

**EtherCAT**

**RC Series Slice I/O**

**User Manual**

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# 1 Product Overview

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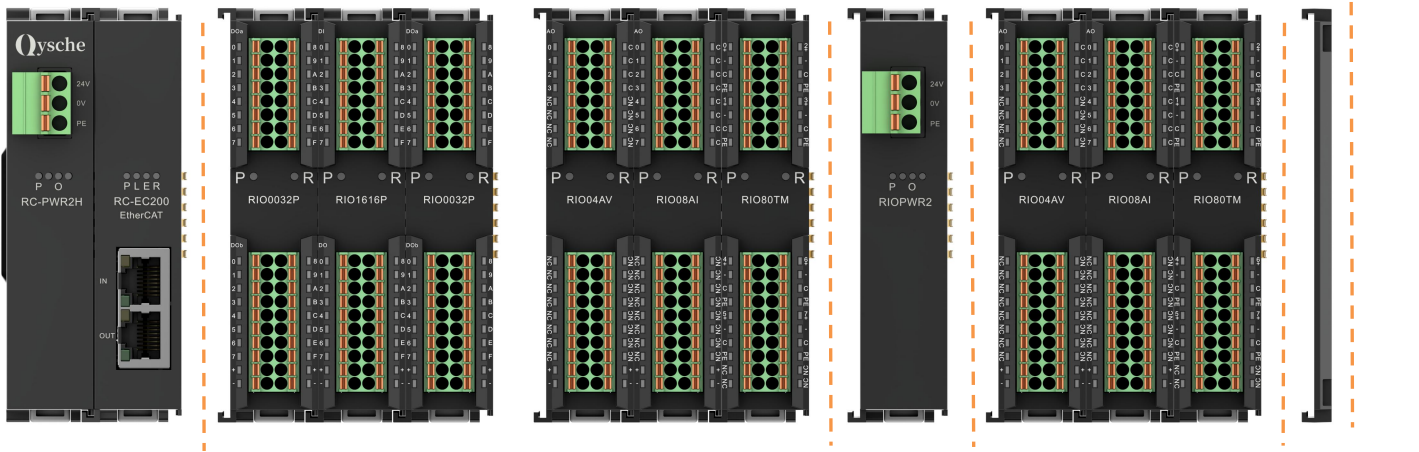
## 1.1 Product Introduction

RC series plug-in I/O modules adopt a structure that combines a coupler and an I/O module. RC-EC2200 is a module kit of RC series plug-in power module and EtherCAT coupler. The coupler connects the expandable I/O module to the fieldbus control system. The I/O module communication backplane adopts X-bus bus, which has high real-time performance and rich module types, providing users with high-speed data acquisition, optimized system configuration, simplified field wiring, and improved system reliability.

## 1.2 Product Features

- **Occupies fewer nodes**  
A node consists of a bus coupler, 1 to 32 X-bus series I/O modules and an end cover.
- **Rich functional expansion**  
It supports flexible expansion and has a full range of I/O types; it can integrate digital, analog, temperature, pulse and other modules to meet the needs of different application scenarios.
- **Flexible configuration**  
Various types of plug-in I/O modules can be combined arbitrarily.
- **Strong compatibility**  
The coupler communication interface complies with communication standards and supports mainstream EtherCAT master stations.
- **Supported configuration parameters**  
Support parameter configuration and automatic saving.
- **Easy diagnosis**  
The innovative channel indicator light design is close to the channel, so the channel status is clear at a glance and detection and maintenance are convenient.
- **Fast speed**  
The backplane uses X-bus: the maximum scanning cycle is 1 ms.

### 1.3 Application Configuration



**Coupler modules**

**I/O Modules Functional modules**

**Extensions Power Module**

**I/O Modules Functional modules**

**End caps**

**Application:**

The application method adopts the combination of power modules, quantities, analog quantities, relays, temperature, pulse and other modules.

**Application configuration:**

According to the requirements of master station access capability, number of sites, I/O points, function type, etc., it can adapt to different types of I/O module combination configurations.

**Configuration rules:**

The modules from left to right are power module, coupler module, I/O module, end cover (mandatory), etc.

# 2 Model List

## 2.1 List of commonly used modules

model	Product Description	
RC-EC2200	EtherCAT coupler kit (power supply RC-PWR2H, coupler RC-EC200)	
RIOPWR2	Extension power module	
RIO3200P	32-channel digital input module, PNP type	
RIO0032P	32-channel digital output module, PNP type	
RIO1600P	16-channel digital input module, PNP type	
RIO0016P	16-channel digital output module, PNP type	
RIO0800P	8-channel digital input module, PNP type	
RIO0008P	8-channel digital output module, PNP type	
RIO1616P	16-channel digital input and output module, PNP type	
RIO80AV	8-channel analog voltage input module	Optional range:0~+10 V, -10~+10 V
RIO40AV	4-channel analog voltage input module	
RIO04AV	4-channel analog voltage output module	
RIO40AI	4-channel analog current input module	Optional range:0~20mA, 4~20mA
RIO08AI	8-channel analog current output module	
RIO04AI	4-channel analog current output module	
RIO0012J	12-channel relay output module	
RIO40TM	4-channel thermal resistor and thermocouple temperature acquisition module	
RIO80TM	8-channel thermal resistor and thermocouple temperature acquisition module	
RIOP20A	Pulse counting module	

# 3 Product Parameters

## 3.1 General parameters

General technical parameters		
Specifications and dimensions	Power Module	106 × 61 × 22.5 mm
	Coupler modules	106 × 61 × 22.5 mm
	I/O Modules	106 × 73 × 25.7 mm
weight	Power Module	110 g
	Coupler modules	80 g
	I/O Modules	90 g
Operating temperature	-10°C~+60°C	
Storage temperature	-20°C~+75°C	
Relative humidity	95%, non-condensing	
Protection level	IP20	

## 3.2 Power parameters

Power parameters		
Power Module	Working power supply	24 VDC (18V~30V)
	Output voltage	5 VDC
	Output Current	2A
Coupler modules	Working power supply	5 VDC
	Working current	400 mA
I/O Modules	Working power supply	5 VDC

### 3.3 Interface parameters

<b>EtherCAT Interface Parameters</b>	
Bus protocol	EtherCAT (MDP)
Number of I/O stations	According to the master station settings
Data transmission medium	Ethernet/EtherCAT CAT5 Cables
Transmission distance	≤100 m (StationandStation distance)
Transfer rate	100 Mbps
Bus interface	2 × RJ45

### 3.4 Digital parameters

<b>Digital input</b>	
Rated voltage	24 VDC (18V~30V)
Signal Points	8, 16, 32
Signal Type	PNP
"0" signal voltage (PNP)	-3~+3 V
"1" signal voltage (PNP)	15~30 V
Input filtering	3 ms
Input Current	4 mA
Isolation method	Optocoupler Isolation
Isolation withstand voltage	500 VAC
Channel indicator light	Green LED light
<b>Digital output</b>	
Rated voltage	24 VDC (18V~30V)
Signal Points	8, 16, 32
Signal Type	PNP
Load Type	Resistive load, inductive load
Single channel rated current	PNP type Max: 500 mA
Port protection	Overvoltage and overcurrent protection
Isolation method	Optocoupler Isolation
Isolation withstand voltage	500 VAC
Channel indicator light	Green LED light

<b>Relay output</b>	
Rated voltage	24 VDC (18V~30V)
Signal Points	12
Isolation method	Optocoupler, relay
Rated load	2 A
Channel indicator light	Green LED light



## 3.5 Analog parameters

### 3.5.1 Technical Parameters

<b>Analog input</b>			
Enter points	4, 8		
Input signal (voltage type)	0~+10 V, -10 ~+10 V (range adjustable)		
Input signal (current type)	0~20 mA, 4~20 mA (adjustable range)		
Resolution	16 bit		
Sampling rate	RIO40AV, RIO80AV, RIO40AI	≤1 ksps	
Accuracy	RIO40AV, RIO80AV, RIO40AI	±0.1%	
Input impedance (voltage type)	≥2 kΩ		
Input impedance (current type)	100 Ω		
Isolation withstand voltage	500 VAC		
Channel indicator light	Green LED light		
<b>Temperature input</b>			
Number of channels	4, 8		
Sensor Type	Thermocouple	Thermal resistor	resistance
Connection	2-wire	2-wire, 3-wire	2-wire
	K: -200~1370°C J: -200~1200°C E: -200~1000°C S: -50~1690°C B: 50~1800°C	Pt100: -200~850°C Pt200: -200~600°C Pt500: -200~600°C Pt1000: -200~600°C	15Ω~3kΩ
Accuracy	±0.3%	±1°C	±0.1%
Sensitivity	0.1°C		±0.1Ω
Resolution	16 bits (int type)		
Channel indicator light	Green LED light		

<b>Analog output</b>			
Output points	4, 8		
Output signal (voltage type)	0~+10 V, -10~+10 V (range adjustable)		
Output signal (current type)	0~20 mA, 4~20 mA (adjustable range)		
Resolution	16 bit		
Accuracy	RIO04AV, RIO04AI, RIO08AI	±0.1%	
Load impedance (voltage)	≥2 kΩ		

type)	
Load impedance (current type)	$\leq 500 \Omega$ (some stock modules $\leq 200 \Omega$ , see note below for details)
Isolation withstand voltage	500 VAC
Channel indicator light	Green LED light

Note: The analog voltage module does not support underflow, underflow and overshoot, while the analog current module supports underflow, underflow and overshoot.

### 3.5.2 Voltage input/output range selection and code value table

Voltage input/output range selection and code value range				
Range selection	0	1	2	3
Range	-10 ~ +10 V	0 ~ +10 V	-10 ~ +10 V	0 ~ +10 V
Code value range	-32768 ~ 32767	0 ~ 32767	-27648 ~ 27648	0 ~ 27648
Voltage input Calculation formula	$D = (65535/20) * U$	$D = (32767/10) * U$	$D = (55296/20) * U$	$D = (27648/10) * U$
Voltage output Calculation formula	$U = (D * 20) / 65535$	$U = (D * 10) / 32767$	$U = (D * 20) / 55296$	$U = (D * 10) / 27648$
Code value Correspondence table	See also Table 3- 1 Voltage code value table.			

Note: D represents the code value, and U represents the voltage.

sheet3- 1Voltage code value table

Range Voltage	0 (default)	1	2	3
	-10~+10V Code value	0~+10V Code value	-10~+10V Code value	0~+10V Code value
-10	-32768	-	-27648	-
-9	-29491	-	-24883	-
-8	-26214	-	-22118	-
-7	-22937	-	-19354	-
-6	-19661	-	-16589	-
-5	-16384	-	-13824	-
-4	-13107	-	-11059	-
-3	-9830	-	-8294	-
-2	-6554	-	-5530	-
-1	-3277	-	-2765	-
0	0	0	0	0
1	3277	3277	2765	2765
2	6554	6553	5530	5530
3	9830	9830	8294	8294
4	13107	13107	11059	11059
5	16384	16384	13824	13824
6	19661	19660	16589	16589
7	22937	22937	19354	19354
8	26214	26214	22118	22118
9	29491	29490	24883	24883
10	32767	32767	27648	27648
	Code value = (65535/20) * voltage	Code value = (32767/10) * voltage	Code value = (55296/20) * voltage	Code value = (27648/10) * voltage
	Voltage = (code value * 20) / 65535	Voltage = (code value * 10) / 32767	Voltage = (code value * 20) / 55296	Voltage = (code value * 10) / 27648

Note: For analog voltage input modules, when the channel input voltage exceeds 10V, the maximum code value is displayed. For analog voltage output modules, when the code value setting exceeds the maximum code value corresponding to the range in the table, the channel outputs 10V voltage.

### 3.5.3 Current input/output range selection and code value table

Analog current input and output range selection and code value range				
Range selection	0	1	2	3
Range	4~20 mA	0~20 mA	4~20 mA	0~20 mA
Code value range	0~65535		0~27648	
Current input calculation formula	$D=(65535/16)*I-16384$	$D=(65535/20)*I$	$D=(27648/16)*I-6912$	$D=(27648/20)*I$
Current output calculation formula	$I=(D+16384)*16/65535$	$I=(D*20)/65535$	$I=((D+6912)*16)/27648$	$I=(D*20)/27648$
Code value Correspondence table	See also Table 3- 2 Current code value table.			

Note: D represents the code value, and I represents the current.

Table 3- 2 Current code value table

Range selection Range	0 (default)	1	2	3
	4~20mA	0~20mA	4~20mA	0~20mA
Current	Code value	Code value	Code value	Code value
0		0		0
1		3277		1382
2		6554		2765
3		9830		4147
4	0	13107	0	5530
5	4096	16384	1728	6912
6	8192	19661	3456	8294
7	12288	22937	5184	9677
8	16384	26214	6912	11059
9	20479	29491	8640	12442
10	24575	32768	10368	13824
11	28671	36044	12096	15206
12	32767	39321	13824	16589
13	36863	42598	15552	17971
14	40959	45875	17280	19354
15	45055	49151	19008	20736
16	49151	52428	20736	22118
17	53247	55705	22464	23501
18	57343	58982	24192	24883
19	61439	62258	25920	26266
20	65535	65535	27648	27648
twenty one	65535	65535	29376	29030
twenty two			31104	30413

22.81423611			32511	31538
22.96238426			32767	31743
twenty three			32767	31795
23.51779514				32511
23.70298032				32767
twenty four				32767
25				
	Code value = (65535/16) * current - 16384	Code value = (65535/20) * current	Code value = (27648/16) * current - 6912	Code value = (27648/20) * current

Note: When the input current of range 2 is greater than 22.81 mA, the code value is displayed as 32767; when the specified code value is greater than 32511, the output current is 22.81 mA.

When the input current of range 3 is greater than 23.52 mA, the code value displayed is 32767; when the specified code value is greater than 32511, the output current is 23.52 mA.

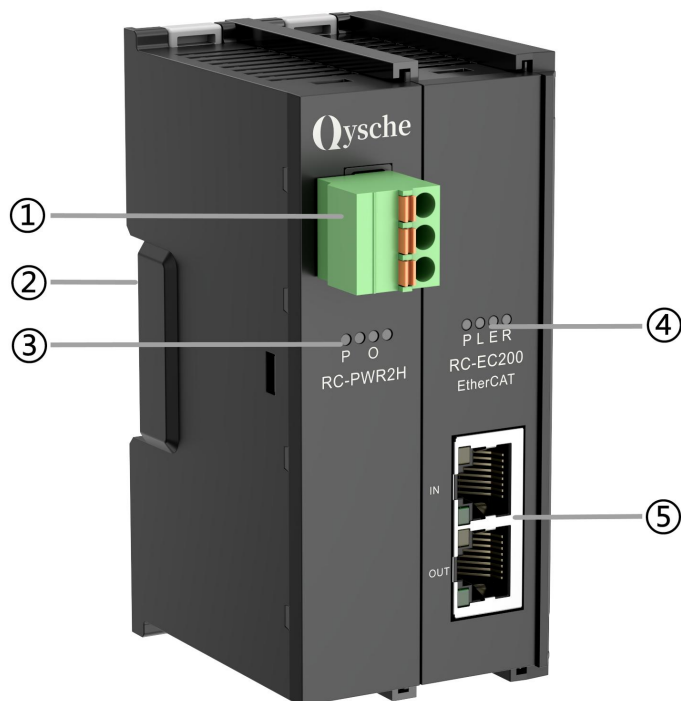
# 4 panel

## 4.1 Coupler Panel

### 4.1.1 Coupler structure

#### Product parts names and function

#### descriptions



serial number	name	illustrate
①	Power Terminal Blocks	Spring-loaded terminal blocks
②	Guide rail slot	Suitable for DIN 35 mm rail fixing

③	Power label, indicator light	Indicates power status
④	System identification and indicator lights	Indicates power supply and module operation status
⑤	Bus interface	2 × RJ45

## 4.1.2 Indicator light function

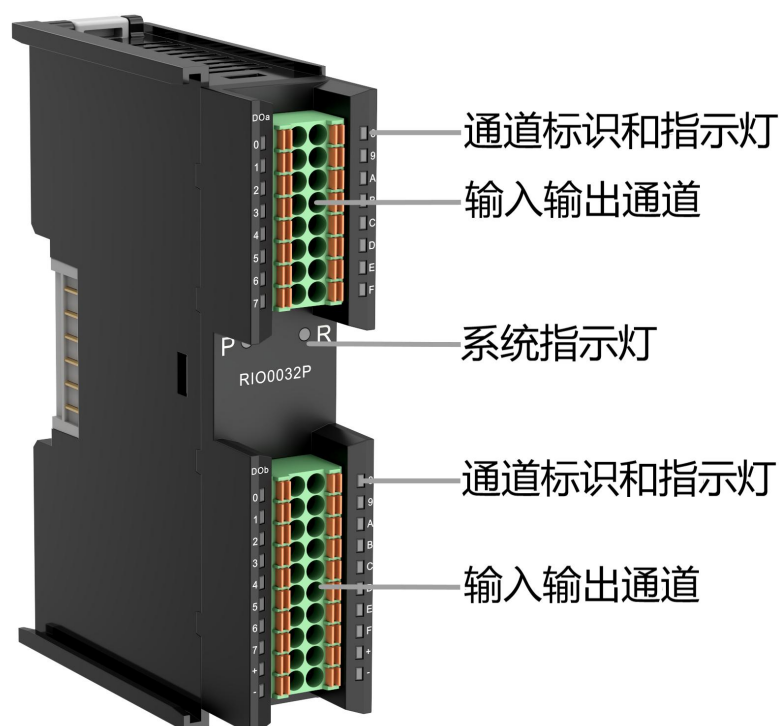
Power module identification and indicator light description				
Logo	color	state	Status description	
P	green	Always on	Working power is normal	
		Flash	Overload 80%, cut off the power supply to the subsequent load	
		Off	The product is not powered or the power supply is abnormal	
O	red	Off	Not overloaded	
		Always on	Load reaches 90%	
Coupler module identification and indicator lights				
name	Logo	color	state	Status description
Power indicator	P	green	Always on	Working power is normal
			Off	The product is not powered or the power supply is abnormal
System indicator	L	green	Always on	X-bus is interacting
			Flashing 1Hz	Bottom bus initialization is normal
			Flashing 5Hz	Bottom bus initialization abnormality
			Flashing 10Hz	I/O module loss response occurs during operation
			Off	Initialization state or no power on
Warning indicator	E	red	Always on	The coupler is in abnormal state
			Off	Initialization state, no power or no error
Operation status indicator	R	green	Always on	EtherCAT OP Status
			Flashing 5Hz	EtherCAT PreOP Status
			Flashing	EtherCAT SafeOP Status
Network port status indicator				
Logo	color	state	Status description	
IN	orange color	Flash then on for 200ms	The connection is established and data is exchanged	
		Off	No data interaction or exception	
	green	Always on	Establishing a network connection	
		Off	Initialization state or no power on	
OUT	orange color	Flash	The connection is established and data is exchanged	

		Off	No data interaction or exception
	green	Always on	Establishing a network connection
		Off	No network connection established or abnormal

## 4.2 I/O Module Panel

### Module parts name and function

#### description



I/O module indicator light description			
Logo	color	state	Status description
P	green	Always on	Power supply is normal
		Off	The product is not powered on or the power supply is abnormal
R	green	Always on	The system is running normally
		Flashing 1 Hz	I/O modules are connected and the X-bus system is ready to interact
		Off	The device is not powered on, the X-bus does not exchange data, or an exception occurs.
Input channel indication	green	Always on	The module detection channel has signal input
		Off	The module channel has no signal input or the signal input is abnormal
Output	green	Always on	The module channel has signal output



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channel indication		Off	The module channel has no signal output or the signal output is abnormal
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# 5 Installation and removal

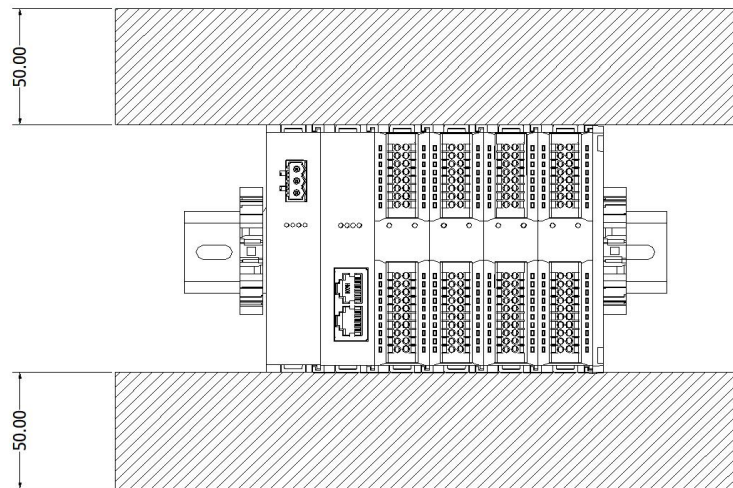
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## 5.1 Installation Guide

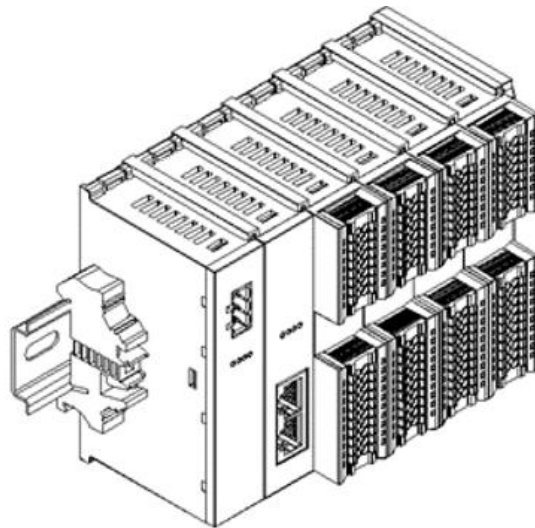
### Installation\removal precautions

- Ensure that the cabinet has good ventilation measures (such as installing an exhaust fan in the cabinet).
- Do not install this device near or over any equipment that may cause overheating.
- Be sure to install the module vertically and maintain air circulation around it (there should be at least 50 mm of air circulation space above and below the module).
- After the module is installed, be sure to install the guide rail fixings at both ends to secure the module.
- Installation and removal must be performed with the power turned off.

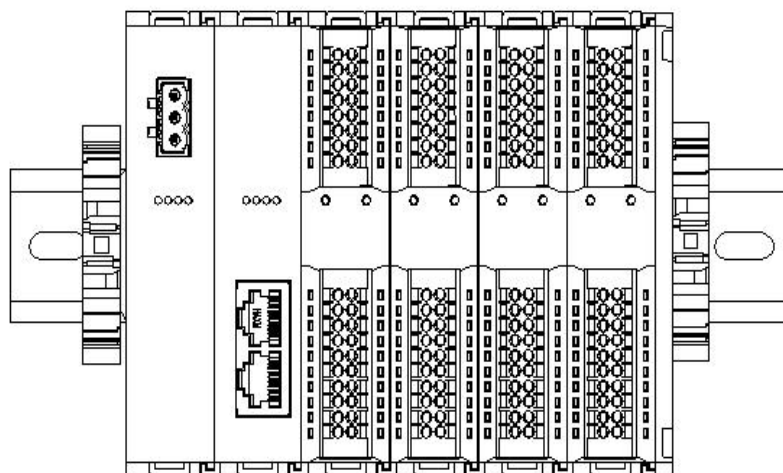
### Minimum gap for module installation ( $\geq 50\text{mm}$ )



**Ensure the module is installed vertically**



**Be sure to install the rail fixings**



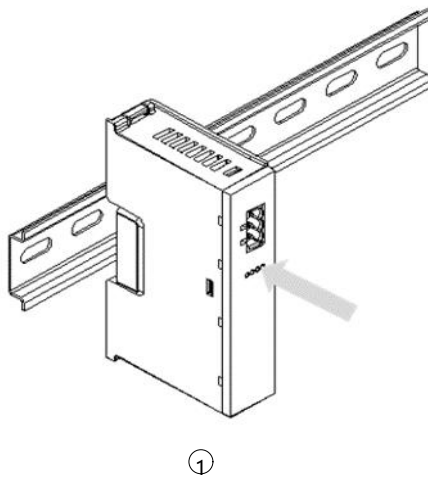
## 5.2 Installation and removal steps

Module installation and removal	
Module installation steps	1. Install the power module on the fixed rail first.
	2. Install the coupler and required I/O modules in sequence on the right side of the power module.
	3. After installing all required I/O modules, install the end covers to complete the module assembly.
	4. Install the guide rail fixings at both ends of the power module and end cover to fix the module.
Module disassembly steps	1. Loosen the guide rail fixings at both ends of the module.
	2. Use a flat-blade screwdriver to pry open the module buckle.
	3. Pull out the disassembled module.

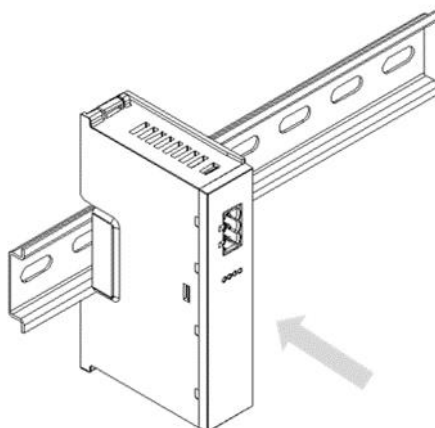
## 5.3 Installation Diagram

### Power module installation

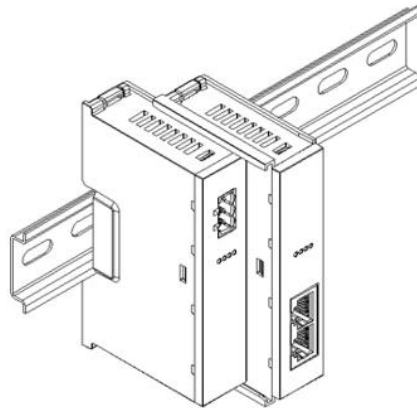
### step



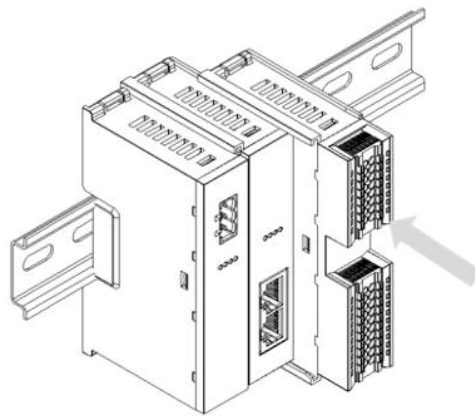
Insert the power module guide slot and align the guide rail vertically as shown in the left figure ①.



As shown in the left figure ②, press the power module hard until you hear a "click" sound, and the module is installed in place.

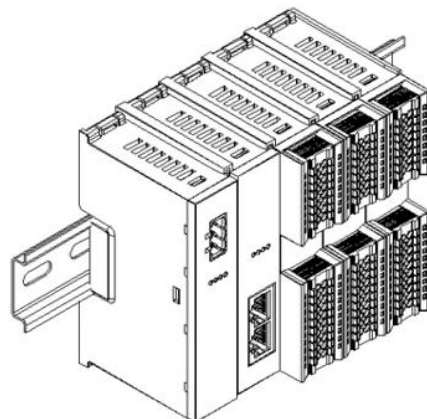
**Coupler module installation****step**

Align the left slot of the coupler module with the right side of the power module and push it in as shown in ③ in the left figure. Press the coupler module firmly until you hear a "click" and the module is installed in place.

**I/O Module Installation****step**

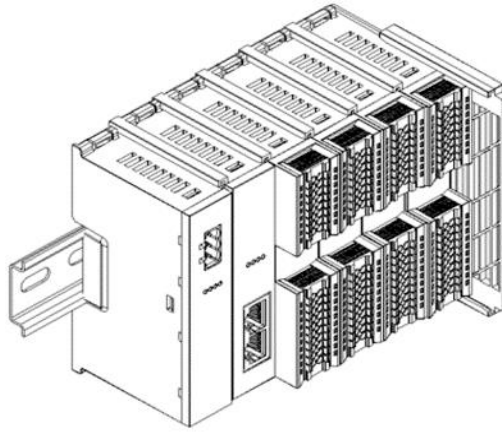
④

Follow the steps for installing the coupler module in the previous step and install the required I/O modules one by one, as shown in Figure ④ and Figure ⑤ on the left.



⑤

**End cap installation****step**

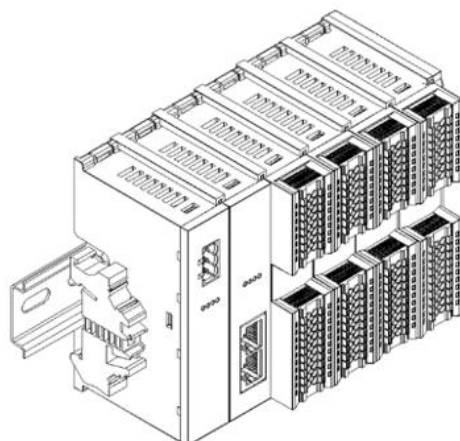


Install the end cover on the right side of the last module, as shown in the left figure ⑥. For installation methods, please refer to the installation method of the coupler module.

⑥

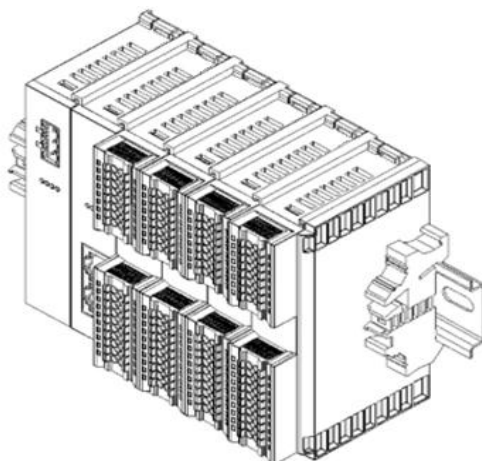
**Rail fixing installation**

**step**



⑦

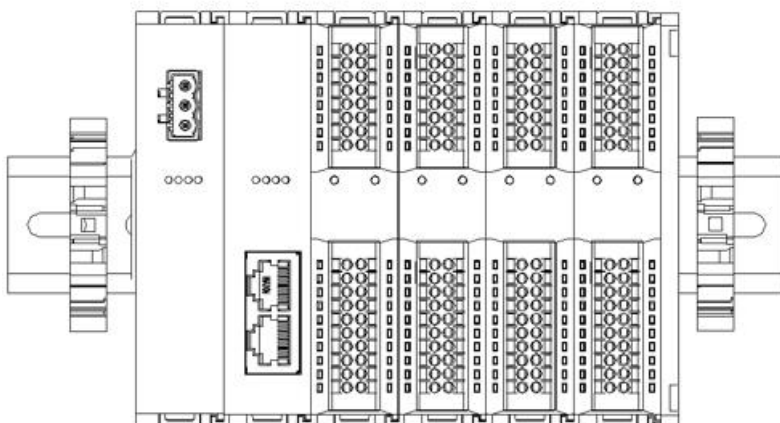
Install and lock the guide rail fixings close to the left side of the coupler, as shown in Figure ⑦ on the left.



Install the guide rail fixture on the right side of the end cover. First push the guide rail fixture toward the coupler to ensure that the module is installed firmly, and then use a screwdriver to tighten the guide rail fixture, as shown in the left figure ⑧.

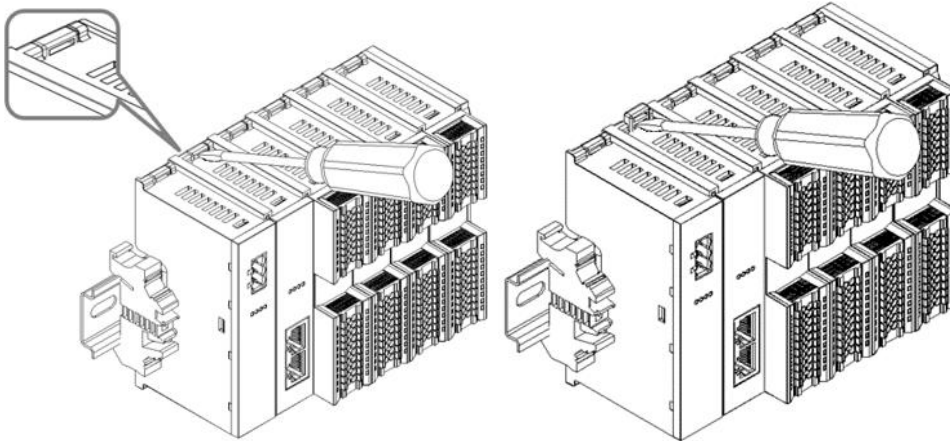
**Disassembly**

**step**



⑨

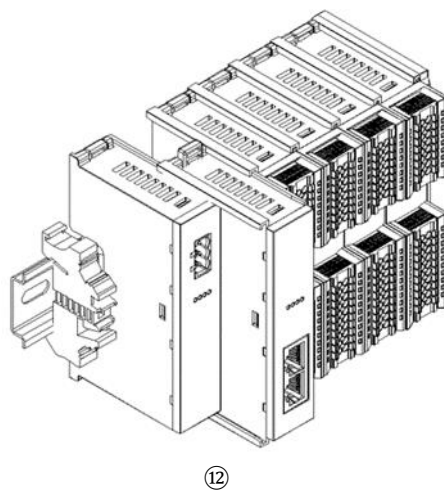
Use a screwdriver to loosen the guide rail fixing at one end of the module and move it to one side to ensure that there is a gap between the module and the guide rail fixing, as shown in Figure ⑨ on the left.



Insert a flat-head screwdriver into the buckle of the module to be removed, and apply force to the module sideways (until you hear a sound), as shown in Figure ⑩ on the left and Figure ⑪ on the right.⑪shown.

**Note: Each module has a buckle on the top and bottom, and all modules are operated in the same way.**

⑩ ⑪



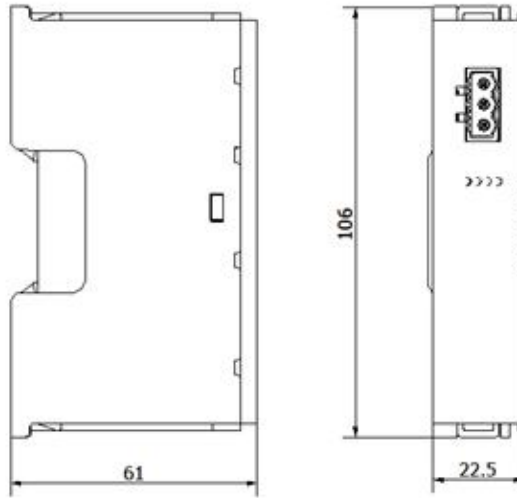
Follow the opposite operation of installing the module to remove the module, as shown in the left figure⑫Shown.

⑫

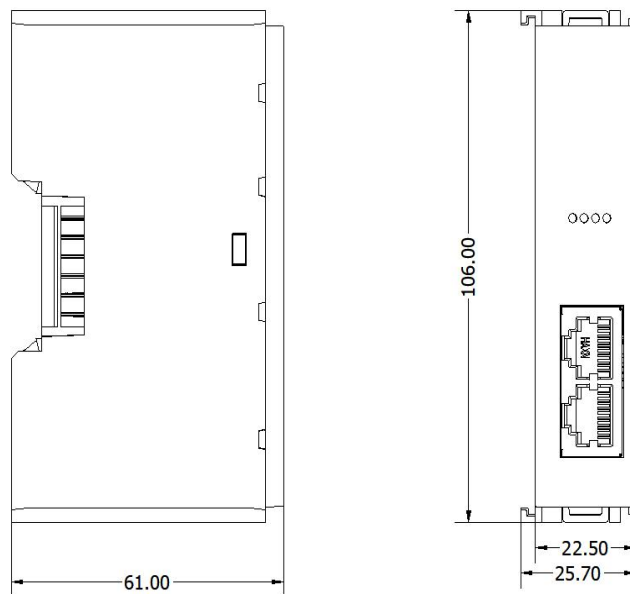


## 5.4 Dimensions

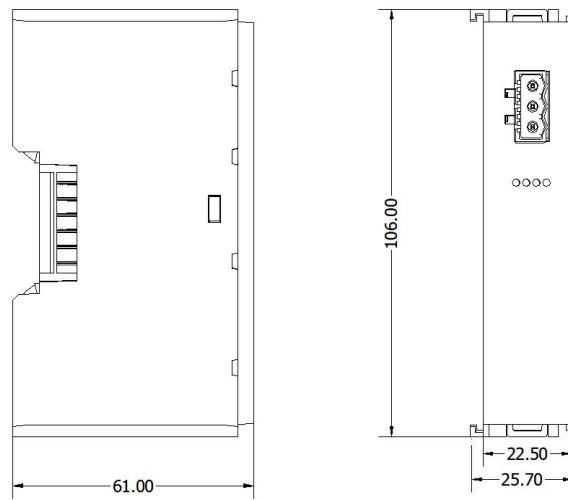
### Power module dimensions (in mm)



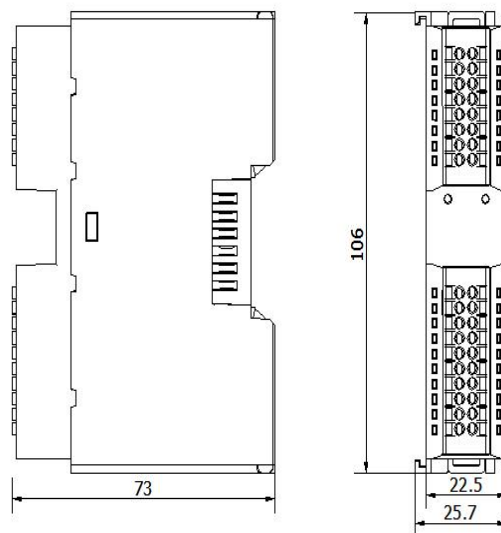
### Coupler dimensions (mm)

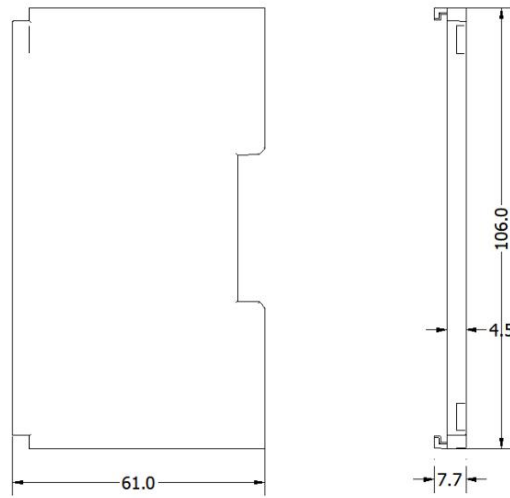


**Extended power supply dimensions (in mm)**



**I/O module dimensions (in mm)**



**End cover dimensions (unit: mm)**

Note: All are installed using DIN 35 mm standard rails, with DIN rail specifications of 35\*7.5\*1.0 and 35\*15\*1.0 (unit: mm).

# 6 wiring

## 6.1 Terminal Blocks

Terminal Blocks		
Signal line terminal	Number of poles	16 P
	Number of poles	20 P
	Wire diameter	twenty two~17 AWG 0.3~1.0 mm <sup>2</sup>
Power Terminals	Number of poles	3P
	Wire diameter	twenty two~16 AWG 0.3~1.5 mm <sup>2</sup>
Bus interface	2 × RJ45	Category 5 or higher UTP or STP (STP is recommended)

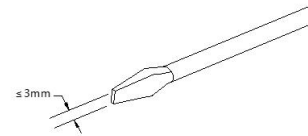
## 6.2 Wiring Instructions and Requirements

### Power Wiring Precautions

- The module system side power supply and field side power supply are configured and used separately. Do not mix them.
- PE must be grounded reliably.

### Wiring tool requirements

The power terminals and signal line terminals adopt a screw-free design, and the cables can be installed and removed using a flat-blade screwdriver (specification:  $\leq 3\text{mm}$ ).



### Stripping length requirements

The recommended cable stripping length for power and signal line terminals is 10 mm.



### Wiring method for power module and I/O module

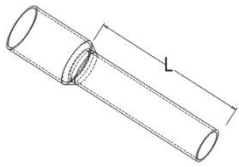
For single-strand rigid wire, after stripping the wire to the corresponding length, press the button and insert the single-strand wire at the same time.



For multi-strand flexible wires, after stripping the wires to the corresponding length, you can directly connect them or use the corresponding standard specifications of cold-pressed terminals (tubular insulated terminals, reference specifications are shown in the following table) to insert the wires while pressing the button.

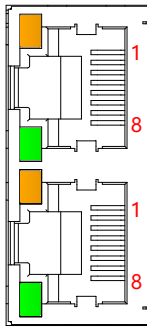


The specifications of power terminals and signal line terminals are shown in the following table:

Specifications of tubular insulation terminals		
Specifications	model	Conductor cross-sectional area mm <sup>2</sup>
 Tube type insulated terminal The length is 10mm	E0310	0.3
	E0510	0.5
	E7510	0.75
	E1010	1.0
	E1510	1.5

### Bus wiring method

It uses a standard RJ45 network interface and a standard crystal connector, and the pin assignments are shown in the following table.



Pin Number	Signal
1	TD+
2	TD-
3	RD+
4	one
5	one
6	RD-
7	one
8	one

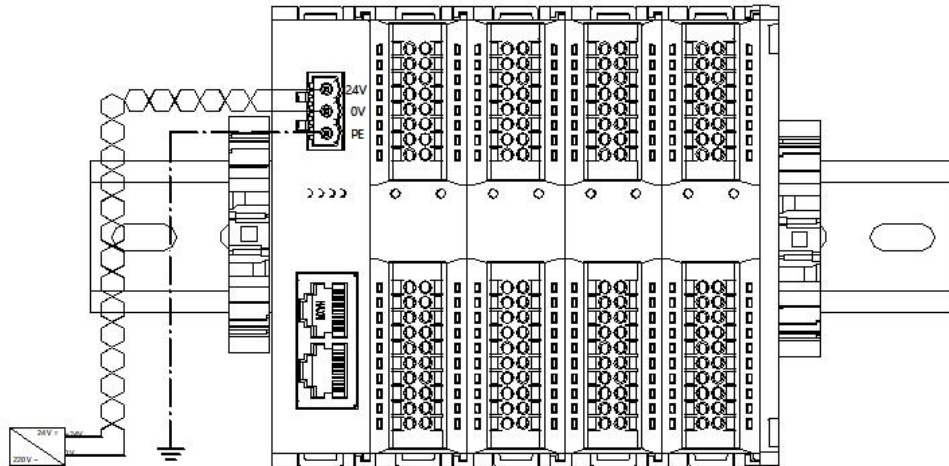
### ⚠ Precautions

- It is recommended to use double-shielded (braided mesh + aluminum foil) STP cable of category 5 or higher as communication cable.
- The length of the cable between devices must not exceed 100 m.

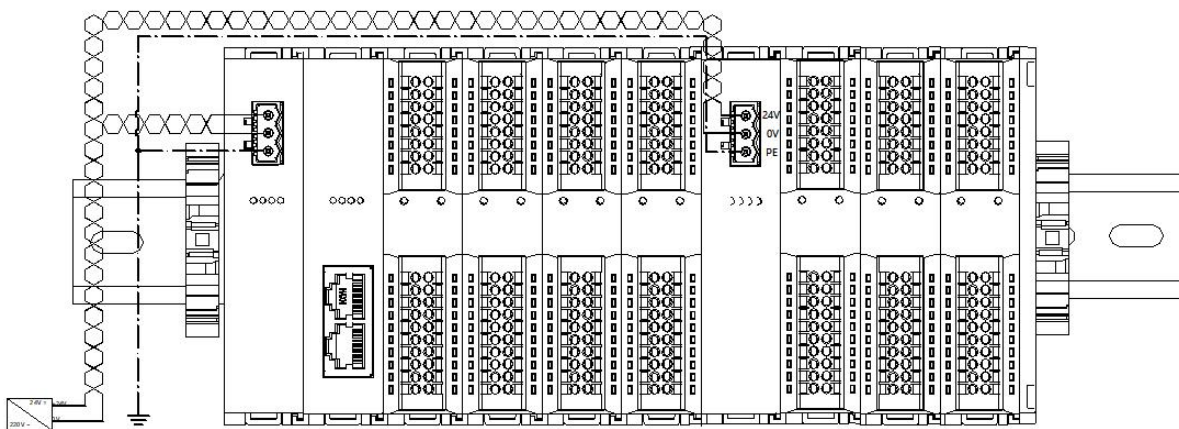
### Power connection: Power module 3P terminal

Use a DC24V power module and refer to the wiring method. Connect the power supply according to the circuit shown in the figure below, and ground PE reliably (twisted pair cables are recommended for power cables).

- picture6- 1Coupler, I/O module, power supply wiring diagram



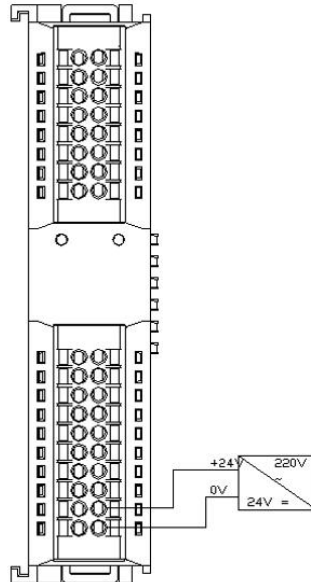
- picture6- 2Coupler, I/O module, power module, I/O module, power supply wiring diagram



### Load power supply wiring: Field side 20P terminal

Press the signal cables into the terminal blocks according to the corresponding I/O module wiring diagram and wiring method.

The load power supply uses a 24 VDC power supply. Refer to the wiring method and connect the power supply according to the circuit shown in the figure below (for details, refer to [6.3 I/O module wiring diagram](#)).



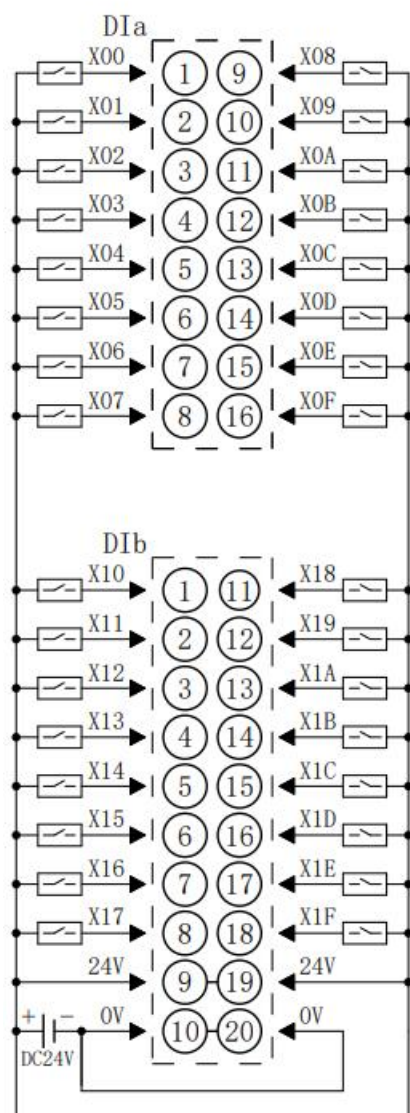
### Signal terminal wiring: 16P\20P terminal

Press the signal cables into the terminal blocks according to the corresponding I/O module wiring diagram and wiring method.

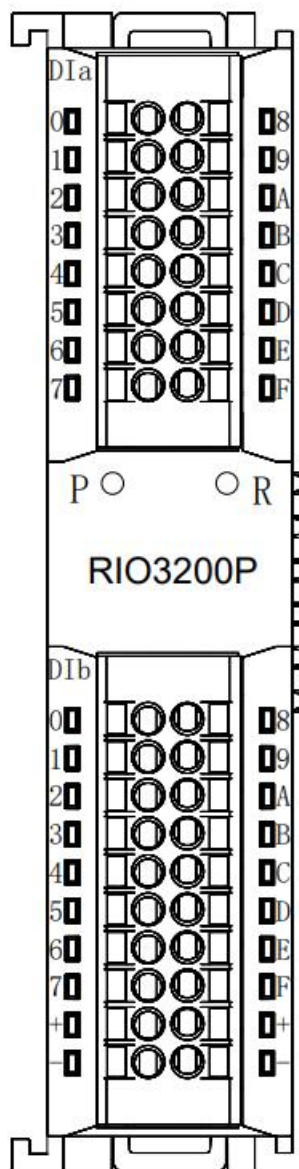


### 6.3 I/O module wiring diagram

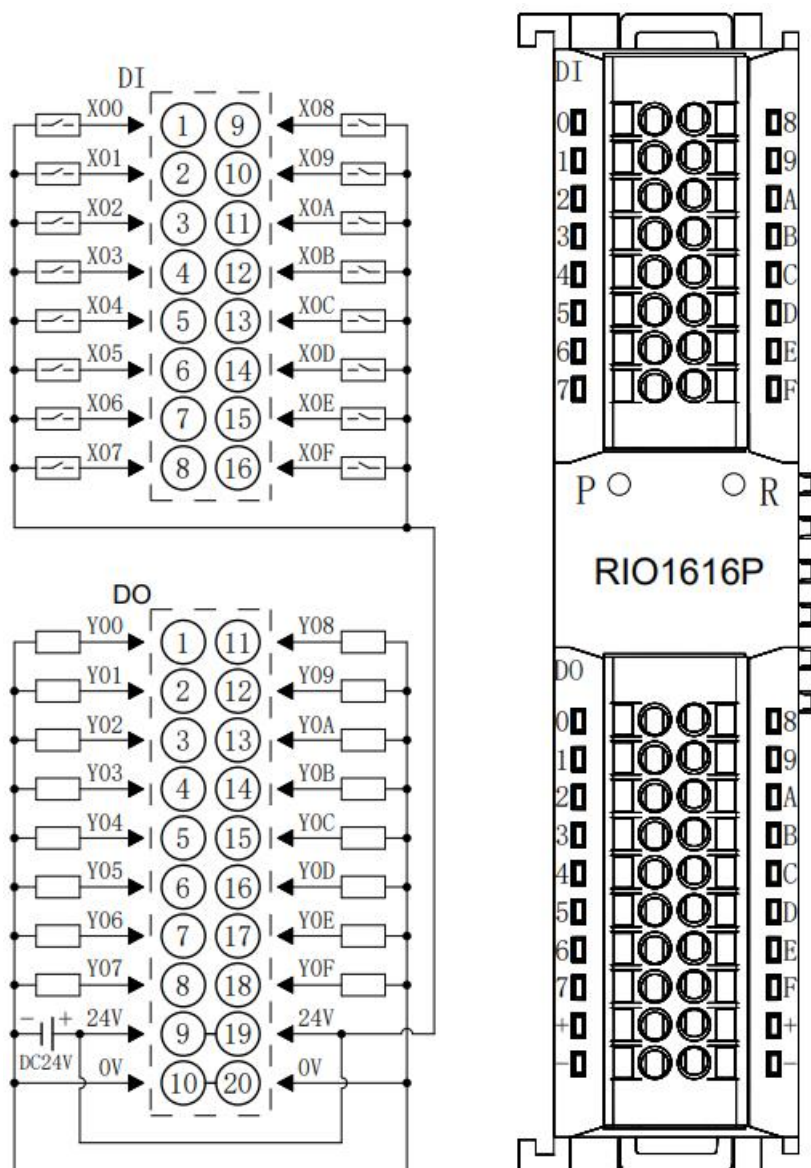
#### 6.3.1 RIO3200P



\*24V内部导通;0V内部导通

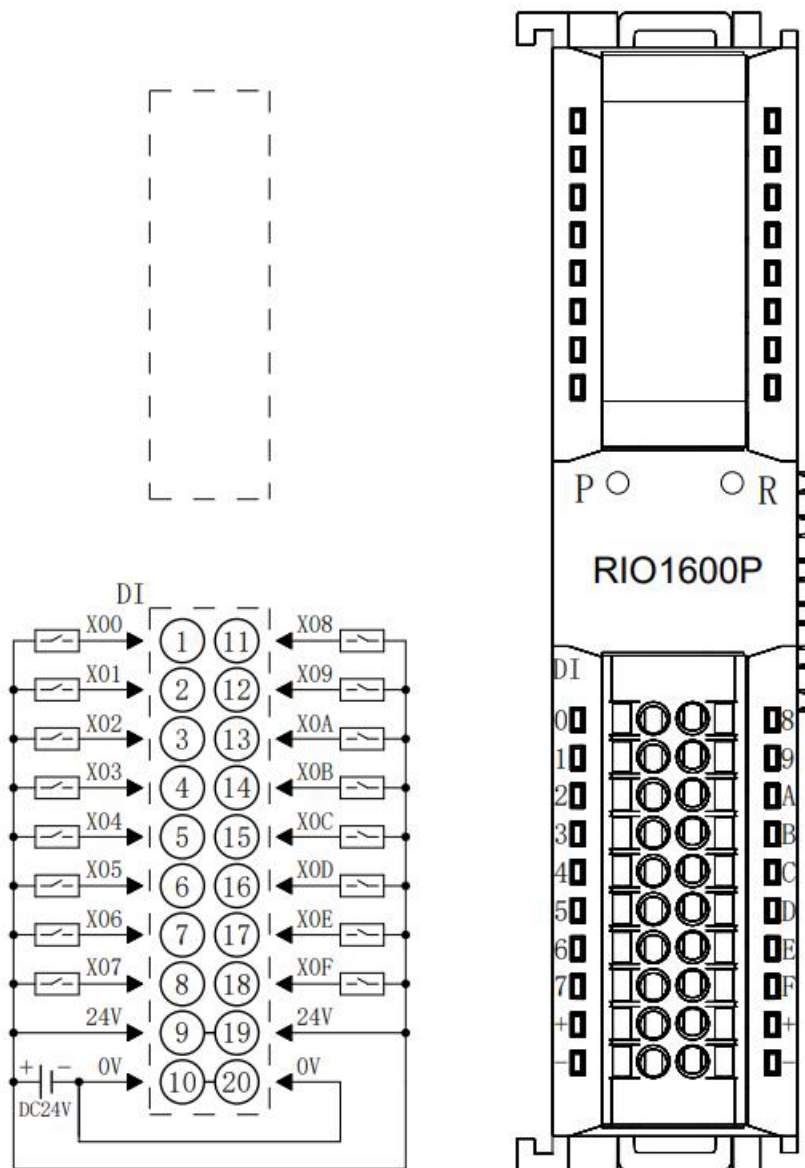


### 6.3.2 RIO1616P



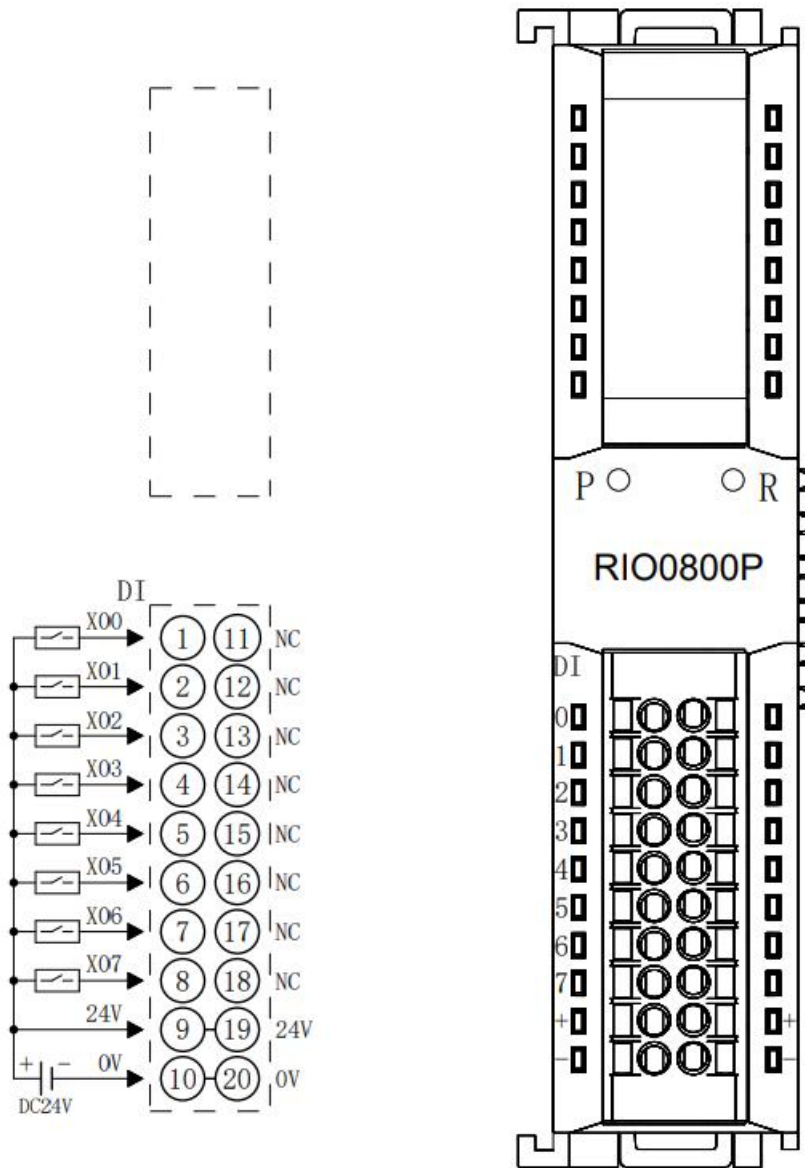
\*24V内部导通;0V内部导通

### 6.3.3 RIO1600P



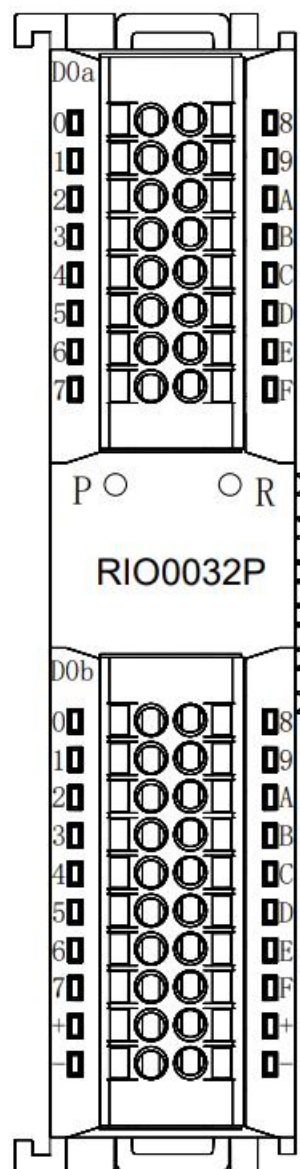
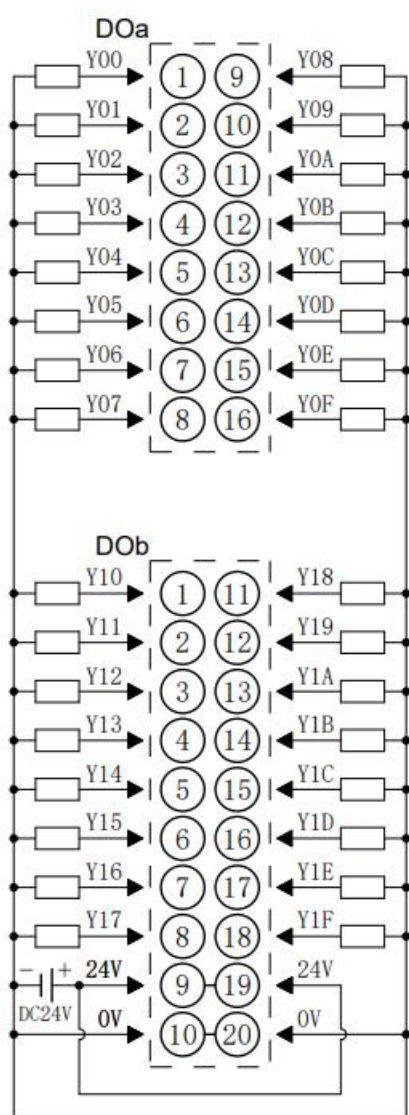
\*24V内部导通;0V内部导通

### 6.3.4 RIO0800P



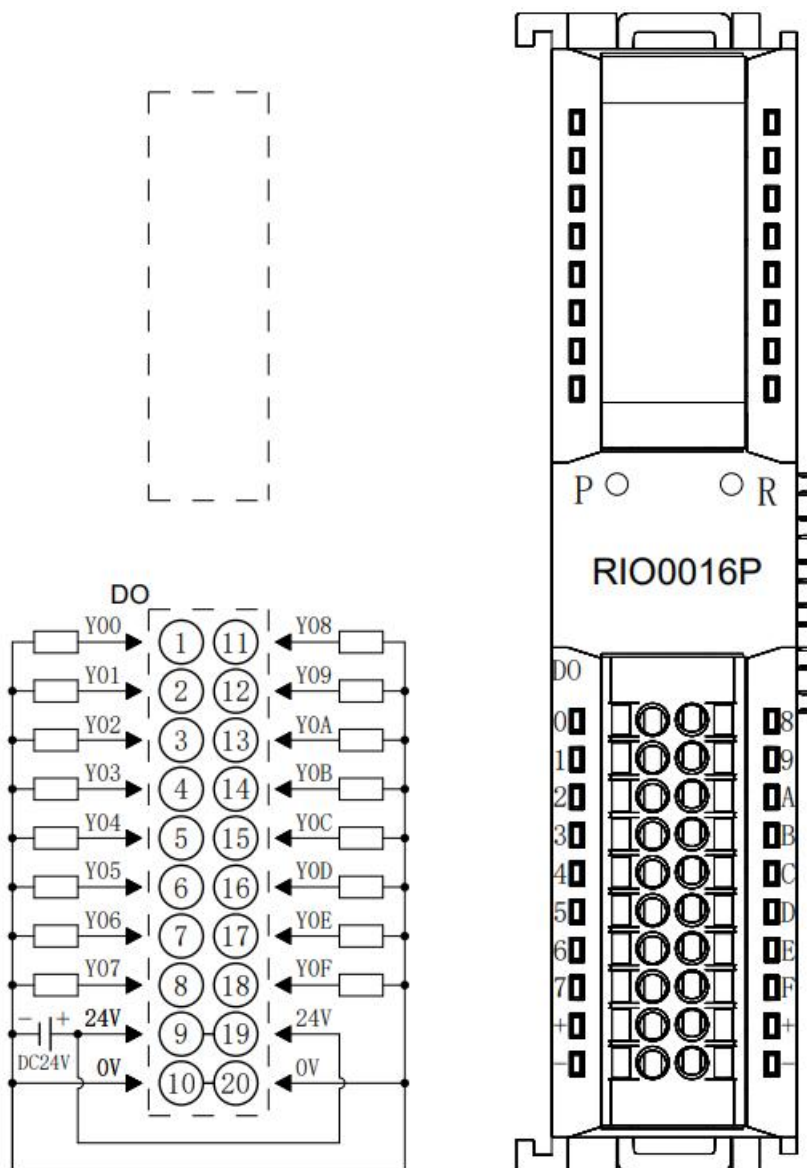
\*24V内部导通;0V内部导通

### 6.3.5 RIO0032P



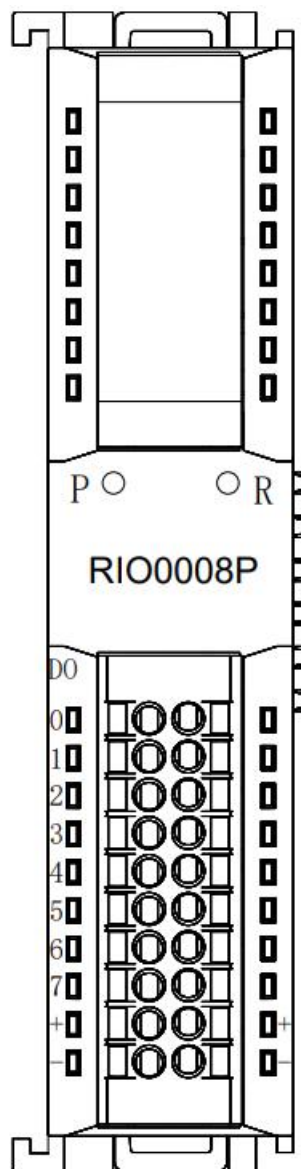
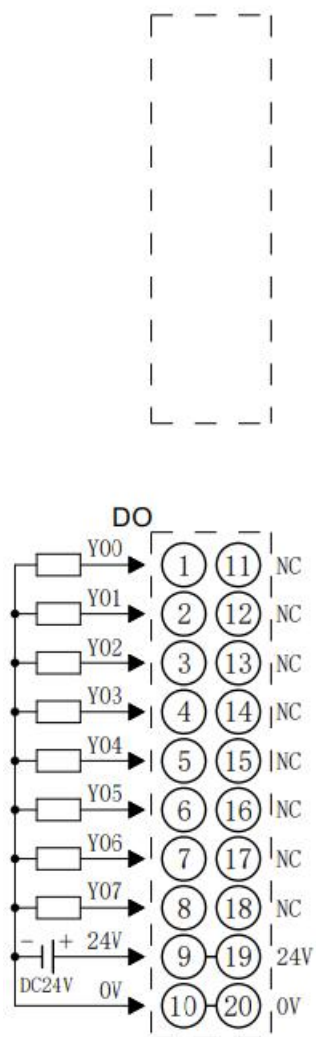
\*24V内部导通;0V内部导通  
\*负载公共端电源需与模块使用同一个电源

### 6.3.6 RIO0016P



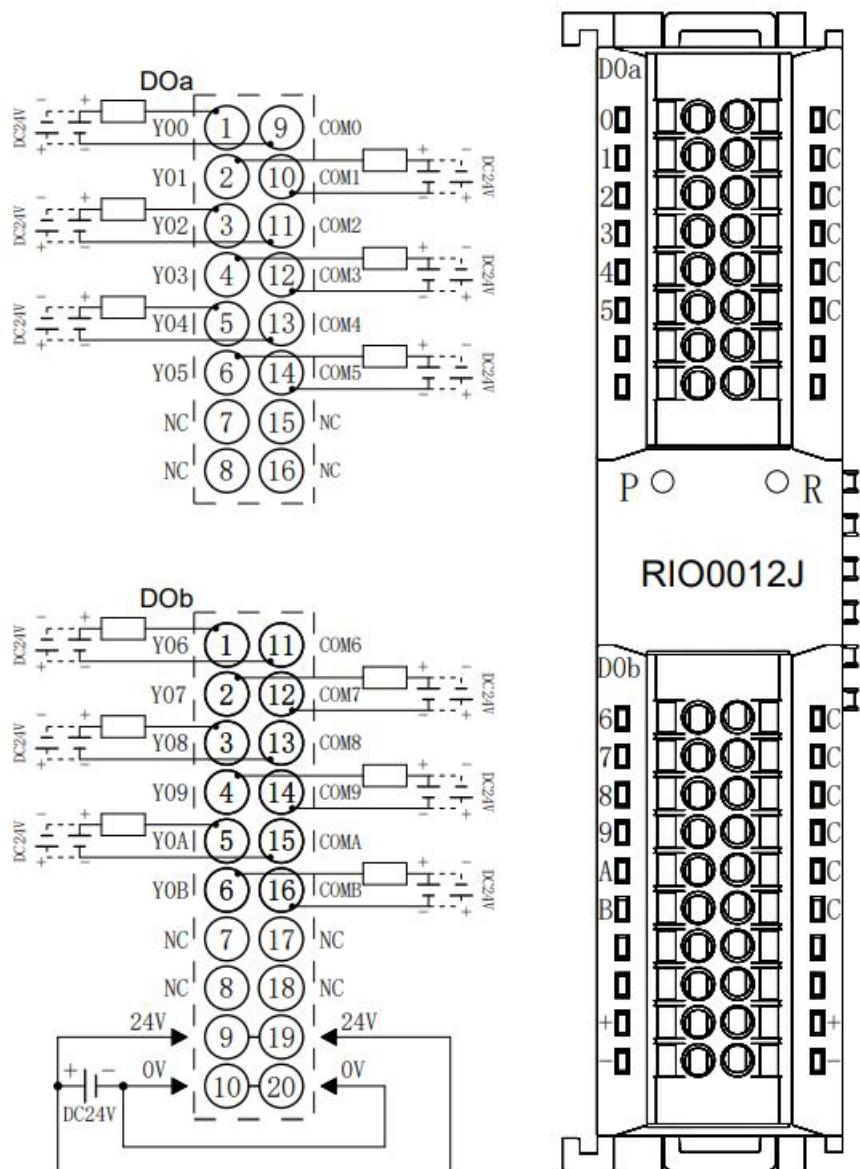
\*24V内部导通;0V内部导通  
 \*负载公共端电源需与模块使用同一个电源

### 6.3.7 RIO0008P



\*24V内部导通;0V内部导通  
\*负载公共端电源需与模块使用同一个电源

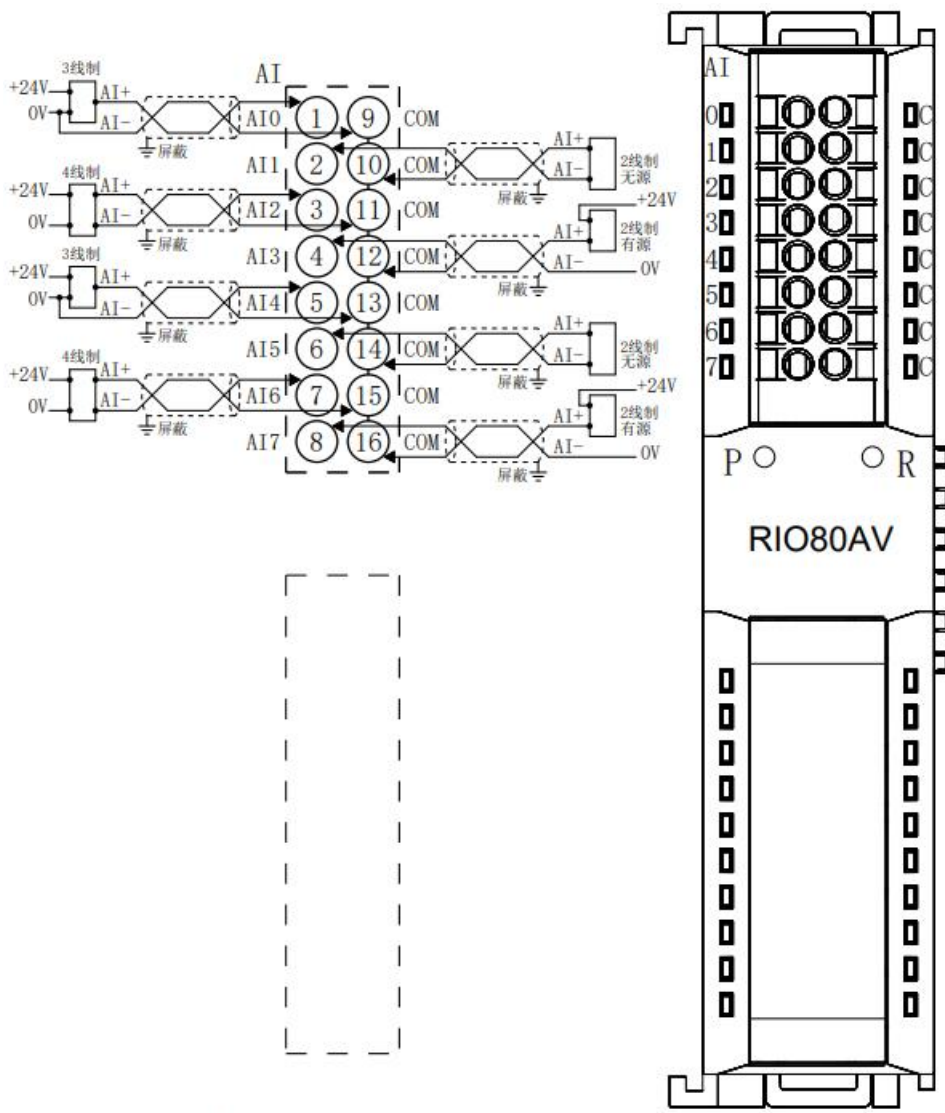
## 6.3.8 RIO0012J



- \*24V内部导通;0V内部导通
- \*负载公共端电源需与模块使用同一个电源
- \*COM可接正极或负极,内部不互通,支持DC0-48V

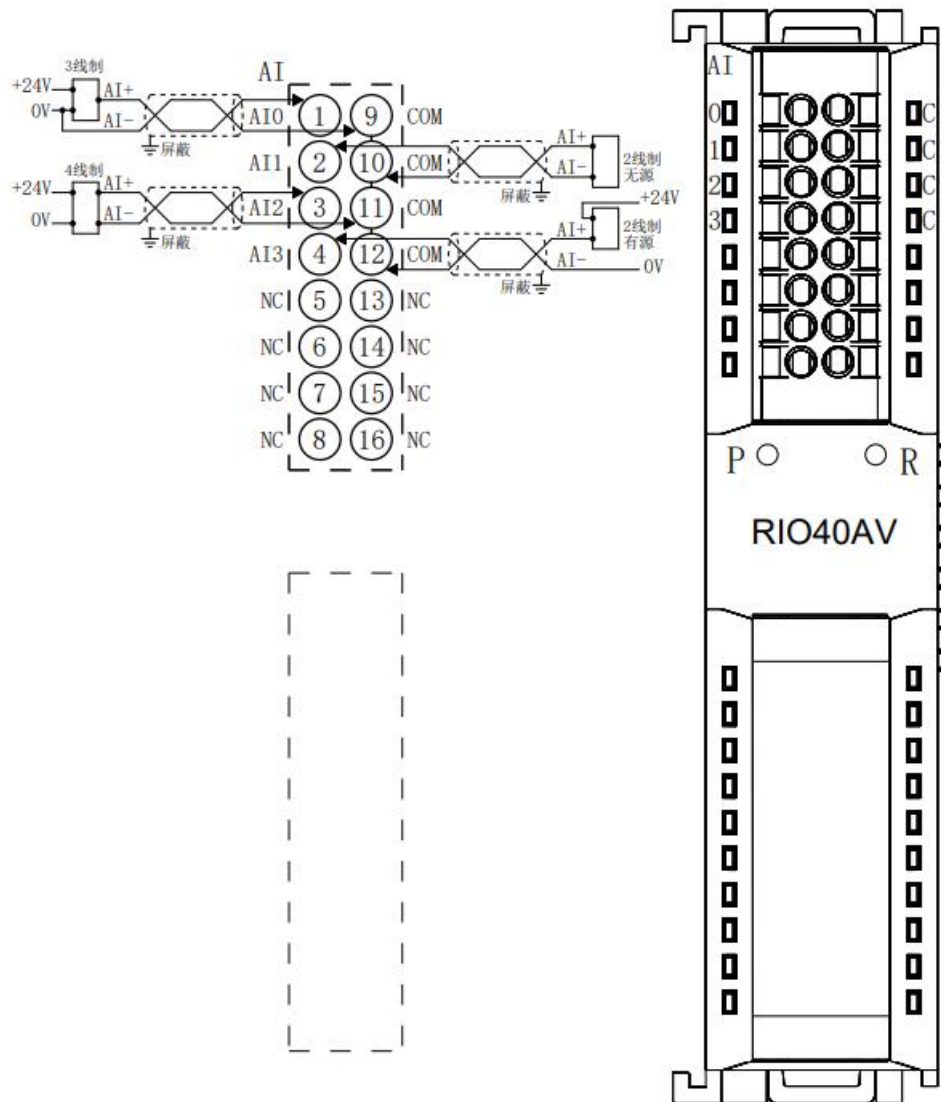


### 6.3.9 RIO80AV



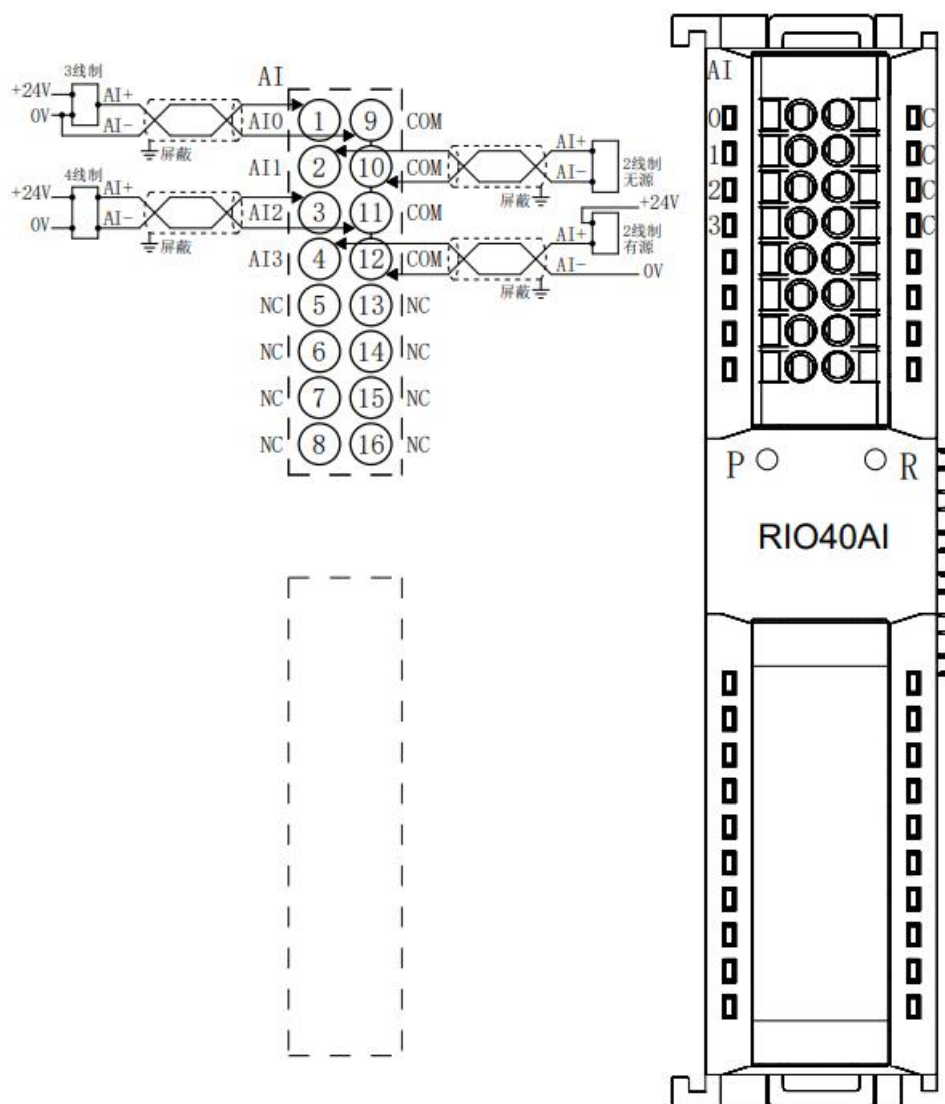
\*COM内部导通  
\*所有通道负载需同源

### 6.3.10 RIO40AV



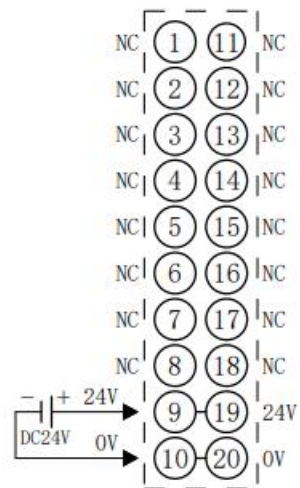
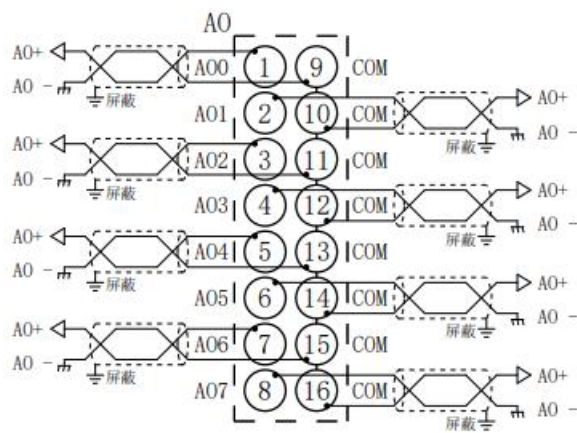
\*COM内部导通  
\*所有通道负载需同源

### 6.3.11 RIO40AI

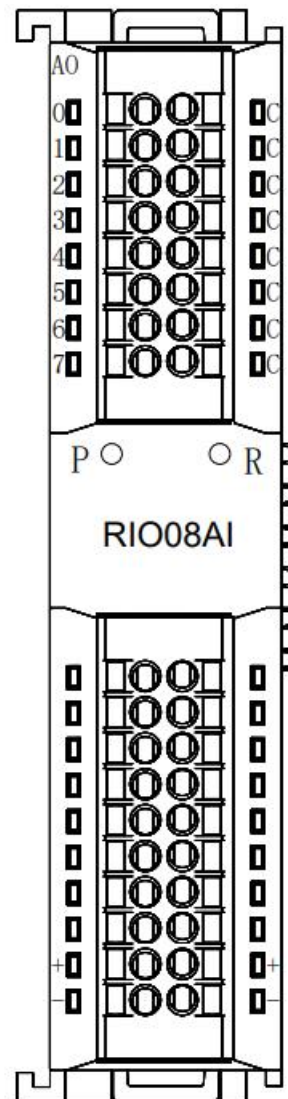


\*COM内部导通  
\*所有通道负载需同源

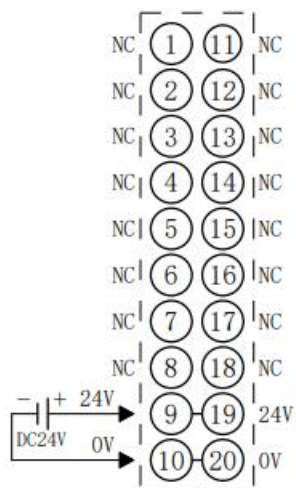
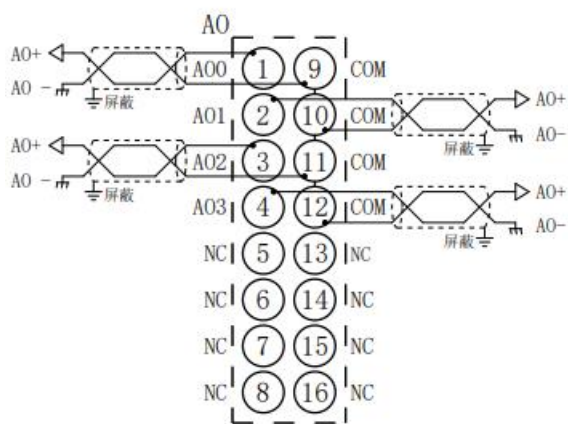
### 6.3.12 RIO08AI



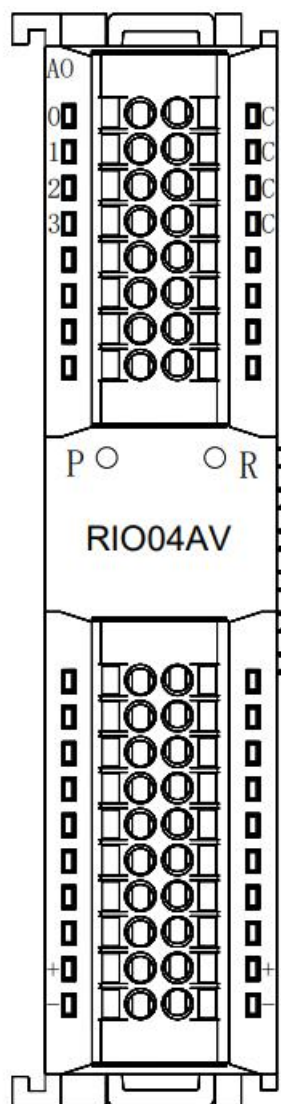
\*COM内部导通  
 \*24V内部导通：0V内部导通



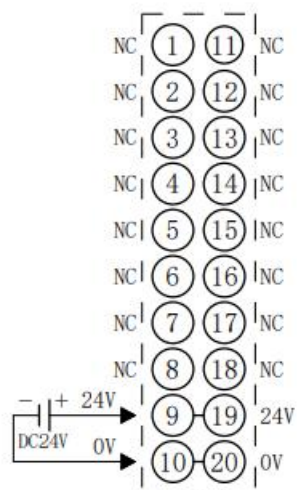
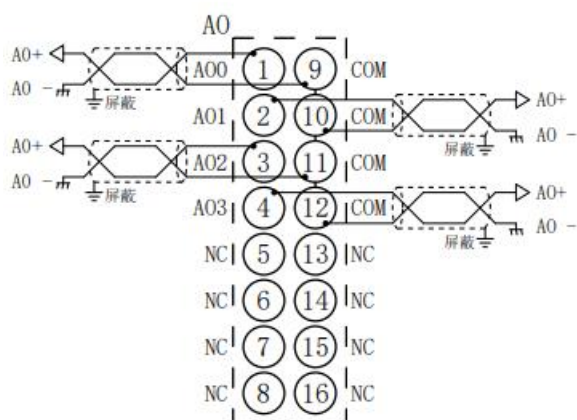
### 6.3.13 RIO04AV



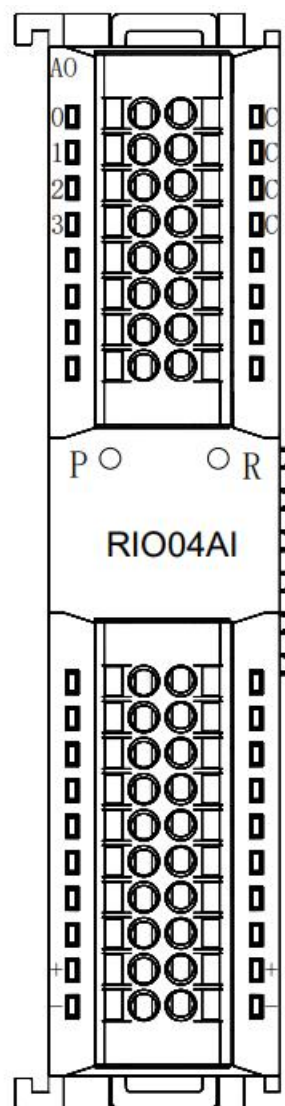
\*COM内部导通  
 \*24V内部导通；0V内部导通



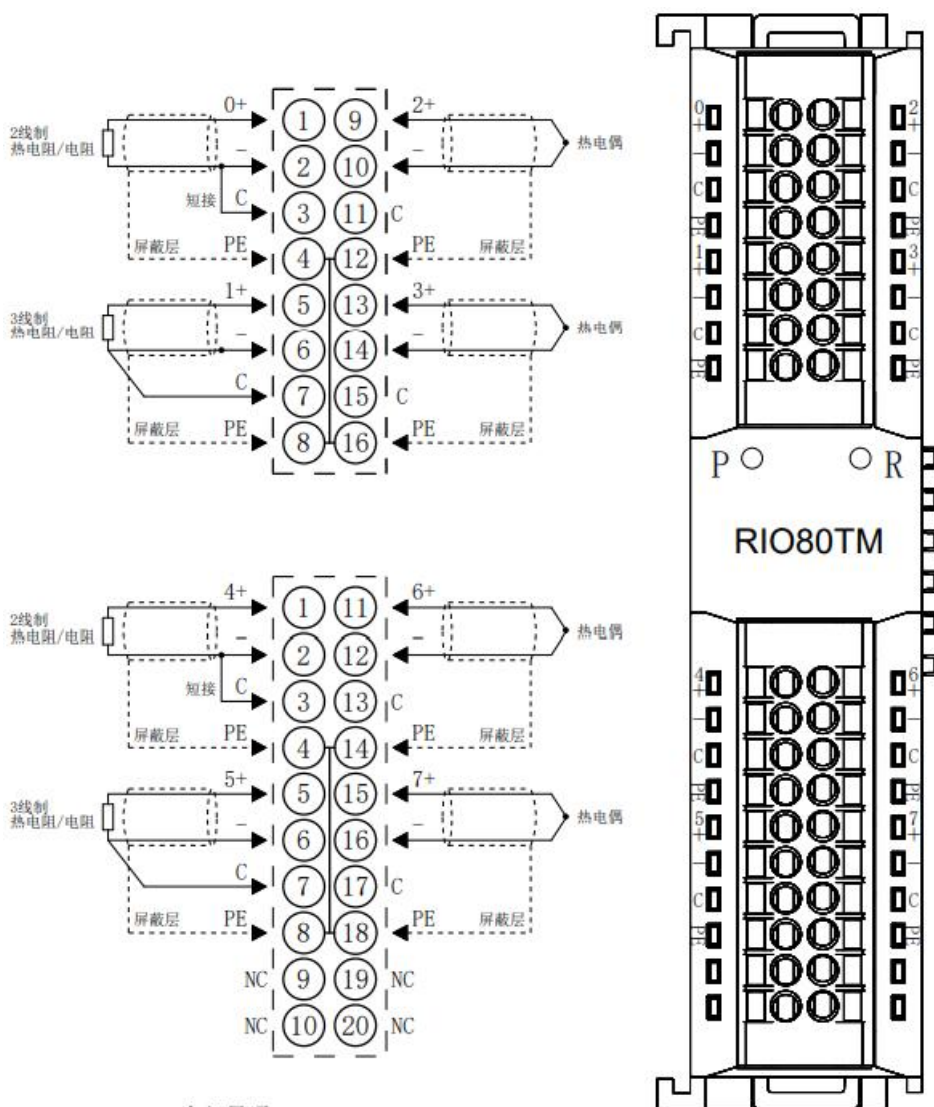
### 6.3.14 RIO04AI



\*COM内部导通  
\*24V内部导通；0V内部导通

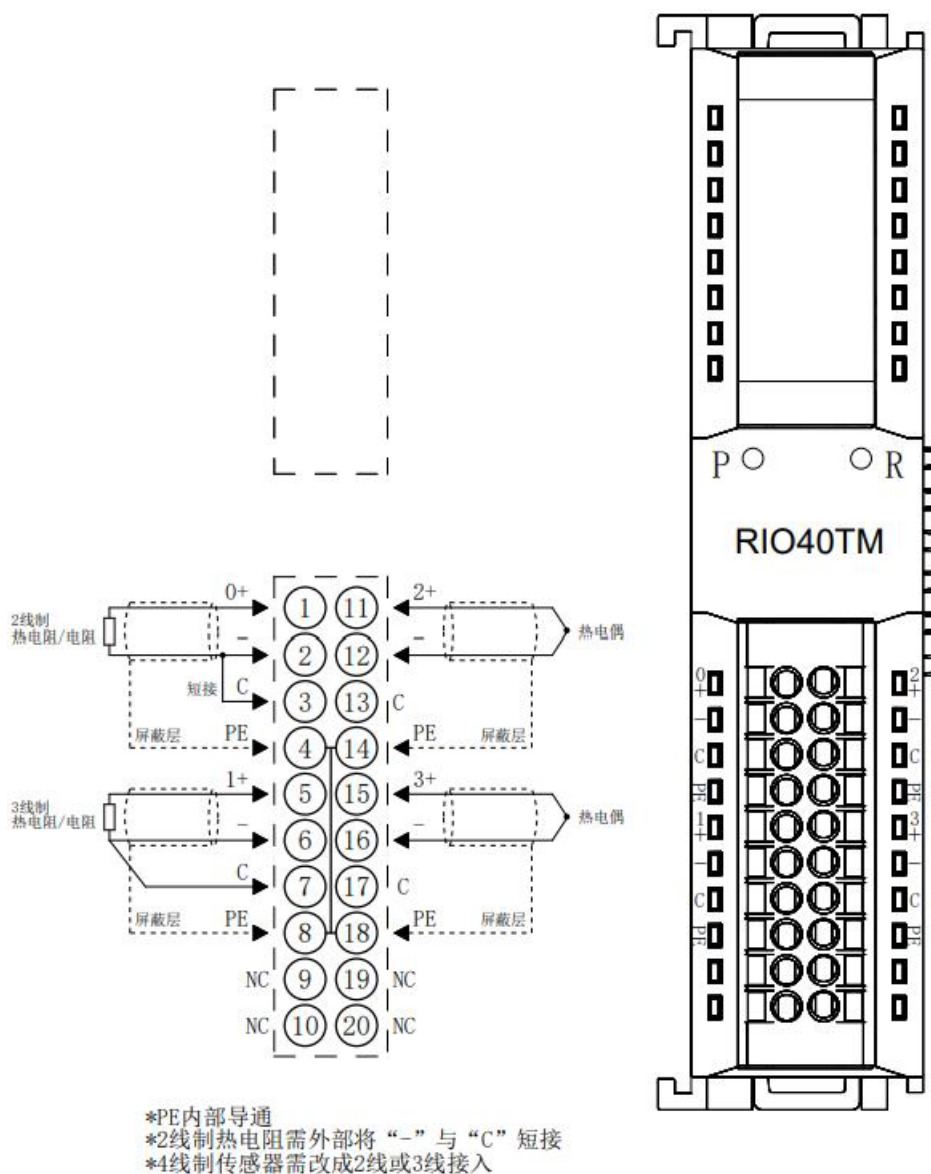


### 6.3.15 RIO80TM



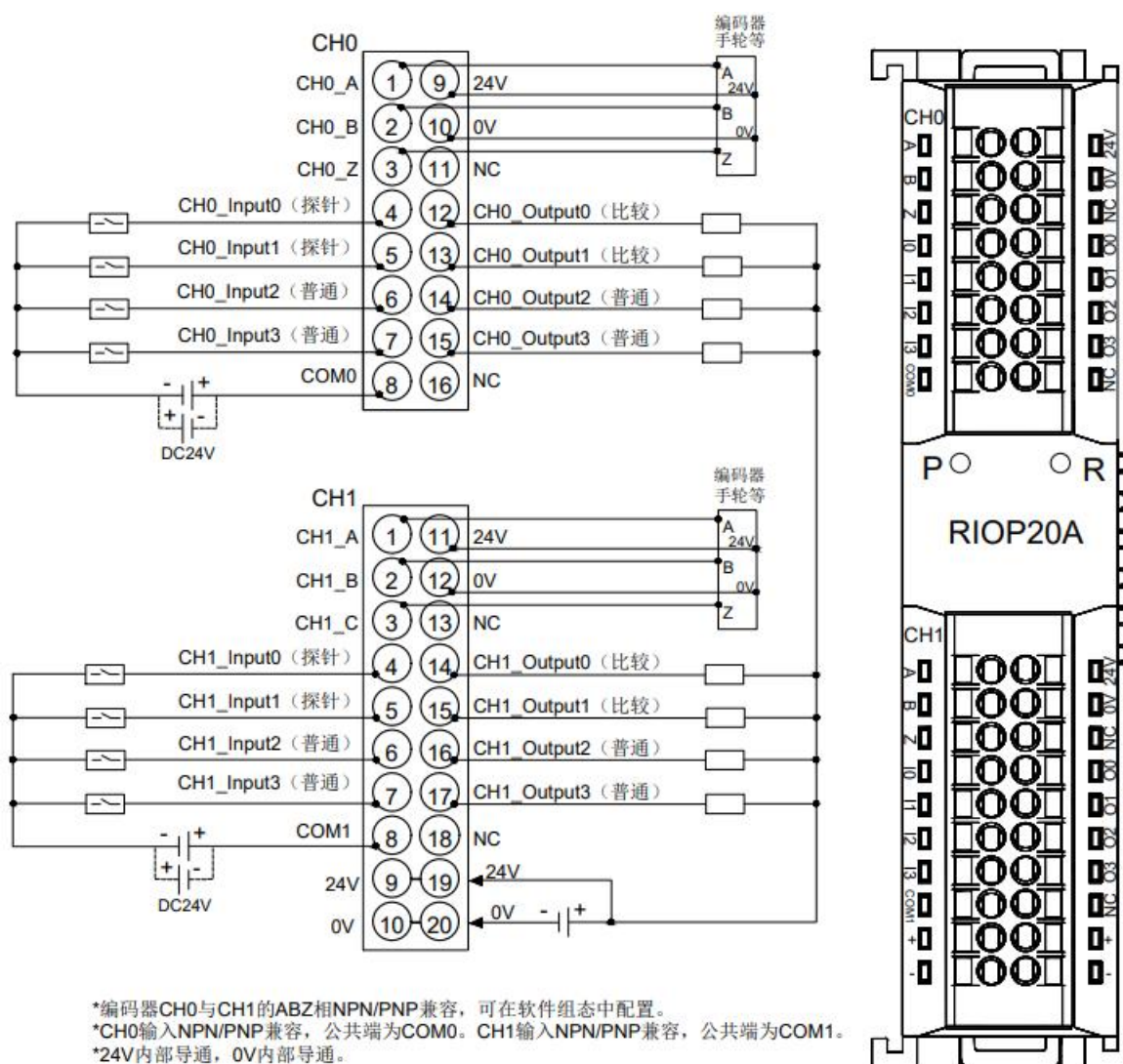
- \*PE内部导通
- \*2线制热电阻需外部将“-”与“C”短接
- \*4线制传感器需改成2线或3线接入

### 6.3.16 RIO40TM





## 6.3.17 RIOP20A



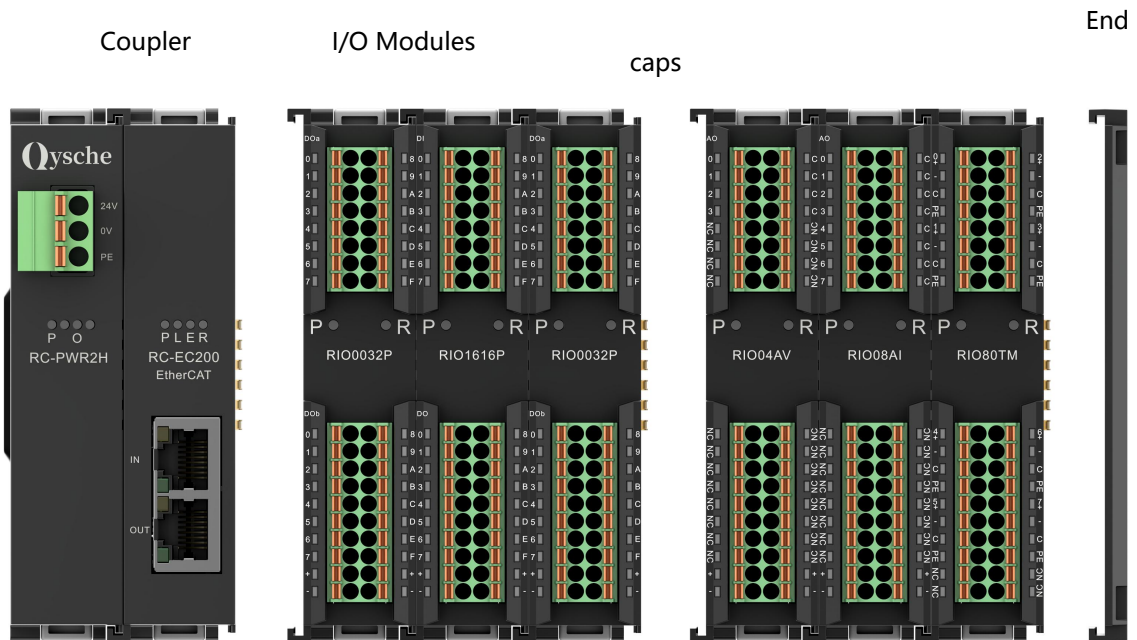
# 7 use

## 7.1 Module Application

### 7.1.1 Application

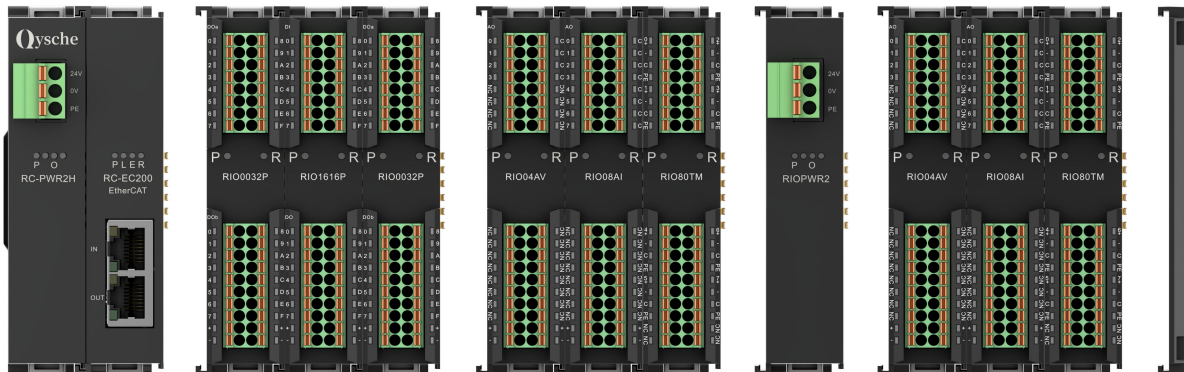
The product adopts the application mode of coupler, I/O module and end cover, and has the following two combination applications.

**Product combination 1 (coupler, I/O module, end cover)**



## Product combination 2 (coupler, I/O module, power module, I/O module, end cover)

Coupler I/O module Power supply module I/O module end cover



### ● Please refer to the following principles for the number of I/O modules to be configured:

1. The maximum power consumption of the I/O module model and quantity configured in the system must be less than the load current provided by the power module.
2. The number of IO modules that can be configured with the coupler is  $\leq 32$ .
3. One power module can support 10 I/O modules. If there are more than 10 I/O modules, an expansion power supply RIOPWR2 is required.



## 7.2 Coupler Function Description

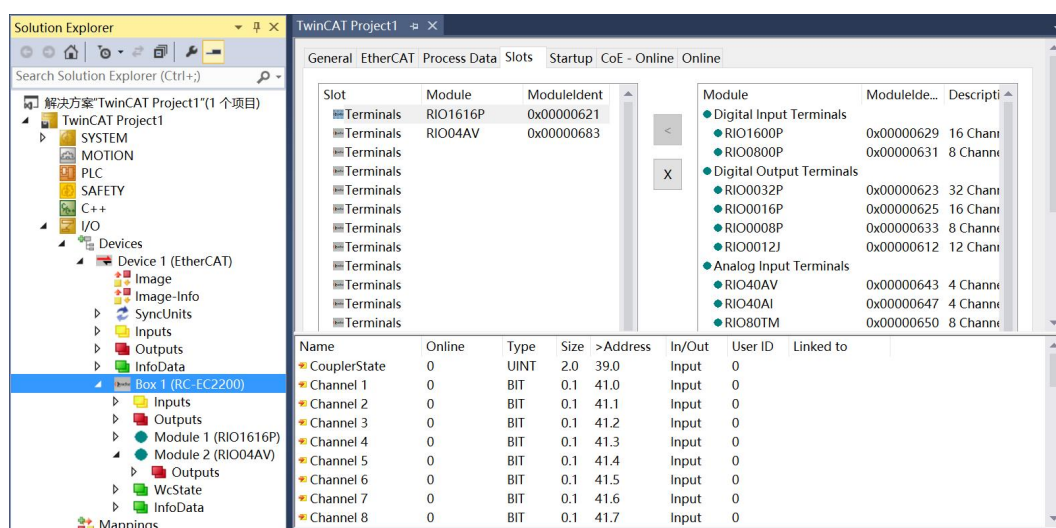
This chapter takes the TwinCAT3 software platform as an example to introduce the coupler function.

### 1. Topology Configuration

The system supports automatic scanning configuration and manual configuration.

- **Manual configuration:**

- Select the target module in SLOT. The display position is different for different master stations.
- After adding the coupler, click on the Slots page  and  Configure the topology as shown in the following figure.



Slot	Module	ModuleIdent	Module	ModuleId...	Descripti...
Terminals	RIO1616P	0x00000621	● Digital Input Terminals		
Terminals	RIO04AV	0x00000683	● RIO1600P	0x00000629	16 Chann
Terminals			● RIO0800P	0x00000631	8 Chann
Terminals			● Digital Output Terminals		
Terminals			● RIO0032P	0x00000623	32 Chann
Terminals			● RIO0016P	0x00000625	16 Chann
Terminals			● RIO0008P	0x00000633	8 Chann
Terminals			● RIO0012J	0x00000612	12 Chann
Terminals			● Analog Input Terminals		
Terminals			● RIO40AV	0x00000643	4 Chann
Terminals			● RIO40AI	0x00000647	4 Chann
Terminals			● RIO80TM	0x00000650	8 Chann

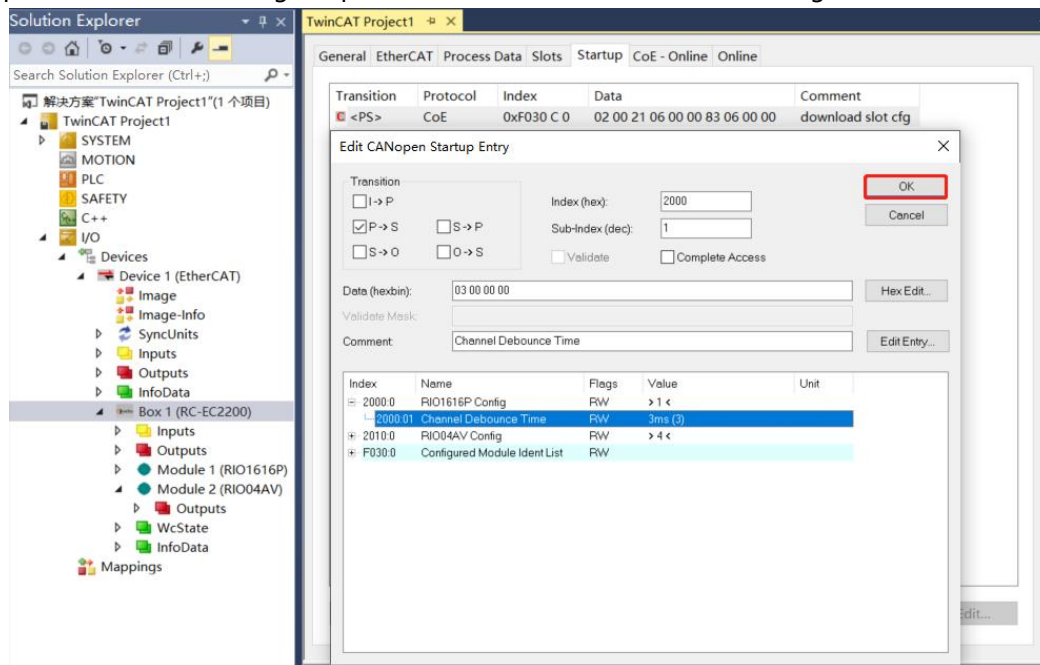
Name	Online	Type	Size	>Address	In/Out	User ID	Linked to
● CouplerState	0	UINT	2.0	39.0	Input	0	
● Channel 1	0	BIT	0.1	41.0	Input	0	
● Channel 2	0	BIT	0.1	41.1	Input	0	
● Channel 3	0	BIT	0.1	41.2	Input	0	
● Channel 4	0	BIT	0.1	41.3	Input	0	
● Channel 5	0	BIT	0.1	41.4	Input	0	
● Channel 6	0	BIT	0.1	41.5	Input	0	
● Channel 7	0	BIT	0.1	41.6	Input	0	
● Channel 8	0	BIT	0.1	41.7	Input	0	

- **Automatic scanning configuration:**

For details, please refer to [7.4.1 Application in TwinCAT3 software environment](#).

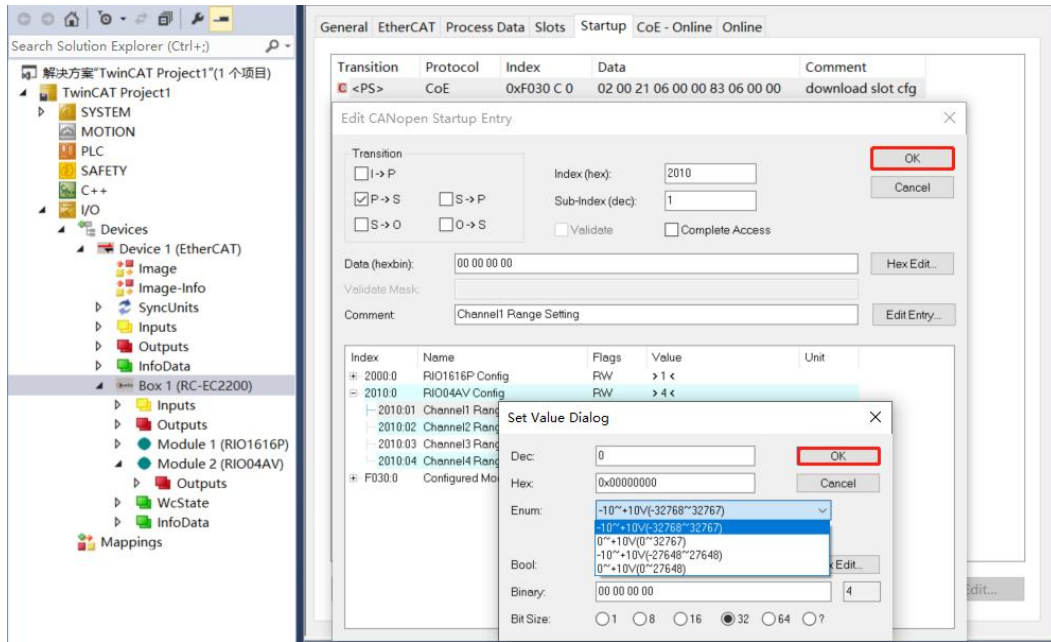
## 2. Parameter settings

- a. Support P -> S settings and startup parameters.
- b. After adding the coupler, on the "Startup" page, right-click and select "Insert" to set the parameters. After setting the parameters, click "OK", as shown in the figure below.



- c. After the parameter modification is completed, you can see the modified parameter items and parameter values under Startup.

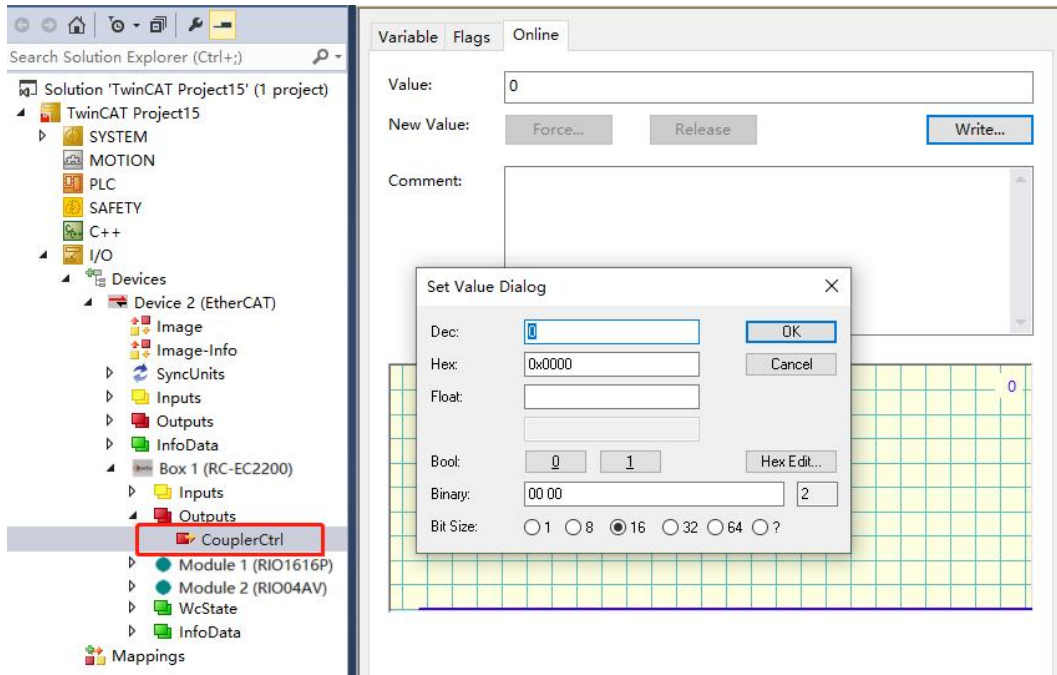
- The master station uses the startup parameter configuration function to configure the IO module parameters when creating a project.
- The master station uses the SDO method to modify parameters. After the operation is completed, the module automatically saves the parameters and takes effect immediately. The parameters are always saved without changing the topology.
- Note: If the device is in OP state, when the output property of the module is modified, the output signal at this time will be cleared and run immediately with the new parameters.
- It is recommended to configure the IO module using the startup parameter method. After completing the configuration, power off the system and then power it on again to confirm whether the parameters are accurately delivered.



### 3. Coupler control word/status word

RC-EC2200 supports a 2-byte control word ("CouplerCtrl") and a 2-byte status word ("CouplerState"), as shown in the following table:

CouplerState	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
	Reserve												X-bus error code display area			
	[15-4]					Reserve										
	[3-0]					X-bus running status, normally "0".										
CouplerCtrl	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
CouplerCtrl writes bits by setting the control word. The output type module can keep the channel output continuously under abnormal conditions.	Reserve															Clear/ Hold
	[15-1]					Reserve										
	[0]					0: By default, the control is cleared. 1: Keep control, default value is "0". The correction will take effect immediately.										



## 7.3 Module parameter setting function

This chapter takes the TwinCAT3 software platform as an example to introduce module parameters, functions and configuration methods.

### 7.3.1 Digital input filter time

Digital input filtering prevents the program from responding to unexpected rapid changes in input signals, which may be caused by switch contact jumping or electrical noise. The digital input filter is currently configured to 3ms by default, and the supported setting range is 0~20ms. When configured to 3ms, it can filter out clutter within 3ms, and channels cannot be configured individually.

An input filter time of 3 ms means that a single signal change from 0 to 1, or from 1 to 0 lasting 3 ms can be detected, while a single high or low pulse shorter than 3 ms will not be detected.

### 7.3.2 Analog filter setting function

- Analog input filtering function

The analog input filtering function can average the data after A/D conversion internally to reduce the impact of fluctuations caused by noise on the input signal.

The analog input is processed by moving average with the specified number of A/D conversions.

- Filter function configuration

Each channel can be configured individually, the configuration range is: 1~200 times, the default is 10 times.

The sampling rate of the 8-channel module is: 1.25KHZ/8 channels (800us/8 channels).

The sampling rate of the 4-channel module is: 2.5KHZ/4 channels (400us/4 channels).

### 7.3.3 Output clear hold function

Keep output: When the communication is disconnected, the module output channel keeps outputting.

Clear output: When the communication is disconnected, the module output channel clears the output.

For the configuration method of output clear hold function, refer to [7.4 Bus module configuration instructions](#).

### 7.3.4 Analog range selection

Analog quantity supports range selection function, see [3.5 Analog parameters](#).

For parameter configuration methods, see [7.4 Bus module configuration instructions](#).



## 7.4 Bus module configuration instructions

### 7.4.1 Application in TwinCAT3 software environment

#### 1、Preparation

- **Hardware Environment**

- **Module Preparation**

This description takes the RC-EC2200 module kit (power supply RC-PWR2H, coupler RC-EC200), RIO1616P, and RIO04AV as examples.

- **A computer with TwinCAT3 software pre-installed**

- **EtherCAT dedicated shielded cable**

- **Switching power supply**

- **Module mounting rails and rail fixings**

- **Device Profile**

- **Hardware configuration and wiring**

Please follow the [5 Installation and removal](#) and [6 Wiring](#) requires action.

#### 2、Pre-configured configuration files

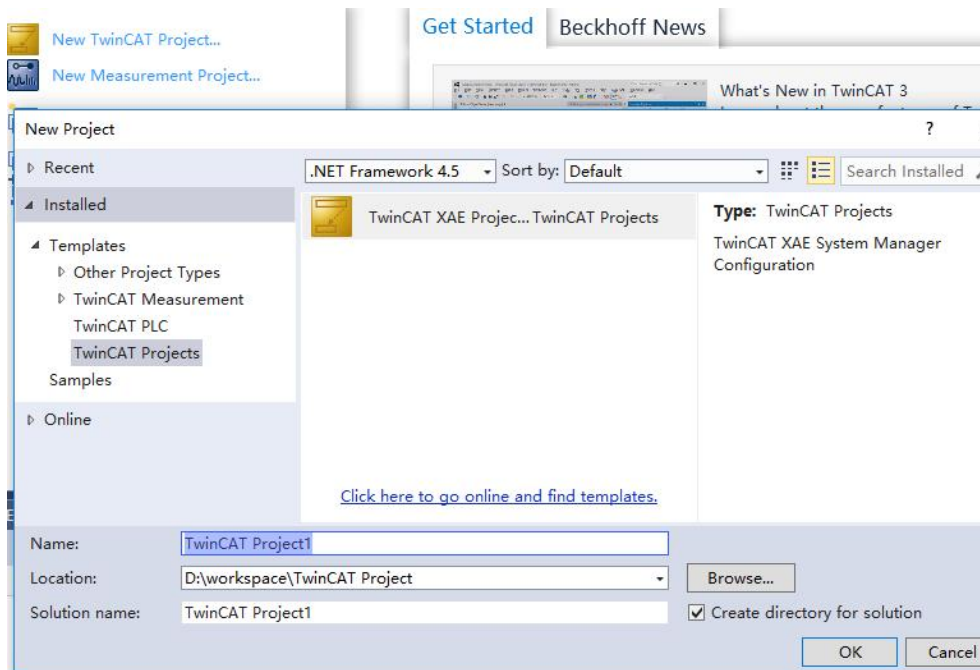
Place the ESI configuration file (EcatTerminal-RC-EC2200\_V3.22\_ENUM.xml) into the TwinCAT installation directory

“C:\TwinCAT\3.1\Config\Io\EtherCAT” , as shown in the figure below.

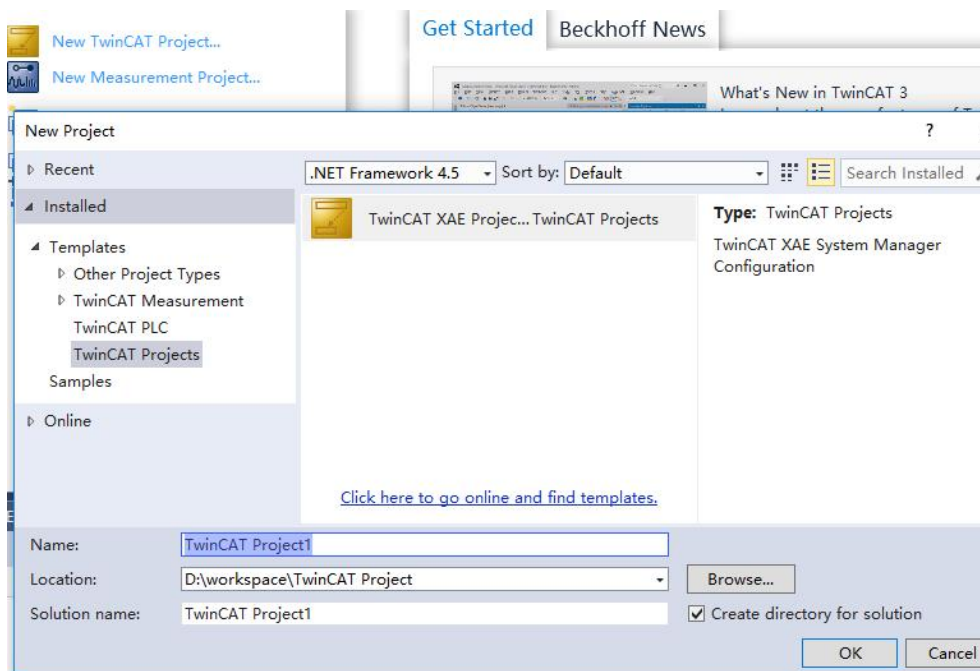
名称	修改日期	类型	大小
Beckhoff EPP1xxx.xml	2017/12/14 11:34	XML 文档	480 KB
Beckhoff EL34xx.xml	2017/12/15 15:35	XML 文档	5,634 KB
Beckhoff EK13xx.xml	2017/12/19 14:30	XML 文档	16 KB
Beckhoff EPP2xxx.xml	2017/12/28 12:22	XML 文档	1,811 KB
Beckhoff EJ1xxx.xml	2018/1/4 10:00	XML 文档	67 KB
Beckhoff EJ3xxx.xml	2018/1/4 10:07	XML 文档	1,169 KB
Beckhoff EJ7xxx.xml	2018/1/4 10:11	XML 文档	2,339 KB
Beckhoff EJ9xxx.xml	2018/1/4 10:23	XML 文档	160 KB
Beckhoff EJ6xxx.xml	2018/1/4 10:31	XML 文档	313 KB
Beckhoff EL30xx.xml	2018/1/11 13:03	XML 文档	11,508 KB
Beckhoff EL37xx.xml	2018/1/23 13:59	XML 文档	11,837 KB
Beckhoff EJ2xxx.xml	2018/1/23 14:21	XML 文档	239 KB
Beckhoff EL5xxx.xml	2018/1/23 15:11	XML 文档	6,307 KB
Beckhoff EJ5xxx.xml	2018/1/23 15:12	XML 文档	218 KB
Beckhoff EL2xxx.xml	2018/1/24 9:40	XML 文档	2,868 KB
Beckhoff EL33xx.xml	2018/1/26 9:34	XML 文档	6,727 KB
Beckhoff ELM3xxx.xml	2018/2/1 10:19	XML 文档	14,238 KB
Beckhoff AX5xxx.xml	2018/2/8 16:15	XML 文档	930 KB
Beckhoff EL1xxx.xml	2018/2/19 17:15	XML 文档	3,387 KB
Beckhoff EL25xx.xml	2018/2/21 10:23	XML 文档	6,543 KB
EcatTerminal-RC-EC2200_V3.22_ENUM.xml	2024/8/14 13:43	XML 文档	206 KB

#### 3、Create a project

- a. Click the TwinCAT icon in the lower right corner of the desktop and select "TwinCAT XAE (VS xxxx)" to open the TwinCAT software, as shown in the figure below.

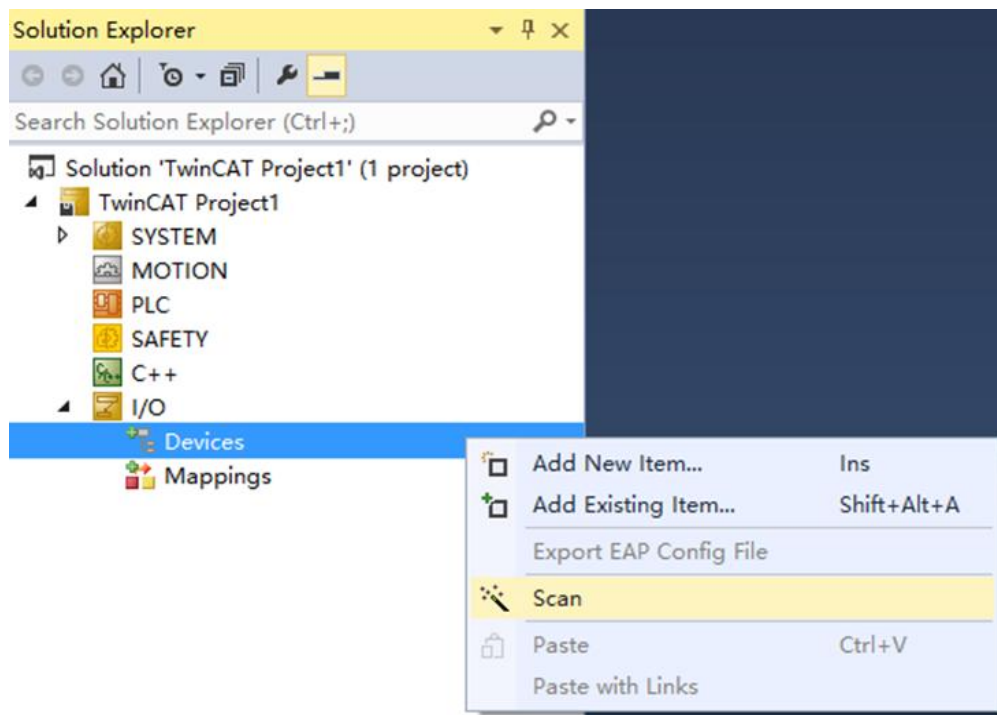


- b. Click "New TwinCAT Project". In the pop-up window, "Name" and "Solution name" correspond to the project name and solution name respectively, and "Location" corresponds to the project path. You can select the default for these three items, then click "OK". The project is created successfully, as shown in the figure below.



## 4. Scan Devices

- a. After creating the project, right-click the "Scan" option under "I/O -> Devices" to scan the slave devices, as shown in the figure below.



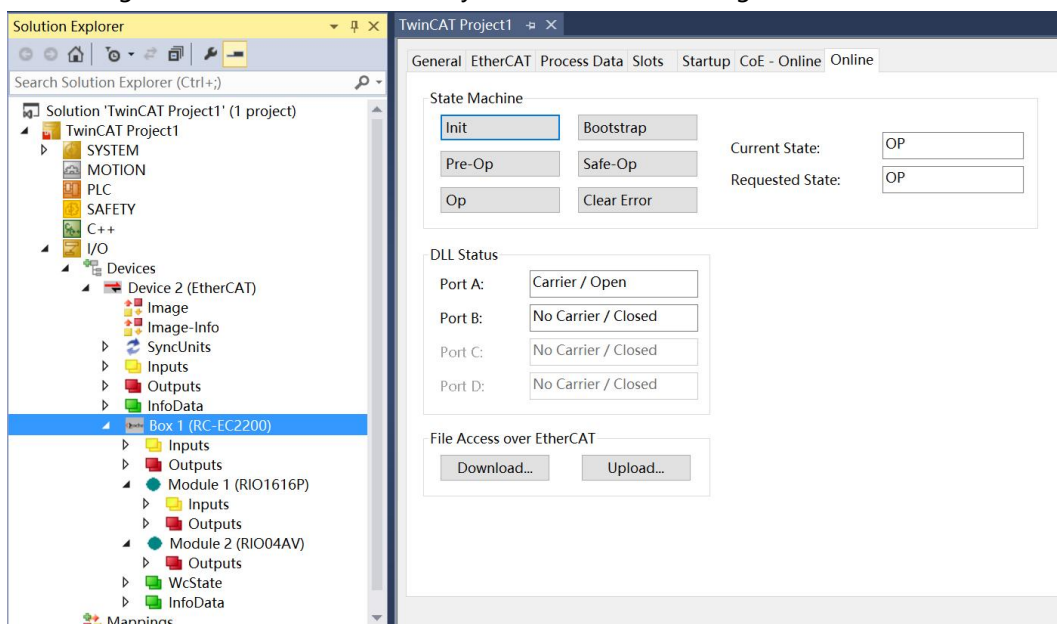
- b. Check the "Local Area Connection" network card, as shown in the figure below.



- c. In the pop-up window "Scan for boxes", click and select "Yes". In the pop-up window "Activate Free Run", click and select "Yes", as shown in the following figure.

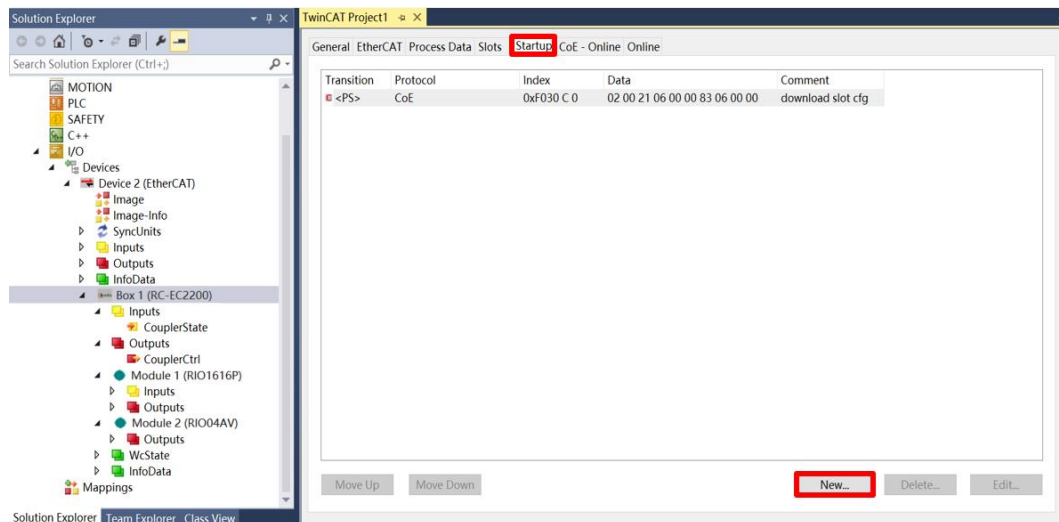


- d. After scanning the devices, you can see Box1 (RC-EC2200), Module 1 (RIO1616P) and Module 2 (RIO04AV) in the left navigation tree. In "Online", you can see that TwinCAT is in "OP" state, and the RUN light of the slave device is always on, as shown in the figure below.

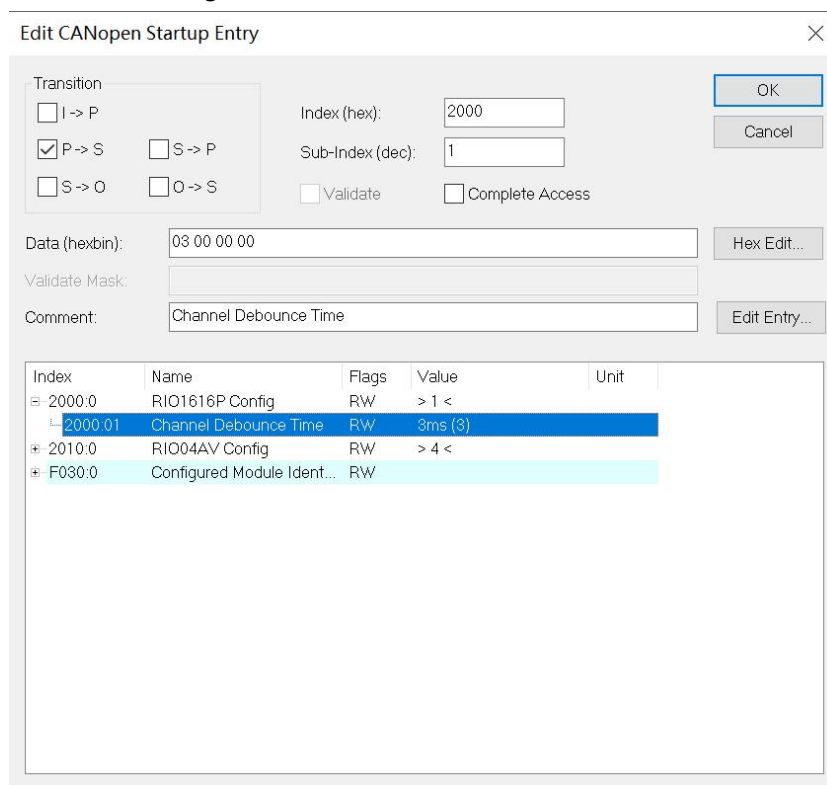


## 5. Parameter configuration

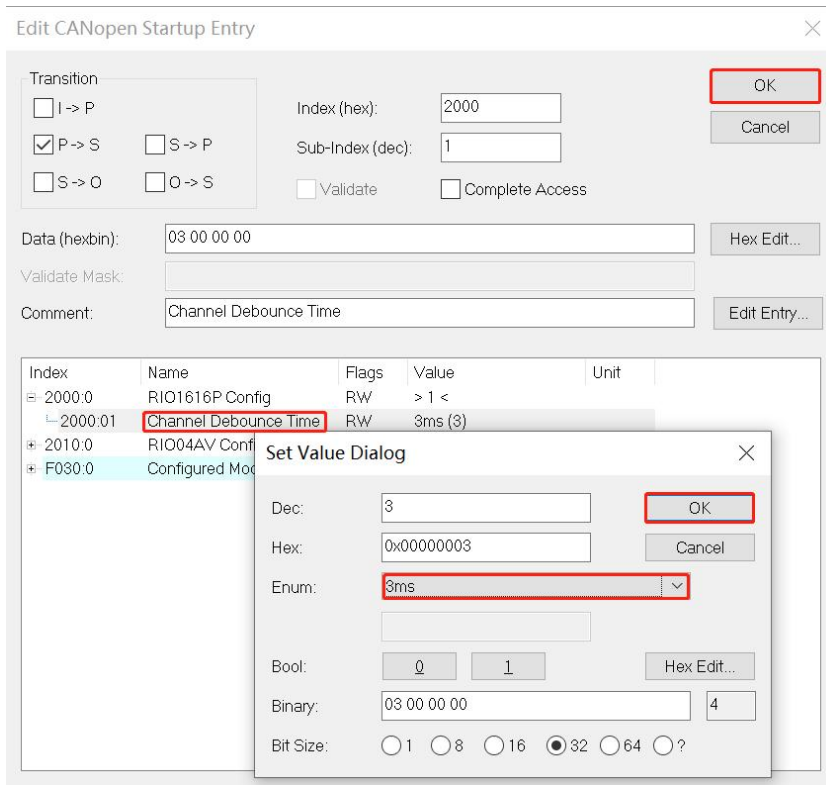
- a. Click "Box1 -> Startup -> New" in the left navigation tree to enter the configuration parameter editing page, as shown in the figure below.



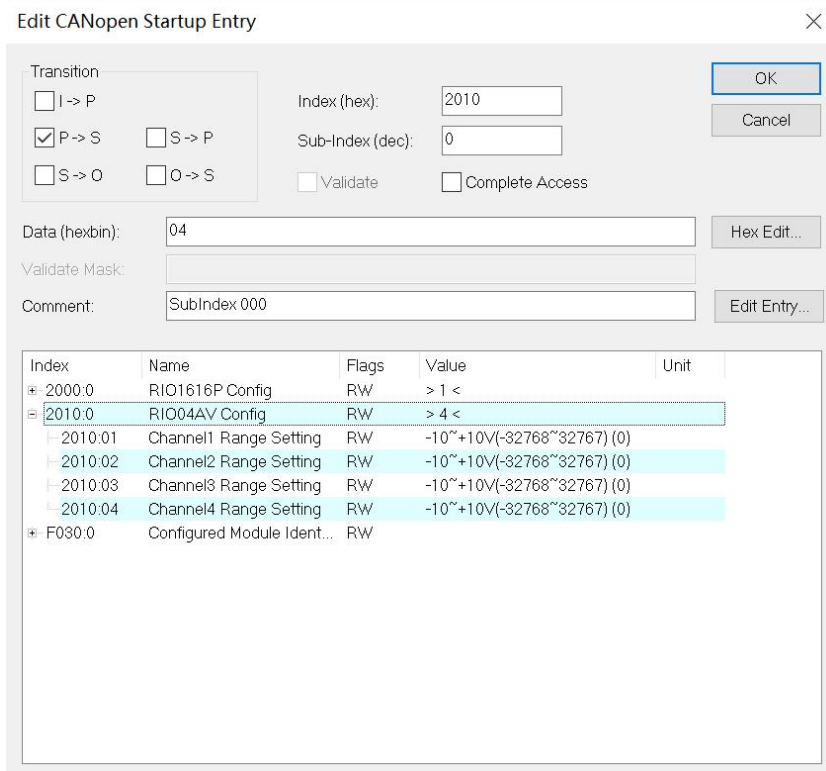
- b. In the Edit CANopen Startup Entry pop-up window, click the "+" in front of Index 2000:0 to expand the configuration parameter menu. You can set related configurations, such as filtering parameters, as shown in the figure below.



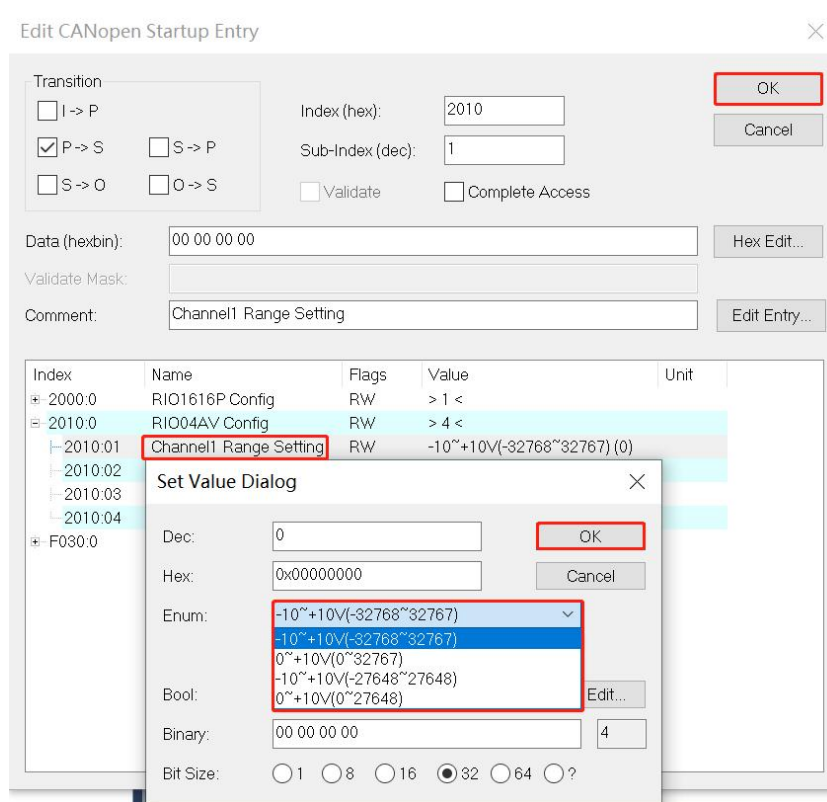
- c. For example, to modify the filtering parameters of the RIO1616P module, double-click "Channel Debounce Time" and modify the parameter value in the drop-down box, as shown in the figure below.



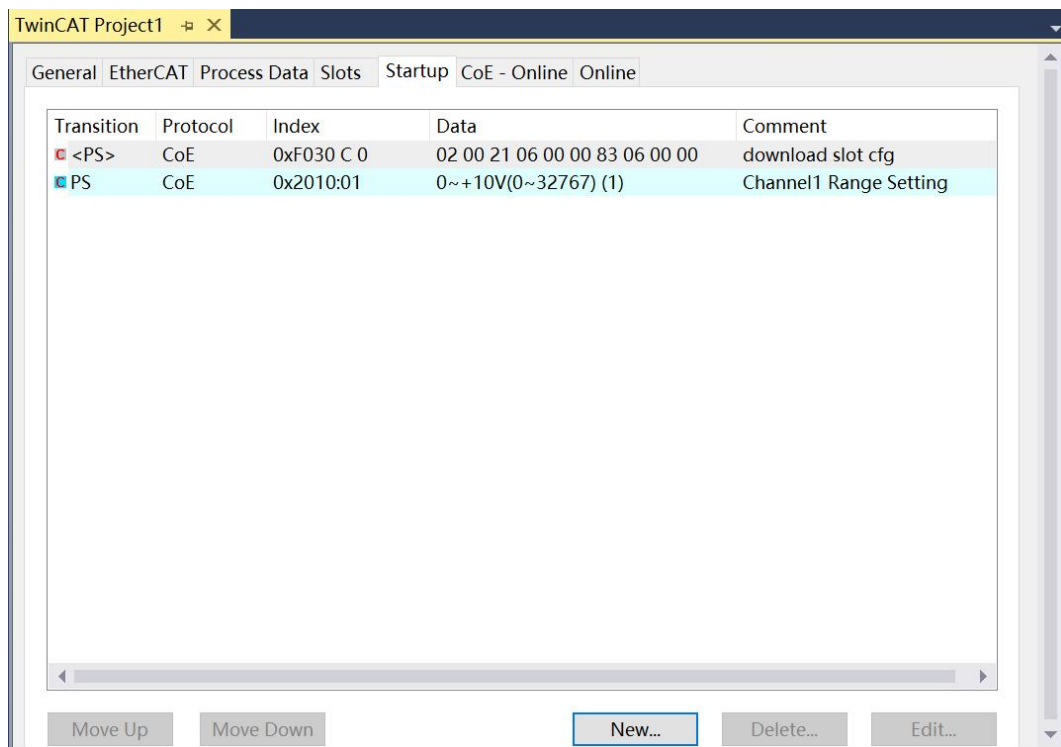
- d. In the Edit CANopen Startup Entry pop-up window, click the "+" in front of Index 2010:0 to expand the configuration parameter menu. You can see 4 configuration parameters. Click any parameter to set related configurations, such as setting the analog range, as shown in the figure below.



- e. For example, to modify the analog range of channel 1 of the RIO04AV module, double-click "Channel1 Range Setting" and modify the parameter value, as shown in the figure below.

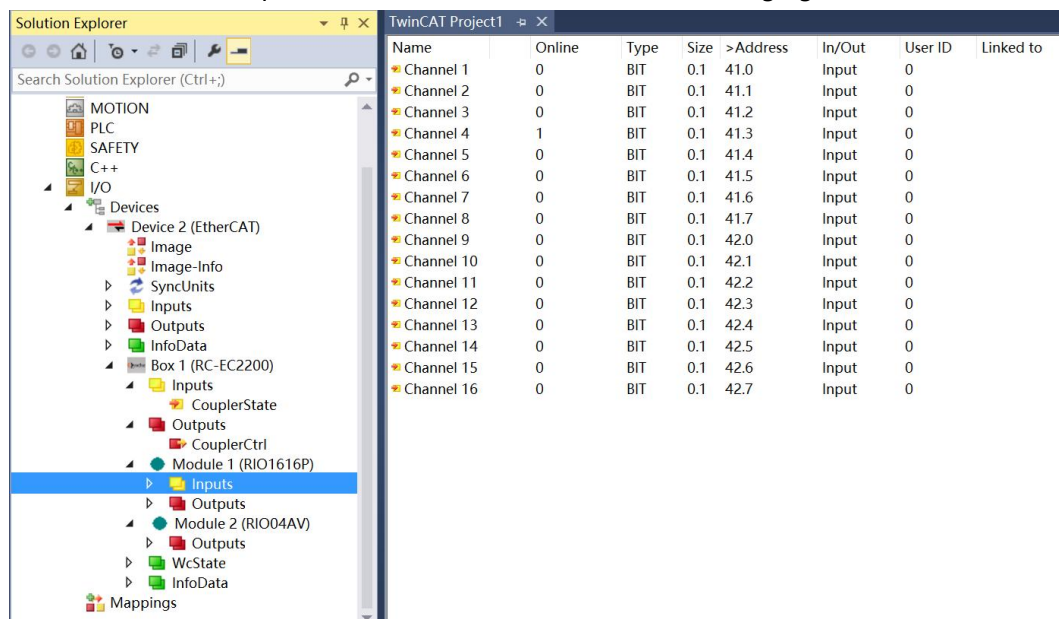


- f. After the parameter modification is completed, the modified parameter items and parameter values can be seen under Startup, as shown in the figure below. After the parameter setting is completed, it is necessary to perform the Reload operation and re-power the module to realize the automatic transmission of parameter settings by the master station.



**g. Verify basic functions**

- a. The left navigation tree "Module 1 -> Inputs" displays the upstream data of the module and is used to monitor the input of the module, as shown in the following figure.



- b. The left navigation tree "Module 1 -> Outputs" displays the downstream data of the module, which is used to control the output of the module, as shown in the following figure.

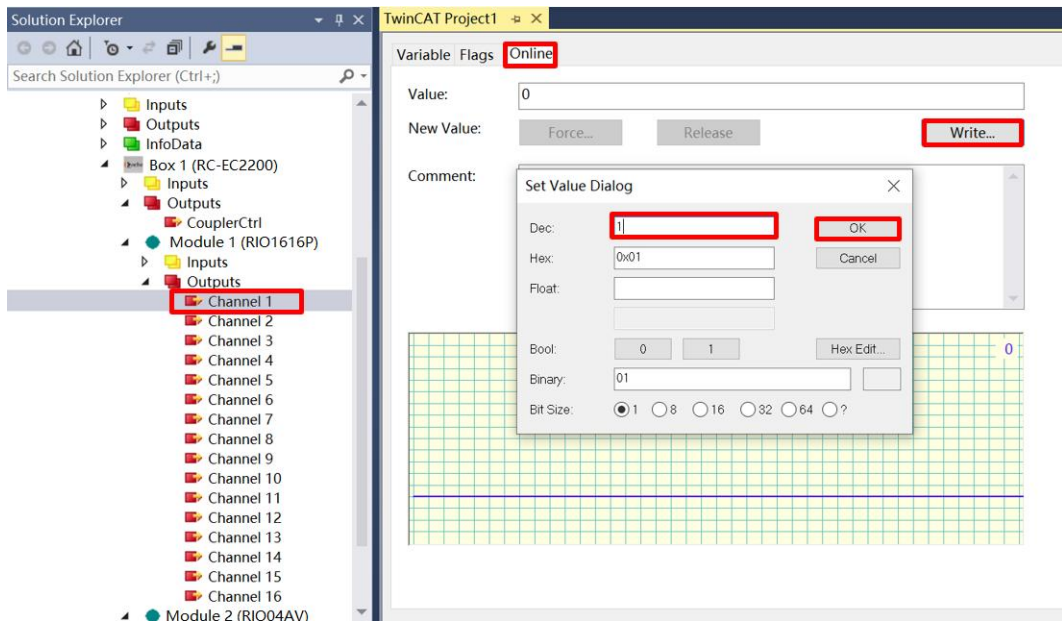


Name	Online	Type	Size	>Address	In/Out	User ID	Linked to
Channel 1	0	BIT	0.1	41.0	Output	0	
Channel 2	0	BIT	0.1	41.1	Output	0	
Channel 3	0	BIT	0.1	41.2	Output	0	
Channel 4	0	BIT	0.1	41.3	Output	0	
Channel 5	0	BIT	0.1	41.4	Output	0	
Channel 6	0	BIT	0.1	41.5	Output	0	
Channel 7	0	BIT	0.1	41.6	Output	0	
Channel 8	0	BIT	0.1	41.7	Output	0	
Channel 9	0	BIT	0.1	42.0	Output	0	
Channel 10	0	BIT	0.1	42.1	Output	0	
Channel 11	0	BIT	0.1	42.2	Output	0	
Channel 12	0	BIT	0.1	42.3	Output	0	
Channel 13	0	BIT	0.1	42.4	Output	0	
Channel 14	0	BIT	0.1	42.5	Output	0	
Channel 15	0	BIT	0.1	42.6	Output	0	
Channel 16	0	BIT	0.1	42.7	Output	0	

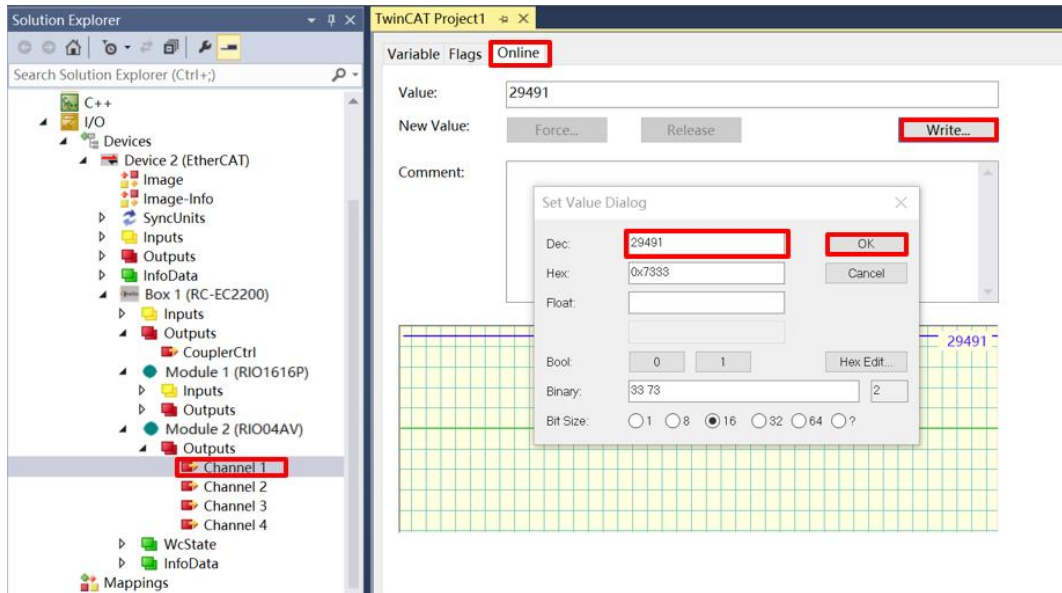
- c. Taking channel 4 of the RIO1616P module as an example, if there is a valid voltage input to the module input channel 4, it can be observed in "Module 1 -> Inputs", as shown in the figure below.

Name	Online	Type	Size	>Address	In/Out	User ID	Linked to
Channel 1	0	BIT	0.1	41.0	Input	0	
Channel 2	0	BIT	0.1	41.1	Input	0	
Channel 3	0	BIT	0.1	41.2	Input	0	
Channel 4	1	BIT	0.1	41.3	Input	0	
Channel 5	0	BIT	0.1	41.4	Input	0	
Channel 6	0	BIT	0.1	41.5	Input	0	
Channel 7	0	BIT	0.1	41.6	Input	0	
Channel 8	0	BIT	0.1	41.7	Input	0	
Channel 9	0	BIT	0.1	42.0	Input	0	
Channel 10	0	BIT	0.1	42.1	Input	0	
Channel 11	0	BIT	0.1	42.2	Input	0	
Channel 12	0	BIT	0.1	42.3	Input	0	
Channel 13	0	BIT	0.1	42.4	Input	0	
Channel 14	0	BIT	0.1	42.5	Input	0	
Channel 15	0	BIT	0.1	42.6	Input	0	
Channel 16	0	BIT	0.1	42.7	Input	0	

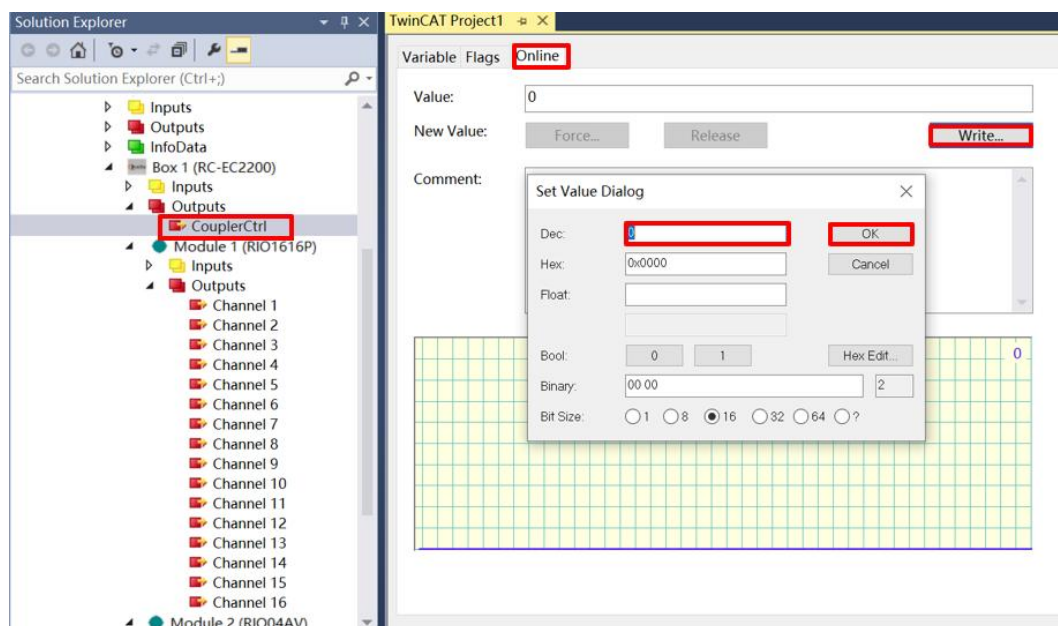
- d. Take channel 1 of the RIO1616P module as an example. If you want to enable the digital output channel Channel 1 of the module, you can click Channel 1 in "Module 1 -> Outputs", click "Write" in the corresponding "Online", and enter the value "1" in "Dec" in the corresponding dialog box. You can see the corresponding channel light on the module, as shown in the figure below.



- e. Take channel 1 of the RIO04V module as an example. If you want to output the analog output channel Channel 1 of the module, you can click Channel 1 in "Module 2-> Outputs", click "Write" in the corresponding "Online", and enter the value "29491" in the "Dec" in the corresponding dialog box. For specific analog parameters, see 3.5 Analog parameters, you can see the corresponding channel light on the module, as shown in the figure below.



- f. Take the RC-EC2200 module as an example. In "Box1->Outputs", click CouplerCtrl, click "Write" in the corresponding "Online", and enter the value "0" in "Dec" in the corresponding dialog box. The output channel of this module will be cleared, as shown in the figure below.



Note: Dec is configured as "0", which means clearing the output, and Dec is configured as "1", which means keeping the output.

## 7.4.2 Application in Sysmac Studio software environment

### 1、Preparation

- **Hardware Environment**

- **Module Preparation**

This description takes the RC-EC2200 module kit (power supply RC-PWR2H, coupler RC-EC200), RIO1616P, and RIO40AV as examples.

- **A computer with Sysmac Studio software pre-installed**
  - **Omron PLC Model: NX1P2 9024DT**
  - **EtherCAT dedicated shielded cable**
  - **Switching power supply**
  - **Module mounting rails and rail fixings**
  - **Device Profile**

- **Hardware configuration and wiring**

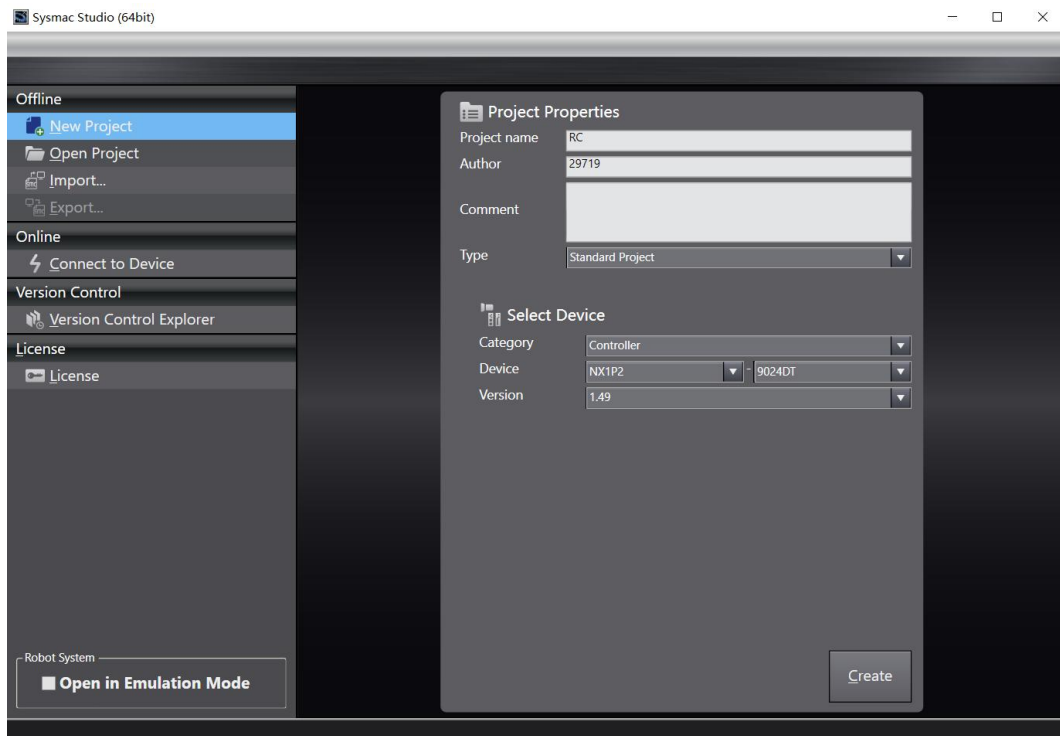
Please follow the [5 Installation and removal](#) and [6 Wiring](#) requires action.

- **Computer IP requirements**

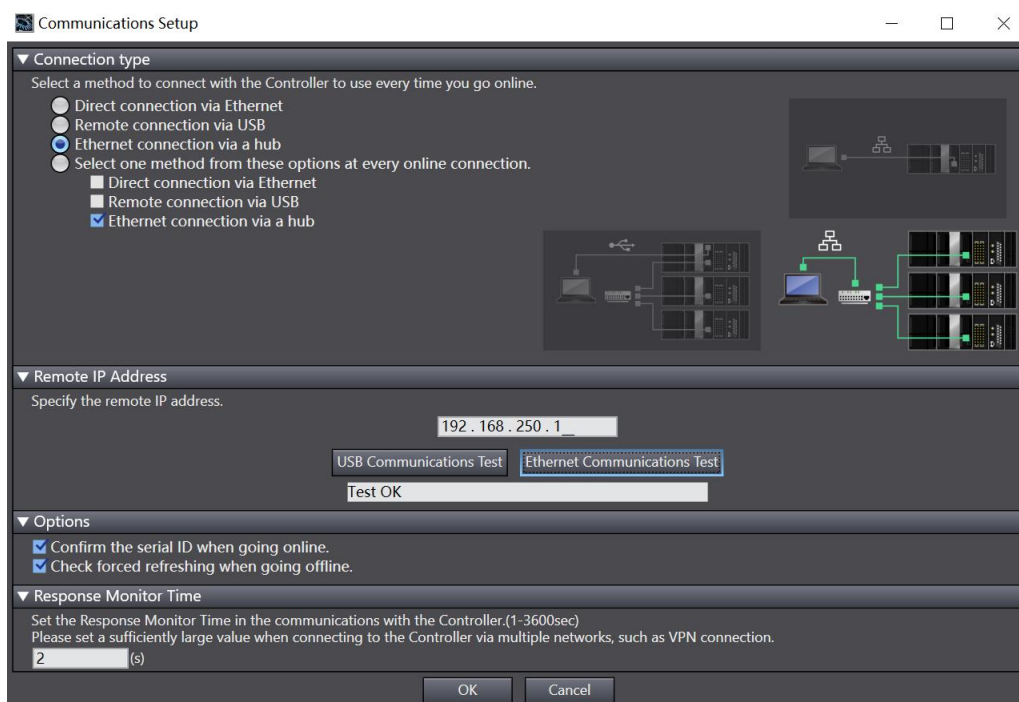
Set the IP address of the computer and the IP address of the PLC, and ensure that they are in the same network segment.

### 2、Adding a device description file

- Log in to Sysmac Studio and click the "New Project" button.



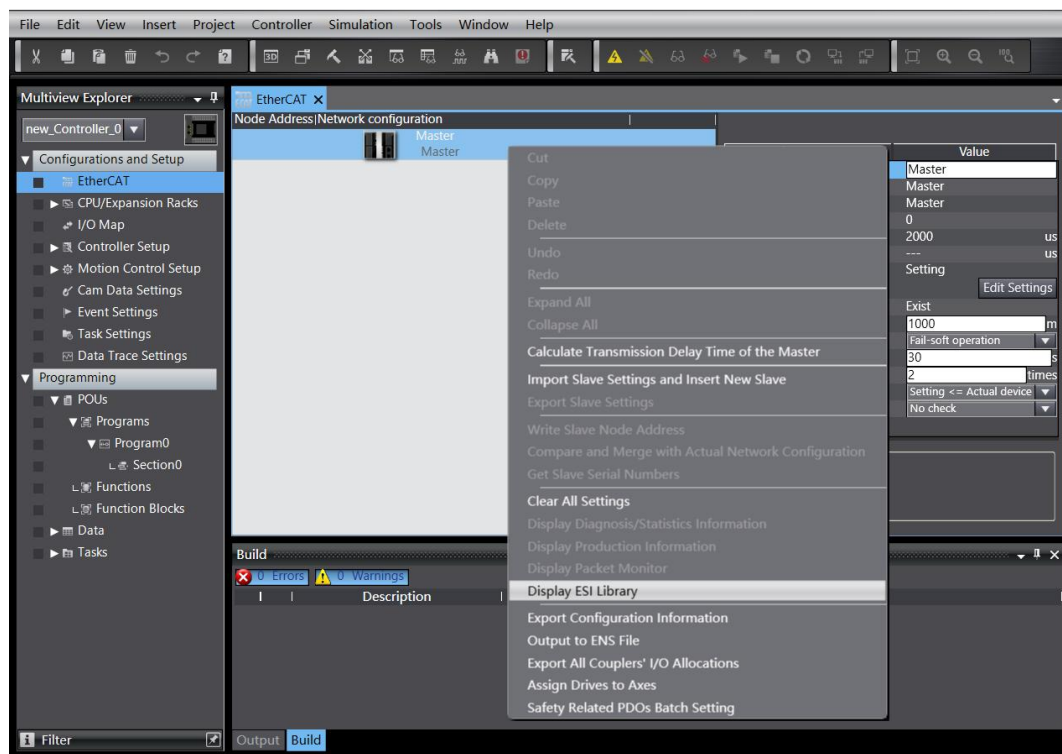
- b. Select the Device, Model, and Version in the Device and Version drop-down lists.
- c. Select "Controller -> Communication Settings", select the method to be used each time you connect to the controller while online, and enter the "Remote IP Address", as shown in the figure below.



- d. Click Ethernet Communication Test. The system displays that the test is successful.

### 3. Add XML File

- a. In the left navigation tree, expand Configuration and Settings and double-click EtherCAT.
- b. Right-click "Main Device" and select "Show ESI Library", as shown in the figure below.

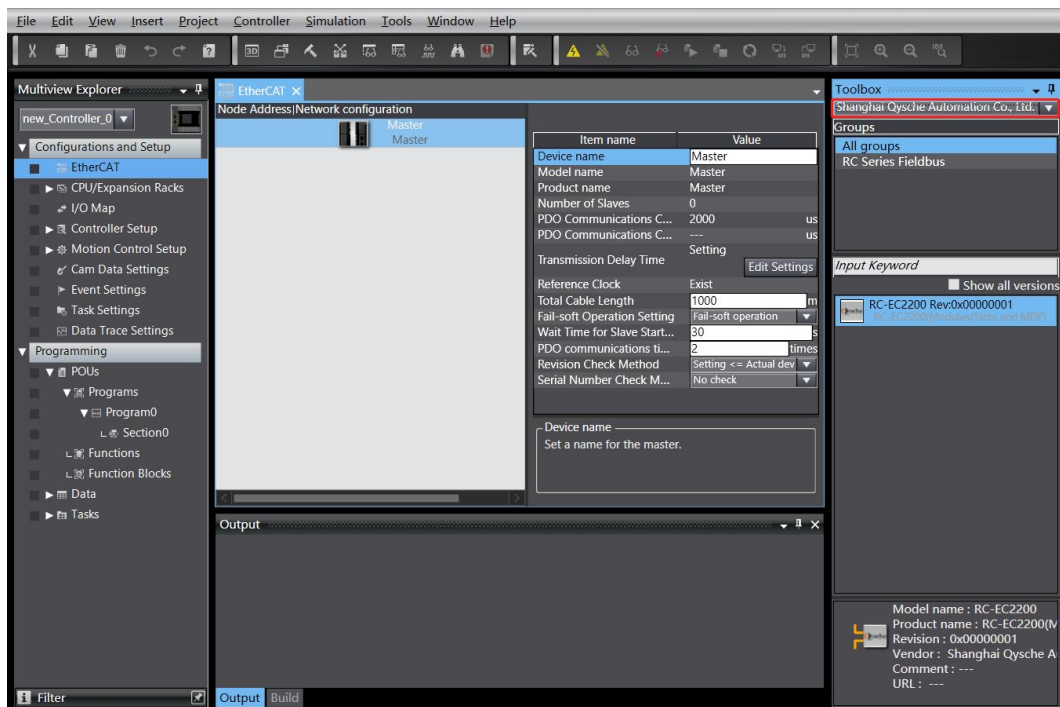


- c. In the pop-up "ESI Library" window, click the "Install (File)" button and select the XML file path.

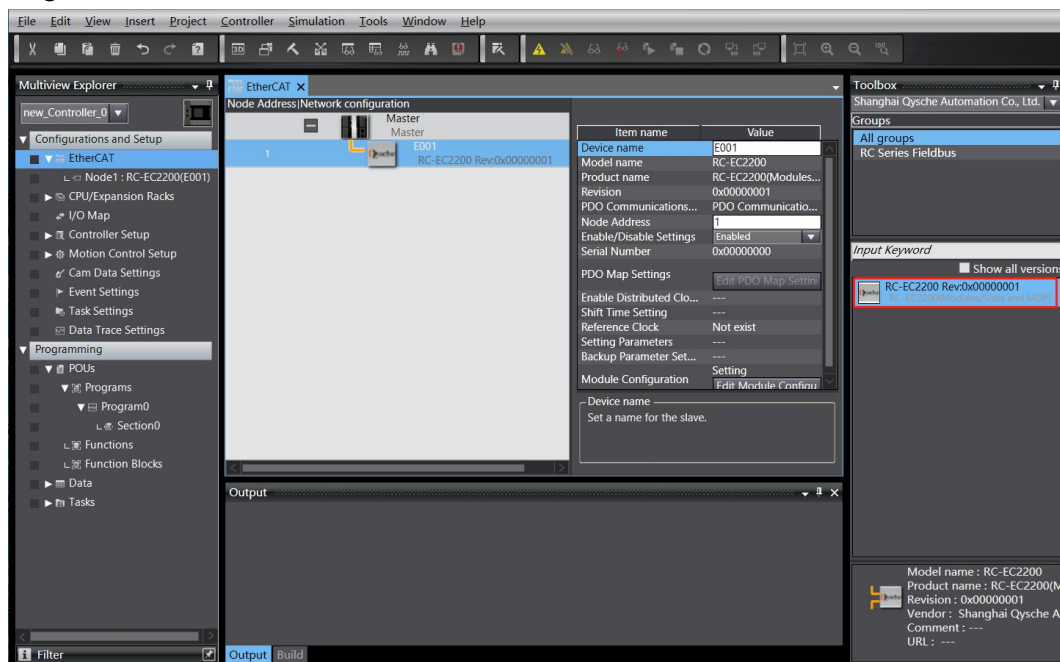
#### 4. Add a device

##### ● Adding a Coupler

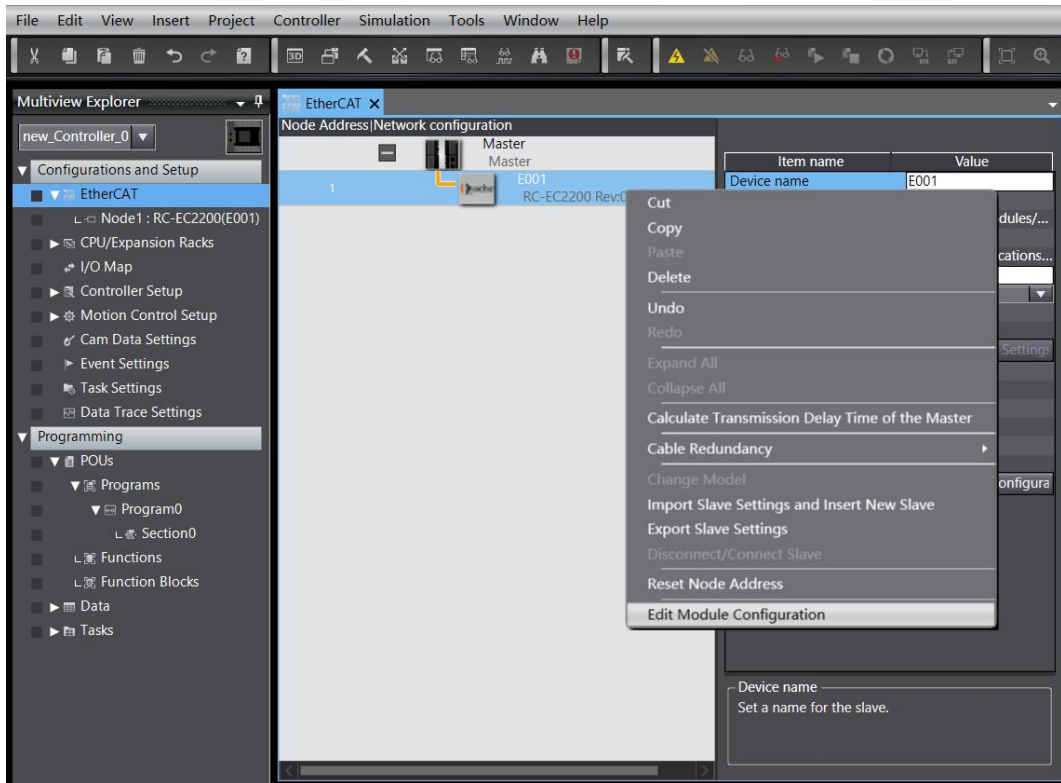
- a. In the left navigation tree, expand "Configuration and Settings" and double-click "EtherCAT" to display the "Node Settings | Network Settings" page.
- b. In the "All Suppliers" drop-down list on the right navigation bar, select "Shanghai Qysche Automation Co., Ltd.", as shown in the following figure.



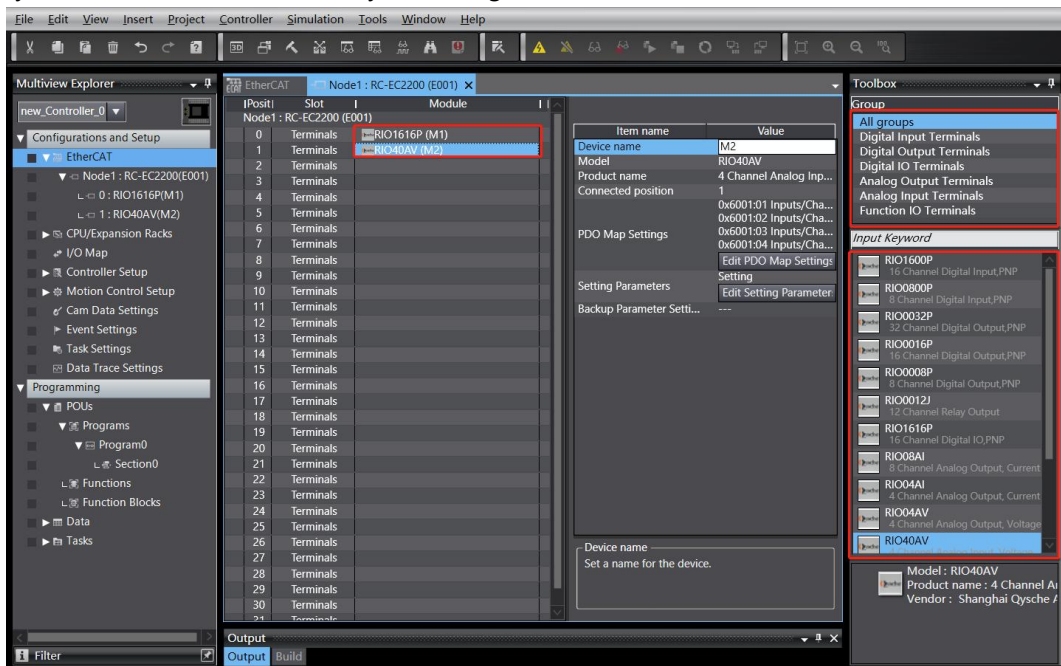
- c. Double-click RC-EC2200 to add the coupler module, as shown below. Add I/O module  
Single device connection:



- a. Select the coupler module you just added, right-click and select "Edit Module Configuration" from the menu options, as shown in the figure below.



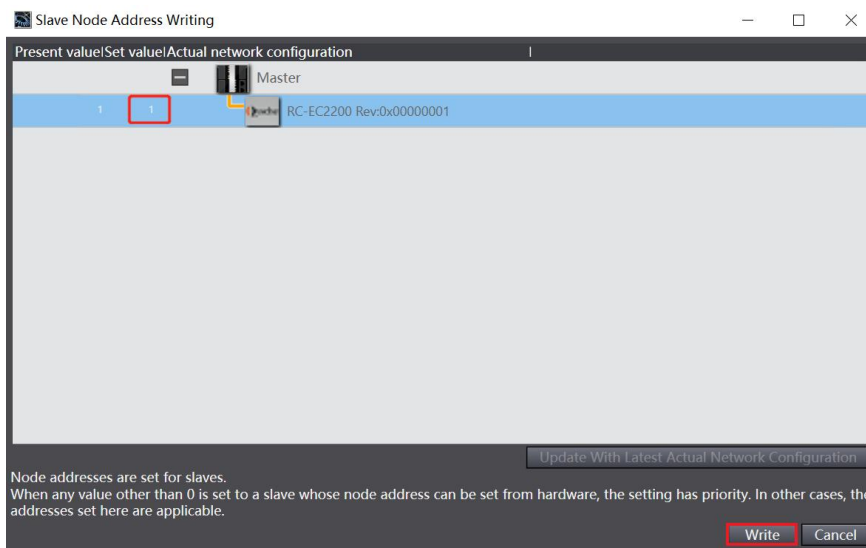
- b. Position the cursor in "Module", click the module in the list on the right, and add I/O modules one by one in the order in which they are configured.



Multi-device cascading:

- a. Select the added coupler module, right-click and select "Edit Module Configuration" from the menu options.
- b. Click "Controller -> Online" in the upper menu bar.

- c. Right-click the master device icon and select "Write Slave Device Node Address", as shown below, and write a "Set Value" that is different from the "Current Value".



- d. Re-power on the PLC and the device at the same time.
- e. Right-click the main device icon and select Compare and Merge with Physical Network Configuration.

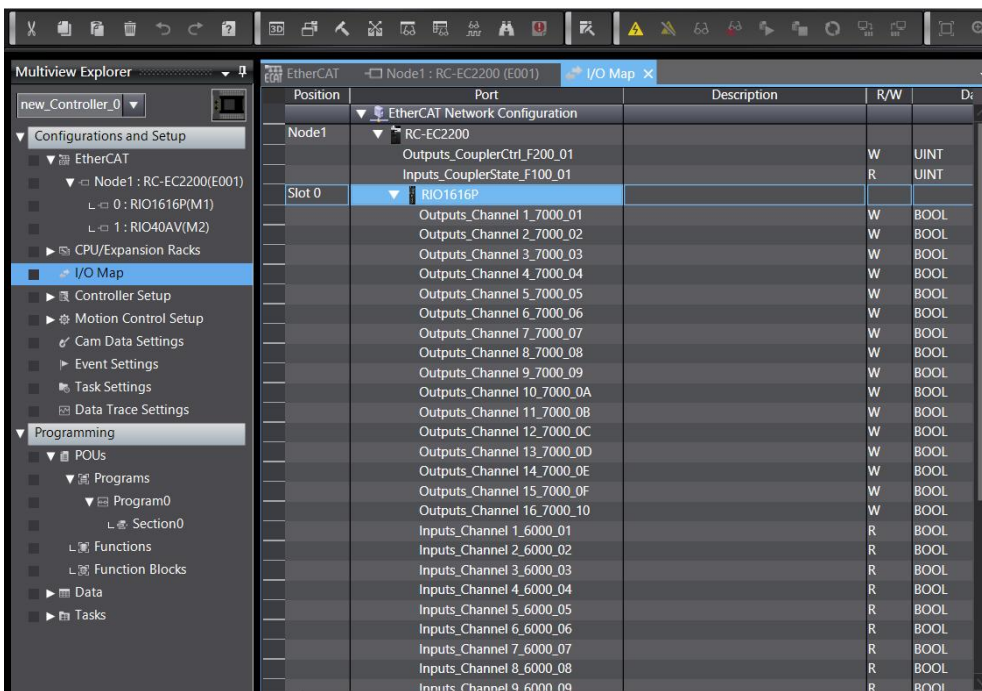
## 5. Configuration Download

- a. Click "Controller -> Transferring -> Transfer to Controller" to transfer the online data to the controller.

## 6. Channel Test

- a. Double-click I/O Mapping in the left navigation tree and select the corresponding I/O module to view and operate the channel data.

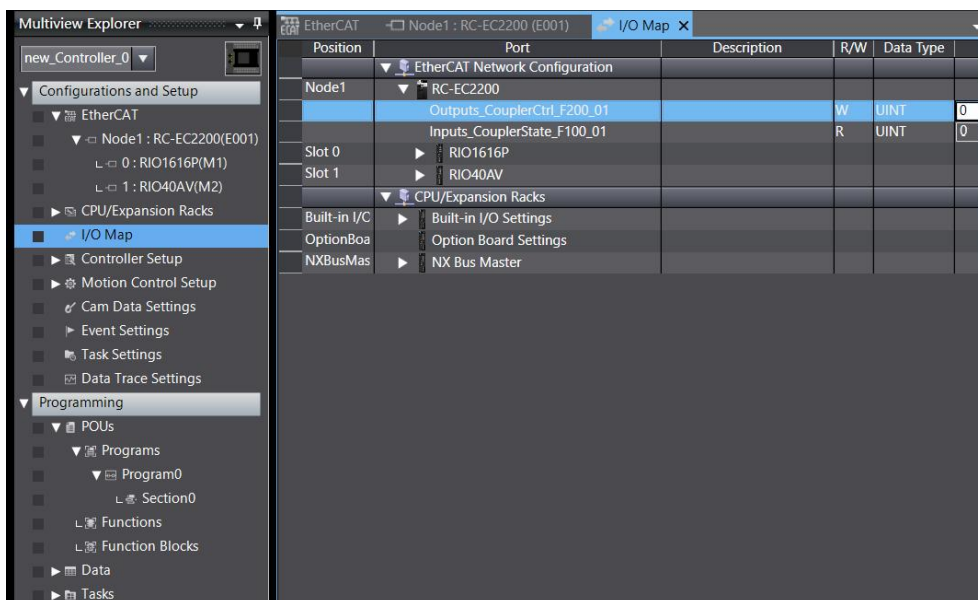




## 7. Module parameter settings

- **Output clear hold function**

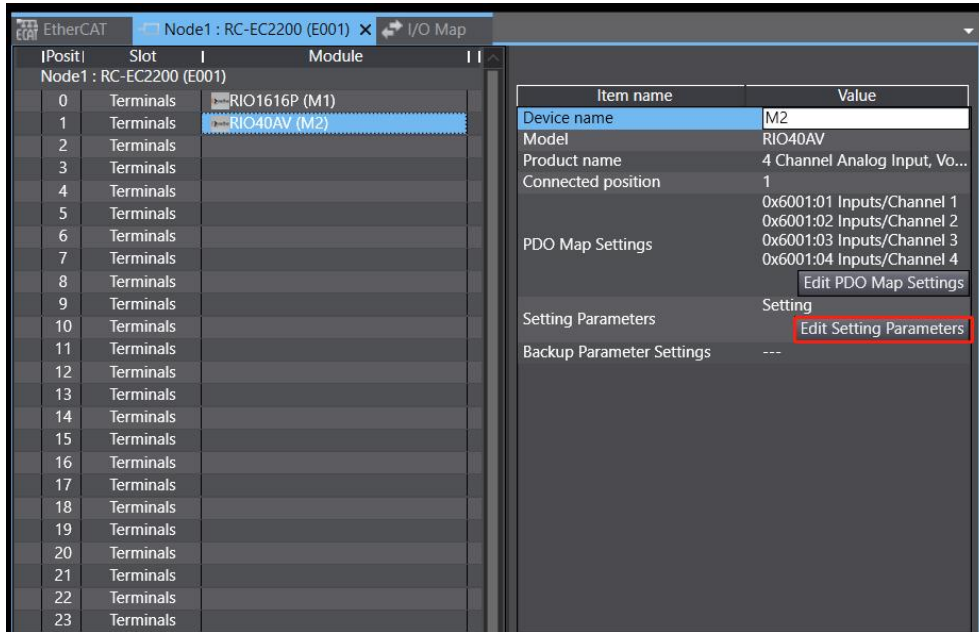
- Double-click I/O Mapping in the left navigation tree to display the I/O Mapping window.
- Expand the node and, when the system is running, write "01" to the corresponding "Outputs\_CouplerCtrl\_F200\_01" to complete the clear/hold function setting.



0: Output clear, 1: Output hold

- **Analog range selection and filter setting**

- Double-click a node in the left navigation tree and select the corresponding input module.
- Once the system is offline, click the Edit Initialization Parameter Settings button.



- Note: If the PLC firmware version is too low, you need to use the EC\_CoESDOWrite and EC\_CoESDORead instructions to write and read the SDO address. Range selection and filter setting
- On the "Edit Initialization Parameter Settings" page, you can select the range and filter settings. [7.3 Module parameter setting function.](#)

