HITACHI PROGRAMMABLE AUTOMATION CONTROLLER

HX Series

APPLICATION MANUAL (Hardware)
(SERVICE MANUAL)

NJI-637A(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 even within the warranty period, the warranty will be void if the fault is due to;

(1) Incorrect use as directed in this manual and / or in the application manual.

(2) Malfunction or failure caused by external device.

(3) Attempted repair by unauthorized personnel.

(4) Other force majeure, such as natural disasters, which beyond the responsibility of manufacturer.

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

○ Repair

Any investigation or repair after the warranty period cannot be covered as free of charge. Also any faults caused by above (1) to (4), will be charged for its repair (or for its investigation), even if the product is within the warranty period. In case of any contact, please ask your supplier or local Hitachi distributor. (Depending on failure part, investigation may not be possible to apply)

○ Ordering parts or asking questions

In case of repair, replacement parts ordering, or any other inquiries, 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 to install PAC
・PAC system engineer
・Person handling PAC
・Person who maintain the installed PAC

Warning

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(2) The content of this document may be changed without notice.

(3) This document has been created with utmost care. However, if errors or questionable areas are found, please contact us.

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Ethernet is registered trademarks of Fuji Xerox Co., Ltd.

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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 classifies as "Danger" and "Caution" in this document.

⬦ **DANGER** : Cases where if handled incorrectly a dangerous circumstance may be created, resulting in possible death or severe injury.

⚠ **CAUTION** : Cases where if handled incorrectly a dangerous circumstance may be created, resulting in possible minor to medium injury to the body, or only mechanical damage

However, depending on the circumstances, items marked with ⚠ CAUTION may result in major accidents.

In any case, they both contain important information, so please follow them closely.

Icons for prohibited items and required items are shown below:

🚫 : Indicates prohibited items (items that may not be performed). For example, when open flames are prohibited, is shown.

❗ : Indicates required items (items that must be performed). For example, when grounding must be performed, is shown.

1. About installation

⚠ CAUTION

- Use this product in an environment as described in the catalog and 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.

- Perform installation according to this manual.
  If installation is not performed adequately, it may result in dropping, malfunction or an operational error in the unit.

- Do not allow foreign objects such as wire chips to enter the unit.
  They may become the cause of fire, malfunction or failure.

2. About wiring

⏚ REQUIRED

- Always perform grounding (FE terminal).
  If grounding is not performed, there is a risk of electric shocks and malfunctions.

⚠ CAUTION

- Connect power supply that meets rating.
  If a power supply that does not meet rating is connected, fire may be caused.

- The wiring operation should be performed by a qualified personnel.
  If wiring is performed incorrectly, it may 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.

- Structure the emergency stop circuit, interlock circuit, etc. outside the programmable automation controller (hereinafter referred to as PAC).
  Damage to the equipment or accidents may occur due to failure of the PAC.
  However, do not interlock the unit to external load via relay drive power supply of the relay output module.

⚠ CAUTION

- When performing program change, forced output, RUN, STOP, etc., while the unit is running, be sure to verify safety.
  Damage to the equipment or accidents may occur due to operation error.

- Supply power according to the power–up order.
  Damage to the equipment or accidents may occur due to malfunctions.

⚠ CAUTION

- Use power supply unit of EH series or HX series for supplying electric power.

⚠ CAUTION

- Do not connect DC power supply module EH-PSD to a master power circuit. Supply a power to EH-PSD through an appropriate isolation transformer less than up to 150 VA by all means.

4. About preventive maintenance

◇ DANGER

- Do not connect the $+$, $-$ of the battery in reverse. Also, do not charge, disassemble, heat, place in fire, or short circuit the battery.
  There is a risk of explosion or fire.

⊘ PROHIBITED

- Do not disassemble or modify the unit.
  Electric shock, malfunction or failure may result.

⚠ CAUTION

- Turn off the power supply before removing or attaching module/unit.
  Electric shock, malfunction or failure may result.

Revision History

No.	Description of revision	Date of revision	Manual number
1	The first edition	2016.11	NJI-637(X)

Table of Contents

Chapter 1　Introduction

Thank you very much for choosing Hitachi Programmable Automation Controller (hereinafter referred to as PAC) HX series.

This application manual describes the hardware of HX-series such as installation and maintenance.

Refer to the other manuals as shown below for information about software or programming.

Please read these manuals carefully before using HX series.

Table 1.1 List of Description materials

Items	Title of material	Manual number
HX series	Application manual (Hardware)	NJI-637*1(X)
	Application manual (Software)	NJI-638*1(X)
	Command reference manual	NJI-639*1(X)

*1 The last alphabet of the manual Number stands for version starting from blank, A, B, C...

1.1　Unpacking

(1) Preparation of programming software HX-CODESYS

The programming software HX-CODESYS Ver3.5 SP8 Patch4 or later is necessary to use the HX series CPU module (hereinafter referred to as HX-CPU).

The existing programming software EHV-CODESYS for the Hitachi programmable controller EHV+ series does not support HX-CPU module. However, HX-CODESYS supports EHV+/Micro-EHV+ series as well.

(2) Initializing of user program

Since memory cells have an undefined status initially, a memory error may be displayed on the 7-segment LED. Be sure to initialize the HX-CPU by HX-CODESYS at the first use.

(3) Battery error indication

HX-CPU is shipped without a lithium battery. The battery is sold separately from CPU.

Since the default value of battery error detection (*2) is 'Enabled', the ERR LED blinks and the 7-segment LED shows '71', which means battery error. If you do not use a battery, disable the battery error detection.

*2 The setting of the battery error detection is found in [PLC Parameters] tab of [Device] in the device tree.

1.2   Instruction Manuals

The modules for EH-150 / EHV series shown in Table 1.2 can be used with HX-CPU. Some modules are not supported by HX-CPU. Refer to the manuals shown in Table 1.2 for further information. As for the modules without manual numbers, refer to chapter 5 to 10 of this manual.

Table 1.2 Related manuals to HX-CPU (1/2)

Product name	Model name	Specifications	Manual number	
			Japanese	English
Power supply module	EH-PSA	Input 100 to 240 V AC Output	-	-
	EH-PSD	Input 21.6 to 26.4 V DC Output	-	-
	EH-PSR	Input 100 to 240 V AC Output for redundancy	-	-
	HX-PSA	Input 100 to 240 V AC Output		
	HX-PSD	Input 21.6 to 26.4 V DC Output		
I/O controller	EH-IOCH2	I/O controller for expansion unit	-	-
Digital input module	EH-XD8	8 points, 24 V DC input	-	-
	EH-XD16	16 points, 24 V DC input	-	-
	EH-XDL16	16 points, 24 V DC input, Intensified filter	-	-
	EH-XDS16	16 points, 24 V DC Fast input	-	-
	EH-XD32	32 points, 24 V DC input	-	-
	EH-XDL32	32 points, 24 V DC input, Intensified filter	-	-
	EH-XDS32	32 points, 24 V DC Fast input	-	-
	EH-XD32E	32 points, 24 V DC input, Spring type terminal block	-	-
	EH-XDL32E	32 points, 24 V DC input, Spring type terminal block, Intensified filter	-	-
	EH-XD32H	32 points, 24 V DC input, Compatible connecter with EM and H-200	-	-
	EH-XD64	64 points, 24 V DC input	-	-
	EH-XA16	16 points, 100 to 120 V AC input	-	-
	EH-XAH16	16 points, 200 to 240 V AC input	-	-
Digital output module	EH-YR8B	8 points, relay output (isolated contact point), 100 / 240VAC, 24V DC	-	-
	EH-YR12	12 points, relay output, 100 / 240 V AC, 24 V DC	-	-
	EH-YR16	16 points, relay output, 100 / 240 V AC, 24 V DC, 16 points / 1 common	-	-
	EH-YR16D	16 points, relay output, 100 / 240 V AC, 24 V DC, 8 points / 1 common	-	-
	EH-YT8	8 points, transistor output, 12 / 24 V DC (sink type)	-	-
	EH-YTP8	8 points, transistor output, 12 / 24 V DC (source type)	-	-
	EH-YT16	16 points, transistor output, 12 / 24 V DC (sink type)	-	-
	EH-YTP16	16 points, transistor output, 12 / 24 V DC (source type)	-	-
	EH-YTP16S	16 points, transistor output, 12 / 24 V DC (source type), short-circuit protection	-	-
	EH-YT32	32 points, transistor output, 12 / 24 V DC (sink type)	-	-
	EH-YTP32	32 points, transistor output, 12 / 24 V DC (source type)	-	-
	EH-YT32E	32 points, transistor output, 12 / 24 V DC (sink type) Spring terminal block	-	-
	EH-YTP32E	32 points, transistor output, 12 / 24 V DC (source type) Spring terminal block	-	-
	EH-YT32H	32 points, transistor output, 5 / 12 / 24 V DC (sink type) Compatible connecter with EM and H-200	-	-
	EH-YT64	64 points, transistor output, 12 / 24 V DC (sink type)	-	-
	EH-YTP64	64 points, transistor output, 12 / 24 V DC (source type)	-	-
	EH-YS16	16 points, triac output, 100 / 240 V AC	-	-

Table 1.2 Related manuals to HX-CPU (2/2)

Product name	Model name	Specifications	Manual number	
			Japanese	English
Analog input module	EH-AX44	12 bits analog input (4 to 20 mA, 0 to 10 V) each 4 ch.	-	-
	EH-AX8V	12 bits analog input 8 ch., Voltage (0 to +10 V)	-	-
	EH-AX8H	12 bits analog input 8 ch., Voltage (-10 to +10 V)	-	-
	EH-AX8I	12 bits analog input 8 ch., Current (4 to 20 mA)	-	-
	EH-AX8IO	12 bits analog input 8 ch., Current (0 to 22 mA)	-	-
	EH-AXH8M	14 bits analog input 8 ch. (0 to 22 mA, 4 to 22 mA, -10 to +10 V, 0 to 10 V)	-	-
	EH-AXG5M	Isolation between channels, 16 bits analog input 5ch. (0 to 22 mA, 4 to 22 mA, -10 to +10 V, 0 to 10 V)	-	-
Analog output module	EH-AY22	12 bits analog output (4 to 20 mA, 0 to 10 V) each 2 ch.	-	-
	EH-AY2H	12 bits analog output 2 ch., Voltage (-10 to +10 V)	-	-
	EH-AY4V	12 bits analog output 4 ch., Voltage (0 to +10 V)	-	-
	EH-AY4H	12 bits analog output 4 ch., Voltage (-10 to +10 V)	-	-
	EH-AY4I	12 bits analog output 4 ch., Current (4 to 20 mA)	-	-
	EH-AYH8M	14 bits analog output 8 ch., (0 to 22 mA, 4 to 22 mA, 0 to 10 V)	-	-
	EH-AYG4M	Isolation between channels, 16 bits analog output 4 ch. (0 to 22 mA, 4 to 22 mA, -10 to +10 V, 0 to 10 V)	-	-
RTD input module	EH-PT4	4 channels resistance temperature detector, Signed 15 bits Platinum (Pt 100 Ω / Pt 1000 Ω)	NJI-323*	NJI-324*(X)
	EH-RTD8	6/8 channels resistance temperature detector, Signed 15 bits Platinum (Pt 100 Ω / Pt 1000 Ω)	-	-
Thermocouple input module	EH-TC8	Signed 15 bits, Thermocouple input (K, E, J, T, B, R, S, N) 8 channels	-	-
Positioning and counter module	EH-CU	2 channels high-speed counter input, 100 kHz max., single/2-phase selectable, 4 points open collector outputs	NJI-321*	NJI-321*(X)
	EH-CUE	1 channel high-speed counter input, 100 kHz max., single/2-phase selectable, 2 points open collector outputs	-	-
	EH-POS	1-axis pulse positioning module	NJI-314*	NJI-315*(X)
Communication module	EH-RMP2	PROFIBUS-DP master module, 512 / 512 words I/O, 8 units per CPU can be installed	NJI-621*	NJI-621*(X)
	EH-IOCP2	PROFIBUS-DP slave controller, 122 / 122 words I/O	NJI-612*	NJI-612*(X)
	EH-IOCA	EtherCAT slave controller, 176 words I/O	NJI-599*	NJI-599*(X)
	EH-FLN3	FL-net interface module	NJI-410*	-
	EH-LNK	CPU link module (coaxial), 8 units per CPU can be mounted	NJI-381*	NJI-381*(X)
	EH-OLNK	CPU link module (optical fiber), 8 units per CPU can be mounted	NJI-395*	NJI-395*(X)
	EH-OLNKG	CPU link module (support optical fiber GI50 / 125 μm cable), 8 units per CPU can be mounted	NJI-395*	NJI-395*(X)
	EH-OLNKE	CPU link module (support optical fiver GI62.5 / 125 μm cable), 8 units per CPU can be mounted	NJI-395*	NJI-395*(X)

* This sign means revision of the manual. The first edition is blank, and the 2nd, 3rd, 4th editions are "A", "B", "C".

MEMO

Chapter 2 Features

2.1   Features of HX Series

Open standards, High-performance, TCO reduction*1

(1) Open standards

  The Hitachi HX Series supports global manufacturing by standardized programming with 5 programming languages compatible with the IEC61131-3 international standard. The integrated EtherCAT master function (industrial open network) enables interconnection of a wide range of devices. Seamless data transfer from field level to cloud is achieved via OPC-Unified Architecture.

(2) High-performance

Through the effective combination of up-to-date developed high-performance CPU with CODESYS software, Hitachi provides logic control and motion control on one CPU with very fast execution speed.
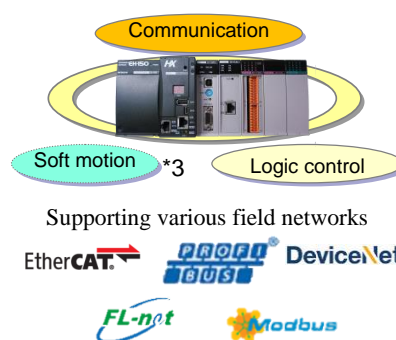
(3) TCO reduction*1

The HX Series is designed to provide the functionality of a PAC Controller (Programmable Automation Controller), which has both features of PLC and IPC.

The HX series contribute to TCO (Total cost of ownership) reduction by reduction of development cost, maintenance cost, and saving of installation space.
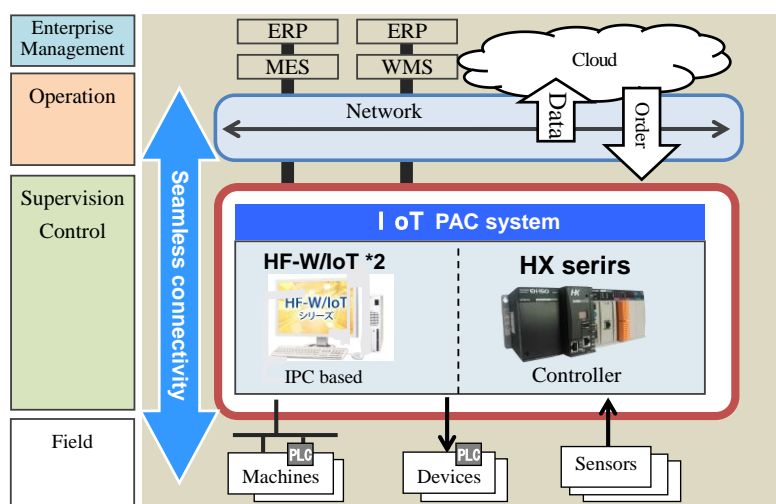
ERP : Enterprise Resource Planning, MES : Manufacturing Execution System

WMS : Warehouse Management System, IPC : Industrial PC

PLC : Programmable Logic Controller

　　*1 Total Cost of Ownership

　　*2 HF-W / IoT is a product of Hitachi Industry and Control Solutions, Ltd.

All modules of EH-150 series can be used.*1

The HX-CPU can use all modules of EH-150 series including input and output modules and communication modules. When using the maximum configuration, consisting of one basic base and 5 expansion bases, the HX-CPU can control up to 66 modules and 4.224 I/O points as local periphery. Further I/O expansion is possible using remote I/O's.

*1 Some high-function modules will be supported in the near future.
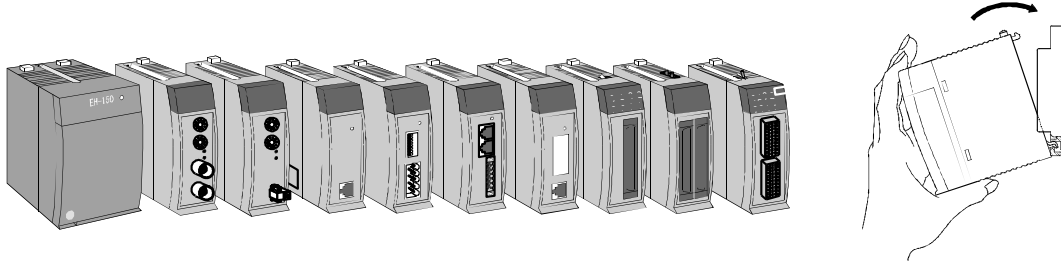
EtherCAT master

In both the Standard Model and the Full Function Model, EtherCAT master function is supported by the built-in Ethernet ports of the CPU.

Various types of slave devices such as inverters, servo drives, and remote I/O are controlled via EtherCAT.

EtherCAT
Slaves

Servo   Inverter   Compact I/O   Slice I/O
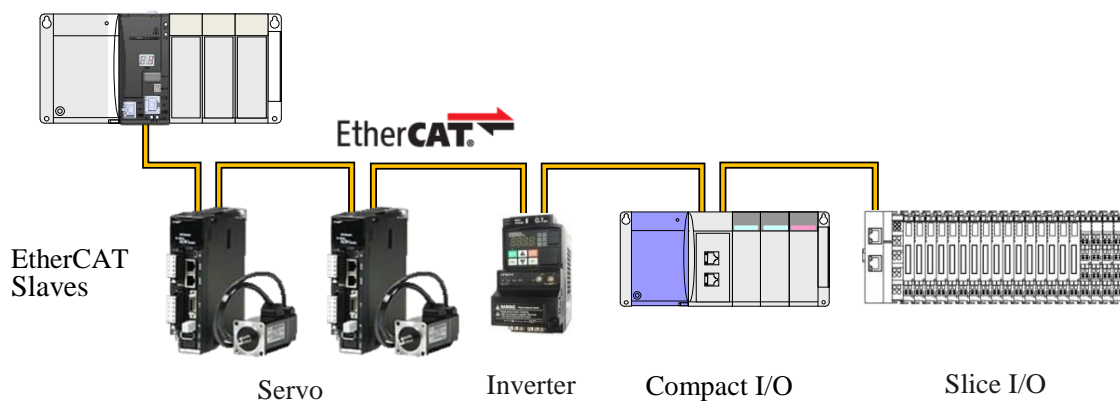
Large size data logging (SD Card)

The Full Function Model has a SD card interface, which makes data logging easy. (Function blocks to access files are available in the CODESYS library.)
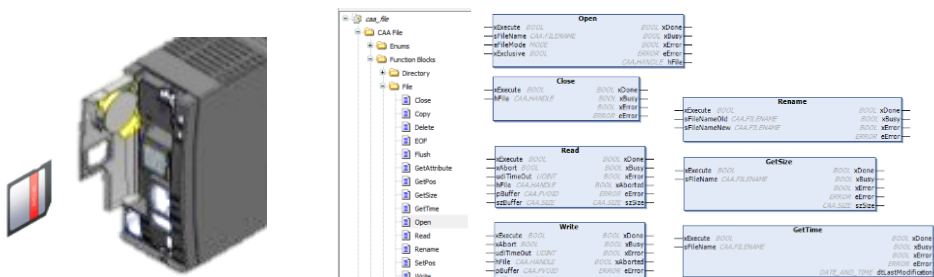
OPC UA Server

OPC UA (Unified Architecture) is a software interface between different manufacturers' devices and a host system based on the concept to unify industrial field and IT field.

The HX-CPU supports OPC-UA server function as standard. OPC-UA server allows easy connectivity with ERP, MES, SCADA, SAP, and various management and analysis software in the host system.

Programmable HMI connectivity

Programmable Touch-panel GP4000 series and EH-TP500 series are connectable with HX-CPU.

- **GP4000 series**

  All models are available with CODESYS V3 Ethernet Driver

  Selectable from 4 models with 12.1", 10.4", 7.5", 5.7" display size

- **EH-TP500 series**

  All models are available with CODESYS V3 Ethernet Driver

  Selectable from 5 models with 15", 13.3", 10.4", 7.0", 4.3" display size

Easy maintenance

- **Fan-less design**

  The CPU has no mechanical parts which need to be replaced.

- **Battery-less design**

  Non-volatile memory is used for programming memory and data memory. The CPU can retain manufacturing data without optional batteries to protect the data from sudden power failures.

Data and Program Protection

- **Block unauthorized access**

  - Detect / Protect unauthorized external access

  - Block unauthorized remote login connection

  - Prevent malicious data hacking

- **Control user access**

  - Login authentication

  - User and group control

  - Setting access authority

Online user registration   Access permission   User management

Web visualization (Monitoring via Web Browser)

Easy remote access to the controller´s web server to monitor the application status without preparing a customized HMI.

Potential cost reduction for hardware and on site resources through off site monitoring.

- Web server function included as standard (in Full Function Model)
- No requirement of customized HMI
- Availability of monitoring via standard web browser
- Remote maintenance, diagnosis and control can be also achieved
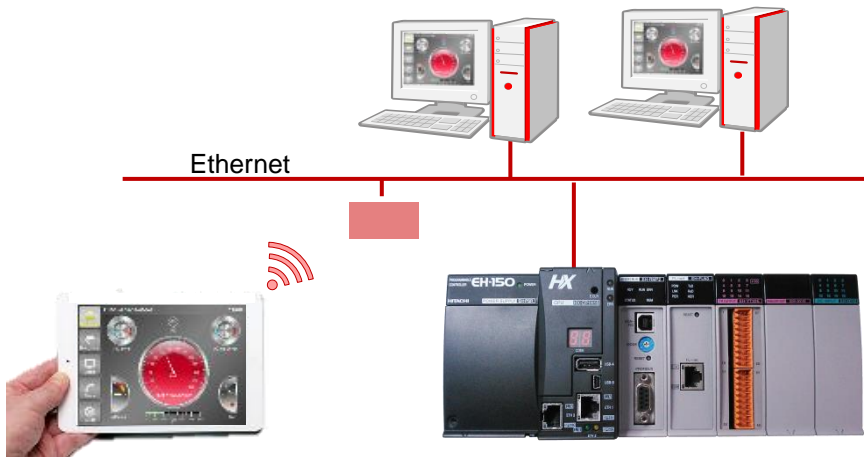
2.2 Integrated Development System HX-CODESYS

CODESYS is the widest-spread IEC61131-3 development system in the world. Over 350 controller manufacturers rely on CODESYS, in addition to tens of thousands of end users from a wide variety of industries.

### HX-CODESYS -integrating various support functions in every phase of development
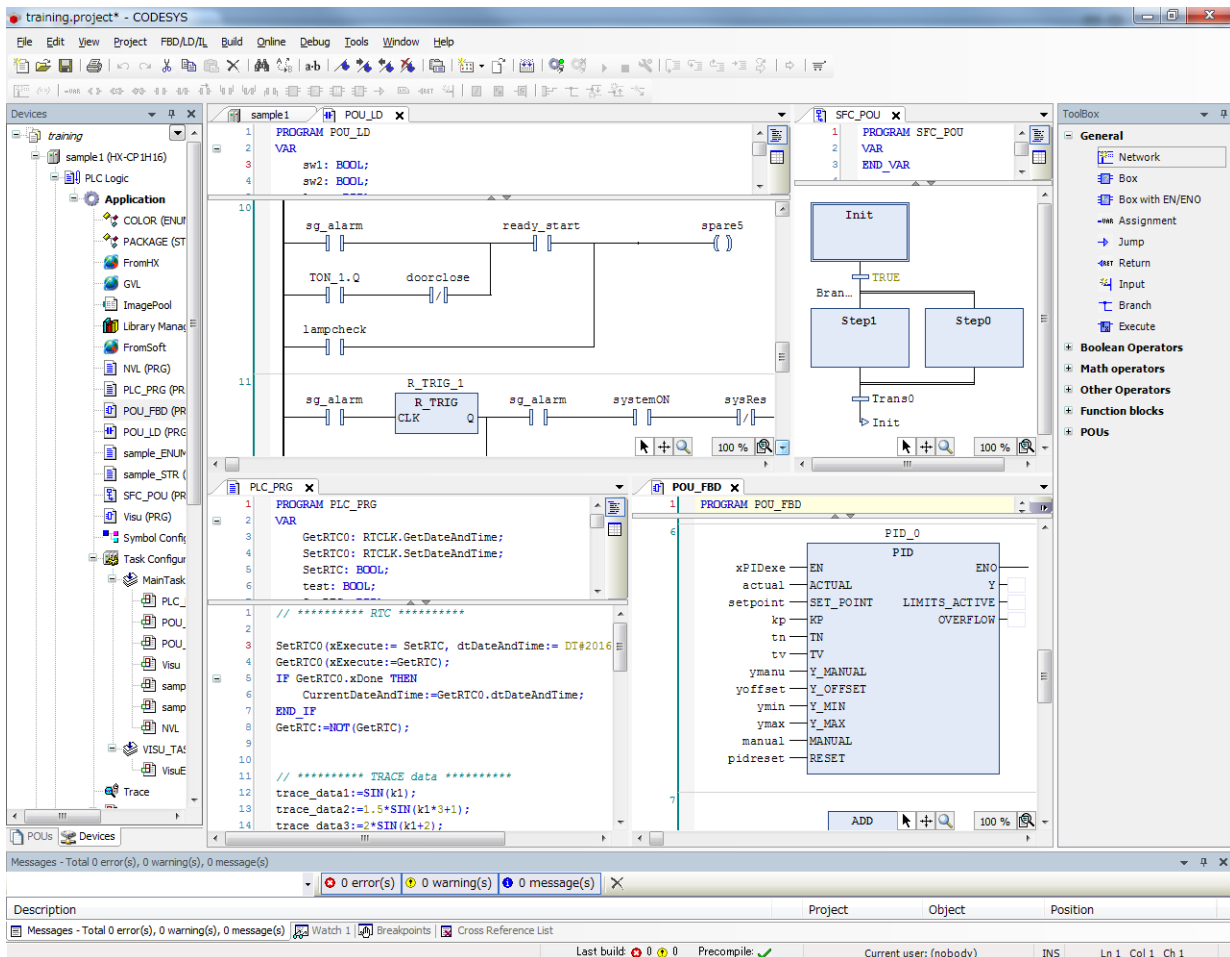
- Project tree allow you collective management of device, task and program of application.
- Integrated configurator for EtherCAT and Modbus can connect I/O channels on slaves to IEC variables.
- HX-CODESYS is including editors for all 5 IEC 61131-3 compliant implementation languages.
- The tool display language supports Japanese, English German, French, Italian, Spanish, Russian, Chinese, eight languages in total.
- Optional object-oriented programming according to IEC 61131-3 (3rd Edition).
- Compiler for optimized powerful machine code of HX-CPU.
- Various function such as automatic input completion and assistance, syntax error check, debug and simulation allow you efficient development.

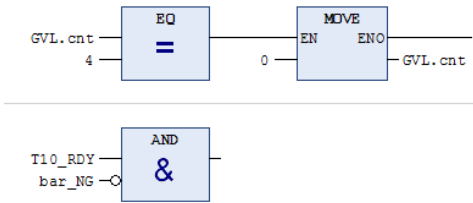## IEC61131-3 compliant 5 languages available to meet users skills and applications

LD (Ladder Diagram)

LD is a graphical language based on relay circuit. LD is suitable for the bit operation such as interlock processes.
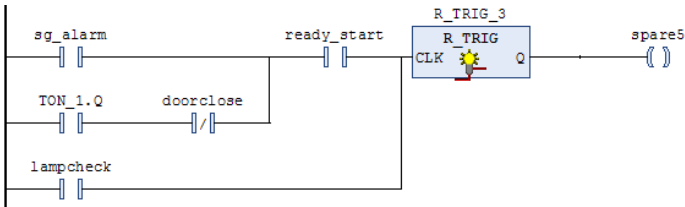
FBD (Function Block Diagram)

FBD is a graphic language where the flow of data and the signal is easy to watch.

ST (Structured Text)

ST is a text language based on PASCAL. It is suitable for branch, repetition and the arithmetic operation that were weak points in LD.

```
1    count_M3 := count_M3 + 1;
2    L2_wait_time (IN:=FALSE, PT:=T#3.6S);
3    L2_wait_time (IN:=TRUE);
4    FOR i:=0 TO count_T
5        K1_temp[i]:=B1_init; // Reset B1
6    END_FOR
7    IF count_Nmax <24 THEN
8        WHILE vxcnt < 10 DO
9            T1max:=125; // Max.=125 C
10        END_WHILE
11    END_IF
12    B100status:=FALSE;  // B100 complete
```

IL (Instruction List)

IL is a text language suitable for traditional PLC. It is suitable for high-speed operation and convenient for read out and collate program.

```
1    LD              t1_open
     AND             t1_rdy
     OR              t2_statusOK
     ST              fwd_cvy10
2    CAL             TON_0(
                 IN:= cvyOK,
                 PT:= T#3s,
                 ET=> ET_TON0)
     LD              TON_0.Q
     ST              start_cvy
```
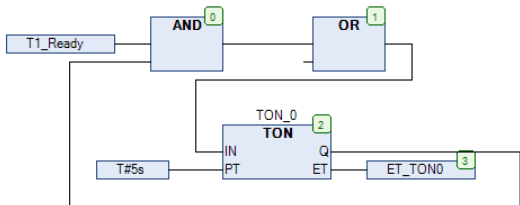
SFC (Sequential Function Chart)

SFC is a graphic language, which can express state transitions. It is suitable for process control to step. Each step can be described with LD, FBD and IL.
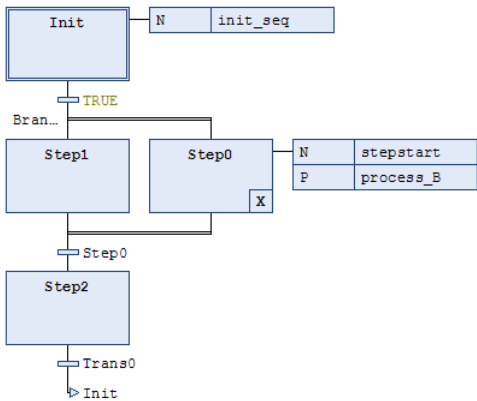
CFC (Continuous Function Chart)

CFC is a graphical language with unrestricted layout of POUs and connections, including feedback paths. (CFC is not IEC61131-3 compliant language.)

Reduction of development time and cost of IEC 61131-3 compliant applications

■   **Local and Global variables**

You can define Local variables that are effective only in each program and Global variables that are effective in the whole program. You can make application programs having high reusability by using local variables and global variables properly.

■   **Structured programming**

You can make programs and function blocks with multi-layer structure. This structured programming improves readability of programs, maintenance characteristics and reliability. As a result, application development efficiency increases.

■   **Library**

Frequently used programs or function blocks can be registered as libraries, which can be called from other projects. In addition, if you don't want to disclose your source codes of library to end users, save it as compiled format. Then source codes will be invisible.
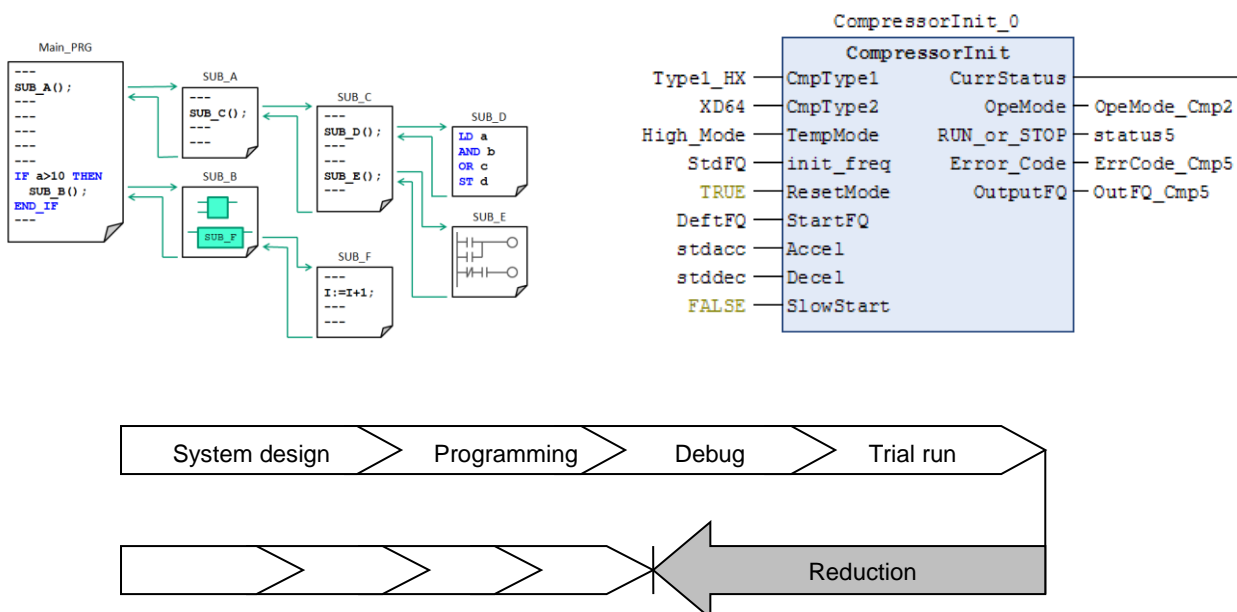
Useful libraries

Various useful libraries such as PID loops are available besides IEC61131-3 standard library.

■   PID

■   Analog output with Slew Rate

■   ASCII conversion

■   BCD conversion

■   Gray code conversion

■   String operation

■   Analog hysteresis

■   Minimum, Maximum, Mean, Variance
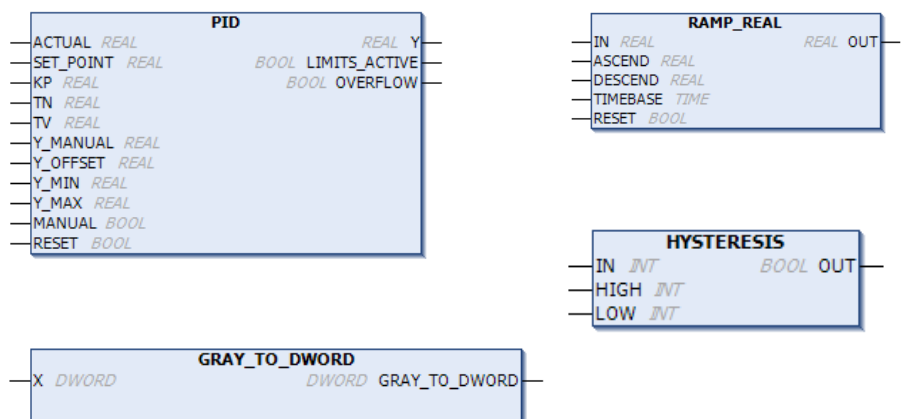
Convenient functions

HX-CODESYS improves programming efficiency, debug efficiency in various convenient functions.

- Automatic input completion and assistance avoiding compile errors because of input errors.
- Color-coded syntax highlighting, for example keywords and connected brackets.
- In LD editor and FBD editor, you can use ST language in function blocks.
- You can change any circuit or command to comment with right-click.
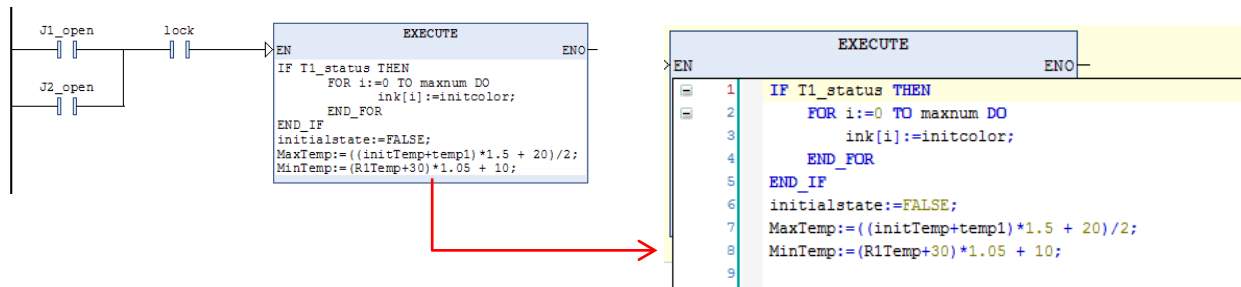

Powerful debugging functions

Powerful debugging functions features save commissioning cost.

- Online-monitor
- Offline-simulation
- Breakpoint
- Force value
- Single step execution
- Single cycle execution
- Flow control
- Program change during run
- Trace
- Visualization
- Web visualization
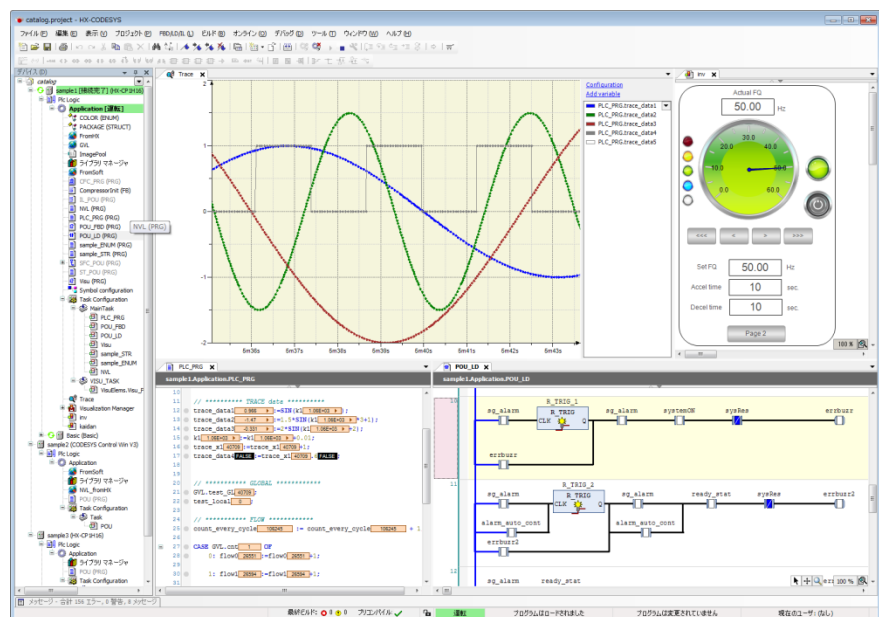
HX-CODESYS

HX-CODESYS is IEC61131-3 compliant integrated development system for only HX series.

CODESYS® is a registered trademark of 3S-Smart Software Solutions GmbH. HX-CODESYS is the same tool with CODESYS, including HX series specific device description files and libraries.

2.3   Communication Functions

Since the HX-CPU Full function model has 3 Ethernet ports (HX-CPU standard model has 2 Ethernet ports), each Ethernet port can communicate with 3 different directions individually, for example, the first port for host computers, the second port for other controllers, and the third port for field devices.
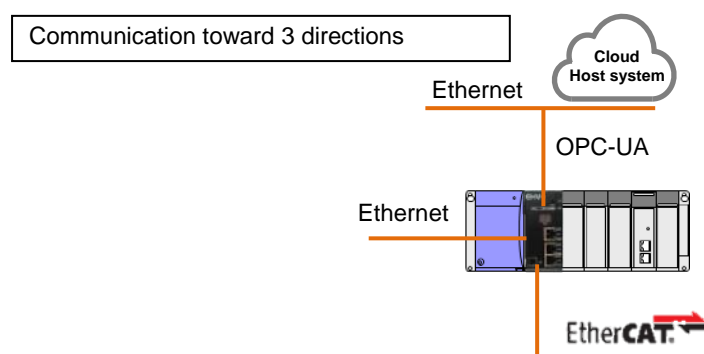
Figure 2.1 Ethernet Communication ports

You can build a flexible system with HX-CPU and Hitachi EtherCAT slave products such as Remote I/O controller slave (EH-IOCA), Inverter and Servo. EH-IOCA is a coupler type slave and can control up to 22 modules per slave node. Therefore, EH-IOCA can control up to 1,408 digital I/O points (176 analog I/O channels). The configuration example is shown in Figure 2.2.

[Configuration Example]
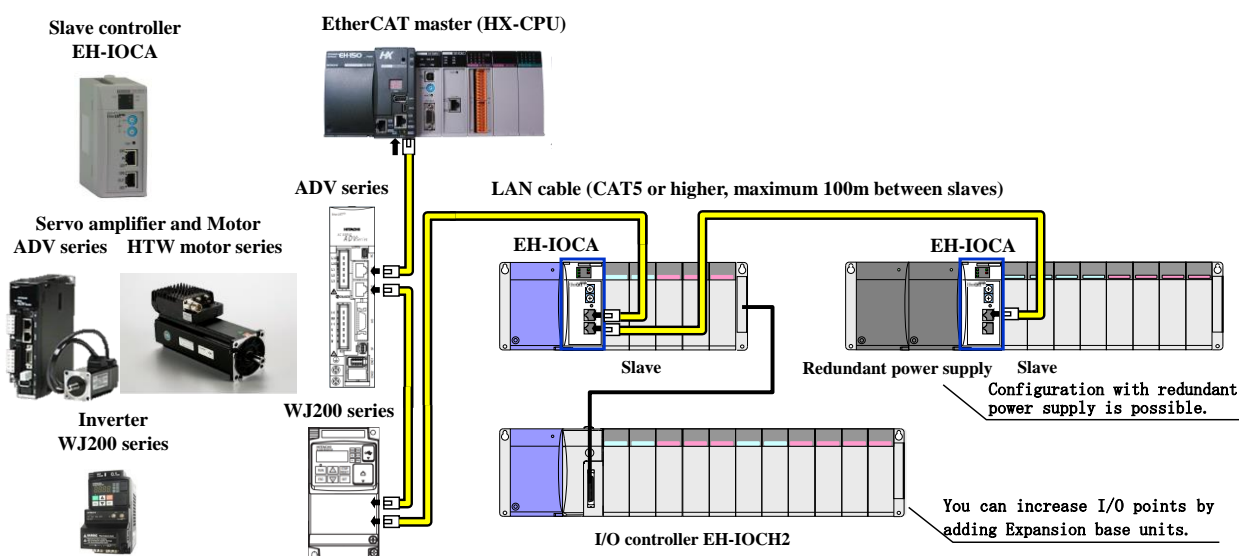
Figure 2.2 EtherCAT configuration

2.4   System Configuration

HX series is a modular type programmable automation controller. The basic configuration is shown in Figure 2.3.
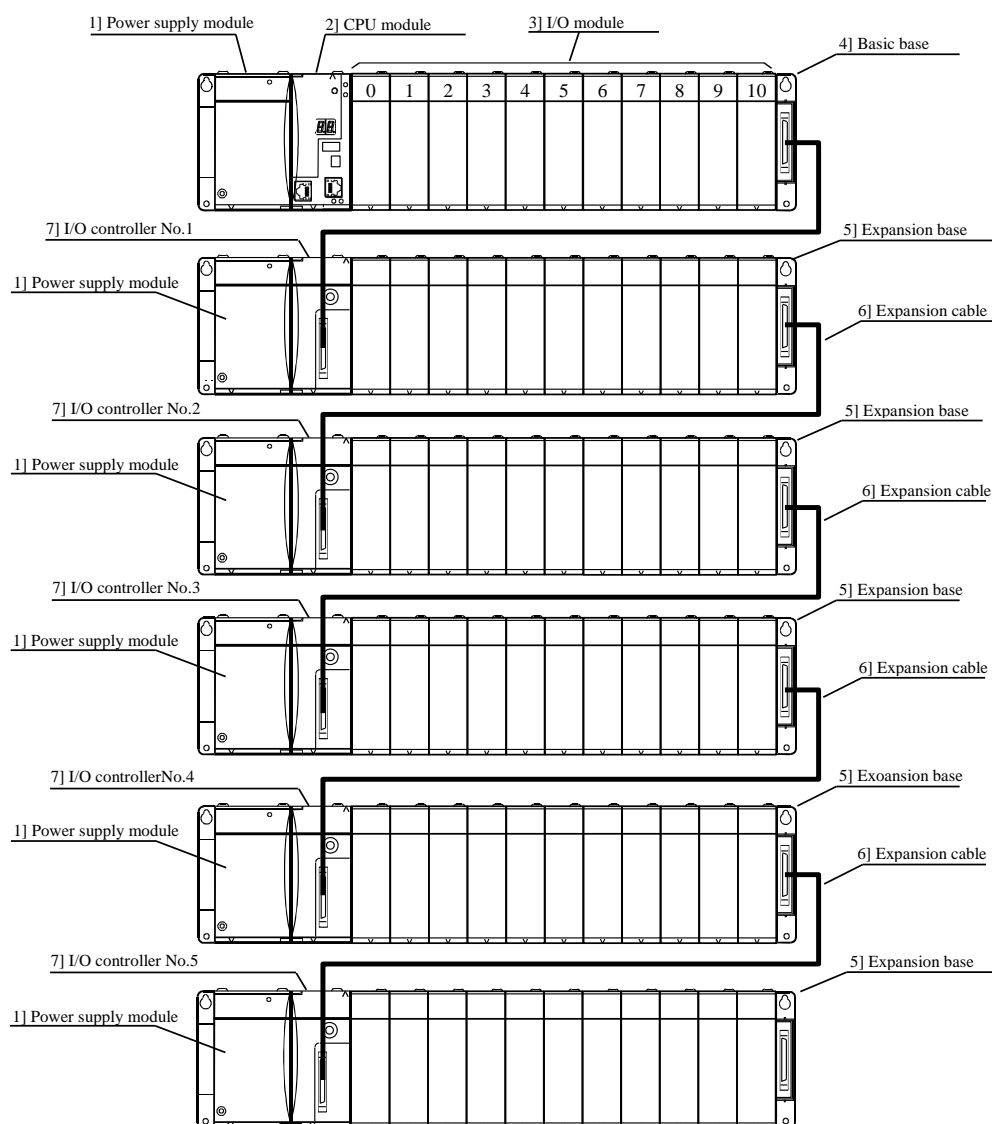
Figure 2.3 System configuration diagram (HX series)

Table 2.1 Modules in HX system configuration

No.	Device name	Description of function
1]	Power supply module	Converts external power supply into internal DC power for the PLC.
2]	CPU module	Reads inputs, executes user program and writes outputs according to the program.
3]	I/O module	Digital modules, analog modules, high-functional modules and communication modules
4]	Basic base	Base unit hosting the CPU module
5]	Expansion base	Base unit hosting the I/O controller
6]	Expansion cable	Cable between base unit and I/O controller. Available cable length are 0.5m, 1m and 2m. The total cable length in all base units is up to 8m.
7]	I/O controller	Interface module for expansion base.

* The basic base 4] and the expansion base 5] are the same product.

Chapter 3 General Specifications

3.1 General Specifications

Table 3.1 General specifications of HX series

Item		Specification
Input Power voltage	AC	100 / 110 / 120 V AC (50 / 60 Hz), 200 / 220 / 240 V AC (50 / 60 Hz)
	DC	24 V DC
Power voltage fluctuation range		85 to 264 V AC
		21.6 to 26.4 V DC
Allowable instantaneous power failure		85 to 100 V AC: when instantaneous power failure of less than 10 ms, operation continues 100 to 264 V AC: when instantaneous power failure of less than 20 ms, operation continues 21.6 to 26.4V DC: when instantaneous power failure of less than 1 ms, operation continues
Operational temperature		0 to 55 °C (0 to 45°C*1)
Storage temperature		- 10 to 75 °C
Operational humidity		5 to 95 % RH (no condensation)
Storage humidity		5 to 95 % RH (no condensation)
Vibration resistance		Conforms to IEC 60068-2-6
Shock resistance		Conforms to IEC 60068-2-27
Noise resistance		○ Noise voltage 1,500 Vpp, Noise pulse width 100 ns, 1 μs (Noise input by a noise simulator across input terminals of a power module according to measuring method of Hitachi-IES) ○ Conforms to IEC61131-2 (not applied for input modules) ○ Static noise 3,000 V at electrode part
Insulation resistance		20 MΩ minimum between AC terminal and frame ground (FE) terminal (Conforms to 500 V DC megger)
Dielectric withstand voltage		1,500 V AC for 1 minute between AC input terminal and frame ground (FE) terminal
Ground		Class D grounding (grounding with the power supply module)
Usage environment		No corrosive gases, no excessive dust
Structure		Open wall-mount type
Cooling		Natural air cooling

*1 If EH-YR16 is used as UL listed product, max. surrounding temperature rating is 45 °C.

3.2   List of System Equipment

(1) Modules

Table 3.2 List of system equipment (1/2)

Product	Model name	Specification	Standard compliant	Remarks
Power module	EH-PSA	Input 100 to 240V AC, Output 5V DC 3.8 A, 24V DC 0.4 A	CE, UL, RCM	*1
	EH-PSD	Input 24 V DC, Output 5 V DC 3.8 A	CE, UL, RCM	*1
	EH-PSR	Input 100 to 240V AC, Output 5V DC 5.6 A *5	CE	*1
	HX-PSA	Input 100 to 240V AC, Output 5V DC 3.8 A, 24V DC 0.4 A	CE, UL, RCM	*1
	HX-PSD	Input 24 V DC, Output 5 V DC 3.8 A	CE, UL, RCM	*1
I/O controller	EH-IOCH2	I/O control module (1 unit / expansion base unit)	CE, UL, RCM	*1
Base unit	EH-BS3A	3 I/O modules installed	CE, UL, RCM	Commonly used for basic or expansion base
	EH-BS5A	5 I/O modules installed	CE, UL, RCM	
	EH-BS6A	6 I/O modules installed	CE, UL, RCM	
	EH-BS8A	8 I/O modules installed	CE, UL, RCM	
	EH-BS11A	11 I/O modules installed	CE, UL, RCM	
	EH-BS8R	Redundant power supply, 8 I/O modules installed	-	
Digital input module	EH-XD8	8 pts., 24V DC input (response time 5 ms)	CE, UL, RCM	*3
	EH-XD16	16 pts., 24V DC input (response time 5 ms)	CE, UL, RCM	*3
	EH-XDL16	16 pts., 24V DC input (response time 16 ms)	CE, RCM	*3
	EH-XDS16	16 pts., 24V DC input (response time 1 ms)	CE, RCM	*3
	EH-XD32	32 pts., 24V DC input (response time 5 ms)	CE, UL, RCM	-
	EH-XDL32	32 pts., 24V DC input (response time 16 ms)	-	-
	EH-XDS32	32 pts., 24V DC input (response time 1 ms)	CE, RCM	-
	EH-XD32E	32 pts., 24V DC input (response time 1 ms), Spring type terminal	CE, UL, RCM	-
	EH-XDL32E	32 pts., 24V DC input (response time 16 ms), Spring type terminal	CE, UL, RCM	-
	EH-XD32H	32 pts., 24V DC input (response time 4 ms), compatible connector with PIM / H-DM (EM / H-200)	CE, RCM	-
	EH-XD64	64 pts., 24V DC input (response time 1 ms)	CE, UL, RCM	-
	EH-XA16	16 pts., 100 to 120V AC input (response time 15 ms)	CE, UL, RCM	*3
	EH-XAH16	16 pts., 200 to 240V AC input (response time 15 ms)	CE, UL, RCM	*3
Digital output module	EH-YR8B	8 pts., Independent relay output, 100 / 240V AC, 24V DC	CE, RCM	*3, *4
	EH-YR12	12 pts., Relay, 100 / 240V AC, 24 V DC	CE, UL, RCM	*3, *4
	EH-YR16	16 pts., Relay, 100 / 240V AC, 24 V DC	CE, UL, RCM	*3, *4
	EH-YR16D	16 pts., Relay, 100 / 240V AC, 24 V DC, 2-common	CE, RCM	*3
	EH-YT8	8 pts., Transistor, 12 / 24V DC (sink type)	CE, UL, RCM	*3, *4
	EH-YTP8	8 pts., Transistor, 12 / 24V DC (source type)	CE, UL, RCM	*3, *4
	EH-YT16	16 pts., Transistor, 12 / 24V DC (sink type)	CE, UL, RCM	*3, *4
	EH-YTP16	16 pts., Transistor, 12 / 24V DC (source type)	CE, UL, RCM	*3, *4
	EH-YTP16S	16 pts., Transistor, 12 / 24V DC (source type)　*3	CE, UL, RCM	Electric short circuit protection
	EH-YT32	32 pts., Transistor, 12 / 24V DC (sink type)　*2	CE, UL, RCM	
	EH-YTP32	32 pts., Transistor, 12 / 24V DC (source type)　*2	CE, UL, RCM	
	EH-YT32E	32 pts., Transistor, 12 / 24V DC (sink type), Spring type terminal	CE, UL, RCM	
	EH-YTP32E	32 pts., Transistor, 12 / 24V DC (source type), Spring type terminal	CE, UL, RCM	
	EH-YT32H	32 pts., Transistor, 5 / 12 / 24V DC (sink type), compatible connector with POM / H-DM (EM / H-200)	CE, RCM	-
	EH-YT64	64 pts., Transistor, 12 / 24V DC (sink type)	CE, UL, RCM	Electric short circuit protection
	EH-YTP64	64 pts., Transistor, 12 / 24V DC (source type)	CE, UL, RCM	
	EH-YS16	16 pts., Triac, 100 / 240V AC	CE, RCM	*3, *4

*1 CPUs, power modules and I/O controllers (EH-IOCH2, EH-IOCP2, EH-IOCA) are mounted on reserved positions only.

*2 Short circuit protection version is from May 2001 production. (MFG. No. 01Exx)

*3 The suggested torque for the terminal connections is 9 in-lbs as below.

*4 Supporting module version is from April 2005 production. (MFG. No. 05Dxx)

*5 The maximum output current of EH-PSR depends on ambient temperature.

       0 to 45°C   : 5.6 A

       45 to 55°C   : 5.0 A

Cable for wiring			Torque to tighten the terminal
Wire Size	Material	Type	
22 - 14 AWG	Cu	Sol / Str.	9in.-lbs (1.02 Nm)

Table 3.2 List of system equipment (2/2)

Product	Model name	Specification	Standard compliant	Remarks
Analog input module	EH-AX44	12 bits, 8 ch. (4 ch. of 4 to 20 mA, 4 ch. of 0 to10 V)	CE, UL, RCM	*3
	EH-AX8V	12 bits, 8 ch., Voltage (0 to 10 V)	CE, UL, RCM	*3
	EH-AX8H	12 bits, 8 ch., Voltage (-10 to +10 V)	CE, UL, RCM	*3
	EH-AX8I	12 bits, 8 ch., Current (4 to 20 mA)	CE, UL, RCM	*3
	EH-AX8IO	12 bits, 8 ch., Current (0 to 22 mA)	CE, UL, RCM	*3
	EH-AXH8M	14 bits, 8 ch. (0 to 22 mA, 4 to 22 mA, -10 to +10 V, 0 to 10 V)	CE, UL, RCM	*3
	EH-AXG5M	12 / 16 bits, 5 ch. (0 to 22 mA, 4 to 22 mA, -10 to +10 V, 0 to 10 V), Galvanic isolation between channels	CE, RCM	*3
	EH-PT4	Signed 15 bits, 4 ch. Resistance Temperature Detector input, PT100 / PT1000	CE, UL, RCM	*3
	EH-RTD8	Signed 15 bits, 6 ch. (3-wire) / 8 ch. (2-wire) Resistance Temperature Detector input, PT100 / PT1000	CE, RCM	*3
	EH-TC8	Signed 15 bits, 8 ch. Thermocouple input (K,E,J,T,B,R,S,N)	CE, UL, RCM	*3
Analog output module	EH-AY22	12 bits, 4 ch. (2 ch. of 4 to 20 mA, 2 ch. of 0 to 10 V)	CE, UL, RCM	*3
	EH-AY2H	12 bits, 2 ch., Voltage (-10 to +10 V)	CE, UL, RCM	*3
	EH-AY4V	12 bits, 4 ch., Voltage (0 to 10 V)	CE, UL, RCM	*3
	EH-AY4H	12 bits, 4 ch., Voltage (-10 to +10 V)	CE, UL, RCM	*3
	EH-AY4I	12 bits, 4 ch., Current (4 to 20 mA)	CE, UL, RCM	*3
	EH-AYH8M	14 bits, 8 ch. (0 to 22 mA, 4 to 22 mA, 0 to 10V)	CE, UL, RCM	*3
	EH-AYG4M	12 / 16 bits, 4 ch. (0 to 22 mA, 4 to 22 mA, 0 to 10 V, -10 to +10 V), Galvanic isolation between channels	CE, RCM	*3
Positioning and counter module	EH-CU	2 channels high-speed counter input, 100 kHz max., single/2-phase selectable, 4 points open collector outputs	CE, UL, RCM	-
	EH-CUE	1 channel high-speed counter input, 100 kHz max., single/2-phase selectable, 2 points open collector outputs	CE, UL, RCM	-
	EH-POS	1-axis pulse positioning module	CE, UL, RCM	-
Communication and network module	EH-RMP2	PROFIBUS-DP master module, 512 / 512 words I/O	CE, RCM	8 units per CPU
	EH-IOCP2	PROFIBUS-DP slave controller, 1,408 points(176 words) I/O	CE, RCM	*1
	EH-IOCA	EterCAT slave controller, 1,408 points (176 words) I/O	CE, RCM	*1
	EH-LNK	CPU link module (coaxial)	CE, RCM	8 units per CPU
	EH-OLNK	CPU link module (optical fiber)	CE, UL, RCM	8 units per CPU
	EH-OLNKG	CPU link module (support optical fiber GI50 / 125 μm cable)	CE, UL, RCM	8 units per CPU
	EH-OLNKE	CPU link module (support optical fiber GI62.5 / 125 μm cable)	CE, UL, RCM	8 units per CPU
	EH-FLN3	FL-net interface module	CE, UL, RCM	2 units per CPU
Dummy module	EH-DUM	Module for an opened slot	CE, UL, RCM	-

*1 CPUs, power modules and I/O controllers (EH-IOCH2, EH-IOCP2, EH-IOCA) are mounted on reserved positions only.
*2 Short circuit protection version is from May 2001 production. (MFG. No. 01Exx)
*3 The suggested torque for the terminal connections is 9 in-lbs as below.

Cable for wiring			Torque to tighten the terminal
Wire Size	Material	Type	
22 - 14 AWG	Cu	Sol / Str.	9in.-lbs (1.02 Nm)

[Installation rule]

- EH-(O)LNK / RMP2 can be mounted up to 8 units per CPU. Available position is from slot 0 to 7 of basic base only.

- EH-FLN3 can be mounted up to 2 units per CPU. Available position is from 0 to 7 of basic base only.

⚠ Caution

The system of HX-CPU supports a maximum of 11 modules per base units. However, the number of modules which can be provided depends on the maximum output current of the power module. Make sure to use HX-CPU in a permissible level of the maximum output current of the power module. Please refer to section 3.3 for list of current consumption.

(2) Peripheral devices

Table 3.3 Peripheral device of HX series

Product	Model name	Specification	Remarks

HX-CODESYS	HX-CDS	IEC 61131-3 compliant programming software with ST (Structured Text), SFC (Sequential Function Chart), FBD (Function Block Diagram), LD (Ladder Logic Diagram) and IL (Instruction List).
		Supported operating system:
		    Windows ® XP, Windows ® 7 (32 / 64 bit), Windows ® 8, Windows ® 8.1,
		    Windows ® 10
		Multilingual support (Japanese, English, German, Spanish, French, Italy, Russian, Chinese)
			-

* Please refer to "Software manual of HX series" for the PC operating environment necessary to use it.
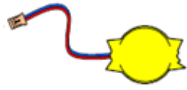
(3) Connection cable

Table 3.4 Connection cables of HX series

Product	Model name	Specification
Cable for connecting basic base I/O controller *1	EH-CB05A	0.5 m (1.64 ft.) length (basic to expansion and expansion to expansion)
	EH-CB10A	1 m (3.28 ft.) length (basic to expansion and expansion to expansion)
	EH-CB20A	2 m (6.56 ft.) length (basic to expansion and expansion to expansion)
Cable for 32 / 64-points I/O module (Both edges connector type)	EH-CBM01W	1 m (3.28 ft.) length (32 / 64-points I/O module to terminal block adaptor)
	EH-CBM03W	3 m (9.84 ft.) length (32 / 64-points I/O module to terminal block adaptor)
	EH-CBM05W	5 m (16.4 ft.) length (32 / 64-points I/O module to terminal block adaptor)
	EH-CBM10W	10 m (32.8 ft.) length (32 / 64-points I/O module to terminal block adaptor)
Cable for 32 / 64-points I/O module (One edges connector type)	EH-CBM01	1 m (3.28 ft.) length (32 / 64-points I/O module to external equipments)
	EH-CBM03	3 m (9.84 ft.) length (32 / 64-points I/O module to external equipments)
	EH-CBM05	5 m (16.4 ft.) length (32 / 64-points I/O module to external equipments)
	EH-CBM10	10 m (32.8 ft.) length (32 / 64-points I/O module to external equipments)
Cable for counter input module	EH-CUC01	1 m (3.28 ft.) length (Counter input module to external equipments)
	EH-CUC02	2 m (6.56 ft.) length (Counter input module to external equipments)
	EH-CUC03	3 m (9.84 ft.) length (Counter input module to external equipments)
	EH-CUC04	4 m (13.1 ft.) length (Counter input module to external equipments)
	EH-CUC05	5 m (16.4 ft.) length (Counter input module to external equipments)

*1 Use in a maximum of 2 m (6.56ft.) between stations, 8 m (26.24ft.) in total

(4) Optional product

Table 3.5 Optional product of HX series

Product	Use	Remarks
HX-BAT	The battery is to work real-time clock only.	

The battery is only needed for the continuous operation of the realtime clock after 8 days of power failure or more. If the realtime clock is read from NTP server, the battery is not necessary. User program and data (retain and persistent) are saved in nonvolatile memories, so the battery is not necessary for them also. The lifetime of the battery is 5 years. Even if the total power failure time is less than below figure, replace it every 5 years.

Table 3.6 The life of battery

The life of battery (Total power failure) [Hr]	
Guaranteed value (MIN) @55 °C	Actual value (MAX) @25 °C
25,000	67,000

3.3　List of Current Consumption

Table 3.7 List of current consumption of modules

Product	Model name	Current consumption [mA]	Product	Model name	Current consumption [mA]
CPU module	HX-CP1S08	1,000	Analog input module	EH-AX44	100
	HX-CP1S08M	1,000		EH-AX8V	100
	HX-CP1H16	1,200		EH-AX8H	100
I/O controller	EH-IOCH2	80		EH-AX8I	100
Base unit	EH-BS3A	200		EH-AX8IO	100
	EH-BS5A	200		EH-AXH8M	70
	EH-BS6A	200		EH-AXG5M	300
	EH-BS8A	200		EH-PT4	160
	EH-BS11A	200		EH-RTD8	300
	EH-BS8R	200		EH-TC8	70
Input module	EH-XD8	30	Analog output module	EH-AY22	100
	EH-XD16	50		EH-AY2H	100
	EH-XDL16	50		EH-AY4V	100
	EH-XDS16	50		EH-AY4H	100
	EH-XD32	60		EH-AY4I	130
	EH-XDL32	60		EH-AYH8M	70
	EH-XD32E	60		EH-AYG4M	730
	EH-XDL32E	60	Positioning, and Counter module	EH-CU	310
	EH-XD32H	60		EH-CUE	310
	EX-XD64	80		EH-POS	300 (600)*1
	EH-XA16	50	Communication and network module	EH-RMP2	780
	EH-XAH16	50		EH-IOCP2	350
Output module	EH-YR8B	220		EH-IOCA	350
	EH-YR12	40		EH-FLN3	350
	EH-YR16	430		EH-LNK	550
	EH-YR16D	430		EH-OLNK	550
	EH-YT8	30		EH-OLNKG	550
	EH-YTP8	30		EH-OLNKE	550
	EH-YT16	50		EH-FLN3	350
	EH-YTP16	50	Dummy module	EH-DUM	0
	EH-YTP16S	50			
	EH-YT32	90			
	EH-YTP32	90			
	EH-YT32E	90			
	EH-YTP32E	90			
	EH-YT32H	90			
	EH-YT64	120			
	EH-YTP64	120			
	EH-YS16	250			

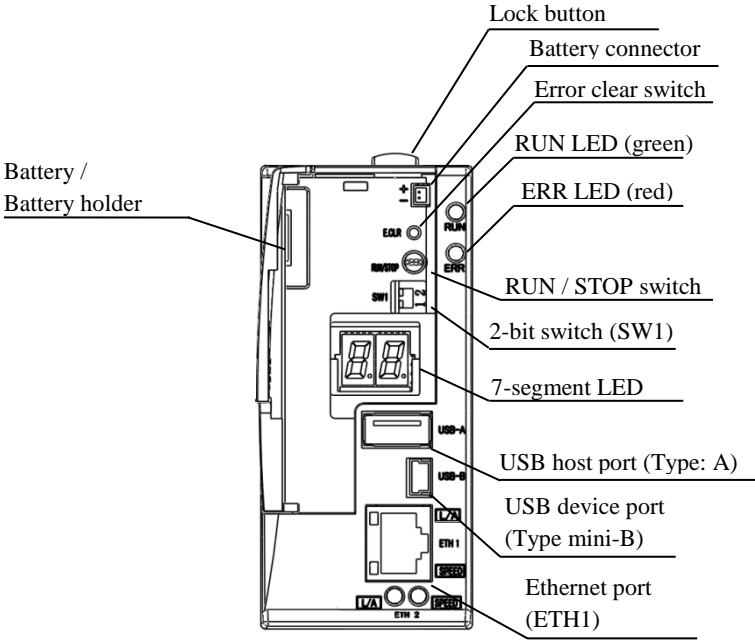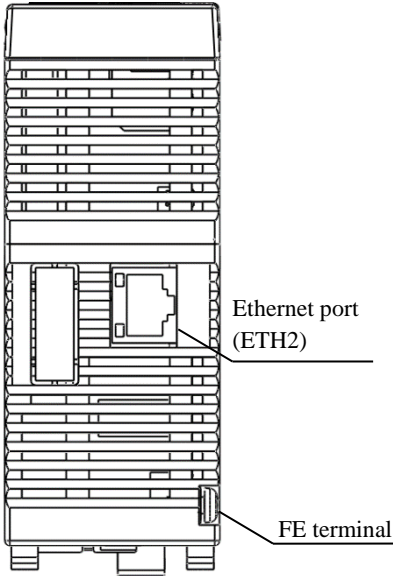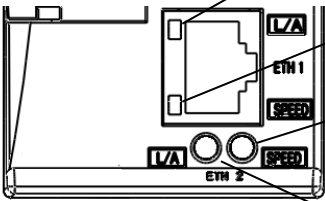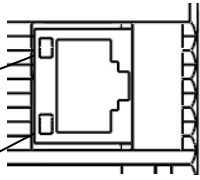*1 In the case of Positioner connected.
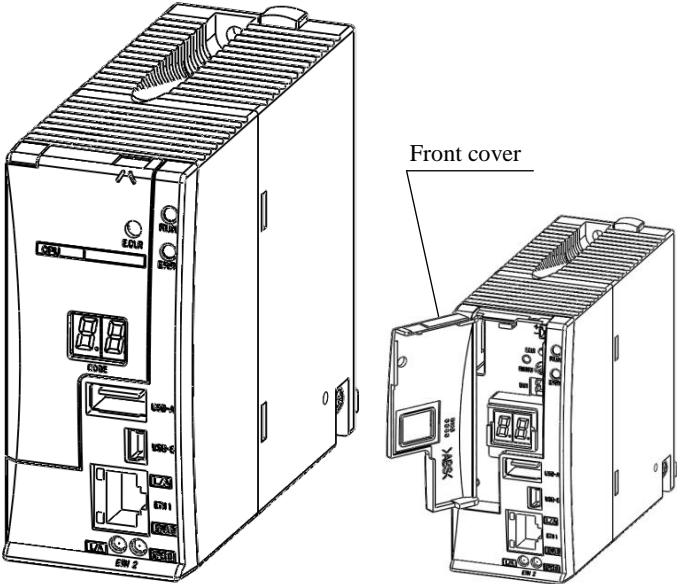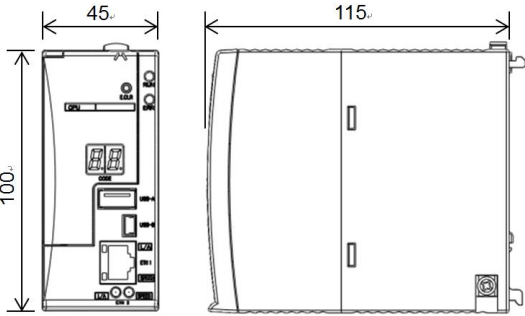
⚠ Caution

The system of HX-CPU supports a maximum of 11 modules per base units. However, the maximum number of mounted modules are limited by output current of the power module. Make sure to select I/O modules in a permissible level of the maximum output current of the power module.
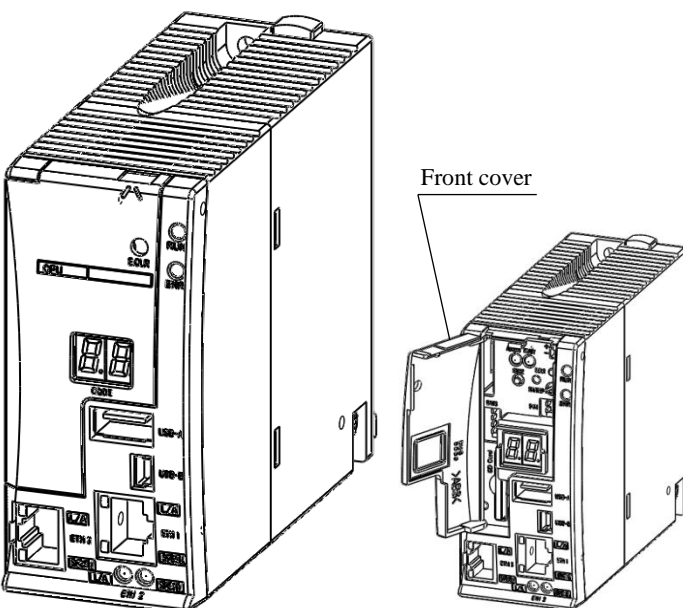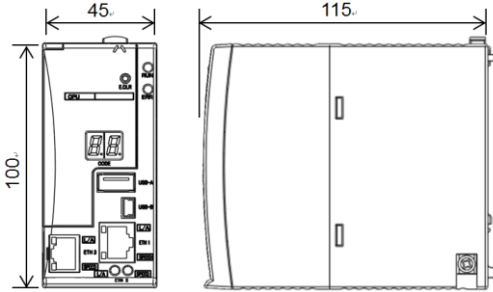
Chapter 4 CPU Modules

4.1　Outline

Standard model, Motion model

Module features		Type	HX-CP1S08, HX-CP1S08M
		Weight	Approx. 0.20 kg (0.44 lb.)
		Current consumption	1,000 mA
		Dimensions (mm (in.))	

Front cover

45　　　115

100

Lock button
Battery connector
Error clear switch
RUN LED (green)
ERR LED (red)

Battery /
Battery holder

RUN / STOP switch

2-bit switch (SW1)

7-segment LED

USB host port (Type: A)

USB device port
(Type mini-B)

Ethernet port
(ETH1)

Ethernet port
(ETH2)

FE terminal

Front view

Bottom view

ETH1 L/A LED (green)

ETH1 SPEED LED (yellow)

ETH2 SPEED LED (yellow)

ETH2 L/A LED (green)

Ethernet port
(ETH2)

Detail of Ethernet port

Full function model

Module features		Type	HX-CP1H16
		Weight	Approx. 0.24 kg (0.53 lb.)
		Current consumption	1,200 mA
		Dimensions (mm (in.))	

Front cover

45   115

100
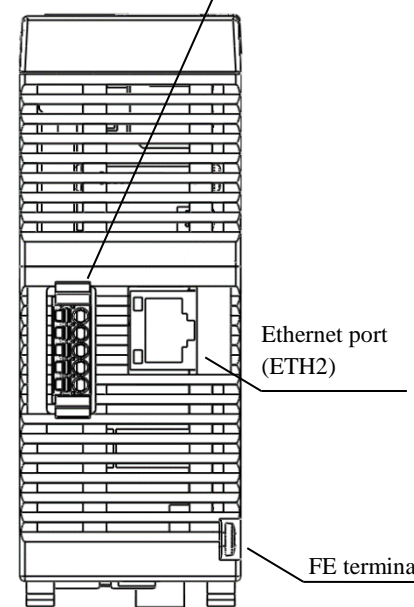
READY LED (green)
ACCESS LED (yellow)
SD card switch (SW2)
Battery /
Battery holder
4-bit switch (SW3)
SD card slot
Ethernet port
(ETH3)

Lock button
Battery connector
Error clear switch
RUN LED (green)
ERR LED (red)
RUN/STOP switch
2-bit switch (SW1)
7-segment LED
USB host port (Type: A)
USB device port
(Type: mini-B)
Ethernet port
(ETH1)
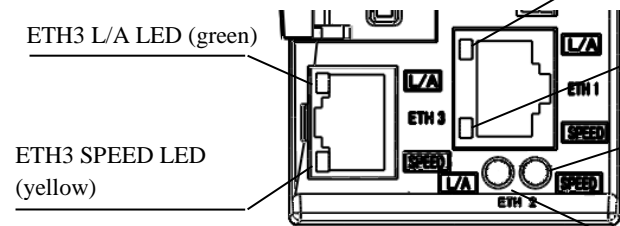
Front view
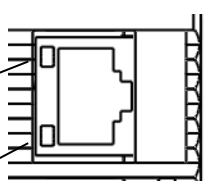
Serial port

Ethernet port
(ETH2)

FE terminal

Bottom view

ETH3 L/A LED (green)

ETH3 SPEED LED
(yellow)

ETH1 L/A LED (green)
ETH1 SPEED LED (yellow)
ETH2 SPEED LED (yellow)

ETH2 L/A LED (green)

Detail of Ethernet port

Ethernet port
(ETH2)

Table 4.1 Description of each item of the CPU modules

No.	Item	Description
1	RUN LED	Indicates operation status. (Green lighting: RUN / off: STOP)
2	ERR LED	Indicates error status. (Red blinking: battery error, I/O module mismatch or initialization of RTC (real time clock) etc. / red lighting: other errors / off: no error)
3	7-segment LED	Indicates error code. And indicates the status of the USB memory with dot LED "." on the right side. (Lighting: mounted, off: not mounted)
4	USB host port (Type: A)	USB host function (Data logging) is supported. A user program is needed to use data logging (File read / write / compare). Supported device is USB memory only.
5	USB device port (Type: mini-B)	USB port supports gateway function (with HX-CODESYS) only. USB cable is not included in the CPU package nor supplied by Hitachi-IES. Use type Mini-B USB cable.
6	Serial port (Full function model)	Serial communication port has a RS-485 interface with terminal connector. It is supporting Modbus-RTU (master / slave) and general purpose. User program is needed to use general purpose.
7	Ethernet port (ETH 1,2)	Ethernet port 1 and 2 have both gateway function (with HX-CODESYS / HMI / OPC) and IEC programming function supporting global network variable, EtherCAT master, Modbus-TCP client / server and OPC-UA server. Do not use other functions together with EtherCAT master in the same port.
8	Ethernet port (ETH 3) (Full function model)	Ethernet port 3 has both gateway function (with HX-CODESYS / HMI / OPC) and IEC programming function supporting global network variable, Modbus-TCP client / server and OPC-UA server. EtherCAT master function is not supported.
9	SD card slot (Full function model)	SD and SDHC cards are supported. Data logging function is supported. A user program is needed to use data logging (File read / write / compare).
10	RUN / STOP switch	When this switch position is in RUN (left), the CPU starts the program execution. At the same time, remote controlling is enabled, in which case, the CPU can be started or stopped by HX-CODESYS via communication command. When this switch position is in STOP (right), the CPU stops the program execution. In this status, remote controlling is disabled.
11	Error clear switch (E.CLR)	If any error occurs, the error code is displayed in the 7-segment LED and remains after the error cause is deactivated. When pressing this button, the error code is cleared. If the error cause is still remaining, the error code will be displayed again.
12	SD card switch(SW2) (Full function model)	When pressing this switch, the SD card is disconnected. Please check the status of READY LED ("Off") before pulling out the SD card.
13	ACCESS LED (Full function model)	Not supported.
14	READY LED (Full function model)	Indicates the status of the SD card. Do not pull out SD card during lighting. (Green lighting: mounted, off: not mounted)
15	SPEED LED	Indicates communication speed of each Ethernet port. (Yellow lighting: 100Mbps, off: 10Mbps or link-down)
16	L/A LED	Indicates the status of each Ethernet communication. (Green lighting: Ethernet link-up, blinking: Data is sent or received, off: link-down)
17	2-bit switch (SW1)	User program can be downloaded, uploaded or verified according to switch position.* Resetting the factory default settings. Please refer to section 13.2.
18	4-bit switch (SW3) (Full function model)	Not supported. Please keep off.
19	Lock button	Press this button to dismount the CPU from the base unit. The CPU module can be fixed firmly by a M4×10mm (0.39 in.) screw.
20	Front cover	Open this cover when operating the switch, button or replacing the battery. Keep the cover closed during operation.
21	Battery holder Battery connector	An optional battery retains the RTC (real time clock) data. Data specified as RETAIN and PERSISTENT and user program are retained without battery. -When inserting the battery, please check the polarity carefully. -The battery is not included in the CPU package. -Replace the battery every five years even if the battery is not empty yet.
22	FE terminal	Connect to Class D grounding.

* User program download function will be supported in near future.

4 – 3
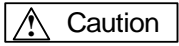
⚠ Caution

Note the cautions for the communication ports.

Since EtherCAT supports 100 Mbps only, communication error might occur depending on installation environment, cable length or external noise. In this case, check your installation environments and take appropriate countermeasures to reduce noise.

4.2   Performance Specifications

Table 4.2 Performance specifications

Item		HX-CP1S08	HX-CP1S08M	HX-CP1H16
Model		Standard Model	Motion Model	Full Function Model
User program memory *1		8 MB	8 MB	16 MB
Source file memory *1		8 MB	8 MB	16 MB *2
Data memory (non-retain) *1		8 MB	8 MB	16 MB
Data memory (retain) *1		250 kB		
Data memory (persistent) *1		250 kB		
Field bus / Marker memory		48 kB		
Number of expansion base units		5 units		
Expansion cables		Between stations : 0.5 m, 1 m, 2 m, Total length: 8 m or less		
Number of I/O points (using 64 points module)		4,224 points		
I/O modules		Common with EH-150 / EHV series (Refer to section 3.2 for detail)		

Programming language		IEC61131-3 compliant 5 languages + CFC
		    LD : Ladder Logic Diagram
		    FBD : Function Block Diagram
		    SFC : Sequential Function Chart
		    IL : Instruction List
		    ST : Structured Text
		    CFC : Continuous Function Chart		

I/O update cycle		Refresh processing		
Execution speed	Boolean instruction	min. 1.0 ns		
	Double-precision floating point	min. 6.6 ns		
Library	PLC standard libraries	✓	✓	✓
	SM3_Basic	-	✓	✓
	SM3_CNC, SM3_Robotics	-	-	-
Communication interfaces	Protocol	CODESYS V3 protocol		
	USB device	1port (Mini-B type connector, USB 2.0 High speed)		
	USB host	1 port (A type connector, USB 2.0 High speed) for USB memory *3		
	Ethernet	2 ports (10/100BASE-T/TX)		3 ports (10/100BASE-T/TX)
	Serial	-	-	1 port (RS-485)
Available communication	OPC UA	✓	✓	✓
	Web Visualization	-	-	✓
	NTP (network time protocol)	✓	✓	✓
	FTP (server)	✓	✓	✓
	EtherCAT Master*6	✓	✓	✓
	(Communication cycle)	min. 1ms		
	Modbus-TCP Client	✓	✓	
	Modbus-TCP Server	✓ (Maximum number of clients : 16)		
	Modbus-RTU Client	-	-	✓
	Modbus-RTU Server	-	-	✓
SD memory card slot		-	-	1 slot (SD / SDHC)
Display and switch	Display	RUN LED, ERR LED, 7-segmented LED (2digits)		
	RUN / STOP switch	STOP / RUN (Remote control of RUN / STOP over communication from HX-CODESYS is enable when switch position is in RUN.)		
	Error clear switch	Clear of error code		
	2-bit switch (SW1)	Reserved for future		
	4-bit switch (SW3)	-	-	Reserved for future
Real-time clock		Built-in RTC (deviation ±60 s/month at 25 °C)		
Battery (Option for RTC)		HX-BAT (for RTC) *4		
Startup time		About 20 to 30 s *5		
Maintenance function	Self-diagram	microcomputer error, watchdog timer error, memory error, program error, system ROM/RAM error, scan time error, battery under-voltage detection, and others		
Compliant		CE, RCM		
Version of CODESYS runtime		3.5.8.22		
Available version of CODESYS		3.5 SP8 patch4 or later		

*1 Because the additional information of the program is stored, the usable memory is slightly smaller than the specification.
*2 The source file memory is shared with files for Web visualization.
*3 For data storage.
*4 The battery is optional for the RTC.
*5 It depends on the size of the user program.
*6 When using the EtherCAT master function, do not configure any other function on the same Ethernet port.

Table 4.3 EtherCAT functional specifications

Item	Specification
Protocol	EtherCAT® protocol (CoE)
Supported communication profiles	CoE (PDO , SDO)
Synchronization (DC)	Supported
Physical layer	100BASE-TX
Modulation system	Baseband communication
Transmission speed	100 Mbps (100BASE-TX)
Duplex mode	Full duplex / Auto MDI
Topology	Daisy-chain, tree
Transmission medium	Twisted pair cable more over category 5 with shield
Transmission range	100 m or less between nodes (IEEE802.3)
Maximum number of slaves	255
Maximum process data size	Input 5,736 bytes / Output 5,736 bytes
Maximum data size of slave	Input 1,434 bytes / Output 1,434 bytes
Maximum massage size	2,048 bytes
Communication cycle time	1 ms or more
Process data communication	・PDO Mapping with the CoE protocol ・Redundant communication even in a slave malfunction ・Stop operation in a slave malfunction
SDO communication	CoE ・Emergency message server (receive from slave) ・SDO request / Response
Configuration	・Setting node address by network scan from programming tool (HX-CODESYS) ・Display of network information
RAS function	・Slave configuration check in the network starting ・Read-out of the error information ・Trouble shoot information
Slave information	・Slave valid / invalid ・joining / out-network of a slave (Slave option)
Mail box	・CoE (CAN open / CAN application layer over EtherCAT)

Table 4.4 Programming functional specifications

Item		Specification
Task Specifi-cations	Number of periodic task	32
	periodic task priority	0 to 31
	Number of event task	8
	System event	25 kinds such as Run / Stop
	Number of status task	8
	Number of freewheeling task	1
Kinds of POU		Program, Function block, Function
Data Types	Bool	BOOL, BYTE, WORD, DWORD, LWORD
	Integer	SINT, INT, DINT, LINT
	Unsigned integer	USINT, UINT, UDINT, ULINT
	Real	REAL, LREAL
	String	STRING, WSTRING
	Time	TIME (T), LTIME (LT)
	Date / time of day	TIME_OF_DAY (TOD), DATE_AND_TIME (DT), DATE (D)
	Others	STRUCT, UNION, ARRAY, ENUMERATION, SUBRANGE, REFERENCE, POINTER, ANY, BIT
	Array number of dimensions	3
Instructions	Arithmetic instructions	ADD, MUL, SUB, DIV, MOD, MOVE
	Boolean instructions	AND, OR, XOR, NOT
	Bit shift	SHL, SHR, ROL, ROR
	Selection	SEL, MAX, MIN, LIMIT, MUX
	Comparison	GT, LT, LE, GE, EQ, NE
	Call	CAL
	Type conversion	BOOL_TO_INT, WORD_TO_INT, and so on
	Arithmetic Functions	ABS, SQRT, LN, LOG, EXP, SIN, COS, TAN, ASIN, ACOS, ATAN, EXPT
	IEC extension	DELETE, ISVALIDREF, NEW, QUERYINTERFACE, QUERYPOINTER, AND_THEN, OR_ELSE, TRY, CATCH, FINALLY, ENDTRY, INDEXOF, ADR, BITADR, INDEXOF, SIZEOF, ANDN, ORN, XORN
Standard library	Flip-Flop	RS, SR
	Counter	CTD, CTU, CTUD
	STRING Functions	CONCAT, DELETE, FIND, INSERT, LEFT, LEN, MID, REPLACE, RIGHT
	Timer	TOF, TON, TP
	Edge Detection	F_TRIG, R_TRIG
	Others	RTC
Other library (extract)	UTIL	BCD Conversions	BCD_TO_INT, INT_TO_BCD
		Bit / Byte Functions	EXTRACT, PACK, PUTBIT, UNPACK
		Mathematic Auxiliary Functions	DEREVATIVE, INTEGRAM LIN_TRAFO, STATISTICS_INT, STATISTICS_REAL,VARIANCE
		PID	PD, PID, PID_FIXCYCLE
		Signal Generators	BLINK, FREQ_MEASURE, GEN
		Function Manipulators	CHARCURVE, RAMP_INT, RAMP_REAL
		Analog Value Processing	HYSTERESIS, LIMITALARM
	FILE	Directory	DirClose, DirCreate, DirList, DirOpen, DirRemove, DirRename
		File	Close, Copy, Delet, EOF, Flush, GetAttribute, GetPos, GetSize, GetTime, Open, Read, Rename, SetPos, Write
	DTU		GetDateAndTime, SetDateAndTime

4.3   Ethernet Port Specifications

The HX-CPU standard model and motion model have two Ethernet ports (ETH1 / 2), and the full function model has three Ethernet ports (ETH1 / 2 / 3).
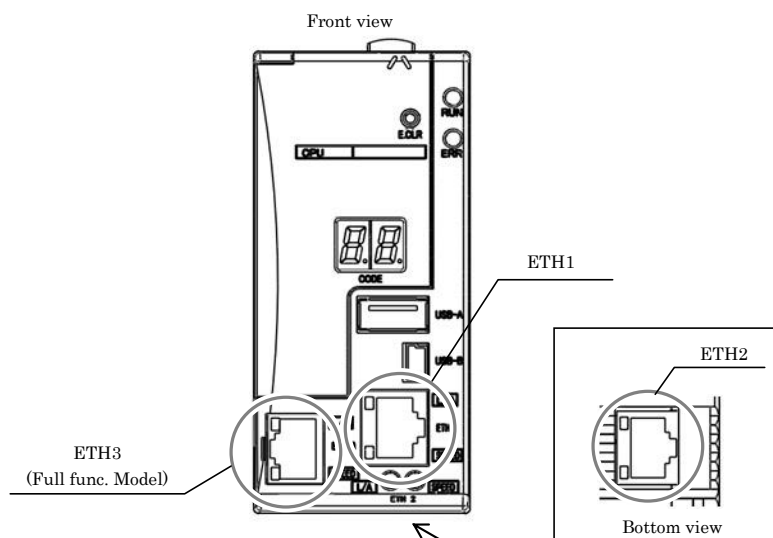

Figure 4.1 HX-CPU Ethernet port

(1) Supported communication functions

Table 4.5 Supported function of Ethernet port

No.	Function	ETH1	ETH2	ETH3	Description
1	Gateway	✓	✓	✓	HMI
2	Global network variable	✓	✓	✓	
3	OPC-UA	✓	✓	✓	
4	Web Visualization	✓	✓	✓	Only full function model
5	NTP client	✓	✓	✓	
6	FTP server	✓	✓	✓	
7	EtherCAT master*1	✓	✓	-	
8	Modbus-TCP	✓	✓	✓	

*1 Do not configure any other function together with EtherCAT master function on one Ethernet port.

(2) Ethernet port specifications

Table 4.6 Ethernet port specifications

Item	Specification
Ethernet Standard	10BASE-T, 100BASE-TX
Transmission mode	AUTO (100 Mbps full, 100 Mbps half, 10 Mbps full, 10 Mbps half)
Modulation system	Baseband
Topology	Star
Transmission medium	Category 5 STP or UTP (STP recommended)
Maximum segment length	100 m or less between nodes
Connector	8-pin modular connector RJ45
Function	EtherCAT master, Modbus-TCP client, Modbus-TCP server, CODESYS gateway (TCP/IP, UDP/IP) , network variable, TCP/IP, UDP/IP, NTP, FTP server, http*1

*1 Supported by the full function model only.

ETH1・ETH2　　　　　ETH3

Pin No.	Signal name
1	TX+
2	TX-
3	RX+
4	NC
5	NC
6	RX-
7	NC
8	NC
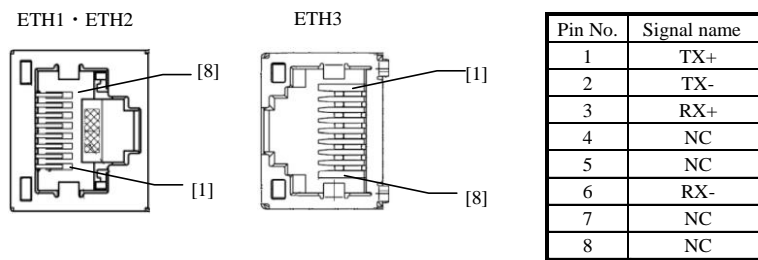
Figure 4.2 HX-CPU Ethernet port connector pin assigned and signal name

(3) IP address default

Table 4.7 Default IP address of Ethernet port

	ETH1	ETH2	ETH3
Default IP address	192.168.0.1	192.168.1.1	192.168.2.1

(4) LED specification (ETH1 to 3)

ETH3 L/A LED (green)　　ETH1 L/A LED (green)
ETH1 SPEED LED (yellow)
ETH3 SPEED LED (yellow)
ETH2 SPEED LED (yellow)
ETH2 L/A LED (green)
Ethernet port (ETH2)
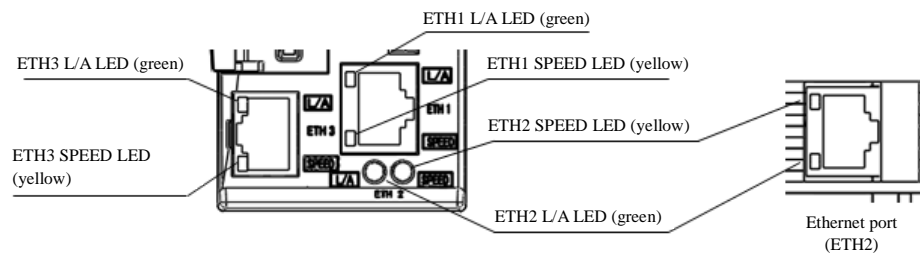
Figure 4.3 Ethernet communication port LED

Table 4.8 Ethernet port LED specification

LED	Color	Status	Remarks
L/A (Link / Activity)	Green	ON	LINK established
		Blinking	During communication
		OFF	Not connected or LINK unestablished
SPEED	Yellow	ON	100 Mbps
		OFF	10 Mbps

(5) Available receiving port No.

Table 4.9 Ethernet port No.

Port No.	Remarks
1740 to 1743	CODESYS gateway (UDP/IP)
11740	CODESYS gateway (TCP/IP)
1217	Gateway communication (TCP/IP)
1202	Network variable (UDP/IP)
8080	CODESYS Webserver (Web Visualization)
4840	CODESYS OPC-UA server
502	Modbus-TCP server
20	FTP server (Transmission data)
21	FTP server (control)
123	NTP server (UDP/IP)
4000 to 4007	CAA.NetBaseService receiving as both UDP/IP and TCP/IP

*1 The port number cannot be changed.

4.4   USB Port Specifications

Front view
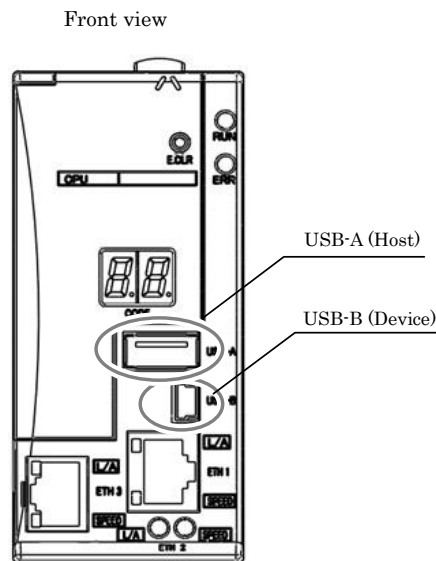
Figure 4.4 USB port

(1) USB-A (Host)

The USB-A port is a USB host port for USB memory (Connector : Type-A).

The usage is data storage for files. In order to create, read or write files, a user program is required. Supported device is USB memory only. Detailed specifications are listed in table 4.10. Depending on hardware characteristics, USB memory may not work properly although specifications are in the range. Be sure to test carefully in advance.

(2) USB-B (Device)

The USB-B port supports the gateway (Connection with a HX-CODESYS) function (Connector : Type-miniB). Use a commercially available standard USB cable with ferrite core.

Table 4.10 USB port specifications

Items		Specification
USB-A (Host)	Standard	USB 2.0 High Speed (480 Mbps)
	Connector	A type
	File system	FAT16 / 32, ext2
	Maximum size	32 GB
	Maximum size of a file	2 GB
	Bus power	500 mA
	Distance	5 m
	Function	Access USB memory (Data logging, file operation, etc.)
USB-B (Device)	Standard	USB 2.0 High Speed (480 Mbps)
	Connector	mini-B type
	Distance	5 m
	Function	CODESYS gateway

4.5   SD Card Specifications
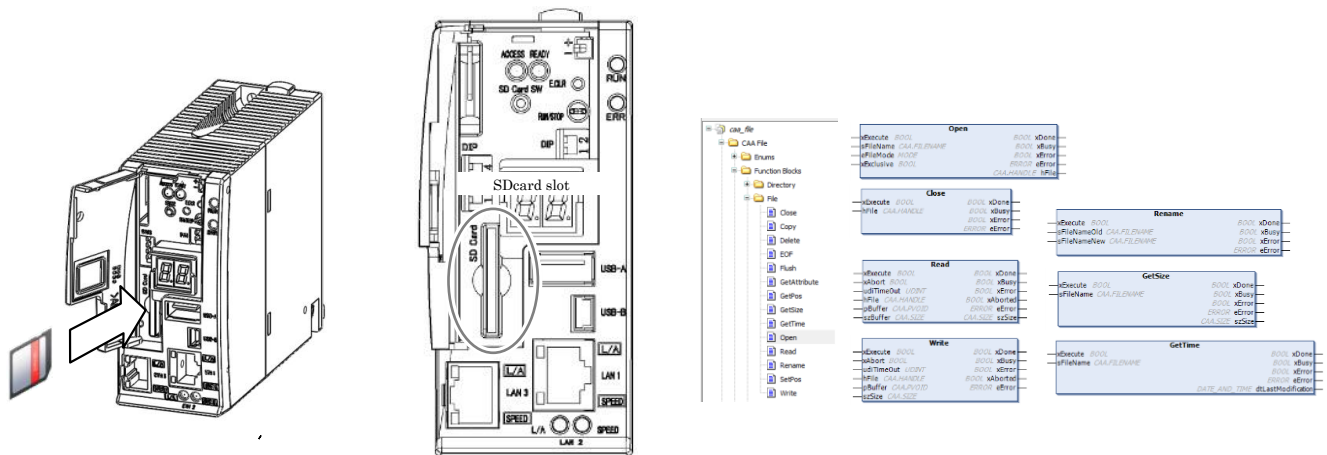
Figure 4.5 SD card

The HX-CPU (Full function model) has a built-in SD card slot. In order to create, read or write files, a user program is required. Detailed specifications are listed in table 4.11. Depending on hardware characteristics, the SD card may not work properly although specifications are in the range. Be sure to test carefully in advance.

Table 4.11 SD card specification

Items		Specification
SD card	Standard	SD (up to 2 GB) , SDHC (2 to 32 GB)
	Bus interface	Normal speed, High speed
	Bus speed	Maximum 25 MB/s
	Version	2.00
	File system	FAT16 / 32, ext2
	Maximum volume	32 GB
	Maximum size of a file	2 GB
	Function	Access SD card (Data logging, File operation, etc.)

4.6   Serial Port Specifications

The Full function model has 2-wired RS-485 serial port. It supports Modbus-RTU master, Modbus-RTU slave and general communication.

Table 4.12 Serial port specifications

Item	Specification
Transmission speed	4,800 / 9,600 / 19,200 / 38,400 / 57,600 / 115,200 bps
Interface	RS-485
Maximum cable length	500 m (546.81 yd.)
Connection mode (Maximum connected units)	1 : N (32 units)
Communication method	Half duplex
Synchronization method	Start-stop synchronization
Supported function	General purpose communication, Modbus-RTU master
Transmission method	Serial transmission (bit serial transmission)
Transmission code outgoing sequence	Send out from the lowest bit in character units
Error control	Vertical parity check, sum check, overrun check, framing check.
Transmission unit	Message unit (variable length)
Maximum message length	4,095 bytes (including control characters)

Front view

Serial port

Front view
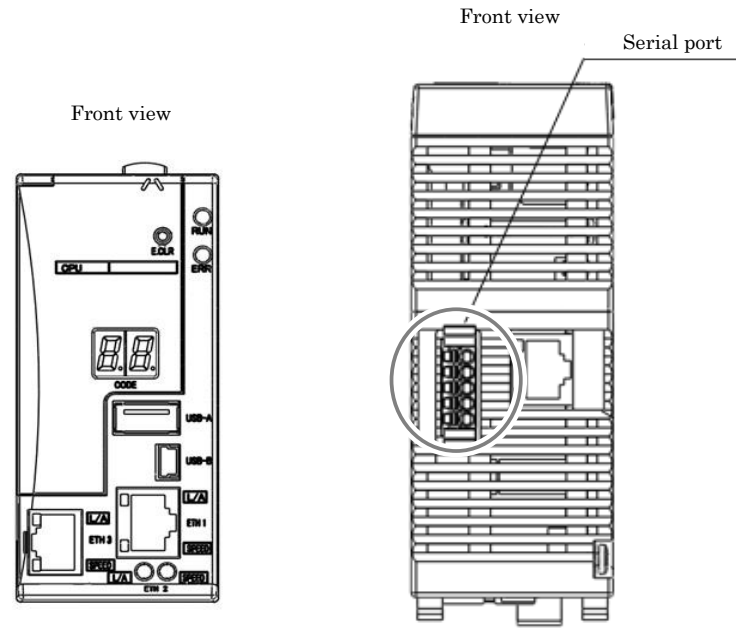
Figure 4.6 Serial communication port

Cable side connector

MPU

[1]SP
[2]SN

[3]SP
[4]SN

[5]FG

[5]FG
[4]SN
[3]SP
[2]SN
[1]SP

Pin no.	Signal	Silk	Description
5	FG	FG	Frame ground
4	SN	-	Transmitting data-
3	SP	+	Transmitting data+
2	SN	-	Transmitting data-
1	SP	+	Transmitting data+
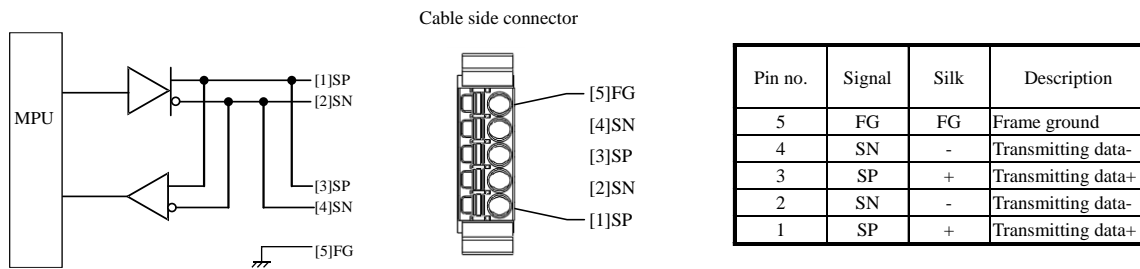
Figure 4.7 Serial port Circuit and pin no.

[1] [2] [3] [4] [5]　　　[1] [2] [3] [4] [5]　　　[1] [2] [3] [4] [5]

SP　　　　SP　　　　SP
SN　　　　SN　　　　SN ・・・
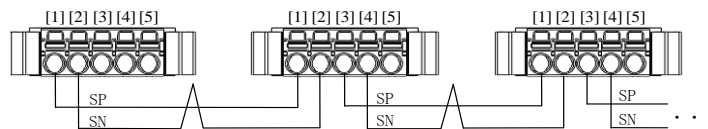
Figure 4.8 RS-485 signal connection diagram

Applicable cable is 0.2 mm^2 – 1.25 mm^2. (AWG 24 - 16)

Depending on the noise environment, connect the shielded wire to FG terminal. This terminal must not connect to ground.

If the HX-CPU is installed at the terminal, install a termination resistor. (120 Ω, 1/4 W)

4.7   Battery Specifications

The use of the battery is optional. The battery is only needed for the continuous operation of the realtime clock after 8 days of power failure or more.

However, if the ambient temperature is 50°C or more, the realtime clock may stop earlier. Use the battery in that case also. If the realtime clock is read from NTP server, the battery is not necessary.

The user program and data (retain and persistent) are saved in nonvolatile memories, so the battery is not necessary for them also.

Type : HX-BAT
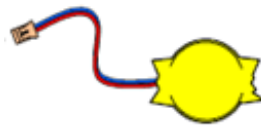
Figure 4.9 HX-CPU battery (option)

Follow the steps below to install the battery to HX-CPU. Be careful about the polarity of a battery.

How to install the battery

1] Prepare a new battery (HX-BAT).

2] Replace the battery while the power supply for the basic base is turned on.

3] Remove the old battery from the battery holder, and unplug the battery connector from the CPU connector.

4] Plug the battery connector of the new battery to the CPU connector.

   Red lead wire is [+] and the black lead wire is [-].

5] Fold the excess lead wire and store it in the space for lead wire storage.

   (Otherwise, the wire may be damaged by the front cover.)

   If replacing the battery without power supplied, power off time should be less than 30 minute.
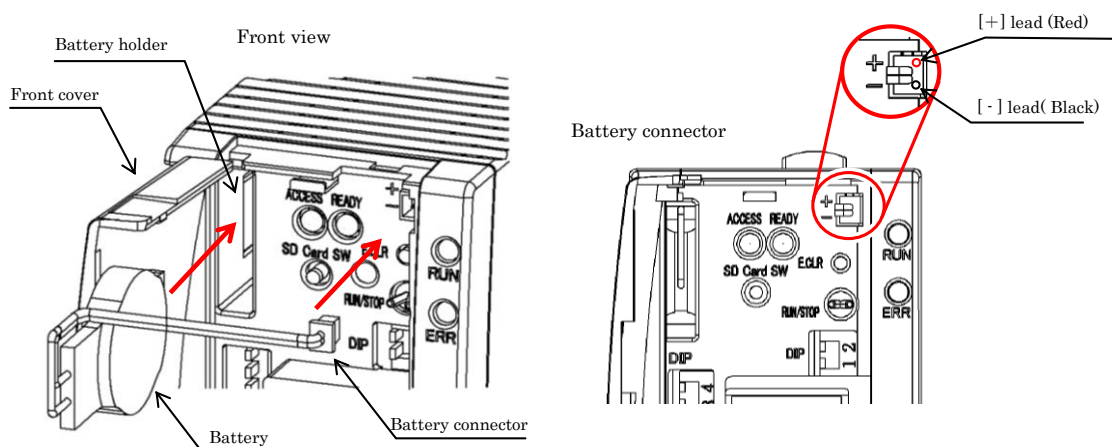
Figure 4.10 Install battery

Refer to the following table for the lifetime of the battery.

Table 4.12 Battery life

Battery life (Total time interruption of power supply) [Hr]	
Guaranteed value (MIN) @55 °C	Actual value (MAX) @25 °C
25,000	67,000

- When using the battery, enable the battery error detection. Refer to the manual section 2.6 Configuration of HX series application manual (Software).

- The life time of the battery is the total power-off time of the CPU module.

- When ERR LED is displayed flashing or the 7-segment LED is displayed 71, replace the battery within 7 days.

- The durable life of the battery is 5 years. Even if the battery is not a life, replace it every 5 years.

◇ **DANGER**
Precaution when handling the battery. Use HX-BAT for the new battery. Be careful because a false replacement may cause the battery to explode. Do not connect + and - of the battery reversely, do not charge, disassemble, heat them, throw them into the fire or short circuit them.
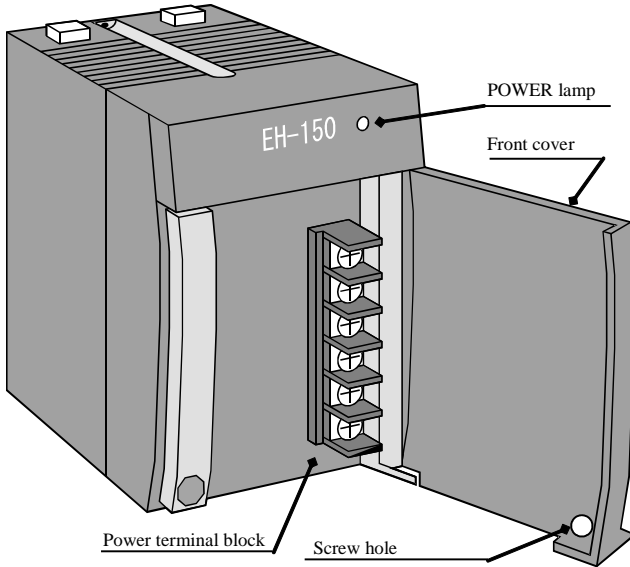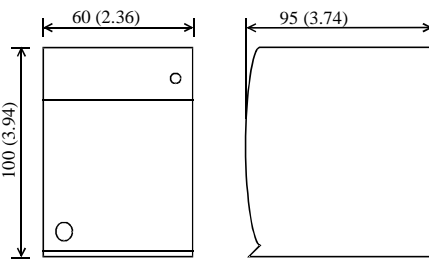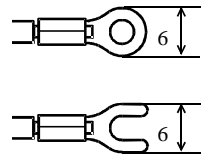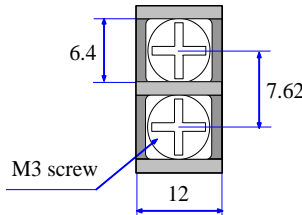
⚠ **CAUTION**
Disposal (collection) of the battery Pack an old battery individually in plastic bag (to prevent short circuit) and follow local disposal rules.
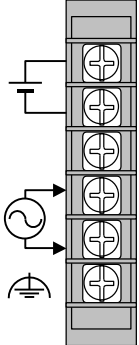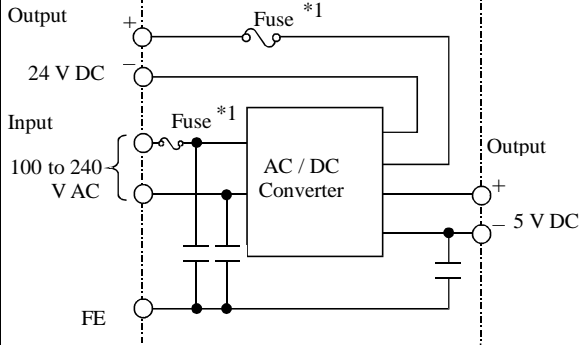
Chapter 5 Power Supply, Base, I/O Controller

5.1   Power Supply Modules

Name and function of each part		Type (Weight)	EH-PSA (Approx. 0.36 kg (0.79 lb.))
			EH-PSD (Approx. 0.28 kg (0.62 lb.))
			EH-PSR (Approx. 0.36 kg (0.79 lb.))
			HX-PSA (Approx. 0.36 kg (0.79 lb.))
			HX-PSD (Approx. 0.28 kg (0.62 lb.))

POWER lamp
Front cover
EH-150
Power terminal block
Screw hole

Dimensions (mm (in.))

60 (2.36)   95 (3.74)   100 (3.94)

Explanation of function	The Power supply modules convert external power into 5V DC for CPU and I/O modules via backplane bus. The operating status can be confirmed with the POWER lamp on the front of the module. Three types are available, AC input type (100 to 240 V AC) and DC input type (21.6 to 26.4 V DC) and redundant type, which can be also used as single power with large power capacity.

Name	Description	LED

POWER lamp	AC power supply:
	  Green lighting Normal operation.
	  Off The fuse for DC24V output is blown.
	  Green blinking Overload of DC power output.
	DC power supply:
	  Green lighting Normal operation.
	  Off DC power output is short-circuited or overloaded.
	Redundant power supply:
	  Green lighting Normal operation.
	  Off DC power output is short-circuited or overloaded.
		Green

Front cover / screw hole (female thread)	Close the cover while power is applied. Remove power before opening the cover to prevent from electric shock. If necessary, lock the cover with M3 × 6 mm (0.24 ft.) screw.	
Power terminal block	The recommended crimp terminals are indicated below. 6 (Recommended) 6 Take great care on handling the terminal because it may fall off if the screw is loose. Unit: mm 6.4 7.62 M3 screw 12	

(1) EH-PSA, HX-PSA
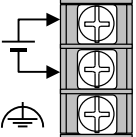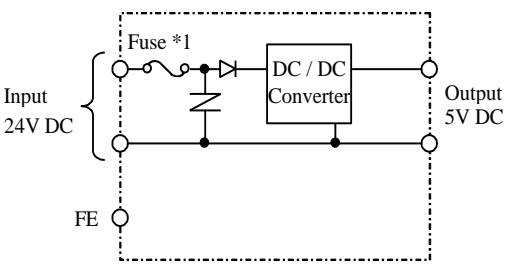
Item	Specification	
Rated output voltage	5 V DC	24 V DC
Maximum DC output current	3.8 A	0.4 A
Efficiency	65 % or more (Load of 5 V 3.8 A 24 V 0.4 A after conducting electricity for 5 minutes at room temperature and humidity)	
Input voltage range	85 to 264 V AC wide range	
Input current	1 A or less (85 to 264 V AC)	
Input rush current	50 A or less (Ta＝25 °C) , 100 A or less (Ta＝55 °C)	
Output overcurrent protection	Output short-circuit protection	
Instantaneous power failure guarantee	Max. 10 ms (85 to 100 V AC), Max. 20 ms (100 V AC to 264 V AC)	
Input leak current	Max. 3.5 mA (60 Hz, 264 V AC)	
Dielectric withstand voltage	1 minute at 1,500 V AC between (AC input) and (DC output) 1 minute at 750 V AC between (DC output) and (FE)	
Insulation resistance	Min. 20 MΩ (500 V DC) (1) Between AC input and FE (2) Between AC input and DC output	

Terminal configuration				Diagram of internal circuit

	[1]	24 V DC+	24V DC output
[1] [2]	[2]	24 V DC−	
[3]	[3]	N.C.	Do not connect.
[4] [5]	[4]	100 to 240 V AC	Power supply input
	[5]	100 to 240 V AC	
[6]	[6]	FE	Connect to Class D grounding.

*1 The POWER lamp does not light up if the internal fuse blows. This fuse is not replaceable by users.

(2) EH-PSD, HX-PSD

Item	Specification
Rated output voltage	5 V DC
Maximum DC output current	3.8 A
Efficiency	Min. 70 % (Load at 5 V DC 3.8 A)
Input voltage range	21.6 to 26.4 V DC
Input current	Max. 1.25 A (with 24 V DC)
Input rush current	Max. 50 A (Ta＝25 °C), 100 A or less (Ta＝55 °C)
Output overcurrent protection	Output short-circuit protection
Instantaneous power failure guarantee	Max. 1 ms (21.6 to 26.4 V DC)
Dielectric withstand voltage	1 minute at 1,500 V AC between DC input and FE
Insulation resistance	20 MΩ or more (500 V DC) (Between DC input and FE)
Insulation method	Non insulation

Terminal configuration				Diagram of internal circuit
	[1]	24 V DC+	Connect the input power.	
	[2]	24 V DC−		
	[3]	FE	Connect to Class D grounding. Connect with 24 V DC(-) because of supporting CE marking.	
	Note		Be sure to remove the connection between FE and 24V DC (-) in insulation resistance measurement or dielectric withstand voltage test.	

Terminal: [1] [2] [3]

Diagram of internal circuit: Input 24V DC — Fuse *1 — DC / DC Converter — Output 5V DC — FE

*1 The POWER lamp does not light up if the internal fuse blows. This fuse is not replaceable by users.

(3) EH-PSR

Item	Specifications
Rated output voltage	5 V DC
Maximum output current	5.6 A(up to 45 deg ambient temp), 5.0 A(from 45 to 55 deg)
Efficiency	65 % or more (Load of 5 V 5.6 A after energizing for 5 minutes at room temperature and humidity)
Input rated voltage range	85 to 264 V AC wide range
Input current	1 A or less (85 to 264 V AC)
Input rush current	50 A or less (Ta=25 °C), 100 A or less (Ta=55 °C)
Output over current protection	Output short circuit protection
Instantaneous power failure guarantee	less than 5 ms (85 to 100 V AC), less than 20 ms (100 to 264 V AC)
Input leak current	3.5 mA or less (60 Hz, 264 V AC)
Dielectric withstand voltage	1 minute at 1,500 V AC between (AC input) and (DC output) 1 minute at 750 V AC between (DC output) and (FE)
Insulation resistance	20 MΩ or more (500 V DC)(1) Between AC input and FE (2) Between AC input and DC output
Error output	Relay 24 V DC, 0.5A
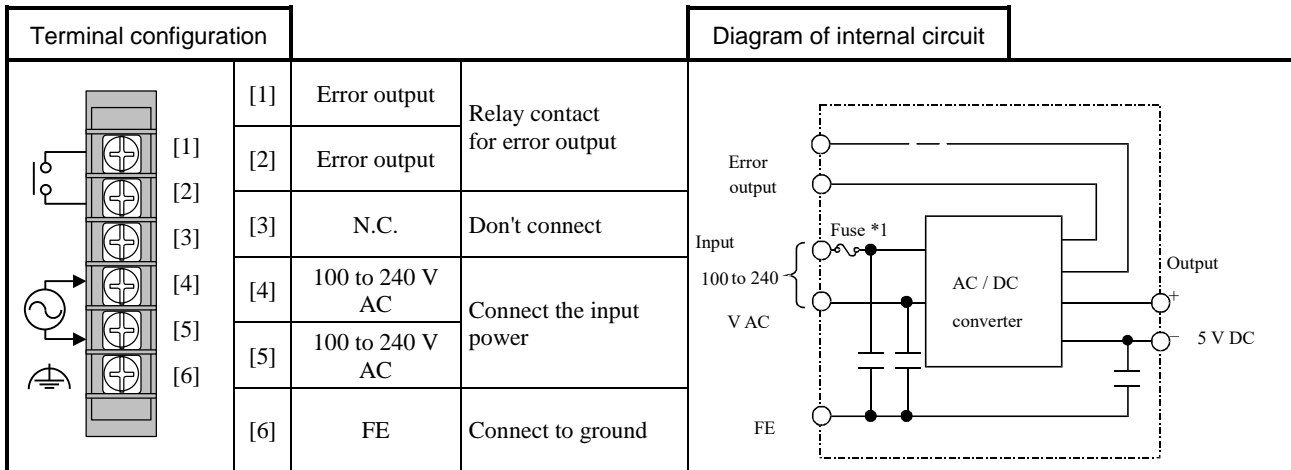
Terminal configuration				Diagram of internal circuit	
	[1]	Error output	Relay contact for error output		
	[2]	Error output			
	[3]	N.C.	Don't connect		
	[4]	100 to 240 V AC	Connect the input power		
	[5]	100 to 240 V AC			
	[6]	FE	Connect to ground		

*1 The POWER lamp does not light up if the internal fuse blows. This fuse is not replaceable by users.

[Available combination]

Base · Power supply CPU type	EH-PSA / EH-PSD / HX-PSA / HX-PSD			EH-PSR		
	EH-BS8R	EH-BS3A,5A,6A,8A	EH-BS11A	EH-BS8R	EH-BS3A,5A,6A,8A	EH-BS11A
HX-CP1S08 / HX-CP1H16 / HX-CP1S08M	Not available *1	Available	Available	Available in redundant power supply system	Restricted use *2	Restricted use *2

*1 EH-PSA/PSD and HX-PSA/PSD cannot be mounted on EH-BS8R. Redundant status is not supported.

*2 Redundant power supply module (EH-PSR) can be mounted on standard bases as large capacity power supply. But in this case, the redundant status is not monitored.

[Monitor of operation status]

Using the combination EH-PSR+HX-CP1S08 or EH-PSR+HX-CP1H16, the operation status can be monitored as input data of the virtual slot A.
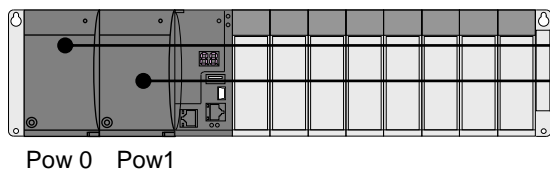
EH-BS8R can host 8 IO modules.
The status of the power supply is monitored as input data of slot A.
 Input %IX*.0: TRUE : Power supply 0 working correctly
 Input %IX*.1: TRUE : Power supply 1 working correctly
"*" is variable depending on the mounted modules.
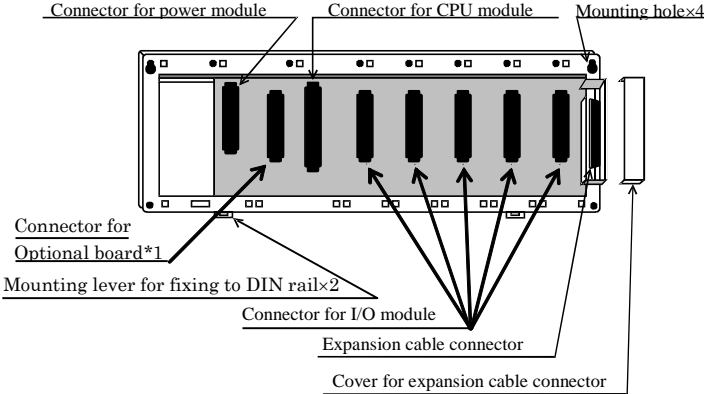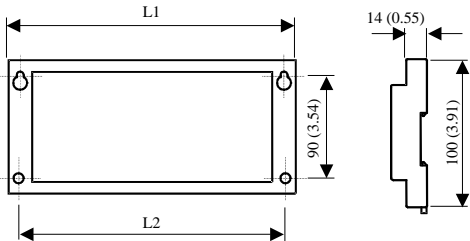
Pow 0   Pow1
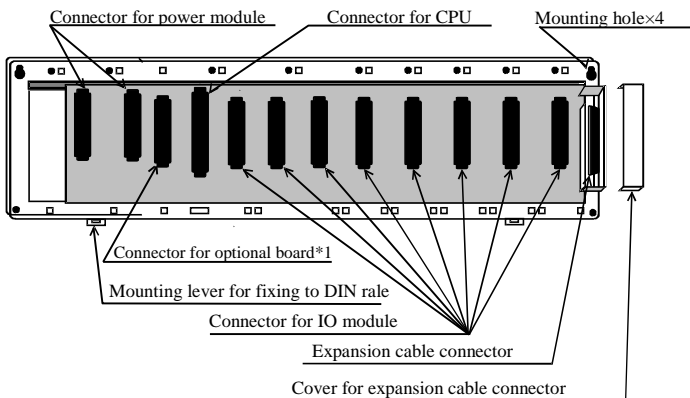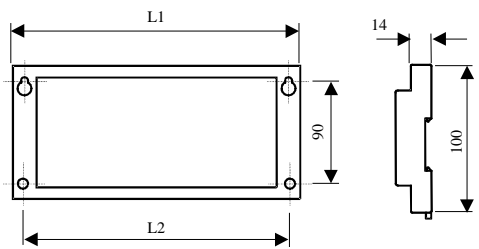
5.2   Base Units

(1)   Standard base unit

Name and function of each part	Type (Weight)	
	EH-BS3A (Approx. 0.22 kg (0.48 lb.))	
	EH-BS5A (Approx. 0.28 kg (0.62 lb.))	
	EH-BS6A (Approx. 0.31 kg (0.68 lb.))	
	EH-BS8A (Approx. 0.36 kg (0.79 lb.))	
	EH-BS11A (Approx. 0.4 kg (0.88 lb.))	

Name and function of each part diagram labels:
- Connector for power module
- Connector for CPU module
- Mounting hole×4
- Connector for Optional board*1
- Mounting lever for fixing to DIN rail×2
- Connector for I/O module
- Expansion cable connector
- Cover for expansion cable connector

Dimensions (mm (in.))

Diagram dimensions: L1, L2, 90 (3.54), 14 (0.55), 100 (3.91)

Communication slot (Slot for only communication module)

EH-BS3A	Slot 0 to 2
EH-BS5A	Slot 0 to 4
EH-BS6A	Slot 0 to 5
EH-BS8A	Slot 0 to 7
EH-BS11A	Slot 0 to 7 (Communication modules are not supported on the slot 8 to A.)

	L1 (Outer dimensions)	L2 (Mounted dimensions)
EH-BS3A	222.5 (8.76)	207 (8.15)
EH-BS5A	282.5 (11.2)	267 (10.51)
EH-BS6A	312.5 (12.31)	297 (10.70)
EH-BS8A	372.5 (14.67)	357 (14.06)
EH-BS11A	462.5 (18.21)	447 (17.6)

Explanation of function	This is the base unit to mount the power supply module, the CPU module, and I/O modules. The base unit has a back plane bus for the power and signal lines. Several different base units are available according to the required number of slots. Choose the right base unit according to your system requirements.
Item	**Description**
Connector for power module	This is the connector for the power module.
Connector for CPU module	This is the connector for the CPU module or I/O controller.
Connector for I/O module	This is the connector for the I/O modules.
Expansion cable connector	This is the connector for connecting the expansion cable.
Mounting hole (4 locations)	Besides DIN rail mounting, it can be fixed directly with M4×20 mm (0.79 in.) screws.
Mounting lever for fixing to DIN rail	Used for DIN rail mounting of the base unit.
Cover for expansion cable connector	This cover is used for protecting the expansion cable connector when it is not used.

*1 Not used for HX series.

(2) Redundant base unit

Name and function of each part		Type(Weight)	EH-BS8R (0.39 kg (0.86 lb.))
		Dimension(mm (in.))	

Connector for power module   Connector for CPU   Mounting hole×4

Connector for optional board*1
Mounting lever for fixing to DIN rale
Connector for IO module
Expansion cable connector
Cover for expansion cable connector

Communication slot

EH-BS8R	Slot 0 to 7

L1
14
90
100
L2

Unit:mm	L1 (Outer dimensions)	L2 (Mounted dimensions)
EH-BS8R	432.5(17.01)	417(16.42)

Function	This is the redundant base unit to mount the power supply modules, the CPU module, and I/O modules. The redundant base unit has a back plane bus for the power and signal lines.
Item	Description
Connector for power module	This is the connector for the power module.
Connector for CPU module	This is the connector for the CPU module or I/O controller.
Connector for I/O module	This is the connector for the I/O modules.
Expansion cable connector	This is the connector for connecting the expansion cable.
Mounting hole (4 locations)	Besides DIN rail mounting, it can be fixed directly with M4×20 mm (0.79 in.) screws.
Mounting lever for fixing to DIN rail	Used for DIN rail mounting of the redundant base unit.
Cover for expansion cable connector	This cover is used for protecting the expansion cable connector when it is not used.

*1 Not used for HX series.

[Error output, Operation status]

Error output and operation status will be change according to occurrence of error and power ON / OFF as follows.

Pow 0   Pow1

Operation status

Input %IX*.0

* is variable depending on the mounting

situation of the module.

FFB0   FFB1
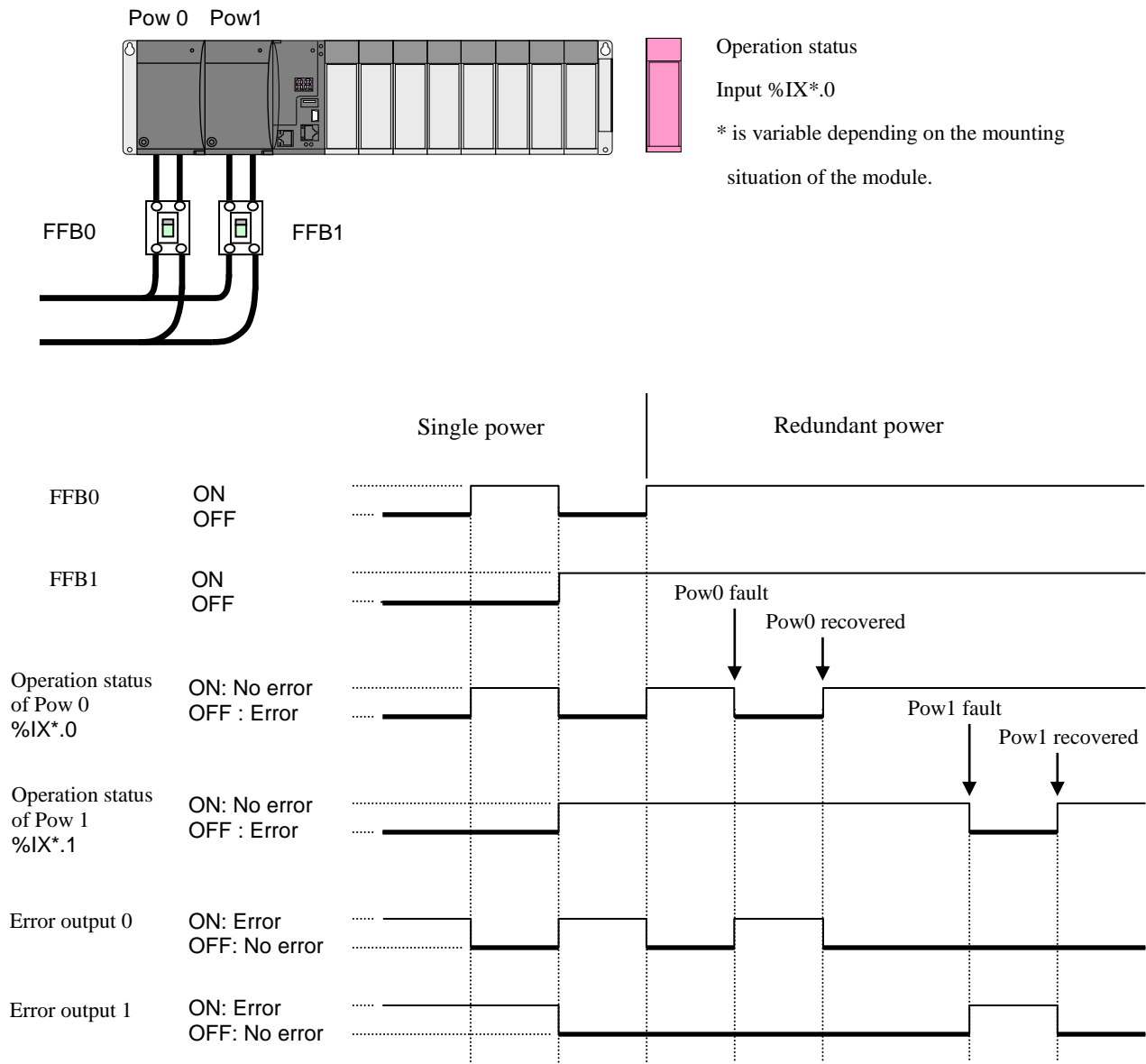
Time chart of Error output and Operation status
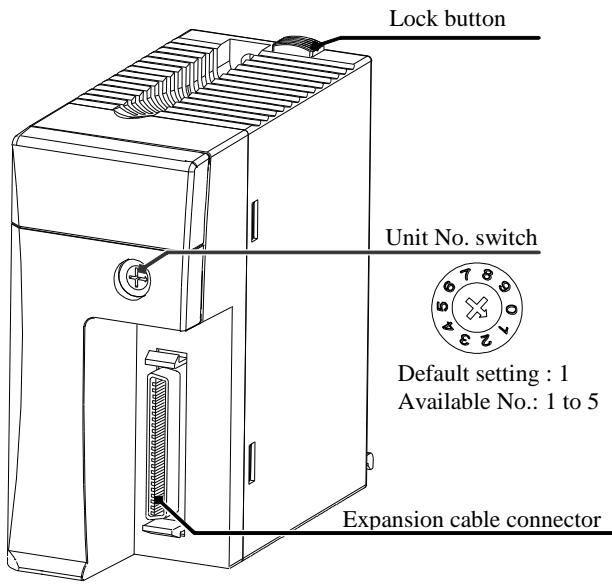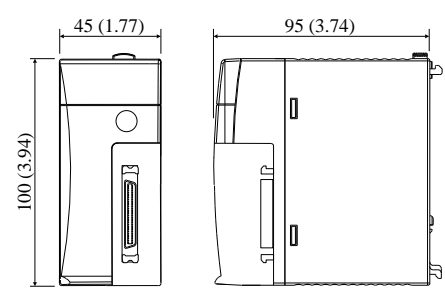
[Replacement of faulted power supply module]

If one of the power supply modules failed, this can be replaced during operation with the other power supply module energized.

1. Make sure to install a circuit breaker for each power line.
2. Make sure to replace a failed power supply module after switching off the power line.
   Beware of electric shock as the other power supply module is energized.

Even if two power supply modules are mounted, the total current consumption of all the modules must be within the capacity of the output current of single power supply module.
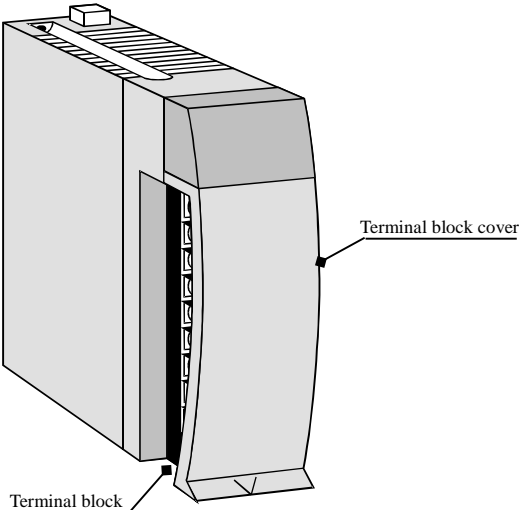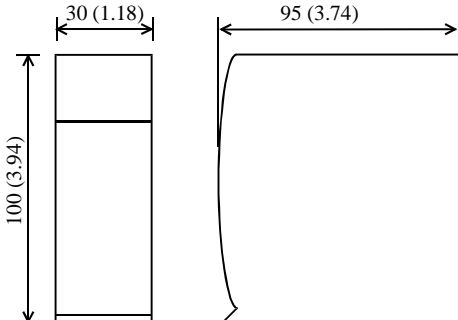
5.3　I/O Controller
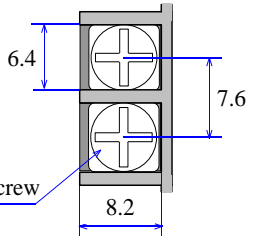
Name and function of each part		Type (Weight)	EH-IOCH2 (Approx 0.14 kg (0.31 lb.))
Lock button Unit No. switch Default setting : 1 Available No.: 1 to 5 Expansion cable connector		Dimensions (mm (in.))	 45 (1.77)　　95 (3.74)　100 (3.94)

Explanation of function	The I/O controller is used to control the I/Os in the expansion unit. It is mounted on the right slot next to the power supply unit on the expansion base. Make sure to set the unit number with ascending order from 1 to 5 from the first expansion unit next to the base unit. Note) - If another number than 1 to 5 is set, it does not work properly.

Item	Description
Lock button	Press this button to dismount. Module can be fixed firmly by a screw of M4 × 10 mm (0.39 in.).
Unit No. switch	This is the rotary switch to set the unit No. Make sure to set unit number with ascending order from 1 to 5 from the first expansion unit next to the base unit. Example)　1 →2→3,　2→4→5,　1→3→5 The setting of the unit number has to be done during power off. If the unit numbers of the I/O controllers are not set correctly, the PLC does not work properly.
Expansion cable connector	This is the connector to connect the expansion cable. Connect the previous base and the I/O controller using the expansion cable.

Chapter 6 Digital I/O Modules

6.1   Outline
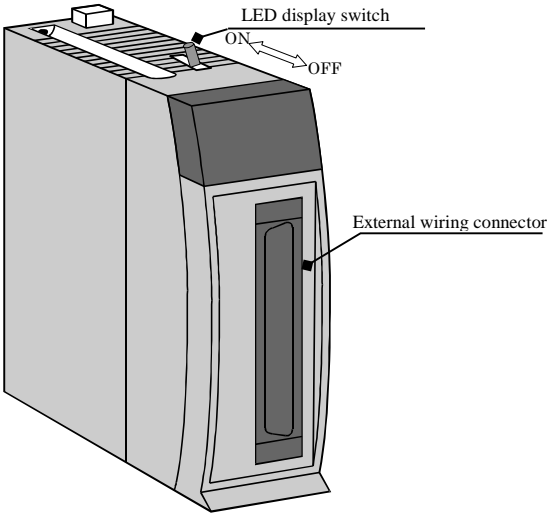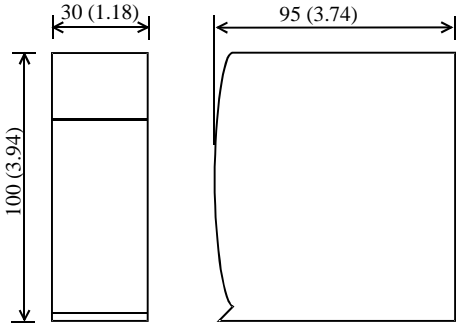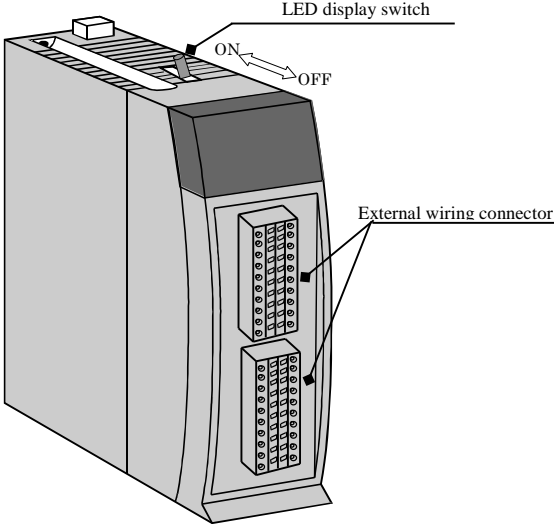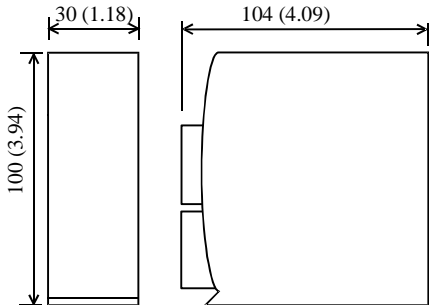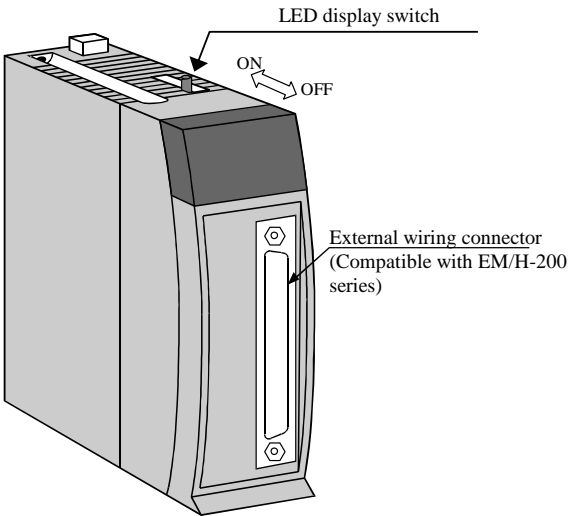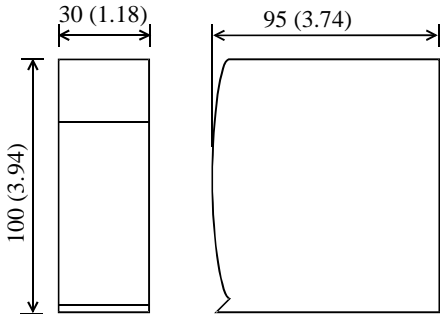
(1)   The appearance of 16-point I/O modules

Name and function of each part		
  Terminal block cover Terminal block	Type (Weight)	EH-XD8(Approx.0.16 kg(0.35 lb.))
		EH-XD16, XDL16(Approx.0.16 kg(0.35 lb.))
		EH-XDS16(Approx.0.16 kg(0.35 lb.))
		EH-XA16,XAH16(Approx.0.18 kg(0.41 lb.))
		EH-YT8,EH-YTP8(Approx.0.16 kg(0.35 lb.))
		EH-YT16,EH-YTP16(Approx.0.16 kg(0.35 lb.))
		EH-YTP16S(Approx.0.16 kg(0.35 lb.))
		EH-YR8B(Approx.0.16 kg(0.35 lb.))
		EH-YR12(Approx.0.20 kg(0.44 lb.))
		EH-YR16,EH-YR16D(Approx.0.24 kg(0.53 lb.))
		EH-YS16(Approx.0.23 kg(0.51 lb.))
	Dimensions (mm (in.))	30 (1.18) 95 (3.74) 100 (3.94)

Name	Description
Terminal block	This is the terminal block for connecting the I/O signals. The terminal block is removable. The screws for the terminal block are M3 screws. Use a crimp terminal fitting the screw diameter. The maximum cable size is 0.75 mm^2 (Use 0.5 mm^2 cable when attaching two crimp terminals to the same terminal.). The recommended crimp terminals are shown below. 6 (0.24) (Recommended) 6 (0.24) Unit: mm (in.) Take great care on handling the terminal because it may fall off if the screw is loose. 6.4 7.6 M3 screw 8.2
Terminal block cover	This is the cover of the terminal block.
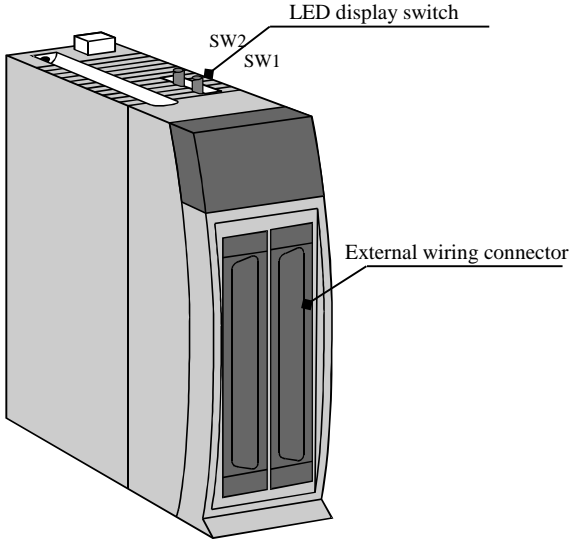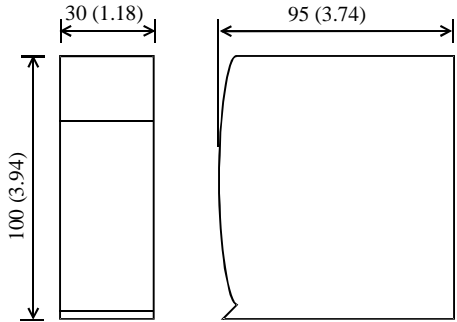
A front view of LED	Indicated contents
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 DC INPUT EH-XD16	The LEDs of the activated input numbers light up.

(2)   The appearance of 32-point I/O modules

Name and function of each part	Type (Weight)	EH-XD32, XDL32 (Approx. 0.15 kg (0.33 lb.))
		EH-XDS32 (Approx. 0.15 kg (0.33 lb.))
		EH-YT32, YTP32 (Approx. 0.15 kg (0.33 lb.))

LED display switch
ON
OFF
External wiring connector

Dimensions (mm (in.))

30 (1.18)   95 (3.74)   100 (3.94)

	Type (Weight)	EH-XD32E, XDL32E (Approx. 0.15 kg (0.33 lb.))
		EH-YT32E, YTP32E (Approx. 0.15 kg (0.33 lb.))

LED display switch
ON
OFF
External wiring connector

Dimensions (mm (in.))

30 (1.18)   104 (4.09)   100 (3.94)

	Type (Weight)	EH-XD32H (Approx. 0.12 kg (0.26 lb.))
		EH-YT32H (Approx. 0.12 kg (0.26 lb.))

LED display switch
ON
OFF
External wiring connector
(Compatible with EM/H-200 series)

Dimensions (mm (in.))

30 (1.18)   95 (3.74)   100 (3.94)

Name	Specification
LED display switch	This switch is used to select the I/O group to be displayed by the LED's.
External wiring connector	This is the connector for connecting the I/O signals.

A front view of LED	Indicated contents
0 1 2 3 +16 4 5 6 7 8 9 10 11 12 13 14 15 DC INPUT EH-XD32	The LEDs of the activated input numbers light up. The status of the 32 points is shown by groups of 16 points on the LED's as following. | Switch	LED +16	Display group
---	---	---
OFF	OFF	0 to 15
ON	ON	16 to 31	

(3)　The appearance of 64-point I/O modules
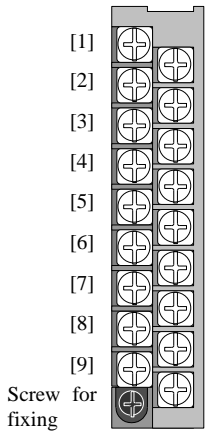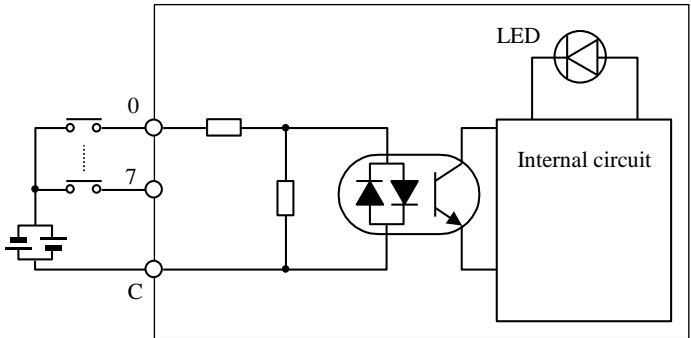
Name and function of each part		Type (Weight)	EH-XD64 (Approx. 0.14 kg (0.31 lb.))
LED display switch SW2 SW1 External wiring connector			EH-YT64, YTP64 (Approx. 0.13 kg (0.29 lb.))
		Dimensions (mm (in.))	30 (1.18)　　95 (3.74) 100 (3.94)
Item	Description		
LED display switch	This switch is used to select the I/O group to be displayed by the LED's.		
External wiring connector	This is the connector for connecting the I/O signals.		

A front view of LED	Indicated contents
0 1 2 3 16 4 5 6 7 8 9 10 11 32 12 13 14 15 DC INPUT EH-XD64	The LEDs of the activated input numbers light up. The status of the 64 points is shown by groups of 16 points on the LED's as following. | SW1	SW2	LED 16	LED 32	Display group
---	---	---	---	---
OFF	OFF	OFF	OFF	0 to 15
ON	OFF	ON	OFF	16 to 31
OFF	ON	OFF	ON	32 to 47
ON	ON	ON	ON	48 to 63	

6.2   Specifications
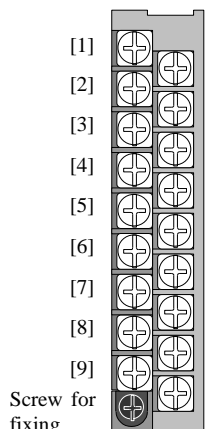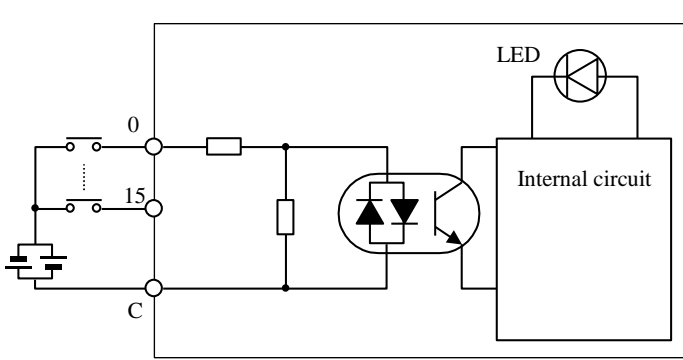
(1) EH-XD8

Specification		EH-XD8
Input type		DC input (common use to sink and source)
Number of input points		8 points
Input voltage		24 V DC (19.2 to 30 V DC)
Input current		Approx. 6.9 mA
Input impedance		Approx. 3.5 kΩ
Operating voltage	ON voltage	Min. 15 V
	OFF voltage	Max. 5 V
Input response time	ON response	Max. 5 ms
	OFF response	Max. 5 ms
Insulation system		Photo-coupler insulation
Input display		LED display (green)
External connection		Removable type screw terminal block (M3)
Number of input points / commons		8 points / 1 common
Internal current consumption		Approx. 30 mA

Terminal configuration	No.	Signal name	Diagram of Internal circuit
	[1]	0	
	[2]	1	
	[3]	2	
	[4]	3	
	[5]	4	
	[6]	5	
	[7]	6	
	[8]	7	
	[9]	C	
	[10]	N.C.	
	[11]	N.C.	
	[12]	N.C.	
	[13]	N.C.	
	[14]	N.C.	
	[15]	N.C.	
	[16]	N.C.	
	[17]	N.C.	
	[18]	C	
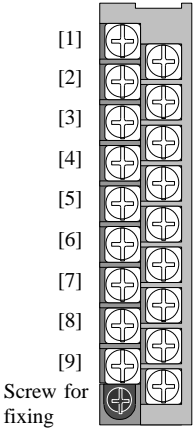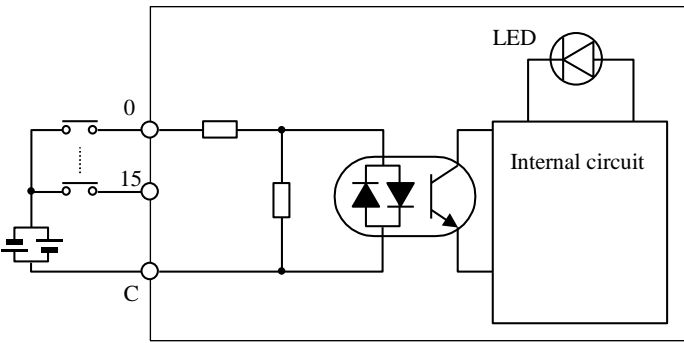
(2) EH-XD16

Specification		EH-XD16
Input type		DC input (common use to sink and source)
Number of input points		16 points
Input voltage		24 V DC (19.2 to 30 V DC)
Input current		Approx. 4.0 mA
Input impedance		Approx. 5.9 kΩ
Operating voltage	ON voltage	Min. 15 V
	OFF voltage	Max. 5 V
Input response time	ON response	Max. 5 ms
	OFF response	Max. 5 ms
Insulation system		Photo-coupler insulation
Input display		LED display (green)
External connection		Removable type screw terminal block (M3)
Number of input points / commons		16 points / 1 common (2 terminals)
Internal current consumption		Approx. 50 mA

Terminal configuration	No.	Signal name	Diagram of Internal circuit
[1] [2] [3] [4] [5] [6] [7] [8] [9] Screw for fixing [10] [11] [12] [13] [14] [15] [16] [17] [18]	[1]	0	
	[2]	1	
	[3]	2	
	[4]	3	
	[5]	4	
	[6]	5	
	[7]	6	
	[8]	7	
	[9]	C	
	[10]	8	
	[11]	9	
	[12]	10	
	[13]	11	
	[14]	12	
	[15]	13	
	[16]	14	
	[17]	15	
	[18]	C	

(3) EH-XDL16

Specification		EH-XDL16
Input type		DC input (common use to sink and source)
Number of input points		16 points
Input voltage		24 V DC (19.2 to 30 V DC)
Input current		Approx. 4.0 mA
Input impedance		Approx. 5.9 kΩ
Operating voltage	ON voltage	Min. 15 V
	OFF voltage	Max. 5 V
Input response time	ON response	Max. 16 ms
	OFF response	Max. 16 ms
Insulation system		Photo-coupler insulation
Input display		LED display (green)
External connection		Removable type screw terminal block (M3)
Number of input points / commons		16 points / 1 common (2 terminals)
Internal current consumption		Approx. 50 mA

Terminal configuration	No.	Signal name	Diagram of internal circuit
	[1]	0	
	[2]	1	
	[3]	2	
[1] [10]	[4]	3	
[2] [11]	[5]	4	
[3]	[6]	5	
[4] [12]	[7]	6	
[5] [13]	[8]	7	
[6] [14]	[9]	C	
[7] [15]	[10]	8	
[8] [16]	[11]	9	
[9] [17]	[12]	10	
Screw for fixing [18]	[13]	11	
	[14]	12	
	[15]	13	
	[16]	14	
	[17]	15	
	[18]	C	

(4) EH-XDS16

Specification		EH-XDS16
Input type		DC input (common use to sink and source)
Number of input points		16 points
Input voltage		24 V DC (19.2 to 30 V DC)
Input current		Approx. 4.0 mA
Input impedance		Approx. 5.9 kΩ
Operating voltage	ON voltage	Min. 15 V
	OFF voltage	Max. 5 V
Input response time	ON response	Max. 1 ms
	OFF response	Max. 1 ms
Insulation system		Photo-coupler insulation
Input display		LED display (green)
External connection		Removable type screw terminal block (M3)
Number of input points / commons		16 points / 1 common (2 terminals)
Internal current consumption		Approx. 50 mA

Terminal configuration	No.	Signal name	Diagram of internal circuit
	[1]	0	
	[2]	1	
	[3]	2	
	[4]	3	
	[5]	4	
	[6]	5	
	[7]	6	
	[8]	7	
	[9]	C	
	[10]	8	
	[11]	9	
	[12]	10	
	[13]	11	
	[14]	12	
	[15]	13	
	[16]	14	
	[17]	15	
	[18]	C	

(5) EH-XA16

Specification		EH-XA16
Input type		AC input
Number of input points		16 points
Input voltage		100 to 120 V AC (85 to 132 V AC)
Input current		4.8 to 7.6 mA (100 V AC / 50Hz)
Input impedance		Approx. 16 kΩ (50 Hz) / Approx. 13 kΩ (60 Hz)
Operating voltage	ON voltage	Min. 79 V AC
	OFF voltage	Max. 20 V AC
Input response time	ON response	Max. 15 ms
	OFF response	Max. 25 ms
Insulation system		Photo-coupler insulation
Input display		LED display (green)
External connection		Removable type screw terminal block (M3)
Number of input points / commons		16 points / 1 common (2 terminals)
Internal current consumption		Approx. 50 mA

Terminal configuration	No.	Signal name	Diagram of Internal circuit
	[1]	0	
	[2]	1	
	[3]	2	
	[4]	3	
	[5]	4	
	[6]	5	
	[7]	6	
	[8]	7	
	[9]	C	
	[10]	8	
	[11]	9	
	[12]	10	
	[13]	11	
	[14]	12	
	[15]	13	
	[16]	14	
	[17]	15	
	[18]	C	
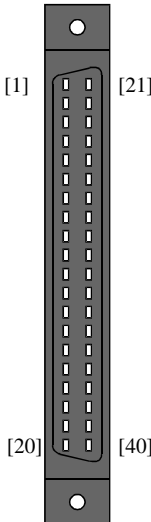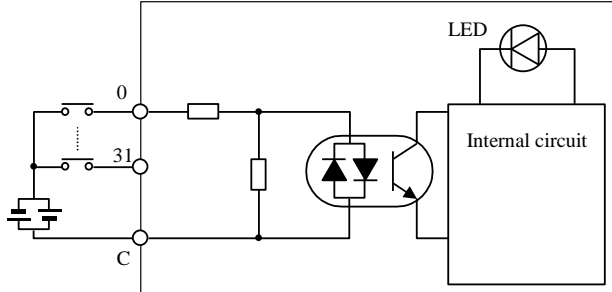
(6) EH-XAH16

Specification		EH-XAH16
Input type		AC input
Number of input points		16 points
Input voltage		200 to 240 V AC (170 to 264 V AC)
Input current		4.3 to 8.0 mA (200 V AC / 50 Hz)
Input impedance		Approx. 32 kΩ (50 Hz) / Approx. 27 kΩ (60 Hz)
Operating voltage	ON voltage	Min. 164 V AC
	OFF voltage	Max. 40 V AC
Input response time	ON response	Max. 15 ms
	OFF response	Max. 25 ms
Insulation system		Photo-coupler insulation
Input display		LED display (green)
External connection		Removable type screw terminal block (M3)
Number of input points / commons		16 points / 1 common (2 terminals)
Internal current consumption		Approx. 50 mA

Terminal configuration	No.	Signal name	Diagram of Internal circuit
	[1]	0	
	[2]	1	
	[3]	2	
	[4]	3	
	[5]	4	
	[6]	5	
	[7]	6	
	[8]	7	
	[9]	C	
	[10]	8	
	[11]	9	
	[12]	10	
	[13]	11	
	[14]	12	
	[15]	13	
	[16]	14	
	[17]	15	
	[18]	C	
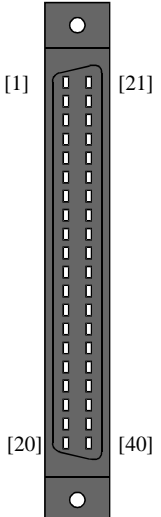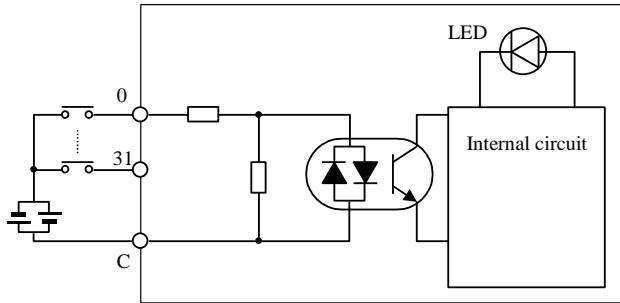
(7) EH-XD32

Specification		EH-XD32
Input type		DC input (Common use to sink and source)
Number of input points		32 points
Input voltage		24 V DC (19.2 to 30.0 V DC)
Input current		Approx. 4.3 mA
Input impedance		Approx. 5.6 kΩ
Operating voltage	ON voltage	Min. 15 V
	OFF voltage	Max. 5 V
Input response time	ON response	Max. 5 ms
	OFF response	Max. 5 ms
Insulation system		Photo-coupler insulation
Input display		LED connector (green)
External connection		Connector
Number of input points / commons		32 points / 1 common (4 terminals)
Internal current consumption		Approx. 60 mA

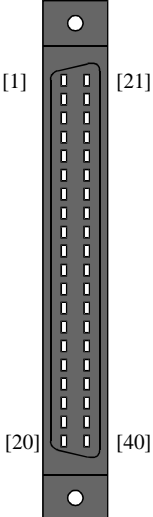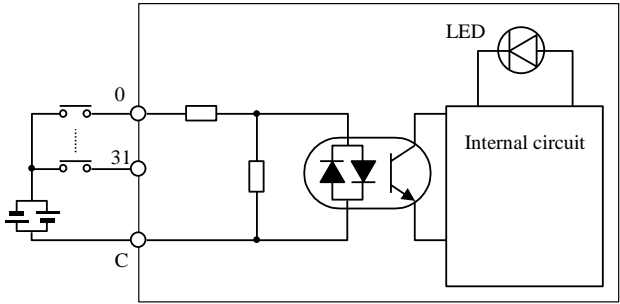| Terminal configuration	No.	Signal name	No.	Signal name	Diagram of Internal circuit
	[1]	0	[21]	16	
	[2]	1	[22]	17	
	[3]	2	[23]	18	
	[4]	3	[24]	19	
	[5]	4	[25]	20	
	[6]	5	[26]	21	
	[7]	6	[27]	22	
	[8]	7	[28]	23	
	[9]	C	[29]	C	
	[10]	8	[30]	24	
	[11]	9	[31]	25	
	[12]	10	[32]	26	
	[13]	11	[33]	27	
	[14]	12	[34]	28	
	[15]	13	[35]	29	
	[16]	14	[36]	30	
	[17]	15	[37]	31	
	[18]	C	[38]	C	
	[19]	N.C.	[39]	N.C.	
	[20]	N.C.	[40]	N.C.	

Applicable connectors
- 120 mm (4.73 in.) of space is required in front of the module. Make sure to secure sufficient space in front of the PLC.
- Use a shield cable and always use a class D grounding.

Manufacturer	Fujitsu Takamizawa	Solder type	Socket: FCN-361J040-AU, Cover: FCN-360C040-E
		Crimp type	Housing: FCN-363J040, Contact: FCN-363J-AU
		Pressure-displacement type	FCN-367J040-AU/F
	AMP	Solder type	1473381-1

(8) EH-XDL32

Specification		EH-XDL32
Input type		DC input (Common use to sink and source)
Number of input points		32 points
Input voltage		24 V DC (19.2 to 30.0 V DC)
Input current		Approx. 4.3 mA
Input impedance		Approx. 5.6 kΩ
Operating voltage	ON voltage	Min. 15 V
	OFF voltage	Max. 5 V
Input response time	ON response	Max. 16 ms
	OFF response	Max. 16 ms
Insulation system		Photo-coupler insulation
Input display		LED connector (green)
External connection		Connector
Number of input points / commons		32 points / 1 common (4 terminals)
Internal current consumption		Approx. 60 mA

Terminal configuration	No.	Signal name	No.	Signal name	Diagram of Internal circuit
	[1]	0	[21]	16	
	[2]	1	[22]	17	
	[3]	2	[23]	18	
	[4]	3	[24]	19	
[1] [21]	[5]	4	[25]	20	
	[6]	5	[26]	21	
	[7]	6	[27]	22	
	[8]	7	[28]	23	
	[9]	C	[29]	C	
	[10]	8	[30]	24	
	[11]	9	[31]	25	
	[12]	10	[32]	26	
	[13]	11	[33]	27	
	[14]	12	[34]	28	
	[15]	13	[35]	29	
[20] [40]	[16]	14	[36]	30	
	[17]	15	[37]	31	
	[18]	C	[38]	C	
	[19]	N.C.	[39]	N.C.	
	[20]	N.C.	[40]	N.C.	

Applicable connectors
- 120 mm (4.73 in.) of space is required in front of the module. Make sure to secure sufficient space in front of the PLC.
- Use a shield cable and always use a class D grounding.

Manufacturer	Fujitsu Takamizawa	Solder type	Socket: FCN-361J040-AU, Cover: FCN-360C040-E
		Crimp type	Housing: FCN-363J040, Contact: FCN-363J-AU
		Pressure-displacement type	FCN-367J040-AU/F
	AMP	Solder type	1473381-1

(9) EH-XDS32

Specification		EH-XDS32
Input type		DC input (Common use to sink and source)
Number of input points		32 points
Input voltage		24 V DC (19.2 to 30.0 V DC)
Input current		Approx. 4.3 mA
Input impedance		Approx. 5.6 kΩ
Operating voltage	ON voltage	Min. 15 V
	OFF voltage	Max. 5 V
Input response time	ON response	Max. 1 ms
	OFF response	Max. 1 ms
Insulation system		Photo-coupler insulation
Input display		LED connector (green)
External connection		Connector
Number of input points / commons		32 points / 1 common (4 terminals)
Internal current consumption		Approx. 60 mA

Terminal configuration	No.	Signal name	No.	Signal name	Diagram of Internal circuit
	[1]	0	[21]	16	
	[2]	1	[22]	17	
	[3]	2	[23]	18	
	[4]	3	[24]	19	
	[5]	4	[25]	20	
	[6]	5	[26]	21	
	[7]	6	[27]	22	
	[8]	7	[28]	23	
	[9]	C	[29]	C	
	[10]	8	[30]	24	
	[11]	9	[31]	25	
	[12]	10	[32]	26	
	[13]	11	[33]	27	
	[14]	12	[34]	28	
	[15]	13	[35]	29	
	[16]	14	[36]	30	
	[17]	15	[37]	31	
	[18]	C	[38]	C	
	[19]	N.C.	[39]	N.C.	
	[20]	N.C.	[40]	N.C.	

Applicable connectors
- 120 mm (4.73 in.) of space is required in front of the module. Make sure to secure sufficient space in front of the PLC.
- Use a shield cable and always use a class D grounding.

Manufacturer	Fujitsu Takamizawa	Solder type	Socket: FCN-361J040-AU, Cover: FCN-360C040-E
		Crimp type	Housing: FCN-363J040, Contact: FCN-363J-AU
		Pressure-displacement type	FCN-367J040-AU/F
	AMP	Solder type	1473381-1

(10)   EH-XD32E

Specification		EH-XD32E
Input type		DC input (Common use to sink and source)
Number of input points		32 points
Input voltage		24 V DC (19.2 to 30.0 V DC)
Input current		Approx. 4.3 mA
Input impedance		Approx. 5.6 kΩ
Operating voltage	ON voltage	Min. 15 V
	OFF voltage	Max. 5 V
Input response time	ON response	Max. 1 ms
	OFF response	Max. 1 ms
Insulation system		Photo-coupler insulation
Input display		LED display (green)
External connection		Spring type terminal block (removable type)
Number of input points / commons		8 points / 1 common (2 terminals)
Internal current consumption		Approx. 60 mA

Terminal configuration	No.	Signal name	No.	Signal name	Diagram of Internal circuit
	[1]	0	[21]	16	
	[2]	1	[22]	17	
	[3]	2	[23]	18	
	[4]	3	[24]	19	
	[5]	4	[25]	20	
	[6]	5	[26]	21	
	[7]	6	[27]	22	
	[8]	7	[28]	23	
	[9]	C1	[29]	C3	
	[10]	C1	[30]	C3	
	[11]	8	[31]	24	
	[12]	9	[32]	25	
	[13]	10	[33]	26	
	[14]	11	[34]	27	
	[15]	12	[35]	28	
	[16]	13	[36]	29	
	[17]	14	[37]	30	
	[18]	15	[38]	31	
	[19]	C2	[39]	C4	
	[20]	C2	[40]	C4	

Applicable connectors		Applicable cable
Manufacturer: Weidmuller Type: B2L3.5/20AUOR Product No.: 175736		0.5 mm^2 - 1.0 mm^2 (stranded or single wire cable) AWG 28 - 18 Crimp terminals are not available.

(11)　EH-XDL32E

Specification		EH-XDL32E
Input type		DC input (Common use to sink and source)
Number of input points		32 points
Input voltage		24 V DC (19.2 to 30 V DC)
Input current		Approx. 4.3 mA
Input impedance		Approx. 5.6 kΩ
Operating voltage	ON voltage	Min. 15 V
	OFF voltage	Max. 5 V
Input response time	ON response	Max. 16 ms
	OFF response	Max. 16 ms
Insulation system		Photo-coupler insulation
Input display		LED display (green)
External connection		Spring type terminal block (removable type)
Number of input points / commons		8 points / 1 common (2 terminals)
Internal current consumption		Approx. 60 mA

Terminal configuration	No.	Signal name	No.	Signal name	Diagram of Internal circuit
	[1]	0	[21]	16	
	[2]	1	[22]	17	
	[3]	2	[23]	18	
[1]　　　　　[21]	[4]	3	[24]	19	
	[5]	4	[25]	20	
	[6]	5	[26]	21	
	[7]	6	[27]	22	
	[8]	7	[28]	23	
	[9]	C1	[29]	C3	
[10]　　　　[30]	[10]	C1	[30]	C3	
[11]　　　　[31]	[11]	8	[31]	24	
	[12]	9	[32]	25	
	[13]	10	[33]	26	
	[14]	11	[34]	27	
	[15]	12	[35]	28	
[16]	[16]	13	[36]	29	
[17]	[17]	14	[37]	30	
	[18]	15	[38]	31	
[20]　　　　[40]	[19]	C2	[39]	C4	
	[20]	C2	[40]	C4	

Applicable connectors		Applicable cable
Manufacturer: Weidmuller Type: B2L3.5/20AUOR Product No.175736		0.5 mm^2 - 1.0 mm^2 (stranded or single wire cable) AWG 28 - 18 Crimp terminals are not available.

(12)   EH-XD32H

Item		EH-XD32H	PIM-DM, PIH-DM (for replacing)
Series		HX / EH-150	EM / EM-Ⅱ, H-200 / 250 / 252B / 252C
Input specification		DC input (Common use to source)	
Number of input points		32 points	
Input voltage		24 V DC (21.6 to 26.0 V DC)	
Input current (24V DC)		Approx. 4.1 mA	Approx. 4.7 mA
Input impedance		Approx. 5.9 kΩ	Approx. 5.1 kΩ
Operating voltage	ON voltage	Min. 19 V	
	OFF voltage	Max. 7 V	
Input response time	ON response	Max. 4 ms	
	OFF response	Max. 4 ms	
Insulation system		Photo-coupler insulation	
Number of input points / commons		32 points / 1 common (4 terminals) *1	
Input display		LED (green) *2	LED (red)
polarity		Common terminal (+)	
External connection		Connector (50 pins)	
Internal current consumption		Approx. 60 mA	Approx. 20 mA

*1 Common terminals are connected internally.

*2 There are 16 points of LED indication. The indicated group is selected by the toggle switch.

Specification of external wiring connector				Wire
Product name	Manufacturer	Product No.	Connection method	
Plug connector	Hirose Electric Co., Ltd.	DX30-50P	Untie crimping	AWG#30
		DX30A-50P		AWG#28
		DX31-50P	Crimping	AWG#30
		DX31A-50P		AWG#28
		DX40-50P	Soldering	-
Die cast cover		DX-50-CV1	-	-

Terminal configuration	No.	Signal name	No.	Signal name	Diagram of Internal circuit
	[25]	NC	[50]	NC	
	[24]	NC	[49]	NC	
	[23]	NC	[48]	NC	
	[22]	NC	[47]	NC	
	[21]	15	[46]	31	
	[20]	14	[45]	30	
	[19]	13	[44]	29	
	[18]	12	[43]	28	
	[17]	11	[42]	27	
	[16]	10	[41]	26	
	[15]	9	[40]	25	
	[14]	8	[39]	24	
	[13]	NC	[38]	NC	
	[12]	C	[37]	C	
	[11]	NC	[36]	NC	
	[10]	7	[35]	23	
	[9]	6	[34]	22	
*1 Reversed direction to EM/H-200 series	[8]	5	[33]	21	
	[7]	4	[32]	20	
	[6]	3	[31]	19	
	[5]	2	[30]	18	
	[4]	1	[29]	17	
	[3]	0	[28]	16	
	[2]	NC	[27]	NC	
	[1]	C	[26]	C	

EH - XD32H (This product)

Internal circuit

PIM-DM, PIH-DM (for replacing) [Reference]

Internal circuit

*1 The connector direction of EH-XD32H is reversed to PIM/PIH-DM of EM/H200 series. Rotate the cable with 180 degrees when replacing. (Not possible to connect in the same direction due to the mechanical structure of the module.)

EM / H-200 series

HX series

Reversed direction

Replacement

Rotate 180 degrees

(13)
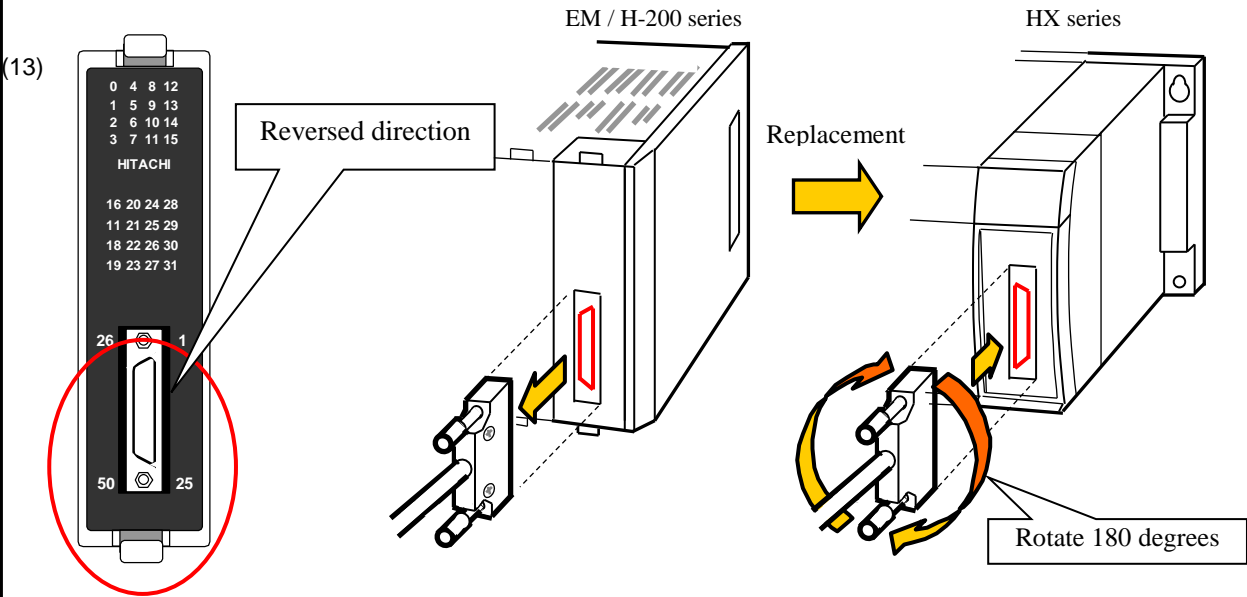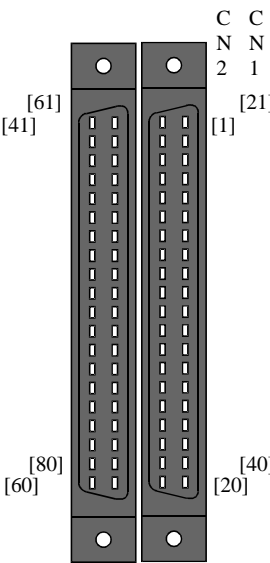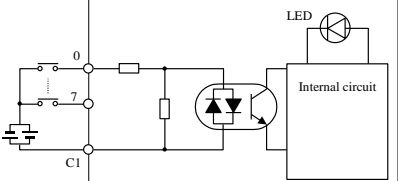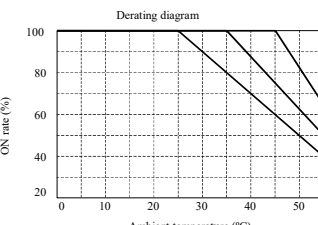
EH-XD64

Specification		EH-XD64
Input type		DC input (Common used to sink and source)
Number of input points		64 points
Input voltage		24 V DC (19.2 to 30.0 V DC)
Input current		Approx. 4.3 mA
Input impedance		Approx. 5.6 kΩ
Operating voltage	ON voltage	Min. 15 V
	OFF voltage	Max. 5 V
Input response time	ON response	Max. 1 ms
	OFF response	Max. 1 ms
Insulation system		Photo-coupler insulation
Input display		LED display (green)*1
External connection		Connector
Number of input points / commons		32 points / 1 common (4 terminals) *2
Internal current consumption		Approx. 80 mA

*1 There are 16 points of LED indication. The indicated group is selected by the toggle switches.
*2 Two groups (C1,C2) are separated. 4 common terminals in one group are connected internally.

Terminal configuration	No.	Signal name	No.	Signal name	No.	Signal name	No.	Signal name	Diagram of Internal circuit
	[41]	32	[61]	48	[1]	0	[21]	16	
	[42]	33	[62]	49	[2]	1	[22]	17	
	[43]	34	[63]	50	[3]	2	[23]	18	
	[44]	35	[64]	51	[4]	3	[24]	19	
	[45]	36	[65]	52	[5]	4	[25]	20	
	[46]	37	[66]	53	[6]	5	[26]	21	
	[47]	38	[67]	54	[7]	6	[27]	22	
	[48]	39	[68]	55	[8]	7	[28]	23	
	[49]	C2	[69]	C2	[9]	C1	[29]	C1	
	[50]	40	[70]	56	[10]	8	[30]	24	
	[51]	41	[71]	57	[11]	9	[31]	25	
	[52]	42	[72]	58	[12]	10	[32]	26	
	[53]	43	[73]	59	[13]	11	[33]	27	
	[54]	44	[74]	60	[14]	12	[34]	28	
	[55]	45	[75]	61	[15]	13	[35]	29	
	[56]	46	[76]	62	[16]	14	[36]	30	
	[57]	47	[77]	63	[17]	15	[37]	31	
	[58]	C2	[78]	C2	[18]	C1	[38]	C1	
	[59]	N.C.	[79]	N.C.	[19]	N.C.	[39]	N.C.	
	[60]	N.C.	[80]	N.C.	[20]	N.C.	[40]	N.C.	

Applicable connectors
- A 120 mm (4.73 in.) space is required for the front of the module. Please choose the installing location (space) accordingly.
- Use a shield cable and always use a class D grounding.
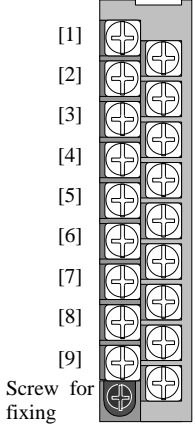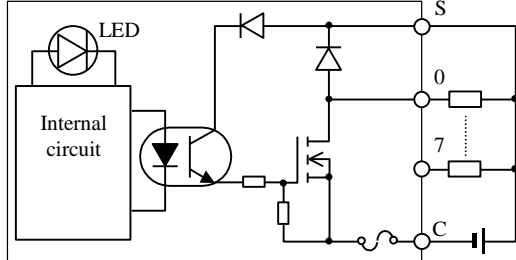
Manufacturer	Fujitsu Takamizawa	Solder type	Socket: FCN-361J040-AU, Cover: FCN-360C040-E
		Crimp type	Housing: FCN-363J040, Contact: FCN-363J-AU
		Pressure-displacement type	FCN-367J040-AU/F
	AMP	Solder type	1473381-1

(14)   EH-YT8

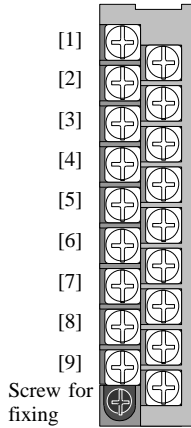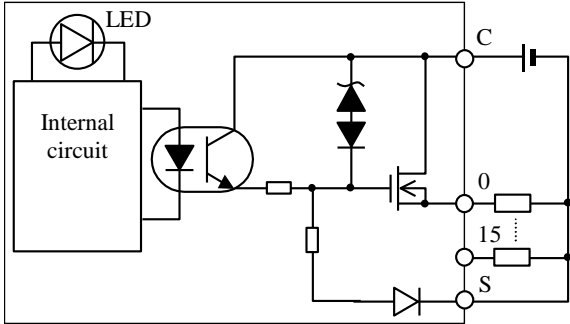| Specification		EH-YT8
Output specification		Transistor output (sink type)
Number of output points		8 points
Rated load voltage		12 / 24 V DC (+10 %, -15 %)
Minimum switching current		1 mA
Leak current		0.1 mA
Maximum load current	1 circuit	0.5 A (0.3 A MFG NO.02F** or before)*1
	1 common	2.4 A
Output response time	OFF➜ON	Max. 0.3 ms
	ON➜OFF	Max. 1 ms
Insulation system		Photo-coupler insulation
Output display		LED display (green)
External connection		Removable type screw terminal block (M3)
Number of output points / commons		8 points / 1 common
Surge removal circuit		Diode
Fuse*2		4 A / 1 common
External power supply (for supplying power to S-terminal)		12 / 24 V DC (+10 %, -15 %) (30 mA at the maximum)
Internal current consumption		Approx. 30 mA
Short-circuit protection function		None

*1 MFG NO. (02F**) indicates June 2002 production.
*2 If the internal fuse is blown, the module needs to be repaired. It is not possible for users to replace it.

Terminal configuration	No.	Signal name	Diagram of Internal circuit
	[1]	0	
	[2]	1	
	[3]	2	
	[4]	3	
	[5]	4	
	[6]	5	
	[7]	6	
	[8]	7	
	[9]	C	
	[10]	N.C.	
	[11]	N.C.	
	[12]	N.C.	
	[13]	N.C.	
	[14]	N.C.	
	[15]	N.C.	
	[16]	N.C.	
	[17]	N.C.	
	[18]	S	

(15)   EH-YT16

Specification		EH-YT16
Output specification		Transistor output (sink type)
Number of output prints		16 points
Rated load voltage		12 / 24 V DC (+10 %, -15 %)
Minimum switching current		1 mA
Leak current		0.1 mA
Maximum load current	1 circuit	0.5 A(0.3 A MFG NO.02F** or before)*1
	1 common	4 A
Output response time	OFF➔ON	Max. 0.3 ms
	ON➔OFF	Max. 1 ms
Insulation system		Photo-coupler insulation
Output display		LED display (green)
External connection		Removable type screw terminal block (M3)
Number of output points / commons		16 points / 1 common
Surge removal circuit		Diode
Fuse*2		8 A / 1 common
External power supply (for supplying power to S-terminal)		12 / 24 V DC (+10 %, -15 %) (30 mA at the maximum)
Internal current consumption		Approx. 50 mA
Short-circuit protection function		None

*1 MFG NO. (02F**) indicates June 2002 production.
*2 If the internal fuse is blown, the module needs to be repaired. It is not possible for users to replace it.

Terminal configuration	No.	Signal name	Diagram of Internal circuit
	[1]	0	
	[2]	1	
	[3]	2	
	[4]	3	
	[5]	4	
	[6]	5	
	[7]	6	
	[8]	7	
	[9]	C	
	[10]	8	
	[11]	9	
	[12]	10	
	[13]	11	
	[14]	12	
	[15]	13	
	[16]	14	
	[17]	15	
	[18]	S	

(16)   EH-YTP8

Specification		EH-YTP8
Output specification		Transistor output (source type)
Number of output points		8 points
Rated load voltage		12 / 24 V DC (+10 %, -15 %)
Minimum switching current		1 mA
Leak current		0.1 mA
Maximum load current	1 circuit	0.5 A (0.3 A MFG NO.02F** or before)*1
	1 common	2.4 A
Output response time	OFF➜ON	Max. 0.3 ms
	ON➜OFF	Max. 1 ms
Insulation system		Photo-coupler insulation
Output display		LED display (green)
External connection		Removal type screw terminal block (M3)
Number of output points / commons		8 points / 1 common
Surge removal circuit		Diode
Fuse*2		4 A / 1 common
External power supply (for supplying power to S-terminal)		12 / 24 V DC (+10 %, -15 %) (30 mA at the maximum)
Internal current consumption		Approx. 30 mA
Short-circuit protection function		None

*1 MFG NO. (02F**) indicates June 2002 production.
*2 If the internal fuse is blown, the module needs to be repaired. It is not possible for users to replace it.

Terminal configuration	No.	Signal name	Diagram of Internal circuit
	[1]	0	
	[2]	1	
	[3]	2	
	[4]	3	
	[5]	4	
	[6]	5	
	[7]	6	
	[8]	7	
	[9]	C	
	[10]	N.C.	
	[11]	N.C.	
	[12]	N.C.	
	[13]	N.C.	
	[14]	N.C.	
	[15]	N.C.	
	[16]	N.C.	
	[17]	N.C.	
	[18]	S	

(17)   EH-YTP16

Specification		EH-YTP16
Output specification		Transistor output (source type)
Number of output points		16 points
Rated load voltage		12 / 24 V DC (+10 %, -15 %)
Minimum switching current		1 mA
Leak current		0.1 mA
Maximum load current	1 circuit	0.5 A (0.3 A MFG NO.02F** or before*1)
	1 common	4 A
Output response time	OFF→ON	Max. 0.3 ms
	ON→OFF	Max. 1 ms
Insulation system		Photo-coupler insulation
Output display		LED display (green)
External connection		Removable type screw terminal block (M3)
Number of output points / commons		16 points / 1 common
Surge removal circuit		Diode
Fuse*2		8 A / 1 common
External power supply (for supplying power to S-terminal)		12 / 24 V DC (+10 %, -15 %) (30 mA at the maximum)
Internal current consumption		Approx. 50 mA
Short-circuit protection function		None

*1 MFG NO. (02F**) indicates June 2002 production.
*2 If the internal fuse is blown, the module needs to be repaired. It is not possible for users to replace it.

Terminal configuration	No.	Signal name	Diagram of Internal circuit
	[1]	0	
	[2]	1	
	[3]	2	
	[4]	3	
	[5]	4	
	[6]	5	
	[7]	6	
	[8]	7	
	[9]	C	
	[10]	8	
	[11]	9	
	[12]	10	
	[13]	11	
	[14]	12	
	[15]	13	
	[16]	14	
	[17]	15	
	[18]	S	

(18)   EH-YTP16S

Specification		EH-YTP16S
Output specification		Transistor output (source type)
Number of output points		16 points
Raged load voltage		12 / 24 V DC (+10 %, -15 %)
Minimum switching current		1 mA
Leak current		0.1 mA
Maximum load current	1 circuit	0.8 A
	1 common	5 A
Output response time	OFF➜ON	Max. 0.3 ms
	ON➜OFF	Max. 1 ms
Insulation system		Photo-coupler insulation
Output display		LED display (green)
External connection		Removable type screw terminal block (M3)
Number of output points / commons		16 points / 1 common
Surge removal circuit		Built-in
Fuse		None
External power supply (for supplying power to S-terminal)		12 / 24 V DC (+10 %, -15 %) (30 mA at the maximum)
Internal current consumption		Approx. 50 mA
Short-circuit protection function		Built-in

Terminal configuration	No.	Signal name	Diagram of Internal circuit
	[1]	0	
	[2]	1	
	[3]	2	
	[4]	3	
	[5]	4	
	[6]	5	
	[7]	6	
	[8]	7	
	[9]	C	
	[10]	8	
	[11]	9	
	[12]	10	
	[13]	11	
	[14]	12	
	[15]	13	
	[16]	14	
	[17]	15	
	[18]	S	

(19)   EH-YR8B

Specification		EH-YR8B
Output specification		Relay output
Number of output points		8 points
Rated load voltage		100 / 240 V AC , 24 V DC
Minimum switching current		1 mA(5 V DC), except after a great current switching
Leak current		None
Maximum load current	1 circuit	2 A
	1 common	2 A
Output response time	OFF➜ON	Max. 10 ms
	ON➜OFF	Max. 10 ms
Insulation system		Relay insulation
Output display		LED display (green)
External connection		Removable type screw terminal block (M3)
Number of output points / commons		1 point / 1 common (Each channel is independent.)
Surge removal circuit		Varistor (Varistor voltage 423 to 517 V)
Fuse		None
External power supply		Not used
Internal current consumption (5V DC)		Approx. 220 mA
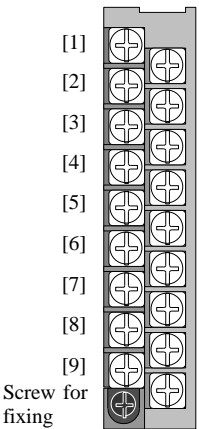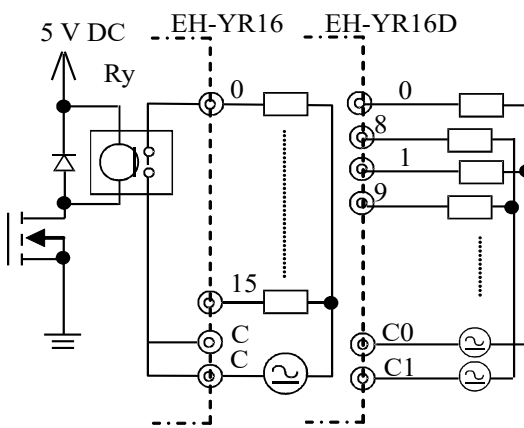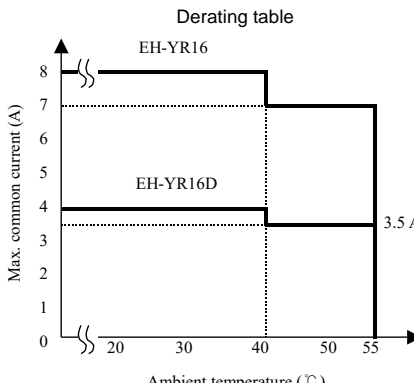
Terminal configuration	No.	Signal name	Diagram of Internal circuit
	[1]	0	
	[2]	1	
	[3]	2	
	[4]	3	
	[5]	4	
	[6]	5	
	[7]	6	
	[8]	7	
	[9]	N.C.	
	[10]	C0	
	[11]	C1	
	[12]	C2	
	[13]	C3	
	[14]	C4	
	[15]	C5	
	[16]	C6	
	[17]	C7	
	[18]	N.C.	

(20)   EH-YR12

Specification		EH-YR12
Output specification		Relay output
Number of output points		12 points
Rated load voltage		100 / 240 V AC, 24 V DC
Minimum switching current		1 mA (5 V DC), except a great current switching
Leak current		None
Maximum load current	1 circuit	2 A
	1 common	5 A
Output response time	OFF➔ON	Max. 10 ms
	ON➔OFF	Max. 10 ms
Insulation system		Photo-coupler insulation
Output display		LED display (green)
External connection		Removable type screw terminal block (M3)
Number of output points / commons		12 points / 1 common (2 terminals)
Surge removal circuit		None
Fuse		None
External power supply		24 V DC (+10 %, -15 %) (70 mA at the maximum)
Internal current consumption (5V DC)		Approx. 40 mA

Terminal configuration	No.	Signal name	Diagram of Internal circuit
	[1]	24V DC+	
	[2]	N.C.	
	[3]	0	
	[4]	1	
	[5]	2	
	[6]	3	
	[7]	4	
	[8]	5	
	[9]	C	
	[10]	24V DC-	
	[11]	N.C.	
	[12]	6	
	[13]	7	
	[14]	8	
	[15]	9	
	[16]	10	
	[17]	11	
	[18]	C	

(21)   EH-YR16 / EH-YR16D

Item		Specification	
Type		EH-YR16	EH-YR16D
Output specification		Relay output	
Rated load voltage		100 / 240 V AC, 24 V DC	
Minimum switching current		1 mA	
Leak current		None	
Maximum load current	1 circuit	2 A	
	1 common	8 A (Ambient temperature 40 ºC) See the below derating table	4 A (Ambient temperature 40 ºC) See the below derating table
Output response time	OFF → ON	Max. 10 ms	
	ON → OFF	Max. 10 ms	
Number of output points		16 points / module	
Number of common points		16 points / 1 common (2 terminals) *1	8 points / 1 common *2
Surge removal circuit		Neither surge protector nor fuse is built in this module. Install proper devices externally at each output and/or the common line.	
Fuse			
Insulation system		Relay insulation	
Output display		LED (green)	
External connection		Removable type screw terminal block (M3)	
Internal current consumption (5 V DC)		Approximately 430 mA	
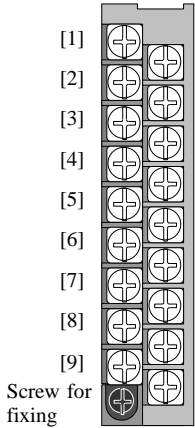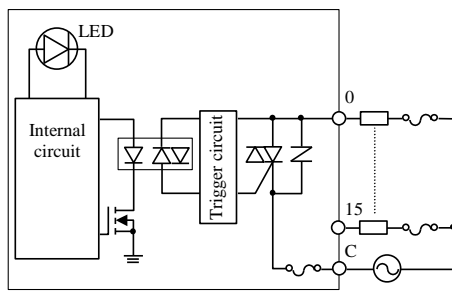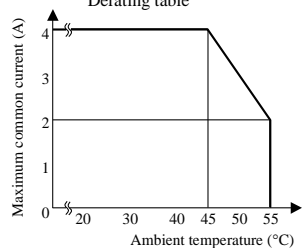
*1 The common terminals are connected internally.

*2 The common terminals are separated.

Terminal configuration	No.	Signal name		Diagram of Internal circuit
		YR16	YR16D	
	[1]	0	0	
	[2]	1	1	
	[3]	2	2	
	[4]	3	3	
	[5]	4	4	
	[6]	5	5	
	[7]	6	6	
	[8]	7	7	
	[9]	C	C0	
	[10]	8	8	
	[11]	9	9	
	[12]	10	10	
	[13]	11	11	
	[14]	12	12	
	[15]	13	13	
	[16]	14	14	
	[17]	15	15	
	[18]	C	C1	

Derating table

(22)   EH-YS16

Specification		EH-YS16
Output specification		Triac output
Number of output points		16 points
Rated load voltage		100 / 240 V AC (85 to 250 V AC)
Minimum switching current		10 mA
Leak current		2 mA or less
Maximum load current	1 circuit	0.3 A
	1 common	4 A (Ambient temperature 45 °C), see the following derating table
Output response time	OFF➔ON	Max. 1 ms
	ON➔OFF	Max. 1 ms + 1/2 cycle
Insulation system		Photo-coupler triac insulation
Output display		LED display (green)
External connection		Removable type screw terminal block (M3)
Number of output points / commons		16 points / 1 common (2 terminals)
Surge removal circuit		Varistor
Fuse		6.3 A (External fuses are necessary.)
Internal current consumption		Approx. 250 mA

Terminal configuration	No.	Signal name	Diagram of Internal output
	[1]	0	
	[2]	1	
	[3]	2	
	[4]	3	
	[5]	4	
	[6]	5	
	[7]	6	
	[8]	7	
	[9]	C	
	[10]	8	
	[11]	9	
	[12]	10	
	[13]	11	
	[14]	12	
	[15]	13	
	[16]	14	
	[17]	15	
	[18]	C	

(23)   EH-YT32
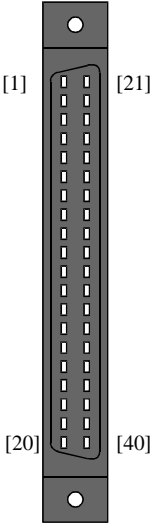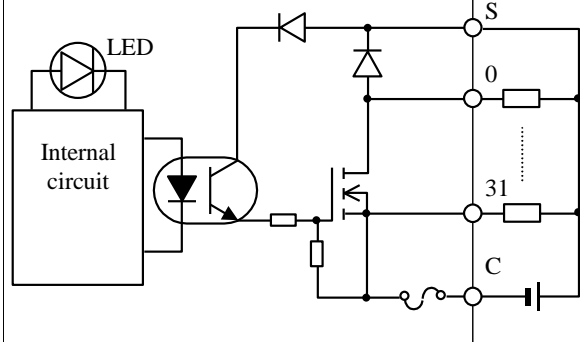
Specification		EH-YT32
Output specification		Transistor output (sink type)
Number of output points		32 points
Rated load voltage		12 / 24 V DC (+10 %, -15 %)
Minimum switching current		1 mA
Leak current		0.1 mA
Maximum load current	1 circuit	0.2 A
	1 common	6.4 A*1
Output response time	OFF➔ON	Max. 0.3 ms
	ON➔OFF	Max. 1 ms
Insulation system		Photo-coupler insulation
Output display		LED display (green)*2
External connection		Connector
Number of output points / commons		32 points / 1 common (4 terminals)
Surge removal circuit		Diode
Fuse*3		10 A / 1 common
External power supply (for supplying power to S-terminal)		12 / 24 V DC (+10 %, -15 %) (30 mA at the maximum)
Internal current consumption (5V DC)		Approx. 90 mA
Short-circuit protection function		Built-in *4

*1 Total current for 4 common terminals. The maximum current for one common terminal is 3A.
*2 There are 16 points of LED indication. The indicated group is selected by the toggle switch.
*3 If the internal fuse is blown, the module needs to be repaired. It is not possible for users to replace it.
*4 Supported by MFG No.01E** or later production. (MFG No.01E** indicates May 2001 production.)

Terminal configuration	No.	Signal name	No.	Signal name	Diagram of Internal circuit
	[1]	0	[21]	16	
	[2]	1	[22]	17	
	[3]	2	[23]	18	
	[4]	3	[24]	19	
	[5]	4	[25]	20	
	[6]	5	[26]	21	
	[7]	6	[27]	22	
	[8]	7	[28]	23	
	[9]	C	[29]	C	
	[10]	S	[30]	S	
	[11]	8	[31]	24	
	[12]	9	[32]	25	
	[13]	10	[33]	26	
	[14]	11	[34]	27	
	[15]	12	[35]	28	
	[16]	13	[36]	39	
	[17]	14	[37]	30	
	[18]	15	[38]	31	
	[19]	C	[39]	C	
	[20]	S	[40]	S	

Applicable connector
- 120 mm (4.73 in.) of space is required in front of the module. Make sure to secure sufficient space in front of the PLC.
- Use a shield cable and always use a class D grounding.

Manufacturer	Fujitsu Takamizawa	Solder type	Socket: FCN-361J040-AU, Cover: FCN-360C040-E
		Crimp type	Housing: FCN-363J040, Contact: FCN-363J-AU
		Pressure-displacement type	FCN-367J040-AU/F
	AMP	Solder type	1473381-1

(24)   EH-YTP32
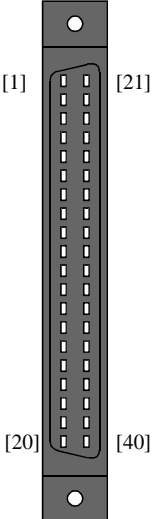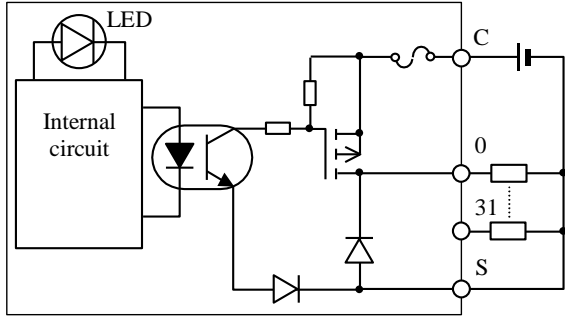
Specification		EH-YTP32
Output specification		Transistor output (source type)
Number of output points		32 points
Rated load voltage		12 / 24 V DC (+10 %, -15 %)
Minimum switching current		1 mA
Leak current		0.1 mA
Maximum load current	1 circuit	0.2 A
	1 common	6.4 A*1
Output response time	OFF➔ON	Max. 0.3 ms
	ON➔OFF	Max. 1 ms
Insulation system		Photo-coupler insulation
Output display		LED display (green)*2
External connection		Connector
Number of output points / commons		32 points / 1 common (4 terminals)
Surge removal circuit		Diode
Fuse*3		10 A / 1 common
External power supply (for supplying power to S-terminal)		12 / 24 V DC (+10 %, -15 %) (30 mA at the maximum)
Internal current consumption (5V DC)		Approx. 90 mA
Short-circuit protection function		Built-in *4

*1 Total current for 4 common terminals. The maximum current for one common terminal is 3A.
*2 There are 16 points of LED indication. The indicated group is selected by the toggle switch.
*3 If the internal fuse is blown, the module needs to be repaired. It is not possible for users to replace it.
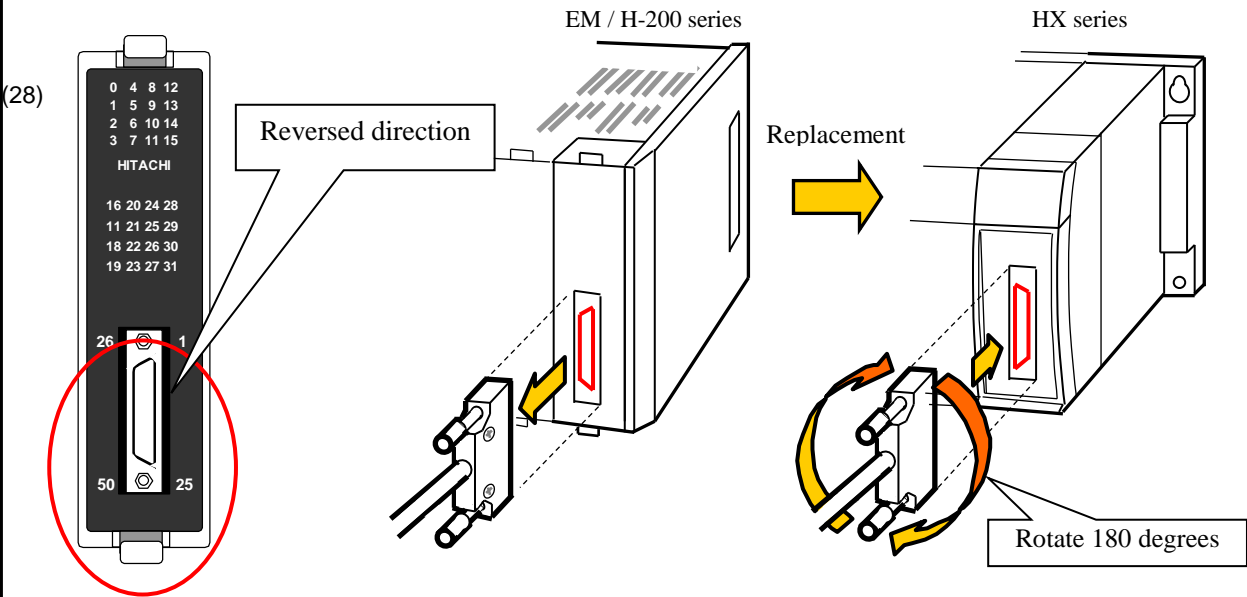*4 Supported by MFG No.01E** or later production. (MFG No.01E** indicates May 2001 production.)

Terminal configuration	No.	Signal name	No.	Signal name	Diagram of Internal circuit
	[1]	0	[21]	16	
	[2]	1	[22]	17	
	[3]	2	[23]	18	
	[4]	3	[24]	19	
[1] [21]	[5]	4	[25]	20	
	[6]	5	[26]	21	
	[7]	6	[27]	22	
	[8]	7	[28]	23	
	[9]	C	[29]	C	
	[10]	S	[30]	S	
	[11]	8	[31]	24	
	[12]	9	[32]	25	
	[13]	10	[33]	26	
	[14]	11	[34]	27	
	[15]	12	[35]	28	
[20] [40]	[16]	13	[36]	29	
	[17]	14	[37]	30	
	[18]	15	[38]	31	
	[19]	C	[39]	C	
	[20]	S	[40]	S	

Applicable cable
- 120 mm (4.73 in.) of space is required in front of the module. Make sure to secure sufficient space in front of the PLC.
- Use a shield cable and always use a class D grounding.
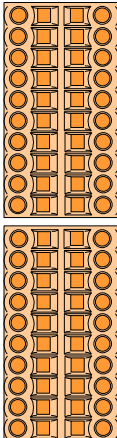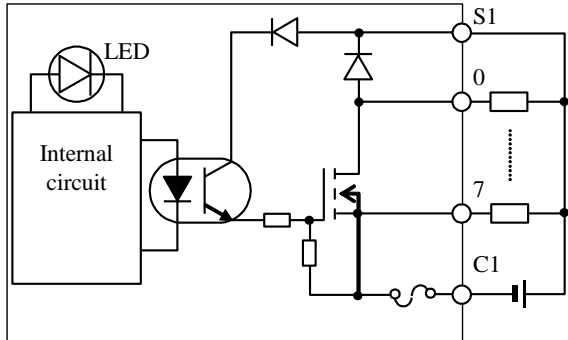
Manufacturer	Fujitsu Takamizawa	Solder type	Socket: FCN-361J040-AU, Cover: FCN-360C040-E
		Crimp type	Housing: FCN-363J040, Contact: FCN-363J-AU
		Pressure-displacement type	FCN-367J040-AU/F
	AMP	Solder type	1473381-1

(25)   EH-YT32E

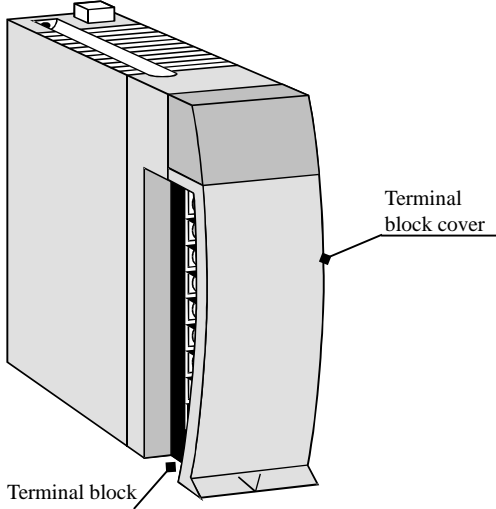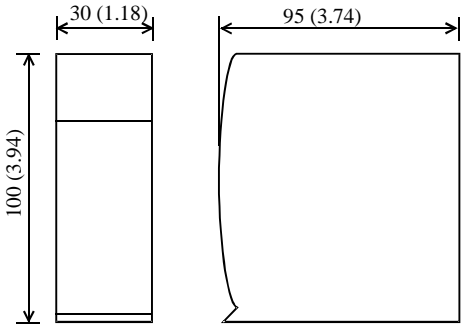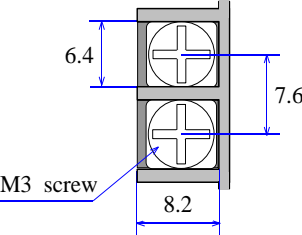| Specification		EH-YT32E
Output specification		Transistor output (sink type)
Number of output points		32 points
Rated load voltage		12 / 24 V DC (+10 %, -15 %)
Minimum switching current		1 mA
Leak current		0.1 mA
Maximum load current	1 circuit	0.2 A
	1 common	1 A
Output response time	OFF➜ON	Max. 0.3 ms
	ON➜OFF	Max. 1 ms
Insulation system		Photo-coupler insulation
Output display		LED display (green)*1
External connection		Spring type terminal block
Number of output points / commons		8 points / 1 common
Surge removal circuit		Diode
Fuse*2		10 A / 1 common
External power supply (for supplying power to S-terminal)		12 / 24 V DC (+10 %, -15 %) (30 mA at the maximum)
Internal current consumption (5V DC)		Approx. 90 mA
Short-circuit protection function		Built-in

*1 There are 16 points of LED indication. The indicated group is selected by the toggle switch.
*2 If the internal fuse is blown, the module needs to be repaired. It is not possible for users to replace it.

Terminal configuration	No.	Signal name	No.	Signal name	Diagram of Internal circuit
	[1]	0	[21]	16	
	[2]	1	[22]	17	
	[3]	2	[23]	18	
[1] [21]	[4]	3	[24]	19	
	[5]	4	[25]	20	
	[6]	5	[26]	21	
	[7]	6	[27]	22	
	[8]	7	[28]	23	
	[9]	C1	[29]	C3	
[10] [30]	[10]	S1	[30]	S3	
[11] [31]	[11]	8	[31]	24	
	[12]	9	[32]	25	
	[13]	10	[33]	26	
	[14]	11	[34]	27	
	[15]	12	[35]	28	
	[16]	13	[36]	29	
[20] [40]	[17]	14	[37]	30	
	[18]	15	[38]	31	
	[19]	C2	[39]	C4	
	[20]	S2	[40]	S4	
Applicable connector			Applicable cable		
Manufacturer: Weidmuller Type: B2L3.5/20AUOR Product No.: 175736			0.5 mm^2 - 1.0 mm^2 (stranded or single wire cable) AWG 28 - 18 Crimp terminals are not available.		

(26)   EH-YTP32E

Specification		EH-YTP32E
Output specification		Transistor output (source type)
Number of output points		32 points
Rated load voltage		12 / 24 V DC (+10 %, -15 %)
Minimum switching current		1 mA
Leak current		0.1 mA
Maximum load current	1 circuit	0.2 A
	1 common	1 A
Output response time	OFF➔ON	Max. 0.3 ms
	ON➔OFF	Max. 1 ms
Insulation system		Photo-coupler insulation
Output display		LED display (green)*1
External connection		Spring type terminal block
Number of output points / commons		8 points / 1 common
Surge removal circuit		Diode
Fuse*2		10 A / 1 common
External power supply (for supplying power to S-terminal)		12 / 24 V DC (+10 %, -15 %) (30 mA at the maximum)
Internal current consumption (5V DC)		Approx. 90 mA
Short-circuit protection function		Built-in

*1 There are 16 points of LED indication. The indicated group is selected by the toggle switch.
*2 If the internal fuse is blown, the module needs to be repaired. It is not possible for users to replace it.

Terminal configuration	No.	Signal name	No.	Signal name	Diagram of Internal circuit
	[1]	0	[21]	16	
	[2]	1	[22]	17	
	[3]	2	[23]	18	
	[4]	3	[24]	19	
	[5]	4	[25]	20	
	[6]	5	[26]	21	
	[7]	6	[27]	22	
	[8]	7	[28]	23	
	[9]	C1	[29]	C3	
	[10]	S1	[30]	S3	
	[11]	8	[31]	24	
	[12]	9	[32]	25	
	[13]	10	[33]	26	
	[14]	11	[34]	27	
	[15]	12	[35]	28	
	[16]	13	[36]	29	
	[17]	14	[37]	30	
	[18]	15	[38]	31	
	[19]	C2	[39]	C4	
	[20]	S2	[40]	S4	

Applicable connectors		Applicable cable
Manufacturer: Weidmuller Type: B2L3.5/20AUOR Product No.: 175736		0.5 mm² - 1.0 mm² (stranded or single wire cable) AWG 28 - 18 Crimp terminals are not available.

(27)   EH-YT32H
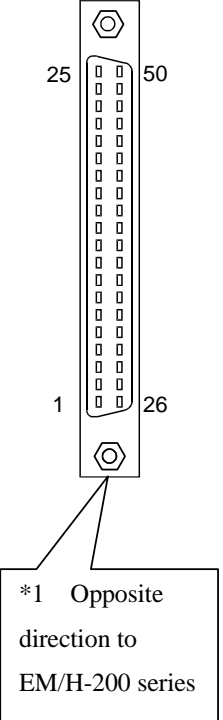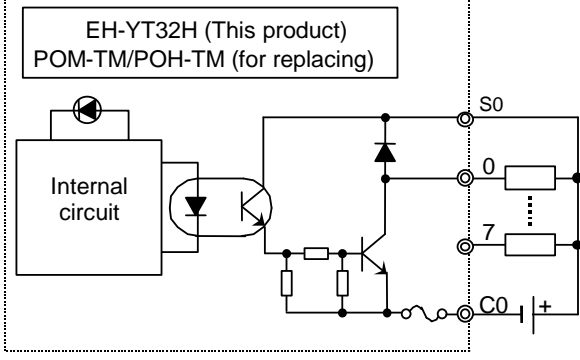
Item		EH-YT32H	POM-TM, POH-TM (for replacing)
Series		HX / EH-150	EM / EM-II, H-200 / 250 / 252
Output specification		Transistor output (sink type)	
Number of output points		32 points	
Rated load voltage		5 / 12 / 24 V DC (5 to 27 V DC)	
Minimum switching current		1 mA	
Leak current		0.05 mA or less	
Maximum output saturation voltage		1 V or less	
Maximum load current	1 point	0.1 A	
	1 common	0.8 A	
Output response time	OFF➔ON	Max. 1 ms	
	ON➔OFF	Max. 1 ms	
Insulation method		Photo-coupler insulation	
Output display		LED (green)*2	LED (red)
External connection		Connector (50 pins)	
Number of common points		8 points / 1 common	
Surge removal circuit		Diode (when using S terminal)	
Fuse*1		2 A / 1 common	1.5 A / 1 common
External power supply*3 (For supplying power to the S terminal)		5 to 27 V DC (maximum 100 mA)	
Internal current consumption (5 V DC)		Approx. 90 mA	Approx. 70 mA
Short-circuit protection		None	

*1 If the internal fuse is blown, the module needs to be repaired. It is not possible for users to replace it.
*2 There are 16 points of LED indication. The indicated group is selected by the toggle switch.
*3 It is necessary to supply 12 / 24 V DC to the S terminals.

Specification of external wiring connector				Wire
Product name	Manufacturer	Product No.	Connection method	
Plug connector	Hirose Electric Co., Ltd.	DX30-50P	Untie crimping	AWG#30
		DX30A-50P		AWG#28
		DX31-50P	Crimping	AWG#30
		DX31A-50P		AWG#28
		DX40-50P	Soldering	-
Die cast cover		DX-50-CV1	-	-

Terminal configuration	No.	Signal name	No.	Signal name	Diagram of Internal circuit
	[25]	NC	[50]	NC	
	[24]	NC	[49]	NC	
	[23]	NC	[48]	NC	
	[22]	NC	[47]	NC	
	[21]	15	[46]	31	
	[20]	14	[45]	30	
	[19]	13	[44]	29	
	[18]	12	[43]	28	
	[17]	11	[42]	27	
	[16]	10	[41]	26	
	[15]	9	[40]	25	
	[14]	8	[39]	24	
	[13]	S1	[38]	S3	
	[12]	C1	[37]	C3	
	[11]	NC	[36]	NC	
	[10]	7	[35]	23	
	[9]	6	[34]	22	
	[8]	5	[33]	21	
	[7]	4	[32]	20	
	[6]	3	[31]	19	
	[5]	2	[30]	18	
	[4]	1	[29]	17	
	[3]	0	[28]	16	
	[2]	S0	[27]	S2	
	[1]	C0	[26]	C2	

25 | | 50

1 | | 26

*1   Opposite direction to EM/H-200 series

EH-YT32H (This product)
POM-TM/POH-TM (for replacing)

Internal circuit

S0
0
7
C0

---

*1   The connector direction of EH-YT32H is reversed to POM/POH-TM of EM/H200 series. Rotate the cable with 180 degrees when replacing. (Not possible to connect in the same direction due to the mechanical structure of the module.)

EM / H-200 series

HX series

(28)

0 4 8 12
1 5 9 13
2 6 10 14
3 7 11 15

HITACHI

16 20 24 28
11 21 25 29
18 22 26 30
19 23 27 31

26 | | 1

50 | | 25

Reversed direction

Replacement

Rotate 180 degrees

EH-YT64

Specification		EH-YTP64
Output specification		Transistor output (source type)
Number of output points		64 points
Rated load voltage		12 / 24 V DC (+10 %, -15 %)
Minimum switching current		1 mA
Leak current		0.1 mA
Maximum load current	1 circuit	0.1 A
	1 common	3.2 A
Output response time	OFF➔ON	Max. 0.3 ms
	ON➔OFF	Max. 1 ms
Insulation system		Photo-coupler insulation
Output display		LED display (green)*1
External connection		Connector
Number of output points / commons		32 points / 1 common (4 terminals)
Surge removal circuit		Diode
Fuse*2		5 A / 1 common
External power supply (for supplying power to S-terminal)		12 / 24 V DC (+10 %, -15 %) (100 mA at the maximum)
Internal current consumption (5V DC)		Approx. 120 mA
Short-circuit protection function		Built-in

*1 There are 16 points of LED indication. The indicated group is selected by the toggle switches.
*2 If the internal fuse is blown, the module needs to be repaired. It is not possible for users to replace it.

Terminal configuration	No.	Signal name	No.	Signal name	No.	Signal name	No.	Signal name	Diagram of Internal circuit
	[41]	32	[61]	48	[1]	0	[21]	16	
	[42]	33	[62]	49	[2]	1	[22]	17	
	[43]	34	[63]	50	[3]	2	[23]	18	
	[44]	35	[64]	51	[4]	3	[24]	19	
	[45]	36	[65]	52	[5]	4	[25]	20	
	[46]	37	[66]	53	[6]	5	[26]	21	
	[47]	38	[67]	54	[7]	6	[27]	22	
	[48]	39	[68]	55	[8]	7	[28]	23	
	[49]	C2	[69]	C2	[9]	C1	[29]	C1	
	[50]	S2	[70]	S2	[10]	S1	[30]	S1	
	[51]	40	[71]	56	[11]	8	[31]	24	
	[52]	41	[72]	57	[12]	9	[32]	25	
	[53]	42	[73]	58	[13]	10	[33]	26	
	[54]	43	[74]	59	[14]	11	[34]	27	
	[55]	44	[75]	60	[15]	12	[35]	28	
	[56]	45	[76]	61	[16]	13	[36]	29	
	[57]	46	[77]	62	[17]	14	[37]	30	
	[58]	47	[78]	63	[18]	15	[38]	31	
	[59]	C2	[79]	C2	[19]	C1	[39]	C1	
	[60]	S2	[80]	S2	[20]	S1	[40]	S1	

Applicable connectors
- 120 mm (4.73 in.) of space is required in front of the module. Make sure to secure sufficient space in front of the PLC.
- Use a shield cable and always use a class D grounding.

Manufacturer	Fujitsu Takamizawa	Solder type	Socket: FCN-361J040-AU, Cover: FCN-360C040-E
		Crimp type	Housing: FCN-363J040, Contact: FCN-363J-AU
		Pressure-displacement type	FCN-367J040-AU/F
	AMP	Solder type	1473381-1

(29)   EH-YTP64

Specification		EH-YTP64
Output specification		Transistor output (source type)
Number of output points		64 points
Rated load voltage		12 / 24 V DC (+10 %, -15 %)
Minimum switching current		1 mA
Leak current		0.1 mA
Maximum load current	1 circuit	0.1 A
	1 common	3.2 A
Output response time	OFF➔ON	Max. 0.3 ms
	ON➔OFF	Max. 1 ms
Insulation system		Photo-coupler insulation
Output display		LED display (green)*1
External connection		Connector
Number of output points / commons		32 points / 1 common (4 terminals)
Surge removal circuit		Diode
Fuse*2		5 A / 1 common
External power supply (for supplying power to S-terminal)		12 / 24 V DC (+10 %, -15 %) (100 mA at the maximum)
Internal current consumption (5V DC)		Approx. 120 mA
Short-circuit protection function		Built-in

*1 There are 16 points of LED indication. The indicated group is selected by the toggle switch.
*2 If the internal fuse is blown, the module needs to be repaired. It is not possible for users to replace it.

Terminal configuration	No.	Signal name	No.	Signal name	No.	Signal name	No.	Signal name	Diagram of Internal circuit
	[41]	32	[61]	48	[1]	0	[21]	16	
	[42]	33	[62]	49	[2]	1	[22]	17	
	[43]	34	[63]	50	[3]	2	[23]	18	
	[44]	35	[64]	51	[4]	3	[24]	19	
	[45]	36	[65]	52	[5]	4	[25]	20	
	[46]	37	[66]	53	[6]	5	[26]	21	
	[47]	38	[67]	54	[7]	6	[27]	22	
	[48]	39	[68]	55	[8]	7	[28]	23	
	[49]	C2	[69]	C2	[9]	C1	[29]	C1	
	[50]	S2	[70]	S2	[10]	S1	[30]	S1	
	[51]	40	[71]	56	[11]	8	[31]	24	
	[52]	41	[72]	57	[12]	9	[32]	25	
	[53]	42	[73]	58	[13]	10	[33]	26	
	[54]	43	[74]	59	[14]	11	[34]	27	
	[55]	44	[75]	60	[15]	12	[35]	28	
	[56]	45	[76]	61	[16]	13	[36]	29	
	[57]	46	[77]	62	[17]	14	[37]	30	
	[58]	47	[78]	63	[18]	15	[38]	31	
	[59]	C2	[79]	C2	[19]	C1	[39]	C1	
	[60]	S2	[80]	S2	[20]	S1	[40]	S1	

Applicable connectors
- 120 mm (4.73 in.) of space is required in front of the module. Make sure to secure sufficient space in front of the PLC.
- Use a shield cable and always use a class D grounding.

Manufacturer	Fujitsu Takamizawa	Solder type	Socket: FCN-361J040-AU, Cover: FCN-360C040-E
		Crimp type	Housing: FCN-363J040, Contact: FCN-363J-AU
		Pressure-displacement type	FCN-367J040-AU/F
	AMP	Solder type	1473381-1

Chapter 7 Analog I/O Modules,
Resistance Temperature Detector Input Modules,
Thermocouple Input Module

7.1   12-bit Analog I/O Modules

Name and function of each part		Type (Weight)	EH-AX44 (Approx. 0.18 kg (0.41 lb.))
			EH-AX8V, AX8H (Approx. 0.18 kg (0.41 lb.))
			EH-AX8I, AX8IO (Approx. 0.18 kg (0.41 lb.))
			EH-AY22 (Approx. 0.18 kg (0.41 lb.))
			EH-AY2H (Approx. 0.18 kg (0.41 lb.))
			EH-AY4V, AY4H (Approx. 0.18 kg (0.41 lb.))
			EH-AY4I (Approx. 0.18 kg (0.41 lb.))

Terminal block cover

Terminal block

Dimensions (mm (in.))

30 (1.18)   95 (3.74)

100 (3.94)

Item	Description
Terminal block	This is the terminal block for connecting the I/O signals. The terminal block is removable. The screws for the terminal block are M3 screws. Use a crimp terminal fitting a screw diameter. The maximum cable size is 0.75 mm^2. (Use 0.5 mm^2 cable when attaching two crimp terminals to the same terminal.) The recommended crimp terminals are shown below. 6 (0.24) (Recommended) 6 (0.24) Unit: mm (in.) Take great care on handling the terminal because it may fall off if the screw is loose. 6.4 7.6 M3 screw 8.2
Terminal block cover	This is the cover of the terminal block.

(1)　EH-AX44

Specification		EH-AX44
Current range		4 to 20 mA
Voltage range		0 to 10 V DC
Number of channels	Current	4 (channel 0 to 3)
	Voltage	4 (channel 4 to 7)
Resolution		12 bits
Conversion time		Max. 5 ms
Overall accuracy		Max. ±1 % (of full-scale value)
Input impedance	Current	Approx. 100Ω
	Voltage	Approx. 100 kΩ
Insulation system	Channel and Internal circuit	Photo-coupler insulation
	Between channels	No insulation
External connection		Removable type screw terminal block (M3)
External power supply		24 V DC (+20 %, -15 %) Approx. 150 mA (Approx. 400 mA at power ON)
External wiring		2-core shield cable (Max. 20 m (65.62 ft.))
Internal current consumption		Approx. 100 mA
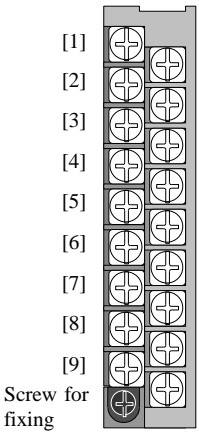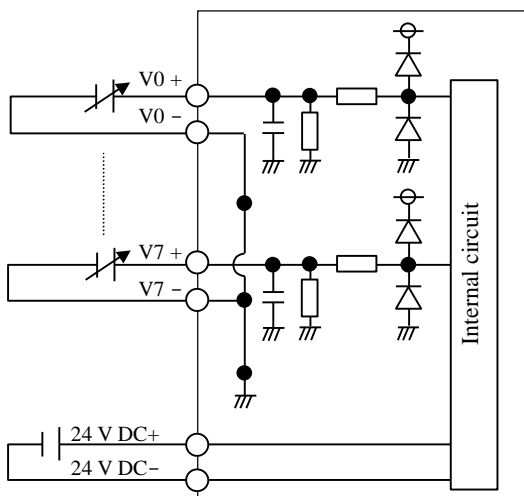
Terminal configuration	No.	Signal name	Diagram of Internal circuit
	[1]	I0 +	
	[2]	I1 +	
	[3]	I2 +	
	[4]	I3 +	
	[5]	V4 +	
	[6]	V5 +	
	[7]	V6 +	
	[8]	V7 +	
	[9]	24 V DC +	
	[10]	I0 -	
	[11]	I1 -	
	[12]	I2 -	
	[13]	I3 -	
	[14]	V4 -	
	[15]	V5 -	
	[16]	V6 -	
	[17]	V7 -	
	[18]	24 V DC -	

Conversion diagram of analog and digital data

(2) EH-AX8V

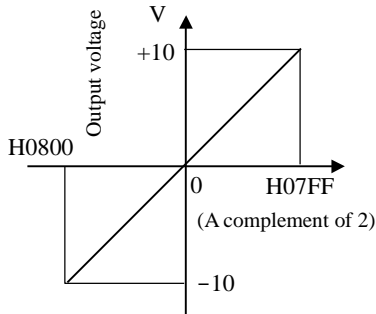| Specification		EH-AX8V
Current range		-
Voltage range		0 to 10 V DC
Number of channels	Current	-
	Voltage	8 (channel 0 to 7)
Resolution		12 bits
Conversion time		Max. 5 ms
Overall accuracy		Max. ±1 % (of full-scale value)
Input impedance	Current	-
	Voltage	Approx. 100 kΩ
Insulation system	Channel and Internal circuit	Photo-coupler insulation
	Between channels	No insulation
External connection		Removable type screw terminal block (M3)
External power supply		24 V DC (+20 %, -15 %) Approx. 150 mA (Approx. 400 mA at power ON)
External wiring		2-core shield cable (Max. 20 m)
Internal current consumption		Approx. 100 mA

Terminal configuration	No.	Signal name	Diagram of Internal circuit
	[1]	V0 +	
	[2]	V1 +	
	[3]	V2 +	
	[4]	V3 +	
	[5]	V4 +	
	[6]	V5 +	
	[7]	V6 +	
	[8]	V7 +	
	[9]	24 V DC +	
	[10]	V0 -	
	[11]	V1 -	
	[12]	V2 -	
	[13]	V3 -	
	[14]	V4 -	
	[15]	V5 -	
	[16]	V6 -	
	[17]	V7 -	
	[18]	24 V DC -	

Conversion diagram of analog and digital data

(3) EH-AX8H
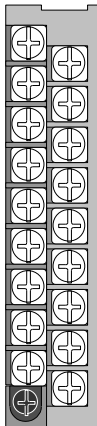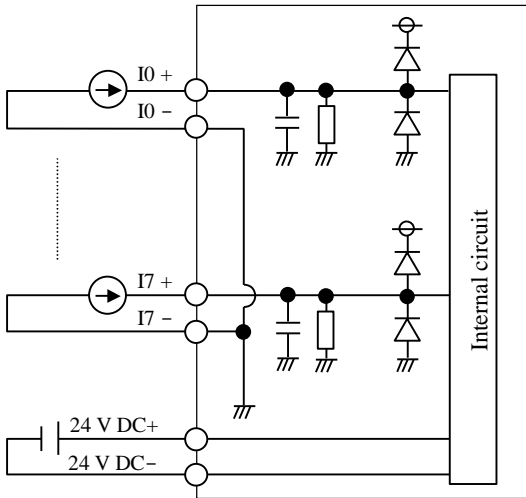
Specification		EH-AX8H
Current range		-
Voltage range		+ / - 10 V DC
Number of channels	Current	-
	Voltage	8 (channel 0 to 7)
Resolution		12 bits
Conversion time		Max. 5 ms
Overall accuracy		Max. ±1 % (of full-scale value)
Input impedance	Current	-
	Voltage	Approx. 100 kΩ
Insulation system	Channel and Internal circuit	Photo-coupler insulation
	Between channels	No insulation
External connection		Removable type screw terminal block (M3)
External power supply		24 V DC (+20 %, -15 %) Approx. 150 mA (Approx. 400 mA at power ON)
External wiring		2-core shield cable (Max. 20 m)
Internal current consumption		Approx. 100 mA

Terminal configuration	No.	Signal name	Diagram of Internal circuit
	[1]	V0 +	
	[2]	V1 +	
	[3]	V2 +	
	[4]	V3 +	
	[5]	V4 +	
	[6]	V5 +	
	[7]	V6 +	
	[8]	V7 +	
	[9]	24 V DC +	
	[10]	V0 −	
	[11]	V1 −	
	[12]	V2 −	
	[13]	V3 −	
	[14]	V4 −	
	[15]	V5 −	
	[16]	V6 −	
	[17]	V7 −	
	[18]	24 V DC −	

Conversion diagram of analog and digital data

(A complement of 2)

(4) EH-AX8I

Specification		EH-AX8I
Current range		4 to 20 mA
Voltage range		-
Number of channels	Current	8 (channel 0 to 7)
	Voltage	-
Resolution		12 bits
Conversion time		Max. 5 ms
Overall accuracy		Max. ±1 % (of full-scale value)
Input impedance	Current	Approx. 100Ω
	Voltage	-
Insulation system	Channel and Internal circuit	Photo-coupler insulation
	Between channels	No insulation
External connection		Removable type screw terminal block (M3)
External power supply		24 V DC (+20 %, -15 %) Approx. 150 mA (Approx. 400 mA at power ON)
External wiring		2-core shield cable (Max. 20 m)
Internal current consumption		Approx. 100 mA

Terminal configuration	No.	Signal name	Diagram of Internal circuit
[1] [2] [3] [4] [5] [6] [7] [8] [9] Screw for fixing [10] [11] [12] [13] [14] [15] [16] [17] [18]	[1]	I0 +	
	[2]	I1 +	
	[3]	I2 +	
	[4]	I3 +	
	[5]	I4 +	
	[6]	I5 +	
	[7]	I6 +	
	[8]	I7 +	
	[9]	24 V DC +	
	[10]	I0 -	
	[11]	I1 -	
	[12]	I2 -	
	[13]	I3 -	
	[14]	I4 -	
	[15]	I5 -	
	[16]	I6 -	
	[17]	I7 -	
	[18]	24 V DC -	

Conversion diagram of analog and digital data

(5) EH-AX8IO

Specification		EH-AX8IO
Current range		0 to 22 mA
Voltage range		-
Number of channels	Current	8 (channel 0 to 7)
	Voltage	-
Resolution		12 bits
Conversion time		Max. 5 ms
Overall accuracy		Max. ±1 % (of full-scale value)
Input impedance	Current	Approx. 100Ω
	Voltage	-
Insulation system	Channel and Internal circuit	Photo-coupler insulation
	Between channels	No insulation
External connection		Removable type screw terminal block (M3)
External power supply		24 V DC (+20 %, -15 %) Approx. 150 mA (Approx. 400 mA at power ON)
External wiring		2-core shield cable (Max. 20 m)
Internal current consumption		Approx. 100 mA

Terminal configuration	No.	Signal name	Diagram of Internal circuit
[1] [2] [3] [4] [5] [6] [7] [8] [9] Screw for fixing [10] [11] [12] [13] [14] [15] [16] [17] [18]	[1]	I0 +	
	[2]	I1 +	
	[3]	I2 +	
	[4]	I3 +	
	[5]	I4 +	
	[6]	I5 +	
	[7]	I6 +	
	[8]	I7 +	
	[9]	24 V DC +	
	[10]	I0 -	
	[11]	I1 -	
	[12]	I2 -	
	[13]	I3 -	
	[14]	I4 -	
	[15]	I5 -	
	[16]	I6 -	
	[17]	I7 -	
	[18]	24 V DC -	

Conversion diagram of analog and digital data

(6) EH-AY22

Specification		EH-AY22
Current range		4 to 20 mA
Voltage range		0 to 10 V DC
Number of channels	Current	2 (channel 2 to 3)
	Voltage	2 (channel 0 to 1)
Resolution		12 bits
Conversion time		Max. 5 ms
Overall accuracy		Max. ±1 % (of full-scale value)
External load resistance	Current	0 to 500Ω
	Voltage	10 kΩ or more
Insulation system	Channel and Internal circuit	Photo-coupler insulation
	Between channels	No insulation
External connection		Removable type screw terminal block (M3)
External power supply		24 V DC (+20 %, -15 %) Approx. 150 mA (Approx. 500 mA at power ON)
External wiring		2-core shield cable (Max. 20 m)
Internal current consumption		Approx. 100 mA
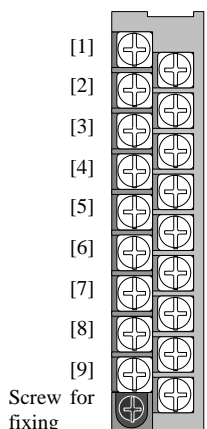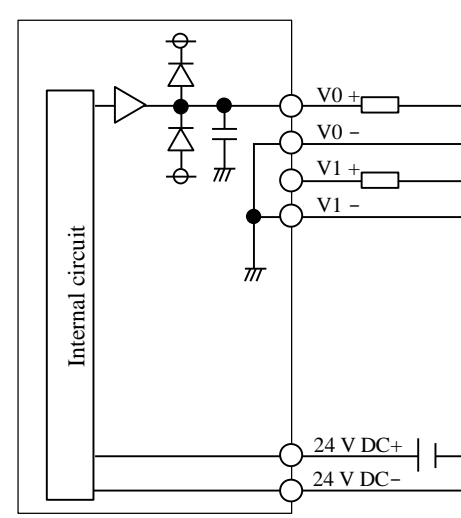
Terminal configuration	No.	Signal name	Diagram of Internal circuit
[1] [2] [3] [4] [5] [6] [7] [8] [9] Screw for fixing [10] [11] [12] [13] [14] [15] [16] [17] [18]	[1]	V0 +	
	[2]	V1 +	
	[3]	I2 +	
	[4]	I3 +	
	[5]	N.C.	
	[6]	N.C.	
	[7]	N.C.	
	[8]	N.C.	
	[9]	24 V DC +	
	[10]	V0 −	
	[11]	V1 −	
	[12]	I2 −	
	[13]	I3 −	
	[14]	N.C.	
	[15]	N.C.	
	[16]	N.C.	
	[17]	N.C.	
	[18]	24 V DC −	

Conversion diagram of analog and digital data

(7) EH-AY2H

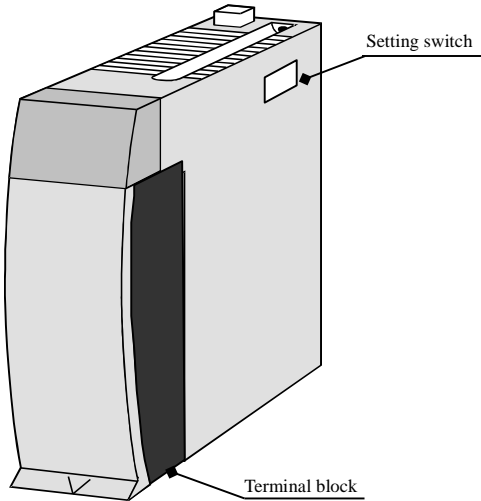| Specification		EH-AY2H
Current range		-
Voltage range		+ / - 10 V DC
Number of channels	Current	-
	Voltage	2 (channel 0 to 1)
Resolution		12 bits
Conversion time		Max. 5 ms
Overall accuracy		Max. ±1 % (of full-scale value)
External load resistance	Current	-
	Voltage	10 kΩor more
Insulation system	Channel and Internal circuit	Photo-coupler insulation
	Between channels	No insulation
External connection		Removable type screw terminal block (M3)
External power supply		24 V DC (+20 %, -15 %) Approx. 150 mA (Approx. 500 mA at power ON)
External wiring		2-core shield cable (Max. 20 m)
Internal current consumption		Approx. 100 mA
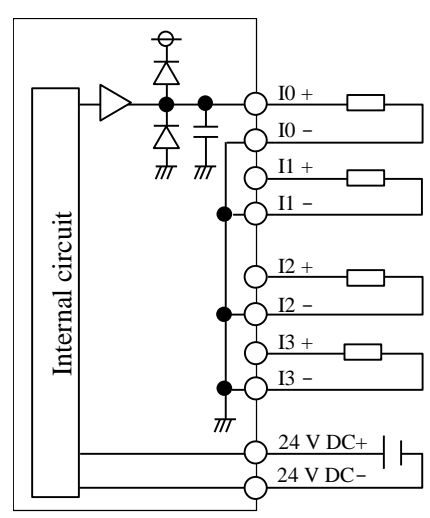
Terminal configuration	No.	Signal name	Diagram of Internal circuit
	[1]	V0 +	
	[2]	V1 +	
	[3]	N.C.	
	[4]	N.C.	
	[5]	N.C.	
	[6]	N.C.	
	[7]	N.C.	
	[8]	N.C.	
	[9]	24 V DC +	
	[10]	V0 -	
	[11]	V1 -	
	[12]	N.C.	
	[13]	N.C.	
	[14]	N.C.	
	[15]	N.C.	
	[16]	N.C.	
	[17]	N.C.	
	[18]	24 V DC -	

Conversion diagram of analog and digital data

(8) EH-AY4I
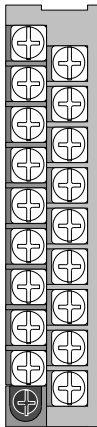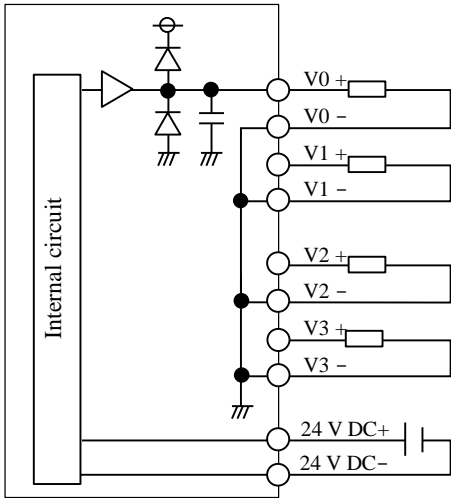
Specification		EH-AY4I
Current range		4 to 20 mA
Voltage range		-
Number of channels	Current	4 (channel 0 to 3)
	Voltage	-
Resolution		12 bits
Conversion time		Max. 5 ms
Overall accuracy		Max. ±1 % (of full-scale value)
External load resistance	Current	0 to 350Ω
	Voltage	-
Insulation system	Channel and Internal circuit	Photo-coupler insulation
	Between channels	No insulation
External connection		Removable type screw terminal block (M3)
External power supply		24 V DC (+20 %, -15 %) Approx. 150 mA (Approx. 500 mA at power ON)
External wiring		2-core shield cable (Max. 20 m)
Internal current consumption		Approx. 130 mA

Terminal configuration	No.	Signal name	Diagram of Internal circuit
	[1]	I0 +	
	[2]	I1 +	
	[3]	I2 +	
	[4]	I3 +	
	[5]	N.C.	
	[6]	N.C.	
	[7]	N.C.	
	[8]	N.C.	
	[9]	24 V DC +	
	[10]	I0 –	
	[11]	I1 –	
	[12]	I2 –	
	[13]	I3 –	
	[14]	N.C.	
	[15]	N.C.	
	[16]	N.C.	
	[17]	N.C.	
	[18]	24 V DC –	

Conversion diagram of analog and digital data

(9) EH-AY4V

Specification		EH-AY4V
Current range		-
Voltage range		0 to 10 V DC
Number of channels	Current	-
	Voltage	4 (channel 0 to 3)
Resolution		12 bits
Conversion time		Max. 5 ms
Overall accuracy		Max. ±1 % (of full-scale value)
External load resistance	Current	-
	Voltage	10 kΩor more
Insulation system	Channel and Internal circuit	Photo-coupler insulation
	Between channels	No insulation
External connection		Removable type screw terminal block (M3)
External power supply		24 V DC (+20 %, -15 %) Approx. 150 mA (Approx. 500 A at power ON)
External wiring		2-core shield cable (Max. 20 m)
Internal current consumption		Approx. 100 mA

Terminal configuration	No.	Signal name	Diagram of Internal circuit
	[1]	V0 +	
	[2]	V1 +	
	[3]	V2 +	
	[4]	V3 +	
	[5]	N.C.	
	[6]	N.C.	
	[7]	N.C.	
	[8]	N.C.	
	[9]	24 V DC +	
	[10]	V0 -	
	[11]	V1 -	
	[12]	V2 -	
	[13]	V3 -	
	[14]	N.C.	
	[15]	N.C.	
	[16]	N.C.	
	[17]	N.C.	
	[18]	24 V DC -	

Conversion diagram of analog and digital data
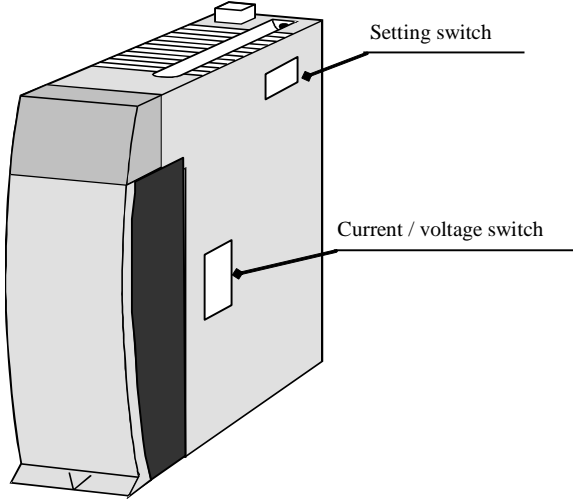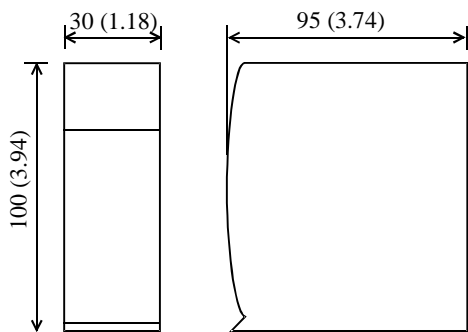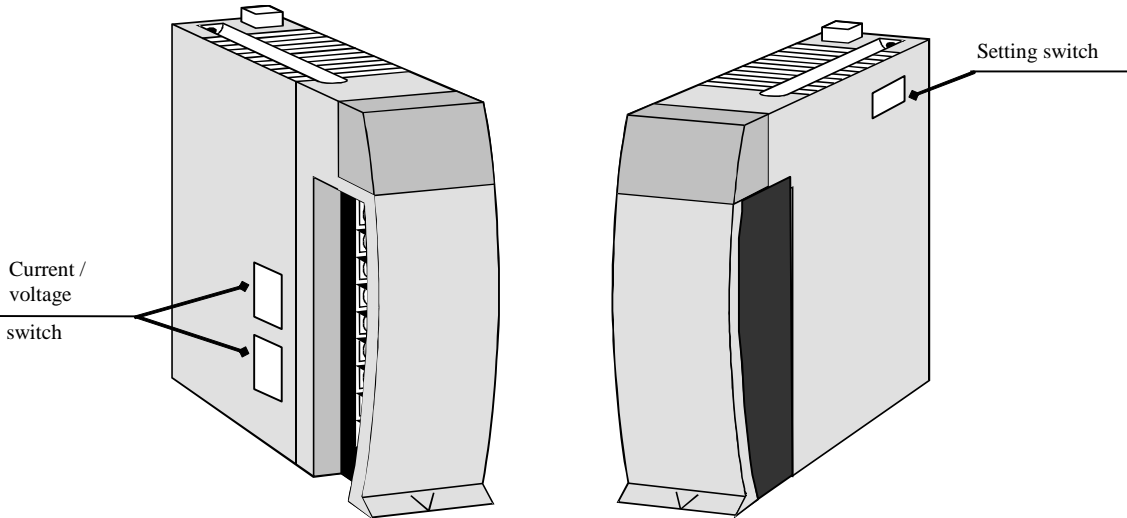
(10)   EH-AY4H

Specification		EH-AY4H
Current range		-
Voltage range		+ / - 10 V DC
Number of channels	Current	-
	Voltage	4 (channel 0 to 3)
Resolution		12 bits
Conversion time		Max. 5 ms
Overall accuracy		Max. ±1 % (of full-scale value)
External load resistance	Current	-
	Voltage	10 kΩ or more
Insulation system	Channel and Internal circuit	Photo-coupler insulation
	Between channels	No insulation
External connection		Removable type screw terminal block (M3)
External power supply		24 V DC (+20 %, -15 %) Approx. 150 mA (Approx. 500 mA at power ON)
External wiring		2-core shield cable (Max. 20 m)
Internal current consumption		Approx. 100 mA

Terminal configuration	No.	Signal name	Diagram of Internal circuit
	[1]	V0 +	
	[2]	V1 +	
	[3]	V2 +	
	[4]	V3 +	
	[5]	N.C.	
	[6]	N.C.	
	[7]	N.C.	
	[8]	N.C.	
	[9]	24 V DC +	
	[10]	V0 −	
	[11]	V1 −	
	[12]	V2 −	
	[13]	V3 −	
	[14]	N.C.	
	[15]	N.C.	
	[16]	N.C.	
	[17]	N.C.	
	[18]	24 V DC −	

Conversion diagram of analog and digital data

7 − 11

7.2   14-bit Analog I/O Modules

Name and function of each part		Type (Weight)	EH-AXH8M (Approx. 0.15 kg (0.34 lb.))
			EH-AYH8M (Approx. 0.18 kg (0.41 lb.))
EH-AXH8M		Dimensions (mm (in.))	

EH-AXH8M

Setting switch

Current / voltage switch

30 (1.18)   95 (3.74)

100 (3.94)

EH-AYH8M

Current / voltage switch

Setting switch

Name	Description
Setting switch	Sets I/O range, input filter, and resolution.
Current / voltage switch	Selects current or voltage.

Front view of LED	Indicating contents
OK 0 1 2 3 4 5 6 7 ANAROG IN EH-AXH8M	OK: LED is ON when the module status is normal operation. 0 to 7: LED's are OFF when the channel status is normal operation. [EH-AXH8M] Blinking when input range is set as 4-22mA and input current is less than 2mA. (when selecting 0.002 mA resolution.) [EH-AYH8M] Blinking when output data is out of the range.

(1)   EH-AXH8M

Specification		EH-AXH8M
Current range		0 to 22 mA / 4 to 22 mA
Voltage range		0 to 10 V DC / -10 to 10 V DC
Number of channels	Current	8 channels (selectable current / voltage in groups of 4 channels)
	Voltage	
Resolution	Current	0.002 mA or 1 / 16,384 (14 bits)
	Voltage	1 mV or 1 / 16,384 (14 bits)
Conversion time		8.9 ms / 8 channels
Overall accuracy	Current	Max. $\pm$0.8 % (of full-scale value)
	Voltage	Max. $\pm$0.5 % (of full-scale value)
Linear error		Max. $\pm$0.1 % (of full-scale value)
Input filter	Valid	Approx. 90 ms (90 % arriving time after the step input)
	Invalid	Max. 18 ms (90 % arriving time after the step input)
Input impedance	Current	249 Ω
	Voltage	Differential 200 kΩ
Insulation system	Channel and Internal circuit	Photo-coupler insulation
	Between channels	No insulation
External connection		Removable type screw terminal block (M3)
External power supply		24 V DC (+20 %, -15 %) Approx. 40 mA (Approx. 300 mA at power ON)
External wiring		2-core shield cable (Max. 20 m)
Internal current consumption		Approx. 70 mA

Terminal configuration	No.	Signal name	Diagram of Internal circuit
[1] [2] [3] [4] [5] [6] [7] [8] [9] Screw for fixing [10] [11] [12] [13] [14] [15] [16] [17] [18]	[1]	0 +	
	[2]	1 +	
	[3]	2 +	
	[4]	3 +	
	[5]	4 +	
	[6]	5 +	
	[7]	6 +	
	[8]	7 +	
	[9]	24 V DC+	
	[10]	0 -	
	[11]	1 -	
	[12]	2 -	
	[13]	3 -	
	[14]	4 -	
	[15]	5 -	
	[16]	6 -	
	[17]	7 -	
	[18]	24 V DC-	

Setting switch			Conversion diagram of analog and digital data

Setting switch

Switch No.	Setup		Function
1, 2	1	2	Channel 0 to 3 input range switching
	OFF	OFF	0 to 10 V DC
	ON	OFF	-10 to 10 V DC
	OFF	ON	0 to 22 mA
	ON	ON	4 to 22 mA
3, 4	3	4	Channel 4 to 7 input range switching
	OFF	OFF	0 to 10 V DC
	ON	OFF	-10 to 10 V DC
	OFF	ON	0 to 22 mA
	ON	ON	4 to 22 mA
5	5		Input filter
	OFF		Valid
	ON		Invalid
6	6		Resolution switching
	OFF		1 / 16,384 (14 bits)
	ON		1 mV to 0.002 mA
7	7		(System mode)
	OFF		Always OFF (Do not turn ON)
8	8		(System mode)
	OFF		Always OFF (Do not turn ON)

Current and Voltage switch

Switch No.	Setup		Function
1 to 8	1 to 4	5 to 8	Switching of current and voltage
	OFF	OFF	Channel 0 to 7 voltage input
	ON	OFF	Channel 0 to 3 current input Channel 4 to 7 voltage input
	OFF	ON	Channel 0 to 3 voltage input Channel 4 to 7 current input
	ON	ON	Channel 0 to 7 current input

Conversion diagram of analog and digital data

0 to 10 V DC

3FFFH(16,383)
Resolution 1/16,384
2710H(10,000)
1FFFH(8,191)
1388H(5,000)
Resolution 1 mV
0   5   10   V

-10 to 10 V DC

Resolution 1/16,384
2710H(10,000)
1FFFH(8,191)
Resolution 1 mV
-10   0000H(0)   V
0   10
(A complement of 2)
E000H(-8,192)
D8F0H(-10,000)

0 to 22 mA

3FFFH(16,383)
3A2EH(14,894)
Resolution 1/16,384
2AF8H(11,000)
2710H(10,000)
1FFFH(8,191)
1388H(5,000)
Resolution 0.002 mA
mA
0   10   20 22

4 to 22 mA

3FFFH(16,383)
38E3H(14,563)
2328H(9,000)
1F40H(8,000)
Resolution 1/16,384
1555H(5,461)
0FA0H(3,000)
0H(0)
Resolution 0.002 mA
mA
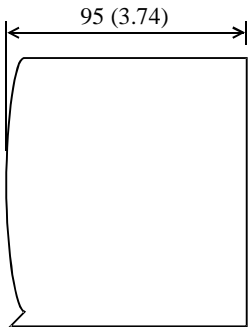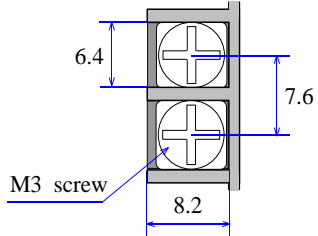F830H(-2,000)   0   4   10   20 22

[Setups shown in the white font on black background are initial factory setting:]

* For this module, please ensure to perform the above setup before use. Furthermore, the power supply needs to be turned off during setup. Otherwise, the setup is invalid. When the input range is switched with the function selection switch, make sure to set the current / voltage switch to the corresponding range accordingly.

(2)   EH-AYH8M

Specification		EH-AYH8M
Current range		0 to 22 mA / 4 to 22 mA
Voltage range		0 to 10 V DC
Number of channels	Current	8 channels (selectable current / voltage in groups of 4 channels)
	Voltage	
Resolution	Current	0.002 mA or 1 / 16,384 (14 bits)
	Voltage	1 mV or 1 / 16,384 (14 bits)
Conversion time		8.9 ms / 8 channels
Overall accuracy	Current	Max. ±0.8 % (of full-scale value)
	Voltage	Max. ±0.8 % (of full-scale value)
Linear error		Max. ±0.2 % (of full-scale value) (range from 0 to 10 V and from 0.05 to 22 mA)
Output filter	Valid	Approx. 200 ms or less (90 % arriving time after setting)
	Invalid	Approx. 18 ms or less (90 % arriving time after setting)
Output impedance	Current	Max. 400Ω
	Voltage	Max. 10 kΩ
Insulation system	Channel and Internal circuit	Photo-coupler insulation
	Between channels	No insulation
External connection		Removable type screw terminal block (M3)
External power supply		24 V DC (+20 %, -15 %) Approx. 150 mA (Approx. 400 mA at power ON)
External wiring		2-core shield cable (Max. 20 m)
Internal current consumption		Approx. 70 mA

Terminal configuration	No.	Signal name	Diagram of Internal circuit
	[1]	0 +	
	[2]	1 +	
	[3]	2 +	
	[4]	3 +	
	[5]	4 +	
	[6]	5 +	
	[7]	6 +	
	[8]	7 +	
	[9]	24 V DC+	
	[10]	0 -	
	[11]	1 -	
	[12]	2 -	
	[13]	3 -	
	[14]	4 -	
	[15]	5 -	
	[16]	6 -	
	[17]	7 -	
	[18]	24 V DC-	

Setting switch			Conversion diagram of analog and digital data
No.	Setup		Function
1, 2	1	2	Channel 0 to 3 output range switching
	OFF	OFF	0 to 10 V DC
	ON	OFF	
	OFF	ON	0 to 22 mA
	ON	ON	4 to 22 mA
3, 4	3	4	Channel 4 to 7 output range switching
	OFF	OFF	0 to 10 V DC
	ON	OFF	
	OFF	ON	0 to 22 mA
	ON	ON	4 to 22 mA
5	5		Output filter
	OFF		Invalid
	ON		Valid
6	6		Resolution switching
	OFF		1 / 16,384 (14 bits)
	ON		1 mV or 0.002 mA
7	7		(System mode)
	OFF		Always OFF (Do not turn ON)
8	8		(System mode)
	OFF		Always OFF (Do not turn ON)

Current and voltage switch

Current and voltage switch
Channel 0 to 3
Current ↕ Voltage

Current and voltage switch
Channel 4 to 7
Current ↕ Voltage

Conversion diagram of analog and digital data

0 to 10 V DC

V
10
Resolution 1mV
Resolution 1/16,384
5
0
1388H (5,000) 1FFFH (8,191) 2710H (10,000) 3FFFH (16,383)

0 to 22 mA

mA
22
20
Resolution 1/16,384
10
0
1388H (5,000) 1D17H (7,447) 2710H (10,000) 3A2EH (14,894)

4 to 22 mA

mA
22
Resolution 0.002mA
20
Resolution 1/16,384
10
4
0
F830H (-2,000) 0FA0H (3,000) 1555H (5,461) 1F40H (8,000) 38E3H (14,563)

Reference) The images is as follows when the output filter is valid.

(Output filter: Invalid)
90%
Max. 18 ms

(Output filter: Valid)
90%
Approx. 200 ms

[Setups shown in the white font on black background are initial factory setting:]

* For this module, please ensure to perform the above setup before use. Furthermore, the power supply needs to be turned off during setup. Otherwise, the setup is invalid. When the input range is switched with the function selection switch, make sure to set the current / voltage switch to the corresponding range accordingly.

7.3   Isolated Analog I/O Modules

Name and function of each part		Type (Weight)	EH-AXG5M (Approx. 0.15 kg (0.34 lb.))
			EH-AYG4M (Approx. 0.15 kg (0.34 lb.))
		Dimensions (mm (in.))	

Setting switch

Terminal block

30 (1.18)   95 (3.74)   100 (3.94)

Name	Description
Terminal block	This is a terminal block for connecting the I/O signals. The terminal block is removable. Screws for the terminal block are M3 screws. Use a crimp terminal fitting to the screw diameter. The maximum thickness of cable is 0.75 mm^2. (Use a 0.5 mm^2 cable when attaching two crimp terminals to the same terminal.) The recommended crimp terminal is shown below. 6 (0.24) (Recommended) 6 (0.24) Take great care on handling the terminal because it may fall off if the screw is loose. Unit: mm (in.)
Setting switch	Sets the switching of the I/O range, valid / invalid of the input filter, and resolution.

Front view of LED	Indicating contents
EH-AXG5M OK HS 16b 12b 0 1 2 3 4 ANALOG IN EH-AXG5M	OK: LED is ON when the module status is normal operation. HS : LED is ON when this module is in high speed conversion mode. LED is OFF when this module is in high accuracy mode. 16b : LED is ON when this module is in high resolution mode. 12b : LED is ON when this module is in 12 bit resolution mode. 0 to 7: LED's are OFF when the channel status is normal operation. LED's corresponding to the channel flashes if the input becomes 2 mA or less when the range is 4 to 22 mA (in high resolution mode.).
EH-AYG4M OK 16b 12b 0 1 2 3 ANALOG OUT EH-AYG4M	OK: LED is ON when the module status is normal operation. 16b : LED is ON when this module is in high resolution mode. 12b : LED is ON when this module is in 12 bit resolution mode. 0 to 3: When selecting current range, LED's corresponding to the channel flashes when broken wire or out of data range was detected.

(1) EH-AXG5M
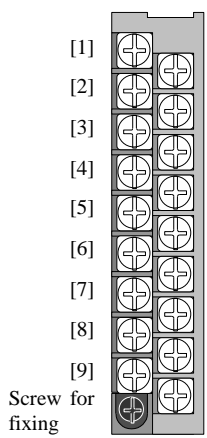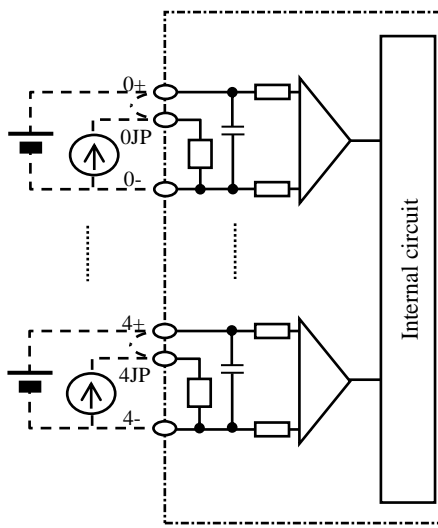
Specification		EH-AXG5M
Current range		0 to 22 mA / 4 to 22 mA
Voltage range		0 to 10 V DC / -10 to 10 V DC
Number of channels	Current	5 channels (selectable current / voltage)
	Voltage	
Resolution	Current	0 to 64,000, -7,111 to 32,000 or 0 to 4,095 (20 mA)
	Voltage	0 to 64,000 or 0 to 4,095
Conversion time		8 ms or 0.25 ms / 5 channels
Overall accuracy[1],[2]	At 25 °C	-0.05 to +0.05 % (of full-scale value)
	Temperature coefficient	-80 to +80 ppm / °C (of full-scale value)
Absolute maximum ratings		Voltage: -15 to 15 V Current :30 mA[3]
Input filter		1 kHz
Input impedance	Current	249 Ω
	Voltage	Differential 200 kΩ
Insulation system	Channel and Internal circuit	Transformer (1,000 V AC, 1 minutes)
	Between channels	Transformer (1,000 V DC, 1 minutes)
External connection		Removable type screw terminal block (M3)
External power supply		None
External wiring		2-core shield cable (Max. 20 m)
Internal current consumption (5 V DC)		Approx. 300 mA

[1] Example) Accuracy at 40 °C is calculated as following,
   0.05 % (accuracy at 25 °C) + 0.008 %/ °C (Temperature coefficient) * 15 °C (difference form 25 °C) = 0.17 %
[2] The accuracy indicates the value 15 minutes after power-up. The value may become slightly higher immediately after power-up.
[3] It is the momentary current value that does not destroy the resistor in the module.

Terminal configuration	No.	Signal name	Diagram of Internal circuit
	[1]	(NC)	
	[2]	(NC)	
	[3]	0 -	
	[4]	1 +	
	[5]	1JP	
	[6]	2 -	
	[7]	3 +	
	[8]	3JP	
	[9]	4 -	
	[10]	(NC)	
	[11]	0 +	
	[12]	0JP	
	[13]	1 -	
	[14]	2 +	
	[15]	2JP	
	[16]	3 -	
	[17]	4 +	
	[18]	4JP	

Setting switch				Conversion diagram of analog and digital data
Switch No.	Setup		Function	
1, 2	1	2	Input range switching	
	OFF	OFF	0 to 10 V DC	
	ON	OFF	-10 to 10 V DC	
	OFF	ON	0 to 22 mA	
	ON	ON	4 to 22 mA	
3, 4	3	4	Moving Average data number	
	OFF	OFF	Not use moving Average	
	ON	OFF	4	
	OFF	ON	16	
	ON	ON	64	
5	5		Resolution	
	OFF		High resolution mode (equally 16 bit)	
	ON		12 bit mode	
6	6		Conversion time	
	OFF		High accuracy, 8 ms (all channels)	
	ON		High speed,0.25 ms (all channels)	
7	7		(System mode)	
	OFF		Always OFF (Do not turn ON)	
8	8		(System mode)	
	OFF		Always OFF (Do not turn ON)	

[Setups shown in the white font on black background are initial factory setting:]

* For this module, please ensure to perform the above setup before use. Furthermore, the power supply needs to be turned off during setup. Otherwise, the setup is invalid.

0 to 10 V DC

FA00H(64,000)
7D00H(32,000)
0FFFH(4,095)
07FFH(2,047)
High resolution
12 bit resolution
0 5 10 V

-10 to 10 V DC

7D00H(32,000)
07FFH(2,047)
-10 0000H(0)
10 V
Signed 16 bits
F800H(-2,048)
8300H(-32,000)
High resolution
12 bit resolution

0 to 22 mA

FA00H(64,000)
E346H(58,182)
0FFFH(4,095)
0 20 22 mA
High resolution
12 bit resolution

4 to 22 mA

7D00H(32,000)
6F1CH(28,444)
0FFFH(4,095)
0H(0)
0 4 20 22 mA
E439H(-7,111)
High resolution
12 bit resolution

7 – 19
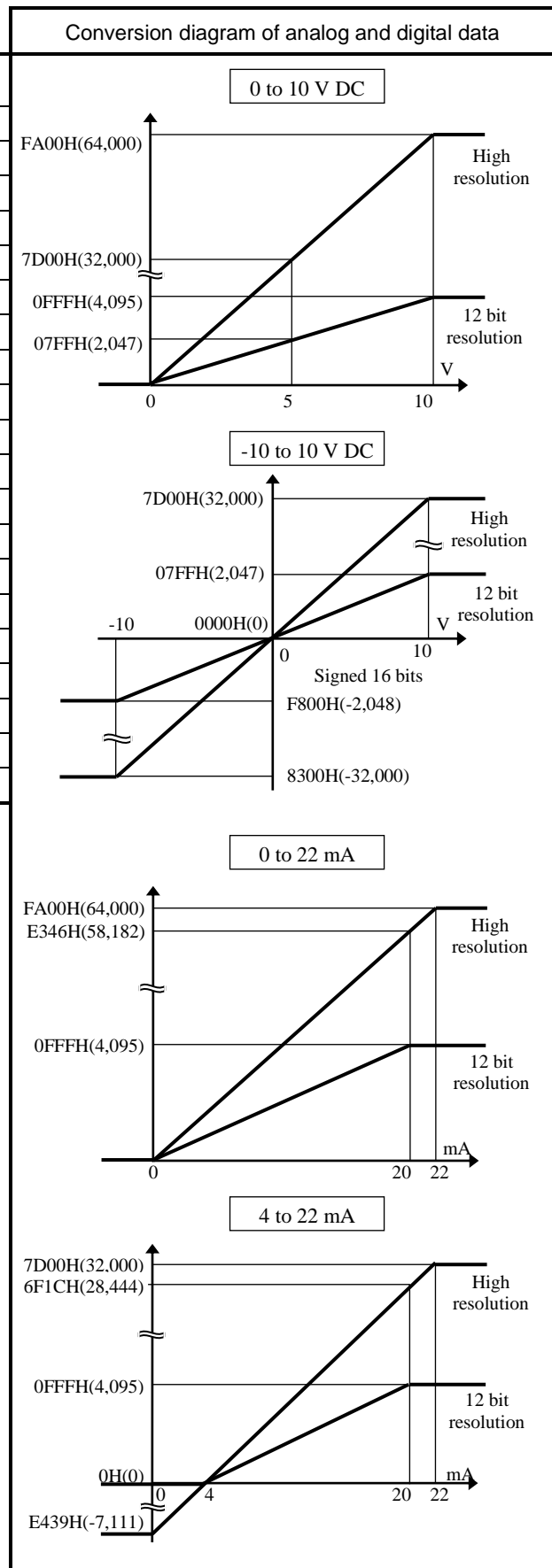
(2)   EH-AYG4M

Specification		EH-AYG4M
Current range		0 to 22 mA / 4 to 22 mA
Voltage range		0 to 10 V DC / -10 to 10 V DC
Number of channels	Current	4 channels (can switch current / voltage)
	Voltage	
Resolution	Current	0 to 64,000, -7,111 to 32,000 or 0 to 4,095 (20 mA)
	Voltage	0 to 64,000 or 0 to 4,095
Conversion time		0.25 ms / 4 channels
Overall accuracy*1,*2	At 25 °C	-0.1 to +0.1 % (of full-scale value)
	Temperature coefficient	-80 to +80 ppm / °C (of full-scale value)
Absolute maximum ratings		Voltage: -15 to 15 V Current :24 mA
Output impedance	Current	More than 1 k Ω
	Voltage	Less than 600 Ω
Insulation system	Channel and Internal circuit	Transformer (1,000 V AC, 1 minutes)
	Between channels	Transformer (1,000 V DC, 1 minutes)
External connection		Removable type screw terminal block (M3)
External power supply		None
External wiring		2-core shield cable (Max. 20 m)
Internal current consumption (5 V DC) *3		Max. 730 mA

*1 Example) Accuracy at 40 °C is calculated as following,
    0.1 % (accuracy at 25 °C) + 0.008 %/ °C (Temperature coefficient) * 15 °C (difference form 25 °C) = 0.22 %
*2 The accuracy indicates the value 15 minutes after power-up. The value may become slightly higher immediately after power-up.
*3 480 mA (All channels output 10 V voltage output with 10 kΩ impedance)
    600 mA (All channels output 10 V voltage output with 1 kΩ impedance) or (All channels output 11 mA current output)
    730 mA (All channels output 22 mA current output)

Terminal configuration	No.	Signal name	Diagram of Internal circuit
	[1]	(NC)	
	[2]	(NC)	
	[3]	0 -	
	[4]	(NC)	
	[5]	1 -	
	[6]	(NC)	
	[7]	2 -	
	[8]	(NC)	
	[9]	3 -	
	[10]	(NC)	
	[11]	V0 +	
	[12]	I0 +	
	[13]	V1 +	
	[14]	I1 +	
	[15]	V2 +	
	[16]	I2 +	
	[17]	V3 +	
	[18]	I3 +	

* Voltage output and current output cannot be used at the same time.

Setting switch				Conversion diagram of analog and digital data

Switch No.	Setup		Function
1, 2	1	2	Output range switching
	OFF	OFF	0 to 10 V DC
	ON	OFF	-10 to 10 V DC
	OFF	ON	0 to 22 mA
	ON	ON	4 to 22 mA
3, 4	3	4	Slew Rate
	OFF	OFF	OFF
	ON	OFF	0.1 s
	OFF	ON	1 s
	ON	ON	10 s
5	5		Resolution
	OFF		High resolution mode (equally 16 bit)
	ON		12 bit mode
6	6		(System mode)
	OFF		Always OFF (Do not turn ON)
7	7		(System mode)
	OFF		Always OFF (Do not turn ON)
8	8		(System mode)
	OFF		Always OFF (Do not turn ON)

Slew Rate function

Slew Rate is a function to change the time of signal change ratio. It defines the time for the full scale value. The image is as following.

Example1)
In the case that the signal setting changes 0 to 5V
[Mode setting]
  Output range:0 to 10 V DC
  Slew Rate   :1 s

Example2)
In the case that the signal setting changes 4 to 22 mA, it is changed to 13 mA before completion of the setting.
[Mode setting]
  Output range : 4 to 22 mA
  Slew Rate   : 10 s

0 to 10 V DC

-10 to 10 V DC

0 to 22 mA

4 to 22 mA

[Setups shown in the white font on black background are initial factory setting:]

* For this module, please ensure to perform the above setup before use. Furthermore, the power supply needs to be turned off during setup. Otherwise, the setup is invalid.

7.4   Resistance Temperature Detector Input Modules
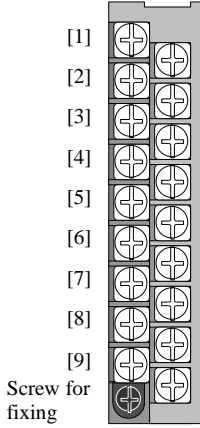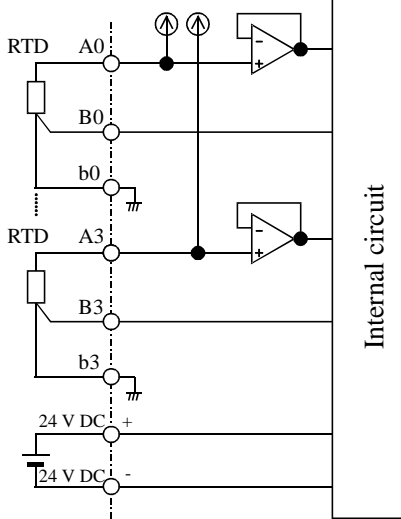
(1)   Resistance temperature detector input

Name and function of each part	Type (Weight)	EH-PT4 (Approx. 0.18 kg (0.40 lb.))
	Dimensions (mm (in.))	

30 (1.18)   95 (3.74)

100 (3.94)

Terminal block cover

Setting switch

Terminal block

Name	Description
Terminal block	This is the terminal block for connecting the I/O signals. The terminal block is removable. The screws for the terminal block are M3 screws. Use a crimp terminal fitting a screw diameter. The maximum cable size is 0.75 mm². (Use 0.5 mm² cable when attaching two crimp terminals to the same terminal.) The recommended crimp terminals are shown below. 6 (0.24) (Recommended) 6 (0.24) Unit: mm (in.) Take great care on handling the terminal because it may fall off if the screw is loose. 6.4 7.6 M3 screw 8.2
Terminal block cover	This is a cover for the terminal block.
Setting switch	Selects a resistance temperature detector to be used and a measuring temperature range.

Resistance temperature detector Measuring temperature range	Switch setup							
	1	2	3	4	5	6	7	8
Pt100 -20 to 40 °C	ON	ON	OFF	OFF	ON	OFF	OFF	OFF
Pt100 -50 to 400 °C	OFF	OFF	ON	OFF	OFF	ON	OFF	OFF
Pt1000 -50 to 400 °C	OFF	OFF	OFF	ON	OFF	OFF	ON	OFF

Note that the temperature data are indefinite in the setup except the above.
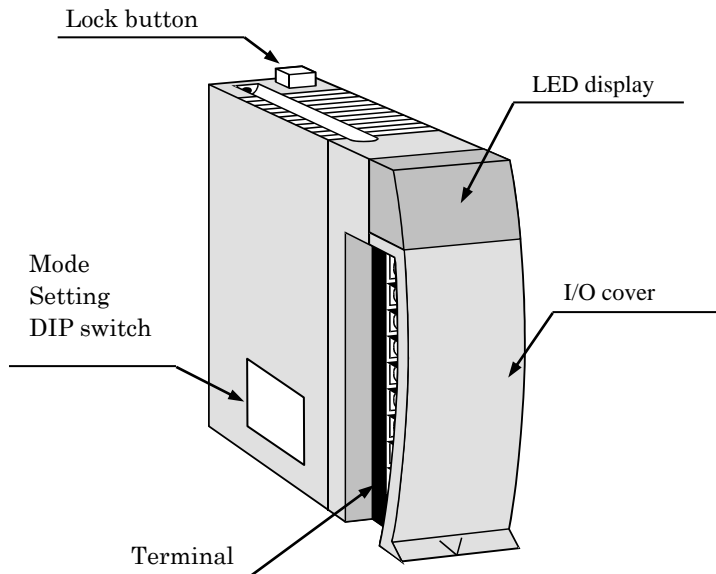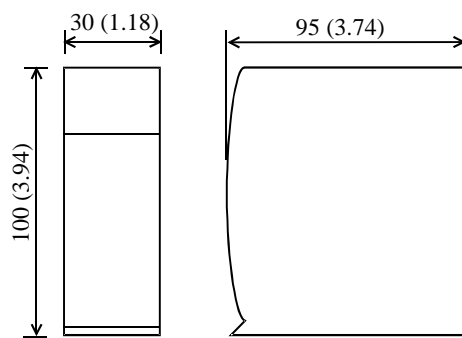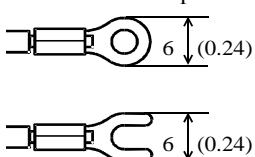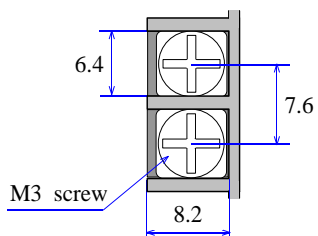
Specification		EH-PT4
Applicable resistance thermometer		Platinum resistance thermometer Pt100 (JIS C 1604-1989) / Pt1000
Temperature conversion data		Signed 15 bits
Accuracy*1	-20 to 40 °C (Pt100)	±0.1 °C @25 °C (±0.5 °C @0 to 55 °C)
	-50 to 400 °C (Pt100)	±0.6 °C @25 °C (±3 °C @0 to 55 °C)
	-50 to 400 °C (Pt1000)	±0.8 °C @25 °C (±6 °C @0 to 55 °C)
Measuring temperature range		-20 to 40 °C / -50 to 400 °C (2 mA constant current system)
Input channel		4 channels
Conversion time		Approx. 1s / 4 channels
Insulation system	Channel and Internal circuit	Photo-coupler insulation
	Between channels	No insulation
External connection		Removable type screw terminal block (M3)
External power supply		24 V DC
External wiring		Shield cable
Unused terminal processing		Temperature conversion data is H7FFF
External wiring resistance		Total resistance of 4 channels 400 Ω at the maximum
Additional function		Linearization
Error detection*2		Temperature conversion data is H7FFF at -51 °C or less, or 410 °C or more
Broken wire processing*2		Temperature conversion data is H7FFF
Internal current consumption		Approx. 160 mA

*1 The accuracy indicates the value 10 minutes after power-up. The value may become slightly higher immediately after the power-up. Also, please consider the influence of the sensor deviation.
*2 Indicates the current terminal wiring in open state. When an open error occurs in the voltage terminal wiring, the data is indefinite.

Terminal configuration	No.	Signal name	Diagram of Internal circuit
	[1]	b0	
	[2]	B0	
	[3]	b1	
	[4]	B1	
	[5]	b2	
	[6]	B2	
	[7]	b3	
	[8]	B3	
	[9]	24 V DC+	
	[10]	A0	
	[11]	N.C.	
	[12]	A1	
	[13]	N.C.	
	[14]	A2	
	[15]	N.C.	
	[16]	A3	
	[17]	N.C.	
	[18]	24 V DC-	

(2)　6 ch.(3-wire) / 8 ch.(2-wire) resistance temperature detector input

Name and function of each part		Model name (Weight)	EH-RTD8(Approx. 0.15 kg (0.33 lb.))
		Dimensions (mm (in.))	

Lock button

LED display

Mode Setting DIP switch

I/O cover

Terminal

30 (1.18)　　95 (3.74)

100 (3.94)

Name	Function
Lock button	Press this button to dismount. Module can be fixed firmly by a screw of M4 × 10 mm (0.39 in.).
I/O cover	This is the cover attached to the terminal block area.
Terminal	This is the terminal block for connecting the I/O signals. The terminal block is removable. The screws for the terminal block are M3 screws. Use a crimp terminal fitting a screw diameter. The maximum cable size is 0.75 mm^2. (Use 0.5 mm^2 cable when attaching two crimp terminals to the same terminal.) The recommended crimp terminals are shown below. 6 (0.24) (Recommended) 6 (0.24) Unit: mm (in.) Take great care on handling the terminal because it may fall off if the screw is loose. 6.4　7.6　M3 screw　8.2
LED display	LED's indicate the status of the module and the input signals as following. OK : LED is ON when the module status is normal operation 2W : LED is ON in 2-wire mode　　LED is OFF in 3-wire mode AMB : LED is ON in -40 to 60 °C mode　　LED is OFF in -200 to 850 °C mode HS : LED is ON: High speed conversion time (0.5 s) 　　LED is OFF: Normal conversion time (1.6 s) 0 to 7 : LED is blinking red : Open-wire or out-of-range is detected in corresponding channel number (0.5 s cycle)

Name	Function
Mode setting DIP switch	These switches are used to set wiring type, temperature range, input filter, conversion time, temperature unit, EH-PT4 compatible mode and sensor type.

No.	Setting	Function
SW1-1	1	Wiring type
	OFF	3-wire
	ON	2-wire
SW1-2	2	Temperature range
	OFF	-200 to 850 °C, °F conversion: -328 to 1,562 °F, EH-PT4 compatible:-60 to 410°C
	ON	-40 to 60°C, °F conversion: -328 to 1,562 °F , EH-PT4 compatible: -25 to 45 °C
SW1-3	3	Input filter
	OFF	None
	ON	16 times moving average
SW1-4	4	Conversion time
	OFF	1.6 s
	ON	0.5 s
SW1-5	5	Temperature unit
	OFF	°C
	ON	°F
SW1-6	6	EH-PT4 compatible mode
	OFF	Disable
	ON	Enable
SW1-7	7	(System mode)
	OFF	Always OFF (Do not turn ON)
SW1-8	8	(System mode)
	OFF	Always OFF (Do not turn ON)
SW2	9	Sensor type
	OFF	Pt1000
	ON	Pt100
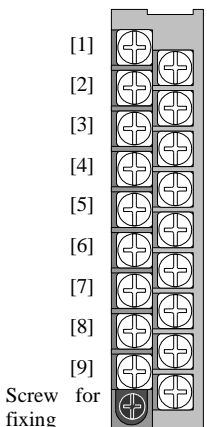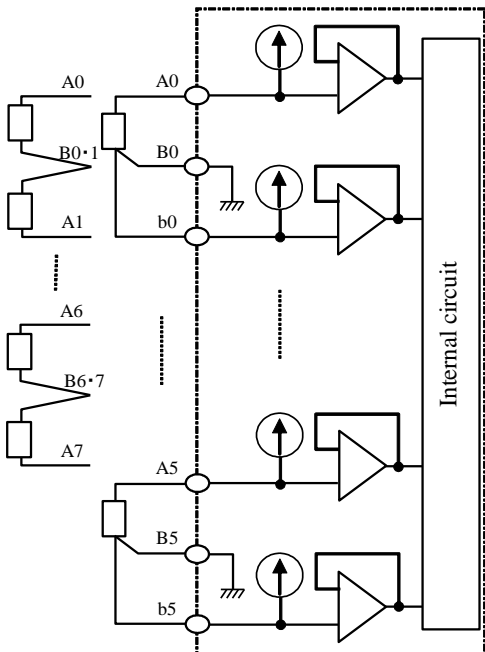
Item		Specification		
Type		EH-RTD8		
Supported RTD type		PT100 / PT1000 (3-wire or 2-wire)		
Number of channel Selectable by the DIP switch		6 (3-wire) or 8 (2-wire)		
Temperature range Selectable by the DIP switch		-200 to 850 °C or -40 to 60 °C		
Resolution Selectable by the DIP switch		°C conversion	°F conversion	PT4 compatible
		-200 to 850°C : 0.1 °C	-328 to 1562 °F : 0.1 °F	-60 to 410 °C : 15 bits
		-40 to 60°C : 0.02 °C	-	-25 to 45 °C : 15 bits
Conversion time Selectable by the DIP switch		1.6 s (all channels) or 0.5 s (all channels)		
Accuracy *1	Standard accuracy (25 °C)	Max. ±0.5 °C (measured temperature under 380 °C) Max. ±0.8 °C (measured temperature over 380 °C)		
	Temperature coefficient	±0.01% / °C (FS)*2 (±0.1°C / °C)		
Measurement current		0.18 mA		
Diagnostic error	LED	LED blinking at error channel		
(Wire breaking detection)	Conversion value	H7FFF		
Input filter Selectable by the DIP switch		None or moving average 16 times		
Warm-up time *3		1 minute		
Isolation	Channel to internal circuit	Photo coupler		
	Between channels	Not isolated		
External connector		Removable terminal (M3)		
Internal current consumption (5 V DC)		Max. 300 mA		
External power supply		None		
Wiring		Twisted shield cable, wiring resistance Max. 5 Ω (Max. 100m of 22 AWG)		

*1 Example : Measuring under 380 °C in ambient temperature 35 °C.(under noise-free environment)
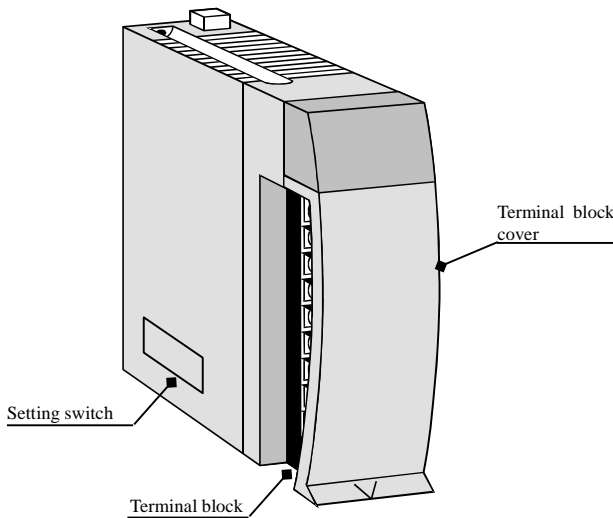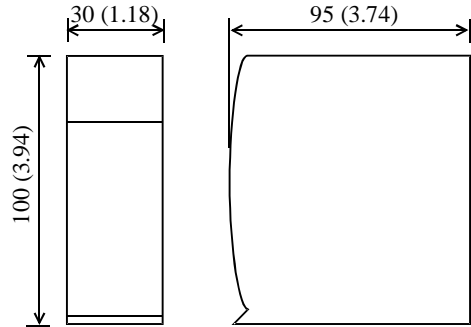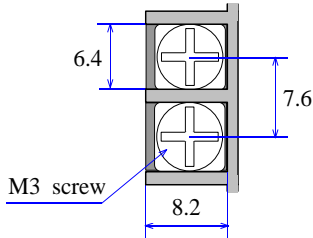
   0.5 °C (standard accuracy) + 0.1 °C / °C (temperature coefficient) × 10 (difference to 25 °C) = ±1.5 °C

*2 Full scale is -200 to 850 °C.

*3 It is the time for data to be stable after power on.

Terminal layout	No.	Signal name		Internal circuit
		2-wire	3-wire	
	[1]	A0	A0	
	[2]	A1	b0	
	[3]	B2·B3	B1	
	[4]	A4	A2	
	[5]	A5	b2	
	[6]	B6·B7	B3	
	[7]	NC	A4	
	[8]	NC	b4	
	[9]	NC	B5	
	[10]	B0·B1	B0	
	[11]	A2	A1	
	[12]	A3	b1	
	[13]	B4·B5	B2	
	[14]	A6	A3	
	[15]	A7	b3	
	[16]	NC	B4	
	[17]	NC	A5	
	[18]	NC	b5	

7.5   Thermocouple Input Module

Name and function of each part	Type (Weight)	EH-TC8 (Approx. 0.16 kg (0.35 lb.))
	Dimensions (mm (in.))	

Terminal block cover

Setting switch

Terminal block

30 (1.18)   95 (3.74)

100 (3.94)

Name	Description
Terminal block	This is the terminal block for connecting the I/O signals. The terminal block is removable. The screws for the terminal block are M3 screws. Use a crimp terminal fitting a screw diameter. The maximum cable size is 0.75 mm^2. (Use 0.5 mm^2 cable when attaching two crimp terminals to the same terminal.) The recommended crimp terminals are shown below. 6 (0.24) (Recommended) 6 (0.24) Unit: mm (in.) Take great care on handling the terminal because it may fall off if the screw is loose. 6.4 7.6 M3 screw 8.2
Terminal block cover	This is the cover of the terminal block.
Select switch	Sets the switching of the temperature range, Celsius / Fahrenheit, etc.

Front view of LED	Indicating contents
OK 0 1 2 3 4 5 6 7 ANAROG IN EH-AXH8M	OK: LED is ON when the module status is normal operation. 0 to 7: LED's are OFF when the channel status is normal operation and flashing in case of detected error.
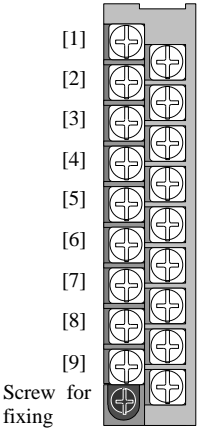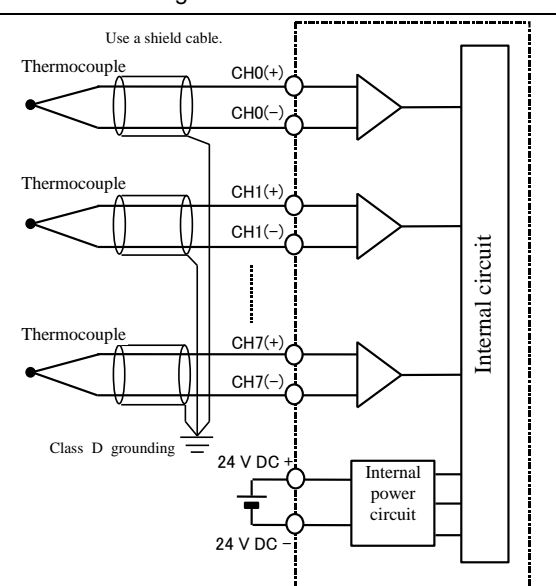
Specification		EH-TC8	
Applicable thermocouple (switchable by a switch)		Conforms to JIS C 1602-1995 Type K, E, J, T, B, R, S, N	
Temperature conversion data		Signed 15 bits	
Measuring temperature range and accuracy*1	Type	Accuracy guaranteed range	Input range
	K	-200 to 1,200 °C 0.4 % (FS)	-270 to 1,370 °C
	E	-200 to 900 °C 0.3 % (FS)	-270 to 1,000 °C
	J	-40 to 750 °C 0.3 % (FS)	-270 to 1,200 °C
	T	-200 to 350 °C 0.8 % (FS)	-270 to 400 °C
	B	600 to 1,700 °C 1.0 % (FS)	0 to 1,820 °C
	R	0 to 1,600 °C 1.0 % (FS)	-50 to 1,760 °C
	S	0 to 1,600 °C 1.0 % (FS)	-50 to 1,760 °C
	N	-200 to 1,200 °C 0.4 % (FS)	-270 to 1,300 °C
Cold junction temperature error*2		Max. ±2 °C (Ambient temperature 15 to 35 °C) Max. ±3 °C (Ambient temperature 0 to 55 °C)	
Resolution		0.1 °C / 0.1 °F (K, E, J, T, N) 1.0 °C / 1.0 °F (B, R, S)	
Input channel		8 channels	
Conversion time		108 / 860 ms	
Insulation system	Channel and Internal circuit	Photo-coupler insulation	
	Between channels	No insulation	
External connection		Removable type screw terminal block (M3)	
External power supply		24 V DC ±10% 100 mA at the maximum	
External wiring*3		Shield cable	
Internal current consumption		Approx. 70 mA	
Error detection	Input upper limit value over / Breaking wiring detection	Input data: H7FFF (The LED corresponding to the channel which detected the error flashes.)	
	Input lower limit value over	Input data: H8000	

*1 The sum of accuracy of each sensor and the cold junction temperature error is the overall accuracy.
   Also, please consider the influence of the sensor deviation.
*2 The Error is the value 10 minutes after power-up. The Error may increase slightly because of a quick change of the ambient
   temperature.
*3 The external wiring length is possible up to 100 m (328 ft.) at the maximum. Please be aware that the measuring result may
   change according to the environment used.

Terminal configuration	No.	Signal name	Diagram of Internal circuit
	[1]	CH0(+)	
	[2]	CH1(+)	
	[3]	CH2(+)	
	[4]	CH3(+)	
	[5]	CH4(+)	
	[6]	CH5(+)	
	[7]	CH6(+)	
	[8]	CH7(+)	
	[9]	24 V DC+	
	[10]	CH0(-)	
	[11]	CH1(-)	
	[12]	CH2(-)	
	[13]	CH3(-)	
	[14]	CH4(-)	
	[15]	CH5(-)	
	[16]	CH6(-)	
	[17]	CH7(-)	
	[18]	24 V DC-	

Item	Switch setup			Setting contents
Thermocouple sensor switching (Common to all channels)	1	2	3	
	OFF	OFF	OFF	Type K
	ON	OFF	OFF	Type E
	OFF	ON	OFF	Type J
	ON	ON	OFF	Type T
	OFF	OFF	ON	Type B
	ON	OFF	ON	Type R
	OFF	ON	ON	Type S
	ON	ON	ON	Type N
Celsius (°C) / Fahrenheit (°F) switching (Common to all channels)	4			
	OFF			Celsius (°C)
	ON			Fahrenheit (°F)
Data updating interval switching	5			
	OFF			860ms
	ON			108ms
Internal cold junction compensation switching	6			
	OFF			Cold junction compensation; Valid
	ON			Cold junction compensation; Invalid
(System mode)	7			
	OFF			Always OFF (Do not turn ON.)
	8			
	OFF			Always OFF (Do not turn ON.)

[Setups shown in the white font on black background are initial factory setting:]

* For this module, please ensure to perform the above setup before use. Furthermore, the power supply needs to be turned off during setup. Otherwise, the setup is invalid.
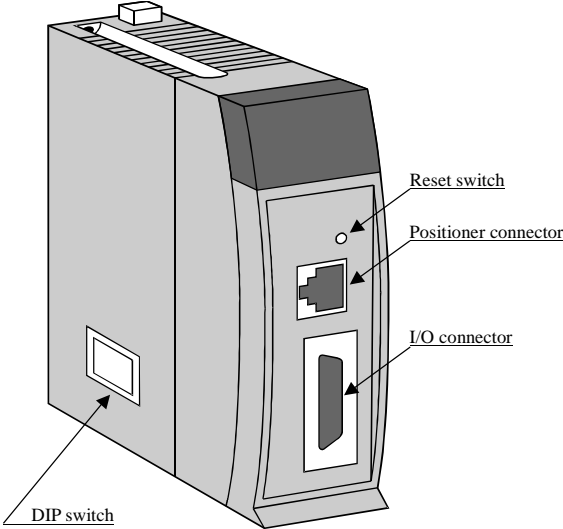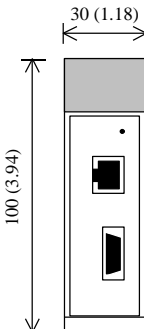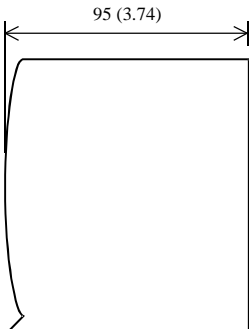
| Reference |

If the internal cold junction compensation is deactivated and a highly accurate ice-bath is installed outside, the temperature can be measured very accurately.

MEMO
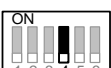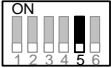
Chapter 8 Positioning and Counter Modules

8.1 Single-axis Positioning Module

Name and function of each part		Type (Weight)	EH-POS (Approx. 0.17 kg (0.37 lb.))

Reset switch
Positioner connector
I/O connector
DIP switch

Dimensions (mm (in.))

30 (1.18)   95 (3.74)   100 (3.94)

Name	Description
Reset switch	The module is reset if this switch is pressed.
Positioner connector	This connector is used for connecting the positioner.
I/O connector	This is a connector (20 pins) for the pulse output and the external control input. Applicable connector Manufacturer: Sumitomo 3M Connecting system: 10120-3000VE (Soldering type) Shell: 10320-52F0-008 (or equivalents)
DIP switch	Switch to select the pulse output method (CW / CCW or CK / Direction switching), output logic (positive / negative logic), and whether external input signals are enabled. Turn off the power and remove the module out of the base to change the setting.

Purpose	Applied switch	Bit 1	Bit 2	Explanation
Choice of pulse output method	Bit 1-2	OFF	OFF	Clock pulse / Direction signal output (Positive logic)
		OFF	ON	Clock pulse / Direction signal output (Negative logic)
		ON	OFF	CW / CCW pulse output (Positive logic)
		ON	ON	CW / CCW pulse output (Negative logic)

Purpose	Applied switch		Explanation
Positioning complete external input signal Disable (COIN) input	Bit 4	OFF	COIN signal enabled
		ON	COIN signal disabled
+ Direction overrun external input signal Disable (+0.RUN) input	Bit 5	OFF	+0.RUN signal enabled
		ON	+0.RUN signal disabled
- Direction overrun external input signal Disable (-0.RUN) input	Bit 6	OFF	-0.RUN signal enabled
		ON	-0.RUN signal disabled

* Always keep Bit 3 OFF

Specifications

Item		Specification
Number of control axes		1 axis
Highest frequency		400 kpulse/s
Positioning data	Capacity	256 points
	Setting procedure	1. Sequence program 2. Positioner (Note: the positioner is optional.)
Positioning	Method	1. Absolute positioning 2. Absolute positioning + Increment positioning 3. Increment positioning
	Positioning instruction	1. Pulse 2. μm 3. inch 4. degree
	Speed instruction	Automatic, manual, and homing 6.25 pulse/s to 400 kpulse/s μm/s、 inch/s、 degree/s input function
	Speed stage	10 stages
	Acceleration and deceleration system	Trapezoid acceleration and deceleration S-curve acceleration and deceleration (3-stage acceleration and deceleration)
	Acceleration and deceleration time	1 to 65,535 ms
	Backlash	0 to 255 pulse
	High and low limit setting	+2,147,483,647 to -2,147,483,648 pulse
	Pulse output method	1. Pulse chain (CW / CCW) 2. Clock + direction signal (CK / Direction) (DIP switch No.1 and No.2 set the choice of pulse output system and the switching of each positive and negative logic.)
	Pulse output procedure	1. Open collector output (Photo-coupler insulation) 2. Line driver output (Photo-coupler insulation)
Homing function		1. Free home position 2. Low speed homing 3. High speed homing 1 4. High speed homing 2 5. Absolute value encoder homing
Teaching		Possible
Manual (JOG) operation		Pulse output by manual input signal
Operation when CPU has stopped		Operation is possible via I/O set or using the positioner
Absolute value encoder input		Supports to Σ series / Σ II series by Yasukawa Electric Co. and P series by SANYO electric Co.
Mounting position		Basic base and Expansion base
Number of units to be mounted simultaneously		Unlimited within power supply capacity of the power module
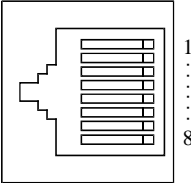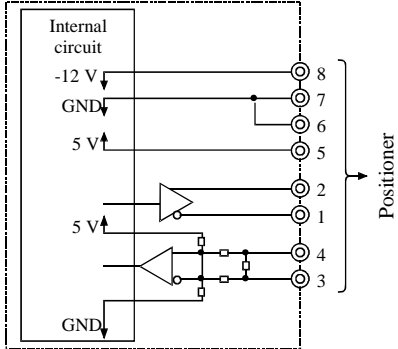
*1 When the CPU is stopped during operation, the motor decelerates and stops.

*2 The maximum travel per one movement is 2,147,483,647 pulses. If the operation is performed exceeding the maximum travel, the motor decelerates and stops at the maximum travel position.
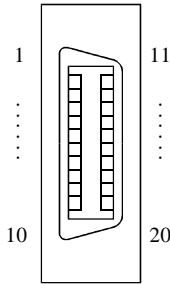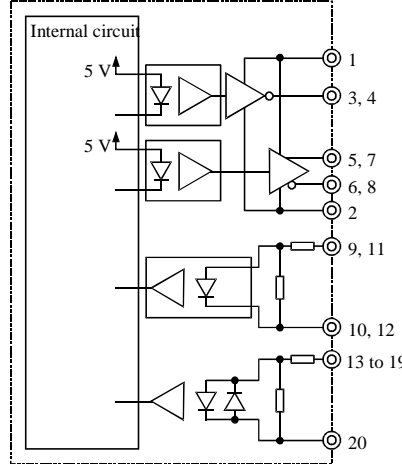
Specifications (continued from the preceding page)

Item		Specification
Output	Pulse chain (CW / CCW) output Clock + Direction signal (CK / Direction) pulse output	1. Open collector output photo-coupler insulation (30 V DC at the maximum, 30 mA resistive load) 2. Line driver output photo-coupler insulation (5 V DC)
	Maximum leak current	Max. 100 µA
	Maximum voltage drop at ON	0.8 V at the maximum (at output current 30 mA)
Input	Input voltage	10.8 to 30 V DC
	Input impedance	Approx. 2.2 kΩ
	Input current	Approx. 10 mA (24 V DC)
	Operating voltage — Minimum ON voltage	9 V
	Operating voltage — Maximum OFF voltage	3.6 V
	Input lag — ON → OFF	Max. 1 ms
	Input lag — OFF → ON	Max. 1 ms
	Polarity	Only encoder signal input uses the plus common inside the unit, and other inputs do not specify polarity.
	Insulation system	Photo-coupler
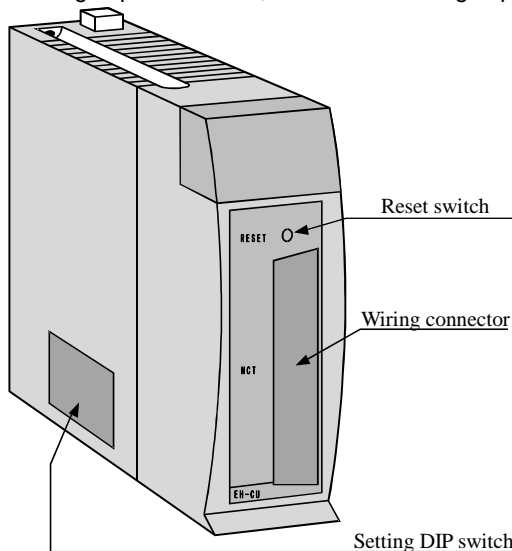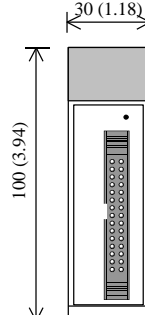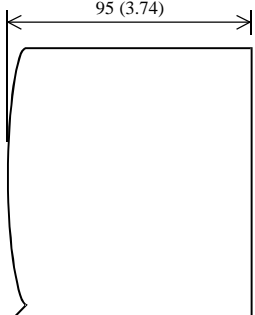
A) Specifications of Positioner connector (CN1): conforms to RS-422

Terminal configuration	No.	Signal	Signal name	Diagram of Internal circuit
	1	Do -	Driver output -	
	2	Do +	Driver output +	
	3	Ri -	Receiver input -	
	4	Ri +	Receiver input +	
	5	5 V DC +	+ 5 V	
	6	0 V	GND	
	7	0 V	GND	
	8	12 V DC -	-12 V	
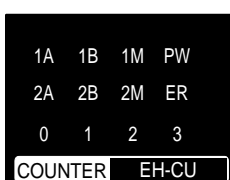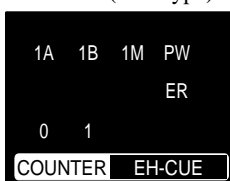
B) Specifications of I/O connector (CN2)

Terminal configuration	No.	Signal	Signal name	Diagram of Internal circuit
	1	5 V DC +	Pulse output power supply	
	2	0 V		
	3	CW	Open collector pulse output	
	4	CCW		
	5	CW +	Line driver pulse output	
	6	CW -		
	7	CCW +		
	8	CCW -		
	9	C +	Encoder C phase	
	10	C -		
	11	PS -	Encoder position signal	
	12	PS +		
	13	COIN	Positioning complete	
	14	PROG	Home position LS	
	15	+ 0.RUN	+ Overrun	
	16	- 0.RUN	- Overrun	
	17	MODE - SEL	Control mode switch	
	18	M - CW	Manual CW	
	19	M - CCW	Manual CCW	
	20	24 V DC +	Control power supply	
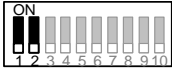
8.2   High Speed Counter Module
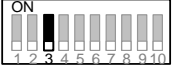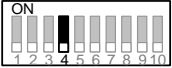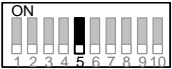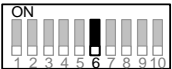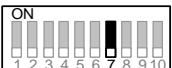
Name and function of each part	Type (Weight)	EH-CU (0.16 kg (0.35 lb.))
EH-CU: 2-ch High speed counter, EH-CUE: 1-ch High speed counter		EH-CUE (0.16 kg (0.35 lb.))

Dimensions (mm (in.))

Reset switch

Wiring connector

Setting DIP switch

30 (1.18)   95 (3.74)   100 (3.94)

Name	Description
Reset switch	The module is reset if this switch is pressed.

Wiring connector	This is a connector with 30 pins (15×2 lines) for connecting the external wiring.
	Note) In EH-CU, common to 2 channels
	Applicable connector on the module side
	      Manufacturer: Hirose Electric Co.
	      Type: HIF3BA-30PA-2.54DS (30 pins male)
	Applicable connector on the wiring side
	      Manufacturer: Hirose Electric Co.
	      Type: HIF3BA-30D-2.54C (30 pins connector)
	            HIF3-2226SCC (connector pin)
	            HIF3-TB2226HC (crimp tool)
	            HIF3--30CV (connector cover)

Setting DIP switch	Performs each initial setting of EH-CU and EH-CUE. Turn off the power and remove the module from the base to change the setting.

LED name

External view of LED part	LED name	Details	Color
1A 1B 1M PW 2A 2B 2M ER 0 1 2 3 COUNTER EH-CU EH-CU (2-ch type)	PW	ON when power is supplied.	Green
	ER	ON when hardware error is detected.	Red
	1A	Phase-A input signal of Channel 1	Green
	1B	Phase-B input signal of Channel 1	Green
	1M	Marker input signal of Channel 1	Green
	2A	Phase-A input signal of Channel 2	Green
	2B	Phase-B input signal of Channel 2	Green
1A 1B 1M PW ER 0 1 COUNTER EH-CUE EH-CUE (1-ch type)	2M	Marker input signal of Channel 2	Green
	0	Digital output Y0	Green
	1	Digital output Y1	Green
	2	Digital output Y2	Green
	3	Digital output Y3	Green

* When the reset button is pushed, "ER" LED lights in a moment, which is not failure.

Purpose	Applied switch	Bit1	Bit 2	Explanation
Select the counter mode (Common between channels)	Bit 1, 2	OFF	OFF	2-phase counter (100 kHz at the maximum)
		OFF	ON	1-phase counter (CW, CCW)
		ON	OFF	1-phase counter (CK, UP / DOWN)
		ON	ON	2-phase multiplied by 4 counter (25 kHz at the maximum)
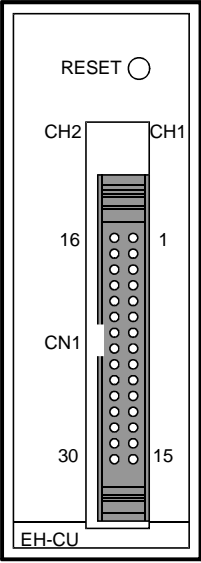
Purpose	Applied switch		Explanation
Select the marker polarity	Bit 3	OFF	Channel 1 Detects the marker at the input OFF edge.
		ON	Channel 1 Detects the marker at the input ON edge.
	Bit 4	OFF	Channel 2 Detects the marker at the input OFF edge.
		ON	Channel 2 Detects the marker at the input ON edge.
Select counting operation during STOP	Bit 5	OFF	Channel 1 Stops counting while the CPU module stops.
		ON	Channel 1 Keeps counting while the CPU module stops.
	Bit 6	OFF	Channel 2 Stops counting while the CPU module stops.
		ON	Channel 2 Keeps counting while the CPU module stops.
Select normal counter / ring counter	Bit 7	OFF	Channel 1 Normal counter
		ON	Channel 1 Ring counter
	Bit 8	OFF	Channel 2 Normal counter
		ON	Channel 2 Ring counter
Select the test mode	Bit 9	OFF	Normal operation
		ON	Test mode (Program for checking is started up.)

* Always keep Bit 10 OFF.
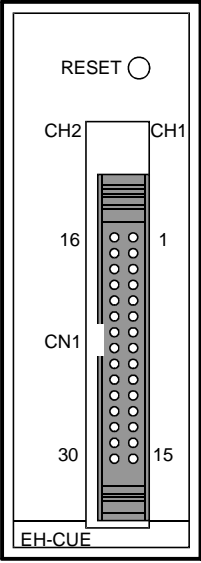
Specifications

Item		Specification	
Type		EH-CU	EH-CUE
Number of channels		2 channels	1 channel
Number of counts at the maximum		32 bits (0 to 4,294,967,295)	
Maximum frequency		100 k Hz (25 k Hz at multiplied by 4)	
Count mode		Select by setting of DIP switch. (EH-CU is common to both channels.) 2-phase, 1-phase (CW / CCW, CK, U / D), 2-phase multiplied by 4	
Differential input current		4 mA or more	
Differential input voltage		12 to 24 V DC	
	Minimum ON voltage	10 V DC	
	Maximum OFF voltage	4 V DC	
Insulation system		Photo-coupler	
Number of input points 3 points / CH	A:A, CW, CK	Phase difference of each channel (A - B) during 2-phase counting +45 ° to +125 ° when up, -45 ° to -125 ° when down	
	B:B, CCW, U / D		
	M: Marker (z)		
Minimum counter pulse width		ON: 4 μs or more, OFF: 4 μs or more	
Minimum marker pulse width		10 μs or more (detected at ON edge)	
External wiring method		30-pin batch connector for both channels	30-pin connector
External wiring		Wired with twisted pair cables and batch shielded cables	
Output voltage		12 / 24 V DC (30 V DC at the maximum)	
Load current		20 mA / point at the maximum	
Output method		Open collector output	
Minimum load current		1 mA	
Output delay time	ON → OFF	Max. 1 ms	
	OFF → ON	Max. 1 ms	
Voltage down at ON		1.5 V at the maximum	
Number of external output points		4 points / module External terminal of output destination can be specified for each channel	2 points / module
	Normal counter	Current value = Set value 1, or Current value > Set value 1	
	Ring counter	Current value = Set value 2	
Leak current		0.5 mA at the maximum	
Polarity		(-) common within the module	
External power supply		12 / 24 V DC (30 V DC at the maximum)	
Insulation system		Photo-coupler	
Mounting position		Basic base, Expansion base (cannot be mounted on the remote base)	
Number of units to be mounted simultaneously		Unlimited within power supply capacity of the power module.	

Specifications of I/O terminal

EH-CU	Terminal configuration	No.	CH2	No.	CH1	Meaning of signal	
		16	Vin A	1	Vin A	Phase A	12 to 24 V DC power supply when using voltage input.
		17	A (+)	2	A (+)		(+) signal when using differential input.
		18	A (-)	3	A (-)		Open collector signal when using voltage input. (-) signal when using differential input.
		19	Vin B	4	Vin B	Phase B	12 to 24 V DC power supply when using voltage input.
		20	B (+)	5	B (+)		(+) signal when using differential input.
		21	B (-)	6	B (-)		Open collector signal when using voltage input. (-) signal when using differential input.
		22	Vin M	7	Vin M	Marker	12 to 24 V DC power supply when using voltage input.
		23	M (+)	8	M (+)		(+) signal when using differential input.
		24	M (-)	9	M (-)		Open collector signal when using voltage input. (-) signal when using differential input.
		25 to 27 N.C.		10 to 12 N.C.			Not connected.
		28	Y2	13	Y0	Output	Counter output.
		29	Y3	14	Y1		Counter output.
		30	Com2	15	Com1		(-) common for counter outputs. Commons 1 and 2 are independent.

The terminal configuration shows: RESET ○, CH2 / CH1, CN1, with pins 16 to 30 (left, CH2) and 1 to 15 (right, CH1). Label: EH-CU.

* The Pin No. assignment of EH-CU does not match with the pin No. assignment of the connector manufacturer.

EH-CUE	Terminal configuration	No.	CH2	No.	CH1	Meaning of signal	
		16	N.C.	1	Vin A	Phase A	12 to 24 V DC power supply when using voltage input.
		17	N.C.	2	A (+)		(+) signal when using differential input.
		18	N.C.	3	A (-)		Open collector signal when using voltage input. (-) signal when using differential input.
		19	N.C.	4	Vin B	Phase B	12 to 24 V DC power supply when using voltage input.
		20	N.C.	5	B (+)		(+) signal when using differential input.
		21	N.C.	6	B (-)		Open collector signal when using voltage input. (-) signal when using differential input.
		22	N.C.	7	Vin M	Marker	12 to 24 V DC power supply when using voltage input.
		23	N.C.	8	M (+)		(+) signal when using differential input.
		24	N.C.	9	M (-)		Open collector signal when using voltage input. (-) signal when using differential input.
		25 to 27 N.C.		10 to 12 N.C.			Not connected.
		28	N.C.	13	Y0	Output	Counter output.
		29	N.C.	14	Y1		Counter output.
		30	N.C.	15	Com1		(-) common for counter output.

The terminal configuration shows: RESET ○, CH2 / CH1, CN1, with pins 16 to 30 (left, CH2) and 1 to 15 (right, CH1). Label: EH-CUE.
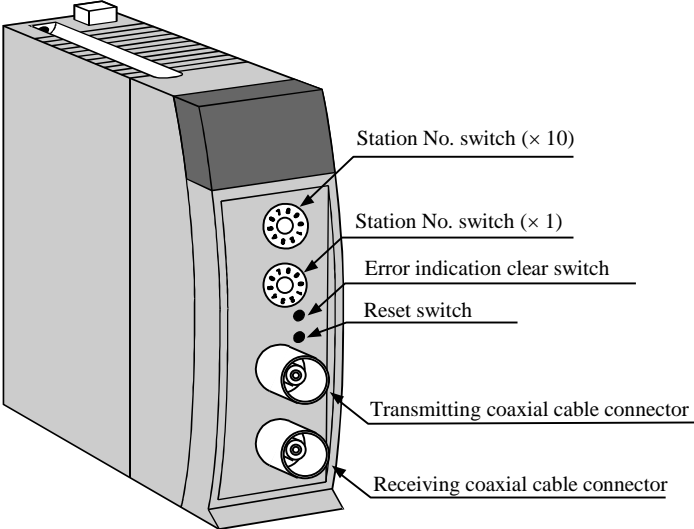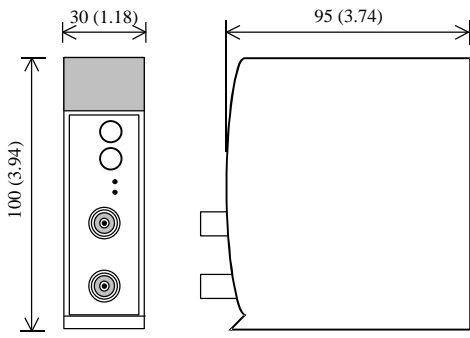
* The Pin No. assignment of EH-CUE does not match with the pin No. assignment of the connector manufacturer.

MEMO

8 – 8

Chapter 9 Communication and Network Modules
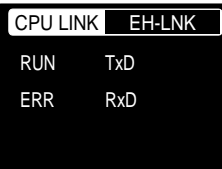
9.1　CPU Link Modules

Coaxial cable type
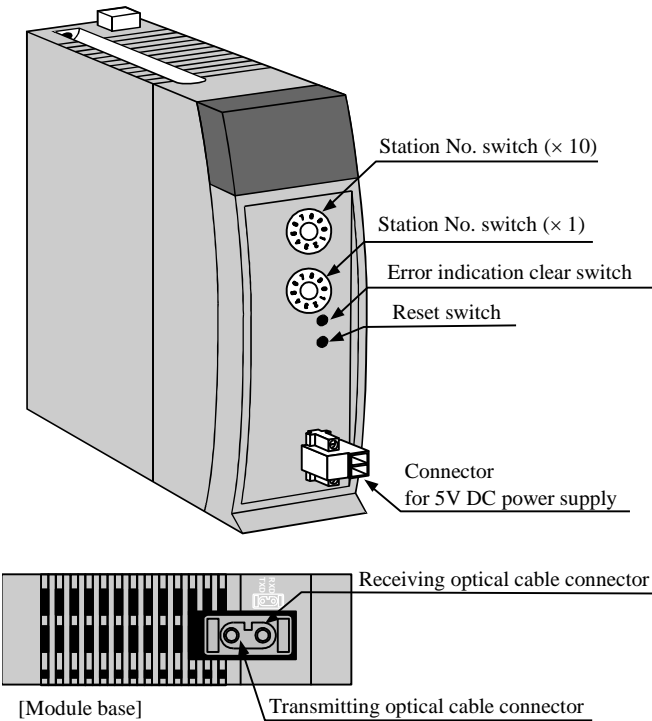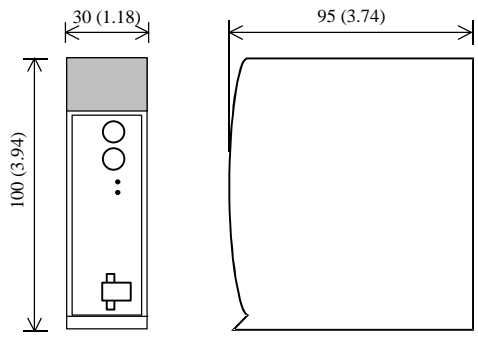
Name and function of each part		Type (Weight)	EH-LNK (Approx. 0.15 kg (0.33 lb.))
Station No. switch (× 10) Station No. switch (× 1) Error indication clear switch Reset switch Transmitting coaxial cable connector Receiving coaxial cable connector		Dimension (mm (in.))	30 (1.18)　95 (3.74)　100 (3.94)

Name	Description
Station No. switch (× 10)	This switch determines the link station No. The switch information is taken when the module is powered up and the reset switch is pressed. The setting range is from 00 to 63. Example) Station No. 18 10-digit … 1 } 1-digit … 8 } Station No. 18
Station No. switch (× 1)	- If 64 or a higher number is set, an out-of-range error of the station No. is detected. - If the station number is duplicated, duplication error is detected. - If there is no station No.00 (master station) in the link system, the system does not work properly.
Error indication clear switch	Clears the indication displayed on ERR LED. (ERR LED will light up again if the error factor is not resolved.)
Reset switch*	The module can be reset by pressing this switch when an error is detected.
Transmitting coaxial cable connector (TXD)	Transmits data from the own station. Connect to RXD on the next station using a coaxial cable.
Receiving coaxial cable connector (RXD)	Receives data from other station. Connect to TXD on the next station using a coaxial cable.

* The CPU module will detect a "Link Module Error (error code: 74H)" if the reset switch is pressed. Please resolve the error of the CPU module after making sure that the link module is operating normally.

LED name

Front view of LED part	LED	Details	Color
CPU LINK　EH-LNK RUN　　TxD ERR　　RxD	TxD	Flashes when data is received.	Green
	RxD	Flashes when data is transmitted.	Green
	RUN	Lights up when the link module is operating properly.	Green
	ERR	Normal state　　　　　　　　　　: OFF Error (data link is possible)　　: Flashing (in 1 s interval) Error (data link is impossible)　: Flashing (in 0.5 s interval), turn on	Red
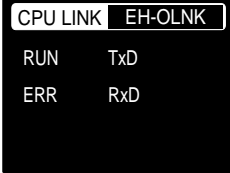
Optical cable type

Name and function of each part	Type (Weight)	EH-OLNK (Approx. 0.15 kg (0.33 lb.))
		EH-OLNKG (Approx.0.15 kg (0.33 lb.))
		EH-OLNKE (Approx. 0.15 kg (0.33 lb.))

Station No. switch (× 10)

Station No. switch (× 1)

Error indication clear switch

Reset switch

Connector for 5V DC power supply

Receiving optical cable connector

[Module base]

Transmitting optical cable connector

Dimensions (mm (in.))

30 (1.18)　　95 (3.74)

100 (3.94)

Name	Description
Station No. switch (× 10)	This switch determines the link station No. The switch information is taken when the module is powered up and the reset switch is pressed. The setting range is from 00 to 63. Example) Station No. 18 10-digit … 1 1-digit … 8 Station No. 18
Station No. switch (× 1)	- If 64 or a higher number is set, an out-of-range error of the station No. is detected. - If the station number is duplicated, duplication error is detected. - If there is no station No.00 (master station) in the link system, the system does not work properly.
Error indication clear switch	Clears the indication displayed on ERR LED. (ERR LED will light up again if the error factor is not resolved.)
Reset switch*	The module can be reset by pressing this switch when an error is detected.
Connector for 5V DC power supply	Supply 5 V DC from another power source if the link system needs to work while this module is not powered.
Receiving optical cable connector (RXD)	Receives data from other station. Connect to TXD on the next station by an optical cable.
Transmitting optical cable connector (TXD)	Transmits data from other station. Connect to RXD on the next station by an optical cable.

* If the reset switch is pressed, the CPU module will detect a "Link Module Error (error code: 74H)". Please resolve the error of the CPU module after making sure that the link module is operating normally.

LED name

Front view of LED part	LED	Details	Color
CPU LINK EH-OLNK RUN TxD ERR RxD	TxD	Flashes when data is received.	Green
	RxD	Flashes when data is transmitted.	Green
	RUN	Lights up when the link module is operating properly.	Green
	ERR	Normal state : OFF Error (data link is possible) : Flashing (in 1s interval) Error (data link is impossible) : Flashing (in 0.5 s interval), turn on	Red
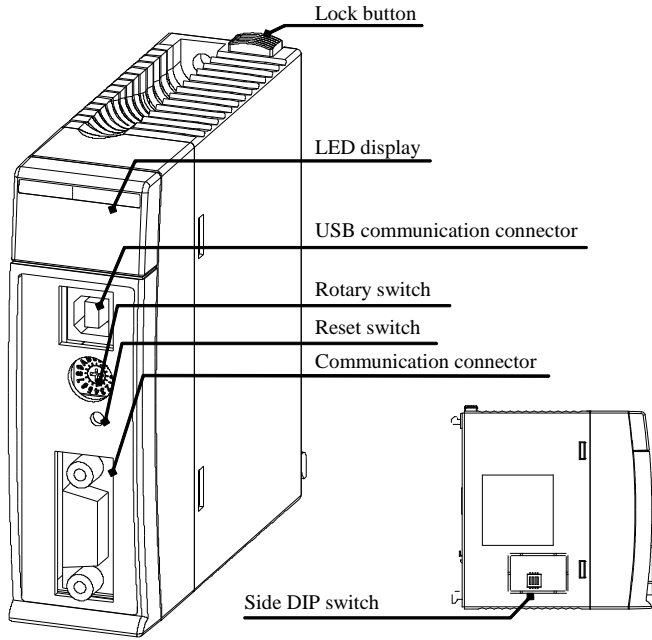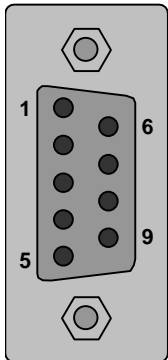
Specifications (CPU link module (coaxial, optical))

	Item		Specification
Functional Specification	Number of connected link modules		64 units at the maximum per link system
	Number of link points		1,024 words per loop (2,048 words per 2 loops)*1
	Data delivery system		Common data area system
	Transmit / Receive distinction on data area allocation		Parameter setup from peripheral devices
	Station No. specifying		Specifies 0 to 63 by a rotary switch.
	Transmission speed		1.0 Mbps
	Transmission method		Half-duplex serial transmission, frame synchronization
	Communication method		Token passing
	Modulation method		Base band
	Refresh time		At 64 stations connection and 1024 words transfer; Approx. 390 ms
	Error check		CRC, overrun check, timeout, open circuit parameter error (Dual specifying of station No., overlap of link area, etc.)
	Self-diagnosis		System ROM / RAM check, watchdog timer check, transmission loop back check
Transmission channel Specification	Transmission channel form		Loop type
	Cable length	Between stations	Maximum 500 m (EH-LNK), Maximum 1,000 m (EH-OLNK), Maximum 2,000 m (EH-OLNKG,E)
		Total extension	Maximum 1,000 m (EH-LNK), Maximum 15,000 m (EH-OLNK,EH-OLNKG,E)
	Error station processing		Bypass system (coaxial), Bypass system (optical; only when supplying 5 V DC from another power source)
	Recommended cable (EH-LNK)		Coaxial cable with shield (equivalent to the 5D-2V with shield)
	Recommended connector (EH-LNK)		Link module side: equivalent to 413631-1 (by AMP)
	Recommended cable and connector (Refer to the instruction of each module for more details.)	EH-OLNK	CA7103- 1 M- 2 L 3 1 Hitachi Hybrid Network Co., Ltd. 1 : cable length, 2 : cable type, 3 : core number
		EH-OLNKG, EH-OLNKE	CA9103S- 1 M-AL11 Hitachi Hybrid Network Co., Ltd. CA9003S- 1 M-AL12 CA9103S- 1 M- 2 B 1 : cable length, 2 : core number For the recommended cable of EH-OLNKE, add "-625" at the end of above types.
Mounting position			Slot 0 to 7 on the basic base

*1 Power failure memory protection is not possible.

9.2   PROFIBUS-DP Master Module 2
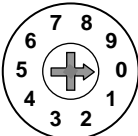
Name and function of each part		Model name	EH-RMP2

Model name	EH-RMP2
Weight	0.16 kg (0.35 lb.)
Current consumption (5 V DC)	0.78 A
Dimensions (mm (in.))	

Name	Function	Remarks
Lock button	Press this button to remove the module from the base unit. The module can be fixed firmly by a M4 × 10mm (0.39in) screw.	
Communication connector	D-sub 9-pin connector for communication cable.	
USB communication connector	Type-B USB connector for configuration.	
LED display	The status of module is displayed on this LED.	
Rotary switch	This is the rotary switch to set network input / output sizes.	
Reset switch	The module can be reset by pressing this switch when an error is detected. When pressing the reset switch, the RDY LED is turned off immediately and the module will be reset.	Please do not press and hold the reset switch.
Side DIP switch	This is the switch to set operation mode.	

Outline of communication connector	Symbol	Indication	Details
PROFIBUS	PROFIBUS	Communication connector	D-sub 9 pin connector. Terminal layouts are shown below.

Pin No.	Details
1	NC
2	NC
3	B-Line
4	NC
5	GND
6	+5 V DC
7	NC
8	A-Line
9	NC

Description of LED display

LED	LED name	Indication	Details
	RDY	Hardware status (Green / Red)	Display EH-RMP2 hardware status. **State** / **Details** Off / Hardware error, Power supply error Flash in green or red / Initialization Lit in red / Hardware error Lit in green / No error
	STATUS	System status (Green / Red)	Display EH-RMP2 system status. **State** / **Details** Off / Power supply error Flash in red / Internal error Lit in red / WDT error Fifth-flash in green / Side DIP switch setting error Forth-flash in green / Link parameter error Triple-flash in green / Configuration data error Double-flash in green / CPU module error Single-flash in green / Initialization Lit in green / No error
	RUN	Network status (Green)	Display PROFIBUS network status. **State** / **Details** Off / No communication established Blinking / Under communication establishment On / Communication established
	ERR	Error status (Red)	Display PROFIBUS error status. **State** / **Details** Off / Communication established Blinking / Slave units at least one are not established On / All slave units are not established
	REM	Operating mode (Green)	No use. It is always off.

PROFIBUS EH-RMP2

RDY   RUN ERR

STATUS   REM

The RDY details table:

State	Details
Off	Hardware error, Power supply error
Flash in green or red	Initialization
Lit in red	Hardware error
Lit in green	No error

The STATUS details table:

State	Details
Off	Power supply error
Flash in red	Internal error
Lit in red	WDT error
Fifth-flash in green	Side DIP switch setting error
Forth-flash in green	Link parameter error
Triple-flash in green	Configuration data error
Double-flash in green	CPU module error
Single-flash in green	Initialization
Lit in green	No error

The RUN details table:

State	Details
Off	No communication established
Blinking	Under communication establishment
On	Communication established

The ERR details table:

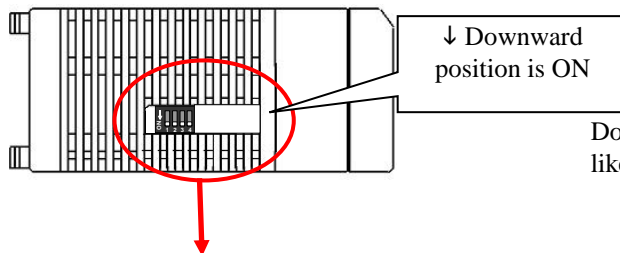| State	Details
Off	Communication established
Blinking	Slave units at least one are not established
On	All slave units are not established

The state of LED is indicated below.

Description of Rotary switch

Rotary switch	Symbol	Meaning	Details of setting			
MODE (rotary switch 0–9) [Default setting: 0]	MODE	Input / Output Sizes	The input / output sizes of PROFIBUS network are set by rotary switch.			
			Value	Network size	Input size	Output size
			0	Variable size	512 words max	512 words max
			1	64W / 64W fixed	64 words	64 words
			2	128W / 128W fixed	128 words	128 words
			3	256W / 256W fixed	256 words	256 words
			4	512W / 512W fixed	512 words	512 words
			5	Variable size	512 words max	512 words max
			6			
			7			
			8			
			9			
			In case of the compatible mode, the input / output sizes of PROFIBUS are fixed at 256words / 256words in spite of setting of this switch.			

Please set the rotary switch to 0 if you use auto addressing function with use of the SYCON.net. If you map each slave I/O address including offset address, please set the rotary switch value 1, 2, 3 or 4. When the actual input / output sizes exceed setting sizes, EH-RMP2 detects an error.

Description of Side DIP switch
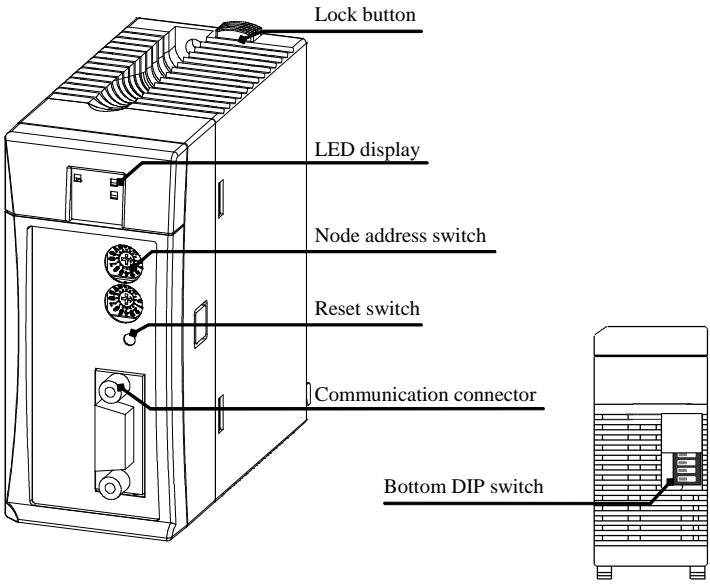
↓ Downward
position is ON

Downward position is ON side in case of side view like left figure.
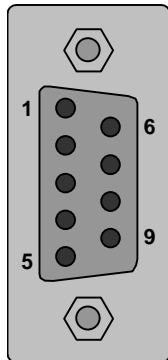
No.	Setting description	Details
1	No use [Default setting: OFF]	Please keep off.
2	EH-RMP compatible mode [Default setting: OFF]	OFF : Standard mode ON : Compatible mode
3,4	Output hold selecting [Default setting: OFF]	When the CPU is switched from RUN to STOP position, it can select output status.

Bit4	Bit3	Position	Output hold function selection
OFF	OFF		Clear mode. When the CPU is switched from RUN to STOP position, EH-RMP2 outputs the zero data to PROFIBUS slave. But the link area (%MW) is not cleared.
OFF	ON		Freeze mode. When the CPU is switched from RUN to STOP position, EH-RMP2 holds output data that is last data received.
ON	OFF		Copy mode. When the CPU is switched from RUN to STOP position, EH-RMP2 continues to copy in the link area (%MW).
ON	ON		Not used.

Performance specification
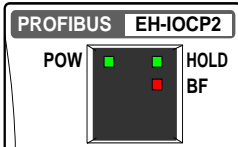
Item	Specifications		
	EH-RMP2		EH-RMP
	Standard mode	Compatible mode	(Previous model)
Communication specifications — Communication protocol	PROFIBUS-DP V0		
Range of node address	0 to 125: Setting by configuration tool		
Maximum I/O size	Input: 512 words, output: 512 words (Setting by rotary switch)	Input: 256 words, output: 256 words	
Connector	D-sub 9 pin		
Topology	BUS		
Communication cable	PROFIBUS cable		
Segment length, Transmit speed	9.6 kbps : 1,200 m 19.2 kbps : 1,200 m 93.75 kbps : 1,200 m 187.5 kbps : 1,000 m 500 kbps : 400 m 1,500 kbps : 200 m 3 Mbps : 100 m 6 Mbps : 100 m 12 Mbps : 100 m		
Maximum connectable number of slaves	125 slaves		
Output hold	Supported (Clear mode, Freeze mode, Copy mode)		
Termination	Not built-in		Built-in
Configuration tool	SYCON.net		SyCon
Functional specifications — Number of modules	8 modules / CPU		
Self-check	WDT check		WDT check System memory check
Error indication	LED		

9.3   PROFIBUS-DP Slave Controller 2

Name and function of each part		Model name	EH-IOCP2

Model name	EH-IOCP2
Weight	0.14 kg (0.31 lb.)
Current consumption (5 V DC)	0.35 A
Dimensions (mm (in.))	

Lock button
LED display
Node address switch
Reset switch
Communication connector
Bottom DIP switch

45 (1.77)   95 (3.74)   100 (3.94)

Name	Function	Remarks
Lock button	Press this button to remove the module from the base unit. The module can be fixed firmly by a M4 × 10mm (0.39in) screw.	
Communication connector	D-sub 9-pin connector for communication cable.	
LED display	The status of module is displayed on this LED.	
Node address switch	This is the switch to set the node address.	
Reset switch	The module can be reset by pressing this switch when an error is detected.	
Bottom DIP switch	This is the switch to set an operation mode (the output hold, etc.).	

Outline of communication connector	Symbol	Indication	Details		
PROFIBUS	PROFIBUS	Communication connector	D-sub 9 pin connector. Terminal layouts are shown below.		
			Pin No.	Details	
			1	NC	
			2	NC	
			3	B-Line	
			4	NC	
			5	GND	
			6	+5 V DC	
			7	NC	
			8	A-Line	
			9	NC	

Description of LED display

Outline	LED name	Indication	Details
PROFIBUS EH-IOCP2 POW ■ ■ HOLD ■ BF	POW	Power supply (Green)	On : indicates that the 5 V DC power is supplied. Off : indicates that the 5 V DC power is not supplied or reset switch is on. **State / Details** Off — Hardware error / Power supply error n times flash — I/O modules failure (n is modules failure point) On — No error
	HOLD	Output hold (Green)	Display the output hold function status. **State / Details** Off — Disable the output hold function On — Enable the output hold function
	BF	Error (Red)	Display PROFIBUS error status or EH-IOCP2 hardware status. **State / Details** Off — No error Blinking — Communication timeout Single-flash — Configration error / I/O modules failure Double-flash — Mount not support modules / Mount at out of area Triple-flash — I/O data size over or zero. On — Internal error

The state of LED is indicated below.

Description of Rotary switch

Rotary switch	Symbol	Meaning	Details of setting
ADR	×10 (Tens digit)	Station No. (00 to 99)	The station No. of PROFIBUS network is set from 00 to 99. The tens digit set by upper rotary switch. The ones digit set by lower rotary switch.
[Default setting : 00]	×1 (Ones digit)		

Description of Bottom DIP switch

↓ Downward position is ON

Downward position is ON side in case of bottom view like left figure.

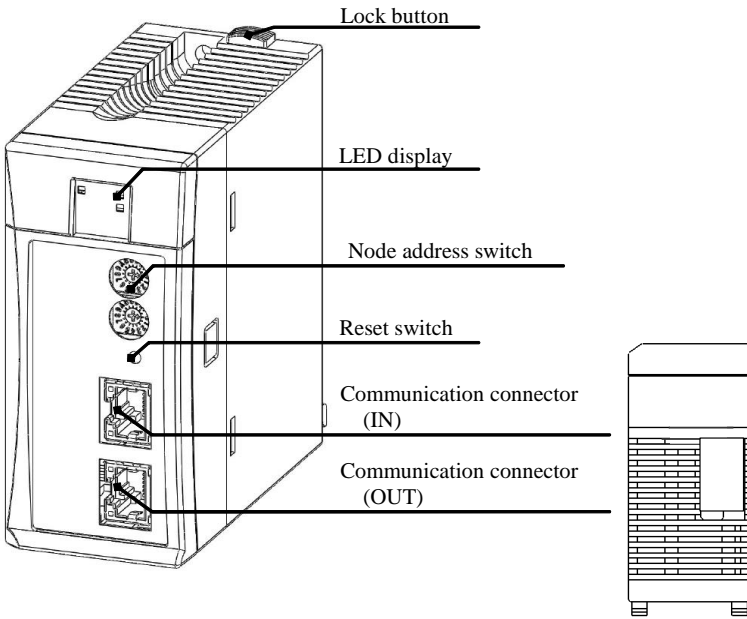| No.	Setting description	Details
1	Output hold function selecting [Default setting: OFF]	When the PROFIBUS master's communication stopped, it is selected whether the output data from the master is held or not. (Hold means the last data received properly is fixed.) Output hold function may be changed action depending on master unit. Please read master's manual and check the combination master unit and EH-IOCP2, before using output hold function of EH-IOCP2. <table><tr><td>Bit1</td><td>Position</td><td>Output hold function selection</td></tr><tr><td>OFF</td><td>img</td><td>Disable the output hold function (Turn off all output data from the master at the communication stopped.)</td></tr><tr><td>ON</td><td>img</td><td>Enable the output hold function (At the communication stopped, output data from master is held with last data received properly.)</td></tr></table>
2	EH-IOCP compatible mode selecting [Default setting: OFF]	It can select whether the EH-IOCP2 operates as standard mode or compatible mode. <table><tr><td>Bit2</td><td>Position</td><td>EH-IOCP compatible mode selection</td></tr><tr><td>OFF</td><td>img</td><td>Standard mode (EH-IOCP2)</td></tr><tr><td>ON</td><td>img</td><td>Compatible mode (EH-IOCP)</td></tr></table>
3	Data swap function selecting [Default setting: OFF]	It can select whether it performs byte swap by a word unit. <table><tr><td>Bit3</td><td>Position</td><td>Data swap function selection</td></tr><tr><td>OFF</td><td>img</td><td>Disable the data swap function</td></tr><tr><td>ON</td><td>img</td><td>Enable the data swap function</td></tr></table>
4	No use [Default setting: OFF]	Please keep off.

Performance specification

Item		Specifications		
		EH-IOCP2		EH-IOCP (Existing model)
		Standard mode	EH-IOCP compatible mode	
Communication specifications	Communication protocol	PROFIBUS-DP V0		
	Range of node address	0 to 99 : Setting by rotary switch		
	Maximum I/O size	Input : 244 bytes, Output : 244 bytes*1		
	Connector	D-sub 9 pin		
	Topology	BUS		
	Communication cable	PROFIBUS cable		
	Segment length, Transmit speed	9.6　kbps　: 1,200 m 19.2　kbps　: 1,200 m 93.75　kbps　: 1,200 m 187.5　kbps　: 1,000 m 500　kbps　:　400 m 1,500　kbps　:　200 m 3　Mbps　:　100 m 6　Mbps　:　100 m 12　Mbps　:　100 m		
	Output hold	Supported*2		
	Data swap	Supported		Not supported
	Termination	Not built-in		Built-in
	GSD file	HITA0E64.GSD	HITA049D.GSD	
Functional specifications	Support base unit	EH-BS3 / 5 / 8 / 3A / 5A / 6A / 8A / 11A / 8R	EH-BS3 / 5 / 8 / 3A / 5A / 6A / 8A	
	Number of modules	22 modules / EH-IOCP2	16 modules / EH-IOCP(2)	
	Number of I/O points	1,408 points: Digital I/O 176 ch : Analog I/O*2	1,024 points: Digital I/O, 128 ch : Analog I/O	
	Expansion unit	1 (use by EH-IOC, EH-IOCH and EH-IOCH2)		
	Refresh time	500 µs		5 ms
	Self-check	WDT check		WDT check System memory check
	Error indication	LED		
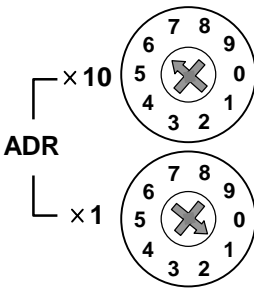
*1 Each I/O size of EH-IOCP2 is expanded from 128 bytes to 244 bytes by software version 0014 or newer.
*2 The output hold function of EH-IOCP2 is supported by software version 0014 or newer.

9.4   EtherCAT Slave Controller
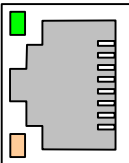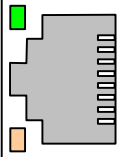
Name and function of each part		Model name	EH-IOCA
		Weight	0.14 kg (0.31 lb.)
		Dimensions (mm (in.))	

Lock button

LED display

Node address switch

Reset switch

Communication connector (IN)

Communication connector (OUT)

45 (1.77)   95 (3.74)

100 (3.94)

Name	Function
Lock button	Press this button to remove the module from the base unit. The module can be fixed firmly by a M4 × 10mm (0.39in) screw.
LED display	The status of module is displayed on this LED.
Node address switch	This is the switch to set the node address.
Reset switch	The module can be reset by pressing this switch when an error is detected.
Communication connector (IN)	This is the connector to connect the incoming communcation cable.
Communication connector (OUT)	This is the connector to connect the outgoing communicaiton cable.

Description of LED display

Outline	LED name	Indication	Details
	POW	Power supply (Green)	On : indicates that the 5V DC power is supplied. Off : indicates that the 5V DC power is not supplied or reset switch is on.
	RUN	Status (Green)	Display an EtherCAT communication status. **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. **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

The state of LED is indicated below.

Description of Rotary switch

Rotary switch	Symbol	Meaning	Details of setting
ADR ×10 ×1 [Default setting : 00]	×10 (Tens digit)	Station No. (1 to 99)	The station No. of EtherCAT network is set from 1 to 99. The tens digit is set by the upper rotary switch. The ones digit is set by the lower rotary switch.
	×1 (Ones digit)		

The node address of EH-IOCA is depending on the node address method of the EtherCAT master unit. If the EtherCAT master uses the fixed node address method, the rotary switch setting of EH-IOCA is valid. If the EtherCAT master uses the logic node address method or auto increment address method, the rotary switch of EH-IOCA is invalid. If the EtherCAT master uses the logic nodes address method or auto increment address method, please set the rotary switch to "00".

Description of Connector

Connector	Symbol	Indication	Details
LINK IN ACT LINK OUT ACT	IN OUT	Communication connector	RJ45 8-pin connector. Terminal layouts are shown below.
				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	
	LINK	LINK LED (Green)	LINK LED lights up if the communication device is connected with a cable.
	ACT	ACT LED (Orange)	ACT LED is flashing during operation.

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.

Item	Details
Twisted pair cable	100BASE-TX (CAT 5 or higher) STP cable
RJ45 connector	CAT 5 or higher, Shielded
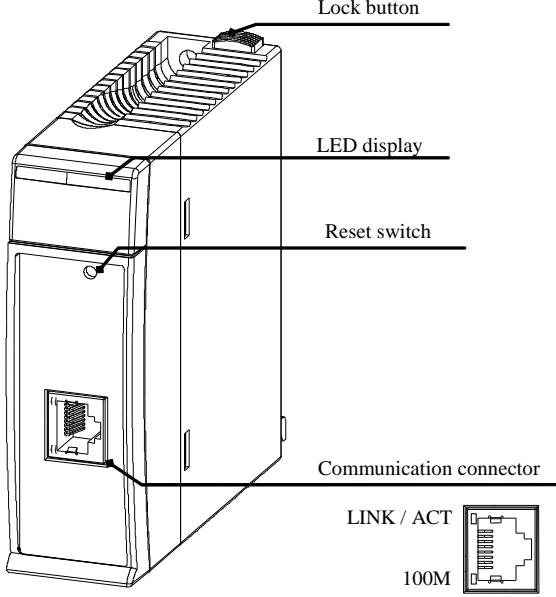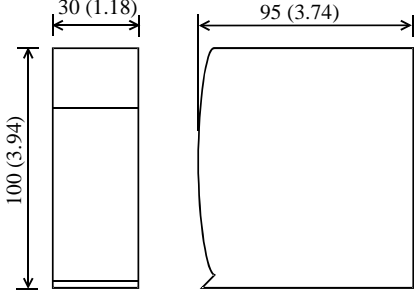
The maximum cable length between connected nodes is 100 m. Note that some cables do not guarantee 100 m. In general, if the conductors are strand wire, the transmission performance will be lower than solid wire and the operation at 100 m distance cannot be guaranteed. Confirm details with the cable manufacturer.

Performance specification

Item		Specifications
Communication specifications	Communication protocol	EtherCAT protocol
	Transmit modulation method	Base band
	Transmit speed	100 Mbps
	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 µs 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 µs
	Self-check	WDT check
	Error indication	LED
	Current consumption	350 mA

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

9.5   FL-net Module 3

Name and function of each part		Model name	EH-FLN3

Model name	EH-FLN3
Weight	0.12 kg (0.26 lb.)
Dimensions (mm (in.))	

30 (1.18)   95 (3.74)   100 (3.94)

LINK / ACT

100M

Name	Function	Remarks
Lock button	Press this button to remove the module from the base unit. The module can be fixed firmly by a M4 × 10mm (0.39in) screw.	
Communication connector	RJ45 type connector. LINK / ACT LED is turned on green at the time of cable connection and blinking during communicating. 100M LED is turned on orange at 100 Mbps, and is turned off at 10 Mbps.	
LED display	The status of module is displayed on this LED.	
Reset switch	The module can be reset by pressing this switch when an error is detected.	

Description of LED display

LED	LED name	Indication	Details
	POW	Power supply (Green)	Display the power(5 V DC) status. **State / Details** Off — Power off Green — Power on
	LNK	Network status (Green)	Display the entry state of FL-net network. **State / Details** Off — Not participation in network Green — Participation in network
	TxD	Transmit (Green)	Display transmission status. **State / Details** Off — Not sending data Green — Sending data
	RxD	Receive (Green)	Display receiving status. **State / Details** Off — Not receiving data Green — Receiving data
	PER	Parameter error (Red)	Display parameter status. **State / Details** Off — No error Red — Parameter error
	HER	Hardware error (Red)	Display hardware status. **State / Details** Off — No error Red — Hardware error

Description of Side DIP switch

↓ Downward
Position is ON

Downward position is ON side in case of side view like left figure.
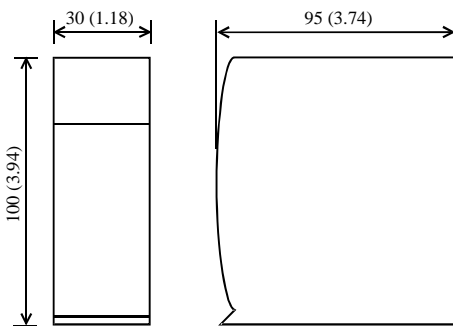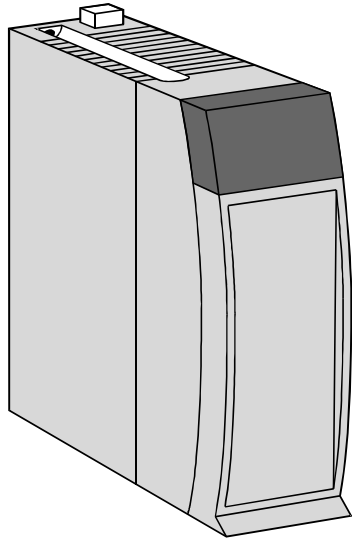
No.	Setting description	Details
1	Communication mode selecting [Default setting: OFF]	Sets up the communication speed. | Bit1	Position	Communication mode
OFF		10M / 100 Mbps Auto negotiation
ON		10 Mbps fixed	
2	No use [Default setting: OFF]	Please keep off.
3	No use [Default setting: OFF]	Please keep off.
4	No use [Default setting: OFF]	Please keep off.

Performance specification
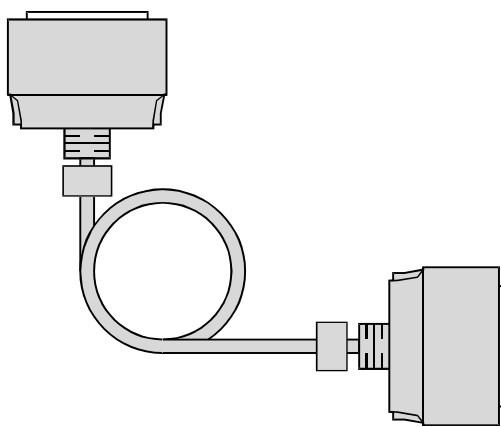
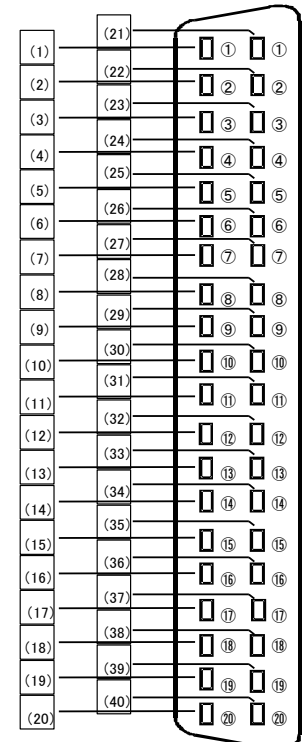|	Item	Specifications
Communication specifications	Communication protocol	FL-net Ver.3.01 class 1
	Baud rate	10M / 100Mbps Auto Negotiation
	Modulation	Baseband transmission
	Electrical interface	Conforms to IEEE802.3 (Conforms to CSMA / CD)
	Communication protocol	UDP/IP FA link protocol
	Communication cable	10 / 100BASE-T CAT5(UTP)
	Maximum transmission distance	100m
	Maximum number of nodes	254 nodes
Functional specifications	Number of modules	2modules / CPU, Mounting position is the slot 0 to 7
	Cyclic transmission	Area1：8 kbits Area2：8 kwords
	Message transmission	Not supported
	Self-check	System memory check WDT check

Chapter 10 Accessories
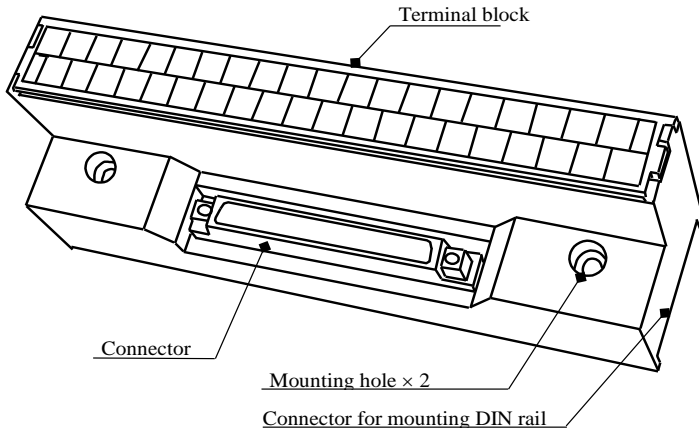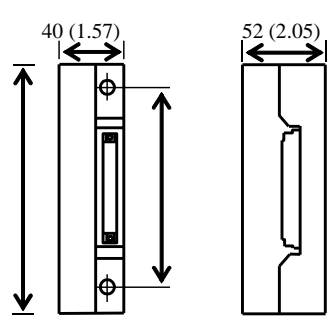
10.1 Dummy Module
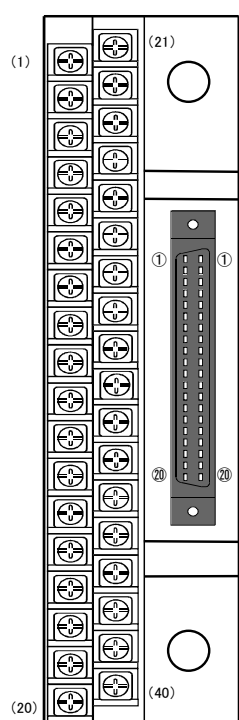
Name and function of each part	Type (Weight)	EH-DUM (Approx. 0.06 kg (0.132 lb.))
	Dimensions (mm (in.))	30 (1.18) · 95 (3.74) · 100 (3.94)
Function	This module is used for protecting non-used slots.	

10.2 Expansion Cable

Name and function of each part	Type	EH-CB05A / 10A / 20A
	Weight	Approx. 0.21 (0.46) / 0.24 (0.53) / 0.30 kg (0.66 lb.)
	Length	0.5 (1.64) / 1.0 (3.28) / 2.0 m (6.56 ft.)
Function	This is the cable between the base unit and the I/O controller on the expansion base. Both connectors are identical; the cable does not have a specific direction.	

10.3   Terminal Block for 32/64 Points I/O Modules

Name and function of each part	Type (Weight)	HPX7DS-40V6 (Approx. 0.22 kg (0.49 lb.))
	Dimensions (mm (in.))	

Terminal block

Connector

Mounting hole × 2

Connector for mounting DIN rail

40 (1.57)   52 (2.05)

Item	Description
Terminal block	This is a terminal block for connecting the external wiring.
Connector	This is a connector with 40 pins = 20 × 2 lines for connecting each module.
Mounting hole	These holes are used when mounting the terminal unit to a panel. Use M4×25 mm screws.
Connector for mounting DIN rail	This connector is used when mounting the terminal unit to a DIN rail.

Terminal configuration

Terminal block   Connector
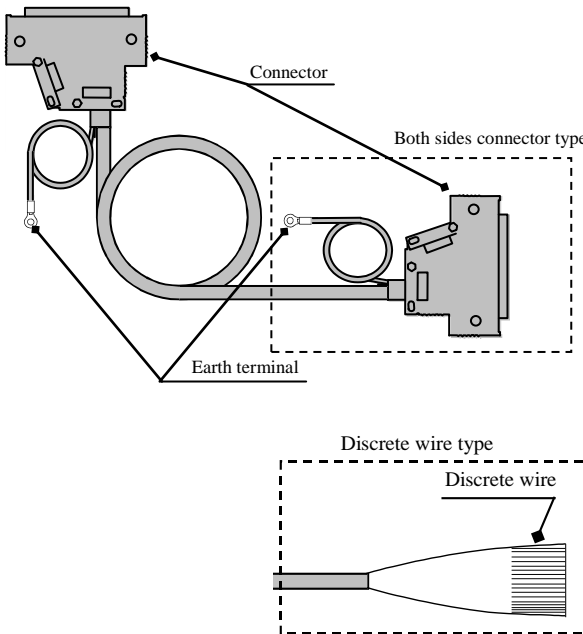
I/O and Terminal block

EH-XD32				EH-YT32 / YTP32			
I/O No. (Signal)	Terminal block No.	I/O No. (Signal)	Terminal block No.	I/O No. (Signal)	Terminal block No.	I/O No. (Signal)	Terminal block No.
Bit00	1	Bit16	21	Bit00	1	Bit16	21
Bit01	2	Bit17	22	Bit01	2	Bit17	22
Bit02	3	Bit18	23	Bit02	3	Bit18	23
Bit03	4	Bit19	24	Bit03	4	Bit19	24
Bit04	5	Bit20	25	Bit04	5	Bit20	25
Bit05	6	Bit21	26	Bit05	6	Bit21	26
Bit06	7	Bit22	27	Bit06	7	Bit22	27
Bit07	8	Bit23	28	Bit07	8	Bit23	28
C	9	C	29	C	9	C	29
Bit08	10	Bit24	30	S	10	S	30
Bit09	11	Bit25	31	Bit08	11	Bit24	31
Bit10	12	Bit26	32	Bit09	12	Bit25	32
Bit11	13	Bit27	33	Bit10	13	Bit26	33
Bit12	14	Bit28	34	Bit11	14	Bit27	34
Bit13	15	Bit29	35	Bit12	15	Bit28	35
Bit14	16	Bit30	36	Bit13	16	Bit29	36
Bit15	17	Bit31	37	Bit14	17	Bit30	37
C	18	C	38	Bit15	18	Bit31	38
N.C.	19	N.C.	39	C	19	C	39
N.C.	20	N.C.	40	S	20	S	40

* **In case of 64-point modules,** the signal No.00 to 31 depends on the table mentioned above. For signal No.32 to 63 (including COM), **consider signal No.00 to 31 as signal No.32 to 63** in above table.
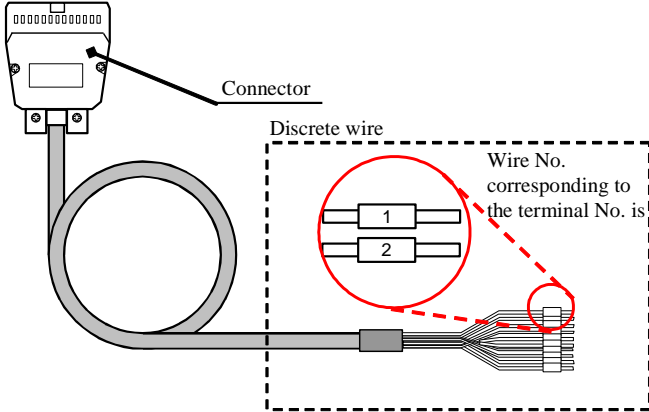
When using the 64-point modules, 2 sets of the terminal block (HPX7DS-40V6) and the connection cable (EH-CBM**W) per module are needed.

10.4   Cable for 32 / 64-Point Modules

Name and function of each part			
	Type (Length) (Both edges connector type)	EH-CBM01W (1 m (3.28 ft.))	
		EH-CBM03W (3 m (9.84 ft.))	
		EH-CBM05W (5 m (16.4 ft.))	
		EH-CBM10W (10 m (32.8 ft.))	
	Type (Length) (One edge connector type)	EH-CBM01 (1 m (3.28 ft.))	
		EH-CBM03 (3 m (9.84 ft.))	
		EH-CBM05 (5 m (16.4 ft.))	
		EH-CBM10 (10 m (32.8 ft.))	
	Diameter	AWG# 28	

Item	Description
Connector	This is the connector to connect the 32/64-point I/O module or the terminal block HPX7DS-40V6.
Discrete wire	These are discrete wires to connect I/O devices.
Earth terminal	Uses this terminal for class D grounding

Cable code for wiring					
Connector Pin No.	Color	Dot (Color)	Connector Pin No.	Color	Dot (Color)
1	Orange	■(Black)	21	Orange	■ ■ ■(Black)
2	Orange	□(Red)	22	Orange	□ □ □(Red)
3	Gray	■(Black)	23	Gray	■ ■ ■(Black)
4	Gray	□(Red)	24	Gray	□ □ □(Red)
5	White	■(Black)	25	White	■ ■ ■(Black)
6	White	□(Red)	26	White	□ □ □(Red)
7	Yellow	■(Black)	27	Yellow	■ ■ ■(Black)
8	Yellow	□(Red)	28	Yellow	□ □ □(Red)
9	Pink	■(Black)	29	Pink	■ ■ ■(Black)
10	Pink	□(Red)	30	Pink	□ □ □(Red)
11	Orange	■ ■(Black)	31	Orange	■ ■ ■ ■(Black)
12	Orange	□ □(Red)	32	Orange	□ □ □ □(Red)
13	Gray	■ ■(Black)	33	Gray	■ ■ ■ ■(Black)
14	Gray	□ □(Red)	34	Gray	□ □ □ □(Red)
15	White	■ ■(Black)	35	White	■ ■ ■ ■(Black)
16	White	□ □(Red)	36	White	□ □ □ □(Red)
17	Yellow	■ ■(Black)	37	Yellow	■ ■ ■ ■(Black)
18	Yellow	□ □(Red)	38	Yellow	□ □ □ □(Red)
19	Pink	■ ■(Black)	39	Pink	■ ■ ■ ■(Black)
20	Pink	□ □(Red)	40	Pink	□ □ □ □(Red)

10.5   Cable for Counter Input Module

Name and function of each part			
Connector Discrete wire Wire No. corresponding to the terminal No. is 1 2	Type (Length) (One edge connector type)	EH-CUC01 (1 m (3.28 ft.))	
		EH-CUC02 (2 m (6.56 ft.))	
		EH-CUC03 (3 m (9.84 ft.))	
		EH-CUC04 (4 m (13.1 ft.))	
		EH-CUC05 (5 m (16.4 ft.))	
	Diameter	AWG# 24	

Item	Description
Connector	This is the connector to connect the counter input module.
Discrete wire	These are discrete wires to connect encoders and output devices.

MEMO

Chapter 11 PAC Installation, Mounting, Wiring

For safe use, avoid installing the PAC in the following locations.

- Excessive dusts, salty air and / or conductive materials (iron powder, etc.)

- Direct sunlight

- Temperature less than 0 °C or more than 55 °C

- Dew condensation

- Humidity less than 5 % or more than 95 %

- Direct vibration and / or impact to the unit

- Corrosive, explosive and / or combustible gasses

- Water, chemicals and / or oil splashing on the PAC

- Close to noise emission devices

11.1   Installation

(1) Installation location and environment

  (a) Use the module in the environment as indicated in chapter 3.1 "General Specifications" when installing the HX-CPU.

  (b) Mount the PAC onto a metal plate.

  (c) Install the PAC in a suitable enclosure such as a cabinet, which is opened with a key, tool, etc.

(2) Installation of a base unit

  (a) Precaution when installing the base unit

    1] Fix the base unit securely with 4 screws (M4, length 20 mm (0.79 in.) or longer) or on a DIN rail when installing it.

    2] Use the unit within the specified allowable ambient temperature range.

      a) Allow ample space for air circulation. (50 mm (1.97 in.) or more at the top and the bottom, 10 mm (0.39 in.) or more at the right and left side)

      b) Avoid installing the unit directly above equipment that generates a lot of heat (heater, transformer, large-capacity resistance, etc.).

      c) Install a fan or a cooler to lower the ambient temperature to below 55 °C when the temperature reaches more than 55 °C.

    3] Avoid mounting of the unit inside a panel where high-voltage equipment is installed.

    4] Install the unit 200 mm (7.87 in.) or more away from high-voltage wires or power wires.

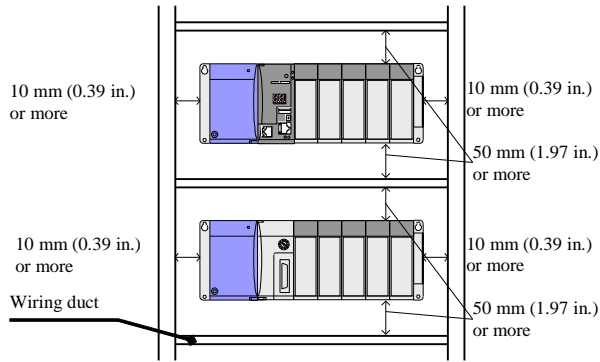   5] Avoid mounting of the unit upside down, in vertical, or in horizontal.
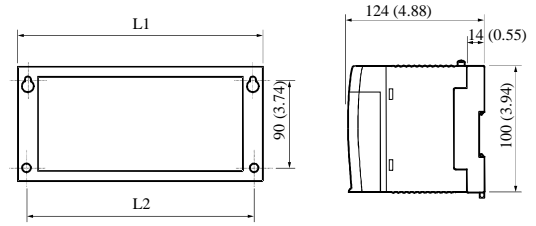
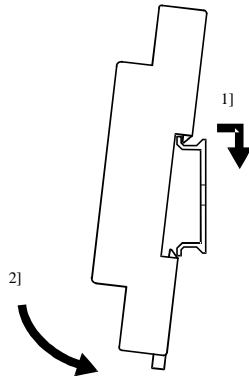Figure 11.1 Installation distances

Figure 11.2 External dimensions

Table 11.1 Dimensional table

Base	L1 (External dimensions)	L2 (Mounted dimensions)
EH-BS3A	222.5 (8.76)	207 (8.15)
EH-BS5A	282.5 (11.2)	267 (10.51)
EH-BS6A	312.5(12.31)	297(11.70)
EH-BS8A	372.5 (14.67)	357 (14.06)
EH-BS11A	462.5 (18.21)	447 (17.6)
EH-BS8R	432.5 (17.01)	417 (16.42)

Unit: mm (in.)

(b) Mounting to a DIN rail

Attaching to a DIN rail

1] Hook the upper edge of the guidance on the base unit to the DIN rail.
2] Press the bottom part of the base unit until it clicks.
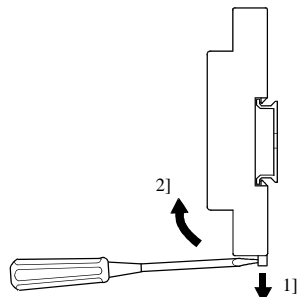
* Make sure the base unit is securely fixed after installation.

Fixing the unit
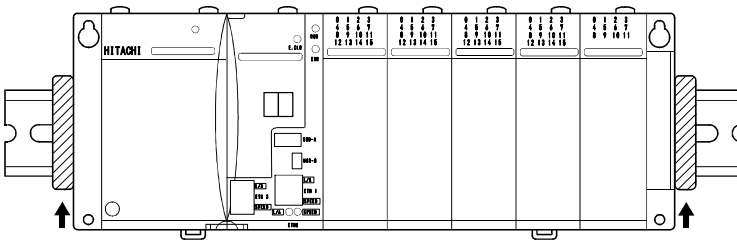
Secure the unit by installing DIN rail fixing brackets from both sides. Otherwise, the base unit may slide away.
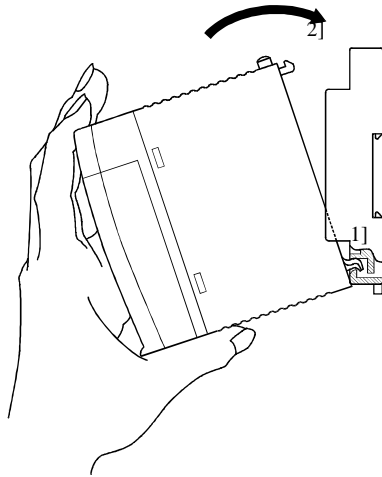
Removing the unit from the DIN rail

1] Pull down the white lever.

2] Pull the bottom side of the base unit towards you.

11.2   Mounting Module

(1) Installing

1] Hook the latches at the bottom of the module to the holes of the base unit.
2] Press down the upper part of the module until it clicks.

*1 Make sure the module does not fall out after mounting.
*2 The power module can be mounted on the left end slot only.
*3 The CPU module and the I/O controller can be mounted only on the right to the power module.

The modules can be fixed firmly with M4×10 mm screws.

(2) Removing
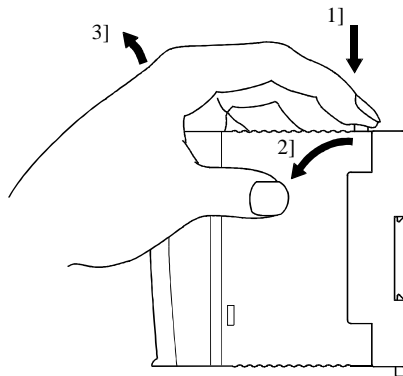
1] Push the lock button.
2] With the lock button pushed in, pull the top of the module toward the front.
3] Raise it toward the top and pull it out.

* The power module has two lock buttons. Both buttons must be pressed.

11.3   Wiring

(1) Separation of the power system

Several different power supplies are used in the field such as power for PLC, power for I/O and power for general equipment. These power supplies should be separated as much as possible.

If these power supplies come from one main power source, separate them with transformers, so that each power supply is an independent system.
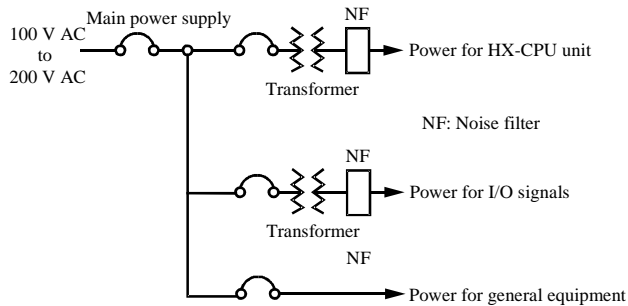

Figure 11.3 Example of power system diagram

(2) Fail safe

1] Install interlock circuits outside the PAC.

When the PAC system is powered up, the system might not work as expected due to differences of startup time between several power supplies. In addition, hardware equipment like power supplies or PLC's can fail in general. In order to prevent the entire system down from a local failure, install emergency stop circuits, protection circuits, interlock circuit and other important circuits which can prevent a machine damage or serious accident outside of PAC system from the view point of fail safe.

Do not make interlock circuits for external load with the power for relay drive of EH-YR12 because the relays in EH-YR12 might work by power in aluminum electrolytic capacitors without power supplied.

2] Install a lightning arrester

To prevent damage to equipment as a result of being struck by lightning, we recommend installing lightning arresters for power supplies.

If AC power is removed and the power consumption of 5 V DC is small, 5 V DC can remain longer time than AC power. If digital AC input modules are used and such time difference is critical, avoid that by installing off-delay timers.
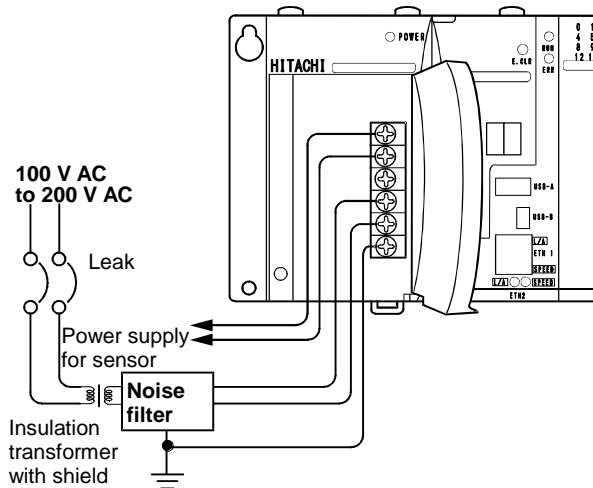
(3) Wiring to the power module

Figure 11.4 Wiring power diagram

100 V AC
to 200 V AC

Leak

Power supply
for sensor

Noise
filter

Insulation
transformer
with shield

(a) For power supply wiring, use a cable of 2 mm^2 (0.0031 in^2.) or more to prevent a voltage drop.

(b) The function ground terminal (FE terminal) should be connected to the ground with 2 mm^2 (0.0031 in^2) or thicker cable with Class D grounding (Max. 100Ω). The appropriate distance for ground cable is within 20 m (65.62 ft.).

1] Grounding of instrumentation cabinets and relay cabinets can be shared.

2] Avoid joint grounding with equipment that can generate noise such as high-frequency heating furnace, large power panel (several kW or more), thyristor exchanger, electric welders, etc.

3] Make sure to connect a noise filter (NF) to the power cable.

(c) The terminal screw size is M3. Tighten screws within a torque range of 0.49 to 0.78 N·m when wiring.

(d) Use the same power supply system for the basic and expansion units.

(4) Wiring cable for I/O signals
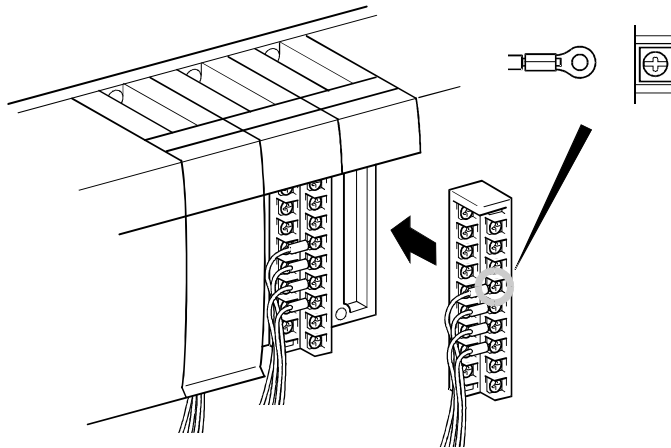

The terminal screw size is M3.

Tighten within a torque range of 0.49 to 0.78 N·m.

Use crimp terminals with diameter of 6 mm (0.24 in.) or less when using it.

Use only up to 2 crimp terminals in the same terminal. Do not use 3 or more crimp terminals in the same terminal.

Use a cable thickness of 0.75 mm^2 (0.0011 in^2.) at the maximum. (Use a 0.5 mm^2 (0.00075 in^2.) cable when adding 2 crimp terminals in the same terminal.)

* Use shielded cables for the relay output modules in order to comply to CE marking, especially to the EMC requirements.

Attaching the terminal block
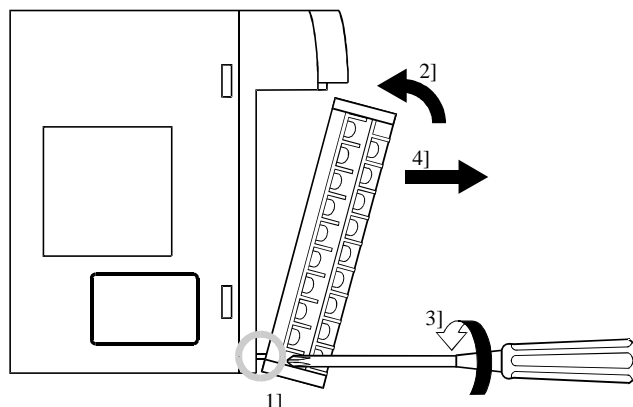
1] Inset the mounting screw to the female thread on the lower part of the module.

2] Push the top of the terminal block until it is latched with a click.

3] Tighten the terminal block mounting screw while holding down the upper part of the terminal block.

4] Pull on the top of the terminal block to make sure that it is locked and cannot fall out.

(5) Input wiring for the input module

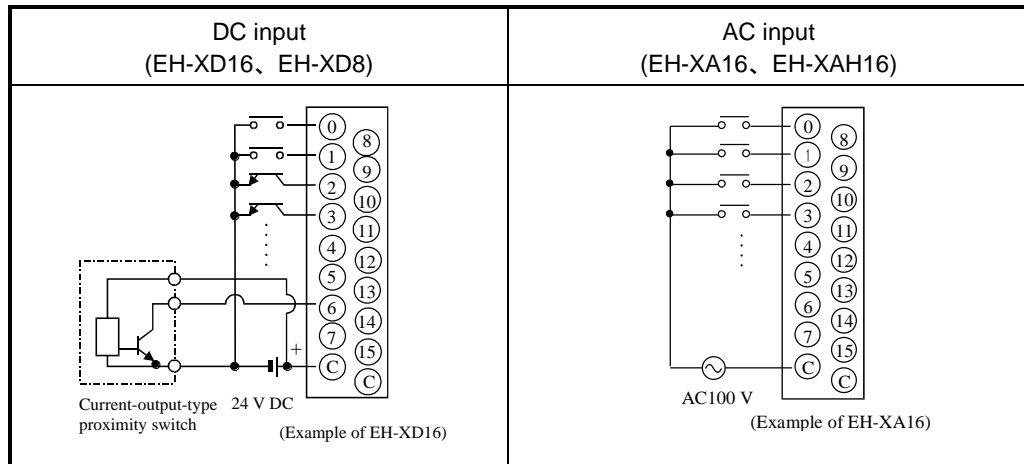| DC input (EH-XD16、EH-XD8)	AC input (EH-XA16、EH-XAH16)

Figure 11.5 Input wiring

(a) DC input module

1] When 24VDC is connected between the input terminal and the common terminal (C), the input status changes to ON, and approximately 6.9 mA current in case of EH-XD8, or approximately 4 mA current in case of EH-XD16, flow to the external input contacts.

2] As for sensors such as proximity switches and photoelectric switches, current-output-type (transistor open collector) can be directly connected. For voltage-output-type sensors, connect them via transistors.

3] Measures to prevent contact failure in high load current contact.
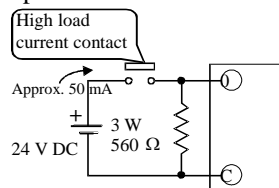
The input current is approximately 6.9 mA for the EH-XD8, and approximately 4 mA for EH-XD16. If it is necessary to use high load current, install a resistance as shown in the diagram at left to supply sufficient current to the contact to prevent from contact failure.

4] Limit the wiring length within 30 m (98.43 ft.).

(b) Wiring for 32 / 64-point input module (EH-XD32, EH-XD64) (Based on CE marking)
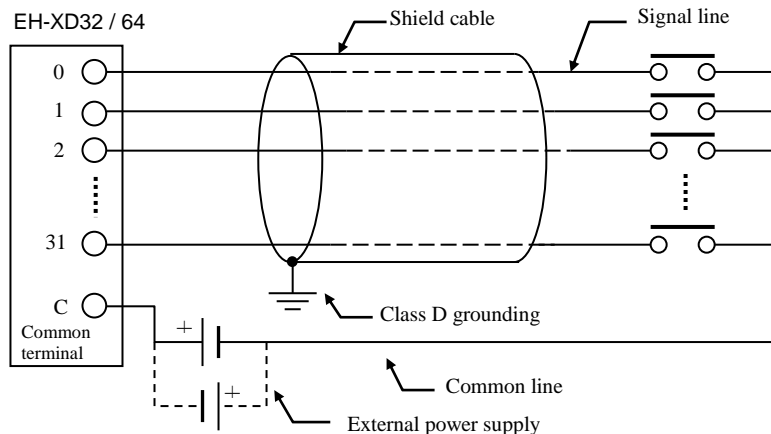
*1 Wire the signal lines with shielded cables and ground the shield with class D.

*2 Wire the common line outside of the shield and put apart from power lines for drives, I/O lines and power supply line.

*3 The external power supply for input load should be connected to the common terminal as close as possible.

(c) AC input module

When using the AC input module with longer cables, voltage may be generated on the input terminal though there are no actual signals, because the leak current may flow by the stray capacity between wirings.
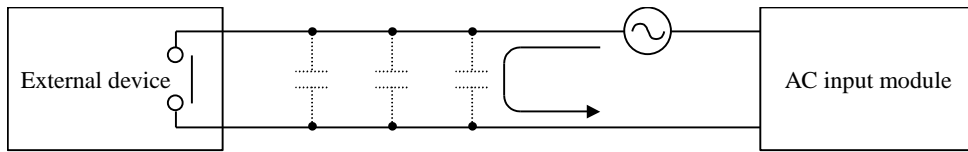
There are the following two methods 1] and 2] as countermeasures. Please limit the voltage caused by the electrostatic combination on the input terminal, to half the maximum OFF voltage level of the input module.

1] Reduce the impedance of the input module by connecting a dummy resistance with the input terminal in parallel.

2] Connect the external power supply to the external device side.
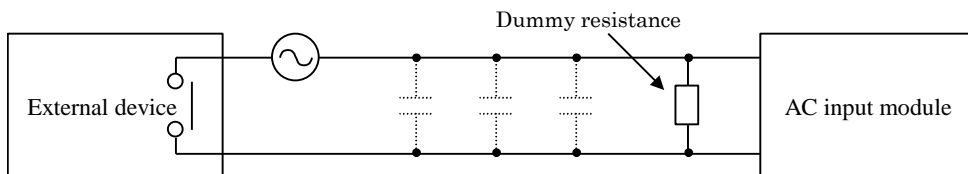
(6) Output wiring for the output module

Item	Relay output (EH-YR12)	Relay output (EH-YR16)	Transistor output (sink type) (EH-YT16, EH-YT8)	Transistor output (source type) (EH-YTP16、 EH-YTP16S, EH-YTP8)
External wiring				

Figure 11.6 Output wiring

(a) Wiring for the relay output module

1] Life of relay contact

Life curve of relay contact
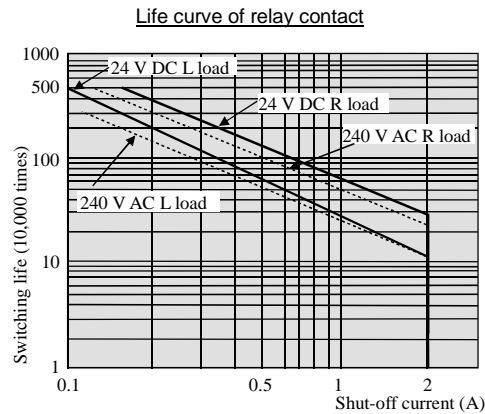
The life of the contact is also in squared reverse proportion to the current, so be aware that interrupting rush current or directly driving the condenser load will drastically reduce the life time of the relay. When switching is done with high frequency, use a transistor output module.

2] Surge killer

For inductive load, connect a surge killer (condenser 0.1 μF, + resistance of around 100 Ω) in parallel to the load. Also, for DC load, connect a flywheel diode.

3] Fuse

A fuse is not built-in in this module. Install a 6A fuse to the common line to prevent from fire.

4] Power supply for driving the relay

Make sure to use the correct 24 V DC power supply polarity to supply the relays. There is a risk that the internal circuit will be damaged if the wiring is wrong. In addition, do not make interlock circuits for external load with the power for relay drive.

(b) Wiring for the transistor output module

1] Flyback diode

Install flyback diodes in parallel in inductive load.

2] S and C terminals

Make sure to use the S terminal and C (common) terminal, otherwise the internal flyback diode does not work, which could result in module failure.

3] Fuse

A fuse is inserted in the common to prevent from fire, but this does not protect transistor devices. Therefore, note that transistor devices could be damaged when the external load is short-circuited. Please contact us for repair if external load is short-circuited.

Also, if the fuse is blown, there will be no output even if the LED lights up.

(c) Wiring for the 32 / 64-point output module (EH-YT32 / YTP32, EH-YT64 / YTP64)(Based on CE marking)
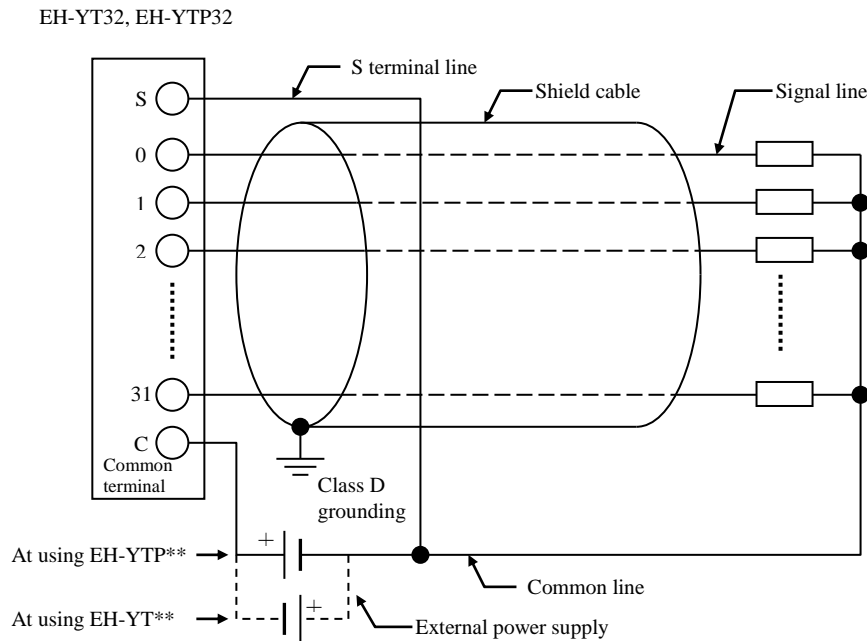
EH-YT32, EH-YTP32

*1 Wire the signal lines with shielded cables and ground the shield with class D.
*2 Wire the common line and S-terminal line outside of the shield and put apart from power lines for drives, I/O lines and power supply line.
*3 The external power supply for input load should be connected to the common terminal as close as possible.

(7) I/O wiring for the analog module

- Do not apply voltage to the analog inputs exceeding the rated input voltage. Do not apply current to the analog inputs exceeding the rated input current. Applying wrong voltage or current may damage the modules and may present a risk of fire.

- Short-circuit unused channels of the analog input modules.

- Short-circuit unused channels of the current outputs of analog output modules.

- Use shielded cables for analog signals and route analog signals apart from other power lines and signal lines of different voltage. Connect the one side of shield to earth ground. However, grounding on the both sides or not grounding may be more effective depending on noise environment. Take an appropriate grounding.

- Route the AC power line and the signal lines separately as much as possible.

- Route the signal lines as close as possible to grounded surfaces such as cabinet elements, metal bars and cabinets panels.
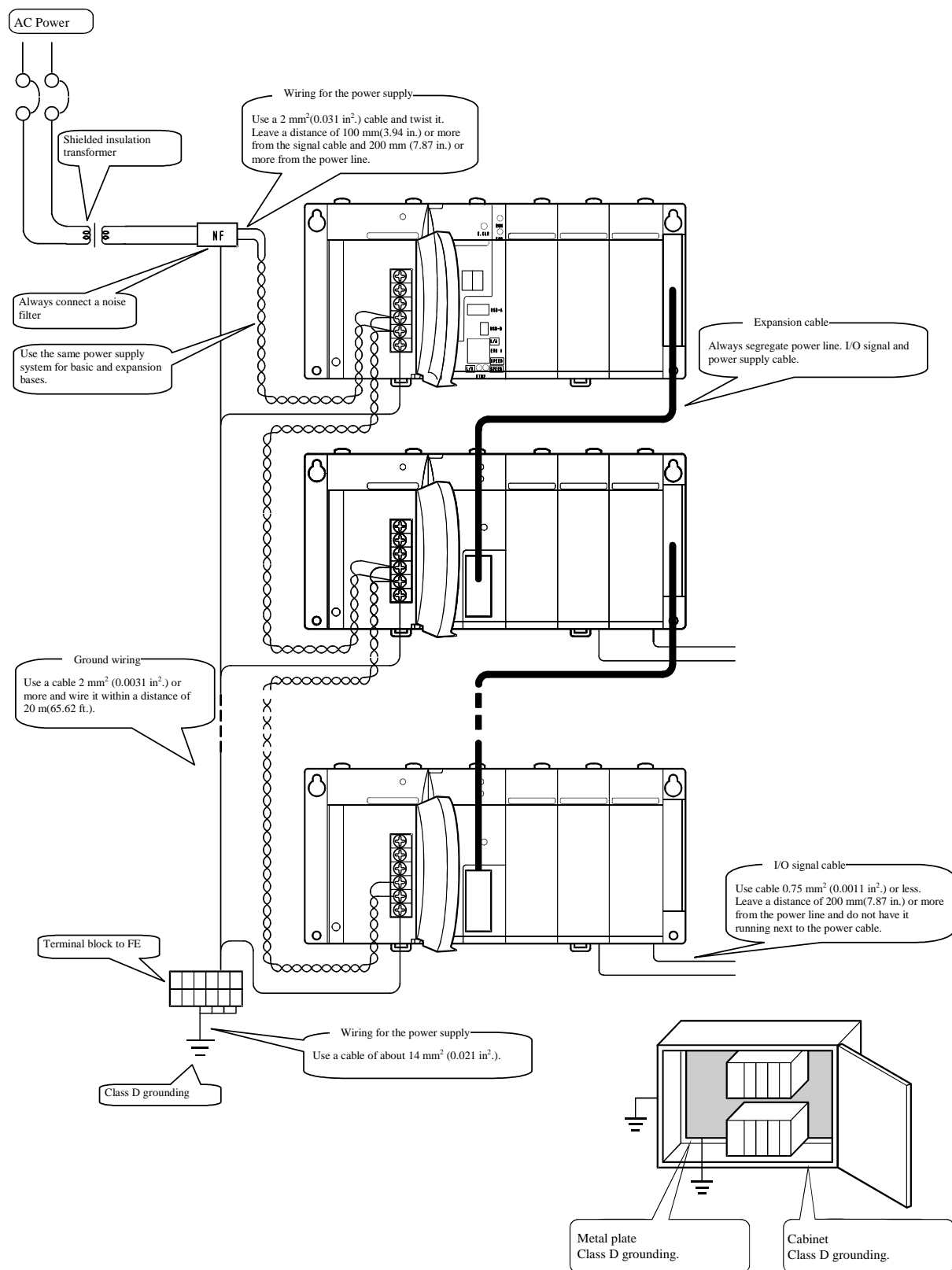
(8) Wiring to the module terminal

Wiring for the power supply
Use a 2 mm^2(0.031 in^2.) cable and twist it. Leave a distance of 100 mm(3.94 in.) or more from the signal cable and 200 mm (7.87 in.) or more from the power line.

AC Power

Shielded insulation transformer

Always connect a noise filter

Use the same power supply system for basic and expansion bases.

Expansion cable
Always segregate power line. I/O signal and power supply cable.

Ground wiring
Use a cable 2 mm^2 (0.0031 in^2.) or more and wire it within a distance of 20 m(65.62 ft.).

Terminal block to FE

Wiring for the power supply
Use a cable of about 14 mm^2 (0.021 in^2.).

Class D grounding

I/O signal cable
Use cable 0.75 mm^2 (0.0011 in^2.) or less. Leave a distance of 200 mm(7.87 in.) or more from the power line and do not have it running next to the power cable.

Metal plate Class D grounding.

Cabinet Class D grounding.

Figure 11.7 Example of wiring

Chapter 12 Maintenance and Inspection

Daily and periodic inspections for HX-CPU are necessary to maintain your system safely.

12.1　Daily and Periodic Inspection

(1) Daily inspection

Check the following items while the system is running.

Table 12.1 Items for daily inspection

Item	LED display	Inspection method	Normal status	Main cause of error
Power module display	POW	Visual check	ON	OFF: Power supply error, etc.
CPU module display	RUN	Visual check	ON (Running)	OFF: Microprocessor error, memory error, etc. Refer to chapter 3 for further information.
	ERR	Visual check	OFF	ON: Serious errors such as microprocessor error or memory error, etc. Refer to chapter 3. Blink: 7x error
	7-segment	Visual check	00	Self-diagnosis error code is displayed.

*1 If power off time is more than 1 week, realtime clock data could be lost due to super capacitor discharged.

(2) Periodic inspection

Turn off the power for the external I/O circuit, and check the following items once every six months.

Table 12.2 Items for periodic inspection

Part	Item	Check criteria	Remarks
Programming software	Check the operation of the programming software	All switch and display lamps work properly.	
Power supply	Check for the voltage fluctuations	EH-PSA, EH-PSR : 85 to 264 V AC EH-PSD : 21.6 to 26.4V DC	Tester
I/O module	Output relay life	Electrical life　　200,000 times Mechanical life　10 million times	Refer to the relay contact file curve (chapter 11).
	LED	Turns ON / OFF correctly	
	External power voltage	Within the specification for each I/O module.	Refer to the specifications of I/O module
Battery (Lithium battery)	Check voltage and status	ERR lamp not blinking. Within 5 years after replaced.	
Mechanical connections	(1) All modules are securely fixed. (2) All connectors are securely fixed. (3) All screws are tightened. (4) No damage in all cables.	No defects	Tighten Check insertion Tighten Visual check
Ambient environment	(1) Temperature (2) Humidity (3) Others	0 to 55 °C 5 to 95 % RH (no condensation) No dust, foreign matter, vibration	Visual check
Spare part	Check the number of parts, the storage condition	No defects	Visual check
Program	Check program contents	Compare the contents of the latest program saved and CPU contents, and make sure they are the same.	Check both master and backup.

12.2 Life of Product

The lifetime of electrolytic capacitors used in the power module is limited. Electrolytic capacitors are used in some of I/O modules to improve noise resistance. If the lifetime is exceeded, the performance of the product is not guaranteed. Make sure to conduct inspection and maintenance as follows.

(1) Power module

Many electrolytic capacitors are used in the power module. It is said that the lifetime of electrolytic capacitor would be half when ambient temperature increases 10 °C.

If the lifetime of electrolytic capacitors is exceeded, the output power becomes unstable especially when the output current is high due to many outputs are activated for example.

Prepare spare units with considering 5 years lifetime in case the ambient temperature is 30 °C. For longer lifetime, take account of installation location in terms of temperature and air circulation around the power unit.

(2) CPU module

Some electrolytic capacitors are used in the CPU module also. If the lifetime of the electrolytic capacitors is exceeded, the CPU module might not work correctly since the noise resistance is not enough. Make sure to overhaul the CPU module periodically.

The CPU module has capacitors to maintain the realtime clock data. The backup time is 7 days. The lifetime of the capacitor is approximately 31,000 hours, but it depends on the ambient temperature. When the capacitor lifetime ends, the backup time will be shorter. If the realtime clock function is used and NTP function is not used and one of the following conditions is fulfilled, use the optional battery.

- The realtime clock must work after 8 days or more of a power failure time.
- HX-CPU is used in ambient temperature more than 50°C.

Be noted of the following descriptions about the lifetime of the battery.

- If the battery is used, make sure to enable the battery error detection. Refer to section 2.6 Configuration in the HX series application manual (Software) for further information.
- The lifetime of the battery is counted as the total power failure time of the CPU module.
- When the ERR LED blinks or "71" is displayed on the 7-segment LED, replace the battery within 7 days.
- The durable lifetime of the battery is 5 years. Even if the battery does not reach the end of life, replace it every 5 years.
- The lifetime of the battery is shown below.

Battery life (Total power failure time)[Hr]	
Guaranteed value (MIN) @55 °C	Actual value (MAX) @25 °C
25,000	67,000

Chapter 13 Troubleshooting

13.1 Error Codes

The HX-CPU has a 7-segment display and an error LED to indicate an error status as listed below. If two or more errors are detected at the same time, the lower error code (higher priority) is displayed. When an error is detected, read the description and follow the countermeasures depending on the error level.


Error clear switch
RUN LED (Green)
ERR LED (Red)
7-segment LED
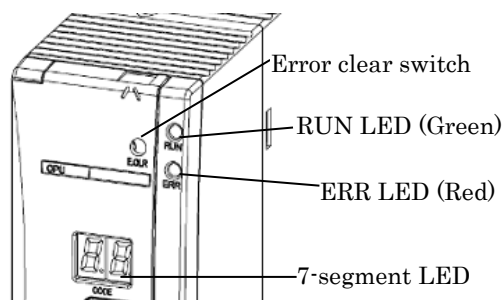
Error code	Error level	Countermeasure
88, 11 to 1F	Serious error	Cycle power. If the Error can't be solved, contact your local supplier.
20 to 34	Exception	Exception status is cleared only by Reset operation. Execute Reset cold / warm / origin by HX-CODESYS
70 to 79	Warning	The user program execution does not stop by a warning. If you need to activate an alarm or any action by a warning, use the CmpHIESErrors_HX library. Press E.CLR button to clear the error code.

Err. code	Error name [Detected when]	Description	PAC System*	Applica-tion	ERR LED
88	Hardware watchdog error [Always]	The watchdog timer detected a microcomputer overload error because the microcomputer did not operate according to the system program.	Stop	Stop	Blink
11	System ROM error (OS) [Power on]	Checksum value of system program (OS) in FLASH does not match the calculated checksum.	Stop	Stop	Blink
12	Read / Write check failed in RAM [Power on]	Read / write check for system RAM has failed.	Stop	Stop	Blink
17	System ROM error (File system) [Power on]	Checksum value of system program (File system) in FLASH does not match the calculated checksum.	Stop	Stop	ON
18	MAC address error [Power on]	MAC address is missing or wrong value.	Stop	Stop	ON
1A	Initialize failed in power management device [Power on]	Initialization of power supply has failed.	Stop	Stop	ON
1F	Flash access failed [Power on]	Access to a FLASH memory has failed.	Stop	Stop	ON

: ON,   : Blink,   ● : OFF

* When a PAC system stops, because a system program of PAC stops, you can't communicate with HX-CODESYS.

Err. code	Error name [Detected when]	Description	PAC System	Application	ERR LED
20	Illegal instruction [Always]	An illegal instruction was detected in the processor.	Run	Stop	Blink
21	Retain identify mismatch [Power on]	An Error of checksum value for retain memory data was detected.	Run	Stop	Blink
23	Unresolved external references [Always]	A library doesn't exist in CPU.	Run	Stop	Blink
24	Software watchdog error [Always]	The actual cycle time has exceeded the watchdog time. Set longer watchdog time.	Run	Stop	Blink
25	Processorload watchdog [Always]	The processor load exceeded 80 %.	Run	Stop	Blink
27	Division by zero [Always]	The divisor of a division command is 0 in the IEC program.	Run	Stop	Blink
28	FPU* Division by zero [Always]	The divisor of a division command is 0 in the IEC program (FPU).	Run	Stop	Blink
29	Access violation [Always]	Access violation was detected in the processor.	Run	Stop	Blink
2A	Overflow [Always]	Overflow was detected in the processor.	Run	Stop	Blink
2B	FPU* Overflow [Always]	FPU overflow was detected in the processor.	Run	Stop	Blink
2C	FPU* Underflow [Always]	FPU underflow was detected in the processor.	Run	Stop	Blink
2E	FPU* Invalid operation [Always]	FPU Invalid operation was detected in the processor.	Run	Stop	Blink
31	Load bootproject failed [Power on]	Checksum value of the user program in FLASH does not match the calculated checksum.	Run	Stop	Blink
32	IoConfig Error [Always]	The Modbus setting outside of the specifications was detected.	Run	Stop	●
34	Config file Error [Power on]	Config file Error was detected in the processor.	Run	Stop	Blink

* FPU means a Floating Point Unit of main processor in the HX-CPU.

: ON,　 : Blink,　● : OFF

Err. code	Error name [Detected when]	Description	PAC System	Application	ERR LED
70	I/O Configuration Error [Always]	I/O configuration does not match with actual I/O modules.	Run	Run	Blink
71	Battery error [Always]	Battery voltage is low or battery is disconnected.	Run	Run	Blink
72	Special module failure [Always]	Hardware error is detected in a special module or communication module.	Run	Run	Blink
74	Comm. module configuration error [Always]	Configuration error is detected in a communication module.	Run	Run	Blink
77	FLASH writing failure [FLASH writing]	A failure has been detected while writing FLASH memory or the number of writing times (100,000 times) has been exceeded.	Run	Run	Blink
78	Checksum mismatch in Flash (IP address) [Power on]	The checksum value of the IP address in FLASH does not match the calculated checksum.	Run	Run	Blink
79	Realtime clock initialized [Power on]	The realtime clock was initialized, because power off time exceeds the 7 days of the guarantee time.	Run	Run	Blink

: ON,   : Blink,   ● : OFF

 * If the error cause is removed, the error code remains except for error code 71 (battery error).
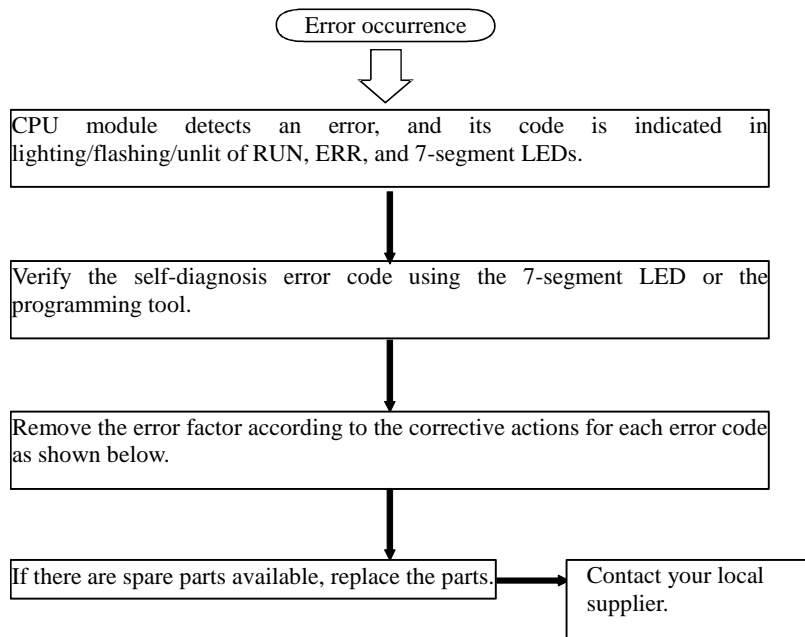
   71 Error and ERR LED blinking automatically disappear if battery is replaced to new one.

   It's possible to deactivate the I/O configuration Error detection and battery error detection in PAC Parameter settings.

   For details, please refer to the application manual [Software].

13.2 Corrective Actions when an Error Occurs

The process flow when an error occurs is shown below.

```
                        ( Error occurrence )
                                 ⇓
  ┌─────────────────────────────────────────────────────────┐
  │ CPU module detects an error, and its code is indicated in │
  │ lighting/flashing/unlit of RUN, ERR, and 7-segment LEDs.  │
  └─────────────────────────────────────────────────────────┘
                                 │
                                 ▼
  ┌─────────────────────────────────────────────────────────┐
  │ Verify the self-diagnosis error code using the 7-segment  │
  │ LED or the programming tool.                               │
  └─────────────────────────────────────────────────────────┘
                                 │
                                 ▼
  ┌─────────────────────────────────────────────────────────┐
  │ Remove the error factor according to the corrective       │
  │ actions for each error code as shown below.                │
  └─────────────────────────────────────────────────────────┘
                                 │
                                 ▼
  ┌────────────────────────────────────────────┐    ┌──────────────────┐
  │ If there are spare parts available, replace │───▶│ Contact your local│
  │ the parts.                                   │    │ supplier.         │
  └────────────────────────────────────────────┘    └──────────────────┘
```

Error code	Error name	Corrective action
88	Hardware watchdog error	Recheck the fixation of the HX-CPU to the basic base unit, and restart the power supply.
11	System ROM error (OS)	If the same error occurs, it is a hardware error in the HX-CPU. Replace the CPU module with a spare unit.
12	Read / Write check failed in RAM	Make sure that there are no machines which generate excessive noise, etc. near HX-CPU system.
17	System ROM error (File system)	
18	MAC address error	
1A	Initialize failed in power management device	
1F	Flash access failed	
20	Illegal instruction	Check the user program.
21	Retain identify mismatch	Login to HX-CPU and reset cold.
23	Unresolved external references	Check the library. In case a user created library is used, please ensure that the checkbox "External implementation" in the property dialog of the Application is disabled.
24	Software watchdog error	Change the software watchdog time of the user program.
25	Processorload watchdog	Change the user program to reduce the Processor load. For example, increase the task cycle time.
27	Division by zero	Change the user program to prevent the division by zero.
28	FPU Division by zero	Check the user program.
29	Access violation	
2A	Overflow	
2B	FPU Overflow	
2C	FPU Underflow	
2E	FPU Invalid operation	
31	Load bootproject failed	The contents of the user program is corrupted. Transfer the program again after initialization.
32	IoConfig Error	Set the correct settings.
34	Config file Error	Transfer the program again and reset the error. When using the supporting function for security protection, reconfigure the supporting function for security protection settings.

Error code	Error name	Corrective action
70	I/O Configuration Error	Check the I/O assignment. Check mechanical connections of I/O modules, I/O controller, and the expansion cables.
71	Battery error	Replace the battery with a new one. Check the connection of the battery connector. When operating without battery, set to disable the "Battery error detection".
72	Special module failure	Refer to the error code of the special module and perform the error recovery processing.
74	Comm. module configuration error	Refer to the error code of the communication module and perform the error recovery processing.
77	FLASH writing failure	After the initialization, download the user program again. If the same error occurs, it is a hardware error in the CPU module. Replace the CPU module with a spare unit.
78	Checksum mismatch in Flash (IP address)	Set the IP address (ETH1, 2, 3) again.
79	Realtime clock initialized	Set the time of the Realtime clock. Refer to "SetDateAndTime" in the application manual [Command references].

Factory default settings

If power cycling is not effective or online connection to the HX-CODESYS is not possible, it is possible to initialize back to factory default settings.

< How to reset the factory default settings >

(1) Remove power from the PAC.
(2) Toggle the RUN / STOP switch to STOP position.
(3) Turn on all 2 bits switches (SW1).
(4) Supply power to the PAC with E.CLR button pressed until "SP" is displayed in the 7-segment LED.

(5) Toggle the RUN / STOP switch to RUN position.
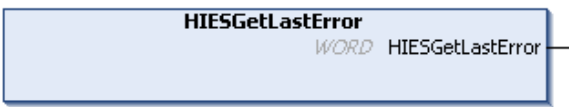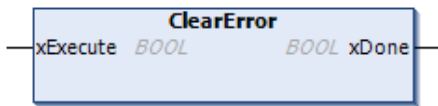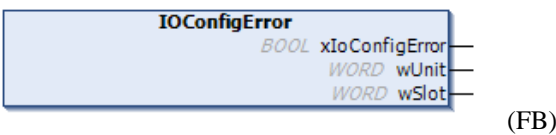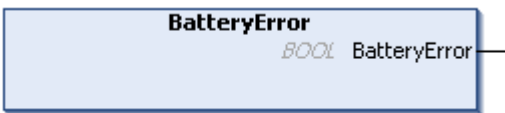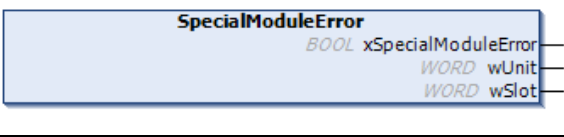(6) It takes a few seconds to delete boot project. Then "Fn" is displayed in the 7-segment LED.
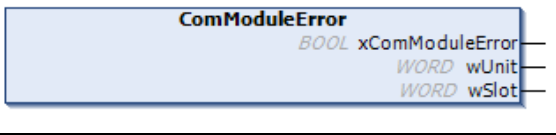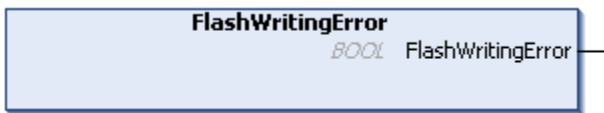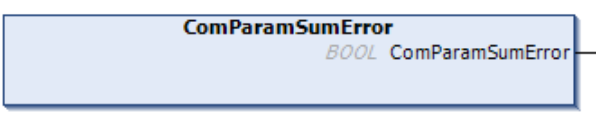

(7) Turn off all 2 bits switches (SW1).
 When turning on the power next time, it starts with the factory default settings.
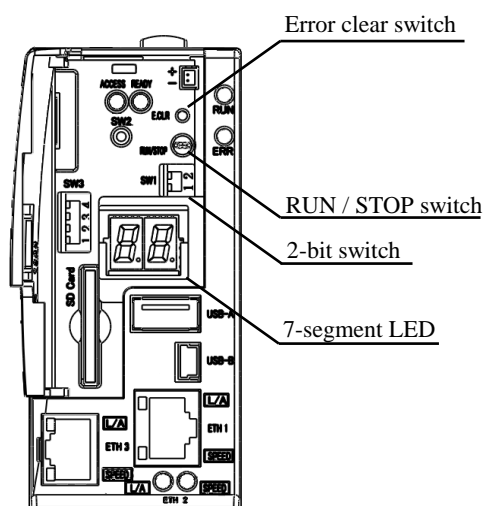
13.3 Error Libraries

Error codes of warnings levels (error code 70 to 78) can be handled by special libraries called "CmpHIESErrors_HX" because the CPU does not stop. If it is not registered in your library repository, install CmpHIESErrors_HX.compiled-library by choosing [Tools]-[Install library...].

Error code	Libraries (CmpHIESErrors_HX)	Input	Output
all	**HIESGetLastError** *WORD* HIESGetLastError	-	Last detected error code (WORD)
All	**ClearError** xExecute *BOOL* *BOOL* xDone	Execution bit to clear error code (BOOL)	Result (BOOL)
70	**IOConfigError** *BOOL* xIoConfigError *WORD* wUnit *WORD* wSlot (FB)	-	70 Error bit (BOOL) Unit number (WORD) Slot number (WORD)
71	**BatteryError** *BOOL* BatteryError	-	71 Error bit (BOOL)
72	**SpecialModuleError** *BOOL* xSpecialModuleError *WORD* wUnit *WORD* wSlot (FB)	-	72 Error bit (BOOL) Unit number (WORD) Slot number (WORD)
74	**ComModuleError** *BOOL* xComModuleError *WORD* wUnit *WORD* wSlot (FB)	-	74 Error bit (BOOL) Unit number (WORD) Slot number (WORD)
77	**FlashWritingError** *BOOL* FlashWritingError	-	77 Error bit (BOOL)
78	**ComParamSumError** *BOOL* ComParamSumError	-	78 Error bit (BOOL)