HX stand-alone CPU unit Instruction manual

HITACHI
Inspire the Next

Thank you for purchasing a HX stand-alone CPU unit (hereinafter referred to as HX).
To operate it safely, please read this instruction manual and all the user manuals carefully. Please be sure to use the latest versions of user manuals and keep them at hand of end users for future reference.

Caution
1. All rights reserved.
2. The content of this manual may be changed without notice.
3. While efforts have been made on this manual to be accurate, please contact us if any mistakes or unclear part is found.

■ Warranty period and coverage

The warranty period is either 18 months after manufacturing date (MFG. No.) or 12 months after installation.
Examination and repair within the warranty period is covered. However within the warranty period, the warranty will be void if the fault is due to ;

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

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

■ Repair

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

■ Ordering spare parts and inquiries

Please contact your local suppliers for ordering products/spare parts or any inquiries with providing the following information.

(1) Product name
(2) MFG. No. (Manufacturing number)
(3) Details of failure

■ Definitions and Symbols

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

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

Safety precautions

⚠ DANGER

- Do not touch terminals while power is ON. There is a risk of electric shock and/or injury.
- Appropriate emergency stop circuit, interlock circuitry and similar safety measures should be added to the HX system to ensure safety in the event of incorrect, missing or abnormal signals caused by broken signal lines, momentary power interruptions or other causes.

⚠ CAUTION

- Always use the power supply voltage listed in specifications. Using other voltage may damage the equipment or present a risk of fire.
- The wiring operation should be performed by a qualified personnel. Failure to do so could result in fire, damage or electric shock.
- When HX is installed to equipment, do not use DC jack for power supply. Malfunction or failure may result.

COMPULSION

- The HX must be grounded. Failure to do so could result in injury to personnel or causing it to malfunction.

PROHIBITION

- Do not attempt to disassemble, repair or modify any part of the HX. Electric shock, malfunction or failure may result.
- Do not separate CPU part and base part.
- Do not connect or disconnect cable unless power has been switched off or the area is known to be Non-Hazardous.(This unit is not industrial control equipment for use in hazardous locations "class I, Division2, Groups A,B,C,D")

⚠ CAUTION

- DO NOT CONNECT DIRECTLY TO LINE VOLTAGE. LINE VOLTAGE MUST BE SUPPLIED BY A SUITABLE, APPROVED ISOLATING TRANSFORMER HAVING SHORT CIRCUIT CAPACITY NOT EXCEEDING 150VA MAXIMUM.

⚠ MISE EN GARDE

- NE PAS CONNECTER DIRECTEMENT A LA TENSION D'ALIMENTATION.CELLE-CI DOIT ETRE FOURNIE PAR UN TRANSFORMATEUR D'ISOLATION POSSEDANT UNE CAPACITE DE COURT-CIRCUIT N'EXCEDANT PAS 150 VA.

■ Common precautions

- Do not turn on power, if the unit appears damaged.
- Do not supply to DC jack and DC connector at the same time.
- Be sure to check all field wiring before HX power on. Otherwise, there is a risk of fire.
- Do not cover vent holes of the housing.
- Do not pull on cables or bend cables beyond their natural limit. Otherwise, there is a risk of breaking of wire.
- Check carefully your HX program before operation.
- Keep HX modules in their boxes during storage and transport.

NJI-672B(X)

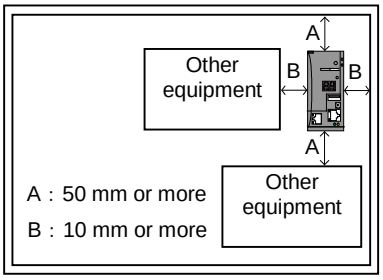
■ Installation environment

Avoid the following locations to install the HX.

- Excessive dusts, salty air, or conductive materials (iron powder, etc.)
- Direct sunlight.
- Temperature less than 0 °C or more than 55 °C.
- Humidity less than 5 % or more than 95 %.
- Dew condensation.
- Direct vibration or impact to the unit.
- Corrosive, explosive or combustible gases.
- Water, chemicals or oil splashing on the HX.
- Close to noise emission devices.

■ Mounting

- Mount the HX on a metal plate and install in a cabinet as follows.



- Be sure to ground the cabinet, the metal plate, and metal duct otherwise there is a risk of malfunction.
- Take appropriate measures when the HX system installed in locations :
  - Influenced easily due to noise or static electricity or other forms of noise.
  - Under strong electromagnetic field.
  - Close to power supplies.
- Installation to a DIN rail

  (1) Mounting to a DIN rail

  1] Hook the claw of HX rear to the DIN rail.

  2] Press the HX into the DIN rail until it clicks. Because HX is fixed to the DIN rail without fixing brackets, fixing brackets is not required.

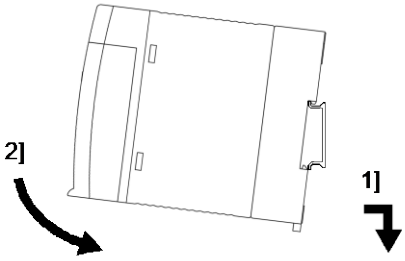


Figure 1 Mounting to a DIN rail

(2) Removing from the DIN rail

1] While lowering the DIN rail fixing mounting lever toward the bottom,

2] Raise the HX upward to remove.

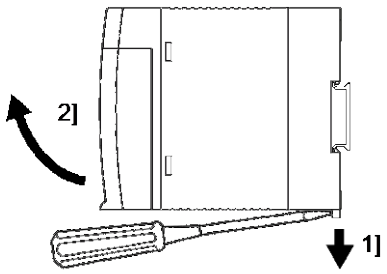


Figure 2 Removing from the DIN rail

■ Wiring for Power Supply

- Appropriate emergency circuitry, interlock circuitry and similar safety measures should be added to the system.
- Appropriate safety measures should be included in the system for unexpected breaking of wire or malsignal caused from instantaneous power failure.
- Install external earth leakage breakers to avoid short circuit accident.
- In case of the following operations, turn off power. Otherwise, there is a danger of breakdown and/or injury and/or fire.
  - Mounting or dismounting HX.
  - Assembling cabinet or machine including HX.
  - Wiring.
- Install EMC filter specified in Table 1 or similar. Using insulation transformer with shield is recommended. Use the isolation AC-DC power supply that is conformed CE marking for power supply to HX.
- When using HX in an equipment, supply power to DC connector shown in Figure 3. DC jack is for debugging on the desk purposes only.
- Wire the power supply according to Figure 4.
- Assemble the power supply cable according to Figure 5.
- Use the power cable of 1.25 to 2.0 mm^2. The recommended length of the power line is 3 m or less.
- Be sure to ground with 100 Ω or less the functional grounding terminal (FE terminal) with a 2.0 to 2.5 mm^2 wire. The recommended length is 20 m or less.

Table 1 Specifications of the EMC filter

Item		Spec.
Rated voltage (V AC)		250
Rated current (A)		3
Withstand voltage (V) (between Terminal and case)		1,500
Insulation resistance (MΩ) (500 V DC, 1min., between terminal and case)		100 (min.)
Attenuation Freq. range (MHz)	Differential mode more than 40 dB	0.5 to 30
	Common mode more than 30 dB	0.15 to 30

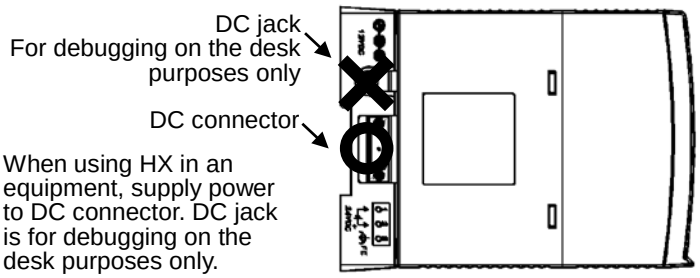


Figure 3 DC power input port

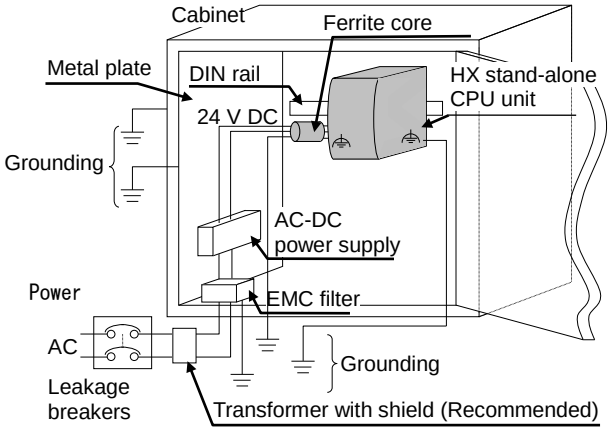


Figure 4 Wiring power diagram

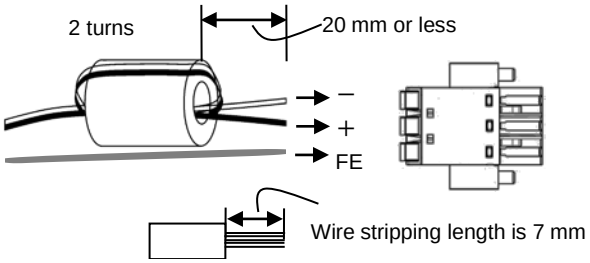


Figure 5 Assembly of power cable

- The input and output cable of the EMC filter should be separated as much as possible. Be sure to ground the EMC filter.
- Recommends installing a lightning arrester to prevent lightning damages.

⚠ CAUTION

- If HX is applied for CE marking (EMC direction), follow the instructions below according to Figure 4 and 5.
  (1) Install EMC filter specified in Table 1.
  (2) Use the isolation AC-DC power supply that is conformed CE marking.
  (3) Use included ferrite core for power cable with 2 turns.

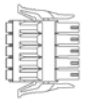
■ Reference manual

Read the following application manual carefully to use the HX safely and properly. Be sure to keep the latest version.

Manual name	Manual No.
HX Application manual (Hardware)	NJI-637*(X)
HX Application manual (Software)	NJI-638*(X)
HX Application manual (Motion)	NJI-650*(X)
HX Application manual (Hybrid)	NJI-653*(X)

* Alphabet before (X) indicates version (A,B…).

■ Accessories

No.	Product name	Specifications / Part number	Appearance	Quantity	Remarks
1	Serial port connector	FMC 1,5/ 5-ST-3,5-RF GY AU (Phoenix Contact)		1	Not included with standard and motion model.
2	Power cable connector	BLF 5.08HC/03/180F SN BK BX (Weidmuller)		1	-
3	Termination resister for serial port	100 Ω, 1/2 W		1	Not included with standard and motion model.
4	Ferrite core for power cable	GRFC-10 (KITAGAWA INDUSTRIES)		1	-
5	Connector cover	A Cover is attached to each port - Ethernet port 1,2,3 - USB host, device port - DC jack	-	Each 1	Included for Ethernet port 1,2 with standard and motion model.

■ Optional

Product name	Part number	Usage	The life of battery (Total power failure time)	Remarks
Lithium battery	HX-BAT	Real-time clock running while powered off	Min. @55°C 25,000 [Hr] Max.@25 °C 67,000 [Hr]	Optional *1

*1 HX-BAT is used to run real-time clock while powered off. RETAIN data memory, PERSISTENT data memory and user program are retained without battery. HX-BAT is optional and not included in CPU module.

■ AC adapter

HX can be supplied power to DC jack by AC adapter.

Use Isolated AC adapter as shown below table.

Item	Specifications
Rated output voltage	12 V DC
Output voltage range	10.8 to 13.2 V DC
Output current	1.0 A or more
Plug Type	ϕ 5.5 * 2.1 (Center positive) Symbol :

⚠ CAUTION

DC jack is for debugging on the desk purposes only.

When HX is installed to equipment, do not use DC jack for power supply. Malfunction or failure may result.

■ Programming software

HX requires programming software.

HX-CODESYS is required for all models. HX-Studio is required for hybrid model.

Product name	Part number	Specification
HX-CODESYS	HX-CDS	IEC 61131-3 full compliant programming software with ST (Structured Text), SFC (Sequential Function Chart), FBD (Function Block Diagram), LD (Ladder Logic Diagram) and IL (Instruction List). Multilingual support (Japanese, English, German, Spanish, French, Italy, Russian, Chinese) Supported operating system: Windows ® 7 SP1 or newer
HX-Studio *1	HX-STD	Eclipse 4.6 Neon CDT 9.1.0 base IDE for Hybrid model application Programming language: C / C++, Connection means to HX-CPU: Ethernet Supported operating system: Windows ® 7, 8, 8.1, 10 (32 / 64 bit) (IEC 61131-3 compliant HX-CODESYS (HX-CDS) is included in DVD)

*1 Only the hybrid model is required.

Windows ® are either registered trademarks or trademarks of Microsoft Corporation in the United States and/or other countries.
CODESYS is registered trademarks of 3S-Smart Software Solutions GmbH.
EtherCAT ® is registered trademark and patented technology, licensed by Beckhoff Automation GmbH, Germany.
Ethernet is registered trademarks of Fuji Xerox Co., Ltd.

■ General Specifications

Item	Specification
Operational temperature	0 to 55 °C
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
Usage environment	No corrosive gases, no excessive dust
Structure	Open wall-mount type
Cooling	Natural air cooling

■ Power supply Specifications

Item	Specification	
	AC-DC power supply	AC adapter
Rated input voltage	24 V DC	12 V DC
Input voltage range	21.6 to 26.4 V DC	10.8 to 13.2 V DC
Input current	0.4 A or less	0.7 A or less
Instantaneous power failure guarantee	1 ms or less	No guarantee
Input rush current (At 24 V DC)	25 A or less (Ta＝25 °C)	
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. - Static noise 3,000 V at electrode part	
Grounding	Ground with 100 Ω or less	
Output overcurrent protection	Output short-circuit protection	
Isolation	Non isolated	
Efficiency	85 % or more	

⚠ CAUTION

Because the varistor is connected to power supply circuit of HX, do not test insulation resistance and withstand voltage.

If insulation resistance and withstand voltage of equipment that installed HX is tested, remove all wiring connecting to HX.

■ Performance Specifications

Item		Specification				
		HX-CP1S08-0	HX-CP1S08M-0	HX-CP1H16-0	HX-CP1H16M-0	HXC-CP1H16-0
Model		Standard	Motion	Full Function	CNC Motion	Hybrid
User program memory *1		8 MB		16 MB		
Source file memory *1		8 MB		16 MB *2		
Data Memory (non-retain) *1		8 MB		16 MB		
Data memory (retain) *1		250 KB				1,024 KB
Data memory (persistent) *1		250 KB				1,024 KB
Field bus / Marker memory		48 KB				
PLC Programming language		IEC61131-3 compliant 5 languages + CFC LD : Ladder Diagram FBD : Function Block Diagram SFC : Sequential Function Chart IL : Instruction List ST : Structured Text CFC : Continuous Function Chart				
C program	Adaptation of C / C++ program	–				○
	Data sharing	–				○
	Web server for application management	–				○
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 library	○	○	○	○	○
	SM3_Basic (for motion)	–	○	–	○	–
	SM3_Robotics (for motion)	–	–	–	○	–
	SM3_CNC (for motion)	–	–	–	○	–
Available communi-cation	OPC UA Server	○	○	○	○	○
	WebVisualization	–	–	○	○	○
	NTP (network time protocol)	○	○	○	○	○
	DNS Client *10	○	○	○	○	○
	FTP Server	○	○	○	○	○
	FTP Client *10	○	○	○	○	○
	EtherCAT Master *3	○	○	○	○	○
	Redundancy EtherCAT *10	○	○	○	○	○
	Modbus-TCP Client	○	○	○	○	○
	Modbus-TCP Server *4	○	○	○	○	○
	Modbus-RTU Master	–	–	○	○	○
	Modbus-RTU Slave	–	–	○	○	○
	Modbus-ASCII Master *10	–	–	○	○	○
Communi-cation interfaces	Ethernet	2 ports (10/100BASE-T/TX)		3 ports (10/100BASE-T/TX)		
	Hardening *8	○	○	○	○	○
	Certification / Cryptograph *8	–	–	–	–	○ (ETH3)
	Serial	–		1 port (RS-485)		
	USB device	1port (Mini-B type connector, USB 2.0 High speed) for connecting programming tool				
USB host *5		1 port (A type connector, USB 2.0 High speed) for USB memory				
SD memory card slot *5		–		1 slot (SD / SDHC)		
Display		RUN LED, ERR LED, 7-segment LED (2digits)				
Switch	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)	Reset the factory default settings				
	4-bit switch (SW3)	–		Reserved for future		
Real-time clock		Built-in RTC (deviation ±60 s/month at 25 °C)				
Battery (Option for RTC) *6		HX-BAT (for RTC)				
Startup time *7		About 20 to 30 s				About 70s or more
Maintenance function		microcomputer error, watchdog timer error, memory error, program error, system ROM / RAM error, scan time error, battery under-voltage detection, and others				
Compliant *9		CE				
Available version of HX-CODESYS		CPU Software version 3.5.8.2x: 3.5 SP8 Patch4 or newer CPU Software version 3.5.13.4x: 3.5 SP13 Patch2 or newer				

(Notes are described in the next page.)

*1 Since additional information needs to be saved, available memory size is slightly smaller than nominal value.

*2 Data for Web visualization is stored in the source file memory.

*3 EtherCAT master function must be configured as stand alone. Do not configure other function with EtherCAT master function.

*4 The maximum number of Modbus-TCP client : 16

*5 File access is possible from user program and FTP client.

*6 The battery is option for realtime clock.

*7 It depends on the size of the user program.

*8 Security protection support functionalities on each device which constructs a system help to secure a required level of security on the system. However, those are not things to protect the system completely from any kinds of security risk which is increased day by day. Continuous security measure is needed to realize and maintain the required security level. We suggest you clarify the target of the security protection on the system and take proper security measures, maintain the system.

*9 UL is not supported. Contact your local supplier for further information.

*10 Available on CPU Software version 3.5.13.40 or newer.

■ Virtual controller Specifications (Hybrid model)

Items		Specification
Virtual controller for application execution	Programming software	IDE for Hybrid model application HX-Studio (DVD includes HX-CODESYS.)
	Adaptation means *1	Download from built-in Web server IF or from HX-Studio
	Programming language	C / C++
	Number of Virtual controllers	Max. 4 (selectable from 1, 2, 4)
	ROM size for application *2	SP8: 27MB SP13: 19MB (Referred files like Library files can be stored in SD card or USB memory)
	Work RAM	Max. 512 MB (e.g.: 512x1, 256x2, 128x4)
	Access port	Ethernet, SD card, Serial port (RS-485), USB host port
	IP address of application	Masquerade, IP forward, Port forward
	Data sharing with PLC program	Read: Max. 5,000 variables, Max. size: 64 KB Write: Max. 5,000 variables, Max. size: 64 KB Variables to be shared are selected at HX-CODESYS. Those can be set as RETAIN / PERSISTENT. Supported data type: BOOL, BYTE, USINT, SINT, WORD, UINT, INT, DWORD, UDINT, DINT, LWORD, ULINT, LINT, REAL, LREAL ARRAY OF <Above data types> *3*4, STRING *3
	Security protection	Certification / Cryptograph (IPsec)
Web server for application management	Supported browser	HTML5 supporting browser (IE11 or newer, Edge38 or newer, Chrome53 or newer, Firefox49 or newer)
	System information display	Window to display system information
	Virtual controller information display	(1) Status display of virtual controller (2) Configuration of virtual controller (3) Operation (Start / Stop) of application
	Shared memory information display	Data display and force of shared memory
	User management display	Registration and delete of user information to access Web server IF

*1 Ethernet port which can connect to built-in Web server IF or HX-Studio differs depending on CPU Software version.

3.5.8.25: ETH3

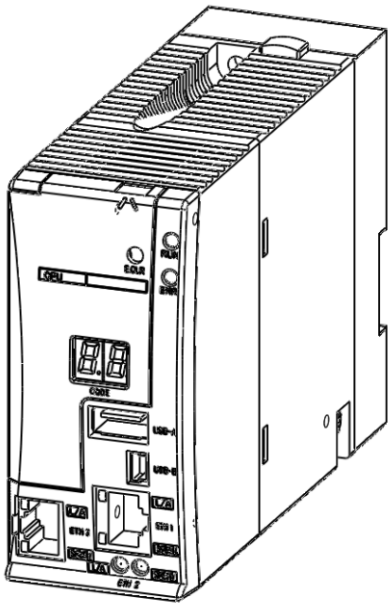
3.5.13.40 or newer: ETH1, ETH2, ETH3

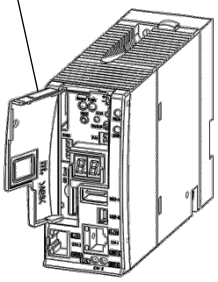
*2 The file size displayed on the PC may differ from the actual size which can be stored in the CPU because files are compressed in the CPU. Please store the target files to an SD card or a USB memory and use it, if file size exceeds the area size.

*3 Available on CPU Software version 3.5.13.40 or newer.

*4 Supported up to 3-dimensional array.

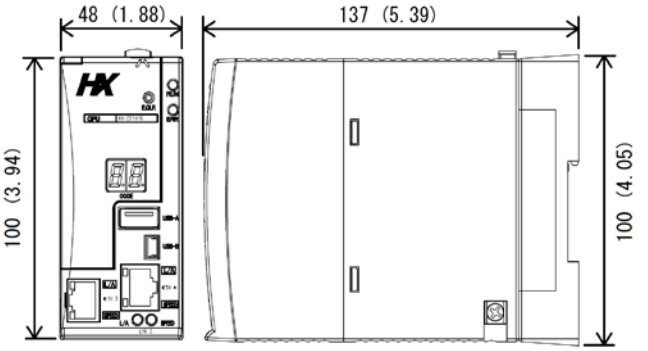
■ Name and function of each part

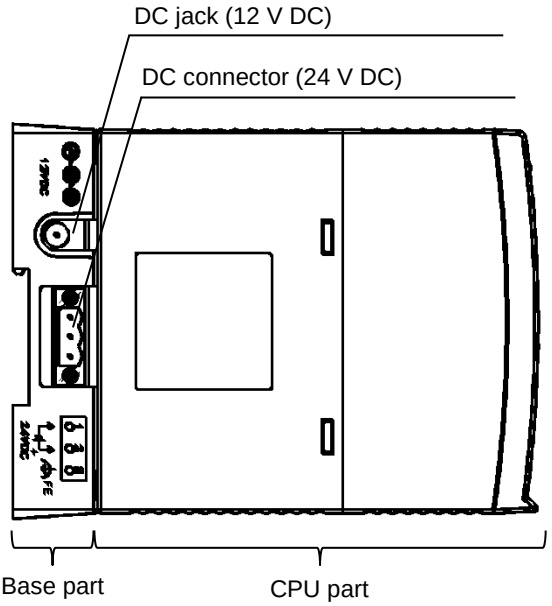




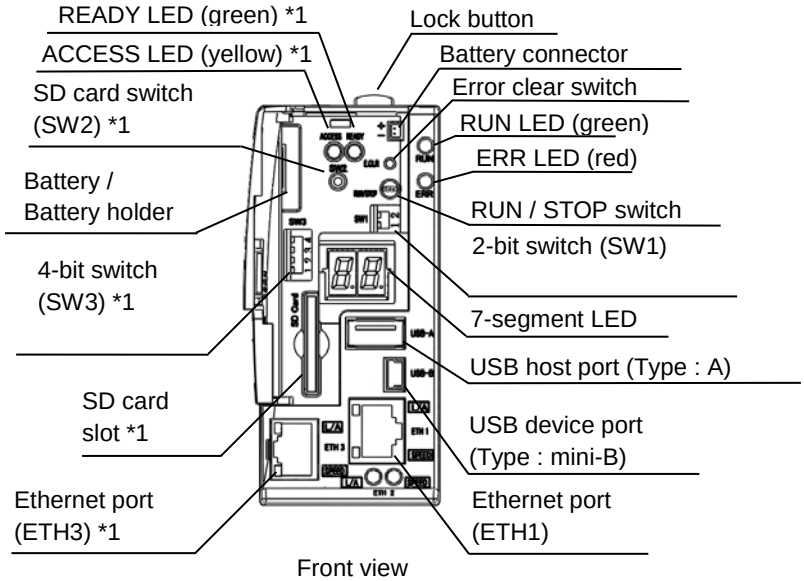
Type	HX-CP1S08*-0	HX*-CP1H16*-0
Weight	Approx.0.26 kg (0.57 lb.)	Approx.0.30 kg (0.66 lb.)

Dimensions (mm (in.))

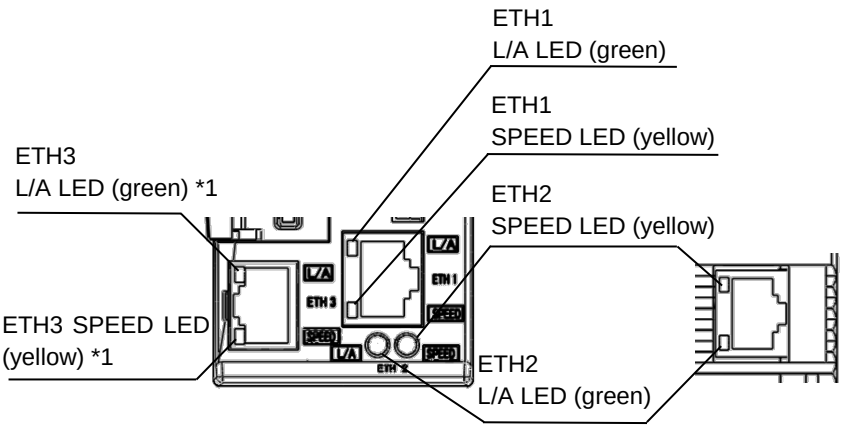




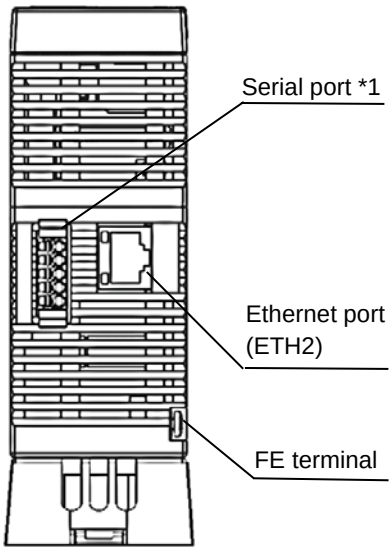
Side view



Front view



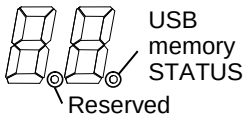
Detail of Ethernet port



Bottom view

1 Not applicable to standard and motion models (HX-CP1S08-0).

Each description of items (1/2)

Item	Description	Access from C program *1
DC jack (12 V DC)	DC power input port. When HX is installed to equipment, do not use DC jack. DC jack is for debugging on the desk purposes only.	–
DC connector (24 V DC)	DC power input port. Supply power to HX, according to “Wiring for power supply” shown on p.2.	–
RUN LED	Indicates operation status. (Green lighting: RUN / off: STOP)	–
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)	–
7-segment LED	Indicates error code. And indicates the status of the USB memory with dot LED “.”on the right. (Lighting: mounting, off: unmount) 	–
USB host port (Type: A)	USB host function (Data logging) is supported. User program is needed to use data logging (File read / write / compare). Support device is USB memory only.	○
USB device port (Type: mini-B)	USB port supports gateway function (with HX-CODESYS) only. USB cable is not included with CPU package nor supplied by Hitachi-IES. Use type Mini-B USB cable.	–
Serial port	Serial communication port (2-wire). [Usage on applications] *1 It is needed to enable RS-485 communication setting on the corresponding virtual controller setting display on Web server. Default setting is disabled. [Usage on PLC program] It is supporting Modbus-RTU (master / slave) and general purpose. User program is needed to use general purpose.	○
Ethernet port (ETH1, 2)	Ethernet port 1, 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 function if EtherCAT master can be used. In the Hybrid model, it is used to connect to HX-Studio and Web server IF for application management. [Usage on applications] *1 Fixed to Masquerade setting. Use ETH3 port, if forwarding functionality is needed.	○
Ethernet port (ETH3)	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. In the Hybrid model, it is used to connect to HX-Studio and Web server IF for application management. [Usage on applications] *1 Set forwarding configuration, if needed. Default setting is Masquerade.	○
SD card slot	SD / SDHC card are supported. Data logging function is supported. User program is needed to use data logging (File read / write / compare).	○
RUN / STOP switch	When this switch position is in RUN (left), CPU start executing program. At the same time, remote controlling is enabled, in which case, CPU is started or stopped by HX-CODESYS over communication. When this switch position is in STOP (right), CPU stop executing program. In this status, remote controlling is disabled.	–
Error clear switch (E.CLR)	If any error occurs, error code is displayed in 7-segment LED and remains after the error cause is deactivated. When pressing this button, error code is cleared. If the error cause is still remaining, error code will be displayed again.	–
SD card witch (SW2)	When pressing this switch, SD card is unmounted. Please check lights-out of READY LED before pull out SD card.	–
ACCESS LED	Not supported.	–
READY LED	Indicates the status of SD card. Do not pull out SD card during lighting. (Green lighting: mounting, off: unmount)	–
SPEED LED	Indicates communication speed of each Ethernet port. (Yellow lighting: 100 Mbps, off: 10 Mbps or link-down)	–
L/A LED	Indicates the status of each Ethernet communication. (Green lighting: Ethernet link-up, blinking: Data is sent or received, off: link-down)	–

*1 Applicable to hybrid model (HXC-CP1H16-0).

Each description of items (2/2)

Item	Description	Access from C program *1
2-bit switch (SW1)	Resetting the factory default settings.	–
4-bit switch (SW3)	Not supported. Please keep off.	–
Lock button	The CPU and base part Locked by this button. Do not separate CPU part and base part.	–
Front cover	Open this cover when operating the switch, button or replacing the battery. Keep the cover closed while cpu execute program.	–
Battery holder Battery connector	RTC (real time clock) data is retained by battery. Data specified as RETAIN and PERSISTENT and user program are retained without battery. -The battery has polarity. When plugging in, check the polarity carefully. -The battery is not included with CPU package. -Replace the battery every five years even when doesn't reach the end of the battery.	–
FE terminal	Connect to grounding.	–

*1 Applicable to hybrid model (HXC-CP1H16-0).

⚠ CAUTION

Note the cautions for the communication ports.

(1) In 100BASE-TX (100 Mbps) communication of Ethernet, connection could be unstable due to external noise depending on cable length, installation environment and etc. In this case, take following countermeasures.
1] Increase the number of times to retry in connected device.
2] Check your installation environments and take appropriate countermeasures to reduce noise.

■ Caution

- HX-CODESYS

Be sure to use the corresponding version of HX-CODESYS which is indicated in the following table. Any versions of EHV-CODESYS do not support HX.

HX-CPU Software version	HX-CODESYS version
V3.5.8.2x	HX-CODESYS Ver.3.5 SP8 Patch4 or newer
V3.5.13.4x	HX-CODESYS Ver.3.5 SP13 Patch2 or newer

- CPU initialization

When you use the HX first time, be sure to initialize (Reset origin) with HX-CODESYS because data memory and RTC could be undefined status.

- Error code without battery

Battery is not included in HX (Battery is optional).
If the setting of [Battery error detection]*1 in HX-CODESYS is enabled (default) without a battery installed, 7-segment LED will indicate "71". If you want to disable this 7-segment LED indication, set disable in this parameter.
*1 The setting of Battery error detection is in configuration-tab of Device in HX-CODESYS.