a WOLONG company

WAC500 Series CPU Module

User Manual

Wolong Electric Group Co.,Ltd

Foreword

Overview

Thank you for purchasing and using the WAC500 series CPU module produced by Wolong Electric Group Co., Ltd.

This manual mainly introduces the basic parameters of the product, mechanical installation, electrical installation.

Who to read

Persons with specialized knowledge of electrical engineering (qualified electrical engineers or persons with equivalent knowledge).

Meets the standard

Certified name	Directive name		Conformity standard
CE certification	EMC directive	2014/30/EU	**24V DC products：** EN 61131-2 **220V AC products：** EN 61131-2 EN 61000-3-2 EN 61000-3-3
	LVD directive	2014/35/EU	EN 61010-1 EN 61010-2-201
	RoHS directive	2011/65/EU amended by(EU) 2015/863	EN IEC 63000
UL/cUL certification	-		-
KCC certification	-		-
EAC certification	-		-

Version change log

Number	Summary of revisions	Release version	Revision date
1	Creation	V1.0	2024.06

About manual access

This manual is not shipped with the product, if you need to get the electronic version of the PDF file, you can get it through the following ways:

- Log on to our official website to get product information and technical support, the access is as follows: Log on to our official website (www.olimc.com.cn)→Service and Support→Data Download→Search for keywords and download.
- Scan the QR code on the product body with your cell phone to get the product supporting manual.

Warranty statement

Under normal use, the product failure or damage, our company is responsible for 18 months warranty (from the date of shipment, to the bar code on the body shall prevail, there is a contract agreement in accordance with the agreement). If the warranty period exceeds 18 months, we will charge the maintenance fee.

Within 18 months, repair costs will be charged for damage to the product caused by the following conditions

- Damage to the product caused by not operating the product as specified in the manual.
- Fire, flood, or abnormal voltage, resulting in damage to the product.
- Product damage caused by using the product for non-normal functions.
- Product damage caused by exceeding the scope of use specified for the product.
- Force majeure (natural disaster, earthquake, lightning strike) factors caused by the product secondary damage.

The relevant service costs are calculated in accordance with the manufacturer's unified standards, and if there is a contract, the principle of contractual priority will be dealt with.

Please refer to the product warranty card for detailed warranty description.

Catalogue

1. Safety precautions

1.1. Security statements

1. Before handling, installation, operation, or maintenance, read this manual in detail and follow all safety precautions marked on the product and in the manual. Neglecting to do so may result in personal injury or equipment damage, or even death.
2. The "DANGER" and "WARNING" items in this manual do not represent all the safety items to be observed, but are only supplementary to all the safety precautions.
3. The product should be used in an environment that complies with the design specifications, otherwise it may cause malfunction. Abnormal functioning or damage to parts caused by failure to comply with the relevant regulations are not covered by the product quality warranty.
4. We do not assume any legal responsibility for personal safety accidents, property damage, etc. caused by illegal operation of the product.

1.2. Definition of security levels

For personal safety as well as to avoid property damage, it is inputant to pay attention to the safety signs and tips in this manual.

Safety marking	Name	Instructions
	Danger	Failure to comply with the relevant requirements may result in serious personal injury or even death.
	Warning	Failure to comply with the relevant requirements may result in personal injury or equipment damage.

Personnel requirements

Qualified professionals: This means that the staff operating the equipment must have undergone and passed professional electrical training and safety knowledge training, and have been familiar with the installation, commissioning, commissioning, and maintenance of the equipment, as well as the steps and requirements of maintenance, and to avoid all kinds of emergencies.

1.3. Security guidance

General principle	
	● Only trained and qualified personnel are permitted to carry out the relevant operations. ● It is prohibited to perform operations such as wiring, checking and replacing devices while the power is on. Make sure that all input power is disconnected before wiring and checking. ● The product is designed to be used indoors in an overvoltage class II electrical environment. The power supply system should be equipped with a lightning protection device to ensure that lightning overvoltage is not applied to the product's power inputs or signal inputs and outputs to avoid

	damage to the equipment. ● Unauthorized modification of the product is prohibited and may cause fire, electric shock or other injury. ● It is prohibited to drop metal shavings, copper wires, screws, cables and other conductive objects inside the product. ● It is prohibited to touch the product with wet objects or body parts, otherwise there is a risk of electric shock.

Portage	
	● Select appropriate handling tools and take mechanical protection measures, such as wearing anti-smash shoes and work clothes, to avoid personal injury. ● Ensure that the product is not subjected to physical shock and vibration.

During control system design	
	● Be sure to design a safety circuit to ensure that the control system still works safely when the external power supply drops out or the programmable controller fails; ● When the rated load current is exceeded or the load is short-circuited, etc., resulting in prolonged overcurrent, the module may smoke or catch fire, and safety devices such as a fuse or fuse should be installed externally.
	● Be sure to set emergency braking circuits, protection circuits, interlocking circuits for forward and reverse operation, and position upper and lower interlocking switches for preventing damage to the machine in the external circuits of the programmable controller; ● For safe operation of the equipment, design external protection circuits and safety mechanisms for output signals related to major accidents; ● The CPU of the programmable controller may turn off all outputs when it detects an abnormality in its own system; when part of the controller's circuitry fails, it may cause its outputs to be uncontrolled, and in order to ensure normal operation, it is necessary to design suitable external control circuits; ● Programmable controller's relay, transistor and other output units are damaged, it will make its output can not be controlled to ON or OFF state; ● Programmable controllers are designed to be used in indoor, overvoltage level Kawasaki electrical environments, and their power supply system level should have lightning protection to ensure that lightning overvoltage is not applied to the programmable controller's power supply inputs or signal inputs, control outputs, and other ports, so as to avoid damage to the equipment.

Installation	
	● It is prohibited to install the product on flammable materials and to avoid close contact or adhesion of the product to flammable materials. ● It is prohibited to operate the product with damaged or missing components. ● Do not use the programmable controller in the following places: places with dust, grease, conductive dust, corrosive gases, flammable gases; places exposed to high temperatures,

	condensation, wind and rain; places with vibration and shock. Electric shock, fire, and misuse can also lead to product damage and deterioration;
	● In order to prevent personnel who do not have relevant knowledge of electrical equipment from accidentally touching it, resulting in equipment damage or the risk of electric shock, the product needs to be installed in a lockable control cabinet with IP20 or higher protection. Only personnel with relevant electrical knowledge and equipment training should operate the control cabinet. ● When installing the product, make sure that the modules are tightly connected and fixed to prevent communication failure or disconnection during use due to poor connection. ● After installation, please check to make sure that there is no obstruction above the product vents, otherwise it may cause excessive heat generation and poor heat dissipation inside the product, resulting in burnt chips triggering system control failures, misoperation and so on.

Wiring	
	● Before wiring, it must be clear that each interface and power supply type, specification, etc., and comply with relevant standards and requirements to ensure that the system is wired correctly. ● In order to ensure the safety of personnel and equipment, should be used to ensure that sufficient wire diameter and specifications of the cable reliable grounding. ● Control signal and communication signal cables should be wired separately from strong interference power lines and power lines. ● Fix the cables with longer distance or larger quality.
	● When performing wiring operations, all power supplies connected to this product must be disconnected. ● At the end of installation and wiring, before power-on operation, please check whether the module terminal cover is installed in place to avoid touching the energized terminals and causing personnel injury, equipment system failure or misoperation. ● When external power supply is input to the product, install protection devices or devices with appropriate specifications to prevent the product from being damaged due to external power supply failure or over-voltage and over-current phenomena.

Commissioning and operation	
	● Before powering up and running, please make sure to check whether the working environment of the product system meets the requirements, and confirm whether the corresponding protection circuit is designed to protect the product to work safely even if the external equipment fails. ● It is prohibited to damage the product's output units such as relays and transistors, or their outputs will not be controlled to ON or OFF state. ● For modules or terminals that require external power supply, safety devices such as fuses or circuit breakers should be installed externally to avoid damage to the product module due to external power supply or equipment failure. ● Be sure to provide emergency brake circuits, protection circuits, interlock circuits for forward and reverse operation, and position upper and lower interlock switches to prevent damage to the machine in the product's external circuit. ● To enable safe operation of the equipment, design external protection circuits and safety

	mechanisms for output signals related to major accidents. ● When the controller system malfunctions, the output may be uncontrolled. In order to ensure that the equipment can be operated normally, design suitable external control circuits.

Warranty, maintenance and component replacement	
	● It is prohibited for the product and components to come into contact with or be accompanied by flammable materials. ● All power connected to the product must be disconnected prior to product care, maintenance, and component operation. ● Metal shavings, copper wires, screws, cables, and other conductive objects are prohibited from entering the interior of the product during care, maintenance, and component replacement. ● During maintenance and component replacement, the product and internal components must be protected from static electricity.
NOTE	● Tighten the screws with the appropriate torque.

When scrapped	
	● The components in the product contain heavy metals and the product must be disposed of as industrial waste at the end of its life.
	● This product should not be disposed of randomly, but should be collected and treated in a special way.

2. Product specification

2.1. Product information

■ Naming convention

WAC521 - 3S 3 G 16 16 D

① ② ③ ④ ⑤ ⑥ ⑦

Number	Name	Clarification
①	Product series (WAC521)	WLCxxx: Wolong-PLC series WACxxx: Wolong-PAC series
②	RJ45 interface (3S)	CPU: CPU module
③	Serial interface (3)	Numbers: 1, 2, 3 means the CPU has 1, 2, 3 RJ45 ports
④	Backplane type (G)	1: 1-way CAN interface
⑤	Input IO (16)	0: no process IO
⑥	Output IO (16)	4: 16-way high-speed DI, 16-way high-speed DO
⑦	Output IO type (D)	N: no backplane

Note : In CPUs with no IO in the body, numbers ⑤, ⑥ and ⑦ are ignored as null.

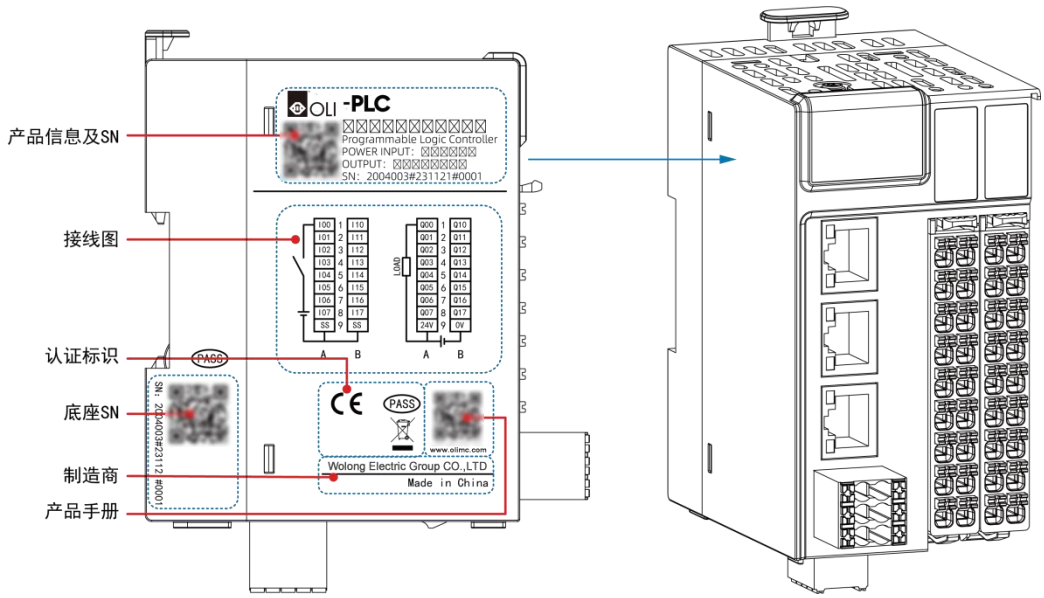
■ Product list

Model number	Machine code	Description
WAC501-1A3G1616D	-	WAC501 one network port 16-input 16-output (drain type) programmable logic controller
*WAC501-1A3G1616S	-	WAC501 one network port 16-input 16-output (source type) programmable logic controller
WAC511-2A3G1616D	-	WAC511 two network ports 16-input 16-output (drain type) programmable logic controller
WAC511-2A3G1616S	-	WAC511 two network ports 16 input 16 output (source type) programmable logic controller
WAC512-2A3G1616D	-	WAC512 two network ports 16 high-speed inputs and 16 high-speed outputs (drain type) programmable logic controller

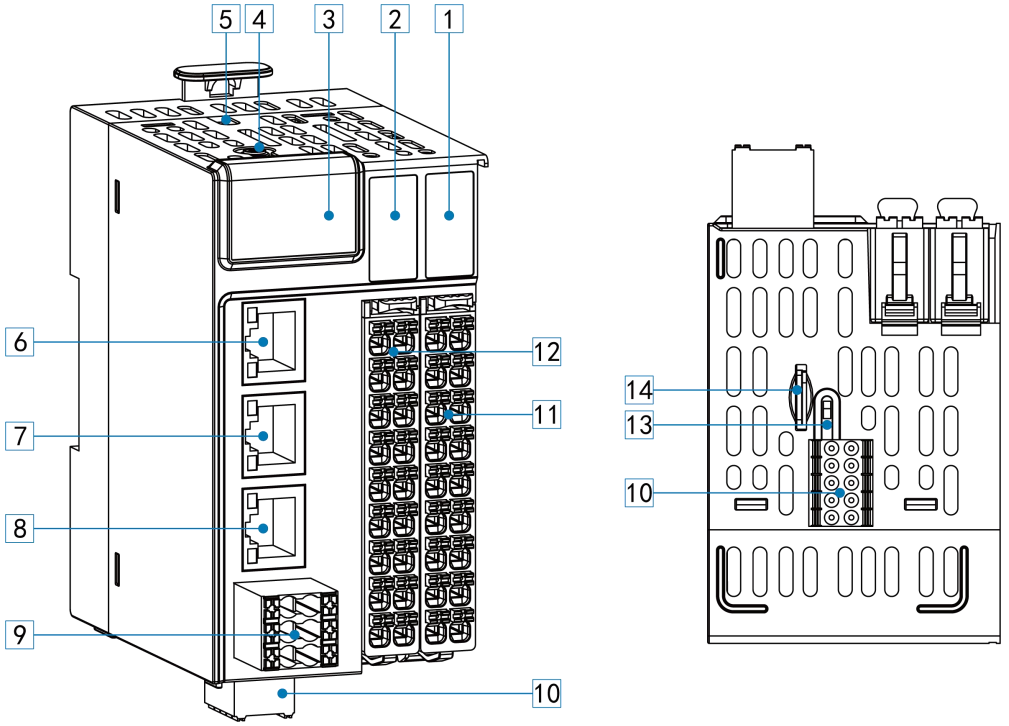
*WAC512-2A3G1616S	-	WAC512 two network ports 16 high-speed input 16 high-speed output (source type) programmable logic controller

Note : The products marked with "*" are products that have been planned but not released, the parameters of this part of the product are for reference only, and the actual parameters of the released products shall prevail.

■ Nameplate marking



■ Description of components



Serial number	Name	Functional description

①	CPU body IO output indication		Output signal indicator
②	CPU body IO input indication		Input signal indicator
③	CPU display panel	Digital tube	Display the current CPU operation status, refer to "Appendix A Fault code comparison table" for details.
		PWR	Always on - normal power supply, off - no power supply
		ERR	Always on - error, off - no error
		RUN	Bright - program is running normally, off - program stops running.
④	MFK function buttons		Complete the function of restoring factory settings
⑤	Type-C interface		External USB flash drive to update user program
⑥	LAN A network interface		According to the model, some models LAN A and LAN B are switches internally, refer to the naming specification and technical parameters for details.
⑦	LAN B network interface		Depending on the model, some models LAN A and LAN B are internal switches, some models do not have LAN B interface, refer to the naming convention and technical specifications of each product for details.
⑧	LAN C network interface		Depending on the model, some models do not have LAN C interface, refer to the naming convention and technical specifications of each product for details.
⑨	Power supply interface		Refer to the "Electrical Installation" section for detailed definitions.
⑩	Communication interface		Supports 3-channel serial communication and 1-channel CAN communication, please refer to "Electrical Installation" section for detailed definition.
⑪	CPU body output IO terminal		16-channel drain or source outputs (zero, hold, and preset functions are supported when the application is stopped)
⑫	CPU body input IO terminal		16 channels of source and drain inputs (supports high-speed interrupt)
⑬	RUN/STOP switch		Toggle dip switches to control the running and stopping of user programs
⑭	MicroSD card interface		For storing user program and user data, upgrading firmware

Note : Refer to each module description for detailed descriptions of each IO module component.

2.2. Technical specification

■ Basic specifications

Item		Specification		
		WAC501-1A3G1616X	WAC512-2A3G1616X	WAC511-2A3G1616X
Memory	Program	16M		
	Data	48M		
	Power down hold	1M		
Performance	Bit Arithmetic	0.004us		
	Word operation	0.020us		
	Floating Point	0.150us		
Programming Languages		ld, st, il, fbd, sfc, cfc		
Registers	Area I	512K		
	Q Area	512K		
	M Area	512K (power-down hold)		
On-board digital IOs		16-channel source and drain inputs with 1K high-speed interrupt support (multiplexed with high-speed inputs)		16-channel source and drain inputs with 1K high-speed interrupt support
		16-channel drain outputs, support clear, hold, and preset functions when application stops (multiplexed with high-speed outputs)		16-channel drain-type outputs, support clear, hold, and preset functions when application stops
High-speed inputs		8 channels of 200K high-speed inputs (single-phase, pulse + direction, A/B phase, CW/CCW)		None
High-speed output		8-axis 200K pulse output (pulse+direction, A/B phase, CW/CCW) or 8-channel PWM		None
Operational Control Capability		Maximum 8 axes	Max. 16 axes	
Pulse axis		0 to 8 axes		None
EtherCAT axes		None	8~16 axes	16axes
Expansion Capability	Remote IO Station	0	72	
	Number of I/O modules	16	1152	
Hot standby capability	Dual power supply redundancy	Support		
	Module hot-swapping	Supported		
Interfaces	Network Port	1 (1000Mbps)	1 (1000Mbps) 1-way (100Mbps)	1-way (1000Mbps) 2-way (100Mbps)
	Switch	None		
	Serial	2xRS485; 1xRS232		

	Communication		
	CAN communication	1xRS485; 1xRS232	
	Backplane bus	Expandable with 16 WL200 IO modules	
	SD card	Up to 32GB for storing user programs and data, data updates, user program updates, firmware updates	
	USB	Type-C interface, support user data update, user program update, USB-WIFI	
	RTC	Built-in rechargeable RTC clock battery	
Bus Protocol	Ethernet	TCP/IP, UDP, OPC UA Server, MQTT, Socket	
	EtherCAT	None	CoE (PDO, SDO) Supports up to 72 slaves
	Ethernet/IP	EtherNet/IP Scanner, EtherNet/IP Adapter	
	Profinet/IO	Master/Slave	
	CANopen	Master	
	Modbus TCP	Master/Slave	
	Modbus RTU	Master/Slave	
	Free Protocol	Serial Free Protocol	
	Network Passthrough	Serial Network Passthrough	
Visualization		Webvisu (Web Visualization)	
IP rating		IP20	
Dimensions (WxHxD)		60.0x105.0x85.0mm	
Weight		205.0g	256.0g

■ Power supply specifications

Items	specifications
Rated voltage of terminal input power supply	24V DC±10% (19.2V DC to 33V DC)
Terminal input power supply rated current	1A (maximum value at 24V DC)
24V input power protection	Supports short circuit, reverse connection, overcurrent (1.1A), overvoltage (33V DC)
Power supply redundancy	Supports two 24V DC power supply redundancy
Module hot-swap function	Support

■ Input specifications

Items	Specifications
Input type	Digital inputs
Input method	Source/Drain
Input channel	16 channels
Input voltage level	24V DC±10% (21.6V DC~26.4V DC)

High speed input (A0~A7. B0~B7)	Input is ON, input current	Input current greater than 8mA
	Input is OFF, input current	Input current less than 2.5mA
	Hardware response time ON/OFF	＜1μs（OFF→ON），＜2μs（ON→OFF）
	Maximum count frequency	800Kpps (2-phase 4x), 200kHz (single input)
	Input impedance	2.73k
ON voltage		≥15V DC
OFF voltage		≤5V DC
Software filtering time		Low speed: 10ms~60ms High speed: 0.5μs~10000μs
Isolated or not		Digital isolation
Common terminal method		16 points/common
Input action display		Input indicator light when input is drive state
Input Derating		75% derating at 55°C operation

■ Output specifications

Items		Specifications
Output type		Digital output
Output method		Drain type
Output channel		16 channels
Rated voltage of terminal input power supply		24V DC (20.4V DC to 28.8V DC)
Rated current of terminal input power supply		10mA (typical value at 24V DC)
Output voltage rating		24V DC±10% (21.6V DC to 26.4V DC)
High speed output (A0~A7. B0~B7)	Output Load (resistive load)	0.5A/point，4A/16 points
	Output Load (inductive load)	7.2W/point, 50W/16 points
	Output Load (lamp load)	5W/point, 40W/16 points

	Hardware response time ON/OFF	＜1μs（OFF→ON），＜2μs（ON→OFF）
	Load current requirement	Load current ≥12mA when used with output greater than 10kHz
	Maximum output frequency	Resistive load 200kHz, inductive load 0.5Hz, lamp load 10Hz
PWM output		Maximum frequency 200kHz, minimum pulse width 2.5us, minimum resolution 2.5us, adjustable duty cycle 0.01% ~ 99.99
Drain current when OFF		Below 30μA, at rated 24V DC voltage
Maximum voltage drop when ON		Below 0.05V DC
Isolated or not		Digital isolation
Common terminal method		16 points/common
Protection		Short-circuit, over-temperature, over-current, under-voltage, reverse connection protection
External inductive load protection		When external inductive load is connected, user needs to connect the diode.
Output action display		Output indicator light when the output is driving state
Output derating		75% derating when working at 55℃

2.3. Environmental norms

Items	Specifications
Operating temperature	-20℃~55℃
Humidity	10%~90%RH, no condensation
Use environment	No corrosive, combustible gas, conductive dust (dust) is not serious occasions
Storage temperature and humidity range	● -40℃~70℃ ● Relative humidity <90%RH, no condensation
Transportation temperature and humidity range	● -40℃~70℃ ● Relative humidity <90%RH, no condensation
Altitude	≤3000m
Pollution level	Level 2
Immunity	Power line 2kV (IEC 61000-4-4)
Overvoltage rating	II
EMC immunity class	Zone B, IEC61131-2

Vibration resistance	IEC60068-2-6 5Hz~8.4Hz, 3.5mmp, 8.4Hz~150Hz, 1g, X/Y/Z triaxial, 10 cycles/axial
Shock resistance	IEC60068-2-27 150m/s2,11ms, ±X/Y/Z six directions, 3 cycles/direction, total 18 cycles

3. Mechanical installation

3.1. Preparation for installation

3.1.1. Installation precautions

Before installation	
	● Please check and ensure all products are in a powered off state before installation. ● Before installation, please check the overall dimensions of the planned system to ensure that there is enough space to accommodate the module. This module should be installed in a control box with >50m of space around it to ensure that the hardware working system can dissipate heat well.

When installation	
	● When installing , please use parts that meet the requirements, such as screws and spacers. ● When installing, please do not drop metal wires, debris, screws and other objects inside the product to avoid causing short circuit or poor heat dissipation.

After installation	
	● After is installed, make sure that the connected communication cables, terminals are firmly connected. ● After the installation of is completed, please make sure that the rail where the module is located is reliably fixed. ● After the installation of is completed, make sure that the space in the chassis is separated from the strong and weak wires, and neatly planned to avoid disorganization, which affects heat dissipation. ● After the installation is completed, please tear off the stickers affixed to the module's heat dissipation holes, so that the heat dissipation is smooth. ● After installation, please check whether the air around the module is circulating.

3.1.2. Installation environment and location

Before safety, check, evaluate and confirm that the installation environment meets the operating conditions of all components, including factors such as temperature, humidity, dust and corrosion protection.

■ Environmental requirements

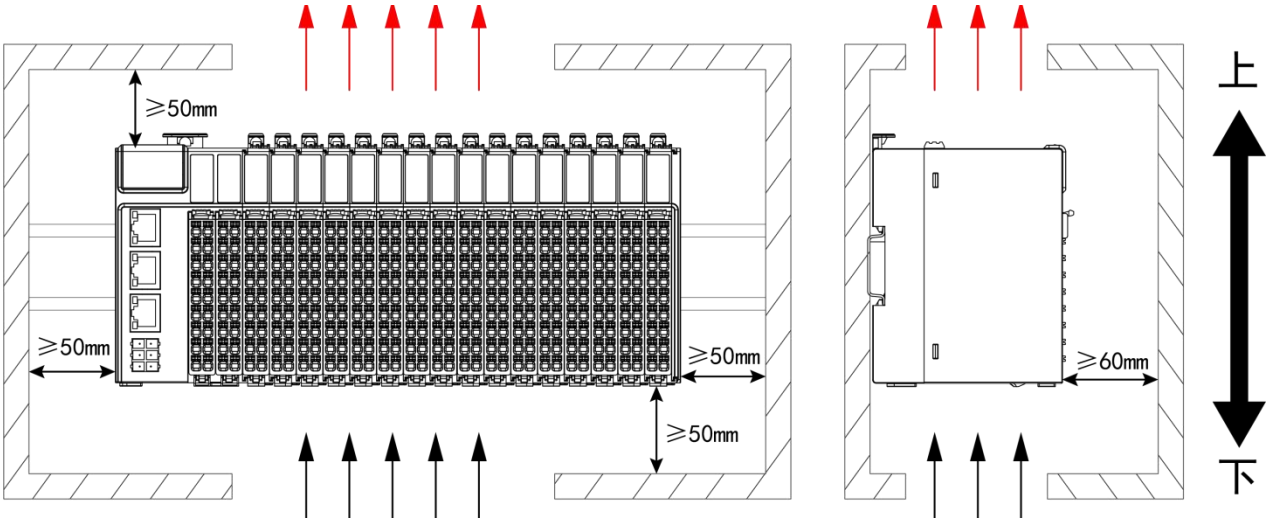
Environment	Requirements
Temperature	● -20°C~55°C ● No drastic change in temperature ● Installed in a closed space such as a cabinet, using a fan for ventilation and heat dissipation if necessary
Humidity	● Relative humidity of air 5%~95% without condensation

■ Place requirements

Place	Requirements
Indoor, overvoltage class II	● No strong electric field, strong magnetic field and direct sunlight ● No dust, iron powder and other conductive powder, oil mist, salt, organic solvents ● No corrosive, flammable gas ● Will not make the body produce direct vibration and suffer conduction shock

3.1.3. Installation space

The best mounting position for this product is horizontal mounting, heat dissipation is designed to be by natural air convection, in order to ensure normal ventilation and heat dissipation and to reserve enough space for wiring, enough clearance should be reserved around this product.

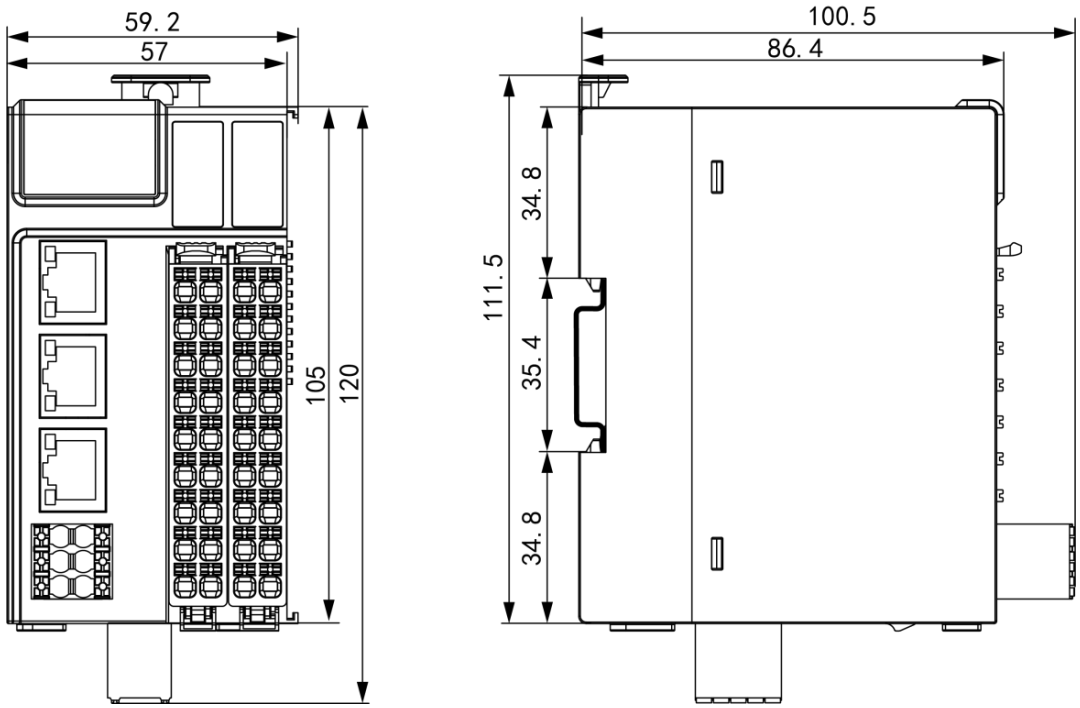


Instruction: If high temperature heat source equipment (heaters, transformers, large resistors, etc.) exists in the vicinity of this product, leave at least 100mm of clearance between it and the high temperature heat source equipment.

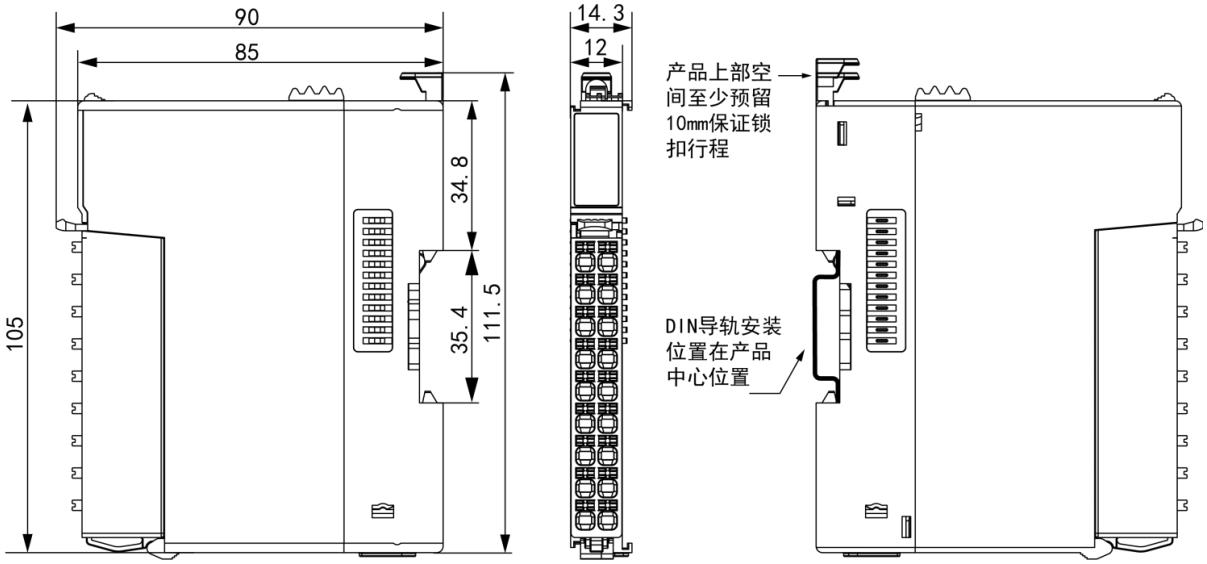
Note : When installing the product in a vertical mounting method other than the one shown above, use a cable duct or other means of cable retention when wiring to prevent the weight of the cable from being applied to the rail clamps and terminals, which could cause the product to fall off the DIN rail or the terminals to fall off due to the weight of the cable, resulting in malfunctioning.

3.1.4. Product dimensions

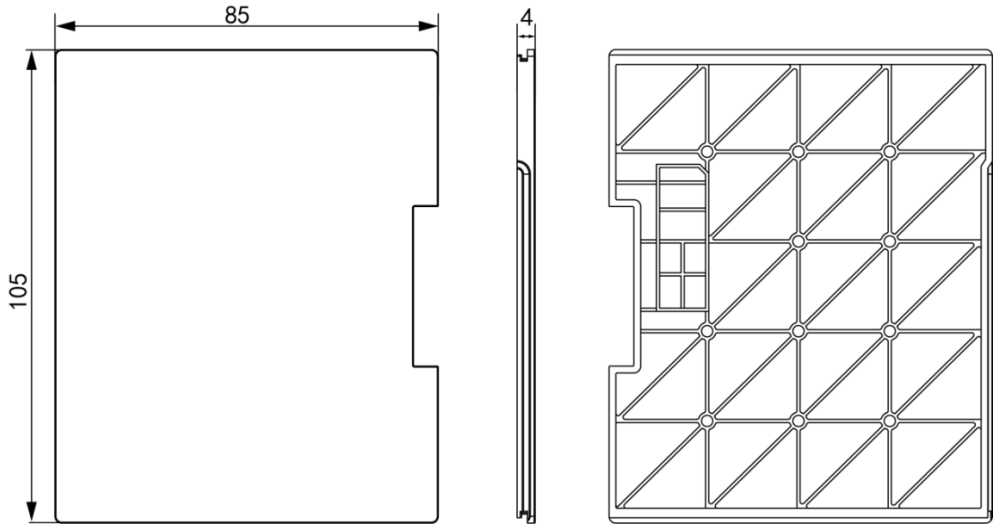
■ CPU（Unit：mm）



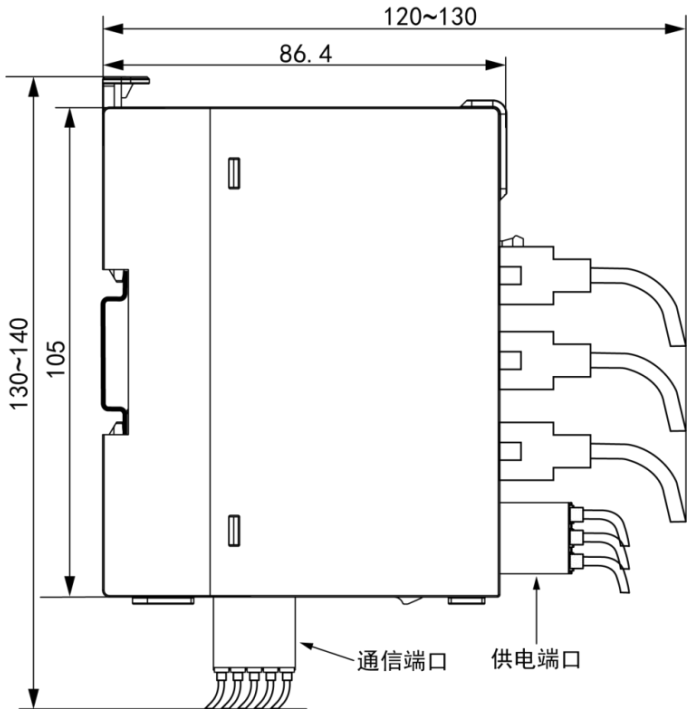
■ IO module (Unit: mm)



■ End cap size (Unit: mm)



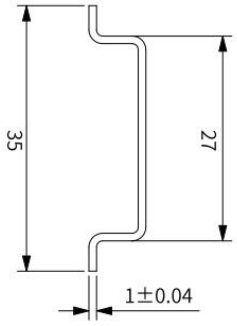
■ Product size after connecting the cable (Unit: mm)



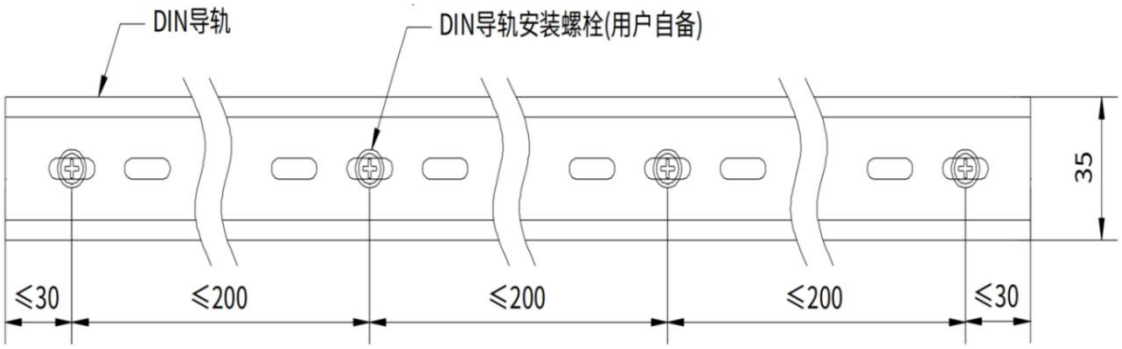
3.2. Installation and dismantling

3.2.1. Installation

Modules are mounted on DIN rails, DIN rails need to comply with IEC60715 standard
(35mm wide, 1mm thick), dimensional information as shown on the right, unit is mm.



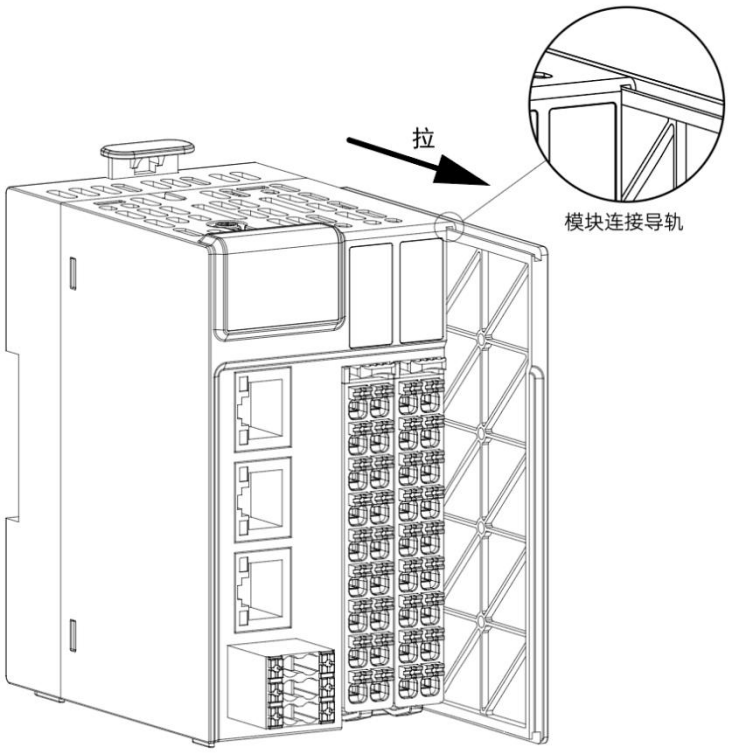
Note : Modules are mounted on DIN rails other than those recommended above (especially DIN rails not 1.0mm thick), the DIN rail latch will fail and the product will not be mounted in place, which may result in the product not working properly.



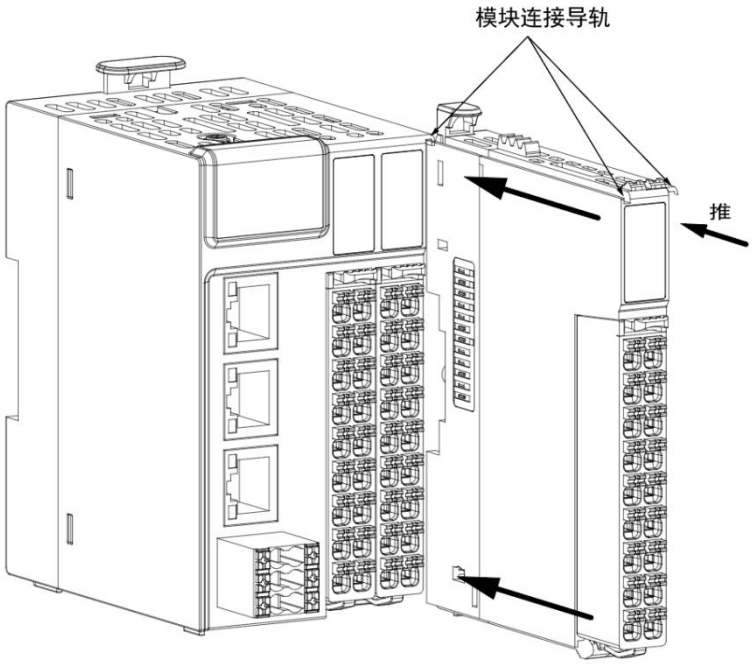
Note : In order to ensure the strength of the DN rail, it is necessary to install the DIN rail mounting bolts (supplied by the user) within 30mm from the end of the DIN rail, and the spacing between the 2 neighboring bolts must be within 200mm.

■ CPU mounted IO module

Step 1 Slide the tail plate out of the module connection rail (factory default CPU has tail plate installed)

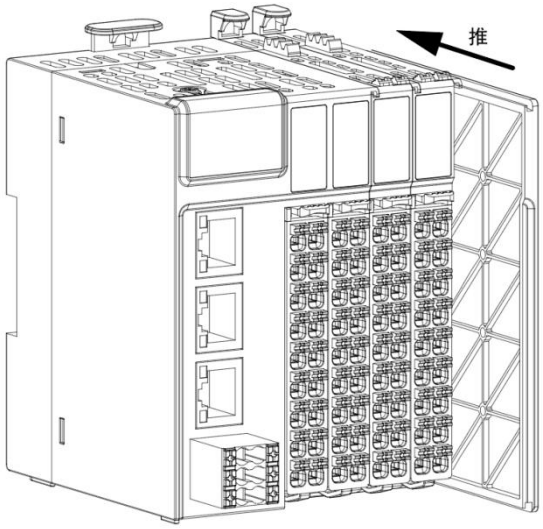


Step 2 Align the IO module with the module connection rails of the CPU and push down on the IO module until the IO module is fully aligned with the CPU module.



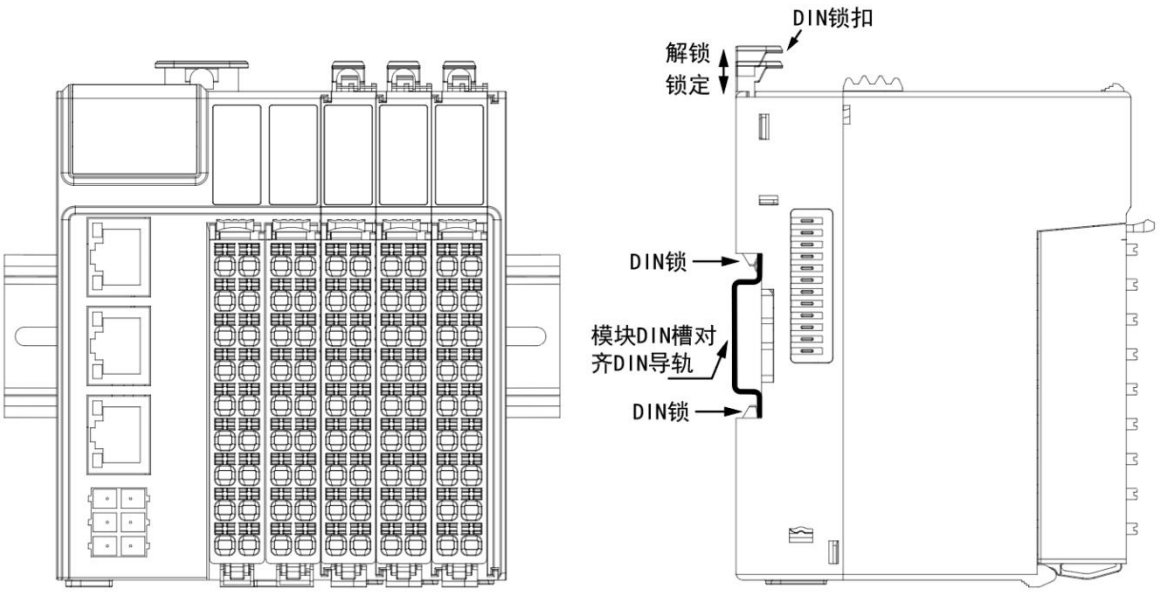
Note : The module and base latches should not be left unlocked for a long period of time or the latches will fail.

Step 3 Install the tail plate to the end of the last IO module following the move1 method (the tail plate must be installed or the module may not be recognized).

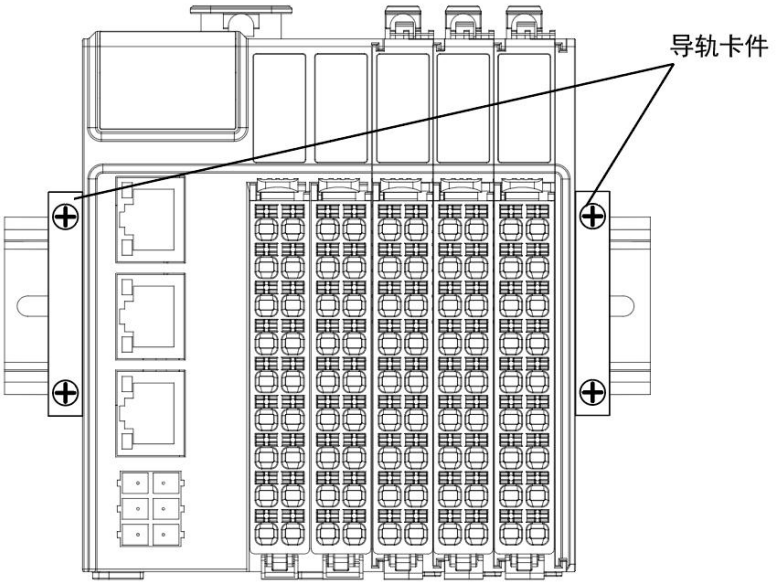


■ Module mounted to DIN rail

Step 1 Align the IO module DIN slot with the DIN rail, press down on the module until the module DIN slot snaps into the DIN rail, and press down on the DIN latch to put the module latch in the locked position.



Step 2 Install rail clamps on both ends of the rail to prevent the product from sliding on the DIN rail.



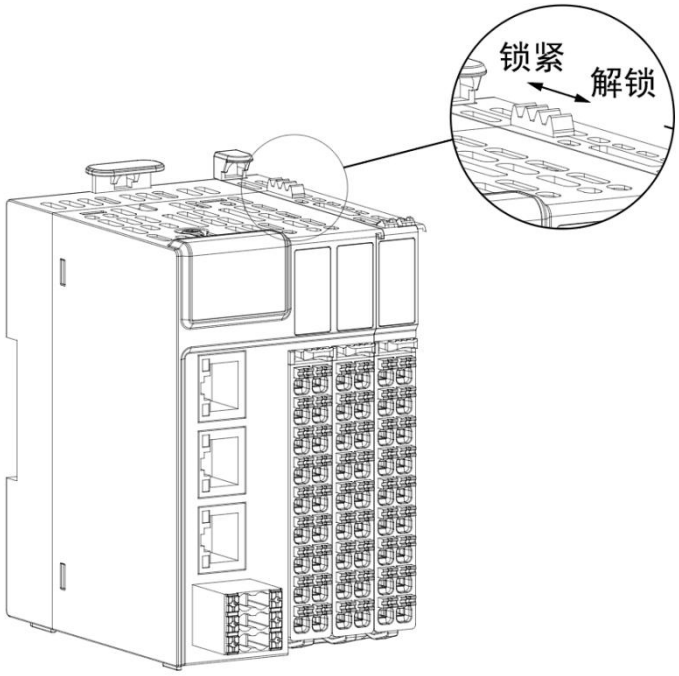
NOTE：

- When the module is not installed on the rail, please keep the rail latch in the locked state, if it is unlocked for a long time it will cause the latch to fail.
- Before installing the module, if the module exists right end cover plate, you need to remove the right end cover plate before installing, the right end cover plate is installed on the rightmost module, without installing the right end cover plate module may not work properly.
- Module installation is complete, you need to make sure that the module and the base latch, the base and the DIN rail latch are in a locked state, otherwise it may lead to the module falling off.
- Module installation is complete, you need to install both ends of the rail fixing clips, rail fixing clips need to be purchased by the user.

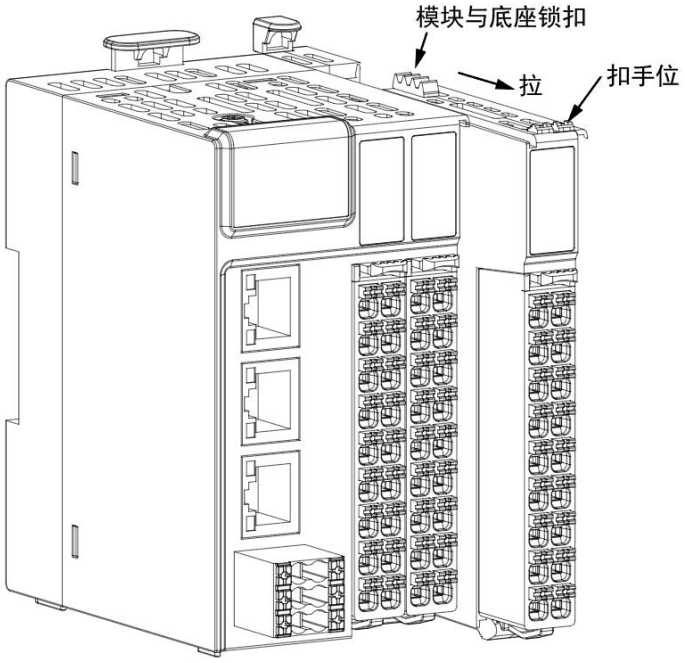
3.2.2. Dismantle

■ Module removal from base

Step 1 Trigger the blue latch between the module and the base on the IO module closer to the module LEDs to place the latch in the unlocked state.



Step 2 Pull on the module grommet bit to pull the module outward until the module separates from the base.

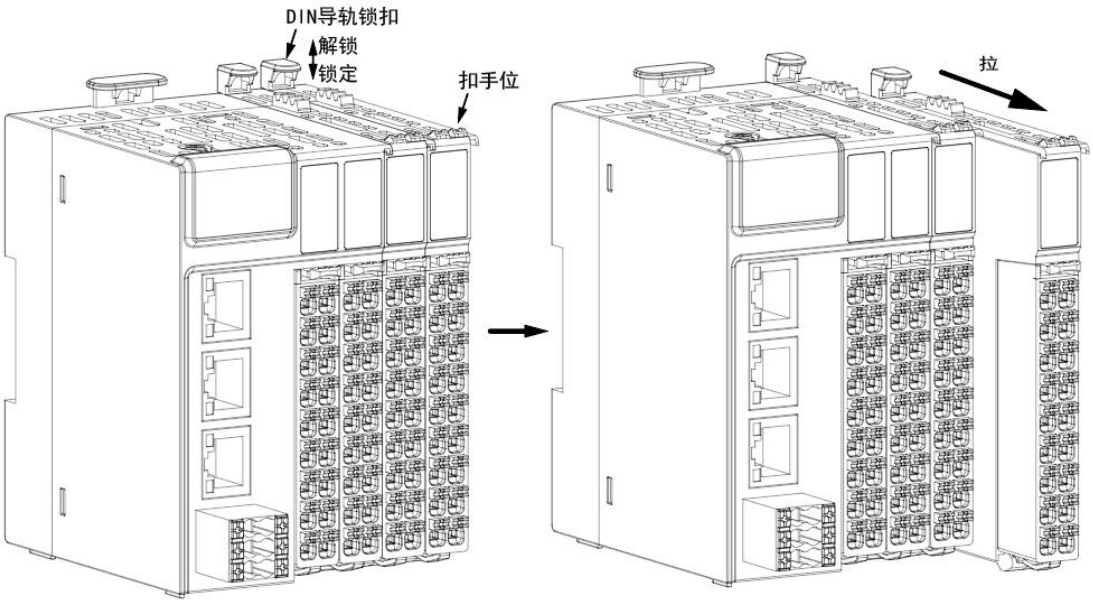


NOTE ：

- If the IO module terminals are already wired, you need to remove the IO module terminals first before disassembling the module;
- After the module is removed from the base, the latch between the module and the base needs to be in a locked state (away from the direction of the IO indicator), prolonged periods of time in an unlocked state can easily lead to latch failure;

■ Module removal from DIN rail

Step 1 With the help of a tool such as a screwdriver, pivot the DIN rail latch of the IO module to be disassembled upward so that the DIN rail latch is in the unlocked state, clasp the gripper bit of the module to be disassembled by hand, and pull the module outward so that the module can be separated from the DIN rail.



NOTE:

- If the IO module terminals are already wired, you need to remove the IO module terminals before disassembling the module;
- Before removing the module from the DIN rail, you need to make sure that the DIN rail latch is in the unlocked state, and the module and the base latch are in the locked state, otherwise the module and the base will be easily separated;
- After the module is removed from the DIN rail, the DIN rail latch needs to be pressed down and locked, as the DIN rail latch is in an unlocked state for a long time, which may easily lead to the failure of the latch;

4. Electrical installation

4.1. Wiring requirements

- When performing wiring, you must ensure that all external power is turned off.
- After completing the wiring, when starting the power supply or operating the module, verify that the module top terminal cover is properly installed. Failure to do so may result in electric shock or incorrect operation.
- When wiring, check the rated voltage and terminal configuration defined by the product norm to ensure proper and safe wiring. Connecting a power supply that does not match the rating or incorrect product safety wiring may cause a fire or damage the product.
- Tighten the screws to the specified torque. Loose screws may cause a short circuit, fire, or incorrect operation.

NOTE : Terminal screws should not be installed too tightly, too tight may cause damage to the screws or modules,
dropping, short-circuiting, or malfunctioning.

- Make sure there are no foreign objects such as metal shavings or wiring remnants in each module. These foreign objects may cause fire, damage, or operational errors.

4.2. Earthing requirements

■ Power cable grounding

- You must use the correct independent grounding method.
- Please use a wire cross-sectional area≥2mm^2, length≤30cm grounding cable and ground the power module's grounding terminal.
- If the grounding point is close to the product, you must ensure that the grounding cable is firm.

■ Shielded cable grounding

- Shielded cables must be used for cables transmitting sensitive signals such as analog I/O, RS485, and EtherCAT.
- The grounding point is as close to the module as possible.
- The exposed shielded part of the shielded cable after stripping is grounded to as large an area of the conductive backplane as possible to ensure good contact.

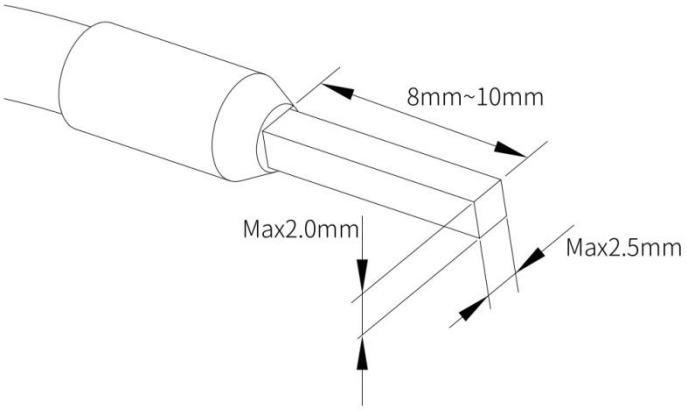
4.3. Cable selection

The wire lug diameters in the following table are for reference only, and can be reasonably calculated and otherwise adjusted according to actual use.

Material name	Adaptable wire		Diameter lug type	Crimping tool
	National	American		

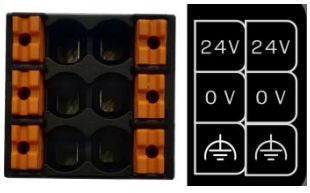
	standard/mm²	standard/AWG		
Tube lugs	0.3	22	E0308	Please select the appropriate crimping pliers to crimp the wires
	0.5	20	E0508	
	0.75	18	E7508	
	1.0	18	E1008	
	1.5	16	E1508	

If other tubular lugs are used, crimp them to the stranded wire in the shape and size required as shown below.



4.4. Terminal definition and wiring

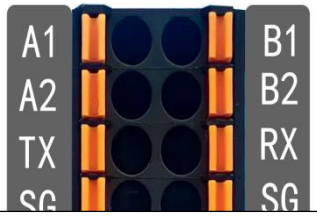
4.4.1. Definition of power supply terminals



Signal description	Left terminal	Right terminal	Signal description
DC 24V power supply positive	24V	24V	DC 24V power supply positive
DC 24V power supply negative	0V	0V	DC 24V power supply negative
PE grounding	⏚	⏚	PE grounding

Note : The power supply interface internally realizes the power redundancy function, and can provide two independent 24V DC power inputs to realize the power redundancy function, and the failure of any one group of power supply will not affect the operation of the system.

4.4.2. Definition of communication terminals



Left terminal	Signal description	Right terminal	Signal description
A1	COM1, RS485 positive	B1	COM1, RS485 negative
A2	COM2, RS485 positive	B2	COM2, RS485 negative

	TX	COM3, RS232 transmit	RX	COM3, RS232 Receive
	SG	Signal ground	SG	Signal ground
	CH	Network 0, CANH	CL	Network 0, CANL

4.4.3. Body IO terminal definition

Input terminal definition

Schematic diagram	Left signal	Left terminal	Right terminal	Right signal
	I00	A0	B0	I10
	I01	A1	B1	I11
	I02	A2	B2	I12
	I03	A3	B3	I13
	I04	A4	B4	I14
	I05	A5	B5	I15
	I06	A6	B6	I16
	I07	A7	B7	I17
	SS	A8	B8	SS

Drain output terminal definition

Schematic diagram	Left signal	Left terminal	Right terminal	Right signal
	Q00	A0	B0	Q10
	Q01	A1	B1	Q11
	Q02	A2	B2	Q12
	Q03	A3	B3	Q13
	Q04	A4	B4	Q14
	Q05	A5	B5	Q15
	Q06	A6	B6	Q16

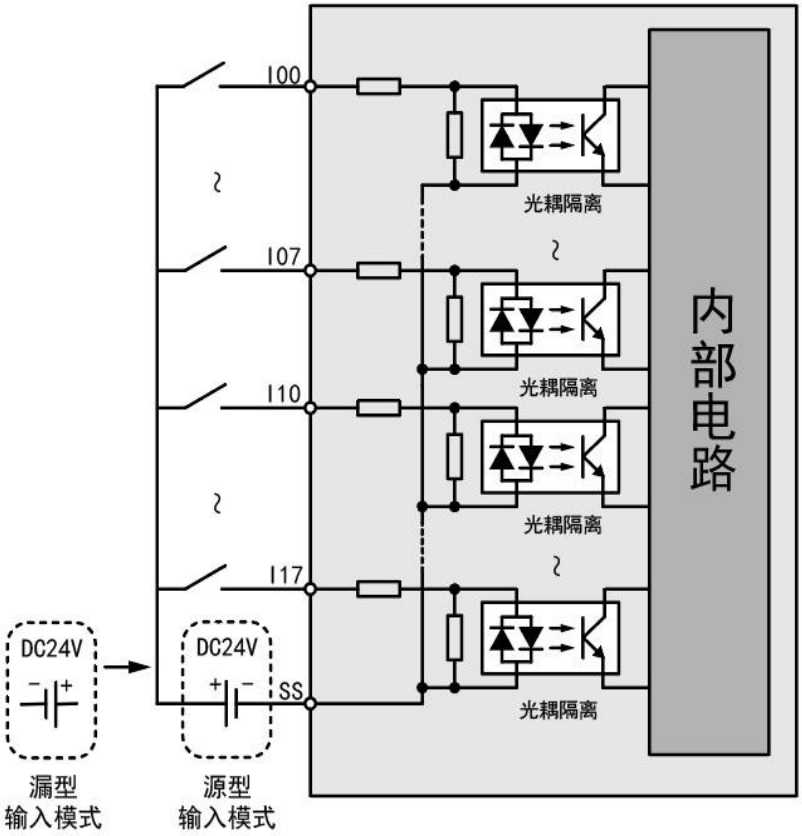
	Q07	A7	B7	Q17
	24V	A8	B8	0V

■ Source type output terminal definition

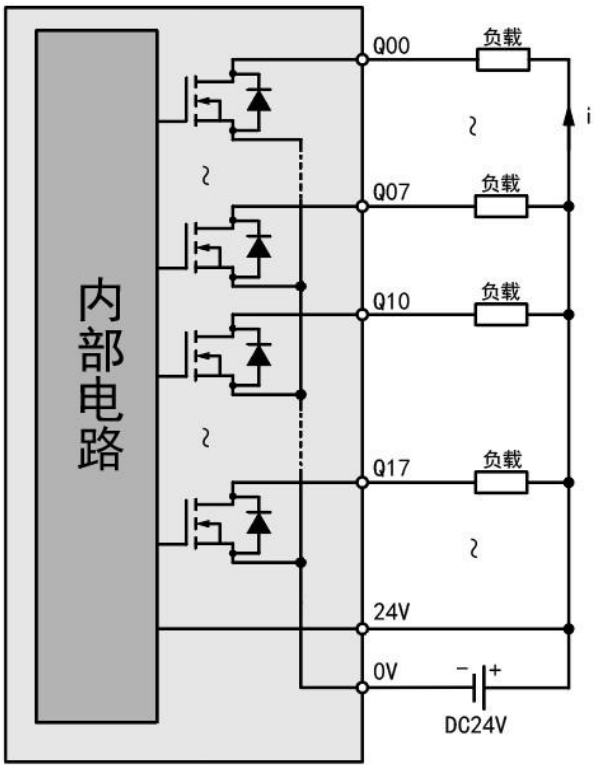
Schematic diagram	Left signal	Left terminal	Right terminal	Right signal
	Q00	A0	B0	Q10
	Q01	A1	B1	Q11
	Q02	A2	B2	Q12
	Q03	A3	B3	Q13
	Q04	A4	B4	Q14
	Q05	A5	B5	Q15
	Q06	A6	B6	Q16
	Q07	A7	B7	Q17
	24V	A8	B8	0V

4.4.4. Body IO terminal wiring

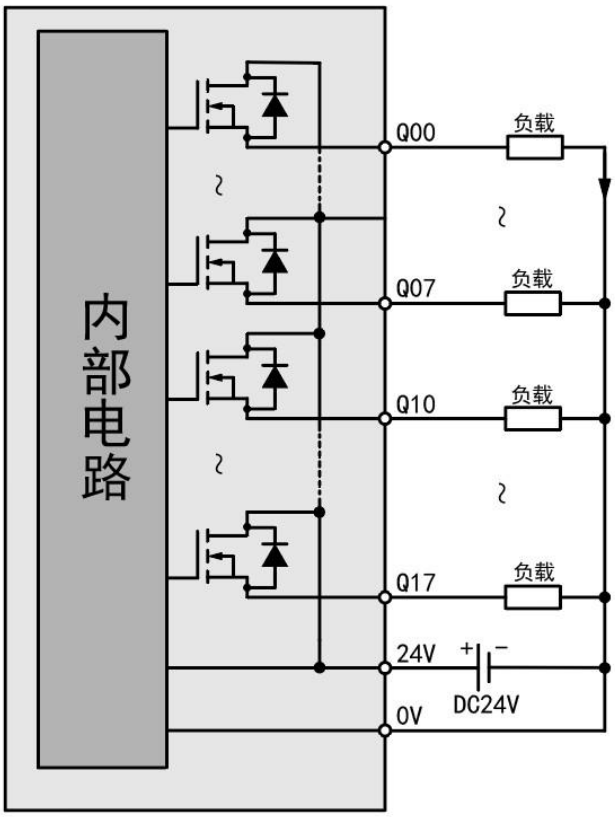
■ Input wiring



■ Drain output wiring



■ Source type output wiring


内部电路
Q00
负载
Q07
负载
Q10
负载
Q17
负载
24V
0V
DC24V

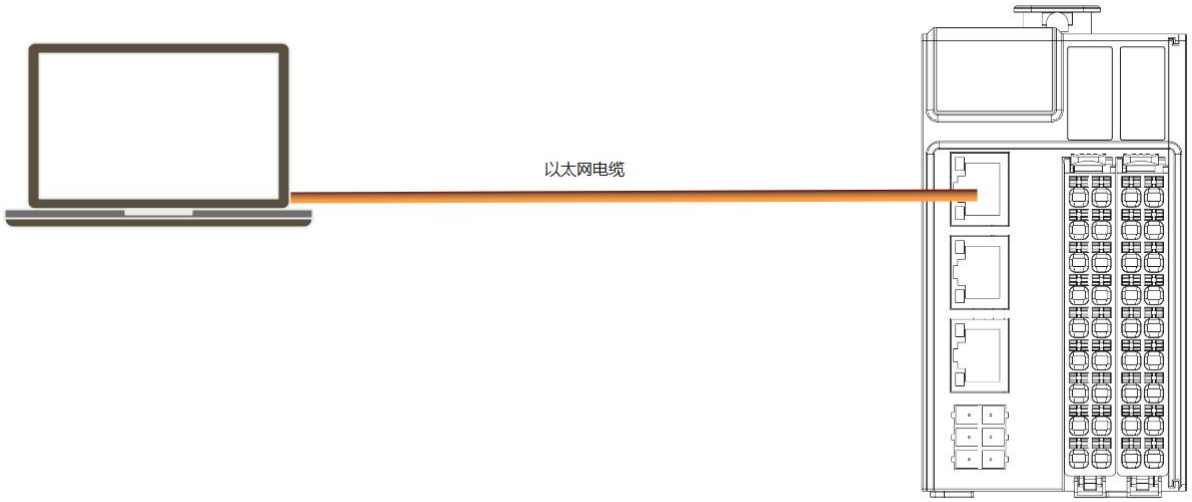
5. Communication links

WAC500 series products provide a complete range of models and series, each model can be seamlessly connected to each other, simplifying the implementation of the project and the use of the process.

5.1. CPU module connection

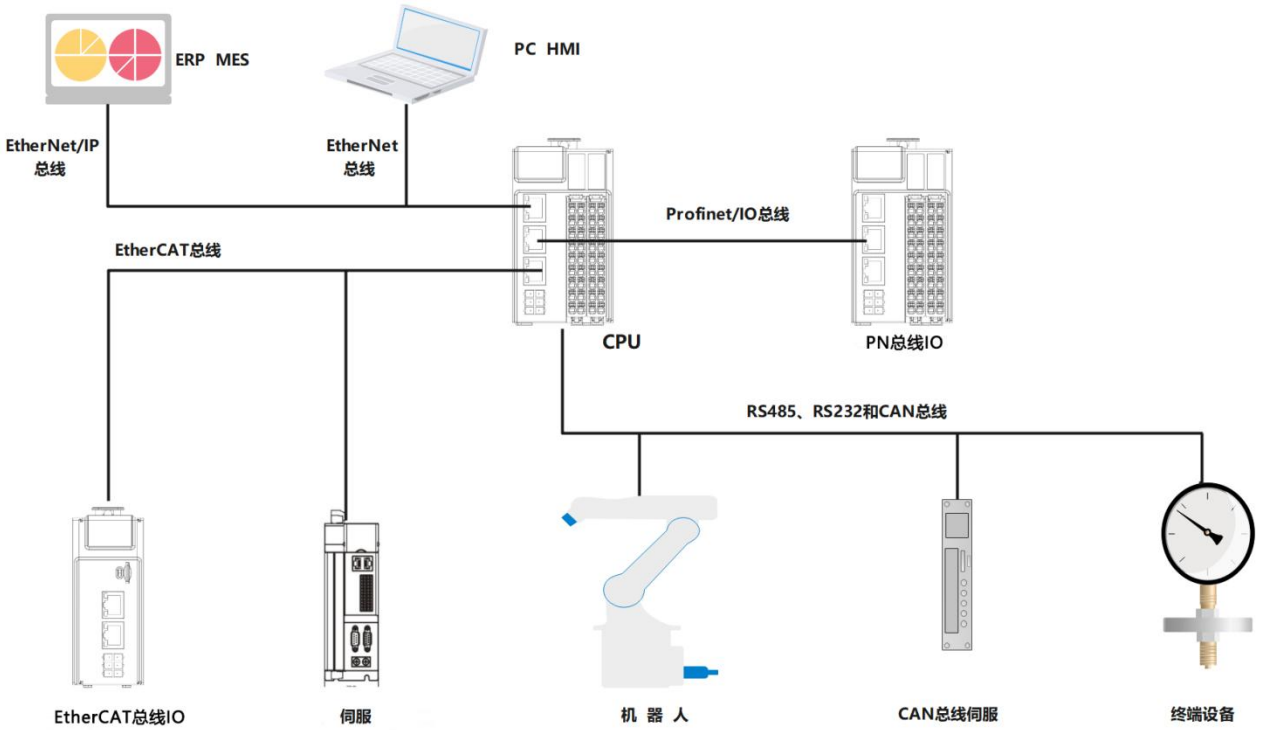
Users can conveniently use an Ethernet cable through the Ethernet port of the CPU module to make a point-to-point connection with PCs, HMIs and other devices. When connecting with the CPU module, please make sure that the IP address of the PC, HMI, etc. is in the same network segment as that of the CPU module, and the factory default IP of LAN A of the WAC500 series CPU module is 192.168.20.80. After connecting, you can use the web configuration tool of WAC500 series CPU module to complete the PLC parameter configuration quickly, please refer to the PLC Configuration section of this article for detailed operation

move.



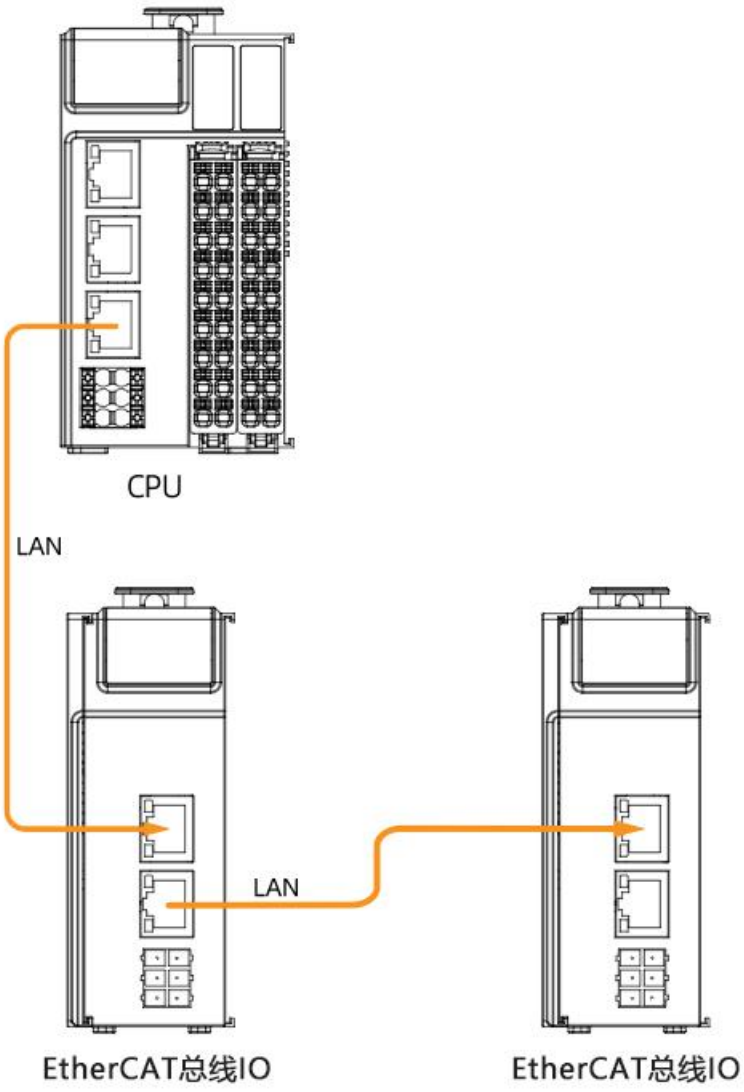
5.2. Communications networking

WAC500 series products integrate rich communication interfaces and support various bus protocols. IO communication to GR200-PNS and other devices that support Profinet/IO protocol; RS485, RS232 or CAN communication to other devices, the schematic diagram is shown below.



5.3. EtherCAT bus connection

The network interface of WAC500 series products supports EtherCAT bus, and the network interface can be configured and EtherCAT slave devices can be added through the configuration and programming software to complete the EtherCAT network.



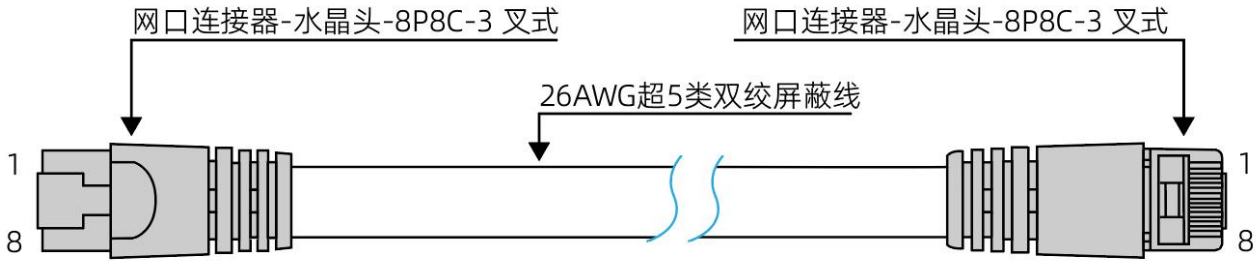
The WAC500 series can be used in combination with EtherCAT-compliant slaves to interconnect devices.

EtherCAT specifications

Items	Specifications descriptive
Communication protocols	EtherCAT protocol
Supported services	CoE (PDO, SDO)
Synchronization	With DC-distributed clock
Physical layer	100BASE-TX
Communication rate	100Mbit/s (100Base-TX)
Duplex	Full duplex
Topology	Linear topology
Transmission media	Shielded network cable, see wiring section
Transmission distance	Less than 100M between two nodes
Number of slaves	64
EtherCAT frame length	44 bytes ~ 1498 bytes
Process data	Maximum 1486 bytes in a single Ethernet frame

Wiring

Shielded network cables are recommended for EtherCAT communication and the cable length between the devices must not exceed 100 meters with the following requirements.



Signal pin assignment

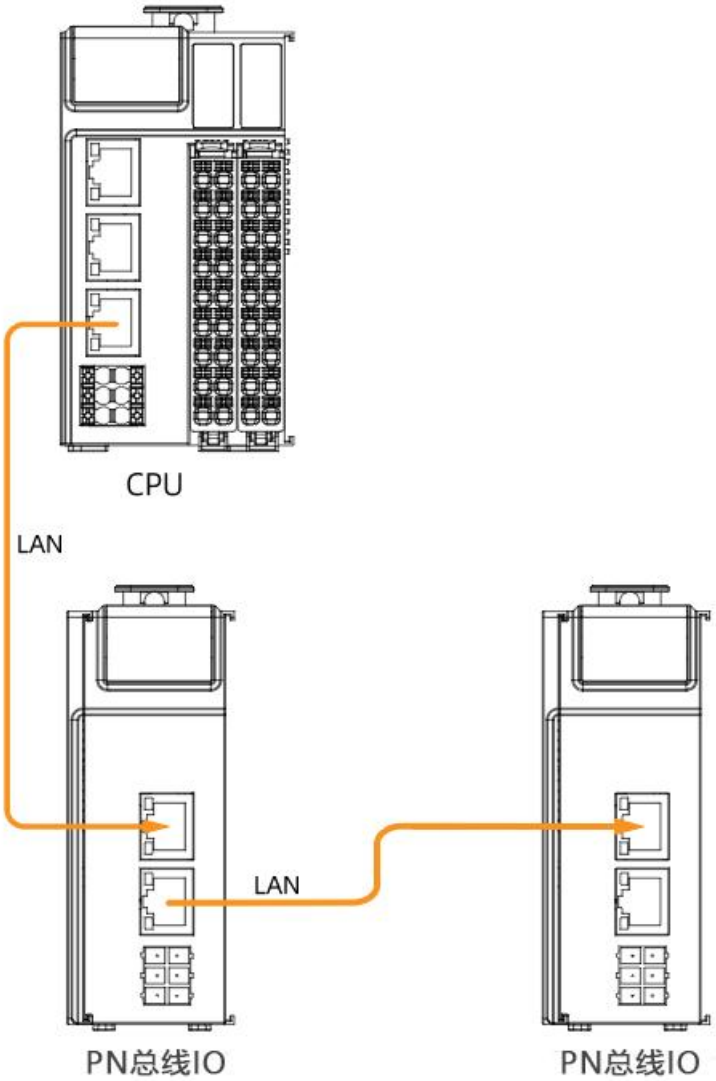
Pin	Signal	Signal direction	Signal description
1	TD+	Output	Data transfer+
2	TD-	Output	Data transmission-
3	RD+	Input	Data reception+
4	---	---	Not used
5	---	---	Not used
6	RD-	Input	Data reception-
7	---	---	Not used
8	---	---	Not used

The cable should be 100% conductivity test, no short circuit, disconnection, misalignment and poor contact phenomenon, recommended to use the following norm of the cable

Items	Specifications
Cable type	Flexible crossover cable, S-FTP, category super 5
Meet the standard	EIA/TIA568A，EN50173，ISO/IEC11801 EIA/TI Abulletin TSB，EIA/TIA SB40-A&TSB36
Conductor cross section	AWG26
Conductor type	Twisted pair
Pair	4

5.4. Profinet /IO bus connection

The network interface of WAC500 series products supports Profinet/IO bus, which can be configured by configuration programming software to add network interface, Profinet/IO master and slave devices to complete Profinet/IO network networking.



Each PROFINET device in the network is uniquely identified by its PROFINET interface. Each PROFINET interface has the following three key attributes:

- A MAC address (factory default)
- An IP address
- PROFINET device name

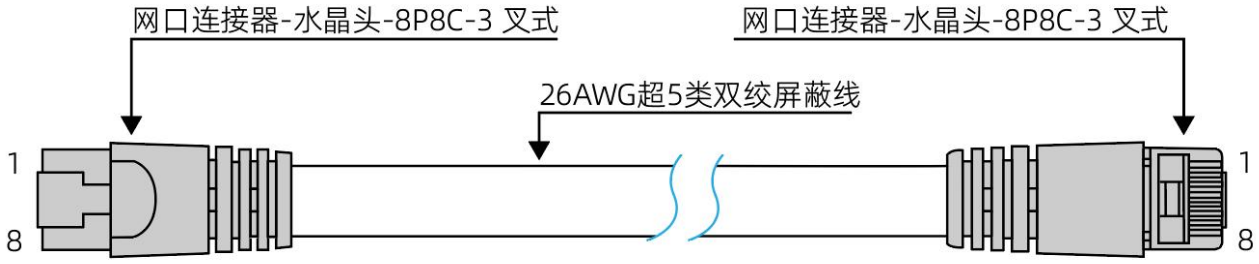
The WAC500 series can be used in combination with PROFINET devices to interconnect devices.

Profinet/IO specifications

Sports event	Specifications description
Communication mode	Profinet/IO
Duplex mode	Full duplex
Topology	Bus, star, ring, tree, hybrid topology
Physical layer	100BASE-TX
Communication rate	100Mbit/s (100Base-TX)
Transmission media	Shielded network cable, see wiring section
Transmission distance	Less than 100M between two nodes
Number of slaves	127

Profinet/IO Wring

Shielded network cables are recommended for Profinet/IO communication, and the cable length between devices must not exceed 100 meters, with the following requirements.



Signal pin assignment

Pin	Signal	Signal direction	Signal description
1	TD+	Output	Data transmission +
2	TD-	Output	Data transmission-
3	RD+	Input	Data reception+
4	---	---	Not used
5	---	---	Not used
6	RD-	Input	Data reception-
7	---	---	Not used
8	---	---	Not used

The cable should be 100% conductivity test, no short circuit, disconnection, misalignment and poor contact phenomenon, recommended to use the following norm of the cable

Items	Specifications
Cable type	Flexible crossover cable, S-FTP, category super 5
Meet the standard	EIA/TIA568A，EN50173，ISO/IEC11801 EIA/TI Abulletin TSB，EIA/TIA SB40-A&TSB36
Conductor cross section	AWG26
Conductor type	Twisted pair
Pair	4

5.5. RS232、RS485、CANbus bus connection

RS232 description of communications

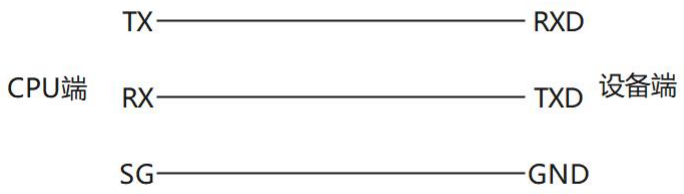
WAC500 series products support RS232 bus, using three signal lines (receive line, transmit line and signal ground line) to quickly realize the full-duplex communication process.

- **Communication specifications**

Items	Instruction

Number of supported channels	1 way
Hardware interface	2x5PIN terminal TX-transmit data RX-receive data, SG - signal ground
Programming interface	COM3
Isolation mode	Digital isolation
Number of slaves	1
Baud rate	1200~115200bps
Short circuit protection	Enhanced ESD protection

- **Connection method**



RS485 communication description

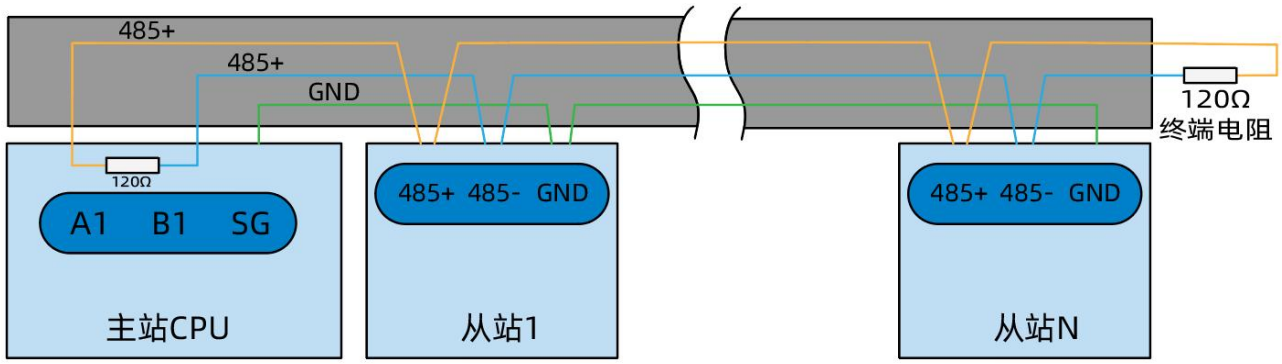
WAC500 series products support RS485 bus, using three-wire system to complete the communication.

- **Correspond specifications**

Items	Instruction
Number of supported channels	2-way
Hardware interface	2x5PIN terminals A1, B1; A2, B2 SG -signal ground
Programming interface	COM1, COM2
Isolation method	Digital isolation
Terminal resistance	120Ω
Number of slaves	31
Baud rate	1200~115200bps

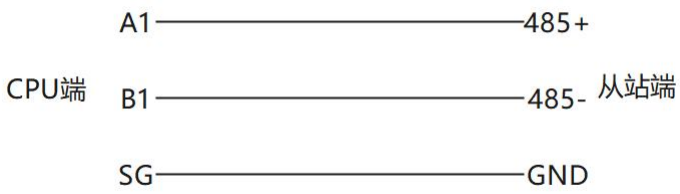
Protection	Short circuit protection

RS485 bus is recommended to use shielded twisted-pair cable connection, both ends of the bus are connected to 120Ω termination matching resistor to prevent signal reflection (WAC500 series CPU has built-in 120Ω termination resistor); all nodes of the 485 signal reference ground connected to a maximum of 31 nodes, each node branch line distance is less than 3m.



- Connection method

Take the first RS485 communication interface for example



CANbus communication description

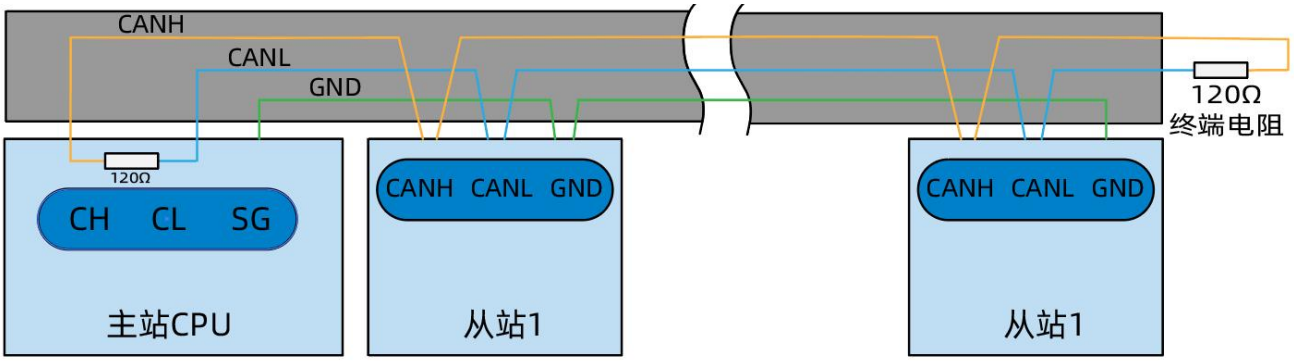
WAC500 series products support CANbus bus, using three-wire system to complete the communication.

- **Communication specifications**

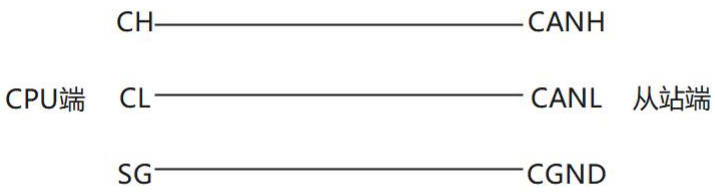
Items	Instruction
Number of supported channels	1 way
Hardware interface	2x5PIN terminal CH, CL, SG -signal ground
Programming interface	Network 0
Isolation method	Digital isolation
Terminal resistance	120Ω
Number of slaves	63

Baud rate	10Kbps, 20Kbps, 50Kbps, 125Kbps, 250Kbps, 500Kbps, 800Kbps, 1Mbps
Protection	Current limiting, overvoltage and ground loss protection (-40 V to 40 V) and thermal shutdown to prevent output short circuits

The CANbus bus connection topology is shown below. It is recommended to use shielded twisted-pair cable to connect the CANbus bus, and two 120Ω termination matching resistors are connected at each end of the bus to prevent signal reflection (120Ω termination resistors are already built in the WAC500 series CPUs). The shielding layer generally uses a single point of reliable grounding.



- Connection method



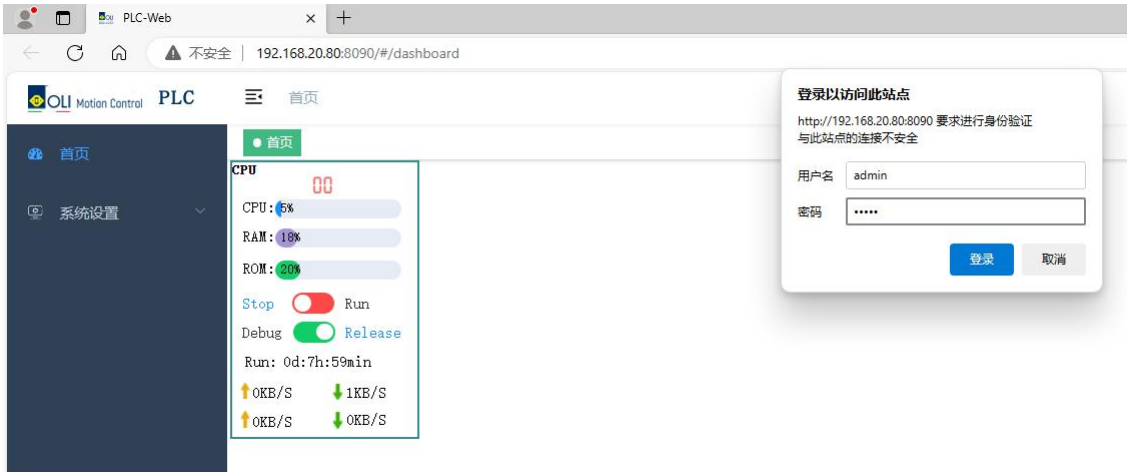
6. PLC configuration

WAC500 series PLC can quickly complete the PLC parameter configuration through the web configuration tool, which greatly improves the ease of use of the PLC.

6.1. Logging in to the web configuration tool

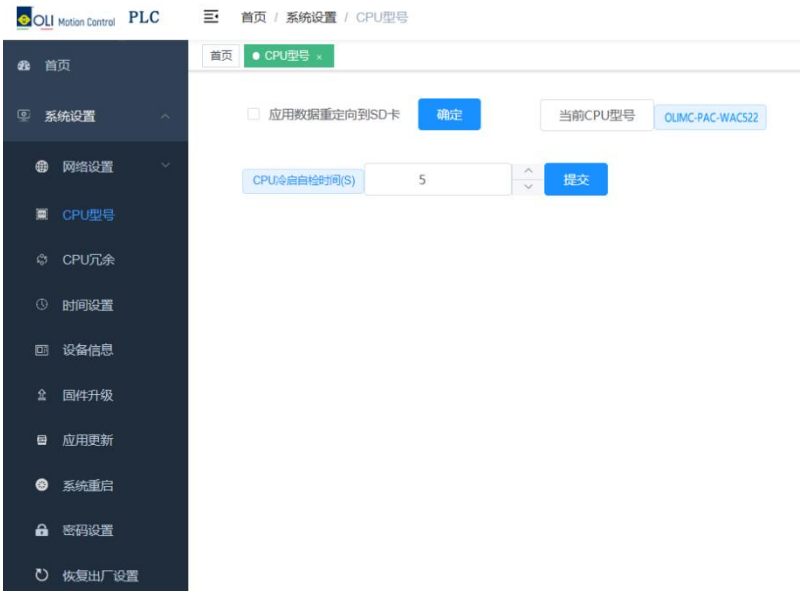
After confirming that the PC is correctly connected to the PLC network, on the PC side, open a browser and enter the CPU's factory default LAN A IP (192.168.20.80) + port number (8090):

Enter the default username/password "admin/admin" to access the web configuration tool.



6.2. CPU model

Configurable application data redirection to SD card, CPU cold start self-test time, view CPU model.



1. Application data redirection to SD card: This function can be enabled when the user's application programs and data are too large. Once enabled, application programs and data will be migrated to SD card, PLC will read and update application programs and data from SD card, please do not plug and unplug SD card during PLC operation to avoid loss of application data.

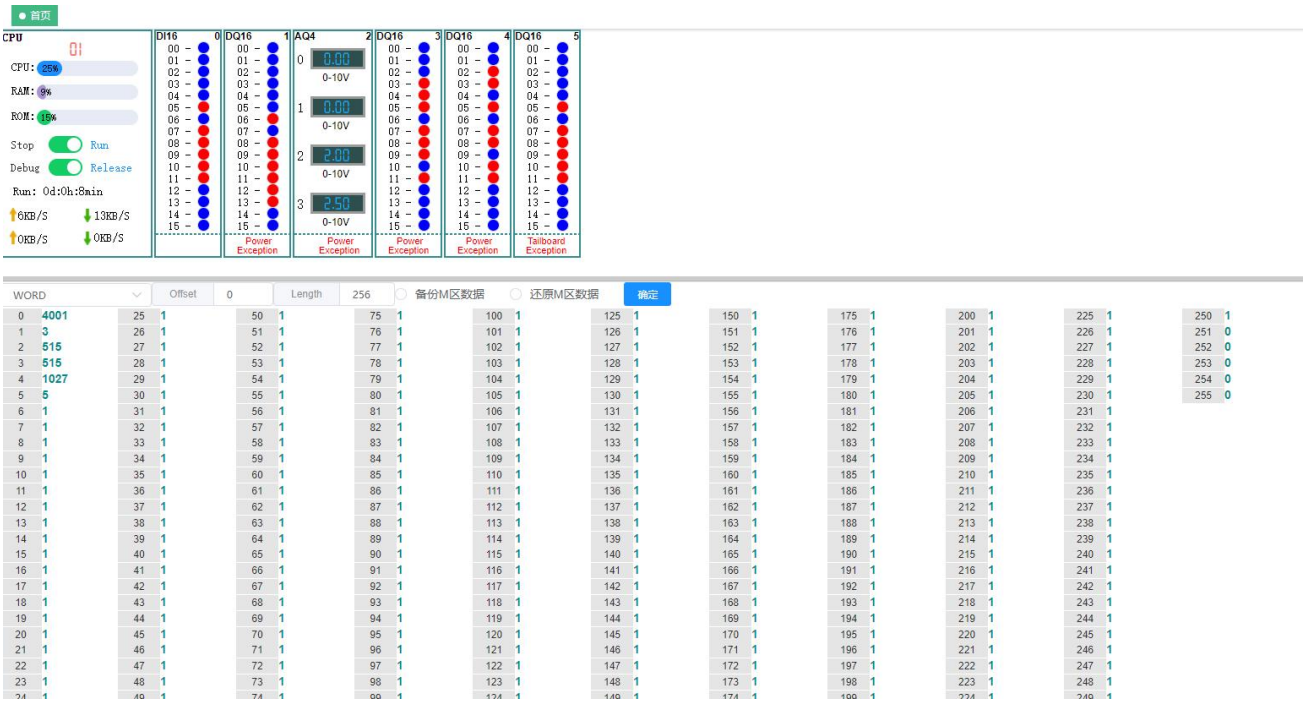
Check the box to enable, click "OK" and restart the PLC; to cancel the function, remove the check box and restart the PLC.

2. Current CPU model: the specific model of the current CPU.

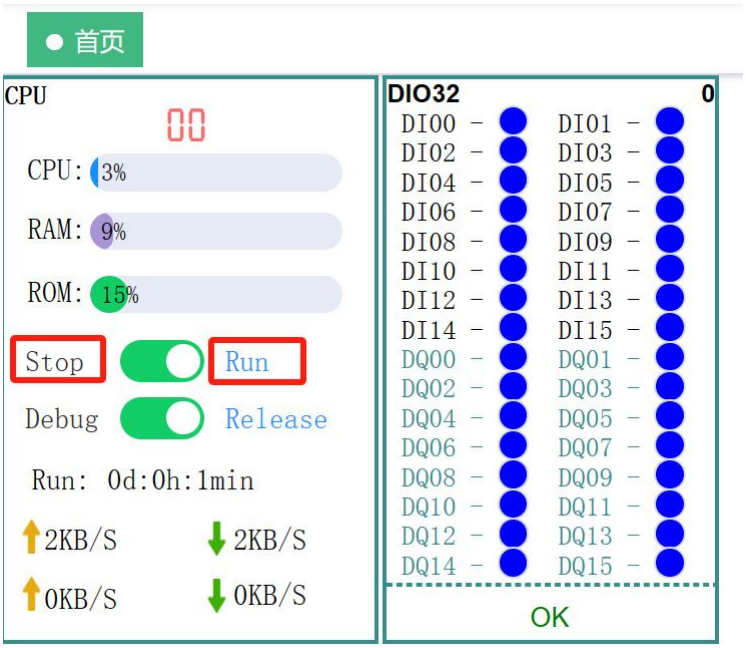
3. CPU cold start self-test time: PLC startup in the time to complete the self-test of various states.

6.3. Monitoring functions

1. In the home page of web configuration tool, you can view the error code, CPU occupancy, memory usage, running time, and the real-time status of each module channel, of which the digital quantity red means TRUE, blue means FALSE. if the module has an error, it will display the current error in real time, Configuration Error means configuration error; Poerr Configuration Error means configuration error; Poerr Exception means power abnormality; Over Current means over current; Channel Error means channel error; Tailboard Exception means tailboard abnormality.



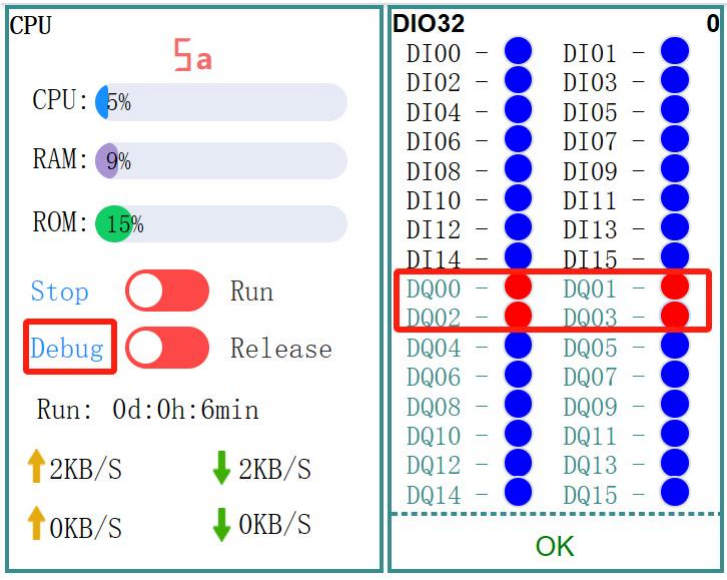
2. Start/stop the user program.



Click "Stop" to stop the user program; click "Run" to run the user program.

3. Debug function.

Click "Debug" to enter the debugging mode, the user program stops, then click on the channel of the output module to control the channel on/off.



Click "Release" to exit debug mode, and then click "Run" to run the user program.

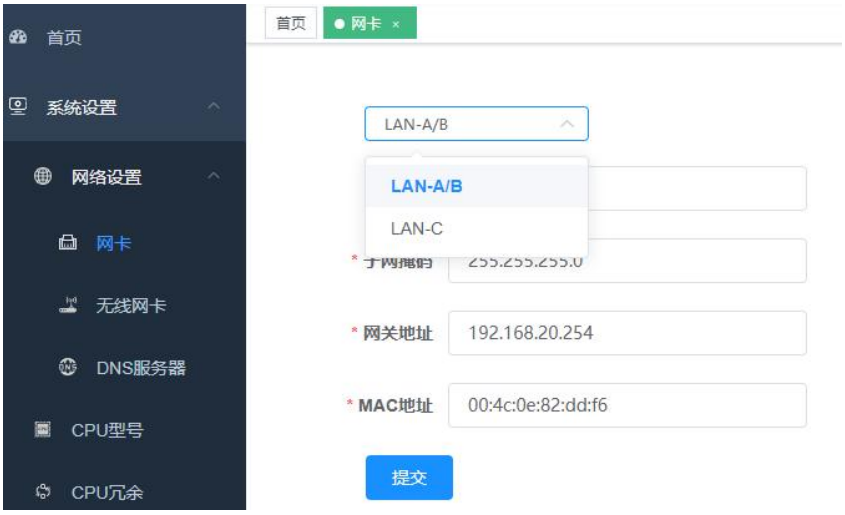
4. Realize read, write, backup and restore operations of M-area data. Click an address in the M area, fill in the value to be written in the dialog box, and complete the write operation to an address in the M area. In the editing area, you can switch the data type to be displayed (BYTE, WORD, DWORD, FLOAT), which can be switched according to the actual needs; Offset means the first starting address of the first column, and you can modify the value of any address by clicking on it; Length is the maximum length of the address displayed on the interface, which is 1024.

You can only perform the operation of "Restore M-area data" after you perform the operation of "Backup M-area data" on the web.

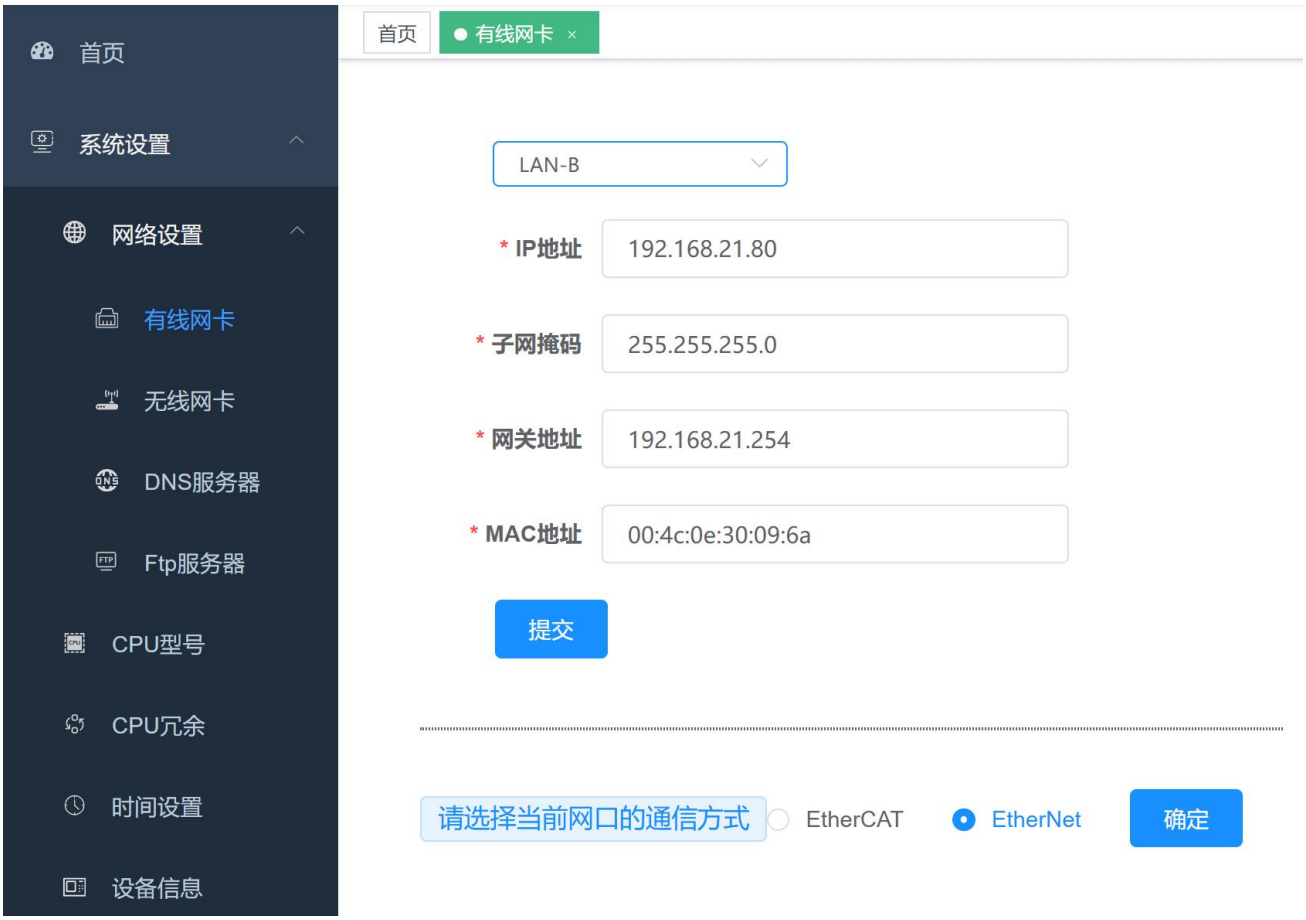
6.4. Network settings

PLC network information can be set.

1. Select the network to be operated.



2. Set the corresponding network IP, subnet mask, gateway information. When the communication mode of the network port needs to be changed, you need to switch it on the webpage, the first network port is EtherNet by default and does not support EtherCAT mode. Please switch the other ports to the corresponding mode according to the actual use.

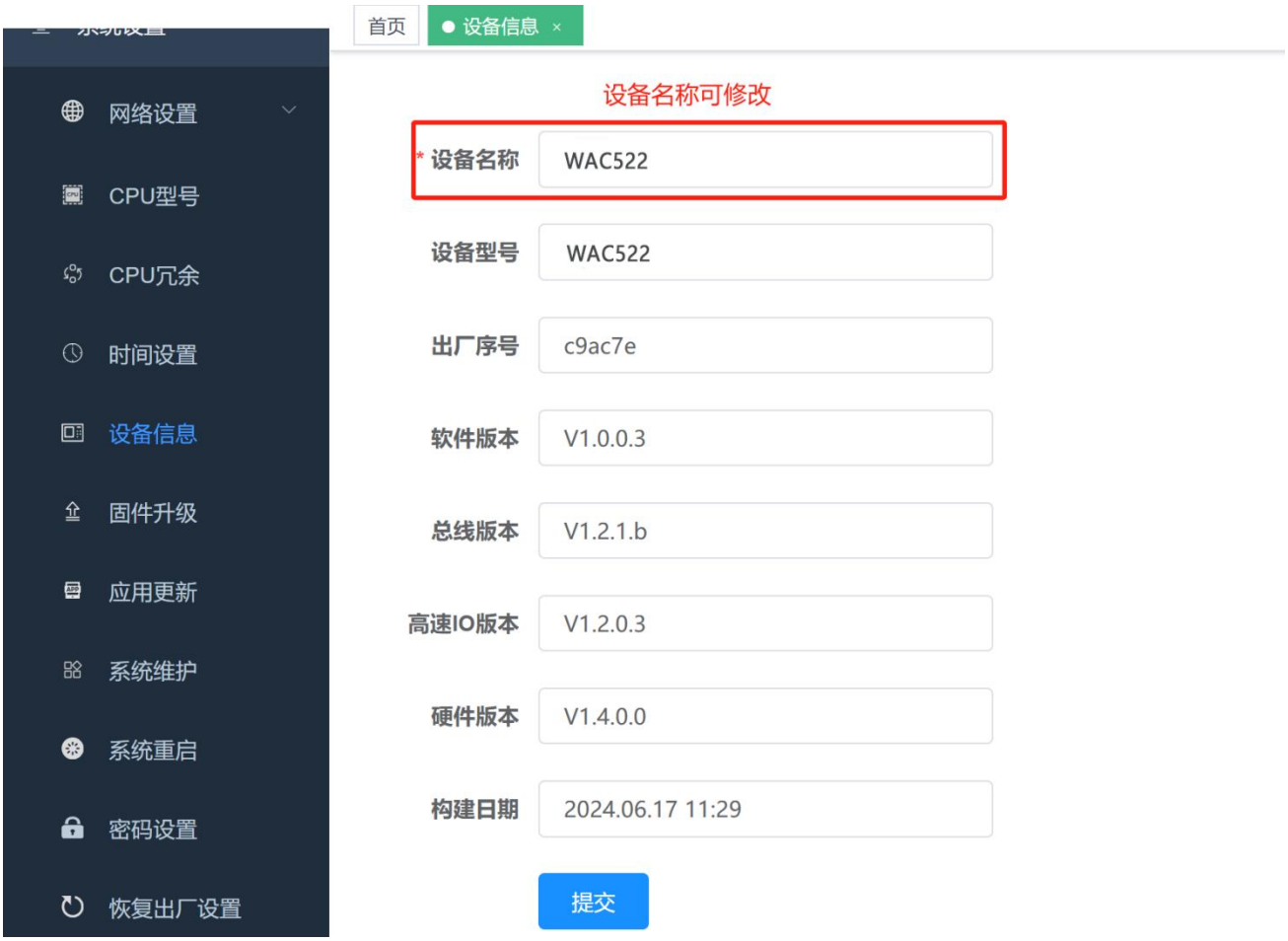


6.5. Time settings

PLC time and NTP calibration can be set. Synchronization frequency indicates how often synchronization is performed.

6.6. Equipment information maintenance

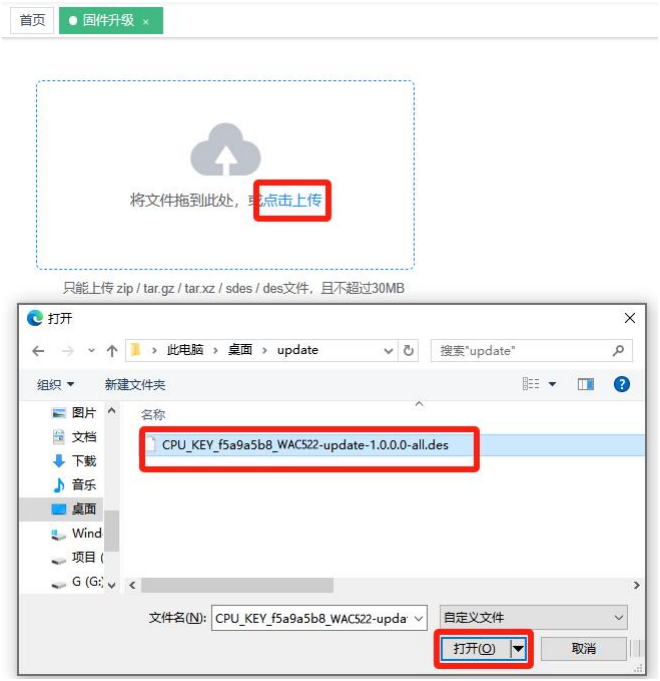
If more than one CPU exists at the same time, in order to better distinguish the specific device we can modify the device name, and can view the device software and hardware version information.



6.7. Firmware upgrade

Firmware upgrade operation can be performed, and the format and size of the upgrade package should meet the requirements.

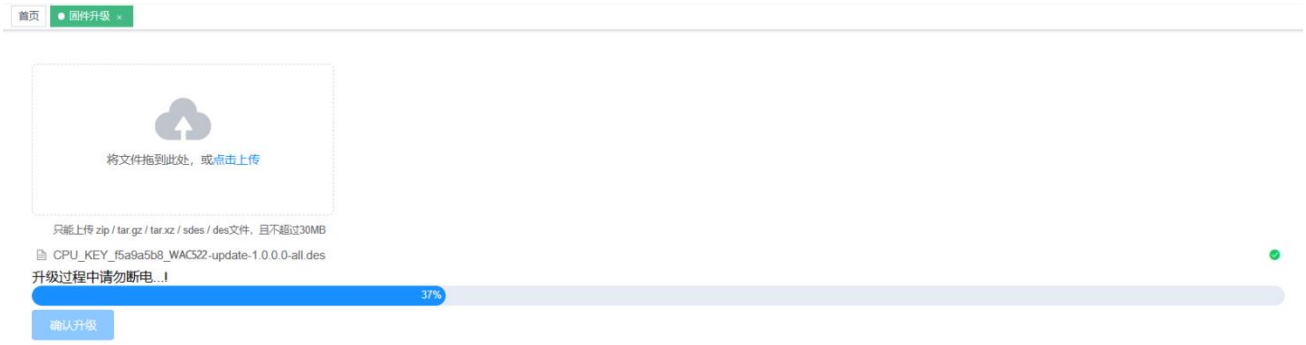
Upload the update package as instructed.



After uploading the firmware upgrade package, click Confirm Upgrade.

Get the upgrade key from the upgrade package to verify the upgrade operation. The upgrade key is the field after CPU_KEY in the upgrade package name, for example, the upgrade package name is "CPU_KEY_f5a9a5b8_MC522-update-1.0.0.0-all", the upgrade key is "f5a9a5b8 ".

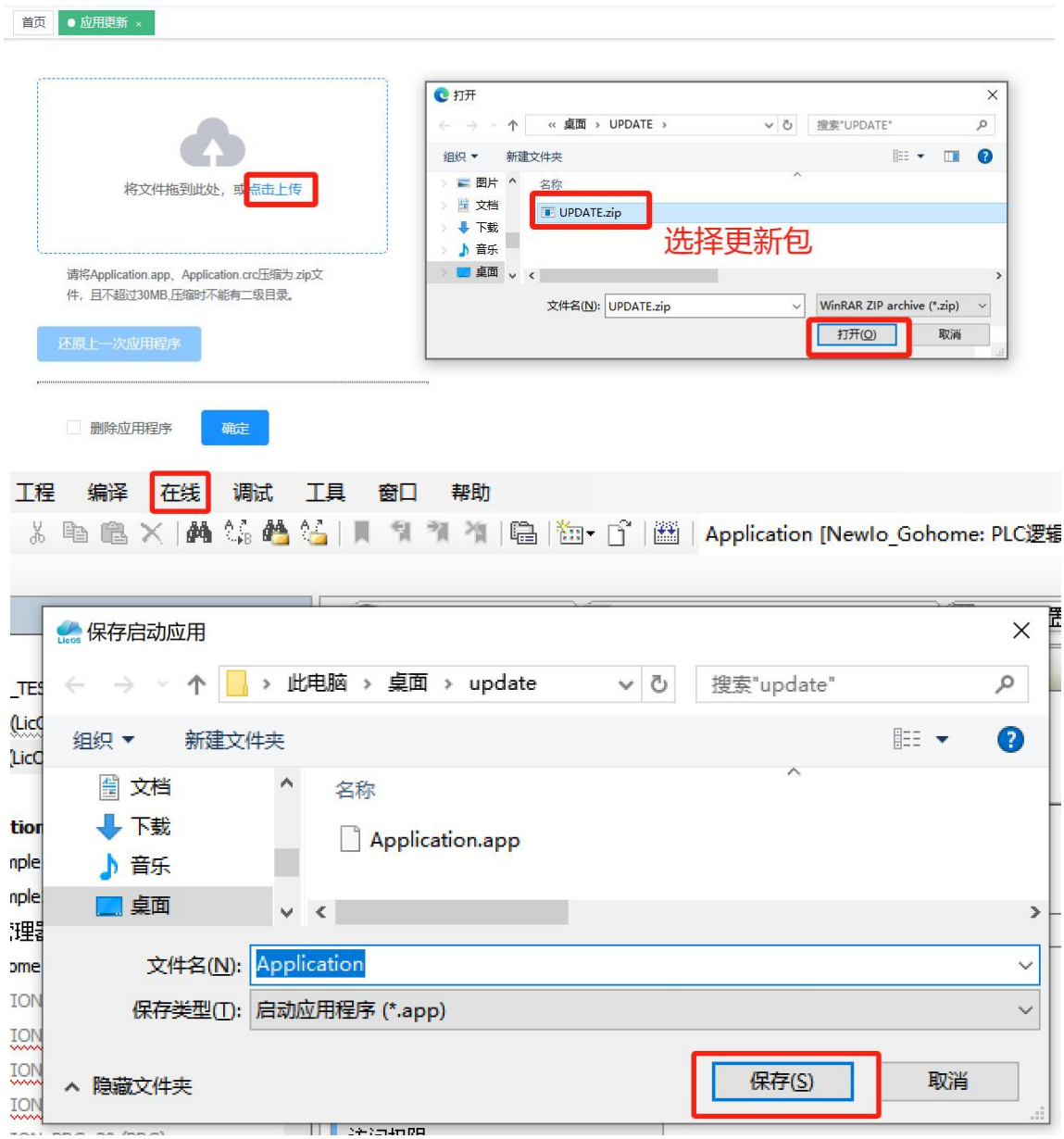
Waiting for the upgrade to complete



The upgrade is complete and the PLC completes an automatic reboot.

6.8. Application updates

You can download and update the user program. First, write the application on Smart Control, compile it without error, click "Online", select "Create Startup Application", choose the file storage path, and save the program file.



Compress the exported application file into a .ZIP file. Go back to "Application Updates" in the web configuration tool to upload the update package.

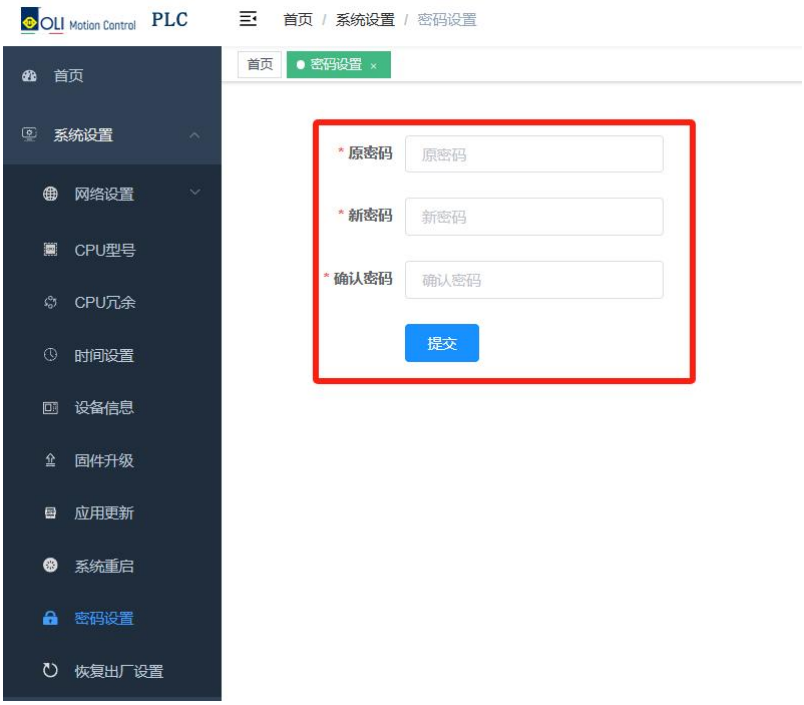
Click "Confirm Upgrade" and wait for the upgrade to complete.

Restore last application: This operation can be performed only after the "Application update" has been performed on the web.

Delete application: Deletes the application from the PLC.

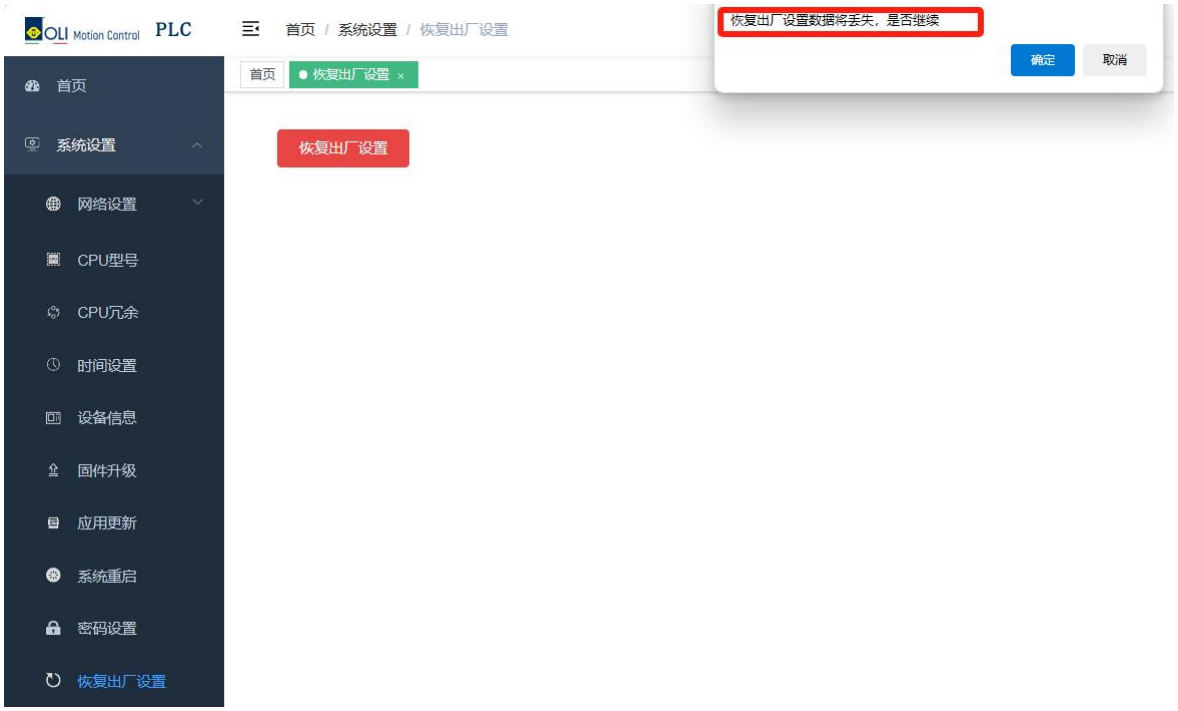
6.9. Password maintenance

Maintenance operation of PLC password can be completed.



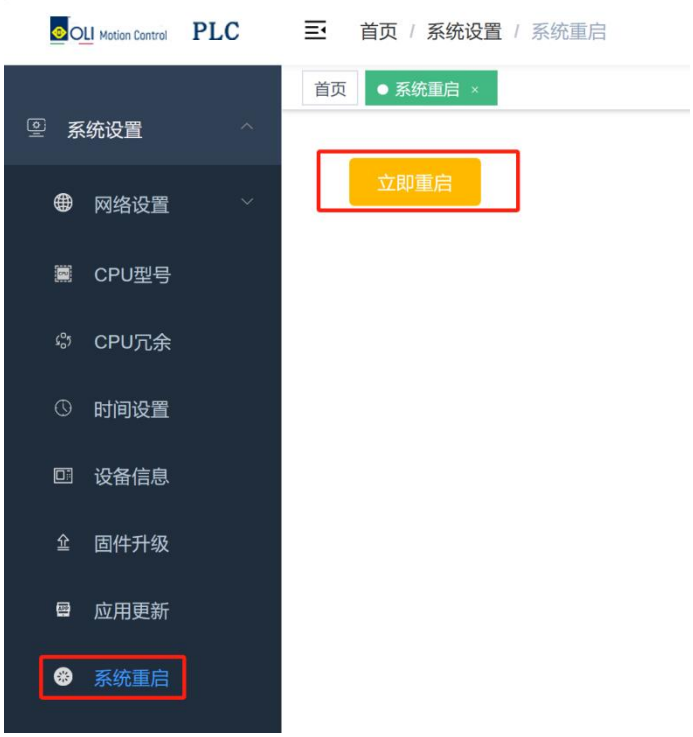
6.10. Restoring factory settings

PLC can be restored to the factory settings of the operation, restore the factory settings of the PLC will be lost after the user to set the data, program, restore the factory data, please be careful to operate.



6.11. System reboot

Users can perform system reboot operations on the PLC from the web page。



6.12. System maintenance

You can view the error code and the corresponding solution.

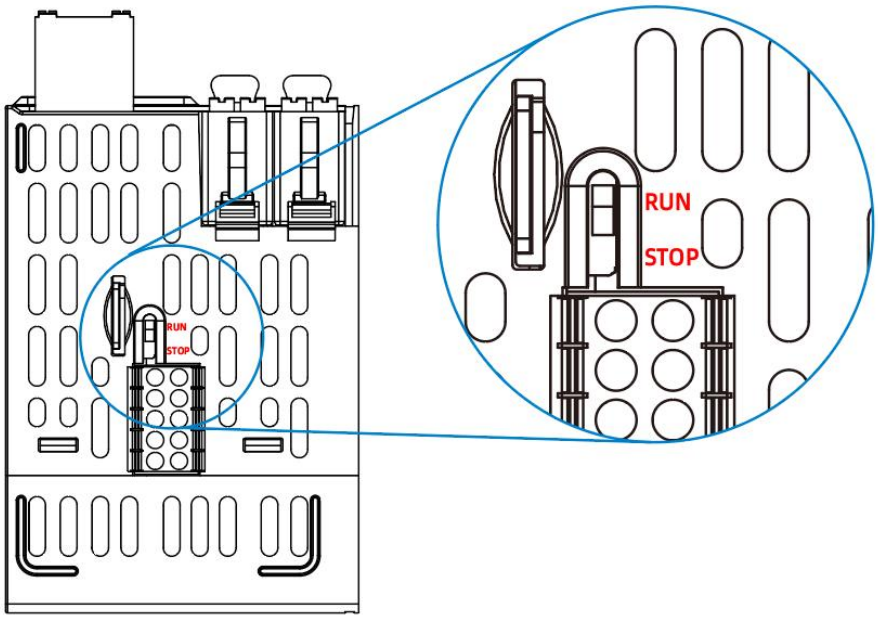
错误码	含义	处理方法
22	系统启动失败	检查系统供电无误后，重新启动
23	系统初始化失败	检查系统供电无误后，重新启动
25	CPU温度过高	请检查系统散热条件
32	EtherCAT主站错误	检查 EtherCAT主站及其各子节点硬件连接、主站源地址（MAC）等参数设置是否正确，例如：网线断路、网口与实际使用是否一致、从站异常
35	Ethernet节点异常	检查Ethernet及其各子节点硬件连接、参数设置是否正确
36	Profinet主站异常	检查Profinet主站及各其子节点硬件连接、参数设置是否正确，例如：Ethernet网络接口及网络信息与实际不一致
37	Profinet从站异常	检查Profinet从站与主站设备硬件连接、参数设置是否正确，例如：与主站网络是否正常、网络设置是否同一个网段
39	Ethernet/IP scanner异常	检查Ethernet/IP scanner及其各子节点硬件连接、参数设置是否正确，例如：与从站网络是否正常、网络设置是否同一个网段
3a	Ethernet/IP adapter	检查Ethernet/IP adapter及其所属模块硬件连接、参数配置是否正确

7. Maintenance and upkeep

7.1. Running and stopping operations

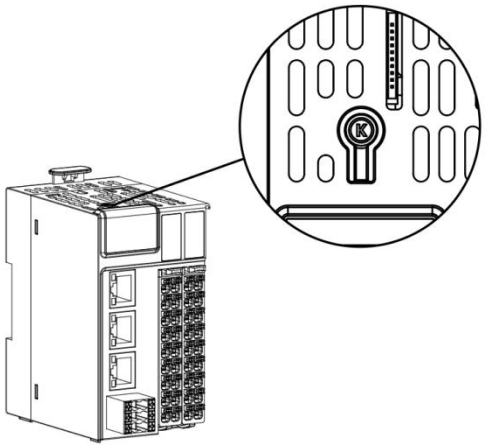
When the user program is written into the CPU module, the start/stop program operation can be executed according to the following steps.

1. At the bottom of the CPU module has a program run/stop dipswitch, need to run the program when the switch to RUN position, at this time if there is no fault is displayed  on the CPU digital pipe; need to stop the program, the switch to STOP position, the program stops, at this time, the digital pipe of the CPU module will be polled to display the PLC's network information (in hexadecimal display of the IP address, subnet mask, gateway information: the digital pipe displays  that the 4 hexadecimal numbers displayed immediately after are IP; the 4 hexadecimal numbers displayed  immediately after are mask; and the 4 hexadecimal numbers displayed  immediately after are gateway. (Refer to Appendix B for display value symbols and value correspondences).



2. You can use the relevant buttons on the web configuration tool to complete the start/stop operation of the PLC program, please refer to the PLC configuration chapter of the home page function for details of the operation process.

7.2. MFK key to restore factory settings



Press the multifunction button to display t1, keep it pressed until display t2, release the button within 5s, it will display P1, then press the multifunction button again until it appears P2, release the button to finish restoring the factory settings, the CPU module will restart automatically.

7.3. SD card firmware upgrade

1. Insert the SD card containing firmware information (maximum capacity is 32GB, file format is FAT32) into the SD card slot of the CPU module.

When the power is restored, the CPU digital pipe will display Ld, indicating that the firmware is being upgraded. When the digital pipe displays do, it means the firmware upgrade is successful.

2. After the firmware upgrade is completed, power down the product and pull out the SD card.
3. Re-power on the product.

7.4. SD card, U disk drive update user program

1. Store the update file compiled by Smart Control in the "Application/Application_new" directory of the SD card or USB flash disk.
2. Insert the SD card or U disk into the corresponding slot of the CPU module.
3. Successful update RUN indicator blinks 6 times, the digital tube will display 88, at this time the PLC re-run the user program, successful operation of the user program will be displayed 00 on the digital tube.
4. If the ERR indicator blinks 3 times, it means the update failed. Please check the update file and stored in the SD card, U disk path is correct. If all are correct, but still failed to burn, please contact technical support to solve the problem.

7.5. Routine maintenance

7.5.1. Daily inspection program

Installation, connection status check

Check sports event	Inspection methods	Treatment

Appearance check	Visual inspection for contamination	Cleaning of dirt and dust
Secure DIN rail mounting	DIN rails are firmly connected to the fixing surfaces.	Secure the DIN rail
Secure mounting of modules	Firm connection of the modules to the DIN rail	Make sure the mounting is secure
Check for loose terminals	Module terminal screws are not loose	Tighten the screws
Check cables and connection terminals	Connection cables and terminals of each module are not loose.	Install cables and terminals
Check sports event		

7.5.2. Regular inspections

The sports events that are inspected once or twice in 6 months to a year are as follows:

Check sports event	Inspection methods	Treatment
Appearance check	Visually inspect for contamination	Clean the dirt and dust
Power supply voltage	Measure the input DC power supply of the system to see if it complies with the product norm.	Confirm the reliability of the power supply system
Ambient temperature and humidity	Measure the ambient temperature and humidity around the system with a thermometer and hygrometer to see if it complies with the product norm Confirm the cause of the environmental changes and deal with it in time.	Ensure the environment
Air	Detect whether there is corrosive gas	Ensure environment meets norm requirements
Cleanliness	Check whether there is dirt accumulation	Eliminate the source of generation to ensure that the system operates in a reliable environment.

In addition, inspections should be carried out when equipment is relocated or remodeled, or when wiring is changed.

Appendix A Fault codes comparison table

Fault code	Digital display	Status meaning	Countermeasures
0x22		System boot failure	Reboot after checking that the system power supply is correct
0x23		System initialization failure	After checking the system power supply, restart the system.
0x32		EtherCAT master error	Check whether the hardware connection of the EtherCAT master and its sub-nodes, the master source address (MAC) and other parameters are set correctly, e.g. whether the network cable is disconnected, whether the network port is the same as the actual one used, or whether the slave is abnormal.
0x35		Ethernet node exception	Check whether the hardware connection and parameter settings of Ethernet and its sub-nodes are correct.
0x36		Profinet master abnormal	Check whether the hardware connection and parameter settings of Profinet master and its sub-nodes are correct, e.g. whether the Ethernet network interface and network information are inconsistent with the actual situation.
0x37		Profinet slave abnormal	Check whether the hardware connection and parameter settings of Profinet slave and master are correct, e.g. whether the network with the master is normal and whether the network settings are in the same network segment.
0x39		Ethernet/IP scanner exception	Check whether the hardware connection and parameter settings of Ethernet/IP scanner and its sub-nodes are correct, e.g. whether the network with the slave is normal and whether the network settings are in the same network segment.
0x3a		Ethernet/IP adapter	Check whether the hardware connection and parameter configuration of Ethernet/IP adapter and its subordinate modules are correct.
0x3c		CAN node exception	Check whether the CAN node communication network and baud rate are correct.
0x3d		CAN master exception	Check whether the hardware connection and parameter settings of the CAN master and its sub-nodes are correct, e.g. the wiring of the CAN communication is wrong, or the slave station ID is not consistent with the physical station number.
0x3e		CAN slave device exception	Check whether the hardware connection and parameter settings of CAN slave devices are correct.
0x3f		Modbus_tcp master exception	Check whether the hardware connection and parameter settings of Modbus_tcp master and its sub-nodes are correct, e.g. whether the IP and port settings of the slave are correct.
0x40		Modbus_tcp slave device exception	Check whether the hardware connection and parameter settings of Modbus_tcp slave devices are correct.

0x42		Modbus_rtu node exception	Check whether the hardware connection and parameter settings of Modbus_rtu node and its sub-nodes are correct, for example, COM port selection is wrong.
0x43		Modbus_rtu master Error	Check whether the hardware connection and parameter settings of Modbus_rtu master and its sub-nodes are correct, for example, the slave address does not match the actual one, and the physical connection between master and slave is disconnected.
0x44		Modbus_rtu slave device exception	Check whether the hardware connection and parameter settings of Modbus_rtu slave devices are correct.
0x5a		Application stop	Check whether the RUN/STOP switch is in the STOP state, if it is in the RUN state, check whether the application program is closed on the web page, and the initial reset device also shows 5a.
0x5b		Application program exception	Check whether there is any error in the application program implementation logic, such as: division by 0, null pointer, array out of bounds.
0x72		Native IO module power supply abnormality	Check whether the power input of the body IO module is normal and whether the output module channel is short-circuited.
0x73		Configuration mismatch	After the 73 error code appears, the digital pipe immediately displays the slot number of the abnormal module. Check the software and hardware configuration according to the display and correct the error, for example, 73 02 means that the hardware configuration of the second module is not consistent with the software configuration.
0x74		Extended IO module power abnormal	After the 74 error code appears, the digital tube immediately shows the slot number of the abnormal module. For example, 74 02 means that the power supply of the second module is abnormal, please check whether the wiring of the corresponding module is correct, for example, check whether the power input of the corresponding extended IO module is normal and whether the output module channel is short-circuited.
0x75		Extended IO module overcurrent/over temperature	After 75 error code appears, the digital pipe immediately displays the slot number of the abnormal module. Check the corresponding module according to the display
0x76		Tailboard abnormal	Check whether the tail plate is firmly installed.
0x77		Extended IO module channel abnormality	When error code 77 appears, the digital pipe immediately shows the slot number of the abnormal module. Check the corresponding expansion IO module according to the display.

Appendix B Comparison table of digital tube display values

Display icons								
Hexadecimal	0	1	2	3	4	5	6	7
Hexadecimal	0	1	2	3	4	5	6	7
Display icons								
Hexadecimal	8	9	A	B	C	D	E	F
Hexadecimal	8	9	10	11	12	13	14	15