RC Series

Temperature acquisition module

User Manual

Table of contents

1 Product Overview

1.1 Product Introduction

RC series temperature acquisition modules support 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 our RC series coupler modules.

1.2 Product Features

- Measurement types support RTD, thermocouple and resistor
- Sensitivity: 0.1℃
- Support single channel filter setting
- Support single channel enable setting
- Disconnect detection is supported for RTD, resistor, and thermocouple type sensors
- Support 50Hz suppression

2 Product Parameters

2.1 General parameters

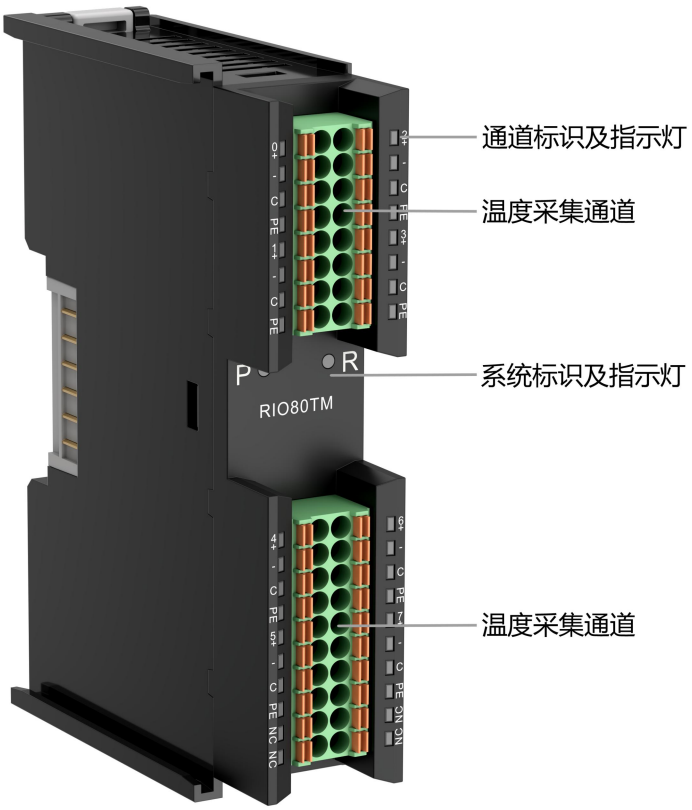
Interface parameters	
Product Model	RIO80TM/RIO40TM
Product Name	RC series temperature acquisition module
Bus protocol	X-bus
Transfer rate	6 Mbps
Station Type	Slave
power supply	5 VDC, powered by X-bus
Rated current consumption	80 mA
Technical Parameters	
Specifications and dimensions	106×73×25.7 mm
weight	120 g
Operating temperature	-10~+60℃
Storage temperature	-20~+75℃
Relative humidity	95%, non-condensing
Protection level	IP20
EMI Characteristics	Compliant with EN IEC61000-6-4-2019
EMS Features	Compliant with EN IEC61000-6-2-2019
Vibration resistance	Complies with EN 60068-2-6
Impact resistance	Complies with EN 60068-2-27/29

Technical Parameters			
Number of channels	4, 8		
Sensor Type	Thermocouple	Thermal resistor	resistance
Connection	2-wire	2-wire, 3-wire	2-wire
	K:-200~1370℃ J:-200~1200℃ E: -200~1000℃ S: -50~1690℃ B: 50~1800℃	Pt100:−200~850℃ Pt200:−200~600℃ Pt500:−200~600℃ Pt1000:−200~600℃	15Ω~3kΩ
Accuracy	±0.3%	±1℃	±0.1%
Sensitivity	0.1℃		±0.1Ω
Resolution	16bit (int type)		
Conversion time (all channels filter level is1 o'clock)	110ms	125 ms	
Filtering	Single channel filtering, configurable (level 1 to 10)		
Disconnection detection	Both support		
Disconnection detection time	2ms		
Maximum input voltage allowed by the channel	30VDC		
Electrical isolation	500VAC, no isolation between channels		
Channel indicator light	greenLED Light		
Overflow and underflow functions	support		

3 panel

3.1 Module Structure

Product Parts Name



3.2 Indicator light function

Logo	color	state	describe
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.
Channel indication	green	Always on	The channel is enabled and the sensor is connected normally
		Off	The channel is prohibited or the sensor is not connected normally

4 wiring

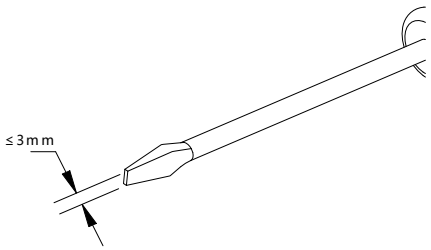
4.1 Terminal Blocks

Terminal Blocks		
Signal line terminal	Number of poles	16 P
	Number of poles	20 P
	Wire diameter	28~16 AWG 0.2~1.5 mm²

4.2 Wiring instructions and requirements

Wiring tool requirements

The terminal adopts a screw-free design, and the installation and removal of the cable can be operated with a flat-blade screwdriver (specification: ≤3 mm) operation.



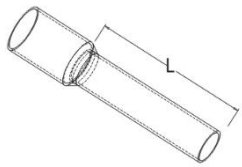
Stripping length requirements

Recommended stripping length 10 mm.

Wiring method

After stripping the corresponding length of the single-strand hard wire, press the button andSingle strand guideWireinsert.

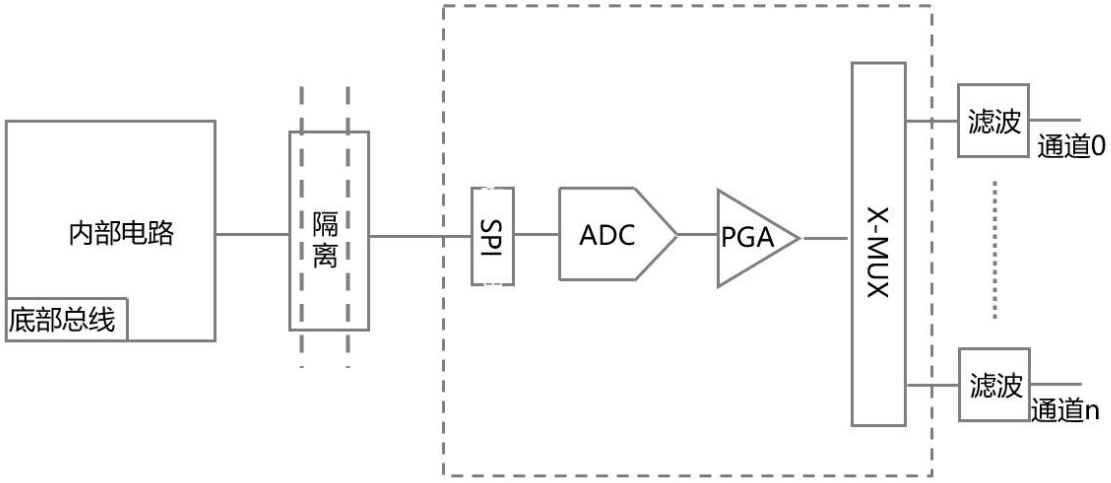
For multi-strand flexible wires, after stripping the wires to the corresponding length, you can directly connect them or use cold-pressed terminals of corresponding standard specifications (tubular insulated terminals, as shown in the following table) to insert the wires while pressing the button.

Specifications of tubular insulation terminals		
Specifications	**model**	**Conductor cross-sectional area mm²**
 The length of the tubular insulated terminal L is ≥10 mm	E0510	0.5
	E7510	0.75
	E7512	
	E1010	1.0
	E1012	
	E1510	1.5
	E1518	

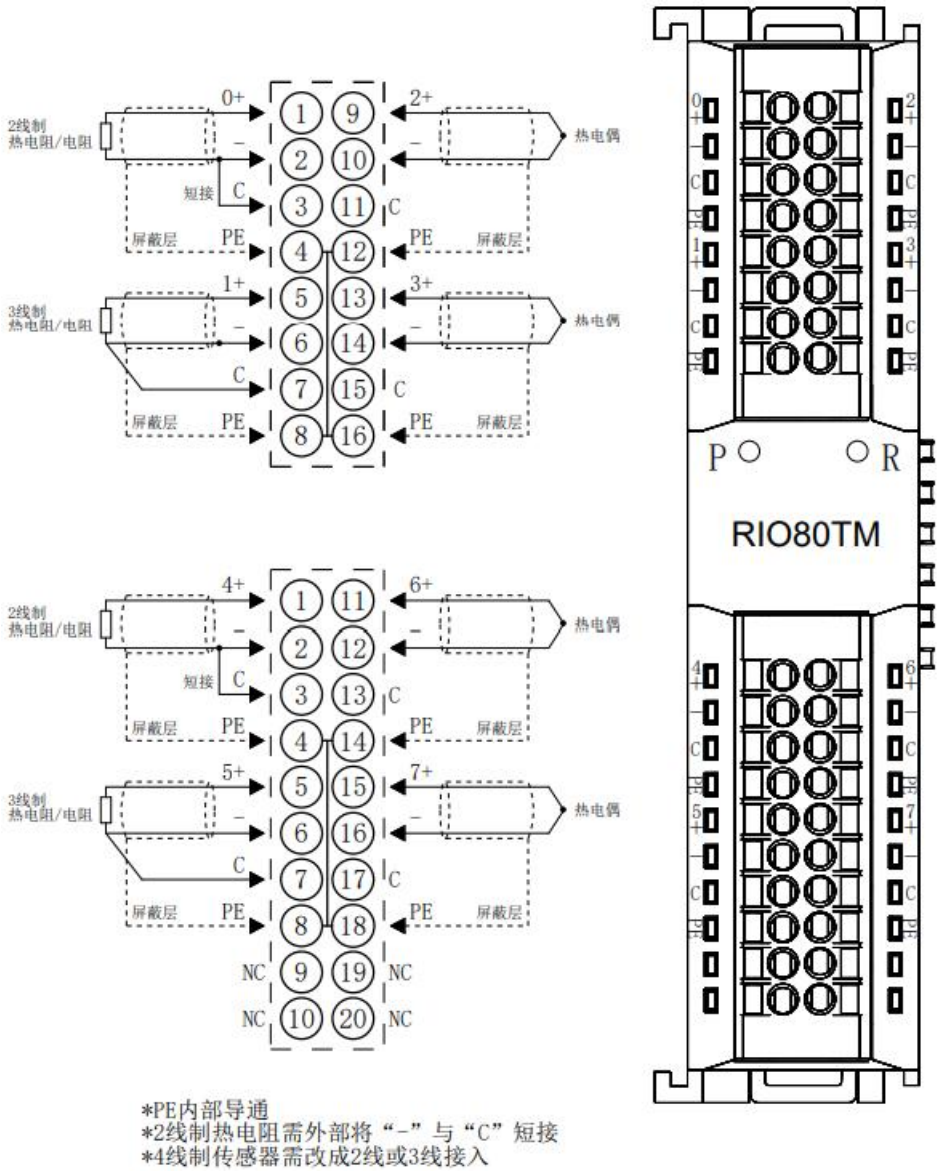
4.3 Wiring Diagram

4.3.1 Electrical Block Diagram

Electrical Block Diagram

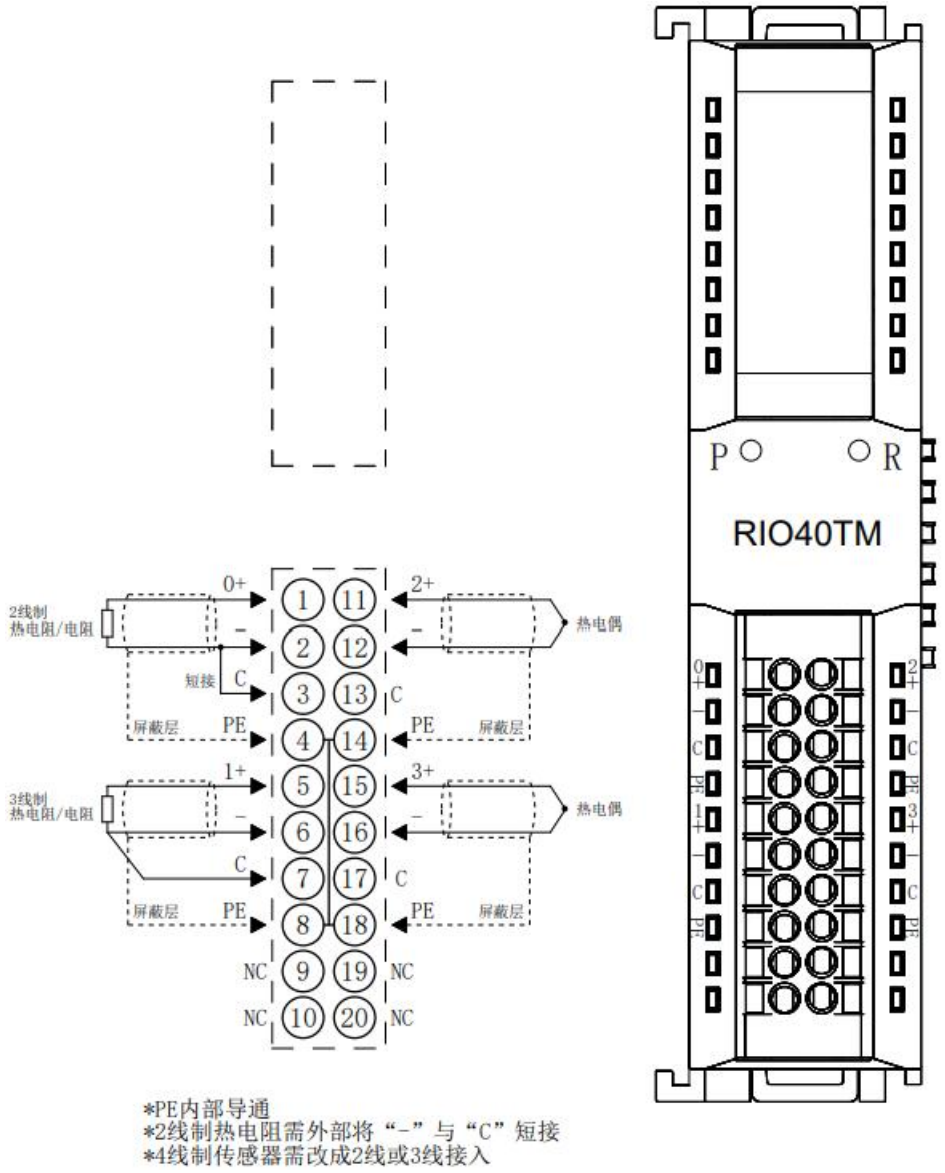

内部电路
底部总线
隔离
SPI
ADC
PGA
X-MUX
滤波
通道0
滤波
通道n

4.3.2 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

4.3.3 RIO40TM



*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

5 use

5.1 Parameter settings and functions

5.1.1 Sensor Type Selection

The module supports sensor type configuration function (for sensor types, see2 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.

5.1.2 Filter function

A single channel of the module can filter each measured value through the filtering function, and perform sliding average processing on the previous N acquisition data to reduce the jitter range of the measured value, thereby improving stability and accuracy.
Filter time = module cycle number (N) × module cycle time
Module cycle time = conversion time + disconnection detection time
Note: ① N configuration range 1~10.
② Filter parameter default setting: 1/time.

5.1.3 Channel enable function

The module can determine whether a channel is used by setting the "Enable/Disable" parameter. If a channel is set to be disabled, the channel is disabled regardless of whether the sensor is connected.show-9999.
Note: All channels are set to Disable by default when leaving the factory.

5.2 Uplink and downlink process data and functions

5.2.1 Temperature/resistance data acquisition

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.

5.2.2 Disconnection Detection

Each channel of the temperature acquisition module supports disconnection detection. When any channel is not connected to a sensor or the sensor is connected incorrectly, the upstream data (Input) displays -9999. Thermocouples (TC), thermal resistors (RTDs), and resistance sensors all support disconnection detection, and display -9999 when disconnected.

5.2.3 Data compensation function

The module's downstream data (Output) is a manual compensation function for each channel data. The data compensation value can be entered according to actual needs. After setting the compensation value, the compensated temperature or resistance value will be automatically calculated in the upstream data (Input), that is, the upstream data is the final compensated temperature or resistance data. Divide the read data by 10 to get the compensated temperature or resistance value in ℃ or Ω.

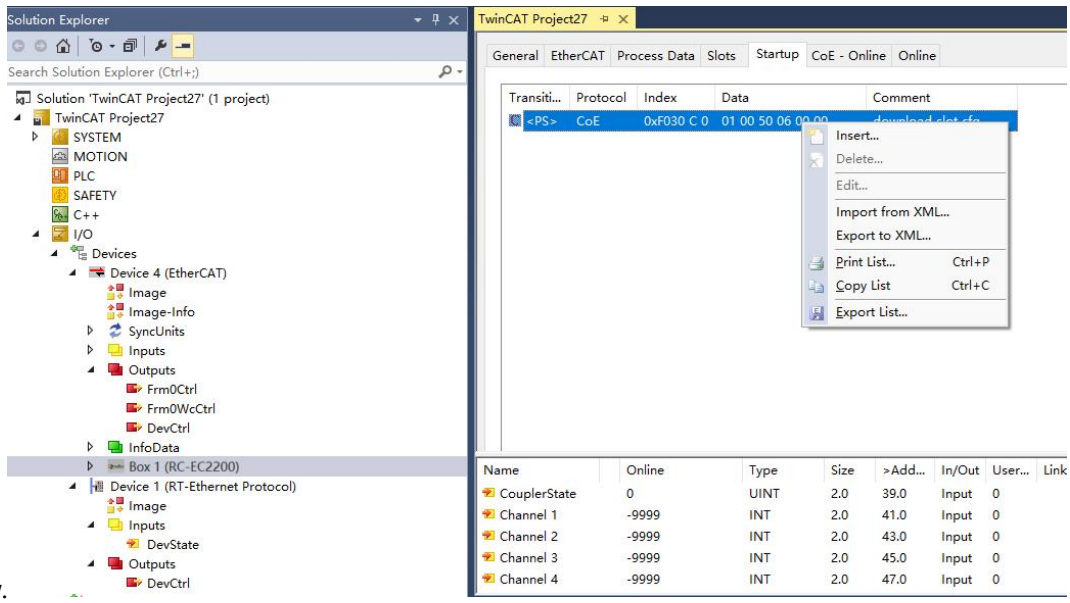
5.3 Use and parameter configuration in TwinCAT3 software environment

The module needs to be used with the "RC-EC2200" coupler.

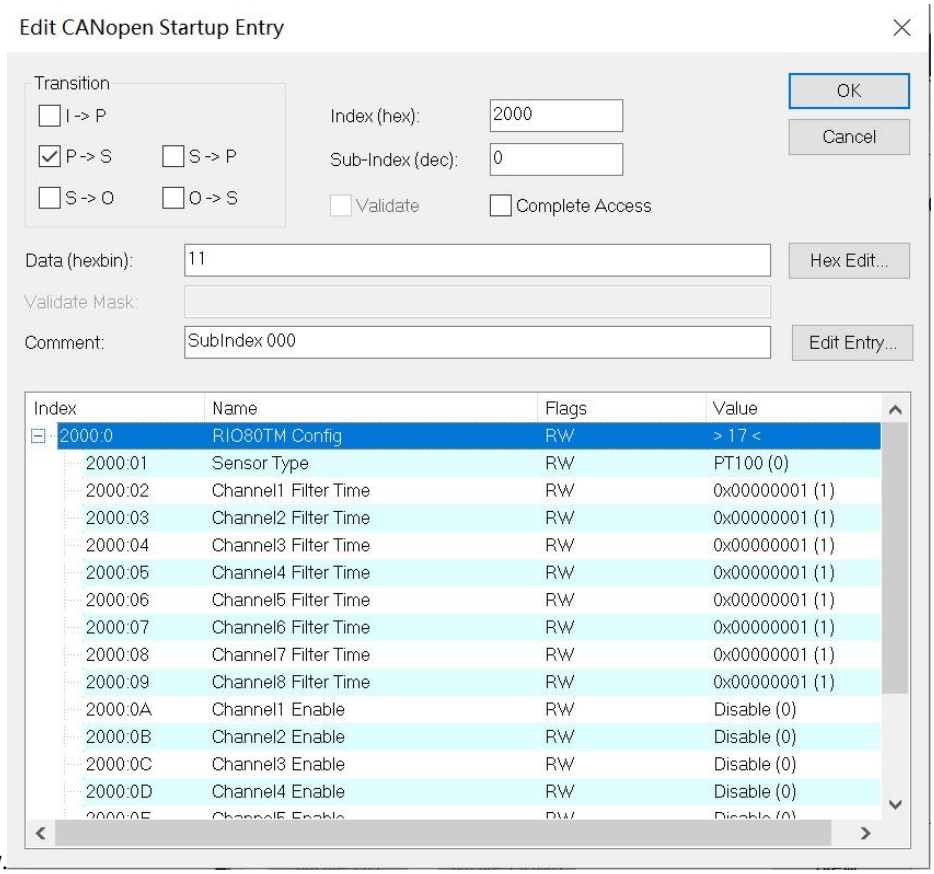
For details on adding and configuring module configuration files, see the usage section of the "RC-EC2200 Coupler Plug-in IO User Manual".

1. Sensor Type Selection

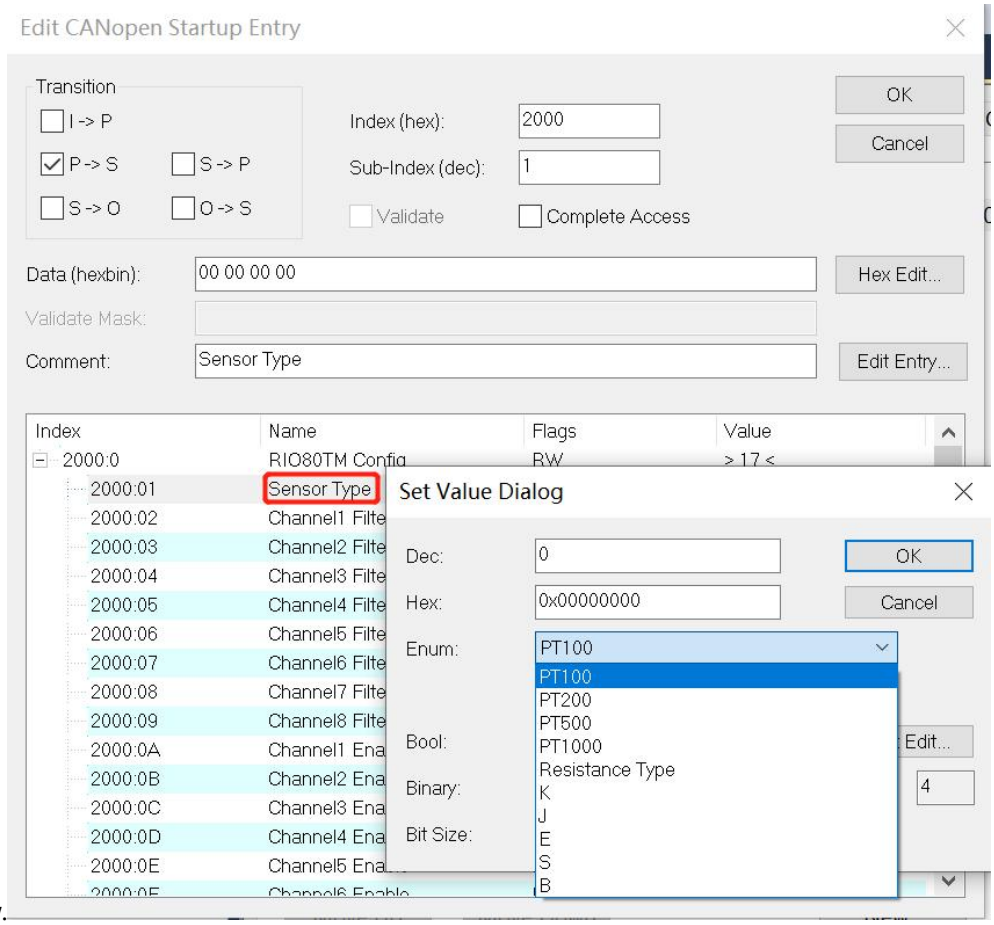
a. Double-click Box1 (RC-EC2200) and switch to the "Startup" tab, as shown in the figure below.



b. Right click and select "Insert" to enter the "Edit CANopen Startup Entry" interface, as shown in the figure below.



c. Select an existing module, such as "RIO80TM", click "Sensor Type", and select the sensor to be used in the "Set Value Dialog" interface, as shown in the figure below.

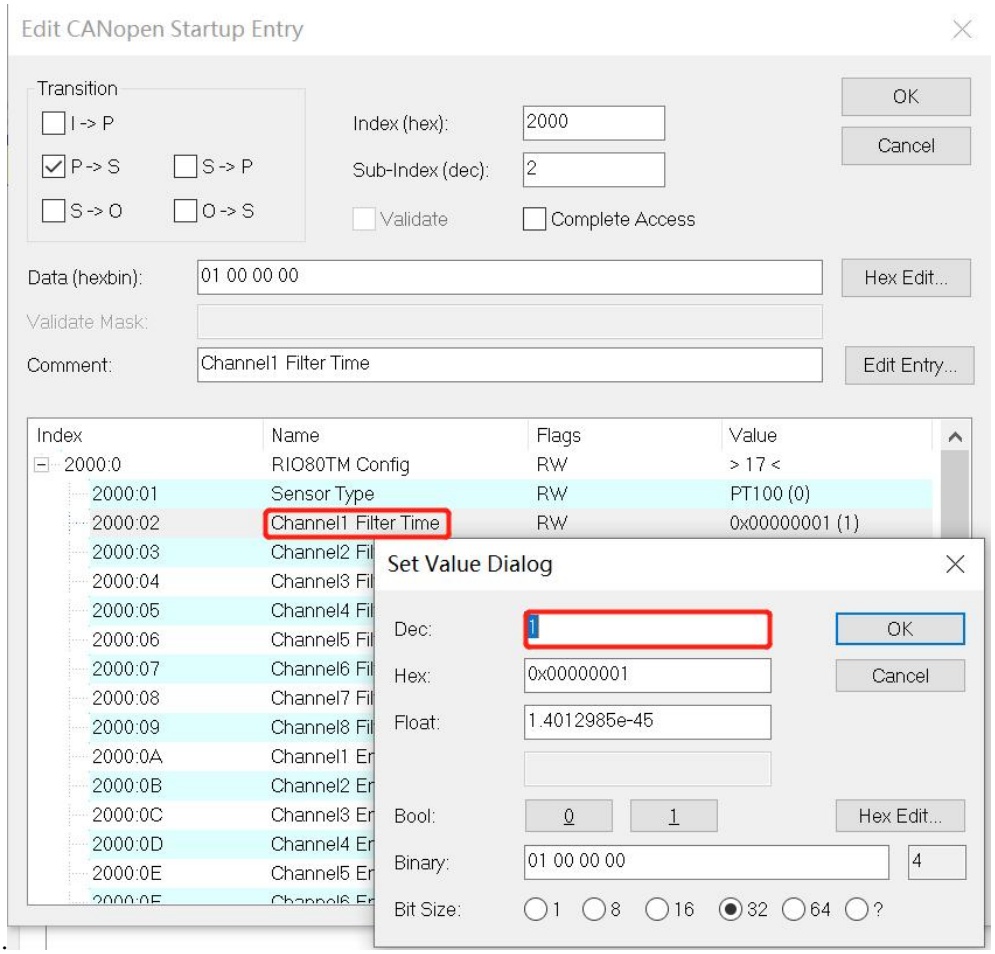


After the configuration is completed, the software needs to be reloaded and the module needs to be powered on again.

2. Filter configuration

a. Enter the "Edit CANopen Startup Entry" interface.

b. Select the channel of the module to be modified and modify the filter value as needed.

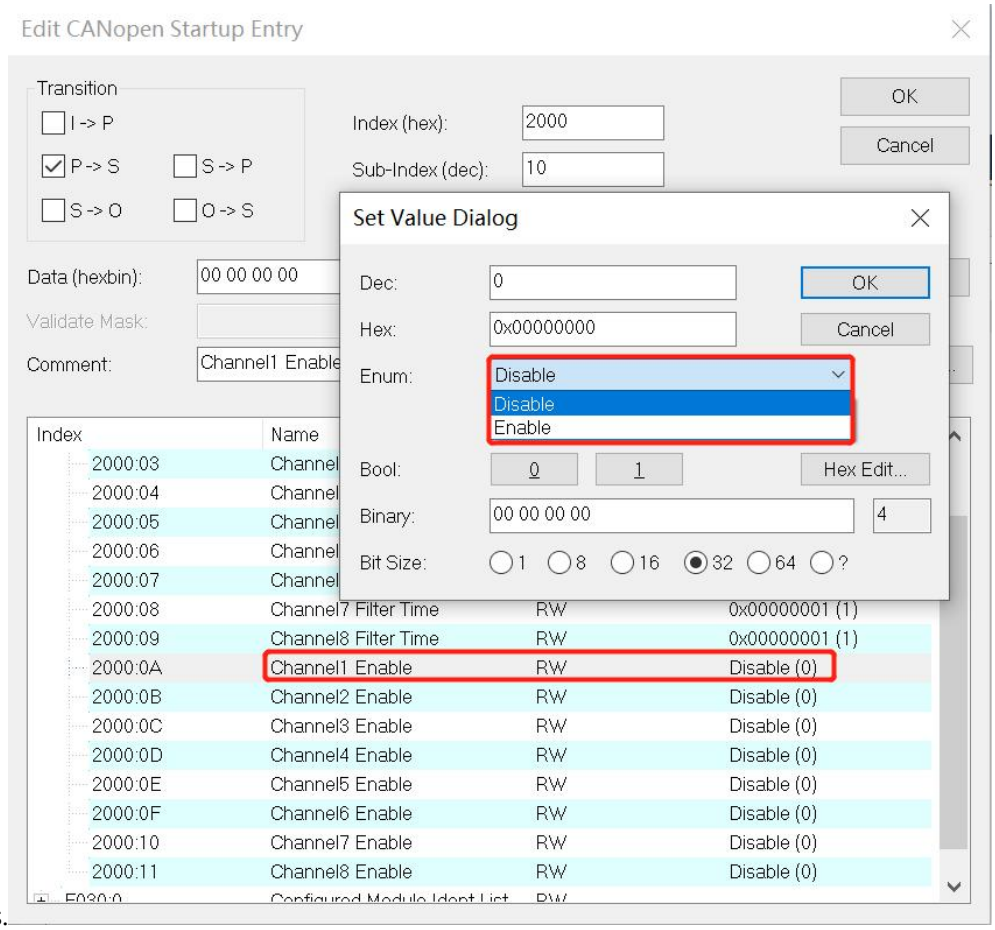


After the configuration is completed, the software needs to be reloaded and the module needs to be powered on again.

3. Channel Enable

a. Enter the "Edit CANopen Startup Entry" interface.

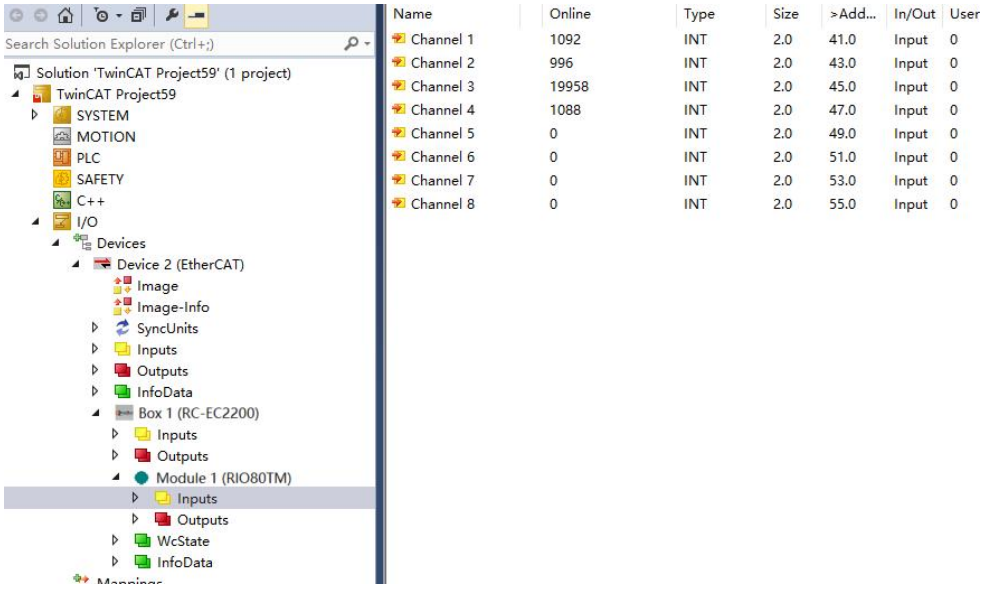
b. Select the channel of the module to be modified and modify the enable parameters.



After the modification is completed, you need to perform the Reload operation and power on the module again.

4. Data Interaction

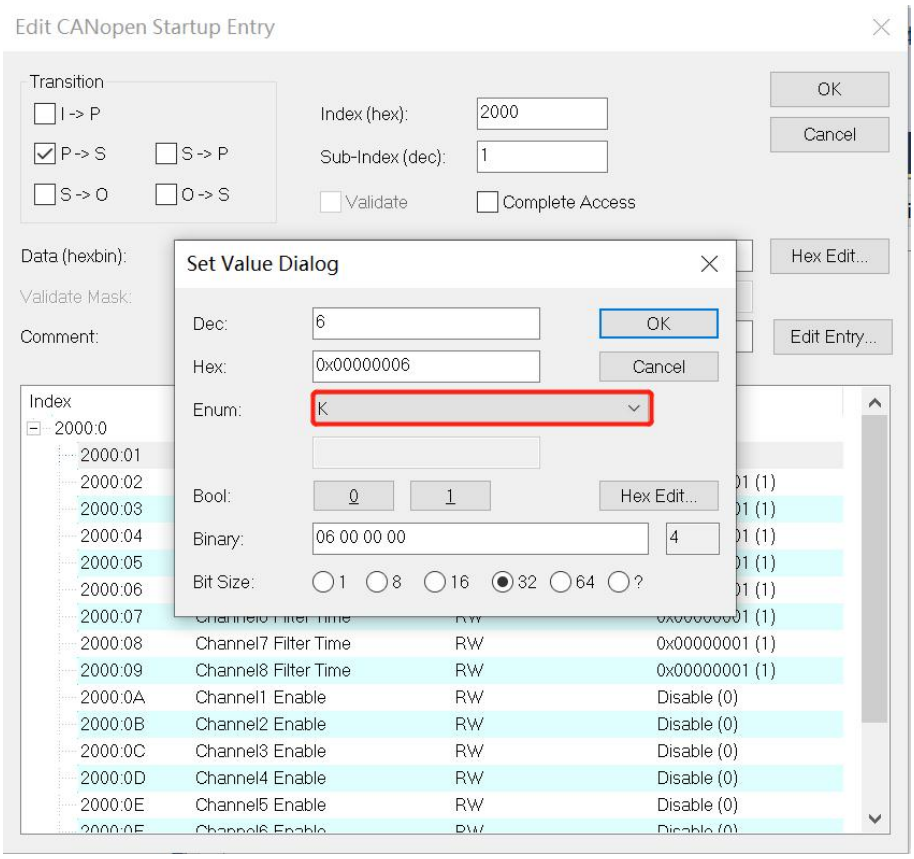
a. Take the RIO80TM module as an example: if the module has signal input, it can be monitored in the "Inputs" of the module, as shown in the figure below.



Input register information table (read-only attribute) The temperature is a 2-byte signed integer, which is 10 times the actual temperature. The read data divided by 10 is the actual temperature or resistance value in ℃ or Ω.

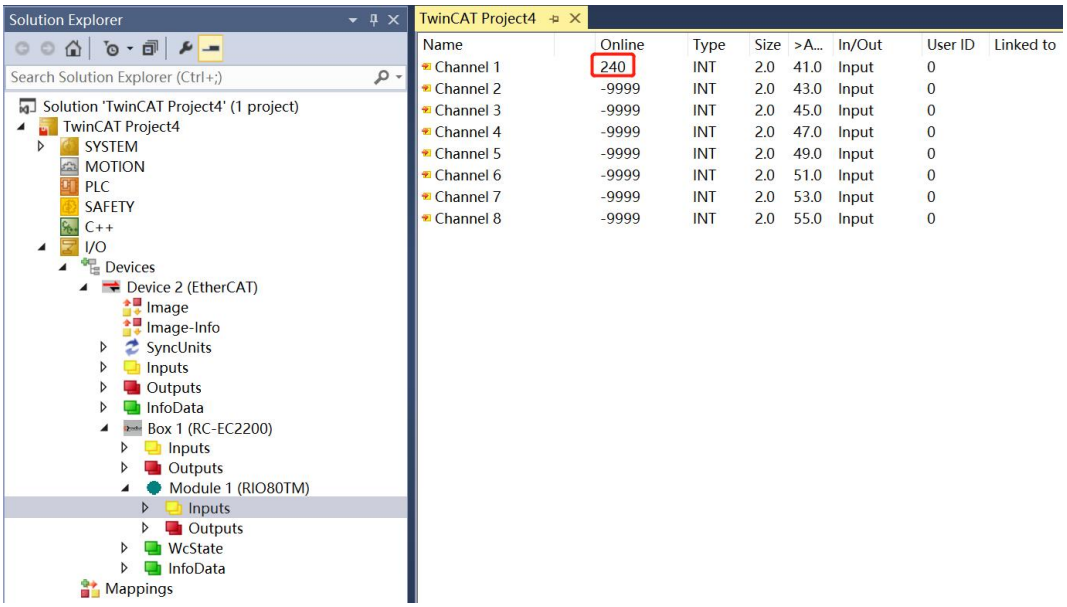
5. Temperature compensation

a. The temperature compensation function only supports thermocouple type sensors. Take the RIO80TM module as an example. Channel 1 is connected to a thermocouple sensor, and the sensor type is selected as K-type thermocouple, as shown in the figure below.

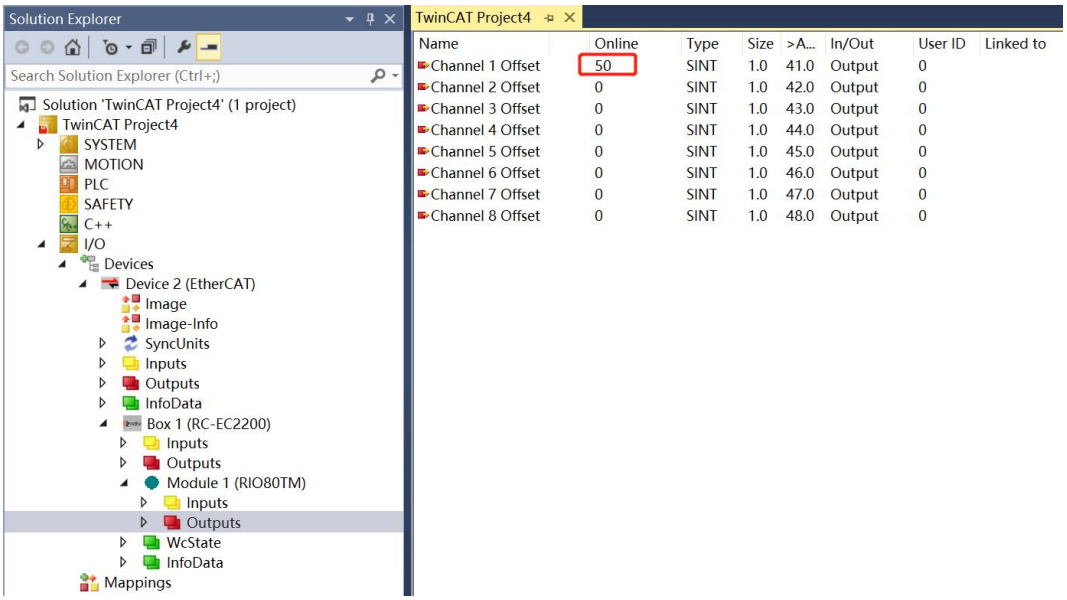


After the modification is completed, you need to perform the Reload operation and power on the module again.

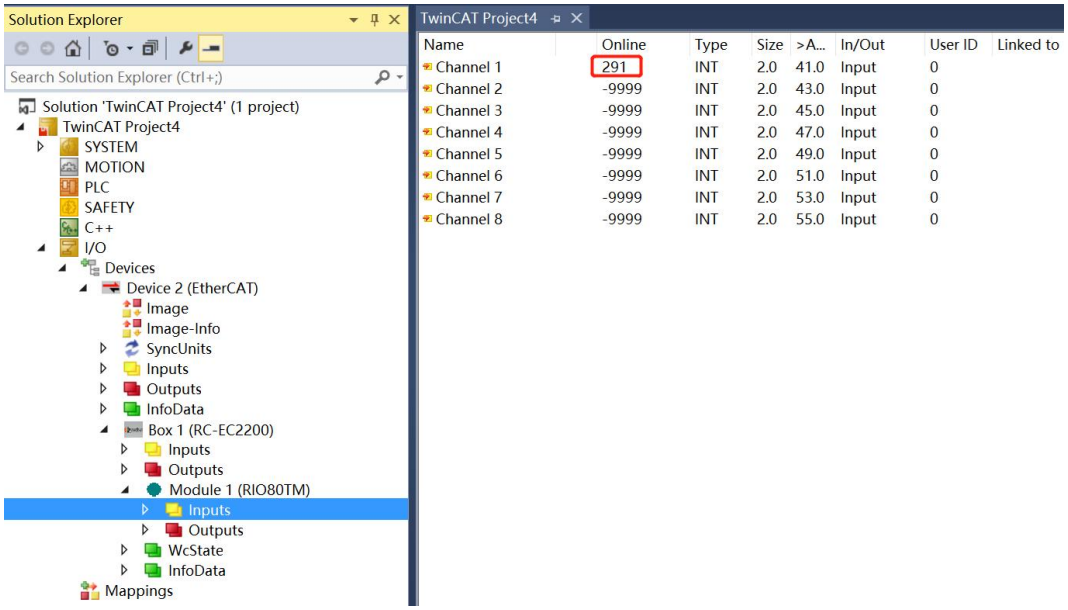
b. After channel 1 is enabled, the measured temperature is 24°C, as shown in the figure below.



c. In the "Outputs" of the module, you can set the temperature compensation value to 50, i.e. 5°C, as shown in the figure below.


Solution Explorer
Search Solution Explorer (Ctrl+;)
Solution 'TwinCAT Project4' (1 project)
TwinCAT Project4
SYSTEM
MOTION
PLC
SAFETY
C++
I/O
Devices
Device 2 (EtherCAT)
Image
Image-Info
SyncUnits
Inputs
Outputs
InfoData
Box 1 (RC-EC2200)
Inputs
Outputs
Module 1 (RIO80TM)
Inputs
Outputs
WcState
InfoData
Mappings
TwinCAT Project4
Name Online Type Size >A... In/Out User ID Linked to
Channel 1 Offset 50 SINT 1.0 41.0 Output 0
Channel 2 Offset 0 SINT 1.0 42.0 Output 0
Channel 3 Offset 0 SINT 1.0 43.0 Output 0
Channel 4 Offset 0 SINT 1.0 44.0 Output 0
Channel 5 Offset 0 SINT 1.0 45.0 Output 0
Channel 6 Offset 0 SINT 1.0 46.0 Output 0
Channel 7 Offset 0 SINT 1.0 47.0 Output 0
Channel 8 Offset 0 SINT 1.0 48.0 Output 0

d. After setting the compensation value, the temperature of channel 1 is 29°C, as shown in the figure below.



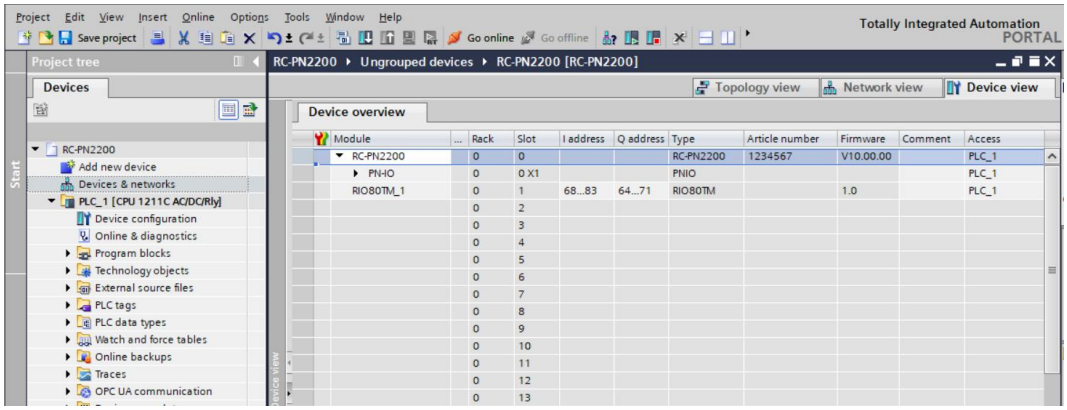
5.4 Usage and parameter configuration in TIA Portal V14 software environment

The module needs to be used with the "RC-PN2200" coupler.

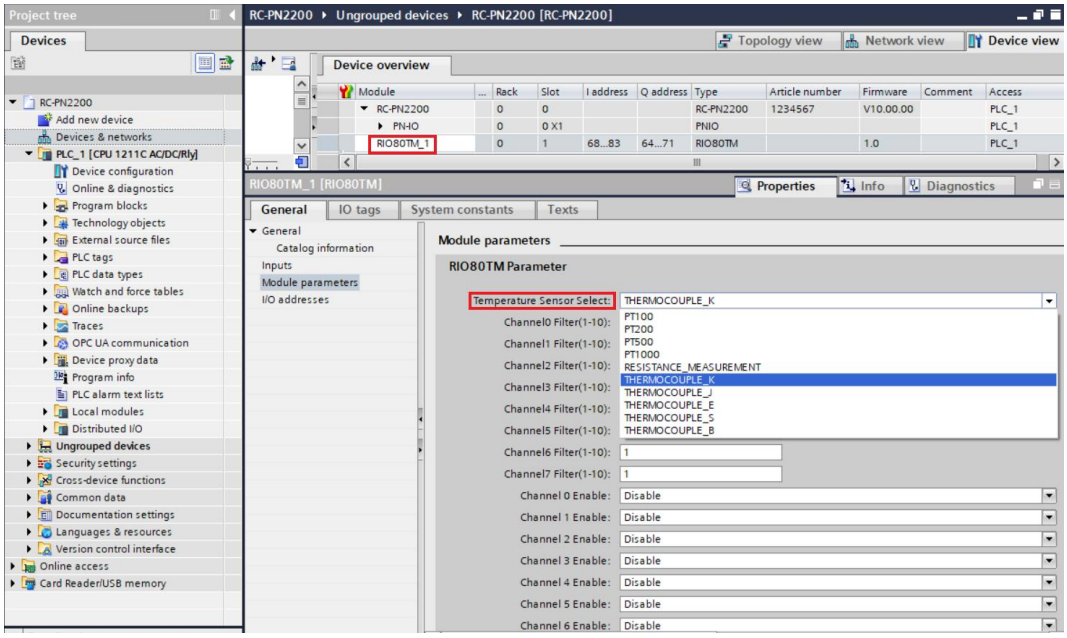
For details on adding and configuring module configuration files, see the usage section of the "RC-PN2200 Coupler Plug-in IO User Manual".

1. Sensor Selection

a. Open the Device View, as shown below.



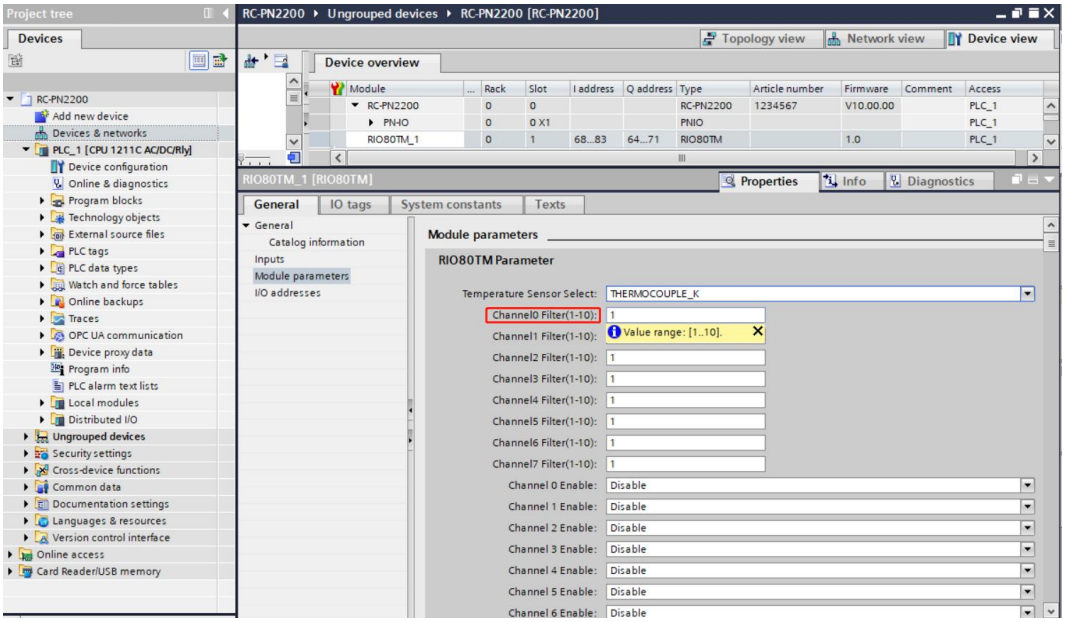
b. In offline state, select an existing module, in this case "RIO80TM", select the corresponding channel, and set the sensor parameters, as shown in the figure below.



***After the modification is completed, download the program and power on the module again**.

2. Filter parameter settings

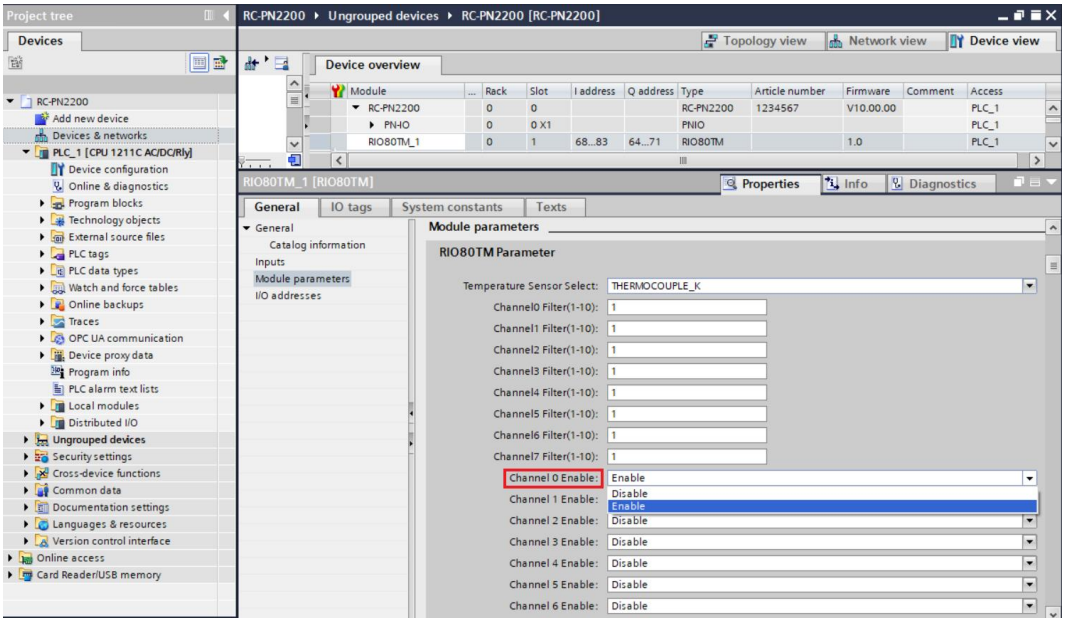
In the "Device View" menu page, select a module of an existing model, in this case "RIO80TM", select the corresponding channel, and set the filter parameters, as shown in the figure below.



***After the modification is completed, download the program and power on the module again**.

3. Channel enable function

In the "Device View" menu page, select a module of an existing model, in this case "RIO80TM", select the corresponding channel, and set the enable parameters, as shown in the figure below.

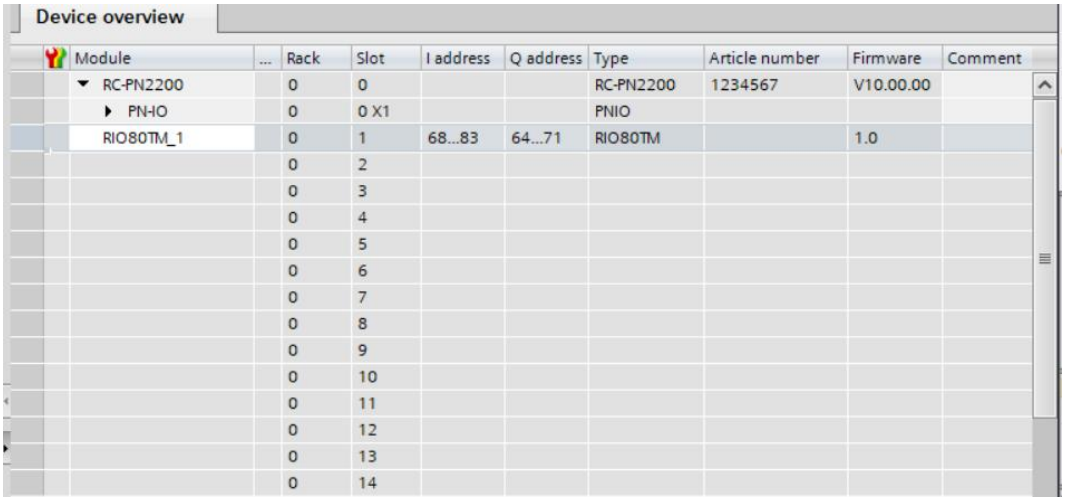


***After the modification is completed, download the program and power on the module again.**

4. Data Display

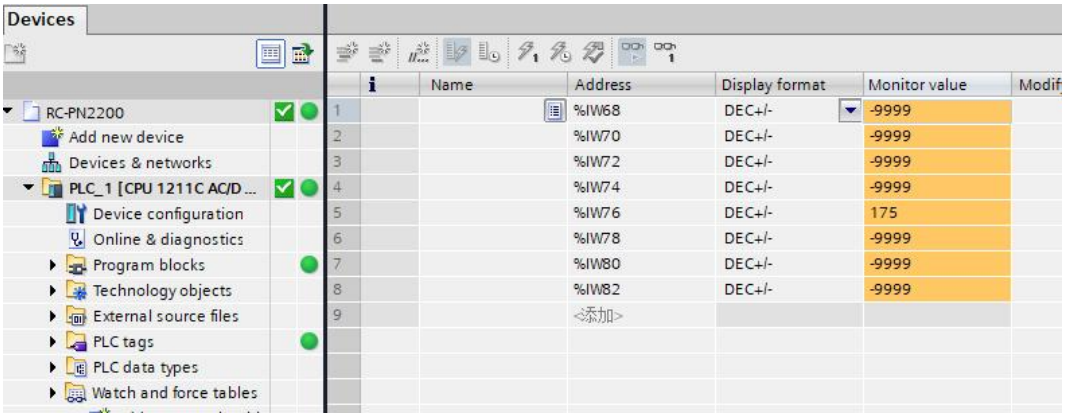
- **IO mapping address**

Click "Device View". Under the "Device Overview" menu folder, you can find the address assigned by the system software to the I/O module, and you can also modify the address as needed, as shown in the figure below.



- **Data Validation**

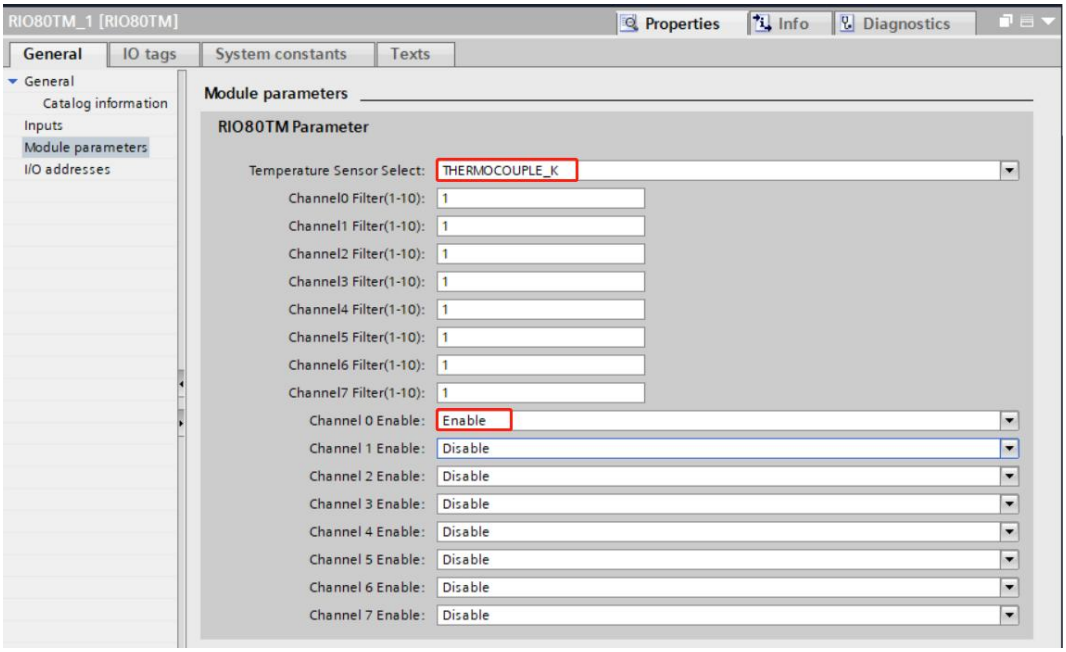
Double-click "Add New Monitoring Table", enter the module channel address, and click  button to monitor the input data, as shown in the figure below.



Input register information table (read-only attribute) The temperature is a 2-byte signed integer, which is 10 times the actual temperature. The read data divided by 10 is the actual temperature or resistance value in ℃ or Ω.

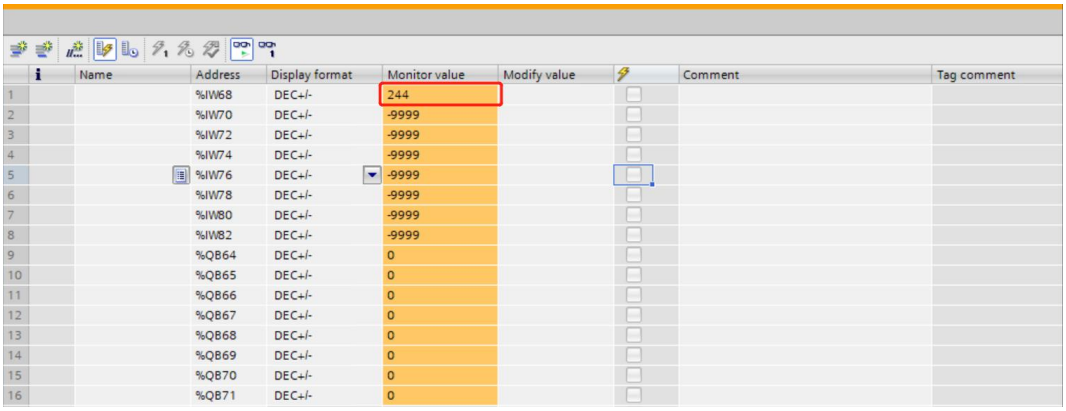
5. Temperature compensation

a. The temperature compensation function only supports thermocouple type sensors. Take the RIO80TM module as an example. Channel 1 is connected to a thermocouple sensor, the sensor type is K-type thermocouple, and channel 1 is enabled, as shown in the following figure.



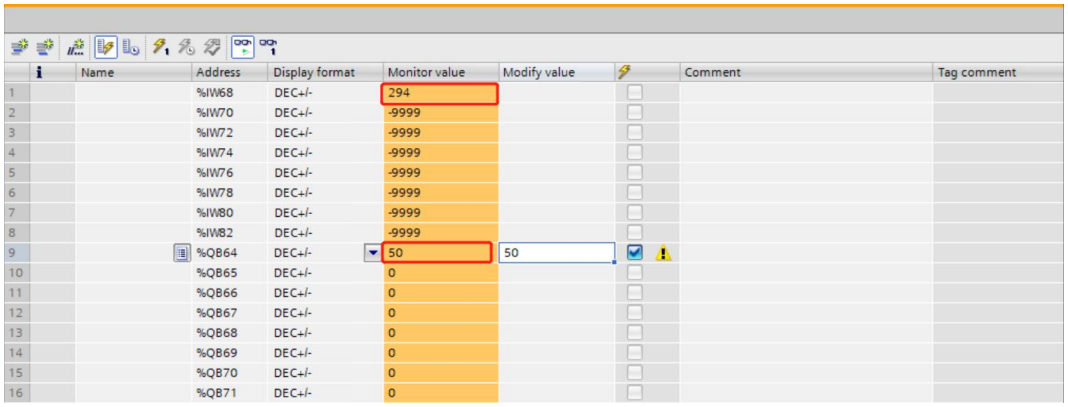
***After the modification is completed, download the program and power on the module again.**

b. Check channel 1 in the monitoring table and the measured temperature is 24.4°C, as shown in the figure below.



	Name	Address	Display format	Monitor value	Modify value	Comment	Tag comment
1		%IW68	DEC+/-	244			
2		%IW70	DEC+/-	-9999			
3		%IW72	DEC+/-	-9999			
4		%IW74	DEC+/-	-9999			
5		%IW76	DEC+/-	-9999			
6		%IW78	DEC+/-	-9999			
7		%IW80	DEC+/-	-9999			
8		%IW82	DEC+/-	-9999			
9		%QB64	DEC+/-	0			
10		%QB65	DEC+/-	0			
11		%QB66	DEC+/-	0			
12		%QB67	DEC+/-	0			
13		%QB68	DEC+/-	0			
14		%QB69	DEC+/-	0			
15		%QB70	DEC+/-	0			
16		%QB71	DEC+/-	0			

c. In the monitoring table output control QB64~QB71, set the temperature compensation value to 50, that is, 5°C. After setting the compensation value, the temperature of channel 1 is 29.4°C, as shown in the figure below.



	Name	Address	Display format	Monitor value	Modify value	Comment	Tag comment
1		%IW68	DEC+/-	294			
2		%IW70	DEC+/-	-9999			
3		%IW72	DEC+/-	-9999			
4		%IW74	DEC+/-	-9999			
5		%IW76	DEC+/-	-9999			
6		%IW78	DEC+/-	-9999			
7		%IW80	DEC+/-	-9999			
8		%IW82	DEC+/-	-9999			
9		%QB64	DEC+/-	50	50		
10		%QB65	DEC+/-	0			
11		%QB66	DEC+/-	0			
12		%QB67	DEC+/-	0			
13		%QB68	DEC+/-	0			
14		%QB69	DEC+/-	0			
15		%QB70	DEC+/-	0			
16		%QB71	DEC+/-	0			