



Digitized Automation for a Changing World

# AH Motion Controller - Hardware Manual

# AH Motion Controller Hardware Manual

## Revision History

Version	Revision	Date
1 <sup>st</sup>	The first version was published.	2017/09/20
2 <sup>nd</sup>	<ol style="list-style-type: none"><li>1. Modules including AH10EN-5A, AH15EN-5A, AH10SCM-5A, AH15SCM-5A, AH10DNET-5A, AH10PFBS-5A, AH10PFBM-5A, AHRTU-DNET-5A, AHRTU-PFBS-5A, AHRTU-ETHN-5A and AHBP03M2-5A (AH motion backplane) were added in Chapter 1.</li><li>2. The information on modules including AH10EN-5A, AH15EN-5A, AH10SCM-5A, AH15SCM-5A, AH10DNET-5A, AH10PFBS-5A, AH10PFBM-5A, AHRTU-DNET-5A, AHRTU-PFBS-5A, AHRTU-ETHN-5A, AHBP03M2-5A (AH motion backplane) as well as updates on I/O network and module configuration were added in Chapter 2.</li><li>3. The reference information on modules in Chapter 3 has changed to AH500 Series Hardware Manual.</li><li>4. The reference information on modules in Chapter 4 has changed to AH500 Series Hardware Manual.</li><li>5. Section 3.2.7: Update information concerning contact 5 and contact 29.</li><li>6. Chapter 4: Change C0,C1, C2, C3 in output circuit diagrams of a transistor to COM</li></ol>	2018/08/31
3 <sup>rd</sup>	<ol style="list-style-type: none"><li>1. Delete Section 1.2 (the content is duplicated with Chapter 3)</li><li>2. Section 3.1 adds applicable atmospheric pressure and shell fire rating.</li><li>3. Section 3.2.1 adds communication port and digital I/O isolation specifications.</li><li>4. Section 3.2.3 update EtherCAT transmission cable</li><li>5. Update Chapter 5 Maintenance and Inspection.</li></ol>	2024/01/31

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# Preface

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## P.1 Introduction

Thank you for purchasing the AH series Motion Controller CPU with our advanced motion control system.

This manual introduces the hardware structures, specifications, and the installation of AH motion controller system products based on AH motion controller CPUs. Please ensure that you understand the configuration and operations of the AH series motion control system, and use the AH series Motion Controller CPU correctly.

To obtain required information for different system configurations, you can navigate between different manuals of AH Motion Controller series manuals and other related manuals.

### P.1.1 Applicable Products

This manual relates to the following products

- AHxxEMC-5A (AH08EMC-5A/AH10EMC-5A/AH20EMC-5A)
- AH500 series modules

### P.1.2 Related Manuals

The related manuals of the AH Motion Controller series motion controllers are composed of the following.

1. **AH Motion Controller - Hardware Manual**

It introduces function specifications, electrical specifications, appearances, dimensions, and etc.

2. **ISPSOFT User Manual**

It introduces the use of ISPSOFT, the programming languages (ladder diagrams, instruction lists, sequential function charts, function block diagrams, and structured texts), the concept of POU, the concept of tasks, and the operation of motion control programming.

3. **AH Motion Controller - Standard Instructions Manual**

It introduces the elements for standard programming including devices, symbols and standard instructions.

4. **AH Motion Controller - Operation Manual**

It introduces basic knowledge of motion control structure, software/hardware setup, quick start of Software operations, devices to be used, motion control operations and troubleshooting.

5. **AH Motion Controller - Motion Control Instructions Manual**

It introduces the elements for motion control programming including axis parameters, symbols and single axis/multi-axes motion instructions.

6. **AH500 Motion Control Module Manual**

It introduces the specifications for the AH500 series motion control modules, the wiring, the instructions, and the functions.

7. **AH500 Module Manual**

It introduces the use of special I/O modules of AH500 series PLCs. For example, network modules, analog I/O modules, temperature measurement modules, and etc.

## P.2 Navigation between Manuals

Before using the products, there are three manuals that should be utilized as fundamental information: **AH Motion Controller - Hardware Manual**, **ISPSOFT User Manual**, and **AH Motion Controller - Standard Instructions Manual**.

With the fundamental manuals, you can understand the basic information of hardware configuration, operation procedures of the software, and the basic instructions for using the system.

To obtain required information for different system configurations and applications, refer to other manuals as indicated in the table below. Reading all manuals related to your system configuration helps you make the most use of the AH series motion control system.

Related manuals		AH Motion series manuals					AH500 Motion Control Module Manual	AH500 Module Manual
		Fundamental			AH Motion Controller – Operation Manual	AH Motion Controller - Instructions Manual		
		AH Motion Controller – Hardware Manual	ISPSOft User Manual	AH Motion Controller – Standard Instructions Manual				
General operation procedures								
1. Overview of AH Motion Controller series products		V						
2. Setting up hardware configuration for the system		V						
	for motion control applications				V			
	for communication (e.g. EtherCAT)							
	for additional motion control modules						V	
	for I/O extension using AH500 series modules							V
3. Getting started with the software		V	V					
	for motion control applications				V			
	for communication (e.g. EtherCAT)							
	for additional motion control modules							V
	for I/O extension using AH500 series modules							
4. Programming		V	V					
	for motion control applications				V	V		



Related manuals		AH Motion series manuals						AH500 Module Manual
		Fundamental			AH Motion Controller – Operation Manual	AH Motion Controller - Instructions Manual		
		AH Motion Controller – Hardware Manual	ISPSoft User Manual	AH Motion Controller – Standard Instructions Manual				
General operation procedures								
	for communication (e.g. EtherCAT)							
	for additional motion control modules						V	
	for I/O extension using AH500 series modules							V
5. Testing and troubleshooting								
	for motion control applications					V*		
	for communication (e.g. EtherCAT)							
	for additional motion control modules		V	V*	V		V	
	for I/O extension using AH500 series modules			V*				V
6. Maintenance and Inspection		V						

**\*Note:** Information regarding Error codes and Indicators and the associated troubleshooting information are attached as Appendices for a quick reference. For the complete troubleshooting of the system, refer to **AH Motion Controller – Operation Manual**.

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# Chapter 1 Product Introduction

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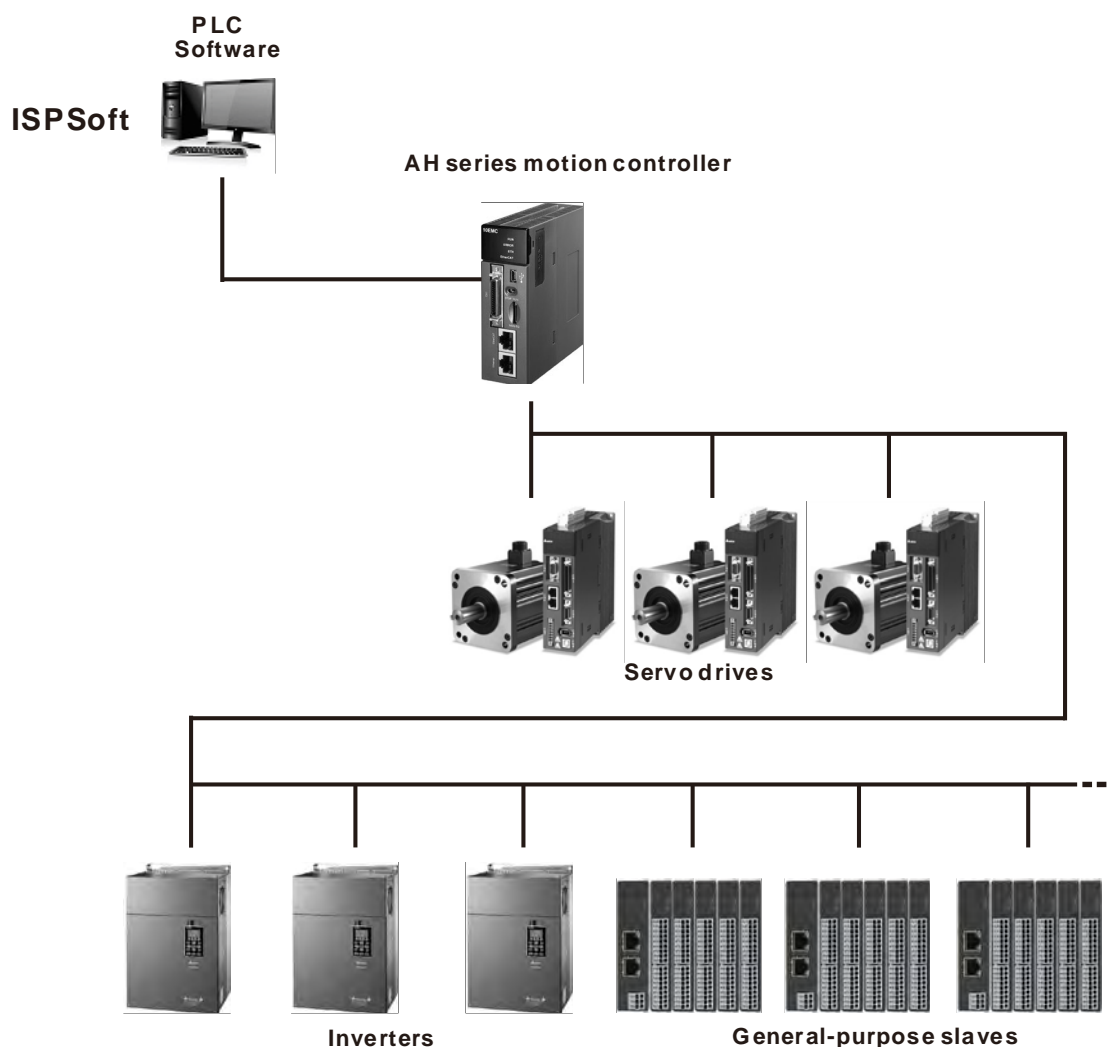
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## 1.1 The AH Series Motion Controller

The AH series motion controllers are the new generation motion controllers that provide high-speed performance through high speed interface, e.g. EtherCAT, and abundant functionality by the various functional modules. In machine automation applications, they provide accessibility, maintainability and reliability which are demanded in machine automation controllers.

The AH series motion controllers support the functionality of AH500 series PLCs, and are fully comply with PLCopen motion control function blocks that are required for motion control. The built-in high-speed motion network interface is capable of synchronizing I/O devices quickly and can be used in motion control devices, machine vision equipment, I/O devices, and more. With these products, you can build up a machine automation system easily through ISPSoft software to achieve maximum functionality and user-friendly operation.

With the machine automation system that is built from Delta products, you can connect devices easily and apply the system as a complete solution with functionality and usability.



### 1.1.1. Product Features

#### Hardware Features

##### 1. High performance motion control

- AHxxEMC-5A features EtherCAT motion control interface and is capable of controlling up to 32 axes. Maximum 6 axes synchronous linear interpolation and 3 axes synchronous circular interpolation.
- Supports PLCopen motion control standard function blocks.

##### 2. High efficiency

- The AH Motion CPU adopts a 32-bit high-speed processor. The instructions are executed at a speed of 0.3 milliseconds per 1k steps. (50% of the instructions are ladder instructions, and 50% of the instructions are other standard instructions.)

##### 3. Multiple I/O modules

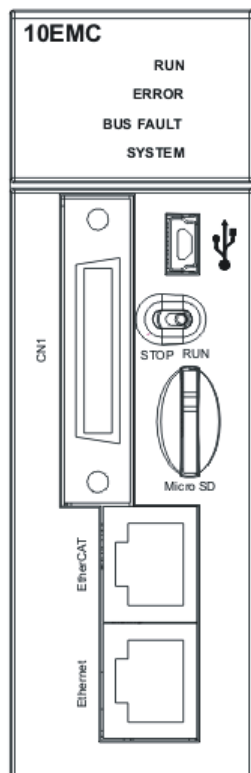
- The I/O modules supported by the AH Motion CPU are digital input/output modules, analog input/output modules, temperature measurement modules, network modules, motion control modules and remote I/O modules.

Module	Description
Digital input/output module	Digital input/output AH16AM10N-5A, AH16AM30N-5A, AH16AN01P-5A, AH16AN01R-5A, AH16AN01S-5A, AH16AN01T-5A, AH16AP11P-5A, AH16AP11R-5A, AH16AP11T-5A, AH32AM10N-5A, AH32AM10N-5B, AH32AM10N-5C, AH32AN02P-5A, AH32AN02P-5B, AH32AN02P-5C, AH32AN02T-5A, AH32AN02T-5B, AH32AN02T-5C, AH64AM10N-5C, AH64AN02P-5C and AH64AN02T-5C
Analog input/output module	Analog input/output AH04AD-5A, AH04DA-5A, AH06XA-5A, AH08AD-5A, AH08AD-5B, AH08AD-5C, AH08DA-5A, AH08DA-5B, and AH08DA-5C
Temperature measurement module	Measuring the temperature AH04PT-5A, AH04TC-5A, AH08TC-5A, and AH08PTG-5A
Motion control module	Controlling the motion AH02HC-5A, AH04HC-5A, AH05PM-5A, AH10PM-5A, AH15PM-5A, AH20MC-5A
Network module	Additional communication interface AH10SCM-5A, AH10COPM-5A, AH10EN-5A, AH15EN-5A, AH10SCM-5A, AH15SCM-5A, AH10DNET-5A, AH10PFBS-5A, AH10PFBM-5A
Remote I/O Module	It can be installed on the main backplane to work as a RTU workstation. (it supports multiple communication ports) AHRTU-DNET-5A, AHRTU-PFBS-5A and AHRTU-ETHN-5A.

##### 4. Larger program capacity and memory

- The program capacity of the AH Motion CPU can be up to 256k steps. Users do not need to change to a more advanced CPU if the user program grows bigger.
- The AH Motion CPU offers 128k words of data registers; 64k words of D devices and 64k words of L devices.

## 5. Serial control interface with multiple functions



- AHxxEMC-5A provides one serial interface through USB: COM1.
- AHBP03M2-5A/AHBP05M2-5A (AH motion backplane) provides one serial interface through terminal block: COM2.
- You can use the USB serial interface (COM1) as RS-232 and terminal block serial interface (COM2) as RS-485 according to the application. The data transfer rate can be increased from 9600 bps to 115200bps.
- ISPSOft, can perform automatic data exchange simply by filling the data exchange form in the software. Users do not need to write any program for this purpose and can save time and efforts. For details of data exchange between devices, refer to **ISPSOft User Manual**.

## 6. Memory card

- The memory card has the following functions.
  - System backup: for user program, CPU parameters, module tables, and setting values in devices.
  - System recovery: for user program, CPU parameters, module tables, and setting values in devices.
  - Parameter storage: The values in the devices
  - Log storage: The system error log and the system status log

## 7. Hot swap

- The AH motion series I/O modules support the on-line uninterruptible hot swapping. When the system runs, users can replace the module with error without stopping the system or setting the module to offline state. After the module is replaced, the new module will resume normal operation automatically.



## Software Features

### 1. Complying with IEC 61131-3

- The AH Motion CPU complies with IEC 61131-3 editing environment which supports various programming languages, multiple function blocks, tasks, and symbol tables.
- The programming languages which are supported are, structured texts (ST), ladder diagrams (LD), sequential function charts (SFC), and Continuous Function Chart (CFC).
- You can select a programming language according to your preference and the convenience. The programming languages support one another so that the programs written by different users are related.

### 2. Various function blocks\*

- In addition to standard IEC61131-3 function blocks (including PLCopen motion control function blocks), we also offer various convenient function blocks (DFB). You can write the program frequently executed in a function block so that the program becomes more structured and can be executed more conveniently.
- The encryption function supported by ISPSOFT provides the secrecy of function blocks for special businesses. The program inside a function block cannot be learned, and the patent of a business will not be infringed.

**\*Note:** A function block is a program element equipped with the operation function. It is similar to a subroutine, and is a type of POU (Program Organization Unit). It cannot operate by itself, and has to be called through the program POU. After the related parameters are transmitted, the function defined by a function block is executed. Besides, the final operation result can be sent to the device or variable used in the superior POU after the execution of the function block is complete.

### 3. Task

- The user program supports 283 tasks at most: 32 cyclic tasks, 32 I/O interrupt tasks, 212 external interrupt tasks, 1 24V LV detection, 4 timed interrupt tasks, and 2 communication interrupt tasks.
- Users can enable and disable a task during the execution of a program by means of TKON and TKOFF.

### 4. On-line debugging mode

- After a single instruction step has been complete, or after a breakpoint is specified, users can easily find the bug in the program by means of the on-line debugging mode supported by the AH Motion CPU.
- Note: Structured Text (ST) do not support on-line debugging mode, and sequential function charts (SFC) programming support the debugging mode during the action and the transition.

## 5. On-line editing mode

- When the system runs, users can make use of the on-line editing mode to update the program without affecting the operation of the system.

## 1.1.2. Overview of the System Configurations

The two categories of system configurations of AH Motion series motion control CPU are as follows.

### ● Basic System Configurations

The AH Motion series CPU basic configurations include the **AH Motion CPU Network Configuration**, **AH500 Series Module Configuration**, and **Supported Software**.

#### AH Motion Network Configuration

- AHxxEMC-5A

You can use the EtherCAT master port built in on the CPU interface to connect to slave devices such as analog and digital I/O, servo drives, AC motor drives and encoder input devices. With EtherCAT network configuration, you can design a system capable of performing very accurate sequence and motion control in a fixed cycle.

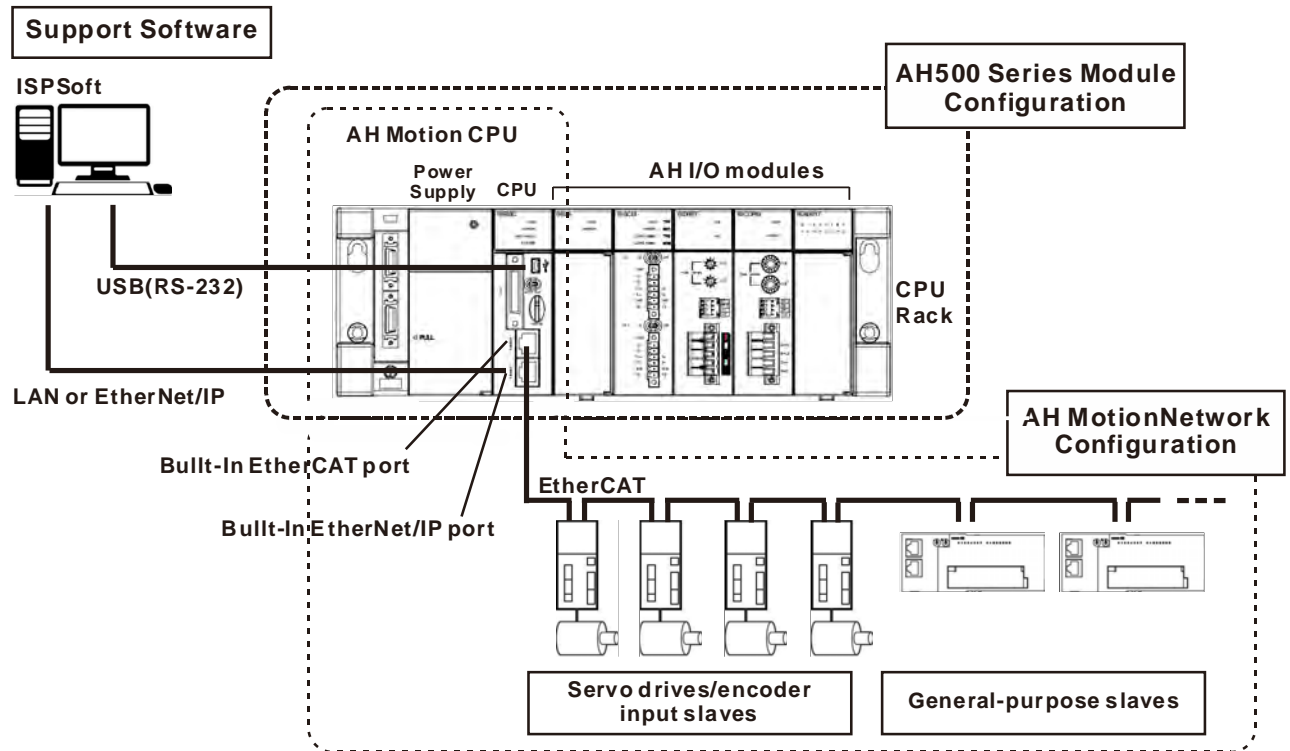
#### AH500 Series Module Configuration

With the motion backplane, you can also add AH500 series I/O modules\* in addition to the EtherCAT network. AH500 series modules can be installed directly to the motion backplane where the CPU module is mounted.

\*Note: a few of AH500 series I/O modules are not supported by the motion backplane. Refer to **Ch2 System Configuration** for the list of supported products.

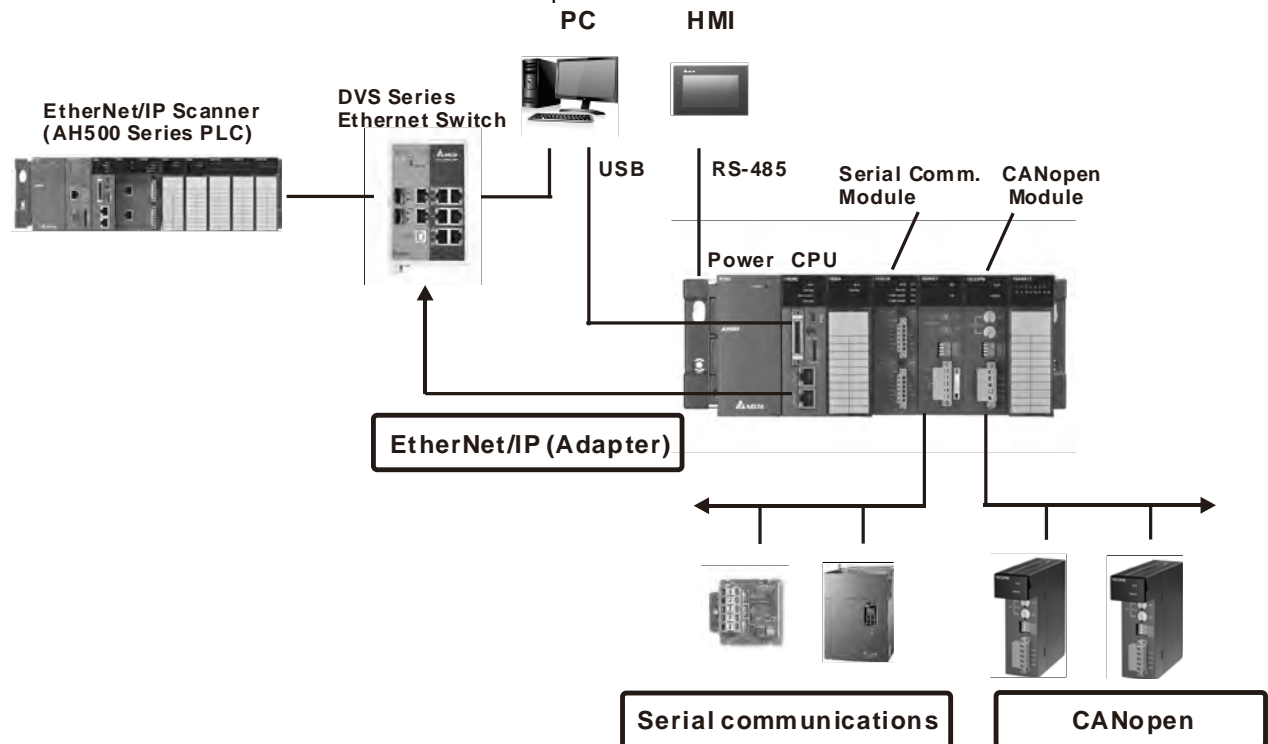
#### Supported Software

ISPSOft is the major programming software that you use for an AH Motion series motion controller. You can connect the software on the computer to the USB interface on the CPU module through a commercially available USB cable. You can also connect ISPSOft to the Ethernet port on the CPU module with an Ethernet cable or to the built-in RS-485 port on the Motion backplane with a RS-485 cable and a converting device, e.g. IFD6500 USB/RS-485 converter. In addition to ISPSOft, you can also use other software for configuring various applications based on different networks.



### ● Other Network Configurations

Through the network interfaces on the AH motion CPU and the motion backplane, you can connect host computers, Human Machine Interfaces (HMI) and other AH series PLCs with RS-232(USB), RS-485, and EtherNet/IP networks. In addition, you can also create CANopen network and additional serial communication network (RS-485) by mounting AH500 series network modules on the motion backplane.





### ● Supported Software

ISPSOft is the major programming software that you use for an AH Motion series motion controller. You can use ISPSOft to set up the controller configurations, parameters, and to develop the program. Debugging and simulate operation.

#### Required software

- **ISPSOft:** Programming and hardware configuration
- **COMMGR:** Communication management
- **EtherCAT Builder:** EtherCAT network configurator (for AHxxEMC-5A)

#### Optional software

- **EtherNet/IP Builder:** EtherNet/IP network configurator
- **CANopen Builder:** CANopen network configurator

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## Chapter 2 System Configuration

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## 2.1 Basic System Configuration

An AH Motion series CPU provides two types of configurations as follows.

### 1. Basic Configurations

The basic configurations explained in this section include the CPU network configuration and the configuration of the I/O modules which are controlled by the CPU.

- AH Motion CPU network configuration
- AH500 Series Module Configuration

### 2. Other Network Configurations

In addition to the main CPU network configuration, you can also set up other network configurations which are connected to the CPU's built-in EtherNet/IP port and other network modules.

2

## AH Motion CPU Network Configuration

- AHxxEMC

The AH Motion CPU provides EtherCAT network as a basic motion system.

With the EtherCAT network system, you can obtain execution results of both sequence and motion control operation in the high speed communications period of EtherCAT network. This feature enables precise sequence control and motion control with a constant cycle time and steady operational results.

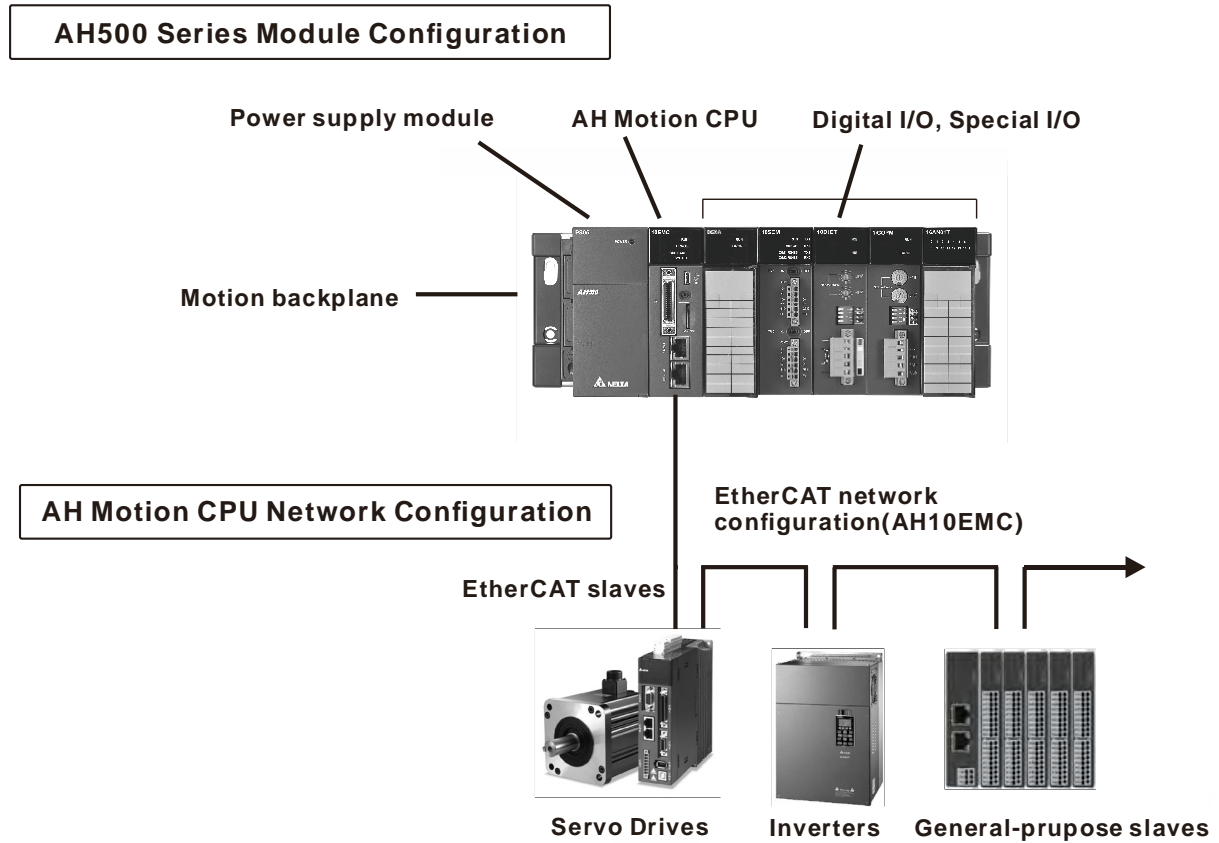
## AH500 Series Module Configuration

### CPU Rack

The CPU Rack consists of products as follows.

- AH Motion series CPU
- AH Motion series backplane
- AH500 series power supply module
- AH500 series motion control modules
- AH500 series network modules\*
- AH500 series digital I/O modules and special I/O modules.

**\*Note:** Some AH500 series network modules are not supported by AH Motion CPU. Refer to **2.1.2 AH500 Series Module Configuration** for the supported models.



### 2.1.1. AH Motion CPU Network Configuration

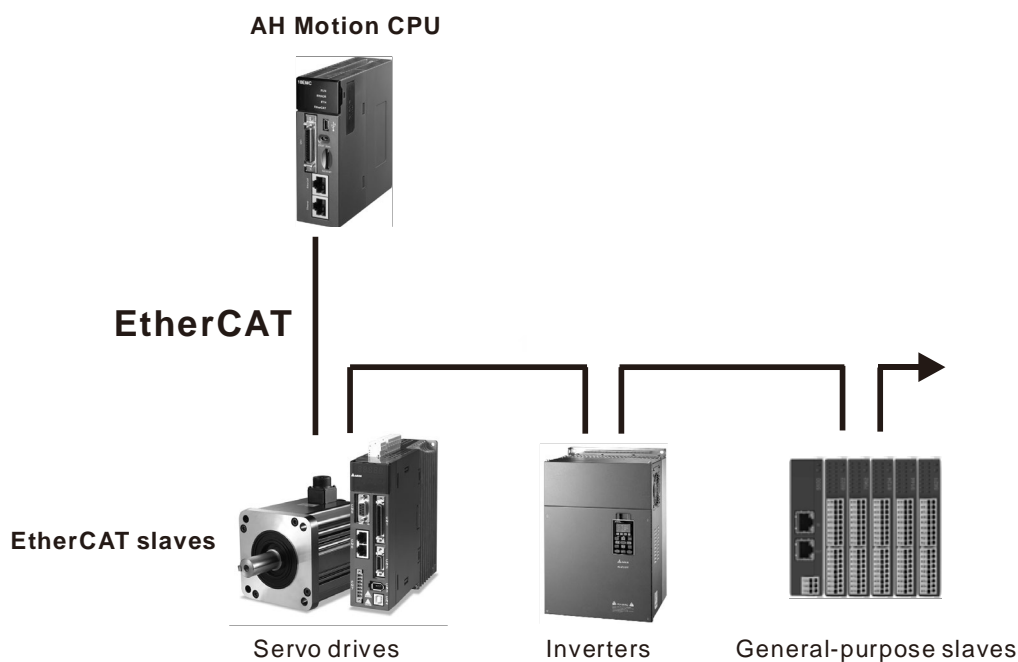
#### AHxxEMC – EtherCAT

The EtherCAT network configuration includes AHxxEMC which is the core motion CPU, an AH motion backplane\*, and an AH500 series power supply module. You can connect the built-in EtherCAT master port to the EtherCAT slave devices.

The AHxxEMC can also be used as a motion control module in an AH500 series PLC configuration. You can install it onto the AH500 series main backplane to perform motion control function.

For more information about this application, refer to **AH500 Motion Control Module Manual**.

**\*Note:** The AH motion backplane must be used together with AHxxEMC when you use AHxxEMC as a motion CPU.

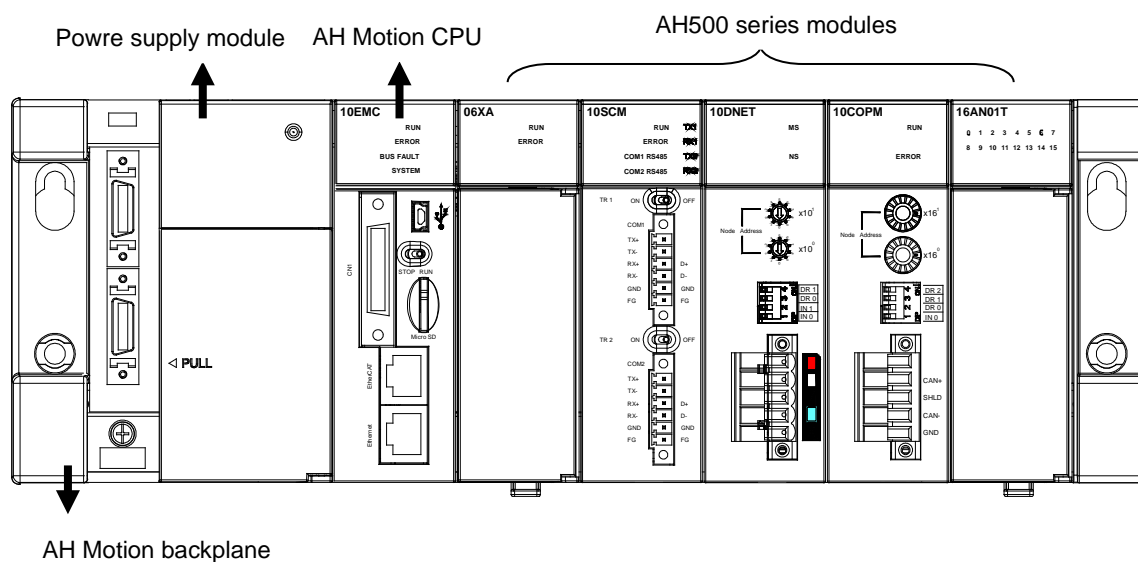


## 2.1.2. AH500 Series Module Configuration

The AH Motion CPU rack consists of a motion backplane with a power supply module and a motion CPU. You can mount additional AH500 series modules to the right for different applications. The available modules include digital input/output modules, analog input/output modules, network modules, and motion control modules.

### ● AH Motion CPU Rack

A CPU module, a power supply module, and I/O modules are installed on a motion backplane.



● **Components**

Component	Model Name	Description
Power supply module	AHPS05-5A	100~240 VAC 50/60 Hz
	AHPS15-5A	24 VDC
AH Motion CPU	AHxxEMC-5A	AH08EMC-5A: 8 axes; AH10EMC-5A: 16 axes; AH20EMC-5A: 32 axes One EtherCAT port One EtherNet/IP port (adapter) One built-in USB port (RS-232) One built-in micro SD interface
Motion backplane	AHBP03M2-5A	Three slots available for additional AH500 series modules.
	AHBP05M2-5A	Five slots available for additional AH500 series modules.
	AHBP07M2-5A	Seven slots available for additional AH500 series modules.
Digital input/output module	AH16AM10N-5A	24 VDC 5 mA 16 inputs Terminal block
	AH32AM10N-5A	24 VDC 5 mA 32 inputs Terminal block
	AH32AM10N-5B	24 VDC 5 mA 32 inputs DB37 connector
	AH32AM10N-5C	24 VDC 5 mA 32 inputs MIL connector
	AH64AM10N-5C	24 VDC 3.2 mA 64 inputs MIL connector
	AH16AM30N-5A	100~240 VAC 4.5 mA~9 mA (100 V, 50 Hz) 16 inputs Terminal block
	AH16AN01R-5A	240 VAC/24 VDC 2 A 16 outputs Relay Terminal block

Component	Model Name	Description
	AH16AN01T-5A	12~24 VDC 0.5 A 16 outputs Sinking output Terminal block
	AH16AN01P-5A	12~24 VDC 0.5 A 16 outputs Sourcing output Terminal block
	AH32AN02T-5A	12~24 VDC 0.1 A 32 outputs Sinking output Terminal block
	AH32AN02T-5B	12~24 VDC 0.1 A 32 outputs Sinking output DB37 connector
	AH32AN02T-5C	12~24 VDC 0.1 A 32 outputs Sinking output MIL connector
	AH32AN02P-5A	12~24 VDC 0.1 A 32 outputs Sourcing output Terminal block
	AH32AN02P-5B	12~24 VDC 0.1 A 32 outputs Sourcing output DB37 connector
	AH32AN02P-5C	12~24 VDC 0.1 A 32 outputs Sourcing output MIL connector
	AH64AN02T-5C	12~24 VDC 0.1 A 64 outputs Sinking output MIL connector

Component	Model Name	Description
	AH64AN02P-5C	12~24 VDC 0.1 A 64 outputs Sourcing output MIL connector
	AH16AN01S-5A	100~240 VAC 0.5 A 16 outputs TRIAC Terminal block
Analog input/output module	AH04AD-5A	Four-channel analog input module Hardware resolution: 16 bits 0/1 V~5 V, -5 V~5 V, 0 V~10 V, -10 V~10 V, 0/4 mA~20 mA, and -20 mA~20 mA Conversion time: 150 us/channel
	AH08AD-5A	Eight-channel analog input module Hardware resolution: 16 bits 0/1 V~5 V, -5 V~5 V, 0 V~10 V, -10 V~10 V, 0/4 mA~20 mA, and -20 mA~20 mA Conversion time: 150 us/channel
	AH08AD-5B	Eight-channel analog input module Hardware resolution: 16 bits 0/1 V~5 V, -5 V~5 V, 0 V~10 V, and -10 V~10 V Conversion time: 150 us/channel
	AH08AD-5C	Eight-channel analog input module Hardware resolution: 16 bits 0/4 mA~20 mA, and -20 mA~20 mA Conversion time: 150 us/channel
	AH04DA-5A	Four-channel analog output module Hardware resolution: 16 bits 0/1 V~5 V, -5 V~5 V, 0 V~10 V, -10 V~10 V, and 0/4 mA~20 mA Conversion time: 150 us/channel
	AH08DA-5A	Eight -channel analog output module Hardware resolution: 16 bits 0/1 V~5 V, -5 V~5 V, 0 V~10 V, -10 V~10 V, and 0/4 mA~20 mA Conversion time: 150 us/channel
	AH08DA-5B	Eight-channel analog output module Hardware resolution: 16 bits 0/1 V~5 V, -5 V~5 V, 0 V~10 V, and -10 V~10 V Conversion time: 150 us/channel
	AH08DA-5C	Eight-channel analog output module Hardware resolution: 16 bits 0/4 mA~20 mA Conversion time: 150 us/channel
	AH06XA-5A	Four-channel analog input module Hardware resolution: 16 bits 0/1 V~5 V, -5 V~5 V, 0 V~10 V, -10 V~10 V, 0/4 mA~20 mA, and -20 mA~20 mA



Component	Model Name	Description
		Conversion time: 150 us/channel Two-channel analog output module Hardware resolution: 16 bits 0/1 V~5 V, -5 V~5 V, 0 V~10 V, -10 V~10 V, and 0/4 mA~20 mA Conversion time: 150 us/channel
Temperature measurement module	AH04PT-5A	Four-channel four-wire/three-wire RTD Sensor type: Pt100/Pt1000/Ni100/Ni1000 sensor, and 0~300 Ω input impedance Resolution: 0.1°C/0.1°F (16 bits) Four-wire conversion time: 150 ms/channel Three-wire conversion time: 300 ms/channel
	AH08PTG-5A	Eight-channel four-wire/three-wire/two-wire RTD Sensor type: Pt100/Pt1000/Ni100/Ni1000, and 0~300 Ω input impedance Resolution: 0.1°C/0.1°F (16 bits) Conversion time: 20 ms/4 channels and 200 ms/8 channels
	AH04TC-5A	Four-channel thermocouple Sensor type: J, K, R, S, T, E, N, and -150~+150 mV Resolution: 0.1°C/0.1°F Conversion time: 200 ms/channel
	AH08TC-5A	Eight-channel thermocouple Sensor type: J, K, R, S, T, E, N, and -150~+150 mV Resolution: 0.1°C/0.1°F Conversion time: 200 ms/channel
Motion control module	AH02HC-5A	Two-channel high-speed counter module (200 kHz)
	AH04HC-5A	Four-channel high-speed counter module (200 kHz)
	AH05PM-5A	Two-axis pulse train motion control module (1 MHz)
	AH10PM-5A	Six-axis pulse train motion control module (Four axes: 1 MHz; Two axes: 200 kHz)
	AH15PM-5A	Four-axis pulse train motion control module (1 MHz )
	AH20MC-5A	Twelve-axis DMCNET (Delta Motion Control Network) motion control module (10 Mbps)
Network module	AH10EN-5A	It is an Ethernet communication module with two Ethernet ports, and supports Modbus TCP protocols, and EtherNet/IP software (V2.0). It can function as a master or a slave.
	AH15EN-5A	It is an Ethernet communication module with two Ethernet ports, and supports Modbus TCP protocols, and IEC60870-5-104. It can function as a master or a slave.
	AH10SCM-5A	It is a serial communication module with two RS-485/RS-422 ports, and supports Modbus and UD Link protocols. One part of communication is isolated from the other part of the communication, and one part of power is isolated from the other part of the power.
	AH15SCM-5A	It is a serial communication module with two RS-232 ports, and supports Modbus and UD Link protocols. One part of communication is isolated from the other part of the communication, and one part of power is isolated from the other part of the power.
	AH10DNET-5A	It is a DeviceNet communication module. It can function as a master or slave. A maximum of 1Mbps per second can be transferred.

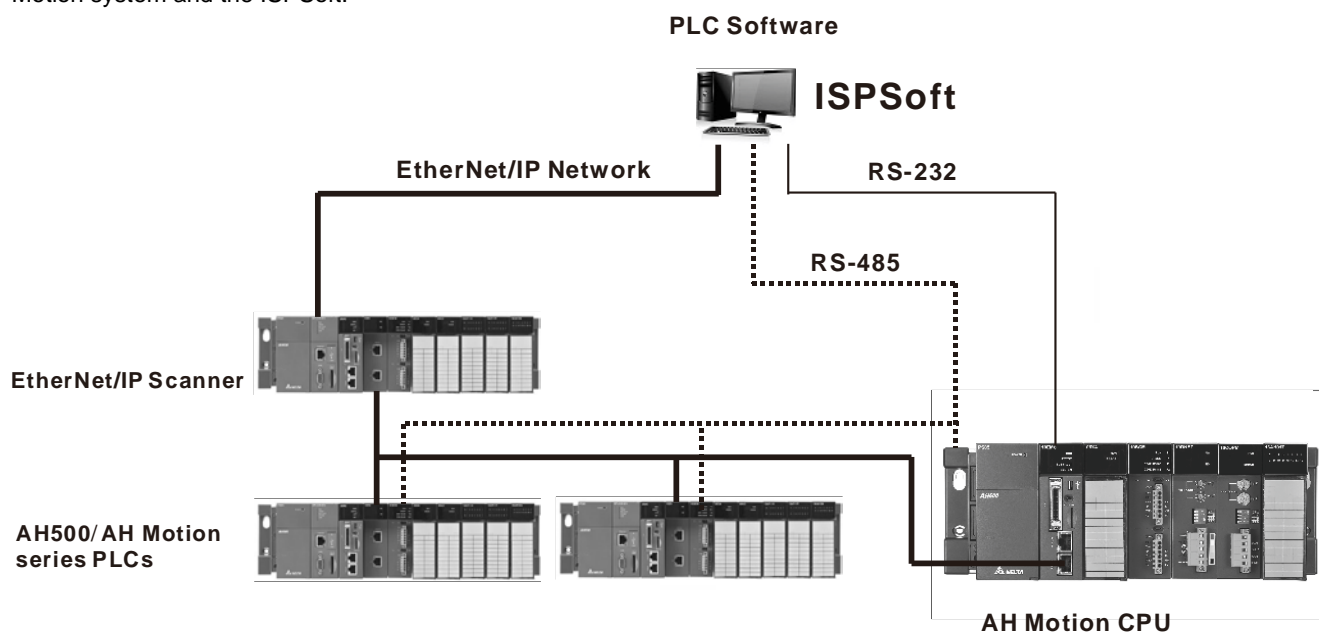
Component	Model Name	Description
	AH10PFBM-5A	It is a PROFIBUS communication module. It can function as a master.
	AH10PFBS-5A	It is a PROFIBUS communication module. It can function as a slave.
	AH10COPM-5A	It is a CANopen communication module. It can function as a master or a slave.
Remote I/O module	AHRTU-DNET-5A	It is a DeviceNet remote I/O communication module.
	AHRTU-PFBS-5A	It is a PROFIBUS remote I/O communication module.
	AHRTU-ETHN-5A	It is an Ethernet remote I/O communication module.
I/O extension cable	UC-ET010-24A or DVPACAB7A10	1.0 meter I/O extension cable (MIL connector) for AH32AM10N-5C and AH64AM10N-5C
	UC-ET010-24C or DVPACAB7B10	1.0 meter I/O extension cable (MIL connector) for AH32AN02T-5C, AH32AN02P-5C, AH64AN02T-5C and AH64AN02P-5C
	UC-ET010-33B or DVPACAB7C10	1.0 meter I/O extension cable (DB37 connector) for AH32AM10N-5B, AH32AN02T-5B, and AH32AN02P-5B
	UC-ET010-13B or DVPACAB7D10	1.0 meter I/O extension cable for AH04HC-5A and AH20MC-5A
	UC-ET010-15B or DVPACAB7E10	1.0 meter I/O extension cable for AH10PM-5A and AH15PM-5A
External terminal module	UB-10-ID32A or DVPAETB-ID32A	I/O external terminal module for AH32AM10N-5C and AH64AM10N-5C 32 inputs
	UB-10-OR16A or DVPAETB-OR16A	I/O external terminal module for AH32AN02T-5C and AH64AN02T-5C 16 relay outputs
	UB-10-OR16B or DVPAETB-OR16B	I/O external terminal module for AH32AN02P-5C and AH64AN02P-5C 16 relay outputs
	UB-10-ID32B or DVPAETB-ID32B	I/O external terminal module for AH32AM10N-5B 32 inputs
	UB-10-OR32A or DVPAETB-OR32A	I/O external terminal module for AH32AN02T-5B 32 relay outputs
	UB-10-OR32B or DVPAETB-OR32B	I/O external terminal module for AH32AN02P-5B 32 relay outputs
	UB-10-OT32A or DVPAETB-OT32A	I/O external terminal module for AH32AN02T-5C, AH32AN02P-5C, AH64AN02T-5C, and AH64AN02P-5C 32 transistor outputs
	UB-10-OT32B or DVPAETB-OT32B	I/O external terminal module for AH32AN02T-5B and AH32AN02P-5B 32 transistor outputs
	UB-10-IO16C or DVPAETB-IO16C	I/O external terminal module for AH04HC-5A and AH20MC-5A
	UB-10-IO24C or DVPAETB-IO24C	I/O external terminal module for AH10PM-5A
	UB-10-IO34C or DVPAETB-IO34C	I/O external terminal module for AH10PM-5A

Component	Model Name	Description
Dummy module	AHASP01-5A	Dummy module used for an empty I/O slot

## 2

## 2.2 Software Connection

Through the network interfaces on the AH motion CPU and the motion backplane, you can connect the CPU to the host computer with RS-232(USB), RS-485, and Ethernet networks. In this configuration, you can also connect ISPSOft with AH500 series PLCs. Refer to *ISPSOft User Manual* for information on the procedures of the connections between the AH Motion system and the ISPSOft.



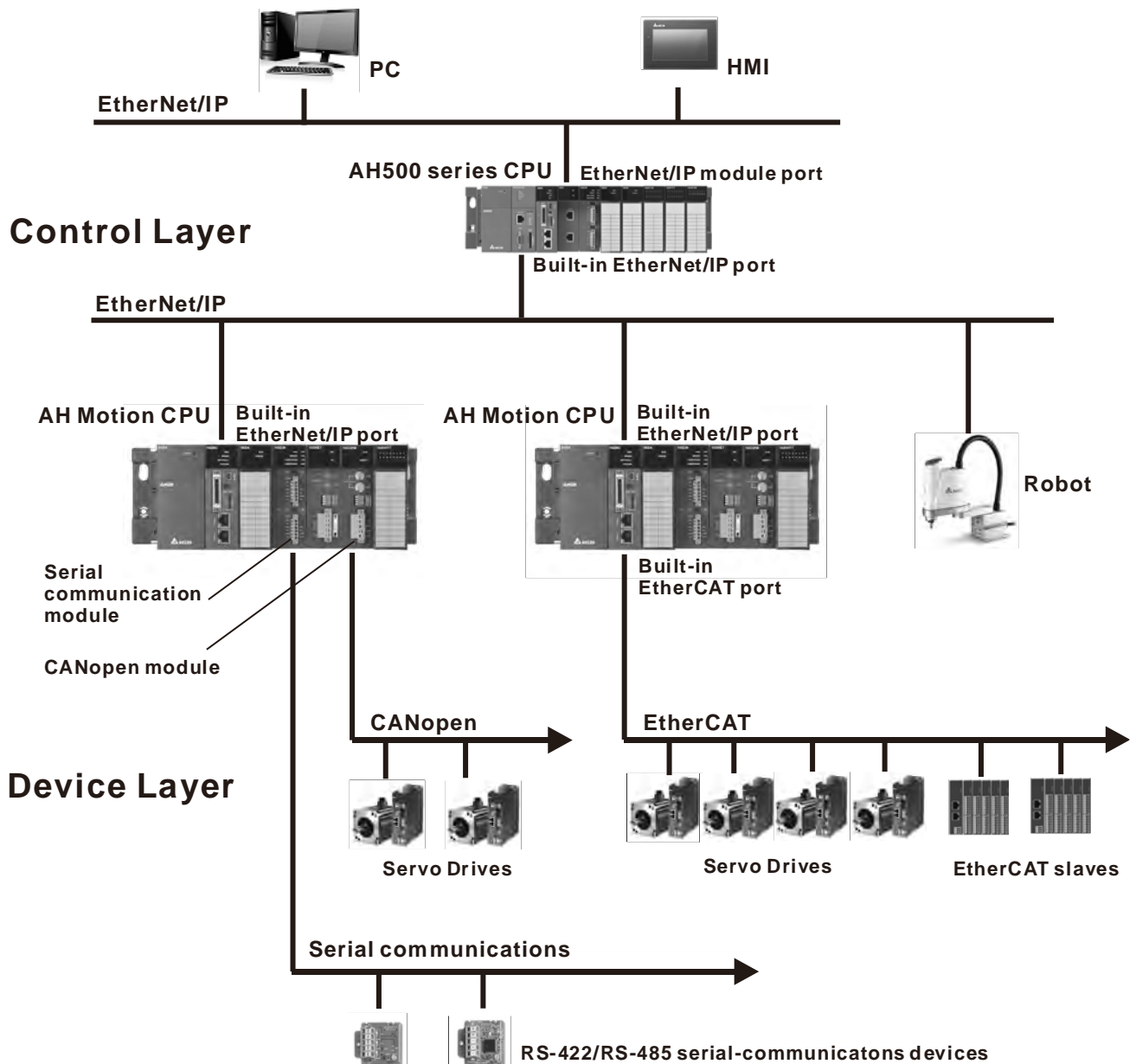
## 2.3 Overall Network Configuration

### - AHxxEMC

In addition to the AH Motion CPU network, e.g. EtherCAT, you can expand AH Motion system with additional networks such as CANopen network and serial communication networks. The diagram below shows the overall network configuration of different layers.

For operation procedures on connecting different communication networks, refer to *ISPSoft User Manual*.

### Information Layer



Layer	Function	Network type	Protocols	Devices
Information Layer	Message communications (CIP) with host personal computer	EtherNet/IP	CIP message communications	Built-in EtherNet/IP port
Control Layer	Automatic data exchange between controllers (no programming required)	EtherNet/IP MODBUS TCP Serial communications	EtherNet/IP MODBUS TCP MODBUS RS-422/RS-485	Delta controllers
Device Layer - field networks	Communication between PLC and devices with serial interface.	Serial communications	MODBUS RS-422/RS-485	Serial communication module
	High-speed, high accuracy communications with servo drives and slaves(32 axes)	EtherCAT	EtherCAT protocol	Built-in EtherCAT port
	High-speed, high accuracy communications with servo drives and slaves (16 axes)	CANopen	CANopen protocol	CANopen module

### 2.3.1 EtherNet/IP

Please refer to EtherNet/IP operation manual for more details.

# Chapter 3   Product Specifications

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## 3.1 Environmental Specifications

Environmental Specifications	
Operating temperature	-20~60°C
Storage temperature	-40~70°C
Operating humidity	5~95% No condensation
Storage humidity	5~95% No condensation
Vibration/Shock resistance	International standards IEC 61131-2, IEC 68-2-6 (TEST Fc)/ IEC 61131-2 & IEC 68-2-27 (TEST Ea)
Operating environment	No corrosive gas exists.
Installation location	In a control box
Applicable atmospheric pressure	Operation: 1013 ~ 795 hPa (equivalent to an altitude of 0 ~ 2000 meters). Storage: 1013 ~ 700 hPa (equivalent to an altitude of 0 ~ 3000 meters).
Pollution degree	2
Enclosure fire-resistance level	UL94V-0

## 3.2 AH Motion CPU

### 3.2.1 General Specifications

- AHxxEMC-5A

General Specifications		
AHxxEMC-5A		Remark
Execution	The program is executed cyclically.	
Input/Output control	Cyclically refreshed inputs/outputs Direct inputs/outputs	The inputs and outputs can be controlled through the direct inputs (DX device) and direct outputs (DY device).
Programming language	IEC 61131-3	
	Ladder diagram (LD), continuous function chart (CFC), structured text (ST), and sequential function chart (SFC).	
Instruction execution speed	0.3 ms/K steps	
Constant scan cycle (ms)	1-32000 (The scan cycle can be increased by one millisecond.)	The scan cycle time can be specified by parameters.
Program capacity (step)	256K steps	
Installation	DIN rails or screws	
Installation of modules	Modules are installed directly on a backplane.	
Number of modules	Five input/output modules at most can be installed on a motion backplane.	

General Specifications		
AHxxEMC-5A		Remark
Number of tasks	283 tasks (32 cyclic tasks, 32 I/O interrupt tasks, 212 external interrupt tasks, 1 24V LV detection, 4 timed interrupt tasks, and 2 communication interrupt tasks).	
Number of input/output devices	X/Y devices (bit): 8192 (X0.0~X511.15/Y0.0~Y511.15) X/Y devices (word): 512 (X0~X511/Y0~Y511)	Number of devices which can be used in a program
Number of inputs/outputs	328 inputs/ 324 outputs (AHxxEMC)	Number of inputs/outputs accessible to an CPU
Input relay [X]	8192 (X0.0~X511.15)	
Output relay [Y]	8192 (Y0.0~Y511.15)	
Auxiliary relay [M]	8192 (M0~M8191)	
Timer [T]	2048 (T0~T2047)	
Counter [C]	2048 (C0~C2047)	
32-bit counter [HC/AC]	HC: 64 (HC0~HC63) AC: 56 (AC0~ AC55) (AHxxEMC)	
Data register [D]	D device (bit): 1048576 (D0.0~D65535.15) D device (word): 65536 (D0~D65535)	
Stepping relay [S]	2048 (S0~S2047)	
Index register [E]	32 (E0~E31)	
Special auxiliary relay [SM]	SM: 2048 (SM0~SM2047)	
Special data register [SR]	SR: 2048 (SR0~SR2047)	
Serial communication port	One RS-232(USB), One RS-485 communication port	
Ethernet port	10/100 M	
USB port	Mini USB	
Memory card slot	Supports Micro SD card (SD 2.0)	
Real-time clock	Years, months, days, hours, minutes, seconds, and weeks	The function is available when the CPU is used together with the motion backplane
Weight	230g	
Isolation Specification	Communication port	USB and COM isolation voltage: 500VAC Ethernet communication isolation voltage: 1500VAC
	Digital I/O point	Digital I/O isolation voltage: 500VAC



## Description of the terminals

Terminal	Description	Response characteristic	Rated input	
			Current	Voltage
<b>X0.0+, X0.0-, X0.1+, X0.1- (*2)</b>	<ol style="list-style-type: none"> <li>Differential input terminals.</li> <li>The functions of the terminals: <ul style="list-style-type: none"> <li>High-speed count: <ul style="list-style-type: none"> <li>The terminals are the RESET input terminals for counter 0~counter 1.</li> <li>X0.0+ and X0.0- are for counter 0.</li> <li>X0.1+ and X0.1- are for counter 1.</li> </ul> </li> <li>High-speed capture: The terminals can function as trigger signals for high-speed captures.</li> </ul> </li> </ol>	1MHz	+/-5mA	+/-5V
<b>X0.2, X0.3, X1.4, X1.5 (*2)</b>	<ol style="list-style-type: none"> <li>Common input terminals.</li> <li>The functions of the terminals: <ul style="list-style-type: none"> <li>High-speed count: <ul style="list-style-type: none"> <li>The terminals are the RESET input terminals for counter 2~counter 5.</li> <li>X0.2 is for counter 2.</li> <li>X0.3 is for counter 3.</li> <li>X1.4 is for counter 4</li> <li>X1.5 is for counter 5</li> </ul> </li> <li>High-speed capture: X0.2 and X0.3 can function as trigger signals for high-speed captures.</li> </ul> </li> </ol>	100kHz(*1)	5mA	24V
<b>X0.8+, X0.8-, X0.9+, X0.9- (*2)</b>	<ol style="list-style-type: none"> <li>Differential input terminals.</li> <li>The functions of the terminals: <ul style="list-style-type: none"> <li>Motion control: The terminals are for a manual pulse generator.</li> <li>High-speed count: <ul style="list-style-type: none"> <li>The terminals are for counter 0.</li> <li>X0.8+ and X0.8- are the A-phase inputs for counter 0. X0.9+ and X0.9- are the B-phase inputs for counter 0.</li> </ul> </li> <li>High-speed capture: The terminals can function as trigger signals for high-speed captures.</li> <li>Interrupt inputs</li> </ul> </li> </ol>	1MHz	+/-5mA	+/-5V
<b>X0.10+, X0.10-, X0.11+, X0.11- (*2)</b>	<ol style="list-style-type: none"> <li>Differential input terminals.</li> <li>The functions of the terminals: <ul style="list-style-type: none"> <li>High-speed count: <ul style="list-style-type: none"> <li>The terminals are for counter 1.</li> <li>X0.10+ and X0.10- are the A-phase inputs for counter 1. X0.11+ and X0.11- are the B-phase inputs for counter 1.</li> </ul> </li> <li>High-speed capture: The terminals can function as trigger signals for high-speed captures.</li> <li>Interrupt inputs</li> </ul> </li> </ol>	1MHz	+/-5mA	+/-5V
<b>X0.12, X0.13, X0.14, X0.15, X1.0, X1.1,</b>	<ol style="list-style-type: none"> <li>Common input terminals.</li> <li>The functions of the terminals: <ul style="list-style-type: none"> <li>High-speed count: <ul style="list-style-type: none"> <li>The terminals are for counter 2~counter 5.</li> <li>X0.12 and X0.13 are for counter 2.</li> <li>X0.14 and X0.15 are for counter 3.</li> </ul> </li> </ul> </li> </ol>	100 kHz(*1)	5mA	24 V

Terminal	Description	Response characteristic	Rated input	
			Current	Voltage
<b>X1.2, X1.3 (*2)</b>	X1.0 and X1.1 are for counter 4. X1.2 and X1.3 are for counter 5. <ul style="list-style-type: none"> <li>High-speed capture: The terminals can function as trigger signals for high-speed captures.</li> <li>Interrupt inputs: X0.12, X0.13, X0.14 and X0.15 can function as interrupt inputs.</li> </ul>			
<b>Y0.8, Y0.9, Y0.10, Y0.11</b>	1. Pulse output terminals (open collector). 2. The function of the terminals: <ul style="list-style-type: none"> <li>High-speed comparison: The terminals can function as high-speed comparison outputs.</li> </ul>	200 kHz	15 mA	24 V

\*1. If the frequency of input signals received by an input terminal must be 200 kHz, the input terminal must be connected to a 1 k $\Omega$  (2 W) resistor in parallel

\*2. From HWCONFIG of the ISPSOFT, two different filter settings for IO inputs can be set, X Input Single Filter Time and X Input Single Frequency Filter Factor. For details, please refer to section 4.4.4.1 in the AH Motion Controller Operation Manual.

### 3.2.2 Motion Control Function Specifications

#### ● AHxxEMC-5A

Specifications	AHxxEMC-5A
<b>Number of substantial axes supported</b>	AH08EMC-5A: 8 axes; AH10EMC-5A: 16 axes; AH20EMC-5A: 32 axes (Axis 1~axis 32)
<b>Storage</b>	The capacity of the built-in storage is 256K steps.
<b>Unit</b>	Motor unit, mechanical unit
<b>Motor control</b>	High-speed motion control system EtherCAT The response time is 100Mbps.
<b>Maximum speed</b>	EtherCAT: 100M bps Differential input: 1MHz Open collector input : 200KHz Open collector output:200KHz

Specifications		AHxxEMC-5A
<b>Input signal</b>	<b>Operating switch</b>	RUN-STOP switch
	<b>Input terminal</b>	X0.0+, X0.0-, X0.1+, X0.1-, X0.8+, X0.8-, X0.9+, X0.9-, X0.10+, X0.10-, X0.11+, X0.11-, X0.2, X0.3, X0.12, X0.13, X0.14, X0.15, X1.0, X1.1, X1.2, X1.3, X1.4, X1.5,
<b>Output signal</b>	<b>Output terminal</b>	Y0.8, Y0.9, Y0.10, and Y0.11
	<b>External communication port</b>	Mini USB port Ethernet port EtherCAT port

Specifications	AHxxEMC-5A
Memory card slot	Supports Micro SD card The maximum capacity is 32 GB.
M-code	M00~M01, M03~M101, and M103~M65535: The execution of a program pauses. (WAIT) You can use them freely.
G-code	G0 (rapid positioning), G1 (linear interpolation), G2 (circular interpolation, clockwise), G3 (circular interpolation, counterclockwise), G4 (dwell), G17 (XY plane selection), G18 (ZX plane selection), G19 (YZ plane selection), G90 (absolute programming), and G91 (incremental programming)
Number of counters	6
Number of high-speed capture/comparison	6
Number of interrupt devices	216

### 3.2.3 Communication Ports

- **AHxxEMC-5A**

AHxxEMC is equipped with a mini USB port and an Ethernet port and an EtherCAT port.

**Mini USB:** A mini USB port can function as a slave station. You can download or upload a program through a mini USB port. The communication protocols supported by the mini USB port are MODBUS ASCII and MODBUS RTU (RS-232).

**Ethernet:** The Ethernet port supports communication protocol MODBUS TCP and EtherNet/IP adapter.

#### MODBUS TCP

The Ethernet port on AH Motion CPU can exchange data with a device with Ethernet interface, e.g. AH500 series PLCs, through a common Ethernet cable.

- Can be connected to ISPSoft. A program can be uploaded/downloaded and monitored.
- Can also function as a standard MODBUS TCP slave.

#### EtherNet/IP adapter

The Ethernet port on AH Motion CPU can be connected by an EtherNet/IP scanner and perform data exchange through a common Ethernet cable.

- Can be connected to EtherNet/IP scanner through I/O connection.
- Can be connected to EtherNet/IP scanner through CIP Message.

Specifications	
Electrical isolation	500 VDC
Connector	RJ45
Transmission cable	CAT-5, CAT-5e, CAT-6

**EtherCAT:** An EtherCAT port can be used to perform motion control function based on EtherCAT communications.

Specifications	
Electrical isolation	500 VDC
Connector	RJ45
Transmission cable	Delta Cable UC-EMC003-02C (0.3M), UC-EMC005-02C (0.5M), UC-EMC010-02C (1M), UC-EMC020-02C (2M), UC-EMC050-02C (5M), UC-EMC100-02C (10M), UC-EMC200-02C (20M) Note: The previously used Delta cable UC-EMCXXX-02A has been discontinued as of December 31, 2022.

## Communication specifications:

Interface	Mini USB	
Specifications		
Serial transmission rate	9,600~57,600 bps	
Number of data bits	7 bits~8 bits	
Parity bit	Even parity bit/Odd parity bit/None	
Number of stop bits	1 data bit~2 data bits	
ASCII mode	Slave stations are supported.	
RTU mode	Slave stations are supported.	
Number of data read/written (ASCII mode)	100 registers	
Number of data read/written (RTU mode)	100 registers	
Interface	Ethernet	
Specifications	MODBUS TCP	EtherNet/IP
Transmission rate	10/100 Mbps	10/100 Mbps
Communication protocol	MODBUS TCP	EtherNet/IP
Number of data read/written	100 registers	250 registers
Maximum transmission distance	100 meters	100 meters
Interface	EtherCAT	
Specifications		
Serial transmission rate	100 Mbps	
Communication protocol	EtherCAT packet format	
Number of axes supported	AH08EMC-5A: 8 axes; AH10EMC-5A: 16 axes; AH20EMC-5A: 32 axes	

### 3.2.4 I/O Addressing of AH Motion CPU

The I/O addressing between AH Motion CPUs and AH500 I/O modules installed on the motion backplane is a part of the CPU specifications. The range of I/O addressing of AH Motion CPUs is explained in this section.

- **Software-defined address**

Every AH motion CPU supports software-defined addresses between AH Motion CPU and its I/O modules. As a default setting, a starting address is given by the software and I/O addresses are automatically allocated according to the starting address. For example, AH16AM10N-5A, digital input module with 16 inputs, takes the **input device range** of 16 bits, starting from Xn.0 (Xn.0~Xn.15).

- **User-defined address**

If you want to define the I/O addresses according to actual needs, you can assign a starting address to an input/output module by software. You can benefit from the user-defined addresses that allow you to obtain a flexible and customized program. The available user-defined addresses for each I/O module will be listed later.

## ■ Software-defined Addresses

### Digital Input/Output Modules

Input/Output devices are automatically assigned to a digital input/output module through HWCONFIG in ISPSOft according to the number of inputs/outputs which the digital input/output module has. The default start addresses are shown below.

**Note:**

1. The below diagram only shows the list of the modules and is not an actual configuration.
2. AH16AR10N-5A(16AR) is not supported.



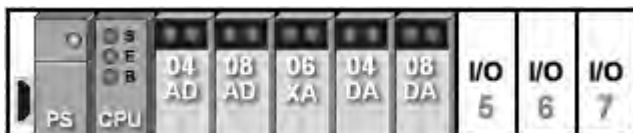
<b>16AM</b>	16 inputs. The <b>input device range</b> occupies 16 bits. (Xn.0~Xn.15)
<b>16AN</b>	16 outputs. The <b>output device range</b> occupies 16 bits. (Yn.0~Yn.15)
<b>16AP</b>	8 inputs and 8 outputs. The <b>input device range</b> occupies 16 bits, and the <b>output device range</b> occupies 16 bits. (Xn.0~Xn.15, and Yn.0~Yn.15)
<b>32AM</b>	32 inputs. The <b>input device range</b> occupies 32 bits. (Xn.0~Xn+1.15)
<b>32AN</b>	32 outputs. The <b>output device range</b> occupies 32 bits. (Yn.0~Yn+1.15)
<b>64AM</b>	64 inputs. The <b>input device range</b> occupies 64 bits. (Xn.0~Xn+3.15)
<b>64AN</b>	64 inputs. The <b>output device range</b> occupies 64 bits. (Yn.0~Yn+3.15)

Information: Rack 1					
Slot No.	Label	Firmware Version	Description	Input Device Range	Output Device Range
-	AHPS05-5A	-	AH Power Supply Module	None	None
-	AHCPU530-EN	1.00	Basic CPU module building with	None	None
0	AH16AM10N-5A	-	16 x DI, 24 VDC	X0.0 ~ X0.15	
1	AH16AN01R-5A	-	16 x DO, Relay 240 VAC/24 VDC		Y0.0 ~ Y0.15
2	AH16AP11R-5A	-	8 x DI VDC, 8 x DO VAC/VDC	X1.0 ~ X1.15	Y1.0 ~ Y1.15
3	AH16AR10N-5A	1.00	16 x DI, 24 VDC	X2.0 ~ X2.15	
4	AH32AM10N-5A	-	32 x DI, 24 VDC	X3.0 ~ X4.15	
5	AH32AN02T-5A	-	32 x DO, NPN 12 to 24 VDC		Y2.0 ~ Y3.15
6	AH64AM10N-5C	-	64 x DI, 24 VDC	X5.0 ~ X8.15	
7	AH64AN02P-5C	-	64 x DO, PNP 12 to 24 VDC		Y4.0 ~ Y7.15

### Analog Input/Output Modules

Input/Output data registers are automatically assigned to an analog input/output module through HWCONFIG in ISPSOft according to the number of registers which is defined for the analog input/output module. A channel occupies two words.

**Note:** The below diagram only shows the list of the modules and is not an actual configuration.



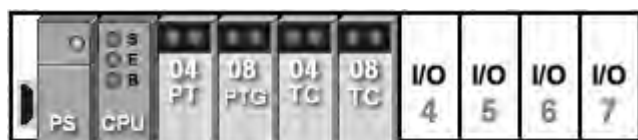
<b>04AD</b>	4 input channels. The <b>input device range</b> occupies 8 data registers.
<b>08AD</b>	8 input channels. The <b>input device range</b> occupies 16 data registers
<b>06XA</b>	4 input channels, and 2 output channels. The <b>input device range</b> occupies 8 data registers, and the <b>output device range</b> occupies 4 data registers.
<b>04DA</b>	4 output channels. The <b>output device range</b> occupies 8 data registers
<b>08DA</b>	8 output channels. The <b>output device range</b> occupies 16 data registers.

Slot No.	Label	Firmware Version	Description	Input Device Range	Output Device Range	Comment
-	AHPS05-5A	-	AH Power Supply Module	None	None	
-	AHCPU530-EN	1.00	Basic CPU module building with Ethernet	None	None	
0	AH04AD-5A	1.00	4 x AI 16bit	D0 ~ D7		
1	AH08AD-5B	1.00	8 x AI 16bit	D8 ~ D23		
2	AH06XA-5A	1.00	4 x 16bit AI, 2 x 16bit AO	D24 ~ D31	D32 ~ D35	
3	AH04DA-5A	1.00	4 x AO 16bit		D36 ~ D43	
4	AH08DA-5B	1.00	4 x AO 16bit		D44 ~ D59	
5						
6						
7						

### Temperature Measurement Modules

Input data registers are automatically assigned to a temperature measurement module through HWCONFIG in ISPSOft according to the number of registers which is defined for the temperature measurement module. A channel occupies two words.

**Note:** The below diagram only shows the list of the modules and is not an actual configuration.



<b>04PT</b>	4 input channels. The <b>input device range</b> occupies 8 data registers.
<b>08PTG</b>	8 input channels. The <b>input device range</b> occupies 16 data registers
<b>04TC</b>	4 input channels. The <b>input device range</b> occupies 8 data registers.
<b>08TC</b>	8 input channels. The <b>input device range</b> occupies 16 data registers

Information: Rack 1						
Slot No.	Label	Firmware Version	Description	Input Device Range	Output Device Range	
-	AHPS05-5A	-	AH Power Supply Module	None	None	
-	AHCPU530-EN	1.00	Basic CPU module building with	None	None	
0	AH04PT-5A	1.00	4 x 3/4 wires RTD input 0.1 degree	D0 ~ D7		
1	AH08PTG-5A	1.00	8 x 3/4 wires RTD input 0.1 degree	D8 ~ D23		
2	AH04TC-5A	1.00	4 x 24 bit TC input 0.1 degree Cel	D24 ~ D31		
3	AH08TC-5A	1.00	8 x 24 bit TC input 0.1 degree Cel	D32 ~ D47		

### Motion Control Modules

Input/Output data registers are automatically assigned to a motion control module through HWCONFIG in ISPSOft according to the number of registers which is defined for the motion control module.

**Note:** The below diagram only shows the list of the modules and is not an actual configuration.



<b>02HC</b>	2 input channels. The <b>input device range</b> occupies 14 data registers, and the <b>output device range</b> occupies 2 data registers.
<b>04HC</b>	4 input channels. The <b>input device range</b> occupies 28 data registers, and the <b>output device range</b> occupies 4 data registers.
<b>05PM</b>	No input registers and no output registers are assigned to it. Please refer to AH500 Motion Control Module Manual for more information about the parameter setting.
<b>10PM</b>	No input registers and no output registers are assigned to it. Please refer to AH500 Motion Control Module Manual for more information about the parameter setting.
<b>15PM</b>	No input registers and no output registers are assigned to it. Please refer to AH500 Motion Control Module Manual for more information about the parameter setting.
<b>20MC</b>	No input registers and no output registers are assigned to it. Please refer to AH500 Motion Control Module Manual for more information about the parameter setting.

Information: Rack 1

Slot No.	Label	Firmware Version	Description	Input Device Range	Output Device Range
-	AHPS05-5A	-	AH Power Supply Modu	None	None
-	AHCPU530-EN	1.00	Basic CPU module buildi	None	None
0	AH02HC-5A	1.00	High speed counter, 2 ch	D0 ~ D13	D14 ~ D15
1	AH02HC-5A	1.00	High speed counter, 2 ch	D16 ~ D29	D30 ~ D31
2	AH05PM-5A	1.00	2-axis pulse-train MC	None	None
3	AH10PM-5A	1.00	6-axis pulse-train MC	None	None
4	AH15PM-5A	1.00	4-axis pulse-train MC	None	None
5	AH20MC-5A	1.00	12-axis DMCNET MC	None	None

### Network Modules

Input/Output data registers are automatically assigned to a network module through HWCONFIG in ISPSOft according to the number of registers which is defined for the network module.

**Note:** The below diagram only shows the list of the modules and is not an actual configuration.





<b>10EN/15EN</b>	The input device range occupies 20 data registers and output device range 20 data registers.
<b>10SCM</b>	The input device range occupies 18 data registers.
<b>10DNET</b>	No input device and output device will be occupied.
<b>10PFBS</b>	No input device and output device will be occupied.
<b>10PFBM</b>	The input device range occupies 15 data registers.
<b>10COPM</b>	The input device range occupies 2 data registers.
<b>15SCM</b>	The input device range occupies 18 data registers.

Information: Rack 1

Slot No.	Label	MDS Version	Description	Input Device Range	Output Device Range
-	AHPS05-5A	-	AH Power Supply Module	None	None
-	AHCPU500-EN	01.00.00	Basic CPU module building	None	None
0	AH10EN-5A	01.00.00	Ethernet master module	D0 ~ D19	D20 ~ D39
1	AH10SCM-5A	01.00.00	Serial communication module	D40 ~ D57	
2	AH10DNET-5A	01.00.00	DeviceNet scanner	None	None
3	AH10PFBS-5A	01.00.00	Profibus slave module	None	None
4	AH10PFBM-5A	01.00.00	Profibus master module	D1058 ~ D1072	
5	AH10COPM-5A	01.00.00	CANopen communication module	D1073 ~ D1074	
6	AH15SCM-5A	00.35.00	Serial communication module	D1139 ~ D1156	

## ■ User-defined Addresses

### Digital Input/Output Modules

You can assign input devices and output devices to a digital input/output module through HWCONFIG in ISPSOft. The **input devices** should be within the range between **X0.0 and X511.15**, and the **output devices** should be within the range between **Y0.0 and Y511.15**. Take AH16AP11R-5A for example. The default input devices are X0.0~X0.15, and the default output devices are Y0.0~Y0.15. You can change the input device range from X0.0~X0.15 to X10.0~X10.15, and change the output device range from Y0.0~Y0.15 to Y20.0~Y20.15.

- The **default** input/output device range: X0.0~X0.15, and Y0.0~Y0.15

Slot No.	Label	Firmware Version	Description	Input Device Range	Output Device Range	Comment
-	AHPS05-5A	-	AH Power Supply Module	None	None	
-	AHCPU530-EN	1.00	Basic CPU module building with Ethernet	None	None	
0	AH16AP11R-5A	-	8 x DI VDC, 8 x DO VAC/VDC	X0.0 ~ X0.15	Y0.0 ~ Y0.15	
1						
2						
3						
4						
5						
6						
7						

- The **user-defined** input/output device range: X10.0~X10.15, and Y20.0~Y20.15

Slot No.	Label	Firmware Version	Description	Input Device Range	Output Device Range	Comment
-	AHPS05-5A	-	AH Power Supply Module	None	None	
-	AHCPU530-EN	1.00	Basic CPU module building with Ethernet	None	None	
0	AH16AP11R-5A	-	8 x DI VDC, 8 x DO VAC/VDC	X10.0 ~ X10.15	Y20.0 ~ Y20.15	
1						
2						
3						
4						
5						
6						
7						

### Analog Input/Output Modules

You can assign input registers and output registers to an analog input/output module through HWCONFIG in ISPSOft. The **input registers** and the **output registers** should be within the range between **D0 and D65535**. Take AH06XA-5A for example. The original input registers are D0~D7, and the original output registers are D8~D11. You can change the input device range from D0~D7 to D50~D57, and change the output device range from D8~D11 to D100~D103.

- The **default** input/output device range: D0~D7, and D8~D11

Slot No.	Label	Firmware Version	Description	Input Device Range	Output Device Range	Comment
-	AHPS05-5A	-	AH Power Supply Module	None	None	
-	AHCPU530-EN	1.00	Basic CPU module building with Ethernet	None	None	
0	AH06XA-5A	1.00	4 x 16bit AI, 2 x 16bit AO	D0 ~ D7	D8 ~ D11	
1						
2						
3						
4						
5						
6						
7						

- The **user-defined** input/output device range: D50~D57, and D100~D103

Slot No.	Label	Firmware Version	Description	Input Device Range	Output Device Range	Comment
-	AHPS05-5A	-	AH Power Supply Module	None	None	
-	AHCPU530-EN	1.00	Basic CPU module building with Ethernet	None	None	
0	AH06XA-5A	1.00	4 x 16bit AI, 2 x 16bit AO	D50 ~ D57	D100 ~ D103	
1						
2						
3						
4						
5						
6						
7						

### Temperature Measurement Modules

You can assign input registers to a temperature measurement module through HWCONFIG in ISPSOft. The **input registers** should be within the range between **D0 and D65535**. Take AH08TC-5A for example. The original input registers are D0~D15. You can change the input device range from D0~D15 to D60~D75.

- The **default** input device range: D0~D151

Slot No.	Label	Firmware Versi...	Description	Input Device Range	Output Device Range	Comment
-	AHPS05-5A	-	AH Power Supply	None	None	
-	AHCPU530-EN	1.00	Basic CPU modul	None	None	
0	AH08TC-5A	1.00	8 x 24bit TC input	D0 ~ D15		
1						
2						
3						
4						
5						
6						
7						

- The **user-defined** input device range: D60~D75

Slot No.	Label	Firmware Versi...	Description	Input Device Range	Output Device Range	Comment
-	AHPS05-5A	-	AH Power Supply	None	None	
-	AHCPU530-EN	1.00	Basic CPU modul	None	None	
0	AH08TC-5A	1.00	8 x 24bit TC input	D60 ~ D75		
1						
2						
3						
4						
5						
6						
7						

### Motion Control Modules

You can assign input registers and output registers to a motion control module through HWCONFIG in ISPSOft. The **input registers** should be within the range between **D0 and D65535**, and the **output registers** should be within the range between **D0 and D65535**. Take AH04HC-5A for example. The original input registers are D0~D27. You can change the **input device range** from D0~D27 to D200~D227.

- The **default** input device range: D0~D27

Slot No.	Label	Firmware Version	Description	Input Device Range	Output Device Range	Comment
-	AHPS05-5A	-	AH Power Supply Module	None	None	
-	AHCPU530-EN	1.00	Basic CPU module building with Ethernet	None	None	
0	AH04HC-5A	1.00	High speed counter, 4 channels	D0 ~ D27	D28 ~ D31	
1						
2						
3						
4						

- The **user-defined** input device range: D200~D227

Slot No.	Label	Firmware Version	Description	Input Device Range	Output Device Range	Comment
-	AHPS05-5A	-	AH Power Supply Module	None	None	
-	AHCPU530-EN	1.00	Basic CPU module building with Ethernet	None	None	
0	AH04HC-5A	1.00	High speed counter, 4 channels	D200 ~ D227	D28 ~ D31	
1						
2						
3						
4						

### Network Modules

You can assign input registers and output registers to a network module through HWCONFIG in ISPSOft. The **input registers** should be within the range between **D0 and D65535**, and the **output registers** should be within the range between **D0 and D65535**. Take AH10EN-5A\* for example. The original input registers are D0~D19. You can change the **input device range** from D0~D19 to D150~D169.

**\*Note:** The diagram below is only a demonstration on changing input device range.

- The **default** input device range: D0~D19

Slot No.	Label	Firmware Version	Description	Input Device Range	Output Device Range	Comment
-	AHPS05-5A	-	AH Power Supply Module	None	None	
-	AHCPU530-EN	1.00	Basic CPU module building with Ethernet	None	None	
0	AH10EN-5A	1.00	Ethernet master module	D0 ~ D19	D20 ~ D39	
1						
2						
3						
4						

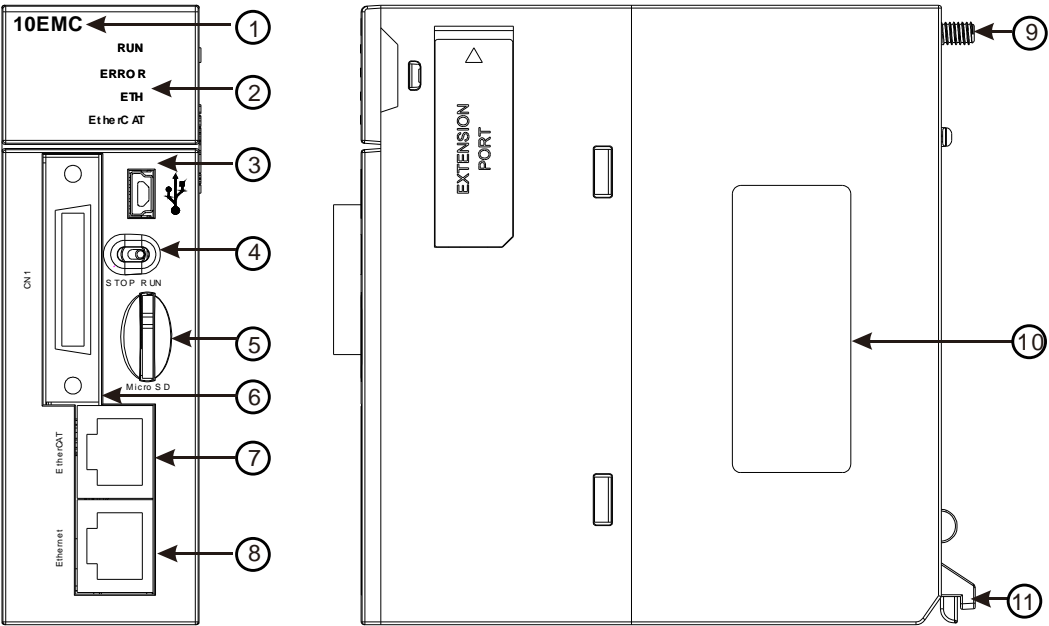
- The **user-defined** input device range: D150~D169

Slot No.	Label	Firmware Version	Description	Input Device Range	Output Device Range	Comment
-	AHPS05-5A	-	AH Power Supply Module	None	None	
-	AHCPU530-EN	1.00	Basic CPU module building with Ethernet	None	None	
0	AH10EN-5A	1.00	Ethernet master module	D150 ~ D169	D20 ~ D39	
1						
2						
3						
4						

3

### 3.2.5 Profiles

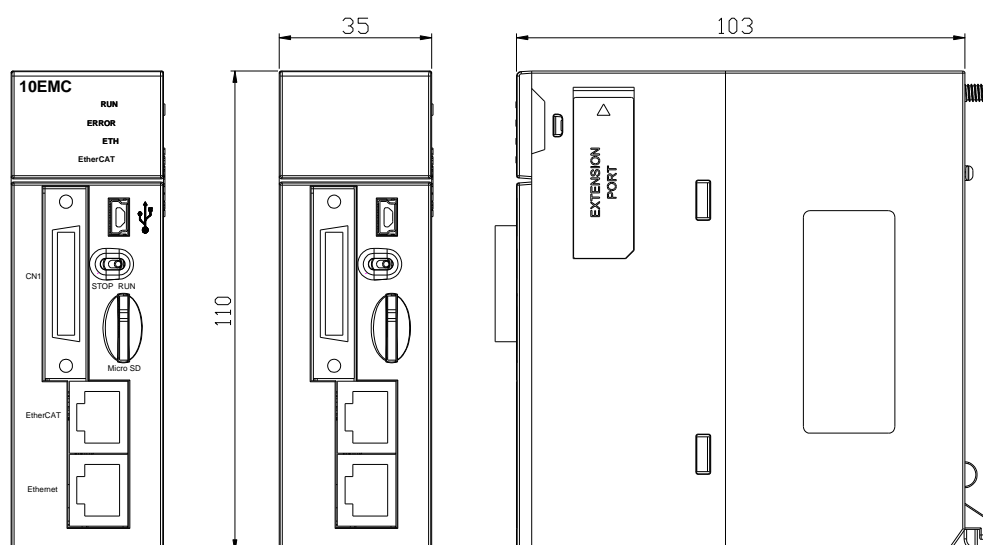
- **AHxxEMC-5A**



Number	Name	Description
1	Model name	Model name of the CPU module
2	RUN LED indicator	Operating status of the CPU module ON: The user program is being executed. OFF: The execution of the user program stops. Blink: The user program is in a debugging mode.

Number	Name	Description
	ERROR LED indicator	Error status of the CPU module ON: A serious error occurs in the system. OFF: The system is normal. Blink: A slight error occurs in the system.
	BUS FAULT LED indicator	Error status of the I/O bus ON: A serious error occurs in the I/O bus. OFF: The I/O bus is normal. Blink: A slight error occurs in the I/O bus.
	SYSTEM LED indicator	System status of the CPU module ON: The external input/output is forced ON/OFF. OFF: The system is in a default status. Blink: The CPU module is being reset / The value in the device is being cleared.
3	Mini USB port	Providing the RS-232 communication interface
4	RUN/STOP switch	RUN: The user program is executed. STOP: The execution of the user program stops.
5	SD slot	Micro SD interface
6	Connector	Connecting the module and an I/O extension cable.
7	EtherCAT port	Providing the EtherCAT communication interface
8	Ethernet port	Providing the Ethernet communication interface
9	Set screw	Fixing the module
10	Label	Nameplate
11	Hook	Connecting the module and a backplane.

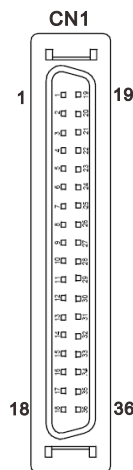
### 3.2.6 Dimensions



Dimensions are in mm.

3.2.7 Arrangement of Terminals

- AHxxEMC-5A



Pin	Terminal	Function		Pin	Terminal	Function	
		Pulse	Count			Pulse	Count
1	COM		COM	19	Y0.11		Out3
2	COM		COM	20	Y0.10		Out2
3	COM		COM	21	Y0.9		Out1
4	COM		COM	22	Y0.8		Out0
5	S/S		S/S	23	X1.3		CntA5
6	X1.5		Rst5	24	X1.2		CntA5
7	S/S		S/S	25	X1.1		CntA4
8	X1.4		Rst4	26	X1.0		CntA4
9	S/S		S/S	27	X0.15	DOG3	CntA3
10	X0.3		Rst3	28	X0.14	DOG2	CntA3
11	S/S		S/S	29	X0.13	DOG1	CntA2
12	X0.2		Rst2	30	X0.12	DOG0	CntA2
13	X0.1-		Rst1-	31	X0.1+		Rst1+
14	X0.11-	DOG5-	CntB1-	32	X0.11+	DOG5+	CntB1+
15	X0.10-	DOG4-	CntA1-	33	X0.10+	DOG4+	CntA1+
16	X0.0-		Rst0-	34	X0.0+		Rst0+
17	X0.9-	MPGB-	CntB0-	35	X0.9+	MPGA-	CntB0+
18	X0.8-	MPGB+	CntA0-	36	X0.8+	MPGA+	CntA0+

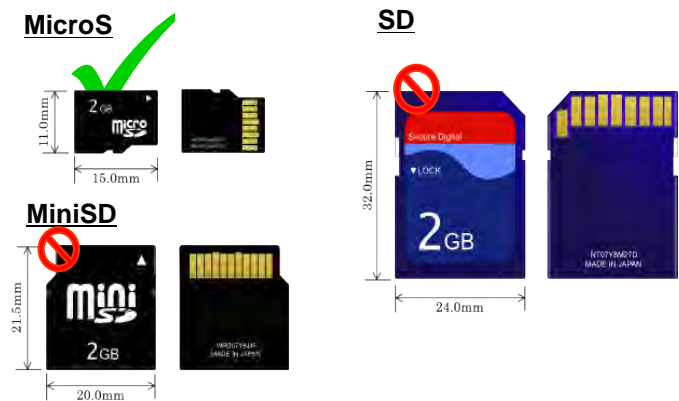
3.2.8 Memory Card Slot

- AHxxEMC-5A

The AH Motion series CPU modules support micro SD cards. You can purchase products which meet the specifications supported by the memory card slot on the AH Motion CPU.

SD Cards

SD cards have three size types: SD cards, miniSD cards, and microSD cards. The AH Motion CPU supports Micro SDHC cards.



### Specifications for Memory Cards

The specifications of SD cards can also be classified into three types according to capacity: SD cards, SDHC cards, and SDXC cards. The AH Motion CPU supports MicroSDHC in FAT32 file system as below. Be sure to purchase products which meet the specifications.

- SD card families

Type	SD	SDHC			SDXC	
Capacity	2 GB Max.	32 GB max.			32 GB~2 TB	
File system	FAT/FAT32	FAT16/FAT32			exFAT	
Size	SD	SDHC	MiniSDHC	MicroSDHC	SDXC	MicroSDXC
Speed class rating	N/A	<b>Class 2 (Min. 2 MB/sec.)</b> <b>Class 4 (Min. 4 MB/sec.)</b> <b>Class 6 (Min. 6 MB/sec.)</b> <b>Class 10 (Min. 10 MB/sec.)</b>			Class 2 (Min. 2 MB/sec.) Class 4 (Min. 4 MB/sec.) Class 6 (Min. 6 MB/sec.) Class 10 (Min. 10 MB/sec.)	

## 3.3 I/O Modules

AH motion controller PLC supports the following I/O module types: digital input/output modules, analog input/output modules, temperature measurement modules, network modules, motion control modules, remote I/O modules. Refer to Chapter 3 of the AH500 Hardware Manual for more details.

## Chapter 4 Installation and Wiring

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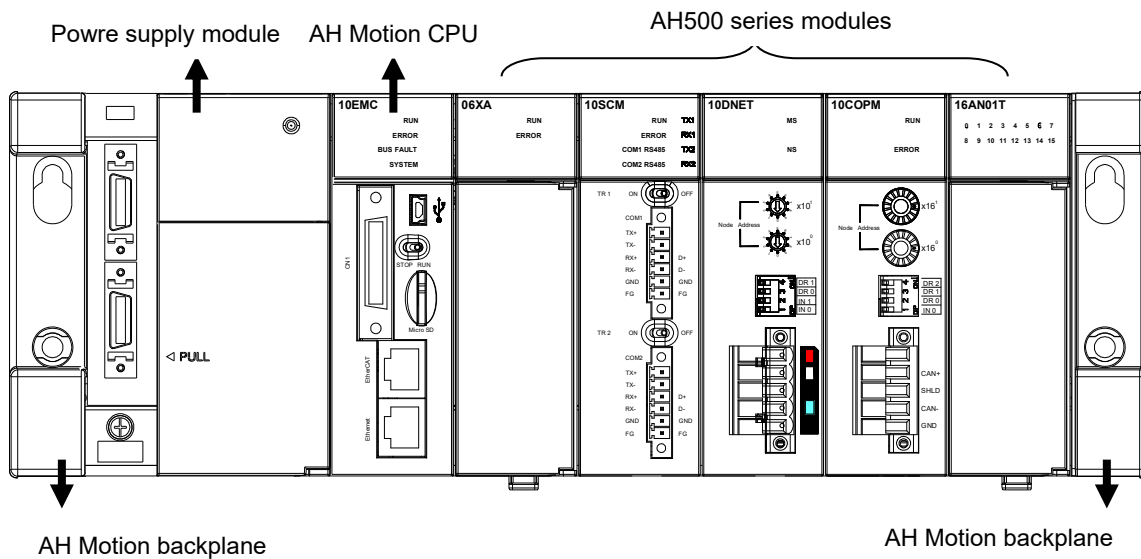


## 4.1 Quick Review before Installation

Before you start the installation and wiring of AH Motion system, we suggest that you review your actual application and have a clear idea of the required components in your system. This section will give you a quick overview of the components in AH Motion CPU rack configuration. You can also refer to **CH2 System Configuration** for planning the system or **CH3 Product Specifications** for choosing proper products for your system.

### 4.1.1 AH Motion Hardware Components

A complete AH Motion CPU rack consists of a Motion backplane, a power supply module, a Motion CPU module, and additional AH500 series I/O modules as below.



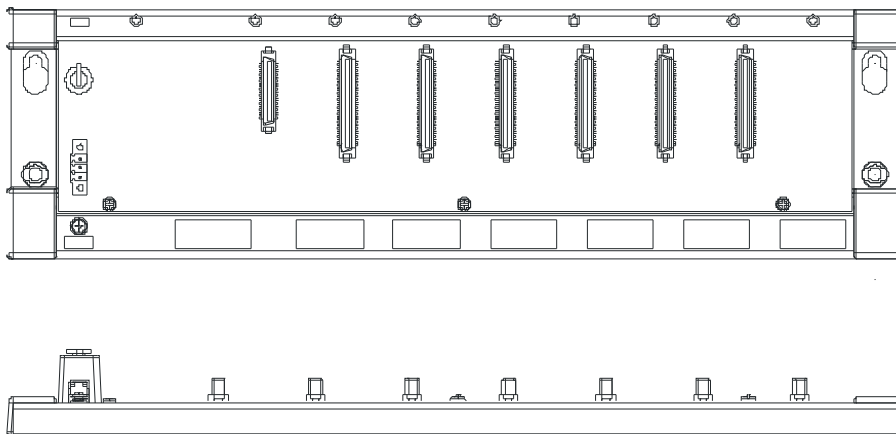
#### ● Basic Components

An AH Motion CPU rack consists of the following four basic components.

##### - Motion backplane

A Motion CPU module and other modules are installed on a Motion backplane which functions as the communication interface between CPU and modules. The Motion backplane also provides an additional COM port (RS-485).

**AHBP05M2-5A:** supporting up to 5 additional I/O modules



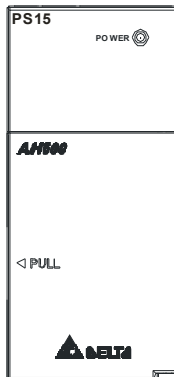
#### - Power supply modules

A power supply module functions to convert alternating current to direct current, or directly provides direct current. It provides power for the modules installed on it. A Motion backplane must be assigned a power supply module. A power supply module has to be installed on the left-most side of a backplane.

##### AHPS05-5A



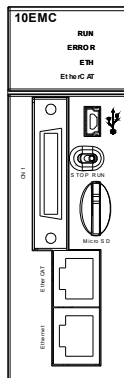
##### AHPS15-5A



#### - Motion CPU module

A Motion CPU module is the core of a complete AH Motion system. It is responsible for controlling and managing the whole system, and is installed in the second slot from the left on the Motion backplane.

##### AHxxEMC-5A



#### - Communication cables

Several communication interfaces are built in a Motion CPU module. You can select a suitable communication cable according to the required application.

Refer to the following table for information about the communication interfaces and the main applications.

Interface	Connector	Application
EtherCAT	RJ45	Industrial network connecting EtherCAT slaves
EtherNet	RJ45	Computer/HMI communication/remote control/data exchange/industrial network
RS-232	Mini USB	Programming
RS-485	Terminal block	Programming

## ● Additional Modules

In addition to the basic components, you can also expand the function by attaching I/O modules or function modules. The following are the applicable modules for an AH Motion CPU rack. You can select the proper products according to your needs.

### - Motion control modules:

<b>AH02HC-5A</b>	Two-channel high-speed counter module (200 kHz)
<b>AH04HC-5A</b>	Four-channel high-speed counter module (200 kHz)
<b>AH05PM-5A</b>	Two-axis pulse train motion control module (1 MHz)
<b>AH10PM-5A</b>	Six-axis pulse train motion control module (Four axes: 1 MHz; Two axes: 200 kHz)
<b>AH15PM-5A</b>	Four-axis pulse train motion control module (1 MHz )
<b>AH20MC-5A</b>	Twelve-axis DMCNET (Delta Motion Control Network) motion control module (10 Mbps)

### - Digital input/output modules:

<b>AH16AM10N-5A</b>	24 VDC, 5 mA, 16 inputs, Terminal block
<b>AH32AM10N-5A</b>	24 VDC, 5 mA, 32 inputs, Terminal block
<b>AH32AM10N-5B</b>	24 VDC, 5 mA, 32 inputs, DB37 connector
<b>AH32AM10N-5C</b>	24 VDC, 5 mA, 32 inputs, MIL connector
<b>AH64AM10N-5C</b>	24 VDC, 3.2 mA, 64 inputs, MIL connector
<b>AH16AM30N-5A</b>	100~240 VAC, 4.5 mA/9 mA (100 V, 50 Hz), 16 inputs, Terminal block
<b>AH16AN01R-5A</b>	240 VAC/24 VDC, 2 A, 16 outputs, Relay, Terminal block
<b>AH16AN01T-5A</b>	12~24 VDC, 0.5 A, 16 outputs, Sinking output(NPN), Terminal block
<b>AH16AN01P-5A</b>	12~24 VDC, 0.5 A, 16 outputs, Sourcing output(PNP), Terminal block
<b>AH16AN01S-5A</b>	110/220 VAC, 0.5 A, 16 outputs, TRIAC, Terminal block
<b>AH32AN02T-5A</b>	12~24 VDC, 0.1 A, 32 outputs, Sinking output(NPN), Terminal block
<b>AH32AN02T-5B</b>	12~24 VDC, 0.1 A, 32 outputs, Sinking output(NPN), DB37 connector
<b>AH32AN02T-5C</b>	12~24 VDC, 0.1 A, 32 outputs, Sinking output(NPN), MIL connector
<b>AH32AN02P-5A</b>	12~24 VDC, 0.1 A, 32 outputs, Sourcing output(PNP), Terminal block
<b>AH32AN02P-5B</b>	12~24 VDC, 0.1 A, 32 outputs, Sourcing output(PNP), DB37 connector
<b>AH32AN02P-5C</b>	12~24 VDC, 0.1 A, 32 outputs, Sourcing output(PNP), MIL connector
<b>AH64AN02T-5C</b>	12~24 VDC, 0.1 A, 64 outputs, Sinking output(NPN), MIL connector
<b>AH64AN02P-5C</b>	12~24 VDC, 0.1 A, 64 outputs, Sourcing output(PNP), MIL connector
<b>AH16AP11R-5A</b>	24 VDC, 5 mA, 8 inputs, 240 VAC/24 VDC, 2 A, 8 outputs, Relay, Terminal block
<b>AH16AP11T-5A</b>	24 VDC, 5 mA, 8 inputs, 12~24 VDC, 0.5 A, 8 output, Sinking output(NPN), Terminal block
<b>AH16AP11P-5A</b>	24 VDC, 5 mA, 8 inputs, 12~24 VDC, 0.5 A, 8 outputs, Sourcing output(PNP), Terminal block

- **Analog input/output modules:**

<b>AH04AD-5A</b>	Four-channel analog input module 16-bit resolution -10~+10 V, 0~10 V, -5~+5 V, 0/1~5 V, 0/4~20 mA, or -20~+20 mA
<b>AH08AD-5A</b>	Eight-channel analog input module 16-bit resolution -10~+10 V, 0~10 V, -5~+5 V, 0/1~5 V, 0/4~20 mA, or -20~+20 mA
<b>AH08AD-5B</b>	Eight-channel analog input module 16-bit resolution -10~+10 V, 0~10 V, -5~+5 V, 0/1~5 V
<b>AH08AD-5C</b>	Eight-channel analog input module 16-bit resolution 0/4~20 mA or -20~+20 mA
<b>AH04DA-5A</b>	Four-channel analog output module 16-bit resolution -10~+10 V, 0~10 V, -5~+5 V, 0/1~5 V, or 0/4~20 mA
<b>AH08DA-5A</b>	Eight-channel analog output module 16-bit resolution -10~+10 V, 0~10 V, -5~+5 V, 0/1~5 V, or 0/4~20 mA
<b>AH08DA-5B</b>	Eight-channel analog output module 16-bit resolution -10~+10 V, 0~10 V, -5~+5 V, or 0/1~5 V
<b>AH08DA-5C</b>	Eight-channel analog output module 16-bit resolution 0/4~20 mA
<b>AH06XA-5A</b>	Four-channel analog input and two-channel analog output module 16-bit resolution Analog input: -10~+10 V, 0~10 V, -5~+5 V, 0/1~5 V, 0/4~20 mA, or -20~+20 mA Analog output: -10~+10 V, 0~10 V, -5~+5 V, 0/1~5 V, or 0/4~20 mA

- **Temperature measurement modules:**

<b>AH04PT-5A</b>	Four-channel four-wire/three-wire RTD Sensor type: Pt100, Pt1000, Ni100, Ni1000, or 0~300 $\Omega$ input impedance
<b>AH08PTG-5A</b>	Eight-channel four-wire/three-wire/two-wire RTD Sensor type: Pt100, Pt1000, Ni100, Ni1000, or 0~300 $\Omega$ input impedance
<b>AH04TC-5A</b>	Four-channel thermocouple Sensor type: J, K, R, S, T, E, N, or -150~+150 mV
<b>AH08TC-5A</b>	Eight-channel thermocouple Sensor type: J, K, R, S, T, E, N, or -150~+150 mV

- **Network modules:**

<b>AH10EN-5A</b>	It is an Ethernet communication module with two Ethernet ports, and supports Modbus TCP protocols, and EtherNet/IP software (V2.0). It can function as a master or a slave.
<b>AH15EN-5A</b>	It is an Ethernet communication module with two Ethernet ports, and supports Modbus TCP protocols, and IEC60870-5-104. It can function as a master or a slave.
<b>AH10SCM-5A</b>	It is a serial communication module with two RS-485/RS-422 ports, and supports

	Modbus and UD Link protocols. One part of communication is isolated from the other part of the communication, and one part of power is isolated from the other part of the power.
AH15SCM-5A	It is a serial communication module with two RS-232 ports, and supports Modbus and UD Link protocols. One part of communication is isolated from the other part of the communication, and one part of power is isolated from the other part of the power.
AH10DNET-5A	It is a DeviceNet communication module. It can function as a master or slave. A maximum of 1Mbps per second can be transferred.
AH10PFBM-5A	It is a PROFIBUS communication module. It can function as a master.
AH10PFBS-5A	It is a PROFIBUS communication module. It can function as a slave.
AH10COPM-5A	It is a CANopen communication module. It can function as a master or a slave.

- **Remote I/O module:**

AHRTU-DNET-5A	It is a DeviceNet remote I/O communication module.
AHRTU-PFBS-5A	It is a PROFIBUS remote I/O communication module.
AHRTU-ETHN-5A	It is an Ethernet remote I/O communication module.

- **Dummy module:**

AHASP01-5A	Dummy module used for an empty I/O slot
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## 4

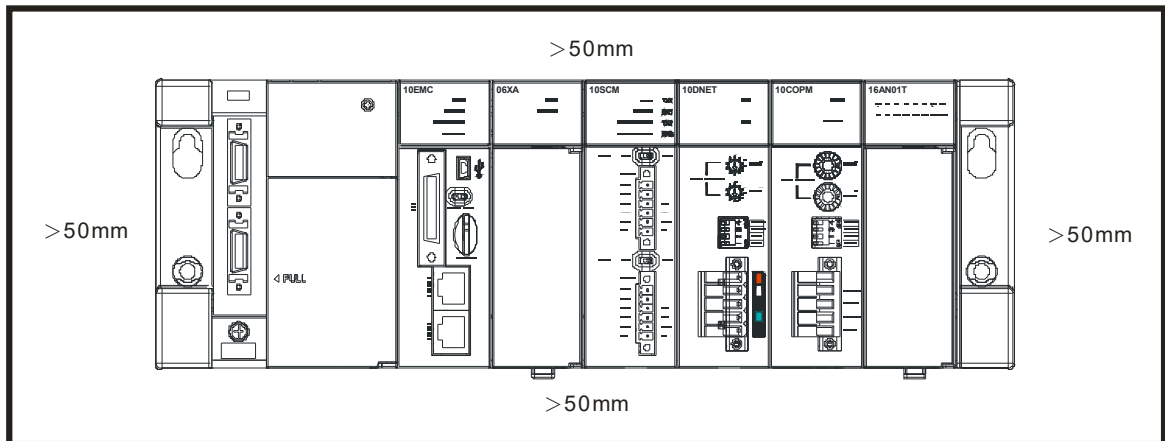
## 4.2 Points to Note on Installation

- An AH Motion system only supports the horizontal installation, and a power supply module has to be installed on the left-most side of a backplane.
- Product dimensions (modules, backplanes, cables and more) should be confirmed when making an installation layout. To obtain sufficient installation space, you should also save proper wiring space for connectors, cables and other instruments.
- Make sure that the work environment conforms to the specifications for the products. It is necessary to take account of the basic temperature/humidity control and the dust/corrosion prevention.
- The electromagnetic interference will result in the wrong action of the whole system. Therefore, you have to do EMC design carefully. Refer to **Appendices** in this manual for more information related to EMC standards.
- If the specifications for the components such as screws and washers are noted specifically in the manual, use the components conforming to the specifications.
- If a cable is connected to a communication port, make sure that the connector of the cable is joined to the port on the module properly.
- A backplane has to be mounted on a plane stably instead of being just set on the plane. After it is installed, make sure that it is fixed on the plane.

## 4.3 Installation

### 4.3.1 CPU Rack Installation in a Control Panel

The motion controller has to be installed in a closed control box. In order to ensure that the PLC dissipates heat properly, the space between the motion controller and the control box has to be larger than 50 millimeters.



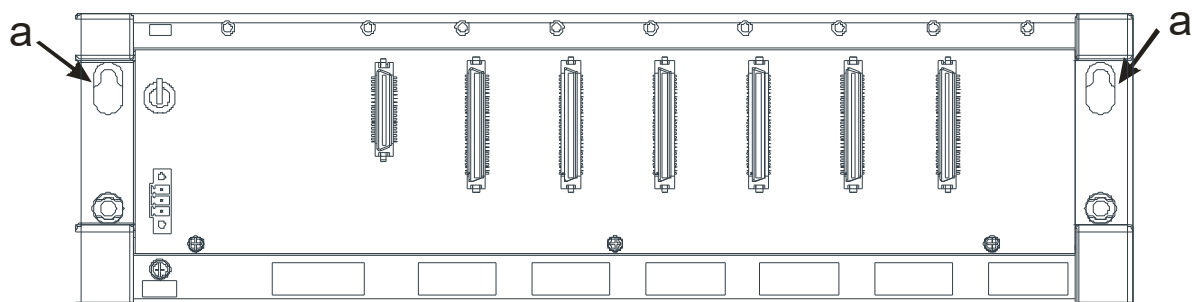
- Keep the motion controller away from high-voltage equipment, high-voltage wires, and high-voltage motors.
- In order to prevent the temperature of a motion controller from rising, do not install the motion controller vertically on the bottom/top in the control box.
- Install a motion controller horizontally in the control box, as shown above.
- If you intend to increase the number of modules, you have to leave some space for installing the modules in the control box.

### 4.3.2 Mounting a Backplane

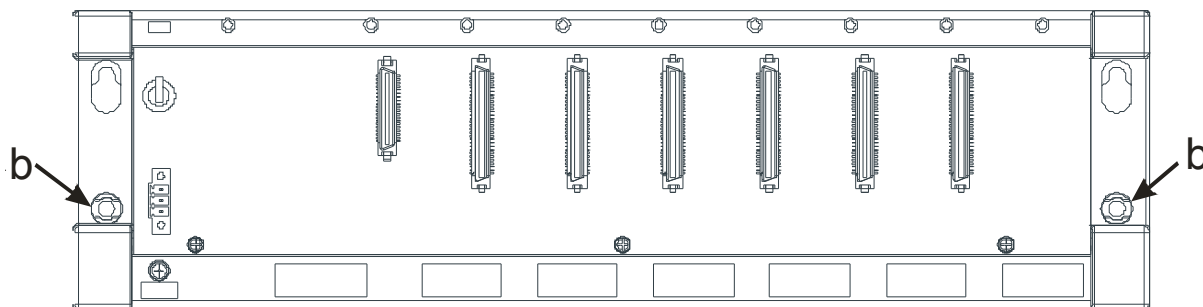
#### ● Fixing a backplane by screws

Mount the backplane on a plane by means of M5 screws, as illustrated below. To fix the backplane, you need to evaluate the length of a screw, the size of a thread, and whether to use a nut according to the actual condition of the plane unless there are specific specifications for a screw which are indicated in the pictures below.

1. Tighten the M5 screws in the holes indicated by **a**.

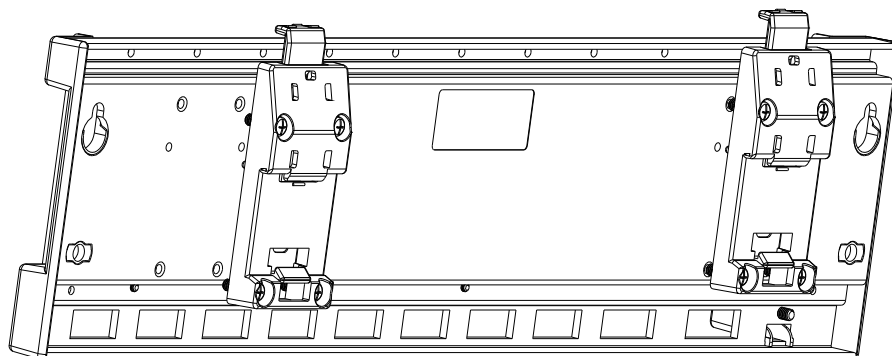


2. Tighten the two screws in the holes indicated by **b**.



- **Installing a DIN rail**

1. The installation is applicable to a 35 millimeter DIN rail.
2. Install the mounting clips on a backplane.

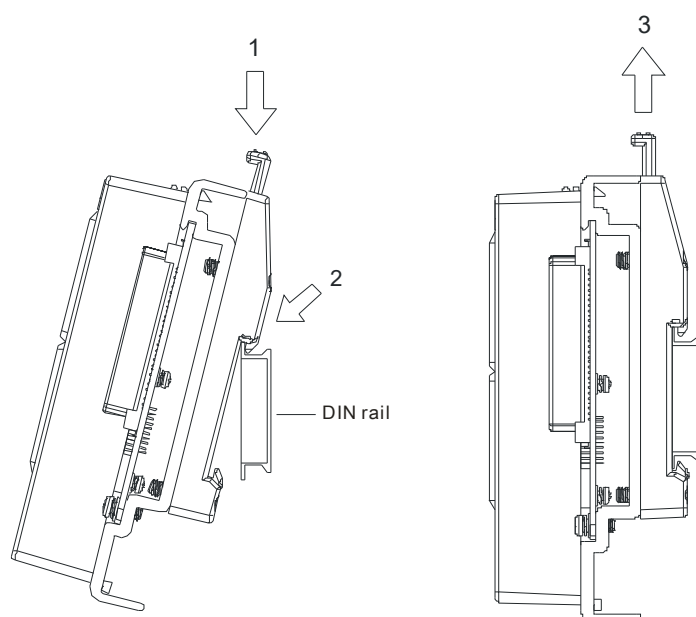


3. Install the backplane on a DIN rail.

Step 1: Press the hook in the direction indicated by the arrow.

Step 2: Mount the DIN rail clips onto a DIN rail.

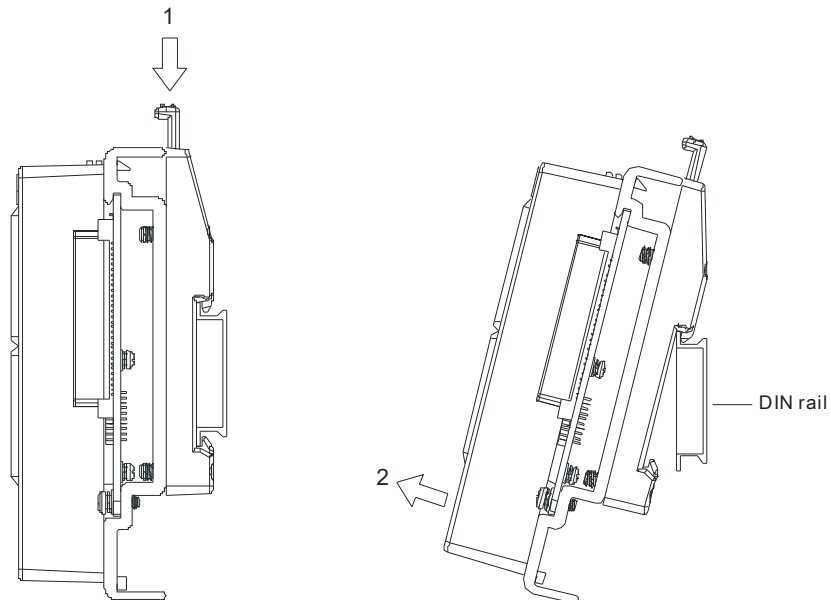
Step 3: Pull the hook to fix the clips and the DIN rail.



- **Removing a DIN rail**

Step 1: Press the hook in the direction indicated by the arrow.

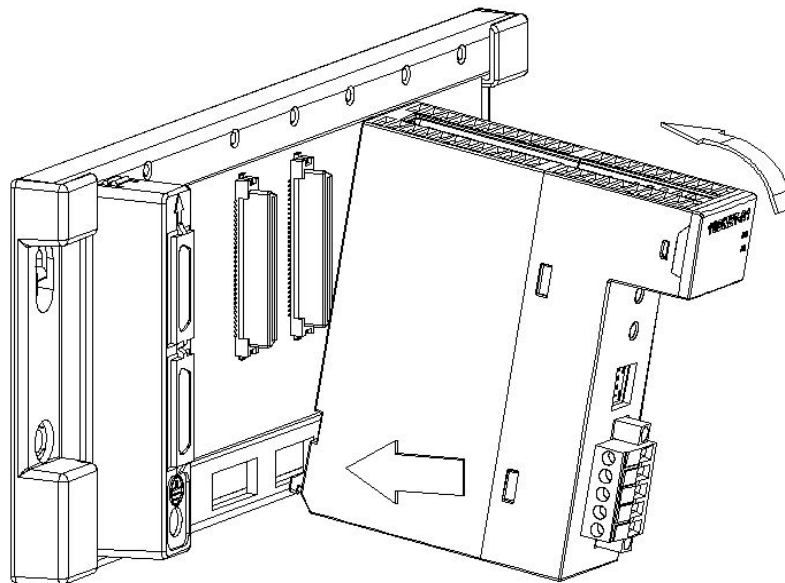
Step 2: Remove the backplane.

**4**

### 4.3.3 Installing a Module

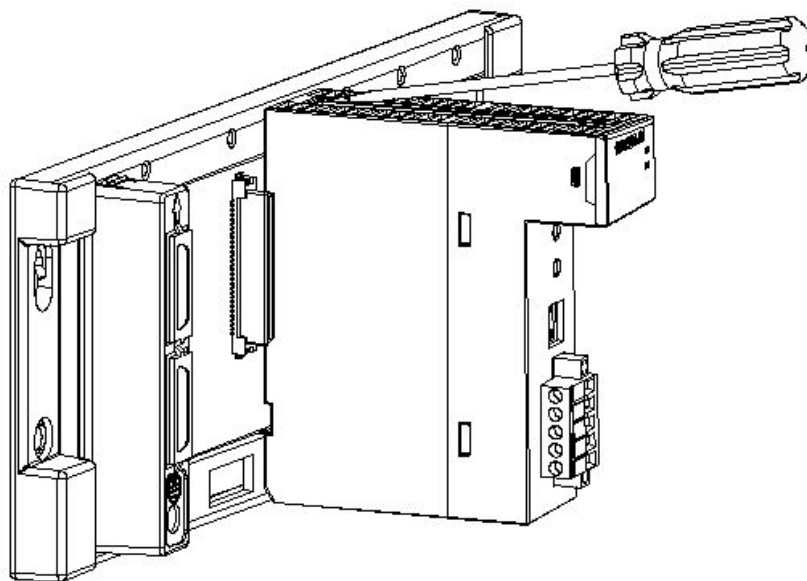
Insert a module into a slot, make sure that the module is installed on the backplane properly, and tighten the screw, as illustrated below.

1. Insert the hook under the module into the hole in the backplane.
2. Push the module in the direction indicated by the arrow until it clicks.





3. Tighten the screw on the module.



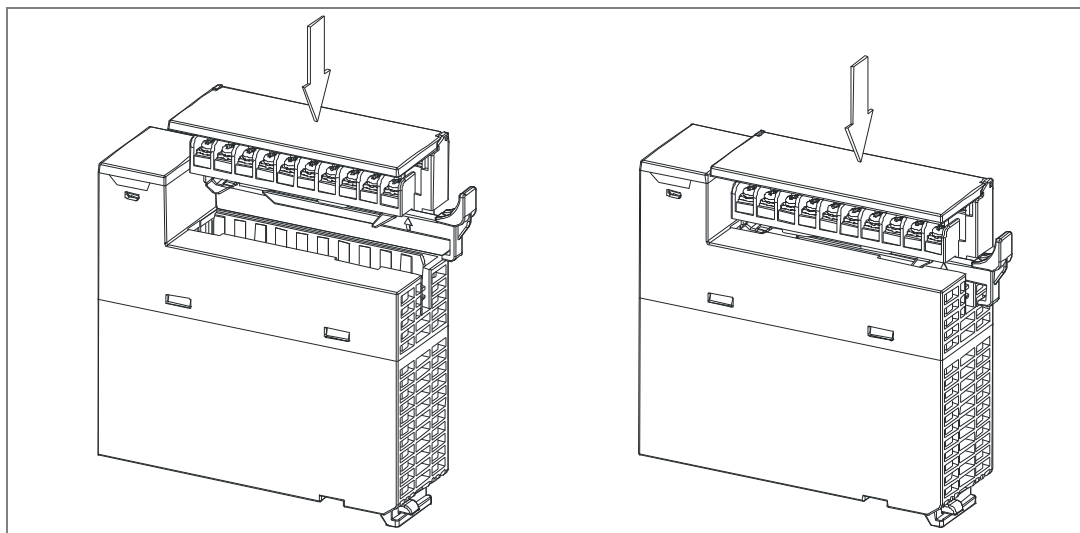
#### 4.3.4 Installing a Removable Terminal Block

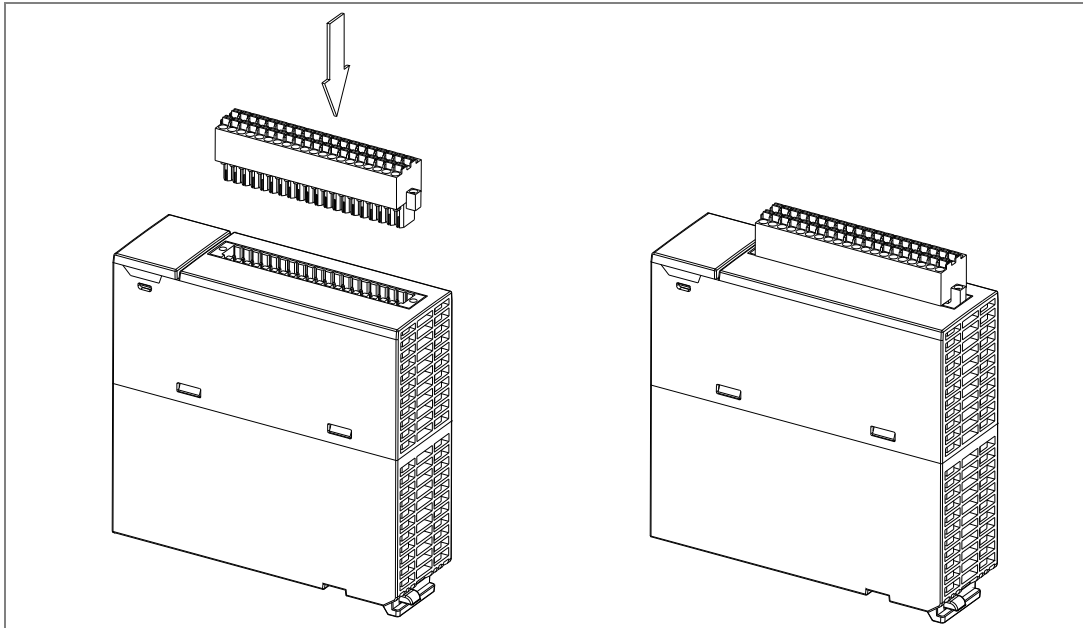
4

- Installation

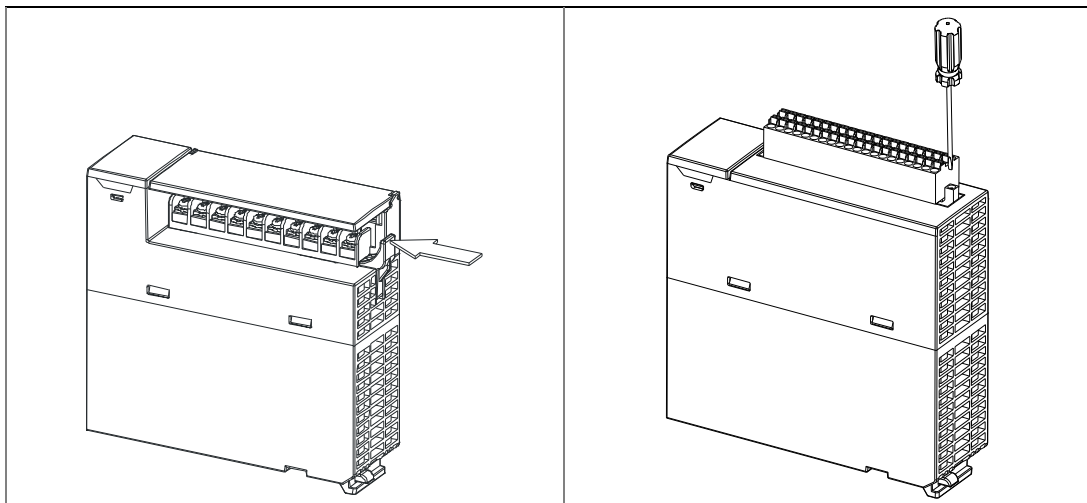
1. Align a terminal block with the printed circuit board, and press it into the module.

**Type 1**



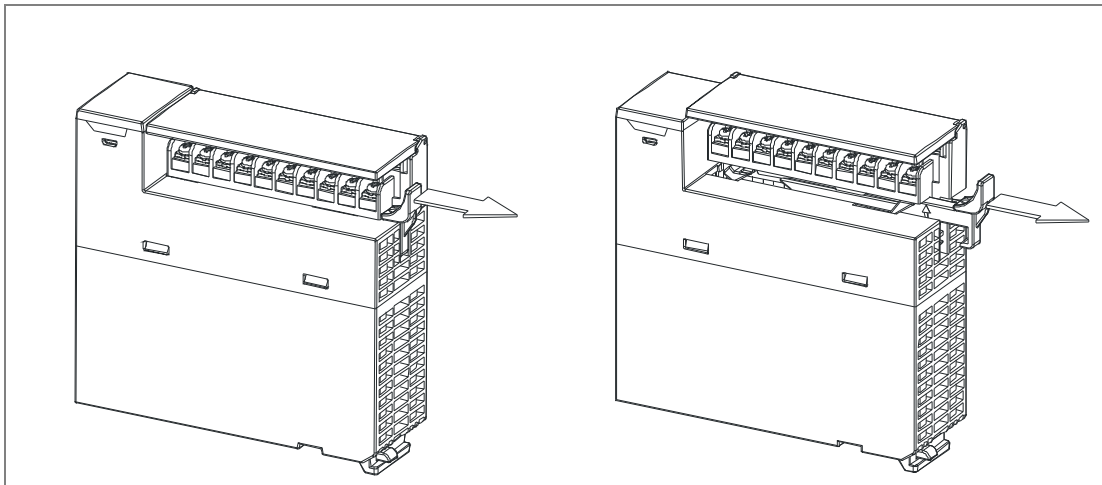
**Type 2**

2. Press the clip in the direction indicated by the arrow. For high-definition terminals (Type 2), a flat head screw driver is required to fasten the screws on both ends.

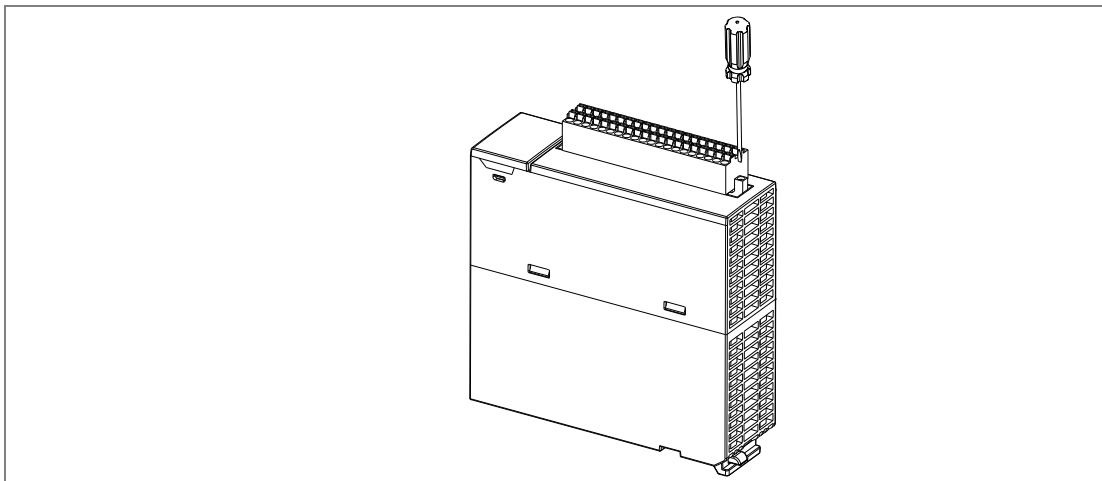
**Type 1****Type 2****● Removal**

1. Pull the clip in the direction indicated by the arrow. For high-definition terminals (Type 2), a flat head screw driver is required to loose the screws on both ends.

**Type 1**



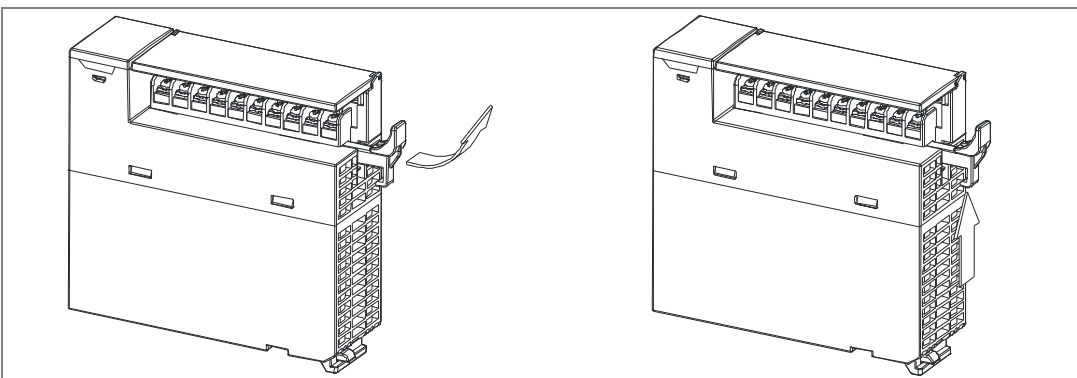
**Type 2**



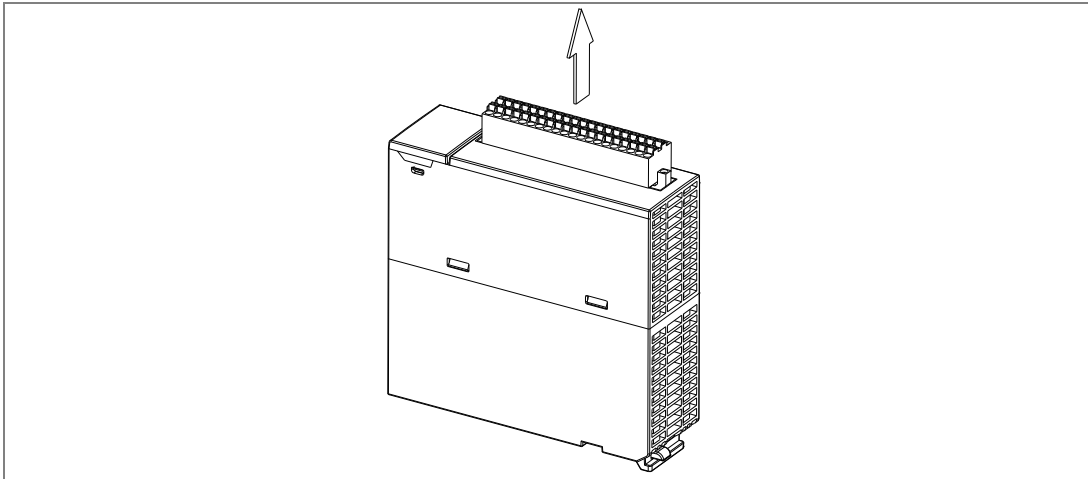
2.

2. Pull up the clip. High-definition terminals(Type 2) can be pull out directly.

**Type 1**



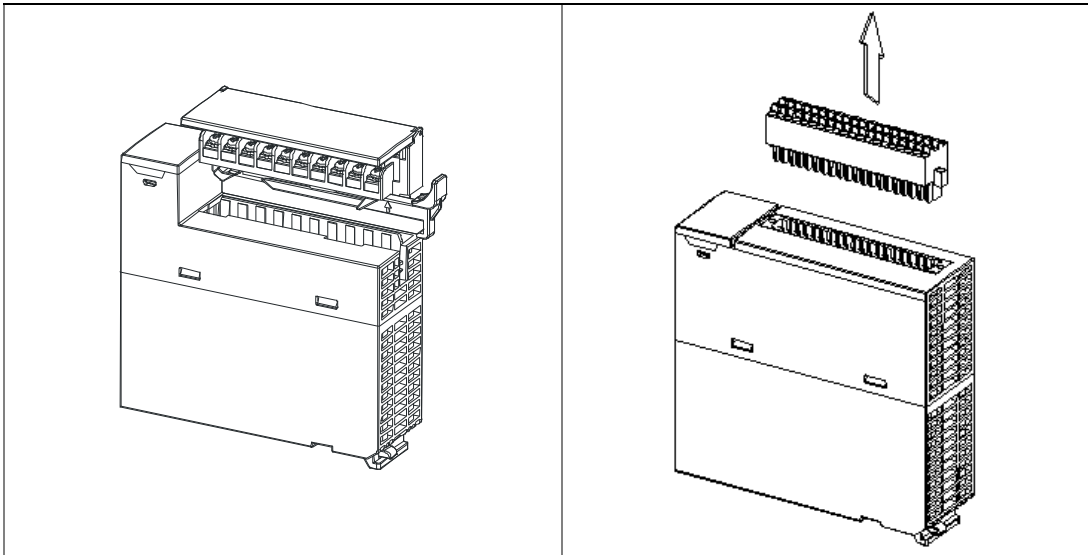
**Type 2**



3. The terminal block is removed.

**Type 1**

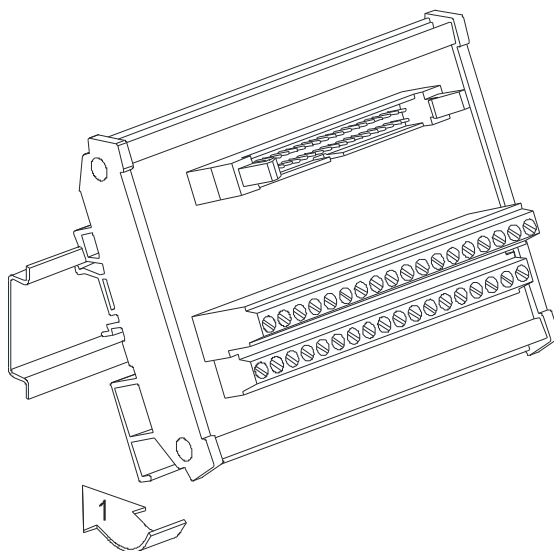
**Type 2**



### 4.3.5 Installing an External Terminal Module

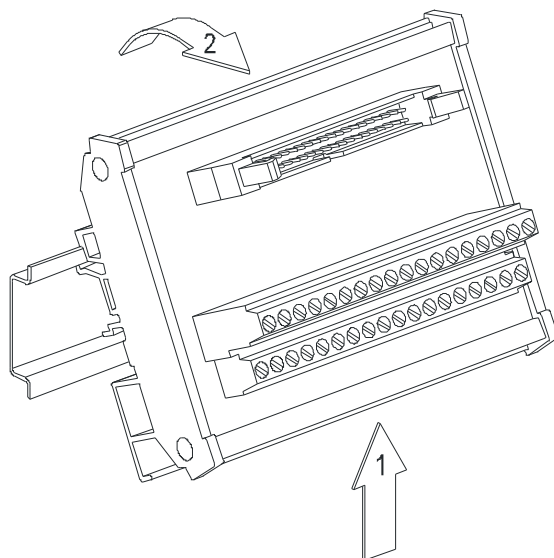
- **Installation**

1. One side of an external terminal module has to be fixed first.
2. Press the terminal module in the direction indicated by arrow 1, and make sure that the groove is combined with the DIN rail.



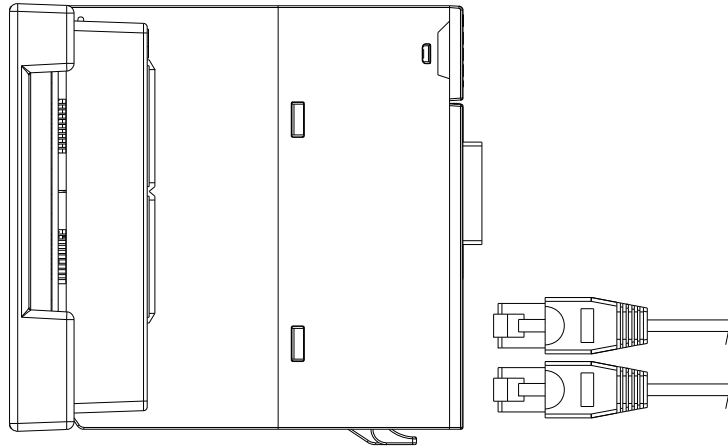
- **Removal**

1. Push the terminal module in the direction indicated by arrow 1.
2. Pull the terminal module in the direction indicated by arrow 2.



### 4.3.6 Connecting Communication Cables

Plug a communication cable in the port on a Motion CPU module, and make sure that the connector of the cable is joined to the port properly. RS-232 (USB), RS-485 (terminals on the backplane), CN1 and RJ45 cables could be used.



### 4.3.7 Installing and Removing a Memory Card

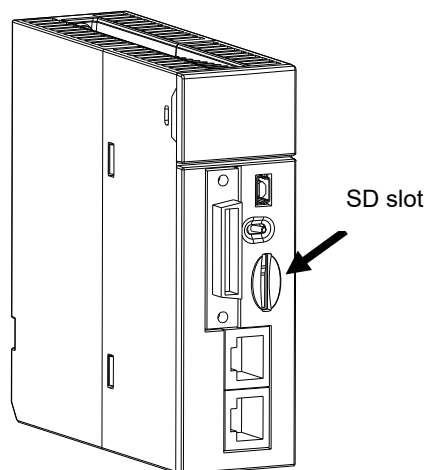
- **Formatting of a Memory Card**

A memory card needs to be formatted before the first use on an AH Motion CPU module. Make sure the file system you use on formatting the SD card is FAT32.



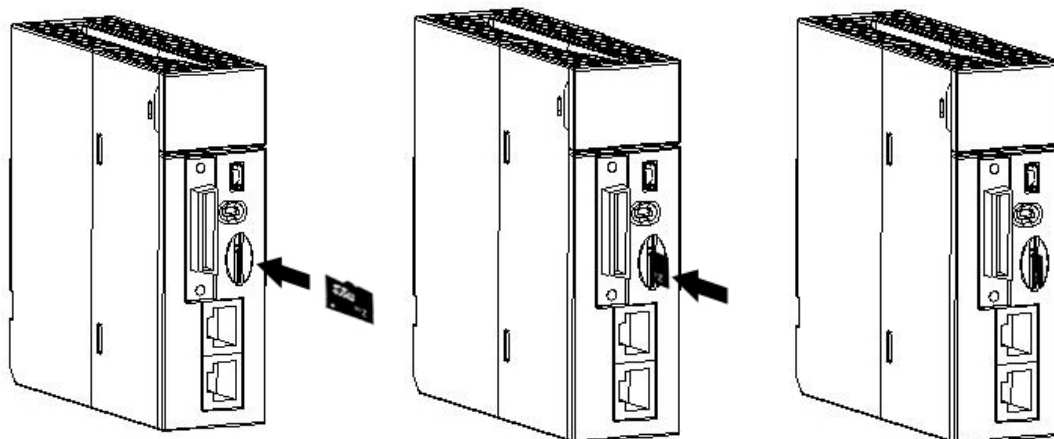
- **SD Slot on a Motion CPU**

As shown below, the SD slot is in the middle of the front of a Motion CPU module.



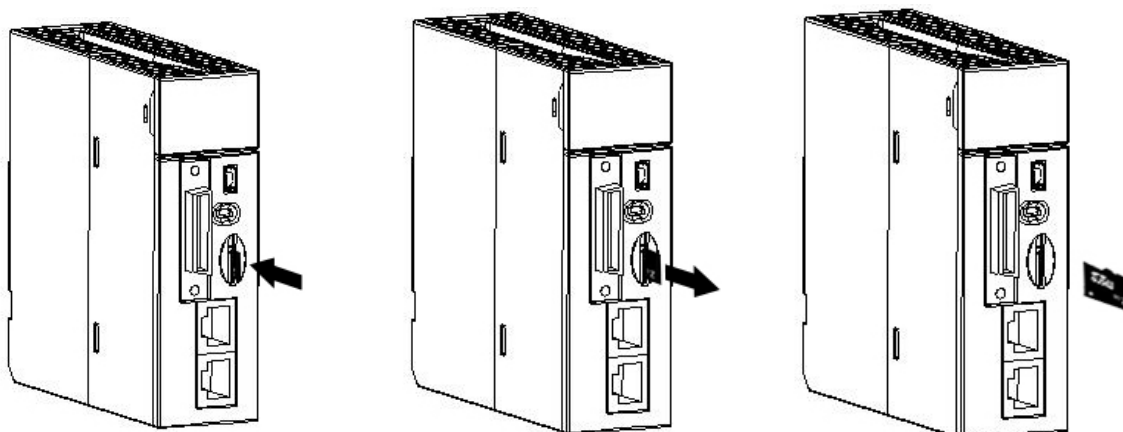
### ● Installing a Memory Card

Insert a memory card into the SD slot in a Motion CPU module, and push it downward until it clicks. After the memory card is installed, it is fixed firmly in the slot. If the memory card is loose, it is not installed correctly. Besides, the memory card has mistake-proofing design. If it is inserted in the wrong direction, it can not be pushed downward. This is to prevent the CPU module from being damaged. The correct way to insert the memory card is shown below.





### ● Removing a Memory Card

After a memory card is pushed downward, it springs from the slot, and you can take it out.



## 4.4 Points to Note about Wiring

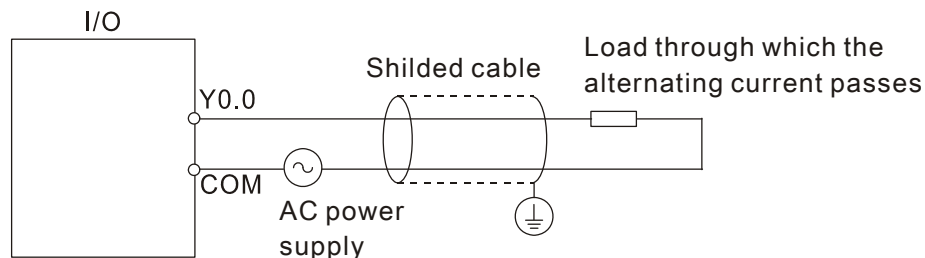
### ● Points for attention

 <b>DANGER</b>	<ul style="list-style-type: none"> <li>● Before installing or wiring a module, you need to make sure that the external power supply is turned off. If the power supply is not turned off, you may get an electric shock, or the product may be damaged.</li> <li>● If the installation of the module or the wiring of the module is complete, you need to make sure that a terminal block cover is installed on the module before you turn on the power supply or operate the module. If the terminal block cover is not installed properly, you may get an electric shock, or the module may not operate normally.</li> </ul>
 <b>WARNING</b>	<ul style="list-style-type: none"> <li>● Be sure to connect the terminals FG and LG with protective grounding conductors. Otherwise, users may get an electric shock, or the module may not operate normally.</li> <li>● To ensure that a PLC is wired correctly, users need to check the rated voltage of the product, and the arrangement of the terminals. If the PLC is connected to the power supply which does not conform to the rated voltage, or the product is not wired correctly, a fire accident will occur, or the product will</li> </ul>

	<p>be damaged.</p> <ul style="list-style-type: none"> <li>● The external connections should be crimped or press-welded by specific tools, or soldered correctly. The improper connections will result in a short circuit, a fire accident, or erroneous operation.</li> <li>● Tighten the terminal screws with the specified torque. If the terminal screws are loose, a short circuit, a fire accident, or erroneous operation will occur. Tightening the terminal screws too far, may cause damage to the terminal screws and the module, resulting in a short circuit or a malfunction.</li> <li>● Make sure that there are no foreign substances such as iron filings or wiring debris inside the module. These foreign substances may result in a fire accident, damage, or erroneous operation.</li> </ul>
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#### ● Wiring an I/O module

- (1) Definition of 2/3/4-wire connection:
  - 2/3-wire connection(passive sensors): share the power circuit with the system
  - 4-wire connection(active sensors): independently powered. Not recommended to share the same power circuit with the system
- (2) Terminals with insulation sleeves can not be arranged as a terminal block. It is recommended that the terminals be covered with insulation tubes.
- (3) Please use single-core cables or twin-core cables. The diameters of the cables used should be in the range of 12 AWG to 22 AWG. The torques applied to the screw terminals should be in the range of 5 kg-cm (4.3 lb-in) to 8 kg-cm (6.9 lb-in). Please use copper conducting wires. The temperature of the copper conducting wires should be 60/75°C.
- (4) Please keep the input cables, the output cables, and the power cable separate from one another.
- (5) If the main circuit and the power cable can not be separated from each other, please use a shielded cable, and ground it at the side of the I/O module. In some cases, the shielded cable is grounded at the opposite side.



- (6) If you wire a module by means of piping, you need to ground the piping correctly.
- (7) Please keep 24 VDC input cables separate from 110 VAC input cables and 220VDC input cables.
- (8) If the wiring length is more than 200 meters (686.67 inches), the leakage current will result from parasitic capacitance, and the system will break down.

#### ● Grounding a cable

Please ground a cable according to the steps below.

- (1) Please ground a cable correctly.
- (2) The area of the cross-section of the cable which is grounded should be 2 mm<sup>2</sup> or larger than 2 mm<sup>2</sup>.
- (3) The ground point should be near the PLC. Ground the cable properly.



**Note**

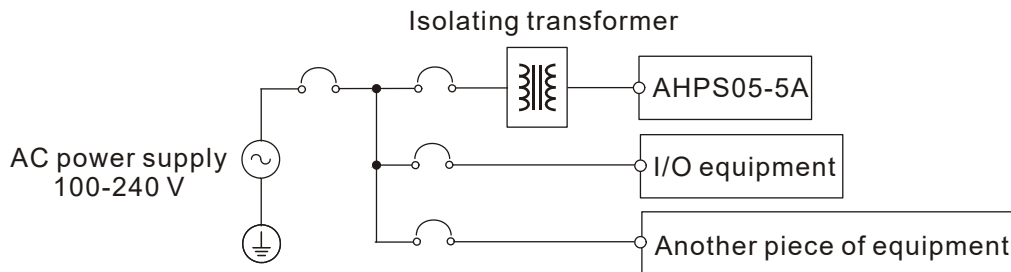
- (1) The 110 V/220 V power cable and the 24 VDC power cable should be thick cables. (The area of the cross-section of the cable is 2 mm<sup>2</sup>, and the diameter of the cable is 14 AWG.) Be sure to twist the power cables at terminal screws. To prevent the short circuit which results from loose screws, you need to use solderless terminals with insulation sleeves.
- (2) If cables are connected to the terminals LG and FG, the cables need to be grounded. Do not connect LG and FG to any devices. If LG and FG are not grounded, the PLC will be susceptible to noise. Since LG have potential, you will get an electric shock if you touch metal parts.

## 4.5 Wiring Power Supply Modules

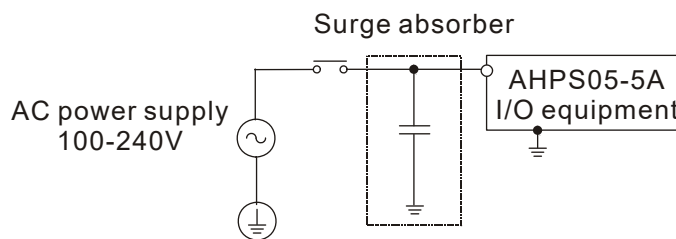
### 4.5.1 Precautions

#### ● Connecting AC power cables

- (1) Please separate the power cable of AHPS05-5A from the power cables for I/O devices and other devices. If there is much noise, connect an isolating transformer.



- (2) The 110 VAC cable, the 220 VAC cable, and the 24 VDC cable should be twisted, and connected to a module within a short distance.
- (3) Do not bundle 110 VAC cable, the 220 VAC cable, the 24 VDC cable, the (high-voltage high-current) main circuit, and the I/O signal cable together. Besides, it is recommended that the distance between adjacent cables should be more than 100 millimeters.
- (4) To prevent the surge resulting from lightning, please install a surge absorber in the way shown below.

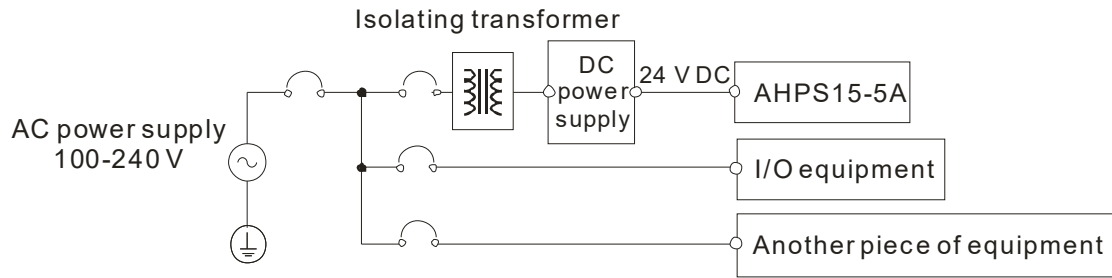


**Points for attention:**

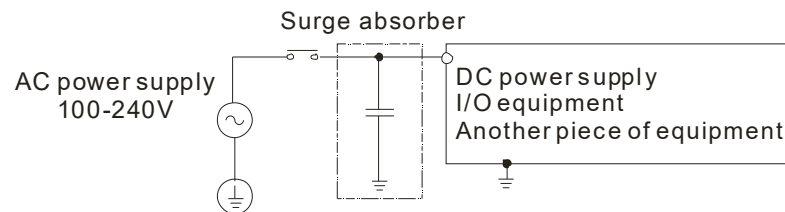
1. The surge absorber and the PLC system should be grounded separately.
2. Please select the surge absorber whose working voltage is not less than the maximum allowable input voltage.

#### ● Connecting DC power cables

- (1) AHPS15-5A is independently supplied with power by a DC power supply. Please separate the power cable of the DC power supply from the power cables for I/O devices and other devices. If there is much noise, connect an isolating transformer.



- (2) The 110 VAC cable, the 220 VAC cable, and the 24 VDC cable should be twisted, and connected to a module within a short distance.
- (3) Do not bundle 110 VAC cable, the 220 VAC cable, the 24 VDC cable, the (high-voltage high-current) main circuit, and the I/O signal cable together. Besides, it is recommended that the distance between adjacent cables should be more than 100 millimeters.
- (4) To prevent the surge resulting from lightning, please install a surge absorber in the way shown below.

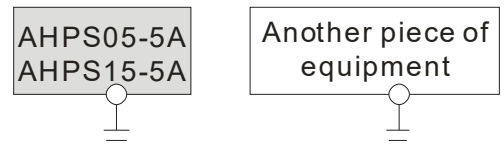


#### Points for attention:

1. The surge absorber and the PLC system should be grounded separately.
2. Please select the surge absorber whose working voltage is not less than the maximum allowable input voltage.

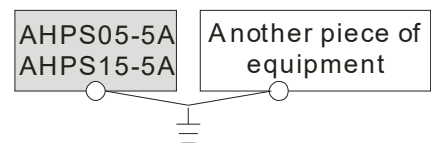
### 4.5.2 Ground

- The diameter of the ground should not be less than the diameters of the cables connected to the terminals L and N.
- If much equipment is used, please use single-point ground.



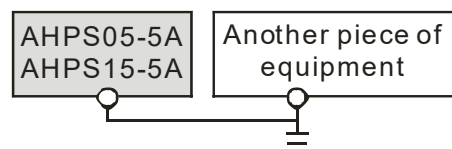
The single-point ground is better.

- If single-point ground can not be used, please use common-point ground.



The common-point ground is permitted.

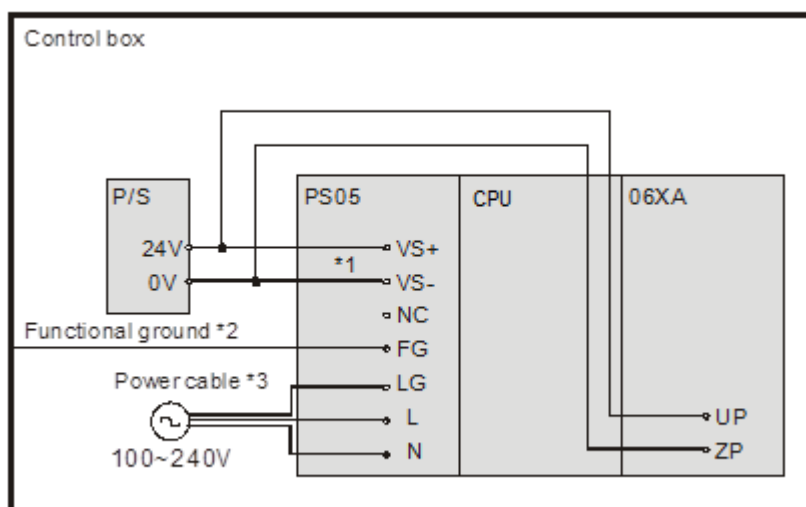
- you can not ground equipment in the way shown on the right.



The equipment can not be grounded in this way.

### 4.5.3 Wiring Power Supply Modules

- Connecting an AC power cable

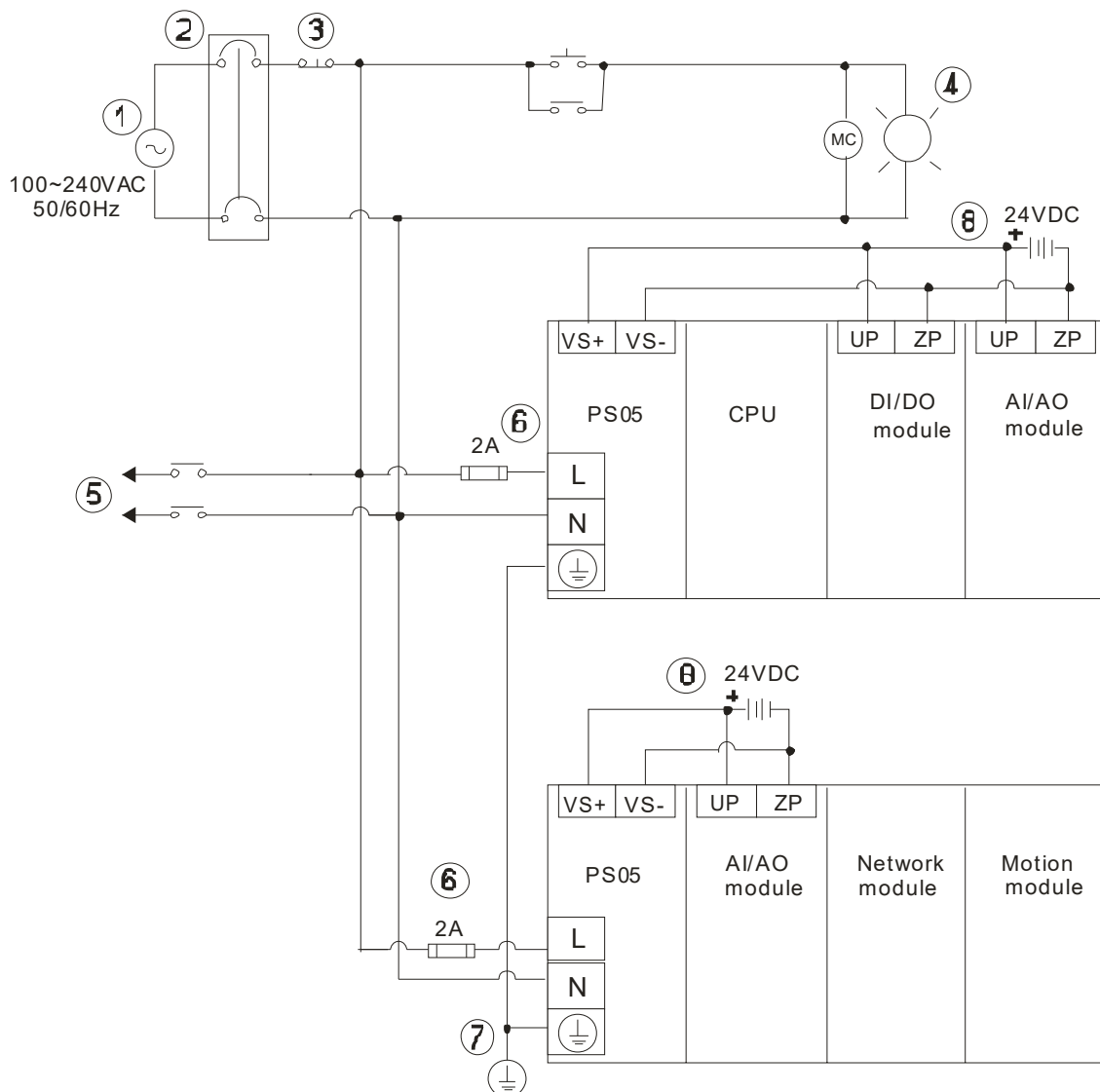


- \*1. 24V on the external power supply is connected to VS+ and VS- on the power supply module. VS+ and VS- can be used to detect whether the voltage of the external power supply is stable.
- \*2. FG on the power supply module is connected to the control box as the functional ground.
- \*3. The live wire and the neutral wire in the AC power cable are connected to L and N on the power supply module respectively. To prevent the system from becoming abnormal, the ground in the AC power cable has to be connected to LG on the power supply module.

The power input of AHPS05-5A is the AC input. You have to pay attention to the following points when you use AHPS05-5A.

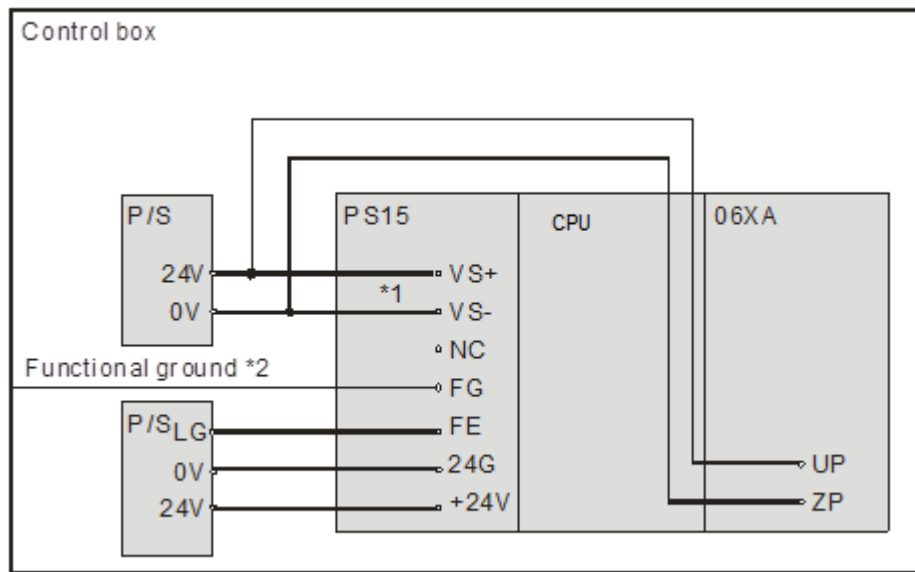
- The alternating-current input voltage is in the range of 100 VAC to 240 VAC. Please connect the power supply to the terminals L and N. If the 110 VAC or the 220 VAC power supply is connected to the input terminals VS+ and VS-, the PLC will be damaged.
- In order to ensure that the external power supply stably provides 24 VDC power, the external power supply can be connected to VS+ and VS-. If the PLC detects that the voltage of the external power supply is lower than the working voltage, you can write a protective program.
- The length of the cable connecting with the ground should be more than 1.6 millimeters.
- If the power cut lasts for less than 10 milliseconds, the PLC keeps running without being affected. If the power cut lasts for long, or if the voltage of the power supply decreases, the PLC stops running, and there is no output. When the power supply returns to normal, the PLC resumes. (You have to notice that there are latched auxiliary relays and registers in the PLC when you write the program.)
- Please use single-core cables or multicore cables. The diameters of the cables used should be in the range of 12 AWG to 22 AWG. The torque applied to the terminal screws should be 9.50 kg-cm (8.25 lb-in). Please use copper conducting wires. The temperature of the copper conductive cables should be 60/75°C.

- **Safety wiring:** The PLC controls many devices, and the activity of any device affects the activity of other devices. If any device breaks down, the whole automatic control system goes out of control, and the danger occurs. The protection circuit is shown below.



①	Alternating-current power supply: 100~240 VAC, and 50/60 Hz
②	Circuit breaker
③	Emergency stop: The emergency stop button can be used to cut off the power when an emergency occurs.
④	Power indicator
⑤	Load through which the alternating current passes
⑥	2 A fuse
⑦	The ground impedance is less than 100 Ω.
⑧	Direct-current power supply: 24 VDC

- Connecting a DC power cable



- \*1. 24V on the external power supply is connected to VS+ and VS- on the power supply module. VS+ and VS- can be used to detect whether the voltage of the external power supply is stable.
- \*2. FG on the power supply module is connected to the control box as the functional ground.
- \*3. +24V and 24G on the power supply module are connected to 24V and 0V on the DC power supply. To prevent the system from becoming abnormal, the ground of the DC power supply has to be connected to FE on the power supply module.

The power input of AHPS15-5A is the DC input. You have to pay attention to the following points when you use AHPS15-5A.

- In order to ensure that the external power supply stably provides 24 VDC power, the external power supply can be connected to VS+ and VS-. If the PLC detects that the voltage of the external power supply is lower than the working voltage, you can write a protective program.
- The length of the cable connecting with the ground should be more than 1.6 millimeters.
- If the power cut lasts for less than 10 milliseconds, the PLC keeps running without being affected. If the power cut lasts for long, or if the voltage of the power supply decreases, the PLC stops running, and there is no output. When the power supply returns to normal, the PLC resumes. (You have to notice that there are latched auxiliary relays and registers in the PLC when you write the program.)
- Please use single-core cables or multicore cables. The diameters of the cables used should be in the range of 12 AWG to 22 AWG. The torque applied to the terminal screws should be 9.50 kg-cm (8.25 lb-in). Please use copper conducting wires. The temperature of the copper conductive cables should be 60/75°C.

#### 4.5.4 Power Consumption

Products	Model name	Internal power consumption	External power consumption
<b>AH Motion CPU</b>	AHxxEMC-5A	4 W	-
<b>Motion control backplane</b>	AHBP03M2-5A	1.2 W	-
	AHBP05M2-5A	1.2 W	-
<b>Motion control module</b>	AH02HC-5A	2.4 W	-
	AH04HC-5A	2.4 W	-
	AH05PM-5A	2.7 W	-
	AH10PM-5A	2.7 W	-
	AH15PM-5A	2.7 W	-
	AH20MC-5A	3 W	-
<b>Digital I/O module</b>	AH16AM10N-5A	0.1 W	1.9 W
	AH16AM30N-5A	0.1 W	-
	AH16AN01P-5A	0.2 W	0.4 W
	AH16AN01R-5A	2.1 W	-
	AH16AN01S-5A	0.6 W	-
	AH16AN01T-5A	0.2 W	0.4 W
	AH16AP11P-5A	0.2 W	0.2 W
	AH16AP11R-5A	1.1 W	-
	AH16AP11T-5A	0.2 W	0.2 W
	AH32AM10N-5A	0.2 W	3.8 W
	AH32AM10N-5B	0.2 W	3.8 W
	AH32AM10N-5C	0.2 W	3.8 W
	AH32AN02P-5A	0.4 W	0.8 W
	AH32AN02P-5B	0.4 W	0.8 W
	AH32AN02P-5C	0.4 W	0.8 W
	AH32AN02T-5A	0.4 W	0.8 W
	AH32AN02T-5B	0.4 W	0.8 W
	AH32AN02T-5C	0.4 W	0.8 W
	AH64AM10N-5C	0.2 W	4.9 W
	AH64AN02P-5C	0.6 W	1.5 W
	AH64AN02T-5C	0.6 W	1.5 W
<b>Analog I/O module</b>	AH04AD-5A	0.35 W	1 W
	AH04DA-5A	0.34 W	2.6 W
	AH06XA-5A	0.34 W	1.4 W
	AH08AD-5A	1.1W	-
	AH08DA-5A	0.36W	4.55W
	AH08AD-5B	1.9 W	-

Products	Model name	Internal power consumption	External power consumption
	AH08DA-5B	0.25 W	2.2 W
	AH08AD-5C	1.6 W	-
	AH08DA-5C	0.25 W	3.7 W
Temperature measurement module	AH04PT-5A	2 W	-
	AH08PTG-5A	0.7W	4W
	AH04TC-5A	1.5 W	-
	AH08TC-5A	1.5 W	-
Network module	AH10EN-5A	1.6 W	-
	AH15EN-5A	1.6 W	-
	AH10SCM-5A	1.2 W	-
	AH15SCM-5A	1.2 W	-
	AH10DNET-5A	0.9 W	0.72 W
	AH10PFBS-5A	1 W	-
	AH10PFBM-5A	2 W	-
	AH10COPM-5A	0.8 W	-
Remote I/O module	AHRTU-DNET-5A	0.75 W	0.72 W
	AHRTU-PFBS-5A	2 W	-
	AHRTU-ETHN-5A	2.16 W	-

## 4.6 Wiring AH Motion CPU Modules

### 4.6.1 Specifications of Inputs and Outputs

- AHxxEMC-5A

General Specifications		
AHxxEMC-5A		Remark
Execution	The program is executed cyclically.	
Input/Output control	Cyclically refreshed inputs/outputs Direct inputs/outputs	The inputs and outputs can be controlled through the direct inputs (DX device) and direct outputs (DY device).
Programming language	IEC 61131-3	
	Ladder diagram (LD), continuous function chart (CFC), structured text (ST), and sequential function chart (SFC).	
Instruction execution speed	0.3 ms/K steps	
Constant scan cycle (ms)	1-32000 (The scan cycle can be increased by one millisecond.)	The scan cycle time can be specified by parameters.
Program capacity (step)	256K steps	
Installation	DIN rails or screws	

General Specifications		
AHxxEMC-5A		Remark
Installation of modules	Modules are installed directly on a backplane.	
Number of modules	Five input/output modules at most can be installed on a motion backplane.	
Number of tasks	283 tasks (32 cyclic tasks; 32 I/O interrupts; 212 external interrupts; 1 24V LV detection)	
Number of input/output devices	X/Y devices (bit): 8192 (X0.0~X511.15/Y0.0~Y511.15) X/Y devices (word): 512 (X0~X511/Y0~Y511)	Number of devices which can be used in a program
Number of inputs/outputs	328 inputs/ 324 outputs (AH10EMC)	Number of inputs/outputs accessible to an CPU
Input relay [X]	8192 (X0.0~X511.15)	
Output relay [Y]	8192 (Y0.0~Y511.15)	
Auxiliary relay [M]	8192 (M0~M8191)	
Timer [T]	2048 (T0~T2047)	
Counter [C]	2048 (C0~C2047)	
32-bit counter [HC/AC]	HC: 64 (HC0~HC63) AC: 56 (AC0~ AC55) (AHxxEMC)	
Data register [D]	D device (bit): 1048576 (D0.0~D65535.15) D device (word): 65536 (D0~D65535)	
Stepping relay [S]	2048 (S0~S2047)	
Index register [E]	32 (E0~E31)	
Special auxiliary relay [SM]	SM: 2048 (SM0~SM2047)	
Special data register [SR]	SR: 2048 (SR0~SR2047)	
Serial communication port	One RS-232(USB), One RS-485 communication port	
Ethernet port	10/100 M	
USB port	Mini USB	
Memory card slot	Supports Micro SD card (SD 2.0)	
Real-time clock	Years, months, days, hours, minutes, seconds, and weeks	The function is available when the CPU is used together with the motion backplane



## Description of the terminals

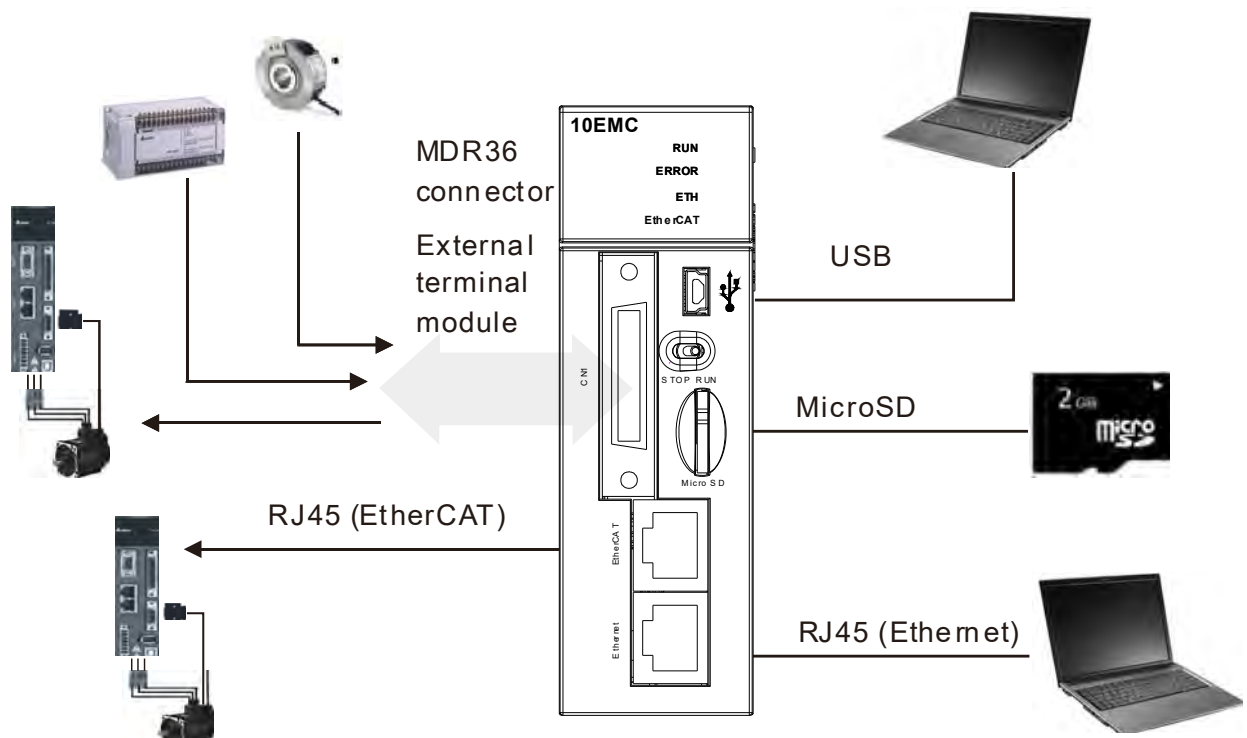
Terminal	Description	Response characteristic	Rated input	
			Current	Voltage
<b>X0.0+, X0.0-, X0.1+, X0.1-</b>	<ol style="list-style-type: none"> <li>Differential input terminals.</li> <li>The functions of the terminals: <ul style="list-style-type: none"> <li>High-speed count: <ul style="list-style-type: none"> <li>The terminals are the RESET input terminals for counter 0~counter 1.</li> <li>X0.0+ and X0.0- are for counter 0.</li> <li>X0.1+ and X0.1- are for counter 1.</li> </ul> </li> <li>High-speed capture: The terminals can function as trigger signals for high-speed captures.</li> </ul> </li> </ol>	1MHz	+/-5mA	+/-5V
<b>X0.2, X0.3, X1.4, X1.5</b>	<ol style="list-style-type: none"> <li>Common input terminals.</li> <li>The functions of the terminals: <ul style="list-style-type: none"> <li>High-speed count: <ul style="list-style-type: none"> <li>The terminals are the RESET input terminals for counter 2~counter 5.</li> <li>X0.2 is for counter 2.</li> <li>X0.3 is for counter 3.</li> <li>X1.4 is for counter 4</li> <li>X1.5 is for counter 5</li> </ul> </li> <li>High-speed capture: The terminals can function as trigger signals for high-speed captures.</li> </ul> </li> </ol>	100kHz(*1)	5mA	24V
<b>X0.8+, X0.8-, X0.9+, X0.9-</b>	<ol style="list-style-type: none"> <li>Differential input terminals.</li> <li>The functions of the terminals: <ul style="list-style-type: none"> <li>Motion control: The terminals are for a manual pulse generator.</li> <li>High-speed count: <ul style="list-style-type: none"> <li>The terminals are for counter 0.</li> <li>X0.8+ and X0.8- are the A-phase inputs for counter 0. X0.9+ and X0.9- are the B-phase inputs for counter 0.</li> </ul> </li> <li>High-speed capture: The terminals can function as trigger signals for high-speed captures.</li> <li>Interrupt inputs</li> </ul> </li> </ol>	1MHz	+/-5mA	+/-5V
<b>X0.10+, X0.10-, X0.11+, X0.11-</b>	<ol style="list-style-type: none"> <li>Differential input terminals.</li> <li>The functions of the terminals: <ul style="list-style-type: none"> <li>High-speed count: <ul style="list-style-type: none"> <li>The terminals are for counter 1.</li> <li>X0.10+ and X0.10- are the A-phase inputs for counter 1. X0.11+ and X0.11- are the B-phase inputs for counter 1.</li> </ul> </li> <li>High-speed capture: The terminals can function as trigger signals for high-speed captures.</li> <li>Interrupt inputs</li> </ul> </li> </ol>	1MHz	+/-5mA	+/-5V
<b>X0.12, X0.13, X0.14, X0.15, X1.0, X1.1,</b>	<ol style="list-style-type: none"> <li>Common input terminals.</li> <li>The functions of the terminals: <ul style="list-style-type: none"> <li>High-speed count: <ul style="list-style-type: none"> <li>The terminals are for counter 2~counter 5.</li> <li>X0.12 and X0.13 are for counter 2.</li> <li>X0.14 and X0.15 are for counter 3.</li> </ul> </li> </ul> </li> </ol>	100kHz(*1)	5mA	24 V

Terminal	Description	Response characteristic	Rated input	
			Current	Voltage
<b>X1.2, X1.3</b>	<p>X1.0 and X1.1 are for counter 4. X1.2 and X1.3 are for counter 5.</p> <ul style="list-style-type: none"> <li>High-speed capture: The terminals can function as trigger signals for high-speed captures.</li> <li>Interrupt inputs: X0.12, X0.13, X0.14 and X0.15 can function as interrupt inputs.</li> </ul>			
<b>Y0.8, Y0.9, Y0.10, Y0.11</b>	<p>1. Pulse output terminals (open collector). 2. The function of the terminals:</p> <ul style="list-style-type: none"> <li>High-speed comparison: The terminals can function as high-speed comparison outputs.</li> </ul>	200 kHz	15 mA	24 V

\*1. If the frequency of input signals received by an input terminal must be 200 kHz, the input terminal must be connected to a 1 k $\Omega$  (2 W) resistor in parallel.

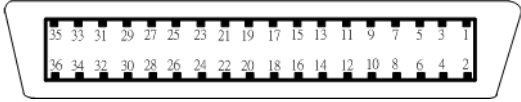
#### 4.6.2 Wiring AHxxEMC-5A

- External devices for AHxxEMC-5A



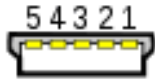
- MDR36 connector

Pin	Function	Pin	Function
1	COM	19	Y0.11
2	COM	20	Y0.10
3	COM	21	Y0.9
4	COM	22	Y0.8
5	S/S	23	X1.3
6	X1.5	24	X1.2
7	S/S	25	X1.1
8	X1.4	26	X1.0
9	S/S	27	X0.15
10	X0.3	28	X0.14
11	S/S	29	X0.13
12	X0.2	30	X0.12
13	X0.1-	31	X0.1+
14	X0.11-	32	X0.11+
15	X0.10-	33	X0.10+
16	X0.0-	34	X0.0+
17	X0.9-	35	X0.9+
18	X0.8-	36	X0.8+



- USB port

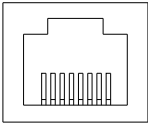
Pin	Function
1	VBUS (4.4–5.25 V)
2	D-
3	D+
4	Ground
5	Ground



Mini-B

- EtherNet/IP port

Pin	Signal	Description
1	TX+	Transmitting data (positive pole)
2	TX-	Transmitting data (negative pole)
3	RX+	Receiving data (positive pole)
4	--	N/C
5	--	N/C
6	RX-	Receiving data

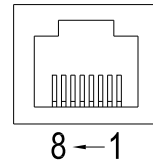


8 ← 1

		(negative pole)	
7	--	N/C	
8	--	N/C	

- EtherCAT port

Pin	Signal	Description
1	TX+	Transmitting data (positive pole)
2	TX-	Transmitting data (negative pole)
3	RX+	Receiving data (positive pole)
4	--	N/C
5	--	N/C
6	RX-	Receiving data (negative pole)
7	--	N/C
8	--	N/C

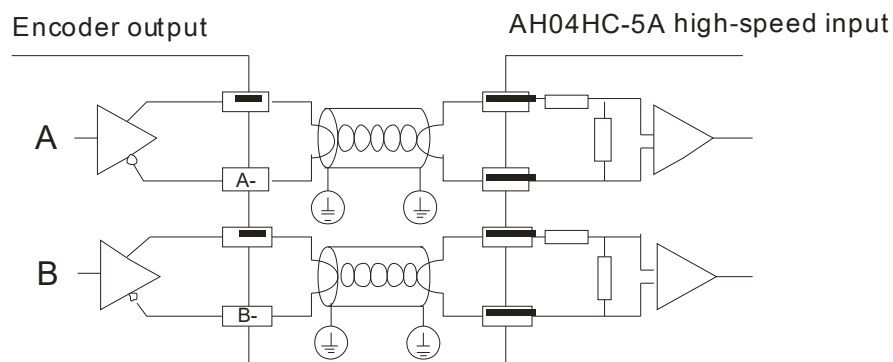


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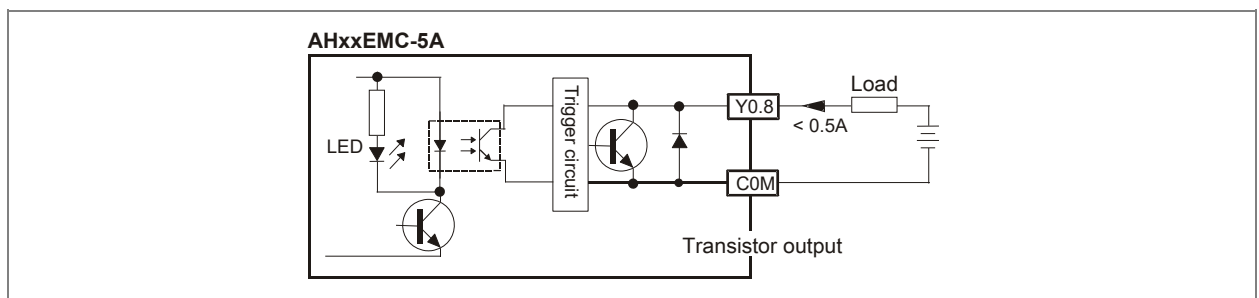
### Wiring the Differential Input Terminals

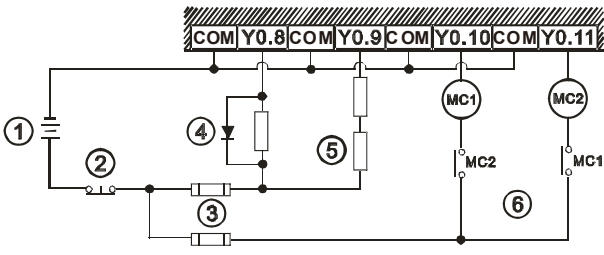
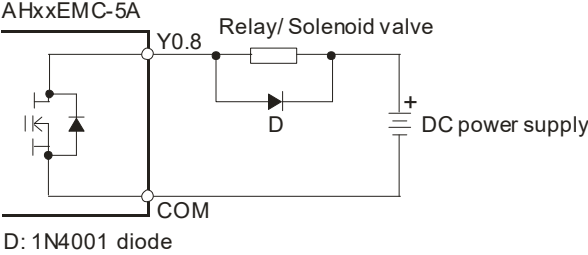
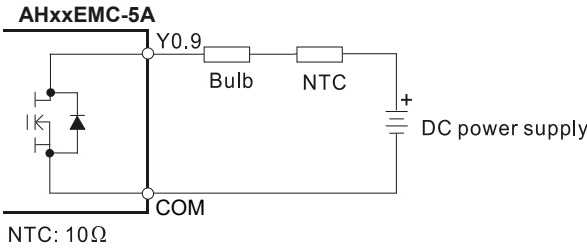
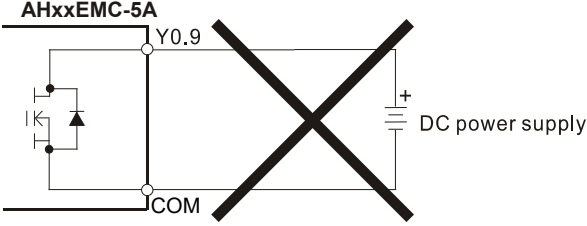
The direct-current signals in voltage 5 V can pass through the high-speed input terminals X0.0+~X0.1+, X0.0~-X0.1-, X0.8+~X0.11+, and X0.8~-X0.11- on AHxxEMC-5A. The frequency of input signals can be up to 1 MHz. These high-speed input terminals are connected to a differential (two-wire) line driver.

- Wiring differential input terminals (The wiring below is used for high speed and high noise.)



### Transistor Output Circuit



					
①	Direct-current power supply	②	Emergency stop	③	Fuse
④	<p>The output terminals of a transistor module are open-collector output terminals. If Y0.8 is a pulse train output terminal of a transistor module, the output current passing through its output pull-up resistor must be greater than 0.1 A to ensure that the transistor module operates normally.</p> <p>A relay or a solenoid valve is used as a DC load. A diode is connected in parallel to absorb the surge voltage which occurs when the load is OFF.</p>  <p>D: 1N4001 diode</p>				
⑤	<p>A bulb (incandescent lamp) is used as a DC load. A thermistor is connected in series to absorb the surge current which occurs when the load is ON.</p>  <p>NTC: 10Ω</p> <p>Y0.9 can not be connected to a power supply directly. It must be connected to a load.</p> 				
⑥	<p>Mutually exclusive output: For example, Y0.10 controls the clockwise rotation of the motor, and Y0.11 controls the counterclockwise rotation of the motor. The interlock circuit which is formed, and the program in the PLC ensure that there are protective measures if an abnormal condition occurs.</p>				

## 4.7 Wiring I/O Modules

AH motion controller PLC supports the following I/O module types: digital input/output modules, analog input/output modules, temperature measurement modules, network modules, motion control modules, remote I/O modules. Refer to Chapter 5 of the AH500 Hardware Manual for more details.

## MEMO

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## Chapter 5 Maintenance and Inspection

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## 5.1 Cautions

Before you undertake the maintenance and the inspection, please pay attention to the following items. **The incorrect or careless operation will lead to damage to the staff and the equipment.**



- To prevent a breakdown of an AH Motion system or a fire accident, please make sure that the ambient environment is not exposed to corrosive substances such as chloride gas and sulfide gas, flammable substances such as oil mist and cutting powder, or dirt.



- To prevent the connectors from oxidizing, or to prevent the staff from getting an electric shock, please do not touch the connectors.



- To prevent the staff from getting an electric shock, please turn off the power before pulling the connectors or loosening the screws.



- To prevent the cables from being damaged, or to prevent the connectors from being loosened, please do not impose weight on the cable, or pull them violently.



- Please make sure that the input voltage is within the rated range.



- Please do not disassemble or alter the modules. Otherwise, the products will break down, a fire accident will occur, or the staff will be injured.

- To prevent a controlled element from malfunctioning, please make sure that the program and the parameters are written into a new CPU module which replaces an old one before restarting the AH Motion system.
- To prevent the improper operation which results in the incorrect output or the damage to the equipment, please refer to the related manuals for more information about operating the modules.
- To prevent the damage to the modules, please touch metal which is grounded or wear an antistatic wrist strap to release the static electricity from the body.
- To prevent the noise from resulting in the breakdown of the system, please keep a proper distance from the system when using a cell phone or a communication apparatus.
- Please avoid installing an AH Motion system under the sun or in a humid environment.
- To prevent the temperature of an element from being high, please make sure that the AH Motion system keeps a proper distance from heat sources such as coils, heating apparatuses, and resistors.
- To protect an AH Motion system, please install an emergency stop switch and an overcurrent protection according to the actual needs.
- To prevent an unexpected shock from resulting in the damage to an AH Motion system and a controlled element, please make sure that the modules are installed firmly.

## 5.2 Daily Maintenance

To keep AH Motion system operating normally, make sure that the ambient environment and the AH Motion system conform to the cautions listed in section 5.1. You then can undertake the daily inspection described below. If any abnormal situation occurs, please follow the remedy and carry out the maintenance.

### 5.2.1 Daily Inspection

No.	Item	Inspection	Criterion	Remedy
1	Appearance	Check visually.	Dirt must not be present.	Remove the dirt.
2	Installing of DIN rail	Check whether the DIN rail is securely installed.	The DIN rail must be installed firmly.	Tighten the screws.
3	Installing of module	Check whether the module is loose. Check if the clip is securely installed on the DIN rail, and if the screws are tightened.	The chip should be securely installed on the DIN rail and the screws must be tightened.	Install the module firmly.
4	Connection	Check whether the removable terminal block is loose.	The removable terminal block must not be loose.	Install the terminal block firmly.
		Check whether the connector is loose.	The connector must not be loose.	Tighten the screws on the connector.
5	LED indicators on Power supply module	Check the POWER LED indicator.	Refer to each module's descriptions on LED indicators.	Refer to each module's troubleshooting section.
	LED indicators on CPU module	Check the CPU LED indicator.		
	LED indicators on Extension module	Check the Extension Module LED indicator.		

## 5.3 Periodic Maintenance

Under the condition that the daily inspection is undertaken, it is suggested that you should carry out the periodic maintenance according to the actual operating environment. After making sure that the ambient environment and the AH Motion system conform to the cautions listed in section 5.1, you then can undertake the periodic inspection described below. If any abnormal situation occurs, please follow the suggested actions and carry out the maintenance.

### 5.3.1 Periodic Inspection

No.	Item		Inspection	Criterion	Remedy
1	Ambient environment	Ambient temperature/humidity	The ambient temperature and the ambient humidity are measured by thermometer and hygrometer.	The ambient temperature and the ambient humidity must conform to the specifications for the modules or the backplane. If the specifications are different, the strictest specifications have priority.	To ensure that the system operates in a stable environment, determine why the environment varies, and resolve the issue.
		Atmosphere	Measure corrosive gas.	Corrosive gas must NOT be present.	
2	Supply voltage		Measure the AC power supply.	The power supply should meet the specifications for the power supply module.	Check the power supply.
3	Installation	Looseness	Check whether the module is loose.	The module must be installed firmly.	Refer to information on module installation.
		Adhesion of dirt	Check the appearance.	Dirt must not be present.	Remove the dirt.
4	Connection	Looseness of terminal screws	Tighten the screws with a screwdriver.	The screws must not be loose.	Tighten the screws.
		Looseness of connectors	Pull the connectors.	The connectors must not be loose.	Tighten the screws on the connectors.
5	PLC system diagnosis		Check the error logs.	No new error occurs.	Refer to each module's troubleshooting section.
6	Maximum scan time			The maximum scan cycle must be within the range specified in the system specifications.	Determine why the scan time exceeds specifications.



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# Appendices

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    A.1.1    EMC Standards Applicable to an AH Motion Controller System ..... 2

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## A.1 EMC Standards for an AH Motion Controller System

### A.1.1 EMC Standards Applicable to an AH Motion Controller System

The EMC standards which are applicable to an AH Motion Controller system are listed below.

- EMI

Port	Frequency range	Level (Normative)	Reference standard
Enclosure port (radiated) (measured at a distance of 10 meters)	30-230 MHz	40 dB (μV/m) quasi-peak	IEC 61000-6-4
	230-1000 MHz	47 dB (μV/m) quasi-peak	
AC power port (conducted)	0.15-0.5 MHz	79 dB (μV) quasi-peak	IEC 61000-6-4
		66 dB (μV) average	
	0.5-30 MHz	73 dB (μV) quasi-peak	
		60 dB (μV) average	

- EMS

Environmental phenomenon	Reference standard	Test		Test level
Electrostatic discharge	IEC 61000-4-2	Contact		± 4 kV
		Air		± 8 kV
Radio frequency electromagnetic field Amplitude modulated	IEC 61000-4-3	80% AM, 1 kHz sinusoidal	2.0-2.7 GHz	1 V/m
			1.4-2.0 GHz	3 V/m
			80-1000 MHz	10 V/m
Power frequency magnetic field	IEC 61000-4-8	60 Hz		30 A/m
		50 Hz		30 A/m

### ● Conducted immunity test

Environmental phenomenon		Fast transient burst	High energy surge	Radio frequency interference
Reference standard		IEC 61000-4-4	IEC 61000-4-5	IEC 61000-4-6
Interface/Port	Specific interface/port	Test level	Test level	Test level
Data communication	Shielded cable	1 kV	1 kV CM	10V
	Unshielded cable	1 kV	1 kV CM	10V
Digital and analog I/O	AC I/O (unshielded)	2 kV	2 kV CM 1 kV DM	10V
	Analog or DC I/O (unshielded)	1 kV	1 kV CM	10V
	All shielded lines (to the earth)	1 kV	1 kV CM	10V
Equipment power	AC power	2 kV	2 kV CM 1 kV DM	10V
	DC power	2 kV	0.5 kV CM 0.5 kV DM	10V
I/O power and auxiliary power output	AC I/O and AC auxiliary power	2 kV	2 kV CM 1 kV DM	10V
	DC I/O and DC auxiliary power	2 kV	0.5 kV CM 0.5 kV DM	10V

## A.1.2 Installation Instructions for the EMC Standards

A PLC must be installed in a control box. The control box protects the PLC, and shields off the electromagnetic interference generated by the PLC.

### ● Control box

- Use a conductive control box.
- To ensure that an inner plate contacts the control box well, users have to mask the paint on the bolts of the plate.
- To ensure that the control box is grounded well even if there is high-frequency noise, users have to connect the control box with a thick wire.

- The diameter of a hole in the control box must be less than 10 millimeters, i.e. 3.94 inches. If the diameter of the hole is larger than 10 millimeters, the radio frequency noise may be emitted.
- To prevent the radio waves from leaking through the interval between the door of the control box and the PLC, the interval needs to be reduced. Besides, users can prevent the radio waves from leaking by putting an EMI gasket on the painted surface.

### ● Connecting a power cable and a ground

The power cable of the PLC system and the ground are connected in a way described below.

- Provide a ground point near the power supply module. Use thick and short wires to connect the terminals LG and FG with the ground. (The length of the wire should be less than 30 centimeters, i.e. 11.18 inches.) LG and FG function to pass the noise generated by the PLC system to the ground. Therefore, the impedance should be as low as possible. Besides, the wires are used to relieve the noise. They themselves carry a lot of noise. Using the short wires can prevent the wires from acting as antennas.
- Twist the ground and the power cable. After the ground and the power cable are twisted, the noise flowing through the power cable is passed to the ground. If a filter is installed on the power cable, the ground and the power cable do not need to be twisted.

## A.1.3 Cables

### Grounding a shielded cable

Cables drawn from the control box carry high-frequency noise. When they are outside the control box, they are like antennas emitting noise. To prevent the emission of noise, the cables connected to digital input/output modules, analog input/output modules, temperature measurement modules, network modules, and motion control modules should be shielded cables.

The use of shielded cables also increases the resistance to noise. If the signal cables connected to digital input/output modules, analog input/output modules, temperature measurement modules, network modules, and motion control modules are shielded cables, and are grounded properly, the resistance to noise is improved. However, the resistance to noise will not meet the specified requirement if users do not use shielded cables or the shielded cables are not grounded correctly. If the shield of a cable is connected with the control box, users have to make sure that the shield contacts the control box. If the control box is painted, users have to scrape the paint. All fastening must be metal, and the shield must contact the surface of the control box. If the surface is not even, users need to use washers to correct the unevenness, or use an abrasive to level the surface.

If the shield of a shielded cable is grounded, it needs to be as close to a module as possible. Users have to make sure that there is no electromagnetic induction between the cable which is grounded and other cable which is grounded. Besides, users have to take appropriate measures so that the shield of a cable contacts the control box.



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## Industrial Automation Headquarters

### Delta Electronics, Inc.

Taoyuan Technology Center  
No.18, Xinglong Rd., Taoyuan District,  
Taoyuan City 330477, Taiwan  
TEL: +886-3-362-6301 / FAX: +886-3-371-6301

## Asia

### Delta Electronics (Shanghai) Co., Ltd.

No.182 Minyu Rd., Pudong Shanghai, P.R.C.  
Post code : 201209  
TEL: +86-21-6872-3988 / FAX: +86-21-6872-3996  
Customer Service: 400-820-9595

### Delta Electronics (Japan), Inc.

Industrial Automation Sales Department  
2-1-14 Shibadaimon, Minato-ku  
Tokyo, Japan 105-0012  
TEL: +81-3-5733-1155 / FAX: +81-3-5733-1255

### Delta Electronics (Korea), Inc.

1511, 219, Gasan Digital 1-Ro., Geumcheon-gu,  
Seoul, 08501 South Korea  
TEL: +82-2-515-5305 / FAX: +82-2-515-5302

### Delta Energy Systems (Singapore) Pte Ltd.

4 Kaki Bukit Avenue 1, #05-04, Singapore 417939  
TEL: +65-6747-5155 / FAX: +65-6744-9228

### Delta Electronics (India) Pvt. Ltd.

Plot No.43, Sector 35, HSIIDC Gurgaon,  
PIN 122001, Haryana, India  
TEL: +91-124-4874900 / FAX: +91-124-4874945

### Delta Electronics (Thailand) PCL.

909 Soi 9, Moo 4, Bangpoo Industrial Estate (E.P.Z),  
Pattana 1 Rd., T.Phraksa, A.Muang,  
Samutprakarn 10280, Thailand  
TEL: +66-2709-2800 / FAX: +66-2709-2827

### Delta Electronics (Australia) Pty Ltd.

Unit 2, Building A, 18-24 Ricketts Road,  
Mount Waverley, Victoria 3149 Australia  
Mail: IA.au@deltaww.com  
TEL: +61-1300-335-823 / +61-3-9543-3720

## Americas

### Delta Electronics (Americas) Ltd.

5101 Davis Drive, Research Triangle Park, NC 27709, U.S.A.  
TEL: +1-919-767-3813 / FAX: +1-919-767-3969

### Delta Electronics Brazil Ltd.

Estrada Velha Rio-São Paulo, 5300 Eugênio de  
Melo - São José dos Campos CEP: 12247-004 - SP - Brazil  
TEL: +55-12-3932-2300 / FAX: +55-12-3932-237

### Delta Electronics International Mexico S.A. de C.V.

Gustavo Baz No. 309 Edificio E PB 103  
Colonia La Loma, CP 54060  
Tlalnepantla, Estado de México  
TEL: +52-55-3603-9200

## EMEA

### Delta Electronics (Netherlands) B.V.

Sales: Sales.IA.EMEA@deltaww.com  
Marketing: Marketing.IA.EMEA@deltaww.com  
Technical Support: iatechnicalsupport@deltaww.com  
Customer Support: Customer-Support@deltaww.com  
Service: Service.IA.emea@deltaww.com  
TEL: +31(0)40 800 3900

### Delta Electronics (Netherlands) B.V.

Automotive Campus 260, 5708 JZ Helmond, The Netherlands  
Mail: Sales.IA.Benelux@deltaww.com  
TEL: +31(0)40 800 3900

### Delta Electronics (Netherlands) B.V.

Coesterweg 45, D-59494 Soest, Germany  
Mail: Sales.IA.DACH@deltaww.com  
TEL: +49 2921 987 238

### Delta Electronics (France) S.A.

ZI du bois Challand 2, 15 rue des Pyrénées,  
Lisses, 91090 Evry Cedex, France  
Mail: Sales.IA.FR@deltaww.com  
TEL: +33(0)1 69 77 82 60

### Delta Electronics Solutions (Spain) S.L.U

Ctra. De Villaverde a Vallecas, 265 1º Dcha Ed.  
Hormigueras - P.I. de Vallecas 28031 Madrid  
TEL: +34(0)91 223 74 20

Carrer Llacuna 166, 08018 Barcelona, Spain

Mail: Sales.IA.Iberia@deltaww.com

### Delta Electronics (Italy) S.r.l.

Via Meda 2-22060 Novedrate(CO)  
Piazza Grazioli 18 00186 Roma Italy  
Mail: Sales.IA.Italy@deltaww.com  
TEL: +39 039 8900365

### Delta Greentech Elektronik San. Ltd. Sti. (Turkey)

Şerifali Mah. Hendem Cad. Kule Sok. No:16-A  
34775 Ümraniye - İstanbul  
Mail: Sales.IA.Turkey@deltaww.com  
TEL: + 90 216 499 9910

### Eltek Dubai (Eltek MEA DMCC)

OFFICE 2504, 25th Floor, Saba Tower 1,  
Jumeirah Lakes Towers, Dubai, UAE  
Mail: Sales.IA.MEA@deltaww.com  
TEL: +971(0)4 2690148