FASTUS

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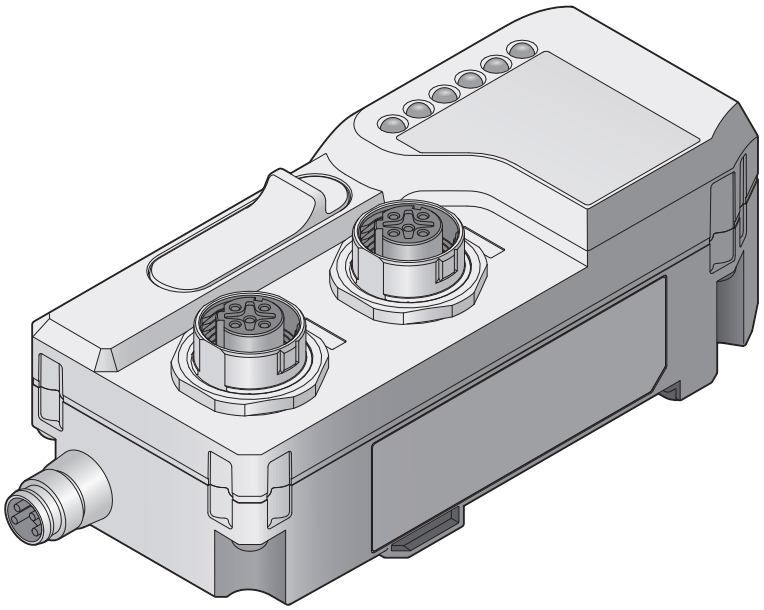
*FASTUS is a product brand of Optex FA.

EtherCAT Communication Unit

UC1-EC

User's Manual



OPTEX FA CO., LTD.

Introduction

Thank you for purchasing the UC1-EC EtherCAT Communication Unit.
This manual contains the information necessary for using the UC1-EC EtherCAT Communication Unit. Read this manual thoroughly before using the product to ensure correct product use with full understanding of the functions and performance of the product. Also, after you have finished reading this manual, store it safely for future reference.

Safety Precautions

This manual uses the following symbols to display safety precautions for ensuring safe operation of the UC1-EC EtherCAT Communication Unit.
Precautions listed here describe important information about safety. Make sure to follow them accordingly.

■ Safety Symbols

The indications and their meanings are as follows.

⚠Warning	Indicates that any improper operation or handling may result in moderate or minor injury, and in rare cases, serious injury or death. Also indicates a risk of serious property damage.
⚠Caution	Indicates that any improper operation or handling may sometimes result in moderate or minor injury or property damage.

■ Notes

⚠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

	**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 with the included end plate mounted to the DIN rail. Make sure locking mechanisms are locked before use.
	Tighten mounting screws with the torque values specified in this manual.
	Do not apply torsional stress to cables. Doing so can cause cables and connectors to malfunction. Secure the communications cable drawn out of this product within lengths of 30 cm to ensure no load is applied to the product.
	Do not drop this product or subject it to strong impact or vibrations. Doing so can cause malfunction.
	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.

⚠Caution	
	Do not cut power during communication.
	Changing the ID number for the addition of the sensor-amplifier requires changing the variables and programs on the master side. If there is a change in the ID number after you add a sensor-amplifier, make sure to change the variables or programs on the master side.
	Set the correct module configuration (i.e., sensor-amplifier and sensor configuration) in the master-side configuration software and download it to this unit. If this has not been downloaded, even if configured differently, this unit can be operated in OPERATIONAL status as long as the number of sensor-amplifiers and sensors in the actual configuration accidentally matches the number of those in the module configuration set in the master.
	There are restrictions on the order of inter-connection for the applicable sensor-amplifiers used to interconnect to this unit. If the order of inter-connection is incorrect, the unit will not operate properly, so interconnect in the correct order.
	To add an applicable sensor-amplifier to this unit after the system is operational, turn OFF the power of this unit.
	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.
	Use conductive type DIN rail because the frame ground (FG) is grounded via the DIN rail.
	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 unit 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.

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

- EtherCAT® is a registered trademark and patented technology, licensed by Beckhoff Automation GmbH, Germany.

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

Notes on overseas regulations and standards

CE Marking

This product complies with the following EN standards of the EMC directive.

Emission

EN 55011:2009+A1:2010 (Group 1, Class A, ≤ 20 kVA)

EN 61131-2:2007

EN 61000-6-4:2007+A1:2011

Immunity

EN 61131-2:2007

EN 61000-6-2:2005

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.

Manual name	Details
Digital Fiber Sensor D3RF Series Instruction Manual	Instruction manual included with digital fiber sensor, D3RF series (inter-connection type). Reference when interconnecting this unit with the D3RF series.
Digital Fiber Sensor D3WF Series Instruction Manual	Instruction manual included with digital fiber sensor, D3WF series (inter-connection type). Reference when interconnecting this unit with the D3WF series.
Displacement Sensor Amplifier Unit CDA Series Instruction Manual	Instruction manual included with the displacement sensor amplifier unit CDA series. Reference when interconnecting this unit with the CDA series.
Displacement Sensor Amplifier Unit CDA Series User's Manual	User's manual for the displacement sensor amplifier unit CDA series. Reference when interconnecting this unit with the CDA series, as well as the instruction manual.
Compact laser displacement sensor CD22 Series Instruction Manual	Instruction manual included with compact laser 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 user’s manual when interconnecting this unit with the through-beam edge sensor, TD1 series.
Digital Fiber Amplifier D4RF Series Instruction Manual	Instruction manual included with the fiber amplifier D4RF series (inter-connection type). Reference when interconnecting this unit with the D4RF series.
Digital Fiber Amplifier D4RF Series User's Manual	User's manual for the digital fiber amplifier D4RF series (inter-connection type). Reference when interconnecting this unit with the D4RF series, as well as the instruction manual.

Manual Structure

Manual Configuration

This document consists of the following chapters.

1 Overview	This chapter describes an overview of the EtherCAT Communication Unit (hereafter referred to as “this unit”).
2 Installation and Wiring	This chapter describes inter-connection between this unit and applicable sensor-amplifier units, connection for EtherCAT communication, and wiring to the power supply.
3 Communication	This chapter describes the data configurations that this unit handles for EtherCAT communication, and provides examples of communication.
4 Specifications	This chapter describes the specifications of this unit.
5 Troubleshooting	This chapter describes troubleshooting methods for specific errors.
6 Appendix	This chapter describes how to install additional applicable sensor-amplifier units.

Contents

3 Communication

Notations Used in This Manual

These are the notations used in this manual.

CAUTION
This indicates particularly important points to observe during operation.

MEMO
This information is useful for operation.

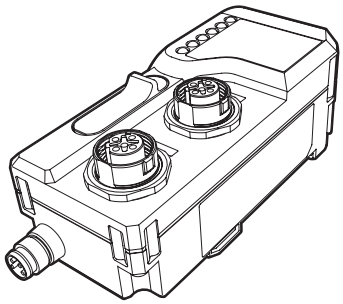
Generic Term for the Fiber Amplifiers

The D4RF, D3WF, and D3RF series, which can be used by interconnecting to this unit, are indicated as "fiber amplifiers".

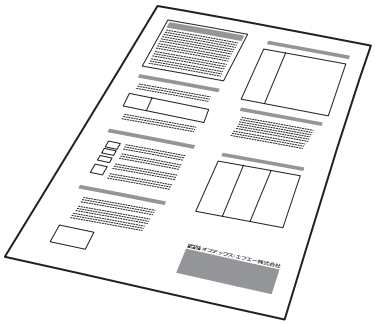
Checking the Included Items

Before you use this unit, check the items included with it. If there are any defective or damaged items, please contact our customer support center.

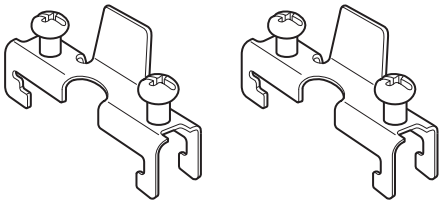
■ Items Included with This Unit



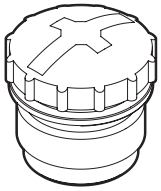
• UC1-EC



• Instruction manual



• End plate × 2



• Protective cap

■ Other Required Items

● Cables

The following cables are used with this unit.

Type	Specifications
EtherCAT cable Commercially available	CAT5e or higher Ethernet cables that fulfill the following specifications • Upstream master EtherCAT cable: M12 connector / LAN cable • Downstream slave EtherCAT cable: M12 connector cable
Power supply cable Optional	M8 connector cable for power supply M84CN-2S: 2 m, M84CN-5S: 5 m, M84CN-10S: 10 m

1

Overview

This chapter describes an overview of the EtherCAT Communication Unit (hereafter referred to as “this unit”).

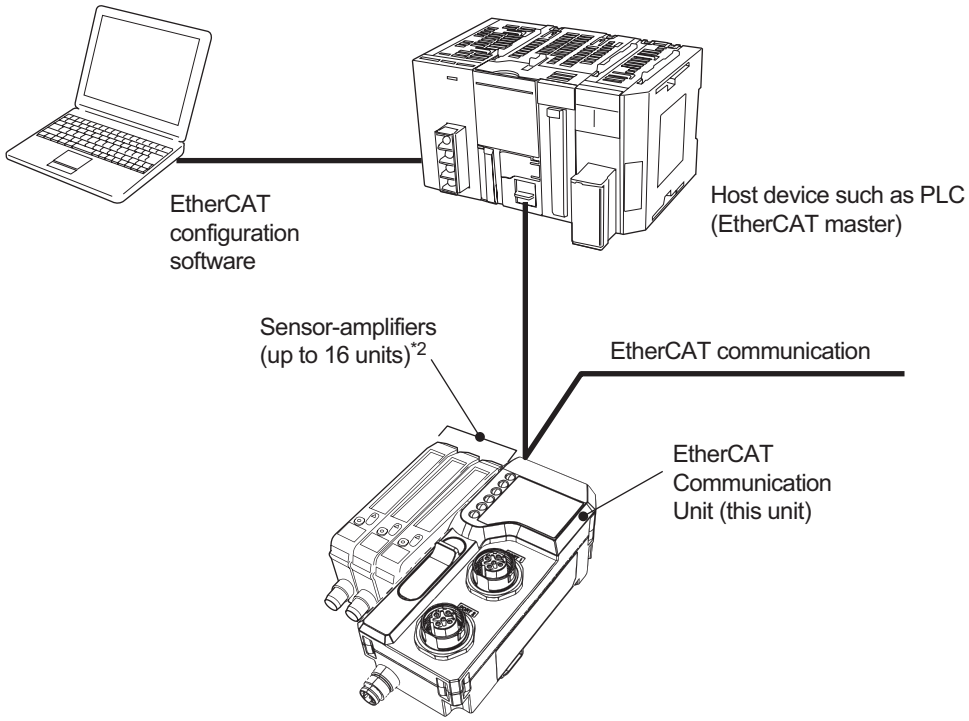
1-1 Product Overview

This unit is an EtherCAT communication slave used for communication between our sensor-amplifiers (hereafter referred to as the “applicable sensor-amplifiers”) and an EtherCAT master (e.g. PLC) manufactured by another company for ON/OFF output, monitoring of the detection amount, writing parameters, and performing operations of the sensors connected to the sensor-amplifiers.
Both PDO (cyclic) and SDO (mailbox) communications are supported.
This unit can be interconnected with up to 16*1 of the following applicable sensor-amplifiers.

- Fiber amplifier (inter-connection type)
- Displacement sensor amplifier unit

*1: The displacement sensor amplifier unit can connect two sensors, thus occupying two sensors in one unit.

EtherCAT System Configuration Example



*2: The displacement sensor amplifier unit can connect two sensors, thus occupying two sensors in one unit.

Type / Number of Applicable Sensor-Amplifier Units

See the following section for applicable sensor-amplifiers that can be interconnected to the EtherCAT system by interconnecting to this unit.

MEMO

For precautions on the configuration of this unit and applicable sensor-amplifiers and sensors, refer to “2-1 Configuration of This Unit and Applicable Sensor-amplifiers and Sensors” (Page 2-2).

Interconnectable Fiber Amplifiers

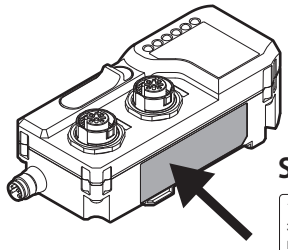
Fiber amplifiers that can interconnect to this unit are D4RF, D3WF and D3RF series inter-connection types. For details on the inter-connection order, refer to “Configuration and Limitations of Applicable Sensor-amplifiers and Sensors” (2-4page)

Light source	Type	Connection	Control output	Model	No. of occupied IDs per unit	max. no. of interconnectable units
4-element red LED	Standard inter-connection, main unit	Connector	1 output	D4RF-TMC4*2	1	16 units*4 (1 x main unit, 15 x expansion units)
		Cable*1	1 output	D4RF-TM*2		
			2 outputs	D4RF-TDM*2		
	Standard inter-connection, expansion unit	Connector	1 output	D4RF-TSC4*2		
		Cable*1	1 output	D4RF-TS*2		
			2 outputs	D4RF-TDS*2		
	Short range and high accuracy inter-connection, main unit	Cable*1	2 outputs	D4RF-TDM-Y*2		
	Short range and high accuracy inter-connection, expansion unit			D4RF-TDS-Y*2		
	Inter-connection for communication unit, main unit	Cable-less	-	D4RF-TM-0*2		
	Inter-connection for communication unit, expansion unit			D4RF-TS-0*2		
	Inter-connection for communication unit, main unit Without display and keys	Connector	-	D4RF-MC4*2		
	Inter-connection for communication unit, expansion unit Without display and keys	Cable-less	-	D4RF-S*2		
	Inter-connection, main unit (Discontinued in March 2024)	Connector	1 x NPN	D3RF-TMCN4*3		
			1 x PNP	D3RF-TMCP4*3		
		Cable*1	1 x NPN	D3RF-TMN*3		
			2 x NPN	D3RF-TDMN*3		
			1 x PNP	D3RF-TMP*3		
			2 x PNP	D3RF-TDMP*3		
	Inter-connection, expansion unit (Discontinued in March 2024)	Connector	1 x NPN	D3RF-TSCN4*3		
			1 x PNP	D3RF-TSCP4*3		
		Cable*1	1 x NPN	D3RF-TSN*3		
			2 x NPN	D3RF-TDSN*3		
			1 x PNP	D3RF-TSP*3		
			2 x PNP	D3RF-TDSP*3		
White LED	Inter-connection, main unit	Connector	1 x NPN	D3WF-TMCN4*3		
			1 x PNP	D3WF-TMCP4*3		
	Inter-connection, expansion unit		1 x NPN	D3WF-TSCN4*3		
			1 x PNP	D3WF-TSCP4*3		

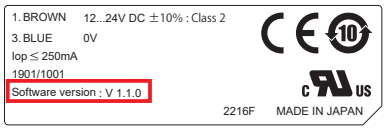
*1:Since the wire function of the cable type can be provided by communication, OPTEX FA recommends the use of a connector type fiber amplifier for connection to this unit.
When using a cable type fiber amplifier, the power line should be insulated to prevent short circuit. A short circuit may damage the equipment.
Also, for the connector type, when the connector cable is not connected, attach the supplied black cap to the M8 connector to prevent the pins from short-circuiting.

*2:To use D4RF with this unit, the software version of this unit must be V1.1.0 or later. Products with software versions earlier than V1.0.9 cannot be used.
The software version is indicated on the product label as follows.

Product label position

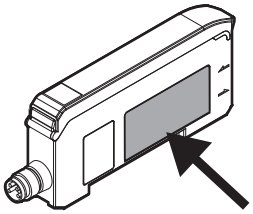


Software version position on label

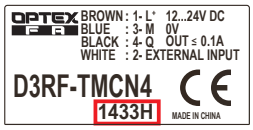


*3:The D3RF fiber amplifier applicable with this unit is lot number “1443 ■ (■ = the alphabet at the end is irrelevant)” or later. Products with lot numbers earlier than “1442 ■” support only some functions.
The D3RF lot number is indicated on the product label as follows.

Product label position



Lot number position on label



*4:The maximum number of units that can be interconnected depends on the maximum ambient temperature and the load current flowing to the control output, as follows.

D3RF/D3WF series

Number of interconnected units	1 to 3	4 to 8	9 to 16
Upper and lower limits of ambient temperature	-25 to +55 ºC	-25 to +50 ºC	-25 to +45 ºC
Max. load current at control output	100 mA	50 mA	0 mA (Control output disabled)

D4RF series

Number of connected units		1	2	3 to 5	6 to 16*
Upper and lower limits of ambient temperature		-25 to +55 ºC	-25 to +55 ºC	-25 to +50 ºC	-25 to +45 ºC
Max. load current per output	**1-output setting**	100 mA	20 mA	20 mA	20 mA
	2-output setting	100 mA	10 mA	10 mA	10 mA

*:For use as a UL certified product when 6 or more units are interconnected, refer to the instruction manual included with the D4RF.

● Interconnectable Displacement Sensor Amplifier Units

When connecting a displacement sensor, interconnect a displacement sensor amplifier unit to this unit.

Product	Interface	Model	No. of occupied IDs per unit	Max. no. of interconnectable units
Displacement sensor amplifier unit	2 x analog outputs 2 x control outputs 1 x external input	<Main unit> CDA-DM2	2	8*2 (1 x main unit + 7 x expansion units)
	1 x analog output 3 x control outputs 2 x external inputs	<Main unit> CDA-M		
	1 x analog output 3 x control outputs 2 x external inputs	<Expansion unit> CDA-S		

Up to two displacement sensors or two through-beam edge laser sensors can be connected to one displacement sensor amplifier unit. Even if only one sensor is connected, it will be recognized as two.

The following sensors can be connected to the CDA a displacment sensor amplifier unit (current as of August, 2019) .

Product	Interface	Connection	Model
Compact laser displacement sensor CD22 series	RS-485 communication type	Pigtail connector*1	CD22-15-485M12 CD22-35-485M12 CD22-100-485M122
Through-beam edge sensor TD1 series	-	Connector	TD1-010M8 TD1-010M8J

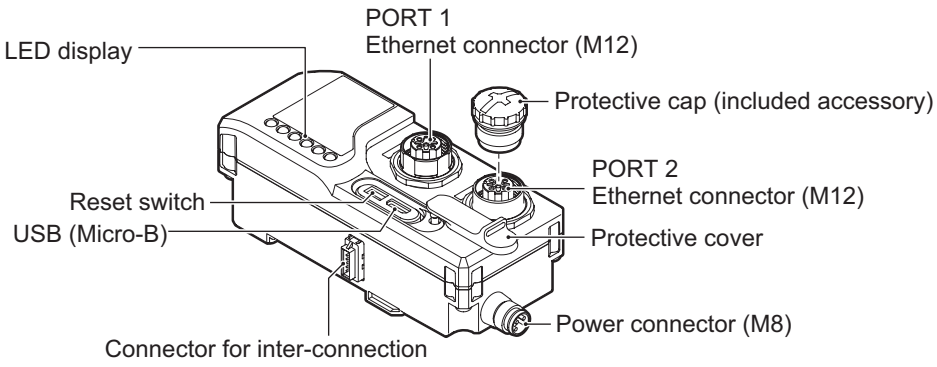
*1: For sensors with pigtail connector, order the optional sensor-to-amplifier extension cable DSL-1204-G02M.

Note: Ultra high-accuracy laser displacement sensor CDX series is not compatible with UC1 and cannot be used.

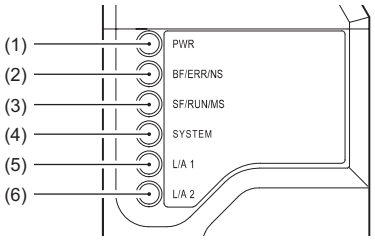
1-2 Part Names and Functions

The following is a description of the names of the parts of this unit and their functions.

UC1-EC Unit



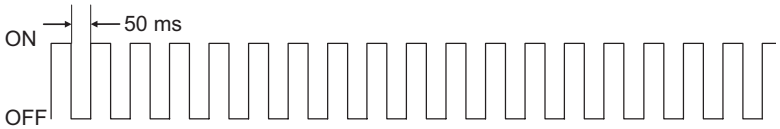
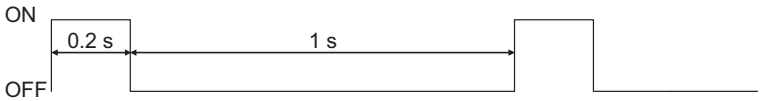
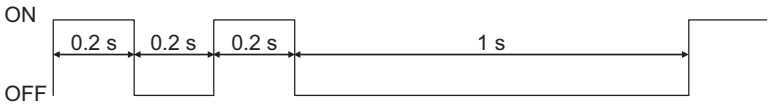
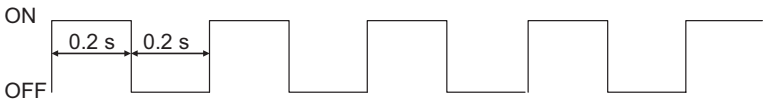
LED Display



Above figure number	LED	Details	Display		Meaning
(1)	PWR	Indicates whether or not power is being supplied to this unit.	Green	Lit	Voltage supply on
				Off	Voltage supply off
(2)	ERR (error)	Indicates abnormal EtherCAT communication status for this unit.	Red	Off	No error
				Flickering	Boot error
				Single flash	Synchronize error, communication data error
				Double flash	Application watchdog timeout
				Blinking	Communication settings error (refer to the memo below for further information)
				Lit	PDI watchdog timeout
(3)	RUN (communicating)	Indicates EtherCAT communication transition state of this unit.	Green	Off	INIT status
				Blinking	PRE-OPERATIONAL status
				Single flash	SAFE-OPERATIONAL status
				Lit	OPERATIONAL status
(4)	SYSTEM (communication ready)	Indicates communication status of this unit.	Green	Off	Not ready for communication (cannot connect)
				Lit	Ready for communication (able to connect)

Above figure number	LED	Details	Display		Meaning
(5)	L/A1 (Link / Activity 1)	Indicates PORT1 (IN) communication status.	Green	Off	PORT1 is not connected to the network
				Lit	PORT1 can be connected to the network but is not communicating
				Flickering	Connected to network and communicating
(6)	L/A2 (Link / Activity 2)	Indicates PORT2 (OUT) communication status.	Green	Off	PORT2 is not connected to the network
				Lit	PORT2 can be connected to the network but is not communicating
				Flickering	Connected to network and communicating

Note: LED blinking state

Name of blinking state	Blinking timing
Flickering	
Single flash	
Double flash	
Blinking	

Refer to “5-4 Troubleshooting List” (Page 5-6) in “Chap. 5 Troubleshooting” for troubleshooting based on blinking state of LED.

MEMO

A communication settings error is one of the following:

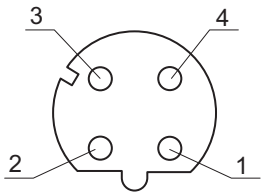
- If a module configuration (i.e., sensor-amplifier and sensor configuration) has already been downloaded to this unit using the master-side configuration software, the downloaded module configuration information does not match the actual configuration.
- If it has not been downloaded to this unit, the number of sensor-amplifiers and sensors actually configured differs from that of the module configuration set in the master.

EtherCAT Connectors (PORT1, PORT2)

Connect the M12 connector / LAN cable to the M12 connection 4 pin.

Connect a network cable from the EtherCAT master side to PORT1 of this unit.

When connecting other slave units, connect a network cable to PORT2 of this unit. When other slave units are not connected, put on the M12 protective cap.



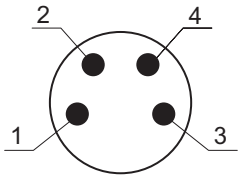
Pin	Terminal name	Function
1	Tx+	Transmitted data: +
2	Rx+	Received data: +
3	Tx-	Transmitted data: -
4	Rx-	Received data: -

MEMO

The EtherCAT node address of this unit is set from the master-side configuration software.

Power Connector

Pin arrangement of the power connector is as follows. Connect this unit when no voltage (0 V) is being supplied.



Pin	Terminal name	Function
1	24 V	Terminal for external power input from12 to 24 VDC. Allowable current is 2 A or under.
2	Not used	-
3	0 V	Terminal for external power input of 0 V.
4	Not used	-

Reset Switch

Press and hold for three seconds or more to restore the factory settings.

MEMO

The settings initialized with the reset switch are as follows. Refer to “3-6-2 Object Dictionary List for This Unit” (Page 3-17) for further information.

- Emergency message notification enabled/disabled (10F3 h sub-index 05 h)
- Unit error notification control (F200 h sub-index 01 h)

USB (Micro-B)

Not used. Do not connect anything to this port.

1-3 Basic Procedures

The procedures to install and configure this unit and start the EtherCAT communication are shown below.

Procedure	Details	References
Prior confirmation	• Check the model number and number of units for applicable sensor-amplifier units to be interconnected to this model (including ambient temperature range, which limits the number of units).	"Chap. 1 Overview" "Chap. 4 Specifications"
	• Check the position of inter-connection with applicable sensor-amplifier units. (Changing the inter-connection position affects the variables and programs on the master side, so consideration should be given to the possibility of future expansion.)	"2-1 Configuration of This Unit and Applicable Sensor-amplifiers and Sensors" (Page 2-2) "6-1 Installing Additional Applicable Sensor-amplifier Units" (Page 6-2)
	• Calculate power consumption • Connect power supply cable	"2-3-2 Wiring with the Power Supply Cable" (Page 2-14)
	• Whether or not the received light levels or measured values are read out with PDO (cyclic) communication (This is related to whether or not PDO mapping is used with default values.) • What to read and write with SDO (mailbox) communication	"Chap. 3 Communication"
↓	↓	
Hardware installation and wiring	Install the EtherCAT master.	Manual of the EtherCAT master being used
	↓	
	Install this unit and applicable sensor-amplifiers to the DIN rail.	"2-2 Installing on a DIN Rail" (Page 2-11)
	↓	
	Wire the EtherCAT communication cable.	"2-3-1 Connecting the Communication Cable" (Page 2-13)
	↓	
	Wire the external power supply.	"2-3-2 Wiring with the Power Supply Cable" (Page 2-14)
	↓	
	Wire sensors to sensor-amplifiers.	Manuals of the applicable sensor-amplifiers
↓	↓	
Operation to communicate with the EtherCAT master	Install the ESI file for this unit.	"3-4 Operations Required for This Unit to Communicate with the EtherCAT Master" (Page 3-8) Manual of the EtherCAT master being used Configuration software manual for the master being used
	↓	
	Add this unit to the EtherCAT system and set module configuration (i.e., sensor-amplifier and sensor configuration) in the master-side configuration software.	
	↓	
	PDO communication: Assign PDO on the master-side configuration software. SDO communication: Create communication program.	
	↓	
	Download slave settings and module configuration (i.e., sensor-amplifier and sensor configuration) information to this unit.	
↓	↓	

Procedure	Details	References
Starting communication	Start system (power ON).	Same as above
	↓	
	Start the EtherCAT communication.	
↓	↓	
Checking operation	Check the displays of the master, this unit, and the sensor-amplifiers.	Manual of the EtherCAT master being used “1-2 Part Names and Functions” (Page 1-6) “5-4 Troubleshooting List” (Page 5-6) sensor-amplifiers / sensors
	↓	
	Verify that the EtherCAT master reads and writes data.	Manual of the EtherCAT master being used
	↓	
	Set the parameters of this unit with SDO communication (if needed).	“3-6 Object Dictionary of This Unit” (Page 3-14) “3-7 Parameter for Each Connected Sensor Amplifier and Sensor” (Page 3-25)
↓	↓	
Troubleshooting	Check the displays of the master, this unit, and the sensor-amplifiers. Check the error codes on the sensor-amplifier and sensor configuration and the device specific error codes with SDO communication.	“Chap. 5 Troubleshooting”

CAUTION

When you use this unit, make sure to add this unit to the EtherCAT system in the master-side configuration software, set the correct module configuration (i.e., sensor-amplifier and sensor configuration) and download the slave settings and the module configuration information into this unit.

Installation and Wiring

This chapter describes inter-connection between this unit and applicable sensor-amplifier units, connection for EtherCAT communication, and wiring to the power supply.

2-1 Configuration of This Unit and Applicable Sensor-amplifiers and Sensors

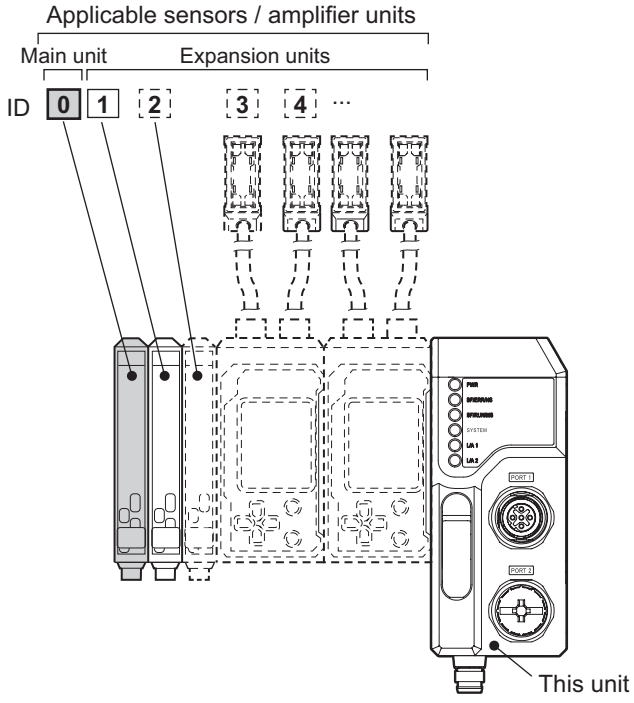
This section describes the configuration of this unit and applicable sensor-amplifiers and sensors.

2-1-1 Assigning ID Numbers for Applicable Sensor-amplifier Units

ID numbers are used to identify connected sensor-amplifiers in PDO and SDO communication.
The ID numbers are 0 - 15 (0 - F in hexadecimal values).
ID = 0 is set for the leftmost amplifier unit (the one furthest from this unit), with subsequent IDs assigned in ascending order toward this unit.
The number of occupied ID numbers differs depending on the type of sensor-amplifier. Details are provided below.

Type of sensor-amplifier	Occupied ID numbers	Notes
D4RF fiber amplifier	1	
D3RF fiber amplifier	1	
D3WF fiber amplifier	1	
CDA displacement sensor amplifier unit	2	A single unit occupies two because the unit can be connected to two sensors.

Connection of Sensor-amplifiers



MEMO

- As indicated above, ID numbers are assigned in ascending order from the left. When an applicable sensor-amplifier unit is added to the left of existing applicable sensor-amplifier units, the ID numbers of the existing applicable sensor-amplifier units change. Therefore, consider the configuration of applicable sensor-amplifier units by interconnection position, which is the ID number, if future expansion is planned. Refer to "6-1 Installing Additional Applicable Sensor-amplifier Units" (Page 6-2) later in this manual for more information on limitations when adding applicable sensor-amplifier units.
- The order of the ID numbers matches the order of the connection positions (slots) of the devices (sensor-amplifier units or sensors) when module configuration is set using the MDP (Modular Device Profile) function of EtherCAT and the element order of the product codes (modular device identification codes in the MDP function) of the devices that are written as an array in the object dictionary of this unit.

2-1-2 Configuration and Limitations of Applicable Sensor-amplifiers and Sensors

Limitations in the configuration of applicable sensor-amplifiers and sensors are as follows.
The following three types of inter-connection configurations are used.

- Configuration to interconnect only fiber amplifiers.
- Configuration to interconnect only displacement sensor amplifier units.
- Mixed configurations in which both the fiber amplifiers and CDA displacement sensor amplifier units are Interconnected.

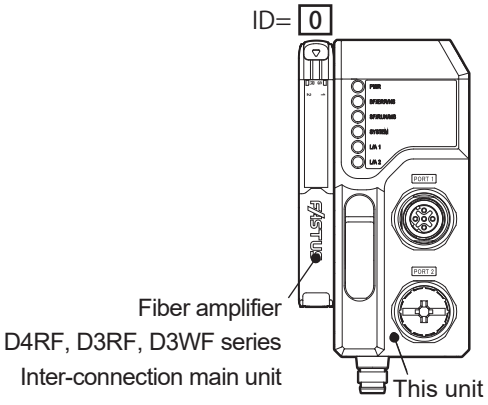
MEMO

If more than the maximum number of applicable sensor-amplifier units (16) are connected, the count of the connected units automatically recognized by this unit returns to 1 (the 17th unit is “1”, the 18th is “2”, etc.). This causes a “sensor-amplifier and sensor configuration error” or “un-downloaded sensor-amplifier and sensor configuration and mismatches in the number of sensor-amplifiers and sensors”. The system reverts to the PRE-OPERATIONAL status and communication is not possible.

■ Configuration to Interconnect Only Fiber Amplifiers

● Interconnect Only One Fiber Amplifier

- When interconnecting any series of fiber amplifiers, the fiber amplifier should be a inter-connection main unit.
- Do not connect an external power supply to the fiber amplifier. For details, see "2-3-2 Wiring with the Power Supply Cable" (2-14 page).

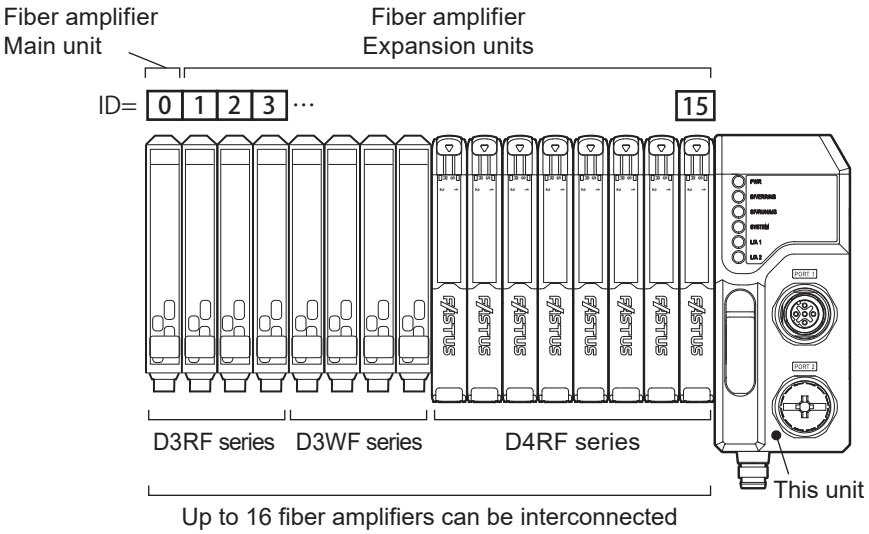


● Multiple Inter-connection

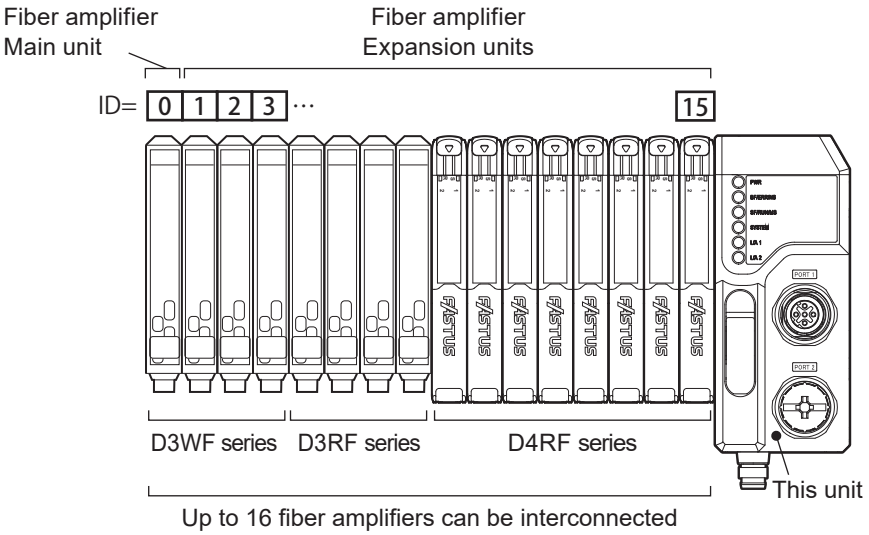
- It is possible to interconnect a single series of fiber amplifiers (e.g., inter-connection with D4RF only) or possible to interconnect multiple series of fiber amplifiers. When interconnecting multiple series of fiber amplifiers, interconnect in the following order from the left (ID = 0):
  ① D3RF → D3WF → D4RF → This unit
  ② D3WF → D3RF → D4RF → This unit.
  Note that the unit will not operate correctly if interconnected in any order other than the above.
- Interconnect the fiber amplifier of the inter-connection main unit to the left end (ID=0). For fiber amplifiers other than the left end, use the inter-connection expansion unit.

- Up to 16 fiber amplifiers can be interconnected.
- Do not connect an external power supply to the fiber amplifier. For details, see "Wiring with the Power Supply Cable" (2-14 page).

Inter-connection example: ① D3RF → D3WF → D4RF →This unit



Inter-connection example: ② D3WF → D3RF → D4RF →This unit



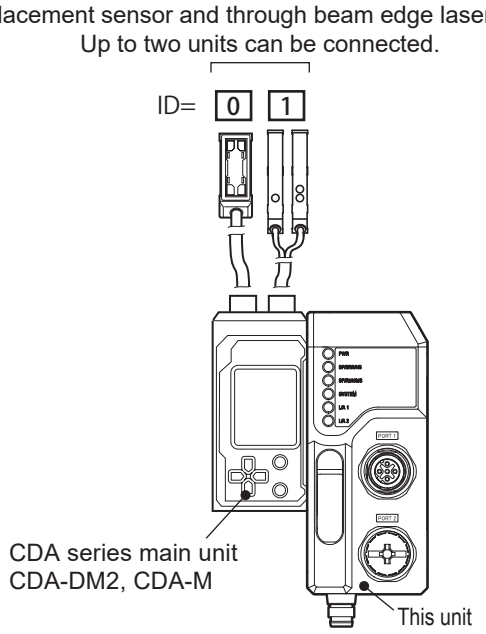
MEMO

The inter-connection order is
① D3RF → D3WF → D4RF → This unit
② D3WF → D3RF → D4RF → This unit
The reason why only two patterns ① and ② can be used is that the current value and setting value in D3RF and D3WF are limited to 14 bits, while the current value and setting value in D4RF are processed as 16 bits. This means that if D4RF is interconnected to the left of D3RF or D3WF, EtherCAT communication can be executed in the OPERATIONAL status, however, the current values sent from the D4RF to the left of the D3RF or D3WF to the master will be incorrect, as will the setting value set by the master.
Invalid connection order errors can be checked by reading the operation error history using SDO communication from the master (error code: 0008E000 h). Refer to "Sensor-amplifier and Sensor
Configuration Error Codes" (5-3 page) for further information.

Configuration to Interconnect Only Displacement Sensor Amplifier Units

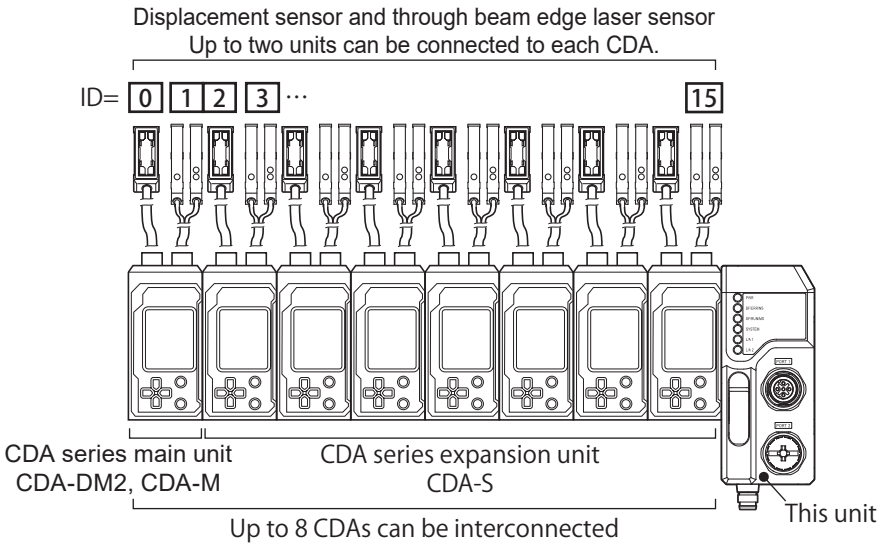
Interconnect Only One Displacement Sensor Amplifier Unit

- Interconnect CDA-DM2 or CDA-M of the main unit of the displacement sensor amplifier unit CDA series.
- Up to two units of displacement sensor CD22 series or through-beam edge laser sensor TD1 series can be connected to CDA.
- When connecting the displacement sensor CD22 to the CDA, select the RS-485 pigtail type and use the optional sensor/amplifier connection cable (DSL-1204-G02M) to connect to each channel of the CDA.
- When connecting the through beam edge laser sensor TD1 to the CDA, use the Y-branch cable (TDCN-Y2-M8) delivered with the TD1 to connect to each channel of the CDA.



Multiple Inter-connection

- Interconnect the CDA series main unit CDA-DM2 or CDA-M to the left end (ID=0, 1). For CDAs other than the left end, use the inter-connection expansion units.
- Up to 8 CDAs can be interconnected.
- Up to two units of displacement sensor CD22 series or through-beam edge laser sensor TD1 series can be connected to each CDA.
- When connecting the displacement sensor CD22 to the CDA, select the RS-485 pigtail type and use the optional sensor/amplifier connection cable (DSL-1204-G02M) to connect to each channel of the CDA.
- When connecting the through beam edge laser sensor TD1 to the CDA, use the Y-branch cable (TDCN-Y2-M8) delivered with the TD1 to connect to each channel of the CDA.

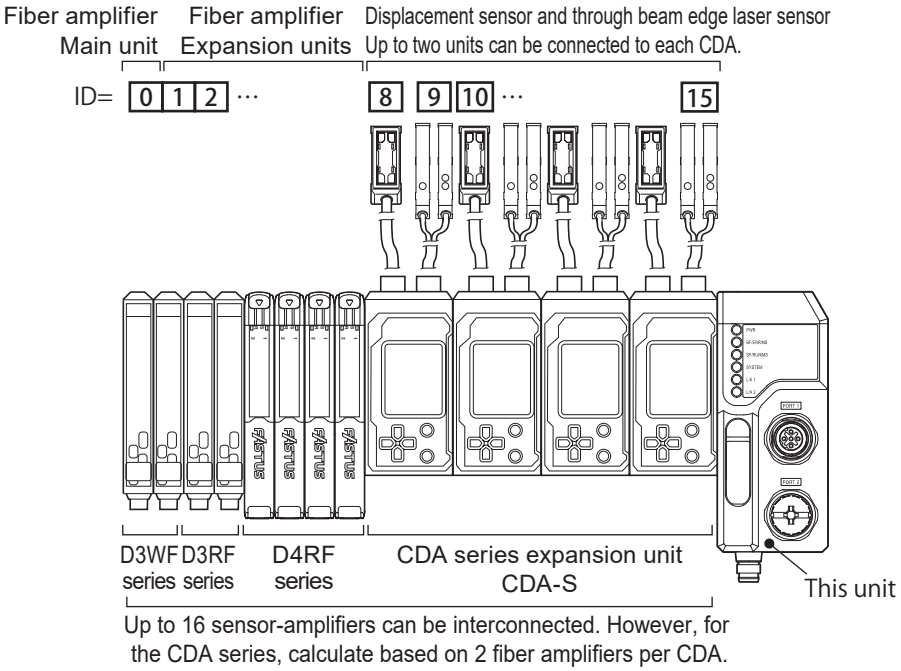


Mixed Configurations in Which Both the Fiber Amplifiers and CDA Displacement Sensor Amplifier Units Are Interconnected

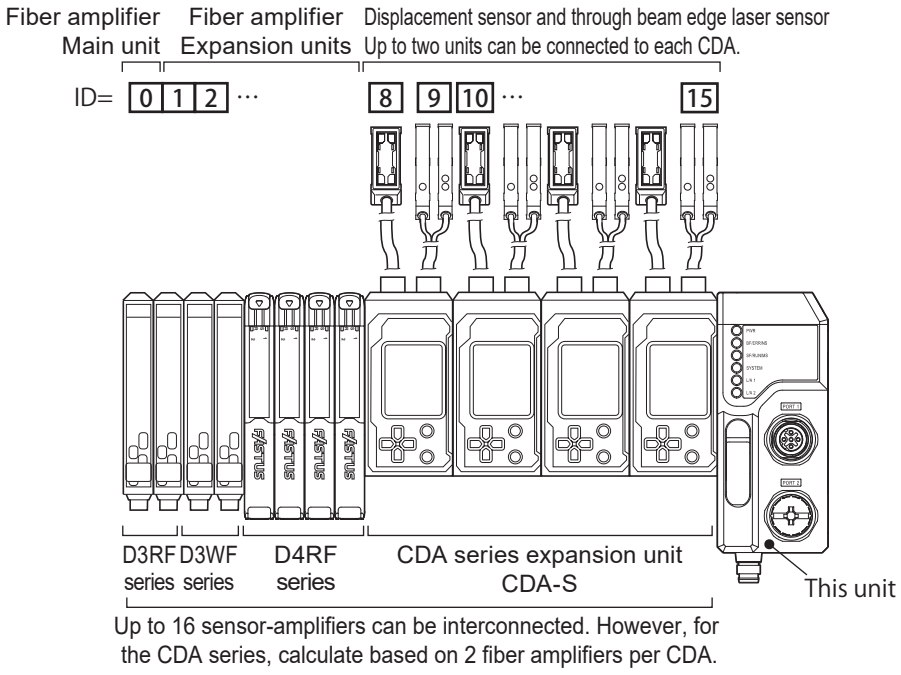
Mixed Inter-connection

- Interconnect the fiber amplifier main unit the left end (ID=0). For all fiber amplifiers and displacement sensor amplifier units other than the left end, use the expansion units.
- The inter-connection order is from left to right:
  ① D3WF → D3RF → D4RF → CDA → This unit
  ② D3RF → D3WF → D4RF → CDA → This unit
  ③ D3WF → D3RF → CDA → D4RF → This unit
  ④ D3RF → D3WF → CDA → D4RF → This unit
  The above four patterns are available.
  Note that the unit will not operate correctly if interconnected in any order other than the above.
- Up to 16 units can be interconnected. Since up to two sensors can be connected to the CDA series, please calculate two sensors in one CDA and interconnect them so that the total number of sensor-amplifiers does not exceed 16.
- Do not connect an external power supply to the fiber amplifier. For details, see “2-3-2 Wiring with the Power Supply Cable” (page 2-14).

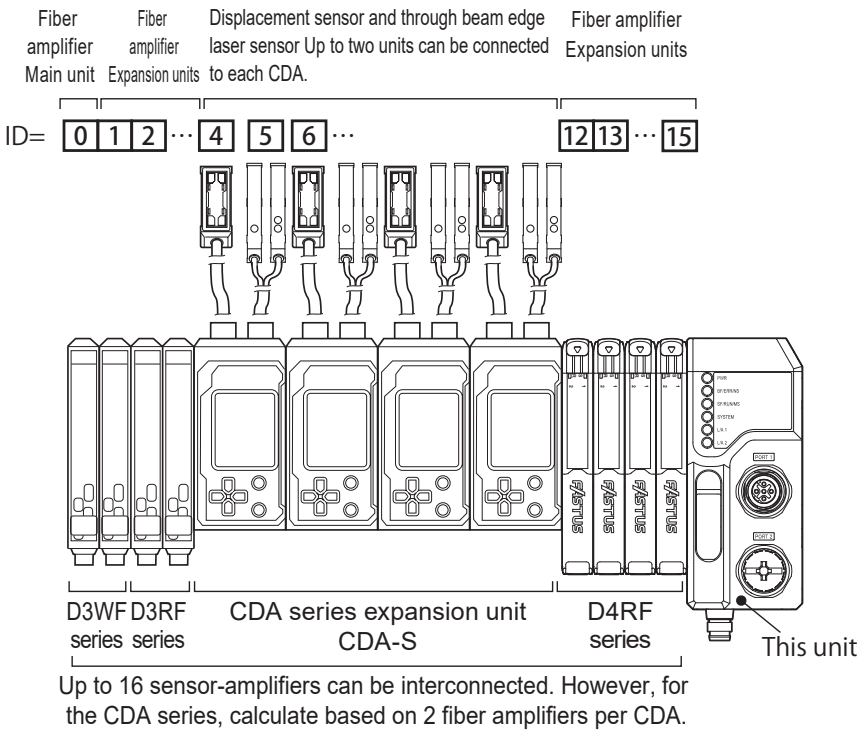
Inter-connection example: ① D3WF → D3RF → D4RF →CDA→This unit



Inter-connection example: ② D3RF → D3WF → D4RF →CDA→This unit

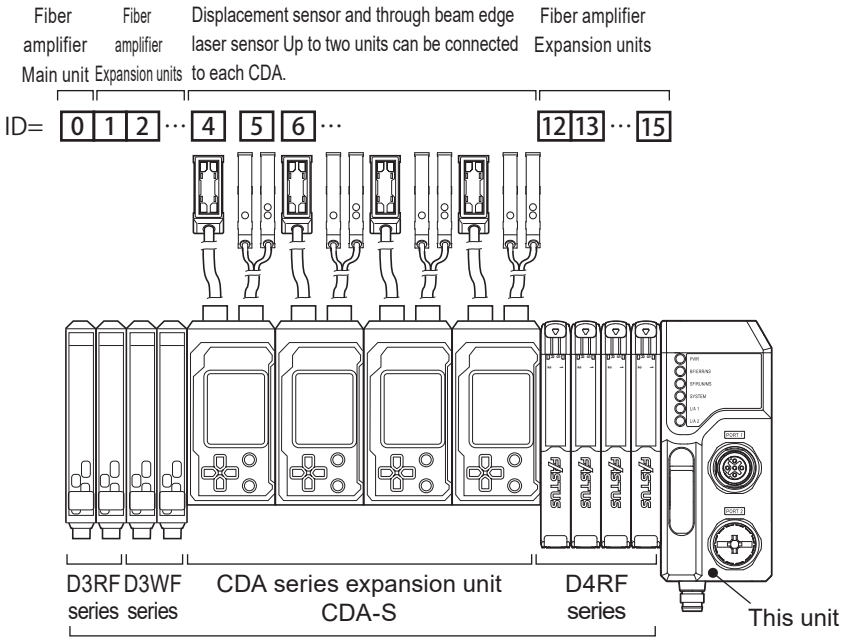


Inter-connection example: ③ D3WF → D3RF → CDA →D4RF→This unit



Up to 16 sensor-amplifiers can be interconnected. However, for the CDA series, calculate based on 2 fiber amplifiers per CDA.

Inter-connection example: ④ D3RF → D3WF → CDA →D4RF→This unit

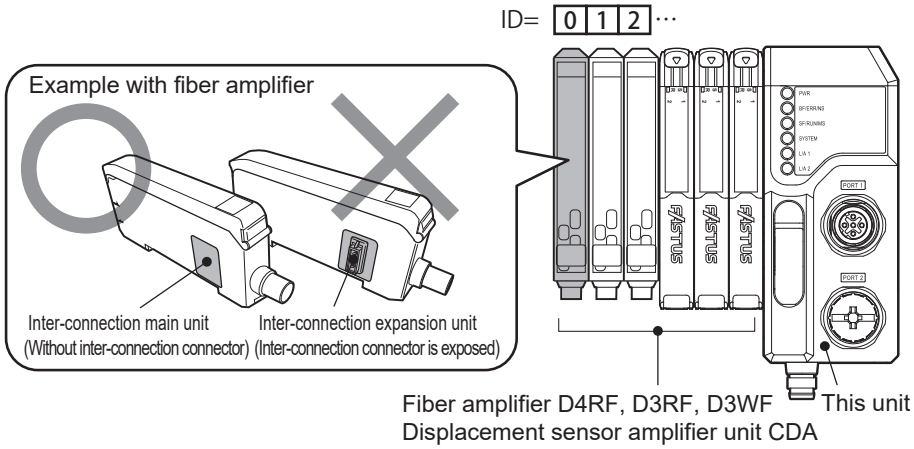


Up to 16 sensor-amplifiers can be interconnected. However, for the CDA series, calculate based on 2 fiber amplifiers per CDA.

MEMO

The inter-connection order is
① D3WF → D3RF → D4RF → CDA → This unit
② D3RF → D3WF → D4RF → CDA → This unit
③ D3WF → D3RF → CDA → D4RF → This unit
④ D3RF → D3WF → CDA → D4RF → This unit
The reason why only 4 patterns can be used is that the current value and setting value in D3RF and D3WF are limited to 14 bits, while the current value and setting value in D4RF are processed as 16 bits. This means that if D4RF is interconnected to the left of D3RF or D3WF, EtherCAT communication can be executed in the OPERATIONAL status, however, the current values sent from the D4RF to the left of the D3RF or D3WF to the master will be incorrect, as will the setting value set by the master.
Invalid connection order errors can be checked by reading the operation error history using SDO communication from the master (error code: 0008E000 h). Refer to “5-2 Sensor-amplifier and Sensor Configuration Error Codes” (Page 5-3) for further information.

CAUTION
When interconnecting the D3RF, D3WF, and D4RF series fiber amplifiers and the CDA series displacement sensor amplifier units, be sure to interconnect the main unit at the left end (ID = 0). If the expansion unit is on the left end, the inter-connection connector will be exposed and interfere with the End plate. In addition, the fiber amplifier may malfunction due to dirt or damage to the inter-connection connector.



2-1-3 Registration of Sensor-amplifier and Sensor Configuration

This unit supports the EtherCAT MDP (Modular Device Profile) function. MDP is a mechanism for managing the configuration of a modular (i.e., building block) slave as an EtherCAT slave of the combined module (in this case, the “sensor-amplifier” or “sensor”).
To use this unit, the configuration of sensor-amplifiers and sensors must be edited using EtherCAT master-side configuration software then downloaded to this unit. By doing this, the configuration can be registered, enabling EtherCAT communication with the master.

MEMO

The configuration data to register this unit as a module configuration in EtherCAT is “Sensor-amplifier” for fiber amplifier and “Sensor” to be connected for CDA.Refer to “3-4-5 Data Stored in This Unit When Sensor-amplifier and Sensor Configuration is Downloaded” (Page 3-10) for further information.

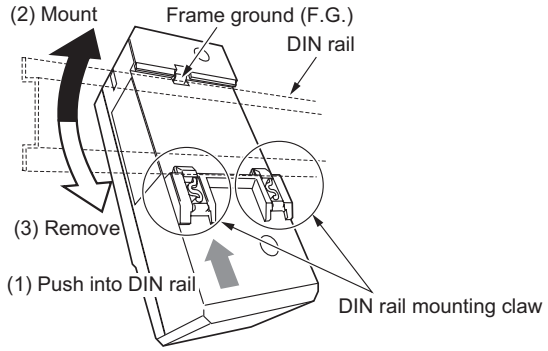
2-2 Installing on a DIN Rail

Install this unit on a DIN rail. Install the applicable sensor-amplifier units in the same way when interconnecting.

MEMO

- Remove the power supply cable during installation. In particular, make sure this unit and the applicable sensor-amplifier units are not powered when interconnecting or removing them.
- In this example, only D3□F units (inter-connection type) are interconnected with this unit, but CDA can be interconnected in the same way.

1 **Align the DIN rail mounting claw at the bottom of this unit with the bottom of the DIN rail, push this unit onto the DIN rail in the direction indicated by (1) and then collapse it in the direction indicated by (2).**

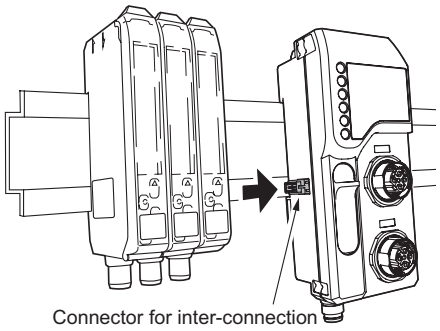


*If this unit is not properly attached to the DIN rail, faults may occur when interconnecting with the applicable sensor-amplifier units or connecting FGs. Make sure the DIN rail mounting claw is fully locked and this unit is securely mounted.

MEMO

To remove this unit from the DIN rail, push this unit onto the DIN rail in the direction indicated by (1) and collapse it in the direction of (3).

2 **Mount the applicable sensor-amplifier units on the DIN rail in the same way and interconnect them with this unit.**



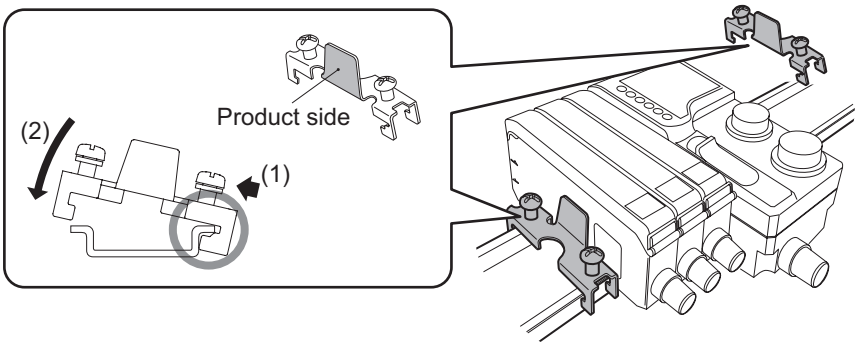
CAUTION

Interconnect this unit securely with the applicable sensor-amplifier units using the connectors for inter-connection. If the connectors for inter-connection are slanted or are not inserted all the way in, this unit or the applicable sensor-amplifier unit may be damaged when powered.

3 **Mount the end plates on both sides of the interconnected units and secure them with screws.**

The tightening torque must be 0.9 N·m or less.

Mount the end plates to both sides of this unit and the applicable sensor-amplifier units with the product side (refer to the diagram below) facing this unit or the applicable amplifier unit. Mount the end plates by catching the notch on the DIN rail as shown in the diagram below.

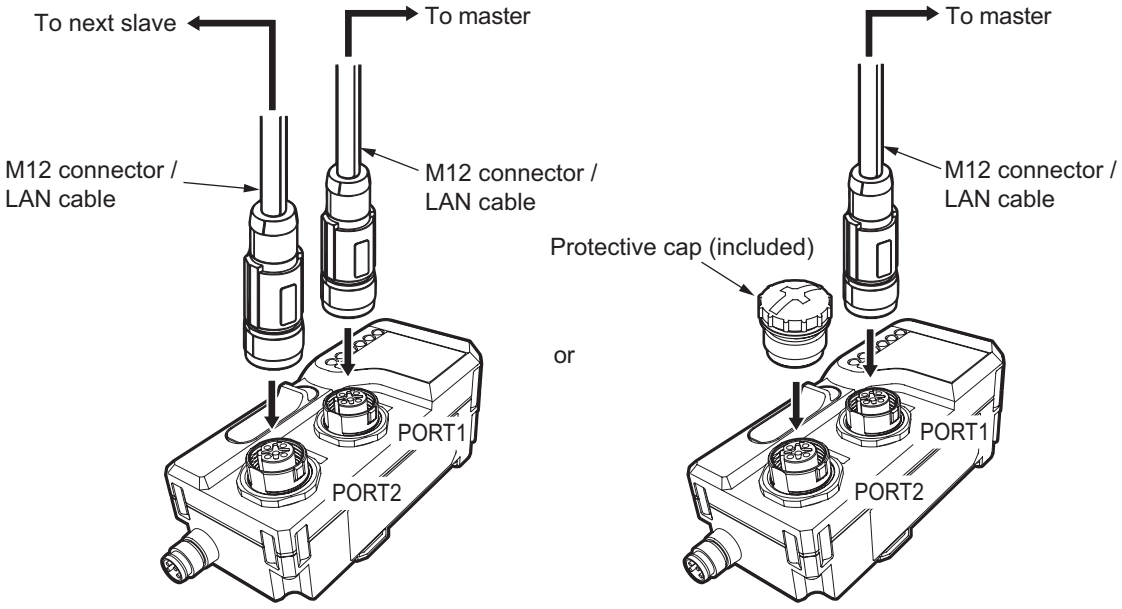


2-3 Wiring

This section describes wiring with the EtherCAT cable and power supply cable.

2-3-1 Connecting the Communication Cable

Connect the M12 connector or LAN cable PORT1 of this unit and connect the other cable upstream (on the master side) of this unit.
If there are slaves downstream from this unit, connect the M12 connector or LAN cable to PORT2 of this unit.
If there are no slaves downstream from this unit, connect the included protective cap to PORT2 of this unit.



2-3-2 Wiring with the Power Supply Cable

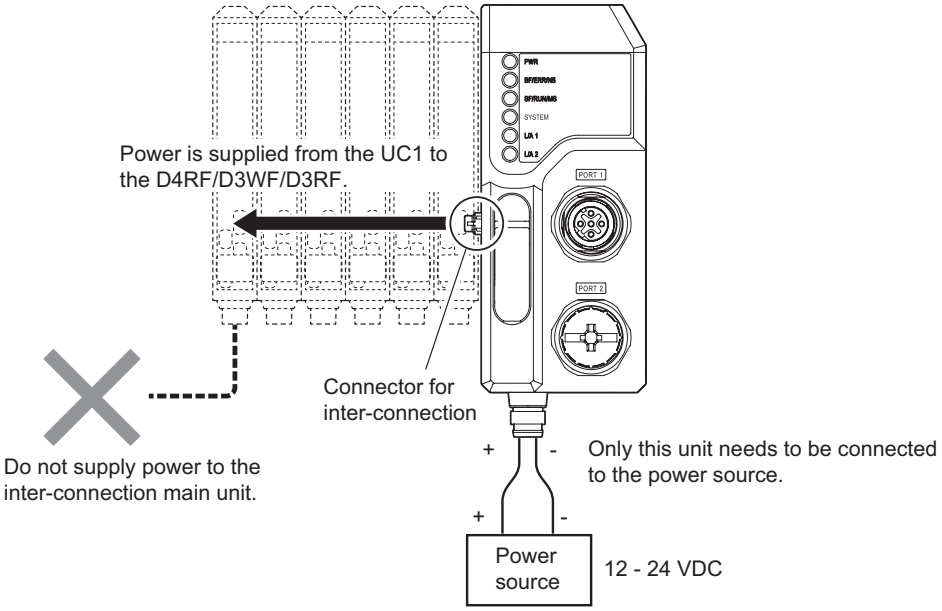
This unit runs on an external power input (12 - 24 VDC / 2 A or less). Make sure the input voltage and current are correct. Incorrect wiring to the power source can cause fire or malfunction.

This unit uses the following dedicated M8 power supply connector cables (sold separately) for external power input.
M84CN-2S: 2 m, M84CN-5S: 5 m, M84CN-10S: 10 m
This section describes wiring with the power supply cable when setting up each inter-connection.

■ Supplying Power

● When Only Fiber Amplifiers Are Interconnected

Connect only this unit to the external power supply as shown in the diagram below. Fiber amplifier is powered by this unit.(Do not supply power to the fiber amplifier).



MEMO

For the inter-connection order and number of inter-connection units, see "2-1-2 Configuration and Limitations of Applicable Sensor-amplifiers and Sensors"(2-2 page).

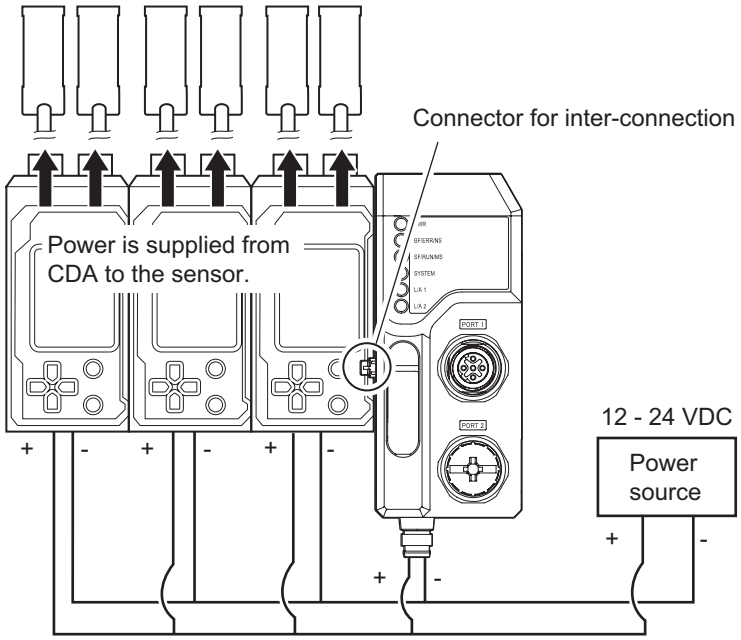
CAUTION

- D3RF, D3WF and D4RF are supplied with power from this unit, so do not connect an external power supply to D3RF, D3WF or D4RF. If GND is not common, communication may not work properly. In addition, overvoltage may occur depending on the conditions.
- When using cable-type fiber amplifiers, perform insulation processing to prevent the power wires (brown/blue) from short-circuiting. Short-circuits may lead to device damage. Furthermore, in the case of connector types, connect the included black cap to the M8 connector when the connector cable is not connected to prevent the pins from short-circuiting.
- The length of the power cable to this unit should be 30 m or less; if it exceeds 30 m, noise from the power cable may affect this unit and peripheral devices.

When Only Displacement Sensor Amplifier Unit CDA Series Is Interconnected

Connect this unit and CDA to the external power supply as shown in the diagram below. Devices such as displacement sensors are powered by CDA.

In this case, this unit's connector for inter-connection is only used for communication.



This unit and all CDA units interconnected with it need to be connected to the same power source.

MEMO

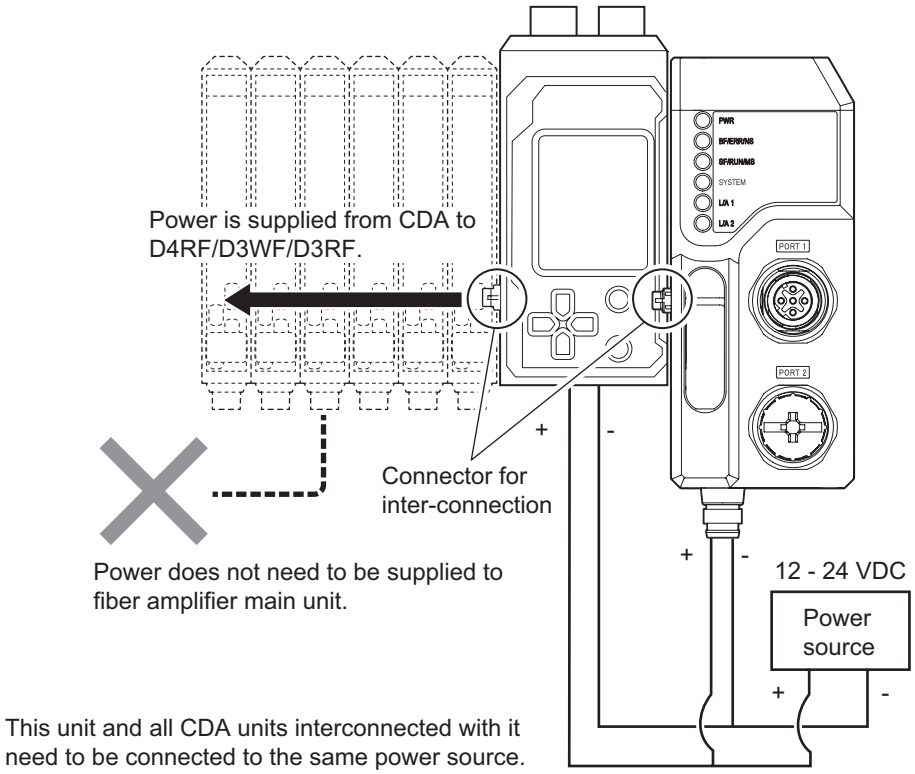
For the inter-connection order and number of inter-connection units, see "2-1-2 Configuration and Limitations of Applicable Sensor-amplifiers and Sensors"(2-2 page).

CAUTION

- All interconnected CDA units must be powered by the same external power source as this unit. Normal communication may not be possible if a different power source is used.
- CDAs are shipped with the stripped part of the lead wires bundled. If power is supplied to a CDA in this state by interconnecting it with another CDA, the CDA will be damaged due to a short circuit. Make sure that each lead wire is not in contact with any other lead wire before turning on the power.
- The system can be operated without wiring this unit to an external power supply.
- The cable length of the power supply cable connected to this unit and the CDA Series must be 30 m or less. If it is longer than 30 m, noise from the power supply cable can affect this unit and its peripheral devices.

When Fiber Amplifier and Displacement Sensor Amplifier Unit Are Interconnected

Connect both this unit and CDA to an external power supply as shown in the figure below. The fiber amplifiers do not require a power supply.



MEMO

For the inter-connection order and number of inter-connection units, see "2-1-2 Configuration and Limitations of Applicable Sensor-amplifiers and Sensors"(2-2 page).

CAUTION

- When fiber amplifiers and CDAs are both interconnected, power to the fiber amplifiers is supplied from this unit through the CDAs. so do not connect an external power supply to D3RF, D3WF or D4RF. If GND is not common, communication may not work properly. In addition, overvoltage may occur depending on the conditions.
- CDAs must be powered by the same external power source as this unit. If a different power source is used, communication may not work properly.
- The cable length of the power supply cable connected to this unit and the CDA Series must be 30 m or less. If it is longer than 30 m, noise from the power supply cable can affect this unit and its peripheral devices.

Calculating Power Consumption

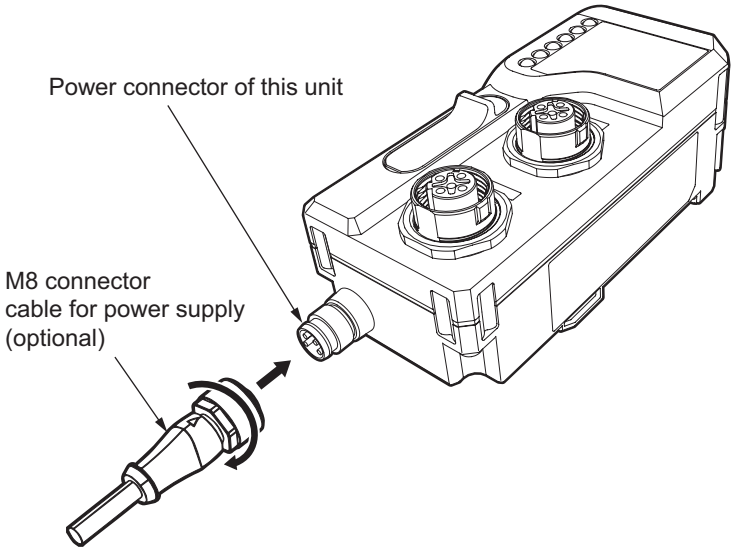
Calculate the power consumed by this unit and the connected sensor-amplifiers and sensors as follows.

Type		Max. power consumption per unit	Number of units
This unit		3 W	1
Sensor-amplifiers	D4RF-TM -TMC4 -TDM -TDM-Y -TS -TSC4 -TDS -TDS-Y	0.792 W	× number of units connected
	-TM-0 -TS-0	0.720 W	× number of units connected
	-MC4 -S	0.624 W	× number of units connected
	D3RF-TMN -TMCN4 -TMP -TMCP4 -TSN -TSCN4 -TSP -TSCP4	0.864 W	× number of units connected
	-TDMN -TDMP -TDSN -TDSP	0.936 W	× number of units connected
	D3WF	0.864 W	× number of units connected
	CDA	1.2 W	× number of units connected
Sensors	CD22 RS-485 communication type	1.68 W	× number of units connected
	TD1	1.68 W	× number of units connected

Connecting Cables

1 **Insert the connector of an M8 power supply connector cable (optional M84CN-xS) to the power connector of this unit.**

2 **Tighten the fixture sufficiently by hand.**



Communication

This chapter describes the data configurations that this unit handles for EtherCAT communication, and provides examples of communication.

3-1 EtherCAT Communication Using This Unit

This section describes the communication that this unit can perform with the EtherCAT master when used as an EtherCAT slave.
This unit can perform the following PDO (cyclic) communication and SDO (mailbox) communication with an EtherCAT master.

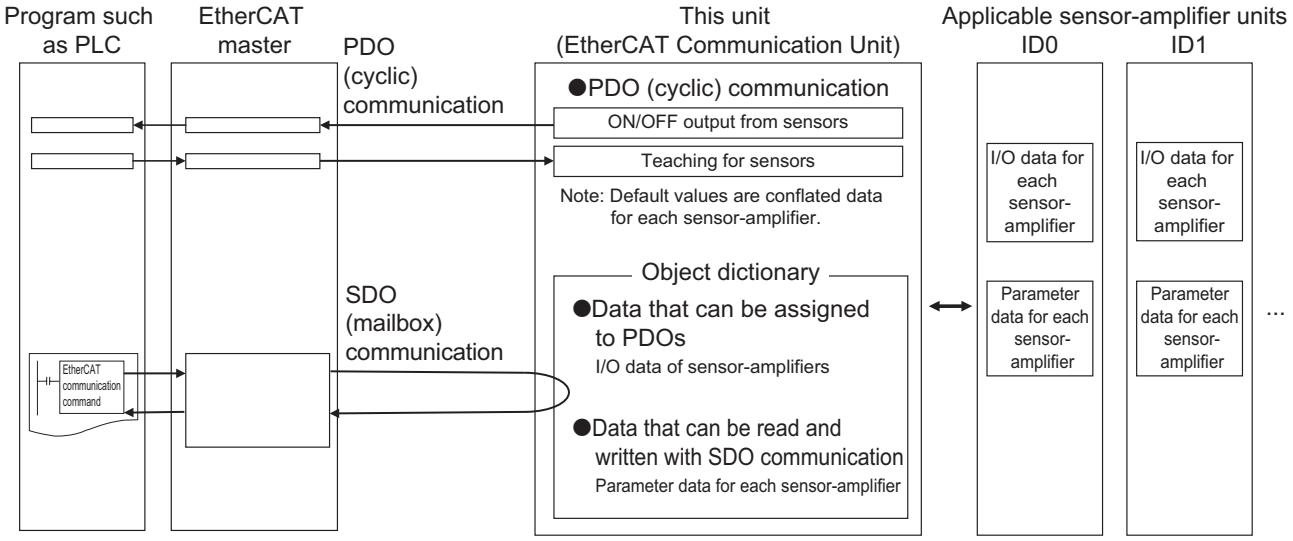
● PDO (Cyclic) Communication

At regular intervals, the pre-determined data in this unit is exchanged with the EtherCAT master.
The process data objects (PDO) in this unit are exchanged.
By default (factory settings), only the bit data collected from the interconnected sensor-amplifiers, such as the sensor ON/OFF outputs and teaching instructions, is assigned.

Note: Periodic communication of word data such as received light levels or measured values is possible by adding a PDO (communication path) using the configuration software on the master side.

● SDO (Mailbox) Communication

Specific data for this unit is read and written by the EtherCAT master when necessary at the desired timing.
All data located in this unit's object dictionary can be read and written.
This method is mainly used to set parameter data for each sensor-amplifier.



MEMO

This unit supports Free Run Mode (i.e., asynchronous) and DC Mode 1 (i.e., synchronized to the output cycle of the Sync0 signal) as EtherCAT synchronization modes. Settings can be configured with the EtherCAT master. Refer to the manual of your EtherCAT master for instructions on configuring the settings.

3-2 PDO (Cyclic) Communication

This unit can input and output the following data from/to the interconnected sensors with the EtherCAT master cyclically:

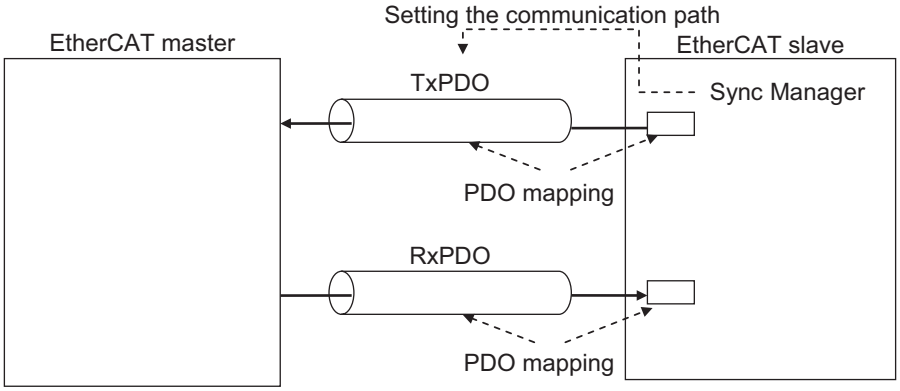
- Output to the Master:
  Bit data: sensor ON/OFF output signals, external input signals, and error status
  Word data: received light level and measured values of sensors

Note: Word data is not assigned in the default PDO mapping.
A PDO can be added using the configuration software of the master.

- Input from the Master:
  Bit data: teaching and error-clearing

3-2-1 Mechanism of PDO Communication

EtherCAT uses Sync Manager to configure the communication path. The PDO mapping determines which data is passed to the path.



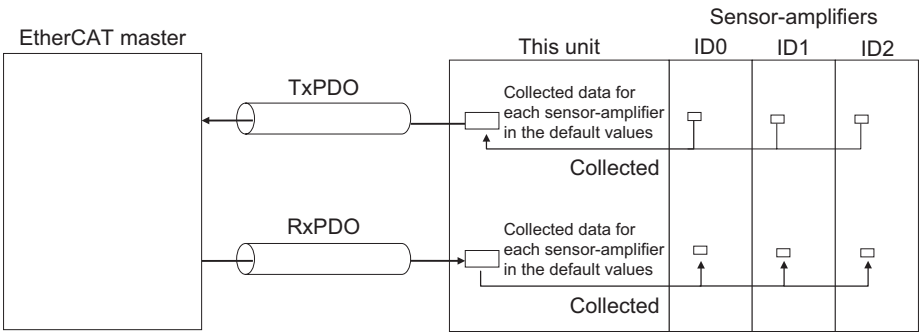
Overview of PDO Mapping

PDO mapping of this unit is performed as follows.

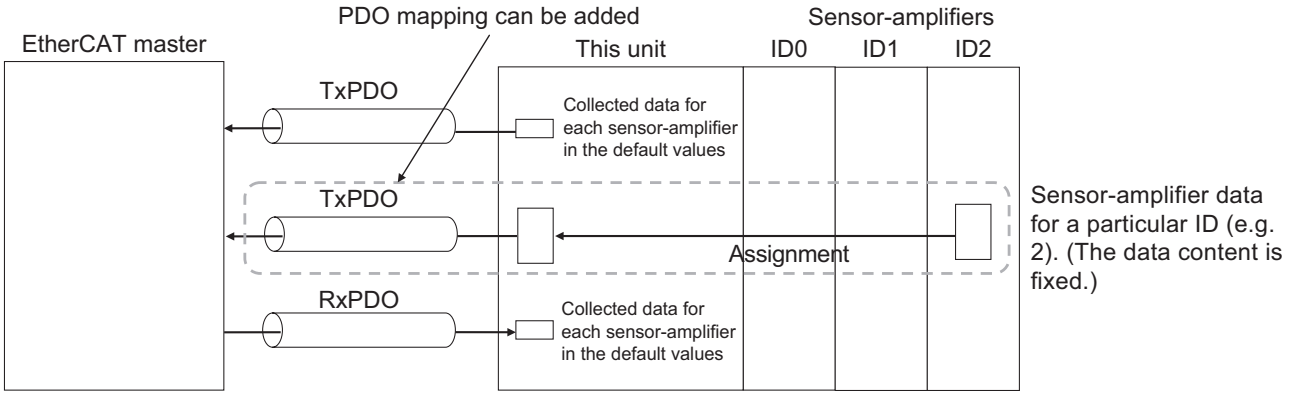
- By default, each PDO is used to transmit from this unit to the master and receive from the master to this unit.

Collected data*1 from the connected sensor-amplifiers is sent to the master and received from the master on each communication path.

*1: Data conflated into 16 bits (1 word) in order of sensor-amplifier's ID.



• Other PDO (communication paths) can be added for a specified ID number using the configuration software of the master. A connection sensor-amplifier with the specified ID number is assigned in advance to the PDO corresponding to the specified ID number. However, the data content to be communicated cannot be changed (it is fixed).
This is mainly necessary when you want to perform PDO communication with the received light level or measured value of the specified sensor-amplifier.



■ Details of PDO Mapping

Details of PDO mapping of this unit to the EtherCAT master are as follows.

● Default Values (Factory Settings)

The following data from the connected sensor-amplifiers is collected and assigned in 16-bit order by sensor-amplifier ID.

PDO mapping	Assigned data	Value		Size	Index / subindex of object dictionary
PDO mapping for 255th transmission (1AFF h)	D4RF: Sensor output 1 D3RF: Sensor output 1 D3WF: Sensor output 1 CDA + CD22: Hi output CDA + TD1: Hi output	Each bit corresponds to a sensor-amplifier 0: OFF 1: ON	Sensor-amplifier IDs correspond to a bit address	2 bytes (16 bits)	F600.01 h
	D3RF: Sensor output 2 D3RF: Sensor output 2 D3WF: Sensor output 2 CDA + CD22: Lo output CDA + TD1: Lo output	Each bit corresponds to a sensor-amplifier 0: OFF 1: ON		2 bytes (16 bits)	F600.02 h
	D4RF: External input D3RF: External input D3WF: External input CDA + CD22: Go output CDA + TD1: Go output	Each bit corresponds to a sensor-amplifier 0: OFF 1: ON		2 bytes (16 bits)	F600.03 h
	D4RF: Error status D3RF: Error status D3WF: Error status CDA + CD22: Error status CDA + TD1: Error status	Each bit corresponds to a sensor-amplifier 0: No error 1: Error		2 bytes (16 bits)	F600.04 h

PDO mapping	Assigned data	Value		Size	Index / subindex of object dictionary
PDO mapping for 255th receipt (16FF h)	D4RF: Execution of teaching D3RF: Execution of teaching D3WF: Execution of teaching CDA + CD22: Execution of teaching CDA + TD1: Execution of teaching	Each bit corresponds to a sensor-amplifier 0→1: First teaching 1→0: Second teaching	Sensor-amplifier IDs correspond to a bit address	2 bytes (16 bits)	F700.01 h
	D4RF: Error clearing D3RF: Error clearing D3WF: Error clearing CDA + CD22: Error clearing CDA + TD1: Error clearing	Each bit corresponds to a sensor-amplifier 0→1: Error cleared		2 bytes (16 bits)	F700.02 h

• PDO mapping for 255th transmission (this unit→master)

Sensor output 1 or Hi output (depending on type of sensor-amplifier)

Offset (bytes) ↓	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
0	ID7	ID6	ID5	ID4	ID3	ID2	ID1	ID0
+1	ID15	ID14	ID13	ID12	ID11	ID10	ID9	ID8

Sensor output 2 or Lo output (depending on type of sensor-amplifier)

Offset (bytes) ↓	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
+2	ID7	ID6	ID5	ID4	ID3	ID2	ID1	ID0
+3	ID15	ID14	ID13	ID12	ID11	ID10	ID9	ID8

External input or Go output (depending on type of sensor-amplifier)

Offset (bytes) ↓	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
+4	ID7	ID6	ID5	ID4	ID3	ID2	ID1	ID0
+5	ID15	ID14	ID13	ID12	ID11	ID10	ID9	ID8

Error status (all types of sensor-amplifier)

Offset (bytes) ↓	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
+6	ID7	ID6	ID5	ID4	ID3	ID2	ID1	ID0
+7	ID15	ID14	ID13	ID12	ID11	ID10	ID9	ID8

• PDO mapping for 255th receipt (master→this unit)

Execution of teaching (all types of sensor-amplifier)

Offset (bytes) ↓	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
0	ID7	ID6	ID5	ID4	ID3	ID2	ID1	ID0
+1	ID15	ID14	ID13	ID12	ID11	ID10	ID9	ID8

Error clearing (all types of sensor-amplifier)

Offset (bytes) ↓	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
+2	ID7	ID6	ID5	ID4	ID3	ID2	ID1	ID0
+3	ID15	ID14	ID13	ID12	ID11	ID10	ID9	ID8

Other values

If you want to perform PDO communication for the received light levels, measured values (or calculated values), or all data for each ID number before collection, you must add the following PDO corresponding to the target sensor-amplifier that you want to communicate with using the master-side configuration software.

PDO mapping	Assigned data	Value	Size	Index / subindex of object dictionary
PDO mapping for 1st - 16th transmission (assignment to PDO of each connected sensor-amplifier) 1A0n Note: n = ID (0 - F)	D4RF: Sensor output 1 D3RF: Sensor output 1 D3WF: Sensor output 1 CDA + CD22: Hi output CDA + TD1: None	00 h: OFF 01 h: ON	1 byte (8 bits)	60n0 Note: n = ID (0 - F)
	D4RF: Sensor output 2 D3RF: Sensor output 2 D3WF: Sensor output 2 CDA + CD22: Lo output CDA + TD1: None	00 h: OFF 01 h: ON	1 byte (8 bits)	
	D4RF: External input D3RF: External input D3WF: External input CDA + CD22: Go output CDA + TD1: None	00 h: OFF 01 h: ON	1 byte (8 bits)	
	D4RF: Error status D3RF: Error status D3WF: Error status CDA + CD22: Error status CDA + TD1: Error status	00 h: No error 01 h: Error	1 byte (8 bits)	
	D4RF: Alarm status D3RF: Alarm status D3WF: Alarm status CDA + CD22: Alarm status CDA + TD1: Alarm status	00 h: Data enabled 01 h: Data disabled	1 byte (8 bits)	
	D4RF: Received light level D3RF: Received light level D3WF: Received light level CDA + CD22: Measurement values or calculation values CDA + TD1: Measurement values or calculation values	0000 - FFFF h	2 bytes (16 bits)	
PDO mapping for 1st - 16th receipt (assignment to PDO of each connected sensor-amplifier) 160n Note: n = ID (0 - F)	D4RF: Execution of teaching D3RF: Execution of teaching D3WF: Execution of teaching CDA + CD22: Execution of teaching	00 h → 01 h: First teaching 01 h → 00 h: Second teaching	1 byte (8 bits)	70n0 Note: n = ID (0 - F)
	D4RF: Error clearing D3RF: Error clearing D3WF: Error clearing CDA + CD22: Error clearing CDA + TD1: Error clearing	00 h → 01 h: Error cleared	1 byte (8 bits)	

3-3 SDO (Mailbox) Communication

The EtherCAT master can read or write the following data using SDO (mailbox) communication when necessary.

- Parameter setting values for each sensor-amplifier
- Sensor ON/OFF output, received light levels, measurement values, etc.
- Sensor-amplifier and sensor connection configuration error codes
- Latest error codes specific to each device

You can read or write data by specifying an index and sub-index of this unit's object dictionary using the EtherCAT communication command on the EtherCAT master.

MEMO

The following malfunctions in sensor-amplifier and sensor connection configurations can be read as error codes from the operation error history using SDO communication. Refer to "5-2 Sensor-amplifier and Sensor Configuration Error Codes" (Page 5-3) for further information.

- Change in the number of connected sensor-amplifiers or sensors
- Configuration error
- Invalid connection order

3-4 Operations Required for This Unit to Communicate with the EtherCAT Master

This section describes the operations required on the EtherCAT master side for this unit to communicate with EtherCAT.
For more information, refer to the manual of the EtherCAT master or that of the master-side configuration software.

3-4-1 Downloading and Installing the ESI File for This Unit

1. **Download the ESI file for this unit from the OPTEX FA website below:**
   https://www.optex-fa.com/
2. **Install the ESI file for this unit in the master-side configuration software**
   Copy the ESI file for this unit (EtherCAT Slave Information file) to the folder specified by the master-side configuration software

3-4-2 Settings for This Unit on the Master-side Configuration Software

This unit supports the EtherCAT MDP (Modular Device Profile) function. Therefore, the module configuration (i.e., correct configuration of the sensor-amplifiers and sensors) must be set up after adding this unit to the EtherCAT system on the master-side configuration software.

There are generally two ways to do this. Add and configure this unit in one of the following ways.
- Offline: Manually add and set the module configuration (i.e., sensor-amplifier and sensor configuration)
- Online: Connect to an actual device and automatically add and set the module configuration (i.e., sensor-amplifier and sensor configuration)

For information on setting the module configuration (i.e., sensor-amplifier and sensor configuration) as a slave supporting MDP, refer to the section on MDP slaves in the manual of your master or the manual of the configuration software for your master.

3-4-3 Configuring EtherCAT Communication on This Unit

■ PDO Communication: Assigning PDO on The Master-Side Configuration Software

If you use the PDO communication, use the master-side configuration software to assign this unit's PDO to inputs and outputs for the host program.

● Adding PDO Mapping (If Required)

Generally, the default values (factory settings) can be used for PDO mapping.
Add the PDO using the master-side configuration software only when you want to assign the received light levels, measured values, or alarms.

● Assigning PDOs to Variables or Addresses for the Host Program

Assign this unit's PDO to the host program's inputs and outputs.
Specifically, assign them to variables or addresses. For variables, arrays or structures are typically used.

■ SDO Communication: Create a Communication Program

If you are using SDO communication, create a communication program.

3-4-4 Downloading Slave Settings and Module Configuration (Amplifier and Sensor Configuration) Information to This Unit

Use the master-side configuration software to download slave settings and module configuration (i.e., the configuration of sensor-amplifiers and sensors) to this unit.

CAUTION
When you use this unit, make sure to add this unit to the EtherCAT system in the master-side configuration software, set the correct module configuration (i.e., sensor-amplifier and sensor configuration) and download the slave settings and the module configuration information into this unit.
Even if the download itself has not been made, if the number of sensor-amplifiers and sensors in the actual configuration accidentally matches the number of those in the module configuration set in the master, this unit can operate in the OPERATIONAL state, even if the configuration is different. Therefore, it is essential to download the module configuration (i.e., the configuration of sensor-amplifiers and sensors) to this unit.
If the download is completed and the actual sensor-amplifiers and sensors configuration does not match the master configuration, this unit will revert to the PRE-OPERATIONAL state and will be unable to perform cyclic (PDO) communication (both ERR and RUN LEDs on the front of this unit will blink).

3-4-5 Stored Data in This Unit for Amplifier and Sensor Configuration Set in the Master

When the module configuration information is downloaded to this unit, the sensor-amplifier and sensor configuration set in the master is stored in the following object dictionary in this unit.

Subindex 01 h of index F030 h

The stored data consists of sensor-amplifier unit or sensor*1 product codes*2 in order of ID number. The data is stored in 16-element arrays.

It can be read from and written to the master using SDO communication when necessary.

*1: If the sensor-amplifier unit is CDA, the product code of each connected sensor is stored. If only one sensor is connected to CDA and one channel is empty, 00000000 h is stored.

*2: The product code is a code defined in the ESI file for this unit to identify modular devices (sensor-amplifier units and sensors) using the EtherCAT MDP function.

Product codes are as follows.

- Fiber-amplifier units:
  D3RF product code: 00001301 h
  D3WF product code: 00001306 h
  D4RF product code
  D4RF-TM, -TMC4, -TS, -TSC4: 00001307 h
  D4RF-TDM, -TDS, -TDM-Y, -TDS-Y: 00001308 h
  D4RF-TM-0, -TS-0: 00001309 h
  D4RF-MC4, -S: 0000130A h
- Sensors connected to CDA:
  CD22-15-485 product code: 00001302 h
  CD22-35-485 product code: 00001303 h
  CD22-100-485 product code: 00001304 h
  TD1 product code: 00001305 h

Note: 00000000 h is used for channels where no sensor is connected to CDA.

Example: The following array is used if the units from the position furthest left from this unit are D3RF main unit → 2 D3RF expansion units → 1 CDA expansion unit (sensor head 1: CD22-15-485, sensor head 2: CD22-35-485) → 1 CDA expansion unit (sensor head 1: CD22-100-485, sensor head 2: TD1).

Element number 0: 00001301 h
Element number 1: 00001302 h
Element number 2: 00001303 h
Element number 3: 00001304 h
Element number 4: 00001305 h

3-4-6 Detecting Sensor-amplifier and Sensor Configuration at Power ON

At power ON, the current configuration of sensor-amplifiers and sensors is stored in the following object dictionary in this unit.

Subindex 01 h of index F050 h

The stored data is the product codes of the sensor-amplifiers or sensors[*1] in order of ID number. It is stored as an array with 16 elements. The stored data is similar to the sensor-amplifier and sensor configuration settings set in the master.

*1: If the sensor-amplifier unit is CDA, the product code of each connected sensor is stored.

If necessary, the products codes can be read out from the master using SDO communication.

3-4-7 If the Sensor-amplifier and Sensor Configuration Matches That Registered

If the sensor-amplifier and sensor configuration (index F030 h) set in the master matches the actual sensor-amplifier and sensor configuration (index f050 h) detected at power ON, this unit will be in OPERATIONAL state (in this case, ERR LED off and RUN LED on).

3-4-8 If the Sensor-amplifier and Sensor Configuration Perform Teach to Sensor

If the sensor-amplifier and sensor configuration (index F030 h) set in the master is different from the actual sensor-amplifier and sensor configuration (index F050 h) detected at power ON, this unit generates the “configuration error” (in this case, the ERR and Run LEDs flash) and EtherCAT communication changes to PRE-OPERATIONAL status and cannot enter the SAFE-OPERATIONAL state.

Use the EtherCAT master-side configuration software to edit the sensor-amplifier and sensor configuration again to match the actual configuration and download it to this unit. Or, match the actual configuration to the configuration set in the master, and then cycle the power.

In the event of the “configuration error” described above, it is possible to check the operation error history by reading the error history using SDO communication from the master (error code: 0007E000 h). Refer to “5-2 Sensor-amplifier and Sensor

Configuration Error Codes” (Page 5-3) for further information.

3-5 Specific Examples of Communication

This section describes specific examples of communication between this unit and the master.
Communication can be performed with PDO communication or SDO communication.

3-5-1 Cyclic Reading of ON/OFF Output from Sensors

Cyclic reading of ON/OFF output from sensors is performed with PDO communication.
PDO mapping is the default (factory setting).
Collected output data from the sensor-amplifiers is cyclically sent to variables in the master.

Example: The following is an example of a variable in the master.
Variable name: Receive PDO gateway
Data type: ARRAY[0..15] OF BOOL (16-element BOOL type array)
Note: The variable name is an example of a name defined by the user.

3-5-2 Perform Teach to Sensor

Teaching of the sensors is performed with PDO communication.
PDO mapping is the default (factory setting).
Collected instructions to the sensor-amplifiers are cyclically sent from variables in the master.

Example: The following is an example of a variable in the master.
Variable name: Transmit PDO gateway
Data type: ARRAY[0..15] OF BOOL (16-element BOOL type array)
Note: The variable name is an example of a name defined by the user.

3-5-3 Cyclic Reading of Received Light Levels from Sensors

Cyclic reading of received light levels from sensors is performed with PDO communication.
PDO mapping must be added using the configuration software on the master side.

Example: Cyclic reading of received light level from D3RF corresponding to ID2 (third from the left)
Add a PDO as follows.
Add the index 1A02 h to the PDO mapping using the master-side configuration software
6020 h is assigned to 1A02 h.

The following is set as a variable in the master.
Variable name: 1st Receive PDO Mapping
Data type: The following structure is an example.

Note: The variable name and member name are examples of names defined by the user.

Member name	Size	
OUT1	Bytes (UINT8)	Sensor output 1
OUT2	Bytes (UINT8)	Sensor output 2
EXTERNAL INPUT	Bytes (UINT8)	External input
ERR	Bytes (UINT8)	Error status
ALARM	Bytes (UINT8)	Alarm status
INCIDENT LEVEL	Words (UINT16)	Received light level

The above received light level is specified as follows for the variable.
1st Receive PDO Mapping.INCIDENT LEVEL

3-5-4 Changing Setting Values of Sensors

The setting values of the sensors can be changed with SDO communication.

Example: Changing the lower threshold of D3RF for ID2 (third from the left)
An SDO writing command is issued to the following index of this unit from the master.

Index: 8020 h is assigned (as the ID is 2, 80n0 (n = ID) is set as “8020 h”).
Subindex: 0B h (lower threshold)

3-6 Object Dictionary of This Unit

The EtherCAT slave has an internal parameter set called “Object dictionary”. The EtherCAT master reads from and writes to this location to monitor and set parameters.
This section provides details on this unit’s object dictionary.

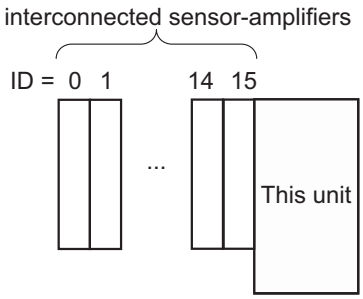
3-6-1 Index Range of Object Dictionary

The index range of the object dictionary in EtherCAT is decided as follows for each function.

Index range (HEX)	Details	Used for this unit ○ = yes, - = no
0000 - 0FFF	Data type area	-
1000 - 1FFF	Communication settings area (identification information, EtherCAT serial interface settings, process data objects, etc.)	○
2000 - 5FFF	Manufacturer-specific data area (objects defined by slave manufacturers)	-
6000 - 6FFF	Input process data area (objects that can be assigned to input process data)	○
7000 - 7FFF	Output process data area (objects that can be assigned to output process data)	-
8000 - 8FFF	Settings data area (objects related to function settings of slaves)	○
9000 - 9FFF	Slave information area (configuration information for module devices, etc.)	○
A000 - AFFF	Diagnostic information area (diagnostic information, status information, statistical information, etc.)	○
B000 - BFFF	Service area	-
C000 - EFFF	Reserved area (cannot be used)	-
F000 - FFFF	Device area (parameters related to devices)	○

Assigning Objects for This Unit

Index numbers of objects for this unit are assigned as follows.



Object type		Collected data for this unit	Data for each connected sensor-amplifier and sensor			
			ID = 0	ID = 1	...	ID = 15
Communication settings area	For TxPDO (slave → master)	1AFF h (factory setting)	1A00 h (PDO needs to be added by user)	1A01 h (PDO needs to be added by user)	...	1A0F h (PDO needs to be added by user)
	For RxPDO (master → slave)	16FF h (factory setting)	1600 h (PDO needs to be added by user)	1601 h (PDO needs to be added by user)	...	160F h (PDO needs to be added by user)
Input process data area (slave → master) Device area (collected data for this unit)		F600 h (assigned to 1AFF h at factory)	6000 h (assigned to 1A00 h at factory)	6010 h (assigned to 1A01 h at factory)	...	600F h (assigned to 1A0F h at factory)
Output process data area (master → slave) Device area (collected data for this unit)		F700 h (assigned to 16FF h at factory)	7000 h (assigned to 1600 h at factory)	7010 h (assigned to 1601 h at factory)	...	700F h (assigned to 160F h at factory)
Settings data area	Setting value information	-	8000 h	8010 h	...	80F0 h
	Operation information	-	80001h	8011h	...	80F1 h
Slave information area		-	9000 h	9010 h	...	90F0 h
Diagnostic information area		-	A000 h	A010 h	...	A0F0 h

Meanings of Arrays in the Object Dictionary List

The meanings of each array are as follows.

Item	Value	Meaning
Index (HEX)	0000 - FFFF	A four-digit hexadecimal number to identify the object
Sub- Index (HEX)	00 - FE	A number to specify each member for array type and structure type objects. Not used for basic data types. Note: 00 is the maximum subindex value within members.
Item		The name of the object. For subindexes, this is the subindex name.
Description		A description of the object. For subindexes, this is the subindex description.
Data type	INT16	16-bit signed integer
	UINT8	8-bit unsigned integer
	UINT16	16-bit unsigned integer
	UINT32	32-bit unsigned integer
	UINT64	64-bit unsigned integer
	WORD	16-bit data
	STRG(x)	Character string (x bytes)
	BOOL	BOOL value
Read / Write	R	Read only
	R/W	Read / write
	W	Write only
Assignable to PDO	No	Cannot be assigned to PDO
	Yes	Can be assigned to PDO
Setting details		For read-only (R) objects, this indicates the range of data that can be acquired. For read / write (R/W) objects and write-only (W) objects, this indicates the range of data that can be set.
Default value		The value set at the factory.

3-6-2 Object Dictionary List for This Unit

The object dictionary list for this unit is as follows.

Refer to “3-7 Parameter for Each Connected Sensor Amplifier and Sensor” (Page 3-25) for information on areas dependent on the type of sensor-amplifier or sensor that is connected.

Index (HEX)	Sub-Index (HEX)	Item	Description	Data type	Read/ Write attribute	Assignable to PDO	Value	Default value
1000	None	Device Type	Indicates the device type of this unit. This is the following modular (building block type). 00001389 h: Modular Device	UINT32	R	No	00001389 h	00001389 h
1008	None	Device Name	Indicates the model of this unit.	STRG(6)	R	No	“UC1-EC”	“UC1-EC”
1009	None	Hardware Version Number	Indicates the version of this unit’s hardware.	STRG(4)	R	No	“0001”	“0001”
100A	None	Software Version Number	Indicates the version of this unit’s software.	STRG(4)	R	No	“0001”	“0001”
1018	00	Identity	Information for identification of this unit	UINT8	R	-	04 h	04 h
	01	Vendor ID	Vendor ID	UINT32	R	No	00000B27 h	00000B27 h
	02	Product code	Product code	UINT32	R	No	00002300 h	00002300 h
	03	Revision	Revision number	UINT32	R	No	00000001 h	00000001 h
	04	Serial number	Serial number	UINT32	R	No	xxxxxxxx h	xxxxxxxx h
10F3	00	Diagnosis History	Error history	UINT8	R	-	15 h	
	01	Maximum Messages	Maximum number of messag-es	UINT8	R	No	00 h	
	02	Newest Message	Subindex number of the latest message	UINT8	R	No		
	03	Newest acknowl-edged message	Latest confirmation error mes-sage	UINT8	R/W	No		
	04	New message available	Latest message status	BOOL	R	No		
	05	Flags for the transmission and storage of diag-nostic message	Indicates whether there is an emergency message notifica-tion	UINT16	R	No	0000 h: No notification 0001 h: Notification	0000 h
	06	Diagnosis Message 1	Operation error history (error code) 1	UINT32	R	No		-
	-							
	15	Diagnosis Message 16	Operation error history (error code) 16	UINT32	R	No		-
160n Note: n = ID (0 - F)	00	1st -16th Receive PDO Mapping	PDO mapping for 1st - 16th receipt (assignment to PDO of each connected sensor-ampli-fier) 70n0 is preset for 160n (fixed) Note: n = ID (0 - F)	UINT8	R	-	02 h	00 h
	01		PDO entry 1	UINT32	R	No	70n0.01 h	-
	02		PDO entry 2	UINT32	R	No	70n0.02 h	-

Index (HEX)	Sub-Index (HEX)	Item	Description	Data type	Read/ Write attribute	Assignable to PDO	Value	Default value
16FF	00	Receive PDO gateway	PDO mapping for 255th receipt (assigned to PDO of collected data)	UINT8	R	-	03 h	03 h
	01	PDO entry 1		UINT32	R	No	F700.01 h	F700.01 h
	02	PDO entry 2		UINT32	R	No	F700.02 h	F700.02 h
1A0n Note: n = ID (0 - F)	00	1st -16th Transmit PDO Mapping	PDO mapping for 1st - 16th transmission (assignment to PDO of each connected sensor-amplifier) 60n0 is preset for 1A0n (fixed) Note: n = ID (0 - F)		R	-	06 h	00 h
	01		PDO entry 1	UINT32	R	No	60n0.01 h	-
	02		PDO entry 2	UINT32	R	No	60n0.02 h	-
	03		PDO entry 3	UINT32	R	No	60n0.03 h	-
	04		PDO entry 4	UINT32	R	No	60n0.04 h	-
	05		PDO entry 5	UINT32	R	No	60n0.05 h	-
	06		PDO entry 6	UINT32	R	No	60n0.06 h	-
1AFF	00	Transmit PDO gateway	PDO mapping for 255th transmission (assigned to PDO of collected data)	UINT8	R	-	04 h	04 h
	01		PDO entry 1	UINT32	R	No	F600.01 h	F600.01 h
	02		PDO entry 2	UINT32	R	No	F600.02 h	F600.02 h
	03		PDO entry 3	UINT32	R	No	F600.03 h	F600.03 h
	04		PDO entry 4	UINT32	R	No	F600.04 h	F600.04 h
1C00	00	Sync Manager Communication Types	Sync manager communication type	UINT8	R	-	04 h	04 h
	01	Communication Type Sync Manager 0	Communication type SM0	UINT8	R	No	01 h	01 h
	02	Communication Type Sync Manager 1	Communication type SM1	UINT8	R	No	02 h	02 h
	03	Communication Type Sync Manager 2	Communication type SM2	UINT8	R	No	03 h	03 h
	04	Communication Type Sync Manager 3	Communication type SM3	UINT8	R	No	04 h	04 h

Index (HEX)	Sub-Index (HEX)	Item	Description	Data type	Read/ Write attribute	Assignable to PDO	Value	Default value
1C12	00	Sync Manager 2 PDO Assignment	Assignment of PDOs for Sync Manager 2	UINT8	R	-	12 h	12 h
	01	1st PDO Mapping object index of assinged PDO	Receipt PDO mapping Assignment 1	UINT16	R	No	16FF h	16FF h
	02	2nd PDO Mapping object index of assinged PDO	Receipt PDO mapping Assignment 2	UINT16	R	No	1600 h	1600 h
	-			-			-	-
	10	16th PDO Mapping object index of assinged PDO	Receipt PDO mapping Assignment 16	UINT16	R	No	160E h	160E h
	12	17th PDO Mapping object index of assinged PDO	Receipt PDO mapping Assignment 17	UINT16	R	No	160F h	160F h
1C13	00	Sync Manager 3 PDO Assignment	Assignment of PDOs for Sync Manager 2	UINT8	R	-	12 h	12 h
	01	1st PDO Mapping object index of assinged PDO	Transmission PDO mapping Assignment 1	UINT16	R	No	1AFF h	1AFF h
	02	2nd PDO Mapping object index of assinged PDO	Transmission PDO mapping Assignment 2	UINT16	R	No	1A01 h	1A01 h
	-			-			-	-
	10	16th PDO Mapping object index of assinged PDO	Transmission PDO mapping Assignment 16	UINT16	R	No	1A0E h	1A0E h
	11	17th PDO Mapping object index of assinged PDO	Transmission PDO mapping Assignment 17	UINT16	R	No	1A0F h	1A0F h

Index (HEX)	Sub-Index (HEX)	Item	Description	Data type	Read/ Write attribute	Assignable to PDO	Value	Default value
60n0 Note: n = ID (0 - F)	00	Module Transmit PDO	Output from each sensor-amplifier (before collection)	UINT8	R	-	06 h	06 h
	01	Output 1	D4RF: Sensor output 1 D3RF: Sensor output 1 D3WF: Sensor output 1 CDA + CD22: Hi output CDA + TD1: None	UINT8	R	Yes	00 h: OFF 01 h: ON	00 h
	02	Output 2	D4RF: Sensor output 2 D3RF: Sensor output 2 D3WF: Sensor output 2 CDA + CD22: Lo output CDA + TD1: None	UINT8	R	Yes	00 h: OFF 01 h: ON	00 h
	03	Output 3 / Exit. Entrance	D4RF: External input D3RF: External input D3WF: External input CDA + CD22: Go output CDA + TD1: None	UINT8	R	Yes	00 h: OFF 01 h: ON	00 h
	04	Erorr Status	D4RF: Error status D3RF: Error status D3WF: Error status CDA + CD22: Error status CDA + TD1: Error status	UINT8	R	Yes	00 h: No error 01 h: Error	00 h
	05	Process Data Status	Indicates the validity of the process data status data.	UINT8	R	Yes	00 h: Data disabled 01 h: Data enabled	00 h
	06	Measurement	D4RF: Received light level D3RF: Received light level D3WF: Received light level CDA + CD22: Measurement values or calculation values CDA + TD1: Measurement values or calculation values	UINT16	R	Yes	0000 - FFFF h	0000 h
70n0 Note: n = ID (0 - F)	00	Module Receive PDO	Instructions to each sensor-amplifier (before collection)	UINT8	R	-	02 h	02 h
	01	Teach Request	D4RF: Execution of teach D3RF: Execution of teach D3WF: Execution of teach CDA + CD22: Execution of teach CDA + TD1: Execution of teach	UINT8	R/W	Yes	00 h → 01 h: First teach 01 h → 00 h: Second teach	00 h
	02	Error Clear	D4RF: Error clearing D3RF: Error clearing D3WF: Error clearing CDA + CD22: Error clearing CDA + TD1: Error clearing	UINT8	R/W	Yes	00 h → 01 h: Error cleared	00 h

Index (HEX)	Sub-Index (HEX)	Item	Description	Data type	Read/ Write attribute	Assignable to PDO	Value	Default value
80n0 Note: n = ID (0 - F)		Module Configuration	Setting value information on connected sensor-amplifiers and sensors (settings data area) Refer to “3-7 Parameter for Each Connected Sensor Amplifier and Sensor” (Page 3-25).		R/W	No	-	-
80n1 Note: n = ID (0 - F)		Module Commands	Operation information on connected sensor-amplifiers and sensors (settings data area) Refer to “3-7 Parameter for Each Connected Sensor Amplifier and Sensor” (Page 3-25).		R/W	No	-	-
90n0 Note: n = ID (0 - F)		Module Identification	Identification information for connected sensor-amplifiers and sensors (slave information area) Refer to “3-7 Parameter for Each Connected Sensor Amplifier and Sensor” (Page 3-25).		R	No	-	-
A0n0 Note: n = ID (0 - F)		Module Diagnostics	Error information for connected sensor-amplifiers and sensors (diagnostic information area) Refer to “3-7 Parameter for Each Connected Sensor Amplifier and Sensor” (Page 3-25).		R	No	-	-
F000	00	Modular Device Profile	Profile of module (sensor-amplifier or sensor)	UINT8	R	-	02 h	02 h
	01		Index period of assignment between connected modules (sensor-amplifiers and sensors)	UINT16	R	No	0010 h	0010 h
	02		Maximum number of modules (sensor-amplifiers and sensors)	UINT16	R	No	0010 h	0010 h
F030	00	Configured Module Ident list	Sensor-amplifier and sensor configuration set in the master for inter-connection with this unit (module configuration set as an MDP slave) Set from the master-side configuration software	UINT8	R	-	10 h	-
	01		16-element product code array (in order from the unit furthest to the left of this unit, i.e. in order of ID number)	UINT32 array	R/W	No	-	-

Index (HEX)	Sub-Index (HEX)	Item	Description	Data type	Read/ Write attribute	Assignable to PDO	Value	Default value
F050	00	Detected Module Ident list	Detected sensor-amplifier and sensor configuration	UINT8	R	-	10 h	-
	01		16-element product code array (in order from the unit furthest to the left of this unit, i.e. in order of ID number). Automatically stored when the power is turned ON.	UINT32 array	R	No	-	-
F100	00	Gateway Status	Status of this unit	UINT8	R	-	03 h	-
	01		Operation status of this unit 0000 h: Idle 0002 h: Operating	UINT16	R	No	0000 - 0003 h	-
	02		The number of sensor-amplifiers interconnected with this unit that are detected by the function for automatic recognition of the number of connected units when the power is turned ON (Note: If more than the maximum number of applicable sensor-amplifier units (16) are connected, the count of the connected units automatically recognized by this unit returns to 1 (the 17th unit is “1”, the 18th is “2”, etc.).)	UINT16	R	No	0000 - 000Fh	0000 h
	03		Latest error code for this unit	UINT16	R/W	No	Error code (refer to “5-3 List of Error Codes for Each Device” (Page 5-4))	0000 h
F200	00	Gateway Control	Unit error notification control It is possible to enable or disable the error history function and emergency message function of this unit.	UINT8	R	-	01 h	-
	01		Set 00001 h to enable these functions. 0000 h: Disabled 0001 h: Enabled	UINT16	R/W	No	0000 h	0000 h

Index (HEX)	Sub-Index (HEX)	Item	Description	Data type	Read/ Write attribute	Assignable to PDO	Value	Default value
F600	00	Gateway Transmit PDO	Output from each sensor-amplifier (after collection)	UINT8	R	-	04 h	04 h
	01	Output 1	D4RF: Sensor output 1 D3RF: Sensor output 1 D3WF: Sensor output 1 CDA + CD22: Hi output CDA + TD1: Hi output	UINT16	R	Yes	Each bit corresponds to a sensor-amplifier 0: OFF 1: ON	Each bit corresponds to a sensor-amplifier 0: OFF 1: ON
	02	Output 2	D4RF: Sensor output 2 D3RF: Sensor output 2 D3WF: Sensor output 2 CDA + CD22: Lo output CDA + TD1: Lo output	UINT16	R	Yes	Each bit correponds to a sensor-amplifier 0: OFF 1: ON	Each bit correponds to a sensor-amplifier 0: OFF 1: ON
	03	Outpu 3/ Exit. Entrance	D4RF: External input D3RF: External input D3WF: External input CDA + CD22: Go output CDA + TD1: Go output	UINT16	R	Yes	Each bit corrsponds to a sensor-amplifier 0: OFF 1: ON	Each bit corrsponds to a sensor-amplifier 0: OFF 1: ON
	04	Erorr Status	D4RF: Error status D3RF: Error status D3WF: Error status CDA + CD22: Error status CDA + TD1: Error status	UINT16	R	Yes	Each bit corresponds to a sensor-amplifier 0: No error 1: Error	Each bit corresponds to a sensor-amplifier 0: No error 1: Error
F700	00	Gateway Receive PDO	Instructions to each sensor-amplifier and sensor (after collection)	UINT8	R	-	02 h	02 h
	01	Teach Request	D4RF: Execution of teach D3RF: Execution of teach D3WF: Execution of teach CDA + CD22: Execution of teaching CDA + TD1: Execution of teaching	UINT16	R/W	Yes	Each bit corresponds to a sensor-amplifier or sensor 0→1: First teaching 1→0: Second teaching	Each bit corresponds to a sensor-amplifier or sensor 0→1: First teaching 1→0: Second teaching
	02	Error Clear	D4RF: Error clearing D3RF: Error clearing D3WF: Error clearing CDA + CD22: Error clearing CDA + TD1: Error clearing	UINT16	R/W	Yes	Each bit corresponds to a sensor-amplifier or sensor 0→1: Error cleared	Each bit corresponds to a sensor-amplifier or sensor 0→1: Error cleared

Index (HEX)	Sub-Index (HEX)	Item	Description	Data type	Read/ Write attribute	Assignable to PDO	Value	Default value
F800	00	Gateway Configuration	Identification information for this unit	UINT16	R	-	FFh	-
	01		Product series	UINT16	R	No	2508 h	2508 h
	02		Product type	UINT16	R	No	0001 h	0001 h
	03		Firmware version	UINT16	R	No	0001 h	0001 h
	04		Product version	UINT16	R	No	0001 h	0001 h
	05		Product revision	UINT16	R	No	0001 h	0001 h
	06		Provider name	STRG(7)	R	No	“OPTEX FA”	“OPTEX FA”
	07		Product name	STRG(6)	R	No	“UC1-EC”	“UC1-EC”
	08		Product ID	UINT32	R/W	No	0020281 h	0020281 h
	09		User ID (maximum 32 characters)	STRG(32)	R	No	“String”	All FF h
	C9		Application firmware version	STRG(4)	R	No	“1003” or greater	“1003”
	CA		Transmission firmware version	STRG(10)	R/W	No	“EC4704. NXF”	“EC4704. NXF”
	CB		Self search	UINT16	R/W	No	0000 h = stop, 0001 h = execute	0000 h
	D5		Reset to factory settings	UINT16	R/W	No	0003 h = execute	0000 h

3-7 Parameter for Each Connected Sensor Amplifier and Sensor

Below is the object dictionary for the settings data area, slave information area and diagnostic information area of this unit when each sensor-amplifier or sensor is connected to this unit.

3-7-1 Parameters of D3RF Fiber Amplifier (Inter-connection Type)

This table indicates the parameters related to the settings, operations, and status confirmation for the D3RF sensor-amplifier.
Refer to the instruction manual of D3RF (inter-connection type) for further information on each parameter.

Settings Data Area

Index (HEX)	Sub-Index (HEX)	Name	Description	Data type	Read/ Write attribute	Assignable to PDO	Setting value range
80n0 Note: n = ID (0 - F)	00	Module Configuration	Settings information on connected sensor-amplifiers	UINT8	R	-	1C h
	01	Display	Display settings	UINT16	R/W	No	0: Number display 1: Bar display 2: Percentage display
	03	Teach-in Mode CH1	Output 1 teaching mode	UINT16	R/W	No	0: Two-point teach 1: One-point teach 2: Through teach 3: Zone teach 4: Auto-teach 5: Percentage teach 6: Zero percentage teach
	04	Teach-in Mode CH2	Output 2 teaching mode	UINT16	R/W	No	
	05	Response Speed	Response speed setting	UINT16	R/W	No	0: 1-HS (22 µs) 1: 2-FS (85 µs) 2: 3-ST (250 µs) 3: 4-LG (1 ms) 4: 5-PL (2 ms) 5: 6-UL (4 ms) 6: 7-EL (8 ms)
	06	Gain	Emitting power setting	UINT16	R/W	No	0: Low power 1: Medium power 2: High power
	07	MF-Input	External input setting	UINT16	R/W	No	0: External teach input 1: Test input 2: Synchronization input 3: Counter reset input 4: External all teaching input 5: No function

Index (HEX)	Sub-Index (HEX)	Name	Description	Data type	Read/ Write attribute	Assignable to PDO	Setting value range
80n0 Note: n = ID (0 - F)	08	Key Lock	Lock level setting	UINT16	R/W	No	0: Unlocked 1: Lock level 1 (fully locked) 2: Lock level 2 (half locked)
	09	Operation Mode CH1	Output 1 operation mode	UINT16	R/W	No	0: L-on (light on) 1: D-on (dark on)
	0A	Operation Mode CH2	Output 2 operation mode	UINT16	R/W	No	
	0B	Threshold Level CH1 Lower Limit	Lower threshold (Far) setting for output 1	UINT16	R/W	No	-999 - 9999 The range that can be written differs depending on the operation mode.
	0C	Threshold Level CH1 Upper Limit	Upper threshold (Near) setting for output 1	UINT16	R/W	No	-999 - 9999 Can only be accessed in zone teaching mode.
	0D	Threshold Level CH2 Lower Limit	Lower threshold (Far) setting for output 2	UINT16	R/W	No	-999 - 9999 The range that can be written differs depending on the operation mode.
	0E	Threshold Level CH2 Upper Limit	Upper threshold (Near) setting for output 2	UINT16	R/W	No	-999 - 9999 Can only be accessed in zone teaching mode.
	0F	Timer setting CH1	One-shot timer specification for output 1	UINT16	R/W	No	0: Off delay time 1: One-shot timer
	10	Timer setting CH2	One-shot timer specification for output 2	UINT16	R/W	No	
	11	Off delay time	Off delay timer time for output 1	UINT16	R/W	No	0 - 9999: 0 - 9999 ms -1 - -9: 0.1 - 0.9 ms
	12	On delay time	On delay timer time for output 1	UINT16	R/W	No	
	13	Off delay time	Off delay timer time for output 2	UINT16	R/W	No	
	14	On delay time	On delay timer time for output 2	UINT16	R/W	No	
	18	Hysteresis	Hysteresis setting	UINT16	R/W	No	1 - 40
	1A	ASC (Automatic Switching threshold tracking)	ASC setting (automatic sensitivity correction)	UINT16	R/W	No	0: None 1: Normal correction 2: High-speed correction 3: Maximum-speed correction
	1B	Energy Saving	Eco mode setting	UINT16	R/W	No	0: Standard 1: Automatically turn OFF indicators 2: 2x emitting cycle 3: Display and emitting cycle
	1C	Reverse Display	Reverse display setting	UINT16	R/W	No	0: Standard 1: Reverse display

Index (HEX)	Sub-Index (HEX)	Name	Description	Data type	Read/ Write attribute	Assignable to PDO	Setting value range
80n1 Note: n = ID (0 - F)	00	Module Commands	Operation information on connected sensor-amplifiers	UINT8	R	-	0D h
	01	Store Zero-reset	Execute zero reset	UINT16	W	No	0 - 65535: Execute
	02	Cancel Zero-reset	Clear zero reset	UINT16	W	No	0 - 65535: Execute
	03	Teach in 1 Point	First teaching	UINT16	W	No	1: Teach for output 1 2: Teach for output 2
	04	Teach in 2 Point	Second teaching	UINT16	W	No	
	0B	Warm start Reset	Restart instruction	UINT16	W	No	3: Execute restart
	0C	Go back to Top Menu Operation	Back to top menu	UINT16	W	No	Execute by writing values
	0D	Factory setting initialization	Initialize setting values	UINT16	W	No	3: Execute initialization (only allowed when unlocked)

Expansion Unit Information Area

Index (HEX)	Sub-Index (HEX)	Name	Description	Data type	Read/Write attribute	Assignable to PDO	Setting value range
90n0 Note: n = ID (0 - F)	00	Module Identification	Identification information on connected sensor-amplifiers	UINT8	R	-	09 h
	01	Product Series	Product series	UINT16	R	No	2101 h: Fiber amplifier 1 output 2102 h: Fiber amplifier 2 output
	02	Product Type	Product type	UINT16	R	No	0017 h
	03	Firmware Version	Firmware version	UINT16	R	No	0100h
	04	Protocol Version	Protocol version	UINT16	R	No	0000 h
	05	Product Revision	Version number of product hardware	UINT16	R	No	0000 h
	06	Vender Name	Vendor name	STRG (7)	R	No	“OPTEX FA”
	07	Product Name	Product name	STRG (4)	R	No	“D3RF”
	08	Product ID	Product ID	UINT16	R	No	-
	09	User ID	User ID (maximum 32 characters)	STRG (32)	R	No	All 20 h

Diagnostic Information Area

Index (HEX)	Sub-Index (HEX)	Name	Description	Data type	Read/Write attribute	Assignable to PDO	Setting value range
A0n1 Note: n = ID (0 - F)	00	Module Diagnoses	Status of D3RF unit	UINT8	R	-	02 h
	01	Operation Status	Operation status of D3RF 0000 h: Initializing 0001 h: Idle 0002 h: Operating 0003 h: Key operation in progress by user	UINT16	R	No	0000 h
	02	Error code	Latest error code for D3RF	UINT16	R/W	No	Error code (refer to “5-3 List of Error Codes for Each Device” (Page 5-4))

3-7-2 Parameters of D3WF Fiber Amplifier (Inter-connection Type)

This table indicates the parameters related to the settings, operations, and status confirmation for the D3WF sensor-amplifier.
Refer to the instruction manual of D3WF (inter-connection type) for further information on each parameter.

Settings Data Area

Index (HEX)	Sub-Index (HEX)	Name	Description	Data type	Read/ Write attribute	Assignable to PDO	Setting value range
80n0 Note: n = ID (0 - F)	00	Module Configuration	Settings information on connected sensor-amplifiers	UINT8	R	-	1C h
	01	Display	Display settings	UINT16	R/W	No	0: Number display 1: Bar display 2: Percentage display
	03	Teach-in Mode CH1	Output 1 teaching mode	UINT16	R/W	No	0: One-point teach 1: Two-point teach 2: Dynamic teach
	04	Teach-in Mode CH2	Output 2 teaching mode	UINT16	R/W	No	
	05	Response Speed	Response speed setting	UINT16	R/W	No	0: 16 µs 1: 200 µs
	06	Gain	Emitting power setting	UINT16	R/W	No	0: Low power 1: Standard power 2: High power 3: Automatic power
	07	MF-Input	External input setting	UINT16	R/W	No	0: Extended input 1: All teach (main unit only) 2: Toggle between light on and dark on 3: Test input 4: Off
	08	Key Lock	Lock level setting	UINT16	R/W	No	0: Cancel 1: Lock 2: Lock except extended input
	09	Operation Mode CH1	Output 1 operation mode	UINT16	R/W	No	0: Automatic 1: L-on (light on) 2: D-on (dark on)
	0A	Operation Mode CH2	Output 2 operation mode	UINT16	R/W	No	
	0B	Threshold Level CH1 Lower Limit	Lower threshold (Far) setting for output 1	UINT16	R/W	No	-999 - 9999 The range that can be written differs depending on the operation mode.
	0D	Threshold Level CH2 Lower Limit	Lower threshold (Far) setting for output 2	UINT16	R/W	No	-999 - 9999 The range that can be written differs depending on the operation mode.

Index (HEX)	Sub-Index (HEX)	Name	Description	Data type	Read/ Write attribute	Assignable to PDO	Setting value range
80n0 Note: n = ID (0 - F)	0F	Timer setting CH1	One-shot timer specification for output 1	UINT16	R/W	No	0: Delay out 1: Individual
	10	Timer setting CH2	One-shot timer specification for output 2	UINT16	R/W	No	
	11	Off delay time	Off delay timer time for output 1	UINT16	R/W	No	0 - 9999: 0 - 9999 ms -1 - -9: 0.1 - 0.9 ms
	12	On delay time	On delay timer time for output 1	UINT16	R/W	No	
	13	Off delay time	Off delay timer time for output 2	UINT16	R/W	No	
	14	On delay time	On delay timer time for output 2	UINT16	R/W	No	
	16	Synchronisation	Synchronization	UINT16	R/W	No	0: Asynchronous 1: Synchronous
	18	Sensitivity	Sensitivity	UINT16	R/W	No	0: 10% 1: 20% 2: 0%
	1A	ASC (Automatic Switching threshold tracking)	ASC setting (automatic sensitivity correction)	UINT16	R/W	No	0: Off 1: On
	1B	Energy Saving	Eco mode setting	UINT16	R/W	No	0: Off 1: On
	1C	Reverse Display	Reverse display setting	UINT16	R/W	No	0: Normal display 1: Reverse display
80n1 Note: n = ID (0 - F)	00	Module Commands	Operation command for connected sensor-amplifiers	UINT8	R	-	0D h
	01	Store Zero-reset	Execute zero reset	UINT16	W	No	Execute with writing operation
	02	Cancel Zero-reset	Clear zero reset	UINT16	W	No	Execute with writing operation
	03	Teach in 1 Point	First teaching	UINT16	W	No	1: Teach for output 1 2: Teach for output 2
	04	Teach in 2 Point	Second teaching	UINT16	W	No	
	0B	Warm start Reset	Restart instruction	UINT16	W	No	3: Execute restart
	0C	Go back to Top Menu Operation	Back to top menu	UINT16	W	No	Execute with writing operation
	0D	Factory setting initialization	Initialize setting values	UINT16	W	No	3: Execute initialization (only allowed when unlocked)

Expansion Unit Information Area

Index (HEX)	Sub-Index (HEX)	Name	Description	Data type	Read/ Write attribute	Assignable to PDO	Setting value range
90n0 Note: n = ID (0 - F)	00	Module Identification	Identification information on connected sensor-amplifiers	UINT8	R	-	09 h
	01	Product Series	Product series	UINT16	R	No	2101 h: Fiber amplifier 1 output 2102 h: Fiber amplifier 2 output
	02	Product Type	Product type	UINT16	R	No	0012 h
	03	Firmware Version	Firmware version	UINT16	R	No	0100 h
	04	Protocol Version	Protocol version	UINT16	R	No	0001 h
	05	Product Revision	Version number of product hardware	UINT16	R	No	0001 h
	06	Vender Name	Vendor name	STRG(7)	R	No	“OPTEX FA”
	07	Product Name	Product name	STRG(8)	R	No	“D3WFxxxx”
	08	Product ID	Product ID	UINT16	R	No	-
	09	User ID	User ID (maximum 32 characters)	STRG(32)	R/W	No	All 20 h

Diagnostic Information Area

Index (HEX)	Sub-Index (HEX)	Name	Description	Data type	Read / write attribute	Assignable to PDO	Setting value range
A0n1	00	Module Diagnoses	Status of D3WF unit	UINT8	R	-	02 h
	01	Operation Status	Operation status of D3WF 0000 h: Initializing 0001 h: Idle 0002 h: Operating 0003 h: Key operation in progress by user	UINT16	R	No	0000 h
	02	Error code	Latest error code for D3WF	UINT16	R/W	No	Error code (refer to “5-3 List of Error Codes for Each Device” (Page 5-4))

3-7-3 Parameters of D4RF Fiber Amplifier (Inter-connection Type)

This table indicates the parameters related to the settings, operations, and status confirmation for the D4RF sensor-amplifier.
The parameters differ depending on the model, refer to the table for the applicable.
Refer to the user's manual of D4RF for further information on each parameter.

■ Settings Data Area

D4RF-TM, -TMC4, -TS, -TSC4

Index (HEX)	Sub-Index (HEX)	Name	Description	Data type	Read/ Write attribute	Assignable to PDO	Setting value range
80n0 Note: n = ID (0 - F)	00	D4RF settings (x)	D4RF setting (x)	UINT	R	-	
	01	Display mode CH1	Display mode	UINT	R/W	No	0 to 3 bit: Value 1: Bar graph 2: Percentage 3: Counter 4: Edge 4 to 7 bit: 0: Hold off 1: Hold peak/bottom 2: Hold peak 4: Hold bottom
	02	Display mode CH2	Display mode	UINT	R/W	No	0 to 3 bit: Value 1: Bar graph 2: Percentage 3: Counter 4: Edge 4 to 7 bit: 0: Hold off 1: Hold peak/bottom 2: Hold peak 4: Hold bottom
	03	Display brightness	Brightness	UINT	R/W	No	10 to 100% (unit: 10%) Rounding down to the nearest 10
	04	Rotate display	Rotate display	UINT	R/W	No	0: Off, 1: On
	05	Invert display	Invert display	UINT	R/W	No	0: Off, 1: On
	06	Alarm display	Alarm display	UINT	R/W	No	0: Off, 1: On
	07	Zeroing	Zeroing	UINT	R/W	No	0: Execute, 1: Not used
	08	Eco mode	Eco mode	UINT	R/W	No	0: Off, 1: On
	09	Current channel	Current channel	UINT	R/W	No	0: CH1, 1: CH2
	0A	SP1 CH1	SP1 CH1	UINT	R/W	No	-9999 to 9999
	0B	SP1 CH2	SP1 CH2	UINT	R/W	No	-9999 to 9999
	0C	SP2 CH1	SP2 CH1	UINT	R/W	No	-9999 to 9999
	0D	SP2 CH2	SP2 CH2	UINT	R/W	No	-9999 to 9999
	0E	Received light amount	Received light amount	INT	R	No	-9999 to 9999
	0F	Lock mode	Lock mode	UINT	R/W	No	Bit2: Lock all Bit3: Lock keys

Index (HEX)	Sub-Index (HEX)	Name	Description	Data type	Read/ Write attribute	Assignable to PDO	Setting value range
80n0 Note: n = ID (0 - F	11	Response time	Response time	UINT	R/W	No	6: 16us/22us 5: 70us 4: 250us 3: 500us 2: 1ms 1: 2ms 0: 8ms
	12	Language	Language	UINT	R/W	No	1: English 6: Espanol 7: Chinese 8: Japanese 10: Korean
	13	Timer mode CH1	Timer mode CH1	UINT	R/W	No	0: Deactivated 1: On delay 2: Off delay 3: On/off delay 4: Pulse output, 5: On delay pulse
	14	Timer mode CH2	Timer mode CH2	UINT	R/W	No	0: Deactivated 1: On delay 2: Off delay 3: On/off delay 4: Pulse output, 5: On delay pulse
	15	Time 1 setup CH1	Timer setup 1 CH1	UINT	R/W	No	1 to 30000 (ms)
	16	Time 1 setup CH2	Timer setup 1 CH2	UINT	R/W	No	1 to 30000 (ms)
	17	Time 2 setup CH1	Timer setup 2 CH1	UINT	R/W	No	1 to 30000 (ms)
	18	Time 2 setup CH2	Timer setup 2 CH2	UINT	R/W	No	1 to 30000 (ms)
	19	Hysteresis CH1	Hysteresis CH1	UINT	R/W	No	1 to 90%
	1A	Hysteresis CH2	Hysteresis CH2	UINT	R/W	No	1 to 90%
	1B	Threshold mode CH1	Threshold mode CH1	UINT	R/W	No	0: Deactivated 1: Single 2: Window 128: Edge
	1C	Threshold mode CH2	Threshold mode CH2	UINT	R/W	No	0: Deactivated 1: Single 2: Window 128: Edge
	1D	Edge direction CH1	Edge direction CH1	UINT	R/W	No	0: Positive 1: Negative 2: Both
	1E	Edge direction CH2	Edge direction CH2	UINT	R/W	No	0: Positive 1: Negative 2: Both
	1F	Cycle offset CH1	Cycle offset CH1	UINT	R/W	No	1 to 255
	20	Cycle offset CH2	Cycle offset CH2	UINT	R/W	No	1 to 255

Index (HEX)	Sub-Index (HEX)	Name	Description	Data type	Read/ Write attribute	Assignable to PDO	Setting value range
80n0 Note: n = ID (0 - F)	21	Edge hysteresis CH1	Edge hys. CH1	UINT	R/W	No	1 to 9999
	22	Edge hysteresis CH2	Edge hys. CH2	UINT	R/W	No	1 to 9999
	23	Teach offset	Teach offset	INT	R/W	No	0% to 99%
	24	Teach mode CH1	Teach mode CH1	UINT	R/W	No	0: 1 point 1: 2 points 2: Auto 3: 1-point Zone 4: 2-point Zone 5: Through
	25	Teach mode CH2	Teach mode CH2	UINT	R/W	No	0: 1 point 1: 2 points 2: Auto 3: 1-point Zone 4: 2-point Zone 5: Through
	26	APC	APC	UINT	R/W	No	0: Off, 1: On
	27	ASC	ASC	UINT	R/W	No	0: Off 1: On-normal 2: On-fast 3: On-high
	28	Emitter status	Emitter status	UINT	R/W	No	0: Sender active 1: Sender not active
	29	Emitter power	Emitter power	UINT	R/W	No	0: Maximum 1: Middle 2: Minimum 10: Auto
	2A	Counter	Counter	UINT	R/W	No	0: Off, 1: On
	2B	Set count	Set count	UINT	R/W	No	0 to 16383
	2C	Counter value	Counter value	UINT	R/W	No	0 reset by writing any value.
	2D	Edge min hight jump CH1	Edge min hight jump CH1	UINT	R/W	No	0 to 9999
	2E	Edge min hight jump CH2	Edge min hight jump CH2	UINT	R/W	No	0 to 9999
	2F	Edge max hight jump CH1	Edge max hight jump CH1	UINT	R/W	No	0 to 9999
	30	Edge max hight jump CH2	Edge max hight jump CH2	UINT	R/W	No	0 to 9999
	31	I/O polarity	I/O polarity	UINT	R/W	No	0: PNP 1: NPN 2: Push-pull
	32	Output mode CH1	Outout mode CH1	UINT	R/W	No	0: Light on/ (N.O.) 1: Dark on/ (N.C.)
	33	Output mode CH2	Outout mode CH2	UINT	R/W	No	0: Light on/ (N.O.) 1: Dark on/ (N.C.)
	34	Pin 2 setting	Pin 2 setting	UINT	R/W	No	0: Deactivated 1: Switch signal 2: Alert 3: Teach-in 4: Sender off 5: Counter reset

Index (HEX)	Sub-Index (HEX)	Name	Description	Data type	Read/ Write attribute	Assignable to PDO	Setting value range
80n1 Note: n = ID (0 - F)	00	D4RF commands (x)	D4RF commands (x) x = model e.g.D4RF commands (D4RF-TM)	UINT	R	No	
	01	Teach 1 point	Teach 1 point	UINT	W	No	1: CH1, 2: CH2
	02	Teach 2 points 1st	Teach 2 points 1st	UINT	W	No	1: CH1, 2: CH2
	03	Teach 2 points 2nd	Teach 2 points 2nd	UINT	W	No	1: CH1, 2: CH2
	04	Teach Auto Start	Teach Auto Start	UINT	W	No	1: CH1, 2: CH2
	05	Teach Auto End	Teach Auto End	UINT	W	No	1: CH1, 2: CH2
	06	Teach 1-point zone	Teach 1-point zone	UINT	W	No	1: CH1, 2: CH2
	07	Teach 2-point zone 1st	Teach 2-point zone 1st	UINT	W	No	1: CH1, 2: CH2
	08	Teach 2-point zone 2nd	Teach 2-point zone 2nd	UINT	W	No	1: CH1, 2: CH2
	09	Teach through	Teach through	UINT	W	No	1: CH1, 2: CH2
	0A	Setting reset	Setting reset	UINT	W	No	1: Execute
	0B	Factory reset	Factory reset	UINT	W	No	1: Execute
	0C	Find me	Find me	UINT	R/W	No	0: Off, 1: On
	0D	Restart	Restart	UINT	W	No	1: Execute
	0E	Go to RUN	Go to RUN	UINT	W	No	1: Execute
	0F	Preset settings	Preset settings	UINT	W	No	1: Preset 1 save 2: Preset 2 save 3: Preset 3 save 4: Preset 4 save 5: Preset 5 save
	10	Preset load	Preset load	UINT	W	No	1: Preset 1 load 2: Preset 2 load 3: Preset 3 load 4: Preset 4 load 5: Preset 5 load
	11	Device display Block1	Device display Block1	STRING (16)	R	No	
	12	Device display Block2	Device display Block2	STRING (16)	R	No	
	13	Device display Block3	Device display Block3	STRING (16)	R	No	
	14	Device display Block4	Device display Block4	STRING (16)	R	No	
	15	Device display Block5	Device display Block5	STRING (16)	R	No	

Index (HEX)	Sub-Index (HEX)	Name	Description	Data type	Read/ Write attribute	Assignable to PDO	Setting value range
80n1 Note: n = ID (0 - F)	16	Device buttons	Device buttons	UINT	W	No	Bit0: Plus button Bit1: Minus button Bit2: Menu/OK button Bit3: Teach/ESC button
	17	Device LEDs	Device LEDs	UINT	R	No	0byte: Power LED 1byte: Q1 LED 2byte: Q2 LED 0: off 1: on 2: blink1(1Hz 50:50) 3: blink2(6Hz 50:50) 4: blink3(4Hz 25:75) 5: blink4(1Hz 50:50) 6: blink5(1Hz 90:10)

D4RF-TDM, -TDS, -TDM-Y, TDS-Y

Index (HEX)	Sub-Index (HEX)	Name	Description	Data type	Read/ Write attribute	Assignable to PDO	Setting value range
80n0 Note: n = ID (0 - F)	00	D4RF settings (x)	D4RF setting (x) x = model e.g.D4RF commands (D4RF-TDM)	UINT	R	-	
	01	Display mode CH1	Display mode	UINT	R/W	No	0 to 3 bit: Value 1: Bar graph 2: Percentage 3: Counter 4: Edge 4 to 7 bit: 0: Hold off 1: Hold peak/bottom 2: Hold peak 4: Hold bottom
	02	Display mode CH2	Display mode	UINT	R/W	No	0 to 3 bit: Value 1: Bar graph 2: Percentage 3: Counter 4: Edge 4 to 7 bit: 0: Hold off 1: Hold peak/bottom 2: Hold peak 4: Hold bottom
	03	Display brightness	Brightness	UINT	R/W	No	10 to 100% (unit: 10%) Rounding down to the nearest 10
	04	Rotate display	Rotate display	UINT	R/W	No	0: Off, 1: On
	05	Invert display	Invert display	UINT	R/W	No	0: Off, 1: On
	06	Alarm display	Alarm display	UINT	R/W	No	0: Off, 1: On
	07	Zeroing	Zeroing	UINT	R/W	No	0: Execute, 1: Not used
	08	Eco mode	Eco mode	UINT	R/W	No	0: Off, 1: On
	09	Current channel	Current channel	UINT	R/W	No	0: CH1, 1: CH2
	0A	SP1 CH1	SP1 CH1	UINT	R/W	No	-9999 to 9999
	0B	SP1 CH2	SP1 CH2	UINT	R/W	No	-9999 to 9999
	0C	SP2 CH1	SP2 CH1	UINT	R/W	No	-9999 to 9999
	0D	SP2 CH2	SP2 CH2	UINT	R/W	No	-9999 to 9999
	0E	Received light amount	Received light amount	INT	R	No	-9999 to 9999
	0F	Lock mode	Lock mode	UINT	R/W	No	Bit2: Lock all Bit3: Lock keys
	11	Response time	Response time	UINT	R/W	No	6: 16us/22us 5: 70us 4: 250us 3: 500us 2: 1ms 1: 2ms 0: 8ms
	12	Language	Language	UINT	R/W	No	1: English 6: Espanol 7: Chinese 8: Japanese 10: Korean

Index (HEX)	Sub-Index (HEX)	Name	Description	Data type	Read/ Write attribute	Assignable to PDO	Setting value range
80n0 Note: n = ID (0 - F	13	Timer mode CH1	Timer mode CH1	UINT	R/W	No	0: Deactivated 1: On delay 2: Off delay 3: On/off delay 4: Pulse output, 5: On delay pulse
	14	Timer mode CH2	Timer mode CH2	UINT	R/W	No	0: Deactivated 1: On delay 2: Off delay 3: On/off delay 4: Pulse output, 5: On delay pulse
	15	Time 1 setup CH1	Timer setup 1 CH1	UINT	R/W	No	1 to 30000 (ms)
	16	Time 1 setup CH2	Timer setup 1 CH2	UINT	R/W	No	1 to 30000 (ms)
	17	Time 2 setup CH1	Timer setup 2 CH1	UINT	R/W	No	1 to 30000 (ms)
	18	Time 2 setup CH2	Timer setup 2 CH2	UINT	R/W	No	1 to 30000 (ms)
	19	Hysteresis CH1	Hysteresis CH1	UINT	R/W	No	1 to 90%
	1A	Hysteresis CH2	Hysteresis CH2	UINT	R/W	No	1 to 90%
	1B	Threshold mode CH1	Threshold mode CH1	UINT	R/W	No	0: Deactivated 1: Single 2: Window 128: Edge
	1C	Threshold mode CH2	Threshold mode CH2	UINT	R/W	No	0: Deactivated 1: Single 2: Window 128: Edge
	1D	Edge direction CH1	Edge direction CH1	UINT	R/W	No	0: Positive 1: Negative 2: Both
	1E	Edge direction CH2	Edge direction CH2	UINT	R/W	No	0: Positive 1: Negative 2: Both
	1F	Cycle offset CH1	Cycle offset CH1	UINT	R/W	No	1 to 255
	20	Cycle offset CH2	Cycle offset CH2	UINT	R/W	No	1 to 255
	21	Edge hysteresis CH1	Edge hys. CH1	UINT	R/W	No	1 to 9999
	22	Edge hysteresis CH2	Edge hys. CH2	UINT	R/W	No	1 to 9999
	23	Teach offset	Teach offset	INT	R/W	No	0% to 99%
	24	Teach mode CH1	Teach mode CH1	UINT	R/W	No	0: 1 point 1: 2 points 2: Auto 3: 1-point Zone 4: 2-point Zone 5: Through

Index (HEX)	Sub-Index (HEX)	Name	Description	Data type	Read/ Write attribute	Assignable to PDO	Setting value range
80n0 Note: n = ID (0 - F)	25	Teach mode CH2	Teach mode CH2	UINT	R/W	No	0: 1 point 1: 2 points 2: Auto 3: 1-point Zone 4: 2-point Zone 5: Through
	26	APC	APC	UINT	R/W	No	0: Off, 1: On
	27	ASC	ASC	UINT	R/W	No	0: Off 1: On-normal 2: On-fast 3: On-high
	28	Emitter status	Emitter status	UINT	R/W	No	0: Sender active 1: Sender not active
	29	Emitter power	Emitter power	UINT	R/W	No	0: Maximum 1: Middle 2: Minimum 10: Auto
	2A	Counter	Counter	UINT	R/W	No	0: Off, 1: On
	2B	Set count	Set count	UINT	R/W	No	0 to 16383
	2C	Counter value	Counter value	UINT	R/W	No	0 reset by writing any value.
	2D	Edge min hight jump CH1	Edge min hight jump CH1	UINT	R/W	No	0 to 9999
	2E	Edge min hight jump CH2	Edge min hight jump CH2	UINT	R/W	No	0 to 9999
	2F	Edge max hight jump CH1	Edge max hight jump CH1	UINT	R/W	No	0 to 9999
	30	Edge max hight jump CH2	Edge max hight jump CH2	UINT	R/W	No	0 to 9999
	31	I/O polarity	I/O polarity	UINT	R/W	No	0: PNP 1: NPN 2: Push-pull
	32	Output mode CH1	Outout mode CH1	UINT	R/W	No	0: Light on/ (N.O.) 1: Dark on/ (N.C.)
	33	Output mode CH2	Outout mode CH2	UINT	R/W	No	0: Light on/ (N.O.) 1: Dark on/ (N.C.)
	34	Pin 2 setting	Pin 2 setting	UINT	R/W	No	0: Deactivated 1: Switch signal 2: Alert 3: Teach-in 4: Sender off 5: Counter reset
	35	Pin 5 setting	Pin 5 setting	UINT	R/W	No	0: Deactivated 1: Switch signal 2: Alert output 7: Input acknowledge
80n1 Note: n = ID (0 - F)	00	D4RF commands (x)	D4RF commands (x) x = model e.g.D4RF commands (D4RF-TDM)	UINT	R	No	
	01	Teach 1 point	Teach 1 point	UINT	W	No	1: CH1, 2: CH2

Index (HEX)	Sub-Index (HEX)	Name	Description	Data type	Read/ Write attribute	Assignable to PDO	Setting value range
80n1 Note: n = ID (0 - F)	02	Teach 2 points 1st	Teach 2 points 1st	UINT	W	No	1: CH1, 2: CH2
	03	Teach 2 points 2nd	Teach 2 points 2nd	UINT	W	No	1: CH1, 2: CH2
	04	Teach Auto Start	Teach Auto Start	UINT	W	No	1: CH1, 2: CH2
	05	Teach Auto End	Teach Auto End	UINT	W	No	1: CH1, 2: CH2
	06	Teach 1-point zone	Teach 1-point zone	UINT	W	No	1: CH1, 2: CH2
	07	Teach 2-point zone 1st	Teach 2-point zone 1st	UINT	W	No	1: CH1, 2: CH2
	08	Teach 2-point zone 2nd	Teach 2-point zone 2nd	UINT	W	No	1: CH1, 2: CH2
	09	Teach through	Teach through	UINT	W	No	1: CH1, 2: CH2
	0A	Setting reset	Setting reset	UINT	W	No	1: Execute
	0B	Factory reset	Factory reset	UINT	W	No	1: Execute
	0C	Find me	Find me	UINT	R/W	No	0: Off, 1: On
	0D	Restart	Restart	UINT	W	No	1: Execute
	0E	Go to RUN	Go to RUN	UINT	W	No	1: Execute
	0F	Preset settings	Preset settings	UINT	W	No	1: Preset 1 save 2: Preset 2 save 3: Preset 3 save 4: Preset 4 save 5: Preset 5 save
	10	Preset load	Preset load	UINT	W	No	1: Preset 1 load 2: Preset 2 load 3: Preset 3 load 4: Preset 4 load 5: Preset 5 load
	11	Device display Block1	Device display Block1	STRING (16)	R	No	
	12	Device display Block2	Device display Block2	STRING (16)	R	No	
	13	Device display Block3	Device display Block3	STRING (16)	R	No	
	14	Device display Block4	Device display Block4	STRING (16)	R	No	
	15	Device display Block5	Device display Block5	STRING (16)	R	No	
	16	Device buttons	Device buttons	UINT	W	No	Bit0: Plus button Bit1: Minus button Bit2: Menu/OK button Bit3: Teach/ESC button
	17	Device LEDs	Device LEDs	UINT	R	No	0byte: Power LED 1byte: Q1 LED 2byte: Q2 LED 0: off 1: on 2: blink1(1Hz 50:50) 3: blink2(6Hz 50:50) 4: blink3(4Hz 25:75) 5: blink4(1Hz 50:50) 6: blink5(1Hz 90:10)

D4RF-TM-0, -TS-0

Index (HEX)	Sub-Index (HEX)	Name	Description	Data type	Read/ Write attribute	Assignable to PDO	Setting value range
80n0 Note: n = ID (0 - F)	00	D4RF settings (x)	D4RF setting (x) x = model e.g.D4RF commands (D4RF-TM-0)	UINT	R	-	
	01	Display mode CH1	Display mode	UINT	R/W	No	0 to 3 bit: Value 1: Bar graph 2: Percentage 3: Counter 4: Edge 4 to 7 bit: 0: Hold off 1: Hold peak/bottom 2: Hold peak 4: Hold bottom
	02	Display mode CH2	Display mode	UINT	R/W	No	0 to 3 bit: Value 1: Bar graph 2: Percentage 3: Counter 4: Edge 4 to 7 bit: 0: Hold off 1: Hold peak/bottom 2: Hold peak 4: Hold bottom
	03	Display brightness	Brightness	UINT	R/W	No	10 to 100% (unit: 10%) Rounding down to the nearest 10
	04	Rotate display	Rotate display	UINT	R/W	No	0: Off, 1: On
	05	Invert display	Invert display	UINT	R/W	No	0: Off, 1: On
	06	Alarm display	Alarm display	UINT	R/W	No	0: Off, 1: On
	07	Zeroing	Zeroing	UINT	R/W	No	0: Execute, 1: Not used
	08	Eco mode	Eco mode	UINT	R/W	No	0: Off, 1: On
	09	Current channel	Current channel	UINT	R/W	No	0: CH1, 1: CH2
	0A	SP1 CH1	SP1 CH1	UINT	R/W	No	-9999 to 9999
	0B	SP1 CH2	SP1 CH2	UINT	R/W	No	-9999 to 9999
	0C	SP2 CH1	SP2 CH1	UINT	R/W	No	-9999 to 9999
	0D	SP2 CH2	SP2 CH2	UINT	R/W	No	-9999 to 9999
	0E	Received light amount	Received light amount	INT	R	No	-9999 to 9999
	0F	Lock mode	Lock mode	UINT	R/W	No	Bit2: Lock all Bit3: Lock keys
80n0 Note: n = ID (0 - F	11	Response time	Response time	UINT	R/W	No	6: 16us/22us 5: 70us 4: 250us 3: 500us 2: 1ms 1: 2ms 0: 8ms
	12	Language	Language	UINT	R/W	No	1: English 6: Espanol 7: Chinese 8: Japanese 10: Korean

Index (HEX)	Sub-Index (HEX)	Name	Description	Data type	Read/ Write attribute	Assignable to PDO	Setting value range
80n0 Note: n = ID (0 - F	13	Timer mode CH1	Timer mode CH1	UINT	R/W	No	0: Deactivated 1: On delay 2: Off delay 3: On/off delay 4: Pulse output, 5: On delay pulse
	14	Timer mode CH2	Timer mode CH2	UINT	R/W	No	0: Deactivated 1: On delay 2: Off delay 3: On/off delay 4: Pulse output, 5: On delay pulse
	15	Time 1 setup CH1	Timer setup 1 CH1	UINT	R/W	No	1 to 30000 (ms)
	16	Time 1 setup CH2	Timer setup 1 CH2	UINT	R/W	No	1 to 30000 (ms)
	17	Time 2 setup CH1	Timer setup 2 CH1	UINT	R/W	No	1 to 30000 (ms)
	18	Time 2 setup CH2	Timer setup 2 CH2	UINT	R/W	No	1 to 30000 (ms)
	19	Hysteresis CH1	Hysteresis CH1	UINT	R/W	No	1 to 90%
	1A	Hysteresis CH2	Hysteresis CH2	UINT	R/W	No	1 to 90%
	1B	Threshold mode CH1	Threshold mode CH1	UINT	R/W	No	0: Deactivated 1: Single 2: Window 128: Edge
	1C	Threshold mode CH2	Threshold mode CH2	UINT	R/W	No	0: Deactivated 1: Single 2: Window 128: Edge
	1D	Edge direction CH1	Edge direction CH1	UINT	R/W	No	0: Positive 1: Negative 2: Both
	1E	Edge direction CH2	Edge direction CH2	UINT	R/W	No	0: Positive 1: Negative 2: Both
	1F	Cycle offset CH1	Cycle offset CH1	UINT	R/W	No	1 to 255
	20	Cycle offset CH2	Cycle offset CH2	UINT	R/W	No	1 to 255
	21	Edge hysteresis CH1	Edge hys. CH1	UINT	R/W	No	1 to 9999
	22	Edge hysteresis CH2	Edge hys. CH2	UINT	R/W	No	1 to 9999
	23	Teach offset	Teach offset	INT	R/W	No	0% to 99%
	24	Teach mode CH1	Teach mode CH1	UINT	R/W	No	0: 1 point 1: 2 points 2: Auto 3: 1-point Zone 4: 2-point Zone 5: Through

Index (HEX)	Sub-Index (HEX)	Name	Description	Data type	Read/ Write attribute	Assignable to PDO	Setting value range
80n0 Note: n = ID (0 - F)	25	Teach mode CH2	Teach mode CH2	UINT	R/W	No	0: 1 point 1: 2 points 2: Auto 3: 1-point Zone 4: 2-point Zone 5: Through
	26	APC	APC	UINT	R/W	No	0: Off, 1: On
	27	ASC	ASC	UINT	R/W	No	0: Off 1: On-normal 2: On-fast 3: On-high
	28	Emitter status	Emitter status	UINT	R/W	No	0: Sender active 1: Sender not active
	29	Emitter power	Emitter power	UINT	R/W	No	0: Maximum 1: Middle 2: Minimum 10: Auto
	2A	Counter	Counter	UINT	R/W	No	0: Off, 1: On
	2B	Set count	Set count	UINT	R/W	No	0 to 16383
	2C	Counter value	Counter value	UINT	R/W	No	0 reset by writing any value.
	2D	Edge min hight jump CH1	Edge min hight jump CH1	UINT	R/W	No	0 to 9999
	2E	Edge min hight jump CH2	Edge min hight jump CH2	UINT	R/W	No	0 to 9999
	2F	Edge max hight jump CH1	Edge max hight jump CH1	UINT	R/W	No	0 to 9999
	30	Edge max hight jump CH2	Edge max hight jump CH2	UINT	R/W	No	0 to 9999
	32	Output mode CH1	Outout mode CH1	UINT	R/W	No	0: Light on/ (N.O.) 1: Dark on/ (N.C.)
	33	Output mode CH2	Outout mode CH2	UINT	R/W	No	0: Light on/ (N.O.) 1: Dark on/ (N.C.)
	00	D4RF commands (x)	D4RF commands (x) x = model e.g.D4RF commands (D4RF-TM-0)	UINT	R	No	
0n1 Note: n = ID (0 - F)	01	Teach 1 point	Teach 1 point	UINT	W	No	1: CH1, 2: CH2
	02	Teach 2 points 1st	Teach 2 points 1st	UINT	W	No	1: CH1, 2: CH2
	03	Teach 2 points 2nd	Teach 2 points 2nd	UINT	W	No	1: CH1, 2: CH2
	04	Teach Auto Start	Teach Auto Start	UINT	W	No	1: CH1, 2: CH2
	05	Teach Auto End	Teach Auto End	UINT	W	No	1: CH1, 2: CH2
	06	Teach 1-point zone	Teach 1-point zone	UINT	W	No	1: CH1, 2: CH2
	07	Teach 2-point zone 1st	Teach 2-point zone 1st	UINT	W	No	1: CH1, 2: CH2

Index (HEX)	Sub-Index (HEX)	Name	Description	Data type	Read/ Write attribute	Assignable to PDO	Setting value range
80n1 Note: n = ID (0 - F)	08	Teach 2-point zone 2nd	Teach 2-point zone 2nd	UINT	W	No	1: CH1, 2: CH2
	09	Teach through	Teach through	UINT	W	No	1: CH1, 2: CH2
	0A	Setting reset	Setting reset	UINT	W	No	1: Execute
	0B	Factory reset	Factory reset	UINT	W	No	1: Execute
	0C	Find me	Find me	UINT	R/W	No	0: Off, 1: On
	0D	Restart	Restart	UINT	W	No	1: Execute
	0E	Go to RUN	Go to RUN	UINT	W	No	1: Execute
	0F	Preset settings	Preset settings	UINT	W	No	1: Preset 1 save 2: Preset 2 save 3: Preset 3 save 4: Preset 4 save 5: Preset 5 save
	10	Preset load	Preset load	UINT	W	No	1: Preset 1 load 2: Preset 2 load 3: Preset 3 load 4: Preset 4 load 5: Preset 5 load
	11	Device display Block1	Device display Block1	STRING (16)	R	No	
	12	Device display Block2	Device display Block2	STRING (16)	R	No	
	13	Device display Block3	Device display Block3	STRING (16)	R	No	
	14	Device display Block4	Device display Block4	STRING (16)	R	No	
	15	Device display Block5	Device display Block5	STRING (16)	R	No	
	16	Device buttons	Device buttons	UINT	W	No	Bit0: Plus button Bit1: Minus button Bit2: Menu/OK button Bit3: Teach/ESC button
	17	Device LEDs	Device LEDs	UINT	R	No	0byte: Power LED 1byte: Q1 LED 2byte: Q2 LED 0: off 1: on 2: blink1(1Hz 50:50) 3: blink2(6Hz 50:50) 4: blink3(4Hz 25:75) 5: blink4(1Hz 50:50) 6: blink5(1Hz 90:10)

D4RF-MC4, -S

Index (HEX)	Sub-Index (HEX)	Name	Description	Data type	Read/ Write attribute	Assignable to PDO	Setting value range
80n0 Note: n = ID (0 - F)	00	D4RF settings (x)	D4RF setting (x) x = model e.g.D4RF commands (D4RF-MC4)	UINT	R	-	

Index (HEX)	Sub-Index (HEX)	Name	Description	Data type	Read/ Write attribute	Assignable to PDO	Setting value range
80n0 Note: n = ID (0 - F)	07	Zeroing	Zeroing	UINT	R/W	No	0: Execute, 1: Not used
	08	Eco mode	Eco mode	UINT	R/W	No	0: Off, 1: On
	09	Current channel	Current channel	UINT	R/W	No	0: CH1, 1: CH2
	0A	SP1 CH1	SP1 CH1	UINT	R/W	No	-9999 to 9999
	0B	SP1 CH2	SP1 CH2	UINT	R/W	No	-9999 to 9999
	0C	SP2 CH1	SP2 CH1	UINT	R/W	No	-9999 to 9999
	0D	SP2 CH2	SP2 CH2	UINT	R/W	No	-9999 to 9999
	0E	Received light amount	Received light amount	INT	R	No	-9999 to 9999
	11	Response time	Response time	UINT	R/W	No	6: 16us/22us 5: 70us 4: 250us 3: 500us 2: 1ms 1: 2ms 0: 8ms
	12	Language	Language	UINT	R/W	No	1: English 6: Espanol 7: Chinese 8: Japanese 10: Korean
	13	Timer mode CH1	Timer mode CH1	UINT	R/W	No	0: Deactivated 1: On delay 2: Off delay 3: On/off delay 4: Pulse output, 5: On delay pulse
	14	Timer mode CH2	Timer mode CH2	UINT	R/W	No	0: Deactivated 1: On delay 2: Off delay 3: On/off delay 4: Pulse output, 5: On delay pulse
	15	Time 1 setup CH1	Timer setup 1 CH1	UINT	R/W	No	1 to 30000 (ms)
	16	Time 1 setup CH2	Timer setup 1 CH2	UINT	R/W	No	1 to 30000 (ms)
	17	Time 2 setup CH1	Timer setup 2 CH1	UINT	R/W	No	1 to 30000 (ms)
	18	Time 2 setup CH2	Timer setup 2 CH2	UINT	R/W	No	1 to 30000 (ms)
	19	Hysteresis CH1	Hysteresis CH1	UINT	R/W	No	1 to 90%
	1A	Hysteresis CH2	Hysteresis CH2	UINT	R/W	No	1 to 90%
	1B	Threshold mode CH1	Threshold mode CH1	UINT	R/W	No	0: Deactivated 1: Single 2: Window 128: Edge
	1C	Threshold mode CH2	Threshold mode CH2	UINT	R/W	No	0: Deactivated 1: Single 2: Window 128: Edge

Index (HEX)	Sub-Index (HEX)	Name	Description	Data type	Read/ Write attribute	Assignable to PDO	Setting value range
80n0 Note: n = ID (0 - F)	1D	Edge direction CH1	Edge direction CH1	UINT	R/W	No	0: Positive 1: Negative 2: Both
	1E	Edge direction CH2	Edge direction CH2	UINT	R/W	No	0: Positive 1: Negative 2: Both
	1F	Cycle offset CH1	Cycle offset CH1	UINT	R/W	No	1 to 255
	20	Cycle offset CH2	Cycle offset CH2	UINT	R/W	No	1 to 255
	21	Edge hysteresis CH1	Edge hys. CH1	UINT	R/W	No	1 to 9999
	22	Edge hysteresis CH2	Edge hys. CH2	UINT	R/W	No	1 to 9999
	23	Teach offset	Teach offset	INT	R/W	No	0% to 99%
	24	Teach mode CH1	Teach mode CH1	UINT	R/W	No	0: 1 point 1: 2 points 2: Auto 3: 1-point Zone 4: 2-point Zone 5: Through
	25	Teach mode CH2	Teach mode CH2	UINT	R/W	No	0: 1 point 1: 2 points 2: Auto 3: 1-point Zone 4: 2-point Zone 5: Through
	26	APC	APC	UINT	R/W	No	0: Off, 1: On
	27	ASC	ASC	UINT	R/W	No	0: Off 1: On-normal 2: On-fast 3: On-high
	28	Emitter status	Emitter status	UINT	R/W	No	0: Sender active 1: Sender not active
	29	Emitter power	Emitter power	UINT	R/W	No	0: Maximum 1: Middle 2: Minimum 10: Auto
	2A	Counter	Counter	UINT	R/W	No	0: Off, 1: On
	2B	Set count	Set count	UINT	R/W	No	0 to 16383
	2C	Counter value	Counter value	UINT	R/W	No	0 reset by writing any value.
	2D	Edge min hight jump CH1	Edge min hight jump CH1	UINT	R/W	No	0 to 9999
	2E	Edge min hight jump CH2	Edge min hight jump CH2	UINT	R/W	No	0 to 9999
	2F	Edge max hight jump CH1	Edge max hight jump CH1	UINT	R/W	No	0 to 9999
	30	Edge max hight jump CH2	Edge max hight jump CH2	UINT	R/W	No	0 to 9999
	32	Output mode CH1	Outout mode CH1	UINT	R/W	No	0: Light on/ (N.O.) 1: Dark on/ (N.C.)
	33	Output mode CH2	Outout mode CH2	UINT	R/W	No	0: Light on/ (N.O.) 1: Dark on/ (N.C.)

Index (HEX)	Sub-Index (HEX)	Name	Description	Data type	Read/ Write attribute	Assignable to PDO	Setting value range
0n1 Note: n = ID (0 - F)	00	D4RF commands (x)	D4RF commands (x) x = model e.g.D4RF commands (D4RF-MC4)	UINT	R	No	
	01	Teach 1 point	Teach 1 point	UINT	W	No	1: CH1, 2: CH2
	02	Teach 2 points 1st	Teach 2 points 1st	UINT	W	No	1: CH1, 2: CH2
	03	Teach 2 points 2nd	Teach 2 points 2nd	UINT	W	No	1: CH1, 2: CH2
	04	Teach Auto Start	Teach Auto Start	UINT	W	No	1: CH1, 2: CH2
	05	Teach Auto End	Teach Auto End	UINT	W	No	1: CH1, 2: CH2
	06	Teach 1-point zone	Teach 1-point zone	UINT	W	No	1: CH1, 2: CH2
	07	Teach 2-point zone 1st	Teach 2-point zone 1st	UINT	W	No	1: CH1, 2: CH2
	08	Teach 2-point zone 2nd	Teach 2-point zone 2nd	UINT	W	No	1: CH1, 2: CH2
	09	Teach through	Teach through	UINT	W	No	1: CH1, 2: CH2
	0A	Setting reset	Setting reset	UINT	W	No	1: Execute
	0B	Factory reset	Factory reset	UINT	W	No	1: Execute
	0C	Find me	Find me	UINT	R/W	No	0: Off, 1: On
	0D	Restart	Restart	UINT	W	No	1: Execute
	0E	Go to RUN	Go to RUN	UINT	W	No	1: Execute
	0F	Preset settings	Preset settings	UINT	W	No	1: Preset 1 save 2: Preset 2 save 3: Preset 3 save 4: Preset 4 save 5: Preset 5 save
	10	Preset load	Preset load	UINT	W	No	1: Preset 1 load 2: Preset 2 load 3: Preset 3 load 4: Preset 4 load 5: Preset 5 load
	17	Device LEDs	Device LEDs	UINT	R	No	0byte: Power LED 1byte: Q1 LED 2byte: Q2 LED 0: off 1: on 2: blink1(1Hz 50:50) 3: blink2(6Hz 50:50) 4: blink3(4Hz 25:75) 5: blink4(1Hz 50:50) 6: blink5(1Hz 90:10)

Expansion Unit Information Area

D4RF all models

Index (HEX)	Sub-Index (HEX)	Name	Description	Data type	Read/ Write attribute	Assignable to PDO	Setting value range
90n0 Note: n = ID (0 - F)	00	D4RF information (x)	D4RF information (x) x = model e.g.D4RF commands (D4RF-TS)	UINT	R	No	
	01	Product series	Product series	UINT	R	No	2110 h: D4RF-TM, -TMC4, -TS, -TSC4 2111 h: D4RF-TDM, -TDS, -TDM-Y, TDS-Y 2112 h: D4RF-TM-0, -TS-0 2113 h: D4RF-MC4, -S
	02	Product type	Product type	UINT	R	No	0x0011 (fixed value)
	03	Firmware version	Firmware version	UINT	R	No	0xabcd a, b, cd d D=0, R=1, S=2
	04	Protocol version	Protocol version	UINT	R	No	0x0001
	05	Product Revision	Product Revision	UINT	R	No	0xXXXX
	06	Vendor name	Vendor name	STRING (16)	R	No	”OPTEX FA”
	07	Product name	Product name	STRING (32)	R	No	Actual product type name
	08	Product ID	Product ID	STRING (16)	R	No	Actual product type code
	09	User Tag name	User Tag name	STRING (32)	R/W	No	*****(default)
	0A	Serial number	Serial number	STRING (16)	R	No	-
	0B	Temperature	Temperature	INT	R	No	XX deg C
	0C	Operating time	Operating time	UINT	R	No	XX hours
	0D	Total time	Total time	UINT	R	No	XX hours
	0E	No. of devices	No. of devices	UINT	R	No	1 to 16
	0F	Edge peak Max	Edge peak Max	INT	R/W	No	0 to 9999, Write any value to execute reset the value on Max. and Min.
	10	Edge peak Min	Edge peak Min	INT	R/W	No	-9999 to 0, Write any value to execute reset the value on Max. and Min.

Diagnostic Information Area

D4RF-TM, -TMC4, -TS, -TSC4, -TDM, -TDS, -TDM-Y, TDS-Y

Index (HEX)	Sub-Index (HEX)	Name	Description	Data type	Read/ Write attribute	Assignable to PDO	Setting value range
A0n0 Note: n = ID (0 - F)	00	D4RF status (x)	D4RF status (x) x = model e.g.D4RF status (D4RF-TM)	UINT	R	-	02 h
	01	Operation Status	Operation Status	UINT	R	No	0000 h: Initializing 0001 h: Teaching 0002 h: Operating 0003 h: Key operation in progress by user
	02	Error code	Error code	UINT	R/W	No	Error code (refer to “5-3 List of Error Codes for Each Device” (Page 5-4))
	03	Input signal status	Input signal status	UINT	R	No	0: off, 1: on
	04	Teach status	Teach status	UINT	R	No	-
	05	Received light	Received light	UINT	R	No	0 to 254: %, 255: Not supported

D4RF-TM-0, -TS-0, -MC4, -S

Index (HEX)	Sub-Index (HEX)	Name	Description	Data type	Read/ Write attribute	Assignable to PDO	Setting value range
A0n0 Note: n = ID (0 - F)	00	D4RF status (x)	D4RF status (x) x = model e.g.D4RF status (D4RF-TM-0)	UINT	R	-	02 h
	01	Operation Status	Operation Status	UINT	R	No	0000 h: Initializing 0001 h: Teaching 0002 h: Operating 0003 h: Key operation in progress by user
	02	Error code	Error code	UINT	R/W	No	Error code (refer to “5-3 List of Error Codes for Each Device” (Page 5-4))
	04	Teach status	Teach status	UINT	R	No	-
	05	Received light	Received light	UINT	R	No	0 to 254: %, 255: Not supported

3-7-4 Parameters of CDA Sensor-amplifier

This table indicates the parameters related to the settings, operations, and status confirmation for the CDA sensor-amplifier.

The parameters that can be assigned differ depending on the connected sensor as follows.

- Compact laser displacement sensor, CD22 series (RS-485 communication type)
- Through-beam edge sensor, TD1 series

Refer to the instruction manual of CD22, TD1 and CDA for further information on each parameter.

■ CD22 Series (RS-485 Communication Type)

● Settings Data Area

Settings of CDA Sensor-amplifier

Index (HEX)	Sub-Index (HEX)	Name	Description	Data type	Read/ Write attribute	Assignable to PDO	Setting value range
80n0 Note: n = ID (0 - F)	00	Module Configuration	Settings information on connected sensor-amplifiers and sensors	UINT8	R	-	38 h
	01	Threshold Near	External output threshold (Near)	UINT16	R/W	No	-32768 - 32767
	02	Threshold Far	External output threshold (Far)	UINT16	R/W	No	
	03	Hysteresis Exit	External output hysteresis setting	UINT16	R/W	No	0 - 32767
	04	Calculation Flags	Calculation flag (setting value for each connected sensor)	UINT16	R/W	No	0: No calculation 1: Calculation
	05	Calculation Coefficient Addition	Sensor measurement addition coefficient (A) (setting value for each connected sensor)	UINT16	R/W	No	-10000 - 10000
	06	Calculation Coefficient Multiplication	Sensor measurement multiplication coefficient (M) (setting value for each connected sensor)	UINT16	R/W	No	-10000 - 10000
	07	Calculation Coefficient Division	Sensor measurement division coefficient (D) (setting value for each connected sensor)	UINT16	R/W	No	1 - 32767
	08	Monitor Calculation Values	Calculation result monitor	UINT16	R/W	No	0: Measurement value for sensor 2 1: Calculation result

Index (HEX)	Sub-Index (HEX)	Name	Description	Data type	Read/ Write attribute	Assignable to PDO	Setting value range
80n0 Note: n = ID (0 - F)	09	Calculation Values Head1	Calculation of measurement values for sensor 1	UINT16	R/W	No	0: None 1: Addition 2: Subtraction 3: Absolute difference
	0A	Calculation Values Head2	Calculation of measurement values for sensor 2	UINT16	R/W	No	
	0B	Calculation Values Unit left Head1	Calculation of measurement values for left sensor 1	UINT16	R/W	No	
	0C	Calculation Values Unit left Head2	Calculation of measurement values for left sensor 2	UINT16	R/W	No	
	0D	I/O polarity	I/O polarity	UINT16	R/W	No	0: PNP (N.O.) 1: NPN (N.O.) 2: PNP (N.C.) 3: NPN (N.C.)
	0E	Selection Exit Out1	Select function for external output 1	UINT16	R/W	No	0: No output 1: Within threshold range for calculation results (GO) 2: Outside near range for calculation results (LO) 3: Outside far range for calculation results (HI) 4: Within threshold range for sensor 1 (GO) 5: Outside near range for sensor 1 (LO) 6: Outside far range for sensor 1 (HI) 7: Within threshold range for sensor 2 (GO) 8: Outside near range for sensor 2 (LO) 9: Outside far range for sensor 2 (HI)
	0F	Selection Exit Out2	Select function for external output 2	UINT16	R/W	No	
	10	Selection Exit Out3	Select function for external output 3	UINT16	R/W	No	
	11	Selection of external Entrance	Select external input	UINT16	R/W	No	0: No function 1: Teaching (rising on far side, falling on near side) 2: BGS/FGS teaching 3: Zero reset 4: Laser emitting off
	12	Selection Analog Exit	Select analog output	UINT16	R/W	No	0: None 1: Calculation results 2: Sensor 1 3: Sensor 2
	13	Analog Scaling	Analog scaling	UINT16	R/W	No	0: No scaling 1: Scaling
	14	Analog Scaling (max.) 10 V / 20 mA	Max analog scaling	UINT16	R/W	No	-32768 - 32767
	15	Analog Scaling (min.) 0 V / 4 mA	Min analog scaling	UINT16	R/W	No	

Index (HEX)	Sub-Index (HEX)	Name	Description	Data type	Read/ Write attribute	Assignable to PDO	Setting value range
80n0 Note: n = ID (0 - F)	16	Baudrate	Sensor head communication speed (setting value for each connected sensor)	UINT16	R/W	No	0: No connection (unit for values below: bps) 1: 9.6k 2: 19.2k 3: 38.4k 4: 57.6k 5: 115.2k 6: 230.4k 7: 312.5k 8: 468.75k 9: 500k 10: 625k 11: 833.3k 12: 937.5k 13: 1250k

● Settings data area (continued)

Settings of Connected CD22 Sensor

Index (HEX)	Sub-Index (HEX)	Name	Setting value name	Data type	Read/ Write attribute	Assignable to PDO	Setting value range		
							CD22 -15-485	CD22 -35-485	CD22 -100-485
80n0 Note: n = ID (0 - F)	1F	Leap Point Close	Output judgment Near threshold	UINT16	R/W	No	-7499 - 7499 (1 µm increments)	-2249 - 2249 (10 µm increments)	-7499 - 7499 (1 µm increments)
	20	Leap Point Away	Output judgment Far threshold	UINT16	R/W	No			
	21	Background ObSB	Output judgment Distance set for FGS2	UINT16	R/W	No			
	22	Tolerance ObSB	Output judgment Operation range for FGS2	UINT16	R/W	No			
	23	Average Number	Number of averaging operations	UINT16	R/W	No	0: 1, 1: 8, 2: 64, 3: 512		
	24	Teach-in-Mode	Teach mode	UINT16	R/W	No	0: Two-point teaching 1: One-point teaching 2: FGS2		
	25	Sampling rate	Sampling period	UINT16	R/W	No	0: 500 µs, 1: 1 ms, 2: 2 ms, 3: 4 ms, 4: Automatic		
	26	Keylock	Key lock function	UINT16	R/W	No	0: No lock 1: Lock		
	27	Switching Behaviour	Select output polarity	UINT16	R/W	No	0: Light on (on within range) 1: Dark on (on outside range)		

Index (HEX)	Sub-Index (HEX)	Name	Setting value name	Data type	Read/ Write attribute	Assignable to PDO	Setting value range		
							CD22 -15-485	CD22 -35-485	CD22 -100-485
80n0 Note: n = ID (0 - F)	28	Calibration Distance close	Actual measurement values on near side	UINT16	R/W	No	-7499 - 7499 (1 µm increments)	-2249 - 2249 (10 µm increments)	-7499 - 7499 (1 µm increments)
	29	Calibration distance Away	Actual measurement values on far side	UINT16	R/W	No			
	2A	Error Behaviour	Select alarm operation	UINT16	R/W	No	0: Output clamp error value (H7FFF) 1: Retain last valid measurement value before hold		
	2B	Clamp holding time	Alarm hold count	UINT16	R/W	No	0 - 9999		
	2D	Zeroing Value	Zero reset value	UINT16	R/W	No	-7499 - 7499 (1 µm increments)	-2249 - 2249 (10 µm increments)	-7499 - 7499 (1 µm increments)
	31	Barycenter	Select receiving light waveform	UINT16	R/W	No	0: Waveform with strongest received light level 1: Closest point to sensor 2: Second closest point to sensor 3: Third closest point to sensor 4: Fourth closest point to sensor 5: Fifth closest point to sensor		
	34	Hysteresis Value	Hysteresis	UINT16	R/W	No	-7499 - 7499 (1 µm increments)	-2249 - 2249 (10 µm increments)	-7499 - 7499 (1 µm increments)
	35	Sensitivity	Sensitivity	UINT16	R/W	No	0: Automatic adjustment, 1: Minimum, 2 Low, 3: Medium, 4: Medium high, 5: High, 6: Maximum		
	36	Light Threshold	Waveform threshold	UINT16	R/W	No	0: Lowest surface, 1: Low position, 2: Center position, 3: High position		
	38	Keylock active	Display indicators	UINT16	R/W	No	0: Continue displaying when locked 1: Turn off when locked		
80n1 Note: n = ID (0 - F)	00	Module Commands	Operation information on connected sensors	UINT8	R	-	0D h		
	01	Save Zero Reposition	Execute zero reset	UINT16	R/W	No	Execute by writing values		
	02	Cancel Zero Reset	Clear zero reset	UINT16	R/W	No	Execute by writing values		
	03	Teach in 1 Point	One-point teaching	UINT16	R/W	No	Execute by writing values		
	04	Teach in 2 Point	Two-point teaching	UINT16	R/W	No	Execute by writing values		
	05	Teach in ObSB	FGS2 teaching	UINT16	R/W	No	Execute by writing values		
	0B	Reset	Restart instruction	UINT16	R/W	No	3: Execute restart		
	0C	Go back to Top Menu Operation	Back to top menu	UINT16	R/W	No	0,1, 2: Execute		
	0D	Reset to Factory Settings	Initialize setting values	UINT16	R/W	No	3: Execute initialization		

Expansion Unit Information Area

Index (HEX)	Sub-Index (HEX)	Name	Description	Data type	Read/ Write attribute	Assignable to PDO	Setting value range
90n0 Note: n = ID (0 - F)	00	Module Identification	Identification information on connected sensors	UINT8	R	-	0A h
	01	Product Range	Product series	UINT16	R	No	1301 h: CD22-15-485 1302 h: CD22-35-4853 1303 h: CD22-100-485
	02	Product Type	Product type	UINT16	R	No	0011 h
	03	Firmware Version	Firmware version	UINT16	R	No	0100 h
	04	Protocol Version	Protocol version	UINT16	R	No	0000 h
	05	Product Revision	Version number of product hardware	UINT16	R	No	0000 h
	06	Vender Name	Vendor name	STRG (7)	R	No	“OPTEX FA”
	07	Product Name	Product name	STRG (11)	R	No	“CD22-XX-XXX”
	08	Product ID	Product ID	UINT16	R	No	-
	09	User ID	User ID (maximum 32 characters)	STRG (32)	R/W	No	All 20 h

Diagnostic Information Area

Index (HEX)	Sub-Index (HEX)	Name	Description	Data type	Read/ Write attribute	Assignable to PDO	Setting value range		
							CD22 -15-485	CD22 -35-485	CD22 -100-485
A0n1 Note: n = ID (0 - F)	00	Module Diagnoses	Status of connected CD22	UINT8	R	-	02 h		
	01	Status	Operation status of connected CD22 0000 h: Initializing 0001 h: Teaching 0002 h: Operating 0003 h: Key operation in progress by user	UINT16	R	No	0000 - 003 h		
	02	Error code	Latest error code for connection CD22	UINT16	R/W	No	Error code (refer to “5-3 List of Error Codes for Each Device” (Page 5-4))		

TD1 Series

Settings Data Area

• Settings of CDA Sensor-amplifier

Index (HEX)	Sub-Index (HEX)	Name	Description	Data type	Read/ Write attribute	Assignable to PDO	Setting value range
80n0 Note: n = ID (0 - F)	00	Module Configuration	Settings information on connected sensor-amplifiers and sensors	UINT8	R	-	38 h
	01	Threshold Near	External output threshold (Near)	UINT16	R/W	No	-32768 - 32767
	02	Threshold Far	External output threshold (Far)	UINT16	R/W	No	
	03	Hysteresis Exit	External output hysteresis setting	UINT16	R/W	No	0 - 32767
	04	Calculation Flags	Calculation flag (setting value for each connected sensor)	UINT16	R/W	No	0: No calculation 1: Calculation
	05	Calculation Coefficient Addition	Sensor measurement addition coefficient (A) (setting value for each connected sensor)	UINT16	R/W	No	-10000 - 10000
	06	Calculation Coefficient Multiplication	Sensor measurement multiplication coefficient (M) (setting value for each connected sensor)	UINT16	R/W	No	-10000 - 10000
	07	Calculation Coefficient Division	Sensor measurement division coefficient (D) (setting value for each connected sensor)	UINT16	R/W	No	1 - 32767
	08	Monitor Calculation Values	Calculation result monitor	UINT16	R/W	No	0: Measurement value for sensor 2 1: Calculation result

Index (HEX)	Sub-Index (HEX)	Name	Description	Data type	Read/ Write attribute	Assignable to PDO	Setting value range
80n0 Note: n = ID (0 - F)	09	Calculation Values Head1	Calculation of measurement values for sensor 1	UINT16	R/W	No	0: None 1: Addition 2: Subtraction 3: Absolute difference
	0A	Calculation Values Head2	Calculation of measurement values for sensor 2	UINT16	R/W	No	
	0B	Calculation Values Unit left Head1	Calculation of measurement values for left sensor 1	UINT16	R/W	No	
	0C	Calculation Values Unit left Head2	Calculation of measurement values for left sensor 2	UINT16	R/W	No	
	0D	I/O polarity	I/O polarity	UINT16	R/W	No	0: PNP (N.O.) 1: NPN (N.O.) 2: PNP (N.C.) 3: NPN (N.C.)
	0E	Selection Exit Out1	Select function for external output 1	UINT16	R/W	No	0: No output 1: Within threshold range for calculation results (GO) 2: Outside near range for calculation results (LO) 3: Outside far range for calculation results (HI) 4: Within threshold range for sensor 1 (GO) 5: Outside near range for sensor 1 (LO) 6: Outside far range for sensor 1 (HI) 7: Within threshold range for sensor 2 (GO) 8: Outside near range for sensor 2 (LO) 9: Outside far range for sensor 2 (HI)
	0F	Selection Exit Out2	Select function for external output 2	UINT16	R/W	No	
	10	Selection Exit Out3	Select function for external output 3	UINT16	R/W	No	
	11	Selection of external Entrance	Select external input	UINT16	R/W	No	0: No function 1: Teaching (rising on far side, falling on near side) 2: BGS/FGS teaching 3: Zero reset 4: Laser emitting off
	12	Selection Analog Exit	Select analog output	UINT16	R/W	No	0: None 1: Calculation results 2: Sensor 1 3: Sensor 2
	13	Analog Scaling	Analog scaling	UINT16	R/W	No	0: No scaling 1: Scaling
	14	Analog Scaling (max.) 10 V / 20 mA	Max analog scaling	UINT16	R/W	No	-32768 - 32767
	15	Analog Scaling (min.) 0 V / 4 mA	Min analog scaling	UINT16	R/W	No	

Index (HEX)	Sub-Index (HEX)	Name	Description	Data type	Read/ Write attribute	Assignable to PDO	Setting value range
80n0 Note: n = ID (0 - F)	16	Baudrate	Sensor head communication speed (setting value for each connected sensor)	UINT16	R/W	No	0: No connection (unit for values below: bps) 1: 9.6k 2: 19.2k 3: 38.4k 4: 57.6k 5: 115.2k 6: 230.4k 7: 312.5k 8: 468.75k 9: 500k 10: 625k 11: 833.3k 12: 937.5k 13: 1250k

● Settings Data Area (continued)

Settings of Connected TD1 Sensor

Index (HEX)	Sub-Index (HEX)	Name	Setting value name	Data type	Read/ Write attribute	Assignable to PDO	Setting value range
80n0 Note: n = ID (0 - F)	23	Average Number	Number of averaging operations	UINT16	R/W	No	1 - 128
	24	Teach-in-Mode	Measurement type	UINT16	R/W	No	0: Edge positive 1: Edge negative 2: Gap / external diameter
	25	Sampling rate	Sampling period	UINT16	R/W	No	0: 500 µs (fixed value)
	2C	Measuring Direction	Measurement direction	UINT16	R/W	No	0: Top to bottom 1: Bottom to top
	2D	Zeroing Value	Offset value	UINT16	R	No	-9.999 - 5.000
	35	Sensitivity	Sensitivity	UINT16	R/W	No	0: Minimum value 1: Second 2: Third 3: Fourth 4: Maximum value 5: Adjusted value
80n1 Note: n = ID (0 - F)	00	Module Commands	Operation information on connected sensors	UINT8	R	-	0D h
	01	Save Zero Reposition	Execute zero reset	UINT16	R/W	No	Execute with writing operation
	02	Cancel Zero Reset	Clear zero reset	UINT16	R/W	No	Execute with writing operation
	0D	Reset to Factory Settings	Initialize setting values	UINT16	R/W	No	3: Execute initialization

Expansion Unit Information Area

Index (HEX)	Sub-Index (HEX)	Name	Description	Data type	Read/ Write attribute	Assignable to PDO	Setting value range
90n0 Note: n = ID (0 - F)	00	Module Identification	Identification information on connected sensors	UINT8	R	-	0A h
	01	Product Range	Product series	UINT16	R	No	2321 h: TD1 2302 h: TD1-K
	02	Product Type	Product type	UINT16	R	No	0011 h
	03	Firmware Version	Firmware version	UINT16	R	No	1011 h
	04	Protocol Version	Protocol version	UINT16	R	No	0000 h
	05	Product Revision	Version number of product hardware	UINT16	R	No	0000 h
	06	Vender Name	Vendor name	STRG(7)	R	No	“OPTEX FA”
	07	Product Name	Product name	STRG(9)	R	No	“TD1-xxxxx”
	08	Product ID	Product ID	UINT16	R	No	-
	09	User ID	User ID (maximum 32 characters)	STRG(32)	R/W	No	All 20 h
	0A	Product Series Amplifier	Amplifier product series	UINT16	R	No	0002 h
	0F	Serial Number	Serial number (set in ASCII code)	UINT16	R	No	-

Diagnostic Information Area

Index (HEX)	Sub-Index (HEX)	Name	Description	Data type	Read/ Write attribute	Assignable to PDO	Setting value range
A0n1 Note: n = ID (0 - F)	00	Module Diagnoses	Status of connected TD1	UINT8	R	-	02 h
	01	Status	Operation status of connected TD1 0000 h: Initializing 0001 h: Teaching 0002 h: Operating 0003 h: Key operation in progress by user	UINT16	R	No	0000 - 003 h
	02	Error code	Latest error code for connection TD1	UINT16	R/W	No	Error code (refer to “5-3 List of Error Codes for Each Device” (Page 5-4))

4

Specifications

This chapter describes the specifications of this unit.

4-1 Specifications

Model		UC1-EC
EtherCAT specifications*1	**Master / slave**	EtherCAT slave
	Conforming standard	IEEE802.3u (100BASE-TX)
	Transfer speed	100Mbps (100BASE-TX)
	Cable	STP Category 5 or higher
	Supported functions	Process data communication, mailbox communication (CoE supported)
	Communication ports	M12 connector × 2
	Distance between nodes	Within 100 m
Connected devices	**Connectable models**	Inter-connection main and expansion unit of D4RF/D3RF/D3WF series Main and expansion unit of CDA series
	Number of units connected	Maximum 16 units*2 (one CDA unit accounts for two units)
	Connection type	5-pin connector for inter-connection (functions as end unit for inter-connection)
Indicators		Power indicator - green (PWR)
		Error indicator - red (ERR)
		Communication status indicator - green (RUN)
		Communication available indicator - green (SYSTEM)
		PORT1 operation indicator - green (L/A1)
		PORT2 operation indicator - green (L/A2)
Data		PDO communication (transmission: max 120 bytes, receipt: max 36 bytes)
		SDO communication
Synchronization mode		Free Run mode (asynchronous) or DC mode 1
Rating	**Power supply voltage**	12 to 24 VDC including ripple (p-p) +/-10%
	Power consumption	Maximum 3 W
Protection circuit		Reverse connection protection
Route stabilization time		1.5 s or less
Environmental resistance	**Ambient temperature range / humidity**	-25 to +55°C/35 to 85% RH (no freezing or condensation)
	Storage temperature / humidity	-40 to +70°C/35 to 85% RH
	Vibration resistance	10 to 55 Hz, double amplitude 1.5 mm, 2 hours in X, Y and Z directions
	Shock resistance	500 m/s2 (approx. 50 G), 3 times in X, Y and Z directions
	Degree of protection	IP50
Applicable laws and regulations	**EMC**	EMC(2014/30/EU)
	Environment	RoHS directive (2011/65/EU), China RoHS (Regulation 32)
Applicable standards		EN 61000-6-2, EN 55011
Company standards		Noise resistance: Passes Feilen Level 3
Mounting		35 mm DIN rail (conductive surface)
Material		Polycarbonate
Included accessories		Instruction manual, M12 protective cap, end plate × 2
Weight		Body around 90 g (including connectors), around 155 g when packaged

*1: EtherCAT is a registered trademark of Beckhoff.

*2: The ambient temperature and maximum number of inter-connections for D3RF, D3WF or D4RF are shown below. However, for use as a UL certified product when 6 to 16 units are interconnected, refer to the instruction manual included with the D4RF.

D3RF/D3WF series

Number of interconnected units	1 to 3	4 to 8	9 to 16
Upper and lower limits of ambient temperature	-25 to +55 ºC	-25 to +50 ºC	-25 to +45 ºC
Max. load current at control output	100 mA	50 mA	0 mA (Control output disabled)

D4RF series

Number of connected units		1	2	3 to 5	6 to 16*
Upper and lower limits of ambient temperature		-25 to +55 ºC	-25 to +55 ºC	-25 to +50 ºC	-25 to +45 ºC
Max. load current per output	**1-output setting**	100 mA	20 mA	20 mA	20 mA
	2-output setting	100 mA	10 mA	10 mA	10 mA

*: For use as a UL certified product when 6 or more units are interconnected, refer to the instruction manual included with the D4RF.

4-2 Data Processing Time

A processing time (total of the following processing times) is required between detection of the applicable sensor and processing of the data by the EtherCAT master.

- Data processing time of applicable sensors or amplifier units
- Data processing time of this unit
- EtherCAT communication period between the EtherCAT master and this unit
- Internal processing time of EtherCAT master

The data processing time of the applicable sensor or amplifier unit and the data processing time of this unit are as follows.

MEMO

Refer to the manual of the EtherCAT master for information on the EtherCAT communication cycle and the internal processing time of the EtherCAT master.

■ Data Processing Time of Applicable Sensors or Amplifier Units

● Data Processing Time of D4RF

Fiber amplifier D4RF can be written without any latency.

● Data Processing Time of D3RF/ D3WF

The D3RF/D3WF fiber amplifier writes setting values requested via this unit to EEPROM before returning a response. As a result, the response time changes depending on the setting value as follows.

• D3RF

Index number 80n0 Note: n = ID (0 - F) Subindex	Setting value name	Conditions	Number of words written	Writing time (ms)*1
01	Display settings		1	5
03	Output 1 teach mode		1	5
04	Output 2 teach mode		1	5
05	Response speed setting	Single output type	8	40
		Single output zone teach	10	50
		Double output type	10	50
		One zone of double output	12	60
		Both zones of double output	14	70
06	Emitting power setting		4	20
07	External input setting		3	15

Index number 80n0 Note: n = ID (0 - F) Subindex	Setting value name	Conditions	Number of words written	Writing time (ms)*1
08	Lock level setting		1	5
09	Output 1 operation mode		1	5
0A	Output 2 operation mode		1	5
0B	Lower threshold (Far) setting for output 1	Edge detection	1	5
		Other	2	10
0C	Upper threshold (Near) setting for output 1		2	10
0D	Lower threshold (Far) setting for output 2		2	10
0E	Upper threshold (Near) setting for output 2		2	10
0F	One-shot timer specification for output 1		2	10
10	One-shot timer specification for output 2		2	10
11	Off delay timer time for output 1		2	10
12	On delay timer time for output 2		2	10
13	Off delay timer time for output 2		2	10
14	On delay timer time for output 2		2	10
18	Hysteresis setting	Single output type	2	10
		Single output zone teaching	3	15
		Double output type	3	15
		One zone of double output	4	20
		Both zones of double output	5	25
1A	ASC setting (automatic sensitivity correction)		1	5
1B	Eco mode setting		3	15
1C	Reverse display setting		1	5

*1: The time varies by several ms depending on the EtherCAT communication cycle.

• **D3WF**

Index number 80n0 Note: n = ID (0 - F) Subindex	Setting value name	Conditions	Number of words written	Writing time (ms)*1
01	Display settings		1	5
03	Output 1 teaching mode		1	5
04	Output 2 teaching mode		1	5
05	Response speed setting	Single output type	8	40
		Single output zone teaching	10	50
		Double output type	10	50
		One zone of double output	12	60
		Both zones of double output	14	70
06	Emitting power setting		4	20
07	External input setting		3	15
08	Lock level setting		1	5
09	Output 1 operation mode		1	5
0A	Output 2 operation mode		1	5
0B	Lower threshold (Far) setting for output 1	Edge detection	1	5
		Other	2	10
0D	Lower threshold (Far) setting for output 2		2	10
0F	One-shot timer specification for output 1		2	10
10	One-shot timer specification for output 2		2	10
11	Off delay timer time for output 1		2	10
12	On delay timer time for output 2		2	10
13	Off delay timer time for output 2		2	10
14	On delay timer time for output 2		2	10
16	Synchronization		2	5
18	Sensitivity		2	5
1A	ASC setting (automatic sensitivity correction)		1	5
1B	Eco mode setting		3	15
1C	Reverse display setting		1	5

*1: The time varies by several ms depending on the EtherCAT communication cycle.

● Data Processing Time of CDA

The CDA displacement sensor amplifier unit writes CDA parameters requested via this unit to EEPROM before returning a response. The response time is 5 ms.

● Data Processing Time of CD22

The CD22 compact laser displacement sensor writes CD22 parameters requested via this unit to EEPROM before returning a response. The response time changes depending on the communication speed setting for communication between CDA and RS-485 as follows.

Communication speed (bps)	Writing time (ms)
9.6k	20
19.2k	10
Other (38.4k - 1250k)	5

● Data Processing Time of TD1

The TD1 through-beam edge sensor writes TD1 parameters requested via this unit to EEPROM before returning a response. The response time changes depending on the communication speed setting for communication between CDA and RS-485 as follows.

Communication speed (bps)	Writing time (ms)
9.6k	20
19.2k	10
Other (38.4k - 1250k)	5

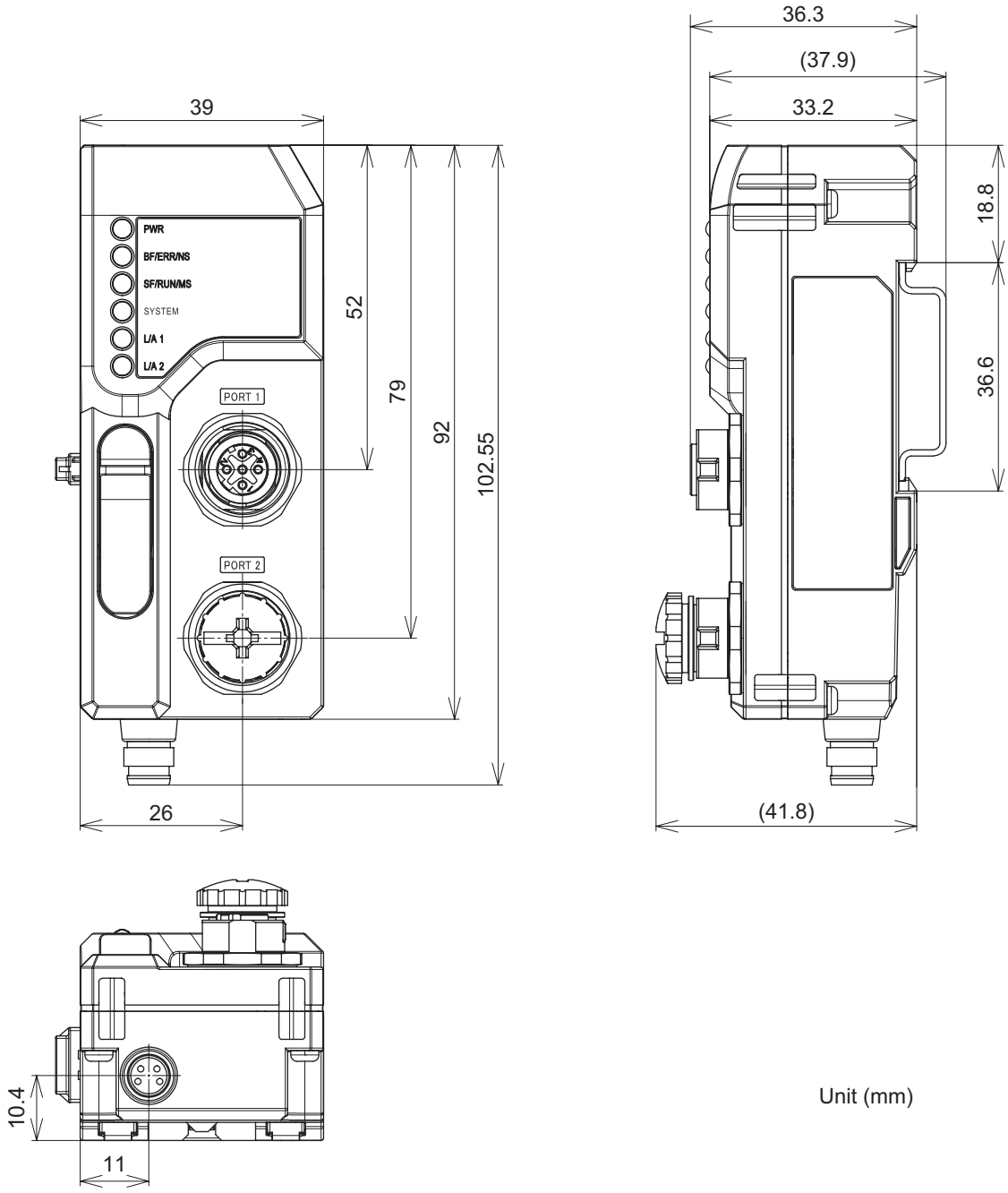
■ Data Processing Time of This Unit

The following processing time is required between detection of the applicable sensor and transmission of data to the EtherCAT master.

Number of units connected	Processing time
1 to 4	160 µs
5 to 8	320 µs
9 to 12	480 µs
13 to 16	640 µs

4-3 Dimensions

UC1-EC



Unit (mm)

5

Troubleshooting

This chapter describes troubleshooting methods for specific errors.

5-1 Types of Error Code

This unit stores the following 2 types of error code in internal storage.

- Sensor-amplifier and sensor connection configuration error codes
- Latest error codes specific to each device

Either type of error code can be read from the master through SDO communication normally or as needed.

Sensor-amplifier and Sensor Configuration Error Codes

When an error occurs in the sensor-amplifier and sensor connection configuration, the error code is stored in this unit's object dictionary index 10F3 h (operation error history).
Stored error codes can be read through SDO communication when "Error notification control of this unit" (index F200 h) is set to 0001 h (enabled).

Item	Storage location in this unit's object dictionary
Sensor-amplifier and sensor connection configuration error codes	Subindex 06 - 15 h of index 10F3 h

Refer to "5-2 Sensor-amplifier and Sensor Configuration Error Codes" (Page 5-3) for more detailed information about each error code.

Latest Error Codes Specific to Each Device

When a device-specific error occurs, the latest error code for each device is stored in this unit's object dictionary index F100 h and A0n1 h as follows.

Item	Storage location in this unit's object dictionary
Latest error code for this unit	Subindex 03 h of index F100 h
Latest error code for D4RF	Subindex 02 h of index A0n1 h Note: n = ID (0 - F)
Latest error code for D3RF	
Latest error code for D3WF	
Latest error code for connection CD22	
Latest error code for connection TD1	

Refer to "5-3 List of Error Codes for Each Device" (Page 5-4) for more information about each error code.

5-2 Sensor-amplifier and Sensor Configuration Error Codes

Sensor-amplifier and sensor configuration error codes are stored in the operation error history (volatile memory).
The storage location is subindex 06 - 15 h of this unit's object dictionary index 10F3 h (Diagnostic History).
Stored error codes can be read through SDO communication when "Error notification control of this unit" (index F200 h) is set to 0001 h (enabled).
Subindex 04h is set to 1 (on) when an error code is stored. Therefore, the stored error code can be read through SDO communication by using this bit as an execution condition.

Error Code	Error type	Error name	Error description	Countermeasure
0006E000 h	Error	Change in the number of interconnected sensor-amplifiers or sensors	The number of interconnected sensor-amplifier units or sensors changed (generally decreased) after the power was turned ON.	There may have been a sensor-amplifier unit or sensor failure, or the power supply may have been turned OFF. Check all interconnected sensor-amplifiers and sensors and their respective power supplies.
0007E000 h	Warning	Configuration error	A configuration error occurred with sensor-amplifier and sensor configuration downloaded to this unit (the current sensor-amplifiers and sensors configuration does not match the configuration set in the master).	Change the sensor-amplifier and sensor configuration on the master-side configuration software to that of the actual device and download it to this unit, or change the configuration of the actual device to match that set in the master and reset the power.
0008E000 h		Invalid inter-connection order	The connection order of the sensor-amplifier unit is incorrect (D3RF or D3WF is interconnected to the right side of D4RF or CDA). In this case, EtherCAT communication can be executed in the OPERATIONAL state, however, the current values sent from the D4RF or CDA to the left of the D3RF or D3WF to the master will be incorrect, as will the setting value set by the master.	Connect the D3RF or D3WF to the left of the D4RF and CDA and reset the power.

MEMO

- Error history data will not be saved to non-volatile memory. Therefore, it will be cleared the next time the power is turned ON.
- "Error notification control of this unit" (index F200 h) must be set to 0001 h (enabled) in order to read the error history. This setting is saved in non-volatile memory, and the setting will be preserved the next time the power is turned ON.

5-3 List of Error Codes for Each Device

The error codes for each device are as follows:

Device	Storage location in this unit's object dictionary
Latest error code for this unit	Subindex 03 h of index F100 h
Latest error code for D4RF	Subindex 02 h of index A0n1 h Note: n = ID (0 - F)
Latest error code for D3RF	
Latest error code for D3WF	
Latest error code for connection CD22	
Latest error code for connection TD1	

Error Codes for This Unit

Error Code	Details
0000 h	No error
0107 h	Configuration error
0108 h	Invalid connection order
0206 h	Change in the number of connected sensor-amplifiers or sensors

Error Codes for Connected Sensor-amplifiers

D4RF

Error Code		Details
High-order byte	Low-order byte	
00 h	00 h	No error.
Applicable address number	01 h	The address number is out of range.
	02 h	The sub address number is out of range.
	03 h	An attempt was made to write a setting value that is out of range.
	04 h	Attempted to write a read-only setting value.
	05 h	Attempted to read a write-only setting value.
	06 h	Other function error.
	07 h	Teach request error.
	08 h	Error during command processing.
	FF h	Other error.

D3RF / D3WF

Error Code		Details
High-order byte	Low-order byte	
00 h	00 h	No error
Relevant index number*1	01 h	The index number is out of range.
	02 h	The sub index number is not supported.
00 h	03 h	An attempt was made to write setting values to sensors that are all locked, or to initialize while locked.
	04 h	The teach target output specification value (1 or 2) is incorrect.
	05 h	Teach mode has no second teach, or the first has not yet been executed.
	06 h	The execution specification value (3) for restart and initialization is incorrect.
Relevant index number*1	07 h	An attempt was made to write a setting value that is out of range.
	08 h	The setting value write operation failed. (Attempted to write a read-only setting value)
00 h	09 h	Teaching to output 2 was attempted while output 2 was in counter mode.
	0B h	The amount of light received during teach was too low.
	0C h	The amount of light received during teach was saturated.
	0D h	There was too little difference in the amount of light received during 2-point teaching.
	0E h	A teaching operation other than auto-teaching was attempted in differential operation mode.
	0F h	A hardware error was detected.

*1: Refer to the respective manual for each device for information regarding the relevant index number.

Error Codes for Connected Sensors

CD22 / TD1

Error Code		Details
High-order byte	Low-order byte	
00 h	00 h	No error
Relevant index number*1	01 h	The index number is out of range.
	02 h	The sub index number is not supported.
	03 h	The ETX code in the command string is invalid.
	04 h	A checksum error was detected.
	05 h	The command code is invalid.
	06 h	A non-regulated parameter was specified.
	07 h	An out of range numeric value was specified.
	08 h	Reserved
	09 h	

*1: Refer to the respective manual for each device for information regarding the relevant index number.

5-4 Troubleshooting List

The following countermeasures should be performed according to the status of the LEDs on the front of this unit and the operation error history.

Phenomenon	Indicators		EtherCAT communication status	Error codes (Error description)	Cause	Countermeasure
	ERR	RUN				
PDO (cyclic) communication cannot be performed	Blinking red	Blinking green	PRE-OPERATIONAL status	0007E000 h (Sensor-amplifier and sensor configuration error)	Module configuration (Sensor-amplifier and sensor configuration) has been downloaded to this unit. The actual sensor-amplifier and sensor configuration does not match the master sensor-amplifier and sensor configuration.*1	Change the sensor-amplifier and sensor configuration on the master-side configuration software to that of the actual device and download it to this unit, or change the configuration of the actual device to match that set in the master and reset the power.
				None (Sensor-amplifier and sensor configuration error)	Module configuration (Sensor-amplifier and sensor configuration) has not been downloaded to this unit. The actual sensor-amplifier and sensor configuration does not match the master sensor-amplifier and sensor configuration.*1	Alter the configuration to match the configuration set in the master and reset the power.
PDO (cyclic) communication can be performed, however, the read / write data is invalid (the read / write data is from an unexpected device)	Off	Lit green	OPERATIONAL status	None (Sensor-amplifier and sensor type mismatch)	Module configuration (Sensor-amplifier and sensor configuration) has not been downloaded to this unit. The model set on the master side is different from the model that is currently connected.	Alter the configuration to match the configuration set in the master and reset the power.
PDO (cyclic) communication can be performed, however, the current value or setting value of the CDA is invalid	Off	Lit green	OPERATIONAL status	0008E000 h (Invalid connection order)	The D3RF or D3WF is interconnected to the right side of the D4RF or CDA.	Interconnect the D3RF or D3Wf to the left of the D4RF or CDA and reset the power.
PDO (cyclic) communication can be performed, however, read / write cannot be performed for some sensor-amplifiers or sensors	Off	Lit green	OPERATIONAL status	0006E000 h (Number of sensor-amplifier units or sensors changed)	Module configuration (Sensor-amplifier and sensor configuration) download is irrelevant. The number of connected sensor-amplifier units or sensors changed (generally decreased) after the power was turned ON.	There may have been a sensor-amplifier unit or sensor failure, or the power supply may have been turned OFF. Check all connected sensor-amplifiers and sensors and their respective power supplies.

*1: Including when the maximum supported number of connected sensor-amplifiers and sensors is exceeding.

Indicators	Cause	Countermeasure
PWR		
Off	Power is not correctly supplied to this unit.	Check and resolve the following potential causes of power interruption, then restart this device according to the specifications of the connected EtherCAT master. • Is the power cable wired correctly? • Is the power cable broken? • Is the power supply voltage within the specified range? • Is the power capacity sufficient? • Is the power supply faulty?

Indicators		Cause	Countermeasure
PWR	ERR		
Lit green	Lit red	A hardware error may have occurred.	If the problem is not resolved even after resetting the power, there is a hardware malfunction. Replace this unit.

5-5 Emergency Message Notifications from EtherCAT Master

The following errors are notified from this unit to the master as emergency messages when they occur.

Emergency error code	Error type	Error description	Countermeasure
8100 h	10 h	The number of connected sensor-amplifier units or sensors changed (generally decreased) after the power was turned ON.	There may have been a sensor-amplifiers unit or sensor failure, or the power supply may have been turned OFF. Check all connected sensor-amplifiers and sensors and their respective power supplies.

Emergency messages can be sent through SDO communication by setting “Error notification control of this unit” (index F200 h) to 0001 h (enabled) and “Emergency message notifications” (subindex 05 h in index 10F3 h) in “Error history” to 0001 h (with notifications).

Configuration of Emergency Messages from This Unit

The emergency message consists of the following 3 bytes of data.

Bit	7	0
0	Emergency error code	
+1		
+2	Error type	

6

Appendix

6-1 Installing Additional Applicable Sensor-amplifier Units

This chapter describes how to install additional applicable sensor-amplifier units.

CAUTION

- Changing the ID number for the addition of the sensor-amplifier requires changing the variables and programs on the master side. If there is a change in the ID number after you add a sensor-amplifier, make sure to change the variables or programs on the master side.
- To add an applicable sensor-amplifier to this unit after the system is operational, turn OFF the power of this unit.

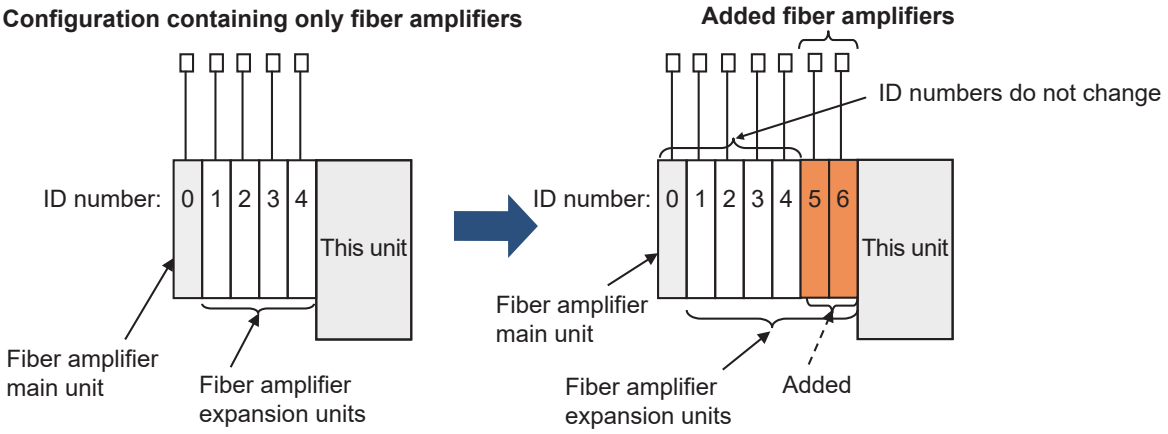
Install additional applicable sensor-amplifier units to the right of existing applicable sensor-amplifier units when possible so that the ID numbers of existing applicable sensor-amplifier units do not change.

The method depends on the situation as follows.

Adding Fiber Amplifiers to a Configuration Containing Only Fiber Amplifiers

- Add fiber amplifier expansion units between the existing fiber amplifiers and this unit. This allows the addition of additional fiber amplifiers without changing the ID numbers of the existing fiber amplifiers.
- D4RF and D3RF/D3WF series can be added; when adding D4RF and D3RF/D3WF mixed together, make sure that D4RF is next to this unit.

Example:

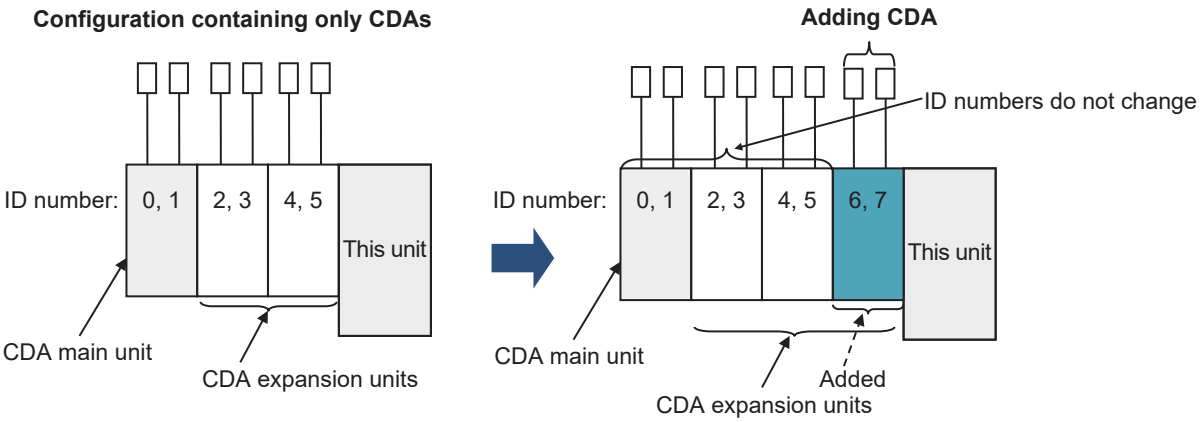


*: If the existing fiber amplifier is the D4RF and to be added is the D3RF or D3WF, add a D3RF or D3WF at the ID number: 0 position. For details, refer to “Configuration to Interconnect Only Fiber Amplifiers” (page 2-4).

Adding CDA to a Configuration Containing Only CDA

- Add CDA expansion units between the existing CDA and this unit. This means that the ID numbers of the existing CDA will not be changed.

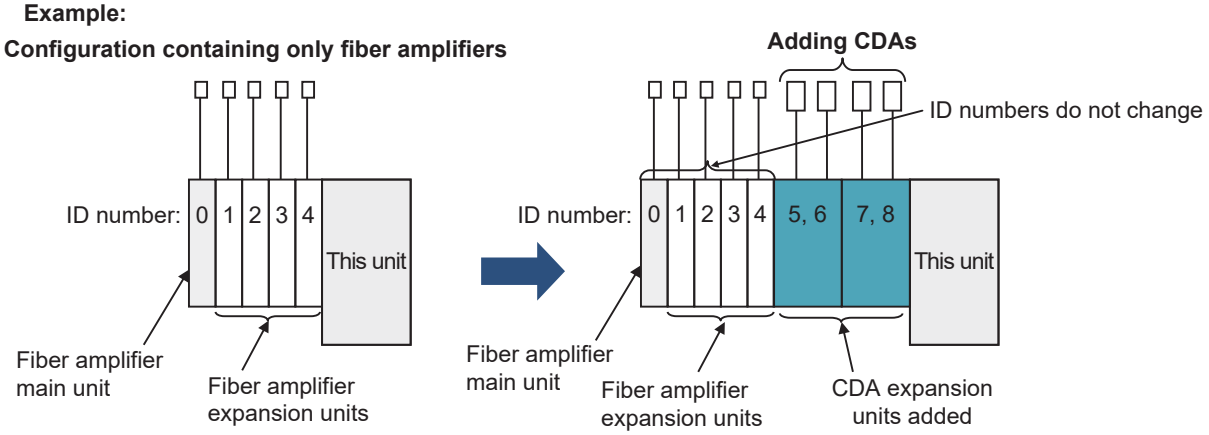
Example:



Adding CDA to a Configuration Containing Only Fiber Amplifiers

- Add CDA expansion units between the existing fiber amplifiers and this unit. This means that the ID numbers of the existing fiber amplifiers will not be changed.

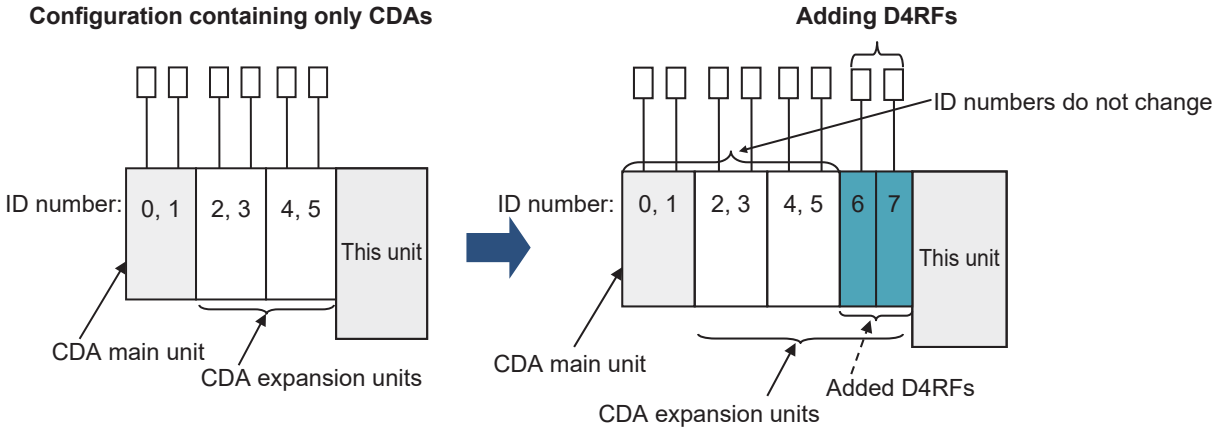
Example:



Adding D4RF to a Configuration Containing Only CDA

Insert D4RF expansion units between the existing CDA and this unit. This means that the ID numbers of the existing CDA will not be changed.

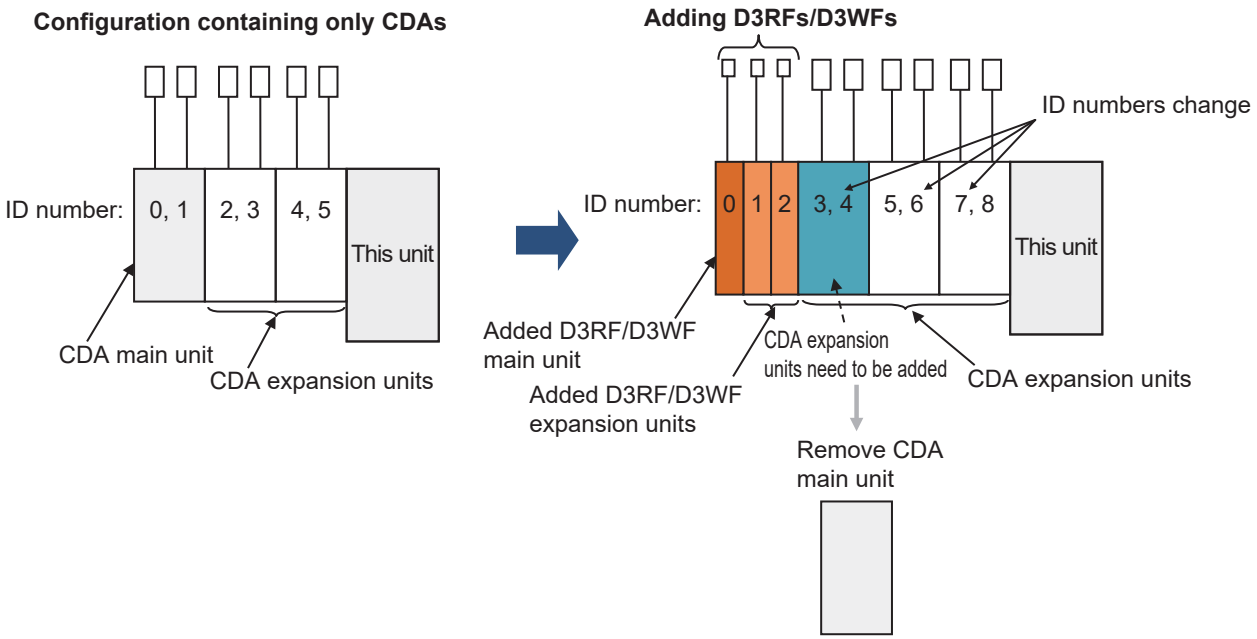
Example:



Adding D3RF or D3WF to a Configuration Containing Only CDA

- Add a D3RF or D3WF main unit in the leftmost position.
- The existing CDA main unit needs to be removed from the inter-connection configuration and replaced with a CDA expansion unit.
- If necessary, D3RF or D3WF expansion units can be added to the right of the D3RF or D3WF main unit.
- Change all variables on the master side and all ID numbers in the program.

Example:

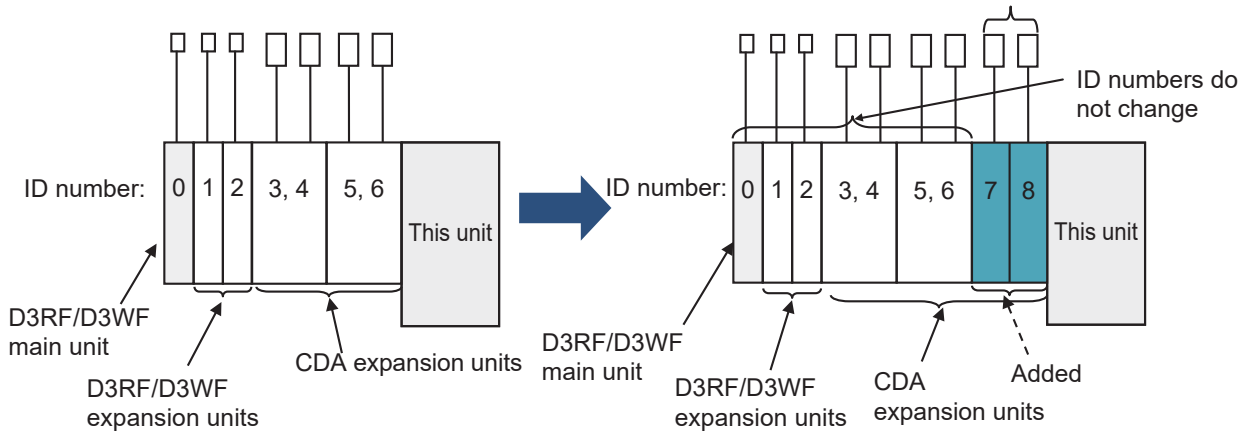


Adding D4RF to a Configuration Containing Both D3RF, D3WF and CDA

- Add D4RF expansion units between the existing CDA and this unit. This means that the ID numbers of the existing D3RF, D3WF and CDA will not be changed.

Example:

Configuration Containing Both D3RF, D3WF and CDA **Adding D4RF expansion units**

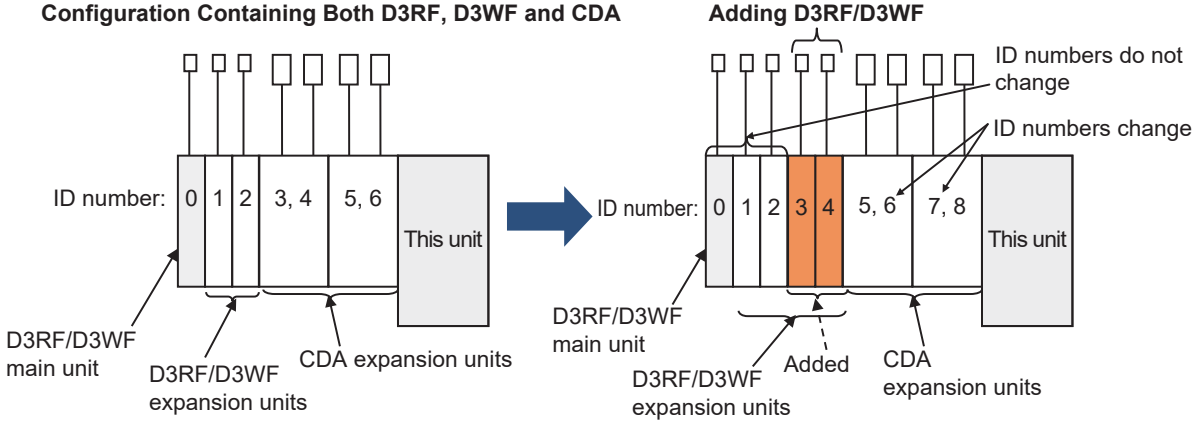


Adding D3RF and D3WF to a Configuration Containing Both D3RF, D3WF and CDA

- Add expansion units for D3RF or D3WF between the existing D3RF or D3WF and the existing CDA. This allows the ID number for the existing D3RF or D3WF to be added without changing the ID number, but the IDs of the variables and programs on the master side of the added D3RF or D3WF and the existing CDA must be changed.

Example:

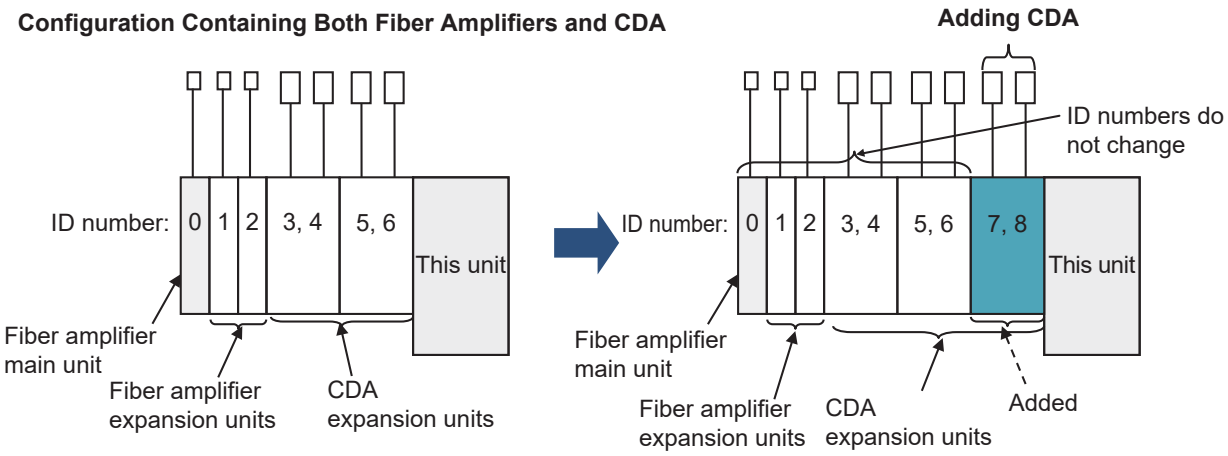
Configuration Containing Both D3RF, D3WF and CDA **Adding D3RF/D3WF**



Adding CDA to a Configuration Containing Both Fiber Amplifiers and CDA

- Add CDA expansion units between the existing CDA and this unit. This means that the ID numbers of the existing Fiber Amplifiers and CDA will not be changed.

Example:



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

The information in this user's manual is correct as of June 2025.
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