Blue Guardian Temperature Control:
Precise Temperature Regulation

User Manual for Integrated Thermostat (DCD66xx Series)

V1.03

Update record of specification			
Date	Edition	Update content	Remarks
2024-03-29	V1.00	Initial release	
2024-04-26	V1.01	Optimize content	
2024-05-16	V1.02	Revise the description in Chapter 1.2	
2024-05-31	V1.03	Delete the content of Section 3.3	

If you encounter any difficulties or technical issues while using the integrated thermostat, please contact us promptly. We will provide you with the most satisfactory and timely technical support. We also welcome your valuable feedback.

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Blue Guardian Temperature Control: Precise Temperature Regulation

address： 314,3rd Floor, No.9, Kemu Langnan Road, Tianhe District, Guangzhou City

Tel: 13609016130

Website:www.lwswk.com

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pay attention to

This document may be updated periodically due to device version upgrades or other reasons. This manual is for user reference only and will not be notified of version updates.

scope of application

This instruction manual is applicable to the **integrated thermostat (DCD66xx)**series products.

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
Integral temperature controller	DCD66xx	

Suitable Object

Applicable to:

R&D engineer, technical support engineer, end user

Brief Introduction of the Content

This document describes the use of integrated temperature controller.

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	Introduce the maintenance of the equipment	

6 safety requirements	Safety tips for device use	

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	Introduce the basic features of the device	
1.4 thermostat parameter	Introduce the detailed parameters of the device	

1.1 Device Overview

The integrated temperature controller is a device that combines temperature acquisition and control output. It can operate independently without requiring an external collector.

The thermostat autonomously calculates the PID output ratio based on the collected temperature PV and setpoint SV, enabling control through various output modes.

A heating power device is designed to achieve temperature control. The equipment provides one RS485 interface for connection to a host computer, supporting up to 16 devices.

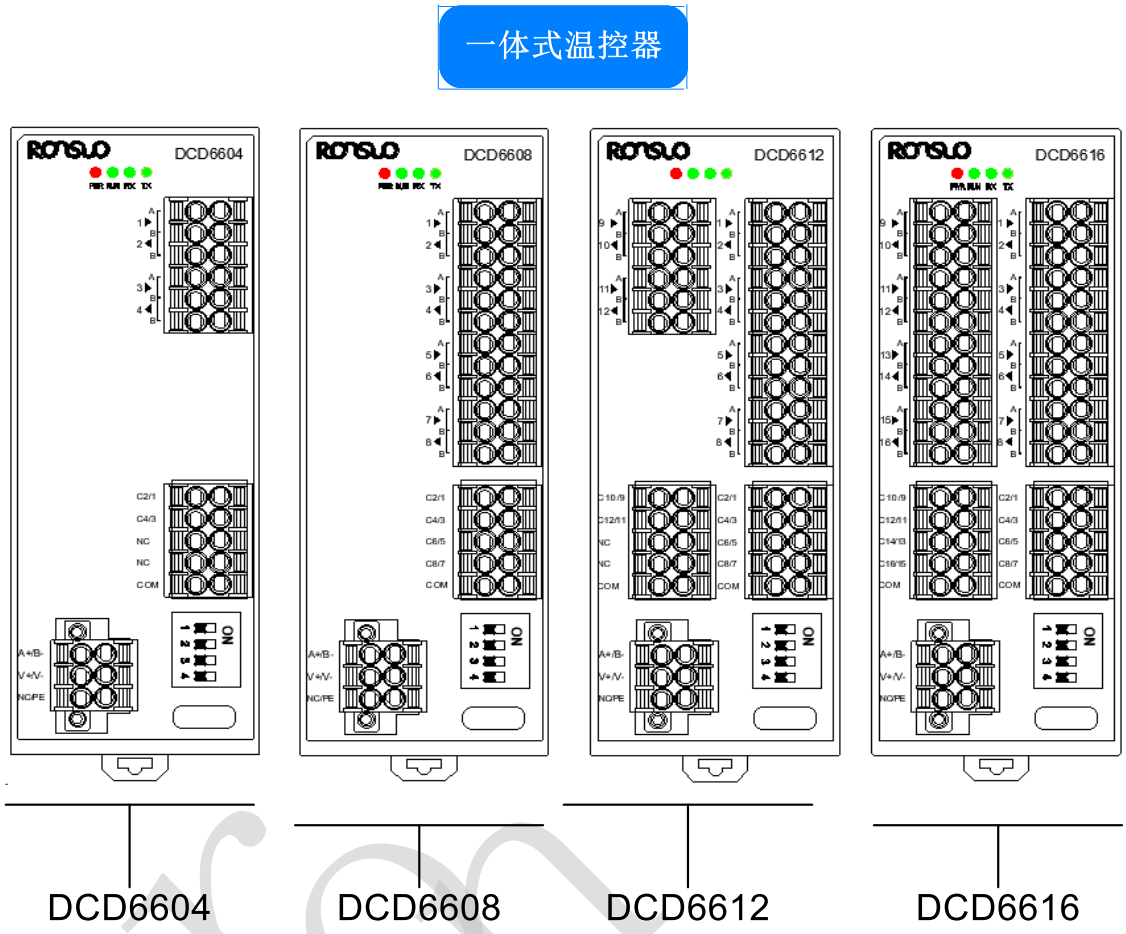
The device uses a 485 bus and operates via the Modbus RTU protocol.

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

The system can effectively protect the safety of controlled items by enabling functions such as output and disabling output when the temperature exceeds the upper limit.

1.2 Demonstration of the Type

The integrated thermostat (DCD66xx) series comprises four models, with their detailed appearances as shown below:



Device model list:

Order number	Name	Model	Explain
1	Integrated temperature controller	DCD6604	4 100-channel PT temperature acquisition, 4-channel PNP/NPN control outputs, DIN35 rail mounting
2		DCD6608	8 100-channel PT temperature sensor, 8-channel PNP/NPN control outputs, DIN35 rail mounting
3		DCD6612	12 12-channel PNP/NPN control output with DIN35 rail mounting and PT100 temperature acquisition
4		DCD6616	16 16-channel PNP/NPN control output with DIN35 rail mounting and PT100 temperature acquisition

1.3 Device Features

1.3.1 Industrial-Grade Design

- High performance industrial 32-bit processor
- Supports long-term stable operation at-20 to 85°C
- High temperature resistant flame retardant PC shell

1.3.2 Reliability and Stability

- With a watchdog design, the system ensures long-term stable operation
- Implement comprehensive protective mechanisms to ensure equipment stability
- The power supply and RS485 interface are equipped with built-in surge and electrostatic protection.
- Input power interface anti-reverse connection protection
- The DO output has a short-circuit protection function.

1.3.3 Product Usability

- The equipment is installed with standard DIN35 guide rails.
- The device features industrial-grade spring-type terminals for easy installation.
- Supports plug-and-play without complex configuration
- Modbu-RTU communication protocol
- Front-end TYPE-C debugging interface for easy debugging
- Supports upper computer software (TSC) configuration management

1.3.4 Product Features

- Supports up to 16 PT100 temperature channels and 16 control outputs (DO outputs configurable as NPN or PNP)
- Supports the Modbus RTU standard protocol and function codes 01,03,05,06,15, and 16.
- The thermostat supports RS485 bus communication (up to 16 units) with optically isolated RS485 interface.
- The thermostat features standard DIN35 rails for easy installation, with a compact design that takes up minimal space.
- The PID parameter settings for the open controller support independent PID for each channel.
- The equipment has multiple overtemperature protection mechanisms
- Temperature control accuracy ≤±0.5℃, temperature acquisition accuracy ≤±0.5℃, resolution 0.01℃

1.4 Thermostat Parameter

The integrated thermostat series (DCD66xx) comprises four models: DCD6604, DCD6608, DCD6612, and DCD6616. The detailed technical specifications of these thermostats are as follows.

Technical Parameters of DCD66xx Thermostat					
Project		DCD6604	DCD6608	DCD6612	DCD6616
Power supply for equipment	Mode of connection	6P-3.50 spring terminal, power input occupies 2P			
	Working voltage	24VDC（12~36V）			
	Module dissipation	≤1.5W			
	Power supply protection	Surge protection, static protection, reverse connection protection			
Device Communication	Interface type	6P-3.50 spring terminal, RS485 communication (upstream) uses 2P			
	Serial port count	1 RS485 communication interface (uplink to host computer)			
	Protocol	Standard Modbus-RTU protocol, supporting function codes 01,03,05,06,15, and 16			
	Communication mode	Supports RS485 bus usage (0x01~0x10)			
	Serial port parameters	Baud rate: 9600,19200,38400 (default), and 115200 Check bit: None, data bit: 8, stop bit: 1			
	Transmission distance	≤1000m			
	Isolation method	Photoelectric isolation			
	Serial port protection	Surge protection, electrostatic protection			
Acquisition channel	Mode of connection	3.50 Spring terminal (3P per channel)			
	Sensor type	PT100 (2-wire/3-wire), default: 3-wire			
	Number of acquisition channels	4 channel	8 channel	12 channel	16 channel
	Sampling period	≤100ms			
	Temperature range	0~250℃			
	Resolution ratio	0.01℃			
Outgoing channel	Interface type	3.50 Spring terminal (1P per channel)			
	Output channels	4 channel	8 channel	12 channel	16 channel
	Output type	NPN type/PNP type, default: PNP			
	Drive current	≤60mA/ channel			
	Output protection	Short circuit protection, static protection			
Design feature	Shell material	High temperature resistant and flame retardant PC			
	Way to install	Standard DIN35 Guide Rail Installation			
	Product size	Height 100mm*width 37.5mm*depth 70.95mm (including terminal 87.25mm)			
Service environment	Working temperature	-20~85℃			
	Storage temperature	-20~105℃			

	Working humidity	10~95% (no condensation)

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 functions	Introduce the functions of each interface of the device	

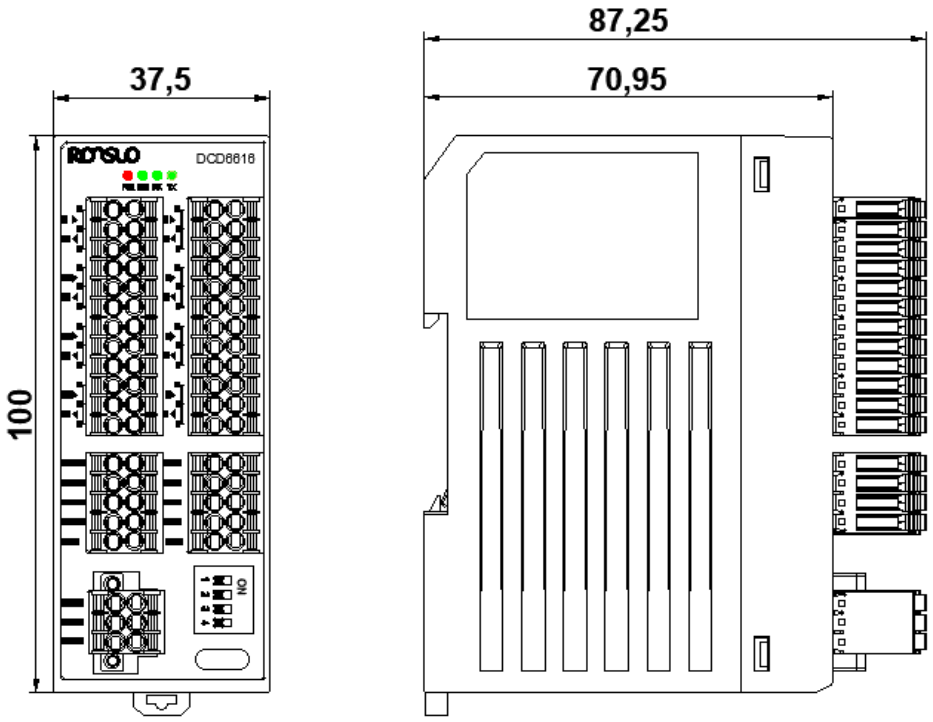
pay attention to：

The integrated thermostat must be properly installed to achieve its designed functionality. Before installation, carefully read the user manual before proceeding. For any questions, please contact our company.

2.1 Device Appearance Dimensions

2.1.1 Thermostat Dimensions

The integrated thermostat (DCD66xx) series features dimensions ranging from 1 to 2, as shown in the figure below.



2.2 Equipment Installation

2.2.1 Installation Requirements

1、 Installation Notes

The integrated thermostat (DCD66xx) features standard DIN35 rails for easy installation. The device must be installed in electrical cabinets equipped with rails, and the installation environment should be kept ventilated and dry. When installed in electrical cabinets, the rails must be properly grounded, and the grounding terminal (PE) on the front panel of the thermostat must also be properly grounded.

As an integrated temperature controller is a precision electronic device, avoid installing it in environments with strong electromagnetic interference, humidity, or flammable/explosive conditions to prevent unnecessary malfunctions or accidents.

2、 Installation space requirements

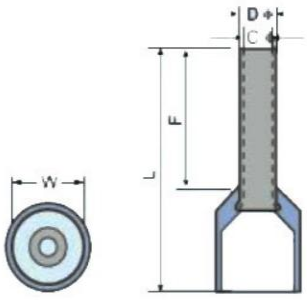
When installing or removing thermostat devices, ensure a minimum operational clearance of 20mm on both sides and 30mm above and below.

2.2.2 Wiring Requirements

The integrated temperature controller (DCD66xx) uses 3.50 spring-type plug-in terminals for both input and output terminals. The wire cross-sectional area of the terminal to be connected should be $^{0.2\sim1.5mm2}$. The wire insulation can be removed to directly connect to the terminal or use a tubular cold-pressed terminal for crimping.

We recommend using a tubular cold-pressed terminal for wiring, as shown in the figure below.

管形冷压端子



1、 Specifications of tubular cold-pressed terminals:

National standard for conductor cross-section mm²	Terminal size (— indicates no special requirements)				
	F	L	W	D	C
0.2~1.5	10.0mm	—	≤3.5mm	≤1.5mm	—

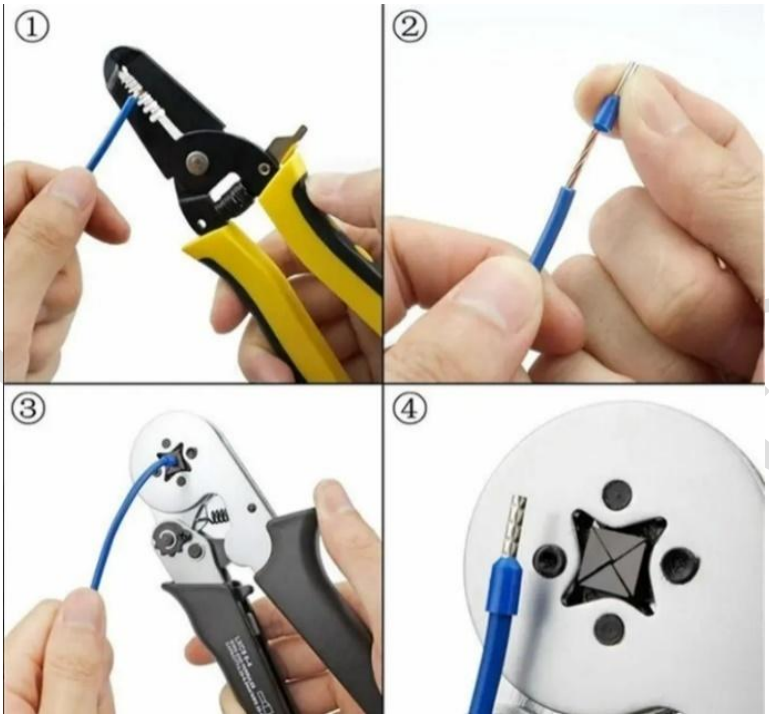
2、 Wireline steps:

Use a special crimping pliers (hexagonal) to crimp, as shown in the following figure: Note: 1) Use a wire stripper to pull off 10mm length of the wire at one end;

2) Insert the removed wire end into the cold-pressed terminal.

3) Simply press the terminals with a wire clamp.

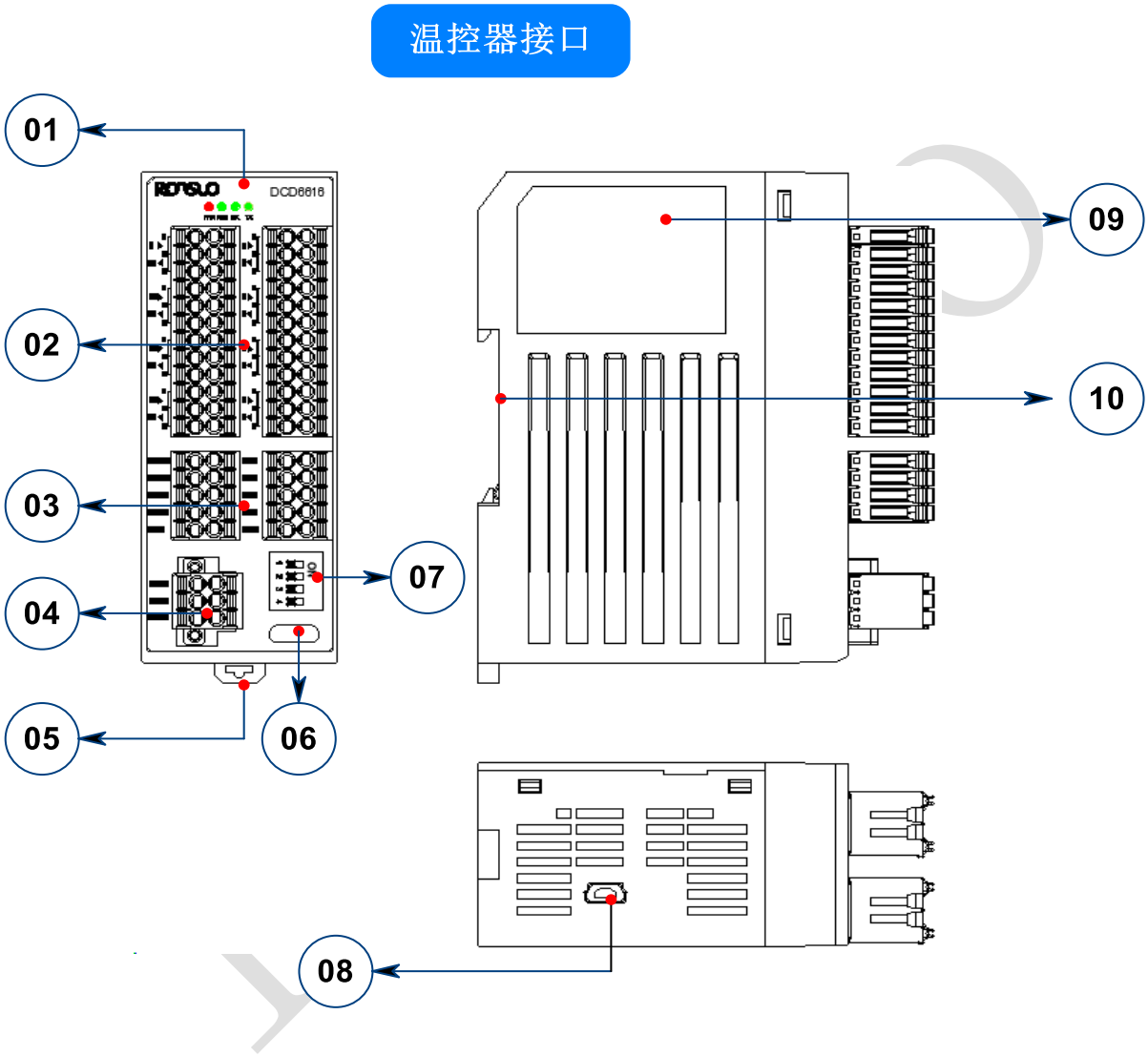
4) Check that the wire terminals are securely fastened without looseness or breakage.



2.3 Device Interface Functions

2.3.1 Interface Functions of the Temperature Controller

1、The interface functions of the integrated thermostat (DCD66xx) series are detailed in the figure below:



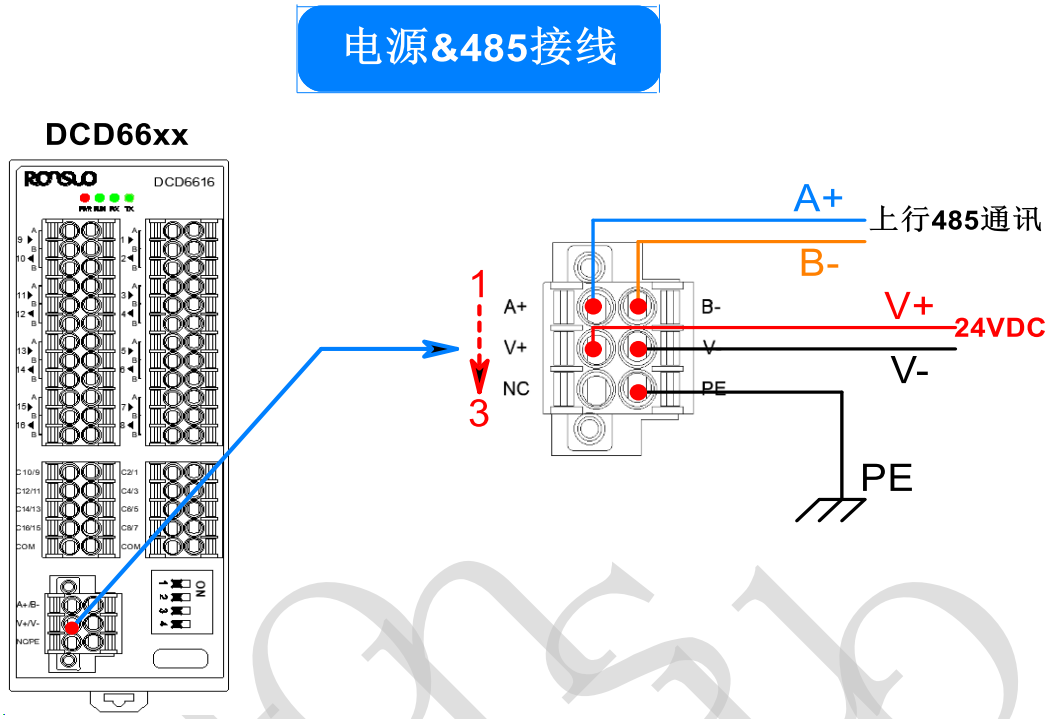
Note: The DCD66xx thermostat (various models) has interfaces with differing channel counts.

2、 Interface Definition and Description of the Temperature Controller:

Number	Definition	Explain
01	Panel LOGO and indicator light	RONSUO: Brand Logo PWR (Red): Power indicator light that remains on during device startup RUN (Green/Red): Status indicator light. The green light flashes normally, and the red light flashes when an alarm occurs. RX (Green): The light flashes when the device is receiving data. TX (Yellow): The device flashes when sending data Model: DCD66xx (xx indicates the channel number)
02	Acquisition channel terminal	Temperature acquisition: Two groups of 24-bit 3.50 spring-type terminals (refer to 2.2.3) support 4-channel/8-channel/12-channel/16-channel PT100 temperature acquisition.
03	Output channel terminal	Control output 2 sets of 10-pin 3.50mm spring terminals (see 2.2.4) supports 4, 8, 12, or 16-channel PNP/NPN outputs
04	485 and power terminals	6 3.50mm spring terminal (see 2.2.2) A+/B-: 485 uplink interface V+/V-: 24VDC (12~36V) NC/PE: NC (non-conductive) / PE (grounding) (connected to earth)
05	Guide rail installation clip	Standard DIN35 rail mounting and securing clips
06	Debugging interface	USB: Type-C Debug Interface (default 921600, N, 8, 1)
07	Code decoding switch	4 Bit position switch, device station number address setting (address 1~16)
08	Firmware upgrade interface	Mini USB port for firmware upgrade
09	Label Information Plate	Print basic information of the device, such as model, power supply, and operating temperature
10	Device installation position	The device features a standard DIN35 rail mounting slot on its back.

2.3.2 Power Supply and 485 Wiring

The 6P plug-and-play 3.5V spring terminal on the DCD66xx thermostat integrates the device's RS485 communication port and power output interface, with wiring configuration as shown in the diagram below.



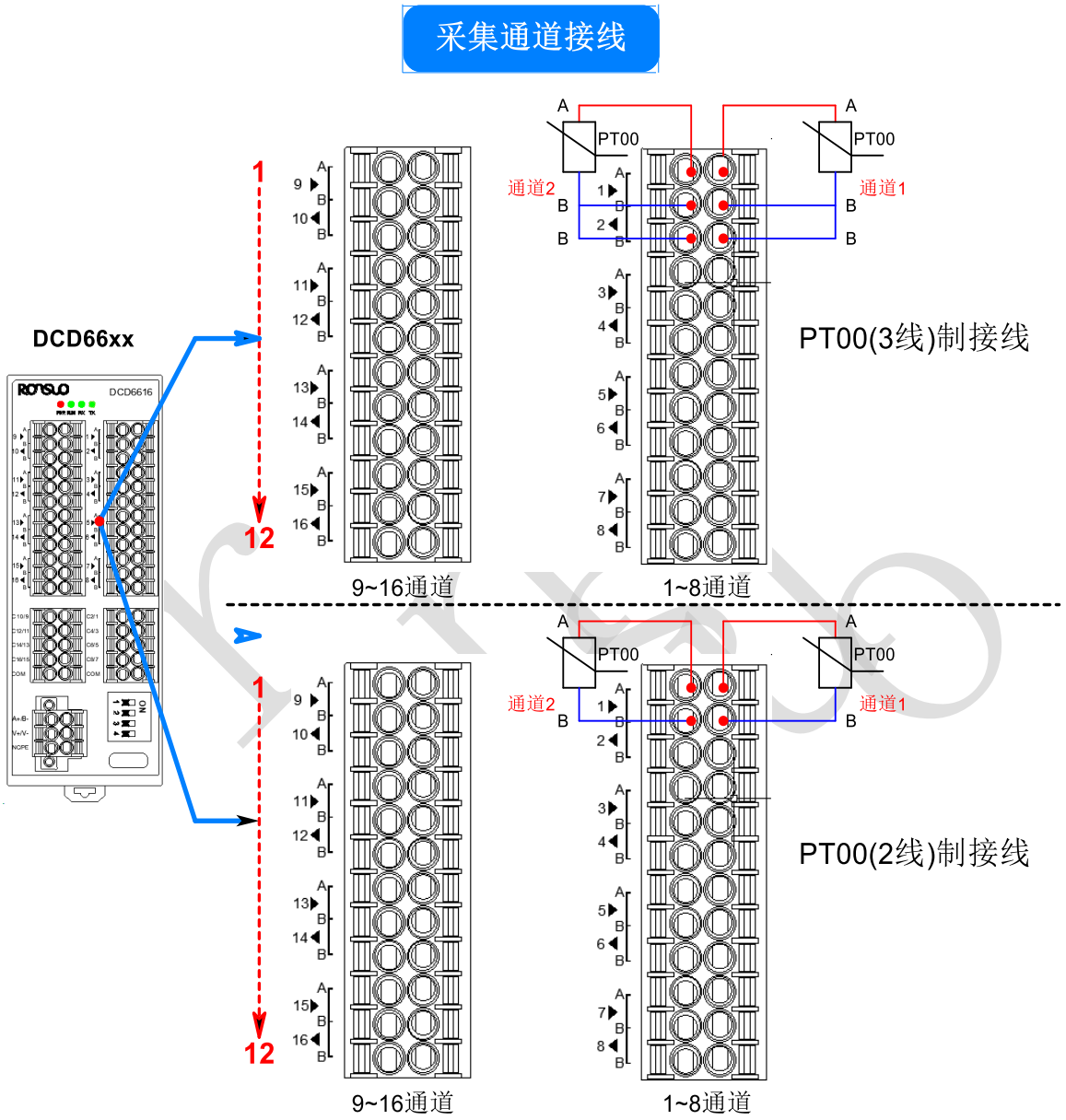
Power supply and 485 interface terminal specifications:

Number	Definition	Explain
1	A+	Connect the RS485 uplink terminal to the host computer or our company's thermostat.
	B−	
2	V+	Positive terminal of the 24VDC power input
	V−	Negative terminal of the 24VDC power input
3	NC	Keep (no connection required)
	PE	Connect to the Earth

2.2.3 Collection Channel Wiring

The integrated temperature controller (DCD66xx) features dual-row 3.50mm spring terminals for data acquisition channels, supporting 3-wire or 2-wire PT100 sensors.

Device access, as shown in the figure below:



Note: 1. The thermostat's temperature acquisition channel supports 3-wire or 2-wire sensor connections. Users should connect them correctly based on their specific application requirements.

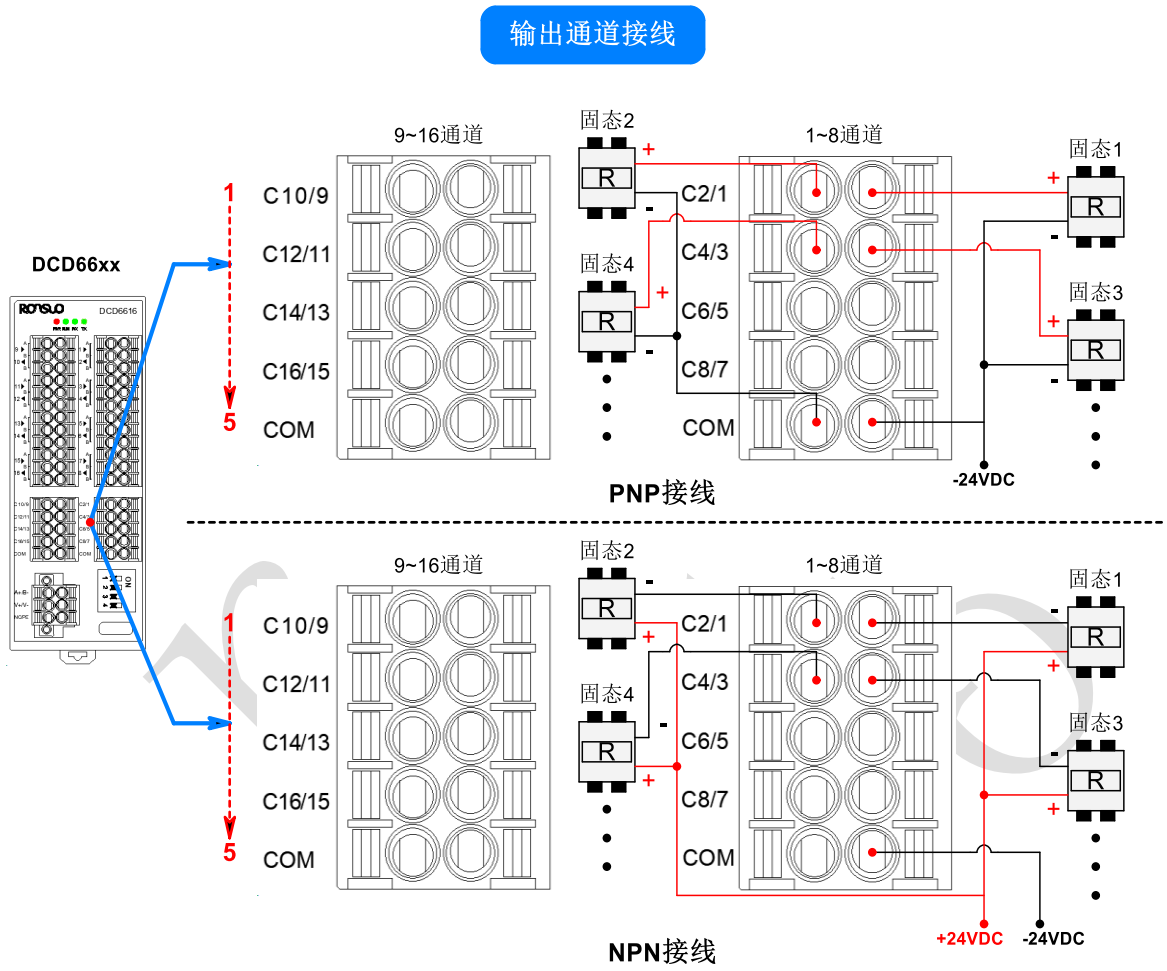
2、 The PT100 sensor features 3-wire connection with line loss temperature compensation, while the 2-wire connection lacks this feature.

3、 The user connected the device correctly with the actual model and channel count.

2.3.4 Output Channel Wiring

The integrated thermostat (DCD66xx) features dual-row 3.5mm spring terminals for output channels, supporting both PNP and NPN outputs. For detailed wiring, refer to the manual.

The wiring is shown below:

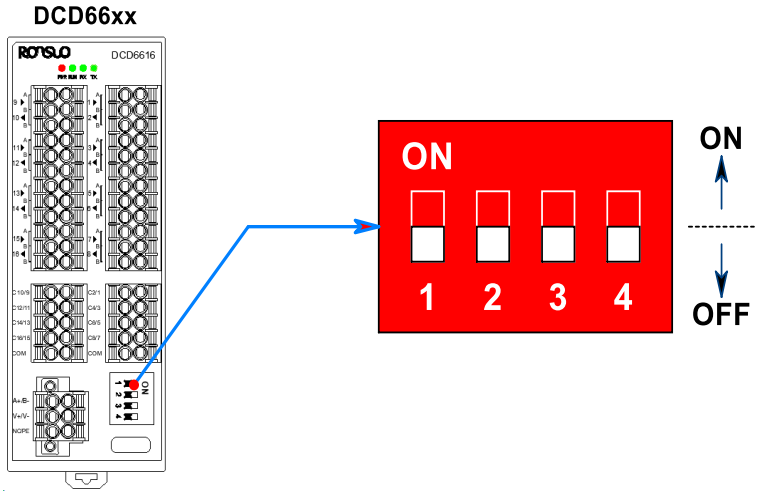


Note: 1. The thermostat control output supports PNP or NPN types. Users should connect them correctly according to their specific applications.

2、 The user connected correctly with the actual device model and channel number.

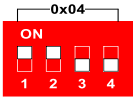
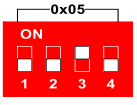
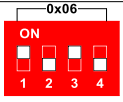
2.3.4 Code Switch Definition

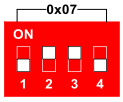
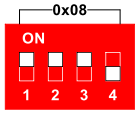
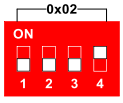
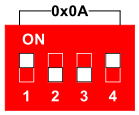
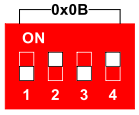
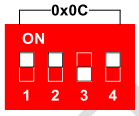
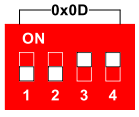
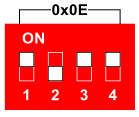
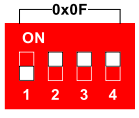
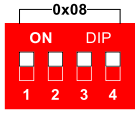
The integrated temperature controller (DCD66xx) uses a 4-digit pull-up switch on its front panel to set the uplink communication station address, as shown in the figure below.



Note: If all pins 1 to 4 are set to OFF in the diagram above, the 485 communication address will be 0x 01.

RS458 communication station number address definition(after setting the pull code address, the device needs to be restarted to take effect):

ON=1 OFF=0	RS485 communication station number address				Address
	4 Bit position code (16 addresses)				
	1	2	3	4	
	0	0	0	0	0x01
	1	0	0	0	0x02
	0	1	0	0	0x03
	1	1	0	0	0x04
	0	0	1	0	0x05
	1	0	1	0	0x06

	0	1	1	0	0x07
	1	1	1	0	0x08
	0	0	0	1	0x09
	1	0	0	1	0x0A
	0	1	0	1	0x0B
	1	1	0	1	0x0C
	0	0	1	1	0x0D
	1	0	1	1	0x0E
	0	1	1	1	0x0F
	1	1	1	1	0x10

3 Device Application and Debugging

About this chapter

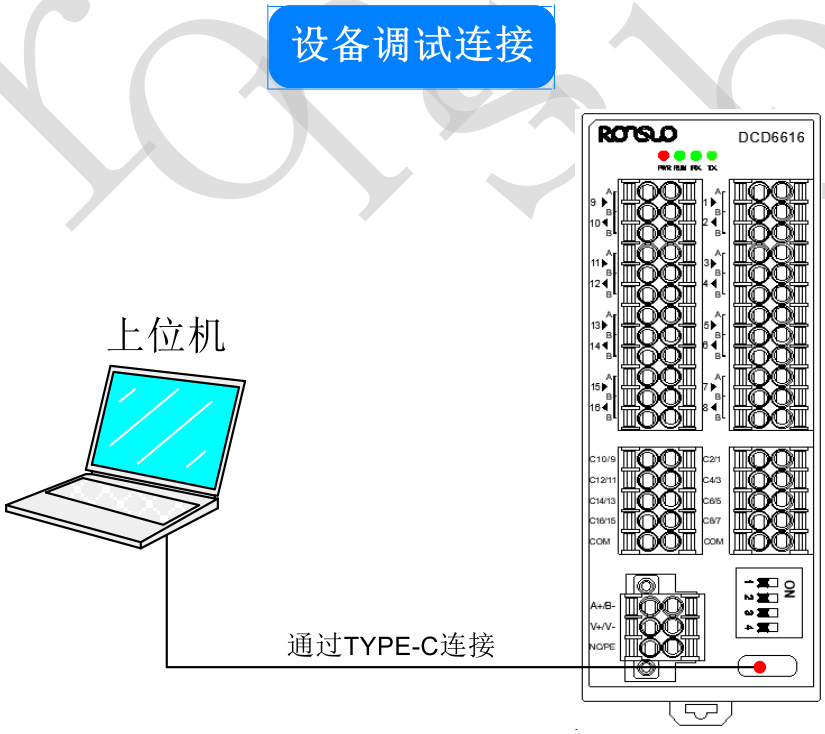
Chapters and sections	Content	Remarks
3.1 Device setup and connection	Introduction to the device debugging and connection method	
3.2 The host computer software (TSC) is used	Introduce the detailed method of upper computer software configuration	

3.1 Device Setup and Connection

The equipment is shipped with default parameter settings. During field deployment, the Temperature Control System Configuration Tool (TSC) must be utilized to configure parameters according to the actual project requirements.

Simply configure the requirements to use it normally. Connect to the host computer using the following method (default computer connection device TYPE-C port).

Communication parameters: 921600, N, 8,1), as shown in the figure below:



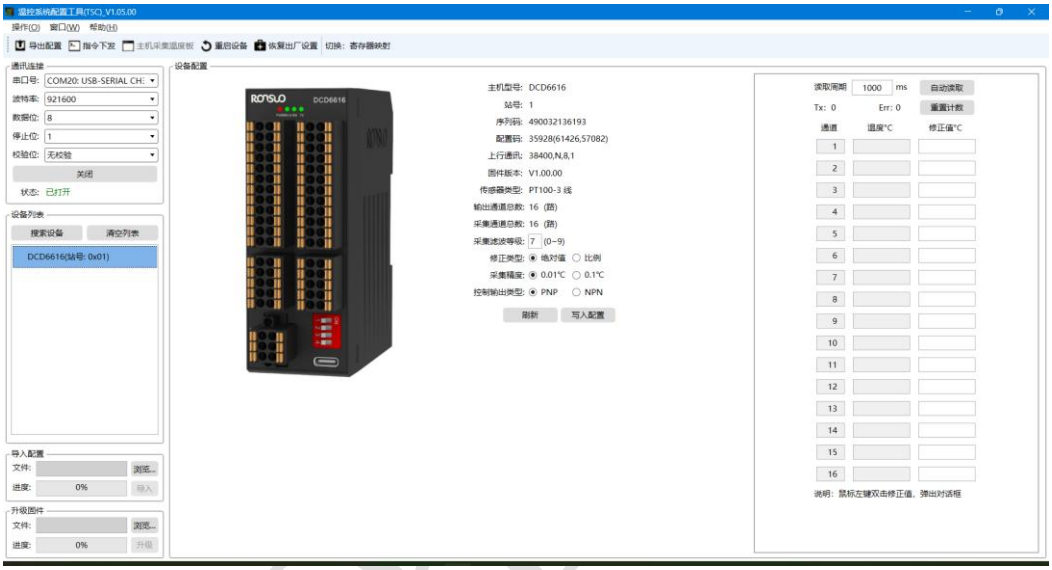
Note: 1) Connect the computer directly to the thermostat as shown in the diagram during debugging.

2) For data communication, please refer to our company's temperature control equipment communication protocol for debugging.

3.2 The Host Computer Software (TSC) Is Used

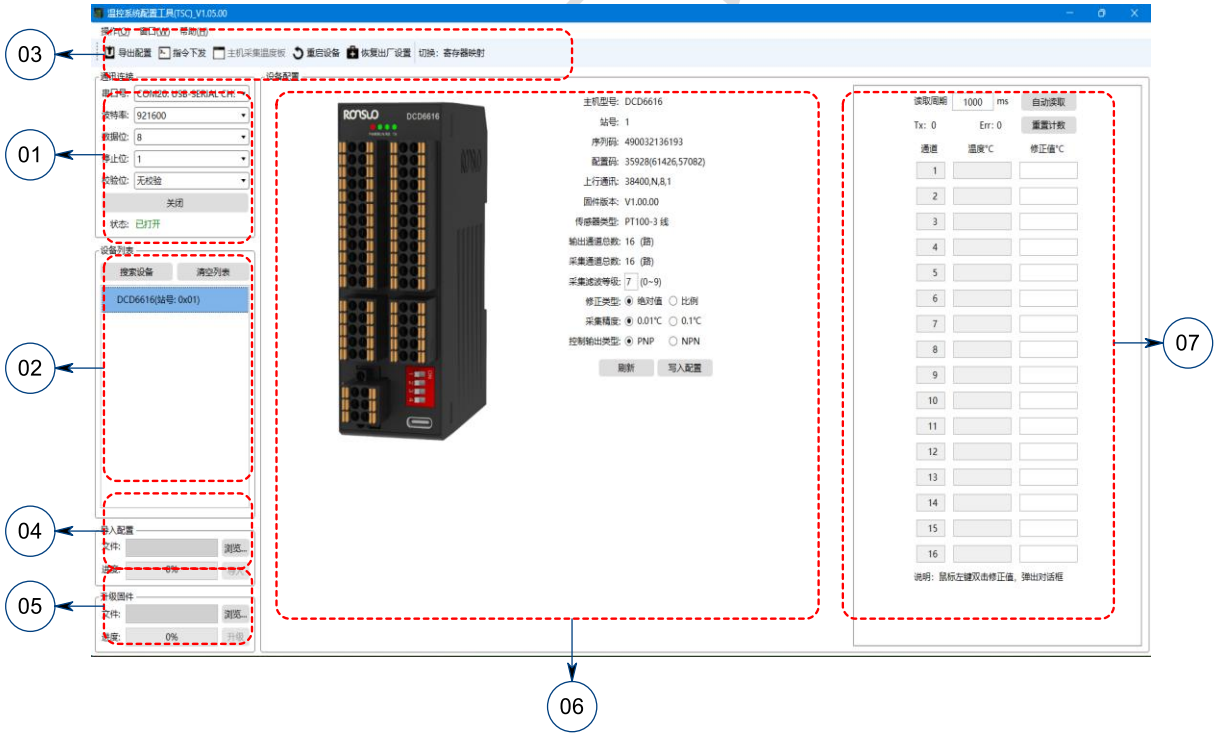
3.2.1 Software Interface

The integrated thermostat (DCD66xx) supports the use of the desktop "Thermostatic Control System Configuration Tool (TSC)" for configuration and management. Double-click [TSC.exe] to open the configuration software. After connecting the device, the home page displays as follows:



3.2.2 Software Features

1、 TSC tool function partition, as shown in the figure below:



2、 TSC Tool Feature Guide:

Number	Definition	Explain
01	Communication junction	Configure communication parameters for connected devices: Serial port: Select the correct COM port for the current connected device Baud rate: 9600~921600 (fixed at 921600 when connected via TYPE-C; select 9600,19200,38400, or 115200 when connected via 485 uplink port) Data bits: 8, stop bits: 1, parity bits: no parity Open/Close: Action button Status: Open/Closed, indicating serial port connection status
02	Device list	Display the connected device list after searching for devices: Search devices: Search connected devices Clear list: Clear the devices displayed in the list List window: Displays the device model and station number address (address in hexadecimal format) that were found. Selected device: Clicks on any found device to display its information on the right side of the tool software.
03	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: Restore the current connected device to its factory default configuration Switch to Device Configuration/Register Mapping to view the configuration window interface
04	Import configuration	Used for importing device configuration files (in practice, you only need to configure one device to export the file, 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: Click the [Import] button to show the import progress percentage
05	Upgrade firmware	For device firmware update: File: Click the [Browse Files] button to select the path to the.bin file Progress: Click the [Upgrade] button to display the upgrade progress percentage Cancel: Click to cancel this firmware upgrade during the process
06	Application Settings	Basic device property configuration area: Parameters for configuring collection and output types
07	Temperature acquisition	This area can collect device temperature channel values

4 Common Faults

The device may experience certain malfunctions during use. 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

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

Exclusion method:

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

2、 Check if the positive and negative terminals of the power cord are reversed.

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

Communication error

Fault: RS485 communication failed

Exclusion method:

1、 Check if the device parameters are configured correctly.

2、 Check if the device panel indicator lights are displaying correctly.

3、 Check if the communication wiring is correct. After confirming the wiring is correct, verify that the communication parameters are properly configured.

4、 Check if the 485 DIP switch address matches the host computer's communication address.

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 is the same as the model of the device configuration.

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

Read the following safety precautions to avoid personal injury and 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 the repairs.

Use the appropriate power supply.

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

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 ground. Before connecting to the input or output terminals of this product, ensure the device is properly grounded.

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

Correct connection.

Use the original accessories when connecting. If you need to make special connections, check the interface labels.

Avoid contact with exposed circuits.

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

Do not operate if a fault is suspected.

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

Provide good ventilation.

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.