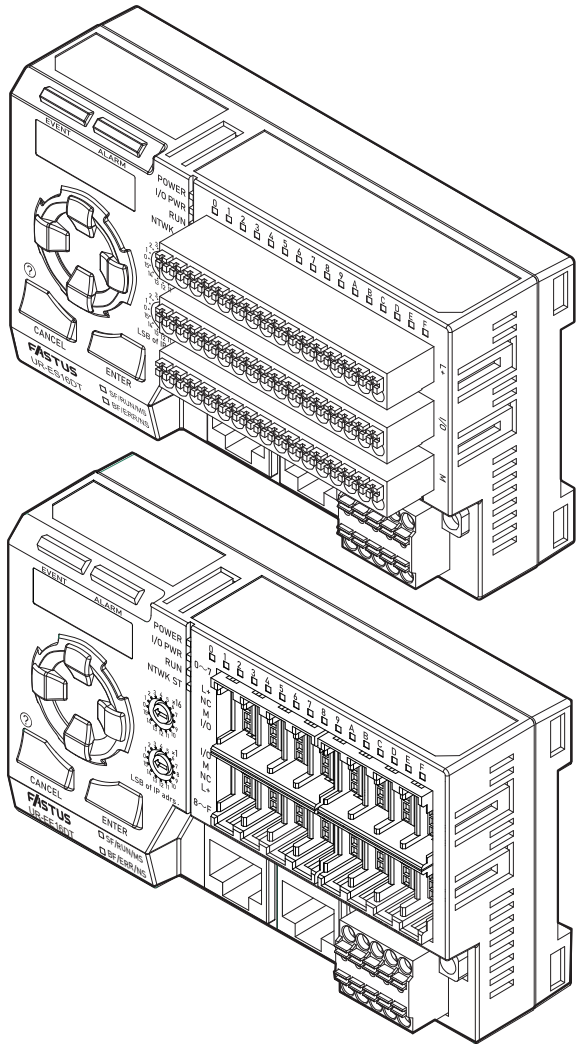
FASTUS

*FASTUS is a product brand of OPTEX FA.

IO-Link Master

UR-ES16DT, UR-EE16DT

User's Manual
CC-Link IE Field Basic Edition



OPTEX FA CO., LTD.

Introduction

Thank you for purchasing the IO-Link Master UR-ES16DT, UR-EE16DT.
This manual contains the information required when using “CC-Link IE Field Basic” 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.

- Trademarks and registered trademarks appearing in this manual are the property of their respective owners.
-

Safety Precautions

This manual uses the following symbols to display safety precautions for ensuring safe operation of the UR-ES16DT and UR-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.
⚠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 Common Edition (UR-ES_UM-XXX-XXXX) (below, the “Common Edition”).

Related Manuals

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

Product Common Edition

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

Manual number	Manual name	Details
UR-ES_UM_E-XXX-XXXX	IO-Link Master UR-ES16DT, UR-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 "CC-Link IE Field Basic" as the host network.
2. Product Initial Settings Related to CC-Link IE Field Basic	Describes initial setting for this product's IP address setting, communication connection, and front panel operation.
3. Communication	Describes the initial settings for CC-Link IE Field Basic communication and IO-Link communication, the configuration of the data to be handled, and communication examples.
4. Specifications	Describes the specifications for CC-Link IE Field Basic with this product.
5. Troubleshooting	Describes methods of troubleshooting, etc. related to CC-Link IE Field Basic communication.
6. Appendix	Describes product master setting values as well as acyclic communication sample programs when using Module FB.

Contents

3 Communication

4 Specifications

5 Troubleshooting

6 Appendix

Notations Used in this Manual

These are the notations used in this manual.

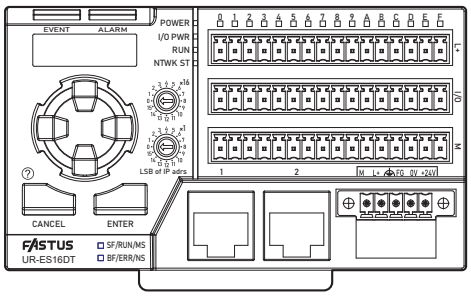
CAUTION
This indicates particularly important points to observe during operation.

MEMO
This information is useful for operation.

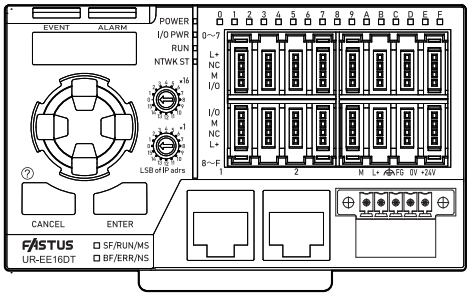
Checking the Included Items

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 CC-Link IE Field Basic master station manual.

Switching Hub

Use the following industrial Switching Hubs.

Type	Specifications
Switching Hub	Layer 2 switch For details on usable Switching Hub, refer to the CC-Link IE Field Basic master station manual and the materials on operation confirmation devices.

Terminology List

This explains the terminology used in this document.

Terminology	Description
CC-Link IE Field Basic master station	Station which controls the entire CC-Link IE Field Basic network. Able to perform cyclic and acyclic communication with all stations. 1 unit exists per 1 network. For short, it is also called the “host master station”.
Cyclic communication (cyclic transmission and process I/O communication)	The host master station regularly reads and writes the status/flag of this product and the process input/output data of the IO-Link device. This product executes process I/O communication (of IO-Link) with the IO-Link device.
Extended access function	This function uses cyclic communication to read and write settings for this product and IO-Link devices (including sensor units connected to UC2-IOL). Host master side programs can be simplified.
Acyclic communication (socket or Modbus/TCP communication)	Reads and writes the designated data in this product or an IO-Link device as necessary, using arbitrary socket communication from the host master station or the Module FB for Mitsubishi Electric PLC below. • For reading: UDP_READ • For writing: UDP_WRITE As well, this product also supports Modbus/TCP communication. However, neither socket communication nor Modbus/TCP communication is capable of writing process data.
Process I/O communication	For IO-Link communication, cyclic communication will be used for requests from the IO-Link master to IO-Link devices.
ISDU communication	For IO-Link communication, acyclic communication will be used for requests from the IO-Link master to IO-Link devices.
Link scan time	Indicates CC-Link IE Field Basic communication link scan time.
GXWorks2/3	A generic term for GXWorks3 and GX Works2.
Remote output (RY)	Information output from the CC-Link IE Field Basic master station to the slave stations in bits. Link device type.
Remote input (RX)	Information input from the slave stations to the CC-Link IE Field Basic master station in bits. Link device type.
Remote register (RWr)	Information input from the slave stations to the CC-Link IE Field Basic master station in units of 16 bits (1 word). Link device type.
Remote register (RWw)	Information output from the CC-Link IE Field Basic master station to the slave stations in units of 16 bits (1 word). Link device type.
Link device	Devices that make up the interior of a CC-Link IE Field Basic network. Generic name for RX, RY, Rwr, and RWw.
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.
Modbus/TCP communication	Request messages are issued from the Modbus/TCP master, and retaining registers within this product are read and written. When this happens, depending on the retaining register number, this product executes ISDU communication (of IO-Link) with the IO-Link device.

1

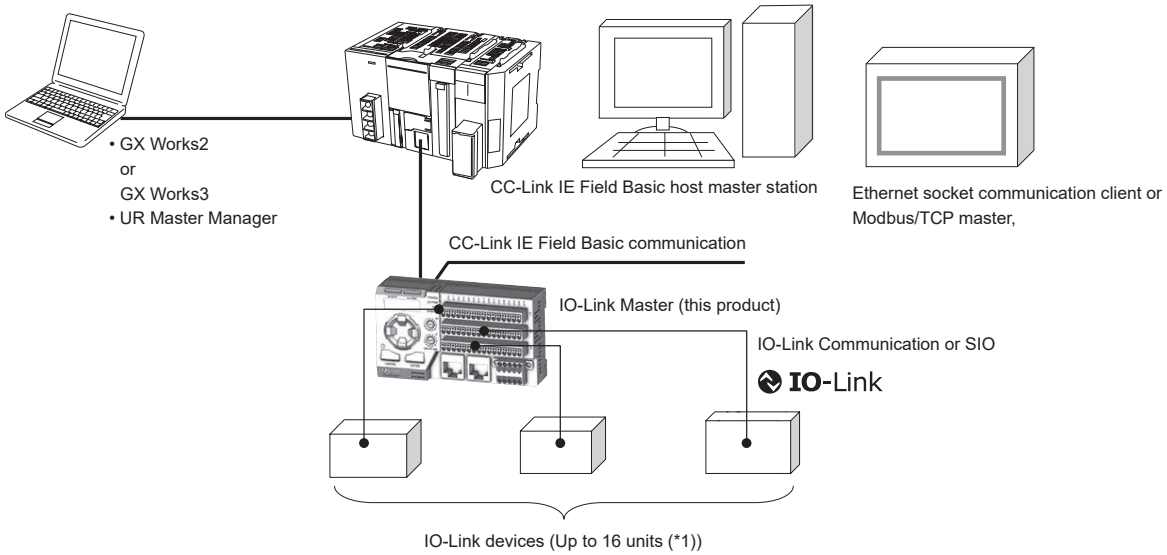
Overview

This chapter provides an overview of the use of “CC-Link IE Field Basic” as the host network.

1-1 Product Overview

When setting the network type to “CC-Link IE Field Basic”, this product conducts cyclic communication with the CC-Link IE Field Basic communication master as a CC-Link IE Field Basic communication slave station, while simultaneously communicating IO-Link process data with the connected IO-Link devices.
Regarding acyclic communication, it is also possible to send/receive data from the socket communication client on settings of this product or the connected IO-Link devices and to read/write IO-Link device process input. Similar processing is also possible with Modbus/TCP communication.

CC-Link IE Field Basic and IO-Link System Configuration Example



*1: To connect a maximum of 16 IO-Link devices to this product, the following conditions are required.
Process data size for this product with all connected IO-Link devices:
Input: Max. 32 words for all channels total
Output: Max. 32 words for all channels total

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
- With the CC-Link IE Field Basic network type, CC-Link IE Field Basic communication is possible as cyclic communication and socket or Modbus/TCP communication as acyclic communication.
- CC-Link IE Field Basic cyclic communication enables input/output with up to 16 IO-Link devices (for

default values, 2 words each input/output per device). Further, reading and writing with partial cyclic communication, without using acyclic communication, is possible for settings of this product, IO-Link device designated index/sub-index values, or “specific data” of sensor units connected to the OPTEX FA IO-Link gateway UC2-IOL (this is called extended access).

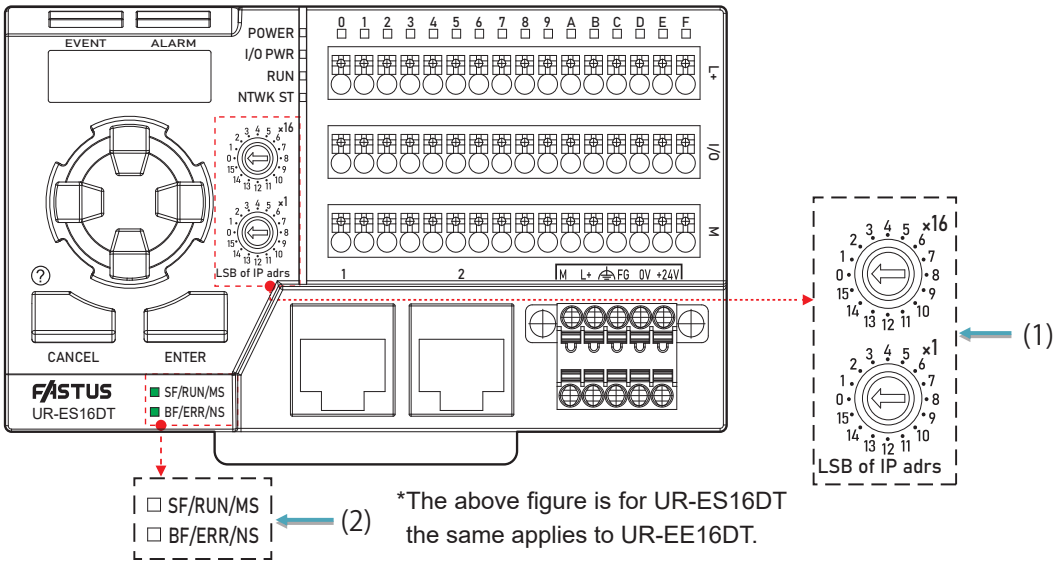
- A time stamp can also be added to the process input data. As a result, it is possible to read the time when the process input data was taken from this machine, as synchronized with the network time, with a resolution of 15.26 µs.
  Additionally, adding parity information calculated from process input data and time information, it is possible to ensure the integrity of process input data and time (data integrity: DI).
  As well, the time can be read from the IO-Link device setting value, stored in this product, and then read from the host PLC.
- Through socket communication or the Module FB for Mitsubishi Electric PLC, it is also possible to read and write this product’s settings or IO-Link device designated index/sub-index values as necessary. IO-Link device process input can also be read (process output writing is not possible).
- Similar processing is also possible with Modbus/TCP communication.
- The front panel buttons of this product can be remotely controlled from a touch panel display, etc., using socket or Modbus/TCP communication.

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 “CC-Link IE Field Basic” 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.

To set other arbitrary IP addresses, refer to “2-2-4 Product IP Address Setting”.

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

Displays the host network status.

As below for CC-Link IE Field Basic.

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 Inputting/Outputting IO-Link Devices and Process Data

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

The input/output methods are as below.

Method	Description		Reference
1) Input/output via cyclic communication	IO-Link device process data is assigned to the CC-Link IE Field Basic master station link device.		-
	For default value	• Input (IO-Link device → CC-Link IE Field Basic master station): 2 words/device • Output (CC-Link IE Field Basic master station → IO-Link device): 2 words/device	"3-3 Cyclic Communication (cyclic transmission/process I/O communication)"
	For other than default value	The following manual or auto allocations are possible.	Common Edition "Chapter 4: Product Functions"
		Manual allocation: With the following master parameters for this product, the allocation size is set to other than default values for each channel. • Input:ss "M40. Process input data words allocation": 0 to 16 words per channel (default value: 2 words) • Output: "M41. Process output data words allocation": 0 to 16 words per channel (default value: 2 words)	
		Auto allocation: In accordance with the actual IO-Link device specifications, the above master parameter word allocation is automatically set. This depends on setting "M42. Process data words auto allocation" to "Yes" (1).	
2) Confirmation with front panel controls	Confirmation is done with product front panel operation.		Common Edition "Chapter 5 Front Panel Controls"
3) Input via acyclic communication	Socket or Modbus/TCP communication enables input only (output writing is not possible)		3-4-1 Socket Communication (UDP/IP or TCP/IP) 3-4-2 Modbus/TCP Communication

1-4 Setting/Monitoring Product Master Parameters

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

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

Method	Description	Reference
1) Setting with front panel controls	Setting is done with product front panel operation.	Common Edition “Chapter 5 Front Panel Controls”
2) Setting via Module FB for Mitsubishi Electric PLC or client socket communication program, or by Modbus/TCP communication	Setting/monitoring is possible via Mitsubishi Electric Module FB for PLC or a client communication program, or by Modbus/TCP communication.	• “3-4-1 Socket Communication (UDP/IP or TCP/IP)” • “App-2 Acyclic Communication Sample Programs Using Module FB” or • “App-3 Sample Socket Communication Program”
3) Setting via cyclic communication extended access	Specific master parameters can be read/written by cyclic communication operation alone (via extended access).	“3-3 Cyclic Communication (cyclic transmission/process I/O communication)”

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

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

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

Method	Description	Reference
1) Setting/monitoring via Module FB for Mitsubishi Electric PLC or client socket communication program, or by Modbus/TCP communication	Setting/monitoring is possible via Module FB for Mitsubishi Electric PLC or a client communication program, or by Modbus/TCP communication.	• “3-4-1 Socket Communication (UDP/IP or TCP/IP)” • “3-4-2 Modbus/TCP Communication”
2) Setting/monitoring via cyclic communication extended access	Specific service data can be read/written by cyclic communication operation alone (via extended access).	“3-3 Cyclic Communication (cyclic transmission/process I/O communication)”
3) Setting/monitoring with front panel controls	Setting/monitoring is possible with front panel controls.	Common Edition “5-1-5 Device Setting Value Window”

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

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

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

Method	Description	Reference
1) Setting/monitoring via Modbus/TCP communication	Setting/monitoring of sensor unit arbitrary data is possible via Modbus/TCP communication.	“3-4-2 Modbus/TCP Communication”
2) Setting/monitoring via cyclic communication extended access	Specific data from the target sensor unit can be read/written by cyclic communication operation alone (via extended access).	“3-3 Cyclic Communication (cyclic transmission/process I/O communication)”

1-7 Basic Procedures

The process from installing and setting this product through beginning CC-Link IE Field Basic and IO-Link communication is indicated below.

Procedure	Details	References
Prior confirmation	System configuration decision: • IO-Link device types and number used In particular, calculate the number of connectable IO-Link devices based on the total process data size of each IO-Link device • (Related to the above) Determine whether to automatically allocate process data from the actual IO-Link device or manually set the number of input or output words for the IO-Link device for each channel • Each channel I/O allocation settings	1-1 Product Overview 3-3 Cyclic Communication (cyclic transmission/process I/O communication) Common Edition
	Data I/O design: • Whether to access settings with cyclic communication data operation, using cyclic communication (whether to use “extended access”) • What to read and write to this product or IO-Link device using acyclic communication	3-3 Cyclic Communication (cyclic transmission/process I/O communication) 3-4 Acyclic Communication (socket or Modbus/TCP communication)
↓	↓	
Hardware installation and wiring	CC-Link IE Field Basic master station mounting	Manual for the CC-Link IE Field Basic master station used
↓	↓	
Initial settings for front panel controls	Set “Network type” to “CC-Link IE Field Basic”	2-2 Initial Settings for Front Panel Controls
	↓	
	Product IP address setting Turn the rotary switch on the product front panel when the power is on, or set the product master parameter “M82. IP address”	2-2-4 Product IP Address Setting Common Edition
↓	↓	
Initial setting via GXWorks2/3 (Register this product to the CC-Link IE Field Basic network)	Reading CSP+ Files into GXWorks2/3	3-2-3 Read the CSP+ File for This Product into GXWorks2/3
	↓	
	In GXWorks 2/3, register this product to the CC-Link IE Field Basic network configuration	3-2-4 Setting CC-Link IE Field Basic Master Unit Parameters
	↓	
	Network configuration settings for CC-Link IE Field Basic between this product and the CC-Link IE Field Basic master station (product IP address setting and input/output assignment on GXWorks2/3)	
	↓	
	Writing configuration contents to the CC-Link IE Field Basic master station	3-2-6 Writing Configuration Contents to the CC-Link IE Field Basic Master Station
	↓	
	CC-Link IE Field Basic established (NTWK ST LED on product front panel lights up green)	1-2 Part Names and Functions

Procedure	Details	References
↓	↓	
Install the IO-Link device profile for the devices 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
↓	↓	
Product parameter setting	Using front panel controls	Common Edition
	When using socket communication from the host master station, Module FB for Mitsubishi Electric PLC, or Modbus/TCP/ISDU communication	3-4 Acyclic Communication (socket or Modbus/TCP communication)
↓	↓	
IO-Link device service data setting	Using front panel controls	Common Edition
	When using socket communication from the host master station, Mitsubishi Electric Module FB for PLC, or Modbus/TCP/ISDU communication	
↓	↓	
Starting communication	Start system (power ON)	
	↓	
	CC-Link IE Field Basic starts IO-Link communication starts	Manual for the CC-Link IE Field Basic master station used
↓	↓	
Checking operation	Verify CC-Link IE Field Basic master station and this product/IO-Link device display	Manual for the CC-Link IE Field Basic master station used 1-2 Part Names and Functions / 5-1 Troubleshooting Each IO-Link device manual
	Verifying read/write data between this product and an IO-Link device	Each IO-Link device manual
	↓	
	Confirmation of data reading/writing via cyclic communication between the CC-Link IE Field Basic master station and this product	3-3 Cyclic Communication (cyclic transmission/process I/O communication) Manual for the CC-Link IE Field Basic master station used
	↓	
	Product or IO-Link device reading/writing via acyclic (UDP or TCP socket/ISDU) communication (as necessary) Executing socket communication or the PLC Module FB for Mitsubishi Electric PLC as below: • For reading: UDP_READ • For writing: UDP_WRITE or Modbus/TCP/ISDU communication	3-4 Acyclic Communication (socket or Modbus/TCP communication)

Procedure	Details	References
↓	↓	
Troubleshooting	Confirmation of the CC-Link IE Field Basic master station and this product/IO-Link device display, response confirmation via acyclic (UDP or TCP socket/ ISDU) communication	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 or maintenance	• "2-2 Initial Settings for Front Panel Controls"
2) Acyclic communication from the host master station	Controlled operation	• "3-4 Acyclic Communication (socket or Modbus/TCP communication))" • "App-1 List of Product Master Parameters" • "App-2 Acyclic Communication Sample Programs Using Module FB"

CAUTION

- If more than 32 words are used on either the input or the output in total, the excess process data will not be assigned to the host master station (and will be ignored).
  To connect a maximum of 16 IO-Link devices to this product, the following conditions are required.
  Process data size for this product with all connected IO-Link devices:
  Input: Max. 32 words for all channels total
  Output: Max. 32 words for all channels total
- To add a particular IO-Link device type for connection after installing IODD data on this product (when required), use IODD_Converter.exe (within UR Master Manager) to install the IO-Link device. Recreate the included IODD data and install it again.
- When the IO-Link ready flag is ON, read and write process data.

2

Product Initial Settings Related to CC-Link IE Field Basic

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

2-1 Ethernet Connection

Shown here is the Ethernet connection configuration when using CC-Link IE Field Basic as the host network.

2-1-1 Connector and Cable

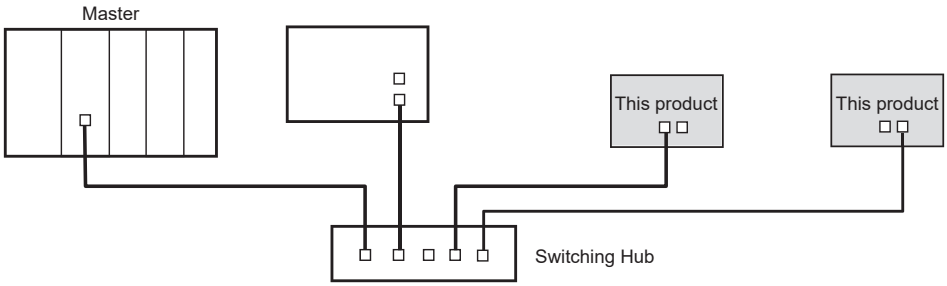
The Ethernet cable may be connected to either of the RJ45 connectors at left or right of the product.
For the cable, use an Ethernet cable that complies with the standard (100BASE-TX).
For details, refer to the CC-Link IE Field Basic master station manuals.

2-1-2 Ethernet Connection Type

Topologies capable of CC-Link IE Field Basic are star or linear bus configurations.

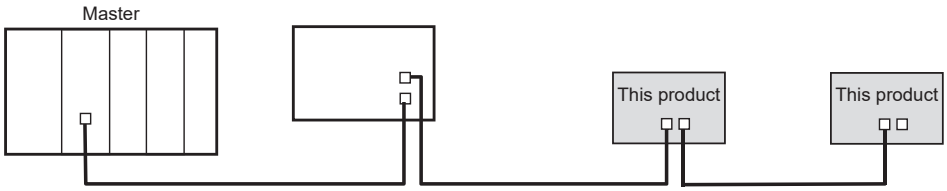
● Star configuration

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 CC-Link IE Field Basic master station manuals.

2-2 Initial Settings for Front Panel Controls

Shown here is the initial setting method via product front panel operation when using “CC-Link IE Field Basic” as the host network.

2-2-1 Powering up the CC-Link IE Field Basic Master Station

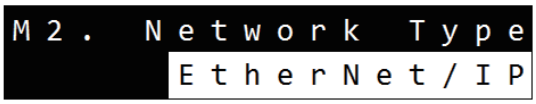
When available, apply power to the CC-Link IE Field Basic master station in advance.
This makes it possible to check whether the master station is connected correctly.

2-2-2 Language

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

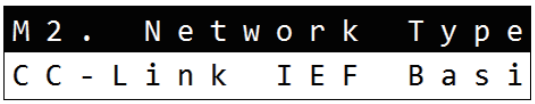
2-2-3 Network Type Setting

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



The factory default network type setting is "EtherNet/IP".

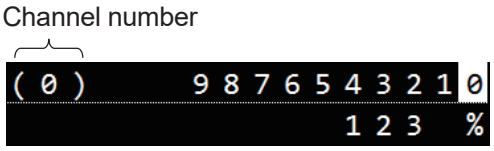
When setting the host industrial network to "CC-Link IE Field Basic," change the network type setting here to "CC-Link IE Field Basic".
Regarding "M2. Network types," refer to Common Edition "5-1-4 Master Parameter List with Product Front" Panel Operation.
Press the [↑] button four times. "CC-Link IE Field Basic" will be displayed as below (scroll display).



Press the [ENTER] button. The network type will switch to "CC-Link IE Field Basic". Wait about twenty seconds while the network chip firmware rewrites.
When rewriting is complete, there will be an automatic reboot.

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

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



Refer to Common Edition [5-1 Front panel controls] for further information about front panel operation.

2-2-4 Product IP Address Setting

Set the product IP address with the operation below. The value set here will also be set as the product IP address in the CC-Link IE Field Basic network configuration setting on GXWorks2/3 (see "3-2-4 Setting CC-Link IE Field Basic Master Unit Parameters").

1 **Turn the rotary switch on the product front panel when the power is on.**
The master parameter will automatically switch to "M82. IP address."

2 **Set the product IP address in accordance with the CC-Link IE Field Basic master station IP address (highest 3 digits): the highest 3 digits should be the same as the master station IP address and the lowest digit unique to the product.**

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

MEMO

- Note that with the product IP address set to the factory default, 192.168.0.n (where n depends on the front panel rotary switch), if, for example, the network address in CC-Link IE Field Basic communication is 192.168.3.☐, the product will not be able to communicate with the master station.
- Static IP is the only way to set the product IP address (the IP address cannot be acquired via BOOTP or DHCP).

When changing the IP address, default gateway, or subnet mask with product front panel controls, refer to Common Edition "5-1 Front Panel Controls".

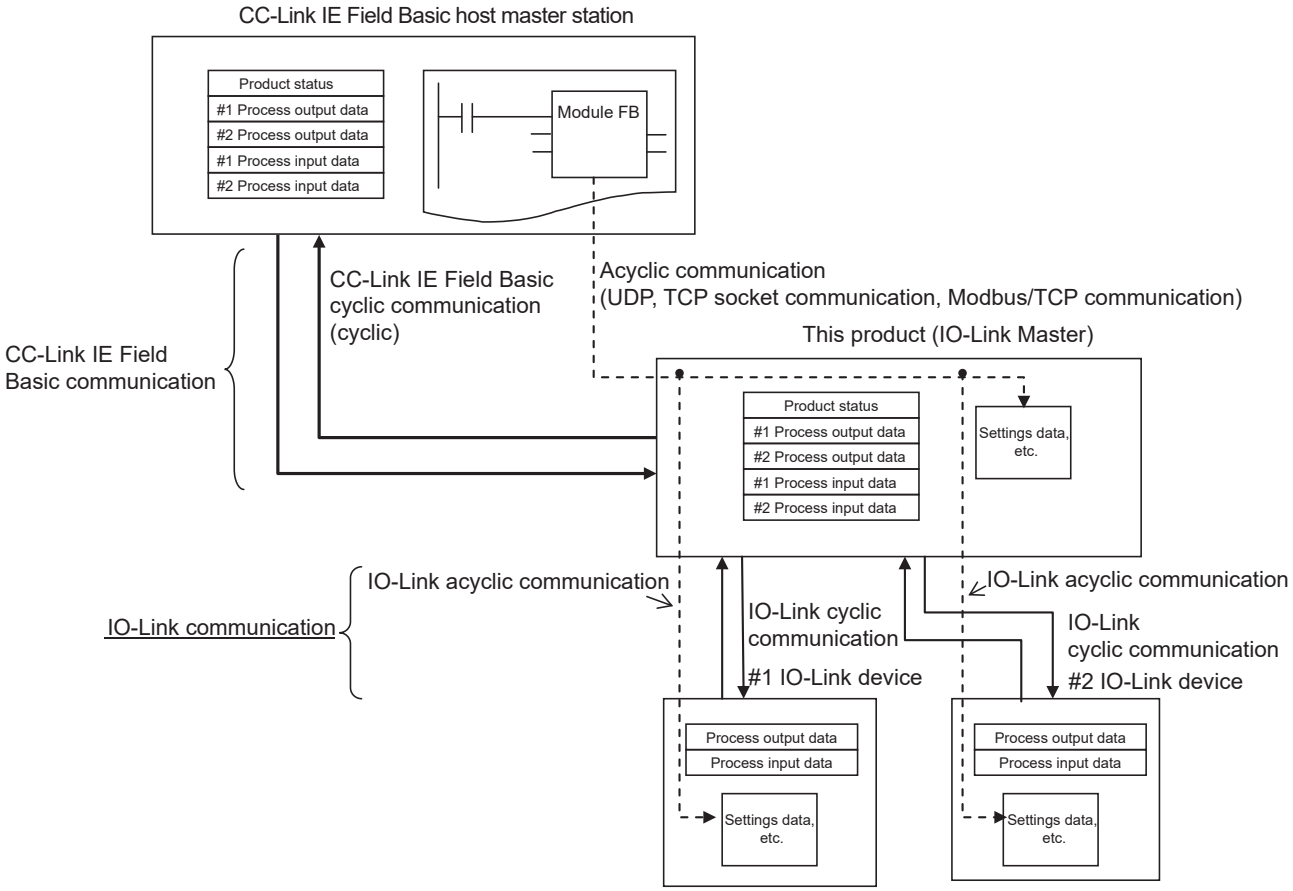
3

Communication

This section describes the initial settings for CC-Link IE Field Basic communication and IO-Link communication, the configuration of the data to be handled, and communication examples.

3-1 Communication System Overview

This product performs IO-Link cyclic communication with the connected IO-Link devices. It collects data from these IO-Link devices and, along with its own status, conveys them through CC-Link IE Field Basic cyclic communication with the CC-Link IE Field Basic master station.
As well, the product can perform acyclic communication with its own and various connected IO-Link device service data from a Module FB for Mitsubishi Electric PLC on the CC-Link IE Field Basic master station, or from socket communication and Modbus/TCP communication programs (*1).



*1: Writing to process data is not possible from socket communication (including the Module FB for Mitsubishi Electric PLC) or Modbus/TCP communication.

3-2 Initial Setting of This Product via Software

Create initial settings for the product with software such as GXWorks2/3 or UR Master Manager.

3-2-1 Required Software

- Engineering tool for CC-Link IE Field Basic:
  GXWorks2 or GXWorks3 (tool used as the product's CC-Link IE Field Basic slave station)
- For import/download from IODD file (device definition) group:
  UR Master Manager
  *IODD files are provided from each IO-Link device manufacturer.

MEMO

Download UR Master Manager from the OPTEX FA website below.
https://www.optex-fa.com/
For UR Master Manager operation, see its user's manual.

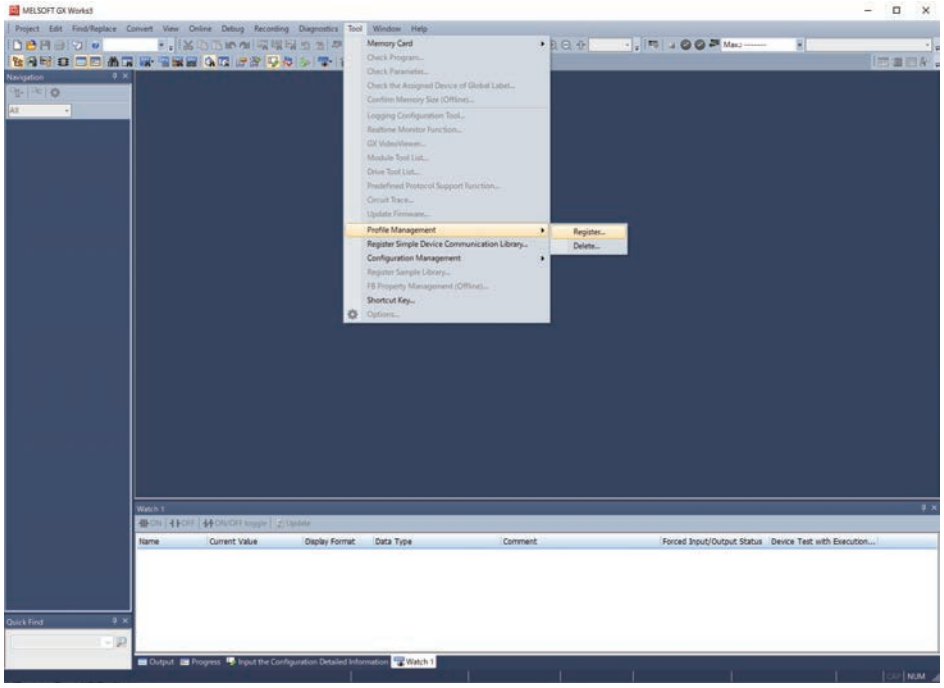
3-2-2 Procedure Overview

1. **Download the CSP+ file for this product from the OPTEX FA website.**
2. **Register the CSP+ file for this product profile in GXWorks2/3.**
3. **In GXWorks 2/3, register this product to the CC-Link IE Field Basic network configuration.**
4. **Input the settings for CC-Link IE Field Basic communication between this product as the slave station and the CC-Link IE Field Basic master station (product IP address and I/O allocation (*1)), and write to the CC-Link IE Field Basic master station.**

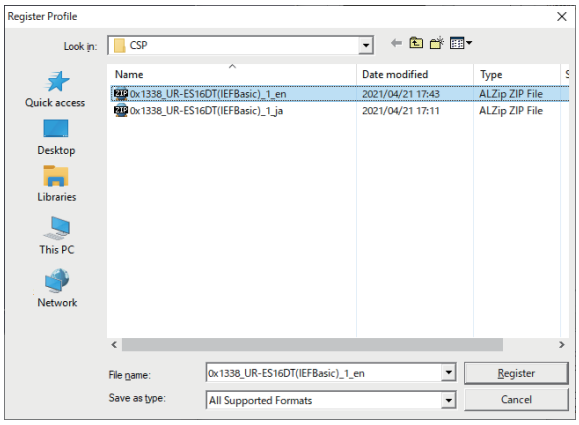
*1: Allocate this product's remote I/O signals to the remote input (RX) and remote output (RY) of the upper CC-Link IE Field Basic master station.

3-2-3 Read the CSP+ File for This Product into GXWorks2/3

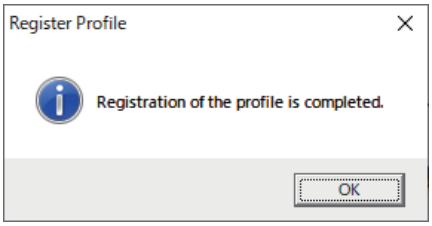
1. **Download the CSP+ file for this product from the OPTEX FA website below.**
   https://www.optex-fa.com/
2. **Register the above CSP+ file for this product in GXWorks2/3. The product protocol version is "1".**
   1. Launch GXWorks2/3 (GXWorks2 or GXWorks3).
   2. From [Profile Management] in the [Tool] menu, select [Register].



3 **Select the CSP+ file prepared in advance and click the [Register] button.**



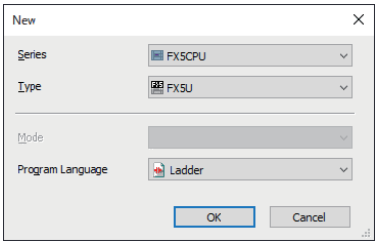
The file is compressed in .zip format and can be registered without unzipping.
Multiple files can also be selected for simultaneous registration by pressing the [Ctrl] and [Shift] keys.
When registration completes normally, the following dialog box will be displayed.



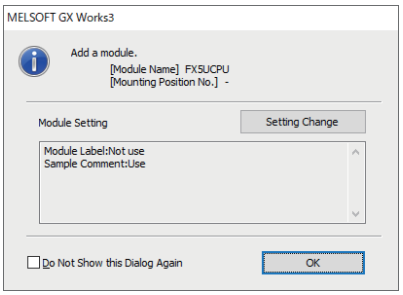
4 **Click the [OK] button and close the window.**
This completes the CSP+ file reading.

5 **Continuing, create a new project or open an existing one in GXWorks2/3.**
Select [New] in the [Project] menu.
If possible, connect the PLC CPU module and computer with a USB cable and turn on the power.
As well, after setting the product's own IP address with "M82. IP address," connect to the CC-Link IE Field Basic Master Unit with an Ethernet cable and turn on the power.

Select the [Series], [Type], and [Program Language] to use for the CPU module.



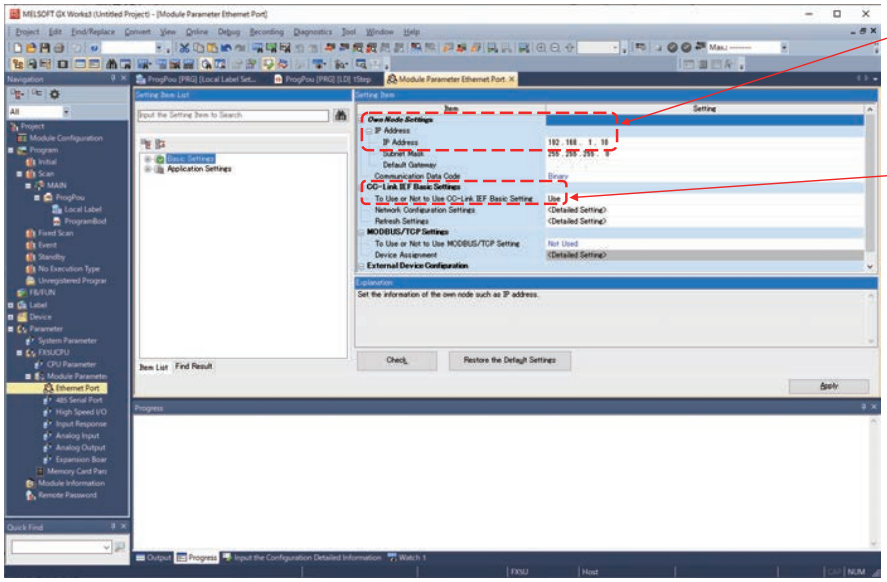
The following dialog box is displayed to confirm the addition of the CPU module (depending on the configuration, the addition may complete automatically without showing the dialog box).



3-2-4 Setting CC-Link IE Field Basic Master Unit Parameters

Set the CC-Link IE Field Basic Master Unit parameters.

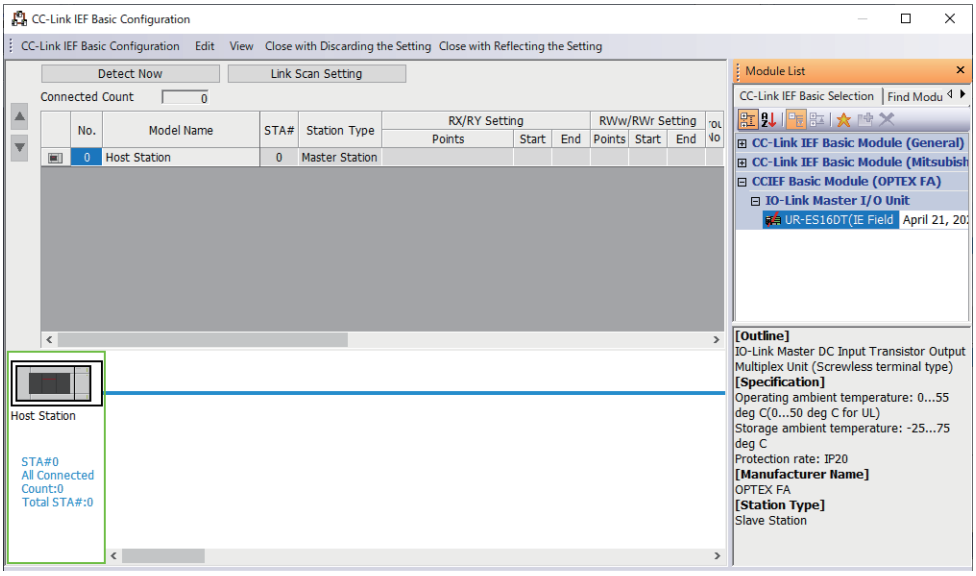
From the module information under Parameter in the navigation tree, double-click on the FX5U CPU module parameter Ethernet port. “Own-Node Setting” is displayed at right: set the master station IP address.
As well, “CC-Link IE Field Basic Setting” are displayed below. Change “To Use or Not to Use CC-Limk IE Field Basic Setting” to “Use”.



Set the CC-Link IE Field Basic master IP address.
The value should be the same as this product's IP address up to the upper three bytes (192.168.1 here).

Change "To Use or Not to Use CC-Limk IE Field Basic Setting" to "Use".
Next, double-click [Detailed Setting] in Network Configuration Settings.

Next, double-click [Detailed Setting] in Network Configuration Settings.
The “CC-Link IE Field Basic Configuration” screen below is displayed.

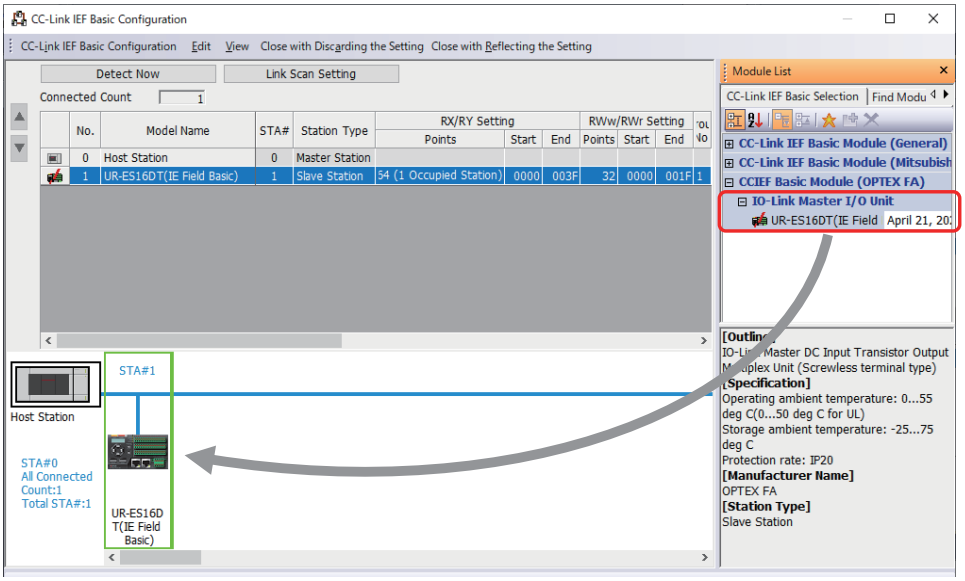


3-2-5 Registering the Product to the CC-Link IE Field Basic Configuration

In GXWorks 2/3, register this product to the CC-Link IE Field Basic configuration.

Registering the Product to the CC-Link IE Field Basic Configuration Offline.

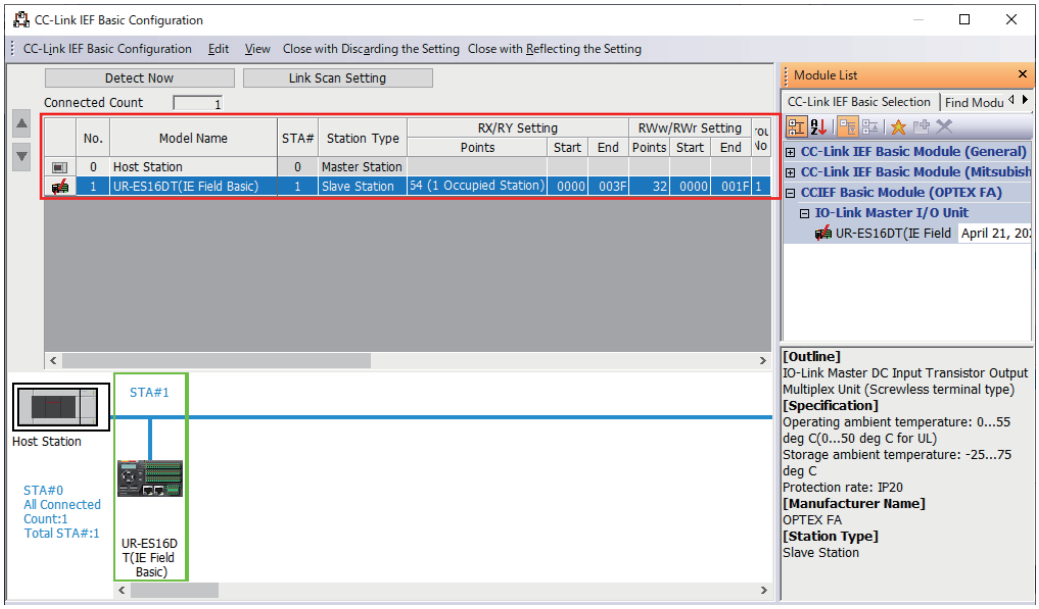
Scroll down the list of modules at right to display “CC-link IE Field Basic Module (OPTEX FA)”.
Open this to find “UR-ES16DT (IE Field Basic)” or “UR-EE16DT (IE Field Basic)” under “IO-Link Master I/O Unit”. The profile version can be confirmed with this date.
Drag and drop “UR-ES16DT” or “UR-EE16DT” into the network map at left.
This product’s number of occupied stations is 1.



This product will be added to the network map.

MEMO

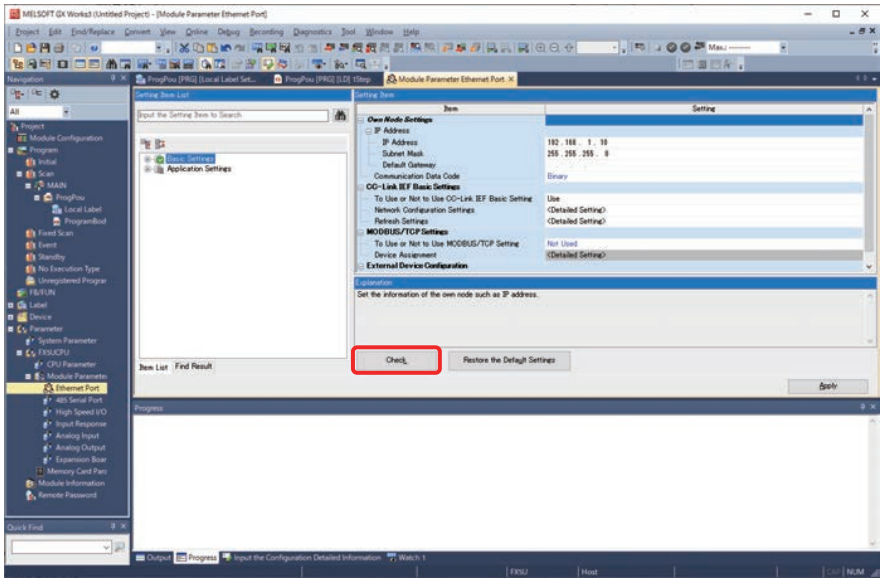
The dragged and dropped modules will also be displayed in the list of stations at top.



In the list of stations displayed at top, set the product's IP address, subnet mask, and allocation of link devices (RX, RY, RWr, RWw) to the product.

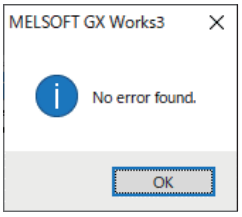
Setting Items	Setting Details
Station number	The top slave station number will be displayed.
IP address	Set the product's IP number. Set the same value as the master parameter "M82. IP address."
Subnet mask	Set the product's IP number. Set the same value as the master parameter "M81. Subnet mask." The default value is 255.255.255.0.
RX/RY setting	Set the following allocations for RX and RY. Points (*1), Start, End *1: 64 points (bits) each are set automatically.
RWw/RWr setting	Set the following allocations for RWw and RWr. Points (*2), Start, End *2: 32 points (words) each are set automatically.

Click [Close with Reflecting the Setting]. The Basic Setting window will return.

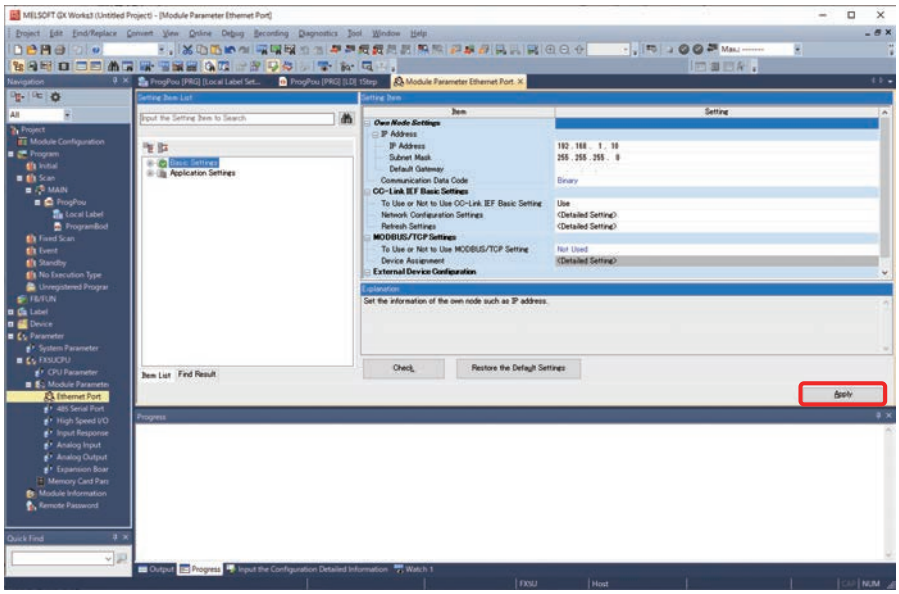


Click the [Check] button.

If there is no problem, the following dialog box will be displayed.



Click the [OK] button. The window below will return.

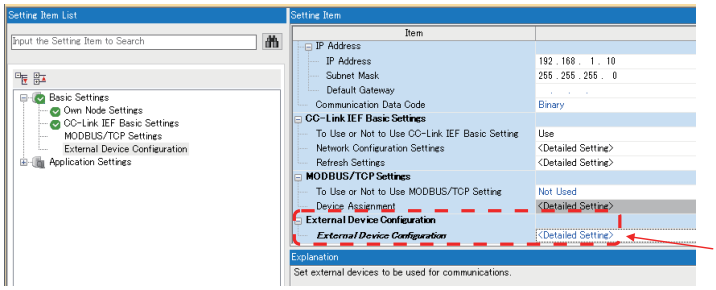


Click the [Apply] button.

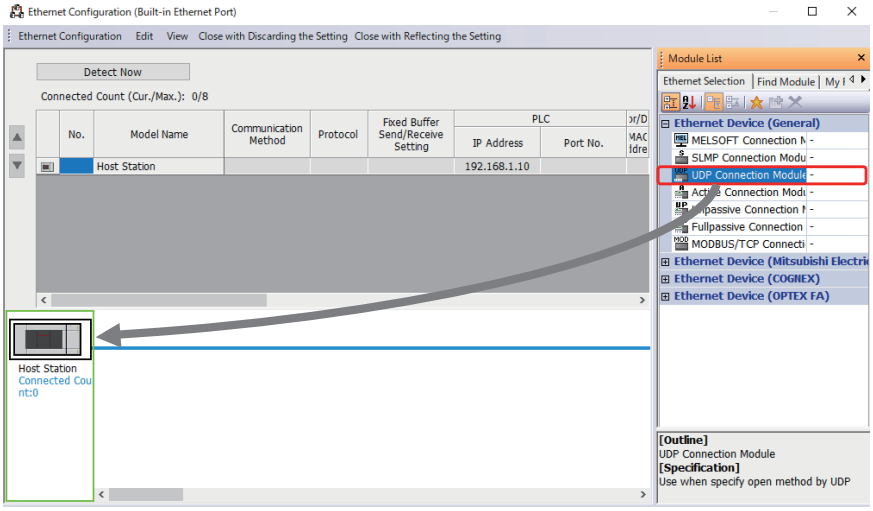
If using only cyclic communication, then at this point the necessary information for CC-Link IE Field Basic network communication has all been input.

When using the Module FB or a socket communication program to read and write setting values with regard to the product, the next required step is “External Device Configuration.”

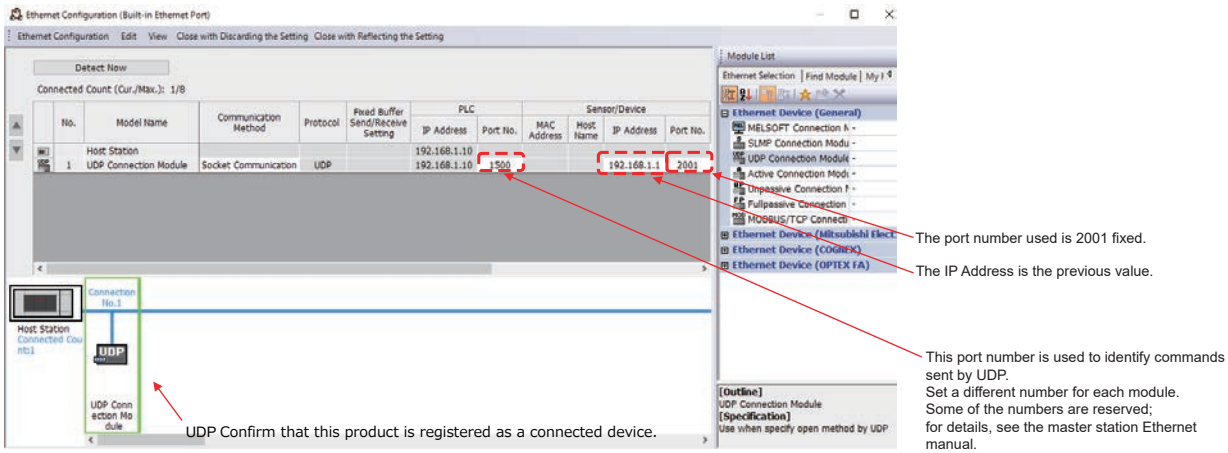
Double-click [Detailed Setting] in “External Device Configuration.”



The Ethernet configuration screen below will be displayed.
Drag and drop “UDP Connection Module,” under “Ethernet Devices (General)” in the unit list at right, into the network map at left.



Set the port number to be used with UDP communication.



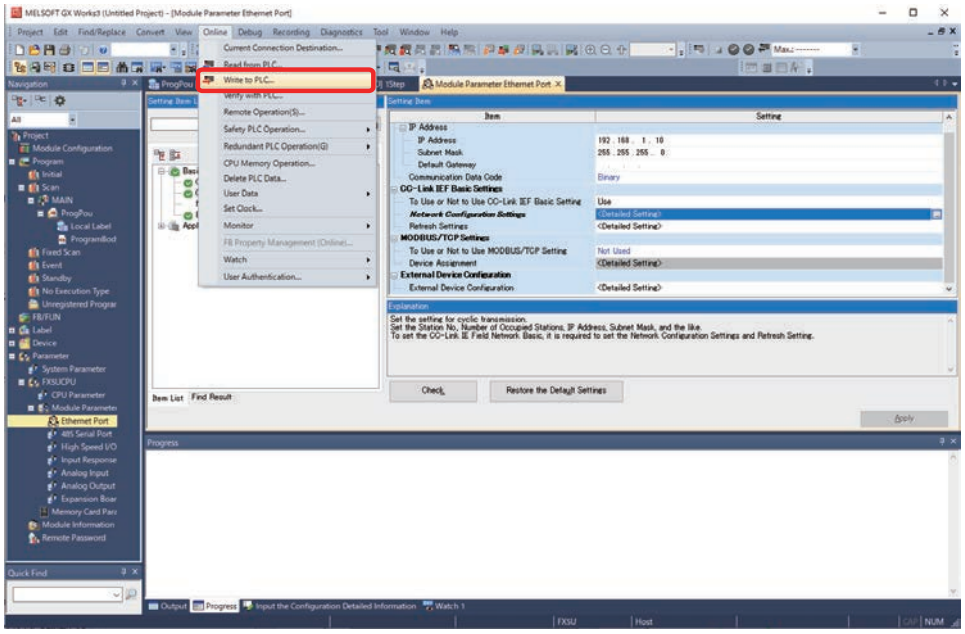
At this point, the necessary information for CC-Link IE Field Basic network communication has all been input.

However, here the settings have been made only on the computer, and the setting details also need to be written to the CC-Link IE Field Basic master station.

3-2-6 Writing Configuration Contents to the CC-Link IE Field Basic Master Station

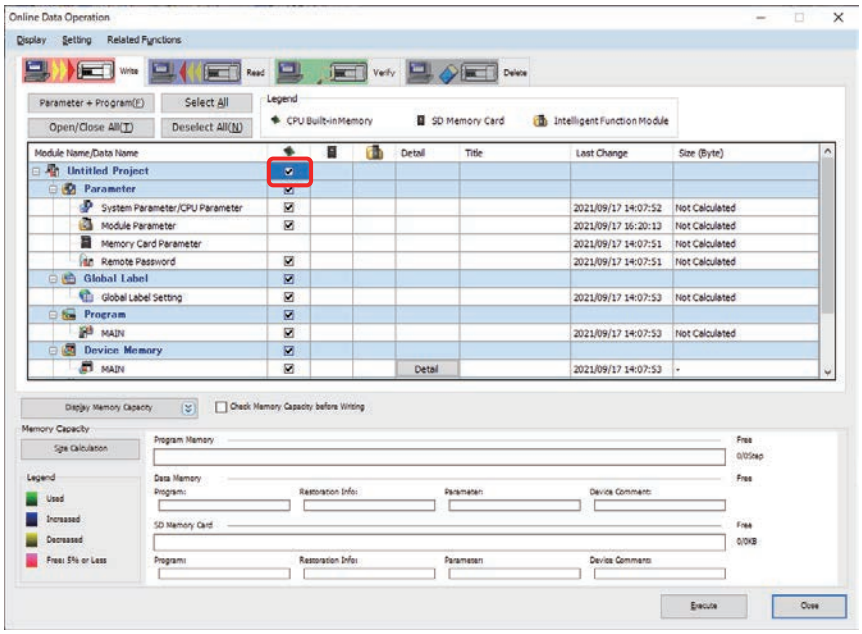
Online, write the setting details required for CC-Link IE Field Basic to the CC-Link IE Field Basic master station.

From the [Online] menu, select [Write to PLC].



Select the parameter to write.

As this is the first time, check the [Untitled Project] checkbox.

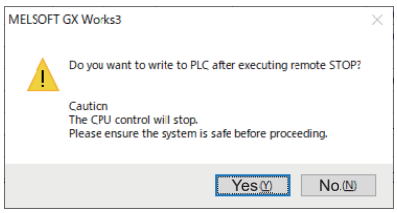


Click the [Execute] button to display the confirmation dialog box for continued writing to the PLC.

Click the [Yes] button. The confirmation dialog box for execution of writing to the PLC after remote stop will be displayed.

Click the [Yes] button. The following confirmation dialog box will be displayed.

Click the [Yes to all] button to begin writing. When complete, the following dialog box will be displayed.

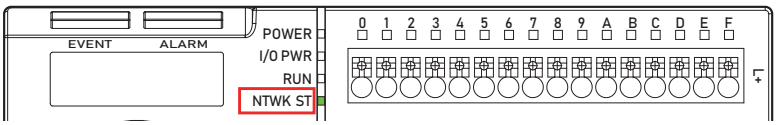


Here the CC-Link IE Field Basic settings are complete on the CC-Link IE Field Basic master station side.

Here, reset the host master station side CPU module.
Restart the CPU module and confirm that CC-Link IE Field Basic communication is established (the Ethernet SD/RD LED is blinking and the product's NTWK ST LED is lit).

MEMO

- When writing setting details to the CC-Link IE Field Basic master station, it must be rebooted.
- If the product front panel NTWK ST LED does not light up green (showing normal communication) even after setting is complete, once again check the GXWorks2/3 settings and product settings.



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

- If communication is not possible even after all the confirmation above, refer to the manuals for each CC-Link IE Field Basic master station.

3-3 Cyclic Communication (cyclic transmission/process I/O communication)

This product exchanges the following data regularly in CC-Link IE Field Basic with the CC-Link IE Field Basic master station link device (RX/RY/RWr/RWw).

- Digital input/digital output in SIO mode, product status/operation flags: Bit unit
- IO-Link device I/O maximum 32 bytes of process data: Word unit

3-3-1 Assigning the Host CC-Link IE Field Basic Master Station to Link Devices

This product assigns the “RX”, “RY”, “RWr” and “RWw” of [Setting Item] in GXWorks2/3 parameter settings [Basic Settings] - [Network Configuration Settings] from the set start numbers to the host master station link devices.

MEMO

Below, this manual explains how to indicate the product status/operation flag link device address with RX/RY setting start number “00”.
Ex.: Event flag: RX17, Latest Event channel: RX10-13

Normal Assignment and Extended Access Enabled Assignment

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

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

The assignment method (normal assignment or extended access enabled assignment) is specified using “Extended access enable flag” (RY10).

The following is shown when both the “M40. Process input data words allocation” and “M41. Process output data words allocation” master parameters are the default values.

3-3-2 Normal Assignment (extended access disabled)

The master station link device allocation to this product when “Extended access enable flag” (RY10) is set to 0 (OFF: Extended access disabled) is as below.

Link device	Word address (Start number +)	Bit address (*1)															
		F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0
RX	0☐	Digital input (channel 0-F: corresponds to bit address 0-F)															
	1☐	Error	IO-Link ready	Synchronization established	Reserved	Latest error channel				Event	I/O power supply	Output overcurrent	Reserved	Latest event channel			
RY	0☐	Digital output (channel 0-F: corresponds to bit address 0-F)															
	1☐	Clear the latest error	Reserved							Clear the latest event	Encoder counter reset	Reserved					Extended access disabled
RWr	00	Process input data channel 0 (*2)															
	01																
	02	Process input data channel 1 (*2)															
	03																
	...	...															
	1E	Process input data channel F (*2)															
	1F																
RWw	00	Process output data channel 0 (*2)															
	01																
	02	Process output data channel 1 (*2)															
	03																
	...	...															
	1E	Process output data channel F (*2)															
	1F																

*1: Depending on the CC-Link IE Field Basic master product, some bit addresses are only 0 to 7. In that case, bit addresses 8 to F can be accessed with the following word (byte) address.

*2: Process input and output data are assigned two words (four bytes) per channel at default values.
With the product master parameters “M40. Process input data words allocation” or “M41. Process output data words allocation,” it is possible to allocate nothing or to change to a different number of words.
With the product master parameter “M42. Process data words auto allocation,” automatic setting of M40/M41 above is possible from the actual IO-Link device specifications.

Assigned Data Content (during normal allocation)

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

- Input from this product to CC-Link IE Field Basic master station

Assignment	Category	Host master station assigned link device address (Start number +)	Data name	Description
Host master station remote input (RX)	Digital input in SIO mode	RX00 to 0F	Digital input (channel 0-F)	Digital input data in SIO mode (PNP input or NPN input). In IO-Link mode, the least-significant value of the bit data defined in process input data format is reflected (this function does not exist on the process data output side).
	Product status	RX1F	Error flag	Changes to 1 (ON) when an error is generated in this product. When this flag is at 1 (ON), access the “Latest error code readout by channel” through acyclic communication. Refer to “App-1-2 Data for Access from PLC” for “Latest error code readout by channel.”
		RX1E	IO-Link ready flag	When communication is established with all IO-Link devices and cyclic communication with the CC-Link IE Field Basic master station, if this flag is at 1 (ON), execute read and write with the IO-Link devices through cyclic or acyclic communication. Note: This flag will go to 1 (ON) even when not all channels’ I/O setting assignments are in IO-Link mode.
		RX1D	Synchronization establishment flag	Changes to 1 (ON) when I/O synchronization (set value number: M21) is set to any of 2/3/4/5/6 (0.4 ms/0.8 ms/1.6 ms/3.2 ms/6.4 ms cycle), while the internal timer in this product is synchronized (within +/-20 µs) with the network time.
		RX18 to 1C	Latest error channel	Channel number of the latest generated error. When accessing the “Latest error code readout by channel” through acyclic communication, specify the channel based on this value.
		RX17	Event flag	Changes to 1 (ON) when an event is occurring in one of the connected IO-Link devices. When this flag is at 1 (ON), access the “Event data readout by channel” data through acyclic communication. Refer to “App-1-2 Data for Access from PLC” for “Latest event data readout by channel”.
		RX16	I/O power supply flag	Changes to 1 (ON) when power is being supplied for I/O by the I/O power supply.
		RX15	Output overcurrent flag	Changes to 1 (ON) when overcurrent is generated in SIO (output).
		RX10 to 13	Latest event channel	Channel number of the latest generated event. When accessing the “Event data readout by channel” through acyclic communication, specify the channel based on this value.

• Output from CC-Link IE Field Basic master station to this product

Assignment	Category	Host master station assigned link device address (Start number +)	Data name	Description
Host master station remote output (RY)	Digital output in SIO mode	RY00 to 0F	Digital output (channel 0 to F)	Digital output data in SIO mode (PNP output or NPN output).
	Product operation flag	RY1F	Clear the latest error	When starting up from 0 (OFF) to 1 (ON), the latest errors are cleared.
		RY17	Clear the latest event	When starting up from 0 (OFF) to 1 (ON), the latest events are cleared.
		RY16	Encoder counter reset	If a SIO device is the encoder, when starting up from 0 (OFF) to 1 (ON), the product internal high-speed counter is reset.
		RY10	Extended access enable flag	Specify extended access disabled (normal) assignment as the assignment method for the cyclic communication area. 0 (OFF): Extended access disabled

Process data

• Input from this product to CC-Link IE Field Basic master station

Type and direction	Assignment	Host master station assigned link device address (Start number +)	Data name	Description
Input from IO-Link devices	Host master station remote register (RWr)	RWr00 to 1F	Process input data Channels 0 - F	Process input data in IO-Link communication mode. Two words (four bytes) per channel at default values.

• Output from CC-Link IE Field Basic master station to this product

Type and direction	Assignment	Host master station assigned link device address (Start number +)	Data name	Description
Output to IO-Link devices	Host master station remote register (RWw)	RWw00 to 1F	Process output data Channels 0 - F	Process output data in IO-Link communication mode. Two words (four bytes) per channel at default values.

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

3-3-3 Extended Access Enabled Assignment

The master station link device allocation to this product when “Extended access enable flag” (RY10) is set to 1 (ON: Extended access enabled) is as below.

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

Link device	Word address (Start number +)	Bit address															
		F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0
RX	0☐	Digital input (channel 0-F: corresponds to bit address 0-F)															
	1☐	Error	IO-Link ready	Synchronization established	Access error	Latest error channel				Event	I/O power supply	Output overcurrent	Access completed	Latest event channel			
RY	0☐	Digital output (channel 0-F: corresponds to bit address 0-F)															
	1☐	Clear the latest error	Reserved	Little endian access	To access UR-ES16DT /-EE16DT parameters	Applicable IO-Link channel (0 to F)				Clear the latest event	Encoder counter reset	Reserved			Write request	Read request	Extended access enabled
RWr	00	Process input data channel 0 (*1)															
	01																
	02	Process input data channel 1 (*1)															
	03																
	...	...															
	1C	Process input data channel E (*1)															
	1D																
	1E	Extended access read data															
	1F																
RWw	00	Process output data channel 0 (*1)															
	01																
	02	Process output data channel 1 (*1)															
	03																
	...	...															
	1A	Process output data channel D (*1)															
	1B																
	1C	Index number or setting value number specification															
		Unit No. of sensor unit connected to UC2-IOL								(Index number (lower byte))							
	1D	Reserved								Byte length or target selection to access	Subindex number or target number						
	1E	Extended access write data															
	1F																

*1: Process input and output data are assigned two words per channel at default values.

With the product master parameters “M40. Process input data words allocation” or “M41. Process output data words allocation,” it is possible to change as below.

No allocation or different number of words

With the product master parameter “M42. Process data words auto allocation,” automatic setting of M40/M41 above is possible from the actual IO-Link device specifications.

Assignment Data Details (when extended access is enabled)

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

• Input from this product to CC-Link IE Field Basic master station

Assignment	Category	Host master station assigned link device address (Start number +)	Data name	Description
Host master station remote input (RX)	Digital input in SIO mode	RX00 to 0F	Digital input (channel 0-F)	Digital input data in SIO mode (PNP input or NPN input). In IO-Link mode, the least-significant value of the bit data defined in process input data format is reflected. (This function does not exist on the process output data side.)
	Product status	RX1F	Error flag	Changes to 1 (ON) when an error is generated in this product. When this flag is at 1 (ON), access the “Latest error code readout by channel” through acyclic communication. Refer to “App-1-2 Data for Access from PLC” for “Latest error code readout by channel” data.
		RX1E	IO-Link ready flag	When communication is established with all IO-Link devices and cyclic communication with the CC-Link IE Field Basic master station, if this flag is at 1 (ON), execute read and write with the IO-Link devices through cyclic or acyclic communication. Note: This flag will go to 1 (ON) even when not all channels’ I/O setting assignments are in IO-Link mode.
		RX1D	Synchronization establishment flag	Changes to 1 (ON) when I/O synchronization (set value number: M21) is set to any of 2/3/4/5/6 (0.4 ms/0.8 ms/1.6 ms/3.2 ms/6.4 ms cycle), while the internal timer in this product is synchronized (within +/-20 µs) with the network time.
		RX1C	Access error (Extended access enabled assignment)	Changes to 1 (ON) along with the access completed bit if an error occurs when requesting reading/writing.
		RX18 to 1B	Latest error channel	Channel number of the latest generated error. When accessing the “Latest error code readout by channel” through acyclic communication, specify the channel based on this value.
		RX17	Event flag	Changes to 1 (ON) when an event is occurring in one of the connected IO-Link devices. When this flag is at 1 (ON), access the “Event data readout by channel” data through acyclic communication. Refer to “App-1-2 Data for Access from PLC” for “Latest event data readout by channel”.
		RX16	I/O power supply flag	Changes to 1 (ON) when power is being supplied for I/O by the I/O power supply.
		RX15	Output overcurrent flag	Changes to 1 (ON) when overcurrent is generated in SIO (output).
		RX14	Access completed (Extended access enabled assignment)	Turns ON when reading/writing has completed. If the read/write request bit is turned off, this bit will also change to 0 (OFF).
		RX10 to 13	Latest event channel	Channel number of the latest generated event. When accessing the “Event data readout by channel” through acyclic communication, specify the channel based on this value.

• Output from CC-Link IE Field Basic master station to this product

Assignment	Category	Host master station assigned link device address (Start number +)	Data name	Description
Host master station remote output (RY)	Digital output in SIO mode	RY00 to 0F	Digital output (channel 0 to F)	Digital output data in SIO mode (PNP output or NPN output).
	Product operation flag	RY1F	Clear the latest error	When starting up from 0 (OFF) to 1 (ON), the latest errors are cleared.
		RY1D	Little endian access (Extended access enabled assignment only)	Specify the byte unit order for “Extended access read data” or “Extended access write data”. 1 (ON): Read and write service data (setting values, etc.) in the IO-Link device in little endian format. Set to 1 (ON) when reading and writing general service data in the IO-Link device. 0 (OFF): Read and write service data (setting values, etc.) in the IO-Link device in big endian format.
		RY1C	To access UR-ES16DT/-EE16DT parameters (Extended access enabled assignment only)	Designate the extended access destination as either this product or an IO-Link device (including sensor units connected to UC2-IOL). 1 (ON): Designates access to this product’s master parameters. Note: Reading/writing product master parameter data is in little endian format (fixed). 0 (OFF): Specify to access service data (setting value, etc.) in the IO-Link device, or access “specific data” from a sensor unit connected to UC2-IOL.
		RY18 to RY1B	Channel No. of IO-Link to access (0 to F) (Extended access enabled assignment only)	If “To access UR-ES16DT/-EE16DT parameters” is 0 (OFF), specify the IO-Link device channel number to access.
		RY17	Clear the latest event	When starting up from 0 (OFF) to 1 (ON), the latest events are cleared.
		RY16	Encoder counter reset	If a SIO device is the encoder, when starting up from 0 (OFF) to 1 (ON), the product internal high-speed counter is reset.
		RY12	Write request (Extended access enabled assignment only)	When this bit starts up, the designated data writing begins.
		RY11	Read request (Extended access enabled assignment only)	When this bit starts up, the designated data reading begins.
		RY10	Extended access enable flag	Specify extended access enabled assignment as the assignment method for the cyclic communication area. 1 (ON): Extended access enabled

Process data/extended access-related data

• Input from this product to CC-Link IE Field Basic master station

Assignment	Category	Host master station assigned link device address (Start number +)	Data name	Description
Host master station remote register (RWr)	Input from IO-Link devices	RWr00 to RWr1D	Process input data Channel 0 to E	Process input data in IO-Link communication mode. Two words (four bytes) per channel at default values.
	Extended access read data	RWr1E, RWr1F	Extended access read data	The value read during extended access. Two words (four bytes). If “Little endian access” is 1 (ON), the byte address +500 will be the lowest-order byte. • Upon a read request, the data read from the target (this product, the IO-Link device, or the target sensor unit connected to UC2-IOL) is stored. • For a write request, a value of 0 will be stored when the operation is complete. • If there is an access error the extended access error code will be stored. Refer to the “Extended access error code list” later in this document for details on extended access error codes.

• Output from CC-Link IE Field Basic master station to this product

Assignment	Category	Host master station assigned link device address (Start number +)	Data name	Description
Host master station remote register (RWw)	Output to IO-Link devices	RWw00 to 1B	Process output data channel 0 - D	Process output data in IO-Link communication mode. Two words (four bytes) per channel at default values.
	Extended access specified data	RWw1C	Index number or setting value number specification	When byte length or target selection to access is 1 to 4 bytes (reading/writing of 1- to 4-byte data), designate the index number of the service data (setting values, etc.) inside the target IO-Link device, the product IO-Link device setting, or designate the setting of the product master parameter setting value number.
		RWw1C bit address 8 to F	Unit No. of sensor unit connected to UC2-IOL	If “byte length or target selection to access” is set to 0 (UC2-IOL mode), specify the connection order as 0 through F, beginning from the left edge of the target sensor unit interconnected with OPTEX FA IO-Link gateway UC2-IOL.
		RWw1D bit address 8 to A	Byte length or target selection to access	Designate whether the read/write target is the target sensor unit connected to the OPTEX FA IO-Link gateway UC2-IOL, or a connected IO-Link device on an arbitrary channel or this product’s master parameters (in that case, also designate the read/write data size at the same time). 0: Read and write target is the “specific data” of a target sensor unit interconnected with UC2-IOL (2-byte data) 1 to 4: Reading/writing 1- to 4-byte data (the read/write target is the connected IO-Link device or this product’s master parameters)
		RWw1D bit address 0 to 7	Subindex number or target number	When byte length or target selection to access is 1 to 4 bytes (reading/writing of 1- to 4-byte data), designate the subindex number of the service data (setting values, etc.) inside the target IO-Link device or the product master parameter target number.

Assignment	Category	Host master station assigned link device address (Start number +)	Data name	Description
	Extended access write data	RWw1E, RWw1F	Extended access write data	Specify the setting value to write via extended access. The data length is two words (four bytes) maximum. Upon a write request, this value will be sent to the target (this product, the IO-Link device, or the target sensor unit connected to UC2-IOL). If “Little endian access” is 1 (ON), RWw1E bit address 0 through 7 will be the lowest-order byte.

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

● Extended access error code list

The following error codes are stored in the front byte (RWr1E bits 0 through 7) of the extended access read data when an access error occurs during extended access.

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

3-3-4 Process Data Words Allocation Example

Below are allocation to this product, allocation to the host master station link device (in this case, a word unit remote register is used for the example), and an actual allocation device example with an IO-Link device connected to this product.

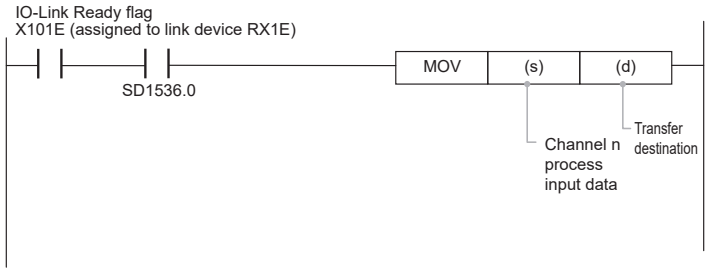
Product channel	IO-Link device process data size example		Result of product auto allocation execution		Host master station remote register		Host master station actual device example	
	Process input data byte count	Process output data byte count	Process input data word count	Process output data word count	RWr (address hexadecimal) Ex.: RWw/RWr start: 00	RWw (address hexadecimal) Ex.: RWw/RWr start: 00	Ex.: W100 up (address hexadecimal)	Ex.: W200 up (address hexadecimal)
0	2	0	1	0	RWr00	-	W100	-
1	2	0	1	0	RWr01	-	W101	-
2	0	2	0	1	-	RWw00	-	W200
3	Not used		0	0				
4	4	0	2	0	RWr02 - 03	-	W102 - 103	-
5	3	0	2	0	RWr04 - 05	-	W104 - 105	-
6	Not used		0	0				
7	Not used		0	0				
8	16	0	8	0	RWr06 - 0D	-	W106 - 10D	-
9	0	1	0	1	-	RWw01	-	W201
A	Not used		0	0				
B	Not used		0	0				
C	Not used		0	0				
D	4	0	2	0	RWr0E - 0F	-	W10E - 10F	-
E	Not used		0	0				
F	Not used		0	0				

CAUTION

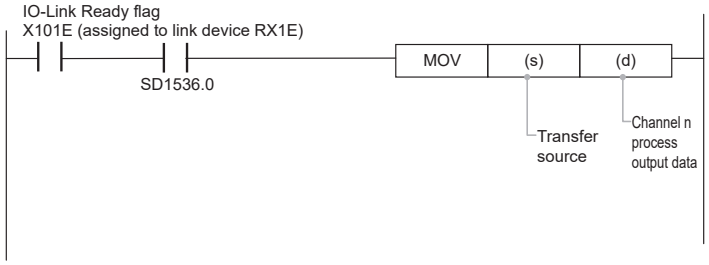
- When either input or output exceeds a total of 32 words (64 bytes), the process data exceeding the total will not be assigned to the host master station (it will be ignored).
  To connect a maximum of 16 IO-Link devices to this product, the following conditions are required.
  Product process data size with the connected IO-Link device group:
  Input: Total of 32 words (64 bytes) over all channels
  Output: Total of 32 words (64 bytes) over all channels

3-3-5 Process Data Reading and Writing Methods

When the IO-Link Ready flag is ON and the CC-Link IE Field Basic data link is normal, read process data.
Ex.: Reading process input data from an IO-Link device on a given channel
With input conditions of link device assigned the IO-Link Ready flag (for instance X101E) ON and SD1536 (cyclic transmission status of each station; when product station number = 1 (among stations 1 to 16)) ON, read out.



When the IO-Link Ready flag is ON and the CC-Link IE Field Basic data link is normal, write process data.
Ex.: Writing process output data from an IO-Link device on a given channel
With input conditions of link device assigned the IO-Link Ready flag (for instance X101E) ON and SD1536 (cyclic transmission status of each station; when product station number = 1 (among stations 1 to 16)) ON, write.
Because there is a communication abnormality when the IO-Link Ready flag is 0 (OFF), handle data transfer destinations suitably.



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

3-3-6 Assignment Data List by Objective with Extended Access Enabled

Assigned data / Link device address / In this situation	Extended access	Byte length or target selection to access	Channel No. of IO-Link to access	Little endian access	To access UR-ES16DT/-EE16DT parameters	Index number or setting value number	Subindex number or target number	Connection order from left end of target sensor unit	Write	Read	Read/ write size designation
	RY10	RWw1D bit address 8 to A	RY18 to RY1B	RY1D	RY1C	RWw1C	RWw1D bit address 0 to 7	RWw1C bit address 8 to F	RY12	RY11	Depends on byte length or target selection to access
To read/write product master parameters to/ from cyclic data	1(ON)	1 to 4 (designate byte length)	Irrelevant	Irrelevant (little endian fixed)	1(ON)	IO-Link device setting or product master parameter setting value number	Master parameter target channel	Irrelevant	1 (ON) or 0 (OFF) designation		Depends on byte length or target selection to access (1 to 4 bytes)
To designate designated IO-Link device index/subindex and read/write data to cyclic		1 to 4	Designation	1 (ON): Little endian format	0(OFF)	Index number	Subindex number	Irrelevant			Depends on byte length or target selection to access (1 to 4 bytes)
To read/write “specific data” in a sensor unit connected to UC2-IOL to cyclic		0				Irrelevant		Designation			No designation (2-byte fixed)

MEMO

An example of the “specific data” in sensor units connected to UC2-IOL, as an extended access target, is below (as of June 2021).

- For Digital Fiber Amplifier D3RF Series
  Index number 110 (6E h): Lower threshold (Far) setting for output 1
- For White Light LED Digital Fiber Amplifier D3WF Series
  Index number 110 (6E h): Lower threshold (Far) setting for output 1
- For CDA Series displacement sensor-amplifier unit
  When the connected sensor is CD22 or TD1, set 108 (6Ch): near threshold and 109 (6Dh): far threshold

MEMO

When the read/write target is a sensor unit connected to UC2-IOL, the user must know what channel UC2-IOL is connected to and what sensor unit is connected in what position.

3-3-7 Actual Access Extension Methods

When the IO-Link Ready flag is at 1 (ON) and the CC-Link IE Field Basic data link is normal, read/write the specific address of the specific target via extended access.

To Write to IO-Link Device Service Data Via Extended Access

- Set extended access (RY10) = 1 (ON).
- Designate the target channel with target IO-Link channel designation (RY18 to RY1B).
- Designate the index number with the index number (RWw1C) and the subindex with the subindex number (output RWw1D, bit address 0 to 7).
- Designate the target IO-Link device service data in little endian format, and set the little endian access (RY1D) to 1 (ON).
- Set the data to be written to extended access write data (RWw1E, RWw1F). When setting little endian access (RY1D) to 1 (ON) as above, write data will be stored in little endian format. RWw1E bits 0 to 7 are the lowest-order bytes and RWw1F bits 8 to F are the highest-order bytes.
- Designate the byte length (1 to 4) to write with the byte length or target selection to access (RWw1D bit address 8 to A).
- When writing, the write request bit (RY12) will change from 0 (OFF) to 1 (ON) as it starts up.
- When access completed = 1 (ON), writing is complete. However, when access error = 1 (ON) at the same time, an error has occurred. Check the extended access read data (RWr1E bit address 0 to 7) error code list.

To Write to Target Sensor Unit Connected to OPTEX FA IO-Link Gateway UC2-IOL Via Extended Access

- Set extended access (RY10) = 1 (ON).
- Designate the channel in which UC2-IOL is connected to this product with target IO-Link channel designation (RY18 to RY1B).
- Designate the connection order of target sensor units connected to UC2-IOL from the left end, using target sensor unit designation (RWw1C, bit address 8 to F). For example, when designating the leftmost unit, 0 is stored.

  Note: The target “specified data” within the target sensor unit includes, if the sensor unit is, for example, the Digital Fiber Amplifier D3RF Series, the index number 110 (6E h) output 1 lower threshold (Far) setting, etc.
- Set the data to be written to extended access write data (RWw1E, RWw1F). When converting to little endian format as below, write data will be stored in little endian format. RWw1E bits 0 to 7 are the low-order bytes and RWw1E bits 8 to F are the high-order bytes.
- UC2-IOL data is in big endian format, so when converting to little endian format, set the little endian access (RY1D) to 1 (ON).
- Store “0” and designate UC2-IOL as the read/write target with the byte length or target selection to access (RWw1D bit address 8 to A).
- When writing, the write request bit (RY12) will change from 0 (OFF) to 1 (ON) as it starts up.

To Write to Product Master Parameters Via Extended Access

- Set extended access (RY10) = 1 (ON).
- Designate product master parameters with UR-ES16DT/-EE16DT (RY1C).
- Designate the setting value number with the setting value number (RWw1C) and the target number with the target channel (RWw1D, bit address 0 to 7).
- Set the data to be written to extended access write data (RWw1E, RWw1F). Store write data as little endian format. RWw1E bits 0 to 7 are the lowest-order bytes and RWw1F bits 8 to F are the highest-order bytes.
- Designate the byte length to write with the byte length or target selection to access (RWw1D bit address 8 to A).
- When writing, the write request bit (RY12) will change from 0 (OFF) to 1 (ON) as it starts up.
- When access completed = 1 (ON), writing is complete. However, when access error = 1 (ON) at the same time, an error has occurred. Check the extended access read data error code list.

3-4 Acyclic Communication (socket or Modbus/TCP communication)

This product supports socket communication (UDP/IP or TCP/IP) or Modbus/TCP communication with regard to acyclic communication.
Thereby, reading/writing of product master parameters and IO-Link device internal service data is possible, as well as reading of process data. However, neither socket communication nor Modbus/TCP communication is capable of writing process data.
Further, this product can perform acyclic communication (ISDU communication) with IO-Link devices based on socket communication or Modbus/TCP communication from the host.

3-4-1 Socket Communication (UDP/IP or TCP/IP)

When the product network type is set to “CC-Link IE Field Basic,” access is possible via socket communication (UDP/IP or TCP/IP) from the client to the product.
Access methods include from a Module FB for Mitsubishi Electric PLC or via creation of a socket communication program.

Using a Module FB for Mitsubishi Electric PLC

OPTEX FA offers a Module FB for Mitsubishi Electric PLCs. The interior is a socket communication program. The use thereof enables setting/reading of IO-Link devices connected to the product or of product master parameters via a Mitsubishi Electric PLC (iQ-F Series).

- FB to read parameter: UDP_READ
- Module FB for writing: UDP_WRITE

Image of UDP_READ in use

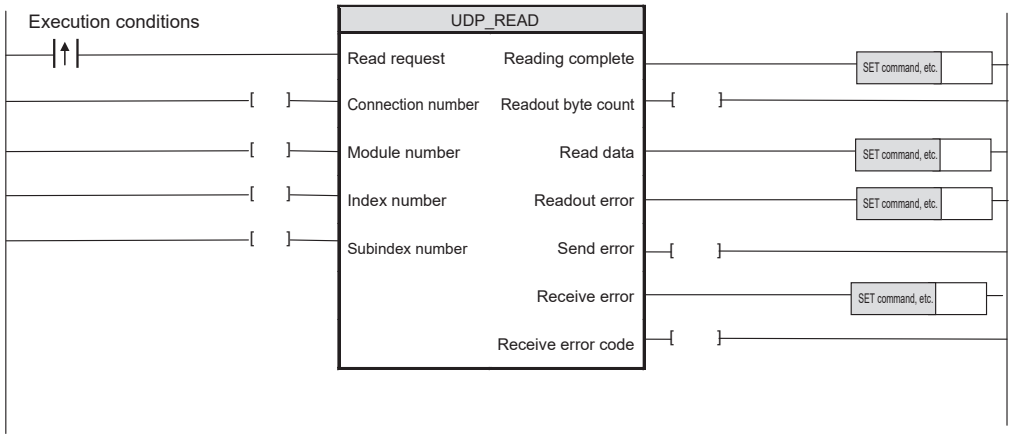
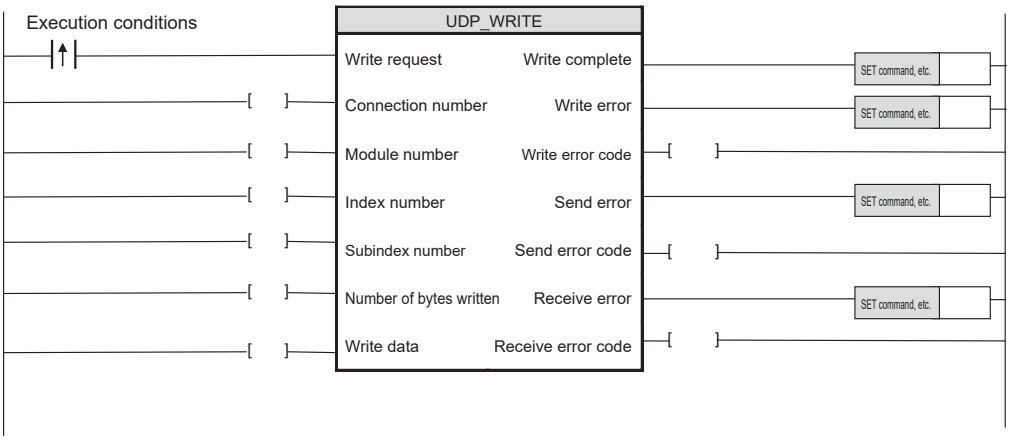


Image of UDP_WRITE in use



Download the above Module FB as needed from the OPTEX FA website below.
https://www.optex-fa.com/

Conditions for the use of a Mitsubishi Electric PLC are as follows.

- Module:
  CPU module: iQ-F Series (FX5, FX5U, etc.)
  Ethernet connection: CPU module built-in Ethernet port
- Engineering tool: GXWorks3

Refer to “App-1 List of Product Master Parameters” for product master parameters.
Refer to each IO-Link device index list for their index numbers and subindex numbers.

Socket Communication Program

After port open processing, the client sends or receives the following data to the product. When data transmission is complete, the port is closed.
Data configuration for data transmission between the client and this product is as below.

Transmitted data

Byte length	Data meaning	Data value	Description
+0	Command	53 h	Data access request
+1	Transfer data designation	Bit 0	Reading process input data/digital input data/allocated status data (*1) Reads out a total of fixed 32 words for all used channels + 1 word digital input + 1 word allocated status data as a batch.
		Bit 2	Setting value access
		Bit 3	Execute by writing setting value access
		Bit 4	Background access mode (When reading/writing data to/from slow IO-Link devices, execution will take place without stopping socket communication from elsewhere.) Also, the normal response code in this mode when bit 2 (setting value access) is 1 will be 62 h (reading) or 42 h (writing). When bit 2 (setting value access) is 0, confirm the response to the command sent immediately before.
		Bit 5	Background access mode forced cancel
		Bits 7 to 6	Reserved (0)

Byte length	Data meaning	Data value	Description
+2	Module designation	80 h to 8F h	IO-Link device channel 0 to 15
		C0 h to CF h	Data length 4 bytes or less for IO-Link devices channels 0 to 15 will be handled as little endian
		FF h	Product master parameters
+3	Index number or master parameter number (low-order byte)		Setting value access index number (low-order byte) or master parameter number (low-order)
+4	Index number or master parameter number (high-order byte)		Setting value access index number (high-order byte) or master parameter number (high-order)
+5	Subindex number		Setting value access subindex number
+6	Write data		Reading setting value byte length * (2 bytes) or writing setting value (1 to 500 bytes) continue.
+7	“		
(below likewise)			

*1: Allocated status data

Allocated status data is composed 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 data content, refer to {Product status data reading} in “4-1 Product Functions” of Common Edition.

*When the setting value byte length for reading is set to 0, the response will correspond to the actual setting value length. In that case, the maximum readable byte length is 500 bytes.
*When the transfer data designation is 10 h, there is no need to send the reading setting value byte length.

Received data

Byte length	Data meaning	Data value	Description
+0	Response code	41 h	Setting value writing normal response
		4E h	No data designation response
		61 h	Setting value reading normal response
		62 h	Setting value reading data in preparation in background access mode
		42 h	Setting value writing processing in background access mode
		51 h	Background access mode cancel complete
		45 h	Setting value writing abnormal response
		46 h	Setting value writing abnormal response (extended error code)
		65 h	Setting value reading abnormal response
		66 h	Setting value reading abnormal response (extended error code)
+1	Error code	00 h	Normal
		02 h	Received socket data is too short
		03 h	Timeout generated in setting value access
		04 h	An unexpected response has returned in setting value access
		05 h	Module designation value is out of range
		06 h	Readout byte count is too long (over 500 bytes)
		07 h	Additional access request made during data access *After making a background access request, be sure to set the send data +1 transfer data designation to 10 h and complete reading or writing, or to 20 h and interrupt.
		08 h	Background access has not been executed even once
	Extended error code		
+2	Read data or next response code		Read data is a setting value (1 to 500 bytes). Ex.: Normal response when transfer data designation is 07 h 70 h, 00 h, process input data 68 bytes, 50 h, 00 h, 61 h, 00 h, setting value read data
+3	“		
(below likewise)			

Example of Data Transmission

Below is an example of data transmission to/from this product using socket communication.

Ex.: Master parameter reading

Reads the product’s master parameter number 8.

- Send data string (master parameter reading)

Byte order	Data value	Description
+0	53 h	Command
+1	04 h	Bit 3 = read designation (0), bit 2 = setting value access
+2	FF h	Module designation = product master parameters
+3	08 h	Master parameter number (decimal 8) low order
+4	00 h	Master parameter number (decimal 8) high order

Byte order	Data value	Description
+5	00 h	Subindex number (decimal 0)
+6	00 h	Reading setting value byte length (decimal 0) low order Note: For 0, only the actual data count is read.
+7	00 h	Reading setting value byte length (decimal 0) high order

• Response data string

Byte order	Data value	Description
+0	61 h	Setting value reading normal response
+1	00 h	Normal response code
	30 h	Read data (beginning of character string “012345”)
	31 h	Read data (2nd byte of character string “012345”)
	32 h	Read data (3rd byte of character string “012345”)
	33 h	Read data (4th byte of character string “012345”)
	34 h	Read data (5th byte of character string “012345”)
	35 h	Read data (6th byte of character string “012345”)

3-4-2 Modbus/TCP Communication

When the product network type is set to “CC-Link IE Field Basic,” access is possible via Modbus/TCP communication from the Modbus/TCP master to the product.
The register numbers below can be accessed.

Register number	Category	Details
00000 to 00067	Product operation-related	This area is for operation of this product from UI devices such as HMI (display)/SCADA. It includes the display indicator character string readout, button operation read/write, display screen switching, and operation lock.
00068 to 00070	Network time-related	The time counted within this product.
00071 to 00087	Status-related	This includes content related to allocated status data, errors, and events.
00088	Operations	Operations such as error clearing are conducted.
00089 to 00345	Digital/process data input-related	SIO digital input and IO-Link process input data (32 bytes/channel). Note: The content below is for readout only. 00346: Digital data output 00347 to 00602: Process data output
00603 to 03871	Index access library-related	This is a library area for ISDU communication with IO-Link devices (including sensor units connected to UC2-IOL). In order to designate an arbitrary index/subindex and read/write to/from connected IO-Link devices (including sensor units connected to UC2-IOL), this area registers channel number/index number designations, etc. (up to 128 items) to a library (called the index access library) and gives operation instructions.

Register number	Category	Details
03872 to 04123	Registered register number library-related	This area registers product non-sequential register numbers in a library (called the registered register number library) in advance and batch-reads designation sizes beginning with one of these numbers. Available only when reading from the Modbus/TCP master (possible only with function codes 03 h or 17 h). Not used for writing. One area registers frequently designated arbitrary register numbers (up to 125 items) as a library, another designates readout size, and a third contains execution data for the registered register number library.
04124 to 04126	Index access library/ registered register number library backup operation-related	This area conducts backup (save) operation of the index access library (0070 to 03871) and registered register number library (3872 to 3997) data to product non-volatile memory. When the power is next turned on, rewriting to the index access library or registered register number library on the user's part is not required.
05500 to 06565	Master parameter-related	This area reads and writes product master parameters.

For details of the product holding register designated during Modbus/TCP communication, refer to 3-2-2 "Detailed list of register numbers" in the Ethernet & Modbus/TCP Edition.

3-4-3 Event Communication

If there is an extreme pressure drop, etc., with an IO-Link device on a given channel, the product spontaneously receives the event code and event type sent from the IO-Link device and saves it in product memory.
At this time, the event flag (allocated to host master station RX17) turns ON, and the channel number where the event took place is stored in "Latest Event channel" (allocated to host master station RX10 to 13).
On this condition, from the Module FB for Mitsubishi Electric PLC or a client socket communication program, it is possible to access the master parameter "event data readout" and read out the event code and event type.

Thereby, the following IO-Link device phenomena can be grasped on the host master station side when they occur.

Errors (ex.: breakdowns, short-circuits) and maintenance information (ex.: maintenance predictive period complete)

Refer to each IO-Link device index list for their event codes.

3-5 Specific Communication Examples (including sample programs)

3-5-1 Example of Cyclic Communication

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

Example Combining IO-Link Communication and SIO

Process input data (4 bytes) from the channel 0 IO-Link device is read from the lower direction (default value).
Process output data (4 bytes) to the channel 1 IO-Link device is written from the upper direction.
Reads bit input data from the channel 2 SIO device (NPN type presence sensor).

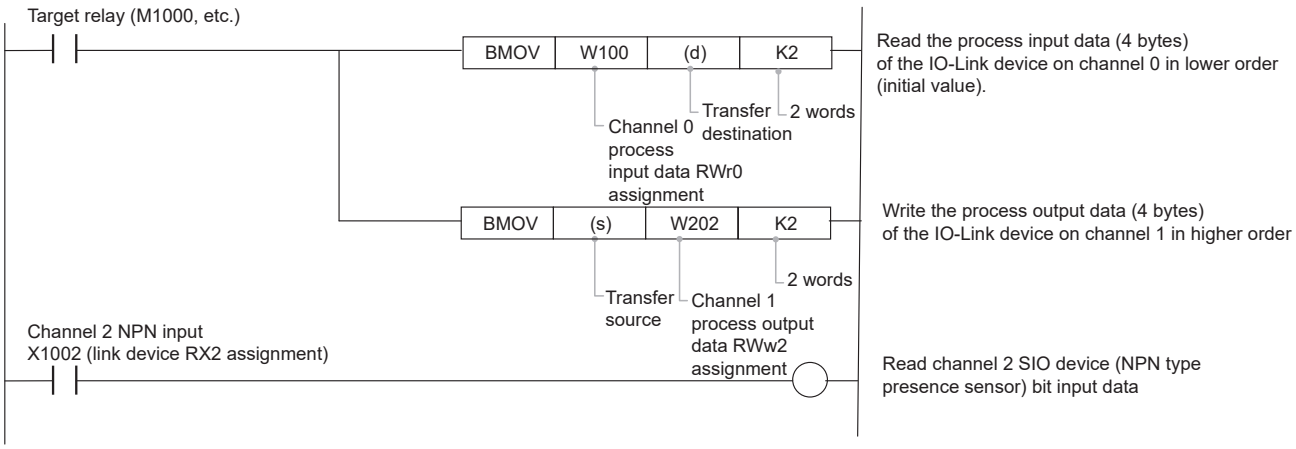
Host master side refresh settings

Link side					CPU side				
Device name	Points	Start	End		Target	Device name	Points	Start	End
RX	64	00000	003F	←→	Designated device	X	32	01000	01077
RY	64	00000	003F	←→	Designated device	Y	32	01000	01077
RWr	32	00000	001F	←→	Designated device	W	32	00100	0011F
RWw	32	00000	001F	←→	Designated device	W	32	00200	0021F

Product CC-Link IE Field Basic station number: Ex.: 1
Product master settings:

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

Master side program example:



3-5-2 Example of Acyclic Communication

This is an example of using acyclic communication to read and write IO-Link device service data.
Use an OPTEX FA Module FB for Mitsubishi Electric PLC or create a socket communication program.
Refer to “App-1 List of Product Master Parameters” for product master parameters.
Refer to each IO-Link device index list for their service data.

Using a Module FB for Mitsubishi Electric PLC

The following Modules FB for Mitsubishi Electric PLCs iQ-F Series are available.

UDP_READ (reading)
UDP_WRITE (writing)

Setting of IO-Link devices connected to the product and product master parameters is possible.
Refer to “App-2 Acyclic Communication Sample Programs Using Module FB” for further information.

MEMO

Download the above Module FB from the OPTEX FA website below.
https://www.optex-fa.com/

Socket Communication Program Creation

See “3-4-1 Socket Communication (UDP/IP or TCP/IP)” and “App-3 Sample Socket Communication Program”.

4

Specifications

This chapter describes the specifications of this product.

4-1 Specifications

4-1-1 Communication Specifications

Item		Specifications
Host network communication protocol		CC-Link IE Field Basic communication, socket communication (UDP/IP, TCP/IP), or Modbus/TCP
Conforming standard		IEEE802.3u
Transmission speed		100 Mbps(100BASE-TX)
Cable		Twisted pair cable (STP) Category 5, 5e or higher
Ethernet connection type		Star configuration, linear bus configuration
Cyclic communication	Method	CC-Link IE Field Basic cyclic transmission
	By station type	Slave station
	Number of occupied stations	1 station
	Distance between nodes	Within 100 m
	IP address setting	Static IP address
	Product standard response time	0.6 ms
	Extended access function	This function uses cyclic communication to read and write settings for this product and IO-Link devices (including sensor units connected to UC2-IOL). Host master side programs can be simplified.
	Port number	• Cyclic data transmission: 61450 (UDP) • Node connection: 61451 (UDP)
Acyclic communication	Method	Socket communication (UDP/IP or TCP/IP) or Modbus/TCP communication
	Access target	Both socket communication and Modbus/TCP: Reading and writing of setting values is possible, as well as reading of process data (writing to process data is not applicable). * Socket communication setting values background access mode is possible.
	Number of simultaneous connections	• Socket communication (UDP/IP: 4, TCP/IP: 1) • Modbus/TCP communication: 2
	IP address setting	Static IP address
	Port number	• Socket communication: 2001 (both TCP and UDP) • Modbus/TCP communication: 502

4-2 Data Processing Time

4-2-1 Process Data Response Time Calculation

The process data response time from the CC-Link IE Field Basic master and through IO-Link is indicated as follows.

MEMO

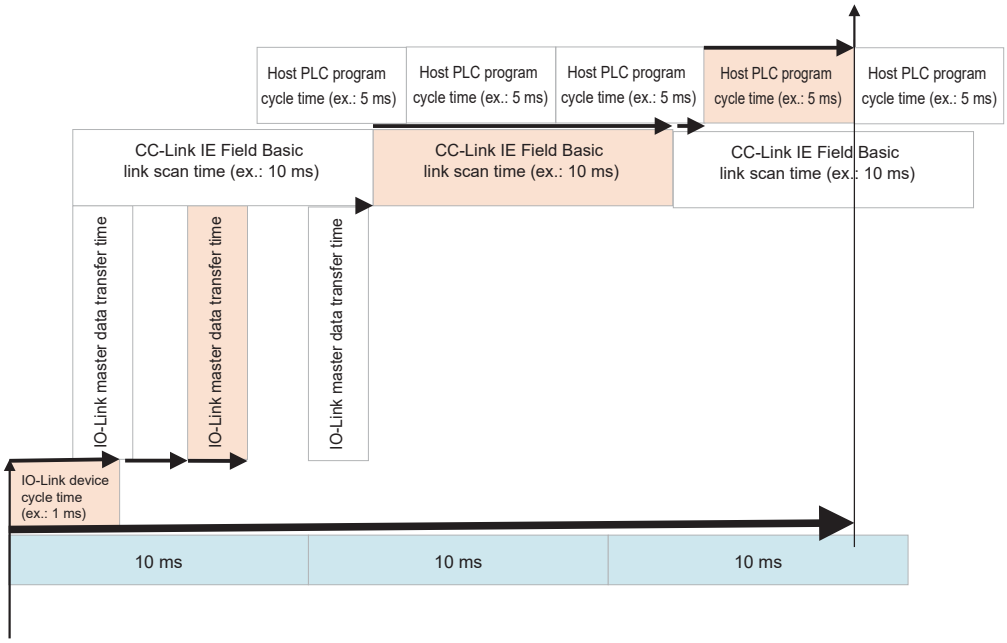
Product standard response time is 0.6 ms. As necessary, divide slave stations into fast-response and slow-response groups. Based on the standard response time of other slave stations in the same group, calculate the link scan time. With regard to the CC-Link IE Field Basic link scan time calculation, refer to the manual of the CC-Link IE Field Basic master.

When CC-Link IE Field Basic and IO-Link Are Not Synchronized

Process input data

(IO-Link cycle time) × (1 to 2) + (CC-Link IE Field Basic link scan time) × (1 to 2) + (host PLC program cycle time) × (1 to 2)

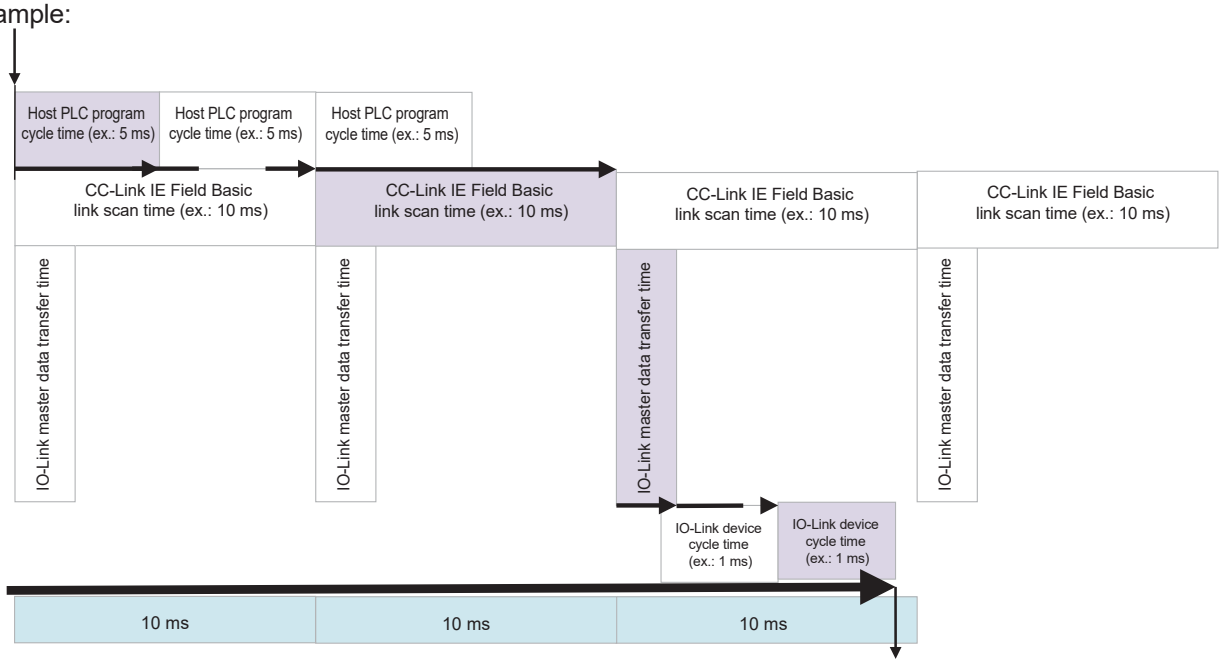
Example:



Process output data

(host PLC program cycle time) + (CC-Link IE Field Basic link scan time) × (1 to 2) + (IO-Link cycle time) × (1 to 2)

Example:



IO-Link Communication Response Time

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

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

The actual IO-Link communication cycle time 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.

Sample Cycle Time for IO-Link

Conditions: Process input data bytes: 2, process output data bytes: 0, 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 CC-Link IE Field Basic, 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 CC-Link IE Field Basic processing chip.
The processing time depends on the number of process data bytes for the IO-Link devices on all channels.
Transfer takes place at approximately 0.1 to 0.4 ms.

4-2-2 I/O Response Time Example

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

Conditions: Possible with the CC-Link IE Field Basic link scan time set to 3 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 × (1 to 2) + CC-Link IE Field Basic link scan time 3 ms × (1 to 2) + host PLC program cycle time 1 ms × (1 to 2) = 4.5 to 9.0 ms

5

Troubleshooting

Describes methods of troubleshooting related to CC-Link IE Field Basic 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	Network configuration setting is wrong	Check whether the network configuration setting is correct on GXWorks2/3.
			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: If the subnet mask is 255.255.255.0: Master: 192.168.0.2 Product: 192.168.0.1 the underlined part is the network part.

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	-	IC inside CC-Link IE Field Basic startup	The CC-Link IE Field Basic network chip is starting up.	-
Off	-		The CC-Link IE Field Basic network chip is not operating.	If the RUN LED does not stay ON (green) even though the power is ON, check the POWER LED. If the RUN LED is unlit even though the POWER LED is lit, the power voltage may be extremely low, or the network type switching may have failed, preventing startup.
Flashing green	-	Network chip firmware transferring	The CC-Link IE Field Basic network chip firmware is undergoing internal transfer.	-
Lit green	Lit green	CC-Link IE Field Basic communication status	Communication with the CC-Link IE Field Basic master station is normal.	-
Lit green	Flashing green		Communication disconnection	• Confirm the CC-Link IE Field Basic master status (for details, refer to the manual of the CC-Link IE Field Basic master station in use). • Confirm the status of the CC-Link IE Field Basic cable. • Confirm the status of the Switching Hub between the CC-Link IE Field Basic 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 CC-Link IE Field Basic master station
				  • Product front panel IP address lowest digit setting
				  • CC-Link IE Field Basic 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 CC-Link IE Field Basic	ALARM LED flashing red	Error flag ON	FFFA	CC-Link IE Field Basic communication has stopped	Confirm the status of the host network (CC-Link IE Field Basic).

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 shut down. 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 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 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.

Code (hexadecimal)	Message	Conditions	Procedure
FFF0	Invalid data in setting value information	There is an invalid character in the setting value information provided by the IO-Link device or in installed IODD data information, or a value exceeding the permitted value was specified.	This is caused by the firmware of the IO-Link device or this product. Update or replace the firmware of the IO-Link device or this product.
FFF1	Writing firmware data is abnormal	An attempt to write invalid data was made when updating the firmware.	There is something wrong with the data for the firmware being written. Reacquire the file and try again.
FFF3	The revision ID of the IO-Link device to verify is not registered in this product	This occurs when the revision ID registered to this product is “00 h”, when device verification (setting value number: M30) is set to a value other than “None”.	Change the setting value for device verification (setting value number: M30) to “None”. Alternately, 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”. Alternately, 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 once 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.

Code (hexadecimal)	Message	Conditions	Procedure
FFFA	Network communication has stopped	This occurs when host CC-Link IE Field Basic communication is established but then disconnected. The error will be automatically cleared when the status is restored.	Check whether the Ethernet cable is disconnected, the host PLC has been reset, or the power has turned OFF. Confirm the host PLC parameters. This product may stop being recognized on the network if host PLC network settings are changed.
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. Alternately, change the setting value for device verification (setting value number: M30) to “None”. Alternately, 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”. Alternately, 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”. Alternately, 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.

6

Appendix

Listed below.

· Product master parameters when reading/writing with socket communication

· Acyclic communication sample programs using Module FB

App-1 List of Product Master Parameters

This list shows product master parameters which can be set/monitored with Modbus/TCP communication or socket communication.

- For Modbus/TCP communication, it is done via writing/reading register numbers 05500 to 06565.
- For socket communication, it is done by designating bit 2/3 with transfer data designation (setting value access/writing or reading), FF h with module designation (product master parameters), master parameter number and target number, and reading/writing.

Refer to “5-1-4 Master parameter list with product front panel operation” in Common Edition for details on setting/monitoring with 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 low-order byte).

App-1-1 User Settings

In socket communication, designate a master parameter number and target number from the table below.

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

Master parameter numbers DEC (HEX)	Target numbers 0 to 15: Corresponds to channel number 0: This product	Data name	R/W	Format	Length in bytes	Value		Front panel controls (Master parameter numbers)	Modbus/TCP communication (register number)	Socket communication
1(1 h)	0	Master parameters reset	RW	UINT	1	0 (default value)	None	●(M1)	●(06500)	●
						1	Initialize I/O assignment for all channels in IO-Link mode. (Storage data, display language, network type, and network No. will not be initialized)			
						2	As above, initialize I/O assignment for all channels in PNP input mode.			
						3	As above, initialize I/O assignment for all channels in NPN input mode.			
						4	As above, initialize I/O assignment for all channels in PNP output mode.			
						5	As above, initialize I/O assignment for all channels in NPN output mode.			
						6	As above, initialize I/O assignment for all channels as unused.			
						7	Delete the installed IODD data.			
						8	Initialize including network setting and language as well. I/O assignment is unused. IODD data is not deleted.			

Master parameter numbers DEC (HEX)	Target numbers 0 to 15: Corresponds to channel number 0: This product	Data name	R/W	Format	Length in bytes	Value		Front panel controls (Master parameter numbers)	Modbus/TCP communication (register number)	Socket communication
2(2 h)	0	Network type	RW	UINT	1	Designate the host industrial network type.		●(M2)	●(06250)	●
						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)	●(05900)	●
5(5 h)	0	Language	RW	UINT	1	0 (default value)	English	●(M5)	●(05901)	●
						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	RW	INT	1	-96 to 96 (default value: 0)	Set the displayed network time (setting value number: M65) to the time difference (15-minute units). If UTC is the standard used for the network time set by the host, setting the time difference to 9 x 4 = 36 will display Japanese time (JST).	●(M6)	●(05902)	●
8(8 h)	0	User tag name	RW	STRING	1 to 32	Up to 32 characters	Set the product user tag name up to 32 characters.	●(M8)	● (05800 to 05815)	●
9(9 h)	0	I/O assignment batch settings	RW	UINT	1	0 (default value)	None	●(M9)	●(06501)	●
						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)	● (05500 to 05515)	●
						1	PNP input mode: Internal pull-down resistance is enabled.			
						2	NPN input mode: Internal pull-up resistance is enabled.			
						3	PNP output mode			
						4	NPN output mode			
						5 (default value)	Not used			

Master parameter numbers DEC (HEX)	Target numbers 0 to 15: Corresponds to channel number 0: This product	Data name	R/W	Format	Length in bytes	Value		Front panel controls (Master parameter numbers)	Modbus/TCP communication (register number)	Socket communication
11(B h)	0 to 15	Input filter time	RW	UINT	1	0 (default value)	None	●(M11)	● (05516 to 05531)	●
						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)	● (05532 to 05547)	●
						1	1 ms			
						2	15 ms			
						3	100 ms			
13(D h)	0 to 15	IO-Link communication and network error output	RW	UINT	1	0 (default value)	Clear	●(M13)	● (05548 to 05563)	●
						1	Input hold			
						2	Output hold			
						3	All Hold			
14(E h)	0	UC2 direct output start channel	RW	UINT	1	0 (default value)	The UC2 direct output function is not used.	●(M14)	●(05906)	●
						1 to 16	The sensor unit output signals received from the OPTEX FA IO-Link gateway UC2-IOL are directly output from the product PNP/NPN output. Specified values 1 through 16 correspond to channel numbers 0 through F on which to "start" output.			
15(F h)	0	Encoder input selection	RW	UINT	1	0 (default value)	Do not use encoder input.	●(M15)	●(05903)	●
						1 to 14	Connect phase A, phase B, and phase Z of the encoder to the following channels (SIO mode digital input). Phase A: Any channel from 0 to D (corresponds to 1 to 14) Phase B: Any channel from 1 to E (corresponds to 1 to 14) Phase Z: Any channel from 2 to F (corresponds to 1 to 14)			
						15, 16	Reserved. Do not set.			
						17 to 31	Connect phase A and phase B of the encoder to the following channels (SIO mode digital input). Phase A: Any channel from 0 to E (corresponds to 17 to 31) Phase B: Any channel from 1 to F (corresponds to 17 to 31) Phase Z: No assignment			
						32	Reserved. Do not set.			
						33 to 48	Phase A: Any channel from 0 to F (33 to 48 supported) Phase B, phase Z: No assignment			

Master parameter numbers DEC (HEX)	Target numbers 0 to 15: Corresponds to channel number 0: This product	Data name	R/W	Format	Length in bytes	Value		Front panel controls (Master parameter numbers)	Modbus/TCP communication (register number)	Socket communication
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)	● (05564 to 05579)	●
						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" in Common Edition for details.	●(M29)	● (05830 to 05893)	●
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)	● (05580 to 05595)	●
						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 + serial number verification Even if the type IDs (vendor ID and device ID) match, if the serial number is different, an error (FFFC h: serial number verify error) is generated, and the process data with the relevant IO-Link device is invalidated. Other operations are the same as set value 1.			
						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 set value 1.			

Master parameter numbers DEC (HEX)	Target numbers 0 to 15: Corresponds to channel number 0: This product	Data name	R/W	Format	Length in bytes	Value		Front panel controls (Master parameter numbers)	Modbus/TCP communication (register number)	Socket communication
31(1F h)	0 to 15	Automatic device parameter backup	RW	UINT	1	0 (default value)	None	●(M31)	● (05596 to 05611)	●
						1	Auto backup When IO-Link device set values are changed, they are automatically backed up in this product. If IO-Link device setting values are changed from this product, the backup operation will automatically start 10 seconds after the last change. Note: When a device with a different vendor ID or device ID is connected, backup is executed at every startup, so reset “Device verification” (set value number: M30) to correct the verification error (FFFE h) as soon as possible.			
						2	Auto restoration At startup, if the IO-Link device set value is different from the one stored in the product, it will be automatically restored (set value downloaded from the product to the IO-Link device). In this case, note that even if the IO-Link device set value is changed, it will be overwritten at the next startup with the data saved in this product.			
						3	Perform auto backup and auto restoration as above together The storage data stored on this product will always match the IO-Link device setting values. In other words, IO-Link device setting values are backed up to this product whenever they are changed. If any setting values are different from the IO-Link device during startup, the setting values stored in this product will be restored.			
32(20 h)	0 to 15	Device parameter backup/restore	RW	UINT	1	0 (default value)	None	●(M32)	● (06550 to 06565)	●
						1	Execute backup (uploading set values from devices to this product) manually			
						2	Execute restoration (downloading set values from the product to devices) manually			
						3	Delete backup data saved in the product manually			
33(21 h)	0 to 15	Conditions for applying IODD data	RW	UINT	1	0	Device	●(M33)	● (05612 to 05627)	●
						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 cyclic communication area When the setting value is 0 words, it will be allocated from the end.	●(M40)	● (05628 to 05643)	●
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 cyclic communication area When the setting value is 0 words, it will be allocated from the end.	●(M41)	● (05644 to 05659)	●

Master parameter numbers DEC (HEX)	Target numbers 0 to 15: Corresponds to channel number 0: This product	Data name	R/W	Format	Length in bytes	Value			Front panel controls (Master parameter numbers)	Modbus/TCP communication (register number)	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)	● (05660 to 05675)	●
						1	Big endian				
						2	Little endian				
44(2C h)	0	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” in Common Edition for details.	●(M44)	●(05904)	●
						1	Serial				
						2	Common Era				
						3	Serial + Parity				
						4	Common Era + Parity				
51(33 h)	0 to 15	IO-Link cycle time	R	UINT	2	1 to 1000	0.1 ms increments		●(M51)	● (06100 to 06115)	●
52(34 h)	0 to 15	IO-Link transmission rate	R	UINT	1	0	Not communicating		●(M52)	● (06116 to 06131)	●
						1	COM1				
						2	COM2				
						3	COM3				
53(35 h)	0 to 15	Number of IO-Link communication errors	R	UINT	1	0 to 255	To clear, write 1 in set value 114 h offset +0.		●(M53)	● (06132 to 06147)	●
54(36 h)	0 to 15	Number of IO-Link ISDU checksum errors	R	UINT	1	0 to 255	To clear, write 1 in set value 114 h offset +0.		●(M54)	● (06148 to 06163)	●
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)	● (06164 to 06179)	●
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)	● (06180 to 06195)	●
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. IO-Link communication mode” in “5-1-4 Master parameter list with product front panel operation” in Common Edition for details.	●(M57)	● (06196 to 06211)	●
58(3A h)	0 to 15	Storage back-up 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 (ex.:December 31. 2022 18:59:00) [18:59:00_22/12/31]		●(M58)	● (06320 to 06463)	●

Master parameter numbers DEC (HEX)	Target numbers 0 to 15: Corresponds to channel number 0: This product	Data name	R/W	Format	Length in bytes	Value		Front panel controls (Master parameter numbers)	Modbus/TCP communication (register number)	Socket communication
60(3C h)	0	System program version of IO-Link master unit	R	UINT	4	P.PPNNLLFF	Displays the data version of the program, etc. P.PP: Firmware, NN: Network chip, LL: Logic, FF: Font 4 bytes in decimal.	●(M60)	● (06300, 06301)	●
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)	● (06302, 06303)	●
62(3E h)	0	Display drive time	R	UINT	4	0 to 262143 (30 years)	Product display operating time information (unit: hours)	●(M62)	● (06304, 06305)	●
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)	●(06251)	●
64(40 h)	0	Internal temperature	R	INT	2	-2739 to 10457	Product internal temperature (unit: 0.1°C)	●(M64)	●(06252)	●
65(41 h)	0	Network time	R	STRING	22	00:00:00.0000_00/01/01 to 23:59:59.0000_99/12/31	Time and date (ex.: December 31, 2022 18:59:00.0000) [18:59:00.0000_22/12/31]	●(M65)	● (00068 to 00070: hexadecimal value)	●
67(43 h)	0	Network timeout time	R/W	UINT	2	0 to 30000	When the network type is “Ethernet & Modbus/TCP,” if Ethernet communication stops and the designated time passes, a network communication error (FFFA h) will be generated. The designated time can be designated in 10ms intervals from 0 to 30,000 (300 seconds). The default value is 0. If set to 0, even if Ethernet communication stops, it will be considered an internal data refresh on a cycle of roughly 10 ms, and no error will be generated. An error will, however, be generated even then if the Ethernet cable is disconnected.	●(M67)	●(05905)	●
80 (50 h)	0	Default gateway	R/W	UINT	4	0.0.0.0 to 255.255.255.255	Set any special designations. If there are none, leave the default values as they are. The default value is 0.0.0.0.	●(M80)	● (06306, 06307)	●
81 (51 h)	0	Subnet mask	R/W	UINT	4	0.0.0.0 to 255.255.255.255	Set any special designations. If there are none, leave the default values as they are. The default value is 255.255.255.0.	●(M81)	● (06308, 06309)	●
82 (52 h)	0	IP address	R/W	UINT	4	0.0.0.0 to 255.255.255.255	Set the product’s IP number to an arbitrary value. Set only when setting to other than the default value of 192.168.0.xxx (xxx is the value set with the rotary switch). Turn the rotary switch on the product front panel when the power is on to move automatically to this “M82. IP address” setting screen.	●(M82)	● (06310, 06311)	●

App-1-2 Data for Access from PLC

In socket communication, designate a master parameter number and target number from 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 ●. For Modbus/TCP communication, as reference, the register number of the equivalent function is shown.

Master parameter numbers	Target numbers	Data name	R/W	Offset	Value	Front panel controls	Socket communication	Reference: Modbus/TCP communication or equivalent register number
100 h	0 to 15 (Corresponds to channel number)	Latest error code readout by channel	R	+0	Error code lower	? -4. Event/ error display	●	See 00073 to 00075
				+1	Error code upper			
				+2	Lower designated index number causing error			
				+3	Upper designated index number causing error			
				+4	Designated index number causing error			
				+5 to 26	Error time and date text string (in order of generation) See the form below. HH:MM:SS YY:MN:DD (HH: hour, MM: minute, SS: second, YY: year last two digits, MN: month, DD: day) Ex.: Generated at 18:59:00 on February 19, 2020: 18:59:00 20/02/19 Note: When 100-µs unit data is added, HH:MM:SS:ssss YY:MN:DD (ssss: seconds in 100-µs units).			

Master parameter numbers	Target numbers	Data name	R/W	Offset	Value	Front panel controls	Socket communication	Reference: Modbus/TCP communication or equivalent register number
101 h	0 to 15 (Corre-sponds to channel number)	Event data readout by channel	R	+0	Event flag	? -4. Event/ error display	●	See 00076 to 00087
				+1	Event byte order 1 type (*1)			
				+2	Event Code Lower			
				+3	Event Code Upper			
				+4	00 h (fixed)			
				+5	Event byte order 2 type (*1)			
				+6	Event Code Lower			
				+7	Event Code Upper			
				+8	00 h (fixed)			
				+9	Event byte order 3 type (*1)			
				+10	Event Code Lower			
				+11	Event Code Upper			
				+12	00 h (fixed)			
				+13	Event byte order 4 type (*1)			
				+14	Event Code Lower			
				+15	Event Code Upper			
				+16	00 h (fixed)			
				+17	Event byte order 5 type (*1)			
				+18	Event Code Lower			
				+19	Event Code Upper			
				+20	00 h (fixed)			
				+21	Event byte order 6 type (*1)			
				+22	Event Code Lower			
				+23	Event Code Upper			
				+24	00 h (fixed)			
				+25 to 150	The text string for generation times of event byte order 1 to 6 will be displayed (in order) after the event. Example 1: Event byte order 1 only generated at 19:15:32 on June 24, 2020: (1) 19:15:32 20/06/24 Example 2: Event byte order 1 to 6 all generat-ed 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	Reference: Modbus/TCP communication or equivalent register number
102 h	0	Set value readout time from IO-Link devices (binary data)	R	+0	15.265 µs unit data lower	-	●	None
				+1	15.265 µs unit data upper			
				+2	Set 0 as January 1, 1970, 00:00:00, counting data every second Lowest-order			
				+3	As above 2nd byte			
				+4	As above 3rd byte			
				+5	Same as above, highest-order			
				+6	Lower parity information with read-out set values as word units with exclusive disjunction (XOR) at 35 AC h			
				+7	Same as above, high-order			
	1	Set value readout time from IO-Link devices (common era data)	R	+0	15.265 µs unit data lower			
				+1	15.265 µs unit data upper			
				+2	s			
				+3	min			
				+4	hr			
				+5	day			
				+6	month			
				+7	year			
				+8	Lower parity information with read-out set values as word units with exclusive disjunction (XOR) at 0 x35AC			
				+9	Same as above, high-order			
	2	Set value readout time from IO-Link devices (text string data)	R		A 27-character text string will be displayed. Ex.: 2020/2/29 18:59:0.1234 parity 8B61 h → 18:59:00.1234 20/02/29 8B61			
103 h	0 (This product)	Event/error message readout	R		Executing readout switches the display to the event/error display window.	? -4. Event/ error display	●	None
				+0	Applicable channel (0 - 15)			
				+1	Designated index number causing error/event qualifier			
				+2	Index number in error Low-order			
				+3	Index number in error High-order			
				+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	Reference: Modbus/TCP communication or equivalent register number
104 h	0 (This product)	Button operation	R	+0	Returns the status of the currently pressed button. Value is the same as below.		-	●	00064
			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	●	None
	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.	-	●	00067
					Bit 1: Device set value write lock				
					Bit 2: /Event/error clear operation lock				
					Bit 3: All button operation lock				
107 h	0	Readout display text string (1st row)	R	+0 to +499	Text string on display Character codes: Japanese: Shift-JIS Simplified Chinese: GB2312 Traditional Chinese: Big-5 Korean: EUC-kr		-	●	00000 to 00031
	1	Readout display text string (2nd row)	R					●	00032 to 00063

Master parameter numbers	Target numbers	Data name	R/W	Offset	Value	Front panel controls	Socket communication	Reference: Modbus/TCP communication or equivalent register number
108 h	1	Right button operation response	R	-	Operation response when remotely operating product buttons by designated target numbers is stored under the following decimals. Responses are as below. 1: Referencing set values 10 - 19: Digit position of set values being edited (equivalent to digits 1-10) 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.	-	●	00064
	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.	-	●	00065
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.	-	●	00088 Bit 0
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.	-	●	None
			W	+0 to +63				

Master parameter numbers	Target numbers	Data name	R/W	Offset	Value	Front panel controls	Socket communication	Reference: Modbus/TCP communication or equivalent register number
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	-	●	None
				+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.			
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.	-	●	None
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.	-	●	None
				+2 to +4	Device 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			

Master parameter numbers	Target numbers	Data name	R/W	Offset	Value	Front panel controls	Socket communication	Reference: Modbus/TCP communication or equivalent register number
111 h	0 (This product)	Diagnostic information	R	+0	Main memory (EEPROM) checksum error count	-	●	None
				+1	Sub memory (flash) checksum error count			
				+2	Always 0.			
				+3	Bit 0-5: Result of pressing switch alone in past			
				+4 to 5	Display device drive power supply voltage (0.1 V unit)			
				+6	Acyclic 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	Set value version number (0)			
				+10	Network communication error count			
				+11	Storage function state number (normally 0, changes when storage-related functions operate)			
				+12 to +13	Reserved (always 0)			
112 h	0 (This product)	Output overcurrent status	R	+0 to +1	Current output overcurrent status. Bits 0-15 are equivalent to I/O channels 0-9 and A-F.	-	●	00072
				+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	-	●	None
				+2 to +4	Device ID			
				+5	Always 0.			
				+6	Revision ID			
				+7	Always 0.			
				+8 to +9	Function ID			

Master parameter numbers	Target numbers	Data name	R/W	Offset	Value	Front panel controls	Socket communication	Reference: Modbus/TCP communication or equivalent register number
114 h	0 to 15 (Corresponds to channel number)	IO-Link device diagnostic information	R	+0	Number of IO-Link communication errors.	-	●	None
			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 units)			
			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, 4-7: Same as 0-3 with IO-Link Revision 1.0)			
			R	+12	IO-Link device on-request data byte count			
			R	+13	Process input data disabled (0: Enabled, 1: Disabled)			
	0	Clear IO-Link communication error count	W	+0	Write 1 to clear all channels' IO-Link communication error count. Write 2 to 17 to clear channels 0 to F separately.			
	1	Clear IO-Link ISDU checksum error count		+0	Write 1 to clear all channels' ISDU checksum error count. Write 2 to 17 to clear channels 0 to F separately.			
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.	-	●	None

Master parameter numbers	Target numbers	Data name	R/W	Offset	Value	Front panel controls	Socket communication	Reference: Modbus/TCP communication or equivalent register number
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.	-	●	None
	0	Start of IO-Link communication trace	W	+0	Bits 3-0: 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.	-	●	None
				+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 No.	R	+0 to +5	6-byte MAC register number data	-	●	None
				+6	I/O voltage measurement calibrated value			
				+7	Internal temperature measurement calibrated value			
				+8 to 23	Product serial number (16 characters)			

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

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

App-2 Acyclic Communication Sample Programs Using Module FB

This is a sample program using an OPTEX FA Module FB for Mitsubishi Electric PLCs.

App-2-1 Usage Example of FB to Read Parameter (UDP_READ)

Ex.: Every 1 second, the product's master parameter unit tag name (M8) is read.

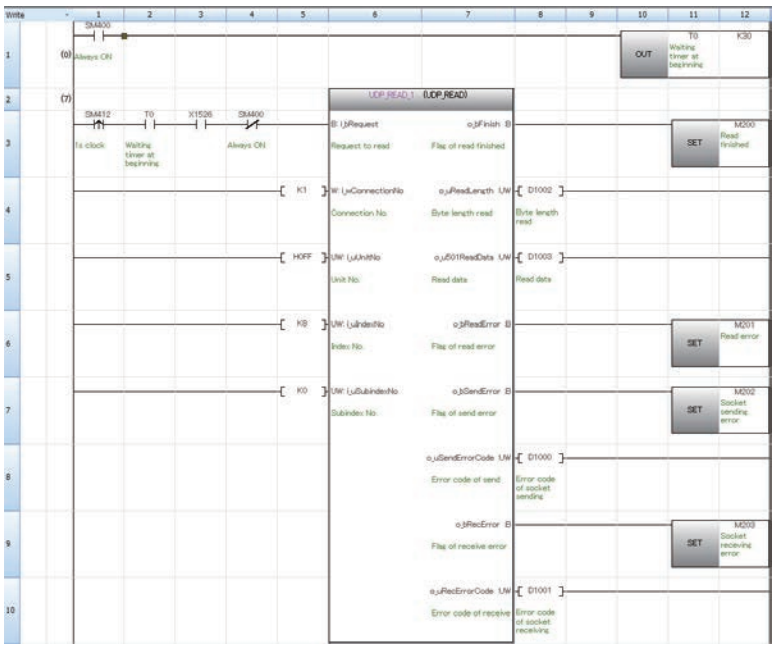
Reads setting values periodically when the 1-second clock starts up.

The connection number is the value designated with the Ethernet configuration setting (built-in Ethernet port).

Module number H0FF indicates the product master parameters.
When accessing the IO-Link devices connected to the product, designate H80 to H8F, which correspond to channel numbers 0 to F.

Designate the setting value number 8 (unit tag name) as the index number.

Designate 0 as the subindex number, as this setting value number is common across channels.



Operated 0.5 seconds after the PLC runs (timer setting is arbitrary).

Sets M200 at read complete.

When read normally, the readout byte count will be stored in D1002.

Read data or error codes are stored in D1003 on.

M201 will be set if a read error occurs.

M202 will be set if a socket send error occurs.

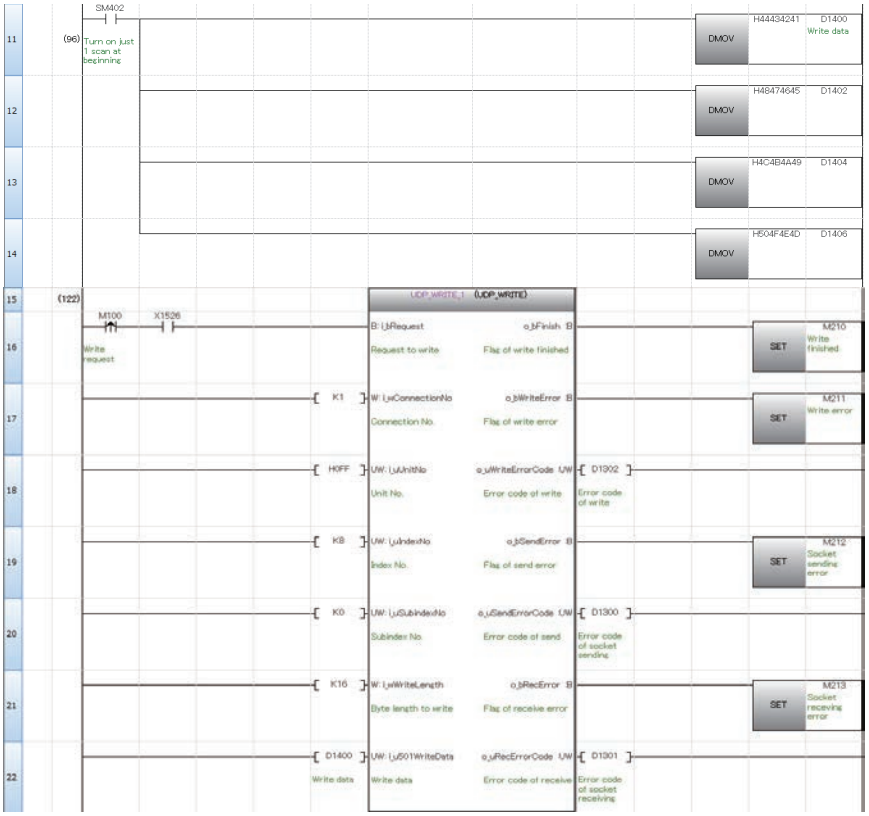
Socket send error codes are stored in D1000.

M203 will be set if a socket receive error occurs.

Socket receive error codes are stored in D1001.

App-2-2 Usage Example of Module FB for Writing (UDP_WRITE)

Ex.: When conditions are met, the product's master parameter unit tag name (M8) writes a given value.



Setting values are written at M100 startup.

The connection number is the value designated with the Ethernet configuration setting (built-in Ethernet port).

Module number H0FF indicates the product master parameters. When accessing the IO-Link devices connected to the product, designate H80 to H8F, which correspond to channel numbers 0 to F.

Designate the setting value number 8 (unit tag name) as the index number.

Designate 0 as the subindex number, as this setting value number is common across channels.

Write data is stored in D1400 on.

Sets M210 at write complete.

M211 will be set if a write error occurs.

Write error codes are stored in D1302.

M212 will be set if a socket send error occurs.

M212 will be set if a socket send error occurs.
Socket send error codes are stored in D1300.

M213 will be set if a socket send error occurs.

Socket receive error codes are stored in D1301.

App-2-3 FB to Read Parameter (UDP_READ) Content

Label List

	Label Name	Data Type		Class	Japanese/日本語(Display Target)
1	i_bRequest	Bit	...	VAR_INPUT	Request to read
2	i_wConnectionNo	Word [Signed]	...	VAR_INPUT	Connection No.
3	i_uUnitNo	Word [Unsigned]/Bit String [16-bit]	...	VAR_INPUT	Unit No.
4	i_uIndexNo	Word [Unsigned]/Bit String [16-bit]	...	VAR_INPUT	Index No.
5	i_uSubindexNo	Word [Unsigned]/Bit String [16-bit]	...	VAR_INPUT	Subindex No.
6	o_bFinish	Bit	...	VAR_OUTPUT	Flag of read finished
7	o_uReadLength	Word [Unsigned]/Bit String [16-bit]	...	VAR_OUTPUT	Byte length read
8	o_u501ReadData	Word [Unsigned]/Bit String [16-bit](0..500)	...	VAR_OUTPUT	Read data
9	o_bReadError	Bit	...	VAR_OUTPUT	Flag of read error
10	o_bSendError	Bit	...	VAR_OUTPUT	Flag of send error
11	o_uSendErrorCode	Word [Unsigned]/Bit String [16-bit]	...	VAR_OUTPUT	Error code of send
12	o_bRecError	Bit	...	VAR_OUTPUT	Flag of receive error
13	o_uRecErrorCode	Word [Unsigned]/Bit String [16-bit]	...	VAR_OUTPUT	Error code of receive
14	m_u2SendControl	Word [Unsigned]/Bit String [16-bit](0..1)	...	VAR	Contorl data of send
15	m_u5SendData	Word [Unsigned]/Bit String [16-bit](0..4)	...	VAR	Send data
16	m_b2SendFlag	Bit(0..1)	...	VAR	Flag of send finished
17	m_bReceiving	Bit	...	VAR	Flag of under receiving
18	m_w2RecControl	Word [Signed](0..1)	...	VAR	Control data of receive
19	m_w501RecData	Word [Signed](0..500)	...	VAR	Receive data
20	m_b2RecFlag	Bit(0..1)	...	VAR	Flag of receive finished
21	m_uTemp	Word [Unsigned]/Bit String [16-bit]	...	VAR	Temporary data
22	m_bSendReq	Bit	...	VAR	Request to send
23	m_bReadError	Bit	...	VAR	Flag of read error
24	m_wReadLength	Word [Signed]	...	VAR	Byte length read

Supplementary description

Label name	Value	Description
Connection number Designate write data number of bytes to 16 bytes.		The number when opening the Ethernet port provided on the Mitsubishi Electric PLC CPU module via socket communication. The connection No. displayed on the UDP connection module with the GXWorks3 Ethernet configuration screen.
Module number		Specifies the read target.
	80 h to 8F h	Channels 0 to F IO-Link devices.
	C0 h to CF h	Channels 0 to F IO-Link devices. Specifies 4 bytes or less of read data as little-endian.
	FF h	Product master parameters.
Index number		IO-Link device internal index number or product master parameter setting value number.
Subindex number		IO-Link device internal subindex number or product master parameter target number.

Module FB Internal Program

Specifies the word point count for socket sending.

In accordance with Ethernet socket communication protocol, command 53 h and transfer data designation 04 h are stored.

Shifts index number low-order byte to high-order byte.

Stores the value designating the module (module number) in the low-order byte with OR.

Shifts index number high-order byte to low-order byte.

Shifts the subindex number to the high-order byte and connects it to the index number high-order byte to form 1-word data.

Specifies the readout byte count as 0 and returns a response with the actual readout byte count.

Sets the relay for socket sending.

Executes socket sending to the designated connection number IP address.

Resets the send request relay as of sending.

Turns the error output relay on for 1 scan in the case of an error in the socket sending results.

Outputs a socket send error code.

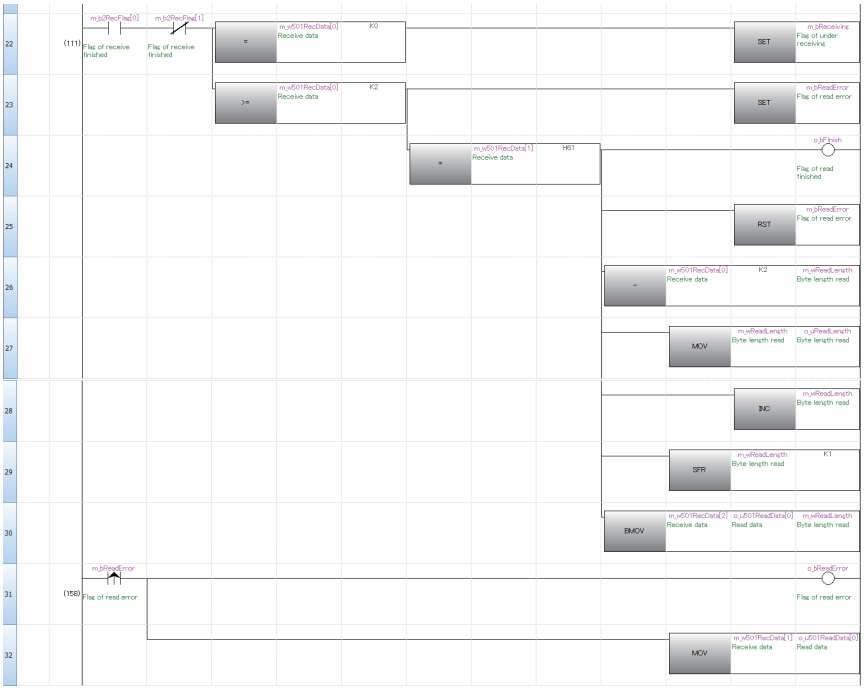
Sets the relay for socket receiving if there is no socket sending error.

Starts socket receiving when the receiving relay starts up.

Resets the receiving relay when receiving begins.

Turns the error output relay on for 1 scan in the case of an error in the socket receiving results.

Outputs a socket receive error code.



Starts receiving again when the receive byte count is 0.

Interprets receive data when the receive byte count is 2 bytes or more. Sets the read error relay in advance and resets afterward if normal.

Beginning receive data is 0061 h: Reading has ended normally.

Outputs as the readout byte count the beginning response code 2 bytes subtracted from the read data byte count.

Converts to word count by adding 1 to the readout byte count and dividing by 2.

Transmits the read data to the extent of the readout word count.

If a readout error is generated, turns the error relay on for 1 scan and outputs an error code.

App-2-4 Module FB for Writing (UDP_WRITE) Content

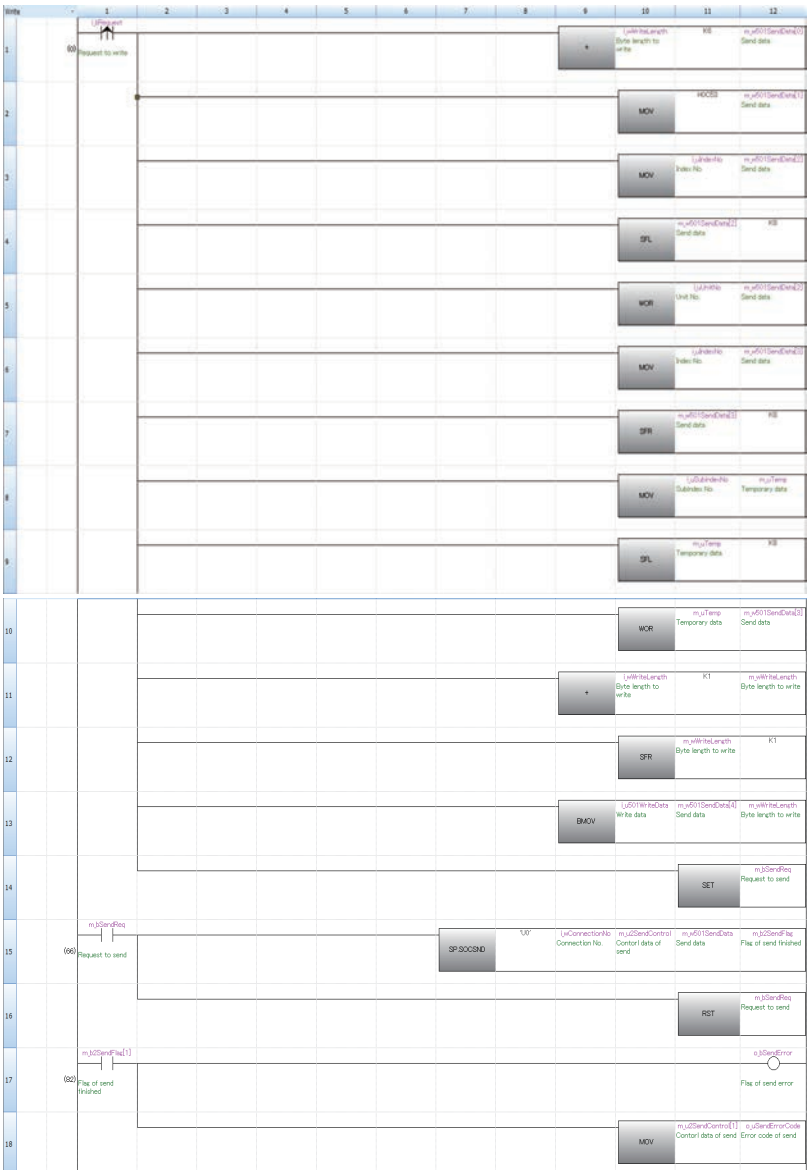
Label List

	Label Name	Data Type		Class	Japanese/日本語(Display Target)
1	i_bRequest	Bit	..	VAR_INPUT	Request to write
2	i_wConnectionNo	Word [Signed]	..	VAR_INPUT	Connection No.
3	i_uUnitNo	Word [Unsigned]/Bit String [16-bit]	..	VAR_INPUT	Unit No.
4	i_uIndexNo	Word [Unsigned]/Bit String [16-bit]	..	VAR_INPUT	Index No.
5	i_uSubindexNo	Word [Unsigned]/Bit String [16-bit]	..	VAR_INPUT	Subindex No.
6	i_wWriteLength	Word [Signed]	..	VAR_INPUT	Byte length to write
7	i_u501WriteData	Word [Unsigned]/Bit String [16-bit](0.500	..	VAR_INPUT	Write data
8	o_bFinish	Bit	..	VAR_OUTPUT	Flag of write finished
9	o_bWriteError	Bit	..	VAR_OUTPUT	Flag of write error
10	o_uWriteErrorCode	Word [Unsigned]/Bit String [16-bit]	..	VAR_OUTPUT	Error code of write
11	o_bSendError	Bit	..	VAR_OUTPUT	Flag of send error
12	o_uSendErrorCode	Word [Unsigned]/Bit String [16-bit]	..	VAR_OUTPUT	Error code of send
13	o_bRecError	Bit	..	VAR_OUTPUT	Flag of receive error
14	o_uRecErrorCode	Word [Unsigned]/Bit String [16-bit]	..	VAR_OUTPUT	Error code of receive
15	m_u2SendControl	Word [Unsigned]/Bit String [16-bit](0.1)	..	VAR	Contor data of send
16	m_w50SendData	Word [Signed](0.500)	..	VAR	Send data
17	m_b2SendFlag	Bit(0.1)	..	VAR	Flag of send finished
18	m_bReceiving	Bit	..	VAR	Flag of under receiving
19	m_w2RecControl	Word [Signed](0.1)	..	VAR	Contor data of receive
20	m_w50RecData	Word [Signed](0.500)	..	VAR	Receive data
21	m_b2RecFlag	Bit(0.1)	..	VAR	Flag of receive finished
22	m_uTemp	Word [Unsigned]/Bit String [16-bit]	..	VAR	Temporary data
23	m_bSendReq	Bit	..	VAR	Request to send
24	m_bWriteError	Bit	..	VAR	Flag of read error
25	m_wWriteLength	Word [Signed]	..	VAR	Byte length to write

Supplementary description

Label name	Value	Description
Connection number		The number when opening the Ethernet port provided on the Mitsubishi Electric PLC CPU module via socket communication. The connection No. displayed on the UDP connection module with the GXWorks3 Ethernet configuration screen.
Module number		Specifies the write target.
	80 h to 8F h	Channels 0 to F IO-Link devices.
	C0 h to CF h	Channels 0 to F IO-Link devices. Specifies 4 bytes or less of write data as little-endian.
	FF h	Product master parameters.
Index number		IO-Link device internal index number or product master parameter setting value number.
Subindex number		IO-Link device internal subindex number or product master parameter target number.

Module FB Internal Program



Specifies the word point count for socket sending.

In accordance with Ethernet socket communication protocol, command 53 h and transfer data designation 0C h are stored.

Shifts index number low-order byte to high-order byte.

Stores the value designating the module (module number) in the low-order byte with OR.

Shifts index number high-order byte to low-order byte.

Shifts the subindex number to the high-order byte and connects it to the index number high-order byte to form 1-word data.

Converts to word count by adding 1 to the write byte count and dividing by 2.

Transmits the write data to the extent of the write word count.

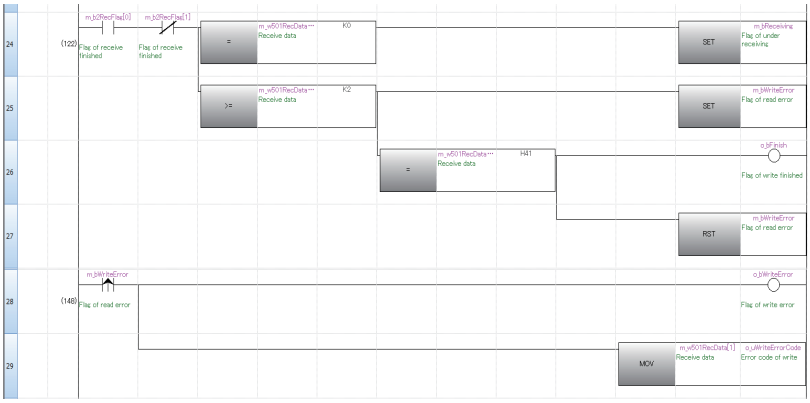
Sets the relay for socket sending.

Executes socket sending to the designated connection number IP address.

Resets the send request relay as of sending.

Turns the error output relay on for 1 scan in the case of an error in the socket sending results.

Outputs a socket send error code.



Starts receiving again when the receive byte count is 0.

Interprets receive data when the receive byte count is 2 bytes or more. Sets the read error relay in advance and resets afterward if normal.

Beginning receive data is 0041 h: Writing has ended normally.

If a readout error is generated, turns the error relay on for 1 scan and outputs an error code.

App-3 Sample Socket Communication Program

This is a sample socket communication program.

```
// UR-ES Series CC-Link IE Field Basic Visual Studio for C++ Sample Program
//
// UR_ES_IEFB_sample.cpp: Defines the console application entry point.
//

#include “stdafx.h”

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

// configuration property → linker → input → add ws2_32.lib; to added dependent files.
// Project character set uses a multi-byte set, not Unicode.
```

Definitions

```
// Definitions
//#define TCPIP                    // Undesignated: UDP, designated: TCP/IP

#define PARAM_LEN        400   // setting value maximum data length
#define RESPCODE_LEN       2   // response code length

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

```
// definition of transfer data
#define PARAM_READ     4                  // setting value read
#define PARAM_WRITE    (PARAM_READ + 8)   // setting value write

// Response code
#define RESP_PWRITE    0x41               // setting value write
#define RESP_WBUSY     0x42               // setting value write busy status
#define RESP_NODATA    0x4E               // no data
#define RESP_PREAD     0x61               // setting value read
#define RESP_PBUSY     0x62               // setting value read busy status

// Ethernet/TCP protocol definition
typedef struct {
  BYTE command;                           // command
  BYTE xferData;                          // transfer data designation
  BYTE unit;                              // unit designation
  BYTE indexL;                            // low-order index number
  BYTE indexH;                            // high-order index number
  BYTE subindex;                          // subindex number
  BYTE readLenL;                          // readout byte count low-order
  BYTE readLenH;                          // readout byte count high-order
} txDataNoWrite;                          // no write

typedef struct {
  BYTE command;                           // command
  BYTE xferData;                          // transfer data designation
  BYTE unit;                              // unit designation
  BYTE indexL;                            // low-order index number
  BYTE indexH;                            // high-order index number
  BYTE subindex;                          // subindex number
  BYTE writeData[PARAM_LEN];              // setting value write data
} txDataPwrite;                           // write setting values only
```

```
// send buffer union
union txBlock {
  txDataPwrite pWrite;                  // setting value write
  txDataNoWrite noWrite;                // read only
};

typedef struct {
  BYTE respCode;                        // response code (RESP_NODATA, RESP_PWRITE)
  BYTE errCode;                         // error code (extended error code)
} rxDataNoRead;                         // no read

typedef struct {
  BYTE respCode;                        // response code (RESP_PREAD)
  BYTE errCode;                         // error code (extended error code)
  BYTE readData[PARAM_LEN];             // setting value read data
} rxDataPread;                          // read setting values only

// receive buffer union
union rxBlock {
  rxDataPread pRead;                    // setting value read only
  rxDataNoRead noRead;                  // setting value write 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;
}
```

```
//---------------------------------------
// receive data console display
// message    : response type character string
// recByte    : receive data length
// respCode    : response code
// respExp    : expected response code
// errCode    : error code
// buffer    : buffer to display
// length    : data length to display
// return    : Nothing
//---------------------------------------
void dispRxData(char *message, int recByte, BYTE respCode, BYTE respExp, BYTE errCode, BYTE *buffer, int length)
{
  int i;

  if (recByte == -1) {
    printf("A socket send error has occurred. ¥n");
   }
  else if (recByte == -2) {
    printf("A socket receive error has occurred. ¥n");
   }
  else if (respCode != respExp || errCode != 0) {
    printf("The %s response code (0x%02X) is abnormal. ¥n", message, respCode);
    printf("The error code is 0x%02X. ¥n", errCode);
   }
   else {
    printf("The %s response code (0x%02X) is normal. ¥n", message, respCode);
    if (length > 0) {
       // display 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 destination IP address
  char destination[32];
  BYTE ipAdrs3rd = 1;   // 3rd byte
  BYTE ipAdrs4th = 31;  // 4th byte
  sprintf_s(destination, 32, "192.168.%d.%d¥0", ipAdrs3rd, ipAdrs4th);

  // designate port number (2001 fixed for UR-ES Ethernet/TCP)
  int port = 2001;

  // set 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);

  // generate socket
  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

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

Sample Program 1: Setting Value Reading

```
//--------------------------------
// Sample 1: Setting value reading
//--------------------------------
// Use a data structure suited to the transfer data designation
// Send: No write data, so txBuffer.noWrite
// Receive: Setting value read data, so rxBuffer.pRead
printf("Sample 1¥n");
txBuffer.noWrite.command = 0x53;
txBuffer.noWrite.xferData = PARAM_READ;
txBuffer.noWrite.unit = 0xFF;                    // target UR-ES unit setting values
txBuffer.noWrite.indexH = 0x00;
txBuffer.noWrite.indexL = 0x08;                  // read index number = 8
txBuffer.noWrite.subindex = 0x00;
txBuffer.noWrite.readLenL = 0;                   // designate 0 for read data length and response will be 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(
  "Setting value read",                          // character string to be displayed
  recByte,                                       // receive data length
  rxBuffer.pRead.respCode,                       // setting value reading response code
  RESP_PREAD,                                    // expected response code
  rxBuffer.pRead.errCode,                        // setting value read error code
  (BYTE *)&rxBuffer.pRead.readData,              // display data address
  recByte - RESPCODE_LEN                         // data length to be displayed (deleting 1 response code portion)
);
```

Sample Program 2: Setting Value Writing

```
    //--------------------------------
    // Sample 2: Setting value writing
    //--------------------------------
    // Use a data structure suited to the transfer data designation
    // Send: Setting value write data, so txBuffer.pWrite
    // Receive: Setting value write response, so rxBuffer.noRead
    printf("Sample 2¥n");
    txBuffer.pWrite.command = 0x53;
    txBuffer.pWrite.xferData = PARAM_WRITE;

    txBuffer.pWrite.unit = 0xFF;                    // target UR-ES unit setting values
    txBuffer.pWrite.indexH = 0x00;
    txBuffer.pWrite.indexL = 0x08;                  // read index number = 8
    txBuffer.pWrite.subindex = 0x00;
    txBuffer.pWrite.writeData[0] = 'a';             // write data
    txBuffer.pWrite.writeData[1] = 'b';
    txBuffer.pWrite.writeData[2] = 'c';
    txBuffer.pWrite.writeData[3] = 'd';
    txBuffer.pWrite.writeData[4] = 'e';
    int pWriteLen = 5;                              // setting value write byte length

    // socket send/receive
    recByte = sendRecSocket(
      dstSocket,                                    // socket ID
      (char *)&txBuffer,                            // send buffer
      (char *)&rxBuffer,                            // receive buffer
      sizeof(txDataNoWrite) + pWriteLen,            // send data length
      sizeof(rxDataNoRead)                          // receive data length
    );
    dispRxData(
      "Setting value write",                        // character string to be displayed
      recByte,                                      // receive data length
      rxBuffer.noRead.respCode,                     // setting value writing response code
      RESP_PWRITE,                                  // expected response code
      rxBuffer.noRead.errCode,                      // setting value writing error code
      (BYTE *)&rxBuffer.noRead.errCode,             // display data address (dummy)
      0                                             // data length to display
    );

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

    return 0;
}
```

Sample Program 3: Setting Value Background Reading

```
//-------------------------------------------------
// Sample 3: Setting value background reading
//-------------------------------------------------
// Use a data structure suited to the transfer data designation
// Send: No write data, so txBuffer.noWrite
// Receive: Setting value read data, so rxBuffer.pRead
printf("Sample 3¥n");
txBuffer.noWrite.command = 0x53;
txBuffer.noWrite.xferData = BACK_READ;

txBuffer.noWrite.unit = 0xFF;                // target UR-ES unit setting values
txBuffer.noWrite.indexH = 0x00;
txBuffer.noWrite.indexL = 0x41;              // read index number = 65
txBuffer.noWrite.subindex = 0x00;
txBuffer.noWrite.readLenL = 0;               // designate 0 for read data length and response will be actual data length
txBuffer.noWrite.readLenH = 0;

do {
  // 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(
  "Setting value read",                      // character string to be displayed
  recByte,                                   // receive data length
  rxBuffer.pRead.respCode,                   // setting value reading response code
  RESP_PREAD,                                // expected response code
  rxBuffer.pRead.errCode,                    // setting value read error code
  (BYTE *)&rxBuffer.pRead.readData,          // display data address
  recByte - RESPCODE_LEN                     // data length to be displayed (deleting 1 response code portion)
);

// Change to background access status confirmation
txBuffer.noWrite.xferData = BACK_STATUS;

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

Sample Program 4: Setting value background writing

```
  //-------------------------------------------------
  // Sample 4: Setting value background writing
  //-------------------------------------------------
  // Use a data structure suited to the transfer data designation
  // Send: No write data, so txBuffer.pWrite
  // Receive: Setting value read data, so rxBuffer.noRead
  printf("Sample 4¥n");
  txBuffer.noWrite.command = 0x53;
  txBuffer.noWrite.xferData = BACK_WRITE;

  txBuffer.noWrite.unit = 0xFF;                    // target UR-ES unit setting values
  txBuffer.noWrite.indexH = 0x00;
  txBuffer.pWrite.indexL = 0x08;                   // read index number = 8
  txBuffer.pWrite.subindex = 0x00;
  txBuffer.pWrite.writeData[0] = 'A';              // write data
  txBuffer.pWrite.writeData[1] = 'B';
  txBuffer.pWrite.writeData[2] = 'C';
  txBuffer.pWrite.writeData[3] = 'D';
  txBuffer.pWrite.writeData[4] = 'E';
  txBuffer.pWrite.writeData[5] = 'F';
  pWriteLen = 6;                                   // setting value write byte length

  do {
    // socket send/receive
    recByte = sendRecSocket(
      dstSocket,                                   // socket ID
      (char *)&txBuffer,                           // send buffer
      (char *)&rxBuffer,                           // receive buffer
      sizeof(txDataNoWrite) + pWriteLen,           // send data length
      sizeof(rxDataNoRead)                         // receive data length
  );
  dispRxData(
    "Setting value write",                         // character string to be displayed
    recByte,                                       // receive data length
    rxBuffer.noRead.respCode,                      // setting value writing response code
    RESP_PWRITE,                                   // expected response code
    rxBuffer.noRead.errCode,                       // setting value writing error code
    (BYTE *)&rxBuffer.noRead.errCode,              // display data address (dummy)
    0                                              // data length to display
  );

  // Change to background access status confirmation
  txBuffer.noWrite.xferData = BACK_STATUS;

 } while (rxBuffer.pRead.respCode == RESP_WBUSY);

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

 return 0;
}
```

Index

L

M

N

O

P

R

S

T

U

W

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.

OPTEX FA CO., LTD.

91 Chudoji-Awata-cho Shimogyo-ku Kyoto 600-8815 JAPAN
TEL. +81-75-325-1314 FAX. +81-75-325-2936
https://www.optex-fa.com

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

UR-ES-CL_UM-E-003-2312