Blue Guardian Temperature Control-Precise Temperature Regulation

TEC Thermostat (TTD7004) User Manual

V1.05

Update record of specification			
Date	Edition	Update content	Remarks
2025-01-20	V1.00	TTD7004 User Manual	
2025-03-07	V1.01	Optimize the description of part of the specification	
2025-04-03	V1.02	Correct the parameter description in <1.4>	
2025-07-09	V1.03	Edit description	
2025-07-19	V1.04	Optimize description content	
2025-08-28	V1.05	Edit description	

If you encounter any difficulties or technical issues while using the TEC thermostat, please feel free to contact us. We will provide you with the most satisfactory and prompt technical support. We also welcome your valuable feedback.

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pay attention to

Due to device version upgrades or other reasons, this document may be updated periodically. This manual is for internal reference only and will not be updated separately.

scope of application

This instruction manual is applicable to the use of **TEC Thermostat (TTD7004)**.

Catalogue

Preface

Company Profile

Guangzhou Blue Guardian is a high-tech enterprise specializing in industrial temperature control, automation control, and information system integration. It provides precision temperature control, environmental monitoring, and industrial data interconnection solutions for industries including optoelectronics manufacturing, semiconductors, thermal equipment, new energy, rubber and plastics, as well as research institutions and universities.

With the mission of 'Smart Temperature Control for More Efficient and Safe Industries', the company provides customers with a series of temperature control products featuring high-precision data acquisition and intelligent control algorithms. These include modular thermostats, TEC thermostats, integrated thermostats, power regulators, I/O acquisition modules, protocol gateways, and host computer software platforms.

unit type

Device name	Model	Remarks
TEC thermostat	TTD7004	

Suitable Object

Applicable to:

R&D engineer, technical support engineer, end user

Brief Introduction of the Content

This document describes the usage of TEC thermostats as follows.

Chapters and sections	Content	Remarks
1 Device Features	Introduce the overall functional performance index parameters of the equipment	
2 Device installation and connection	Introduction to Equipment Installation and Wiring Marking	
3 Device Application and Debugging	Introduction to Network and Debugging Equipment of Device Application	
4 Common faults	Introduction to Common Equipment Faults and Troubleshooting	
5 Maintenance	Introducing equipment maintenance	
6 safety requirements	Safety Tips for Using the Device	

1 Device Features

About this chapter

Chapters and sections	Content	Remarks
1.1 Device Overview	Display device basic information	
1.2 demonstration of the type	Introduce the device model and combination usage instructions	
1.3 Device Features	Introduction to the basic features of the device	
1.4 thermostat parameter	Display device specifications	

1.1 Device Overview

The TEC thermostat is a highly integrated temperature control device that combines temperature acquisition with bidirectional DC temperature control output, enabling direct drive.

The DC load (such as TEC cooling elements) eliminates the cumbersome steps of external collectors and solid-state relays. This thermostat operates based on real-time data acquisition.

The temperature value (PV) and the user-set target value (SV) are used to intelligently calculate the PID control ratio and adjust the cooling/heating power via PWM.

The device's output enables precise temperature control. Additionally, it is equipped with a 100Mbps high-speed network interface for easy connection with upper-level systems.

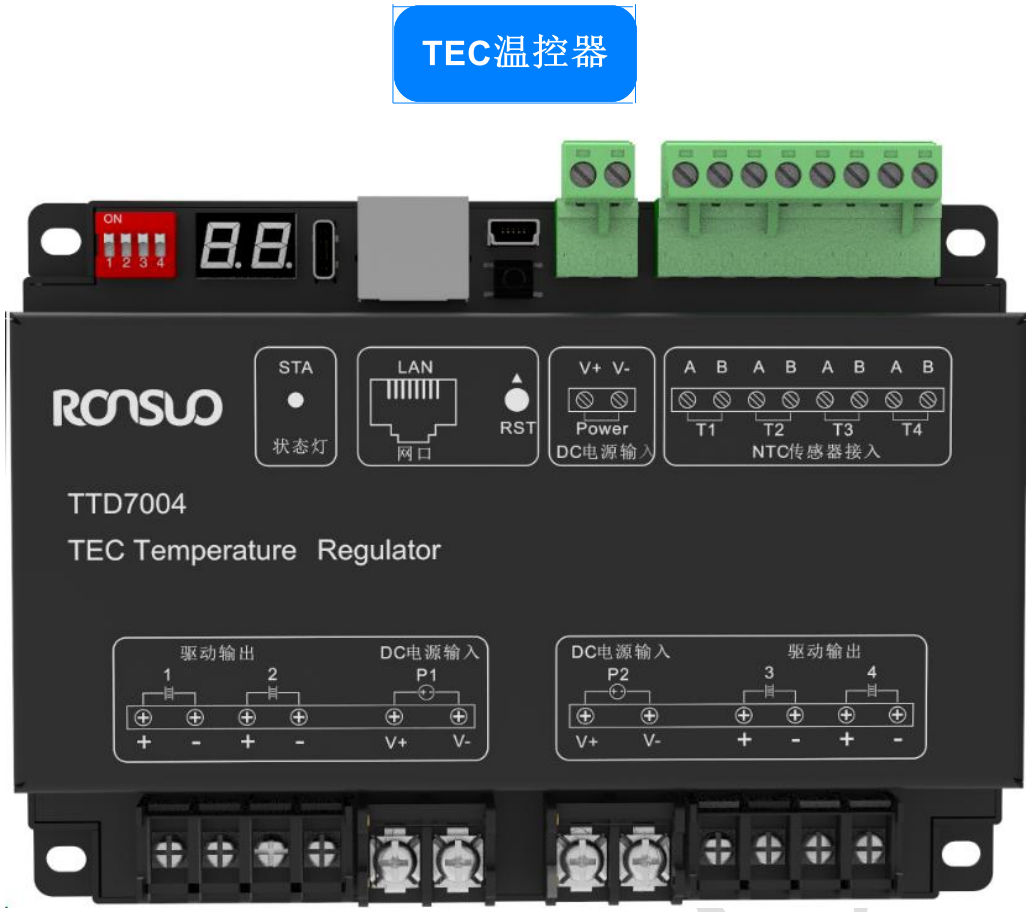
The bit machine establishes connections and supports the standard Modbus TCP/RTU communication protocol, ensuring efficient and compatible data transmission.

The device features precise temperature control, excellent stability, strong anti-interference capability, and multi-stage over-temperature protection. The system automatically halts operation when an over-temperature alarm is triggered.

Output, control temperature limit alarm when the output is closed and other functions, can effectively protect the safety of the controlled items.

1.2 Demonstration of the Type

Front view of the TEC thermostat (TTD7004), with detailed product appearance as shown below:



（**TTD7004**正面视图）

Device model list:

Order number	Name	Model	Explain
1	TEC Thermostat	TTD7004	Integrated 4-channel NTC temperature acquisition and 4-channel 15A DC bidirectional load output (TEC cooling element). Upstream 100M Ethernet ModbusTCP protocol communication, screw-fixed installation.

1.3 Device Features

1.3.1 Industrial Design

- Equipped with a high-performance industrial-grade 32-bit processor
- Supports long-term stable operation at-20 to 85°C
- Aluminum alloy shell, anti electromagnetic interference

1.3.2 Reliability and Stability

- With watchdog design, ensures long-term stable system operation
- Implement comprehensive protective mechanisms to ensure equipment stability
- Power input interface with built-in surge and static protection
- Power input interface anti-reverse protection and load output channel short-circuit protection function

1.3.3 Product Usability

- The device employs detachable terminals for temperature acquisition, facilitating maintenance.
- Supports plug-and-play without complex configuration
- Communication standard: Modbus TCP/RTU protocol
- The host features a TYPE-C port on the front for easy debugging
- Supports upper computer software (TSC) configuration management

1.3.4 Product Features

- Supports 4-channel NTC temperature acquisition (range-60 to 150°C)
- Supports 4-channel DC bidirectional control output (directly drives TEC cooling elements for heating or cooling)
- Supports Modbus TCP/RTU standard protocols and function codes 01,03,05,06,15, and 16.
- 100M uplink Ethernet communication for temperature controller
- Temperature Controller with Integrated Multi-channel Design for Temperature Acquisition and Control
- The PID parameter settings for the open controller support independent PID for each channel and feature self-tuning.
- The device features multiple over-temperature protection mechanisms, load output circuit breaker alarm, and short-circuit protection functions.
- Temperature control accuracy: ≤±0.1℃, Resolution: 0.01℃

1.4 Thermostat Parameter

The TEC thermostat (TTD7004) device has the following detailed specifications.

Technical Parameters of TTD7004 Thermostat		
Project		**Parameter**
Power supply for equipment	Mode of connection	2P-5.08 Terminal block
	Working voltage	24VDC（12~36V）
	Device power consumption	≤1.5W (static)
	Power supply protection	Surge protection, static protection, reverse connection protection
Uplink Ethernet communication	Interface type	RJ45 network port
	Number of network ports	1 individual
	Communicating protocol	Standard Modbus TCP/RTU protocol, supporting function codes 01,03,05,06,15, and 16
	Network port rate	100Mbps
	Transmission distance	≤100m
	Default parameter	Communication: Modbus TCP, port: 502 IP：192.168.1.21 Mask:255.255.255.0 Gateway:192.168.1.1
Acquisition channel	Mode of connection	8P-5.08 Terminal blocks (2P per channel)
	Sensor type	NTC thermistor (customizable importable calibration table), default: NTC10K-B3950
	Channel number	4 channel
	Sampling period	≤10ms
	Temperature measurement range	-60~150℃
	Temperature measurement accuracy	≤±0.2℃
	Resolution ratio	0.1°C/0.01°C, default: 0.01
Load input power supply	Mode of connection	2P-gate terminal (2 sets), supports simultaneous input of different DC voltages
	Input voltage	4~30VDC (single-phase overcurrent capacity: 30A)

Outgoing channel	Interface type	4P-gate terminal (2 sets)
	Output channels	4 channel

	Output type	PWM switching mode
	Load current	≤15A/Channel (directly drives the TEC chip for heating or cooling)
	Output protection	Short-circuit/overload protection, circuit breaker alarm detection
Design feature	Shell material	Aluminum alloy shell
	Way to install	M3.5*4 threaded hole for fixed installation (see Section 2.1.1)
	Product size	150mm*130mm*28mm (length x width x height)
Service environment	Working temperature	-20~85℃
	Storage temperature	-20~105℃
	Working humidity	10~95% (no condensation)
Functional description	Pilot lamp	Power indicator, operation indicator, input/output indicator, alarm display digital tube
	Alarm indication	When an alarm is detected, it can be displayed via an indicator light or retrieved by reading a specified register.
	Self-tuning	Channel supports independent self-tuning
	PID control	The channel supports independent SV value setting and PID control.
	Temperature control accuracy	≤±0.1℃
	Data communication	Modbus Ethernet Communication

2 Device Installation and Connection

About this chapter

Chapters and sections	Content	Remarks
2.1 Device appearance dimensions	Describe the device's dimensions	
2.2 equipment installation	Introduce the installation steps and precautions	
2.3 Device interface function	Introduce the functions of each interface of the device	

pay attention to ：

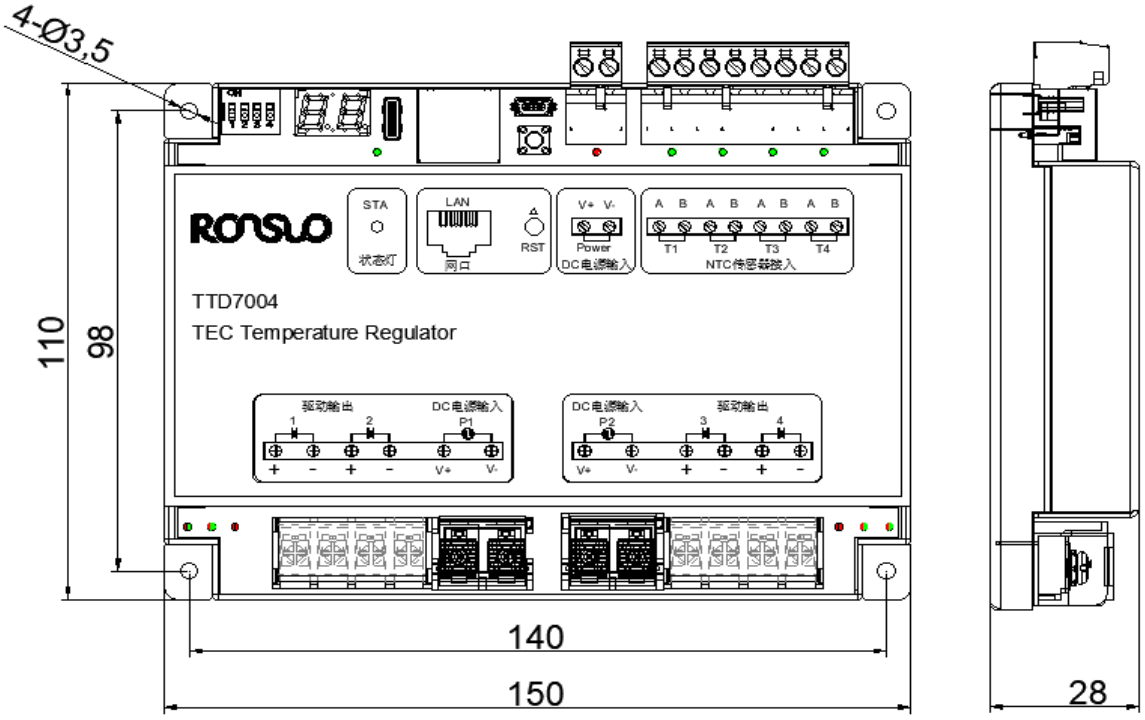
The TEC thermostat must be properly installed to achieve its intended functionality. Always read the user manual carefully before installation. For any questions, please contact our company.

2.1 Device Appearance Dimensions

2.1.1 Thermostat Dimensions

The TEC thermostat (TTD7004) features the following dimensions, as shown in the figure below:

TEC温控器外观尺寸



2.2 Equipment Installation

2.2.1 Installation Requirements

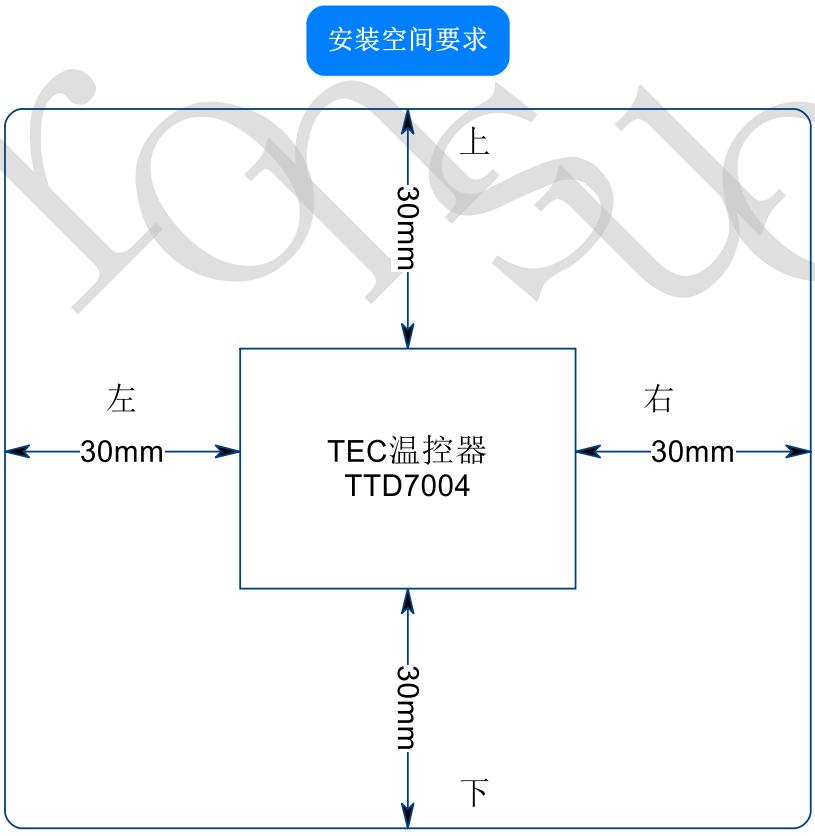
1、 Installation Notes

The TEC thermostat (TTD7004) is installed using screws and must be mounted within an electrical cabinet. The installation environment should be kept ventilated and dry. When installed in an electrical cabinet, the device must also be properly grounded (see Section 2.3.2).

The TEC thermostat is a precision electronic device. Do not install it in environments with strong electromagnetic interference, humidity, or flammable/explosive conditions to prevent unnecessary malfunctions or accidents.

2、 Storage space requirements

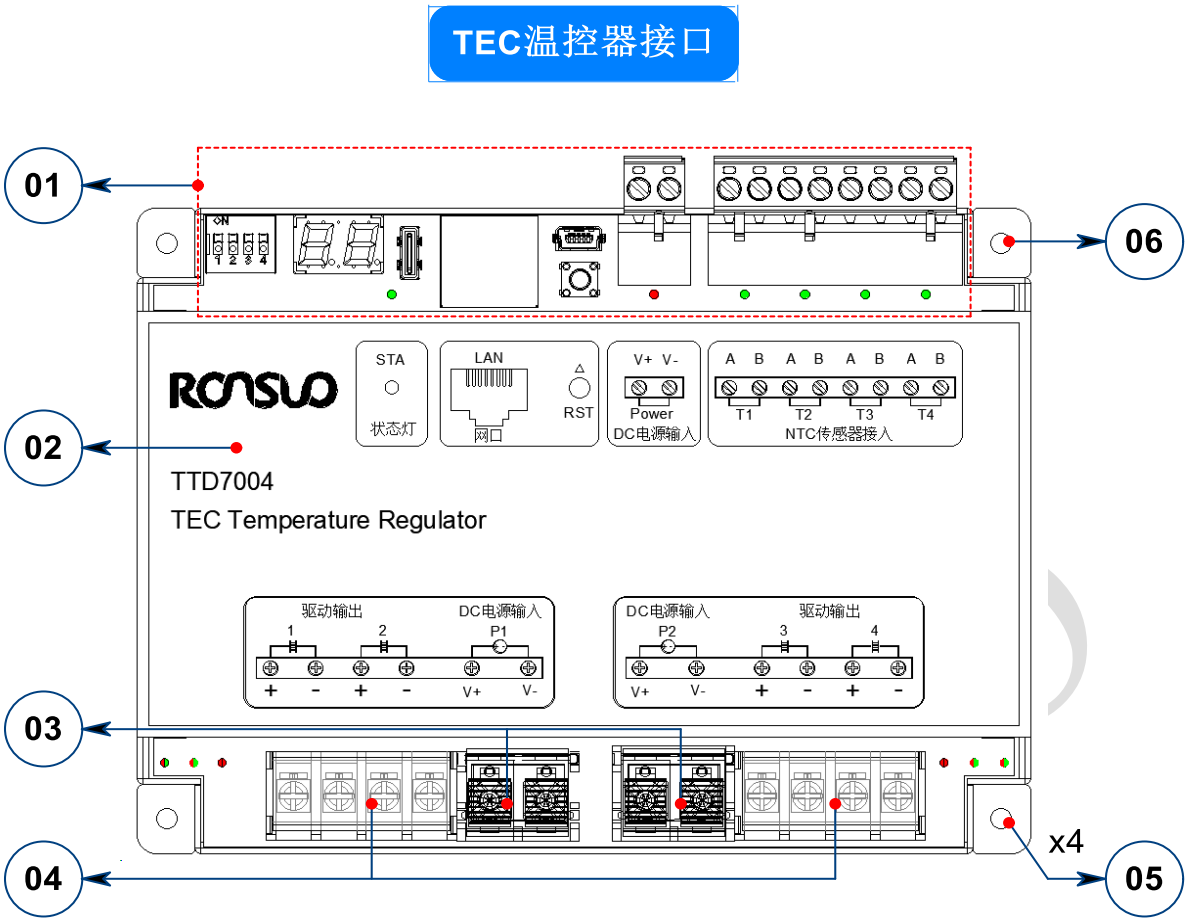
When installing or removing thermostat devices, maintain a minimum operational clearance of 30mm on both sides and 30mm vertically.



2.3 Device Interface Function

2.3.1 Interface Function of Thermostat

1、 The TEC thermostat (TTD7004) features the following device interface functions, as shown in the figure below:

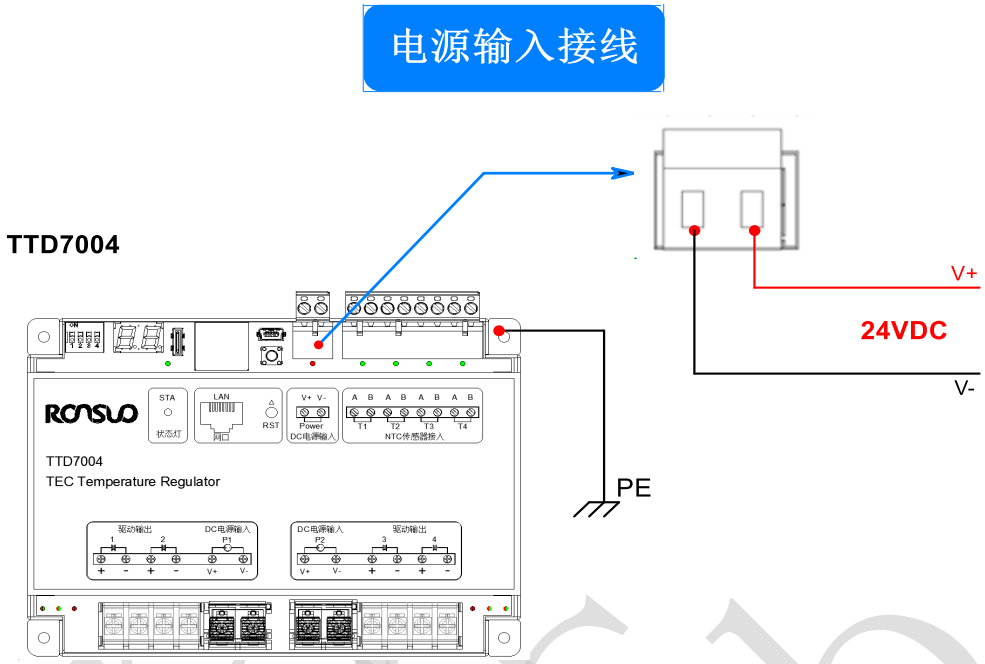


2、 TEC Thermostat Interface Specifications:

Number	Definition	Explain
01	Code decoding switch	4 bit position switch (see 2.3.4) Set the IP address with the 4th bit incrementing (0~15)
	Digital display	Display device alarm codes (see 3.3)
	TYPE-C port	Debugging interface
	RJ45 port	Ethernet uplink communication interface (see 2.3.3)
	Reset button	Long press for 3 to 5 seconds to reset the device to factory settings (all parameters)
	Power input of equipment	2P-5.08 Power Supply Terminal for Equipment (Refer to 2.3.2)
	NTC sensor access	NTC access (see 2.3.5) T1: NTC sensor interface for channel 1 T2: The second NTC sensor interface T3: The third NTC sensor interface T4: NTC sensor interface for channel 4
02	Panel screen printing	Print the device's external interface labels
03	Load power input	Load power input (see 2.3.5) P1: Load input power 1, for the 1/2 channel load output P2: Load input power supply 2, for the 3rd/4th load output
04	Drive output	Load access (see 2.3.5) 4 TEC refrigeration unit load access
05	Installing screw hole	4 Φ3.5 mounting and fixing hole
06	Landing	Install the fixed screw holes and ensure proper grounding (PE) for the equipment.

2.3.2 Power Input Wiring

The 2P plug-and-play 5.08 terminal on the TEC thermostat (TTD7004) serves as the power input for the device, with the wiring configuration shown in the diagram below:

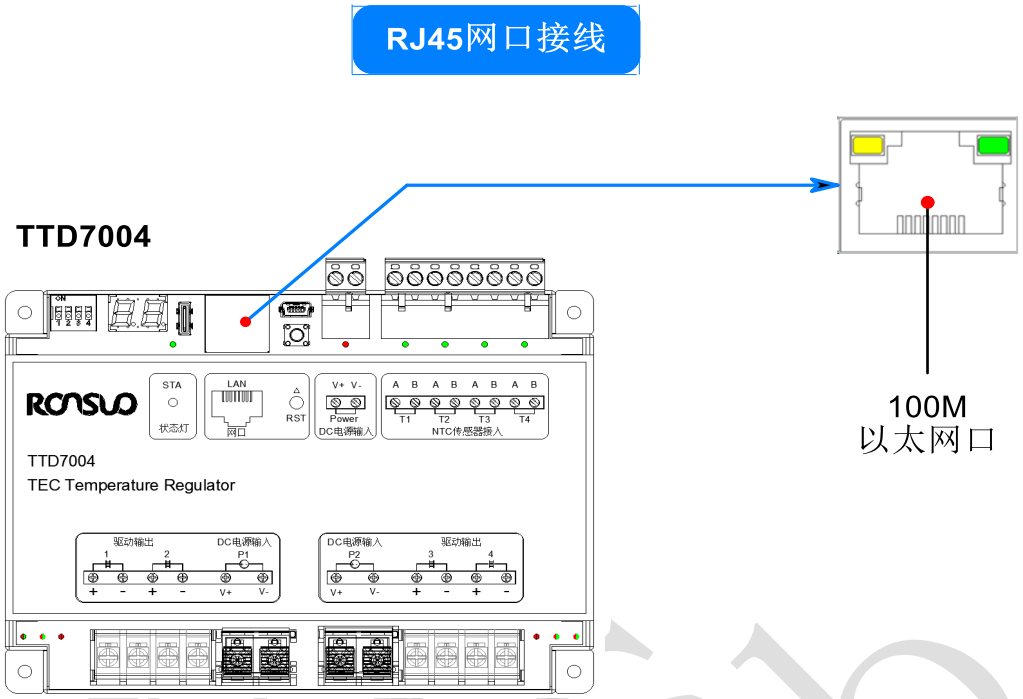


Power interface terminal definition description:

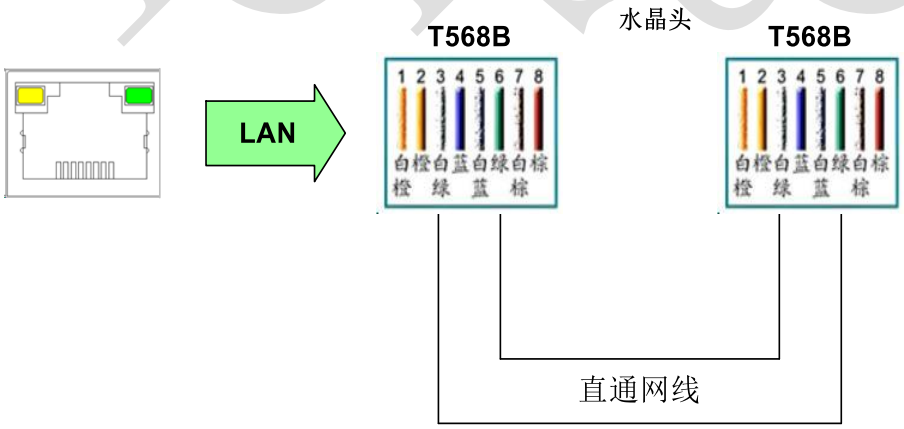
Number	Definition	Explain
1	V+	24VDC power input positive terminal
	V-	Negative terminal of the 24VDC power input
	PE	Connecting the Earth

2.3.3 CJ45 Connection

The RJ45 network interface on the TEC thermostat (TTD7004) serves as an uplink Ethernet communication port, with the wiring configuration shown in the diagram below.

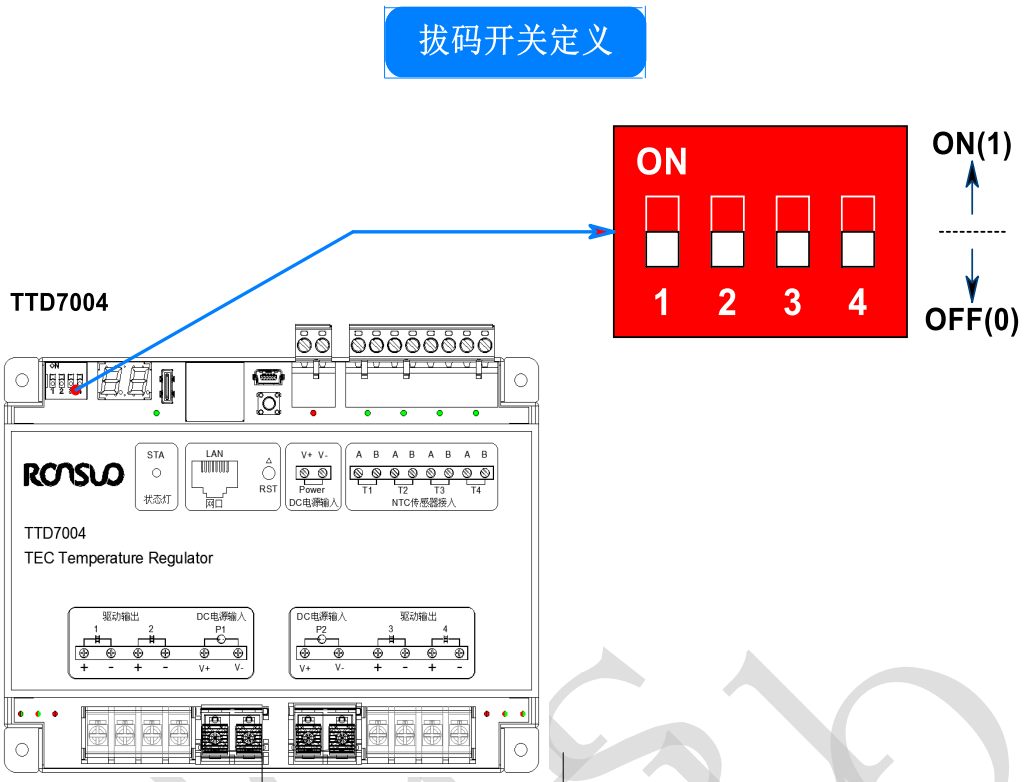


Definition of Ethernet RJ45 Connector:

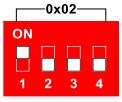
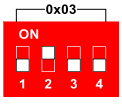
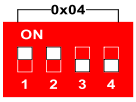
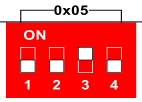


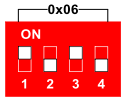
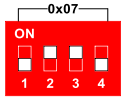
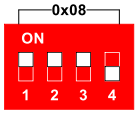
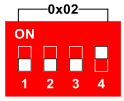
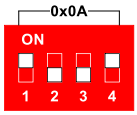
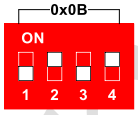
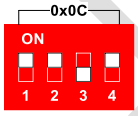
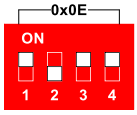
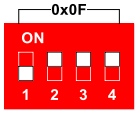
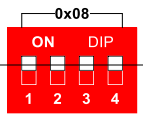
2.3.4 Code Switch Definition

The 4-bit pull-up switch on the TEC thermostat (TTD7004) can be configured to increment the IP address's 4th bit, as shown in the figure below:



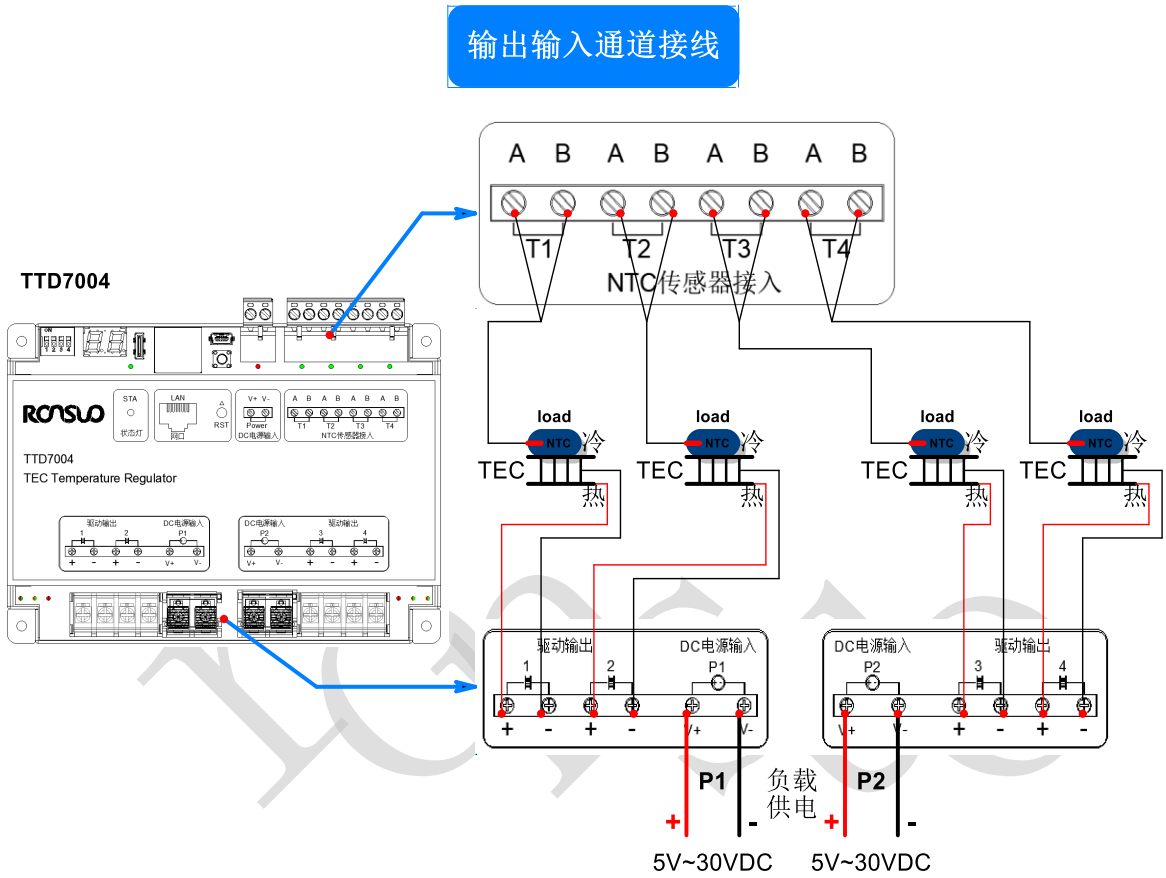
Pull-up switch definition(requires device restart to take effect after setup):

ON=1 OFF=0	4 bit position code switch				Define IP for barcode scanning
	1	2	3	4	
	0	0	0	0	Example ： The default IP address is 192.168.1.21
	1	0	0	0	Indicates: 192.168.1.21+1 The actual IP is:192. 168. 1. 22
	0	1	0	0	Indicates: 192.168.1.21+2 The actual IP is:192. 168. 1. 23
	1	1	0	0	Indicates: 192.168.1.21+3 The actual IP is:192. 168. 1. 24
	0	0	1	0	Indicates: 192.168.1.21+4 The actual IP is:192. 168. 1. 25

	1	0	1	0	Indicates: 192.168.1.21+5 The actual IP is:192. 168. 1. 26
	0	1	1	0	Indicates: 192.168.1.21+6 The actual IP is:192. 168. 1. 27
	1	1	1	0	Indicates: 192.168.1.21+7 The actual IP is:192. 168. 1. 28
	0	0	0	1	Indicates: 192.168.1.21+8 The actual IP is:192. 168. 1. 29
	1	0	0	1	Indicates: 192.168.1.21+9 The actual IP is:192. 168. 1. 30
	0	1	0	1	Indicates: 192.168.1.21+10 The actual IP is:192. 168. 1. 31
	1	1	0	1	Indicates: 192.168.1.21+11 The actual IP is:192. 168. 1. 32
	0	0	1	1	Indicates: 192.168.1.21+12 The actual IP is:192. 168. 1. 33
	1	0	1	1	Indicates: 192.168.1.21+13 The actual IP is:192. 168. 1. 34
	0	1	1	1	Indicates: 192.168.1.21+14 The actual IP is:192. 168. 1. 35
	1	1	1	1	Indicates: 192.168.1.21+15 The actual IP is:192. 168. 1. 36

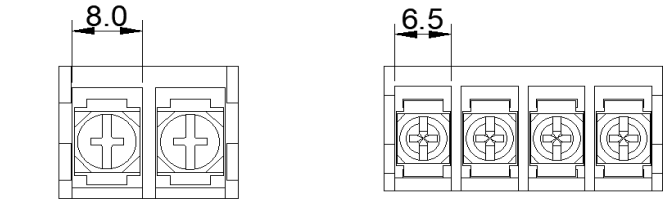
2.3.5 Input-Output Channel Wiring

The TEC thermostat (TTD7004) features two sets of grid terminals on its output channel, directly connecting to the TEC's DC load. Its input channel uses 8-pin 5.08mm terminals, supporting NTC sensor integration. The detailed wiring configuration is illustrated in the diagram below.



栅栏接线端子规格：

单位:mm



Note: 1. Connect the TTD7004 driver output to the TEC cooling element, and properly connect it to the TEC's positive and negative terminals as shown in the diagram above.

2、 When driving output channels 1/2, connect the load power supply P1; when driving channels 3/4, connect the load power supply P2.

3、 The input voltage values for load power supply P1/P2 do not need to be identical (e.g., P1's load power supply is 5V, while P2's is 15V). Both load power supplies operate as independent systems.

4、 When selecting Y-type terminal, attention should be paid to the specifications and dimensions of the equipment fence terminal.

3 Device Application and Debugging

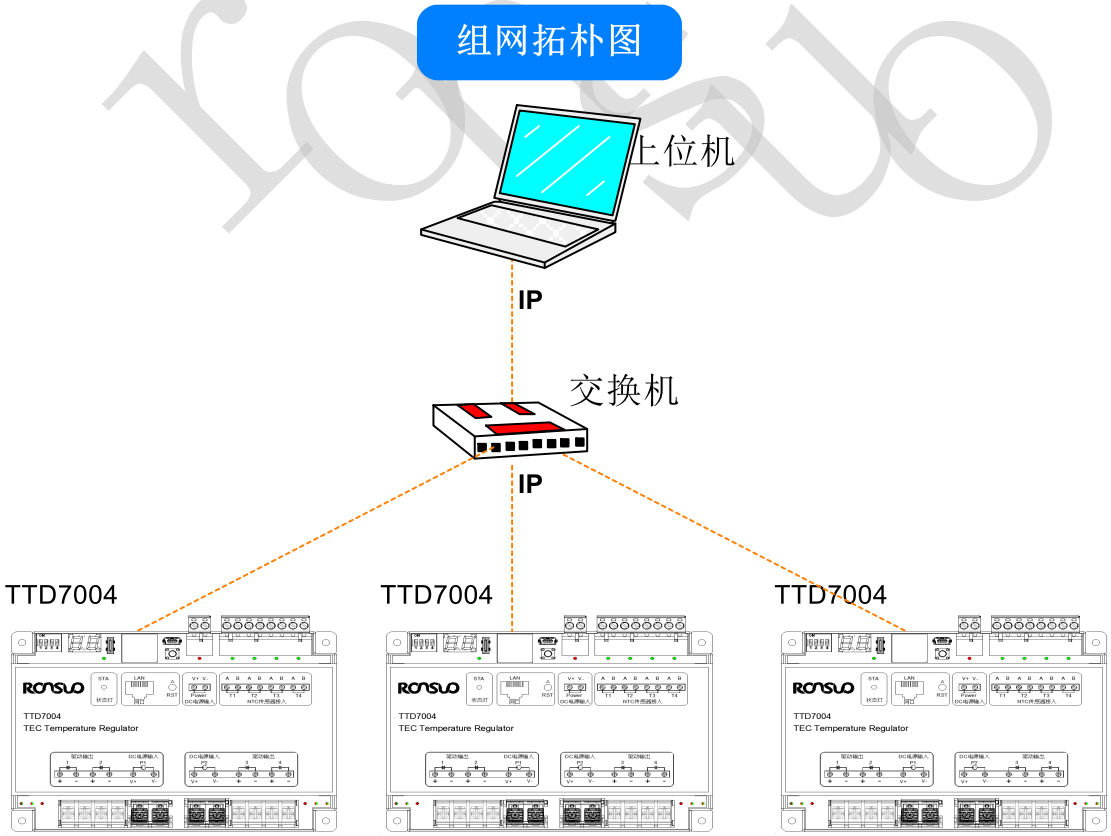
About this chapter

Chapters and sections	Content	Remarks
3.1 Network configuration and debugging	Introduction to device networking and connection debugging	
3.2 The host computer software (TSC) is used	Introduce the detailed method of upper computer software configuration	
3.3 Alarm code	Display code explanation for device alarms	

3.1 Network Configuration and Debugging

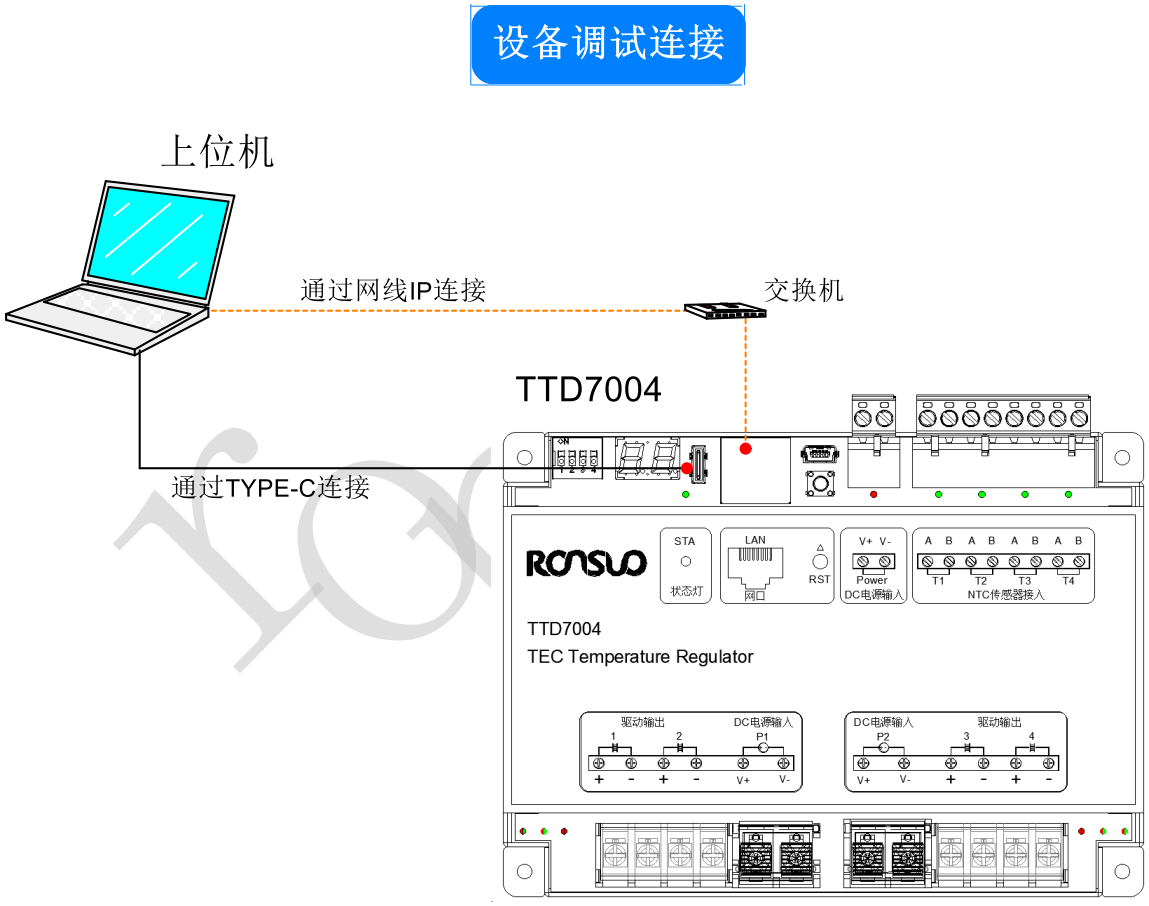
3.1.1 Network Topology Diagram

The TEC thermostat (TTD7004) typically employs the following networking configuration in practical project applications, as illustrated in the diagram below:



3.1.2 Device Setup and Connection

The device comes with default parameter settings upon factory delivery. For field deployment, simply configure it using the Temperature Control System Configuration Tool (TSC) according to the project's specific requirements to ensure proper operation. Connect to the host computer via the following interface configuration (TYPE-C port default parameters: 921600, N, 8, 1; default network IP:192. 168. 1. 21). Detailed setup instructions are shown in the diagram below:



Note: 1. For computer-to-thermostat debugging, connect the device correctly as shown in the diagram (use either IP or USB connection method).

2、 When performing data communication, please refer to our company's temperature control device communication protocol for debugging.

3、 The TSC tool on the host computer can directly operate temperature control and data acquisition.

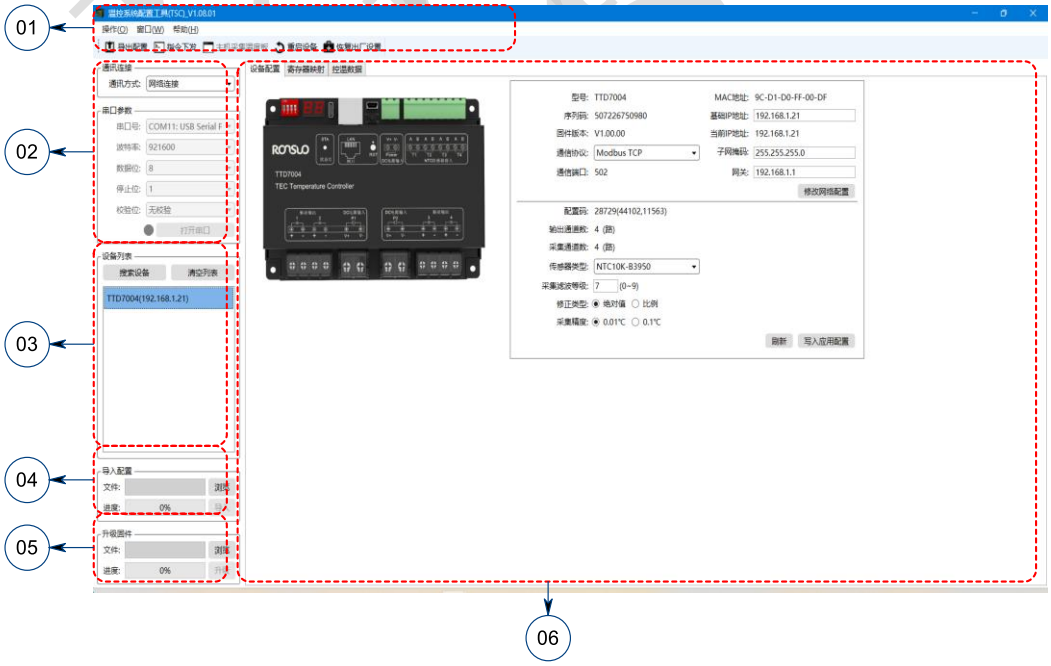
3.2 The Host Computer Software (TSC) Is Used

3.2.1 Software Interface

The TEC thermostat (TTD7004) supports configuration management via the desktop-based " Thermostat System Configuration Tool (TSC)". Double-click [TSC.exe] to launch the configuration software. When connecting the device via IP, the home screen displays as shown below:

3.2.2 Software Features

1、 The TSC tool features the following sections:



2、 TSC Tool Function Area Description:

Number	Definition	Explain
01	Quick Access	Export configuration: Export the device's configuration file (.cfg) for import into other devices of the same model. Issue command: Debugging application window. Use when debugging is needed. Host temperature acquisition board: The current device model is not supported Restart device: Restart the current connected device Restore factory settings: Reset the current connected device to its factory default configuration
02	Communication junction	Configure communication parameters for connected devices: 【 communication junction 】 : Network connection: Search for devices directly in the Device list section. Serial port connection: Enter the following serial port parameters. Serial port parameters: Serial port: Select the correct COM port for the current connected device Baud rate: 921600 (fixed at 921600 when the thermostat is connected via TYPE-C); Data bits: 8 bits, stop bit: 1 bit, parity bit: none. Open/Close serial port: operation button
03	Device list	After searching for devices, the connected device list is displayed: [Device List]: Search devices: Search connected devices Clear list: Clear devices displayed in the list List window: Displays the found device models and IP addresses Selected device: Click any device found to display its information on the right side of the tool software.
04	Import configuration	Used for importing device profiles (in practice, you only need to configure one device to export the profile, which can then be imported to other devices of the same model). File: Click the [Browse Files] button to select the path to the.cfg file Progress: Shows the import progress percentage Import: Click the button to start importing the configuration
05	Upgrade firmware	For device firmware updates: File: Click the [Browse Files] button to select the path to the.bin file Progress: Shows the percentage of the upgrade update progress Upgrade: Click the button to start firmware update
06	Configuration	Basic device attribute configuration area: Apply network configuration: Modify the protocol and network IP information, then click the button to save the configuration Write application configuration: Click the button to save configuration after modifying device parameters
	Classification window	Device Configuration: Basic Device Settings

		Register Mapping: Device Register Mapping Configuration Window Temperature control data: Device temperature control debugging window

3.3 Alarm Code

Order number	Alarm code (digital tube)	Explain The digital display flashes when an alarm is triggered.
1	E1	The device is not authorized
2	E2	Device self-check error alert
3	E3	The output channel short-circuit alarm will not be automatically cleared after restoration.
4	C4	Output circuit breaker alarm, which will be automatically cleared after normal operation resumes
5	C5	The system triggers an overload alarm. The alarm will not be cleared automatically after the system returns to normal.
6	Always on	The system is working properly. The display shows the number of output channels.

4 Common Faults

During use, the device may experience certain malfunctions. Users can address the issues by following the troubleshooting methods listed below to restore normal operation. If the problem persists, please contact our company.

power failure

Fault: All panel indicators fail to illuminate after power-on.

Exclusion method:

1、 Check if the power connection is properly connected to the terminals.

2、 Check if the positive and negative terminals of the power cord are connected in reverse.

3、 Use a multimeter to check if the input voltage is within the specified range (12~36VDC).

Network communication failure

Fault: TSC cannot find the device or has an abnormal communication with the slave.

Exclusion method:

1、 Check that the network cable is securely connected to the computer.

2、 Disconnect the computer from the WIFI network before debugging.

3、 Disable the virtual network card for the computer.

4、 Use the ping command to check if the IP address is reachable.

5、 Confirm the computer has a fixed IP address on the same network segment as the device.

6、 Check if the host and slave are connected with a straight-through network cable.

Abnormal temperature during collection

Fault: Abnormal temperature acquisition

Exclusion method:

1、 Check whether the temperature sensor wiring is correct.

2、 Check if the terminal is securely fastened without any looseness.

3、 Check whether the temperature sensor is in good contact with the object.

4、 Check whether the model of the access temperature sensor matches the device configuration model.

5、 Check whether the register address and the number of reads are correct.

5 Maintenance

When maintenance is required, disconnect the power supply first. Under normal operating conditions, the equipment requires no regular maintenance. Simply check the equipment status and verify that the wiring terminals and interfaces are not loose every 12 months, then clean the surface dust using a dry soft-bristled brush. When the equipment is not in use for an extended period, disconnect the power supply. Avoid storing it in areas with excessively cold or hot temperatures or high humidity.

6 Safety Requirements

Please read the following safety precautions to avoid personal injury and prevent damage to this product or any other connected products.

Inadvisable. To avoid potential hazards, this product must be used strictly within the specified parameters.

Only authorized technicians from our company are permitted to perform repairs.

Use the appropriate power supply.

Check the input power type, voltage value, and polarity of the device.

Connect and disconnect correctly.

Do not disconnect the data communication cable while the device is powered on.

equipment ground 。

To prevent electric shock, the casing grounding wire must be connected to the earth. Before connecting to the input or output terminals of this product, ensure that this device

The grounding is correct. The grounding wire resistance should be less than 1 Ω.

Correct connection.

When connecting, use the original accessories provided with the device. If you need to make special connections, check the port labels.

Avoid contact with exposed circuits.

Do not touch exposed contacts or components while the equipment is energized.

Do not operate when a suspected fault is present.

If you suspect this product is damaged, please have it repaired by our authorized service personnel.

Provide a well-ventilated environment.

Handle this device carefully to avoid strong impacts or vibrations. Do not install it in areas with severe shaking. Never touch the power switch or this

device with wet hands.

Do not operate in humid environments.

Do not operate in explosive environments.

Keep the surface of the device clean and dry.