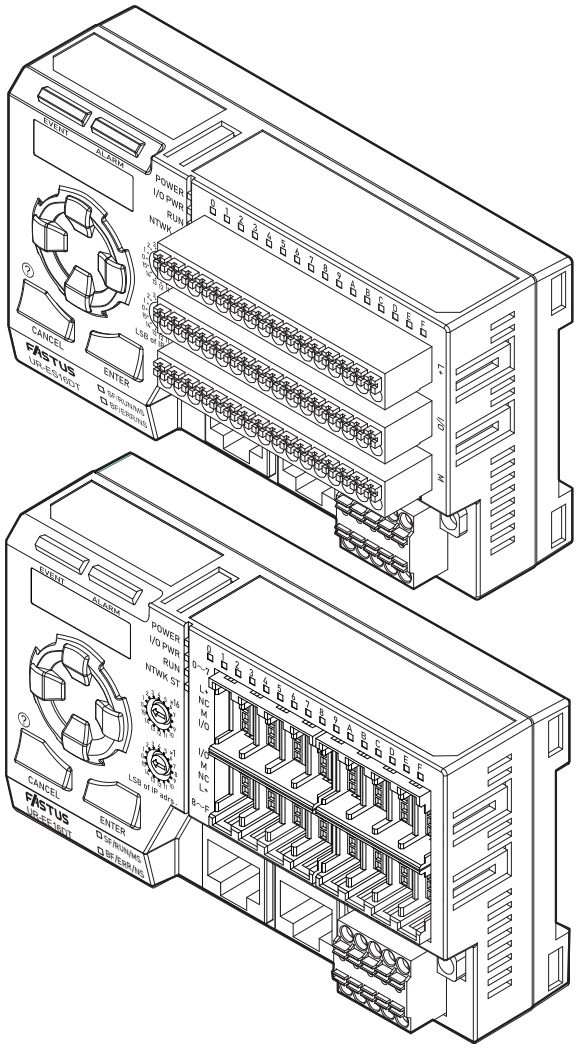
FASTUS

*FASTUS is a product brand of OPTEX FA.

IO-Link Master

UR-ES16DT, UR-EE16DT

User's Manual
Ethernet & Modbus/TCP Edition



OPTEX FA CO., LTD.

Introduction

Thank you for purchasing the UR-ES16DT/-EE16DT IO-Link Master.
This manual contains the information required when using “Ethernet & Modbus/TCP” 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/-EE16DT 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/-EE16DT 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-XXX-XXXX	IO-Link Master UR-ES16DT/-EE16DT 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	Provides an overview of the use of "Ethernet & Modbus/TCP" as the host network.
2. Initial setting of this product with regard to Ethernet & Modbus/TCP	Describes initial setting for this product's IP address setting, communication connection, and front panel operation.
3. Communication	This section describes the initial settings required for this product to perform Ethernet & Modbus/TCP communication, details of Modbus/TCP communication, and details of Ethernet socket communication.
4. Specifications	Describes the specifications for Ethernet & Modbus/TCP with this product.
5. Troubleshooting	Describes methods of troubleshooting related to Ethernet & Modbus/TCP communication.
6. Appendix	Describes product master parameters as well as socket communication programs.

Contents

2 Initial Setting of This Product with Regard to Ethernet & Modbus/TCP

3 Communication

Notations Used in this Manual

These are the notations used in this manual.

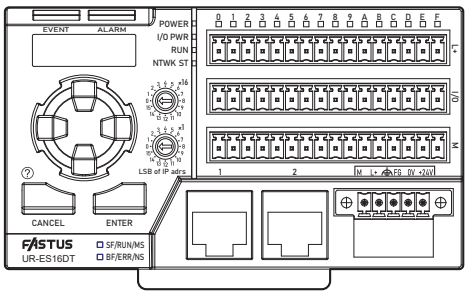
CAUTION
This indicates particularly important points to observe during operation.

MEMO
This information is useful for operation.

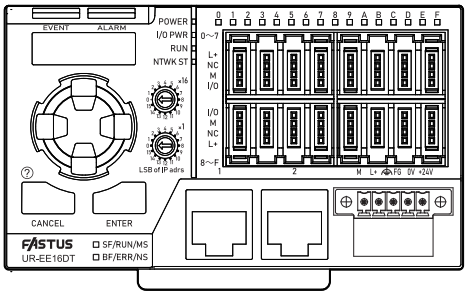
Checking the Included Items

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



• UR-EE16DT unit

- Device terminal block: x 3 (for UR-ES16DT)
- Power terminal block
- RJ45 connector protective cap: x 2 (attached to the unit)
- Instruction manual

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). For details, refer to the user's manual of the Modbus/TCP master or Ethernet socket communication client to be used.

Switching Hub

The following general-purpose Switching Hub can be used for Modbus/TCP or Ethernet socket communication. PORT1 and PORT2 of this product can be used for daisy chain (cascade) connection.

Type	Specifications
Switching Hub	A general-purpose Switching Hub can be used. For details, refer to the user's manual of the Modbus/TCP master or Ethernet socket communication client to be used.

Terminology List

This explains the terminology used in this document.

Terminology	Description
Modbus/TCP	It is a widely-used standardized protocol for industrial Ethernet that implements Modbus as a control protocol in the application layer on the TCP/IP protocol.
Modbus/TCP master	PLC and HMI of the master station of Modbus/TCP communication, etc.
Modbus/TCP communication	Request messages are issued from the Modbus/TCP master, and Holding registers within this product are read and written. When this happens, depending on the Holding register number, this product executes ISDU communication (of IO-Link) with the IO-Link device.
Function code	It is a code that indicates the request type requested by the Modbus/TCP master. The function codes supported by this product are as follows. 03 h: Read Multiple Holding Registers 06 h: Write Single Holding Register 10 h: Write Multiple Holding Registers 17 h: Read/Write Multiple Holding Registers
Holding register	A memory that allows reading and writing. An address (referred to as “register number”) is assigned to each word (16 bits).
Register number	This is the number of the holding register specified on the software such as PLC, HMI and OPC server with a built-in Modbus communication driver. In this product, the register numbers are 400001 to 465536. They are shown in decimal. The “4” in the highest digit of the register number indicates the holding register. The remaining digits are the data register number (decimal number) plus “1”. Therefore, (data register number) = (register number) -400001.
Data register number	This is the register number used in the actual Modbus communication frame. It is specified in hexadecimal on the communication frame.
ISDU Access Library	This is the library area for ISDU communication with IO-Link devices. By registering the index/sub-index number of the IO-Link device to be accessed in this area, it becomes possible to read/write up to 128 types of parameters at once using a simple trigger. It can also be used together with recipe functions such as HMI.
Modbus address monitor registration	Registers the register addresses that are frequently read from the Modbus/TCP master into the library. Up to 125 addresses can be registered, which are output to the output area of the library. By reading the library output area from the Modbus/TCP master, it becomes possible to read up to 125 words at once using a single read command for data from multiple non-consecutive register addresses, achieving improved communication efficiency.
Socket communication	Indicates product unique protocol communication within Ethernet socket communication. This communication designates the IP address and port number (2001 on this product) to send and receive data with UDP/IP or TCP/IP.

1

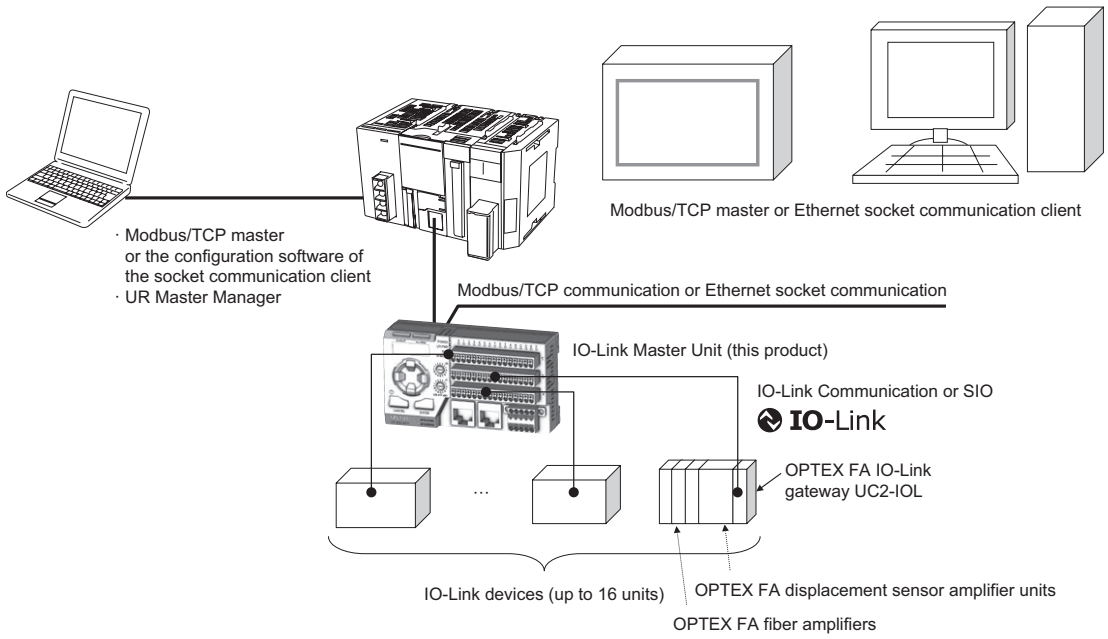
Overview

This chapter provides an overview of the use of “Ethernet & Modbus/TCP” as the host network.

1-1 Product Overview

When the network type is set to “Ethernet & Modbus/TCP”, this product can read and write to the holding registers in this product from the Modbus/TCP master. It also supports sending and receiving data from clients that use Ethernet socket communication.
In either case, the user can read and write the IO-Link process data of this product, digital I/O, settings of this product, and settings of IO-Link devices via Modbus/TCP or Ethernet socket communication.

Configuration Example of Modbus/TCP Communication or Ethernet Socket Communication and IO-Link System



Features

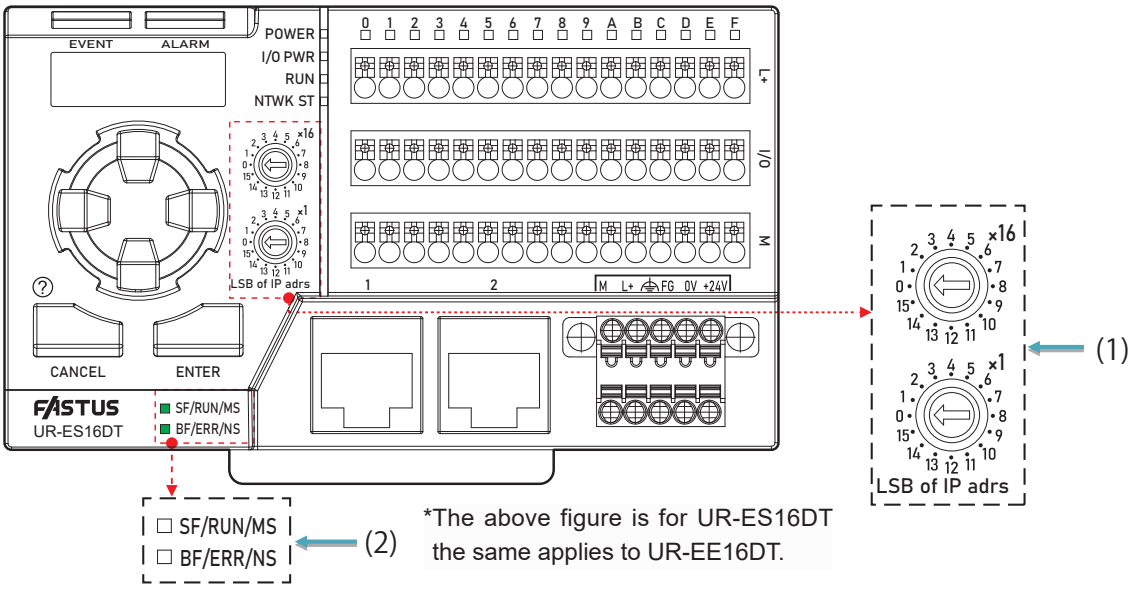
- The host network type can be switched among the following depending on the setting.
  - EtherNet/IP (default value)
  - EtherCAT
  - PROFINET (planned)
  - Ethernet & Modbus/TCP
  - CC-Link IE Field Basic
- The Modbus/TCP communication and socket communication (TCP/UDP) can be used with the “Ethernet & Modbus/TCP” network type.
- Enables efficient access to the parameters (ISDU communication) of the IO-Link device.
  By registering the index/sub-index number of the IO-Link device to be accessed in the library inside of this product, it becomes possible to read/write up to 128 types of parameters at once using a simple trigger. It can also be used together with recipe functions such as HMI.
- Enables efficient communication with the Modbus/TCP master.
  By registering the register address numbers that are frequently read from the Modbus/TCP master in the library inside this product, it becomes possible to read up to 125 words at once using a single read command for data from multiple non-consecutive register addresses.
- If the CC-Link IE Field Basic is selected as the network type, it becomes possible to use both the CC-Link IE Field Basic and Modbus/TCP communication at the same time.
  The I/O data used for control can be accessed via cyclic communication of the PLC's CC-Link IE Field Basic, and the parameters of the IO-Link device can be accessed directly via Modbus/TCP communication of the HMI. It supports complex apps without a PLC ladder program.

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 & Modbus/TCP” 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 & Modbus/TCP, it is as follows.

SF/RUN/MS

- Off: Network chip is not active or power is off.
- Blinking: Network chip is working.
- Lit: Network chip is ready.

BF/ERR/NS

- Off: Ethernet cable is not connected or power is off.
- Blinking: Ethernet cable is connected, but communication has not been established.
- Lit: Ethernet communication has been established. This may also indicate that communication is ready.

1-3 Overview of Specifications and Functions for Ethernet & Modbus/TCP

This section outlines the specifications and functions when “Ethernet & Modbus/TCP” is selected as the network type.

1-3-1 For Modbus/TCP Communication

Specifications

<table>
<tr><th>Item</th><th>Details</th></tr>
<tr><td>Corresponding protocols</td><td>Modbus/TCP, Modbus/UDP</td></tr>
<tr><td>Corresponding function code</td><td>03 h, 06 h, 10 h, 17 h
<table>
<tr><td>Function code (FC)</td><td colspan="2">Details</td><td>Number of words that can be accessed with one function code</td></tr>
<tr><td>03 h</td><td>Read holding registers</td><td>Read Multiple Holding Registers</td><td>1 to 125 words</td></tr>
<tr><td>06 h</td><td>Write single register</td><td>Write Single Holding Register</td><td>1 word</td></tr>
<tr><td>10 h</td><td>Write multiple registers</td><td>Write Multiple Holding Registers</td><td>1 to 123 words</td></tr>
<tr><td rowspan="2">17 h</td><td rowspan="2">Read/Write multiple registers</td><td rowspan="2">Read/Write Multiple Holding Registers</td><td>Read: 1 to 125 words</td></tr>
<tr><td>Write: 1 to 121 words</td></tr>
</table></td></tr>
<tr><td>Corresponding Modbus data area</td><td>Holding register
Register number: 400001 to 465536 (data address: 0 to 65535)</td></tr>
<tr><td>Master/server</td><td>Operates as a Modbus server device</td></tr>
<tr><td>Port number</td><td>502 (fixed)
Both Modbus/TCP and Modbus/UDP are supported by the same port number.</td></tr>
<tr><td>Ethernet</td><td>IEEE 802.3u, 10BASE-T/100BASE-TX automatic identification</td></tr>
<tr><td>No. of connectable units</td><td>Number of units that can be connected from one Modbus/TCP master: It depends on the specifications of the Modbus/TCP master.</td></tr>
<tr><td>Number of simultaneous connections</td><td>Modbus/TCP: 2
Modbus/UDP: 4</td></tr>
</table>

Functional Overview

Functions	Details
Inputting/outputting IO-Link process data	Specify the corresponding register number in unsigned integer and perform reading/writing. Note: The maximum input/output of IO-Link process data is 32 bytes (16 words) per channel for both input and output. It directly accesses process data in IO-Link devices via Modbus/TCP communication. It has no relation with the master parameter M40/41 ("M40. Process input data words allocation" and “M41. Process output data words allocation”).
Digital input/output	
Allocated status data confirmation, allocated operation data instruction	
Settings of this product	
Efficient access to the parameters (ISDU communication) of the IO-Link device	By registering the index/sub-index number of the IO-Link device to be accessed in the library inside of this product, it becomes possible to read/write up to 128 types of parameters at once using a simple trigger.
Efficient communication with the Modbus/TCP master	By registering the register address numbers that are frequently read from the Modbus/TCP master in the library inside this product, it becomes possible to read up to 125 words at once using a single read command for data from multiple non-consecutive register addresses.
Remote control of this product	Specify the corresponding register number in unsigned integer and perform writing/reading.
Network Time function	Specify the corresponding register number in unsigned integer and perform reading/writing.

1-3-2 For Ethernet Socket Communication

Specifications

Item	Details
Supported socket communication	TCP/IP, UDP/IP
Server/client	Server
Socket communication port number	2001 (decimal number) Fixed (common to both TCP/IP and UDP/IP)
Number of simultaneous connections	TCP/IP: 2 pcs UDP/IP: 4 pcs
IP address	Fixing method
Subnet mask	255.255.255.0
Default gateway	None or 0.0.0.0

Functional Overview

Functions	Details
Inputting/outputting IO-Link process data	Reads process input data, digital input and allocated status data, and writes process output data, digital I/O and allocated operation data with a data access request. Reads up to 32 words in total for all channels to be used, 1 word for digital input, and 1 word for allocated status data in a batch. Writes up to 32 words in total for all channels to be used, 1 word for digital output, and 1 word for allocated operation data in a batch. The allocation of process data for each channel is based on the master parameter M40/41 ("M40. Process input data words allocation" and “M41. Process output data words allocation”) of this product.
Digital input/output	
Inputting allocated status data, outputting allocated operation data	
IO-Link device setting	Specify the index number or sub-index number and execute the parameter access by writing with a data access request.
Settings of this product	Specify the master parameter number and execute the parameter access by writing with a data access request.

1-4 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 (*1)	Modbus/TCP communication	Specify the corresponding register number (00089 to 00802) in unsigned integer and perform writing or reading Input: Up to 32 bytes/channel Output: Up to 32 bytes/channel	3-2 Modbus/TCP Communication
		Input (monitor) only: Discontinuous register numbers of this product can be registered as a library in advance and read them in a batch (registered register number library function: depends on the corresponding register numbers 03872 to 04123).	
	Ethernet socket communication	Reads process input data, digital input or allocated status data, and writes process output data, digital I/O or allocated operation data with a data access request Input: Total of 32 words (64 bytes) over all channels Output: Total of 32 words (64 bytes) over all channels	3-3 Ethernet Socket Communication
2) Confirmation with front panel controls	Confirmation is done with product front panel operation.		Common Edition “Chapter 5 Front Panel Controls”

*1: For Modbus/TCP communication, it may be possible to perform cyclic communication (automatic communication) depending on the master.

1-5 Setting/Monitoring Product Master Parameters

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

Methods for setting/monitoring are as shown below.

Method	Description		Reference
1) Setting with front panel controls	Setting is done with product front panel operation.		Common Edition “Chapter 5 Front Panel Controls”
2) Setting/monitoring via acyclic communication	Modbus/TCP communication	Specify the corresponding register number (05500 to 06565) in unsigned integer and perform writing or reading.	3-2 Modbus/TCP Communication
		Monitor only: Discontinuous register numbers of this product can be registered as a library in advance and read them in a batch.	
	Ethernet socket communication	Execute parameter access (read/write), specify the master parameter of this product by unit specification, and specify the master parameter number or target number with a data access request.	3-3 Ethernet Socket Communication

1-6 IO-Link Device Service Data Setting/Monitoring

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

Methods for setting/monitoring are as shown below.

Method	Description		Reference
1) Setting with front panel controls	Setting is done with product front panel operation.		Common Edition “Chapter 5 Front Panel Controls”
2) Setting/monitoring via acyclic communication	Modbus/TCP communication	Specify the corresponding register number (00603 to 03871) in unsigned integer and perform writing or reading (ISDU access library function).	3-2 Modbus/TCP Communication
		Monitor only: Discontinuous register numbers of this product can be registered as a library in advance and read them in a batch.	
	Ethernet socket communication	Execute parameter access (read/write), specify the channel number by unit specification, specify the index number / sub-index number with a data access request.	3-3 Ethernet Socket Communication

1-7 Setting/Monitoring Data from UC2-IOL Connected Sensor Unit

This section shows the method of setting or monitoring the OPTEX FA IO-Link gateway on the data of the target sensor unit connected to the UC2-IOL.

Methods for setting/monitoring are as shown below.

Method	Description		Reference
Setting/monitoring via acyclic communication	Modbus/TCP communication	Specify the corresponding register number (00603 to 03871) in unsigned integer and perform writing or reading (ISDU access library function).	3-2 Modbus/TCP Communication
		Monitor only: Discontinuous register numbers of this product can be registered as a library in advance and read them in a batch.	

1-8 Basic Procedures

The process from installing and setting this product through beginning Modbus/TCP and IO-Link communication is indicated below.
Decide in advance whether to use Modbus/TCP or Ethernet socket communication.

1-8-1 For Modbus/TCP Communication

Procedure	Details	References
Prior confirmation	Prepare an Ethernet connection cable and Switching Hub	Checking the Included Items Manual of the Modbus/TCP master being used
↓	↓	
Hardware installation and wiring	Setting the lowest digit (n) of the IP address (192.168.0.n) of this product with the rotary switch on the front of this product	2-1 Setting the Last Digit of the IP Address of This Product
↓	↓	
Initial Settings for Front Panel Controls	Set “Network Type” to “Ethernet & Modbus/TCP”	2-3 Initial Settings for Front Panel Controls
↓	↓	
Operation to communicate with the Modbus/TCP master	Confirming that “Network Type” setting is “Ethernet & Modbus/TCP”	3-1-1 Confirming the Network Type Setting
	↓	
	Setting the Modbus/TCP master	• 3-1 Initial Operation Required for This Product to Perform Modbus/TCP Communication or Ethernet Socket Communication • Manual of the Modbus/TCP master being used
	↓	
	In the Modbus/TCP master, specify the register number of this product in unsigned integer to create a Modbus/TCP communication program or set for automatic input/output by the communication driver	
↓	↓	
This product's Parameter settings	Using front panel controls	Common Edition
	For a communication program from Modbus/TCP master or automatic input/output by communication driver	Manual of the Modbus/TCP master being used
↓	↓	
IO-Link device parameter setting	Using front panel controls	Common Edition
	For a communication program from Modbus/TCP master or automatic input/output by communication driver	Manual of the Modbus/TCP master being used
↓	↓	
Install the IO-Link Device Profile for the Device Connecting to this Product	(When using other companies' IO-Link devices (*1)) Using the IODD_Converter.exe in UR Master Manager, select “Ethernet/TCP” as the network type and transfer (install) Upon installation, the IO-Link device process data and settings can be referenced and changed with names from this product.	Common Edition
↓	↓	

Procedure	Details	References
Starting communication	Start system (power ON)	
	↓	
	Start Modbus/TCP communication (Including PING test) Starting IO-Link communication	Manual of the Modbus/TCP master being used
↓	↓	
Checking operation	Modbus/TCP master and this product or IO-Link device's display verification	• Manual of the Modbus/TCP master being used • Common Edition Each IO-Link device manual
	↓	
	Verifying read/write data between this product and an IO-Link device	Each IO-Link device manual
	↓	
	Verifying data read/write between Modbus/TCP master and this product	Manual of the Modbus/TCP master being used
↓	↓	
Troubleshooting	Verifying the display of the Modbus/TCP master and this product or IO-Link device	Chapter 5 Troubleshooting

1-8-2 For Ethernet Socket Communication

Procedure	Details	References
Prior confirmation	• Prepare an Ethernet connection cable and Switching Hub	Checking the Included Items Client manual of the Ethernet socket communication
↓	↓	
Hardware installation and wiring	Setting the lowest digit (n) of the IP address (192.168.0.n) of this product with the rotary switch on the front of this product	2-1 Setting the Last Digit of the IP Address of This Product
↓	↓	
Initial Settings for Front Panel Controls		Common Edition
↓	↓	
Operation to communicate with the Modbus/TCP master	Confirming that “Network Type” setting is “Ethernet & Modbus/TCP”	3-1-1 Confirming the Network Type Setting
	↓	
	Client settings of Ethernet socket communication	• 3-1 Initial Operation Required for This Product to Perform Modbus/TCP Communication or Ethernet Socket Communication • Client manual of the Ethernet socket communication
	↓	
	Creating communication programs (open processing, sending/receiving data, closing) on the client side via Ethernet socket communication	
↓	↓	

Procedure	Details	References
This product's Parameter settings	Using front panel controls	Common Edition
	When using a communication program from the Ethernet client	Client manual of the Ethernet socket communication
↓	↓	
IO-Link device parameter setting	Using front panel controls	Common Edition
	When using a communication program from the Ethernet client	Client manual of the Ethernet socket communication
↓	↓	
Install the IO-Link Device Profile for the Device Connecting to this Product	(When using other companies' IO-Link devices (*1)) Using the IODD_Converter.exe in UR Master Manager, select “UDP (CC-Link IE Field Basic)” 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)	
	↓	
	Starting Ethernet socket communication (Including PING test) Starting IO-Link communication	Client manual of the Ethernet socket communication
↓	↓	
Checking operation	Ethernet client and this product / IO-Link device's display verification	• Client manual of the Ethernet socket communication • Common Edition • Each IO-Link device manual
	↓	
	Verifying read/write data between this product and an IO-Link device	Each IO-Link device manual
	↓	
	Verifying data read/write between the Ethernet client and this product	Client manual of the Ethernet socket communication
↓	↓	
Troubleshooting	Verifying the display of the Ethernet client and this product / IO-Link device	Chapter 5 Troubleshooting

MEMO

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

Method	Main application	References
1) Unit front operation	Startup time or Maintenance	• “2-3 Initial Settings for Front Panel Controls”
2) Communication from Modbus/TCP master or Ethernet client	Controlled operation	• “3-2 Modbus/TCP Communication” • “3-3 Ethernet Socket Communication” • “App-1 List of Product Master Parameters” • “App-2 Socket Communication Sample Programs”

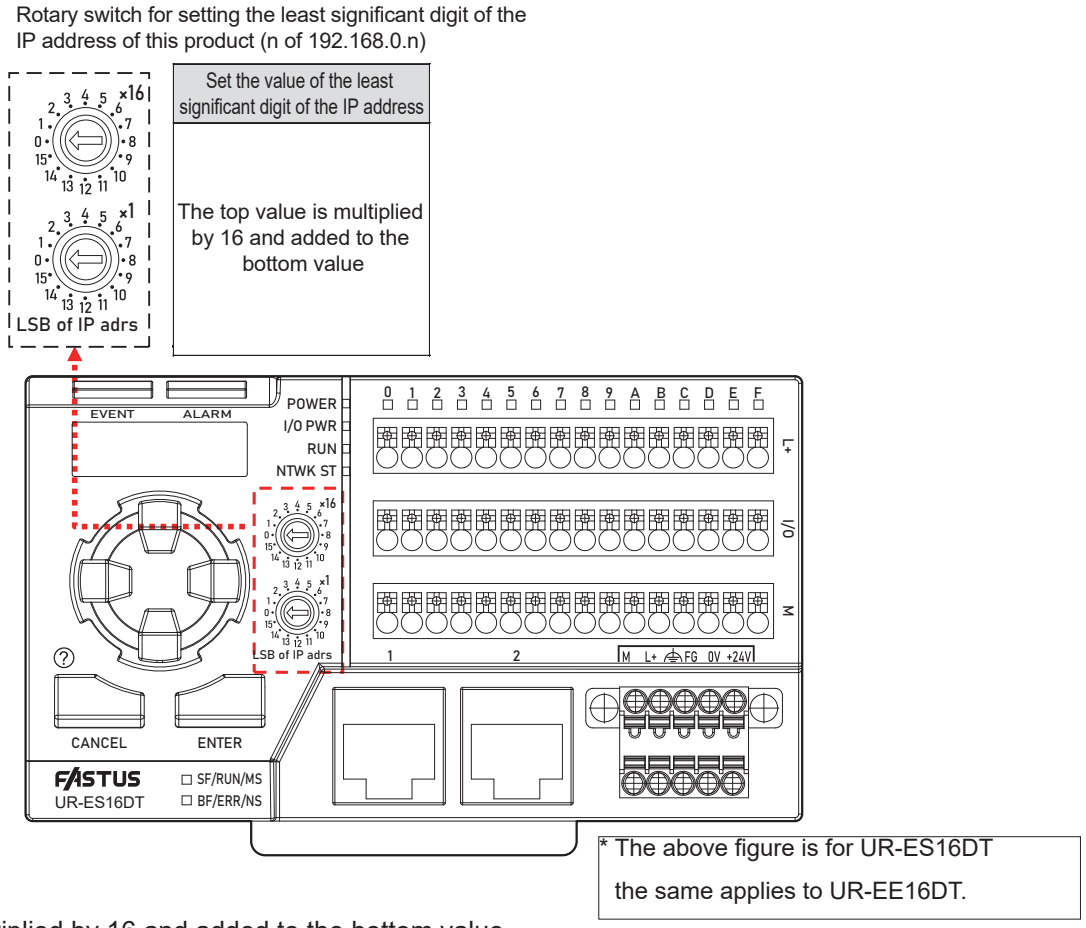
2

Initial Setting of This Product with Regard to Ethernet & Modbus/TCP

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

2-1 Setting the Last Digit of the IP Address of This Product

Before turning on the power, use the front rotary switch to set the lowest digit (n of 192.168.0.n) of the IP address of this product as a node for host network Modbus/TCP or Ethernet socket communication.



* The above figure is for UR-ES16DT the same applies to UR-EE16DT.

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

The IP address is initially set to 192.168.0.n (n is the value of the front rotary switch).
To change it from 192.168.0.n, set the master parameter “M82. IP address” by operating the front panel controls. Turning the front rotary switch while the power is on automatically switches 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 “5-1-1 Front Panel Controls” and “5-1-4 Master Parameter List with Product Front Panel Operation” of Common Edition.

Note that 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 Modbus/TCP communication or Ethernet socket communication is used as the host network.

2-2-1 Connector and Cable

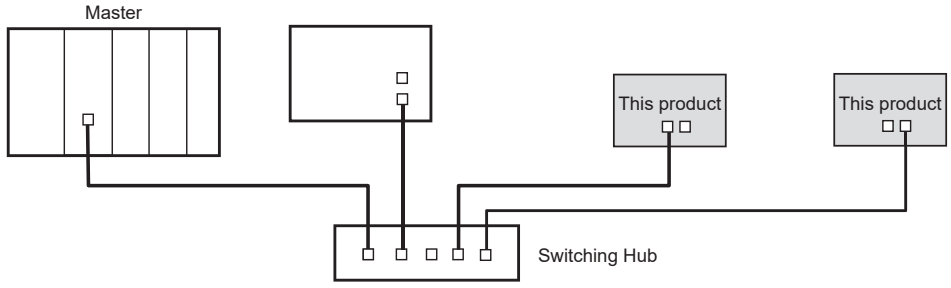
The Ethernet cable may be connected to either of the RJ45 connectors at left or right of the product.
For the cable, use an Ethernet cable that complies with the standard (100BASE-TX, 10BASE-T).
For details, refer to the manual of the client of Modbus/TCP master or Ethernet socket communication.

2-2-2 Ethernet Connection Status

Topologies capable of Modbus/TCP or Ethernet socket communication are star or line connections.

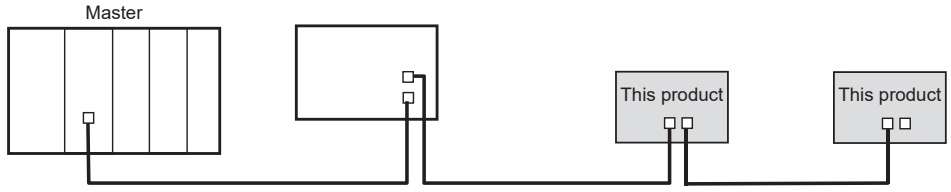
● Star configuration

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 type network is a connection format in which devices are connected by daisy chain.
It doesn't require a Switching Hub and shortens the required length of LAN cables.
The upstream side (master side) / downstream side can be connected to either PORT1 or PORT2 of this product.



For details, refer to the manual of the client of Modbus/TCP master or Ethernet socket communication.

2-3 Initial Settings for Front Panel Controls

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

2-3-1 Powering Up the Modbus/TCP Master

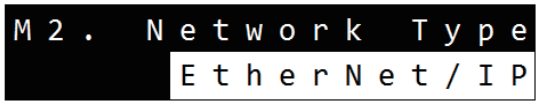
When available, apply power to the Modbus/TCP master station in advance.
This makes it possible to check whether the master is connected correctly.

2-3-2 Language Selection

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

2-3-3 Network Type Setting

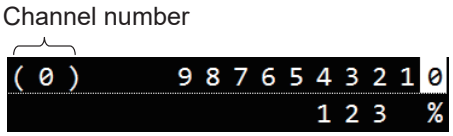
Continuing, the window automatically switches to the network type setting screen shown below.



The factory default network type setting is “EtherNet/IP”.
When setting the host industrial network to “Ethernet & Modbus/TCP”, change the network type setting here to “Ethernet & Modbus/TCP”.
Regarding “M2. Network types,” refer to Common Edition 5-1-4 Master Parameter List with Product Front Panel Operation.
Press the [↑] button three times. “Ethernet & Modbus/TCP” will be displayed as below (scroll display).

Press the [ENTER] button. Wait for about twenty seconds. 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 (When necessary) Setting the IP Address of This Product to Any Value

The factory default product IP address is 192.168.0.n (the n value is determined by the front panel rotary switch).
To set the IP address of this product to a desired value, turning the rotary switch at the front of this product while the power is on automatically switches to the master parameter “M82. IP address”. If necessary, set the IP address of this product to any value.

3

Communication

This section describes the initial settings for Modbus/TCP communication or Ethernet socket communication, the configuration of the data to be handled, and communication examples.

3-1 Initial Operation Required for This Product to Perform Modbus/TCP Communication or Ethernet Socket Communication

This section describes the operations required on the Modbus/TCP master or Ethernet client for this product to perform Modbus/TCP communication or Ethernet socket communication, and the operations required for IO-Link communication with the IO-Link device.

For details, refer to the Modbus/TCP master manual or the Ethernet client manual.
Contact the manufacturer of the Modbus/TCP master regarding the Modbus/TCP configuration software.

3-1-1 Confirming the Network Type Setting

Confirm that the master parameter “M2. Network type” is set to “Ethernet & Modbus/TCP”.
It is set in the initial settings using the front panel. Refer to “2-3-3 Network Type Setting” for further information.

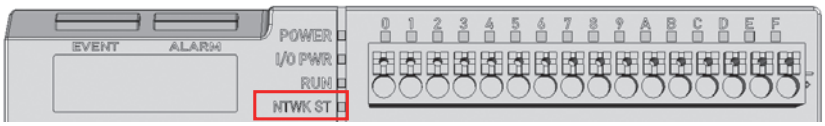
Regarding “M2. Network types” of master parameters, refer to “5-1-4 Master Parameter List with Product Front Panel Operation” in Common Edition.

3-1-2 Modbus/TCP Communication Settings Between Modbus/TCP Master and This Product

The required settings differ depending on the Modbus/TCP master. Refer to the manual of the Modbus/TCP master.

MEMO

- When writing setting details to the Modbus/TCP master, it must be rebooted.
- Changes in the IP address, subnet mask or default gateway of this product will be updated after the power is turned back on.
- If the NTWK ST LED on the front panel does not light up in green (indicating normal communication) after the settings are complete, recheck the settings made on the Modbus/TCP master and the settings of this product (IP address, subnet mask, default gateway).



- If communication is not possible even after all the confirmation above, refer to the manuals for each Modbus/TCP master.

3-1-3 Ethernet Socket Communication Settings Between Ethernet Client and This Product

The required settings differ depending on the Ethernet client. Refer to the manual of the Ethernet socket communication client.

3-2 Modbus/TCP Communication

This section shows the overview and detailed list of the Holding registers in the product when accessing it from the Modbus/TCP master via Modbus/TCP communication.
Use the function code (03 h, 06 h, 10 h or 17 h) in the Modbus/TCP request message to access the Holding register of this product according to the function.

3-2-1 Overview of Register Number

Holding register (decimal)	Category	Details
00000 … 00067	Operation of this product	This area is for operating this product from UI devices such as HMI (display) and SCADA. It consists of reading the character strings displayed on the product display, pressing buttons (up, down, left, right, Enter, Cancel), switching the product menu and locking the operation.
00068 … 00070	This product's time	This is the time that this product counts internally. Set the time to display when an error or event occurs. You can also check the Modbus / TCP communication cycle by reading and comparing the time of this product's time multiple times.
00071 … 00088	Status/operation data	It consists of details related to errors, events and resetting various statuses.
00089 … 00802	I/O	I/O input/output area. Input: Process data 16, IO-Link process data 32 bytes/channel Output: Process data 16, IO-Link process data 32 bytes/channel
00603 … 03871	ISDU Access Library	This is the library area for ISDU communication with IO-Link devices. By registering the index/sub-index number of the IO-Link device to be accessed in this area, it becomes possible to read/write up to 128 types of parameters at once using a simple trigger. It can also be used together with recipe functions such as HMI.
03872 … 04123	Modbus address monitor registration	Registers the register addresses that are frequently read from the Modbus/TCP master into the library. Up to 125 addresses can be registered, which are output to the output area of the library. By reading the library output area from the Modbus/TCP master, it becomes possible to read up to 125 words at once using a single read command for data from multiple non-consecutive register addresses, achieving improved communication efficiency. The library output area is read-only.
04124 … 04126	Backing up	This area backs up the value of a specific register address to the non-volatile memory area of this product. <Target> ISDU Access Library (0070 to 03871) Modbus address monitor registration (3872 to 3997) When the power is turned back on, the value at the time of backup trigger will be restored.

Holding register (decimal)	Category	Details
04127 … 04190	External device access status	The values of the remote registers RWr and RWw of the CC-Link IE Field Basic master station are monitored. *When [CC-Link IEF Basic] is selected from the product menu [M2. Network], two protocols of CC-Link IEF Basic and Modbus/TCP can be used simultaneously.
05500 … 06565	Master parameters	This is the parameter area of this product.
07000 … 07031	User area	This is the area that can be freely used by the user.
07032 … 08311	Basic information of connected device	This area stores information (vendor name, device model, user tag) of the IO-Link device connected to this product.

Reference: Usage Holding register range by purpose

Purpose	Holding register range (decimal)
Accessing I/O (IO-Link process data).	Process input: 00090 to 00345 Process output: 00347 to 00602
Accessing I/O (digital).	Digital input: 00089 Digital output: 00346
Checking the error and event status.	Status data: 00071 to 00072 Error: 00073 to 00075 Event: 00076 to 00087
Resetting the status of errors, events, etc.	00088
Accessing the parameters (ISDU) of the IO-Link device connected to this product.	00603 to 03871
Changing the parameters of this product.	05500 to 06565
Improving the communication efficiency between the Modbus/TCP master and this product.	03872 to 04123
Retaining the parameters of the ISDU access library or Modbus address monitor registration even after this product is turned off.	04124 to 04126
Remotely controlling the screen of this product from a UI device such as HMI/SCADA.	00000 to 00067
Setting the time to display when an error or event occurs.	00068 to 00070
Checking the Modbus / TCP communication cycle.	
Checking the vendor name, device model or user tag of the IO-Link device connected to this product.	07032 to 08311
Setting an operation authority interlock address on this product when accessing this product from multiple Modbus/TCP masters.	07000 to 07031

3-2-2 Detailed List of Register Numbers

The details of the Holding register of this product specified via Modbus/TCP communication are described below in decimal.

On the communication frame, the Holding register number is specified in hexadecimal.

Product Operation

Category	Data name	Holding register (decimal)	R/W	Bit 15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Character string displayed on the display	1st line	00000 … 00031	R	Up to 32 words															
	2nd line	00032 … 00063		Up to 32 words															
Button operation		00064	R/W	→:0001 h, ←:0002 h, ↑:0004 h, ↓:0008 h, CANCEL:0010 h, ENTER:0020 h															
Switching the displayed screen	Specify the screen to switch to	00065	R/W	Channel 0 to F: 0 h to F h				<Screen type code> Process data: 1 h Master parameter: 2 h Device parameter: 3 h Event/error display: 4 h				Parameter number 1 to 99 (01 h to 63 h)							
	Displayed screen	00066	R	Channel 0 to F: 0 h to F h				<Screen type code> Process data: 1 h Master parameter: 2 h Device parameter: 3 h "S" or later: 4 h Event/error display: 5 h				Parameter number 1 to 99 (01 h to 63 h)							
Operation lock	Interlock for each operation	00067	R/W	Reserved												All button operation lock	Event/error clear operation lock	Device parameter write lock	Master parameter write lock

This Product's Time

Category	Data name	Holding register (decimal)	R/W	Bit 15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
This product's time	Inside this product Count time *1	00068	R/W	Time in milliseconds or less (unit: 15.625 μs)															
		00069	R/W	Low order of UNIX time (unsigned integer)															
		00070		High order of UNIX time (unsigned integer)															

*1: It does not reflect the UNIX time counted in the host network in real time.
Since the time is not retained, you need to set the time when the power is turned on again.

Status/Operation Data

Category	Data name	Holding register (decimal)	R/W	Bit															
				15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Status flag *1		00071	R	Error flag	IO-Link ready flag	Reserved		Latest error channel				Event flag	I/O power supply flag	Output overcurrent flag	Reserved	Latest event channel			
		00072	R	Applicable channels 0 to F															
Errors		00073	R	Latest error code															
		00074	R	Index number that caused the latest error															
		00075	R	Reserved								Sub-index number that caused the latest error							
Events	<Low-order> Event 0 to 5 flag <High-order> Event 0	00076	R	Type of event 0		Meaning of event 0		Source of event 0	Event 0 Cause			Details available	Reserved	Event 5 occurred	Event 4 occurred	Event 3 occurred	Event 2 occurred	Event 1 occurred	Event 0 occurred
	Event 0	00077		Event code															
	Event 1	00078	R	Type		Meaning		Source	Cause			Reserved							
		00079		Event code															
	Event 2	00080	R	Type		Meaning		Source	Cause			Reserved							
		00081		Event code															
	Event 3	00082	R	Type		Meaning		Source	Cause			Reserved							
		00083		Event code															
	Event 4	00084	R	Type		Meaning		Source	Cause			Reserved							
		00085		Event code															
	Event 5	00086	R	Type		Meaning		Source	Cause			Reserved							
		00087		Event code															
Status operation, reset		00088	R/W	Reserved													Count	Clear the latest error (*2)	Clear the latest event (*2)	Find Me

*1: For the details of each data, refer to {Reading status data of this product} in “4-1 Product functions” in the Common Edition. If the host network type is “Ethernet & Modbus/TCP”, the “synchronization establishment flag” does not exist.

*2: For the details of each data, refer to {Writing operation data of this product} in “4-1 Product functions” in the Common Edition.

I/O (digital)

Category	Data name	Holding register (decimal)	R/W	Bit															
				15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Bit input	Channels 0 to F	00089	R	CH F	CH E	CH D	CH C	CH B	CH A	CH 9	CH 8	CH 7	CH 6	CH 5	CH 4	CH 3	CH 2	CH 1	CH 0
Bit output		00346	R/W	CH F	CH E	CH D	CH C	CH B	CH A	CH 9	CH 8	CH 7	CH 6	CH 5	CH 4	CH 3	CH 2	CH 1	CH 0

I/O (Process Data)

Category	Data name	Holding register (decimal)	R/W	Bit															
				15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Process data input	CH 0	00090 … 00105	R	Process input data received from channel 0 Up to 32 bytes (16 words)															
	CH 1	00106 … 00121	R	Process input data received from channel 1 Up to 32 bytes (16 words)															
	CH 2	00122 … 00137	R	Process input data received from channel 2 Up to 32 bytes (16 words)															
	CH 3	00138 … 00153	R	Process input data received from channel 3 Up to 32 bytes (16 words)															
	CH 4	00154 … 00169	R	Process input data received from channel 4 Up to 32 bytes (16 words)															
	CH 5	00170 … 00185	R	Process input data received from channel 5 Up to 32 bytes (16 words)															
	CH 6	00186 … 00201	R	Process input data received from channel 6 Up to 32 bytes (16 words)															
	CH 7	00202 … 00217	R	Process input data received from channel 7 Up to 32 bytes (16 words)															
	CH 8	00218 … 00233	R	Process input data received from channel 8 Up to 32 bytes (16 words)															
	CH 9	00234 … 00249	R	Process input data received from channel 9 Up to 32 bytes (16 words)															
	CH A	00250 … 00265	R	Process input data received from channel A Up to 32 bytes (16 words)															
	CH B	00266 … 00281	R	Process input data received from channel B Up to 32 bytes (16 words)															
	CH C	00282 … 00297	R	Process input data received from channel C Up to 32 bytes (16 words)															
	CH D	00298 … 00313	R	Process input data received from channel D Up to 32 bytes (16 words)															
	CH E	00314 … 00329	R	Process input data received from channel E Up to 32 bytes (16 words)															
	CH F	00330 … 00345	R	Process input data received from channel F Up to 32 bytes (16 words)															

Category	Data name	Holding register (decimal)	R/W	Bit															
				15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Process data output	CH 0	00347 … 00362	R/W	Process output data sent to channel 0 Up to 32 bytes (16 words)															
	CH 1	00363 … 00378	R/W	Process output data sent to channel 1 Up to 32 bytes (16 words)															
	CH 2	00379 … 00394	R/W	Process output data sent to channel 2 Up to 32 bytes (16 words)															
	CH 3	00395 … 00410	R/W	Process output data sent to channel 3 Up to 32 bytes (16 words)															
	CH 4	00411 … 00426	R/W	Process output data sent to channel 4 Up to 32 bytes (16 words)															
	CH 5	00427 … 00442	R/W	Process output data sent to channel 5 Up to 32 bytes (16 words)															
	CH 6	00443 … 00458	R/W	Process output data sent to channel 6 Up to 32 bytes (16 words)															
	CH 7	00459 … 00474	R/W	Process output data sent to channel 7 Up to 32 bytes (16 words)															
	CH 8	00475 … 00490	R/W	Process output data sent to channel 8 Up to 32 bytes (16 words)															
	CH 9	00491 … 00506	R/W	Process output data sent to channel 9 Up to 32 bytes (16 words)															
	CH A	00507 … 00522	R/W	Process output data sent to channel A Up to 32 bytes (16 words)															
	CH B	00523 … 00538	R/W	Process output data sent to channel B Up to 32 bytes (16 words)															
	CH C	00539 … 00554	R/W	Process output data sent to channel C Up to 32 bytes (16 words)															
	CH D	00555 … 00570	R/W	Process output data sent to channel D Up to 32 bytes (16 words)															
	CH E	00571 … 00586	R/W	Process output data sent to channel E Up to 32 bytes (16 words)															
	CH F	00587 … 00602	R/W	Process output data sent to channel F Up to 32 bytes (16 words)															

ISDU Access Library

Category	Data name	Holding register (decimal)	R/W	Bit															
				15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Instruction	Execution target ISDU library specification (*2)	00603	R/W	LB015	LB014	LB013	LB012	LB011	LB010	LB009	LB008	LB007	LB006	LB005	LB004	LB003	LB002	LB001	LB000
		00604		LB031	LB030	LB029	LB028	LB027	LB026	LB025	LB024	LB023	LB022	LB021	LB020	LB019	LB018	LB017	LB016
		00605		LB047	LB046	LB045	LB044	LB043	LB042	LB041	LB040	LB039	LB038	LB037	LB036	LB035	LB034	LB033	LB032
		00606		LB063	LB062	LB061	LB060	LB059	LB058	LB057	LB056	LB055	LB054	LB053	LB052	LB051	LB050	LB049	LB048
		00607		LB079	LB078	LB077	LB076	LB075	LB074	LB073	LB072	LB071	LB070	LB069	LB068	LB067	LB066	LB065	LB064
		00608		LB095	LB094	LB093	LB092	LB091	LB090	LB089	LB088	LB087	LB086	LB085	LB084	LB083	LB082	LB081	LB080
		00609		LB111	LB110	LB109	LB108	LB107	LB106	LB105	LB104	LB103	LB102	LB101	LB100	LB099	LB098	LB097	LB096
		00610		LB127	LB126	LB125	LB124	LB123	LB122	LB121	LB120	LB119	LB118	LB117	LB116	LB115	LB114	LB113	LB112
	Read/write execution trigger	00611	R/W	0001 h: Read execution 0002 h: Write execution 0000 h: ISDU access library result (00612 to 00636) all clear execution The moment when each of the above values is written will be the execution trigger.															
Result	Read/write execution reception	00612	R	0001 h: Read execution reception 0002 h: Write execution reception 0000 h: ISDU access library result (00612 to 00636) all clear execution reception															
	Execution status	00613	R	Reserved												Suspended due to an unexpected error	All completed (including errors)	All completed (all normal)	Executing
	Error code	00614	R	0000 h: No error Other values: Latest error code															
	Statistics	00615	R	Total number selected as execution target from LB000 to LB127: 0000 h to 0080 h															
		00616	R	Total number of normal completions from LB000 to LB127: 0000 h to 0080 h															
		00617	R	Total number of error completions from LB000 to LB127: 0000 h to 0080 h															
		00618	R	Total number of incompletions from LB000 to LB127: 0000 h to 0080 h															
		00619	R	Completion progress rate: 0.0% to 100.0% (0000 h to 03E8 h)															
	Supports the normal completion flag ISDU library number	00620	R	LB015	LB014	LB013	LB012	LB011	LB010	LB009	LB008	LB007	LB006	LB005	LB004	LB003	LB002	LB001	LB000
		00621		LB031	LB030	LB029	LB028	LB027	LB026	LB025	LB024	LB023	LB022	LB021	LB020	LB019	LB018	LB017	LB016
		00622		LB047	LB046	LB045	LB044	LB043	LB042	LB041	LB040	LB039	LB038	LB037	LB036	LB035	LB034	LB033	LB032
		00623		LB063	LB062	LB061	LB060	LB059	LB058	LB057	LB056	LB055	LB054	LB053	LB052	LB051	LB050	LB049	LB048
		00624		LB079	LB078	LB077	LB076	LB075	LB074	LB073	LB072	LB071	LB070	LB069	LB068	LB067	LB066	LB065	LB064
		00625		LB095	LB094	LB093	LB092	LB091	LB090	LB089	LB088	LB087	LB086	LB085	LB084	LB083	LB082	LB081	LB080
		00626		LB111	LB110	LB109	LB108	LB107	LB106	LB105	LB104	LB103	LB102	LB101	LB100	LB099	LB098	LB097	LB096
		00627		LB127	LB126	LB125	LB124	LB123	LB122	LB121	LB120	LB119	LB118	LB117	LB116	LB115	LB114	LB113	LB112
	Reserved	00628		Reserved															
	Supports the error completion flag ISDU library number	00629	R	LB015	LB014	LB013	LB012	LB011	LB010	LB009	LB008	LB007	LB006	LB005	LB004	LB003	LB002	LB001	LB000
		00630		LB031	LB030	LB029	LB028	LB027	LB026	LB025	LB024	LB023	LB022	LB021	LB020	LB019	LB018	LB017	LB016
		00631		LB047	LB046	LB045	LB044	LB043	LB042	LB041	LB040	LB039	LB038	LB037	LB036	LB035	LB034	LB033	LB032
		00632		LB063	LB062	LB061	LB060	LB059	LB058	LB057	LB056	LB055	LB054	LB053	LB052	LB051	LB050	LB049	LB048
		00633		LB079	LB078	LB077	LB076	LB075	LB074	LB073	LB072	LB071	LB070	LB069	LB068	LB067	LB066	LB065	LB064
		00634		LB095	LB094	LB093	LB092	LB091	LB090	LB089	LB088	LB087	LB086	LB085	LB084	LB083	LB082	LB081	LB080
		00635		LB111	LB110	LB109	LB108	LB107	LB106	LB105	LB104	LB103	LB102	LB101	LB100	LB099	LB098	LB097	LB096
		00636		LB127	LB126	LB125	LB124	LB123	LB122	LB121	LB120	LB119	LB118	LB117	LB116	LB115	LB114	LB113	LB112
Reserved		00637 … 00699		Reserved															

Category	Data name	Holding register (decimal)	R/W	Bit															
				15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
ISDU library read/write execution target index registration details	LB 000	00700	R/W(*1)	Target channel specification: Channel 0 to F: 0000 h to 000 F h															
		00701	R/W(*1)	Index number specification															
		00702	R/W(*1)	Sub-index number specification															
		00703	R/W(*1)	Specify the request data length specification and size in bytes. Note: When 0000 h is specified, reading is executed according to the number of bytes of the actual IO-Link device. (Variable) Writing is not executed.															
		00704	R/W(*1)	UC2-IOL dedicated extension code 01 h to 10 h: Specify the number of the sensor unit connected to UC2-IOL (Specify the connection order 1 to 16 from the left end of the sensor unit connected) 00 h: Specify the normal IO-Link device								Switching endian 00 h: Not switched 01 h: Switched							
		00705 00706	R/W(*1)	User memo Any value can be entered. It can be used for specifying indirect register numbers of control devices and making memos.															
		00707	—	Reserved															
		00708 … 00723	R/W(*1)	Request data (up to 32 bytes) Reading: Read data is stored. Writing: The user stores the write data in this area in advance.															
	LB 001	00724 … 00747	R/W(*1)	Same as above (24 words)															
	…	…	…	…															
	LB 126	03724 … 03747	R/W(*1)	Same as above (24 words)															
	LB 127 Request data extended version	03748	R/W(*1)	Target specification: channel 0 to F h (0000 to 000 F h), this product (FF00 h)															
		03749	R/W(*1)	Index number specification															
		03750	R/W(*1)	Sub-index number specification															
		03751	R/W(*1)	Request data length specification															
		03752	R/W(*1)	UC2-IOL dedicated extension code Example: For UC2-IOL, 01 h to 10 h: Connected devices #1 to 16 specified								Switching endian 00 h: Not switched 01 h: Switched							
		03753 03754	R/W(*1)	User memo															
		03755	Reserved																
		03756 … 03871	R/W(*1)	Request data (Up to 232 bytes)															

*1: The parameter when “4342 h” (backup execution) is written to the execution trigger (register address: 4124) related to the backup is backed up to the non-volatile memory of this product. The value is automatically read when this product is turned on again.

*2: ON: Select the corresponding ISDU library number as the access execution target.

OFF: The corresponding ISDU library number is not targeted for accessing.

It is executed sequentially from the youngest ISDU library number.

Modbus Address Monitor Registration

Category	Data name	Holding register (decimal)	R/W	Bit 15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Modbus address monitor registration (instruction)	n+0	03872	R/W(*1)	Specify the Holding register address number to which the value is read from the Modbus master. Up to 125 addresses can be registered.															
	n+1	03873																	
	n+2	03874																	
	n+3 … n+124	03875 … 03996																	
	Number of monitor words	03997	R/W(*1)	Specify how many words of registered address are enabled from n+0. 0001 h to 007D h: 1 to 125 words 0000 h: Function is not used															
Modbus address monitor registration (output)	Number of monitor words (Reception)	03998	R	Indicates that the specified number of monitor words was received. 0001 h to 007D h: 1 to 125 words 0000 h: Function is not used															
	n+0	03999	R	Values of the Holding register specified by n+0 to 124 of the Modbus address monitor registration (command) is stored. These can be read from the Modbus/TCP master with one command for up to 125 words starting from 03999. This is a useful function for improving the communication efficiency from the Modbus/TCP master.															
	n+1 … n+124	04000 … 04123	R																

*1: The parameter when “4342 h” (backup execution) is written to the execution trigger (register address: 4124) related to the backup is backed up to the non-volatile memory of this product. The value is automatically read when this product is turned on again.

Backing Up

Category	Data name	Holding register (decimal)	R/W	Bit 15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Backing up	Execution trigger	04124	R/W	Backs up the parameters of the ISDU access library and Modbus address monitor registration to the non-volatile memory of this product. 4342 h: Backup execution 4C43 h: Erase all backups 0000 h: Execution status flag clear execution Note: The backup target is the parameters of the following register numbers. · 00700 to 03871: ISDU access specification ISDU library number LB 000 to 127 · 03872 to 03997: Modbus address monitor registration (command) n+0 to n+124, number of monitor words															
	Execution reception	04125	R	4342 h: Execute backup reception 4C43 h: Backup erasure reception 0000 h: Execution status flag clear execution reception Other than the above values, echo back will not be performed and the last value will be maintained.															
	Execution status	04126	R	Reserved													Completed W/ error(s)	Completed normally	Executing

MEMO

The maximum number of writing of the non-volatile memory of this product is at least 100,000.
In order to protect the memory element, do not periodically write to the parameter of this product through backups, etc.

External Device Access Status

Category	Data name	Holding register (decimal)	R/W	Bit															
				15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
External device access status monitor	Rwr CC-Link IEF Basic	04127	R	Details of the communication of remote register RWr n+0 of the CC-Link IE Field Basic master station															
		04128 … 04158		Same as above n+1 … Same as above n+31															
	RWw CC-Link IEF Basic	04159	R	Details of the communication of remote register RWw n+0 of the CC-Link IE Field Basic master station															
		04160 … 04190		Same as above n+1 … Same as above n+31															
	Reserved	04191 … 04999	Reserved																

Master Parameters

Data name	Target CH	Holding register (decimal)	R/W	Parameter (monitor)	
M10. I/O setting	CH 0 … CH F	05500 … 05515	RW	0	IO-Link mode
				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
M11. Input filter	CH 0 … CH F	05516 … 05531	RW	0 (default value)	None
				1	0.1 ms
				2	1 ms
				3	5 ms
				4	10 ms
				5	20 ms
M12. Input hold time	CH 0 … CH F	05532 … 05547	RW	0 (default value)	None
				1	1 ms
				2	15 ms
				3	100 ms
M13. IO-Link communication and network error handling	CH 0 … CH F	05548 … 05563	RW	0 (default value)	Clear
				1	Input hold
				2	Output hold
				3	All Hold

Data name	Target CH	Holding register (decimal)	R/W	Parameter (monitor)	
M21. I/O synchronization	CH 0 … CH F	05564 … 05579	RW	0 (default value)	Asynchronous IO-Link communication uses individual devices' fastest times. The digital I/O status is also continually updated.
				2	I/O is synchronized at 0.4 ms cycle. It is targeted for the IO-Link process data and digital I/O. Synchronization is performed between multiple channels for which the same cycle is set.
				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.
M30. Device verification	CH 0 … CH F	05580 … 05595	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.
				1	Verification of type ID (vendor ID and device ID) 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.
M30. Device verification	CH 0 … CH F	05580 … 05595	RW	2	Type ID + 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 Parameter 1.
				3	Type ID + 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 Parameter 1.
M31. Automatic device parameter backup	CH 0 … CH F	05596 … 05611	RW	0 (default value)	None
				1	Auto backup When IO-Link device Parameters are changed, they are automatically backed up in this product. If IO-Link device parameters 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" (parameter number: M30) to correct the verification error (FFFE h) as soon as possible.

Data name	Target CH	Holding register (decimal)	R/W	Parameter (monitor)	
M31. Automatic device parameter backup	CH 0 … CH F	05596 … 05611	RW	2	Auto restoration Automatically restore (download parameters from this product to the IO-Link device) if the IO-Link device parameters differ from the data stored on this product during startup. In this case, note that even if the IO-Link device parameter 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 parameters. In other words, IO-Link device parameters are backed up to this product whenever they are changed. If any parameters are different from the IO-Link device during startup, the parameters stored in this product will be restored.
M33. Conditions for applying IODD data	CH 0 … CH F	05612 … 05627	RW	0	Device
				1 (default value)	IODD
M40. Process input data words allocation	CH 0 … CH F	05628 … 05643	RW		This setting does not have effect on Modbus protocol communication.
M41. Process output data words allocation	CH 0 … CH F	05644 … 05659	RW		This setting does not have effect on Modbus protocol communication.
M43. Process data LSB/MSB	CH 0 … CH F	05660 … 05675	RW	0 (default value)	Little endian
				1	Big endian
Reserved		05676 … 05799	Reserved		
M8. User tag name of this IO-Link master unit	This product	05800 … 05815	RW	Up to 32 characters	Set the product user tag name up to 32 characters.
Reserved		05816 … 05829	Reserved		
M29. Device ID	CH 0 … CH F	05830 … 05893	RW	0 h to FFFFFF h (Default value: 0 h)	This is the device ID used for verification with IO-Link devices. Refer to the Common Edition “M29. Device ID” in “5-1-4 Master parameter list with product front panel operation” for details.
Reserved		05866 … 05899	Reserved		
M4. Display brightness	This product	05900	RW	1 to 20 (Default value: 7)	Display brightness Values multiplied by 5 are equivalent to % display.

<table>
<tr><th>Data name</th><th>Target CH</th><th>Holding register (decimal)</th><th>R/W</th><th colspan="2">Parameter (monitor)</th></tr>
<tr><td rowspan="10">M5.
Language</td><td rowspan="10">This product</td><td rowspan="10">05901</td><td rowspan="10">RW</td><td>0 (default value)</td><td>English</td></tr>
<tr><td>1</td><td>Japanese</td></tr>
<tr><td>2</td><td>German</td></tr>
<tr><td>3</td><td>Chinese (Simplified)</td></tr>
<tr><td>4</td><td>French</td></tr>
<tr><td>5</td><td>Spanish</td></tr>
<tr><td>6</td><td>Portuguese</td></tr>
<tr><td>7</td><td>Italian</td></tr>
<tr><td>9</td><td>Korean</td></tr>
<tr><td>10</td><td>Chinese (Traditional)</td></tr>
<tr><td>M6.
Time zone
-UTC-</td><td>This product</td><td>05902</td><td>RW</td><td>-96 to 96 (Default value: 0)</td><td>Set the time zone (in 15-minute increments) for the displayed network time (parameter number: M65). If the network time set from the host is based on UTC, setting the time zone as 9 x 4 = 36 will display the Japan standard time (JST).</td></tr>
<tr><td>M15.
Encoder input (ABZ)</td><td>This product</td><td>05903</td><td>RW</td><td>0 h (default value)</td><td>Do not use encoder input.</td></tr>
<tr><td colspan="6">Connect the phases A, B and Z of the encoder to the channel (NPN or PNP input) of this product.
The following is a correlation table between the channel of this product connected to phases A, B and Z of the encoder and the parameter (hexadecimal number) of this register (“-” is not allocated).
<table>
<tr><td>Value</td><td>00</td><td>01</td><td>02</td><td>03</td><td>04</td><td>05</td><td>06</td><td>07</td><td>08</td><td>09</td><td>0A</td><td>0B</td><td>0C</td><td>0D</td><td>0E</td><td>0F</td></tr>
<tr><td></td><td colspan="16">Connecting the encoder to the following channel</td></tr>
<tr><td>Phase A</td><td>-</td><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td><td>9</td><td>A</td><td>B</td><td>C</td><td>D</td><td>-</td></tr>
<tr><td>Phase B</td><td>-</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td><td>9</td><td>A</td><td>B</td><td>C</td><td>D</td><td>E</td><td>-</td></tr>
<tr><td>Phase Z</td><td>-</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td><td>9</td><td>A</td><td>B</td><td>C</td><td>D</td><td>E</td><td>F</td><td>-</td></tr>
</table>
<table>
<tr><td>Value</td><td>10</td><td>11</td><td>12</td><td>13</td><td>14</td><td>15</td><td>16</td><td>17</td><td>18</td><td>19</td><td>1A</td><td>1B</td><td>1C</td><td>1D</td><td>1E</td><td>1F</td></tr>
<tr><td></td><td colspan="16">Connecting the encoder to the following channel</td></tr>
<tr><td>Phase A</td><td>-</td><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td><td>9</td><td>A</td><td>B</td><td>C</td><td>D</td><td>E</td></tr>
<tr><td>Phase B</td><td>-</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td><td>9</td><td>A</td><td>B</td><td>C</td><td>D</td><td>E</td><td>F</td></tr>
</table>
<table>
<tr><td>Value</td><td>20</td><td>21</td><td>22</td><td>23</td><td>24</td><td>25</td><td>26</td><td>27</td><td>28</td><td>29</td><td>2A</td><td>2B</td><td>2C</td><td>2D</td><td>2E</td><td>2F</td></tr>
<tr><td></td><td colspan="16">Connecting the encoder to the following channel</td></tr>
<tr><td>Phase A</td><td>-</td><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td><td>9</td><td>A</td><td>B</td><td>C</td><td>D</td><td>E</td></tr>
</table>
<table>
<tr><td>Value</td><td>30</td></tr>
<tr><td></td><td>CH</td></tr>
<tr><td>Phase A</td><td>F</td></tr>
</table></td></tr>
<tr><td>M44.
Time stamp</td><td>This product</td><td>05904</td><td>RW</td><td colspan="2">This setting does not have effect on Modbus protocol communication.</td></tr>
<tr><td>M67.
Network timeout</td><td>This product</td><td>05905</td><td>R/W</td><td>0 to 30000</td><td>When the network type is “Ethernet & Modbus/TCP”, if the Ethernet communication is interrupted and the specified time elapses, a network communication stop error (FFFA h) occurs.
The specified time can be specified from 0 to 30000 (300 seconds) in 10 ms increments.
If it set to the default value of 0, even if Ethernet communication is interrupted, it is considered that the data has been updated internally at a cycle of about 10 ms and no error occurs. Even in such a case, an error will occur if the Ethernet cable is disconnected.</td></tr>
</table>

Data name	Target CH	Holding register (decimal)	R/W	Parameter (monitor)		
M14. UC2-IOL direct output start channel	This product	05906	RW	0 (default value)	The UC2 direct output function is not used.	
				1 to 16	The output signal of the sensor unit received from the OPTEX FA IO-Link gateway UC2-IOL is output directly from the PNP/NPN output of this product. Specified values 1 through 16 correspond to channel numbers 0 through F for the output is “started”.	
Reserved		05907 … 06099	Reserved			
M51. IO-Link cycle time -Process value-	CH 0 … CH F	06100 … 06115	R	1 to 1000	0.1 ms increments	
M52. IO-Link transmission rate	CH 0 … CH F	06116 … 06131	R	0	Not communicating	
				1	COM1	
				2	COM2	
				3	COM3	
M53. IO-Link communication error	CH 0 … CH F	06132 … 06147	R	0 to 255	To clear data, write 1 in offset +0 of parameter 114 h.	
M54. IO-Link ISDU checksum errors	CH 0 … CH F	06148 … 06163	R	0 to 255	To clear data, write 1 in offset +0 of parameter 114 h.	
M55. IO-Link transmission rate error	CH 0 … CH F	06164 … 06179	R	-1000 to 1000	IO-Link transmission rate error 0.1% unit, signed	
M56. IO-Link signal width error	CH 0 … CH F	06180 … 06195	R	-1000 to 1000	IO-Link transmission signal width error 0.1% unit, signed	
M57. Communication mode	CH 0 … CH F	06196 … 06211	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 to Common Edition “M57. Communication mode” in “5-1-4 Master parameter list with product front panel operation” for details.
Reserved		06212 … 06249	Reserved			
M2. Network type	This product	06250	RW	Specify the host industrial network type.		
				2 (default value)	EtherNet/IP	
				3	EtherCAT	
				4 (planned)	PROFINET (planned)	
				5	Ethernet & Modbus/TCP	
				6	CC-Link IE Field Basic	
M63. I/O power supply voltage	This product	06251	R	0 to 308	Supplied to product I/O power supply (unit: 0.1 V)	
M64. Internal temperature	This product	06252	R	-2739 to 10457	Product internal temperature (unit: 0.1°C)	
M66. Network communication cycle	This product	06253	R	0 to 15000	It is irrelevant when the network type is “Ethernet & Modbus/TCP”.	

Data name	Target CH	Holding register (decimal)	R/W	Parameter (monitor)	
Reserved		06254 … 06299	Reserved		
M60. System program version of IO-Link master unit	This product	06300, 06301	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.
M61. Total operation hours of IO-Link master unit	This product	06302, 06303	R	0 to 2097151 (239 years)	Product cumulative operating time information (unit: hours)
M62. Display driven hours	This product	06304, 06305	R	0 to 262143 (30 years)	Product display operating time information (unit: hours)
M80. Default gateway	This product	06306, 06307	R/W	0.0.0.0 to 255.255.255.255	Change if otherwise specified. If not, leave the default value. The default value is 0.0.0.0.
M81. Subnet mask	This product	06308, 06309	R/W	0.0.0.0 to 255.255.255.255	Change if otherwise specified. If not, leave the default value. The default value is 255.255.255.0.
M82. IP address	This product	06310, 06311	R/W	0.0.0.0 to 255.255.255.255	Set the IP address of this product to any value. This is set only when changing the default value of 192.168.0.xxx (xxx is the value set by the rotary switch). Turning the front rotary switch while the power is on automatically switches to “M82. IP address” setting window.
Reserved		06312 … 06319	Reserved		
M58. Storage backup time	CH 0 … CH F	06320 … 06463	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)
Reserved		06464 … 06499	Reserved		
M1. IO-Link master parameters reset	This product	06500	RW	0 (default value)	None
				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.

Data name	Target CH	Holding register (decimal)	R/W	Parameter (monitor)	
M9. I/O batch setting	This product	06501	RW	0 (default value)	None
				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.
M9. I/O batch setting	This product	06501	RW	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.
Reserved		06502 … 06549	Reserved		
M32. Device parameter backup/restore	CH 0 … CH F	06550 … 06565 (corresponds to channel number)	RW	0 (default value)	None
				1	Perform backup (uploading parameters from the device to this product) manually.
				2	Perform restoration (downloading parameters from the product to the device) manually.
				3	Delete the backup data stored in this product manually.

User Area

Category	Data name	Holding register (decimal)	R/W	Bit															
				15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
User free area	Address that can be freely used by the user	07000 … 07031	R/W	Up to 32 words															

Basic Information of Connected Device

Category	Data name	Holding register (decimal)	R/W	Bit															
				15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Connection IO-Link device vendor name	CH 0 Vendor name	07032 … 07063	R	Character string Up to 32 words															
	…	…		…															
	CH F Vendor name	07512 … 07543		Character string Up to 32 words															
Connected IO-Link device / Device model	CH 0 Device model	07544 … 07575	R	Character string Up to 32 words															
	…	…		…															
	CH F Device model	08024 … 08055		Character string Up to 32 words															

Category	Data name	Holding register (decimal)	R/W	Bit															
				15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Connected IO-Link device / User tag	CH 0 User tag	08056 … 08071	R	Character string Up to 32 words															
	…	…		…															
	CH F User tag	08296 … 08311		Character string Up to 32 words															

3-2-3 Modbus TCP/UDP Communication Example

This section shows the specification of register numbers in the example of reading/writing service data of the IO-Link device and the example of batch monitoring the process data via Modbus TCP/UDP communication. For the communication frame that contains the function code, refer to “3-2-4 Example of Communication Frame for Each Function Code (FC)”.

Read/Write Service Data to and from the IO-Link Device

Example: Reading/writing the service data of the following two IO-Link devices and the service data of the sensor unit connected to the UC2-IOL.

- Reading the detection margin when light enters the photoelectric sensor Z4 on channel 0.
- Teaching instruction of the photoelectric sensor Z4 on channel 1 (writing)
- Writing the output 1 lower threshold (Far) setting of the leftmost digital fiber amplifier D3RF Series connected to the UC2-IOL on channel 2

- The index number of the detection margin of the photoelectric sensor Z4 when the light enters is A3 h, and the sub-index number is 1 h
- The teaching index number of the photoelectric sensor Z4 is 02 h, and the write data is A0 h
- Leftmost position: The index number of output 1 lower threshold (Far) of digital fiber amplifier D3RF series at 01 h is 6E h

Therefore, the following values are registered in the index access library

Execution ISDU library	Holding register top n (decimal)	n+0	n+1	n+2	n+3	n+4	n+5 to n+7	n+8 to n+23
		Target channel	Index number specification	Sub-index number specification	Request data length specification (byte unit)	Extension code	User memo/ reservation	Request data
LB000	700	0000 h	00A3 h	0001 h	0002 h	0000 h	0 fixed	Read data is stored
LB001	724	0001 h	0002 h	0000 h	0002 h	0000 h	0 fixed	00A0 h
LB002	748	0002 h	006E h	0000 h	0002 h	0000 h	0 fixed	Store write data in advance

Then, the values to the following register numbers are written.

- To execute LB000, set Bit 0 of 00603 to 1 (ON) and write 001 h (read execution) to 00611.
- To execute LB001, set Bit 1 of 00603 to 1 (ON) and write 002 h (write execution) to 00611.
- To execute LB002, set Bit 2 of 00603 to 1 (ON) and write 002 h (write execution) to 00611.

Check whether it completed normally with Bits 0 to 2 of 00620.
Check whether it completed with an error by checking Bits 0 to 2 of 00629.

Batch Monitor the Process Data

Example: Reading the following process data of this product from the Modbus/TCP master in a batch.

- 2 bytes process data input for channel 0 IO-Link device (1 word)
- 4 bytes process data input for channel 1 IO-Link device (2 word)
- 4 bytes process data input for channel 2 IO-Link device (2 word)

Therefore, set the register number and batch read size of the process data input in the registered register number library as follows.

Register number (word unit, decimal)	Registered register number	Parameter (registered register number: hexadecimal)	Details of the registered register number
03872	0	00090(005A h)	2 bytes process data input for channel 0 IO-Link device
03873	1	00106(006A h)	Top 2 bytes process data input for channel 1 IO-Link device
03874	2	00107(006B h)	Last 2 bytes process data input for channel 1 IO-Link device
03875	3	00122(007A h)	Top 2 bytes process data input for channel 2 IO-Link device
03876	4	00123(007B h)	Last 2 bytes process data input for channel 2 IO-Link device
03997	Batch read word count	0005 h	Specify batch reading of 5 words in total

Then, specify the following register number and word count size from the Modbus/TCP master, and execute batch read.

- Top register number: 03999
- Batch read words count size: The value of 03998 (0005 h)

3-2-4 Example of Communication Frame for Each Function Code (FC)

This section shows the transmission frame and reception frame for each of the following function codes that are supported by this product in Modbus TCP/UDP communication.

Corresponding Modbus function code:

Function code	Details	Number of words that can be accessed
03 h	Read holding registers	1 to 125 words
06 h	Write single register	1 word
10 h	Write multiple registers	1 to 123 words
17 h	Read/Write multiple registers	Read: 1 to 125 words Write: 1 to 121 words

FC 03 h (Read Multiple Holding Registers)

This command reads the value of the Modbus register number of this product from the Modbus/TCP master.

Example: The following is where 4 words (87 to 90) are read together starting with register number 87 (decimal).

Transmission frame

Byte order	Item	Data length	High/low-order byte	Value	Details
+0	Transfer ID	2 byte	High-order	00 h	It is used for pairing the transmission from the Modbus/TCP master and the response from this product. The value can remain fixed at 0000 h.
+1			Low-order	00 h	
+2	Protocol ID	2 byte	High-order	00 h	Specify the protocol type. For the Modbus protocol, specify 0000 h.
+3			Low-order	00 h	

Byte order	Item	Data length	High/low-order byte	Value	Details
+4	Total number of bytes	2 byte	High-order	00 h	Specify the message byte length from the byte order +6 to +11. For this multi-read command transmission, the value is fixed at 0006 h.
+5			Low-order	06 h	
+6	Unit ID	1 byte	-	FF h	This is for routing with other lines. It can be any value as it is not used in this product.
+7	Function code	1 byte	-	03 h	03 h is the Modbus function code that reads the value of this product.
+8	Read top register number (hexadecimal specification)	2 byte	High-order	00 h	Specify the top register number of this product to be read in unsigned integer. For register number 0087, specify 0057 h. Refer to “3-3 Ethernet Socket Communication” for details on the register number.
+9			Low-order	57 h	
+10	Readout word count	2 byte	High-order	00 h	Specify how many words are read from the register number specified by the read top register number. To read 4 words, specify 0004 h. Since the maximum number of reading points is 125 words, 007D h is the maximum specified value.
+11			Low-order	04 h	

Reception frame (normal)

Byte order	Item	Data length	High/low-order byte	Value	Details
+0	Transfer ID	2 byte	High-order	00 h	The Modbus/TCP master returns a copy of the transfer ID value specified during transmission from this product.
+1			Low-order	00 h	
+2	Protocol ID	2 byte	High-order	00 h	The Modbus/TCP master returns a copy of the protocol ID value specified during transmission from this product.
+3			Low-order	00 h	
+4	Total number of bytes	2 byte	High-order	00 h	Returns the message byte length from the byte order 7 to the end. The value changes depending on the data read word count. If 4 words are read, the value will be 000B h.
+5			Low-order	0B h	
+6	Unit ID	1 byte	-	FF h	The Modbus/TCP master returns a copy of the unit ID value specified during transmission from this product.
+7	Function code	1 byte	-	03 h	Returns the executed Modbus function code 03 h.
+8	Data byte count	1 byte	-	08 h	Byte length of the read data. If 4 words are read, 08 h will be returned. As the maximum number of read words is 125 words (250 bytes), the maximum value will be 00FA h.
+9	Read data n+0	2 byte	High-order	04 h	The read-out register number value of this product. 1st word Example: When the value is an integer 1234: 04D2 h
+10			Low-order	D2 h	
+11	Same as above n+1	2 byte	High-order	16 h	The read-out register number value of this product. 2nd word Example: When the value is an integer 5678: 162E h
+12			Low-order	2E h	
+13	Same as above n+2	2 byte	High-order	03 h	The read-out register number value of this product. 3rd word Example: When the value is an integer 1000: 03E8 h
+14			Low-order	E8 h	
+15	Same as above n+3	2 byte	High-order	FC h	The read-out register number value of this product. 4th word Example: When the value is a signed integer -1000: FC18 h
+16			Low-order	18 h	

Reception frame (with error)

Byte order	Item	Data length	High/low-order byte	Value	Details
+0	Transfer ID	2 byte	High-order	00 h	The Modbus/TCP master returns a copy of the transfer ID value specified during transmission from this product.
+1			Low-order	00 h	
+2	Protocol ID	2 byte	High-order	00 h	The Modbus/TCP master returns a copy of the protocol ID value specified during transmission from this product.
+3			Low-order	00 h	
+4	Total number of bytes	2 byte	High-order	00 h	Returns the message byte length from the byte order +6 to +8.
+5			Low-order	03 h	
+6	Unit ID	1 byte	-	FF h	The Modbus/TCP master returns a copy of the unit ID value specified during transmission from this product.
+7	Function code	1 byte	-	83 h	It returns the value of the executed Modbus function code 03 plus 80 h (highest bit in the byte), which indicates an error.
+8	Error code	1 byte	-	** h	The generated error code is returned. (01 h function code error, 02 h register number specification error, 03 h data error, 04 h server device error)

FC 06 h (Write Single Holding Register)

This command writes the value from the Modbus/TCP master to one word of the Modbus register number of this product.

Example: The following is when writing a value to register number 345 (decimal).

Transmission frame

Byte order	Item	Data length	High/low-order byte	Value	Details
+0	Transfer ID	2 byte	High-order	00 h	It is used for pairing the transmission from the Modbus/TCP master and the response from this product. The value can remain fixed at 0000 h.
+1			Low-order	00 h	
+2	Protocol ID	2 byte	High-order	00 h	Specify the protocol type. For the Modbus protocol, specify 0000 h.
+3			Low-order	00 h	
+4	Total number of bytes	2 byte	High-order	00 h	Specify the message byte length from the byte order +6 to +11. For this single write command transmission, the value will be fixed at 0006 h.
+5			Low-order	06 h	
+6	Unit ID	1 byte	-	FF h	This is for routing with other lines. It can be any value as it is not used in this product.
+7	Function code	1 byte	-	06 h	06 h is the Modbus function code that writes the values to the register number 1 word of this product.
+8	Write target register number (Hexadecimal specification)	2 byte	High-order	01 h	Specify the register number of this product to write in unsigned integer. For register number 0345, specify 0159 h. For details on the register number, refer to “3-2-2 Detailed List of Register Numbers”.
+9			Low-order	59 h	
+10	Write value	2 byte	High-order	03 h	Specify the value to be written. Example: When writing an integer 1000: 03E8 h
+11			Low-order	E8 h	

Reception frame (normal)

Byte order	Item	Data length	High/low-order byte	Value	Details
+0	Transfer ID	2 byte	High-order	00 h	The Modbus/TCP master returns a copy of the transfer ID value specified during transmission from this product.
+1			Low-order	00 h	
+2	Protocol ID	2 byte	High-order	00 h	The Modbus/TCP master returns a copy of the protocol ID value specified during transmission from this product.
+3			Low-order	00 h	
+4	Total number of bytes	2 byte	High-order	00 h	Returns the message byte length from the byte order +6 to +11.
+5			Low-order	06 h	
+6	Unit ID	1 byte	-	FF h	The Modbus/TCP master returns a copy of the unit ID value specified during transmission from this product.
+7	Function code	1 byte	-	06 h	Returns the executed Modbus function code 06 h.
+8	Write target register number (hexadecimal specification)	2 byte	High-order	01 h	The written register number is returned.
+9			Low-order	59 h	
+10	Write value	2 byte	High-order	03 h	The written value is returned.
+11			Low-order	E8 h	

Reception frame (with error)

Byte order	Item	Data length	High/low-order byte	Value	Details
+0	Transfer ID	2 byte	High-order	00 h	The Modbus/TCP master returns a copy of the transfer ID value specified during transmission from this product.
+1			Low-order	00 h	
+2	Protocol ID	2 byte	High-order	00 h	The Modbus/TCP master returns a copy of the protocol ID value specified during transmission from this product.
+3			Low-order	00 h	
+4	Total number of bytes	2 byte	High-order	00 h	Returns the message byte length from the byte order +6 to +8.
+5			Low-order	03 h	
+6	Unit ID	1 byte	-	FF h	The Modbus/TCP master returns a copy of the unit ID value specified during transmission from this product.
+7	Function code	1 byte	-	86 h	The executed Modbus function code 06 h is returned with the value obtained by adding 80 h (highest bit in the byte), which indicates an error.
+8	Error code	1 byte	-	** h	The generated error code is returned. (01 h function code error, 02 h register number specification error, 03 h data error, 04 h server device error)

FC 10 h (Write Multiple Holding Registers)

This command writes the value from the Modbus/TCP master to multiple words of the Modbus register number of this product.

Example: The following is where the values are written collectively for 4 words (345 to 348) with the register number 345 (decimal) at the top.

Transmission frame

Byte order	Item	Data length	High/low-order byte	Value	Details
+0	Transfer ID	2 byte	High-order	00 h	It is used for pairing the transmission from the Modbus/TCP master and the response from this product. The value can remain fixed at 0000 h.
+1			Low-order	00 h	
+2	Protocol ID	2 byte	High-order	00 h	Specify the protocol type. For the Modbus protocol, specify 0000 h.
+3			Low-order	00 h	
+4	Total number of bytes	2 byte	High-order	00 h	Specify the message byte length from the byte order +6 to the end. The value changes depending on the number of data write word count. When writing 4 words, it will be 000F h.
+5			Low-order	0F h	
+6	Unit ID	1 byte	-	FF h	This is for routing with other lines. It can be any value as it is not used in this product.
+7	Function code	1 byte	-	10	10 h is the Modbus function code that writes the value to multiple words of the register number of this product.
+8	Write top register number (hexadecimal specification)	2 byte	High-order	01	Specify the top register number of this product to be written in hexadecimal. For register number 0345, specify 0159 h. For details on the register number, refer to “3-2-2 Detailed List of Register Numbers”.
+9			Low-order	59	
+10	Number of written words (hexadecimal specification)	2 byte	High-order	00 h	Specify how many words are written from the register number specified by the write top register number. To write 4 words, specify 0004 h. As the maximum number of written words is 123, the maximum specified value will be 007B h.
+11			Low-order	04 h	
+12	Same number of bytes as above	1 byte	-	08 h	When writing 4 words, specify 08 h in 8 bytes.
+13	Write data n+0	2 byte	High-order	04 h	1st word of the written value. Example: When the value is an integer 1234: 04D2 h
+14			Low-order	D2 h	
+15	Same as above n+1	2 byte	High-order	16 h	2nd word of the written value. Example: When the value is an integer 5678: 162E h
+16			Low-order	2E h	
+17	Same as above n+2	2 byte	High-order	03 h	3rd word of the written value. Example: When the value is an integer 1000: 03E8 h
+18			Low-order	E8 h	
+19	Same as above n+3	2 byte	High-order	FC h	4th word of the written value. Example: When the value is a signed integer -1000: FC18 h
+20			Low-order	18 h	

Reception frame (normal)

Byte order	Item	Data length	High/low-order byte	Value	Details
+0	Transfer ID	2 byte	High-order	00 h	The Modbus/TCP master returns a copy of the transfer ID value specified during transmission from this product.
+1			Low-order	00 h	
+2	Protocol ID	2 byte	High-order	00 h	The Modbus/TCP master returns a copy of the protocol ID value specified during transmission from this product.
+3			Low-order	00 h	
+4	Total number of bytes	2 byte	High-order	00 h	Returns the message byte length from the byte order +6 to +11.
+5			Low-order	06 h	
+6	Unit ID	1 byte	-	FF h	The Modbus/TCP master returns a copy of the unit ID value specified during transmission from this product.
+7	Function code	1 byte	-	10 h	Returns the executed Modbus function code 10 h.
+8	Write top register number (hexadecimal specification)	2 byte	High-order	01 h	The written top register number is returned.
+9			Low-order	59 h	
+10	Number of written words (hexadecimal specification)	2 byte	High-order	00 h	The number of written words is returned.
+11			Low-order	04 h	

Reception frame (with error)

Byte order	Item	Data length	High/low-order byte	Value	Details
+0	Transfer ID	2 byte	High-order	00 h	The Modbus/TCP master returns a copy of the transfer ID value specified during transmission from this product.
+1			Low-order	00 h	
+2	Protocol ID	2 byte	High-order	00 h	The Modbus/TCP master returns a copy of the protocol ID value specified during transmission from this product.
+3			Low-order	00 h	
+4	Total number of bytes	2 byte	High-order	00 h	Returns the message byte length from the byte order +6 to +8.
+5			Low-order	03 h	
+6	Unit ID	1 byte	-	FF h	The Modbus/TCP master returns a copy of the unit ID value specified during transmission from this product.
+7	Function code	1 byte	-	90 h	The executed Modbus function code 10 h is returned with the value obtained by adding 80 h (highest bit in the byte), which indicates an error.
+8	Error code	1 byte	-	**	The generated error code is returned. (01 function code error, 02 register number specification error, 03 data error, 04 server device error)

FC 17 h (Read/Write Multiple Holding Registers)

This command reads/writes the value from the Modbus/TCP master to multiple words of the Modbus register number of this product.

Example: The following is where 4 words (87 to 90) are read together starting with register number 87 (decimal), and the values are written collectively for 4 words (345 to 348) with the register number 345 (decimal) at the top.

Transmission frame

Byte order	Item	Data length	High/low-order byte	Value	Details
+0	Transfer ID	2 byte	High-order	00 h	It is used for pairing the transmission from the Modbus/TCP master and the response from this product. The value can remain fixed at 0000 h.
+1			Low-order	00 h	
+2	Protocol ID	2 byte	High-order	00 h	Specify the protocol type. For the Modbus protocol, specify 0000 h.
+3			Low-order	00 h	
+4	Total number of bytes	2 byte	High-order	00 h	Specify the message byte length of the byte order +6 or less. The value changes depending on the number of data write word count. When writing 4 words, it will be 0013 h.
+5			Low-order	13 h	
+6	Unit ID	1 byte	-	FF h	This is for routing with other lines. It can be any value as it is not used in this product.
+7	Function code	1 byte	-	17 h	17 is the Modbus function code that reads/writes the value to multiple words of the register number of this product.
+8	Read top register number (hexadecimal specification)	2 byte	High-order	00 h	Specify the top register number of this product to be read in unsigned integer. For register number 0087, specify 0057 h. Refer to “3-2-2 Detailed List of Register Numbers” for details on the register number.
+9			Low-order	57 h	
+10	Readout word count	2 byte	High-order	00 h	Specify how many words are read from the register number specified by the read top register number. To read 4 words, specify 0004 h. As the maximum number of read words is 125, the maximum specified value will be 007D h.
+11			Low-order	04 h	
+12	Write top register number (hexadecimal specification)	2 byte	High-order	01 h	Specify the register number of this product to write in unsigned integer. For register number 0345, specify 0159 h. Refer to “3-2-2 Detailed List of Register Numbers” for details on the register number.
+13			Low-order	59 h	
+14	Number of written words (hexadecimal specification)	2 byte	High-order	00 h	Specify how many words are written from the register number specified by the write top register number. To write 4 words, specify 0004 h. As the maximum number of written words is 121, the maximum specified value will be 0079 h.
+15			Low-order	04 h	
+16	Same number of bytes as above	1 byte	-	08 h	When writing 4 words, specify 08 in 8 bytes.
+17	Write data n+0	2 byte	High-order	04 h	1st word of the written value. Example: When the value is an integer 1234: 04D2 h
+18			Low-order	D2 h	
+19	Same as above n+1	2 byte	High-order	16 h	2nd word of the written value. Example: When the value is an integer 5678: 162E h
+20			Low-order	2E h	
+21	Same as above n+2	2 byte	High-order	03 h	3rd word of the written value. Example: When the value is an integer 1000: 03E8 h
+22			Low-order	E8 h	
+23	Same as above n+3	2 byte	High-order	FC h	4th word of the written value. Example: When the value is a signed integer -1000: FC18 h
+24			Low-order	18 h	

Note: The maximum write data is n+120.

Reception frame (normal)

Byte order	Item	Data length	High/low-order byte	Value	Details
+0	Transfer ID	2 byte	High-order	00 h	The Modbus/TCP master returns a copy of the transfer ID value specified during transmission from this product.
+1			Low-order	00 h	
+2	Protocol ID	2 byte	High-order	00 h	The Modbus/TCP master returns a copy of the protocol ID value specified during transmission from this product.
+3			Low-order	00 h	
+4	Total number of bytes	2 byte	High-order	00 h	Returns the message byte length from the byte order +6 to the end. The value changes depending on the data read word count. If 4 words are read, the value will be 000B h.
+5			Low-order	0B h	
+6	Unit ID	1 byte	-	FF h	The Modbus/TCP master returns a copy of the unit ID value specified during transmission from this product.
+7	Function code	1 byte	-	17 h	Returns the executed Modbus function code 17 h.
+8	Read data byte count	1 byte	-	08 h	Byte length of the read data. If 4 words are read, 08 h will be returned.
+9	Read data n+0	2 byte	High-order	04 h	The read-out register number value of this product. 1st word Example: When the value is an integer 1234: 04D2 h
+10			Low-order	D2 h	
+11	Same as above n+1	2 byte	High-order	16 h	The read-out register number value of this product. 2nd word Example: When the value is an integer 5678: 162E h
+12			Low-order	2E h	
+13	Same as above n+2	2 byte	High-order	03 h	The read-out register number value of this product. 3rd word Example: When the value is an integer 1000: 03E8 h
+14			Low-order	E8 h	
+15	Same as above n+3	2 byte	High-order	FC h	The read-out register number value of this product. 4th word Example: When the value is a signed integer -1000: FC18 h
+16			Low-order	18 h	

Reception frame (with error)

Byte order	Item	Data length	High/low-order byte	Value	Details
+0	Transfer ID	2 byte	High-order	00 h	The Modbus/TCP master returns a copy of the transfer ID value specified during transmission from this product.
+1			Low-order	00 h	
+2	Protocol ID	2 byte	High-order	00 h	The Modbus/TCP master returns a copy of the protocol ID value specified during transmission from this product.
+3			Low-order	00 h	
+4	Total number of bytes	2 byte	High-order	00 h	Returns the message byte length from the byte order +6 to +8.
+5			Low-order	03 h	
+6	Unit ID	1 byte	-	FF h	The Modbus/TCP master returns a copy of the unit ID value specified during transmission from this product.
+7	Function code	1 byte	-	97 h	It returns the value of the executed Modbus function code 17 h plus 80 h (highest bit in the byte), which indicates an error.
+8	Error code	1 byte	-	** h	The generated error code is returned. (01 h function code error, 02 h register number specification error, 03 h data error, 04 h server device error)

3-3 Ethernet Socket Communication

This section shows the data structure when sending/receiving data from a client to this product via socket communication.

3-3-1 Transmission Data and Reception Data

After opening the port, the client sends or receives the following data to or from the product. The port is closed when there no longer is the need to send or receive data.

Transmitted data

Byte count	Meaning of data	Value of data	Description	
+0	Command	53 h	Data access request	
Unit specification +1	Transfer data specification	Bit 0	Reading process input data / digital input / allocated status data (*1) Up to 32 words (*3) for all channels used + 1 word for digital input + 2 words for allocated status data are read at once.	
		Bit 1	Writing process output data / digital I/O / allocated operation data (*2) Up to 32 words (*3) for all channels used + 1 word for digital output + 2 words for allocated operation data are read at once.	
		Bit 2	Parameter access	When reading the parameter, bit 2 = 1 and bit 3 = 0. When writing the parameter, bit 2 = 1 and bit 3 = 1.
		Bit 3	Executes parameter access by writing (1) or reading (0)	
		Bit 4	Background access mode: Allows the data to be read/written from a slow IO-Link device without interrupting the socket communication from others. When Bit 2 is 1, the normal response code will be 62 h (read) and 42 h (write). When Bit 2 is 0, the response of the last command sent will be checked.	
		Bit 5	Forced stop of background access	
		Bit 7 to 6	Reserved (0)	
+2	Specify unit	80 h to 8F h	IO-Link device channel 0 to F	Note: In Ethernet socket communication, the data of the target sensor unit connected to UC2-IOL is read and written via UC2-IOL indexes 262 and 263.
		C0 h to CF h	IO-Link device Channels 0 to F Specify the read/ write data of 4 bytes or less in little endian.	
		FF h	Product master parameters	
+3	Index number or master parameter number Low-order byte		IO-Link device index number (decimal low-order) of the parameter access, or parameter number (low-order) for the master parameter of this product	
+4	Index number or master parameter number High-order byte		IO-Link device index number (decimal high-order) of the parameter access, or parameter number (high-order) for the master parameter of this product	
+5	Sub-index number or master parameter target number		The IO-Link device sub-index number of the parameter access, or the target number for the master parameter of this product.	

Byte count	Meaning of data	Value of data	Description
+6	Write data		The write data continues as digital output data (2 bytes), allocated operation data (2 bytes), process output data for all channels (64 bytes), parameter bytes to be read (*4) (2 bytes) and parameter to be written (1 to 500 bytes). If process output data is not specified, it will start with the parameter.
+7	Same as above		
(Same below)			

*1: Allocated status data

The allocated status data consists of the following bits.

Bit	Data name
15	Error flag
14	IO-Link ready flag
8 to 11	Latest error channel
7	Event flag
6	I/O power supply flag
5	Output overcurrent flag
0 to 3	Latest event channel

For the details of each data, refer to {Reading status data of this product} in “4-1 Product functions” of Common Edition.

If the host network type is “Ethernet & Modbus/TCP”, the “synchronization establishment flag” does not exist.

*2: Allocated operation data

The allocated operation data consists of the following bits.

Bit	Data name
15	Clear the latest error
7	Clear the latest event
6	Reset encoder counter

For the details of each data, refer to {Writing operation data of this product} in “4-1 Product functions” of Common Edition.

*3: With socket communication, process data assigned to this product are read or written in a batch for all channels according to the following settings in the master parameter of this product.

M40. Number of process input data words allocation

M41. Number of process output data words allocation

Therefore, the allocation for each channel depends on the master parameter M40/41 of this product.

*4: If decimal 0 is specified for the number of bytes of the parameter to be read, the response for the length of the actual parameter will be returned. In such a case, the maximum number of bytes that can be read will be 500 bytes. If the transfer data specification is decimal 10, it is not necessary to send the parameter bytes to be read.

Received Data

Byte order	Meaning of data	Value of data	Description
+0	Response code	41 h	Parameter write normal response
		4E h	Response without data specification
		50 h	Process output data write normal response
		61 h	Parameter read normal response
		70 h	Process input data read header
		62 h	Parameter read data is being prepared in the background access mode
		42 h	Parameter writing is being processed in the background access mode
		51 h	Background access mode canceled
		45 h	Parameter write error response
		46 h	Parameter write error response (extension error code)
		65 h	Parameter read error response
		66 h	Parameter read error response (extension error code)
+1	Error code	00 h	Normal
		02 h	Received socket data length is too short
		03 h	Time-out occurred in parameter access
		04 h	Unexpected response is returned in the parameter access
		05 h	The unit-specified value is out of range
		06 h	The number of parameter bytes to be read is too long (over 500 bytes)
		07 h	An access request was made again during data access. *After making a background access request, set the transfer data specification of transmission data +1 to 10 to complete reading or writing, or set it to 20 to cancel.
		08 h	Background access has never been performed
	Extension error code		
+2	Read data or the next response code		The write data continues as digital input data (2 bytes), allocated status data (2 bytes), process input data for all channels (64 bytes) and read data (1 to 400 bytes). If process input data is not specified, it will start with the parameter. Example: Normal response when transfer data specification is 07 70 h, 00 h, process input data (68 bytes), 50 h, 00 h, 61 h, 00 h, parameter read data
+3	Same as above		
(Same below)			

3-3-2 Example of Data Transmission/Reception

Below are some examples of sending and receiving data to and from this product via socket communication.

Example: Exchanging Process Input/Output Data

Process input data (including allocated status data) for all channels of this product are read and process output data (including allocated operation data) for all channels are written.

The allocation of process input data for each channel depends on the settings of the master parameter M40 (“Number of process input data words allocation”) of this product. The allocation of process output data for each channel depends on the settings of the master parameter M41 (“Number of process output data words allocation”) of this product.

Transmission data string (process I/O data exchange)

Byte order	Value of data	Description
+0	53 h	Command
+1	03 h	Bit 1 = Digital output data and write of process output data of all channels (including allocated operation data) Bit 0 = Reads the digital input data and process input data for all channels (including allocated status data)
+2	00 h	Unit specification (dummy)
+3	00 h	Low order of index number (dummy)
+4	00 h	High order of index number (dummy)
+5	00 h	Subindex number (dummy)
+6	15 h	Digital output data output on/off control Channels 0 to 7: Supports bits 0 to 7 (Example: Channels 0, 2 and 4 will be on at 15 h)
+7	30 h	Digital output data output on/off control Channels 8 to F: Supports bits 8 to 15 (Example: Channels C and D will be on at 30 h)
+8	00 h	Process output data allocated operation data low order
+9	00 h	Process output data allocated operation data high order
+10	00 h	Process output data allocation +0 word low order
+11	00 h	Process output data allocation +0 word high order
+12	00 h	Process output data allocation +1 word low order
+13	00 h	Process output data allocation +1 word high order
+14	00 h	Process output data allocation +2 word low order
+15	00 h	Process output data allocation +2 word high order
…	…	…
+72	00 h	Process output data allocation +31 word low order
+73	00 h	Process output data allocation +31 word high order

Response data string

Byte order	Value of data	Description
+0	70 h	Process input data read header
+1	00 h	Normal response code
+2	A2 h	Digital input Data input on/off state Channels 0 to 7: Supports bits 0 to 7 (Example: Channels 1, 5 and 7 will be on at A2 h)
+3	18 h	Digital input Data input on/off state Channels 8 to F: Supports bits 8 to 15 (Example: Channels B and C will be on at 18 h)
+4	00 h	Process input data allocation status data low order
+5	00 h	Process input data allocation status data high order
+6	00 h	Process input data allocation +0 word low order
+7	00 h	Process input data allocation +0 word high order
+8	00 h	Process input data allocation +1 word low order
+9	00 h	Process input data allocation +1 word high order
+10	00 h	Process input data allocation +2 word low order
+11	00 h	Process input data allocation +2 word high order
…	…	…
+68	00 h	Process input data allocation +31 word low order
+69	00 h	Process input data allocation +31 word high order
+70	50 h	Process output data write normal response
+71	00 h	Normal response code

Example: Exchanging Process Input/Output Data and Reading Master Parameter

Process input data (including allocated status data) for all channels of this product are read and process output data (including allocated operation data) for all channels are written. At the same time, the master parameter number 8 of this product is read.

Transmission data string (exchanging process input/output data and reading master parameter)

Byte order	Value of data	Description
+0	53 h	Command
+1	07 h	Bit 3 = Read specification (0), Bit 2 = Parameter access, Bit 1 = Digital output data and write of process output data of all channels (including allocated operation data) Bit 0 = Reads the digital input data and process input data for all channels (including allocated status data)
+2	FF h	Unit specification = Master parameter of this product
+3	08 h	Low order of the master parameter number (decimal 8)
+4	00 h	High order of the master parameter number (decimal 8)
+5	00 h	Subindex number (decimal 0)
+6	15 h	Digital output data output on/off control Channel 0 to 7: Supports bits 0 to 7 (Example: Channels 0, 2, and 4 will be on at 15 h)
+7	30 h	Digital output data output on/off control Channels 8 to F: Supports bits 8 to 15 (Example: Channels C and D will be on at 30 h)
+8	00 h	Process output data allocated operation data low order
+9	00 h	Process output data allocated operation data high order
+10	00 h	Process output data allocation +0 word low order
+11	00 h	Process output data allocation +0 word high order
+12	00 h	Process output data allocation +1 word low order
+13	00 h	Process output data allocation +1 word high order
+14	00 h	Process output data allocation +2 word low order
+15	00 h	Process output data allocation +2 word high order
…	…	…
+72	00 h	Process output data allocation +31 word low order
+73	00 h	Process output data allocation +31 word high order
+74	00 h	Low order of the number of bytes (decimal 0) of the parameter to be read Note: For decimal 0, only the actual number of data is read.
+75	00 h	High order of the number of bytes (decimal 0) of the parameter to be read

Response data string

Byte order	Value of data	Description
+0	70 h	Process input data read header
+1	00 h	Normal response code
+2	A2 h	Digital input Data input on/off Channel 0 to 7: Supports bits 0 to 7 (Example: Channels 1, 5 and 7 will be on at A2 h)
+3	18 h	Digital input Data input on/off Channels 8 to F: Supports bits 8 to 15 (Example: Channels B and C will be on at 18 h)
+4	00 h	Process input data allocation status data low order
+5	00 h	Process input data allocation status data high order
+6	00 h	Process input data allocation +0 word low order
+7	00 h	Process input data allocation +0 word high order
+8	00 h	Process input data allocation +1 word low order
+9	00 h	Process input data allocation +1 word high order
+10	00 h	Process input data allocation +2 word low order
+11	00 h	Process input data allocation +2 word high order
…	…	…
+68	00 h	Process input data allocation +31 word low order
+69	00 h	Process input data allocation +31 word high order
+70	50 h	Process output data write normal response
+71	00 h	Normal response code
+72	61 h	Parameter read completed
+73	00 h	Normal response code
+74	30 h	Read data (1st byte of character string “012345”)
+75	31 h	Read data (2nd byte of character string “012345”)
+76	32 h	Read data (3rd byte of character string “012345”)
+77	33 h	Read data (4th byte of character string “012345”)
+78	34 h	Read data (5th byte of character string “012345”)
+79	35 h	Read data (6th byte of character string “012345”)

3-3-3 Flow in Background Access

Example: IO-Link Device Parameter Read Request

Reads the index number decimal 1000 of the IO-Link device on channel 0 in the background.

Transmission data string (IO-Link device parameter read request)

Byte order	Value of data	Description
+0	53 h	Command
+1	14 h	Bit 4 = Background access, Bit 3 = Read specification (0), Bit 2 = Parameter access
+2	80 h	Unit specification (IO-Link device on channel 0)
+3	E8 h	Lower index number (decimal 1000)
+4	03 h	Upper index number (decimal 1000)
+5	01 h	Subindex number (decimal 1)
+6	00 h	Low order of the number of bytes of the parameter to be read Note: For decimal 0, only the actual number of data is read.
+7	00 h	High order of the number of bytes (decimal 0) of the parameter to be read

Response data string

The following parts will not occur if there is no conflict.

Byte order	Value of data	Description
+0	65 h	Parameter read error response
+1	07 h	Background access is being used elsewhere

Transmission data string (resend)

The following parts will not occur if there is no conflict.

Byte order	Value of data	Description
+0	53 h	Command
+1	14 h	Bit 4 = Background access, Bit 2 = Parameter access
+2	80 h	Unit specification (IO-Link device on channel 0)
+3	E8 h	Lower index number (decimal 1000)
+4	03 h	Upper index number (decimal 1000)
+5	01 h	Subindex number (decimal 1)
+6	00 h	Low order of the number of bytes of the parameter to be read Note: For decimal 0, only the actual number of data is read.
+7	00 h	High order of the number of bytes (decimal 0) of the parameter to be read

Response data string

Byte order	Value of data	Description
+0	62 h	Read data is being prepared
+1	00 h	Normal response code

Transmission data (status check)

Byte order	Value of data	Description
+0	53 h	Command
+1	10 h	Bit 4 = Background access
+2	80 h	Unit specification (IO-Link device on channel 0) Note: Sends the same data as when a read request is made.
+3	E8 h	Lower index number (decimal 1000)
+4	03 h	Upper index number (decimal 1000)
+5	01 h	Subindex number (decimal 1)

Response data string

Byte order	Value of data	Description
+0	61 h	Reading completed
+1	00 h	Normal response code
+2	D0 h	Low order of read data (decimal 2000)
+3	07 h	High order of read data (decimal 2000)

Example: IO-Link Device Parameter Write Request

Writes the index number decimal 100 of the IO-Link device on channel 3 to decimal 500 in background.

Transmission data string (parameter write request)

Byte order	Value of data	Description
+0	53 h	Command
+1	1C h	Bit 4 = Background access, Bit 3 = Write specification (1), Bit 2 = Parameter access
+2	83 h	Unit specification (IO-Link device on channel 3)
+3	64 h	Lower index number (decimal 100)
+4	00 h	Upper index number (decimal 100)
+5	00 h	Subindex number (decimal 0)
+6	F4 h	Low order of write data (decimal 500)
+7	01 h	High order of write data (decimal 500)

Response data string

The following parts will not occur if there is no conflict.

Byte order	Value of data	Description
+0	45 h	Parameter write error response
+1	07 h	Background access is being used elsewhere

Transmission data string (resend)

The following parts will not occur if there is no conflict.

Byte order	Value of data	Description
+0	53 h	Command
+1	1C h	Bit 4 = Background access, Bit 3 = Write specification (1), Bit 2 = Parameter access
+2	83 h	Unit specification (IO-Link device on channel 3)
+3	64 h	Lower index number (decimal 100)
+4	00 h	Upper index number (decimal 100)
+5	00 h	Subindex number (decimal 0)
+6	F4 h	Low order of write data (decimal 500)
+7	01 h	High order of write data (decimal 500)

Response data string

Byte order	Value of data	Description
+0	42 h	Writing in progress
+1	00 h	Normal response code

Transmission data (status check)

Byte order	Value of data	Description
+0	53 h	Command
+1	10 h	Bit 4 = Background access
+2	83 h	Unit specification (IO-Link device on channel 3) Note: Sends the same data as when a read request is made.
+3	64 h	Lower index number (decimal 100)
+4	00 h	Upper index number (decimal 100)
+5	00 h	Subindex number (decimal 0)

Response data string

Byte order	Value of data	Description
+0	41 h	Writing completed
+1	00 h	Normal response code

4

Specifications

Describes the specifications for “Ethernet & Modbus/TCP” network types with this product.

4-1 Specifications

4-1-1 Communication Specifications

Item		Specifications
Host network communication protocol		Modbus/TCP communication or Ethernet socket communication (protocol dedicated for UR-E Series)
Conforming standard		IEEE802.3u
Transmission speed		10 Mbps (10BASE-T), 100 Mbps (100BASE-TX)
Cable		Twisted pair cable (STP) Category 5, 5e and above
Ethernet connection type		Star configuration, linear bus configuration
Modbus communication	Master (client) / Server	Operates as a Modbus server
	Transport layer protocol	TCP or UDP
	Port number	502 (common to TCP/IP and UDP/IP)
	Corresponding function code	3, 6, 16, 23
	Register number	400001 to 465536
	Distance between nodes	Within 100m
	IP address setting	Static IP address only
	No. of connectable units	Number of units that can be connected from one Modbus/TCP master: It depends on the specifications of the Modbus/TCP master
	Number of simultaneous connections	Modbus/TCP: 2 Modbus/UDP: 4
Socket communication	Transport layer protocol	TCP or UDP
	Port number	2001 (common to TCP/IP and UDP/IP)
	IP address setting	Static IP address only
	Number of simultaneous connections	TCP/IP: 2 UDP/IP: 4

4-2 Data Processing Time

4-2-1 Process Data Response Time Calculation

Below is the response time of process data from the Ethernet socket communication client via Ethernet socket communication and IO-Link.

MEMO

The processing time of the client that uses the Ethernet socket communication is determined by the program on the client side of the Ethernet socket communication, but here it is assumed that the host program and the Ethernet socket communication are synchronized.

Ethernet Socket Communication Request Message Processing Time of This Product

The Ethernet socket communication request message processing time is from when this product receives a request message from the Ethernet socket communication client to when the processing is completed and the response message is sent.
This depends on the data transferred from the client, the type of accessed data, and the size of data as follows.

Process input data

(IO-Link cycle time) x 1 to 2 + (host program cycle time) x 1 to 2
Example) When the IO-Link cycle time is 0.5 ms and the host program cycle time is 10 ms: 10.5 to 21 ms

Process output data

(Cycle time of host program) + (IO-Link cycle time) x 1 to 2
Example) When the IO-Link cycle time is 0.5 ms and the host program cycle time is 10 ms: 10.5 to 11 ms

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 of 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, on-request data bytes: 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 IO-Link communication, 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 network 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.

Condition: Ethernet socket communication cycle of 10 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 programmed is as follows.
(IO-Link device cycle time 0.5 ms) x 1 to 2 + (host program cycle time 10 ms) x 1 to 2 = 10.5 to 21 ms

5

Troubleshooting

Describes methods of troubleshooting related to Modbus/TCP 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		Make sure the IP address is not a duplicate of any other.
Off	Flashing green	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 the subnet mask is not 255.255.255.0 and the default gateway is not 0.0.0.0, change to these settings.
Flashing green	Lit green	Connection not established	Incorrect device file	Check if the device file of this product is used on the master side.
			IP address setting is invalid	• Check whether the device IP address is correctly set on the master side. • Make sure the network part is the same in the master and product IP addresses. Example) When the subnet mask is 255.255.255.0: Master: 192.168.0.2 This product: 192.168.0.1 The underlined part is the network.

Front LEDs (on this product)	Status	Procedure
L/A 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	-	Internal IC startup of Modbus/TCP	The Modbus/TCP network chip is starting up.	-
Off	-		Network chip for Modbus/TCP 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.
Flashing green	-	Network chip firmware transferring	The Modbus/TCP network chip firmware is undergoing internal transfer.	-

Front LEDs (on this product)		Status	Details	Procedure
RUN	NTWK ST			
Lit green	Lit green	Modbus/TCP communication status	Communication with the Modbus/TCP master station is normal.	-
Lit green	Flashing green		Communication disconnection	• Confirm the Modbus/TCP master status (for details, refer to the manual of the Modbus/TCP master station in use). • Confirm the status of the Modbus/TCP cable. • Confirm the status of the Switching Hub between the Modbus/TCP 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 the Modbus/TCP master
				  • Product front panel lowest digit setting IP address
				  • Modbus/TCP 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 Modbus/TCP	ALARM LED flashing red	Error flag ON	FFFA	Modbus/TCP communication stops	Confirm the status of the host network (Modbus/TCP).

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.). This ISDU handling error may occur when the power supply to the IO-Link device is unstable. Use a power supply with sufficient capacity
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”.

Code (hexadecimal)	Message	Conditions	Procedure
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.
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.

Code (hexadecimal)	Message	Conditions	Procedure
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.
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 “Type 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 “Type 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 Modbus/TCP communication is established but then is 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

The following is listed.

· Master parameter of this product when reading and writing by Modbus/TCP communication or socket communication

· Socket communication program example

App-1 List of Product Master Parameters

This section lists the master parameters of this product that can be set or monitored via socket communication.

- For Modbus/TCP communication, register numbers 05500 to 06565 are written or read.
  For details, refer to "■ Master Parameters" in "3-2-2 Detailed List of Register Numbers" in "3-2 Modbus/TCP Communication".
- For socket communication, bit 2/3 (parameter access / write or read) with transfer data specification, FF h (master Parameter of this unit) with unit specification, master parameter number, and target number are specified and written/read.

To set or monitor with the front panel controls, Common Edition refer to "5-1-4 Master Parameter List with Product Front Panel Operation".

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).

App-1-1 User Settings

For socket communication, specify the master parameter number and target number in the table below.
Note: In the right column of the table below, items that can be accessed via product front panel operation, Modbus/TCP communication or socket communication are marked with ●.

Master parameter numbers DEC (HEX)	Target number 0 to 15: Corresponds to channel number 0: This product	Data name	R/W	Format	Length bytes	Value		Front panel controls (Master parameter numbers)	Socket communication
1(1 h)	0	IO-Link master parameters reset	RW	UINT	1	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.		
2(2 h)	0	Network type	RW	UINT	1	Specifies the host industrial 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	Display brightness	RW	UINT	1	1 to 20 (default value: 7)	Display brightness Values multiplied by 5 are equivalent to % display.	●(M4)	●
5(5 h)	0	Language	RW	INT	1	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	Time zone -UTC-	RW	UINT	1	-96 to 96 (default value: 0)	Set the time zone (in 15-minute increments) for the displayed network time (parameter number: M65). If the network time set from the host is based on UTC, setting the time zone as 9 x 4 = 36 will display the Japan standard time (JST).	●(M6)	●

Master parameter numbers DEC (HEX)	Target number 0 to 15: Corresponds to channel number 0: This product	Data name	R/W	Format	Length bytes	Value		Front panel controls (Master parameter numbers)	Socket communication
8(8 h)	0	User tag name of this IO-Link master unit	RW	STRING	1 to 32	Up to 32 characters	Set the product user tag name up to 32 characters.	●(M8)	●
9(9 h)	0	I/O batch setting	RW	UINT	1	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	I/O assignment settings	RW	UINT	1	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		
11(B h)	0 to 15	Input filter	RW	UINT	1	0 (default value)	None	●(M11)	●
						1	0.1 ms		
						2	1 ms		
						3	5 ms		
						4	10 ms		
						5	20 ms		
12(C h)	0 to 15	Input hold time	RW	UINT	1	0 (default value)	None	●(M12)	●
						1	1 ms		
						2	15 ms		
						3	100 ms		
13(D h)	0 to 15	Handling of IO-Link communication and network error generation	RW	UINT	1	0 (default value)	Clear	●(M13)	●
						1	Input hold		
						2	Output hold		
						3	All Hold		
14(E h)	0	UC2-IOL direct output start channel	RW	UINT	1	0 (default value)	The UC2 direct output function is not used.	●(M14)	●
						1 to 16	The output signal of the sensor unit received from our IO-Link gateway UC2-IOL is output directly from the PNP/NPN output of this product. Specified values 1 through 16 correspond to channel numbers 0 through F on which to "start" output.		

Master parameter numbers DEC (HEX)	Target number 0 to 15: Corresponds to channel number 0: This product	Data name	R/W	Format	Length bytes	Value		Front panel controls (Master parameter numbers)	Socket communication
15(F h)	0	Encoder input(ABZ)	RW	UINT	1	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		
21(15 h)	0 to 15	I/O synchronization	RW	UINT	2	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	Device ID	RW	UINT	3	0x0 - 0xFFFFFF (default value: 0x 0)	This is the device ID used for verification with IO-Link devices. Refer to "M29. Device ID" in "5-1-4 Master parameter list with product front panel operation" of Common Edition for details.	●(M29)	●

Master parameter numbers DEC (HEX)	Target number 0 to 15: Corresponds to channel number 0: This product	Data name	R/W	Format	Length bytes	Value		Front panel controls (Master parameter numbers)	Socket communication
30(1E h)	0 to 15	Device verification	RW	UINT	1	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.		
						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 Parameter 1.		
						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 Parameter 1.		

Master parameter numbers DEC (HEX)	Target number 0 to 15: Corresponds to channel number 0: This product	Data name	R/W	Format	Length bytes	Value		Front panel controls (Master parameter numbers)	Socket communication
31(1F h)	0 to 15	Automatic device parameter backup	RW	UINT	1	0 (default value)	None	●(M31)	●
						1	Auto backup When IO-Link device Parameters 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” (Parameter number: M30) to correct the verification error (FFFE h) as soon as possible.		
						2	Auto restoration Automatically restore (download setting values from this product to the IO-Link device) if the IO-Link device setting values differ from the data stored on this product during startup. In this case, note that even if the IO-Link device Parameter 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.		
32(20 h)	0 to 15	Device parameter backup/restore	RW	UINT	1	0 (default value)	None	●(M32)	●
						1	Execute backup (uploading Parameters from devices to this product) manually		
						2	Execute restoration (downloading Parameters from the product to devices) manually		
						3	Delete backup data saved in the product manually		
33(21 h)	0 to 15	Conditions for applying IODD data	RW	UINT	1	0	Device	●(M33)	●
						1 (default value)	IODD		
40(28 h)	0 to 15	Process input data words allocation	RW	UINT	1	0 to 16 (default value: 2)	Process input data words allocated to the input cycle communication area If the parameter is 0 words, it will be assigned in a packed manner.	●(M40)	●
41(29 h)	0 to 15	Process output data words allocation	RW	UINT	1	0 to 16 (default value: 2)	Process output data words allocated to the output cycle communication area If the parameter is 0 words, it will be assigned in a packed manner.	●(M41)	●

Master parameter numbers DEC (HEX)	Target number 0 to 15: Corresponds to channel number 0: This product	Data name	R/W	Format	Length bytes	Value			Front panel controls (Master parameter numbers)	Socket communication
42(2A h)	0	Process data words auto allocation	RW	UINT	1	0 (default value)	None		●(M42)	●
						1	Auto allocation			
43(2B h)	0 to 15	Process data LSB/MSB	RW	UINT	1	0 (default value)	Little endian		●(M43)	●
						1	Big endian			
44(2C h)	0 (This product)	Time stamp	RW	UINT	1	0 (default value)	No	Refer to “M44. Time stamp” in “5-1-4 Master Parameter List with Product Front Panel Operation” of Common Edition 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 -Process value-	R	UINT	1	1 to 1000	0.1 ms increments		●(M51)	●
52(34 h)	0 to 15 (corresponds to channel number)	IO-Link transmission rate	R	UINT	1	0	Not communicating		●(M52)	●
						1	COM1			
						2	COM2			
						3	COM3			
53(35 h)	0 to 15 (corresponds to channel number)	IO-Link communication error	R	UINT	1	0 to 255	To clear data, write 1 in offset +0 of parameter 114 h		●(M53)	●
54(36 h)	0 to 15	IO-Link ISDU checksum errors	R	UINT	1	0 to 255	To clear data, write 1 in offset +0 of parameter 114 h.		●(M54)	●
55(37 h)	0 to 15	IO-Link transmission rate error	R	INT	2	-1000 to 1000	IO-Link transmission rate error (0.1% unit, signed)		●(M55)	●
56(38 h)	0 to 15	IO-Link signal width error	R	INT	2	-1000 to 1000	IO-Link transmission signal width error (0.1% unit, signed)		●(M56)	●
57(39 h)	0 to 15	IO-Link communication mode	R	UINT	1	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 to “M57. Communication mode” in “5-1-4 Master Parameter List with Product Front Panel Operation” of Common Edition for details.	●(M57)	●
58(3A h)	0 to 15	Storage backup time	R	STRING	17	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 (Example: 18:59:00 20/02/29)		●(M58)	●

Master parameter numbers DEC (HEX)	Target number 0 to 15: Corresponds to channel number 0: This product	Data name	R/W	Format	Length bytes	Value		Front panel controls (Master parameter numbers)	Socket communication
60(3C h)	0	System program version of IO-Link master unit	R	UINT	4	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	Total operation hours of IO-Link master unit	R	UINT	4	0 to 2097151 (239 years)	Product cumulative operating time information (unit: hours)	●(M61)	●
62(3E h)	0	Display driven hours	R	UINT	4	0 to 262143 (30 years)	Product display operating time information (unit: hours)	●(M62)	●
63(3F h)	0	I/O power supply voltage	R	UINT	2	0 to 308	Voltage supplied to product I/O power supply (unit: 0.1 V)	●(M63)	●
64(40 h)	0	Internal temperature	R	UINT	2	-2739 to 10457	Product internal temperature (unit: 0.1°C	●(M64)	●
65(41 h)	0	Network time	R	STRING	22	00:00:00 00/01/01 to 23:59:59 99/12/31	Time and date (ex.: 18:59:00 20/2/29) Returns as a character string.	●(M65)	●
66(42 h)	0	Network communication cycle	R	UINT	2	0 to 15000	It is irrelevant when the network type is “Ethernet & Modbus/TCP”.	●(M66)	●
67(43 h9	0	Network timeout	R/W	UINT	2	0 to 30000	When the network type is “Ethernet & Modbus/TCP”, if the Ethernet communication is interrupted and the specified time elapses, a network communication stop error (FFFA h) occurs. The specified time can be specified from 0 to 30000 (300 seconds) in 10 ms increments. If it set to the default value of 0, even if Ethernet communication is interrupted, it is considered that the data has been updated internally at a cycle of about 10 ms and no error occurs. Even in such a case, an error will occur if the Ethernet cable is disconnected.	●(M67)	●
80 (50 h)	0	Default gateway	R/W	UINT	4	0.0.0.0 to 255.255. 255.255	Change if otherwise specified. If not, leave the default value. The default value is 0.0.0.0.	●(M80)	●
81 (51 h)	0	Subnet mask	R/W	UINT	4	0.0.0.0 to 255.255. 255.255	Change if otherwise specified. If not, leave the default value. The default value is 255.255.255.0	●(M81)	●
82 (52 h)	0	IP address	R/W	UINT	4	0.0.0.0 to 255.255. 255.255	Set the IP address of this product to any value. This is set only when changing the default value of 192.168.0.xxx (xxx is the value set by the rotary switch). Turning the front rotary switch while the power is on automatically switches to “M82. IP address” setting window	●(M82)	●

App-1-2 Data for Access from PLC

For socket communication, specify the master parameter number and target number in the table below.

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

Master parameter numbers	Target numbers	Data name	R/W	Offset	Value	Front panel controls	Socket communication
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 increments).		

Master parameter numbers	Target numbers	Data name	R/W	Offset	Value	Front panel controls	Socket communication
101 h	0 to 15 (corresponds to channel number)	Event data readout by channel	R	+0	Event flag	? -4. Event/ error display	●
				+1	Event byte order 1 type (*1)		
				+2	Event code upper		
				+3	Event code lower		
				+4	0		
				+5	Event byte order 2 type (*1)		
				+6	Event code upper		
				+7	Event code lower		
				+8	0		
				+9	Event byte order 3 type (*1)		
				+10	Event code upper		
				+11	Event code lower		
				+12	0		
				+13	Event byte order 4 type (*1)		
				+14	Event code upper		
				+15	Event code lower		
				+16	0		
				+17	Event byte order 5 type (*1)		
				+18	Event code upper		
				+19	Event code lower		
				+20	0		
				+21	Event byte order 6 type (*1)		
				+22	Event code upper		
				+23	Event code lower		
				+24	0		
				+25 to +150	The text string for generation times of event byte orders 1 to 6 will be displayed (in order) after the event byte order. Ex. 1: Event byte order 1 only generated at 19:15:32 on June 24, 2020: (1) 19:15:32 20/06/24 Ex. 2: Event byte orders 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	Socket communication
102 h	0	Parameter 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 Parameters as word units with exclusive disjunction (XOR) at 35 AC h		
				+7	Same as above, upper		
	1	Parameter 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	second		
				+3	minute		
				+4	hour		
				+5	day		
				+6	month		
				+7	year		
				+8	Lower parity information with readout Parameters as word units with exclusive disjunction (XOR) at 0 x35AC		
				+9	Same as above, upper		
	2	Parameter 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 to 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	Socket communication
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 Parameter 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	Socket communication
108 h	1	Right button operation response	R	-	Operation response when remotely operating product buttons using the specified target number is stored under the following decimals. Responses are as below. 1: Referencing Parameters 10 to 19: Digit position of Parameters 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			

Master parameter numbers	Target numbers	Data name	R/W	Offset	Value	Front panel controls	Socket communication
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	Socket communication
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	Noncyclic communication timeout 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	Parameter 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)		

Master parameter numbers	Target numbers	Data name	R/W	Offset	Value	Front panel controls	Socket communication
112 h	0 (This product)	Output overcurrent status	R	+0 to +1	Current output overcurrent status. 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.		
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.	-	●
			R	+1	IO-Link ISDU sum error count		
			R	+2 to +3	IO-Link transmission rate error (0.1% unit, signed)		
			R	+4 to +5	IO-Link transmission signal width error (0.1% unit, signed)		
			R	+6 to +7	Actual cycle time for IO-Link communication (0.1 ms increments)		
			R	+8	IO-Link transmission rate (0: not communicating, 1: COM1, 2: COM2, 3: COM3)		
			R	+9	Process input data byte count		
			R	+10	Process output data byte count		
			R	+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)		
			R	+12	IO-Link device on-request data byte count		
			R	+13	Process input data invalid (0: valid, 1: invalid)		
	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	Socket communication
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 register number and serial number	R	+0 to +5	6-byte MAC register number data	-	●
				+6	I/O voltage measurement calibrated value		
				+7	Internal temperature measurement calibrated value		
				+8 to +23	Product serial number (16 characters)		

*1: Details of event type (from IO-Link specifications)

Bit 7 to 6	Event occurrence type	0: Reservation, 1: Single, 2: Occurrence, 3: Resolution
Bit 5 to 4	Event type	0: Reservation, 1: Notification, 2: Warning, 3: Error
Bit 3	Event source	0: Device, 1: Master
Bit 2 to 0	Event cause	0: Unknown, 1 to 3: Reservation, 4: Application, 5 to 7: Reservation

App-2 Socket Communication Sample Programs

Here is an example of socket communication program.

Note: When performing socket communication from a PC to this product, specify a fixed IP address and a subnet mask of 255.255.255.0. The default gateway is blank (or 0.0.0.0).
If it is necessary to make the upper 3 digits of the IP address of the PC the same as the upper 3 digits of the IP address of this product, add the IP address as a port using the [Detail Setting] button in “Properties” of “Internet Protocol Version 4 (TCP/IPv4)”.

```
// Sample program for UR-ES Series Ethernet/TCP Visual Studio C++
//
// UR_ES_sample.cpp: Defines the entry point for console application.
//

#include “stdafx.h”

// Added include file
#include <winsock2.h>
#include <ws2tcpip.h>

// Add ws2_32.lib; to Configuration properties -> Linker -> Input -> Additional dependent files.
// For the project character set, use the multi-byte character set instead of Unicode.
```

Various Definitions

```
// Various definitions
//#define TCPIP                                   // Unspecified: UDP, specified: TCP/IP

#define PDIN_LEN          68                    // Process input data length
#define PDOUT_LEN         68                    // Process output data length
#define PARAM_LEN         400                   // Maximum data length of parameters
#define RESPCODE_LEN 2                          // Response code length

//Definition of the unit to access
#define UNIT_MAIN         0xFF                  // Specify the UR-ES unit
#define UNIT_IOL_CH0      0x80                  // IO-Link device on channel 0
#define UNIT_IOL_CH1      0x81                  // IO-Link device on channel 1
#define UNIT_IOL_CH2      0x82                  // IO-Link device on channel 2
#define UNIT_IOL_CH3      0x83                  // IO-Link device on channel 3
#define UNIT_IOL_CH4      0x84                  // IO-Link device on channel 4
#define UNIT_IOL_CH5      0x85                  // IO-Link device on channel 5
#define UNIT_IOL_CH6      0x86                  // IO-Link device on channel 6
#define UNIT_IOL_CH7      0x87                  // IO-Link device on channel 7
#define UNIT_IOL_CH8      0x88                  // IO-Link device on channel 8
#define UNIT_IOL_CH9      0x89                  // IO-Link device on channel 9
#define UNIT_IOL_CHA      0x8A                  // IO-Link device on channel A
#define UNIT_IOL_CHB      0x8B                  // IO-Link device on channel B
#define UNIT_IOL_CHC      0x8C                  // IO-Link device on channel C
#define UNIT_IOL_CHD      0x8D                  // IO-Link device on channel D
#define UNIT_IOL_CHE      0x8E                  // IO-Link device on channel E
#define UNIT_IOL_CHF      0x8F                  // IO-Link device on channel F

// Definition of transfer data
#define PDIN_DATA         1                     // Read process input data
#define PDOUT_DATA        2                     // Write process output data
#define PARAM_READ        4                     // Read parameter
#define PARAM_WRITE       (PARAM_READ + 8)      // Write parameter
#define BACK_STATUS       0x10                  // Background access mode
#define BACK_READ         (PARAM_READ + BACK_STATUS) // Background reading of parameter
#define BACK_WRITE        (PARAM_WRITE + BACK_STATUS)// Background writing of parameter

// Response code
#define RESP_PWRITE       0x41                  // Write parameter
#define RESP_NODATA       0x4E                  // No data
#define RESP_PDOUT        0x50                  // Write process output data
#define RESP_PREAD        0x61                  // Read parameter
#define RESP_PDIN         0x70                  // Read process input data
#define RESP_PBUSY        0x62                  // Parameter read busy
```

```
// Ethernet/TCP protocol definition
typedef struct{
    BYTE command;                   // Command
    BYTE xferData;                  // Transfer data specification
    BYTE unit;                      // Unit specification
    BYTE indexL;                    // Lower index number
    BYTE indexH;                    // Upper index number
    BYTE subindex;                  // Subindex number
    BYTE readLenL;                  // Lower byte length to read
    BYTE readLenH;                  // Upper byte length to read
} txDataNoWrite;                    // No write

typedef struct {
    BYTE command;                   // Command
    BYTE xferData;                  // Transfer data specification
    BYTE unit;                      // Unit specification
    BYTE indexL;                    // Lower index number
    BYTE indexH;                    // Upper index number
    BYTE subindex;                  // Subindex number
    BYTE pdOutData[PDOUT_LEN];      // Process output data
    BYTE readLenL;                  // Lower byte length to read
    BYTE readLenH;                  // Upper byte length to read
} txDataPDout;                      // Write process output data only

typedef struct {
    BYTE command;                   // Command
    BYTE xferData;                  // Transfer data specification
    BYTE unit;                      // Unit specification
    BYTE indexL;                    // Lower index number
    BYTE indexH;                    // Upper index number
    BYTE subindex;                  // Subindex number
    BYTE writeData[PARAM_LEN];      // Parameter write data
} txDataPwrite;                     // Write parameter only

typedef struct {
    BYTE command;                   // Command
    BYTE xferData;                  // Transfer data specification
    BYTE unit;                      // Unit specification
    BYTE indexL;                    // Lower index number
    BYTE indexH;                    // Upper index number
    BYTE subindex;                  // Subindex number
    BYTE pdOutData[PDOUT_LEN];      // Parameter write data
    BYTE writeData[PARAM_LEN];      // Parameter write data
} txDataPDoutPwrite;                // Write process output data and parameter
```

```
// Send buffer union
union txBlock {
	txDataPDoutPwrite pdOutPwrite; // Write process output data and parameter
	txDataPwrite pWrite;           // Write parameter
	txDataPDout pdOut;             // Write process output data
	txDataNoWrite noWrite;         // Read only
};

typedef struct {
	BYTE respCode;                 // Response code (RESP_NODATA, RESP_PDOUT, RESP_PWRITE)
	BYTE errCode;                  // Error code (extension error code)
} rxDataNoRead;                    // No read

typedef struct {
	BYTE respCode;                 // Response code (RESP_PDIN)
	BYTE errCode;                  // Error code (extension error code)
	BYTE pdInData[PDIN_LEN];       // Process input data
} rxDataPDin;                      // Read process input data

typedef struct {
	BYTE respCode;                 // Response code (RESP_PREAD)
	BYTE errCode;                  // Error code (extension error code)
	BYTE readData[PARAM_LEN];      // Parameter read data
} rxDataPread;                     // Read parameter only

typedef struct {
	rxDataPDin pdIn;               // Response to process read input data
	rxDataPread pRead;             // Response to read parameter
} rxDataPDinPread;

typedef struct {
	rxDataPDin pdIn;               // Response to process read input data
	rxDataNoRead pWrite;           // Response to write parameter
} rxDataPDinPwrite;

typedef struct {
	rxDataNoRead pdOut;            // Response to write process output data
	rxDataPread pRead;             // Response to read parameter
} rxDataPDoutPread;

typedef struct {
	rxDataNoRead pdOut;            // Response to write process output data
	rxDataNoRead pWrite;           // Response to write parameter
} rxDataPDoutPwrite;

typedef struct {
	rxDataPDin pdIn;               // Response to process read input data
	rxDataNoRead pdOut;            // Response to write process output data
} rxDataPDinPDout;

typedef struct {
	rxDataPDin pdIn;               // Response to process read input data
	rxDataNoRead pdOut;            // Response to write process output data
	rxDataPread pRead;             // Response to read parameter
} rxDataPDinPDoutPread;

typedef struct {
	rxDataPDin pdIn;               // Response to process read input data
	rxDataNoRead pdOut;            // Response to write process output data
	rxDataNoRead pWrite;           // Response to write parameter
} rxDataPDinPDoutPwrite;
```

```
// Receive buffer union
	union rxBlock {
	rxDataPDinPDoutPwrite pdInOutWrite; //  Read process input data, write process output data, and write parameter
	rxDataPDinPDoutPread pdInOutPread;//  Read process input data, write process output data and read parameter
	rxDataPDinPDout pdInOut;		//  Read process input data read and write process output data
	rxDataPDoutPwrite pdOutPwrite;	//  Write process output data and parameter
	rxDataPDoutPread pdOutPread;	//  Write process output data and read parameter
	rxDataPDinPwrite pdInPwrite;	//  Read process output data and write parameter
	rxDataPDinPread pdInPread;	//  Read process input data and parameter
	rxDataPread pRead;		//  Read parameter only
	rxDataPDin pdIn;		//  Read process input data only
	rxDataNoRead noRead;		//  Write process output data or parameter only
};

// Global variable
struct sockaddr_in dstAddr;

//--------------------------------------
// Socket send/receive
// dstSocket  : Connection socket ID
// txBuffer   : Send buffer
// rxBuffer   : Receive buffer
// txLength   : Send data length
// rxLength   : Receive data length
// return     : Receive data length
//          -1  : Send error
//          -2  : Receive error
//--------------------------------------
int sendRecSocket(int dstSocket, char *txBuffer, char *rxBuffer, int txLength, int rxLength)
{
	// Socket send
#ifdef TCPIP
	if (send(dstSocket, txBuffer, txLength, 0) == 0) return -1;
#else
	if (sendto(dstSocket, txBuffer, txLength, 0, (struct sockaddr *)&dstAddr, sizeof(dstAddr)) == 0) return -1;
#endif

	// Socket receive
	int recByte;
	recByte = recv(dstSocket, rxBuffer, rxLength, 0);
	if (recByte < 2) return -2;

	return recByte;
}
```

```
//---------------------------------------
// Console display of receive data
// message   : Response type string
// recByte   : Receive data length
// respCode  : Response code
// respExp   : Expected response code
// errCode   : Error code
// buffer    : Displayed buffer
// length    : Displayed data length
// return    : None
//---------------------------------------
void dispRxData(char *message, int recByte, BYTE respCode, BYTE respExp, BYTE errCode, BYTE *buffer, int length)
{
	int i;

	if (recByte == -1) {
		printf("There was an error with socket send. ¥n");
	}
	else if (recByte == -2) {
		printf("There was an error with socket receive. ¥n");
	}
	else if (respCode != respExp || errCode != 0) {
		printf("%s response code (0x% 02X) is abnormal. ¥n", message, respCode);
		printf("The error code is 0x%02X. ¥n", errCode);
	}
	else {
		printf("%s response code (0x% 02X) is normal. ¥n", message, respCode);
		if (length > 0) {
			// Displays the received data in hexadecimal
			printf("Read data:");
			for (i = 0; i < length; i++) {
				printf("%02X ", buffer[i]);
			}
			printf("¥n");
		}
	}
}
```

Main Processing

```
//---------------
// Main function
//---------------
int main()
{
	// Socket initialization
	WSADATA wsdata;
	if (WSAStartup(MAKEWORD(2, 0), &wsdata)) {
		printf (“Socket initialization failed¥n”);
		return 2;
	}

	// Set the destination IP address
	char destination[32];
	BYTE ipAdrs3rd = 1;	// 3rd byte
	BYTE ipAdrs4th = 30;	// 4th byte
	sprintf_s(destination, 32, “192.168.%d.%d¥0”, ipAdrs3rd, ipAdrs4th);

	// Specify the port number (fixed to 2001 for Ethernet/TCP of UR-ES)
	int port = 2001;

	// Set the socket structure
	memset(&dstAddr, 0, sizeof(dstAddr));
	dstAddr.sin_port = htons(port);
	dstAddr.sin_family = AF_INET;
	InetPton(AF_INET, destination, &dstAddr.sin_addr.s_addr);

	// Socket generation
	int dstSocket;
#ifdef TCPIP
	// TCP/IP connection
	dstSocket = socket(AF_INET, SOCK_STREAM, 0);

	// Connect to socket
	if (connect(dstSocket, (struct sockaddr *) &dstAddr, sizeof(dstAddr))) {
		printf(“Could not connect to%s ¥n”, destination);
		return 1;
	}
	printf(“Connected to%s ¥n”, destination);
#else
	// UDP connection
	dstSocket = socket(AF_INET, SOCK_DGRAM, 0);
#endif

	// Secure send/receive buffer
	union txBlock txBuffer = { 0 };
	union rxBlock rxBuffer = { 0 };
	int recByte;
```

Sample Program 1: Exchanging Process Input Data and Process Output Data

```
//------------------------------------------------------------
// Sample 1: Exchanging process input data and process output data
//------------------------------------------------------------
// Structure according to the transfer data specification
// Send: As it is process output data, txBuffer.pdOut
// Receive: As it is a response of process input data + process output data, rxBuffer.pdInOut
printf("sample 1¥n");
txBuffer.pdOut.command = 0x53;
txBuffer.pdOut.xferData = PDIN_DATA | PDOUT_DATA;

// Process output data: Turn on the output of channel 2 and channel F
txBuffer.pdOut.pdOutData[0] = 0x04;
txBuffer.pdOut.pdOutData[1] = 0x80;

// Socket send/receive
recByte = sendRecSocket(
      dstSocket,                                  // Socket ID
      (char *)&txBuffer,                          // Send buffer
      (char *)&rxBuffer,                          // Receive buffer
      sizeof(txDataPDout),                        // Send data length
      sizeof(rxDataPDinPDout)                     // Receive data length
);
dispRxData(
      "Read process input data",                  // Displayed character string
      recByte,                                    // Receive data length
      rxBuffer.pdInOut.pdIn.respCode,             // Response code of read process input data
      RESP_PDIN,                                  // Expected response code
      rxBuffer.pdInOut.pdIn.errCode,              // Error code of read process input data
      (BYTE *)&rxBuffer.pdInOut.pdIn.pdInData,    // Display data address
      PDIN_LEN                                    // Displayed data length
);
dispRxData(
      "Write process output data",                // Displayed character string
      recByte,                                    // Receive data length
      rxBuffer.pdInOut.pdOut.respCode,            // Response code of write process output data
      RESP_PDOUT,                                 // Expected response code
      rxBuffer.pdInOut.pdOut.errCode,             // Error code of write process output data
      (BYTE *)&rxBuffer.pdInOut.pdOut.errCode,    // Display data address (dummy)
      0                                           // Displayed data length
);
```

Sample Program 2: Reading Parameter

```
//--------------------------------
// Sample 2: Reading parameter
//--------------------------------
// Structure according to the transfer data specification
// Send: There is no data to write, so txBuffer.noWrite
// Receive: Parameter read data, so rxBuffer.pRead
printf("sample 2¥n");
txBuffer.noWrite.command = 0x53;
txBuffer.noWrite.xferData = PARAM_READ;
txBuffer.noWrite.unit = 0xFF;                  // Targets the parameters of the UR-ES unit
txBuffer.noWrite.indexH = 0x00;
txBuffer.noWrite.indexL = 0x08;                // Read index number = 8
txBuffer.noWrite.subindex = 0x00;
txBuffer.noWrite.readLenL = 0;                 // If 0 is specified as the data length to be read, the response will be the actual data length
txBuffer.noWrite.readLenH = 0;

// Socket send/receive
recByte = sendRecSocket(
      dstSocket,                               // Socket ID
      (char *)&txBuffer,                       // Send buffer
      (char *)&rxBuffer,                       // Receive buffer
      sizeof(txDataNoWrite),                   // Send data length
      sizeof(rxDataPread)                      // Receive data length
);
dispRxData(
      "Read parameter",                        // Displayed character string
      recByte,                                 // Receive data length
      rxBuffer.pRead.respCode,                 // Response code of read parameter
      RESP_PREAD,                              // Expected response code
      rxBuffer.pRead.errCode,                  // Error code of read default value
      (BYTE *)&rxBuffer.pRead.readData,        // Display data address
      recByte - RESPCODE_LEN                   // Displayed data length (delete one response code)
);
```

Sample Program 3: Exchanging Process Input Data and Process Output Data and Reading Parameters

```
//------------------------------------------------------------------------------
// Sample 3: Exchanging process input data and process output data and reading parameters
//------------------------------------------------------------------------------
// Structure according to the transfer data specification
// Send: As it is process output data, txBuffer.pdOut
// Receive: Process input data + Process output data response + Parameter read data, so rxBuffer.pdInOutPread
printf("sample 3¥n");
txBuffer.pdOut.command = 0x53;
txBuffer.pdOut.xferData = PDIN_DATA | PDOUT_DATA | PARAM_READ;

// Process output data: Turn on the output of channels 6 and 8
txBuffer.pdOut.pdOutData[0] = 0x40;
txBuffer.pdOut.pdOutData[1] = 0x01;
txBuffer.pdOut.unit = 0xFF;                    // Targets the parameters of the UR-ES unit
txBuffer.pdOut.indexH = 0x00;
txBuffer.pdOut.indexL = 0x41;                  // Read index number = 65
txBuffer.pdOut.subindex = 0x00;
txBuffer.pdOut.readLenL = 0;                   // If 0 is specified as the data length to be read, the response will be the actual
data length
txBuffer.pdOut.readLenH = 0;

// Socket send/receive
recByte = sendRecSocket(
      dstSocket,                               // Socket ID
      (char *)&txBuffer,                       // Send buffer
      (char *)&rxBuffer,                       // Receive buffer
      sizeof(txDataPDout),                     // Send data length
      sizeof(rxDataPDinPDoutPread)             // Receive data length
);
dispRxData(
      "Read process input data",               // Displayed character string
      recByte,                                 // Receive data length
      rxBuffer.pdInOutPread.pdIn.respCode,     // Response code for read process input data
      RESP_PDIN,                               // Expected response code
      rxBuffer.pdInOutPread.pdIn.errCode,      // Error code of read process input data
      (BYTE *)&rxBuffer.pdInOutPread.pdIn.pdInData,  // Display data address
      PDIN_LEN                                 // Displayed data length
);
dispRxData(
      "Write process output data",             // Displayed character string
      recByte,                                 // Receive data length
      rxBuffer.pdInOutPread.pdOut.respCode,    // Response code of write process output data
      RESP_PDOUT,                              // Expected response code
      rxBuffer.pdInOutPread.pdOut.errCode,     // Error code of write process output data
      (BYTE *)&rxBuffer.pdInOutPread.pdOut.errCode,  // Display data address (dummy)
      0                                        // Displayed data length
);
dispRxData(
      "Read parameter",                        // Displayed character string
      recByte,                                 // Receive data length
      rxBuffer.pdInOutPread.pRead.respCode,    // Response code of read parameters
      RESP_PREAD,                              // Expected response code
      rxBuffer.pdInOutPread.pRead.errCode,     // Error code of read parameters
      (BYTE *)&rxBuffer.pdInOutPread.pRead.readData,  // Display data address
      recByte - PDIN_LEN - (RESPCODE_LEN * 3)  // Displayed data length (delete process input data and three response codes)
);
```

Sample Program 4: Exchanging Process Output Data and Writing Parameters

```
//------------------------------------------------------------
// Sample 4: Exchanging process output data and writing parameters
//------------------------------------------------------------
// Structure according to the transfer data specification
// Send: Process output data + parameter write data, so txBuffer.pdOutPwrite
// Receive: Process output data response + parameter write response, so rxBuffer.pdOutPwrite
printf("sample 4¥n");
txBuffer.pdOutPwrite.command = 0x53;
txBuffer.pdOutPwrite.xferData = PDOUT_DATA | PARAM_WRITE;

// Process output data: Turn on the output of channels 6 and 8
txBuffer.pdOutPwrite.pdOutData[0] = 0x40;
txBuffer.pdOutPwrite.pdOutData[1] = 0x01;

txBuffer.pdOutPwrite.unit = 0xFF;                    // Targets the parameters of the UR-ES unit
txBuffer.pdOutPwrite.indexH = 0x00;
txBuffer.pdOutPwrite.indexL = 0x08;                  // Write index number = 8
txBuffer.pdOutPwrite.subindex = 0x00;
txBuffer.pdOutPwrite.writeData[0] = 'a';             // Data to be written
txBuffer.pdOutPwrite.writeData[1] = 'b';
txBuffer.pdOutPwrite.writeData[2] = 'c';
txBuffer.pdOutPwrite.writeData[3] = 'd';
txBuffer.pdOutPwrite.writeData[4] = 'e';
int pWriteLen = 5;                                   // Parameter write byte length

// Socket send/receive
recByte = sendRecSocket(
      dstSocket,                                     // Socket ID
      (char *)&txBuffer,                             // Send buffer
      (char *)&rxBuffer,                             // Receive buffer
      sizeof(txDataPDout) + pWriteLen,               // Send data length
      sizeof(rxDataPDoutPwrite)                      // Receive data length
);
dispRxData(
      "Write process output data",                   // Displayed character string
      recByte,                                       // Receive data length
      rxBuffer.pdOutPwrite.pdOut.respCode,           // Response code of write process output data
      RESP_PDOUT,                                    // Expected response code
      rxBuffer.pdOutPwrite.pdOut.errCode,            // Error code of write process output data
      (BYTE *)&rxBuffer.pdOutPwrite.pdOut.errCode,   // Display data address (dummy)
      0                                              // Displayed data length
);
dispRxData(
      "Write parameter",                             // Displayed character string
      recByte,                                       // Receive data length
      rxBuffer.pdOutPwrite.pWrite.respCode,          // Response code of write parameter
      RESP_PWRITE,                                   // Expected response code
      rxBuffer.pdOutPwrite.pWrite.errCode,           // Error code of write parameter
      (BYTE *)&rxBuffer.pdOutPwrite.pWrite.errCode,  // Display data address (dummy)
      0                                              // Displayed data length
);
```

Sample Program 5: Exchanging Process Input Data and Process Output Data and Reading Parameters in the Background

```
//-----------------------------------------------------------------------------------------
    // Sample 5: Exchanging process input data and process output data and reading parameters in the background
    //-----------------------------------------------------------------------------------------
    // Structure according to the transfer data specification
    // Send: As it is process output data, txBuffer.pdOut
    // Receive: Process input data + Process output data response + Parameter read data, so rxBuffer.pdInOutPread
    printf("sample 5¥n");
    txBuffer.pdOut.command = 0x53;
    txBuffer.pdOut.xferData = PDIN_DATA | PDOUT_DATA | BACK_READ;

    // Process output data: Turn on the output of channels 6 and 8
    txBuffer.pdOut.pdOutData[0] = 0x40;
    txBuffer.pdOut.pdOutData[1] = 0x01;
    txBuffer.pdOut.unit = 0xFF;                 // Targets the parameters of the UR-ES unit
    txBuffer.pdOut.indexH = 0x00;
    txBuffer.pdOut.indexL = 0x41;               // Read index number = 65
    txBuffer.pdOut.subindex = 0x00;
    txBuffer.pdOut.readLenL = 0;                // If 0 is specified as the data length to be read, the response will be the actual data length
    txBuffer.pdOut.readLenH = 0;

    do {
        // Socket send/receive
        recByte = sendRecSocket(
            dstSocket,                                      // Socket ID
            (char *)&txBuffer,                              // Send buffer
            (char *)&rxBuffer,                              // Receive buffer
            sizeof(txDataPDout),                            // Send data length
            sizeof(rxDataPDinPDoutPread)                    // Receive data length
        );
        dispRxData(
            "Read process input data",                      // Displayed character string
            recByte,                                        // Receive data length
            rxBuffer.pdInOutPread.pdIn.respCode,            // Response code for read process input data
            RESP_PDIN,                                      // Expected response code
            rxBuffer.pdInOutPread.pdIn.errCode,             // Error code of read process input data
            (BYTE *)&rxBuffer.pdInOutPread.pdIn.pdInData,   // Display data address
            PDIN_LEN                                        // Displayed data length
        );
        dispRxData(
            "Write process output data",                    // Displayed character string
            recByte,                                        // Receive data length
            rxBuffer.pdInOutPread.pdOut.respCode,           // Response code of write process output data
            RESP_PDOUT,                                     // Expected response code
            rxBuffer.pdInOutPread.pdOut.errCode,            // Error code of write process output data
            (BYTE *)&rxBuffer.pdInOutPread.pdOut.errCode,   // Display data address (dummy)
            0                                               // Displayed data length
        );
        dispRxData(
            "Read parameter",                               // Displayed character string
            recByte,                                        // Receive data length
            rxBuffer.pdInOutPread.pRead.respCode,           // Response code of read parameters
            RESP_PREAD,                                     // Expected response code
            rxBuffer.pdInOutPread.pRead.errCode,            // Error code of read parameters
            (BYTE *)&rxBuffer.pdInOutPread.pRead.readData,  // Display data address
            recByte - PDIN_LEN - (RESPCODE_LEN * 3)         // Displayed data length (delete process input data and three response codes)
        );

        // Change to background access status check
        txBuffer.pdOut.xferData = PDIN_DATA | PDOUT_DATA | BACK_STATUS;

    } while (rxBuffer.pdInOutPread.pRead.respCode == RESP_PBUSY);

    // Close socket
    closesocket(dstSocket);
    WSACleanup();

    return 0;
}
```

App-3 Index

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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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The information in this user's manual is correct as of December 2023
UR-ES-EM_UM-E-003-2312