Intelligent Temperature Controller

For GTP-A Version

Features:

⊙ Multi input signal, multi models for option.

⊙ With measurement display, control output, alarm output, transmission output,
   RS485 communication, etc.

⊙ Multi PID control algorithms for option, with self-turning function.

⊙ Suitable for industrial machinery, machine tools, general measuring instruments and equipments.

National High-tech Enterprise / National Standard Drafting Unit

Service line: 400-0760-168   Version code：KKGTP-A01E-A/0-20240614

This manual describes the settings, wiring, and names of various parts of the thermostat. Please read this manual carefully before using this product, and use it correctly after understanding the content. And please keep it in a safe place for future reference.

I. Precautions for safety use

⚠ Warnning

1) When a malfunction or abnormality of this product may cause a serious accident in the system, please install an appropriate protection circuit externally.

2) Do not turn on the power until all wiring is completed. Failure to do so may cause electric shock, fire, or malfunction.

3) Do not use outside the scope of the product specifications. Doing so may cause fire or failure.

4) Do not use in places with flammable or explosive gas.

5) Do not touch high-voltage parts such as power terminals after power-on. Otherwise there is a danger of electric shock.

6) Do not disassemble, repair and modify this product. Failure to do so may cause electric shock, fire, or malfunction.

❶ Caution

1) This product must not be used in atomic energy equipment and medical equipment related to human life.

2) When this product is used in a domestic environment, radio wave interference may occur. Adequate countermeasures should be taken at this time.

3) This product is protected against electric shock through reinforced insulation. When embedding this product in a device and wiring, follow the specifications that the embedded device meets.

4) In order to prevent the occurrence of surge when all indoor wiring is longer than 30m when this product is used and in case the wiring is outdoor, an appropriate surge suppression circuit must be installed.

5) This product is manufactured on the premise that it is installed in a device. In order to prevent users from approaching high-voltage parts such as power terminals, please take necessary measures on the final product.

6) Be sure to follow the precautions in this manual, otherwise there is a danger of causing serious injury or accident.

7) Please observe local regulations when wiring.

8) In order to prevent damage to the machine and prevent machine failure, please install an appropriate capacity fuse on the power cord or larger capacity input and output lines connected to this product to protect the circuit.

9) Please do not mix metal pieces and wire debris into this product, otherwise it may cause electric shock, fire and failure.

10) Tighten the screws with the specified torque. Failure to fully tighten the screws may result in electric shock or fire.

11) In order not to hinder the heat dissipation of this product, please do not block the heat dissipation window holes and equipment vents around the cabinet.

12) Do not connect any wires to the unused terminals of this product.

13) Be sure to clean it after the power is off. Wipe the dirt on the product with a dry soft cloth, and do not use hygroscopic agents, otherwise it may cause deformation and discoloration.

14) Please do not hit or wipe the display panel with hard objects.

15) This manual assumes that the reader has basic knowledge in electrical, control, computer, and communications.

16) The illustrations, data examples, and screen examples used in this manual are entered for easy understanding of the manual and are not guaranteed to be the result of their operation.

17) In order to use this product safely for a long time, regular maintenance is necessary. Some parts of this product are limited by lifespan, and some may change due to long-term use.

18) Without prior notice, the contents of the manual may be changed. The content of the manual is expected to be free of any loopholes. If you have any questions or objections, please contact us.
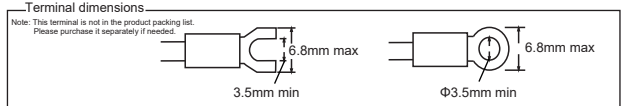
⚠ Installation and wiring precautions

1) This product is used in the following environmental standards. (IEC61010-1) [Overvoltage Category Ⅱ, Pollution Degree 2]

2) Please use within the surrounding environment, temperature, humidity and environmental conditions of the following : Temperature: 0 to 50 ° C; Humidity: 45 to 85% RH; Environmental conditions: indoor use, altitude less than 2000m.

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3) Avoid using in the following places: places where condensation may occur due to drastic temperature changes; places where corrosive gas or flammable gas is generated; places where direct vibration or may impact the product; water, oil, chemical Products, smoke,Places with steam, places with a lot of dust, salt, and metal powder, places with large clutter interference, and prone to static electricity, magnetic fields, and noise; places
   where the airflow of air conditioning or heating directly blows; places with direct sunlight; Places where heat can build up.

4) For installation, please consider the following points before installation:
   In order not to saturate the heat, allow sufficient ventilation space.
   Please consider the wiring and maintenance environment, etc. Please make sure that there is more than 50mm space above and below this product.
   Please do not install it directly above the heat-generating machine (such as heater, transformer, semiconductor manipulator, high-capacity resistor).
   If the ambient temperature is above 50 ° C, use a forced fan or cooler to cool it. However, do not allow the cooled air to blow directly into the product.
   In order to improve anti-interference performance and safety, please install as far away as possible from high-voltage equipment and power equipment.
   Do not install high-voltage machines in the same cabinet as this product.
   The distance between this product and the power line should be more than 200mm.
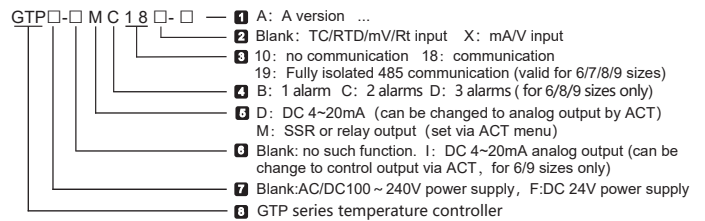   Install the power machine as far away as possible.

⚠ Wiring precautions:

1) In the case of thermocouple input, please use the specified compensation wire; if the device to be measured is a metal heating object, please use insulated thermocouple; the thermocouples must be isolated from each other.

2) In the case of thermal resistance input, please use a wire with a small resistance and a (3-wire) non-resistance difference, but the total length should be within 5m; this product does not have this function for the time being.

3) In order to avoid the influence of noise interference, please keep the input wire away from the instrument power line, power supply line and load line.

4) In order to reduce the influence of power and heavy load power lines on this product, it is recommended to use a noise filter where it is easily affected. If using a noise filter, be sure to install it on a grounded panel and minimize the wiring between the output side of the noise filter and the power terminals; do not install fuses, switches, etc. on the wiring of the output side of the noise filter. Otherwise, the effect of the filter will be reduced.

5) The output time of this product when it is powered on is about 5 seconds. If signals such as interlocked circuits are used, please use a delay relay.

6) Please use shielded twisted pair as far as possible for the transmission output line. If necessary, you can also connect a common mode coil at the front of the signal receiving equipment to suppress the interference of the line and ensure the signal is reliable and stable.

7) Please use shielded twisted-pair cables for long-distance RS485 communication lines, and ground the shielding layer on the host side to ensure reliable and stable communication.

8) There is no fuse for this product; please configure it according to the rated voltage 250V and rated current 1A, fuse type: time-delay fuse.

9) Please use a suitable "Slotted" screwdriver and wire,
   Terminal pitch: 5.0mm
   Screwdriver size: 0.6X3.5 "Slotted" length is more than 130mm
   Recommended tightening torque: 0.5N.m
   Suitable wire: 0.25 to 1.65mm single or multi-core flexible cord

10) Do not contact the crimp terminal or the bare wire with an adjacent terminal.

Terminal dimensions
Note: This terminal is not in the product packing list.
Please purchase it separately if needed.

6.8mm max   6.8mm max
3.5mm min   Φ3.5mm min

11) The temperature resistance of the wire connected to the terminalshould be at least 70℃.

II. Model Illustration

GTP□-□M C 1 8 □- □   ❶ A: A version ...
❷ Blank: TC/RTD/mV/Rt input   X: mA/V input
❸ 10: no communication 18: communication
19: Fully isolated 485 communication (valid for 6/7/8/9 sizes)
❹ B: 1 alarm C: 2 alarms D: 3 alarms (for 6/8/9 sizes only)
❺ D: DC 4~20mA (can be changed to analog output by ACT)
M: SSR or relay output (set via ACT menu)
❻ Blank: no such function. I: DC 4~20mA analog output (can be change to control output via ACT，for 6/9 sizes only)
❼ Blank:AC/DC100～240V power supply，F:DC 24V power supply
❽ GTP series temperature controller

III. General model description

No.	Model number	OUT1 control output			Alarm output			Analog	Comm.	Auxiliary power
		RELAY	SSR	4～20mA	AL1 OUT2	AL2	AL3	4～20mA	RS485	24V
1	GTP□-MC18□	●	●		●	●			●	●
2	GTP□-MC10□	●	●		●	●				●
3	GTP□-IMC18□	●	●	●	●	●		◎	●	●
4	GTP□-IMC10□	●	●	●	●	●		◎		●

□:The default "Blank" input signal is TC/RTD/Mv/Rt; "X" input signal is 4 ～ 20mA/0 ～ 10V.

●:Standard configuration function.

◎:With this function, but multiplexed with other functions. This series has only one DC 4-20mA output, but it can be configured for main control output or transmission output through the ACT menu.

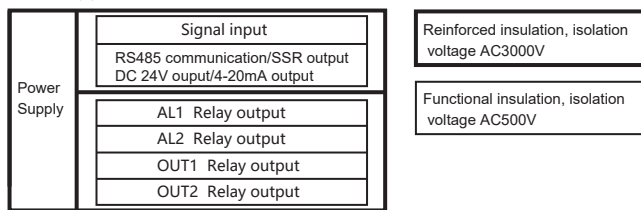## IV. Main Technical Parameters

Sampling speed	2 times per second
Relay capacity	AC 250V /3A Life of rated load>100000 times
Power supply	AC/DC 100 ～ 240V (85-265V)，DC 24V
Total consumption	< 10VA
SSR output	DC 24V impulse level, load<30mA
Current output	DC 4~20mA load<500Ω
Communication port	RS485 port Modbus-RTU protocol
Insulation impedance	Input, output, power to housing＞20MΩ
ESD	IEC/EN61000-4-2 Contact ±4KV /Air ±8KV perf.Criteria B
Pulse traip anti-interference	IEC/EN61000-4-4 ±2KV perf.Criteria B
Surge immunity	IEC/EN61000-4-5 ±2KV perf.Criteria B
Voltage drop & short interruption immunity	IEC/EN61000-4-29 0% ～ 70% perf.Criteria B
Isolation withstand voltage	Signal input & output & power 3000VAC 1min, <60V Low voltage circuit between DC500V,1min
Power-off protection	10 years,times of writing:1 million times
Panel protection level	IP65(IEC60529)
Safety standard	IEC61010-1 Overvoltage category Ⅱ, pollution level 2, level Ⅱ (Enhanced insulation)
Shell material	PC/ABS (flame class UL94V-0)
Panel material	PC
Weight	About 300g
Ambient environment	Indoor use, temperature: 0~50℃, no condensation, humidity:＜85%RH, altitude<2000m

3. Measurement signal parameter table

Input type	Symbol	Measurement Range		Resolution	Accuracy (23℃±0.5)	Input resistance Auxiliary current	Commincation Code
		℃	°F				
K1	Ы1	-50 ～ 1200	-60 ～ 2200	1℃	0.5%F.S±3digits	>1MΩ	0
K2	Ы2	-50.0 ～ 999.9	-60.0 ～ 999.9	0.2℃	0.5%F.S±1℃	>1MΩ	16
J1	J1	0 ～ 1200	0 ～ 2200	1℃	0.5%F.S±3digits	>1MΩ	1
J2	J2	0.0 ～ 999.9	0 ～ 999.9	0.2℃	0.5%F.S±1℃	>1MΩ	17
E1	E1	0 ～ 850	0 ～ 1500	1℃	0.5%F.S±3digits	>1MΩ	2
E2	E2	0.0 ～ 850.0	0 ～ 999.9	0.3℃	0.5%F.S±1℃	>1MΩ	18
T1	t1	-50 ～ 400	-60 ～ 750	1℃	0.5%F.S±3℃	>1MΩ	3
T2	t2	-50.0 ～ 400.0	-60.0 ～ 750.0	0.4℃	0.5%F.S±3℃	>1MΩ	19
B	b	250 ～ 1800	250 ～ 3200	1℃	1%F.S±2℃	>1MΩ	4
R	r	-10 ～ 1700	-10 ～ 3000	1℃	1%F.S±2℃	>1MΩ	5
S	S	-10 ～ 1600	-10 ～ 2900	1℃	1%F.S±2℃	>1MΩ	6
N1	n1	-50 ～ 1200	-60 ～ 2200	1℃	0.5%F.S±1℃	>1MΩ	7
N2	n2	-50.0 ～ 999.9	-60 ～ 999.9	0.2℃	0.5%F.S±1℃	>1MΩ	20
PT100-1	Pt1	-200.0 ～ 600.0	-200.0 ～ 999.9	0.2℃	0.5%F.S±0.3℃	0.33mA	8
PT100-2	Pt2	-200 ～ 600	-300 ～ 1100	1℃	0.5%F.S±3digits	0.33mA	21
JPT100-1	JPt1	-200.0 ～ 500.0	-200.0 ～ 900.0	0.2℃	0.5%F.S±0.3℃	0.33mA	9
JPT100-2	JPt2	-200 ～ 500	-300 ～ 900	1℃	0.5%F.S±3digits	0.33mA	22
CU50-1	CU51	-50.0 ～ 150.0	-60.0 ～ 300.0	0.2℃	0.5%F.S±3℃	0.33mA	10
CU50-2	CU52	-50 ～ 150	-60 ～ 300	1℃	0.5%F.S±3℃	0.33mA	23
CU100-1	CU01	-50.0 ～ 150.0	-60.0 ～ 300.0	0.2℃	0.5%F.S±1℃	0.33mA	11
CU100-2	CU02	-50 ～ 150	-60 ～ 300	1℃	0.5%F.S±3digits	0.33mA	24
0 ～ 50mV	mV	-1999 ～ 9999		12bit	0.5%F.S±3digits	0.33mA	12
0 ～ 400Ω	rt	-1999 ～ 9999		12bit	0.5%F.S±3digits	0.33mA	13
* 4 ～ 20mA	mA	-1999 ～ 9999		12bit	0.5%F.S±3digits	<50Ω	14
* 0 ～ 10V	V	-1999 ～ 9999		12bit	0.5%F.S±3digits	>1MΩ	15

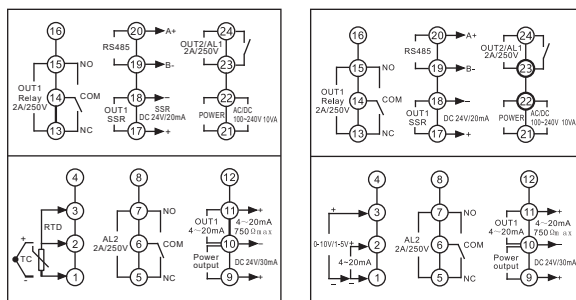*: Please indicate the input signal requirements before order.

3、隔离模式框图：

Power Supply	Signal input	Reinforced insulation, isolation voltage AC3000V
	RS485 communication/SSR output DC 24V ouput/4-20mA output	
	AL1 Relay output	Functional insulation, isolation voltage AC500V
	AL2 Relay output	
	OUT1 Relay output	
	OUT2 Relay output	

V. Dimensions and installation method.

1、Dimensions and hole size.

Panel size   Side size   Hole size

45.20
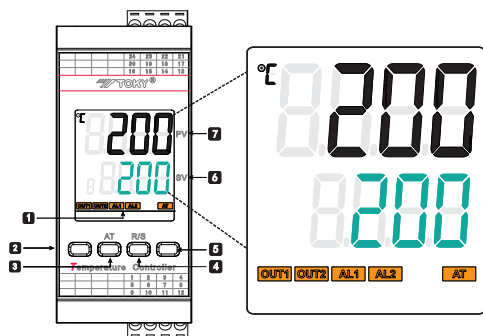
109.41 99.00 35.00 119.50
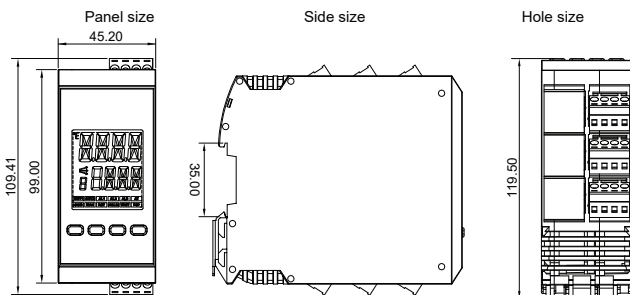
VI. Connection Diagram

In case of any change, please subject to the wiring diagram on the actual equipment.

VII. Name of universal panel

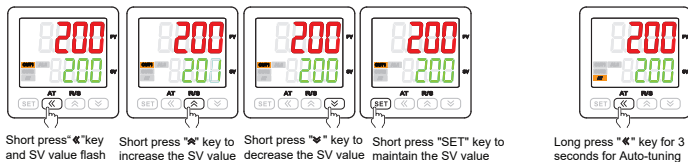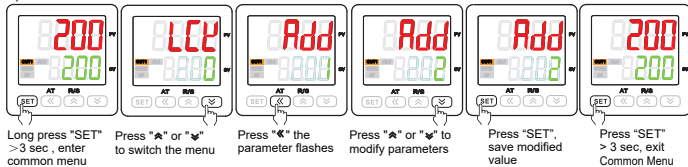| No.	Symbol	Name	Function description
1	OUT1	OUT1 LED(orange)	Main control output indicator, light when the output is ON
	OUT2	OUT2 LED(orange)	Cooling output indicator, light when the output is ON
	AL1	Alarm1# LED(orange)	1st alarm output indicator: ON=Alarm output, OFF=no output.
	AL2	Alarm2 # LED(orange)	2nd alarm output indicator: ON=Alarm output, OFF=no output.
	AT	AT LED (orange)	Self-tuning indicator, when it lights up, it is in the tuning state
2	SET	SET function key	Menu key/confirm key, used to enter or exit parameter modification mode or confirm saving modified parameters
3	≪	Shift/AT Key	Activation key/shift key/AT auto-tuning key, long press to enter or exit auto-tuning in measurement control mode
4	≫	Increase /R/S	Increase key. In measurement control mode, press and hold to switch between RUN/STOP mode and view the menu in reverse order.
5	≪	Decrease Key	Decrease key, view menu in normal order
6	SV	Display window(Green)	Setting value or parameter display window, "STOP" means control is stopped.
7	PV	Display window(White)	Measurement value or parameter code display window

Ⅷ. Operation Process and Menu Illustration

1. Operation process and method
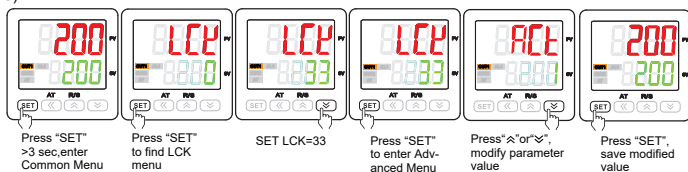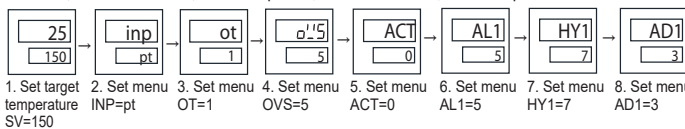1) Modify the SV setting value

Short press"≪"key and SV value flash   Short press "≫" key to increase the SV value   Short press "≪" key to decrease the SV value   Short press "SET" key to maintain the SV value   Long press "≪" key for 3 seconds for Auto-tuning

2). Common Menu

Long press "SET" >3 sec , enter common menu   Press "≫" or "≪" to switch the menu   Press "≪" the parameter flashes   Press "≫" or "≪" to modify parameters   Press "SET", save modified value   Press "SET" > 3 sec, exit Common Menu

3). Advanced menu

Press "SET" >3 sec,enter Common Menu   Press "SET" to find LCK menu   SET LCK=33   Press "SET" to enter Advanced Menu   Press "≫"or"≪", modify parameter value   Press "SET", save modified value

2、Operation examples
1) Example 1, ON/OFF control：
Sensor：K type, measure range -50~1300℃; target temperature: 100℃; control mode: heatin; control requirement: ON/OFF control, when current temperature PV reaches 100℃, stop heating; when PV is lower than 98℃, start heating again; control output: relay; alarm: 1 alarm, when PV>110℃, alarm output on; when PV<105℃, alarm output off.

25 / 150	→	inp / pt	→	ot / 1	→	oVS / 5	→	ACT / 0	→	AL1 / 5	→	HY1 / 7	→	AD1 / 3

1. Set target temperature SV=150   2. Set menu INP=pt   3. Set menu OT=1   4. Set menu OVS=5   5. Set menu ACT=0   6. Set menu AL1=5   7. Set menu HY1=7   8. Set menu AD1=3

2) Example 2, PID control:
Sensor: PT100, measure range -200~600℃; target temperature: 150℃; control mode: heating; control requirement: PID control (note: in order to get stable temperature control, please use the auto-tuning function when the controller is powered on for the first time; if the temperature control is stable after the auto tuning, there is no need to repeat this step in the future usage.); control output: SSR; alarm: 1 alarm, when PV>SV+5℃, alarm output on, when PV<SV-2℃, alarm output off.

IX. Menu Illustration

☐ : No mater what model, what control mode it is, it will always display these parameters.
▨ : According to different model, control mode, these parameters will be hidden.

1. Regular Menu

No.	Symbol	Name	Illustration	Setting range	Factory setting
1	SP-m	SP-M	Slope display value. When SPRT setting is valid, press SET key switching to this menu to view the heating speed.	FL ～ FH	
2	AL1	AL1	1st alarm value, note: the minus is dealed as absolute value when it is set as deviation alarm. Refer to (1) Alarm parameters and output logic diagram	FL ～ FH	10
3	HY1	HY1	1st alarm hystersis	0 ～ 1000	1
4	Ad1	AD1 (1)	1st alarm mode. Note:when AL1 is used as OUT2(cooling output), should set AD1=0(close alarm function). When AD1>6, 2nd alarm function is invalid.	0 ～ 12	3
5	AL2	AL2	2nd alarm value,	FL ～ FH	5
6	HY2	HY2	2nd alarm hystersis	0 ～ 1000	1
7	Ad2	AD2 (1)	2nd alarm mode,see table (1) alarm logic diagram	0 ～ 6	4
8	AL3	AL3	3rd alarm value, note: the minus is dealed as absolute value when it is as a deviation value.	FL ～ FH	200
9	HY3	HY3	3rd alarm hystersis	0 ～ 1000	1
10	Ad3	AD3 (1)	3rd alarm mode,see table (1) alarm logic diagram	0 ～ 6	1
11	PS	PS	Amend value, display value= actual measured value + amend value	FL ～ FH	0
12	inP	INP	Optional input signal. Note: after selecting the signal, please properly set below relevant parameters: SV,AL1,HY1,AL2,HY2,P,OVS,DB.	refer to input signal parameters table page 3	K1

Continued

No.	Symbol	Name	Illustration	Setting range	Factory setting
13	ot	OT	Control mode, 0:ON/OFF heating control, relevant parameter: DB. 1: PID heating control, relevant parameters: P, I, D, OVS, CP, ST, SPD, PDC. 2: ON/OFF cooling control, relevant parameter DB; need to set PT when it is used for compressor control. 3:PID heating & cooling control(cooling control OUT2 will output through AL1 relay), relevant parameters: P, I, D, OVS, CP, CP1, PC, DB, ST, SPD, PDC. 4: Over temperature cooling output, relevant parameter: DB 5. PID cooling, relevant parameter: P, I, D, OVS, CP, ST, SPD, PDC.	0 ~ 5	1
14	A-A	A-M	Auto-manual control switch, AUTO(0): auto control only; MAN(1): manual control only; AM(2): auto-manual switch	AUTO~AM	AUTO
15	P	P	Proportional band, the smaller the value is,the faster the system responds,otherwise,it is slower. When P=0, no PID control, unit same as PV	0 ~ 9999	30
16	I	I	Integral time, the smaller the value is, the stronger the integral action is, otherwise, it is weeker. When I=0, no integral action, unit: s.	0 ~ 9999	120
17	d	D	Differential time, the greater the value is, the stronger the differential actiontion is,otherwise,it is weeker. When D=0, no differential action. Set D=0 when controlling fast systems, e.g., pressure, speed; unit: s	0 ~ 9999	30
18	oVS	OVS	Overshoot limit, during PID control process, when PV (measured value) > SV(set value) + OVS(overshoot limit), force to close output. The smaller this value is, the smaller the PID adjustment range is, the worse the control stability is.When set to 0, close this function. Please set the appropriate value according to the actual situation.	0 ~ 9999	0
19	CP	CP	OUT1 control cycle, 1: SSR control output, 4-200: relay control output. Unit: s	1 ~ 200	20
20	CP1	CP1	OUT2 relay output cycle. Unit: s	4 ~ 200	20
21	PC	PC	OUT2 cooling proportionality coefficient, the higher of value,the stronger of cooling	1 ~ 100	10
22	db	DB	ON/OFF control hystersis (positive and negative work the same); when OT=3, it is the dead zone for cooling control (positive and negative work differently); after change the INP setting, please change this parameter according to the decimal point position.	-1000~1000	5
23	LCK	LCK	Lock function. 0001:SV value can't be modified. 0010: SV can be checked only, can't be modified. 0033: can enter to advanced menu. 0123: menus reset to factory setting	0~9999	0

2. Advanced menu illustration

No.	Symbol	Name	Illustration	Setting range	Factory setting
24	ACt	ACT	Control execution mode. 0:relay or SSR control output. 1:SSR control output only. 2: 4~20mA control output, setting should comply with the selected configuration of the meter. When this menu is set as 3,4~20mA is used as analog output for size 4,7 products. When this menu is set as 0 or 1, 4-20mA output is used as analog output, for size 6,9 products. 4: When individual SSR outputs, the main control relay will change to AL2 output in size 4,7 products; 5: When it is 4-20mA output, change AL2 to the main control relay in size 4 and 7 products. (Note: Instructions for ordering)	0~2 (0~5)	0
25	AE1	AE1 (2)	the 1st alarm extensions function, refer to alarm extension function table	0~5	0
26	AE2	AE2 (2)	the 2nd alarm extensions function, refer to alarm extension function table	0~5	0
27	AE3	AE3 (3)	the 3rd alarm extensions function, refer to alarm extension function table	0~5	0
28	dP	DP	Decimal point setting, 1 decimal at most for TC & RTD input	0~3	0
29	dtr	DTR	PV fuzzy tracking value, properly set this value on some occasions, it can get a more stable control display value, this value is unrelated with actual measured value. Note: after setting this value, when alarm setting value is equal to SV setting value, alarm output operation is subject to actual measured value. Set 0 to close this function.	0.0 ~ 2.0 (0~20)	1.0 (10)
30	Ft	FT	Filter coefficient, the higher of value, the stronger of filter function	0 ~ 255	10
31	Ut	UT	Temperature unit: ℃: Celsius degrees. ℉: Fahrenheit degrees. Note: No unit for linear signal	(25)℃ (26)℉	(25)℃
32	SSM	SSM	RUN/STOP operation switch, 0: close 1: open This setting is only related to panel operations and is not related to communication	0 ~ 1	0
33	SLL	SLL	Limit the lower limit of the target setting value, SV cannot be modified beyond this range	FL~FH	
34	SLH	SLH	Limit the high limit of the target setting value, SV cannot be modified beyond this range	FL~FH	
35	FL	FL	Measure range low limit, the setting value must be less than measure range high limit	Refer to signal parameter table	-50
36	FH	FH	Measure range high limit,the setting value must be more than measure range low limit.	Refer to signal parameter table	1200
37	brL	BRL	The low limit of analog range, note: when this value is higher than high limit,it is reverse analog output.	FL~FH	-50
38	brH	BRH	The high limit of analog range, note: when this value is lower the low limit, it is reverse analog output.	FL~FH	1200
39	oLL	OLL	Output low limit, limit the output low limit current amplitude. Set value must be less than high limit.	-5.0~100.0	0
40	oLH	OLH	Output high limit,limit the output high limit current amplitude. Setting value must be larger than low limit.	0.0 ~ 105.0	100.0
41	St	ST	Auto-tune function, 0: work normally after power on, 1: automatically enter PID parameters auto-tune status after power-on; long press "AT" key to exit auto-tune.	0~1	0
42	SPd	SPD	PID control speed adjustment,option: 0 (N) No , 1 (s) slow, 2 (ss) medium slow, 3(SSS)very slow, 4 (F) fast, 5 (FF) medium fast, 6 (FFF) very fast	0~6	N
43	Pdc	PDC	PID algorithm option: 0(FUZ): Advanced fuzzy PID algorithm; 1(STD): normal PID algorithm	0~1	FUZ
44	P-S	PRS	Set the parameter save location: 0 (EEP): EEPROM has power-off protection;1 (RAM): RAM without power-off protection	EEP/RAM	EEP
45	-SS	RSS	RUN/STOP save location: 0 (EEP): EEPROM has power-off protection;1 (RAM): RAM without power-off protection	EEP/RAM	EEP
46	Pt	PT	Compressor start delay time, unit: s	0~9999	0
47	bAd	BAD	Baud 0 (4.8): 4800; 1 (9.6): 9600; 2 (19.2): 19200 3 (38.4): 38400; 4 (57.6): 57600; 5 (115.2): 115200	0~5	9.6

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Continued

No.	Symbol	Name	Illustration	Setting range	Factory setting
48	Add	ADD	Communication ADD	0~247	1
49	P-tY	PRTY	Communication parity check setting, 0:NO 1:ODD 2:EVEN	0~2	N0
50	dtc	DTC	Communication data transport sequence 000; the 1st bit function reserved; the 2nd bit is byte sequence exchange; the 3rd bit function reserved.	Refer to COM. protocol note③	0
51	SP-t	SPRT	The set value of the heating slope, 0: Don't have this function, unit: ℃/minute. When the SPRT setting is valid, during PID operation, if the measured value is lower than the setting value, the temperature will be raised to the setting value using the SPRT defined heating rate limit value. Unit: per minute, if SPRT=5, the temperature will be raised to the setting value at 5 ℃ per minute.	0~9999	0
52	CAE	CAE	User self-calibration function, this parameter is only for the input signals except TC/RTD; Y:use the self-calibration parameters;N: Don't use the self-calibration parameters.	0 (N) 1 (Y)	N
53	CAL	CAL	Self-calibration low limit input operation, after add the low end signal to the signal input terminal,flash YES to activate, after confirm and display OK, the input signal low end calibration is completed.	YES/OK	YES
54	CAH	CAH	Self-calibration high limit input operation, after add the high end signal to the signal input terminal,flash YES to activate, after confirm and display OK, the input signal high end calibration is completed.	YES/OK	YES
55	VEr	VER	Software version	——————	

(1) Alarm parameters and output logic diagram:
Symbol description: "☆" means HY, "▲" means alarm value, "△" means SV value

Alarm code	Alarm mode	Alarm output (AL1 & AL2 are independent from each) Image:the hatched section means the alarm action
0	Alarm close	
1	High limit absolute value alarm	
2	Low limit absolute value alarm	
3	※High limit deviation value alarm	
4	※Low limit deviation value alarm	
5	※High/low limit deviation value alarm	
6	※High/low limit interval value alarm	
7	High/low limit absolute value interval alarm	
8	※High/ow limit deviation value interval alarm	
9	※High limit absolute value and low limit deviation value interval alarm	
10	※High limit deviation value and low limit absolute value interval alarm	
11	※High/low limit absolute value alarm	
12	High/low limit deviation value alarm	

※ For deviation alarm, if alarm value is set as a negative number, it will be used as an absolute value. Two groups of alarm parameters (AL1, AL2) below 7-12 are used in combination, AL1 alarm output, AD2 must be set to 0.

(2) Alarm extension function table

AE1~AE3 value	Alarm handling method when it displays HHHH/LLLL	Power on, alarm inhibition
0	Alarm status remains the same	Power on, no alarm inhibition (As long as the alarm condition is met, alarm output immediately)
1	Forced alarm output	
2	Forced alarm close	
3	Alarm status remains the same	Power on, alarm inhibition (After power on and before the PV value reaches the SV for the first time, the alarm will not output. After that alarm work normally)
4	Forced alarm output	
5	Forced alarm close	

X. Key function operation
1. RUN/Stop mode
1) Under the measure mode, press and hold "R/S" key > 3 sec to enter STOP mode, SV window will display "STOP", main control output stops or keep the minimum output.
2) Under STOP mode, press and hold "R/S" key to exit STOP mode. Press "《" key to modify SV value.
3) Under STOP mode, alarm output and analog output work normally.
2. PID auto-tune operation:
1) Before auto-tuning, please switch off the load power, or set the meter as STOP mode.
2) Before auto-tuning, PV value should meet below condition: when it is PID heating control, PV needs to be much smaller than SV; when it is PID cooling control, PV needs to be much greater than SV.
3) Before auto-tuning, please set a proper alarm value or eliminate the alarm condition, in order to prevent the auto-tuning procedure from being affected by alarm output.
4) Set PID type and SV value; the factory default setting is fuzzy PID.
5) Set as PID control, if there is OLL & OLH output limitation, please set the output to a proper range; factory default setting is OLL=0%, OLH=100% .
6) Exit STOP mode, or switch on the load power, and immediately press and hold "AT" key to enter auto-tuning mode, then the AT indicator light is on .
7) The auto-tuning procedure will take some time, in order not to affect auto-tune result, please don`t modify the parameters or power-off.
8) When AT light turns off, it automatically exits auto-tune mode, PID parameters will be updated automatically, and then the meter will control automatically and precisely.
9) During the auto-tuning procedure, below actions will cause the termination of the precess, press and hold "AT" key, measure beyond the scope, abnormal display, switch to STOP mode, power-off, etc.
10) Note: In the occasions with output limiting operation, sometimes, even if the auto-tuning is carried out, the best PID parameters still cannot be obtained.
11) Experienced users can set a proper PID parameter according to their experience.

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3. PID heating and proportional cooling control operation

1) Set the control mode OT as 3.
2) PID heating control operates on OUT1; proportional cooling control operates on OUT2.
3) Proportional cooling control OUT2 outputs via AL1 alarm function terminals.
4) Please set the cooling start hystersis DB to a value greater than 5, to ensure the cooling output will not affect the PID heating control.
5) Please set the cooling control cycle CP1 and the cooling proportionality coefficient PC to the proper value.
6) When PV value > SV+DB value, the cooling control start to effect; the bigger value of PV, the longer output time of OUT2.

4. Auto-manual switch function

1) Enter common menu, set parameter A-M as "AM".
2) After return back to measure control interface, press " SET " key to switch auto-manual operation.
3) When it is switched to manual control, lower line LED will display output percentage: M0~M100 (corresponding to 0%~100%), press UP key and DOWN key to modify the output percentage.
4) Before the switch from manual control to auto control, in order to ensure the smooth switch, please press Shift key to modify the SV value first.
5) After the meter is rebooted, the default setting is manual control and output 0%.

5. Fixed manual control function

1) Set the A-M parameters to "MAN".
2) After returning to the measurement control interface, the output volume can be manually adjusted.
3) After powering on again, the manual output volume before power failure can be restored.

6. Linear signal self-calibration function

1) Set the INP type and confirm it is one of 0~50mV, RT (0~400Ω), 4~20mA and 0~10V input.
2) Add the input signal to the correct input channel.
3) Enter the menu lower limit calibration CAL, press "AT" to flash "YES"; and at this time, adjust the input signal to the minimum value and input it into the instrument.
4) When "YES" is flashing and the minimum signal value has been input to the instrument; press the " SET " key to confirm and save the calibration value.
5) After calibrating the lower limit, enter the upper limit calibration menu CAH, and flash "YES" in the same way.
6) Adjust the input signal to the maximum value and input it into the instrument. And when "YES" flashes, press " SET " to confirm and save the calibration upper limit value.
7) After calibration, you can enter CAE and change "N" to "Y" to enable self-calibration; otherwise, use the factory calibration value.
8) The calibrated upper limit input linear signal value should not exceed the input standard value range ±10%.
9) If you are not satisfied with the calibration results after calibration, you can recalibrate.

XI. Checking methods of simple fault

Display	Checking methods
LLLL/HHHH	Checks whether the input disconnection and whether normal of FH/ FL value, working environment temperature and whether input signal is selected correctly.
No display after power on	Check whether the voltage is normal; whether there is poor contact; internal protection for excessive grid harmonics;
No output	Check whether the wiring is correct; whether there is poor contact; whether the ACT/OT menu settings are incorrect;
No communication	Check hardware connection, instrument settings and software reading settings; hexadecimal conversion errors; address errors; data errors

XII.Communication Protocol

The instrument uses Modbus RTU communication protocol, reads the function number 0x03 of the holding register in area 04, writes the function number 0x10 or 0x06, and uses 16-bit CRC for verification. The instrument does not return verification errors. The data type is a 16-bit signed or unsigned integer,

Data frame format:

Start bit	Data bit	Stop bit	Check bit
1	8	1	None/odd parity/even parity

1. Read register

For example:Host reads integer SV(set value 200)

The address code of SV is 0x2000, because SV is integer(2 dyte), seizes 1 data register. The memory code of decimal integer 200 is 0x00C8. Note: when reading data, should read DP value or confirm DP menu value first to ensure the decimal point postion, after that transform the read data to get the actual value. Conversely, it should transform the data to corresponding ratio before writing the data in meter.

Read multiple registers	Meter ADD	Function code	Start ADD high bit	Start ADD low bit	Data byte length high bit	Data byte length low bit	CRC code	CRC code
Host request	0x01	0x03	0x20	0x00	0x00	0x01	0x8F	0xCA
Slave responds normally	0x01	0x03	0x02 Data byte		0x00	0xC8	0xB9	0xD2
Slave responds abnormally	0x01	0x83	0x02 Error code Example, the host request address is 0x2011				0xC0	0xF1

Example: host writes multiple registers (using function code 10) to write the SV value (SV=150).

The register address of SV is 0x2000, because the data type of SV is a 16-bit integer (2 bytes), 1 register. The decimal integer 150 is converted to hexadecimal code 0x0096. Before writing data, you should first convert the data to the corresponding magnification and then write the data to the instrument.

2. Write multiple registers

Host request (write multiple registers)										
Meter ADD	Function code	ADD high bit	ADD low bit	Data high bit	Data low bit	Data byte length	Data high bit	Data low bit	CRC code	CRC code
0x01	0x10	0x20	0x00	0x00	0x01	0x02	0x00	0x96	0x07	0xFC

Slave responds normally (write multiple registers)							
Meter ADD	Function code	Start ADD high bit	Start ADD low bit	Data byte length high bit	Data byte length low bit	※CRC code low bit	※CRC code high bit
0x01	0x10	0x20	0x00	0x00	0x01	0x0A	0x09

Host writes single register (06 function code) writes SV value (SV=150)

Write single register	Meter ADD	Function code	ADD high bit	ADD low bit	Data high bit	Data low bit	CRC code	CRC code
Host request	0x01	0x06	0x20	0x00	0x00	0x96	0x02	0x64
Slave responds normally	0x01	0x06	0x20	0x00	0x00	0x96	0x02	0x64
Slave responds abnormally	0x01	0x86 Function code	0x02 Error code				0xC3	0xA1

Communication abnormal handling method:

When responding abnormally, set the highest bit of the function number to 1.

For example: if the function number requested by the host is 0x03, the corresponding function number returned by the slave is 0x83.

Error type code:

0x01--Illegal function: The function number sent by the host is not supported by the instrument.

0x02--Illegal address: The register address specified by the host exceeds the allowable range of the instrument parameter address.

0x03--Illegal value: The write data value sent by the host exceeds the allowable range of the instrument.

Meter parameters address mapping table

No.	Add(Register No①)	Variable name	Register	R/W	Remark
1	0x2000 (48193)	Setting value SV	1	R/W	
2	0x2001 (48194)	1st alarm value AL1	1	R/W	
3	0x2002 (48195)	1st alarm hysteresis HY1	1	R/W	
4	0x2003 (48196)	2nd alarm value AL2	1	R/W	
5	0x2004 (48197)	2nd alarm hysteresis HY2	1	R/W	
6	0x2005 (48198)	Display low limit FL	1	R/W	
7	0x2006 (48199)	Display high limit FH	1	R/W	
8	0x2007 (48200)	Analog output low limit BRL	1	R/W	
9	0x2008 (48201)	Analog output high limit BRH	1	R/W	
10	0x2009 (48202)	Control output low limit OLL	1	R/W	
11	0x200A (48203)	Control output high limit OLH	1	R/W	Default 1 decimal point
12	0x200B (48204)	Overshoot limit OVS	1	R/W	
13	0x200C (48205)	Heat & Cool control dead zone DB	1	R/W	
14	0x200D (48206)	Proportional coefficient of cooling PC	1	R/W	Default 1 decimal point
15	0x200E (48207)	Amend value PS	1	R/W	
16	0x200F (48208)	PV fuzzy tracking value DTR	1	R	Engineering work without decimal point
17	0x2010 (48209)	Measured value PV	1	R	
18	0x2011 (48210)	Output percentage MV	1	R/W	0~100
19	0x2012 (48211)	Auto-Manual switch A-M	1	R/W	0:Auto; 1: Manual 2:Auto-Manual switch
20	0x2013 (48212)	3rd alarm value AL3	1	R/W	
21	0x2014 (48213)	3rd alarm hysteresis HY3	1	R/W	
22	0x2015 (48214)	Set value lower limit SLL	1	R/W	
23	0x2016 (48215)	Set value higher limit SLH	1	R/W	
24	0x2017 (48216)	Panel R/S operation switch SSM	1	R/W	
25	0x2018 (48217)	Set parameter storage location PRS	1	R/W	
26	0x2019 (48218)	RUN/STOP storage location RSS	1	R/W	
27	0x201A (48219)	Slope display value SR-M	1	R	
28	0x201B (48220)	Slope temperature rise set value SPRT	1	R/W	
Reserve					
29	0x2100 (48449)	1st alarm mode AD1	1	R/W	
30	0x2101 (48450)	2nd alarm mode AD2	1	R/W	
31	0x2102 (48451)	1st alarm extended function AE1	1	R/W	
32	0x2103 (48452)	2nd alarm extended function AE2	1	R/W	
33	0x2104 (48453)	Control mode OT	1	R/W	
34	0x2105 (48454)	Output mode ACT	1	R/W	
35	0x2106 (48455)	RUN/STOP operation	1	R/W	1:RUN 2:STP 3:Run auto-tune 4:Stop auto-tune
36	0x2107 (48456)	Decimal pointDP	1	R/W	
37	0x2108 (48457)	Unit display UT	1	R/W	25 (℃) 26 (℉)
38	0x2109 (48458)	Filter constants FT	1	R/W	
39	0x210A (48459)	Proportional coefficient P	1	R/W	No decimal point
40	0x210B (48460)	Integral time I	1	R/W	No decimal point
41	0x210C (48461)	Differential time D	1	R/W	No decimal point
42	0x210D (48462)	Control speed fine-tune SPD	1	R/W	
43	0x210E (48463)	Heating control cycle CP	1	R/W	No decimal point
44	0x210F (48464)	Cooling control cycle CP1	1	R/W	No decimal point
45	0x2110 (48465)	Cooling delay time PT	1	R/W	No decimal point
46	0x2111 (48466)	Optional input signal INP	1	R/W	Refer to signal table
47	0x2112 (48467)	Meter address ADD	1	R/W	
48	0x2113 (48468)	Communication baud rate BAD	1	R	
49	0x2114 (48469)	Comm. data transfer sequence DTC	1	R	Note③
50	0x2115 (48470)	PID arithmetic type PDC	1	R	
51	0x2116 (48471)	Lock LCK	1	R	
52	0x2117 (48472)	Meter name	1	R	
53	0x2118 (48473)	Output state	1	R	Note②
54	0x2119 (48474)	Parity Check PRTY	1	R	
55	0x211A (48475)	3rd alarm mode AD3	1	R/W	
56	0x211B (48476)	3rd alarm extended function AE3	1	R/W	

R: Read only;R/W: Read & write

Note①: The register number is the address converted to decimal plus 1 and then the register identification code 4 is added in front; for example: the register number of the data address 0x2000 is 8192 + 1 = 8193 and then 4 is added in front, that is, the register number 48193; Related applications can be seen, such as Siemens S7-200 PLC.

Note ②: Measurement status indication. When the data bit is 1, it means execution, and when it is 0, it means no execution.

D8	D7	D6	D5	D4	D3	D2	D1	D0
AL3	STOP	HHHH	LLLL	AT	AL2	AL1	OUT2	OUT1

Note③: DTC communication data transmission sequence description

DTC: □ □ □ — Reserve
— Byte transfer order: when it is 0, the sequence is 1, 2; and when it is 1, the sequence is 2, 1
— Reserve

XIII. Version and Revision History

Date	Version	Revision content
2024.06.14	A/0	1st edition