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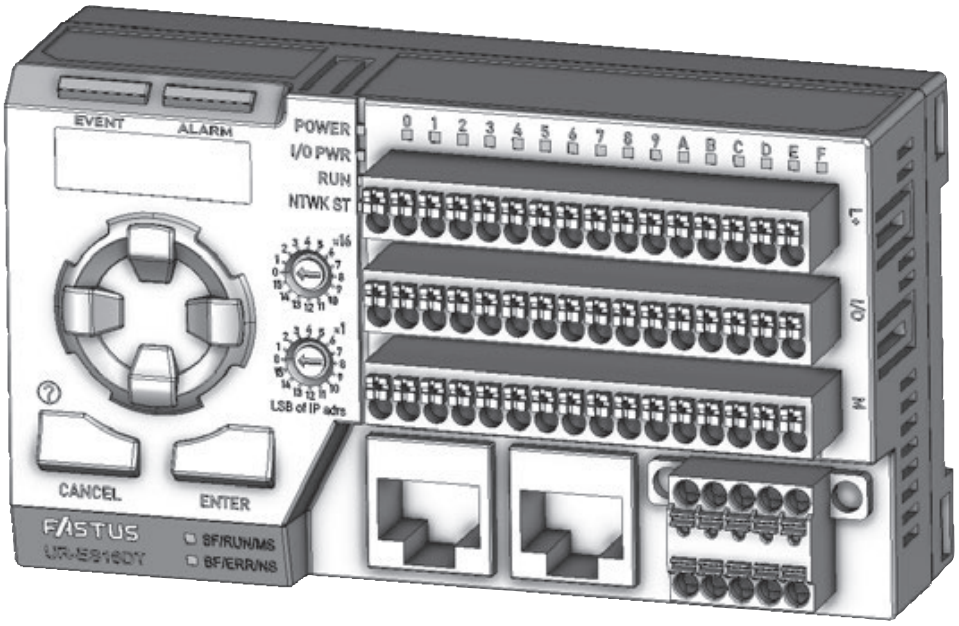
IO-Link Master

UR-ES16DT

User's Manual
EtherNet/IP Edition



OPTEX FA CO., LTD.

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Introduction

Thank you for purchasing the IO-Link Master UR-ES16DT.
This manual contains the information required when using “EtherNet/IP” as the host network.
Read this manual thoroughly before using the product to ensure correct product use with full understanding of the functions and performance of the product. Also, after you have finished reading this manual, store it safely for future reference.

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Safety Precautions

This manual uses the following symbols to display safety precautions for ensuring safe operation of the UR-ES16DT IO-Link Master (hereafter, “this product”).
Precautions listed here describe important information about safety. Make sure to follow them accordingly.

Safety Symbols

The indications and their meanings are as follows.

⚠WARNING	Indicates that any improper operation or handling may result in moderate or minor injury, and in rare cases, serious injury or death. Also indicates a risk of serious property damage. Improper handling can also result in damage to property.
⚠CAUTION	Indicates that any improper operation or handling may sometimes result in moderate or minor injury or property damage.

Notes

For common product functions, see “IO-Link Master UR-ES16DT User’s Manual Common Edition” (UR-ES_UM-XXX-XXXX) (below, the “Common Edition”).

Related Manuals

Manuals related to this manual are as follows. Reference them as needed.

Product Common Edition

Describes common functions not related to the host network type used.

Manual number	Manual name	Details
UR-ES_UM-E-XXX-XXXX	IO-Link Master UR-ES16DT User's Manual Common Edition (Referred to herein as the "Common Edition.")	Describes this product's common functions and performance as well as operation. Be sure to read these documents.

Manual Structure

This manual's content is structured as follows.

1. Overview	Describes the overview when using "EtherNet/IP" as the host network.
2. Initial setting of this product with regard to EtherNet/IP	Describes initial setting for this product's IP address setting, communication connection, and front panel operation.
3. Communication	Describes the initial settings for EtherNet/IP communication and IO-Link communication, the configuration of the data to be handled, and communication examples.
4. Specifications	This chapter describes the specifications related to EtherNet/IP for this unit.
5. Troubleshooting	Describes methods of troubleshooting related to EtherNet/IP communication.
6. Appendix	Describes the method for assignment other than the process data default value, and the procedures when communicating the master parameters for this product when reading and writing in the Explicit message communication, and the representative EtherNet/IP masters.

Contents

3 Communicate

Notations Used in this Manual

These are the notations used in this manual.

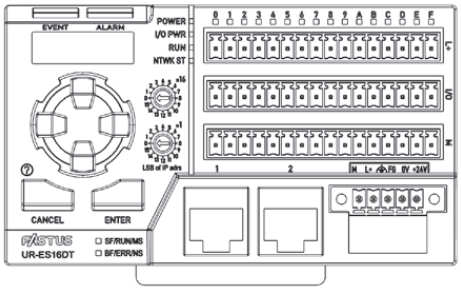
CAUTION
This indicates particularly important points to observe during operation.

MEMO
This information is useful for operation.

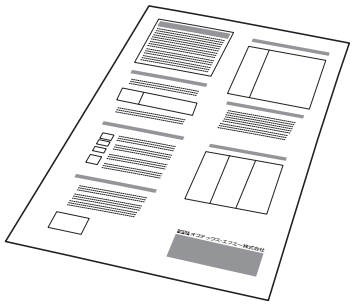
Checking the Included Items

Before use, confirm the product packaging. If there are any defective or damaged items, please contact our customer support center (refer to the end of this manual).

Product Packaging



• UR-ES16DT unit



• Instruction manual

- I/O terminal block: three pieces
- Power terminal block: one piece
- RJ45 connector protective cap: two pieces (attached to unit)

Other Required Items

Cables

This product uses the following cables.

Type	Specifications
Ethernet cable	Ethernet cables that fulfill the following specifications · Connector: RJ45 connector · Cable: Use an Ethernet cable of category 5 or above that complies with a standard (1000BASE-T, 100BASE-TX, 10BASE-T).

Switching Hub

Use the following industrial Switching Hub.

Type	Specifications
Industrial-use Switching Hub	You will need to select a Switching Hub in accordance with how much load you will be using on the network, for what kind of communication. For details, refer to the user's manual for the EtherNet/IP Master that you are using.

Terminology List

This explains the terminology used in this document.

Terminology	Description
EtherNet/IP	A standard network for an industrial-use Ethernet, equipped with CIP (Common Industrial Protocol) as a control protocol, mounted on an application layer of a TCP/IP protocol widely used in the Ethernet.
EtherNet/IP Master	Master station PLC, etc., for EtherNet/IP communication (operated as a scanner in cyclic communication).
EtherNet/IP configuration software	Software for preparation of EtherNet/IP network configurations. Select depending on the EtherNet/IP Master.
Cyclic communication (cyclic transmission and process I/O communication)	The EtherNet/IP Master regularly reads and writes the status/flag of this product and the process input/output data of the IO-Link device. This product executes process I/O communication (of IO-Link) with the IO-Link device.
Extended access function	This function uses cyclic communication to read and write settings for this product and IO-Link devices (including sensor units connected to UC2-IOL). Host master side programs can be simplified.
Cyclic communication area	An area where the EtherNet/IP Master, as the originator, cyclically inputs or outputs the target. Uses EtherNet/IP configuration software to specify each connection.
Explicit message communication (Explicit message communication and ISDU communication)	When necessary, use the Explicit message communication instructions from the EtherNet/IP Master to read and write the specified data in this product or IO-Link device. When this happens, this product executes ISDU communication (of IO-Link) with the IO-Link device.
Connection	In EtherNet/IP cyclic communication, the node on one side requests establishment of a logical communication line, and when that line is established, uses the line to exchange data with a partner node. Indicates the logical communication line at that time. The device that requests establishment of a connection is called the “originator” and the device receiving the request is called the “target”.
Object	Refers to the clumpy substances that define the data or its activities held in communication specifications or each device.
Class	Expresses the object type. Defines all properties characterizing a clump of objects.
Instance	Refers to the substances inside an object (the instance is what embodies the class).
Attribute	Refers to the detailed information inside an instance.
Service codes	Refers to the access method for providing objects.
Assembly object	An object that is particularly used in cyclic communication within an object. Gathers (assembles) data inside own device, and places it on the connection.
Packet interval (RPI)	The data update cycle for each connection between the originator and target in EtherNet/IP cyclic communications. Sets the EtherNet/IP Master side for each connection. The minimum packet interval for this product is 1ms.

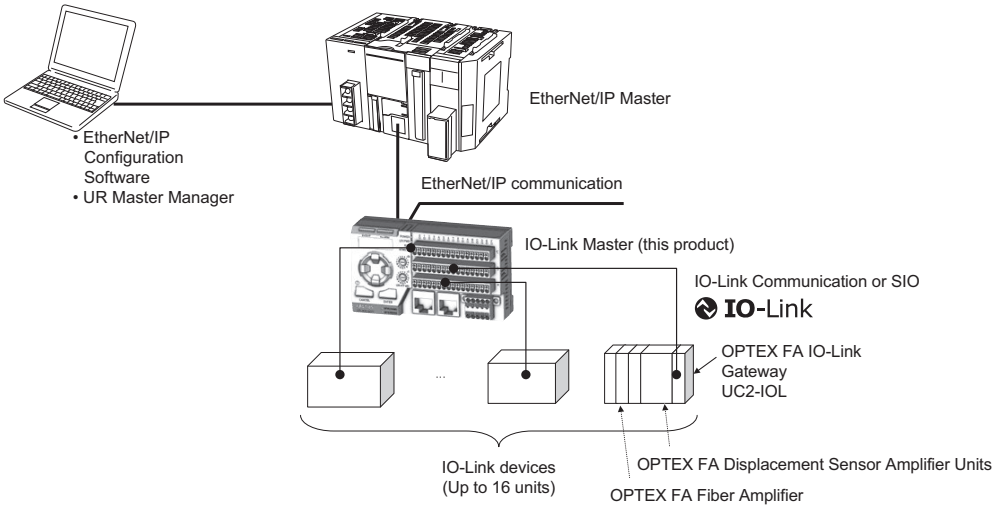
Overview

This chapter describes the overview when using “EtherNet/IP” as the host network.

1-1 Product Overview

When setting the network type to “EtherNet/IP”, this product conducts EtherNet/IP cyclic communication with the EtherNet/IP communication master, while simultaneously communicating IO-Link process data with the connected IO-Link devices.
In addition, it enables receiving of acyclic communication messages from the EtherNet/IP communication master, conversion of that to an IO-Link ISDU communication, and reading and writing of service data inside the IO-Link device when necessary.
In cyclic communication, it also enables read and write in response to a specific IO-Link device or target address in this product without using acyclic communication, through use of cyclic communication operation only.
In addition, it also enables cyclic communication or acyclic communication for sensor units that are connected to OPTEX FA IO-Link gateway UC2-IOL.

EtherNet/IP and IO-Link System Configuration Example



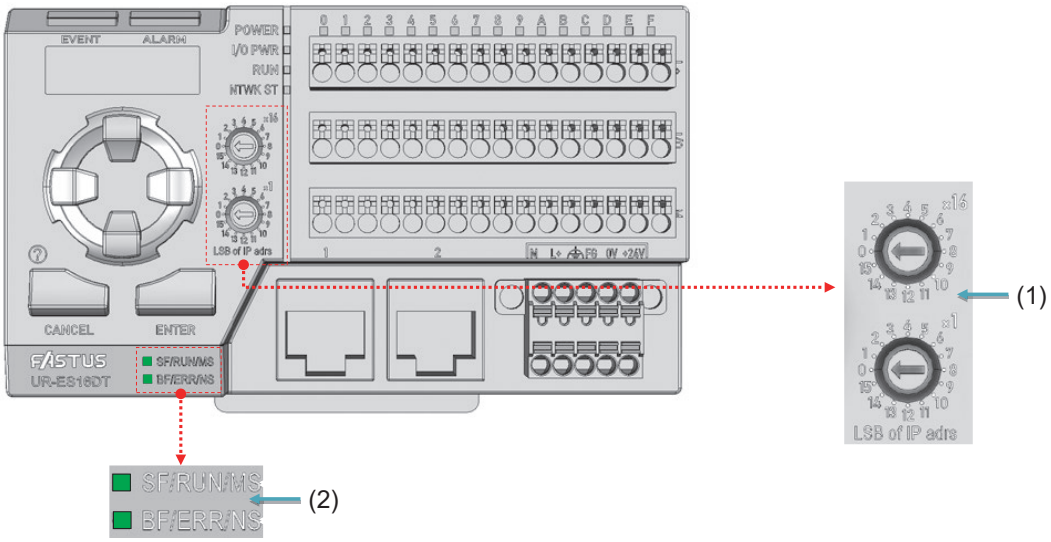
Features

- The host network type can be switched among the following depending on the setting.
  - EtherNet/IP (default value)
  - EtherCAT
  - PROFINET (planned)
  - Ethernet & Modbus/TCP
  - CC-Link IE Field Basic
- EtherNet/IP cyclic communication enables input/output with up to 16 IO-Link devices (up to 32 bytes input and up to 4 bytes output per device). Further, reading and writing with partial cyclic communication, without using acyclic communication, is possible for settings of this product, IO-Link device designated index/sub-index values, or “specific data” of sensor units connected to the OPTEX FA IO-Link gateway UC2-IOL (this is called extended access).
- By using the EtherNet/IP Explicit communication instructions, reading and writing is possible for settings of this product, IO-Link device designated index/sub-index values, or arbitrary data of sensor units connected to the OPTEX FA IO-Link gateway UC2-IOL, as necessary.
- The front buttons of this product can be remotely controlled from a touch panel display using EtherNet/IP.

1-2 Part Names and Functions

1-2-1 Part Names and Functions

The part names and functions after assembling the terminal block, when using “EtherNet/IP” as the host network, are as follows.
Refer to Common Edition for other part names and functions.



(1) IP address lowest digit setting switch

Sets the lowest digit of the IP address value (the “n” in 192.168.0.n). The top value is multiplied by 16 and added to the bottom value.

(2) SF/RUN/MS LED, BF/ERR/NS LED

Displays the host network status.
For EtherNet/IP, this is as follows.

SF/RUN/MS	BF/ERR/NS	Operation status
Lit green	Lit green	Normal communication status (connection established) Note: Also includes assembly instance conflicts.
Lit green	Flashing green	Connection not established
Flashing red	Lit red	IP address conflict condition (if Address Conflict Detection [ACD] is enabled)
Lit green	Flashing red	Exclusive Owner connection timeout
Flashing green	Off	IP address conflict condition (if Address Conflict Detection [ACD] is disabled)
Off	Off	No power supply

1-3 Inputting/Outputting IO-Link Devices and Process Data

This section explains how to input/output process data of IO-Link devices connected to the product.

The input/output methods are as below.

Method	Description		Reference
1) Input/output via cyclic communication	IO-Link device process data is assigned to the EtherNet/IP Master cyclic communication area.		-
	For default value	• Input (IO-Link device → EtherNet/IP Master): 32 bytes/device (however, Channel F only is 20 bytes) • Output (EtherNet/IP Master → IO-Link device): 4 bytes/device	"3-3 Cyclic Communication Details"
	For other than default value	The following manual or auto assignments are possible.	• Common Edition Chapter 4: Product Functions • "App-1 Assignment Method Other Than Process Data Default Value"
		Manual assignment: With the following master parameters for this product, the allocation size is set to other than default values for each channel. • Input: M40. Process input data words allocation: 0 to 16 words per channel (default value: 16 words) • Output: M41. Process output data words allocation: 0 to 16 words per channel (default value: 2 words)	
		Auto assignment: In accordance with the actual IO-Link device specifications, the above master parameter word allocation is automatically set. This depends on setting "M42. Process data words auto allocation" to "Yes" (1).	
2) Confirmation with front panel controls	Confirmation is done with product front panel operation.		Common Edition "Chapter 5 Front Panel Controls"

1-4 Setting/Monitoring Product Master Parameters

This section describes how to set/monitor product master parameters.

As shown below, there are three setting/monitoring methods.

Method	Description	Reference
1) Setting with front panel controls	Setting/monitoring is done with product front panel operation.	Common Edition “Chapter 5 Front Panel Controls”
2) Setting by Explicit communication instruction from EtherNet/IP Master	Setting/monitoring is done for the “Product Object” by Explicit communication instruction from EtherNet/IP Master.	“3-6-1 This Unit’s Object (Class ID: 64 h)”
3) Setting via cyclic communication extended access	Specific master parameters can be read/written by cyclic communication operation alone without using the Explicit message communication (via extended access).	“3-3 Cyclic Communication Details”

1-5 IO-Link Device Service Data Setting/Monitoring

This section explains how to set/monitor service data inside IO-Link devices connected to the product.

As shown below, there are three setting/monitoring methods.

Method	Description	Reference
1) Setting/ monitoring by Explicit communication instruction from EtherNet/ IP Master/	Setting/monitoring is done for the “IO-Link device object connected to the Product” by Explicit communication instruction from EtherNet/IP Master.	“3-6-2 IO-Link Device Object Connected to This Unit (Class ID: 80 to 8F h)”
2) Setting/ monitoring via cyclic communication extended access	Specific service data inside IO-Link devices can be read/ written by cyclic communication operation alone without using the Explicit message communication (via extended access).	“3-3 Cyclic Communication Details”
3) Setting/ monitoring with front panel controls	Setting/monitoring is possible with front panel controls.	Common Edition “5-1-5 Device Setting Value Window”

1-6 Setting/Monitoring Data from UC2-IOL Connected Sensor Unit

Setting/monitoring methods for data from the target sensor unit interconnected with OPTEX FA IO-Link gateway UC2-IOL are shown here.

As shown below, there are two setting/monitoring methods.

Method	Description	Reference
1) Setting/ monitoring by Explicit communication instruction from EtherNet/ IP Master/	Setting/monitoring is done for the “IO-Link device object connected to the Product” by Explicit communication instruction from EtherNet/IP Master. Arbitrary data in a sensor unit interconnected with UC2-IOL can be read or written in acyclic communication.	“3-6-2 IO-Link Device Object Connected to This Unit (Class ID: 80 to 8F h)”
2) Setting/ monitoring via cyclic communication extended access	Specific sensor unit data interconnected with UC2-IOL can be read/written by cyclic communication operation alone without using the Explicit message communication (via extended access).	“3-3 Cyclic Communication Details”

1-7 Basic Procedures

The procedures to install and configure this unit and start the EtherNet/IP and IO-Link communication are shown below.

Procedure	Details	References
Prior confirmation	• Which EtherNet connection type to use in EtherNet/IP	2-2 Ethernet Connection
	• Prepare an Ethernet connection cable and Switching Hub	Checking the Included Items Manual of the EtherNet/IP Master being used
	Data I/O design: • Whether to access settings with cyclic communication data operation, using cyclic communication, and without using acyclic communication (whether to use “extended access”) • What to read and write to this product or IO-Link device using acyclic communication	3-2 Cyclic Communication Mechanism in This Unit 3-3 Cyclic Communication Details 3-4 Explicit Message Communication Mechanism in This Unit 3-5 Explicit Message Communication Details
↓	↓	
Hardware installation and wiring	Setting the product IP address (192.168.0.n) lowest digit setting (n) using the rotary switch on the front of the product	2-1 Configuring the IP Address for This Unit
↓	↓	
Initial Settings for Front Panel Controls	Set the “Network type” setting to “EtherNet/IP”	2-3 Initial Settings for Front Panel Controls
↓	↓	
Operation to communicate with the EtherNet/IP Master	Check that the “Network type” setting is at “EtherNet/IP”	3-1-1 Network Type Setting Confirmation
	↓	
	Install the EDS file for this product	3-1 Initial Operations Required for This Unit to Communicate with EtherNet/IP Manual of the EtherNet/IP Master being used Manual of the EtherNet/IP configuration software being used
	↓	
	• Cyclic communication: Add this unit to the EtherNet/IP system in the EtherNet/IP configuration software, configure the connection, and configure the cyclic communication area • Acyclic communication: Create a communication program	
	↓	
	Download connection settings to the master	
↓	↓	
This product parameter	Using front panel controls	Common Edition
	Using Explicit communication instruction from EtherNet/IP Master	3-6-1 This Unit’s Object (Class ID: 64 h)
↓	↓	
IO-Link device service data setting	Using front panel controls	Common Edition
	Using Explicit communication instruction from EtherNet/IP Master	“3-6-2 IO-Link Device Object Connected to This Unit (Class ID: 80 to 8F h)”
↓	↓	

Procedure	Details	References
IO-Link device profile Install for the device connecting to this product	(When using other companies' IO-Link device (*1)) Use the IODD_Converter.exe in UR Master Manager, select "EtherNet/IP" as the network type and transfer (install) *1: Upon installation, the IO-Link device process data and settings can be referenced and changed with names from this product.	Common Edition
↓	↓	
Starting communication	Start system (power ON)	
	↓	
	Start EtherNet/IP communication Starting IO-Link communication	Manual of the EtherNet/IP Master being used
↓	↓	
Checking operation	EtherNet/IP Master and this product/IO-Link device display check	Manual of the EtherNet/IP Master being used Common Edition Each IO-Link device manual
	↓	
	Verify that the EtherNet/IP Master reads and writes data	Manual of the EtherNet/IP Master being used
	↓	
	Verifying read/write data between this product and an IO-Link device	Each IO-Link device manual
	↓	
	Verify that EtherNet/IP Master and this product reads/writes data via cyclic communication to/from this product	Manual of the EtherNet/IP Master being used
	↓	
	Execute PLC Explicit communication instruction for reading and writing to this product or IO-Link device (when required) using acyclic communication	3-3 Cyclic Communication Details 3-5 Explicit Message Communication Details
↓	↓	
Troubleshooting	EtherNet/IP Master and this product/IO-Link device display check, acyclic (Explicit) communication response check	Chapter 5 Troubleshooting

MEMO

Product master parameters and connected IO-Link device settings can be changed by any of the three following methods. The applications of each are as follows.

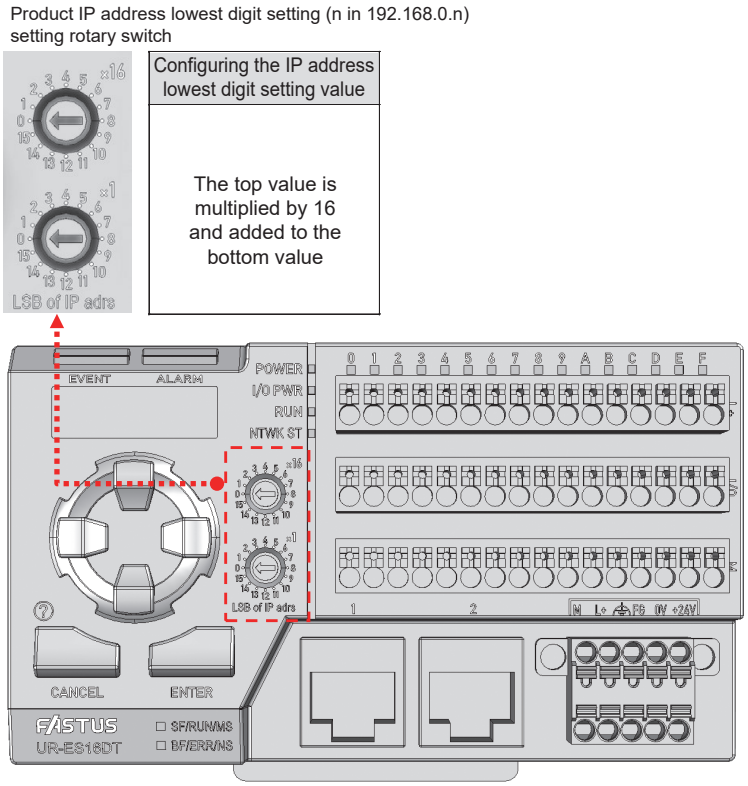
Method	Main application	References
1) Unit front operation	Startup time or Maintenance	• Common Edition
2) Acyclic communication from EtherNet/IP Master	Controlled operation	• "3-5 Explicit Message Communication Details" • "3-7-2 Example of Explicit Message Communication" • "App-2 List of Master Parameters for This Product"
3) Cyclic communication extended access from EtherNet/IP Master	When you want to more easily perform IO-Link device setting changes	• "3-3 Cyclic Communication Details"

Initial Setting of This Product with Regard to EtherNet/IP

Describes initial setting for this product's IP address setting, communication connection, and front panel operation.

2-1 Configuring the IP Address for This Unit

Before inserting the power, use the front panel rotary switch to set the product IP address lowest digit setting (n in 192.168.0.n) as the host network EtherNet/IP node.



The top value is multiplied by 16 and added to the bottom value.
For example, when setting to 250, set the upper switch to 15 and the lower switch to 10.

The IP address in the default setting is 192.168.0.n (the n value is determined by the front panel rotary switch). When changing to something other than 192.168.0.n, set the “M82. IP address” master parameter with product front panel controls. Note, turning the front panel rotary switch when the power is on causes an automatic move to “M82. IP address”.

The default gateway value is 0.0.0.0.
When a change is required, set the “M80. Default gateway” master parameter with product front panel controls.
The subnet mask default value is 255.255.255.0.
When a change is required, set the “M81. Subnet mask” master parameter with product front panel controls.

When changing the IP address, default gateway, or subnet mask with product front panel controls, refer to Common Edition “5-1-1 Front Panel Controls” and “5-1-4 Master Parameter List with Product Front Panel Operation”.

Static IP is the only way to set the product IP address (the IP address cannot be acquired via BOOTP or DHCP).

2-2 Ethernet Connection

Shown here is the Ethernet connection configuration when using EtherNet/IP as the host network.

2-2-1 Connector and Cable

The Ethernet cable may be connected to either of the RJ45 connectors at left or right of the product.
For the cable, use an Ethernet cable that complies with a standard (1000BASE-T, 100BASE-TX, 10BASE-T).
For details, refer to the user's manual for each EtherNet/IP Master.

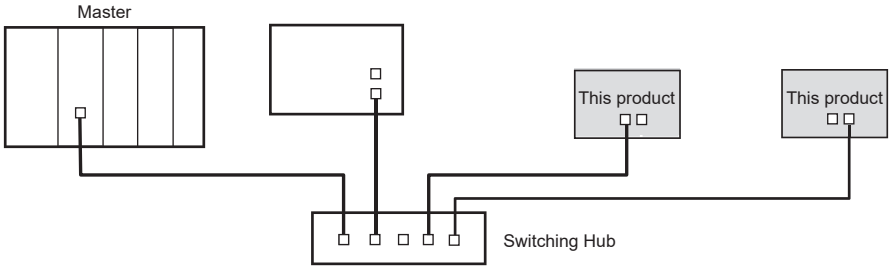
2-2-2 Ethernet Connection Status

Connect connectors/cables depending on the Ethernet connection type.
This unit supports the following connection types.

- Star configuration
- Linear bus configuration
- Device level ring configuration

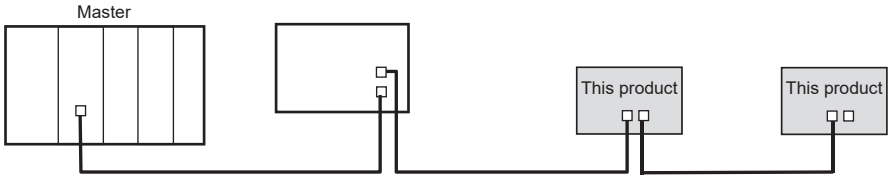
Star configuration

The star configuration network enables connection of various devices from a Switching Hub.
Connection to either Port 1 or Port 2 of the product is possible.



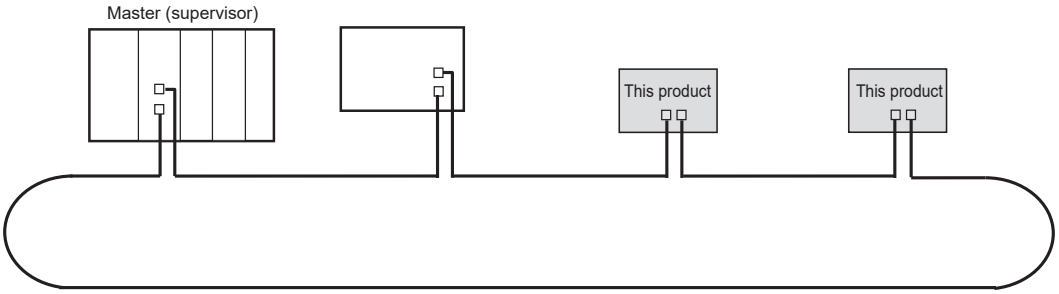
Linear bus configuration

A linear bus configuration network is a connection type in which devices are daisy chained together.
This requires no Switching Hub and can result in a shorter total LAN cable length.
The upstream device (toward the master) and downstream device can be connected to either PORT1 or PORT2 on this unit.



Device Level Ring Configuration

A device level ring (DLR) configuration network is a connection type that provides strong resilience to outages.
Connection to either Port 1 or Port 2 of the product is possible.
Devices are installed in a ring shape. If a single device fails or is disconnected, the network switches to a linear bus configuration to maintain connectivity.
A managing device called a supervisor is required on the network.
All devices connected to a DLR configuration network must support DLR.



To check status information on the DLR protocol for this unit, use Explicit message communication to read the DLR object (class ID: 47 h).

MEMO

This unit supports a function called Device Level Ring Protocol (DLR), which allows the network to be switched quickly if a communication outage occurs. This can only be used when using a device level ring configuration.
This function allows the network to be switched quickly (for example, if there are 50 nodes, switching will take from 1 to 7 ms from detecting the error to recovering connectivity). Refer to the manual of the DLR compatible master for more information.

2-3 Initial Settings for Front Panel Controls

Shown here is the initial setting method via product front panel operation when using “EtherNet/IP” as the host network.

2-3-1 Powering Up the EtherNet/IP Master

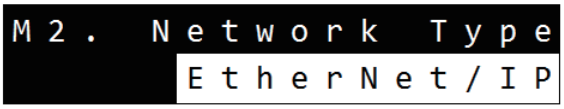
When available, apply power to the EtherNet/IP Master station in advance.
This makes it possible to check whether the master is connected correctly.

2-3-2 Language

After turning the product on for the first time, select the language setting.

2-3-3 Network Type Setting

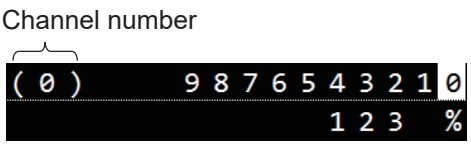
Continuing, the window automatically switches to the network type setting screen shown below.



The factory default network type setting is “EtherNet/IP”.
Press the [ENTER] button. Wait about 20 seconds.
When rewriting is complete, there will be an automatic reboot.

After the reboot, the process data display window will appear (if language selection is complete).

The following process data display is an example of the start window when turning the power on after selecting the language.



Refer to Common Edition “5-1 Front Panel Controls for Further Information” about front panel operation.

2-3-4 Configuring the IP Address for This Unit (When Necessary)

The factory default product IP address is 192.168.0.n (the n value is determined by the front panel rotary switch).

If you want to set an arbitrary value to the Product IP address, turning the rotary switch on the product front panel when the power is on causes an automatic move to “M82. IP address”. Configure the Product IP address to any arbitrary value as necessary.

Communicate

Describes the initial settings for EtherNet/IP communication and IO-Link communication, the configuration of the data to be handled, and communication examples.

3-1 Initial Operations Required for This Unit to Communicate with EtherNet/IP

This section describes the operations required on the EtherNet/IP Master for this unit to perform EtherNet/IP communication, and the operations required for IO-Link communication with the IO-Link device.

For more information, refer to the manual of the EtherNet/IP Master or that of the EtherNet/IP configuration software being used.
For the EtherNet/IP configuration software, please inquire at the EtherNet/IP Master manufacturer.

3-1-1 Network Type Setting Confirmation

Please check that the master parameter setting “M2. Network Type” is set to “EtherNet/IP”.
Set the initial settings on the unit's front panel controls. Refer to “2-3-3 Network Type Setting” for further information.

Note, regarding the Master parameter “M2. Network types”, refer to Common Edition “5-1-4 Master Parameter List with Product Front Panel Operation”.

3-1-2 Downloading and Installing the EDS File for This Product

1 **Download the EDS file for this unit from the OPTEX FA website below:**
https://www.optex-fa.com/
The EDS file is the file below.
UR-ES16DT V1.0.1.EDS

2 **Install the EDS file for this product in the EtherNet/IP configuration software.**
Copy the EDS file for this unit (Electronic Data Sheets file) to the folder specified by the EtherNet/IP configuration software.

3-1-3 Configuring EtherNet/IP Master, and EtherNet/IP Communication with This Unit

The settings required differ depending on whether cyclic communication or Explicit message communication is being used.

■ Cyclic Communication

If using the cyclic communication function, design and configure by following the procedure below.

● Design

1 **Determine which data in this unit to use with cyclic communication**
There are two types of internal data (assembly instances) for cyclic communication in this unit.

Determine which data to transmit periodically (both can be used).

2 **Confirm the connection I/O type to use**

Confirm the connection I/O type to use.

3 **Confirm the assembly instance and size of each type of data**

Each type of data uses a predetermined assembly instance and size, as shown below. Confirm this information ahead of time.

Cyclic communication internal data	Assembly instance	Size	Data direction
Input	101(65 h)	504 byte fixed	Target (This Unit) → Originator (EtherNet/IP Master)
Output	100(64 h)	68 byte fixed	Originator (EtherNet/IP Master) → Target (This Unit)

Configuration

Use the EtherNet/IP configuration software to configure the following.

1 **Register this unit on the EtherNet/IP network in the configuration software, and then enter the IP address of this unit, configured in "3.2.2 Configuring the IP Address for This Unit" (192.168.0.n (n is the value set with the front rotary switch)).**

2 **Create a cyclic communication area on the EtherNet/IP Master for which to assign data from this unit.**

3 **Select the connection I/O type of this unit (target).**

4 **Assign the assembly instance of this unit to the input/output of the selected connection.**

5 **Select the cyclic communication area on the assigned EtherNet/IP Master.**

6 **Configure the RPI, timeout value, and connection type for the connection parameters.**

7 **To use two connections, repeat steps 3 through 6 above.**

Explicit Message Communication

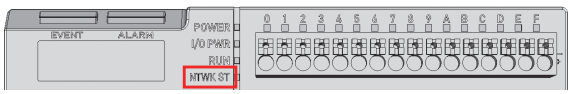
If you are using Explicit message communication, create a communication program on the EtherNet/IP Master.

3-1-4 Downloading Connection Settings to the EtherNet/IP Master

Use the EtherNet/IP configuration software to download the configured connection to the EtherNet/IP Master. Cyclic communication will automatically start.

MEMO

- When writing setting details to the EtherNet/IP Master, the EtherNet/IP Master must be reset.
- If the IP address, subnet mask, or default gateway setting for this unit is changed, the value is effective upon power restart.
- If the product front panel NTWK ST LED does not light up green (showing normal communication) even after setting is complete, once again check the settings performed by the EtherNet/IP configuration software, and the product settings (IP address, subnet mask, default gateway).



- If communication is not possible even after all the confirmation above, refer to the manuals for each EtherNet/IP Master.

3-2 Cyclic Communication Mechanism in This Unit

During cyclic communication, a device opens a logical communication line called a “connection” with another device. Data communication begins once this is successfully opened.
The device that opens the connection is called the “originator” and other device is called the “target”.
Generally, a device that has the originator function is called a “scanner” while a device with only the target function is called an “adapter”.
This unit is an “adapter”.
Note that a “scanner” can function as either an originator or target.

MEMO

Cyclic communication in EtherNet/IP is based on objects that send and receive data within own device gathered into a single connection called an “Assembly object” in the middle of the EtherNet/IP object.
Selection of an instance ID (assembly instance ID) for the connection being used serves to enable batch sending or receiving.

3-2-1 Connections Supported by This Unit

The one connection below is provided in the EDS file of this unit.

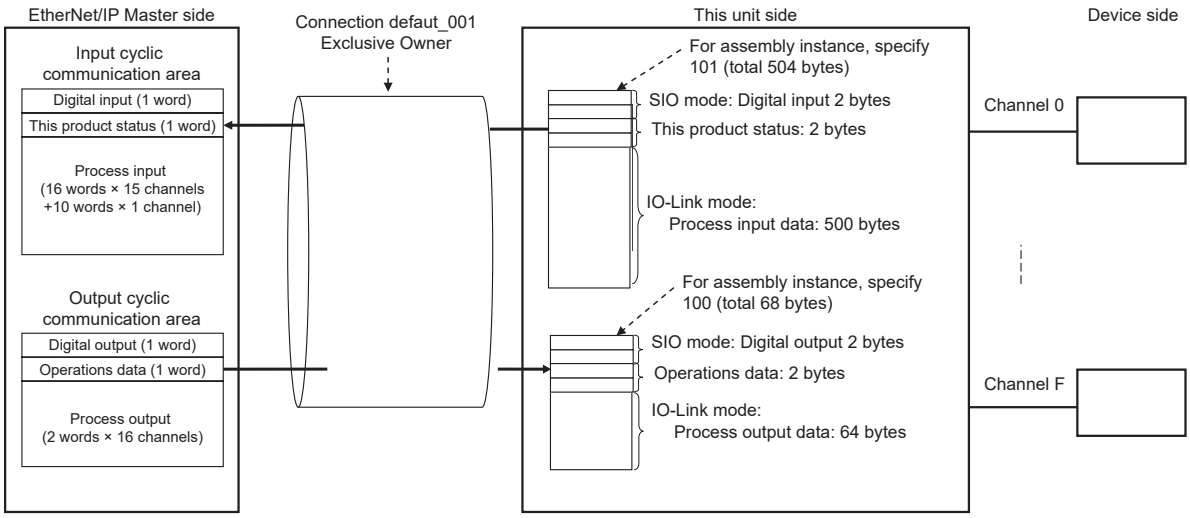
Connection name	Connection I/O type
defaut_001	Exclusive Owner

Exclusive Owner is a connection I/O type that allows both the input instance (*1) and output instance (*1) to be configured.

*1: These are instances for the assembly object.

The assembly instances assigned to the above connection are as follows.

Connection name	Connection I/O type	Assembly instance already defined using EDS file	
		Input (This product → EtherNet/IP Master)	Output (EtherNet/IP Master → This product)
defaut_001	Exclusive Owner	101 (65 h): Total 504 bytes fixed Breakdown: • Digital input in SIO mode: 2 bytes • Status data: 2 bytes • Process input data in IO-Link mode: 500 bytes	100 (64 h): Total 68 bytes fixed Breakdown: • Digital output in SIO mode: 2 bytes • Operations data: 2 bytes • Process output data in IO-Link mode: 64 bytes



MEMO

- It may not be possible to use multiple connections at the same time, depending on the EtherNet/IP Master.
- To specify a memory area in the cyclic communication area of the EtherNet/IP Master, specify an area that will retain memory even if the operation mode of the EtherNet/IP Master changes. Otherwise, the information in the memory area performing cyclic communication will be cleared when then operation mode of the master is changed.

3-2-2 Available Connection Types

The following connection types can be selected for each assembly instance of this unit.

Assembly instance	Connection type	
	Multicast (Multi-castconnection)	Unicast (Point to Point connection)
101: Input	Can be selected	
100: Output	Cannot be used	Fixed

3-3 Cyclic Communication Details

Here is described the content of input and output due to cyclic communication between the EtherNet/IP Master and this product, and this product and the IO-Link device.

3-3-1 Overview of Cyclic Communication (Cyclic Transmission/ Process I/O Communication) Assignments

This unit can input and output the IO-Link device data connected to this product, to the EtherNet/IP Master cyclically.

The unit can be switched between using either of the following two assignment methods.

- Normal assignment: Assignment method where everything is cyclic data shared type.
- Extended access enabled assignment: This assignment method enables setting values to be accessed without using Explicit message communication, for other than normal cyclic data shared type assignments.
  The following can be accessed.
  - Any service data in any connected IO-Link device
  - Product master setting values
  - Specific data in a sensor unit interconnected with UC2-IOL

During Normal Assignment

Input (This product → EtherNet/IP Master)

Input Byte Address (Start number +)	Category	Details
+0 to +3	Digital input and status data	Digital input in SIO mode and product status are stored.
+4 to +503	Process input data	Process input data is stored in order from Channel 0 to F. If the master parameter “M40. Process input data word allocation” is the default value, 32 bytes are assigned to each channel. • If the channel is not being used, then 00 h is stored in all 32 bytes. • If the process input data for the IO-Link device connected to the channel is less than 32 bytes, then 00 h is stored in the open byte at the topmost address within the 32 bytes.

● Output (EtherNet/IP Master → This product)

Output byte address (Start number +)	Category	Details
+0 to +3	Digital output and operations data	Digital output in SIO mode and product operations data are stored.
+4 to +67	Process output data	Process output data is stored in order from Channel 0 to F. If the master parameter “M41. Process output data word allocation” is the default value, 4 bytes are assigned to each channel. • If the channel is not being used, then all 4 bytes are ignored. • If the process output data for the IO-Link device connected to the channel is less than 4 bytes, then the open byte at the topmost address within the 4 bytes is not sent to the IO-Link device. • If the process output data for the IO-Link device connected to the channel exceeds 4 bytes, then all the data for the excessive part is sent to the IO-Link device as 00 h.

■ Extended Access Enabled Assignment

● Input (This product → EtherNet/IP Master)

Input byte address (Start number +)	Category	Details
+0 to +3	Digital input and status data	Digital input in SIO mode and product status are stored.
+4 to +499	Process input data	Process input data is stored in ascending channel number order from Channel 0 to F. If the master parameter “M40. Process input data word allocation” is the default value, 32 bytes are assigned to each channel from Channel 0 to E. The 16 bytes are assigned to Channel F only. • If the channel is not being used, then 00 h is stored in all 32 or 16 bytes. • If the process output data for the IO-Link device connected to the channel is less than 32 or 16 bytes, then 00 h is stored in the open byte at the topmost address within the 32 or 16 bytes.
+500 to +503	Extended access read data	Extended access read data is stored.

Output (EtherNet/IP Master → This product)

Output byte address (Start number +)	Category	Details
+0 to +3	Digital output and operations data	Digital output in SIO mode and product operations data are stored.
+4 to +59	Process output data	Process output data is stored in ascending channel number order from Channel 0 to D (Channel E and F are not assigned). If the master parameter “M41. Process output data word allocation” is the default value, 4 bytes are assigned to each channel. • If the channel is not being used, then all 4 bytes are ignored. • If the process output for the channel is less than 4 bytes, then the open byte at the topmost address within the 4 bytes is not sent to the IO-Link device. • If the process output for the channel exceeds 4 bytes, then all the data for the excessive part is sent to the IO-Link device as 00 h.
+60 to +67	Extended access specified data and extended access write data	Stores the data specified for extended access, and the data written with extended access.

The process input and process output data in the product cyclic communication is basically assumed to be both the “M40. Process input data words allocation” and “M41. Process output data words allocation” master parameters being used as the above default values.

For when both the “M40. Process input data words allocation” and “M41. Process output data words allocation” master parameters are other than the default values, refer to “App-1 Assignment Method Other Than Process Data Default Value”.

Reference) Points of difference in assignment content between the normal assignment and extended access enabled assignment
The normal assignment and extended access enabled assignment differ as shown below.

Input (This product → EtherNet/IP Master)

Data type	When normal assignment (Extended access disabled)	Extended access enabled assignment
Process input data	Same (Channels 0 to E are each 32 bytes)	
	Channel F: 20 bytes	Channel F: 16 bytes
Digital input data	Same (Channels 0 to F are each 1 bit)	
Status data	The bits noted at right do not exist. Others are the same.	Access completed, and there is a bit showing access error.
Extended access read data	Does not exist.	Read request bit rising, for read data.

Output (EtherNet/IP Master → This product)

Data type	When normal assignment (Extended access disabled)	Extended access enabled assignment
Process output data	Same (Channels 0 to D: Each 4 bytes)	
	Channels E to F: Each 4 bytes	Channels E to F: None
Digital output data	Same (Channels 0 to F are each 1 bit)	
Operations data	The bits noted at right do not exist. Others are the same.	The bits below exist. • Bit requests write or read when rising • Bit specifies the product master parameters • Bit specifies byte order during service data writing inside IO-Link device
Extended access specified data	Does not exist.	Data specifies target selection to access, and the address. The following specifications exist. • IO-Link device channel • Any service data within IO-Link device, or (product master parameter) setting value number/target number • The sensor unit connection position, when IO-Link device is OPTEX FA UC2-IOL, and has direct access to the target sensor unit interconnected with it • Mode for setting the target selection to access to a sensor unit interconnected with UC2-IOL, or to the connected IO-Link device or product master parameters (in such case, the data size is also specified at the same time)
Extended access write data	Does not exist.	Write request bit rising, for write data.

MEMO

"Specific data" in a sensor unit interconnected with UC2-IOL for the extended access target, is the data below (as of June 2021).

- For digital fiber amp D3RF series
  Index number 110 (6E h): Lower threshold (Far) setting for output 1
- For white light source digital fiber amp D3WF series
  Index number 110 (6E h): Lower threshold (Far) setting for output 1
- For CDA Series displacement sensor-amplifier unit
  When connection sensor is CD22 or TD1, 108 (6Ch): Near threshold, 109 (6Dh): Far threshold settings

MEMO

When the target selection to access are set to a sensor unit interconnected with UC2-IOL, the user has a need to grasp to which channel UC2-IOL is connected, and which sensor unit is interconnected at which position.

The following is shown when both the "M40. Process input data words allocation" and "M41. Process output data words allocation" master parameters are the default values.
Refer to "App-1 Assignment Method Other Than Process Data Default Value" for uses other than the default value.

3-3-2 Normal Assignment (Extended Access Disabled)

When “Extended access enable flag” (output byte address +2, bit address 0) is set to 0 (OFF: Extended access disabled), the product assignment to the master cyclic communication area is as shown below.

Input (This Product → EtherNet/IP Master) : 504 Bytes

Input byte address (Start number +)	Bit address							
	7	6	5	4	3	2	1	0
+0	Digital input (Channels 0 to 7: Corresponds to bit address 0 to 7)							
+1	Digital input (Channels 8 to F: Corresponds to bit address 8 to F)							
+2	Event flag	I/O power supply flag	Output overcurrent flag	Reserved	Latest event channel			
+3	Error flag	IO-Link ready flag	Synchronization establishment flag	Reserved	Latest error channel			
+4	Process input data Channel 0 (32 bytes)							
...								
+35								
+36	Process input data Channel 1 (32 bytes)							
...								
+67								
...	...							
+452	Process input data Channel E (32 bytes)							
...								
+483								
+484	Process input data Channel F (20 bytes)							
...								
+503								

Output (EtherNet/IP Master → This Product): 68 Bytes

Output byte address (Start number +)	Bit address							
	7	6	5	4	3	2	1	0
+0	Digital output (Channels 0 to 7: Corresponds to bit address 0 to 7)							
+1	Digital output (Channels 8 to F: Corresponds to bit address 8 to F)							
+2	Clear the latest event	Reset encoder counter	Reserved					0 (Extended access disabled)
+3	Clear the latest error	Reserved						
+4	Process output data Channel 0 (4 bytes)							
...								
+7								
+8	Process output data Channel 1 (4 bytes)							
...								
+11								
...	...							
+64	Process output data Channel F (4 bytes)							
...								
+67								

Normal Assignment (In Case the Extended Access is Not Enabled)

Digital input/digital output (SIO mode), and product status/operation flags

- Input from this product to EtherNet/IP Master

Assignment	Category	Data name	Description	Assignment cyclic communication area address at default value (Start number +)
Input cyclic communication area for EtherNet/IP Master	Digital input in SIO mode	Digital input (Channels 0 to 7/8 to F)	Digital input data in SIO mode (PNP input or NPN input). In IO-Link mode, the least-significant value of the bit data defined in process input data format is reflected (note, this function does not exist on the process output data side).	Input Byte Address +0/+1
	This product status	Event flag	Sets to 1 (ON) when an event is occurring in one of the connected IO-Link devices. When this flag is set to 1 (ON), access the “Event data readout by channel” data through Explicit message communication. For “Latest event data readout by channel”, refer to “App-2-2 Data for Access from PLC”.	Input Byte Address +2, Bit Address 7
		I/O power supply flag	Sets to 1 (ON) when power is being supplied for I/O by the I/O power supply.	Input Byte Address +2, Bit Address 6
		Output overcurrent flag	Sets to 1 (ON) when overcurrent is generated in SIO (output).	Input Byte Address +2, Bit Address 5
		Latest event channel	Channel number of the latest generated event. When accessing the “Event data readout by channel” through Explicit message communication, specify the channel based on this value.	Input Byte Address +2, Bit Address 0 to 3
		Error flag	Sets to 1 (ON) when an error is generated in this product. When this flag is set to 1 (ON), access the “Latest error code readout by channel” through Explicit message communication. For “Latest error code readout by channel” data, refer to “App-2-2 Data for Access from PLC”.	Input Byte Address +3, Bit Address 7
		IO-Link ready flag	When communication is established with all IO-Link devices, and EtherNet/IP is established with the EtherNet/IP Master, if this flag is set to 1 (ON), execute cyclic communication read or Explicit message communication write with the IO-Link device. Note: This flag will be set to 1 (ON) even when not all channels' I/O setting assignments are in IO-Link mode.	Input Byte Address +3, Bit Address 6
		Synchronization establishment flag	Sets to 1 (ON) when I/O synchronization (setting value number: M21) is set to any of 2/3/4/5/6 (0.4 ms/0.8 ms/1.6 ms/3.2 ms/6.4 ms cycle), while the internal timer in this product is synchronized (within +/-20 µs) with the network time.	Input Byte Address +3, Bit Address 5
		Latest error channel	Channel number of the latest generated error. When accessing the “Latest error code readout by channel” through Explicit message communication, specify the channel based on this value.	Input Byte Address +3, Bit Address 0 to 3

• Output from EtherNet/IP Master to this product

Assignment	Category	Data name	Description	Assignment cyclic communication area address at default value (Start number +)
Output cyclic communication area for EtherNet/IP Master	Digital output in SIO mode	Digital output (Channels 0 to 7/8 to F)	Digital output data in SIO mode (PNP output or NPN output).	Output Byte Address +0/+1
	Unit operation flag	Clear the latest event	When rising from 0 (OFF) to 1 (ON), clear the latest event.	Output Byte Address +2, Bit Address 7
		Reset encoder counter	For SIO device as encoder, when rising from 0 (OFF) to 1 (ON), reset the fastest counter in the unit.	Output Byte Address +2, Bit Address 6
		Extended access enable flag	Specify extended access disabled (normal) assignment as the assignment method for the cyclic communication area. 0 (OFF): Extended access disabled	Output Byte Address +2, Bit Address 0
		Clear the latest error	When rising from 0 (OFF) to 1 (ON), clear the latest error.	Output Byte Address +3, Bit Address 7

Process data

• Input from this product to EtherNet/IP Master

Type and direction	Assignment	Data name	Description	Assignment cyclic communication area address at default value (Start number +)
Input from IO-Link devices	Input cyclic communication area for EtherNet/IP Master	Process input data Channel 0 to E	Process input data in IO-Link communication mode. At default value, each channel is 32 bytes.	Input Byte Address +4 to +483
		Process input data Channel F	Process input data in IO-Link communication mode. At default value, Channel F is 20 bytes.	Input Byte Address +484 to +503

• Output from EtherNet/IP Master to this product

Type and direction	Assignment	Data name	Description	Assignment cyclic communication area address at default value (Start number +)
Output to IO-Link devices	Output cyclic communication area for EtherNet/IP Master	Process output data Channel 0 to F	Process output data in IO-Link communication mode. At default value, each channel is 4 bytes.	Output Byte Address +4 to +67

In this product, the process data for the IO-Link device is converted into little endian format at the default value. The “Process data LSB/MSB” master parameter can be used to change this to big endian format for each channel.

3-3-3 Extended Access Enabled Assignment

When “Extended access enable flag” (output byte address +2, bit address 0) is set to 1 (ON: Extended access enabled), the master cyclic communication area is as shown below.
The area in yellow below is data only when extended access is enabled.

Input (This Product → EtherNet/IP Master) : 504 Bytes

Input byte address (Start number +)	Bit address							
	7	6	5	4	3	2	1	0
+0	Digital input (Channels 0 to 7: Corresponds to bit address 0 to 7)							
+1	Digital input (Channels 8 to F: Corresponds to bit address 8 to F)							
+2	Event flag	I/O power supply flag	Output overcurrent flag	Access completed	Latest event channel			
+3	Error flag	IO-Link ready flag	Synchronization establishment flag	Access error	Latest error channel			
+4	Process input data Channel 0 (32 bytes)							
...								
+35								
+36	Process input data Channel 1 (32 bytes)							
...								
+67								
...	...							
+452	Process input data Channel E (32 bytes)							
...								
+483								
+484	Process input data Channel F (16 bytes)							
...								
+499								
+500	Extended access read data (4 bytes)							
...								
+503								

Output (EtherNet/IP Master → This Product): 68 Bytes

Output byte address (Start number +)	Bit address							
	7	6	5	4	3	2	1	0
+0	Digital output (Channels 0 to 7: Corresponds to bit address 0 to 7)							
+1	Digital output (Channels 8 to F: Corresponds to bit address 8 to F)							
+2	Clear the latest event	Reset encoder counter	Reserved			Write request	Read request	1 (Extended access enabled)
+3	Clear the latest error	Reserved	Little endian access	To access UR-ES16DT parameters	Channel No. of IO-Link to access (0 to F)			
+4	Process output data Channel 0 (4 bytes)							
...								
+7								
+8	Process output data Channel 1 (4 bytes)							
...								
+11								
...	...							
+56	Process output data Channel D (4 bytes)							
...								
+59								
+60	Index number (lower byte)							
+61	Index number (higher byte)							
	Unit No. of sensor unit connected to UC2-IOL							
+62	Subindex number or target number							
+63	Reserved					Byte length or target selection to access		
+64	Extended access write data							
...								
+67								

Assignment Data Details (When Extended Access is Enabled)

Digital input/digital output (SIO mode), and product status/operation flags

- Input from this product to EtherNet/IP Master

Assignment	Category	Data name	Description	Assignment cyclic communication area address at default value (Start number +)
Input cyclic communication area for EtherNet/IP Master	Digital input in SIO mode	Digital input (Channels 0 to 7/8 to F)	Digital input data in SIO mode (PNP input or NPN input). In IO-Link mode, the least-significant value of the bit data defined in process input data format is reflected. (This function does not exist on the process output data side.)	Input Byte Address +0/+1
	This product status	Event flag	Sets to 1 (ON) when an event is occurring in one of the connected IO-Link devices. When this flag is set to 1 (ON), access the “Event data readout by channel” data through Explicit message communication. For “Latest event data readout by channel”, refer to “App-2-2 Data for Access from PLC”.	Input Byte Address +2, Bit Address 7
		I/O power supply flag	Sets to 1 (ON) when power is being supplied for I/O by the I/O power supply.	Input Byte Address +2, Bit Address 6
		Output overcurrent flag	Sets to 1 (ON) when overcurrent is generated in SIO (output).	Input Byte Address +2, Bit Address 5
		Access completed (Extended access enabled assignment only)	Turns ON when reading/writing has completed. If the read/write request bit turns OFF, this bit will turn OFF also.	Input Byte Address +2, Bit Address 4
		Latest event channel	Channel number of the latest generated event. When accessing the “Event data readout by channel” through Explicit message communication, specify the channel based on this value.	Input Byte Address +2, Bit Address 0 to 3
		Error flag	Sets to 1 (ON) when an error is generated in this product. When this flag is set to 1 (ON), access the “Latest error code readout by channel” through Explicit message communication. For “Latest error code readout by channel” data, refer to “App-2-2 Data for Access from PLC”.	Input Byte Address +3, Bit Address 7
		IO-Link ready flag	When communication is established with all IO-Link devices, and EtherNet/IP is established with the EtherNet/IP Master, if this flag is set to 1 (ON), execute cyclic communication read or Explicit message communication write with the IO-Link device. Note: This flag will be set to 1 (ON) even when not all channels' I/O setting assignments are in IO-Link mode.	Input Byte Address +3, Bit Address 6

Assignment	Category	Data name	Description	Assignment cyclic communication area address at default value (Start number +)
Input cyclic communication area for EtherNet/IP Master	This product status	Synchronization establishment flag	Sets to 1 (ON) when I/O synchronization (setting value number: M21) is set to any of 2/3/4/5/6 (0.4 ms/0.8 ms/1.6 ms/3.2 ms/6.4 ms cycle), while the internal timer in this product is synchronized (within +/-20 µs) with the network time.	Input Byte Address +3, Bit Address 5
		Access error (Extended access enabled assignment only)	If an error occurs when requesting reading/writing, this turns on along with the access completed bit.	Input Byte Address +3, Bit Address 4
		Latest error channel	Channel number of the latest generated error. When accessing the “Latest error code readout by channel” through Explicit message communication, specify the channel based on this value.	Input Byte Address +3, Bit Address 0 to 3

- Output from EtherNet/IP Master to this product

Assignment	Category	Data name	Description	Assignment cyclic communication area address at default value (Start number +)
Output cyclic communication area for EtherNet/IP Master	Digital output in SIO mode	Digital output (Channels 0 to 7/8 to F)	Digital output data in SIO mode (PNP output or NPN output).	Output Byte Address +0/+1
	Unit operation flag	Clear the latest event	When rising from 0 (OFF) to 1 (ON), clear the latest event.	Output Byte Address +2, Bit Address 7
		Reset encoder counter	For SIO device as encoder, when rising from 0 (OFF) to 1 (ON), reset the fastest counter in the unit.	Output Byte Address +2, Bit Address 6
		Write request (Extended access enabled assignment only)	With this bit rising, the specified data write is started.	Output Byte Address +2, Bit Address 2
		Read request (Extended access enabled assignment only)	With this bit rising, the specified data read is started.	Output Byte Address +2, Bit Address 1
		Extended access enable flag	Specify extended access enabled assignment as the assignment method for the cyclic communication area. 1 (ON): Extended access enabled	Output Byte Address +2, Bit Address 0
		Clear the latest error	When rising from 0 (OFF) to 1 (ON), clear the latest error.	Output Byte Address +3, Bit Address 7

Assignment	Category	Data name	Description	Assignment cyclic communication area address at default value (Start number +)
Output cyclic communication area for EtherNet/IP Master	Unit operation flag	Little endian access (Extended access enabled assignment only)	Specify the byte unit order for “Extended access read data” or “Extended access write data”. 1 (ON): Read and write service data (setting values, etc.) in the IO-Link device in little endian format. Set to 1 (ON) when reading and writing general service data in the IO-Link device. 0 (OFF): Read and write service data (setting values, etc.) in the IO-Link device in big endian format.	Output Byte Address +3, Bit Address 5
		To access UR-ES16DT parameters (Extended access enabled assignment only)	Specifies whether to set the extended access destination to this product, or to the IO-Link device (including sensor units connected to UC2-IOL). 1 (ON): Specifies access to the product master parameters. Note: Read and write for the product master parameters is the little endian format (fixed). 0 (OFF): Specify to access service data in the IO-Link device, or “Specific data” from a sensor unit interconnected with UC2-IOL.	Output Byte Address +3, Bit Address 4
		Channel No. of IO-Link to access (0 to F) (Extended access enabled assignment only)	If UR-ES16DT parameters is set to 0 (OFF), specify the IO-Link device channel number to access.	Output Byte Address +3, Bit Address 0 to 3

Process data / Extended access-related data

- Input from this product to EtherNet/IP Master

Assignment	Category	Data name	Description	Assignment cyclic communication area address at default value (Start number +)
Input cyclic communication area for EtherNet/IP Master	Input from IO-Link devices	Process input data Channel 0 to E	Process input data in IO-Link communication mode. At default value, each channel is 32 bytes.	Input Byte Address +4 to +483
		Process input data Channel F	Process input data in IO-Link communication mode. At default value, Channel F is 16 bytes.	Input Byte Address +484 to +499
	Extended access read data		The value read during extended access. 4 bytes. If “Little endian access” is set to 1 (ON), the byte address +500 will be the lowest-order byte. • Data read from the target at time of read request (the target sensor unit interconnected with this product, an IO-Link device, or UC2-IOL) is stored. • For a write request, a value of 0 will be stored when the operation is complete. • During an access error, the extended access error code will be stored. For details on extended access error codes, refer to “Extended access error code list”.	Input Byte Address +500 to +503

• Output from EtherNet/IP Master to this product

Assignment	Category	Data name	Description	Assignment cyclic communication area address at default value (Start number +)
Output cyclic communication area for EtherNet/IP Master	Output to IO-Link devices	Process output data Channel 0 to D	Process output data in IO-Link communication mode. At default value, each channel is 4 bytes.	Output Byte Address +4 to +59
	Extended access specified data	Index number (lower byte)	When the byte length or target selection to access is 1 to 4 (read and write of 1 to 4 byte data), either the index number for service data in the corresponding IO-Link device (setting value, etc.), or the setting value number of the product master parameter, specifies the low-order byte.	Output Byte Address +60
		Index number (higher byte)	When the byte length or target selection to access is 1 to 4 (read and write of 1 to 4 byte data), either the index number for service data in the corresponding IO-Link device (setting value, etc.), or the setting value number of the product master parameter, specifies the high-order byte.	Output Byte Address +61
		Unit No. of sensor unit connected to UC2-IOL	When the byte length or target selection to access is set to 0 (UC2-IOL mode), specify the connection order as 0 through F, beginning from the left edge of the target sensor unit interconnected with OPTEX FA IO-Link gateway UC2-IOL.	Output Byte Address +61
		Subindex number or target number	When the byte length or target selection to access is 1 to 4 (read and write of 1 to 4 byte data), the sub-index number for service data in the corresponding IO-Link device (setting value, etc.) and the target number of the product master parameter are specified.	Output Byte Address +62
		Byte length or target selection to access	Specifies the target selection to access to be set to a target sensor unit interconnected with the OPTEX FA IO-Link gateway UC2-IOL, to an IO-Link device connected to a given channel, or to the product master parameters (in such case, the data size for read and write is also specified at the same time). 0: Target selection to access is the “Specific data” of a target sensor unit interconnected with UC2-IOL (2-byte data) 1 to 4: Read and write of 1 to 4 byte data (the target selection to access is the connected IO-Link device or the product master parameters)	Output Byte Address +63, Bit address 0 to 3
	Extended access write data		Specify the setting value to write via extended access. 4 bytes. Value at time of write request is sent to the target (the target sensor unit interconnected with this product, an IO-Link device, or UC2-IOL). If “Little endian access” is set to 1 (ON), the byte address +64 will be the lowest-order byte.	Output Byte Address +64 to +67

In this product, the process data for the IO-Link device is converted into little endian format at the default value. The “Process data LSB/MSB” master parameter can be used to change this to big endian format for each channel.

● Extended access error code list

The following error codes are stored in the front
(+500) byte of the extended access read data when an access error occurs during extended access.

Error Code	Details
11 h	The specified index number does not exist in the IO-Link device for which reading was attempted.
23 h	Failed to write setting value (attempted to write a read-only setting value).
30 h	Outside the range of setting value write data.
33 h	The set value data for which writing was attempted is too long.
34 h	The read setting value data length is 0 (read error).
80 h	The channel number to be accessed is out of range.
81 h	The IO-Link device for which set value writing was attempted is not connected.
82 h	The IO-Link device for which set value writing was attempted does not support ISDU communication.
90 h	IODD installation data format error.
91 h	IODD installation checksum error.
92 h	IODD installation address error.
93 h	IODD installation address discontinuous error.
94 h	Cannot be executed when the storage function is BUSY.

3-3-4 Assignments for Default Values

The assignment examples below are shown as normal assignments when both the “M40. Process input data words allocation” and “M41. Process output data words allocation” master parameters remain at the default values.

Example) Process data size for connected IO-Link device

This product Channel number	**Example of process data size for connected IO-Link device**	
	Process input data byte count	**Process output data byte count**
0	32	0
1	8	0
2	0	2
3	Not used	
4	3	0
5	0	3
6	0	8
7	Not used	
...		
F		

Process output data words allocation

This product Channel number	**M40. Process input data words allocation default value**	**M41. Process output data words allocation default value**
0	16	2
1	16	2
2	16	2
3	16	2
4	16	2
5	16	2
6	16	2
7	16	2
...	...	...
E	16	2
F	10	2

Input

Byte address	Input
+0	Digital input Channels 0 to 7
+1	Digital input Channel 8 to F
+2	Status data Low-order byte
+3	Status data High-order byte
+4	Channel 0 IO-Link process input data 32 bytes
...	
+35	
+36	Channel 1 IO-Link process input data 8 byte
...	
+43	
+44	(Channel 1 continued) Open (Note 1) 24 bytes (0 stored)
...	
+67	
+68	Channel 2 Input not used 32 bytes (0 stored)
...	
+99	
+100	Channel 3 Channel not used 32 bytes (0 stored)
...	
+131	
+132	Channel 4 IO-Link process input data 3 bytes
...	
+134	
+135	(Channel 4 continued) Open (Note 1) 29 bytes (0 stored)
...	
+163	
+164	Channel 5 Input not used 32 bytes (0 stored)
...	
+195	
+196	Channel 6 Input not used 32 bytes (0 stored)
...	
+227	
+228	Channels 7 to F Channel not used 32 bytes × 8, 20 bytes × 1 (0 stored)
...	
+503	

Output

Byte address	Output
+0	Digital output Channels 0 to 7
+1	Digital output Channels 8 to F
+2	Operations data Low-order byte
+3	Operations data High-order byte
+4	Channel 0 Output not used 4 bytes
...	
+7	
+8	Channel 1 Output not used 4 bytes
...	
+11	
+12	Channel 2 IO-Link process output data 2 bytes
+13	
+14	(Channel 2 continued) Open (Note 1) 2 bytes (0 sent)
+15	
+16	Channel 3 Channel not used 4 bytes (0 sent)
...	
+19	
+20	Channel 4 Output not used 4 bytes
...	
+23	
+24	Channel 5 IO-Link process output data 3 bytes
+25	
+26	
+27	(Channel 5 continued) Open 1 byte (Note 1)
+28	Channel 6 IO-Link process output data Low-order 4 bytes only are sent (Remaining high-order 4 bytes are ignored)
...	
+31	
+32	Channels 7 to F Channel not used 4 bytes × 9 (0 sent)
...	
+67	

Note 1: Open regions in used channels are unrelated to the “M43 Process data LSB/MSB” settings. Becomes the high-order byte side

3-3-5 Assignment Data List by Objective with Extended Access Enabled

Assigned data / At such a time as this		Extended access	Byte length or target selection to access	Channel No. of IO-Link to access	Little endian access	To access UR-ES16DT parameters	Index number or setting value number		Subindex number or target number	Connection in order from left edge of target sensor unit	Write	Read	Read and write size specification
							High-order byte	Low-order byte					
Address	Output byte Address	+2	+63	+3	+3	+3	+61	+60	+62	+61	+2		Based on byte length or target selection to access
	Bit address	0	0 to 3	0 to 3	5	4	Specification None	Specification None	Specification None	Specification None	2	1	
When using cyclic data to perform read and write of the product master parameters		1(ON)	1 to 4 (Specify the byte count)	Un related	Unrelated (Little endian fixed)	1(ON)	Master parameter setting value number		Master parameter target channel	Unrelated	1(ON) Or 0 (OFF) specification		Based on byte length or target selection to access (1 to 4 bytes)
When specifying index/sub-index within a specified IO-Link device, for cyclic reading and writing of data			1 to 4	Specification	1 (ON): Little endian format	0(OFF)	Index number		Subindex number	Unrelated			Based on byte length or target selection to access (1 to 4 bytes)
When cyclically reading and writing “specific data” in a target sensor unit interconnected with UC2-IOL			0				Unrelated			Specification			Specification None (2 byte fixed)

3-3-6 Process Data Reading and Writing Methods

Please read the process data when the IO-Link ready flag is set to 1 (ON) and the EtherNet/IP cyclic communication is normal.
Ex.) When reading process input data from any of the channel IO-Link devices
The IO-Link ready flag performs read-out as the input condition when the assigned cyclic communication area (input byte address +3, bit address 6) is set to 1 (ON) and the cyclic communication abnormality is set to 0 (OFF).

Please write the process data when the IO-Link ready flag is set to 1 (ON) and the EtherNet/IP cyclic communication is normal.
Ex.) When writing process output data from the IO-Link device
The IO-Link ready flag performs write as the input condition when the assigned cyclic communication area (input byte address +3, bit address 6) is set to 1 (ON) and the EtherNet/IP cyclic communication abnormality is set to 0 (OFF).
Because there is an abnormality in the IO-Link communication when the IO-Link Ready flag is set to 0 (OFF), handle data transfer destinations suitably.

CAUTION
When the IO-Link ready flag is set to 1 (ON), read and write process data.

3-3-7 Actual Access Extension Methods

Please read and write the specific address that is specifically targeted in extended access when the IO-Link ready flag is set to 1 (ON) and the EtherNet/IP cyclic communication is normal.

When Using Extended Access to Write to the IO-Link Device Service Data

- Set extended access (output byte address +2, bit address 0)=1 (ON).
- Use Channel No. of IO-Link to access (output byte address +3, bit address 0 to 3) to specify the target channel.
- Use the index number (output byte address +60: Low order, +61: High order) to specify the index number, and the sub-index number (output byte address +62) to specify the sub-index number.
- If service data for the target IO-Link device is converted to little endian format, set the little endian access (output byte address +3, bit address 5) to 1 (ON).
- Set the write data to the extended access write data (output byte address +64 to 67). If the above case is converted to little endian format, the write data is stored in the little endian format. +64 is the low-order byte, and +67 is the high-order byte.
- Use the byte length or target selection to access (output byte address +63, bit address 0 to 3) to specify the write byte count (1 to 4).
- When writing, the write request bit (output byte address +2, bit address 2) is elevated from 0 (OFF) to 1 (ON).
- With access complete = 1 (ON), write is completed. However, if at the same time there is access error=1 (ON), as this means that an error has occurred, please check the extended access read data error code.

When Extended Access is Used to Write to the Target Sensor Unit Interconnected with OPTEX FA IO-Link Gateway UC2-IOL

- Set extended access (output byte address +2, bit address 0)=1 (ON).
- Use Channel No. of IO-Link to access (output byte address +3, bit address 0 to 3) to specify the channel connected by UC2-IOL to the product.
- Use the unit No. of sensor unit connected to UC2-IOL (output byte address +61) to specify the connection in order from left edge of target sensor unit. For example, if the left edge module is specified, store 0.
  Note: The “Specific data” that is a target within the target sensor unit can, for the digital fiber amp D3RF series, for example, be set to the index number 110 (6E h) lower threshold (Far) setting for output 1, etc.
- Set the write data to the extended access write data (output byte address +64 to 67). If the case below is converted to little endian format, the write data is stored in the little endian format. +64 is the low-order byte, and +65 is the high-order byte.
- Since the UC2-IOL data is a big endian format, when converted to the little endian format, set the Little endian access (output byte address +3, bit address 5) to 1 (ON).
- Use the target selection to access·byte count (output byte address +63, bit address 0 to 3) to store “0”, and specify UC2-IOL as the read target.
- When writing, the write request bit (output byte address +2, bit address 2) is elevated from 0 (OFF) to 1 (ON).

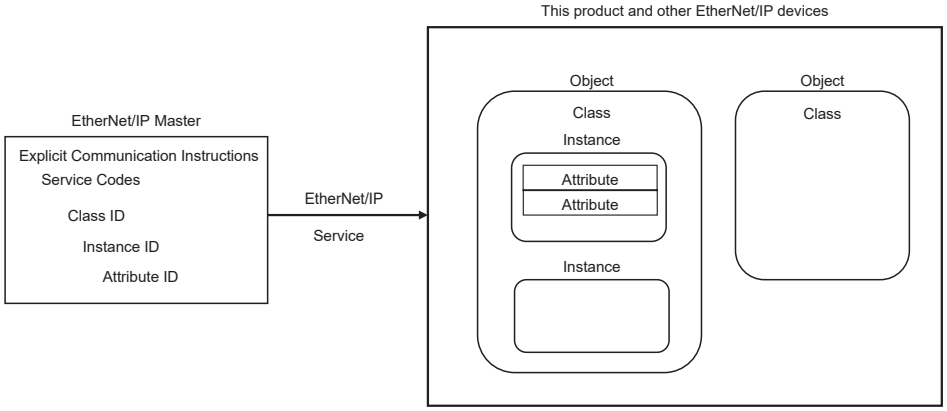
When Using Extended Access to Write to the Product Master Parameters

- Set extended access (output byte address +2, bit address 0)=1 (ON).
- Use UR-ES16DT parameter specification (output byte address +3, bit address 4) to specify the product master parameters.
- Use the setting value number (output byte address +60: Low order, +61: High order) to specify the setting value, and the target channel (output byte address +62) to specify the target number.
- Set the write data to the extended access write data (output byte address +64 to 67). Store write data in little endian format. +64 is the low-order byte, and +67 is the high-order byte.
- Use the target selection to access·byte count (output byte address +63, bit address 0 to 3) to specify the write byte count.
- When writing, the write request bit (output byte address +2, bit address 2) is elevated from 0 (OFF) to 1 (ON).
- With access complete = 1 (ON), write is completed. However, if at the same time there is access error=1 (ON), as this means that an error has occurred, please check the extended access read data error code.

3-4 Explicit Message Communication Mechanism in This Unit

In EtherNet/IP, call the clumpy substance that defines the data or its activities held in communication specifications or each device an “Object”.
In Explicit message communication, specify the following in the Explicit communication command on the EtherNet/IP Master side according to the access method to this object and the data to be accessed.

- Service Code: Code for object access method
- Class ID: Object ID
- Instance ID: Substance ID inside Object
- Attribute ID: Detailed Information ID inside Instance



For this product, access can be performed for the following.

- Service data inside IO-Link device connected to this product (setting value, etc.)
- Arbitrary data for target sensor unit interconnected with OPTEX FA IO-Link gateway UC2-IOL connected to this product
- Product master setting values

For a list of services supported by this product, refer to “3-5-1 List of Services Supported by Objects in This Unit”.

3-5 Explicit Message Communication Details

Function that returns a response to requests from the Explicit message communication instructions for the EtherNet/IP Master, to exchange data with the EtherNet/IP Master when necessary.
In response to the product master parameters, designate a master parameter number and target number for access.
For the details of product master parameter numbers and target numbers, refer to “App-2 List of Master Parameters for This Product”.

Further, this product can perform Explicit message communication (ISDU communication) with IO-Link devices based on Explicit message communication from the EtherNet/IP Master.
When needed, access the IO-Link devices via this product from the EtherNet/IP Master or product front panel operation. Mainly reads and writes service data such as service data, identification data or diagnosis information data within the IO-Link devices.
When the IO-Link Ready flag is ON, read and write IO-Link device service data.

Refer to each IO-Link device index list for their index numbers and subindex numbers.

3-5-1 List of Services Supported by Objects in This Unit

The following table lists services supported by objects in this unit. Refer to “3-6 Details of Objects Supported by This Unit” for further information.

Object name	Class ID	Details	Application
This unit's object	64 h	This object reads and writes data from this unit.	• When the setting value number in this unit is specified, and the master parameters are written
IO-Link device object connected to this unit	80 h to 8F h	Object reading and writing specified data inside the sensor unit connected to service data inside the IO-Link device (setting values, etc.), or to the OPTEX FA IO-Link gateway UC2-IOL, connected to this product. 80 h to 8F h corresponds to Channels 0 to F.	• When using Explicit message communication to read and write service data inside IO-Link device connected to this product (setting value, etc.), from the EtherNet/IP Master
			• When using Explicit message communication to read and write specification data (received light level, etc.) for sensor units connected to the OPTEX FA IO-LinkGateway UC2-IOL, from the EtherNet/IP Master
Identity object	01 h	This object provides identification information and general information on this unit.	Confirm the vendor ID of this unit, perform a reset operation, etc.
Message Router object	02 h	This object is located within the node and is used to distribute explicit message requests to the appropriate application objects. It has no class attributes or instance attributes.	—
Assembly object	04 h	This object binds the attributes of multiple objects. This allows data between each object to be sent and received using a single connection.	• Acyclically execute functions similar to cyclic communication • Read whether error diagnosis is enabled or disabled

Object name	Class ID	Details	Application
Connection Manager object	06 h	This object assigns and manages internal resources associated with both cyclic communication and Explicit message communication.	—
DLR object	47 h	This object provides a status information interface for the Device Level Ring (DLR) protocol when using a ring configuration network environment. Note: The DLR protocol is used to switch the network quickly when a communication outage occurs.	Read the network topology, network status, supervisor IP address, etc. when using the DLR function
QoS object	48 h	This object manages all data and activity related to the Quality of Service (QoS) function of a device. It includes the DSCP setting in the IP header.	Configure QoS-related settings Note: This is used for time-critical applications such as DLR.
TCP/IP Interface object	F5 h	This object writes and reads settings such as the IP address, subnet mask, and default gateway.	When configuring/monitoring TCP/IP-related settings Specifically shown below. • Enable/disable the Address Conflict Detection (ACD) function
Ethernet Link object	F6 h	This object provides parameters, error counters, and status information for the Ethernet IEEE 802.3 communication interface.	Confirm the current communication speed

3-5-2 List of Explicit Messages Seen from Objective

Explicit message elements / At such a time as this	Service codes		Class ID	Instance ID	Attribute ID	
	Read-out	Write			Low-order byte	High-order byte
When performing read and write of the product master parameters, when necessary	0E h	10 h	64 h	Master parameter setting value number	Master parameter target channel	00 h
When specifying index/sub-index within a specified IO-Link device, for reading and writing of data when necessary			80 to 8F h: Channels 0 to F compatible	Index number inside IO-Link device	Subindex number inside IO-Link device	00 h: Big endian specification 64 h: Little endian access
When reading and writing arbitrary data, as necessary, for target sensor unit interconnected with OPTEX FA IO-Link gateway UC2-IOL				Index number for sensor unit setting value	00 h	Specifies the below for each connection in order from left edge of sensor unit Big endian specification: 01 h to 10 h (1 h to 10 h from left edge) Little endian access: 65 h to 74 h (1 h to 10 h from left edge)

3-6 Details of Objects Supported by This Unit

Here are descriptions of monitoring and setting content details based on Explicit message communication from EtherNet/IP Master.

The EtherNet/IP Master can read or write the following data using Explicit message communication when necessary.

- Product (UR-ES16DT parameters) master setting values
- Service data inside IO-Link device connected to this product (setting value, etc.)
- Arbitrary data for target sensor unit interconnected with OPTEX FA IO-Link gateway UC2-IOL connected to this product

Explicit communication instructions from the EtherNet/IP Master can be used to specify the class ID, instance ID, and attribute ID of a given object, to read and write data.

Refer to “3-5-1 List of Services Supported by Objects in This Unit” for information on supported objects.

This unit contains sets of parameters called “Objects”. The EtherNet/IP Master reads from and writes to this location to monitor and set parameters.

3-6-1 This Unit's Object (Class ID: 64 h)

This object reads and writes data from this unit.

Instance ID used to specify the setting value number.
Attribute ID low-order byte to specify the target number. The attribute ID high-order byte is 00 h (always read and write in little endian format).
For the details of product master parameter setting value numbers and target numbers, refer to “App-2 List of Master Parameters for This Product”.

Instance/Attribute Range

Instance ID	Attribute ID	
	Low-order byte	High-order byte (Note 2)
Master parameter setting value number in this product 0000 h to 01FF h	00 h to FF h: Target number for master parameters within this product	00 h: Always read and write in little endian format.

Service Codes

Service code	Service name	Details
0E h	Get_Attribute_Single	Read the value of the specified attribute.
10 h	Set_Attribute_Single	Write the value of the specified attribute.

3-6-2 IO-Link Device Object Connected to This Unit (Class ID: 80 to 8F h)

Object reading and writing specified data inside the sensor unit connected to specified service data inside the IO-Link device, or to the OPTEX FA IO-Link gateway UC2-IOL, connected to this product. Note, when reading and writing, the byte order can be specified.

In the instance ID, specifies the index number inside the IO-Link device, or the index number of the sensor unit setting value.
In the attribute ID low-order bytes, specifies the sub-index number inside the IO-Link device. In the attribute ID high-order bytes, specifies the endian format.
Regarding the IO-Link device or each index number in the sensor unit, please refer to all materials where the endian list is recorded.

Instance/Attribute Range

Application	Instance ID	Attribute ID	
		Low-order byte	High-order byte (Note 2)
Access to normally connected IO-Link devices	Index number inside IO-Link device	00 h to 0F h: Subindex number inside IO-Link device 0 to F	00 h: Big endian specification 64 h: Little endian access
Direct access to sensor unit connected to OPTEX FA IO-Link gateway UC2-IOL	Index number for sensor unit setting value (Note 1) Example: D3RF lower threshold for output 1 is 6E h (110).	00 h (In the future, the sub-index number when specifying the sub-index number in sensor units)	Specifies the below for each connection in order from left edge of sensor unit • Big endian specification: 01 h to 10 h (1 h to 10 h from left edge) • Little endian access: 65 h to 74 h (1 h to 10 h from left edge)

Note 1: Regarding the index numbers in the sensor unit setting values (some sub-index numbers), please refer to the index lists in each sensor unit.
Note 2: Use the attribute ID high-order bytes to identify whether to access the IO-Link device, or to access the sensor units connected to UC2-IOL.

Service Codes

Service code	Service name	Details
0E h	Get_Attribute_Single	Read the value of the specified attribute.
10 h	Set_Attribute_Single	Write the value of the specified attribute.

3-6-3 Identity Object (Class ID: 01 h)

This object provides identification information and general information on this unit.

Instance/Attribute Range

Instance ID	Attribute ID
01 h	01 h to 09 h

Service Codes

Service code	Service name	Details
01 h	Get_Attributes_All	Read the values of all attributes.
05 h	Reset	Soft reset this unit, or return it to factory settings and then soft reset it. Set the following reset types for the parameter. Reset type 0: Restart Reset type 1: Return to factory settings and then restart
0E h	Get_Attribute_Single	Read the value of the specified attribute

Attribute ID List

Attribute ID	Parameter name	Details	Attribute	Data	
				Data type	Default value
01 h	Vendor ID	Vendor ID	Read	UINT	05F6 h
02 h	Device Type	Device type	Read	UINT	000C h (communication adapter)
03 h	Product Code	Product code	Read	UINT	250A h
04 h	Revision	Identity object revision	Read	Struct	-
	Major Revision	Major revision	Read	USINT	01 h
	Minor Revision	Minor revision	Read	USINT	01 h
05 h	Status	Device status	Read	WORD	Value varies depending on device status. Refer to "*1: Device status" for further information.
06 h	Serial Number	Serial number	Read	UDINT	Device serial number
07 h	Product Name	Product name	Read	SHORT_ STRING	“UR-ES16DT”
08 h	State	Device operation state	Read	USINT	Value varies depending on device operation state. Refer to "*2: Device operation state" for further information.
09 h	Configuration Consistency Value	Configuration value applied	Read	UINT	0000 h

*1: Device status

Bit	Name	Description
0	Owned by Master	Set to 1 (ON) when connection with master complete
1	Reserved	Always 0
2	Configured	Set to 1 (ON) when configuration complete
3	Reserved	Always 0
4 to 7	Extended Device Status	Indicates extended information on the device status. 0: Not used 1: Not used 2: Status when at least one I/O connection failure has occurred 3: Status when I/O connection is not established 4: Not used 5: Status when critical fault has occurred (MS error) 6: Status when at least one I/O connection is established, and at least one is in the RUN mode 7: Status when at least one I/O connection is established, and all are in the idle status 8 to 15: Not used
8	Minor Recoverable Fault	Recoverable minor error
9	Minor Unrecoverable Fault	Unrecoverable minor error
10	Major Recoverable Fault	Recoverable major error
11	Major Unrecoverable Fault	Unrecoverable major error
12 to 15	Reserved	Always 0

*2: Device operation state

Value	Description
00 h	Nonexistent
01 h	Self-test
02 h	Standby
03 h	Operating
04 h	Recoverable major error
05 h	Unrecoverable major error
FF h	Default value

Reset Service Parameters

Specify the reset type when the service code is 05 h (Reset).

Data	Parameter name	Details	Attribute
0	Reset type 0	Restart.	Write
1	Reset type 1	Return to factory settings and then restart.	Write

3-6-4 Message Router Object (Class ID: 02 h)

This object is located within the node and is used to distribute explicit message requests to the appropriate application objects. It has no class attributes or instance attributes.

3-6-5 Assembly Object (Class ID: 04 h)

This object binds the attributes of multiple objects. This allows data between each object to be sent and received using a single connection.

Instance/Attribute Range

Instance ID		Attribute ID
Output	64 h(100)	03 h, 04 h
Input	65 h(101)	

Service Codes

Service code	Service name	Details
0E h	Get_Attribute_Single	Read the value of the specified attribute

Attribute ID List

- For instance ID 64 h (100)

Attribute ID	Parameter name	Details	Attribute	Data	
				Data type	Default value
03 h	Data	Output from EtherNet/IP Master to this product	Read	ARRAY of BYTE	00 h
04 h	Size	Size (bytes)	Read	UINT	0044 h(68)

- For instance ID 65 h (101)

Attribute ID	Parameter name	Details	Attribute	Data	
				Data type	Default value
03 h	Data	Input from this product to EtherNet/IP Master	Read	ARRAY of BYTE	00 h
04 h	Size	Size (bytes)	Read	UINT	01F8 h(504)

3-6-6 Connection Manager Object (Class ID: 06 h)

There are no instances.

This object assigns and manages internal resources associated with both cyclic communication and Explicit message communication.

3-6-7 DLR Object (Class ID: 47 h)

This object provides a status information interface for the Device Level Ring (DLR) protocol when using a ring configuration network environment. The DLR protocol is used to switch the network quickly when a communication outage occurs.

Instance/Attribute Range

Instance ID	Attribute ID
01 h	01 h, 02 h, 0A h, 0C h

Service Codes

Service code	Service name	Details
01 h	Get_Attributes_All	Read the values of all attributes.
0E h	Get_Attribute_Single	Read the value of the specified attribute

Attribute ID List

Attribute ID	Parameter name	Details	Attribute	Data	
				Data type	Default value
01 h	Network Topology	Network topology 0: Linear bus topology 1: Ring topology	Read	USINT	00 h
02 h	Network Status	Network status Bit 0: Indicates normal status Bit 1: Indicates that a ring fault was detected Bit 2: Indicates that an invalid loop was detected Bit 3: Indicates that an error occurred in some part of the network Bit 4: Not used (Supervisor Only)	Read	USINT	00 h
0A h	Active Supervisor Address	Supervisor IP and MAC address	Read	Struct	
	IP Address	Supervisor IP address	Read	UDINT	00000000 h
	Mac Address	Supervisor MAC address	Read	ARRAY of 6 USINTs	000000000000 h
0C h	Capability Flags	List of functions supported by the DLR object Bit 0: Not used Bit 1: Indicates that beacon-based rings are supported Bit 5: Not used Bit 6: Not used Bit 7: Indicates that the flush_table is supported.	Read	DWORD	00000082 h

3-6-8 QoS Object (Class ID: 48 h)

This object manages all data and activity related to the Quality of Service (QoS) function of a device. It includes the DSCP setting in the IP header. It is required for time-critical applications, such as using DLR.

Instance/Attribute Range

Instance ID	Attribute ID
01 h	01 h, 04 h to 08 h

Service Codes

Service code	Service name	Details
0E h	Get_Attribute_Single	Read the value of the specified attribute
10 h	Set_Attribute_Single	Write the value to the specified attribute.

Attribute ID List

Attribute ID	Parameter name	Details	Attribute	Data	
				Data type	Default value
04 h	DSCP Urgent	Differentiated Services Code Point (DSCP) value of Urgent Priority message in cyclic communication (Valid range: 0 to 63)	Read/write	USINT	55(37 h)
05 h	DSCP Scheduled	DSCP value of Scheduled Priority message in cyclic communication (Valid range: 0 to 63)	Read/write	USINT	47(2F h)
06 h	DSCP High	DSCP value of High Priority message in cyclic communication (Valid range: 0 to 63)	Read/write	USINT	43(2B h)
07 h	DSCP Low	DSCP value of Low Priority message in cyclic communication (Valid range: 0 to 63)	Read/write	USINT	31(1F h)
08 h	DSCP Explicit	DSCP value of message (Class 3 or UCMM) in Explicit message communication (Valid range: 0 to 63)	Read/write	USINT	27(1B h)

3-6-9 TCP/IP Interface Object (Class ID: F5 h)

This object writes and reads settings such as the IP address, subnet mask, and default gateway.

Instance/Attribute Range

Instance ID	Attribute ID
01 h	01 h to 0D h

Service Codes

Service code	Service name	Details
01 h	Get_Attributes_All	Read the values of all attributes.
0E h	Get_Attribute_Single	Read the value of the specified attribute.
10 h	Set_Attribute_Single	Write the value to the specified attribute.

Attribute ID List

Attribute ID	Parameter name	Details	Attribute	Data	
				Data type	Default value
01 h	Interface Status	Interface status Bit 0 to 3: 0=IP address setting not completed 1=Address applied, set by a static address 2=Setting applied by hardware (not supported by UR-ES16DT) Bit 4: Indicates that a new TTL or Mcast Config value was set. The value will be applied upon reset. Bit 5: Indicates that a new value is pending for Interface Configuration. This bit is not switched on, as it is reset when the value is set via UR-ES16DT. Bit 6: Indicates that an address conflict was detected in the network by the ACD function. Bit 7: Indicates that an address conflict was detected in the network by the ACD function, and that the port cannot currently be used.	Read	DWORD	00000002 h
02 h	Configuration Capability	List of functions supported by the TCPIP object Bit 0: BOOTP client (unsupported) Bit 1: DNS client (unsupported) Bit 2: DHCP client (unsupported) Bit 3: DHCP/DNS client (unsupported) Bit 4: Configurable via configuration (unsupported) Bit 5: Configurable via hardware	Read	DWORD	000000A0 h

Attribute ID	Parameter name	Details	Attribute	Data	
				Data type	Default value
03 h	Configuration Control	IP address configuration method Bit 0 to 3: 0=Set static IP address 1=Obtain address using BOOTP function (unsupported) 2=Obtain address using DHCP function (unsupported) Bit 4: DNS function support (unsupported)	Read/ write	DWORD	00000000 h
04 h	Physical Link Object	The path to the link object in the physical layer	Read	Struct	None
	Path Size	Path size (set to 0 and cannot be changed for models with Multi Port)		UINT	0000 h
	Path	The path to the link object in the physical layer		Padded EPATH	None
05 h	Interface Cofiguration	EtherNet/IP unit settings	Read/ write	Struct	-
	IP Address	IP address		UDINT	192.168.0.1
	Network Mask	Subnet mask		UDINT	255.255. 255.0
	Gateway Address	Default gateway		UDINT	0.0.0.0
	Name Server	Primary name server		UDINT	0.0.0.0
	Name Server2	Secondary name server		UDINT	0.0.0.0
	Domain Name	Domain name		STRING	""
06 h	Host Name	Host name	Read/ write	STRING	""
07 h	Safety Network Number	Safety network	Read	6 octets	No support
08 h	TTL Value	TTL value for multicast packets (valid range: 1 to 255)	Read/ write	USINT	1
09 h	Mcast Config	Multicast address settings	Read/ write	Struct	
	Alloc Control	Multicast determination method 0=The multicast address and number of addresses are determined automatically (default value) 1=The multicast address and number of addresses are determined by the user		USINT	00 h
	Reserved	Reserved	-	USINT	-
	Num Mcast	Number of multicast addresses		UINT	Assigned automatically
	Mcast Start Addr	Starting multicast address		UDINT	Assigned automatically
0A h	SelectAcd	Address Conflict Detection (ACD) function enabled/disabled 0=Disabled 1=Enabled (default value) Specify whether to enable or disable the function that searches for IP address conflicts with other devices on the network.	Read/ write	BOOL	01 h

Attribute ID	Parameter name	Details	Attribute	Data	
				Data type	Default value
0B h	LastConflict Detected	Information on the address conflict that was last detected	Read/ write	Struct	
	AcdActivity	ACD status when a conflict is detected 0=No conflict detected (default value) 1=Conflict while generating an IPV4 address 2=Conflict during operation 3=Conflict during semi-active probe		USINT	00 h
	Remote MAC	MAC address of the device with a conflicting IP address detected by ARP		ARRAY of 6 USINTs	0
	ArpPdu	Copy of the IP address conflict information from ARP		ARRAY of 28 USINTs	0
0C h	EtherNet/IP Quick Connect	Quick Connect enabled/disabled 0 = Disabled 1 = Enabled	Read/ write	BOOL	00 h
0D h	Encapsulation Inactivity Timeout	Timeout during packet generation. The TCP socket will be closed if the specified time is exceeded. 0=Function disabled Default value: 120 seconds (valid range: 1 to 3600 seconds, 0001 to 0E10 h)	Read/ write	UINT	0078 h (120 seconds)

3-6-10 Ethernet Link Object (Class ID: F6 h)

This object provides parameters, error counters, and status information for the Ethernet IEEE 802.3 communication interface.

Instance/Attribute Range

Instance ID		Attribute ID
Port1	01 h	01 h to 0B h
Port2	02 h	

Service Codes

Service code	Service name	Details
01 h	Get_Attributes_All	Read the values of all attributes.
0E h	Get_Attribute_Single	Read the value of the specified attribute
10 h	Set_Attribute_Single	Write the value to the specified attribute.
4C h	Get And Clear	Reset and read the specified attribute.

Attribute ID List

Attribute ID	Parameter name	Details	Attribute	Data	
				Data type	Default value
01 h	Interface Speed	Interface communication speed 0=0M Speed 10=10M Speed 100=100M Speed	Read	UDINT	The set communication speed
02 h	Interface Flags	Interface status flag Bit 0: Link status Bit 1: Half-duplex (0) or full-duplex (1) Bits 2 - 4: 0: Performing auto negotiation 1: Failed to perform auto negotiation and detect speed 2: Failed to perform auto negotiation but detected speed successfully 3: Successfully performed auto negotiation 4: Auto negotiation not attempted Bit 5: Reset required to apply settings Bit 6: Hardware fault (always 0)	Read	DWORD	Value varies depending on settings
03 h	Physical Address	Device MAC address	Read	ARRAY of 6 USINTs	Device MAC address
04 h	Interface Counters	Counter value related to packets received on interface	Read/ read and clear	Struct	0
	In Octets	Octets received on interface		UDINT	0
	In Ucast Packets	Unicast packets received on interface		UDINT	0
	In NUcast Packets	Packets other than unicast packet received on interface		UDINT	0
	In Discards	Inbound packets discarded after receipt		UDINT	0
	In Errors	Inbound packets including errors (not including those discarded)		UDINT	0
	In Unknown Protos	Inbound packets received via unknown protocol		UDINT	0
	Out Octets	Octets sent on interface		UDINT	0
	Out Ucast Packets	Unicast packets sent on interface		UDINT	0
	Out Nucast Packets	Packets other than unicast packet sent on interface		UDINT	0
	Out Discards	Discarded outbound packets		UDINT	0
	Out Errors	Outbound packets including errors		UDINT	0

Attribute ID	Parameter name	Details	Attribute	Data	
				Data type	Default value
05 h	Media Counters	Counter values related to Ethernet media	Read/ read and clear	Struct	0
	Alignment Errors	Received frames not composed of octets where the data length is an integer value		UDINT	0
	FCS Errors	Received frames that did not pass through FCS check		UDINT	0
	Single Collisions	Frames successfully sent for which a collision was predicted		UDINT	0
	Multiple Collisions	Frames successfully sent for which at least one collision was predicted		UDINT	0
	SQE Test Errors	Number of SQE test error messages generated		UDINT	0
	Deferred Trans-missions	Frames where the initial transmission was delayed due to busy status		UDINT	0
	Late Collisions	Number of times where a collision was detected after the 512-bit time when sending a packet		UDINT	0
	Excessive Colli-sions	Frames for which sending failed due to excessive collisions		UDINT	0
	MAC Transmit Errors	Frames for which sending failed due to an internal MAC sublayer transmission error		UDINT	0
	Carrier Sense Errors	Time where assertion was not performed due to loss of carrier detection function for frame transmission		UDINT	0
	Frame Too Long	Frames received exceeding the maximum size allowed		UDINT	0
	MAC Receive Errors	Frames for which receipt failed due to an internal MAC sublayer receive error		UDINT	0
06 h	Interface Control	Physical layer interface settings	Read/ write	Struct	0
	Control Bits	Interface management bit Bit 0: Auto negotiation status (1: Yes, 0: No [fixed setting]) Bit 1: Type of fixed setting (0: Half-duplex, 1: Full-duplex)		WORD	0001 h (auto negotiation)
	Forced Interface Speed	Interface speed 10 Mbps: 000A h 100 Mbps: 0064 h Set to 0 (0000 h) for auto negotiation.		UINT	0000 h
07 h	Interface Type	Interface type Bit 0: Unknown interface type Bit 1: Device dedicated interface Bit 2: Twisted pair Bit 3: Optical fiber	Read	USINT	02 h

Attribute ID	Parameter name	Details	Attribute	Data	
				Data type	Default value
08 h	Interface State	Interface status Bit 0: Unknown status Bit 1: Normal Bit 2: Interface disabled Bit 3: Interface test status	Read	USINT	Value varies depending on interface status
09 h	Admin State	Administrator permissions enabled/disabled 1=Enabled (default value) 2=Disabled	Read/ write	USINT	01 h
0A h	Interface Label	Label name for each interface	Read	SHORT_ STRING	Instance 1: “Port1” Instance 2: “Port2”
0B h	Interface Capability	Functions supported by interface	Read	Struct	
	Capability Bits	Functions supported by interface Bit 0: Reset required to apply manual settings Bit 1: Auto negotiation support Bit 2: Auto MDIX support Bit 3: Manual speed/communication method can be configured		DWORD	0000000F h
	Speed/Duplex Options	List of communication speeds/communication methods supported by interface	Read	Struct	
		Number of component elements		USINT	04 h
		Communication speed/communication method		ARRAY of Struct	
		Communication speed 1 000A h =10M Speed 0064 h =100M Speed		UINT	000A h
		Communication method 1 00 h = Half-duplex 01 h = Full-duplex		USINT	00 h
		Communication speed 2		UINT	000A h
		Communication method 2		USINT	01 h
		Communication speed 3		UINT	0064 h
		Communication method 3		USINT	00 h
		Communication speed 4		UINT	0064 h
		Communication method 4		USINT	01 h

3-7 Specific Examples of Communication

3-7-1 Example of Cyclic Communication

Below is an example of combining IO-Link communication and SIO for cyclic communication.

Example Combining IO-Link Communication and SIO

Process input data (4 bytes) from the channel 0 IO-Link device is read in little endian format (default value).
Process output data (4 bytes) to the channel 1 IO-Link device is written in big endian format.
Reads bit input data from the channel 2 SIO device (NPN type optoelectric switch).

This product EtherNet/IP address: Ex.) 192.168.0.1
Product master settings:

- I/O assignment function setting (set value number: M10)
  Channel 0: IO-Link, channel 1: IO-Link, channel 2: npn input
- Process data LSB/MSB (set value number: M43):
  Channel 1: Higher order (Big)

3-7-2 Example of Explicit Message Communication

Below is an example of using Explicit message communication to read and write IO-Link device service data. For details of services supported by object in this product, refer to “3-6 Details of Objects Supported by This Unit”.

IO-Link Device Service Data Writing

Ex.) Change IO-Link-supported Z4 Series compact photoelectric sensor index number 128 (80 h) “L-on/D-on switching” from 0 (default value) to the following 1 or 2 via EtherNet/IP Master Explicit message communication instructions.
0: Setting via main body L/D selection knob (default value)
1: L-on (light on)
2: D-on (dark on)

Readout of Event Code When Event Occurs

When the event flag (process input data byte address +2, bit address 7 assigned) is ON, read out the following via EtherNet/IP Master Explicit message communication instructions.

- Latest event channel (process input data byte address +2, bit address 0 to 3 assigned) = n
- Index number 101 h subindex number n, offset +0: event flag, offset +1: event #1 type, offset +2 to +3: event code

Readout of Error Code When Error Occurs

When the error flag (process input data byte address +3, bit address 7 assigned) is ON, read out the following via EtherNet/IP Master Explicit message communication instructions.

- Latest error channel (process input data byte address +3, bit address 0 to 3 assigned) = n
- Index number 100 h, subindex number n, offset +0 to +1: channel n latest error code

Specifications

This chapter describes the specifications of this unit.

4-1 Specifications

4-1-1 Communication Specifications

Item	Specifications
Host Network Communication Protocol	EtherNet/IP
Applicable version	EtherNet/IP adapter
Authentication version	CT17
Conforming standard	IEEE802.3u
Transmission speed	10 Mbps (10BASE-T), 100 Mbps (100BASE-TX)
Cable	Twisted pair cable (STP) Category 5/5e or higher
Ethernet Connection Type	Star configuration, linear bus configuration, device level ring configuration
Distance between nodes	Within 100 m
IP address configuration	Static IP address only
Cyclic Communication (Implicit Message)	• Class1 service
Acyclic Communication (Explicit Message)	• Class3 message • UCMM
Support objects	• Identity object • Message Router object • Assembly object • Connection Manager object • DLR object • QoS object • TCP/IP Interface object • Ethernet Link object • This unit's object • IO-Link device object connected to this unit
Reset service	• Type0 • Type1
Maximum no. of connections	Class1: 5, Class3: 8, UCMM: 8
Packet interval (RPI)	1 - 3200 ms
Unit Allowable Communications Band Width	1000 pps
EtherNet/IP Product Internal Response Time	0.6 ms or less
Extended access function	This function uses cyclic communication to read and write settings for this product and IO-Link devices (including sensor units connected to UC2-IOL). Host master side programs can be simplified.
Other functions	• ACD(Address Conflict Detection) • DLR(Device Level Ring) • Auto Negotiation • Auto MDIX • Quick Connect

4-2 Data Processing Time

4-2-1 Process Data Response Time Calculation

The process data response time from the EtherNet/IP Master and through IO-Link is indicated as follows.

MEMO

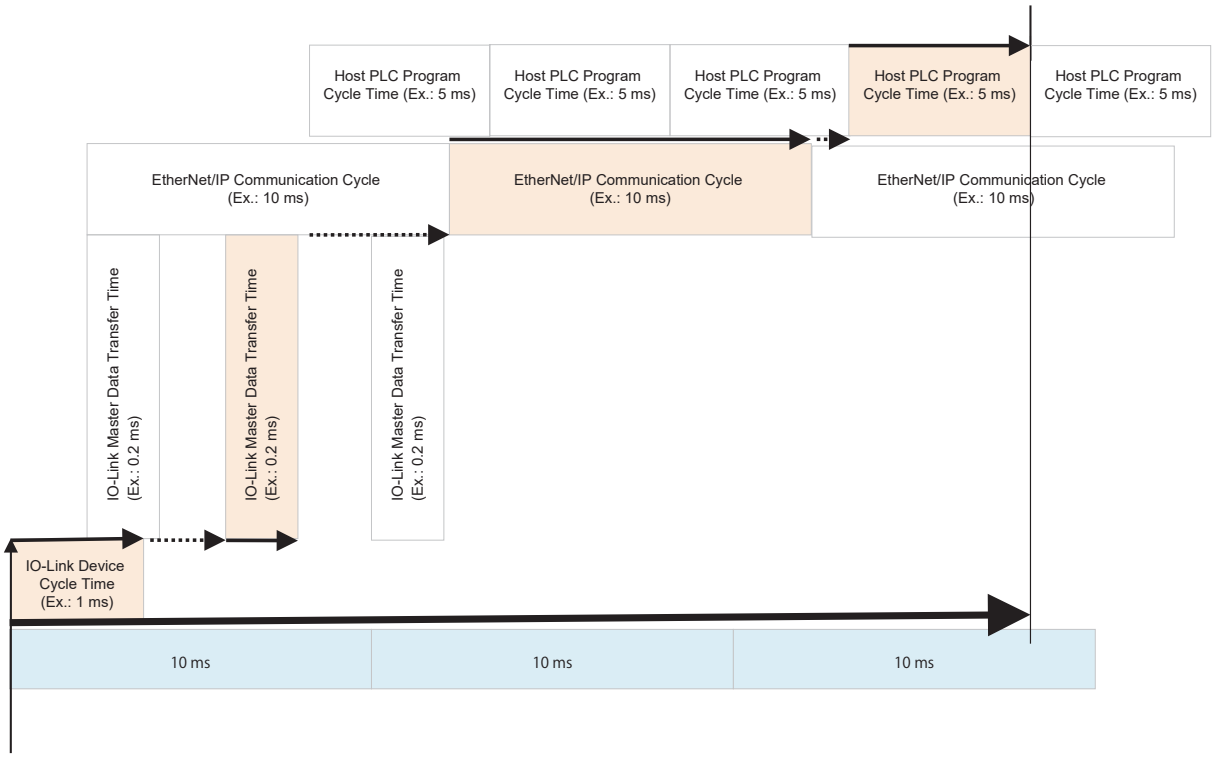
Refer to the manual of the EtherNet/IP Master for information on the EtherNet/IP communication cycle and the internal processing time of the EtherNet/IP Master.

EtherNet/IP and IO-Link Are Not Synchronized

Process input data

(IO-Link Cycle Time) × 1 - 2 + (EtherNet/IP Communication Cycle) × 1 - 2 + (Host PLC Program Cycle Time) × 1 - 2

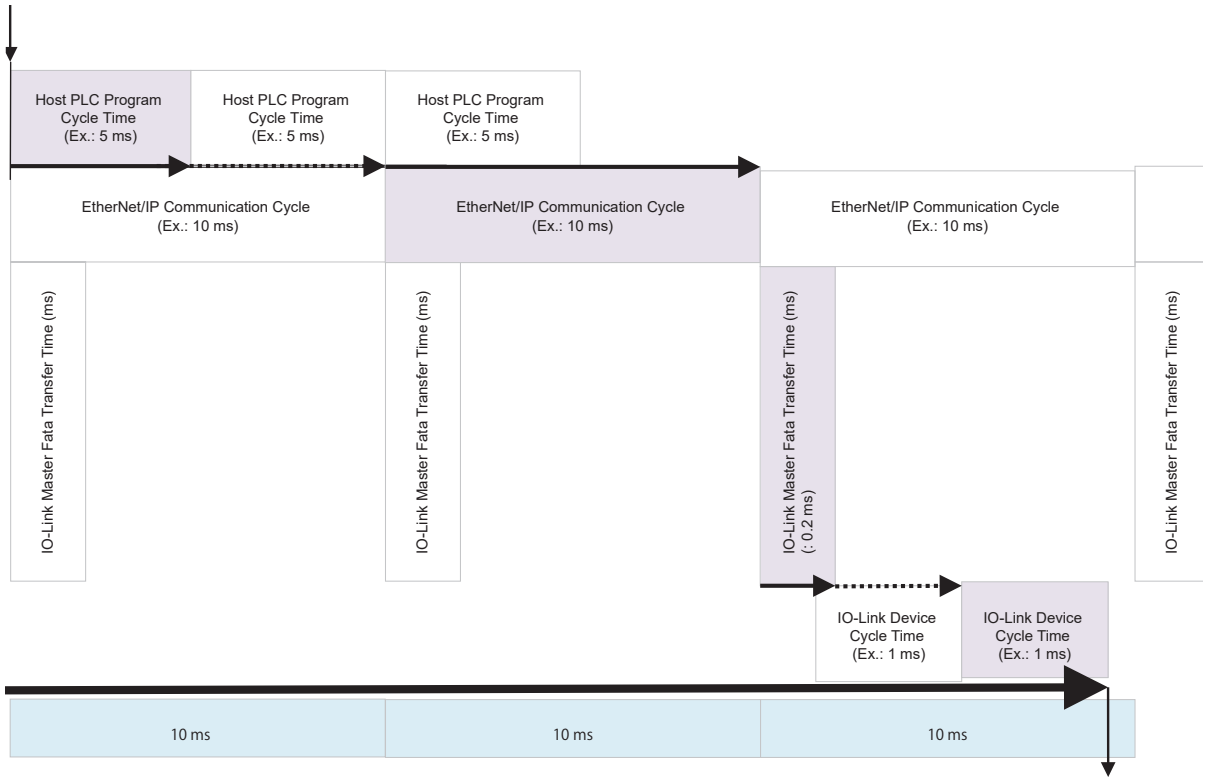
Example:



Process output data

(Host PLC Program Cycle Time) + (EtherNet/IP Communication Cycle) × 1 - 2 + (IO-Link Cycle Time) × 1 - 2

Example:



IO-Link Communication Response Time

The minimum cycle time for IO-Link devices is defined by individual device.

- Minimum cycle time of “0” : The fastest cycle time supported by this product will be used.
- Minimum cycle time specified : This product will communicate with the IO-Link device at the specified cycle time.

The actual cycle time in IO-Link communication can be confirmed in the “master parameters (M51. IO-Link cycle time -Process value-)” for this product.

Note: This product performs IO-Link communication using hardware logic rather than software, so the fastest time is 0.3 ms.

The cycle time can be specified on this product. This is set in “master parameters M50. Specified cycle time” in this product. However, it cannot be set faster than the minimum cycle time of the IO-Link device.

Example of Cycle Time for IO-Link

Conditions: Process input data bytes: 2, process output data bytes: 0, bytes read or written through Explicit message communication (ISDU communication): 1

Minimum 0.35 ms: Add the command, checksum and reserve bytes, and then multiply by 0.05 ms.

COM3 : 0.4 ms (time under 0.1 ms rounded up)

COM2 : 2.4 ms

COM1 : 19.2 ms

Synchronization Function Between IO-Link Communication and Digital I/O

For EtherNet/IP, if the master parameter “M21. I/O synchronization” is set to “Synchronous timer 0.8/1.6/3.2/6.4 ms” in this product, the internal timer of this product will be used to synchronize IO-Link communication or digital I/O transfer between multiple channels set to the same setting value at a cycle of 0.8/1.6/3.2/6.4 ms. (This can also be confirmed in master parameter “M51. IO-Link cycle time -Process value-”.)
However, in order to suppress noise generated by the communication signal. IO-Link communication delays each channel 0.56 µs instead of sending at the exact same time.

Internal Data Transfer Processing Time for This Product

IO-Link device process input data is first rearranged through software in this product, and then transferred to the EtherNet/IP processing chip.
The processing time depends on the number of process data bytes for the IO-Link devices on all channels. It will be transferred at a speed of approximately 0.1 to 0.4 ms.

4-2-2 I/O Response Time Example

In the following example, the I/O response time is calculated for a system where 16 OPTEX FA Z4 Series miniature photoelectric sensors (IO-Link-compatible) are connected to this product using IO-Link communication.
Note that the minimum cycle time for Z4 Series sensors (IO-Link-compatible) is 0.5 ms.

Conditions: This is possible with the EtherNet/IP communication cycle set to 1 ms.
Z4 Series photoelectric sensor process data: Averaged received light level (bit 15 - 1) + output (bit 0) (default value)
The time required for output to pass from the 16 Z4 Series sensors, through this product, into the host PLC, and then to be program processed is as follows.
IO-Link device cycle time 0.5 ms × 2-3 + EtherNet/IP communication cycle 1 ms × 1-2 + Host PLC program cycle time 1 ms × 1-2 = 3-5.5 ms

Troubleshooting

Describes methods of troubleshooting related to EtherNet/IP communication.

5-1 Troubleshooting

5-1-1 Troubleshooting Based on LEDs

Front LEDs (on this product)		Status	Details	Procedure
NS	MS			
Lit red	Flashing red	Duplicate IP addresses within the network	Address Conflict Detection (ACD) enabled (*1)	Make sure the IP address is not a duplicate of any other.
Off	Flashing green	IP address conflict within the network		Address Conflict Detection (ACD) disabled (*1)
		Ethernet cable is not connected		Confirm that the Ethernet cable is connected.
		IP address is not set correctly		Confirm the product IP address setting.
		Network starting up (about 7 seconds)		If there has been no change, even after waiting 10 seconds for startup, check the IP address, subnet mask, and default gateway settings.
Flashing green	Lit green	Connection not established	Device file is incorrect	Confirm that the device file for this unit is being used on the master.
			Master configuration is invalid	• Confirm that the IP address for the device is configured correctly on the master. • Make sure the network part is the same in the master and product IP addresses. Example: If the subnet mask is 255.255.255.0: Master: 192.168.0.2 Product: 192.168.0.1 The underlined part is the network part.
Flashing red	Lit green	Exclusive Owner connection timeout		• Reset the power for this product. • Reconnect the Exclusive Owner connection on the master.

*1: Based on TCP/IP Interface object (Class ID: F5 h) attribute ID: 0A h (ACD function) (Default value: Enabled).

Front LEDs (on this product)	Status	Procedure
L/A1 or L/A2		
Off	LAN cable is disconnected	Check whether the L/A1 or L/A2 LAN cables are disconnected.

Front LEDs (on this product)		Status	Details	Procedure
RUN	NTWK ST			
Lit green	-	EtherNet/IP internal IC startup	The EtherNet/IP network chip is starting up.	-
Off	-		The EtherNet/IP network chip is not operating.	If the RUN LED does not stay ON (green) even though the power is ON, check the POWER LED. If the RUN LED is unlit even though the POWER LED is lit, the power voltage may be extremely low, or the network type switching may have failed, preventing startup.

Front LEDs (on this product)		Status	Details	Procedure
RUN	NTWK ST			
Flashing green	-	Network chip firmware transferring	The EtherNet/IP network chip firmware is undergoing internal transfer.	-
Lit green	Lit green	EtherNet/IP communication status	Communication with EtherNet/IP Master station is being performed correctly.	-
Lit green	Flashing green		Communication disconnection	• Confirm the EtherNet/IP Master status (refer to the manual for the EtherNet/IP Master being used). • Confirm the EtherNet/IP cable status. • Confirm the status of the Switching Hub between the EtherNet/IP Master and this product. • Confirm the following if no problems are found. • IP address setting • Subnet mask setting • Default gateway setting After changing the IP address, subnet mask, or default gateway setting, restart the product power.
-	Off		Not communicating	• Confirm the following. • Communication wiring with EtherNet/IP Master station • Product front panel IP address lowest digit setting • EtherNet/IP Master Status • Reset the CPU module of the host PLC.

5-1-2 Troubleshooting Based on Symptoms

Phenomenon	Front LEDs (on this product)	Cyclic communication flag	Error code (hexadecimal)	Probable cause	Procedure
Data sent to/received from an IO-Link device via IO-Link communication cannot be read/written properly by EtherNet/IP	ALARM LED flashing red	Error flag ON	FFFA	EtherNet/IP communication has stopped	Confirm the Host Network (EtherNet/IP) status.

5-1-3 Error Code List

Code (hexadecimal)	Message	Conditions	Procedure
1000	No Service generated in ISDU communication	This occurs when the start code of the ISDU communication response used to access the setting value for the IO-Link device is “0” (No Service).	A setting value that is not supported by the IO-Link device is being accessed in this case. Confirm what you are trying to access (index number, etc.).
1001	IO-Link communication has stopped	This occurs when communication is established with an IO-Link device but then is disconnected. This error does not occur if the I/O power supply is shutdown. The error is also automatically cleared if IO-Link communication is restored.	Check the wiring between the IO-Link device and this product. Check the I/O power supply. Confirm whether the issue is resolved after changing the connection to another channel for this product or replacing the IO-Link device and cable.
1100	Timeout generated in ISDU communication	When using ISDU communication to access an IO-Link device setting value, no ISDU communication response is received even after five seconds have passed.	Confirm what you are trying to access on the IO-Link device (index number, write data, etc.).
5600	Checksum error generated in ISDU communication	When using ISDU communication to access an IO-Link device setting value, a mismatch occurs when calculating the checksum of the ISDU communication response.	This could be caused by noise between the IO-Link device and this product. Resolve this through such means as using a separate conduit for the power line, or maintaining distance between the C/Q wires of other IO-Link devices (do not bundle wires together). Confirm that the cable between the IO-Link device and this product is not too long (over 20 m).
5700	Unregulated ISDU communication data length	This occurs when the data length of the ISDU communication response is either “0” or too long, when using ISDU communication to access an IO-Link device setting value.	
6001	Revision ID verification error	The revision ID registered in this product does not match the revision ID of the connected IO-Link device. Process data is not transferred and setting values are not accessed.	Change the setting value for device verification (setting value number: M30) to “None”.
8033	Setting value is too long	This occurs when the data length is too long, when using ISDU communication to access an IO-Link device setting value.	Write data using the data length specified for the IO-Link device.
FF23	Storage data does not match the connected device vendor ID or device ID	This occurs when the value of the vendor ID or device ID of the connected IO-Link device differs from the stored storage data, when device verification (setting value number: M30) is set to “None” and storage data exists (however, this only occurs when power is turned ON).	If an IO-Link device with a vendor ID or device ID that differs from the storage data is connected, connect the correct IO-Link device. If it is safe to delete the storage data stored on this product by channel, write with device parameter backup/restore (setting value number: M32) set to “Delete”.
FF24	Storage buffer overload	This occurs when setting value data is too long and cannot be stored, when backing up setting values from an IO-Link device. The data length stored during backup will be “16 bytes + index 18 (model name) length + number of setting values to backup × 4 + total data length of setting values to backup”. This can be stored as long as it is 4,032 bytes or less.	Backup cannot be performed for the connected IO-Link device because the storage data is too large.

Code (hexadecimal)	Message	Conditions	Procedure
FF25	Storage data access was refused	This occurs when access to storage data is locked on the IO-Link device.	If this is required, release the lock setting (index number 12) on the IO-Link device.
FFEA	Duplicate IP addresses	A module with a duplicate IP address was connected.	Confirm the IP address of the connected module.
FFEB	Timeout generated in conflict with ISDU communication	While attempting to perform ISDU communication on the same IO-Link channel, ISDU communication was being used elsewhere and communication could not be performed within a time 330 times the cycle time.	Storage takes some time, so wait a short while and try ISDU communication again (access by index number to IO-Link device).
FFEC	EEPROM write protection signal abnormality	The write protection signal is always permitted for the EEPROM used for saving setting values, etc.	This will not cause any immediate issues with operation. However, this indicates a hardware error and the hardware will need to be replaced.
FFED	Failure in EEPROM writing	Setting value, storage data and operation time writing failed.	There is something wrong with the connection to the EEPROM, or the EEPROM has reached its maximum number of writes. It can be rewritten 1,000,000 times.
FFEE	IO-Link trace has stopped automatically	This is a notification indicating that IO-Link tracing has stopped due to an error occurring or the buffer being full.	Read the IO-Link trace data and confirm communication information.
FFEF	Storage was interrupted	An error response was received from the IO-Link device while backing up to or restoring from storage, and the storage stopped operating. Backed up data will not be saved. The data being restored may have partially been transferred to the IO-Link device.	Perform the storage operation (backup or restore) again. If this occurs again, it may be due to noise. If so, resolve this through such means as using a separate conduit for the power line, or maintaining distance between the C/Q wires of other IO-Link devices (do not bundle wires together). Confirm that the cable between the IO-Link device and this product is not too long (over 20 m). If this still occurs, it may be caused by the firmware of the IO-Link device or this product. If so, update or replace the firmware of the IO-Link device or this product.
FFF0	Invalid data in setting value information	There is an invalid character in the setting value information provided by the IO-Link device or in installed IODD data information, or a value exceeding the permitted value was specified.	This is caused by the firmware of the IO-Link device or this product. Update or replace the firmware of the IO-Link device or this product.
FFF1	Writing firmware data is abnormal	An attempt to write invalid data was made when updating the firmware.	There is something wrong with the data for the firmware being written. Reacquire the file and try again.
FFF3	The revision ID of the IO-Link device to verify is not registered in this product	This occurs when the revision ID registered to this product is “00 h”, when device verification (setting value number: M30) is set to a value other than “None”.	Change the setting value for device verification (setting value number: M30) to “None”. Or, register the revision ID of the IO-Link device to verify.

Code (hexadecimal)	Message	Conditions	Procedure
FFF4	IO-Link device model name is different	This occurs when the model name (index number 18 [product name] character string) of the registered IO-Link device differs from the model name of the device that is actually connected, when device verification (setting value number: M30) is set to “Model name”. Cyclic communication is not performed with the applicable IO-Link device.	Change the setting value for device verification (setting value number: M30) to a value other than “Model name”. Or, connect the correct IO-Link device.
FFF5	Unsupported setting value version	The version of the setting value data restored to setting value memory is new, and it may not be possible to recognize some of it.	Update the firmware of this product.
FFF6	Internal temperature is too high	This occurs when the temperature of the main CPU exceeds 85°C. The error occurs every 10 minutes.	Lower the operating temperature of this product, install a cooling fan, or lower the output load current (for example, by using a separate relay).
FFF7	EEPROM write frequency is too high	The setting value write count occurs under the following conditions. • The count is cleared if nothing is written for 450 seconds. • When writing twice with a frequency of once in less than 1 second. • When writing 20 times with a frequency of 1 in less than 10 seconds. • When writing 200 times with a frequency of once in less than 110 seconds.	Confirm whether setting value write operations are being performed frequently from the host PLC. Confirm whether IO-Link device setting values are frequently rewritten, with automatic device parameter backup (setting value number: M31) set to “Backup” or “Both”.
FFF8	Software version does not match	There is version incompatibility with the main firmware, host network communication firmware or IO-Link communication logic, and some functions may not operate normally.	Update the FPGA data of this product and the network chip firmware.
FFF9	Network chip is not operating	This occurs when there is no communication between the main CPU and the chip that is performing host network processing.	The network chip may have failed, or power may have turned OFF while the network chip firmware was being updated.
FFFA	Network communication has stopped	This occurs when host EtherNet/IP communication is established but then disconnected. The error will be automatically cleared when the status is restored.	Check whether the Ethernet cable is disconnected, the host PLC has been reset, or the power has turned OFF. Confirm the host PLC parameters. This product may stop being recognized on the network if host PLC network settings are changed.

Code (hexadecimal)	Message	Conditions	Procedure
FFFB	IO-Link device is not connected	This occurs when the IO-Link device is not connected under the following conditions. • The IO-Link device is not connected when running storage functions (manual or automatic backup/ restore of IO-Link device) • Ten seconds elapse without the IO-Link device connecting after the I/O power supply is turned ON, when device verification (setting value number: M30) is set to a value other than “None” • The IO-Link device is not connected when confirming device information or reading/writing a setting value number from the device setting values window • The user switched to the device setting value window when connected to a device that does not support ISDU communication	Connect the IO-Link device properly. Or, change the setting value for device verification (setting value number: M30) to “None”. Or, set the I/O assignment settings (setting value number: M10) to a value other than “IO-Link” for any channels not connected to an IO-Link device.
FFFC	Serial number verification error	This occurs when the registered serial number differs from the serial number of the connected IO-Link device, when device verification (setting value number: M30) is set to “Serial number”. Cyclic communication is not performed with the applicable IO-Link device.	Change the setting value for device verification (setting value number: M30) to a value other than “Serial number”. Or, connect the correct IO-Link device.
FFFD	No backup data	This occurs when storage data is not saved in this product, when restoring storage data to an IO-Link device.	A backup must be performed in order to perform a restore. Select “Backup” in device parameter backup/restore (setting value number: M32) and perform a backup.
FFFE	IO-Link device type ID is different	This occurs when the registered vendor ID or device ID differs from the value of the connected IO-Link device, when device verification (setting value number: M30) is set to a value other than “None”. Cyclic communication is not performed with the applicable IO-Link device.	Change the setting value for device verification (setting value number: M30) to “None”. Or, connect the correct IO-Link device.
FFFF	Type ID of the device to restore is different	This occurs when the vendor ID or device ID differs when storage data is restored (manual restore or automatic restore) to an IO-Link device.	Connect the correct IO-Link device.

*Errors will be ignored if the same error code occurs within one second on the same channel.

*Up to 20 entries will be stored across all channels in the buffer used to store error information. Error information will begin being discarded beginning with the oldest entry when the number of entries exceeds 20.

Appendix

List the following.

·Assignment method other than process data default value

·Mast setting value for this product when using Explicit message communication for read/write

·Example of procedure for communicating with representative EtherNet/IP Master

App-1 Assignment Method Other Than Process Data Default Value

When the “M40. Process input data words allocation” and “M41. Process output data words allocation” master parameters are the default values, the process data assignment is as follows.
Input: 32 bytes per each channel (when extended access is disabled, Channel F only is 20 bytes; when in extended access, Channel F only is 16 bytes)
Output: 4 bytes per each channel (when extended access is disabled, from Channel 0 to F; when in extended access, from Channel 0 to D only)

Here, the assignment method is shown when wanting to perform any assignment other than noted above, for any of the reasons below.

- On the EtherNet/IP Master side, when not wanting to assign an unused channel, or not wanting to create a used channel open area (however, open areas after packing and assignment will exist)
- When connecting an IO-Link device exceeding 4 bytes in output size

There are methods for manual configuration, and methods for auto assignment.
When not connected or when the configuration value is 0 words, it is packed and assigned. However, open areas after packing and assignment will exist in cyclic communication areas.

- Manual Configuration:

With the following master parameters for this product, the allocation size is manually set for each channel.
Input: “M40. Process input data words allocation”: 0 to 16 words per channel (default value: 16 words)
Output: “M41. Process output data words allocation”: 0 to 16 words per channel (default value: 2 words)

- Auto assignment:

In accordance with the actual IO-Link device specifications, the above master parameter word allocation is automatically set. In channels that are not connected, 0 words are automatically set.

App-1-1 Cyclic Communication Operation Other Than Default Value

As a result of manual assignment or auto assignment, cyclic communication becomes operations as shown below.

When Normal Assignment (Extended Access Disabled)

Input (This product → EtherNet/IP Master)

Input Byte Address (Start number +)	Category	Details
+0 to +3	Digital input and status data	Digital input in SIO mode and product status are stored.
+4 to +503	Process input data	Process input data is packed and stored in ascending channel number order from Channel 0 to F. Assigned in accordance with the “M40. Process input data words allocation” configuration. • When the channel setting is 0 words, it is packed and assigned. • If the process input data for the IO-Link device connected to the channel is smaller than the setting size, then 00 h is stored in the open byte at the topmost address within the setting size. • If the process input data for the IO-Link device connected to the channel is larger than the setting size, the process input data exceeding the setting size will be ignored (the setting size is stored).

Output (EtherNet/IP Master → This product)

Output Byte Address (Start number +)	Category	Details
+0 to +3	Digital output and operations data	Digital output in SIO mode and product operations data are stored.
+4 to +67	Process output data	Process output data is packed and stored in ascending channel number order from Channel 0 to F. Assigned in accordance with the “M41. Process output data words allocation” configuration. • When the channel setting is 0 words, it is packed and assigned. • If the process output data for the IO-Link device connected to the channel is smaller than the setting size, then the excessive part at the topmost address within the setting size is ignored (not sent from this product to the IO-Link device). • If the process output data for the IO-Link device connected to the channel is larger than the setting size, “0” will be sent in the portion of the process output data exceeding the set size from this product to the IO-Link device. • If the total size of the process output data from Channel 0 to F exceeds 64 bytes, then the data for the excessive part is not sent to the IO-Link device.

Extended Access Enabled Assignment

Input (This product → EtherNet/IP Master)

Input Byte Address (Start number +)	Category	Details
+0 to +3	Digital input and status data	Digital input in SIO mode and product status are stored.
+4 to +499	Process input data	Process input data is packed and stored in ascending channel number order from Channel 0 to F. Assigned in accordance with the “M40. Process input data words allocation” configuration. • When the channel setting is 0 words, it is packed and assigned. • If the process input data for the IO-Link device connected to the channel is smaller than the setting size, then 00 h is stored in the open byte at the topmost address within the setting size. • If the process input data for the IO-Link device connected to the channel is larger than the setting size, the process input data exceeding the setting size will be ignored (the setting size is stored).
+500 to +503	Extended access read data	Extended access read data is stored.

Output (EtherNet/IP Master → This product)

Output Byte Address (Start number +)	Category	Details
+0 to +3	Digital output and operations data	Digital output in SIO mode and product operations data are stored.
+4 to +59	Process output data	Process output data is packed and stored in ascending channel number order from Channel 0 to F. Assigned in accordance with the “M41. Process output data words allocation” configuration. • When the channel setting is 0 words, it is packed and assigned. • If the process output data for the IO-Link device connected to the channel is smaller than the setting size, then the excessive part at the topmost address within the setting size is ignored (not sent from this product to the IO-Link device). • If the process output data for the IO-Link device connected to the channel is larger than the setting size, “0” will be sent in the portion of the process output data exceeding the set size from this product to the IO-Link device. • If the total size of the process output data from Channel 0 to F exceeds 56 bytes, then the data for the excessive part is not sent to the IO-Link device.
+60 to +67	Extended access specified data and extended access write data	Stores the data specified for extended access, and the data written with extended access.

App-1-2 Cyclic Communication Assignment Other Than Default Value

Normal Assignment (Extended Access Disabled)

Input (This product → EtherNet/IP Master) : 504 bytes

Input Byte Address (Start number +)	Bit Address							
	7	6	5	4	3	2	1	0
+0	Digital input (Channels 0 to 7: Corresponds to bit address 0 to 7)							
+1	Digital input (Channels 8 to F: Corresponds to bit address 8 to F)							
+2	Event flag	I/O power supply flag	Output overcurrent flag	Reserved	Latest event channel			
+3	Error flag	IO-Link ready flag	Synchronization establishment flag	Reserved	Latest error channel			
+4	Process input data (In response to “M40. Process input data word allocation”, setting value channels other than 0 words are packed and assigned in order of rising channel number.)							
...								
+503								

Output (EtherNet/IP Master → This product): 68 bytes

Output Byte Address (Start number +)	Bit Address							
	7	6	5	4	3	2	1	0
+0	Digital output (Channels 0 to 7: Corresponds to bit address 0 to 7)							
+1	Digital output (Channels 8 to F: Corresponds to bit address 8 to F)							
+2	Clear the latest event	Reset encoder counter	Reserved					0 (Extended access disabled)
+3	Clear the latest error	Reserved						
+4	Process output data (In response to “M41. Process output data words allocation” setting, setting value channels other than 0 words are packed and assigned in order of rising channel number.)							
...								
+67								

Extended Access Enabled Assignment

The area in yellow below is data only when extended access is enabled.

Input (This product → EtherNet/IP Master) : 504 bytes

Input Byte Address (Start number +)	Bit Address							
	7	6	5	4	3	2	1	0
+0	Digital input (Channels 0 to 7: Corresponds to bit address 0 to 7)							
+1	Digital input (Channels 8 to F: Corresponds to bit address 8 to F)							
+2	Event flag	I/O power supply flag	Output overcurrent flag	Access completed	Latest event channel			
+3	Error flag	IO-Link ready flag	Synchronization establishment flag	Access error	Latest error channel			
+4 ... +499	Process input data (In response to “M40. Process input data words allocation”, setting value channels other than 0 words are packed and assigned in order of rising channel number.)							
+500 ... +503	Extended access read data (4 bytes)							

Output (EtherNet/IP Master → This product): 68 bytes

Output Byte Address (Start number +)	Bit Address							
	7	6	5	4	3	2	1	0
+0	Digital output (Channels 0 to 7: Corresponds to bit address 0 to 7)							
+1	Digital output (Channels 8 to F: Corresponds to bit address 8 to F)							
+2	Clear the latest event	Reset encoder counter	Reserved			Write request	Read-out request	1 (Extended access enabled)
+3	Clear the latest error	Reserved	Little endian access	To access UR-ES16DT parameters	Channel No. of IO-Link to access (0 to F)			
+4 ... +59	Process output data (In response to “M41. Process output data words allocation” setting, setting value channels other than 0 words are packed and assigned in order of rising channel number.)							
+60	Index number (lower byte)							
+61	Upper byte specification for index number or setting value number							
	Unit No. of sensor unit connected to UC2-IOL							
+62	Subindex number or target number							
+63	Reserved					Byte length or target selection to access		
+64 ... +67	Extended access write data							

App-1-3 Assignments for Other Than Default Values

The assignment examples below are shown as normal assignments when the “M40. Process input data words allocation” and “M41. Process output data words allocation” master parameters are at other than the default values.

Example) Process data size for connected IO-Link device

This product Channel Number	Example of process data size for connected IO-Link device	
	Process input data byte count	Process output data byte count
0	32	0
1	8	0
2	0	2
3	Not used	
4	3	0
5	0	3
6	0	8
7	Not used	
...		
F		

Example) Process output data words allocation when aligned with the product (same as auto assignment)

Channel Number	M40. Process input data words allocation setting value	M41. Process output data words allocation setting value
0	16	0
1	4	0
2	0	1
3	0	0
4	2	0
5	0	2
6	0	4
7	0	0
...	...	...
E	0	0
F	0	0

If the setting value is 0 words, as shown below, then input and output are both packed and assigned.
As a result, when creating a cyclic communication area on the EtherNet/IP Master side, please read and write the byte address after packing.

Input

Byte Address	Input
+0	Digital input Channels 0 to 7
+1	Digital input Channels 8 to F
+2	Status data Low-order byte
+3	Status data High-order byte
+4	Channel 0 IO-Link process input data 32 bytes
…	
+35	
+36	Channel 1 IO-Link process input data 8 bytes
…	
+43	
+44	Channel 4 IO-Link process input data 3 bytes
…	
+46	
+47	(Channel 4 continued) Open (Note 1) 1 bytes (0 stored)
+48	Open (0 stored)
…	
+503	

Output

Byte Address	Output
+0	Digital output Channels 0 to 7
+1	Digital output Channels 8 to F
+2	Operations data Low-order byte
+3	Operations data High-order byte
+4	Channel 2 IO-Link process output data 2 bytes
…	
+7	
+8	Channel 5 IO-Link process output data 3 bytes
…	
+10	
+11	(Channel 5 continued) Open (Note 1) 1 bytes (0 sent)
+12	Channel 6 IO-Link process output data 8 bytes
…	
+19	
+20	Open (0 sent)
…	
+67	

Note 1: Open regions in used channels are unrelated to the “M43 Process data LSB/MSB” settings. Becomes the high-order byte side.

App-2 List of Master Parameters for This Product

Here, Explicit message communication is used to show the setting/monitorable product master parameters in a list. For the setting/monitor in front panel operation,Common Edition refer to “5-1-4 Master parameter list with product front panel operation”.

EtherNet/IP is dependent on writing/reading “This unit's object (class ID: 64 h)”.
The master parameter setting value number in this product is set by the instance ID of the corresponding object. The target numbers is specified by the attribute ID low-order byte of the corresponding object.

The master parameters are classified as below.

- User settings
- Data for access from PLC

Note that this product's master parameters are handled as little endian (beginning from the lower byte).

Note: In the right column of the table below, items that can be accessed via product front panel operation or communication from the EtherNet/IP Master are marked with ●.

App-2-1 User Settings

Master parameter numbers	Target number	Data name	R/W	Value		Front panel controls (Master parameter numbers)	Communication from EtherNet/IP Master
1(1 h)	0 (This product)	IO-Link master parameters reset	RW	0 (default value)	None	●(M1)	●
				1	Initialize I/O assignment for all channels in IO-Link mode. (Storage data, display language, network type, and network No. will not be initialized)		
				2	As above, initialize I/O assignment for all channels in PNP input mode.		
				3	As above, initialize I/O assignment for all channels in NPN input mode.		
				4	As above, initialize I/O assignment for all channels in PNP output mode.		
				5	As above, initialize I/O assignment for all channels in NPN output mode.		
				6	As above, initialize I/O assignment for all channels as unused.		
				7	Delete the installed IODD data.		
				8	Initialize including network setting and language as well. I/O assignment is unused. IODD data is not deleted.		

Master parameter numbers	Target number	Data name	R/W	Value		Front panel controls (Master parameter numbers)	Communication from EtherNet/IP Master
2(2 h)	0 (This product)	Network type	RW	Specifies the host industrial-use network type.		●(M2)	●
				2 (default value)	EtherNet/IP		
				3	EtherCAT		
				4 (planned)	PROFINET (planned)		
				5	Ethernet & Modbus/TCP		
				6	CC-Link IE Field Basic		
4(4 h)	0 (This product)	Display brightness	RW	1 to 20 (default value: 7)	Display brightness Values multiplied by 5 are equivalent to % display.	●(M4)	●
5(5 h)	0 (This product)	Language	RW	0 (default value)	English	●(M5)	●
				1	Japanese		
				2	German		
				3	Chinese (Simplified)		
				4	French		
				5	Spanish		
				6	Portuguese		
				7	Italian		
				9	Korean		
				10	Chinese (Traditional)		
6(6 h)	0 (This product)	Time zone	RW	-96 to 96 (default value: 0)	Set the time difference (15-minute units) from the displayed network time (setting value number: M65). If the network time set from the host is the UTC standard, setting “9×4=36” for the time difference will display Japan time (JST).	●(M6)	●
8(8 h)	0 (This product)	User tag name of this IO-Link master unit	RW	Up to 32 characters	Set the product user tag name up to 32 characters.	●(M8)	●
9(9 h)	0 (This product)	I/O assignment batch settings	RW	0 (default value)	None	●(M9)	●
				1	Change I/O assignment settings for all channels to IO-Link mode.		
				2	Change I/O assignment for all channels to PNP input mode.		
				3	Change I/O assignment for all channels to NPN input mode.		
				4	Change I/O assignment for all channels to PNP output mode.		
				5	Change I/O assignment for all channels to NPN output mode.		
				6	Change I/O assignment for all channels to unused.		
10 (A h)	0 to 15 (corresponds to channel number)	I/O assignment settings	RW	0	IO-Link Mode	●(M10)	●
				1	PNP input mode: Internal pull-down resistance is enabled.		
				2	NPN input mode: Internal pull-up resistance is enabled.		
				3	PNP output mode		
				4	NPN output mode		
				5 (default value)	Not used		

Master parameter numbers	Target number	Data name	R/W	Value		Front panel controls (Master parameter numbers)	Communication from EtherNet/IP Master
11(B h)	0 to 15 (corresponds to channel number)	Input filter time	RW	0 (default value)	None	●(M11)	●
				1	0.1ms		
				2	1ms		
				3	5ms		
				4	10ms		
				5	20ms		
12(C h)	0 to 15 (corresponds to channel number)	Input hold time	RW	0 (default value)	None	●(M12)	●
				1	1ms		
				2	15ms		
				3	100ms		
13(D h)	0 to 15 (corresponds to channel number)	IO-Link communication and network error handling	RW	0 (default value)	Clear	●(M13)	●
				1	Input hold		
				2	Output hold		
				3	All Hold		
14(E h)	0 (This product)	UC2-IOL direct output start channel	RW	0 (default value)	The UC2 direct output function is not used.	●(M14)	●
				1 to 16	The sensor unit output signal received from OPTEX FA IO-Link gateway UC2-IOL is output directly from this product's PNP/NPN output. Specified values 1 through 16 correspond to channel numbers 0 through F on which to “start” output.		
15(F h)	0 (This product)	Encoder input selection	RW	0 (default value)	Do not use encoder input.	●(M15)	●
				1 to 14	Connect phase A, phase B, and phase Z of the encoder to the following channels (SIO mode digital input). Phase A: Any channel from 0 to D (corresponds to 1 to 14) Phase B: Any channel from 1 to E (corresponds to 1 to 14) Phase Z: Any channel from 2 to F (corresponds to 1 to 14)		
				15, 16	Reserved. Do not set.		
				17 to 31	Connect phase A and phase B of the encoder to the following channels (SIO mode digital input). Phase A: Any channel from 0 to E (corresponds to 17 to 31) Phase B: Any channel from 1 to F (corresponds to 17 to 31) Phase Z: No assignment		
				32	Reserved. Do not set.		
				33 to 48	Phase A: Any channel from 0 to F (33 to 48 supported) Phase B, phase Z: No assignment		

Master parameter numbers	Target number	Data name	R/W	Value		Front panel controls (Master parameter numbers)	Communication from EtherNet/IP Master
21(15 h)	0 to 15 (corresponds to channel number)	I/O synchronization	RW	0 (default value)	Asynchronous IO-Link communication uses individual devices' fastest times. The digital I/O status is also continually updated.	●(M21)	●
				2	Using the product's internal timer, at an 0.4 ms cycle, synchronize IO-Link communication or digital I/O transfer between multiple channels with the same setting (I/O synchronization).		
				3	As above, synchronization at 0.8 ms cycle		
				4	As above, synchronization at 1.6 ms cycle		
				5	As above, synchronization at 3.2 ms cycle		
				6	As above, synchronization at 6.4 ms cycle		
				7 to 1003	Specify the IO-Link communication cycle time at 0.4 ms to 100.0 ms.		
29(1D h)	0 to 15 (corresponds to channel number)	Device ID	RW	0x0 - 0xFFFFFF (default value: 0x0)	This is the device ID used for verification with IO-Link devices. Refer to Common Edition“M29. Device ID” in “5-1-4 Master parameter list with product front panel operation” for details.	●(M29)	●
30(1E h)	0 to 15 (corresponds to channel number)	Device verification	RW	0 (default value)	None Note: Even for “None”, if storage data is already saved in the product, when turning on the power (unit and I/O power), the IO-Link device type ID and storage data type ID will be verified. An error (FF23 h) will occur if the type ID does not match. The revision ID is not verified.	●(M30)	●
				1	Type ID (vendor ID and device ID) verification If the registered type ID and connected device type ID are different, an error (FFFE h: type ID verification error) is generated and the process data with the relevant IO-Link device is treated as invalid. As well, if IO-Link communication is not established within 10 seconds of turning on the I/O power, an error (FFFB h: IO-Link device not connected) is generated. At the same time, the revision ID is also verified.		

Master parameter numbers	Target number	Data name	R/W	Value		Front panel controls (Master parameter numbers)	Communication from EtherNet/IP Master
30(1E h)	0 to 15 (corresponds to channel number)	Device verification	RW	2	Type ID and serial number verification Even if the type IDs (vendor ID and device ID) match, if the serial number is different, an error (FFFC h: serial number verify error) is generated, and the process data with the relevant IO-Link device is invalidated. Other operations are the same as set value 1.	●(M30)	●
				3	Type ID and device model name verification Even if the type IDs (vendor ID and device ID) match, if the device model name is different, an error (FFF4 h: model name verification error) is generated, and the process data with the relevant IO-Link device is invalidated. Other operations are the same as set value 1.		
31(1F h)	0 to 15 (corresponds to channel number)	Automatic device parameter backup	RW	0 (default value)	None	●(M31)	●
				1	Auto backup When IO-Link device set values are changed, they are automatically backed up in this product. If IO-Link device setting values are changed from this product, the backup operation will automatically start 10 seconds after the last change. Note: When a device with a different vendor ID or device ID is connected, backup is executed at every startup, so reset “Device verification” (set value number: M30) to correct the verification error (FFFE h) as soon as possible.		
				2	Auto restoration At startup, if the IO-Link device set value is different from the one stored in the product, it will be automatically restored (set value downloaded from the product to the IO-Link device). In this case, note that even if the IO-Link device set value is changed, it will be overwritten at the next startup with the data saved in this product.		
				3	Perform auto backup and auto restoration as above together The storage data stored on this product will always match the IO-Link device setting values. In other words, IO-Link device setting values are backed up to this product whenever they are changed. If any setting values are different from the IO-Link device during startup, the setting values stored in this product will be restored.		

Master parameter numbers	Target number	Data name	R/W	Value			Front panel controls (Master parameter numbers)	Communication from EtherNet/IP Master
32(20 h)	0 to 15 (corresponds to channel number)	Device parameter backup/ restore	RW	0 (default value)	None		●(M32)	●
				1	Execute backup (uploading set values from devices to this product) manually			
				2	Execute restoration (downloading set values from the product to devices) manually			
				3	Delete backup data saved in the product manually			
33(21 h)	0 to 15 (corresponds to channel number)	IODD Install Data Prioritized	RW	0	Device Prioritized		●(M33)	●
				1 (default value)	IODD data Prioritized			
40(28 h)	0 to 15 (corresponds to channel number)	Process input data words allocation	RW	0 to 16 (default value: 16)	Process input data words allocated to input cyclic communication area If the setting value is 0 words, it is packed and assigned.		●(M40)	●
41(29 h)	0 to 15 (corresponds to channel number)	Process output data words allocation	RW	0 to 16 (default value: 2)	Process output data words allocated to output cyclic communication area If the setting value is 0 words, it is packed and assigned.		●(M41)	●
42(2A h)	0 (This product)	Process data words auto allocation	RW	0 (default value)	None		●(M42)	●
				1	Auto allocation			
43(2B h)	0 to 15 (corresponds to channel number)	Process data LSB/ MSB	RW	0 (default value)	Lower order (Little)		●(M43)	●
				1	Higher order (Big)			
44(2C h)	0 (This product)	Time stamp	RW	0 (default value)	No	Refer to Common Edition"M44. Time stamp" in "5-1-4 Master parameter list with product front panel operation" for details.	●(M44)	●
				1	Serial			
				2	Common Era BCD			
				3	Serial + Parity			
				4	Common Era + Parity			
51(33 h)	0 to 15 (corresponds to channel number)	IO-Link cycle time	R	1 to 1000	0.1 ms increments		●(M51)	●
52(34 h)	0 to 15 (corresponds to channel number)	IO-Link transmission rate	R	0	Not communicating		●(M52)	●
				1	COM1			
				2	COM2			
				3	COM3			
53(35 h)	0 to 15 (corresponds to channel number)	Number of IO-Link communication errors	R	0 to 255	To clear, write 1 in set value 114 h offset +0.		●(M53)	●

Master parameter numbers	Target number	Data name	R/W	Value			Front panel controls (Master parameter numbers)	Communication from EtherNet/IP Master
54(36 h)	0 to 15 (corresponds to channel number)	IO-Link ISDU checksum errors	R	0 to 255	To clear, write 1 in set value 114 h offset +0.		●(M54)	●
55(37 h)	0 to 15 (corresponds to channel number)	IO-Link transmission rate error	R	-1000 to 1000	IO-Link transmission rate error (0.1% unit, signed)		●(M55)	●
56(38 h)	0 to 15 (corresponds to channel number)	IO-Link signal width error	R	-1000 to 1000	IO-Link transmission signal width error (0.1% unit, signed)		●(M56)	●
57(39 h)	0 to 15 (corresponds to channel number)	IO-Link communication mode	R	0 to 7	0: NOCOM 1: STARTUP 2: PREOPERATE 3: OPERATE 5: STARTUP (Rev.1.0) 6: PREOPERATE (Rev.1.0) 7: OPERATE (Rev.1.0)	Refer toCommon Edition “M57. Communication mode” in “5-1-4 Master parameter list with product front panel operation” for details.	●(M57)	●
58(3A h)	0 to 15 (corresponds to channel number)	Storage backup time	R	00:00:00 00/01/01 to 23:59:59 99/12/31	The storage data backup time is displayed as below. Time and date (ex.: 18:59:00 20/02/29)		●(M58)	●
60(3C h)	0 (This product)	System program version of IO-Link master unit	R	P.PPNNLLFF	Display the data version of the program, etc. P.PP: Firmware, NN: Network chip, LL: Logic, FF: Font 4 bytes in decimal.		●(M60)	●
61(3D h)	0 (This product)	Total operation hours of IO-Link master unit	R	0 to 2097151 (239 years)	Product cumulative operating time information (unit: hours)		●(M61)	●
62(3E h)	0 (This product)	Display drive time	R	0 to 262143 (30 years)	Product display operating time information (unit: hours)		●(M62)	●
63(3F h)	0 (This product)	I/O power supply voltage	R	0 to 308	Voltage supplied to product I/O power supply (unit: 0.1 V)		●(M63)	●
64(40 h)	0 (This product)	Internal temperature	R	-2739 to 10457	Product internal temperature (unit: 0.1°C)		●(M64)	●
65(41 h)	0 (This product)	Network time	R	00:00:00 00/01/01 to 23:59:59 99/12/31	Time and date (ex.: 18:59:00 20/2/29)		●(M65)	●
66(42 h)	0 (This product)	Network communication cycle	R	0 to 15000	Returns the host network communication cycle (for EtherNet/IP, RPI) in 0.01 ms units. It will be forced to operate at a 150 ms cycle if the host network is disconnected.		●(M66)	●
80(50 h)	0 (This product)	Default gateway	R/W	0.0.0.0 to 255.255.255.255	If there are particular specifications, perform configuration. If there are not, then leave at the default value. The default value is 0.0.0.0.		●(M80)	●

Master parameter numbers	Target number	Data name	R/W	Value		Front panel controls (Master parameter numbers)	Communication from EtherNet/IP Master
81(51 h)	0 (This product)	Subnet mask	R/W	0.0.0.0 to 255.255.255.255	If there are particular specifications, perform configuration. If there are not, then leave at the default value. The default value is 255.255.255.0.	●(M81)	●
82(52 h)	0 (This product)	IP address	R/W	0.0.0.0 to 255.255.255.255	Configure the Product IP address to any arbitrary value. Configure only when setting to other than the default value 192.168.0.xxx (xxx is the value set by rotary switch). Note, turning this product's front panel rotary switch when the power is on causes an automatic move to this “M82. IP address” setting screen.	●(M82)	●

App-2-2 Data for Access from PLC

Master parameter numbers	Target numbers	Data name	R/W	Offset	Value	Front panel controls	Communication from EtherNet/IP Master
100 h	0 to 15 (corresponds to channel number)	Latest error code readout by channel	R	+0	Error code lower	? -4. Event/error display	●
				+1	Error code upper		
				+2	Lower designated index number causing error		
				+3	Upper designated index number causing error		
				+4	Designated index number causing error		
				+5 to 26	Error time and date text string (in order of generation) See the form below. HH:MM:SS YY:MN:DD (HH: hour, MM: minute, SS: second, YY: year last two digits, MN: month, DD: day) Ex.: Generated at 18:59:00 on February 19, 2020: 18:59:00 20/02/19 Note: When 100-µs unit data is added, HH:MM:SS:ssss YY:MN:DD (ssss: seconds in 100-µs units).		

Master parameter numbers	Target numbers	Data name	R/W	Offset	Value	Front panel controls	Communication from EtherNet/IP Master
101 h	0 to 15 (corresponds to channel number)	Event data readout by channel	R	+0	Event flag	? -4. Event/ error display	●
				+1	Event #1 type (*1)		
				+2	Event Code Upper		
				+3	Event Code Lower		
				+4	0		
				+5	Event #2 type (*1)		
				+6	Event Code Upper		
				+7	Event Code Lower		
				+8	0		
				+9	Event #3 type (*1)		
				+10	Event Code Upper		
				+11	Event Code Lower		
				+12	0		
				+13	Event #4 type (*1)		
				+14	Event Code Upper		
				+15	Event Code Lower		
				+16	0		
				+17	Event #5 type (*1)		
				+18	Event Code Upper		
				+19	Event Code Lower		
				+20	0		
				+21	Event #6 type (*1)		
				+22	Event Code Upper		
				+23	Event Code Lower		
				+24	0		
				+25 to 150	The text string for generation times of events #1 to #6 will be displayed (in order) after the event #. Ex. 1: Event #1 only generated at 19:15:32 on June 24, 2020: (1) 19:15:32 20/06/24 Ex. 2: Events #1 to #6 all generated at different times: (1) 19:15:32 20/06/24 (2) 19:10:18 20/6/24 (3) 18:25:32 20/06/24 (4) 19:05:48 20/6/24 (5) 19:15:32 20/06/24 (6) 19:10:18 20/6/2		

Master parameter numbers	Target numbers	Data name	R/W	Offset	Value	Front panel controls	Communication from EtherNet/IP Master
102 h	0	Set value readout time from IO-Link devices (binary data)	R	+0	15.265 µs unit data lower	-	●
				+1	15.265 µs unit data upper		
				+2	Set 0 as January 1, 1970, 00:00:00, counting data every second, least-significant		
				+3	As above 2nd byte		
				+4	As above 3rd byte		
				+5	Same as above, most-significant		
				+6	Lower parity information with readout set values as word units with exclusive disjunction (XOR) at 35 AC h		
				+7	Same as above, upper		
	1	Set value readout time from IO-Link devices (CE BCD data)	R	+0	15.265 µs unit data lower		
				+1	15.265 µs unit data upper		
				+2	s		
				+3	min		
				+4	hr		
				+5	day		
				+6	month		
				+7	year		
				+8	Lower parity information with readout set values as word units with exclusive disjunction (XOR) at 0 x35AC		
				+9	Same as above, upper		
	2	Set value readout time from IO-Link devices (text string data)	R		A 27-character text string will be displayed. Ex.: 2020/2/29 18:59:0.1234 parity 8B61 h → 18:59:00.1234 20/02/29 8B61		
103 h	0 (This product)	Event/error message readout	R		Executing readout switches the display to the event/error display window.	? -4. Event/error display	●
				+0	Applicable channel (0 - 15)		
				+1	Designated index number causing error/event qualifier		
				+2	Lower index number in error		
				+3	Upper index number in error		
				+4	Error code lower		
				+5	Error code upper		
				+6	Message text string		
				+7	(continues)		

Master parameter numbers	Target numbers	Data name	R/W	Offset	Value		Front panel controls	Communication from EtherNet/IP Master
104 h	0 (This product)	Button operation	R	+0	Returns the status of the currently pressed button. Value is the same as below.		-	●
			W	-	Writes the decimal below. 1: Right button operation 2: Left button operation 4: [↑] button operation 8: [↓] button operation 16: [CANCEL] button operation 32: [ENTER] button operation	Remotely operates the product buttons. Operation is the same as pressing once, not holding. Note: Even if buttons are remotely operated here, the display off timer will not be cleared.		
105 h	0	Event/error clear	R	-	Executes operation equivalent to pressing the ENTER, Down, and Up buttons on the event/error menu. Executes with readout.		? -4. Event/error display	●
	1	Go to next event						
	2	Return to previous event						
106 h	0 (This product)	Operation lock	RW	-	Bit 0: Master parameter write lock	Note: Start up while pressing the CANCEL button to release the lock temporarily.	-	●
					Bit 1: Device set value write lock			
					Bit 2: /Event/error clear operation lock			
					Bit 3: All button operation lock			
107 h	0	Readout display text string (1st row)	R	+0 to +499	Text string on display Character codes: Japanese: Shift-JIS Simplified Chinese: GB2312 Traditional Chinese: Big-5 Korean: EUC-kr		-	●
	1	Readout display text string (2nd row)	R					

Master parameter numbers	Target numbers	Data name	R/W	Offset	Value	Front panel controls	Communication from EtherNet/IP Master
108 h	1	Right button operation response	R	-	Each operation response when remotely operating product buttons at specified target numbers is stored under the following decimals. Responses are as below. 1: Referencing set values 10 to 19: Digit position of set values being edited (equivalent to digits 1 to 10) 100 up: Digit position in text string being edited Values up to 255 are 1-byte responses; values from 256 up are 2-byte responses. Even if buttons are remotely operated here, the display off timer will not be cleared. When specifying over 192 values, only 192 will be received. The readout values at that point are channel numbers.	-	●
	2	Left button operation response					
	4	Up button operation response					
	8	Down button operation response					
	16	CANCEL button operation response					
	32	ENTER button operation response					
	192	Process data information update operation response					
109 h	0 (This product)	Readout of channel numbers displayed	R	+0	When the IO-Link device numbers specified in writing are out of range, an out-of-range error will be generated without switching. The readout will return the current channel numbers.	-	●
10A h	0 (This product)	Find Me requests	RW	+0	0: Cancel a Find Me request to the product 1: Send a Find Me request to the product During Find Me, the event/error display will blink and the display will show “I am here.” Press any button to clear Find Me.	-	●
10D h	0 to 15 (corresponds to channel number)	Model name thumb value registration for verification	R	+0 to +1	Write the model name as a text string to calculate and store the thumb value. The readout value will be a 16-bit thumb value.	-	●
			W	+0 to +63			
10E h	0 to 15 (corresponds to channel number)	Vendor ID and device ID registered for verification	RW	+0 to +1	Registered IO-Link device vendor ID	-	●
				+2 to +4	Registered IO-Link device ID		
				+5	0		
				+6	Registered IO-Link device revision ID Value 10 h indicates that the revision ID is 1.0. Value 11 h indicates that the revision ID is 1.1.		

Master parameter numbers	Target numbers	Data name	R/W	Offset	Value	Front panel controls	Communication from EtherNet/IP Master
10F h	0 to 15 (corresponds to channel number)	Write serial number to be registered	W	+0 to +15	Writes the serial number used for verification with IO-Link devices.	-	●
110 h	0 to 15 (corresponds to channel number)	Readout of vendor ID/device ID of storage data backed up in this product and registered vendor ID/device ID and serial number	R	+0 to +1	Vendor ID in product backup data Note: In the case of a vendor ID mismatch, it will be invalid and 0 will be read out.	-	●
				+2 to +4	Vendor ID in product backup data Note: In the case of a device ID mismatch, it will be invalid and 0 will be read out.		
				+5	0		
				+6 to +7	Storage backup execution times since power on		
				+8 to +9	Storage restoration execution times since power on		
				+10 to +26	Text string of date and time of backup		
111 h	0 (This product)	Diagnostic information	R	+0	Main memory (EEPROM) checksum error count	-	●
				+1	Sub memory (flash) checksum error count		
				+2	Always 0.		
				+3	Bit 0 to 5: Result of pressing switch alone in past		
				+4 to 5	Display device drive power supply voltage (0.1 V unit)		
				+6	Explicit Communication Time-Out Count		
				+7	Main memory (EEPROM) write frequency Updated every 450 seconds, with an alarm generated at over 200.		
				+8	Maximum value of the internal temperature measured inside the product. (unit: °C)		
				+9	Set value version number (0)		
				+10	Network communication error count		
				+11	Storage function state number (normally 0, changes when storage-related functions operate)		
				+12 to +13	Reserved (Always 0)		
112 h	0 (This product)	Output overcurrent condition	R	+0 to +1	Current output overcurrent condition. Bits 0 to 15 are equivalent to I/O channels 0 to 9 and A to F.	-	●
				+2 to +17	Output overcurrent count for channels 0 to F. Counted up to 255.		
			W	+0	Write 1 to clear all channels' output overcurrent count. Write 2 to 17 to clear Channels 0 to F separately.		

Master parameter numbers	Target numbers	Data name	R/W	Offset	Value	Front panel controls	Communication from EtherNet/IP Master
113 h	0 to 15 (corresponds to channel number)	Read vendor ID and device ID of IO-Link device currently connected.	R	+0 to +1	Vendor ID	-	●
				+2 to +4	Device ID		
				+5	Always 0.		
				+6	Revision ID		
				+7	Always 0.		
				+8 to +9	Function ID		
114 h	0 to 15 (corresponds to channel number)	IO-Link device diagnostic information	R	+0	Number of IO-Link communication errors.	-	●
				+1	IO-Link ISDU sum error count		
				+2 to +3	IO-Link transmission rate error (0.1% unit, signed)		
				+4 to +5	IO-Link transmission signal width error (0.1% unit, signed)		
				+6 to +7	Actual cycle time for IO-Link communication (0.1 ms units)		
				+8	IO-Link transmission rate (0: not communicating, 1: COM1, 2: COM2, 3: COM3)		
				+9	Process input data byte count		
				+10	Process output data byte count		
				+11	IO-Link communication status (0: NOCOM, 1: STARTUP, 2: PREOPERATE, 3: OPERATE, 4 to 7: Same as 0 to 3 with IO-Link Revision 1.0)		
				+12	IO-Link device on-request data byte count		
				+13	Process input data disabled status (0: Enabled, 1: Disabled)		
	0	Clear IO-Link communication error count	W	+0	Write 1 to clear all channels' IO-Link communication error count. Write 2 to 17 to clear channels 0 to F separately.		
	1	Clear IO-Link ISDU checksum error count		+0	Write 1 to clear all channels' ISDU checksum error count. Write 2 to 17 to clear Channels 0 to F separately.		

Master parameter numbers	Target numbers	Data name	R/W	Offset	Value	Front panel controls	Communication from EtherNet/IP Master
1FA h	0 to 7 (Supports 8 type IDs)	Readout of vendor IDs and device IDs of installed IODD information	R	-	Returns 8 vendor IDs and device IDs each. Returns 4 digits of vendor IDs and 6 digits of device IDs as hexadecimal text strings. Format: VVVV-DDDDDD, VVVV--DDDDDD, …, VVVV-DDDDDD Note: Of the part not registered, the - will be stored. Up to 64 types of IODD data can be installed. Target number 0 corresponds to the 1st through 8th, target number 1 to the 9th through 16th, and so on until target number 7 and the 56th through 64th.	-	●
1FE h	0 to 31	Readout of IO-Link communication trace data	R	+0 to +127	From the position where the channel number was specified, 128 bytes of trace send/receive data will return as a hexadecimal text string. When it is read out, the trace ends. The specified channel number 31 is the most recent trace data, 30 is the previous one, and 0 is the oldest data. A “>” is inserted at the start of the send data and a “:” at the start of the receive data.	-	●
	0	Start of IO-Link communication trace	W	+0	Bits 3 to 0: IO-Link device channel number Saves the specified IO-Link device send/receive data to buffer memory (4096 bytes). Bit 5: Set to 1 to stop the trace when an IO-Link communication error is generated. Bit 6: Set to 1 to stop the trace when an ISDU communication negative response is generated. Bit 7: Set to 1 to stop the trace when the buffer is full.	-	●
				+1	Bit 0: Set to 1 to add a line break instead of “>” at the start of send data.		
1FF h	0 (This product)	Readout of MAC address and serial No.	R	+0 to +5	6-byte MAC address data	-	●
				+6	I/O voltage measurement calibrated value		
				+7	Internal temperature measurement calibrated value		
				+8 to 23	Product serial number (16 characters)		

*1: Event type details (from IO-Link specifications)

Bits 7 to 6	Event generation type	0: Reservation, 1: Single, 2: Generated, 3: Cleared
Bits 5 to 4	Event type	0: Reservation, 1: Notification, 2: Warning, 3: Error
Bit 3	Event generation source	0: Device, 1: Master
Bits 2 to 0	Event cause	0: Unclear, 1 to 3: Reservation, 4: Application, 5 to 7: Reservation

App-3 Method for Communication with Each Company's EtherNet/IP Master

Here is described an example of a procedure when this product communicates with a representative EtherNet/IP Master shown below.

- Omron: NX1P2 Built-in EtherNet/IP Port
- Mitsubishi Electric: EtherNet/IP Network Interface Module RJ71EIP91

App-3-1 The Omron EtherNet/IP Master

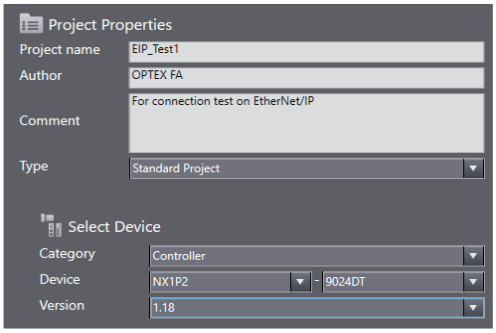
Configuration of Host Devices

PLC	NX Series NX1P2
EtherNet/IP Master	NX1P2 Built-in EtherNet/IP Port
PLC software	Sysmac Studio
EtherNet/IP configuration software	

Example of Used Procedure

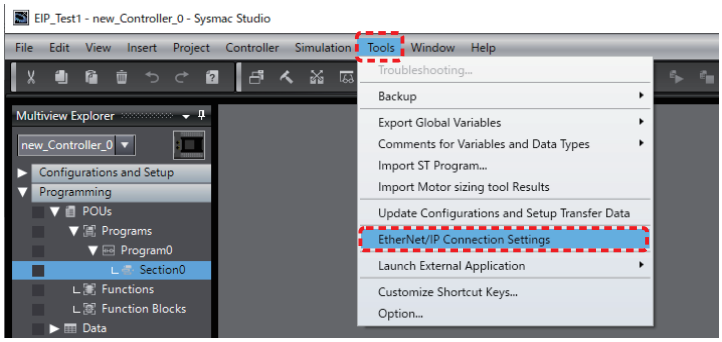
Sysmac Studio Project Creation

Start up Sysmac Studio, and create a new project.

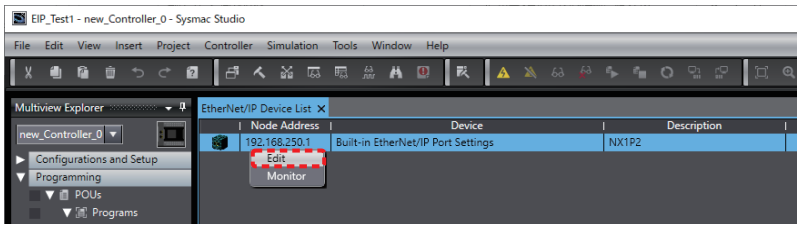


EtherNet/IP Connection Settings Startup

From the [Tools] Menu, select the [EtherNet/IP Connection Settings]/

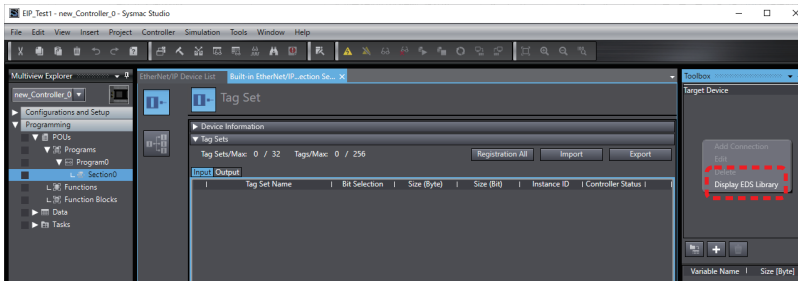


Right-click the mouse over the EtherNet/IP Master, and select [Edit].

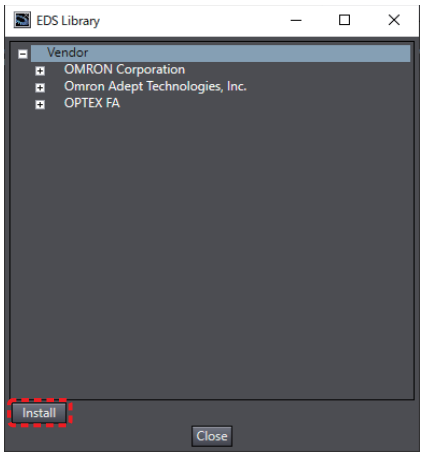


Install the EDS file for this product

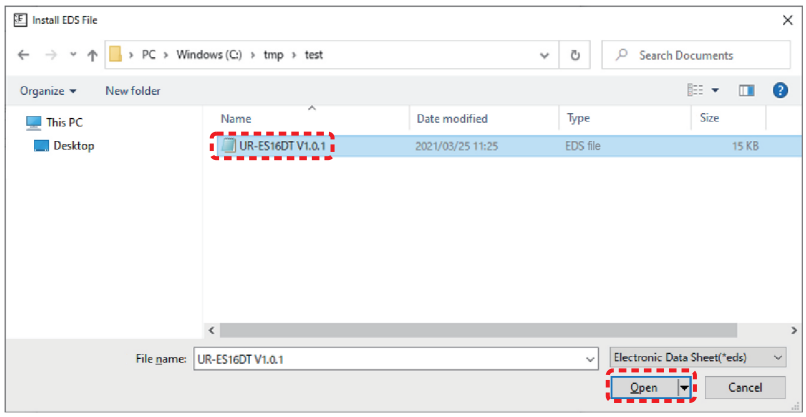
Right-click the mouse in the “Target Device” at the right of the screen, and select [Display EDS Library].



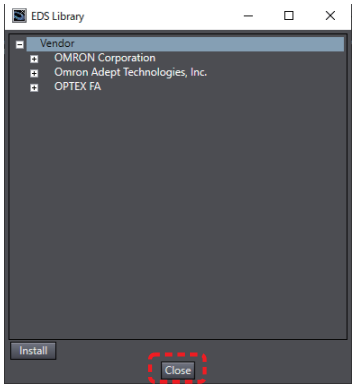
The [EDS Library] window is displayed (initially, “OPTEX FA” is not displayed).
Here, click [Install].



As a file selection dialogue is displayed, select the previously downloaded EDS File (“UR-ES16DT V1.0.1”), and click [Open].

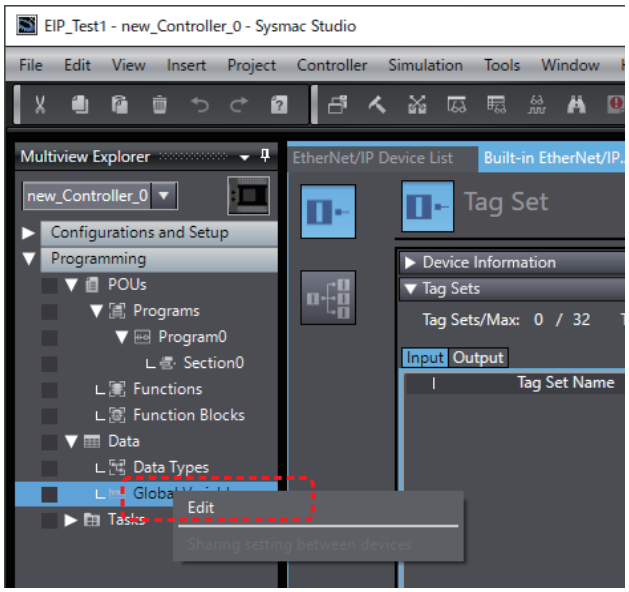


Clicking the [+] icon to the left of “OPTEX FA” in the “EDS Library” window displays “IO-Link Master”, and clicking the [+] to the left displays the product (UR-ES16DT).
After confirmation, click [Close].

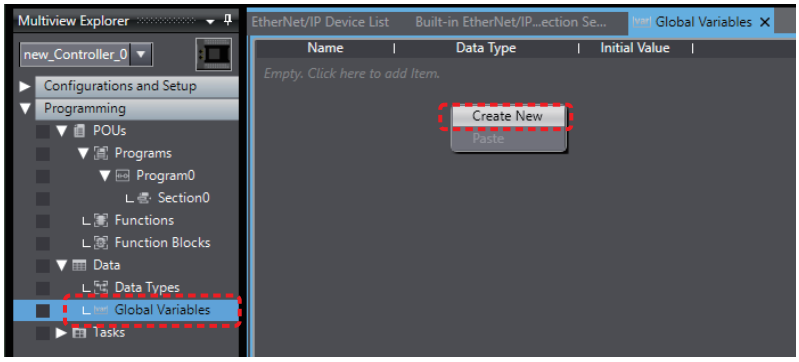


● Definition of global variable (network variable)

Next, we define the global variables (network variables) for delivery of process data.
Click and deploy [▽ Data] on the left side of the screen, right-click the Global Variable below, and select [Edit].



As the [Global Variable] window is displayed, either left-click or right-click to select [Create New].

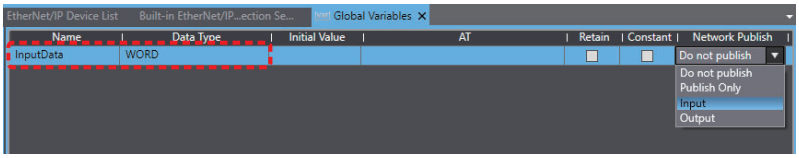


Input the name and data type of the newly registered Global Variable. The Global Variable registered at this time is as shown below.

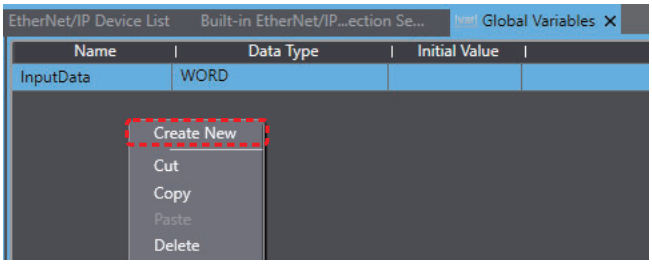
Any name that conforms to the naming regulations is acceptable. Always set the Network Publish Attributes to “input” or “output” as shown below (in particular, called “Network Variable”).

Name	Data type	Network Publish	Description
InputData	WORD	Input	Input On-Off information
StatusData	WORD	Input	Errors and other bit information
PdInData	ARRAY [0..249] OF WORD	Input	IO-Link process input data group 250 words
OutputData	WORD	Output	Output On-Off information
ControlData	WORD	Output	Error clearing and other controls
PdOutData	ARRAY [0..31] OF WORD	Output	IO-Link process output data group 32 words

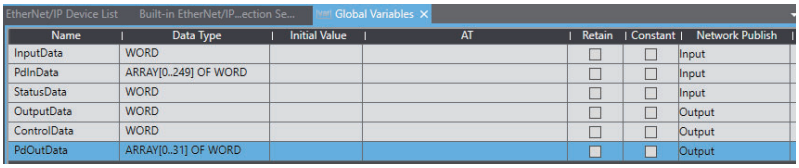
Example)



Right-click on the window to select [Create New] and add more variables.



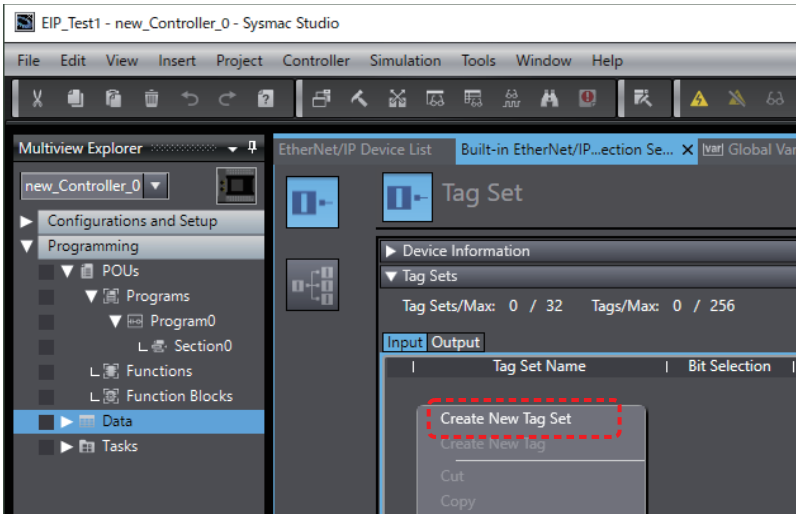
When all inputs are completed, it will appear as shown below. This completes the Global Variable (Network Variable) settings (the Global Variable window may be closed without problem).



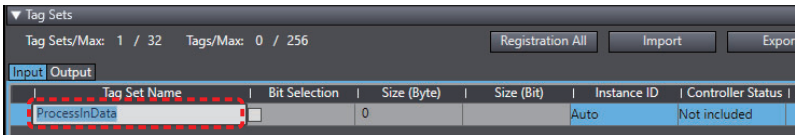
Tag set and create under tag

• Create New Tag Set

Next, create new Tag Set, for delivery of cyclic data through connections. Right-click the mouse inside the Tag Set [Input] window, and select [Create New Tag Set].

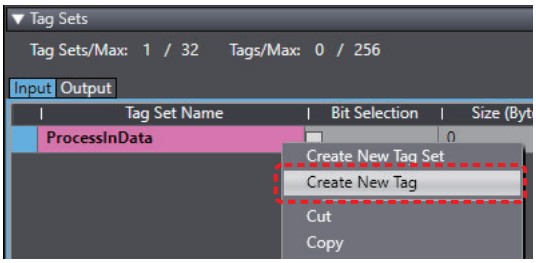


At the top, input the “Tag Set” name. Here, since this is process input data, temporarily set it as “ProcessInData”.

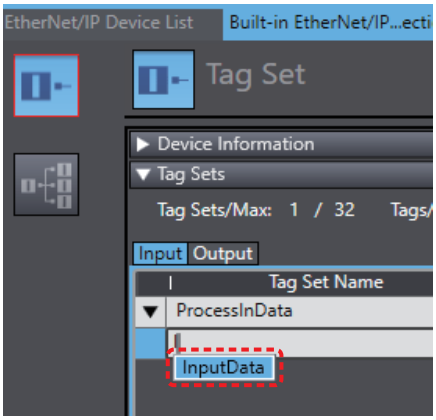


• Tag Create

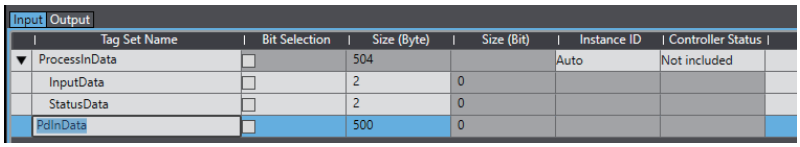
After inputting the Tag Set name, next, create and add a “Tag” registered to the Tag Set. Right-click the mouse and select [Create New Tag].



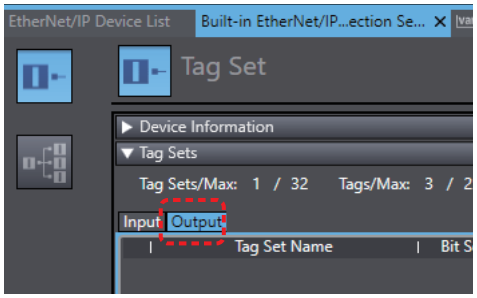
Set the head Tag to “InputData” registered to Global Variable.



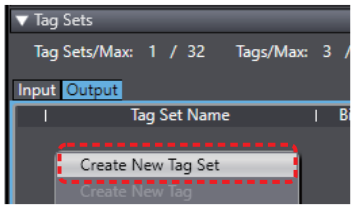
In the same way, create further Tags, add and input “StatusData” and “PdInData” registered in Global Variables, and end the input.



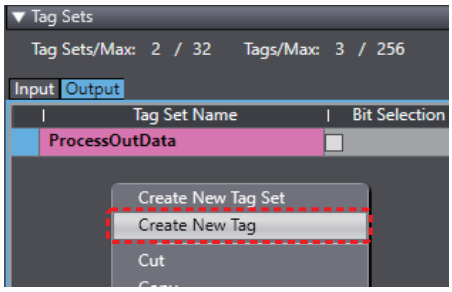
Next, configure the output Tag Sets in the same way. Click the [Output] tab..



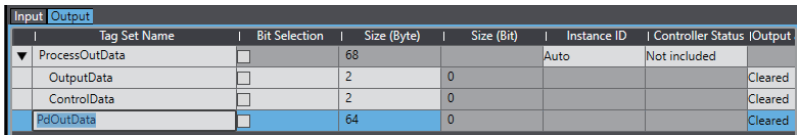
In the same way as input, right-click and create the Tag Set.



Here, for the name use “ProcessOutData”. Then, proceed to create Tags.

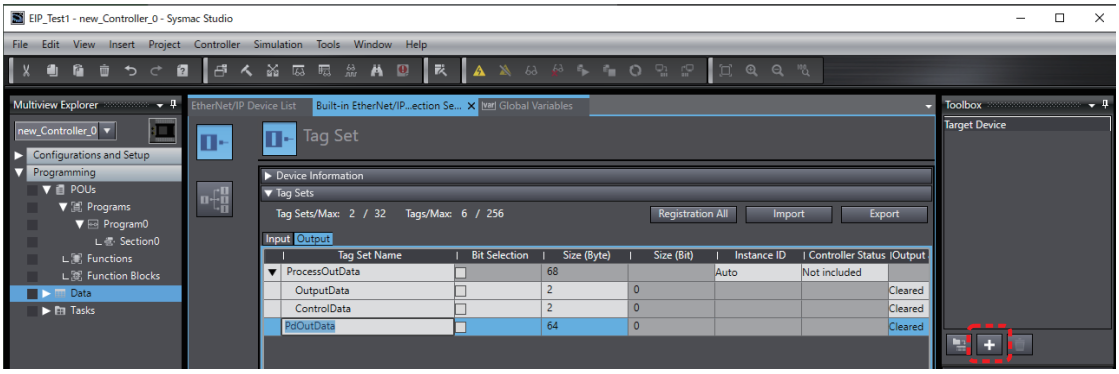


Set the Tags in order from the registered Global Variables, to “OutputData”, “ControlData”, and “PdOutData”.

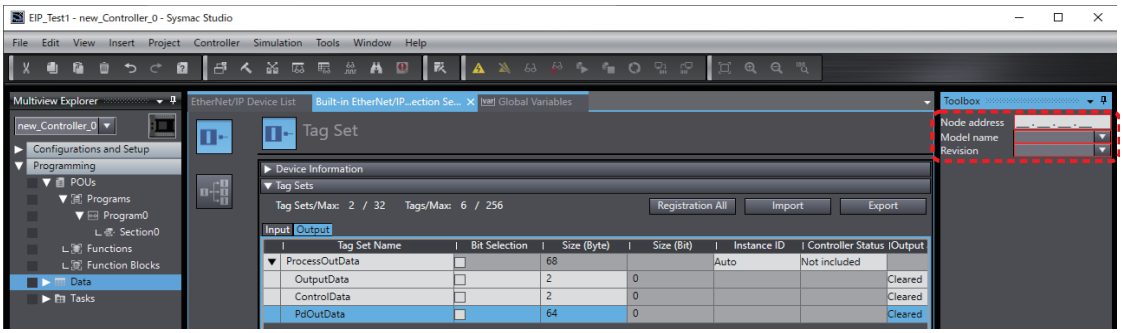


Add target device to the product

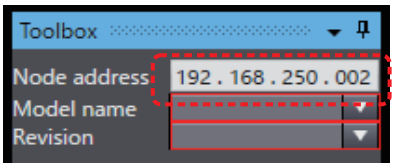
Next, click the [+] button at the bottom right of the screen. Add as Target Devices to the product.



Select a node address (IP Address) and model name for the product, as a Target Device.

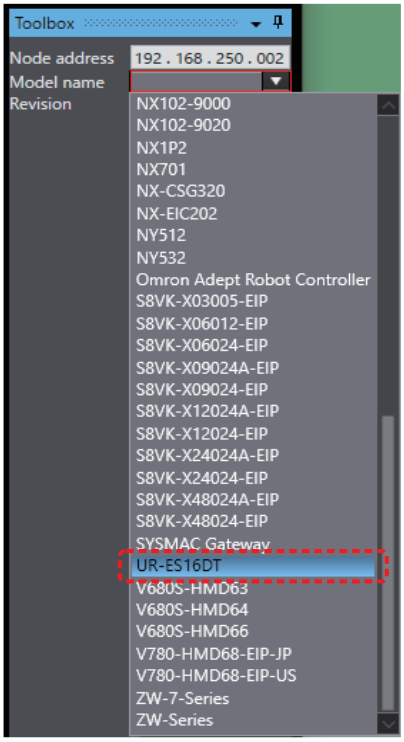


Input the product's node address (IP Address). Since the default value for the built-in EtherNet/IP port IP Address is “192.168.250.1”, this time, configure the next at “192.168.250.2”.

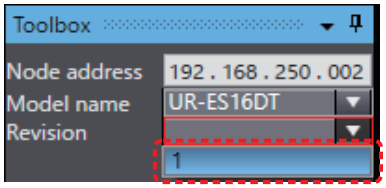


Clicking [▽] to the right of the model name displays the list of installed devices in the EDS file.

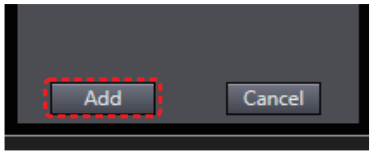
From the list, select this product (“UR-ES16DT”).



Since there is only one “Revision”, select “1”.



Click [Add] at the bottom right of the screen.

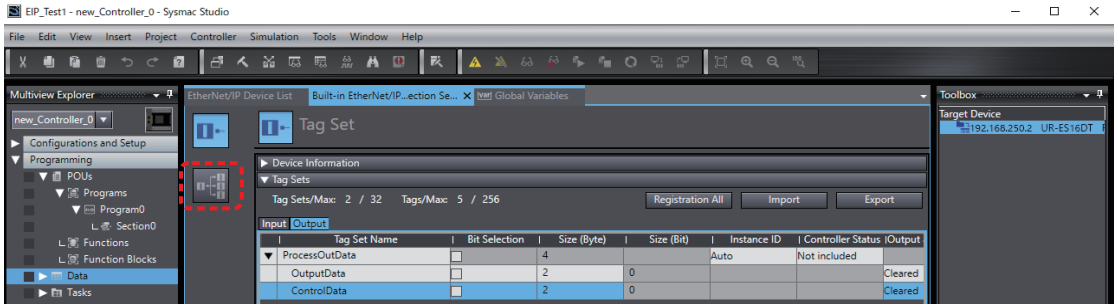


With this action, the product (UR-ES16DT) for the node address “192.168.250.2” is registered as a Target Device.

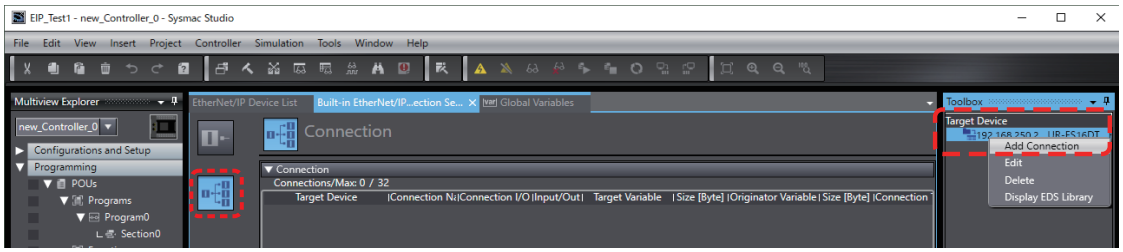
Creating connection with this product

- Add Connection

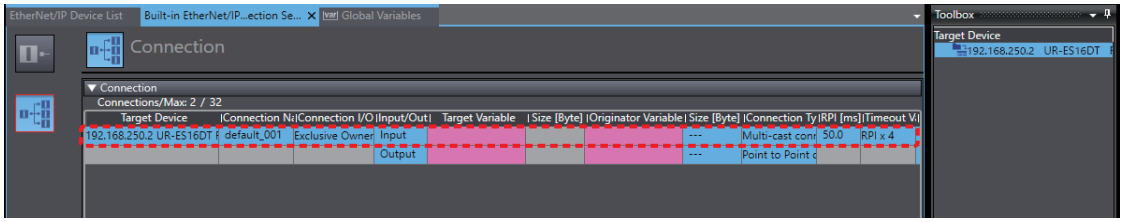
After adding the required number of Target Devices, click the Connection icon on the left of the screen.



The Connection Setting screen shown below is displayed. Right-click the mouse on the product for the above Target Devices, select [Add Connection], and create a connection with this product.



When the connection has been added, the connection setting with this product is displayed as shown below.



- Input of Target Variable Row

In the [Target Variable] row, input the target side (product) “Assembly Instance ID” in decimal.

Then, input the below (or simultaneously press [Ctrl] and Space key to select the value from the displayed list).

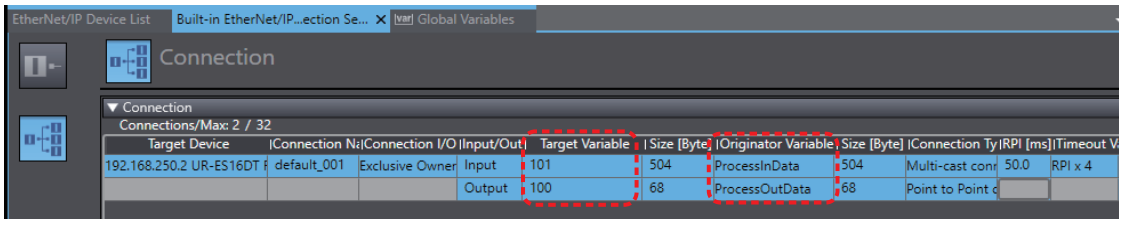
  - Input Target Variable: “101”
  - Output Target Variable: “100”

- Input of Originator Variable Row

  In the [Originator Variable] row, input the originator side (PLC) Tag Set name.

  Then, input the below (or simultaneously press [Ctrl] and Space key to select the character string from the displayed list).

  - Input Originator Variable: “ProcessInData” created in the Tag Set
  - Output Originator Variable: “ProcessOutData” created in the Tag Set

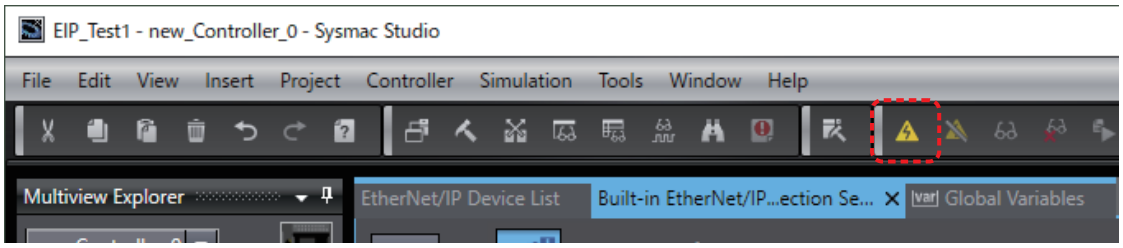


● Transferring to the EtherNet/IP Master of the EtherNet/IP connection settings

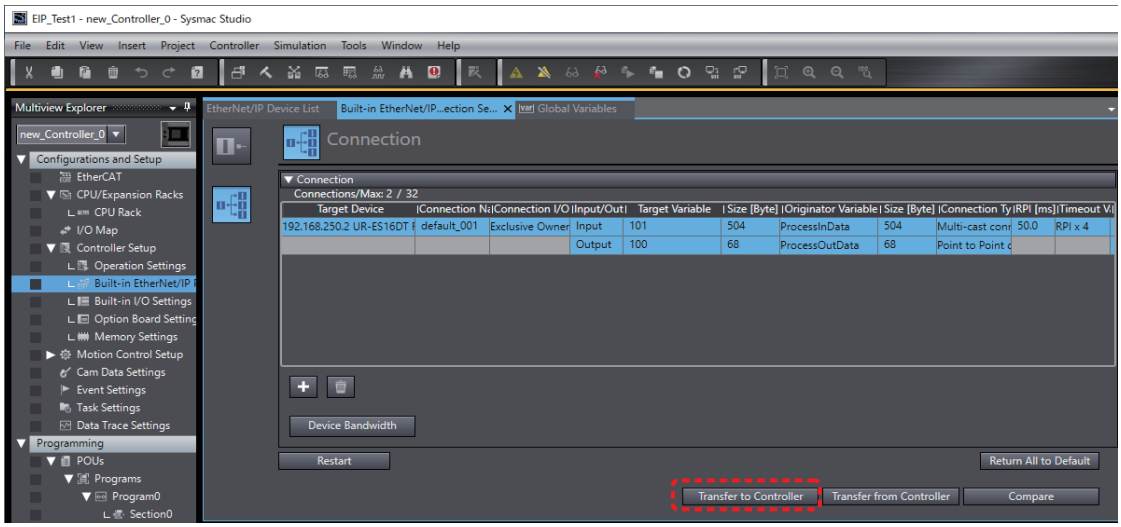
With this action, the necessary EtherNet/IP connection settings have been completed. Switch to online mode for transferring the settings.

Beforehand, use an Ethernet cable to directly connect the PC Ethernet connector with the Ethernet connector of NX1P2 PORT1.

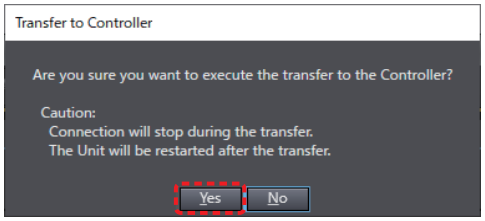
Click the Online icon on the Tool Bar.



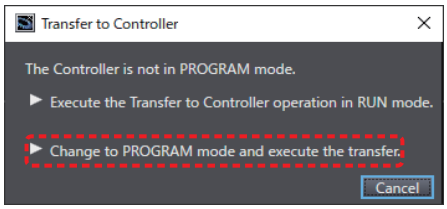
When the online connection is obtained, as the screen transfer [Transfer To Controller] button will become active, click that button.

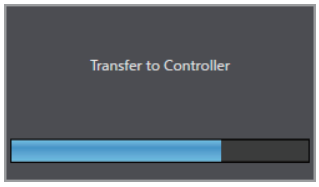


As the confirmation window is displayed, click [Yes].

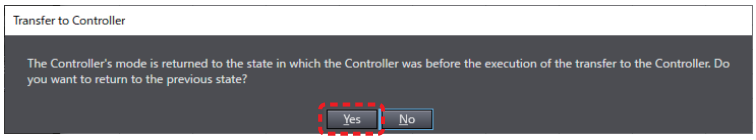


If in operation, a confirmation message is displayed. Select as necessary.

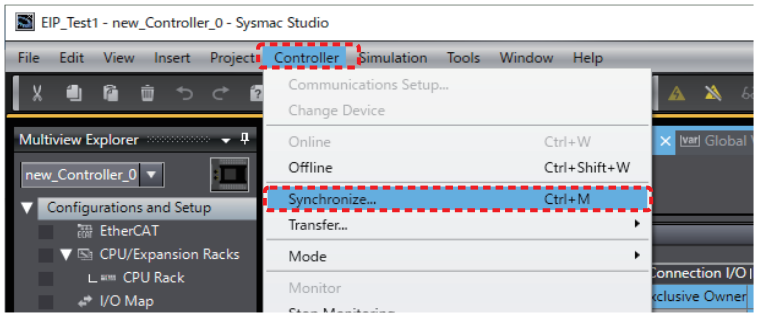




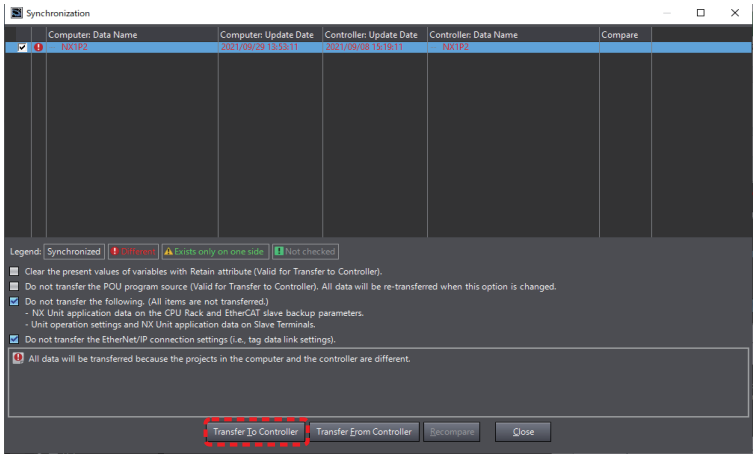
As the screen showing whether to confirm in operations mode is displayed, click [Yes].



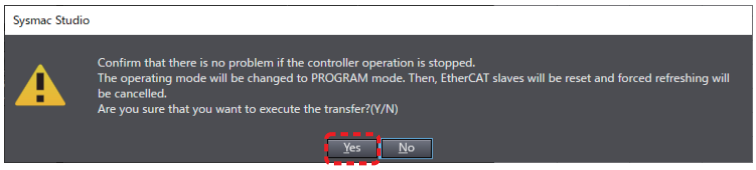
To transfer other settings, from the [Controller] menu, select [Synchronize].

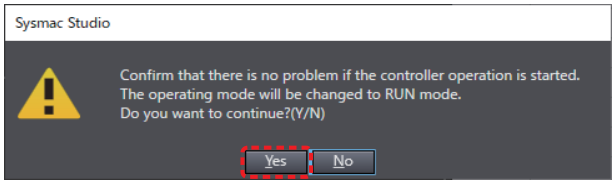


Click the transfer [Transfer To Controller] button.

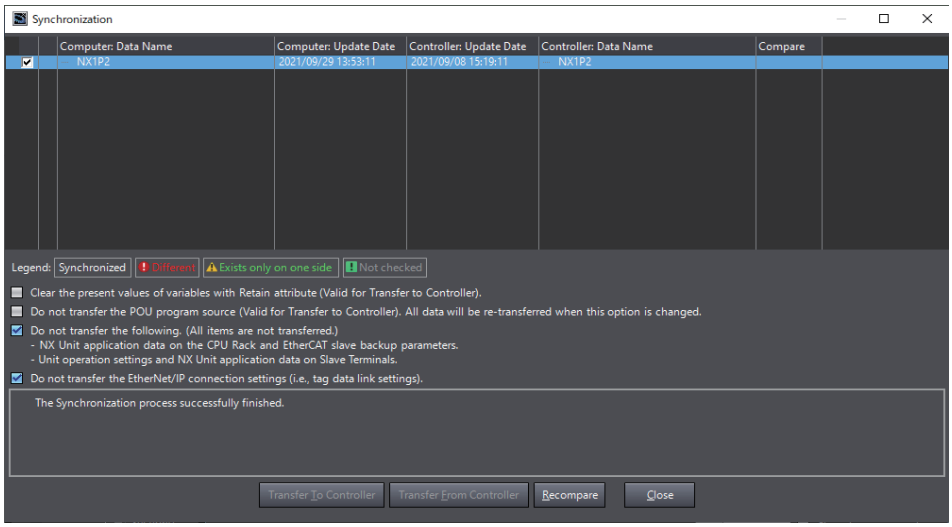


As the confirmation message is displayed, click the respective [Yes].





When synchronization (transfer) is completed, the window below is displayed.



In this status, communication with this product (UR-ES16DT) is enabled.

● Product IP address setting

Configure this product “M82. IP Address” to “192.168.250.2”.

The product IP address lowest digit setting is determined by a rotary switch on the front of this product.
Turning the rotary switch when the power is on in this product causes an automatic move to the “M82. IP address” master parameters.
Since the default value on the 3rd row is “0”, use this product's front panel button to set to “250”.
Finally, pressing the [ENTER] button on this product automatically restarts and enables the changed IP Address.

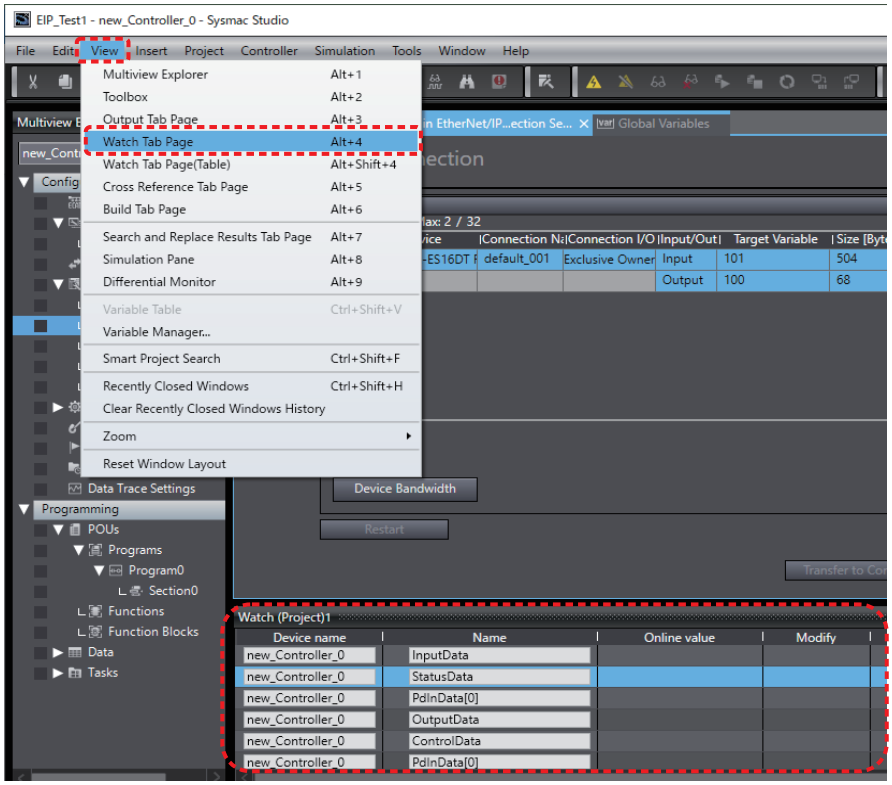
(Remarks)
If the EDS file has been updated for this type, etc., and the previous EDS file registration has been deleted, please delete the old data in the folder below. Both extensions “*.eds” and “*.edh” are present.
C:¥Program Files (x86)¥OMRON¥Sysmac Studio¥IODeviceProfiles¥EipConnection¥Eds
*Please be aware that, depending on the Sysmac Studio version, this information may vary.

● Cyclic communication assignment

For cyclic communication, communication is achieved through “Tag Data Links”.
The Global Variable (Network Variable) assigned to tags under the Tag Set is the cyclic communication area.

Confirmation of cyclic communication data

For confirmation of cyclic communication data, select [Watch Tab Page] from the [View] menu, as shown below, and register the Global Variable (Network Variable). This action enables monitoring or changes.

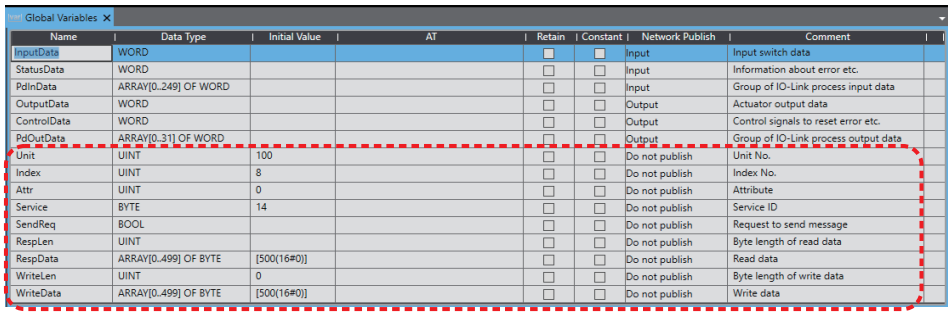


Example of setting value access using acyclic communication (Explicit Message Communication)

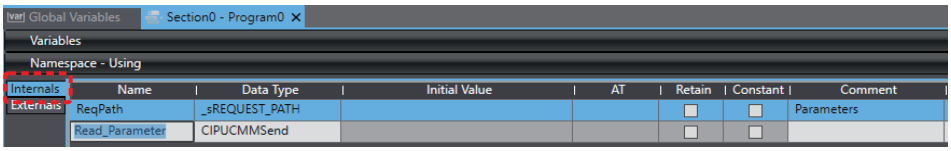
Acyclic communication executes CIP communications instructions, and issues a CIP (Expliciti communication) message.

- Variable Registration

Adds necessary items to the Global Variables.



Adds necessary items to Internal Variables.



External Variables set items that are used among the Global Variables.

Global Variables | Section0 - Program0

Variables

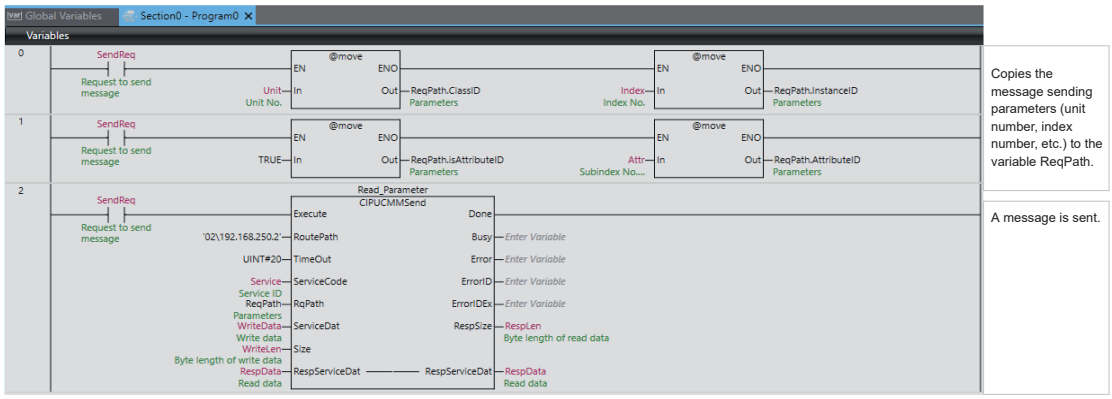
Namespace - Using

Internals / Externals

Name	Data Type	Constant	Comment
Unit	UINT	☐	Unit No.
Index	UINT	☐	Index No.
Attr	UINT	☐	Subindex No. & extended data
Service	BYTE	☐	Service ID
SendReq	BOOL	☐	Request to send message
RespLen	UINT	☐	Byte length of read data
RespData	ARRAY[0..499] OF BYTE	☐	Read data
WriteLen	UINT	☐	Byte length of write data
WriteData	ARRAY[0..499] OF BYTE	☐	Write data

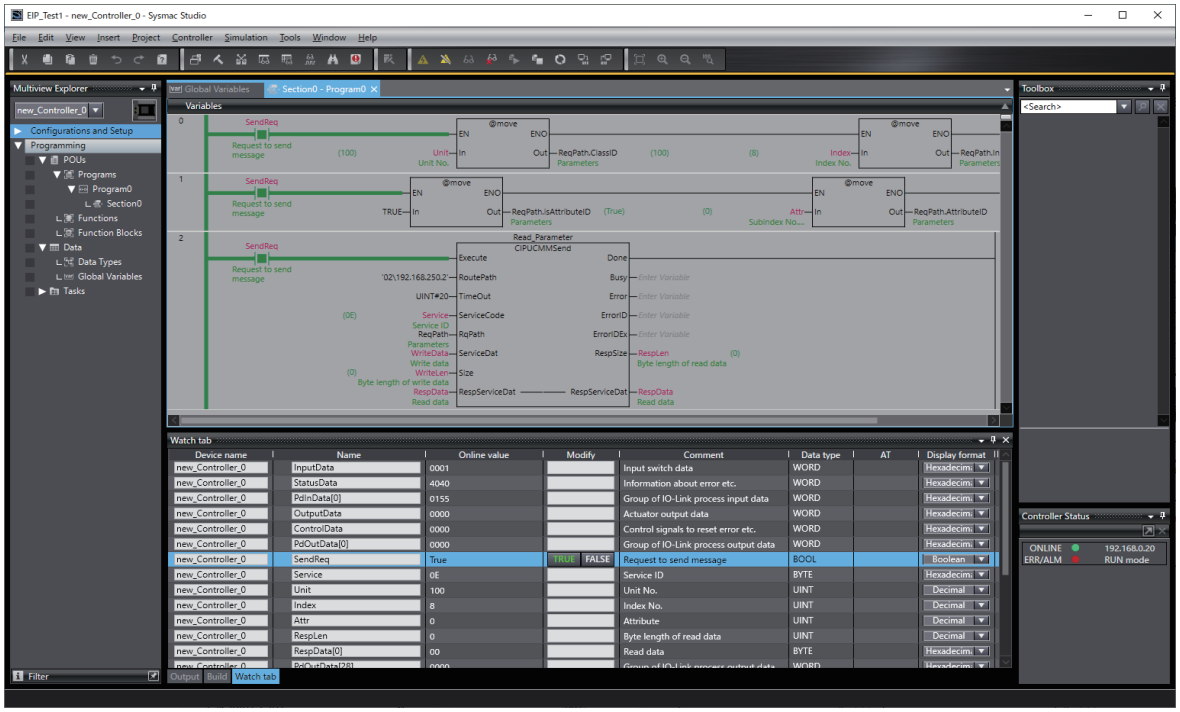
- Example of acyclic communication program

The below shows the absolute minimum items.



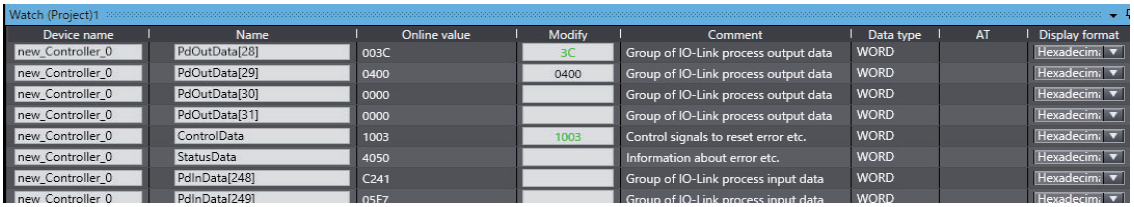
- Execution of CIP Communication Instructions

The necessary variables are registered in the Sysmac Studio's Watch Window, and when in online mode, the "Request to send message" bit is set to ON, as shown below, and the message sent.



Example of setting value access using the extended access function

Operation is enabled in the Sysmac Studio Watch Tab Page.



Example) Assignment when extended access enabled

Network Variable Name	Bit	Details
PdOutData [28]	bit 15 to 0	Index number or setting value number specification
	bit 15 to 8	Unit No. of sensor unit connected to UC2-IOL
PdOutData [29]	bit 11 to 8	Byte length or target selection to access
	bit 7 to 0	Subindex number or target number
PdOutData [30]	bit 15 to 0	Extended access write data low-order word
PdOutData [31]	bit 15 to 0	Extended access write data high-order word
ControlData	bit 13	Little endian variable
	bit 12	To access UR-ES16DT parameters
	bit 11 to 8	Channel No. of IO-Link to access
	bit 7	Clear the latest event
	bit 6	Reset encoder counter
	bit 2	Write request
	bit 1	Read request
	bit 0	Extended access enable flag
StatusData	bit 12	Access error
	bit 4	Access completed
PdInData [248]	bit 15 to 0	Read data low-order word (when an error, an error code)
PdInData [249]	bit 15 to 0	Read data high-order word

App-3-2 The Mitsubishi Electric EtherNet/IP Master

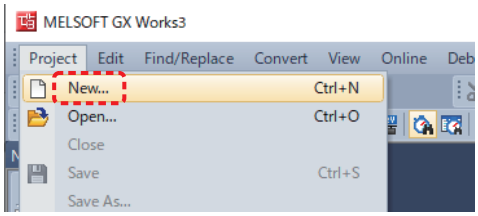
Configuration of Host Devices

PLC	iQ-R Series R04CPU
EtherNet/IP Master	EtherNet/IP Network Interface Module RJ71EIP91
PLC software	GX Works3
EtherNet/IP configuration software	EtherNet/IP Configuration Tool for RJ71EIP91

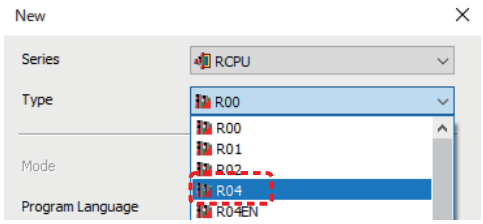
Example of Used Procedure

GX Works3 project creation

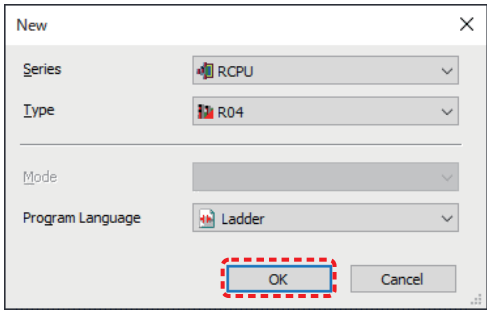
Start up GX Works3, and create a new project.



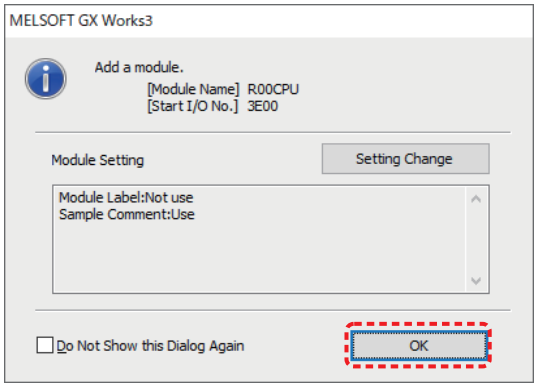
Select the CPU type to be used.



Here, set the Program Language to “Ladder”, and click [OK].



To confirm addition of R04CPU, click [OK].

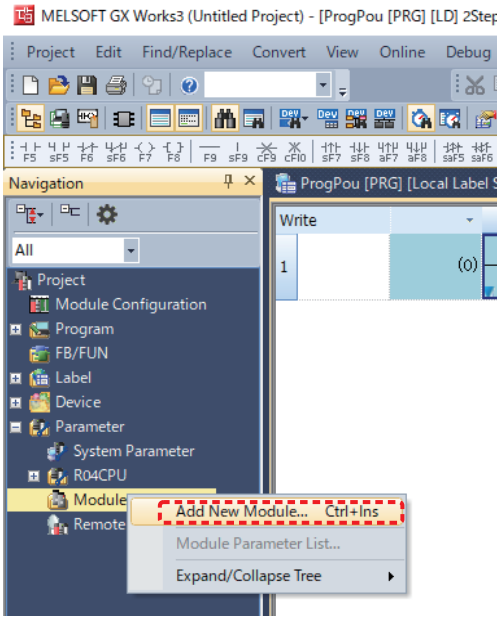


6 Appendix

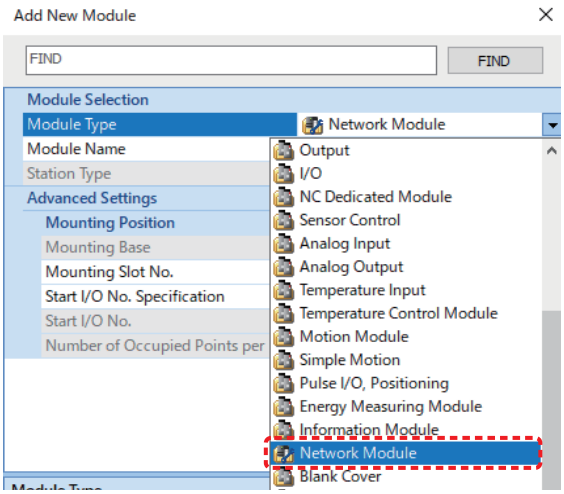
● Addition of EtherNet/IP network interface module

Next, add the EtherNet/IP Network Interface Module.

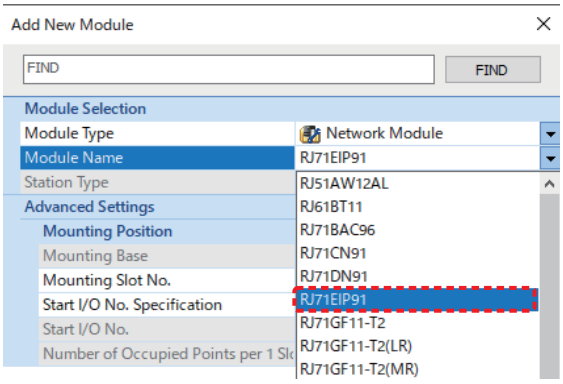
Click and deploy the [+] icon left of Parameter on the left of the screen, right-click [Module Information], and select [Add New Module].



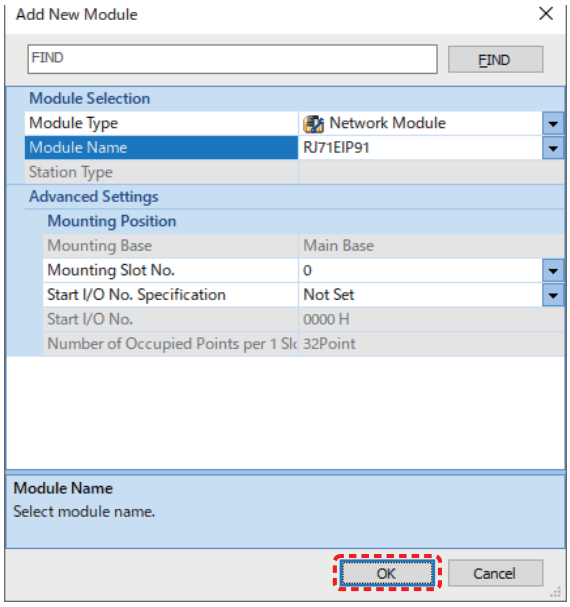
In the displayed [Add New Module] window, select “Network Module” from [Module Type].



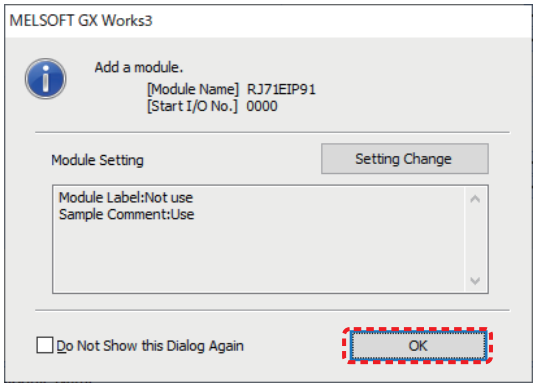
From [Module Name], select “RJ71EIP91”.



This time, leave the other settings in their default values and click [OK].



As a confirmation window is displayed, click [OK].

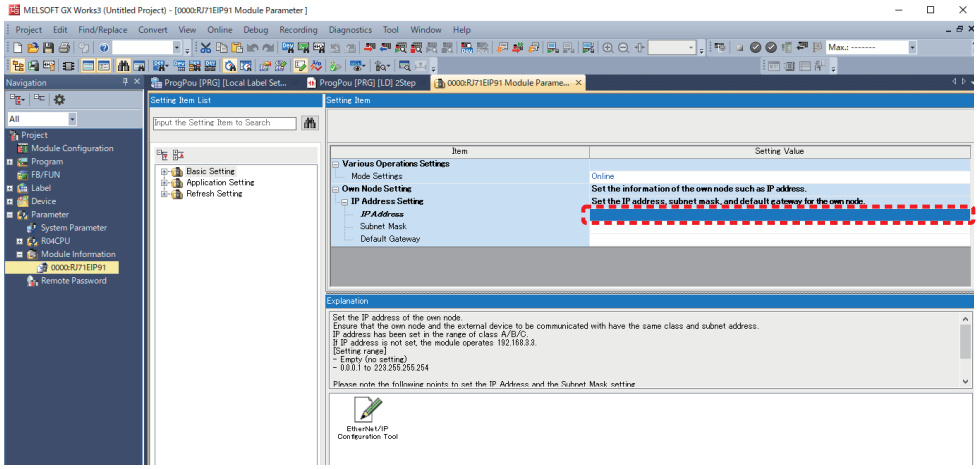


● EtherNet/IP network interface module (EtherNet/IP Master) IP address setting

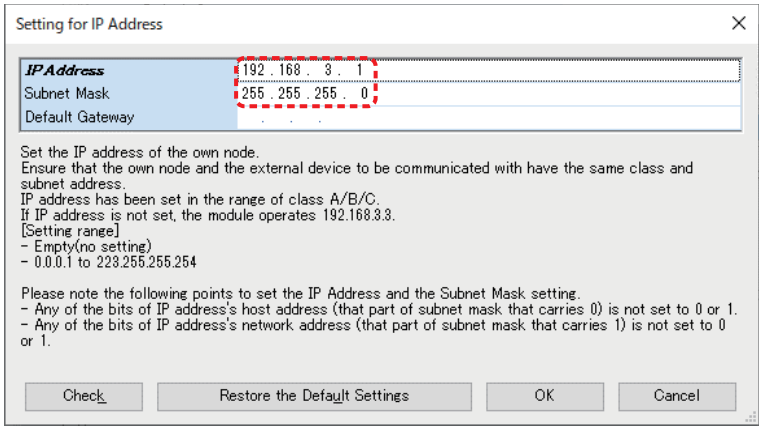
Next, set the module parameters for the EtherNet/IP Network Interface Module RJ71EIP91.

From the left navigation tree, display [0000:RJ71EIP91] under [Parameter]-[Module Information], and double-click it.

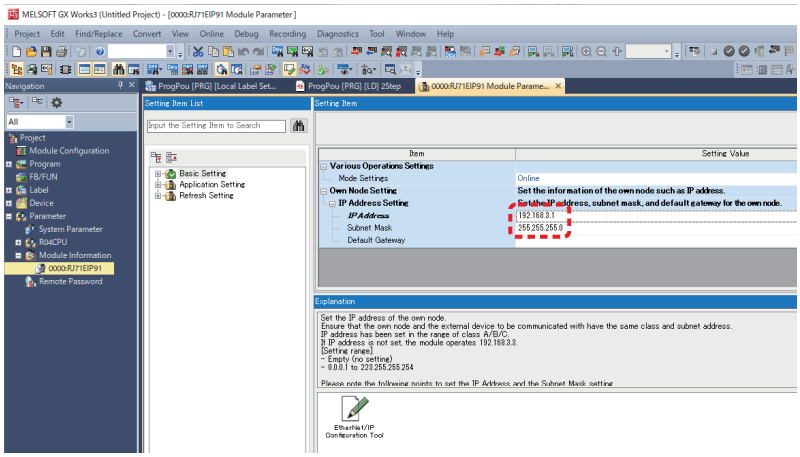
To set the IP address for RJ71EIP91 itself, double-click [IP Address].under the IP Address setting in [Own Node Setting] at the right of the screen.



The IP address setting screen is displayed. Here, input the IP address at “192.168.3.1”, and Subnet Mask at “255.255.255.0”. After completion, click [OK].

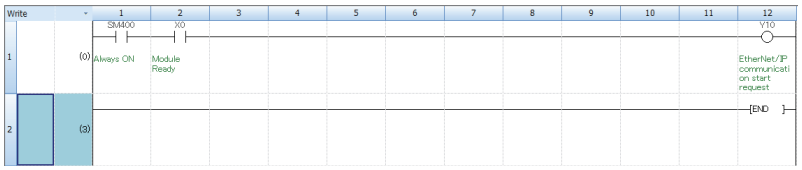


With this action, the EtherNet/IP Network Interface Module IP Address-related items are set.



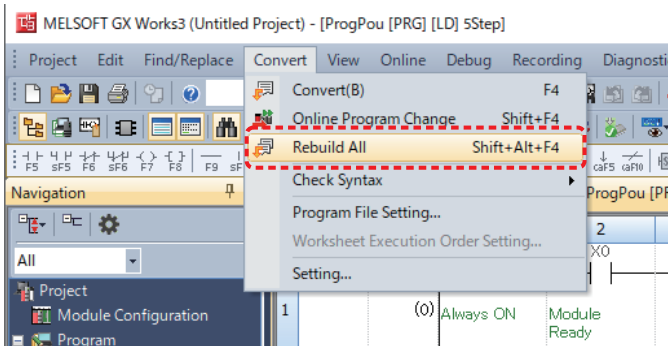
Creation of ladder program

Since EtherNet/IP Network Interface Module RJ71EIP91 requires the Ladder Program to start up EtherNet/IP communication, input the program.

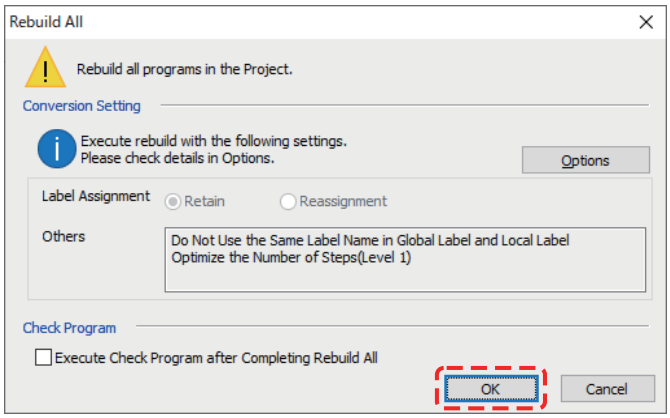


Execute rebuild all (compile)/write to PLC

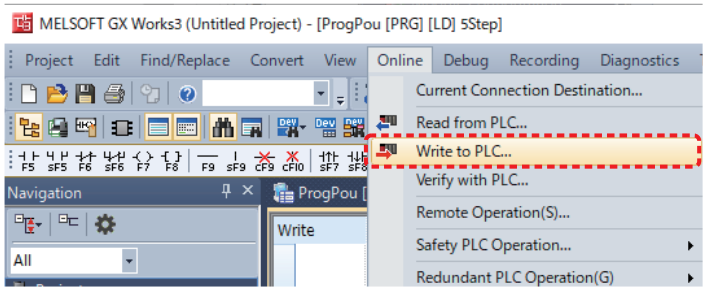
Here, execute Rebuild All.



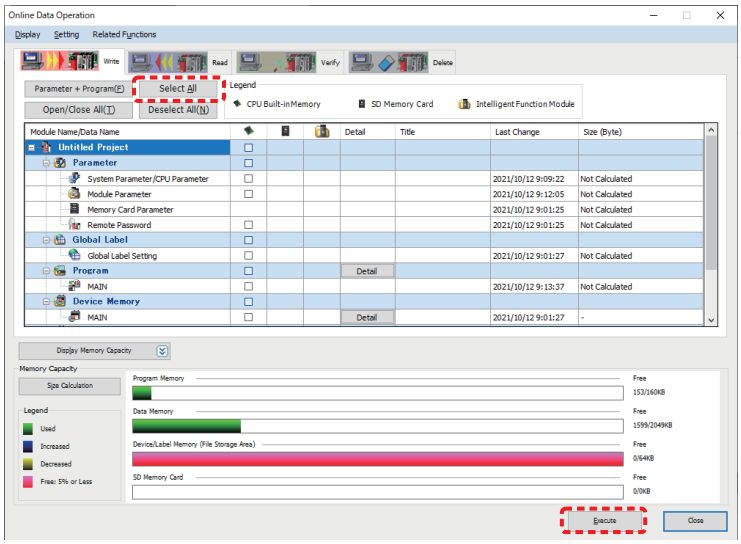
As a confirmation window is displayed, click [OK].



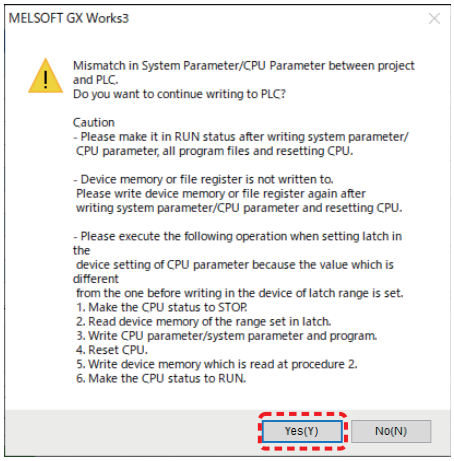
Write settings to the PLC.



The Online Data Operation window is displayed. Here, click the [Select All] button to select all data, and then click [Execute] at lower right.

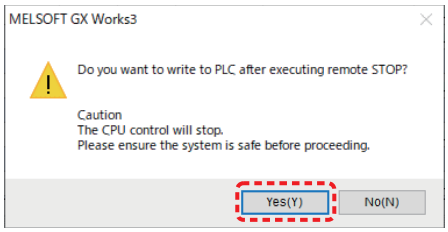


As a confirmation message is displayed, click [Yes].

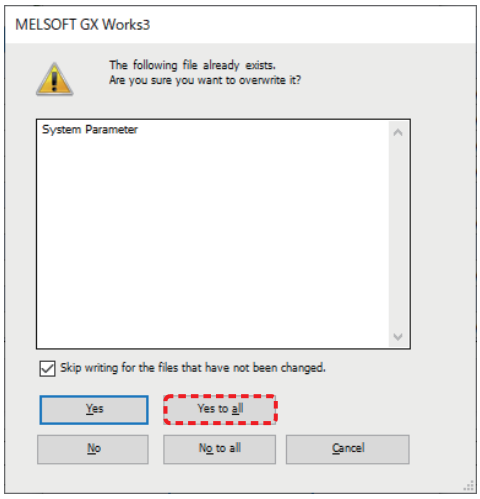


*There may already be function block or other data stored, and there may be a request to delete it. In such case, click the Delete icon, and perform the delete operation.

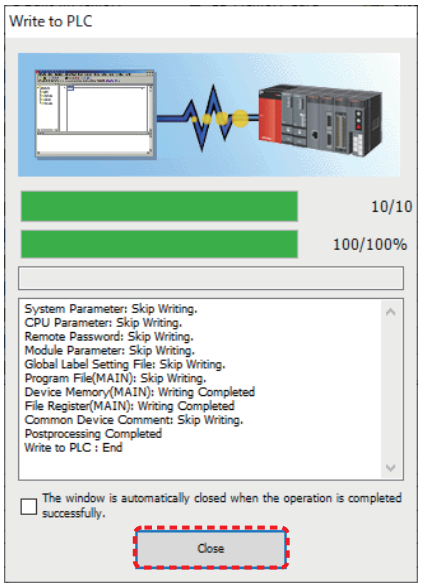
As a confirmation message is displayed for moving to STOP mode, click [Yes].



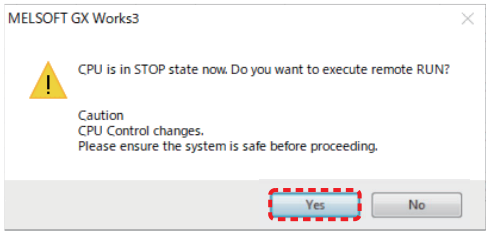
As an over-write confirmation message is displayed, click [Yes to all].



If the Write to PLC via USB is ended, click [Close].

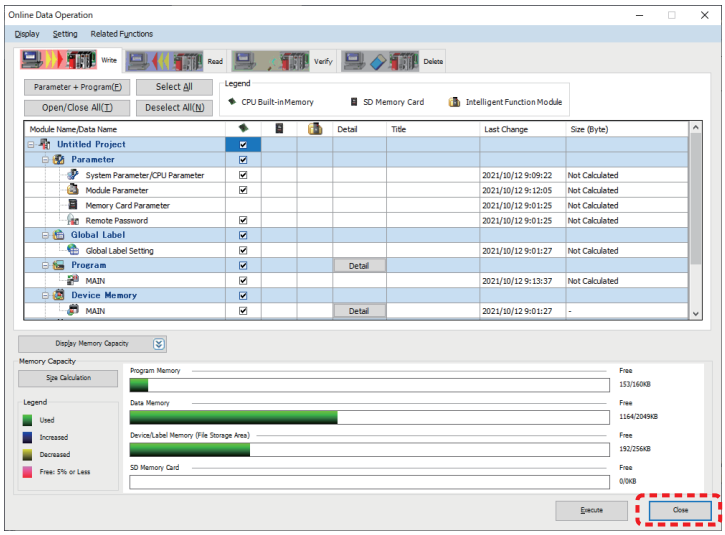


As a confirmation message is displayed for moving to RUN mode, click [Yes].



As a completed message is displayed, click [OK].

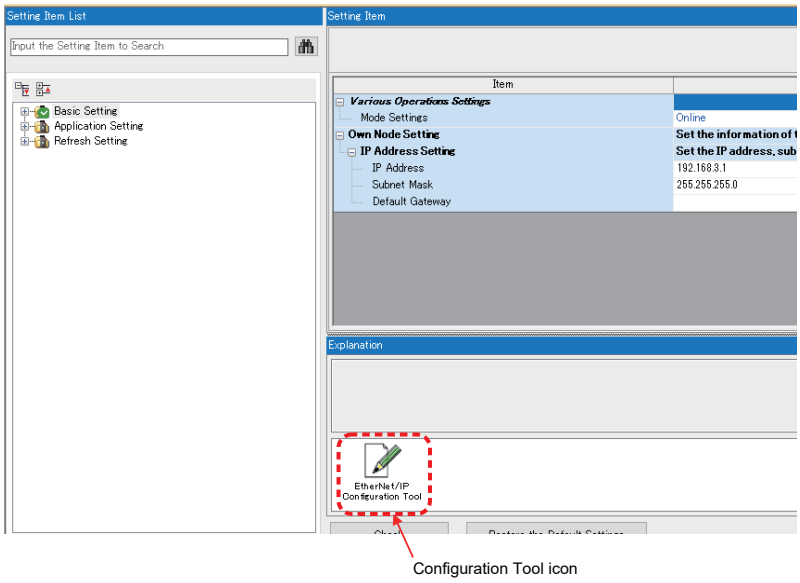
Click [Close] at lower right to close the [Online Data Operation] window.



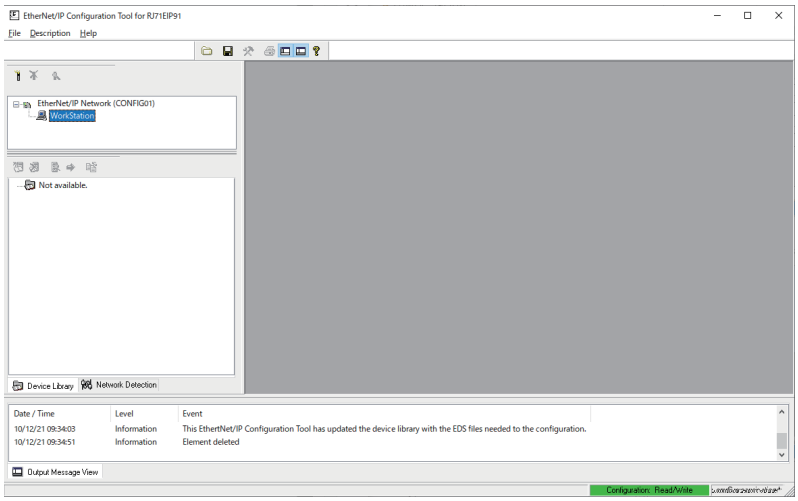
To enable the settings, depress the toggle switch equipped on the front cover of R04CPU to the left side, and hold it there for 2 seconds to reset.

● Registration as EtherNet/IP network interface module EtherNet/IP Master (scanner)

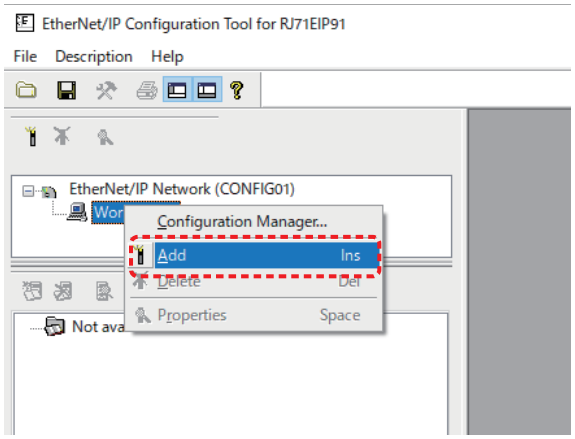
Next, register the EtherNet/IP Network Interface Module RJ71EIP91 as the EtherNet/IP Master (Scanner).
From the left navigation tree, display [0000:RJ71EIP91] under [Parameter]-[Module Information], and double-click it.
As the Configuration Tool icon is displayed at the bottom, double-click it to start it up.
(Note: Before this, download the Configuration Tool from the Mitsubishi Electric home page, and install it)



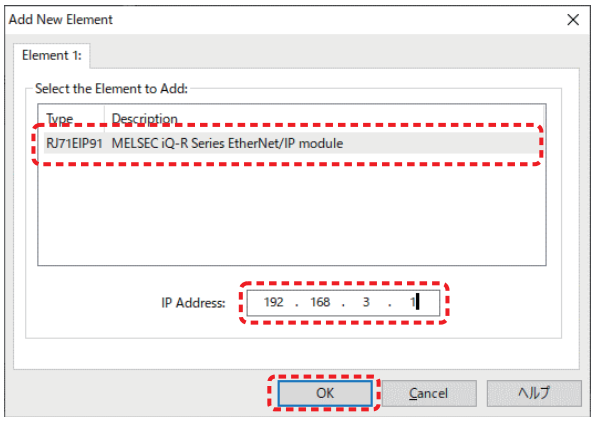
Start up the Configuration Tool EtherNet/IP Configuration Tool for RJ71EIP91.



Right-click [WorkStation] and select [Add].



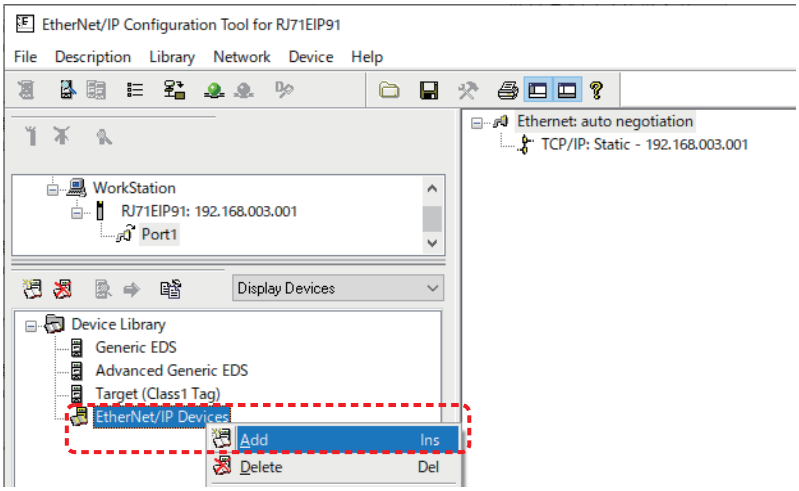
A list of additional modules is displayed. Select “RJ71EIP91” and click [OK].
Here, set the IP Address to “192.168.3.1” (same as the preceding “EtherNet/IP Network Interface Module (EtherNet/IP Master) IP Address setting”). For the Configuration Tool, use this IP address to access the EtherNet/IP Network Interface Module RJ71EIP91.



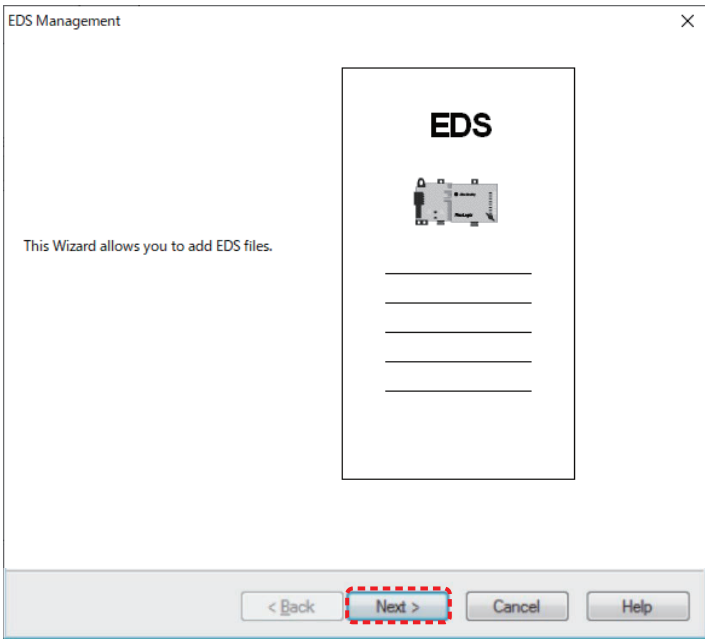
With this action, RJ71EIP91 has been registered as the EtherNet/IP Master (Scanner).

Install the EDS file for this product

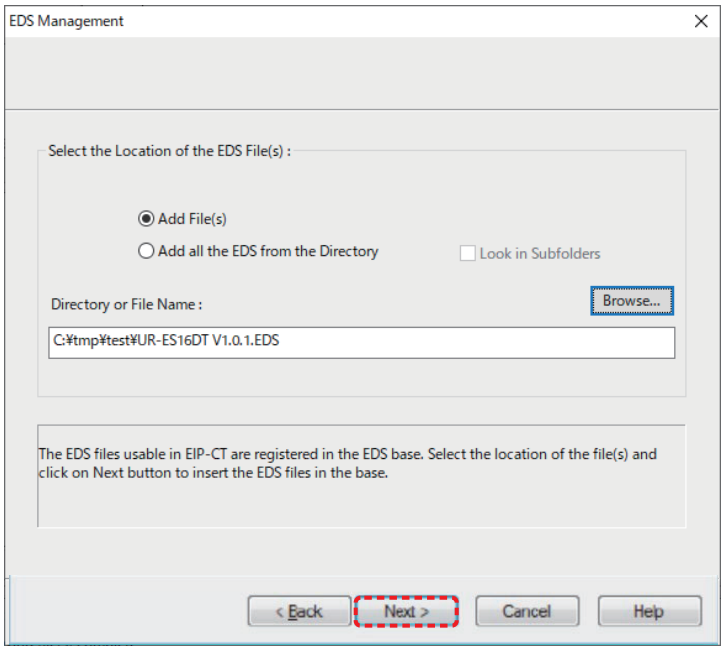
Next, right-click [EtherNet/IP Devices] in the window below, and select [Add].



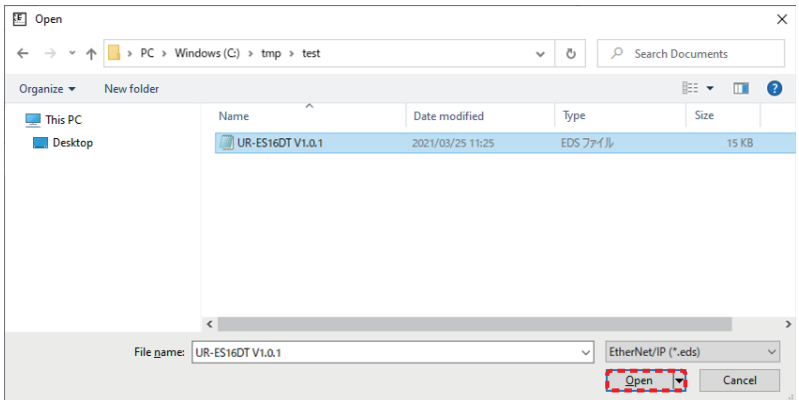
As the EDS Management Window is displayed, click [Next].



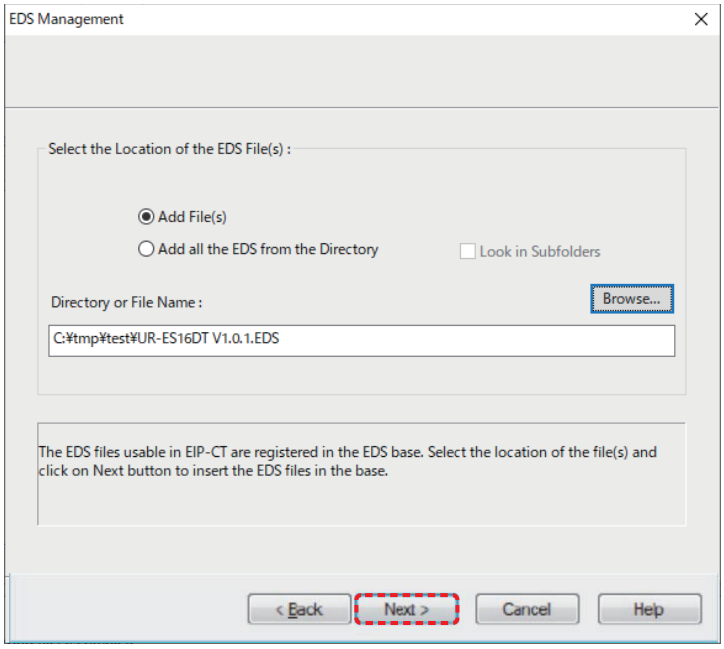
Either specify a specific file, or specify a folder, and select all to register. Here, as the intent is to register this product (UR-ES16DT) EDS only, stay here and click [Browse..].



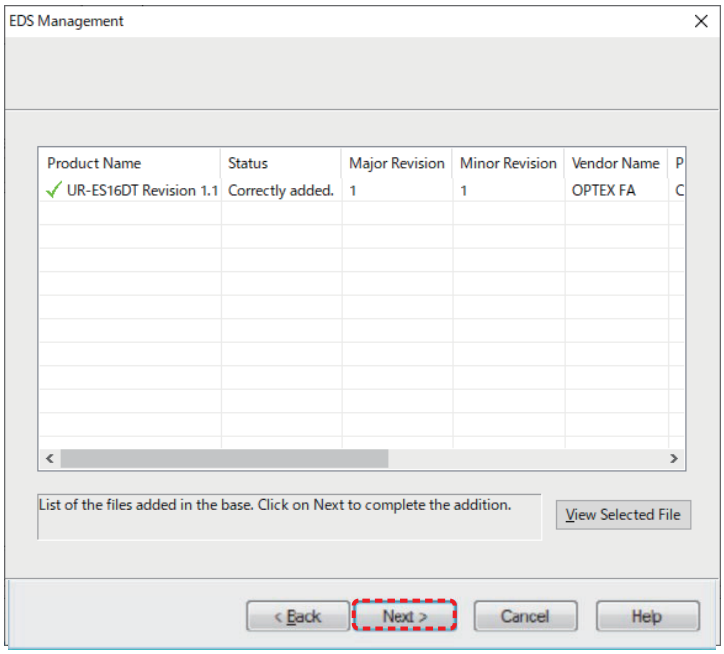
Move the EDS file to the folder where it is stored, select the product EDS file “UR-ES16DT V1.0.1”, and click [Open].



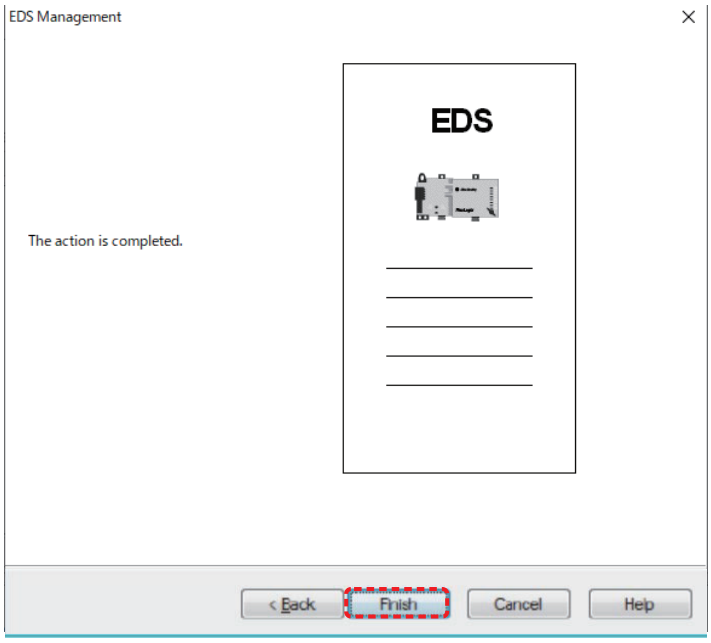
Since the filename is reflected, click [Next].



The list of installed EDS files is displayed, and if there are no mistakes, click [Next].

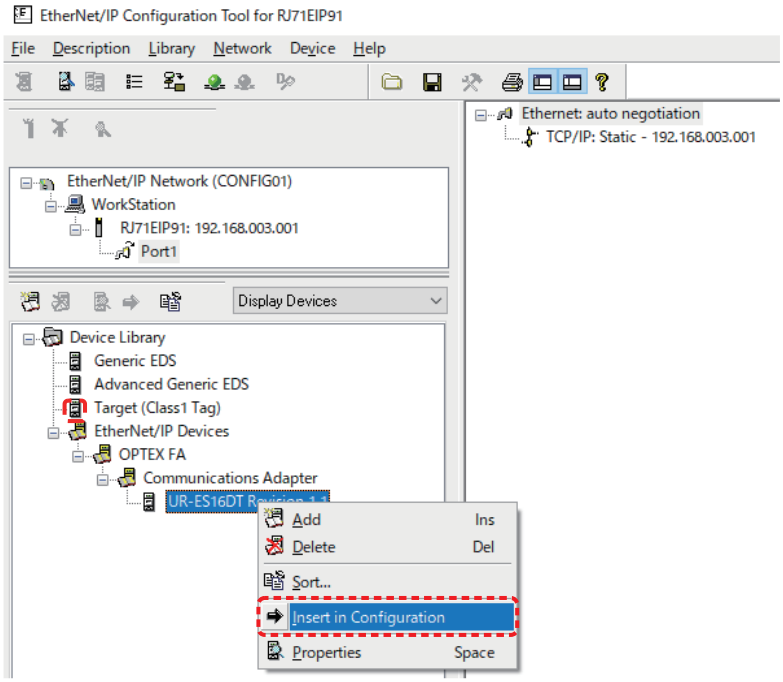


With this action, as installation of the EDS file for this product is completed, click [Finish].



Add to Product Network Configuration Settings

To add this product to the EtherNet/IP network configuration, click and deploy the [+] icon to the left of “OPTEX FA”. As this product is displayed as “UR-ES16DT Revision 1.1”, right-click it and select [Insert in Configuration].

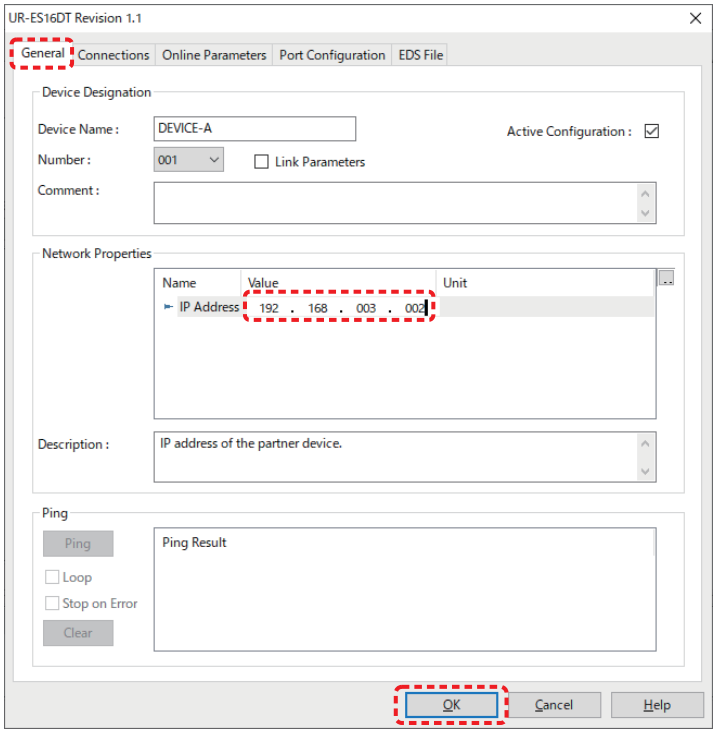


With this action, EtherNet/IP network configuration is added as a device (adapter) connected to this product.

Product IP address setting

Next, as the [UR-ES16DT Revision 1.1] window is displayed, set this product IP Address to “192.168.003.002” in the [General] tab [Network Properties].

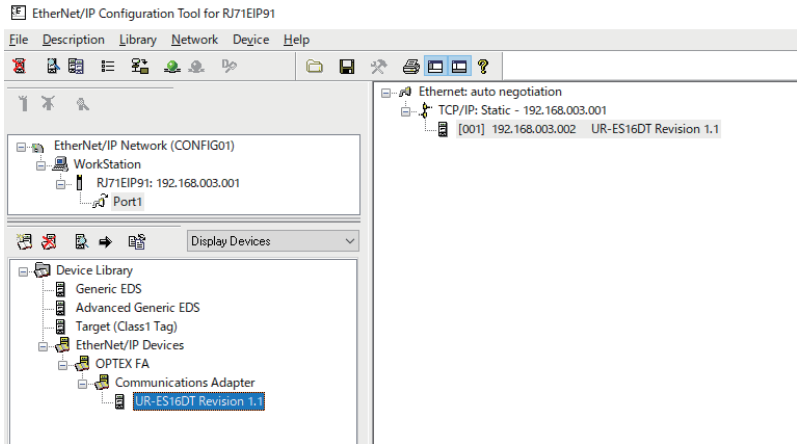
Since the other tabs are for information confirmation, leave as is and click [OK].



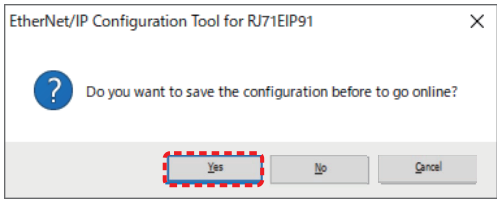
With this, the EtherNet/IP network configuration settings are completed.

● Download configuration settings for the EtherNet/IP Network Interface Module

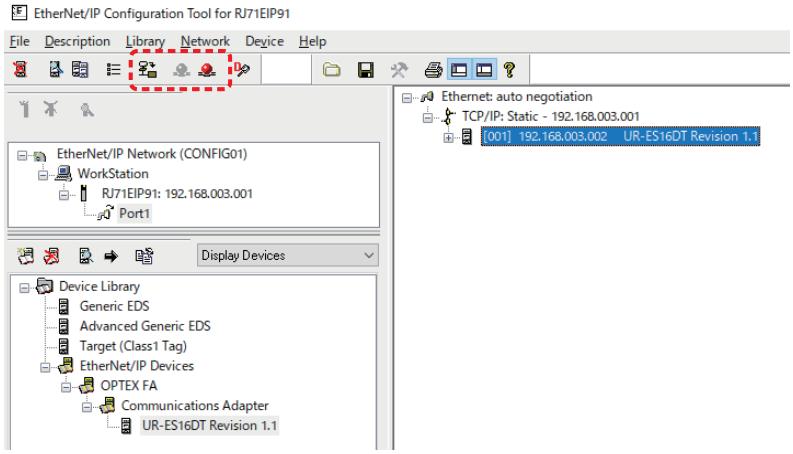
Use an Ethernet cable to directly connect the PC Ethernet connector and the RJ71EIP91 Ethernet connector (Note: This is not the R04CPU Ethernet connector), and click the Online icon.



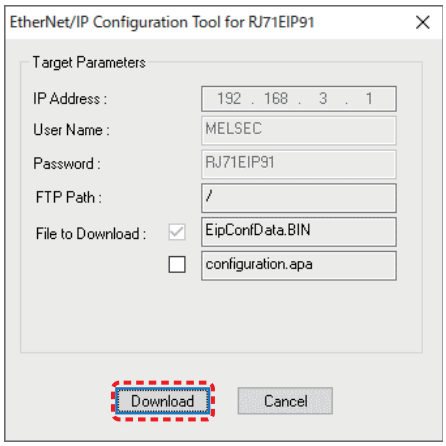
As a save confirmation message is displayed, click [Yes].



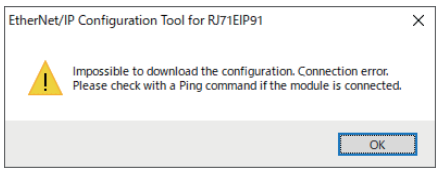
When the online connection is successful, the Online icon is grayed out, and the Offline icon becomes active. Click the Download icon to the left.



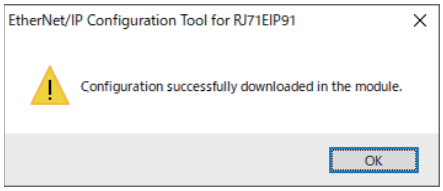
Information for the RJ71EIP91 download destination for the EtherNet/IP network configuration settings is displayed, and if there are no mistakes, click [Download].



If the message below is displayed, then the download has failed. Change the PC's IP Address setting, and try it again.



If the message below is displayed, the download was successful.



To enable the EtherNet/IP network configuration settings, depress the toggle switch equipped in the R04CPU front cover to the left, and hold it there for 2 seconds to reset.
If R04CPU is set to RUN mode, EtherNet/IP communication is started.

● Cyclic Communication Assignment

Cyclic communication uses “Class1 instance communication” to perform communication.
This product cyclic communication area is automatically assigned in order of connection number (Note 1) to the Class1 Input Area and Class1 Output Area below, in the (Intelligent Function Module) buffer memory within the Ethernet Module.

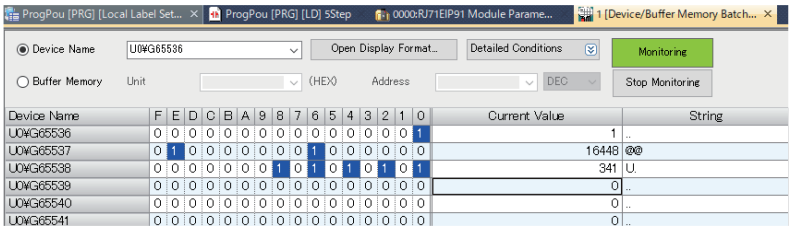
- Class1 Input Area: Un¥G65536 to Un¥G98303
- Class1 Output Area: Un¥G196608 to Un¥G229375

Note 1: The Instance ID is not specified, and the Connection No. is specified to determine the target.

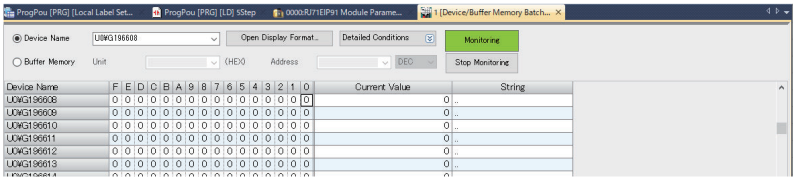
Confirmation of cyclic communication data

The cyclic communication data can confirm the [Device/Buffer Memory Batch Monitor].

Process input data is assigned from U0¥G65536, as shown below.



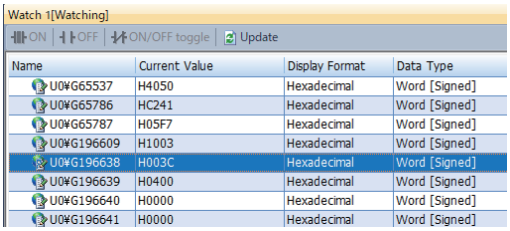
Process output data is assigned from U0¥G196608, as shown below.



Example of setting value access using the extended access function

Use the extended access function to enable access to the setting value.

Here, the product master parameter “M60.Version No.” is read in 4 bytes.



Assignment list when extended access enabled:

- Input (This product → EtherNet/IP Master)

Device Name	Bit	Details
U0¥G65536	bit 15 to 0	Digital input ON/OFF
U0¥G65537	bit 15	Error flag
	bit 14	IO-Link ready flag
	bit 12	Access error
	bit 11 to 8	Latest error channel
	bit 7	Event flag
	bit 6	I/O power supply flag
	bit 5	Output overcurrent flag
	bit 4	Access completed
	bit 3 to 0	Latest event channel
U0¥G65538 to U0¥G65785		IO-Link process input data group Total 248 words
U0¥G65786		Extended access read data lower order words (when in error, an error code)
U0¥G65787		Extended access read data high-order word

• Output (EtherNet/IP Master → This product)

Device Name	Bit	Details
U0¥G196608	bit 15 to 0	Digital output ON/OFF
U0¥G196609	bit 15	Clear the latest error
	bit 13	Little endian variable
	bit 12	To access UR-ES16DT parameters
	bit 11 to 8	Channel No. of IO-Link to access
	bit 7	Clear the latest event
	bit 6	Reset encoder counter
	bit 2	Write request
	bit 1	Read request
	bit 0	Extended access enable flag
U0¥G196610 to U0¥G196637		IO-Link process output data group Total 28 words
U0¥G196638	bit 15 to 0	Index number or setting value number specification
	bit 15 to 8	Unit No. of sensor unit connected to UC2-IOL
U0¥G196639	bit 11 to 8	Byte length or target selection to access
	bit 7 to 0	Subindex number or target number
U0¥G196640	bit 15 to 0	Extended access write data low-order word
U0¥G196641	bit 15 to 0	Extended access write data high-order word

● Access to setting values using acyclic communication (Explicit Message communication)

Acyclic communication, uses “Class3 Message Communication” to perform communication.
Function block can be used to enable use of acyclic communication (Explicit Message Communication).
For details, refer to the Mitsubishi Industry [MELSEC iQ-R EtherNet/IP Network Interface Module User's Manual (application edition)].

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FASTUS

Attention: Not to be Used for Personnel Protection.

Never use these products as sensing devices for personnel protection. Doing so could lead to serious injury or death.
These sensors do not include the self-checking redundant circuitry necessary to allow their use in personnel safety applications.
A sensor failure or malfunction can cause either an energized or de-energized sensor output condition.
Please consult our distributors about safety products which meet OSHA, ANSI and IEC standards for personnel protection.

- Specifications are subject to change without prior notice.
- Specifications and technical information not mentioned here are written in Instruction Manual. Or visit our website for details.
- All the warnings and cautions to know prior to use are given in Instruction Manual.

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https://www.optex-fa.com

The information in this user's manual is correct as of January 2023

UR-ES-EI_UM-E-001-2301