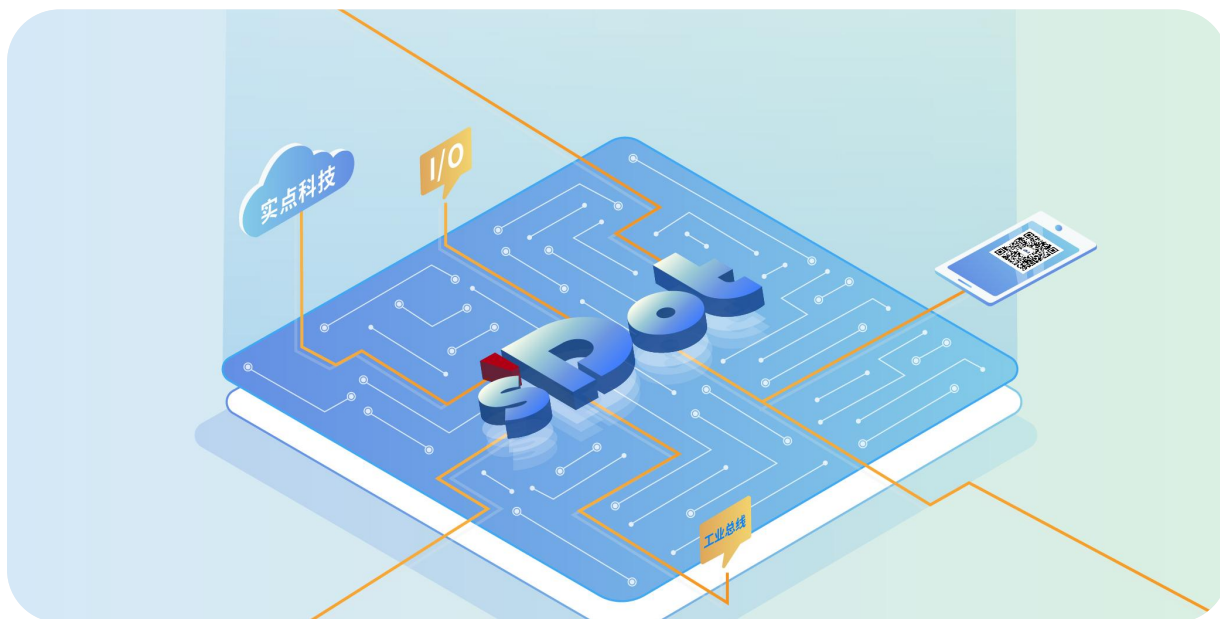




EtherCAT

EC7A Series Integrated I/O

User Manual



Nanjing Solidot Electronic Technology Co., Ltd.

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1 Product Overview

1.1 Product Introduction

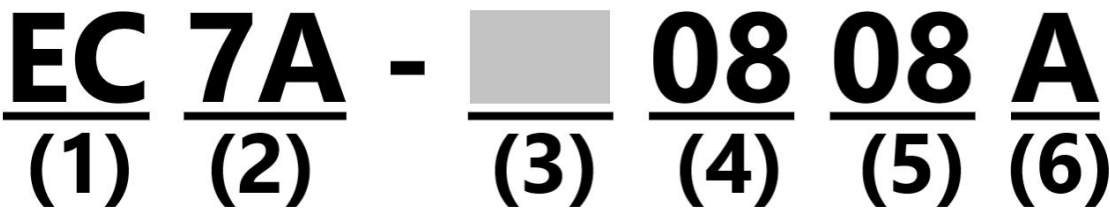
The EC7A series integrated I/O modules adopt the EtherCAT industrial Ethernet bus interface and are standard I/O architecture EtherCAT slave devices. They are compatible with EtherCAT networks from multiple manufacturers, providing users with a variety of options for high-speed data acquisition, optimized system configuration, simplified field wiring, and improved system reliability.

1.2 Product Features

- **IP67 protection rating**
Suitable for harsh industrial environments.
- **Small size**
Suitable for applications with limited space.
- **Fast**
Based on a high-performance EtherCAT ASIC communication chip, it enables direct control and faster speed.
- **Easy to diagnose**
The innovative channel indicator light design is placed close to the channel, making the channel status clear at a glance and facilitating inspection and maintenance.
- **Easy configuration**
It is easy to configure and supports major mainstream EtherCAT master stations.
- **Simple and quick wiring**
Using standard cables simplifies wiring.

2 Naming Rules

2.1 Naming Rules



Serial Number	Meaning	Value description		
(1)	Bus Protocol	EC: EtherCAT protocol		
(2)	Protection level	7A: IP67		
(3)	I/O types	Default: Digital		
(4)	Number of input signal points	16: 16-channel input	08: 8-channel input	00:0 channel input
(5)	Number of output signal points	16: 16-channel output	08: 8-channel output	00:0 channel output
(6)	signal type	A: NPN	B: PNP	

2.2 Model List

model	Product Description
EC7A-1600A	16-channel digital input module, NPN type
EC7A-1600B	16-channel digital input module, PNP type
EC7A-0808A	8-channel digital input/output module, NPN type
EC7A-0808B	8-channel digital input/output module, PNP type
EC7A-0016A	16-channel digital output module, NPN type
EC7A-0016B	16-channel digital output module, PNP type

3 Product Parameters

3.1 General parameters

Interface parameters	
Bus Protocol	EtherCAT
Bus interface	2×M12, 4Pin, D-code
Electrical isolation	500VAC
Number of I/O stations	According to the main site
Data transmission medium	UTP or STP of Category 5 or higher (STP recommended)
Transmission distance	≤100m (distance between stations)
Transmission rate	100Mbps
Technical parameters	
Configuration method	via the main site
Power interface	2×M12, 5Pin, L-code
power supply	24 VDC (18V~30V)
	Reverse polarity protection
US total current	Max: 16A
US consumes current	≤35mA
UL Total Current	Max: 16A
UL consumes current	25mA +Sensor supply current +Load output current
Electrical isolation between GNDS and GNDL	yes
weight	660g
size	225.5×62.5×32.6mm
Operating temperature	-25~+70℃
Storage temperature	-40~+85℃

relative humidity	95%, no condensation
Protection level	IP67

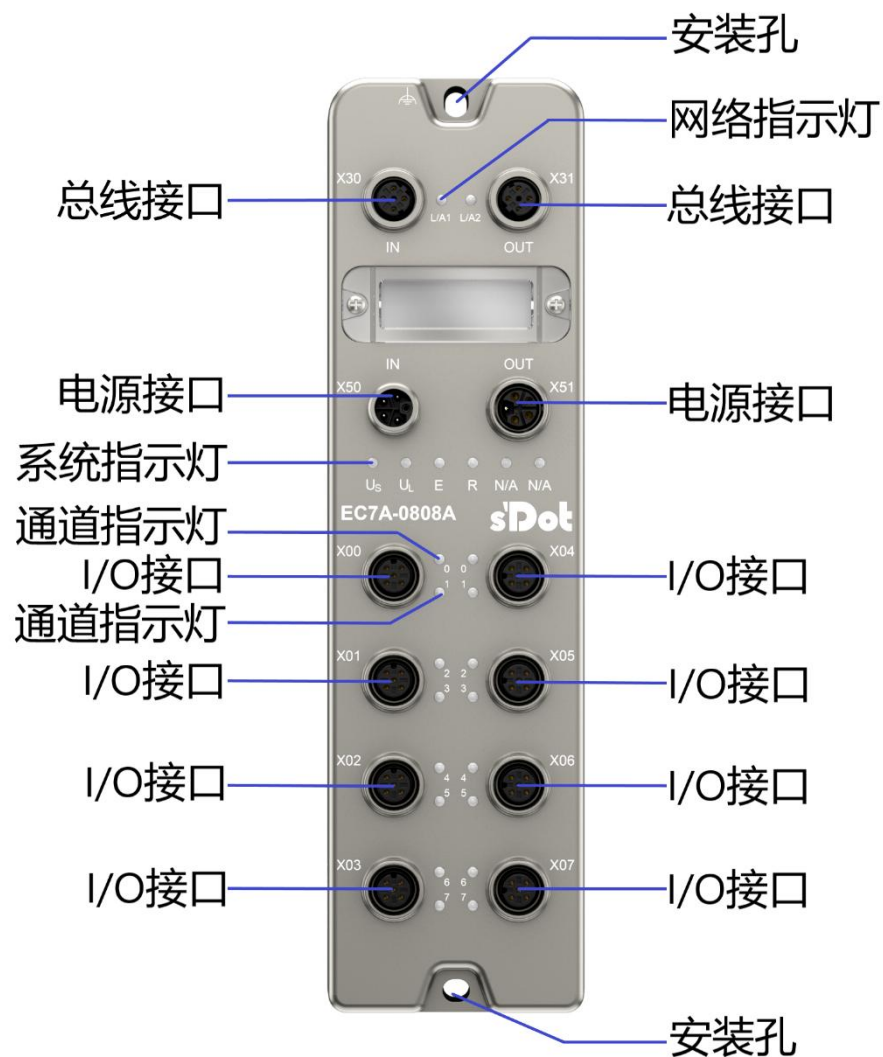
3.2 Digital parameters

Digital input						
Product Model	EC7A-1600A	EC7A-1600B	EC7A-0808A	EC7A-0808B	EC7A-0016A	EC7A-0016B
Rated voltage	24 VDC (18V~30V)				-	
signal points	16		8			
Input Interface	8×M12, 5Pin, A-code					
signal type	NPN	PNP	NPN	PNP		
"0" signal voltage	15~30V	-3~+3V	15~30V	-3~+3V		
"1" signal voltage	-3~+3V	15~30V	-3~+3V	15~30V		
Input filtering	none					
Input current	4mA					
Total power supply for sensors	Max: 2A (from UL)					
Isolation methods	Optical isolation					
Isolation and withstand voltage	500VAC					
Channel indicator lights	Green LED lights					
Digital output						
Rated voltage	-		24 VDC (18V~30V)			
signal points			8		16	
Output interface			8×M12, 5Pin, A-code			
signal type			NPN	PNP	NPN	PNP
Load type			Resistive load, inductive load			
Single-channel rated current			Max: 500mA (from UL)			
Total output current			Max: 4A (from UL)		Max: 8A (from UL)	
Port protection			Overcurrent protection			
Isolation methods			Optical isolation			
Isolation and withstand voltage			500VAC			
Channel indicator lights			Green LED lights			

4 Panel

4.1 Product Structure

Product Parts Names



4.2 Indicator light function

Name	Logo	Color	State	Status Description
Network indicator IN	L/A1	green	ON	Establish network connection
			blinking	Network connection and data exchange
			Extinguish	No data interaction or anomaly
Network indicator light OUT	L/A2	green	ON	Establish network connection
			blinking	Network connection and data exchange
			Extinguish	No data interaction or anomaly
System power indicator	US	green	ON	Power supply is normal
			Extinguish	The product is not powered on or the power supply is abnormal.
Load power indicator	UL	green	ON	Power supply is normal
			Extinguish	The product is not powered on or the power supply is abnormal.
RUN status indicator	R	green	ON	The system is running normally.
			blinking	2Hz: The device is in Pre-OP state. 1Hz: The device is in Safe-OP state.
			Extinguish	The device is in Init or not powered.
Alarm indicator	E	red	ON	The system is malfunctioning.
			blinking	Device offline or slave configuration error
			Extinguish	The system is running normally or not powered on.
Input channel indicator	0 ~ F	green	ON	The module channel has a signal input.
			Extinguish	The module channel has no signal input or the signal input is abnormal.
Output channel indicator	0 ~ F	green	ON	The module channel has signal output.
			Extinguish	The module channel has no signal output or the signal output is abnormal.

4.3 Bus interface definition

Bus interface connection view (M12, D-code, hole end)

Definitions

1

4

3

2

IN

Bus

3

2

1

4

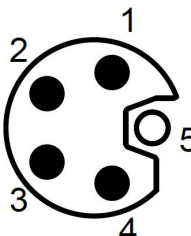
OUT

Pin	Function
1	TX+, send data+
2	RX+, receiving data+
3	TX - Send data -
4	RX-, Data Receiver-

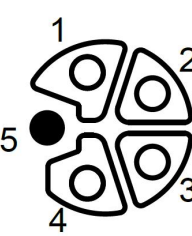
4.4 Power interface definition

Power interface connection view (M12, L-code, pin end & hole end)

Definitions



IN



OUT

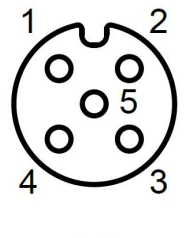
Power

Pin	Function	Wire core color
1	+24V US	Brown
2	0V GNDL	white
3	0V GNDS	blue
4	+24V UL	black
5	PE	Ash

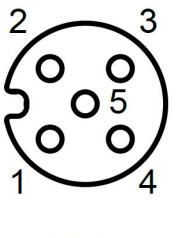
4.5 I/O interface definition

I/O interface connection view (M12, A-code, hole end)

Definitions



DI



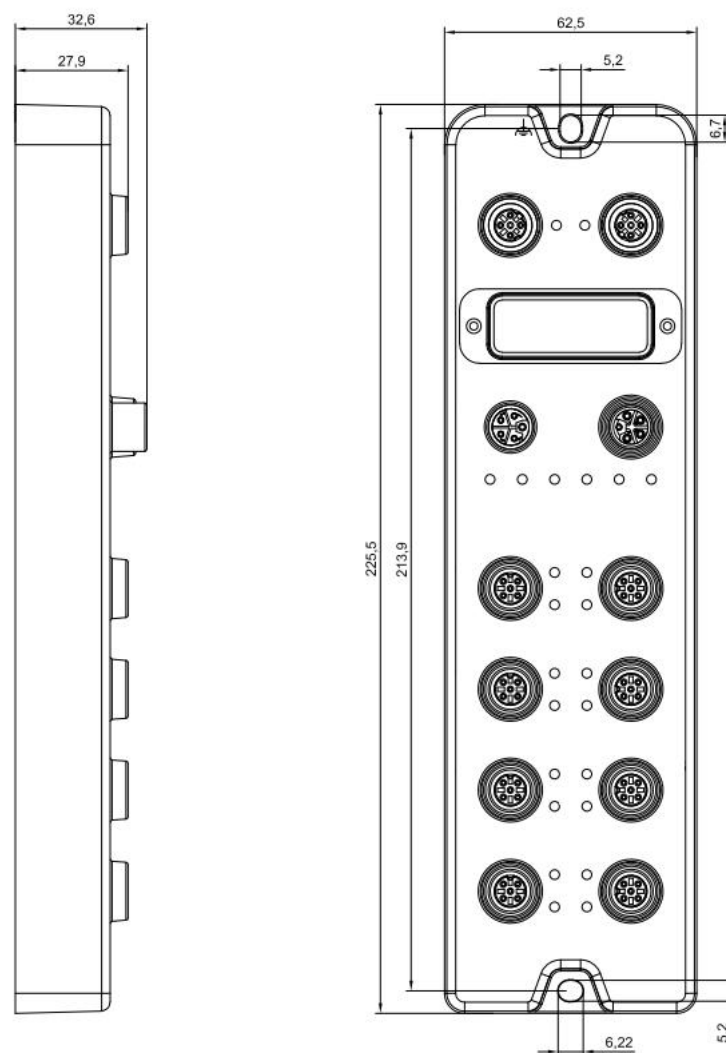
DO

Pin	Function	Wire core color
1	+24V UL/NC	Brown
2	DI/DO B	white
3	0V GNDL	blue
4	DI/DO A	black
5	PE	Ash

5 Installation and connectionWire

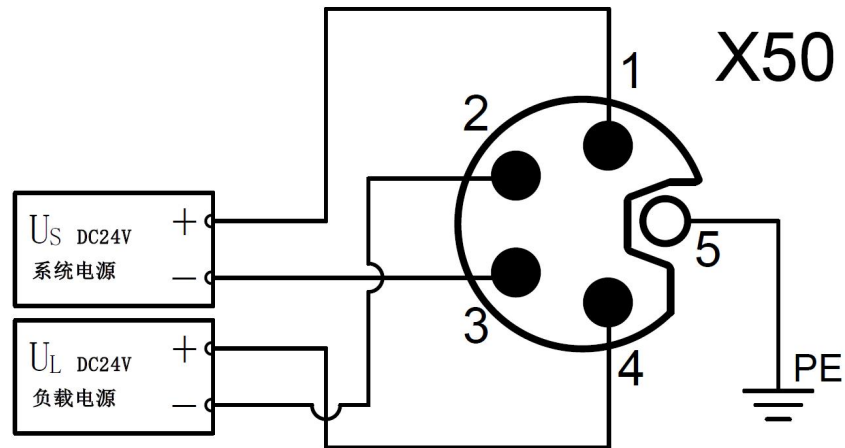
5.1 Outline Dimensions

External dimensions (unit: mm)



5.4 Wiring instructions

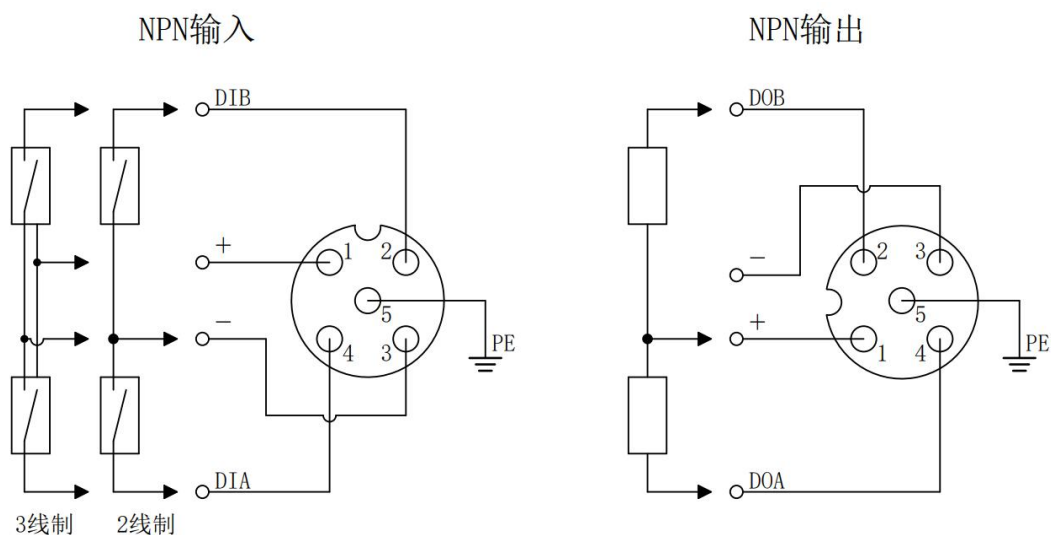
5.4.1 Power interface wiring diagram

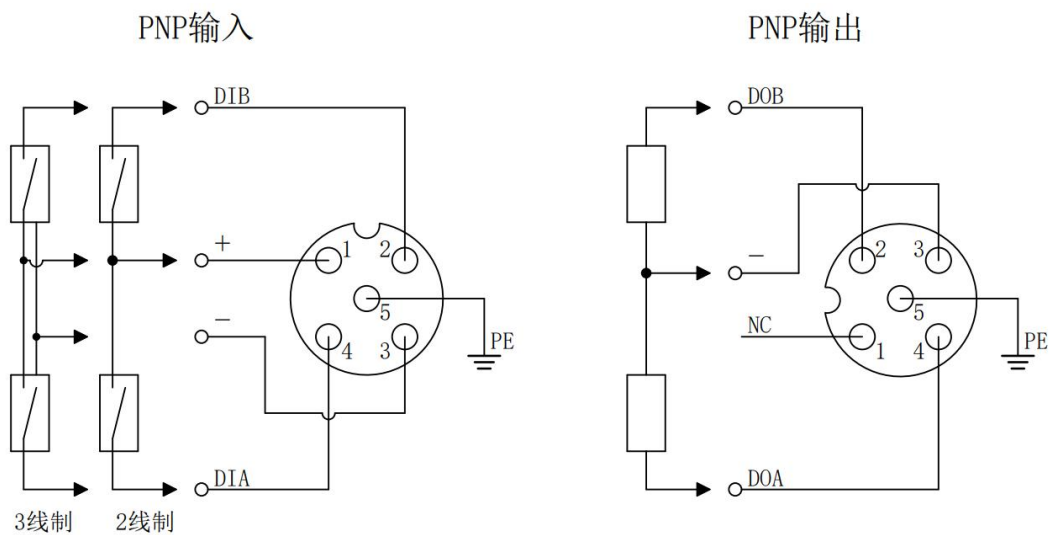


⚠ Precautions

- It is recommended that the system power supply and the load power supply be powered by different switching power supplies to ensure operational stability.
- Please refer to the power supply rules [Power supply rules](#) chapter.

5.4.2 I/O Interface Wiring Diagram





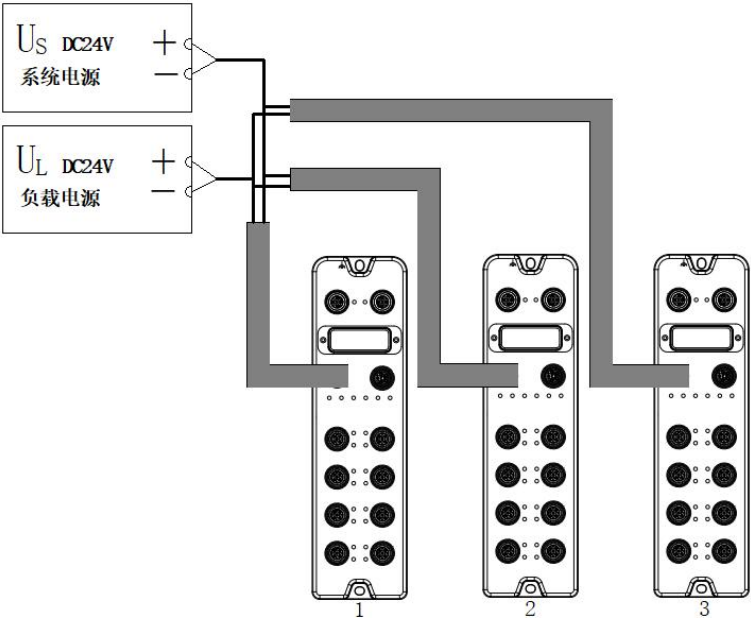
⚠ Precautions

- Install the module's waterproof cap on unused connector interfaces and tighten it to avoid compromising the IP67 protection rating.
- Pin 1 of the PNP output interface is NC, while pin 1 of other types of interfaces is +24V UL.

6 Power supply rules

6.1 Direct power supply rules

Each module is powered directly from the switching power supply, without using an OUT interface. The total current consumption of the load power supply for each module should be $\leq 8A$.



The voltage drop in the power cable varies depending on the total current consumed by the module's load power supply and the cable material. The table below shows the voltage drop when using our standard cable.

Total current consumed by the power supply (A)	Voltage drop (V) at different cable lengths			
	1m	3m	5m	10m
8	0.64	1.12	1.60	2.72
7	0.56	0.98	1.40	2.38
6	0.48	0.84	1.20	2.04
5	0.40	0.70	1.00	1.70
4	0.32	0.56	0.80	1.36
3	0.24	0.42	0.60	1.02

2	0.16	0.28	0.40	0.68
1	0.08	0.14	0.20	0.34

■ Example of calculating the total current consumption of the module when directly powered

For example, module 1 is EC7A-1600A, module 2 is EC7A-0808A, and module 3 is EC7A-0016A. The usage of each module is shown in the table below:

Module Name	I/O ports			External connection devices	
	port name	Pin Name	I/O mode	Product Name	Specification
Module 1	Ports 1-8	Pin4	DI (Input current 4mA)	3-wire sensor	Current consumption: 30mA
		Pin2	DI (Input current 4mA)		Current consumption: 30mA
Module 2	Ports 1-4	Pin4	DI (Input current 4mA)	3-wire sensor	Current consumption: 30mA
		Pin2	DI (Input current 4mA)		Current consumption: 30mA
	Ports 4~8	Pin4	DO	Solenoid valve	Load current: 500mA
		Pin2	DO		Load current: 500mA
Module 3	Ports 1-8	Pin4	DO	Solenoid valve	Load current: 500mA
		Pin2	DO		Load current: 500mA

The total current consumption is calculated, and the current consumption of a single module is calculated as shown in the table below:

Module Name	Power type	Total current consumption calculation items	Calculation results
Module 1	System power US	System current consumption	Module system-side power consumption 35mA
	Load power supply UL	Module input current and sensor current consumption	For all ports (Sensor current consumption) + (Channel input current * Number of input points) = (30mA*16) + (4mA*16) =544mA
Module 2	System power US	System current consumption	Module system-side power consumption 35mA
	Load power supply UL	Module input current and sensor current consumption	For ports 1-4 (Sensor current consumption) + (Channel input current * Number of input points) = (30mA*8) + (4mA*8) =272mA

		Load output current	For ports 5~8 Channel output current * number of output points =500mA*8 =4A
Module 3	System power US	System current consumption	Module system-side power consumption 35mA
	Load power supply UL	Load output current	For ports 1-8 Channel output current * number of output points =500mA*16 =8A

In summary, the current consumption of each module is as follows:

- For the system power supply US, each module consumes 35mA of current.
- For load power supply UL:

The load power supply UL of module 1 (EC7A-1600A) consumes 544mA, which is less than the maximum load power supply UL current of 8A.

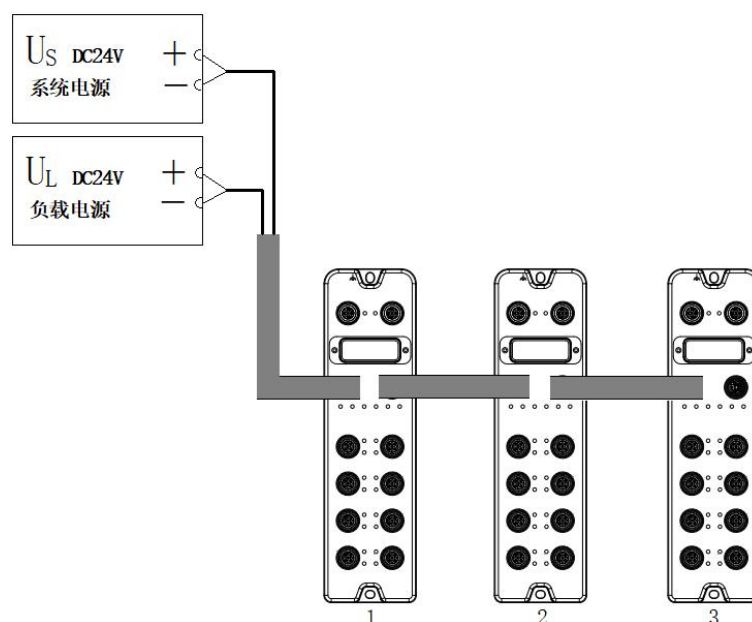
The load power supply UL of module 2 (EC7A-0808A) consumes a current of $272\text{mA} + 4\text{A} = 4.272\text{A}$, which is less than the maximum current of the module load power supply UL of 8A.

The load power supply UL of module 3 (EC7A-0016A) consumes 8A of current, which is equal to the maximum current of the module's load power supply UL, which is 8A.

In this example, the requirement is met because the total current consumption of each module meets the requirement that the total current consumption of the module load power supply is $\leq 8\text{A}$.

6.2 Series power supply rules

The modules are connected in series via the OUT interface. The total current consumption of the load power supply of each module should be $\leq 8\text{A}$, and the total current consumption of the system power supply and load power supply of all modules should be $\leq 16\text{A}$.



When powered in series, the current consumed by the modules connected in series will flow through the module's internal circuit, resulting in a voltage drop. The voltage drop in the power cable varies depending on the total current consumed by the module's load power supply and the cable material. The table below shows the voltage drop when using our standard cables.

Total current consumed by the power supply (A)	Voltage drop (V) in the internal circuit of the module	Voltage drop (V) at different cable lengths			
		1m	3m	5m	10m
16	0.64	1.28	2.24	3.20	5.44
15	0.60	1.20	2.10	3.00	5.10
14	0.56	1.12	1.96	2.80	4.76
13	0.52	1.04	1.82	2.60	4.42
12	0.48	0.96	1.68	2.40	4.08
11	0.44	0.88	1.54	2.20	3.74
10	0.40	0.80	1.40	2.00	3.40
9	0.36	0.72	1.26	1.80	3.06
8	0.32	0.64	1.12	1.60	2.72
7	0.28	0.56	0.98	1.40	2.38
6	0.24	0.48	0.84	1.20	2.04
5	0.20	0.40	0.70	1.00	1.70
4	0.16	0.32	0.56	0.80	1.36
3	0.12	0.24	0.42	0.60	1.02
2	0.08	0.16	0.28	0.40	0.68
1	0.04	0.08	0.14	0.20	0.34

⚠ Precautions

- The total current consumed by the power supply of each module's load should be $\leq 8A$.
- As shown in the figure above, when power is supplied in series, the total current consumed by the system power supply and load power supply of all modules should meet the rule of $"1+2+3" \leq 16A$.

■ Example of calculating the total current consumption of the module when powered in series

For example, module 1 is EC7A-1600A, module 2 is EC7A-0808A, and module 3 is EC7A-0016A. The usage of each module is similar to...[Example of calculating the total current consumption of the module when directly powered](#)" same.

Calculate the total current consumption:

$$US = 35\text{mA} + 35\text{mA} + 35\text{mA} = 105\text{mA}$$

$$UL = 544\text{mA} + 4.272\text{A} + 8\text{A} = 12.816\text{A}$$

In this example, the requirement is met because the total current consumed by the system power supply US and the load power supply UL of all modules meets the rule "1+2+3"≤16A.

☞ Precautions

- In series power supply mode, if the total current consumed by the system power supply US or the total current consumed by the load power supply UL exceeds 16A, please change some modules to direct power supply mode to ensure that the total current consumed by the system power supply US or the total current consumed by the load power supply UL is ≤16A.

7 Use

7.1 Configuration module application

7.1.1 Application in the TwinCAT3 software environment

1、Preparation

- **Hardware environment**

- **Module model EC7A-0808A**
- **One computer, pre-installed with TwinCAT3 software.**
- **EtherCAT dedicated shielded cable**
- **One switching power supply**
- **Device configuration file**

Configuration file retrieval

address:<https://www.solidotech.com/cn/resources/configuration-files>

- **Hardware configuration and wiring**

Please follow the instructions.[5 Installation and wiring](#)"Required Operation"

2、Pre-configured configuration files

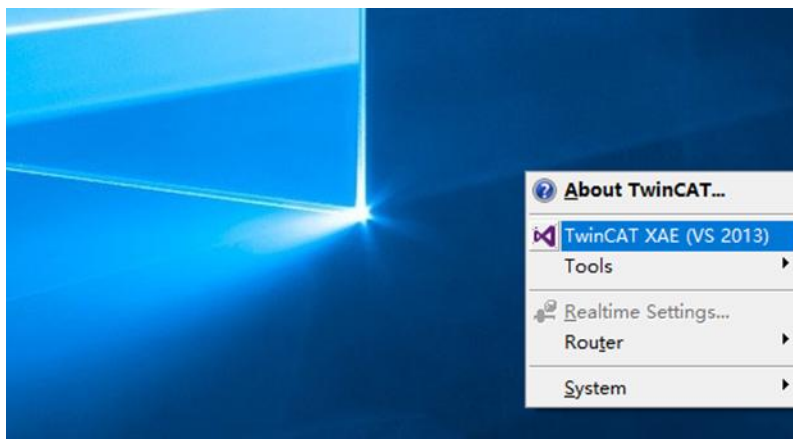
Place the ESI configuration file (Solidotech EC7A_V1.0.0.xml) in the TwinCAT installation directory "C:\TwinCAT\3.1\Config\Io\EtherCAT", as shown in the image below.

此电脑 > 本地磁盘 (C:) > TwinCAT > 3.1 > Config > Io > EtherCAT

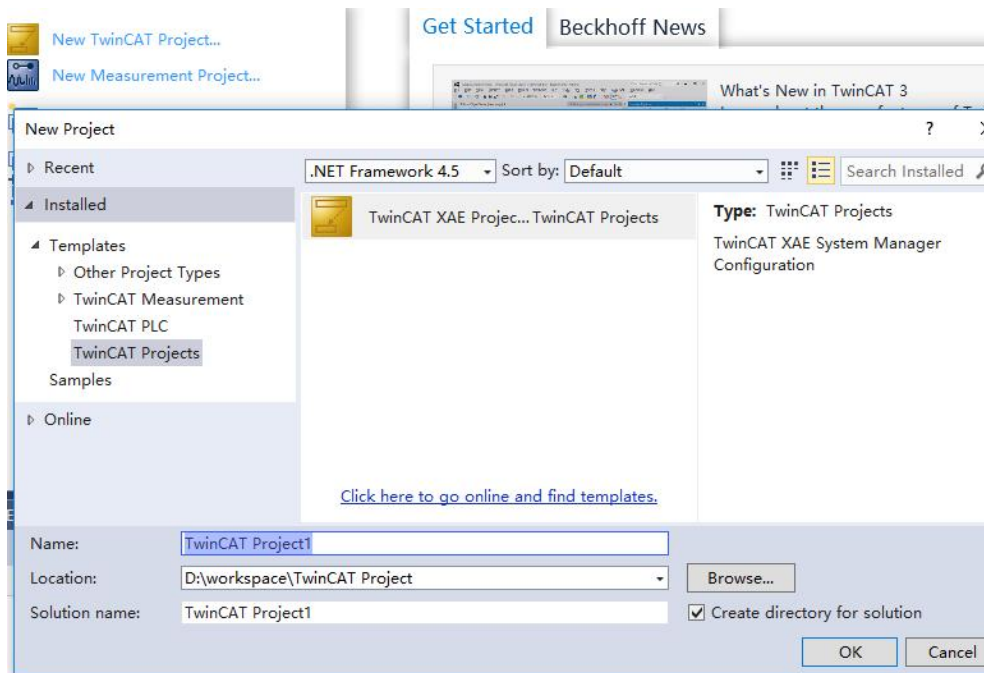
名称	修改日期	类型	大小
Beckhoff ER4xxx.xml	2022/6/20 7:53	XML 文档	318 KB
Beckhoff ER5xxx.xml	2022/6/20 7:53	XML 文档	273 KB
Beckhoff ER6xxx.xml	2022/8/22 14:55	XML 文档	2,040 KB
Beckhoff ER7xxx.xml	2022/6/20 7:53	XML 文档	2,717 KB
Beckhoff ER8xxx.xml	2022/6/20 7:53	XML 文档	207 KB
Beckhoff EtherCAT EvaBoard.xml	2022/2/18 16:16	XML 文档	72 KB
Beckhoff EtherCAT Terminals.xml	2022/2/18 16:16	XML 文档	54 KB
Beckhoff FB1XXX.xml	2022/2/18 16:16	XML 文档	49 KB
Beckhoff FCxxx.xml	2022/2/18 16:16	XML 文档	21 KB
Beckhoff FM3xxx.xml	2022/2/18 16:16	XML 文档	367 KB
Beckhoff ILxxx-B110.xml	2022/2/18 16:16	XML 文档	8 KB
Solidotech EC7A_V1.0.0.xml	2026/1/8 15:50	XML 文档	12 KB

3. Create a project

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

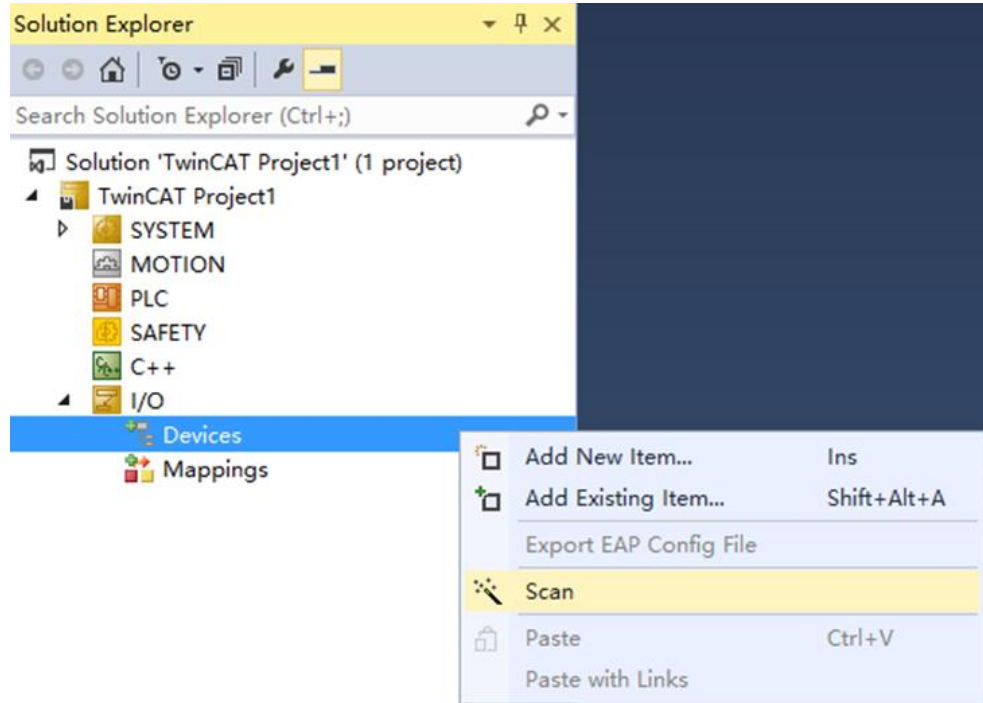


- Select "New TwinCAT Project". In the pop-up window, "Name" and "Solution name" correspond to the project name and solution name, respectively, and "Location" corresponds to the project path. These three items can be left as default. Then click "OK". The project will be created successfully, as shown in the figure below.



4. Scanning equipment

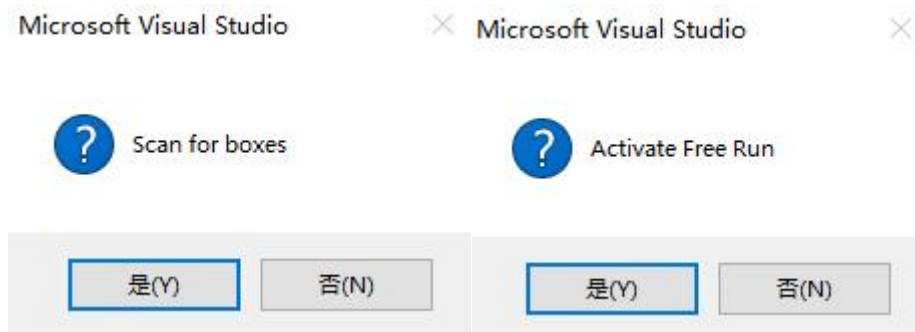
- a. After creating the project, right-click the "Scan" option under "I/O -> Devices" to scan for slave devices, as shown in the figure below.



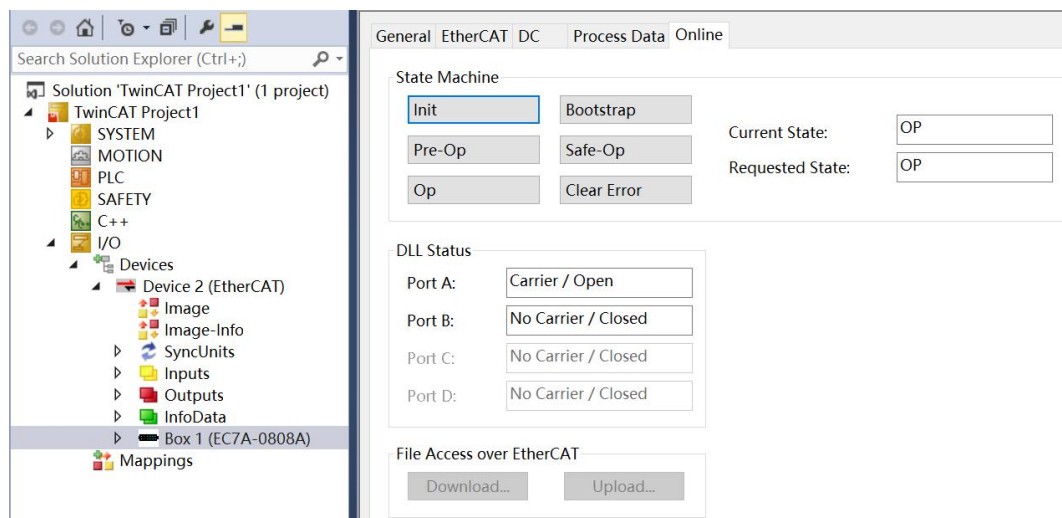
- b. Select the "Local Area Connection" network adapter, as shown in the image below.



- c. Select "Yes" for "Scan for boxes" and "Yes" for "Activate Free Run", as shown in the image below.



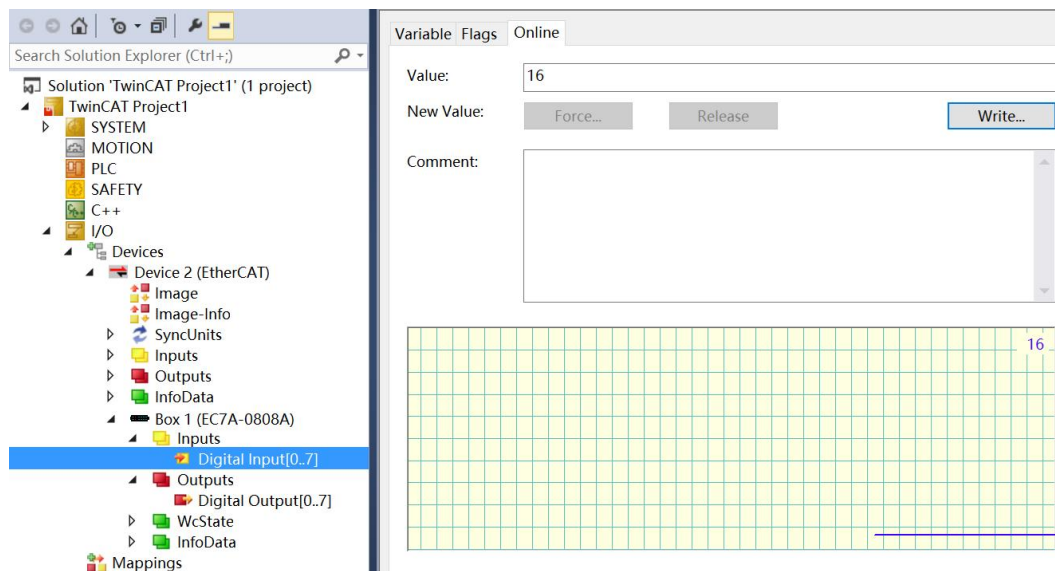
- d. After the device is scanned, you can see Box1 (EC7A-0808A) in the left navigation tree. Under "Online", you can see that TwinCAT is in "OP" state. You can also observe that the RUN light of the slave device is always on, as shown in the figure below.



5. Data Interaction

Digital input operations for each channel:

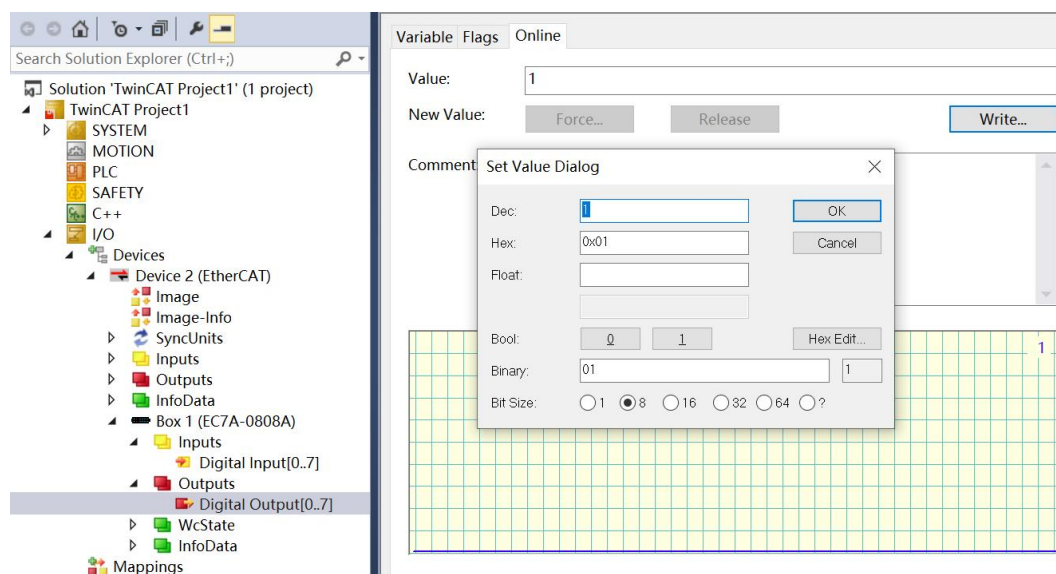
Taking the Input[4] channel as an example, if there is a valid voltage input in the Input[4] channel of the slave device, it can be observed in "Digital Input[0...7]" on Box 1 in TwinCAT, as shown in the figure below.



Note: 16 (0x10) is converted to binary as 00001000b. The 8 bits correspond to 8 input channels. When an effective voltage is input, the corresponding bit is set to 1.

Digital output operations for each channel:

Taking the Output[0] input channel as an example, if you want the slave device's digital output channel Output[0] to output, you can left-click "Write" at the corresponding "Online" position on Digital Output[0...7] in TwinCAT, and enter the value "1" at the "Dec" position in the corresponding dialog box. You can see the corresponding channel light on the slave device, as shown in the figure below.



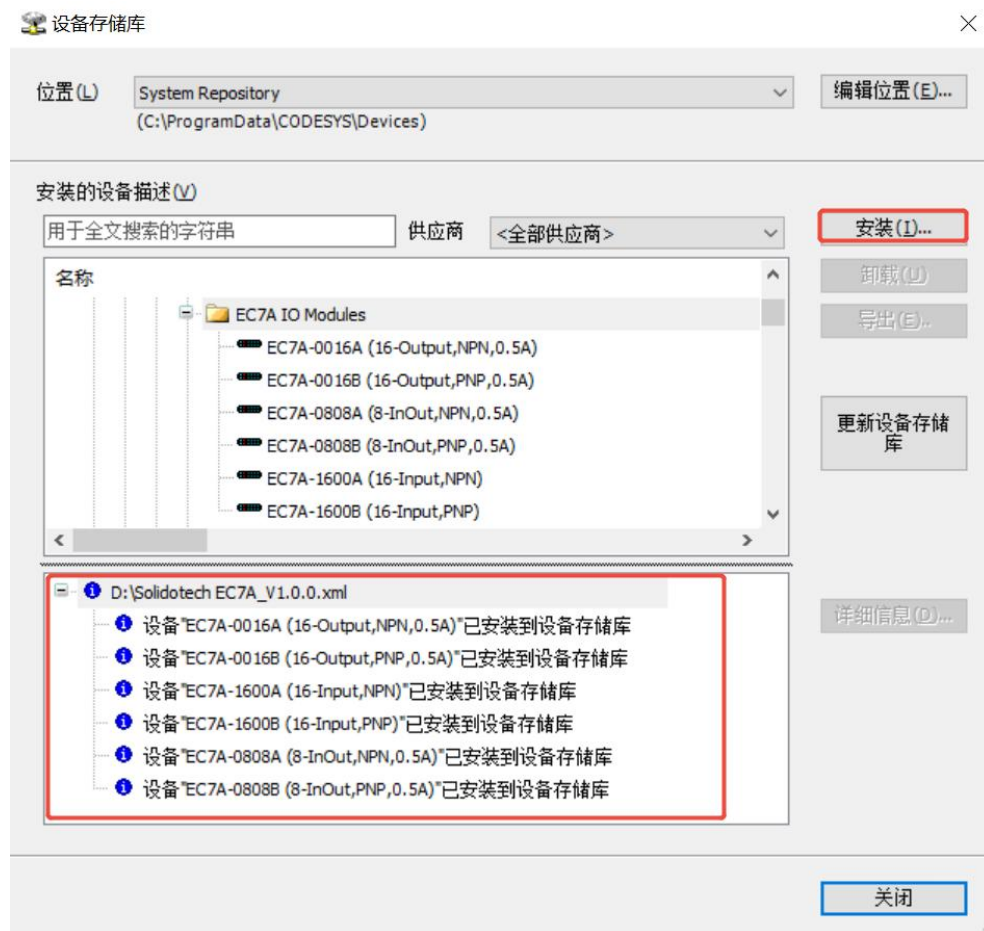
7.1.2 Application in the CODESYS V3.5 software environment

1、Preparation

- **Hardware environment**
 - **Module model EC7A-0808A**
 - **One computer, pre-installed with CODESYS V3.5 and CODESYS Control Win V3 - x64 SysTray software.**
 - **EtherCAT dedicated shielded cable**
 - **One switching power supply**
 - **Device configuration file**
Configuration file retrieval
address:<https://www.solidotech.com/cn/resources/configuration-files>
- **Hardware configuration and wiring**
Please follow the instructions.[5 Installation and wiring](#)"Required Operation"

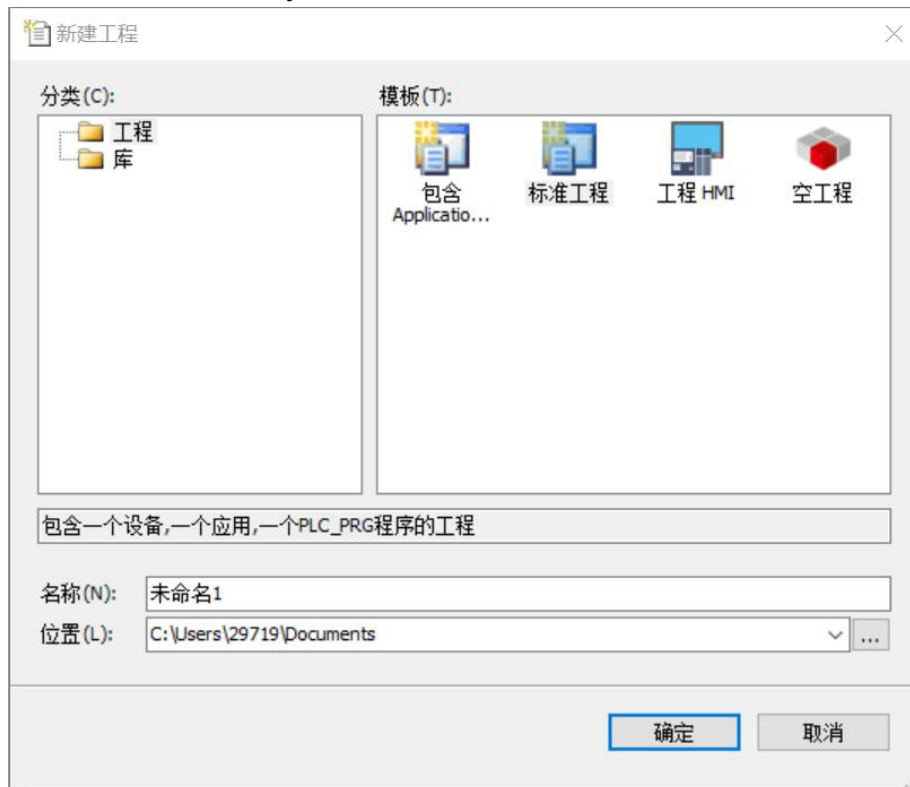
2、Install device configuration file

- a. Log in to CODESYS.
- b. Select "Tools -> Device Repository".
- c. Click "Install," select the relevant XML file for installation (file format: Solidotech EC7A_V1.0.0.xml).
Successful installation will display "Device xxxx has been installed to the device repository," as shown in the image below.



3、New construction projects

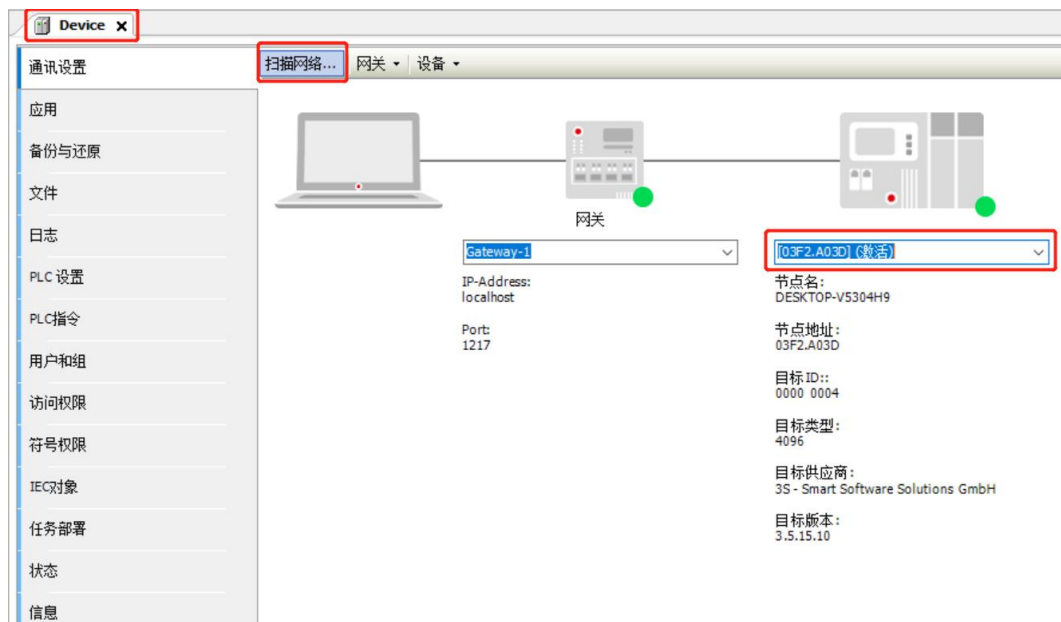
- a. Click "File -> New Project", enter a name, and click "OK", as shown in the image below.



4、Scanning Network

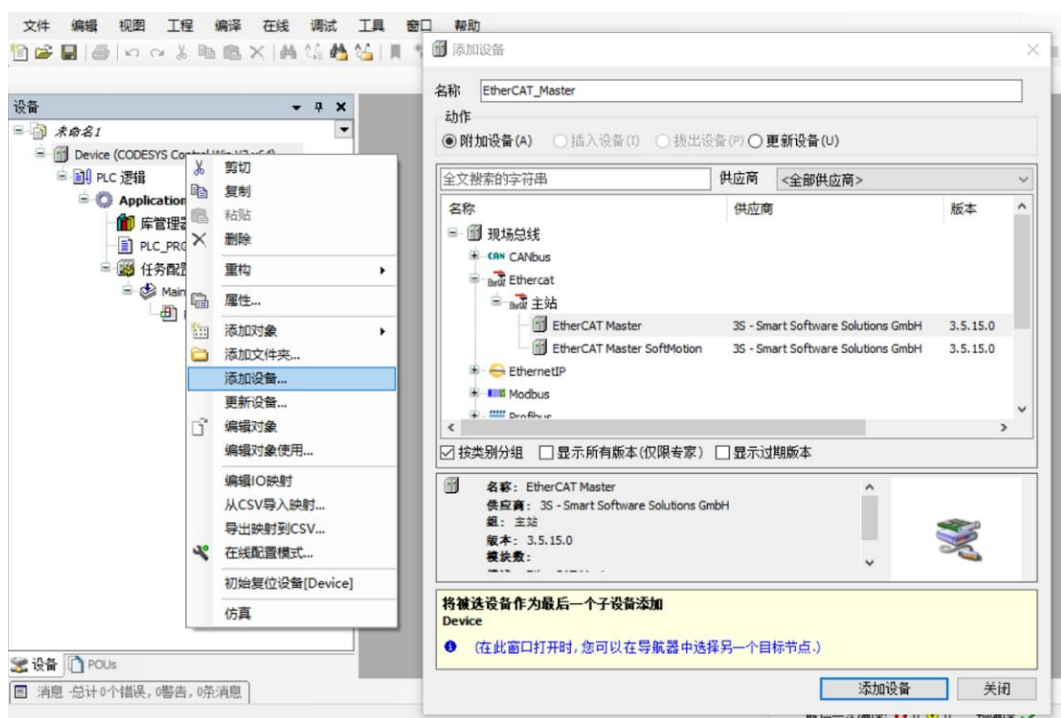
- a. To start the PLC, use "CODESYS Control Win V3 - x64 SysTray". Locate "CODESYS Control Win V3 - x64 SysTray" in the lower right corner of your computer, right-click and select "Start PLC".
- b. Double-click "Device (CODESYS Control Win V3 X64)" in the left navigation tree of CODESYS, and then click "Scan Network".

- c. Select the device and choose the correct controller network path, as shown in the figure below.



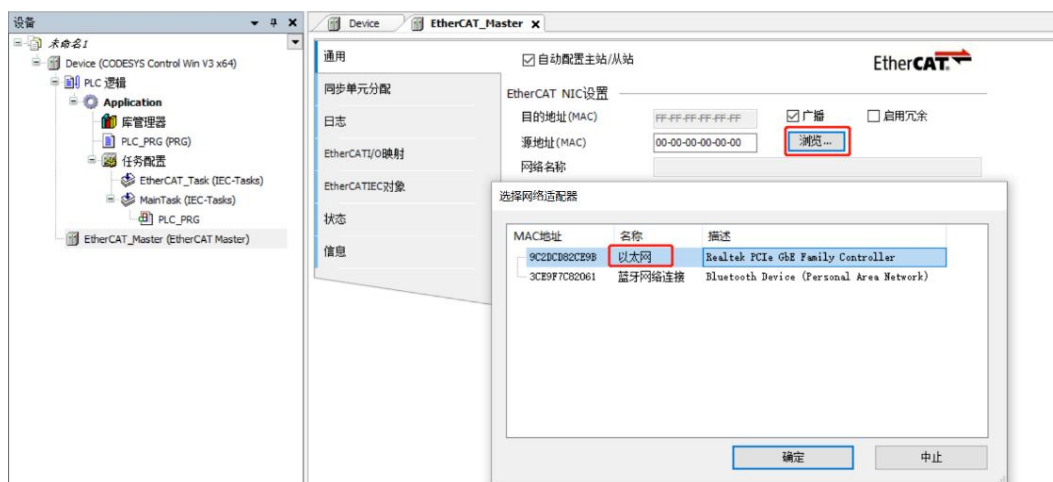
5. Add EtherCAT Master

- a. Right-click "Device (CODESYS Control Win V3 X64)" in the left navigation tree of CODESYS, click "Add Device", and select...Add the following steps: "EtherCAT -> Master -> EtherCAT Master".



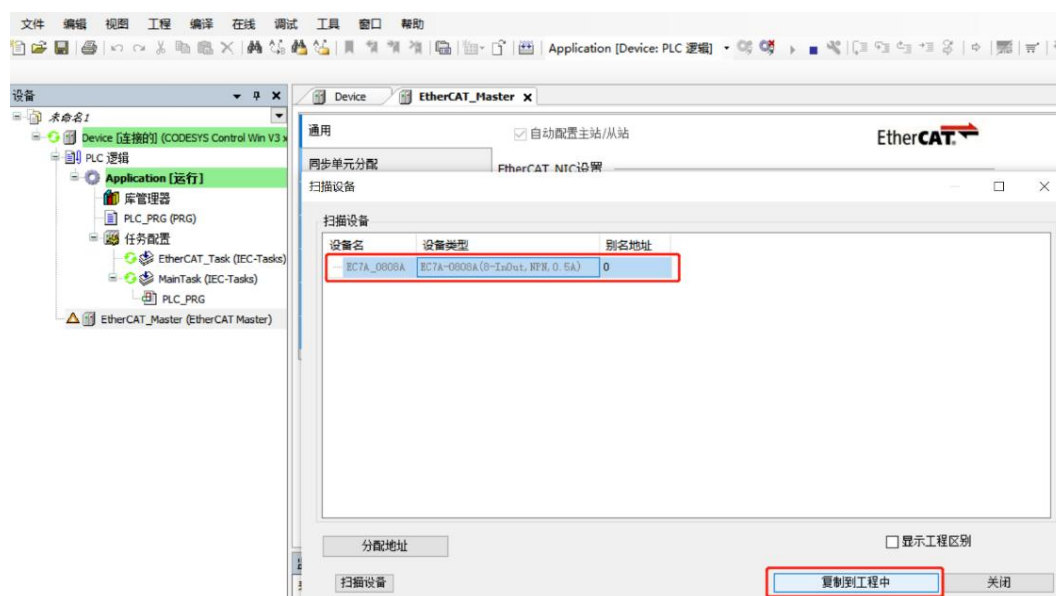
6. Configure EtherCAT Master

- a. Double-click "EtherCAT_Master (EtherCAT Master)" in the left navigation tree to open the main menu on the right, then click...Click the "Browse" button and select Ethernet.

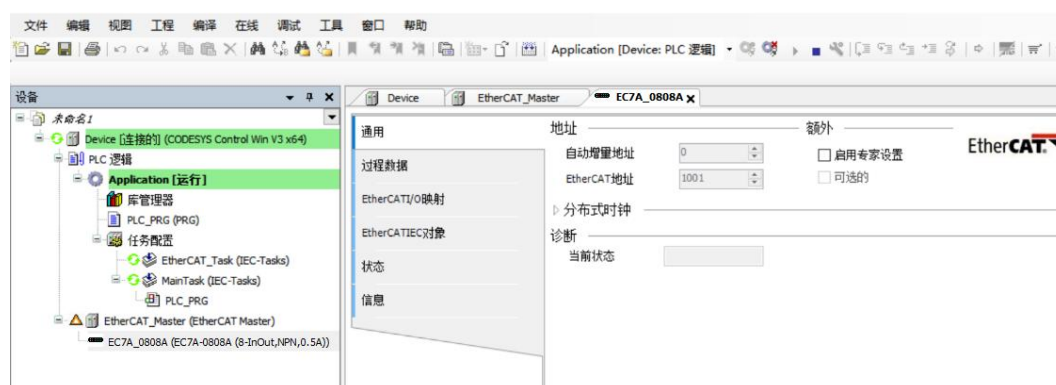


7、Scanning equipment

- Before the first scan, you must log in to the PLC program, right-click "EtherCAT_Master (EtherCAT Master)" in the left navigation tree, select the scanning device, scan the corresponding device, select the module, and click "Copy to Project", as shown in the figure below.

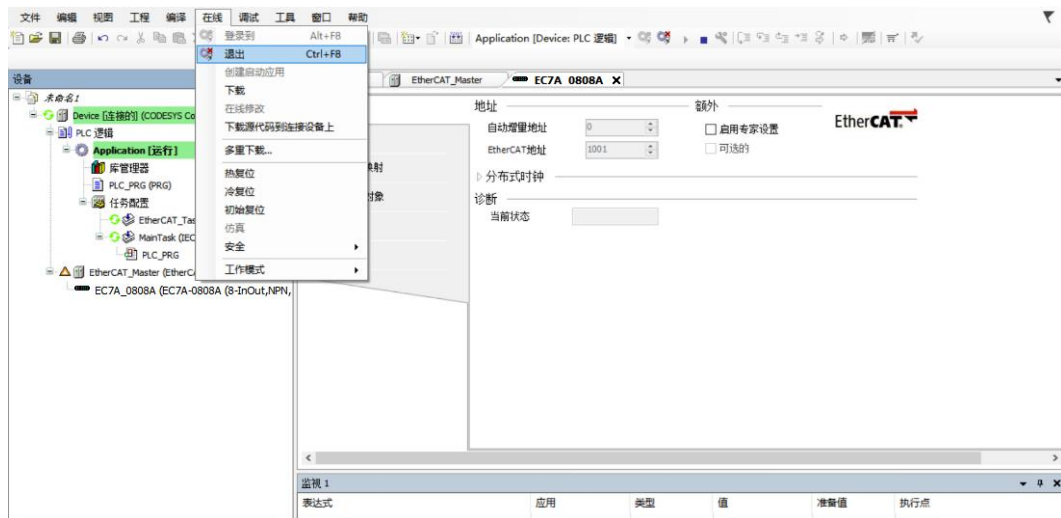


- After successful copying, it will look like the image below.

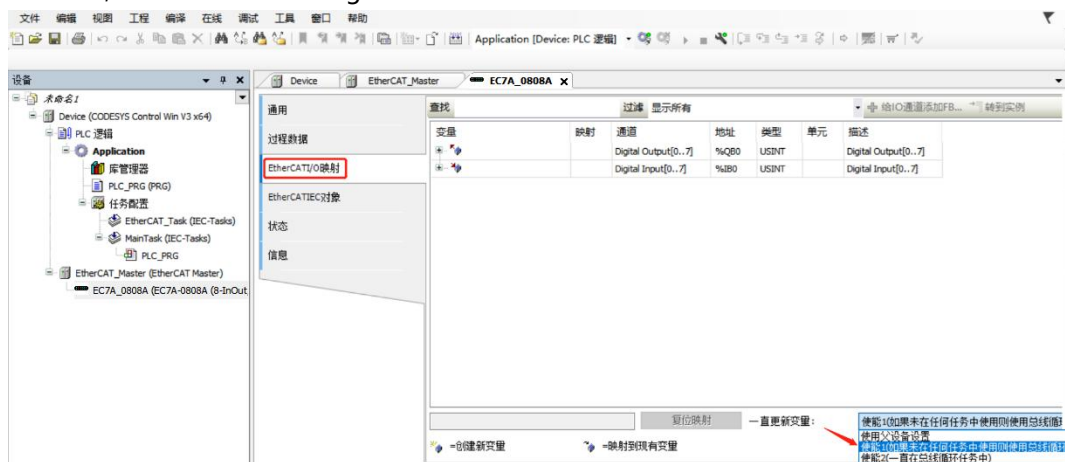


8、Test IO module

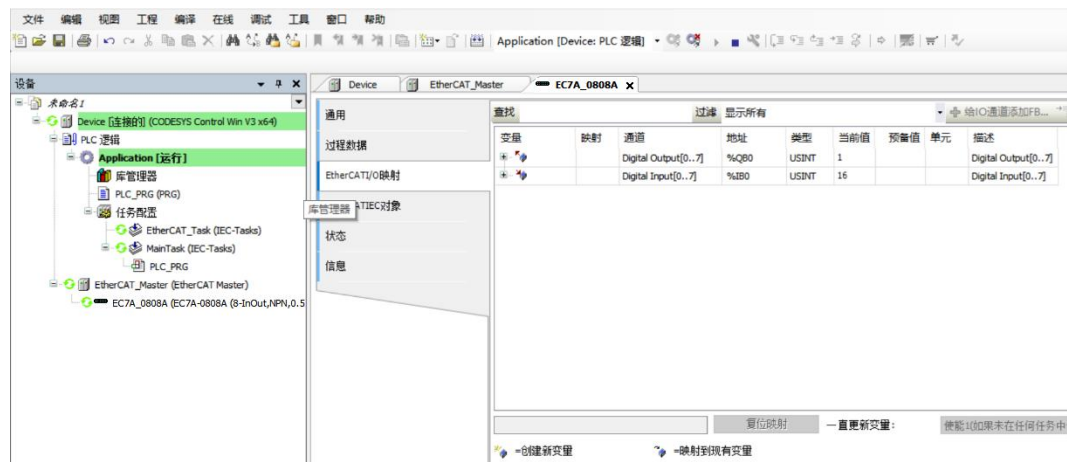
- a. Configure the I/O module bus mode by clicking the menu bar."Online -> Exit" to exit the PLC, as shown in the figure below.



- b. Select "EtherCAT I/O Mapping" in the EC7A-0808A module menu.
c. In the "Continuously Update Variables" menu at the bottom right of the page, select "Enable 1" mode, as shown in the image below.



- d. Log in again and run the software to test the module, as shown in the image below.



7.1.3 Applications in the Sysmac Studio software environment

1、Preparation

- **Hardware environment**

- **Module model EC7A-0808A**
- **One computer, pre-installed with Sysmac Studio software.**
- **One Omron PLC**
This instruction uses model NJ301-1100 as an example.
- **EtherCAT dedicated shielded cable**
- **One switching power supply**
- **Device configuration file**

Configuration file retrieval

address: <https://www.solidotech.com/cn/resources/configuration-files>

- **Hardware configuration and wiring**

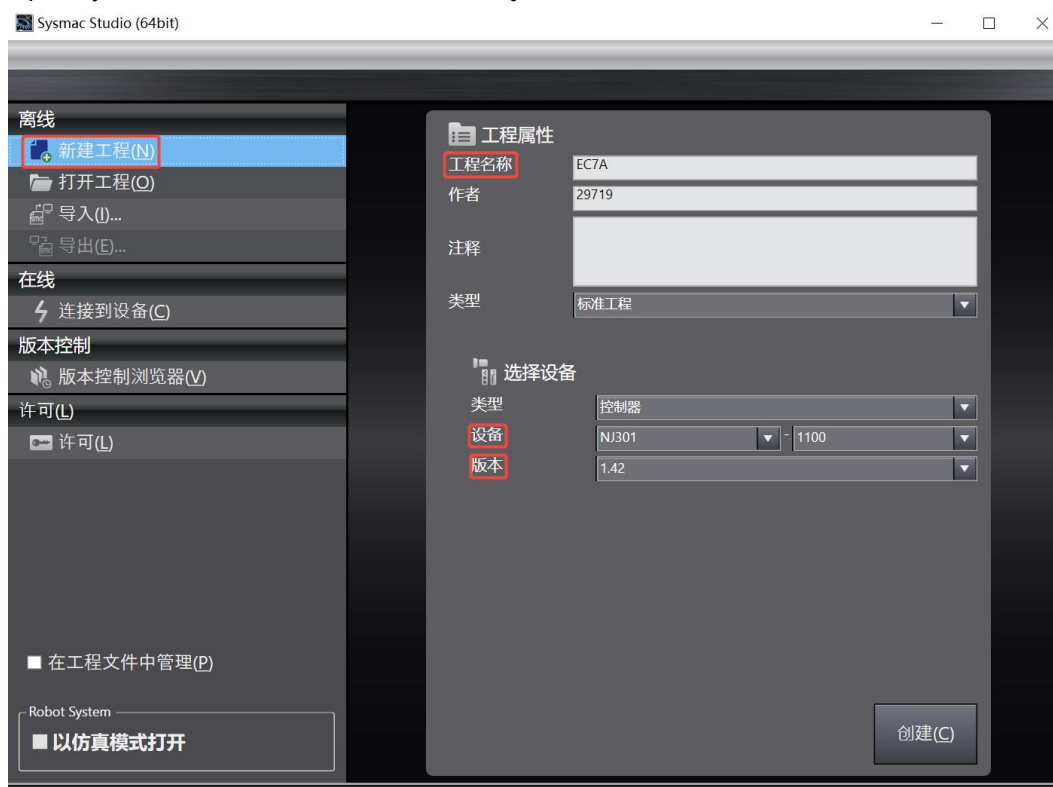
Please follow the instructions. [5 Installation and wiring](#) "Required Operation"

- **Computer IP Requirements**

Configure the computer's IP address and the PLC's IP address to ensure they are on the same network segment.

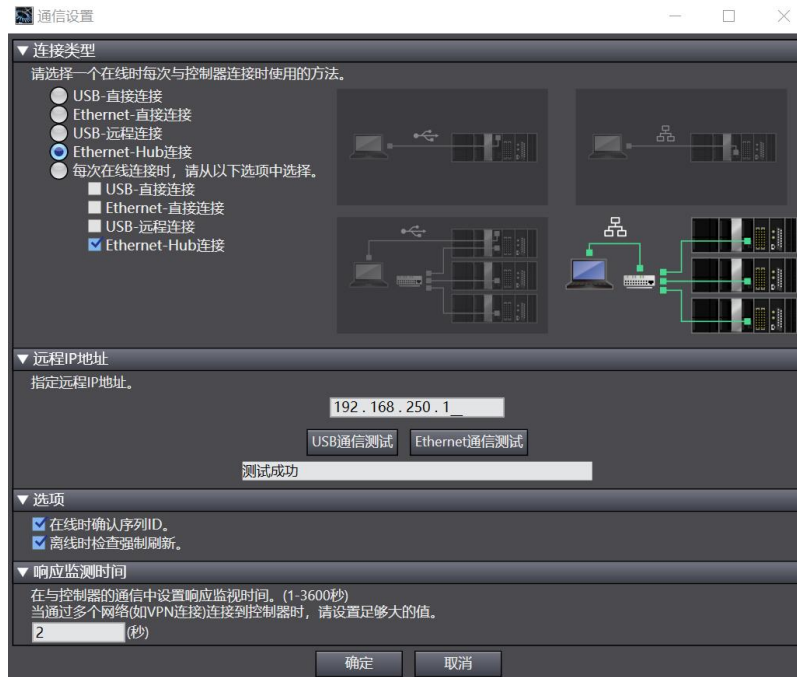
2、New construction projects

- Open Sysmac Studio and click the "New Project" button.



- Project Name: Custom.

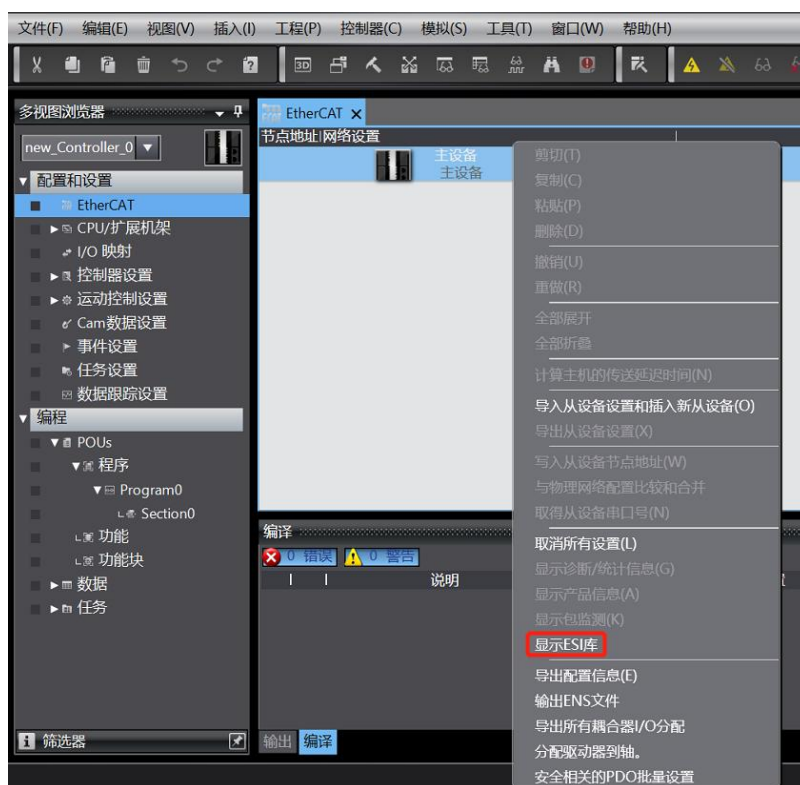
- Select Equipment: Select the corresponding PLC model for "Equipment", and we recommend selecting V1.40 or above for "Version".
- b. After entering the project properties, click the "Create" button.
- c. Click "Controller -> Communication Settings" in the menu bar, select the method to use each time you connect to the controller when online, and enter the "Remote IP Address", as shown in the figure below.



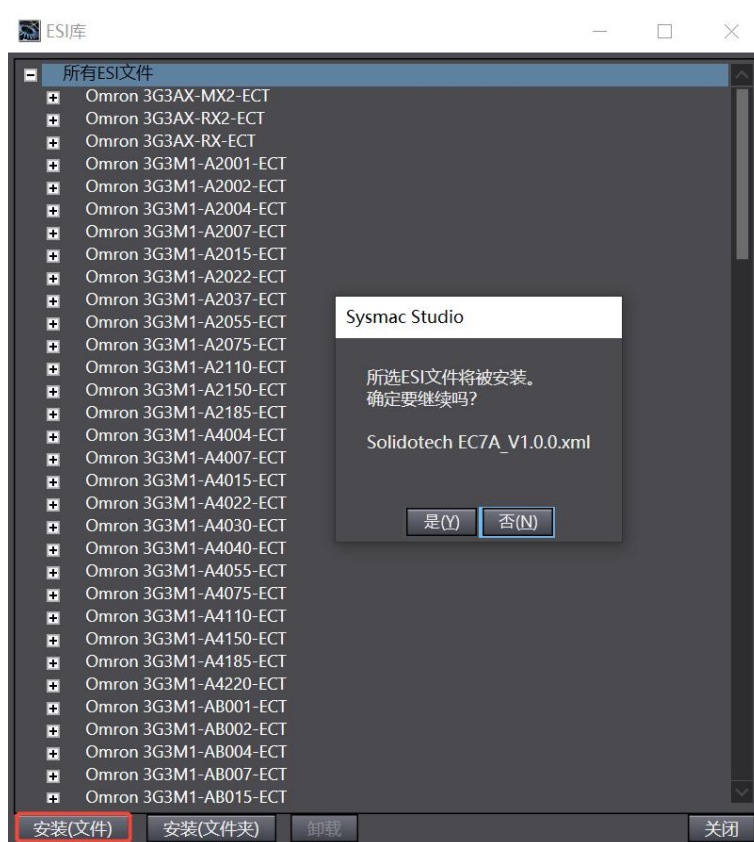
- d. Click "Ethernet Communication Test", and the system displays that the test was successful.

3、Install XML file

- a. Expand "Configuration and Settings" in the left navigation tree and double-click "EtherCAT".
- b. Right-click "Master Device" and select "Show ESI Libraries", as shown in the figure below.



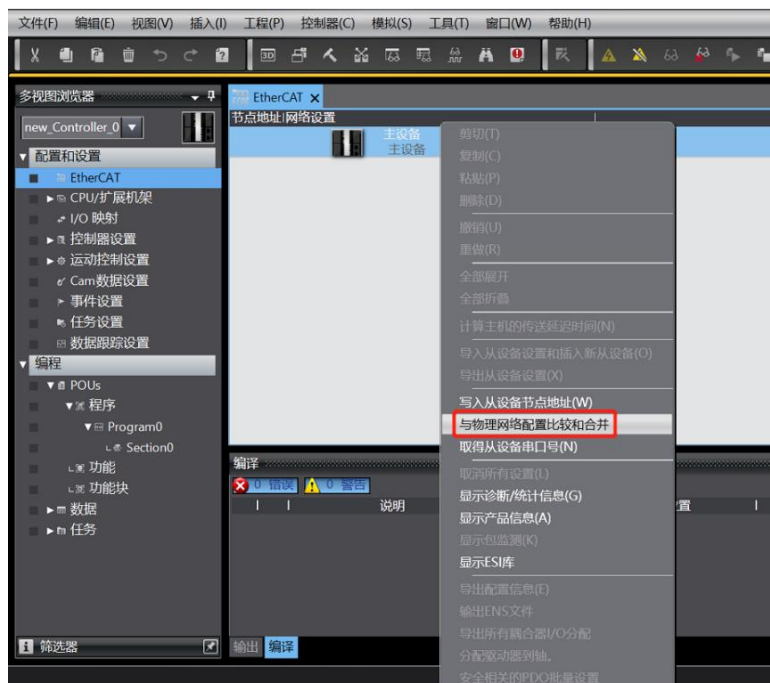
- c. In the pop-up "ESI Library" window, click the "Install (File)" button, select the XML file path, and click the "Yes" button to complete the installation.



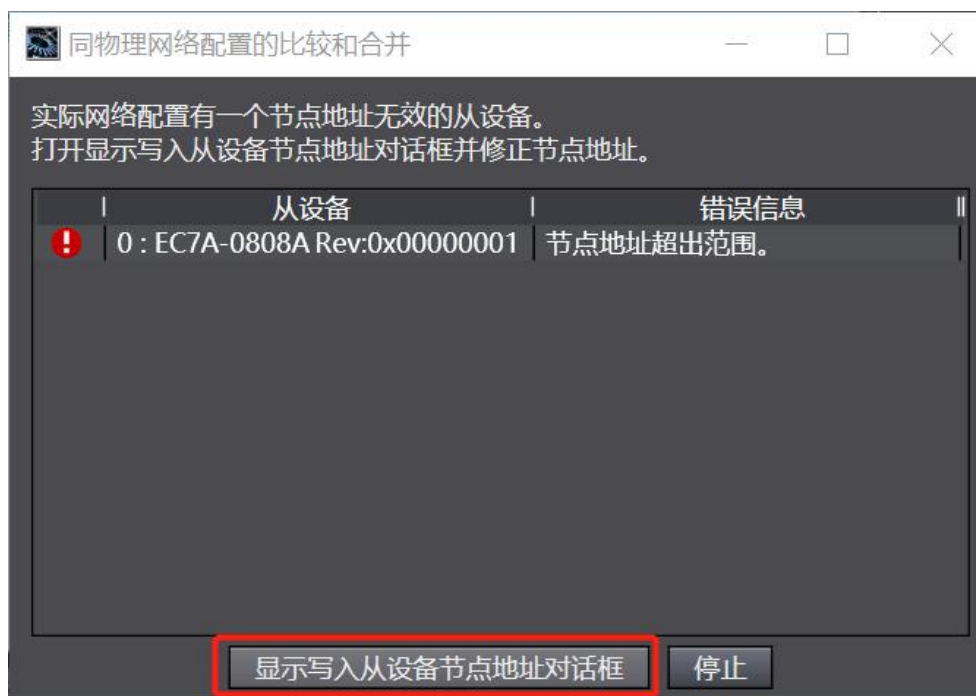
4. Adding devices and setting node addresses

There are two ways to add a device: online scanning and offline addition. This guide will use online scanning as an example.

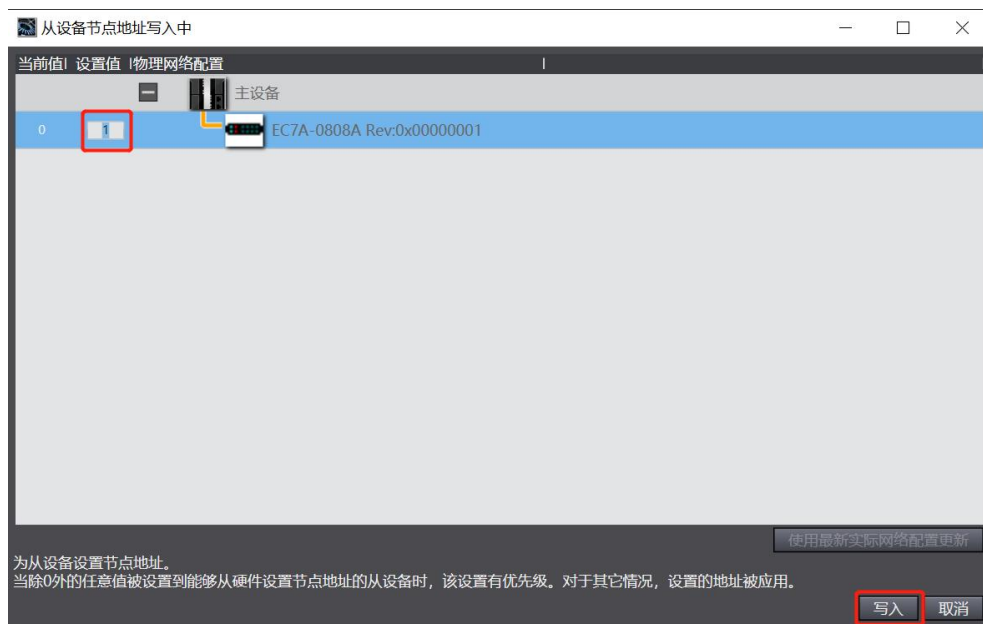
- a. Click the toolbar  To access the online settings, right-click "Master Device" and select "Compare and merge with physical network configurations," as shown in the image below.



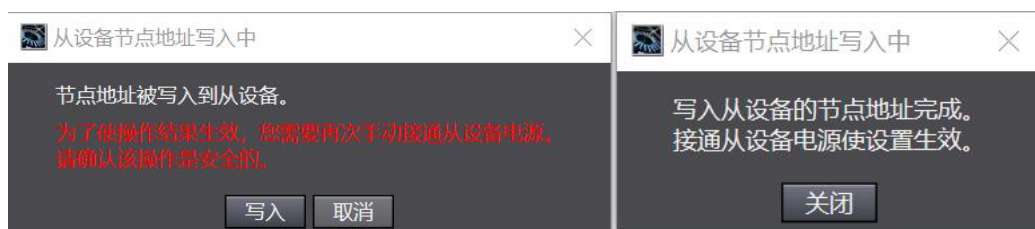
- b. In the pop-up "Compare and merge with physical network configuration" dialog box, click "Show Write slave node address dialog box", as shown in the figure below.



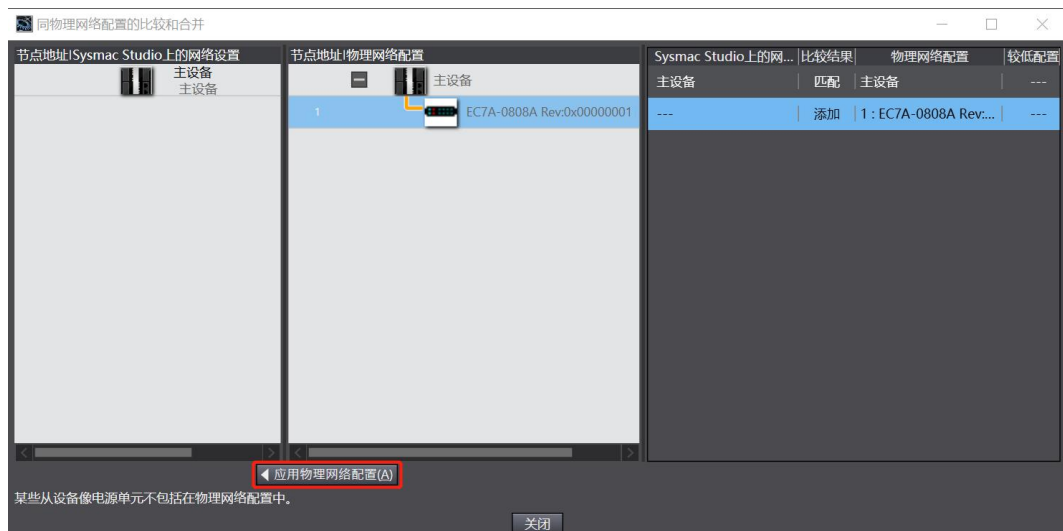
- c. In the dialog box for setting the node address, click the value under Set Value to enter the node address, and then click the "Write" button, as shown in the figure below.



- d. After writing, a power-on prompt will appear as shown in the image below. Click the "Write" button and then restart the slave device power according to the prompt.



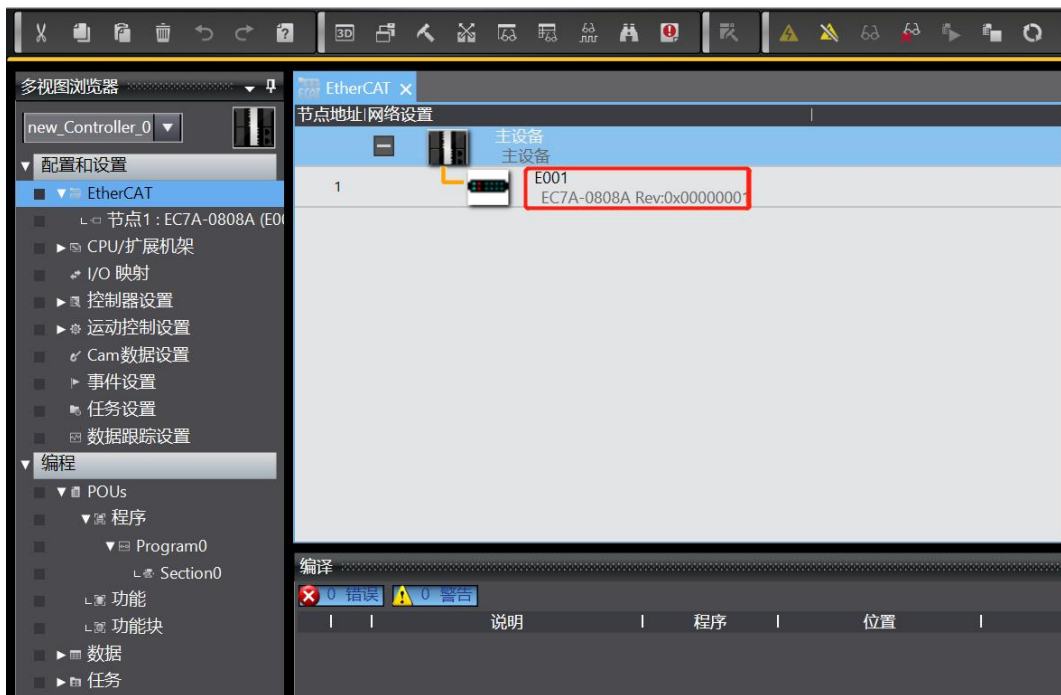
- e. Right-click "Master device", click "Compare and merge with physical network configuration", a dialog box will pop up, click "Apply physical network configuration", as shown in the figure below.



- f. Click the "Apply" button in the pop-up dialog box, as shown in the image below.

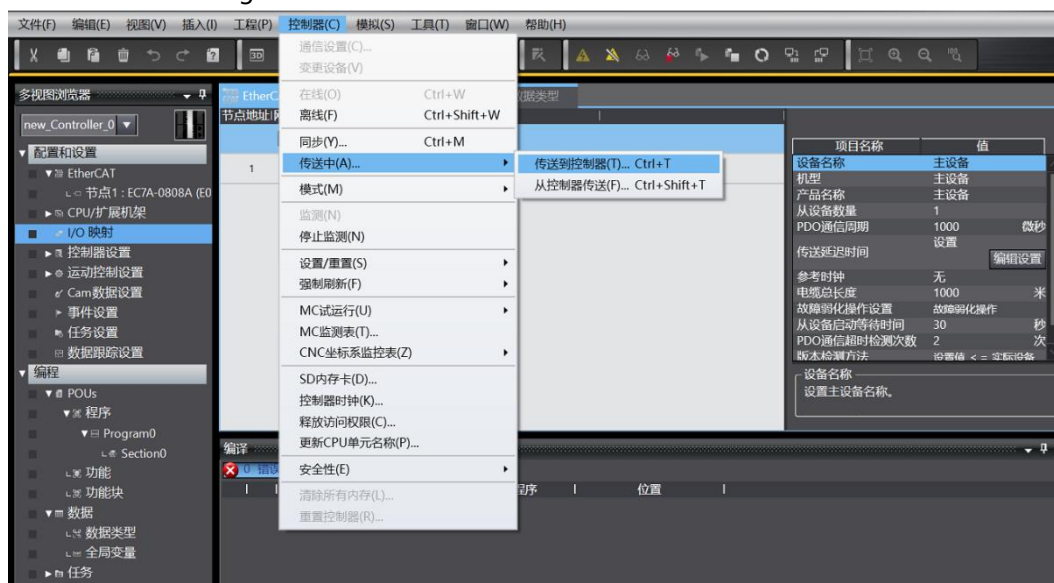


- g. After the topology application is complete, close the dialog box. The module will then be displayed in the network settings screen, as shown in the image below.



5、Download the configuration to the PLC

- Click the "Controller -> Transmitting (A) -> Transmitting to Controller (T)" button in the menu bar, as shown in the figure below.

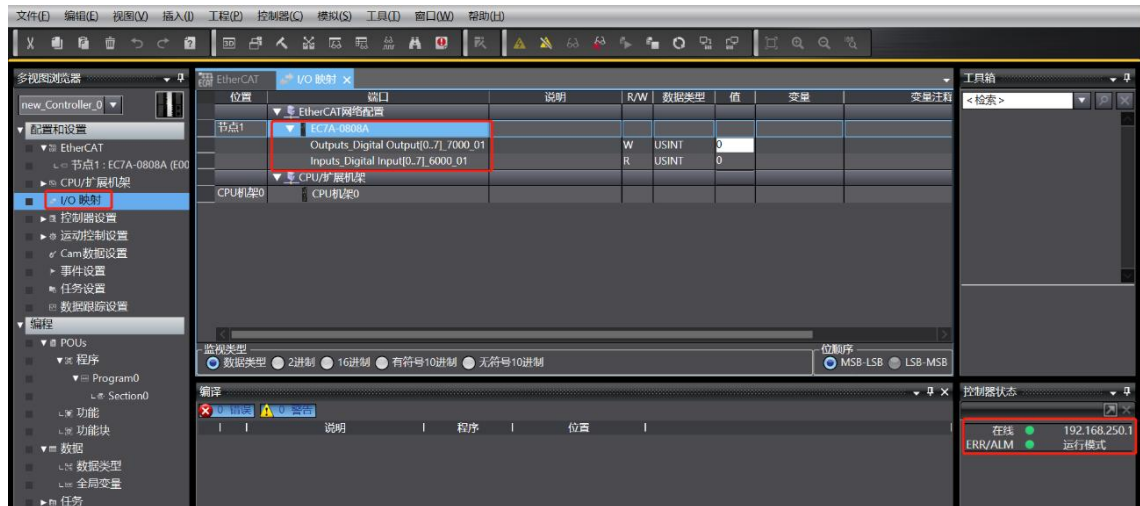


- Download the configuration to the PLC, as shown in the figure below. After the download is complete, you need to power it back on.



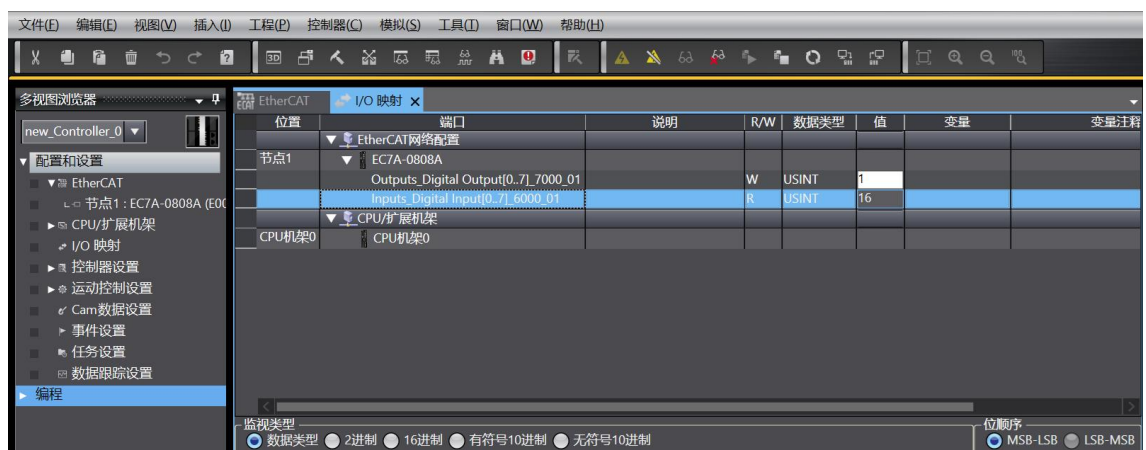
6、Test IO module

- a. After powering on again, you can see that the PLC is in running mode in the lower right corner. Double-click "I/O Mapping" in the left navigation tree to monitor and force the input and output signals, as shown in the figure below.



Digital input operations for each channel:

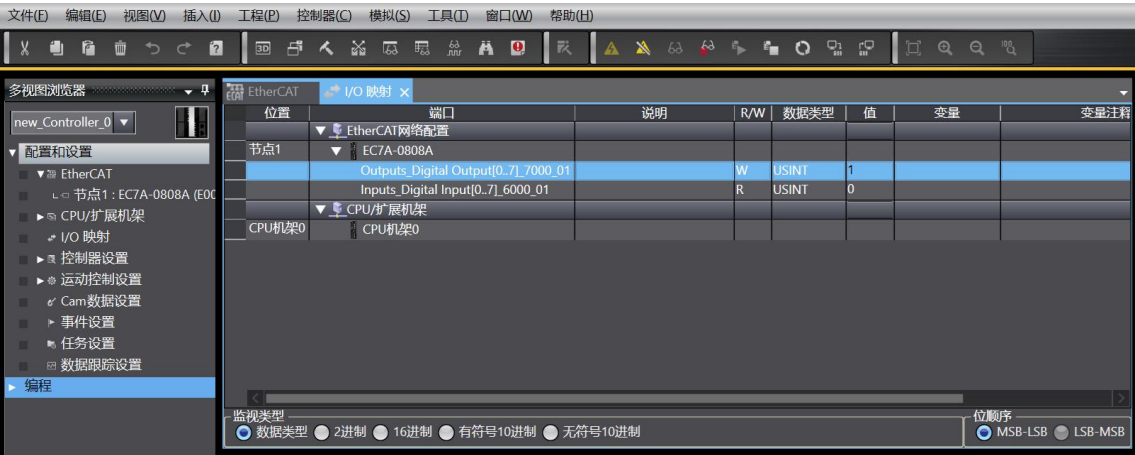
Taking the Input[4] channel as an example, if there is a valid voltage input in the Input[4] channel of the slave device, it can be observed in "Inputs_Digital Input[0...7]" in "I/O Mapping", as shown in the figure below.



Note: 16 (0x10) is converted to binary as 00001000b. The 8 bits correspond to 8 input channels. When an effective voltage is input, the corresponding bit is set to 1.

Digital output operations for each channel:

Taking the Output[0] input channel as an example, if you want the slave device to output the digital output channel Output[0], you can write "1" in the "value" field of Outputs_Digital Output[0...7]. You can see the corresponding channel light on the slave device, as shown in the figure below.



8 FAQ

8.1 The device cannot be found in the software.

1. Verify that the ESI configuration file is installed correctly.
2. Verify that the ESI configuration file version is accurate.
3. Do I need to restart the TwinCAT software after installing the ESI configuration file?

8.2 The device cannot enter OP state.

1. Confirm that the project setup is correct.
2. Confirm the node station number settings.
3. Confirm that the device power supply is normal.
4. Is the EtherCAT communication cable working properly?
5. Should the device be powered on and off again after the slave node address is changed?