

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 IEC61131-3 international 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.

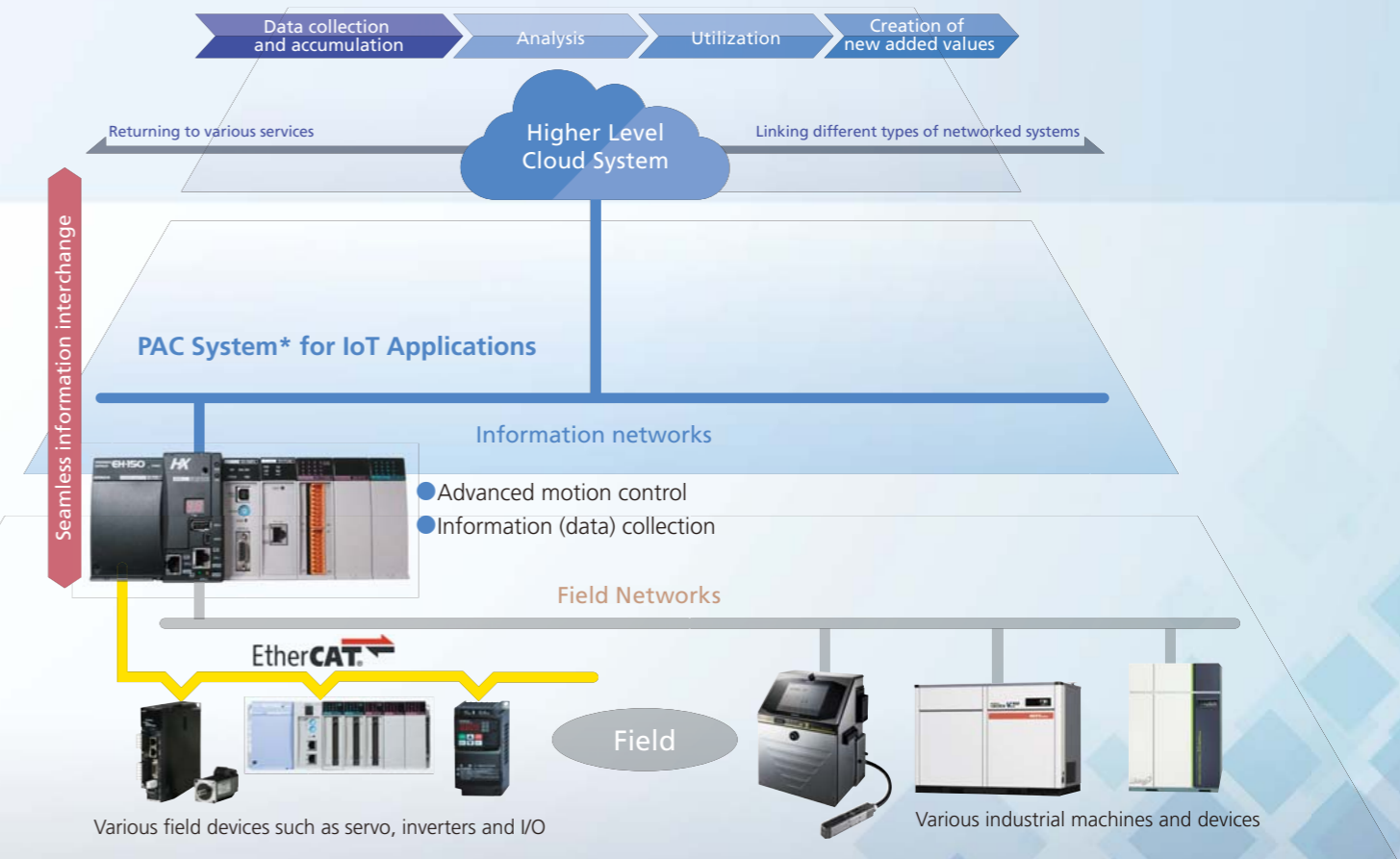
PLC Based PAC System for IoT Applications

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)
- ✓ **Sensor and actuator control**
(Various sensors and actuators including Hitachi inverters)
- ✓ **OPC-UA for communication with higher level information systems**
ERP linkage, MES connection, SCADA system connection, etc.
- ✓ **Supports data logging using SD memory**
- ✓ **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)
- ✓ **Supports function blocks for PLC open compliant motion control**
- ✓ **Supports programming languages compatible with IEC61131-3 international standards**



* 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).

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.

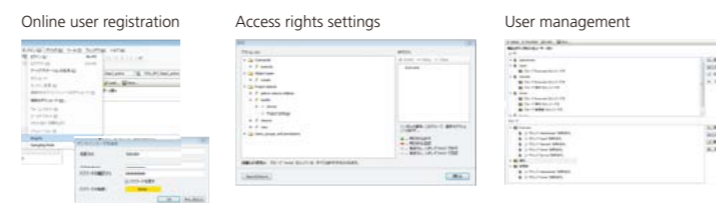
Prevention of unauthorized external access

- 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

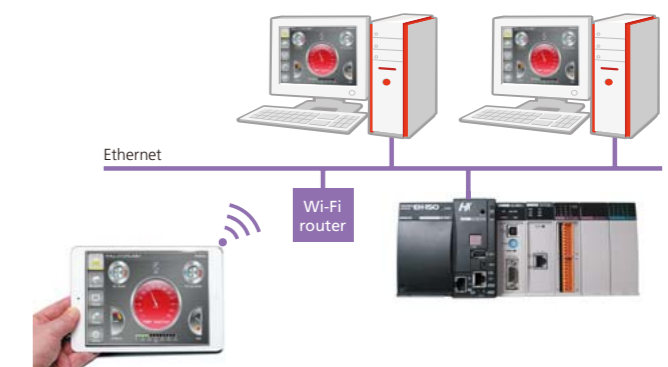
Items	Model	Specifications				
		Standard model HX-CP1508	Motion model HX-CP1508M	Full function model HX-CP1H16	CNC motion model HX-CP1H16M	Hybrid model HXC-CP1H16
User program memory		8 MB		16 MB		
Source file memory		8 MB		16 MB		
Data memory (non-retain)		8 MB		16 MB		
Data memory (Retain, Persistent)		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				
USB host (USB memory)	1 port (A type connector, USB 2.0 High speed): for data storage					
SD memory card slot			1 slot (SD / SDHC)			
Display and switch	Display	RUN LED, ERR LED, 7-segmenyted 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				Approx. 70 sec	
Maintenance function	Self-diagnosis (CPU error, Watch-dog timer error, Memory / Battery error etc.)					
Compliant	UL/cUL, CE, RCM				UL/cUL, CE	
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



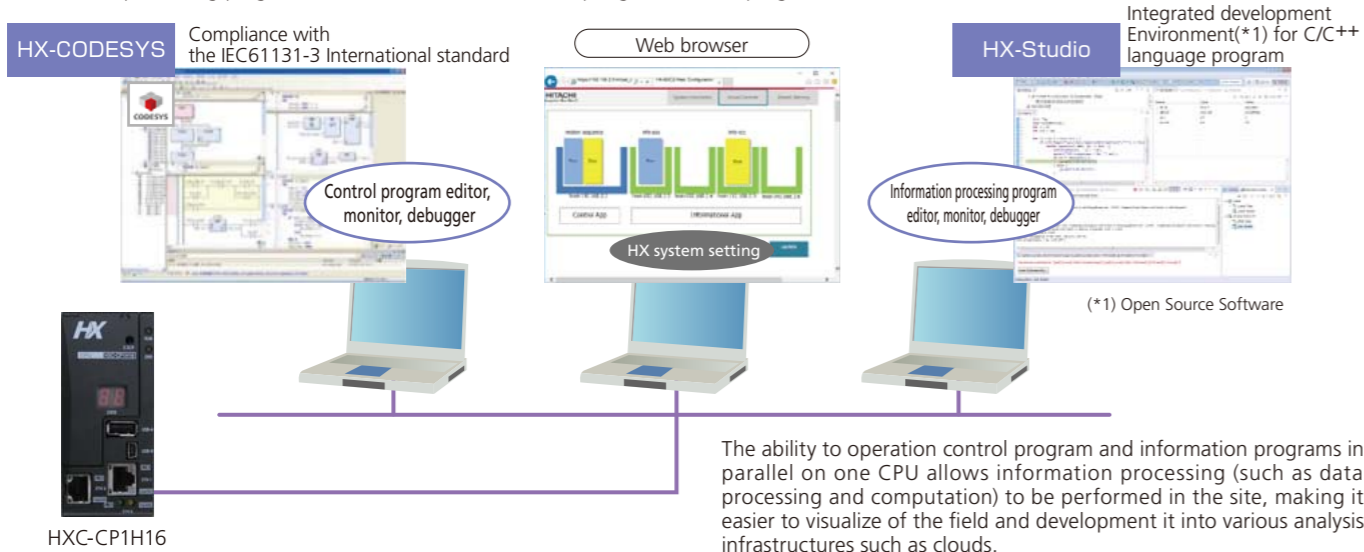
HX series Hybrid model NEW



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.

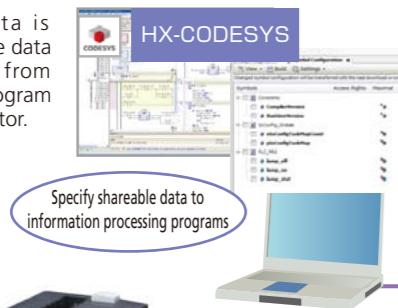
Information processing programs are executed without interrupting PLC control program on one CPU.



The ability to operation 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.



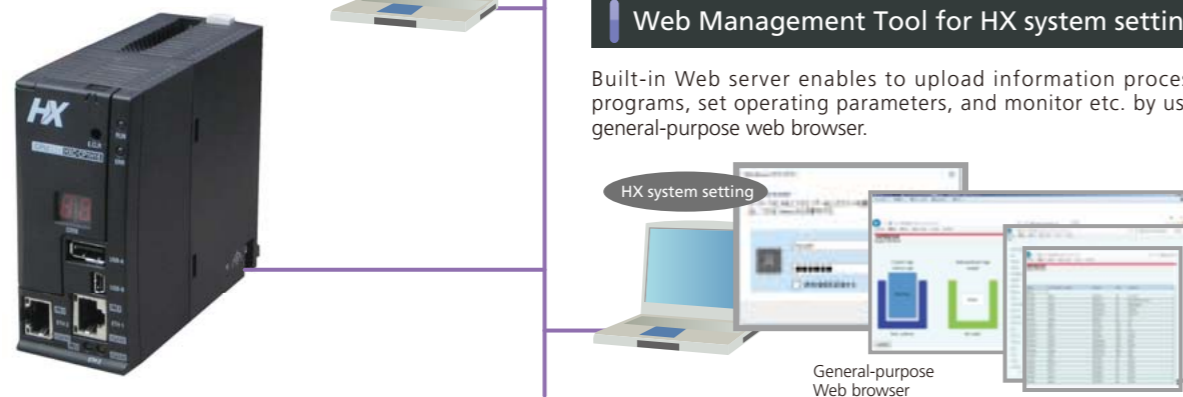
Information processing programs can be changed without stopping the control program execution

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

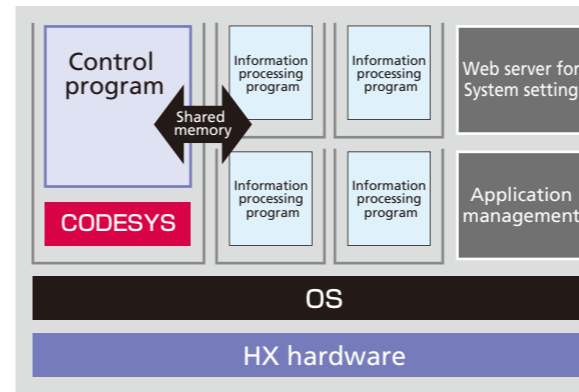


Web Management Tool for HX system setting

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

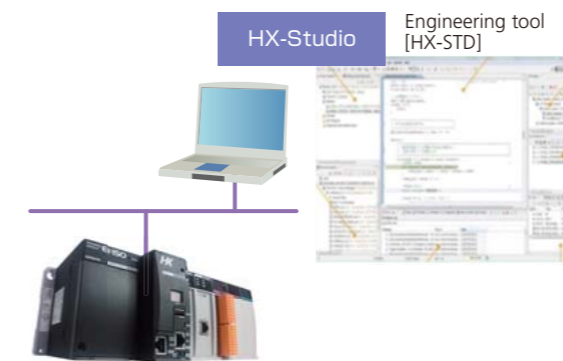
The ability to implement control-to-edge computing with one CPU module meets the needs of making industry systems IoT and applying various IoT technologies to industrial controllers.

Hybrid Model [HXC-CP1H16]

- Program data memory: 16 MB
- Retention memory: 2 MB
- Serial communications: RS-485
- USB: Host-device
- FTP: Server
- NTP: Client
- Modbus-RTU: Master/Slave
- Ethernet port: 3
- SD: SDHC
- OPC-UA: Server
- EtherCAT: master
- Modbus-TCP: Client/Server
- Web: Visualization
- C/C++ program: 32 MB
- C/C++ work RAM: 512 MB

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

(*3) C/C++ Development Tooling (Plug-in for Eclipse)



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	CPU module: SD card, Ethernet port(LAN3) Serial port(RS-485) USB(host)
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* ¹ , network variables, TCP/IP, UDP/IP, NTP, FTP server, http* ²
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
	Supported function	file system
USB device	Standard	USB 2.0 High Speed (480 Mbps)
	Connector	mini-B type
	Transmission distance	5 m
	Supports function	CODESYS gateway (exclusively for integrated development environment HX-CODESYS connection)
Serial* ³	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
Supports function	Modbus-RTU mater, Modbus-RTU slave, generic communications	
SD memory card* ³	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
	Maximum capacity per file	2 GB
Supports function	File system	

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

*2: HX-CP1508, CP1508M does not support the http function.

*3: Serial ports, SD memory are not available for HX-CP1508, CP1508M.

EtherCAT® Master Specifications

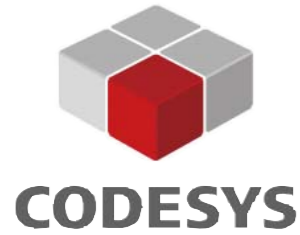
Items	Specifications
Communication protocol	EtherCAT® dedicated protocol (CoE)
Support service	CoE (process data, SDO communications)
Synchronous communications (DC)	Supported
Physical layer	100BASE-TX
Modulation method	Base band
Transmission speed	100M bit/s (100BASE-TX)
Duplex mode	Full duplex/Auto
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* ¹	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"> • PDO mapping with CoE • Fall back operations when a slave abnormality occurs • Suspension of operations when a slave abnormality occurs
SDO communications	CoE <ul style="list-style-type: none"> • Emergency message server (receiving from slave) • SDO request/response
Configuration	<ul style="list-style-type: none"> • Node address setting by HX-CODESYS network scanning • Network information display
RAS function	<ul style="list-style-type: none"> • Slave configuration check when the networks starts • Error information read • Troubleshooting information
Slave information	<ul style="list-style-type: none"> • Slave activation/deactivation • Slave withdrawal/re-entry (slave option)
Mail box	<ul style="list-style-type: none"> • CoE (CANopen/CAN application layer over EtherCAT®)

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

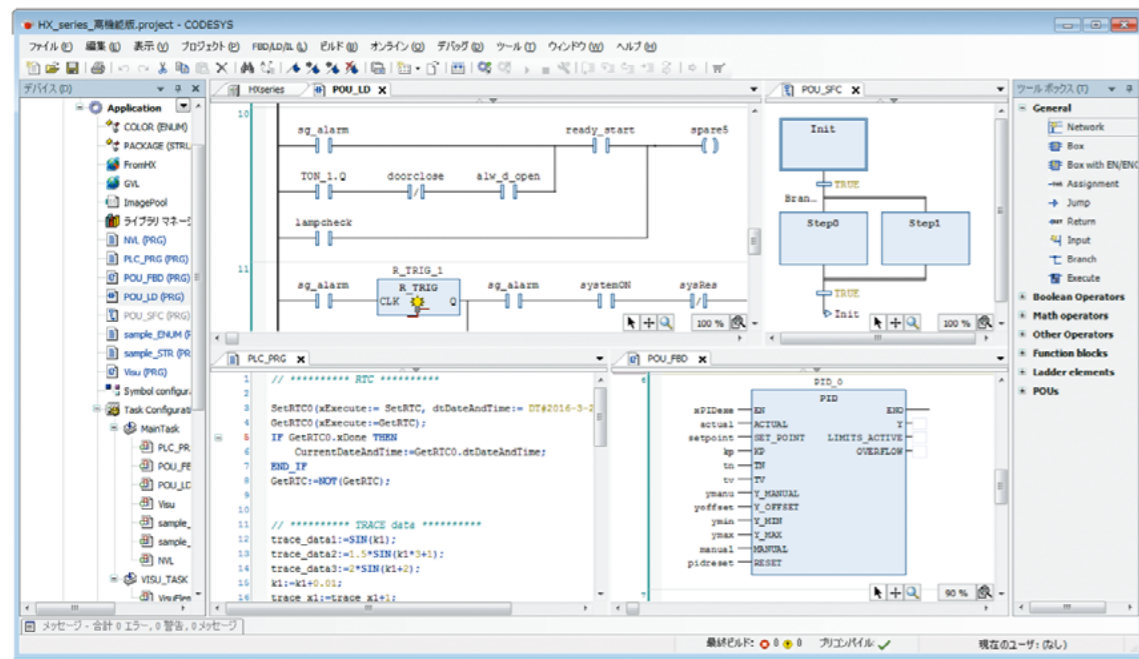
*1: The communication cycle must be increased depending on the number of slave devices to be connected.

IEC61131-3 international standards compliant

Integrated Development Environment CODESYS



CODESYS 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.

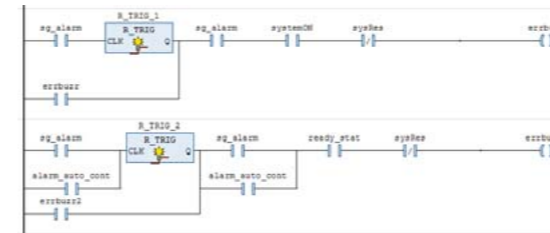


- ✓ Executes collective control of devices, tasks, and programs for applications in the project tree structure
- ✓ Incorporates the EtherCAT®/Modbus configuration that makes it possible to execute unified controls of I/O for slave devices by using tag names
- ✓ Supports five programming languages in 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

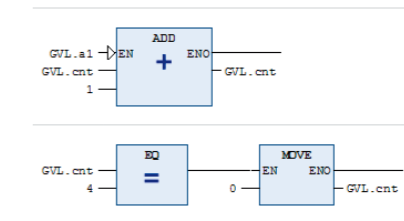
LD (Ladder Logic Diagram)

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



FBD (Function Block Diagram)

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



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
    
```

IL (Instruction List)

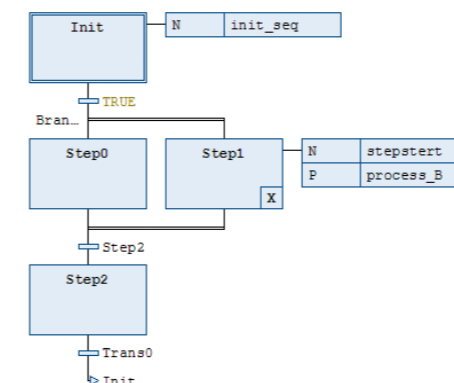
An imperative (mnemonic) text language for conventional PLCs. It is suitable for high-speed operations and short programs.

```

LD      sg_alarm
CR (    TON_1.Q
ANDN   doorclose
AND    alw_d_open
)
AND    ready_start
CR     lampcheck
ST     spare5
CAL    R_TRIG_1(
        CLK:= sg_alarm)
LD     R_TRIG_1.Q
CR    errbuzr
AND   sg_alarm
AND   systemON
ANDN  sysRes
ST    errbuzr
    
```

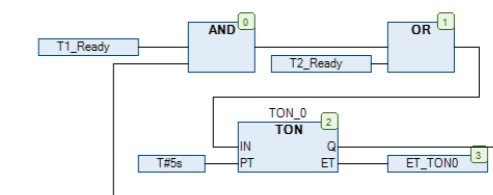
SFC (Sequential Function Chart)

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.



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

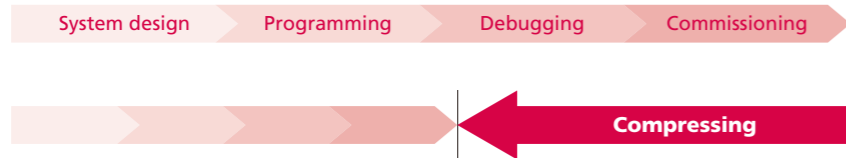
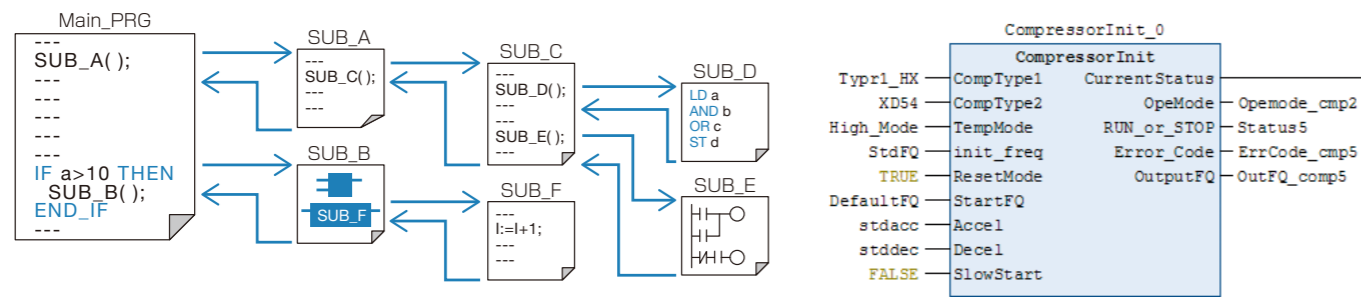
It is possible to define local variables, which are only effective for each program, and global variables, which are common to all programs. Properly using local variables and global variables makes it possible to create application programs with high rates of reusability.

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

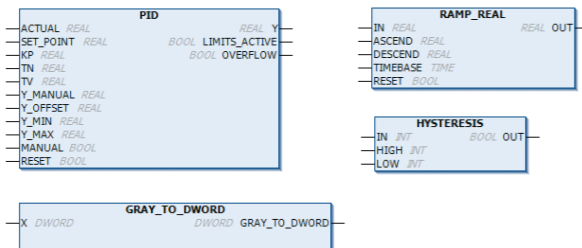
Since function blocks of commonly used process can be registered in the library, frequently used process can be easily reused in other application programs. Process contents of these function blocks can be also set as hidden, therefore can be distributed to end users without disclosing technical information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

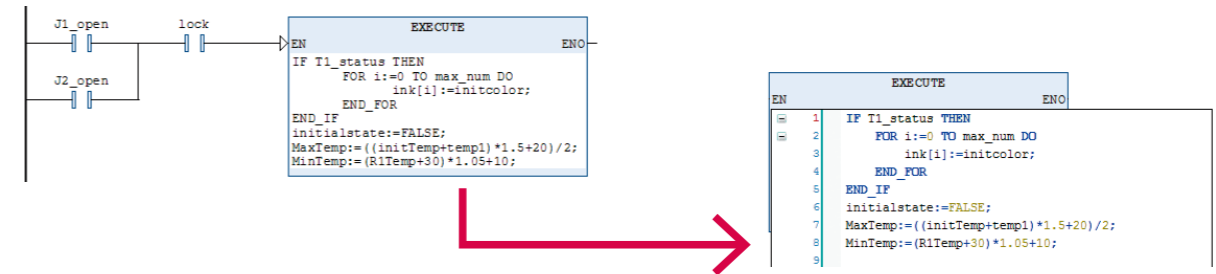
- PID control
- Slew rate output
- ASCII conversion/BCD conversion
- Gray code conversion
- Character string operations
- Analog hysteresis
- Minimum/Maximum/Average/Dispersion



Convenient functions

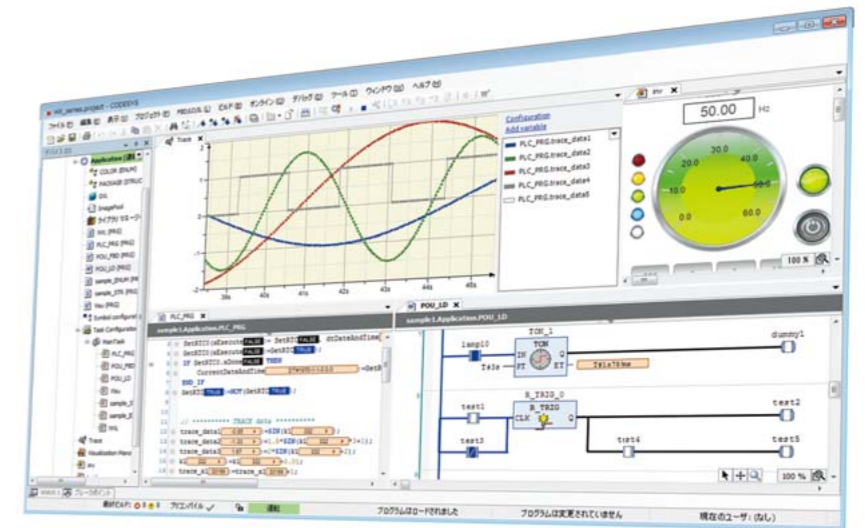
Convenient functions enhance the efficiency of programming and debugging.

- 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



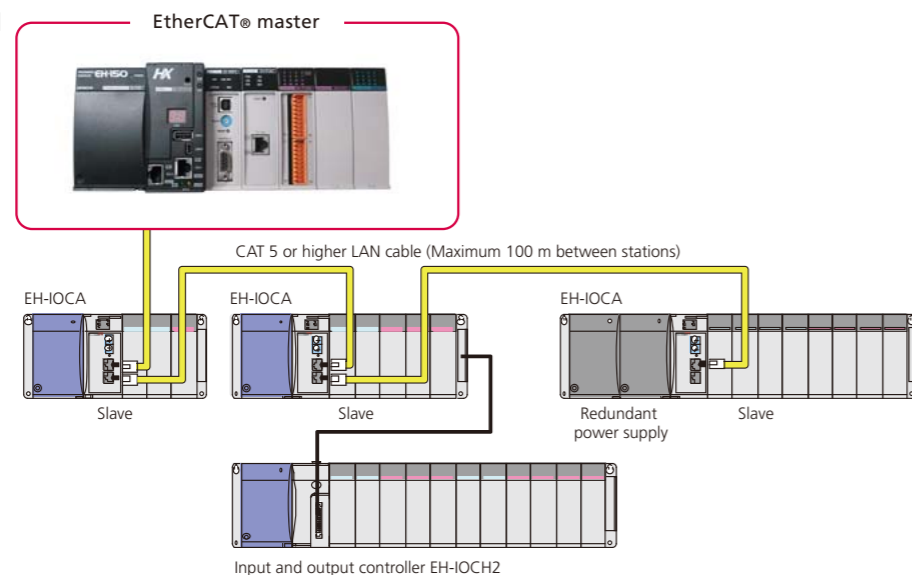
- ✓ **1408 points for maximum input and output (analog input and output 176ch)**
Users can create any configurations because of the coupler type. It can be also applied to the large-scale control system.
- ✓ **Compatible with EH-150/EHV/EHV+ series**
Power supplies, bases, and I/O modules (some are excluded) 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
	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	
Output module	EH-YR8B	8 points, independent contact relay output, 100/240 V AC, 24 V 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 (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
	EH-YS16	16 points, triac output, 100/240 V AC
	Input and output mixed module	EH-MTT32
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
Analog output module	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
	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

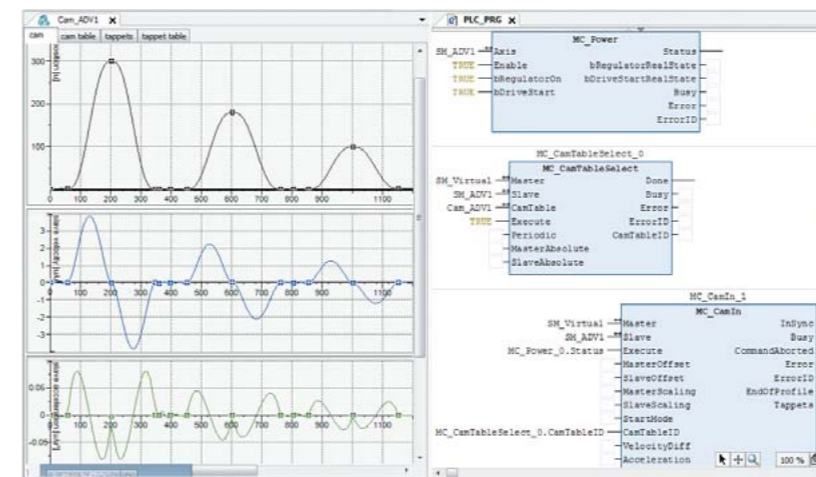
- ✓ Supports function blocks for PLCopen Motion Control
- ✓ Enables motion control by connecting servo with EtherCAT®
- ✓ Enables use of multiple axes coordination operations for CNC and robots by using the SoftMotion CNC package
- ✓ Enables execution of not only simple single axis control, but also 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_ProisionProfile)	
	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)			
Multiple axes	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		

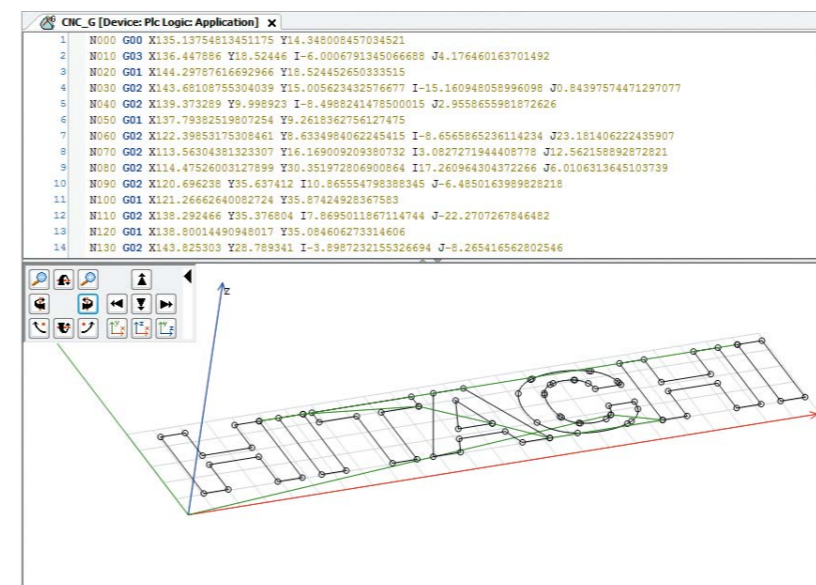
SoftMotion (Motion model, CNC motion model)

- 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

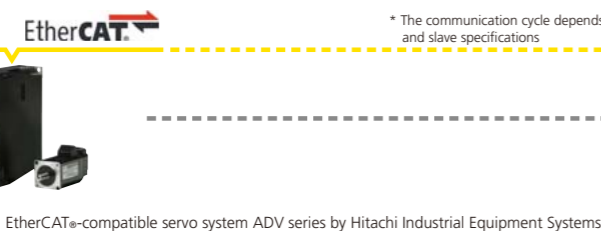


CNC (G codes), Robotics (CNC motion model)

- 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



Motion model, CNC motion model



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.)



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. 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.)



32 pts. Output module (connector)

- EH-YT32 : 32 pts. Transistor (sink)
- EH-YTP32 : 32 pts. Transistor (source)



64 pts. Input module (connector)

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



64 pts. Output module (connector)

- EH-YT64 : 64 pts. Transistor (sink)
- EH-YTP64 : 64 pts. Transistor (source)



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.)



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

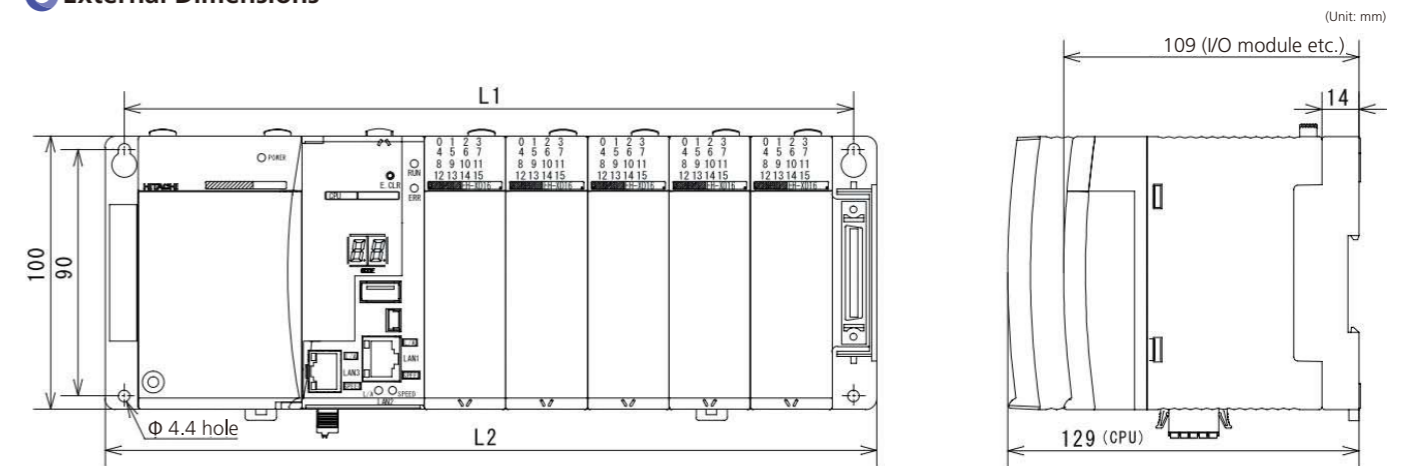


Serial communication Module: EH-SIO
 Interface: RS-232C×1, RS-232C / 422 / 485×1
 Communication mode : Half-duplex
 Communication speed : 300-57,600 bps
 Communication protocol: Non-protocol
 Modbus-RTU master



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

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

General Specifications

Model/Type	Specifications				
	Standard	Full Function	Motion	CNC motion	Hybrid
Items	HX-CP1S08	HX-CP1H16	HX-CP1S08M	HX-CP1H16M	HXC-CP1H16
Operating ambient temperature	0 to 55°C				
Storage ambient temperature	-10 to 75°C				
Operating ambient humidity	5 to 95% RH (No condensation)				
Storage ambient humidity	5 to 95% RH (No condensation)				
Vibration resistance	IEC60068-2-6 compliant				
Noise resistance	○ 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.) ○ IEC61131-2 compliant ○ 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	

Components List

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

Items	Model	Specifications	I/O type	Basic base (*1)	Expansion base (*2)	Slave (*3)	Current consumption (mA) (*4)	Remarks
CPU module	HX-CP1S08	Standard model, program capacity 8 MB	—	●	—	—	1,000	
	HX-CP1H16	Full Function model, program capacity 16 MB	—	●	—	—	1,200	
	HX-CP1S08M	Motion model (supports Soft Motion), program capacity 8 MB	—	●	—	—	1,000	
	HX-CP1H16M	CNC motion model (supports Soft Motion, CNC (G code)), program capacity 16 MB	—	●	—	—	1,200	
	HXC-CP1H16	Hybrid model, program capacity 16MB, C/C** program capacity 32MB	—	●	—	—	1,200	
Power supply module	EH-PSA	Input 100 to 240 V AC, output 5 V DC 3.8 A, 24 V DC 0.4 A	—	●	●	●	—	
	EH-PSD	Input 24 V DC, output 5 V DC 3.8 A	—	●	●	●	—	
	EH-PSR	Input 100 to 240 V AC, output 5 V DC 5.6 A (45°C maximum ambient temperature)	—	●	●	●	—	
I/O controller	EH-IOCH2	Input and output control module, mounting one unit per extended base	—	—	●	—	80	*4
Base unit	EH-BS3A	3 input and output modules installed	—	●	●	●	200	
	EH-BS5A	5 input and output modules installed	—	●	●	●	200	
	EH-BS6A	6 input and output modules installed	—	●	●	●	200	
	EH-BS8A	8 input and output modules installed	—	●	●	●	200	
	EH-BS11A	11 input and output modules installed	—	●	●	●	200	
	EH-BS8R	8 input and output modules installed, power supply redundancy supported (2 units of EH-PSR mounted)	—	●	●	●	200	
Digital input / output module	EH-XD8	8 points, 24 V DC input, response time 5 ms	DI16	●	●	●	50	
	EH-XD16	16 points, 24 V DC input, response time 5 ms	DI16	●	●	●	50	
	EH-XDL16	16 points, 24 V DC input, response time 16 ms	DI16	●	●	●	50	
	EH-XDS16	16 points, 24 V DC input, response time 1 ms	DI16	●	●	●	50	
	EH-XD32	32 points, 24 V DC input, response time 5 ms	DI32	●	●	●	60	
	EH-XDL32	32 points, 24 V DC input, response time 16 ms	DI32	●	●	●	60	
	EH-XDS32	32 points, 24 V DC input, response time 1 ms	DI32	●	●	●	60	
	EH-XD32E	32 points, 24 V DC input, response time 1 ms, screw clamp type terminal block	DI32	●	●	●	60	
	EH-XDL32E	32 points, 24 V DC input, response time 16 ms, screw clamp type terminal block	DI32	●	●	●	60	
	EH-XD32H	32 points, 24 V DC input, response time 4 ms, sink type, 32-point compatible connector for EM/H-200	DI32	●	●	●	60	
	EH-XD64	64 points, 24 V DC input, response time 1 ms	DI64	●	●	●	80	
	EH-XA16	16 points, 100 to 120 V AC input, response time 15 ms	DI16	●	●	●	50	
	EH-XAH16	16 points, 200 to 240 V AC input, response time 15 ms	DI16	●	●	●	50	
	EH-YR8B	8 points, independent contact relay output, 100/240 V AC, 24 V DC	DO16	●	●	●	220	
	EH-YR12	12 points, relay output, 100/240 V AC, 24 V DC	DO16	●	●	●	40	
	EH-YR16	16 points, relay output, 100/240 V AC, 24 V DC	DO16	●	●	●	430	
	EH-YR16D	16 points, relay output, 2 common 100/240 V AC, 24 V DC	DO16	●	●	●	430	
	EH-YT8	8 points, transistor output, 12/24 V DC, sink type	DO16	●	●	●	30	
	EH-YTP8	8 points, transistor output, 12/24 V DC, source type	DO16	●	●	●	30	
	EH-YT16	16 points, transistor output, 12/24 V DC, sink type	DO16	●	●	●	50	
	EH-YTP16	16 points, transistor output, 12/24 V DC, source type	DO16	●	●	●	50	
	EH-YTP16S	16 points, transistor output, 12/24 V DC, source type (with a short circuit)	DO16	●	●	●	50	
	EH-YT32	32 points, transistor output, 12/24 V DC, sink type	DO32	●	●	●	90	
	EH-YTP32	32 points, transistor output, 12/24 V DC, source type (with a short circuit)	DO32	●	●	●	90	
	EH-YT32E	32 points, transistor output, 12/24 V DC, sink type, removable spring type terminal block	DO32	●	●	●	90	
	EH-YTP32E	32 points, transistor output, 12/24 V DC, source type, removable spring type terminal block (with a short circuit)	DO32	●	●	●	90	

*1: ● means mountable on the Basic base.
 *2: ● means mountable on the Expansion base.
 *3: ● means mountable on the EtherCAT® and PROFIBUS®-DP slave base.
 *4: Mounts to the right of the power supply module of each expansion base (CPU mounting position of the Basic base. Fixed mounting position.)

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

Items	Model	Specifications	I/O type	Basic base (*1)	Expansion base (*2)	Slave (*3)	Current consumption (mA) (*4)	Remarks
Digital input module	EH-YT32H	32 points, transistor output, 5/12/24 V DC, sink type, 32-point compatible connector for EM/H-200	DO32	●	●	●	90	
	EH-YT64	64 points, transistor output, 12/24 V DC, sink type	DO64	●	●	●	120	
	EH-YTP64	64 points, transistor output, 12/24 V DC, source type (with a short circuit)	DO64	●	●	●	120	
	EH-YS16	16 points, triac output, 100/240 V AC	DO16	●	●	●	250	
Input and output mixed module	EH-MTT32	16-point TTL input, sink type, 16-point TTL output, sink type	DIO32	●	●	●	140	
Analog input / output module	EH-AX44	12 bits analog input, 4 to 20 mA, 0 to 10 V 4 ch. each	AI8	●	●	●	100	
	EH-AX8V	12 bits analog input 8 ch., voltage 0 to +10 V	AI8	●	●	●	100	
	EH-AX8H	12 bits analog input 8 ch., voltage -10 to +10 V	AI8	●	●	●	100	
	EH-AX8I	12 bits analog input 8 ch., current 4 to 20 mA	AI8	●	●	●	100	
	EH-AX8IO	12 bits analog input 8 ch., current 0 to 22 mA	AI8	●	●	●	130	
	EH-AXH8M	14 bits analog input 8 ch., 0 to 22 mA, 4 to 22 mA, -10 to +10 V, 0 to 10 V	AI8	●	●	●	70	
	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	AI8	●	●	●	300	
	EH-AY22	12 bits analog output, 4 to 20 mA, 0 to 10 V 2 ch. each	AO8	●	●	●	100	
	EH-AY2H	12 bits analog output 2 ch., voltage -10 to +10 V	AO8	●	●	●	100	
	EH-AY4V	12 bits analog output 4 ch., voltage 0 to +10 V	AO8	●	●	●	100	
	EH-AY4H	12 bits analog output 4 ch., voltage -10 to +10 V	AO8	●	●	●	100	
	EH-AY4I	12 bits analog output 4 ch., current 4 to 20 mA	AO8	●	●	●	130	
	EH-AYH8M	14 bits analog output 8 ch., 0 to 22 mA, 4 to 22 mA, 0 to 10 V	AO8	●	●	●	70	
	EH-AYG4M	16 bits analog output module with insulation 4 ch., 0 to 22 mA, 4 to 22 mA, 0 to 10 V	AO8	●	●	●	730	
Resistance temperature detector input module	EH-PT4	4 ch. resistance temperature detector (Pt100/Pt1000) input, Signed 15 bits	AI4	●	●	●	160	
	EH-RTD8	6/8 ch. resistance temperature detector (Pt100/Pt1000) input, Signed 15 bits	AI4/AI8	●	●	●	300	
Thermocouple input module	EH-TC8	8 ch. thermocouple (K, E, J, T, B, R, S, N) input, signed 15 bits	AI8	●	●	●	70	
Counter input module	EH-CU	2 ch. high speed counter input, maximum frequency 100 kHz	EH-CU/E	●	●	●	310	
	EH-CUE	1 ch. high speed counter input, maximum frequency 100 kHz	EH-CU/E	●	●	●	310	
Serial communications module	EH-SIO	Serial communications module RS-232C/422/485, multipurpose, Modbus master	EH-SIO	●	●	●	250	
Field Network module	EH-RMP2	PROFIBUS®-DP Master Module 256 words input/256 words output	EH-LNK	●	—	—	100	*6
	EH-IOCP2	PROFIBUS®-DP Slave Controller 256 words input/256 words output	—	—	—	●	100	*7
	EH-IOCA	EtherCAT® Slave Controller Input and output maximum 1,408 points	—	—	—	●	350	*7

*1: ● means mountable on the Basic base.
 *2: ● means mountable on the Expansion base.
 *3: ● means mountable on the EtherCAT® and PROFIBUS®-DP slave base.
 *4: Mounts to the right of the power supply module of each Expansion base (CPU mounting position of the Basic base. Fixed mounting position.)
 *5: It is possible to use a maximum of 2 units. Mountable slots are 0 to 7 for the Basic base only.
 *6: It is possible to use a maximum of 8 units. Mountable slots are 0 to 7 for the Basic base only.
 *7: Mounts to the right of the power supply module of each slave base (CPU mounting position of the Basic base. Fixed mounting position.)

* 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-TMCM	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)	
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

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.
 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.

Cautions Regarding Safety

- Please read all manuals and instructions carefully before use to ensure safety and proper use of the product.
- 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.
- 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.
- 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.
- 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.

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Network



Germany

Hitachi Europe GmbH,
Industrial Components & Equipment Group
Am Seestern 18 (Euro Center)
D-40547 Düsseldorf, GERMANY
TEL: (+49) (211) 5283-0
FAX: (+49) (211) 5283-649
<http://www.hitachi-eu.com/>
<http://www.hitachi-ds.com/>

U.S.A

Hitachi America, Ltd.
Industrial Components & Equipment Division
50 Prospect Avenue,
Tarrytown, NY 10591-4698
TEL: +1 (914) 332-5800
FAX: +1 (914) 332-5555
<http://www.hitachi-america.us/ice/>

China

**Hitachi Industrial Equipment Systems
(CHINA) Co., Ltd.**
(Shanghai Office)
Industrial Equipment Systems Division
12th Floor, Rui Jin Building No. 205,
Maoming Road (S) Shanghai, 200020
TEL: +86 (21) 5489-2378
FAX: +86 (21) 3356-5070
(Beijing Office)
14th Floor Beijing Fortune Building,
5 Dong San Huan Bei Lu,
Chao Yang District, Beijing 100004
TEL: +86 (10) 6590-8180
FAX: +86 (10) 6590-8189

**Hitachi Industrial Equipment Systems
(Hong Kong) Co., Ltd.**
(Hong Kong Office)
6th Floor, North Tower, World Finance Centre,
Harbour City, Canton Road, Tsim Sha Tsui,
Kowloon Hong Kong.
TEL: +852-2735-9218
FAX: +852-2735-6793

Taiwan Hitachi Asia Pacific Co., Ltd.
3rd Floor, Hung Kuo Building No.167
Tun-Hwa North Road, Taipei (105), Taiwan
TEL: (+886) (2) 2514-3666
FAX: (+886) (2) 2514-7664

Singapore

Hitachi Asia Ltd.
Industrial Components & Equipment Division
No.30 Pioneer Crescent
#10-15, West Park Bizcentral
Singapore 628560
TEL: (+65) (6305)-7400
FAX: (+65) (6305)-7401
<http://www.hitachi.com.sg/>

Thailand

Hitachi Asia (Thailand) Co., Ltd.
18th Floor, Ramaland Building,
952 Rama IV Road, Bangrak
Bangkok 10500
TEL: (+66) (2) 632-9292
FAX: (+66) (2) 632-9299
<http://www.hitachi.co.th/>

Australia

Hitachi Australia Pty Ltd.
Suite 801, Level 8, 123 Epping Road,
North Ryde, NSW, 2113, Australia
TEL: (+61) (2) 9888-4100
FAX: (+61) (2) 9888-4188
<http://www.hitachi.com.au/>

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Hitachi Industrial Equipment Systems Co., Ltd.

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The HX series controllers are produced at the factory registered under the ISO 14001 standard for environmental management system and the ISO 9001 standard for quality management system.