

HITACHI PROGRAMMABLE CONTROLLER

EHV+

**EtherCAT[®] Slave Controller
(EH-IOCA)
APPLICATION MANUAL
(SERVICE MANUAL)**

NJI-599(X)

○ Warranty period and coverage

The warranty period is the shorter period either 18 months from the date of manufacture or 12 months from the date of installation.

However within the warranty period, the warranty will be void if the fault is due to;

- (1) Incorrect use as directed in this manual and the application manual.
- (2) Malfunction or failure of external other devices than this unit.
- (3) Attempted repair by unauthorized personnel.
- (4) Natural disasters.

The warranty is for the PLC only, any damage caused to third party equipment by malfunction of the PLC is not covered by the warranty.

○ Repair

Any examination or repair after the warranty period is not covered. And within the warranty period any repair and examination which results in information showing the fault was caused by any of the items mentioned above, the repair and examination cost are not covered. If you have any questions regarding the warranty please contact with your supplier or the local Hitachi Distributor. (Depending on failure part, examination might be impossible.)

○ Ordering parts or asking questions

When contacting us for repair, ordering parts or inquiring about other items, please have the following details ready before contacting the place of purchase.

- (1) Model
- (2) Manufacturing number (MFG.No.)
- (3) Details of the malfunction

○ Reader of this manual

This manual is described for the following person.

- Person considering the introduction of PLC
- PLC system engineer
- Person handling PLC
- Manager after installing PLC

Warning

- (1) Reproduction of the contents of this manual, in whole or in part, without written permission of Hitachi-IES, is prohibited.
- (2) The content of this document may be changed without notice.
- (3) While efforts have been made to be accurate, if any wrong or missing information is found, please contact us.

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

Safety Precautions

Read this manual and related documents thoroughly before installing, operating, performing preventive maintenance or performing inspection, and be sure to use the unit correctly. Use this product after acquiring adequate knowledge of the unit, all safety information, and all cautionary information. Also, make sure this manual enters the possession of the chief person in charge of safety maintenance.

Safety caution items are classified as “Danger” and “Caution” in this document.



: Identifies information about practice or circumstances, which may lead to personal injury or death, property damage, or economic loss.



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However, depending on the circumstances, items marked with



may result in major accidents.

The both marks show important information. Be sure to follow the instructions.

Icons for prohibited items and required items are shown below:



: Identifies prohibition. For example, when open flames are prohibited,



is indicated.



: Identifies requirement. For example, when grounding must be performed,



is indicated.

1. Installation

CAUTION

- Use this product in an environment as described in the catalog or this document.
If this product is used in an environment subject to high temperature, high humidity, excessive dust, corrosive gases, vibration or shock, it may result in electric shock, fire or malfunction.
- Be sure to install the PLC according to this manual. Failure to do so could result in damage by falling off, failure or malfunction.
- Do not allow foreign objects such as wire chips to enter the unit.
They may become the cause of fire, malfunction or failure.

2. Wiring

REQUIRED

- The PLC must be grounded (FE terminal).
Failure to do so could result in injury to personnel or causing it to malfunction.

CAUTION

- Always use the power supply voltage listed in specifications. Using other voltage may damage the equipment or present a risk of fire.
- The wiring operation should be performed by a qualified personnel.
Failure to do so could result in fire, damage or electric shock.

3. Precautions when using the unit

DANGER

- Do not touch the terminals while the power is on.
There is a risk of electric shock.
- Appropriate emergency stop circuit, interlock circuitry and similar safety measures should be added to the PLC system to ensure safety in the event of incorrect, missing or abnormal signals caused by broken signal lines, momentary power interruptions or other causes. Do not share the power supply of relay output module and interlock circuitry because relay output might not work properly due to switching noise from interlock circuitry.

CAUTION

- When performing program change, forced output, RUN, STOP, etc., while the unit is running, be sure to check system safety carefully. Failure to do so could lead to damage to equipment.
- Supply power according to the power-up order.
Failure to do so could lead to damage to equipment or malfunction.


CAUTION

USE POWER SUPPLY UNIT OF EH-PS SERIES FOR SUPPLYING ELECTRIC POWER.

4. Preventive maintenance

 **DANGER**

- Do not connect the +/- of the battery in reverse polarity. Do not recharge, disassemble, heat, place in fire, or short circuit the battery. There is a risk of explosion or fire.

 **PROHIBITED**

- Do not attempt to disassemble, repair or modify any part of the PLC.
Electric shock, malfunction or failure may result.

 **CAUTION**

- Turn off power to the PLC before mounting or dismantling the module
Electric shock, malfunction or failure may result.

Revision History

No.	Description of revision	Date of revision	Manual number
1	The first edition	Mar. 2014	NJI-599(X)

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Chapter 1 Introduction

1.1 Before use

Thank you very much for choosing Hitachi Programmable Controller (hereinafter referred to as PLC), EHV+ series. This manual explains how to use the EtherCAT[®] slave controller with the Hitachi EHV+ Programmable Controller. Read this manual thoroughly and keep for installation operations, maintenance checks and other procedures. The following documentation related to PLC is also available and should be used together with this manual.

Table 1.1-1 List of Description materials

Items	Title of document	Manual number
EHV+ series	EHV+ APPLICATION MANUAL	NJI-564*(X)
EtherCAT [®] Slave controller	EH-IOCA APPLICATION MANUAL (This manual)	NJI-599*(X)


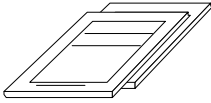
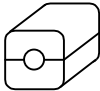
* The alphabet between the number and (X) means version (A,B...) and the space means the first edition.

1.2 Item packaged with the module

Great care has been taken in the manufacture of this product, but we advise that the following points are checked immediately after purchase.

1. Is the model the same one that you ordered?
2. Has the product been damaged in any way?
3. Are any of the accessories listed in Table 1.2-1 missing?

Table 1.2-1 List of accessories supplied with the EH-IOCA

No.	Product name	Model name	Appearance	Quantity	Remarks
1	EtherCAT [®] Slave controller	EH-IOCA		1	
2	Instruction manual	NJI-578 (X)		1	
3	Ferrite Core	SFC-10		2	For applying CE marking (EMC direction). Please refer to 4.3.2 Connect communication cable.

1.3 Combination with the EtherCAT[®] masters

EH-IOCA has some cautions when using the EtherCAT[®] master is EHV+ CPU module or others. Please care in accordance with the following points.

- If using the EtherCAT[®] master is EHV+ CPU module.

The combination of EH-IOCA can be operated by EHV+ CPU module is shown below.

Table 1.3-1 support EHV+ CPU module

Product name	Model name	Supported CPU software version	Supported EtherCAT [®] master library version
EHV+ series CPU module	EHV-CPU1102	Ver.3.4.4.5	Ver.3.5.3.60
	EHV-CPU1025		

- If using the EtherCAT[®] master is others

The EtherCAT[®] device profile model of EH-IOCA is modular device profile. So the EtherCAT[®] master must be able to operate modular device profile. If the EtherCAT[®] master can't operate modular device profile, the EtherCAT[®] master can't use EH-IOCA.

Chapter 2 EtherCAT[®] network

2.1 Feature of EtherCAT[®]

EtherCAT[®] (Ethernet Control Automation Technology) is a high-performance industrial network system that enables faster and more efficient communications based on Ethernet. It can communicate in short cycle time since Ethernet frame transmit for each node at high speed.

2.2 Feature of EH-IOCA

EH-IOCA is slave controller on EtherCAT[®] protocol of industrial network. EH-IOCA is helpful as I/O controller of EtherCAT[®] system.

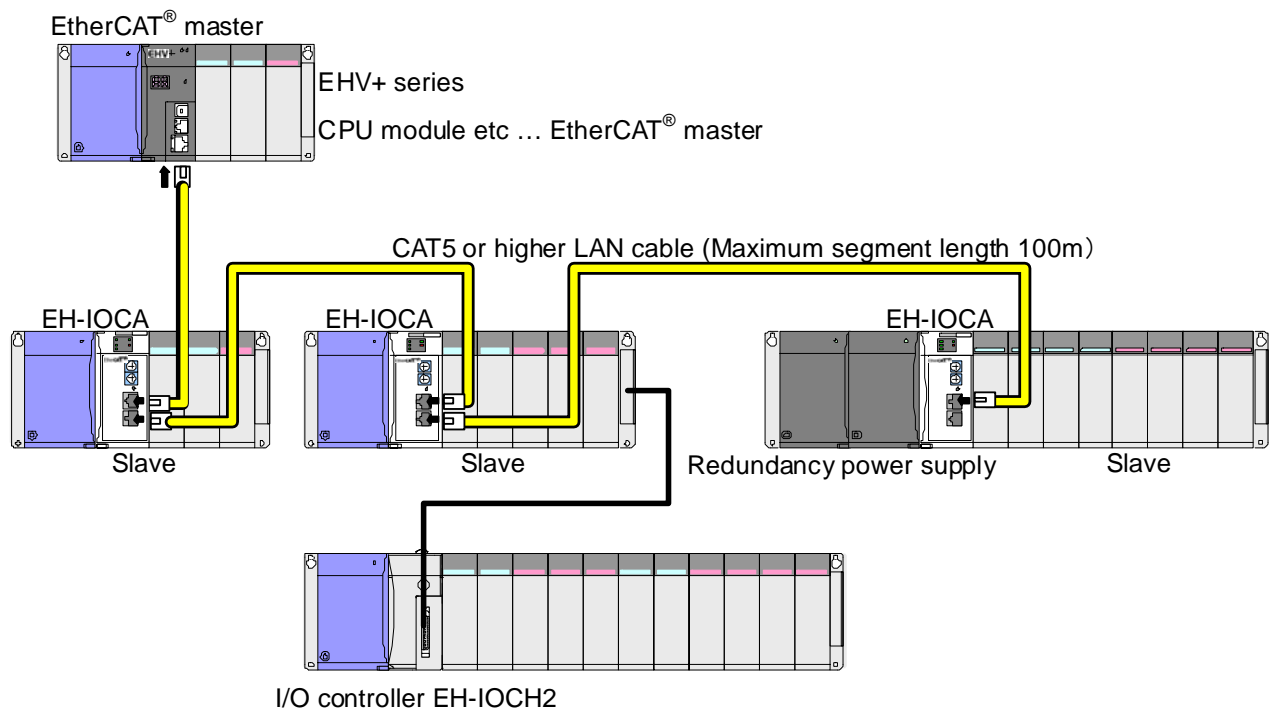


Figure 2.2-1 Example of EH-IOCA system

(1) Maximum I/O 1,408 points

Since it is coupler type, any I/O modules can be freely and flexibly used up to 1,408 points of digital I/O or 176 channels of analog I/O.

(2) Compatibility of EH-150 series

Existing power supply units, base units and I/O modules of the EH-150 series can be used. (Several I/O modules are not supported. Refer to following pages for further information.)

(3) High-speed response, high reliability

The minimum communication cycle is 200 μ s. In addition, it is possible to hold the output data at the communication error occurs.

(4) Easy connectivity with EHV+ series

It gives greatly reduced man-hour for the work such as wiring and configuration by using with EHV+ series CPU module that supports the EtherCAT[®] master function.



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Chapter 3 Specifications of EH-IOCA

3.1 General Specifications

General specifications are shown in Table 3.1-1. These specifications are common in EH-150 series.

Table 3.1-1 General specifications

Item	Specifications
Operating ambient temperature	0 to 55 °C
Storage ambient temperature	−10 to 75 °C
Operating ambient humidity	5 to 95 % RH (no condensation)
Storage ambient humidity	5 to 95 % RH (no condensation)
Vibration resistance	Conforms to IEC 60068-2-6
Noise resistance	<ul style="list-style-type: none"> ○ Noise voltage 1,500 Vpp Noise pulse width 100 ns, 1μ (Noise created by the noise simulator is applied across the power supply modules's input terminals. This is determined by this company's measuring method.) ○ Based on IEC61131-2 ○ Static noise: 3,000V at metal exposed area
Insulation resistance	20 MΩ or more between the AC external and case ground (FE) terminal (based on 500 V DC)
Dielectric withstand voltage	1,500 V AC for 1 minute between the AC external terminal and case ground (FE) terminal
Grounding	Class D grounding (ground with power supply module)
Usage environment	No corrosive gases, no excessive dust
Structure	Open, wall-mount type
Cooling	Natural air cooling

3.2 Functional Specifications

Functional specifications are shown in Table 3.2-1.

Table 3.2-1 Functional Specifications

	Item	Specifications
Communication specifications	Communication protocol	EtherCAT [®] protocol
	Transmit modulation method	Base band
	Transmit speed	100Mbps
	Physical layer	100BASE-TX (IEEE802.3)
	Connector	RJ45 (IN, OUT)
	Topology	Daisy-chain
	Recommended cable	CAT5 or higher, STP cable
	Maximum segment length	100 m
	Communication cycle	200 μ s or over *1
	Node address range	1 to 99:Setting by rotary switch 1 to 65,535:Setting by EtherCAT [®] master
	Process data	Fixed PDO mapping
	Mailbox	Support
	Cycle mode	Free Run mode (asynchronous)
	Output hold	Support
Functional specifications	Support base unit	EH-BS3A/5A/6A/8A/11A/8R
	Number of modules	22 modules / EH-IOCA
	Number of I/O points	1,408 points: Digital I/O 176 ch : Analog I/O
	Expansion unit	1
	Refresh time	500 μ s
	Self-check	WDT check
	Error indication	LED
	Current consumption	350mA

*1 The communication cycle is dependent on the specification of the EtherCAT[®] Master.



CAUTION

Digital I/O module, Analog I/O module, Resistance temperature detective input module, Thermocouple input module, counter module and positioning module are supported on the base unit using EH-IOCA. Note that the others are not supported.
Do not mount these modules on the slave base unit.

For information on the ESI files for EH-IOCA, contact your local supplier.

3.2.1 EH-IOCA supported modules

EH-IOCA supported modules and units are shown in Table 3.2.1-1,2. Shaded modules and units had ceased in production. I/O Assignment symbol are mean to I/O type on the EtherCAT® network.

Table 3.2.1-1 supported modules (1 / 2)

Product name	Model name	Specifications	Supported	I/O Assignment symbol
Power module	EH-PSA	Input 100 to 240 V AC, Output 5V DC 3.8A, 24V DC, 0.4A	○	—
	EH-PSD	Input 21.6 to 26.4 V DC, Output 5 V DC 3.8 A	○	—
	EH-PSR	Redundant power supply, Input 100 to 240 V AC, Output 5 V DC 5.6 A, (up to 45 deg ambient temp)	○	—
Base unit	EH-BS3A	3 I/O modules installed.	○	—
	EH-BS5A	5 I/O modules installed.	○	—
	EH-BS6A	6 I/O modules installed.	○	—
	EH-BS8A	8 I/O modules installed.	○	—
	EH-BS11A	11 I/O modules installed.	○	—
	EH-BS8R	Redundant power supply, 8 I/O modules installed.	○	—
	EH-BS3	3 I/O modules installed.	×	—
	EH-BS5	5 I/O modules installed.	×	—
Input and output controller	EH-IOC	Input and output control module (1 unit/1expansion)	×	—
	EH-IOCH	Input and output control module (1 unit/1expansion)	×	—
	EH-IOCH2	Input and output control module (1 unit/1expansion)	○	—
Digital input module	EH-XD8	8 points, 24 V DC input	○	X16
	EH-XD16	16 points, 24 V DC input	○	X16
	EH-XDL16	16 points, 24 V DC input, Intensified filter	○	X16
	EH-XD32	32 points, 24 V DC input	○	X32
	EH-XDL32	32 points, 24 V DC input, Intensified filter	○	X32
	EH-XD32E	32 points, 24 V DC input, Spring type terminal block	○	X32
	EH-XDL32E	32 points, 24 V DC input, Spring type terminal block, Intensified filter	○	X32
	EH-XD32H	32 points, 24 V DC input, Connector compatible with EM/H-200 series	○	X32
	EX-XD64	64 points, 24 V DC input	○	X64
	EH-XA16	16 points, 100 to 120 V AC input	○	X16
	EH-XAH16	16 points, 200 to 240 V AC input	○	X16
Digital output module	EH-YR8B	8 points, relay output (isolated contact point), 100/240 V AC, 24 V DC	○	Y16
	EH-YR12	12 points, relay output, 100/240 V AC, 24 V DC	○	Y16
	EH-YR16	16 points, relay output, 100/240 V AC, 24 V DC, 16 points/1 common	○	Y16
	EH-YR16D	16 points, relay output, 100/240 V AC, 24 V DC, 8 points/1 common	○	Y16
	EH-YT8	8 points, transistor output, 12/24 V DC (sink type)	○	Y16
	EH-YTP8	8 points, transistor output, 12/24 V DC (source type)	○	Y16
	EH-YT16	16 points, transistor output, 12/24 V DC (sink type)	○	Y16
	EH-YTP16	16 points, transistor output, 12/24 V DC (source type)	○	Y16
	EH-YTP16S	16 points, transistor output, 12/24 V DC (source type)	○	Y16
	EH-YT32	32 points, transistor output, 12/24 V DC (sink type)	○	Y32
	EH-YTP32	32 points, transistor output, 12/24 V DC (source type)	○	Y32
	EH-YT32E	32 points, transistor output, 12/24 V DC (sink type), Spring terminal block	○	Y32
	EH-YTP32E	32 points, transistor output, 12/24 V DC (source type), Spring terminal block	○	Y32
	EH-YT32H	32 points, transistor output, 5/12/24 V DC (sink type), Connector compatible with EM/H-200 series	○	Y32
	EH-YT64	64 points, transistor output, 12/24 V DC (sink type)	○	Y64
	EH-YTP64	64 points, transistor output, 12/24 V DC (source type)	○	Y64
TTL I/O module	EH-MTT32	16 points TTL output, 16 points TTL input, 4 to 27V DC	○	B1_1

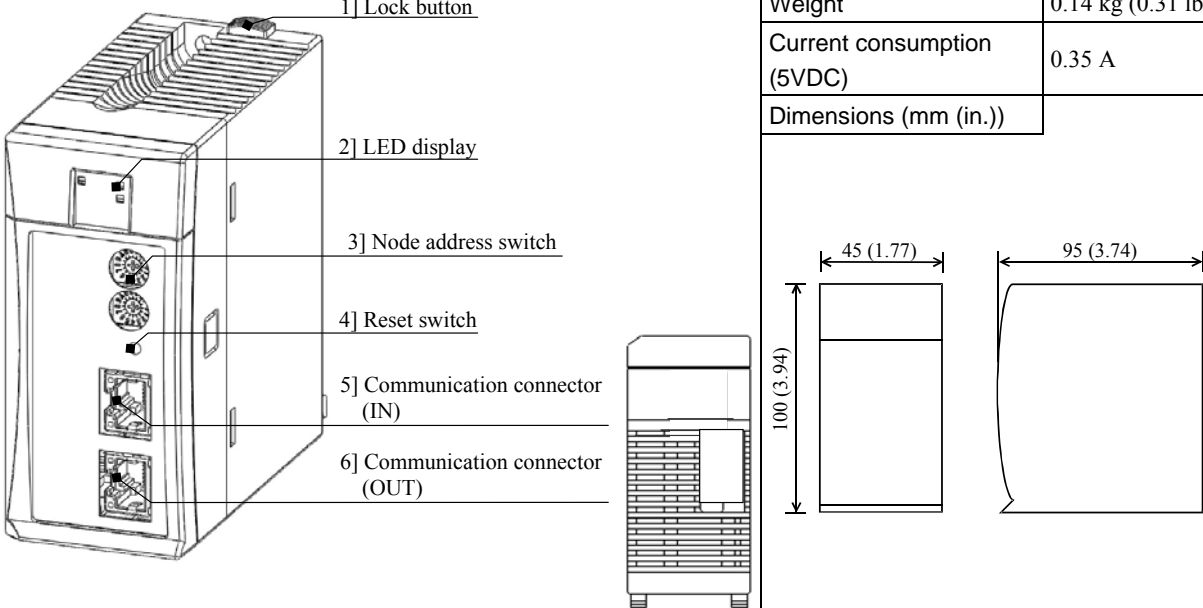
Table 3.2.1-2 supported modules (2 / 2)

Product name	Model name	Specifications	Supported	I/O Assignment symbol
Analog input module	EH-AX44	12 bits analog input (4 to 20mA, 0 to 10 V) each 4 ch.	○	X8W
	EH-AX8V	12 bits analog input 8 ch., Voltage (0 to +10 V)	○	X8W
	EH-AX8H	12 bits analog input 8 ch., Voltage (-10 to +10 V)	○	X8W
	EH-AX8I	12 bits analog input 8 ch., Current (4 to 20 mA)	○	X8W
	EH-AX8IO	12 bits analog input 8 ch., Current (0 to 22 mA)	○	X8W
	EH-AXH8M	14 bits analog input (0 to 22mA, 4 to 22mA, -10 to +10V, 0 to 10V) 8 ch.	○	X8W
	EH-AXG5M	Isolated analog input (0 to 22mA, 4 to 22mA, -10 to +10V, 0 to 10V) 5 ch.	○	X8W
Analog output module	EH-AY22	12 bits analog output (4 to 20mA, 0 to 10 V) each 2 ch.	○	Y8W
	EH-AY2H	12 bits analog output 2 ch., Voltage (-10 to +10 V)	○	Y8W
	EH-AY4V	12 bits analog output 4 ch., Voltage (0 to +10 V)	○	Y8W
	EH-AY4H	12 bits analog output 4ch., Voltage (-10 to +10 V)	○	Y8W
	EH-AY4I	12 bits analog output 4 ch., Current (4 to 20 mA)	○	Y8W
	EH-AYH8M	14 bits analog output (0 to 22mA, 4 to 22mA, 0 to 10V) 8 ch.	○	Y8W
	EH-AYG4M	Isolated analog output (0 to 22mA, 4 to 22mA, -10 to +10V, 0 to 10V) 4 ch.	○	Y8W
RTD input module	EH-PT4	4 channels resistance bulb input, Signed 15 bits Platinum (Pt 100Ω / Pt 1000Ω)	○	X4W
Thermocouple input module	EH-TC8	Signed 15 bits, Thermocouple input (K, E, J, T, B, R, S, N) 8 points	○	X8W
Counter module	EH-CU	2 channels high-speed counter input, Maximum frequency of 100 kHz, 1/ 2-phases switchover, 4-point opened collector output	○	X5Y3W
	EH-CUE	1 channel high-speed counter input, Maximum frequency of 100 kHz, 1 /2-phases switchover, 2-point opened collector output	○	X5Y3W
Positioning module	EH-POS	1-axis pulse positioning module	○	X4Y4W
	EH-POS4	4-axes pulse positioning module	×	X4Y4W
Communication and network module	EH-SIO	Serial communication module, RS-232C / RS-422 / RS-485 general-purpose, Modbus protocol, Hi-Protocol, Simple data link	×	—
	EH-ETH	Ethernet module IEEE802.3 standard, 10BASE-T	×	—
	EH-ETH2	Ethernet module IEEE802.3 standard, 10BASE-T/ 100BASE-TX (Auto negotiation)	×	—
	EH-LNK	CPU link module (coaxial)	×	—
	EH-OLNK	CPU link module (optical fiber)	×	—
	EH-OLNKG	CPU link module (support optical fiber GI50/125μm cable)	×	—
	EH-OLNKE	CPU link module (support optical fiber GI62.5/125μm cable)	×	—
	EH-TRMME	Compact remote master module, Twisted pair cable	×	—
	EH-TRMLE	Compact remote slave module, Twisted pair cable	×	—
	EH-TRME2	Compact remote 2 master module, Twisted pair cable	×	—
	EH-TRLE2	Compact remote 2 slave module, Twisted pair cable	×	—
	EH-TLNKE	Compact LINK module, Twisted pair cable	×	—
	EH-TRLLE	Compact I/O LINK module, Twisted pair cable	×	—
	EH-RMD	Device Net master module	×	—
	EH-IOCD	Device Net slave controller, 256 words input / 256 words output	×	—
	EH-RMP	PROFIBUS-DP master module	×	—
EH-IOCP	PROFIBUS-DP slave controller, 208 words input / output	×	—	
Dummy module	EH-DUM	Module for an opened slot	○	—*2

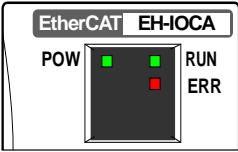
*1 If unsupported modules are mounted on the base of EH-IOCA, EH-IOCA may malfunction.

*2 If dummy modules are mounted on the base of EH-IOCA, I/O assignment symbol is not displayed.

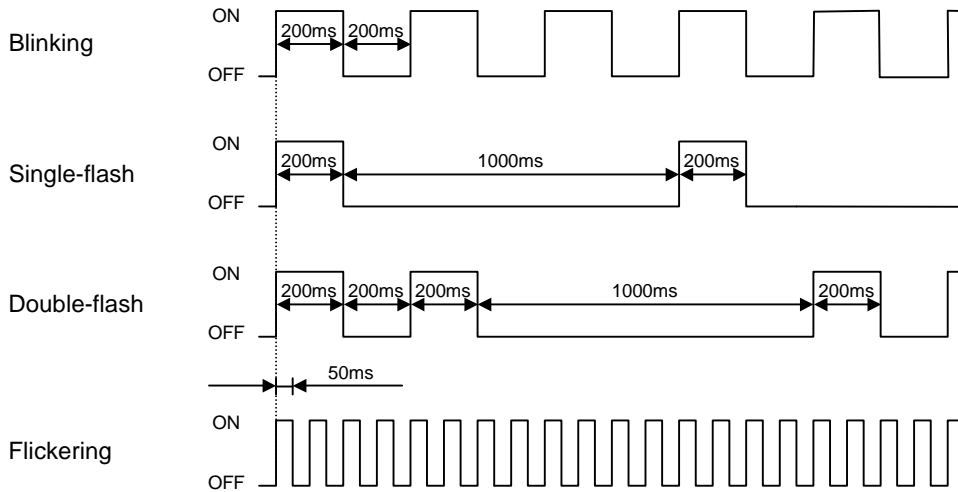
3.3 Name and function of each part

Name and function of each part		Model name	EH-IOCA
		Weight	0.14 kg (0.31 lb)
		Current consumption (5VDC)	0.35 A
		Dimensions (mm (in.))	
No.	Name	Function	Remarks
1]	Lock button	Press this button to dismount. Module can be fixed firmly by a screw of M4 × 10mm (0.39in).	
2]	LED display	The status of module is displayed on this LED.	
3]	Node address switch	This is a switch to set the node address.	
4]	Reset switch	The module can be reset by pressing this switch when error such as the module abnormal occurred.	
5]	Communication connector (IN)	This is a connector to connect a cable for communication.	
6]	Communication connector (OUT)	This is a connector to connect a cable for communication.	

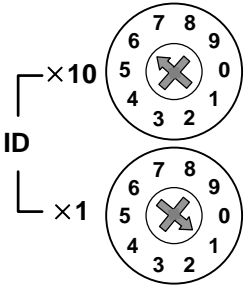
■ Description of LED display

LED	LED name	Indication	Details													
	POW	Power supply (Green)	On : indicates that the DC5V power is supplied. Off : indicates that the DC5V power is not supplied or reset switch is on.													
	RUN	Status (Green)	Display an EtherCAT [®] communication status. <table border="1" data-bbox="735 389 1369 589"> <thead> <tr> <th>State</th> <th>Details</th> </tr> </thead> <tbody> <tr> <td>Off</td> <td>Init</td> </tr> <tr> <td>Blinking</td> <td>PRE-OPERATIONAL</td> </tr> <tr> <td>Single-flash</td> <td>SAFE-OPERATIONAL</td> </tr> <tr> <td>On</td> <td>OPERATIONAL</td> </tr> </tbody> </table>	State	Details	Off	Init	Blinking	PRE-OPERATIONAL	Single-flash	SAFE-OPERATIONAL	On	OPERATIONAL			
	State	Details														
Off	Init															
Blinking	PRE-OPERATIONAL															
Single-flash	SAFE-OPERATIONAL															
On	OPERATIONAL															
ERR	Error (Red)	Display EtherCAT [®] error status or EH-IOCA hardware status. <table border="1" data-bbox="735 629 1393 936"> <thead> <tr> <th>State</th> <th>Details</th> </tr> </thead> <tbody> <tr> <td>Off</td> <td>No error</td> </tr> <tr> <td>Blinking</td> <td>Configuration error</td> </tr> <tr> <td>Single-flash</td> <td>EtherCAT[®] synchronism failure Communication data failure</td> </tr> <tr> <td>Double-flash</td> <td>Application watchdog timeout</td> </tr> <tr> <td>Flickering</td> <td>Boot error</td> </tr> <tr> <td>On</td> <td>PDI watchdog timeout</td> </tr> </tbody> </table>	State	Details	Off	No error	Blinking	Configuration error	Single-flash	EtherCAT [®] synchronism failure Communication data failure	Double-flash	Application watchdog timeout	Flickering	Boot error	On	PDI watchdog timeout
State	Details															
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Flickering	Boot error															
On	PDI watchdog timeout															

The state of LED is indicated below.

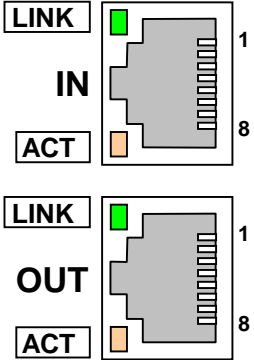


■ Description of Rotary switch

Rotary switch	Symbol	Meaning	Details of setting
 <p>[Default setting: U=0, L=0]</p>	U (upper)	Station No. (1 to 99)	The station No. of EtherCAT [®] network is set from 1 to 99. The tens place set by upper rotary switch. The ones place set by lower rotary switch.
	L (lower)		

Node address of EH-IOCA is set by node address method of EtherCAT[®] master unit. If EtherCAT[®] master use fixed node address method, rotary switch of EH-IOCA is valid. If EtherCAT[®] master use logic node address method or auto increment address method, rotary switch of EH-IOCA is invalid. If EtherCAT[®] master use logic nodes address method or auto increment address method, please set the rotary switch to “00”.

■ Description of Connector

Connector	Symbol	Indication	Details																		
	IN	Communication connector	RJ45 8-pin connector. Terminal layouts are shown below. <table border="1" data-bbox="845 1064 1268 1422"> <thead> <tr> <th>Pin No.</th> <th>Details</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>Send data + (TD+)</td> </tr> <tr> <td>2</td> <td>Send data - (TD-)</td> </tr> <tr> <td>3</td> <td>Receive data + (RD+)</td> </tr> <tr> <td>4</td> <td>NC</td> </tr> <tr> <td>5</td> <td>NC</td> </tr> <tr> <td>6</td> <td>Receive data - (RD-)</td> </tr> <tr> <td>7</td> <td>NC</td> </tr> <tr> <td>8</td> <td>NC</td> </tr> </tbody> </table>	Pin No.	Details	1	Send data + (TD+)	2	Send data - (TD-)	3	Receive data + (RD+)	4	NC	5	NC	6	Receive data - (RD-)	7	NC	8	NC
	Pin No.	Details																			
	1	Send data + (TD+)																			
	2	Send data - (TD-)																			
3	Receive data + (RD+)																				
4	NC																				
5	NC																				
6	Receive data - (RD-)																				
7	NC																				
8	NC																				
OUT																					
LINK	LINK LED (Green)	LINK LED light up if the communication device are connected with a cable.																			
ACT	ACT LED (Orange)	ACT LED is flashing during operation.																			

Please refer to “4.3 Wiring EtherCAT[®] network” for the wiring of connector.



MEMO

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Chapter 4 Installation

4.1 Mounting modules

(1) Mounting

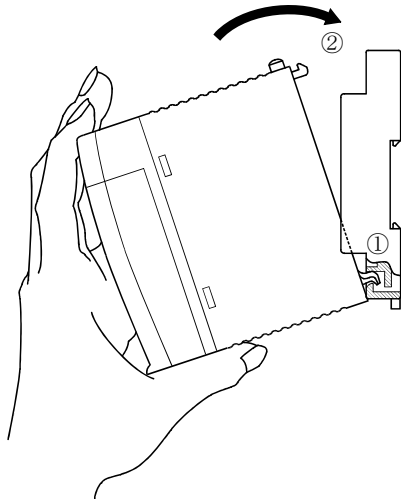


Figure 4.1-1 Mounting Module

- 1] Hook the lower part of the module to the hole in the base.
- 2] Press in the upper side of the module until it clicks.

Note 1: Make sure the module is mounted securely.

Note 2: Slot position of power supply module is fixed as 1st slot of base unit.

Note 3: Slot position of CPU module is fixed as 2nd slot of base unit.

Modules can be fixed firmly by M4×10mm screws.

(2) Removing

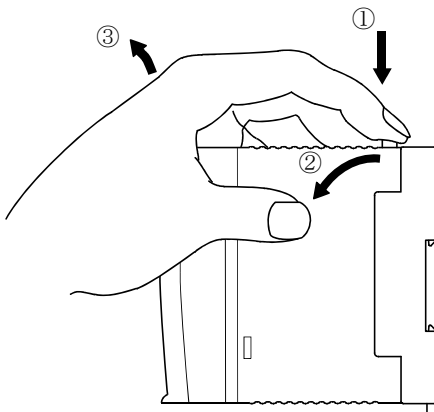


Figure 4.1-2 Removing Module

- 1] Press the lock button.
- 2] With the lock button pressed, pull the top of the module.
- 3] Pull the unit away from the base unit.

Note: Press the lock button for a power supply module.

4.2 Mountable slots for EH-IOCA

EH-IOCA is mountable on only slot for CPU (right side of power supply module).

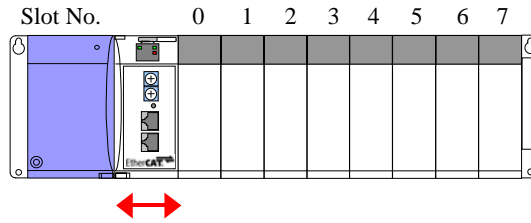


Figure 4.2-1 Mountable slots for EH-IOCA

4.3 Wiring EtherCAT[®] network

4.3.1 Recommended cable

Recommended cable of EH-IOCA is shown below. But if EH-IOCA is used in noisy environment, we recommend cables with double, aluminum tape and braided shielding.

Table 4.3.1-1 Recommended cable of EH-IOCA

Item	Details
Twisted pair cable	100BASE-TX (CAT 5 or higher) STP cable
RJ45 connector	CAT 5 or higher, Shielded

The maximum cable length between connected nodes is 100m. Note that some cables do not guarantee 100m. In general, if the conductors are strand wire, the transmission performance will be lower than solid wire and the operation at 100m distance cannot be guaranteed. Confirm details with the cable manufacturer.

4.3.2 Connect communication cable

Connect the communication cable from EtherCAT® master unit to the IN connector of EH-IOCA. Connect another communication cable from OUT connector of the first slave unit to the IN connector of next slave unit. Note that nothing should be connected to the OUT connector of the slave unit at the terminal end of the network.

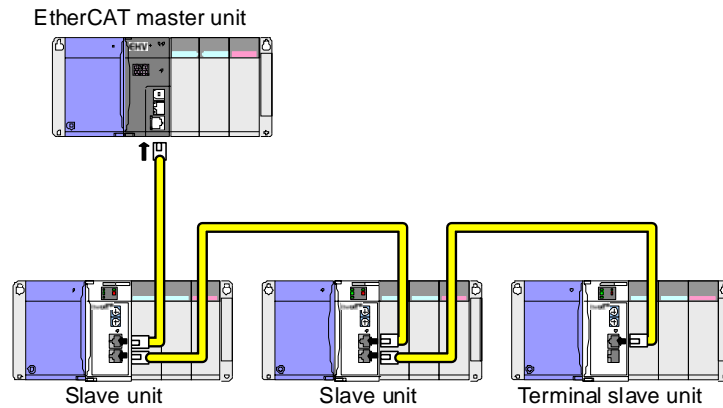


Figure 4.3.2-1 Connect communication cable

Connect the connector of the communications cable surely.

Do not put the communications cable in a duct same as other power lines and a wiring duct of I/O.

Separate approximately 300mm from other ducts.

It may be improved when put a ferrite core in a cable as measures to the induction noise for the communications cables.



When EH-IOCA gets into communication with EtherCAT® master unit, the communication may not establish depending on the master unit.

In that case, follow the operations below.

- 1] Reconnect the connector of the communication cable.
- 2] Reboot EH-IOCA.



If EH-IOCA is applied for CE marking (EMC direction), follow the instructions below.

- 1] Communication cable must be routed in metal duct separated from power or I/O cables as much as possible.
- 2] Use included ferrite core for communication cable with one turn as the picture below.

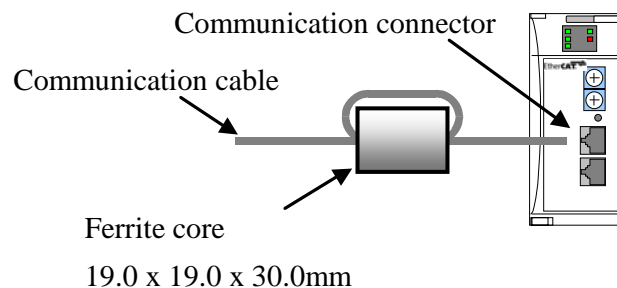


Figure 4.3.2-2 Use ferrite core

4.4 Mount redundant power supply modules (EH-PSR, EH-BS8R)

If you use EH-PSR and EH-BS8R, it must use breaker to each power supply modules.

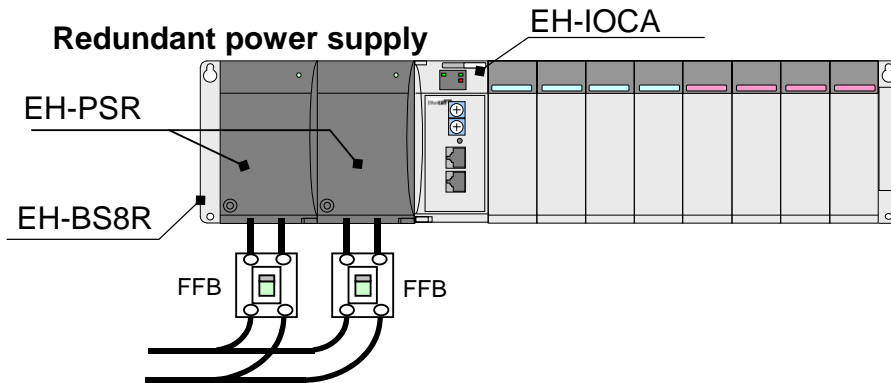


Figure 4.4-1 Use redundant power supply

If you use power operation monitor of redundant power supply, please refer to the section “5.3.2 Mount example”.

4.5 Mount expansion unit

EH-IOCA can use one expansion unit use by EH-IOCH2. Then rotary switch of EH-IOCH2 must be set 1. Expansion unit can use redundant power supply.

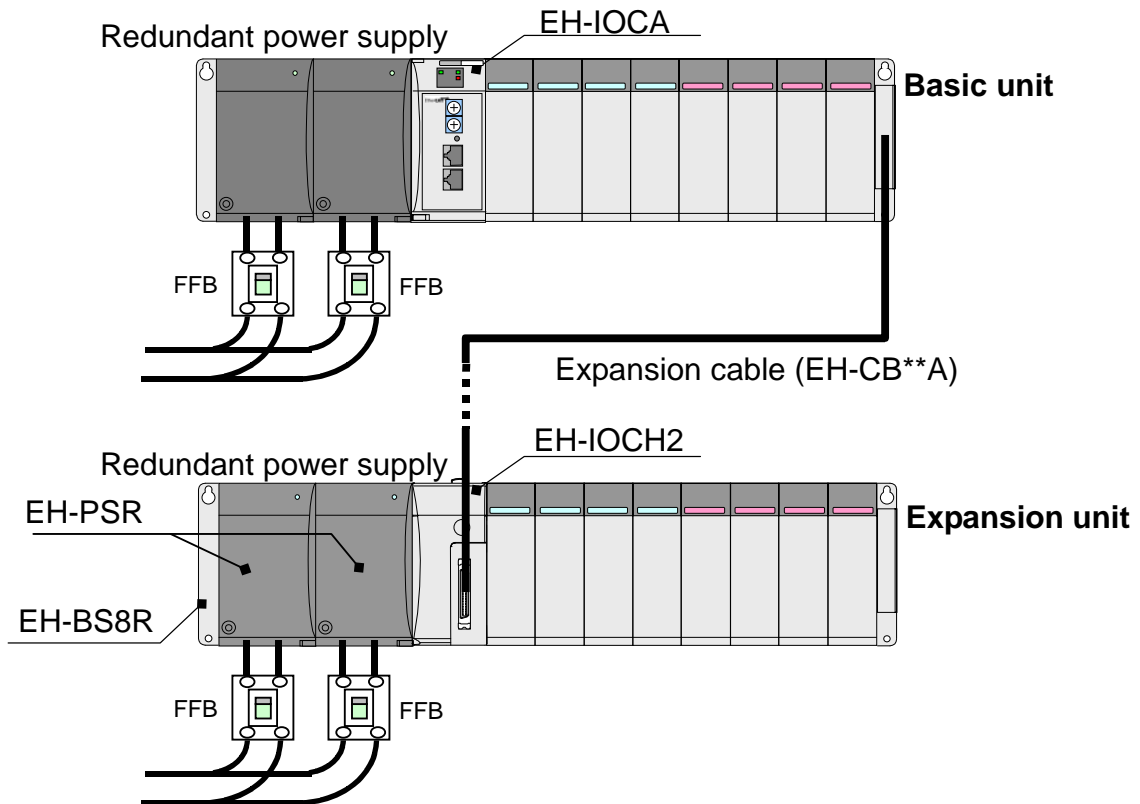


Figure 4.5-1 Use expansion unit

Chapter 5 EtherCAT[®] communications

5.1 CoE interface

EH-IOCA use “CAN application protocol over EtherCAT[®] (CoE)”, a communication interface to be applied for EtherCAT[®] devices, as the device profile of the open network standard “CAN application protocol”.

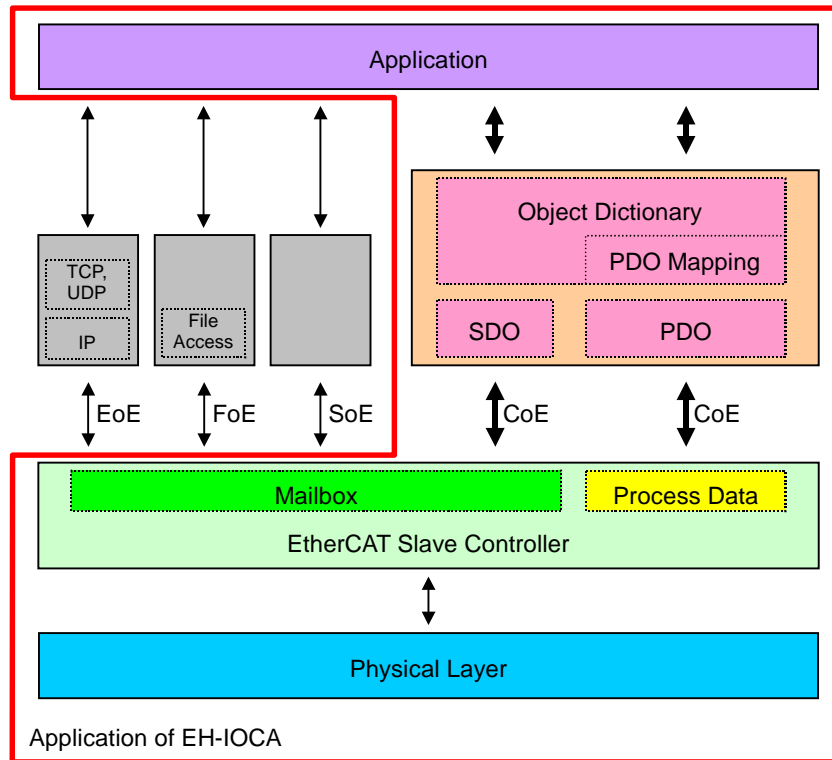


Figure 5.1-1 Application of EH-IOCA

CoE has two types of object dictionaries, PDO (process data object) and SDO (service data object). PDO is composed of object dictionaries that can be mapped. The process data is defined by PDO mapping. PDO is used in PDO communications for regularly exchanging process data. SDO is able to read and write all object dictionaries and is used in non-fixed-cycle type SDO (event type messages) communications.

EH-IOCA handles the data refreshing of each module and status information by PDO communication, and EH-IOCA handles the information of EH-IOCA (Device type, Vender ID etc...) by SDO communication.

5.2 ESI files

Parameters of EtherCAT® slaves are defined by ESI files. Each ESI file defines Vendor ID, Device group, PDO mapping, and sync manager.

ENI file that includes the network configuration information is produced by installing ESI files in the configuration tool. EtherCAT® master unit can operate by writing (downloading) ENI file.

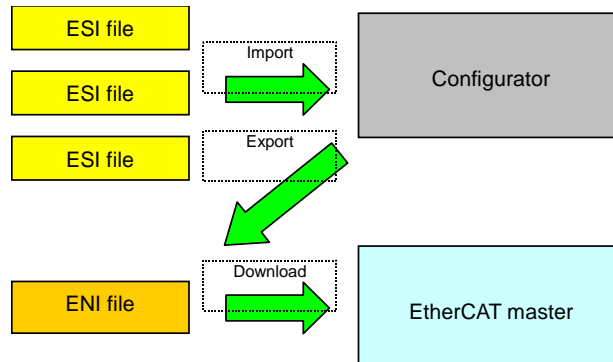


Figure 5.2-1 ESI files

For information on the ESI files for EH-IOCA, contact your local supplier.

5.3 Modular Device Profile

Device profile model of EH-IOCA conforms EtherCAT® Modular Device Profile. I/O modules are fixed mapping in PDO mapping table by the module.

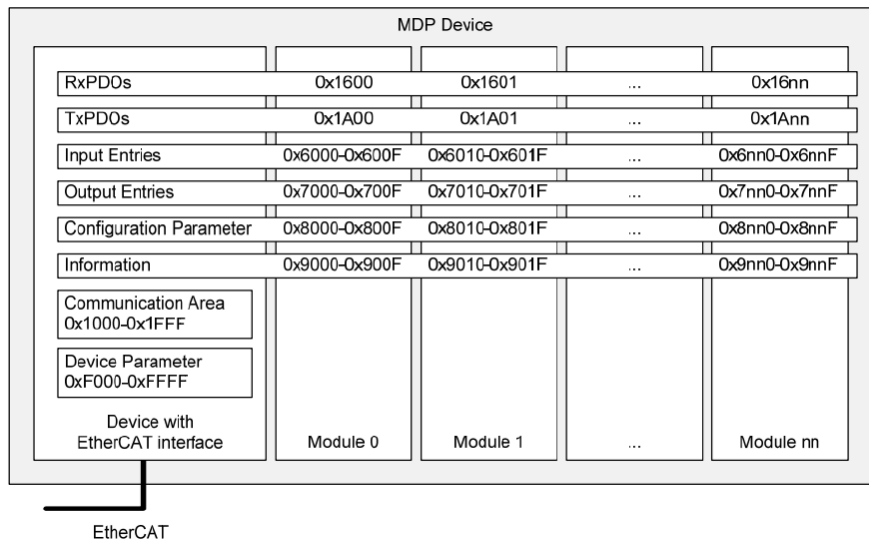


Figure 5.3-1 Modular Device Profile

RxPDO and TxPDO are handled in case of cyclic data transfer. Input Entries, Output Entries, Configuration Parameter, Information, Communication Area, Device Parameter are handled by SDO communication.

5.3.1 PDO mapping of each I/O module

EH-IOCA assigns each I/O module position and module information to mapping table when EH-IOCA is power on. Mapped index can't be changed. Mounted modules are defined RxPDO and TxPDO, and resisted SM Assignment Lists. SM Assignment Lists can't be changed by user.

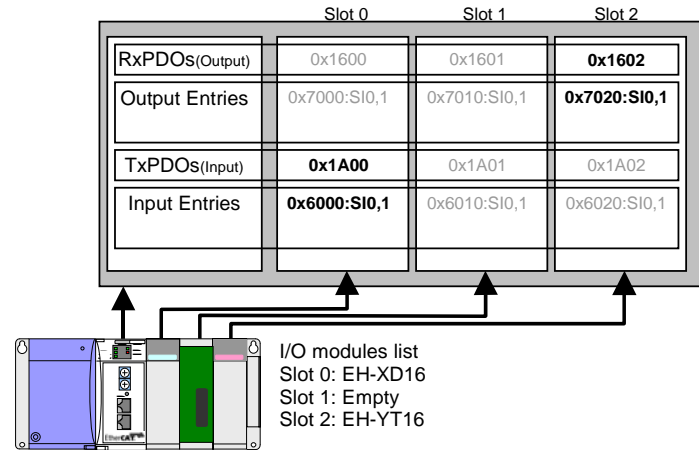


Figure 5.3.1-1 EH-IOCA mapping

The relations between each module mounted position and module number on the EtherCAT® network are shown below.

Table 5.3.1-1 Slot position and module number 1

Slot position	Module No.
Basic unit slot 0	Module 1
Basic unit slot 1	Module 2
Basic unit slot 2	Module 3
Basic unit slot 3	Module 4
Basic unit slot 4	Module 5
Basic unit slot 5	Module 6
Basic unit slot 6	Module 7
Basic unit slot 7	Module 8
Basic unit slot 8	Module 9
Basic unit slot 9	Module 10
Basic unit slot 10	Module 11

Table 5.3.1-2 Slot position and module number 2

Slot position	Module No.
Expansion unit slot 0	Module 12
Expansion unit slot 1	Module 13
Expansion unit slot 2	Module 14
Expansion unit slot 3	Module 15
Expansion unit slot 4	Module 16
Expansion unit slot 5	Module 17
Expansion unit slot 6	Module 18
Expansion unit slot 7	Module 19
Expansion unit slot 8	Module 20
Expansion unit slot 9	Module 21
Expansion unit slot 10	Module 22

The relations between each module number and index are shown Table 5.3.1-3, 5.3.1-4, 5.3.1-5, 5.3.1-6.

Table 5.3.1-3 Each module number object address 1

EtherCAT® object dictionary	Module number					
	1	2	3	4	5	6
RxPDOs	0x1600	0x1601	0x1602	0x1603	0x1604	0x1605
TxPDOs	0x1A00	0x1A01	0x1A02	0x1A03	0x1A04	0x1A05
Input Entries	0x6000	0x6010	0x6020	0x6030	0x6040	0x6050
Output Entries	0x7000	0x7010	0x7020	0x7030	0x7040	0x7050
Configuration Parameter	0x8000	0x8010	0x8020	0x8030	0x8040	0x8050
Information	0x9000	0x9010	0x9020	0x9030	0x9040	0x9050

Table 5.3.1-4 Each module number object address 2

EtherCAT® object dictionary	Module number					
	7	8	9	10	11	—
RxPDOs	0x1606	0x1607	0x1608	0x1609	0x160A	—
TxPDOs	0x1A06	0x1A07	0x1A08	0x1A09	0x1A0A	—
Input Entries	0x6060	0x6070	0x6080	0x6090	0x60A0	—
Output Entries	0x7060	0x7070	0x7080	0x7090	0x70A0	—
Configuration Parameter	0x8060	0x8070	0x8080	0x8090	0x80A0	—
Information	0x9060	0x9070	0x9080	0x9090	0x90A0	—

Table 5.3.1-5 Each module number object address 3

EtherCAT® object dictionary	Module number					
	12	13	14	15	16	17
RxPDOs	0x160B	0x160C	0x160D	0x160E	0x160F	0x1610
TxPDOs	0x1A0B	0x1A0C	0x1A0D	0x1A0E	0x1A0F	0x1A10
Input Entries	0x60B0	0x60C0	0x60D0	0x60E0	0x60F0	0x6100
Output Entries	0x70B0	0x70C0	0x70D0	0x70E0	0x70F0	0x7100
Configuration Parameter	0x80B0	0x80C0	0x80D0	0x80E0	0x80F0	0x8100
Information	0x90B0	0x90C0	0x90D0	0x90E0	0x90F0	0x9100

Table 5.3.1-6 Each module number object address 4

EtherCAT® object dictionary	Module number					
	18	19	20	21	22	—
RxPDOs	0x1611	0x1612	0x1613	0x1614	0x1615	—
TxPDOs	0x1A11	0x1A12	0x1A13	0x1A14	0x1A15	—
Input Entries	0x6110	0x6120	0x6130	0x6140	0x6150	—
Output Entries	0x7110	0x7120	0x7130	0x7140	0x7150	—
Configuration Parameter	0x8110	0x8120	0x8130	0x8140	0x8150	—
Information	0x9110	0x9120	0x9130	0x9140	0x9150	—

Data sizes of each I/O assignment symbol are shown below. Input modules are assigned 0x60nn sub-index 1. Output modules are assigned 0x70nn sub-index 1. (“nn” is slot position.)

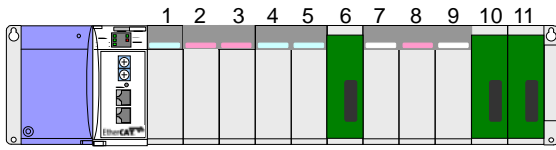
Table 5.3.1-7 Data sizes of each I/O assignment symbol

I/O assignment symbol	Device ID	Data type	Input sizes (Rx)	Output sizes (Tx)
X16	0x00000001	UINT	2 bytes	—
X32	0x00000002	UDINT	4 bytes	—
X64	0x00000003	ULINT	8 bytes	—
X4Y4W	0x00000004	ARRAY [0..3] OF UINT / ARRAY [0..3] OF UINT	8 bytes	8 bytes
Y16	0x00000005	UINT	—	2 bytes
Y32	0x00000006	UDINT	—	4 bytes
Y64	0x00000007	ULINT	—	8 bytes
B1_1	0x00000008	UINT/UINT	2 bytes	2 bytes
B2_1	0x00000009	UDINT/UINT	4 bytes	2 bytes
B1_2	0x0000000A	UINT/UDINT	2 bytes	4 bytes
B2_2	0x0000000B	UDINT/UDINT	4 bytes	4 bytes
X4W	0x00000011	ARRAY [0..3] OF UINT	8 bytes	—
X8W	0x00000012	ARRAY [0..7] OF UINT	16 bytes	—
X7Y1W	0x00000013	ARRAY [0..6] OF UINT / ARRAY [0..0] OF UINT	14 bytes	2 bytes
X6Y2W	0x00000014	ARRAY [0..5] OF UINT / ARRAY [0..1] OF UINT	12 bytes	4 bytes
X5Y3W	0x00000015	ARRAY [0..4] OF UINT / ARRAY [0..2] OF UINT	10 bytes	6 bytes
X3Y5W	0x00000016	ARRAY [0..2] OF UINT / ARRAY [0..4] OF UINT	6 bytes	10 bytes
X2Y6W	0x00000017	ARRAY [0..1] OF UINT / ARRAY [0..5] OF UINT	4 bytes	12 bytes
X1Y7W	0x00000018	ARRAY [0..0] OF UINT / ARRAY [0..6] OF UINT	2 bytes	14 bytes
Y8W	0x00000019	ARRAY [0..7] OF UINT	—	16 bytes
Y4W	0x0000001A	ARRAY [0..3] OF UINT	—	8 bytes

For information on relation between model name of I/O modules and I/O assignment symbol, please refer to “3.2 Functional Specifications”.

5.3.2 Mount example

(1) If you use only basic unit.



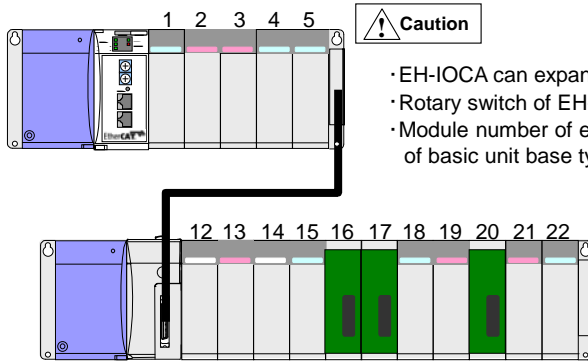
Item	Model name	I/O assignment symbol
Power supply module	EH-PSA	—
Base unit	EH-BS8A	—
Module 1	EH-XD16	X16
Module 2	EH-YT16	Y16
Module 3	EH-YT32	Y32
Module 4	EH-AX8V	X8W
Module 5	EH-XD64	X64

Item	Model name	I/O assignment symbol
Module 6	Empty	—
Module 7	EH-CU	X5Y3W
Module 8	EH-AY8H	Y8W
Module 9	EH-POS	X4Y4W
Module 10	Empty	—
Module 11	Empty	—

Table 5.3.2-1 Case 1 PDO mapping

Item	Module number										
	1	2	3	4	5	6	7	8	9	10	11
Input type	UINT	—	—	ARRAY [0..7] OF UINT	ULINT	—	ARRAY [0..4] OF UINT	—	ARRAY [0..3] OF UINT	—	—
Output type	—	UINT	UDINT	—	—	—	ARRAY [0..2] OF UINT	ARRAY [0..7] OF UINT	ARRAY [0..3] OF UINT	—	—
RxPDOs	—	0x1601	0x1602	—	—	—	0x1606	0x1607	0x1608	—	—
Output Entries	—	0x7010:01	0x7020:01	—	—	—	0x7060:01	0x7070:01	0x7080:01	—	—
TxPDOs	0x1A00	—	—	0x1A03	0x1A04	—	0x1A06	—	0x1A08	—	—
Input Entries	0x6000:01	—	—	0x6030:01	0x6040:01	—	0x6060:01	—	0x6080:01	—	—

(2) If you use expansion unit.



Caution

- EH-IOCA can expand a one unit.
- Rotary switch of EH-IOCH2 must be set 1.
- Module number of expansion unit is starting from 12 regardless of basic unit base type.

Item	Model name	I/O assignment symbol
Power supply module	EH-PSA	—
Base unit	EH-BS8A	—
Module 1	EH-XD32	X32
Module 2	EH-YT64	Y64
Module 3	EH-YT32	Y32
Module 4	EH-PT4	X4W
Module 5	EH-XD16	X16
Module 12	EH-MTT32	B1/1
Module 13	EH-AYG4M	Y8W

Item	Model name	I/O assignment symbol
Module 14	EH-POS	X4Y4W
Module 15	EH-AXG5M	X8W
Module 16	Empty	—
Module 17	Empty	—
Module 18	EH-XD64	X64
Module 19	EH-YT16	Y16
Module 20	Empty	—
Module 21	EH-YT32	Y32
Module 22	EH-PT4	X4W

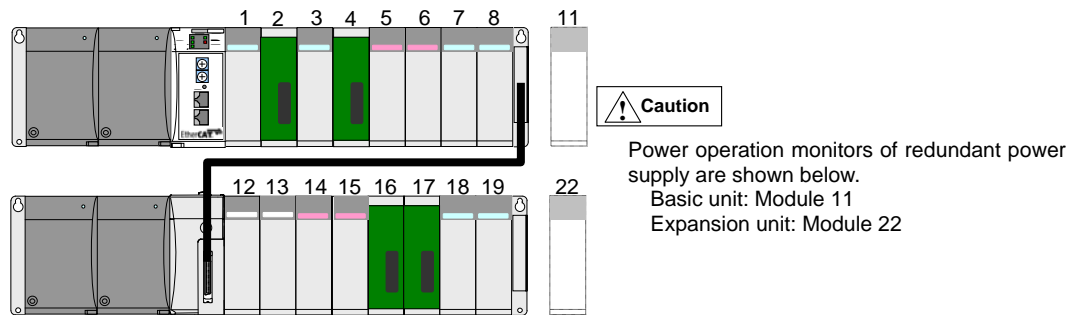
Table 5.3.2-2 Case 2 PDO mapping (basic unit)

Item	Modules number										
	1	2	3	4	5	6	7	8	9	10	11
Input type	UDINT	—	—	ARRAY [0..3] OF UINT	UINT	—	—	—	—	—	—
Output type	—	ULINT	UDINT	—	—	—	—	—	—	—	—
RxPDOs	—	0x1601	0x1602	—	—	—	—	—	—	—	—
Output Entries	—	0x7010:01	0x7020:01	—	—	—	—	—	—	—	—
TxPDOs	0x1A00	—	—	0x1A03	0x1A04	—	—	—	—	—	—
Input Entries	0x6000:01	—	—	0x6030:01	0x6040:01	—	—	—	—	—	—

Table 5.3.2-3 Case 2 PDO mapping (expansion unit)

Item	Modules number										
	12	13	14	15	16	17	18	19	20	21	22
Input type	UINT	—	ARRAY [0..3] OF UINT	ARRAY [0..7] OF UINT	—	—	ULINT	—	—	—	ARRAY [0..3] OF UINT
Output type	UINT	ARRAY [0..7] OF UINT	ARRAY [0..3] OF UINT	—	—	—	—	UINT	—	UDINT	—
RxPDOs	—	0x160C	0x160D	—	—	—	—	0x1612	—	0x1614	—
Output Entries	—	0x70C0:01	0x70D0:01	—	—	—	—	0x7120:01	—	0x7140:01	—
TxPDOs	0x1A0B	—	0x1A0D	0x1A0E	—	—	0x1A11	—	—	—	0x1A15
Input Entries	0x60B0:01	—	0x60D0:01	0x60E0:01	—	—	0x6110:01	—	—	—	0x6150:01

(3) If you use redundant power supply



Item	Model name	I/O assignment symbol
Power supply module	EH-PSR	—
Base unit	EH-BS8R	—
Module 1	EH-XD32	X32
Module 2	Empty	—
Module 3	EH-XD32	X32
Module 4	Empty	—
Module 5	EH-YT32	Y32
Module 6	EH-YT32	Y32
Module 7	EH-AXH8M	X8W
Module 8	EH-AXH8M	X8W

Item	Model name	I/O assignment symbol
Module 11	EH-PSR*1	X16
Module 12	EH-CU	X5Y3W
Module 13	EH-CUE	X5Y3W
Module 14	EH-AYH8M	Y8W
Module 15	EH-AYH8M	Y8W
Module 16	Empty	—
Module 17	Empty	—
Module 18	EH-YTP16	Y16
Module 19	EH-YTP16	Y16
Module 22	EH-PSR*1	X16

*1 Power operation monitor

Table 5.3.2-4 Case 3 PDO mapping (basic unit)

Item	Modules number										
	1	2	3	4	5	6	7	8	9	10	11
Input type	UDINT	—	UDINT	—	—	—	ARRAY [0..7] OF UINT	ARRAY [0..7] OF UINT	—	—	UINT
Output type	—	—	—	—	UDINT	UDINT	—	—	—	—	—
RxPDOs	—	—	—	—	0x1604	0x1605	—	—	—	—	—
Output Entries	—	—	—	—	0x7040:01	0x7050:01	—	—	—	—	—
TxPDOs	0x1A00	—	0x1A02	—	—	—	0x1A06	0x1A07	—	—	0x1A0A
Input Entries	0x6000:01	—	0x6020:01	—	—	—	0x6060:01	0x6070:01	—	—	0x60A0:01

Table 5.3.2-5 Case 3 PDO mapping (expansion unit)

Item	Modules number										
	12	13	14	15	16	17	18	19	20	21	22
Input type	ARRAY [0..4] OF UINT	ARRAY [0..4] OF UINT	—	—	—	—	UINT	UINT	—	—	UINT
Output type	ARRAY [0..2] OF UINT	ARRAY [0..2] OF UINT	ARRAY [0..7] OF UINT	ARRAY [0..7] OF UINT	—	—	—	—	—	—	—
RxPDOs	0x160B	0x160C	0x160D	0x160E	—	—	—	—	—	—	—
Output Entries	0x70B0:01	0x70C0:01	0x70D0:01	0x70E0:01	—	—	—	—	—	—	—
TxPDOs	0x1A0B	0x1A0C	—	—	—	—	0x1A11	0x1A12	—	—	0x1A15
Input Entries	0x60B0:01	0x60C0:01	—	—	—	—	0x6110:01	0x6120:01	—	—	0x6150:01

5.3.3 Device status

EtherCAT® has Device status function which can send the internal status of each node device to the master unit.

Index of device status is 0xF100. Device status of EH-IOCA is shown below.

Table 5.3.3-1 Device status (0xF100)

Sub-index	Item
1	Status
2	Module RES
3	Module WDT
4	Module FAIL
5	Module IDER
6	FPGA Version
7	CPU Version

Information of each item is shown below.

(1) Status

Bit No.	Name	Meaning	Description
0	WDTEN	0: Watchdog error 1: No error	This bit is always ON.
1	MRES	0: Normal 1: Modules reset	Some I/O modules are reset state. For information, please refer to Module RES.
2	MWDT	0: Normal 1: Modules watchdog error	Some I/O modules are watchdog error. For information, please refer to Module WDT.
3	MFAIL	0: Normal 1: Modules failure	Some I/O modules are failure. For information, please refer to Module FAIL.
4	MIDER	0: Normal 1: Modules ID mismatch	Some I/O modules are mismatch between mount modules and recent modules. For information, please refer to Module IDER.
5-15	Undefined	-	-

(2) Module RES

Bit No.	Name	Meaning	Description
0	RES1	0: Module 1 no error 1: Module 1 reset state	Indicate module 1 reset state.
1	RES2	0: Module 2 no error 1: Module 2 reset state	Indicate module 2 reset state.
2	RES3	0: Module 3 no error 1: Module 3 reset state	Indicate module 3 reset state.
~	~	~	~
20	RES21	0: Module 21 no error 1: Module 21 reset state	Indicate module 21 reset state.
21	RES22	0: Module 22 no error 1: Module 22 reset state	Indicate module 22 reset state.
22-31	Undefined	-	-

(3) Module WDT

Bit No.	Name	Meaning	Description
0	WDT1	0: Module 1 no error 1: Module 1 watchdog error	Indicate module 1 watchdog error state
1	WDT2	0: Module 2 no error 1: Module 2 watchdog error	Indicate module 2 watchdog error state
2	WDT3	0: Module 3 no error 1: Module 3 watchdog error	Indicate module 3 watchdog error state
~	~	~	~
20	WDT21	0: Module 21 no error 1: Module 21 watchdog error	Indicate module 21 watchdog error state
21	WDT22	0: Module 22 no error 1: Module 22 watchdog error	Indicate module 22 watchdog error state
22-31	Undefined	-	-

(4) Module FAIL

Bit No.	Name	Meaning	Description
0	FAIL1	0: Module 1 no error 1: Module 1 failure	Indicate module 1 failure state
1	FAIL2	0: Module 2 no error 1: Module 2 failure	Indicate module 2 failure state
2	FAIL3	0: Module 3 no error 1: Module 3 failure	Indicate module 3 failure state
~	~	~	~
20	FAIL21	0: Module 21 no error 1: Module 21 failure	Indicate module 21 failure state
21	FAIL22	0: Module 22 no error 1: Module 22 failure	Indicate module 22 failure state
22-31	Undefined	-	-

(5) Module IDER

Bit No.	Item	Meaning	Description
0	IDER1	0: Module 1 no error 1: Module 1 ID mismatch	Indicate module 1 ID mismatch state
1	IDER2	0: Module 2 no error 1: Module 2 ID mismatch	Indicate module 2 ID mismatch state
2	IDER3	0: Module 3 no error 1: Module 3 ID mismatch	Indicate module 3 ID mismatch state
~	~	~	~
20	IDER21	0: Module 21 no error 1: Module 21 ID mismatch	Indicate module 21 ID mismatch state
21	IDER22	0: Module 22 no error 1: Module 22 ID mismatch	Indicate module 22 ID mismatch state
22-31	Undefined	-	-

(6) FPGA Version

Bit No.	Item	Meaning	Description
0-15	FVER	-	Indicate FPGA version of EH-IOCA.

(7) CPU Version

Bit No.	Item	Meaning	Description
0-15	CVER	-	Indicate CPU version of EH-IOCA

5.3.4 Device control

EtherCAT® has device control function which can send the unit information of each node device to the master unit. Index of device control is 0xF200. Device control of EH-IOCA is shown below.

Table 5.3.4-1 Device control (0xF200)

Bit No.	Name	Meaning	Description
0	ORST	0: Output reset 1: Output hold	When the communication state changed from Op mode to other mode, it is selected whether the output data from the master is held or not.
1-15	Undefined	-	-

5.4 Communication state transitions

The communication state of EtherCAT® slave units is indicated by the EtherCAT® state machine (ESM) that is controlled by the master unit. According to the communication state, the communication method is decided.

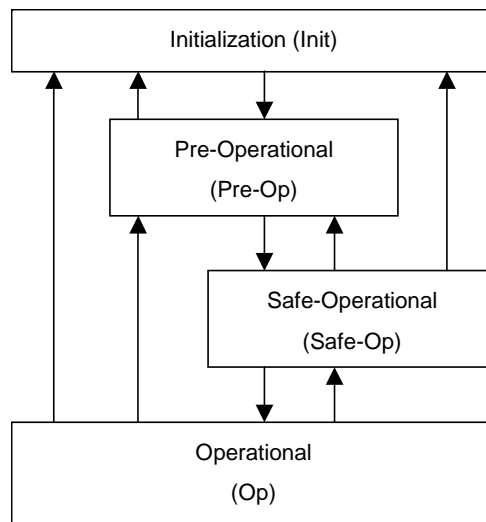


Figure 5.4-1 Communication state transitions

Table 5.4-1 Each communication state

State	Description	SDO communication	PDO communication
Initialization (Init)	This state is initializing communications. Communications are not possible.	Not possible	Not possible
Pre-Operational (Pre-Op)	This state is after the completion of initial setting. Communications are possible to use SDO communication only.	Possible	Not possible
Safe-operational (Safe-Op)	This state is after failure detection in OP state. Communications are possible to use SDO communication and the input data in PDO communication.	Possible	Possible (Input data only)
Operational (Op)	This state is being normal communications. Communications are possible to use SDO and PDO communication.	Possible	Possible



MEMO

A series of horizontal dashed lines spanning the width of the page, providing a template for writing a memo.

Chapter 6 Troubleshooting

6.1 Error indicates

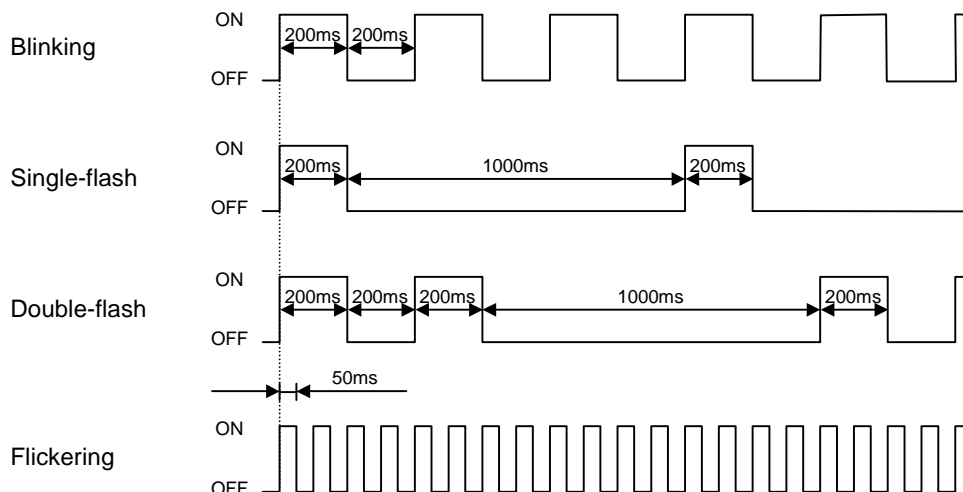
When EH-IOCA occur error, each LEDs are ON, Blink, or OFF.

Error descriptions are shown below.

Table 6.1-1 Indicates EH-IOCA errors

LED	Indicate pattern	Description	Cause	Actions
	ON	No error	—	—
	OFF	Hardware error Power supply error	<ul style="list-style-type: none"> The power is not properly supplied to the EH-IOCA. EH-IOCA is broken. 	<ul style="list-style-type: none"> Check power of power supply module. Replace EH-IOCA.
	OFF	No error	—	—
	Blinking	Configuration error	It is mismatch between master side configuration data and EH-IOCA mounted modules.	Check system and node address and push reset switch of EH-IOCA.
	Single-flash	EtherCAT [®] synchronism failure Communication data failure	Error data appear on EtherCAT [®] network.	<ul style="list-style-type: none"> Check the connection of the communication cable. Check there are no sources of noise near the communication cable.
	Double-flash	Application watchdog timeout	Communications error occurred.	<ul style="list-style-type: none"> Check the connection of the communication cable. Check there are no sources of noise near the communication cable.
	Flickering	Boot error	EH-IOCA fail boot, when EH-IOCA is power on.	Replace EH-IOCA.
	ON	Link established in physical layer	—	—
	OFF	Link not established in physical layer	Link in physical layer has not been established.	<ul style="list-style-type: none"> Check the connection of the communication cable. Check there are no sources of noise near the communication cable. Check communication speed of host is "Auto".

The state of LED is indicated below.



6.2 AL status code

AL status codes are shown below.

Table 6.2-1 AL status code lists

Code	Item	Description	Actions
0x0000	No error	Operation is normal.	—
0x0001	Unspecified error	Unspecified error detected.	Recheck the EH-IOCA and restart the power supply. If the same error occurs, it is a hardware error in the EH-IOCA. Replace the EH-IOCA with a spare.
0x0002	No memory	Memory is none.	Recheck the EH-IOCA and restart the power supply. If the same error occurs, it is a hardware error in the EH-IOCA. Replace the EH-IOCA with a spare.
0x0011	Illegal state transition request received	An Illegal state transition request Received.	Check the transition setting in the master unit.
0x0012	Error state transition received	A transition request to an unknown state was received.	Check the transition setting in the master unit.
0x0015	Illegal mailbox received	A mailbox to an unknown state was received.	Check the mailbox setting in the master unit.
0x0016	Mailbox setting error	A mailbox setting to an unknown state was received.	Check the mailbox setting in the master unit.
0x001B	Process data watchdog timeout	A timeout was detected for an I/O data transmission frame.	Check the WDT settings in the master unit
0x001F	Invalid watchdog configuration	An illegal watchdog setting was received by master.	Check the WDT settings in the master unit
0x0024	Invalid input mapping	An illegal TxPDO was received by master.	Check the TxPDO settings in the master unit
0x0025	Invalid output mapping	An illegal RxPDO was received by master.	Check the RxPDO settings in the master unit
0x002C	Fatal sync error	During operation, sync0 not interrupted.	After checking the following items, restart the slave units. <ul style="list-style-type: none"> • Check the communications cable whether or not it is wired correctly. • Check the communications cable whether or not it is taking noise resistance.

Appendix 1 EtherCAT[®] object dictionary

Object dictionaries of EH-IOCA are shown below.

Index	Object name	Sub index	Data type	Access	PDO mapping	Initial value	Description
0x1000	Device Type	0x00	UNSIGNED32	RO	Not possible	0x00001389	Indicates the device type of each slave.
0x1001	Error Register	0x00	UNSIGNED8	RO	Not possible	0x00	Indicates the error register of CoE communication.
0x1008	Manufacturer Device Name	0x00	VISIBLE_STRING	RO	Not possible	“EH-IOCA”	Indicates the model name of each slave.
0x1009	Manufacturer Hardware version	0x00	VISIBLE_STRING	RO	Not possible	“1.00”	Indicates the hardware version of each slave.
0x100A	Manufacturer Software version	0x00	VISIBLE_STRING	RO	Not possible	“5.10”	Indicates the software version of each slave.
0x1018	Identify Object	0x00	UNSIGNED8	RO	Not possible	4	Indicates the information of EtherCAT [®] coupler type.
	Vendor ID	0x01	UNSIGNED32	RO	Not possible	0x0000051D	Indicates the vender ID.
	Product code	0x02	UNSIGNED32	RO	Not possible	0x02010010	Indicates the product code.
	Revision	0x03	UNSIGNED32	RO	Not possible	0x00000001	Indicates the revision No.
	Serial number	0x04	UNSIGNED32	RO	Not possible	0x00000000	Indicates the serial No.
0x10F1	Error Settings	0x00	UNSIGNED8	RO	Not possible	0x02	Indicates the slave error reaction.
	Local Error Reaction	0x01	UNSIGNED32	RW	Not possible	0x00000001	Set the slave error reaction.
	Sync Error Counter Limit	0x02	UNSIGNED8	RW	Not possible	0x00000004	Set the limit value of event miss counter.

Index	Object name	Sub index	Data type	Access	PDO mapping	Initial value	Description
0x1600-1615	RxPDO Mapping	0x00	UNSIGNED8	RO	Not possible	0x01	Indicates PDO mappings information from Module 1 to Module 22.
	Sub Index 1	0x01	UNSIGNED32	RO	Not possible	0x7**0:01,1	* is a index number.
0x16FF	RxPDO Mapping	0x00	UNSIGNED8	RO	Not possible	0x01	Indicates PDO mapping of device control information.
	Sub Index 1	0x01	UNSIGNED32	RO	Not possible	0xF200:01,16	
0x1A00-1A15	TxPDO Mapping	0x00	UNSIGNED8	RO	Not possible	0x01	Indicates PDO mappings information from Module 1 to Module 22.
	Sub Index 1	0x01	UNSIGNED32	RO	Not possible	0x6**0:01,1	* is a index number.
0x1AFF	TxPDO Mapping	0x00	UNSIGNED8	RO	Not possible	0x01	Indicates PDO mapping of device status information.
	Sub Index 1	0x01	UNSIGNED32	RO	Not possible	0xF100:01,16	
	Sub Index 2	0x02	UNSIGNED32	RO	Not possible	0xF100:02,32	
	Sub Index 3	0x03	UNSIGNED32	RO	Not possible	0xF100:03,32	
	Sub Index 4	0x04	UNSIGNED32	RO	Not possible	0xF100:04,32	
	Sub Index 5	0x05	UNSIGNED32	RO	Not possible	0xF100:05,32	
	Sub Index 6	0x06	UNSIGNED32	RO	Not possible	0xF100:06,16	
Sub Index 7	0x07	UNSIGNED32	RO	Not possible	0xF100:07,16		

Index	Object name	Sub index	Data type	Access	PDO mapping	Initial value	Description
0x1C00	Sync Manager	0x00	UNSIGNED8	RO	Not possible	0x04	Indicates sync manager type.
	Communication Type	0x01	UNSIGNED8	RO	Not possible	0x01	Indicates receive mailbox setting.
		0x02	UNSIGNED8	RO	Not possible	0x02	Indicates send mailbox setting.
		0x03	UNSIGNED8	RO	Not possible	0x03	Indicates process data output setting.
		0x04	UNSIGNED8	RO	Not possible	0x04	Indicates process data input setting.
0x1C12	RxPDO Assign	0x00	UNSIGNED8	RO	Not possible	0x01	Indicates number of sync manager RDO assign. * is a index number.
	Sub Index 001-023	0x01-0x17	UNSIGNED16	RO	Not possible	0x16**	Indicates status of sync manager RDO assign. * is a index number.
0x1C13	TxPDO Assign	0x00	UNSIGNED8	RO	Not possible	0x01	Indicates number of sync manager TDO assign. * is a index number.
	Sub Index 001-023	0x01-0x17	UNSIGNED16	RO	Not possible	0x1A**	Indicates status of sync manager TDO assign. * is a index number.

Index	Object name	Sub index	Data type	Access	PDO mapping	Initial value	Description
0x1C32	Sync Manager Output Parameter	0x00	UNSIGNED8	RO	Not possible	32	Indicates EtherCAT® communication mode of sync manager 2.
	Synchronization Type	0x01	UNSIGNED16	RW	Not possible	1	Indicates synchronization type. EH-IOCA is fixed free run mode (0x0001).
	Cycle Time	0x02	UNSIGNED32	RW	Not possible	2000000	Indicates cycle time. (ns)
	Synchronization Types supported	0x04	UNSIGNED16	RO	Not possible	16414	Indicates synchronization types supported.
	Minimum Cycle Time	0x05	UNSIGNED32	RO	Not possible	31200	Indicates minimum cycle time.
	Calc and Copy Time	0x06	UNSIGNED32	RO	Not possible	0	Indicates calc and copy time.
	Get Cycle Time	0x08	UNSIGNED16	RW	Not possible	0	Indicates get cycle time.
	Delay Time	0x09	UNSIGNED32	RO	Not possible	0	Indicates hardware delay time.
	Sync0 Cycle Time	0x0A	UNSIGNED32	RW	Not possible	0	Indicates sync0 cycle time.
	SM-Event Missed	0x0B	UNSIGNED32	RO	Not possible	0	Indicates cycle time error count.
	Cycle Time Too Small	0x0C	UNSIGNED32	RO	Not possible	2	Indicates cycle time to small error count.
	Sync Error	0x20	BOOL	RO	Not possible	False	Indicates sync error.

Index	Object name	Sub index	Data type	Access	PDO mapping	Initial value	Description
0x1C33	Sync Manager Input Parameter	0x00	UNSIGNED8	RO	Not possible	32	Indicates EtherCAT® communication mode of sync manager 2.
	Synchronization Type	0x01	UNSIGNED16	RW	Not possible	1	Indicates synchronization type. EH-IOCA is fixed free run mode (0x0001).
	Cycle Time	0x02	UNSIGNED32	RW	Not possible	2000000	Indicates cycle time. (ns)
	Synchronization Types supported	0x04	UNSIGNED16	RO	Not possible	16414	Indicates synchronization types supported.
	Minimum Cycle Time	0x05	UNSIGNED32	RO	Not possible	31200	Indicates minimum cycle time.
	Calc and Copy Time	0x06	UNSIGNED32	RO	Not possible	0	Indicates calc and copy time.
	Get Cycle Time	0x08	UNSIGNED16	RW	Not possible	0	Indicates get cycle time.
	Delay Time	0x09	UNSIGNED32	RO	Not possible	0	Indicates hardware delay time.
	Sync0 Cycle Time	0x0A	UNSIGNED32	RW	Not possible	0	Indicates sync0 cycle time.
	SM-Event Missed	0x0B	UNSIGNED32	RO	Not possible	0	Indicates cycle time error count.
	Cycle Time Too Small	0x0C	UNSIGNED32	RO	Not possible	2	Indicates cycle time to small error count.
Sync Error	0x20	BOOL	RO	Not possible	False	Indicates sync error.	
0x6000-6150	Input Entry	0x00	UNSIGNED32	RO	Not possible	—	Indicates input data object.
0x7000-7150	Output Entry	0x00	UNSIGNED32	RO	Not possible	—	Indicates output data object.

Index	Object name	Sub index	Data type	Access	PDO mapping	Initial value	Description
0xF000	Modular device profile	0x00	UNSIGNED8	RO	Not possible	2	Indicates modular device profile information of EH-IOCA.
	Number of object	0x01	UNSIGNED16	RO	Not possible	0x0010	Indicates number of object
	Maximum number of modules	0x02	UNSIGNED16	RO	Not possible	0x0016	Indicates maximum number of modules.
0xF030	Configured Module List	0x00	UNSIGNED8	RO	Not possible	0x00	—
	Sub Index 001-254	0x01-0xFE	UNSIGNED32	RW	Not possible	0x00000000	Indicates module ID.
0xF050	Detected Module List	0x00	UNSIGNED8	RO	Not possible	0x00	—
	Sub Index 001-254	0x01-0xFE	UNSIGNED32	RO	Not possible	0x00000000	Indicates module ID.

Index	Object name	Sub index	Data type	Access	PDO mapping	Initial value	Description
0xF100	Device Status	0x00	UNSIGNED8	RO	Not possible	0x07	—
	Status	0x01	UNSIGNED16	RO	Possible	0x0001	Indicates device status.
	Module RES	0x02	UNSIGNED32	RO	Possible	0x00000000	Indicates reset status of each module.
	Module WDT	0x03	UNSIGNED32	RO	Possible	0x00000000	Indicates watchdog status of each module.
	Module FAIL	0x04	UNSIGNED32	RO	Possible	0x00000000	Indicates fail status of each module.
	Module IDER	0x05	UNSIGNED32	RO	Possible	0x00000000	Indicates ID mismatch status of each module.
	FPGA Version	0x06	UNSIGNED16	RO	Possible	—	Indicates FPGA version. Initial value is different each model.
	CPU Version	0x07	UNSIGNED16	RO	Possible	—	Indicates CPU version. Initial value is different each model.
0xF200	Device Control	0x00	UNSIGNED8	RO	Not possible	0x01	—
		0x01	UNSIGNED16	RW	Possible	0x0000	Indicates device control.