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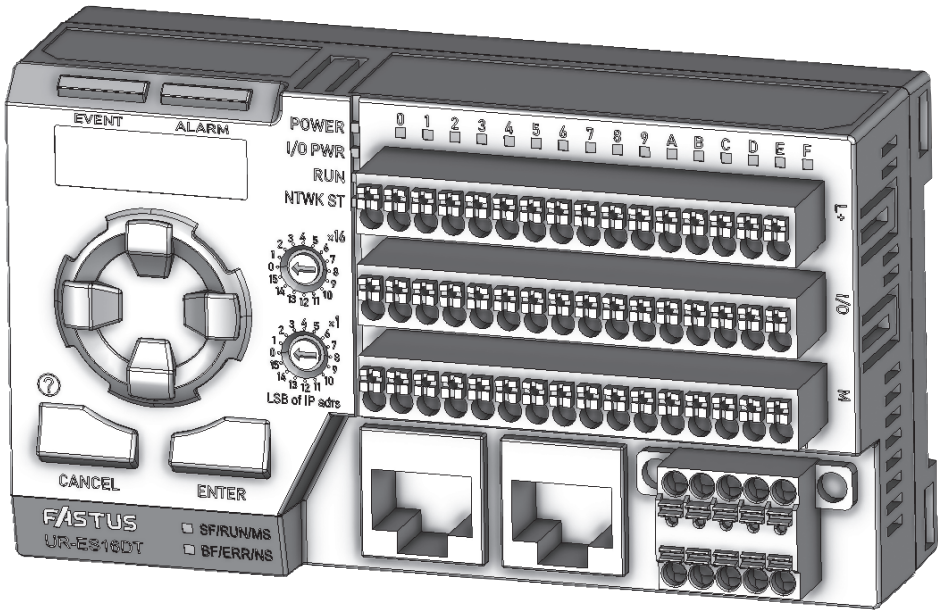
IO-Link Master

UR-ES16DT

User's Manual
Common Edition



OPTEX FA CO., LTD.

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Introduction

Thank you for purchasing the UR-ES16DT IO-Link Master.
This manual contains essential information for using the IO-Link Master UR- ES16DT regardless of the field network type (for the essential information on each field network type, refer to the respective communication section).
Read this manual thoroughly before using the product to ensure correct product use with full understanding of the functions and performance of the product. After reading the manual, keep it in a safe and accessible location for further reference.

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Safety Precautions

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

Safety Symbols

The indications and their meanings are as follows.

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

Notes

⚠WARNING	
	Do not disassemble, repair, modify, deform under pressure, or attempt to incinerate this product. Doing so may cause injury or fire.
	Do not use this product in water or in a location where it may be exposed to water. Do not use this product if wet. Doing so may cause a fire or damage the product.
	This product is not explosion-proof and should not be used around flammable or explosive gases or liquids. Doing so may cause ignition resulting in an explosion or fire.
	Do not use air dusters or any spray that uses flammable gas around the product or on the inside of the product. Doing so may cause ignition resulting in an explosion or fire.
	Do not use this product in environments other than industrial environments. If used in other environments, it may cause induction and radiation interference.
	Do not install this product or its cables in any of the following locations. Doing so may cause a fire, damage, or a malfunction. 1. Locations where dust, salt, iron powders, or vapor (steam) is present. 2. Locations subjected to corrosive gases or flammable gases. 3. Locations where water, oil, or chemical splashes may occur. 4. Locations where heavy vibrations or impacts may occur. 5. Locations where the ambient temperature exceeds the rated range. 6. Locations subject to rapid temperature changes (or where condensation occurs). 7. Locations with strong electric or magnetic fields. 8. Outdoor locations or locations subject to direct light.
	Do not use the product at voltages or with AC power supplies that exceed the rated voltage. Doing so may cause a fire or damage the product.

⚠WARNING

	**Field network communication is shut off** The process output data is held or cleared according to the “IO-Link and network error handling” of the Master parameters in this product. It also holds or turns off PNP/NPN output data. At this time, take safety measures outside this product so that the system works on the safe side.
	**After IO-Link communication has been shut off** If the IO-Link communication fails, the process output data is held or cleared according to the “IO-Link and network error handling” of the Master parameters in this product. At this time, take safety measures outside this product so that the system works on the safe side.
	**What to do in the event of a malfunction such as smoke being emitted from the product** If you detect any malfunction including emission of smoke, abnormal smells or sounds, or the body becoming very hot, immediately stop operating the product and turn off the power. Failure to do so can cause fire. Repairing the product is dangerous and should in no way be performed by the customer. Contact an OPTEX FA sales representative for repairs.
	**What to do if water enters the product** If water or any other liquid enters the product or the cable, immediately stop operating the product and turn off the power. Using the product in this condition may cause a fire.

⚠CAUTION

	Do not touch this product or the cable with wet hands. Doing so may damage the product.
	When wiring this product, do so properly according to this manual and specified instruction manuals. Incorrect wiring can cause product failure or malfunction.
	Connect only specified cables to this product. Use of cables other than those specified can cause malfunction.
	Keep wiring separate from high voltage and motor circuits. Using the same wiring can cause malfunction or failure. If this is unavoidable, shield with a conductor such as an earthed conduit.
	Install this product as far away as possible from high-voltage equipment, equipment that generates large switching surges and equipment that generates noise, such as welding machines or inverter motors.
	Use this product mounted on a DIN rail secured with the end plates, sold separately. Make sure to use the product while locked, when a locking mechanism is equipped.
	Tighten the mounting screws that attach the power terminal block to the main unit with a torque value of 0.25 N•m or less.
	Do not apply torsional stress to cables. Doing so can cause cables and connectors to malfunction. Fix communication cables connected to this product within lengths of 30 cm without applying stress to the product.

⚠CAUTION	
	Do not drop this product or subject it to strong impact or vibrations. Doing so may damage the product.
	This product generates heat during operation, so do not maintain physical contact for long periods of time. Doing so can cause low-temperature burns, etc.
	Use this product within the rated range.
	Do not turn off power during communication.
	Make sure to turn OFF the power before connecting or disconnecting cables and connectors. Connection or disconnection while running can cause malfunction.
	Always hold the connector when connecting or disconnecting cables and do not apply excessive force to cables.
	When removing a connector, do not touch the terminals inside the connector or allow foreign objects to get inside.
	Do not connect an actuator that does not support IO-Link to the channel of this product set to IO-Link mode. Depending on the operation of establishing IO-Link communication, the actuator may repeat ON/OFF operation with an unintended short cycle.
	Make sure to turn OFF the I/O power supply before replacing the IO-Link device.
	When the program in the host master processes the process input data in IO-Link mode, make sure to confirm that the IO-Link Ready flag is ON before executing the program.
	When using power cables or commercially available switching regulators, make sure the frame ground (FG) is grounded.
	Wait until after transient state (approx. 2 sec.) when power is turned ON before use.
	Make sure to attach the protective cap when the connector of this product is not attached to a cable.
	Make sure to use an isolation transformer for DC power supply.
	If a surge occurs in the power supply used, use a surge absorber for the source of generation.
	If this product used in a manner not specified by the manufacturer, the protection provided by this product may be impaired.

Maintenance

Do not use thinner, benzene, acetone or kerosene to clean devices.

Handling Precautions

(1) After carefully considering the intended use, required specifications, and usage conditions, install and use the product within the specified ranges.
(2) Due to advances in technology, published content, including the hardware, software, and system information published in this user's manual, is subject to change without notice.
(3) When using this product, it is the responsibility of the customer to ensure necessary safety designs in hardware, software, and systems in order to prevent any threat to life, physical health, and property due to product malfunction or failure.
(4) This product is not intended for use with nuclear power, railways, aviation, vehicles, medical equipment, food-handling equipment, or any application where particular safety measures are required. Absolutely do not use this product for any of these fields.
(5) This product cannot be used in applications that directly or indirectly detect human bodies for the purpose of ensuring safety. Do not use this product as a detection device for ensuring human safety.
(6) Do not use this product for the development of weapons of mass destruction, for military use, or for any other military application. Moreover, if this product is to be exported, comply with all applicable export laws and regulations, including the "Foreign Exchange and Foreign Trade Act" and the "Export Administration Regulations," and carry out the necessary procedures pursuant to the provisions therein.
(7) For more details on conformity to the Restriction of Hazardous Substances Directive for this product, please contact an OPTEX FA sales representative.
Before using this product, fully examine the applicable environmental laws and regulations, and operate the product in conformity to such laws and regulations.
OPTEX FA does not assume any responsibility for damages or losses occurring as a result of noncompliance with applicable laws and regulations.

Trademarks

- Company, system and product names in this manual are the trademarks or registered trademarks of their respective companies.

Notes on Overseas Regulations and Standards

To use this product as an EN standard compliant product, make sure to observe the following installation specifications.

- Install in a conductive enclosure (control panel, etc.).
- Use a power supply cable of 30 m or less.

Related Manuals

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

Product Communication Edition

Describes communication according to the field network type used.

Manual number	Manual name	Details
UR-ES-EI_UM-E-XXX-XXXX	IO-Link Master UR-ES16DT User's Manual EtherNet/IP Edition	Describes common functions and performance as well as operation when using "EtherNet/IP" as the field network. Be sure to read this when using cyclic or acyclic communication via EtherNet/IP.
UR-ES-EM_UM-E--XXX-XXXX	IO-Link Master UR-ES16DT User's Manual Ethernet & Modbus/TCP Edition	Describes common functions and performance as well as operation when using "Ethernet & Modbus/TCP" as the field network. Be sure to read this when using Modbus/TCP communication or Ethernet socket communication.
UR-ES-CL_UM-E--XXX-XXXX	IO-Link Master UR-ES16DT User's Manual CC-Link IE Field Basic Edition	Provides an overview of the use of "CC-Link IE Field Basic" as the field network. Be sure to read this when using cyclic communication via CC-Link IE Field Basic or acyclic communication via UDP socket communication.
UR-ES-EC_UM-E--XXX-XXXX	IO-Link Master UR-ES16DT User's Manual EtherCAT Edition	Describes common functions and performance as well as operation when using "EtherCAT" as the field network. Be sure to read this when using cyclic or acyclic communication via EtherCAT.

Peripherals

Refer to the following for other peripherals

Manual name	Details
IO-Link Remote Input Unit UR-DS16D Instruction manual	The instruction manual included with the IO-Link Remote Input Unit. Refer to the IO-Link Remote Input Unit specifications, settings and index list.
IO-Link Remote Output Unit UR-DS16T Instruction manual	The instruction manual included with the IO-Link Remote Output Unit. Refer to the IO-Link Remote Output Unit specifications, settings and index list.
IO-Link Remote I/O Unit UR-DS8D8T Instruction manual	The instruction manual included with the IO-Link Remote Input/Output Unit. Refer to the IO-Link Remote Input/Output Unit specifications, settings and index list.
Photoelectric sensor Z4 series Instruction manual	The instruction manual included with the photoelectric sensor, Z4 series. Refer to this for Z4 series specifications and settings.
TOF Distance Setting Sensor TOF-DL250GC series Instruction manual	The instruction manual included with the TOF Distance Setting Sensor TOF-DL250GC series. Refer to this for TOF-DL250GC series specifications and settings.
IO-Link gateway UC2-IOL Instruction manual	The instruction manual included with the IO-Link gateway UC2-IOL. Refer to this when connecting this product with UC2-IOL.
Digital fiber amplifier D3RF series Instruction manual	The instruction manual included with the digital fiber amplifier, D3RF series. Refer to this when connecting D3RF sensors with UC2-IOL.
White light source digital fiber amplifier D3WF series Instruction manual	The instruction manual included with the white light source digital fiber amplifier, D3WF series. Refer to this when connecting this D3WF sensors with UC2-IOL.
Displacement sensor amplifier unit CDA series Instruction manual	Instruction manual included with the displacement sensor amplifier unit, CDA series. Refer to this when connecting CDA amplifiers with UC2-IOL.
Displacement sensor amplifier unit CDA series User's Manual	User's manual for the displacement sensor amplifier unit, CDA series. Refer to this manual when connecting CDA amplifiers with UC2-IOL.

Manual name	Details
Displacement sensor CD22 series Instruction manual	Instruction manual included with the displacement sensor, CD22 series (RS-485 communication type). Reference when connecting the CD22 series with the CDA series.
Through-beam Edge Sensor TD1 series Instruction manual	The instruction manual included with the through-beam edge sensor, TD1 series. Reference when connecting the TD1 series with the CDA series.
Through-beam Edge Sensor TD1 series User's Manual	The user's manual for the through-beam edge sensor, TD1 series. Reference this when connecting the TD1 series with the CDA series.

Manual Structure

This manual's content is structured as follows.

1. Overview	This chapter describes an overview of the IO-Link Master (hereafter "this product").
2. Installation, wiring and front operation for initial settings	This chapter describes installation of this product, setting of 4th octet for field network connection, communication connection, power supply connection and initial settings with the front operation panel of this product.
3. Communication	This chapter provides an overview of how this product performs field network communication and IO-Link communication, and information on the initial settings for performing IO-Link communication.
4. Product functions	This chapter describes the functions of this product.
5. Front panel operations	This chapter describes how to operate the front panel of this product.
6. Specifications	This chapter describes the specifications of this product.
7. Troubleshooting	This chapter describes what you need to know when using this product such as troubleshooting.

Contents

7 Troubleshooting

Notations Used in this Manual

These are the notations used in this manual.

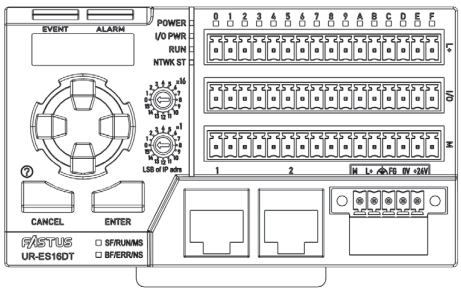
CAUTION
This indicates particularly important points to observe during operation.

MEMO
This information is useful for operation.

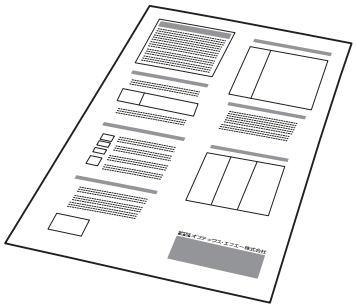
Checking the Included Items

Before you use this product, check the items included with it. If there are any defective or damaged items, please contact OPTEX FA or your local distributor.

Product Packaging



• UR-ES16DT unit



• Instruction manual

- 3x I/O terminal block
- 1x Power terminal block
- 2x RJ45 connector protective cap (attached to unit)

Other Required Items

Cables

This product uses the following cables.

Type	Specifications
Ethernet cable	Ethernet cables that fulfill the following specifications • Connector: RJ45 plug connector Cable: Use an Ethernet cable of category 5 or above that complies with a standard (1000BASE-T, 100BASE-TX, 10BASE-T). Refer to the manual for Product Communication Edition according to the field network type. For details, refer to the user's manual of each field network master.

Switching hub

The usable switching hubs depend on the communication type of the field network.
Refer to the manual for Product Communication Edition according to the field network type.

Terminology List

This explains the terminology used in this document.

Terminology	Description
IO-Link Master	This is our IO-Link Master that supports various field network communications. This is referred to as “this product” within this document.
IO-Link Master	This device performs IO-Link communication with IO-Link devices in an IO-Link system, and also operates as a local station of field network.
IO-Link device	This is an I/O device, such as a sensor or actuator, that can perform IO-Link communication with the IO-Link Master.
SIO device	This is an I/O device that does not support IO-Link communication.
I/O assignment settings	Specifies IO-Link communication or digital input/output with an external device (IO-Link device or SIO device) connected to this product. The following can be selected for each device to be connected. • IO-Link mode • PNP input mode • NPN input mode • PNP output mode • NPN output mode • Not used Note: This product does not have IO-Link specification Pin2 sink (PNP) input functions.
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 handling	This is an indexed service data unit used for acyclic communication of I/O device parameters.
Event communication	For IO-Link communication, acyclic communication will be used for notifications from IO-Link devices to the IO-Link Master. When an event occurs on any IO-Link device, the event flag and up to the latest 6 event types/event codes of the IO-Link device on each channel are displayed in the “Event data read” of the master parameters of this product.
Cycle time	This describes the IO-Link communication cycle time.
Process input data	For IO-Link communication process I/O communication, cyclic data transmission will be used for data from IO-Link devices to the IO-Link Master.
Process output data	For IO-Link communication process I/O communication, cyclic data transmission will be used for data from the IO-Link Master to IO-Link devices.
Channel	I/O terminals on this product to be connected with IO-Link or I/O devices. Numbers from 0 to F (hexadecimal) are preassigned.
Master parameters	Data of this product that can be read and written by operating the controls on the front of this product, acyclic communication on the field network, or extended access in cyclic communication.
Process data	Data of the IO-Link device that can be read and written using IO-Link process I/O communication. General name for process input data or process output data.
Service data	Data of the IO-Link device that can be read and written using IO-Link ISDU handling (acyclic).
Events	Shows events that occur within the IO-Link device. There are 3 types: notifications, errors and warnings.
Event code	Each IO-Link device event has an associated event (notification, error, warning) code. When the event flag turns ON, the event code is read by executing the acyclic communication program on the field network master. Alternatively, the event code can be checked using the event/error display window on the front of the product.
Errors	Refers to errors with this product. When an error occurs, the error code and the specified index number and sub-index number that caused the error are stored in the “Latest error code for each channel readout” field of the product’s master parameters.

Terminology	Description
Error code	Error codes detected by this product. If the error flag is ON, the field network master can execute a acyclic communication program to read the error code. Alternatively, the error code can be checked using the event/error display on the front of the product.
IO-Link ready flag	One type of process input data. A flag that turns ON when communicating with IO-Link devices on all connection channels and when field network communication with the field network master is established.
Event flag	One type of process input data. A flag that turns ON when an event occurs on 1 or more IO-Link devices. The latest channel in which the event occurred is stored in the latest event channel.
Error flag	One type of process input data. A flag that turns ON when an error occurs on 1 or more IO-Link devices. The latest channel in which the error occurred is stored in the latest error channel.
Extended access	A communication method that allows the cyclic communication area to be used (without using acyclic communication) to read and write parameters. The following can be accessed. • Any service data in any connected IO-Link device • Product master parameters • Specific data in a sensor unit interconnected with UC2-IOL
Byte length or target selection to access	Specify which of the following target selection to access to use when extended access is enabled. • Target sensor unit interconnected with OPTEX FA IO-Link gateway UC2-IOL • Connection of any channel Master parameter of IO-Link device or this product (specify the data size to be read and written at this time).
I/O synchronization	Synchronizes multiple channel IO-Link communication or digital I/O transfer.
Process data sequence conversion	Converts the IO-Link device process data to little endian format or big endian format and transfers it to the field network. Specify for each channel.
Little endian format	One of the methods of arranging data in bytes, in which data is arranged in reverse order from the lowest-order byte.
Big endian format	One of the methods of arranging data in bytes, in which the data is arranged in order from the highest-order byte.
Device validation	With IO-Link communication, process data is transferred only when the IO-Link device has the same registered revision ID, type ID, serial number, or model name. Specify for each channel.
Revision ID	IO-Link protocol version implemented on the IO-Link device.
Type ID	The ID that identifies the type. A generic term for vendor ID and device ID.
Vendor ID	ID that identifies the manufacturer of the IO-Link device.
Device ID	ID that identifies the type of the IO-Link device (consisting of one or more types).
IO-Link communication and network error handling	When the field network communication shuts down, IO-Link process output data is retained or cleared to zero. It also holds or turns off PNP/NPN output data. When IO-Link communication shuts down, IO-Link process input data is retained or cleared to zero. This provides a fail-safe. Set for each IO-Link channel.
Input hold time	Holds ON for the specified time after the input signal turns ON. Specify for each channel.
Input filter time	Configures the filter that removes input signal noise. Specify for each channel.
Manual backup/restore of settings	Manually backs up/restores the parameters in the IO-Link device. Specify for each channel.
Automatic storage (backup/restore) of settings	Automatically backs up/restores the parameters in the IO-Link device. Specify for each channel.
Storage data	If the IO-Link device supports the data storage function, this is the parameter in the IO-Link device that can be backed up to or restored from this product.
UR Master Manager	Tool for setting up a third party's IO-Link device profile for the device connected to this product. Using Ethernet communication, it is possible to transfer IODD data to this product, and to monitor or change the parameters, and to back up or restore the parameters.

Overview

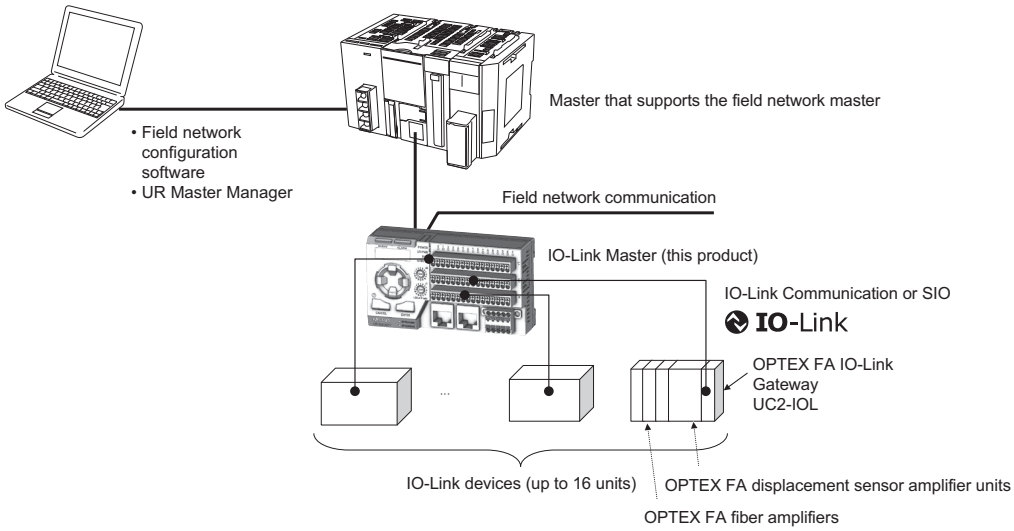
This section describes an overview of this product.

1-1 Product Overview

This product is an IO-Link Master equipped with the field network communication function.
This communicates in an upper network with a field network master that supports a field network, and simultaneously performs IO-Link process data communication with the connected IO-Link devices.
Depending on the network type, it is also capable of receiving communication messages from the master that supports field network communication, with IO-Link ISDU handling, and reading/writing service data in the IO-Link device when necessary.

It can also be used to check and change settings, check process data, and check events using the front panel controls.
It is also possible to use setup tool software (free download available) to back up and restore the settings of the IO-Link devices, check and change the settings of the IO-Link devices, and check the current value of the process data.

Structure Example of Field Network and IO-Link System



Features

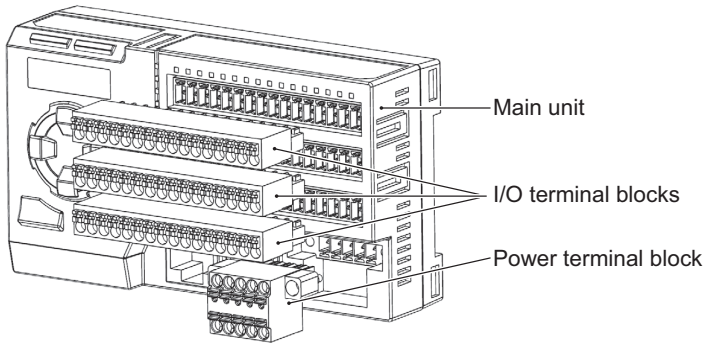
- The field network can be switched among the followings in the setting menu.
  - EtherNet/IP (default value)
  - EtherCAT
  - PROFINET (under development)
  - Ethernet & Modbus/TCP
  - CC-Link IE Field Basic
- No. of IO-Link Devices: Up to 16 units.
- NPN device connection is possible with SIO. Mixed connection of NPN devices and PNP devices is possible. Moreover, the output is equipped with an overcurrent protection circuit.
- IO-Link communication can be processed with independent hardware logics to achieve the fastest cycle time of the specifications, 0.3ms.

- The IODD data transfer function is supported. This enables parameters and process data of IO-Link devices to be displayed on the display of this product or on a human machine interface unit connected with PLC through a field network, by installing a converted IODD file to this product.
- With OPTEX FA IO-Link device or a third party's IO-Link device that supports IO-Link Object Profile Plus (OP+), setting parameters can be displayed on this product in multiple languages without transferring an IODD file.
- 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 product, as being with the network time, at 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).
  Also, time data read from parameters of IO-Link devices can be stored in this product, and then can be read by a master PLC.
- It is possible to connect the rotary encoder as an SIO device to this product and send the current value of the high-speed counter to the field network master on the process data side.
- The OLED display and operation keys enable the following actions on the front panel:
  - Master parameter setting
  - I/O assignment status monitoring
  - Changes of connected IO-Link device settings
  - Monitoring of connected IO-Link device process data
  - Display in multiple languages is supported. (English, French, German, Italian, Japanese, Korean, Portuguese, Simplified Chinese, Spanish, Traditional Chinese)
- The type ID (vendor ID and device ID) of the IO-Link device can be saved in the unit, enabling the device connection and configuration to be verified. Furthermore, the serial number and model name can be referred.
- The IO-Link device settings can also be saved on this product enabling device settings that are saved prior to device replacement to be uploaded (restored) from this product to the replaced IO-Link device (both automatic and manual methods are available).

1-2 Part Names and Functions

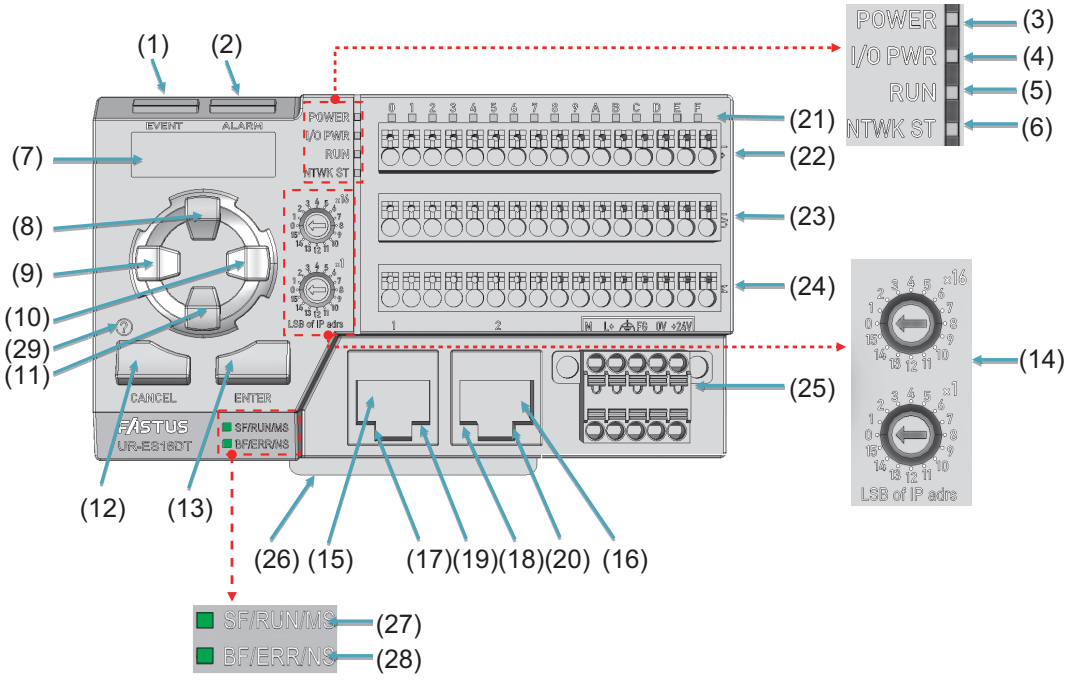
1-2-1 Prior to Use

Assemble the included I/O terminal blocks (three pieces) and power terminal block (one piece) to the main unit as shown below.



1-2-2 Part Names and Functions

The names and functions of each part after assembling the terminal blocks are as follows.



(1) EVENT LED (yellow)

Blinks while an event is occurring on one of the connected IO-Link devices.
At this time, the “event flag” is turned ON.
For details about event flags, refer to the [Cyclic Communication] section.

(2) ALARM LED (red)

Blinks while this product is detecting an error.
At this time, the “error flag” is turned ON.
For details about error flags, refer to the [Cyclic Communication] section.

(3) POWER LED (green)

Indicates the status of the unit power supply of this machine.
Illuminated: Power on
Off: Power off or unit power supply voltage drop.

(4) I/O PWR LED (green)

Indicates the power supply status of the I/O power supply.
Illuminated: I/O power supply available (17 V or higher)
Blinking: I/O voltage is in the range of 10 - 17 V.
Off: No I/O power supply, or I/O voltage drop (less than 10 V).

(5) RUN LED (green)

Lights when the internal IC of the field network starts up.

(6) NTWK ST LED (green)

Displays the status of the field network communication.
Illuminated: Normal communication
Blinking: Communication interruption
Off: Not communicating

(7) Display

A display for showing various information.
The display will turn off automatically after 10 minutes of inactivity.
Press any key to resume the display.
If the cumulative display drive time is 100 hours or less, automatic shut off of the display is not activated.

(8) [↑] key

Press at the following times.
- To switch menu
- To increase parameters
- To switch to previous setting item
- To switch the process data being displayed

(9) [←] key

Press at the following times.
- To switch to the previous channel
- Move the digit of the parameter to be changed to the left

(10) [→] key

Press at the following times.
- To switch to the next channel
- Move the digit of the parameter to be changed to the right

(11) [↓] key

Press at the following times.
- To switch menu
- To decrease parameters
- To switch to next setting item
- To switch the process data being displayed

(12) [CANCEL] key

Press at the following times.
- To show help
- Batch display of I/O assignment
- Canceling parameter changes

(13) [ENTER] key

Press at the following times.
- Entering the parameter change mode
- Confirming parameter changes
- Clearing errors or events
- Selecting menus and confirming

(14) Last octet setting switches for this product's IP address

Sets the last octet of the IP address value (the "n" in 192.168.0.n). Multiply the value of the upper switch by 16, then add it to the value of lower switch.

(15) Ethernet connector P1

(16) Ethernet connector P2

PORT1 and PORT2 connectors (RJ45 connector) for the field network connection. Connect the Ethernet cable.

(17) DATA LED (yellow)

(18) DATA LED (yellow)

Lights when data is being sent/received via Ethernet.

(19) LINK LED (green)

(20) LINK LED (green)

Lights when the Ethernet connection is enabled.

(21) 0 - F LED (orange)

Indicates the ON/OFF status of the inputs or outputs.
During IO-Link communication, the ON/OFF status of the least significant bit of the BOOL type data specified in the process input data or the same bit of the process output data is displayed (*1).
Blinks if the PNP or NPN output is in an overcurrent state.
*:1 The contents of the process input data format with index number 14 and the process output data format with index number 15 in the IO-Link device are read, interpreted, and displayed.

(22) I/O power supply terminal block (L+)

Supplies 24 VDC to I/O devices.
The (25) terminal block I/O power supply L+ is connected internally.

(23) I/O signal terminal block (I/O)

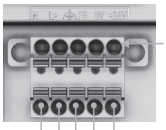
Connects the signal to the I/O device.

(24) I/O power supply terminal block (M)

Connects 0 V to I/O devices.
The (25) terminal block I/O power supply M is connected internally.

(25) Power supply terminal block (0, +24 V)

Supply the unit power supply (+24 V, 0 V) and the I/O power supply (L+, M).



+24 V and 0 V terminals on the upper row can be used to supply power to L+ and M in the left of upper row or other devices.
The top and bottom terminals are connected internally.

The bottom supplies each power supply.
Unit power supply +24 V
Unit power supply 0 V
FG (type 3 ground)
I/O power supply L+
I/O power supply M

(26) DIN rail mounting hook

The part where the lower hook on the back of this product slides for attaching/removing the product to/from the DIN rail.

(27) SF/RUN/MS LED

(28) BF/ERR/NS LED

Displays the field network status.

(29) ⓘ

Pressing this key will show an error message on the display.

1-3 Basic Procedures

The process from installing and setting this product through establishment of field network and IO-Link communication is described below.

Procedure	Details		References
Prior confirmation	System configuration decision: • IO-Link device or SIO device types and number used • Each channel I/O assignment settings • Allocating process data by initial value, automatically allocating from the actual IO-Link device or manually setting the number of input/output words of the IO-Link device for each channel		1-1 Product Overview 4-1 Product Functions
	• Data I/O design	Depends on field network	Communication manual of field network selected on this product
	• Selection of filed network connection		
	• Preparing the field network connection cable and switching hub		
	• Assignment and setting of the last octet of field network's IP address on this product		
↓	↓		
Hardware installation and wiring	Installing the field network master		Manual of field network master
	↓		
	Assemble the included I/O terminal blocks (three pieces) and power terminal block (one piece) to the main unit		1-2 Part Names and Functions
	↓		
	Installing on a DIN Rail		2-1 Installing on a DIN Rail
	↓		
	Setting the address of this product on the network (Depending on the field network)		Communication manual of field network selected on this product
	↓		
	Connection of Ethernet cable for field network		Communication manual of field network selected on this product
	↓		
	Wiring to IO-Link connection terminals		2-3-2 Unit Power and I/O Power Supply Connections
	↓		
	Connection of unit power supply		2-3-2 Unit Power and I/O Power Supply Connections
↓	↓		
Initial settings via front panel operations	Turn-on of the unit power		2-4 Initial Settings through Front Panel Operations
	↓		
	Language selection		
	↓		
	Network type setting		
	↓		
	I/O Assignment Settings		
↓	↓		

Procedure	Details		References
Operation to communicate with the field network master	Confirming that the “Network Type” is set to the used filed network		Communication manual of field network selected on this product
	↓		
	(When necessary) Installing profiles for the field network on this product	Depends on field network types	Communication manual of field network selected on this product Manual of field network master Manual of the configuration software for the field network
	↓		
	Creating communication settings or communication programs		
	↓		
	(When necessary) Download communication settings to network master		
↓	↓		
Product parameter setting	Setting via front panel operations on this product		5-1-3 Master Parameters Display 5-1-4 Master Parameter List with Product Front Panel Operations
	(As required) Setting by the communication programs on a field network master		Communication manual of field network selected on this product
	(As required) Setting with UR Master Manager from OPTEX FA (downloaded free)		UR Master Manager User’s Manual
↓	↓		
IO-Link device parameter setting	In case of front panel operations on this product		5-1-5 Device Identification Display
	(As required) Setting by the communication programs on a field network master		Communication manual of field network selected on this product
	(As required) Setting with UR Master Manager from OPTEX FA (downloaded free)		UR Master Manager User’s Manual
↓	↓		
Transferring of IO-Link device profiles of devices connected to this product to this product	When using an IO-Link device made by a third party (*1) Use the IODD_Converter.exe in UR Master Manager to transfer the IODD files (device definitions) of connected third party IO-Link devices to this product. *1: Upon the transfer, the IO-Link device process data and settings can be monitored with names and can be changed.		UR Master Manager User’s Manual
↓	↓		
Starting communication	Start system (power ON)		
	↓		
	Starting a field network Starting IO-Link communication		Manual of field network master 5-1-2 Process Data Display
↓	↓		

Procedure	Details	References
Checking operation	Check of display of IO-Link devices on field network master and this product	Manual of field network master Each IO-Link device manual
	↓	
	Check of read and write data by a field network master	Manual of field network master
	Check of read and write of process data between this product and IO-Link devices	Each IO-Link device manual
	(When necessary) When using OPTEX FA UR Master Manager (free download available)	UR Master Manager User's Manual
	↓	
	Check of read and write data by communication between this product and field network master	Manual of field network master
	↓	
	(When necessary) Execution of communication programs on PLC for read and write between this product and IO-Link devices	Communication manual of field network selected on this product
↓	↓	
Backup/restore	(When necessary) Backup and restoration of this product's settings or storage data from IO-Link devices on this product	UR Master Manager User's Manual
↓	↓	
Troubleshooting	Check of display of IO-Link devices and communication response on a field network master and this product	Chapter 7 Troubleshooting Communication manual of field network selected on this product

CAUTION

- To add an IO-Link device to be connected, after having transferred IODD data to this product, on the IODD_Converter.exe on UR Master Manger, recreate the IODD data with the additional data of IO-Link device and transfer it again to this product.
- While the IO-Link ready flag is ON, perform read and write of process data.

Installation, Wiring and Front Panel Operation for Initial Settings

Describes initial settings for this product's installation, the last octet value of this product's IP address, communication connection, power supply wiring, and front panel operation.

2-1 Installing on a DIN Rail

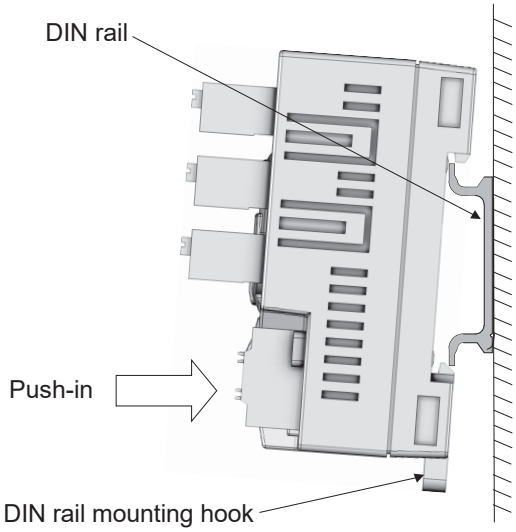
Install this product on a DIN rail.

MEMO

- This product cannot be screw-mounted.
- Install this product at least 10 mm away from an adjacent device and structure.
- Remove the power supply wires during installation. Make sure that this product is not powered, especially when connecting or disconnecting it from an IO-Link device.

Follow the steps below to install.

1. **Place the upper groove on the upper edge of DIN rail.**
2. **Push the lower side from the front.**
3. **Slide the DIN rail mounting hook up to lock the product in place.**

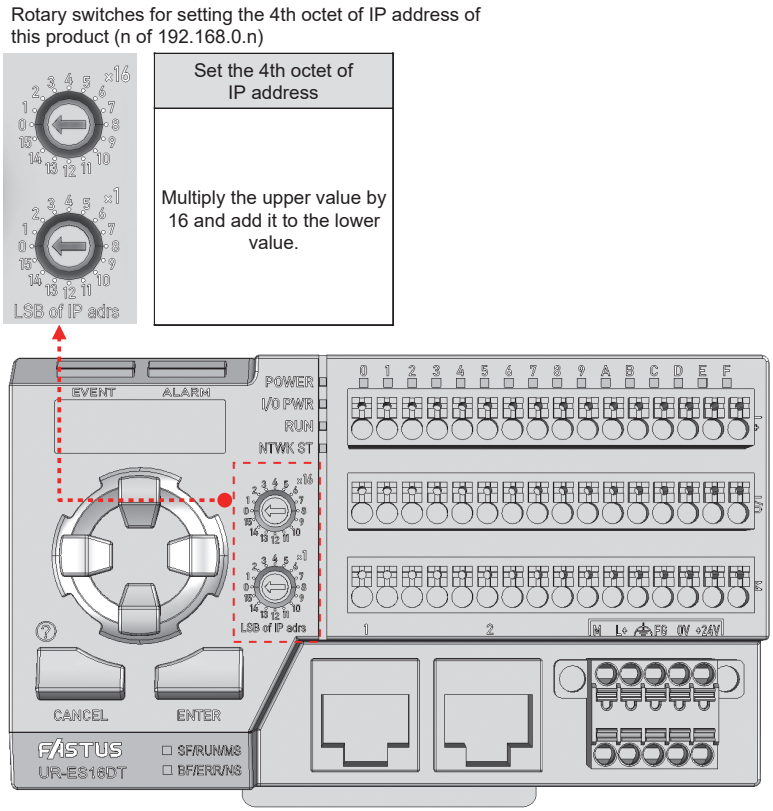


Follow the steps below to uninstall.

1. **While pushing down the DIN rail mounting hook, pull it forward from the bottom.**
   The lower hook on the back of this product will come off from the DIN rail.
2. **Remove the upper side of this product from the DIN rail.**

2-2 Setting IP Address

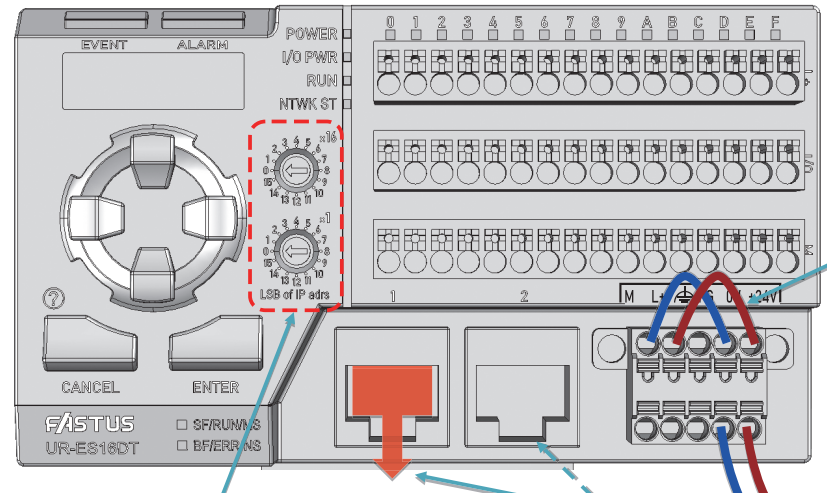
When the upper 3 octets of network IP address are "192.168.0", set the last octet of this product on the rotary switches on the front panel, before turning power on.



When the upper 3 octets of IP address are not "192.168.0", set an address in M82. IP address in the master parameter through front panel operations. Turning the front rotary switch while the power is on will automatically switch to "M82. IP address".

The setting method differs depending on the field network type.
Refer to the communication manual of this product, according to selected field network.

2-3 Wiring



Jumper wires to supply power from the unit power supply (+24V, 0V) to the I/O power supplies (L+, M).

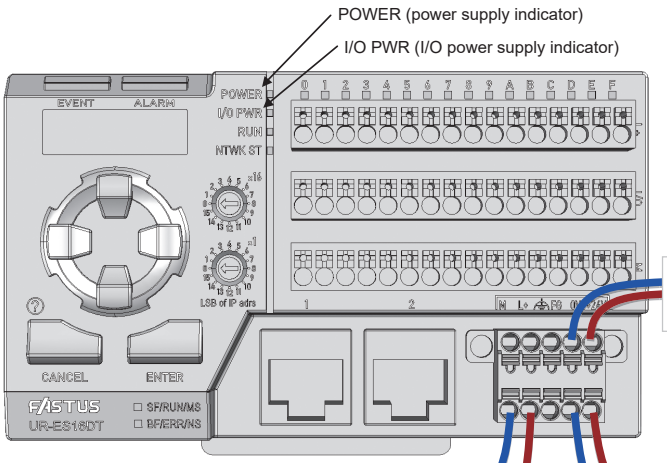
Use the rotary switches to set the 4th octet of IP address assigned.

Connect to a field network master with an Ethernet cable.
It can be connected to either the port 1 or 2.

Wires to connect a 24 VDC power supply. This shows a case where power is supplied from the unit power supply (+24V, 0V) to the I/O power supplies (L+, M).

2-3-1 Checking the Power Supply

Turn the power on and check that the "POWER" (power supply indicator) and "I/O PWR" (input/output power indicator) LEDs are illuminated. If these are not illuminated, check the power supply and wiring.
If the "I/O PWR" (input / output power indicator) LED is blinking, it indicates that the power supply voltage is low (lower than 17 V).



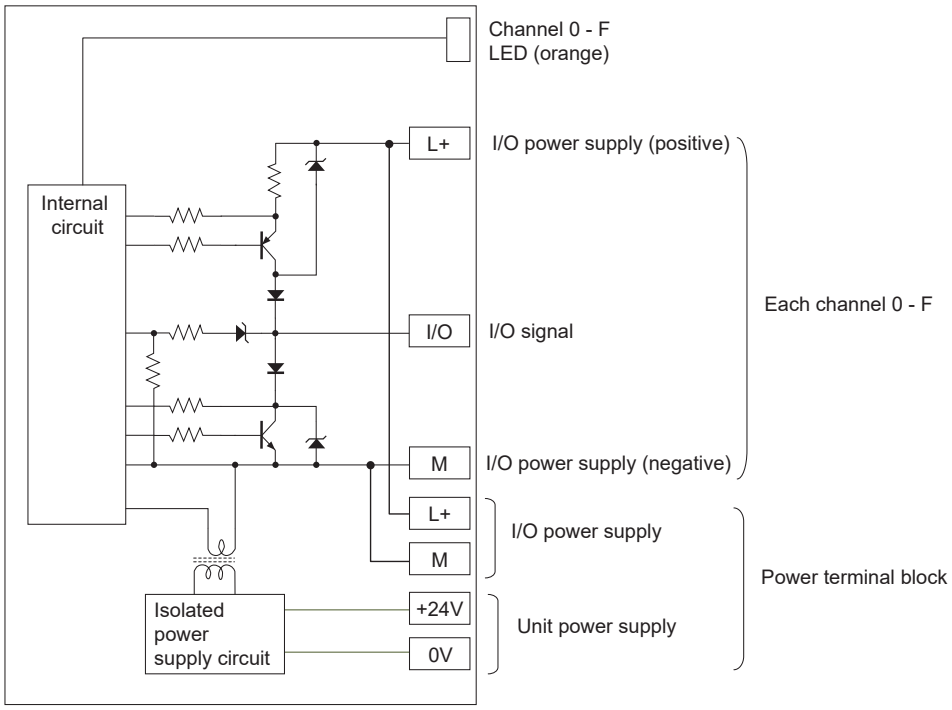
Supply power to Remote I/O units or external devices.

Power supply for I/O terminals, M and L+

Power supply for operation of this unit

2-3-2 Unit Power and I/O Power Supply Connections

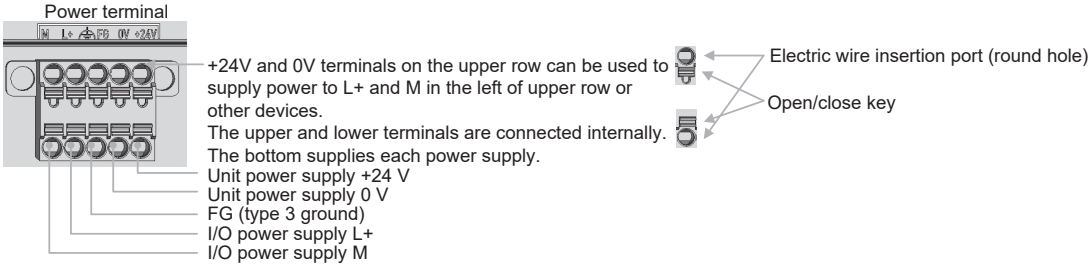
Internal Circuit Diagram



Unit Power and I/O Power Supply Connections

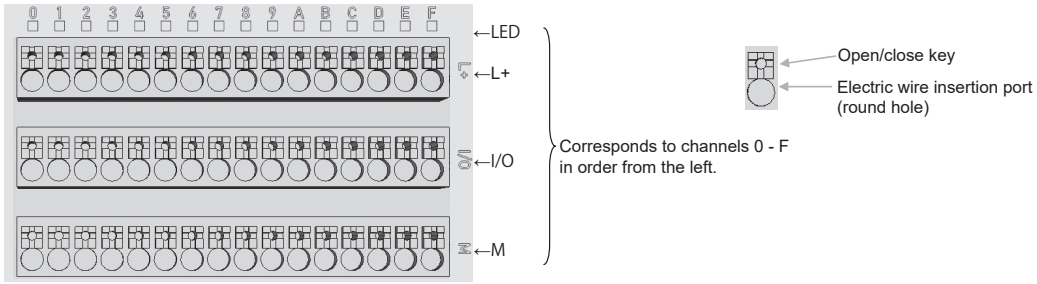
Unit power and I/O power are supplied to the power terminal block.

Use the upper terminals for jumper connection to share the unit power supply with I/O power.



Applicable wires should be between AWG 24 to 16 with a rated temperature of 75 ºC or higher.

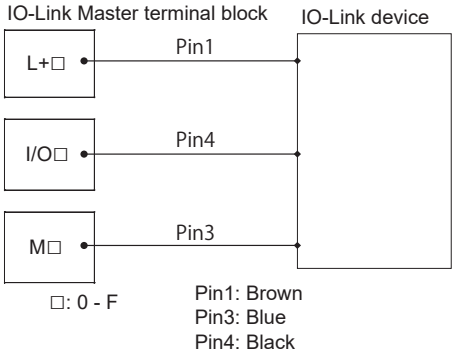
I/O Terminal Block Wiring



Channel		0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
LED		●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
L+	I/O power supply (positive)																
I/O	I/O signal																
M	I/O power supply (negative)																

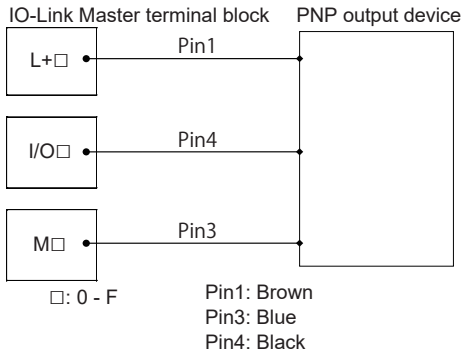
Applicable wires should be between AWG 28 to 16 with a rated temperature of 75 ºC or higher.

IO-Link communication wiring

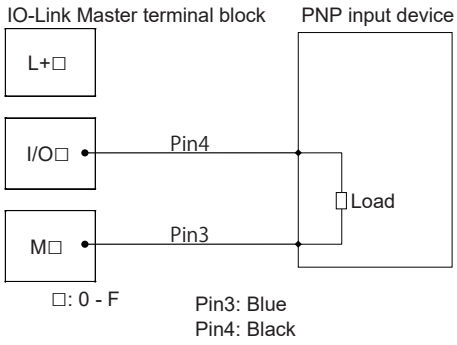


SIO mode

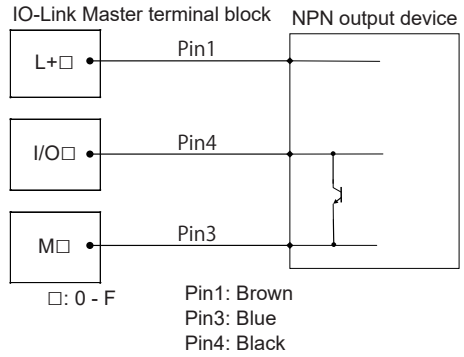
• Wiring for source (PNP input)



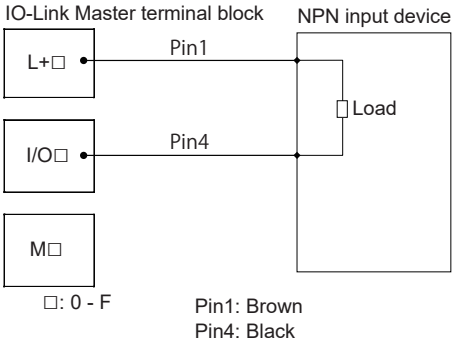
• Wiring for source (PNP output)



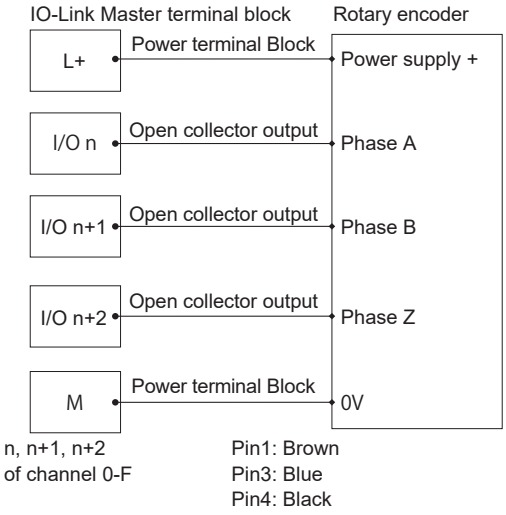
• Wiring for sink (NPN input)



• Wiring for sink (NPN output)



• Rotary encoder wiring



Cable Installation

Ferrule type crimp terminals, solid wire or stranded wire can be used.
For ferrule crimp terminals, attach the ferrule crimp terminal to the end of the cable.
In this case, use a ferrule crimp terminal with a diameter and length that matches the terminal block.
For solid wire or stranded wire installations, the cross-sectional area of the wire must meet the specifications.
The length of stripped insulation for solid or stranded wires is 10 mm.

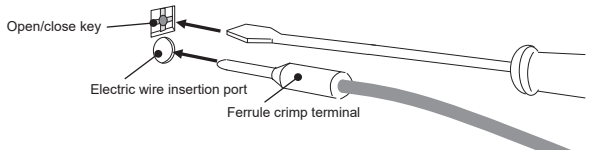
Wire to be used

- For +24 V/0 V/L+/M/FG terminal block
  AWG 24 to16
  Use wires with a rated temperature of 75°C or higher.
- For L+/ I/O /M input/output terminal blocks
  AWG 28 to16
  Use wires with a rated temperature of 75°C or higher.
- Cable Length
  Up to 30 m (between power source and IO-Link Master)
  Up to 20 m (between IO-Link Master and IO-Link device)

Cable installation method

1 **Insert the wire into the electric wire insertion port and push it in.**

2 **While pushing the open/close push button with a precision flat-blade screwdriver, insert the wire from the electric wire insertion port until the ferrule crimp terminal hits the bottom, and then release the open/close push button.**

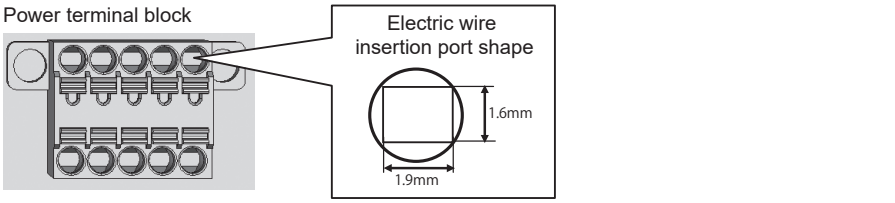


3 **After wiring, pull the wire lightly to make sure it is securely clamped.**

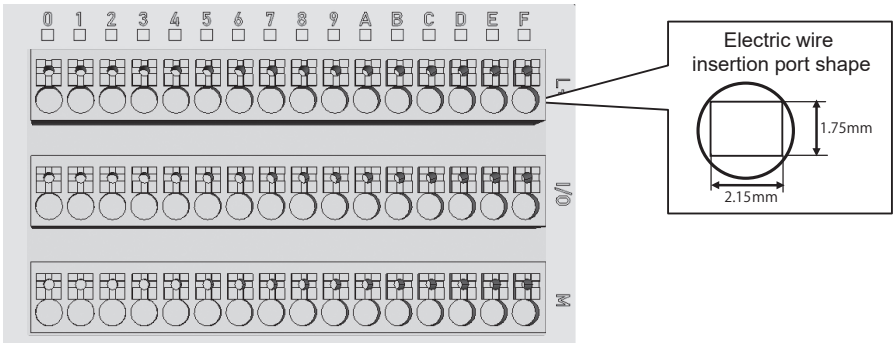
● Electric wire insertion port shape

Before inserting the ferrule crimp terminal, check the shape of the electric wire insertion port and the shape of the ferrule crimp terminal.
Pay attention to the orientation of the ferrule crimp terminal when inserting it.
Inserting a ferrule crimp terminal that is larger than the electric wire insertion port below may damage the terminal block.

Power terminal block



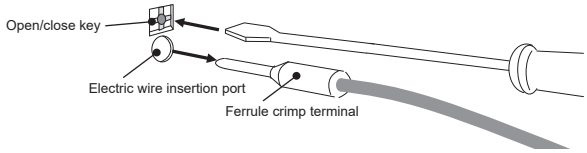
I/O terminal block



■ Cable Removal

1 **Push down the open/close push button with the precision flat-blade screwdriver or flat-blade screwdriver to release the wire.**

2 **While the open/close button is pushed in, pull the wire out.**



2-4 Initial Settings through Front Panel Operations

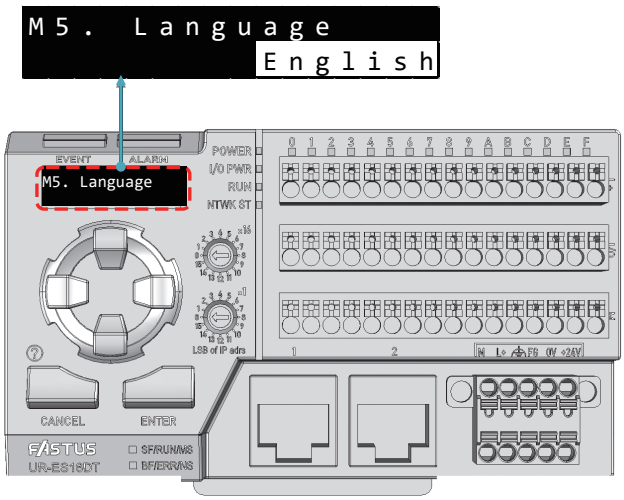
Shown here are the initial setting procedures via front panel operations of this product, upon newly use of this product.

2-4-1 Powering Up the Field Network Master

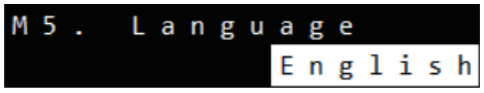
When available, apply power to the field network master station in advance.
This makes it possible to check whether the field network master is connected correctly.

2-4-2 Language

When you turn the power on for the first time, "M5. Language" menu is shown on the display on the upper left of this product, as shown below.



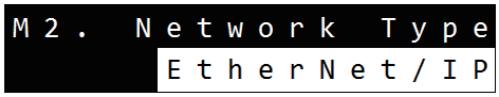
The language displayed will change each time you press the [↑] key.



Press the [ENTER] key.
The language setting changes to English.

2-4-3 Network Type Setting

Subsequently, the display automatically switches to the network type setting screen shown below.



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

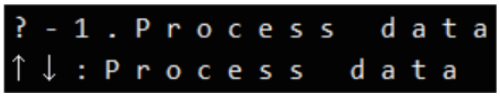
Regarding "M2. Network type," refer to "5-1-4 Master Parameter List with Product Front Panel Operations".
Press the [↑] key and select the field network type to use.
Press the [ENTER] key.
The network type switches to the field network type to be used. Wait about twenty seconds while the network chip firmware rewrites.
When rewriting is complete, this product will reboot automatically.

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

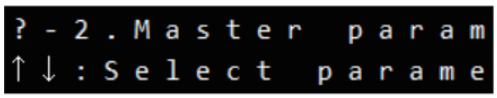
2-4-4 I/O Assignment Settings

The default setting for the I/O function is "Unused" for all channels. Change the I/O function settings as needed.

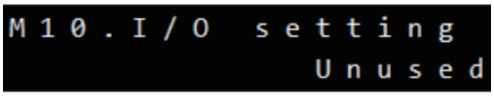
After startup, press the [CANCEL] key to move to the top menu of the following process data display.
For window transition, refer to "5-1-1 Overview of Display Operations".



Press the [↓] key. The display switches to the top menu of the following master parameter setting.



Press the [ENTER] key. The screen switches to the top menu of the following master parameter setting.



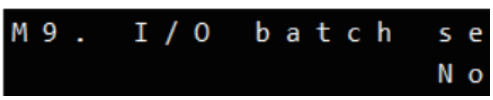
As you can see, all the I/O function settings are set to "Unused" by default. Change the I/O function settings as needed.
The same setting of I/O assignments to all channels can be made by batch.

MEMO

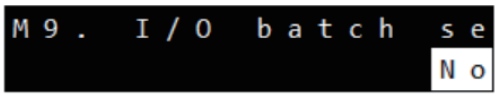
- The setting can be changed efficiently by selecting the functions you use most in this batch change and then change channels with other settings individually in M10. I/O setting.

For I/O Assignment Batch Setting

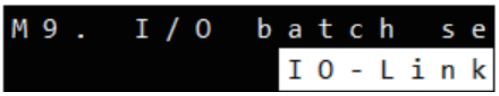
Press the [↑] key. The screen switches to the "I/O batch setting" screen as shown below.



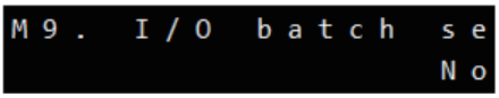
Press the [ENTER] key to change the set value.



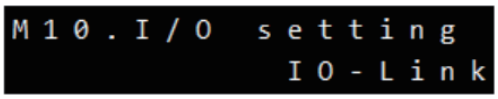
Pressing the [↑] key will scroll through "IO-Link" → "pnp input" → "npn input" → "PNP output" → "NPN output" → "Unused" options in order.
Select the function to be set with the [↑] or [↓] key and press the [ENTER] key.



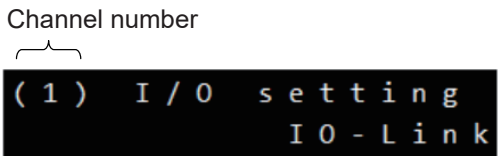
Click the [No] or [CANCEL] key to return without changing the settings.



To set the I/O function for each channel, click the [↓] key to display "M10. I/O setting".

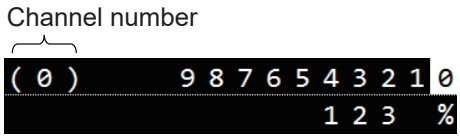


To switch channels, press the [←] or [→] keys.



To change the settings, press the [ENTER] key. The parameter flashes (the parameter can be changed at this time). Press the [↑] or [↓] keys to select the value to set. Press the [ENTER] key to confirm the set value.

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



Refer to [5-1 Front Panel Operations] for details of settings.

Communication

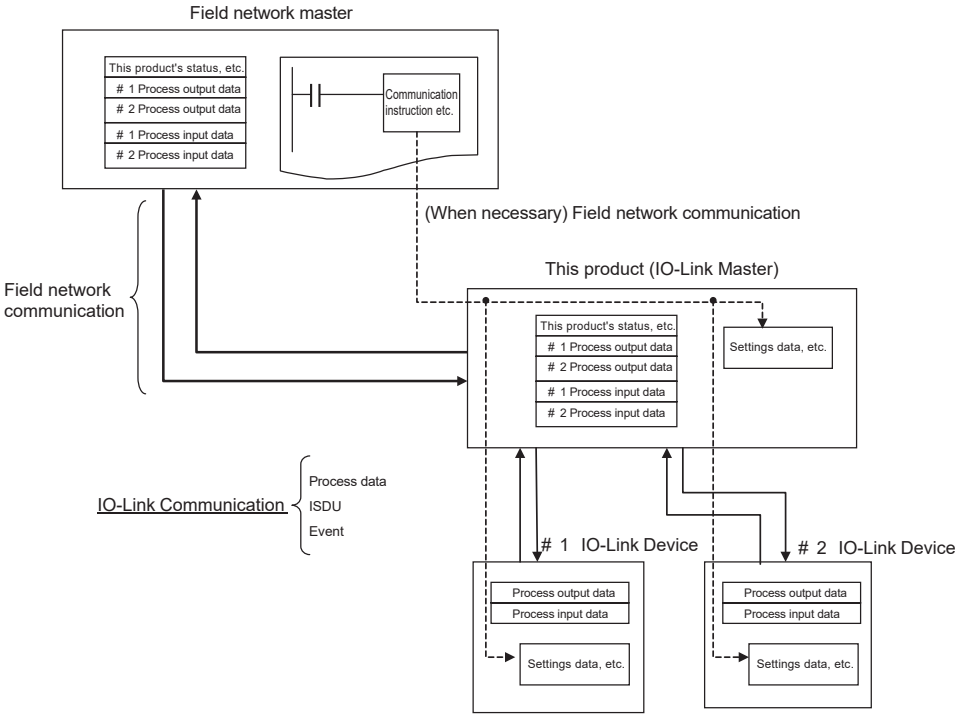
This section provides an overview of how this product performs field network communication and IO-Link communication, and information on the initial settings for performing IO-Link communication.

3-1 Communication System Overview

This section describes the communication that can be executed with the field network master and connected IO-Link devices.

- Field network communication according to the field network type is possible.
- IO-Link communication with the connected IO-Link device is possible.

IO-Link communication includes process data communication, ISDU communication and event communication.



3-1-1 Field Network Communication

The following field network types can be selected on this product in the setting menu.

- EtherNet/IP (default value)
- EtherCAT
- PROFINET (under development)
- Ethernet & Modbus/TCP
- CC-Link IE Field Basic

The setting is made in “M2. Network type” in the master parameter setting.

The details of the communication with the field network differs depending on the field network type. Refer to the manual for Product Communication Edition according to the field network type.

3-1-2 IO-Link Communication

This product can execute the following IO-Link communication.

Process Data

This product periodically exchanges predetermined data to and from the connected IO-Link devices. This communication is automatically executed, when the power is turned ON.
The process data can, also, be monitored on the front display of this product.

The method of reading and writing process data from the field network master differs depending on the field network type. Refer to the manual for Product Communication Edition according to the field network type.

MEMO

The method of accessing process data from the field network master and the size of each channel for each field network type are as follows. Note that the size of the initial value of the process data differs depending on the field network type.

Network type		Accessing process data from the field network master	Size of the process data for each channel	
			Default value	Setting range by master parameter M40/41 (*1)
EtherNet/IP		Access process data assigned to this product by IO-Link process communication	Input: 32 bytes (16 words) Output: 4 bytes (2 words)	Maximum input of 512 bytes (256 words) for all channels Maximum output of 64 bytes (32 words) for all channels
CC-Link IE Field Basic (*2)			Input: 4 bytes (2 words) Output: 4 bytes (2 words)	Maximum input of 64 bytes (32 words) for all channels Maximum output of 64 bytes (32 words) for all channels
EtherCAT (*3)				
Ethernet & Modbus/TCP	Socket communication			
	Modbus/TCP communication	Direct access to process data in an IO-Link device via Modbus/TCP communication	Input: 32 bytes (16 words) Output: 32 bytes (16 words)	Not defined

*1: For EtherNet/IP and CC-Link IE Field Basic, it is the range when extended access is disabled.
*2: When using the CC-Link IE Field Basic with socket communication or with Modbus/TCP communication, it's not possible to write to the process data.
*3: Socket communication and Modbus/TCP communication are not possible with EtherCAT.

MEMO

This product can input/output the following data to/from the host master regardless of the field network type.

Direction	Type	Generic data name	Size	Details
This product → Master	This product's status data	Assignment status data	1 Word	It consists of the following. • Error flag • IO-Link ready flag • Latest error channel • Event flag • I/O power supply flag • Output overcurrent flag • Latest event channel For details, refer to {Reading this product's status data} in "4-1 Product Functions".
	Process data with connected IO-Link device Communication data	IO-Link process input data	Depends on the IO-Link device	For the process data of an IO-Link device, refer to the process data details of the specific IO-Link device.
Master → This product	Operation data to this product	Allocated operation data	1 Word	It consists of the following. • Clear the latest error • Clear the latest event • Reset encoder counter For details, refer to {Writing operation data of this product} in "4-1 Product Functions".
	Process data with connected IO-Link device Communication data	IO-Link process output data	Depends on the IO-Link device	For the process data of an IO-Link device, refer to the process data details of the specific IO-Link device.

ISDU Handling (Indexed Service Data Unit Handling)

This product can read and write the data of a specified index in the service data of the connected IO-Link devices as needed. This depends on the read/write instruction from the field network master or the device parameters set using the front panel operations.

The method of reading and writing from the field network master differs depending on the field network type.

Refer to the manual for Product Communication Edition according to the field network type.

Refer to each IO-Link device index list for service data.

Event

If there is a extreme pressure drop, etc., with an IO-Link device on a given channel, the product receives the event code and event type sent from the IO-Link device and saves it in the memory of this product. It can store up to six event types and event codes.

At this time, the "event flag" turns ON, and the channel number where the event took place is stored in "Latest event channel". On this condition, from field network master station communication program, it is possible to access the master parameter "event data readout" and read out the event code and event type.

Alternatively, the event name and event code can be checked using the event/error display on the front display of this product.

Thereby, the following IO-Link device status can be obtained on the field network master side when they occur.

Errors (ex.: breakdowns, short-circuits) and maintenance information (ex.: reach to predicted maintenance time)

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

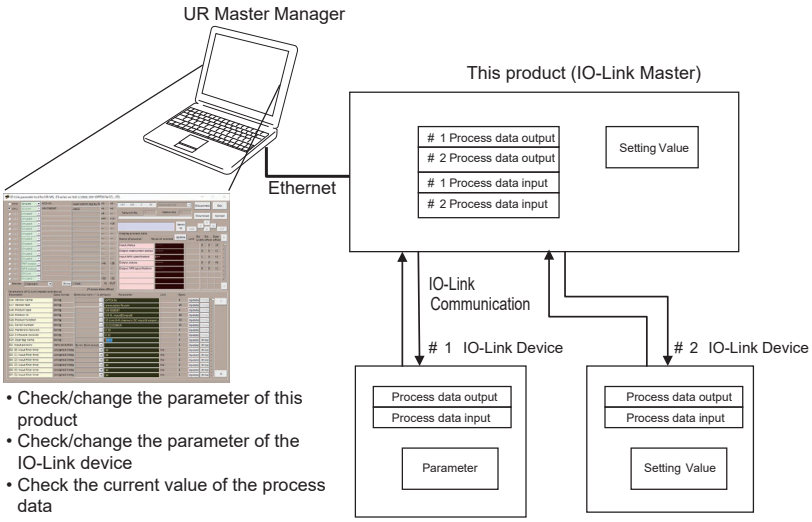
The position of event-related flags by the field network communication depends on the field network type.

Refer to the manual for Product Communication Edition according to the field network type.

MEMO

UR Master Manager (free download available) can be used to check/change the following.

- Check/change the parameter of this product
- Check/change the setting data of the IO-Link device via this product
- Check the current value of the process data



For more information on UR Master Manager, refer to the UR Master Manager User's Manual.

3-2 Initial Settings for IO-Link Communication

This section describes the operations required for this product to perform the IO-Link communication with IO-Link devices.

The initial settings required for field network communication differ depending on the field network type. Refer to the manual for Product Communication Edition according to the field network type.

3-2-1 Checking I/O Mode Assignments

The I/O setting assignment status can be checked on the front display of this product.
After selecting the language, in the startup screen of process data displayed when turning on the power, press the [ENTER] key for a batch display of the I/O assignment status as below.

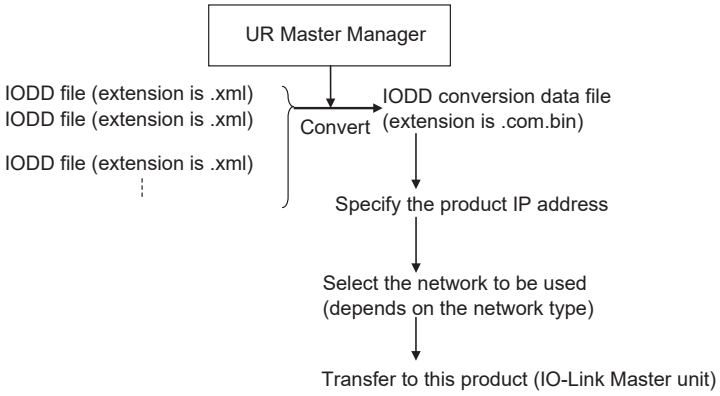
Example:
I: IO -Link Mode setting (IO-Link device is not connected while blinking)
n: NPN input mode setting
N: NPN output mode setting
- : Not used

Refer to “Chapter 5 Front Panel Operations ” for details.

3-2-2 Transfer of a Profile of Third-party IO-Link Device

To connect a third-party IO-Link device, convert and transfer its IODD file that describes the device to this product. This enables the numbers and names of parameters described in an IODD file of each IO-Link device to be displayed on the front display of this product.
To use an IO-Link device from OPTEX FA and a third-part IO-Link device that supports IO-Link Object Profile Plus, OP+, these procedures are not necessary, as IODD data is contained in those products.

Use the UR Master Manager to convert IODD files, in XML, of connected IO-Link devices into a single IODD file, in binary file. After conversion, transfer the file to this product via field network.
Up to 64 files of IODD can be converted into a single file to be transfered to this product.
This can be made through the following procedures.



To be prepared: IODD_Converter.exe (in UR Master Manager)

Note: No installer is provided. Save the program in a folder to use.

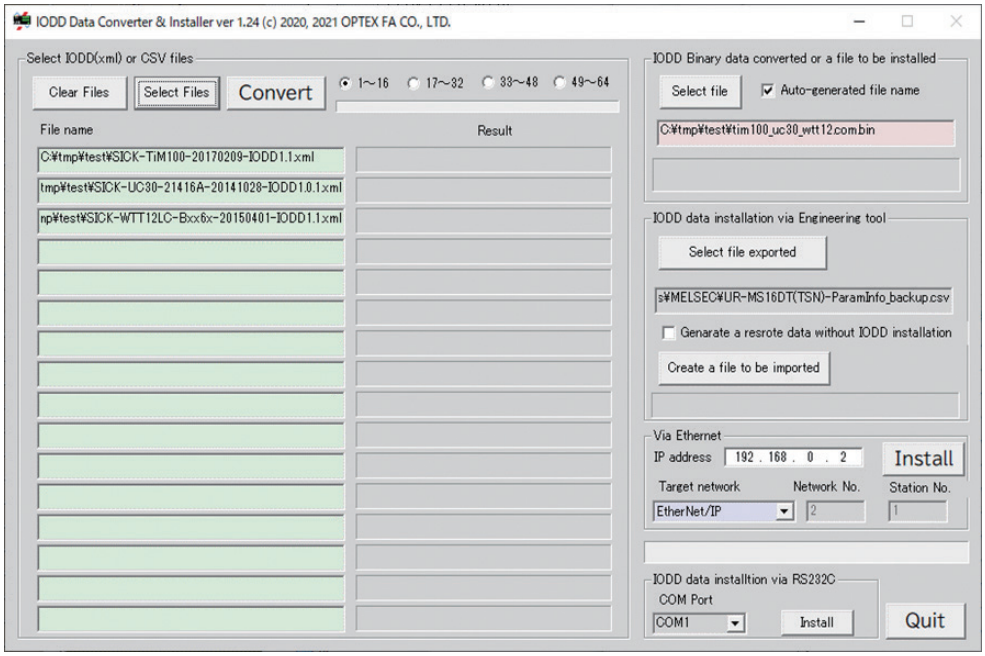
MEMO

Download UR Master Manager from the OPTEX FA website below.
https://www.optex-fa.com/

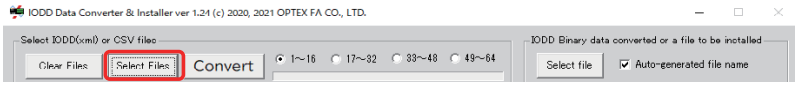
Download the IODD file provided by the corresponding IO-Link device manufacturer in advance.
The IODD file can be downloaded from the website of the manufacturer of the IO-Link device or the IODD finder website (https://ioddfinder.io-link.com/).
Also, to select multiple files at once, save the IODD files in the same folder.

1 Double-click IODD_Converter.exe.

When IODD_Converter.exe in UR Master Manager is launched, the following dialog box will be displayed.



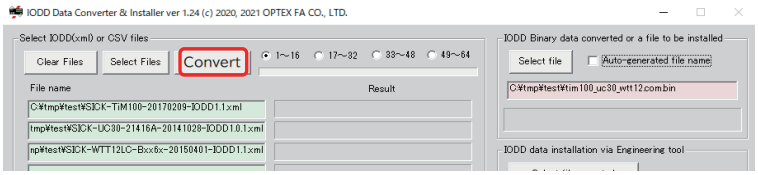
2 **Click the [Select Files] button to specify the IODD file to be converted.**



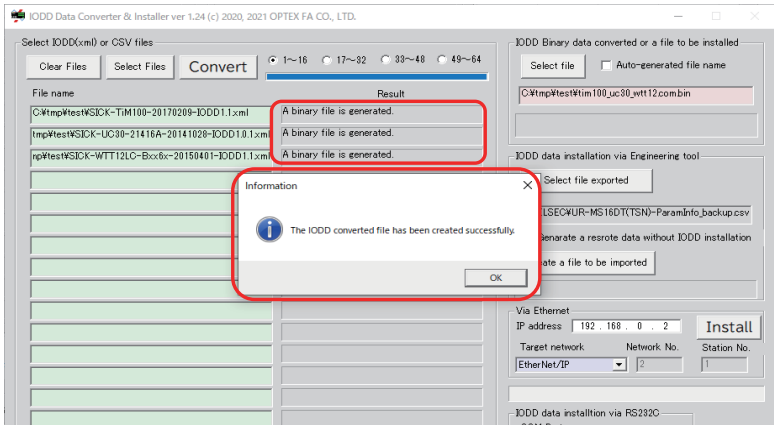
3 **Click the [Open] key.**

The selected IODD filename will be displayed.
File names can also be directly edited.

4 **Check “Auto-generated file name”, then click the [Convert] button.**



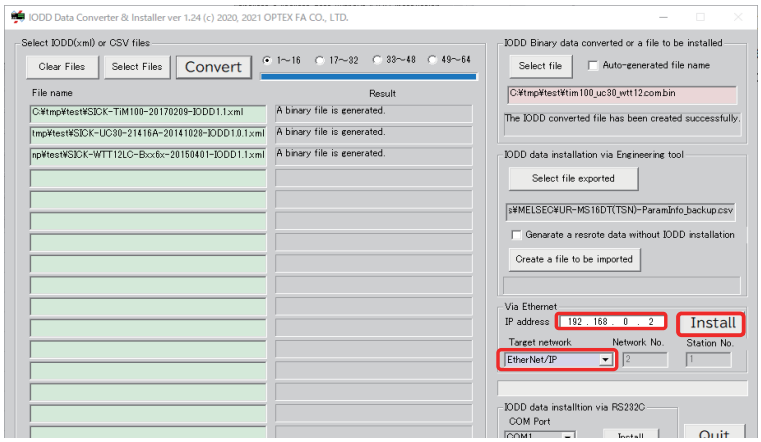
This converts the IODD data and a single IODD conversion data file is generated.
The file name extension is .com.bin.
After the IODD conversion data file is successfully generated, the dialog box, “The IODD converted file has been created successfully.” will be displayed. Also, the message, “A binary file has been generated.” will be displayed with each IODD file.



5 **Click the [OK] button.**

6 **To download the file to this product, specify the IP address of this product.**

In the IP address field under “Install via Ethernet”, enter the IP address of this product.

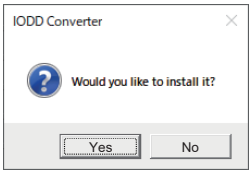


Select [Target network] from the following.

- EtherNet/TCP:
  TCP/IP connection for Ethernet socket communication.
- EtherNet/IP:
  EtherNet/IP connection.
- UDP (CC-Link IE Field Basic):
  UDP connection for Ethernet socket communication or CC-Link IE Field Basic connection.
- EtherCAT:
  Since other connections are not possible with EtherCAT, so switch to another network before transferring IODDs.

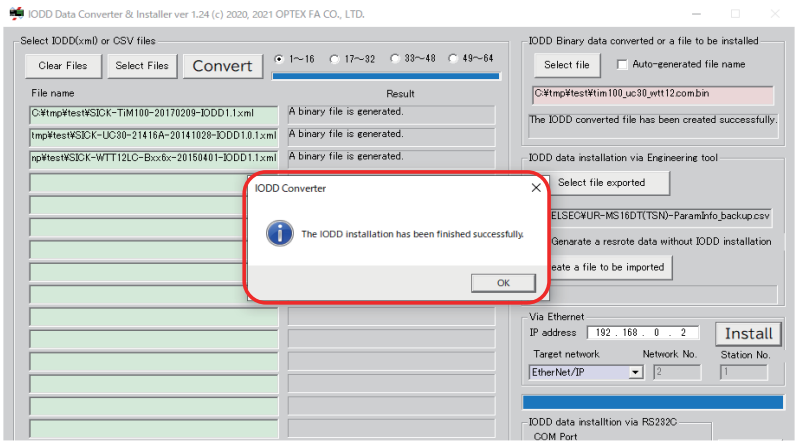
7 **Click the [Install] key.**

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



9 **Start up this product, while pressing the [ENTER] key on the front panel (to enable Ethernet socket communication).**
Wait until the “NTWK ST LED” on the front panel lights up.

10 **When the transfer (installation) of the IODD converted file to this product is completed, the following dialog box will be displayed.**



11 **Click the [OK] key.**
The set values have been written to this product.
Other required settings can be written in the same way.

CAUTION
To add IO-Link devices to be connected, after transferring the IODD converted file to this product:
Transfer IODD_Converter.exe (in UR Master Manager) to create a new IODD converted file including the added IO-Link devices and transfer it again to this product.
A list of transfered IO-Link IODD files is displayed on IODD_Converter.exe. If the added IO-Link device's IODD file is not in the list, convert the added IODD files and transfer it again to this product.

3-2-3 Confirming the Network Type Setting

Make sure that the master parameter "M2. Network type" is set to the field network type to be used. Set in the initial settings for front panel operations. Refer to "2-4-3 Network Type Setting" for further information.

For setting "M2. Network type" of the master parameter, refer to "5-1-4 Master Parameter List with Product Front Panel Operations".

Product Functions

This chapter describes the functions of this product.

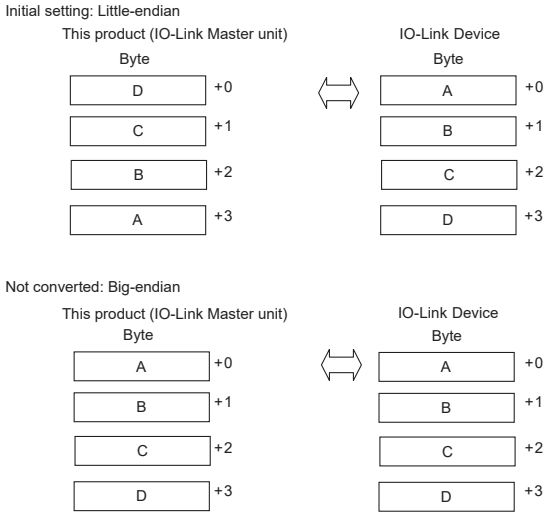
4-1 Product Functions

Following is a list of product functions.

Category	Function	I/O assignment settings	Product functions
Basic IO-Link communication	Process data	IO-Link mode	The method of reading and writing process data of the IO-Link device from the field network master differs depending on the field network type. Refer to the manual for Product Communication Edition according to the field network type.
	ISDU	IO-Link mode	The method of reading and writing the service data of the IO-Link device via ISDU handling from the field network master differs depending on the field network type. Refer to the manual for Product Communication Edition according to the field network type.
	Event	IO-Link mode	If the event flag is ON, the event code can be read using the acyclic communication program on the field network master. Up to six history records stored in this product (event types: notification, warning, error; event sources: device, master, etc.). For details, refer to the "Event communication" section of the corresponding communication edition.
Reading and writing the master parameters of this product	Reading and writing the master parameters of this product	-	The master parameters of this product can be read and written by acyclic communication from the field network master. The method of reading and writing from the field network master of the master parameters of this product differs depending on the field network type. Refer to the manual for Product Communication Edition according to the field network type. The parameter numbers / target numbers and values of the master parameters are common among the field networks. (However, some master parameter numbers do not exist in some field network types. Refer to "List of Product Master Parameters" in the corresponding communication section.)
Reading the status data of this product		-	The following "allocated status data" can be read by cyclic communication or acyclic communication from the field network master.
	Error flag	IO-Link mode or SIO(*1)	This flag turns on, when an error is generated in this product. When this flag is 1 (on), access the "Latest error code read by channel" through acyclic communication. Refer to "Data for Access from PLC" in "List of Product Master Parameters" of each communication edition for "Latest error code read by channel" data.
	IO-Link ready flag	IO-Link mode	When communications with all IO-Link devices and a master station of EtherNet/IP or CC-Link IE Field Basic are established, this flag turns on. Read and/or write with the IO-Link devices through the cyclic or acyclic communication can be executed. Note: This flag will turn to 1 (on) even when not all channels' I/O setting assignments are in IO-Link mode.
	Synchronization establishment flag (Depending on the field network type)	IO-Link mode	This flag turns 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. Note: This flag is invalid with Ethernet & Modbus/TCP.
	Channel with the latest error occurred	IO-Link mode or SIO(*1)	Channel number of the latest generated error. When accessing the "Latest error code read by channel" through acyclic communication, specify the channel based on this value.

Category	Function	I/O assignment settings	Product functions
	Event flag	IO-Link mode	This flag turns on, when an event is occurring in one of the connected IO-Link devices. When this flag is 1 (on), access the "Event data readout by channel" data through acyclic communication. Refer to "Data for Access from PLC" in "List of Product Master Parameters" of each communication edition for "Event data read by channel".
	I/O power supply flag	SIO(*1)	This flag turns on, when power is supplied from the I/O power supply.
	Output overcurrent flag	SIO(*1)	This flag turns on, when overcurrent is generated in SIO (output).
	Channel with the latest event occurred	IO-Link mode	Channel number of the latest generated event. When accessing the "Event data read by channel" through acyclic communication, specify the channel based on this value.
Writing operation data to this product		-	The following "allocated operation data" can be written by cyclic communication or acyclic communication from the field network master.
	Clear the latest error	IO-Link mode or SIO(*1)	Clears the latest error when rising from 0 (off) to 1 (on).
	Clear the latest event	IO-Link mode	Clear the latest event when rising from 0 (off) to 1 (on).
	Reset encoder counter	SIO(*1)	When the SIO device is an encoder, the high-speed counter of this product will be reset when the SIO device rises from 0 (off) to 1 (on).
Assignment of IO-Link device process data to this product	Process data automatic allocation/ manual setting	IO-Link mode	The process data can be allocated with a size other than the initial value either by setting each channel manually or automatically based on the actual device. The initial value of the allocation size differs depending on the network type as follows. [For EtherNet/IP] • Input: 32 bytes for each channel (20 bytes for channel F only when extended access is disabled. 16 bytes for channel F only when extended access is enabled) • Output: 4 bytes for each channel (channels 0 - F when extended access is disabled. Channels 0 - D when extended access is enabled.) [For CC-Link IE Field Basic/EtherCAT] • Input: 4 bytes (2 words) for each channel (channels 0 - E when extended access is enabled) • Output: 4 bytes (2 words) for each channel (channels 0 - D when extended access is enabled) [Using Ethernet & Modbus/TCP and socket communication] • Input: 4 bytes for each channel • Output: 4 bytes for each channel [Using Ethernet & Modbus/TCP, and Modbus TCP/UDP communication] This setting is irrelevant. It is used for any of the following purposes. • If there is an IO-Link device of a size other than the above • When you do not want to allocate unused channels or create empty areas for used channels on the field network master (however, there will be empty areas after the allocation). • When automatic setting is used, it is not necessary to check the specifications of each IO-Link device. However, as automatic setting is executed on both the input and output, it needs to be set manually in you wish to choose either input or output. If it is not connected to the network or the parameter is 0 words, it will be allocated in a shortened manner. However, empty areas after allocation exist in the cyclic communication area.

Category	Function	I/O assignment settings	Product functions
IO-Link device validation	Device validation	IO-Link mode	This function verifies the compatibility and identity of a connected IO-Link device. When this parameter is written, the model, model name (sum value) and serial number of the IO-Link device connected to each channel are saved to the storage data on this product. When IO-Link communication is started the next time (including when the power of this product is turned on, or when I/O assignment is changed to IO-Link mode), this function runs a preset validation method that was set. If a validation error occurs, it does not perform cyclic communication with the applicable IO-Link device(*1). The following settings are available. • Validation/type ID (vendor ID and device ID): Verify the type ID only. • Validation/type ID + model name: Verify the type ID and model name. • Validation/type ID + serial number: Verify the type ID and serial number. • No validation: Validation is not performed. Cyclic communication is performed unconditionally with the applicable IO-Link device(*2). The registered model, ID serial number and model name will also be deleted. Error codes: • Type ID mismatch: Validated: FFFE h Not validated: FF23 h • Model name mismatch: FFF4 h • Serial number mismatch: FFFC h • Revision ID mismatch: 6001 h *1: If automatic restoration is enabled, automatic restoration will be performed (parameters will be transfered from this product to the IO-Link device). *2: However, even if this is set to "Not validated", only the type ID will be verified when the power (unit power supply and I/O power supply) is turned ON if there is already storage data in this product. An error (FF23 h) will occur if the model ID does not match. (If the user changes the connected model after backup, an error is generated to notify the user that storage data for a different type ID remains.) If this is set to "Not validated", the revision ID (that is, the IO-Link protocol version implemented in the IO-Link device) will not be verified. Usage: This prevents malfunction by stopping cyclic communication with the IO-Link device, in case that an IO-Link device is replaced with an unexpected IO-Link device or is connected in a wrong channel.
I/O operation during communication error	IO-Link communication and network error handling	IO-Link mode	• Output hold: Hold IO-Link process output data and PNP/NPN output when field network communication is disconnected. Input will be OFF. • Input hold: Hold IO-Link process input data when communication is disconnected with a certain IO-Link device. Output will be OFF. • All hold: Hold IO-Link process input data when communication is disconnected with a certain IO-Link device. Hold process output data and PNP/NPN output when field network communication is disconnected. • Clear (default value): Clear IO-Link process input data to zero when communication is disconnected with a certain IO-Link device. Also, when the field network communication shuts down, IO-Link process output data is cleared to zero. Clear process input data to zero. Turn PNP/NPN output OFF. Usage: This implements a failsafe by either holding IO-Link process data or clearing it to zero, when there is an IO-Link communication or field network communication error.

Category	Function	I/O assignment settings	Product functions
		SIO(*1)	• Output hold: Hold PNP/NPN output data when field network communication is disconnected. Turn PNP/NPN input data OFF. • Clear: Turn PNP/NPN output data OFF when field network communication is disconnected. Usage: This implements a failsafe by either holding PNP/NPN output data or turning it OFF, when there is a field network communication error.
IO-Link communication related	IO-Link ready flag	IO-Link mode	This function turns ON when all channels are engaged in IO-Link communication and a field network communication has been established with the field network master. This is used as an execution condition for process input, process output and acyclic communication.
	Endianness conversion of process data	IO-Link mode	Switches the high-order bytes and low-order bytes of data sent and received between this product and an IO-Link device, for each channel. Initial value: Little-endian format Sends and receives data from the low-order byte for the byte unit in the IO-Link device with data from the high-order byte in this product. No order: Big-endian format Sends and receives data from the low-order byte for the byte unit in the IO-Link device with data from the low-order byte in this product.  Usage: IO-Link devices use big-endian byte order format, but PLC often handles data in little-endian format. By converting data to the little-endian format in this product, PLC will not need to perform conversion.
I/O synchronization setting	I/O synchronization	IO-Link mode or SIO(*1)	Use IO-Link communication or digital I/O transfer to maintain synchronization for IO-Link devices on multiple channels. Usage example: • Sample data from multiple sensors at the same time. • Control multiple electric actuators synchronously.
Time information function	Network time	IO-Link mode or SIO(*1)	The network time (parameter number: M65) is displayed on this product, which takes the time zone (parameter number: M6) into consideration. The internal timer of this product can also be synchronized with the network time (using the I/O synchronization [parameter number: M21] setting).
	Synchronization establishment flag (Depending on the field network type)	IO-Link mode or SIO(*1)	This flag turns ON when the internal timer of this product is synchronized with the network time (within +/-20 µs). Note: It does not exist if the field network type is "Ethernet & Modbus/TCP".

Category	Function	I/O assignment settings	Product functions
	Allocation of time information to process input data	IO-Link mode or SIO(*1)	Time information and parity information can be added to process input data. This is set using time stamp (parameter number: M44).
	Storage of time when a parameter is read from IO-Link device	IO-Link mode	The time when a parameter is read from an IO-Link device is saved in this product, then to be read from the host PLC.
IO-Link device parameter backup/ restore (from/to this product)	Manual backup/ restore of settings	IO-Link mode	This function manually backs up and restores parameters (stored parameters) stored in IO-Link devices. Select one of the followings. The process can be executed either by operating the controls on the front panel of this product, or by writing parameters from the field network master. • Restore: Download ("restore") storage data stored in this product to an IO-Link device. • Backup: Upload ("backup") parameters from the IO-Link device to this product. • Delete: Delete all IO-Link device storage data stored in this product. Note 1: This function can be used only if the connected IO-Link device supports the data storage function. Note 2: Error code "FFFF h" will occur if the vendor ID or device ID of the restore target IO-Link device differs from the storage data from this product, when restoring. Usage: This allows parameters from the old IO-Link device to be carried over from this product, when replacing an IO-Link device with a new device. Note: The configuration software for field network communication or OPTEX FA UR series parameter backup tool can also be used to backup and restore parameters of an IO-Link device through this product.
	Automatic device parameter backup	IO-Link mode	This function automatically backs up and restores parameters (stored parameters) stored in IO-Link devices. Note: This function can be used only if the connected IO-Link device supports the data storage function. Select from the followings. • Restore: When IO-Link communication starts, automatically download ("restore") the storage data in this product to the IO-Link device, if the IO-Link device storage data in this product does not match the parameters in the connected IO-Link device(*1). *1: The master parameters in this product will overwrite, when IO-Link communication is next started, even if the parameters in the IO-Link device are changed during IO-Link communication. • Backup: Upload ("backup") parameters from the IO-Link device to this product, if parameters in the IO-Link device are changed during IO-Link communication. • Restore and backup: Automatically restore or backup so that storage data in this product always matches parameters in the IO-Link device. • None: Restore and backup are not automatically performed. Note: Error code "FFFF h" will occur if the vendor ID or device ID of the restore target IO-Link device differs from the storage data from this product, when automatically restoring.

Category	Function	I/O assignment settings	Product functions
			Usage: This allows parameters from the old IO-Link device to be carried over from this product, when replacing an IO-Link device with a new device. Note: The configuration software for field network communication can also be used to backup and restore parameters from an IO-Link device through this product. Refer to the UR Master Manager user's manual for further information.
Input-related	Input hold time	SIO(*1)	This function holds ON for the specified time once the input signal turns ON. Usage: This ensures that even SIO input signals with a short ON time are transmitted to the field network master. The hold time can be increased for situations where the sensor ON time is short and the field network master cannot reliably pick up that the sensor is ON.
	Input filter time	SIO(*1)	This function sets a filter to eliminate input signal noise. Usage: This can eliminate erroneous input caused by noise or erroneous sensor detection on workpiece edges, etc.
	Encoder input (high-speed counter function)	SIO(*2)	The high-speed counter function can be used by connecting the incremental encoder with open collector output to this product as an SIO device. Assign phase A and phase B (and phase Z, if required) to each channel of the SIO mode PNP input or NPN input. Assignment is specified using the "M15. Encoder input (ABZ)" master parameter. The channel numbers assigned to phase A, phase B, and phase Z must be in continuous order (if phase A is n, phase B must be n+1 and phase Z must be n+2). • When using phase A and phase B as input (regardless of whether phase Z is used) The count is multiplied by four, and the count value will be 13 bits per rotation with 32 bits for the rotation count. The count maximum frequency is 250 kpps. • Count values of one rotation or lower will fit in one word (two bytes) on the process input data side of the channel assigned to phase A. • 32 bits for the rotation count will fit in two words (four bytes) from the second word (+4) on the process input data side of the channel assigned to phase A. • When using only phase A as input The count is doubled, the count value is 45 bits, and it is input in 3 words on the process input data side (however, this product can only display up to 32 bits). In all above cases, the current count value of 3 words (6 bytes) is cleared when the "reset encoder counter" (output byte address +2, bit address 6) rises from 0 (OFF) to 1 (ON). Note that the count current value mentioned above is the value when the cyclic communication data of the field network is updated.
Status monitoring-related	Number of IO-Link communication errors	IO-Link mode	This counts the number of IO-Link communication errors on each channel. Usage: This can be used when diagnosing IO-Link communication quality based on the number of communication errors.
	I/O power supply flag	IO-Link mode	This function monitors whether the I/O power supply is on or off. Usage: This monitors whether the product I/O power supply is on or off.
	I/O power supply voltage	IO-Link mode	This function can be used to check the voltage supplied to the I/O power supply (unit: 0.1 V) Usage: This monitors the voltage of the product I/O power supply.

Category	Function	I/O assignment settings	Product functions
	Output overcurrent flag	SIO(*1)	This function turns RX15 (hexadecimal value) ON when there is a PNP/NPN output overcurrent. Usage: An output overcurrent occurs when this flag is ON, so this can be used to discover issues such as a short circuit in the load.
	Total operation hours of IO-Link master unit	IO-Link mode or SIO(*1)	This function can be used to check the cumulative operating time since this product was first turned ON (unit: hours) Usage: This can be used for product maintenance.
	Display drive time	IO-Link mode or SIO(*1)	This function can be used to check the cumulative operating time since the front display on this product was turned ON (unit: hours) Usage: This can be used for product maintenance.
	Internal temperature	IO-Link mode or SIO(*1)	This function can be used to check the internal temperature of this product (unit: 0.1°C) Usage: This can be used for product maintenance.

*1. SIO: Either mode of PNP input, NPN input, PNP output or NPN output

*2. SIO: Either mode of PNP input or NPN input

Front Panel Operations

This chapter describes how to operate the front panel of this product.

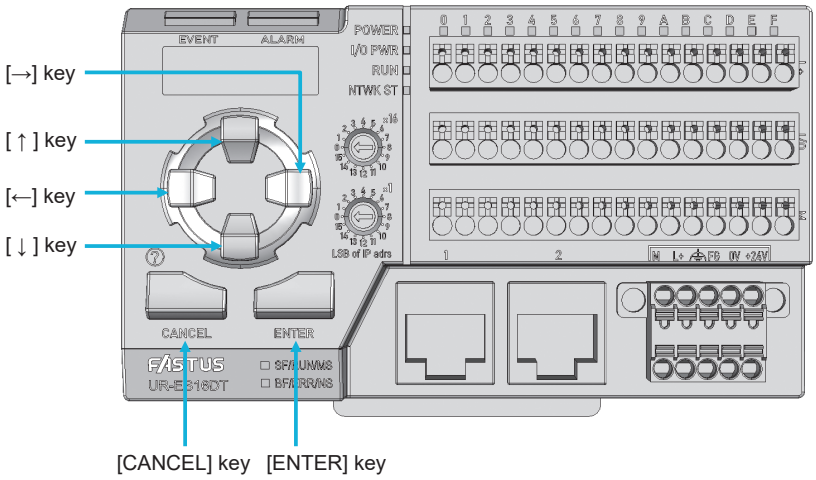
5-1 Front Panel Operations

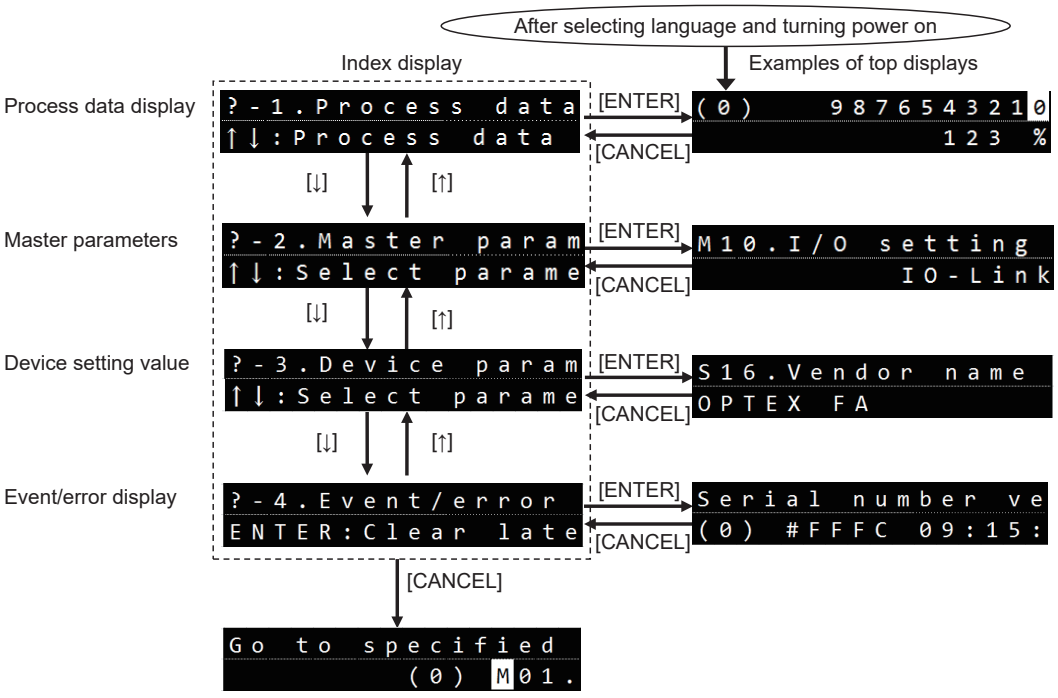
5-1-1 Overview of Display Operations

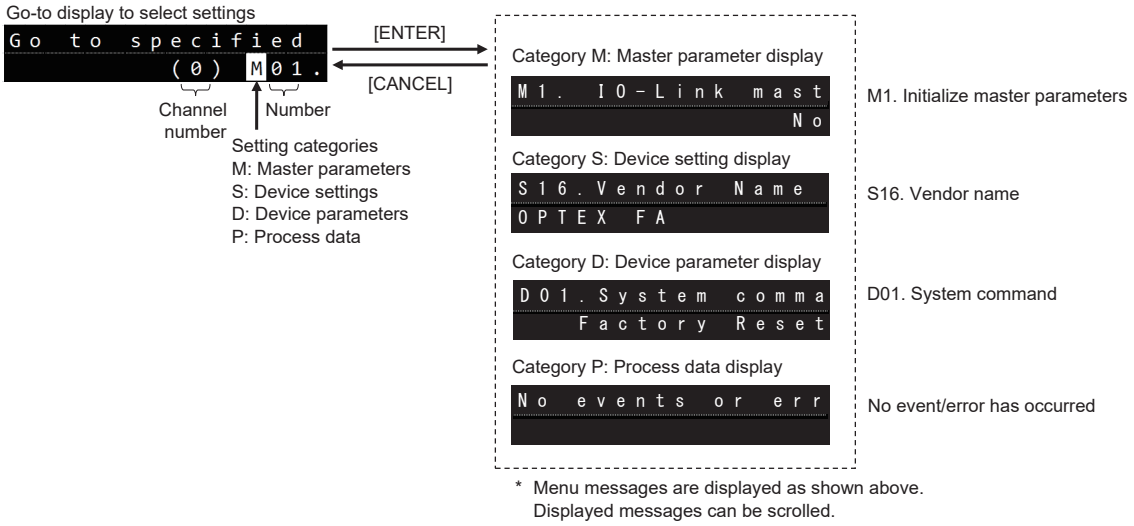
The following display operations can be made through the front panel of this product.

- Process data display
- Master parameter display
- Device setting display
- Event/error display

The displays are operated, using the following keys.



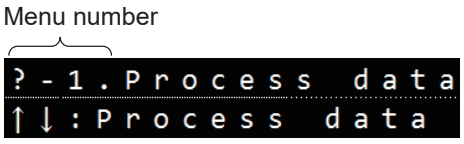




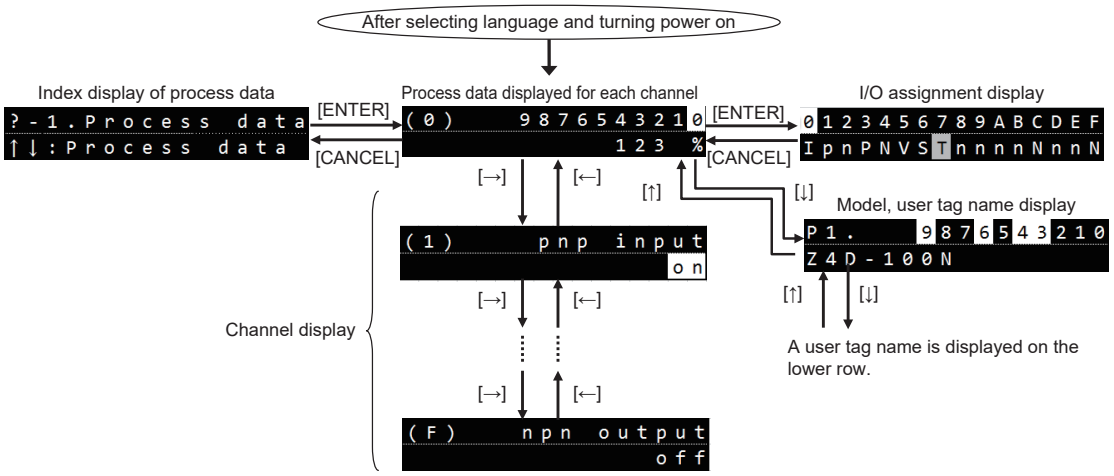
5-1-2 Process Data Display

I/O assignment or process data is displayed.

Index display:

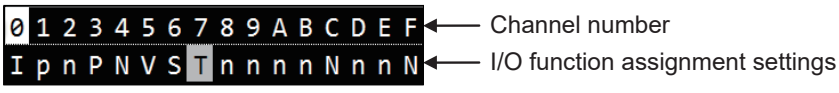


Menu transition:



I/O Assignment Display

This display shows the I/O assignment setting (and device validation status) for each channel, as well as any current IO-Link communication errors or validation errors.



The I/O assignment and device validation settings for each channel are displayed using the following codes beneath the channel number.

I : IO-Link mode (no validation) note: This blinks, when an IO-Link device is not connected or there is a communication error

V : IO-Link mode (validation/Type ID)

S : IO-Link mode (validation/serial number)

T : IO-Link mode (validation/model name)

p : PNP input mode

n : NPN input mode

P : PNP output mode

N : NPN output mode

— : Unused

In IO-Link mode, the IO-Link device connection status, communication status and device validation status are indicated by blinking the following characters.

I blinking : An IO-Link device is not connected or there is a communication error.

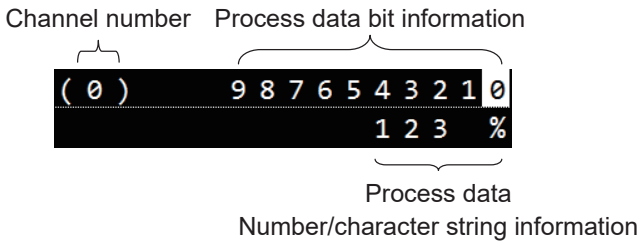
V blinking: An IO-Link device with different type ID (vendor ID or device ID) is connected.

S blinking: An IO-Link device with different type ID (vendor ID or device ID) or serial number is connected.

T blinking: An IO-Link device with different type ID (vendor ID or device ID) or model name is connected.

If I, V, S or T are shown as a lowercase letter (i, v, s or t), it indicates that the process input data of the IO-Link device is invalid.

Process Data Display



The display shown above is displayed upon power on, after language setting.

The following are displayed on the upper row.

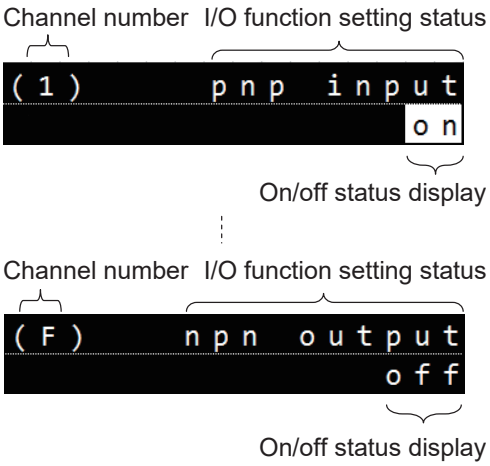
Left: Channel number (0 - F)

Right: Process data bit information (up to 10 bits)

Pressing the [↑] and [↓] keys switches the lower row as follows.

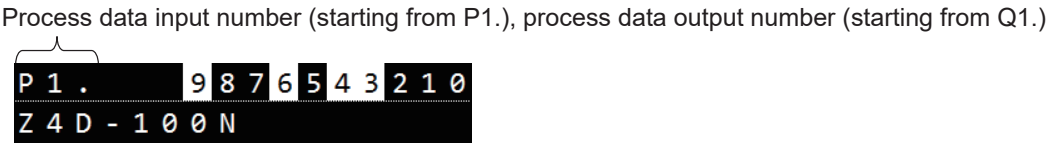
- Process input data (hexadecimal)
- Process output data (hexadecimal)

Examples:



Process data switch/product type/user tag name display

Example:



The following are displayed on the upper row.

Left: P☐ (process input data number), Q☐ (process output data number)

Note: Numbers are assigned continuously including P and Q.

The display will switch to “(0)” for approximately one second after transitioning to this menu. If IO-Link device process data for channel x was being displayed, “(x)” will be displayed.

Right: Process data bit information (up to 10 bits)

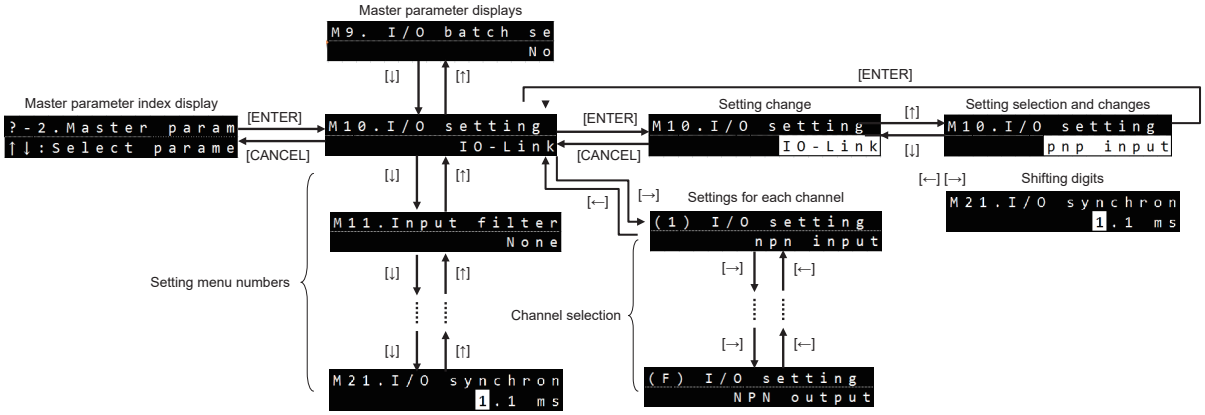
The model number or user tag name is displayed in the lower row.

5-1-3 Master Parameters Display

Through the operations of front panel of this product, the master parameters, user settings, of this product can be edited and monitored.

Index display:

Display transition:



Note: “M5. Language” will be displayed, when the power is turned on for the first time. Refer to “2-4-2 Language” for further information.

Description of each display:

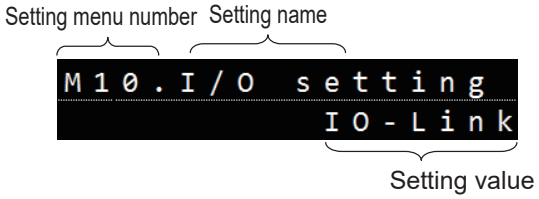
The following are displayed on the upper row.

Left: M☐: (setting menu number of this product)

Right: Setting name

The setting value is displayed on the lower row.

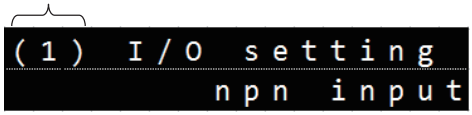
Example:



Channel settings

Example:

Channel number display (will switch to channel number display when the channel is switched or five seconds have passed).



5-1-4 Master Parameter List with Product Front Panel Operations

The following shows the master parameters with product front panel operations.

Setting Items (setting value number following by setting name)	R/W	Setting for product or channel	Setting value range	Description
M1. IO-Link master parameters reset	RW	This product	No (default value)	Do not reset master parameters to factory default.
			IO-Link	Resets master parameters to factory default. The I/O assignment settings will be changed to IO-Link mode for all channels. The registered vendor ID, device ID, serial number and storage data will also be deleted. The network type, network number and language will not be reset to the factory defaults.
			pnp input	Resets master parameters to factory defaults with the I/O assignment settings set to PNP input mode for all channels.
			npn input	Resets master parameters to factory defaults with the I/O assignment settings set to NPN input mode for all channels.
			PNP output	Resets master parameters to factory defaults with the I/O assignment settings set to PNP output mode for all channels.
			NPN output	Resets master parameters to factory defaults with the I/O assignment settings set to NPN input mode for all channels.
			Not used	Resets master parameters to factory defaults with the I/O assignment settings set to unused.
			Delete IODD	Delete the installed IODD data. Parameters will not be reset to the factory defaults.
			Factory defaults	Resets settings (including network settings and language) to the factory defaults. I/O assignment settings will be changed to unused. IODD data is not deleted.
M2. Network type	RW	This product	EtherNet/IP (Default value)	“EtherNet/IP” is used for the field network type.
			EtherCAT (under development)	Uses “EtherCAT” for the field network type.
			PROFINET (under development)	Uses “PROFINET” for the field network type.
			Ethernet & Modbus/TCP	Uses “Ethernet and Modbus TCP/IP, UDP/IP” for the field network type.
			CC-Link IE Field Basic	Uses “CC-Link IE Field Basic” for the field network type.
M4. Display brightness	RW	This product	5 to 100% (default value: 35%)	Set the brightness of the display.

Setting Items (setting value number following by setting name)	R/W	Setting for product or channel	Setting value range	Description
M5. Language	RW	This product	English (default value)	Set the display language to English.
			Japanese	Set the display language to Japanese. Shift-JIS is used for the character code.
			German	Set the display language to German.
			Simplified Chinese	Set the display language to Chinese (simplified). GB2312 is used for the character code.
			French	Set the display language to French.
			Spanish	Set the display language to Spanish.
			Portuguese	Set the display language to Portuguese.
			Italian	Set the display language to Italian.
			Korean	Set the display language to Korean. EUC-kr is used for the character code.
			Traditional Chinese	Set the display language to traditional Chinese. Big-5 is used for the character code.
M6. Time zone -UTC-	RW	This product	-24.00 to 24.00 (Default value: 0.00)	Set the time zone displayed as the network time (setting value number: M65). If the network time set in the host is based on UTC, setting the time zone to 9.00 will display the time in Japan time (JST). Note: The date will be written differently from the values set in the field network.
M8. User tag name of this IO-Link master unit	RW	This product	Up to 32 characters	Set the user tag name for this product.
M9. I/O batch setting	RW	All channels	No (default value)	
			IO-Link	Change I/O assignment settings for all channels to IO-Link mode.
			pnp input	Change I/O assignment for all channels to PNP input mode.
			npn input	Change I/O assignment for all channels to NPN input mode.
			PNP output	Change I/O assignment for all channels to PNP output mode.
			NPN output	Change I/O assignment for all channels to NPN output mode.
			Not used	Change I/O assignment for all channels to unused.
M10. I/O setting	RW	All channels	IO-Link	Connect the IO-Link device to the applicable channel and perform control using process data.
			pnp input	Connect a PNP output device to the applicable channel.
			npn input	Connect an NPN output device to the applicable channel.
			PNP output	Connect a PNP input device to the applicable channel.
			NPN output	Connect an NPN input device to the applicable channel.
			Unused (default value)	Turn input OFF and output nothing for the applicable channel.

Setting Items (setting value number following by setting name)	R/W	Setting for product or channel	Setting value range	Description
M11. Input filter time	RW	All channels	None (default value)	The noise filter (on delay) is not used.
			0.1 ms	Set the denoise filter for 0.1 ms for PNP/NPN inputs, detecting pulse widths of exceeding 0.1 ms.
			1 ms	Set the denoise filter for 1 ms for PNP/NPN inputs, detecting pulse widths of exceeding 1 ms.
			5 ms	Set the denoise filter for 5 ms for PNP/NPN inputs, detecting pulse widths of exceeding 5 ms.
			10 ms	Set the denoise filter for 10 ms for PNP/NPN inputs, detecting pulse widths of exceeding 10 ms.
			20 ms	Set the denoise filter for 20 ms for PNP/NPN inputs, detecting pulse widths of exceeding 20 ms.
M12. Input hold time	RW	All channels	None (default value)	The input hold is not used.
			1 ms	Holds an input for 1 ms upon its turn on.
			15 ms	Holds an input for 15 ms upon its turn on.
			100 ms	Holds an input for 100 ms upon its turn on.
M13. IO-Link and network error handling	RW	All channels	Clear (default value)	Clear process input data to “0” when communication with the IO-Link device is disconnected. Clear process output data to “0” and turn PNP/NPN output OFF when field network is disconnected.
			Input hold	Hold process input data when communication with the IO-Link device is disconnected. Turn output OFF.
			Output hold	Hold process output data and PNP/NPN output when field network is disconnected. Turn input OFF.
			All hold	Hold process input data when communication with the IO-Link device is disconnected. Hold process output data and PNP/NPN output when field network is disconnected.
M14. UC2-IOL direct output start channel	RW	This product	None (default value)	The UC2 direct output function is not used.
			0 to 15	Output signals of sensor units connected with OPTEX FA IO-Link gateway, UC2-IOL, can be output as PNP/NPN directly from the I/O terminals of this product. A designated value of 0 through 15 corresponds to a channel number of output start channel, 0 through F. When multiple sensor units are connected to a UC2-IOL, or when multiple units of UC2-IOL are connected, an output from the leftmost sensor unit connected to the UC2-IOL is allocated to the smallest channel number of this product. When I/O assignment settings of the channels after the start channel are not PNP output or NPN output, channel allocation to such channels is skipped and is shifted to later channels.

Setting Items (setting value number following by setting name)	R/W	Setting for product or channel	Setting value range	Description
M15. Encoder input (ABZ)	RW	This product	None (default value)	The encoder input is not used.
			Use the up and down keys to select the phase A, phase B, and phase Z input channel from the left. "-" means that it will not be used. "---" is reserved and must not be set.	Input encoder phase A to the far-left channel with SIO mode. Input encoder phase B to the channel in the middle with SIO mode. Input encoder phase Z to the far-right channel with SIO mode. If set to "-" (hyphen), phase Z will not be input.
			"-" (space) "-" (space) "-"	All assignments will be disabled.
M21. I/O synchronization	RW	All channels	Asynchronous (default value)	IO-Link communication is made at the fastest communication time of each device. The digital I/O status is updated as needed. If anything other than "Asynchronous" is set for the setting value, the actual cycle time for IO-Link will be the same or longer compared with asynchronous. The IO-Link cycle time value written to the IO-Link device will be the asynchronous value.
			network synchronization	For future reservations. The behavior is the same as asynchronous.
			0.4 ms synchronous timer	Use the internal timer of this product to synchronize (I/O synchronization) IO-Link communication or digital I/O transfer among multiple channels with the same settings, at a cycle of 0.4, 0.8, 1.6, 3.2 or 6.4 ms. The built-in timer is used to synchronize IO-Link communication and PNP/NPN input/output transfer at intervals of 0.4/0.8/1.6/3.2/6.4 ms. Write the network time from the host field network periodically to synchronize with the network time. The synchronous timer calculates data under 4 seconds for the network time counted every 15.26 µs as ×625÷256 and converts it to a time in 6.25 µs increments, with the lower 10 bits (0 - 1023) as the timer value from 0 to 6.4 ms. The "Synchronization establishment flag" turns ON when the internal timer of this product is synchronized with the network time (within +/-20 µs) (If the field network type is "Ethernet & Modbus/TCP", the "Synchronization establishment flag" does not exist).
			0.8 ms synchronous timer	
			1.6 ms synchronous timer	
			3.2 ms synchronous timer	
			6.4 ms synchronous timer	
			0.4 - 100.0 ms	Specify the IO-Link communication cycle time. This will be asynchronous with the network.
M29. Device ID	RW	All channels	0 - FFFFFF h	This is the device ID of the IO-Link device used with "M30. Device validation". There is normally no need to set this. However, it may be possible to switch functionality for some IO-Link devices by changing the registered device ID here. To do so, specify the registration device ID here in hexadecimal. If the setting value is changed, the IO-Link device communicates from the beginning.

Setting Items (setting value number following by setting name)	R/W	Setting for product or channel	Setting value range	Description
M30. Device validation	RW	All channels	None (default value)	Communicate unconditionally with the connected IO-Link device. The registered type ID (vendor ID and device ID) will also be deleted. Note 1: If there is already storage data in this product, the type ID of the connected I/O-Link device will be compared with the type ID of the storage data when the power (module power supply and I/O power supply) is turned ON, even if this is set to “None”. An error (FF23h) will be generated if they differ. Note 2: An error (FFFB h) will not occur even if IO-Link communication is established 10 seconds after I/O power supply is turned ON.
			Type ID	Transfer process data only if the device is the same as the registered type ID (vendor ID and device ID). If the type ID differs, an error (FFFE h) will occur and process data with the applicable IO-Link device will be invalidated. When the setting value is written, the type (vendor ID and device ID), model name sum value and serial number of the connected IO-Link device will be registered. Note 1: An error (FFFB h) will occur if IO-Link communication is not established within 10 seconds after I/O power supply is turned ON. Note 2: The revision ID will also be verified.
			Serial number	Transfer process data only for devices where the serial number is the same as the registered type (vendor ID and device ID). If the type ID differs, an error (FFFE h) will occur and process data with the applicable IO-Link device will be invalidated. If the serial number differs, an error (FFFC h) will occur and process data will be invalidated. Automatic restore will be performed if the automatic restore setting is activated. When the setting value is written, the type (vendor ID and device ID), model name sum value and serial number of the connected IO-Link device will be registered. Note 1: An error (FFFB h) will occur if IO-Link communication is not established within 10 seconds after I/O power supply is turned ON. Note 2: The revision ID will also be verified.
			Type name	Transfer process data only if the device is the same as the registered type (vendor ID and device ID) and model name. If the type ID differs, an error (FFFE h) will occur and process data with the applicable IO-Link device will be invalidated. If the model name differs, an error (FFF4 h) will occur and process data will be invalidated. Automatic restore will be performed if the automatic restore setting is activated When the setting value is written, the type (vendor ID and device ID), model name sum value and serial number of the connected IO-Link device will be registered. Note 1: An error (FFFB h) will occur if IO-Link communication is not established within 10 seconds after I/O power supply is turned ON. Note 2: The revision ID will also be verified.

Setting Items (setting value number following by setting name)	R/W	Setting for product or channel	Setting value range	Description
M31. Automatic device parameter backup	RW	All channels	None (default value)	Restore and backup are not automatically performed. Storage functionality is controlled manually (M32. Device parameter backup/restore).
			Backup	Automatically perform a backup (upload parameters to this product) when there is a change to an IO-Link device setting value. If IO-Link device parameters are changed from this product, the backup operation will automatically start 10 seconds after the last change. Note: If a device with a different vendor ID or device ID is connected, a backup will be performed each time upon startup. Re-configure “M30. Device validation” immediately to clear the validation error (FFFE h).
			Restore	Automatically restore (download parameters from this product to the IO-Link device) if the IO-Link device parameters differ from the data stored on this product during startup. In this case, note that even if the IO-Link device set value is changed, it will be overwritten at the next startup with the data saved in this product.
			Both	Automatically perform both backup and restore. The storage data stored on this product will always match the IO-Link device parameters. In other words, IO-Link device parameters are backed up to this product whenever they are changed. If any parameter is different from the IO-Link device during startup, the parameters stored in this product will be restored.
M32. Device parameter backup/restoration	RW	All channels	No (default value)	Manual backup/restore of parameters is not performed.
			Backup	Manually backup the IO-Link device (upload parameters from the device to this product). Note: When creating a backup file containing the storage data of the IO-Link device using the “UR series parameter backup tool” (free download available), use this operation to back up the storage data of the IO-Link device to this product in advance.
			Restore	Manually restore to the IO-Link device (download parameters from this product to the device). Note: This will not be performed if there is no backup data stored in this product.
			Delete	Delete backup data stored in this product. Note: This will not be performed if there is no backup data stored in this product.
M33. Conditions for applying IODD data	RW	All channels	Device	Prioritize and use data on the IO-Link device, if it supports the parameter server function.
			IODD (default value)	Prioritize and use IODD data if the IODD data installed on this product matches the vendor ID and device ID of the IO-Link device.

Setting Items (setting value number following by setting name)	R/W	Setting for product or channel	Setting value range	Description
M40. Process input data words allocation	RW	All channels	0 to 16 Words (Default value: Depends on the “M2. Network type” setting. [For EtherNet/IP]: 16 words [For CC-Link IE Field Basic] or [For socket communication via Ethernet & Modbus/TCP]: 2 words [For Modbus TCP/UDP communication with Ethernet & Modbus/TCP]: This setting is irrelevant)	Set the number of words allocated to this product for the process input data of the applicable IO-Link device. • If the set number of words is 0, the process input data for that channel will not be assigned. • If the number of set words is smaller than the number of bytes of the process input data for the connected IO-Link device, process input data exceeding the set size will be ignored (it will not be transferred from the IO-Link device to this product). • If the number of set words is larger than the number of bytes of the process input data for the connected IO-Link device, “0” will be transferred in the portion of data exceeding the size of the process input data from the IO-Link device to this product.
M41. Process output data words allocation	RW	All channels	0 to 16 Words (Default value: 2 words regardless of the network type. However, [Using Ethernet & Modbus/TCP and Modbus TCP/UDP communication]: This setting is irrelevant.)	Set the number of words allocated to this product for the process output data of the applicable IO-Link device. • If the set number of words is 0, the process output data for that channel will not be assigned. • If the number of set words is smaller than the size of the process output data for the connected IO-Link device, “0” will be transferred in the portion of the process output data exceeding the set size from this product to the IO-Link device. • If the number of set words is larger than the size of the process output data for the connected IO-Link device, the portion of data exceeding the size of the process output data will be ignored (it will not be transferred from this product to the IO-Link device).
M42. Process data words auto allocation	RW	This product	No (default value)	Automatic allocation of process data word is not performed.
			Yes	Word allocation for process input/output data (setting value number: M40/M41) will be automatically set according to the specified amount of process input/output data for the connected IO-Link device. Perform this with the required IO-Link device connected and all IO-Link communication established. “0” will be written for the number of process input/output data allocation words on any channels without IO-Link communication established.
M43. Process data LSB/MSB	RW	All channels	Little endian (default value)	Convert process data for the applicable IO-Link device into little-endian format and transfer it to field network. Refer to “4-1 Product Functions” for further information.
			Big endian	Leave process data for the applicable IO-Link device in big-endian format and transfer it to the field network. Refer to “4-1 Product Functions” for further information.

Setting Items (setting value number following by setting name)	R/W	Setting for product or channel	Setting value range	Description
M44. Timestamp	RW	This product	No (default value)	Time and parity data are not added to process input data.
			Serial	Attach the serial time when the process input data was obtained and store it as three-word data, after process input data is allocated. The serial time is a value where the first one word is the result of dividing one second by 65536 (= 15.2 µs). The remaining two words are used as data to count each second (with Jan. 1, 1970 00:00 as “0”).
			Time	Attach the time and date taking the time zone -UTC- (setting value number: M6) against the network time when process input data was obtained into consideration, and store it as four-word BCD format data, after process input data is allocated. This is a value where the first one word is the result of dividing one second by 65536 (= 15.2 µs). The remaining three words are six bytes of data containing in order the seconds, minutes, hours, day and month.
			Serial + Parity	Store the parity information from the process input data and time information as one word following the serial time described above. Parity information is a value determined by running exclusive OR (XOR) at the individual word level for 35AC h, process input data and time information. Time information is used to prevent data falsification.
			Time + parity	Store the parity information from the process input data and time information as one word following the time described above. Parity information is a value determined by running exclusive OR (XOR) at the individual word level for 35AC h, process input data and time information. Time information is used to prevent data falsification.
M51. IO-Link cycle time -Process value-	R	All channels	0.1 ms increments	Actual cycle time with an IO-Link device
M52. IO-Link transmission rate	R	All channels	Not used	Communication is not established with the IO-Link device.
			COM1(4800 bps)	Communicating over COM1 with the IO-Link device.
			COM2(38.4 kbps)	Communicating over COM2 with the IO-Link device.
			COM3(230.4 kbps)	Communicating over COM3 with the IO-Link device.
M53. IO-Link communication error	R	All channels	0 to 255	The number of communication errors with the IO-Link device. This will be cleared, when the data is overwritten or the power is turned on again.
M54. ISDU checksum error	R	All channels	0 to 255	The number of ISDU communication checksum errors with the IO-Link device. This will be cleared, when the data is overwritten or the power is turned on again.
M55. IO-Link transmission rate error	R	All channels	0.1% increments	The communication speed measurement error for the IO-Link device. Check the number of communication errors if the measurement error is ±3% or larger.
M56. IO-Link signal width error	R	All channels	0.1% increments	The ON/OFF ratio measurement error for IO-Link device communication signals. Check the number of communication errors if the measurement error is ±20% or larger.

Setting Items (setting value number following by setting name)	R/W	Setting for product or channel	Setting value range	Description
M57. IO-Link communication mode	R	All channels	NOCOM	IO-Link has not started communication.
			STARTUP	Reading basic information for the IO-Link device. The process will stop here if there is a revision ID error.
			PREOPERATE	In a state prior to exchanging process data.
			OPERATE	Exchanging process data and operating.
			STARTUP(Rev.1.0)	Same as above. However, this indicates the IO-Link device has a revision ID of 1.0 (10 h).
			PREOPERATE (Rev.1.0)	
			OPERATE(Rev.1.0)	
M58. Storage backup time	R	All channels	Time and date	Display the time when storage data was backed up. This will be displayed as “00:00:00 00/00/00” if there is no backup data. The date will be written as YY/MM/DD (for Japanese, Korean, Chinese and Traditional Chinese), MM/DD/YY (for English) or DD/MM/YY (other languages).
M60. System program version of IO-Link master unit	R	This product	P.PPNNLLFF	Display the data version of the program, etc. P.PP: Firmware, NN: Network chip, LL: Logic, FF: Font
M61. Total operation hours of IO-Link master unit	R	This product	Displayed in 0.1 hour increments	Display the total cumulative operation time of this product since the power was first turned ON. This is counted internally in 7.5 minute increments, so any time under 7.5 minutes when the power is turned OFF will be discarded.
M62. Display drive time	R	This product	Displayed in 0.01 hour increments	Displays the time that the display has been activated, since the first power on. This is counted internally in 56 second increments, but is written to memory every 7.5 minutes (as with the operation hours). After 100 hours have elapsed, the display automatically turns off, after 10 minutes any key on this product is not operated.
M63. I/O power supply voltage	R	This product	0.1 V increments	Display the voltage of the I/O power supply. The measurement accuracy is +/-5%.
M64. Internal temperature	R	This product	0.1°C increments	Display the internal temperature. The measurement accuracy is +/-2°C.
M65. Network time	R	This product	Time and date	Displays the time and date in consideration of the M6. Time zone in the network time. The date will be written as YY/MM/DD (in Japanese and Chinese), MM/DD/YY (in English) or DD/MM/YY (other languages).
M66. Network communication cycle	R	This product	0.00 to 150.00 ms	Display the cycle at which process data is sent to and received from the field network. It will be forced to operate at a 150 ms cycle if the field network is disconnected.

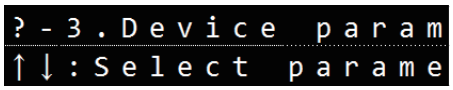
Setting Items (setting value number following by setting name)	R/W	Setting for product or channel	Setting value range	Description
M66. Network timeout time	RW	This product	0 to 30000	This is valid only when “M2. Network type” is “Ethernet & Modbus/TCP”. When Ethernet communication stops and the specified time elapses, a “network communication stop error” (FFFA h) occurs. The time is specified in 10 ms increments from 0 to 30000 (300 seconds). The default value is 0. If the value is 0, even if Ethernet communication is interrupted, the data is considered to have been updated internally at about 10 ms cycle and no error occurs. An error will occur if the Ethernet cable is disconnected.
M80. Default gateway		This product	0.0.0.0 to 255.255.255.255	Set if otherwise specified on the field network. If not, keep the default value. The default value is 0.0.0.0. This is valid only when “M2. Network type” is “EtherNet/IP”, “CC-Link IE Field Basic” or “Ethernet & Modbus/TCP”.
M81. Subnet mask		This product	0.0.0.0 to 255.255.255.255	Set if otherwise specified on the field network. If not, keep the default value. The default value is 255.255.255.0. This is valid only when “M2. Network type” is “EtherNet/IP”, “CC-Link IE Field Basic” or “Ethernet & Modbus/TCP”.
M82. IP address		This product	0.0.0.0 to 255.255.255.255	Set the IP address of this product to any value. Set this only when changing the initial value 192.168.0.xxx (xxx is the value set by the rotary switches) (Example: In CC-Link IE Field Basic, if the network address of the first 3 octets are 192.168.3.□, set any value here.) Turning the front rotary switches of this product while the power is on will automatically switch to “M82. IP address” setting window. This is valid only when “M2. Network type” is “EtherNet/IP”, “CC-Link IE Field Basic” or “Ethernet & Modbus/TCP”.
M83. Station number	RW	This product	0 to 255	The station number (station address) of the EtherCAT for this product is displayed. The station number is set by the rotary switch.
C1. Device reset	W	All channels	No (default value)	Reset is not performed.
			Reboot	Send system command 80 h to the IO-Link device.
			Application reset	Send system command 81 h to the IO-Link device.
			Initialize parameters	Send system command 82 h to the IO-Link device.
			Back-to-box	Send system command 83 h to the IO-Link device.

If an IO-Link device with OP+ setting value information version 1 or later is connected, “C1. Device reset” will not be displayed.
In this case, send any system command (supported by the applicable device) to index number 02 (system command) from the device parameters window.

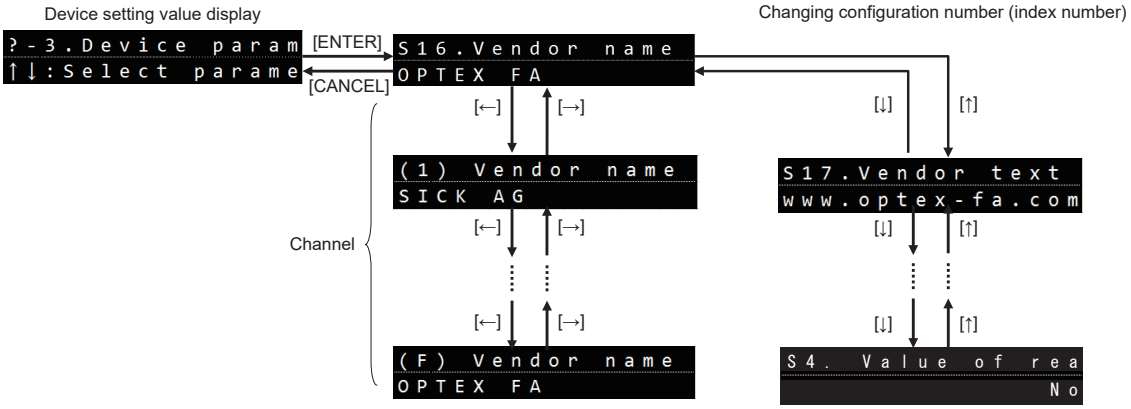
Note: M29 and M52 through M66 described above will not be displayed using the up and down keys in the master parameter menu. Enter the setting value number directly to navigate. The up and down keys can be used to select for 10 minutes after navigating.

5-1-5 Device Identification Display

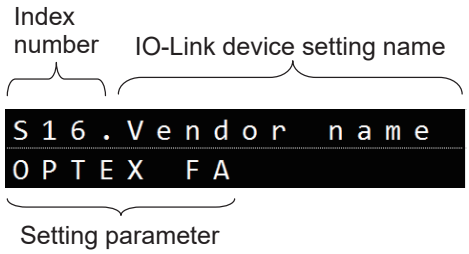
Device information from each IO-Link device can be confirmed and a specified index number can be read and written by this product.
A specified index number can be written even if IODD data is not installed.
Index display:



(Not displayed if an IO-Link device is not connected)
Menu transition:



Description of each display:
The followings are displayed on the upper row.
Left: S☐ (IO-Link device index number)
Right: Setting name
The setting parameter is displayed on the lower row.
Example:



Device Information Confirmation

The following device information of standard indexes can be read.

Standard indexes

Setting (upper row)	Description	Read-only: R, Read/write: R/W
S16. Vendor name	Read the value of index 16 (vendor name) and display it as a character string.	R
S17. Vendor text	Read the value of index 17 (vendor text) and display it as a character string.	R

Setting (upper row)	Description	Read-only: R, Read/write: R/W
S18. Product type	Read the value of index 18 (product name) and display it as a character string.	R
S19. Product ID	Read the value of index 19 (product ID) and display it as a character string.	R
S20. Product function	Read the value of index 20 (product text) and display it as a character string.	R
S21. Serial number	Read the value of index 21 (serial number) and display it as a character string.	R
S22. Hardware revision	Read the value of index 22 (hardware revision) and display it as a character string.	R
S23. Firmware revision	Read the value of index 23 (firmware revision) and display it as a character string.	R
S24. User tag name	Read the value of index 24 (application specific tag) and display it as a character string.	R/W

Manual Setting of Setting Data (For a Specified Index Number)

As shown below, an index number can be specified, and its setting data can be read and written manually.

Setting (upper row)	Description	Read-only: R, Read/write: R/W
S1. Index to read	Specifies an index number directly to access a device. (Access to the index number 3 is restricted by the IO-Link specifications.)	R/W
S2. Subindex	Next, specify the subindex number directly.	R/W
S3. Type of index	Specify the setting value data type of the index to access. Select either signed number, signed integer, character string or hexadecimal floating point number (read-only).	R/W
S4. Read data	Read data is displayed. "----------" will be displayed if a read error occurs. Press the [ENTER] key to edit the setting value. Press the [ENTER] key again to write that setting value.	R/W

5-1-6 Device Diagnostic Display

If the IO-Link device supports the parameter server function, the name of the setting value and the setting value read will be displayed.

Description of each window:

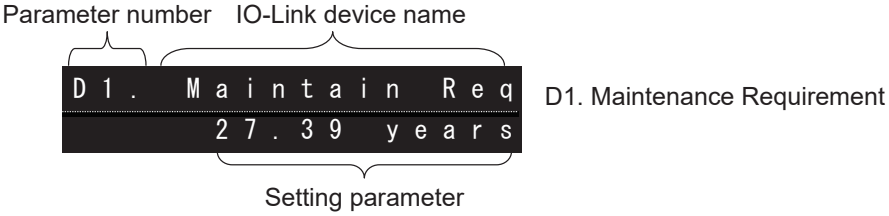
The followings are displayed on the upper row.

Left: D□ (device parameter number)

Right: Setting name

The setting value is displayed on the lower row.

Example:



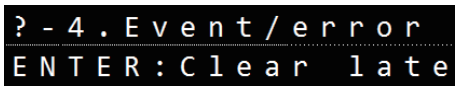
* Windows are displayed as shown above.
  Messages that cannot be displayed all at once will scroll.

Setting (upper row)	Description	Read-only: R, Read/write: R/W
D1. **********	The setting value will be displayed here if setting value information is registered to the IO-Link device and IODD data is installed.	R or R/W

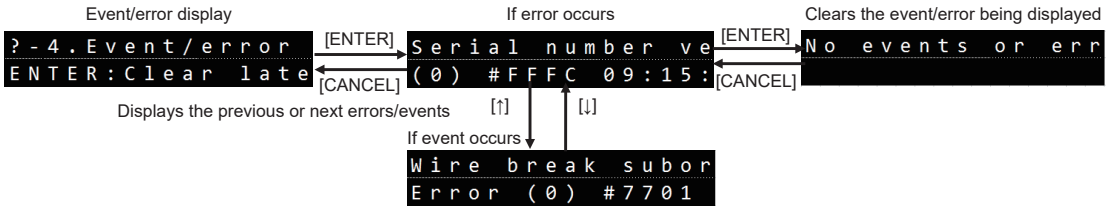
5-1-7 Event/Error Display

The event code/event name for the latest and six most recent events can be read from the IO-Link device, along with the error code/error message of present error.

Index display:

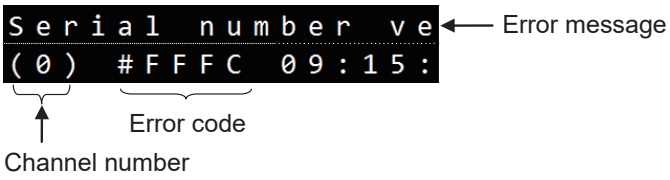


Menu transition:



If an error

Example:



The error message is displayed on the upper row.

The followings are displayed on the lower row.

Left: Channel number (0 to F)

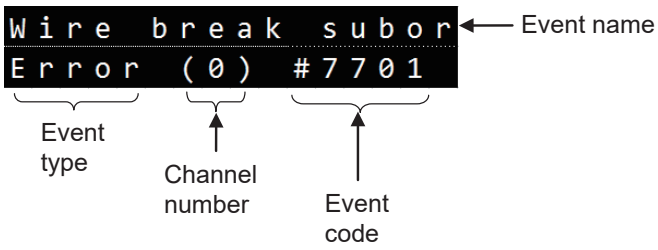
Right: Error code (#) and error time (example: #FFFC 09:00:59 20/06/24)

Note: The index number and subindex number that caused the error will be displayed after the error code and before the error time on the row beneath the error message (“Invalid index number”), as shown below.

Example: Index=0064-01 (index number: 0064, subindex number: 01)

If an event

Example:



The event name is displayed on the upper row.

The following are displayed on the lower row.

Left: Event type (notification, error or warning)

Center: Channel number (0 to F)

Right: Event code (#) and event time (example: #7701 09:00:59 20/06/24)

Clears the event/error being displayed

The following is an example where no errors or events have occurred.

A message indicating no errors/events is displayed on the upper row.

Specifications

This chapter describes the specifications of this product.

6-1 Specifications

6-1-1 General Specifications

Item		Specifications
Power supply voltage		24 VDC +/-15% (SELV and LIM power supplies, or UL 1310 Class 2 power supplies) (*1)
Current consumption		195mA
Insulation resistance		5 MΩ or more (between external power supply and unit power supply at 500 VDC)
Input/output common		Sink/source switchable per channel
Connectors		Field network: 2x RJ45 Socket
		Power Connector: 5-pole, 2-row spring-clamp terminal block
		Input/output: 3x 16-channel spring-clamp terminal blocks
Indicators		POWER LED (green), EVENT LED (yellow), ALARM LED (red), I/O LED (orange)
Display		OLED (Display language: English, Japanese, Simplified Chinese, Traditional Chinese, Korean, French, Spanish, German, Portuguese, Italian)
Environmental resistance	Operating temperature/humidity	0 to +55°C/5 to 95% RH (no freezing or condensation) (*2)
	Storage temperature/humidity	-25 to +75°C/5 to 95% RH (no freezing or condensation)
	Vibration resistance	IEC 61131-2 compliant
	Shock resistance	IEC 61131-2 compliant
	Operating environment	No corrosive gas
	Operating altitude	0 to 2000 m
	Installation location	In door use
	Degree of protection	IP20 (non-UL certified)
Overvoltage category		II or less
Pollution degree		2 or less
Applicable regulations	EMC	EMC Directive (2014/30/EU)
	Environment	RoHS Directive (2011/65/EU), China RoHS (Regulation 32)
Applicable standard		EN 61131-2
NRTL certification		UL Listed Programmable Controllers Certified for US and Canada.
Company standards		Noise resistance: Passes Feilen Level 3
Compatible DIN rail		TH35-7.5Fe, TH35-7.5Al
Cable Length		Between power source and IO-Link Master: Up to 30 m
		Between IO-Link master and IO-Link device: Maximum 20 m
Compatible power cable size		Power terminal block: AWG 24 to 16; I/O terminal block: AWG 28 to 16
Material		Housing: PC, keys, DIN rail mounting hook: POM; Terminal block: PA
Weight		Approx. 195 g (including terminal blocks, when not wired)
Included accessories		Instruction manual, I/O terminal block: three pieces, power terminal block: one piece
		RJ45 connector protective cap x 2 (attached to unit)

*1: Use a Class 2 power supply or a power supply compliant with SELV (Safety Extra-Low Voltage) circuit and LIM (Limited Energy Circuit) circuit standards.

*2: UL certification conditions: 0 to +55°C when I/O output load current is 2 A/16 points or less, and 0 to +50°C when 2.5 A/16 points.

6-1-2 Functional Specifications

Item	Specifications
I/O operation for communication errors	Holding or clearing process data or PNP/NPN output data can be specified when IO-Link communication or field network communication is disconnected.
Condition monitoring	• Number of IO-Link communication errors • I/O power supply flag • I/O power supply voltage • Output overcurrent flag • Master operating time • Display drive time • Internal temperature

6-1-3 Field Network

Item	Specifications
Network type	Depending on the setting, selectable from the following: - EtherNet/IP (default value) - EtherCAT - PROFINET (under development) - Ethernet & Modbus/TCP - CC-Link IE Field Basic For the specifications of each communication, refer to the corresponding communication manual.
Communication port	2× RJ45 socket connectors

6-1-4 IO-Link Specifications

Item	Specifications
Basic IO-Link communication	Process data, ISDU, event
IO-Link revision	1.1 and 1.0
Communication speed	COM1 (4800 bps) / COM2 (38400 bps) / COM3 (230.4 kbps)
Physical layer	IO-Link-compliant
Minimum cycle time	0.3 ms
Number of ports	16
I/O assignment	Switchable in the following 6 modes by setting for each channel: • Disable mode • IO-Link communication mode • SIO(PNP input) mode • SIO(NPN input) mode • SIO(PNP output) mode • SIO(NPN output) mode

Item		Specifications
Functions	Basic IO-Link communication	Process data, ISDU, event
	Allocation of process data of IO-Link devices to this product	Process data can be automatically allocated from the actual IO-Link devices or manually set for each channel
	IO-Link device validation	Can be collated with the type of IO-Link device (*1) registered in this unit for each channel. *1: Type ID only, type ID plus serial number, or type ID plus model name can be selected for each channel.
	IO-Link communication related	• Process input condition: IO-Link ready flag • Process data endianness conversion • I/O synchronization: I/O synchronization • Backup/restore of IO-Link device settings (to/from this product): manual backup/restore of settings, or automatic storage (backup/restore) of settings

6-1-5 Input/Output Specifications

Input Specifications

Item		Specifications
Rated input voltage		24 VDC +/-20% (SELV and LIM power supplies, or UL 1310 Class 2 power supplies) (*1)
Rated input current (typical values)		PNP: 5.5mA, NPN: 5.0mA
Insulation method		Transformer, photocoupler insulation
Maximum number of simultaneous input points		100% simultaneous ON
Voltage and current at ON		PNP: 15 VDC or more, 5.5 mA or more, NPN: 13 VDC or more, 3.0 mA or more Note: NPN is the voltage seen from the 24 V side.
Voltage and current at OFF		PNP: 10 VDC or lower, 2.0 mA or lower, NPN: 8 VDC or lower, 2.0 mA or lower Note: NPN is the voltage seen from the 24 V side.
Input resistance		PNP: 5.5 mA rated current circuit load, NPN: 4.7kΩ
Input response time		0 ms, 0.1 ms, 1 ms, 5 ms, 10 ms, 20 ms (default: 0 ms)
Functions	Input related	• Input hold time • Input filter time • Encoder input (high-speed counter function)

*1: Use a Class 2 power supply or a power supply compliant with SELV (Safety Extra-Low Voltage) circuit and LIM (Limited Energy Circuit) circuit standards.

Output Specifications

Item	Specifications
Rated load voltage	10.8 to 26.4 VDC (SELV and LIM power supplies, or UL 1310 Class 2 power supplies) (*1)
Maximum output load current	0.2 A per 1 point, 2.5 A per 16 points (*2)
Overcurrent protection current	0.5A
OFF output leakage current	0.1 mA or less (0.2 mA or less for NPN output only)
Maximum output voltage drop (when ON)	PNP: 1.8 V, NPN: 1.6 V
Surge suppressor	Zener diode
Output response time	0.1 ms or less

*1: Use a Class 2 power supply or a power supply compliant with SELV (Safety Extra-Low Voltage) circuit and LIM (Limited Energy Circuit) circuit standards.

*2: UL certification conditions: 0 to +55°C when I/O output load current is 2 A/16 points or less, and 0 to +50°C when 2.5 A/16 points.

UL Satisfaction Ratings

The total load current and ambient temperature of the connected devices to the UR-ES16DT are limited as follows:

Maximum load current of 2.5A or below.
Operating ambient temparature 50ºC or below.

Maximum load current of 2A or below.
Operating ambient temparature 55ºC or below.

6-2 Data Processing Time

6-2-1 Access Time to IO-Link Parameters via IO-Link ISDU Handling

When IO-Link ISDU handling is used to write IO-Link device parameters, the time required for writing will depend on the IO-Link cycle time and the data length of the IO-Link device parameters to write.
Although this does not include the delay time for acyclic communication of field network itself, this delay will not have much of an effect.

Expect data writing to take 10 ms at the fastest IO-Link cycle time.
This time may exceed 100 ms if the data length is long or the IO-Link cycle time is slow.

Examples are shown below.

Item	Read example			Write example		
Index number to access(*1)	40	80	1000	41	80	1000
Subindex number to access(*2)	0	1	0	0	1	0
Number of data bytes to access(*3)	4 byte	4 byte	8 byte	2 bytes	4 byte	16 byte
Busy count until IO-Link device returns response	1	1	1	1	1	1
Actual cycle time for IO-Link communication	0.6 ms	1 ms	2 ms	0.6 ms	1 ms	2 ms
Number of bytes for on-request data for IO-Link device (1, 2, 8, 32)	1 byte	1 byte	1 byte	1 byte	1 byte	1 byte
Number of command and checksum bytes	5 byte	6 byte	7 byte	5 byte	6 byte	7 byte
Number of cycles required for access	10	11	16	8	11	25
Resulting time until access is complete	**6 ms**	**11 ms**	**32 ms**	**4.8 ms**	**11 ms**	**50 ms**

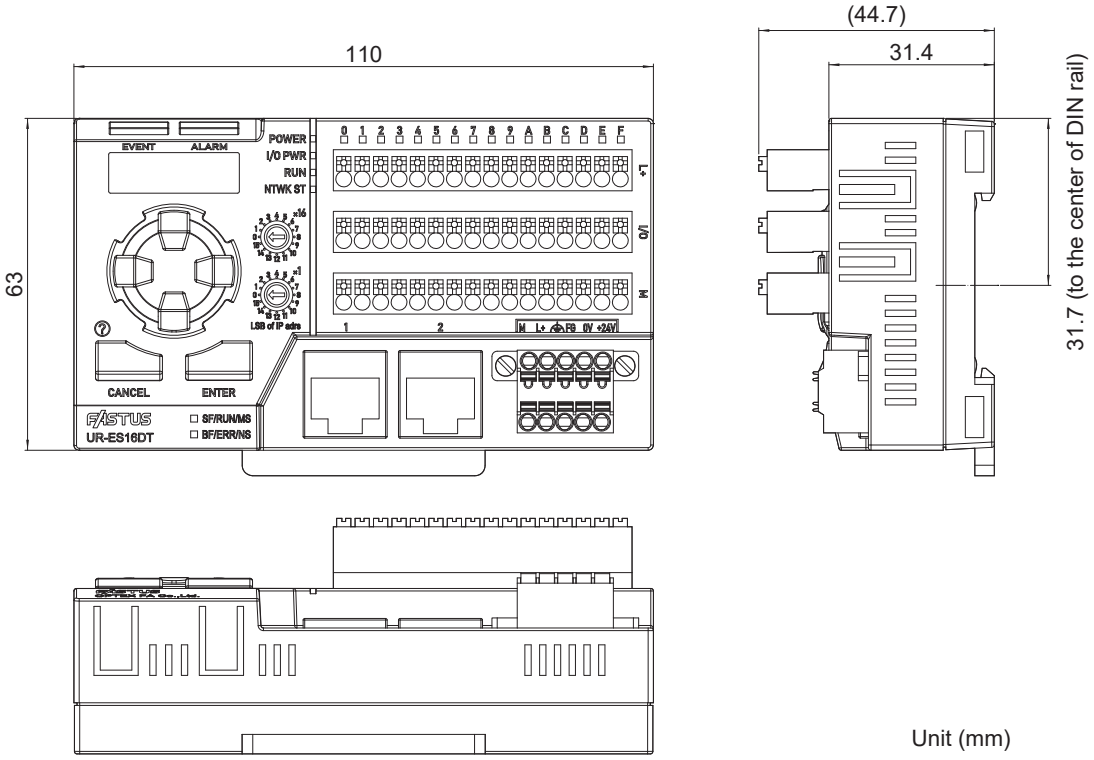
*1: Index numbers 256 and above are specified as three bytes regardless of the subindex number.

*2: This will be specified as two bytes if the index number is 255 or lower and the subindex number is not 0.

*3: If the number of command and checksum bytes is 16 or higher (including the specified number of index number bytes described above and the number of bytes to write) when written, the number of bytes will be increased by one to specify the number of bytes. When reading, if the number of bytes to read is 14 or higher, the number of bytes will be increased by one to specify the number of bytes.

6-3 Dimensions

UR-ES16DT



Unit (mm)

Troubleshooting

This chapter describes what you need to know for use of this product, such as troubleshooting.

7-1 Troubleshooting

7-1-1 Troubleshooting Based on LEDs

Front LEDs (on this product)	Status	Procedure
POWER		
Off	Power is not supplied to this product correctly	Check and resolve the following potential causes of power interruption. Restart this product according to the specifications of the connected field network master. • Are the power cables connected correctly? • Are the power cables broken? • Is the power supply voltage within the specified range? • Is the power capacity sufficient? • Is the power supply faulty?

Front LEDs (on this product)	Status	Procedure
Link LED or Data LED		
Off	Network cable is disconnected	Check whether the P1 or P2 network cable is disconnected.

Front LEDs (on this product)		Status	Details	Procedure
EVENT	ALARM			
Flashing yellow	-	Event occurring in IO-Link device	An event has occurred in the IO-Link device connected to a channel. The “Event flag” (assigned to byte address +2 and bit address 7) also turns ON. The applicable channel is also stored in “Latest event channel” (assigned to byte address +2 and bit address 0 to 3).	The event code can be read using the following procedures. • Using acyclic communication of field network master, read from “Read event data” in master parameters or, • Check the “Event/error display window” on the front of this product Then, implement the required measures based on the event code of each IO-Link device.
-	Flashing red	Error occurring in this product	An error has occurred in this product. The “Error flag” (assigned to byte address +2 and bit address 7) also turns ON. The applicable channel is also stored in “assigned to byte address +3 and bit address 0 to 3”.	The error code can be read using the following procedures. • Using acyclic communication from field network master, read from “Read latest error code by channel” in master parameters or, • Check the “Event/error display window” on the front of this product Refer to “7-1-3 Error code list” and implement the required measures.

7-1-2 Troubleshooting Based on Symptoms

Symptom	Front LEDs (on this product)	Cyclic communication flag	Error code (hexadecimal)	Probable cause		Procedure
Unable to communicate (IO-Link communication) with an IO-Link device	I/O PWR OFF	I/O power supply flag OFF	-	I/O power supply error	I/O power supply OFF error	Confirm the voltage at the I/O power supply terminal block (L+) or power terminal block.
					Below 12 V.	
	ALARM LED flashing red	IO-Link ready flag ON and error flag ON	1001 (after IO-Link communication has been established once)	IO-Link communication error	The IO-Link cable is disconnected.	Confirm that the IO-Link cable is connected.
					The IO-Link cable is shorted.	
					The IO-Link device has failed.	Replace the IO-Link device.
Data sent to/ received from an IO-Link device via IO-Link communication cannot be read/ written properly by field network master	ALARM LED OFF	-	-	Process data was read and written when IO-Link communication was not properly established with the IO-Link device.	The IO-Link ready flag was not read as an execution condition.	Read process data with the IO-Link ready flag ON.
					IO-Link ready flag is not written as an execution condition.	Write process data with the IO-Link ready flag ON.
				When process data (in bytes) in the IO-Link device is expanded into words in the field network master, the high-order/ low-order bytes are reversed.	Depending on the type of IO-Link device, process data from the low-order byte in the IO-Link device must be allocated as words in order from the low-order byte to the low-order word in the field network master, when process data stored in bytes in the IO-Link device is allocated to the field network master.	Change the setting of “Process data sequence conversion” in the master parameters of this product from the default of “Little endian” to “Big endian”.
				Process data from an IO-Link device is not allocated to the field network master.	When used with the default value, the process output data of the connected IO-Link device exceeds 4 bytes.	• Set the following values to change the initial value of the process data of the corresponding channel. • Process data words auto allocation (setting value number: M42): Yes or • Process output data words allocation (setting value number: M41)

Symptom	Front LEDs (on this product)	Cyclic communication flag	Error code (hexadecimal)	Probable cause		Procedure
					When changing the initial value, the total process output data of all connected IO-Link devices exceeds 32 words (64 bytes) while extended access is disabled. Or, it exceeds 28 words (56 bytes) while extended access is enabled.	● If there is process data that does not need to be allocated: Ensure that the process data of all connected IO-Link devices does not exceed 32 words (64 bytes) or 28 words (56 bytes) for output. Set the following values and manually set the process data for each channel (restrict and allocate the number of works for output for the IO-Link device on each channel to this product). • Process data words auto allocation (setting value number: M42): None or • Process output data words allocation (setting value number: M41) ● If there is no process data that does not need to be allocated: Use an additional product to reduce the number of IO-Link devices connected to this product using IO-Link communication.
	EVENT LED flashing yellow	Event flag ON	-	Device event (error level) occurring in IO-Link device		Check the event/error display window or send a noncyclic communication program from the field network master to read the event code. Refer to the manual for the IO-Link device being used and perform troubleshooting.
	ALARM LED flashing red	Error flag ON	FFFA	Field network communication stopped		Confirm the status of the field network.
			FFFB	IO-Link device not connected		Confirm that the applicable IO-Link device is connected. Or, change the setting value for device validation (setting value number: M30) to “None”. Or, set the I/O assignment settings (setting value number: M10) to a value other than “IO-Link” for any channels not connected to an IO-Link device.
			FF23	The vendor ID or device ID differs between the stored data and the connected IO-Link device.		Confirm the vendor ID and device ID of the applicable IO-Link device. Or, clear the storage data.
			FFF3	The revision ID of the IO-Link device to validate is not registered in this product (00 h)		Change the setting value for device validation (setting value number: M30) to “None”. Or, register the revision ID of the IO-Link device to verify.

Symptom	Front LEDs (on this product)	Cyclic communication flag	Error code (hexadecimal)	Probable cause	Procedure
			FFF4	IO-Link device validation error (model name mismatch)	If the correct IO-Link device is currently connected, overwrite with this setting value (“Model name”) to re-register with the model name of the currently connected IO-Link. Or, connect the correct IO-Link device.
			FFFC	IO-Link device validation error (serial number mismatch)	If the correct IO-Link device is currently connected, overwrite with this setting value (“Serial number”) to re-register with the serial number of the currently connected IO-Link device. Or, connect the correct IO-Link device.
			FFFE	IO-Link device validation error (vendor ID or device ID mismatch)	If the correct IO-Link device is currently connected, overwrite with this setting value (“type ID”) to re-register with the vendor ID and device ID of the currently connected IO-Link device. Or, connect the correct IO-Link device.
			6001	IO-Link device validation error (revision ID mismatch)	If the correct IO-Link device is currently connected, overwrite with this setting value (a value other than “None (default value)”) to re-register with the revision ID of the currently connected IO-Link. Or, connect the correct IO-Link device.
Storage data cannot be restored to the IO-Link device using the manual backup/ restore of settings or automatic device parameter backup functions.	ALARM LED flashing red	Error flag ON	FFFD	No backup data found in this product	Backup the parameters from the applicable IO-Link device to this product.
			FFFF	The type ID of the IO-Link device to restore does not match	Confirm the type ID of the applicable IO-Link device.
The unique parameters of an IO-Link device cannot be displayed/written using the IO-Link device parameter display on the front of this product.			-	IODD data (including the applicable IO-Link device) is not installed on this product.	Use IODD_Converter.exe (in UR Master Manager) to create new IODD data including the corresponding IO-Link devices and load it to the product.

7-1-3 Error code list

Code (hexadecimal)	Message	Conditions	Procedure
1000	No Service generated in ISDU handling	This occurs when the start code of the ISDU handling response used to access the parameters of the IO-Link device is “0” (No Service).	A setting value that is not supported by the IO-Link device is being accessed in this case. Confirm what you are trying to access (index number, etc.).
1001	IO-Link communication has stopped	This occurs when communication is established with an IO-Link device but then is disconnected. This error does not occur if the I/O power supply is shutdown. The error is also automatically cleared if IO-Link communication is restored.	Check the wiring between the IO-Link device and this product. Check the I/O power supply. Confirm whether the issue is resolved after changing the connection to another channel for this product or replacing the IO-Link device and cable.
1100	Timeout generated in ISDU handling	When using ISDU handling to access an IO-Link device setting value, no ISDU handling 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 handling	When using ISDU handling to access an IO-Link device setting value, a mismatch occurs when calculating the checksum of the ISDU handling 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 handling data length	This occurs when the data length of the ISDU handling response is either “0” or too long, when using ISDU communication to access an IO-Link device setting value.	
6001	Revision ID validation 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 parameters are not accessed.	Change the setting value for device validation (setting value number: M30) to “None”.
8033	Setting value is too long	This occurs when the data length is too long, when using ISDU handling 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 validation (setting value number: M30) is set to “None” and storage data exists (however, this only occurs when power is turned ON).	If an IO-Link device with a vendor ID or device ID that differs from the storage data is connected, connect the correct IO-Link device. If it is safe to delete the storage data stored on this product by channel, write with device parameter backup/restore (setting value number: M32) set to “Delete”.
FF24	Storage buffer overload	This occurs when setting value data is too long and cannot be stored, when backing up parameters from an IO-Link device. The data length stored during backup will be “16 bytes + index 18 (model name) length + number of parameters to backup × 4 + total data length of parameters to backup”. This can be stored as long as it is 4,032 bytes or less.	Backup cannot be performed for the connected IO-Link device because the storage data is too large.

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

Code (hexadecimal)	Message	Conditions	Procedure
FFF4	IO-Link device model name is different	This occurs when the model name (index number 18 [product name] character string) of the registered IO-Link device differs from the model name of the device that is actually connected, when device validation (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 validation (setting value number: M30) to a value other than “Type name”. Or, connect the correct IO-Link device.
FFF5	Unsupported setting value version	The version of the setting value data restored to setting value memory is new, and it may not be possible to recognize some of it.	Update the firmware of this product.
FFF6	Internal temperature is too high	This occurs when the temperature of the main CPU exceeds 85°C. The error occurs every 10 minutes.	Lower the operating temperature of this product, install a cooling fan, or lower the output load current (for example, by using a separate relay).
FFF7	EEPROM write frequency is too high	The setting value write count occurs under the following conditions. • The count is cleared if nothing is written for 450 seconds. • When writing twice with a frequency of once in less than 1 second. • When writing 20 times with a frequency of 1 in less than 10 seconds. • When writing 200 times with a frequency of once in less than 110 seconds.	Confirm whether setting value write operations are being performed frequently from the host PLC. Confirm whether IO-Link device parameters 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, field 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 field network processing.	The network chip may have failed, or power may have turned OFF while the network chip firmware was being updated.
FFFA	Network communication has stopped	This occurs when field network communication is established but then disconnected. The error will be automatically cleared when the status is restored.	Check whether the Ethernet cable is disconnected, the host PLC has been reset, or the power has turned OFF. Confirm the host PLC parameters. This product may stop being recognized on the network if host PLC network settings are changed.

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

* Errors will be ignored if the same error code occurs within one second on the same channel.
* Up to 20 entries will be stored across all channels in the buffer used to store error information. Error information will begin being discarded beginning with the oldest entry when the number of entries exceeds 20.

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FASTUS

Attention: Not to be Used for Personnel Protection.

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

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

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The information in this user's manual is correct as of December 2022

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