General Specifications

A8 Overview

GS 34S01A01-01EN

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Overview

The OpreX Intelligent Edge Controller A8 Series is a Linux-based embedded controller designed for enhanced programming efficiency.

Through "Data Stream" technology that abstracts devices, it accelerates the parallel development of programs and hardware, thereby reducing engineering costs.

It allows developers to focus on developing value-added control programs. With high reproducibility through deterministic control using timestamps, it brings efficiency and stability to equipment development.

The A8 series enables mastery of equipment control programming, control over time, and innovation in control.

Features

- **Data stream program development: Flexible data structures and control logic**

Data for devices (software components) on this controller can be freely configured by developers using a configuration tool. For example, multiple freely selected devices of different types can be reorganized into a single array data, or custom APIs can be generated for reading and writing data with a single call. In addition to the conventional method of programming to match pre-arranged device structures, developers can also choose a development approach where the device structure is aligned with developed programs.

This allows for a highly flexible program structure, excellent portability, and simple, easily readable designs.

- **Data stream program development: High throughput real-time control**

As devices have various purposes, the responsiveness during operation varies depending on the protocols and functional limitations required to achieve those purposes. This issue accumulates to cause unstable equipment control.

This controller adopts a mechanism that prevents programs from directly operating devices, thereby minimizing the impact of device operations. This allows anyone to easily, and without conscious effort, create control programs with high real-time performance and throughput.

- **Data stream program development: Time management and data updates for device operations**

This controller assigns a timestamp and status to the data of all devices targeted for operation. Timestamps are synchronized regardless of the device's purpose or type, allowing programs to monitor and use data change times. By visualizing data changes aligned with timestamps, an improvement in data analysis quality can be expected, as required in modeling design and other fields.

Devices are managed by their dedicated service. These services conceal device access procedures and communication protocols, ensuring that data is always up-to-date.

- **Featuring world-standard open communication protocols: EtherCAT and OPC UA**

For its fieldbus, the controller adopts EtherCAT from ETG (EtherCAT Technology Group), which is rapidly gaining global popularity. For communication with peripherals, it employs the international standard OPC UA, which is gaining recognition as an industrial protocol.

- **Extensive functions for equipment embedding**

Switches and LEDs are located on the front of the CPU module. These maintenance functions assist customers' manufacturing and maintenance operations.

RAS functions are also available to address faults and abnormalities, ensuring safe and reliable operation.

- **Security support**

Protects your assets, including systems, programs, and data, from malicious attacks.

It enhances software measures, such as secure boot, various data encryption, and user management functions. Furthermore, to ensure tamper resistance, a protective cover is installed on the CPU module to prevent unauthorized access or operation as one of the measures.

- **Enhanced soft error tolerance**

In recent years, controllers have become more susceptible to radiation due to semiconductor miniaturization and low-voltage operation. This controller contributes to customers' safe operations by enhancing soft error tolerance with the following functions:

- Enhanced error detection and correction
- Multi-bit error detection function

- **Backup-battery-less model available and energy-saving measures**

This promotes sustainability.

- Data to be retained during power outages is saved in non-volatile MRAM memory, eliminating the need for battery backup.
- To maintain the time of the RTC (Real-time clock), a battery backup is required, but by combining it with a function to obtain the time from an external time server, it can be operated without a backup battery.
- If a backup battery is not required, specify the /NBT option code.
- It can collectively monitor the power supplied from the power supply module to each module in real-time. It can also monitor differences in power consumption due to variations in programs and energy consumed by equipment.

Models and suffix codes

■ Hardware

Table Power supply module

		Description
Model	A8HPU	Power supply module
Suffix code	-16	Output capacity: 40 W, Input voltage: 24 VDC
	-0P	10-pole push-in terminal block

Table CPU module

		Description
Model	A8HCA	CPU module
Suffix code	-11	Linux
	-0N	Main memory: 4 GB, System memory: 8 MB, Storage: 16 GB
Option code	/NBT	No backup battery equipped
	/STN (*1)	Standard license EtherCAT, Motion control: 8 axes, PID control: 16 loops
	/ADV (*1)	Advanced license EtherCAT, Motion control: 32 axes, PID control: 64 loops

*1: /STN and /ADV cannot be specified together.

■ Software

Table Configuration tool

		Description
Model	A8SUT	Configuration tool
Suffix code	-0	0: Fixed
	0	Hardware and security settings
	-M	Multi-lingual support (Japanese/English)
	W	Windows OS compatible

Table SDK (Software Development Kit)

		Description
Model	A8SCK	SDK (Software Development Kit)
Suffix code	-0	0: Fixed
	0	C/C++ SDK for A8HCA
	-M	Multi-lingual support (Japanese/English)
	W	Windows OS compatible

■ Spare parts

Table Spare parts

Name	Part number	Available module
RTC backup battery	A1156EB	A8HCA-11-0N
Front cover	T9132BK	A8HCA-11-0N
End plate (*1)	T9132AA	A8HCA-11-0N
10-pole push-in terminal block	A2320JT	A8HPU-16-0P

*1: The end plate is included as standard with the power supply module.

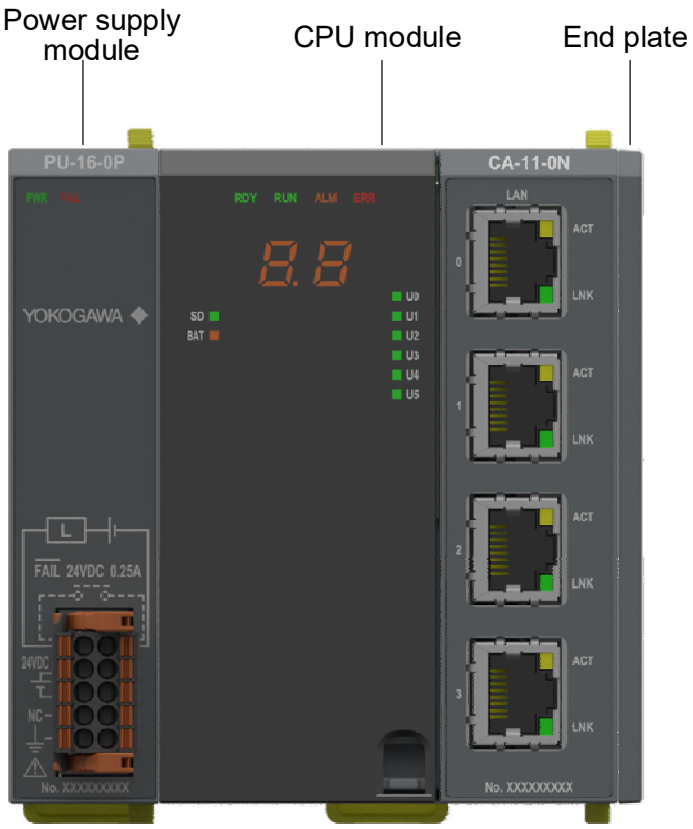
System configuration

The A8 Series allows you to build a system composed of multiple nodes.

A node is the basic configuration unit, which is the smallest unit of the system, and consists of a power supply module, CPU module, and other components.

■ Basic configuration

The following figure shows the basic configuration of the A8 Series:

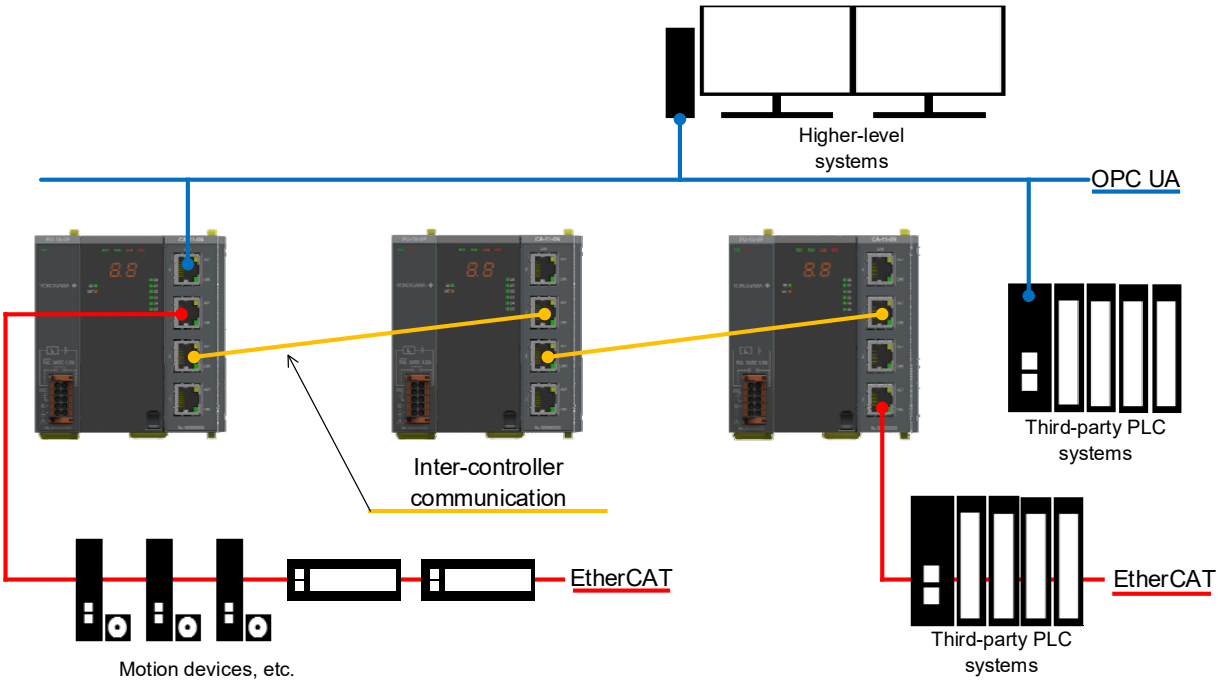


The following table lists the types and quantities of modules that can be installed in a single node:

Module	Description	Available number of modules
Power supply module	Supplies power to the controller.	1 [module/node]
CPU module	Controls how the controller operates.	1 [module/node]

■ System configuration

The following figure shows an example system configuration of the A8 Series:



■ Multi-CPU node configuration

This controller uses its inter-controller communication function between CPU nodes to enable CPU modules of different nodes connected via Ethernet cables to share their time and data.

■ External equipment configuration

External equipment can be integrated into the system using the following communication functions:

- **Socket communication (TCP/UDP)**
- **OPC UA Server**
- **OPC UA Client**
- **EtherCAT Main device feature**

Hardware specifications

■ Common specifications

● Environmental specifications

Item	Specification
Operating ambient temperature	0 to 55°C
Operating ambient humidity	5 to 95% RH (non-condensing)
Operating ambient atmosphere	No corrosive or flammable gases and no excessive dust
Storage ambient temperature	-25 to 75°C
Storage ambient humidity	5 to 95% RH (non-condensing)
Grounding	A8HPU-16-0P: Functional grounding
Noise immunity	EN IEC 61131-2 compliant
Withstand voltage	Specified for each module
Insulation resistance	Specified for each module
Vibration resistance	JIS B 3502:2021 and IEC 61131-2:2017 compliant Frequency: 5 to 8.4 Hz, Zero-to-peak amplitude: 3.5 mm Frequency: 8.4 to 150 Hz, Acceleration: 10 m/s^2 (1G) 10 sweep cycles in X, Y, and Z directions (1 octave/min)
Shock resistance	JIS B 3502:2021 and IEC 61131-2:2017 compliant 150 m/s^2 (15G), Operating time: 11 ms, Sinusoidal wave pulse: 3 times in each X, Y, and Z direction
Installation	In the control panel (*1)
Installation altitude	2000 meters or less above sea level

*1: This product is open-type equipment. It must be installed in a metallic enclosure with an impact rating of 6.8J or more, or IK09 or more.

● Mounting and appearance specifications

Item	Specification
Cooling method	Natural convection cooling
Mounting procedure	Mounted to DIN rail
Exterior color	Light charcoal gray

■ Module specifications

● Power supply module

Item	Specification
Model	A8HPU-16-0P
Power supply voltage	24 VDC
Power supply voltage Variation range (*1)	20.4 to 28.8 VDC (-15% to +20%)
Rated input power	45 W
Inrush current	10 A max. (28.8 VDC, Ta = 25°C)
Rated output power	40 W
Rated output voltage	5.2 VDC
Rated output current	7.7 A
Protection circuit (*2)	Built-in time-lag fuse (non-replaceable) Reverse polarity protection circuit
Insulation resistance	5 MΩ or more at 500 VDC (between all FG terminals and the other terminals and circuit (*2))
	5 MΩ or more at 500 VDC (between all FAIL signal contact output terminals and the other terminals and circuit (*3))
Withstand voltage	500 VAC for 1 minute (between all FG terminals and the other terminals (*2))
	1000 VAC for 1 minute (between all FAIL signal contact outputs terminals and the other terminals (*3))
Hold-up time	5 ms (24 V) 2 ms (20.4 V)
FAIL signal contact output (*4)	Contact rating: 24 VDC (20.4 to 28.8 VDC) Rated current: 0.25 A (0.3 A max.) ON voltage: 0.5 V Leakage current when off: 0.1 mA
External connection (*5)	10-pole push-in terminal block
Dimensions (*6)	23 (W) x 100 (H) x 84.6 (D) mm (excluding protrusions)
Weight	145 g

*1: Avoid connecting a power supply that produces over 30 VDC. Avoid connecting an AC power supply. Connecting one of these power supplies may cause a malfunction.

*2: The FAIL signal contact output terminal, 24VDC terminal, and internal circuit

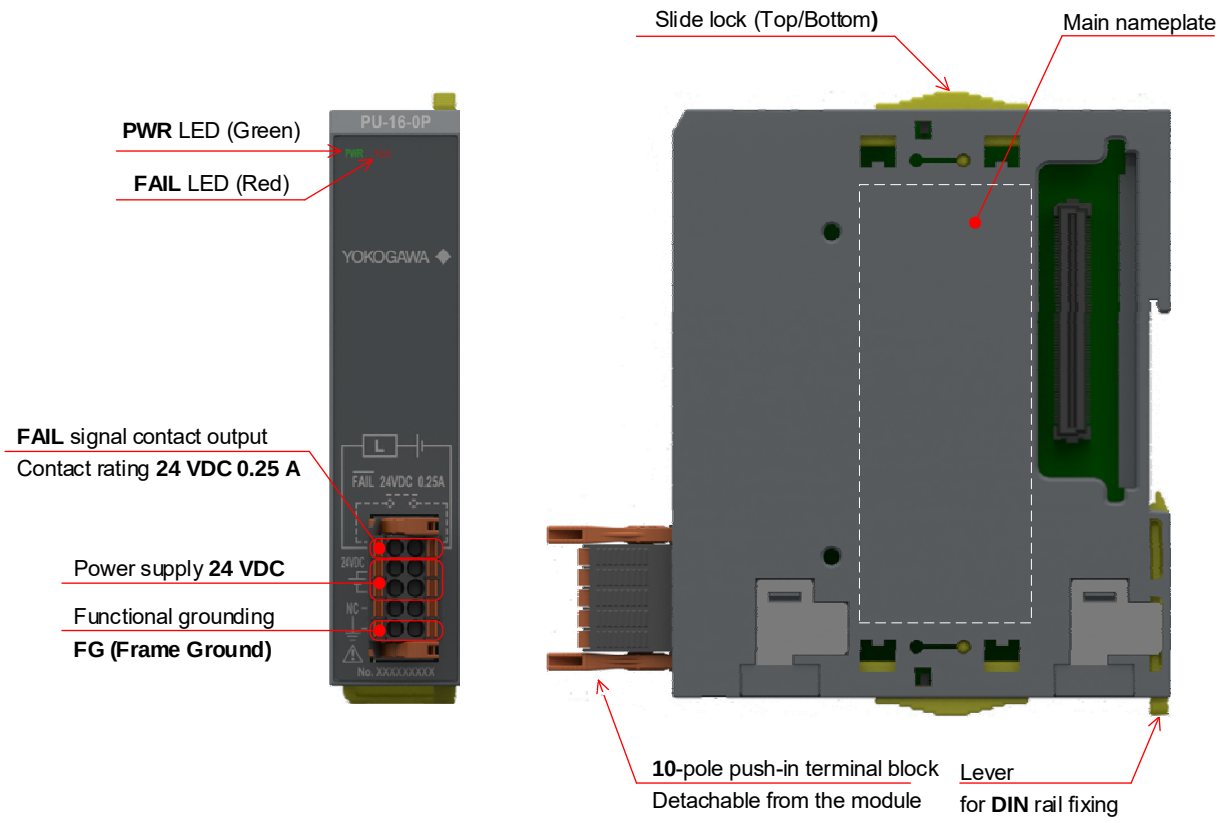
*3: The FG terminal, 24VDC terminal, and internal circuit

*4: If an inductive load, such as a relay, is connected, a surge suppressor is required on the load side. Install a surge suppressor or diode near the load to ensure that the voltage applied to the FAIL signal contact output terminal does not exceed the contact rating. For details on the installation method, refer to "Connection between the FAIL signal contact output and output equipment" in “A4.5.2 How to wire the power supply module" of "A8 Hardware Manual" (IM 34S01C11-01EN). The FAIL signal contact output has no polarity.

*5: When wiring to this module, be sure to use the terminal block provided.
A 10-pole push-in terminal block (model: A2320JT) is available as spare parts.

*6: For details, refer to the dimensional drawings.

Name and function of each part



LED indicators and status

PWR indication	FAIL indication	Status of FAIL signal contact output	System status
Green solid	Light off	Short-circuit	The power supply module is operating correctly. The CPU module is operating correctly or has a minor fault.
Green solid	Red solid	Open circuit	The power supply module is operating correctly. The CPU module is booting up, or it has a medium or serious fault.
Light off	Light off	Open circuit	Power outage, or the power supply module failed.

Compatible electrical wires

Wire type	Solid/Stranded wire
Wire material	Copper
Compatible wire size (*1)	AWG 20 to 16 (0.5 to 1.5 mm^2)
Wire temperature rating	80°C or higher

*1: Use an electrical wire of size AWG 18 (0.75 mm^2) or higher for ground wiring.

- When not using ferrule terminals, strip approximately 10 mm of insulation from the wire end before use.
- When using ferrule terminals, use stranded wires.
  Follow the ferrule manufacturer's specifications for wire stripping length
- The following table lists the recommended ferrule terminals and crimping tool:

	Compatible electrical wires		Manufacturer	
			PHOENIX CONTACT	
	AWG	mm^2	Model	Recommended crimping tool
Insulation sleeve included	AWG20	0.5 mm^2	AI0.5-10 WH	CRIMPFOX CENTRUS 6S
	AWG18	0.75 mm^2	AI0.75-10 GY	
Insulation sleeve not included	AWG20	0.5 mm^2	A0.5-8	
	AWG20	0.5 mm^2	A0.5-10	
	AWG18	0.75 mm^2	A0.75-8	
	AWG18	0.75 mm^2	A0.75-10	
	--	1.0 mm^2	A1-8	
	--	1.0 mm^2	A1-10	
	AWG16	1.5 mm^2	A1.5-10	

- **End plate (*1)**

Item	Specification
Part number	T9132AA
Dimensions (*2)	4 (W) x 100 (H) x 84.6 (D) mm (excluding protrusions)
Weight	45 g

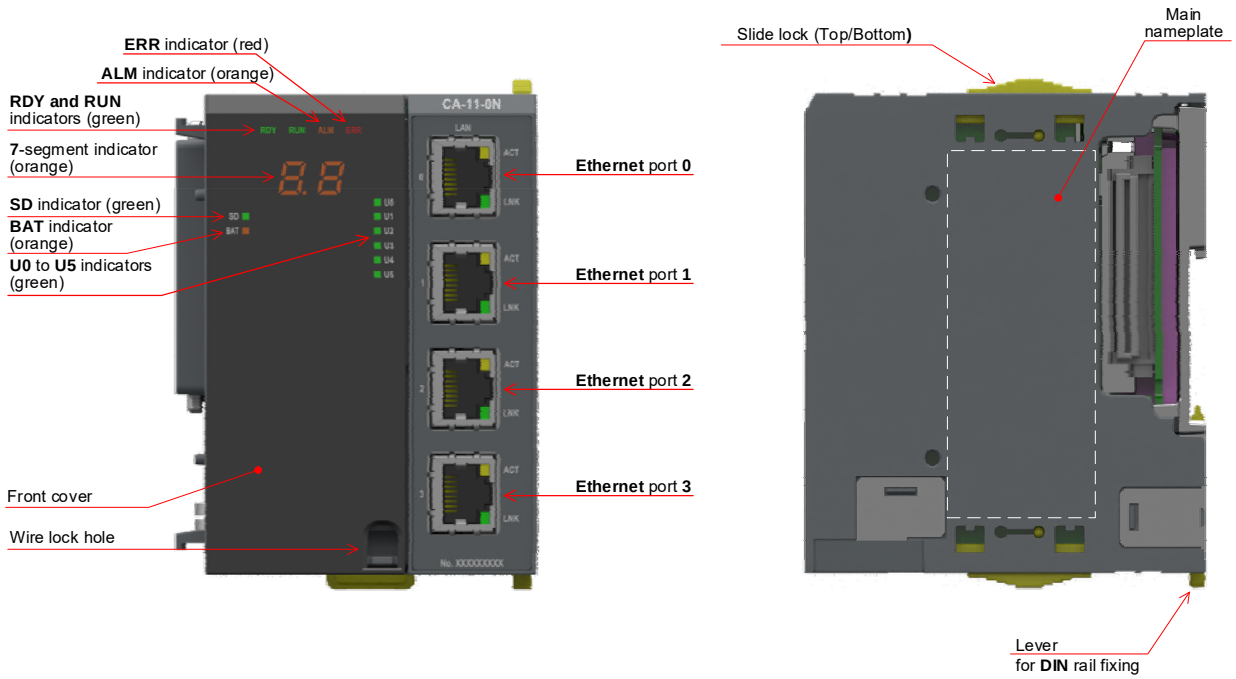
*1: The end plate is included as standard with the power supply module. It is also available as spare parts.
*2: For details, refer to the dimensional drawings.

● CPU module

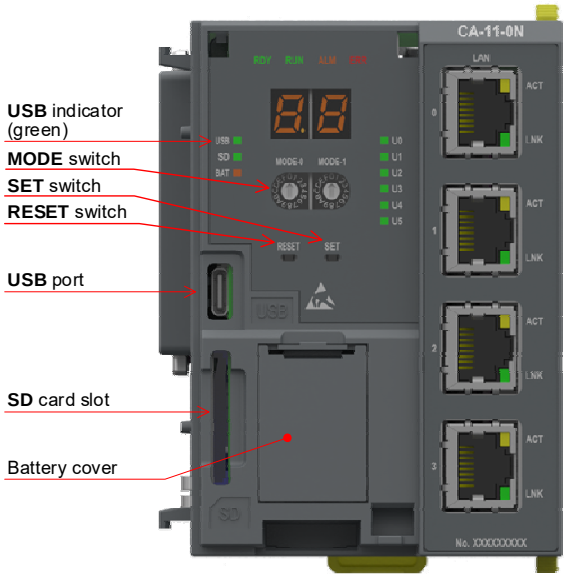
Item		Specification
Model		A8HCA-11-0N
CPU		Cortex-A53（Quad 1.2GHz）
OS		Linux (Kernel 6.6.70-rt51、Ubuntu 24.04)
Endian format		Little-endian
Memory	DDR4 SDRAM	4 GB (with ECC)
	MRAM	8MB
	eMMC	16GB
Interface	Ethernet	10BASE-T, 100BASE-TX, 1000BASE-T (4 ports)
	SD (*1)	Supports SDHC cards, SDXC cards, and UHS-I
	USB	USB2.0 device, Type-C connector
RAS functions	Instantaneous power interruption detection	Detects instantaneous power interruption and notifies user applications.
	Watchdog timer	Monitors the operating status of user applications.
	SD card fault detection	Detects overcurrent or short circuit and cuts off card power.
	FAIL signal output	Activates the power supply module's FAIL signal contact output to notify external devices upon fault detection.
Time	RTC (*2)	Year, month, day, hour, minute, second, day of week ±23 ppm (@25°C), equivalent to ±60 seconds per month (battery backup)
Security		Supports TPM 2.0 and secure boot.
Indicator LEDs		Two 7-segment displays, RDY, RUN, ERR, ALM, SD, USB, BAT, U0, U1, U2, U3, U4, U5
Switches	MODE0 switch	Selects functions for boot mode.
	MODE1 switch	Selects functions for smart access.
	SET switch	Executes maintenance functions.
	RESET switch	Executes forced hardware reset.
Maximum modules installable		1 module/1 node
Power consumption		9.0 W
Dimensions (*3)		70 (W) x 100 (H) x 84.6 (D) mm (excluding protrusions)
Weight		655 g (excluding battery and SD memory card)

*1: Use an SD memory card that complies with the operating temperature range of 0 to 85°C.
*2: The valid range is from January 1, 2001, 00:00:00 to December 31, 2099, 23:59:59.
Since normal operation cannot be guaranteed, do not set values exceeding the above range.
*3: For details, refer to the dimensional drawings.

Name and function of each part



When the front cover is removed



■ Accessories

Applicable module	Model	Accessory name	Quantity
A8HPU-16-0P	T9132AA	End plate	1
A8HPU-16-0P	A2320JT	10-pole push-in terminal block	1

■ Spare parts

● Backup battery

Customers are allowed to replace the battery themselves. To purchase, please contact our sales office with the part number.

For replacement procedures, refer to "A8 CPU Module" (IM 34S01M11-01EN).

Product name	Model	Recommended replacement cycle
Backup battery	A1156EB	10 years

● Mechanical parts

To purchase the parts shown in the table below, please contact our sales office with the part number.

Product name	Model	Available module
Front cover	T9132BK	A8HCA-11-0N
End plate	T9132AA	A8HCA-11-0N
10-pole push-in terminal block	A2320JT	A8HPU-16-0P

Functional specifications

■ Software operating environment

● Configuration tool

This tool is used for configuring and maintaining the controller.

Item		Specification
Model		A8SUT-00-MW
Operating environment	PC	PC/AT-compatible
	OS	Microsoft Windows 11 (64bit) Japanese or English version
	Required software	.NET 8.0
	CPU	1 GHz or faster 64-bit processor
	Memory	8 GB or more
	HDD free space	3 GB or more
	Display	1366 x 768 pixels or higher
	Communication I/F	USB, Ethernet
	Supported printer	A4-size printer compatible with the above OS
	Supported Japanese input	Microsoft IME, etc.

● Configuration tool functions

The basic functions of this configuration tool are listed below:

- Project management function
  Allows for creating version-controllable projects. Project files can be generated as user-managed encrypted files, enabling secure operational management.

- CPU configuration function
  Allows for configuring the CPU configuration, network and security settings, and functions that operate on the controller.

- Data stream configuration function
  Allows for editing the definitions of tags used in the data stream. It maps various data, such as CPU system data and data from communication standards (e.g., EtherCAT, OPC UA), to tags.

- OPC UA configuration function
  Allows for configuring the OPC UA Server/Client setups. It also manages certificates used by Servers/Clients.

- EtherCAT configuration function
  Allows for configuring EtherCAT Main and Sub devices settings and performing online diagnostics. It also enables managing ESI files of other equipment on the Sub devices information management screen.

- Motion configuration function
  Allows for setting axis parameters used in motion control.

- Monitor function
  Allows for connecting to the CPU module to monitor its status online. Users can verify data on the data stream and check data of any devices registered in the watch monitor.

- Maintenance function
  Allows for directly connecting to the CPU module to configure it online. No project files are required.

- Security function
  Allows for configuring various security items to ensure secure operation of this controller.

- RAS functions
  Allows for configuring the RAS functions and managing various log information.

● SDK (Software Development Kit)

This is the software development kit for developing user programs that run within the controller. It provides a development environment container with a toolchain for program development pre-installed.

Item		Specification
Model		A8SCK-00-MW
Toolchain		GCC 13 series
Operating environment	CPU module	A8HCA-11-0N
	OS	Ubuntu 24.04 or later

■ CPU module functional specifications

● Automatic data update function

This controller centrally manages data that can be used by programs, allowing access to all data from the data stream. The data within the data stream also includes data intended for external devices connected to this controller.

The automatic data update function is responsible for automatically updating the I/O data of external devices. System developers can access I/O data by simply configuring the devices and data, thus eliminating the need to be concerned with external device-related communication and access processes. The target devices and data subject to update are listed below:

- Data disclosed by other CPU modules
  The controller automatically reads data disclosed by other CPU modules connected via inter-controller communication.
- Node data of external OPC UA Servers
  The controller automatically updates Node data held by external OPC UA Servers.
- Node data of the local OPC UA Server
  When acting as an OPC UA Server, the controller updates Node data that it discloses to external Client devices.
- PDO data of EtherCAT Sub devices
  The controller updates PDO data used in EtherCAT cyclic communication with Sub devices.

● RAS functions

This function self-diagnoses hardware and system functions, notifies external systems and programs of faults or abnormalities, and offers information for maintenance.

- LED and 7-segment LED displays indicating operating status
- System logs
- Operation logs
- FAIL contact output
- Instantaneous power interruption detection
- Watchdog function
- Alarm monitor

● Security function

The controller provides functions to protect itself from malicious attacks.

Functions	Information leakage	Unauthorized access	Data tampering	Denial of service
Account management	✓	✓	--	--
Certificate management	✓	✓	✓	--
Security check	--	--	✓	--
Protection	✓	✓	--	✓
Log management	--	✓	--	--

- Account management
  Access to the CPU module via tools or other means can be restricted by user accounts and passwords. Furthermore, permissions can be set for user accounts to limit the functions they can operate.
  Restrictions, such as password policies and lockouts due to login attempt limits, can also be configured.
- Certificate management
  Certificates used for access authentication and integrity checks are managed. If you want to connect a device to this controller, add the certificate of the connection destination. The controller also provides functions for checking certificate expiration dates and updating them, as certificates have expiration dates.

- Security check
  The controller has verification functions using electronic signatures to prevent the introduction and execution of unauthorized files, as well as functions to check for tampering due to unauthorized operations.
  There are two types of signature verification functions: a secure boot function that verifies at startup, and a file download verification function.
  The tampering check function periodically verifies that files have not been tampered with while the controller is operating.

- Protection
  The controller provides the function to protect user applications and user systems.

- Log management
  Operations performed on this controller are recorded in a log. If an abnormality occurs, users can check for unauthorized operations to determine if they were the cause.

● User operation functions

The controller provides functions for user operation:

- Configuration tool
  Runs on a personal computer and is used to configure and operate the controller. It connects via Ethernet or USB.

- Boot mode
  Executes specified operations at power-on and during a reset start. The function to be executed is selected using the MODE0 switch on the front of the CPU module.

- Smart access
  Executes specified operations while the CPU module is operating. After selecting a function with the MODE1 switch on the front of the CPU module, it is executed by pressing the SET switch.

The following tables list the selectable functions for boot mode and smart access, along with their corresponding MODE switch numbers.

For details on the maintenance mode and smart access functions, refer to "● Maintenance functions".

Boot mode		
MODE0	**Category**	**Function**
0	Standard mode	Operation mode
1		Stop mode
2		Reserved (*1)
3		Reserved (*1)
4		Reserved (*1)
5	Maintenance mode	System restore
6		System format
7		Firmware update
8		Factory reset
9		Reserved (*1)
A		Reserved (*1)
B		Reserved (*1)
C		Reserved (*1)
D		Reserved (*1)
E	Manufacturer reserved mode (*2)	Manufacturer reserved
F		Manufacturer reserved

Smart access	
MODE1	**Function**
0	Alarm clear
1	SD memory card unmount
2	Module information retrieval
3	Log backup
4	IP address display
5	Reserved (*3)
6	Reserved (*3)
7	Reserved (*3)
8	OS shut down
9	OS reboot
A	Reserved (*3)
B	Reserved (*3)
C	Reserved (*3)
D	Reserved (*3)
E	Reserved (*3)
F	Reserved (*3)

*1: Same operation as MODE0 switch position 1.
*2: When the controller is powered on in manufacturer reserved mode, the RDY LED does not light up, or the error number is displayed on the 7-segment LED.
*3: Setting the switch to a position reserved for smart access executes no function.

Maintenance functions

This controller provides convenient functions for mass production of devices incorporating this controller and maintenance operations.

Item	User operation function		
	Configuration tool	Boot mode	Smart access
Firmware update	Available	Available	--
License management	Available	--	--
Duplication	Available	Available	--
Backup/Restore	Available	Partially (*1)	Partially (*2)
SD memory card unmount	Available	--	Available
System shutdown	Available	--	Available
System restart	Available	--	Available
System format	Available	Available	--
Factory reset	--	Available	--
Alarm clear	--	--	Available
Module information retrieval	--	--	Available
IP address display	--	--	Available

*1: Only the system data restore function is supported.
*2: Only log backup is supported

- Firmware update
  Allows customers themselves to update the CPU module's firmware.
- License management
  Used to manage the runtime licenses embedded in the CPU module.
- Duplication
  Duplicates a system built on one CPU module to another.
- Backup/Restore
  Backs up and restores system files created within the CPU module.
- SD memory card unmount
  Prepares the SD memory card for safe removal from the controller.
- System shutdown/restart
  Stops/Restarts the CPU module. This is necessary to prevent file corruption within the module due to power loss during writing.
- System format
  Deletes files downloaded to the controller.
- Factory reset
  Initializes the controller to its factory defaults.
- Alarm clear
  Clears alarms (minor faults) occurring in the CPU module.
- Module information retrieval
  Saves information about the CPU module to an SD memory card or other storage. The retrieved data can be used for maintenance.
- Log file save
  Saves the CPU module's logs to an SD memory card or other storage.
- IP address display
  Displays the IP addresses of LAN0 to LAN4 on the 7-segment LED.

■ Programming specifications

● C/C++ language programming specifications

Item	Specification	Notes
Development tool	Visual Studio Code	General-purpose development tool from Microsoft
OS (*1)	Microsoft Windows 11 (64bit)	--
Toolchain	GCC 13 series	Installed on the SDK
Libraries (*2)	Data stream access	--
	System administration	--
	OPC UA Server/Client	--
	Controller-to-controller communication	--
	EtherCAT	--
	Motion control	--
	PID control	--

*1: An operating system that runs Visual Studio Code. It depends on the version used.
*2: Only libraries provided by this controller are listed. Standard libraries provided by the OS are also available.

● Data stream access library

Provides functions to access the data stream, which is the data management area within this controller. This library is automatically generated when the user defines the system configuration, and sets the data and data tags (data names) to be used in programs using the configuration tool.

● System management library

Allows users to set and retrieve the date and time, control the LEDs, and obtain various statuses. It also provides support for RAS and a watchdog timer.

- **OPC UA Server library**

Provides OPC UA Server functions. The supported version of the OPC UA standard is Version 1.05.

Item				Specification
Transport/data encoding method				uatcp-uasc-uabinary
EndpointUrl				opc.tcp://XXX.XXX.XXX.XXX:4840 (*1)
Maximum number of nodes				30,000
Maximum node data size (*2)				1,330,000 bytes
Maximum number of sessions				64
Subscription (*3)		Maximum number of subscriptions		200
		Maximum number of monitored items		2500 (*4)
		Configurable sampling cycle		5, 10, 50, 100, 200, 500, 1000 milliseconds
		Configurable publish cycle		5, 10, 50, 100, 200, 500, 1000 milliseconds
Method				Unsupported
Security	Application authentication	Authentication method		X509 v3
		Type of authentication		Disable Authentication with self-signed certificates Authentication with Certificate Authority (CA) signed certificates
		Number of certificates	Self-signed certificate (own)	1
			Trusted	100
			Revoked (issuers)	100
			Rejected	100
		Security mode		None Sign SignAndEncrypt
		Security policy		None Basic256Sha256 Aes128_Sha256_RsaOaep Aes256_Sha256_RsaPss Basic128Rsa15 (deprecated) Basic256 (deprecated)
	User authentication	Type		Anonymous Identity Token UserName Identity Token X509 Identity Token
		Password encryption		Basic256Sha256 Aes128_Sha256_RsaOaep Aes256_Sha256_RsaPss Basic128Rsa15 (deprecated) Basic256 (deprecated)
		Number of certificates	Trusted	100
			Revoked (issuers)	100
			Rejected	100

*1: XXX.XXX.XXX.XXX is the IP address set for the LAN.

*2: The sum of ObjectNode and VariableNode.

*3: This function is specified in "Part 4, Section 5.13 Subscription Service Set" and "Section 5.12 Monitored Item Service Set" in the OPC UA standard. It operates based on the connected Client's settings.

*4: Array and structure data type variables count as 1 Node.

- **OPC UA Client library**

Provides OPC UA Client functions. The supported version of the OPC UA standard is Version 1.05.

Item				Specification
Transport/data encoding method				uatcp-uasc-uabinary
Maximum number of sessions				20 (*1)
Subscription				Unsupported
Method				Unsupported
Security	Application authentication	Authentication method		X509 v3
		Type of authentication		Disable Authentication with self-signed certificates Authentication with Certificate Authority (CA) signed certificates
		Number of certificates	Self-signed certificate (own)	1
			Trusted	100
			Revoked (issuers)	100
			Rejected	100
		Security mode		None Sign SignAndEncrypt
		Security policy		None Basic256Sha256 Aes128_Sha256_RsaOaep Aes256_Sha256_RsaPss Basic128Rsa15 (deprecated) Basic256 (deprecated)
	User authentication	Type		Anonymous Identity Token UserName Identity Token X509 Identity Token
		Password encryption		Basic256Sha256 Aes128_Sha256_RsaOaep Aes256_Sha256_RsaPss Basic128Rsa15 (deprecated) Basic256 (deprecated)
		Number of certificates	Self-signed certificate (own)	64

*1: It refers to the number of concurrent client application connections, including the number of OPC UA refresh groups.

- **EtherCAT library**

Provides functions, such as change to the Main device state and access to communication status, PDO access for cyclic data exchange between Main devices and Sub devices, SDO access for on-demand data exchange with Sub devices, changes to the Sub device state and access to registers, and Hot Connect for safe connection and disconnection of Sub devices.

Table EtherCAT communication specifications

Item	Specification
PDO size	Input: 8192 bytes or less Output: 8192 bytes or less Communication cycle of greater than or equal to 1 ms and less than 2 ms: 2048 bytes or less for input and output combined Communication cycle of 2 ms or more: 8192 bytes or less for input and output combined
PDO size per Sub device	Input: 1472 bytes or less Output: 1472 bytes or less
Mailbox data size	Input: 1024 bytes or less Output: 1024 bytes or less
Communication cycle	1, 2, 4, 5, 10, 20, 25 ms
Maximum number of Sub devices	128
Available Ethernet port	LAN1, LAN2, LAN3
Cable length between Sub devices	Within 100 m
Configuration tool	Configuration tool

● Motion control library

Provides functions defined in PLCopen Motion Control. It is used in conjunction with the EtherCAT Main device library to control axes compatible with EtherCAT communication interface.

Table Motion control specifications

Item	Specification
Interface	EtherCAT
Physical layer	100BASE-TX (port used for EtherCAT communication)
Communication specifications	Based on EtherCAT library communication specifications (*1)
Number of control axes	Max. 32 axes
Control cycle	Same as the PDO communication cycle for EtherCAT communication
Sync mode	DC synchronization
Applicable CiA402 drive profiles	・Cyclic synchronous position mode ・Homing mode

*1: Sub devices controlled by the motion control library do not support the hot connect function of EtherCAT communication.

● PID control library

Provides functions to perform PID calculation for manipulated variables. PID control can be implemented by combining the library, data from the data stream, and measurements from user programs. Unlike the Temperature Control and PID module, control loops can be freely customized by using PID calculation as a library in user programs.

Item	Specification
Control cycle	1, 2, 5, 10, 20, 50, 100, 200 ms
Operation mode	Automatic operation (AUTO) / Manual operation (MAN)
Number of control loops	Up to 64 loops
PID control mode	Standard PID control mode / Fixed-point control mode
Control output	Forward/reverse
Proportional band	0.1 to 999.9%
Integral time	OFF, 1 to 6000 sec (*1)
Derivative time	OFF, 1 to 6000 sec (*1)
Manual reset	-0.5 to 105.0%
Anti-reset windup	50.0 to 200.0%, automatic

*1: The number of decimal places can be changed when a control cycle of 10 ms or less is selected.

● Controller-to-controller communication library

Provides functions to connect CPU nodes via Ethernet cables and share data among them.

Shared data is managed as collections called "datasets," and data is periodically exchanged in units of datasets.

Item		Specification
Topology		Daisy chain/Star (*1)
Available Ethernet port	Daisy chain	(Terminal node) LAN1 or LAN2 (Relay node) LAN1 and LAN2
	Star	LAN1 or LAN2
Communication port		4840
Number of CPU nodes		Up to 16 nodes
Number of datasets		Up to 2 per CPU node
Data size(*2)		Up to 32,768 bytes per dataset
Communication	Communication method	Peer to Peer UDP-based multicast
	Communication cycle (*2)	5, 10, 50, 100, 200, 500, 1000 ms Up to 2 types of cycles across the entire system
Security		Not supported.

*1: Star and daisy chain topologies can also be mixed.

*2: Limited by the number of CPU nodes, the number of datasets, and data size.

Fault ranks and LED indication

■ Fault ranks

Fault rank	Description
Serious fault	The core hardware cannot execute.
Medium fault	User applications cannot start or continue. It indicates that an event whose severity is categorized as a "failure" occurred.
Minor fault	User applications can continue, but they operate abnormally. It indicates that an event whose severity is categorized as a "warning" occurred.

■ Status LED indication

State	Indicator LEDs				Meaning of indication
Serious fault	All LEDs off				Serious fault occurred.
Medium fault	RDY			ERR	Stopped due to medium fault.
Medium fault	RDY		ALM	ERR	Stopped due to medium fault after minor fault occurred.
Minor fault	RDY		ALM		Stopped by operation due to minor fault.
Minor fault	RDY	RUN	ALM		Minor fault occurred during operation.
Normal stop	RDY				Stopped by operation.
Normal operation	RDY	RUN			Operating normally.

LED	Color	Meaning of indication
RDY	Green	On: Normal. Off: Serious fault (e.g., CPU error, hardware inability to run, power failure, or other severe faults).
RUN	Green	On: Controlled by user application. Off: Controlled by user application, serious/medium fault occurred.
ALM	Orange	On: Minor fault (abnormality exists but user application can continue). Off: Normal.
ERR	Red	On: Medium fault (user application cannot start or continue). Off: Normal.
7-segment x 2	Orange	On: Displays status of various operations, or error factors during abnormalities. Off: Normal.
SD	Green	On: Card mounted. Blinking: Card access in progress. Off: Card unmounted
USB	Green	Blinking: USB data transmission/reception in progress.
BAT (*1)	Orange	On: Battery voltage low. Off: Battery voltage normal.
U0, U1, U2, U3, U4, U5	Green	On: Controlled by user application. Off: Controlled by user application.

*1: Always off for the backup-battery-less model.

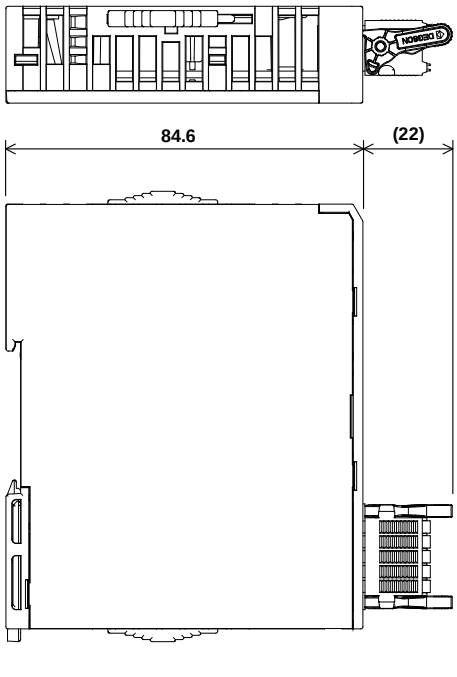
■ LED indication for Ethernet communication status

LED	Color	Meaning of indication
ACT	Yellow	On: Ethernet data transmission/reception in progress.
LINK	Green	On: Ethernet link active.

External dimensions

■ Power supply module

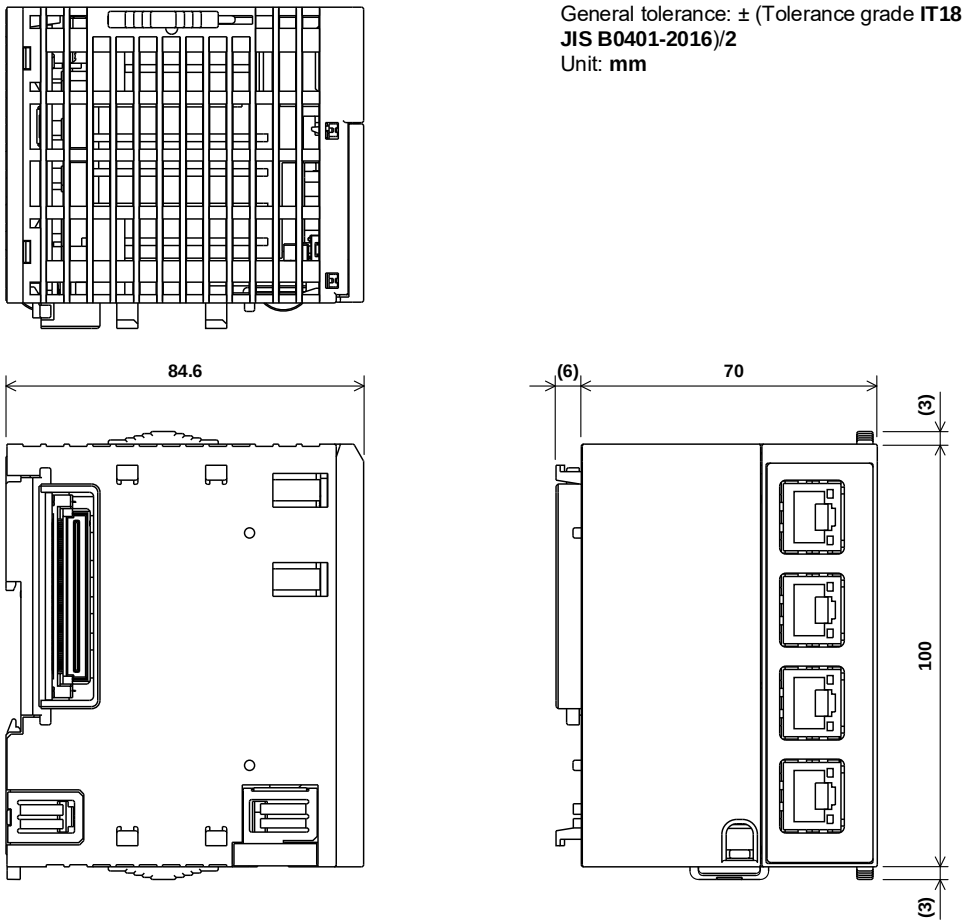
A8HPU-16-0P



General tolerance: ± (Tolerance grade **IT18** value of **JIS B0401-2016**)/**2**
Unit: **mm**

■ CPU module

A8HCA-11-0N

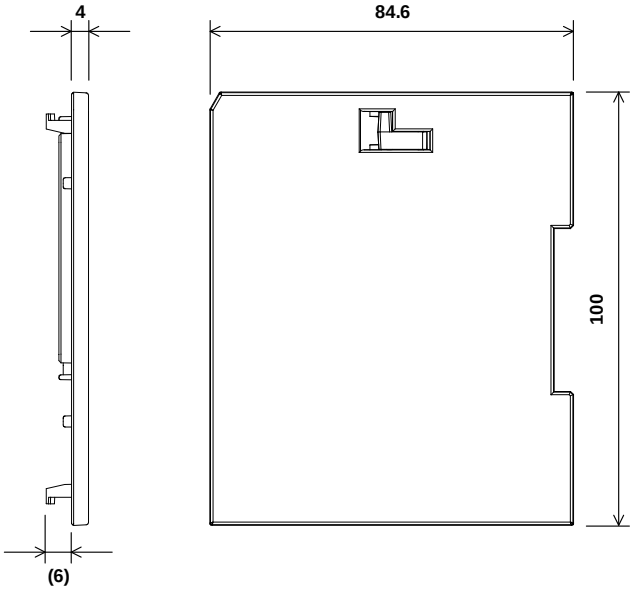


General tolerance: ± (Tolerance grade **IT18** value of **JIS B0401-2016**)/**2**
Unit: **mm**

■ End plate

T9132AA

General tolerance: ±(Tolerance grade **IT18** value of **JIS B0401-2016**)/**2**
Unit: **mm**



Certified standards/Conforming modules

For certified standards/conforming modules, refer to the following website:
https://www.yokogawa.com/solutions/products-and-services/control/control-devices/

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