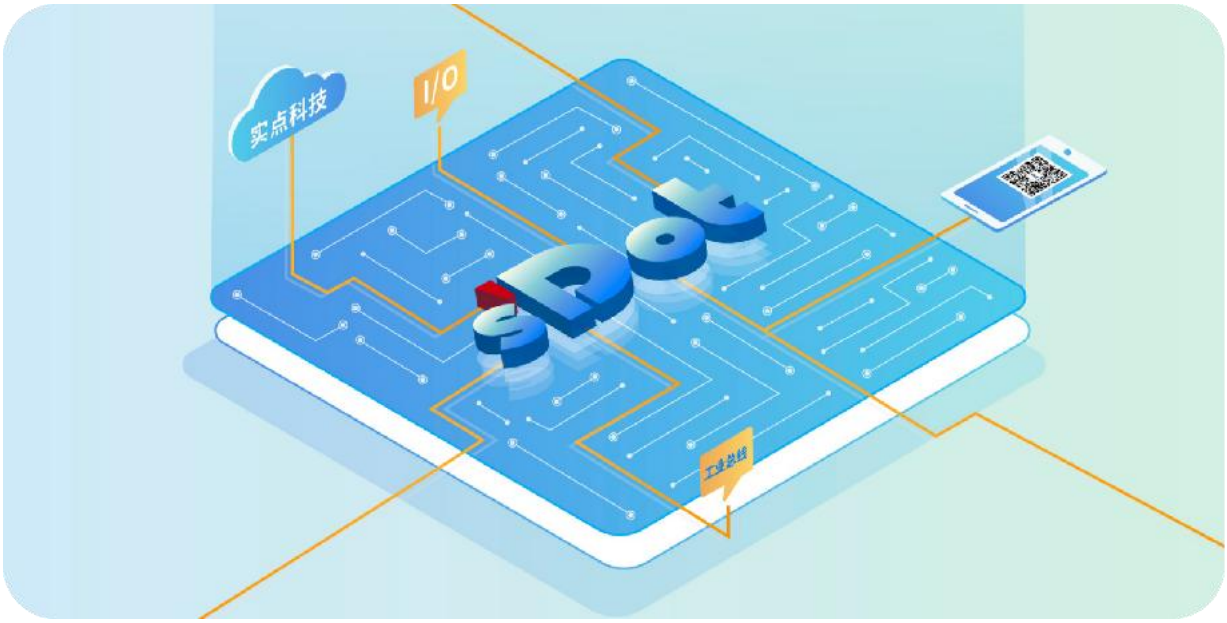

XB6S Series

Temperature acquisition module

User Manual

Nanjing Solidot Electronic Technology Co., Ltd.

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1 Product Overview

1.1 Product Introduction

XB6S series temperature acquisition module supports thermal resistors, thermocouples and other types of sensors. There are two types of modules: 4-channel and 8-channel. They use X -bus bottom bus and are compatible with XB6S series couplers. The modules occupy a small space and are highly practical, providing users with high-speed data acquisition, optimized system configuration, simplified on-site wiring, and improved system reliability .

1.2 Product Features

- **Various measurement types**
  The measurement types supported are thermocouples, RTDs, and resistors .
- **High sensitivity**
  Sensitivity: 0.1 ℃ .
- **Channel filter**
  Support single channel filter setting.
- **Disconnection Detection**
  Disconnect detection is supported for RTD, resistor, and thermocouple type sensors.
- **Noise Suppression**
  Supports 50Hz , 60Hz , 10Hz and no noise suppression configurations.
- **Small size**
  Compact structure and small space occupation.
- **Easy diagnosis**
  The indicator lights are fully designed, the module status is clear at a glance, and detection and maintenance are convenient.
- **Easy to install**
  DIN 35 mm standard rail installation .
  It adopts spring-type terminal blocks, making wiring convenient and quick.
- **Easy configuration**
  The configuration is simple.

2 Product Parameters

2.1 General parameters

Interface parameters		
Product Model	XB6S-A40TM	XB6S-A80TM
Bus protocol	X -bus	
Bus input power rated voltage	5 VDC (4.5V ~ 5.5V)	
Rated current consumption	100mA	110mA
Power consumption	0.5W	0.55W
Transfer rate	6 Mbps	
Station Type	Slave	
Power supply	5 VDC , powered by X -bus	
General parameters		
Specifications and dimensions	106.4 × 25.7 × 72.3 mm	
Weight	90 g	110 g
Operating temperature	-20 ℃~ + 60 ℃	
Storage temperature	-40 ℃ ~+ 80 ℃	
Relative humidity	95 %, non- condensing	
Protection level	IP20	
Safety Certification	CE certification, UL certification	
Green Environmental Certification	RoHS certification, REACH certification	

Technical Parameters			
Number of channels	4, 8		
Sensor Type	Thermocouple	Thermal resistor	Resistor
Connection	2-wire	2-wire, 3-wire	2-wire
Sensor code and range	B: 50~1800℃ C: (reserved) [1] E: -200~1000℃ J: -200~1200℃ K: -200~1370℃ L: (reserved) N: (reserved) R: (reserved) S: -50~1690℃ T: (reserved) U: (reserved)	Pt100: −200~850℃ Pt200: −200~850℃ Pt500: −200~850℃ Pt1000: −200~850℃ Ni120: (reserved) Ni100: -60~250℃ Ni1000: -60~250℃ Ni200: (reserved) Ni500: (reserved)	15Ω~3kΩ 15Ω~150Ω (reserved) 15Ω~300Ω (reserved) 15Ω~600Ω (reserved)
Accuracy	±0.3% @25℃ (FS) ±0.5% @-20~60℃ (FS)	±0.1% @25℃ (FS) ±0.3% @-20~60℃ (FS)	±0.1% @25℃ (FS) ±0.3% @-20~60℃ (FS)
Sensitivity	0.1 ℃		± 0.1 Ω
Temperature measurement units	Supports switching between Celsius, Fahrenheit, and thermodynamic temperature scale units (the default unit is Celsius) [2]		
Resolution	16 bits (int type)		
Channel conversion time	29ms/ch 115ms/8ch	73ms/ch 290ms/8ch	
Filter	Single channel filter, configurable (level 0 to 10)		
Disconnection Detection	Support		
Disconnection detection time	2ms		
Misconnection overvoltage protection	±30V		
Noise Suppression	50Hz, 60Hz, 10Hz, no noise suppression		
Excitation current	<2mA		
Input Impedance	≥10KΩ		
Isolation method	Digital Isolation		
Isolation withstand voltage	500VDC		
Channel indicator light	Green LED light		

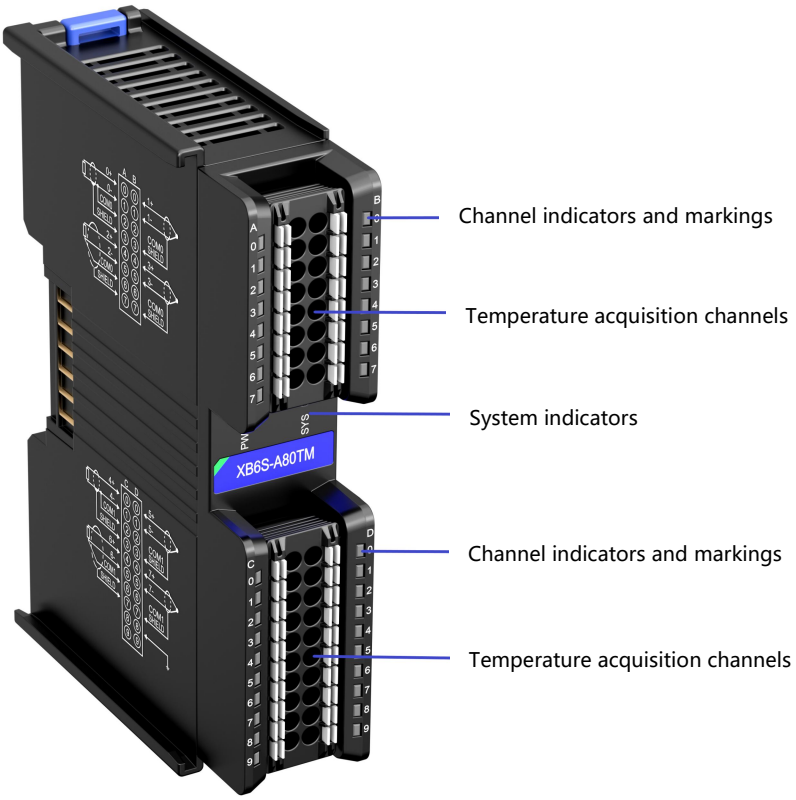
Note [1]: Sensor codes C, L, N, R, T, U, Ni120, Ni200, Ni500, 15Ω～150Ω, 15Ω～300Ω, and 15Ω～600Ω are not currently supported.

Note [2]: Fahrenheit (°F) = 32+T (℃)×1.8; Thermodynamic temperature scale (K) = T (℃)+273.15.

3 Panel

3.1 Panel structure

Product Parts Name



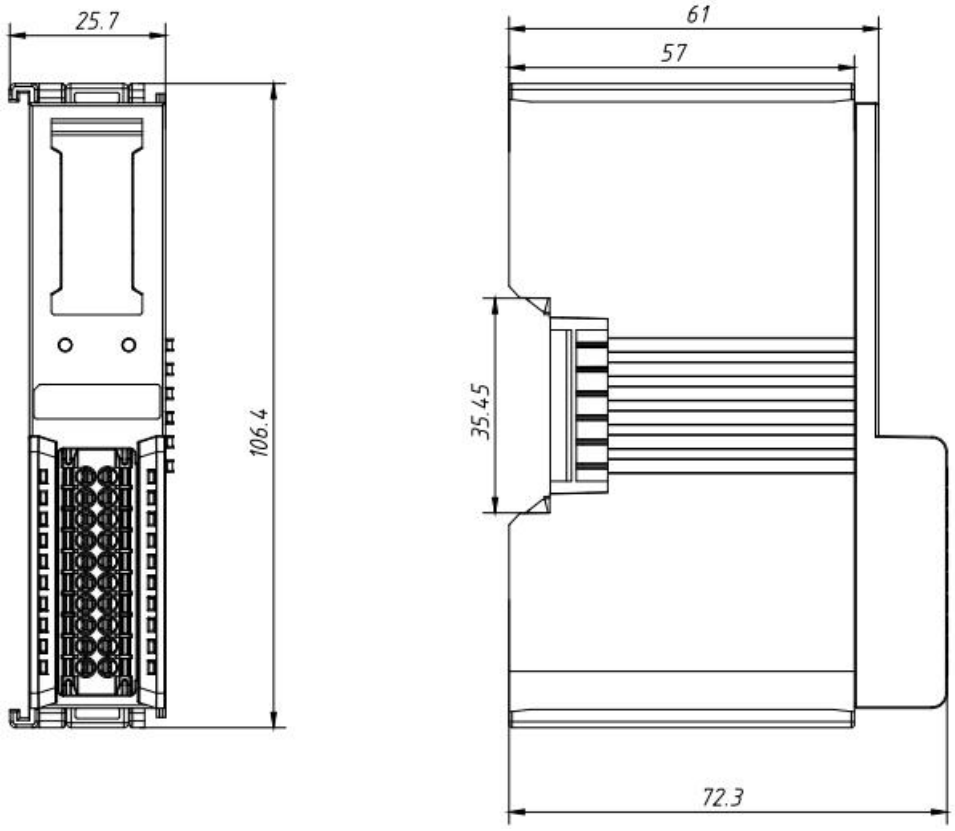
3.2 Indicator light function

Temperature acquisition module indicator light definition				
Marking	**Name**	**Color**	**State**	**Status description**
PWR	Power indicator	Green	ON	Power supply is normal
			OFF	The product is not powered on or the power supply is abnormal
SYS	Operation status indicator	Green	ON	The system is running normally
			Flashing 1 Hz	No business data interaction, waiting to establish business data interaction
			Flashing 10 Hz	Firmware Upgrade
			OFF	System not working
0~7	Channel indicator light	Green	ON	The channel is enabled and the sensor is connected normally
			OFF	The channel is prohibited or the sensor is not connected normally

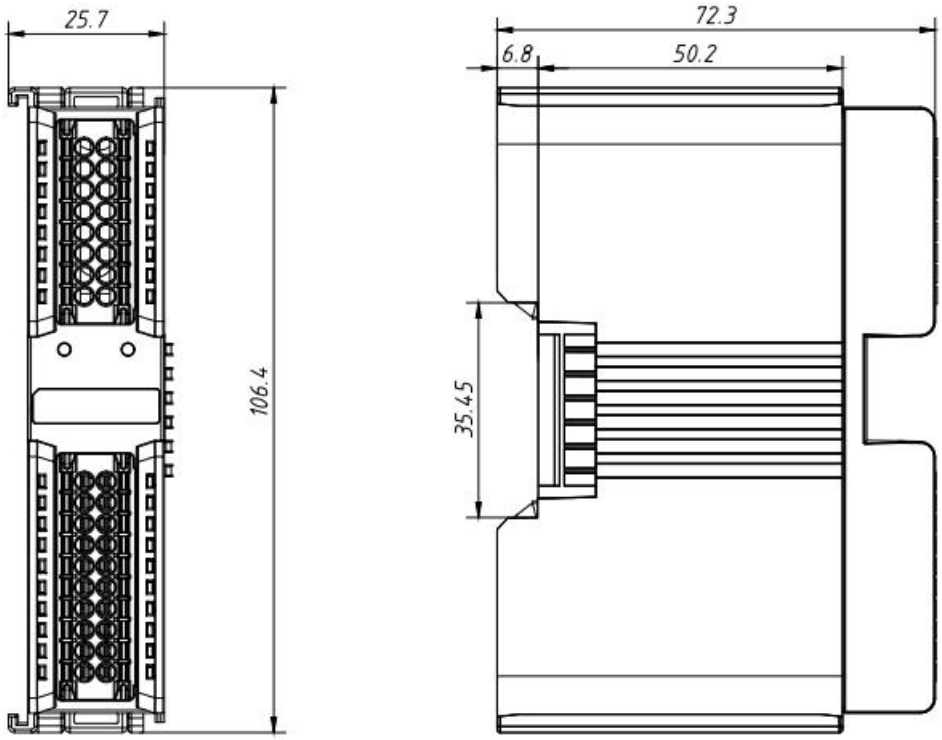
4 Installation and uninstall

4.1 Dimensions

4-channel temperature acquisition module dimensions (unit: mm)



8- channel temperature acquisition module dimensions (unit: mm)



4.2Installation Guide

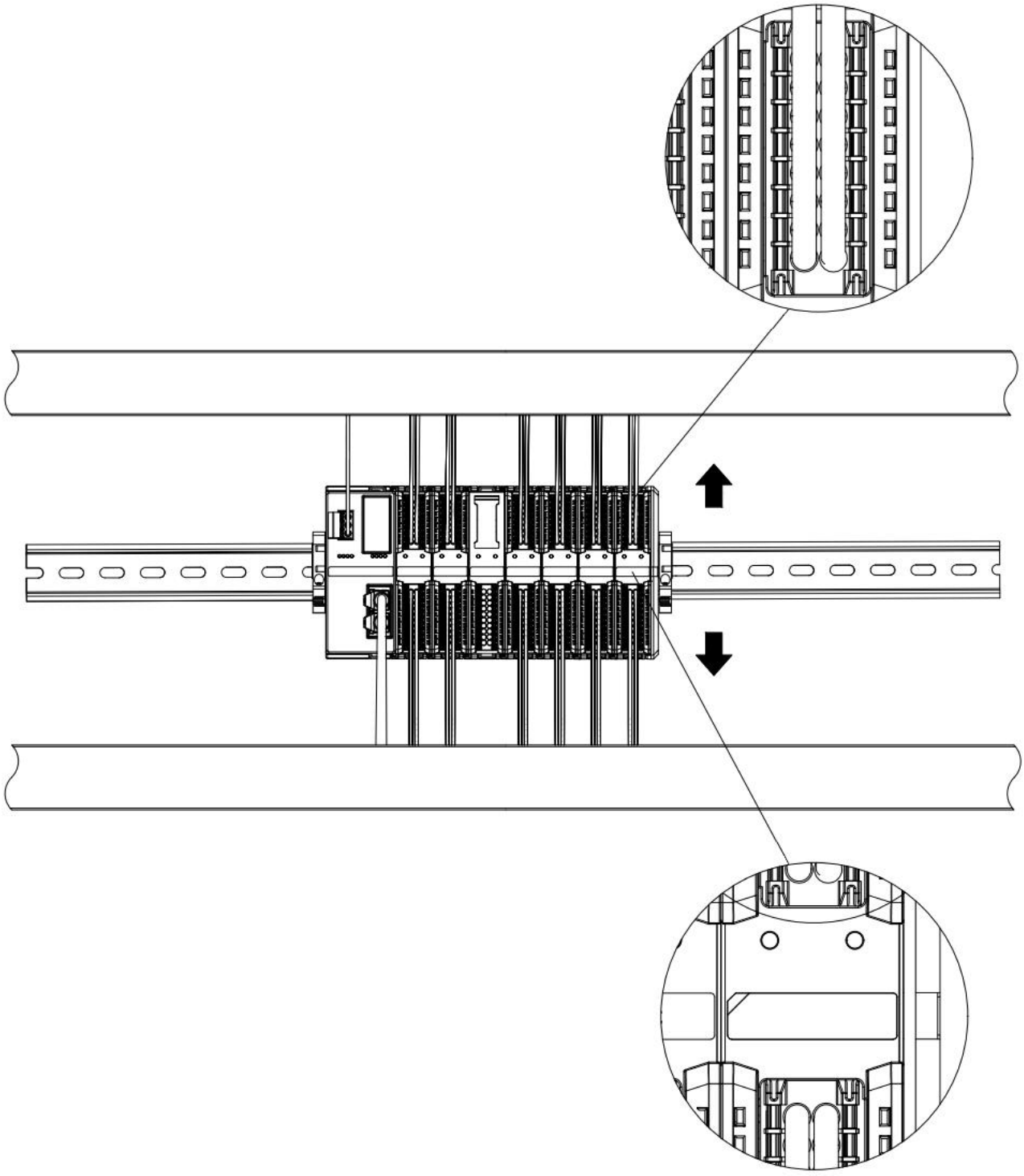
Installation\uninstall precautions

- **The module protection level is IP 20. The module needs to be installed in a cabinet and used indoors.**
- **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 on the fixing rail 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 uninstall must be performed with the power turned off.**
- **After the module is installed, it is recommended to connect and route the cables in an up-and-down manner.**

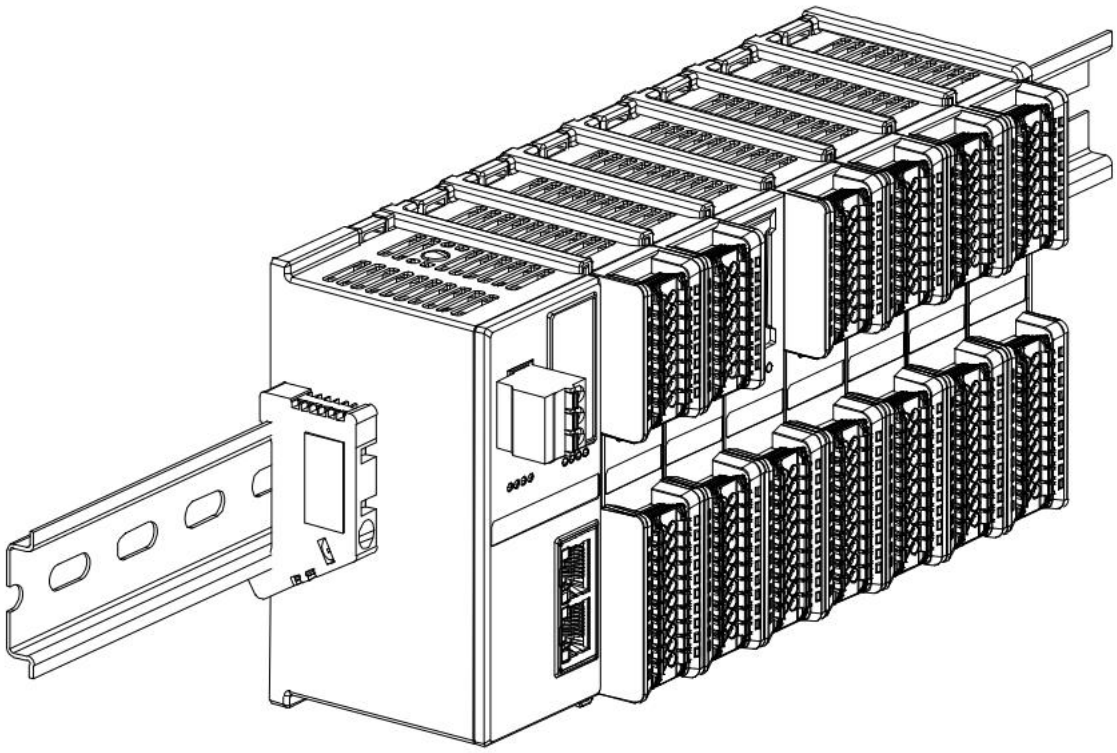
Warning

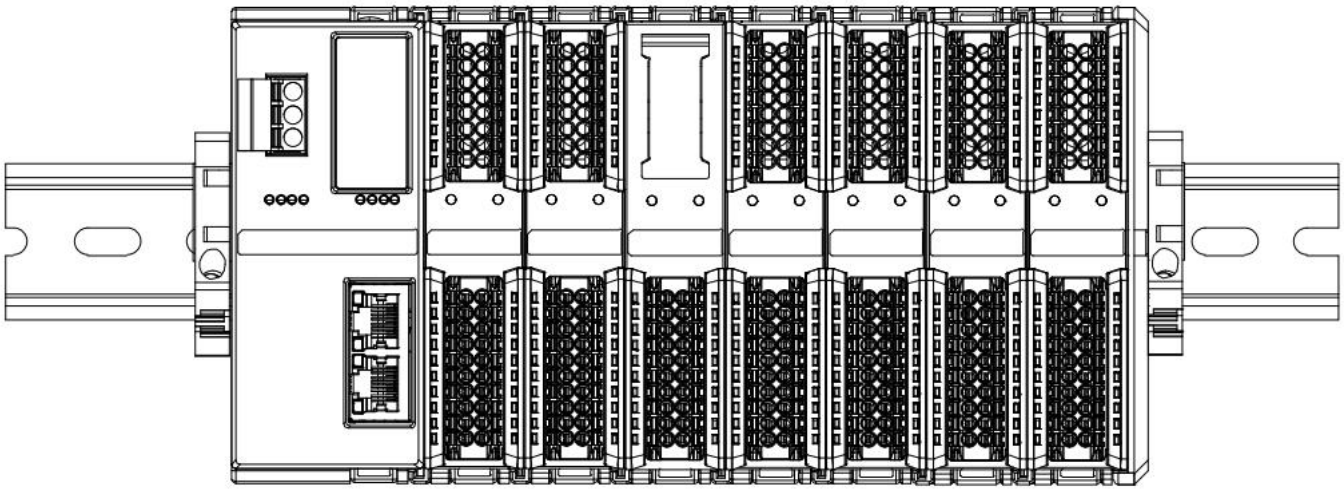
- If the protection provided by the device may be jeopardized if it is not used in accordance with the product user manual.

Module installation diagram, minimum clearance between top and bottom (≥50 mm)

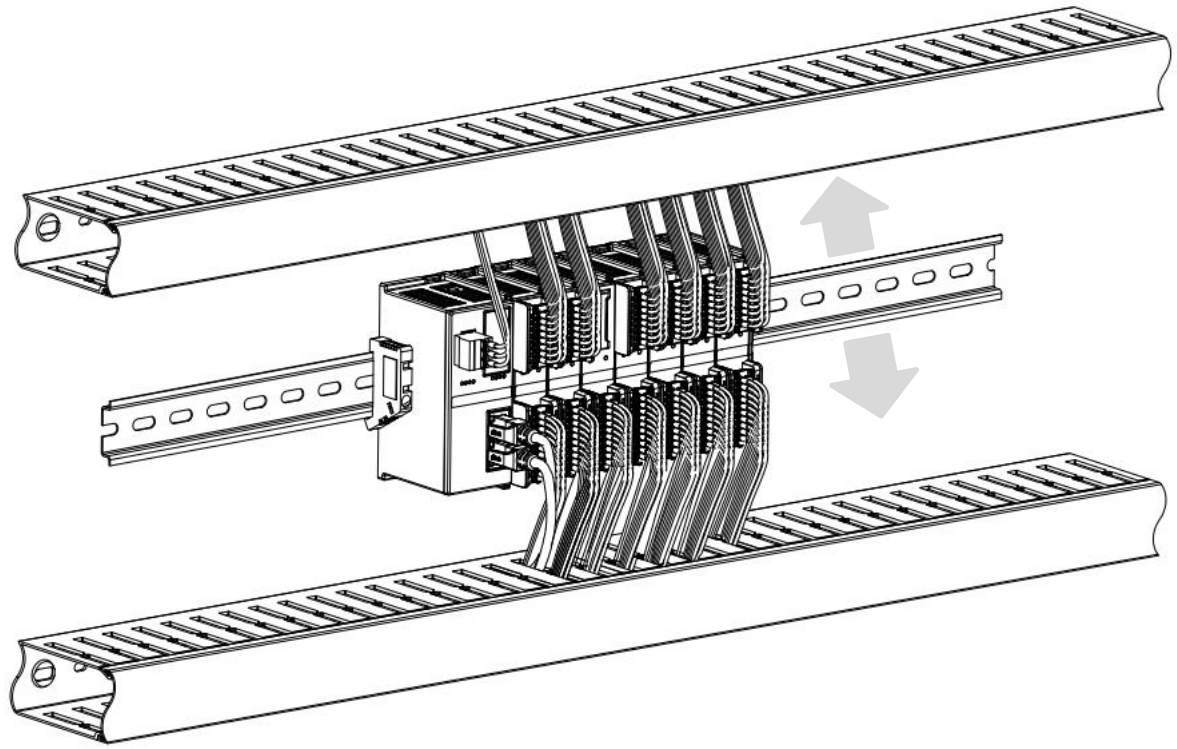


Ensure the module is installed vertically





Module upper and lower wiring diagram



4.3 Installation and uninstall steps

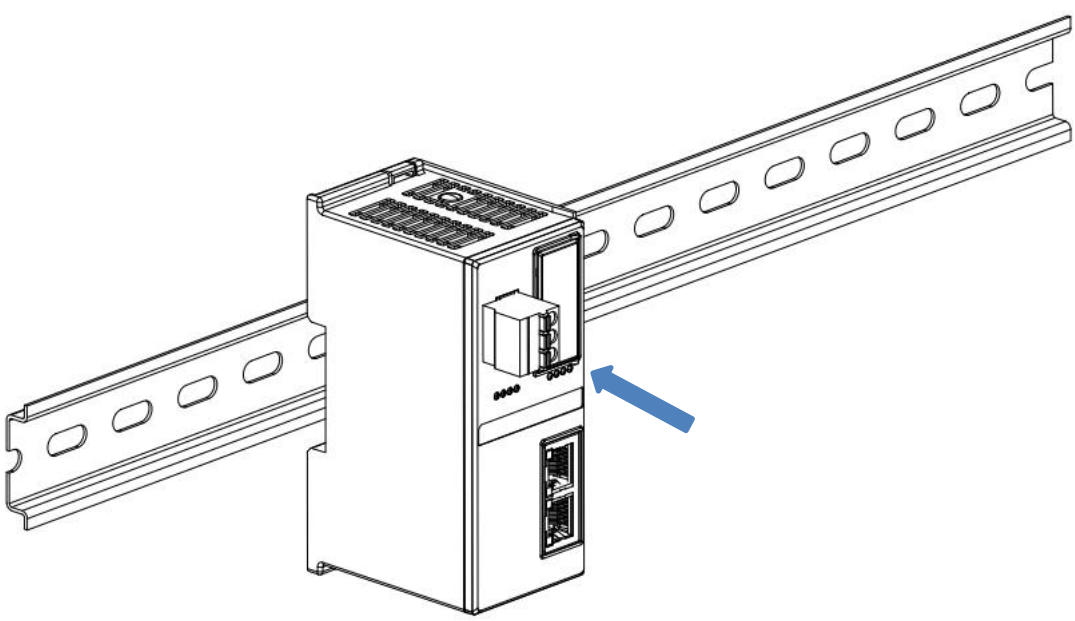
Module installation and uninstall	
Module installation steps	1. Install the coupler module on the fixed guide rail first.
	2. Install the required I /O modules or functional modules in sequence on the right side of the coupler module.
	3. After installing all required modules, install the end cap to complete the module installation.
	4. Install the guide rail fixings at both ends of the coupler module and the end cap to fix the module.
Module uninstall 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 uninstalled module.

4.4 Installation and uninstall diagram

Coupler module installation

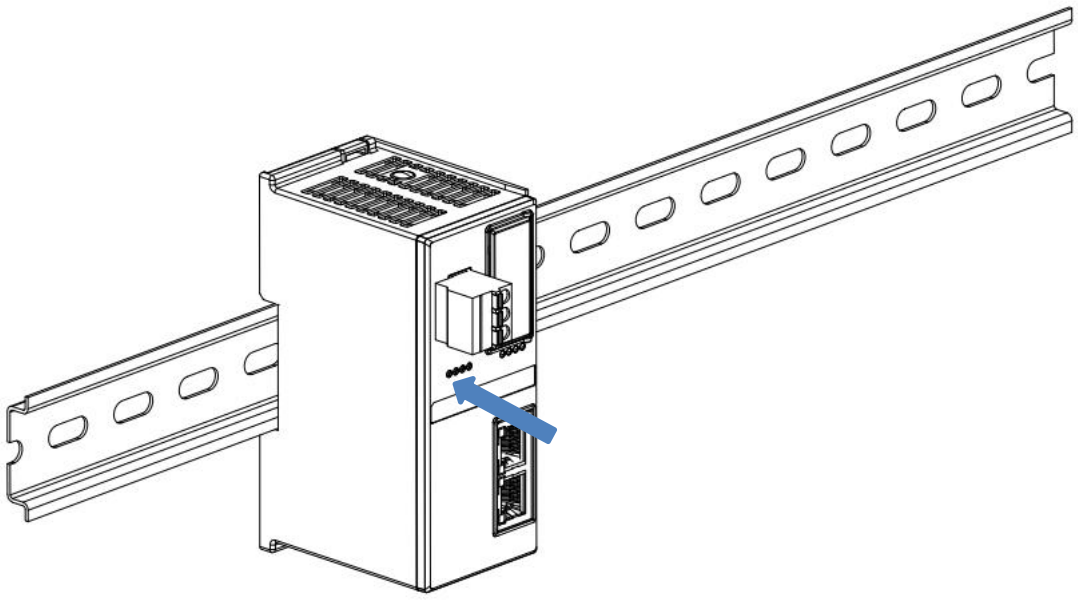
■ Align the coupler module vertically with the guide rail slot, as shown in Figure ① below.

①



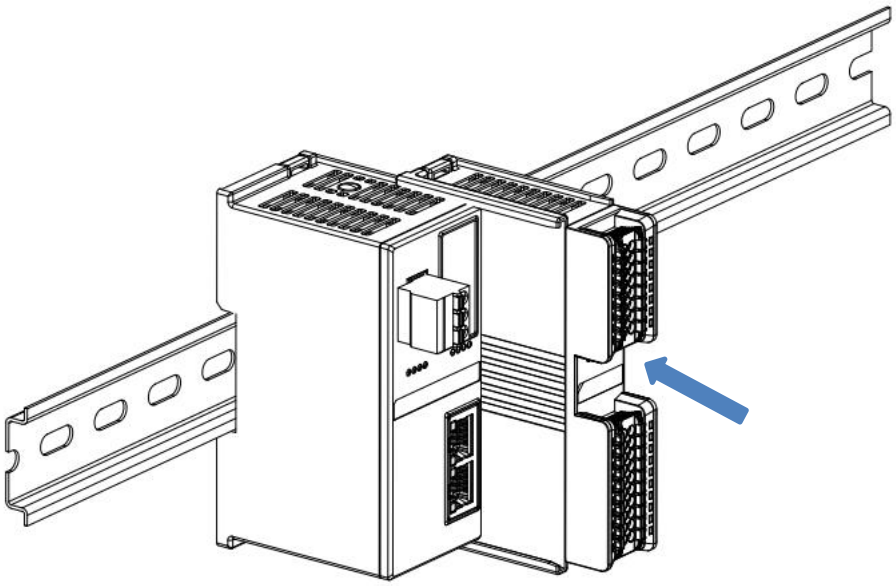
■ Press the coupler module in the direction of the guide rail with force until you hear a "click" sound, and the module is installed in place, as shown in Figure ② below.

②

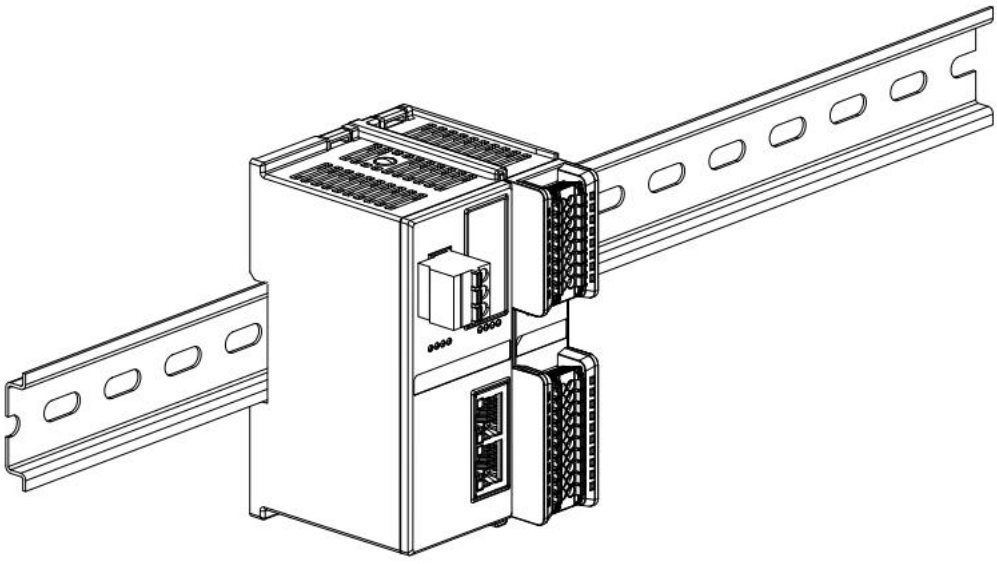


I /O Module Installation

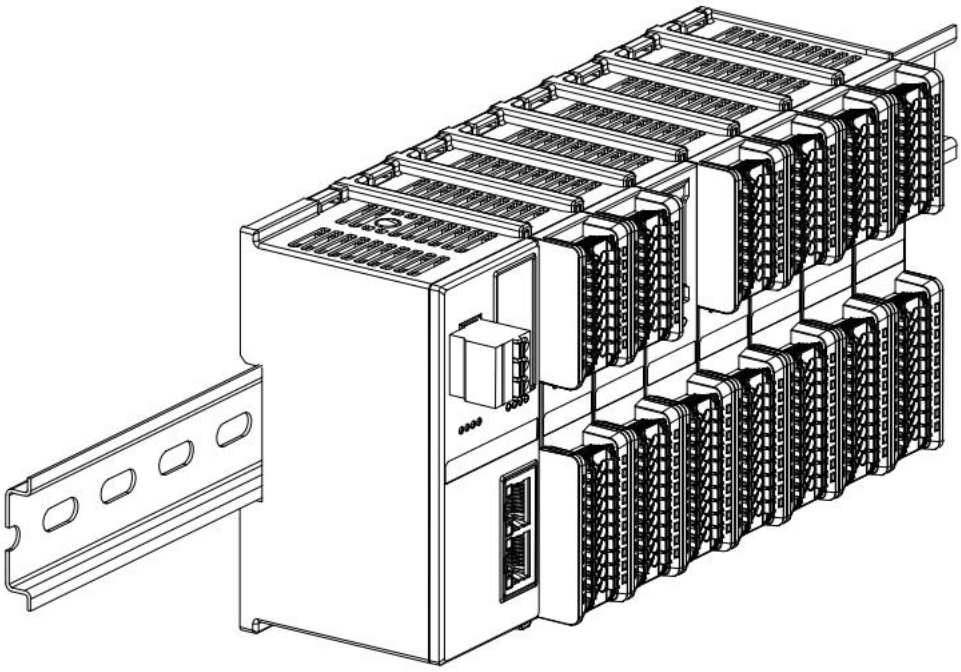
■ Follow the steps above to install the coupler module and install the required I/O modules or functional modules one by one . Push them in as shown in Figures ③, ④, and ⑤ below. When you hear a "click", the module is installed in place.



③



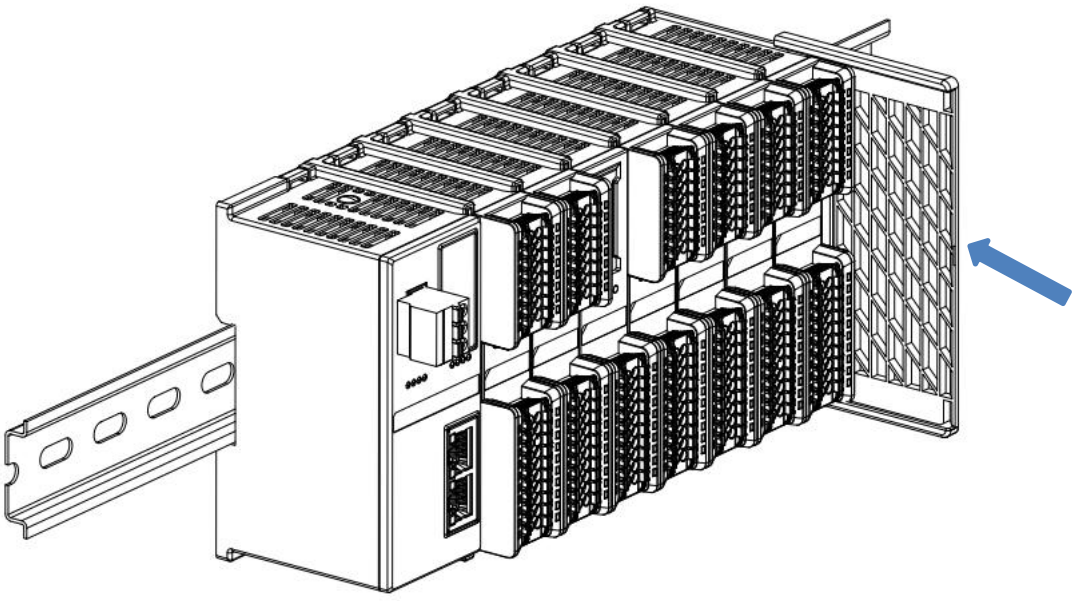
④



⑤

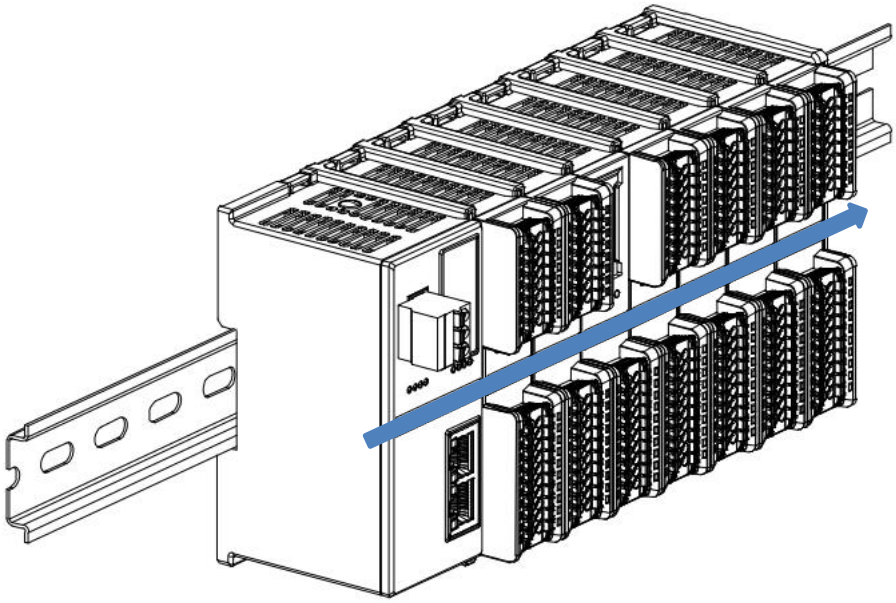
End cap installation

■ Install the end cap on the right side of the last module, aligning one side of the end cap groove with the guide rail. For installation, refer to the installation method of the I/O module and push the end cap inwards into place, as shown in Figure ⑥ below .



⑥

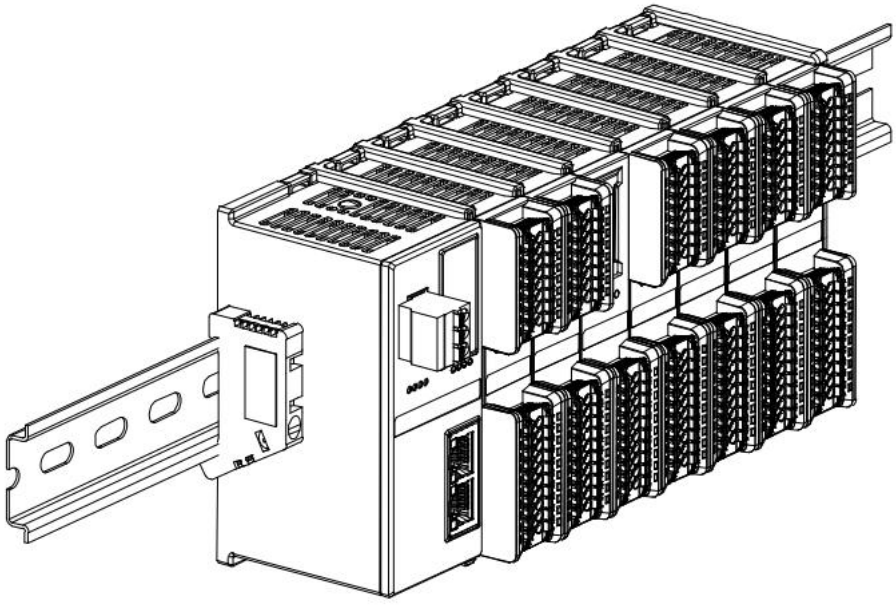
■ After the end cap is installed, check whether the front of the entire module is flat, and ensure that all modules and end cap are installed in place and the front is flush, as shown in Figure ⑦ below.



⑦

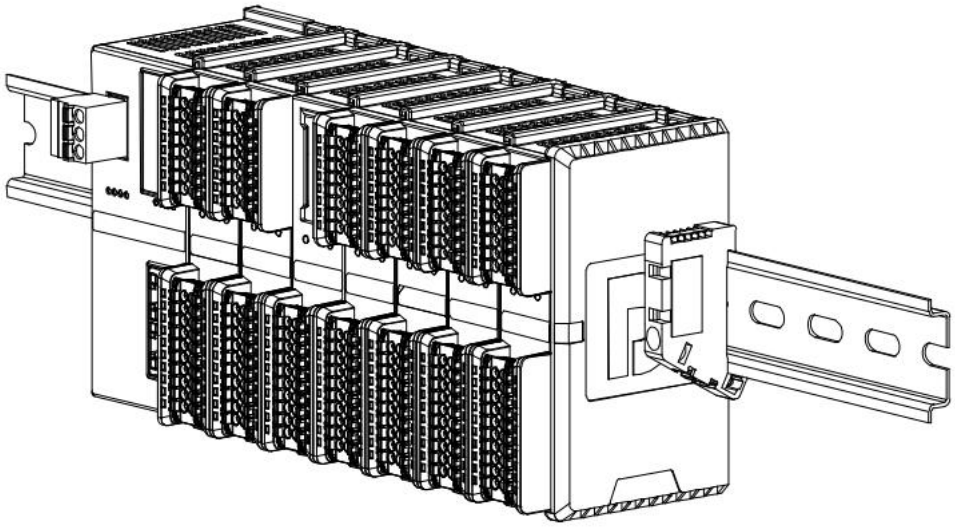
Guide rail fixtures installation

■ Install and tighten the guide rail fixtures close to the left side of the coupler, as shown in Figure ⑧ below.



⑧

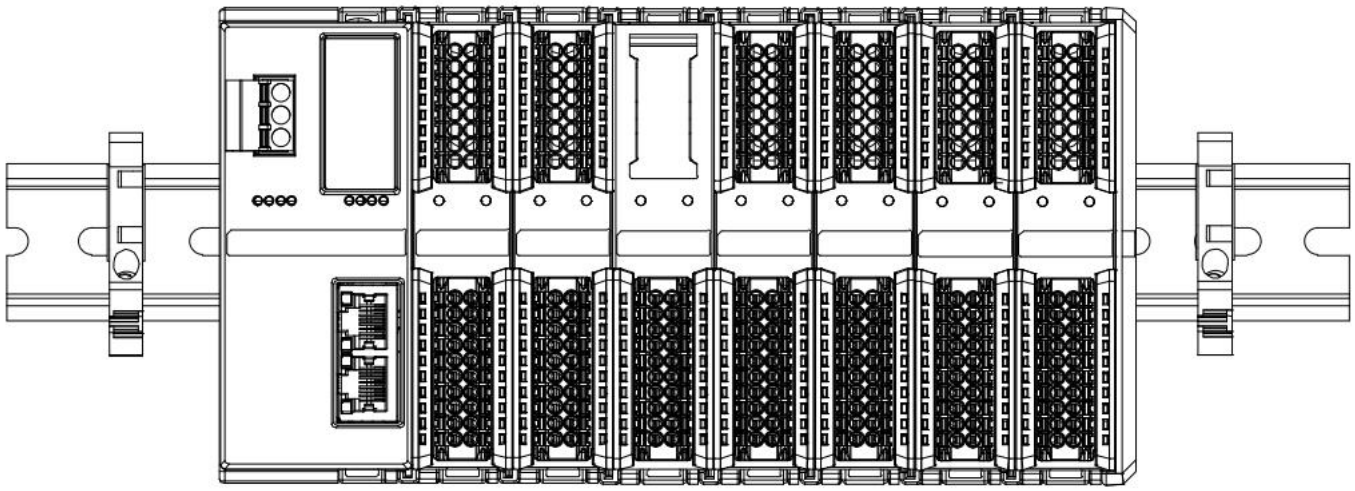
- Install the rail fixture on the right side of the end cap, first push the rail fixtures firmly in the direction of the coupler to ensure that the module is mounted tightly and lock the rail fixtures with a screwdriver, as shown in Figure ⑨ below .



⑨

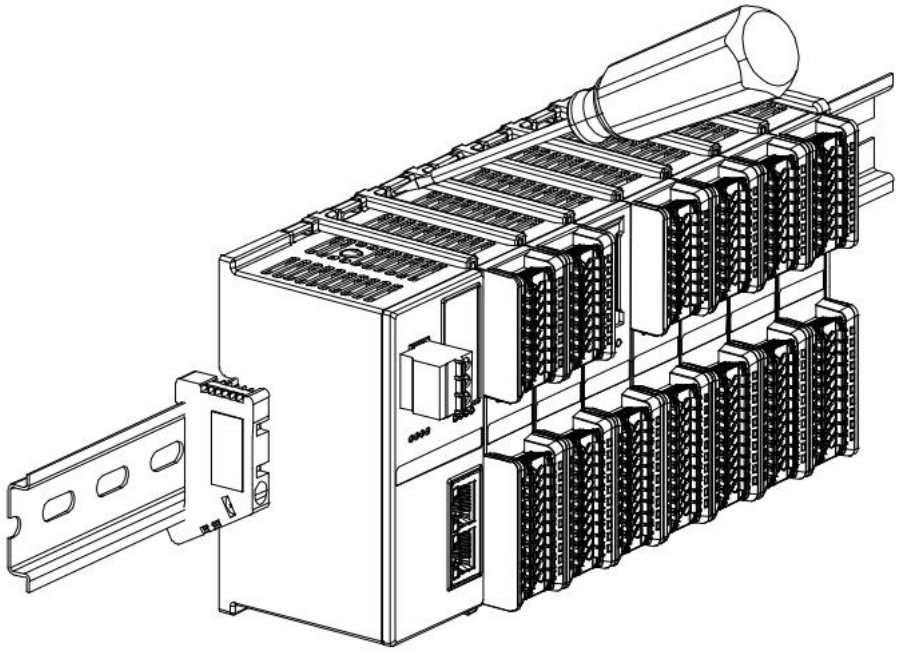
Uninstall

- Use a screwdriver to loosen the guide rail fixtures at one end of the module and move them to another side to ensure that there is a gap between the module and the guide rail fixtures, as shown in Figure ⑩ below.

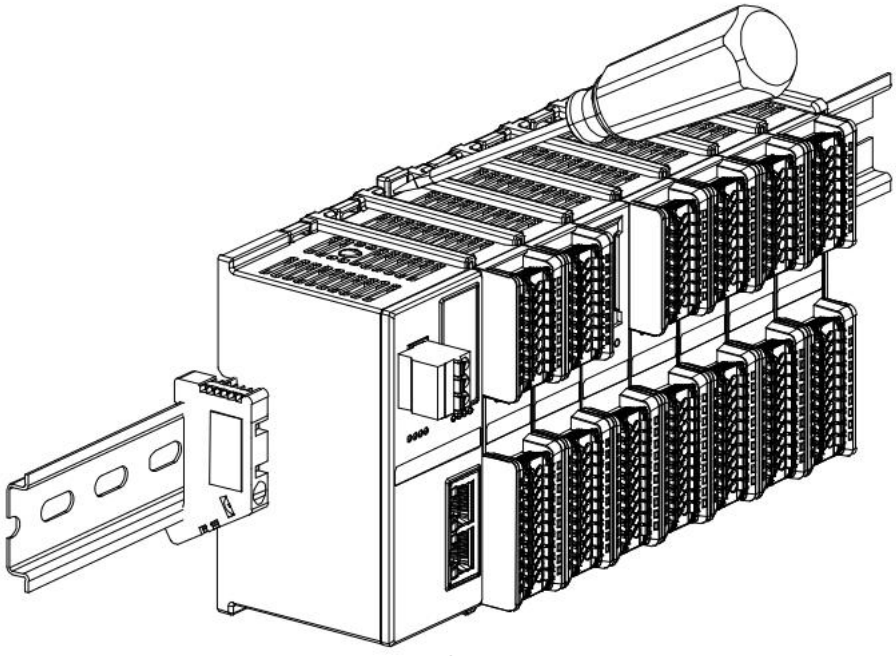


⑩

■ Insert a flat-blade screwdriver into the buckle of the module to be uninstalled, and apply force to the module sideways (until you hear a sound), as shown in Figures ⑪ and ⑫ below. **Note: Each module has a buckle on the top and bottom, and all modules are operated in the same way.**

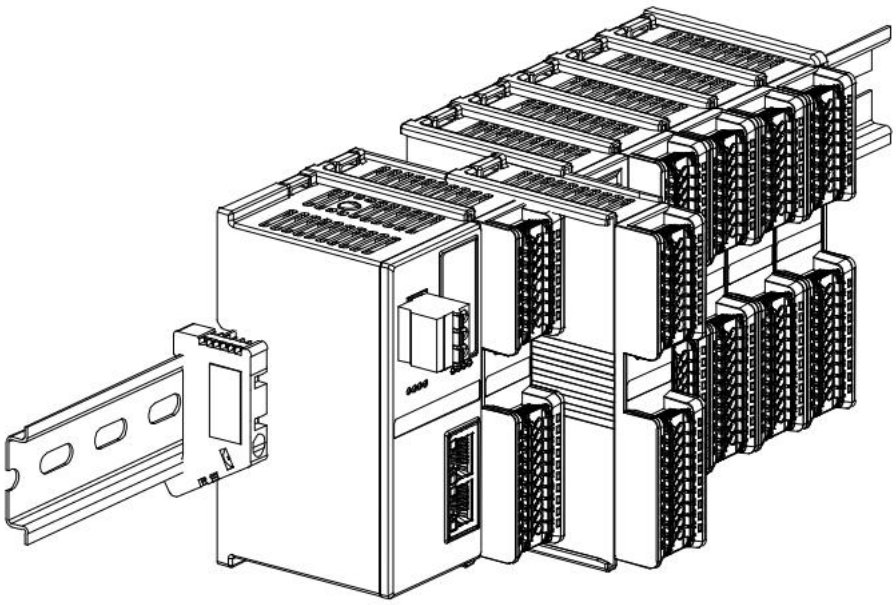


⑪



⑫

■ Follow the opposite steps of installing the module to uninstall the module, as shown in Figure ⑬ below .

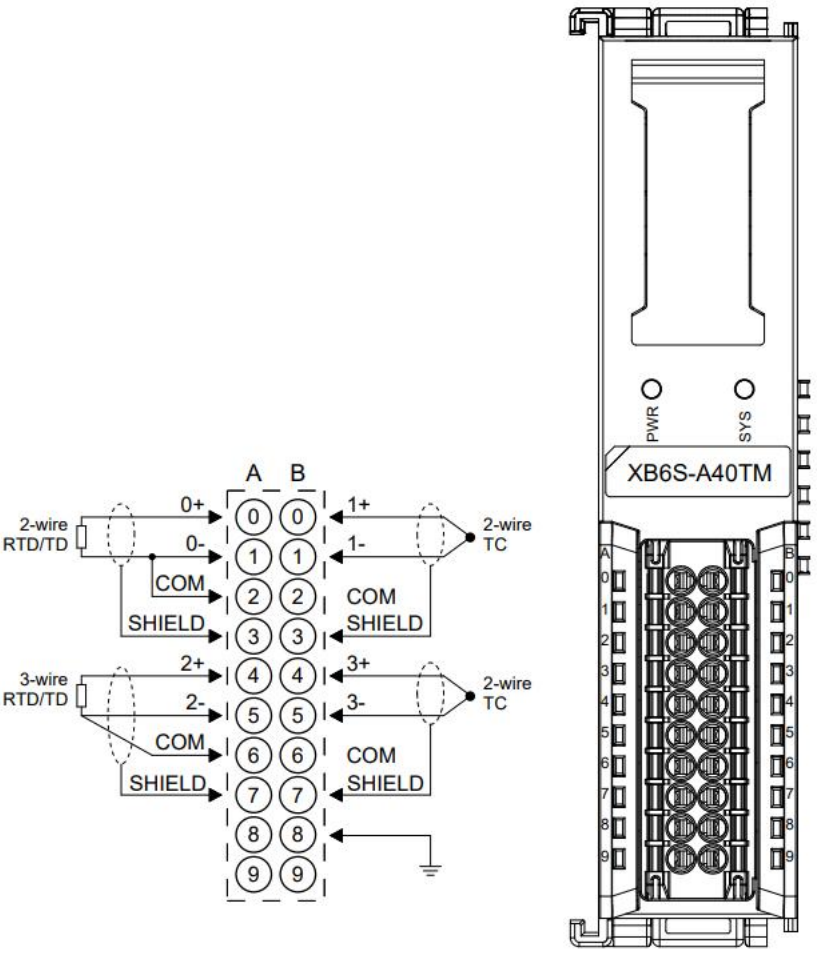


⑬

5 Wiring

5.1 Wiring Diagram

5.1.1 XB6S-A40TM

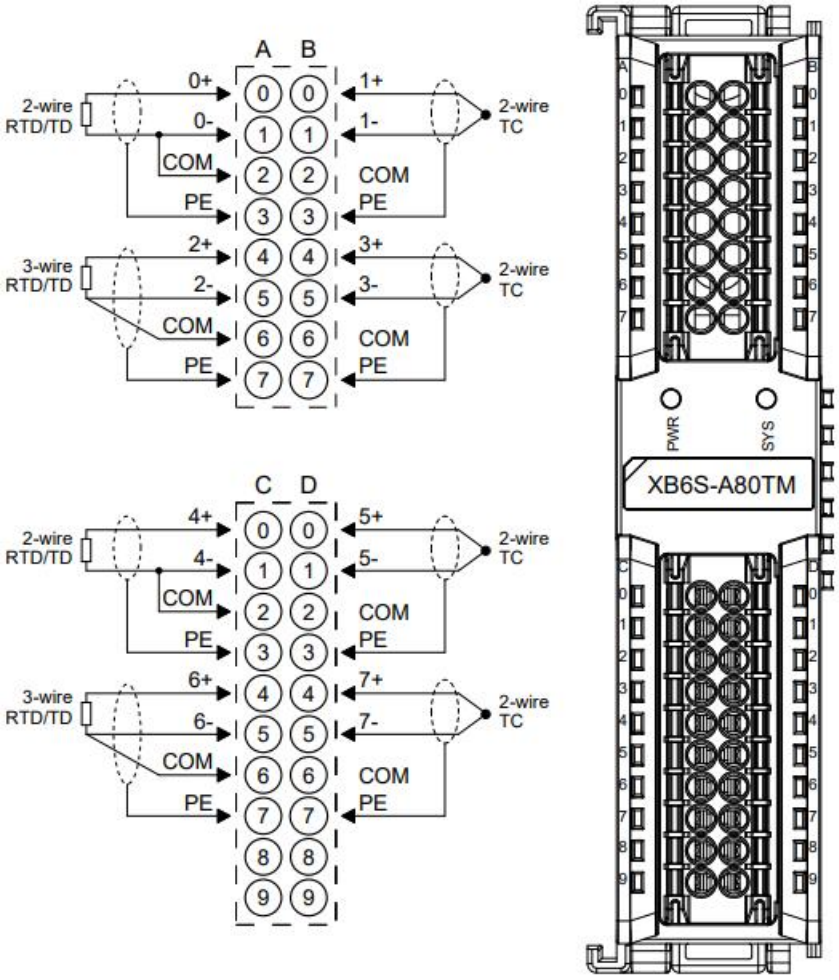


*SHIELDinternal conduction

*2-wire thermal resistor needs to short-circuit "-" and "C" externally

*4-wire sensor needs to be changed to 2-wire or 3-wire connection

5.1.2 X B6S-A80TM



*SHIELD internal conduction

*2-wire thermal resistor needs to short-circuit "-" and "C" externally

*4-wire sensor needs to be changed to 2-wire or 3-wire connection

6 Operation

6.1 Configuration parameter definition

Taking XB6S-A80TM as an example, there are 31 parameters in total for module configuration, among which channel filter time parameters, channel enable parameters and temperature compensation parameters can be set for a single channel. Channel 0 is used as an example to introduce the configuration parameters, as shown in the following table.

Function	Parameter name	Value range	Default value
Sensor Type Selection	Sensor Type	0 : PT100	0
		1：PT200	
		2：PT500	
		3：PT1000	
		4：Ni120_ID（Reserve）	
		5：THERMOCOUPLE_K	
		6：THERMOCOUPLE_J	
		7：THERMOCOUPLE_T（Reserve）	
		8：THERMOCOUPLE_E	
		9：THERMOCOUPLE_N（Reserve）	
		10：THERMOCOUPLE_S	
		11：THERMOCOUPLE_R（Reserve）	
		12：THERMOCOUPLE_B	
		13：THERMOCOUPLE_C（Reserve）	
		14：THERMOCOUPLE_L（Reserve）	
		15：THERMOCOUPLE_U（Reserve）	
		16：Ni 100	
		17：Ni 1000	
		18：LG-Ni 1000（Reserve）	
		19：Ni 200（Reserve）	
		20：Ni 500（Reserve）	
		21：RESISTANCE_15:150（Reserve）	

		22：RESISTANCE_15:300（Reserve）	
		23：RESISTANCE_15:600（Reserve）	
		24：RESISTANCE_15:3000	
		25：-1 : 1V（Reserve）	
		26：-250 : 250mV（Reserve）	
		27：-50 : 50mV（Reserve）	
		28: -80 : 80mV (Reserve)	
Filter Type	Filter Type	0 : Default	0
		1: 50hz	
		2:6 0hz	
		3: 10hz	
Cold junction compensation function	Call Compensation Mode	0: Internal Compensation	0
		1: Disable	
Temperature measurement unit switch	Temp Mode	0: Centigrade	0
		1: Fahrenheit	
		2: Thermodynamic	
Channel filter time	Filter Time All	0~10	0
	Filter Time CH00	0~10	255 (follow Filter Time All)
Channel Enable	Enable All	0: Disabled 1:Enable	1
	Enable CH00	0: Disabled 1:Enable 2: Follow Enable All	2
Temperature compensation	Cmp All	- 10000~10000	0
	Cmp CH00	- 10000~10000	32767 (Follow Cmp All)

6.1.1 Sensor Type Selection

The module supports sensor type configuration function (for sensor types, see 2 Product Parameters).

The same module only supports the same type of sensor, and a single channel cannot be configured.

Note: The default sensor type is PT100 .

6.1.2 Filter function

The module provides no filtering, 50Hz , 60Hz , and 10Hz hardware filtering configuration functions.

The channel filter time setting function can support module overall settings (Filter Time All) and single channel settings (Filter Time CHxx) **.** Any channel can be set using Filter Time CHxx or set to Filter Time All. The single channel setting has a higher priority than the overall setting.
Filter Time All can set the filter range from 0 to 10, and the default is 0.
Filter Time CHxx for a single channel is 255, which follows Filter Time All. The filter range for a single channel can be set from 0 to 10.

6.1.3 Cold junction compensation function

The cold junction compensation function supports two compensation modes: internal cold junction compensation mode and closed cold junction compensation mode. The internal cold junction compensation mode is enabled by default.

6.1.4 Temperature measurement unit switch

The module supports configuration conversion of temperature measurement units between Celsius , Fahrenheit , and Thermodynamic temperature scales .

Note: The default sensor measurement unit is Celsius .

6.1.5 Channel enable function

The module can determine whether the channel is used through the "Enable/Disable" parameter setting. If the channel is set to disabled, the channel is disabled and no display - 9999 will be displayed regardless of whether the sensor is connected .

The channel enable function can support module overall settings (Enable All) and single channel settings (Enable CHxx) **.** Any channel can be set using Enable CHxx or set to Enable All. Single channel settings have higher priority than overall settings.
Enable All is enabled by default.
Enable CHxx single channel is set to follow Enable All.

6.1.6 Temperature compensation function

The module supports manual cold-end compensation for each channel data in thermocouple and thermal resistor modes. The data compensation value can be entered according to actual needs. After setting the compensation value, the compensated temperature will be automatically calculated in the upstream data (Input), that is, the upstream data is the final compensated temperature. Divide the read data by 10 to get the compensated temperature in °C.

The temperature compensation function can support module overall settings (Cmp All) and single channel settings (Cmp CHxx) **.** Any channel can be set using Cmp CHxx or set to Cmp All. Single channel settings have higher priority than overall settings.

Cmp All can set the temperature compensation range from -10000 to 10000 (-1000℃ to 1000℃), and the default is 0.

The default setting of Cmp CHxx single channel is 32767, which follows Cmp All. The temperature compensation range of a single channel can be set from -10000 to 10000 (-1000℃ to 1000℃).

6.2 Process data

6.2.1 Upstream data

Upstream data 16 bytes (2 bytes per channel, channel n ranges from 0 to 7)				
Name	**Definition**	**Value Range**	**Data Types**	**Length**
Channel n	Channel n temperature/resistance data acquisition	-32768~32767	Int16	2 bytes

Data description:

◆ **Temperature/resistance data acquisition Channel [n]**

The upstream data (input) of the temperature module is the temperature or resistance data collected by each channel. The data of each channel is a 2-byte signed integer, and the collected data is 10 times the actual data . Divide the read data by 10 to get the actual temperature or resistance value in ℃ or Ω.

6.3 Module Configuration Description

6.3.1 Application in TwinCAT3 software environment

1、Preparation

- **Hardware Environment**
  - **Module preparation, this instruction takes XB6S-EC2002 + XB6S-A80TM topology as an example**
  - **A computer with TwinCAT3 software pre-installed**
  - **EtherCAT dedicated shielded cable**
  - **Switching power supply**
  - **Device Configuration File**

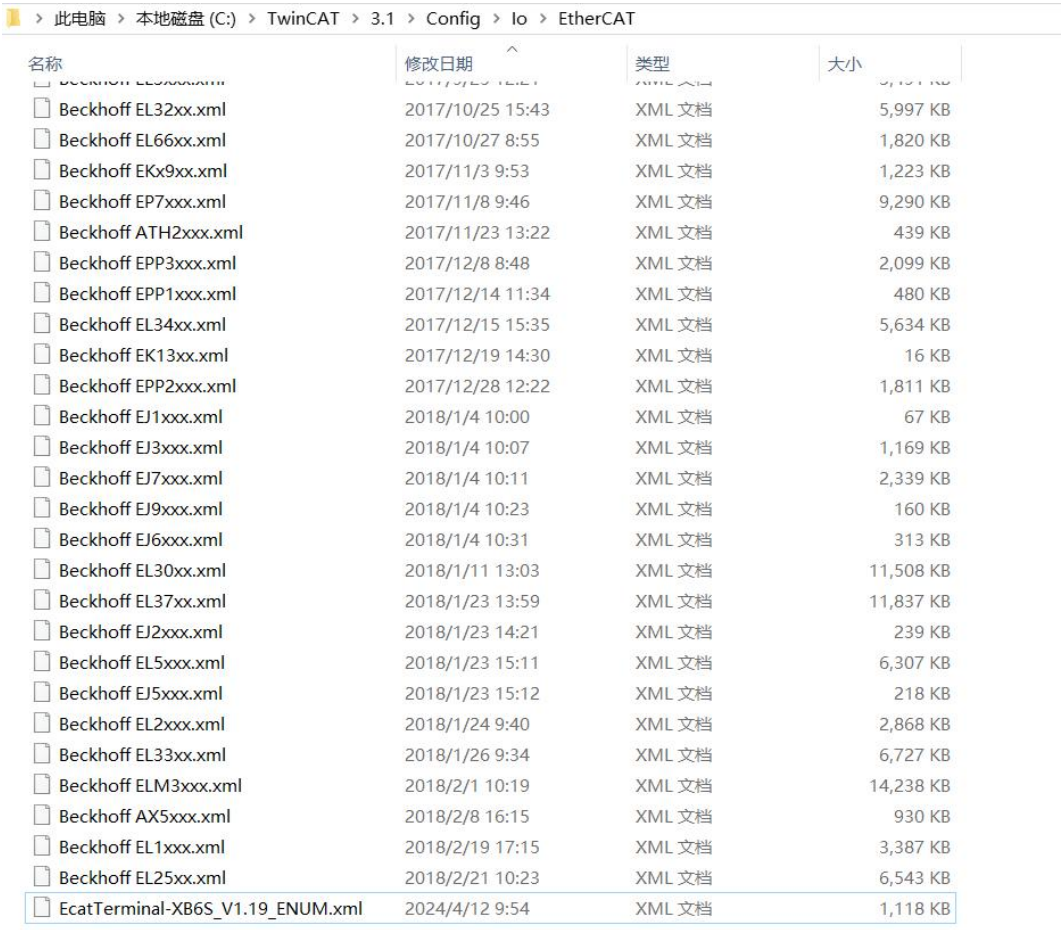
    Configuration file acquisition address:

    https://www.solidotech.com/cn/resources/configuration-files
- **Hardware configuration and wiring**

  Please follow the instructions in " 4 Installation and uninstall " and " 5 Wiring "

2、Pre-configured configuration files

Place the ESI configuration file (EcatTerminal-XB6S_V1.19_ENUM.xml) in the TwinCAT installation directory " C:\TwinCAT\3.1\Config\Io\EtherCAT " , as shown in the figure below .



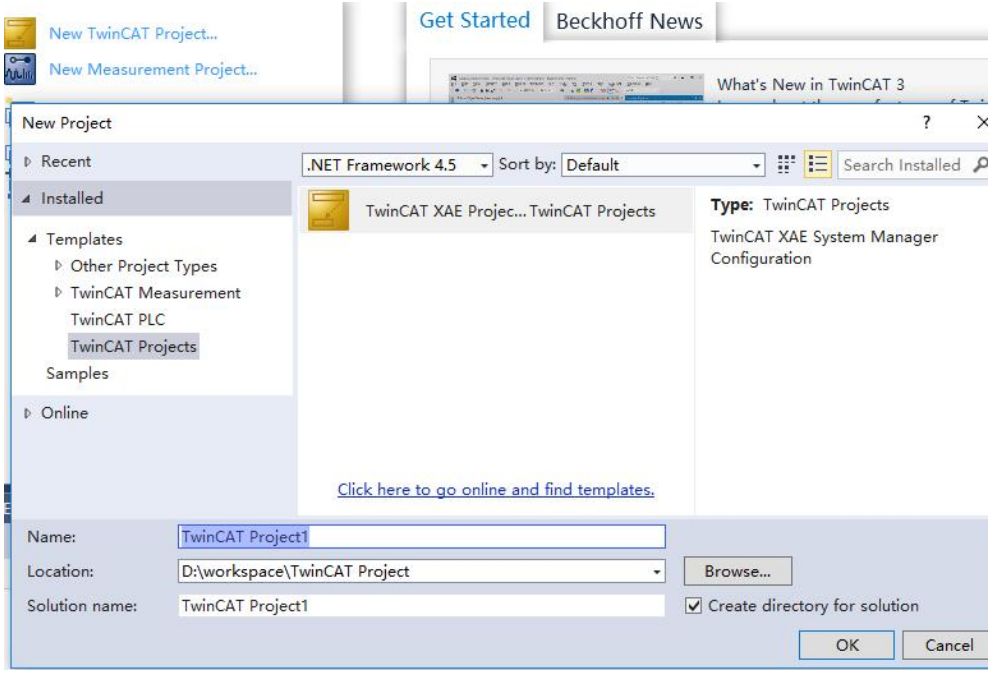
此电脑 › 本地磁盘 (C:) › TwinCAT › 3.1 › Config › Io › EtherCAT

名称	修改日期	类型	大小
Beckhoff EL32xx.xml	2017/10/25 15:43	XML 文档	5,997 KB
Beckhoff EL66xx.xml	2017/10/27 8:55	XML 文档	1,820 KB
Beckhoff EKx9xx.xml	2017/11/3 9:53	XML 文档	1,223 KB
Beckhoff EP7xxx.xml	2017/11/8 9:46	XML 文档	9,290 KB
Beckhoff ATH2xxx.xml	2017/11/23 13:22	XML 文档	439 KB
Beckhoff EPP3xxx.xml	2017/12/8 8:48	XML 文档	2,099 KB
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-XB6S_V1.19_ENUM.xml	2024/4/12 9:54	XML 文档	1,118 KB

3、Create a project

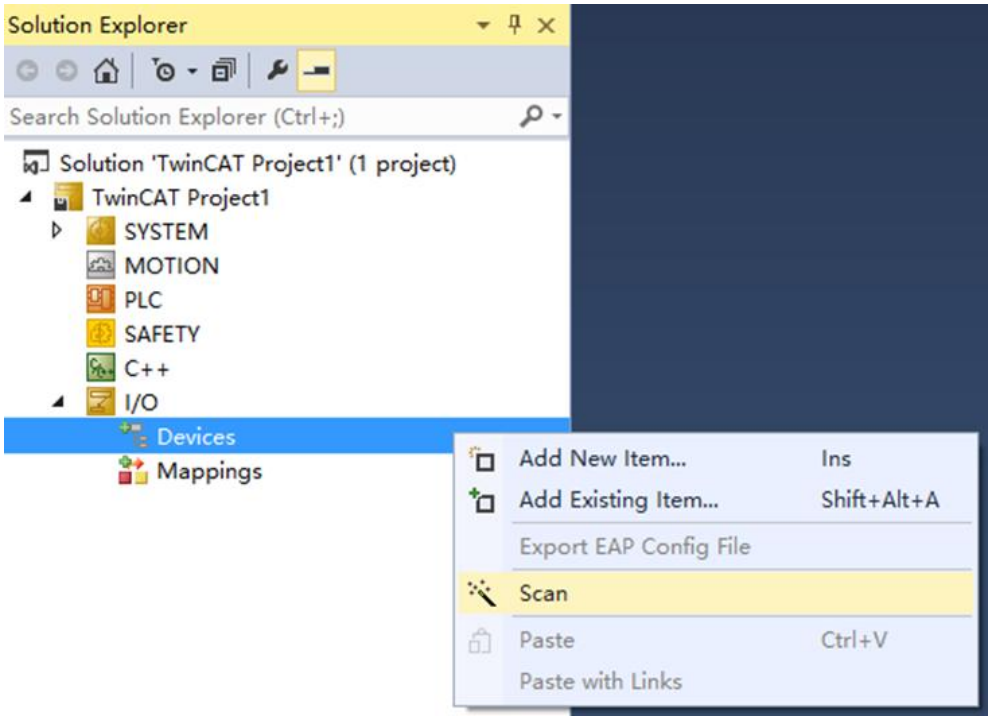
a. Click the TwinCAT icon in the lower right corner of the desktop and select "TwinCAT XAE (VS xxxx)" to open the TwinCAT software, as shown in the figure below.

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.

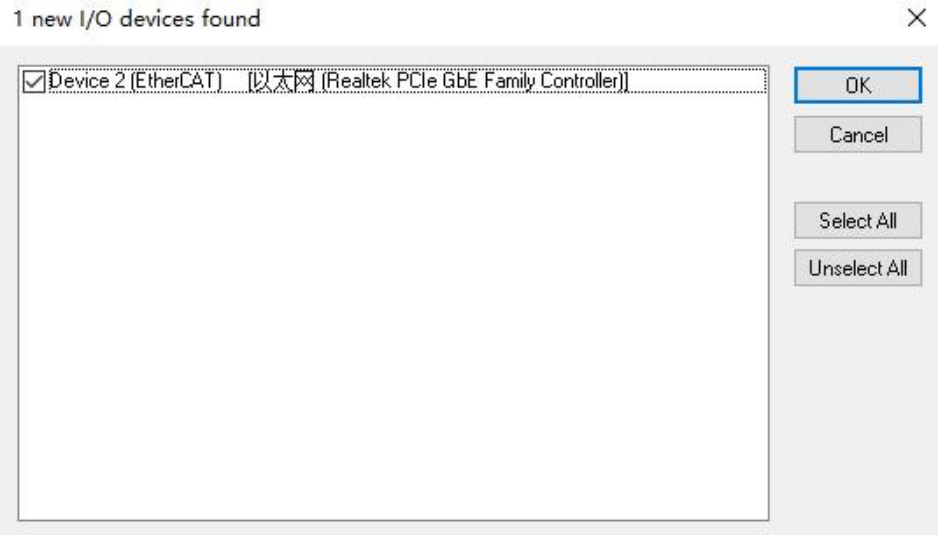


4、Scan Devices

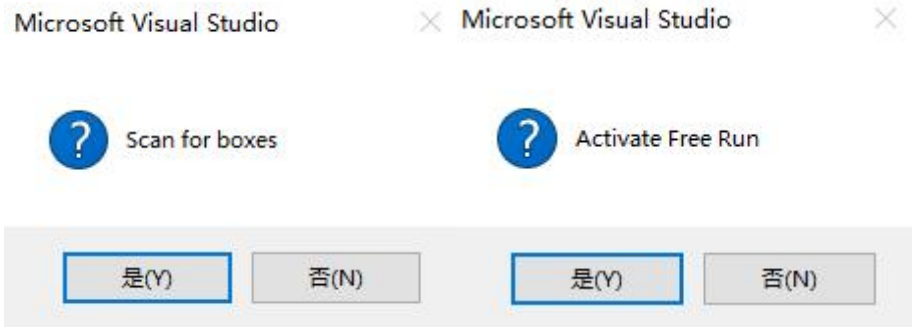
a. After creating the project, right-click the "Scan" option under " I/O - > Devices" to scan the slave devices , as shown in the figure below.



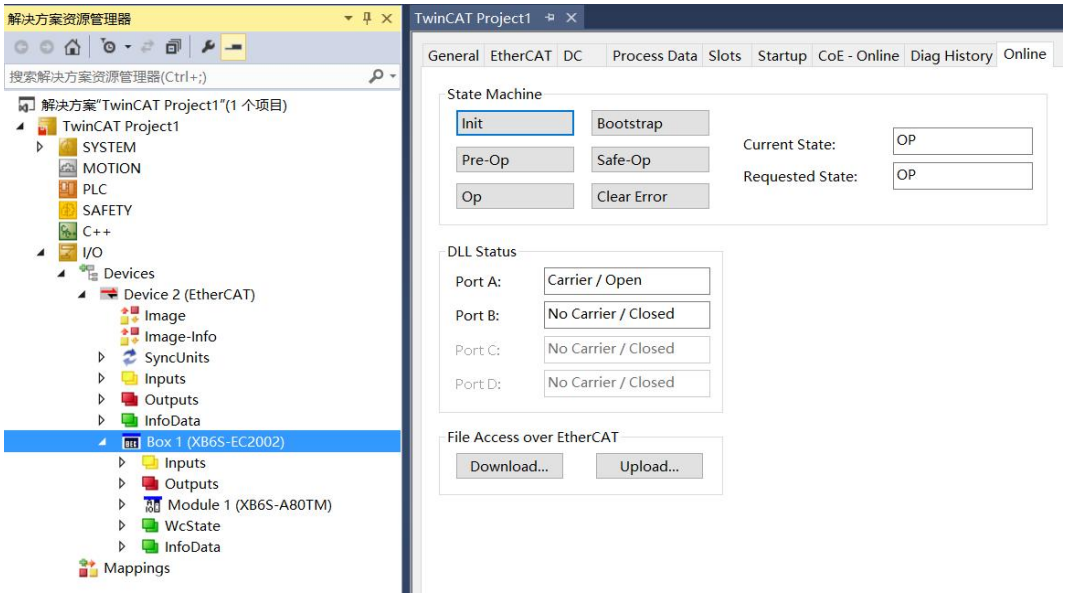
b. Check the "Local Area Connection" network card, as shown in the figure below.



c. A pop-up window "Scan for boxes " appears, click and select "Yes"; a pop-up window "Activate Free Run ” click and select “Yes”, as shown in the following figure.

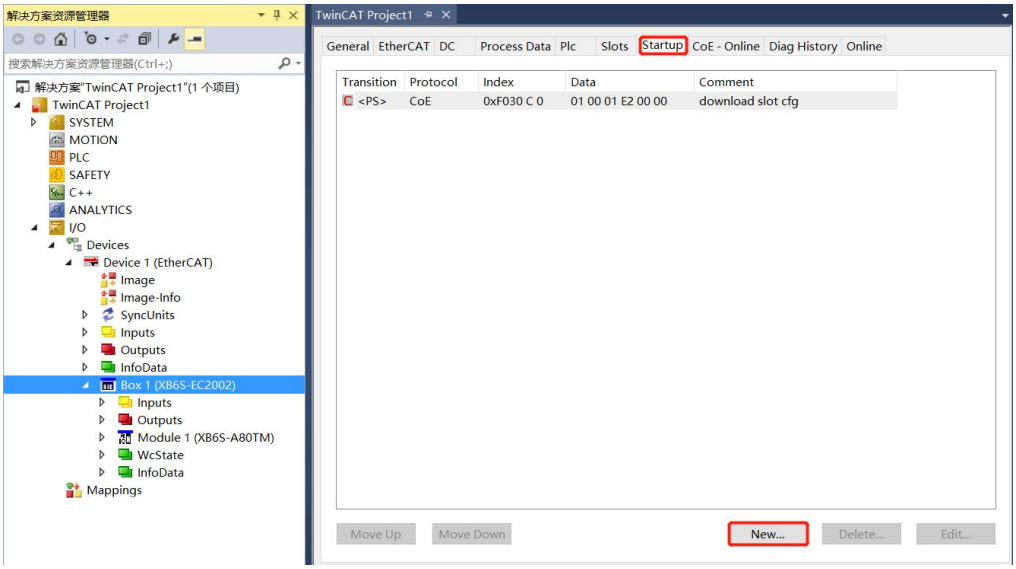


d. After scanning the device, you can see Box 1 (XB6S-EC2002) and Module 1 (XB6S-A80TM) in the left navigation tree. At " Online " , you can see that TwinCAT is in "OP" state, and the RUN light of the slave device is on , as shown in the figure below.

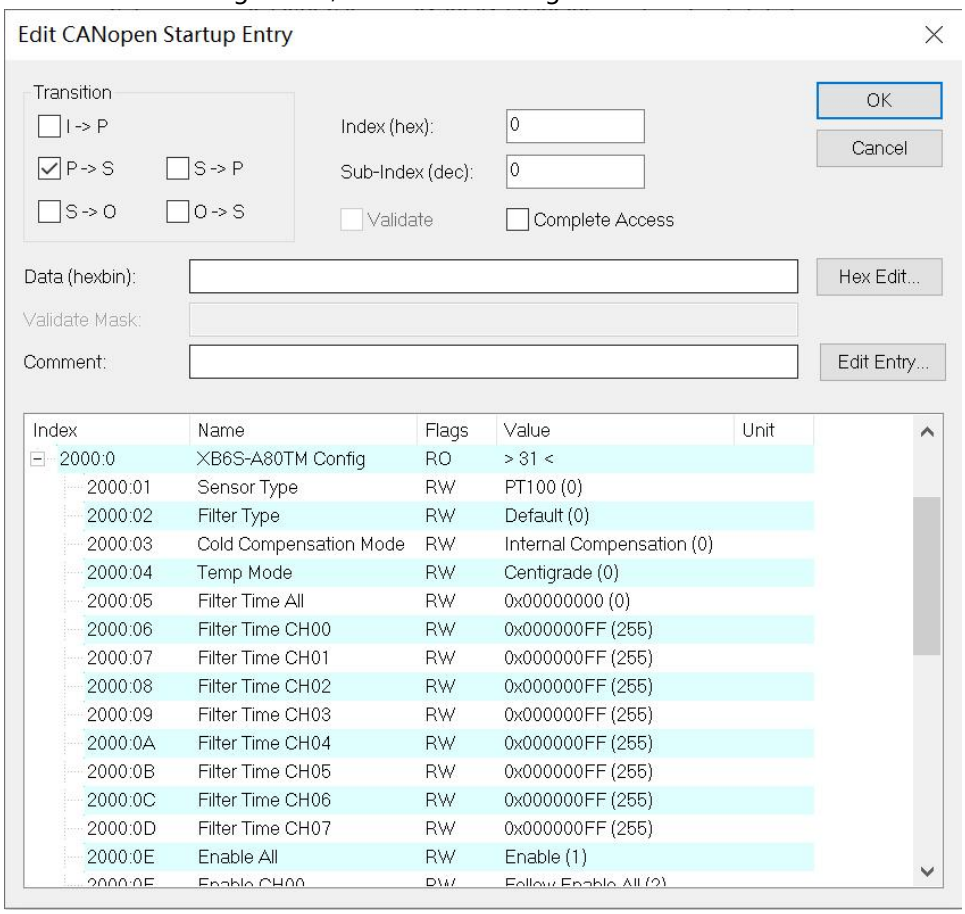


5、Parameter configuration

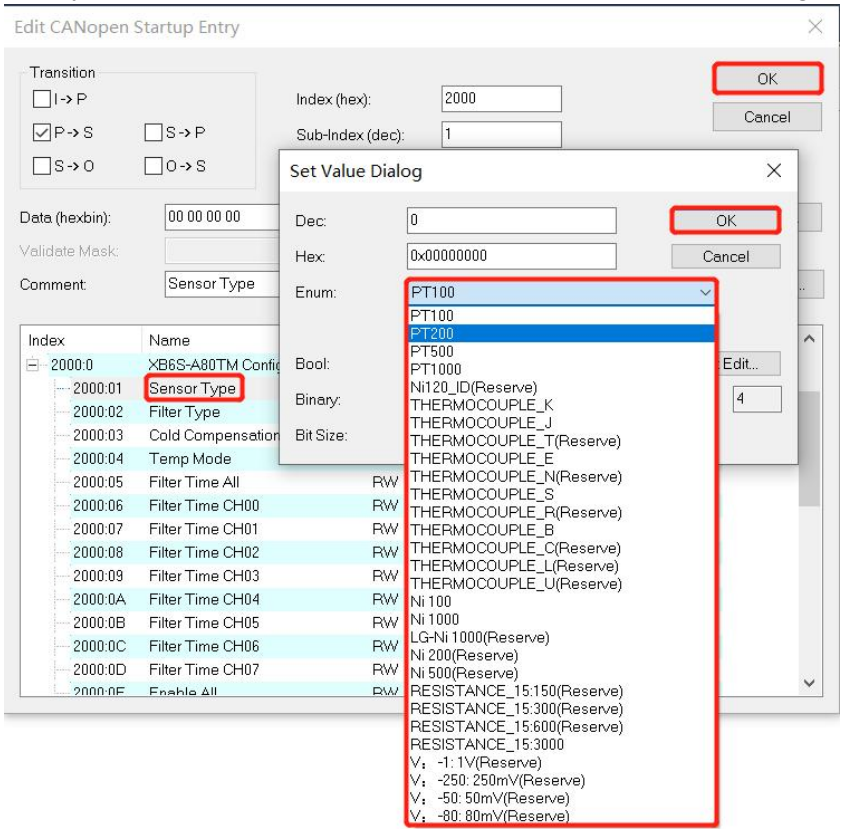
a. Click "Box1 -> Startup -> New" in the left navigation tree to enter the configuration parameter editing page, as shown in the figure below.



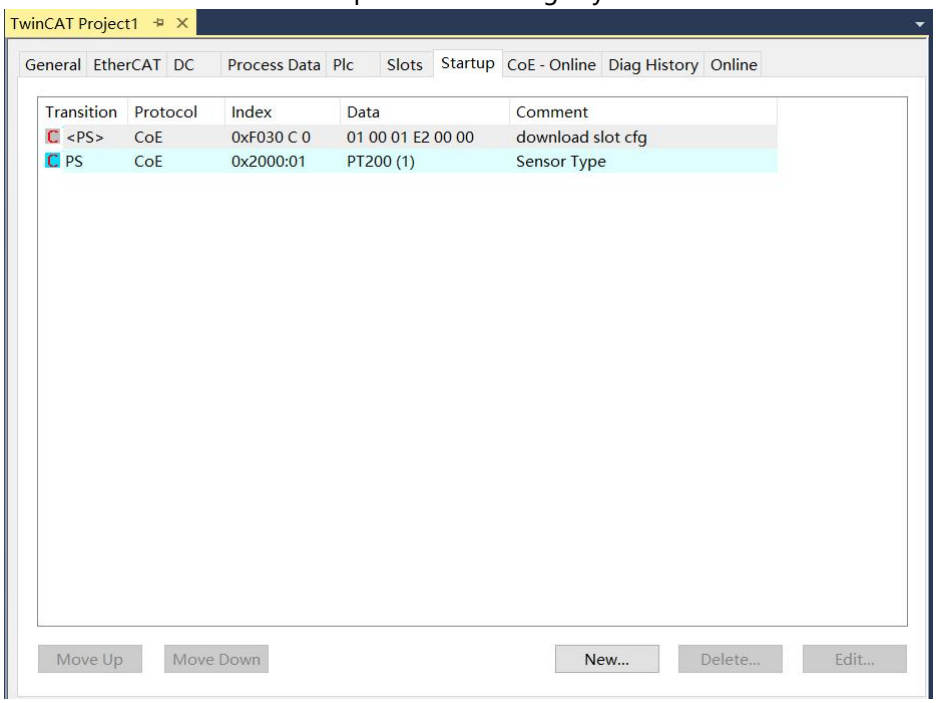
b. Edit CANopen Startup Entry pop-up window, click the "+" in front of Index 2000 : 0 to expand the configuration parameter menu. You can see 28 configuration parameters . Click the parameter to set the related configuration, as shown in the figure below.



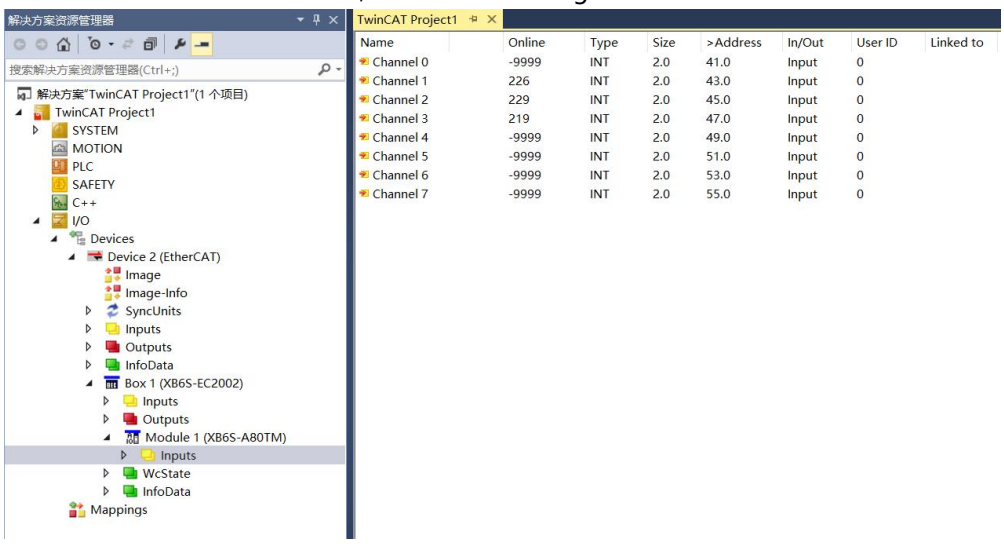
c. For example, to modify the sensor type selection, you can double-click " Sensor Type " and modify the parameter value in the drop-down box, as shown in the figure below.



d. 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.



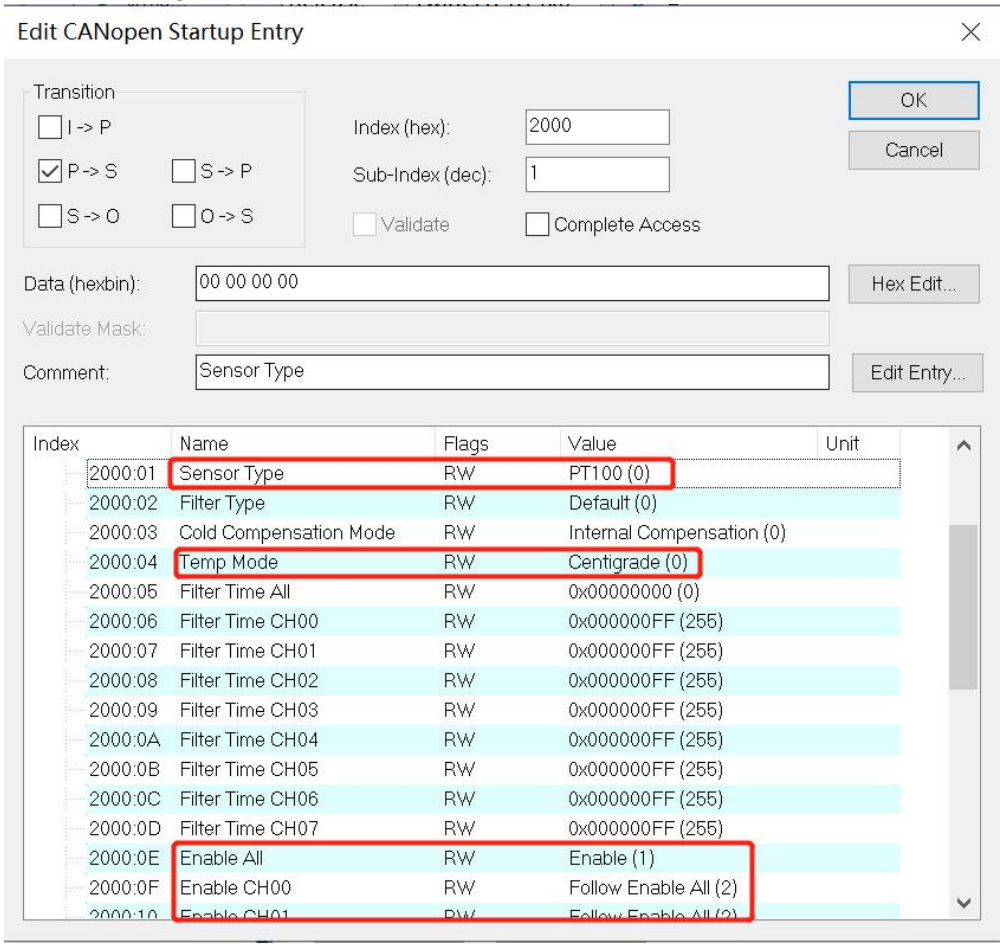
e. In the left navigation tree "Module 1 - > Inputs" displays the module's upstream data and is used to monitor the module's status, as shown in the figure below.



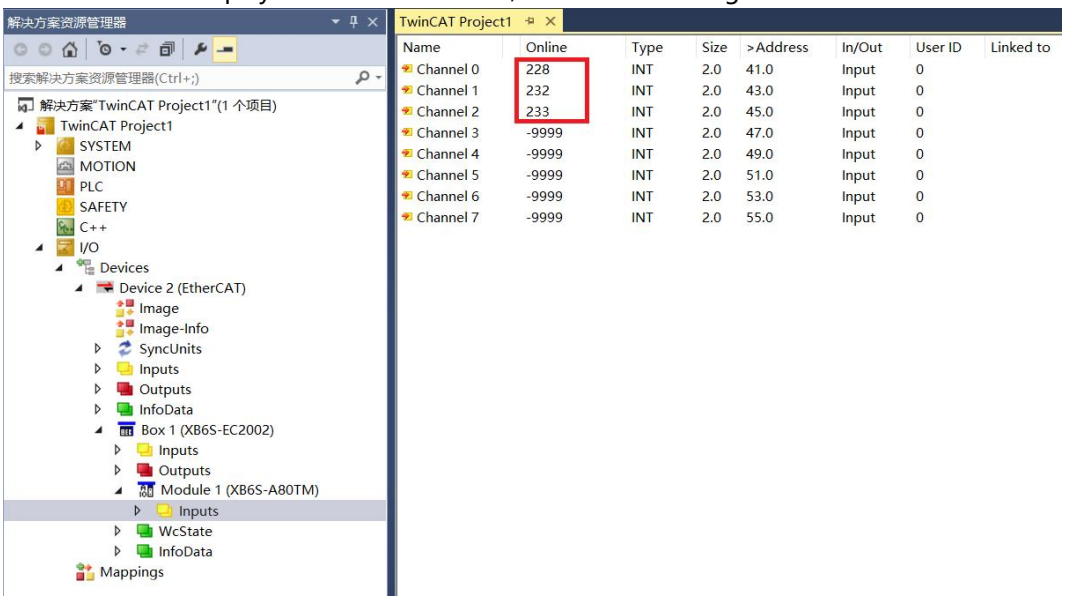
Module Functionality Examples

◆ **Temperature input channel data monitoring**

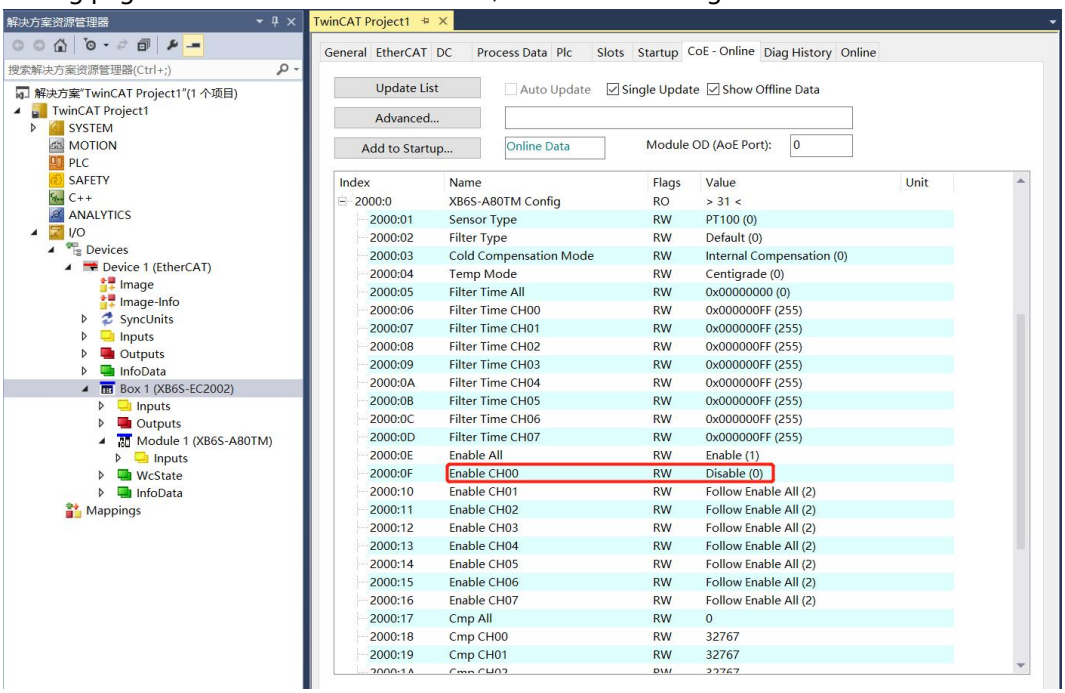
a. Channel 0 ~ Channel 2 are connected to thermistor sensors, and the configuration parameters are configured as needed. Select PT100 as the sensor type , and the temperature measurement unit switch is set to Celsius by default. Channel 0 ~ Channel 2 are set to enable by default, as shown in the figure below.



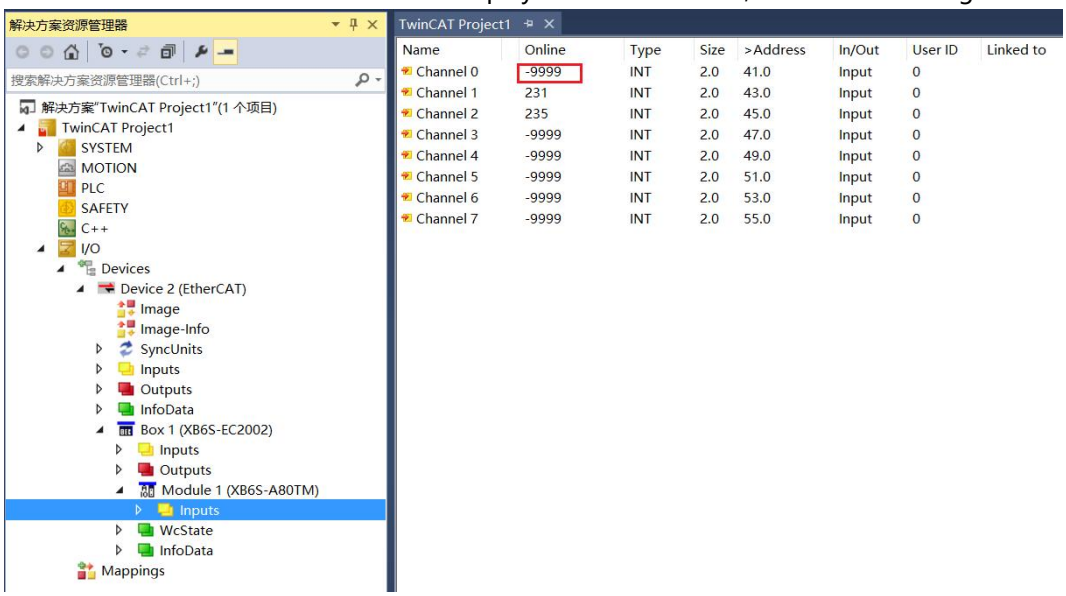
b. It can be seen that the current temperature values of channel 0 to channel 2 are 228 , 232 , and 233, namely 22.8 ℃, 23.2 ℃, and 23.3 ℃ respectively . The other channels are not connected to sensors and the displayed values are - 9999 , as shown in the figure below.



c. Click "Box1 -> CoE-Online" in the left navigation tree to enter the configuration parameter editing page and set channel 0 to disabled, as shown in the figure below.

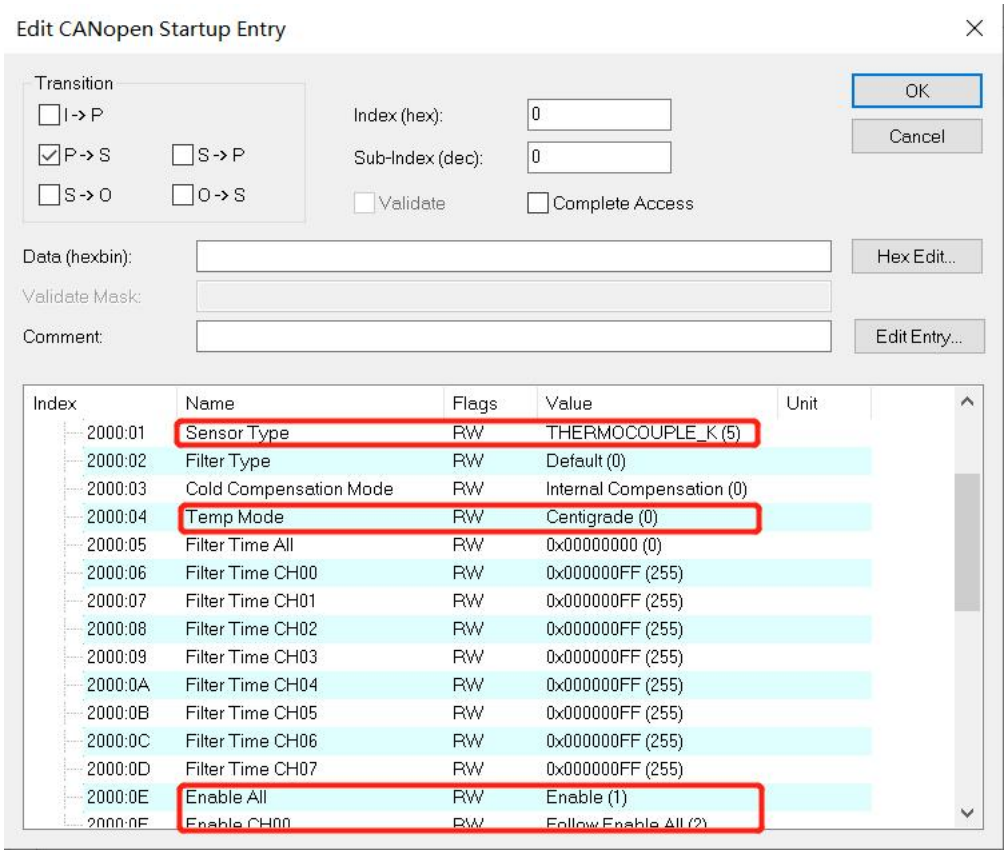


d. You can see that the current channel 0 displays a value of -9999 , as shown in the figure below.

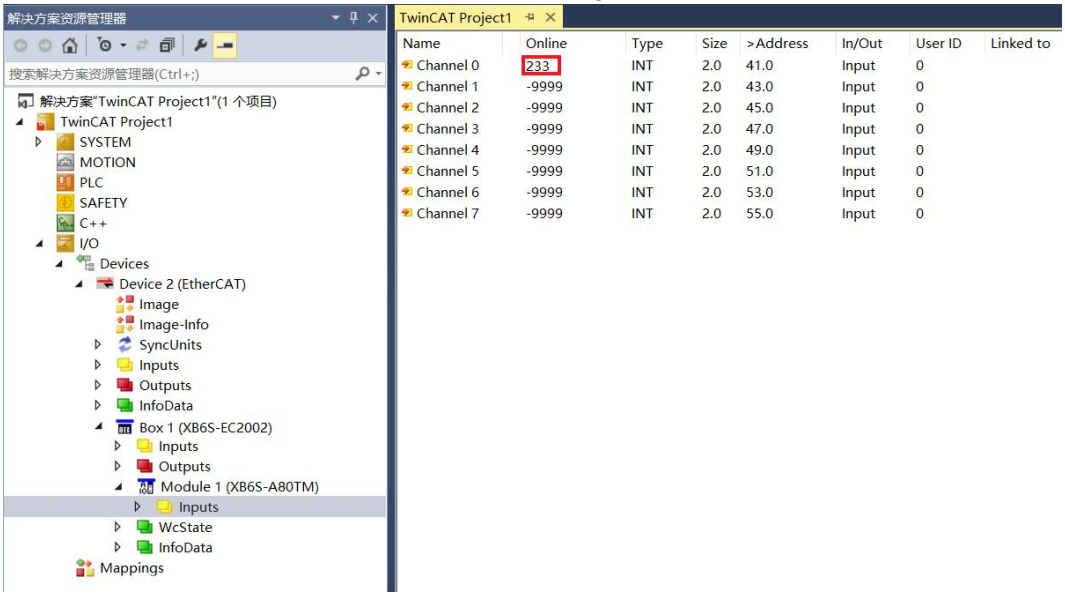


◆ **Temperature compensation function**

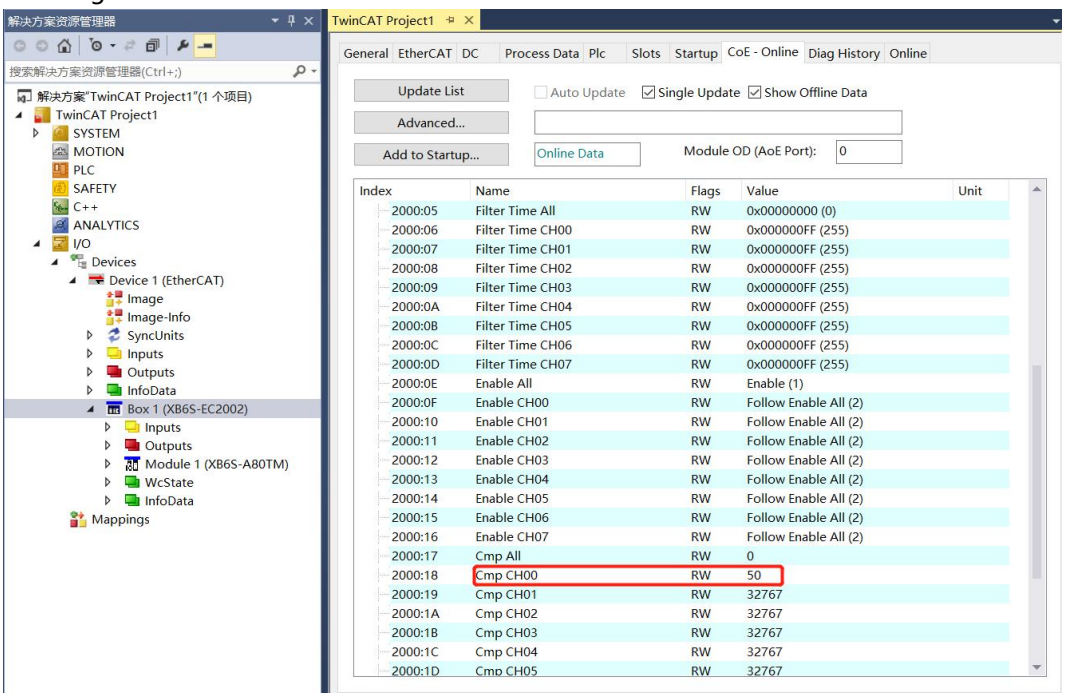
a. Channel 0 is connected to a thermocouple sensor. The configuration parameters are configured as needed. The sensor type is selected as K-type thermocouple. The temperature measurement unit is switched to Celsius by default. Channel 0 is enabled by default, as shown in the figure below.



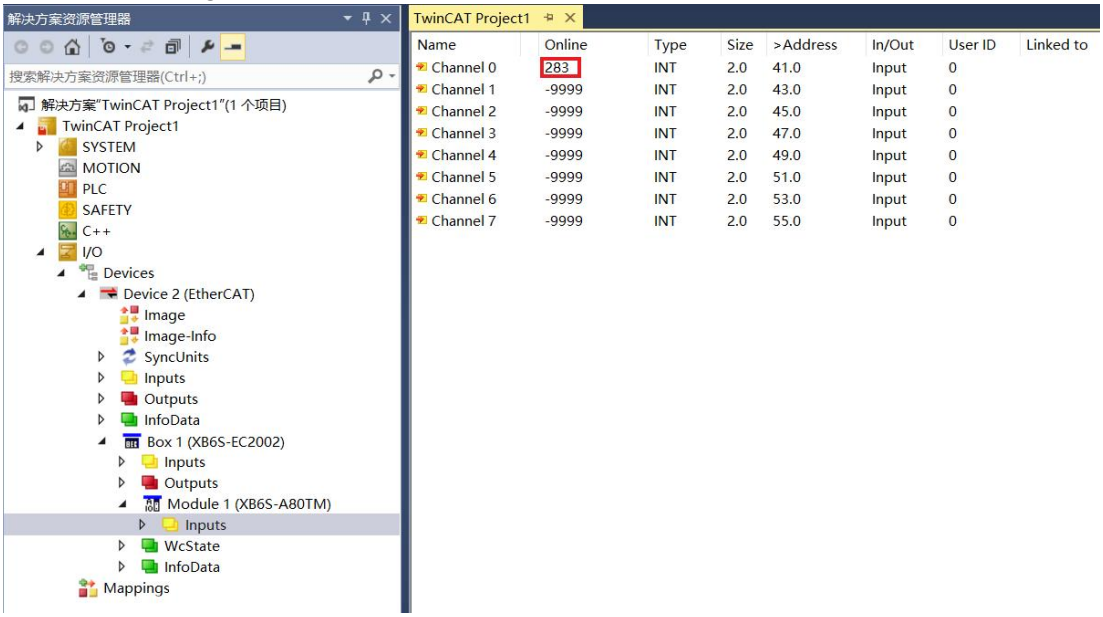
b. Taking module channel 0 as an example, you can see that the temperature value measured by channel 0 is 233 , which is 23.3℃, as shown in the figure below.



c. Click "Box1 -> CoE-Online" in the left navigation tree to enter the configuration parameter editing page and set the channel 0 temperature compensation value to 50, that is, 5°C, as shown in the figure below.

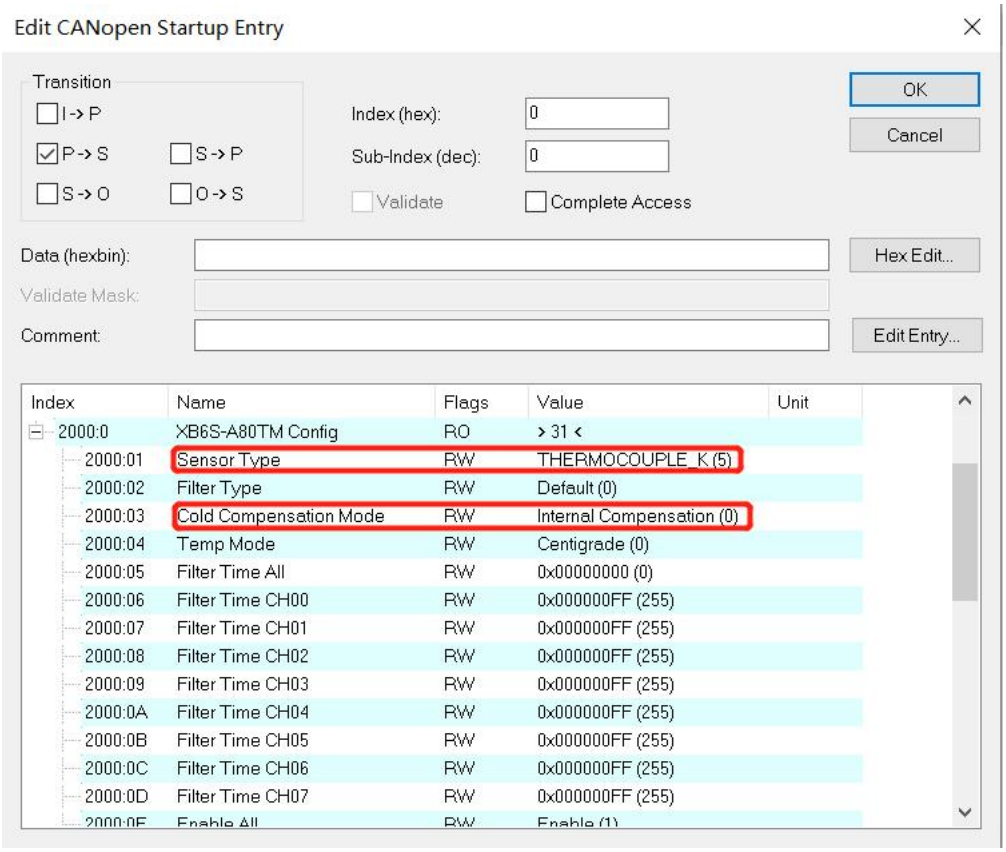


d. After setting the compensation value, the temperature value of channel 0 is 283 , which is 28.3 ℃, as shown in the figure below.

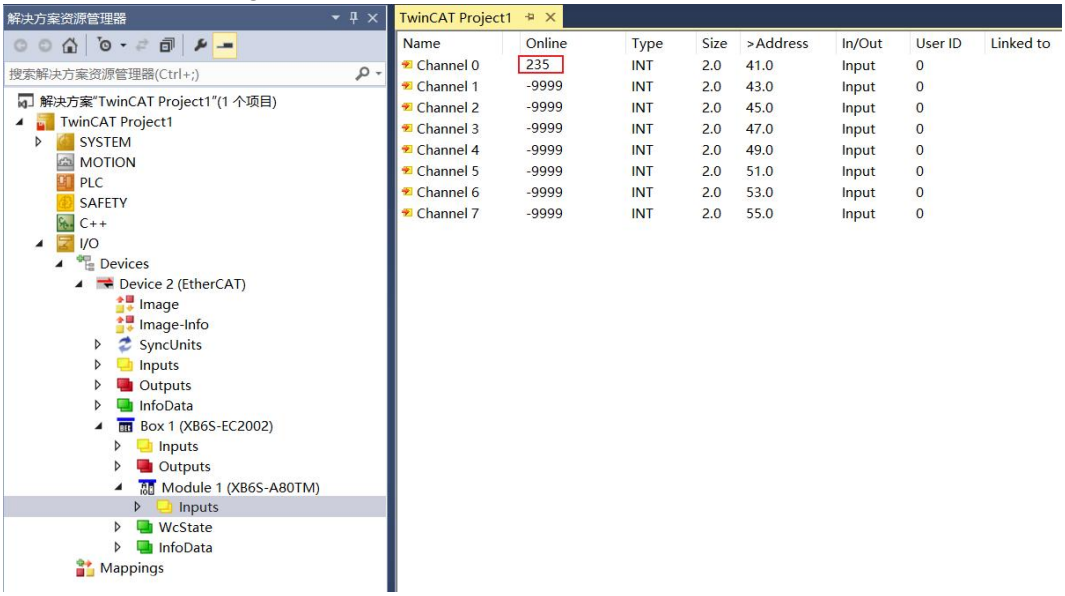


◆ **Temperature cold junction compensation function**

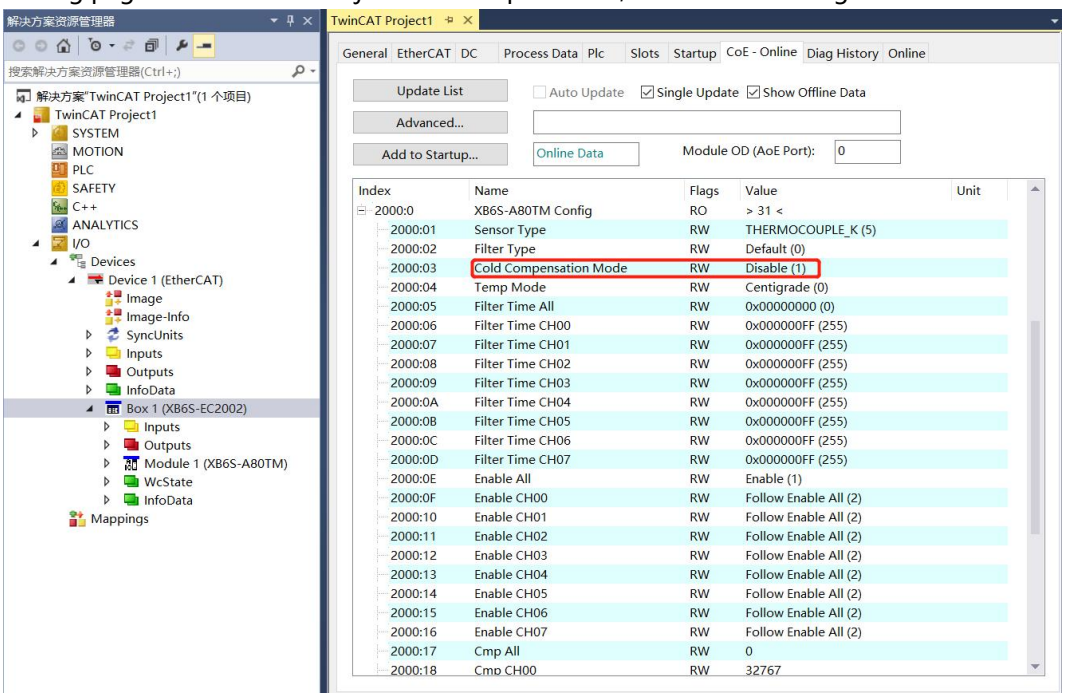
a. Channel 0 is connected to a thermocouple sensor, and the configuration parameters are configured as needed. Select K-type thermocouple as the sensor type, and set the cold junction compensation to on, as shown in the figure below.



b. You can see the temperature value when the cold junction compensation of channel 0 is turned on, as shown in the figure below.



c. Click "Box1 -> CoE-Online" in the left navigation tree to enter the configuration parameter editing page and turn off cold junction compensation, as shown in the figure below.



d. the temperature value when the cold junction compensation of channel 0 is turned off, as shown in the figure below.