Environment-resistive Remote Terminal

NXR-series

IO-Link Master Unit for EtherCAT®

User's Manual

NXR-ILM08C-ECT

IO-Link Master Unit for EtherCAT

always in control

W640-E1-01

NOTE

Trademarks

Copyrights

Introduction

Thank you for purchasing an NXR-series IO-Link Master Unit for EtherCAT.
This manual contains information that is necessary to use the NXR-series IO-Link Master Unit for EtherCAT. Please read this manual and make sure you understand the functionality and performance of the NXR-series IO-Link Master Unit for EtherCAT 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

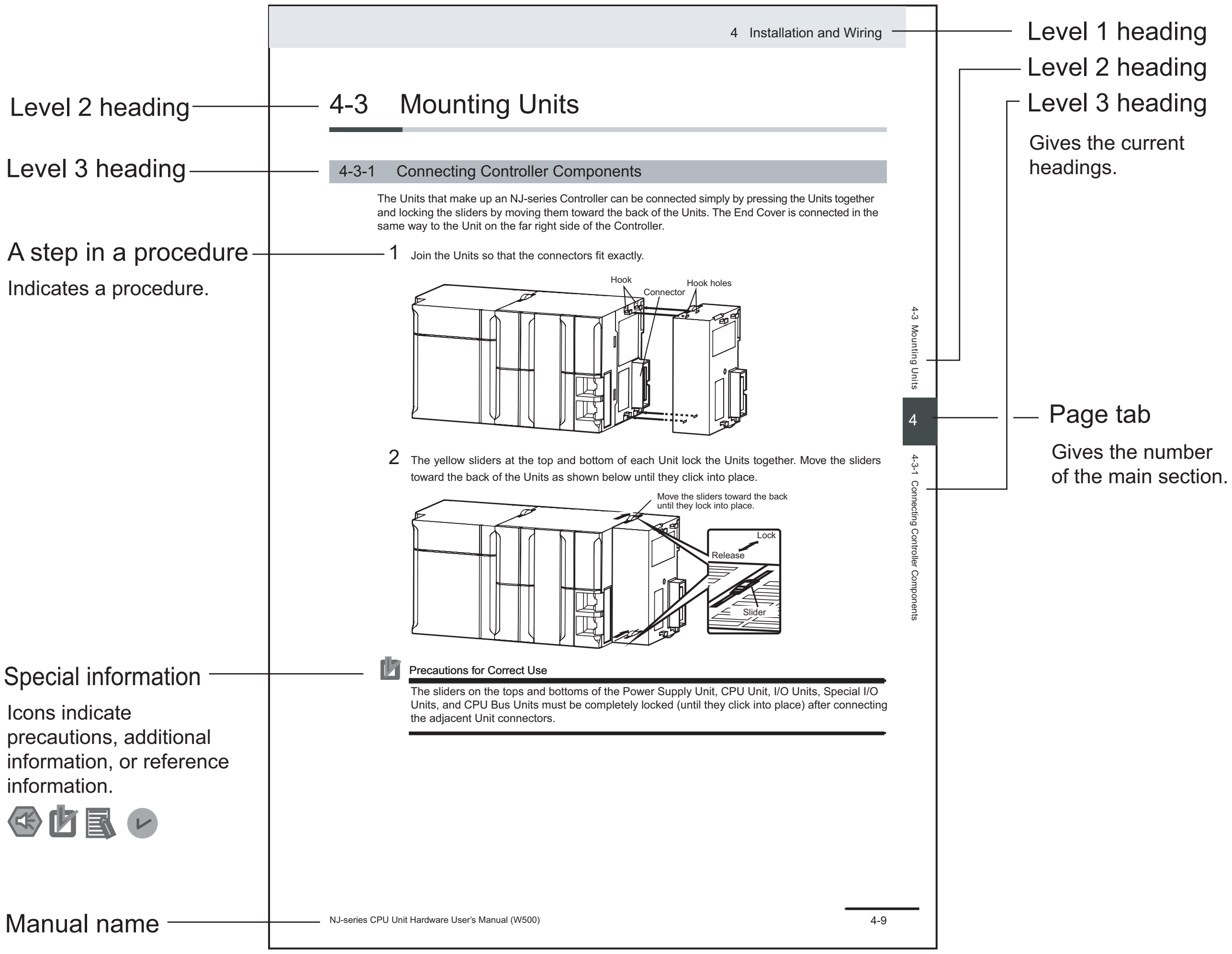
This manual covers the following product.

- NXR-series IO-Link Master Unit for EtherCAT
  NXR-ILM08C-ECT

Manual Structure

Page Structure

The following page structure is used in this manual.



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

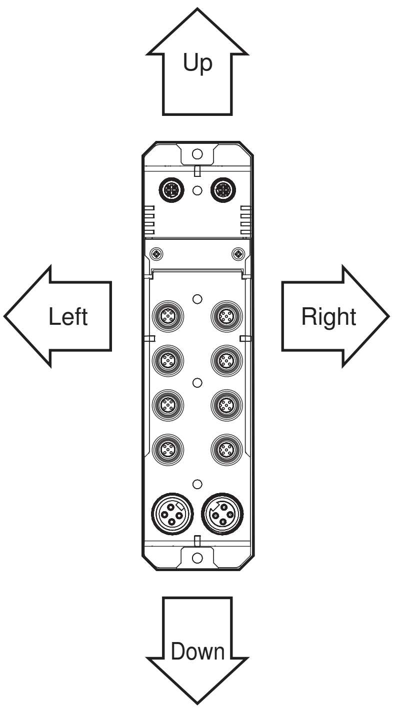
Additional information to read as required.
This information is provided to increase understanding or make operation easier.

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.



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Terms and Conditions Agreement

Warranty, Limitations of Liability

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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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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.

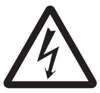
Safety Precautions

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 EtherCAT.
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.

Transferring

Always confirm safety at the destination node before you transfer Unit configuration information, parameters, settings, or other data from tools such as the Sysmac Studio. The devices or machines may operate unexpectedly, regardless of the operating mode of the Controller.

Security Measures

Anti-virus protection
Install the latest commercial-quality antivirus software on the computer connected to the control system and maintain to keep the software up-to-date.

Security measures to prevent unauthorized access
Take the following measures to prevent unauthorized access to our products.

- Install physical controls so that only authorized personnel can access control systems and equipment.
- Reduce connections to control systems and equipment via networks to prevent access from untrusted devices.
- Install firewalls to shut down unused communications ports and limit communications hosts and isolate control systems and equipment from the IT network.
- Use a virtual private network (VPN) for remote access to control systems and equipment.
- Adopt multifactor authentication to devices with remote access to control systems and equipment.
- Set strong passwords and change them frequently.
- Scan virus to ensure safety of USB drives or other external storages before connecting them to control systems and equipment.

Data input and output protection
Validate backups and ranges to cope with unintentional modification of input/output data to control systems and equipment.

- Checking the scope of data
- Checking validity of backups and preparing data for restore in case of falsification and abnormalities
- Safety design, such as emergency shutdown and fail-soft operation in case of data tampering and abnormalities

Data recovery
Backup data and keep the data up-to-date periodically to prepare for data loss.

When using an intranet environment through a global address, connecting to a SCADA or an unauthorized terminal such as an HMI or to an unauthorized server may result in network security issues such as spoofing and tampering. You must take sufficient measures such as restricting access to the terminal, using a terminal equipped with a secure function, and locking the installation area by yourself.

When constructing an intranet, communication failure may occur due to cable disconnection or the influence of unauthorized network equipment. Take adequate measures, such as restricting physical access to network devices, by means such as locking the installation area.

When using a device equipped with the SD Memory Card function, there is a security risk that a third party may acquire, alter, or replace the files and data in the removable media by removing the removable media or unmounting the removable media. Please take sufficient measures, such as restricting physical access to the Controller or taking appropriate management measures for removable media, by means of locking the installation area, entrance management, etc., by yourself.

Cautions

⚠ Caution

Online Editing

Execute online editing only after confirming that no adverse effects will be caused by deviations in the timing of I/O. If you perform online editing, the task execution time may exceed the task period, I/O may not be refreshed with external devices, input signals may not be read, and output timing may change.

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.

Using the I/O Port Quick Settings

- 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.

EtherCAT Communications

- Make sure that the communications distance, number of nodes connected, and method of connection for EtherCAT are within specifications.
  Do not connect the Units to EtherNet/IP, a standard in-house LAN, or other networks.
  An overload may cause the network to fail or malfunction.
- Malfunctions or unexpected operation may occur for some combinations of EtherCAT revisions of the master and slaves. If you disable the revision check in the network settings, use the Sysmac Studio to check the slave revision settings in the master and the actual slave revisions, and then make sure that functionality is compatible in the slave manuals or other references. You can check the actual slave revisions from the Sysmac Studio or on slave nameplates.
- After you transfer the user program to the built-in EtherCAT port on the NJ/NX-series CPU Unit, the built-in EtherCAT port is restarted and communications with the EtherCAT slaves are cut off. During that period, the slave outputs behave according to the *slave settings*.
  The time that communications are cut off depends on the EtherCAT network configuration.
  Before you transfer the user program, confirm that the system will not be adversely affected.

- EtherCAT communications are not always established immediately after the power supply is turned ON. Use the system-defined variables in the user program to confirm that communications are established before attempting control operations.
- If frames sent to EtherCAT slaves are lost due to noise or other causes, slave I/O data is not communicated, and the intended operation is sometimes not achieved. Perform the following processing if noise countermeasures are necessary.
  Program the Input Data Invalid system-defined variable as an interlock condition in the user program.
  Set the *PDO communications timeout detection count* setting in the EtherCAT master to at least 2.
  For details, refer to the user's manual for the built-in EtherCAT port on the connected CPU Unit or Industrial PC.
- If you disconnect the cable from an EtherCAT slave or turn OFF the power supply of an EtherCAT slave to disconnect it from the network, any current communications frames may be lost. If frames are lost, slave I/O data is not communicated, and the intended operation is sometimes not achieved. Perform the following processing for a slave that needs to be replaced.
  Program the Input Data Invalid system-defined variable as an interlock condition in the user program.
  Set the *PDO communications timeout detection count* setting in the EtherCAT master to at least 2.
  For details, refer to the user's manual for the built-in EtherCAT port on the connected CPU Unit or Industrial PC.

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.
  a) Changing the operating mode of the CPU Unit or Industrial PC (including changing the setting of the Operating Mode at Startup)
  b) Changing the user program or settings
  c) Changing set values or present values

d) Forced refreshing

- After you change the Unit settings including IO-Link settings, always sufficiently check the safety at the connected devices before you transfer them.

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.

EtherCAT Communications

Do not disconnect the EtherCAT communications cables during operation. The outputs will become unstable.

Regulations and Standards

Conformance to EMC and Electrical Safety Laws and Regulations

Concepts

● Conformance to EMC Regulations

OMRON devices that comply with EU Directives also conform to the related EMC regulations 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 electrical safety regulations 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).

● Conformance to Electrical Safety Regulations

The NXR-series products comply with electrical safety regulations that are required by EU Directives, UKCA, and other specific laws and regulations. To ensure that the machine or device in which the NXR-series products are used complies with electrical safety regulations, 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 electrical safety laws and regulations 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 electrical safety laws and regulations.
- 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.

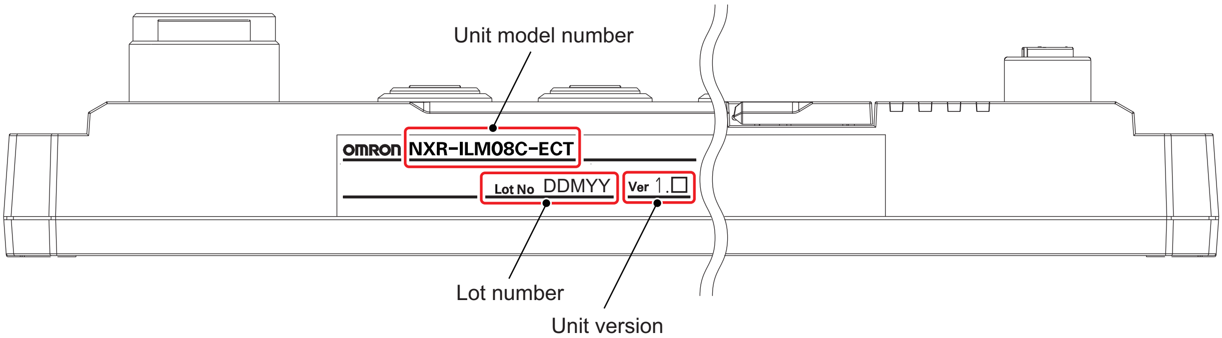
Unit Versions

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.



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)

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-7 Version Information* on page A-68 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 EtherCAT® User's Manual	W640	NXR-ILM08C-ECT	Learning how to use an NXR-series IO-Link Master Unit for EtherCAT.	The hardware, setup methods, and functions of the NXR-series IO-Link Master Unit for EtherCAT 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 EtherCAT® Port User's Manual	W505	NX701-□□□□ NX502-□□□□ NX102-□□□□ NX1P2-□□□□ NJ501-□□□□ NJ301-□□□□ NJ101-□□□□	Using the built-in EtherCAT port on an NJ/NX-series CPU Unit.	Information on the built-in EtherCAT port is provided. This manual provides an introduction and provides information on the configuration, features, and setup.
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	Abbre-viation	Description
application layer status, AL status	---	Status for indicating information on errors that occur in an application on a slave.
CAN application protocol over Ether-CAT	CoE	A CAN application protocol service implemented on EtherCAT.
CAN in Automation	CiA	CiA is the international users’ and manufacturers’ group that develops and supports higher-layer protocols.
EtherCAT slave controller	ESC	A controller for EtherCAT slave communications.
EtherCAT slave information	ESI	An XML file that contains setting information for an EtherCAT slave.
EtherCAT state machine	ESM	An EtherCAT communications state machine.
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 communi-cations 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 de-vice	---	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 de-scribed as "non-IO-Link external device".
non-IO-Link input device	---	A device such as a sensor that cannot perform IO-Link communica-tions.
non-IO-Link output device	---	A device such as an actuator that cannot perform IO-Link communica-tions.
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.
I/O port	---	A logical interface that is used by the NJ/NX-series CPU Unit or NY-series Industrial PC to exchange data with an external device (slave or Unit).
I/O map settings	---	Settings that assign variables to I/O ports. Assignment information be-tween I/O ports and variables.
I/O refreshing	---	Cyclic data exchange with external devices that is performed with pre-determined memory addresses.
PDO communications	---	An acronym for process data communications.
SDO communications	---	One type of EtherCAT communications in which service data objects (SDOs) are used to transmit information whenever required.

Term	Abbre-viation	Description
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.
Slave Information Interface	SII	Slave information that is stored in non-volatile memory in the slave.
index	---	Address of an object within an application process.
object	---	An abstract representation of a particular component within a device, which consists of data, parameters, and methods.
Operational	---	A state in EtherCAT communications where SDO communications and I/O are possible.
subindex	---	Sub-address of an object within the object dictionary.
receive PDO	RxPDO	A process data object received by an EtherCAT slave.
Sync Manager	SM	Collection of control elements to coordinate access to concurrently used objects.
Safe-Operational	---	A state in EtherCAT communications where only SDO communications and reading input data from slaves are possible. Outputs from slaves are not performed.
transmit PDO	TxPDO	A process data object sent from an EtherCAT slave.
task period	---	The interval at which the primary periodic task or a periodic task is executed. Refer to the software user’s manual for the connected CPU Unit or Industrial PC for details.
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 Flag
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 Flag	---	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.
device variable	---	A variable that is used to access a specific device through an I/O port by an NJ/NX-series CPU Unit or NY-series Industrial PC. Process data on an EtherCAT slave is allocated to this variable. For NX-series CPU Units to which NX Units can be connected, I/O data for the NX Units on a CPU Unit is allocated. A user application on a CPU Unit or Industrial PC accesses a device that can be connected, by directly reading and writing this device variable.
network configuration information	---	The EtherCAT network configuration information held by the EtherCAT master.
primary periodic task	---	The task with the highest priority. Refer to the software user’s manual for the connected CPU Unit or Industrial PC for details.
Pre-Operational	---	A state in EtherCAT communications where only SDO communications are possible with the slaves, i.e., no I/O can be performed.
process output data	---	Output data sent from the IO-Link master to the IO-Link devices in IO-Link communications.

Term	Abbre-viation	Description
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.

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. W640-E1-01

Revision code

Revision code	Date	Revised content
01	December 2023	Original production

1

Features and System Configuration

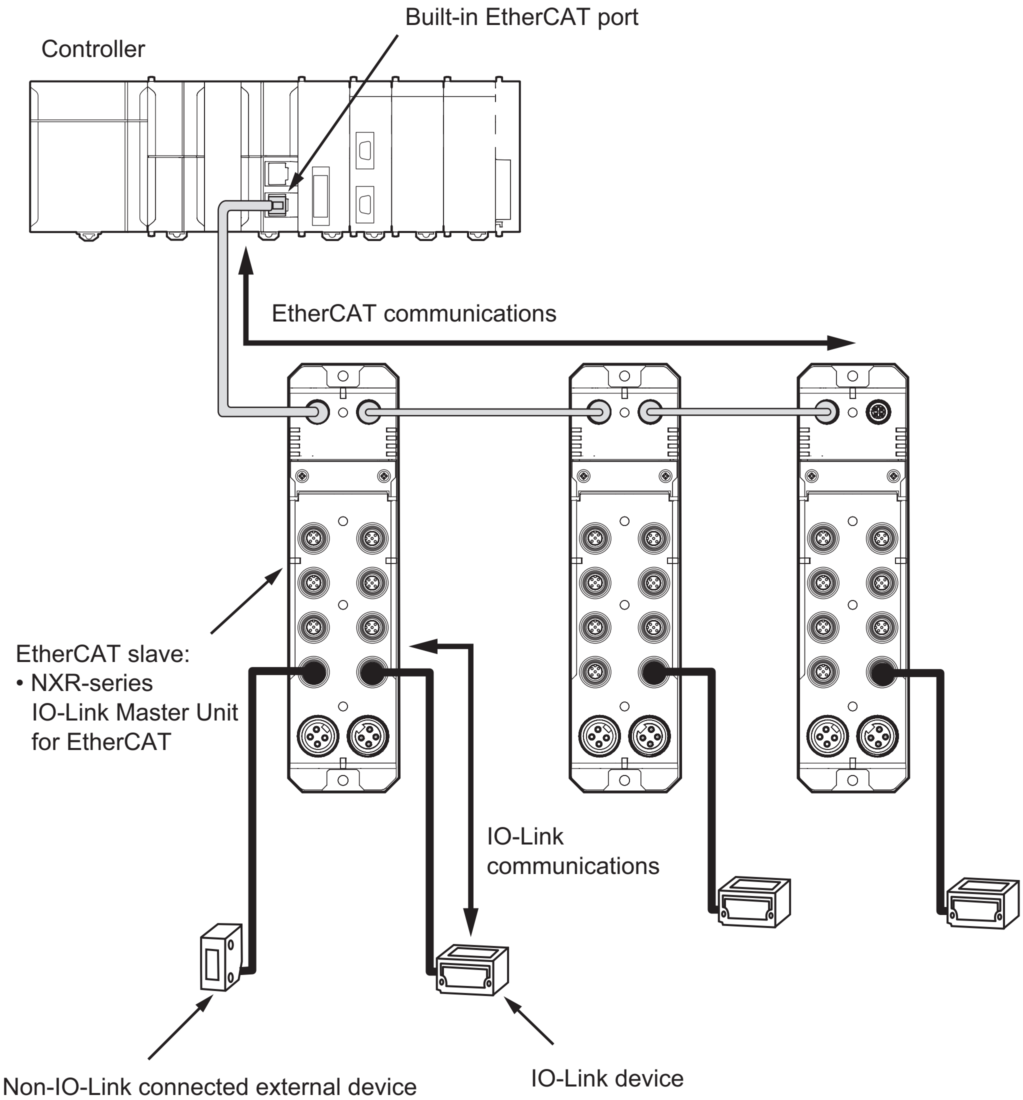
This section describes the features and system configuration of the NXR-series IO-Link Master Unit for EtherCAT.

1-1 Introduction to the IO-Link Master Unit

The NXR-series IO-Link Master Unit for EtherCAT is an EtherCAT slave that provides IO-Link master functions with an environmental resistance of IP67.
An NXR-series IO-Link Master Unit for EtherCAT receives data from the EtherCAT master through the EtherCAT network and outputs the data to connected external devices. It also sends the data that is input from connected external devices to the EtherCAT master through the EtherCAT 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 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

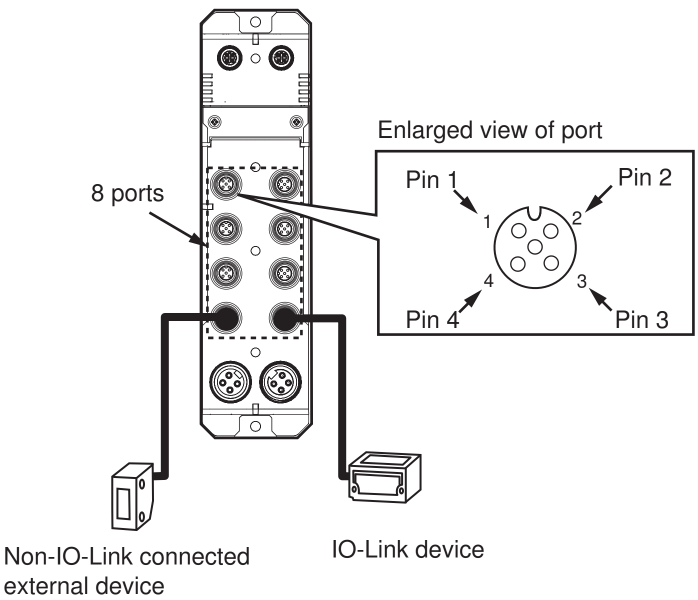
You can also connect external devices such as non-IO-Link sensors or actuators that support only ON/OFF signals.

1-1-2 Functions of Port Pins and Connected External Devices

An NXR-series IO-Link Master Unit for EtherCAT 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 *9-3 Communications Mode Settings* on page 9-7 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.



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

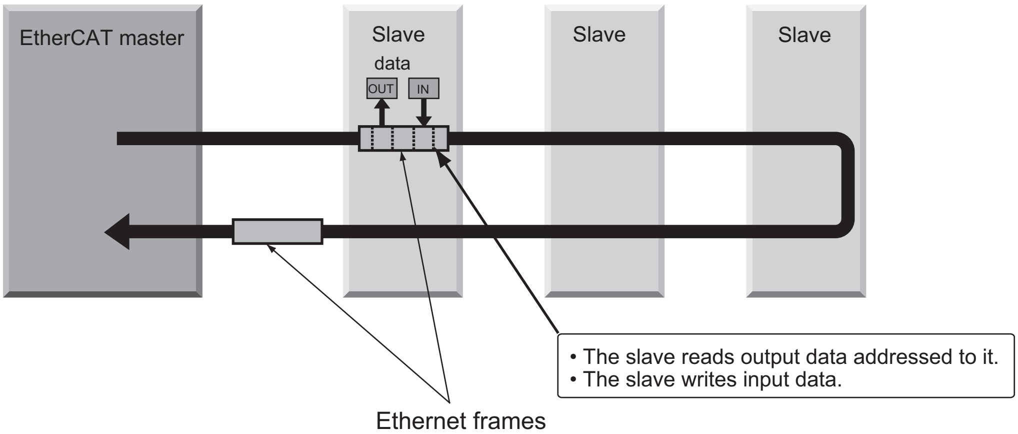
Pin 1 and pin 3 are used to device power supply + and device power supply -, respectively. Refer to *3-4-3 I/O Connectors* on page 3-12 for details on I/O connectors. Refer to *5-4-4 Wiring Examples* on page 5-22 for details on wiring with connected external devices.

1-2 Introduction to EtherCAT

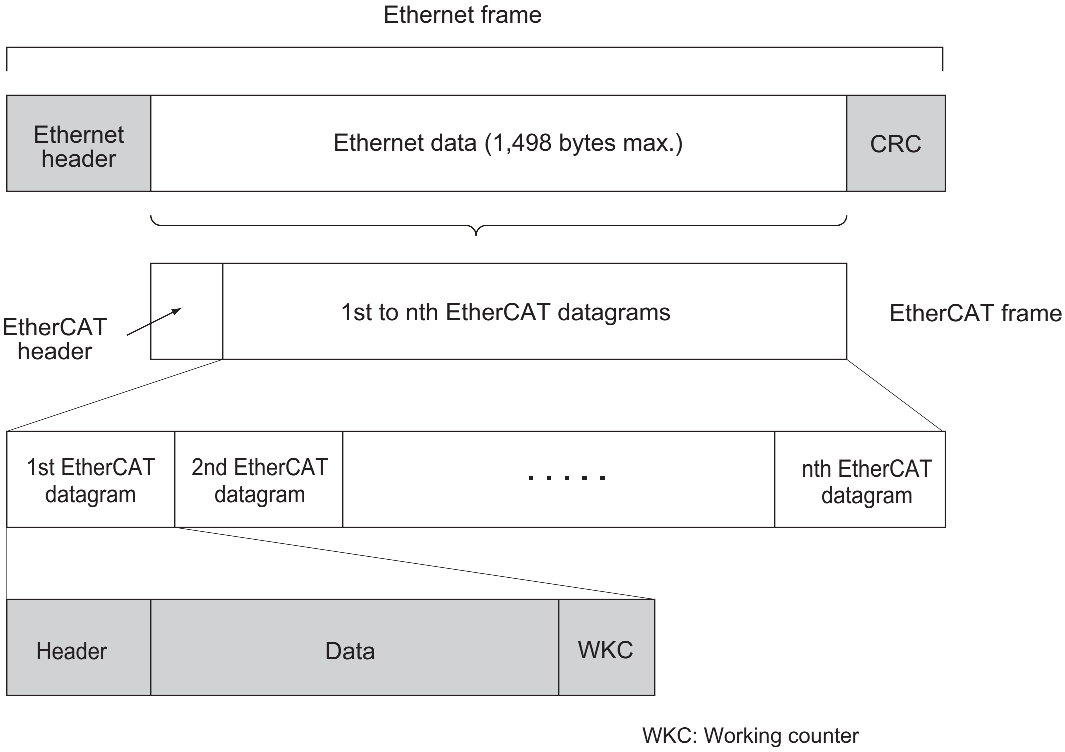
EtherCAT (Ethernet Control Automation Technology) is a high-performance industrial network system that enables faster and more efficient communications based on Ethernet.
Each node achieves a short communications cycle time by transmitting Ethernet frames at high speed.
Although EtherCAT is a unique communications protocol, standard Ethernet technology is used for the physical layer, which means you can use Ethernet cables for wider application.
The effectiveness of EtherCAT can be fully utilized not only in large control systems that require high processing speeds and system integrity, but also in small and medium control systems.

1-2-1 How EtherCAT Works

With EtherCAT, Ethernet frames pass through all of the slave nodes.
When a frame passes through a slave node, the slave node reads and writes the data in the area that is allocated to it in the frame in a few nanoseconds.
The Ethernet frames that are transmitted by the EtherCAT master pass through all EtherCAT slaves without stopping. The last slave returns all of the frames, which again pass through all of the slaves before returning to the EtherCAT master.
This mechanism ensures high speed and realtime data transmission.



The data exchanges that are cyclically performed between the EtherCAT master and EtherCAT slaves use EtherCAT datagrams that are stored directly in the Ethernet frames.
Each EtherCAT datagram consists of a header (including the data length and one or more slave addresses), data, and a working counter (i.e., check bits).
If you think of an Ethernet frame as a train, the EtherCAT datagrams would be the cars of the train.

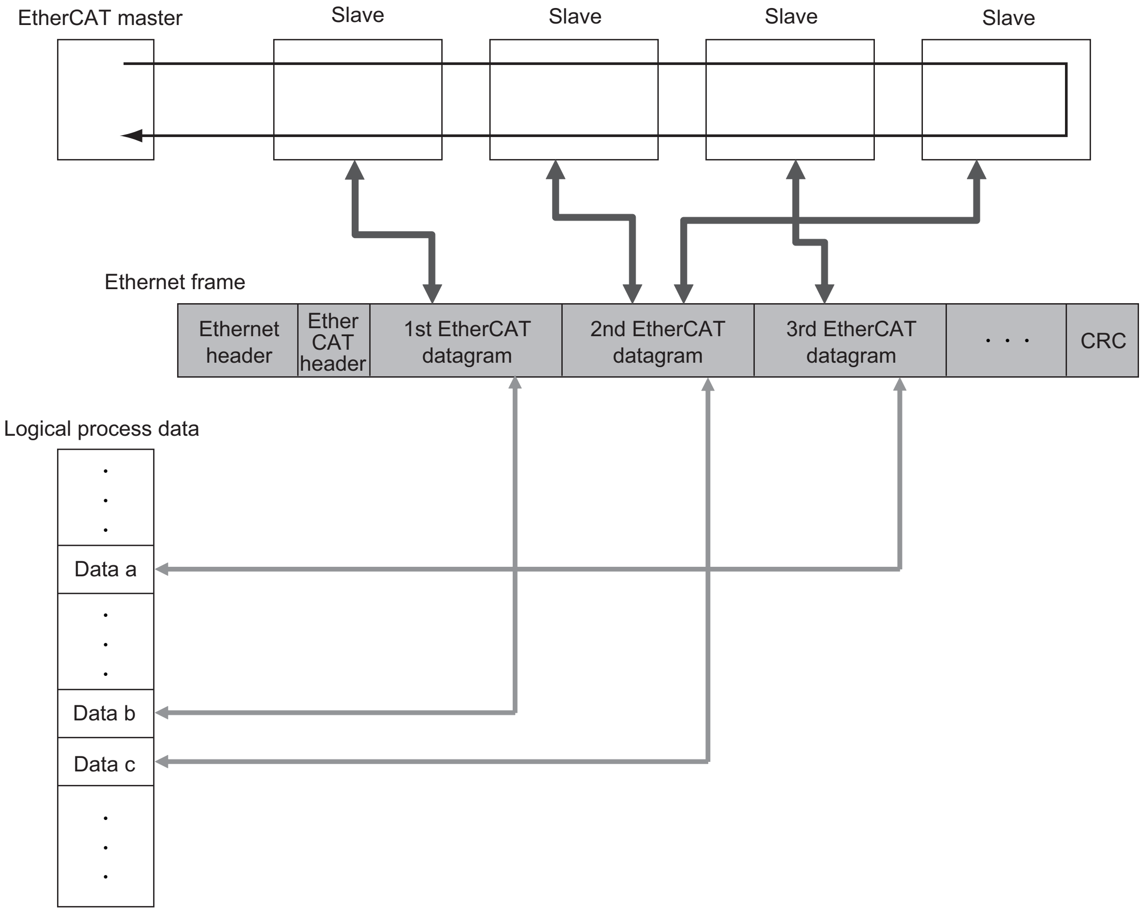


1-2-2 Types of EtherCAT Communications

The following two types of communications are available with EtherCAT.
PDO communications are executed in each EtherCAT communications cycle to refresh data continuously. SDO communications are executed between PDO communications.

Process Data Communications (PDO Communications)

PDO communications transfers process data cyclically and in realtime.
The EtherCAT master maps the logical process data space to the nodes to achieve cyclic communications between the EtherCAT master and slaves.



Mailbox Communications (SDO Communications)

SDO communications is used to perform message communications.
Whenever necessary, the EtherCAT master sends a command to a slave, and then the slave returns a response to the EtherCAT master.
The following data communications can be performed.

- Reading and writing process data
- Setting slaves
- Monitoring slave status

1-3 Features of the IO-Link Master Unit

This section describes the following features of the NXR-series IO-Link Master Unit for EtherCAT.
- Features as an EtherCAT slave
- Features as an IO-Link master

1-3-1 Features as an EtherCAT Slave

The features of the NXR-series IO-Link Master Unit for EtherCAT as an EtherCAT slave are described below.

● Data Exchange between EtherCAT Master and IO-Link Devices

Through the IO-Link Master Unit, the data can be exchanged over the EtherCAT network between the EtherCAT master and IO-Link devices that are connected to the IO-Link Master Unit. Data exchange is possible using the following communications.

a. Real-time process data communications (Refer to *6-1-4 Process Data Objects (PDOs)* on page 6-4.)
b. Message communications executed whenever necessary (Refer to *6-1-5 Service Data Objects (SDOs)* on page 6-7.)

● Support for Ring Topology

The IO-Link Master Unit supports ring topology. When the Unit is combined with an EtherCAT master that supports ring topology and a ring topology is configured in an EtherCAT system, it can continue communications even if a link is not established at a location in the EtherCAT physical layer of the ring topology. Refer to the specifications of the EtherCAT master for more information on ring topology.

● Support for Extensive Troubleshooting Functionality

The IO-Link Master Unit supports extensive troubleshooting functions through its Sysmac device functionality. Since the Unit allows checking the Diagnosis History including time information from the EtherCAT master, you can know what occurred and where in the system.
This makes it easy to narrow down the error cause.
(Refer to *9-2 Sysmac Device Functionality* on page 9-5.)

1-3-2 Features as an IO-Link Master

The features of the NXR-series IO-Link Master Unit for EtherCAT 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]
- 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.

● Diagnosis of Circuits Connected to IO-Link Devices

You can detect disconnection, short-circuit, power ON status, and other information between the IO-Link Master Unit and IO-Link devices.

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

You can read and write user-specified data in the IO-Link devices from the Controller through SDO communications. This allows you to change IO-Link device parameter settings, monitor status, and perform operations, as needed.
(Refer to *Section 10 Setting Up IO-Link Devices* on page 10-1.)

● 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 *1-1-2 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 *9-8 IO-Link Device Verification* on page 9-18.)

● 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 *9-13 IO-Link Total Communications Lost Frames* on page 9-29.)

● 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 *9-9 I/O Cable Short-circuit Detection* on page 9-22.)

● 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 supplied correctly to the IO-Link Master Unit.

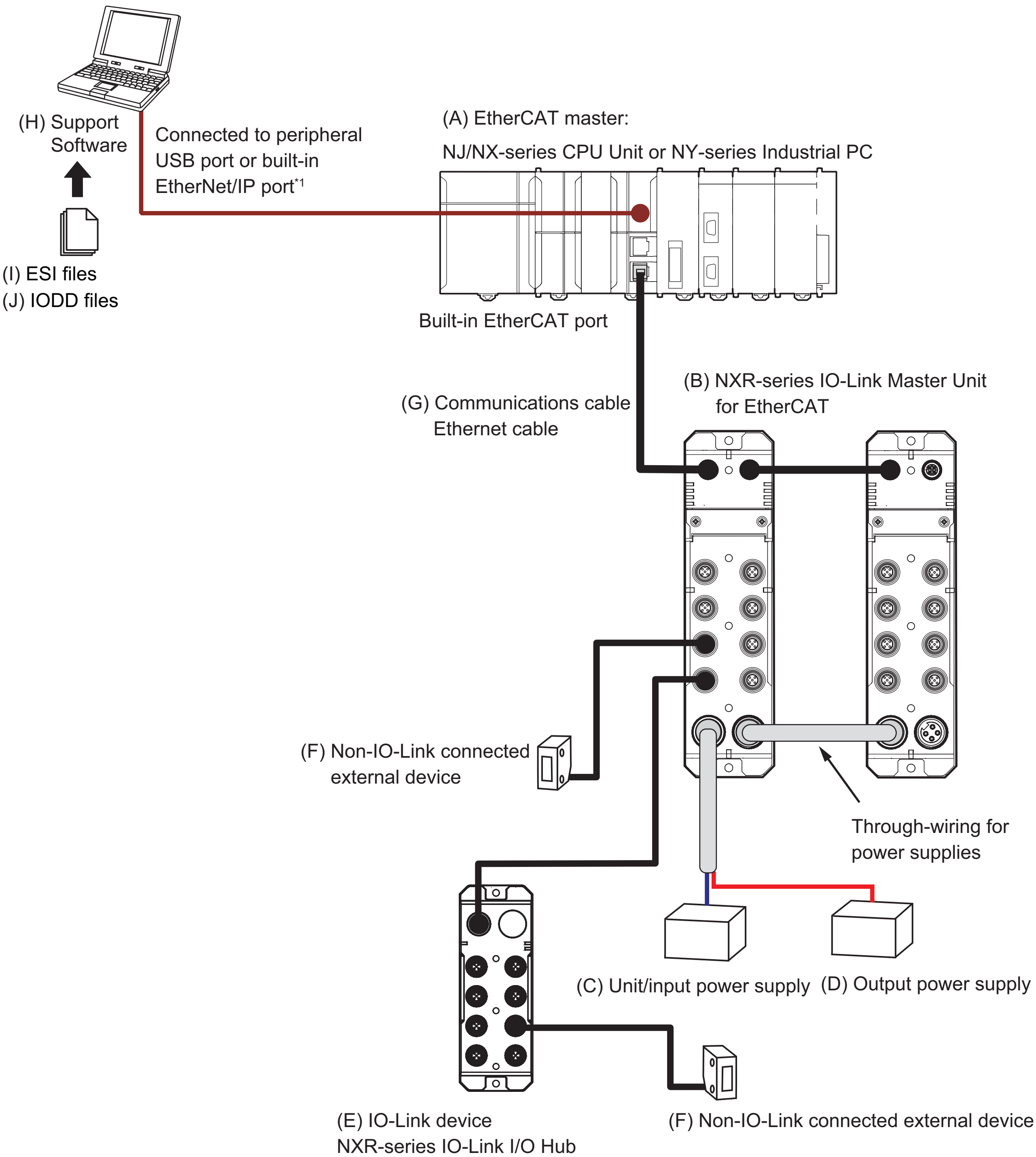
(Refer to *9-10 Monitoring Unit/Input Power Supply Voltage* on page 9-24 and *9-11 Monitoring Output Power Supply Voltage* on page 9-26.)

● 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 *9-14 Backing Up and Restoring IO-Link Device Parameters* on page 9-32 and *12-2-3 Replacing IO-Link Devices* on page 12-5.)

1-4 System Configuration

An example of a system configuration for an NXR-series IO-Link Master Unit for EtherCAT is shown below. The example uses an NJ/NX-series CPU Unit and an NY-series Industrial PC.



*1. The connection method depends on the model of the NJ/NX-series CPU Unit or NY-series Industrial PC.

The description of each item is given below.

Letter	Item	Description
(A)	EtherCAT master	The EtherCAT master manages the EtherCAT network, monitors the status of the slaves, and exchanges I/O data with the slaves.
(B)	NXR-series IO-Link Master Unit for EtherCAT	A device that outputs the data that is received from the EtherCAT master to a connected external device and sends the data that is input from a connected external device to the EtherCAT master through the EtherCAT network. The NXR-series IO-Link Master Unit for EtherCAT is an EtherCAT slave 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 EtherCAT. It exchanges data with IO-Link devices through IO-Link communications.
(C)	Unit/input power 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 supply connector (input). *1
(D)	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). *1
(E)	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 communications with the IO-Link master. *2 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 EtherCAT in IO-Link communications. You can connect non-IO-Link connected external devices to the NXR-series IO-Link I/O Hub.
(F)	Non-IO-Link connected external 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.
(G)	Communications cable	Use a double-shielded cable with aluminum tape and braiding of category 5 (100BASE-TX) or higher, and use straight wiring.
(H)	Support Software*3	The Support Software configures and monitors the Controller, IO-Link Master Unit, and IO-Link devices. The Support Software depends on the Controller that you use. OMRON provides the following Support Software. • Sysmac Studio: The Support Software for configuring the EtherCAT master, creating user programs, monitoring, troubleshooting, and configuring the IO-Link Master Unit. • CX-ConfiguratorFDT: The Support software for configuring and monitoring IO-Link devices that are connected to the IO-Link Master Unit.
(I)	ESI (EtherCAT Slave Information) files	The ESI files contain information that is unique to EtherCAT slaves in XML format. You can load an ESI file into the EtherCAT master Configuration Software to easily allocate slave process data and make other settings. The ESI files for OMRON EtherCAT slaves are already installed in the Sysmac Studio. You can update the Sysmac Studio to get the ESI files for the most recent models.
(J)	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 or IO-Link Community website.

*1. 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 5-10 for details on power supply cables.

*2. Refer to *5-4 Connecting I/O Cables* on page 5-18 for details on I/O cables for connecting the IO-Link Master Unit to IO-Link devices and non-IO-Link connected external devices.

*3. Refer to *1-5 Support Software* on page 1-13 for details on the Support Software used for systems with IO-Link Master Units.

1-5 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 EtherCAT. The Support Software used depends on the scope of the applicable system. Refer to *A-7 Version Information* on page A-68 for information on the Support Software versions.

Destination to which IO-Link Master Unit is connected		Applicable Support Software			
Controller	**EtherCAT master**	**Creating the user program**	**Setting the PDO mapping**	**Setting up IO-Link Master Unit**	**Setting and monitoring IO-Link devices**
NJ/NX-series CPU Unit or NY-series Industrial PC	Built-in EtherCAT ports on NJ/NX-series CPU Unit or NY-series Industrial PC	Sysmac Studio	Sysmac Studio	Sysmac Studio	CX-ConfiguratorFDT
Controller from another company	EtherCAT master from another company	Software from another company	Software from another company	Software from another company	*1

*1. From the controller from another company, make settings through message communications. Or use a commercially-available IO-Link USB master to make settings from the CX-ConfiguratorFDT. For the commercially available IO-Link USB master, the following models are recommended.

Model	Manufacturer
USB-2-IOL-0002	TURCK
IO-Link-Master02-USB	Pepperl+Fuchs

1-6 Functions of the IO-Link Master Unit

Refer to the following section for details on the functions of the NXR-series IO-Link Master Unit for EtherCAT.

• *Section 9 Functions* on page 9-1

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
- EtherCAT 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 UKCA IO-Link conformance EtherCAT 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 EtherCAT Communications Specifications

Item	Specification
Communications protocols	EtherCAT protocol
Modulation	Baseband
Link speed	100 Mbps
Physical layer	100BASE-TX (IEEE802.3)
Connectors	M12 (D-coding, female) x 2 (shielded) CN IN: EtherCAT input CN OUT: EtherCAT output

Item	Specification
Topology	Depends on the specifications of the EtherCAT master*1*2
Transmission media	Category 5 or higher twisted-pair cable (Recommended cable: double-shielded cable with aluminum tape and braiding)
Transmission distance	Distance between nodes (slaves): 50 m or less
Noise immunity	Conforms to IEC 61000-4-4, 1 kV or more
Node address setting method	Setting with hexadecimal ID switch or Configuration Software
Node address range*3	• Setting with hexadecimal ID switch: 01 to FF hex (1 to 255) • Setting with Configuration Software: 0001 to FFFF hex (1 to 65,535)
Indicators	L/A IN (Link/Activity IN) × 1 L/A OUT (Link/Activity OUT) × 1 RUN × 1 ERR × 1
Process data	Variable PDO mapping
PDO size/node	Input: 1 to 270 bytes Output: 2 to 258 bytes
Mailbox	Emergency messages, SDO requests, and SDO responses
Synchronization type	Free-Run Mode

*1. The IO-Link Master Unit conforms to the EtherCAT standards. Confirm the specifications of the connected EtherCAT master for the supported topology. Note that the IO-Link Master Unit supports the ring topology.

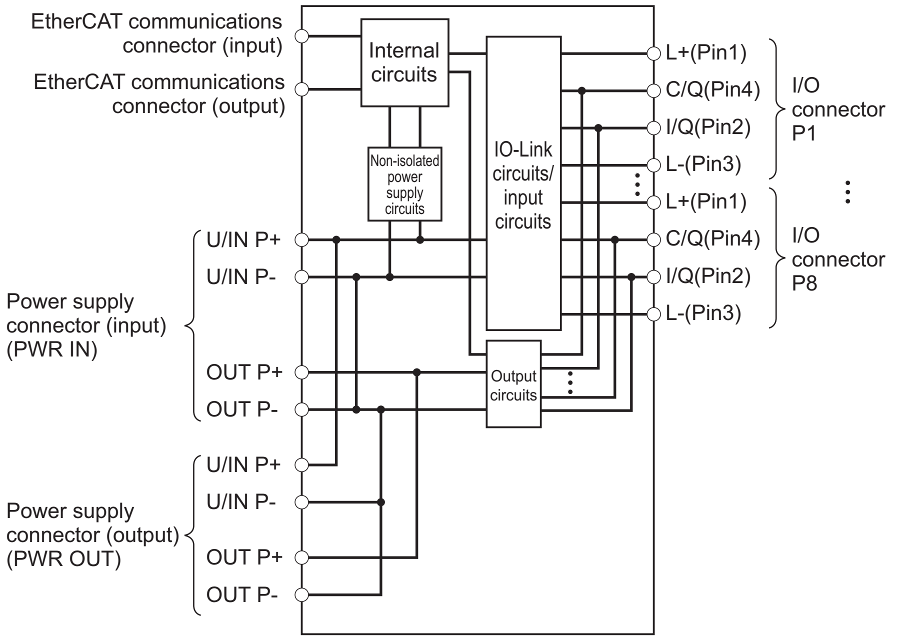
*2. For the ring topology, the minimum value of the supported communications cycle is 125 μs. Allowing the IO-Link Master Unit to operate with a shorter communications cycle than the minimum value may cause the loss of EtherCAT communications frames or a communications stop.

*3. The setting range of the node address depends on the specifications of the connected EtherCAT master. Check the specifications of the EtherCAT master for the supported node address setting range of the EtherCAT master.

2-1-3 Unit Specifications

Item		Specification
Unit name		IO-Link Master Unit
Model		NXR-ILM08C-ECT
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 • 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

Item		Specification
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		• EtherCAT 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		• EtherCAT 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 EtherCAT 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[*1] 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[*2]
	Short-circuit detection	Provided[*2]
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[*2]
	Short-circuit detection	Provided[*2]

Item		Specification
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*3
	Short-circuit detection	Provided*3
Current consumption	Unit/input power supply	60 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
Circuit layout		

*1. 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.

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

*3. 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	Setting up communications with the Controller		In the Sysmac Studio project, register the IO-Link Master Unit in the EtherCAT network configuration.	*Sysmac Studio Version 1 Operation Manual (Cat. No. W504)*
3	Setting up IO-Link Master Unit	Device Parameter Settings	Set the device parameters of the IO-Link Master Unit with the Sysmac Studio. You can also use the I/O port quick settings, which allows for using the rotary switches to set the communications mode and data size for the I/O ports of the IO-Link Master Unit. *1	• *7-2 Setting Device Parameters* on page 7-4 • *9-17 I/O Port Quick Settings* on page 9-47
		PDO Map Settings	Configure the PDO Map Settings of the IO-Link Master Unit with the Sysmac Studio.	*7-3 Setting PDO Mappings* on page 7-6
		Setting Parameters	Configure the setting parameters of the IO-Link Master Unit with the Sysmac Studio.	*7-4 Configuring the Setting Parameters* on page 7-21
4	Allocating Variables to the I/O Ports		Use I/O Map in the Sysmac Studio to allocate variables to the I/O ports of the IO-Link Master Unit.	• *Sysmac Studio Version 1 Operation Manual (Cat. No. W504)* • *A-5 Example of Allocating Variables to the I/O Ports* on page A-63
5	Creating the User Program		Use the Sysmac Studio to create a user program.	*Sysmac Studio Version 1 Operation Manual (Cat. No. W504)*
6	Making Hardware Settings and Installing and Wiring the IO-Link Master Unit	Setting Explicit Device ID	Remove the rotary switch cover. Use the rotary switches to set the Explicit Device ID. *2	• *5-1-3 Installation Method* on page 5-2 • *3-3-1 ID Switch* on page 3-9
		Installation	Mount the IO-Link Master Unit with M5 screws.	*5-1-3 Installation Method* on page 5-2
		Wiring	Wire the following. • Connect the communications cables. • Connect the power supply cables. • Connect the I/O cables.	• *5-2 EtherCAT Network Wiring* on page 5-4 • *5-3 Connecting the Power Supplies* on page 5-10 • *5-4 Connecting I/O Cables* on page 5-18
7	Turning ON the Power Supplies		Turn ON the power supplies to the Controller and IO-Link Master Unit. For the IO-Link Master Unit, turn ON the Unit/input power supply and output power supply.	---

Step	Item		Description	Reference
8	Going Online from the Sysmac Studio and Downloading the Configuration		Set up communications with the Controller in the Sysmac Studio and go online with the Controller. Use the *synchronization* function of the Sysmac Studio to download the user program and network configuration information to the Controller and the device parameters to the IO-Link Master Unit. *3	*Sysmac Studio Version 1 Operation Manual (Cat. No. W504)*
9	Cycling the Power Supplies		Cycle the power supplies to the Controller and IO-Link Master Unit. For the IO-Link Master Unit, cycle the Unit/input power supply and output power supply.	---
10	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 10 Setting Up IO-Link Devices* on page 10-1
11	Checking Operation	Checking Operation by Appearance	Check the indicators on the IO-Link Master Unit.	*Section 11 Troubleshooting* on page 11-1
12		Checking Operation by Current Error	Use the Sysmac Studio to check that no errors occurred.	
13		Checking the User Program and Variables	Check the operation of the user program and device variables.	---

*1. The device parameters of the IO-Link Master Unit that you can set using the I/O port quick settings are limited. Refer to *9-17 I/O Port Quick Settings* on page 9-47 for details.

*2. You can also use the software to set the Explicit Device ID. However, the setting method depends on the EtherCAT master specifications. For the software setting method, refer to the user's manual for the EtherCAT master to use.

*3. When you use the *synchronization* function of the Sysmac Studio to download data, by default, the device parameters of the IO-Link Master Unit are not included in the download target. To download the device parameters of the IO-Link Master Unit, include the EtherCAT slave backup parameters in the transfer target. The device parameters of the IO-Link Master Unit are the EtherCAT slave backup parameters.

3

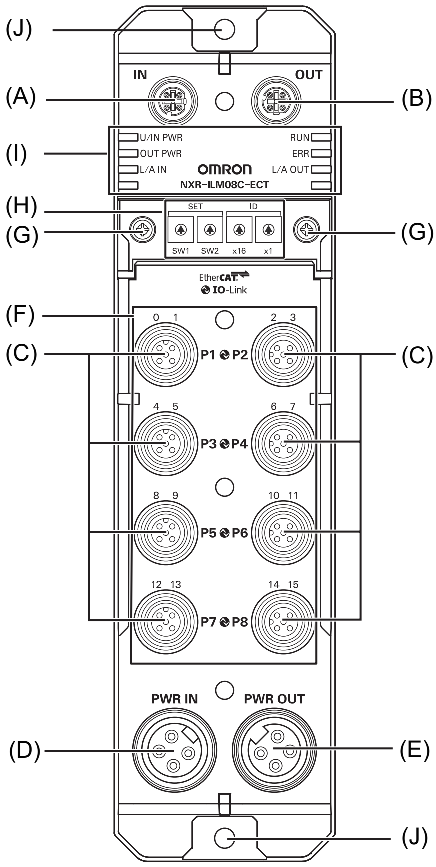
Part Names and Functions

3

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)	EtherCAT communications connector (input)	The connector for EtherCAT port (input). • M12 connector (D-coding, female) Connect a communications cable.
(B)	EtherCAT communications connector (output)	The connector for EtherCAT port (output). • 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.

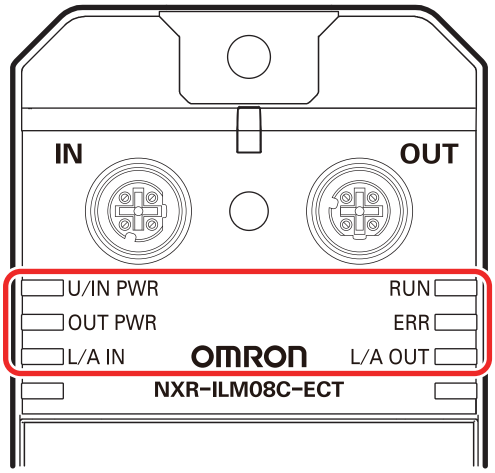
Letter	Name	Function
(G)	Cover mounting holes	The screw holes for mounting the rotary switch cover. They are provided in two locations. The above figure shows the holes when the cover is mounted with screws.
(H)	Rotary switches	The switches for setting the Explicit Device ID and for the I/O port quick settings.
(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



RUN Indicator

This indicator shows the operating status of the Unit.

Color	Status		Description
Green		Lit	Operational state
		Single flash	Safe-Operational state
		Blinking	Pre-Operational state
---		Not lit	Init state

ERR Indicator

This indicator shows information on errors.

Color	Status		Description
Red		Lit	PDI Watchdog Timeout
		Double flash	Process Data WDT Error
		Blinking	• Slave Unit Verification Error • Mailbox Setting Error • RxPDO Setting Error • TxPDO Setting Error • PDO WDT Setting Error • SM Event Mode Setting Error • TxPDO Mapping Error • RxPDO Mapping Error • Illegal State Transition Request Received • Error State Transition Received • Non-volatile Memory Checksum Error
---		Not lit	No error

L/A IN Indicator

The Link/Activity indicator for EtherCAT port (input). This indicator shows the link status and communications status of the EtherCAT port (input).

Color	Status		Description
Green		Lit	A link was established in the physical layer.
		Flickering	A link was established and communications are in operation.
---		Not lit	A link was not established in the physical layer.

L/A OUT Indicator

The Link/Activity indicator for EtherCAT port (output). This indicator shows the link status and communications status of EtherCAT port (output).

Color	Status		Description
Green		Lit	A link was established in the physical layer.
		Flickering	A link was established and communications are in operation.
---		Not lit	A link was not established in the physical layer.

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.

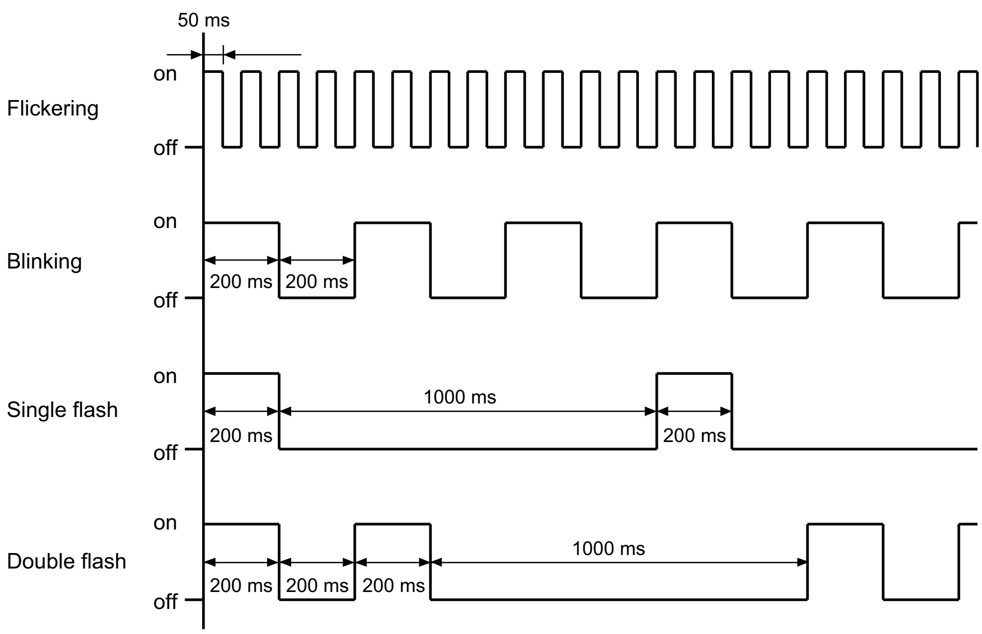
OUT PWR Indicator

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.

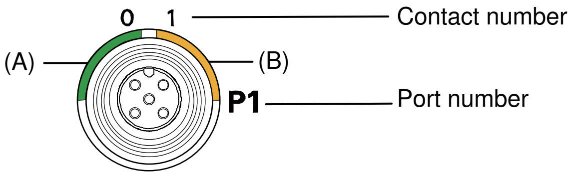
Additional Information

The timing of flashing and flickering of the indicators is shown below.



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 *7-3-3 Details of PDO Entries* on page 7-9 for details on I/O data during digital input and 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, or short-circuit status for pin 4/pin 1.

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

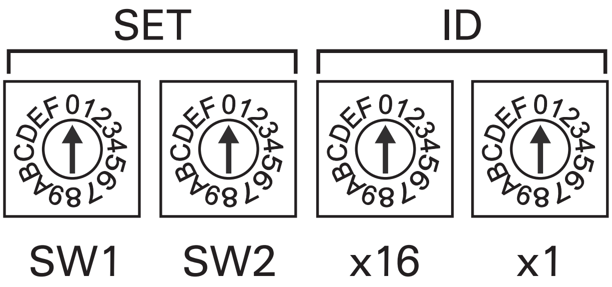
This indicator shows the digital I/O status or short-circuit status for pin 2.

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

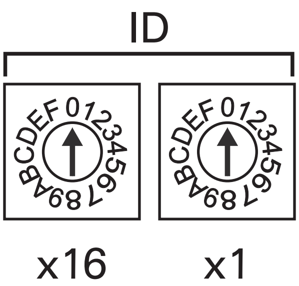
Use the rotary switches for setting the Explicit Device ID and the I/O port quick settings of the IO-Link Master Unit.



These rotary switches are described below.

3-3-1 ID Switch

The ID switch sets the Explicit Device ID which is used to enable the EtherCAT master to recognize the IO-Link Master Unit on the EtherCAT network.
This manual abbreviates the Explicit Device ID as ID for indication.
For the built-in EtherCAT ports on the NJ/NX-series CPU Unit and NY-series Industrial PC, the ID of the IO-Link Master Unit is used as the node address.
The following shows the ID switch.



The ID is set with the two-digit hexadecimal ID switches. The left switch sets the upper digit, and the right switch sets the lower digit.
There are two methods to set the ID: setting with ID switch and setting with software.

- **Setting the ID with the ID switch**
  Use the ID switch to set the ID in the range from 1 to 255. If you set the ID switch to 00 hex, the setting is made with the software.
  Setting range: 01 to FF hex (1 to 255)
  The ID is set to 00 hex (0) at the factory.

- **Setting the ID with the software**
  To set the ID with the software, set the ID switch to 00 hex. Use the EtherCAT master Configuration Software to set the ID.
  Setting range: 1 to 65,535

The setting range of the ID depends on the specifications of the connected EtherCAT master. Check the specifications of the EtherCAT master for the supported ID setting range of the EtherCAT master.

Precautions for Correct Use

- The ID that is set with the ID switch or software is read only once when the Unit power supply is turned ON or the Unit is restarted. Even if the setting is changed after the Unit power supply is turned ON or after the Unit is restarted, the new setting will not be used until the next time when the power is turned ON or the Unit is restarted.
- An error may occur on the EtherCAT master if the same ID is set for more than one slave present on the EtherCAT network.
- An error may occur on the EtherCAT master if the ID is not within the setting range specified for the EtherCAT master.

Additional Information

The ID is loaded to the register 0012 hex of the EtherCAT slave controller for the IO-Link Master Unit when the power supply to the IO-Link Master Unit is turned ON.

3-3-2 SET Switch

SW1 is not used.

SW2 is used as the quick setting switch for I/O ports.

Using the quick setting switch allows you to easily set the communications mode for the I/O ports and the IO-Link device configuration settings information without Configuration Software or SDO communications. The default setting is 0 hex.

Refer to *9-17 I/O Port Quick Settings* on page 9-47 for details.

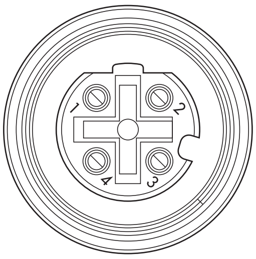
3-4 Connectors

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

- EtherCAT communications connectors
- Power supply connectors
- I/O connectors

3-4-1 EtherCAT Communications Connectors

The EtherCAT communications connectors are used for EtherCAT communications. In this manual, they are sometimes referred to as "communications connectors".



The specifications are as follows:

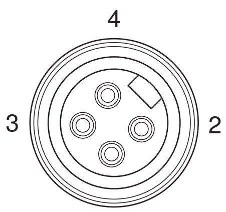
- Electrical specifications
  Conform to IEEE 802.3 standards.
- Connector structure
  M12 connector (D-coding, female, shielded) x 2
- Pin arrangement

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

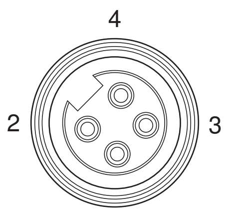
The power supply connectors are used for supplying power to the IO-Link Master Unit.

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

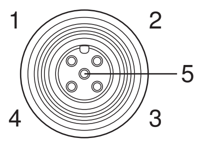
The maximum power supply current is 9 A, which is the sum of the Unit/input power supply current and the output power supply current. Do not use the Unit beyond the maximum power supply current. Otherwise, an excess current flows through the power supply cable, and it may cause fire.

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 supply 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.

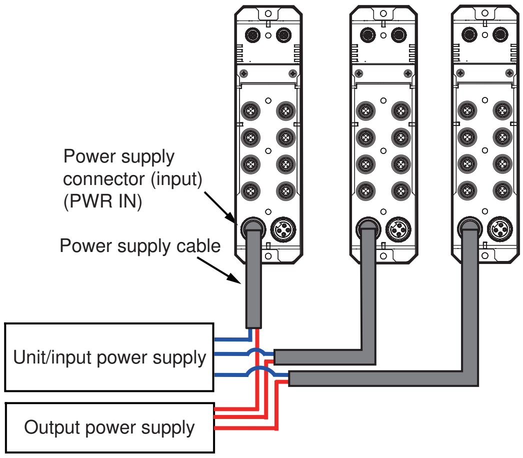
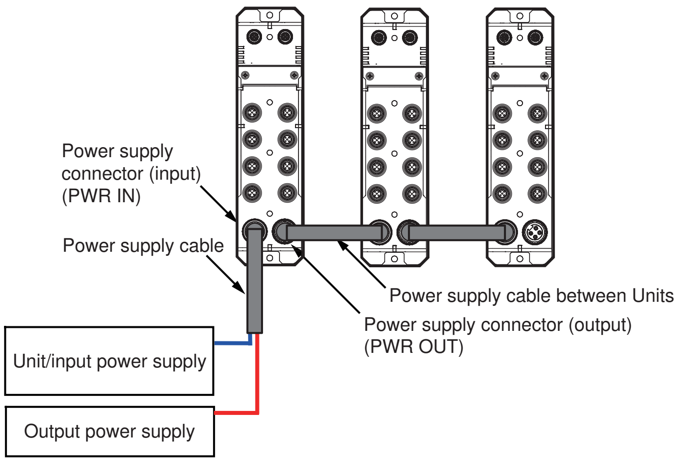
Type	Applications
Unit/input power supply	The Unit/input power supply provides power to the IO-Link Master Unit for operation and interface with input devices. The following are applications. • Operation of the internal circuits and input circuits of the IO-Link Master Unit • Power supply to IO-Link 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

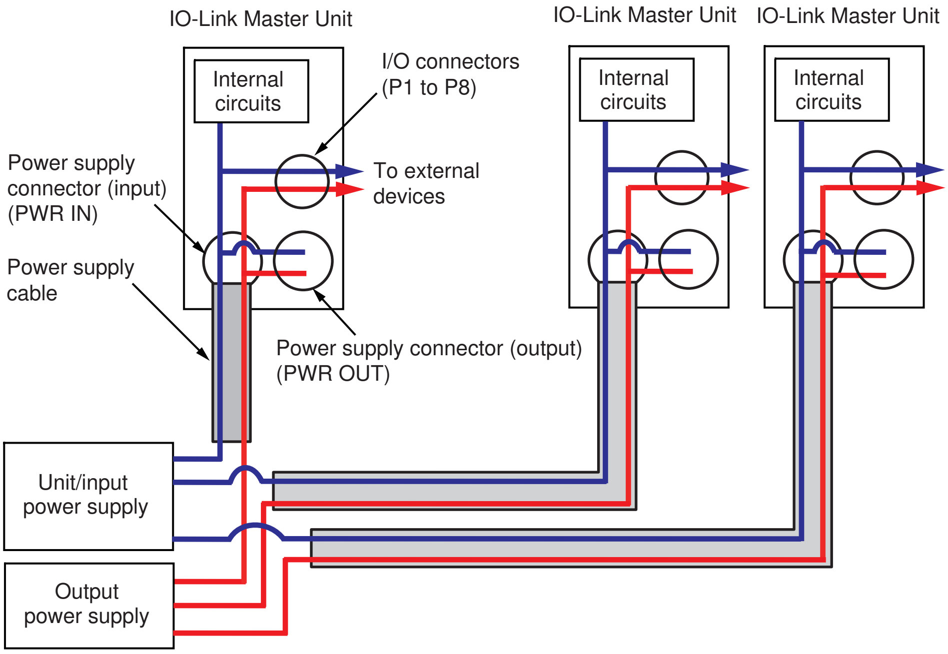
There are two methods to supply power to IO-Link Master Units as shown below.

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. 	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. 	Through-wiring can reduce the overall length of the power supply cables used in the system.

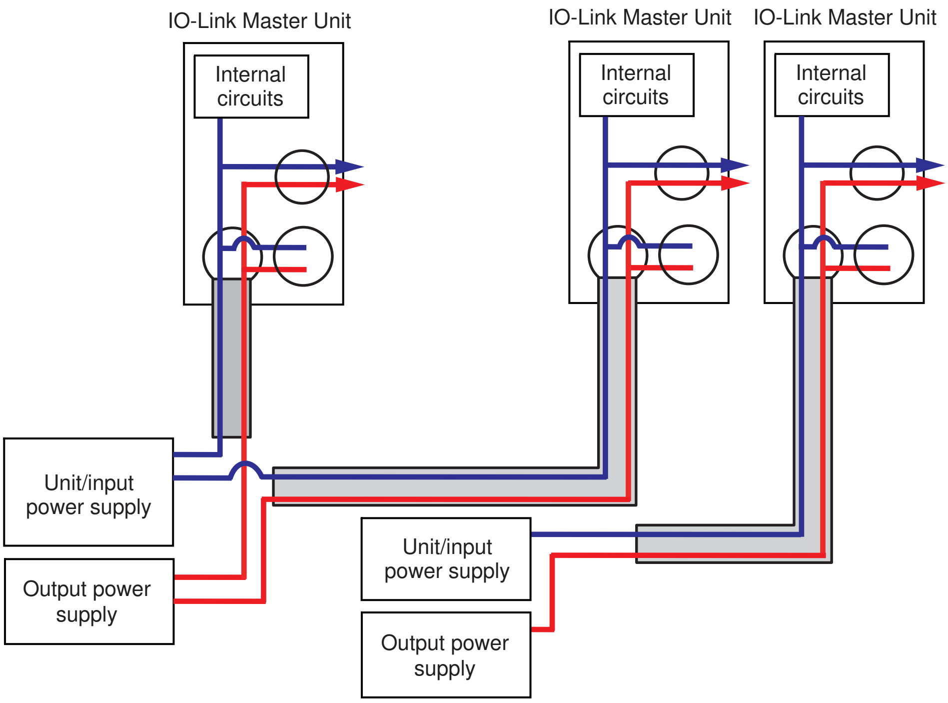
The details of system configuration are shown below.

● 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 EtherCAT network as shown below.

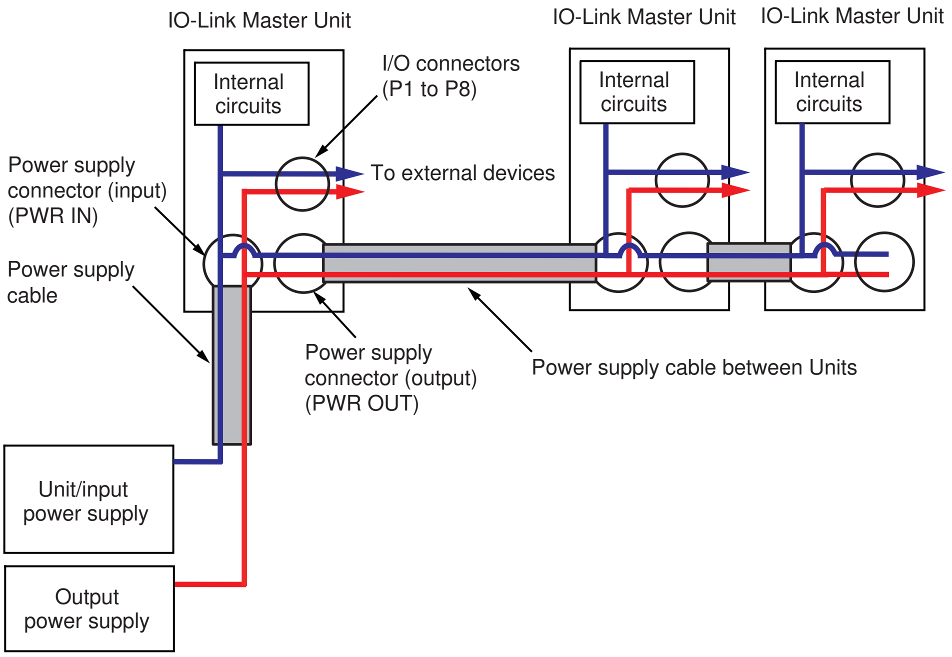


Precautions for Correct Use

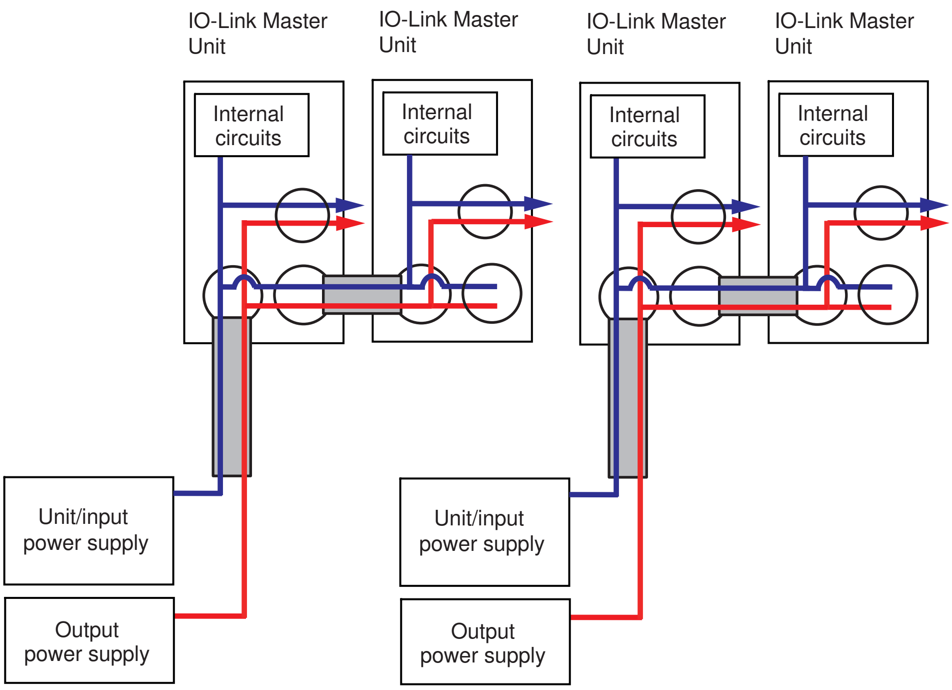
- Always use separate power supplies for the Unit/input power supply and the output power supply. If you supply power from the same power supply, load variations in output devices may cause malfunctions.
- If a short-circuit occurs in a Unit/input power supply or output power supply, the Unit/input power 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 EtherCAT 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)

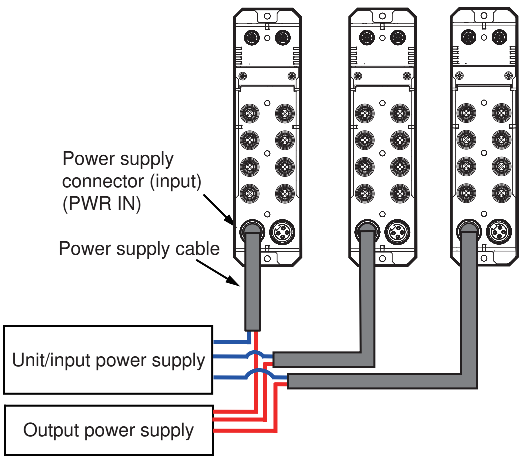
*1. Do not exceed the maximum load current of the digital outputs for pin 2 and digital outputs for pin 4 (2 A/pin) and the maximum port current (4 A/port).
*2. This is load current to IO-Link devices with digital inputs for pin 2.

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.



● 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	60 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
	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
ILM2 and ILM3	Unit/input power supply	Current consumption from Unit/input power supply	60 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)
   = (60 mA + 103.0 mA + 36.3 mA) + (100 mA + 2 A + 1 A)
   ≈ 3.30 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)
   = (60 mA + 69.3 mA) + (100 mA + 2 A)
   ≈ 2.23 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)
≈ 2.23 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 Application conditions for connected external devices	Use the conditions specified in *Calculation Example for the Total Current Consumption in Direct Power Supply* on page 4-9. The conditions lead to the sum of total current consumption from each power supply by each Unit below: • ILM1: 3.30 A • ILM2: 2.23 A • ILM3: 2.23 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 3.30 A.)
ILM2	0.51 V (3 A is used because the cable length is 3 m and the total current consumption is 2.23 A.)
ILM3	0.69 V (3 A is used because the cable length is 5 m and the total current consumption is 2.23 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

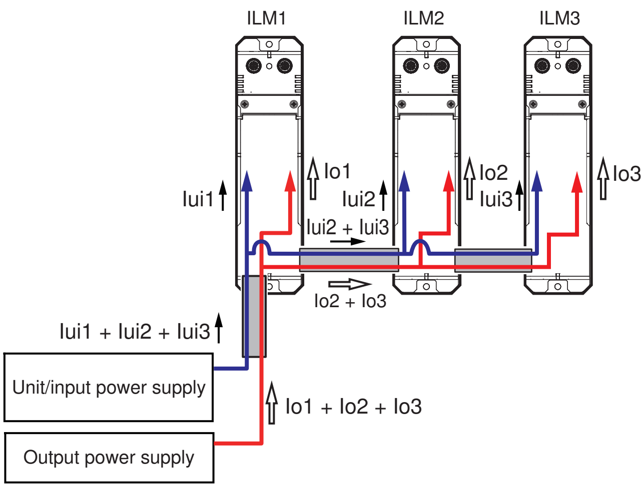
Design condition	Reference for confirmation method
(b) The input circuit specifications of IO-Link Master Unit and the voltage specifications of connected external devices are met even if the Unit/input power supply voltage drops.*2	*Calculating the Voltage Drop in Power Supply with Through-wiring* on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



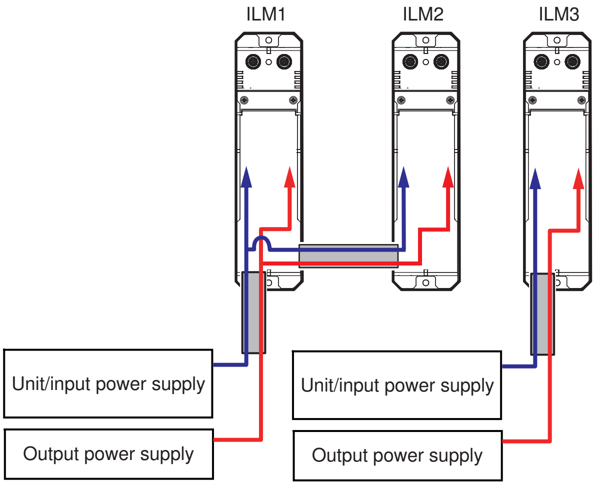
Iui1: Total current consumption of ILM1 from Unit/input power supply
Iui2: Total current consumption of ILM2 from Unit/input power supply
Iui3: Total current consumption of ILM3 from Unit/input power supply
Io1: Total current consumption of ILM1 from output power supply
Io2: Total current consumption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

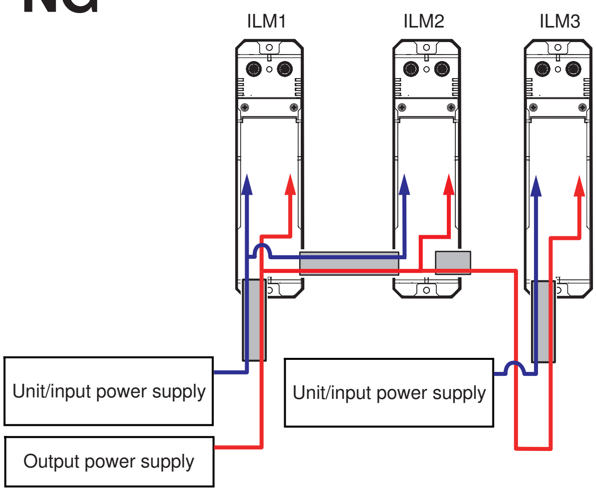
Example: A system with additional external power supplies



Precautions for Correct Use

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

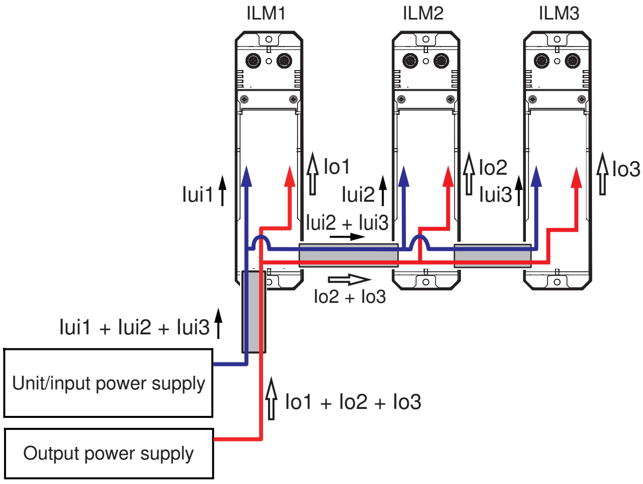
NG



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)
   = (60 mA + 103.0 mA + 36.3 mA) + (100 mA + 2 A + 1 A)
   ≈ 3.30 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)
   = (60 mA + 69.3 mA) + (100 mA + 2 A)
   ≈ 2.23 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)
≈ 2.23 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)
= (3.30 A + 2.23 A + 2.23 A)
= 7.76 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

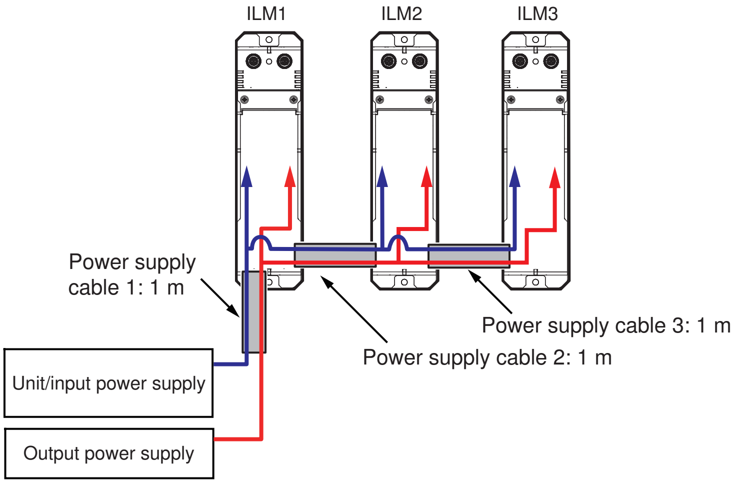
When the power supply method is power supply with through-wiring, the current to be consumed by other IO-Link Master Units flows through each IO-Link Master Unit, which causes voltage drop in the internal circuits of the Units.
Voltage drop in the internal circuits of IO-Link Master Units and power supply 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. 
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 7.76 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) = 7.76 A - 3.30 A = 4.46 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) = 7.76 A - 3.30 A - 2.23 A = 2.23 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.

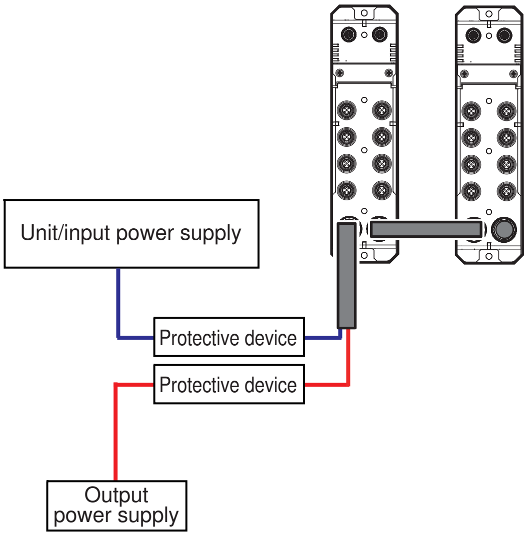
Selecting Protective Devices

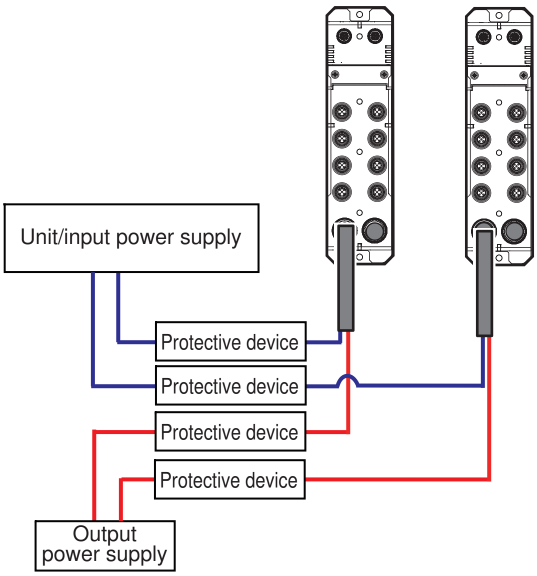
Consider the following items when you select protective devices.

- 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.


Unit/input power supply
Protective device
Protective device
Output
power supply


Unit/input power supply
Protective device
Protective device
Protective device
Protective device
Output
power supply

5

Installation and Wiring

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

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.

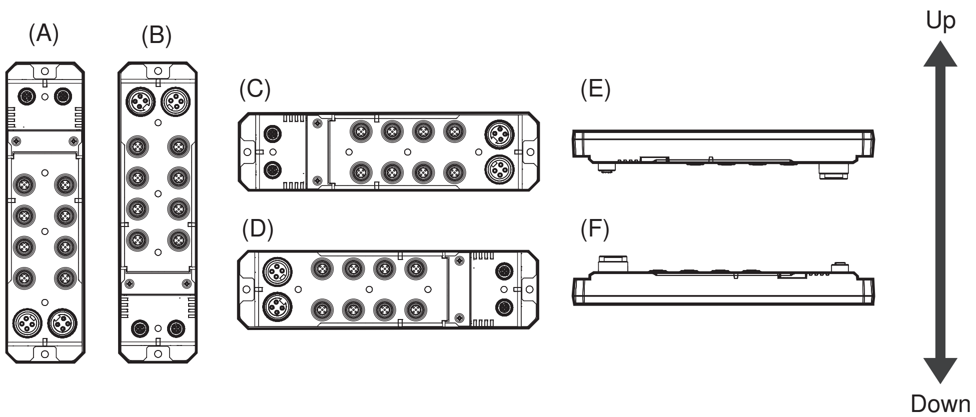
- Locations subject to direct sunlight
- Locations subject to ambient temperatures or humidity outside the range specified in the specifications of the Unit
- Locations subject to condensation as the result of severe changes in temperature
- Locations subject to corrosive or flammable gases
- Locations 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

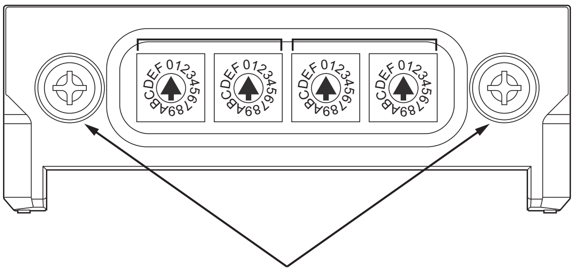
This section describes the following installation methods for the IO-Link Master Unit.

- 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.



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-6 Dimensions* on page A-67 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 EtherCAT Network Wiring

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

5-2-1 Installation Standards

To ensure that the EtherCAT communication network is installed properly, refer to IEC 61784-5-12 standard in conjunction with IEC 61918.

5-2-2 Installation Precautions

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

Precautions When Installing a Network

- When you install an EtherCAT 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 EtherCAT 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 5-31 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 5-31 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 communications 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 EtherCAT cables shown in the Connected Devices section. These communications cables have a cable shield that is connected to the connector hoods at both ends.

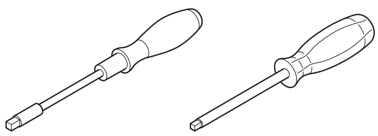
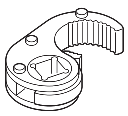
5-2-3 Preparing for Wiring

● Preparing Communications Cables

For communications cables, use the EtherCAT communications cables shown in *5-5 Connected Devices* on page 5-31.
Refer to *5-5-1 EtherCAT Cables* on page 5-31 for details.

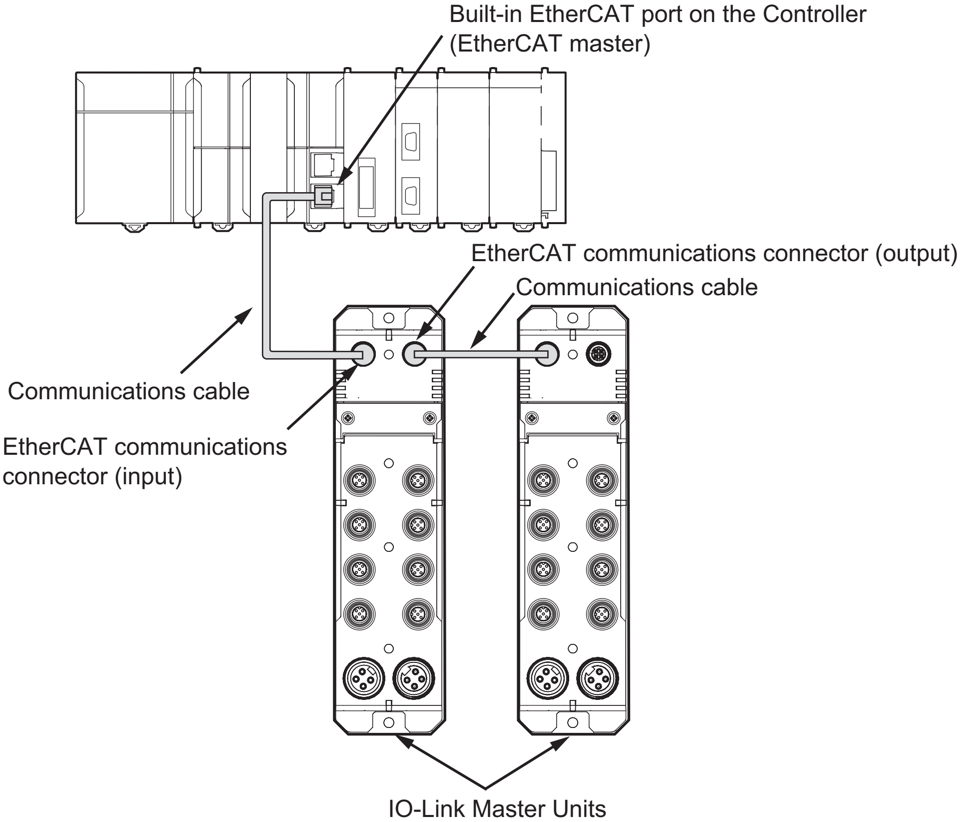
● Preparing Tightening Tools

Use the following tools to tighten the M12 screw connectors of EtherCAT cables to a specified torque.

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

5-2-4 Connecting Communications Cables

Connect the communications cable from the EtherCAT master to the EtherCAT communications connector (input) on the IO-Link Master Unit, and then connect the communications cable to the next IO-Link Master Unit to the EtherCAT communications connector (output).
Do not connect anything to the EtherCAT communications connector (output) on the IO-Link Master Unit at the end of the network.

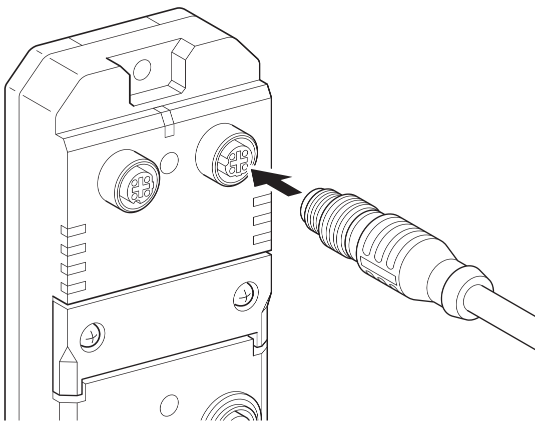


The following describes the communications cable connection procedure, tightening torque, and waterproof covers.

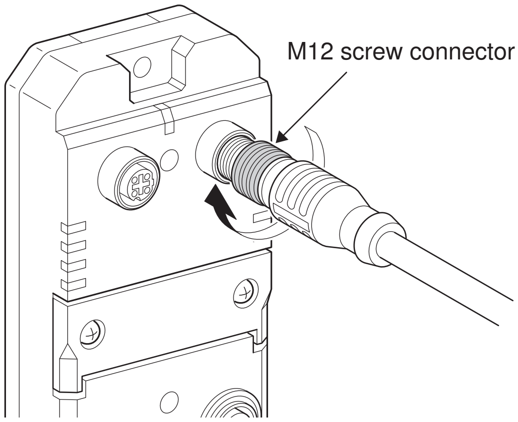
Connection Procedure

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 communications cable.

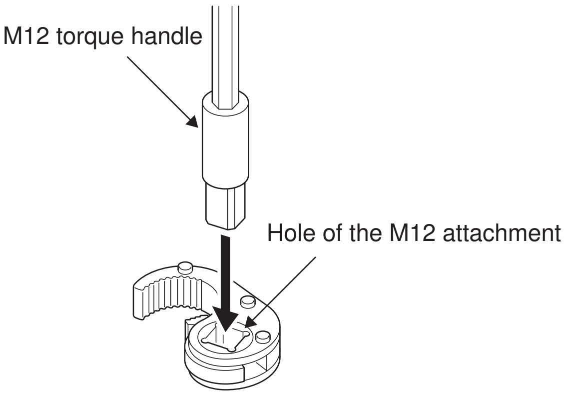
1 Push the M12 plug (male) of the EtherCAT cable into the communications connector (female) of the IO-Link Master Unit. At this time, be careful of the orientation of the communications connector.



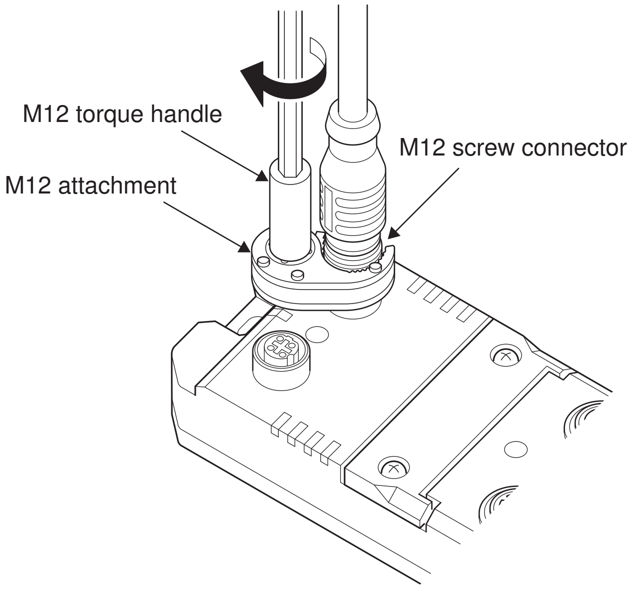
2 Rotate the M12 screw connector of the EtherCAT cable in the direction shown in the following figure to tighten it. Tighten the connector before tightening it to the specified torque.



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.



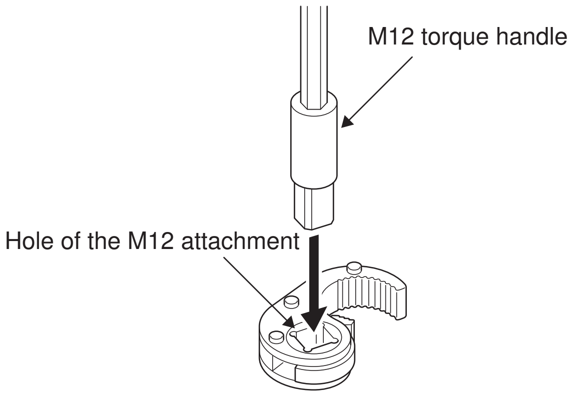
4 Mount the M12 attachment on the M12 screw connector of the EtherCAT cable. After you mount the M12 attachment, rotate the M12 torque handle in the direction shown in the following figure to tighten the M12 screw connector to the specified torque.



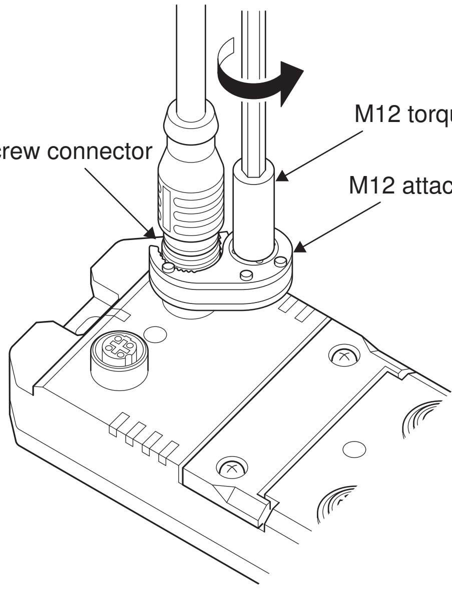
Removal Procedure

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 communications 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.



2 Mount the M12 attachment on the M12 screw connector of the EtherCAT 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.



3 Rotate the M12 screw connector of the EtherCAT cable in the direction opposite to the connection direction.

Tightening Torque

Tighten the M12 screw connectors of EtherCAT 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
EtherCAT communications connectors	M12	0.5 to 0.6 N·m

Waterproof Covers

Install waterproof covers for EtherCAT communications connectors on any unused EtherCAT connectors. For waterproof covers, use the M12 waterproof cover shown in *5-5 Connected Devices* on page 5-31. 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 EtherCAT 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 5-31 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 5-31 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.

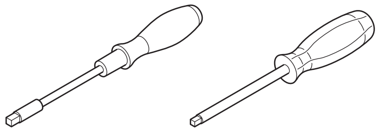
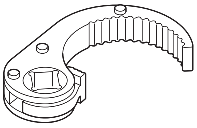
5-3-2 Preparing for Wiring

● Preparing Power Supply Cables

For power supply cables, use the power supply cables shown in *5-5 Connected Devices* on page 5-31.
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.

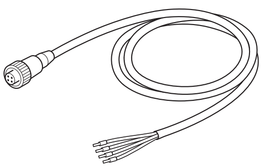
Name and appearance	Manufactur-er	Model	Remarks
M12 torque handle Product, setting aid for torque 	Weidmuller	Screwty-M12-DM	The model on the left is a set of an M12 torque handle and an M12 attachment. Use the M12 attachment when you wire communications cables and I/O cables.
M23 attachment 	Weidmuller	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 5-31, 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.

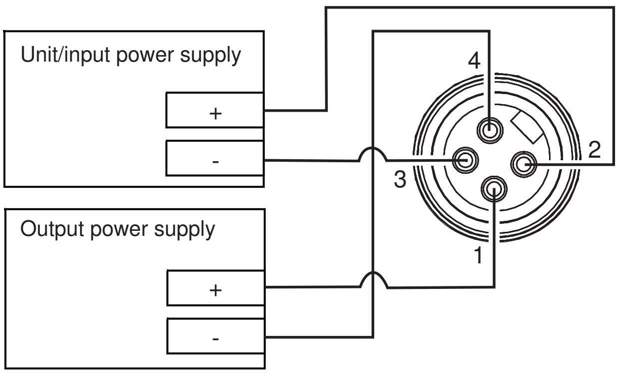
- 72MNf4□□□ or 72MNfL4□□□

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

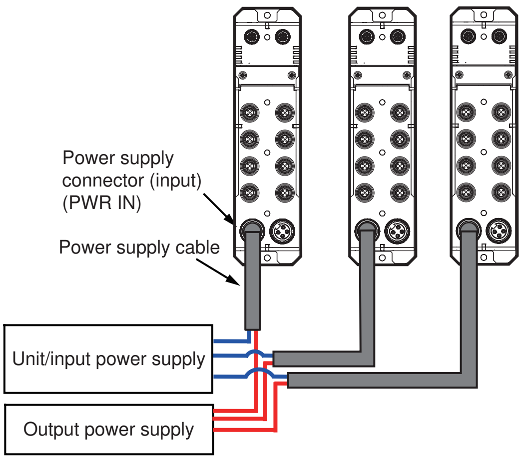


Pin arrangement of power supply connector (input)		External power supply wiring	Color of power supply cable discrete wire
Pin No.	Signal name		
1	OUT P+	Connect the positive (+) side of the output power supply.	Red
2	U/IN P+	Connect the positive (+) side of the Unit/input power supply.	Green
3	U/IN P-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

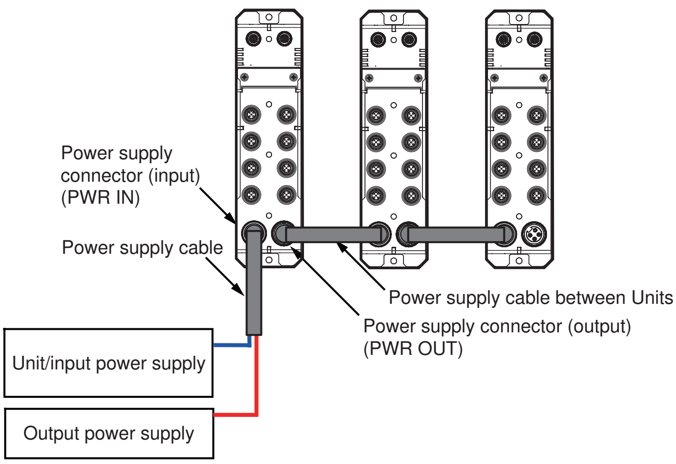
5-3-4 Connecting Power Supply Cables

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

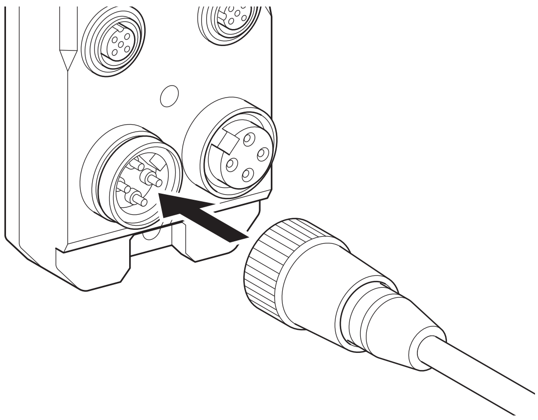
Always use separate power supplies for the Unit/input power supply and the output power supply. If you supply power from the same power supply, load variations in output devices may cause malfunctions.

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

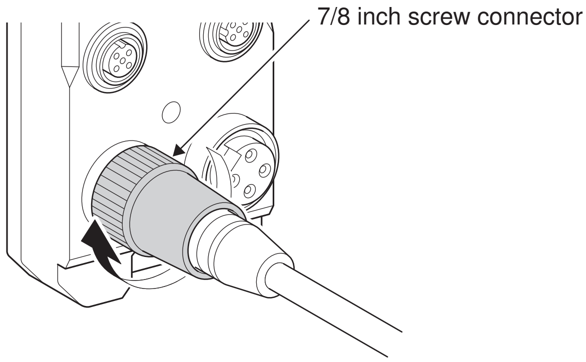
Connection Procedure

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.

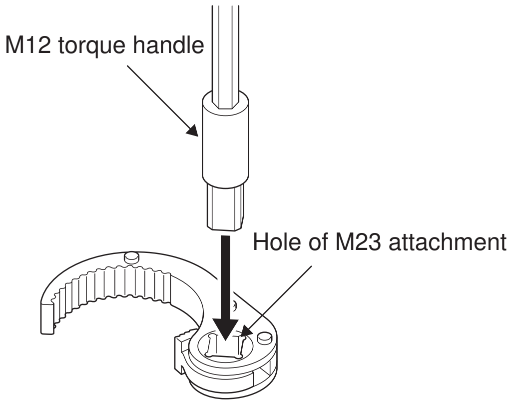
1 Push the 7/8 inch connector (female) of the power supply cable into the power supply connector (input) (male) of the IO-Link Master Unit. At this time, be careful of the orientation of the power supply connector.



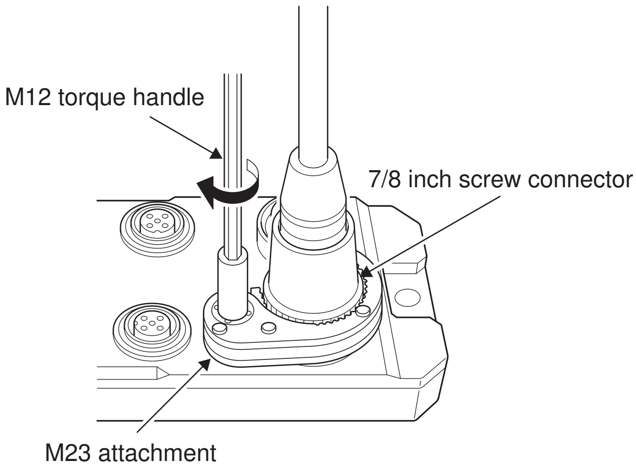
2 Rotate the 7/8 inch screw connector of the power supply cable in the direction shown in the following figure to tighten it. Tighten the connector before tightening it to the specified torque.



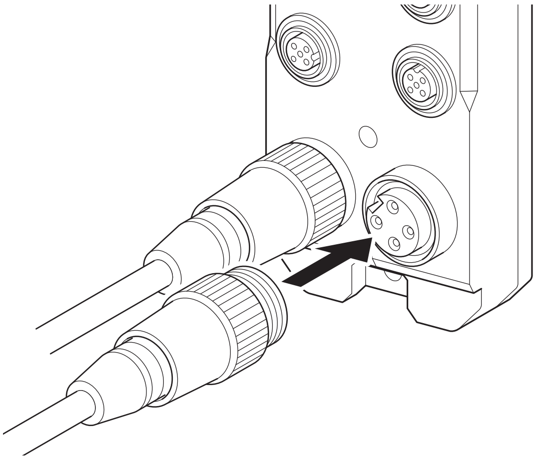
3 Set the M12 torque handle to the specified torque. Then, insert the torque handle into the tightening hole of the M23 attachment. When you tighten the connector, place the M23 attachment in the orientation shown in the following figure and insert the torque handle.
Refer to *Tightening Torque* on page 5-17 for information on the specified torque.



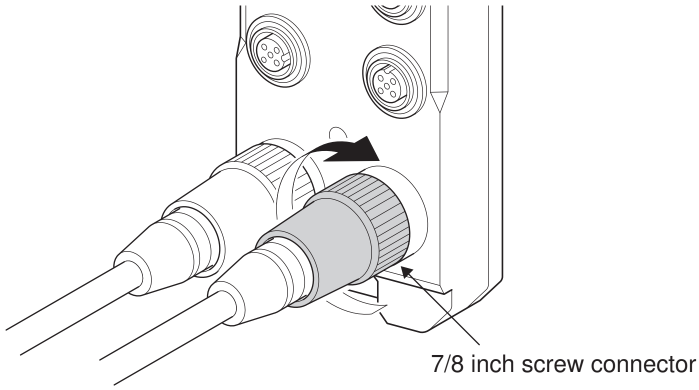
4 Mount the M23 attachment on the 7/8 inch screw connector of the power supply cable. After you mount the M23 attachment, rotate the M12 torque handle in the direction shown in the following figure to tighten the 7/8 inch screw connector to the specified torque.



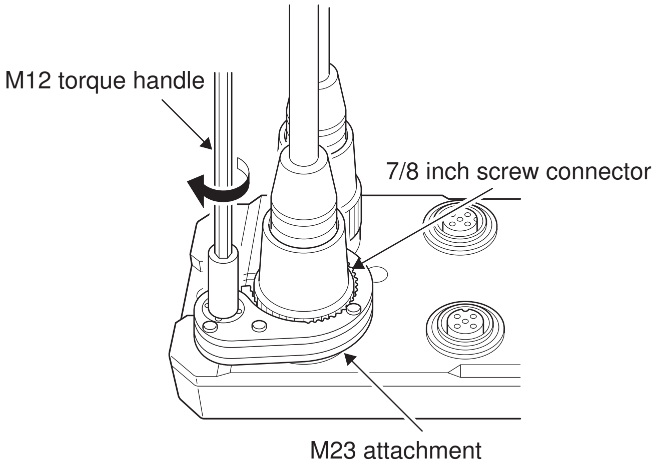
5 When the power is supplied with through-wiring, push the 7/8 inch connector (male) of the power supply cable into the power supply connector (output) (female) of the IO-Link Master Unit. At this time, be careful of the orientation of the power supply connector.



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.



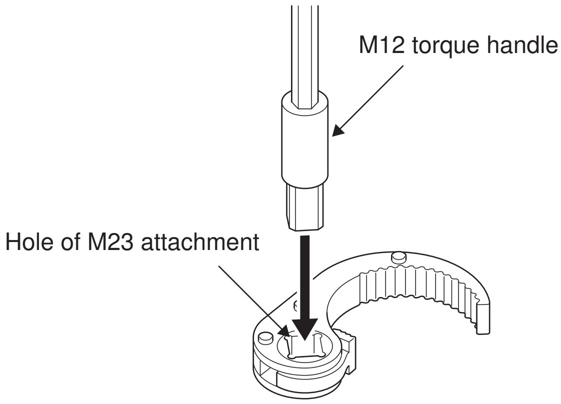
7 Mount the M23 attachment on the 7/8 inch screw connector of the power supply cable. After you mount the M23 attachment, rotate the M12 torque handle in the direction shown in the following figure to tighten the 7/8 inch screw connector to the specified torque.



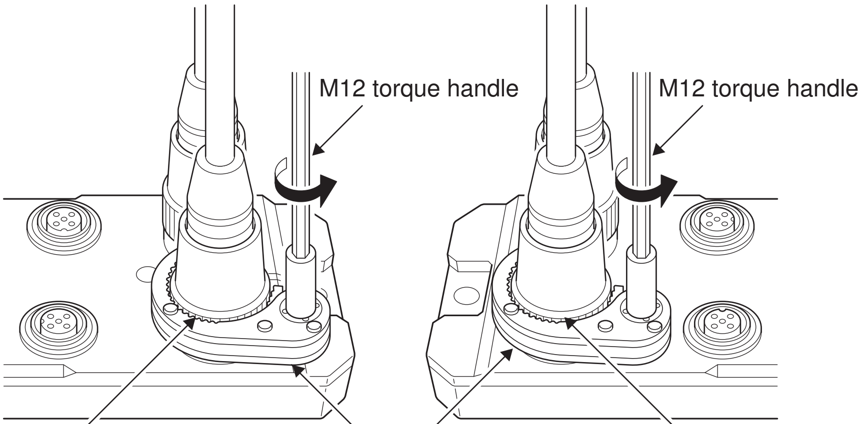
Removal Procedure

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.



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.



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 5-31. 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 5-31 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 5-31 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.

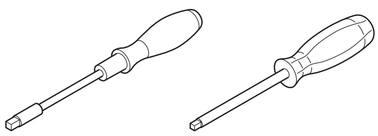
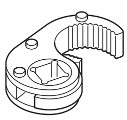
5-4-2 Preparing for Wiring

● Preparing I/O Cables

For I/O cables, use the I/O cables shown in *5-5 Connected Devices* on page 5-31.
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

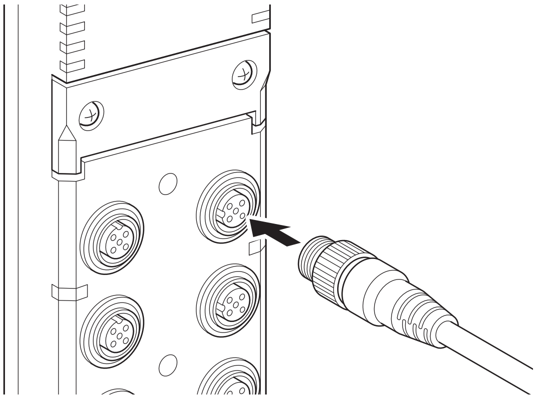
5-4-3 Connecting I/O Cables

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

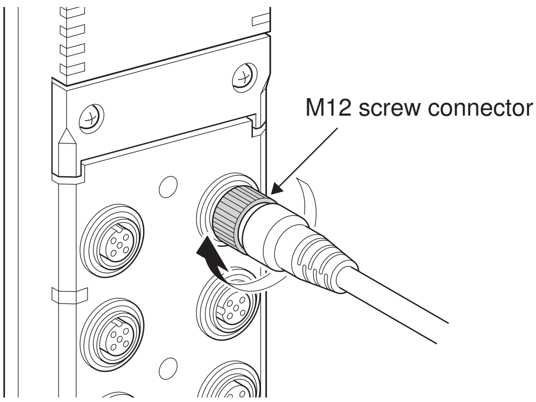
Connection Procedure

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.

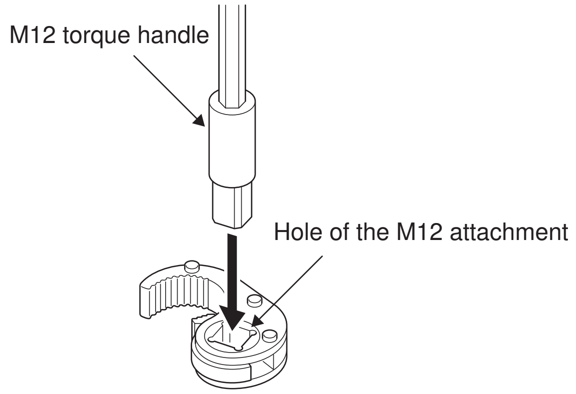
1 Push the M12 plug (male) of the I/O cable into the I/O connector (female) of the IO-Link Master Unit. At this time, be careful of the orientation of the I/O connector.



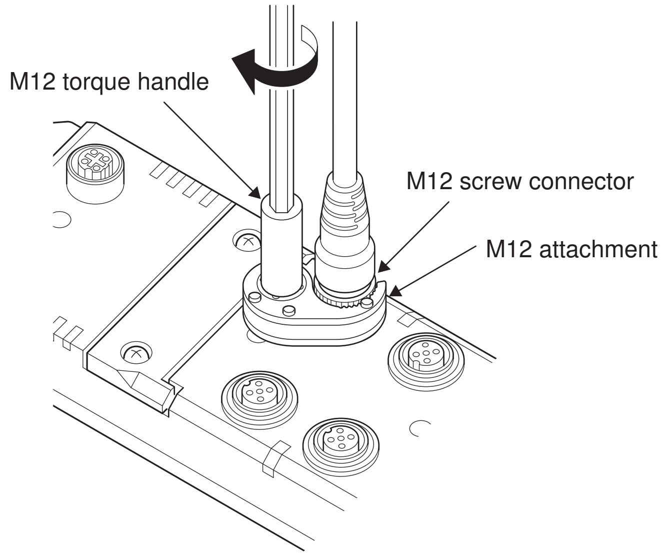
2 Rotate the M12 screw connector of the I/O cable in the direction shown in the following figure to tighten it. Tighten the connector before tightening it to the specified torque.



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 5-21 for information on the specified torque.



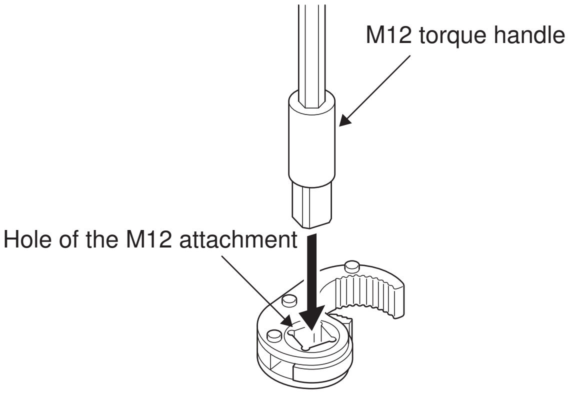
4 Mount the M12 attachment on the M12 screw connector of the I/O cable. After you mount the M12 attachment, rotate the M12 torque handle in the direction shown in the following figure to tighten the M12 screw connector to the specified torque.



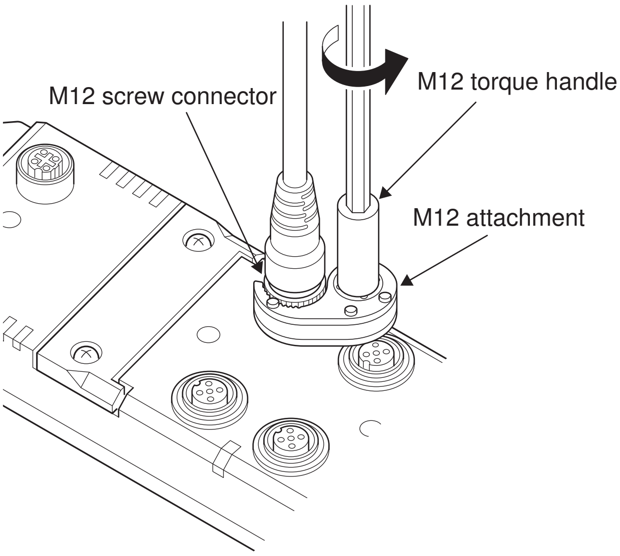
Removal Procedure

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.



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.



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 5-31. 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

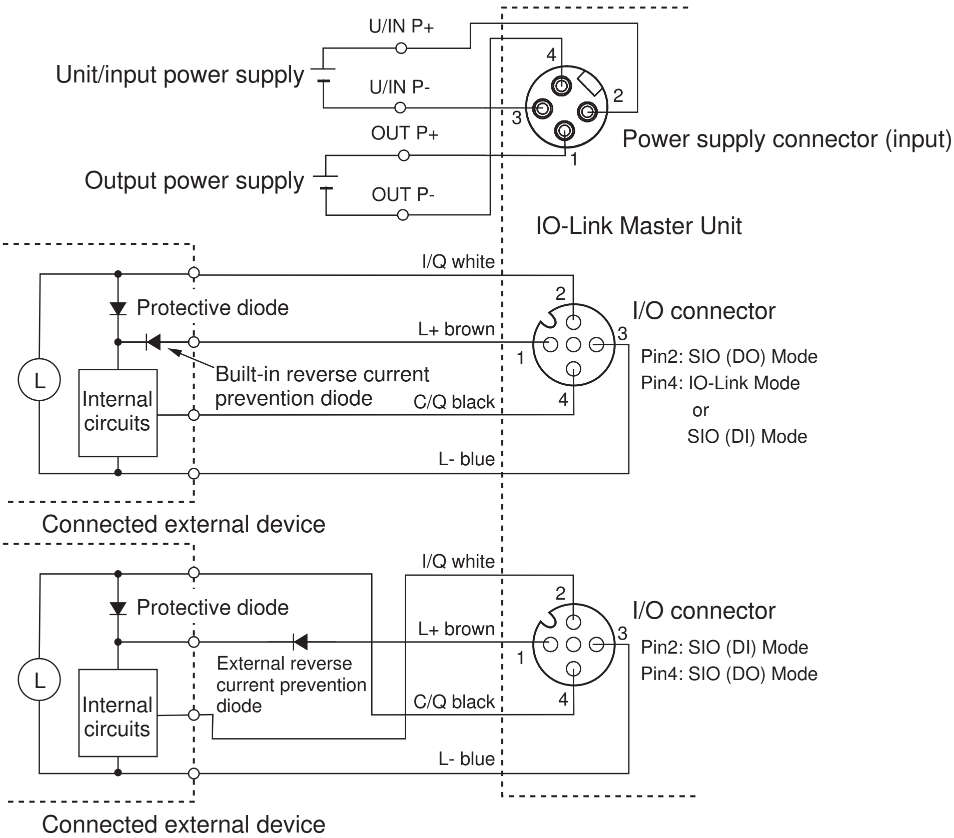
Wring examples with a branch connector are also shown.
The external devices that you connect to the I/O connectors depend on the communications mode settings for pin 4 and pin 2 of the port on the IO-Link Master Unit. Refer to *9-3 Communications Mode Settings* on page 9-7 for information on the communications mode settings.

Precautions for Correct Use

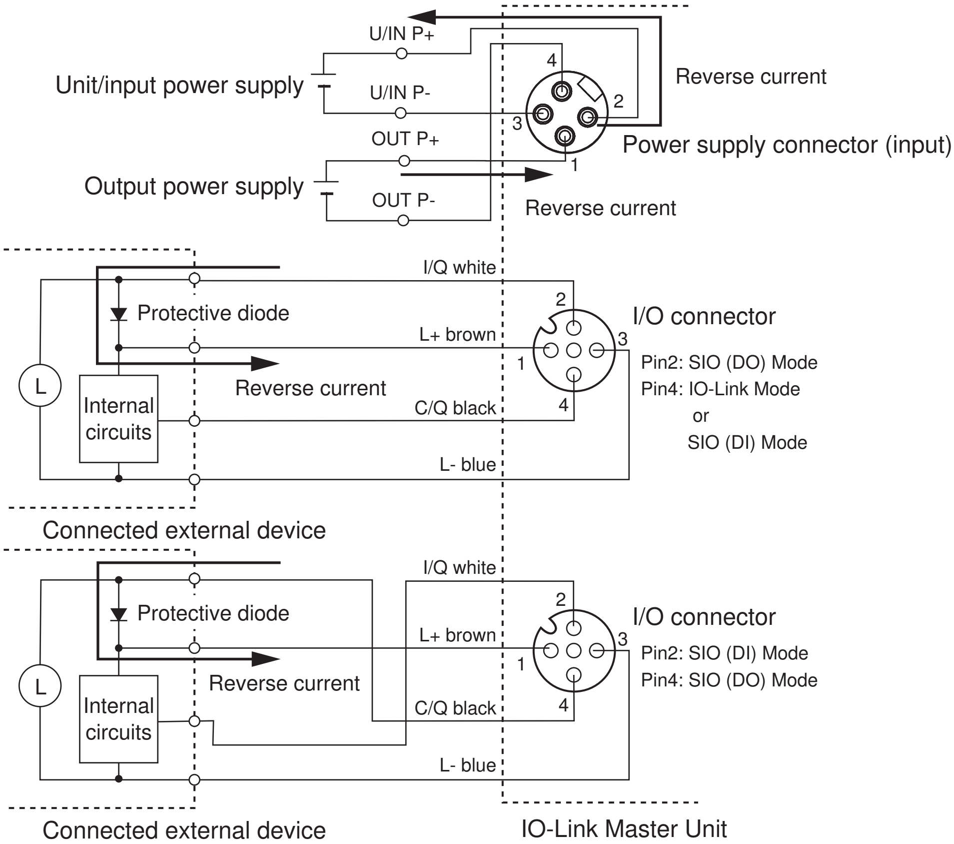
If you set the following mode to pin 2 and pin 4 of the port for the IO-Link Master Unit and connect the Unit with external devices, use the external devices without protective diodes in the locations shown in the following figure.

- 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.



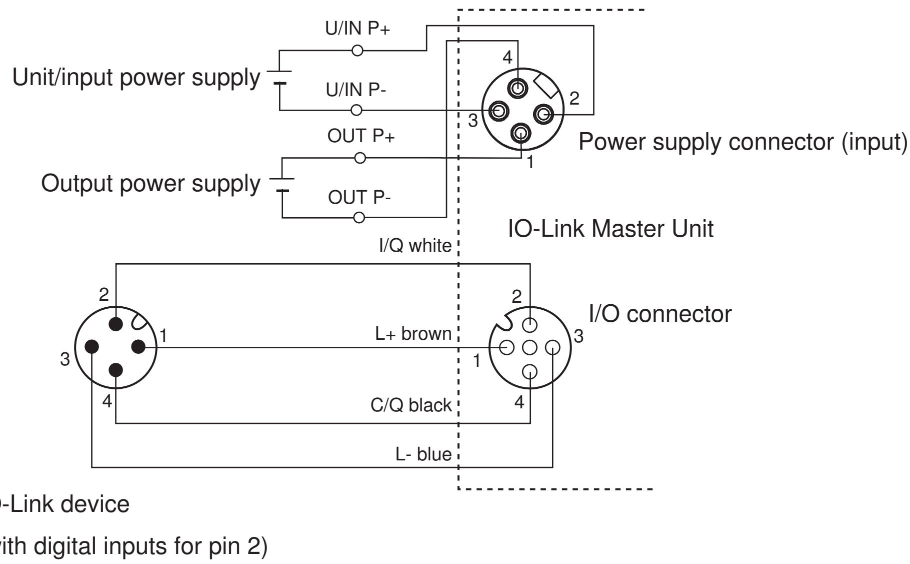
Wiring Examples for IO-Link Devices

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.

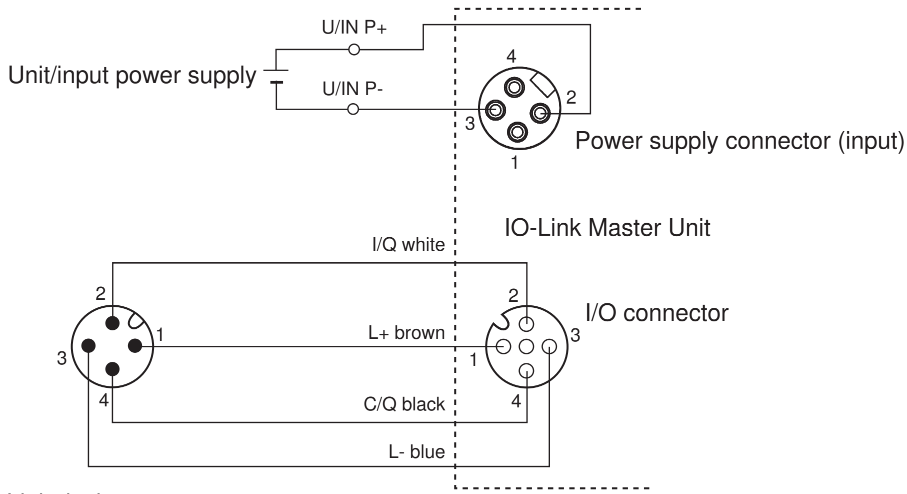
Pin 4: IO-Link Mode, pin 2: SIO (DO) Mode



● 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

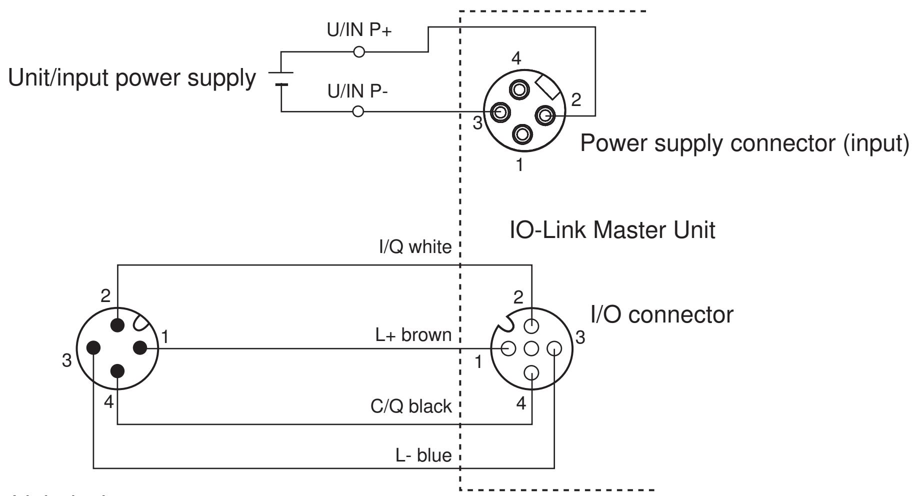


IO-Link device
(with digital outputs for pin 2)

● 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



IO-Link device
(without digital inputs or outputs for pin 2)

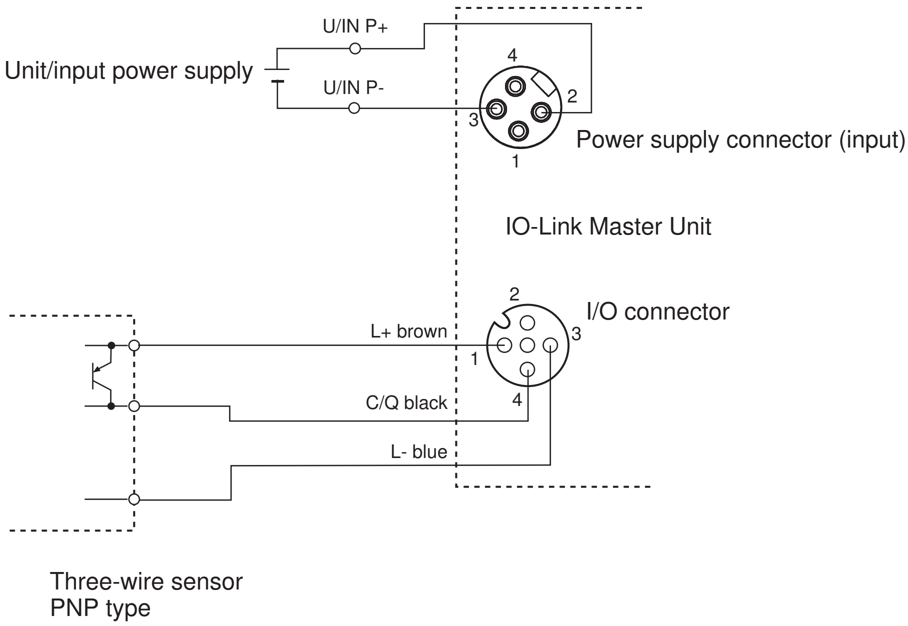
Wiring Examples for Non-IO-Link Input Devices

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.

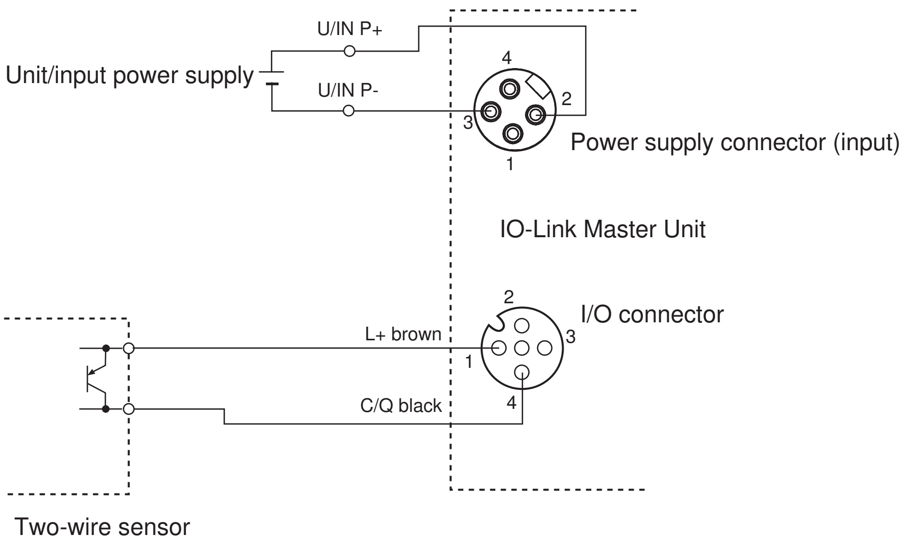
Pin 4: SIO (DI) Mode, pin 2: Disabled



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

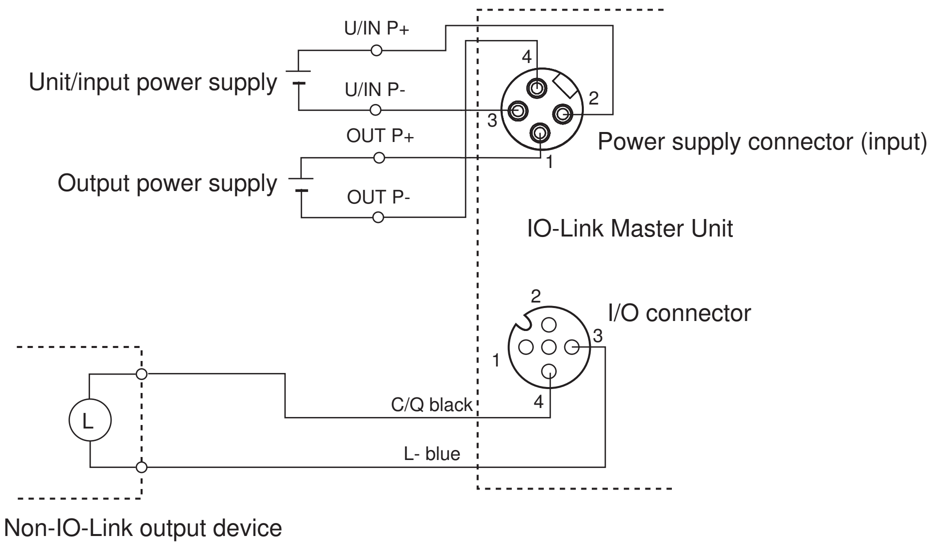


Wiring Example for Non-IO-Link Output Devices

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



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 5-29 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.

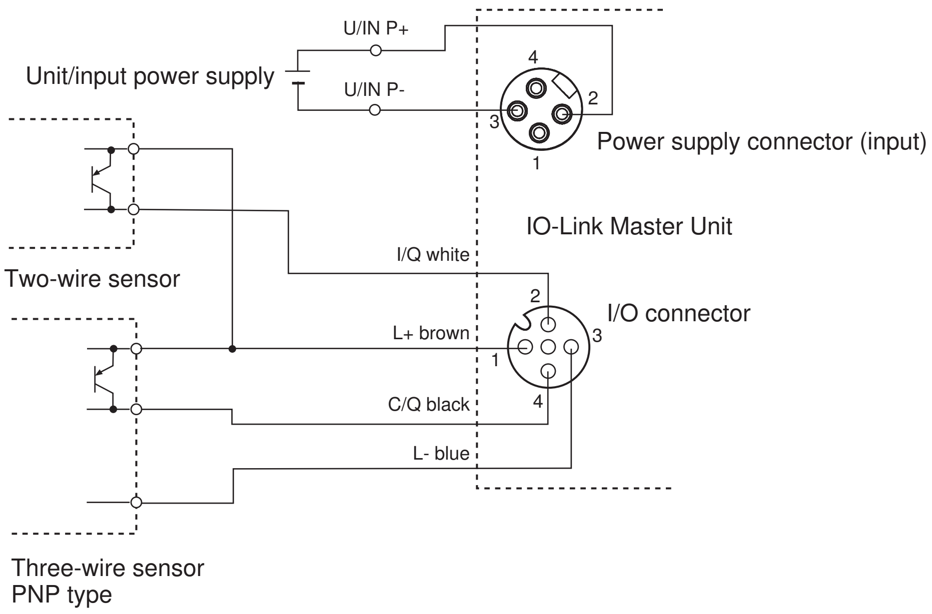
- XS5R-D426-1 (OMRON)

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.

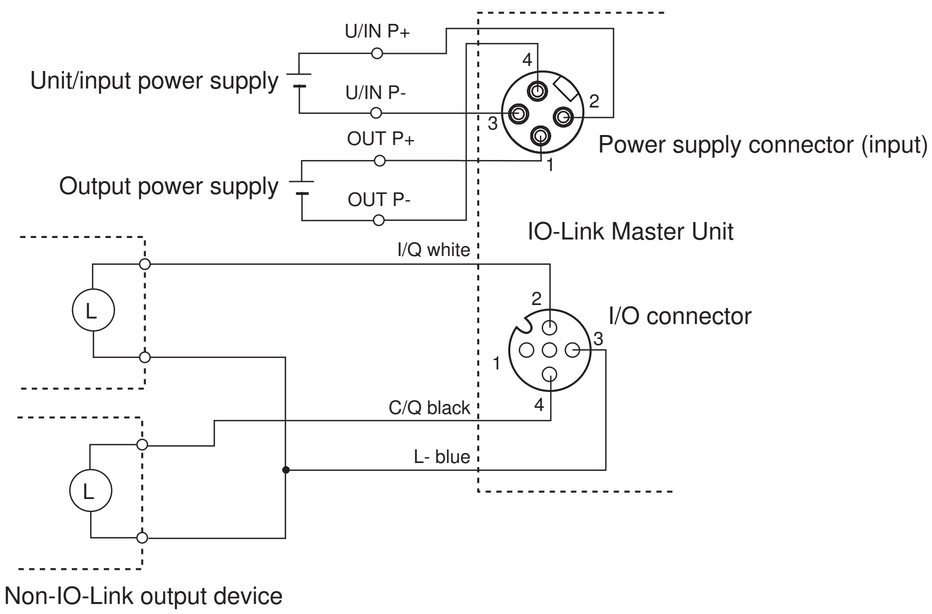
Pin 4: SIO (DI) Mode, pin 2: SIO (DI) Mode



● 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



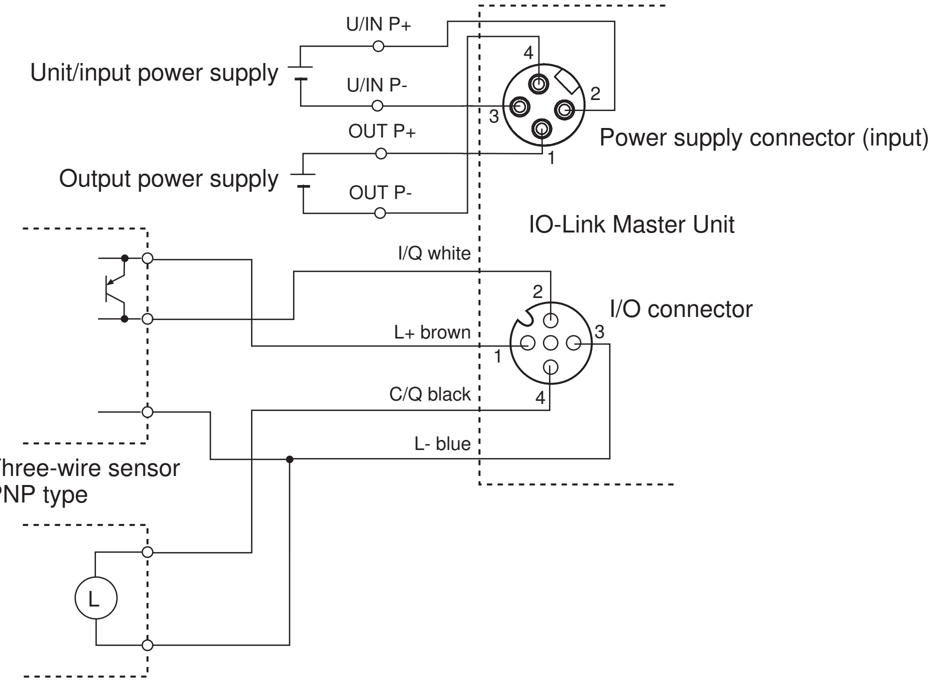
Precautions for Correct Use

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 5-29 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



Precautions for Correct Use

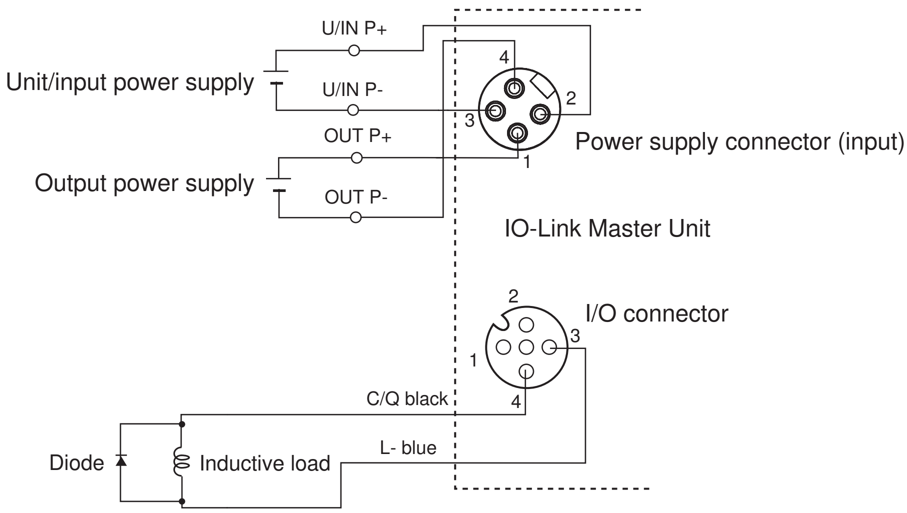
If you use a inductive load (solenoid valve, etc.), use a device with built-in diodes for absorbing counter-electromotive force, or externally install the diodes. Refer to *5-4-5 Precautions When Wiring External Output Signal Lines* on page 5-29 for details.

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

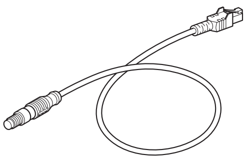

U/IN P+
Unit/input power supply
U/IN P-
OUT P+
Output power supply
OUT P-
4
2
3
1
Power supply connector (input)
IO-Link Master Unit
2
I/O connector
3
1
4
C/Q black
L- blue
Diode
Inductive load

5-5 Connected Devices

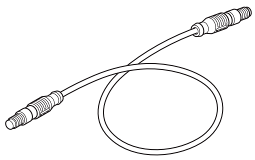
This section describes the connected devices for wiring the IO-Link Master Unit.

5-5-1 EtherCAT Cables

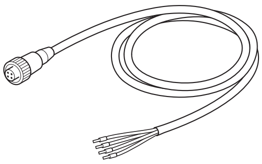
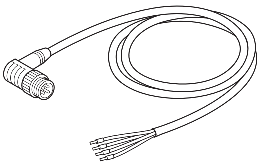
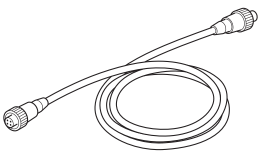
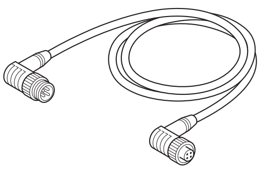
● Connection Cables between IO-Link Master Unit and EtherCAT Master or EtherCAT Slave with RJ45 Connectors

Name and appearance	Manufac-turer	Specifica-tion	Num-ber of cable con-duc-tors	Available connec-tors	Cable connec-tion direc-tion	Cable length	Model
Industrial Ethernet Connectors with Cable 	OMRON Corpora-tion	M12 plug (D-coding, male) to RJ45	4	Screw connector	Straight/ straight	0.5 m	XS2W-T421-BMC-SS
						1 m	XS2W-T421-CMC-SS
						2 m	XS2W-T421-DMC-SS
						3 m	XS2W-T421-EMC-SS
						5 m	XS2W-T421-GMC-SS
						10 m	XS2W-T421-JMC-SS

● Connection Cables between IO-Link Master Units

Name and appearance	Manufacturer	Specification	Number of cable conductors	Available connectors	Cable connection direction	Cable length	Model
Industrial Ethernet Connectors with Cable 	OMRON Corporation	M12 plug (D-coding, male) to M12 plug (D-coding, male)	4	Screw connector	Straight/ straight	0.5 m	XS2W-T421-BM2-SS
						1 m	XS2W-T421-CM2-SS
						2 m	XS2W-T421-DM2-SS
						3 m	XS2W-T421-EM2-SS
						5 m	XS2W-T421-GM2-SS
						10 m	XS2W-T421-JM2-SS

5-5-2 Power Supply Cables

Name and appearance	Manufacturer	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.

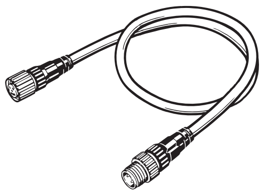
Name and appearance	Manu-facturer	Specification	Number of cable conduc-tors	Available connectors	Cable connec-tion direc-tion	Cable length	Model
XS3W Connector with Cable (M8 socket/M12 plug) 	OMRON Corpora-tion	M8 socket (A-coding, fe-male) to M12 plug (A-cod-ing, male), uses DC	4	M8 screw connector, 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

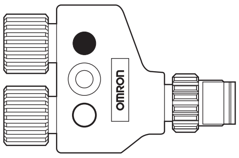
The following cables are used as extension cables from IO-Link devices or non-IO-Link connected external devices with an M12 plug. These cables can also be used for direct connection with IO-Link devices with an M12 plug.

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

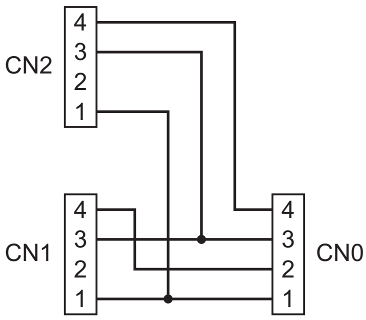
● Branch Connector for I/O Connectors

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

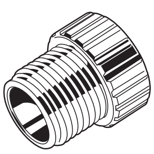
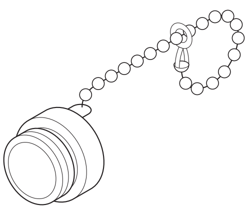
*1. Connectors for the IO-Link Master Unit are not Smartclick connectors. Use I/O cable tightening tools to install this ca-ble. The Smartclick connector of the branch connector also serves as a screw connector.

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

6

EtherCAT and IO-Link Communications

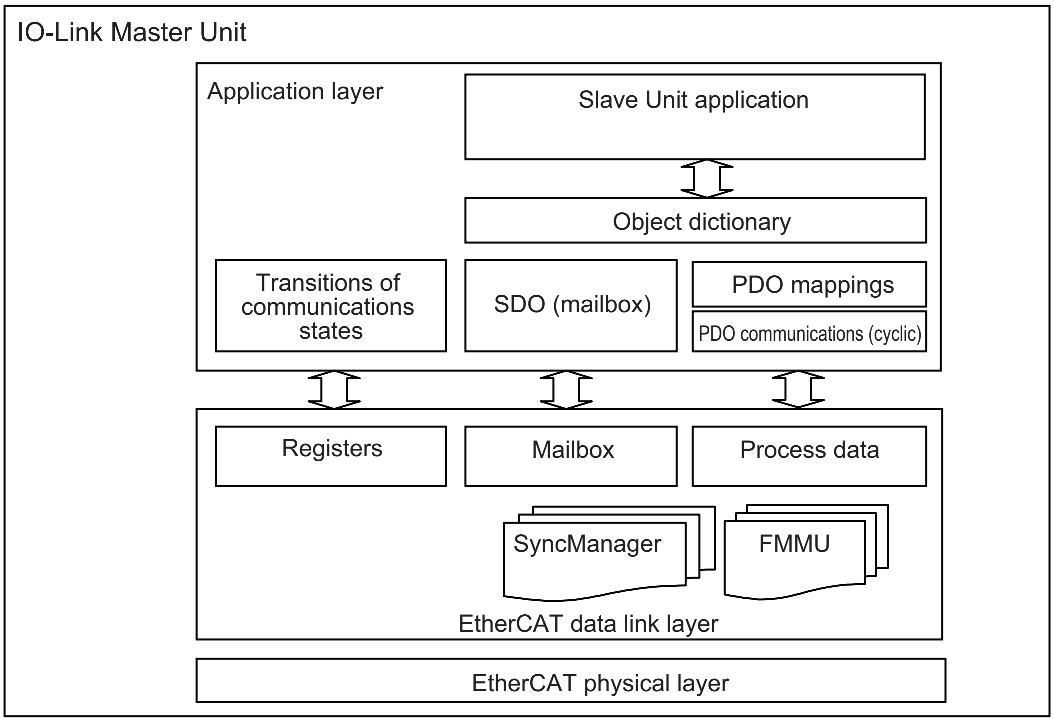
This section describes the EtherCAT communications and IO-Link communications of the IO-Link Master Unit.

6-1 EtherCAT Communications

This section describes an overview of EtherCAT communications, data exchange with PDOs and SDOs of the IO-Link Master Unit, setting items, and communications performance.

6-1-1 Structure of CAN Application Protocol over EtherCAT (CoE)

EtherCAT allows the use of multiple protocols for communications. However, the IO-Link Master Unit uses the *CAN application protocol over EtherCAT (CoE)* as the device profile for the *CAN application protocol*. The CoE is a communications interface that is designed to provide compatibility with EtherCAT devices. The CAN application protocol is an open network standard.
The following figure shows how the CoE is structured for an IO-Link Master Unit.



The object dictionary for the CAN application protocol is broadly divided into PDOs (process data objects) and SDOs (service data objects).

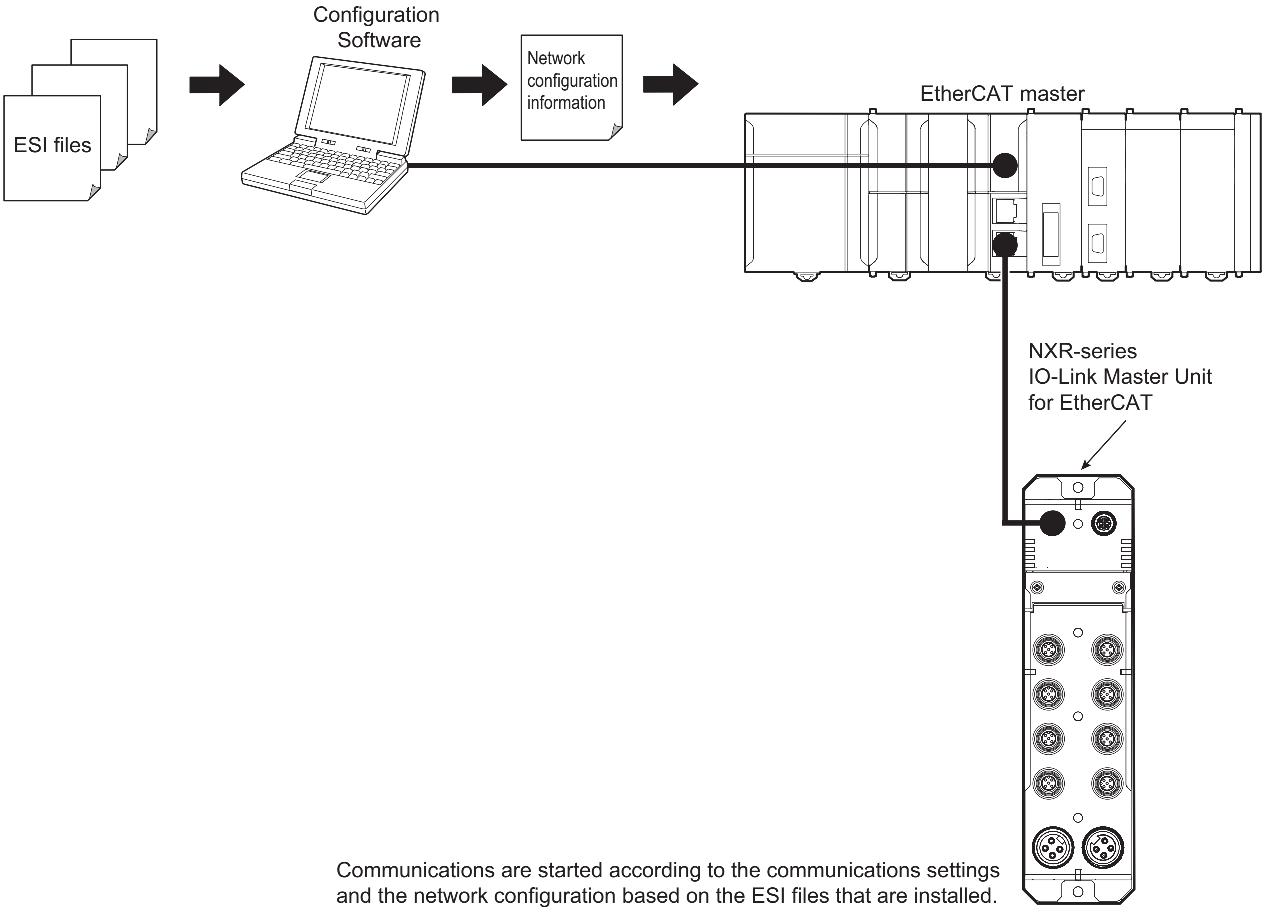
PDOs are contained in the object dictionary. The PDOs can be mapped in the object dictionary. The process data is defined by the PDO mappings. The PDOs are used in PDO communications for periodic exchange of process data.

SDOs are the objects that can be read and written. SDOs are used in non-periodic SDO communications (event-driven message communications).

If you use the CoE interface to set the object dictionary for PDOs and SDOs, you can provide EtherCAT devices with the same device profiles as the CAN application protocol.

6-1-2 EtherCAT Slave Information Files (ESI Files)

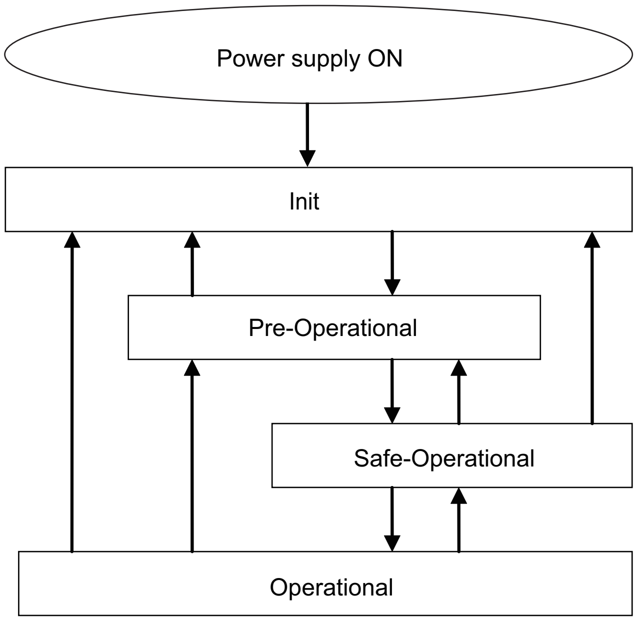
The setting information for an EtherCAT slave is provided in an ESI file (EtherCAT Slave Information). The EtherCAT communications settings are defined based on the ESI files of the connected slaves and the network connection information.
You can create the network configuration information by installing ESI files into the network setup software (Configuration Software).
You can download the network configuration information to the EtherCAT master to configure the EtherCAT network.



ESI files for the IO-Link Master Units can be downloaded from the OMRON website (http://www.ia.omron.com/).

6-1-3 Transitions of Communications States

The state transition model for communications control of the IO-Link Master Units is controlled by the EtherCAT master.
The following figure shows the communications state transitions from when the power supply is turned ON.



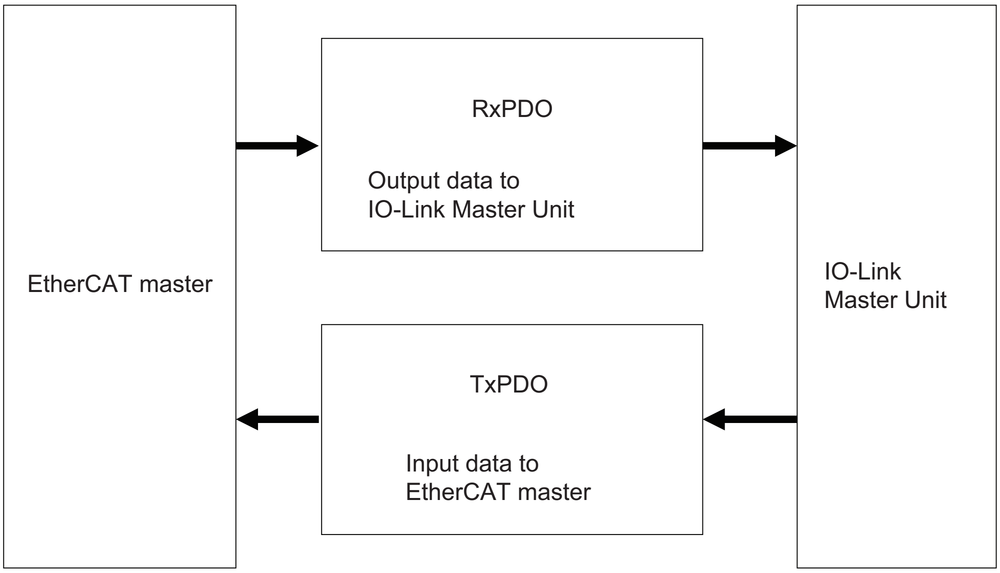
Status	SDO communications	Sending PDOs	Receiving PDOs	Description
Init	Not possible	Not possible	Not possible	Communications are being initialized. Communications are not possible.
Pre-Operational	Possible	Not possible	Not possible	Only SDO communications (message communications) are possible in this state. This state is entered after initialization is completed. It is used to initialize network settings.
Safe-Operational	Possible	Possible	Not possible	In this state, both SDO communications (message communications) and sending PDOs are possible. Receiving PDOs are not possible. Information, such as status, is sent from the IO-Link Master Unit.
Operational	Possible	Possible	Possible	This is the normal state for communications. PDO communications are used to control the I/O data.

6-1-4 Process Data Objects (PDOs)

This section describes the process data objects that are used by the IO-Link Master Unit.

Overview of Process Data Objects

Process data objects (PDOs) are used to transfer data during cyclic communications in realtime. There are two types of process data objects (PDOs): the RxPDOs, which are used by the IO-Link Master Unit to receive data from the EtherCAT master; and the TxPDOs, which are used by the IO-Link Master Unit to send data to the EtherCAT master.



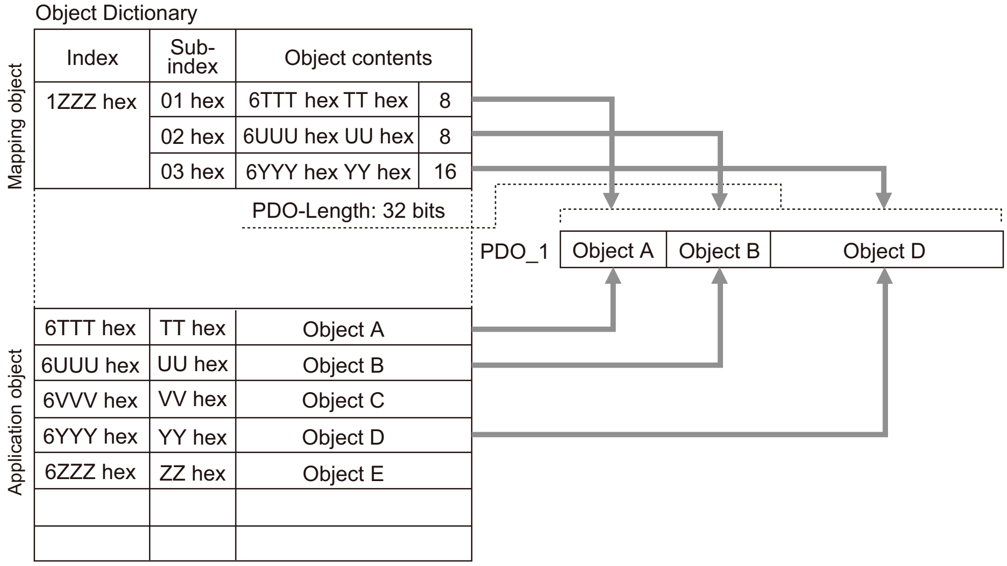
The EtherCAT application layer can hold more than one object to enable the transfer of various process data of the IO-Link Master Unit.
The contents of the process data are defined in the PDO mapping objects.

PDO Mappings

This section describes the mechanism of PDO mapping in EtherCAT and the PDO mappings of the IO-Link Master Unit.

● PDO Mapping Scheme in EtherCAT

The PDO mapping scheme in EtherCAT is described below.
Three application objects (A, B, and D) are allocated to the PDO mapping object (name: PDO_1) at index 1ZZZ hex.
As described here, PDO mapping shows how application objects are assigned to PDO mapping objects.
Indexes and subindexes are also assigned to application objects.



Application objects define the I/O data allocated to the PDO mapping objects.
The PDO mapping objects define these I/O data sets.

● PDO Mapping with IO-Link Master Units

PDO mapping objects contain the I/O data provided by the IO-Link Master Units.
PDO mapping objects for the RxPDOs are managed in the object dictionary from indexes 1600 hex to 1602 hex, and for the TxPDOs from indexes 1A00 hex to 1BFF hex.
The IO-Link Master Unit has the following PDO mapping objects.

- An object for which an application object (PDO entry) can be allocated
- An object for which the allocation of an application object (PDO entry) is fixed

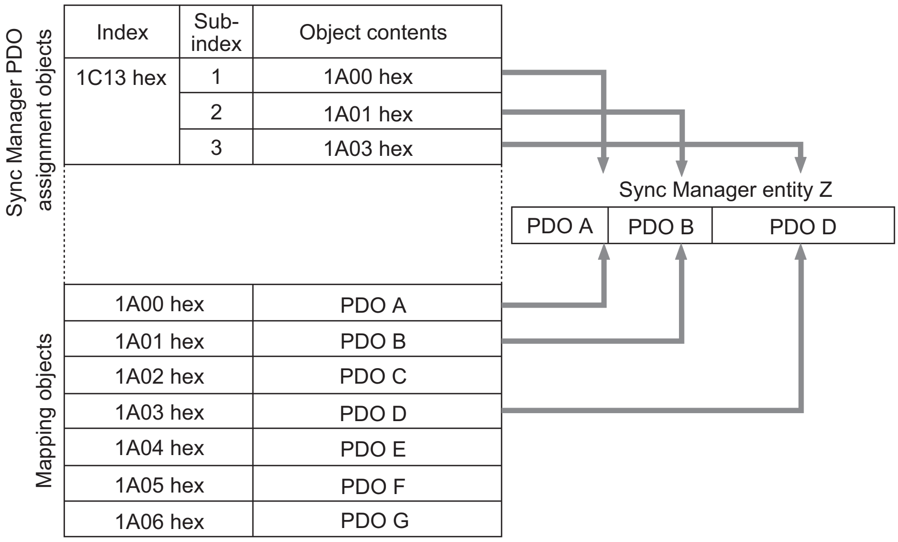
In the subsequent sections of this manual, the application object is called a PDO entry for explanation.
The PDO mapping object of the IO-Link Master Unit for which the PDO entry can be allocated, the PDO entry is allocated by default (factory setting).
You can change the PDO entry from the default value.
Refer to *A-1-5 PDO Mapping Objects* on page A-10 for details on the PDO mapping method, PDO mapping objects, and PDO entries for the IO-Link Master Unit.

Allocating PDOs

This section describes the mechanism of PDO allocation of the EtherCAT slave and the PDO allocation to the IO-Link Master Unit.

● Scheme for Assigning PDOs to EtherCAT Slaves

You can assign more than one PDO mapping objects for the PDO allocation to an EtherCAT slave.
Allocate the PDO mapping objects to the index 1C12 hex (for RxPDO) and index 1C13 hex (for TxPDOs) of the Sync Manager objects.
The following example shows how PDOs are assigned.



In this example, three PDO mapping objects (PDO A, PDO B, and PDO D) are allocated to index 1C13 hex (for TxPDOs).
Similarly, a PDO (for the RxPDO) is assigned to the index 1C12 hex.
These assignments determine the PDOs to use for communications between the EtherCAT master and slave.

● Allocating PDOs to the IO-Link Master Unit

The IO-Link Master Unit has the following PDO mapping objects.

- An object that can be allocated to the Sync Manager
- An object that is fixed for the allocation to the Sync Manager

In the IO-Link Master Unit, PDOs are allocated by default (factory setting). These PDOs determine both the RxPDOs and TxPDOs that are used for communications with the EtherCAT master.
For the PDO mapping object that can be allocated to the Sync Manager, you can change the allocation from the default value.
Refer to *A-1-5 PDO Mapping Objects* on page A-10 for details on the PDO allocation method to the IO-Link Master Unit and PDO mapping objects.

6-1-5 Service Data Objects (SDOs)

This section describes the service data objects that are supported by the IO-Link Master Unit.

Introduction

IO-Link Master Units support SDO communications.
The EtherCAT master can read and write data from and to entries in the object dictionary with SDO communications to make parameter settings and monitor status.
Refer to *A-1 CoE Objects* on page A-2 for the objects that you can use with SDO communications.

Abort Codes

The following table lists the abort codes for the SDO communications errors.

Value	Meaning
06010000 hex	Unsupported access to an object.
06010002 hex	Attempt to write to a read-only object.
06010003 hex	Writing cannot be made to the subindex. To make writing, write 0 to the subindex 00 hex.
06020000 hex	The object does not exist in the object directory.
06040041 hex	The object cannot be mapped to the PDO.
06040042 hex	Number/length of mapped objects exceeds PDO length.
06070010 hex	Data type does not match, length of service parameter does not match.
06090011 hex	Missing subindex.
06090030 hex	Value of parameter exceeded range (only for write access).
08000021 hex	The data cannot be read and written due to internal status.
08000022 hex	The data cannot be read and written in this status.

6-1-6 Communications Mode

The IO-Link Master Unit supports the following communications mode for the communications mode between the master and slaves for EtherCAT communications.

- Free-Run Mode

In Free-Run Mode, the slave processes the I/O (i.e., refreshes the I/O data) asynchronous to the communications cycle of the master.

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

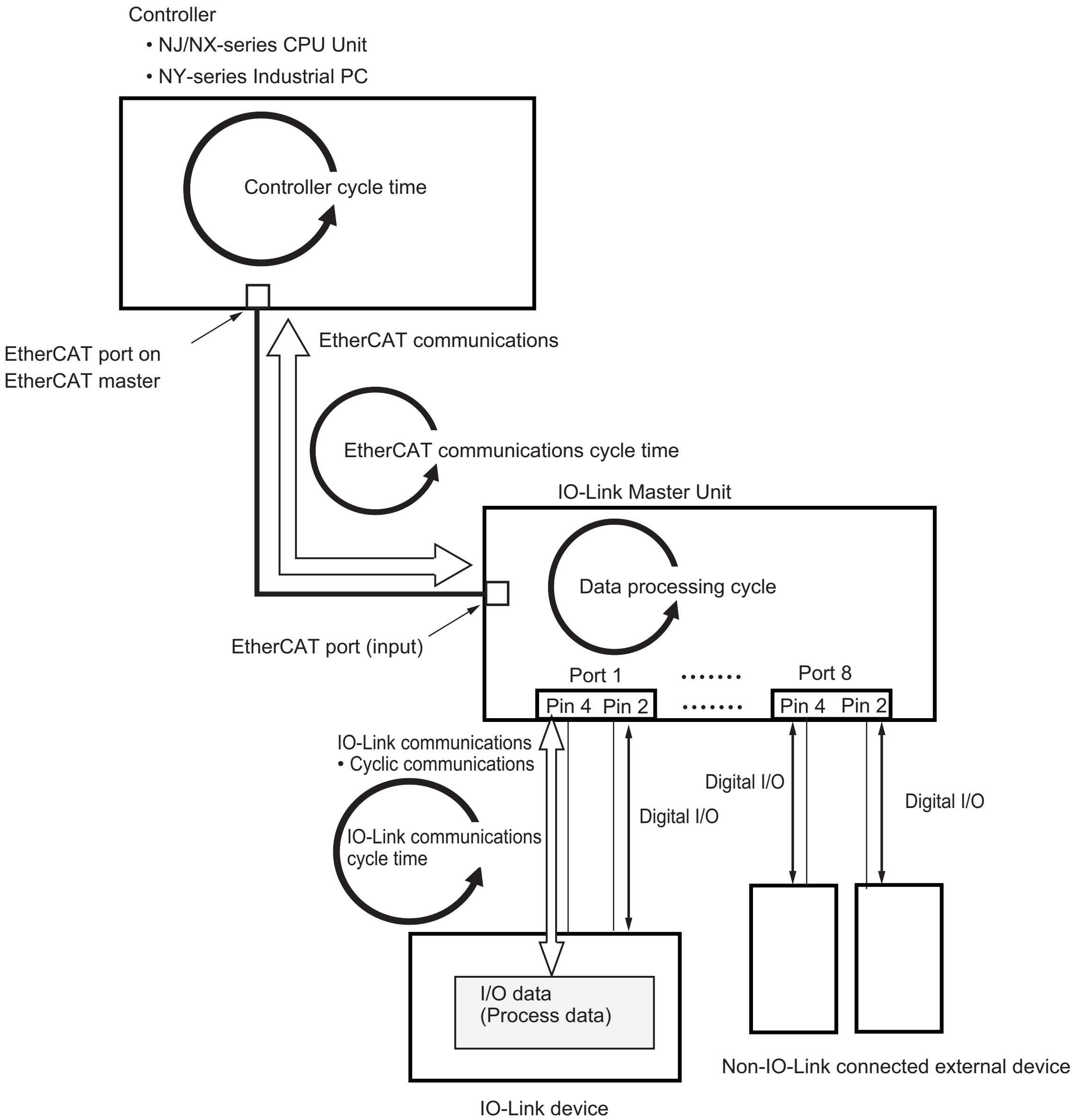
The following sections describes the cyclic communications and message communications for IO-Link communications.

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 EtherCAT Communications

The following shows the cyclic communications of the IO-Link Master Unit, including EtherCAT communications.



● 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 EtherCAT Communications

Cyclic communications for IO-Link communications are not synchronized with cyclic communications for EtherCAT 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 EtherCAT communications with the EtherCAT master.

- 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 *9-8 IO-Link Device Verification* on page 9-18 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 *7-3-3 Details of PDO Entries* on page 7-9 for details on the specifications of *Input Data Enabled*. Refer to *A-3 Sample Programming* on page A-50 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. Cycle the Unit/input power supply to the IO-Link Master Unit.

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.
Message communications from OMRON controllers to IO-Link devices use the following communications instructions for IO-Link devices.

Instruction	Function overview
IOL_ReadObj	Reads data from an IO-Link device object.
IOL_WriteObj	Writes data to an IO-Link device object.

For details of the communications instructions and sample programming, refer to the instructions reference manual for the connected NJ/NX-series CPU Unit or NY-series Industrial PC.

Conditions for Message Communications

The following conditions must be met.

- Communications must be established between the Controller 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**, an error will occur in communications instructions for IO-Link devices.

7

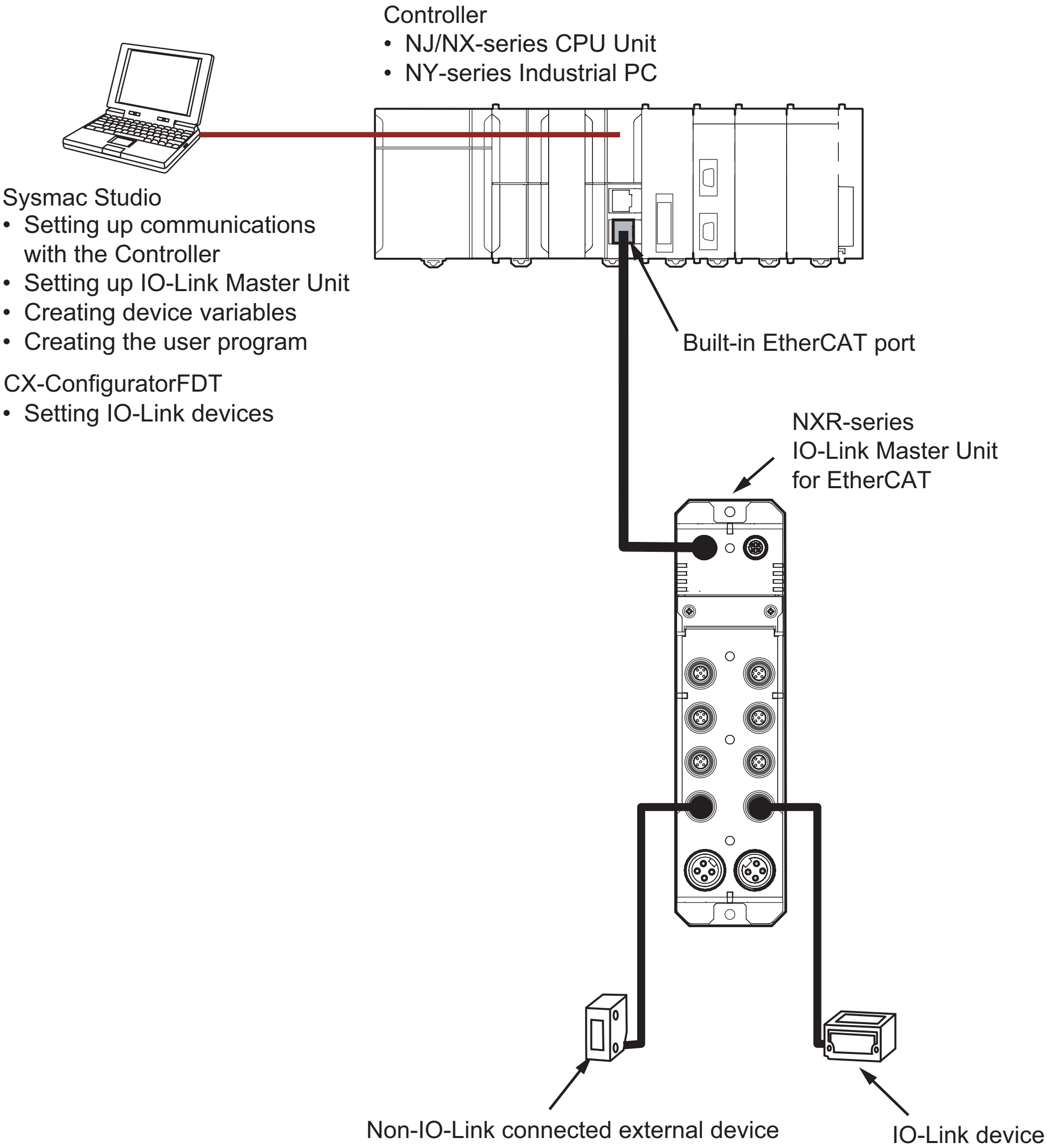
Setting Up IO-Link Master Unit

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 using an example of establishing a connection with an OMRON EtherCAT master to access I/O data in the IO-Link Master Unit.

A configuration example is shown below.



7-1-1 Setting Items

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

Classification	Item	Description
IO-Link Master Unit Settings	Device Parameter Settings	Set IO-Link master functions.
	PDO Map Settings	Set the allocation of data for the IO-Link Master Unit that communicates process data with the Controller.
	Setting Parameters	Set the parameter that is automatically set by the Controller when EtherCAT communications start or when a slave is reconnected.
	Setting Explicit Device ID	Use the ID switch of the IO-Link Master Unit to set the Explicit Device ID.
IO-Link Device Settings	Parameter Settings	Set the IO-Link device parameters.

7-1-2 Setting Procedures

Refer to *2-2 Application Procedures* on page 2-6 for the setting procedures to access I/O data in the IO-Link Master Unit from the Controller.

7-2 Setting Device Parameters

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

7-2-1 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 cycling power", transfer the setting to the IO-Link Master Unit and then cycle the Unit/input power supply to the IO-Link Master Unit to apply the change.

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

Setting	Description	Update timing	Reference
Port□ Device Verification Setting	Set the operation of IO-Link device verification.	After cycling power	*9-8 IO-Link Device Verification* on page 9-18
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.		*9-14 Backing Up and Restoring IO-Link Device Parameters* on page 9-32
Port□ Load Rejection Output Setting	Set the load rejection output operation.		*9-5 Load Rejection during Communications Errors with Controller* on page 9-10
Pin4 Communications Mode Setting	Set the communications mode for pin 4.		*9-3 Communications Mode Settings* on page 9-7
Pin2 Communications Mode Setting	Set the communications mode for pin 2.		
Port□ Pin4 Input Filter Value Setting	Set the input filter value of digital inputs for pin 4.		*9-6 Digital Input Filter* on page 9-12
Port□ Pin2 Input Filter Value Setting	Set the input filter value of digital inputs for pin 2.		
Device ID	Set the device ID of the connected IO-Link device.		*9-8 IO-Link Device Verification* on page 9-18
Vendor ID	Set the vendor ID of the connected IO-Link device.		
IO-Link Revision	Set the IO-Link revision of the connected IO-Link device.		
Port□ Communication Delay Time	Set the IO-Link communications delay time.		*9-16 IO-Link Communications Delay Time Settings* on page 9-44
Process Data In Length	Set the size of the process input data from the connected IO-Link device.		*A-1-10 Manufacturer-specific Object 4* on page A-38
Process Data Out Length	Set the size of the process output data to the connected IO-Link device.		
Port□ Serial Number Configuration Data	Set the serial number of the connected IO-Link device.		*9-8 IO-Link Device Verification* on page 9-18

Setting	Description	Update timing	Reference
Offset Setting of Port□ Digital Input Data Collection	Specify the position of the bit to extract from IO-Link Input Data.		*9-7 Digital Input Collection* on page 9-15
Session Timeout	Set the status (Success or Error) hold time for messages for IO-Link devices.	Enabled at all times	*A-1-8 Manufacturer-specific Object 2* on page A-23

7-2-2 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 using the Backup Parameter Settings with the Sysmac Studio.
This setting method allows you to set all device parameter items.

1 Open the project for the Controller in the Sysmac Studio.

2 Right-click **EtherCAT** in the Multiview Explorer and select **Edit** from the menu.

3 In the EtherCAT tab page, select the IO-Link Master Unit and click the **Edit Backup Parameter Settings** button.

4 Set each item in the Edit Backup Parameter Settings tab page.

In addition, using the IO-Link Master Simple Settings in the Sysmac Studio enables you to configure device parameter settings other than Session Timeout. In particular, you can easily configure the following IO-Link device information.

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

Refer to *A-4 IO-Link Master Simple Settings* on page A-59 for information on the setting procedures with the IO-Link Master Simple Settings.

7-3 Setting PDO Mappings

This section describes the PDO mapping setting procedure for the IO-Link Master Unit and the PDO specifications.

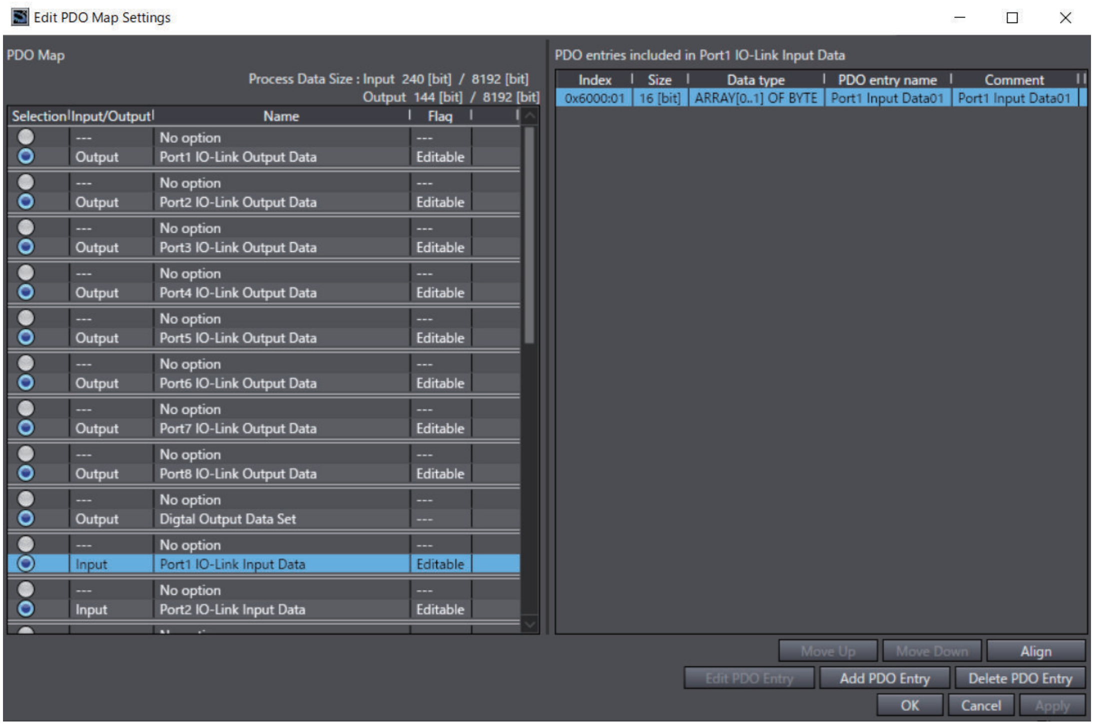
The following items are described for the PDO specifications.

- PDO Mapping Objects and PDO Entries That Can Be Allocated
- Details of PDO Entries

7-3-1 Methods for Setting PDO Mappings

Setting PDO Mappings with the Sysmac Studio

1. Open the project for the Controller in the Sysmac Studio.
2. Right-click **EtherCAT** in the Multiview Explorer and select **Edit** from the menu.
3. In the EtherCAT tab page, select the IO-Link Master Unit and click the **Edit PDO Map Settings** button.
4. Set each item in the Edit PDO Map Settings window.



● Allocating PDOs (PDO Mapping Object Selection)

In the PDO Map area, select the PDO mapping object of the IO-Link Master Unit to allocate to the Sync Manager.

● **PDO Mapping (PDO Entry Registration)**

PDO entries allocated to the selected PDO mapping object are displayed. You can add, delete, and rearrange the order of the PDO entries.

Setting PDO Mappings with the IO-Link Master Simple Settings

Using the IO-Link Master Simple Settings in the Sysmac Studio selects the PDO mapping objects *Port □ IO-Link Input Data* and *Port□ IO-Link Output Data* according to the process data structure of the configured IO-Link device. Refer to *A-4 IO-Link Master Simple Settings* on page A-59 for information on the setting procedures with the IO-Link Master Simple Settings.

7-3-2 PDO Mapping Objects and PDO Entries That Can Be Allocated

This section describes the data structure of PDO mapping objects and PDO entries that can be assigned to the IO-Link Master Unit.

PDO mapping object				Selection of PDO mapping object		Change of PDO entry		
PDO type	Index (hex)	Object name	Description	Selection	Default	Editing	Default entries	Maximum entries
RxPDO	1600	Port1 IO-Link Output Data	Indicates the IO-Link Output Data Set from the EtherCAT master to port 1 on the IO-Link Master Unit. Up to 16 data in 2 BYTE arrays can be registered. Each data size is 2 bytes.	Possible	Selected	Possible	1	16
	Indexes: 1601 to 1606							
	1607	Port8 IO-Link Output Data	Indicates the IO-Link Output Data Set from the EtherCAT master to port 8 on the IO-Link Master Unit. Up to 16 data in 2 BYTE arrays can be registered. Each data size is 2 bytes.	Possible	Selected	Possible	1	16
	1700	Digtal Output Data Set	Indicates the Digital Output Data Set from the EtherCAT master to ports 1 to 8 on the IO-Link Master Unit.	Possible	Selected	Not possible	1	1
TxPDO	1A00	Port1 IO-Link Input Data	Indicates the IO-Link Input Data Set from port 1 on the IO-Link Master Unit to the EtherCAT master. Up to 16 data in 2 BYTE arrays can be registered. Each data size is 2 bytes.	Possible	Selected	Possible	1	16
	Indexes: 1A01 to 1A06							
	1A07	Port8 IO-Link Input Data	Indicates the IO-Link Input Data Set from port 8 on the IO-Link Master Unit to the EtherCAT master. Up to 16 data in 2 BYTE arrays can be registered. Each data size is 2 bytes.	Possible	Selected	Possible	1	16
	1B00	I/O Port Status Information	Indicates the I/O port status of the IO-Link Master Unit.	Possible	Selected	Not possible	1	1
	1B01	Port1_2 I/O Port Error Status Information	Indicates the error status of ports 1 and 2 on the IO-Link Master Unit.	Possible	Selected	Not possible	1	1
	1B02	Port3_4 I/O Port Error Status Information	Indicates the error status of ports 3 and 4 on the IO-Link Master Unit.	Possible	Selected	Not possible	1	1

PDO mapping object				Selection of PDO mapping object		Change of PDO entry		
PDO type	Index (hex)	Object name	Description	Selec-tion	Default	Editing	De-fault entries	Maxi-mum entries
	1B03	Port5_6 I/O Port Error Status Infor-mation	Indicates the error status of ports 5 and 6 on the IO-Link Master Unit.	Possible	Selected	Not pos-sible	1	1
	1B04	Port7_8 I/O Port Error Status Infor-mation	Indicates the error status of ports 7 and 8 on the IO-Link Master Unit.	Possible	Selected	Not pos-sible	1	1
	1B05	Digital Input Data Set	Indicates the Digital Input Data Set from ports 1 to 8 on the IO-Link Master Unit to the EtherCAT master.	Possible	Selected	Not pos-sible	1	1
	1BFE	New Messages Available Informa-tion	Indicates the new messages available. This notification indicates the update of the error log.	Possible	Selected	Not pos-sible	2	2
	1BFF	Sysmac Error Sta-tus Information	Indicates the Sysmac error status.	Possible	Selected	Not pos-sible	1	1

The following table shows the PDO entries corresponding to these PDO mapping objects.
The PDO entry type that can be registered to the PDO mapping object is fixed. Different type of PDO entry cannot be registered.

PDO mapping object			PDO entry		Reference
PDO type	Index (hex)	Object name	Index (hex)	Object name	
RxPDO	1600	Port1 IO-Link Output Data	7000	Port1 Output Data	*PDO Entries Assigned to Port□ IO-Link Output Data* on page 7-9
	Indexes: 1601 to 1606				
	1607	Port8 IO-Link Output Data	7070	Port8 Output Data	*PDO Entries Assigned to Port□ IO-Link Output Data* on page 7-9
	1700	Digtal Output Data Set	3100	Digital Output Data	*PDO Entry Assigned to Digital Output Data Set* on page 7-9
TxPDO	1A00	Port1 IO-Link Input Data	6000	Port1 Input Data	*PDO Entries Assigned to Port□ IO-Link Input Da-ta* on page 7-11
	Indexes: 1A01 to 1A06				
	1A07	Port8 IO-Link Input Data	6070	Port8 Input Data	*PDO Entries Assigned to Port□ IO-Link Input Da-ta* on page 7-11
	1B00	I/O Port Status Information	3000	I/O Port Status	*PDO Entry Assigned to I/O Port Status Information* on page 7-12
	1B01	Port1_2 I/O Port Error Sta-tus Information	3001	Port1_2 I/O Port Error Status	*PDO Entry Assigned to Port1_2 I/O Port Error Sta-tus Information* on page 7-13
	1B02	Port3_4 I/O Port Error Sta-tus Information	3002	Port3_4 I/O Port Error Status	*PDO Entry Assigned to Port3_4 I/O Port Error Sta-tus Information* on page 7-15
	1B03	Port5_6 I/O Port Error Sta-tus Information	3003	Port5_6 I/O Port Error Status	*PDO Entry Assigned to Port5_6 I/O Port Error Sta-tus Information* on page 7-16
	1B04	Port7_8 I/O Port Error Sta-tus Information	3004	Port7_8 I/O Port Error Status	*PDO Entry Assigned to Port7_8 I/O Port Error Sta-tus Information* on page 7-16
	1B05	Digital Input Data Set	3005	Digital Input Data	*PDO Entry Assigned to Digital Input Data Set* on page 7-16
	1BFE	New Messages Available In-formation	10F3	Diagnosis History Subindex 04 hex: New Messages Available	*PDO Entry Assigned to New Messages Available Information* on page 7-19
	1BFF	Sysmac Error Status Infor-mation	2002	Sysmac Error Subindex 01 hex: Sysmac Error Status	*PDO Entry Assigned to Sysmac Error Status Infor-mation* on page 7-20

7-3-3 Details of PDO Entries

This section provides the details of PDO entries that can be allocated to the PDO mapping objects of the IO-Link Master Unit.

The meaning of the symbol used in the description is as follows.

- Port □ indicates the I/O port number of the IO-Link Master Unit, where "□" is 1 to 8.
- I/O port name is the name of the I/O port, which is a logical interface that is used by the NJ/NX-series CPU Unit and NY-series Industrial PC to exchange data with an external device (slave or Unit).
- When Data type is ARRAY, Default and Data range indicate values per element of the array.

PDO Entries Assigned to Port□ IO-Link Output Data

This is the process output data to the IO-Link device that is connected to port □ in IO-Link Mode. The data format is defined by the IO-Link device.

Index (hex)	Subindex (hex)	Object name	Default	Data range	Size	Data type	Description	I/O port name
7000	01	Port1 Output Data01	0000 hex	0000 hex to FFFF hex	2 bytes	ARRAY[0..1] OF BYTE	Indicates the Output Data 01 from the EtherCAT master to port 1 on the IO-Link Master Unit.	Port1 Output Data01
	Subindexes: 02 to 0F							
	10	Port1 Output Data16	0000 hex	0000 hex to FFFF hex	2 bytes	ARRAY[0..1] OF BYTE	Indicates the Output Data 16 from the EtherCAT master to port 1 on the IO-Link Master Unit.	Port1 Output Data16
Indexes: 7010 to 7060*1								
7070	01	Port8 Output Data01	0000 hex	0000 hex to FFFF hex	2 bytes	ARRAY[0..1] OF BYTE	Indicates the Output Data 01 from the EtherCAT master to port 8 on the IO-Link Master Unit.	Port8 Output Data01
	Subindexes: 02 to 0F							
	10	Port8 Output Data16	0000 hex	0000 hex to FFFF hex	2 bytes	ARRAY[0..1] OF BYTE	Indicates the Output Data 16 from the EtherCAT master to port 8 on the IO-Link Master Unit.	Port8 Output Data16

*1. Indexes 7010 hex, 7020 hex, 7030 hex, 7040 hex, 7050 hex, and 7060 hex are shown in abbreviated form. For indexes 7010 hex to 7060 hex, the port number in each object name is allocated in ascending order, from port 2 to port 7. Data definitions for items other than Object name are the same as those for indexes 7000 hex and 7070 hex.

PDO Entry Assigned to Digital Output Data Set

Digital Output Data is data that indicates the output set value for pin 4 or pin 2 of the I/O port in SIO (DO) Mode.

Index (hex)	Subindex (hex)	Object name	Default	Data range	Size	Data type	Description	I/O port name
3100	01	Digital Output Data	0000 hex	0000 hex to FFFF hex	2 bytes	WORD	Indicates the Digital Output Data from the EtherCAT master to the IO-Link Master Unit.	Digital Output Data

● Bit Configuration of Digital Output Data

Bit	Data name	Description	I/O port name
0	Port1 Pin4 Digital Output Bit	Indicates the Digital Output Data from the EtherCAT master to pin 1 of port 1 on the IO-Link Master Unit. TRUE: The Port1 Pin4 Digital Output Bit is ON. FALSE: The Port1 Pin4 Digital Output Bit is OFF.	Port1 Pin4 Digital Output Bit
1	Port1 Pin2 Digital Output Bit	Indicates the Digital Output Data from the EtherCAT master to pin 2 of port 1 on the IO-Link Master Unit. TRUE: The Port1 Pin2 Digital Output Bit is ON. FALSE: The Port1 Pin2 Digital Output Bit is OFF.	Port1 Pin2 Digital Output Bit
2	Port2 Pin4 Digital Output Bit	Indicates the Digital Output Data from the EtherCAT master to pin 4 of port 2 on the IO-Link Master Unit. TRUE: The Port2 Pin4 Digital Output Bit is ON. FALSE: The Port2 Pin4 Digital Output Bit is OFF.	Port2 Pin4 Digital Output Bit
3	Port2 Pin2 Digital Output Bit	Indicates the Digital Output Data from the EtherCAT master to pin 2 of port 2 on the IO-Link Master Unit. TRUE: The Port2 Pin2 Digital Output Bit is ON. FALSE: The Port2 Pin2 Digital Output Bit is OFF.	Port2 Pin2 Digital Output Bit
4	Port3 Pin4 Digital Output Bit	Indicates the Digital Output Data from the EtherCAT master to pin 4 of port 3 on the IO-Link Master Unit. TRUE: The Port3 Pin4 Digital Output Bit is ON. FALSE: The Port3 Pin4 Digital Output Bit is OFF.	Port3 Pin4 Digital Output Bit
5	Port3 Pin2 Digital Output Bit	Indicates the Digital Output Data from the EtherCAT master to pin 2 of port 3 on the IO-Link Master Unit. TRUE: The Port3 Pin2 Digital Output Bit is ON. FALSE: The Port3 Pin2 Digital Output Bit is OFF.	Port3 Pin2 Digital Output Bit
6	Port4 Pin4 Digital Output Bit	Indicates the Digital Output Data from the EtherCAT master to pin 4 of port 4 on the IO-Link Master Unit. TRUE: The Port4 Pin4 Digital Output Bit is ON. FALSE: The Port4 Pin4 Digital Output Bit is OFF.	Port4 Pin4 Digital Output Bit
7	Port4 Pin2 Digital Output Bit	Indicates the Digital Output Data from the EtherCAT master to pin 2 of port 4 on the IO-Link Master Unit. TRUE: The Port4 Pin2 Digital Output Bit is ON. FALSE: The Port4 Pin2 Digital Output Bit is OFF.	Port4 Pin2 Digital Output Bit
8	Port5 Pin4 Digital Output Bit	Indicates the Digital Output Data from the EtherCAT master to pin 4 of port 5 on the IO-Link Master Unit. TRUE: The Port5 Pin4 Digital Output Bit is ON. FALSE: The Port5 Pin4 Digital Output Bit is OFF.	Port5 Pin4 Digital Output Bit

Bit	Data name	Description	I/O port name
9	Port5 Pin2 Digital Output Bit	Indicates the Digital Output Data from the EtherCAT master to pin 2 of port 5 on the IO-Link Master Unit. TRUE: The Port5 Pin2 Digital Output Bit is ON. FALSE: The Port5 Pin2 Digital Output Bit is OFF.	Port5 Pin2 Digital Output Bit
10	Port6 Pin4 Digital Output Bit	Indicates the Digital Output Data from the EtherCAT master to pin 4 of port 6 on the IO-Link Master Unit. TRUE: The Port6 Pin4 Digital Output Bit is ON. FALSE: The Port6 Pin4 Digital Output Bit is OFF.	Port6 Pin4 Digital Output Bit
11	Port6 Pin2 Digital Output Bit	Indicates the Digital Output Data from the EtherCAT master to pin 2 of port 6 on the IO-Link Master Unit. TRUE: The Port6 Pin2 Digital Output Bit is ON. FALSE: The Port6 Pin2 Digital Output Bit is OFF.	Port6 Pin2 Digital Output Bit
12	Port7 Pin4 Digital Output Bit	Indicates the Digital Output Data from the EtherCAT master to pin 4 of port 7 on the IO-Link Master Unit. TRUE: The Port7 Pin4 Digital Output Bit is ON. FALSE: The Port7 Pin4 Digital Output Bit is OFF.	Port7 Pin4 Digital Output Bit
13	Port7 Pin2 Digital Output Bit	Indicates the Digital Output Data from the EtherCAT master to pin 2 of port 7 on the IO-Link Master Unit. TRUE: The Port7 Pin2 Digital Output Bit is ON. FALSE: The Port7 Pin2 Digital Output Bit is OFF.	Port7 Pin2 Digital Output Bit
14	Port8 Pin4 Digital Output Bit	Indicates the Digital Output Data from the EtherCAT master to pin 4 of port 8 on the IO-Link Master Unit. TRUE: The Port8 Pin4 Digital Output Bit is ON. FALSE: The Port8 Pin4 Digital Output Bit is OFF.	Port8 Pin4 Digital Output Bit
15	Port8 Pin2 Digital Output Bit	Indicates the Digital Output Data from the EtherCAT master to pin 2 of port 8 on the IO-Link Master Unit. TRUE: The Port8 Pin2 Digital Output Bit is ON. FALSE: The Port8 Pin2 Digital Output Bit is OFF.	Port8 Pin2 Digital Output Bit

PDO Entries Assigned to Port□ IO-Link Input Data

This is the process input data from the IO-Link device that is connected to port □ in IO-Link Mode. The data format is defined by the IO-Link device.

Index (hex)	Subindex (hex)	Object name	Default	Data range	Size	Data type	Description	I/O port name
6000	01	Port1 Input Data01	0000 hex	0000 hex to FFFF hex	2 bytes	ARRAY[0..1] OF BYTE	Indicates the Input Data 01 from port 1 on the IO-Link Master Unit to the EtherCAT master.	Port1 Input Data01
	Subindexes: 02 to 0F							
	10	Port1 Input Data16	0000 hex	0000 hex to FFFF hex	2 bytes	ARRAY[0..1] OF BYTE	Indicates the Input Data 16 from port 1 on the IO-Link Master Unit to the EtherCAT master.	Port1 Input Data16
Indexes: 6010 to 6060*1								
6070	01	Port8 Input Data01	0000 hex	0000 hex to FFFF hex	2 bytes	ARRAY[0..1] OF BYTE	Indicates the Input Data 01 from port 8 on the IO-Link Master Unit to the EtherCAT master.	Port8 Input Data01
	Subindexes: 02 to 0F							
	10	Port8 Input Data16	0000 hex	0000 hex to FFFF hex	2 bytes	ARRAY[0..1] OF BYTE	Indicates the Input Data 16 from port 8 on the IO-Link Master Unit to the EtherCAT master.	Port8 Input Data16

*1. Indexes 6010 hex, 6020 hex, 6030 hex, 6040 hex, 6050 hex, and 6060 hex are shown in abbreviated form. For indexes 6010 hex to 6060 hex, the port number in each object name is allocated in ascending order, from port 2 to port 7. Data definitions for items other than Object name are the same as those for indexes 6000 hex and 6070 hex.

PDO Entry Assigned to I/O Port Status Information

Index (hex)	Subindex (hex)	Object name	Default	Data range	Size	Data type	Description	I/O port name
3000	01	I/O Port Status	0000 hex	0000 hex to FFFF hex	2 bytes	WORD	Data that indicates the operating status of the IO-Link Master Unit.	I/O Port Status

● Bit Configuration of I/O Port Status

Bit	Data name	Description	I/O port name
0	Port1 Input Data Enabled	TRUE: Indicates that the IO-Link Input Data for port 1 is enabled. FALSE: Indicates that one of the following occurred in IO-Link Mode and the IO-Link Input Data is disabled. • Port1 IO-Link Communications Error • Port1 Verification Error • Port1 Device I/O Size Error • Port1 Device Error-level Event • Port1 Pin1 Short-circuit Error • Port1 Pin2 Short-circuit Error • Port1 Pin4 Short-circuit Error • A non-IO-Link sensor is connected in IO-Link Mode. Always FALSE in SIO (DI) Mode and SIO (DO) Mode.	Port1 IN Data Enable
Bits: 1 to 6			

Bit	Data name	Description	I/O port name
7	Port8 Input Data Enabled	TRUE: Indicates that the IO-Link Input Data for port 8 is enabled. FALSE: Indicates that one of the following occurred in IO-Link Mode and the IO-Link Input Data is disabled. • Port8 IO-Link Communications Error • Port8 Verification Error • Port8 Device I/O Size Error • Port8 Device Error-level Event • Port8 Pin1 Short-circuit Error • Port8 Pin2 Short-circuit Error • Port8 Pin4 Short-circuit Error • A non-IO-Link sensor is connected in IO-Link Mode. Always FALSE in SIO (DI) Mode and SIO (DO) Mode.	Port8 IN Data Enable
8 to 11	Reserved	---	---
12	PDO Size Shortage	TRUE: Indicates that the PDO size is insufficient for one of ports 1 to 8. One of the following occurred. • The set *Port□ IO-Link Device Configuration Data/Process Data In Length* is larger than the input PDO mapping size for the port. • The set *Port□ IO-Link Device Configuration Data/Process Data Out Length* is larger than the output PDO mapping size for the port. FALSE: Indicates that PDO size is sufficient for all ports 1 to 8.	PDO Size Shortage
13	I/O Port Error	TRUE: Indicates that an error occurred in one of ports 1 to 8. Check the I/O Port Error Status for each port to determine what error occurred on which port. FALSE: Indicates that no error occurred on all ports 1 to 8.	I/O Port Error
14	Unit/Input Power Supply Voltage Drop	TRUE: Indicates that the Unit/input power supply voltage is below the lower limit of the rating. FALSE: Indicates that the Unit/input power supply voltage is not below the lower limit of the rating.	Unit/Input Supply Power Drop
15	Output Power Supply Voltage Drop	TRUE: Indicates that the output power supply voltage is below the lower limit of the rating. FALSE: Indicates that the output power supply voltage is not below the lower limit of the rating.	Output Supply Power Drop

PDO Entry Assigned to Port1_2 I/O Port Error Status Information

Index (hex)	Subindex (hex)	Object name	Default	Data range	Size	Data type	Description	I/O port name
3001	01	Port1_2 I/O Port Error Status	0000 hex	0000 hex to FFFF hex	2 bytes	WORD	Data that indicates the error status for ports 1 and 2.	Port1_2 I/O Port Error Status

● Bit Configuration of Port1_2 I/O Port Error Status

Bit	Data name	Description	I/O port name
0	Port1 IO-Link Communications Error	TRUE: 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.	Port1 Communication Error
1	Port1 Pin1 Short-circuit Error	TRUE: Indicates that a short-circuit error occurred between pin 1 and pin 3 of port 1. FALSE: Indicates that none of the above errors occurred.	Port1 Pin1 Short-circuit Error
2	Port1 Verification Error	TRUE: 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 configuration of the IO-Link device that is actually connected matches the IO-Link device configuration settings information for port 1.	Port1 Compare Error
3	Port1 Device I/O Size Error	TRUE: Indicates that one of the following errors occurred. • The process input data size for the actually connected IO-Link device is larger than the *Port1 IO-Link Device Configuration Data/Process Data In Length*. • The process output data size for the actually connected IO-Link device is larger than the *Port1 IO-Link Device Configuration Data/Process Data Out Length*. FALSE: Indicates that none of the above errors occurred.	Port1 Device I/O Size Error
4	Port1 Device Error-level Event	TRUE: An error-level event occurred in the IO-Link device for port 1. FALSE: Indicates that none of the above events occurred.	Port1 Device Error
5	Port1 Device Warning-level Event	TRUE: An warning-level event occurred in the IO-Link device for port 1. FALSE: Indicates that none of the above events occurred.	Port1 Device Warning
6	Port1 Pin2 Short-circuit Error	TRUE: Indicates that a short-circuit error occurred between pin 2 and pin 3 of port 1. FALSE: Indicates that none of the above errors occurred.	Port1 Pin2 Short-circuit Error
7	Port1 Pin4 Short-circuit Error	TRUE: Indicates that a short-circuit error occurred between pin 4 and pin 3 of port 1. FALSE: Indicates that none of the above errors occurred.	Port1 Pin4 Short-circuit Error

Bit	Data name	Description	I/O port name
8	Port2 IO-Link Communications Error	TRUE: IO-Link communications are not established for port 2. 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.	Port2 Communication Error
9	Port2 Pin1 Short-circuit Error	TRUE: Indicates that a short-circuit error occurred between pin 1 and pin 3 of port 2. FALSE: Indicates that none of the above errors occurred.	Port2 Pin1 Short-circuit Error
10	Port2 Verification Error	TRUE: 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 2. FALSE: Indicates that the configuration of the IO-Link device that is actually connected matches the IO-Link device configuration settings information for port 2.	Port2 Compare Error
11	Port2 Device I/O Size Error	TRUE: Indicates that one of the following errors occurred. • The process input data size for the actually connected IO-Link device is larger than the *Port2 IO-Link Device Configuration Data/Process Data In Length*. • The process output data size for the actually connected IO-Link device is larger than the *Port2 IO-Link Device Configuration Data/Process Data Out Length*. FALSE: Indicates that none of the above errors occurred.	Port2 Device I/O Size Error
12	Port2 Device Error-level Event	TRUE: An error-level event occurred in the IO-Link device for port 2. FALSE: Indicates that none of the above events occurred.	Port2 Device Error
13	Port2 Device Warning-level Event	TRUE: An warning-level event occurred in the IO-Link device for port 2. FALSE: Indicates that none of the above events occurred.	Port2 Device Warning
14	Port2 Pin2 Short-circuit Error	TRUE: Indicates that a short-circuit error occurred between pin 2 and pin 3 of port 2. FALSE: Indicates that none of the above errors occurred.	Port2 Pin2 Short-circuit Error
15	Port2 Pin4 Short-circuit Error	TRUE: Indicates that a short-circuit error occurred between pin 4 and pin 3 of port 2. FALSE: Indicates that none of the above errors occurred.	Port2 Pin4 Short-circuit Error

PDO Entry Assigned to Port3_4 I/O Port Error Status Information

Index (hex)	Subindex (hex)	Object name	Default	Data range	Size	Data type	Description	I/O port name
3002	01	Port3_4 I/O Port Error Status	0000 hex	0000 hex to FFFF hex	2 bytes	WORD	Data that indicates the error status for ports 3 and 4.	Port3_4 I/O Port Error Status

For bit configuration, refer to *Bit Configuration of Port1_2 I/O Port Error Status* on page 7-14 with port 1 replaced by port 3 and port 2 replaced by port 4.

PDO Entry Assigned to Port5_6 I/O Port Error Status Information

Index (hex)	Subindex (hex)	Object name	Default	Data range	Size	Data type	Description	I/O port name
3003	01	Port5_6 I/O Port Error Status	0000 hex	0000 hex to FFFF hex	2 bytes	WORD	Data that indicates the error status for ports 5 and 6.	Port5_6 I/O Port Error Status

For bit configuration, refer to *Bit Configuration of Port1_2 I/O Port Error Status* on page 7-14 with port 1 replaced by port 5 and port 2 replaced by port 6.

PDO Entry Assigned to Port7_8 I/O Port Error Status Information

Index (hex)	Subindex (hex)	Object name	Default	Data range	Size	Data type	Description	I/O port name
3004	01	Port7_8 I/O Port Error Status	0000 hex	0000 hex to FFFF hex	2 bytes	WORD	Data that indicates the error status for ports 7 and 8.	Port7_8 I/O Port Error Status

For bit configuration, refer to *Bit Configuration of Port1_2 I/O Port Error Status* on page 7-14 with port 1 replaced by port 7 and port 2 replaced by port 8.

PDO Entry Assigned to Digital Input Data Set

Digital Input Data is data that indicates the input value in one of the following cases.

- The Port□ Pin4 Communications Mode Setting and Pin2 Communications Mode Setting are SIO (DI) Mode.
- The Port□ Pin4 Communications Mode Setting is IO-Link Mode and the Offset Setting of Port□ Digital Input Data Collection is correct.

In cases other than the above, each bit is fixed to FALSE.

Index (hex)	Subindex (hex)	Object name	Default	Data range	Size	Data type	Description	I/O port name
3005	01	Digital Input Data	0000 hex	0000 hex to FFFF hex	2 bytes	WORD	Digital Input Data from the IO-Link Master Unit to the EtherCAT master.	Digital Input Data

Bit Configuration of Digital Input Data

Bit	Data name	Description	I/O port name
0	Port1 Pin4 Digital Input Bit	• When the Port1 Pin4 Communications Mode Setting is SIO (DI) Mode Digital Input Data from pin 4 of port 1. TRUE: The Port1 Pin4 Digital Input Bit is ON. FALSE: The Port1 Pin4 Digital Input Bit is OFF. • When the Port1 Pin4 Communications Mode Setting is IO-Link Mode and the Offset Setting of Port1 Digital Input Data Collection is correct TRUE: In the Port1 IO-Link Input Data, the input bit in the specified offset position is ON. FALSE: In the Port1 IO-Link Input Data, the input bit in the specified offset position is OFF.	Port1 Pin4 Digital Input Bit
1	Port1 Pin2 Digital Input Bit	• When the Port1 Pin2 Communications Mode Setting is SIO (DI) Mode Digital Input Data from pin 2 of port 1. TRUE: The Port1 Pin2 Digital Input Bit is ON. FALSE: The Port1 Pin2 Digital Input Bit is OFF.	Port1 Pin2 Digital Input Bit
2	Port2 Pin4 Digital Input Bit	• When the Port2 Pin4 Communications Mode Setting is SIO (DI) Mode Digital Input Data from pin 4 of port 2. TRUE: The Port2 Pin4 Digital Input Bit is ON. FALSE: The Port2 Pin4 Digital Input Bit is OFF. • When the Port2 Pin4 Communications Mode Setting is IO-Link Mode and the Offset Setting of Port2 Digital Input Data Collection is correct TRUE: In the Port2 IO-Link Input Data, the input bit in the specified offset position is ON. FALSE: In the Port2 IO-Link Input Data, the input bit in the specified offset position is OFF.	Port2 Pin4 Digital Input Bit
3	Port2 Pin2 Digital Input Bit	• When the Port2 Pin2 Communications Mode Setting is SIO (DI) Mode Digital Input Data from pin 2 of port 2. TRUE: The Port2 Pin2 Digital Input Bit is ON. FALSE: The Port2 Pin2 Digital Input Bit is OFF.	Port2 Pin2 Digital Input Bit
4	Port3 Pin4 Digital Input Bit	• When the Port3 Pin4 Communications Mode Setting is SIO (DI) Mode Digital Input Data from pin 4 of port 3. TRUE: The Port3 Pin4 Digital Input Bit is ON. FALSE: The Port3 Pin4 Digital Input Bit is OFF. • When the Port3 Pin4 Communications Mode Setting is IO-Link Mode and the Offset Setting of Port3 Digital Input Data Collection is correct TRUE: In the Port3 IO-Link Input Data, the input bit in the specified offset position is ON. FALSE: In the Port3 IO-Link Input Data, the input bit in the specified offset position is OFF.	Port3 Pin4 Digital Input Bit
5	Port3 Pin2 Digital Input Bit	• When the Port3 Pin2 Communications Mode Setting is SIO (DI) Mode Digital Input Data from pin 2 of port 3. TRUE: The Port3 Pin2 Digital Input Bit is ON. FALSE: The Port3 Pin2 Digital Input Bit is OFF.	Port3 Pin2 Digital Input Bit

Bit	Data name	Description	I/O port name
6	Port4 Pin4 Digital Input Bit	• When the Port4 Pin4 Communications Mode Setting is SIO (DI) Mode Digital Input Data from pin 4 of port 4. TRUE: The Port4 Pin4 Digital Input Bit is ON. FALSE: The Port4 Pin4 Digital Input Bit is OFF. • When the Port4 Pin4 Communications Mode Setting is IO-Link Mode and the Offset Setting of Port4 Digital Input Data Collection is correct TRUE: In the Port4 IO-Link Input Data, the input bit in the specified offset position is ON. FALSE: In the Port4 IO-Link Input Data, the input bit in the specified offset position is OFF.	Port4 Pin4 Digital Input Bit
7	Port4 Pin2 Digital Input Bit	• When the Port4 Pin2 Communications Mode Setting is SIO (DI) Mode Digital Input Data from pin 2 of port 4. TRUE: The Port4 Pin2 Digital Input Bit is ON. FALSE: The Port4 Pin2 Digital Input Bit is OFF.	Port4 Pin2 Digital Input Bit
8	Port5 Pin4 Digital Input Bit	• When the Port5 Pin4 Communications Mode Setting is SIO (DI) Mode Digital Input Data from pin 4 of port 5. TRUE: The Port5 Pin4 Digital Input Bit is ON. FALSE: The Port5 Pin4 Digital Input Bit is OFF. • When the Port5 Pin4 Communications Mode Setting is IO-Link Mode and the Offset Setting of Port5 Digital Input Data Collection is correct TRUE: In the Port5 IO-Link Input Data, the input bit in the specified offset position is ON. FALSE: In the Port5 IO-Link Input Data, the input bit in the specified offset position is OFF.	Port5 Pin4 Digital Input Bit
9	Port5 Pin2 Digital Input Bit	• When the Port5 Pin2 Communications Mode Setting is SIO (DI) Mode Digital Input Data from pin 2 of port 5. TRUE: The Port5 Pin2 Digital Input Bit is ON. FALSE: The Port5 Pin2 Digital Input Bit is OFF.	Port5 Pin2 Digital Input Bit
10	Port6 Pin4 Digital Input Bit	• When the Port6 Pin4 Communications Mode Setting is SIO (DI) Mode Digital Input Data from pin 4 of port 6. TRUE: The Port6 Pin4 Digital Input Bit is ON. FALSE: The Port6 Pin4 Digital Input Bit is OFF. • When the Port6 Pin4 Communications Mode Setting is IO-Link Mode and the Offset Setting of Port6 Digital Input Data Collection is correct TRUE: In the Port6 IO-Link Input Data, the input bit in the specified offset position is ON. FALSE: In the Port6 IO-Link Input Data, the input bit in the specified offset position is OFF.	Port6 Pin4 Digital Input Bit
11	Port6 Pin2 Digital Input Bit	• When the Port6 Pin2 Communications Mode Setting is SIO (DI) Mode Digital Input Data from pin 2 of port 6. TRUE: The Port6 Pin2 Digital Input Bit is ON. FALSE: The Port6 Pin2 Digital Input Bit is OFF.	Port6 Pin2 Digital Input Bit

Bit	Data name	Description	I/O port name
12	Port7 Pin4 Digital Input Bit	• When the Port7 Pin4 Communications Mode Setting is SIO (DI) Mode Digital Input Data from pin 4 of port 7. TRUE: The Port7 Pin4 Digital Input Bit is ON. FALSE: The Port7 Pin4 Digital Input Bit is OFF. • When the Port7 Pin4 Communications Mode Setting is IO-Link Mode and the Offset Setting of Port7 Digital Input Data Collection is correct TRUE: In the Por7 IO-Link Input Data, the input bit in the specified offset position is ON. FALSE: In the Port7 IO-Link Input Data, the input bit in the specified offset position is OFF.	Port7 Pin4 Digital Input Bit
13	Port7 Pin2 Digital Input Bit	• When the Port7 Pin2 Communications Mode Setting is SIO (DI) Mode Digital Input Data from pin 2 of port 7. TRUE: The Port7 Pin2 Digital Input Bit is ON. FALSE: The Port7 Pin2 Digital Input Bit is OFF.	Port7 Pin2 Digital Input Bit
14	Port8 Pin4 Digital Input Bit	• When the Port8 Pin4 Communications Mode Setting is SIO (DI) Mode Digital Input Data from pin 4 of port 8. TRUE: The Port8 Pin4 Digital Input Bit is ON. FALSE: The Port8 Pin4 Digital Input Bit is OFF. • When the Port8 Pin4 Communications Mode Setting is IO-Link Mode and the Offset Setting of Port8 Digital Input Data Collection is correct TRUE: In the Port8 IO-Link Input Data, the input bit in the specified offset position is ON. FALSE: In the Port8 IO-Link Input Data, the input bit in the specified offset position is OFF.	Port8 Pin4 Digital Input Bit
15	Port8 Pin2 Digital Input Bit	• When the Port8 Pin2 Communications Mode Setting is SIO (DI) Mode Digital Input Data from pin 2 of port 8. TRUE: The Port8 Pin2 Digital Input Bit is ON. FALSE: The Port8 Pin2 Digital Input Bit is OFF.	Port8 Pin2 Digital Input Bit

PDO Entry Assigned to New Messages Available Information

Indicates the new messages available. This notification indicates the update of the error log.
Using the New Messages Available notification to the EtherCAT master as a trigger, you can check errors that occurred in the IO-Link Master Unit by reading the *Diagnosis History* (10F3 hex) CoE object of the IO-Link Master Unit from the EtherCAT master.
This allows you to use this manual to view and correct errors.

Index (hex)	Subindex (hex)	Object name	Default	Data range	Size	Data type	Description	I/O port name
10F3	04	New Messages Available	FALSE	FALSE or TRUE	1 bit	BOOL	This tells whether the error log is updated. TRUE: The error log is updated. FALSE: The error log is not updated. The error log is updated at the following times. The status changes to TRUE when the error log is updated. The status changes to FALSE when the subindex number of the most recent error log is written to subindex 03 hex (Newest Acknowledged Message) by the EtherCAT master.	New Messages Available
---	---	---	---	---	7 bits	---	Reserved	---

PDO Entry Assigned to Sysmac Error Status Information

Indicates the Sysmac error status.
The Sysmac error status has error level information that is commonly defined for all Sysmac devices.

Index (hex)	Subindex (hex)	Object name	Default	Data range	Size	Data type	Description	I/O port name
2002	01	Sysmac Error Status	00 hex	00 hex to FF hex	1 byte	USINT	Indicates the Sysmac error status of the IO-Link Master Unit status.	Sysmac Error Status

● Bit Configuration of Sysmac Error Status

Bit	Data name	Description	I/O port name
0 to 3	Reserved	---	---
4	Observation	Indicates the error status of the observation among the event levels. • TRUE: Error • FALSE: No error The error log is updated at the following times. • The status changes to TRUE when an error occurs. • The status changes to FALSE when the error is reset. Even if the cause of the error has been removed, you must reset the error for the status to change to FALSE.	Observation
5	Minor Fault	Indicates the error status of the minor fault among the event levels. • TRUE: Error • FALSE: No error The error log is updated at the following times. • The status changes to TRUE when an error occurs. • The status changes to FALSE when the error is reset. Even if the cause of the error has been removed, you must reset the error for the status to change to FALSE.	Minor Fault
6 to 7	Reserved	---	---

7-4 Configuring the Setting Parameters

This section describes how to configure the Setting Parameters of the IO-Link Master Unit with the Sysmac Studio.

Configuring the Setting Parameters of the IO-Link Master Unit with the Sysmac Studio

1. Open the project for the Controller in the Sysmac Studio.
2. Right-click **EtherCAT** in the Multiview Explorer and select **Edit** from the menu.
3. In the EtherCAT tab page, select the IO-Link Master Unit and click the **Edit Setting Parameters** button.
   The Edit Setting Parameters tab page is displayed.
   This setting affects the parameter that is automatically set by the EtherCAT master when EtherCAT communications start or when a slave is reconnected.
   The setting parameter for the IO-Link Master Unit is the following CoE object.

Index (hex)	Subindex (hex)	Object name	Default	Data range	Unit	Data attribute	Size	Access	PDO mapping
10F3	05	Flags	0000 hex	0000 hex, 0001 hex	---	Enabled at all times	2 bytes (U16)	RW	Not possible

7-5 Backing Up and Restoring Device Parameters

For backing up and restoring the device parameters of the IO-Link Master Unit, refer to the user's manual for the built-in EtherCAT port on the connected CPU Unit or Industrial PC.

8

I/O Refreshing

This section describes I/O refreshing of the IO-Link Master Unit.

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 EtherCAT.

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.

- Cyclic communications for EtherCAT communications
- Cyclic communications for IO-Link communications

These communications are asynchronous.

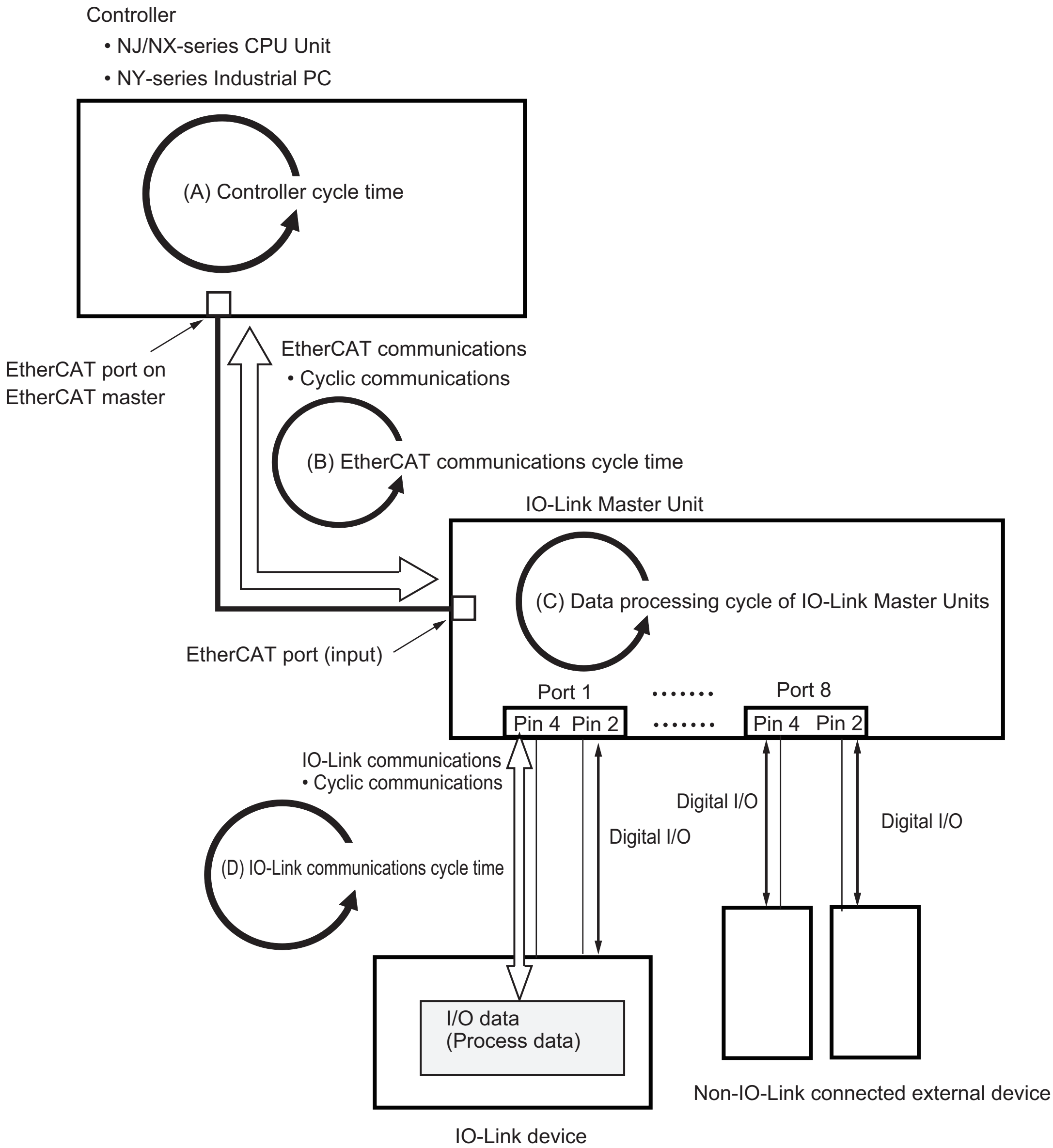
The operation of I/O refreshing between the Controller and the IO-Link Master Unit or between the IO-Link Master Unit and the connected IO-Link devices is affected by the following four cycle elements.

(A) Cycle time of the Controller

(B) EtherCAT communications cycle time

(C) Data processing cycle of the IO-Link Master Unit

(D) IO-Link communications cycle time



(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.

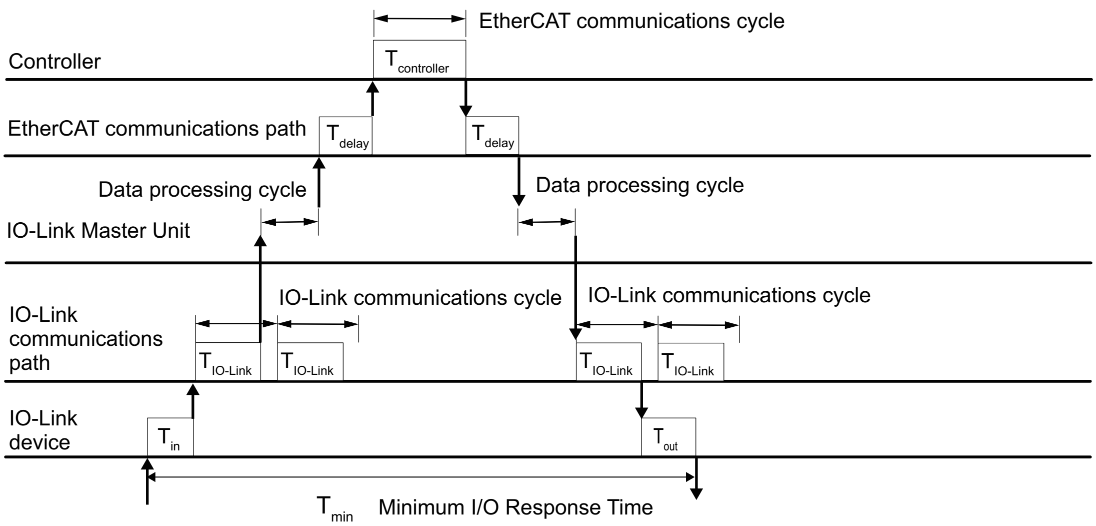
The I/O response time of an IO-Link device that has digital inputs or outputs for pin 2 and the I/O response time of pin 2 of a port that is set to SIO (DI) Mode or SIO (DO) Mode for ON/OFF signals are the same as the I/O response time for non-IO-Link connected external devices. Refer to *8-2-2 I/O Response 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.

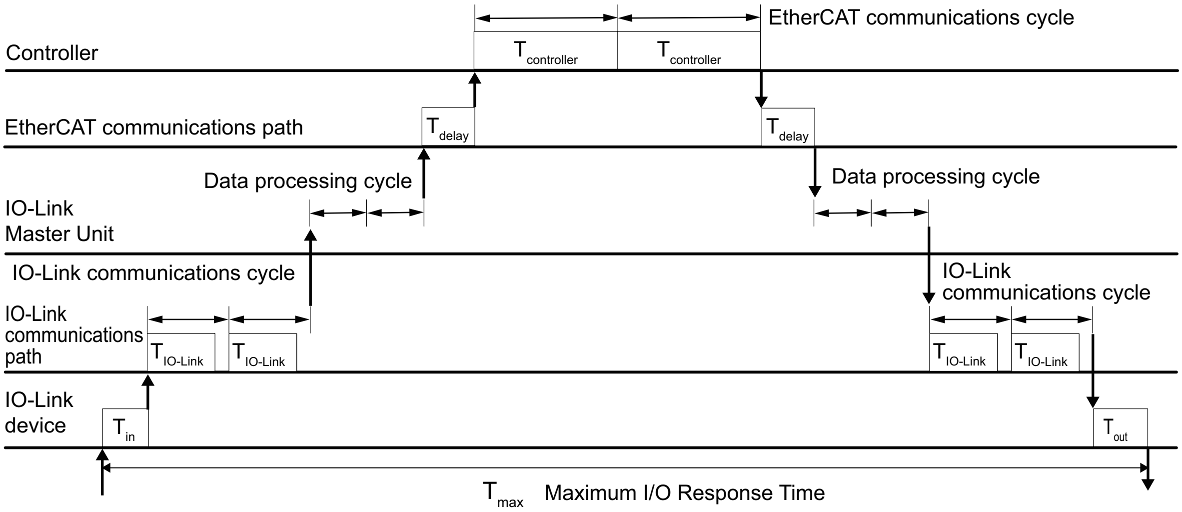
● Minimum I/O Response Time

Tmin = T_{in} + ($T_{IO\text{-}Link}$ × IO-Link data size (bytes) × 2) + (Data processing cycle × 2) + (T_{delay} × 2) + $T_{controller}$ + T_{out}



● Maximum I/O Response Time

Tmax = T_{in} + (IO-Link communications cycle × 4) + (Data processing cycle × 4) + (T_{delay} × 2) + ($T_{controller}$ × 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
T_{delay}	This is the transmission delay time of the EtherCAT master. It is calculated using the transmission delay time display function of the EtherCAT master with the Sysmac Studio. For details, refer to *Transmission Delay Time* in *System Response Time in Process Data Communications* in the user's manual for the built-in EtherCAT port on the connected CPU Unit or Industrial PC.
$T_{controller}$	This is the Controller cycle time. Refer to the user's manual for the connected Controller for the value.
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

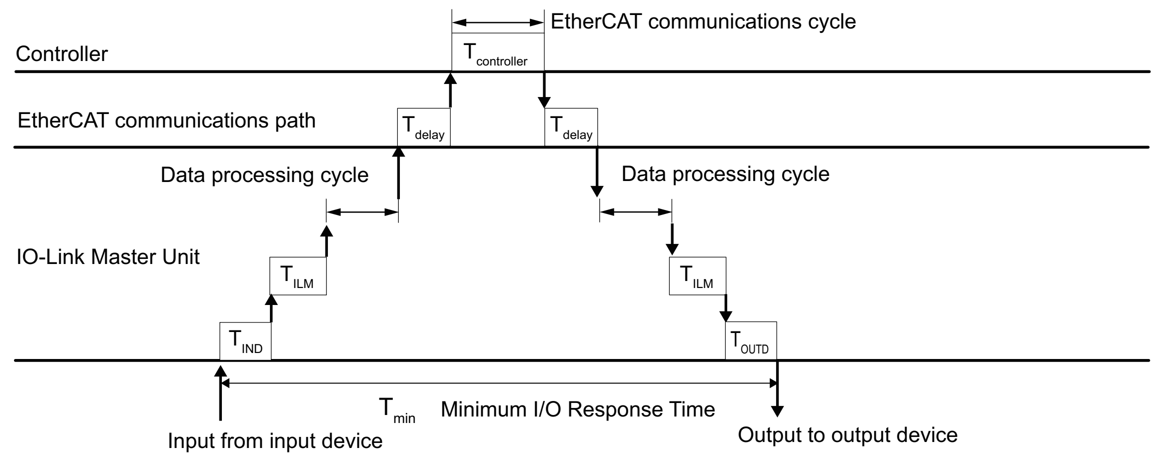
I/O response time here means the time during which an input signal from an non-IO-Link input device to the IO Link Master Unit is processed by the Controller and the result is output from the IO Link Master Unit to the non-IO-Link output device.
This applies to pin 2 or pin 4 of a port that is used in 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.

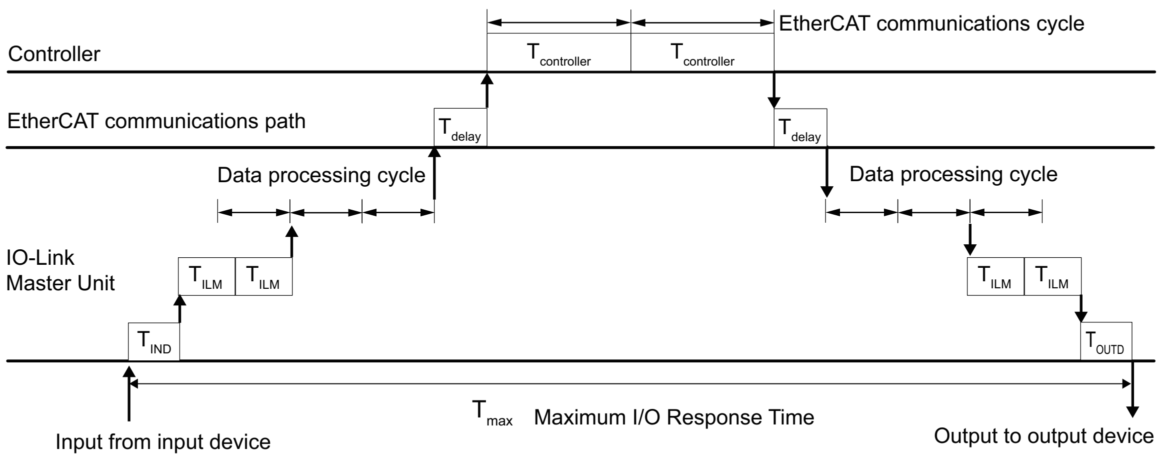
● Minimum I/O Response Time

Tmin = T_{IND} + (T_{ILM} × 2) + (Data processing cycle × 2) + (T_{delay} × 2) + $T_{controller}$ + T_{OUTD}



● Maximum I/O Response Time

Tmax = T_{IND} + (T_{ILM} × 4) + (Data processing cycle × 4) + (T_{delay} × 2) + ($T_{controller}$ × 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
T_{delay}	This is the transmission delay time of the EtherCAT master. It is calculated using the transmission delay time display function of the EtherCAT master with the Sysmac Studio. For details, refer to *Transmission Delay Time* in *System Response Time in Process Data Communications* in the user's manual for the built-in EtherCAT port on the connected CPU Unit or Industrial PC.
$T_{controller}$	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.

9

Functions

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

9-1 List of Functions

This section provides a list and overview of the functions of the IO-Link Master Unit.

The meaning of the symbol used in the description is as follows.

- Port □ indicates the I/O port number of the IO-Link Master Unit, where "□" is 1 to 8.

Category	Function name	Description	Reference
Functions as an EtherCAT slave	Sysmac device functionality	The IO-Link Master Unit is a Sysmac device that is designed to achieve optimum functionality and ease of operation when combined with an NJ/NX/NY-series Controller and the Sysmac Studio. This is called Sysmac device functionality. The Sysmac device functionality includes the following. • Error notification based on the Sysmac error status • Saving node address settings • Verifying the EtherCAT network configuration using serial numbers • SII data checking	*9-2 Sysmac Device Functionality* on page 9-5
Functions as an IO-Link master	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. • Pin2 Communications Mode Setting • Pin4 Communications Mode Setting	*9-3 Communications Mode Settings* on page 9-7
	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.	*9-4 Automatic Baud Rate Setting for IO-Link Communications* on page 9-9
	Load rejection during communications errors with Controller	A function that safely controls the output to an IO-Link device or non-IO-Link device if an error occurs during communications with the Controller.	*9-5 Load Rejection during Communications Errors with Controller* on page 9-10
	Digital input filter	A function that removes the chattering and noise of the input signal when the port is set to SIO (DI) Mode.	*9-6 Digital Input Filter* on page 9-12
	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.	*9-7 Digital Input Collection* on page 9-15
	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.	*9-8 IO-Link Device Verification* on page 9-18

Category	Function name	Description	Reference
	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.	*9-9 I/O Cable Short-circuit Detection* on page 9-22
	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.	*9-10 Monitoring Unit/Input Power Supply Voltage* on page 9-24
	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.	*9-11 Monitoring Output Power Supply Voltage* on page 9-26
	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.	*9-12 Monitoring Total Power-ON Time* on page 9-28
	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.	*9-13 IO-Link Total Communications Lost Frames* on page 9-29
	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.	*9-14 Backing Up and Restoring IO-Link Device Parameters* on page 9-32
	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.	*9-15 Recording Last-connected Device Information* on page 9-41
	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.	*9-16 IO-Link Communications Delay Time Settings* on page 9-44
	I/O port quick settings	A function that enables the IO-Link Master Unit to operate according to the device parameter settings that correspond to the Quick Setting Switch Value (1 to F hex) when the power is turned ON.	*9-17 I/O Port Quick Settings* on page 9-47

9-2 Sysmac Device Functionality

“Sysmac devices” is a generic name for EtherCAT slaves and other OMRON control components that were designed with the same communications and user interface specifications.
You can use the IO-Link Master Unit together with NJ/NX/NY-series Machine Automation Controllers and the Sysmac Studio Automation Software to achieve optimum functionality and ease of operation. This is called Sysmac device functionality.
EtherCAT slaves that are Sysmac devices have unique Sysmac device functionality. The IO-Link Master Unit has the functionality.
This section describes the Sysmac device functionality of the IO-Link Master Unit.

9-2-1 Error Notifications Based on the Sysmac Error Status

You can notify the EtherCAT master of error status and level based on the Sysmac error status in the following PDO mapping object of the IO-Link Master Unit.
This PDO mapping object is selected by default.

PDO mapping object		Application object (PDO entry)		
Object name	Index (hex)	Object name	Index (hex)	Subindex (hex)
Sysmac Error Status Information	1BFF	Sysmac Error Status	2002	01

The Sysmac error status has error level information that is commonly defined for all Sysmac devices.

The notification of the Sysmac error status to the EtherCAT master acts as a trigger that allows you to use the troubleshooting functions on the Sysmac Studio and NA-series HMI connected to the NJ/NX-series CPU Unit to view and correct errors that occur in the IO-Link Master Unit.
When an error occurs in the IO-Link Master Unit, the NJ/NX-series CPU Unit is notified of it. The notification to the NJ/NX-series CPU Unit acts as a trigger that allows you to use the troubleshooting functions on the Sysmac Studio and NA-series HMI to perform troubleshooting.

In addition, the following notification of error status to the EtherCAT master acts as a trigger to read the *Diagnosis History* (10F3 hex) CoE object of the IO-Link Master Unit, and allows you to check errors that occur in the IO-Link Master Unit.

- New messages available or Sysmac error status

This allows you to use this manual to view and correct errors.

Refer to *11-1 Checking for Errors* on page 11-2 for details on error notification and check method for the IO-Link Master Unit.
Refer to *A-1-7 Manufacturer-specific Object 1* on page A-20 for details on the Sysmac error status.

9-2-2 Saving Node Address Settings

This function is used to set EtherCAT node addresses on the built-in EtherCAT ports on the NJ/NX-series CPU Unit and NY-series Industrial PC from the Sysmac Studio.
If the ID switch of the IO-Link Master Unit is set to 00 hex (0), you can use the software setting that is set with the node address setting on the Sysmac Studio.

Place the Sysmac Studio online with the NJ/NX-series CPU Unit or the NY-series Industrial PC to set the node address from the Sysmac Studio.
For the procedure to set the node address from the Sysmac Studio, refer to the user's manual for the built-in EtherCAT port on the connected CPU Unit or Industrial PC.
Refer to *3-3-1 ID Switch* on page 3-9 for the ID switch setting of the IO-Link Master Unit.

9-2-3 Verifying the EtherCAT Network Configuration Using Serial Numbers

The IO-Link Master Unit saves the serial numbers to the non-volatile memory in the Unit.
The built-in EtherCAT ports on the NJ/NX-series CPU Unit and NY-series Industrial PC use the serial numbers to verify the EtherCAT network configuration. The Sysmac Studio is used for verification.
A Network Configuration Verification Error occurs if the specified standard is not met.
This function detects when the IO-Link Master Unit was replaced so that you can remember to set the parameters for the IO-Link Master Unit.
Place the Sysmac Studio online with the NJ/NX-series CPU Unit or the NY-series Industrial PC to verify the EtherCAT network configuration using serial numbers from the Sysmac Studio.
Refer to the user's manual for the built-in EtherCAT port on the connected CPU Unit or Industrial PC for the procedure to verify the EtherCAT network configuration using the serial number from the Sysmac Studio.

9-2-4 SII Data Checking

The IO-Link Master Unit checks the information in the SII (slave information interface).
The SII contains setting information that is unique to each EtherCAT slave. It is written to the non-volatile memory in the EtherCAT slave.
Because the IO-Link Master Unit is a Sysmac device, it checks the SII information at the slave. If the slave contains SII information that prevents it from operating, a Slave Unit Verification Error occurs to inform you that there is an error in the SII data.

Precautions for Correct Use

Do not change the SII information with setting software from other manufacturers.

9-3 Communications Mode Settings

This section describes the communications mode settings.

9-3-1 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.
- Port□ IO-Link Device Configuration Data/Pin4 Communications Mode Setting
- Port□ IO-Link Device Configuration Data/Pin2 Communications Mode Setting

9-3-2 Details on Function

Set the type of the external device connected to each port on the IO-Link Master Unit.
You can set *Pin4 Communications Mode Setting* and *Pin2 Communications Mode Setting* independently. There are no restrictions on the port operations with the combination of these settings.

Settings

Use the Sysmac Studio or SDO communications to configure the following settings.

Index (hex)	Subindex (hex)	Object name	Size (Data type)	Description
8000	---	Port1 IO-Link Device Configuration Data	---	---
	28	Pin4 Communications Mode Setting	2 bytes (U16)	Set the communications mode for pin 4. 0: Disable Port 1: SIO (DI) Mode 2: SIO (DO) Mode 3: IO-Link Mode The default setting is 3.
	29	Pin2 Communications Mode Setting	2 bytes (U16)	Set the communications mode for pin 2. 0: Disable Port 1: SIO (DI) Mode 2: SIO (DO) Mode The default setting is 1.
Indexes: 8010 to 8060*1				

Index (hex)	Subindex (hex)	Object name	Size (Data type)	Description
8070	---	Port8 IO-Link Device Configuration Data	---	---
	28	Pin4 Communications Mode Setting	2 bytes (U16)	Set the communications mode for pin 4. 0: Disable Port 1: SIO (DI) Mode 2: SIO (DO) Mode 3: IO-Link Mode The default setting is 3.
	29	Pin2 Communications Mode Setting	2 bytes (U16)	Set the communications mode for pin 2. 0: Disable Port 1: SIO (DI) Mode 2: SIO (DO) Mode The default setting is 1.

*1. Indexes 8010 hex, 8020 hex, 8030 hex, 8040 hex, 8050 hex, and 8060 hex are shown in abbreviated form. For indexes 8010 hex to 8060 hex, the port number in each object name is allocated in ascending order, from port 2 to port 7. Data definitions for items other than Object name are the same as those for indexes 8000 hex and 8070 hex.

Refer to *A-1-10 Manufacturer-specific Object 4* on page A-38 for information on CoE objects.

Additional Information

You can use a branch connector to connect two or more external devices to a port.
At this time, set *Pin4 Communications Mode Setting* and *Pin2 Communications Mode Setting* individually to SIO (DI) Mode or SIO (DO) Mode.

Refer to *7-2 Setting Device Parameters* on page 7-4 for the setting procedure with the Sysmac Studio.
Refer to *A-1-10 Manufacturer-specific Object 4* on page A-38 for CoE objects that are set through SDO communications.

Setting Example for Each Connected Device

For each connected external device, set *Pin4 Communications Mode Setting* and *Pin2 Communications Mode Setting*.
The following is a setting example.

Connected external device	Pin4 Communications Mode Setting	Pin2 Communications 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 (DI) Mode
IO-Link device (with digital outputs for pin 2)	IO-Link Mode	SIO (DO) 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

9-4 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.

9-5 Load Rejection during Communications Errors with Controller

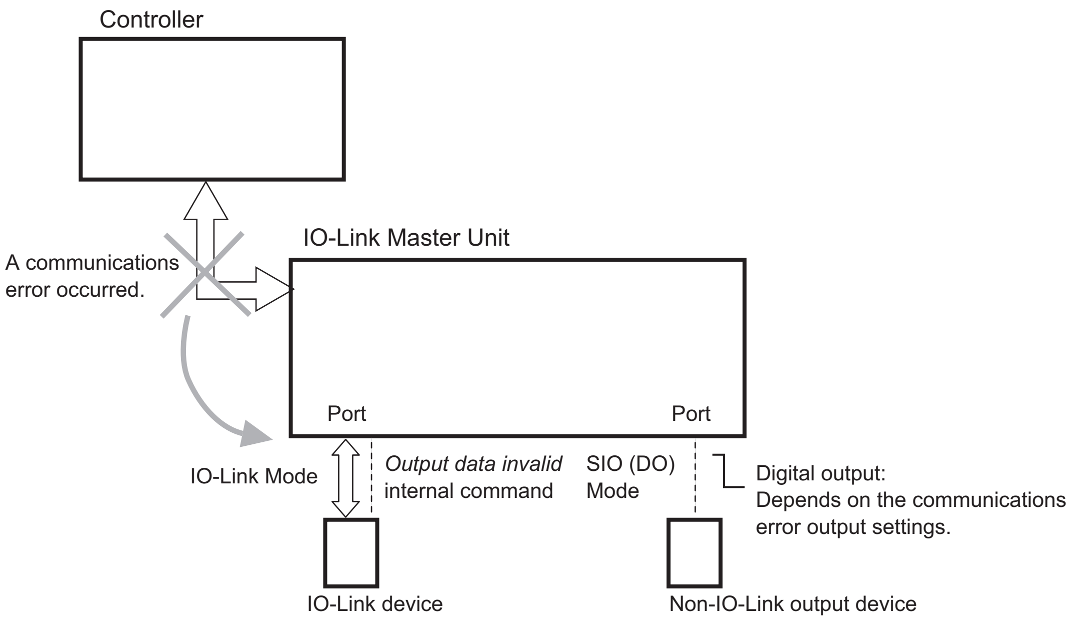
This section describes the load rejection during communications errors with Controller.

9-5-1 Overview of Function

A function that safely controls the output to an IO-Link device or non-IO-Link device if an error occurs during communications between the Controller and the IO-Link Master Unit.
This function is applicable to IO-Link devices and non-IO-Link output devices.
This function uses the *Port□ Load Rejection Output Setting*.

9-5-2 Details on Function

The IO-Link Master Unit performs an output operation depending on the *Port□ Load Rejection Output Setting* if an error occurs during communications between the Controller and 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 Sysmac Studio or SDO communications to configure the following settings.

Index (hex)	Subindex (hex)	Object name	Size (Data type)	Description
3204	---	Load Rejection Output Setting	---	---
	01	Port1 Load Rejection Output Setting	1 byte (U8)	Set the load rejection output setting. • IO-Link Mode 0: Enable (Sends an output data invalid notification to the IO-Link device.) 1: Disable (Continues the IO-Link communications.) • SIO (DO) Mode 0: Enable (Clears the output value.) 1: Disable (Holds the output value.) The default setting is 0.
	Subindexes: 02 to 07			
	08	Port8 Load Rejection Output Setting	1 byte (U8)	Set the load rejection output setting. • IO-Link Mode 0: Enable (Sends an output data invalid notification to the IO-Link device.) 1: Disable (Continues the IO-Link communications.) • SIO (DO) Mode 0: Enable (Clears the output value.) 1: Disable (Holds the output value.) The default setting is 0.

Refer to *A-1-8 Manufacturer-specific Object 2* on page A-23 for information on CoE objects.

Refer to *7-2 Setting Device Parameters* on page 7-4 for the setting procedure with the Sysmac Studio.
Refer to *A-1-8 Manufacturer-specific Object 2* on page A-23 for CoE objects that are set through SDO communications.

9-6 Digital Input Filter

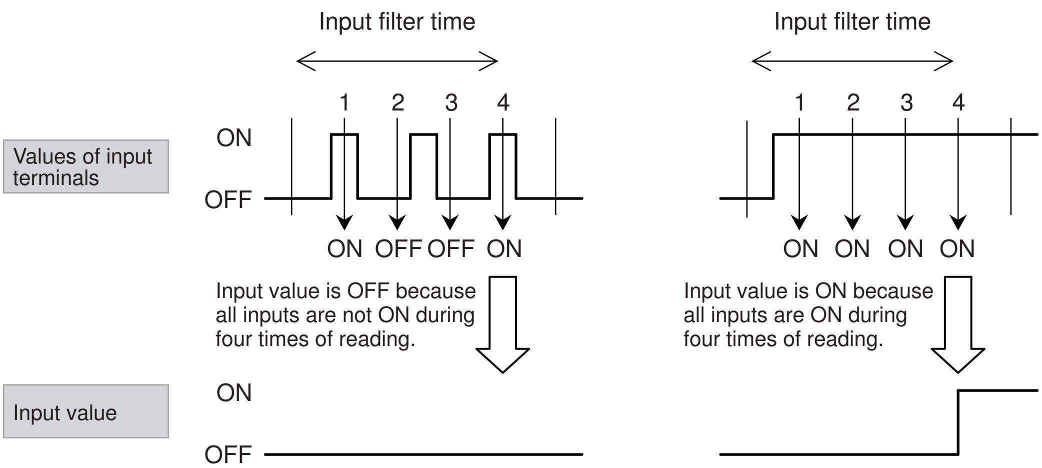
This section describes the digital input filter.

9-6-1 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□ Pin4 Input Filter Value Setting* and *Port□ Pin2 Input Filter Value Setting*.

9-6-2 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 Sysmac Studio or SDO communications to configure the following settings.

Index (hex)	Subindex (hex)	Object name	Size (Data type)	Description
3205	---	Input Filter Setting	---	---
	01	Port1 Pin4 Input Filter Value Setting	1 byte (U8)	Set the filter time for the input signal. 0: No filter 1: 0.25 ms 2: 0.5 ms 3: 1 ms 4: 2 ms 5: 4 ms 6: 8 ms 7: 16 ms 8: 32 ms 9: 64 ms 10: 128 ms 11: 256 ms The default setting is 3.
	02	Port1 Pin2 Input Filter Value Setting	1 byte (U8)	
	03	Port2 Pin4 Input Filter Value Setting	1 byte (U8)	
	04	Port2 Pin2 Input Filter Value Setting	1 byte (U8)	
	05	Port3 Pin4 Input Filter Value Setting	1 byte (U8)	
	06	Port3 Pin2 Input Filter Value Setting	1 byte (U8)	
	07	Port4 Pin4 Input Filter Value Setting	1 byte (U8)	
	08	Port4 Pin2 Input Filter Value Setting	1 byte (U8)	
	09	Port5 Pin4 Input Filter Value Setting	1 byte (U8)	
	0A	Port5 Pin2 Input Filter Value Setting	1 byte (U8)	
	0B	Port6 Pin4 Input Filter Value Setting	1 byte (U8)	
	0C	Port6 Pin2 Input Filter Value Setting	1 byte (U8)	
	0D	Port7 Pin4 Input Filter Value Setting	1 byte (U8)	
	0E	Port7 Pin2 Input Filter Value Setting	1 byte (U8)	
	0F	Port8 Pin4 Input Filter Value Setting	1 byte (U8)	
	10	Port8 Pin2 Input Filter Value Setting	1 byte (U8)	

Refer to *A-1-8 Manufacturer-specific Object 2* on page A-23 for information on CoE objects.

Refer to *7-2 Setting Device Parameters* on page 7-4 for the setting procedure with the Sysmac Studio.

Refer to *A-1-8 Manufacturer-specific Object 2* on page A-23 for CoE objects that are set through SDO communications.

9-7 Digital Input Collection

This section describes the digital input collection.

9-7-1 Overview of Function

A function that applies the specified 1-bit value in the IO-Link Input Data for each port to the Digital Input Data of the IO-Link Master Unit when the port is set to IO-Link Mode.
As a result, the bit data in the input data from the IO-Link device can be aggregated into the Digital Input Data of the IO-Link Master Unit.
For example, you can use this function to input control bits in an IO-Link device that does not support digital inputs for pin 2 to the Digital Input Data.
This function uses the *Offset Setting of Port□ Digital Input Data Collection*.

9-7-2 Details on Function

This function extracts a 1-bit value from the position set in *Offset Setting of Port□ Digital Input Data Collection* among the IO-Link Input Data for each port.
It then places the 1-bit values extracted from all ports in *Digital Input Data* one after the other in the order of port numbers.
For an offset setting value in *Offset Setting of Port□ Digital Input Data Collection*, 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 PDO mapping used for the IO-Link Master Unit.
If the offset value that exceeds the size of the IO-Link Input Data is set, the relevant bit value in the *Digital 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 *Digital Input Data* is 0.

Digital Input Data

Bit position	00	Port1 Pin4 *1
	01	Port1 Pin2
	02	Port2 Pin4 *2
	03	Port2 Pin2
	04	Port3 Pin4 *3
	05	Port3 Pin2
	06	Port4 Pin4 *4
	07	Port4 Pin2
	08	Port5 Pin4 *5
	09	Port5 Pin2
	10	Port6 Pin4 *6
	11	Port6 Pin2
	12	Port7 Pin4 *7
	13	Port7 Pin2
	14	Port8 Pin4 *8
	15	Port8 Pin2

Port1 Input Data

Of the data size in 1 byte, specify the bit data of offset position 0.

	Bit position							
	07	06	05	04	03	02	01	00
PD0	7	6	5	4	3	2	1	0

Port2 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

Port5 Input Data

Of the data size in 4 bytes, specify the bit data of offset position 0.

	Bit position							
	07	06	05	04	03	02	01	00
PD0	31	30	29	28	27	26	25	24
PD1	23	22	21	20	19	18	17	16
PD2	15	14	13	12	11	10	9	8
PD3	7	6	5	4	3	2	1	0

Port8 Input Data

Of the data size in 8 bytes, specify the bit data of offset position 32.

	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

*1. Bit data specified in the input data when pin 4 of port 1 is in IO-Link Mode
*2. Bit data specified in the input data when pin 4 of port 2 is in IO-Link Mode
*3. Bit data specified in the input data when pin 4 of port 3 is in IO-Link Mode
*4. Bit data specified in the input data when pin 4 of port 4 is in IO-Link Mode
*5. Bit data specified in the input data when pin 4 of port 5 is in IO-Link Mode
*6. Bit data specified in the input data when pin 4 of port 6 is in IO-Link Mode
*7. Bit data specified in the input data when pin 4 of port 7 is in IO-Link Mode
*8. Bit data specified in the input data when pin 4 of port 8 is in IO-Link Mode

Settings

Use the Sysmac Studio or SDO communications to configure the following settings.

Index (hex)	Subindex (hex)	Object name	Size (Data type)	Description
320C	---	Offset Setting of Digital Input Data Collection	---	---
	01	Offset Setting of Port1 Digital Input Data Collection	1 byte (U8)	Specify the position of the bit to extract from IO-Link Input Data. Setting range: 00 to FF hex The default setting is 0.
	Subindexes: 02 to 07			
	08	Offset Setting of Port8 Digital Input Data Collection	1 byte (U8)	Specify the position of the bit to extract from IO-Link Input Data. Setting range: 00 to FF hex The default setting is 0.

Refer to *A-1-8 Manufacturer-specific Object 2* on page A-23 for information on CoE objects.

Refer to *7-2 Setting Device Parameters* on page 7-4 for the setting procedure with the Sysmac Studio. Refer to *A-1-8 Manufacturer-specific Object 2* on page A-23 for CoE objects that are set through SDO communications.

9-8 IO-Link Device Verification

This section describes IO-Link device verification.

9-8-1 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.

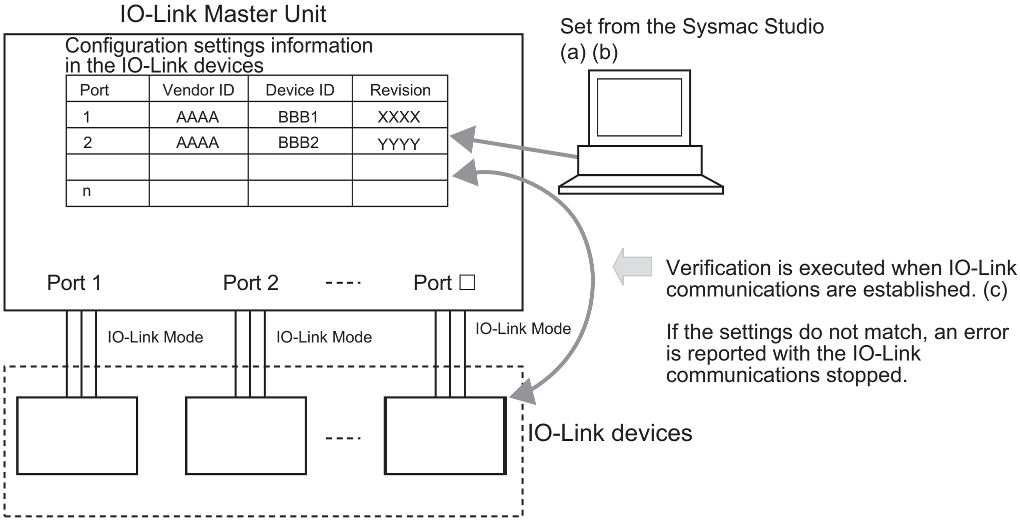
9-8-2 Details on Function

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□ IO-Link Device Configuration Data/Device ID
Port□ IO-Link Device Configuration Data/Vendor ID
Port□ IO-Link Device Configuration Data/IO-Link Revision
Port□ Serial Number Configuration Data

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-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.

Settings

Use the Sysmac Studio or SDO communications to configure the following settings.

Index (hex)	Subindex (hex)	Object name	Size (Data type)	Description
3201	---	IO-Link Device Verification Setting	---	---
	01	Port1 Device Verification Setting	1 byte (U8)	Set the operation of device verification. 0: No check 1: VendorID, DeviceID and IO-Link Revision Check 2: VendorID, DeviceID, IO-Link Revision and SerialNo Check The default setting is 0.
	Subindexes: 02 to 07			
	08	Port8 Device Verification Setting	1 byte (U8)	Set the operation of device verification. 0: No check 1: VendorID, DeviceID and IO-Link Revision Check 2: VendorID, DeviceID, IO-Link Revision and SerialNo Check The default setting is 0.
8000	---	Port1 IO-Link Device Configuration Data	---	---
	04	Device ID	4 bytes (U32)	Set the device ID of the connected IO-Link device. Setting range: 00000000 to 00FFFFFF hex The default setting is 0.
	05	Vendor ID	4 bytes (U32)	Set the vendor ID of the connected IO-Link device. 00000000 to 0000FFFF hex The default setting is 0.
	20	IO-Link Revision	1 byte (U8)	Set the major revision in the upper 4 bits and the minor revision in the lower 4 bits of the IO-Link revision of the connected IO-Link device. Setting range: 00 to FF hex*1 The default setting is 0.
Indexes: 8010 to 8060*2				

Index (hex)	Subindex (hex)	Object name	Size (Data type)	Description
8070	---	Port8 IO-Link Device Configuration Data	---	---
	04	Device ID	4 bytes (U32)	Set the device ID of the connected IO-Link device. Setting range: 00000000 to 00FFFFFF hex The default setting is 0.
	05	Vendor ID	4 bytes (U32)	Set the vendor ID of the connected IO-Link device. 00000000 to 0000FFFF hex The default setting is 0.
	20	IO-Link Revision	1 byte (U8)	Set the major revision in the upper 4 bits and the minor revision in the lower 4 bits of the IO-Link revision of the connected IO-Link device. Setting range: 00 to FF hex*1 The default setting is 0.

*1. If the set value of IO-Link Revision is 00 hex, the IO-Link revision is not verified even when the set value of IO-Link Device Verification Setting is other than 0 (Enabled to verify).

*2. Indexes 8010 hex, 8020 hex, 8030 hex, 8040 hex, 8050 hex, and 8060 hex are shown in abbreviated form. For indexes 8010 hex to 8060 hex, the port number in each object name is allocated in ascending order, from port 2 to port 7. Data definitions for items other than Object name are the same as those for indexes 8010 hex and 8070 hex.

Index (hex)	Subindex (hex)	Object name	Size (Data type)	Description
8001	---	Port1 Serial Number Configuration Data	STRING (16)	Set the serial number of the connected IO-Link device. Setting range: 16 characters max. The default setting is NULL.
Indexes: 8011 to 8061*1				
8071	---	Port8 Serial Number Configuration Data	STRING (16)	Set the serial number of the connected IO-Link device. Setting range: 16 characters max. The default setting is NULL.

*1. Indexes 8011 hex, 8021 hex, 8031 hex, 8041 hex, 8051 hex, and 8061 hex are shown in abbreviated form. For indexes 8011 hex to 8061 hex, the port number in each object name is allocated in ascending order, from port 2 to port 7. Data definitions for items other than Object name are the same as those for indexes 8001 hex and 8071 hex.

Refer to *A-1-8 Manufacturer-specific Object 2* on page A-23 and *A-1-10 Manufacturer-specific Object 4* on page A-38 for information on CoE objects.

Refer to *7-2 Setting Device Parameters* on page 7-4 for the setting procedure with the Sysmac Studio. Refer to *A-1-8 Manufacturer-specific Object 2* on page A-23 for CoE objects that are set through SDO communications.

9-9 I/O Cable Short-circuit Detection

This section describes I/O cable short-circuit detection.

9-9-1 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.

9-9-2 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-circuit is detected	Notification method
Between pin 1 and pin 3	Port□ Pin1 Short-circuit Error changes to TRUE.
Between pin 2 and pin 3	Port□ Pin2 Short-circuit Error changes to TRUE.
Between pin 4 and pin 3	Port□ Pin4 Short-circuit Error changes to TRUE.

From the user program, etc., access *Port□ Pin1 Short-circuit Error*, *Port□ Pin2 Short-circuit Error*, and *Port□ Pin4 Short-circuit Error* in the *I/O Port Error Status* of I/O data.
Refer to *11-3 Checking for Errors with the Status in I/O Data* on page 11-14 for information on the above data.

The following tables show how the function works with Pin4 Communications Mode Setting and Pin2 Communications Mode Setting.
Pin 4

Set value of Pin4 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 Port		Detection and protection disabled

Pin 2

Set value of Pin2 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 Port		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.

9-10 Monitoring Unit/Input Power Supply Voltage

This section describes monitoring Unit/input power supply voltage.

9-10-1 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.

9-10-2 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/Input 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. The status changes to FALSE if the voltage exceeds the minimum value of the rating after it once changes to TRUE.

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.

Accessing I/O Data in the IO-Link Master Unit

You can use this method to read the *Unit/Input Power Supply Voltage Drop*.
From the user program, etc., access the *Unit/Input Power Supply Voltage Drop* in the *I/O Port Status* of I/O data.
Refer to *11-3 Checking for Errors with the Status in I/O Data* on page 11-14 for information on *Unit/Input Power Supply Voltage Drop*.

Reading Parameters through SDO Communications

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*.
Read parameters from the following CoE objects through SDO communications.

Index (hex)	Subindex (hex)	Object name	Size (Data type)	Description
320D	---	Unit/Input Power Supply Voltage Information	---	---
	01	Unit/Input Power Supply Voltage	2 bytes (U16)	Indicates the present value of the Unit/input power supply voltage. The unit is 0.1 V. The default setting is 0.
	02	Maximum Unit/Input Power Supply Voltage	2 bytes (U16)	Indicates the maximum value of the Unit/input power supply voltage. The unit is 0.1 V. The default setting is 0.
	03	Minimum Unit/Input Power Supply Voltage	2 bytes (U16)	Indicates the minimum value of the Unit/input power supply voltage. The unit is 0.1 V. The default setting is 0.

Refer to *A-1-8 Manufacturer-specific Object 2* on page A-23 for information on CoE objects.

9-11 Monitoring Output Power Supply Voltage

This section describes monitoring output power supply voltage.

9-11-1 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.

9-11-2 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. The status changes to FALSE if the voltage exceeds the minimum value of the rating after it once changes to TRUE.

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.

Accessing I/O Data in the IO-Link Master Unit

You can use this method to read the *Output Power Supply Voltage Drop*.
From the user program, etc., access the *Output Power Supply Voltage Drop* in the *I/O Port Status* of I/O data.
Refer to *11-3 Checking for Errors with the Status in I/O Data* on page 11-14 for information on *Output Power Supply Voltage Drop*.

Reading Parameters through SDO Communications

You can use this method to read the *Output Power Supply Voltage*, *Maximum Output Power Supply Voltage*, and *Minimum Output Power Supply Voltage*.
Read parameters from the following CoE objects through SDO communications.

Index (hex)	Subindex (hex)	Object name	Size (Data type)	Description
320E	---	Output Power Supply Voltage Information	---	---
	01	Output Power Supply Voltage	2 bytes (U16)	Indicates the present value of the output power supply voltage. The unit is 0.1 V. The default setting is 0.
	02	Maximum Output Power Supply Voltage	2 bytes (U16)	Indicates the maximum value of the output power supply voltage. The unit is 0.1 V. The default setting is 0.
	03	Minimum Output Power Supply Voltage	2 bytes (U16)	Indicates the minimum value of the output power supply voltage. The unit is 0.1 V. The default setting is 0.

Refer to *A-1-8 Manufacturer-specific Object 2* on page A-23 for information on CoE objects.

9-12 Monitoring Total Power-ON Time

This section describes monitoring total power-ON time.

9-12-1 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.

9-12-2 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 through SDO Communications

Read parameters from the following CoE objects through SDO communications.

Index (hex)	Subindex (hex)	Object name	Size (Data type)	Description
320F	---	Total Power-ON Time	---	---
	01	Total Power-ON Time	4 bytes (UDINT)	Indicates the total power-ON time (Unit: h). Range: 0 to 715,827,882 The default setting is 0.

Refer to *A-1-8 Manufacturer-specific Object 2* on page A-23 for information on CoE objects.

9-13 IO-Link Total Communications Lost Frames

This section describes the IO-Link total communications lost frames.

9-13-1 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

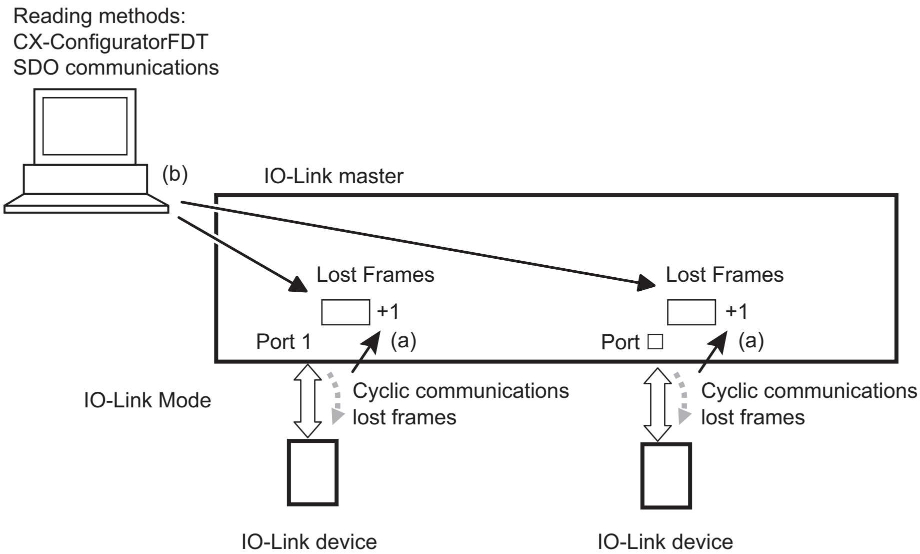
9-13-2 Details on Function

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□ Diagnosis Data/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
CX-ConfiguratorFDT's Diagnosis tab page	*Reading Parameters into the CX-ConfiguratorFDT's Diagnosis Tab Page* on page 9-30
SDO communications	*Reading and Writing Parameters through SDO Communications* on page 9-30



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.

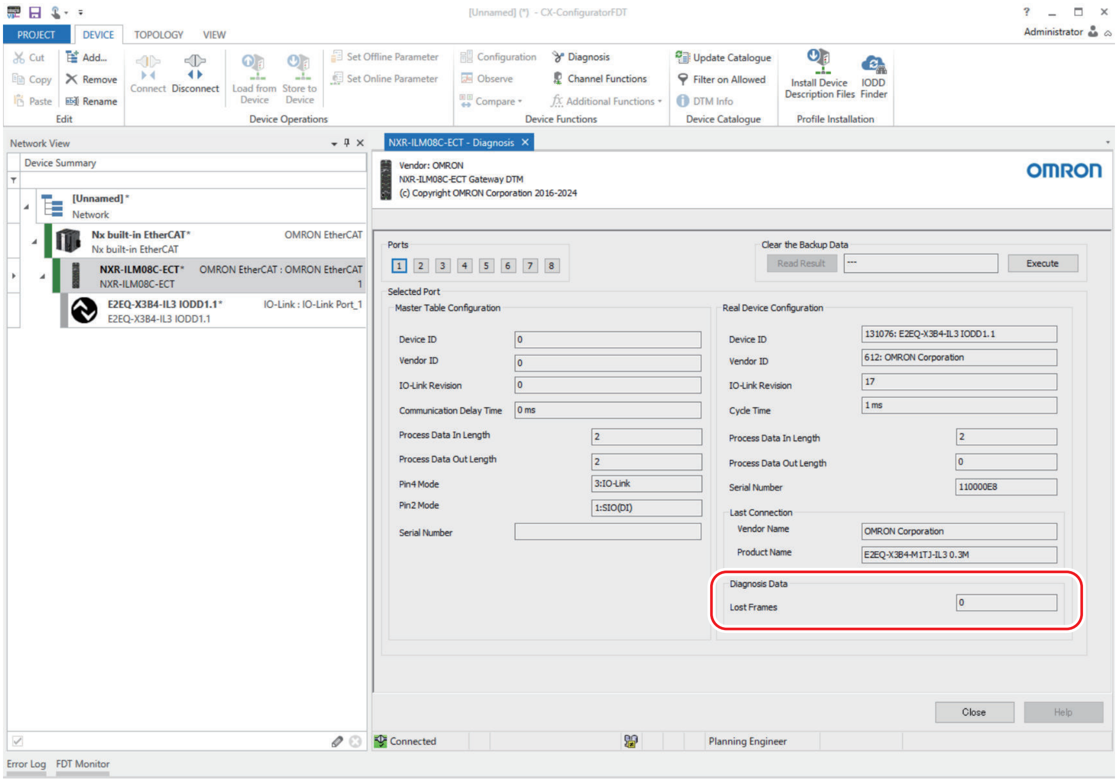
Set the *Port□ Diagnosis Data/Lost Frames* value to less than 255 to continue to count from the value. To change the value, use SDO communications.

Reading Parameter Values

● 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 *10-2 Setting IO-Link Devices with the CX-ConfiguratorFDT* on page 10-3 for information 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 and Writing Parameters through SDO Communications

Read/write parameters from/to the following CoE objects through SDO communications.

Index (hex)	Subindex (hex)	Object name	Size (Data type)	Description
A000	---	Port1 Diagnosis Data	---	---
	02	Lost Frames	1 byte (U8)	This is the total number of lost frames of IO-Link cyclic communications for port 1. If you write a value, totaling the number of retries starts from the written value. Write 00 hex to reset the total. Setting range: 00 to FF hex The default setting is 0.
Indexes: A010 to A060*1				
A070	---	Port8 Diagnosis Data	---	---
	02	Lost Frames	1 byte (U8)	This is the total number of lost frames of IO-Link cyclic communications for port 8. If you write a value, totaling the number of retries starts from the written value. Write 00 hex to reset the total. Setting range: 00 to FF hex The default setting is 0.

*1. Indexes A010 hex, A020 hex, A030 hex, A040 hex, A050 hex, and A060 hex are shown in abbreviated form. For indexes A010 hex to A060 hex, the port number in each object name is allocated in ascending order, from port 2 to port 7. Data definitions for items other than Object name are the same as those for indexes A000 hex and A070 hex.

Refer to *A-1-10 Manufacturer-specific Object 4* on page A-38 for information on CoE objects.

9-14 Backing Up and Restoring IO-Link Device Parameters

This section describes the backup and restoration of parameter settings in IO-Link devices.

9-14-1 Overview of Function

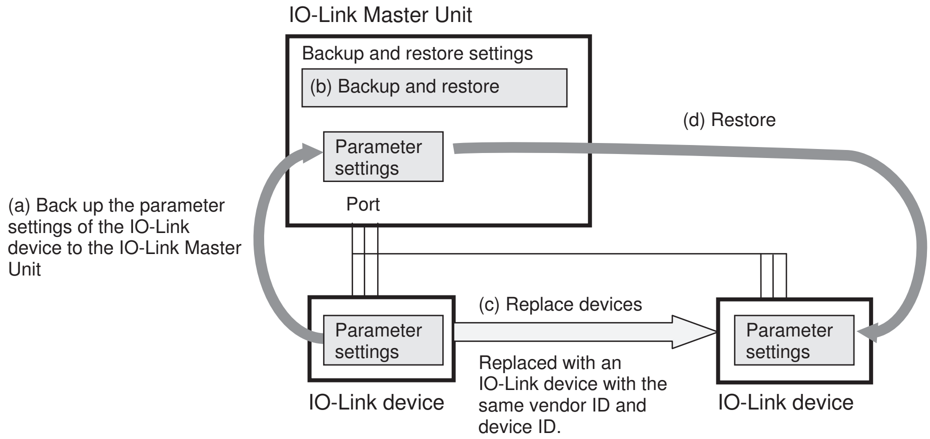
A function that is used to replace a connected IO-Link device with a new IO-Link device of the same model without use of the CX-ConfiguratorFDT.
This function is used to back up the parameter settings from the IO-Link devices to the IO-Link Master Unit and restore them from the IO-Link Master Unit to 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 *9-14-2 Backing Up IO-Link Device Parameters* on page 9-33.

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 *9-14-3 Restoring IO-Link Device Parameters* on page 9-37 for the restoration procedure.

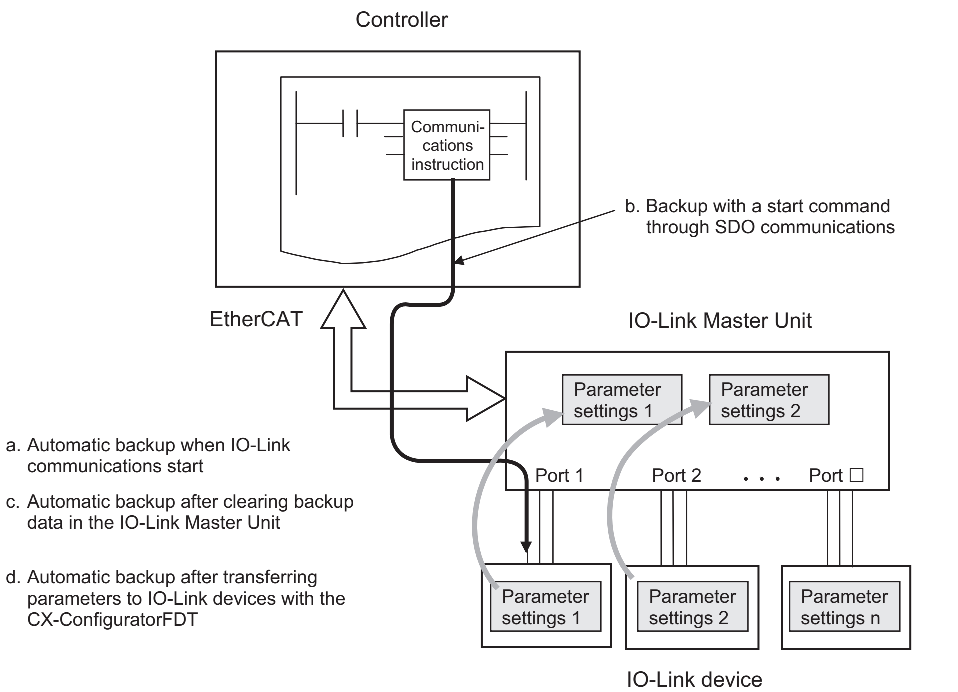


9-14-2 Backing Up IO-Link Device Parameters

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 through SDO 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□ IO-Link Device Configuration Data/Pin4 Communications Mode Setting	IO-Link Mode
Port□ Device Verification Setting	Other than **No check**
Port□ Backup/Restore Setting	Other than **Do Not Execute**

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 Warning-level Device Event Flag 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□ IO-Link Device Configuration Data/Pin4 Communications Mode Setting	IO-Link Mode
Port□ Device Verification Setting	Other than **No check**
Port□ Backup/Restore Setting	Backup

- 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 Warning-level Device Event Flag occurs at that time.

Backup with a Start Command through SDO Communications

This method is used to change the settings of an IO-Link device through SDO communications and back up the settings of only the individual IO-Link device, e.g., when changing over a production line.

By sending a start command through SDO 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□ IO-Link Device Configuration Data/Pin4 Communications Mode Setting	IO-Link Mode
Port□ Device Verification Setting	Other than **No check**
Port□ Backup/Restore Setting	Backup

- The Parameter upload start service data is supported by the IO-Link device.

Index	0002 hex
Write data	05 hex (Start command)

Refer to *9-14-5 Executing a Start Command for Backup through SDO Communications* on page 9-38 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 Warning-level Device Event Flag 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 with the CX-ConfiguratorFDT or through SDO communications.
- When the settings of the IO-Link devices are changed through SDO 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□ IO-Link Device Configuration Data/Pin4 Communications Mode Setting	IO-Link Mode
Port□ Device Verification Setting	Other than **No check**
Port□ Backup/Restore Setting	Other than **Do Not Execute**

For information on how to clear backup data, refer to *9-14-6 Clearing Backup Data* on page 9-38.

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□ IO-Link Device Configuration Data/Pin4 Communications Mode Setting	IO-Link Mode
Port□ Device Verification Setting	Other than **No check**
Port□ Backup/Restore Setting	Backup

● 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 *10-2-10 Going Online* on page 10-11 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 *10-2-10 Going Online* on page 10-11 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.

9-14-3 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□ IO-Link Device Configuration Data/Pin4 Communications Mode Setting	IO-Link Mode
Port□ Device Verification Setting	Other than **No check**
Port□ Backup/Restore Setting	Restore

- 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.

9-14-4 Settings

This section describes the settings for backing up and restoring IO-Link device parameters.
Refer to *9-3 Communications Mode Settings* on page 9-7 for *Port□ IO-Link Device Configuration Data/Pin4 Communications Mode Setting*. Refer to *9-8 IO-Link Device Verification* on page 9-18 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. Use the Sysmac Studio or SDO communications to configure the following settings.

Index (hex)	Subindex (hex)	Object name	Size (Data type)	Description
3202	---	Backup/Restore Setting	---	---
	01	Port1 Backup/Restore Setting	1 byte (U8)	Set whether to back up or restore the parameter settings of the IO-Link device for port 1, or disable the backup/restore function. 00 hex: Do Not Execute 01 hex: Backup 02 hex: Restore The default setting is 0.
	Subindexes: 02 to 07			
	08	Port8 Backup/Restore Setting	1 byte (U8)	Set whether to back up or restore the parameter settings of the IO-Link device for port 8, or disable the backup/restore function. 00 hex: Do Not Execute 01 hex: Backup 02 hex: Restore The default setting is 0.

Refer to *A-1-8 Manufacturer-specific Object 2* on page A-23 for information on CoE objects.

9-14-5 Executing a Start Command for Backup through SDO Communications

Send a message to the IO-Link device to execute a start command for backup by writing the following *Description* to the CoE objects listed below.

Index (hex)	Subindex (hex)	Object name	Size (Data type)	Description
4000	---	Port1 Message for IO-Link Device	---	---
	01	Control	1 byte (U8)	02 hex: Write
	03	Index	2 bytes (U16)	0002 hex: Index 2 of the IO-Link device object
	05	Length	1 byte (U8)	01 hex: 1 byte
	06	Data	(ARRAY[0..231] OF BYTE)	05 hex: Backup start command to the IO-Link device
Indexes: 4010 to 4060*1				
4070	---	Port8 Message for IO-Link Device	---	---
	01	Control	1 byte (U8)	02 hex: Write
	03	Index	2 bytes (U16)	0002 hex: Index 2 of the IO-Link device object
	05	Length	1 byte (U8)	01 hex: 1 byte

*1. Indexes 4010 hex, 4020 hex, 4030 hex, 4040 hex, 4050 hex, and 4060 hex are shown in abbreviated form. For indexes 4010 hex to 4060 hex, the port number in each object name is allocated in ascending order, from port 2 to port 7. Data definitions for items other than Object name are the same as those for indexes 4000 hex and 4070 hex.

Refer to *A-1-9 Manufacturer-specific Object 3* on page A-36 for information on CoE objects.

9-14-6 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 **No check**, 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 through SDO communications

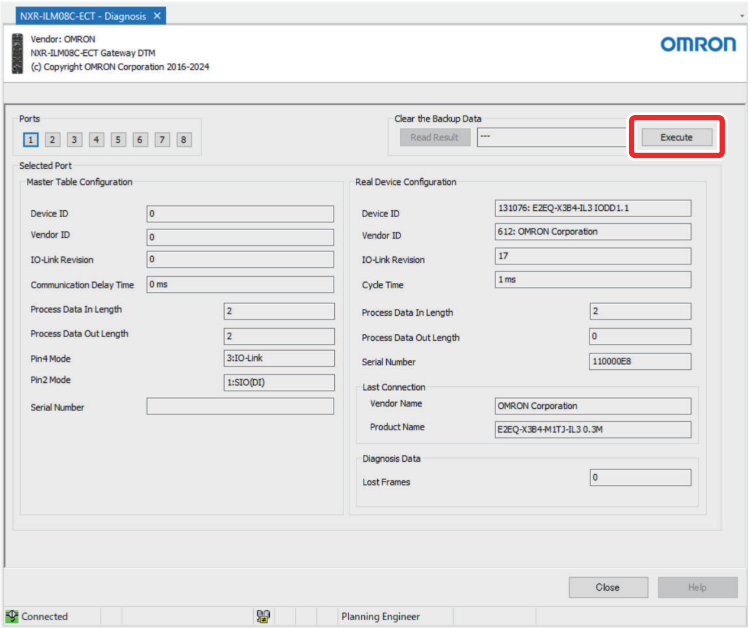
With either method, when the backup data is cleared, the backup data of all ports will be cleared.

- Applicable communications modes
  IO-Link Mode, SIO (DI) Mode, SIO (DO) Mode, or Disable Port

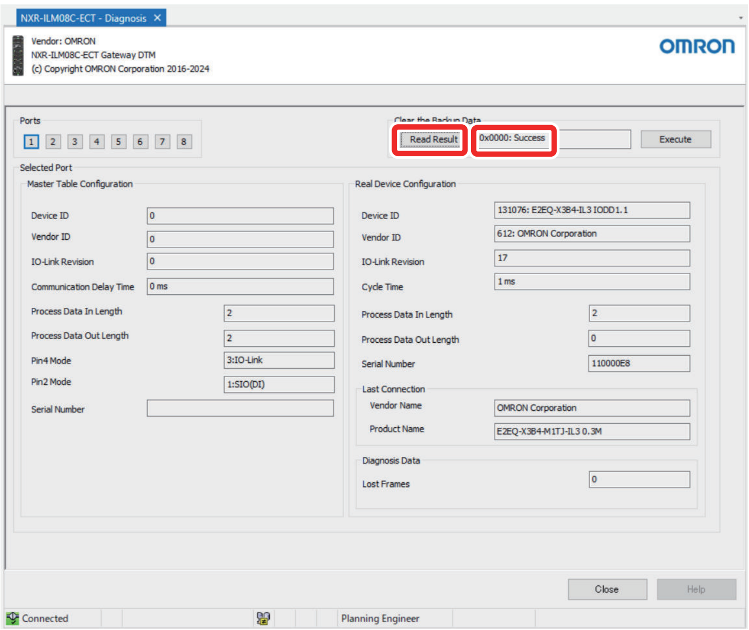
Clearing Backup Data with the CX-ConfiguratorFDT

You can use the CX-ConfiguratorFDT to clear the backup data in the IO-Link Master Unit.
Refer to *10-2-5 Starting the CX-ConfiguratorFDT* on page 10-6 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, clicking the **Read Result** button in the **Clear the Backup Data** area displays the results of the clearing operation. Details are given below. If the clearing operation is executed normally, **0x0000: Success** will be displayed.

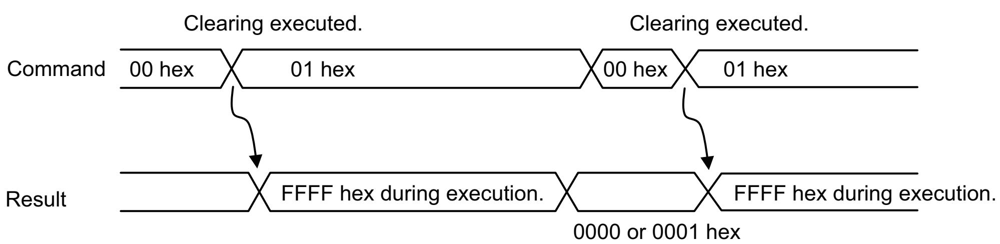


Clearing Backup Data through SDO Communications

Execute a command to clear the backup data by writing to the following CoE object through SDO communications.

Index (hex)	Subindex (hex)	Object name	Size (Data type)	Description
3209	---	Clear Backup Data Command	---	---
	01	Command	1 byte (U8)	Clears the backup data in the IO-Link master. Backup data is cleared when the value changes from 00 hex to 01 hex. 00 hex: Do Not Execute 01 hex: Clear
	02	Result	2 bytes (U16)	Indicates the result of clearing the backup data. 0000 hex: Backup completed or not executed. 0001 hex: Backup failed. FFFF hex: Backup in progress.

The relation between the Command and Result objects is given below.
The backup data is cleared when the value of the Clear Backup Data Command object changes from 00 hex to 01 hex.
The value of the Result object is FFFF hex while clearing the data is in progress.
After the data is cleared, the value of the Result object changes to 0000 hex for a normal end and to 0001 hex for an error end.



9-15 Recording Last-connected Device Information

This section describes recording last-connected device information.

9-15-1 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.

9-15-2 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.

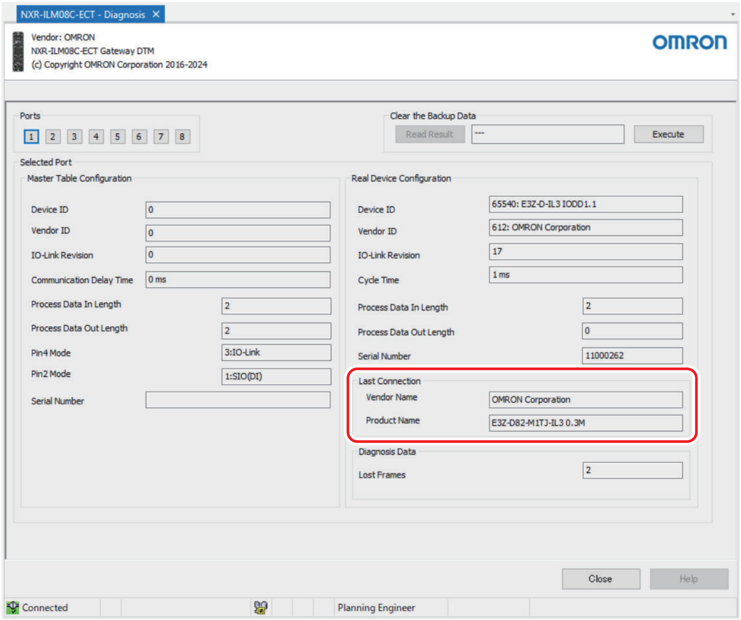
The IO-Link Master Unit updates the above information with information on the connected IO-Link devices when IO-Link communications are started.
This information is retained in the IO-Link Master Unit even if you remove the IO-Link devices. Therefore, you can check the vendor name and product name of 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 CX-ConfiguratorFDT's Diagnosis Tab Page

1. Select the DTM for the IO-Link Master Unit and go online with the Unit.
   Refer to *10-2 Setting IO-Link Devices with the CX-ConfiguratorFDT* on page 10-3 for information 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 SDO Communications

Read parameters from the following CoE objects through SDO communications.

Index (hex)	Subindex (hex)	Object name	Size (Data type)	Description
8002	---	Port1 Vendor Name of the Last Connected IO-Link Device	STRING (16)	Indicates the vendor name of the IO-Link device last connected to port 1. The default setting is NULL.
Indexes: 8012 to 8062*1				
8072	---	Port8 Vendor Name of the Last Connected IO-Link Device	STRING (16)	Indicates the vendor name of the IO-Link device last connected to port 8. The default setting is NULL.

*1. Indexes 8012 hex, 8022 hex, 8032 hex, 8042 hex, 8052 hex, and 8062 hex are shown in abbreviated form. For indexes 8012 hex to 8062 hex, the port number in each object name is allocated in ascending order, from port 2 to port 7. Data definitions for items other than Object name are the same as those for indexes 8012 hex and 8072 hex.

Index (hex)	Subindex (hex)	Object name	Size (Data type)	Description
8003	---	Port1 Product Name of the Last Connected IO-Link Device	STRING (16)	Indicates the product name of the IO-Link device last connected to port 1. The default setting is NULL.
Indexes: 8013 to 8063*1				

Index (hex)	Subindex (hex)	Object name	Size (Data type)	Description
8073	---	Port8 Product Name of the Last Connected IO-Link Device	STRING (16)	Indicates the product name of the IO-Link device last connected to port 8. The default setting is NULL.

*1. Indexes 8013 hex, 8023 hex, 8033 hex, 8043 hex, 8053 hex, and 8063 hex are shown in abbreviated form. For indexes 8013 hex to 8063 hex, the port number in each object name is allocated in ascending order, from port 2 to port 7. Data definitions for items other than Object name are the same as those for indexes 8003 hex and 8073 hex.

Refer to *A-1-10 Manufacturer-specific Object 4* on page A-38 for information on CoE objects.

9-16 IO-Link Communications Delay Time Settings

This section describes the IO-Link communications delay time settings.

9-16-1 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□ Communication Delay Time*.

9-16-2 Details on Function

This function extends the IO-Link communications cycle time based on the delay time set in *Port□ Communication Delay Time*. However, the extended IO-Link communications cycle time is limited to a maximum of 132.8 ms.

Settings

Use the Sysmac Studio or SDO communications to configure the following settings.

Index (hex)	Subindex (hex)	Object name	Size (Data type)	Description
3210	---	Communication Delay Time	---	---
	01	Port1 Communication Delay Time	1 byte (U8)	Set the IO-Link communications delay time for port 1. Setting range: 00 to BF hex The default setting is 0. Refer to *Delay Time for the Set Value* on page 9-45 for the delay time for the set value.
	Subindexes: 02 to 07			
	08	Port8 Communication Delay Time	1 byte (U8)	Set the IO-Link communications delay time for port 8. Setting range: 00 to BF hex The default setting is 0. Refer to *Delay Time for the Set Value* on page 9-45 for the delay time for the set value.

Refer to *A-1-8 Manufacturer-specific Object 2* on page A-23 for information on CoE objects.

● Delay Time for the Set Value

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
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	---	---

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)
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	---	---

9-17 I/O Port Quick Settings

9-17-1 Overview of Function

A function that enables the IO-Link Master Unit to operate according to the device parameter settings that correspond to the Quick Setting Switch Value (1 to F hex) when the power is turned ON.
Using this function allows you to set the device parameters of the IO-Link Master Unit without Configuration Software or SDO communications, which reduces the work required for startup of equipment, etc.

9-17-2 Details on Function

If the Quick Setting Switch Value is 0 hex when the power is turned ON, the I/O port quick settings are disabled.
When the I/O port quick settings are disabled, the IO-Link Master Unit uses the device parameters stored in it as the operating values. Refer to *7-2-2 Setting the Device Parameters of the IO-Link Master Unit* on page 7-5 for how to set the device parameters.

If the Quick Setting Switch Value is 1 to F hex when the power is turned ON, the I/O port quick settings are enabled.
When the I/O port quick settings are enabled, the IO-Link Master Unit uses the device parameters set by the I/O port quick settings as the operating values.
The IO-Link Master Unit uses the device parameters set by the I/O port quick settings as the operating values at this time since they have priority over the device parameters stored in the IO-Link Master Unit.
The device parameters of the IO-Link Master Unit that are set by the I/O port quick settings are as follows.

- *Port□ IO-Link Device Configuration Data/Pin4 Communications Mode Setting*
- *Port□ IO-Link Device Configuration Data/Pin2 Communications Mode Setting*
- *Port□ IO-Link Device Configuration Data/Process Data In Length*
- *Port□ IO-Link Device Configuration Data/Process Data Out Length*

The Process Data In Length and Process Data Out Length for each port are set to 20 bytes.
The Pin4 Communications Mode Setting and Pin2 Communications Mode Setting for each port are set as shown in the table below. The meanings of abbreviations used in the table are as follows.

IN: SIO (DI) Mode
OUT: SIO (DO) Mode
IO-Link: IO-Link Mode

		Quick Setting Switch Value									
		0	1	2	3	4	5	6	7	8	9
Port 1	Pin 4	Software settings (I/O port quick settings disabled)	IN	IN	IN	IN	IN	IN	IN	IN	OUT
	Pin 2		IN	IN	IN	IN	IN	IN	IN	IN	OUT
Port 2	Pin 4		OUT	IN	IN	IN	IN	IN	IN	IN	OUT
	Pin 2		OUT	IN	IN	IN	IN	IN	IN	IN	OUT
Port 3	Pin 4		OUT	OUT	IN	IN	IN	IN	IN	IN	OUT
	Pin 2		OUT	OUT	IN	IN	IN	IN	IN	IN	OUT
Port 4	Pin 4		OUT	OUT	OUT	IN	IN	IN	IN	IN	OUT
	Pin 2		OUT	OUT	OUT	IN	IN	IN	IN	IN	OUT
Port 5	Pin 4		OUT	OUT	OUT	OUT	IN	IN	IN	IN	OUT
	Pin 2		OUT	OUT	OUT	OUT	IN	IN	IN	IN	OUT
Port 6	Pin 4		OUT	OUT	OUT	OUT	OUT	IN	IN	IN	OUT
	Pin 2		OUT	OUT	OUT	OUT	OUT	IN	IN	IN	OUT
Port 7	Pin 4		OUT	OUT	OUT	OUT	OUT	OUT	IN	IN	OUT
	Pin 2		OUT	OUT	OUT	OUT	OUT	OUT	IN	IN	OUT
Port 8	Pin 4		OUT	OUT	OUT	OUT	OUT	OUT	OUT	IN	OUT
	Pin 2		OUT	OUT	OUT	OUT	OUT	OUT	OUT	IN	OUT

		Quick Setting Switch Value					
		A	B	C	D	E	F
Port 1	Pin 4	IO-Link	IO-Link	IO-Link	IO-Link	IO-Link	IO-Link
	Pin 2	IN	OUT	IN	OUT	IN	OUT
Port 2	Pin 4	IO-Link	IO-Link	IO-Link	IO-Link	IO-Link	IO-Link
	Pin 2	IN	OUT	IN	OUT	IN	OUT
Port 3	Pin 4	IO-Link	IO-Link	IO-Link	IO-Link	IO-Link	IO-Link
	Pin 2	IN	OUT	IN	OUT	IN	OUT
Port 4	Pin 4	IO-Link	IO-Link	IO-Link	IO-Link	IO-Link	IO-Link
	Pin 2	IN	OUT	IN	OUT	IN	OUT
Port 5	Pin 4	IO-Link	IO-Link	IN	IN	OUT	OUT
	Pin 2	IN	OUT	IN	IN	OUT	OUT
Port 6	Pin 4	IO-Link	IO-Link	IN	IN	OUT	OUT
	Pin 2	IN	OUT	IN	IN	OUT	OUT
Port 7	Pin 4	IO-Link	IO-Link	IN	IN	OUT	OUT
	Pin 2	IN	OUT	IN	IN	OUT	OUT
Port 8	Pin 4	IO-Link	IO-Link	IN	IN	OUT	OUT
	Pin 2	IN	OUT	IN	IN	OUT	OUT

You can read the Quick Setting Switch Value from the following CoE object through SDO communications. Use this method to confirm that the Quick Setting Switch Value is the intended value. It is not possible to change the Quick Setting Switch Value through SDO communications.

Index (hex)	Subindex (hex)	Object name	Size (Data type)	Description
3211	01	Quick Setting Switch Value	1 byte (U8)	Indicates the Quick Setting Switch Value. The data range is 0 to F hex.

Precautions for Correct Use

- If you change the setting of the quick setting switch when the IO-Link Master Unit is operating, the setting change is not reflected in the device parameters of the IO-Link Master Unit set by the Quick Setting Switch Value or I/O port quick settings, and the operating values of the IO-Link Master Unit. After changing the setting of the quick setting switch, cycle the Unit/input power supply so that the setting change of the quick setting switch is reflected.
- If you change the device parameters set by the I/O port quick settings using method a) or b) below when the Quick Setting Switch Value is 1 to F hex, the changed values are saved in the IO-Link Master Unit, but not reflected in the operating values.
  a) Writing the device parameters with the Configuration Software or through SDO communications
  b) Restoring the device parameters of the IO-Link Master Unit
  If you read or back up the device parameter values at this time, the following operation c) or d) occurs.
  c) If you read the device parameters with the Configuration Software or through SDO communications, the changed values are read.
  d) If you back up the device parameters of the IO-Link Master Unit, the changed values are backed up.
  If you change the setting of the quick setting switch to 0 hex in this state and then cycle the Unit/input power supply, the changed values will be the operating values of the IO-Link Master Unit.
- If you set the Quick Setting Switch Value to A to F hex, the Pin4 Communications Mode Setting for the port is set to IO-Link Mode. At this time, set the PDO entry allocated to the IO-Link Input Data and IO-Link Output Data for the port to 20 bytes. If the PDO entry allocated to the IO-Link Input Data and IO-Link Output Data for the port is less than 20 bytes, the PDO Size Shortage bit of the I/O Port Status is TRUE. However, even with the PDO Size Shortage status, the IO-Link Input Data and IO-Link Output Data allocated to the PDO entry will be I/O refreshed normally.

10

Setting Up IO-Link Devices

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

10-1 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 EtherCAT.

- 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 6-12
- *A-3-3 Configuring IO-Link Devices through Message Communications* on page A-52

The following section covers details on setting IO-Link devices with the CX-ConfiguratorFDT.

10-2 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 EtherCAT.

10-2-1 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.

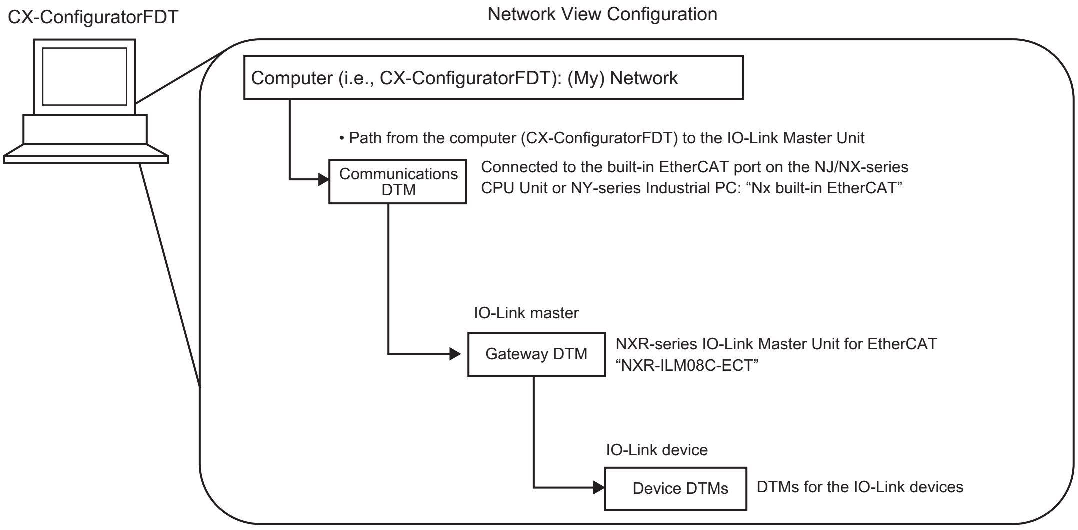
Functions of the CX-ConfiguratorFDT

- 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

You create the network configuration by registering the path to the IO-Link Master Unit, the IO-Link Master Unit, and the IO-Link devices for ports of the IO-Link Master Unit from your computer (i.e., with CX-ConfiguratorFDT).
You create the network configuration by placing the following DTMs (device type managers) in the network configuration.

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

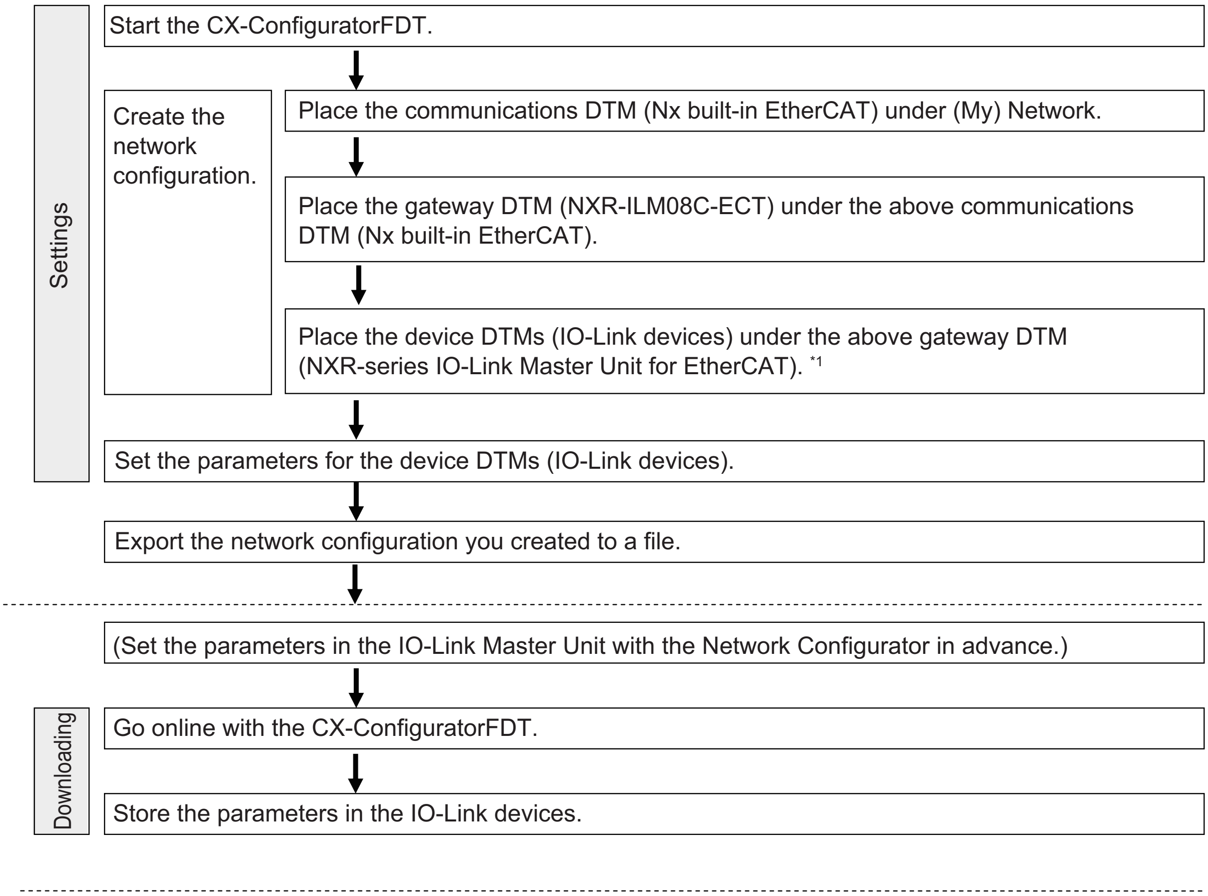


Version Information

You can use the gateway DTM "NXR-ILM08C-ECT" with the CX-ConfiguratorFDT version 3.01 or higher, or CX-ConfiguratorFDT version 2.59 or higher with automatic update as of January 2024 applied.

10-2-2 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.



*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.

10-2-3 Installing the CX-ConfiguratorFDT in Your Computer

If you install the Sysmac Studio or CX-One, the CX-ConfiguratorFDT is installed automatically.
Refer to *A-7 Version Information* on page A-68 for CX-ConfiguratorFDT versions that support the gateway DTM for the NXR-series IO-Link Master Unit for EtherCAT.

10-2-4 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 **Install Device Description Files** or **IODD Finder** from the **Profile Installation** tab page of the **Device** or **Topology** ribbon.

10-2-5 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
  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 **Update Catalog** from the **Device** or **Topology** ribbon.

10-2-6 Creating the Network Configuration

To create a network configuration for the NXR-series IO-Link Master Unit for EtherCAT, 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. Select **Empty project**.
3. Right-click **(My) Network** in the Network View and select **Add**.
   The **Add** dialog box is displayed.
4. Select the communications DTM for **Nx built-in EtherCAT** and click the **OK** button.
   The selected communications DTM is displayed under (My) Network.
5. Right-click **Nx built-in EtherCAT** and select **Add**.
   The **Add** dialog box is displayed.
6. Select the gateway DTM for **NXR-ILM08C-ECT** and click the **OK** button.
   Under (My) Network, **NXR-ILM08C-ECT** is displayed, which is the NXR-series IO-Link Master Unit for EtherCAT.
7. Double-click **NXR-ILM08C-ECT** that is added. Set the EtherCAT station address and click the **OK** button in the Configuration tab page displayed on the right.
8. Right-click **NXR-ILM08C-ECT** and select **Add**.
   The **Add** dialog box is displayed.

9 Select the device DTM for the IO-Link device that you use and click the **OK** button.
The **Select Channel** dialog box is displayed.

10 Select the port on the IO-Link Master Unit to which the IO-Link device is connected and click the **OK** button.
Select any port from **IO-Link Port_1** to **IO-Link Port_8**.

11 Repeat steps 8 to 10 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.

- **Nx built-in EtherCAT**: Connection method settings
- **NXR-ILM08C-ECT**: EtherCAT station address setting

Refer to *10-2-10 Going Online* on page 10-11 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 **Nx built-in EtherCAT** and select **Scan** – **Scan and Create**.
- For the CX-ConfiguratorFDT version lower than 3.0, right-click **Nx built-in EtherCAT** and select **Scan** – **Create Network**.

The downstream network configuration is created automatically.

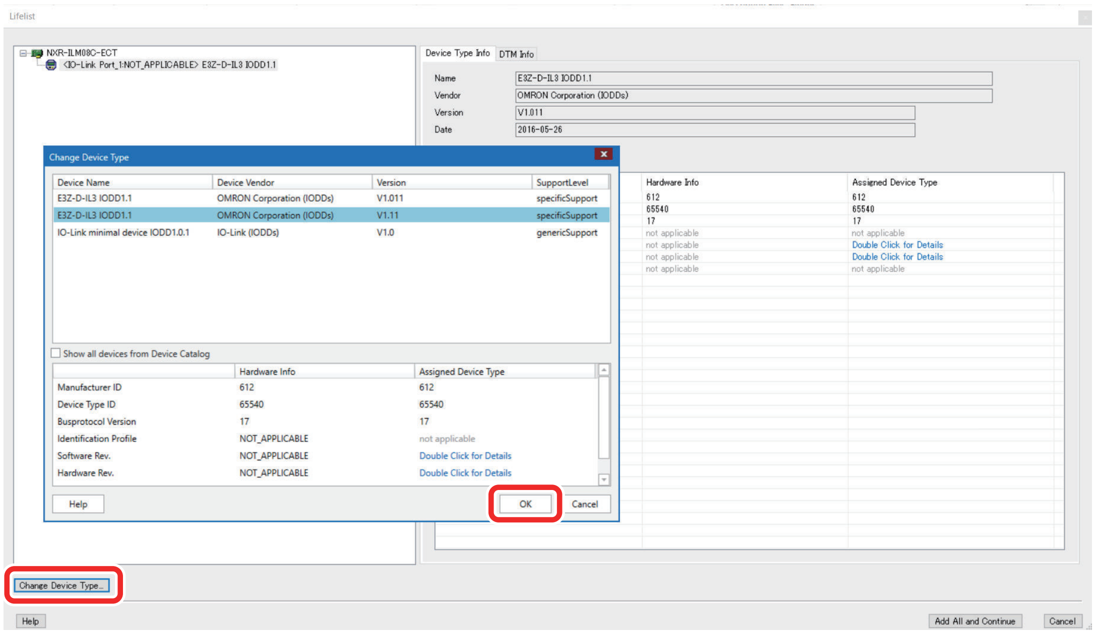
3 Follow the message displayed on the CX-ConfiguratorFDT.

Note You can create only the configuration of NXR-series IO-Link Master Units for EtherCAT connected to the built-in EtherCAT ports of an NJ/NX-series CPU Unit or NY-series Industrial PC. The operation differs depending on the version as follows.

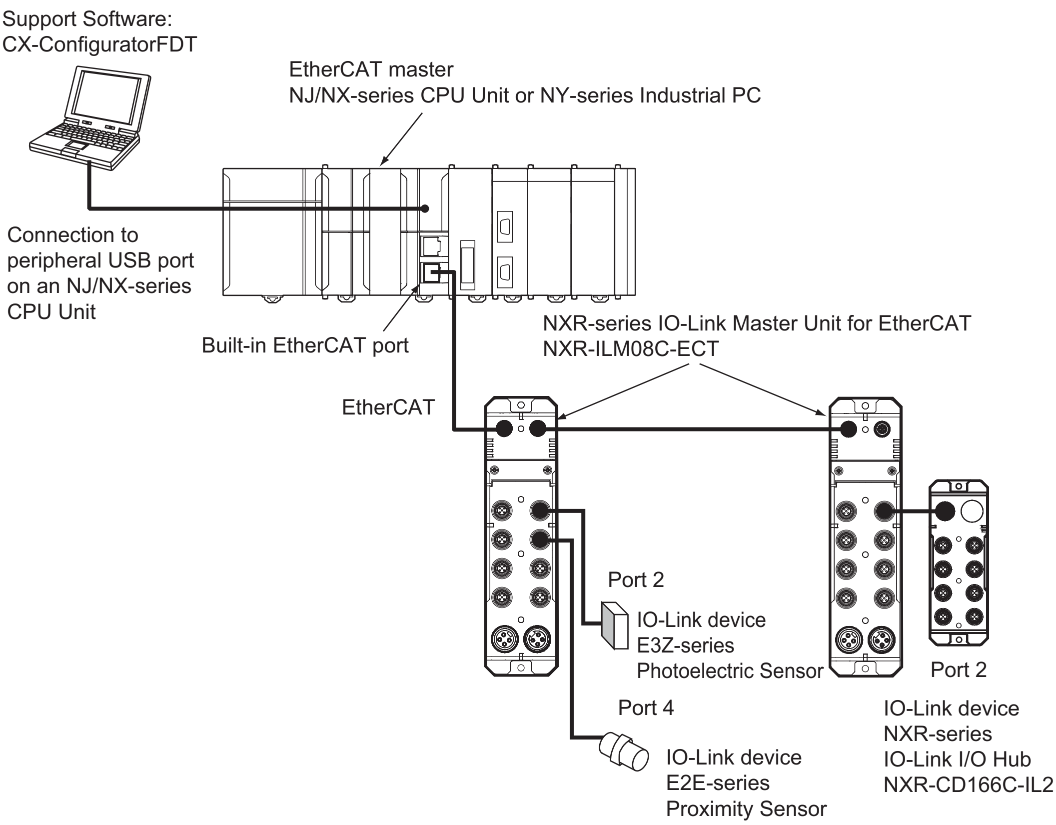
- For the CX-ConfiguratorFDT version 3.0 or higher, right-click **Nx built-in EtherCAT** and select **Scan** – **Scan and Select**.
- For the CX-ConfiguratorFDT version lower than 3.0, right-click **Nx built-in EtherCAT** and select **Scan** – **Life List**.

Additional Information

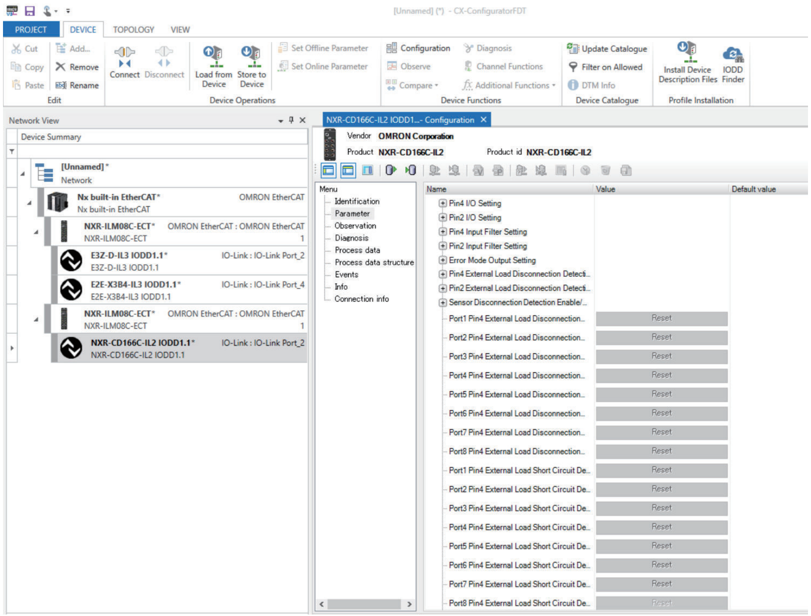
If the IO-Link device that is detected by an automatic network configuration creation has the IODD files with more than one version, you can click the **Change Device Type…** button in the Life List window to change the version of IODD files that are used.
An example of changing the version of the IODD files used by a detected IO-Link device is shown below.
Clicking the **OK** button changes the version from V1.011 to V1.11.



(An example of the EtherCAT network configuration)



For the above system configuration, use the CX-ConfiguratorFDT to create a network configuration as shown below.



10-2-7 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.

10-2-8 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.

10-2-9 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.

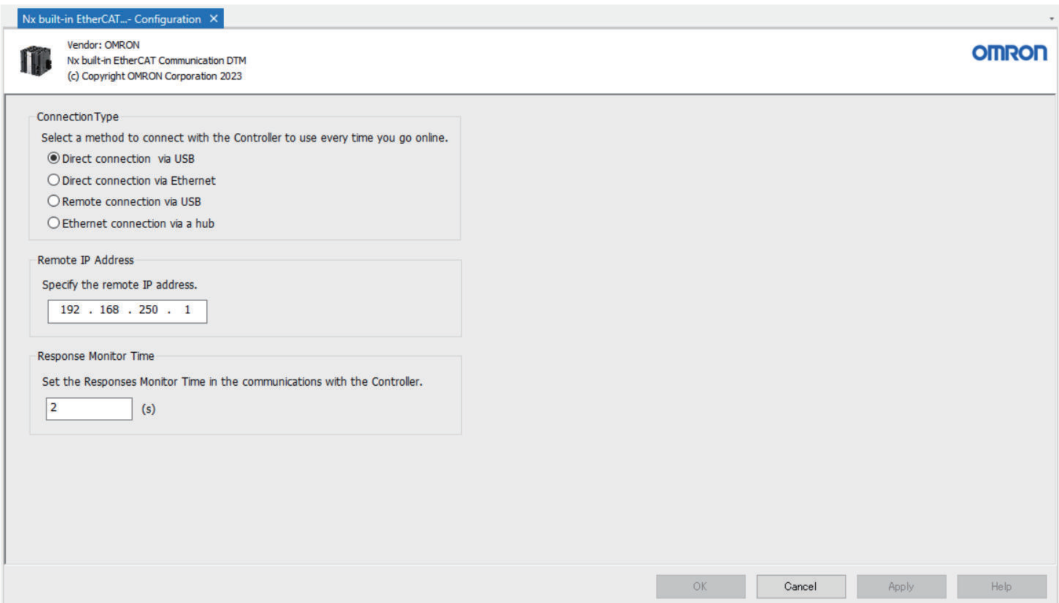
2 Select the file name and click the **Open** button. The exported network configuration is displayed in the Network View.

10-2-10 Going Online

This section describes the settings and procedures to go online with the network when the communications DTM is **Nx built-in EtherCAT**.

Select the Connection Method

1 Right-click the communications DTM and select **Configuration**, or select **Configuration** from the **Device** menu.
The Connection Type dialog box is displayed.



2 Select one of the following four connection methods.

Connection method	Description
Direct connection via USB	The USB port on the computer is connected directly to the peripheral USB port on the Controller.

Connection method	Description
Direct connection via Ethernet	The Ethernet port on the computer is connected directly to the built-in EtherNet/IP port on the Controller.
Remote connection via USB	The USB port on the computer is connected directly to the peripheral USB port on a Controller and then a connection is made through the Ethernet network to the built-in EtherNet/IP port on another Controller.
Ethernet connection via a hub	The Ethernet port on the computer is connected through the Ethernet network to the built-in EtherNet/IP port on a Controller.

3 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 the 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 the 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 Support Software goes online.

Precautions for Correct Use

If the following settings are made on an NJ/NX-series Controller, connection may not be possible through **Direct Connection via Ethernet**, **Remote Connection via USB**, or **Ethernet connection via a Hub**. 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.

10-2-11 Precautions When Transferring All of IO-Link Device Settings

The function differs between CX-ConfiguratorFDT version 3.0 or higher and lower versions.

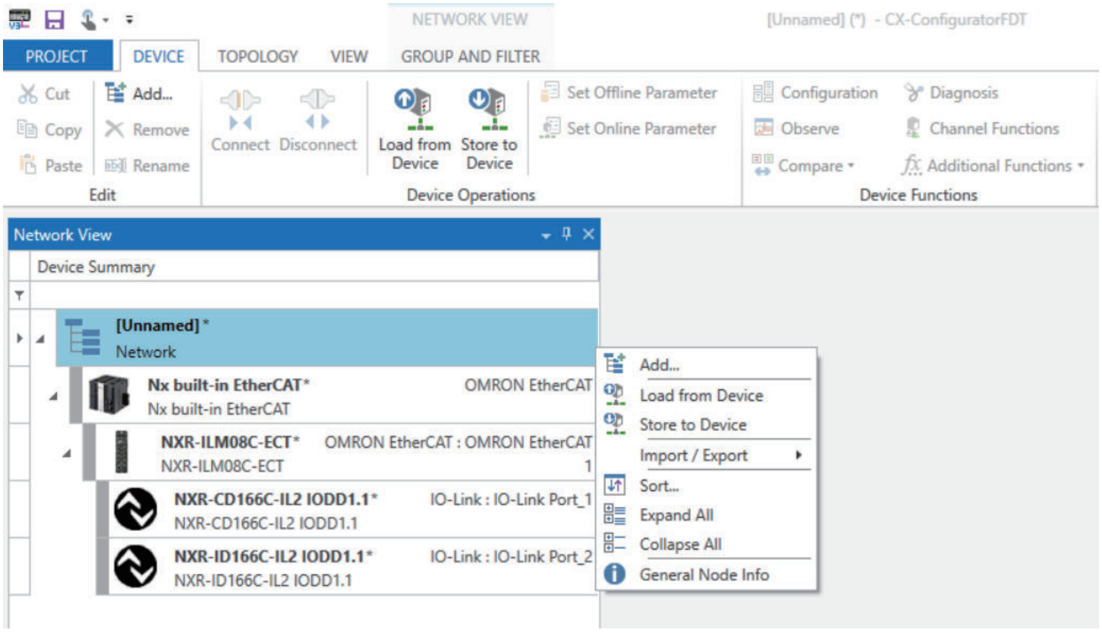
CX-ConfiguratorFDT Version 3.0 or Higher

For the CX-ConfiguratorFDT version 3.0 or higher, 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 (Nx built-in EtherCAT), you can easily create the project file shown below by the following procedure.

- Delete unnecessary devices from a copy of the project file created with the CX-ConfiguratorFDT 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.

10-2-12 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 the EtherCAT master 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.

11

Troubleshooting

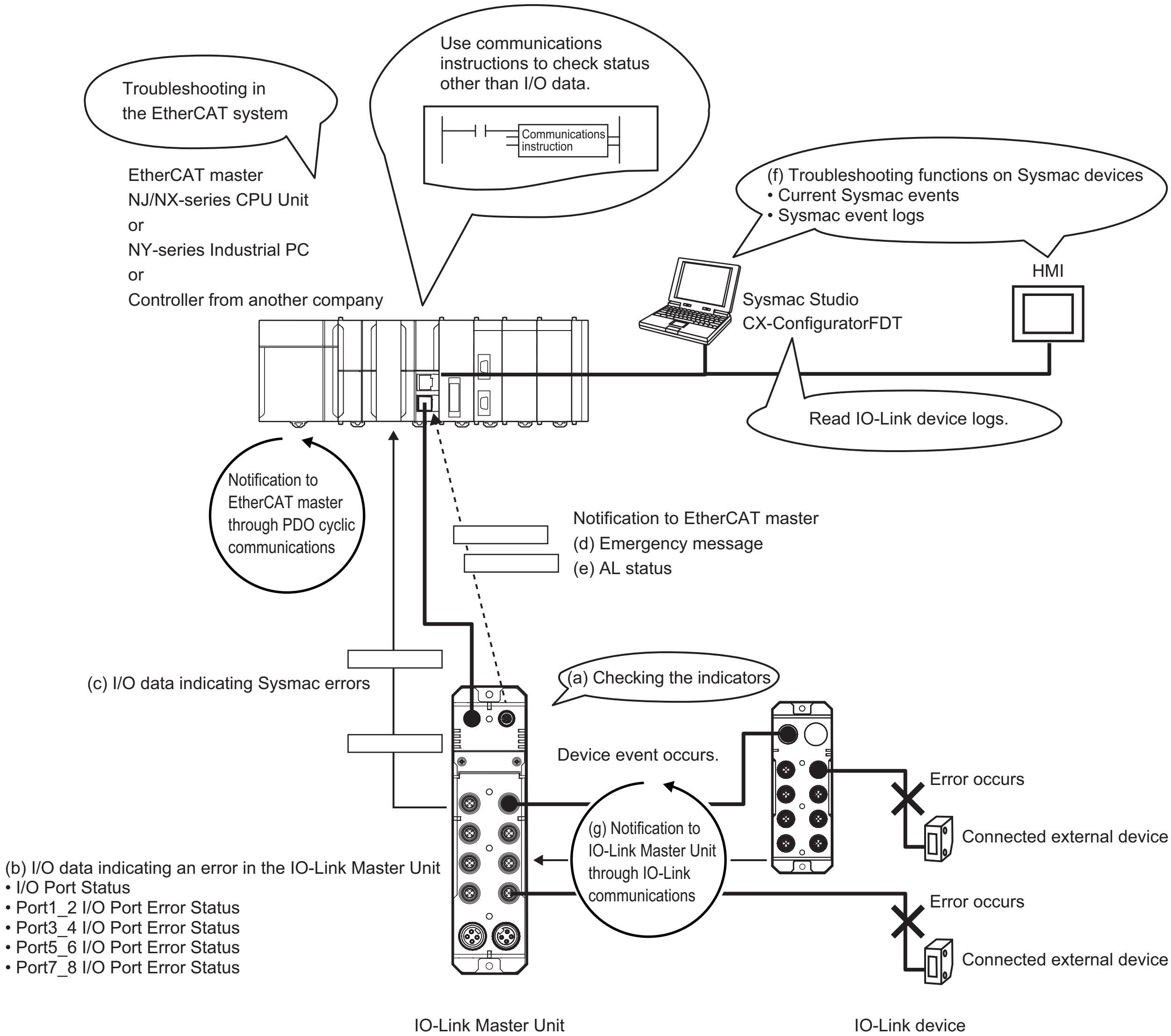
This section describes troubleshooting for the IO-Link Master Unit.

11-1 Checking for Errors

This section describes how an error is notified to you, and what and how you should check for errors.

11-1-1 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.



Letter	Notification method	Checking method	Information to check	Reference
(a)	Notification of IO-Link Master Unit errors by indicators	Visual check of 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 EtherCAT network. I/O indicators show the IO-Link communications status or digital I/O status of each port.	*11-2 Checking for Errors and Troubleshooting with the Indicators* on page 11-6
(b)	Notification of IO-Link Master Unit errors by I/O Port Status and I/O Port Error Status in I/O data	Check of the I/O Port Status and I/O Port Error Status in the I/O data in the IO-Link Master Unit with the user program in the Controller or the Support Software corresponding to the Controller.	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. • *PDO Size Shortage* in *I/O Port Status* • *I/O Port Error* in *I/O Port Status* • *Unit/Input Power Supply Voltage Drop* in *I/O Port Status* • *Output Power Supply Voltage Drop* in *I/O Port Status* • Each bit of *Port1_2 I/O Port Error Status* • Each bit of *Port3_4 I/O Port Error Status* • Each bit of *Port5_6 I/O Port Error Status* • Each bit of *Port7_8 I/O Port Error Status*	*11-3 Checking for Errors with the Status in I/O Data* on page 11-14
(c)	Notification of Sysmac errors in the IO-Link Master Unit by Sysmac Error Status in I/O data	Check of the Sysmac Error Status in the I/O data in the IO-Link Master Unit with the user program in the Controller or the Support Software corresponding to the Controller.	You can check the occurrence and cause of Sysmac errors that occurred in the IO-Link Master Unit with the status in the I/O data. If an error occurs, you can use the Controller to check the occurrence of current errors for each Sysmac Error Status level.	*11-3 Checking for Errors with the Status in I/O Data* on page 11-14
(d)	Notification of EtherCAT application-level errors in the IO-Link Master Unit by emergency messages through SDO communications	Dependent on the specifications of the EtherCAT master. For NJ/NX-series CPU Units or NY-series Industrial PCs, check the errors with the Sysmac Studio or HMI.	You can check the emergency messages received from the IO-Link Master Unit through SDO communications. For NJ/NX-series CPU Units or NY-series Industrial PCs, you can also check the Emergency Message Detected event (Sysmac event code: 64200000 hex).	*11-5 Error Notification through Emergency Messages* on page 11-27
(e)	Notification of errors related to EtherCAT communications in the IO-Link Master Unit by AL status	Dependent on the specifications of the EtherCAT master. For NJ/NX-series CPU Units or NY-series Industrial PCs, check the errors with the Sysmac Studio or HMI.	You can check the AL status received from the IO-Link Master Unit. For NJ/NX-series CPU Units or NY-series Industrial PCs, you can also check the Slave Application Error event (Sysmac event code: 84280000 hex).	*11-6 Error Notifications Based on the AL Status* on page 11-30

Letter	Notification method	Checking method	Information to check	Reference
(f)	Notification of current Sysmac events in the IO-Link Master Unit and the Sysmac event logs by troubleshooting functions on Sysmac devices	Only for NJ/NX-series CPU Units or NY-series Industrial PCs, check the errors with the Sysmac Studio or HMI.	You can check current Sysmac events in the IO-Link Master Unit and the Sysmac event logs with the Sysmac Studio or HMI.	*11-4 Checking for Errors and Troubleshooting with the Troubleshooting Functions* on page 11-15
(g)	Notification of the occurrences of errors in IO-Link devices and information on them by device events	Check of the device events of IO-Link devices in the Configuration tab page for the IO-Link device in the CX-ConfiguratorFDT.	You can check the error-level or warning-level information recorded by IO-Link devices. *1 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 following events recorded by the IO-Link Master Unit. a) Error-level Device Event b) Warning-level Device Event Flag • Read the following I/O data. a) *Port□ Device Error-level Event* or *Port□ Device Warning-level Event* in *Port1_2 I/O Port Error Status*, *Port3_4 I/O Port Error Status*, *Port5_6 I/O Port Error Status*, and *Port7_8 I/O Port Error Status*	*11-8 Checking for Device Events and Troubleshooting IO-Link Devices* on page 11-33

*1. Applicable only to IO-Link devices that support device events.

11-1-2 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 *I/O Port Status* in the I/O data.	*11-2 Checking for Errors and Troubleshooting with the Indicators* on page 11-6 *11-3 Checking for Errors with the Status in I/O Data* on page 11-14

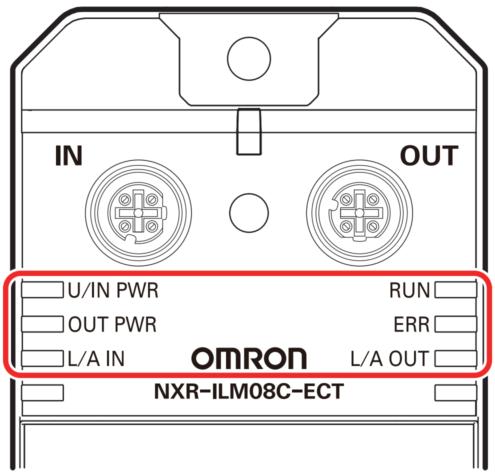
Step	Item	Description	Reference
2	Isolating the error cause	If there is an error, perform the following checks to isolate the cause of the error.	---
		Check the status of each indicator according to *11-2 Checking for Errors and Troubleshooting with the Indicators* on page 11-6.	*11-2 Checking for Errors and Troubleshooting with the Indicators* on page 11-6
		Check the status that indicates an error in the I/O data in the IO-Link Master Unit. • *I/O Port Status* Indicates the source of the error in the IO-Link Master Unit. • *Port1_2 I/O Port Error Status* Indicates the source of the error for port 1 and port 2. • *Port3_4 I/O Port Error Status* Indicates the source of the error for port 3 and port 4. • *Port5_6 I/O Port Error Status* Indicates the source of the error for port 5 and port 6. • *Port7_8 I/O Port Error Status* Indicates the source of the error for port 7 and port 8.	*11-3 Checking for Errors with the Status in I/O Data* on page 11-14
		If you use an NJ/NX/NY-series Controller, check the current errors and the log of past errors with the Sysmac Studio or NA-series HMI.	*11-4 Checking for Errors and Troubleshooting with the Troubleshooting Functions* on page 11-15
		If you use an EtherCAT master from another company, check the emergency messages, AL status, and error logs in the EtherCAT system.	• *11-5 Error Notification through Emergency Messages* on page 11-27 • *11-6 Error Notifications Based on the AL Status* on page 11-30
		Check the device events of IO-Link devices, if any.	*11-8 Checking for Device Events and Troubleshooting IO-Link Devices* on page 11-33
3	Troubleshooting the error	After you isolate the cause of the error, perform troubleshooting.	---

11-2 Checking for Errors and Trouble-shooting with the Indicators

This section describes how to check for errors with the indicators and perform troubleshooting.

11-2-1 Checking for Errors and Troubleshooting with the Status Indicators

Status indicators show the status of the IO-Link Master Unit or EtherCAT network.
The status indicators include the following indicators. The checking and troubleshooting methods with each indicators are described below.



Name	Description	Reference
RUN Indicator	The RUN indicator shows the operating status of EtherCAT communications.	*Checking for Errors and Trouble-shooting with the RUN and ERR Indicators* on page 11-6
ERR Indicator	The ERR indicator provides information on errors as an EtherCAT slave.	
L/A IN Indicator	The L/A IN indicator shows the link activity of the EtherCAT input port.	*Checking for Primary Errors and Troubleshooting with the L/A IN and L/A OUT Indicators* on page 11-8
L/A OUT Indicator	The L/A OUT indicator shows the link activity of the EtherCAT output port.	
U/IN PWR Indicator	This indicator shows the status of the Unit/input power supply.	*Checking for Errors and Trouble-shooting with the U/IN PWR Indicator* on page 11-9
OUT PWR Indicator	This indicator shows the status of the output power supply.	*Checking for Errors and Trouble-shooting with the OUT PWR Indicator* on page 11-9

Checking for Errors and Troubleshooting with the RUN and ERR Indicators

The following abbreviations are used to describe the status of the indicators.

Abbrev.	Indicator status
B	Blinking
SF	Single flash
DF	Double flash
---	Undefined

RUN	ERR	Cause	Description	Correction
Green	Red			
Not lit	Lit	Unit Processing Error	A fatal error occurred in the Unit.	Cycle the power supply. If the error still occurs, replace the Unit.
Not lit	B	Slave Unit Verification Error	An error occurred in Slave Unit verification.	Replace the Unit.
Not lit	B	Mailbox Setting Error	An incorrect mailbox setting was detected for the Sync Manager.	You can clear the error by executing Reset EtherCAT Error. To correct this error permanently, correct the mailbox setting in the EtherCAT master.
B	B	RxPDO Setting Error	An RxPDO Setting Error was detected.	You can clear the error by executing Reset EtherCAT Error. To correct this error permanently, correct the RxPDO in the EtherCAT master.
B	B	TxPDO Setting Error	A TxPDO Setting Error was detected.	You can clear the error by executing Reset EtherCAT Error. To correct this error permanently, correct the TxPDO in the EtherCAT master.
B	B	PDO WDT Setting Error	An incorrect PDO WDT setting was detected.	You can clear the error by executing Reset EtherCAT Error. To correct this error permanently, correct the setting in the EtherCAT master.
B	B	SM Event Mode Setting Error	An unsupported SM Event Mode was set.	You can clear the error by executing Reset EtherCAT Error. To correct this error permanently, correct the setting in the EtherCAT master.
B	B	TxPDO Mapping Error	An incorrect TxPDO was set.	You can clear the error by executing Reset EtherCAT Error. To correct this error permanently, correct the setting in the EtherCAT master.
B	B	RxPDO Mapping Error	An incorrect RxPDO was set.	You can clear the error by executing Reset EtherCAT Error. To correct this error permanently, correct the setting in the EtherCAT master.
---	B	Illegal State Transition Request Received	An incorrect state transition request was received.	You can clear the error by executing Reset EtherCAT Error. Review the EtherCAT master settings.
---	B	Error State Transition Received	An unclear state transition was received.	You can clear the error by executing Reset EtherCAT Error. Review the EtherCAT master settings.

RUN	ERR	Cause	Description	Correction
Green	Red			
SF	DF	Process Data WDT Error	Process data communications were stopped for more than the specified period of time.	You can clear the error by executing Reset EtherCAT Error. • Check the EtherCAT master status and the communications cable, and eliminate the cause of the error. • Check the operation of the EtherCAT master and take appropriate measures if there is a problem.
---	Lit	PDI Watchdog Timeout	A PDI Watchdog Timeout was detected.	Cycle the power supply. If the error still occurs, replace the Unit.
---	---	Non-volatile Memory Hardware Error	An error occurred in non-volatile memory.	Replace the Unit.
---	B	Non-volatile Memory Checksum Error	An error occurred in the control parameters.	Return the control parameters to their default settings.

Checking for Primary Errors and Troubleshooting with the L/A IN and L/A OUT Indicators

L/A IN L/A OUT	Unit status	Cause	Correction
Green			
Lit	A link is established.	---	(The 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.	No link is established in the physical layer.	Check the following items and restart the Unit according to the specifications of the connected EtherCAT master. • 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.
		The EtherCAT master is not started.	Make sure that the EtherCAT master is operating correctly. If you use an NJ/NX-series CPU Unit or NY-series Industrial PC as the EtherCAT master, check the mode of the EtherCAT master and the node address of the Unit. If you use an EtherCAT master from another company, refer to the instruction manual for the product.
		A hardware failure occurred.	If the problem persists even after you take the above corrective measures, the Unit may have a hardware failure. Replace the Unit.

Checking for Errors and Troubleshooting with the U/IN PWR Indicator

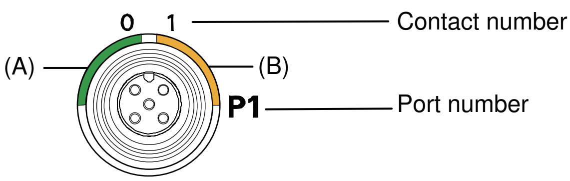
U/IN PWR Green	Unit status	Cause	Correction
Lit	Unit/input power supply provided	The Unit/input power is supplied.	(This is the normal status.)
Not lit	No Unit/input power supply	The Unit/input power is not supplied, or is insufficient.	Check the following items and make sure that power is correctly 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.

11-2-2 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 11-10
(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 11-13

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 11-10.
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 *9-13 IO-Link Total Communications Lost Frames* on page 9-29.) • Make sure that the set value of the IO-Link communications delay time is appropriate. (Refer to *9-16 IO-Link Communications Delay Time Settings* on page 9-44.) 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 11-13.
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.

11-3 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.

11-3-1 Checking for Errors in the IO-Link Master Unit

You can check the status in the I/O 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
I/O Port Status	Indicates that some error occurred in the IO-Link Master Unit or I/O ports. Check the following information to determine what error occurred.
Port1_2 I/O Port Error Status	Identifies the cause of the error that occurred in port 1 and port 2.
Port3_4 I/O Port Error Status	Identifies the cause of the error that occurred in port 3 and port 4.
Port5_6 I/O Port Error Status	Identifies the cause of the error that occurred in port 5 and port 6.
Port7_8 I/O Port Error Status	Identifies the cause of the error that occurred in port 7 and port 8.

From the user program, etc., access the above values in the I/O data.
Refer to *7-3-3 Details of PDO Entries* on page 7-9 for details on I/O data.

You can also check these status values by reading the CoE objects through SDO communications.
Refer to *A-1-8 Manufacturer-specific Object 2* on page A-23 for information on CoE objects.

11-3-2 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.

11-4 Checking for Errors and Troubleshooting with the Troubleshooting Functions

Error management on the IO-Link Master Unit is based on the methods used for the NJ/NX/NY-series Controllers.
You can use the Support Software or NA-series HMI to check the meanings of errors and the troubleshooting procedures.

11-4-1 How to Check for Errors

Checking for Errors from the Sysmac Studio

When an error occurs, you can place the Sysmac Studio online to the CPU Unit to check current errors and the log of past errors.
Refer to the user's manual for the CPU Unit which is connected online for information on checking errors.

Checking for Errors from the NA-series HMI

You can check current errors and the log of past errors on the Troubleshooter screen with the NA-series HMI connected to the built-in EtherNet/IP port of the CPU Unit.
Refer to *Identifying and Resetting Errors with an HMI* in the *NJ/NX-series Troubleshooting Manual (Cat. No. W503)* for the procedure to check for errors using the HMI.

Additional Information

The Troubleshooter screen is installed on the NA-series HMI by default. Drawing and other works are not required at all.

11-4-2 Number of Errors That Can Be Checked

Current Errors

The following table shows the number of simultaneous notifications of current errors that the IO-Link Master Unit can send.

Event level	Number of simultaneous notifications	Applicable CoE object
Minor fault	32 errors	Sysmac Minor Fault (2004 hex)
Observation	32 errors	Sysmac Observation (2003 hex)

If the number of errors that occur simultaneously exceeds the maximum number of simultaneous notifications of current errors that the IO-Link Master Unit can send, the notifications are sent with a priority given to the oldest and highest-level errors. Errors that exceed the number of simultaneous notifications are not sent. Errors that are not sent are also reflected as errors in the error status.

Log of Past Errors

The following table shows the number of past errors that can be recorded by the IO-Link Master Unit.

Log category	Event level	Recordable number of errors	Applicable CoE object
System event log	Minor fault	64 errors total	Diagnosis History (10F3 hex)
	Observation		
	Information		

When the number of past errors exceeds the recordable number of errors for the IO-Link Master Unit, the Unit overwrites the old error for recording.

11-4-3 Error Table

This section provides a table of the errors (events) that can occur in the IO-Link Master Unit.

The following abbreviations are used in the event level column.

Abbreviation	Name
Maj	Major fault level
Prt	Partial fault level
Min	Minor fault level
Obs	Observation
Info	Information

Symbol	Meaning
○	Event levels that are defined by the system.
☉	Event levels that can be changed by the user.

Note ☉ appears only for events for which the user can change the event level.

Refer to the troubleshooting manual for the connected CPU Unit or Industrial PC for all NJ/NX/NY-series event codes.

Event code	Event name	Meaning	Assumed cause	Level					Reference
				Maj	Prt	Min	Obs	Info	
04A10000 hex	Non-volatile Memory Hardware Error	An error occurred in non-volatile memory.	• Non-volatile memory failure • Noise				○		page 11-20

Event code	Event name	Meaning	Assumed cause	Level					Reference
				Maj	Prt	Min	Obs	Info	
14A00000 hex	Non-volatile Memory Checksum Error	An error occurred in the control parameters.	Noise			○			page 11-20
847C0000 hex	Device Configuration Verification Error	The connected device is different from the IO-Link device registered for a port of the IO-Link Master.	The connected device is different from the IO-Link device registered for a port of the IO-Link Master.			○			page 11-21
84840000 hex	I/O Cable Short-circuit	There is a short-circuit in the cable that connects the IO-Link master and device.	There is a short-circuit in the I/O cable. An IO-Link device has failed.			○			page 11-22
84A00000 hex	Slave Unit Verification Error	An error occurred in Slave Unit verification.	An error occurred in the control board.			○			page 11-23
84790000 hex	Error-level Device Event	An error-level event occurred in the IO-Link device.	Use CX-ConfiguratorFDT to confirm the IO-Link event code of the IO-Link device.				○		page 11-24
847A0000 hex	IO-Link Communications Error	An error occurred in IO-Link communications with a device.	• The I/O cable is broken. Or, the IO-Link device is disconnected from the port. • An IO-Link device has failed. • The communications are affected by noise.				○		page 11-25
84860000 hex	Warning-level Device Event Flag	A warning-level event occurred in the IO-Link device.	Use CX-ConfiguratorFDT to confirm the IO-Link event code of the IO-Link device.				○		page 11-26
84820000 hex	IO-Link Device Configuration Information Created	IO-Link device configuration information was created.	IO-Link device configuration information was created.					○	page 11-26

11-4-4 Error Descriptions

This section describes the information that is given for individual errors.

How to Read Controller Error Descriptions

The items that are used to describe individual errors (events) are described in the following copy of an error table.

<table>
<tr><td>Event name</td><td colspan="3">Gives the name of the error.</td><td>Event code</td><td colspan="2">Gives the code of the error.</td></tr>
<tr><td>Meaning</td><td colspan="6">Gives a short description of the error.</td></tr>
<tr><td>Source</td><td colspan="2">Gives the source of the error.</td><td>Source details</td><td>Gives details on the source of the error.</td><td>Detection timing</td><td>Tells when the error is detected.</td></tr>
<tr><td rowspan="2">Error attributes</td><td>Level</td><td colspan="2">Tells the level of influence on control. *1</td><td>Log category</td><td colspan="2">Tells which log the error is saved in. *2</td></tr>
<tr><td>Recovery</td><td colspan="5">Gives the recovery method. *3</td></tr>
<tr><td>Effects</td><td>User program</td><td>Tells what will happen to execution of the user program. *4</td><td>Operation</td><td colspan="3">Provides special information on the operation that results from the error.</td></tr>
<tr><td>Indicators</td><td colspan="6">Gives the status of the built-in EtherNet/IP port and built-in EtherCAT port indicators. Indicator status is given only for errors in the EtherCAT Master Function Module and the EtherNet/IP Function Module.</td></tr>
<tr><td rowspan="2">System-defined variables</td><td colspan="2">Variable</td><td colspan="2">Data type</td><td colspan="2">Name</td></tr>
<tr><td colspan="6">Lists the variable names, data types, and meanings for system-defined variables that provide direct error notification, that are directly affected by the error, or that contain settings that cause the error.</td></tr>
<tr><td rowspan="2">Cause and correction</td><td colspan="2">Assumed cause</td><td colspan="2">Correction</td><td colspan="2">Prevention</td></tr>
<tr><td colspan="6">Lists the possible causes, corrections, and preventive measures for the error.</td></tr>
<tr><td>Attached information</td><td colspan="6">This is the attached information that is displayed by the Support Software or an HMI. *5, *6</td></tr>
<tr><td>Precautions/ Remarks</td><td colspan="6">Provides precautions, restrictions, and supplemental information. If the user can set the event level, the event levels that can be set, the recovery method, operational information, and other information are also provided.</td></tr>
</table>

*1. One of the following:
- Major fault: Major fault level
- Partial fault: Partial fault level
- Minor fault: Minor fault level
- Observation
- Information

*2. One of the following:
- System: System event log
- Access: Access event log

*3. One of the following:
- Automatic recovery: Normal status is restored automatically when the cause of the error is removed.
- Error reset: Normal status is restored when the error is reset after the cause of the error is removed.
- Cycle the power supply: Normal status is restored when the power supply to the Controller is turned OFF and then back ON after the cause of the error is removed.
- Controller reset: Normal status is restored when the Controller is reset after the cause of the error is removed.
- Depends on cause: The recovery method depends on the cause of the error.

*4. One of the following:
  - Continues: Execution of the user program will continue.
  - Stops: Execution of the user program stops.
  - Starts: Execution of the user program starts.

*5. “System information” indicates internal system information that is used by OMRON.

*6. Refer to the appendices of the troubleshooting manual for the connected CPU Unit or Industrial PC for the applicable range of the HMI Troubleshooter.

Error Descriptions

Event name	Non-volatile Memory Hardware Error			**Event code**	04A10000 hex	
Meaning	An error occurred in non-volatile memory.					
Source	EtherCAT Master Function Module		**Source details**	Slave	**Detection timing**	Continuously
Error attributes	**Level**	Observation		**Log category**	System	
	Recovery	---				
Effects	**User program**	Continues.	**Operation**	Writing to non-volatile memory will not be possible.		
Indicators	**EtherCAT NET RUN**		**EtherCAT NET ERR**		**EtherCAT LINK/ACT**	
	---		---		---	
System-defined variables	**Variable**		**Data type**		**Name**	
	None		---		---	
Cause and correction	**Assumed cause**		**Correction**		**Prevention**	
	• Non-volatile memory failure • Noise		Use the Configuration Software or SDO communications to initialize the non-volatile memory, and then restart the slave.		Implement noise countermeasures.	
Attached information	None					
Precautions/ Remarks	The emergency error code is 5530 hex.					

Event name	Non-volatile Memory Checksum Error			**Event code**	14A00000 hex	
Meaning	An error occurred in the control parameters.					
Source	EtherCAT Master Function Module		**Source details**	Slave	**Detection timing**	When establishing communications after turning ON power to the Slave Unit
Error attributes	**Level**	Minor fault		**Log category**	System	
	Recovery	Error reset (after cycling Slave Unit power)				
Effects	**User program**	Continues.	**Operation**	The Slave Unit's I/O communications stop and the outputs turn OFF.		
Indicators	**EtherCAT NET RUN**		**EtherCAT NET ERR**		**EtherCAT LINK/ACT**	
	---		Flashes at 1-s intervals.		---	
System-defined variables	**Variable**		**Data type**		**Name**	
	None		---		---	
Cause and correction	**Assumed cause**		**Correction**		**Prevention**	
	Noise		Use the Configuration Software or SDO communications to initialize the non-volatile memory, and then restart the slave.		Implement noise countermeasures.	
Attached information	None					
Precautions/ Remarks	The emergency error code is 6330 hex.					

Event name	Device Configuration Verification Error			Event code	847C0000 hex	
Meaning	The connected device is different from the IO-Link device registered for a port of the IO-Link Master.					
Source	EtherCAT Master Function Module		Source details	Slave	Detection timing	When an IO-Link device is connected
Error attributes	Level	Minor fault		Log category	System	
	Recovery	Reset error				
Effects	User program	Continues.	Operation	Operation will continue. In the port with the error, cyclic communications with the IO-Link device are not correct.		
System-defined variables	Variable		Data type		Name	
	None		---		---	
Cause and correction	Assumed cause		Correction		Prevention	
	The connected device is different from the IO-Link device registered for a port of the IO-Link Master.		Connect the IO-Link device registered for the port of the IO-Link Master.		Connect the IO-Link device registered for the port of the IO-Link Master.	
Attached information	Attached information 1: Port where error occurred 1 hex: Port 1 2 hex: Port 2 3 hex: Port 3 4 hex: Port 4 5 hex: Port 5 6 hex: Port 6 7 hex: Port 7 8 hex: Port 8					
Precautions/ Remarks	The emergency error code is FF2☐ hex. **Note** ☐ represents port number 1 to 8.					

<table>
<tr><td>Event name</td><td colspan="3">I/O Cable Short-circuit</td><td>Event code</td><td colspan="2">84840000 hex</td></tr>
<tr><td>Meaning</td><td colspan="6">There is a short-circuit in the cable that connects the IO-Link master and device.</td></tr>
<tr><td>Source</td><td colspan="2">EtherCAT Master Function Module</td><td>Source details</td><td>Slave</td><td>Detection timing</td><td>Continuously</td></tr>
<tr><td rowspan="2">Error attributes</td><td>Level</td><td colspan="2">Minor fault</td><td>Log category</td><td colspan="2">System</td></tr>
<tr><td>Recovery</td><td colspan="5">Reset error</td></tr>
<tr><td>Effects</td><td>User program</td><td>Continues.</td><td>Operation</td><td colspan="3">Operation will continue.
In the port with the error, cyclic communications with the IO-Link device are not correct.</td></tr>
<tr><td rowspan="2">System-defined variables</td><td colspan="2">Variable</td><td colspan="2">Data type</td><td colspan="2">Name</td></tr>
<tr><td colspan="2">None</td><td colspan="2">---</td><td colspan="2">---</td></tr>
<tr><td rowspan="3">Cause and correction</td><td colspan="2">Assumed cause</td><td colspan="2">Correction</td><td colspan="2">Prevention</td></tr>
<tr><td colspan="2">There is a short-circuit in the I/O cable.</td><td colspan="2">Check to see if there is a short-circuit in the I/O cable. If there is a short-circuit, replace the cable.</td><td colspan="2">None</td></tr>
<tr><td colspan="2">An IO-Link device has failed.</td><td colspan="2">Replace the IO-Link device.</td><td colspan="2">None</td></tr>
<tr><td>Attached information</td><td colspan="6">Attached information 1: Port where error occurred
1 hex: Port 1
2 hex: Port 2
3 hex: Port 3
4 hex: Port 4
5 hex: Port 5
6 hex: Port 6
7 hex: Port 7
8 hex: Port 8</td></tr>
<tr><td>Precautions/ Remarks</td><td colspan="6">The emergency error code is FF4□ hex.
Note □ represents port number 1 to 8.</td></tr>
</table>

Event name	Slave Unit Verification Error			**Event code**	84A00000 hex	
Meaning	An SII verification error occurred.					
Source	EtherCAT Master Function Module		**Source details**	Slave	**Detection timing**	When establishing communications after turning ON power to the Slave Unit
Error attributes	**Level**	Minor fault		**Log category**	System	
	Recovery	Error reset (after cycling Slave Unit power)				
Effects	**User program**	Continues.	**Operation**	A slave with an error cannot enter Pre-operational state.		
Indicators	**EtherCAT NET RUN**		**EtherCAT NET ERR**		**EtherCAT LINK/ACT**	
	---		---		---	
System-defined variables	**Variable**		**Data type**		**Name**	
	None		---		---	
Cause and correction	**Assumed cause**		**Correction**		**Prevention**	
	An error occurred in the control board.		If cycling the power supply does not correct the problem, replace the Slave Unit.		None	
Attached information	None					
Precautions/ Remarks	The AL-Status Code is 0014 hex.					

Event name	Error-level Device Event			**Event code**	84790000 hex	
Meaning	An error-level event occurred in the IO-Link device.					
Source	EtherCAT Master Function Module		**Source details**	Slave	**Detection timing**	Continuously
Error attributes	**Level**	Observation		**Log category**	System	
	Recovery	Reset error. If the error cannot be recovered, cycle the power supply to the slave because the error is continued in the IO-Link device.				
Effects	**User program**	Continues.	**Operation**	Operation will continue. It is possible that the data received from the IO-Link device is not correct.		
System-defined variables	**Variable**		**Data type**		**Name**	
	None		---		---	
Cause and correction	**Assumed cause**		**Correction**		**Prevention**	
	Use CX-ConfiguratorFDT to confirm the IO-Link event code of the IO-Link device.		Check the correction from the IO-Link event code of the IO-Link device.		Check the prevention measures from the IO-Link event code of the IO-Link device.	
Attached information	Attached information 1: Port where error occurred 1 hex: Port 1 2 hex: Port 2 3 hex: Port 3 4 hex: Port 4 5 hex: Port 5 6 hex: Port 6 7 hex: Port 7 8 hex: Port 8					
Precautions/ Remarks	The emergency error code is FF6☐ hex. **Note** ☐ represents port number 1 to 8.					

<table>
<tr><td>Event name</td><td colspan="3">IO-Link Communications Error</td><td>Event code</td><td colspan="2">847A0000 hex</td></tr>
<tr><td>Meaning</td><td colspan="6">An error occurred in IO-Link communications with a device.</td></tr>
<tr><td>Source</td><td colspan="2">EtherCAT Master Function Module</td><td>Source details</td><td>Slave</td><td>Detection timing</td><td>Continuously</td></tr>
<tr><td rowspan="2">Error attributes</td><td>Level</td><td colspan="2">Observation</td><td>Log category</td><td colspan="2">System</td></tr>
<tr><td>Recovery</td><td colspan="5">Reset error</td></tr>
<tr><td>Effects</td><td>User program</td><td>Continues.</td><td>Operation</td><td colspan="3">Operation will continue.
It is possible that the data received from the IO-Link device is not correct.</td></tr>
<tr><td rowspan="2">System-defined variables</td><td colspan="2">Variable</td><td colspan="2">Data type</td><td colspan="2">Name</td></tr>
<tr><td colspan="2">None</td><td colspan="2">---</td><td colspan="2">---</td></tr>
<tr><td rowspan="4">Cause and correction</td><td colspan="2">Assumed cause</td><td colspan="2">Correction</td><td colspan="2">Prevention</td></tr>
<tr><td colspan="2">The I/O cable is broken. Or, the IO-Link device is disconnected from the port.</td><td colspan="2">Check the I/O cable to see if it is broken. If the cable is broken, replace it.
Or, connect the IO-Link device to the port.</td><td colspan="2">None</td></tr>
<tr><td colspan="2">An IO-Link device has failed.</td><td colspan="2">Replace the IO-Link device.</td><td colspan="2">None</td></tr>
<tr><td colspan="2">The communications are affected by noise.</td><td colspan="2">Implement noise countermeasures.</td><td colspan="2">Implement noise countermeasures.</td></tr>
<tr><td>Attached information</td><td colspan="6">Attached information 1: Port where error occurred
1 hex: Port 1
2 hex: Port 2
3 hex: Port 3
4 hex: Port 4
5 hex: Port 5
6 hex: Port 6
7 hex: Port 7
8 hex: Port 8</td></tr>
<tr><td>Precautions/ Remarks</td><td colspan="6">The emergency error code is FF0☐ hex.
Note ☐ represents port number 1 to 8.</td></tr>
</table>

Event name	Warning-level Device Event Flag			Event code	84860000 hex	
Meaning	A warning-level event occurred in the IO-Link device.					
Source	EtherCAT Master Function Module		Source details	Slave	Detection timing	Continuously
Error attributes	Level	Observation		Log category	System	
	Recovery	Reset error. If the error cannot be recovered, cycle the power supply to the slave because the error is continued in the IO-Link device.				
Effects	User program	Continues.	Operation	Operation will continue. It is possible that the data received from the IO-Link device is not correct.		
System-defined variables	Variable		Data type		Name	
	None		---		---	
Cause and correction	Assumed cause		Correction		Prevention	
	Use CX-ConfiguratorFDT to confirm the IO-Link event code of the IO-Link device.		Check the correction from the IO-Link event code of the IO-Link device.		Check the prevention measures from the IO-Link event code of the IO-Link device.	
Attached information	Attached information 1: Port where error occurred 1 hex: Port 1 2 hex: Port 2 3 hex: Port 3 4 hex: Port 4 5 hex: Port 5 6 hex: Port 6 7 hex: Port 7 8 hex: Port 8					
Precautions/ Remarks	None					

Event name	IO-Link Device Configuration Information Created			Event code	84820000 hex	
Meaning	IO-Link device configuration information was created.					
Source	EtherCAT Master Function Module		Source details	Slave	Detection timing	Continuously
Error attributes	Level	Information		Log category	System	
	Recovery	---				
Effects	User program	Continues.	Operation	Not affected.		
System-defined variables	Variable		Data type		Name	
	None		---		---	
Cause and correction	Assumed cause		Correction		Prevention	
	IO-Link device configuration information was created.		---		---	
Attached information	None					
Precautions/ Remarks	None					

11-5 Error Notification through Emergency Messages

If an EtherCAT slave error occurs, you can send messages from the slave to the master using slave-initiated communications.

11-5-1 What Is an Emergency Message?

An emergency message is a message that is sent from the slave using SDO communications when an application-level error occurs in the EtherCAT slave.
In an IO-Link System, you can send an emergency message if this error occurs in an IO-Link device, such as an IO-Link communications error.
The IO-Link Master Unit sends an emergency message to the EtherCAT master when it detects the error.
Every time the Unit power supply is turned ON, the IO-Link Master Unit is started with emergency message communications enabled.
Emergency messages cannot be sent while there is an EtherCAT communications error.

11-5-2 Emergency Message Detected Event

If an NJ/NX-series CPU Unit or NY-series Industrial PC detects that an emergency message was sent from the IO-Link Master Unit, an Emergency Message Detected event (Sysmac event code: 64200000 hex) occurs.
If this event occurs, you can place the Sysmac Studio online with the NJ/NX-series CPU Unit or NY-series Industrial PC and check the emergency message (including the emergency error code) in attached information 1 to attached information 3 in the Emergency Message Detected event in the Troubleshooting dialog box.
If an Emergency Message Detected event occurs, the *_EC_SlavEmergErr* system-defined variable (Emergency Message Detected) changes to TRUE. Therefore, you can use the user program to check whether the slave has sent an emergency message.

11-5-3 Contents of Emergency Messages

An emergency message is composed of 8-byte data as shown below.

Byte	0	1	2	3	4	5	6	7
Contents	Emergency error code		Reserved		Sysmac event code			

11-5-4 List of Emergency Error Codes

The following table lists the emergency error codes that are used by the IO-Link Master Unit, and the corrections for the errors.

Emergency error code (hex)	Error name	Description	Error log record	Notification to EtherCAT master	Correction
5530	Non-volatile Memory Hardware Error	A timeout was detected when data is written to non-volatile memory during EtherCAT communications.	Saved.	Can be notified.	Write the data again.
6330	Non-volatile Memory Checksum Error	An error occurred in the data in non-volatile memory of the slave.	Saved.	Can be notified.	There is an error in the data in non-volatile memory. Use the Configuration Software or SDO communications to initialize the non-volatile memory, and then restart the slave. (Applicable index: 1011 hex (Restore Default Parameters))
FF01 to FF08 (corresponding to port 1 to port 8)	IO-Link Communications Error	A fatal error occurred in IO-Link communications.	Saved.	Can be notified.	Check the I/O cable to see if it is broken. Or Replace the IO-Link device. Or Implement noise countermeasures. Or Replace the IO-Link Master Unit.
FF21 to FF28 (corresponding to port 1 to port 8)	Device Configuration Verification Error	The connected IO-Link device does not match the configuration settings.	Saved.	Can be notified.	Connect the IO-Link device registered for the port of the IO-Link master.
FF41 to FF48 (corresponding to port 1 to port 8)	I/O Cable Short-circuit	A short-circuit error occurred in the I/O cable.	Saved.	Can be notified.	Check the I/O cable to see if it is short-circuited. Or Replace the IO-Link device.
FF61 to FF68 (corresponding to port 1 to port 8)	Device Event	An error-level event notification was received from an IO-Link device.	Saved.	Can be notified.	Check the IO-Link event code from the IO-Link device from the CX-ConfiguratorFDT, and refer to the manual for the IO-Link device to perform troubleshooting.

You can isolate the causes of errors from the emergency error codes.
Emergency messages cannot be sent while there is an EtherCAT communications error.
Refer to the *11-4-3 Error Table* on page 11-16 for Sysmac event codes.

11-5-5 Emergency Message Error Log and How to Read It

A log of the errors that were reported with emergency messages is saved in the following location. You can read the saved emergency messages with SDO communications instructions.

Type	Save location of error log	Number of messages saved
IO-Link master	Non-volatile memory of IO-Link master	Maximum of 64 messages

SDO communications instructions read subindexes 06 hex to 45 hex (Diagnosis Message 1 to 64) of index 10F3 hex (Diagnostic History).

Emergency messages are saved sequentially in the error log starting from Newest Message (10F3:02) to Diagnosis Message 64, and the next emergency message is saved by returning to Diagnosis Message 1. Even if an emergency message cannot be sent to the EtherCAT master, it is still saved in the error log. Errors related to non-volatile memory are not saved in the error log.

11-6 Error Notifications Based on the AL Status

For an IO-Link Master Unit, the EtherCAT master can detect errors in the Unit with the AL status if an EtherCAT communications error occurs.

For an NJ/NX-series CPU Unit or NY-series Industrial PC, a Slave Application Error event (Sysmac event code: 84280000 hex) occurs when an AL status error occurs in the IO-Link Master Unit.
If you connect the NJ/NX-series CPU Unit or NY-series Industrial PC and the Sysmac Studio, you can find the following AL status codes in attached information 1 for Slave Application Error events in the Troubleshooting dialog box.
You can isolate the causes of errors from these AL status codes.

AL status code	Name	Cause	Correction
0001 hex	State Transition Impossible	The number of received state transition requests exceeded the limit set by the application. • A fatal error occurred. • Operation was synchronized in DC Mode.	An error occurred in the EtherCAT slave. Check the indicator status.
0011 hex	Illegal State Transition Request Received	An incorrect state transition request was received.	Change the status correctly.
0012 hex	Error State Transition Received	An unclear state transition request was received.	Change the status correctly.
0014 hex	Slave Unit Verification Error	The non-volatile memory for SII backup does not match the information in the SII (vendor ID, product code, IO-Link revision, and serial number).	Cycle the power supply. If the error still occurs, replace the Unit.
0016 hex	Mailbox Setting Error	An incorrect mailbox setting was detected for the Sync Manager.	Correct the settings, and then download the settings to the EtherCAT Master Unit again.
001B hex	Process Data WDT Error	A timeout was detected for an I/O data send frame.	Review the following items, and restart the slave based on the specifications of the connected EtherCAT master. • Wire the EtherCAT communications cable correctly. • Check to see if the EtherCAT communications cable is exposed to excessive noise.
001D hex	RxPDO Setting Error	An error was detected in the RxPDO settings.	Correct the settings, and then download the settings to the EtherCAT Master Unit again.

AL status code	Name	Cause	Correction
001E hex	TxPDO Setting Error	An error was detected in the TxPDO settings.	Correct the settings, and then download the settings to the EtherCAT Master Unit again.
001F hex	PDO WDT Setting Error	An incorrect PDO WDT setting was detected.	Correct the settings, and then download the settings to the EtherCAT Master Unit again.
0024 hex	TxPDO Mapping Error	An illegal TxPDO was set. • An incorrect TxPDO was set, e.g., the index, subindex, or size was outside of the allowable range.	Correct the settings, and then download the settings to the EtherCAT Master Unit again.
0025 hex	RxPDO Mapping Error	An illegal RxPDO was set. • An incorrect RxPDO was set, e.g., the index, subindex, or size was outside of the allowable range.	Correct the settings, and then download the settings to the EtherCAT Master Unit again.
0028 hex	SM Event Mode Setting Error	An unsupported SM Event Mode was set.	Correct the settings, and then download the settings to the EtherCAT Master Unit again.
0029 hex	Buffer Mode Setting Error	Three buffers were not set.	Correct the settings, and then download the settings to the EtherCAT Master Unit again.
0030 hex	DC Mode Not Supported	Invalid DC SYNC Configuration	Correct the synchronization setting to Free-Run, and download the settings to the EtherCAT master.

11-7 Resetting Errors

Current errors in the IO-Link Master Unit are retained, unless you reset them, until you turn OFF the power supply or restart the IO-Link Master Unit.
To reset an error, you must remove the cause of the current error. If you reset an error without removing the cause, the same error will occur again.
For any of the following recoverable errors that affect IO-Link communications, removing the error cause and then resetting the error restores the IO-Link communications.

- Error-level Device Event (84790000 hex)
- IO-Link Communications Error (847A0000 hex)
- Device Configuration Verification Error (847C0000 hex)
- I/O Cable Short-circuit (84840000 hex)

For recoverable errors that do not affect IO-Link communications, resetting the error has no effect on the IO-Link communications.

Precautions for Correct Use

Resetting the error does not remove the cause of the error.
Always remove the cause of the error, and then reset the error. If you repeat resetting an error without removing the cause of the error, the same error will be newly registered in the error log.

Refer to the troubleshooting manual for the connected CPU Unit for information on how to reset current errors in the IO-Link Master Unit. You can also reset the current errors by writing values to the *Sysmac Error Status Clear* (2002:02 hex) CoE object. Refer to *Sysmac Error Status Clear* (2002:02 hex) in *A-1-7 Manufacturer-specific Object 1* on page A-20 for details on this object.

Additional Information

The ESI file of the IO-Link Master Unit specifies to write values to the *Sysmac Error Status Clear* (2002:02 hex) CoE object as an initialization command for moving from Pre-Operational state to Safe-Operational state.

11-8 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.

11-8-1 Troubleshooting with Device Events

1. Check if there is any device event in the IO-Link device.
   Refer to *11-8-2 Checking the Occurrence of Device Events* on page 11-33 for the checking procedure.

2. If there is, check the device event with the CX-ConfiguratorFDT.
   Refer to *11-8-3 Checking for Device Events* on page 11-34 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.

11-8-2 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 *11-4-1 How to Check for Errors* on page 11-15 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 *I/O Port Error Status*
  From the user program, etc., access the above values in the Input Data of I/O data.
  Refer to *7-3-2 PDO Mapping Objects and PDO Entries That Can Be Allocated* on page 7-7 for details on I/O data.

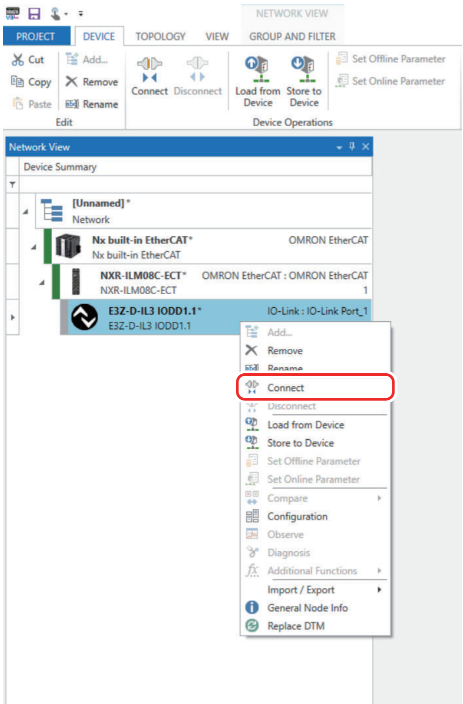
You may also read these status values into CoE objects through SDO communications.
Refer to *A-1-8 Manufacturer-specific Object 2* on page A-23 for information on CoE objects.

11-8-3 Checking for Device Events

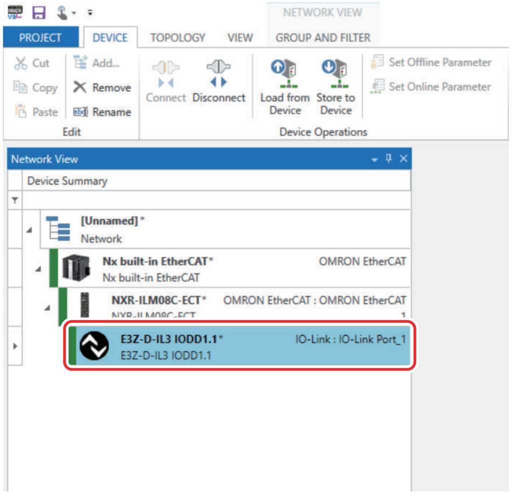
Use the CX-ConfiguratorFDT to check for device events.

1 Go online with the IO-Link device.
Refer to *10-2-10 Going Online* on page 10-11 for information on how to go online.

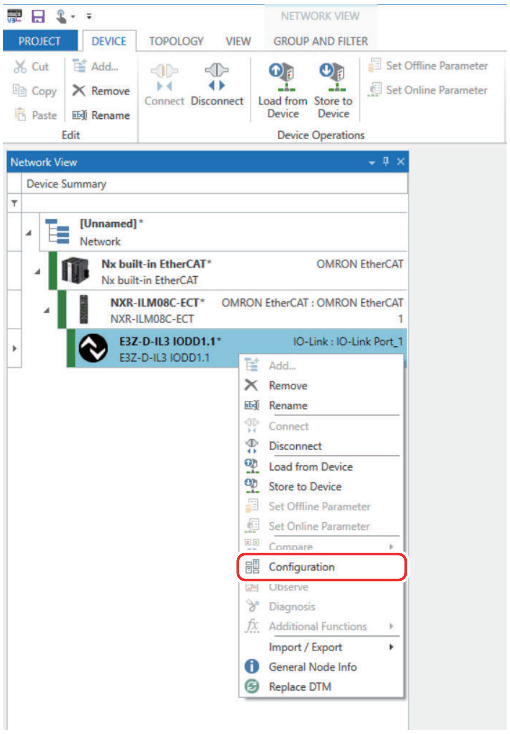
2 Go online with the IO-Link device. The operation differs depending on the version as follows.
- For the CX-ConfiguratorFDT version 3.0 or higher, right-click the device DTM for the IO-Link device, and select **Connect**.
- For the CX-ConfiguratorFDT version lower than 3.0, right-click the device DTM for the IO-Link device, and select **Go online**.



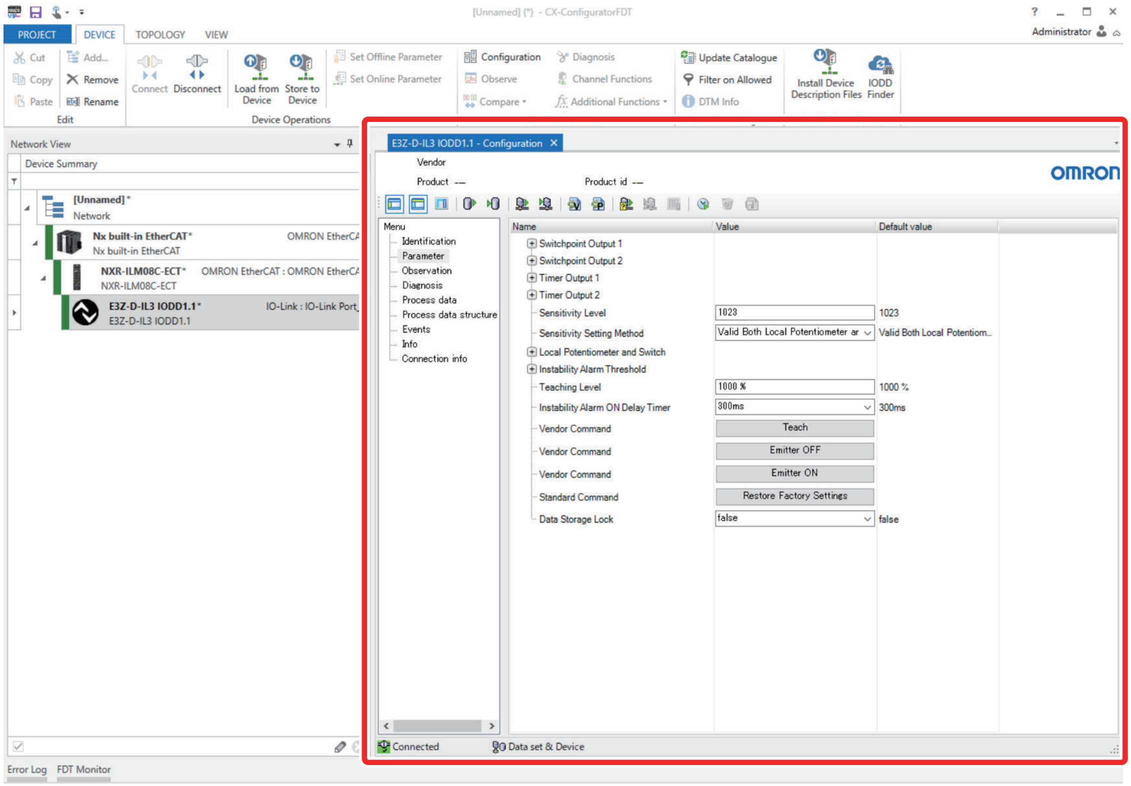
The Support Software goes online.
When the Support Software goes online, the following occurs depending on the version.
- For the CX-ConfiguratorFDT version 3.0 or higher, the status bar to the left of the devices in the Network View turns green.
- For the CX-ConfiguratorFDT version lower than 3.0, the devices in the Network View are displayed in bold.



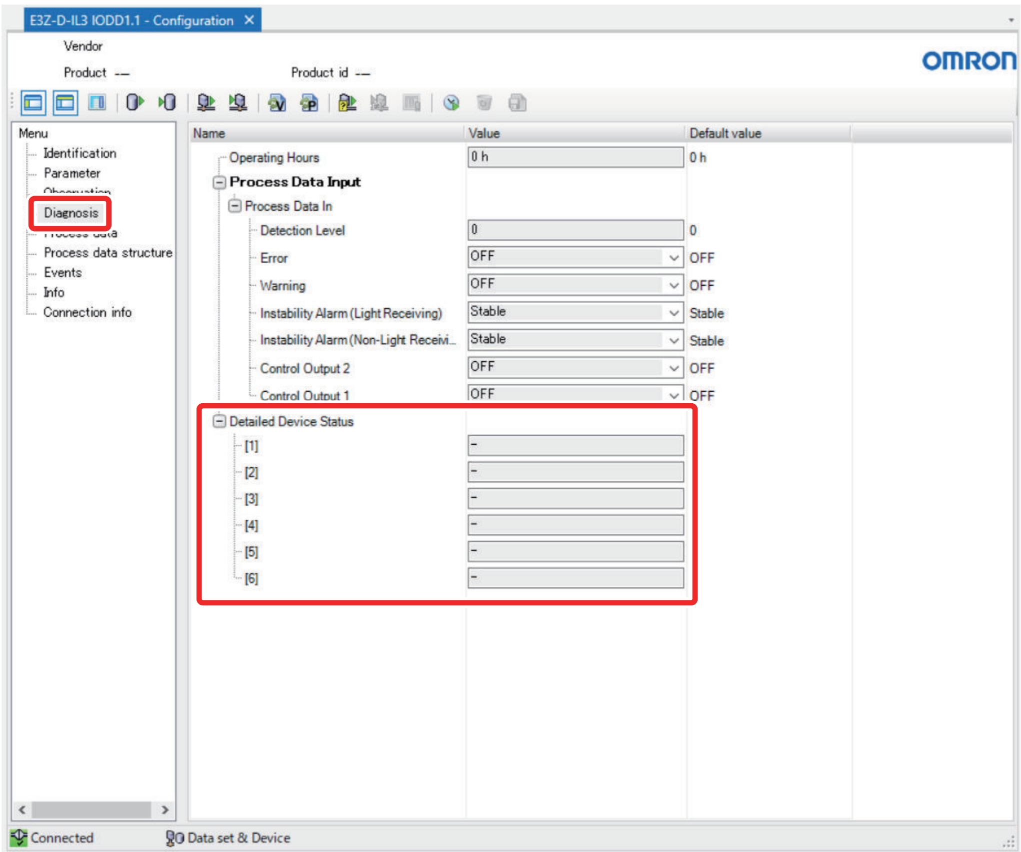
3 Right-click the device DTM for the IO-Link device and select **Configuration**.



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.



11-9 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 Controller 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 EtherCAT master and the IO-Link Master Unit.
The IO-Link Master Unit cannot hold the output during load rejection.	The Load Rejection Output Setting is *Enable (Clears the output value.)*.	Change the Load Rejection Output Setting to *Disable (Holds the output value.)*.
The IO-Link Master Unit cannot clear the output during load rejection.	The Load Rejection Output Setting is *Disable (Holds the output value.)*.	Change the Load Rejection Output Setting to *Enable (Clears the output value.)*.
The IO-Link Master Unit does not operate with the communications mode settings, Process Data In Length, and Process Data Out Length for the I/O port configured with the Configuration Software or through SDO communications.	The power supply is not cycled after the setting.	Cycle the power supply.
	The Quick Setting Switch Value is other than *0* with the I/O port quick settings enabled.	Make sure that the Quick Setting Switch Value is *0* and cycle the power supply.

12

Inspection and Maintenance

This section describes inspection and maintenance of the IO-Link Master Unit.

12-1 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.

12-1-1 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.

12-1-2 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

12-2 Maintenance Procedures

12-2-1 Handling the Unit to Replace

The NXR-series IO-Link Master Unit for EtherCAT is a 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.

12-2-2 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 backup 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 *9-14 Backing Up and Restoring IO-Link Device Parameters* on page 9-32.

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 Sysmac Studio.

• Preparation

Before you replace the IO-Link Master Unit, back up the device parameter settings of the IO-Link Master Unit.

Refer to *7-5 Backing Up and Restoring Device Parameters* on page 7-22 for the backup methods.

• Replacement Procedure

1. Turn OFF the power supply to all connected devices, or disconnect the old IO-Link Master Unit from the EtherCAT network.
2. Turn OFF the Unit/input power supply and output power supply to the old IO-Link Master Unit.
3. Set a new IO-Link Master Unit so that it has the same rotary switch settings as those of the previous Unit.
4. Replace the IO-Link Master Unit.
5. Turn ON the Unit/input power supply and output power supply to the new IO-Link Master Unit.
6. Turn ON the power supply to the connected devices, or connect a new IO-Link Master Unit to the EtherCAT network.
7. Restore and verify the device parameter settings in the new IO-Link Master Unit.
   Refer to *7-5 Backing Up and Restoring Device Parameters* on page 7-22 for information on the restore method.

12-2-3 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 *9-14 Backing Up and Restoring IO-Link Device Parameters* on page 9-32.

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.

12-2-4 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.

Refer to *7-5 Backing Up and Restoring Device Parameters* on page 7-22 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 *10-2-8 Exporting the Created Network Configuration to a File* on page 10-10 for the backup method.

• Replacement Procedure

1. Turn OFF the power supply to all connected devices, or disconnect the old IO-Link Master Unit from the EtherCAT network.

2. Turn OFF the Unit/input power supply and output power supply to the old IO-Link Master Unit.

3. 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.

4. Replace the IO-Link Master Unit and IO-Link devices.

5. Turn ON the Unit/input power supply and output power supply to the new IO-Link Master Unit.

6. Turn ON the power supply to the connected devices, or connect a new IO-Link Master Unit to the EtherCAT network.

7. Restore and verify the device parameter settings in the new IO-Link Master Unit.
   Refer to *7-5 Backing Up and Restoring Device Parameters* on page 7-22 for information on the restore method.

8. Use the CX-ConfiguratorFDT to store the backed up IO-Link device parameter settings to the new IO-Link devices.
   Refer to *10-2-12 Transferring the IO-Link Device Parameters* on page 10-13 for information on how to store the parameter settings.

A

Appendices

The appendices provide information on supported CoE objects, sample programming, Windows firewall configuration, and other supplemental information.

A-1 CoE Objects

This section describes the CoE objects that are implemented in the IO-Link Master Unit.

Precautions for Safe Use

After you change the settings of the IO-Link Master Unit, always sufficiently check the safety at the connected devices before you cycle the power supply.

A-1-1 Object Dictionary Area

The CAN application protocol over EtherCAT (CoE) is based on the object dictionary for the CAN application protocol.
All objects are assigned 4-digit hexadecimal indexes and consist of the following areas.

Index	Area	Description
0000 hex to 0FFF hex	Data Type Area	This area contains data type definitions.
1000 hex to 1FFF hex	CoE Communications Area	This area contains object definitions that can be used for all servers that perform specialized communications. PDO mapping objects
2000 hex to 2FFF hex	Manufacturer-specific Area 1	This area contains objects that are defined for all OMRON products.
3000 hex to 5FFF hex	Manufacturer-specific Area 2	This area contains objects that are defined for the IO-Link Master Unit.
6000 hex to 9FFF hex	Device Profile Area	This area contains objects that are defined by the CiA401 Generic I/O Module Device Profile (a profile that specifies the CAN application protocol interface for devices with digital I/O and analog I/O).
A000 hex to EFFF hex	Reserved Area	This area is reserved for future use.
F000 hex to FFFF hex	Modular Device-specific Area	This area contains objects that are defined by modular devices.

A-1-2 Data Types

The following data types are used in this profile.

Data type	Abbreviation	Size	Range of values
Boolean	BOOL	1 bit	0 (FALSE) or 1 (TRUE)
Unsigned8	U8	1 byte	0 to 255
Unsigned16	U16	2 bytes	0 to 65,535
Unsigned32	U32	4 bytes	0 to 4,294,967,295
Unsigned64	U64	8 bytes	0 to 18,446,744,073,709,551,615
Visible string	VS	---	---
ARRAY[0..Y] OF BYTE	ARRAY[0..Y] OF BYTE	Y+1 bytes	---

A-1-3 Format of Objects

This manual describes objects in the following format.

Index (hex)	Subindex (hex)	Object name	Default value	Data range	Unit	Data attribute	Size	Access	PDO mapping	Complete access
<Index>	<Subindex>	<Object name>	<Default setting>	<Data range>	<Unit>	<Data attribute>	<Size>	<Access>	<Possible/Not possible>	<Possible/ Not possible>

Items within the < > brackets are replaced with data. Each item has the following meaning.

Item	Description
Index	This is the index of the object that is expressed as a four-digit hexadecimal number.
Subindex	This is the subindex of the object that is expressed as a two-digit hexadecimal number.
Object name	This is the name of the object. For a subindex, this is the name of the subindex.
Default value	This is the value that is set when the product is shipped from the factory.
Data range	For a read-only (RO) object, this is the range of the data that you can read. For a read/write (RW) object, this is the setting range of the data.
Unit	This is the physical unit of measure.
Data attribute	This is the timing when changes to writable objects are enabled. A: Enabled at all times B: Enabled when the Unit changes from Pre-Operational state to Safe-Operational state C: Enabled when the Unit changes from Pre-Operational state to Init state R: Enabled when the power supply is cycled ---: Write-prohibited
Size	This is the size of the object in bytes.
Access	This indicates whether the object is read-only or read/write. RO: Read-only RW: Read/write
PDO mapping	This indicates whether the object allows PDO mapping.
Complete access*1	This indicates whether the object allows complete access.

*1. Complete access is used to read from or write to a batch of objects. It allows you to read from or write to all subindexes of an object at a time.

A-1-4 Communication Objects

This section describes the communication objects of the IO-Link Master Unit.

Index (hex)	Subindex (hex)	Object name	Default value	Data range	Unit	Data attribute	Size	Access	PDO mapping	Complete access
1000	---	Device Type	00001389 hex	00001389 hex	---	---	4 bytes (U32)	RO	Not possible	Not possible

- This object gives the CoE device profile number for the IO-Link Master Unit.

Index (hex)	Sub-index (hex)	Object name	Default value	Data range	Unit	Data attribute	Size	Access	PDO mapping	Complete access
1008	---	Manufacturer Device Name	NXR-ILM08C-ECT	NXR-ILM08C-ECT	---	---	20 bytes (VS)	RO	Not possible	Not possible

• This object gives the model of the IO-Link Master Unit.

Index (hex)	Sub-index (hex)	Object name	Default value	Data range	Unit	Data attribute	Size	Access	PDO mapping	Complete access
1009	---	Manufacturer Hardware Version	“V1.00” (padded with 15 spaces (character 20 hex))	(padded with 20 spaces (character 20 hex))	---	---	20 bytes (VS)	RO	Not possible	Not possible

• This object gives the hardware version of the IO-Link Master Unit in ASCII code.

Index (hex)	Sub-index (hex)	Object name	Default value	Data range	Unit	Data attribute	Size	Access	PDO mapping	Complete access
100A	---	Manufacturer Software Version	“V1.00” (padded with 15 spaces (character 20 hex))	(padded with 20 spaces (character 20 hex))	---	---	20 bytes (VS)	RO	Not possible	Not possible

• This object gives the software version of the IO-Link Master Unit in ASCII code.
Start with “V” (56 hex), and delimit three characters of ASCII codes with a period (2E hex), e.g. “V1.00”. If it is composed of plural modules, delimit them with a space (20 hex) and return the version in 20 bytes or shorter which is filled from the head, e.g. “V1.00 V1.02 V1.01”.

Index (hex)	Sub-index (hex)	Object name	Default value	Data range	Unit	Data attribute	Size	Access	PDO mapping	Complete access
1018	---	Identity Object	---	---	---	---	---	---	---	Possible
	0	Number of entries	04 hex	04 hex	---	---	1 byte (U8)	RO	Not possible	---
	1	Vendor ID	00000083 hex	00000083 hex	---	---	4 bytes (U32)	RO	Not possible	---
	2	Product Code	00000189 hex	00000189 hex	---	---	4 bytes (U32)	RO	Not possible	---
	3	Revision Number	00010000 hex	00000000 to FFFFFFFF hex	---	---	4 bytes (U32)	RO	Not possible	---
	4	Serial Number	Every slave has a unique number	00000000 to FFFFFFFF hex	---	---	4 bytes (U32)	RO	Not possible	---

This object gives information on the IO-Link Master Unit.

- Subindex 01 hex gives the vendor's ID.
- Subindex 02 hex gives the value that is assigned to the IO-Link Master Unit.
- Subindex 03 hex gives the revision number of the IO-Link Master Unit.
  Bits 16 to 31: These bits give the major revision number of the IO-Link Master Unit.
  Bits 0 to 15: These bits give the minor revision number of the IO-Link Master Unit.
- Subindex 04 hex gives the serial number of the IO-Link Master Unit. This is a unique value for each product.

Index (hex)	Sub-index (hex)	Object name	Default value	Data range	Unit	Data attribute	Size	Access	PDO mapping	Complete access
10E0	---	Device Identification Reload	---	---	---	---	---	---	---	Not possible
	0	Maximum supported Subindex	03 hex	03 hex	---	---	1 byte (U8)	RO	Not possible	---
	1	Configured Station Alias register value	0000 hex	0000 to FFFF hex	---	A	2 bytes (U16)	RW	Not possible	---
	3	Reload ID-selector value	0000 hex	0000 to FFFF hex	---	A	2 bytes (U16)	RW	Not possible	---

- Subindex 01 hex gives the software setting of the node address.
  When Writing:

If the hardware setting value of the ID switch is set to 0, the value that you write to this object is the software setting value of the node address. (Set the value to write in the ESC register 0012 hex.)
If the hardware setting value of the ID switch is set to a value other than 0, the hardware setting value of the ID switch is enabled. This causes an SDO communications error and returns abort code 08000021 hex.
When Reading:
If the hardware setting value of the ID switch is set to 0, the software setting (the value written to the ESC register 0012 hex) is given.
If the hardware setting value of the ID switch is set to a value other than 0, the hardware setting value of the ID switch is given.

- Subindex 03 hex gives the hardware setting of the ID switch.
  When Writing:
  If the hardware setting value of the ID switch is set to 0, an SDO communications error occurs and abort code 08000021 hex is returned, regardless of the write value.
  If the hardware setting value of the ID switch is set to a value other than 0 and write value is 0000 hex, the hardware setting value of the ID switch is written to the ESC register 0012 hex.
  If the write value is any other value than 0000 hex, an SDO communications error occurs and abort code 08000021 hex is returned.
  When Reading:
  This gives the hardware setting value of the ID switch.

Index (hex)	Sub-index (hex)	Object name	Default value	Data range	Unit	Data attribute	Size	Access	PDO mapping	Complete access
10F3	---	Diagnosis History	---	---	---	---	---	---	---	Not possible
	00	Number of entries	45 hex	45 hex	---	---	1 byte (U8)	RO	Not possible	---
	01	Maximum Messages	40 hex	40 hex	---	---	1 byte (U8)	RO	Not possible	---
	02	Newest Message	00 hex	00 hex, 06 to 45 hex	---	---	1 byte (U8)	RO	Not possible	---
	03	Newest Acknowledged Message	00 hex	00 hex, 06 to 45 hex	---	---	1 byte (U8)	RW	Not possible	---
	04	New Messages Available	FALSE	FALSE, TRUE	---	---	1 bit	RO	Possible	---
	05	Flags	0000 hex	0000, 0001 hex	---	A	2 bytes (U16)	RW	Not possible	---
	06	Diagnosis Message 1	---	---	---	---	30 bytes (ARRAY[0..29] OF BYTE)	RO	Not possible	---
	…	…	…	…	…	…	…	…	…	…
	45	Diagnosis Message 64	---	---	---	---	30 bytes (ARRAY[0..29] OF BYTE)	RO	Not possible	---

- This object gives a maximum of 64 diagnosis messages. This object is also used to enable or disable emergency messages.
- Subindex 01 hex (Maximum Messages) gives the number of error messages.
- Subindex 02 hex (Newest Message) gives the subindex number of the most recent diagnosis message.
- Subindex 03 hex (Newest Acknowledged Message) gives the number of the newest acknowledged message. The operations for reading and writing are different as described in the following table.

Reading/ writing	Operation
Reading	The subindex of the most recent error log record is returned (06 to 45 hex). If there are no records in the error log, 00 hex is returned.

Reading/ writing	Operation
Writing	Write the number of the error log record between 06 and 45 hex. The value of subindex 04 hex (Newest Messages Available) changes to FALSE. If you write 00 hex, the entire error log is cleared. If you write values other than 00 hex and 06 to 45 hex, the abort code 06090030 hex is returned. If you write a subindex that does not have an error log record, the abort code 06090030 hex is returned.

- Subindex 04 hex (New Messages Available) provides notification of new messages. It indicates if the error log has been updated. When the error log is updated, the value changes to 1 (TRUE). The value changes to 0 (FALSE) in the following cases.
  a) Subindex 03 hex (Newest Acknowledged Message) gives the subindex number of the most recent error log record.
  b) The error log has not been updated.
- Subindex 05 hex (Flags) is the control flags for the error log. Use this to specify whether to enable or disable notification of errors by emergency messages. Set this to 0001 hex to enable notification, or 0000 hex to disable notification. This is set to 0000 hex (disable emergency notification) when the power supply is turned ON. Even if it is set to disable notification, the error log records will be saved for errors that are described to be saved in *11-5-4 List of Emergency Error Codes* on page 11-27.
- Subindexes 06 hex to 45 hex (Diagnosis Message 1 to 64) give the diagnosis messages.
  Subindex 06 hex (Diagnosis Message 1) to subindex 45 hex (Diagnosis Message 64) store up to 64 errors as they occur. The 65th error is stored by returning to subindex 06 hex (Diagnosis Message 1).
- The following table gives the format of a diagnosis message.
  The presence of the flag parameters 1 to 4 and detail parameters 1 to 4, and the number of parameters if they are present, are determined depending on the event type. The bits 8 to 15 of the flag indicate the presence and quantity.

Item	Data type	Details
Diag Code	U32	Bits 16 to 31: Emergency error code*1 Bits 0 to 15: E800 hex
Flags	U16	Bits 8 to 15: Number of attached information of the event Bits 4 to 7: Source of time information for Time Stamp • 1: Local time stamp (CoE object index 10F8 hex) Bits 0 to 3: Event level • 0: Information • 1: Observation • 2: Minor fault
Text ID	U16	Upper 4 digits of the event code. *2
Time Stamp	UINT64	The time that the error occurred. *3
Flag parameter 1	U16	Bits 12 to 15: Fixed to 0 Bits 0 to 11: Data type of detail parameter 1*4
Detail parameter 1	(Dependent on the flag parameter 1)	Attached information 1 of the event
Flag parameter 2	U16	Bits 12 to 15: Fixed to 0 Bits 0 to 11: Data type of detail parameter 2*4

Item	Data type	Details
Detail parameter 2	(Dependent on the flag parameter 2)	Attached information 2 of the event
Flag parameter 3	U16	Bits 12 to 15: Fixed to 0 Bits 0 to 11: Data type of detail parameter 3*4
Detail parameter 3	(Dependent on the flag parameter 3)	Attached information 3 of the event
Flag parameter 4	U16	Bits 12 to 15: Fixed to 0 Bits 0 to 11: Data type of detail parameter 4*4
Detail parameter 4	(Dependent on the flag parameter 4)	Attached information 4 of the event

*1. Refer to *11-5-4 List of Emergency Error Codes* on page 11-27 for details on the emergency error codes.
*2. Refer to *Error Descriptions* on page 11-20 for details on the event codes for errors.
*3. The System Time of the CPU Unit is used.
*4. The following shows the meaning of each value.

Value (hex)	Data type
001	Boolean
002	Integer8
003	Integer16
004	Integer32
005	Unsigned8
006	Unsigned16
007	Unsigned32
008	Real32
011	Real64
015	Integer64
01B	Unsigned64

Index (hex)	Subindex (hex)	Object name	Default value	Data range	Unit	Data attribute	Size	Access	PDO mapping	Complete access
10F9	---	CoE Time Distribution Object	---	---	---	---	---	---	---	Not possible
	00	Number of entries	01 hex	01 hex	---	---	1 byte (U8)	RO	Not possible	---
	01	Local time of CoE time distribution	0000000000000000 hex	0000000000000000 hex to FFFFFFFFFFFFFFFF hex	ns	A	8 bytes (U64)	RW	Not possible	---

- This object is the source of information on the error occurrence time that is recorded in the error log. The System Time of the CPU Unit is read.
- The time is indicated in an elapsed time from 1970/1/1, 0:00:00.

A-1-5 PDO Mapping Objects

The PDO mapping object for the IO-Link Master Unit are as follows.

Index (hex)	Description	Reference
1600 to 1607, 1700	PDO mapping object for receiving data from the EtherCAT master to the IO-Link Master Unit	*PDO Mapping Object for Receiving Data from the EtherCAT Master to the IO-Link Master Unit* on page A-10
1A00 to 1A07, 1B00 to 1B05	PDO mapping objects for sending data from the IO-Link Master Unit to the Ether-CAT master	*PDO Mapping Objects for Sending Data from the IO-Link Master Unit to the EtherCAT Master* on page A-12
1BFE	PDO mapping object for sending new mes-sages available information	*PDO Mapping Object for Sending New Messag-es Available Information* on page A-15
1BFF	PDO mapping object for sending Sysmac error status information	*PDO Mapping Object for Sending Sysmac Error Status Information* on page A-16

These PDO mapping objects are writable only when the IO-Link Master Unit is in Pre-Operational state.
Subindex 01 hex and onwards give the mapped application object information.

31 to 16	15 to 8	7 to 0
Index	Subindex	Bit length
MSB		LSB

Bits 16 to 31: Index of the assigned object
Bits 8 to 15: Subindex of the assigned object
Bits 0 to 7: Bit length of the assigned object (i.e., a bit length of 32 bits is given as 20 hex)

PDO Mapping Object for Receiving Data from the EtherCAT Master to the IO-Link Master Unit

Indexes 1600 hex to 1607 hex and index 1700 hex are PDO mapping objects for receiving data from the EtherCAT master to the IO-Link Master Unit.

Index (hex)	Sub-index (hex)	Object name	Default value	Data range	Unit	Data at-trib-ute	Size	Ac-cess	PDO map ping	Com-plete access
1600	---	Port1 IO-Link Output Data	---	---	---	---	---	---	---	Possi-ble
	00	Number of objects in this PDO	01 hex	00 to 10 hex	---	B	1 byte (U8)	RW	Not pos-sible	---

Index (hex)	Sub-index (hex)	Object name	Default value	Data range	Unit	Data at-trib-ute	Size	Ac-cess	PDO map ping	Com-plete access
	01	1st Output Object to be mapped	70000110 hex	70000110 hex, 70000210 hex, 70000310 hex, 70000410 hex, 70000510 hex, 70000610 hex, 70000710 hex, 70000810 hex, 70000910 hex, 70000A10 hex, 70000B10 hex, 70000C10 hex, 70000D10 hex, 70000E10 hex, 70000F10 hex, 70001010 hex	---	B	4 bytes (U32)	RW	Not pos-sible	---
	Subindexes: 02 to 0F									
	10	16th Output Object to be mapped	70001010 hex	70000110 hex, 70000210 hex, 70000310 hex, 70000410 hex, 70000510 hex, 70000610 hex, 70000710 hex, 70000810 hex, 70000910 hex, 70000A10 hex, 70000B10 hex, 70000C10 hex, 70000D10 hex, 70000E10 hex, 70000F10 hex, 70001010 hex	---	B	4 bytes (U32)	RW	Not pos-sible	---
Indexes: 1601 to 1606										
1607	---	Port8 IO-Link Output Data	---	---	---	---	---	---	---	Possi-ble
	00	Number of objects in this PDO	01 hex	00 to 10 hex	---	B	1 byte (U8)	RW	Not pos-sible	---

Index (hex)	Sub-index (hex)	Object name	Default value	Data range	Unit	Data at-trib-ute	Size	Ac-cess	PDO map ping	Com-plete access
	01	1st Output Object to be mapped	70700110 hex	70700110 hex, 70700210 hex, 70700310 hex, 70700410 hex, 70700510 hex, 70700610 hex, 70700710 hex, 70700810 hex, 70700910 hex, 70700A10 hex, 70700B10 hex, 70700C10 hex, 70700D10 hex, 70700E10 hex, 70700F10 hex, 70701010 hex	---	B	4 bytes (U32)	RW	Not pos-sible	---
	Subindexes: 02 to 0F									
	10	16th Output Object to be mapped	70701010 hex	70700110 hex, 70700210 hex, 70700310 hex, 70700410 hex, 70700510 hex, 70700610 hex, 70700710 hex, 70700810 hex, 70700910 hex, 70700A10 hex, 70700B10 hex, 70700C10 hex, 70700D10 hex, 70700E10 hex, 70700F10 hex, 70701010 hex	---	B	4 bytes (U32)	RW	Not pos-sible	---
1700	---	Digtal Output Data Set	---	---	---	---	---	---	---	Possi-ble
	00	Number of objects in this PDO	01 hex	---	---	---	1 byte (U8)	RO	Not pos-sible	---
	01	1st Output Object to be mapped	31000110 hex	---	---	---	4 bytes (U32)	RO	Not pos-sible	---

PDO Mapping Objects for Sending Data from the IO-Link Master Unit to the EtherCAT Master

Indexes 1A00 hex to 1A07 hex and indexes 1B00 hex to 1B05 hex are PDO mapping objects for sending data from the IO-Link Master Unit to the EtherCAT master.

Index (hex)	Sub-index (hex)	Object name	Default value	Data range	Unit	Data at-trib-ute	Size	Ac-cess	PDO map ping	Com-plete access
1A00	---	Port1 IO-Link Input Data	---	---	---	---	---	---	---	Possi-ble
	00	Number of objects in this PDO	01 hex	00 to 10 hex	---	B	1 byte (U8)	RW	Not pos-sible	---
	01	1st Input Object to be mapped	60000110 hex	60000110 hex, 60000210 hex, 60000310 hex, 60000410 hex, 60000510 hex, 60000610 hex, 60000710 hex, 60000810 hex, 60000910 hex, 60000A10 hex, 60000B10 hex, 60000C10 hex, 60000D10 hex, 60000E10 hex, 60000F10 hex, 60001010 hex	---	B	4 bytes (U32)	RW	Not pos-sible	---
	Subindexes: 02 to 0F									
	10	16th Input Object to be mapped	60001010 hex	60000110 hex, 60000210 hex, 60000310 hex, 60000410 hex, 60000510 hex, 60000610 hex, 60000710 hex, 60000810 hex, 60000910 hex, 60000A10 hex, 60000B10 hex, 60000C10 hex, 60000D10 hex, 60000E10 hex, 60000F10 hex, 60001010 hex	---	B	4 bytes (U32)	RW	Not pos-sible	---
Indexes: 1A01 to 1A06										
1A07	---	Port8 IO-Link Input Data	---	---	---	---	---	---	---	Possi-ble
	00	Number of objects in this PDO	01 hex	00 to 10 hex	---	B	1 byte (U8)	RW	Not pos-sible	---

Index (hex)	Sub-index (hex)	Object name	Default value	Data range	Unit	Data at-trib-ute	Size	Ac-cess	PDO map ping	Com-plete access
	01	1st Input Object to be mapped	60700110 hex	60700110 hex, 60700210 hex, 60700310 hex, 60700410 hex, 60700510 hex, 60700610 hex, 60700710 hex, 60700810 hex, 60700910 hex, 60700A10 hex, 60700B10 hex, 60700C10 hex, 60700D10 hex, 60700E10 hex, 60700F10 hex, 60701010 hex	---	B	4 bytes (U32)	RW	Not pos-sible	---
	Subindexes: 02 to 0F									
	10	16th Input Object to be mapped	60701010 hex	60700110 hex, 60700210 hex, 60700310 hex, 60700410 hex, 60700510 hex, 60700610 hex, 60700710 hex, 60700810 hex, 60700910 hex, 60700A10 hex, 60700B10 hex, 60700C10 hex, 60700D10 hex, 60700E10 hex, 60700F10 hex, 60701010 hex	---	B	4 bytes (U32)	RW	Not pos-sible	---
1B00	---	I/O Port Status Infor-mation	---	---	---	---	---	---	---	Possi-ble
	00	Number of objects in this PDO	01 hex	00 to 01 hex	---	---	1 byte (U8)	RO	Not pos-sible	---
	01	1st Input Object to be mapped	30000110 hex	30000110 hex	---	---	4 bytes (U32)	RO	Not pos-sible	---
1B01	---	Port1_2 I/O Port Error Status Information	---	---	---	---	---	---	---	Possi-ble
	00	Number of objects in this PDO	01 hex	00 to 01 hex	---	---	1 byte (U32)	RO	Not pos-sible	---
	01	1st Input Object to be mapped	30010110 hex	30010110 hex	---	---	4 bytes (U32)	RO	Not pos-sible	---

Index (hex)	Sub-index (hex)	Object name	Default value	Data range	Unit	Data at-trib-ute	Size	Ac-cess	PDO map ping	Com-plete access
1B02	---	Port3_4 I/O Port Error Status Information	---	---	---	---	---	---	---	Possi-ble
	00	Number of objects in this PDO	01 hex	00 to 01 hex	---	---	1 byte (U32)	RO	Not pos-sible	---
	01	1st Input Object to be mapped	30020110 hex	30020110 hex	---	---	4 bytes (U32)	RO	Not pos-sible	---
1B03	---	Port5_6 I/O Port Error Status Information	---	---	---	---	---	---	---	Possi-ble
	00	Number of objects in this PDO	01 hex	00 to 01 hex	---	---	1 byte (U32)	RO	Not pos-sible	---
	01	1st Input Object to be mapped	30030110 hex	30030110 hex	---	---	4 bytes (U32)	RO	Not pos-sible	---
1B04	---	Port7_8 I/O Port Error Status Information	---	---	---	---	---	---	---	Possi-ble
	00	Number of objects in this PDO	01 hex	00 to 01 hex	---	---	1 byte (U32)	RO	Not pos-sible	---
	01	1st Input Object to be mapped	30040110 hex	30040110 hex	---	---	4 bytes (U32)	RO	Not pos-sible	---
1B05	---	Digital Input Data Set	---	---	---	---	---	---	---	Possi-ble
	00	Number of objects in this PDO	01 hex	00 to 01 hex	---	---	1 byte (U32)	RO	Not pos-sible	---
	01	1st Input Object to be mapped	30050110 hex	30050110 hex	---	---	4 bytes (U32)	RO	Not pos-sible	---

PDO Mapping Object for Sending New Messages Available Information

Index 1BFE hex is a PDO mapping object for sending New Messages Available Information.

Index (hex)	Sub-index (hex)	Object name	Default value	Data range	Unit	Data at-trib-ute	Size	Ac-cess	PDO map ping	Com-plete access
1BFE	---	New Messages Available Information	---	---	---	---	---	---	---	Possi-ble
	00	Number of objects in this PDO	02 hex	02 hex	---	---	1 byte (U8)	RO	Not pos-sible	---

Index (hex)	Sub-index (hex)	Object name	Default value	Data range	Unit	Data attribute	Size	Access	PDO mapping	Complete access
	01	1st Input Object to be mapped	10F30401 hex	10F30401 hex	---	---	4 bytes (U32)	RO	Not possible	---
	02	2nd Input Object to be mapped	00000007 hex	00000007 hex	---	---	4 bytes (U32)	RO	Not possible	---

PDO Mapping Object for Sending Sysmac Error Status Information

Index 1BFF hex is a PDO mapping object for sending Sysmac Error Status Information.

Index (hex)	Sub-index (hex)	Object name	Default value	Data range	Unit	Data attribute	Size	Access	PDO mapping	Complete access
1BFF	---	Sysmac Error Status Information	---	---	---	---	---	---	---	Possible
	00	Number of objects in this PDO	01 hex	01 hex	---	---	1 byte (U8)	RO	Not possible	---
	01	1st Input Object to be mapped	20020108 hex	20020108 hex	---	---	4 bytes (U32)	RO	Not possible	---

A-1-6 Sync Manager Communications Objects

The EtherCAT communications memory is set with objects 1C00 hex to 1C13 hex.

Index (hex)	Sub-index (hex)	Object name	Default value	Data range	Unit	Data attribute	Size	Access	PDO mapping	Complete access
1C00	---	Sync Manager Communication Type	---	---	---	---	---	---	---	Possible
	00	Number of used SM channels	04 hex	04 hex	---	---	1 byte (U8)	RO	Not possible	---
	01	Communication Type Sync Manager 0	01 hex	01 hex	---	---	1 byte (U8)	RO	Not possible	---
	02	Communication Type Sync Manager 1	02 hex	02 hex	---	---	1 byte (U8)	RO	Not possible	---
	03	Communication Type Sync Manager 2	03 hex	03 hex	---	---	1 byte (U8)	RO	Not possible	---
	04	Communication Type Sync Manager 3	04 hex	04 hex	---	---	1 byte (U8)	RO	Not possible	---

- The Sync Managers are set as follows:
  SM0: Mailbox receive (EtherCAT master to IO-Link Master Unit)
  SM1: Mailbox send (IO-Link Master Unit to EtherCAT master)
  SM2: Process data output (EtherCAT master to IO-Link Master Unit)
  SM3: Process data input (IO-Link Master Unit to EtherCAT master)

Index (hex)	Sub-index (hex)	Object name	Default value	Data range	Unit	Data attribute	Size	Access	PDO mapping	Complete access
1C10	---	Sync Manager 0 PDO Assignment	---	---	---	---	---	---	---	Possible
	00	Number of assigned PDOs	00 hex	00 hex	---	---	1 byte (U8)	RO	Not possible	---

- This object gives the number of PDO mappings that are used by Sync Manager 0.
- The Mailbox Receive Sync Manager does not have any PDOs.

Index (hex)	Sub-index (hex)	Object name	Default value	Data range	Unit	Data attribute	Size	Access	PDO mapping	Complete access
1C11	---	Sync Manager 1 PDO Assignment	---	---	---	---	---	---	---	Possible
	00	Number of assigned PDOs	00 hex	00 hex	---	---	1 byte (U8)	RO	Not possible	---

- This object gives the number of PDO mappings that are used by Sync Manager 1.
- The Mailbox Transmit Sync Manager does not have any PDOs.

Index (hex)	Sub-index (hex)	Object name	Default value	Data range	Unit	Data attribute	Size	Access	PDO mapping	Complete access
1C12	---	Sync Manager 2 PDO Assignment	---	---	---	---	---	---	---	Possible
	00	Number of assigned RxPDOs	01 hex	00 to 03 hex	---	B	1 byte (U8)	RW	Not possible	---
	01	1st PDO Mapping object index of assigned RxPDO	1601 hex	0000 hex, 1601 to 1603 hex	---	B	2 bytes (U16)	RW	Not possible	---
	02	2nd PDO Mapping object index of assigned RxPDO	0000 hex	0000 hex, 1602 to 1603 hex	---	B	2 bytes (U16)	RW	Not possible	---
	03	3rd PDO Mapping object index of assigned RxPDO	0000 hex	0000 hex, 1603 hex	---	B	2 bytes (U16)	RW	Not possible	---

- This object gives the receive PDO that is used by Sync Manager 2.

Index (hex)	Sub-index (hex)	Object name	Default value	Data range	Unit	Data attribute	Size	Access	PDO mapping	Complete access
1C13	---	Sync Manager 3 PDO Assignment	---	---	---	---	---	---	---	Possible
	00	Number of assigned TxPDOs	03 hex	01 to 06 hex	---	B	1 byte (U8)	RW	Not possible	---
	01	1st PDO Mapping object index of assigned TxPDO	1A00 hex	1A00 hex	---	B	2 bytes (U16)	RW	Not possible	---
	02	2nd PDO Mapping object index of assigned TxPDO	1A01 hex	0000 hex, 1A01 to 1A03 hex, 1BFE to 1BFF hex	---	B	2 bytes (U16)	RW	Not possible	---
	03	3rd PDO Mapping object index of assigned TxPDO	1BFE hex	0000 hex, 1A02 to 1A03 hex, 1BFE to 1BFF hex	---	B	2 bytes (U16)	RW	Not possible	---
	04	4th PDO Mapping object index of assigned TxPDO	0000F hex	0000 hex, 1A03 hex, 1BFE to 1BFF hex	---	B	2 bytes (U16)	RW	Not possible	---
	05	5th PDO Mapping object index of assigned TxPDO	0000 hex	0000 hex, 1BFE to 1BFF hex	---	B	2 bytes (U16)	RW	Not possible	---
	06	6th PDO Mapping object index of assigned TxPDO	0000 hex	0000 hex, 1BFF hex	---	B	2 bytes (U16)	RW	Not possible	---

- This object gives the transmit PDO that is used by Sync Manager 3.

Index (hex)	Sub-index (hex)	Object name	Default value	Data range	Unit	Data attribute	Size	Access	PDO mapping	Complete access
1C32	---	Sync Manager 2 Synchronization	---	---	---	---	---	---	---	Possible
	00	Number of Synchronization Parameters	05 hex	05 hex	---	---	1 byte (U8)	RO	Not possible	---
	01	Synchronization Type	0000 hex	0000 hex	---	B	2 bytes (U16)	RW	Not possible	---
	02	Cycle Time	00000000 hex	00000000 to FFFFFFFF hex	ns	---	4 bytes (U32)	RO	Not possible	---
	04	Synchronization Types supported	0001 hex	0001 hex	---	---	2 bytes (U16)	RO	Not possible	---
	05	Minimum Cycle Time	00000000 hex	00000000 hex	ns	---	4 bytes (U32)	RO	Not possible	---

- This object gives the specifications of the EtherCAT communications mode for Sync Manager 2.
- Subindex 01 hex gives the EtherCAT communications mode for Sync Manager 2 of the IO-Link Master Unit.
  0000 hex: Free-Run Mode
- Subindex 02 hex gives the cycle time. In Free-Run Mode, the time between two local timer events is given.
- Subindex 04 hex gives the type of synchronization that is supported by the IO-Link Master Unit. It is 0001 hex for the IO-Link Master Unit.
- Subindex 05 hex gives the minimum cycle time that is supported by the IO-Link Master Unit. It is 0000 hex for the IO-Link Master Unit.

Index (hex)	Sub-index (hex)	Object name	Default value	Data range	Unit	Data attribute	Size	Access	PDO mapping	Complete access
1C33	---	Sync Manager 3 Synchronization	---	---	---	---	---	---	---	Possible
	00	Number of Synchronization Parameters	05 hex	05 hex	---	---	1 byte (U8)	RO	Not possible	---
	01	Synchronization Type	0000 hex	0000 hex	---	B	2 bytes (U16)	RW	Not possible	---
	02	Cycle Time	00000000 hex	00000000 to FFFFFFFF hex	ns	---	4 bytes (U32)	RO	Not possible	---
	04	Synchronization Types supported	0001 hex	0001 hex	---	---	2 bytes (U16)	RO	Not possible	---
	05	Minimum Cycle Time	00000000 hex	00000000 hex	ns	---	4 bytes (U32)	RO	Not possible	---

- This object gives the specifications of the EtherCAT communications mode for Sync Manager 3.
- Subindex 01 hex gives the EtherCAT communications mode for Sync Manager 2 of the IO-Link Master Unit.
  0000 hex: Free-Run Mode
- Subindex 02 hex gives the cycle time. In Free-Run Mode, the time between two local timer events is given.
- Subindex 04 hex gives the type of synchronization that is supported by the IO-Link Master Unit. It is 0001 hex for the IO-Link Master Unit.
- Subindex 05 hex gives the minimum cycle time that is supported by the IO-Link Master Unit. It is 0000 hex for the IO-Link Master Unit.

A-1-7 Manufacturer-specific Object 1

Index (hex)	Sub-index (hex)	Object name	Default value	Data range	Unit	Data attribute	Size	Access	PDO mapping	Complete access
2002	---	Sysmac Error	---	---	---	---	---	---	---	Not possible
	00	Number of entries	02 hex	02 hex	---	---	1 byte (U8)	RO	Not possible	---
	01	Sysmac Error Status	01 hex	00 to FF hex	---	---	1 byte (U8)	RO	Possible	---
	02	Sysmac Error Status Clear	00 hex	00 to 01 hex	---	A	1 byte (U8)	RW	Not possible	---

- This object gives the Sysmac error status for the IO-Link Master Unit.

- The assignments of bits in the Sysmac error status at subindex 01 hex are listed below.
  The applicable bit is 0 (FALSE) if no error exists, or 1 (TRUE) if an error exists.
  Bits 6 to 7: Reserved
  Bit 5: Minor Fault
  Bit 4: Observation
  Bits 0 to 3: Reserved
  Refer to *7-3-3 Details of PDO Entries* on page 7-9 for details on this status.
- Subindex 02 hex is used to clear the Sysmac Error Status.
  Write 01 hex to clear the Sysmac Error Status. If you write a value other than 01 hex, the command is invalid and the abort code 06090030 hex is returned.
  When a read is performed, 00 hex is given.

Index (hex)	Sub-index (hex)	Object name	Default value	Data range	Unit	Data attribute	Size	Access	PDO mapping	Complete access
2003	---	Sysmac Observation	---	---	---	---	---	---	---	Possible
	00	Number of Observation	00 hex	00 to 20 hex	---	---	1 byte (U8)	RO	Not possible	---
	01	Observation 1	---	---	---	---	12 bytes (ARRAY[0..11] OF BYTE)	RO	Not possible	---
	Subindexes 02 to 09 hex									
	20	Observation 32	---	---	---	---	12 bytes (ARRAY[0..11] OF BYTE)	RO	Not possible	---

- This object gives observation level events that are detected by the IO-Link Master Unit.
- Subindex 00 hex gives the number of observations that are detected by the IO-Link Master Unit.
- Subindexes 01 hex to 20 hex give the error log records for up to 32 observations that currently exist. If an observation is detected when there are 32 logs for observations, the 33rd log is not recorded.
- Observations are stored in the order that they occur from subindexes 01 hex to 20 hex.
- The logs are cleared when 1 (TRUE) is written to the Sysmac Error Status Clear (02 hex) in the Sysmac Error Status (2002 hex).
- The following table gives the format of each log.

Item	Data type	Details
Error code	U32	Event code (stored in little endian)
Type of error detail	U32	Byte 0: Attached information is not provided for 0, and attached information is provided for 1. Byte 1: Attached information is not provided for 0, and attached information is provided for 4. Byte 2 to 3: 0007 hex (fixed)

Item	Data type	Details
Error detail	U32	When the occurring observation has no attached information 1, it indicates 0. When the attached information 1 is provided, it is indicated. Even if an error has two or more attached information, only the attached information 1 is indicated.

Refer to *11-4-3 Error Table* on page 11-16 for the event codes.

Index (hex)	Sub-index (hex)	Object name	Default value	Data range	Unit	Data attribute	Size	Access	PDO mapping	Complete access
2004	---	Sysmac Minor Fault	---	---	---	---	---	---	---	Possible
	00	Number of Minor Fault	00 hex	00 to 20 hex	---	---	1 byte (U8)	RO	Not possible	---
	01	Minor Fault 1	---	---	---	---	12 bytes (ARRA[0..11] OF BYTE)	RO	Not possible	---
	Subindexes 02 to 09 hex									
	20	Minor Fault 32	---	---	---	---	12 bytes (ARRAY[0..11] OF BYTE)	RO	Not possible	---

- This object gives minor fault level events that are detected by the IO-Link Master Unit.
- Subindex 00 hex gives the number of minor faults that are detected by the IO-Link Master Unit.
- Subindexes 01 hex to 20 hex give the error log records for up to 32 minor faults that currently exist. If a minor fault is detected when there are 32 logs for minor faults, the 33rd log is not recorded.
- Minor faults are stored in the order that they occur from subindexes 01 hex to 20 hex.
- The logs are cleared when 1 (TRUE) is written to the Sysmac Error Status Clear (02 hex) in the Sysmac Error Status (2002 hex).
- The following table gives the format of each log.

Item	Data type	Details
Error code	U32	Event code (stored in little endian)
Type of error detail	U32	Byte 0: Attached information is not provided for 0, and attached information is provided for 1. Byte 1: Attached information is not provided for 0, and attached information is provided for 4. Byte 2 to 3: 0007 hex (fixed)
Error detail	U32	When the occurring minor fault has no attached information 1, it indicates 0. When the attached information 1 is provided, it is indicated. Even if an error has two or more attached information, only the attached information 1 is indicated.

Refer to *11-4-3 Error Table* on page 11-16 for the event codes.

Index (hex)	Sub-index (hex)	Object name	Default value	Data range	Unit	Data attribute	Size	Access	PDO mapping	Complete access
2100	---	Error History Clear	00000000 hex	---	---	A	4 bytes (U32)	RW	Not possible	Not possible

- This object is used to clear the diagnosis messages in the Diagnosis History (10F3 hex).
- The diagnosis messages are cleared only when you write a specific value. The designated value means “elcl.”

MSB			LSB
l	c	l	e
6C hex	63 hex	6C hex	65 hex

If you write a value other than the ones given, the result is invalid and the abort code is returned.

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Index (hex)	Sub-index (hex)	Object name	Default value	Data range	Unit	Data attribute	Size	Access	PDO mapping	Complete access
3000	---	I/O Port Status	---	---	---	---	---	---	---	Not possible
	00	Number of entries	01 hex	01 hex	---	---	1 byte (U8)	RO	Not possible	---
	01	I/O Port Status	0000 hex	0000 to FFFF hex	---	---	2 bytes (U16)	RO	Possible	---

The following table shows the bit configuration of the *I/O Port Status* object. The status can be accessed either as WORD data or BOOL data.

Bit	Meaning	Default value	Data range
0	Port1 Input Data Enabled	FALSE	FALSE/TRUE
1	Port2 Input Data Enabled	FALSE	FALSE/TRUE
2	Port3 Input Data Enabled	FALSE	FALSE/TRUE
3	Port4 Input Data Enabled	FALSE	FALSE/TRUE
4	Port5 Input Data Enabled	FALSE	FALSE/TRUE
5	Port6 Input Data Enabled	FALSE	FALSE/TRUE
6	Port7 Input Data Enabled	FALSE	FALSE/TRUE
7	Port8 Input Data Enabled	FALSE	FALSE/TRUE
12	PDO Size Shortage	FALSE	FALSE/TRUE
13	I/O Port Error	FALSE	FALSE/TRUE
14	Unit/Input Power Supply Voltage Drop	FALSE	FALSE/TRUE
15	Output Power Supply Voltage Drop	FALSE	FALSE/TRUE

When *I/O Port Error* is TRUE, it indicates that an error occurred on one of ports 1 to 8.
When *PDO Size Shortage* is TRUE, it indicates that one of the following occurred.

- *Port□ IO-Link Device Configuration Data/Process Data In Length* is larger than the input PDO mapping size for the port.
- *Port□ IO-Link Device Configuration Data/Process Data Out Length* is larger than the output PDO mapping size for the port.

Index (hex)	Sub-index (hex)	Object name	Default value	Data range	Unit	Data attribute	Size	Access	PDO mapping	Complete access
3001	---	Port1_2 I/O Port Error Status	---	---	---	---	---	---	---	Not possible
	00	Number of entries	01 hex	01 hex	---	---	1 byte (U8)	RO	Not possible	---
	01	Port1_2 I/O Port Error Status	0000 hex	0000 to FFFF hex	---	---	2 bytes (U16)	RO	Possible	---

The following table shows the bit configuration of the *Port1_2 I/O Port Error Status* object. The status can be accessed either as WORD data or BOOL data.

Bit	Meaning	Default value	Data range
0	Port1 IO-Link Communications Error	FALSE	FALSE/TRUE
1	Port1 Pin1 Short-circuit Error	FALSE	FALSE/TRUE
2	Port1 Verification Error	FALSE	FALSE/TRUE
3	Port1 Device I/O Size Error	FALSE	FALSE/TRUE
4	Port1 Device Error-level Event	FALSE	FALSE/TRUE
5	Port1 Device Warning-level Event	FALSE	FALSE/TRUE
6	Port1 Pin2 Short-circuit Error	FALSE	FALSE/TRUE
7	Port1 Pin4 Short-circuit Error	FALSE	FALSE/TRUE
8	Port2 IO-Link Communications Error	FALSE	FALSE/TRUE
9	Port2 Pin1 Short-circuit Error	FALSE	FALSE/TRUE
10	Port2 Verification Error	FALSE	FALSE/TRUE
11	Port2 Device I/O Size Error	FALSE	FALSE/TRUE
12	Port2 Device Error-level Event	FALSE	FALSE/TRUE
13	Port2 Device Warning-level Event	FALSE	FALSE/TRUE
14	Port2 Pin2 Short-circuit Error	FALSE	FALSE/TRUE
15	Port2 Pin4 Short-circuit Error	FALSE	FALSE/TRUE

When *Port□ Device I/O Size Error* is TRUE, it indicates that one of the following occurred.
- *Port□ IO-Link Device Configuration Data/Process Data In Length* is smaller than the process input data size for the actually connected IO-Link device.
- *Port□ IO-Link Device Configuration Data/Process Data Out Length* is smaller than the process output data size for the actually connected IO-Link device.

Index (hex)	Sub-index (hex)	Object name	Default value	Data range	Unit	Data attribute	Size	Access	PDO mapping	Complete access
3002	---	Port3_4 I/O Port Error Status	---	---	---	---	---	---	---	Not possible
	00	Number of entries	01 hex	01 hex	---	---	1 byte (U8)	RO	Not possible	---
	01	Port3_4 I/O Port Error Status	0000 hex	0000 to FFFF hex	---	---	2 bytes (U16)	RO	Possible	---

For the bit configuration of the *Port3_4 I/O Port Error Status* object, refer to the bit configuration of the *Port1_2 I/O Port Error Status* object with port 1 replaced by port 3 and port 2 replaced by port 4.

Index (hex)	Sub-index (hex)	Object name	Default value	Data range	Unit	Data attribute	Size	Access	PDO mapping	Complete access
3003	---	Port5_6 I/O Port Error Status	---	---	---	---	---	---	---	Not possible
	00	Number of entries	01 hex	01 hex	---	---	1 byte (U8)	RO	Not possible	---
	01	Port5_6 I/O Port Error Status	0000 hex	0000 to FFFF hex	---	---	2 bytes (U16)	RO	Possible	---

For the bit configuration of the *Port5_6 I/O Port Error Status* object, refer to the bit configuration of the *Port1_2 I/O Port Error Status* object with port 1 replaced by port 5 and port 2 replaced by port 6.

Index (hex)	Sub-index (hex)	Object name	Default value	Data range	Unit	Data attribute	Size	Access	PDO mapping	Complete access
3004	---	Port7_8 I/O Port Error Status	---	---	---	---	---	---	---	Not possible
	00	Number of entries	01 hex	01 hex	---	---	1 byte (U8)	RO	Not possible	---
	01	Port7_8 I/O Port Error Status	0000 hex	0000 to FFFF hex	---	---	2 bytes (U16)	RO	Possible	---

For the bit configuration of the *Port7_8 I/O Port Error Status* object, refer to the bit configuration of the *Port1_2 I/O Port Error Status* object with port 1 replaced by port 7 and port 2 replaced by port 8.

Index (hex)	Sub-index (hex)	Object name	Default value	Data range	Unit	Data attribute	Size	Access	PDO mapping	Complete access
3005	---	Digital Input Data	---	---	---	---	---	---	---	Not possible
	00	Number of entries	01 hex	01 hex	---	---	1 byte (U8)	RO	Not possible	---
	01	Digital Input Data	0000 hex	0000 to FFFF hex	---	---	2 bytes (U16)	RO	Possible	---

The following table shows the bit configuration of the *Digital Input Data* object. The status can be accessed either as WORD data or BOOL data.

Bit	Meaning	Default value	Data range
0	Port1 Pin4 Digital Input Bit	FALSE	FALSE/TRUE
1	Port1 Pin2 Digital Input Bit	FALSE	FALSE/TRUE
2	Port2 Pin4 Digital Input Bit	FALSE	FALSE/TRUE
3	Port2 Pin2 Digital Input Bit	FALSE	FALSE/TRUE
4	Port3 Pin4 Digital Input Bit	FALSE	FALSE/TRUE
5	Port3 Pin2 Digital Input Bit	FALSE	FALSE/TRUE
6	Port4 Pin4 Digital Input Bit	FALSE	FALSE/TRUE
7	Port4 Pin2 Digital Input Bit	FALSE	FALSE/TRUE
8	Port5 Pin4 Digital Input Bit	FALSE	FALSE/TRUE
9	Port5 Pin2 Digital Input Bit	FALSE	FALSE/TRUE
10	Port6 Pin4 Digital Input Bit	FALSE	FALSE/TRUE
11	Port6 Pin2 Digital Input Bit	FALSE	FALSE/TRUE
12	Port7 Pin4 Digital Input Bit	FALSE	FALSE/TRUE
13	Port7 Pin2 Digital Input Bit	FALSE	FALSE/TRUE
14	Port8 Pin4 Digital Input Bit	FALSE	FALSE/TRUE
15	Port8 Pin2 Digital Input Bit	FALSE	FALSE/TRUE

Index (hex)	Sub-index (hex)	Object name	Default value	Data range	Unit	Data attribute	Size	Access	PDO mapping	Complete access
3100	---	Digital Output Data	---	---	---	---	---	---	---	Not possible
	00	Number of entries	01 hex	01 hex	---	---	1 byte (U8)	RO	Not possible	---
	01	Digital Output Data	0000 hex	0000 to FFFF hex	---	A	2 bytes (U16)	RW	Possible	---

The following table shows the bit configuration of the *Digital Output Data* object. The status can be accessed either as WORD data or BOOL data.

Bit	Meaning	Default value	Data range
0	Port1 Pin4 Digital Output Bit	FALSE	FALSE/TRUE
1	Port1 Pin2 Digital Output Bit	FALSE	FALSE/TRUE
2	Port2 Pin4 Digital Output Bit	FALSE	FALSE/TRUE
3	Port2 Pin2 Digital Output Bit	FALSE	FALSE/TRUE
4	Port3 Pin4 Digital Output Bit	FALSE	FALSE/TRUE
5	Port3 Pin2 Digital Output Bit	FALSE	FALSE/TRUE
6	Port4 Pin4 Digital Output Bit	FALSE	FALSE/TRUE
7	Port4 Pin2 Digital Output Bit	FALSE	FALSE/TRUE
8	Port5 Pin4 Digital Output Bit	FALSE	FALSE/TRUE
9	Port5 Pin2 Digital Output Bit	FALSE	FALSE/TRUE
10	Port6 Pin4 Digital Output Bit	FALSE	FALSE/TRUE
11	Port6 Pin2 Digital Output Bit	FALSE	FALSE/TRUE
12	Port7 Pin4 Digital Output Bit	FALSE	FALSE/TRUE
13	Port7 Pin2 Digital Output Bit	FALSE	FALSE/TRUE
14	Port8 Pin4 Digital Output Bit	FALSE	FALSE/TRUE
15	Port8 Pin2 Digital Output Bit	FALSE	FALSE/TRUE

Index (hex)	Sub-index (hex)	Object name	Default value	Data range	Unit	Data attribute	Size	Access	PDO mapping	Complete access
3201	---	IO-Link Device Verification Setting	---	---	---	---	---	---	---	Not possible
	00	Number of entries	08 hex	08 hex	---	---	1 byte (U8)	RO	Not possible	---
	01	Port1 Device Verification Setting	00 hex	00 to 02 hex	---	R	1 byte (U8)	RW	Not possible	---
	Subindexes: 02 to 07									
	08	Port8 Device Verification Setting	00 hex	00 to 02 hex	---	R	1 byte (U8)	RW	Not possible	---

The meanings of the set values for the *Device Verification Setting* are as follows:

Set value	Meaning
00 hex	Devices are not verified.
01 hex	Devices are verified for the Vendor ID, Device ID, and IO-Link Revision.
02 hex	Devices are verified for the Vendor ID, Device ID, IO-Link Revision, and Serial Number.

Index (hex)	Sub-index (hex)	Object name	Default value	Data range	Unit	Data attribute	Size	Access	PDO mapping	Complete access
3202	---	Backup/Restore Setting	---	---	---	---	---	---	---	Not possible
	00	Number of entries	08 hex	08 hex	---	---	1 byte (U8)	RO	Not possible	---
	01	Port1 Backup/Restore Setting	00 hex	00 to 02 hex	---	R	1 byte (U8)	RW	Not possible	---
	Subindexes: 02 to 07									
	08	Port8 Backup/Restore Setting	00 hex	00 to 02 hex	---	R	1 byte (U8)	RW	Not possible	---

The meanings of the set values for the *Backup/Restore Setting* are as follows:

Set value	Meaning
00 hex	The backup/restore functions are disabled.
01 hex	The backup functions are enabled.
02 hex	The restore function is enabled.

Index (hex)	Sub-index (hex)	Object name	Default value	Data range	Unit	Data attribute	Size	Access	PDO mapping	Complete access
3204	---	Load Rejection Output Setting	---	---	---	---	---	---	---	Not possible
	00	Number of entries	08 hex	08 hex	---	---	1 byte (U8)	RO	Not possible	---
	01	Port1 Load Rejection Output Setting	00 hex	00 hex, 01 hex	---	R	1 byte (U8)	RW	Not possible	---
	Subindexes: 02 to 07									
	08	Port8 Load Rejection Output Setting	00 hex	00 hex, 01 hex	---	R	1 byte (U8)	RW	Not possible	---

The *Load Rejection Output Setting* is used to set the load rejection outputs to use when Controller communications errors occur.
The meanings of the set values are as follows.

Set value	Meaning
00 hex	• IO-Link Mode Enable: Output rejection notification is sent to the IO-Link device. • SIO (DO) Mode Enable: The output value is cleared to OFF.

Set value	Meaning
01 hex	• IO-Link Mode Disable: IO-Link communications continue with the last output data that was received. • SIO (DO) Mode Disable: The output that was last received is retained.

Index (hex)	Sub-index (hex)	Object name	Default value	Data range	Unit	Data attribute	Size	Access	PDO mapping	Complete access
3205	---	Input Filter Setting	---	---	---	---	---	---	---	Not possible
	00	Number of entries	10 hex	10 hex	---	---	1 byte (U8)	RO	Not possible	---
	01	Port1 Pin4 Input Filter Value Setting	03 hex	00 to 0B hex	---	R	1 byte (U8)	RW	Not possible	---
	02	Port1 Pin2 Input Filter Value Setting	03 hex	00 to 0B hex	---	R	1 byte (U8)	RW	Not possible	---
	03	Port2 Pin4 Input Filter Value Setting	03 hex	00 to 0B hex	---	R	1 byte (U8)	RW	Not possible	---
	04	Port2 Pin2 Input Filter Value Setting	03 hex	00 to 0B hex	---	R	1 byte (U8)	RW	Not possible	---
	05	Port3 Pin4 Input Filter Value Setting	03 hex	00 to 0B hex	---	R	1 byte (U8)	RW	Not possible	---
	06	Port3 Pin2 Input Filter Value Setting	03 hex	00 to 0B hex	---	R	1 byte (U8)	RW	Not possible	---
	07	Port4 Pin4 Input Filter Value Setting	03 hex	00 to 0B hex	---	R	1 byte (U8)	RW	Not possible	---
	08	Port4 Pin2 Input Filter Value Setting	03 hex	00 to 0B hex	---	R	1 byte (U8)	RW	Not possible	---
	09	Port5 Pin4 Input Filter Value Setting	03 hex	00 to 0B hex	---	R	1 byte (U8)	RW	Not possible	---
	0A	Port5 Pin2 Input Filter Value Setting	03 hex	00 to 0B hex	---	R	1 byte (U8)	RW	Not possible	---
	0B	Port6 Pin4 Input Filter Value Setting	03 hex	00 to 0B hex	---	R	1 byte (U8)	RW	Not possible	---
	0C	Port6 Pin2 Input Filter Value Setting	03 hex	00 to 0B hex	---	R	1 byte (U8)	RW	Not possible	---
	0D	Port7 Pin4 Input Filter Value Setting	03 hex	00 to 0B hex	---	R	1 byte (U8)	RW	Not possible	---
	0E	Port7 Pin2 Input Filter Value Setting	03 hex	00 to 0B hex	---	R	1 byte (U8)	RW	Not possible	---

Index (hex)	Sub-index (hex)	Object name	Default value	Data range	Unit	Data attribute	Size	Access	PDO mapping	Complete access
	0F	Port8 Pin4 Input Filter Value Setting	03 hex	00 to 0B hex	---	R	1 byte (U8)	RW	Not possible	---
	10	Port8 Pin2 Input Filter Value Setting	03 hex	00 to 0B hex	---	R	1 byte (U8)	RW	Not possible	---

Set the filter times for the digital input signals in the *Input Filter Setting* object.
The meanings of the set values are as follows.

Set value	Meaning
00 hex	No filter
01 hex	0.25 ms
02 hex	0.5 ms
03 hex	1 ms (default)
04 hex	2 ms
05 hex	4 ms
06 hex	8 ms
07 hex	16 ms
08 hex	32 ms
09 hex	64 ms
0A hex	128 ms
0B hex	256 ms

Index (hex)	Sub-index (hex)	Object name	Default value	Data range	Unit	Data attribute	Size	Access	PDO mapping	Complete access
3207	---	Create IO-Link Device List Command	---	---	---	---	---	---	---	Not possible
	00	Number of entries	01 hex	01 hex	---	---	1 byte (U8)	RO	Not possible	---
	01	Create IO-Link Device List Command	00 hex	00 hex, 01 hex	---	A	1 byte (U8)	RW	Not possible	---

The Create IO-Link Device List Command object creates configuration information on the connected IO-Link devices as the configuration information for device verification.
The meanings of the set values are as follows.

Set value	Meaning
00 hex	Nothing is performed.
01 hex	Creates configuration information on the IO-Link devices connected to all ports.

Index (hex)	Sub-index (hex)	Object name	Default value	Data range	Unit	Data attribute	Size	Access	PDO mapping	Complete access
3209	---	Clear Backup Data Command	---	---	---	---	---	---	---	Not possible
	00	Number of entries	02 hex	00 to 02 hex	---	---	1 byte (U8)	RO	Not possible	---
	01	Command	00 hex	00 hex, 01 hex	---	A	1 byte (U8)	RW	Possible	---
	02	Result	0000 hex	0000 to FFFF hex	---	---	2 bytes (U32)	RO	Not possible	---

Clears the backup data of the IO-Link devices stored in the IO-Link master when the set value of subindex 01 hex (*Command*) changes from 00 hex to 01 hex.
The meanings of the set values are as follows.

Set value	Meaning
00 hex	Does not clear the IO-Link backup data.
01 hex	Clears the IO-Link backup data.

Subindex 02 hex (*Result*) is used to display the cleared status of the IO-Link device backup data that is stored in the IO-Link Master Unit.
The meanings of the values are as follows:

Set value	Meaning
0000 hex	Clearing backup data is completed or not executed.
0001 hex	Clearing backup data failed.
FFFF hex	Execution is in progress.

Index (hex)	Sub-index (hex)	Object name	Default value	Data range	Unit	Data attribute	Size	Access	PDO mapping	Complete access
320A	---	Message Timeout for IO-Link Device	---	---	---	---	---	---	---	Not possible
	00	Number of entries	01 hex	01 hex	---	---	1 byte (U8)	RO	Not possible	---
	01	Session Timeout	03 hex	00 to FF hex	s	A	1 byte (U8)	RW	Not possible	---

Set the status (Success or Error) hold time for messages for IO-Link devices. The unit is seconds.

Index (hex)	Sub-index (hex)	Object name	Default value	Data range	Unit	Data attribute	Size	Access	PDO mapping	Complete access
320C	---	Offset Setting of Digital Input Data Collection	---	---	---	---	---	---	---	Not possible
	00	Number of entries	08 hex	08 hex	---	---	1 byte (U8)	RO	Not possible	---
	01	Offset Setting of Port1 Digital Input Data Collection	00 hex	00 to FF hex	---	R	1 byte (U8)	RW	Not possible	---
	Subindexes: 02 to 07									
	08	Offset Setting of Port8 Digital Input Data Collection	00 hex	00 to FF hex	---	R	1 byte (U8)	RW	Not possible	---

If the offset value is set in excess of the IO-Link data size, the bit data collected in the Digital Input Data is always 0.

Example 1: If the IO-Link data size is 2 bytes, the set range is enabled from 00 to 0F hex.
If the set range is 10 to FF hex, the data collected in the Digital Input Data is always 0.

Example 2: If the IO-Link data size is 16 bytes, the set range is enabled from 00 to 7F hex.
If the set range is 80 to FF hex, the data collected in the Digital Input Data is always 0.

Index (hex)	Sub-index (hex)	Object name	Default value	Data range	Unit	Data attribute	Size	Access	PDO mapping	Complete access
320D	---	Unit/Input Power Supply Voltage Information	---	---	---	---	---	---	---	Not possible
	00	Number of entries	03 hex	03 hex	---	---	1 byte (U8)	RO	Not possible	---
	01	Unit/Input Power Supply Voltage	00 hex	0000 to FFFF hex	0.1 V	---	2 bytes (U16)	RO	Not possible	---
	02	Maximum Unit/Input Power Supply Voltage	00 hex	00 to FFFF hex	0.1 V	---	2 bytes (U16)	RO	Not possible	---
	03	Minimum Unit/Input Power Supply Voltage	00 hex	00 to FFFF hex	0.1 V	---	2 bytes (U16)	RO	Not possible	---

Subindex 01 hex (*Unit/Input Power Supply Voltage*) indicates the current value of the Unit/input power supply voltage. The unit is 0.1 V.
Subindex 02 hex (*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.
Subindex 03 hex (*Minimum Unit/Input 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.

Index (hex)	Sub-index (hex)	Object name	Default value	Data range	Unit	Data attribute	Size	Access	PDO mapping	Complete access
320E	---	Output Power Supply Voltage Information	---	---	---	---	---	---	---	Not possible
	00	Number of entries	03 hex	03 hex	---	---	1 byte (U8)	RO	Not possible	---
	01	Output Power Supply Voltage	00 hex	0000 to FFFF hex	0.1 V	---	2 bytes (U16)	RO	Not possible	---
	02	Maximum Output Power Supply Voltage	00 hex	0000 to FFFF hex	0.1 V	---	2 bytes (U16)	RO	Not possible	---
	03	Minimum Output Power Supply Voltage	00 hex	0000 to FFFF hex	0.1 V	---	2 bytes (U16)	RO	Not possible	---

Subindex 01 hex (*Output Power Supply Voltage*) indicates the current value of the output power supply voltage. The unit is 0.1 V.
Subindex 02 hex (*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.
Subindex 03 hex (*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.

Index (hex)	Sub-index (hex)	Object name	Default value	Data range	Unit	Data attribute	Size	Access	PDO mapping	Complete access
320F	---	Total Power-ON Time	---	---	---	---	---	---	---	Not possible
	00	Number of entries	01 hex	01 hex	---	---	1 byte (U8)	RO	Not possible	---
	01	Total Power-ON Time	00 hex	00000000 to 2AAAAAAA hex	h	---	4 bytes (U32)	RO	Not possible	---

Index (hex)	Sub-index (hex)	Object name	Default value	Data range	Unit	Data attribute	Size	Access	PDO mapping	Complete access
3210	---	Communication Delay Time	---	---	---	---	---	---	---	Not possible
	00	Number of entries	08 hex	08 hex	---	---	1 byte (U8)	RO	Not possible	---
	01	Port1 Communication Delay Time	00 hex	00 to BF hex	---	R	1 byte (U8)	RW	Not possible	---
	Subindexes: 02 to 07									
	08	Port8 Communication Delay Time	00 hex	00 to BF hex	---	R	1 byte (U8)	RW	Not possible	---

The bit configuration and time for the Communication Delay Time object are as follows.

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Time value		Multiplier					

The time calculated from the time value and the multiplier is given in the following table.

Bits 6 to 7	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

Index (hex)	Sub-index (hex)	Object name	Default value	Data range	Unit	Data attribute	Size	Access	PDO mapping	Complete access
3211	---	Quick Setting Switch Value	---	---	---	---	---	---	---	Not possible
	00	Number of entries	01 hex	01 hex	---	---	1 byte (U8)	RO	Not possible	---
	01	Quick Setting Switch Value	01 hex	00 to 0F hex	---	---	1 byte (U8)	RO	Not possible	---

A-1-9 Manufacturer-specific Object 3

Index (hex)	Sub-index (hex)	Object name	Default value	Data range	Unit	Data attribute	Size	Access	PDO mapping	Complete access
4000	---	Port1 Message for IO-Link Device	---	---	---	---	---	---	---	Possible
	00	Number of entries	11 hex	11 hex	---	---	1 byte (U8)	RO	Not possible	---
	01	Control	00 hex	00 hex, 02 to 03 hex	---	A	1 byte (U8)	RW	Not possible	---
	02	Status	00 hex	00 to 05 hex	---	---	1 byte (U8)	RO	Not possible	---
	03	Index	0000 hex	0000 to FFFF hex	---	A	2 bytes (U16)	RW	Not possible	---
	04	Subindex	00 hex	00 to FF hex	---	A	1 byte (U8)	RW	Not possible	---
	05	Length	00 hex	00 to FF hex	---	A	1 byte (U8)	RW	Not possible	---
	06	Data	00 hex	00 to FF hex (All of the 232 bytes)	---	A	232 bytes (ARRAY[0..231] OF BYTE)	RW	Not possible	---
	07	Error Code	0000 hex	0000 to FFFF hex	---	---	2 bytes (U16)	RO	Not possible	---
	10	Timeout	0000 hex	0000 to FFFF hex	---	A	2 bytes (U16)	RW	Not possible	---
	11	Sequence No	00 hex	00 to FF hex	---	A	1 byte (U8)	RW	Not possible	---
Indexes: 4010 to 4060*1										
4070	---	Port8 Message for IO-Link Device	---	---	---	---	---	---	---	Possible
	00	Number of entries	11 hex	11 hex	---	---	1 byte (U8)	RO	Not possible	---
	01	Control	00 hex	00 hex, 02 to 03 hex	---	A	1 byte (U8)	RW	Not possible	---

Index (hex)	Sub-index (hex)	Object name	Default value	Data range	Unit	Data attribute	Size	Access	PDO mapping	Complete access
	02	Status	00 hex	00 to 05 hex	---	---	1 byte (U8)	RO	Not possible	---
	03	Index	0000 hex	0000 to FFFF hex	---	A	2 bytes (U16)	RW	Not possible	---
	04	Subindex	00 hex	00 to FF hex	---	A	1 byte (U8)	RW	Not possible	---
	05	Length	00 hex	00 to FF hex	---	A	1 byte (U8)	RW	Not possible	---
	06	Data	00 hex	00 to FF hex (All of the 232 bytes)	---	A	232 bytes (ARRAY[0..231] OF BYTE)	RW	Not possible	---
	07	Error Code	0000 hex	0000 to FFFF hex	---	---	2 bytes (U16)	RO	Not possible	---
	10	Timeout	0000 hex	0000 to FFFF hex	---	A	2 bytes (U16)	RW	Not possible	---
	11	Sequence No	00 hex	00 to FF hex	---	A	1 byte (U8)	RW	Not possible	---

*1. Indexes 4010 hex, 4020 hex, 4030 hex, 4040 hex, 4050 hex, and 4060 hex are shown in abbreviated form. The port number in each object name is allocated in ascending order, from port 2 to port 7. Data definitions for items other than Object name are the same as those for indexes 4000 hex and 4070 hex.

A-1-10 Manufacturer-specific Object 4

Index (hex)	Sub-index (hex)	Object name	Default value	Data range	Unit	Data attribute	Size	Access	PDO mapping	Complete access
8000	---	Port1 IO-Link Device Configuration Data	---	---	---	---	---	---	---	Not possible
	00	Number of entries	28 hex	28 hex	---	---	1 byte (U8)	RO	Not possible	---
	04	Device ID	00000000 hex	00000000 to 00FFFFFF hex	---	R	4 bytes (U32)	RW	Not possible	---
	05	Vendor ID	00000000 hex	00000000 to 0000FFFF hex	---	R	4 bytes (U32)	RW	Not possible	---
	20	IO-Link Revision	00 hex	00 to FF hex	---	R	1 byte (U8)	RW	Not possible	---
	24	Process Data In Length	02 hex	00 to 20 hex	---	R	1 byte (U8)	RW	Not possible	---
	25	Process Data Out Length	02 hex	00 to 20 hex	---	R	1 byte (U8)	RW	Not possible	---
	28	Pin4 Communications Mode Setting	03 hex	00 to 03 hex	---	R	1 byte (U8)	RW	Not possible	---
	29	Pin2 Communications Mode Setting	01 hex	00 to 02 hex	---	R	1 byte (U8)	RW	Not possible	---
Indexes: 8010 to 8060[*1]										
8070	---	Port8 IO-Link Device Configuration Data	---	---	---	---	---	---	---	Not possible
	00	Number of entries	28 hex	28 hex	---	---	1 byte (U8)	RO	Not possible	---
	04	Device ID	00000000 hex	00000000 to 00FFFFFF hex	---	R	4 bytes (U32)	RW	Not possible	---
	05	Vendor ID	00000000 hex	00000000 to 0000FFFF hex	---	R	4 bytes (U32)	RW	Not possible	---
	20	IO-Link Revision	00 hex	00 to FF hex	---	R	1 byte (U8)	RW	Not possible	---
	24	Process Data In Length	02 hex	00 to 20 hex	---	R	1 byte (U8)	RW	Not possible	---

Index (hex)	Sub-index (hex)	Object name	Default value	Data range	Unit	Data attribute	Size	Access	PDO mapping	Complete access
	25	Process Data Out Length	02 hex	00 to 20 hex	---	R	1 byte (U8)	RW	Not possible	---
	28	Pin4 Communications Mode Setting	03 hex	00 to 03 hex	---	R	1 byte (U8)	RW	Not possible	---
	29	Pin2 Communications Mode Setting	01 hex	00 to 02 hex	---	R	1 byte (U8)	RW	Not possible	---

*1. Indexes 8010 hex, 8020 hex, 8030 hex, 8040 hex, 8050 hex, and 8060 hex are shown in abbreviated form. For indexes 8010 hex to 8060 hex, the port number in each object name is allocated in ascending order, from port 2 to port 7. Data definitions for items other than Object name are the same as those for indexes 8000 hex and 8070 hex.

Use *Pin4 Communications Mode Setting* to set pin 4 communications mode for each port. The meanings of the set values are as follows.

Set value	Meaning
00 hex	Disable Port
01 hex	SIO (DI) Mode
02 hex	SIO (DO) Mode
03 hex	IO-Link Mode (default)

Use *Pin2 Communications Mode Setting* to set pin 2 communications mode for each port. The meanings of the set values are as follows.

Set value	Meaning
00 hex	Disable Port
01 hex	SIO (DI) Mode (default)
02 hex	SIO (DO) Mode

Index (hex)	Sub-index (hex)	Object name	Default value	Data range	Unit	Data attribute	Size	Access	PDO mapping	Complete access
8001	---	Port1 Serial Number Configuration Data	---	---	---	R	16 bytes (VS)	RW	Not possible	Not possible
Indexes: 8011 to 8061*1										
8071	---	Port8 Serial Number Configuration Data	---	---	---	R	16 bytes (VS)	RW	Not possible	Not possible

*1. Indexes 8011 hex, 8021 hex, 8031 hex, 8041 hex, 8051 hex, and 8061 hex are shown in abbreviated form. For indexes 8011 hex to 8061 hex, the port number in each object name is allocated in ascending order, from port 2 to port 7. Data definitions for items other than Object name are the same as those for indexes 8001 hex and 8071 hex.

Index (hex)	Sub-index (hex)	Object name	Default value	Data range	Unit	Data attribute	Size	Access	PDO mapping	Complete access
8002	---	Port1 Vendor Name of the Last Connected IO-Link Device	---	---	---	A	64 bytes (VS)	RW	Not possible	Not possible
Indexes: 8012 to 8062*1										
8072	---	Port8 Vendor Name of the Last Connected IO-Link Device	---	---	---	A	64 bytes (VS)	RW	Not possible	Not possible

*1. Indexes 8012 hex, 8022 hex, 8032 hex, 8042 hex, 8052 hex, and 8062 hex are shown in abbreviated form. For indexes 8012 hex to 8062 hex, the port number in each object name is allocated in ascending order, from port 2 to port 7. Data definitions for items other than Object name are the same as those for indexes 8002 hex and 8072 hex.

Index (hex)	Sub-index (hex)	Object name	Default value	Data range	Unit	Data attribute	Size	Access	PDO mapping	Complete access
8003	---	Port1 Product Name of the Last Connected IO-Link Device	---	---	---	A	64 bytes (VS)	RW	Not possible	Not possible
Indexes: 8013 to 8063*1										
8073	---	Port8 Product Name of the Last Connected IO-Link Device	---	---	---	A	64 bytes (VS)	RW	Not possible	Not possible

*1. Indexes 8013 hex, 8023 hex, 8033 hex, 8043 hex, 8053 hex, and 8063 hex are shown in abbreviated form. For indexes 8013 hex to 8063 hex, the port number in each object name is allocated in ascending order, from port 2 to port 7. Data definitions for items other than Object name are the same as those for indexes 8003 hex and 8073 hex.

Index (hex)	Sub-index (hex)	Object name	Default value	Data range	Unit	Data attribute	Size	Access	PDO mapping	Complete access
9000	---	Port1 IO-Link Device Information Area	---	---	---	---	---	---	---	Not possible
	00	Number of entries	25 hex	25 hex	---	---	1 byte (U8)	RO	Not possible	---
	04	Device ID	00000000 hex	00000000 to 00FFFFFF hex	---	---	4 bytes (U32)	RO	Not possible	---
	05	Vendor ID	00000000 hex	00000000 to 0000FFFF hex	---	---	4 bytes (U32)	RO	Not possible	---
	20	IO-Link Revision	00 hex	00 to FF hex	---	---	1 byte (U8)	RO	Not possible	---
	22	Cycle Time	00 hex	00 to FF hex	---	---	1 byte (U8)	RO	Not possible	---
	24	Process Data In Length	02 hex	00 to 20 hex	---	---	1 byte (U8)	RO	Not possible	---
	25	Process Data Out Length	02 hex	00 to 20 hex	---	---	1 byte (U8)	RO	Not possible	---
Indexes: 9010 to 9060*1										
9070	---	Port8 IO-Link Device Information Area	---	---	---	---	---	---	---	Not possible
	00	Number of entries	25 hex	25 hex	---	---	1 byte (U8)	RO	Not possible	---
	04	Device ID	00000000 hex	00000000 to 00FFFFFF hex	---	---	4 bytes (U32)	RO	Not possible	---
	05	Vendor ID	00000000 hex	00000000 to 0000FFFF hex	---	---	4 bytes (U32)	RO	Not possible	---
	20	IO-Link Revision	00 hex	00 to FF hex	---	---	1 byte (U8)	RO	Not possible	---
	22	Cycle Time	00 hex	00 to FF hex	---	---	1 byte (U8)	RO	Not possible	---
	24	Process Data In Length	02 hex	00 to 20 hex	---	---	1 byte (U8)	RO	Not possible	---

Index (hex)	Sub-index (hex)	Object name	Default value	Data range	Unit	Data attribute	Size	Access	PDO mapping	Complete access
	25	Process Data Out Length	02 hex	00 to 20 hex	---	---	1 byte (U8)	RO	Not possible	---

*1. Indexes 9010 hex, 9020 hex, 9030 hex, 9040 hex, 9050 hex, and 9060 hex are shown in abbreviated form. For indexes 9010 hex to 9060 hex, the port number in each object name is allocated in ascending order, from port 2 to port 7. Data definitions for items other than Object name are the same as those for indexes 9000 hex and 9070 hex.

Index (hex)	Sub-index (hex)	Object name	Default value	Data range	Unit	Data attribute	Size	Access	PDO mapping	Complete access
9001	---	Port1 Serial Number Information Data	---	---	---	---	16 bytes (VS)	RO	Not possible	Not possible
Indexes: 9011 to 9061*1										
9071	---	Port8 Serial Number Information Data	---	---	---	---	16 bytes (VS)	RO	Not possible	Not possible

*1. Indexes 9011 hex, 9021 hex, 9031 hex, 9041 hex, 9051 hex, and 9061 hex are shown in abbreviated form. For indexes 9011 hex to 9061 hex, the port number in each object name is allocated in ascending order, from port 2 to port 7. Data definitions for items other than Object name are the same as those for indexes 9001 hex and 9071 hex.

Index (hex)	Sub-index (hex)	Object name	Default value	Data range	Unit	Data attribute	Size	Access	PDO mapping	Complete access
9002	---	Port1 Connected Vendor Name	---	---	---	---	64 bytes (VS)	RO	Not possible	Not possible
Indexes: 9012 to 9062*1										
9072	---	Port8 Connected Vendor Name	---	---	---	---	64 bytes (VS)	RO	Not possible	Not possible

*1. Indexes 9012 hex, 9022 hex, 9032 hex, 9042 hex, 9052 hex, and 9062 hex are shown in abbreviated form. For indexes 9012 hex to 9062 hex, the port number in each object name is allocated in ascending order, from port 2 to port 7. Data definitions for items other than Object name are the same as those for indexes 9002 hex and 9072 hex.

Index (hex)	Sub-index (hex)	Object name	Default value	Data range	Unit	Data attribute	Size	Access	PDO mapping	Complete access
9003	---	Port1 Connected Product Name	---	---	---	---	64 bytes (VS)	RO	Not possible	Not possible
Indexes: 9013 to 9063*1										
9073	---	Port8 Connected Product Name	---	---	---	---	64 bytes (VS)	RO	Not possible	Not possible

*1. Indexes 9013 hex, 9023 hex, 9033 hex, 9043 hex, 9053 hex, and 9063 hex are shown in abbreviated form. For indexes 9013 hex to 9063 hex, the port number in each object name is allocated in ascending order, from port 2 to port 7. Data definitions for items other than Object name are the same as those for indexes 9003 hex and 9073 hex.

Index (hex)	Sub-index (hex)	Object name	Default value	Data range	Unit	Data attribute	Size	Access	PDO mapping	Complete access
A000	---	Port1 Diagnosis Data	---	---	---	---	---	---	---	Not possible
	00	Number of entries	02 hex	02 hex	---	---	1 byte (U8)	RO	Not possible	---
	02	Lost Frames	00 hex	00 to FF hex	---	A	1 byte (U8)	RW	Not possible	---
Indexes: A010 to A060*1										
A070	---	Port8 Diagnosis Data	---	---	---	---	---	---	---	Not possible
	00	Number of entries	02 hex	02 hex	---	---	1 byte (U8)	RO	Not possible	---
	02	Lost Frames	00 hex	00 to FF hex	---	A	1 byte (U8)	RW	Not possible	---

*1. Indexes A010 hex, A020 hex, A030 hex, A040 hex, A050 hex, and A060 hex are shown in abbreviated form. For indexes A010 hex to A060 hex, the port number in each object name is allocated in ascending order, from port 2 to port 7. Data definitions for items other than Object name are the same as those for indexes A000 hex and A070 hex.

A-1-11 Device Profile Area

Index (hex)	Sub-index (hex)	Object name	Default value	Data range	Unit	Data attribute	Size	Access	PDO mapping	Complete access
6000	---	Port1 Input Data	---	---	---	---	---	---	---	Not possible
	00	Number of entries	10 hex	10 hex	---	---	1 byte (U8)	RO	Not possible	---
	01	Port1 Input Data01	0000 hex	0000 to FFFF hex	---	---	2 bytes (ARRAY[0..1] OF BYTE)	RO	Possible	---
	Subindexes: 02 to 0F									
	10	Port1 Input Data16	0000 hex	0000 to FFFF hex	---	---	2 bytes (ARRAY[0..1] OF BYTE)	RO	Possible	---
Indexes: 6010 to 6060*1										
6070	---	Port8 Input Data	---	---	---	---	---	---	---	Not possible
	00	Number of entries	10 hex	10 hex	---	---	1 byte (U8)	RO	Not possible	---
	01	Port8 Input Data01	0000 hex	0000 to FFFF hex	---	---	2 bytes (ARRAY[0..1] OF BYTE)	RO	Possible	---
	Subindexes: 02 to 0F									
	10	Port8 Input Data16	0000 hex	0000 to FFFF hex	---	---	2 bytes (ARRAY[0..1] OF BYTE)	RO	Possible	---

*1. Indexes 6010 hex, 6020 hex, 6030 hex, 6040 hex, 6050 hex, and 6060 hex are shown in abbreviated form. For indexes 6010 hex to 6060 hex, the port number in each object name is allocated in ascending order, from port 2 to port 7. Data definitions for items other than Object name are the same as those for indexes 6000 hex and 6070 hex.

Index (hex)	Sub-index (hex)	Object name	Default value	Data range	Unit	Data attribute	Size	Access	PDO mapping	Complete access
7000	---	Port1 Output Data	---	---	---	---	---	---	---	Not possible
	00	Number of entries	10 hex	10 hex	---	---	1 byte (U8)	RO	Not possible	---
	01	Port1 Output Data01	0000 hex	0000 to FFFF hex	---	---	2 bytes (ARRAY[0..1] OF BYTE)	RW	Possible	---
	Subindexes: 02 to 0F									
	10	Port1 Output Data16	0000 hex	0000 to FFFF hex	---	---	2 bytes (ARRAY[0..1] OF BYTE)	RW	Possible	---
Indexes: 7010 to 7060*1										
7070	---	Port8 Output Data	---	---	---	---	---	---	---	Not possible
	00	Number of entries	10 hex	10 hex	---	---	1 byte (U8)	RO	Not possible	---
	01	Port8 Output Data01	0000 hex	0000 to FFFF hex	---	---	2 bytes (ARRAY[0..1] OF BYTE)	RW	Possible	---
	Subindexes: 02 to 0F									
	10	Port8 Output Data16	0000 hex	0000 to FFFF hex	---	---	2 bytes (ARRAY[0..1] OF BYTE)	RW	Possible	---

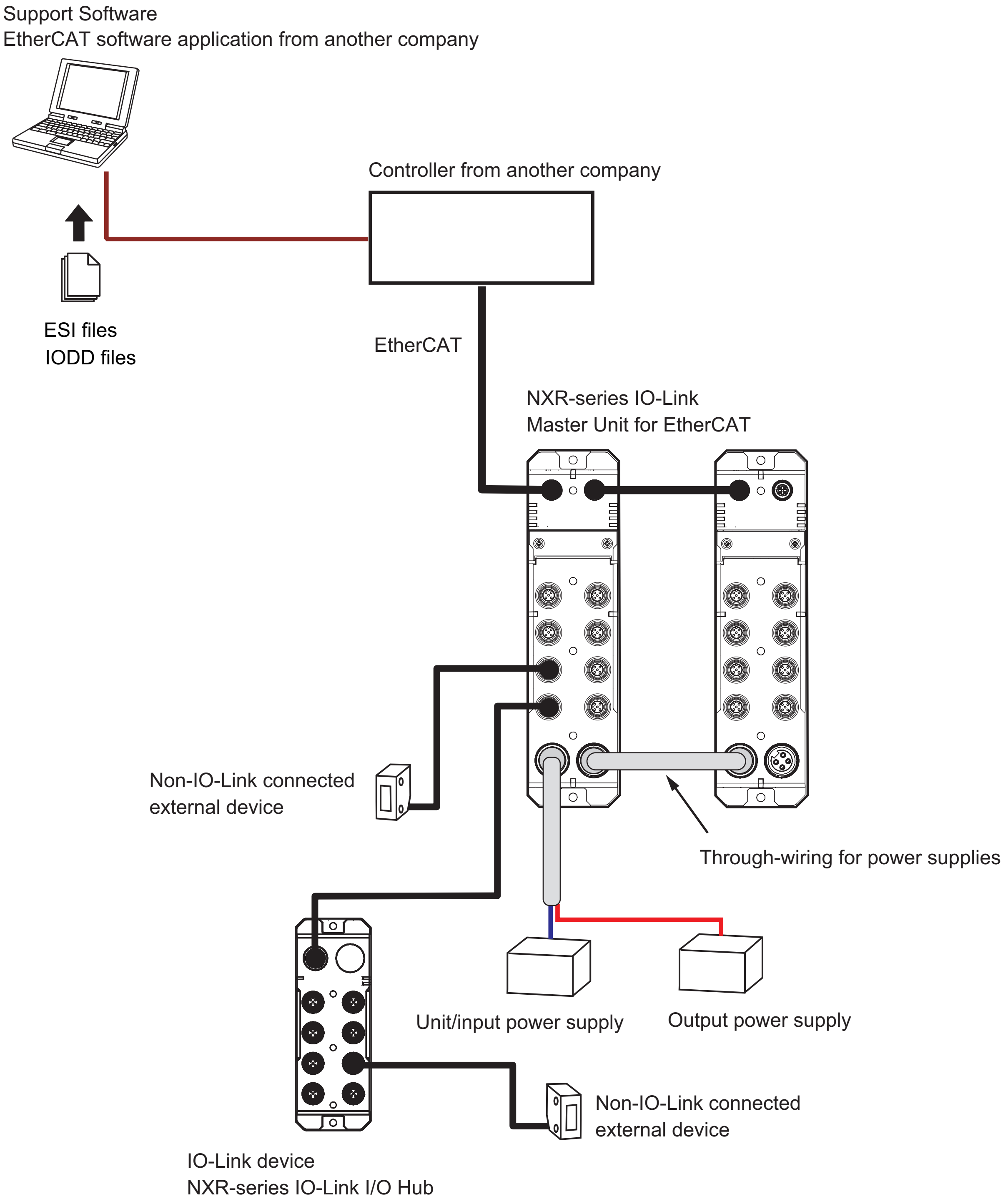
*1. Indexes 7010 hex, 7020 hex, 7030 hex, 7040 hex, 7050 hex, and 7060 hex are shown in abbreviated form. For indexes 7010 hex to 7060 hex, the port number in each object name is allocated in ascending order, from port 2 to port 7. Data definitions for items other than Object name are the same as those for indexes 7000 hex and 7070 hex.

A-2 System Configuration for Controllers from Another Company

This section describes the IO-Link system configuration when a controller from another company is used.

A-2-1 System Configuration

The following describes the system configuration when a controller from another company is used.



Support Software

Refer to *1-5 Support Software* on page 1-13.

A-2-2 Basic Application Procedure

This section describes the basic application procedures for the IO-Link Master Unit when a controller from another company is used.

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	Setting Explicit Device ID	Remove the rotary switch cover. Use the rotary switches to set the Explicit Device ID. *1	• *5-1-3 Installation Method* on page 5-2 • *3-3-1 ID Switch* on page 3-9
		Installation	Mount the IO-Link Master Unit with M5 screws.	*5-1-3 Installation Method* on page 5-2
		Wiring	Wire the following. • Connect the communications cables. • Connect the power supply cables. • Connect the I/O cables.	• *5-2 EtherCAT Network Wiring* on page 5-4 • *5-3 Connecting the Power Supplies* on page 5-10 • *5-4 Connecting I/O Cables* on page 5-18
3	Turning ON the Power Supplies		Turn ON the power supplies to the Controller and IO-Link Master Unit. For the IO-Link Master Unit, turn ON the Unit/input power supply and output power supply.	---
4	Going Online with the Software Application from Another Company		From the Controller, go online with the software application from another company.	Instruction manual for software application from another company
5	Setting up communications with the Controller		In the software application from another company, register the IO-Link Master Unit in the EtherCAT network configuration and configure communications settings between the IO-Link Master Unit and the Controller. Download the communications settings to the Controller.	Instruction manual for software application from another company
6	Setting the Device Parameters of the IO-Link Master Unit		Use the software application from another company to move the IO-Link Master Unit to Pre-Operational state of EtherCAT communications. From the Controller, set the device parameters of the IO-Link Master Unit through SDO communications. You can also use the I/O port quick settings, which allows for using the rotary switches to set the communications mode and data size for the I/O ports of the IO-Link Master Unit. *2	• Instruction manual for software application from another company • *7-2 Setting Device Parameters* on page 7-4 • *9-17 I/O Port Quick Settings* on page 9-47
7	Cycling the Power Supplies		Cycle the Unit/input power supply and output power supply to the IO-Link Master Unit.	---
8	Configuring the PDO Map Settings of the IO-Link Master Unit		Use the software application from another company to configure the PDO Map Settings of the IO-Link Master Unit.	Instruction manual for software application from another company
9	Configuring the Setting Parameters of the IO-Link Master Unit		Use the software application from another company to configure the setting parameters of the IO-Link Master Unit.	Instruction manual for software application from another company
10	Allocating Variables to the I/O Ports		Use the software application from another company to allocate variables to the I/O ports of the IO-Link Master Unit.	Instruction manual for software application from another company

Step	Item	Description	Reference
11	Creating the User Program	Use the software application from another company to create a user program.	Instruction manual for software application from another company
12	Downloading the User Program	From the Controller, go online with the software application from another company. Configure the PDO mappings and setting parameters of the IO-Link Master Unit, allocate variables to I/O ports, and download the user program.	Instruction manual for software application from another company
13	Setting and Transferring the IO-Link Device Parameters	Use the software application from another company to move the IO-Link Master Unit to Pre-Operational state of EtherCAT communications. From the Controller, set the IO-Link device parameters through SDO communications.	• Instruction manual for software application from another company • *A-3-3 Configuring IO-Link Devices through Message Communications* on page A-52
14	Checking Operation	Check the operation of the user program.	• Instruction manual for software application from another company • *Section 11 Troubleshooting* on page 11-1

*1. You can also use the software to set the Explicit Device ID. However, the setting method depends on the EtherCAT master specifications. For the software setting method, refer to the user's manual for the EtherCAT master to use.

*2. The device parameters of the IO-Link Master Unit that you can set using the I/O port quick settings are limited. Refer to *9-17 I/O Port Quick Settings* on page 9-47 for details.

A-3 Sample Programming

A-3-1 I/O Data Communications with Valid I/O Data

To use I/O data in the user program, check that the I/O data is valid before you perform I/O data communications.

This section describes an example of I/O data communications between a Controller and an IO-Link Master Unit, where the Controller is the built-in EtherCAT ports 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 *_EC_PDSlavTbl[1]* (Process Data Communicating Slave Table) is TRUE.	This indicates that the EtherCAT slave is communicating process data. “[1]” is the EtherCAT node address.
(2)	The value of *_EC_CommErrTbl[1]* (Communications Error Slave Table) is FALSE.	This indicates that an error detected by the EtherCAT master did not occur in the EtherCAT slave. “[1]” is the EtherCAT node address.
(3)	The value of *_EC_InDataInvalid* (Input Data Invalid) is FALSE.	This indicates that the input value is normal and the process data communications executed in the primary periodic task are normal.
(4)	In Port☐ Input Data Enabled of the I/O Port Status, the bit corresponding to the port is TRUE.*1	This indicates that the input data to the port on the IO-Link Master Unit is valid. ☐ indicates the port number.
(5)	The value of Port☐ I/O Port Error Status is 16#0.	This indicates that no error occurred in the port on the IO-Link Master Unit. ☐ indicates the port number.

*1. Always FALSE in SIO (DI) Mode and SIO (DI) Mode.

For the above conditions (1) to (3), refer to the description of system-defined variables related to the built-in EtherCAT ports in the *NJ/NX-series CPU Unit Built-in EtherCAT Port User’s Manual (Cat. No. W505)*.

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 the node address of the IO-Link Master Unit is 1.

User-defined Variables

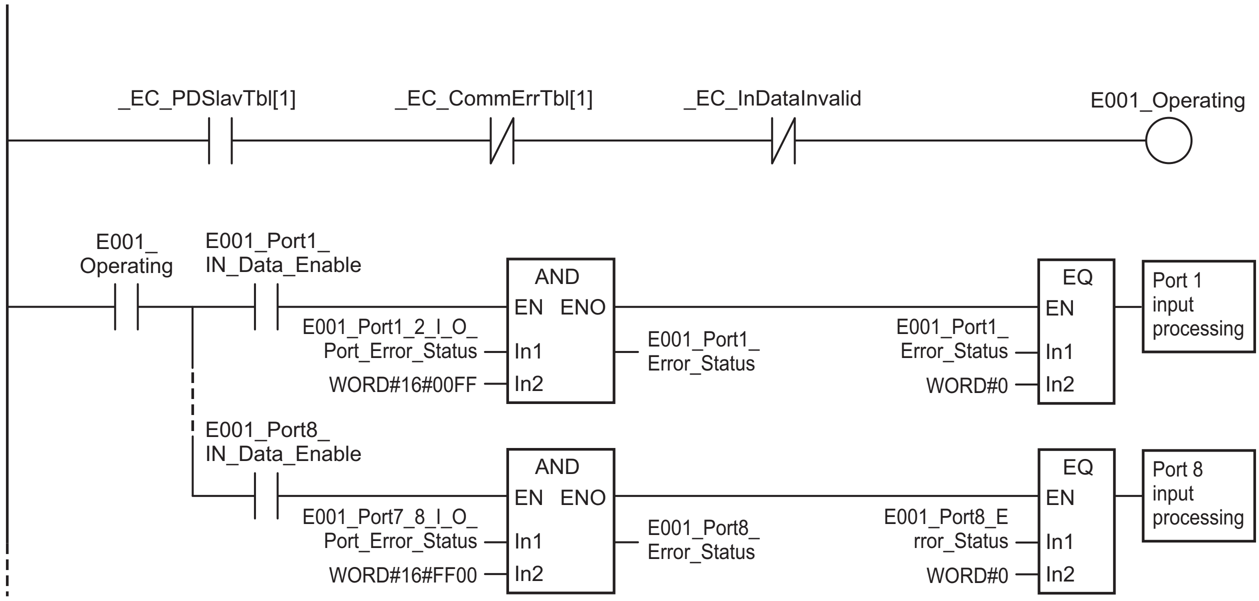
Name	Data type	Default	Comment
E001_Port1_IN_Data_Enable	BOOL	FALSE	Defined with an IO-Link Master Unit device variable. This data is for condition (4). This indicates the Port Input Data Enabled bit for port 1.
• • •	• • •	• • •	• • •
E001_Port8_IN_Data_Enable	BOOL	FALSE	Defined with an IO-Link Master Unit device variable. This data is for condition (4). This indicates the Port Input Data Enabled bit for port 8.
E001_Port1_Error_Status	WORD	16#0	Defined with an internal variable. This data is for condition (5). It indicates the error status for port 1.

Name	Data type	Default	Comment
• • •	• • •	• • •	• • •
E001_Port8_Error_Status	WORD	16#0	Defined with an internal variable. This data is for condition (5). It indicates the error status for port 8.
E001_Port1_2_I_O_Port_Error_Status	WORD	16#0	Defined with an IO-Link Master Unit device variable. This data aggregates the error status for ports 1 and 2. The lower 1 byte indicates the error status for port 1 and the upper 1 byte indicates the error status for port 2.
• • •	• • •	• • •	• • •
E001_Port7_8_I_O_Port_Error_Status	WORD	16#0	Defined with an IO-Link Master Unit device variable. This data aggregates the error status for ports 7 and 8. The lower 1 byte indicates the error status for port 7 and the upper 1 byte indicates the error status for port 8.
E001_Operating	BOOL	FALSE	Defined with an internal variable. This bit indicates that the IO-Link Master Unit is operating normally. It is TRUE if conditions (1), (2) and (3) are met.

System-defined Variables

Name	Data type	Comment
_EC_PDSlavTbl[1]	BOOL	This data is for the built-in EtherCAT port in condition (1). This bit indicates that the EtherCAT slave is communicating process data.
_EC_CommErrTbl[1]	BOOL	This data is for the built-in EtherCAT port in condition (2). This bit indicates whether an error detected by the master occurred in the EtherCAT slave.
_EC_InDataInvalid	BOOL	This data is for the built-in EtherCAT port in condition (3). This bit indicates whether the process data communications executed in the primary periodic task are valid.

Program Example



A-3-2 Configuring the IO-Link Master Unit through Message Communications

You can configure the parameter settings of the IO-Link Master Unit through SDO communications.
The IO-Link Master Unit provides CoE objects that allow for setting the device parameters of the IO-Link Master Unit. From the user program in the Controller, you can specify the index and subindex of the relevant object and write values through SDO communications to configure the IO-Link Master Unit. To write the values from an OMRON Controller to CoE objects in the IO-Link Master Unit, use the EtherCAT communications instruction EC_CoESDOWrite. Refer to the *NJ/NX-series Instructions Reference Manual (Cat. No. W502)* for details on the communications instruction and sample programming.

A-3-3 Configuring IO-Link Devices through Message Communications

You can configure the parameter settings of IO-Link devices through SDO communications.
The IO-Link Master Unit provides CoE objects that allow for setting the device parameters of IO-Link devices. From the user program in the Controller, you can specify the index and subindex of the relevant object and write values through SDO communications to configure the parameter settings of IO-Link devices.
To write settings from an OMRON Controller to an IO-Link device, use the IO-Link communications instruction IOL_WriteObj. Refer to the *NJ/NX-series Instructions Reference Manual (Cat. No. W502)* for details on the communications instruction and sample programming.

Before you write settings from a controller from another company to an IO-Link device, access the CoE objects for sending messages to the IO-Link device through SDO communications. The following provides details on how to access the relevant object of the IO-Link Master Unit.

- Format of objects
- Controller processing

- Restrictions

Format of Objects

These CoE objects are used to send messages to the IO-Link device for each port.
The following describes the formats of the objects. It contains only the information necessary to explain the access procedures described later in this manual.

Object name		Reference	Default value	Setting range	Attribute	Index	Subindex
Port□ Message for IO-Link Device*1	Control	*Control*(page A-53)	00 hex	00 to 03 hex	RW	4000 hex + 10 hex × (port number -1)	01 hex
	Status	*Status*(page A-53)	00 hex	00 to 05 hex	RO		02 hex
	Index	*Index*(page A-54)	0000 hex	0000 to FFFF hex	RW		03 hex
	Subindex	*Subindex*(page A-54)	00 hex	00 to FF hex	RW		04 hex
	Length	*Length*(page A-54)	00 hex	00 to FF hex	RW		05 hex
	Data	*Data*(page A-54)	*2	*3	RW		06 hex
	Error Code	*Error Code*(page A-54)	0000 hex	0000 to FFFF hex	RO		07 hex
	Timeout	*Timeout*(page A-54)	0000 hex	0000 to FFFF hex	RW		10 hex
	Sequence No	*Sequence No*(page A-54)	00 hex	00 to FF hex	RW		11 hex

*1. "□" indicates the port number.
*2. All of the 232 bytes are 00 hex.
*3. All of the 232 bytes are 00 to FF hex.

An explanation of each object is provided below.

- **Control**
  This object controls the writing and reading of the messages that are sent. The meanings of the set values are as follows.

Set value	Meaning
00 hex	No processing
01 hex	Reserved
02 hex	Writing
03 hex	Reading

- **Status**
  This object shows the status of the IO-Link master or IO-Link device when a sent message is received. The meanings of the values are as follows.

Value	Meaning
00 hex	No operation
01 hex	Busy
02 hex	Successful
03 hex	Reserved
04 hex	Error (IO-Link Master)
05 hex	Error (IO-Link Device)

- **Index**
  This object specifies the index number of the object held by the IO-Link device.

- **Subindex**
  This object specifies the subindex number of the object held by the IO-Link device.

- **Length**
  This object specifies the size of the data to be written when writing. The unit is bytes.

- **Data**
  This object specifies the data to be written when writing.

- **Error Code**
  This object indicates the error code when the status value of subindex 02 hex is 04 hex or 05 hex. The meanings of the error codes are as follows. When the value of status is 02 hex, the meaning is normal end, and the value of error code is 0000 hex.

Status value	Error code value	Error code meaning	Correction
04 hex	4806 hex	The port communications setting is not IO-Link Mode.	Set the port communications setting to IO-Link Mode.
	4807 hex	There is no IO-Link device.	Connect an IO-Link device.
		The I/O power is OFF.	Turn ON the I/O power.
		Timeout has occurred.	Change the timeout setting.
		An IO-Link Communications Module Processing Error occurs.	Refer to the Sysmac event code and take the corresponding measure. Refer to the *11-4-3 Error Table* on page 11-16 for details on the Sysmac event codes.
	4808 hex	An IO-Link Communications Error occurs.	
		A Device Configuration Verification Error occurs.	
05 hex	• Upper 1 byte Error code defined in the IO-Link standard • Lower 1 byte Additional code defined in the IO-Link standard	Refer to Table C.1 Error Types in Annex C of the *IO-Link Interface and System Specification Version 1.1.2* for details on the meanings of the error codes.	Refer to the instruction manuals for the connected IO-Link devices and take the corresponding measure.

- **Timeout**
  This object is the time that the IO-Link Master Unit monitors a response from an IO-Link device. The unit is ms. The monitoring time is an integer number of seconds obtained by rounding up the less-than-second part (lower 3 digits in decimal notation) of the set value to the nearest second. When 0000 hex is specified, the monitoring time is 2 s.

- **Sequence No**
  This object specifies the sequence number of the message to be sent.

Precautions for Correct Use

This object allows complete access.
However, pay attention to the following when you read or write the object with complete access.
This object has reserve and padding areas as follows.

- Two bytes including one byte of number of entries and one byte of padding before the Control object
  The total size of the object will be 245 bytes including the above contents.

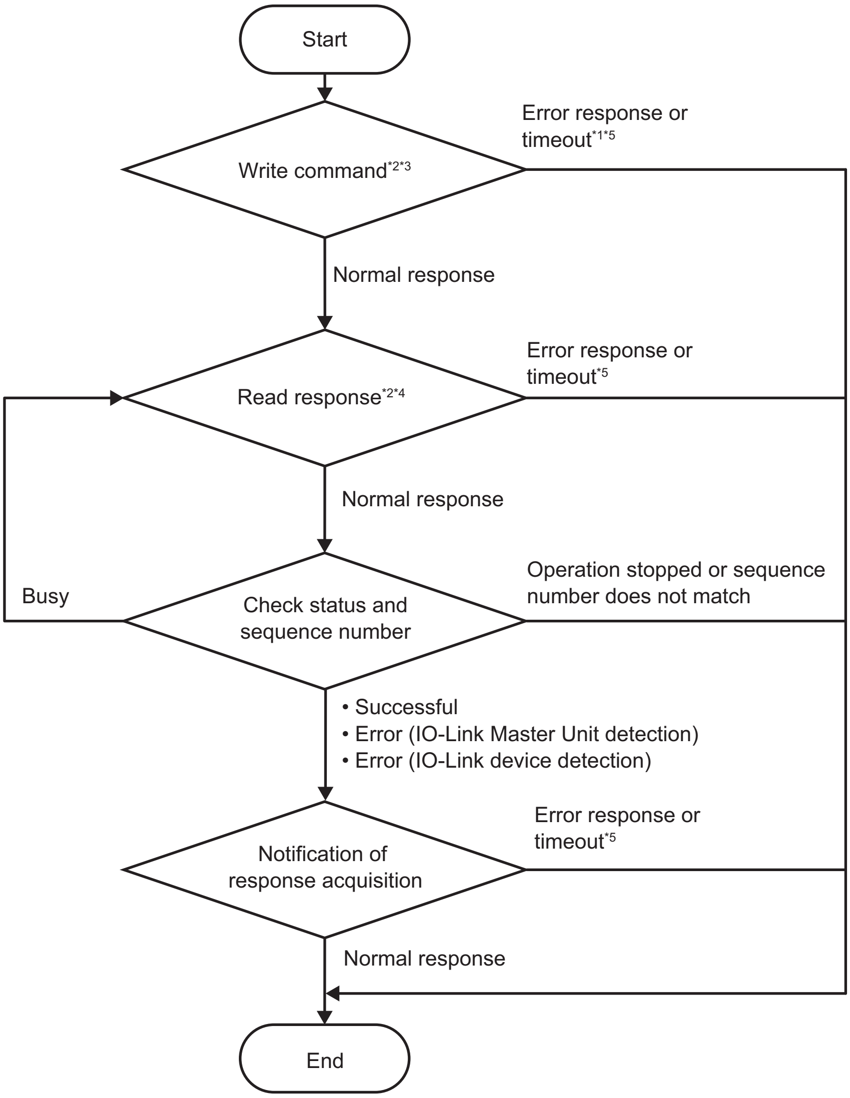
Precautions are as follows.

- When you read the object
  Reserve, padding and number of entries are included in the read values.
- When you write the object
  Specify all write values to 00 for the reserve, padding and number of entries.

Controller Processing

The following describes controller processing for access form the controller to an IO-Link device.
Create the user program for the controller processing according to the following descriptions.

● Controller Processing Flow Chart



*1. If the IO-Link Master Unit performs the command write process during message processing, an error response is returned. If that happens, end the process. After ending the process, perform the command write process again.
*2. If the controller does not support complete access, perform reading or writing for each subindex number.
*3. If you write for each subindex number, write the Control object last.
*4. Give an interval after the command writing process before executing the response read process. This allows you to prevent repeating of the read process due to being busy.
*5. An error response or timeout for the execution of a communications instruction.

● Controller Processing Procedure

Step	Controller processing		Communications direction*1	IO-Link Master Unit processing
1	Write command	Send a command to the object for accessing an IO-Link device. Specify the following values. • Control When writing, the value is 0x02 (Write). When reading, the value is 0x03 (Read). • Status --- • Index Index number of the IO-Link device • Subindex Subindex number of the IO-Link device • Length When writing, size of the data to be written • Data When writing, data to be written • Error Code --- • Timeout Response monitoring time • Sequence No When writing, any value in the range of 00 to FF hex	→	Receive a command, detect that the control value changes from 0x00 (No processing), and set the status value to 0x01 (Busy). Then, send a message to the IO-Link device. After receiving a response from the IO-Link device, update the following values. • Length (when reading) • Data (when writing) • Error Code • Sequence No After updating, change the status value to one of the following. • 0x02: Successful • 0x04: Error (IO-Link Master) • 0x05: Error (IO-Link Device)
2	Read response	When writing was performed in step 1, send a read command to the same address as that in step 1.	←	Send a response to the controller.
3	Check status and sequence number	Check the status and sequence number of the read data. Send a read command until the status becomes one of the following. • 0x02: Successful • 0x04: Error (IO-Link Master) • 0x05: Error (IO-Link Device) When reading, check that the read sequence number matches the sequence number specified in the sent command. If it matches, send a response for the sent command.	←	Send a response to the controller.

Step	Controller processing		Communications direction*1	IO-Link Master Unit processing
4	Notification of response acquisition	Send a command with the following values specified to notify the IO-Link Master Unit that a response was acquired from the IO-Link Master Unit. • Control 00 hex: No processing • Status --- • Index --- • Subindex --- • Length --- • Data --- • Error Code --- • Timeout --- • Sequence No ---	→	Receive a command, detect that the control value changes from 0x00 (No processing), and set the status value to 0x00 (No operation).

*1. →: Sending of command from the controller to the IO-Link Master Unit
←: Sending of response from the IO-Link Master Unit to the controller

Restrictions

The restrictions are given below.

- Do not perform message communications and access from CX-ConfiguratorFDT at the same time for the IO-Link Master Unit.
- Do not perform message communications to the IO-Link Master Unit when the IO-Link Master Unit is starting.
- Do not turn OFF the power of the IO-Link Master Unit and IO-Link device during the execution of message communications with the IO-Link Master Unit.
- The timing of reflecting the values to be written to an IO-Link device depends on the specifications of the IO-Link device. For details on the reflection timing of IO-Link devices, refer to the instruction manuals for the connected IO-Link devices.

A-4 IO-Link Master Simple Settings

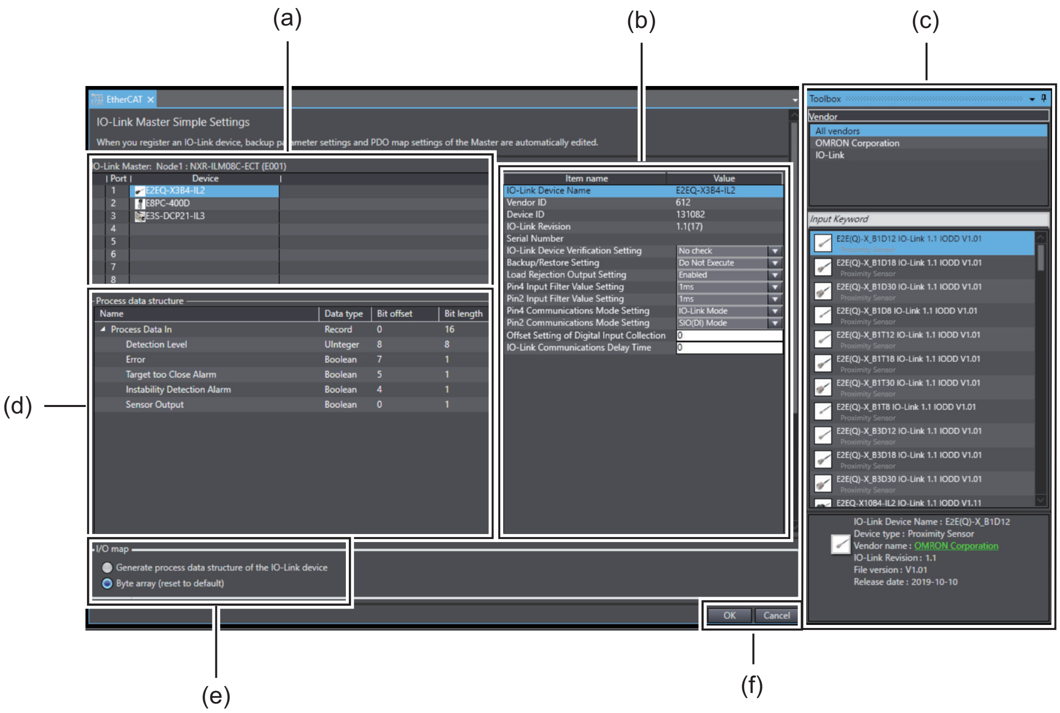
The IO-Link Master Simple Settings tab page allows you to perform parameter setting and I/O data size editing at once for the IO-Link Master Unit.

1 Open the project for the Controller.

2 Right-click **EtherCAT** in the Multiview Explorer and select **Edit** from the menu.

3 In the EtherCAT tab page, right-click the IO-Link Master Unit and select **IO-Link Master Simple Settings**.

4 The IO-Link Master Simple Settings tab page is displayed.

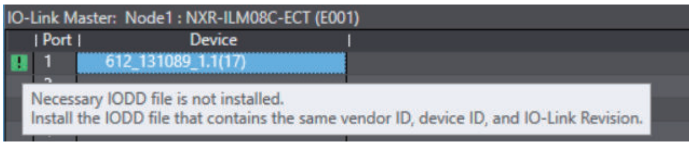


	Item	Description
(a)	Device registration area	Register the IO-Link devices to connect to the IO-Link Master Unit.
(b)	IO-Link port setting area	The settings of the port selected in the device registration area are displayed.
(c)	Toolbox	A list of IO-Link devices is displayed. You can add an IO-Link device to any port position by dragging and dropping it from this list to the device registration area.
(d)	Process data structure pane	The process data structure of the selected IO-Link device is displayed.
(e)	I/O Map display method selection	Select how to display IO-Link device ports in the I/O Map. • Generate process data structure of the IO-Link device: Displays ports according to the process data structure. • Byte array (reset to default): Displays ports as byte arrays.

	Item	Description
(f)	**OK** button	Use this button to return to the previous tab page with the settings saved.
	Cancel button	Use this button to return to the previous tab page with the settings discarded.

Precautions for Correct Use

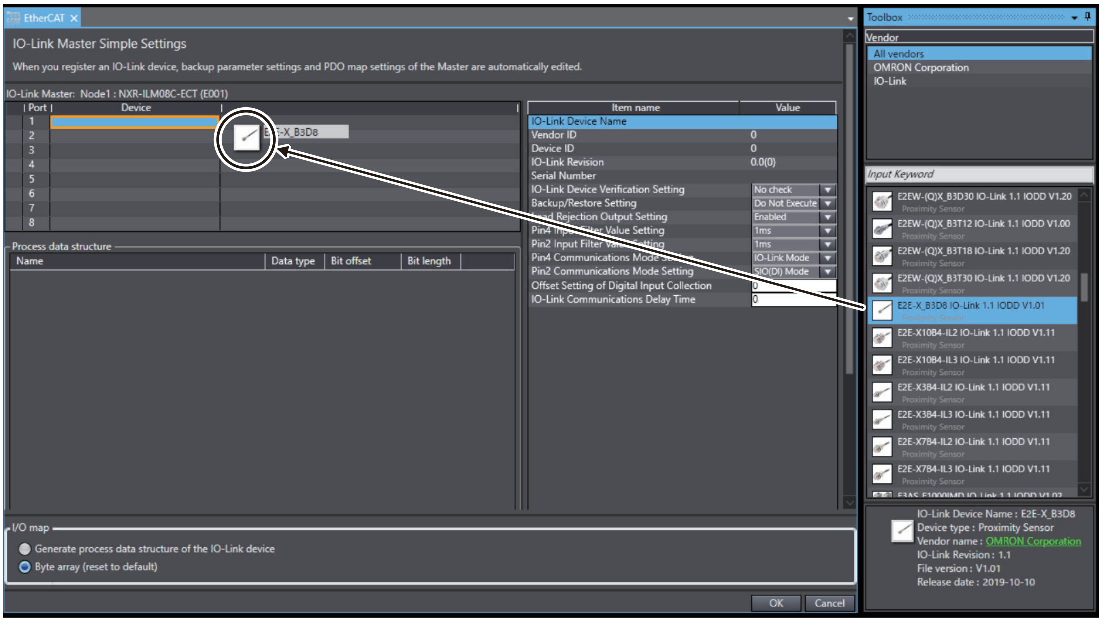
If the IODD file for the set IO-Link devices is not installed in the computer, the IO-Link device name in the device registration area will be displayed as an ID in the following format:
Vendor ID_Device ID_IO-Link Revision (Decimal representation of IO-Link revision)
Example: 612_131089_1.1(17)



To display the correct device name, install an IODD file with the corresponding vendor ID, device ID, and IO-Link revision. To install an IODD file, right-click in the device registration area and select **Install IODD File**.

A-4-1 Setting IO-Link Master Parameters and Editing the I/O Data Size in the IO-Link Master Simple Settings Tab Page

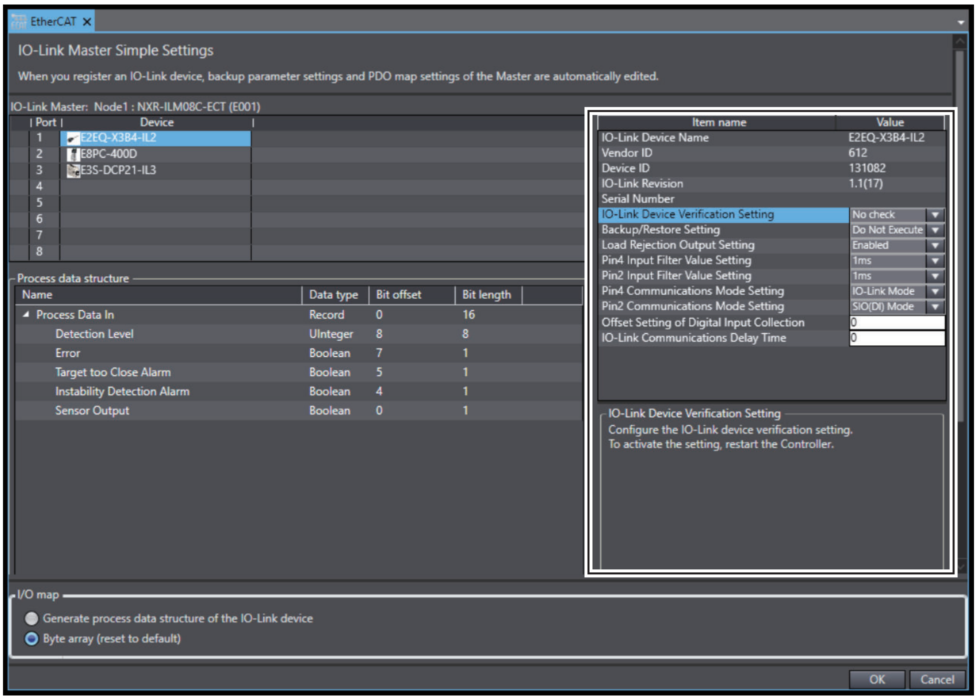
1 In the device registration area, select the port to which to connect the IO-Link device. Then, in the Toolbox, double-click the IO-Link device, or right-click the IO-Link device and select **Insert**. You can also register an IO-Link device by dragging and dropping it to a port in the device registration area.



Additional Information

- If IO-Link devices are connected to the IO-Link master, you can connect the Sysmac Studio online and register the IO-Link devices that are actually connected to the IO-Link master. To use this function, right-click in the device registration area and select **Compare and Get Actual IO-Link Device Information**.
- If IO-Link devices are connected to the IO-Link master, you can connect the tool online and get the serial numbers of the IO-Link devices. To use this function, right-click in the device registration area and select **Get Serial Numbers of All IO-Link Devices**.
- If the IO-Link device to register is not displayed in the Toolbox, you need to install its IODD file. To install an IODD file, right-click in the device registration area and select **Install IODD File**.

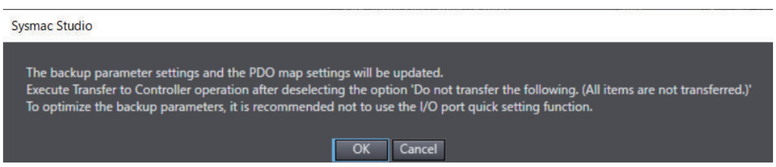
2 Select the port in the device registration area and edit the parameters displayed in the IO-Link port setting area.



Precautions for Correct Use

You cannot edit the parameters in the online state.

3 Click the **OK** button at the lower right of the IO-Link Master Simple Settings tab page. The following dialog box is displayed.



Confirm the displayed message and click the **OK** button.

This completes the parameter setting and I/O data size editing procedure for the IO-Link master.

A-4-2 Generating the Process Data Structure of the IO-Link Device

If you select the **Generate process data structure of the IO-Link device** option button in the IO-Link Master Simple Settings tab page, I/O ports will be generated in the I/O Map according to the process data structure of the IO-Link device at the end of the IO-Link Master Simple Settings operation. This facilitates the IO-Link device's access to the process data.
The process data structure of an IO-Link device will be displayed in the Process data structure pane.

Version Information

To use this function, you need Sysmac Studio version 1.57 or higher and an NJ/NX-series CPU Unit with unit version 1.40 or later.

A-5 Example of Allocating Variables to the I/O Ports

Use **Configurations and Setup** – **I/O Map** on the Sysmac Studio to allocate variables to the I/O ports of the IO-Link Master Unit.
The following example uses port 1 (Photoelectric Sensor) and port 2 (Proximity Sensor) of an IO-Link Master Unit.

Additional Information

You can use the IO-Link Master Simple Settings function to set the IO-Link Master Unit and generate I/O ports in the I/O Map according to the process data structure of the IO-Link device. For these I/O ports, the variables that are generated in the **Create Device Variable** facilitate programming because they have data types and variable names set according to the process data structure of the IO-Link device.

A-5-1 Checking the Status of the IO-Link Master Unit

In this example, checking is performed for the following errors.
- Device Configuration Verification Error
- IO-Link Communications Error
- Pin1 Short-circuit Error
- Error-level Device Event

I/O Map

I/O port	R W	Data type	Variable name	Variable comment
▼NXR-ILM08C-ECT				
Port1 Compare Error	R	BOOL	E001_Port1_Compare_Error	Device Configuration Verification Error
Port1 Communication Error	R	BOOL	E001_Port1_Communication_Error	IO-Link Communications Error
Port1 Pin1 Short-circuit Error	R	BOOL	E001_Port1_Pin1_Short_circuit_Error	Pin1 Short-circuit Error
Port1 Device Error	R	BOOL	E001_Port1_Device_Error	Error-level Device Event

A-5-2 IO-Link Process Input Data from E3Z Photoelectric Sensors, and I/O Map

The allocation of the IO-Link process input data and the I/O Map in the E3Z Photoelectric Sensor are as described below.

Allocation of Process Input Data

PD0							
7	6	5	4	3	2	1	0
Detected light level monitor output							

PD1							
7	6	5	4	3	2	1	0
Major error	Minor error	Not used (0)	Instability Alarm (Non-Light Receiving)	Instability Alarm (Non-Light Blocking)	Not used (0)	Sensor output 2	Sensor output 1

I/O Map

I/O port	R W	Data type	Variable name	Variable comment
▼NXR-ILM08C-ECT				
▼Port1 Input Data01	R	ARRAY[0..1] OF BYTE	IO_LinkData1	
[0]	R	BYTE	IO_LinkData1[0]	PD0
[1]	R	BYTE	IO_LinkData1[1]	PD1

Additional Information

The table below shows the resulting I/O Map when you use the IO-Link Master Simple Settings function to generate I/O ports and then automatically generate variable names.

I/O port	R W	Data type	Variable name
▼NXR-ILM08C-ECT			
▼Port1 Input Data01	R	ARRAY[0..1] OF BYTE	E001_Port1_Input_Data01
Port1 Detection Level	R	USINT	E001_Port1_Detection_Level
Port1 Control Output 1	R	BOOL	E001_Port1_Control_Output_1
Port1 Control Output 2	R	BOOL	E001_Port1_Control_Output_2
Port1 Instability Alarm (Non-Light Receiving)	R	BOOL	E001_Port1_Instability_Alarm_Non_Light_Receiving_0
Port1 Instability Alarm (Light Receiving)	R	BOOL	E001_Port1_Instability_Alarm_Light_Receiving_0
Port1 Warning	R	BOOL	E001_Port1_Warning
Port1 Error	R	BOOL	E001_Port1_Error

A-5-3 IO-Link Process Input Data from E3S Color Mark Sensors, and I/O Map

The allocation of the IO-Link process input data and the I/O Map in the E3S Color Mark Sensor are as described below.

Allocation of Process Input Data

	Bit							
	7	6	5	4	3	2	1	0
PD0	--- (Not used.)	--- (Not used.)	--- (Not used.)	--- (Not used.)	--- (Not used.)	B light emission	G light emission	R light emission

	Bit							
	7	6	5	4	3	2	1	0
PD1	Major error	Minor error	--- (Not used.)	--- (Not used.)	Instability alarm	--- (Not used.)	Control output 2	Control output 1
PD2	Always 0 (Not used.)				R detected light level monitor output, upper 4 bits			
PD3	R detected light level monitor output, lower 8 bits							
PD4	Always 0 (Not used.)				G detected light level monitor output, upper 4 bits			
PD5	G detected light level monitor output, lower 8 bits							
PD6	Always 0 (Not used.)				B detected light level monitor output, upper 4 bits			
PD7	B detected light level monitor output, lower 8 bits							

I/O Map

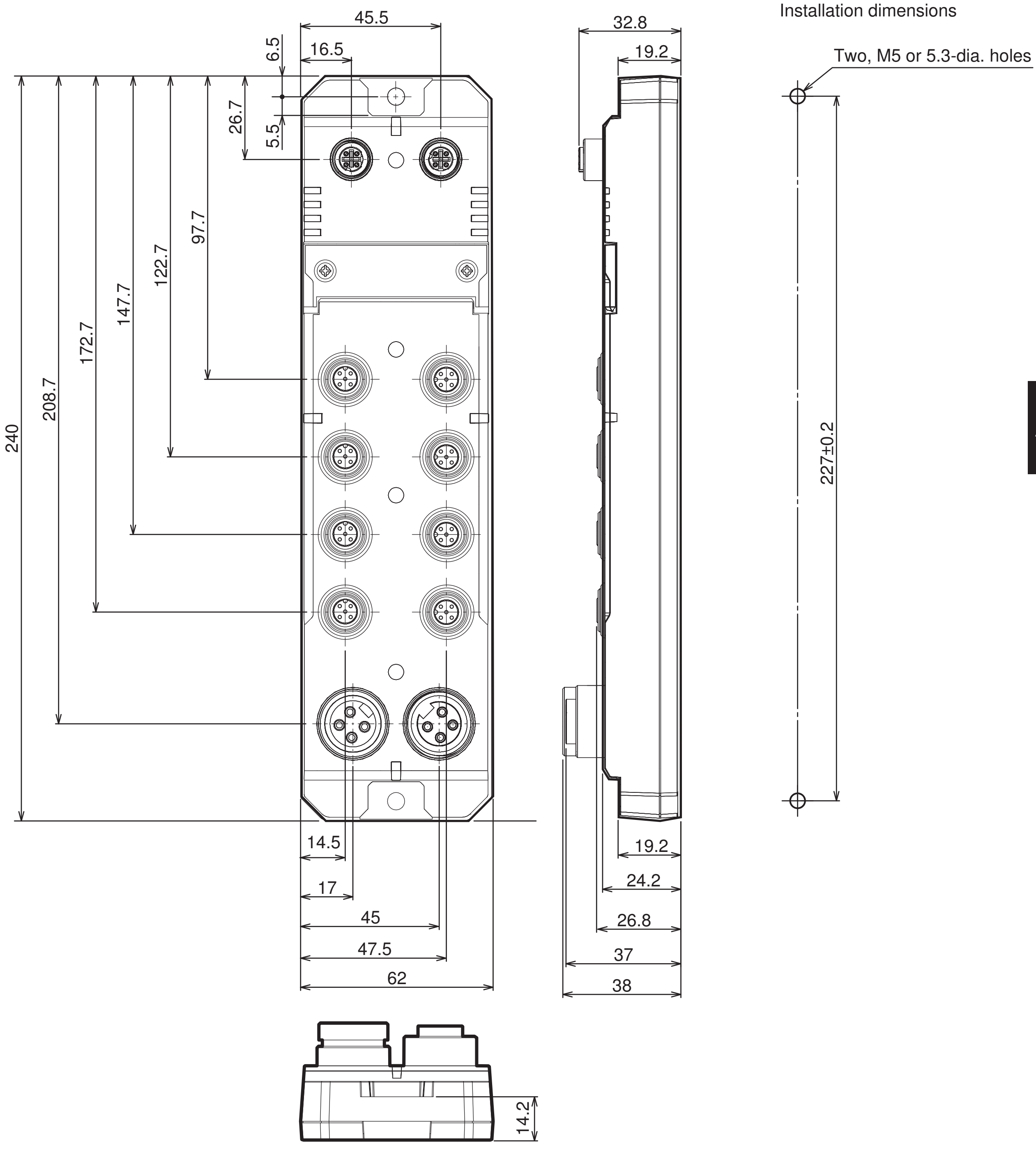
I/O port	R W	Data type	Variable name	Variable comment
▼NXR-ILM08C-ECT				
▼Port1 Input Data01	R	ARRAY[0..1] OF BYTE	ColorMarkStatus	
[0]	R	BYTE	ColorMarkStatus[0]	PD0
[1]	R	BYTE	ColorMarkStatus[1]	PD1
▼Port1 Input Data02	R	ARRAY[0..1] OF BYTE	R_Data	
[0]	R	BYTE	R_Data[0]	PD2
[1]	R	BYTE	R_Data[1]	PD3
▼Port1 Input Data03	R	ARRAY[0..1] OF BYTE	G_Data	
[0]	R	BYTE	G_Data[0]	PD4
[1]	R	BYTE	G_Data[1]	PD5
▼Port1 Input Data04	R	ARRAY[0..1] OF BYTE	B_Data	
[0]	R	BYTE	B_Data[0]	PD6
[1]	R	BYTE	B_Data[1]	PD7

Additional Information

The table below shows the resulting I/O Map when you use the IO-Link Master Simple Settings function to generate I/O ports and then automatically generate variable names.

I/O port	R W	Data type	Variable name
▼NXR-ILM08C-ECT			
▼Port1 Input Data01	R	ARRAY[0..1] OF BYTE	E001_Port1_Input_Data01
Port1 Light Emitting Color	R	BYTE	E001_Port1_Light_Emitting_Color
Port1 Control Output 1	R	BOOL	E001_Port1_Control_Output_1
Port1 Control Output 2	R	BOOL	E001_Port1_Control_Output_2
Port1 Instability Alarm	R	BOOL	E001_Port1_Instability_Alarm
Port1 Warning	R	BOOL	E001_Port1_Warning
Port1 Error	R	BOOL	E001_Port1_Error
▼Port1 Input Data02	R	ARRAY[0..1] OF BYTE	E001_Port1_Input_Data02
Port1 Incident Light Level Red_high	R	BYTE	E001_Port1_Incident_Light_Lev-el_Red_high
Port1 Incident Light Level Red_low	R	BYTE	E001_Port1_Incident_Light_Lev-el_Red_low
▼Port1 Input Data03	R	ARRAY[0..1] OF BYTE	E001_Port1_Input_Data03
Port1 Incident Light Level Green_high	R	BYTE	E001_Port1_Incident_Light_Lev-el_Green_high
Port1 Incident Light Level Green_low	R	BYTE	E001_Port1_Incident_Light_Lev-el_Green_low
▼Port1 Input Data04	R	ARRAY[0..1] OF BYTE	E001_Port1_Input_Data04
Port1 Incident Light Level Blue_high	R	BYTE	E001_Port1_Incident_Light_Lev-el_Blue_high
Port1 Incident Light Level Blue_low	R	BYTE	E001_Port1_Incident_Light_Lev-el_Blue_low

A-6 Dimensions



A-7 Version Information

The following table describes the relationship between the unit version of the IO-Link Master Units and the versions of the Support Software. With a combination of the following unit version or later and the following version or higher, you can use all of the functions that are supported by that unit version of the IO-Link Master Unit.

Unit version	Corresponding version of Support Software	
	Sysmac Studio	CX-ConfiguratorFDT
Ver. 1.0	Ver. 1.57	Ver. 3.01, or Ver. 2.59 with automatic update as of January 2024 applied

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OMRON Corporation **Industrial Automation Company**

Kyoto, JAPAN **Contact : www.ia.omron.com**

Regional Headquarters

OMRON EUROPE B.V.
Wegalaan 67-69, 2132 JD Hoofddorp
The Netherlands
Tel: (31) 2356-81-300 Fax: (31) 2356-81-388

OMRON ELECTRONICS LLC
2895 Greenspoint Parkway, Suite 200
Hoffman Estates, IL 60169 U.S.A.
Tel: (1) 847-843-7900 Fax: (1) 847-843-7787

OMRON ASIA PACIFIC PTE. LTD.
438B Alexandra Road, #08-01/02 Alexandra
Technopark, Singapore 119968
Tel: (65) 6835-3011 Fax: (65) 6835-3011

OMRON (CHINA) CO., LTD.
Room 2211, Bank of China Tower,
200 Yin Cheng Zhong Road,
PuDong New Area, Shanghai, 200120, China
Tel: (86) 21-6023-0333 Fax: (86) 21-5037-2388

Authorized Distributor:

Cat. No. W640-E1-01 1223