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Safety Instructions

Please read the instructions carefully and keep it properly before installing, operating and running this thermostat.

Warning

The thermostat monitors dangerous electrical transformers. It may cause serious damage to property or personal injury or even death if you fail to operate the machine according to regulations in this manual.

Only qualified technician should be allowed to operate the thermostat. The technician should be familiar with all the safety instructions, installation, operation and maintenance procedures before operation. The normal operation of the thermostat depends on the proper transportation, installation, operation and maintenance.

1. Power voltage of the thermostat is 220VAC~240VAC, 50Hz/60Hz;
2. Please make sure all wires are correctly secure;
3. Please do not contact exposed live parts after power on;
4. Terminals L, N, 1, 2, 3, 4, 5, 6, 7 carry dangerous voltages;
5. It cannot be short-circuited between terminals of fan output 1, 2, 3, 4, 5, 6 and terminal 7;
6. Before the high-voltage test of dry transformer is in progress, the sensor cable must be removed from the thermostat to avoid damaging this equipment!

Attention

1. Please read the instructions carefully before using it;
2. The thermostat shall be used for purposes specified by our company only. The thermostat may suffer a fault and even failure if it is changed without approval;
3. Please avoid using this thermostat in the atmosphere containing SO_2, H_2S or other corrosive gases. Otherwise, contacts of the thermostat relay will lose efficacy;
4. Connect electrical wiring after installation. Make sure all the connection is correct before power on;
5. Do not grill sensor probes with a lighter (Flame temperature is about 800℃);
6. Do not apply voltage and current that is greater than the maximum ratings in the relay output contacts;
7. When the actual product is the custom special models, if the specification content is conflict to the manual content, '9 special models attached' shall prevail.
8. Keep the instructions in easy reach, and send it to all users.

Contents

1. Introduction

The thermostat is a new generation of temperature controller designed especially for air-cooled dry-type transformers. It uses advanced computer control technology and data storage technology. The thermostat has strong anti-jamming capability for adoption of anti-jamming measures combination of hardware and software. The thermostat can keep the transformers operated safely and is an important device to protect dry-type transformers. Parameter-setting is easy achieved by several key set, and parameters will not lose after power off. The thermostat has a function of 'black box', it can record and check the instantaneous temperature of the winding of transformer before power failure. The thermostat is characterized by simple operation, easy installation and maintenance.

Production standard: JB/T7631-2016 Electronic temperature indicators for transformers.

Certification passed: ISO9001: Quality Management Systems-requirements.

2. Product Type

Type	Function
BWDK-3208BE	Three-phase circular measurement; Fault, over-temper alarm and over-temper trip output; 6-channel fan control function and phase failure protection; Three 4~20mA analogue current output and RS485 serial communication function.
BWDK-4208BE	Three-phase windings and iron core circular measurement; Fault, over-temper alarm, over-temper trip and iron core alarm output; 6-channel fan control function and phase failure protection; Four 4~20mA analogue current output and RS485 serial communication function.

3. Technical Indicators

3.1 Range of measurement: -30.0℃～240.0℃

3.2 Grade of accuracy: Grade 1 (Grade 0.5 for thermostat, Grade B for sensor)

3.3 Resolution : 0.1℃

3.4 Room temperature: -40℃～+60℃

3.5 Power voltage: AC220V±10% (50Hz/60Hz)

3.6 Power consumption: 8W

3.7 Sensor: Three (Four) Pt100 platinum thermo-resistors, three PTC Thermistor

3.8 Control of output capacity: 10A/220VAC (Resistance)

3.9 Weight: ＜3Kg

3.10 Overall dimension of thermostat: 260mm×200mm×85mm (High×Width×Deep)

3.11 Analogue output: 4~20mA current

3.12 Digital output: RS485 serial communication interface

4. Features

4.1 Three-phase winding (and iron core temperature) circular display or maximum value display function.

4.2 Fan control function. Auto start and stop fan according to the set value so that dry-type transformers could work safely at normal temperatures. Fan will start when the highest temperature among any three phases exceeds the set value of fan-start, or start the fan manually. At the same time, the panel 'fan' indicator light.

4.2.1 Thermostat can connect 1~6 fans or do not connect any. If there are fans, when fans start, the corresponding led indicator turn green.

4.2.2 If fan phase failure occurs, the corresponding led indicator turn red with alarm. If the number of connected fans is less than 6, the LED for the unconnected fans will not be on. If the number of external fans is less than 6, set the number of fans to be the actual number of fans, and the fan must be connected from No.1.

4.3 Over temperature alarm function. When the highest temperature among any three phases exceeds the set value of over-temp alarm, the led indicator 'Over-temp' turn light with alarm and the terminal(14, 15, 16) outputs a switch signal.

4.4 Over temperature trip function. When the highest temperature among any three phases exceeds the set value of over-temp trip, the led indicator 'Trip' turn light with alarm and the terminal(11, 12, 13) outputs a switch signal. When the highest coil temp has increased the preset limit for 6 seconds, it will send an alarm signal.

4.4.1 If the PTC sensor has been used, the Auto-Power-Cut output terminals will not activate unless both kinds of sensors, the PT100 and PTC, have detected the coils' temperature meets the preset limit, thus increasing the reliability of Power-Cut function.

4.5 Thermostat fault alarm function. When there is fault in thermostat, the led indicator 'Fault' turn light with alarm and the terminal (17, 18, 19) outputs a switch signal.

4.5.1 Different colors represent different phase thermostat fault: Yellow represents phase A, green represents phase B, red represents phase C. If not light, the thermostat works normally.

4.5.2 –oP- represents open circuit of sensor, -oL- represents short circuit of sensor in the temperature display area.

4.5.3 When there is a phase or two-phase fault in the thermostat, the fan is controlled according to the temperature signal of the sensor. When the three-phase sensor fails, the fan is turned on immediately.

4.6 Parameter setting function. You can set the stop and start fan value, over-temp alarm value, over-temp trip value, the timing of fan, communication address, baud rate and the number of fan control by directly through the key. Those setting value will save when power off.

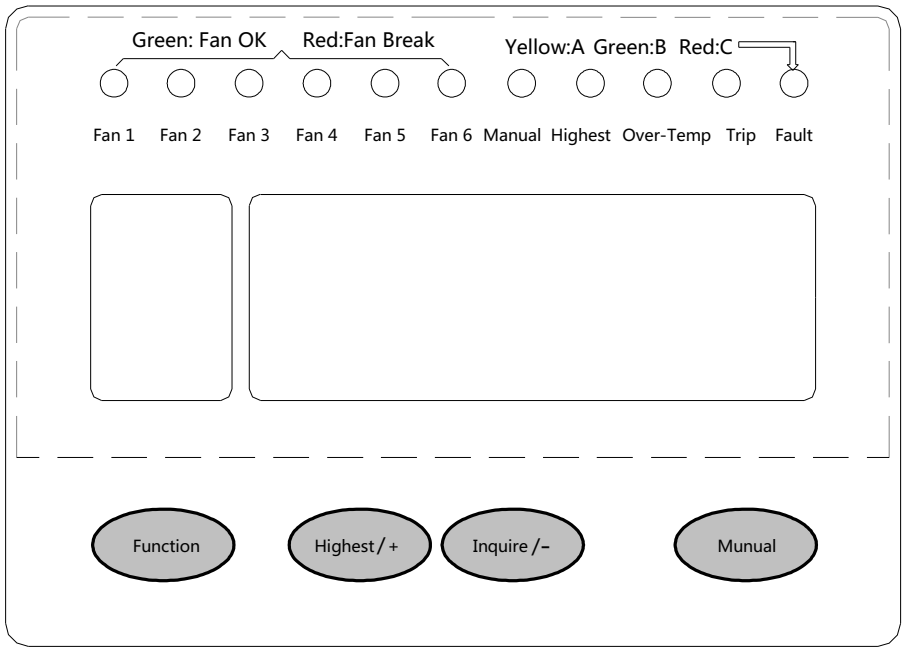
4.7 Manually control the fan function. Start fan manually by pressing the key 'Manual'. This feature is also available as a fun test function.

4.8 Start the fan with a timer function. 0 to 255 hours can be arbitrarily set (If 0 is set, it means no timer function). After regular time arrives, the fan will start 1 minute. 24 hours is set by our factory.

4.9 With 'Black box' function. The thermostats automatically record instantaneous temperature of the three -phase windings before power failure. In order to avoid the power down and change the memory data again, if the temperature below 80℃ before power down, not to refresh the original record temperature.

4.10 History highest temperature. Recording the highest temperature of each phase since power on, to prepare query.

5. Operating Instructions



5.1 First power: The thermostat is displaying temperature of phase A, B, C (d iron core circular measurement/ambient temperature) circularly when power on and the self-test is completed. If the thermostat is not connected with the sensor, the fan automatically starts.

5.2 Maximum value and circular value display switching: The thermostat will enter maximum value state by pressing the key 'Highest/+' under circular displaying status and the indicator 'Highest' lights, then it displays the highest temperature of the 3 windings; Vice versa.

5.3 Start fan manually: The thermostat will start the fan manually by pressing the key 'Manual' under normal working mode and the indicator ' Manual' lights ; Vice versa.

5.4 Power-down data query function: Pressing the key 'Inquire/-' continuously, the thermostat is displaying the temperature of phase A, B, C sequentially (d iron core circular measurement/ambient

temperature) before power down and historical maximum temperature of phase A, B, C.

5.5 Inquire control parameters

Steps	Display / Key	The first digital	The second ～ the fifth digital	Description	Remark
1	Function	1	80.0	Temperature value for fan stop	The factory setting is 80.0 ℃
2	Function	2	100.0	Temperature value for fan start	The factory setting is 100.0 ℃
3	Function	3	130.0	Over-temp alarm value	The factory setting is 130.0 ℃
4	Function	4	150.0	Over-temp trip value	The factory setting is 150.0 ℃
5	Function	H	24	Interval timing for starting fan	The factory setting is 24h 0 indicates no timed function
6	Function	P	1	Communication address of the thermostat	The factory setting is 1
7	Function	b	96	The parameter is the baud rate	The factory setting is 96
8	Function	F	6	The number of fan controlled	The factory setting is 6
9	Function	Return to regular display status			

5 .6 Control parameters'modification

Steps	Display / Key	The first digital	The second ～ the fifth digital	Description	Remark
1	Function	1	80.0	Temperature value for fan stop	The factory setting is 80.0℃
2	Press 3 times Manual	1 .	80.0	Press Highest/+ Inquire/- for setting, range: -30.0～240.0	When the decimal of the first digital lights which means entering parameter setting state
3	Function	2 .	100.0	Press Highest/+ Inquire/- for setting, range: -30.0～240.0	The factory setting is 100℃

4	Function	3 .	130.0	Press Highest/+ Inquire/- for setting, range: -30.0～240.0	The factory setting is 130℃
5	Function	4 .	150.0	Press Highest/+ Inquire/- for setting, range: -30.0～240.0	The factory setting is 150℃
6	Function	H .	24	Press Highest/+ Inquire/- for setting, range: 0～255	The factory setting is 24h 0 indicates no timed function
7	Function	P .	1	Press Highest/+ Inquire/- for setting, range: 1～199	The factory setting is 1
8	Function	b.	96	Press Highest/+ Inquire/- for setting, range: 24, 48, 96, 192	The factory setting is 96
9	Function	F .	6	Press Highest/+ Inquire/- for setting, range: 0～6	The factory setting is 6
10	Function	=	0.0	Operation simulation	Can be set by pressing '+' or '-' keys, i.e. when the simulation temp.=130ºC, over temp alarm signals will be produced and the alarming terminals will close. Note1： Regarding the actual operating temperature point, internal parameters shall prevails. Note 2: When the trip is simulated, please remove the sensor, otherwise the actual tripping contact will not be closed.
11	Function	Return to regular display status			

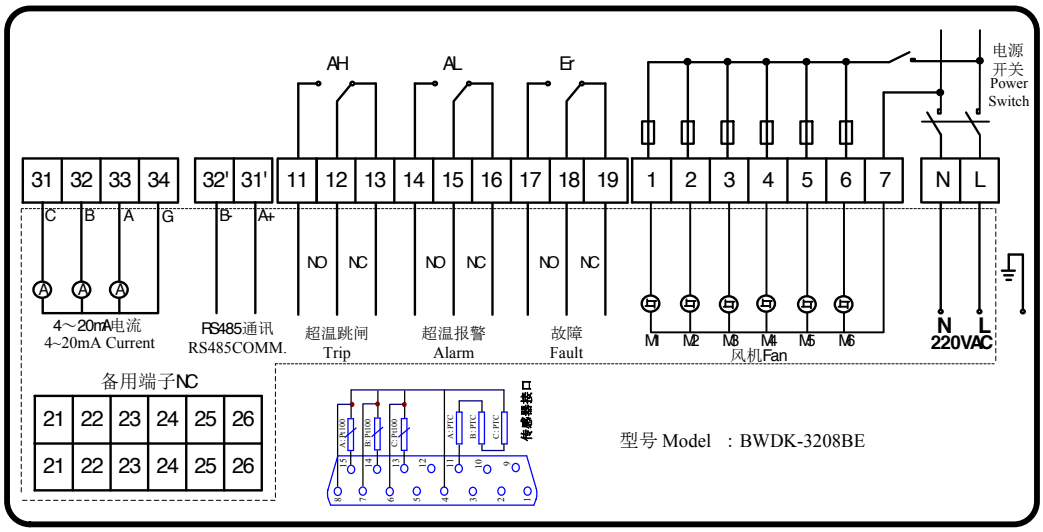
Note: When setting parameters, make sure that over-temp trip value＞ over-temp alarm value＞ start fan

temperature value＞ stop fan temperature value, and the minimum interval is not less than 5℃.

5.7 Inquire data

Steps	Display / Key	The first digital	The second~ the fifth digital	Description	Remark
1	Inquire/-	A.	XXX.X	Temperature of phase A before power failure	
2	Inquire/-	b.	XXX.X	Temperature of phase B before power failure	
3	Inquire/-	c.	XXX.X	Temperature of phase C before power failure	
4	Inquire/-	d.	XXX.X	Temperature of d-way before power failure	If there is d-way measured
5	Inquire/-	1.	XXX.X	Phase A highest temp since power on	Press 'Manual' key will clear current valve
6	Inquire/-	2.	XXX.X	Phase B highest temp since power on	Press 'Manual' key will clear current valve
7	Inquire/-	3.	XXX.X	Phase C highest temp since power on	Press 'Manual' key will clear current valve
8	Inquire/-	4.	XXX.X	D-way highest temp since power on	If there is d-way measured
9	Inquire/-	Return to regular display status			

6. Wiring Diagram (BWDK-3208BE)



6.1 Power terminals (L&N): The instrument's main power resource AC220V.

6.2 Fan outputs (1~7): 0-6 fans can be used in the system according to the real application. If one fan is needed, using terminals 1&7. If two fans are needed, using terminals 1, 2&7. If three fans are needed, using terminals 1, 2, 3&7. If four fans are needed, using terminals 1, 2, 3, 4&7. If five fans are needed, using terminals 1, 2, 3, 4, 5&7. If six fans are needed, using terminals 1, 2, 3, 4, 5, 6&7.

Note: If the fans were connected wrongly, the LED indication will not be correct, and the alarming signals will be activated.

6.3 Fault outputs (17&18&19): When the thermostat fault, they will be activated, thus sending a switch signal to the remote alarming unit.

6.4 Over temp alarm terminals (14&15&16): When the over temp alarm is needed they will be activated, thus sending a switch signal to the remote control unit.

6.5 Power cut terminals (11&12&13): When the power cutoff is needed they will be activated, thus sending a switch signal to cutoff power.

6.6 Sensors socket (DB15): Connecting the three coils temperature sensors.

6.7 4~20mA current output: Terminals 31, 32, 33, 34 outputs 4~20mA current corresponding to the temperature of phase A, B, C. (4mA corresponding to 0.0℃, 20mA corresponding to 200.0℃)

6.8 RS485 communication: Terminals 31', 32' is RS485 communication interface.

6.9 Spare terminals are terminal 21~26.

7. Communication Protocol

7.1 Instructions on communication setting: MODBUS RTU communication protocol.

- Using asynchronous communication data transfer format of RS485;
- Baud rate is set 9600bps, 19200bps, 4800bps or 2400bps; No check bit, 8-bit data, 1 stop bit;
- Using CRC16;
- Communication distance<1200m/twisted pair(It is related to the number of thermostat and communication lines).

7.2 Data Format

a. Master computer transmit data

No.	Description	Value	Remark
1	Address	01H-C7H	
2	Function code	03H	Fixed format
3	Initial address high 8-bit	00H	Definition of Initial address see as below
4	Initial address low 8-bit	××H	
5	Data number word high 8-bit	00H	
6	Data number word low 8-bit	××H	
7	CRC check low 8-bit	××H	
8	CRC check high 8-bit	××H	

b. Slave computer sends back data

No.	Description	Value	Remark
1	Address	01H-C7H	

2	Function code	03H	
3	The number of bytes of returned data	××H	Returns the data word×2
4	Status word high 8-bit	××H	Definition of status bit see as below
5	Status word low 8-bit	××H	
6	Temperature data high 8-bit in phase A	00H	Unit: ℃ Actual temperature is equal to the temperature data minus 23H
7	Temperature data low 8-bit in phase A	××H	
8	Temperature data high 8-bit in phase B	00H	
9	Temperature data low 8-bit in phase B	××H	
10	Temperature data high 8-bit in phase C	00H	
11	Temperature data low 8-bit in phase C	××H	
12	Interval fan timing high 8-bit	00H	If '0', it indicates the fan has no timed start function
13	Interval fan timing low 8-bit	××H	
14	Temperature data high 8-bit in d-way	00H	If there is no d-way, the data is invalid
15	Temperature data low 8-bit in d-way	××H	
16	CRC check low 8-bit	××H	
17	CRC check high 8-bit	××H	

c. Definition of Initial address

Initial address	Description	
0000	Status word high 8-bit	Status word
	Status word low 8-bit	
0001	Temperature data high 8-bit in phase A	Temperature data in phase A
	Temperature data low 8-bit in phase A	
0002	Temperature data high 8-bit in phase B	Temperature data in phase B
	Temperature data low 8-bit in phase B	
0003	Temperature data high 8-bit in phase C	Temperature data in phase C
	Temperature data low 8-bit in phase C	
0004	Interval fan timing high 8-bit	
	Interval fan timing low 8-bit	
0005	Temperature data high 8-bit in d-way	Temperature data in d-way
	Temperature data low 8-bit in d-way	

d. Definition of status word low 8-bit

Bit 0='0', it indicates sensor of phase A works in normal;

Bit 0='1', it indicates sensor of phase A failed.

Bit 1='0', it indicates sensor of phase B works in normal;

Bit 1='1', it indicates sensor of phase B failed.

Bit 2='0', it indicates sensor of phase C works in normal;

Bit 2='1', it indicates sensor of phase C failed.

Bit 3='0', it indicates fan has not started;

Bit 3='1', it indicates fan has started.

Bit 4='0', it indicates the winding has not over-temperature;

Bit 4='1', it indicates the winding has over-temperature.

Bit 5='0', it indicates it has not output trip signal;
Bit 5='1', it indicates it has output trip signal.
Bit 6='0', it indicates sensor of d-way works in normal;
Bit 6='1', it indicates sensor of d-way failed.
Bit 7='0', it indicates the d-way has not over-temperature, if there is no d-way, the data is invalid;
Bit 7='1', it indicates the d-way has over-temperature, if there is no d-way, the data is invalid;

e. Definition of status word high 8-bit
Bit 0='0', The door is close, if there is no door terminal, the data is invalid
Bit 0='1', The door is open, if there is no door terminal, the data is invalid
Bit 1='0', The fan is ok;
Bit 1='1', The fan is fault;

f. Example

When communication address of a thermostat is 1, temperature in phase A is 64.0℃, temperature in phase B is 54.0℃, temperature in phase C is 68.0℃, timed start time of fan is 24 hours, temperature in d-way is 65.0℃, sensor Pt100 works in normal, fan has not started, it has not outputs over-temperature alarm and trip signal.

Master computer transmit data:

01H－03H－00H－00H－00H－06H－C5H－C8H

Slave computer sends back data:

01H－03H－0CH－00H－00H－00H－63H－00H－59H－00H－67H－00H－18H－00H－64H－52H－A3H

7.3 Setting of communication address

Each instrument shall be provided communication address, if a PC simultaneously monitors multiple instruments, each instrument shall be provided with a different communication address.

8. Installation

8.1 Refer to figure 2, drill a rectangular hole of 232×182mm in the embedded body and also drill another four holes of same size as installation B holes.

8.2 Put the thermostat case bottom into the rectangular hole of 232×182mm in the embedded body. The four ϕ4.5 holes in the case should be overlapped exactly with the holes in embedded body.

8.3 Put the four provided supporting legs through the four holes in the case bottom and fix the case onto the embedded body by 4 M4 screws.

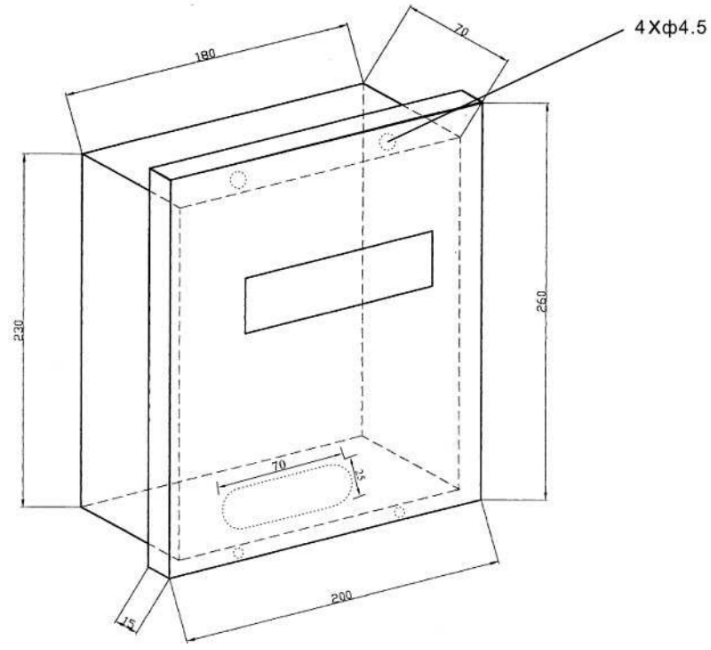


Figure1

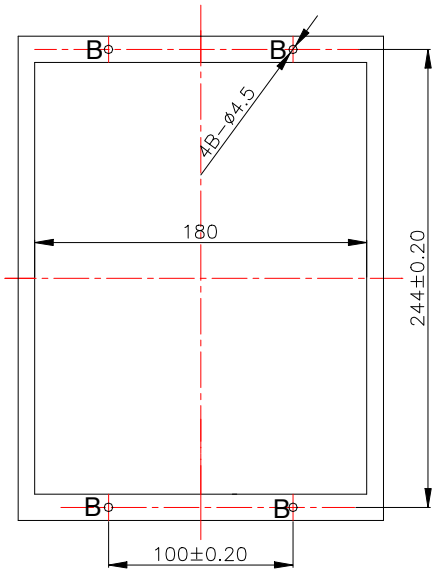


Figure2

9. Common problem

Fault phenomena	Analysis	Solution
Black screen or no displays of temperature control panel	Power failure (such as power loss or under voltage) ; Power switch is not turned on.	Check the power supply and the power switch with a multi-meter.
	Controller power circuit failure	Manufacturer handling
“OP” blinks in X-phase, fault light on	Sensor plug is unplugged, loose or in poor contact.	Tighten the temperature sensor joint screw or replace
	Sensor failure or damage;	Replacement of temperature sensor
	The temperature sensor measurement circuit is damaged.	Replacement of temperature controller
“OL” blinks in X-phase, fault light on	Sensor failure or damage	Replacement of temperature sensor
Temperature controller alarm, showing fan fault	Loose or poor connection of fan terminals	Check whether the terminal connection of fan is normal
	The number of fans set by controller does not conform to the actual connection.	Set the number of fans in temperature control as the actual number in use
	Fan fused	Check if the fan is faulty and replace the fuse
Fan runs of itself before	Manual start-up of fan state	Press "manual " to cancel fan start-up

starting temperature is reached.	Regular start and stop of fan	Normal state
	View fan start-stop parameters	Modification of fan start-stop parameters
	Failure on control circuit	Replacement of the controller
Failure to turn off the fan manually after manual start of fan.	The measured temperature value is just between the positive and negative backlash values of fan.	Normal state
Fans do not start when the temperature is over the set value of fan action	View fan start-stop parameters	Modification of fan start-stop parameters
	Problem with air switch or fuse in the fan circuit	Replacement of air switch or fuse
	Control loop failure	Replacement of controller
Three-phase temperature display deviates from the actual temperature	Fixed depth of temperature sensor	Check whether the probe of the sensor is fixed at different depth in the transformer or if the probe is detached from the fixed hole. Adjust the fixed depth or return the probe to the fixed hole.
	Temperature sensor failure	Replacement of sensors
Fixed display of temperature value of X-phase	In the maximum value display state.	Switch to the circular display state.
Controller and background system are not connected.	The setting problem of communication parameter	Check if the communication parameter settings are correct.
	The connection problem of communication circuit	Check that the two wires in the communication circuit are connected properly; Check that the A+, B-wiring (Alignment wiring of A+, B-) of RS485 are correct.
	The failure of controller communication loop	Replacement of controller
	Software matching	Communication between manufacturer and backstage system manufacturer
Intermittent communication between temperature controller and background system	Loading capacity of background system equipment	Communicate with background system manufacturers
	On-site interference	Replacement of communication connection cable as shielded cable

10. The specific Models

When the actual product is the custom special models，Please see the attached paste.