or SNTP server in *NTP/SNTP Server IP Address* and transfer it again. Then, cycle the Unit/input power supply or restart the Unit.
			The NTP or SNTP server is stopped.	Check if the NTP or SNTP server at the remote connection is operating normally and set it to operate normally if it is not.
			An error occurred in communications with the NTP or SNTP server.	Check the communications path to the NTP or SNTP server at the remote connection and take corrective measures if there are any problems.
Lit green	Flashing red	Exclusive Owner Tag Data Link Timeout	A connection timeout was detected in an Exclusive Owner connection for implicit message communications.	Check the following items. • The communications cable is connected correctly. • The EtherNet/IP scanner is operating normally. If the size of the input tag set for an Exclusive Owner connection to the EtherNet/IP is changed, cycle the Unit/input power supply or restart the Unit.

MS	NS	Unit status	Cause	Correction
Flashing red	Lit red	IP Address Duplication	The IP address of the EtherNet/IP port is also used as the IP address of another node.	Perform either of the following and then cycle the Unit/input power supply or restart the Unit. • Correct the IP address settings so that the same address is not used by more than one node. • Remove the node that has the duplicate IP address from the network.

*1. A state in which there are no established connections and no occurrences of timeout in Exclusive Owner connections with the IP address obtained.

*2. A state in which there are one or more connections with the IP address obtained.

Checking for Primary Errors and Troubleshooting with the L/A ETH1 and L/A ETH2 Indicators

L/A ETH1 L/A ETH2 Green	Unit status	Cause	Correction
Lit	A link is established.	---	(The Coupler Unit is in standby status after the link was established in the physical layer.)
Flashing	A link is established and communications are in progress.	---	(This is the normal status.)
Not lit	No link is established.	---	After you check the following items for the communications cables, cycle the Unit/input power supply or restart the Unit. • Make sure that the communications cable is wired correctly. • Make sure that there are no breaks in the communications cable or loose connections with the connectors. • Make sure that the cable is of the appropriate length. • Make sure that the communications cable meets the recommended specifications. If the error occurs again even after you check the above items and cycle the Unit/input power supply, replace the Unit.

Checking for Errors and Troubleshooting with the U/IN PWR Indicator

U/IN PWR Green	Unit status	Cause	Correction
Lit	Unit/input power supply provided	The Unit/input power is supplied.	(This is the normal status.)

U/IN PWR Green	Unit status	Cause	Correction
Not lit	No Unit/input power supply	The output power is not supplied, or is insufficient.	Check the following items and make sure that power is correctly supplied from the Unit/input power supply. • Make sure that the power supply cable is wired correctly. • Make sure that there are no breaks in the power supply cable. • Make sure that the supply voltage is within the rated range. • Make sure that the power supply has enough capacity. • Make sure that the power supply has not failed.

Checking for Errors and Troubleshooting with the OUT PWR Indicator

OUT PWR Green	Unit status	Cause	Correction
Lit	Output power supply provided	The output power is supplied.	(This is the normal status.)
Not lit	No output power supply	The output power is not supplied, or is insufficient.	Check the following items and make sure that power is correctly supplied from the output power supply. • Make sure that the power supply cable is wired correctly. • Make sure that there are no breaks in the power supply cable. • Make sure that the supply voltage is within the rated range. • Make sure that the power supply has enough capacity. • Make sure that the power supply has not failed.

12-2-2 Checking for Errors and Troubleshooting with the I/O Indicators

I/O indicators show the IO-Link communications status or digital I/O status.

The I/O indicators include the following indicators.
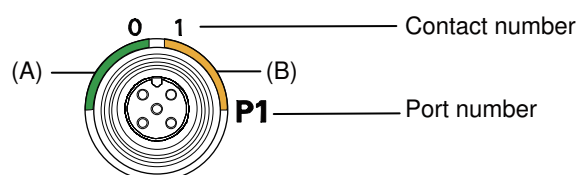
Example: I/O indicator for port 1

Letter	Name	Description	Reference
(A)	Pin 4/Pin 1 status indicator	This indicator shows the IO-Link communications status or digital I/O status for pin 4 or pin 1.	*Checking for Errors and Troubleshooting with the Pin 4/Pin 1 Status Indicator* on page 12-10

Letter	Name	Description	Reference
(B)	Pin 2 status indicator	This indicator shows the digital I/O status for pin 2.	*Checking for Errors and Troubleshooting with the Pin 2 Status Indicator* on page 12-13

Checking for Errors and Troubleshooting with the Pin 4/Pin 1 Status Indicator

● How to Check for Errors

The Unit status in each communications mode is given below.

Pin 4/Pin 1 status	Unit status in each communications mode				Reference
	IO-Link Mode	SIO (DI) Mode	SIO (DO) Mode	Disable	
Lit green	IO-Link communications are in progress.	---	---	---	(This is the normal status.)
Lit yellow	---	The input is ON	The output is ON	---	(This is the normal status.)
Flashing red	One of the following occurred: • IO-Link Communications Error • Device Configuration Verification Error • Error-level Device Event • I/O Port Short-circuit Error A short-circuit occurred between pin 1 and pin 3 or between pin 4 and pin 3.	I/O Port Short-circuit Error A short-circuit occurred between pin 1 and pin 3.	I/O Port Short-circuit Error A short-circuit occurred between pin 1 and pin 3 or between pin 4 and pin 3.	I/O Port Short-circuit Error A short-circuit occurred between pin 1 and pin 3.	Perform troubleshooting. Refer to *Troubleshooting* on page 12-10.
Not lit	IO-Link communications stopped.[1]	The input is OFF	The output is OFF	No error occurred	(This is the normal status.)

*1.   This refers to a state in which IO-Link device verification is disabled or no IO-Link device is connected.

● Troubleshooting

- **IO-Link Mode**

Unit status	Cause	Correction
IO-Link Communications Error	• The I/O cable is broken. • The connected external device is faulty. • The IO-Link Master Unit is faulty. • The IO-Link communications are unstable. • A communications timeout occurred due to the effect of IO-Link communications delay.	Check the following items, and then cycle the Unit/input power supply or restart the Unit. • Make sure that the I/O cable is wired correctly. • Make sure that there are no breaks in the I/O cable or loose connections with the connectors. • Make sure that the connected external device is not faulty. • Make sure that the IO-Link communications are stable. (Refer to *10-12 IO-Link Total Communications Lost Frames* on page 10-27.) • Make sure that the set value of the IO-Link communications delay time is appropriate. (Refer to *10-15 IO-Link Communications Delay Time Settings* on page 10-42.) If this error persists even after you perform the above corrections, replace the Unit.
Device Configuration Verification Error	• The connected IO-Link device does not agree with the registered information. • The configuration settings for the IO-Link device are incorrect.	Connect the IO-Link device registered in the IO-Link Master Unit. Check that the registered configuration settings are correct.
Error-level Device Event	An error-level event occurred in the IO-Link device.	Use the CX-ConfiguratorFDT to check the device event of the connected IO-Link device. Refer to the manual for the IO-Link device and perform troubleshooting according to the obtained information.
Short-circuit between pin 1 and pin 3	The power supply to the IO-Link device is short-circuited. The cause is one of the following: • There is a short-circuit in the I/O cable. • The connected external device is faulty.	Check the following items, and then cycle the Unit/input power supply and the output power supply. • Make sure that the I/O cable is wired correctly. • Make sure that there are no short-circuits in the I/O cable or loose connections with the connectors. • Make sure that the connected external device is not faulty. If this error persists even after you perform the above corrections, replace the Unit.
Short-circuit between pin 4 and pin 3	There is a short-circuit between the IO-Link communications line and device power supply -. The cause is one of the following: • There is a short-circuit in the I/O cable. • The connected external device is faulty.	Check the following items, and then cycle the Unit/input power supply and the output power supply. • Make sure that the I/O cable is wired correctly. • Make sure that there are no short-circuits in the I/O cable or loose connections with the connectors. • Make sure that the connected external device is not faulty. If this error persists even after you perform the above corrections, replace the Unit.

• **SIO (DI) Mode**

Unit status	Cause	Correction
Short-circuit between pin 1 and pin 3	There is a short-circuit in the power supply to the input sensor. The cause is one of the following: • There is a short-circuit in the I/O cable. • The connected external device is faulty.	Check the following items, and then cycle the Unit/ input power supply and the output power supply. • Make sure that the I/O cable is wired correctly. • Make sure that there are no short-circuits in the I/O cable or loose connections with the connectors. • Make sure that the connected external device is not faulty. If this error persists even after you perform the above corrections, replace the Unit.

• **SIO (DO) Mode**

Unit status	Cause	Correction
Short-circuit between pin 1 and pin 3	There is a short-circuit in the power supply to the input sensor. The cause is one of the following: • There is a short-circuit in the I/O cable. • The connected external device is faulty.	Check the following items, and then cycle the Unit/ input power supply and the output power supply. • Make sure that the I/O cable is wired correctly. • Make sure that there are no short-circuits in the I/O cable or loose connections with the connectors. • Make sure that the connected external device is not faulty. If this error persists even after you perform the above corrections, replace the Unit.
Short-circuit between pin 4 and pin 3	There is a load short-circuit in the output. The cause is one of the following: • There is a short-circuit in the I/O cable. • The connected external device is faulty.	Check the following items, and then cycle the Unit/ input power supply and the output power supply. • Make sure that the I/O cable is wired correctly. • Make sure that there are no short-circuits in the I/O cable or loose connections with the connectors. • Make sure that the connected external device is not faulty. If this error persists even after you perform the above corrections, replace the Unit.

• **Disable**

Unit status	Cause	Correction
Short-circuit between pin 1 and pin 3	The connected external device is short-circuited. The cause is one of the following: • There is a short-circuit in the I/O cable. • The connected external device is faulty.	Check the following items, and then cycle the Unit/ input power supply and the output power supply. • Make sure that the I/O cable is wired correctly. • Make sure that there are no short-circuits in the I/O cable or loose connections with the connectors. • Make sure that the connected external device is not faulty. If this error persists even after you perform the above corrections, replace the Unit.

Checking for Errors and Troubleshooting with the Pin 2 Status Indicator

● How to Check for Errors

The Unit status in each communications mode is given below.

Pin 2 status	Unit status in each communications mode			Reference
	SIO (DI) Mode	SIO (DO) Mode	Disable	
Lit yellow	The input is ON	The output is ON	---	(This is the normal status.)
Flashing red	---	I/O Port Short-circuit Error Short-circuit between pin 2 and pin 3	---	Perform troubleshooting. Refer to *Troubleshooting* on page 12-13.
Not lit	The input is OFF	The output is OFF	(Always not lit)	(This is the normal status.)

● Troubleshooting

Unit status	Cause	Correction
Short-circuit between pin 2 and pin 3	There is a load short-circuit in the output. The cause is one of the following: • There is a short-circuit in the I/O cable. • The connected external device is faulty.	Check the following items, and then cycle the Unit/ input power supply and the output power supply. • Make sure that the I/O cable is wired correctly. • Make sure that there are no short-circuits in the I/O cable or loose connections with the connectors. • Make sure that the connected external device is not faulty. If this error persists even after you perform the above corrections, replace the Unit.

12-3 Checking for Errors with the Status in I/O Data

This section provides information on checking for errors with the status in I/O data.

12-3-1 Checking for Errors in the IO-Link Master Unit

You can check the status in the I/O the data for the IO-Link Master Unit by the user program in the Controller or with the Support Software corresponding to the Controller.

The I/O data that indicates errors is as follows.

Name	Description
Unit Error Collection Status	Indicates that some error occurred in the IO-Link Master Unit. Check the following information to determine what error occurred.
Unit Error Status	Identifies the cause of the error that occurred in the IO-Link Master Unit or EtherNet/IP network.
Port □ Error	The status that indicates some error occurred in port □. Check the Port □ Error Status to determine what error occurred.
Port □ Error Status	Identifies the cause of the error that occurred in port □.

From the user program, etc., access the above values in the Input Assembly of I/O data.
Refer to *7-6-3 Details on Input Assembly Data* on page 7-47 for details on I/O data.

You may send an explicit message to a certain CIP object to read the error status.
Refer to *A-1-11 Error Status Object (Class ID: 383 Hex)* on page A-34 for information on the CIP object.

12-3-2 Checking for Errors in IO-Link Devices

The I/O data of IO-Link devices is reflected on the IO-Link Input Data in the I/O data for the IO-Link Master Unit.
Each IO-Link device may have status information that is defined individually in the I/O data of IO-Link devices.
Access the status of each IO-Link device and use its information to check for errors.
Refer to the manual of each IO-Link device for details on the I/O data.

12-4 Checking for Errors and Troubleshooting with the Network Configurator

This section describes how to check for errors and troubleshoot them with the Network Configurator.

12-4-1 Information That You Can Access from the Network Configurator

You can check the following information that indicates the EtherNet/IP communications status and errors with the Network Configurator.
This information is called network status.
It is not the IO-Link Master Unit, but the EtherNet/IP scanner, that has the network status.
- Ethernet Status
- Data Link Status
- Configuration Error Status
- Target Node Status
- Target Controller Status
- Connection Status
- Controller Log
- Tag Status
- Ethernet Information

Refer to *12-4-2 Checking the Network Status with the Network Configurator* on page 12-15 for how to check the network status.

12-4-2 Checking the Network Status with the Network Configurator

This section describes the procedure to check the network status with the Network Configurator and the information that you can get from the network status.
Note that the tab pages of the Network Configurator used here are the ones that you see when you use the built-in EtherNet/IP port on an NJ/NX-series CPU Unit as the EtherNet/IP scanner.

Checking the Network Status

Use the following procedure to check the network status in the Network Configurator's Monitor Device dialog box.

1 Go online with the network that includes the IO-Link Master Unit.
Refer to *7-3-1 Going Online* on page 7-9 for information on how to go online.

2 Select the CPU Unit and select **Device** – **Monitor** from the menu, or right-click it and select **Monitor**.
The Monitor Device dialog box is displayed.
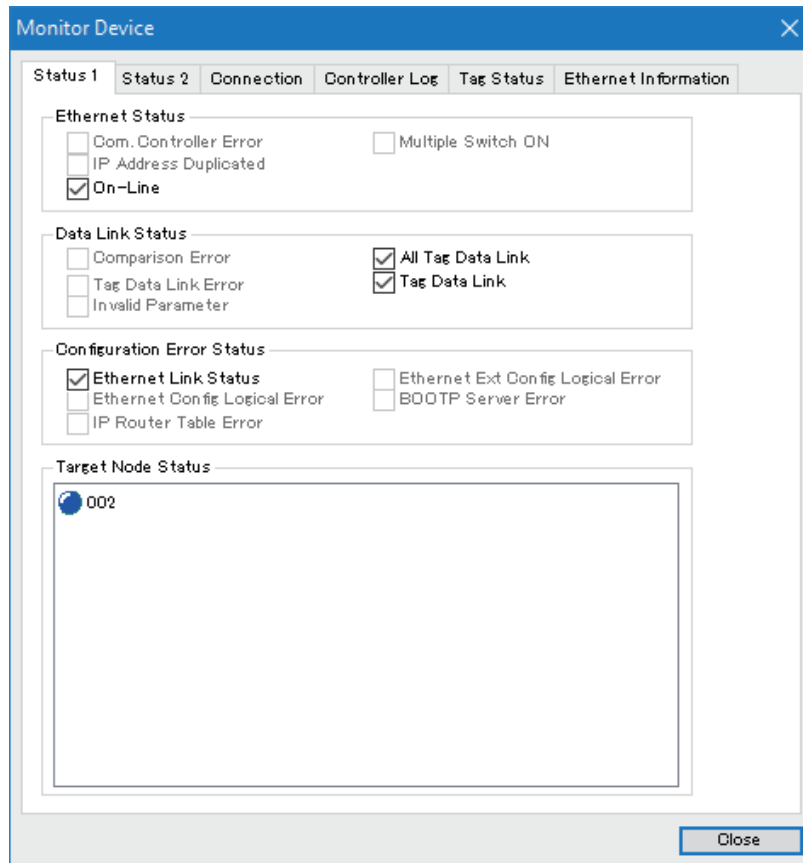
Network Status That You Access from the Monitor Device Dialog Box

● Connection Tab Page

The **Target Node Status** area displays information about the target node that acts as the originator.

If all tag data link connections to the node are established and normal, this information is displayed in blue. If any connection is broken it is displayed in red. However, this information is displayed in gray if the connection to the node is stopped.

In the **Connection Status** area, the **Status** column shows the current status of each connection that is set as the originator. This information can be used to identify the cause of tag data link errors. Refer to *12-4-3 Connection Status Codes and Troubleshooting* on page 12-20 for details on the information displayed in the **Connection Status** area.
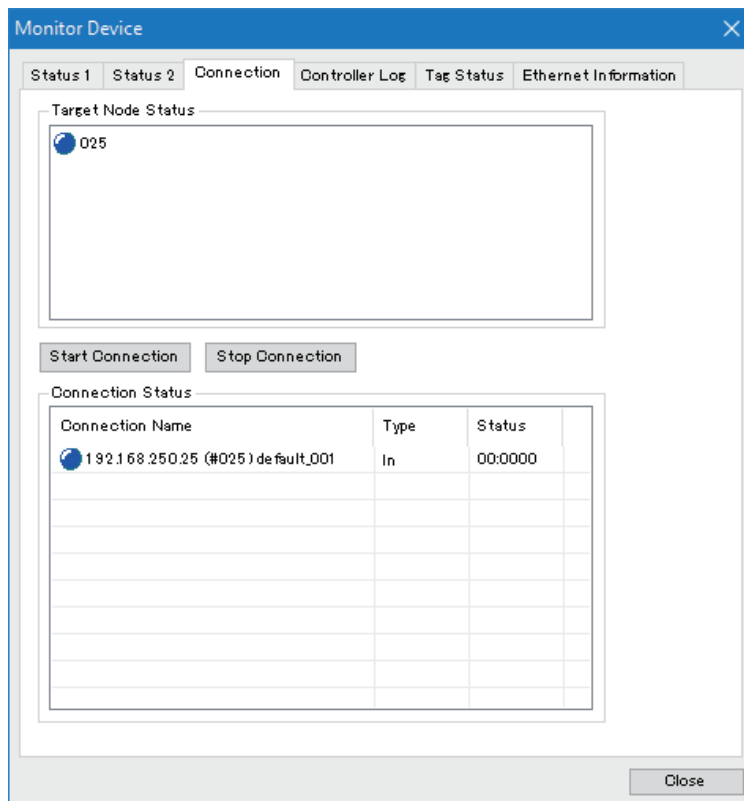
● **Controller Log Tab Page**

The Controller Log tab page displays the Controller event log that is stored in the NJ/NX-series CPU Unit.

The error history shows errors that have occurred. It can be saved in a file in the computer.

Refer to the *NJ/NX-series Troubleshooting Manual (Cat. No. W503)* for event details.
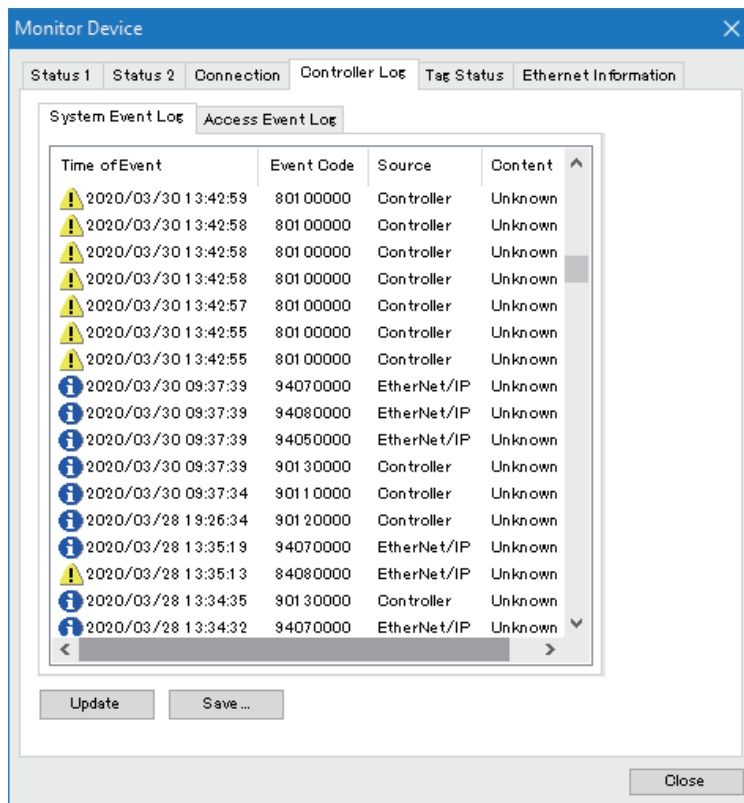
📑 **Additional Information**

> If you use a CJ/CS/CP-series CPU Unit as the EtherNet/IP scanner, note that the screen speci-
> fications are different from those of the built-in EtherNet/IP port on an NJ/NX-series CPU Unit.
> The Controller error logs stored in the CPU Unit are displayed in the **Controller Error History**
> tab page.
> Refer to the user's manual for the CJ/CS/CP-series CPU Unit for details on the **Controller
> Error Log** tab page.

● **Tag Status Tab Page**

This tab page displays in the **Status** column whether the tag settings for each tag in tag data links
are set so that data can be exchanged correctly with the CPU Unit.

Status	Description
Normal resolution completed	Normal data exchange is possible.
Resolving	The variables with tags are being resolved. When the resolution is completed normally, a connection will be established and the data exchange will start.
Different sizes	Different sizes are set for the network variables and the tag settings. A connection will not be established for a tag for which this error occurs.
No tag	A network variable specified in the tag setting is not listed in the CPU Unit. A connection will not be established for a tag for which this error occurs.
Attribute error	One of the following occurred: • A network variable specified in the tag setting cannot be written because it has the Constant attribute. • The I/O direction that is set in the tag data link settings does not agree with the I/O direction of the variable in the CPU Unit. A connection will not be established for a tag for which this error occurs.

If the status is not "Normal resolution completed", check the tag data link settings or the network variable settings in the variable table in the CPU Unit.
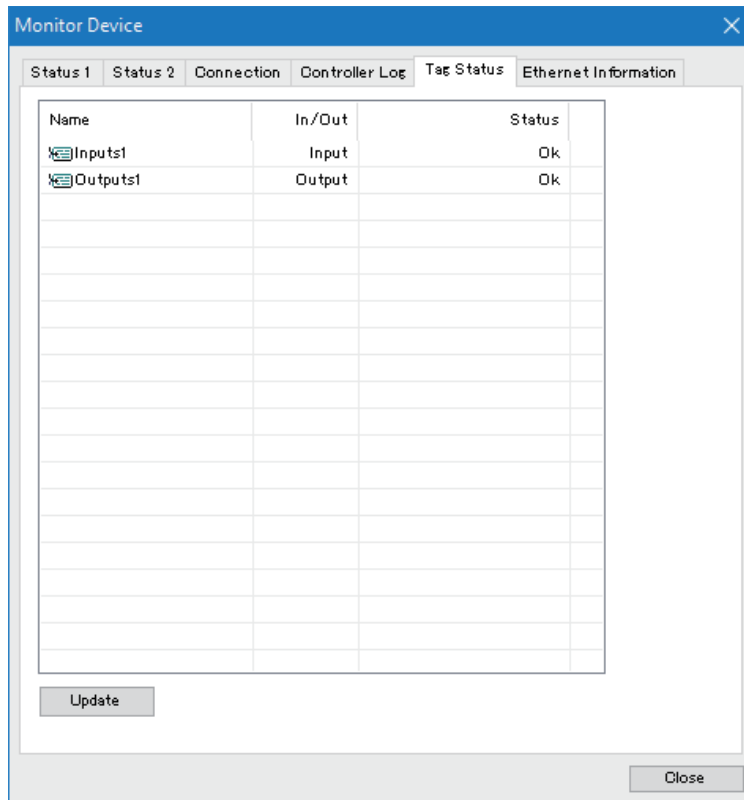
● Ethernet Information Tab Page

This tab page displays the communications status at the communications driver level of the Ether-Net/IP port.

The **Error counter** information can be used to confirm whether communications problems have occurred.

The **Tag Data Link** information can be used to confirm characteristics such as the bandwidth usage (pps).

12-4-3 Connection Status Codes and Troubleshooting

This section explains how to identify and correct errors based on the tag data link's connection status. The corrections are described for two types of configurations below.

Configura-tion name	Originator	Target
Configuration 1	CJ1W-EIP21, CJ2H-CPU□□-EIP, CJ2M-CPU3□, NJ/NX-series CPU Unit built-in Ether-Net/IP port, or other OMRON EtherNet/IP scanner	NXR-series IO-Link Master Unit for Ether-Net/IP
Configuration 2	EtherNet/IP scanner from another manufacturer	NXR-series IO-Link Master Unit for Ether-Net/IP

The connection status can be read in the **Connection** tab page of the Network Configurator's Monitor Device dialog box.

Additional Information

The connection status has the same meaning as the Connection Manager's General and Additional error response codes, as defined in the CIP specifications.

The following table shows the sources of errors and error correction for each configuration and connection status.

Connection status		Source of error	Correction	
General Status (hex)	Addition- al Status (hex)		Configuration 1	Configuration 2
00	0000	Normal status code: The connection has been opened and the tag data link is communicating normally.	---	---
01	0100	Error code returned from target: Attempted to open multiple con- nections for the same connec- tion.	This error does not oc- cur.	Depends on the origina- tor's specifications. (This error should not occur. If it does, contact the origi- nator device's manufac- turer.)
01	0103	Error code returned from target: Attempted to open a connection with an unsupported transport class.	This error does not oc- cur.	Confirm that the origina- tor supports Class 1.
01	0106	Duplicate consumers: Attempted to open multiple con- nections for single-consumer data.	If the tag data link is stopped or started, this error may occur accord- ing to the timing, but the system will recover auto- matically.	If the tag data link is stopped or started, this error may occur accord- ing to the timing, but the system will recover auto- matically.
01	0107	Error code returned from target: Attempted to close a connec- tion, but that connection was al- ready closed.	This error does not oc- cur.	This is not an error be- cause the connection is already closed.
01	0108	Error code returned from target: Attempted to open a connection with an unsupported connection type.	This error does not oc- cur.	Check which connection types can be used by the originator. (An error will occur if a connection oth- er than a multicast or point-to-point connection is set.)
01	0109	Error code returned from target: The connection size settings are different in the originator and target.	Check the connection (sizes) set in the originator and target.	
01	0110	Error code returned from target: The target was unable to open the connection, because of its operating status, such as down- loading settings.	Check whether the tag data link is stopped at the target. (Restart the tag data link communications with the software switch.)	
01	0111	Error code returned from target: The RPI was set to a value that exceeds the specifications.	This error does not oc- cur.	Set the originator's RPI setting to 10 seconds or less.

Connection status		Source of error	Correction	
General Status (hex)	Additional Status (hex)		Configuration 1	Configuration 2
01	0112	Error code returned from target: The RPI was set to a value that differs from other established Multi-cast connection.	Set the originator's RPI setting to the same value of the RPI for the other nodes with the same output tag set. Set the originator's connection type to Point to Point connection so that multiple nodes can operate at different RPIs.	Set the originator's RPI setting to the same value of the RPI for the other nodes with the same output tag set. Set the originator's connection type to Point to Point connection so that multiple nodes can operate at different RPIs.
01	0113	Error code generated by originator or returned from target: Attempted to open more connections than allowed by the specifications (32).	Check the connection settings (number of connections) at the originator and target.	Check the connection settings (number of connections) at the originator and target. Check the connection specifications for devices from other manufacturers.
01	0114	Error code returned from target: The Vendor ID and Product Code did not match when opening connection.	This error does not occur.	Check the originator's connection settings.
01	0115	Error code returned from target: The Product Type did not match when opening connection.	This error does not occur.	Check the originator's connection settings.
01	0116	Error code returned from target: The Major/Minor Revisions did not match when opening connection.	Check the major and minor revisions set for the target device and connection. If necessary, obtain the most recent EDS file and set it again.	Check the originator's connection settings.
01	0117	Error code returned from target: The tag set specified in the connection's target variables does not exist.	Check whether the originator and target tag sets and tags are set correctly.	Check the originator's connection settings. Check whether the target tag sets and tags are set correctly.
01	0118	Error code returned from target: There is a mistake in the size specified with the data octet included in the connection path.	This error does not occur.	Check the originator's connection settings.

Connection status		Source of error	Correction	
General Status (hex)	Addition-al Status (hex)		Configuration 1	Configuration 2
01	011 A	Error code generated by origi-nator: Connection could not be estab-lished because the buffer was full due to high traffic.	Unexpected network traffic may have been re-ceived. Use the **Ethernet Information** tab page on the Monitor Device dia-log box on the Network Configurator to check the bandwidth usage, and correct the load. If there are places where broadcast storms occur, such as loop connec-tions in the network con-nection format, then cor-rect them.	Depends on the target's specifications. (Contact the target device's man-ufacturer.)
01	011B	Error code returned from target: The RPI was set to a value that is below the specifications.	This error does not oc-cur.	Set the originator's RPI setting to 1 ms or great-er.
01	0123	Error code returned from target: A request was received to open a type of connection that is not supported (a connection type going from the originator to the target).	This error does not oc-cur.	Check the originator's connection type. An error will occur if any type oth-er than multicast or point-to-point is speci-fied.
01	0124	Error code returned from target: A request was received to open a type of connection that is not supported (a connection type going from the target to the originator).	This error does not oc-cur.	Check the originator's connection type. An error will occur if any type oth-er than multicast or point-to-point is speci-fied.
01	0127	Error code returned from target: A different data size is set for the connection in the originator and target (data from the origi-nator to the target).	Check the connection (sizes) set in the originator and target (data from the originator to the target).	
01	0128	Error code returned from target: A different data size is set for the connection in the originator and target (data from the target to the originator).	Check the connection (sizes) set in the originator and target (data from the target to the originator).	
01	0203	Error code generated by origi-nator: The connection timed out.	Tag data link communications from the target timed out. Check the power supply and cable wiring of the devices in the communications path, including the target and switches. If performance has dropped due to heavy traffic, change the performance set-tings. For example, increase the timeout time or RPI setting.	

Connection status		Source of error	Correction	
General Status (hex)	Addition- al Status (hex)		Configuration 1	Configuration 2
01	0204	Error code generated by origi- nator: The connection open process timed out.	There was no response from the target. Check the power supply and cable wiring of the devices in the communications path, including the target and switches.	
01	0205	Error code returned from target: There was a parameter error in the frame used to open the connection.	This error does not oc- cur.	Depends on the origina- tor's specifications. (Contact the originator device's manufacturer.)
01	0302	Error code generated by origi- nator or returned from target: The tag data link's allowable bandwidth (pps) was exceeded.	Check the connection settings (number of con- nections and RPI) at the originator and target.	Check the connection settings (number of con- nections and RPI) at the originator and target.
01	0311	Error code returned from target: There was a parameter error in the frame used to open the connection.	This error does not oc- cur.	Depends on the origina- tor's specifications. (Contact the originator device's manufacturer.)
01	0312	Error code returned from target: There was a parameter error in the frame used to open the connection.	This error does not oc- cur.	Depends on the origina- tor's specifications. (Contact the originator device's manufacturer.)
01	0315	Error code returned from target: There was a parameter error in the frame used to open the connection.	This error does not oc- cur.	Depends on the origina- tor's specifications. (Contact the originator device's manufacturer.)
01	0316	Error code returned from target: There was a parameter error in the frame used to close the connection.	This error does not oc- cur.	Depends on the origina- tor's specifications. (Contact the originator device's manufacturer.)
01	031C	Error code generated by origi- nator: Some other error occurred.	This error does not oc- cur.	Depends on the origina- tor's specifications. (Contact the originator device's manufacturer.)
08	---	Error code returned from target: There is no Forward Open or Large Forward Open service in the target device.	This error does not oc- cur.	Depends on the origina- tor's specifications. (Contact the originator device's manufacturer.)
D0	0001	Error code generated by origi- nator: The connection operation is stopped.	The connection was stopped because the Tag Data Link Stop Bit was turned ON, or the settings data is being downloaded. Either turn ON the Tag Data Link Start Switch, or wait until the settings data has been downloaded. This code includes fatal Con- troller errors and Unit failure.	Depends on the origina- tor's specifications. (Contact the originator device's manufacturer.)

Connection status		Source of error	Correction	
General Status (hex)	Addition- al Status (hex)		Configuration 1	Configuration 2
D0	0002	Error code generated by origi- nator: The connection is being opened (opening processing in progress).	Wait until the opening processing is completed.	Depends on the origina- tor's specifications. (Contact the originator device's manufacturer.)
OMRON error code				
01	0810	Error code returned from target: New data could not be obtained from the CPU Unit when open- ing connection. (The Unit will automatically recover, and at- tempt to open the connection again.)	This error may occur if the CPU Unit's task peri- od was long when open- ing the connection or some problem in the Controller caused the Controller to stop. If the task period was too long, operation recovers auto- matically. If the Control- ler has stopped, identify the error from the error information in the CPU Unit.	The meaning of this error code is defined by each vendor, so it depends on the originator's specifica- tions. (Contact the origi- nator device's manufac- turer.)
01	0811	Error code generated by origi- nator: New data could not be obtained from the CPU Unit when open- ing connection. (The Unit will automatically recover, and at- tempt to open the connection again.)	This error may occur if the CPU Unit's task peri- od was long when open- ing the connection. If the task period was too long, operation recovers auto- matically.	The meaning of this error code is defined by each vendor, so it depends on the originator's specifica- tions. (Contact the origi- nator device's manufac- turer.)

12-5 Checking for Errors and Troubleshooting with the Event Logs of the IO-Link Master Unit

This section describes how to check for errors and troubleshoot them with the event logs of the IO-Link Master Unit.

12-5-1 Event Logs

Overview

The IO-Link Master Unit records events, such as errors and status changes, that occur in it.
Such events that occurred are called events, while recording events so that the user can read them is called the event log function.
Reading recorded events from event logs allows you to easily correct errors that occurred.

Function

Events refer to the following:
- Errors that occurred in the IO-Link Master Unit or IO-Link devices
- Status changes in the IO-Link Master Unit

If an event occurs, the IO-Link Master Unit saves the identifier of the event in it as an event log.
Cycling the Unit/input power supply or restarting the Unit clears the event log.
However, high-level events are retained even after you cycle the Unit/input power supply or restart the Unit.
Whether an event is retained is defined for each event.
Refer to *12-5-3 Event Codes for Errors and Troubleshooting Procedures* on page 12-30 for details on events.

The IO-Link Master Unit can record up to 40 event logs. When there are already 40 events and a new event occurs, the oldest event log is replaced with the new event log.

You can add the time of event occurrence to event logs.
Moreover, you may use the time that was read from the NTP server or SNTP server for the time of event occurrence.
Refer to *7-4 Setting the Automatic Clock Adjustment* on page 7-23 for information on the settings.

![Precautions icon] **Precautions for Correct Use**

By default, the IO-Link Master Unit does not add the time of event occurrence to event logs.
To use the time read from the NTP server or SNTP server to record the time of event occurrence, set the function as follows.
• Set *Event Log Logged Data Configuration* to **Event Identifier + Time Stamp**.
• Set a valid IP address of the NTP or SNTP server in *NTP/SNTP Server IP Address*.
The IO-Link Master Unit uses the time read from the NTP server or SNTP server for the time of event occurrence only if both of the above settings are configured as specified.
Example 1: Event Log tab page when the set value of *Event Log Logged Data Configuration* is **Event Identifier**
The time of event occurrence is "1972/01/01 00:00:00".
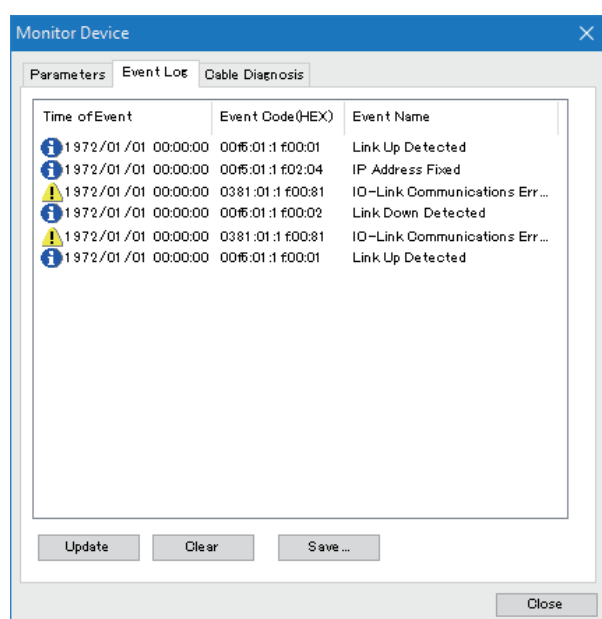
Example 2: Event Log tab page when the set value of *Event Log Logged Data Configuration* is **Event Identifier + Time Stamp** and the set value of *NTP/SNTP Server IP Address* is **(blank)**
When the set value is **(blank)**, automatic clock adjustment is disabled.
In this case, the IO-Link Master Unit starts measuring the time of event occurrence at "1972/01/01 00:00:00".
If you cycle the Unit/input power supply or restart the Unit, the Unit starts measuring the time at "1972/01/01 00:00:00" again.
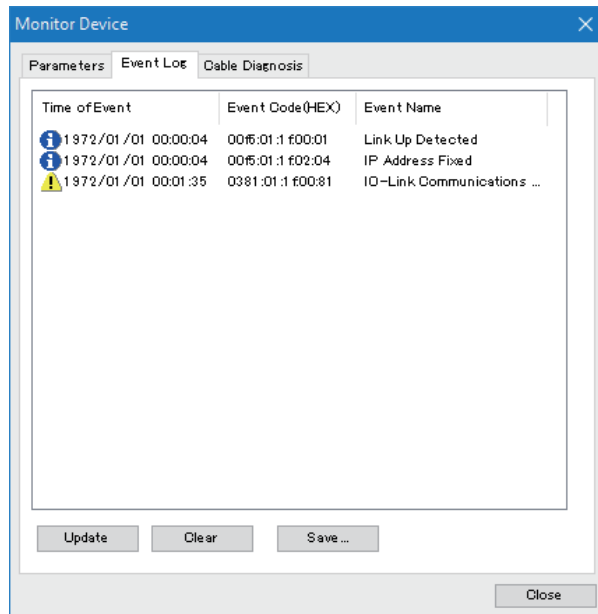
You can read and clear event logs with the Network Configurator or through an explicit message.

Refer to *12-5-2 Reading and Clearing Event Logs* on page 12-28 for information on how to read and clear event logs.

Refer to *12-5-3 Event Codes for Errors and Troubleshooting Procedures* on page 12-30 or *A-1-7 Event Log Object (Class ID: 41 Hex)* on page A-18 for the format of event logs.

12-5-2 Reading and Clearing Event Logs

There are two ways to read and clear event logs, i.e., using the Network Configurator or using an explicit message.

Using the Network Configurator's Monitor Device Dialog Box

● **Reading Event Logs**

1 Go online with the network that includes the IO-Link Master Unit.
Refer to *7-3-1 Going Online* on page 7-9 for information on how to go online.

2 Select the IO-Link Master Unit and select **Device** – **Monitor** from the menu, or right-click it and select **Monitor**.
The Monitor Device dialog box is displayed.

3 Click the **Event Log** tab of the Monitor Device dialog box.
The Event Log tab page is displayed.
It shows a list of event logs.
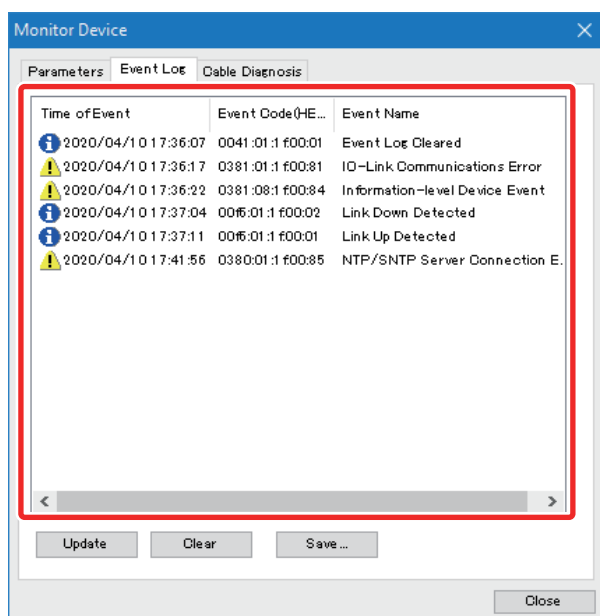
● **Clearing Event Logs**

1 Display the Event Log tab page of the Monitor Device dialog box.
For the display method, refer to *Reading Event Logs* on page 12-28 above.

2 Click the **Clear** button in the Event Log tab page.
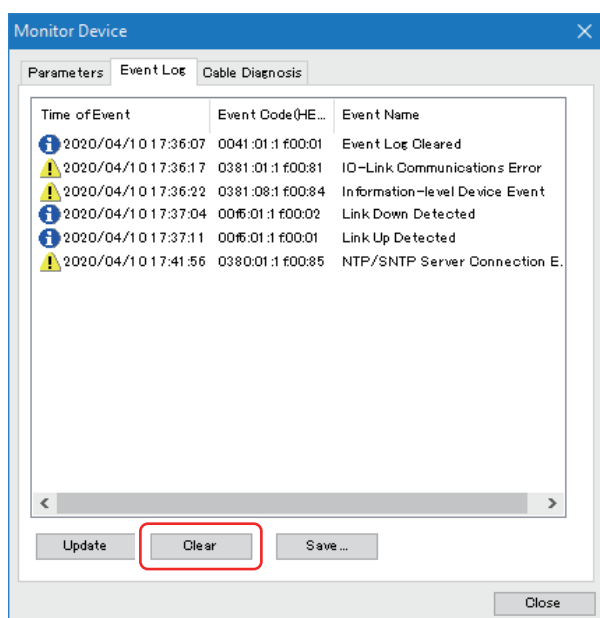
The event logs are cleared.

Using an Explicit Message

● **Reading Event Logs**

Send an explicit message to the following CIP object to read the data.

Class ID	Event Log object (41 hex)
Instance ID	01 hex
Attribute ID (Instance)	0D hex Event/Data Log Size 0E hex Event/Data Log
Service code	Get Attribute Single (0E hex)

● **Clearing Event Logs**

Send an explicit message to the following CIP object to clear event logs.

Class ID	Event Log object (41 hex)
Instance ID	01 hex
Attribute ID (Instance)	Not specified
Service code	Reset (05 hex)

Refer to *A-1-7 Event Log Object (Class ID: 41 Hex)* on page A-18 for information on the CIP object.

12-5-3 Event Codes for Errors and Troubleshooting Procedures

This section describes how to read the event codes of errors and troubleshoot them according to the event logs.

Format and Meaning of Event Codes

An event code consists of 12 hexadecimal digits. It is formatted as follows.

Format of event codes

a. extended error code -1

b. extended error code -2

c. error/event code

d. object instance

e. object class
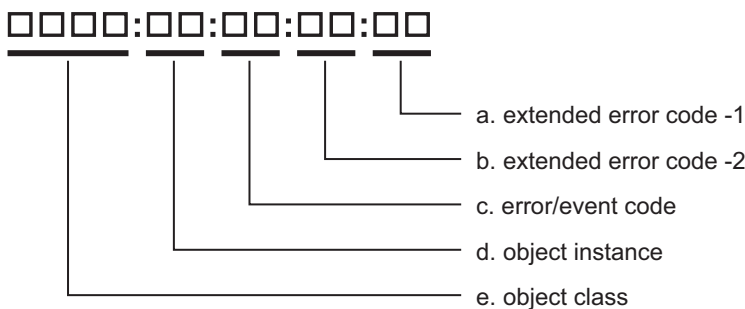
a. extended error code -1	Lower digits of the expansion error code. This contains the detailed error code.
b. extended error code -2	Upper digits of the expansion error code. This contains the error code in the class. The most significant bit of these digits indicates the event category: 1 for warning and 0 for information.
c. error/event code	This is the CIP general status code. It contains IF hex that indicates a vendor-specific error for all events.
d. object instance	CIP object instance ID for the event source. "nn" indicates the port number of the port nearest to the error location.

e. object class   CIP object class ID for the event source.

Details on Events

Details on each event are described below.

Event code	Category	Retained or Not re- tained	Event name	Cause	Correction
0380:01:1F:00:81	Warning	Retained	Non-volatile Memory Hard- ware Error	Non-volatile memory failure	Cycle the Unit/input power supply. If cycling the Unit/input power sup- ply does not clear the error, re- place the Unit.
0380:01:1F:00:82	Warning	Retained	Non-volatile Memory Check- sum Error	The power supply to the Unit was turned OFF or Support Soft- ware communications were disconnected while settings were written.	Transfer the settings to the Unit again. Do not turn OFF the Unit/input power supply or disconnect Sup- port Software communications while you transfer the settings to the Unit.
0380:01:1F:00:83	Warning	Retained	Unit Processing Error	An error occurred in the software.	Cycle the Unit/input power supply. If cycling the Unit/input power sup- ply does not clear the error, re- place the Unit. If this error occurs again even after you replace the Unit, contact your OMRON representative.
00F5:01:1F:xx:81 xx: Fourth octet value of the IP address	Warning	Retained	IP Address Du- plication	The IP address of the EtherNet/IP port is al- so used as the IP ad- dress of another node.	Perform either of the following and then cycle the Unit/input power supply or restart the Unit. • Correct the IP address settings so that the same address is not used by more than one node. • Remove the node that has the duplicate IP address from the network.
00F5:01:1F:00:82	Warning	Retained	TCP/IP Setting Error (Local IP Address)	The TCP/IP settings are incorrect.	Correct and transfer the settings again. Then, cycle the Unit/input power supply or restart the Unit.
				The IP address deliv- ered from the BOOTP or DHCP server is in- correct.	Set the IP address correctly in the settings of the BOOTP or DHCP server. Then, cycle the Unit/input power supply or restart the Unit.
0380:01:1F:00:84	Warning	Retained	Automatic Clock Adjustment Set- ting Error	The IP address setting for the NTP/SNTP Server IP Address is incorrect.	Correct the IP address of the NTP or SNTP server in *NTP/SNTP Server IP Address* and transfer it again. Then, cycle the Unit/input power supply or restart the Unit.

Event code	Category	Retained or Not retained	Event name	Cause	Correction
00F5:01:1F:00:83	Warning	Retained	BOOTP/DHCP Server Connection Error	The BOOTP or DHCP server is stopped.	Set the BOOTP or DHCP server to operate normally.
				An error occurred in communications with the BOOTP or DHCP server.	Check the communications path to the BOOTP or DHCP server and take corrective measures if there are any problems.
0380:01:1F:00:85	Warning	Retained	NTP/SNTP Server Connection Error	The NTP or SNTP Server IP address is incorrect.	Correct the IP address of the NTP or SNTP server in *NTP/SNTP Server IP Address* and transfer it again. Then, cycle the Unit/input power supply or restart the Unit.
				The NTP or SNTP server is stopped.	Check if the NTP or SNTP server at the remote connection is operating normally and set it to operate normally if it is not.
				An error occurred in communications with the NTP or SNTP server.	Check the communications path to the NTP or SNTP server at the remote connection and take corrective measures if there are any problems.
0381:nn:1F:00:81	Warning	Retained	IO-Link Communications Error	• The I/O cable is broken. • The connected external device is faulty. • The IO-Link Master Unit is faulty. • The IO-Link communications are unstable. • A communications timeout occurred due to the effect of IO-Link communications delay.	Check the following items, and then cycle the Unit/input power supply or restart the Unit. • Make sure that the I/O cable is wired correctly. • Make sure that there are no breaks in the I/O cable or loose connections with the connectors. • Make sure that the connected external device is not faulty. • Make sure that the IO-Link communications are stable. (Refer to *10-12 IO-Link Total Communications Lost Frames* on page 10-27.) • Make sure that the set value of the IO-Link communications delay time is appropriate. (Refer to *10-15 IO-Link Communications Delay Time Settings* on page 10-42.) If this error persists even after you perform the above corrections, replace the Unit.

Event code	Category	Retained or Not retained	Event name	Cause	Correction
0381:nn:1F:00:86	Warning	Retained	I/O Port Short-circuit Error	• There is a short-circuit in the I/O cable. • The connected external device is faulty.	Check the following items, and then cycle the Unit/input power supply and the output power supply. • Make sure that the I/O cable is wired correctly. • Make sure that there are no short-circuits in the I/O cable or loose connections with the connectors. • Make sure that the connected external device is not faulty. If this error persists even after you perform the above corrections, replace the Unit.
0381:nn:1F:00:82	Warning	Retained	Device Configuration Verification Error	• The connected IO-Link device does not agree with the registered information. • The configuration settings for the IO-Link device are incorrect.	Connect the IO-Link device registered in the IO-Link Master Unit. Check that the registered configuration settings are correct.
0381:nn:1F:00:83	Warning	Retained	Error-level Device Event	An error-level event occurred in the IO-Link device.	Use the CX-ConfiguratorFDT to check the device event of the connected IO-Link device. Refer to the manual for the IO-Link device and perform troubleshooting according to the obtained information.
0381:nn:1F:00:84	Warning	Retained	Warning-level Device Event Flag	A warning-level event occurred in the IO-Link device.	Use the CX-ConfiguratorFDT to check the device event of the connected IO-Link device. Refer to the manual for the IO-Link device and perform troubleshooting according to the obtained information.

Event code	Category	Retained or Not retained	Event name	Cause	Correction
0381:nn:1F:00:87	Warning	Retained	Device I/O Size Error	• The size of the process input data from the connected IO-Link device is larger than the set value for the IO-Link Master Unit. • The size of the process output data to the connected IO-Link device is larger than the set value for the IO-Link Master Unit.	Correct and transfer the *Port □ Configuration Data /Process Data In Length* or *Port □ Configuration Data /Process Data Out Length* settings again. Then, cycle the Unit/input power supply or restart the Unit.
0381:nn:1F:00:88	Warning	Retained	Assembly Error	The process output data size set for the IO-Link Master Unit is larger than the IO-Link output data size for the Output Assembly selected in connection settings.	Select an Output Assembly that has larger IO-Link Output Data than the *Port □ Configuration Data /Process Data Out Length* setting and correct the tag data link settings. Refer to *7-7 Setting Tag Data Links* on page 7-62 for information on the tag data link settings.
00F6:xx:1F:00:01 xx: EtherNet/IP port number	Information	Not retained	Link Up Detected	Establishment of an Ethernet link was detected.	---
00F6:xx:1F:00:02 xx: EtherNet/IP port number	Information	Not retained	Link Down Detected	An EtherNet/IP cable is broken, disconnected, or loose.	Connect the EtherNet/IP cable securely. If the cable is broken, replace it.
				The Ethernet switch power supply is turned OFF or failed.	Turn ON the power supply to the Ethernet switch. Replace the Ethernet switch if it fails.
				The link speed does not match.	Make the port settings at the remote node to the auto negotiation setting.
				The communications are unstable due to noise.	Implement noise countermeasures.
0381:00:1F:00:05	Information	Retained	IO-Link Device Configuration Information Created	IO-Link device configuration information was created.	---
0001:01:1F:00:01	Information	Retained	Restart Executed	A restart was executed.	---
0041:01:1F:00:01	Information	Retained	Event Log Cleared	The event log was cleared.	---

Event code	Category	Retained or Not retained	Event name	Cause	Correction
00F5:01:1F:xx:04 xx: Fourth octet value of the IP address	Information	Not retained	IP Address Fixed	The correct IP address has been determined and Ethernet communications can start.	---
00F5:01:1F:00:05	Information	Not retained	BOOTP/DHCP Client Started	The BOOTP or DHCP client was started.	---
0380:01:1F:yy:86 yy: System information	Warning	Not retained	Non-volatile Memory Write Error	Writing data to non-volatile memory failed.	Cycle the Unit/input power supply. If cycling the Unit/input power supply does not clear the error, replace the Unit.
0381:00:1F:xx:09 xx: Output Assembly Instance Number for which the Output Data Invalid Detected event was detected	Information	Retained	Output Data Invalid Detected	An Exclusive Owner connection timed out because an EtherNet/IP cable is broken, disconnected, or loose.	Connect the EtherNet/IP cable securely. If the cable is broken, replace it.
				The Exclusive Owner connection timed out because the power supply to the Ethernet switch was turned OFF.	Turn ON the power supply to the Ethernet switch. Replace the Ethernet switch if it fails.
				A tag data link was stopped or the connection settings were reconfigured at the originator. Or, the Exclusive Owner connection timed out because the power supply to the originator was turned OFF or the originator was reset.	Restart the tag data link on the originator. If the size of the input tag set for an Exclusive Owner connection from the originator is changed, cycle the Unit/input power supply or restart the Unit.
				An Idle command was notified from the originator.	Operate the originator so that a Run command is notified from the originator.

12-6 Checking for Device Events and Troubleshooting IO-Link Devices

This section describes how to check for device events and troubleshoot IO-Link devices.
The troubleshooting procedure provided here is applicable only to IO-Link devices that support device events.

12-6-1 Troubleshooting with Device Events

1 Check if there is any device event in the IO-Link device.
Refer to *12-6-2 Checking the Occurrence of Device Events* on page 12-36 for the checking procedure.

2 If there is, check the device event with the CX-ConfiguratorFDT.
Refer to *12-6-3 Checking for Device Events* on page 12-37 for the checking procedure.

3 Refer to the manual for the IO-Link device and perform troubleshooting according to the information obtained with the CX-ConfiguratorFDT.

> **Additional Information**
>
> - An IO-Link device registers an error that occurred in it as a device event.
>   When a device event is registered, the IO-Link device notifies the occurrence of the device event to the IO-Link Master Unit.
>   The IO-Link Master Unit then applies the notified information on the event occurrence to its I/O data and records it as an event.
> - For each IO-Link device, unique device events are defined.
>   Refer to the manual for the IO-Link device for the meaning and correction of each device event.

12-6-2 Checking the Occurrence of Device Events

Use the information mentioned below to check the occurrence of device events in the IO-Link device.
There are two checking methods.

- Read the events recorded by the IO-Link Master Unit.
  Error-level Device Event, Warning-level Device Event Flag
  Refer to *12-5-2 Reading and Clearing Event Logs* on page 12-28 for information on how to read event logs.
- Read the following I/O data.
  Port □ Device Error-level Event or *Port □ Device Warning-level Event* in *Port □ Error Status* in *I/O Port Error Status*
  From the user program, etc., access the above values in the Input Assembly of I/O data.
  Refer to *7-6-3 Details on Input Assembly Data* on page 7-47 for details on I/O data.

You may send an explicit message to a certain CIP object to read the error status.

Refer to *A-1-11 Error Status Object (Class ID: 383 Hex)* on page A-34 for information on the CIP object.

12-6-3 Checking for Device Events

Use the CX-ConfiguratorFDT to check for device events.

1 Go online with the IO-Link device.
Refer to *11-2-10 Going Online* on page 11-10 for information on how to go online.

2 Go online with the IO-Link device. The operation differs depending on the version as follows.
- For the CX-ConfiguratorFDT version 3.0 or higher, right-click the device DTM for the IO-Link device, and select **Connect**.
- For the CX-ConfiguratorFDT version lower than 3.0, right-click the device DTM for the IO-Link device, and select **Go online**.
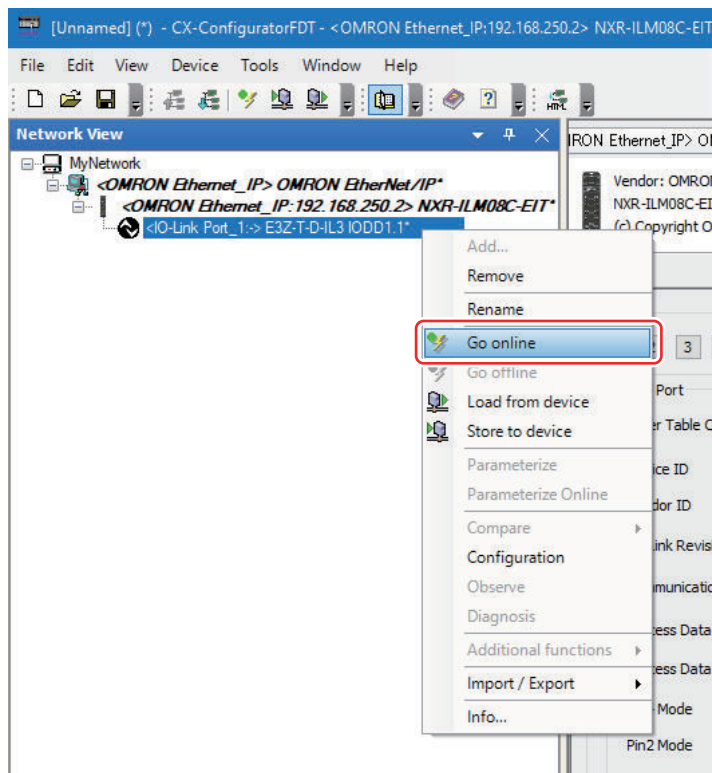
The Support Software goes online.
When the Support Software goes online, the following occurs depending on the version.
- For the CX-ConfiguratorFDT version 3.0 or higher, the status bar to the left of the devices in the Network View turns green.
- For the CX-ConfiguratorFDT version lower than 3.0, the devices in the Network View are displayed in bold.
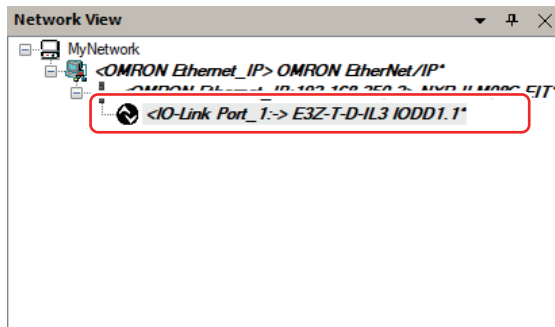
3 Right-click the device DTM for the IO-Link device and select **Configuration**.
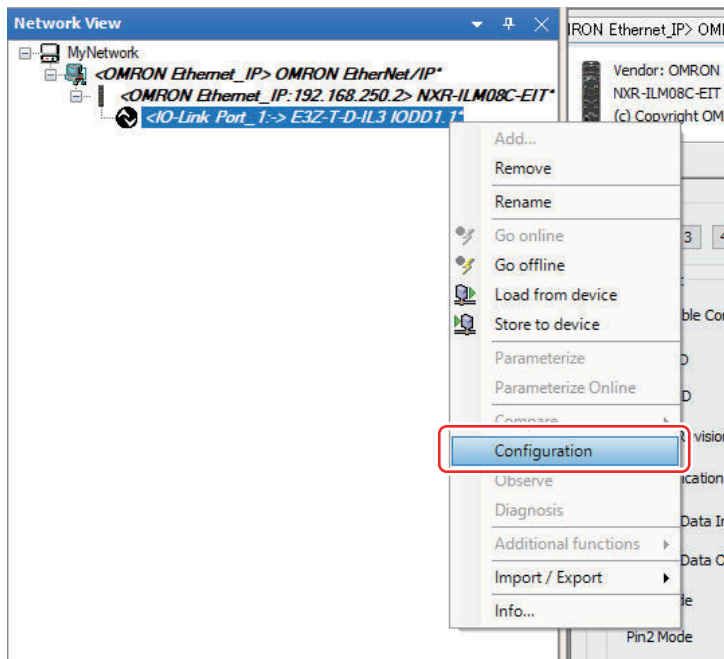
The Configuration tab page is displayed.
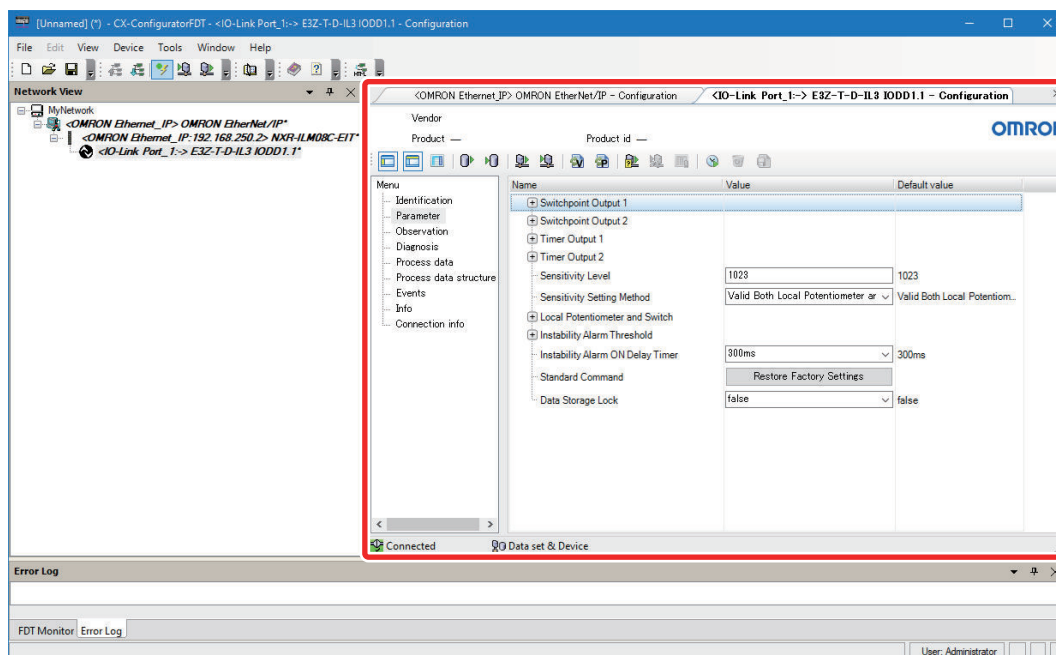
4 In the device DTM Configuration tab page for the IO-Link device, select **Diagnosis**.
The **Diagnosis** tab page is displayed.
Device events are shown in this tab page.
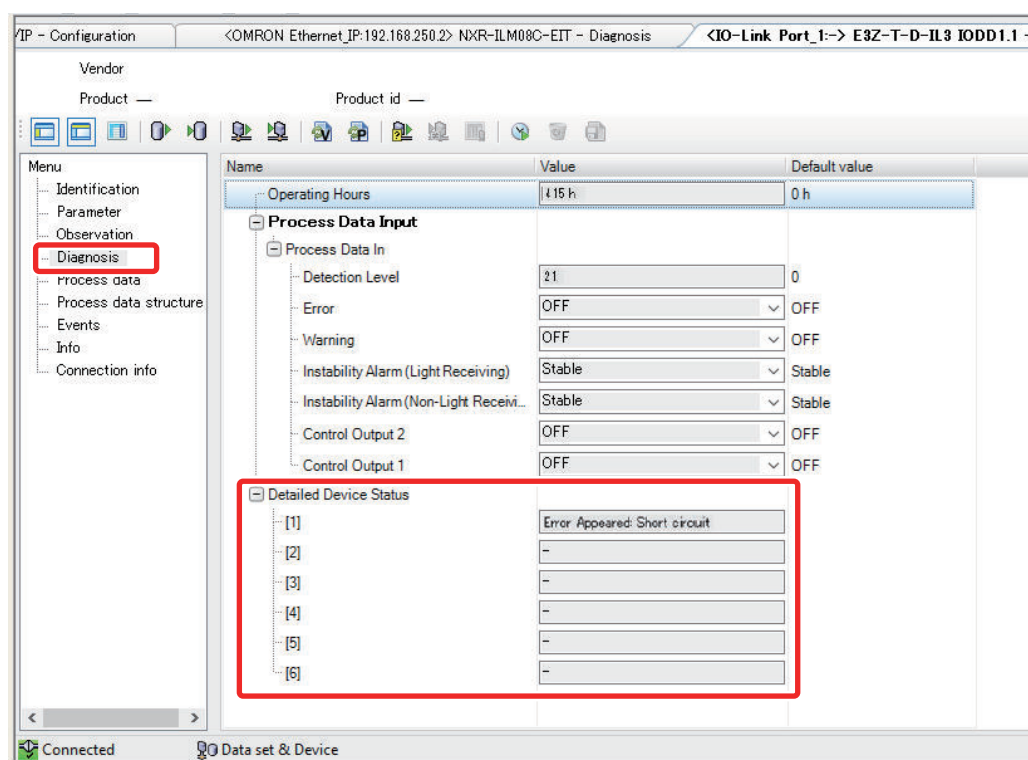
12-7 Assumed Causes and Corrections for Other Errors

This section describes assumed causes and corrections for other errors.

Problem	Cause	Correction
Although a connected external device is ON, nothing is input and the I/O indicator is not lit either.	The Unit is not wired correctly with the connected external device.	Check the wiring with the connected external device.
	The wiring to the connected external device is disconnected.	Check the wiring with the connected external device.
	A connected external device is defective.	Replace the connected external device.
A connected external device is ON and the I/O indicator is lit, but nothing is input.	A communications error occurred.	Check if an error occurred between the EtherNet/IP scanner and the IO-Link Master Unit.
There is a delay in the ON and OFF timing for input values.	An input filter may be set.	Set the input filter value to 0. Alternatively, change the input filter to an appropriate value.
When the output is ON, nothing is output although the I/O indicator is lit.	The Unit is not wired correctly with the connected external device.	Check the wiring with the connected external device.
	The wiring to the connected external device is disconnected.	Check the wiring with the connected external device.
	A connected external device is defective.	Replace the connected external device.
	Load short-circuit protection is in progress.	Immediately turn OFF the applicable output and remove the cause of the short-circuit.
Although the output is ON, nothing is output and the I/O indicator is not lit either.	A communications error occurred.	Check if an error occurred between the EtherNet/IP scanner and the IO-Link Master Unit.
The IO-Link Master Unit cannot hold outputs during communications errors or Idle.	In output settings during communications errors/Idle, the Fault/Idle Action setting is Clear.	Change the Fault/Idle Action setting to Hold.
The IO-Link Master Unit cannot clear outputs during communications errors or Idle.	In output settings during communications errors/Idle, the Fault/Idle Action setting is Hold.	Change the Fault/Idle Action setting to Clear.

12-8 Resetting Errors

This section describes how to reset errors in the IO-Link Master Unit.

12-8-1 Overview of Resetting Errors

If an error occurs in an IO-Link Master Unit, and you remove the cause of the error, the IO-Link Master Unit automatically recovers and starts operating normally.
However, the behavior of the error status in the I/O data for the IO-Link Master Unit is determined by the combination of the Hold Setting For Error Status and Clear Error Status Flag service settings.

12-8-2 Hold Setting For Error Status

Use the following setting to set the behavior of the error status when the error cause is removed.

Use the Network Configurator or an explicit message to configure the following setting.

Setting	Description	Default	Setting range	Update timing
Hold Setting For Error Status	Set the behavior of the error status when the error cause is removed.	TRUE	TRUE or FALSE[1]	After restart

*1. The set values are described as follows:

Set value	Description
TRUE	The error status does not change to FALSE when the error cause is removed. To clear the error, use the Clear Error Status Flag service.
FALSE	The error status changes to FALSE when the error cause is removed.

Refer to *7-5-2 Setting the Device Parameters of the IO-Link Master Unit* on page 7-30 for the setting procedure with the Network Configurator.
Refer to *A-1-11 Error Status Object (Class ID: 383 Hex)* on page A-34 for information on the CIP object that is set through an explicit message.

12-8-3 Clearing the Error Status

Send an explicit message to the following CIP object to set the error status to FALSE (i.e., clear the error status).

Class ID	Error status object (383 hex)
Instance ID	00 hex
Attribute ID (Instance)	Not specified
Service code	Clear Error Status Flag (35 hex)

Refer to *A-1-11 Error Status Object (Class ID: 383 Hex)* on page A-34 for information on the CIP object.

13

Inspection and Maintenance

This section describes inspection and maintenance of the IO-Link Master Unit.

13-1 Cleaning and Inspection

This section describes daily device maintenance such as cleaning and inspection.

Inspect the IO-Link Master Unit daily or periodically in order to keep it in optimal operating condition.

13-1-1 Cleaning

Clean the device regularly as described below in order to keep it in optimal operating condition.

- Wipe the device over with a soft, dry cloth when performing daily cleaning.
- If dirt remains even after wiping with a soft, dry cloth, wipe with a cloth that has been wet with a sufficiently diluted detergent (2%) and wrung dry.
- The IO-Link Master Unit will become stained if items such as rubber, vinyl products, or adhesive tape are left on it for a long period. Remove such items during regular cleaning.

Precautions for Correct Use

Never use volatile solvents, such as paint thinner, benzene, or chemical wipes. They may deteriorate the engraved or printed surfaces of the product.

13-1-2 Inspection Procedure

Be sure to perform periodic inspections to ensure the Unit is maintained in the optimal operating condition.

Inspections should be performed every six months to every year.

When you operate the Unit in a location subject to extremely high temperatures and high humidity or dust, perform inspections more frequently.

▌ Tools Required for Inspections

● Tools Always Required

- Phillips screwdriver
- Torque handle
- Voltage tester or digital voltmeter
- Industrial alcohol and pure cotton cloth

● Tools Required Occasionally

- Oscilloscope
- Thermometer and hygrometer

▌ Inspection Items

Inspect the following items to check if the results meet the criteria.

If the results do not meet the criteria, improve the environment or adjust the Unit so that inspection results meet the criteria.

Item	Inspection	Criteria	Tool
Environment	Check the ambient temperature and the temperature inside the panel	-10 to 55°C	Thermometer
	Check the ambient humidity and the humidity inside the panel	25% to 85% (with no condensation)	Hygrometer
	Check for accumulation of dust	No accumulation of dust	Inspect visually
Installation condition	Check that the Unit is securely fixed	No looseness	Phillips screwdriver
	Check that the waterproof covers of the cables are tightened to an appropriate torque on the connectors of the Unit	The covers are tightened to the specified torque	Torque handle
	The rotary switch cover is tight	No looseness	Phillips screwdriver
	Check for damaged connecting cables	No visible damage	Inspect visually

13-2 Maintenance Procedures

13-2-1 Handling the Unit to Replace

The NXR-series IO-Link Master Unit for EtherNet/IP is an network component. Note that a failure in the Unit may affect the entire network. If the Unit fails, repair it immediately.
To restore the functionality of the network as soon as possible, it is recommended to prepare a spare.

Considerations for Replacing the Unit

When you find a fault during inspection and replace the Unit, keep in mind the following:
- After replacement, check that there are no problems with the new Unit.
- When you return a faulty Unit for repair, send the Unit to your OMRON representative with a note describing your problem in as much detail as possible.
- For poor contact, take a clean cotton cloth, soak the cloth in industrial alcohol, and carefully wipe the contacts.

Settings after Replacing the Unit

After Unit replacement, set the Unit so that it has the same switch settings and other settings as those of the previous Unit.

13-2-2 Replacing the IO-Link Master Unit

This section describes how to replace the IO-Link Master Unit. It covers the replacement procedures with and without the Support Software.

> **Precautions for Correct Use**
>
> If you replace the IO-Link Master Unit with an IO-Link Master Unit to which IO-Link device back-up data was previously written, clear the IO-Link device backup data before you connect IO-Link devices.
> If the restore condition is met when IO-Link device backup data remains in the Unit, the backup data will be written to the IO-Link devices.
> For details on how to restore backup data to IO-Link devices, refer to *10-13 Backing Up and Restoring IO-Link Device Parameters* on page 10-31.

Replacing the IO-Link Master Unit with the Support Software

The procedure to replace the IO-Link Master Unit with the Support Software is described below.
For the Support Software, use the Network Configurator.

• Preparation
Before you replace the IO-Link Master Unit, back up the device parameter settings of the IO-Link Master Unit.

For the backup, use the Network Configurator.
Refer to *7-8-3 Backing Up and Restoring with the Network Configurator* on page 7-77 for the backup methods.

• Replacement Procedure

1 Turn OFF the following power supplies.
- Unit/input power supply and output power supply to the IO-Link Master Unit
- Power supplies to the EtherNet/IP scanner and adapter connected to the IO-Link Master Unit

2 Set a new IO-Link Master Unit so that it has the same rotary switch settings as those of the previous Unit.
Set the IP address in advance.

3 Replace the IO-Link Master Unit.

4 Turn ON the Unit/input power supply and output power supply to the new IO-Link Master Unit.

5 Use the Network Configurator to write the Link Settings from the old IO-Link Master Unit to the new the IO-Link Master Unit.

6 Use the Network Configurator to restore the backed up device parameter settings from the old IO-Link Master Unit to the new IO-Link Master Unit.
Refer to *7-8-3 Backing Up and Restoring with the Network Configurator* on page 7-77 for information on the restore method.

7 Turn ON the power supplies to the EtherNet/IP scanner and adapter connected to the IO-Link Master Unit.

Replacing the IO-Link Master Unit without the Support Software

The procedure to replace the IO-Link Master Unit without the Support Software is described below.

• Preparation
Before you replace the IO-Link Master Unit, back up the device parameter settings of the IO-Link Master Unit.
Create a user program for backup through an explicit message and execute a backup. In addition, create in advance a user program to write device parameters and Link Settings to the IO-Link Master Unit through an explicit message.
Refer to *A-2-4 Backing Up and Restoring Devices Parameters of IO-Link Master Units* on page A-55 for information on the sample programming.

• Replacement Procedure

1 Turn OFF the following power supplies.
- Unit/input power supply and output power supply to the IO-Link Master Unit
- Power supplies to the EtherNet/IP scanner and adapter connected to the IO-Link Master Unit

2 Set a new IO-Link Master Unit so that it has the same rotary switch settings as those of the previous Unit.
Set the IP address in advance.

3 Replace the IO-Link Master Unit.

4 Turn ON the Unit/input power supply and output power supply to the new IO-Link Master Unit.

5 Use the user program that you created in advance to write the Link Settings and device parameter settings from the old IO-Link Master Unit to the new the IO-Link Master Unit.
Refer to *A-2-4 Backing Up and Restoring Devices Parameters of IO-Link Master Units* on page A-55 for information on the sample programming.

6 Turn ON the power supplies to the EtherNet/IP scanner and adapter connected to the IO-Link Master Unit.

13-2-3 Replacing IO-Link Devices

This section describes how to replace an IO-Link device on the assumption that:
- The parameter settings of the IO-Link device are backed up to the IO-Link Master Unit before replacement.
- The IO-Link Master Unit is set to restore the backup data stored in it to the IO-Link device.

For information on how to back up and restore IO-Link device parameter settings, refer to *10-13 Backing Up and Restoring IO-Link Device Parameters* on page 10-31.

1 Turn OFF the Unit/input power supply and output power supply to the IO-Link Master Unit.

2 Replace the IO-Link device.

3 Turn ON the Unit/input power supply and output power supply to the IO-Link Master Unit.
Restoration is executed automatically when IO-Link communications start.

13-2-4 Replacing the IO-Link Master Unit and IO-Link Devices at the Same Time

This section describes how to replace the IO-Link Master Unit and IO-Link devices at the same time.

• Preparation
Before you replace the IO-Link Master Unit, back up the device parameter settings of the IO-Link Master Unit.
For the backup, use the Network Configurator.
Refer to *7-8-3 Backing Up and Restoring with the Network Configurator* on page 7-77 for the backup methods.
In addition, back up the parameter settings of the connected IO-Link devices in advance before you replace them.
To back up the parameter settings, use the CX-ConfiguratorFDT to export the network configuration that you created as a file.

Refer to *11-2-8 Exporting the Created Network Configuration to a File* on page 11-10 for the backup method.

• **Replacement Procedure**

1 Turn OFF the following power supplies.
   • Unit/input power supply and output power supply to the IO-Link Master Unit
   • Power supplies to the EtherNet/IP scanner and adapter connected to the IO-Link Master Unit

2 Set a new IO-Link Master Unit so that it has the same rotary switch settings as those of the previous Unit. If the IO-Link devices have switches, set new IO-Link devices so that they have the same switch settings as those of the previous IO-Link devices.
   Set the IP address of the IO-Link Unit in advance.

3 Replace the IO-Link Master Unit and IO-Link devices.

4 Turn ON the Unit/input power supply and output power supply to the new IO-Link Master Unit.

5 Use the Network Configurator to write the Link Settings from the old IO-Link Master Unit to the new the IO-Link Master Unit.

6 Use the Network Configurator to restore the backed up device parameter settings from the old IO-Link Master Unit to the new IO-Link Master Unit.
   Refer to *7-8-3 Backing Up and Restoring with the Network Configurator* on page 7-77 for information on the restore method.

7 Use the CX-ConfiguratorFDT to store the backed up IO-Link device parameter settings to the new IO-Link devices.
   Refer to *11-2-12 Transferring the IO-Link Device Parameters* on page 11-25 for information on how to store the parameter settings.

8 Turn ON the power supplies to the EtherNet/IP scanner and adapter connected to the IO-Link Master Unit.

A

Appendices

The appendices provide information on supported CIP objects, sample programming, Windows firewall configuration, and other supplemental information.

A-1 Supported CIP Objects

The supported CIP objects are listed below.

To access CIP objects in the IO-Link Master Unit, use an explicit message. Refer to *6-1-2 Explicit Message Communications* on page 6-4 for information on the method to access CIP objects through an explicit message.

Object name	Function	Reference
Identity object	Reads the product information from the IO-Link Master Unit or restarts the IO-Link Master Unit.	*A-1-1 Identity Object (Class ID: 01 Hex)* on page A-2
Assembly object	Binds the I/O data in the IO-Link Master Unit with I/O data from the external devices connected to it.	*A-1-2 Assembly Object (Class ID: 04 Hex)* on page A-4
TCP/IP Interface object	Configures the TCP/IP interface settings.	*A-1-3 TCP/IP Interface Object (Class ID: F5 Hex)* on page A-8
Ethernet Link object	Reads various information on an Ethernet Link.	*A-1-4 Ethernet Link Object (Class ID: F6 Hex)* on page A-11
DLR object	Indicates the status of the DLR network.	*A-1-5 DLR Object (Class ID: 47 Hex)* on page A-16
QoS object	Sets the value of the IPv4 DiffServ Code Point (DSCP) under Ethernet frame priority control.	*A-1-6 QoS Object (Class ID: 48 Hex)* on page A-17
Event Log object	Reads errors and events that occurred in the IO-Link Master Unit.	*A-1-7 Event Log Object (Class ID: 41 Hex)* on page A-18
Unit management object	Aggregates unit Information on the IO-Link Master Unit.	*A-1-8 Unit Management Object (Class ID: 380 Hex)* on page A-21
IO-Link object	Aggregates information on IO-Link master functions of the IO-Link Master Unit.	*A-1-9 IO-Link Object (Class ID: 381 Hex)* on page A-24
Diagnosis object	Executes the communications cable diagnosis and reads network statistical information.	*A-1-10 Diagnosis Object (Class ID: 382 Hex)* on page A-32
Error status object	Sets the hold setting for error status and provides the error cause or information for troubleshooting the IO-Link Master Unit.	*A-1-11 Error Status Object (Class ID: 383 Hex)* on page A-34

Precautions for Correct Use

For the above CIP objects, if the data type of parameter data is INT, UINT, UDINT, ULINT, WORD, or DWORD, store the data to write in little endian format. The read data is also stored in little endian format.

However, in this manual, the attributes values are written in big endian format.

A-1-1 Identity Object (Class ID: 01 Hex)

The Identify object reads the product information from the IO-Link Master Unit or restarts the IO-Link Master Unit.

Service Code

The service code specifies the service to execute.

Service code (hex)	Parameter name	Description	Supported service range	
			Class	Instance
01	Get_Attribute_All	Reads the values of all attributes.	No	Yes
05	Reset	00 hex: Restarts 01 hex: Restarts with default settings	No	Yes
0E	Get_Attribute_Single	Reads the value of a specified attribute.	Yes	Yes

Class ID and Instance ID

The class ID and instance ID are given in the following table.

ID type	Value (hex)
Class ID	01
Instance ID	00: Specifies the class. 01: Specifies the instance.

Attribute ID

The attribute ID specifies the information to read.

● Class Attribute ID

The class attribute ID specifies the attribute of the entire object.

Attribute ID (hex)	Parameter name	Description	Attribute	Data	
				Data type	Value (hex)
01	Revision	Revision of the object	Read	UINT	0001
02	Max Instance	Maximum instance number	Read	UINT	0001

● Instance Attribute ID

The instance attribute ID specifies the attribute ID of the instance.

Attribute ID (hex)	Parameter name	Description	Attribute	Data	
				Data type	Value (hex)
01	Vendor ID	Vendor ID	Read	UINT	002F
02	Device Type	Device type	Read	UINT	000C
03	Product Code	Product code	Read	UINT	Refer to *Value of Product Code* on page A-4 below.
04	Revision	Device CIP revision	Read	STRUCT	---
	Major Revision	Major revision	Read	USINT	Refer to *Value of Revision* on page A-4 below.
	Minor Revision	Minor revision	Read	USINT	
05	Status	IO-Link Master Unit status	Read	WORD	Refer to *Values of Status* on page A-4 below.
06	Serial Number	Serial number	Read	UDINT	Unique number assigned to each IO-Link Master Unit
07	Product Name	Product name	Read	SHORT STRING	Refer to *Value of Product Name* on page A-4 below.

● **Value of Product Code**

Model	Value of Product Code (hex)
NXR-ILM08C-EIT	06A3

● **Value of Revision**

Unit version of IO-Link Master Unit	CIP revision	
	Value of Major Revision (hex)	Value of Minor Revision (hex)
Ver.1.1	01	01
Ver.1.0		

● **Values of Status**

Bit	Name	Description
0	Owned	Indicates that the IO-Link Master Unit opened a connection as the target. • TRUE: Open. • FALSE: Not open.
1	Reserved	Always FALSE
2	Configured	Always TRUE
3	Reserved	Always FALSE
4 to 7	Extended Device Status	Always FALSE
8	Minor Recoverable Fault	Always FALSE
9	Minor Unrecoverable Fault	Always FALSE
10	Major Recoverable Fault	• TRUE: An IP Address Duplication occurred. • FALSE: The above error did not occur.
11	Major Unrecoverable Fault	Always FALSE
12 to 15	Reserved	Always FALSE

● **Value of Product Name**

Value (hex)	Description
0E4E58522D494C4D3038432D454954	Indicates "NXR-ILM08C-EIT."

A-1-2 Assembly Object (Class ID: 04 Hex)

The Assembly object binds the I/O data in the the IO-Link Master Unit with I/O data from the external devices connected to it.

Service Code

The service code specifies the service to execute.

Service code (hex)	Parameter name	Description	Supported service range	
			Class	Instance
0E	Get_Attribute_Single	Reads the value of a specified attribute.	Yes	Yes
10	Set_Attribute_Single	Writes the value of a specified attribute.	No	Yes

Class ID and Instance ID

The class ID and instance ID are given in the following table.

ID type	Value (hex)	Description
Class ID	04	---
Instance ID	00	Specifies the class.
	6E	Specifies Input Assembly Instance Number 110. This includes the following data. • Unit Status • Port Error Status • Pin 4/Pin 2 Digital Input Data • Integrated IO-Link Input Data • IO-Link Input Data (2 bytes × 8 ports)
	6F	Specifies Input Assembly Instance Number 111. This includes the following data. • Unit Status • Port Error Status • Pin 4/Pin 2 Digital Input Data • Integrated IO-Link Input Data • IO-Link Input Data (8 bytes × 8 ports)
	70	Specifies Input Assembly Instance Number 112. This includes the following data. • Unit Status • Port Error Status • Pin 4/Pin 2 Digital Input Data • Integrated IO-Link Input Data • IO-Link Input Data (32 bytes × 8 ports)
	7E	Specifies Input Assembly Instance Number 126. This includes the following data. • Unit Status • Port Error Status • Pin 4/Pin 2 Digital Input Data • Integrated IO-Link Input Data
	84	Specifies Output Assembly Instance Number 132. This includes the following data. • Pin 4/Pin 2 Digital Output Data • IO-Link Output Data (2 bytes × 8 ports)
	85	Specifies Output Assembly Instance Number 133. This includes the following data. • Pin 4/Pin 2 Digital Output Data • IO-Link Output Data (8 bytes × 8 ports)
	86	Specifies Output Assembly Instance Number 134. This includes the following data. • Pin 4/Pin 2 Digital Output Data • IO-Link Output Data (32 bytes × 8 ports)
	94	Specifies Output Assembly Instance Number 148. This includes the following data. • Pin 4/Pin 2 Digital Output Data
	C5	Specifies Output Assembly Instance Number 197. This is the Input Only Heart Beat instance.

If you use a master from another company, set the following instance IDs according to the connection form of the tag data link communications (implicit message). These settings are not required if you import the EDS file into the support software of the other company.

Connection I/O type	Instance ID	
	Input Assembly Instance Number (hex)	Output Assembly Instance Number (hex)
Exclusive Owner	6E	84
	6F	85
	70	86
	7E	94
Input Only	6E	C5
	6F	C5
	70	C5
	7E	C5

Attribute ID

The attribute ID specifies the information to read.

● Class Attribute ID

The class attribute ID specifies the attribute of the entire object.

Attribute ID (hex)	Parameter name	Description	Attribute	Data	
				Data type	Value (hex)
01	Revision	Revision of the object	Read	UINT	0002
02	Max Instance	Maximum instance number	Read	UINT	00FF

● Instance Attribute ID

The instance attribute ID specifies the attribute ID of the instance.

Attribute ID for Instance ID 6E Hex

Attribute ID (hex)	Parameter name	Description	Attribute	Data	
				Data type	Value
03	Data	• Unit Status • Port Error Status • Pin 4/Pin 2 Digital Input Data • Integrated IO-Link Input Data • IO-Link Input Data (2 bytes × 8 ports)	Read	ARRAY OF BYTE	46 bytes data

Attribute ID for Instance ID 6F Hex

Attribute ID (hex)	Parameter name	Description	Attribute	Data	
				Data type	Value
03	Data	• Unit Status • Port Error Status • Pin 4/Pin 2 Digital Input Data • Integrated IO-Link Input Data • IO-Link Input Data (8 bytes × 8 ports)	Read	ARRAY OF BYTE	94 bytes data

Attribute ID for Instance ID 70F Hex

Attribute ID (hex)	Parameter name	Description	Attribute	Data	
				Data type	Value
03	Data	• Unit Status • Port Error Status • Pin 4/Pin 2 Digital Input Data • Integrated IO-Link Input Data • IO-Link Input Data (32 bytes × 8 ports)	Read	ARRAY OF BYTE	286 bytes data

Attribute ID for Instance ID 7E Hex

Attribute ID (hex)	Parameter name	Description	Attribute	Data	
				Data type	Value
03	Data	• Unit Status • Port Error Status • Pin 4/Pin 2 Digital Input Data • Integrated IO-Link Input Data	Read	ARRAY OF BYTE	30 bytes data

Attribute ID for Instance ID 84 Hex

Attribute ID (hex)	Parameter name	Description	Attribute	Data	
				Data type	Value
03	Data	• Pin 4/Pin 2 Digital Output Data • IO-Link Output Data (2 bytes × 8 ports)	Read/Write	ARRAY OF BYTE	18 bytes data Default value: All 0s

Attribute ID for Instance ID 85 Hex

Attribute ID (hex)	Parameter name	Description	Attribute	Data	
				Data type	Value
03	Data	• Pin 4/Pin 2 Digital Output Data • IO-Link Output Data (8 bytes × 8 ports)	Read/Write	ARRAY OF BYTE	66 bytes data Default value: All 0s

Attribute ID for Instance ID 86 Hex

Attribute ID (hex)	Parameter name	Description	Attribute	Data	
				Data type	Value
03	Data	• Pin 4/Pin 2 Digital Output Data • IO-Link Output Data (32 bytes × 8 ports)	Read/Write	ARRAY OF BYTE	258 bytes data Default value: All 0s

Attribute ID for Instance ID 94 Hex

Attribute ID (hex)	Parameter name	Description	Attribute	Data	
				Data type	Value
03	Data	• Pin 4/Pin 2 Digital Output Data	Read/Write	ARRAY OF BYTE	2 bytes data Default value: All 0s

A-1-3 TCP/IP Interface Object (Class ID: F5 Hex)

The TCP/IP Interface object configures the TCP/IP interface settings.

Service Code

The service code specifies the service to execute.

Service code (hex)	Parameter name	Description	Supported service range	
			Class	Instance
01	Get_Attribute_All	Reads the values of all attributes.	No	Yes
0E	Get_Attribute_Single	Reads the value of a specified attribute.	Yes	Yes
10	Set_Attribute_Single	Writes the value of a specified attribute.	No	Yes

Class ID and Instance ID

The class ID and instance ID are given in the following table.

ID type	Value (hex)
Class ID	F5
Instance ID	00: Specifies the class. 01: Specifies the instance.

Attribute ID

The attribute ID specifies the information to read.

● Class Attribute ID

The class attribute ID specifies the attribute of the entire object.

Attribute ID (hex)	Parameter name	Description	Attribute	Data	
				Data type	Value (hex)
01	Revision	Revision of the object	Read	UINT	0004

● Instance Attribute ID

The instance attribute ID specifies the attribute ID of the instance.

Attrib- ute ID (hex)	Parameter name	Description	Attribute	Data	
				Data type	Value (hex)
01	Status	Interface IP address setting condition	Read	DWORD	Refer to *Values of Status* on page A-10 below.
02	Configuration Capability	Controller configuration and settings that are possible for the interface	Read	DWORD	Refer to *Values of Configuration Capability* on page A-10 below.
03	Configuration Control	IP address setting method when interface started	Read/ Write	DWORD	Refer to *Values of Configuration Control* on page A-11 below. Default: 00000000

Attribute ID (hex)	Parameter name		Description	Attribute	Data	
					Data type	Value (hex)
04	Physical Link Object		Path to physical link object	Read	STRUCT	---
		Path size	Path size in words		UINT	0000
		Path	Fixed path to physical link object		Padded EPATH	---
05	Interface Configuration		Interface settings	Read/ Write	STRUCT	---
		IP Address	IP address		UDINT	Set value Default: C0A8FA01
		Network Mask	Subnet mask		UDINT	Set value Default: FFFFFF00
		Gateway Address	Default gateway		UDINT	Set value Default: 00000000
		Name Server	Primary name server		UDINT	00000000 (fixed)
		Name Server 2	Secondary name server		UDINT	00000000 (fixed)
		Domain Name	Domain name		STRING	0000 (fixed)
06	Host Name		Host name	Read/ Write	STRING	0000 (fixed) Default: 0000
0A	SelectAcd		ACD Setting	Read/ Write	BOOL	TRUE: Enable FALSE: Disable Default: TRUE
0B	LastConflictDetected		Information on the last detected IP address duplication	Read/ Write	STRUCT	---
		AcdActivity	ACD state when IP address duplication was last detected		USINT	00 to 03 Default: 00
		RemoteMAC	MAC address in the ARP PDU when IP address duplication was last detected		Array OF 6 USINT	Default: All 0s
		ArpPdu	Raw data in the ARP PDU when IP address duplication was last detected		ARRAY OF 28 USINT	Default: All 0s
0C	EtherNet/IP QuickConnect		QuickConnect Setting	Read/ Write	BOOL	TRUE: Enable FALSE: Disable Default: FALSE
0D	Encapsulation Inactivity Timeout		Encapsulation inactivity timeout time	Read/ Write	UINT	0000: Disable 0001 to 0E10: Timeout time (in seconds) Default: 0078

● **Values of Status**

Bit	Name	Description
0 to 3	Interface Configuration Status	Indicates the configuration status of the instance attribute ID 05 hex (Interface Configuration). • 0: Not set or initializing • 1: IP address already set by a method other than directly setting the IP address with hardware switches • 2: IP address already set by directly setting with hardware switches • 3 to 15: Reserved
4	Reserved	Always FALSE
5	Interface Configuration Pending	• TRUE: The setting of the instance attribute ID 05 hex (Interface Configuration) was changed. The IO-Link Master Unit must be restarted to enable the change. • FALSE: The setting of the instance attribute ID 05 hex (Interface Configuration) was not changed.
6	AcdStatus	• TRUE: An IP address duplication was detected. However, this IP address can be used to continue CIP communications. • FALSE: No IP address duplication was detected.
7	AcdFault	• TRUE: This IP address cannot be used to continue CIP communications. • FALSE: No IP address duplication was detected. Or, although an IP address duplication was detected, this IP address can be used to continue CIP communications.
8 to 31	Reserved	Always FALSE

● **Values of Configuration Capability**

Bit	Name	Description
0	BOOTP Client	Always TRUE: Indicates that an BOOTP client is supported.
1	DNS Client	Always FALSE: Indicates that no DNS client is supported.
2	DHCP Client	Always TRUE: Indicates that a DHCP client is supported.
3	DHCP-DNS Update	Always FALSE: Indicates that no DHCP-DNS Update is supported.
4	Configuration Settable	• TRUE: IP address was set by a method other than directly setting the IP address with hardware switches. Indicates the instance attribute ID 05 hex (Interface Configuration) can be set. • FALSE: IP address was directly set with hardware switches. Indicates the instance attribute ID 05 hex (Interface Configuration) cannot be set.
5	Hardware Configurable	Always TRUE: Indicates that directly setting the IP address with hardware switches is possible.
6	Interface Configuration Change Requires Reset	Always FALSE: Indicates that resetting the devices is unnecessary to enable a change to the instance attribute ID 05 hex (Interface Configuration).
7	AcdCapable	Always TRUE: Indicates that IP address duplication detection is supported.
8 to 31	Reserved	Always FALSE

● **Values of Configuration Control**

Bit	Name	Description
0 to 3	Configuration Method	Sets the method to set the IP address of the IO-Link Master Unit. • 0: Uses the setting that is saved in non-volatile memory. • 1: Sets the IP address by the BOOTP server. • 2: Sets the IP address by the DHCP server. • 3 to 15: Reserved
4	DNS Enable	Always FALSE: DNS is disabled.
5 to 31	Reserved	Always FALSE

A-1-4 Ethernet Link Object (Class ID: F6 Hex)

The Ethernet Link object reads various information on an Ethernet Link.

Service Code

The service code specifies the service to execute.

Service code (hex)	Parameter name	Description	Supported service range	
			Class	Instance
01	Get_Attribute_All	Reads the values of all attributes.	No	Yes
0E	Get_Attribute_Single	Reads the value of a specified attribute.	Yes	Yes
10	Set_Attribute_Single	Writes the value of a specified attribute.	No	Yes
4C	Get_and_Clear	Reads and then clears a specified attribute value.[1]	No	Yes

*1. This service is supported by the following instance attribute IDs.
   • Interface Counters (04 hex)
   • Media Counters (05 hex)

Class ID and Instance ID

The class ID and instance ID are given in the following table.

ID type	Value (hex)
Class ID	F6
Instance ID	00: Specifies the class. 01: Specifies EtherNet/IP port 1. 02: Specifies EtherNet/IP port 2.

Attribute ID

The attribute ID specifies the information to read.

● **Class Attribute ID**

The class attribute ID specifies the attribute of the entire object.

Attribute ID (hex)	Parameter name	Description	Attribute	Data	
				Data type	Value (hex)
01	Revision	Revision of the object	Read	UINT	0004
02	Max Instance	Maximum instance number	Read	UINT	0002
03	Number of Instances	Number of instances of this object	Read	UINT	0002

● **Instance Attribute ID**

The instance attribute ID specifies the attribute ID of the instance.

Attrib-ute ID (hex)	Parameter name	Description	Attrib-ute	Data	
				Data type	Value (hex)
01	Interface Speed	Interface communications speed	Read	UDINT	000A: 10 Mbps 0064: 100 Mbps
02	Interface Flags	Interface status	Read	DWORD	Refer to *Values of Interface Flags* on page A-14 below.
03	Physical Address	Interface MAC address	Read	ARRAY OF USINT[1]	MAC address
04	Interface Counters	Interface counter	Read	STRUCT	---
	In Octets	Number of bytes of receive data		UDINT	00000000 to FFFFFFFF
	In Ucast Packets	Number of bytes of unicast receive data		UDINT	00000000 to FFFFFFFF
	In NUcast Packets	Number of bytes of non-uni-cast receive data		UDINT	00000000 to FFFFFFFF
	In Discards	Number of bytes of discard-ed receive data		UDINT	00000000 to FFFFFFFF
	In Errors	Number of bytes of error re-ceive data		UDINT	00000000 to FFFFFFFF
	In Unknown Protos	Number of bytes of unsup-ported protocol receive data		UDINT	00000000 to FFFFFFFF
	Out Octets	Number of bytes of send da-ta		UDINT	00000000 to FFFFFFFF
	Out Ucast Packets	Number of bytes of unicast send data		UDINT	00000000 to FFFFFFFF
	Out NUcast Packets	Number of bytes of non-uni-cast send data		UDINT	00000000 to FFFFFFFF
	Out Discards	Number of bytes of discard-ed send data		UDINT	00000000 to FFFFFFFF
	Out Errors	Number of bytes of error send data		UDINT	00000000 to FFFFFFFF

Attrib- ute ID (hex)	Parameter name	Description	Attrib- ute	Data	
				Data type	Value (hex)
05	Media Counters	Media counters	Read	STRUCT	---
	Alignment Errors	Number of received align- ment error frames		UDINT	00000000 to FFFFFFFF
	FCS Errors	FCS error reception count		UDINT	00000000 to FFFFFFFF
	Single Collisions	Number of successfully sent frames with a collision de- tected		UDINT	00000000 to FFFFFFFF
	Multiple Collisions	Number of successfully sent frames with more than one collision detected		UDINT	00000000 to FFFFFFFF
	SQE Test Errors	Number of occurrences of SQE test errors		UDINT	00000000 to FFFFFFFF
	Deferred Transmis- sions	Number of frames with a send delay		UDINT	00000000 to FFFFFFFF
	Late Collisions	Number of times of collisions detected in 512 bit time after packet transmission		UDINT	00000000 to FFFFFFFF
	Excessive Collisions	Number of unsuccessfully sent frames due to excessive collisions		UDINT	00000000 to FFFFFFFF
	MAC Transmit Errors	Number of unsuccessfully sent frames due to a MAC layer transmission error		UDINT	00000000 to FFFFFFFF
	Carrier Sense Errors	Number of times of detected carrier sensor errors		UDINT	00000000 to FFFFFFFF
	Frame Too Long	Number of frames that ex- ceeded the maximum frame size		UDINT	00000000 to FFFFFFFF
	MAC Receive Errors	Number of unsuccessfully re- ceived frames due to a MAC layer reception error		UDINT	00000000 to FFFFFFFF
06	Interface Control	Physical interface configura- tion	Read/ Write	STRUCT	---
	Control Bits	Interface control bits		WORD	Refer to *Values of Control Bits* on page A-15 below. Default: 0001
	Forced Interface Speed	Forced interface speed		UINT	Refer to *Values of Forced Interface Speed* on page A-15 below. Default: 0000
07	Interface Type	Interface type	Read	USINT	02
08	Interface State	Interface state	Read	USINT	Refer to *Values of Interface State* on page A-15 below.

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A-1 Supported CIP Objects

A-1-4 Ethernet Link Object (Class ID: F6 Hex)

Attrib-ute ID (hex)	Parameter name			Description	Attrib-ute	Data		
						Data type		Value (hex)
0A	Interface Label			Interface identification text string	Read	SHORT STRING		Instance 1: "Ethernet Port 1" Instance 2: "Ethernet Port 2"
0B	Interface Capability			Interface communications performance	Read	STRUCT		---
		Capability Bits		Communications performance setting			DWORD	Refer to *Values of Capability Bits* on page A-15 below.
		Speed/Duplex Options		Communications speed/bidirectional options			STRUCT	---
			Speed/Duplex Array Count	Communications speed/bidirectional array size				USINT	04
			Speed/Duplex Array	Communications speed/bidirectional array				ARRAY OF STRUCT	---
				Interface Speed	Interface communications speed				UINT	000A: 10 Mbps
				Interface Duplex Mode	Interface bidirectional mode				USINT	00: Half Duplex
			Speed/Duplex Array	Communications speed/bidirectional array				ARRAY OF STRUCT	---
				Interface Speed	Interface communications speed				UINT	000A: 10 Mbps
				Interface Duplex Mode	Interface bidirectional mode				USINT	01: Full Duplex
			Speed/Duplex Array	Communications speed/bidirectional array				ARRAY OF STRUCT	---
				Interface Speed	Interface communications speed				UINT	0064: 100 Mbps
				Interface Duplex Mode	Interface bidirectional mode				USINT	00: Half Duplex
			Speed/Duplex Array	Communications speed/bidirectional array				ARRAY OF STRUCT	---
				Interface Speed	Interface communications speed				UINT	0064: 100 Mbps
				Interface Duplex Mode	Interface bidirectional mode				USINT	01: Full Duplex

*1. The array size is 6.

● **Values of Interface Flags**

Bit	Name	Description
0	Link Status	• TRUE: An Ethernet link is established. • FALSE: No Ethernet link is established.
1	Half/Full Duplex	• TRUE: Full Duplex • FALSE: Half Duplex

Bit	Name	Description
2 to 4	Negotiation Status	• 00 hex: Auto-negotiation is in progress. • 01 hex: Auto-negotiation and speed detection failed. Communicating at 10 Mbps, Half Duplex. • 02 hex: Auto-negotiation failed, but speed detection was successful. Communicating at Half Duplex. • 03 hex: Auto-negotiation was successful. • 04 hex: Operating in fixed mode.
5	Manual Setting Requires Reset	Refer to the description of Bit 0 in *Values of Capability Bits* on page A-15 below.
6	Local Hardware Fault	Always FALSE
7 to 31	Reserved	Always FALSE

● Values of Control Bits

Bit	Name	Description
0	Auto-negotiate	• TRUE: Auto-negotiate is enabled. • FALSE: Auto-negotiate is disabled. Operating according to the Forced Duplex Mode and Forced Interface Speed settings.
1	Forced Duplex Mode	This bit is used when Auto-negotiate is FALSE. If this bit is set when Auto-negotiate is TRUE, the error code 0C hex (Object State Conflict) is returned. • TRUE: Full Duplex • FALSE: Half Duplex
2 to 15	Reserved	Always FALSE

● Values of Forced Interface Speed

If Auto-negotiate is FALSE, set the forced interface speed. If a value not listed in the following table is set, the error code 09 hex (Invalid Attribute Value) is returned.

Value (hex)	Description
0A	10 Mbps
64	100 Mbps

If this field is set when Auto-negotiate is TRUE, the error code 0C hex (Object State Conflict) is returned.

● Values of Interface State

Value (hex)	Description
00	Status unclear
01	Ready to send/receive
02	Disabled
03	Testing
04 to FF	Reserved

● Values of Capability Bits

Bit	Name	Description
0	Manual Setting Requires Reset	Indicates whether resetting the device is required after the Interface Control Attribute is changed. Always FALSE: Resetting the device is not required.

Bit	Name	Description
1	Auto-negotiate	Always TRUE: Auto-negotiation is supported.
2	Auto-MDIX	Always TRUE: Auto-MDIX is supported.
3	Manual Speed/Duplex	Always TRUE: Manual Speed/Duplex setting is supported.
4 to 31	Reserved	Always FALSE

A-1-5　DLR Object (Class ID: 47 Hex)

The DLR object indicates the status of the DLR network.

Service Code

The service code specifies the service to execute.

Service code (hex)	Parameter name	Description	Supported service range	
			Class	Instance
01	Get_Attribute_All	Reads the values of all attributes.	No	Yes
0E	Get_Attribute_Single	Reads the value of a specified attribute.	Yes	Yes
10	Set_Attribute_Single	Writes the value of a specified attribute.	No	Yes

Class ID and Instance ID

The class ID and instance ID are given in the following table.

ID type	Value (hex)
Class ID	47
Instance ID	00: Specifies the class. 01: Specifies the instance.

Attribute ID

The attribute ID specifies the information to read.

● Class Attribute ID

The class attribute ID specifies the attribute of the entire object.

Attribute ID (hex)	Parameter name	Description	Attribute	Data	
				Data type	Value (hex)
01	Revision	Revision of the object	Read	UINT	0003

● Instance Attribute ID

The instance attribute ID specifies the attribute ID of the instance.

Attribute ID (hex)	Parameter name	Description	Attribute	Data	
				Data type	Value (hex)
01	Network Topology	Current network topology	Read	USINT	Refer to *Values of Network Topology* on page A-17 below.
02	Network Status	Current network status	Read	USINT	Refer to *Values of Network Status* on page A-17 below.

Attribute ID (hex)	Parameter name	Description	Attrib-ute	Data	
				Data type	Value (hex)
0A	Active Supervisor Address	IP and MAC addresses of the active ring supervisor	Read	ARRAY OF STRUCT	---
	Supervisor IP Address	IP address of the active ring supervisor		UDINT	IP address of the ring supervisor. All 0s if the IP address of the ring supervisor is not set
	Supervisor MAC Address	MAC address of the active ring supervisor		ARRAY OF USINT[1]	Ethernet MAC address of the active ring supervisor
0C	Capability Flags	Capability flag of the DLR device	Read	DWORD	00000082 (fixed) Flush_Tables frame is supported in a Beacon-based ring node.

*1.   The array size is 6.

● Values of Network Topology

Value (hex)	Description
00	Linear topology
01	Ring topology

● Values of Network Status

Value (hex)	Description
00	Operating normally in a linear or ring topology.
01	A ring fault was detected. The network is enabled only if it is operating in a ring topology.
02	An unexpected loop was detected. The network is enabled only if it is operating in a liner topology.

A-1-6   QoS Object (Class ID: 48 Hex)

The QoS object sets the value of the IPv4 DiffServ Code Point (DSCP) under Ethernet frame priority control.

Service Code

The service code specifies the service to execute.

Service code (hex)	Parameter name	Description	Supported service range	
			Class	Instance
0E	Get_Attribute_Single	Reads the value of a specified attribute.	Yes	Yes
10	Set_Attribute_Single	Writes the value of a specified attribute.	No	Yes

Class ID and Instance ID

The class ID and instance ID are given in the following table.

ID type	Value (hex)
Class ID	48

ID type	Value (hex)
Instance ID	00: Specifies the class.
	01: Specifies the instance.

Attribute ID

The attribute ID specifies the information to read.

● Class Attribute ID

The class attribute ID specifies the attribute of the entire object.

Attribute ID (hex)	Parameter name	Description	Attribute	Data	
				Data type	Value (hex)
01	Revision	Revision of the object	Read	UINT	0001

● Instance Attribute ID

The instance attribute ID specifies the attribute ID of the instance.

Attribute ID (hex)	Parameter name	Description	Attribute	Data	
				Data type	Value (hex)
04	DSCP Urgent	DSCP value of the CIP Class 0/1 Urgent priority message	Read/Write	USINT	00 to 3F Default: 37
05	DSCP Scheduled	DSCP value of the CIP Class 0/1 Scheduled priority message	Read/Write	USINT	00 to 3F Default: 2F
06	DSCP High	DSCP value of the CIP Class 0/1 High priority message	Read/Write	USINT	00 to 3F Default: 2B
07	DSCP Low	DSCP value of the CIP Class 0/1 Low priority message	Read/Write	USINT	00 to 3F Default: 1F
08	DSCP Explicit	DSCP value of the CIP UCMM, Class 2/3, or other EtherNet/IP message	Read/Write	USINT	00 to 3F Default: 1B

A-1-7 Event Log Object (Class ID: 41 Hex)

The Event Log object reads errors and events that occurred in the IO-Link Master Unit.

Service Code

The service code specifies the service to execute.

Service code (hex)	Parameter name	Description	Supported service range	
			Class	Instance
05	Reset	Clears the event log.	No	Yes
0E	Get_Attribute_Single	• When a class is specified: Reads the value of the specified class attribute ID. • When an instance is specified: Reads the value of the specified instance attribute. When Event/Data Log (attribute ID: 0E hex) is specified, this reads all event logs.	Yes	Yes

Service code (hex)	Parameter name	Description	Supported service range	
			Class	Instance
10	Set_Attrib- ute_Single	Writes the value of a specified attribute.	Yes	Yes

Reset (Service Code: 05 Hex)

Clears the event log.

● Request Data Format

Parameter name	Description	Data type	Value (hex)
Service	Service code	USINT	05
Request Path Size	Request path size	USINT	02
Request Path	Request path	Padded EPATH	20412401
Parameter	Parameters	USINT	• 00: Clears only the event logs in RAM. • 01: Clears all event logs in RAM and non-vola-tile memory.

● Response Format

When the execution is successful:

Parameter name	Description	Data type	Value (hex)
Reply Service	Reset service response	USINT	85
Reserved	Reserved	octet	00
General Status	Code that indicates normal	USINT	00
Size of Additional Status	Size of Additional status	USINT	00

When the execution failed:

Parameter name	Description	Data type	Value (hex)
Reply Service	Reset service response	USINT	85
Reserved	Reserved	octet	00
General Status	Current error code defined by CIP	USINT	Current error code[1]
Size of Additional Status	Size of Additional status	USINT	00

*1. The error codes defined by CIP for the current error are as follows.

Value (hex)	Description
02	Resource unavailable
10	Device state conflict
13	Not enough data
15	Too much data
1F	Vendor specific error
20	Invalid parameter

Class ID and Instance ID

The class ID and instance ID are given in the following table.

ID type	Value (hex)
Class ID	41
Instance ID	00: Specifies the class.
	01: Specifies the instance.

Attribute ID

The attribute ID specifies the information to read.

● Class Attribute ID

The class attribute ID specifies the attribute of the entire object.

Attribute ID (hex)	Parameter name	Description	Attribute	Data	
				Data type	Value (hex)
01	Revision	Revision of the object	Read	UINT	0001
02	Max Instance	Maximum instance number	Read	UINT	0001
03	Number of Instances	Number of instances of this object	Read	UINT	0001
32	Time Format	Format of time information	Read	USINT	*1
33	Present Time	Current time	Read/Write	TIME*2	80000000 to 7FFFFFFF Default: 00000000
				DATE AND TIME*3	DT#1972010100:00:00.000 to DT#2151060623:59:59.999 Default: 000000000000

*1. One of the following values is read depending on whether automatic clock adjustment is enabled or disabled.

Automatic clock adjustment	Value (hex)	Description
When the function is disabled	DB	Indicates that the data type is TIME.
When the function is enabled	CF	Indicates that the data type is DATE AND TIME.

*2. This is the data type for attribute ID 32 hex when the value is DB hex.
*3. This is the data type for attribute ID 32 hex when the value is CF hex. When automatic clock adjustment is enabled, the object reads the value retrieved from the NTP or SNTP server.

● Instance Attribute ID

The instance attribute ID specifies the attribute ID of the instance.

Attribute ID (hex)	Parameter name	Description	Attribute	Data	
				Data type	Value (hex)
02	State	Instance state	Read	USINT	00: Non-existent 02: Empty 03: Available 04: Full/Overwrite
09	Logged Data Configuration	Event Log Logged Data Configuration	Read/Write	BYTE	00: Event Identifier 01: Event Identifier + Time Stamp Default: 00

Attribute ID (hex)	Parameter name	Description	Attribute	Data	
				Data type	Value (hex)
0C	Event/Data Log Maximum Size	Maximum number of event log entries	Read	UDINT	00000028
0D	Event/Data Log Size	Number of currently registered event logs	Read	UDINT	00000000 to 00000028
0E	Event/Data Log	Event logs	Read	ARRAY OF STRUCT	*1
18	Event Identifier Format	Event log format	Read	USINT	01: 48-bit object model/error format

*1. The data format for each event log is shown in the following table. All the registered event logs are read in order from the oldest. Refer to *12-5-3 Event Codes for Errors and Troubleshooting Procedures* on page 12-30 for details on event codes for errors and troubleshooting procedures.
The data format differs depending on the value of attribute ID 09 hex (Logged Data Configuration).

- When attribute ID 09 hex is 00 hex (Event Identifier)

Byte offset	Data type	Description
0	UINT	CIP object class ID for the event source
2	USINT	CIP object instance ID for the event source
3	USINT	CIP general status code. For the IO-Link Master Unit, this is fixed to 1F hex.
4	UINT	Expansion error code: • Lower byte: Error code in the class • Upper byte: Detailed code

- When attribute ID 09 hex is 01 hex (Event Identifier + Time Stamp)

Byte offset	Data type	Description
0	UINT	CIP object class ID for the event source
2	USINT	CIP object instance ID for the event source
3	USINT	CIP general status code. For the IO-Link Master Unit, this is fixed to 1F hex.
4	UINT	Expansion error code: • Lower byte: Error code in the class • Upper byte: Detailed code
5	TIME or DATE AND TIME	Time of event occurrence: • When automatic clock adjustment is disabled: TIME (4 bytes) • When automatic clock adjustment is enabled: DATE AND TIME (6 bytes)

A-1-8   Unit Management Object (Class ID: 380 Hex)

The Unit management object aggregates unit information on the IO-Link Master Unit.

Service Code

The service code specifies the service to execute.

Service code (hex)	Parameter name	Description	Supported service range	
			Class	Instance
01	Get_Attribute_All	Reads the values of all attributes.	Yes	No
0E	Get_Attribute_Single	Reads the value of a specified attribute.	Yes	Yes

Service code (hex)	Parameter name	Description	Supported service range	
			Class	Instance
10	Set_Attribute_Single	Writes the value of a specified attribute.	No	Yes

Class ID and Instance ID

The class ID and instance ID are given in the following table.

ID type	Value (hex)
Class ID	380
Instance ID	00: Specifies the class.
	01: Specifies the instance.

Attribute ID

The attribute ID specifies the information to read.

● Class Attribute ID

The class attribute ID specifies the attribute of the entire object.

Attribute ID (hex)	Parameter name	Description	Attribute	Data	
				Data type	Value (hex)
01	Revision	Revision of the object	Read	UINT	0001
02	Max Instance	Maximum instance number	Read	UINT	0001
03	Number of Instances	Number of instances of this object	Read	UINT	0001

● Instance Attribute ID

The instance attribute ID specifies the attribute ID of the instance.

Attribute ID (hex)	Parameter name	Description	Attribute	Data	
				Data type	Value (hex)
01	Unit Version	Unit version	Read	DWORD	Unit version of the IO-Link Master Unit[1]
02	Hardware Version	Hardware version	Read	DWORD	Hardware version of the IO-Link Master Unit
03	Software Version	Software version	Read	DWORD	Software version of the IO-Link Master Unit
04	Lot Number	Lot number	Read	DWORD	Unique number assigned to each IO-Link Master Unit
05	Unit/Input Power Supply Voltage	Unit/input power supply voltage (Unit: 0.1 V)	Read	UINT	0000 to FFFF
06	Maximum Unit/Input Power Supply Voltage	Maximum Unit/input power supply voltage (Unit: 0.1 V)	Read	UINT	0000 to FFFF
07	Minimum Unit/Input Power Supply Voltage	Minimum Unit/input power supply voltage (Unit: 0.1 V)	Read	UINT	0000 to FFFF

Attribute ID (hex)	Parameter name	Description	Attrib- ute	Data	
				Data type	Value (hex)
08	Output Power Supply Voltage	Output power supply voltage (Unit: 0.1 V)	Read	UINT	0000 to FFFF
09	Maximum Output Power Supply Voltage	Maximum output power sup- ply voltage (Unit: 0.1 V)	Read	UINT	0000 to FFFF
0A	Minimum Output Pow- er Supply Voltage	Minimum output power supply voltage (Unit: 0.1 V)	Read	UINT	0000 to FFFF
0B	Total Power-ON Time	Total power-ON time (Unit: h)	Read	UDINT	00000000 to 2AAAAAAA
0C	NTP/SNTP Server IP Address	IP address of the NTP/SNTP server from which to get time information with the automatic clock adjustment	Read/ Write	SHORT STRING	"0": Automatic clock adjust- ment disabled Not "0": NTP/SNTP Server IP Address Default: All 0s
0D	Time Zone	Time zone used with the auto- matic clock adjustment	Read/ Write	UINT	0000 to 002A[*2] Default: 000F

*1. Bits 24 to 31: Integer part of the unit version
    Bits 16 to 23: Decimal part of the unit version
    Bits 0 to 15: Reserved
    (Example) For Ver.1.0, 0100□□□□ hex

*2. The values of Time Zone are listed below.

Value (hex)	Description
0000	(GMT -12:00) Kwajalein
0001	(GMT -11:00) Midway Island
0002	(GMT -10:00) USA (Hawaii)
0003	(GMT -09:00) USA (Alaska)
0004	(GMT -08:00) Canada, USA (Pacific)
0005	(GMT -07:00) Canada, USA (Mountain)
0006	(GMT -06:00) Canada, USA (Central)
0007	(GMT -05:00) Canada, USA (Eastern)
0008	(GMT -04:00) Canada (Atlantic)
0009	(GMT -03:30) Canada (Newfoundland)
000A	(GMT -03:00) Argentina
000B	(GMT -02:00) Antarctica
000C	(GMT -01:00) Azores
000D	(GMT +00:00) England
000E	(GMT +00:00) United Kingdom, Portugal
000F	(GMT +00:00) Greenwich Mean Time (UTC)
0010	(GMT +01:00) France, Germany, Italy, Spain, Switzerland
0011	(GMT +01:00) Sweden
0012	(GMT +02:00) Bulgaria, Finland, Greece
0013	(GMT +03:00) Russia (Moscow, St. Petersburg)
0014	(GMT +03:30) Iran
0015	(GMT +04:00) Russia (Samara, Izhevsk)
0016	(GMT +04:30) Afghanistan
0017	(GMT +05:00) Russia (Yekaterinburg, Perm)

A

A-1 Supported CIP Objects

A-1-8 Unit Management Object (Class ID: 380 Hex)

Value (hex)	Description
0018	(GMT +05:30) India
0019	(GMT +05:45) Nepal
001A	(GMT +06:00) Russia (Novosibirsk, Omsk)
001B	(GMT +06:30) Myanmar
001C	(GMT +07:00) Thailand
001D	(GMT +07:00) Vietnam
001E	(GMT +08:00) Australia (Western)
001F	(GMT +08:00) China
0020	(GMT +08:00) Taiwan
0021	(GMT +09:00) Japan
0022	(GMT +09:00) Republic of Korea
0023	(GMT +09:30) Australia (Northern Territory), Australia (South)
0024	(GMT +10:00) Australia (New South Wales/Queensland/Victoria)
0025	(GMT +10:30) Australia (Lord Howe Island)
0026	(GMT +11:00) New Caledonia
0027	(GMT +11:30) Norfolk Island
0028	(GMT +12:00) New Zealand
0029	(GMT +12:45) Chatham Island
002A	(GMT +13:00) Tonga

A-1-9　IO-Link Object (Class ID: 381 Hex)

The IO-Link object aggregates information on IO-Link master functions of the IO-Link Master Unit.

Service Code

The service code specifies the service to execute.

Service code (hex)	Parameter name	Description	Supported service range	
			Class	Instance
01	Get_Attribute_All	Reads the values of all attributes.	Yes	No
0E	Get_Attribute_Single	Reads the value of a specified attribute.	Yes	Yes
10	Set_Attribute_Single	Writes the value of a specified attribute.	No	Yes
32	IO-Link Device list Setting	Instructs the IO-Link Master Unit to create a device list.	Yes	No
33	Backup Data Clear	Clears the backup data.	Yes	No
34	Message for IO-Link device	Sends a message to a IO-Link device.	No	Yes

IO-Link Device list Setting (Service Code: 32 Hex)

Instructs the IO-Link Master Unit to create a device list for IO-Link device verification. The request format, format for normal responses, format for error responses, and CIP error codes are given below.

● **Request Data Format**

Parameter name	Description	Data type	Value (hex)
Service	Service code	USINT	32
Request Path Size	Request path size	USINT	03
Request Path	Request path	Padded EPATH	210081032400

● **Response Format**

When the execution is successful:

Parameter name	Description	Data type	Value (hex)
Reply Service	IO-Link Device list Setting service response	USINT	B2
Reserved	Reserved	octet	00
General Status	Code that indicates normal	USINT	00
Size of Additional Status	Size of Additional status	USINT	00

When the execution failed:

Parameter name	Description	Data type	Value (hex)
Reply Service	IO-Link Device list Setting service response	USINT	B2
Reserved	Reserved	octet	00
General Status	Current error code defined by CIP	USINT	Current error code[1]
Size of Additional Status	Size of Additional status	USINT	00 to 01
Additional Status	Additional status	UINT	Additional status

*1.   The error codes defined by CIP for the current error are as follows.

Value (hex)	Description
02	Resource unavailable
10	Device state conflict
13	Not enough data
15	Too much data
1F	Vendor specific error
20	Invalid parameter

Backup Data Clear (Service Code: 33 Hex)

Clears the backup data in the IO-Link Master Unit.

● **Request Data Format**

Parameter name	Description	Data type	Value (hex)
Service	Service code	USINT	33
Request Path Size	Request path size	USINT	03
Request Path	Request path	Padded EPATH	210081032400

● **Response Format**

When the execution is successful:

Parameter name	Description	Data type	Value (hex)
Reply Service	Backup Data Clear service response	USINT	B3

Parameter name	Description	Data type	Value (hex)
Reserved	Reserved	octet	00
General Status	Code that indicates normal	USINT	00
Size of Additional Status	Size of Additional status	USINT	00

When the execution failed:

Parameter name	Description	Data type	Value (hex)
Reply Service	Backup Data Clear service response	USINT	B3
Reserved	Reserved	octet	00
General Status	Current error code defined by CIP	USINT	Current error code[1]
Size of Additional Status	Size of Additional status	USINT	00 to 01
Additional Status	Additional status	UINT	Additional status

*1. The error codes defined by CIP for the current error are as follows.

Value (hex)	Description
02	Resource unavailable
10	Device state conflict
13	Not enough data
15	Too much data
1F	Vendor specific error
20	Invalid parameter

Message for IO-Link device (Service Code: 34 Hex)

Sends a message to an IO-Link device connected to the IO-Link Master Unit.

● Request Data Format

Parameter name	Description	Data type	Value (hex)
Service	Service code	USINT	34
Request Path Size	Request path size	USINT	03
Request Path	Request path	Padded EPATH	210081032401 to 210081032408
Kind	Command type	USINT	00: Read 01: Write
Timeout	Time (s) for the IO-Link master to monitor the response from the IO-Link device	USINT	00 to 05
Index	Index number of the IO-Link device object (service data)	UINT	0000 to FFFF
Subindex	Subindex number of the IO-Link device object (service data)	USINT	00 to FF
Write Data Size[1]	Write data size	USINT	01 to E8
Write Data[1]	Write data	ARRAY OF USINT	00 to FF

*1. The data format when the command type is Write.

● Response Format

When the execution is successful:

Parameter name	Description	Data type	Value (hex)
Reply Service	Message for IO-Link device service response	USINT	B4
Reserved	Reserved	octet	00
General Status	Code that indicates normal	USINT	00
Size of Additional Status	Size of Additional status	USINT	00
Read Data Size[1]	Read data size	USINT	01 to FF
Read Data[1]	Read data	ARRAY OF USINT	00 to FF

*1.   The data format when the command type is Read.

Format for Error Responses When General Status Is Other Than D0 Hex or D1 Hex:

Parameter name	Description	Data type	Value (hex)
Reply Service	Message for IO-Link device service response	USINT	B4
Reserved	Reserved	octet	00
General Status	Current error code defined by CIP	USINT	Current error code[1]
Size of Additional Status	Size of Additional status	USINT	00 to 01
Additional Status	Additional status	UINT	Additional status

*1.   The error codes defined by CIP for the current error are as follows.

Value (hex)	Description
02	Resource unavailable
10	Device state conflict
13	Not enough data
15	Too much data
1F	Vendor specific error
20	Invalid parameter

Format for Error Responses When General Status Is D0 Hex or D1 Hex:

Parameter name	Description	Data type	Value (hex)
Reply Service	Message for IO-Link device service response	USINT	B4
Reserved	Reserved	octet	00
General Status	Current error code defined by CIP	USINT	D0: Error in the IO-Link Master Unit D1: Error in the IO-Link device
Size of Additional Status	Size of Additional status	USINT	01

Parameter name	Description	Data type	Value (hex)
Additional Status	Additional status [0] Error code of an error in the IO-Link Master Unit or IO-Link device	UINT	When General Status is D0: • 4806: The communications mode of the port is not IO-Link Mode. • 4807: The IO-Link device does not exist, or the connection with the device timed out. • 4808: An IO-Link Communications Error or Device Configuration Verification Error occurred. When General Status is D1: • Upper 1 byte: Error code defined in the IO-Link standard • Lower 1 byte: Additional code defined in the IO-Link standard[1]

*1. Refer to *Annex C Error Types* of the IO-Link standard *IO-Link Interface and System Specification* for the meanings of the error codes.

Class ID and Instance ID

The class ID and instance ID are given in the following table.

ID type	Value (hex)
Class ID	381
Instance ID	00: Specifies the class. 01 to 08: Specifies port 1 to 8.

Attribute ID

The attribute ID specifies the information to read.
Port □ represents port number 1 to 8.

● Class Attribute ID

The class attribute ID specifies the attribute of the entire object.

Attribute ID (hex)	Parameter name	Description	Attribute	Data	
				Data type	Value (hex)
01	Revision	Revision of the object	Read	UINT	0001
02	Max Instance	Maximum instance number	Read	UINT	0008
03	Number of Instances	Number of instances of this object	Read	UINT	0008

● Instance Attribute ID

The instance attribute ID specifies the attribute ID of the instance.

Attribute ID (hex)	Parameter name	Description	Attribute	Data	
				Data type	Value (hex)
01	Status Data	Status data	Read	UINT	Refer to *Values of Status Data* on page A-31 below.

Attribute ID (hex)	Parameter name	Description	Attribute	Data	
				Data type	Value (hex)
02	Port □ Device Verification Setting	Port □ Device Verification Setting	Read/ Write	USINT	Refer to *Values of Port □ Device Verification Setting* on page A-31 below. Default: 00
03	Port □ Backup/Restore Setting	Port □ Backup/Restore Setting	Read/ Write	USINT	00: Do not Execute 01: Backup 02: Restore Default: 00
04	Port □ Fault/Idle Action	Port □ Fault/Idle Action	Read/ Write	BOOL	Refer to *Values of Fault/Idle Action* on page A-31 below. Default: 00
06	Port □ Pin 4 Input Filter Value Setting	Port □ Pin 4 Input Filter Value Setting	Read/ Write	USINT	Refer to *Values of Pin 4 Input Filter Value Setting and Pin 2 Input Filter Value Setting* on page A-31 below. Default: 03
07	Port □ Pin 2 Input Filter Value Setting	Port □ Pin 2 Input Filter Value Setting	Read/ Write	USINT	
08	Port □ Configuration Data /Device ID	Port □ Configuration Data / Device ID	Read/ Write	UDINT	00000000 to 00FFFFFF Default: 00000000
09	Port □ Configuration Data /Vendor ID	Port □ Configuration Data / Vendor ID	Read/ Write	UDINT	00000000 to 0000FFFF Default: 00000000
0A	Port □ Configuration Data /IO-Link Revision	Port □ Configuration Data /IO-Link Revision	Read/ Write	USINT	00 to FF Default: 00
0B	Port □ Configuration Data /Communication Delay Time	Port □ Configuration Data / Communication Delay Time	Read/ Write	USINT	00 to BF[*1] Default: 00
0C	Port □ Configuration Data /Process Data In Length	Port □ Configuration Data / Process Data In Length (Unit: byte)	Read/ Write	USINT	00 to 20 Default: 02
0D	Port □ Configuration Data /Process Data Out Length	Port □ Configuration Data / Process Data Out Length (Unit: byte)	Read/ Write	USINT	00 to 20 Default: 02
0E	Port □ Pin 4 Communications Mode Setting	Port □ Pin 4 Communications Mode Setting	Read/ Write	USINT	Refer to *Values of Port □ Pin 4 Communications Mode Setting* on page A-32 below. Default: 03
0F	Port □ Pin 2 Communications Mode Setting	Port □ Pin 2 Communications Mode Setting	Read/ Write	USINT	Refer to *Values of Port □ Pin 2 Communications Mode Setting* on page A-32 below. Default: 01
10	Port □ Configuration Data /Serial Number	Port □ Configuration Data / Serial Number	Read/ Write	SHORT STRING	The data size is 16 bytes. Default: All 0s
11	Port □ Information Area / Device ID	Port □ Information Area / Device ID	Read	UDINT	---
12	Port □ Information Area / Vendor ID	Port □ Information Area / Vendor ID	Read	UDINT	---
13	Port □ Information Area /IO-Link Revision	Port □ Information Area /IO-Link Revision	Read	USINT	---

Attribute ID (hex)	Parameter name	Description	Attribute	Data	
				Data type	Value (hex)
14	Port □ Information Area / Cycle Time	Port □ Information Area / Cycle Time	Read	USINT	00 to BF[*1]
15	Port □ Information Area / Process Data In Length	Port □ Information Area / Process Data In Length (Unit: byte)	Read	USINT	---
16	Port □ Information Area / Process Data Out Length	Port □ Information Area / Process Data Out Length (Unit: byte)	Read	USINT	---
17	Port □ Information Area / Serial Number	Port □ Information Area / Serial Number	Read	SHORT STRING	The data size is 16 bytes.
18	Port □ Vendor Name of the Last Connected IO-Link Device	Port □ Vendor Name of the Last Connected IO-Link Device	Read	SHORT STRING	The data size is 64 bytes.
19	Port □ Product Name of the Last Connected IO-Link Device	Port □ Product Name of the Last Connected IO-Link Device	Read/ Write	SHORT STRING	The data size is 64 bytes. Default: All 0s
1A	Port □ Information Area / Vendor Name	Port □ Information Area / Vendor Name	Read	SHORT STRING	The data size is 64 bytes.
1B	Port □ Information Area / Product Name	Port □ Information Area / Product Name	Read	SHORT STRING	The data size is 64 bytes.
1C	Port □ Lost Frames	Port □ Lost Frames[*2]	Read/ Write	USINT	00 to FF Default: 00
1D	Offset Setting of Port □ IO-Link Input Data Collection Port	Offset Setting of Port □ IO-Link Input Data Collection Port[*3]	Read/ Write	USINT	00 to FF Default: 00

*1. The bit configuration and time for the Configuration Data /Communication Delay Time and Information Area /Cycle Time are as follows.

07	06	05		00
Time value		Multiplier		

The time calculated from the time value and the multiplier is given in the following table.

Bits 07 to 06 (hex)	Time value	Multiplier	Formula	Time
00	0.1 ms	0 to 63	Multiplier × 0.1	0 to 6.3 ms
01	0.4 ms	0 to 63	6.4 + Multiplier × 0.4	6.4 to 31.6 ms
10	1.6 ms	0 to 63	32 + Multiplier × 1.6	32 to 132.8 ms
11	Reserved	Reserved	Reserved	Reserved

*2. This is the number of IO-Link communications lost frame counts. You can preset it to any value when writing.

*3. Specify the position of the bit to extract from IO-Link Input Data.
If the offset value that exceeds the size of the IO-Link Input Data is set, the relevant bit value in the Integrated IO-Link Input Data is 0.
For example, when the size of the IO-Link Input Data is 2 bytes, the valid setting range is 0 to 15. If you set 16 at this time, the relevant bit in the Integrated IO-Link Input Data is 0.

● **Values of Status Data**

Bit	Name	Description (hex)
0	Pin 4 Communications Mode Setting	• 00: Disable
1		• 01: SIO (DI) Mode
2		• 02: SIO (DO) Mode
3		• 03: IO-Link Mode
4	Error	• 00: None of the following errors occurred.
5		• 03: Device ID mismatch
6		• 04: Vendor ID mismatch
7		• 05: IO-Link revision mismatch
		• 08: Device I/O Size Error (IN)
		• 09: Device I/O Size Error (OUT)
		• 0A: Device does not exist
8	Pin 2 Communications Mode Setting	• 00: Disable
9		• 01: SIO (DI) Mode
10		• 02: SIO (DO) Mode

● **Values of Port □ Device Verification Setting**

Value (hex)	Description
00	No check
01	Check the vendor ID, device ID, and IO-Link revision.
02	Check the vendor ID, device ID, IO-Link revision, and serial number.

● **Values of Fault/Idle Action**

Value (hex)	Description	
	During communications errors	During idle
00	• IO-Link Mode: Sends output disabled notification to the IO-Link device.	
	• SIO (DO) Mode: Clears the output value.	
01	• IO-Link Mode: Sends output disabled notification to the IO-Link device.	
	• SIO (DO) Mode: Holds the output value.	

● **Values of Pin 4 Input Filter Value Setting and Pin 2 Input Filter Value Setting**

Value (hex)	Input filter time
00	No filter
01	0.25 ms
02	0.5 ms
03	1 ms
04	2 ms
05	4 ms
06	8 ms
07	16 ms
08	32 ms
09	64 ms
0A	128 ms
0B	256 ms

● **Values of Port □ Pin 4 Communications Mode Setting**

Value (hex)	Description
00	Disable
01	SIO (DI) Mode
02	SIO (DO) Mode
03	IO-Link Mode

● **Values of Port □ Pin 2 Communications Mode Setting**

Value (hex)	Description
00	Disable
01	SIO (DI) Mode
02	SIO (DO) Mode

A-1-10   Diagnosis Object (Class ID: 382 Hex)

The diagnosis object executes the communications cable diagnosis and reads network statistical information.

Service Code

The service code specifies the service to execute.

Service code (hex)	Parameter name	Description	Supported service range	
			Class	Instance
01	Get_Attribute_All	Reads the values of all attributes.	Yes	No
0E	Get_Attribute_Single	Reads the value of a specified attribute.	Yes	Yes
10	Set_Attribute_Single	Writes the value of a specified attribute.	No	Yes
3A	Exec Cable Diagnosis	Executes a communications cable diagnosis.	No	Yes

Exec Cable Diagnosis (Service Code: 3A Hex)

Executes a communications cable diagnosis of an EtherNet/IP port on the IO-Link Master Unit. The request format, format for normal responses, format for error responses, and CIP error codes are given below.

● **Request Data Format**

Parameter name	Description	Data type	Value (hex)
Service	Service code	USINT	3A
Request Path Size	Request path size	USINT	03
Request Path	Request path	Padded EPATH	210082032401 to 210082032402

● **Response Format**

When the execution is successful:

Parameter name	Description	Data type	Value (hex)
Reply Service	Exec Cable Diagnosis service response	USINT	BA

Parameter name	Description	Data type	Value (hex)
Reserved	Reserved	octet	00
General Status	Code that indicates normal	USINT	00
Size of Additional Status	Size of Additional status	USINT	00

When the execution failed:

Parameter name	Description	Data type	Value (hex)
Reply Service	Exec Cable Diagnosis service response	USINT	BA
Reserved	Reserved	octet	00
General Status	Current error code defined by CIP	USINT	Current error code[1]
Size of Additional Status	Size of Additional status	USINT	00

*1. The error codes defined by CIP for the current error are as follows.

Value (hex)	Description
02	Resource unavailable
10	Device state conflict
13	Not enough data
15	Too much data
1F	Vendor specific error
20	Invalid parameter

Class ID and Instance ID

The class ID and instance ID are given in the following table.

ID type	Value (hex)
Class ID	382
Instance ID	00: Specifies the class. 01: Specifies EtherNet/IP port 1. 02: Specifies EtherNet/IP port 2.

Attribute ID

The attribute ID specifies the information to read.

● Class Attribute ID

The class attribute ID specifies the attribute of the entire object.

Attribute ID (hex)	Parameter name	Description	Attribute	Data	
				Data type	Value (hex)
01	Revision	Revision of the object	Read	UINT	0001
02	Max Instance	Maximum instance number	Read	UINT	0002
03	Number of Instances	Number of instances of this object	Read	UINT	0002

● Instance Attribute ID

The instance attribute ID specifies the attribute ID of the instance.

Attribute ID (hex)	Parameter name	Description	Attrib-ute	Data	
				Data type	Value (hex)
01	Link Down Counter	Link Down Count	Read	UDINT	00000000 to FFFFFFFF
02	Parameter	Communications cable diagnosis information	Read	UINT	Upper 1 byte: • 00: Not executed • 01: Normal • 02: Short-circuit • 03: Disconnection • F1: Already diagnosed • F2: Read error • F3: Other diagnosis error Lower 1 byte: • Error occurrence location from the diag-nosed port (Unit: m)

A-1-11 Error Status Object (Class ID: 383 Hex)

The error status object sets the hold setting for error status and provides the error cause or information for troubleshooting the IO-Link Master Unit.

Service Code

The service code specifies the service to execute.

Service code (hex)	Parameter name	Description	Supported service range	
			Class	Instance
01	Get_Attribute_All	Reads the values of all attributes.	Yes	No
0E	Get_Attribute_Single	Reads the value of a specified attribute.	Yes	Yes
10	Set_Attribute_Single	Writes the value of a specified attribute.	No	Yes
35	Clear Error Status Flag	Clears the error status.	Yes	No

Clear Error Status Flag (Service Code: 35 Hex)

Clears all error status values. This service is enabled only when the value of *Hold setting for Error Status* (attribute 01 hex) is TRUE. The request format, format for normal responses, format for error responses, and CIP error codes are given below.

● Request Data Format

Parameter name	Description	Data type	Value (hex)
Service	Service code	USINT	35
Request Path Size	Request path size	USINT	03
Request Path	Request path	Padded EPATH	210083032400

● Response Format

When the execution is successful:

Parameter name	Description	Data type	Value (hex)
Reply Service	Clear Error Status Flag service response	USINT	B5

Parameter name	Description	Data type	Value (hex)
Reserved	Reserved	octet	00
General Status	Code that indicates normal	USINT	00
Size of Additional Status	Size of Additional status	USINT	00

When the execution failed:

Parameter name	Description	Data type	Value (hex)
Reply Service	Clear Error Status Flag service response	USINT	B5
Reserved	Reserved	octet	00
General Status	Current error code defined by CIP	USINT	Current error code[1]
Size of Additional Status	Size of Additional status	USINT	00 to 01
Additional Status	Additional status	UINT	Additional status

*1. The error codes defined by CIP for the current error are as follows.

Value (hex)	Description
02	Resource unavailable
10	Device state conflict
13	Not enough data
15	Too much data
1F	Vendor specific error
20	Invalid parameter

Class ID and Instance ID

The class ID and instance ID are given in the following table.

ID type	Value (hex)
Class ID	383
Instance ID	00: Specifies the class. 01: Specifies the instance.

Attribute ID

The attribute ID specifies the information to read.
Port □ represents port number 1 to 8.

● Class Attribute ID

The class attribute ID specifies the attribute of the entire object.

Attribute ID (hex)	Parameter name	Description	Attribute	Data type	Value (hex)
01	Revision	Revision of the object	Read	UINT	0001
02	Max Instance	Maximum instance number	Read	UINT	0001
03	Number of Instances	Number of instances of this object	Read	UINT	0001

● Instance Attribute ID

The instance attribute ID specifies the attribute ID of the instance.

Attribute ID (hex)	Parameter name	Description	Attribute	Data	
				Data type	Value (hex)
01	Hold Setting For Error Status	Hold setting for error status	Read/ Write	BOOL	• TRUE: The error status does not change to FALSE when the error cause is removed. To change the error status to FALSE, use the *Clear Error Status Flag* service. • FALSE: The error status changes to FALSE when the error cause is removed. Default: TRUE
04	Unit Error Aggregation Status	Unit Error Collection Status	Read	BYTE	• 20: The value is 20 hex when any of the attributes 05 to 5B hex is TRUE. • 00: The above errors did not occur.
05	Unit/Input Power Supply Voltage Drop	Unit/Input Power Supply Voltage Drop	Read	BOOL	Refer to *Unit Error Status* in *Unit Status* on page 7-47 in *7-6-3 Details on Input Assembly Data* on page 7-47.
06	Output Power Supply Voltage Drop	Output Power Supply Voltage Drop	Read	BOOL	
07	Setting error of the automatic adjustment function for the clock information	Automatic Clock Adjustment Setting Error	Read	BOOL	
08	Connection failure with NTP/SNTP server	NTP/SNTP Server Connection Error	Read	BOOL	
0A	Link Down detection on EtherNet/IP port 1	EtherNet/IP Port 1 Link Down Detected	Read	BOOL	
0B	Link Down detection on EtherNet/IP port 2	EtherNet/IP Port 2 Link Down Detected	Read	BOOL	
0C	I/O Port 1 Error	Port 1 Error	Read	BOOL	Refer to *Port Error* in *Unit Status* on page 7-47 in *7-6-3 Details on Input Assembly Data* on page 7-47.
0D	I/O Port 2 Error	Port 2 Error	Read	BOOL	
0E	I/O Port 3 Error	Port 3 Error	Read	BOOL	
0F	I/O Port 4 Error	Port 4 Error	Read	BOOL	
10	I/O Port 5 Error	Port 5 Error	Read	BOOL	
11	I/O Port 6 Error	Port 6 Error	Read	BOOL	
12	I/O Port 7 Error	Port 7 Error	Read	BOOL	
13	I/O Port 8 Error	Port 8 Error	Read	BOOL	

Attrib-ute ID (hex)	Parameter name	Description	Attrib-ute	Data	
				Data type	Value (hex)
*1	I/O Port □ Communication Error	Port □ IO-Link Communications Error	Read	BOOL	Refer to *I/O Port Error Status* on page 7-49 in *7-6-3 Details on Input Assembly Data* on page 7-47.
	I/O Port □ Compare Error	Port □ Verification Error	Read	BOOL	
	I/O Port □ Device IO Size Error	Port □ Device I/O Size Error	Read	BOOL	
	I/O Port □ Device Error	Port □ Device Error-level Event	Read	BOOL	
	I/O Port □ Device Information	Port □ Device Warning-level Event	Read	BOOL	
	I/O Port □ Assembly Error	Port □ Assembly Error	Read	BOOL	
	I/O Port □ Pin 1 Short Error	Port □ Pin 1 Short-circuit Error	Read	BOOL	
	I/O Port □ Pin 2 Short Error	Port □ Pin 2 Short-circuit Error	Read	BOOL	
	I/O Port □ Pin 4 Short Error	Port □ Pin 4 Short-circuit Error	Read	BOOL	

*1. The attribute IDs for each port are shown in the following table.

Parameter name	Attribute IDs for each port							
	Port 1	Port 2	Port 3	Port 4	Port 5	Port 6	Port 7	Port 8
I/O Port □ Communication Error	14	1D	26	2F	38	41	4A	53
I/O Port □ Compare Error	15	1E	27	30	39	42	4B	54
I/O Port □ Device IO Size Error	16	1F	28	31	3A	43	4C	55
I/O Port □ Device Error	17	20	29	32	3B	44	4D	56
I/O Port □ Device Information	18	21	2A	33	3C	45	4E	57
I/O Port □ Assembly Error	19	22	2B	34	3D	46	4F	58
I/O Port □ Pin 1 Short Error	1A	23	2C	35	3E	47	50	59
I/O Port □ Pin 2 Short Error	1B	24	2D	36	3F	48	51	5A
I/O Port □ Pin 4 Short Error	1C	25	2E	37	40	49	52	5B

A

A-1 Supported CIP Objects

A-1-11 Error Status Object (Class ID: 383 Hex)

A-2　Sample Programming

A-2-1　Tag Data Links with Valid I/O Data

To use data to create tag data links in the user program, check that the I/O data is valid before you create them.

This section describes an example of creating a tag data link between a Controller and an IO-Link Maser Unit, where the Controller is the built-in EtherNet/IP port on an NJ/NX-series CPU Unit. Create the user program that meets all of the following conditions.

No.	Condition	Description
(1)	The value of _EIP_ErrSta (Built-in EtherNet/IP Error) is 0000 hex.	These indicate that the built-in EtherNet/IP port is enabled for tag data links.
(2)	The _EIP_EtnOnlineSta (Online) variable is TRUE.	
(3)	In the _EIP_EstbTargetSta (Normal Target Node Information) variable, the bit corresponding to the connected IO-Link Master Unit is TRUE.	This indicates that a connection is established between the EtherNet/IP port and the IO-Link Master Unit, and a tag data link is active.
(4)	The Unit Status is Port Input Data Enabled and the bit corresponding to the port is TRUE.[1]	These indicate that the input data to each port on the IO-Link Master Unit is valid.
(5)	The Unit Status is Port Error and the bit corresponding to the port is FALSE.	
(6)	The value of Unit Error Collection Status is 0000 hex.	This indicates that no error occurred in the IO-Link Master Unit.

*1.　Always FALSE in SIO (DI) Mode and SIO (DI) Mode.

It depends on the OMRON EtherNet/IP scanner that you use to check if conditions (1) to (3) are met. Refer to *Ladder Programming for Tag Data Links* in the user's manual for the OMRON EtherNet/IP scanner that you use.

The following is an example of programming I/O data processing with valid input data, where an NJ/NX-series CPU Unit is the Controller and an IO-Link Master Unit is target node #01.

▌ User-defined Variables

Use network variables to define the following components.

Name	Data type	Default	Comment
Node01_Port1_InputDataEnable	BOOL	FALSE	Data for node #01 in condition (4) This indicates the Port Input Data Enabled bit for port 1.
• • •	• • •	• • •	• • •
Node01_Port8_InputDataEnable	BOOL	FALSE	Data for node #01 in condition (4) This indicates the Port Input Data Enabled bit for port 8.
Node01_Port1Error	BOOL	FALSE	Data for node #01 in condition (5) This indicates the Port Error bit for port 1.
• • •	• • •	• • •	• • •
Node01_Port8Error	BOOL	FALSE	Data for node #01 in condition (5) This indicates the Port Error bit for port 8.

Name	Data type	Default	Comment
Node01_UnitErrAggStat	WORD	16#0	Data for node #01 in condition (6)
			This indicates the Unit Error Collection Status.

System-defined Variables

Name	Data type	Comment
_EIP_ErrSta	WORD	Data for the built-in EtherNet/IP port in condition (1)
		This is the error status.
_EIP_EtnOnlineSta	BOOL	Data for the built-in EtherNet/IP port in condition (2)
		This is the online status.
_EIP_EstbTargetSta[1]	ARRAY [0..255] OF BOOL	Data for the built-in EtherNet/IP port in condition (3)
		This is Normal Target Node Information for node #01.

Program Example
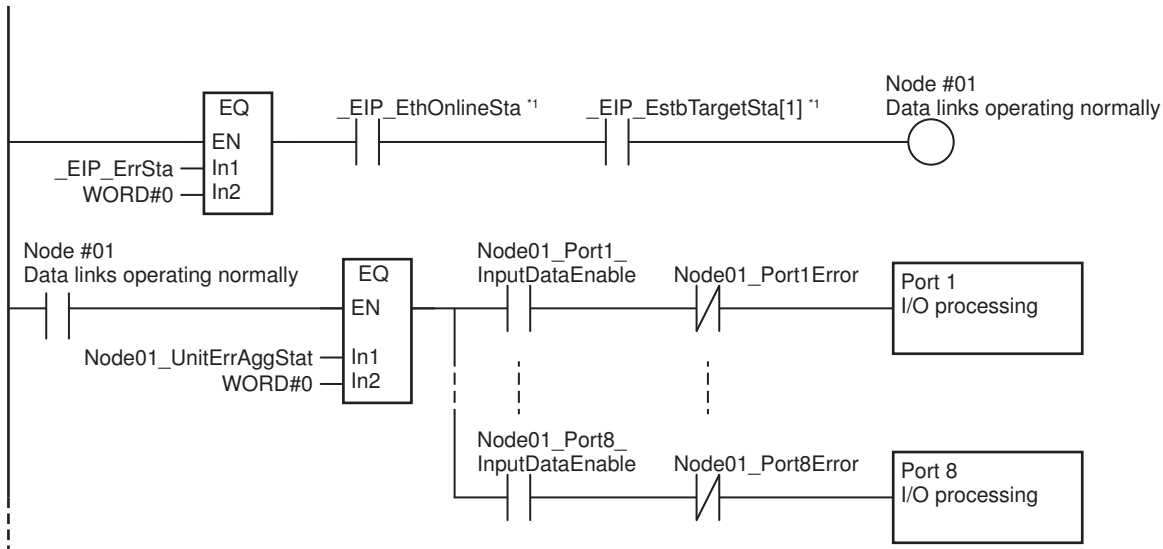
*1. This is a system-defined variable for NJ-series CPU Units. Refer to the user's manual for the built-in EtherNet/IP scanner on your NX-series CPU Unit for information on system-defined variables for NX-series CPU Units.

A-2-2 Configuring the IO-Link Master Unit with Message Communications

This section provides sample programming to configure the parameter settings of an IO-Link Master Unit through an explicit message.

The IO-Link Master Unit provides a CIP object that allows for setting the device parameters of an IO-Link Master Unit. From the user program in the Controller, you can send an explicit message that specifies the Class ID, Instance ID, and Attribute ID of the relevant object and write values to configure the IO-Link Master Unit.

The method to specify these IDs depends on the data size of the CIP object's class ID. Here, sample programing examples for configuring the following two parameter settings for an IO-Link Master Unit are described, where an NJ/NX-series CPU Unit is used as the Controller.

Example	Data size of Class ID	Description
Program example 1	16 bits	Set the Pin 2 Input Filter Setting for port 1 to 128 ms.
Program example 2	8 bits	Set the Speed & Duplex setting for EtherNet/IP port 1 to 100 Mbps Half Duplex.

Assume that the IP address of the IO-Link Master Unit is 192.168.250.2.
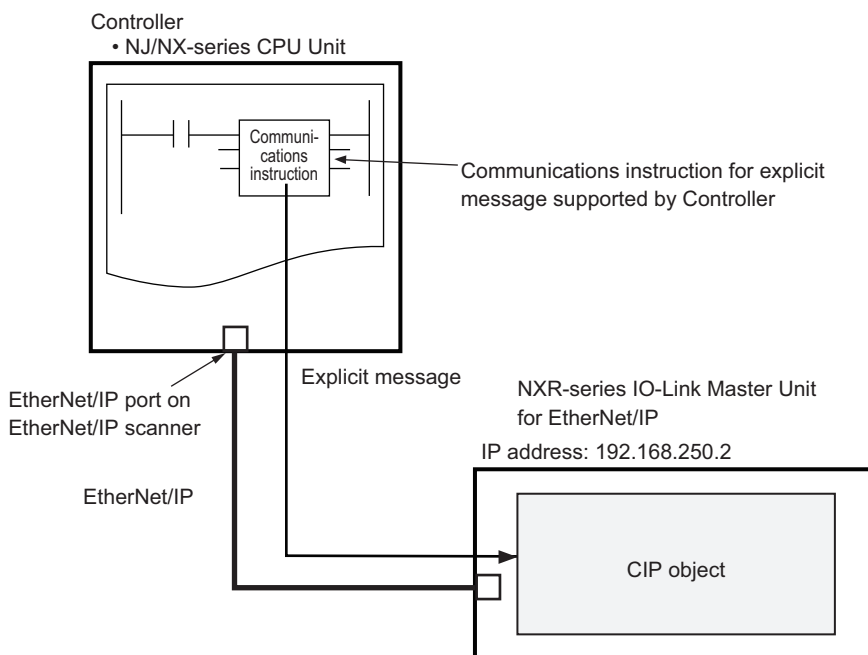
NJ/NX-series CPU Units support the following special instructions that you can send through an explicit message.

• CIPSend instruction
• CIPUCMMSend instruction

Here, an example of using the CIPUCMMSend instruction is provided. When you use the CIPUCMM-Send instruction for an IO-Link Master Unit, some restrictions apply. For details on the restrictions, refer to *Special Instructions for the Controller* on page 6-5 in *Accessing CIP Objects through an Explicit Message* on page 6-5.

Program Example 1

This example sets the Pin 2 Input Filter Setting for port 1 to 128 ms.

The content of the message is to write a setting to the attribute for the Pin 2 Input Filter Value Setting for port 1.
To write the setting, the Set_Attribute_Single service is used.
Pin 2 Input Filter Value Setting is a parameter that does not change until after the Unit is restarted. The written setting is reflected after the IO-Link Master Unit is restarted. Therefore, the Reset service of the Identity object is used to perform the restart processing.
The settings are shown below.

Item		Value	Description
Route path		'02\192.168.250.2'	Specifies the network type number and destination IP address. The network type number "02" specifies the built-in EtherNet/IP port on the CPU Unit.[1]
Setting write processing	Class ID	381 hex	Specifies the IO-Link object. The data size is 16 bits.
	Instance ID	01 hex	Specifies the port number.
	Attribute ID	07 hex	Specifies the instance attribute that specifies Pin 2 Input Filter Value Setting.
	Service code	10 hex	Specifies the Set_Attribute_Single service to write a value to the specified attribute.
	Service data	0Ahex	Specifies 128 ms (0A hex) as the set value of the input filter time for pin 2.
Restart processing	Class ID	01 hex	Specifies the Identity object. The data size is 8 bits.
	Instance ID	01 hex	Specifies 01 hex.
	Attribute ID	---	The specification is not necessary.
	Service code	05 hex	Specifies the Reset service of the Identity object to restart the IO-Link Master Unit.
	Service data	00 hex	Specifies Restart (00 hex).

[1]. Refer to *Route Path* in the user's manual for your OMRON EtherNet/IP scanner for information on how to specify the network type number.

For the setting write processing, the data size of the class ID is 16 bits. Therefore, for the request path, set the ClassIDLogicalFormat member of _sREQUEST_PATH_EX type to _*16BIT*.
For the restart processing, the data size of the class ID is 8 bits. Therefore, for the request path, set the ClassIDLogicalFormat member of _sREQUEST_PATH_EX type to _*8BIT*.

● LD

Name	Data type	Default	Comment
OperatingEnd	BOOL	False	Setting write processing completed
Trigger_Write	BOOL	False	Execution condition for setting write processing
Operating_Write	BOOL	False	Setting write in progress
ReqPath_Write	_sREQUEST_PATH_EX	(ClassIDLogicalFormat:=_8BIT, ClassID:=0, InstanceIDLogicalFormat:=_8BIT, InstanceID:=0, isAttributeID:=False, AttributeIDLogicalFormat:=_8BIT, AttributeID:=0)	Request path for setting write processing
SerDat_Write	BYTE	16#0A	Service data for setting write processing
RespDat_Write	ARRAY[0..10] OF BYTE	[11(16#0)]	Response data for setting write processing
RS_Write_instance	RS		Reset-Priority Keep for setting write processing

Name	Data type	Default	Comment
CIPUCMM-Send_Write_instance	CIPUCMMSend		CIPUCMMSend instance for setting write processing
RestartingEnd	BOOL	False	Restart processing completed
Trigger_Restart	BOOL	False	Execution condition for restart processing
Operating_Restart	BOOL	False	Restart processing in progress
ReqPath_Restart	_sREQUEST_PATH_EX	(ClassIDLogicalFormat:=_8BIT, ClassID:=0, InstanceIDLogicalFormat:=_8BIT, InstanceID:=0, isAttributeID:=False, AttributeIDLogicalFormat:=_8BIT, AttributeID:=0)	Request path for restart processing
SerDat_Restart	BYTE	16#00	Service data for restart processing
RespDat_Restart	ARRAY[0..10] OF BYTE	[11(16#0)]	Response data for restart processing
RS_Restart_instance	RS		Reset-Priority Keep for restart processing
CIPUCMMSend_Restart_instance	CIPUCMMSend		CIPUCMMSend instance for restart processing

Determine if write processing is completed.

CIPUCMMSend_Write_instance.Done   OperatingEnd

CIPUCMMSend_Write_instance.Error

Accept trigger.

Trigger_Write   CIPUCMMSend_Write_instance.Busy   RS_Write_instance   Operating_Write

RS

Set   Q1

OperatingEnd — Reset1

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Write processing

Operating_Write

```
                                        @MOVE
                                     EN      ENO ──── ReqPath_Write.ClassIDLogicalFormat
       _eCIP_LOGICAL_FORMAT#_16BIT ── In      Out

                                        @MOVE
                                     EN      ENO ──── ReqPath_Write.ClassID
                     UDINT#16#381 ── In      Out

                                        @MOVE
                                     EN      ENO ──── ReqPath_Write.InstanceID
                          UDINT#1 ── In      Out

                                        @MOVE
                                     EN      ENO ──── ReqPath_Write.isAttributeID
                             TRUE ── In      Out

                                        @MOVE
                                     EN      ENO ──── ReqPath_Write.AttributeID
                          UDINT#7 ── In      Out
```

CIPUCMMSend_Write_instance

```
                           CIPUCMMSend
                     ── Execute          Done ──
   '02\192.168.250.2' ── RoutePath       Busy ──
            UINT#20 ── TimeOut          Error ──
         BYTE#16#10 ── ServiceCode    ErrorID ──
       ReqPath_Write ── RqPath        ErrorIDEx ──
       SerDat_Write ── ServiceDat     RespSize ──
            UINT#1 ── Size
                     ── RespServiceDat
       RespDat_Write ──────────────────────────── RespDat_Write
```

Processing after write normal end

Operating_Write   CIPUCMMSend_Write_instance.Done

Inline ST
```
1 // Processing after write normal end
2:
```

Processing after write error end

Operating_Write   CIPUCMMSend_Write_instance.Error

Inline ST
```
1 // Processing after write error end
2:
```

Determine if restart processing is completed.

CIPUCMMSend_Restart_instance.Done   RestartingEnd

CIPUCMMSend_Restart_instance.Error

Accept trigger.

RS_Restart_instance

Trigger_Restart   CIPUCMMSend_Restart_instance.Busy   Operating_Restart
                                                        RS
                                                    Set   Q1
                                      RestartingEnd ── Reset1

Restart processing

Operating_Restart

```
                                    @MOVE
                                EN       ENO  ─  ReqPath_Restart.ClassIDLogicalFormat
   _eCIP_LOGICAL_FORMAT#_8BIT ─ In       Out

                                    @MOVE
                                EN       ENO  ─  ReqPath_Restart.ClassID
             UDINT#16#01       ─ In       Out

                                    @MOVE
                                EN       ENO  ─  ReqPath_Restart.InstanceID
             UDINT#1           ─ In       Out

                                    @MOVE
                                EN       ENO  ─  ReqPath_Restart.isAttributeID
             FALSE             ─ In       Out
```

CIPUCMMSend_Restart_instance

```
                          CIPUCMMSend
                     Execute          Done
  '02\192.168.250.2' ─ RoutePath       Busy
          UINT#20    ─ TimeOut         Error
       BYTE#16#05    ─ ServiceCode     ErrorID
    ReqPath_Restart  ─ RqPath          ErrorIDEx
    SerDat_Restart   ─ ServiceDat      RespSize
          UINT#1     ─ Size
                       RespServiceDat
    RespDat_Restart  ────────────────── RespDat_Restart
```

Processing after restart normal end

Operating_Restart   CIPUCMMSend_Restart_instance.Done

Inline ST

```
1 // Processing after restart normal end
2:
```

Processing after restart error end

Operating_Restart   CIPUCMMSend_Restart_instance.Error

Inline ST

```
1 // Processing after restart error end
2:
```

● **ST**

Internal variables	Name	Data type	Default	Comment
	Trigger_Write	BOOL	False	Execution condition for setting write processing
	Operating_Write	BOOL	False	Setting write in progress
	Stage_Write	INT	0	Setting write processing state transition

In-ter-nal vari-able s	Name	Data type	Default	Comment
	ReqPath_Write	_sRE-QUEST_PATH_EX	(ClassIDLogicalFormat:=_8BIT, ClassID:=0, InstanceIDLogicalFormat:=_8BIT, InstanceID:=0, isAttributeID:=False, AttributeIDLogicalFormat:=_8BIT, AttributeID:=0)	Request path for setting write processing
	SerDat_Write	BYTE	16#0A	Service data for setting write processing
	RespDat_Write	ARRAY[0..10] OF BYTE	[11(16#0)]	Response data for setting write processing
	CIPUCMM-Send_Write_instance	CIPUCMMSend		CIPUCMMSend instance for setting write processing
	Trigger_Restart	BOOL	False	Execution condition for restart processing
	Operating_Restart	BOOL	False	Restart processing in progress
	Stage_Restart	INT	0	Restart processing state transition
	ReqPath_Restart	_sRE-QUEST_PATH_EX	(ClassIDLogicalFormat:=_8BIT, ClassID:=0, InstanceIDLogicalFormat:=_8BIT, InstanceID:=0, isAttributeID:=False, AttributeIDLogicalFormat:=_8BIT, AttributeID:=0)	Request path for restart processing
	SerDat_Restart	BYTE	16#00	Service data for restart processing
	RespDat_Restart	ARRAY[0..10] OF BYTE	[11(16#0)]	Response data for restart processing
	CIPUCMMSend_Re-start_instance	CIPUCMMSend		CIPUCMMSend instance for restart processing

External variable	Name	Data type	Constant	Comment
	_EIP_EtnOnlineSta*1	BOOL	☑	Online

*1. This is a system-defined variable for NJ-series CPU Units. Refer to the user's manual for the built-in EtherNet/IP scanner on your NX-series CPU Unit for information on system-defined variables for NX-series CPU Units.

```
// Start setting write processing when Trigger_Write changes to TRUE
IF ((Trigger_Write=TRUE) AND (Operating_Write=FALSE) AND (_EIP_EtnOnlineSta=TRUE))
THEN
  Operating_Write        :=TRUE;
```

```
  Stage_Write           :=INT#1;
  CIPUCMMSend_Write_instance(
    Execute             :=FALSE,
    // Initialize instance to use for setting write processing
    RqPath              :=ReqPath_Write,// Request path for setting write
    ServiceDat          :=Dummy,          // Dummy
    RespServiceDat      :=RespDat_Write);// Dummy
END_IF;

// Write processing
IF (Operating_Write=TRUE) THEN
  CASE Stage OF
  1 :                                           // Send message
ReqPath_Write.ClassIDLogicalFormat  :=_16BIT;
    // Set ClassID data size to _16BIT
    ReqPath_Write.ClassID      :=UINT#16#381;// Specify IO-Link object
    ReqPath_Write.InstanceID   :=UINT#01;
    ReqPath_Write.isAttributeID :=TRUE;
    ReqPath_Write.AttributeID  :=UINT#07;
    // Attribute ID for Pin 2 Input Filter Value Setting
    CIPUCMMSend_Write_instance(
      Execute           :=TRUE,
      RoutePath         :='02\192.168.250.2',// Route path
      TimeOut           :=UINT#20,          // Setting write timeout value
      ServiceCode       :=BYTE#16#10,       // Setting write service code
      RqPath            :=ReqPath_Write,    // Setting write request path
      ServiceDat        :=SerDat_Write,     // Setting write service data
      Size              :=UINT#1,           // Number of setting write elements
      RespServiceDat:=RespDat_Write);// Setting write processing response data

    IF (CIPUCMMSend_Write_instance.Done=TRUE) THEN
      Stage_Write       :=INT#0;           // Setting write normal end
    ELSIF (CIPUCMMSend_instance.Error=TRUE) THEN
      Stage             :=INT#30;          // Setting write error end
  END_IF;

  0:                                           // Write normal end processing
    Operating_Write     :=FALSE;
    Trigger_Write       :=FALSE;

  ELSE                                         // Write error end processing
    Operating_Write     :=FALSE;
    Trigger_Write       :=FALSE;
  END_CASE;
END_IF;

// Start restart processing when Trigger_Restart changes to TRUE
```

```
IF ((Trigger_Restart=TRUE) AND (Operating_Restart=FALSE) AND (_EIP_EtnOnlineSta=TRUE))
THEN
  Operating_Restart      :=TRUE;
  Stage_Restart          :=INT#1;
  CIPUCMMSend_Restart_instance(
    Execute              :=FALSE,
    // Initialize instance to use for restart processing
    RqPath               :=ReqPath_Restart,// Request path for restart processing
    ServiceDat           :=Dummy,          // Dummy
    RespServiceDat       :=RespDat_Restart);// Dummy
END_IF;


// Restart processing
IF (Operating_Restart=TRUE) THEN
  CASE Stage_Restart OF
  1:                                        // Send message
    ReqPath_Restart.ClassIDLogicalFormat  :=_8BIT;
    // Set ClassID data size to _8BIT
    ReqPath_Restart.ClassID     :=UINT#16#01;// Specify Identity object
    ReqPath_Restart.InstanceID   :=UINT#01;
    ReqPath_Restart.isAttributeID  :=FALSE;
    CIPUCMMSend_Restart_instance(
      Execute          :=TRUE,
      RoutePath        :='02\192.168.250.2',// Route path
      TimeOut          :=UINT#20,           // Restart timeout value
      ServiceCode      :=BYTE#16#05,        // Restart service code
      RqPath           :=ReqPath_Restart,   // Restart request path
      ServiceDat       :=SerDat_Restart,    // Restart service data
      Size             :=UINT#1,            // Number of restart elements
      RespServiceDat   :=RespDat_Restart);// Restart processing response data

    IF (CIPUCMMSend_Restart_instance.Done=TRUE) THEN
      Stage_Restart     :=INT#0;    // Restart normal end
    ELSIF (CIPUCMMSend_Restart_instance.Error=TRUE) THEN
      Stage_Restart     :=INT#30;   // Restart error end
    End_IF;

  0:                                 // Processing after restart normal end
    Operating_Restart   :=FALSE;
    Trigger_Restart     :=FALSE;

  ELSE                               // Processing after restart error end
    Operating_Restart   :=FALSE;
    Trigger_Restart     :=FALSE;
  END_CASE;
END_IF;
```

Program Example 2

This example sets the Speed & Duplex setting for EtherNet/IP port 1 to 100 Mbps Half Duplex.

The content of the message is to write a setting to the attribute for Speed & Duplex.
To write the setting, the Set_Attribute_Single service is used.
Speed & Duplex is a parameter that is updated immediately. The written setting is immediately reflected on the IO-Link Master Unit. Therefore, it is unnecessary to use the Reset service of the Identity object to restart the Unit.
The settings are shown below.

Item	Value	Description
Route path	'02\192.168.250.2'	Specifies the network type number and destination IP address. The network type number "02" specifies the built-in EtherNet/IP port on the CPU Unit.[1]
Class ID	F6 hex	Specifies the Ethernet Link object. The data size is 8 bits.
Instance ID	01 hex	Specifies EtherNet/IP port 1.
Attribute ID	06 hex	Specifies the instance attribute that specifies Interface Control (physical interface configuration).
Service code	10 hex	Specifies the Set_Attribute_Single service to write a value to the specified attribute.
Service data	00000064 hex	Sets Control Bits to Auto-negotiate disabled and Half Duplex (0000 hex) and Forced Interface Speed to 100 Mbps (0064 hex).

*1.   Refer to *Route Path* in the user's manual for your OMRON EtherNet/IP scanner for information on how to specify the network type number.

The data size of the class ID is 8 bits. Therefore, for the request path, set the ClassIDLogicalFormat member of _sREQUEST_PATH_EX type to _8BIT.

● **LD**

Among the variables used in program example 1, use those used for the program for setting write processing. However, in this example, set the default of the service data stored in the *SerDat_Write* variable as follows.

Name	Data type	Default	Comment
SerDat_Write	ARRAY[0..3] OF BYTE	[2(16#0),16#64,16#0]	Service data

In programming, make the following changes to program example 1.
• Change the ClassIDLogicalFormat member value for the request path, class ID value, attribute ID value, service data value, and service data size.
• Remove the restart processing.
The following diagram shows where to change the value or size. The locations enclosed in red rectangles are changed.

Write processing

Operating_Write


```
                                    @MOVE
                              EN         ENO      ─ ReqPath_Write.ClassIDLogicalFormat
_eCIP_LOGICAL_FORMAT#_8BIT ─  In          Out

                                    @MOVE
                              EN         ENO      ─ ReqPath_Write.ClassID
           UDINT#16#F6 ─      In          Out

                                    @MOVE
                              EN         ENO      ─ ReqPath_Write.InstanceID
              UDINT#1 ─       In          Out

                                    @MOVE
                              EN         ENO      ─ ReqPath_Write.isAttributeID
                 TRUE ─       In          Out

                                    @MOVE
                              EN         ENO      ─ ReqPath_Write.AttributeID
              UDINT#6 ─       In          Out

                            CIPUCMMSend_Write_instance
                                  CIPUCMMSend
                              Execute          Done
          '02\192.168.250.2' ─ RoutePath       Busy
                   UINT#20 ─  TimeOut          Error
               BYTE#16#10 ─  ServiceCode       ErrorID
             ReqPath_Write ─ RqPath            ErrorIDEx
           SerDat_Write[0] ─ ServiceDat        RespSize
                    UINT#4 ─  Size
                              RespServiceDat
             RespDat_Write ─                             ─ RespDat_Write
```
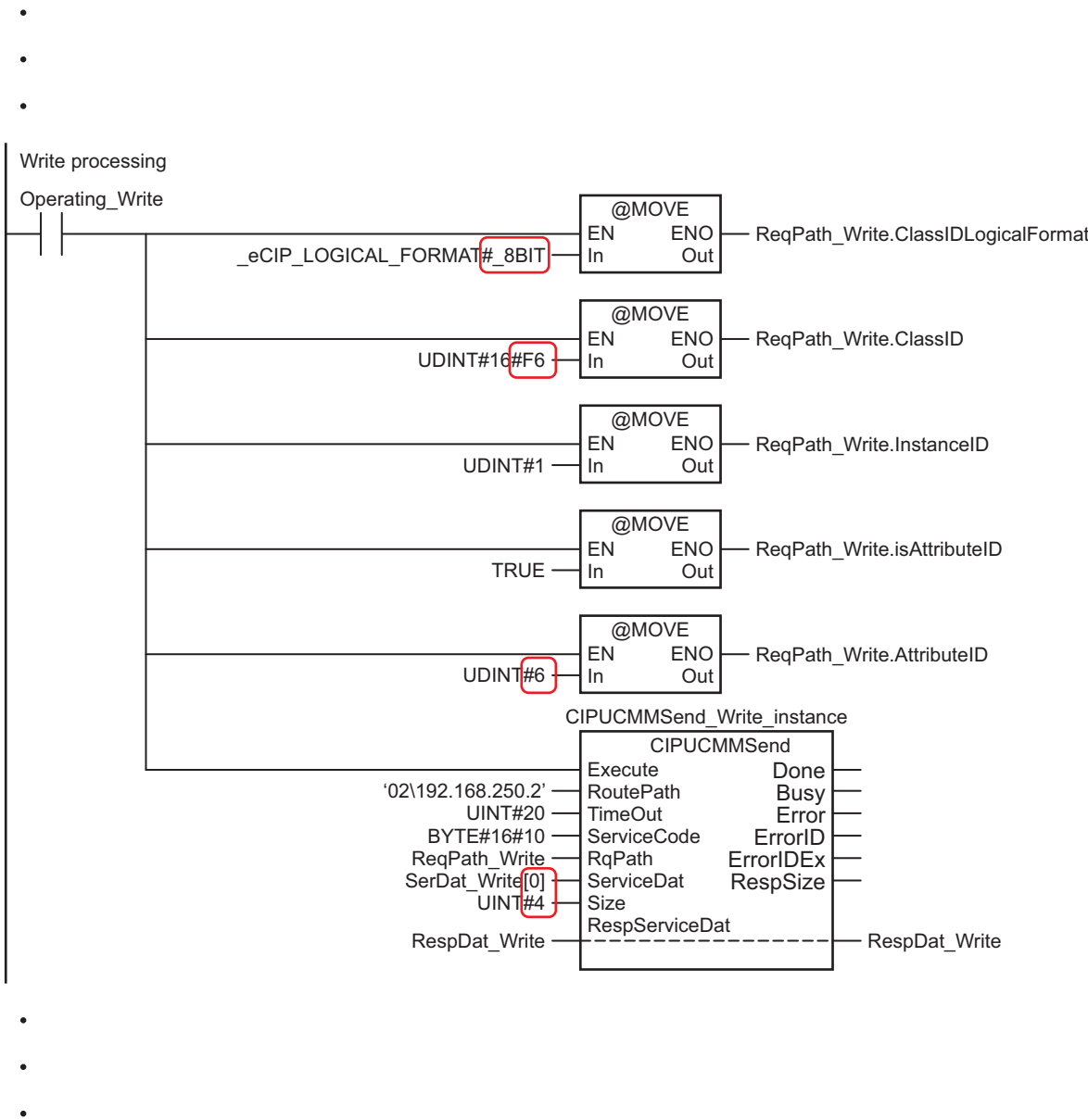
● ST

Among the variables used in program example 1, use those used for the program for setting write processing. However, in this example, set the default of the service data stored in the *SerDat_Write* variable as follows.

Internal variables	Name	Data type	Default	Comment
	SerDat_Write	ARRAY[0..3] OF BYTE	[2(16#0),16#64,16#0]	Service data

In programming, make the following changes to program example 1.

• Change the ClassIDLogicalFormat member value for the request path, class ID value, attribute ID value, service data value, and service data size.

• Remove the restart processing.

The following diagram shows where to change the value or size. The locations enclosed in red rectangles are changed.

A

A-2 Sample Programming

A-2-2 Configuring the IO-Link Master Unit with Message Communications

-
-
-

```
// Write processing
IF (Operating_Write=TRUE) THEN
 CASE Stage OF
 1 :                                          // Send message
   ReqPath_Write.ClassIDLogicalFormat   :=_8BIT;   // Set ClassID data size to _8BIT
   ReqPath_Write.ClassID          :=UINT#16#F6;    // Specify Ethernet Link object
   ReqPath_Write.InstanceID      :=UINT#01;
   ReqPath_Write.isAttributeID    :=TRUE;
   ReqPath_Write.AttributeID      :=UINT#06;        //Interface Control attribute ID
   CIPUCMMSend_Write_instance(
     Execute            :=TRUE,
     RoutePath          :='02\192.168.250.2',      // Route path
     TimeOut            :=UINT#20,                  // Setting write timeout value
     ServiceCode        :=BYTE#16#10,               // Setting write service code
     RqPath             :=ReqPath_Write,            // Setting write request path
     ServiceDat         :=SerDat_Write[0],          // Setting write service data
     Size               :=UINT#4,                   // Number of setting write elements
     RespServiceDat     :=RespDat_Write);           // Setting write processing response data
```

-
-
-

A-2-3   Configuring IO-Link Devices with Message Communications

This section provides sample programming to configure the parameter settings of an IO-Link device with explicit message communications.

The IO-Link Master Unit provides a CIP object that allows for setting the device parameters of IO-Link devices. From the user program in the Controller, you can send an explicit message that specifies the Class ID, Instance ID, and Attribute ID of the relevant object and write values to configure the parameter settings of IO-Link devices.

Here, a sample programing example for setting the Input Filter Setting for an IO-Link device connected to port 1 to 128 ms is described, where an NJ/NX-series CPU Unit is used as the Controller.

Assume that the IP address of the IO-Link Master Unit is 192.168.250.2.

This example assumes that, in the Input Filter Setting of the IO-Link device, the index number of service data is 3000 hex and the set value for setting the input filter time to 128 ms is 0A hex.

It is based on the assumption that the Input Filter Setting parameters are updated immediately. Refer to the user's manual for your IO-Link device for information on the update timing of the IO-Link device settings.
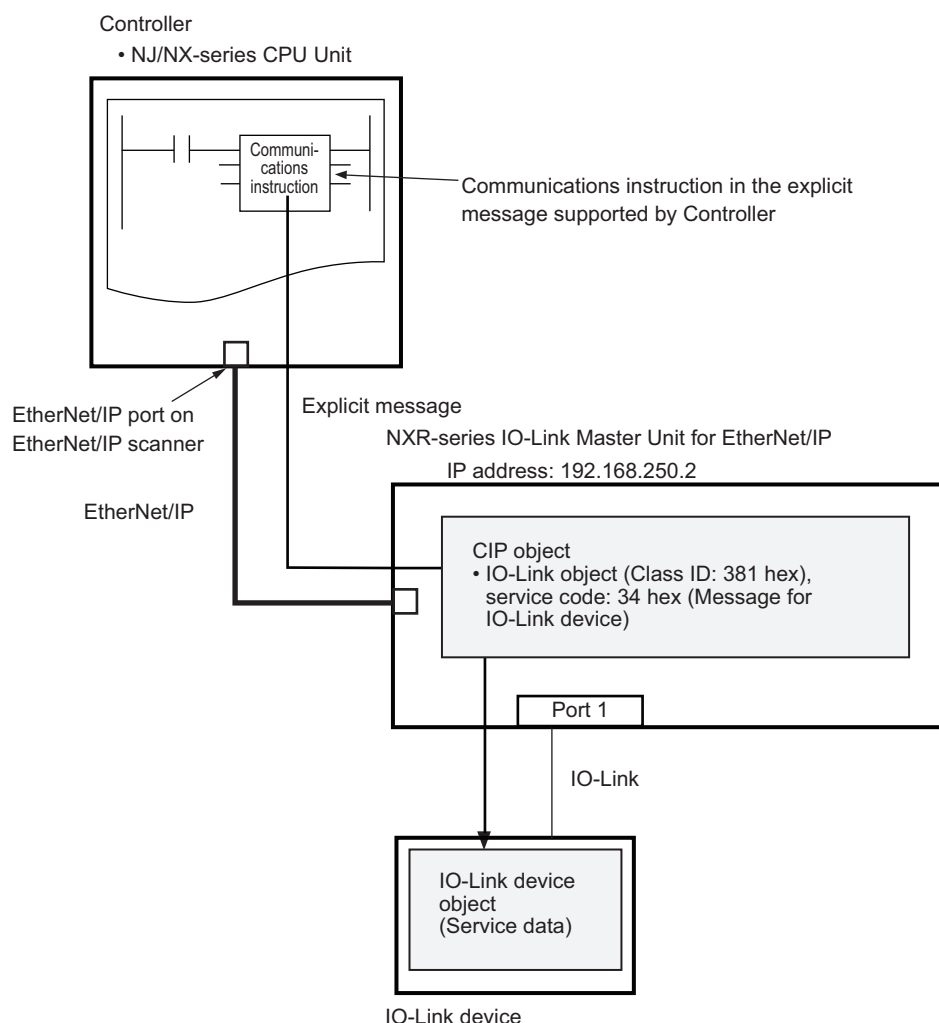
NJ/NX-series CPU Units support the following special instructions that you can send through an explicit message.

- CIPSend instruction
- CIPUCMMSend instruction

Here, an example of using the CIPUCMMSend instruction is provided. When you use the CIPUCMMSend instruction for an IO-Link Master Unit, some restrictions apply. For details on the restrictions, refer to *Special Instructions for the Controller* on page 6-5 in *Accessing CIP Objects through an Explicit Message* on page 6-5.

Program Example

This example sets the Input Filter Setting for an IO-Link device to 128 ms.

The content of the message is to write data to the service data of the Input Filter Setting for the IO-Link device. To write the setting, the Message for IO-Link device service is used.
The settings are shown below.

Item	Value	Description
Route path	'02\192.168.250.2'	Specifies the network type number and destination IP address. The network type number "02" specifies the built-in EtherNet/IP port on the CPU Unit.[1]
Class ID	381 hex	Specifies the IO-Link object. The data size is 16 bits.
Instance ID	01 hex	Specifies the port number.
Attribute ID	00 hex	Specifies 00 hex.
Service code	34 hex	Specifies the service to send a message to the IO-Link device.
Service data	'0105300001010A'	Refer to *Service Data Settings* on page A-52 below.

[1]. Refer to *Route Path* in the user's manual for your OMRON EtherNet/IP scanner for information on how to specify the network type number.
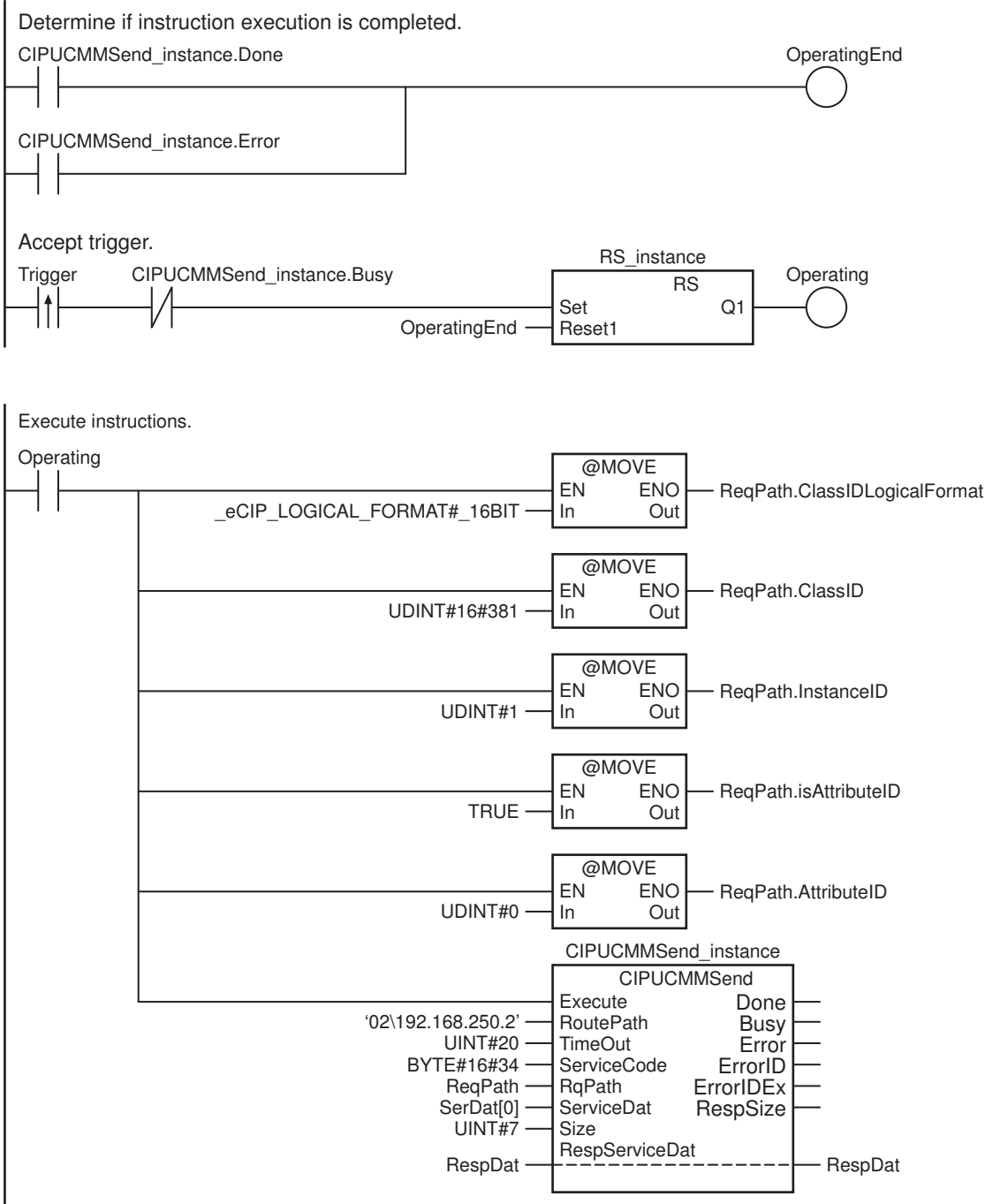
● **Service Data Settings**

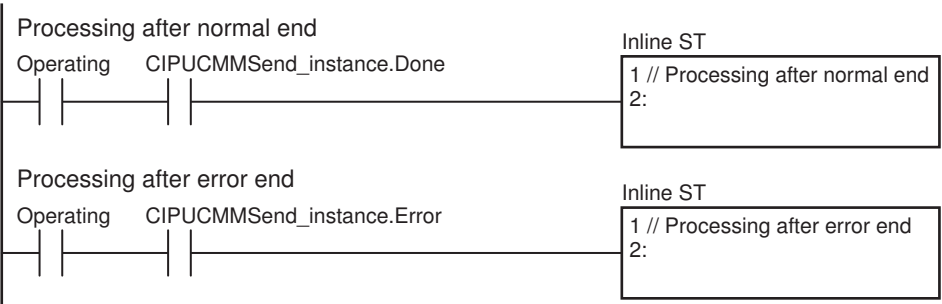| Parameter name	Data type	Value (hex)	Description
Kind	USINT	01	The following command types are provided. • 00 hex: Read • 01 hex: Write Specify Write.
Timeout	USINT	05	Specifies the time for the IO-Link Master Unit to monitor the response from the IO-Link device.
Index	UINT	3000	Specifies the index number of the object that specifies the Input Filter Setting for the IO-Link device.
Subindex	USINT	01	Specifies the subindex number of the object that specifies the port to set the input filter for the IO-Link device.
Length	USINT	01	Specifies the byte data size of Write Data.
Write Data	USINT	0A	Specifies 128 ms (0A hex) as the set value of the input filter time for the IO-Link device.

The data size of the class ID is 16 bits. Therefore, for the request path, set the ClassIDLogicalFormat member of _sREQUEST_PATH_EX type to _16BIT.

LD

Name	Data type	Default	Comment
OperatingEnd	BOOL	False	Processing completed
Trigger	BOOL	False	Execution condition
Operating	BOOL	False	Processing in progress
ReqPath	_sREQUEST_PATH_EX	(ClassIDLogicalFormat:=_8BIT, ClassID:=0, InstanceIDLogicalFormat:=_8BIT, InstanceID:=0, isAttributeID:=False, AttributeIDLogicalFormat:=_8BIT, AttributeID:=0)	Request path
RespDat	ARRAY[0..10] OF BYTE	[11(16#0)]	Response data
SerDat	ARRAY[0..6] OF BYTE	[16#1,16#5,16#30,2(16#00),16#01,16#0A]	Service data
Dummy	BYTE	16#0	Dummy

Name	Data type	Default	Comment
RS_instance	RS		
CIPUCMMSend_instance	CIPUCMMSend		

Determine if instruction execution is completed.

```
CIPUCMMSend_instance.Done                                    OperatingEnd
    | |                                                          ( )

CIPUCMMSend_instance.Error
    | |
```

Accept trigger.

```
                                                    RS_instance
Trigger    CIPUCMMSend_instance.Busy                     RS         Operating
  |↑|              |/|                              Set        Q1      ( )
                                    OperatingEnd — Reset1
```

Execute instructions.

```
Operating
   | |                                    @MOVE
                                      EN       ENO — ReqPath.ClassIDLogicalFormat
          _eCIP_LOGICAL_FORMAT#_16BIT — In       Out

                                          @MOVE
                                      EN       ENO — ReqPath.ClassID
                          UDINT#16#381 — In       Out

                                          @MOVE
                                      EN       ENO — ReqPath.InstanceID
                                UDINT#1 — In       Out

                                          @MOVE
                                      EN       ENO — ReqPath.isAttributeID
                                   TRUE — In       Out

                                          @MOVE
                                      EN       ENO — ReqPath.AttributeID
                                UDINT#0 — In       Out

                                    CIPUCMMSend_instance
                                        CIPUCMMSend
                                   Execute        Done
              '02\192.168.250.2' — RoutePath      Busy
                         UINT#20 — TimeOut        Error
                      BYTE#16#34 — ServiceCode    ErrorID
                          ReqPath — RqPath        ErrorIDEx
                       SerDat[0] — ServiceDat     RespSize
                          UINT#7 — Size
                                    RespServiceDat
                          RespDat —————————————— RespDat
```

Processing after normal end

Operating   CIPUCMMSend_instance.Done

Inline ST

```
1 // Processing after normal end
2:
```

Processing after error end

Operating   CIPUCMMSend_instance.Error

Inline ST

```
1 // Processing after error end
2:
```

ST

Internal variables	Name	Data type	Default	Comment
	Trigger	BOOL	False	Execution condition
	Operating	BOOL	False	Processing in progress
	Stage	INT	0	State transition
	ReqPath	_sREQUEST_PATH_EX	(ClassIDLogicalFormat:=_8BIT, ClassID:=0, InstanceIDLogicalFormat:=_8BIT, InstanceID:=0, isAttributeID:=False, AttributeIDLogicalFormat:=_8BIT, AttributeID:=0)	Request path
	RespDat	ARRAY[0..10] OF BYTE	[11(16#0)]	Response data
	SerDat	ARRAY[0..6] OF BYTE	[16#1,16#5,16#30,2(16#00),16#01,16#0A]	Service data
	CIPUCMM-Send_instance	CIPUCMMSend		

External variable	Name	Data type	Constant	Comment
	_EIP_EtnOnlineSta[*1]	BOOL	☑	Online

*1. This is a system-defined variable for NJ-series CPU Units. Refer to the user's manual for the built-in EtherNet/IP scanner on your NX-series CPU Unit for information on system-defined variables for NX-series CPU Units.

```
// Start sequence when Trigger changes to TRUE
IF ((Trigger=TRUE) AND (Operating=FALSE) AND (_EIP_EtnOnlineSta=TRUE))
THEN
    Operating=                 :=TRUE;
    Stage                      :=INT#1;
    CIPUCMMSend_instance(
        Execute                :=FALSE,                   // Initialize instance
        ServiceDat             :=Dummy,                   // Dummy
    RespServiceDat             :=RespDat);                // Dummy
END_IF;


IF (Operating==TRUE) THEN
```

```
CASE Stage OF
1 :                                              // Send message
   ReqPath.ClassIDLogicalFormat:=_16BIT;// Set ClassID data size to _16BIT
   ReqPath.ClassID      :=UINT#16#381;
   ReqPath.InstanceID   :=UINT#16#01;
   ReqPath.isAttributeID:=TRUE;
   ReqPath.AttributeID  :=UINT#00;
   CIPUCMMSend_instance(
      Execute          :=TRUE,
      RoutePath        :='02\192.168.250.2',          // Route path
      TimeOut          :=UINT#20,                      // Timeout value
      ServiceCode      :=BYTE#16#34,                   // Service code
      RqPath           :=ReqPath,                      // Request path
      ServiceDat       :=SerDat[0],                      // Service data
      Size             :=UINT#7,                       // Number of elements
      RespServiceDat   :=RespDat);                     // Response data

   IF (CIPUCMMSend_instance.Done=TRUE) THEN
      Stage           :=INT#0;                         // Normal end
   ELSIF (CIPUCMMSend_instance.Error=TRUE) THEN
      Stage           :=INT#30;                        // Error end
   END_IF;

0:                                               // Normal end processing
   Operating=          :=FALSE;
   Trigger             :=FALSE;

ELSE                                             // Error end processing
   Operating=          :=FALSE;
   Trigger             :=FALSE;

   END_CASE;
END_IF;
```

A-2-4   Backing Up and Restoring Devices Parameters of IO-Link Master Units

This section provides sample programming to back up and restore the device parameters of an IO-Link Master Unit through an explicit message.
The IO-Link Master Unit provides a CIP object that allows for setting the device parameters of an IO-Link Master Unit. From the user program in the Controller, you can send an explicit message that specifies the Class ID, Instance ID, and Attribute ID of the relevant object to use the following services for backup or restore.
- Service for backup: Get_Attribute_Single
- Service for restore: Set_Attribute_Single

Here, sample programing examples for backing up and restoring the device parameters of an IO-Link Master Unit are described, where an NJ/NX-series CPU Unit is used as the Controller.

Program Example	Services used in programming	Program description
Backup	Get_Attribute_Single (0E hex)	Backs up the Pin 2 Input Filter Value Setting for port 1.
Restore	Set_Attribute_Single (10 hex)	Restores the Pin 2 Input Filter Value Setting for port 1.

Assume that the IP address of the IO-Link Master Unit is 192.168.250.2.

Program Example for Backup

This is an example of backup by reading the device parameters from the IO-Link Master Unit.
The read device parameters are saved for restore operation. For example, they are saved in retained variables. Refer to the user's manual for your CPU Unit for information on retained variables.

The content of the message is to read a setting from the attribute of the Pin 2 Input Filter Setting for port 1.
To read the setting, the Get_Attribute_Single service is used.
The settings are shown below.
The response data is stored in the *respDat* variable. The data size of response data in reading the attribute of the Pin 2 Input Filter Setting for port 1 is 1 byte. To back up parameters, transfer *respDat[0]* that is the first one byte of *respDat* to the *BackupData* retained variable.

Item	Value	Description
Route path	'02\192.168.250.2'	Specifies the network type number and destination IP address. The network type number "02" specifies the built-in EtherNet/IP port on the CPU Unit.[1]
Class ID	381 hex	Specifies the IO-Link object. The data size is 16 bits.
Instance ID	01 hex	Specifies the port number.
Attribute ID	07 hex	Specifies the instance attribute that specifies Pin 2 Input Filter Value Setting.
Service code	0Ehex	Specifies the Get_Attribute_Single service to read a value into the specified attribute.
Service data	Dummy	In this example, specify Dummy because there is no service data.

*1. Refer to *Route Path* in the user's manual for your OMRON EtherNet/IP scanner for information on how to specify the network type number.

● LD

Name	Data type	Default	Re-tained	Comment
OperatingEnd	BOOL	False		Processing completed
Trigger	BOOL	False		Execution condition
Operating	BOOL	False		Processing in progress

Name	Data type	Default	Re-tained	Comment
ReqPath	_sREQUEST_PATH_EX	(ClassIDLogicalFormat:=_8BIT, ClassID:=0, InstanceIDLogicalFormat:=_8BIT, InstanceID:=0, isAttributeID:=False, AttributeIDLogicalFormat:=_8BIT, AttributeID:=0)		Request path
RespDat	ARRAY[0..10] OF BYTE	[11(16#0)]		Response data
SerDat	BYTE			Service data
BackupData	BYTE		☑	Backup data
Dummy	BYTE	16#0		Dummy
RS_instance	RS			
CIPUCMMSend_in-stance	CIPUCMMSend			

Determine if instruction execution is completed.

CIPUCMMSend_instance.Done   OperatingEnd

CIPUCMMSend_instance.Error

Accept trigger.

Trigger   CIPUCMMSend_instance.Busy

RS_instance
RS
Set   Q1   Operating
OperatingEnd — Reset1

Execute instructions.

Operating

```
                                    @MOVE
                            EN           ENO      ReqPath.ClassIDLogicalFormat
_eCIP_LOGICAL_FORMAT#_16BIT In          Out
```

```
                                    @MOVE
                            EN           ENO      ReqPath.ClassID
              UDINT#16#381   In          Out
```

```
                                    @MOVE
                            EN           ENO      ReqPath.InstanceID
                  UDINT#1    In          Out
```

```
                                    @MOVE
                            EN           ENO      ReqPath.isAttributeID
                     TRUE    In          Out
```

```
                                    @MOVE
                            EN           ENO      ReqPath.AttributeID
                  UDINT#7    In          Out
```

CIPUCMMSend_instance

```
                          CIPUCMMSend
                      Execute         Done
     '02\192.168.250.2'  RoutePath      Busy
            UINT#20      TimeOut        Error
          BYTE#16#0E     ServiceCode    ErrorID
             ReqPath     RqPath         ErrorIDEx
              Dummy      ServiceDat     RespSize
             UINT#1      Size
                         RespServiceDat
            RespDat   ------------------  RespDat
```

Backup processing

Operating

```
                                    @MOVE
                            EN           ENO
               RespDat[0]   In          Out      BackupData
```

Processing after normal end

Operating   CIPUCMMSend_instance.Done

Inline ST

```
1 // Processing after normal end
2:
```

Processing after error end

Operating   CIPUCMMSend_instance.Error

Inline ST

```
1 // Processing after error end
2:
```

● **ST**

Internal varia- bles	Name	Data type	Default	Re- tained	Comment
	Trigger	BOOL	False		Execution condition
	Operating	BOOL	False		Processing in prog- ress

Internal varia-bles	Name	Data type	Default	Re-tained	Comment
	Stage	INT	0		State transition
	ReqPath	_sREQUEST_PATH_EX	(ClassIDLogicalFor-mat:=_8BIT, ClassID:=0, InstanceIDLogicalFor-mat:=_8BIT, InstanceID:=0, isAttributeID:=False, AttributeIDLogicalFor-mat:=_8BIT, AttributeID:=0)		Request path
	RespDat	ARRAY[0..10] OF BYTE	[11(16#0)]		Response data
	SerDat	BYTE			Service data
	BackupData	BYTE		☑	Backup data
	Dummy	BYTE	16#0		Dummy
	CIPUCMM-Send_instance	CIPUCMMSend			

External variable	Name	Data type	Constant	Comment
	_EIP_EtnOnlineSta[*1]	BOOL	☑	Online

*1. This is a system-defined variable for NJ-series CPU Units. Refer to the user's manual for the built-in EtherNet/IP scan-ner on your NX-series CPU Unit for information on system-defined variables for NX-series CPU Units.

```
// Start sequence when Trigger changes to TRUE
IF ((Trigger=TRUE) AND (Operating=FALSE) AND (_EIP_EtnOnlineSta=TRUE))
THEN
  Operating            :=TRUE;
  Stage                :=INT#1;
  CIPUCMMSend_instance(
    Execute            :=FALSE,                // Initialize instance
    RqPath             :=ReqPath,              // Request path
    ServiceDat         :=Dummy,                // Dummy
  RespServiceDat       :=RespDat);             // Dummy
END_IF;

IF (Operating=TRUE) THEN
  CASE Stage OF
  1 :                                          // Send message
    ReqPath.ClassIDLogicalFormat :=_16BIT;// Set ClassID data size to _16BIT
    ReqPath.ClassID       :=UINT#16#381;       // Specify IO-Link object
    ReqPath.InstanceID    :=UINT#01;
    ReqPath.isAttributeID :=TRUE;
    ReqPath.AttributeID   :=UINT#07;
    // Attribute ID for Pin 2 Input Filter Value Setting
```

```
CIPUCMMSend_instance(
  Execute              :=TRUE,
  RoutePath            :='02\192.168.250.2',   // Route path
  TimeOut              :=UINT#20,              // Timeout value
  ServiceCode          :=BYTE#16#0E,           // Service code
  RqPath               :=ReqPath,              // Request path
  ServiceDat           :=SerDat,               // Service data
  Size                 :=UINT#1,               // Number of elements
  RespServiceDat       :=RespDat);             // Response data


  BackupData           :=RespDat[0]            // Backup


IF (CIPUCMMSend_instance.Done=TRUE) THEN
  Stage                :=INT#0;                // Normal end
ELSIF (CIPUCMMSend_instance.Error=TRUE) THEN
  Stage                :=INT#30;               // Error end
END_IF;


0:                                             // Normal end processing
  Operating=           :=FALSE;
  Trigger              :=FALSE;


ELSE                                           // Error end processing
  Operating            :=FALSE;
  Trigger              :=FALSE;


END_CASE;
END_IF;
```

Program Example for Restore

This is an example of restore by reading the values of retained variables that you backed up and writing the device parameters to the IO-Link Master Unit.

The content of the message is to write a setting to the attribute for the Pin 2 Input Filter Value Setting for port 1.
To write the setting, the Set_Attribute_Single service is used.
Pin 2 Input Filter Value Setting is a parameter that does not change until after the Unit is restarted. The written setting is reflected after the IO-Link Master Unit is restarted. Therefore, the Reset service of the Identity object is used to perform the restart processing.

The set values are the same as those of program example 1 in *A-2-2 Configuring the IO-Link Master Unit with Message Communications* on page A-39. Transfer and write the backed up service data *BackupData* to the service data *SerDat_Write*.

Add the following processing to program example 1 in *A-2-2 Configuring the IO-Link Master Unit with Message Communications* on page A-39.

• Transfer the backup data *BackupData* to the service data *SerDat_Write*.

Details are given below.

Add the processing enclosed in a red rectangle.

● LD

Determine if instruction execution is completed.

CIPUCMMSend_instance.Done   OperatingEnd

CIPUCMMSend_instance.Error

Accept trigger.

Trigger   CIPUCMMSend_instance.Busy   RS_instance
                                                                                         RS   Operating
                                                                             Set   Q1
                                                         OperatingEnd — Reset1

Restore processing

Operating_Write
                                                                   @MOVE
                                                           EN   ENO
                                   BackupData — In   Out — SerDat_Write

Write processing

•

•

•
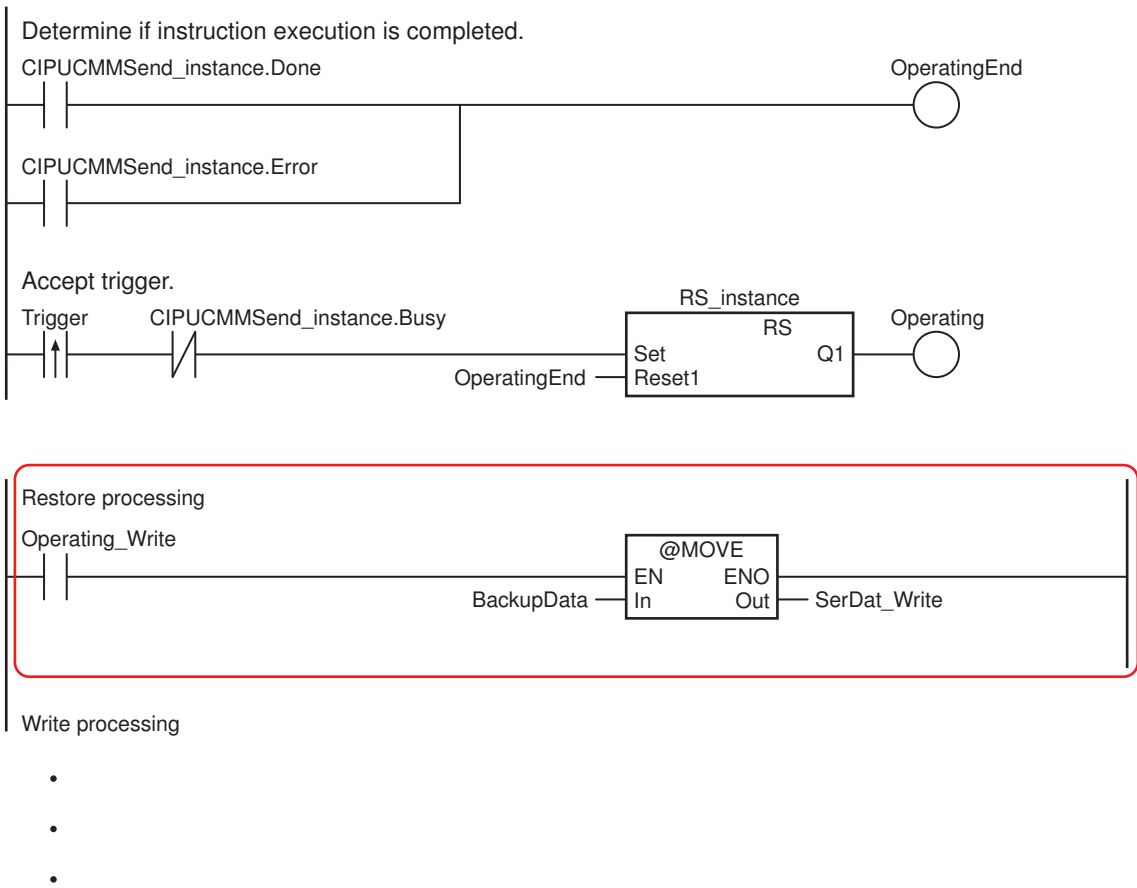
● **ST**

// Start setting write processing when Trigger_Write changes to TRUE
IF ((Trigger_Write=TRUE) AND (Operating_Write=FALSE) AND (_EIP_EtnOnlineSta=TRUE)

　•

　•

　•

// Write processing
IF (Operating_Write=TRUE) THEN
　CASE Stage OF
　1 :　　　　　　　　　　　　　　　　　　// Send message
　　SerDat_Write　　　　　:= BackupData;　　// Restore processing
　　ReqPath_Write.ClassIDLogicalFormat　:=_16BIT;　　// Set ClassID data size to _16BIT
　　ReqPath_Write.ClassID　　:=UINT#16#381;　　// Specify IO-Link object

　•

　•

　•

A-3   Configuring the Windows Firewall

Better firewall security for Windows has increased the restrictions for data communications. Before you connect the Network Configurator and CX-ConfiguratorFDT to a CPU Unit and start communications through the following procedures, you may need to change the settings of the Windows firewall as described in this section.

- If you select **Option** – **Select Interface** – **Ethernet I/F**
- If you select **Option** – **Select Interface** – **NJ/NX Series Ethernet Direct I/F**
- If you select **Option** – **Select Interface** – **NJ/NX Series USB Port**

  Precautions for Correct Use

> The main function of the firewall is to prevent illegal access from external sources (e.g., the Internet). The changes that are made with the following procedures are to connect the Network Configurator and CX-ConfiguratorFDT to a CPU Unit. If your computer is on an inhouse network, make sure that security will not be jeopardized before you change the settings.

The procedure is described below. It assumes that you use the CX-ConfiguratorFDT. To use the Network Configurator, replace the CX-ConfiguratorFDT in the procedure with Network Configurator.

The following shows the configuration procedure on Windows 10.
Always perform steps 1 to 9 if you cannot go online. The **User Account Control** dialog box may be displayed during this procedure. If it appears, click the **Continue** button and continue with the procedure.

1　Select **Windows System** – **Control Panel** from the Windows **Start** menu.
　　The **Control Panel** is displayed.

2　In the **Control Panel**, click **View by:** on the right and select **Large icons** or **Small icons**.
　　All Control Panel Items are displayed.
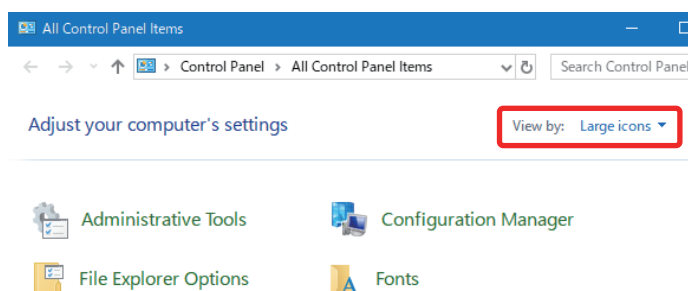
3　Select **Administrative Tools**, and double-click **Windows Defender Firewall with Advanced Security** in the displayed dialog box.
　　The **Windows Defender Firewall with Advanced Security** dialog box is displayed.

4　Select **Inbound Rules** under **Windows Defender Firewall with Advanced Security on Local Computer** on the left side of the dialog box.
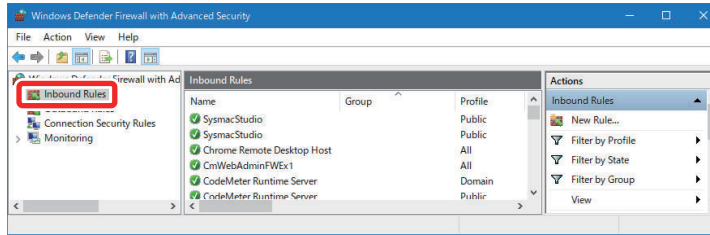
5 Select **New Rule** under **Inbound Rules** in the **Actions** area on the right side of the dialog box.
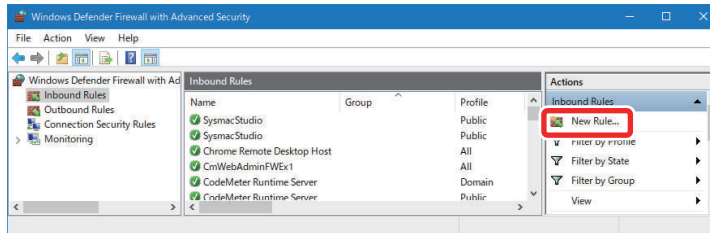
6 Follow the steps below to make the settings in the **New Inbound Rule Wizard** dialog box. Select the specified option at each step, and click the **Next** button to move to the next step.

Rule Type	Select **Custom**.
Program	Select **All programs**.
Protocol and Ports	Select **ICMPv4** as the protocol type.
Scope	Select **Any IP address** for all.
Action	Select **Allow the connection**.
Profile	Select **Domain**, **Private**, and **Public**.
Name	Enter an arbitrary name (e.g., Omron_EIP).

7 Click the **Finish** button. The rule that you defined (i.e., Omron_EIP) is registered in the list of **Inbound Rules**. Close the **Windows Defender Firewall with Advanced Security** dialog box.
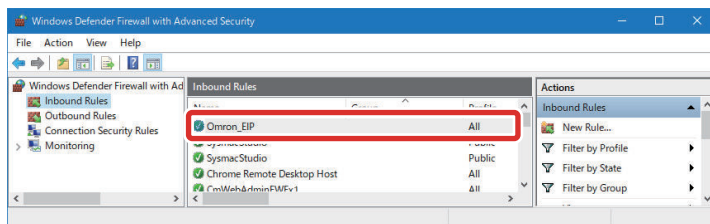
8 When you attempt to connect to the CPU Unit from the CX-ConfiguratorFDT, the **Windows Security Alert** dialog box is displayed.

9 Click the **Allow access** button.
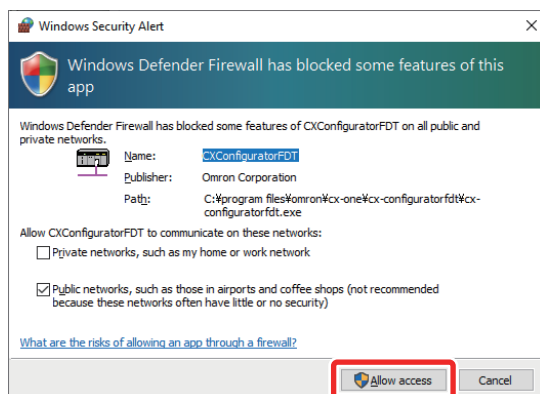
This allows USB connection and EtherNet/IP connection to the CX-ConfiguratorFDT, and you will be able to connect to the CPU Unit with the CX-ConfiguratorFDT.

A

A-4   Dimensions

Installation dimensions

Two, M5 or 5.3-dia. holes

45.5
6.5
16.5
26.7
5.5
97.7
122.7
147.7
172.7
208.7
240

32.8
19.2

227±0.2

14.5
17
45
47.5
62

19.2
24.2
26.8
37
38

14.2
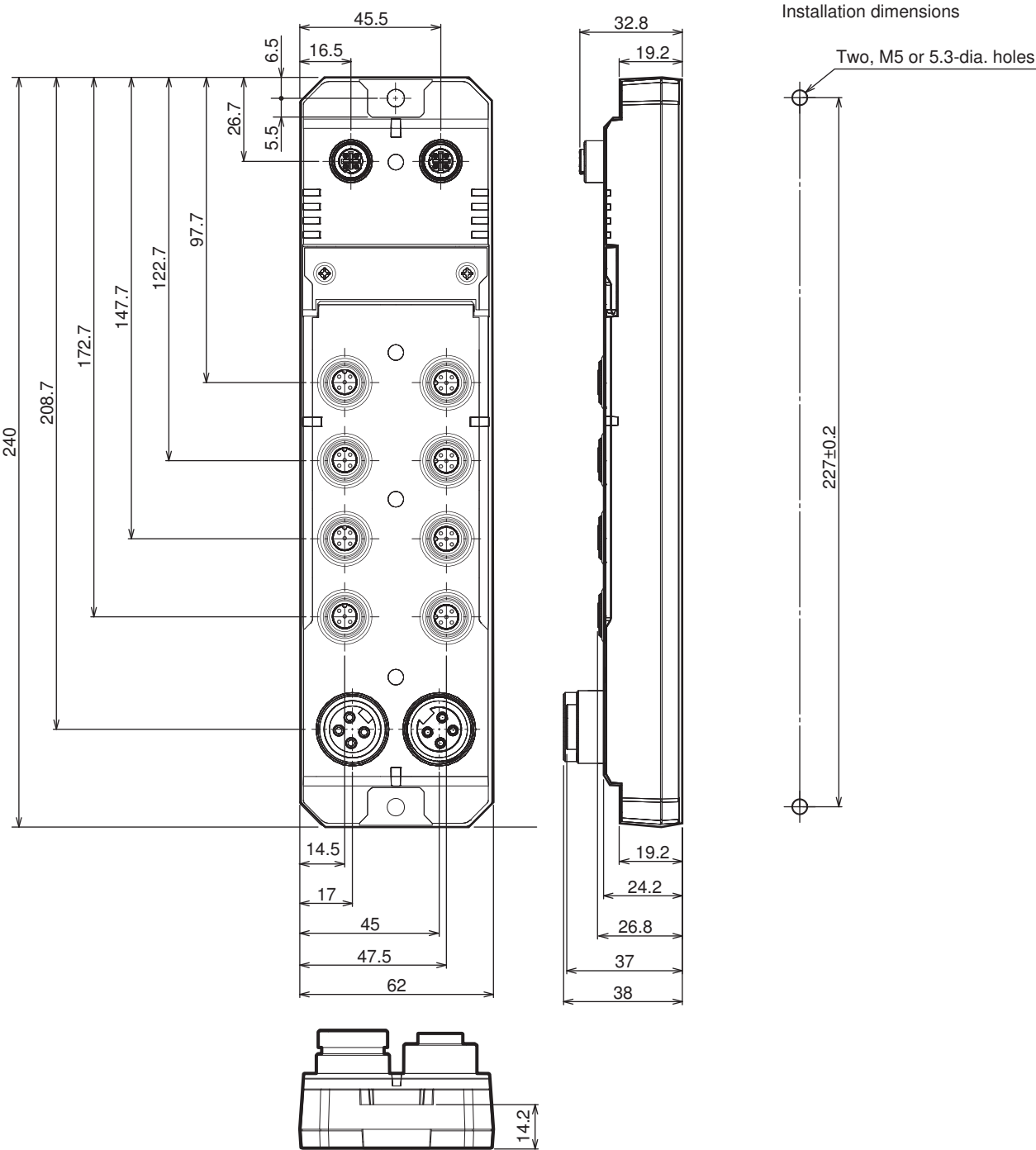
A-5   Version Information

This section describes the relationship between the unit versions of the IO-Link Master Units and the CPU Units and the versions of the Support Software.

A-5-1   Relationship between Unit Versions

This section describes the relationship between the unit versions of the IO-Link Master Units and the CPU Units and the versions of the Support Software for different system configurations.

If you use any of the combinations of versions/unit versions that are the same or that are later or higher than the corresponding versions given in the following table, you can use all of the functions that are supported by that unit version of the IO-Link Master Unit. Refer to *A-5-2 Functions That Were Added or Changed for Each Unit Version* on page A-68 for the functions that are supported for each unit version of the IO-Link Master Unit.
Refer to version-related information given in the user's manuals of the CPU Unit for corresponding versions when using CPU Unit versions and Support Software versions that are the same or that are later or higher than the corresponding versions.

Depending on the type and model of the Unit, some Units do not have all of the versions given in the corresponding versions. If a Unit does not have the specified version, support is provided by the oldest available version after the specified version. Refer to the user's manuals for the specific Units for the relation between models and versions.

Connection to the NJ/NX-series CPU Unit

The following describes the relationship between the unit version of the IO-Link Master Units and the NJ/NX-series CPU Units and the versions of the Support Software.

• NX-series CPU Unit

IO-Link Master Unit		Corresponding unit version/version			
Model	Unit version	Unit version of CPU Unit	Sysmac Studio version	Network Configurator version	CX-ConfiguratorFDT version
NXR-ILM08C-EIT	Ver.1.1	Ver.1.14	Ver.1.40	Ver.3.69	Ver.2.54
	Ver.1.0				

• NJ-series CPU Unit

IO-Link Master Unit		Corresponding unit version/version				
Model	Unit version	Unit version of CPU Unit	Unit version of CJ1W-EIP21	Sysmac Studio version	Network Configurator version	CX-ConfiguratorFDT version
NXR-ILM08C-EIT	Ver.1.1	Ver.1.14	Ver.2.1	Ver.1.40	Ver.3.69	Ver.2.54
	Ver.1.0					

Connection to the CS/CJ/CP-series CPU Unit

The following describes the relationship between the unit version of the IO-Link Master Units and the CS/CJ/CP-series CPU Units and the versions of the Support Software.

• CS1G/CS1H/CJ1M CPU Unit

IO-Link Master Unit		Corresponding unit version/version			
Model	Unit ver-sion	Unit version of CPU Unit	Unit version of CS1W-EIP21/ CJ1W-EIP21	Network Config-urator version	CX-Configura-torFDT version
NXR-ILM08C-EIT	Ver.1.1	Ver.3.0	Ver.2.1	Ver.3.69	Ver.2.54
	Ver.1.0				

• CJ2H-CPU6□/CJ2M-CPU1□/CP1H CPU Unit

IO-Link Master Unit		Corresponding unit version/version			
Model	Unit ver-sion	Unit version of CPU Unit	Unit version of CJ1W-EIP21	Network Config-urator version	CX-Configura-torFDT version
NXR-ILM08C-EIT	Ver.1.1	Ver.3.0	Ver.2.1	Ver.3.69	Ver.2.54
	Ver.1.0				

• CJ2H-CPU6□-EIP CPU Unit

IO-Link Master Unit		Corresponding unit version/version			
Model	Unit ver-sion	Unit version of CPU Unit	Unit version of CJ1W-EIP21	Network Config-urator version	CX-Configura-torFDT version
NXR-ILM08C-EIT	Ver.1.1	Ver.1.5	Ver.2.1	Ver.3.69	Ver.2.54
	Ver.1.0				

• CJ2M-CPU3□ CPU Unit

IO-Link Master Unit		Corresponding unit version/version			
Model	Unit ver-sion	Unit version of CPU Unit	Unit version of CJ1W-EIP21	Network Config-urator version	CX-Configura-torFDT version
NXR-ILM08C-EIT	Ver.1.1	Ver.1.5	Ver.2.1	Ver.3.69	Ver.2.54
	Ver.1.0				

A-5-2　Functions That Were Added or Changed for Each Unit Version

This section shows the functions that were added or changed for each unit version of the IO-Link Master Unit. You can use the added or changed functions with the versions/unit versions given in the table or with later/higher versions.
Refer to version-related information given in the user's manuals of the CPU Unit for corresponding versions when using CPU Unit versions and Support Software versions that are the same or that are later or higher than the corresponding versions.

Depending on the type and model of the Unit, some Units do not have all of the versions given in the corresponding versions. If a Unit does not have the specified version, support is provided by the oldest

available version after the specified version. Refer to the user's manuals for the specific Units for the relation between models and versions.

Connection to the NJ/NX-series CPU Unit

The following table shows the relationship when the NJ/NX-series CPU Unit is connected.

• NX-series CPU Unit

| Function | Change or addition | IO-Link Master Unit | | Corresponding unit version/version | | | |
		Model	Unit version	Unit version of CPU Unit	Sysmac Studio version	Network Configurator version	CX-Configura-torFDT version
IO-Link communications delay time settings	Addition	NXR-ILM08C-EIT	Ver.1.1	Ver.1.14	Ver.1.40	Ver.3.69	Ver.2.54

• NJ-series CPU Unit

| Function | Change or addition | IO-Link Master Unit | | Corresponding unit version/version | | | | |
		Model	Unit version	Unit version of CPU Unit	Unit version of CJ1W-EIP21	Sysmac Studio version	Network Configurator version	CX-Configura-torFDT version
IO-Link communications delay time settings	Addition	NXR-ILM08C-EIT	Ver.1.1	Ver.1.14	Ver.2.1	Ver.1.14	Ver.3.69	Ver.2.54

Connection to the CS/CJ/CP-series CPU Unit

The following table shows the relationship when the CS/CJ/CP-series CPU Unit is connected.

• CS1G/CS1H/CJ1M CPU Unit

| Function | Change or addition | IO-Link Master Unit | | Corresponding unit version/version | | | |
		Model	Unit version	Unit version of CPU Unit	Unit version of CS1W-EIP21/CJ1W-EIP21	Network Configurator version	CX-Configura-torFDT version
IO-Link communications delay time settings	Addition	NXR-ILM08C-EIT	Ver.1.1	Ver.3.0	Ver.2.1	Ver.3.69	Ver.2.54

• CJ2H-CPU6□/CJ2M-CPU1□/CP1H CPU Unit

Function	Change or addition	IO-Link Master Unit		Corresponding unit version/version			
		Model	Unit version	Unit version of CPU Unit	Unit version of CJ1W-EIP21	Network Configurator version	CX-Configura-torFDT version
IO-Link communications delay time settings	Addition	NXR-ILM08C-EIT	Ver.1.1	Ver.3.0	Ver.2.1	Ver.3.69	Ver.2.54

- **CJ2H-CPU6□-EIP CPU Unit**

Function	Change or addition	IO-Link Master Unit		Corresponding unit version/version			
		Model	Unit version	Unit version of CPU Unit	Unit version of CJ1W-EIP21	Network Configurator version	CX-Configura-torFDT version
IO-Link communications delay time settings	Addition	NXR-ILM08C-EIT	Ver.1.1	Ver.1.5	Ver.2.1	Ver.3.69	Ver.2.54

- **CJ2M-CPU3□ CPU Unit**

Function	Change or addition	IO-Link Master Unit		Corresponding unit version/version			
		Model	Unit version	Unit version of CPU Unit	Unit version of CJ1W-EIP21	Network Configurator version	CX-Configura-torFDT version
IO-Link communications delay time settings	Addition	NXR-ILM08C-EIT	Ver.1.1	Ver.1.5	Ver.2.1	Ver.3.69	Ver.2.54

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