

Industrial Controllers for IoT Applications

**HITACHI**  
Inspire the Next

PAC System

# HX Series

Integrating Core Control and Communications of Automated Machines  
and Production Facilities into One



# Next-generation Industrial Controllers for IoT and Globalization

In the manufacturing industry, following the globalization of the supply chain, there has been a demand for a revolution in production and services using IoT\*. With that backdrop, we are working on the automation of systems, focusing mainly on Programmable Logic Controllers (PLC), which control various plant facility devices, and IPCs (industrial PCs), which are responsible for gathering data from plant facility devices and communicating with servers and other higher level information systems. We provide an environment not only for controlling plant facility devices using advanced control functions, but also for seamlessly transmitting plant facility device information to the cloud.

\* IoT: Internet of Things

## Open Technologies

The new controllers make it easy to secure programming engineers throughout the world by adopting a programming language that conforms to IEC61131-3international standards and support the construction of global production systems. Furthermore, the adoption of the open industrial network EtherCAT® enables connections with many EtherCAT® supported facility devices that have rapidly gained popularity in recent years. Compliance with OPC-UA, Industry 4.0 recommended communications standards, makes it possible to provide an environment where data can be transmitted seamlessly to the cloud.

## High Performance

By leveraging CPU performance characterized by its increasingly rapid processing speeds in recent years and incorporating CODESYS, a software PLC, sequence controls (controls implemented according to a previously determined order) and advanced motion controls synchronized with sensors can be simultaneously executed with only a single CPU in the controller.

## Simple Configuration

These next-generation industrial controllers were developed as PAC (programmable automation controllers) with both PLC and IPC functions. Compared to existing systems, these controllers contribute to reductions in TCO, including the costs of introduction, development, and maintenance, as well as to space saving.

## PLC Based PAC System for IoT Applications

### HX Series

Integrating Core Control and Communications of Automated Machines and Production Facilities

#### Communication Control      Motion Control      Sequence Control

##### ✓ EtherCAT® Motion Control

- Controls multiple axes and I/O using EtherCAT®
- (Various EtherCAT slave devices such as Hitachi AC Servo ADV series)



- Supports function blocks for PLC open compliant motion control

##### ✓ Supports programming languages compatible with IEC61131-3 international standards

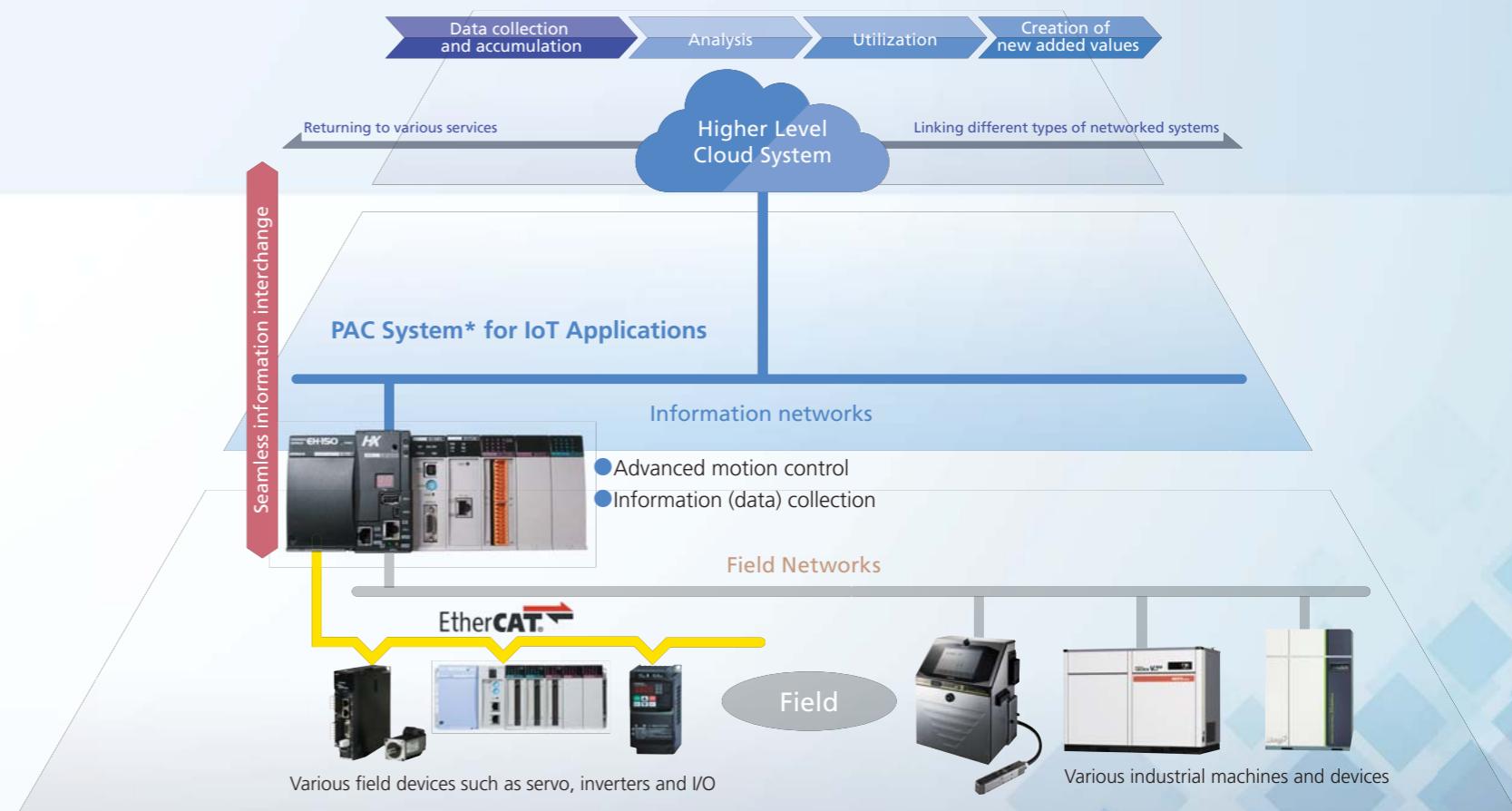
- OPC-UA for communication with higher level information systems
- ERP linkage, MES connection, SCADA system connection, etc.



- Supports information communications  
Ethernet (TCP/IP), IP communications, web support, etc.

- Connection with various control equipment and HMI

- Field network support  
(Partially combined use with dedicated master modules)



\* PAC (Programmable Automation Controller) system:

A new type of controller system with functions that respond to a variety of needs, in addition to typical PLC functions; for example, advanced controls, multifunction networks, and human machine interfaces (HMI).

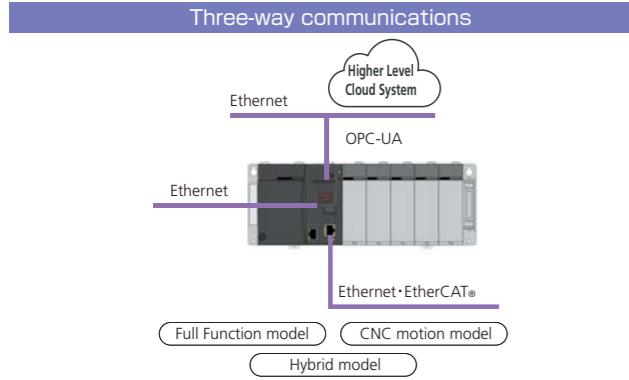


### Next Generation Industrial Controllers that Respond to IoT Trends in Industrial Fields

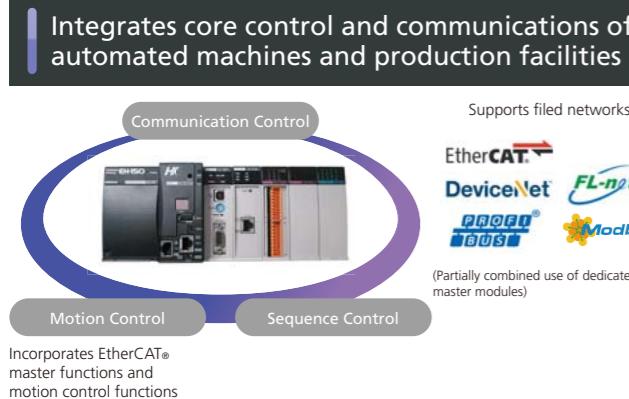
- Supports OPC-UA, an interface for connecting information with industries
- Supports information communications (Ethernet) and control communications (EtherCAT®)
- Supports data logging for sites using SD memory
- Integrates sequence control with motion control, achieving high performance

3 Ethernet ports are standard\* (Full Function model, CNC motion model, Hybrid model)

\*Standard model and Motion model are 2 Ethernet ports

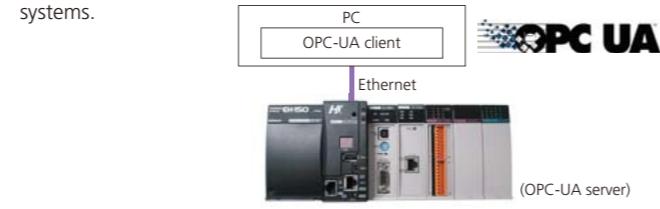


This enables independent communication with higher level information systems, between controllers, and with lower level equipment. A variety of communications can be made using different methods.

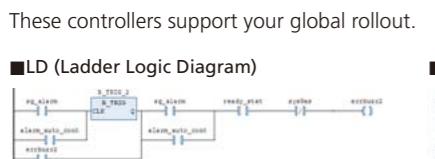


### OPC-UA has soft interface standards between industrial equipment and the OPC-UA server function is standard (for all models)

OPC-UA has Industry 4.0 recommended communication standards and these products incorporate the OPC-UA\* server. They can be used as an interface for exchanging new information with higher level systems.



Supporting programming languages compatible with IEC61131-3 international standards (for all models)

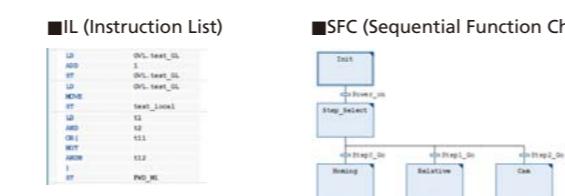
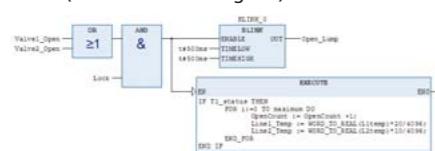


#### ST (Structured Text)

#### IL (Instruction List)

#### SFC (Sequential Function Chart)

#### FBD (Function Block Diagram)



### CPU modules that can be selected to cater to your applications

	Hardware Specifications			Functional Specifications		
Standard model	Program data memory <b>8MB</b>	Ethernet port <b>2</b>	USB Host-device	EtherCAT® master		
Full Function model	Program data memory <b>16MB</b>	Ethernet port <b>3</b>	USB Host-device SD	Serial communications RS-485	EtherCAT® master Web Visualization	
Motion model	Program data memory <b>8MB</b>	Ethernet port <b>2</b>	USB Host-device	EtherCAT® master	Soft motion	
CNC motion model	Program data memory <b>16MB</b>	Ethernet port <b>3</b>	USB Host-device SD	Serial communications RS-485	EtherCAT® master Web Visualization Soft motion (G codes)	CNC (G codes)
Hybrid model	Program data memory <b>16MB</b>	Ethernet port <b>3</b>	USB Host-device SD	Serial communications RS-485	EtherCAT® master Web Visualization	C/C++ program

Functional Specifications

EtherCAT® master

EtherCAT® master  
Web Visualization

EtherCAT® master

Soft motion

EtherCAT® master

EtherCAT® master  
Web Visualization  
Soft motion  
(G codes)

EtherCAT® master

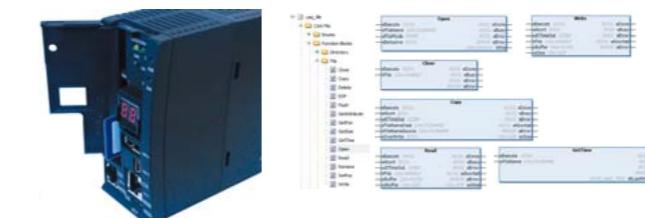
EtherCAT® master  
Web Visualization

C/C++ program

\* One port exclusively used for tracking between CPUs

### SD memory for large capacity data logging (Full Function model, CNC motion model, Hybrid model)

SD memory can be mounted on the CPU model, which makes it possible to easily log the data generated on the site (Function blocks for file access are available.)



### Supporting function blocks for PLC open compliant motion control (Motion model, CNC motion model)

From PTP positioning with a single axis and interpolation control and synchronization control of electronic cam to speed control and torque control, various functions are possible through the combined use of FBS.

Motion control in conformance with PLC open standards  

- Single axis Part I and Part II
- Master axis/Slave axis (For example: MC\_CamIn, MC\_GearIn, MC\_Phasing, etc.)



### Reduction in maintenance costs (all models)

#### No fan

The mechanical mechanism for consumables is not adopted for CPU modules.

#### No battery

Nonvolatile memory is adopted for program memory and data memory. Machine production records are stored without batteries. Even if power is turned off due to the unexpected outage, important programs and data will be protected.  
Note: To maintain calendar and clock data, the battery is required.

### EtherCAT® master & soft motion (EtherCAT® master function is incorporated into all models; soft motion function is incorporated into the Motion model, CNC motion model.)

EtherCAT® master function and motion control function are incorporated into the LAN port of the CPU module. A combined use of an EtherCAT® slave beside servo is possible (inverters, IO terminals, and so on.)

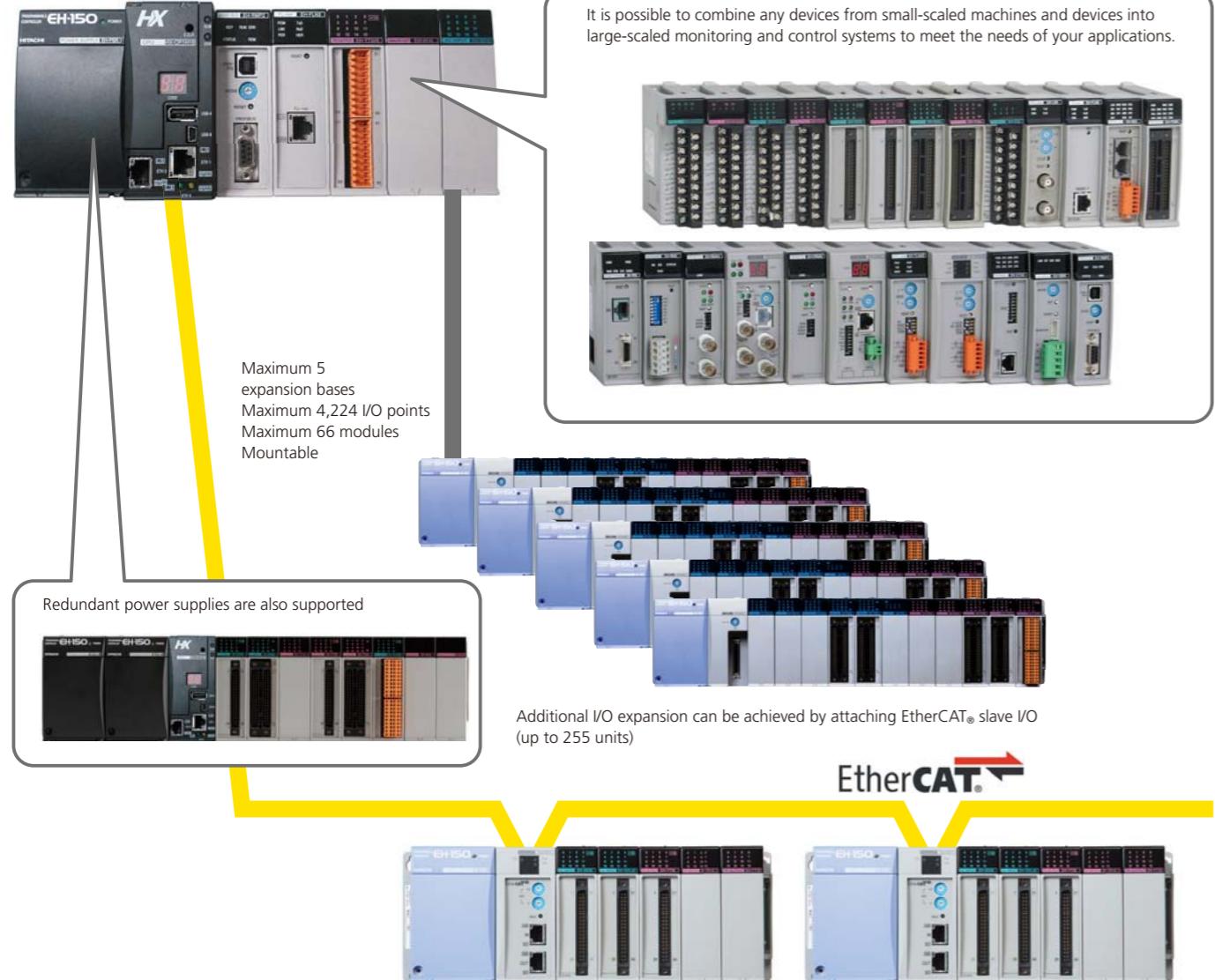


### Enabling connecting with EH-TP500 series HMI

It is possible to connect with 4.3"-15" High performance touch screen EH-TP500 series.

### Flexibly extendable structure by adopting plug-in type modules

Functions can be extended using various modules from the reliable and proven EH-150/EHV/EHV+ series (digital input and output, analog input and output, and various function modules.)



### Protecting machine production and information

Unauthorized access will be prevented and your machine information will be protected when a connection is made to networks.

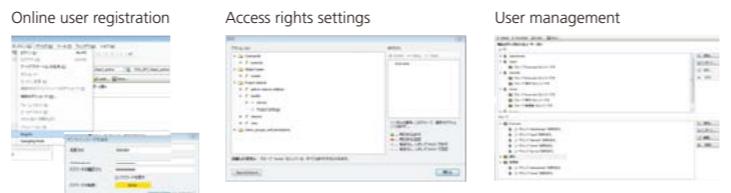
#### Prevention of unauthorized external access

- Prevention and detection of unauthorized external packets
- Prevention of unauthorized remote log-ins
- Prevention of the provision of information and functions to attackers

#### Access user control

Login authentication, user and group management, access right settings

#### Creating a library for dedicated functions (non-display)



### Functional Specifications

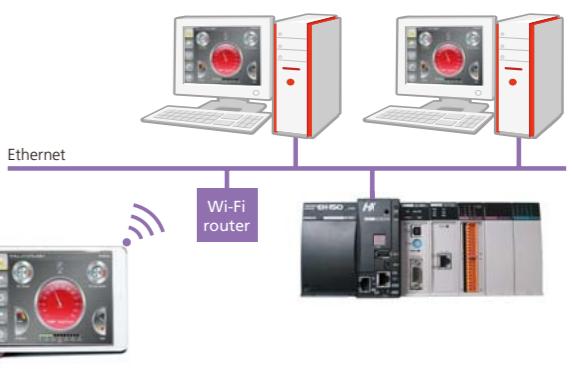
Items	Model	Specifications				
		Standard model	Motion model	Full function model	CNC motion model	Hybrid model
User program memory	HX-CP1S08	8 MB			16 MB	
Source file memory	HX-CP1S08M	8 MB			16 MB	
Data memory (non-retain)	HX-CP1H16	8 MB			16 MB	
Data memory (Retain, Persistent)	HX-CP1H16M			500 KB		2,048 KB
Max. number of expansion bases					5	
Max. expansion distance				0.5 m, 1 m, 2 m between bases, total max 8 m		
Max. number of I/O modules per base			4,224 I/Os			
I/O module			EH-150 / EHV series I/O modules are available			
PLC programming language			IEC61131-3 compliant 5 languages (LD / FBD / SFC / IL / ST) + CFC			
Information programming language	C/C++ languages program			–		●
	Shared memory			–		●
	Web management for system setting			–		●
I/O updating cycle			Refresh processing			
Processing time	Bit operation(min.)			1.0 ns		
	Double-precision floating point(min.)			6.6 ns		
Available library	Standard PLC library	●	●	●	●	●
	SM3_Basic	–	●	–	●	–
	SM3_Robotics	–	–	–	●	–
	SM3_CNC	–	–	–	●	–
Available feature	OPC UA server	●	●	●	●	●
	Web Visualization	–	–	●	●	●
	NTP (network time protocol)	●	●	●	●	●
	FTP server	●	●	●	●	●
	EtherCAT® master	●	●	●	●	●
	Modbus-TCP client	●	●	●	●	●
	Modbus-TCP server	●	●	●	●	●
	Modbus-RTU master	–	–	●	●	●
	Modbus-RTU slave	–	–	●	●	●
Communication interface	Ethernet	2 ports (10/100BASE-T/TX)			3 ports (10/100BASE-T/TX)	
	Original hardening	●	●	●	●	●
	Access control, Encryption	–	–	–	–	● (ETH3)
	Serial comm. Port	–			1 port (RS-485)	
	USB device	1 port (Mini-B type connector, USB 2.0 High speed): for programming			1 port (A type connector, USB 2.0 High speed): for data storage	
	USB host (USB memory)	1 port (A type connector, USB 2.0 High speed): for data storage			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			
Real-time clock			Built-in RTC (deviation ±60 s/month at 25°C), Backup time 7 days [without Battery]			
Battery*			HX-BAT (for RTC)			
Start-up time			Approx. 20 to 30 sec			
Maintenance function			Self-diagnosis (CPU error, Watch-dog timer error, Memory / Battery error etc.)			
Compliant			UL/cUL, CE, RCM			
Available version of HX-CODESYS			Ver.3.5 SP8 Patch4 or later			

\*: Batteries are required to retain calendar clock data. In the case of synchronization with NTP server time, and in order to retain user programs and data memory with outage retaining attributes, batteries are not required.

### Monitoring via web browser (Web Visualization)

It is possible to have access to the web server of the controller with a generic web browser without preparing the dedicated HMI and a monitor. This reduces dedicated terminals for monitoring and raises productivity.

- Comes standard in the web server
- No need for dedicated HMI
- Monitoring with a generic web browser
- Remote maintenance, diagnosis, and control



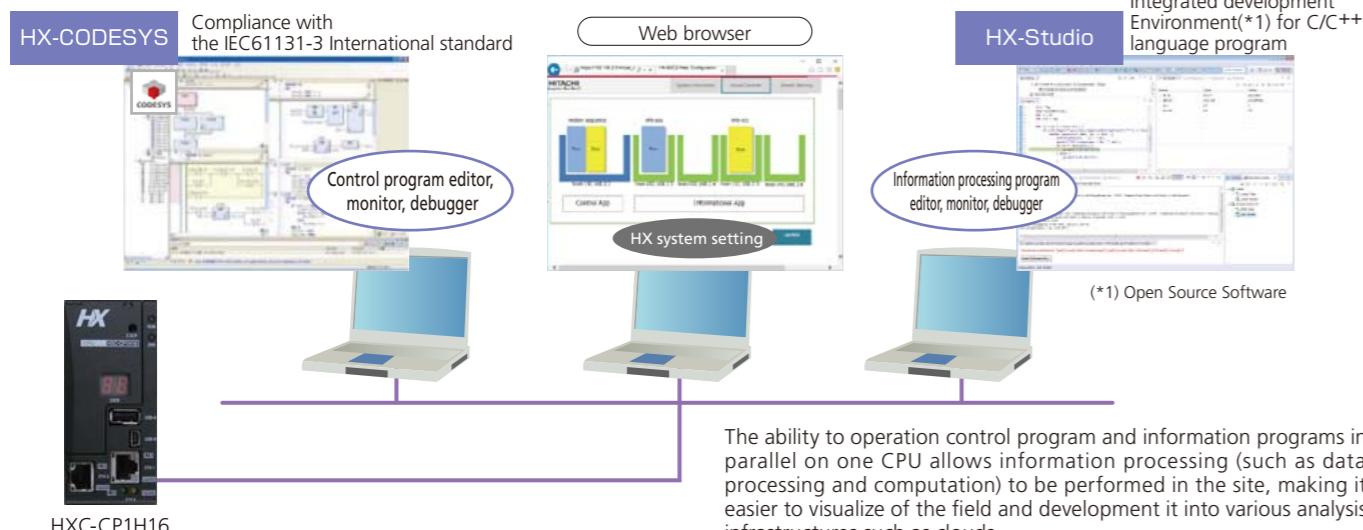
# HX series Hybrid model NEW



**Flexible solution for industrial IoT as field data collection, IoT platform connection, data processing into a useful format and edge computing on manufacturing site etc.**

A PLC control program and information processing programs (C/C++ language program) can be executed simultaneously on one CPU.

Information processing programs are executed without interrupting PLC control program on one CPU.



The ability to operate control program and information programs in parallel on one CPU allows information processing (such as data processing and computation) to be performed in the site, making it easier to visualize of the field and development it into various analysis infrastructures such as clouds.

**Data-sharing between control program and information processing programs**

Important control data is protected by specifying the data range which is accessed from information processing program at the control program editor.



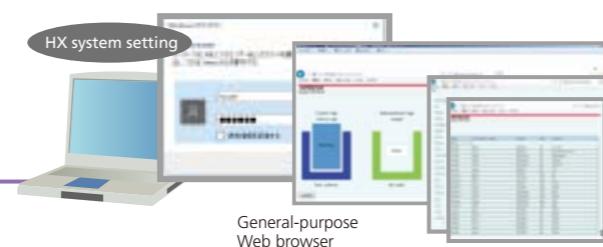
Specify shareable data to information processing programs

**Information processing programs can be changed without stopping the control program execution**

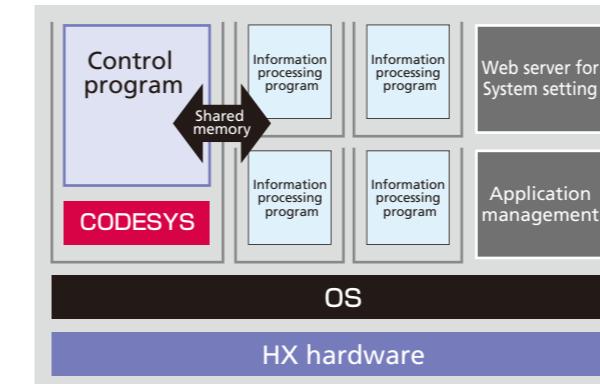
Program upload, online debugging, and online change of information processing programs are available during the control program execution without disturbing the control action.

**Web Management Tool for HX system setting**

Built-in Web server enables to upload information processing programs, set operating parameters, and monitor etc. by using a general-purpose web browser.



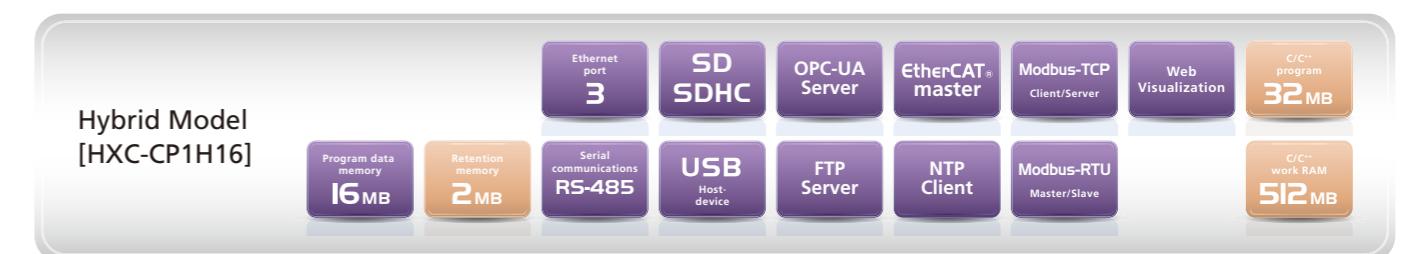
**Up to 4 information processing programs can be executed in parallel as virtual controllers**



Maximum 32MB program area is available for information processing program files. Up to 4 C-language programs can be installed, each program is executed independently and asynchronously in parallel.

**Control performance and function are equivalent to the Full-function model**

The ability to implement control-to-edge computing with one CPU module meets the needs of making industry systems IoT and applying various IoT technologies to industrial controllers.



**Integrated Development Environment "Eclipse CDT(\*3)" based engineering tool HX-Studio**



Development environment for information processing program is based on "Eclipse". It is software which has usability as same as Eclipse and HX hybrid model specific function plug-in is adapted.

(Development Environment for control program is "HX-CODESYS")

Item	Operating Environment
CPU	More than Intel Core 2 Duo 2GB recommend
Required memory	1GB or more (2GB or more recommend)
Hard disk free space	4GB or more for installation (Executing virtual-memory 512MB or larger)
Display	Resolution of 1024x768 dots or more is recommend
Disc drive	DVD drive
Interface	Ethernet 10BASE-T/100BASE-TX
OS	Windows 7, Windows 8.1 Windows 10 (32/64bit)

Classification	Specification (including CPU module combinations)
Platform	Eclipse 4.6 Neon CDT 9.1.0 base (English/Japanese)
Supported languages	C language (C/C++)
Connection	Ethernet (LAN3)
Information processing program capacity	Max. 32MB in CPU module (SD card/USB memory can be specified)
Number of information processing programs	Up to 4 in CPU module (selected form 1/2/4)
Work RAM	Max. 512Mbyte (selected form 512 / 256x2 / 128x4)
User memory	Max. 2,048KB (Retain 1,024KB / Persistent 1,024KB) Specified on the control program
Accessed range	SD card, Ethernet port(LAN3) Serial port(RS-485) USB(host) CPU data memory (Specified variable by the control program)
Build	Cross GCC (gcc-linaro-5.3-2016.02)
Debugger	Debug execution, resumption, forced stop, breakpoint, step execution, variable/structure value reference/edit
Specific function	New Project Creation Wizard, CPU Communication setting, Online (Including Download/Offline, Execute/Stop, Delete, and Online Debugging)
Security protection	Authentication and Encryption(IPsec communication)

## Functional Specifications

Items	Specifications
Ethernet port specifications	Physical layer 10BASE-T, 100BASE-TX
	Transmission mode AUTO (100 Mbps full duplex, 100 Mbps half duplex, 10 Mbps full duplex, 10 Mbps half duplex)
	Modulation method Base band
	Topology Star type
	Transmission media Twist pair cable with shields (STP), category 5/5e or higher
	Transmission distance 100 m
	Supports function EtherCAT® master, Modbus-TCP client, Modbus-TCP server, CODESYS Gateway* <sup>1</sup> , network variables, TCP/IP, UDP/IP, NTP, FTP server, http* <sup>2</sup>
USB host	Standard USB 2.0 High Speed (480 Mbps)
	Connector A type
	File system FAT32
	Maximum capacity 32 GB
	Maximum capacity per file 2 GB
	Bus power source capacity 500 mA
	Transmission distance 5 m
USB device	Supported function file system
	Standard USB 2.0 High Speed (480 Mbps)
	Connector mini-B type
	Transmission distance 5 m
Serial* <sup>3</sup>	Supports function CODESYS gateway (exclusively for integrated development environment HX-CODESYS connection)
	Standard RS-485
	Transmission speed 4,800 / 9,600 / 19.2k / 38.4k / 57.6k / 115.2k / 230k bps
	Communication method 2-wire type, half duplex
	Synchronous method Start-stop synchronous communication
	Maximum message length 256 bytes (Modbus-RTU)
	Connector Phoenix (5 pin) MC1, 5/5-G-3, 5-RN (AU)
	Terminal resistor 120 Ω (Attached)
	Transmission distance 500 m
	Error check Vertical parity check, overrun check, framing check
SD memory card* <sup>3</sup>	Supports function Modbus-RTU master, Modbus-RTU slave, generic communications
	Standard SD (Maximum 2 GB), SDHC (2 to 32 GB)
	Bus interface Normal speed, high speed
	Bus speed Maximum 25 MB/s
	Specification version 2.00
	File system FAT16/32, ext2/3
	Maximum capacity 32 GB
Supports function	2 GB
	File system

\*1: Gateway is a communication function with the integrated development environment (CODESYS).

\*2: HX-CP1S08, CP1S08M does not support the http function.

\*3: Serial ports, SD memory are not available for HX-CP1S08, CP1S08M.

## EtherCAT® Master Specifications

Items	Specifications
Communication protocol EtherCAT® dedicated protocol (CoE)	
Support service CoE (process data, SDO communications)	
Synchronous communications (DC) Supported	
Physical layer 100BASE-TX	
Modulation method Base band	
Transmission speed 100M bit/s (100BASE-TX)	
Duplex mode Full duplex/Auto	
Topology Daisy chain, branch wires	
Transmission media Twist pair cable with shields, category 5 or higher	
Transmission distance Within 100 m in distance between nodes (IEEE802.3)	
Maximum number of slaves 255	
Maximum process data size Input 5,736 bytes/Output 5,736 bytes	
Maximum size per slave Input 1,434 bytes/Output 1,434 bytes	
Maximum message size 2,048 bytes	
Communication cycle* <sup>1</sup> About 1 ms (motion control 2 ms/4 axes, 4 ms/8 axes, 8 ms/16 axes)	
Process data communications	<ul style="list-style-type: none"> <li>PDO mapping with CoE</li> <li>Fall back operations when a slave abnormality occurs</li> <li>Suspension of operations when a slave abnormality occurs</li> </ul>
SDO communications	<ul style="list-style-type: none"> <li>CoE</li> <li>Emergency message server (receiving from slave)</li> <li>SDO request/response</li> </ul>
Configuration	<ul style="list-style-type: none"> <li>Node address setting by HX-CODESYS network scanning</li> <li>Network information display</li> </ul>
RAS function	<ul style="list-style-type: none"> <li>Slave configuration check when the networks starts</li> <li>Error information read</li> <li>Troubleshooting information</li> </ul>
Slave information	<ul style="list-style-type: none"> <li>Slave activation/deactivation</li> <li>Slave withdrawal/re-entry (slave option)</li> </ul>
Mail box	<ul style="list-style-type: none"> <li>CoE (CANopen/CAN application layer over EtherCAT®)</li> </ul>

\* Ethernet ports should not be used for purposes other than the EtherCAT® master function when using the EtherCAT® master function.

\*1: The communication cycle must be increased depending on the number of slave devices to be connected.

IEC61131-3 international standards compliant

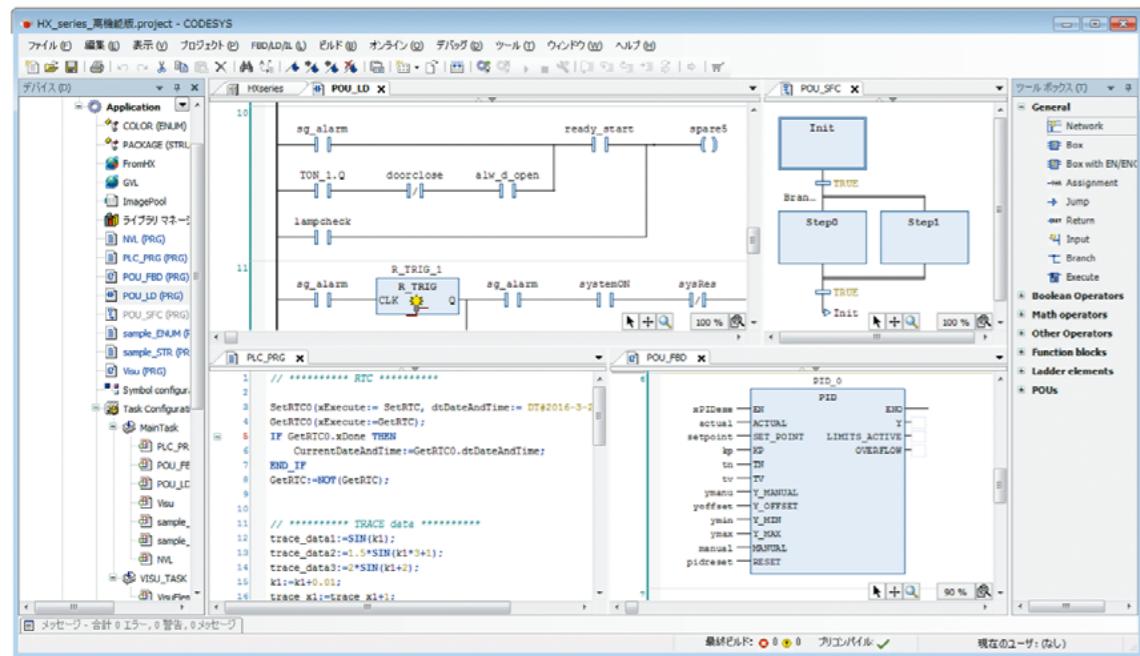
# Integrated Development Environment

## CODESYS



CODESYS

CODESYS is an integrated development environment that is in conformance with IEC61131-3, international standards. It is a cutting-edge PLC application development tool that has been used by more than 350 controller manufacturers and over tens of thousands of end users in various industries around the world.

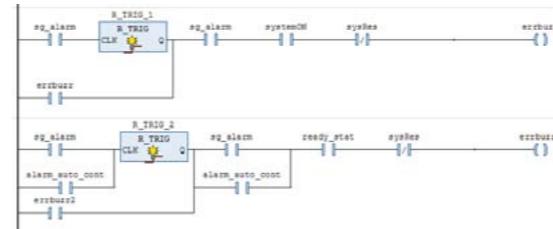


- Executes collective control of devices, tasks, and programs for applications in the project tree structure
- Incorporates the EtherCAT®/Modbus configuration that makes it possible to execute unified controls of I/O for slave devices by using tag names
- Supports five programming languages in conformance with IEC61131-3, international standards + CFC (Continuous Function Chart)
- Supports the eight total languages for tool display; in addition to Japanese and English, German, French, Italian, Spanish, Russian, and Chinese
- Enables object-oriented programming in conformance with IEC61131-3 (3rd edition)
- Incorporates a dedicated compiler for each platform that makes it possible to create efficient, powerful machine codes
- Enhances development efficiency using diverse functions such as input assist, grammar check, debugging function, and simulation

Enabling you to select from five languages in conformance with IEC61131-3, according to the intended purpose and the programmer's skills

### LD (Ladder Logic Diagram)

A graphic language based on relay circuits. It is suitable for bit operations, such as interlock processing.



### ST (Structured Text)

A text language based on PASCAL. It is perfect for uses that are not handled well by LD, such as branching, repeating, and numerical operations.

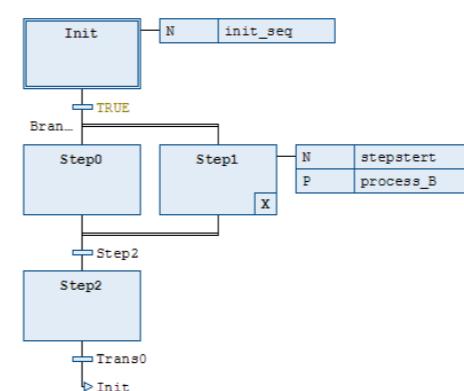
```

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_I DO
5   K1_temp[i]:=B1_init; //Reset B1
6 END_FOR
7 IF count_Nmax <24 THEN
8   WHILE vxcount<10 DO
9     T1max:=125; //Max.=125 digC
10    END WHILE
11 END_IF
12 B100status:=FALSE; //B100 complete

```

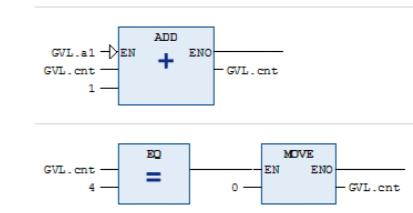
### SFC (Sequential Function Chart)

A graphic language that can express status transition. It is suitable for processing progress. Programs at each step are described in LD, FBD, ST, and IL.



### FBD (Function Block Diagram)

A graphic language that makes it easy to see data and signal flows.



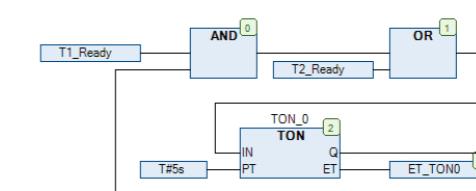
### IL (Instruction List)

An imperative (mnemonic) text language for conventional PLCs. It is suitable for high-speed operations and short programs.

LD	IL
sg_alarm	sg_alarm
OR (	OR (
ANDN	TON_1.Q
AND	doorclose
)	alw_d_open
AND	ready_start
OR	lampcheck
ST	spare5
CAL	R_TRIGGER_1(
LD	CLK:= sg_alarm)
OR	R_TRIGGER_1.Q
AND	errbuzr
AND	sg_alarm
ANDN	systemON
ANDN	sysRes
ST	errbuzr

### CFC (Continuous Function Chart)

A graphic FBD editor with no restrictions on POU layout and connection. It is possible to give feedback from output to input (non IEC61131-3 language).



### Reduces software development costs

#### Local variables and global variables

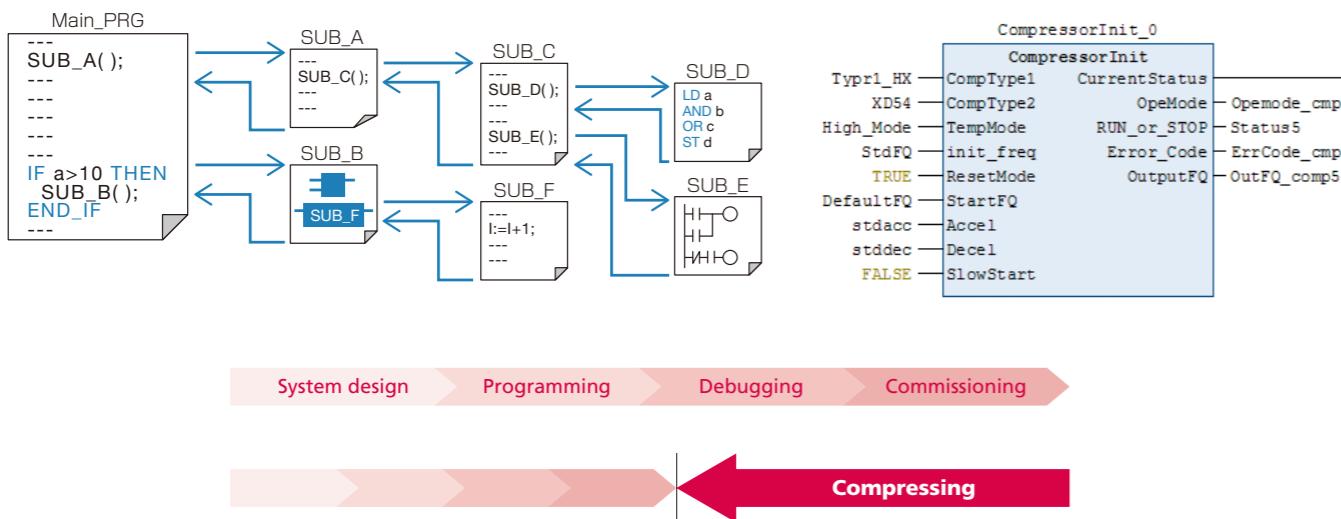
It is possible to define local variables, which are only effective for each program, and global variables, which are common to all programs. Properly using local variables and global variables makes it possible to create application programs with high rates of reusability.

#### Structured programming

It is possible to create a hierarchy of programs and function blocks. This enhances the readability of application programs, and improves the stability, and as a result enhances efficiency in application development.

#### Creating a library

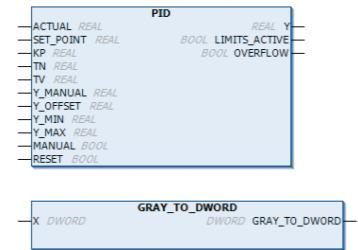
Since function blocks of commonly used process can be registered in the library, frequently used process can be easily reused in other application programs. Process contents of these function blocks can be also set as hidden, therefore can be distributed to end users without disclosing technical information to outside.



### Useful libraries

Convenient and usable commands are incorporated into the standard library; for example, in addition to standard commands in conformance with IEC61131-3, PID and various conversion commands.

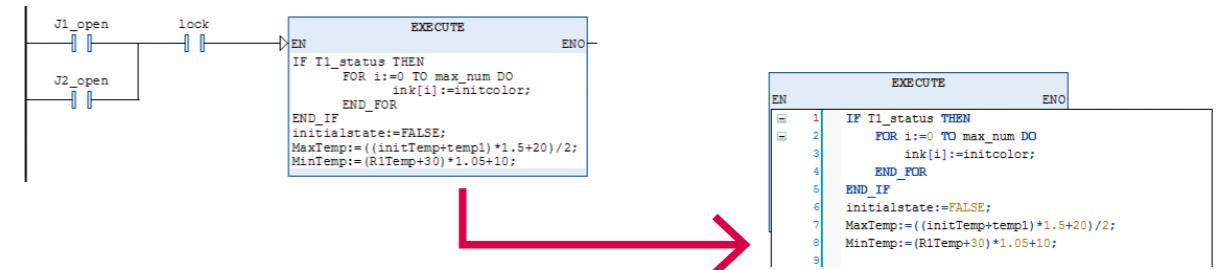
- PID control
- Slew rate output
- ASCII conversion/BCD conversion
- Gray code conversion
- Character string operations
- Analog hysteresis
- Minimum/Maximum/Average/Dispersion



### Convenient functions

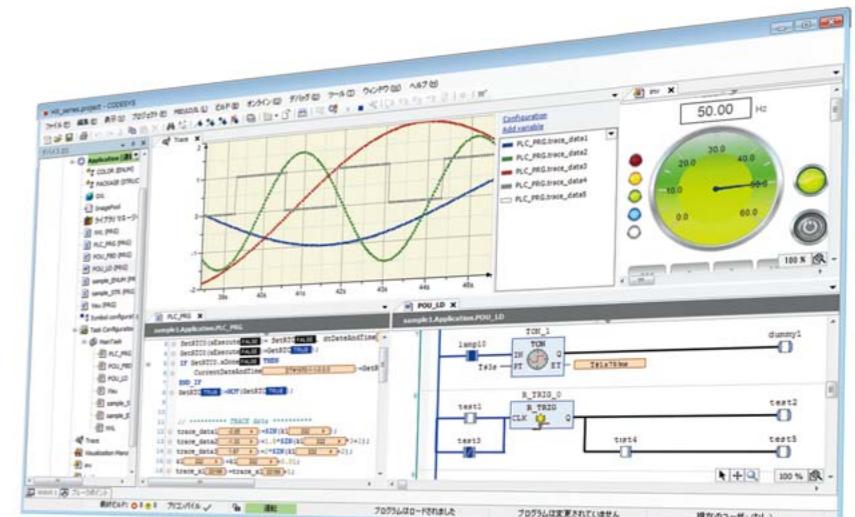
Convenient functions enhance the efficiency of programming and debugging.

- The automatic input complement function and the input assistant function prevent compilation errors due to input mistakes
- Color changes automatically for imperative language and the corresponding parentheses are highlighted
- ST language can be used together with LD and FBD editors
- Any circuit can be commented out by right-clicking



### The powerful debugging function reduces commissioning costs

- Online monitor
- Offline simulation
- Break points
- Force
- Single step execution
- Single cycle scan
- Flow control
- Online change
- Trace
- Visualization
- Web visualization



# EtherCAT® Slave Controller & I/O Module



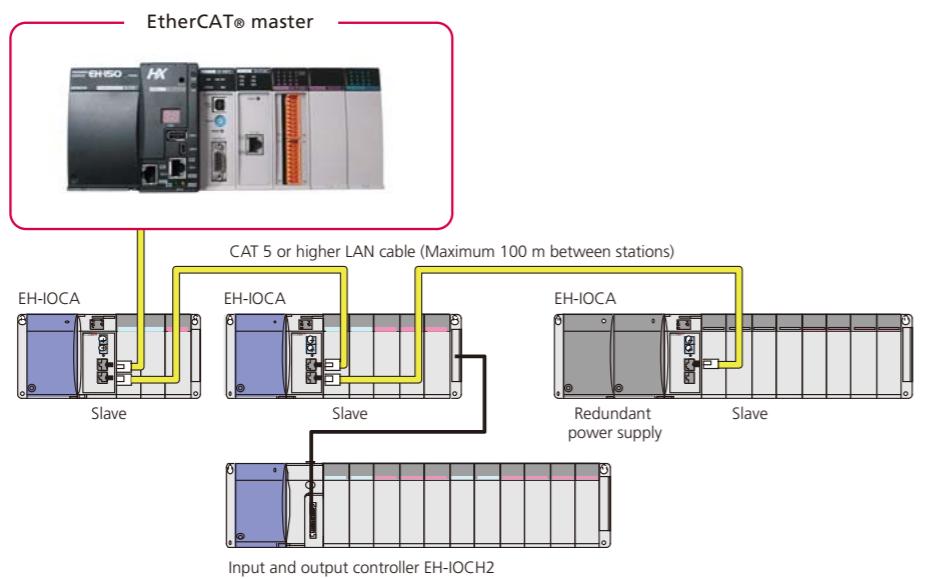
- 1408 points for maximum input and output (analog input and output 176ch)**  
Users can create any configurations because of the coupler type. It can also be applied to the large-scale control system.
- Compatible with EH-150/EHV/EHV+ series**  
Power supplies, bases, and I/O modules (some are excluded) of the EH-150/EHV/EHV+ series can be used.
- High-speed response and high reliability**  
The communication cycle is 200 µs. When communication abnormalities occur, the output data can be retained.

## EtherCAT® Slave Controller Specifications

Items	Model	Specifications
		EH-IOCA
Communication specifications	Communication protocol	EtherCAT® dedicated protocol
	Modulation method	Base band
	Transmission speed	100 Mbps
	Physical layer	100BASE-TX (IEEE802.3)
	Connector	RJ45 (IN, OUT)
	Topology	Daisy chain
	Communication cable	Category 5 or higher STP cable
	Communication distance	Within 100 m in distance between nodes (slaves)
	Communication cycle	200 µs or higher*1
	Node address range	1 to 99: Setting by the node address switch 1 to 65535: Setting by EtherCAT® master
	Process data	Fixed PDO mapping
	Mail box	Support
	Synchronous mode	Free Run mode (asynchronous)
	Output hold function	Support (set by master)
Functional specifications	Usable base	EH-BS3A/5A/6A/8A/11A/8R
	Number of mounted modules	Maximum 22 units per slave device
	Input and output points	1408 points for digital input and output, 176 ch for analog input and output
	Number of expansion units	1
	Refresh time	500 µs fixed
	Self-diagnostics	WDT check
	Error display	LED
	Consumption current	350 mA

\*1: The communication cycle depends on EtherCAT® master specifications.

## [Configuration Example]



## EtherCAT® Slave Mountable Modules

Product	Model	Specifications
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
	EH-XDS16	16 points, 24 V DC input
	EH-XD32	32 points, 24 V DC input
	EH-XDL32	32 points, 24 V DC input
	EH-XDS32	32 points, 24 V DC input
	EH-XD32E	32 points, 24 V DC input
	EH-XDL32E	32 points, 24 V DC input
	EH-XD32H	32 points, 24 V DC input
	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
	EH-YR8B	8 points, independent contact relay output, 100/240 V AC, 24 V DC
Output module	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 (with a short circuit)
	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
	EH-YTP32E	32 points, transistor output, 12/24 V DC, Source Type
	EH-YT32H	32 points, transistor output, 5 to 24 V DC, Sink Type
	EH-YT64	64 points, transistor output, 12/24 V DC, Sink Type
	EH-YTP64	64 points, transistor output, 12/24 V DC, Source Type
Input and output mixed module	EH-YS16	16 points, triac output, 100/240 V AC
	EH-MTT32	16 points TTL input, Sink Type, 16 points TTL output, Sink Type
Analog input module	EH-AX44	12 bits analog input, 4 to 20 mA, 0 to 10 V, 4 ch each
	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 22 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	16 bits analog input module with insulation 5 ch., 0 to 22 mA, 4 to 22 mA, -10 to +10 V, 0 to 10 V
	EH-AY22	12 bits analog output, 4 to 20 mA, 0 to 10 V, 2 ch each
Analog output module	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	16 bits analog output module with insulation 4 ch., 0 to 22 mA, 4 to 22 mA, 0 to 10 V
Resistance thermometer sensor module	EH-PT4	4 ch resistance thermometer sensor (Pt100/Pt1000) input, signed 15 bit
	EH-PTD8	6/8 ch resistance thermometer sensor (Pt100/Pt1000) input, signed 15 bit
Thermocouple input module	EH-TC8	8 ch thermocouple (K, E, J, T, B, R, S, N) input, signed 15 bits
Counter module	EH-CU	2 channel high speed counter input, maximum frequency 100 kHz
	EH-CUE	1 channel high speed counter input, maximum frequency 100 kHz
Dummy module	EH-DUM	Module for empty slots

## Supporting function blocks for PLCopen compliant motion control

# Incorporating the Motion Control Function\* (SoftMotion)

\*Motion model, CNC motion model

- Supports function blocks for PLCopen Motion Control
- Enables motion control by connecting servo with EtherCAT®
- Enables use of multiple axes coordination operations for CNC and robots by using the SoftMotion CNC package
- Enables execution of not only simple single axis control, but also synchronous control of multiple axes by using the electronic cam function, and to freely program the position, speed, acceleration with the graphical editor
- Enables simulation of operations without connecting to a real drive by using the functions of virtual axes
- Enables diverse control from I/O control to robot control with a single unit through combined use of PLC functions (sequence control function)

### Motion Function Specifications

Items		Specifications
Control mode		Position control, speed control and torque control
By axis type		Drive axis, virtual axis, encoder axis
Single axis	Position control	Absolute value positioning Specifies the target position in the absolute position coordinates (MC_MoveAbsolute)
		Relative value positioning Specifies the target position in the relative position by setting the current position as the start point (MC_MoveRelative)
		Target position change Adds relative distance to the last position command (MC_MoveAdditive)
		Superimposed positioning Superimposes relative distance and speed on the last position command (MC_MoveSuperimposed)
		Position profile moving Operates according to the specified time-position profile (MC_ProfileProfile)
Speed control	Speed control	Specifies the target speed (MC_MoveVelocity)
	Speed profile moving	Operates according to the specified time-speed profile (MC_VelocityProfile)
Torque control		Specifies the torque (SMC_SetTorque)
Others	Stop	Ends operations (MC_Halt)
	Compulsory stop	Ends operations. Other commands cannot cut in while this command is being executed (MC_Stop)
	Acceleration profile moving	Operates according to the specified time-acceleration profile (MC_AccelerationProfile)
Cam operation		The subordinate axis operates by maintaining the position relations with the master axis (real axis or virtual axis)
		The position relations are defined in the user-created cam table, using a graph or numerals (MC_CamIn, MC_CamOut, MC_CamTableSelect)
Gear operation		Operates at the speed ratio specified by the master axis (real axis or virtual axis) and the subordinate axis (MC_GearIn, MC_GearOut, MC_GearInPos)
Tappet		Controls digital output according to the position of the main axis
		The relationships between the position and digital output are user-defined in a tappet table (MC_CamTappetAction)
Relative value main axis phase correction		Corrects the phase difference of the main axis and the slave axis (MC_Phasing)
CNC (locus control)		Operates according to the locus specified by graphics or G codes in the CNC editor

Motion model, CNC motion model



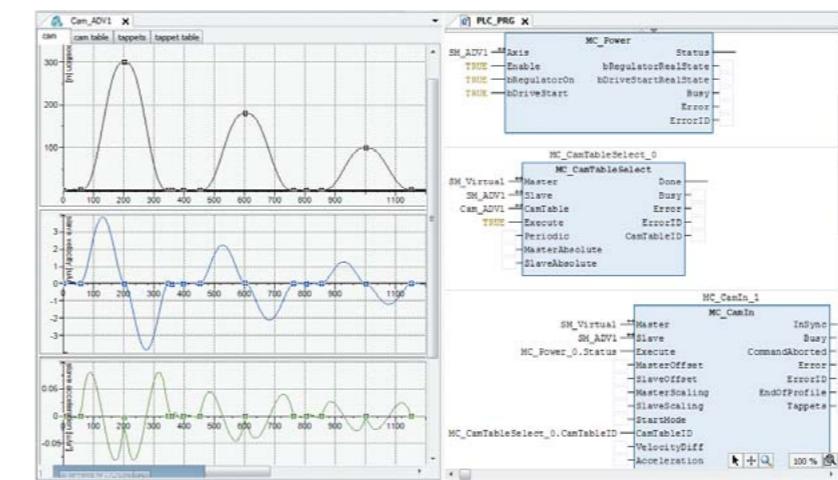
EtherCAT®

\* The communication cycle depends on EtherCAT® master and slave specifications

EtherCAT®-compatible servo system ADV series by Hitachi Industrial Equipment Systems

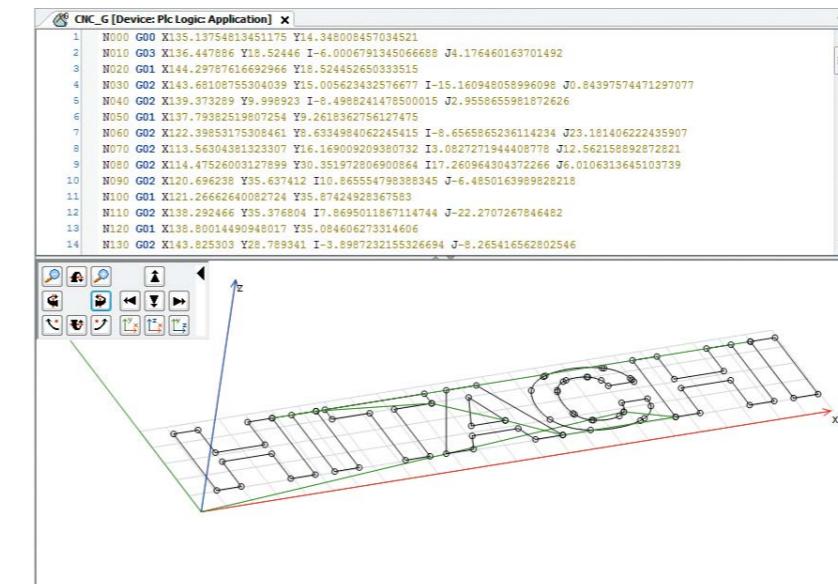
### SoftMotion (Motion model, CNC motion model)

- Diverse motion function blocks make it possible to respond to a wide range of controls, from PTP control with a single axis to synchronous control with multiple axes
- It is possible to execute programming for the electronic cam with the graphical cam editor, which makes it easy to intuitively visualize the movement



### CNC (G codes), Robotics (CNC motion model)

- Enable locus control programming with coordinate input in the graphical 3D display or the table format, or G codes
- Achieve intuitive visualization of movement, for example, automatic locus display from the input coordinates, and visual display of the acceleration and slowdown band of the locus
- Enable coordinate reading from the DXF file, and conversion to G codes
- Support coordinate-type conversion functions, such as conversion from rectangular coordinates to polar coordinates
- Support different speed profiles, such as trapezoid acceleration and deceleration, S shaped acceleration and deceleration, jerk-limited acceleration and deceleration (air supplement control)
- Achieve movements needed for processing machines and others, such as tool diameter compensation, edge smoothing, and setting the continuous operations according to accuracy



## Functional Modules Common in the Reliable and Proven EH-150/EHV+ Series

### DC and AC digital input and output modules



**8 / 16 pts. Input module (terminal block)**  
 EH-XD8 : 8 pts. 24 V DC  
 (response time 5 ms max.)  
 EH-XD16 : 16 pts. 24 V DC  
 (response time 5 ms max.)  
 EH-XDL16 : 16 pts. 24 V DC  
 (response time 16 ms max.)  
 EH-XDS16 : 16 pts. 24 V DC  
 (response time 1 ms max.)  
 EH-XA16 : 16 pts. 100 to 120 V AC  
 (response time 15 ms max.)  
 EH-XAH16: 16 pts. 200 to 240 V AC  
 (response time 15 ms max.)



**32 pts. Input module (connector)**  
 EH-XD32 : 32 pts. 24 V DC  
 (response time 5 ms max.)  
 EH-XDL32: 32 pts. 24 V DC  
 (response time 15 ms max.)  
 EH-XDS32: 32 pts. 24 V DC  
 (response time 1 ms max.)



**64 pts. Input module (connector)**  
 EH-XD64: 64 pts. 24 V DC  
 (response time 1 ms max.)



**32 pts. Input module (Spring type terminal block)**  
 EH-XD32E : 32 pts. 24 V DC  
 (response time 5 ms max.)  
 EH-XDL32E: 32 pts. 24 V DC  
 (response time 16 ms max.)



**8 / 16 pts. Output module (terminal block)**  
 EH-YT8 : 8 pts. Transistor (sink)  
 EH-YTP8 : 8 pts. Transistor (source)  
 EH-YT16 : 16 pts. Transistor (sink)  
 EH-YTP16 : 16 pts. Transistor (source)  
 EH-YTP16S: 16 pts. Transistor  
 (source with short circuit protection)  
 EH-YS16 : 16 pts. Triac  
 EH-YR12 : 12 pts. Relay  
 EH-YR16 : 16 pts. Relay  
 EH-YR8B : 8 pts. Isolated relay  
 EH-YR16D : 16 pts. Relay (2 common)



**32 pts. Output module (connector)**  
 EH-YT32 : 32 pts. Transistor (sink)  
 EH-YTP32: 32 pts. Transistor (source)



**64 pts. Output module (connector)**  
 EH-YT64 : 64 pts. Transistor (sink)  
 EH-YTP64: 64 pts. Transistor (source)



**32 pts. Output module (Spring type terminal block)**  
 EH-YT32E : 32 pts. Transistor (sink)  
 EH-YTP32E: 32 pts. Transistor (source)

### Digital input and output modules



#### DC Input and DC Output modules

EH-XD32H: 32 pts. DC 24 V input  
 (EM / H-200 compatible connector type)  
 EH-YT32H: 32 pts. DC 24 V output  
 (EM / H-200 compatible connector type)

### Analog input and output modules



#### Analog Input module

EH-AX44 : 12-bit analog input, Current 4 to 20 mA, Voltage 0 to 10 V, 4 ch each  
 EH-AX8V : 12-bit analog input, Voltage 0 to 10 V, 8 ch  
 EH-AX8H : 12-bit analog input, Voltage -10 to 10 V, 8 ch  
 EH-AX8I : 12-bit analog input, Current 4 to 20 mA, 8 ch  
 EH-AX8IO : 12-bit analog input, Current 0 to 22 mA, 8 ch  
 EH-AXH8M: 14-bit analog input, Current 0 to 22 mA / 4 to 22 mA, Voltage -10 to 10 V / 0 to 10 V, 8 ch  
 EH-AXG5M: 16-bit analog input, Current 0 to 22 mA / 4 to 22 mA, Voltage -10 to 10 V / 0 to 10 V, 5 ch Isolated

#### Analog Output module

EH-AY22 : 12-bit analog output, Current 4 to 20 mA, Voltage 0 to 10 V, 2 ch each  
 EH-AY4V : 12-bit analog output, Voltage 0 to 10 V, 4 ch  
 EH-AY4H : 12-bit analog output, Voltage -10 to 10 V, 4 ch  
 EH-AY4I : 12-bit analog output, Current 4 to 20 mA  
 EH-AY2H : 12-bit analog output, Voltage -10 to 10 V, 2 ch  
 EH-AYH8M: 14-bit analog output, Current 0 to 22 mA / 4 to 22 mA, Voltage 0 to 10 V, 8 ch  
 EH-AYG4M: 16-bit analog output, Current 0 to 22 mA / 4 to 22 mA, Voltage -10 to 10 V / 0 to 10 V, 4 ch Isolated

#### RTD and thermocouple Input module

EH-PT4 : Signed 15-bit, Pt100 / Pt1000, 4 ch  
 EH-RTD8 : Signed 15-bit, Pt100 / Pt1000, 6 ch (3 wire) / 8 ch (2 wire)  
 EH-TC8 : Signed 15-bit, Thermo-couple (K, E, J, T, B, R, S, N) 8 ch

### Counter modules



#### High speed counter module

EH-CU : Maximum 100 kHz, 2 ch  
 EH-CUE: Maximum 100 kHz, 1 ch

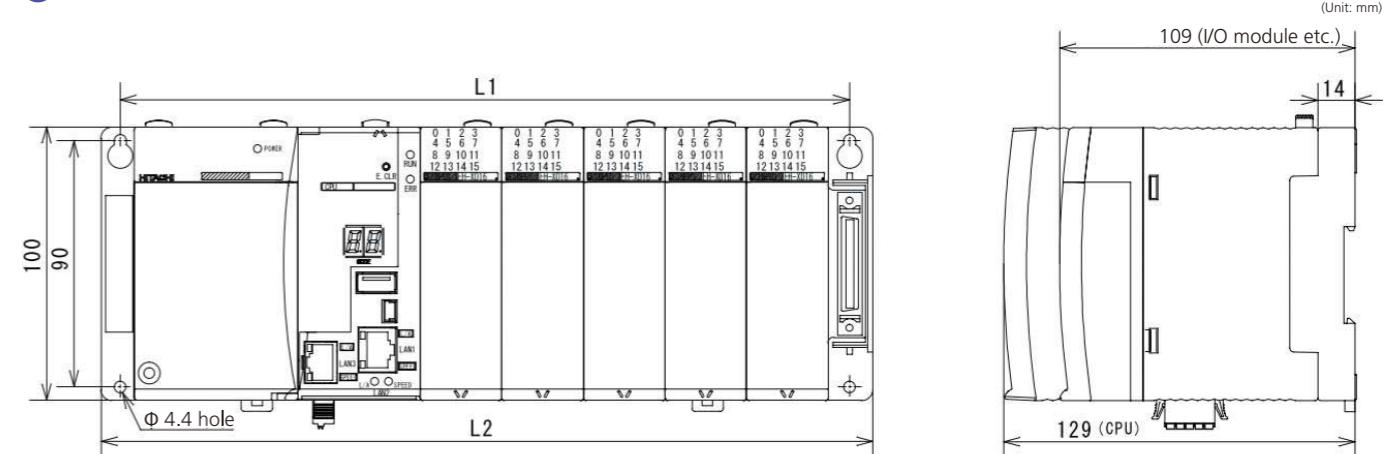
### Communication and Network modules



#### Serial communication Module: EH-SIO

Interface: RS-232Cx1, RS-232C / 422 / 485x1  
 Communication mode : Half-duplex  
 Communication speed : 300-57,600 bps  
 Communication protocol: Non-protocol  
 Modbus-RTU master

### External Dimensions



Base model	EH-BS11A	EH-BS8A	EH-BS6A	EH-BS5A	EH-BS3A	EH-BS8R
Number of I/O module slots	11	8	6	5	3	8
L1	447	357	297	267	207	417
L2	462.5	372.5	312.5	282.5	222.5	432.5



#### PROFIBUS® DP V0 Master / Slave Controller

Number of slave-connected units: Max. 125  
 (of which maximum 22 units are EH-IOCP2)  
 Communication speed Max. 12 Mbps  
 Communication distance Max. 1,200 m (Lower than 93.75 kbps)  
 Input / Output data 512 words / 512 words

### General Specifications

Items	Model/Type				
	Standard	Full Function	Motion	CNC motion	Hybrid
Operating ambient temperature	HX-CP1508	HX-CP1H16	HX-CP1508M	HX-CP1H16M	HXC-CP1H16
Storage ambient temperature				-10 to 75°C	
Operating ambient humidity				5 to 95% RH (No condensation)	
Storage ambient humidity				5 to 95% RH (No condensation)	
Vibration resistance				IEC60068-2-6 compliant	
Noise resistance	O Noise voltage 1,500 Vpp, Noise pulse width 100 ns, 1 µs (Noise created by the noise simulator is applied across the power supply module's input terminals. This is determined by this company's measuring methods.) O IEC61131-2 compliant O Static noise: 3,000 V at metal exposed area				
Insulation resistance	20 MΩ or more between the AC external terminal and case ground (FE) terminal (based on 500 V DC mega)				
Dielectric withstand voltage	1,500 V AC for 1 minute between the AC external terminal and case ground (FE) terminal				
Grounding		Class D grounding (ground with power supply module)			
Usage environment			No corrosive gases, no excessive dust		
Structure			Open, wall-mount type		
Cooling			Natural air cooling		
Dimensions			45 mm (W) × 100 mm (H) × 115 mm (D)		
Weight	190 g	240 g	190 g	240 g	
Current consumption	5 V DC 1,000 mA	5 V DC 1,200 mA	5 V DC 1,000 mA	5 V DC 1,200 mA	



\* Please check the usable units, restrictions, and other matters in the product manual before selecting components.

Items	Model	Specifications	Remarks
Others	EH-DUM	Module for empty slots	
	EH-TMCV	Half-size terminal block cover (Lot 10 configuration)	
	HX-BAT	Clock data is stored in memory retained by battery.	*1
Extension cable	EH-CB05A	Length: 0.5 m, common for Base to Extension, Extension to Extension	
	EH-CB10A	Length: 1.0 m, common for Base to Extension, Extension to Extension	
	EH-CB20A	Length: 2.0 m, common for Base to Extension, Extension to Extension	
Terminal block	HPX7DS-40V6	Terminal block for 32-/64-point modules	
External connection cable for 32-/64-point input and output modules	EH-CBM01W	Length 1 m (Connector in both ends)	
	EH-CBM03W	Length 3 m (Connector in both ends)	
	EH-CBM05W	Length 5 m (Connector in both ends)	
	EH-CBM10W	Length 10 m (Connector in both ends)	
	EH-CBM01	Length 1 m (Connector and open ends)	
	EH-CBM03	Length 3 m (Connector and open ends)	
	EH-CBM05	Length 5 m (Connector and open ends)	
	EH-CBM10	Length 10 m (Connector and open ends)	
External connection cable for EM/H-200 compatible 32-point input and output modules	CBM-02	Length 2 m (Connector and open ends)	
	CBM-05	Length 5 m (Connector and open ends)	
	CBM-10	Length 10 m (Connector and open ends)	
Cable for counter modules	EH-CUC01	Length 1 m (Connector and open ends)	
	EH-CUC02	Length 2 m (Connector and open ends)	
	EH-CUC03	Length 3 m (Connector and open ends)	
	EH-CUC04	Length 4 m (Connector and open ends)	
	EH-CUC05	Length 5 m (Connector and open ends)	

Item	Model	Specifications	Remarks
Integrated development environment HX-CODESYS	HX-CDS	Integrated development environment in conformance with IEC61131-3	*2
Engineering tool HX-Studio	HX-STD	C/C++ program development environment for Hybrid model	*3

\*1: Batteries are required to retain calendar clock data only.

Batteries are not required in the case of synchronization with the calendar clock of the NTP server and in order to retain user programs and data memory with outage retaining attributes.

\*2: A cable for connecting the PC to the CPU (A-mini B type USB cable or LAN cable) must be obtained by the customer.

\*3: HX-Studio is dedicated to LAN connection.

Cautions for Selecting Products
<p>This document explains the representative features of the products. It does not cover all information, such as restrictions in usage and the combined use of units. Be sure to read the manual of the product before selecting it.</p> <p>We are not responsible for any damage caused by reasons which are not attributable to our company, damage to machinery at the customer's site caused by the malfunctioning of our products, loss of profits, damage caused by special circumstances, regardless of it was foreseeable by our company, secondary damage, compensation for accidents, damage to things other than our products, and other agreements with your business.</p>

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<ul style="list-style-type: none"> <li>● Please read all manuals and instructions carefully before use to ensure safety and proper use of the product.</li> <li>● The operating environment shall be within the range specified in the catalog, the manuals, and the instructions. Do not use the products in the following environments: high temperatures, high humidity, dust, corrosive gas, many vibrations, and shocks. This may cause fires, malfunctioning, electrical shocks, and erroneous operations.</li> <li>● Follow the manuals and the instructions while the installing the products and wiring to ensure safety. The set up should be conducted by qualified people with special skills in electrical work and wiring. Please be sure to prevent contamination from foreign articles.</li> <li>● Some of the products in this catalog have restrictions on usage and usage location and require routine inspection. Please inquire with the retail store where you purchased them or our company.</li> <li>● These products are manufactured under strict quality control. However, if they are intended for use at important facilities where human lives may be lost if a malfunction occurs, or at facilities where significant loss can be predicted, install safety devices to prevent major accidents.</li> </ul>

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# Network



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