M-Series Motion Controller

M100

Hardware Manual

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※ Preface

Thank you for purchasing and using the M100-series controller products independently developed and manufactured by Hechuan Technology Co., Ltd.

The M100-series controller is a pulse-type motion controller independently developed and manufactured by HCFA, featuring rich functionalities, superior performance, and user-friendly operation. It integrates the functions of a Programmable Logic Controller (PLC) and motion control. The controller is equipped with built-in input/output channels and multiple communication interfaces. Its built-in input/output channels support high-speed I/O, with a maximum of 6 high-speed output channels and 2 high-speed input channels.

This manual primarily describes the products listed in the table:

Name	Model	I/O quantity	Brief description
M-series CPU unit	HCM100-14MR-A	8-channel input	The M100-series CPU unit is equipped with built-in input/output channels and multiple communication interfaces. It supports high-speed input/output, with a maximum of 6 high-speed output channels and 2 high-speed input channels. All models are standard-equipped with USB, RS485 and RS232 communication interfaces; some models can expand RS485, RS232, CAN, and other communication interfaces via expansion cards.
	HCM100-14MT3-A	6-channel output	
	HCM100-20MR-A	12-channel input	
	HCM100-20MT4-A	8-channel output	
	HCM100-30MR-A	16-channel input	
	HCM100-30MT6-A	14-channel output	
	HCM100-40MR-A	24-channel input	
	HCM100-40MT6-A	16-channel output	
	HCM100-48MR-A	28-channel input	
	HCM100-48MT6-A	20-channel output	
	HCM100-60MR-A	36-channel input	
	HCM100-60MT6-A	24-channel output	

Target reader

Users who purchase or use HCFA's M100-series motion controllers can refer to this manual for wiring, installation, diagnoses, post-maintenance procedures, and other related tasks. Users are required to have a basic understanding of electrical and automation knowledge.

This manual contains essential information for using HCFA's M100-series motion controllers. Please read this manual carefully before use and operate correctly while paying full attention to safety.

Related manual

Partial specifications or restrictions for products in this manual may be described in other manuals, as detailed in the table below:

Name	Main content
M100 installation instruction	Instruction sheet (installation & operation)
M-Series Controller Basic Logic Instruction Manual	Instruction manual
M-Series Controller Motion Control Instruction Manual	Instruction manual
M-Series Controller Communication Instruction Manual	Instruction manual

※ Safety precautions

Safety icons

To ensure safe use of this product, this manual uses the following icons and icon descriptions to indicate precautions. The precautions listed here are all of critical importance to safety. These must be strictly observed. The icons and their meanings are as follows.

DANGER ⚠	Improper operation may cause minor to moderate injuries, or major injuries/death in severe cases, and potential property damage.
WARNING ⚠	Improper operation may cause minor to moderate injuries or equipment damage.
CAUTION ⚠	Improper operation may cause minor injuries or equipment damage.
NOTE	Improper operation may damage the environment/equipment or cause data loss.

Safety rules

Precautions for startup and maintenance

DANGER ⚠

- Do not touch terminals in a powered state. There is a risk of electric shock and potential malfunctions.
- Ensure the power supply is completely disconnected from the external source before cleaning or wiring the module or terminals.
- Operating with power applied poses a risk of electric shock.
- For operations such as program changes, forced outputs, RUN, and STOP on running equipment, ensure familiarity with this manual and confirm safety beforehand. Incorrect operations may lead to mechanical damage or accidents.

Precautions during startup and maintenance

CAUTION ⚠

- Do not disassemble or modify the module, as this may cause malfunctions, errors, or fires.
- For equipment repairs, consult Hechuan Technology Co., Ltd.
- Always disconnect the power supply before installing or removing equipment cables; otherwise, module malfunctions or errors may occur.
- Ensure the power supply is disconnected before installing or removing the following equipment; otherwise, module malfunctions or errors may occur:
  --- Peripheral devices, display modules, functional expansions
  --- Expansion modules, special adapters
  --- Batteries, power supply terminals, memory cards

Precautions for disposal

CAUTION ⚠

- When disposing of the product, treat it as industrial waste. For battery disposal, follow the specific regulations designated by each region for separate processing.

Precautions for transportation and storage

CAUTION ⚠

• As the equipment is precision equipment, avoid subjecting it to impacts exceeding the general specification values stated in Section 3.1 during transportation. Otherwise, it may cause equipment malfunctions. After transportation, perform an operational check on the equipment.

Safety key points

Transportation and disassembly

• When transporting the unit, use a dedicated packaging box. Additionally, avoid applying excessive vibration or impact to the unit during transportation.

• Do not disassemble, repair, or modify this product; otherwise, malfunctions or fires may occur.

• Do not drop the product or subject it to abnormal vibration or impact; otherwise, product malfunctions or burnout may occur.

During installation

• Always cut off the power supply when assembling the unit. Failure to disconnect the power supply may cause the unit to malfunction or become damaged.

• When connecting the power supply unit, controller, or I/O unit, ensure that the connectors between the units are properly engaged.

During wiring

• Follow the specified wiring procedures outlined in this manual. Before powering on, carefully check the settings of all wiring and switches.

• Perform terminal wiring using the methods described in this manual.

• Use appropriate wiring components and tools during wiring; otherwise, cable disconnection, short circuits, or broken wires may occur.

• Select suitable cables for wiring. For details, refer to Section 5.2. Do not forcefully twist or pull the cables.

During power supply design

• When selecting an external power supply, consider the power capacity and surge current during turn-on specified in this manual, and choose a power supply with sufficient margin. Otherwise, the external power supply may fail to start or the power voltage may be unstable, leading to malfunctions.

• Use the capacity of the IO power supply within the unit's specifications.

• Do not apply a voltage exceeding the rated value to the input unit.

• Do not apply a voltage or load exceeding the rated value to the output unit or slave devices.

• A surge current may be generated when the power is turned on. When selecting fuses or circuit breakers for the external circuit, consider the melting characteristics and the above points, and ensure sufficient margin in the design.

• For surge current specifications, refer to this manual.

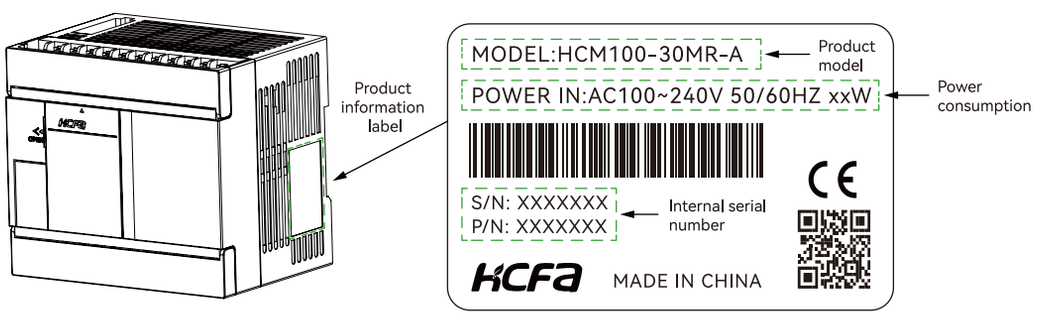
※ Version information confirmation

Each unit and slave device in the M100 series is identified by a unique number that represents its hardware revision or version. When there are changes to the hardware or software specifications, the respective hardware revision or version is up dated. As a result, even units or slave devices of the same model can have different functions or performance if their hardware revisions or versions differ.

Hardware version

The version can be confirmed via the identification information on the product's side label.

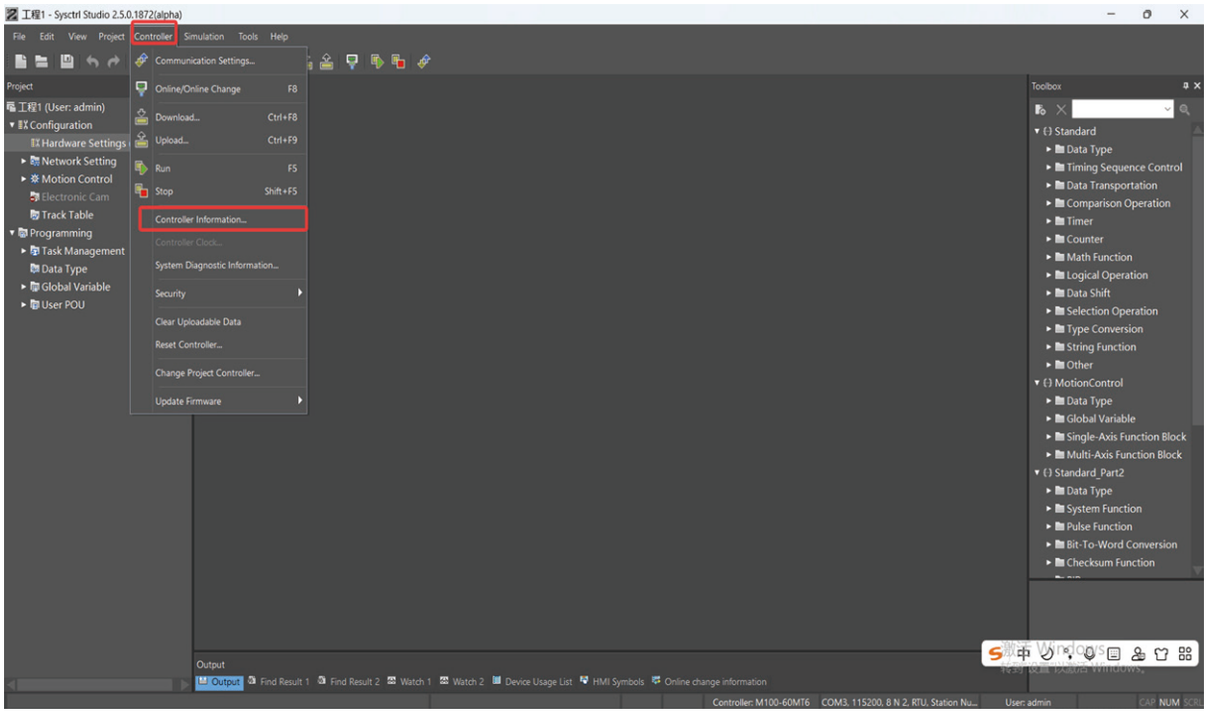
The identification information label for the M100-series CPU unit HCM1 □□ - □□□□ - □ is shown in the figure below.

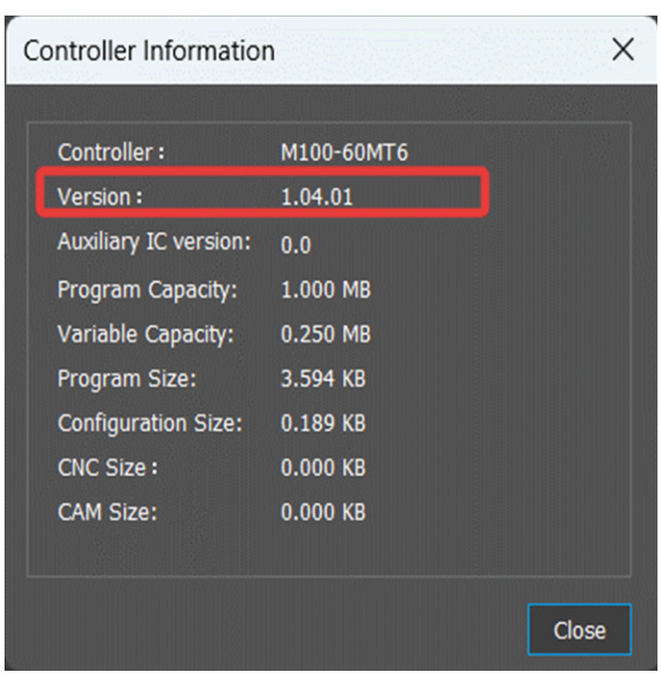


Item	Description
Product information label	Describes basic product information such as the current product model and power consumption.
Product model	Displays the product model. MODEL: Product model
Power consumption	Displays the rated voltage and power consumption required for normal operation of the product.
Internal serial number	Displays the internal serial number of the product. P/N, S/N: Internal serial number.

Software version

Select 【Controller】 - 【Controller Information】from the top menu bar of Sysctrl Studio. The current controller's software version can be viewed in the pop-up 【Controller Information】window.





Manual version record

Version number	Update description
V1.0	Initial version

※ Term description

Term	Description
CPU unit	The control center of the automation controller. It executes tasks, refreshes I/O of each unit and slave device, etc. In the M100 series, it is denoted as HCM1 □□ - □□□□ - □ .
Axis	A functional unit in the motion control function module. It assigns drive mechanisms of external servo drives, detection mechanisms of encoder inputs, etc.
Upload	Transfer data from the controller to Sysctrl Studio.
Download	Transfer data from Sysctrl Studio to the controller.
Motion control command	Motion control definition commands required for executing motion control functions. Motion control commands include those based on PLCopen's motion control function blocks and those independent of the motion control function module.

※ Copyright notice

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1.1 Product feature and main function description of M100-series controller

1.1.1 Hardware feature

Model	IO quantity	Pulse axis quantity	Communication interface	
			Serial port	USB
HCM100-14MR-A	8-channel input	/	1*RS485 1*RS232	1 Channel
HCM100-14MT3-A	6-channel output	3 Axes		
HCM100-20MR-A	12-channel input	/		
HCM100-20MT4-A	8-channel output	4 Axes		
HCM100-30MR-A	16-channel input	/		
HCM100-30MT6-A	14-channel output	6 Axes		
HCM100-40MR-A	24-channel input	/		
HCM100-40MT6-A	16-channel output	6 Axes		
HCM100-48MR-A	28-channel input	/		
HCM100-48MT6-A	20-channel output	6 Axes		
HCM100-60MR-A	36-channel input	/		
HCM100-60MT6-A	24-channel output	6 Axes		

- **Standard USB/Type-C interface**

The Sysctrl Studio (PC software) can communicate with the CPU unit and transfer data via the USB/Type-C interface.

- **RS485/RS232 communication interface**

Some models support RS485/RS232 (master/slave) connections for devices such as touchscreens, VFDs, and barcode scanners.

1.2 M-series controller definition

The M100-series controller is a pulse-type motion controller independently developed and manufactured by HCFA, featuring rich functionalities, superior performance, and user-friendly operation. It integrates the functions of a Programmable Logic Controller (PLC) and motion control. The controller is equipped with built-in input/output channels and multiple communication interfaces. Its built-in input/output channels support high-speed I/O, with a maximum of 6 high-speed output channels and 2 high-speed input channels. All models are standard-equipped with USB, RS485, and RS232 communication interfaces; some models can expand RS485, RS232, CAN, and other communication interfaces via expansion cards.

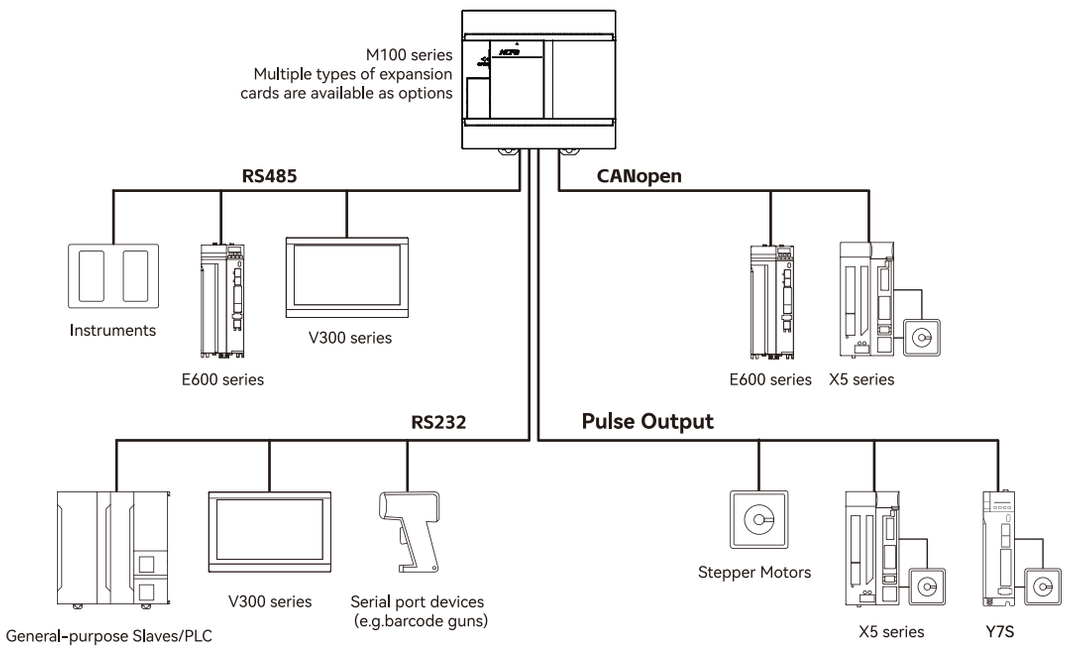
The M100-series controller is equipped with multiple communication interfaces, including USB, RS485, RS232, and CAN. Among these, the RS485 and RS232 interfaces support Modbus protocol and custom protocol, and can function as both a master and a slave; the CAN communication interface supports the CANopen DS301v4.02 protocol and can function as both a master and a slave.

The M100-series controller provides a comprehensive and user-friendly set of motion control functions that comply with the internationally recognized motion command standards established by PLCopen. It supports a full range of single-axis operations, including homing, positioning, and speed regulation, while also incorporating advanced features such as electronic gearing.

1.3 Controller overview

1.3.1 System configuration

The system topology of the M100-series controller is shown below.



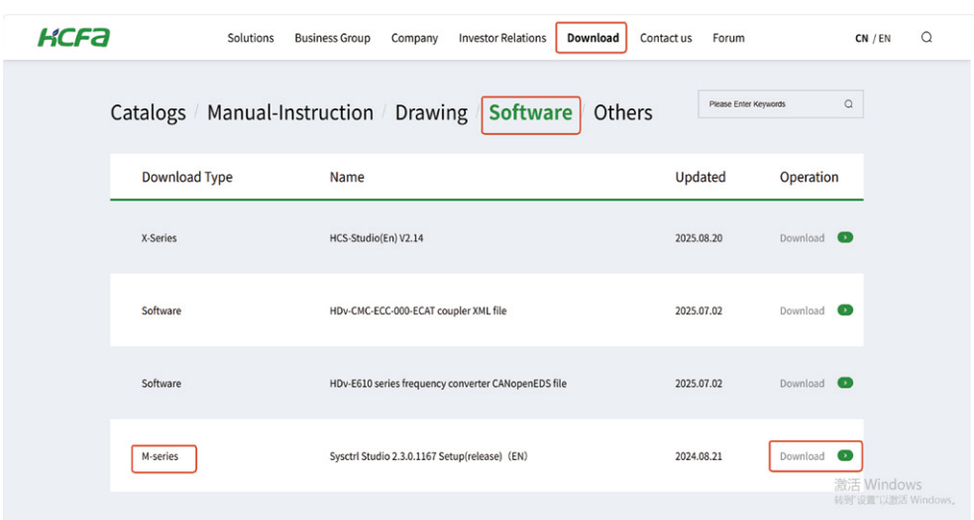
1.3.2 Software description

◆ Supported connection method

Model		M100-series controller
USB	Quantity	1x Type-C (USB 2.0)
	Supported function	Program upload and download ,software monitoring and debugging, firmware upgrade etc.

◆ Software download link

To download the software, please visit the official English website of Zhejiang Hechuan Technology Co., Ltd.: https://www.hcfaglobal.com/. Click [Download] at the top of the page, then on the redirected page, click 【Software】 → 【Sysctrl Studio 2.3.0.1167 Setup (Release) (EN)】 → 【Download】.



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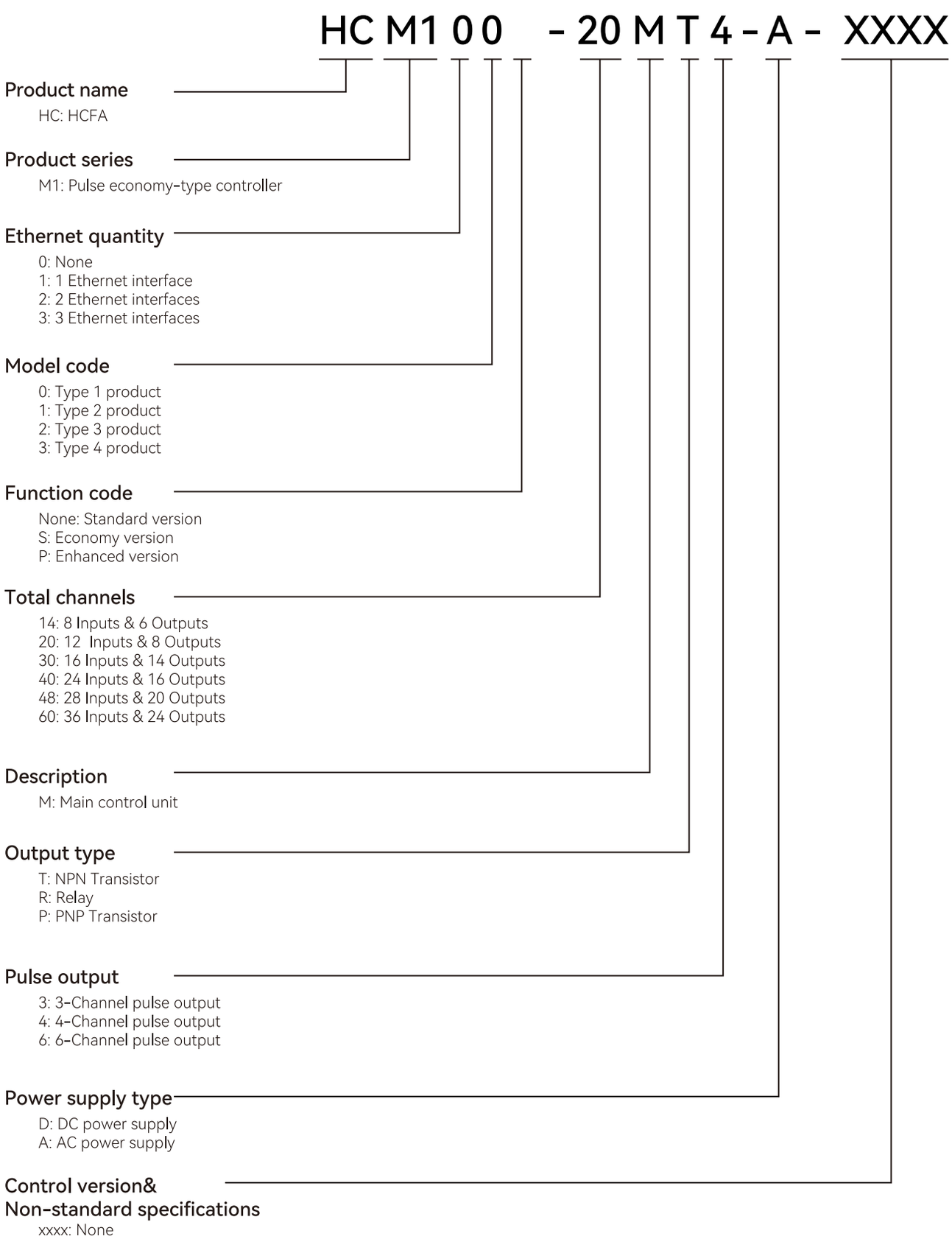
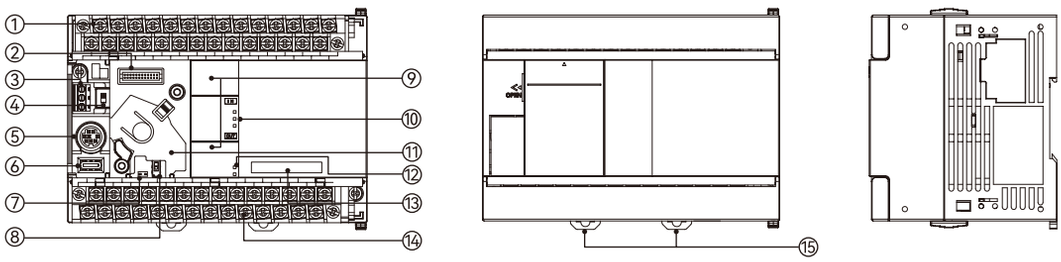
2.1 Product model



2.2 Basic composition

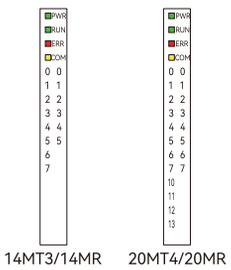
2.2.1 Names and functions of CPU components



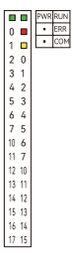
No.	Name	Function
(1)	Input terminal	Digital input channels and common terminal
(2)	Expansion card interface pin header	Used to connect the expansion card
(3)	RS485 communication interface	Supports Modbus master or slave mode, and custom communication protocols
(4)	RUN/STOP switch	Starts or stops the operation of the controller's programs. Toggle to RUN to start, and to STOP to stop.
(5)	RS232 communication interface	Supports Modbus master or slave mode, and custom communication protocols
(6)	Type-C interface	USB 2.0 interface, supporting user program upload/download, firmware upgrades, etc. after connecting to a host computer
(7)	Battery interface pin header	Used to connect the RTC (Real-Time Clock) battery
(8)	Burning switch	Switch for firmware burning
(9)	Channel status indicator	Indicates the current channel status. For details on the indicators, refer to 2.2.2 Indicator description.
(10)	System status indicator	Displays the operating status of the controller system
(11)	RTC battery compartment	Place the RTC battery
(12)	RS485/RS232 communication indicator	Displays the communication status of the RS232/485 communication interface
(13)	Product name	Product model
(14)	Output terminal	Digital output channels and common terminal
(15)	DIN rail mounting latch	Latch structure for mounting the controller on a DIN rail

2.2.2 Indicator description

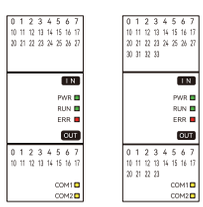
Silkscreen	Indicator	Color	State	Function
PWR	Power status	Green	Not lit	Power not connected
			Lit	Power normally connected
RUN	Operation status	Green	Not lit	Controller stopped
			Lit	Normal operation
ERR	System fault status	Red	Not lit	No fault occurs
			Lit	Fault occurs
COM / COM1 / COM2	RS485 communication status	Yellow	Not lit	No data sent
			Blinking	Sending data to other devices
14MR/14MT3				
IN N (0~7)	Input status	Green	Not lit	Input signal not detected on channel N
			Lit	Input signal detected on channel N
OUT N (0~5)	Output status	Green	Not lit	No signal output on channel N
			Lit	Signal output on channel N
20MR/20MT4				
IN N (0~7,10~13)	Input status	Green	Not lit	Input signal not detected on channel N
			Lit	Input signal detected on channel N
OUT N (0~7)	Output status	Green	Not lit	No signal output on channel N
			Lit	Signal output on channel N
30MR/30MT6				
IN N (0~7,10~17)	Input status	Green	Not lit	Input signal not detected on channel N
			Lit	Input signal detected on channel N
OUT N (0~7,10~15)	Output status	Green	Not lit	No signal output on channel N
			Lit	Signal output on channel N
40MR/40MT6				
N N (0~7,10~17,20~27)	Input status	Green	Not lit	Input signal not detected on channel N
			Lit	Input signal detected on channel N
OUT N (0~7,10~17)	Output status	Green	Not lit	No signal output on channel N
			Lit	Signal output on channel N
48MR/48MT6				
IN N (0~7,10~17,20~27,30~33)	Input status	Green	Not lit	Input signal not detected on channel N
			Lit	Input signal detected on channel N
OUT N (0~7,10~17,20~23)	Output status	Green	Not lit	No signal output on channel N
			Lit	Signal output on channel N
60MR/60MT6				
IN N (0~7,10~17,20~27,30~37,40~43)	Input status	Green	Not lit	Input signal not detected on channel N
			Lit	Input signal detected on channel N
OUT N (0~7,10~17,20~27)	Output status	Green	Not lit	No signal output on channel N
			Lit	Signal output on channel N



14MT3/14MR 20MT4/20MR



30MT6/30MR


40MT6/40MR 48MT6/48MR

60MT6/60MR

2.2.3 Expansion card

Item		Specification
		M100-series controller
Supported quantity		1
Model	RS485 communication	HCMXB-2RS485-100-BD
	RS232 communication	HCMXB-2RS232-100-BD
	CAN communication	HCMXB-CAN-100-BD

* For details on the RS485 communication expansion card, refer to 6.2 RS485 communication.

* For details on the RS232 communication expansion card, refer to 6.3 RS232 communication.

* For details on the CAN communication expansion card, refer to 6.4 CAN communication.

2.2.4 USB/Type-C interface

Item		Specification
		M100-series controller
USB	Number of interfaces	1x Type-C (USB 2.0)
	Supported function	Program upload and download ,software monitoring and debugging, firmware upgrade

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3.5.1 RS485 specifications 27

3.5.2 RS232 specifications 27

3.5.3 CAN specifications 27

3.1 General specifications

Item		Specification				
Weight		HCM100-14MR-A: 320g (net weight); HCM100-14MT3-A: 300g (net weight); HCM100-20MR-A: 380g (net weight); HCM100-20MT4-A: 330g (net weight); HCM100-30MR-A: 430g (net weight); HCM100-30MT6-A: 400g (net weight); HCM100-40MR-A: 560g (net weight); HCM100-40MT6-A: 540g (net weight); HCM100-48MR-A: 650g (net weight); HCM100-48MT6-A: 620g (net weight); HCM100-60MR-A: 710g (net weight); HCM100-60MT6-A: 650g (net weight).				
Dimensions		HCM100-14MR-A / HCM100-14MT3-A: 60.5mm (W) *90.0mm (H)*75.0mm (D) HCM100-20MR-A / HCM100-20MT4-A: 75.5mm (W) *90.0mm (H)*75.0mm (D) HCM100-30MR-A / HCM100-30MT6-A: 100.0mm (W) *90.0mm (H)*75.0mm (D) HCM100-40MR-A / HCM100-40MT6-A: 130.0mm (W) *96.5mm (H)*82.1mm (D) HCM100-48MR-A / HCM100-48MT6-A: 175.0mm (W) *96.5mm (H)*82.1mm (D) HCM100-60MR-A / HCM100-60MT6-A: 175.0mm (W) *96.5mm (H)*82.1mm (D)				
Operating environment	Operating temperature	0~55℃				
	Storage temperature	-25~70℃				
	Ambient humidity	10% ~95%, (no-condensing)				
	Ambient environment	Low levels of dust and corrosive gases				
	Altitude/Pressure	Below 2000 m (80 kPa)				
	Noise immunity	≥ 1500 Vp-p, pulse width 1μs, 50ms (based on noise simulator); compliant with IEC standards (IEC 61000-4-2/3/4/6)				
	Vibration resistance	Installation condition	Frequency (Hz)	Acceleration (m/s^2)	Single amplitude (mm)	10 times in each of X, Y, Z directions (total 80 times each)
		When installed on a DIN rail:	10~57	—	0.035	
			57~150	4.9	—	
	Shock (Impact) resistance	Acceleration: 150 m/s^2; Duration: 11 ms; 2 times in each of X, Y, Z directions.				
	IP rating	IP20				
	Pollution degree	Pollution degree II,Generally only non-conductive contamination, but temporary conductivity due to occasional condensation should be expected.				
Isolation method		Digital isolation				
Heat dissipation method		Passive heat dissipation, natural air cooling				
Installation position		Inside the control cabinet				
Main body material		Standard PPE material				
Certification		CE				

3.2 Electrical specifications

Item	Specification											
	14MT3	14MR	20MT4	20MR	30MT6	30MR	40MT6	40MR	48MT6	48MR	60MT6	60MR
Power supply voltage	AC100 ~ 240V (-15% ~ 10%) , 50 / 60Hz ± 5%											
Power consumption	7W	9W	7W	10W	8W	11W	11W	13W	11W	14W	12W	18W
Power fuse rating	3.15A											
DC24V output voltage	DC24V (-10%~+10%)											
DC24V output current	Max. 500mA											
Insulation resistance	5 MΩ or more (between all inputs/outputs and ground: 500 V AC)											

3.3 Performance specifications

Item			Specification					
			14MT3-A 14MR-A	20MT4-A 20MR-A	30MT6-A 30MR-A	40MT6-A 40MR-A	48MT6-A 48MR-A	60MT6-A 60MR-A
Programming	Program capacity		256 KBytes					
	Variable capacity		256 KBytes (including 16 KBytes of persistent data memory)					
	I area (%)		128Bytes					
	Q area (%Q)		128Bytes					
	M area (%M)		128KBytes					
Programming language			LD, ST, C/C++					
Axis capacity	Number of pulse axes*		3 Axes 100k	4 Axes 100k	6 Axes 100k	6 Axes 100k	6 Axes 100k	6 Axes 100k
	Number of encoder axes		2					
	Number of virtual axes		≤ 16					
	Number of virtual encoder axes		≤ 16					
	Total number of axes (pulse axes + encoder axes + virtual axes)		≤ 16					
Right expansion	Maximum number of expansion modules		Right-side expansion not supported; expandable via optional HCMX-CAN-100-BD card for CAN remote expansion					
RTC battery			Built-in					
Optional card	Maximum number of optional cards		1					
Host IO channel	Input	Number of channels	8-channel inputs	12-channel inputs	16-channel inputs	24-channel inputs	28-channel inputs	36-channel inputs
		Function	Supports 8-channel external interrupts and 2-channel high-speed pulse inputs (100kHz) (AB phase, pulse+direction, single pulse)					
	Out-put*	Number of channels	6-channel outputs	8-channel outputs	14-channel outputs	16-channel outputs	20-channel outputs	24-channel outputs
		Function *	Supports 3-channel pulse outputs (100KHz) (pulse+direction)	Supports 4-channel pulse outputs (100KHz) (pulse+direction)	Supports 6-channel pulse outputs (100KHz) (pulse+direction)			

USB	Number of interfaces		1 USB2.0 Type-C
	Supported function		Program upload and download ,software monitoring and debugging, firmware upgrade
Serial port	RS485	Number of interfaces	Max. 3 channels: 1 built-in channels, expandable by 2 more with optional HCMXB-2RS485-100-BD card
		Supported protocol	Modbus Master/Slave (ASCII/RTU); Custom protocol
		Max. number of slaves	32
		Baud rate (bps)	9600, 19200, 38400, 57600, 115200
	RS232	Number of interfaces	Max. 3 channels: 1 built-in channels, expandable by 2 more with optional HCMXB-2RS232-100-BD card
		Supported protocol	Modbus Master/Slave (ASCII/RTU); Custom protocol
		Max. number of slaves	1
		Baud rate (bps)	9600, 19200, 38400, 57600, 115200
CAN	Number of interfaces		Expandable by 1 channel with optional HCMXB-CAN-100-BD card
	Supported protocol		CANopen protocol (DS301), can act as master or slave; supports 32 slaves when acting as master

Note: Only MT models support pulse output. MT models feature NPN output, while MR models feature relay output.

3.4 IO specifications

3.4.1 Terminal configuration of M100-series controller

HCM100-14MR-A

	E	S/S	I1	I3	I5	I7
L*[1]	N	I0	I2	I4	I6	
	0V	Q0	Q1	Q2	Q4	·
24V	COM0*[2]	COM1	COM2	Q3	Q5	

HCM100-20MR-A

	E	S/S	I1	I3	I5	I7	I11	I13
L	N	I0	I2	I4	I6	I10	I12	
	0V	Q0	Q1	Q2	Q3	Q4	Q6	·
24V	COM0	COM1	COM2	COM3	COM4	Q5	Q7	

HCM100-14MT3-A

	E	S/S	I1	I3	I5	I7
L	N	I0	I2	I4	I6	
	0V	Q0	Q1	Q2	Q4	·
24V	COM0	COM1	COM2	Q3	Q5	

HCM100-20MT4-A

	E	S/S	I1	I3	I5	I7	I11	I13
L	N	I0	I2	I4	I6	I10	I12	
	0V	Q0	Q1	Q2	Q3	Q4	Q6	·
24V	COM0	COM1	COM2	COM3	COM4	Q5	Q7	

HCM100-30MR-A

	E	S/S	S/S	I1	I3	I5	I7	I11	I13	I15	I17
L	N	S/S	I0	I2	I4	I6	I10	I12	I14	I16	
	0V	Q0	Q1	Q2	Q4	COM3	Q7	Q11	Q12	Q14	·
24V	COM0	COM1	COM2	Q3	Q5	Q6	Q10	COM4	Q13	Q15	

HCM100-30MT6-A

	E	S/S	S/S	I1	I3	I5	I7	I11	I13	I15	I17
L	N	S/S	I0	I2	I4	I6	I10	I12	I14	I16	
	0V	Q0	Q1	Q2	Q4	COM3	Q7	Q11	Q12	Q14	·
24V	COM0	COM1	COM2	Q3	Q5	Q6	Q10	COM4	Q13	Q15	

HCM100-40MR-A

	E	S/S	I1	I3	I5	I7	I11	I13	I15	I17	I21	I23	I25	I27
L	N	I0	I2	I4	I6	I10	I12	I14	I16	I20	I22	I24	I26	
	0V	Q0	Q1	Q2	·	Q4	Q6	·	Q10	Q12	·	Q14	Q16	·
24V	COM0	COM1	COM2	Q3	COM3	Q5	Q7	COM4	Q11	Q13	COM5	Q15	Q17	

HCM100-40MT6-A

	E	S/S	I1	I3	I5	I7	I11	I13	I15	I17	I21	I23	I25	I27
L	N	I0	I2	I4	I6	I10	I12	I14	I16	I20	I22	I24	I26	
	0V	Q0	Q1	Q2	·	Q4	Q6	·	Q10	Q12	·	Q14	Q16	·
24V	COM0	COM1	COM2	Q3	COM3	Q5	Q7	COM4	Q11	Q13	COM5	Q15	Q17	

HCM100-48MR-A

	E	S/S	I1	I3	I5	I7	I11	I13	I15	I17	I21	I23	I25	I27	I31	I33	·	·	·	·
L	N	I0	I2	I4	I6	I10	I12	I14	I16	I20	I22	I24	I26	I30	I32	·	·	·	·	
	0V	Q0	Q1	Q2	·	Q4	Q6	·	Q10	Q12	·	Q14	Q16	·	Q20	Q22	·	·	·	·
24V	COM0	COM1	COM2	Q3	COM3	Q5	Q7	COM4	Q11	Q13	COM5	Q15	Q17	COM6	Q21	Q23	·	·	·	

HCM100-48MT6-A

	E	S/S	I1	I3	I5	I7	I11	I13	I15	I17	I21	I23	I25	I27	I31	I33	·	·	·	·
L	N	I0	I2	I4	I6	I10	I12	I14	I16	I20	I22	I24	I26	I30	I32	·	·	·	·	
	0V	Q0	Q1	Q2	·	Q4	Q6	·	Q10	Q12	·	Q14	Q16	·	Q20	Q22	·	·	·	·
24V	COM0	COM1	COM2	Q3	COM3	Q5	Q7	COM4	Q11	Q13	COM5	Q15	Q17	COM6	Q21	Q23	·	·	·	

HCM100-60MR-A

	E	S/S	I1	I3	I5	I7	I11	I13	I15	I17	I21	I23	I25	I27	I31	I33	I35	I37	I41	I43
L	N	I0	I2	I4	I6	I10	I12	I14	I16	I20	I22	I24	I26	I30	I32	I34	I36	I40	I42	
	0V	Q0	Q1	Q2	·	Q4	Q6	·	Q10	Q12	·	Q14	Q16	·	Q20	Q22	·	Q24	Q26	·
24V	COM0	COM1	COM2	Q3	COM3	Q5	Q7	COM4	Q11	Q13	COM5	Q15	Q17	COM6	Q21	Q23	COM7	Q25	Q27	

HCM100-60MT6-A

	E	S/S	I1	I3	I5	I7	I11	I13	I15	I17	I21	I23	I25	I27	I31	I33	I35	I37	I41	I43
L	N	I0	I2	I4	I6	I10	I12	I14	I16	I20	I22	I24	I26	I30	I32	I34	I36	I40	I42	
	0V	Q0	Q1	Q2	·	Q4	Q6	·	Q10	Q12	·	Q14	Q16	·	Q20	Q22	·	Q24	Q26	·
24V	COM0	COM1	COM2	Q3	COM3	Q5	Q7	COM4	Q11	Q13	COM5	Q15	Q17	COM6	Q21	Q23	COM7	Q25	Q27	

Note 1: For the input terminals, connect L to the live wire, N to the neutral wire, E to the ground wire, and S/S serves as the common terminal.

2: For the output terminals, COM is the common terminal, and the DC output is between 24V and 0V; the thick-line isolated area contains one group, and the COM terminals within the isolated area are mutually conductive.

3.4.2 Terminal description for input channel and output channel of M100-series controller

Item		14MT3	14MR	20MT4	20MR	30MT6	30MR	40MT6	40MR	48MT6	48MR	60MT6	60MR
Input	General input	8 (I0~I7)		12 (I0~I7) (I10~I13)		16 (I0~I7) (I10~I17)		24 (I0~I7) (I10~I17) (I20~I27)		28 (I0~I7) (I10~I17) (I20~I27) (I30~I33)		36 (I0~I7) (I10~I17) (I20~I27) (I30~I37) (I40~I43)	
	High-speed input channel	2 (I0~I3)											
Output	General output	6 (Q0~Q5)		8 (Q0~Q7)		14 (Q0~Q7) (Q10~Q15)		16 (Q0~Q7) (Q10~Q17)		20 (Q0~Q7) (Q10~Q17) (Q20~Q23)		24 (Q0~Q7) (Q10~Q17) (Q20~Q27)	
	High-speed output channel	3 (Q0~Q5)	0	4 (Q0~Q7)	0	6 (Q0~Q7, Q10~Q13)	0	6 (Q0~Q7, Q10~Q13)	0	6 (Q0~Q7, Q10~Q13)	0	6 (Q0~Q7, Q10~Q13)	0

3.4.3 General IO input/output

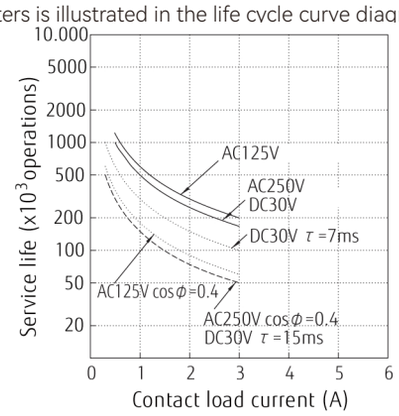
◆ General IO input

Item	Specification					
	14MT3-A 14MR-A	20MT4-A 20MR-A	30MT6-A 30MR-A	40MT6-A 40MR-A	48MT6-A 48MR-A	60MT6-A 60MR-A
Number of input channels	8	12	16	24	28	36
Input channel number	I0~I7	I0~I7,I10~I13	I0~I7,I10~I17	I0~I7,I10~I17, I20~I27	I0~I7,I10~I17, I20~I27,I30~I33	I0~I7,I10~I17,I20~I27,I30~I37,I40~I43
Device corresponding to the input channel	%IX0.0~%IX0.7	%IX0.0~%IX0.7, %IX1.0~%IX1.3	%IX0.0~%IX0.7, %IX1.0~%IX1.7	%IX0.0~%IX0.7, %IX1.0~%IX1.7, %IX2.0~%IX2.7	%IX0.0~%IX0.7, %IX1.0~%IX1.7, %IX2.0~%IX2.7, %IX3.0~%IX3.3	%IX0.0~%IX0.7,%IX1.0~%IX1.7,%IX2.0~%IX2.7,%IX3.0~%IX3.7,%IX4.0~%IX4.3
Input signal mode	Sink mode or source mode Sink mode: The common terminal is connected to the 24V of the DC 24V power supply. Source mode: The common terminal is connected to the 0V of the DC 24V power supply.					
Input channel terminal type	Non-detachable terminal			Detachable terminal		
Common terminal configuration	All channels/common terminals; common terminal S/S can be connected to 24V or 0V of a DC 24V power supply					
Input voltage/current	DC 24V/5mA					
Voltage when ON	≥ DC 15V					
Voltage when OFF	≤ DC 5V					
Input current when ON	>4mA					
Input current when OFF	<2.5mA					
Response time: OFF -> ON	< 2.5μs					
Response time: ON -> OFF	< 2.5μs					
Input impedance	2.7kΩ					
Isolation method	Integrated chip capacitive isolation					
Input operation indication	When the isolated digital input receiver is driven, the input channel indicator lights up.					

◆ General IO output

Item		Specification					
		14MT3-A	20MT4-A	30MT6-A	40MT6-A	48MT6-A	60MT6-A
Number of output channels		6	8	14	16	20	24
Output channel number		Q0~Q5	Q0~Q7	Q0~Q7,Q10~Q15	Q0~Q7,Q10~Q17	Q0~Q7,Q10~Q17, Q20~Q23	Q0~Q7,Q10~Q17, Q20~Q27
Device corresponding to the output channel		%QX0.0~%QX0.5	%QX0.0~%QX0.7	%QX0.0~%QX0.7, %QX1.0~%QX1.5	%QX0.0~%QX0.7, %QX1.0~%QX1.7	%QX0.0~%QX0.7, %QX1.0~%QX1.7 %QX2.0~%QX2.3	%QX0.0~%QX0.7, %QX1.0~%QX1.7 %QX2.0~%QX2.7
Output channel type		Transistor sink output					
Common terminal configuration		Max. 8 channels/common terminal, i.e., up to 8 output channels share a common terminal					
Output channel terminal type		Non-detachable terminal			Detachable terminal		
Leakage current when OFF		<10μA					
Maximum load		Resistive load: 0.5A per channel, 4A per common channel					
		Inductive load: 7.2W per channel, 24W per common channel					
		Bulb load: 5W per channel, 18W per common channel					
Minimum load		1mA / 5V					
Maximum response time	OFF -> ON	< 2.5μs					
	ON -> OFF	< 2.5μs					
Output isolation voltage		3.75kV					

Item	Specification					
	14MR-A	20MR-A	30MR-A	40MR-A	48MR-A	60MR-A
Number of output channels	6	8	14	16	20	24
Output channel number	Q0~Q5	Q0~Q7	Q0~Q7,Q10~Q15	Q0~Q7,Q10~Q17	Q0~Q7,Q10~Q17, Q20~Q23	Q0~Q7,Q10~Q17, Q20~Q27
Device corresponding to the output channel	%QX0.0~%QX0.5	%QX0.0~%QX0.7	%QX0.0~%QX0.7, %QX1.0~%QX1.5	%QX0.0~%QX0.7, %QX1.0~%QX1.7	%QX0.0~%QX0.7, %QX1.0~%QX1.7 %QX2.0~%QX2.3	%QX0.0~%QX0.7, %QX1.0~%QX1.7 %QX2.0~%QX2.7
Output channel type	Relay output					
Common terminal configuration	Max. 4 channels/common terminal, i.e., up to 4 output channels share a common terminal					
Output channel terminal type	Non-detachable terminal			Detachable terminal		
Output voltage level	250V AC 24V DC					

Maximum load		Resistive load: 2A per channel, 8A per common channel
		Inductive load: Relay contacts are non-polarized and can be connected to both AC and DC power supplies. Each relay can handle a maximum current of 2A. The service life of relay contacts depends on several factors, including the contact operating voltage, contact current magnitude, and load type (time-constant t, power-factor cos ψ). The relationship among these parameters is illustrated in the life cycle curve diagram below. 
		Bulb load: 100W (220V AC)
Minimum load		1mA / 5V
Max. response time	OFF -> ON	Approx. 15ms
	ON -> OFF	Approx. 15ms
Max. switching frequency		1Hz
Isolated (Y/N)		Y

3.4.4 High-speed input/output

◆ High-speed input

Item		Specification					
		14MT3-A 14MR-A	20MT4-A 20MR-A	30MT6-A 30MR-A	40MT6-A 40MR-A	48MT6-A 48MR-A	60MT6-A 60MR-A
Maximum pulse frequency		100KHZ					
Number of input channels		2					
Input channel number		I0~I3					
Device corresponding to the input channel		%IX0.0~%IX0.3					
Input form	AB phase	Channel 1: I0~I1; Channel 2: I2~I3					
	Pulse+direction	In channel 1: I0 is pulse, I1 is direction; In channel 2: I2 is pulse, I3 is direction					
	Single pulse	In channel 1: I0 is pulse, In channel 2: I2 is pulse					
Interrupt		I0~I7 Supports interrupt tasks (rising edge or falling edge), Additionally, the position of the high-speed input channel can be accurately captured through the input channel					

◆ High-speed output

Item		Specification					
		14MT3-A	20MT4-A	30MT6-A	40MT6-A	48MT6-A	60MT6-A
Maximum pulse frequency		100KHZ					
Number of pulse axes		3 Axes	4 Axes	6 Axes			
Number of output channels		3	4	6			
Output channel number		Q0~Q5	Q0~Q7	Q0~Q7, Q10~Q13			
Device corresponding to the output channel		%QX0.0~%QX0.5	%QX0.0~%QX0.7	%QX0.0~%QX0.7, %QX1.0~%QX1.3			
Output form	Pulse+direction	Q0~Q5 Even-numbered channels are pulse, odd-numbered channels are direction	Q0~Q7 Even-numbered channels are pulse, odd-numbered channels are direction	Q0~Q7, Q10~Q13 Even-numbered channels are pulse, odd-numbered channels are direction			

3.5 Communication specifications

3.5.1 RS485 specifications

Item	Specification
Interface type	3-Pin serial communication terminal
Data transfer rate	9600, 19200, 38400, 57600, 115200bps
Maximum transmission distance	500m (at 9600bps)
Supported protocol	Modbus master/slave (ASCII/RTU); custom communication protocol
Isolation method	Digital isolator insulation
Termination resistor	External 120Ω
Number of supported slaves	32

3.5.2 RS232 specifications

Item	Specification
Interface type	Round-head communication terminal
Data transfer rate	9600, 19200, 38400, 57600, 115200bps
Maximum transmission distance	15m (at 9600bps)
Supported protocol	Modbus master/slave (ASCII/RTU); custom communication protocol
Isolation method	Digital isolator insulation
Number of supported slaves	1

3.5.3 CAN specifications

Item	Specification
Interface type	6-Pin communication terminal
Data transfer rate	Maximum 1Mbps
Maximum transmission distance	2500m (at 20kbit/s)

Supported protocol	CANOpen
Isolation method	Digital isolator insulation
Termination resistor	External 120Ω
Number of supported slaves	32

Chapter 4 Software Configuration and Usage Steps

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4.1 Software usage steps

◆ Step1. Installation

Step	Content	Reference
1-1 Establish configuration	• Install on DIN rail • Connect units to each other	Chapter 5 Installation and Wiring
1-2 Configure slave	• Slave node address setting	

◆ Step 2. Wiring

Step	Content	Reference
2-1 EtherNet cable wiring	• Wiring of built-in EtherNet/IP interface	Chapter 5 Installation and Wiring
2-2 I/O wiring	• Wiring of basic I/O unit	
2-3 Computer (Sysctrl Studio) wiring	• USB cable wiring • Wiring of built-in EtherNet/IP interface	

◆ Step 3. Software configuration and setup

Step	Content	Reference
3-1 Configure IO and addresses	• Create a new project • Assign device variables to I/O interfaces • Create axes and assign to real or virtual axes	Chapter 2 CPU Unit Model and Component Description
3-2 Configure communication	• Establish communication between modules	Software Instruction Manual
3-3 Configure hardware configuration	• Create slave/unit configurations	
3-4 Configure task cycles	• Relationship between tasks and programs • Cycle of each tasks • Refresh cycle of slaves/units	
3-5 Design programs	• Design POU (Program Organization Unit) • Design variables	

◆ Step 4. Download and debugging

Step	Content	Reference
4-1 Online connection with Sysctrl Studio and project download	• Turn on the power of the controller and connect online with Sysctrl Studio.	Chapter 5 Installation and Wiring Software Instruction Manual

Chapter 5 Installation and Wiring

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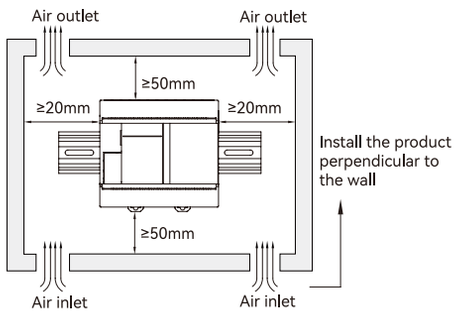
5.1 Installation instructions

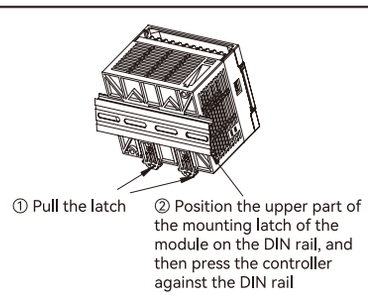
5.1.1 Installation within a control cabinet

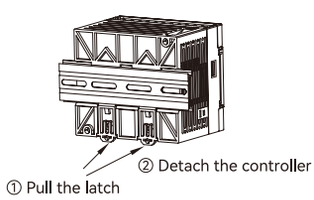
Please install the product perpendicular to the wall and ensure a sufficient cooling effect via natural air or a cooling fan. Please leave enough clearance around the product as shown in the right figure. During a side-by-side installation, please leave a horizontal clearance of more than 20 mm on both sides.

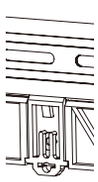
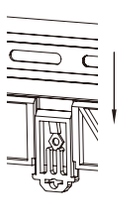


5.1.2 DIN rail mounting and dismounting

Before installation, check that the DIN rail mounting latch is in a locked state. During mounting, position the upper part of the mounting latch of the module on the DIN rail, and then press the controller against the DIN rail until a clear click is heard (which indicates the latch is momentarily opened and locked onto the rail). During dismounting, pull the latch upwards until a clear click is heard (which indicates the latch is unlocked), and then directly remove the controller.

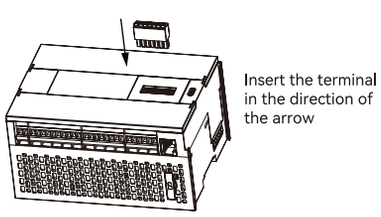


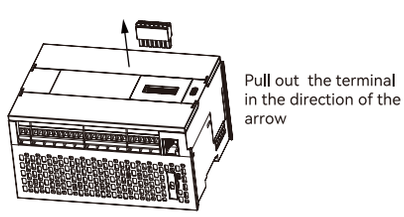


Locked	Unlocked
	

5.1.3 Removable terminal block mounting and dismounting

The mounting and dismounting of the removable terminal block are shown in the figures below.

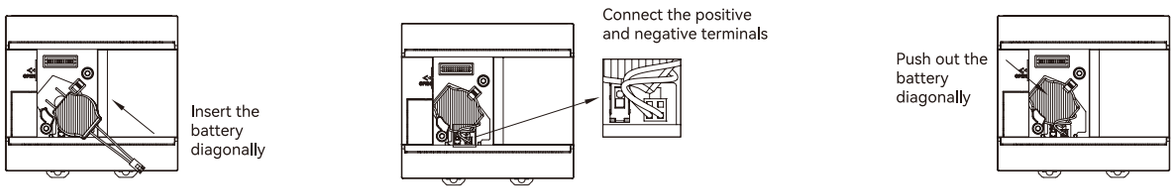




5.1.4 Battery mounting and dismounting

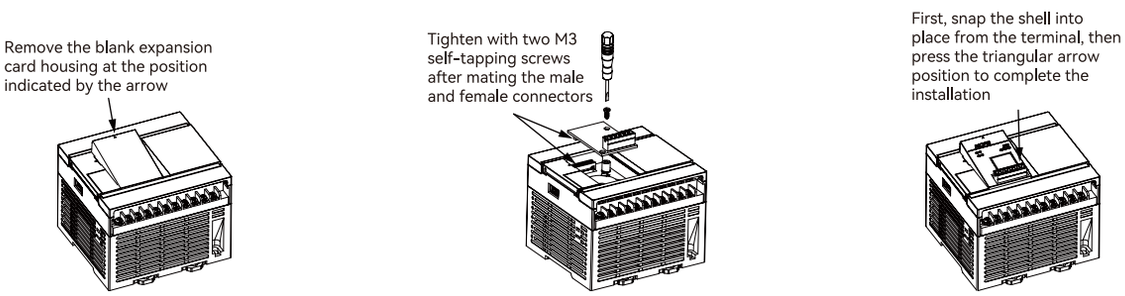
Insert a flat-blade screwdriver into the semicircular hole on the right side of the battery compartment, pry it outward, and then take out the battery compartment and the button battery inside along the direction of the arrow to complete the dismounting. Align the positive terminal of the battery with the "+" sign inside the battery compartment, insert the battery into the compartment, and then push the battery compartment into the device along the direction of the arrow to complete the

mounting.



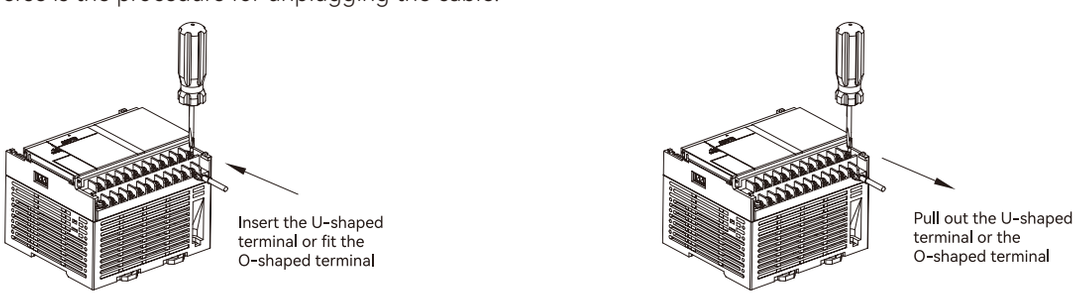
5.1.5 Expansion card mounting and dismounting

During mounting, place the controller horizontally. First, remove the blank expansion card housing at the position indicated by the arrow, then install the expansion card PCB. Connect the male connector of the controller to the female connector of the expansion card, use a screwdriver to tighten the two screws on the connectors, and finally install the expansion card housing. The installation is now complete. During dismounting, the reverse process is followed.



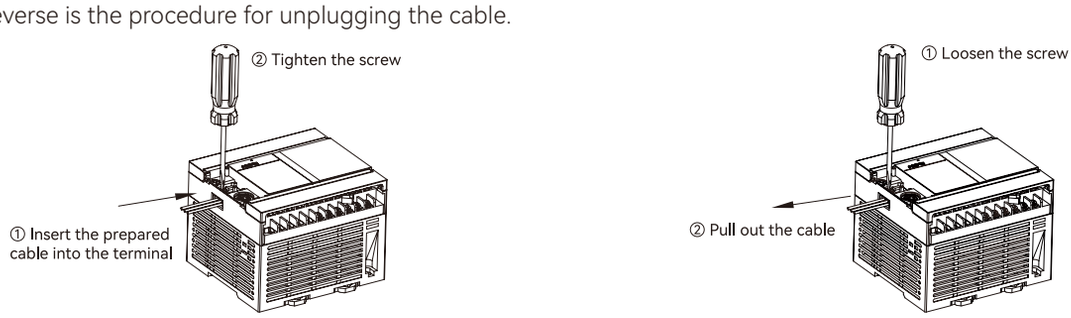
5.1.6 Cable connecting and disconnecting I

During connecting, use a small cross-point screwdriver to loosen the screws first. Insert the U-shaped terminal or fit the O-shaped terminal and then tighten the screws. Gently tug the cable, if the cable is secured firmly, then the connection is finished. The reverse is the procedure for unplugging the cable.



5.1.7 Cable connecting and disconnecting II

During connecting, use a slotted screwdriver to loosen the screw of the RS485 terminal first. Insert the prepared cable into the RS485 terminal and then tighten the screw. Gently tug the cable, if the cable is secured firmly, then the connection is finished. The reverse is the procedure for unplugging the cable.



5.2 Wiring instructions

5.2.1 Terminal configuration of M100-series controller

HCM100-14MR-A

	E	S/S	I1	I3	I5	I7
L*[1]	N	I0	I2	I4	I6	
	0V	Q0	Q1	Q2	Q4	·
24V	COM0*[2]	COM1	COM2	Q3	Q5	

HCM100-14MT3-A

	E	S/S	I1	I3	I5	I7
L	N	I0	I2	I4	I6	
	0V	Q0	Q1	Q2	Q4	·
24V	COM0	COM1	COM2	Q3	Q5	

HCM100-20MR-A

	E	S/S	I1	I3	I5	I7	I11	I13
L	N	I0	I2	I4	I6	I10	I12	
	0V	Q0	Q1	Q2	Q3	Q4	Q6	·
24V	COM0	COM1	COM2	COM3	COM4	Q5	Q7	

HCM100-20MT4-A

	E	S/S	I1	I3	I5	I7	I11	I13
L	N	I0	I2	I4	I6	I10	I12	
	0V	Q0	Q1	Q2	Q3	Q4	Q6	·
24V	COM0	COM1	COM2	COM3	COM4	Q5	Q7	

HCM100-30MR-A

	E	S/S	S/S	I1	I3	I5	I7	I11	I13	I15	I17
L	N	S/S	I0	I2	I4	I6	I10	I12	I14	I16	
	0V	Q0	Q1	Q2	Q4	COM3	Q7	Q11	Q12	Q14	·
24V	COM0	COM1	COM2	Q3	Q5	Q6	Q10	COM4	Q13	Q15	

HCM100-30MT6-A

	E	S/S	S/S	I1	I3	I5	I7	I11	I13	I15	I17
L	N	S/S	I0	I2	I4	I6	I10	I12	I14	I16	
	0V	Q0	Q1	Q2	Q4	COM3	Q7	Q11	Q12	Q14	·
24V	COM0	COM1	COM2	Q3	Q5	Q6	Q10	COM4	Q13	Q15	

HCM100-40MR-A

	E	S/S	I1	I3	I5	I7	I11	I13	I15	I17	I21	I23	I25	I27
L	N	I0	I2	I4	I6	I10	I12	I14	I16	I20	I22	I24	I26	
	0V	Q0	Q1	Q2	·	Q4	Q6	·	Q10	Q12	·	Q14	Q16	·
24V	COM0	COM1	COM2	Q3	COM3	Q5	Q7	COM4	Q11	Q13	COM5	Q15	Q17	

HCM100-40MT6-A

	E	S/S	I1	I3	I5	I7	I11	I13	I15	I17	I21	I23	I25	I27
L	N	I0	I2	I4	I6	I10	I12	I14	I16	I20	I22	I24	I26	
	0V	Q0	Q1	Q2	·	Q4	Q6	·	Q10	Q12	·	Q14	Q16	·
24V	COM0	COM1	COM2	Q3	COM3	Q5	Q7	COM4	Q11	Q13	COM5	Q15	Q17	

HCM100-48MR-A

	E	S/S	I1	I3	I5	I7	I11	I13	I15	I17	I21	I23	I25	I27	I31	I33	·	·	·	·
L	N	I0	I2	I4	I6	I10	I12	I14	I16	I20	I22	I24	I26	I30	I32	·	·	·	·	
	0V	Q0	Q1	Q2	·	Q4	Q6	·	Q10	Q12	·	Q14	Q16	·	Q20	Q22	·	·	·	·
24V	COM0	COM1	COM2	Q3	COM3	Q5	Q7	COM4	Q11	Q13	COM5	Q15	Q17	COM6	Q21	Q23	·	·	·	

HCM100-48MT6-A

	E	S/S	I1	I3	I5	I7	I11	I13	I15	I17	I21	I23	I25	I27	I31	I33	·	·	·	·
L	N	I0	I2	I4	I6	I10	I12	I14	I16	I20	I22	I24	I26	I30	I32	·	·	·	·	
	0V	Q0	Q1	Q2	·	Q4	Q6	·	Q10	Q12	·	Q14	Q16	·	Q20	Q22	·	·	·	·
24V	COM0	COM1	COM2	Q3	COM3	Q5	Q7	COM4	Q11	Q13	COM5	Q15	Q17	COM6	Q21	Q23	·	·	·	

HCM100-60MR-A

	E	S/S	I1	I3	I5	I7	I11	I13	I15	I17	I21	I23	I25	I27	I31	I33	I35	I37	I41	I43
L	N	I0	I2	I4	I6	I10	I12	I14	I16	I20	I22	I24	I26	I30	I32	I34	I36	I40	I42	
	0V	Q0	Q1	Q2	·	Q4	Q6	·	Q10	Q12	·	Q14	Q16	·	Q20	Q22	·	Q24	Q26	·
24V	COM0	COM1	COM2	Q3	COM3	Q5	Q7	COM4	Q11	Q13	COM5	Q15	Q17	COM6	Q21	Q23	COM7	Q25	Q27	

HCM100-60MT6-A

	E	S/S	I1	I3	I5	I7	I11	I13	I15	I17	I21	I23	I25	I27	I31	I33	I35	I37	I41	I43
L	N	I0	I2	I4	I6	I10	I12	I14	I16	I20	I22	I24	I26	I30	I32	I34	I36	I40	I42	
	0V	Q0	Q1	Q2	·	Q4	Q6	·	Q10	Q12	·	Q14	Q16	·	Q20	Q22	·	Q24	Q26	·
24V	COM0	COM1	COM2	Q3	COM3	Q5	Q7	COM4	Q11	Q13	COM5	Q15	Q17	COM6	Q21	Q23	COM7	Q25	Q27	

*Note 1: For the input terminals, connect L to the live wire, N to the neutral wire, E to the ground wire, and S/S serves as the common terminal.

2: For the output terminals, COM is the common terminal, and the DC output is between 24V and 0V; the thick-line isolated area contains one group, and the COM terminals within the isolated area are mutually conductive.

5.2.2 Power supply wiring

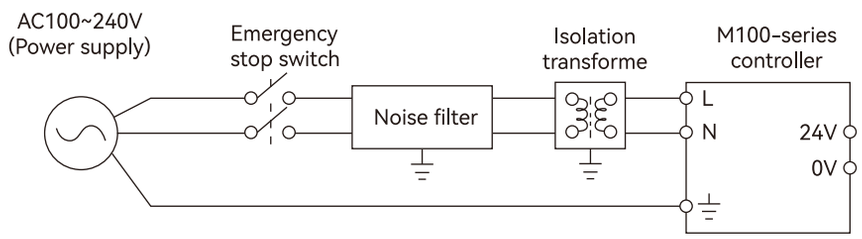
Please connect the L and N terminals of the power supply to the L and N terminals of the M100-series controller respectively. It is mandatory to connect the ground wire of the power supply to the grounding terminal of the M100-series controller to prevent system abnormalities.

It is recommended to install a noise filter and an isolation transformer in front of the controller's power supply. The isolation transformer should be placed between the noise filter and the controller's power supply.

It is recommended to add an emergency stop switch to the power input terminal of the controller to enable immediate power-off in case of emergency.

The 24V and 0V terminals of the M100-series controller are output power supplies, with a maximum output current of 500mA. The 24V terminal must not be powered by other power supplies.

It is recommended to route the AC power cables and the DC 24V power supply cables separately, with a distance of at least 100mm between the cables.

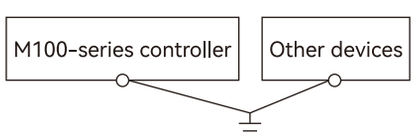


5.2.3 Grounding

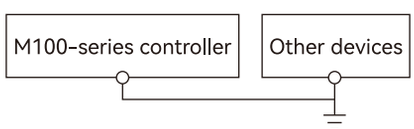
The wire diameter of the grounding cable must not be smaller than that of the L and N wires of the power cable.

When multiple devices need to be grounded simultaneously, it is recommended to ground each device independently, as shown in the figure below.

When multiple devices are grounded simultaneously, if it is not possible to ground each device independently, it is recommended to ground them in the manner shown in the figure below.



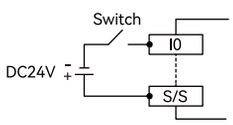
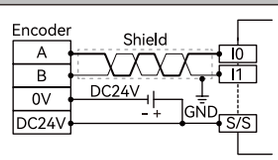
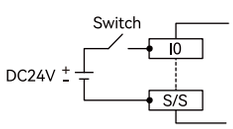
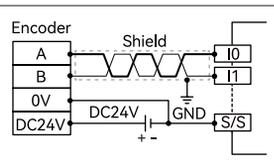
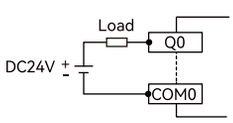
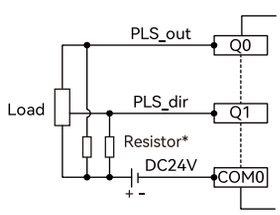
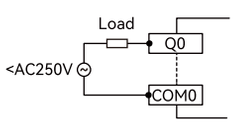
When multiple devices are grounded simultaneously, the grounding method shown in the figure below must not be used.



5.2.4 I/O wiring

◆ IO terminal description

Item		14MT3	14MR	20MT4	20MR	30MT6	30MR	40MT6	40MR	48MT6	48MR	60MT6	60MR
Input	General input	8 (I0~I7)		12 (I0~I7) (I10~I13)		16 (I0~I7) (I10~I17)		24 (I0~I7) (I10~I17) (I20~I27)		28 (I0~I7) (I10~I17) (I20~I27) (I30~I33)		36 (I0~I7) (I10~I17) (I20~I27) (I30~I37) (I40~I43)	
	High-speed input	2 (I0~I3)											
Output	General output	6 (Q0~Q5)		8 (Q0~Q7)		14 (Q0~Q7) (Q10~Q15)		16 (Q0~Q7) (Q10~Q17)		20 (Q0~Q7) (Q10~Q17) (Q20~Q23)		24 (Q0~Q7) (Q10~Q17) (Q20~Q27)	
	High-speed output channels	3 (Q0~Q5)	0	4 (Q0~Q7)	0	6 (Q0~Q7, Q10~Q13)	0	6 (Q0~Q7, Q10~Q13)	0	6 (Q0~Q7, Q10~Q13)	0	6 (Q0~Q7, Q10~Q13)	0

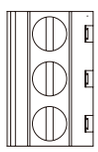
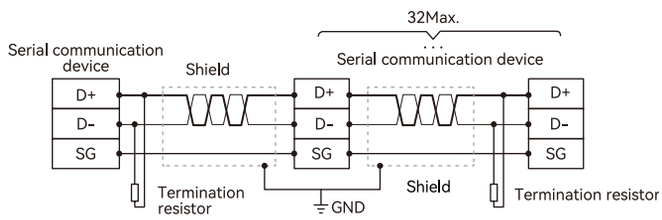
Type		General IO wiring	High-speed IO wiring
Input	Sink input		
	Source input		
Output	Transistor type		
	Relay type		

*Note : Connect a resistor of about 500 Ω between the output terminal and the 24V terminal when the output channel is used as a high-speed output.

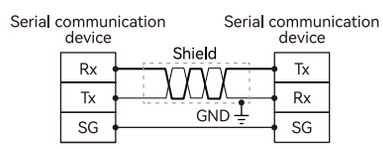
5.2.5 Communication wiring

Please refer to Chapter 6 for communication wiring in this chapter.

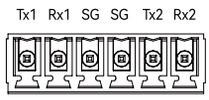
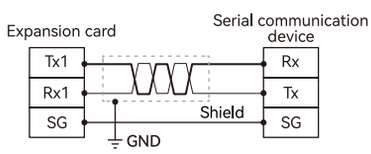
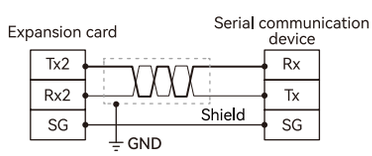
◆ RS485 communication terminal

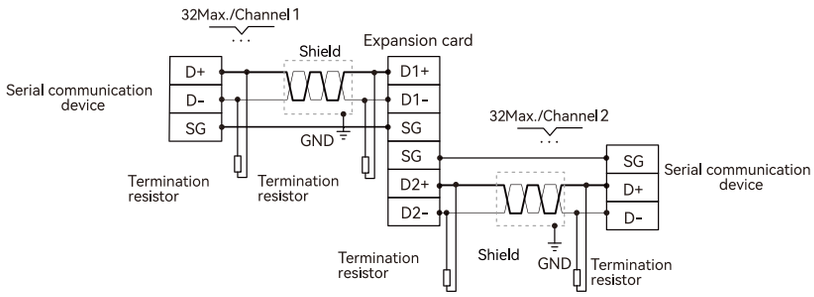
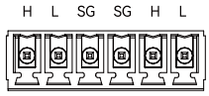
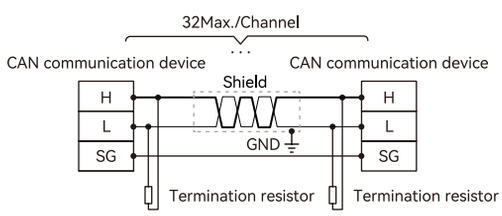
RS485 communication terminal			RS485 wiring
Serial data	D+		
	D-		
Signal ground	SG		

◆ RS232 communication terminal

RS232 communication terminal			RS232 Wiring
-	-	1		
		2	
		3	
Serial data	Rx	4	
	Tx	5	
-	-	6	
		7	
Signal ground	SG	8	

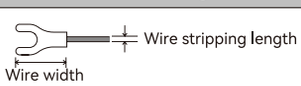
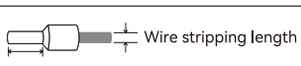
◆ Expansion card communication terminals

RS232 communication terminal			RS232 channel 1 wiring	RS232 channel 2 wiring
RS232 channel 1 data transmission	Tx1			
RS232 channel 1 data reception	Rx1			
RS232 channel 1 signal reference ground	SG*			
RS232 channel 2 signal reference ground	SG*			
RS232 channel 2 data transmission	Tx2			
RS232 channel 2 data reception	Rx2			

RS485 communication terminal			RS485 wiring
RS485 channel 1 communication signal +	D1+		
RS485 channel 1 communication signal -	D1-		
RS485 channel 1 signal reference ground	SG*		
RS485 channel 2 signal reference ground	SG*		
RS485 channel 2 communication signal +	D2+		
RS485 channel 2 communication signal -	D2-		
CAN communication terminal			CANOpen wiring
CAN communication signal (high)	H		
CAN communication signal (low)	L		
CAN communication signal reference ground	SG		
CAN communication signal reference ground	SG		
CAN communication signal (high)	H		
CAN communication signal (low)	L		

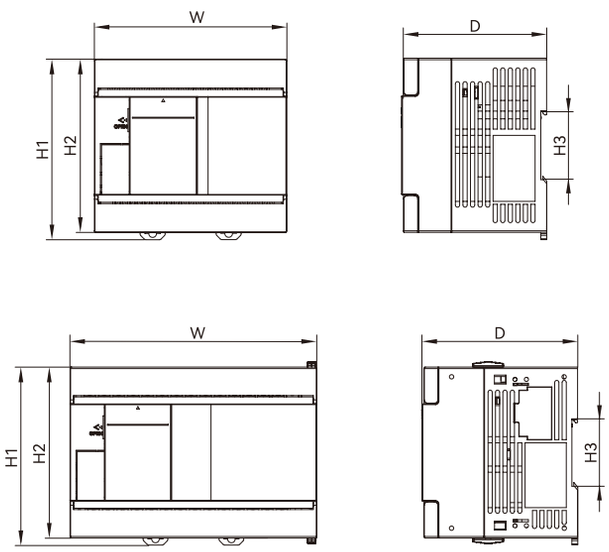
* Note: Signal reference ground (SG) is internally conductive.

5.2.6 Installation and wire gauge specifications

Controller terminal	Wire gauge range: AWG	Wire stripping length: mm	Schematic diagram
I/O, power supply, grounding terminals	22~18	6~7	
RS485 communication terminal	30~16	5~6	

5.3 Product dimensions

5.3.1 CPU unit dimensions



Model	Outline dimensions					Weight: g
	W1	H1	H2	H3	D	
HCM100-14MT3-A	60.50	93.70	90	35.50	75	300
HCM100-14MR-A						320
HCM100-20MT4-A	75.50					330
HCM100-20MR-A						380
HCM100-30MT6-A	100					400
HCM100-30MR-A						430
HCM100-40MT6-A	130	96.54	95.82	35.50	82.10	540
HCM100-40MR-A						560
HCM100-48MT6-A	175					620
HCM100-48MR-A						650
HCM100-60MT6-A	175					650
HCM100-60MR-A						710

Chapter 6 Communication

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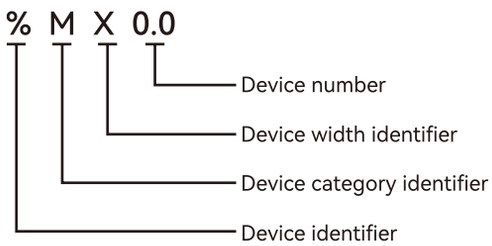
6.1 Device and Modbus address

6.1.1 Device name and range

◆ **Device representation method**



M-series controller devices use the "%" symbol for identification. Users can select the required device based on the device category and width. Devices can be accessed by bit, byte, word, double word, or quad word. The representation method is shown in the table below:

Item	Content				
Device identifier	%: Indicates the use of a device				
Device category	I	Q	M	-	-
	Input device	Output device	Intermediate device	-	-
Device width	X	B	W	D	L
	Bit device	Byte device	Word device	Double word device	Quad word device
Device index	-	-	-	-	-
Bit offset	-	-	-	-	-
Device example	%IX0.0	%IB0	%IW0	%ID0	%IL0
	%QX0.0	%QB0	%QW0	%QD0	%QL0
	%MX0.0	%MB0	%MW0	%MD0	%ML0

◆ **The device correspondence is shown in the table below:**

As shown in the table, %ML0 consists of %MB0~%MB7, %MW0~%MW3, and %MD0~%MD1; %MD0 consists of %MB0~%MB3 and %MW0~%MW1; %MW0 consists of %MB0~%MB1. The numbering of bit devices is consistent with the labeling of byte devices. For example, Bit 0 of %MB2 corresponds to %MX2.0; %MB2 consists of %MX2.0~2.7; %MW1 consists of %MX2.0~2.7 and %MX3.0~3.7.

Device category	Device correspondence																							
	The 1st WORD						The 2nd WORD						The 3rd WORD						The 4th WORD					
	Bit 0	…	Bit 7	Bit 8	…	Bit 15	Bit 0	…	Bit 7	Bit 8	…	Bit 15	Bit 0	…	Bit 7	Bit 8	…	Bit 15	Bit 0	…	Bit 7	Bit 8	…	Bit 15
%MX	%MX0.0~0.7			%MX1.0~1.7			%MX2.0~2.7			%MX3.0~3.7			%MX4.0~4.7			%MX5.0~5.7			%MX6.0~6.7			%MX7.0~7.7		
%MB	%MB0			%MB1			%MB2			%MB3			%MB4			%MB5			%MB6			%MB7		
%MW	%MW0						%MW1						%MW2						%MW3					
%MD	%MD0												%MD1											
%ML	%ML0																							

As shown in the table, %ML1 consists of %MB8~%MB15, %MW4~%MW7, and %MD2~%MD3; %MD2 consists of %MB8~%MB11 and %MW4~%MW5; %MW4 consists of %MB8~%MB9. The numbering of bit devices is consistent with the labeling of byte devices. For example, Bit 0 of %MB8 corresponds to %MX8.0; %MB8 consists of %MX8.0~8.7. %MW4 consists of %MX8.0~8.7 and %MX9.0~9.7.

Device category	Device correspondence																							
	The 5th WORD						The 6th WORD						The 7th WORD						The 8th WORD					
	Bit 0	…	Bit 7	Bit 8	…	Bit 15	Bit 0	…	Bit 7	Bit 8	…	Bit 15	Bit 0	…	Bit 7	Bit 8	…	Bit 15	Bit 0	…	Bit 7	Bit 8	…	Bit 15
%MX	%MX8.0~8.7			%MX9.0~9.7			%MX10.0~10.7			%MX11.0~11.7			%MX12.0~12.7			%MX13.0~13.7			%MX14.0~14.7			%MX15.0~15.7		
%MB	%MB8			%MB9			%MB10			%MB11			%MB12			%MB13			%MB14			%MB15		
%MW	%MW4						%MW5						%MW6						%MW7					
%MD	%MD2												%MD3											
%ML	%ML1																							

◆ Device range:

The device range of the M100-series controller is shown in the table below:

Device category	Device representation method	Device range
%IX	%IX0.0~%IX0.7 %IX1.0~%IX1.7	%IX0.0~%IX127.7
%QX	%QX0.0~%QX0.7 %QX1.0~%QX1.7	%QX0.0~%QX127.7
%MX	%MX0.0~%MX0.7 %MX1.0~%MX1.7	%MX0.0~%MX131071.7
%IB	%IB0	%IB0~%IB127
%QB	%QB0	%QB0~%QB127
%MB	%MB0	%MB0~%MB131071
%IW	%IW0	%IW0~%IW63
%QW	%QW0	%QW0~%QW63
%MW	%MW0	%MW0~%MW65535
%ID	%ID0	%ID0~%ID31
%QD	%QD0	%QD0~%QD31
%MD	%MD0	%MD0~%MD32767
%IL	%IL0	%IL0~%IL15
%QL	%QL0	%QL0~%QL15
%ML	%ML0	%ML0~%ML16383

Note: %MW0~%MW999 are default as power-outage retention addresses.

6.1.2 Modbus addresses corresponding to devices

The devices listed in the table below support standard MODBUS function codes (e.g., 03/06/10/01/02/05/0F, etc.) and can be accessed via RS232, or RS485 communication. When users need to read/write the bit devices of the controller through an HMI (Human-Machine Interface), they can use the bit devices of output devices as intermediate bit devices. For example, %QX50.0~%QX127.7 can be used as intermediate bit devices; any output device without control output channels can serve as an intermediate bit device.

Device area	Device category	Device range	Modbus address
I (Input device)	Bit device (bit)	%IX0.0~%IX0.7	0x6000~0x6007
		%IX1.0~%IX1.7	0x6008~0x600F
		……	……
		%IX127.0~%IX127.7	0x63F8~0x63FF
	Word device (word)	%IW0~%IW63	0x8000~0x803F
Q (Output device)	Bit device (bit)	%QX0.0~%QX0.7	0xA000~0xA007
		%QX1.0~%QX1.7	0xA008~0xA00F
		……	……
		%QX127.0~%QX127.7	0xA3F8~0xA3FF
	Word device (word)	%QW0~%QW63	0xA000~0xA03F
M (Intermediate device)	Word device (word)	%MW0~%MW32767	0x0000~0x7FFF

Conversion method for QX-related bit devices to Modbus addresses:

For example, QXA.B: Convert A×8+B to hexadecimal, then add 16#A000

Example: %QX50.1 corresponds to Modbus address 0xA191. Calculation: 50×8+1=401=16#191

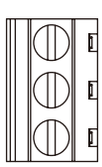
16#191+16#A000=0xA191

6.2 RS485 communication

6.2.1 RS485 communication interface pin definition

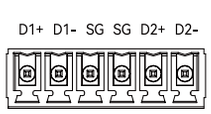
The M100-series controller has one built-in independent RS485 communication interfaces. The pin definitions of the RS485 communication interface are shown in the figure below:

Pin definition	Abbreviation	Description
D+	Serial data	RS485 positive signal
D-	Serial data	RS485 negative signal
SG	Reference ground	RS485 signal reference ground



The M100-series motion controller can be expanded with one expansion card to add two independent RS485 communication interfaces. Only one RS485 expansion card can be installed. The model of the RS485 expansion card is HCMXB-2RS485-100-BD. The pin definitions of the RS485 expansion card communication interface are shown in the figure below:

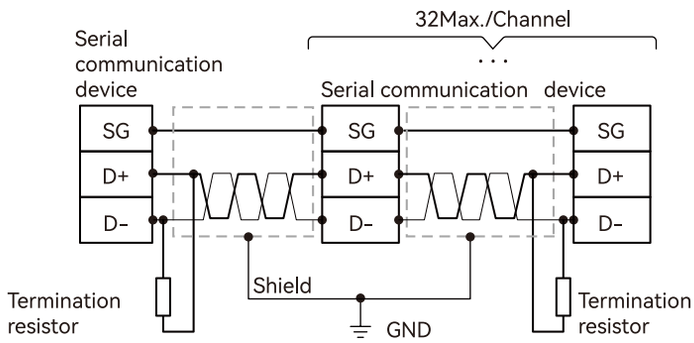
Pin definition	Function
D1+	RS485 channel 1 communication signal +
D1-	RS485 channel 1 communication signal -
SG	RS485 channel 1 signal reference ground
SG	RS485 channel 2 signal reference ground
D2+	RS485 channel 2 communication signal +
D2-	RS485 channel 2 communication signal -



6.2.2 RS485 communication interface function description

The RS485 communication interfaces of the M100-series motion controller support the same functions: they support Modbus communication protocols, can act as a Modbus master or slave, and support custom communication protocols. Touch screens, PLCs, or other Modbus master devices can read/write data from/to the internal devices of the M100-series motion controller via the RS485 communication interface. When the RS485 communication interface acts as a master, it can connect to 32 slaves; when acting as a slave, the station number range is 1~255, and broadcast functionality is not supported.

6.2.3 RS485 bus network topological architecture



◆ Recommended RS-485 wiring method:

- Install a 120Ω termination resistor (with power ≥ 1/4 W) at both the start and end of the RS485 bus.
- Use shielded twisted-pair cables with grounded shielding wires to ensure stable communication.
- Connect the RS485 reference grounds of different devices together to prevent communication instability caused by differing system reference grounds.

6.2.4 RS485 supported communication format

The RS485 communication interface supports ASCII or RTU communication formats, with a maximum baud rate of up to 115200 bps.

Baud rate	9600; 19200; 38400; 57600; 115200					
Mode	ASCII				RTU	
Communication format	7,E,1	7,E,2	7,N,1	7,N,2	8,E,1	8,E,2
	7,O,1	7,O,2	8,E,1	8,E,2	8,N,1	8,N,2
	8,N,1	8,N,2	8,O,1	8,O,2	8,O,1	8,O,2

6.2.5 Function codes and exception response codes supported by RS485

◆ The function codes supported by the RS485 communication interface of the M100-series motion controller are listed in the table below:

Category	Function code	Description	Broadcastable (Y/N)	Read/Write maximum length	Operable device
Bit device	0x01	Definition: Read the value of bit devices. M-series controller bit device values can all be read using function code 01.	N	256	%IX,%QX
	0x02	Definition: Read the value of input bit devices. M-series controller bit device values can all be read using function code 02.	N	256	%IX,%QX
	0x05	Write the value of a single bit device.	Y	1	%QX
	0x0F	Write the values of multiple bit devices.	Y	256	%QX
Word device	0x03	Read the value of single or multiple word devices.	N	100	%MW,%QW,%IW
	0x04	Definition: Read the value of single or multiple input word devices. M-series controller word device values can all be read using function code 04.	N	100	%MW,%QW,%IW
	0x06	Write the value of a single word device.	Y	1	%MW,%QW
	0x10	Write the values of multiple word devices.	Y	100	%MW,%QW
	0x17	Read/Write the value of single or multiple word devices.	Y	100	%MW,%QW, %IW (read only)

◆ The following table lists the exception response codes supported by the RS485 communication interface of the M100-series motion controller:

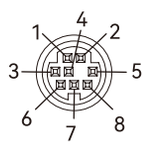
Exception response code	Description	Troubleshooting
1	The slave does not support the function code specified by the master.	Specify a function code supported by the slave.
2	The slave does not support the Modbus address specified by the master.	Specify a Modbus address supported by the slave.
3	The read/write data length specified exceeds the limit.	When the controller acts as a slave: For word devices, the maximum read/write length per operation is 100 WORDs. For bit devices, the maximum read/write length per operation is 256 bits. The controller returns this exception code if the limits are exceeded.
7	The checksum calculated by the master and slave differs.	Confirm that the baud rate and communication format of the master and slave are consistent. Check for interference near the bus. Check that the bus is a shielded cable. Ensure both the master and slave are grounded.

6.3 RS232 communication

6.3.1 RS232 communication interface pin definition

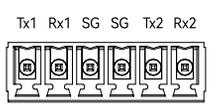
The M100-series controller has one built-in independent RS232 communication interfaces. The pin definitions of the RS232 communication interface are shown in the figure below:

Pin definition		Abbreviation	Description
1	-	-	-
2			
3			
4	Rx	Serial data	RS232 channel data reception
5	Tx	Serial data	RS232 channel data transmission
6	-	-	-
7			
8	SG	Reference ground	RS232 signal reference ground



The M100-series motion controller can be expanded with one expansion card to add two independent RS232 communication interfaces. Only one RS232 expansion card can be installed. The model of the RS232 expansion card is HCMXB-2RS232-100-BD. The pin definitions of the RS232 expansion card communication interface are shown in the figure below:

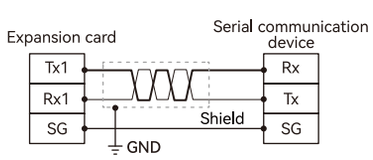
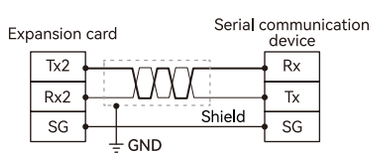
Pin definition	Function
Tx1	RS232 channel 1 data transmission
Rx1	RS232 channel 1 data reception
SG*	RS232 channel 1 signal reference ground
SG*	RS232 channel 2 signal reference ground
Tx2	RS232 channel 2 data transmission
Rx2	RS232 channel 2 data reception



6.3.2 RS232 communication interface function description

The RS232 communication interfaces of the M100-series motion controller support the same functions: they support the Modbus communication protocol, can act as a Modbus master or slave, and support custom communication protocols. Touchscreens, PLCs, or other Modbus master devices can read/write data from/to the internal devices of the M100-series motion controller via the RS232 communication interface. Each RS232 communication interface can connect to one slave when acting as a master. When the controller acts as a slave, the station number range is 1~255, and broadcast functionality is not supported.

6.3.3 RS232 bus network topological architecture

RS232 channel 1 wiring	RS232 channel 2 wiring
	

6.3.4 RS232 supported communication format

The RS232 communication interface supports ASCII or RTU communication formats, with a maximum baud rate of up to 115200 bps.

Baud rate	9600; 19200; 38400; 57600; 115200					
Mode	ASCII				RTU	
Communication format	7,E,1	7,E,2	7,N,1	7,N,2	8,E,1	8,E,2
	7,O,1	7,O,2	8,E,1	8,E,2	8,N,1	8,N,2
	8,N,1	8,N,2	8,O,1	8,O,2	8,O,1	8,O,2

6.3.5 Function codes and exception response codes supported by RS232

◆ The function codes supported by the RS232 communication interface of the M100-series motion controller are listed in the table below:

Category	Function code	Description	Broadcastable (Y/N)	Read/Write maximum length	Operable device
Bit device	0x01	Definition: Read the value of bit devices. M-series controller bit device values can all be read using function code 01.	N	256	%IX,%QX
	0x02	Definition: Read the value of input bit devices. M-series controller bit device values can all be read using function code 02.	N	256	%IX,%QX
	0x05	Write the value of a single bit device.	Y	1	%QX
	0x0F	Write the values of multiple bit devices.	Y	256	%QX
Word device	0x03	Read the value of single or multiple word devices.	N	100	%MW,%QW,%IW
	0x04	Definition: Read the value of single or multiple input word devices. M-series controller word device values can all be read using function code 04.	N	100	%MW,%QW,%IW
	0x06	Write the value of a single word device. .	Y	1	%MW,%QW
	0x10	Write the values of multiple word devices.	Y	100	%MW,%QW
	0x17	Read/Write the value of single or multiple word devices.	Y	100	%MW,%QW, %IW (read only)

◆ The following table lists the exception response codes supported by the RS232 communication interface of the M100-series motion controller:

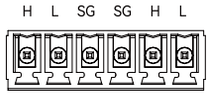
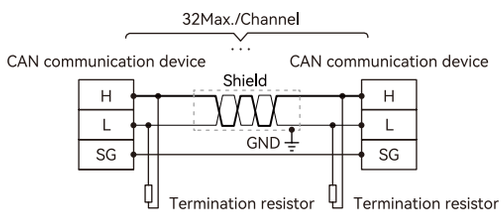
Exception response code	Description	Troubleshooting
1	The slave does not support the function code specified by the master.	Specify a function code supported by the slave.
2	The slave does not support the Modbus address specified by the master.	Specify a Modbus address supported by the slave.
3	The read/write data length specified exceeds the limit.	When the controller acts as a slave: For word devices, the maximum read/write length per operation is 100 WORDs. For bit devices, the maximum read/write length per operation is 256 bits. The controller returns this exception code if the limits are exceeded.

7	The checksum calculated by the master and slave differs.	Confirm that the baud rate and communication format of the master and slave are consistent. Check for interference near the bus. Check that the bus is a shielded cable. Ensure both the master and slave are grounded.

6.4 CAN communication

6.4.1 CAN communication interface pin definition

The M100-series motion controller does not have a built-in CAN communication interface, but it can be expanded with an expansion card to add an independent CAN communication interface. Only one CAN expansion card can be installed. The model of the CAN expansion card is HCMXB-CAN-100-BD. The pin definitions of the CAN expansion card communication interface are shown in the figure below:

CAN communication terminal			CANOpen wiring
CAN communication signal (high)	H		
CAN communication signal (low)	L		
CAN communication signal reference ground	SG		
CAN communication signal reference ground	SG		
communication signal (high)	H		
CAN communication signal (low)	L		

The CAN communication interface can be used as a master in a CANopen network or as a slave to another master. The master/slave role can be selected in the software.

◆ When used as a master, it supports the following functions:

- Supports the CANopen protocol DS301v4.02.
- Supports master services for network management (Network Management Object: NMO).
- Supports monitoring of slave disconnection.

  * The master's slave disconnection monitoring mechanism includes two types: Heartbeat and NodeGuarding. The controller only supports Heartbeat.

  * Other stations can send Heartbeat messages to the controller, which monitors their disconnection status.

- Supports up to 32 slaves.
- Supports Process Data Object (PDO) services:

  * Up to 200 RxPDOs are supported, with a total data size of up to 1000 bytes for all RxPDOs.

  * Up to 200 TxPDOs are supported, with a total data size of up to 1000 bytes for all TxPDOs.

  * PDO transmission types: Data change trigger (asynchronous 255), synchronous periodic trigger (synchronous 1~240), synchronous aperiodic trigger (synchronous 0).

  * PDO mapping: Each PDO can map up to 8 bytes of parameters.

- Supports Service Data Object (SDO) services.

• Data types that PDO and SDO can operate on:

Number of data bits	Data type
8-bit	SINT, USINT, BYTE
16-bit	INT, UINT, WORD,
32-bit	DINT, UDINT, REAL, DWORD

• Synchronous message range: 1-65535ms. Synchronous messages enable synchronized actions among multiple devices.

◆ When used as a slave, it supports the following functions:

• Supports the CANopen protocol DS301v4.02.

• Supports Network Management Object (NMO) services.

• Supports monitoring of other stations' disconnection status.

* Supports Heartbeat error control but not Node Guarding error control.

* Other stations can send Heartbeat messages to the controller, which monitors their disconnection status.

• Supports PDO services

* Up to 8 RxPDOs are supported, with each PDO mapping up to 8 bytes of parameters. The total data size of all RxPDOs is up to 64 bytes.

* Up to 8 TxPDOs are supported, with each PDO mapping up to 8 bytes of parameters. The total data size of all TxPDOs is up to 64 bytes.

• PDO transmission types: Event trigger, data change trigger, synchronous periodic trigger, synchronous aperiodic trigger.

• Supports Service Data Object (SDO) services

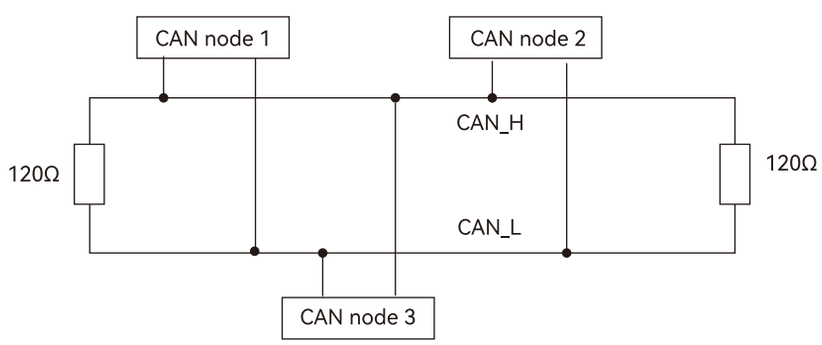
6.4.2 PDO mapping of CANopen communication interface

When the M100-series motion controller is configured as a CANopen master, the PDO data area for controlling slaves has a length of 500 WORDs, ranging from %MW63500 to %MW63999; the data area for receiving slave data also has a length of 500 WORDs, ranging from %MW63000 to %MW63499.

When the M100-series motion controller is configured as a CANopen slave, the PDO data area for receiving master data has a length of 32 WORDs, ranging from %MW63000 to %MW63031; the data area for sending data to the master also has a length of 32 WORDs, ranging from %MW63500 to %MW63531.

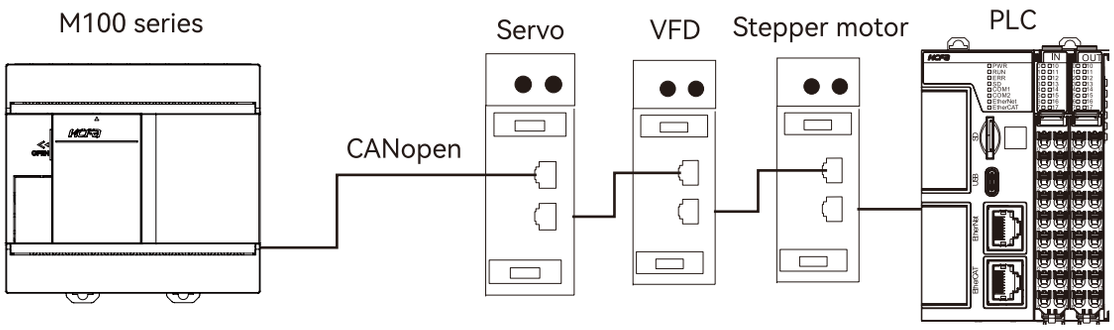
6.4.3 CANopen bus hardware connection

To enhance the stability of CANopen communication, both ends of the CANopen bus network need to be connected to a 120Ω termination resistor. The diagram below shows a schematic of the basic CANopen network topology.



- When building a CANopen network, it is recommended to use dedicated CANopen cables.
- Connect a 120Ω resistor in series between CAN_H and CAN_L at both ends of the CANopen network.

6.4.4 CANopen bus network topological architecture



6.4.5 Communication rate and distance of CANopen communication interface

The transmission distance of the CANopen bus is related to its baud rate. The table below shows the maximum communication distance corresponding to different baud rates.

Transmission speed (bits per second)	20K	50K	125K	250K	500K	1M
Maximum communication distance (meters)	2500	1000	500	250	100	40

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Zhejiang Hechuan Technology Co., Ltd.
No.5, Qinshan Road, Longyou Industrial Zone, Quzhou City, Zhejiang Province

R&D Center (Hangzhou)
No. 299, Lixin Road, Qingshanhu Road, Lin'an District, Hangzhou City, Zhejiang Province, P.R. China

400 TEL - 400-012-6969

HCFA Official Website - www.hcfa.cn