Intelligent Temperature Controller User Manual

Apply to TE-F version series

Features

⊙Optional input signal types and models
⊙With functions of measurement display, control output, alarm output, analog output, RS485 communication, etc.
⊙Multi PID control algorithms for option, with auto-tuning function.
⊙ Support PID heating, PID cooling, PID heating and cooling, ON-OFF control.

National High-tech Enterprise/ National Standard Drafting Unit

Hotline：400-0760-168 Version code：KKTEW-F01E-A/0-20250722

The instruction explains temperature controller settings, connections, name,etc. Please read carefully before you use the temperature controller, and use it correctly based on understanding the content. Please keep it properly for necessary reference

I. safety instruction

⚠ Warning

1) Please set the proper protection circuit in the external when the failure or abnormal of products lead to a major system accidents
2) Please don`t plug in before completing all the wires, or it may lead to electric shock, fire, fault.
3) Do not use outside the scope of product specification, or it may lead to fire, fault.
4) Do not use in places with flammable, explosive gases.
5) Do not touch power terminal and other high voltage part when power on, otherwise there is a risk of electric shock.
6) Do not remove, repair and modify this product, otherwise it may lead to electric shock, fire, fault.

⚠ Caution

1) The product should not be used in atomic energy equipment and medical devices related to human life.
2) The product may occur radio interference when it used at home. Adequate countermeasures should be taken in this case.
3) The product gets an electric shock protection through reinforced insulation. When the product is embedded in devices and wiring, please subject to the specification of embedded devices.
4) In order to prevent surge occurring, proper surge suppression circuits should be set up for all indoor wiring that more than 30m occasions as well as wiring for outdoor.
5) The product is produced by mounting on the disk. To avoid users approaching high-voltage parts such as power terminals, please take necessary measures on the end product.
6) Be sure to observe the precautions in this manual, otherwise there is a risk of causing major injuries or accidents.
7) Please observe the local regulations when wiring.
8) To prevent machine damage and failure, please install an appropriate capacity fuse on the connected power lines or larger capacity input and output lines or other ways to protect the circuit.
9) Please don't mix metal pieces and wire debris into this product, otherwise it may lead to electric shock, fire, fault.
10) Please tighten the screws according to the specified torque, otherwise it may lead to electric shock and fire.
11) In order not to hinder the heat dissipation of this product, please do not block the cooling windows around the housing and equipmenr vents.
12) Please do not connect any unused terminal.
13) Please be sure to do cleaning after power off, use a dry soft cloth to wipe dirt on the product, and do not use moisture absorbers, otherwise it may lead to deformation and discoloration.
14) Please do not knock or rub the panel with rigid thing.
15) This manual assumes that the reader has a basic knowledge of electricity, control, computer and communication.
16) The examples of illustrations, pictures and data used in this manual are recorded for the convenience of understanding, are not guaranteed to be the results of the operation.
17) Regular maintenance is necessary for the safe long-term using. Some parts of this product are subject to a limited life span, and some may change in performance due to years of using.
18) Without prior notice, the contents of this manual may be change. We hope there is no loophole, if you have any questions or objections, please contact us.

Caution of Installation & Connection

1. Installation

1) This product is subject to the following environmental standards.
(IEC61010-1) [Overvoltage category Ⅱ, class of pollution 2]
2) Please use the product in the following scope： temperature:0~50℃
Humidity:45~85%RH. Environment condition: indoor Altitude ＜ 2000m.

3) Please avoid using in the following places:
Where there is a possibility of condensation due to intense temperature changes. Where generating corrosive or flammable gases. Where subject to direct vibration or potential impact. Where have water, oil, chemicals, somke, steam. Where have a lot of dust, salt, metal powder. Where interfered by noise, static electricity and magnetic field. Where directly exposed to air condition flow and heating. Where directly exposed to sunlight. Where heat accumulation may occur due to radiation.
4) Please consider the following points before installation:
To avoid heat saturation, please open sufficient ventilation space. Please consider wiring and maintenance environment, and make sure there is more than 50mm below this product. Please avoid installing directly above the high heat generating machine. (E.g. heater, transformer, semiconductor operator, high capacity resistor.) When the surrounding ＞50℃, please use a forced fan or cooling machine. But do not let the cool air blow directly to the product. For better anti-interference performance and security, please try to stay away from high pressure machines, power machines to install. Do not install with high pressure machine on the same plate.The distance between the product and the power line should be more than 200mm. Please install the power machine as far as possible.

2.Cable cautions：
1) Please use specified compensation wire where TC input. Please use insulated TC if the measured device is heated metal. The influence of external resistance is about 0.3 μ V/Ω.
2) For RTD input, please use wires with low resistance, and cables (3-wire type) with no resistance difference, parallel wiring, and a single wire resistance is less than 10Ω.
3) To avoid noise interference, please wire the input signal away from the meter cable, power cable, load cable.
4) To reduce the impact of power cables and load cables, it is recommended to use a noise filter when vulnerable. If using a noise filter, be sure to install it on a grounded disk, and make the wiring shortest between the noise filter output side and power terminal. Do not install fuse and switch on the wiring of noise filter output side, otherwise it will reduce the effect of filter.
5) The time from the input of power to the output is about 5s. Please use a timer relay when using interlocking circuit signals.
6) Please use the twisted-pair cable with a shielding layer for the transmission output line. it is necessary to connect the common mode coil at the front end of the signal receiving devices to suppress interference for stable signals.
7) Please use a shield-twisted pair as long distance RS485 communication line, and connect the shield on the host side to ensure stable commuinication.
8) This product dose not have a fuse. If needed, please configure according to the rated voltage 250V, rated current 1A. Fuse type: delay fuse
9) Please use a suitable slotted screwdriver and wire.
Terminal screw size：M3X8 (with 6.8X6.8 square)
Recommended tightening torque of terminal：0.4N.m
Recommended tightening torque of fixed bracket：0.2N.m
Suitable cable：0.25 ~ 1.65mm single/multiple core cable
10) Please do not contact the crimp terminals or exposed sections with adjacent terminals.

II. Model Illustration

TE4□-□ R C 1 8 □W- F
1 F：version
2 Blank：TC/RTD/mV/Rt input X：mA/V input
3 10：single input without comm. 18：Single input with RS485
4 B：1 alarm output C: 2 alarm output
6 R: relay output S: SSR output. D：DC 4~20mA control output.
(can set as 4-20mA analog output by ACT menu)
K: SCR output (need to be customized)
M: relay and ssr (switched by ACT menu)
8 Blank：none I：DC 4~20mA analog output (can set as main control output by ACT menu, available for TEY6/9)
7 Blank：AC/DC 100～240V F：DC 24V
8 4：48H*48W*73L 7：72H*72W*73L 6：96H*48W*73L
8：48H*96W*73L 9：96H*96W*73L (unit: mm)
9 TE series temperature controller

III. Model Description

No.	Model	OUT1 control output			Alarm output		Analog output	Comm.	Auxilliary power
		RELAY	SSR	4～20mA	AL1 OUT2	AL2	4～20mA	RS485	24V
1	TE4-DC18□W			●	●	●	◎	●	●
2	TE4-DC10□W			●	●	●	◎		●
3	TE4-RC18□W	●			●	●		●	
4	TE4-SC18□W		●		●	●		●	
5	TE4-MC10□W	●	●		●	●			
6	TE7-DC18□W			●	●	●	◎	●	●
7	TE7-DC10□W			●	●	●	◎		●
8	TE7-MC18□W	●	●		●	●		●	
9	TE7-MC10□W	●	●		●	●			
10	TE6/8/9-IMC18□W	●	●	●	●	●	◎	●	●
11	TE6/8/9-IMC10□W	●	●	●	●	●	◎		●
12	TE6/8/9-DC18□W		●	●	●	●	◎	●	●
13	TE6/8/9-DC10□W		●	●	●	●	◎		●
14	TE6/8/9-MC18□W	●	●		●	●		●	
15	TE6/8/9-MC10□W	●	●		●	●			

□: Blank: input signal is TC/RTD/mV/R. X : input signal is 4 ~ 20mA/0 ~ 10V.
●: Standard configuration function
◎: TE temperature controller has only one DC 4-20mA output (can set as main control output or analog output by ACT menu)

IV. Specifications

1. Electrical parameters

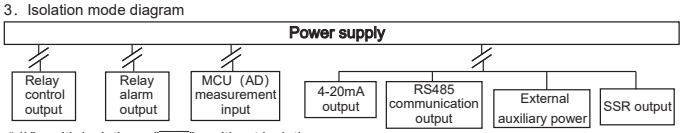
Sampling rate	8 times/second
Relay capacity	AC 250V /3A rated load life ＞100,000 times
Power supply	AC/DC 100 ~ 240V (85-265V), DC 24V
Power consumption	＜10VA
Environment	Indoor use only, temperature: 0~50℃ no condensation, humidity＜85%RH, altitude<2000m
Storage environment	-10 ~ 60℃, no condensation
SSR output	DC 24V pulse voltage, load<30mA
Current output	DC 4 ~ 20mA load<500Ω, temperature drift 250PPM
Communication port	RS485 port Modbus-RTU protocol
Insulation impedance	Input, output, power to meter 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
Dielectric strength	Among Signal input, output and power supply: 2000VAC 1min Less than 60V low voltage circuit: AC 500V，1min
Total weight	About 400g
Meter casing material	Shell and panel base frame: PC/ABS (flame class UL94V-0)
Panel material	PC
Power-off data protection	10 years, can write data for 1 million times
Safety Standard	IEC61010-1 Overvoltage category Ⅱ pollution level 2，class Ⅱ (reinforced insulation)

2. Measurement signal parameters:

Input type	Symbol	Measurement range	Resolution	Accuracy	Input impedance/ auxiliary current	Parameter code
K1	K1	-50 ～ 1200	1℃	0.5%F.S±3digits	>500KΩ	0
K2	K2	-50.0 ～ 999.9	0.2℃	0.5%F.S±1℃	>500kΩ	16
J1	J1	0 ～ 1200	1℃	0.5%F.S±3digits	>500KΩ	1
J2	J2	0.0 ～ 999.9	0.2℃	0.5%F.S±1℃	>500KΩ	17
E1	E1	0 ～ 850	1℃	0.5%F.S±3digits	>500KΩ	2
E2	E2	0.0 ～ 850.0	0.3℃	0.5%F.S±1℃	>500KΩ	18
T1	t1	-50 ～ 400	1℃	0.8%F.S±3℃	>500KΩ	3
T2	t2	-50.0 ～ 400.0	0.4℃	0.8%F.S±3℃	>500KΩ	19
B	b	250 ～ 1800	1℃	1%F.S±2℃	>500KΩ	4
R	r	-10 ～ 1700	1℃	1%F.S±2℃	>500KΩ	5
S	S	-10 ～ 1600	1℃	1%F.S±2℃	>500KΩ	6
N1	n1	-50 ～ 1200	1℃	0.8%F.S±1℃	>500KΩ	7
N2	n2	-50.0 ～ 999.9	0.2℃	0.8%F.S±1℃	>500KΩ	20
PT100-1	Pt1	-200.0 ～ 600.0	0.2℃	0.5%F.S±0.3℃	0.2mA	8
PT100-2	Pt2	-200 ～ 600	1℃	0.5%F.S±3digits	0.2mA	21
JPT100-1	JPt1	-200.0 ～ 500.0	0.2℃	0.5%F.S±0.3℃	0.2mA	9
JPT100-2	JPt2	-200 ～ 500	1℃	0.5%F.S±3digits	0.2mA	22
CU50-1	Cu51	-50.0 ～ 150.0	0.2℃	0.5%F.S±3℃	0.2mA	10
CU50-2	Cu52	-50 ～ 150	1℃	0.5%F.S±3℃	0.2mA	23
CU100-1	Cu01	-50.0 ～ 150.0	0.2℃	0.5%F.S±1℃	0.2mA	11
CU100-2	Cu02	-50 ～ 150	1℃	0.5%F.S±3digits	0.2mA	24
0 ～ 50mV	2U	-1999 ～ 9999	12bit	0.5%F.S±3digits	>500kΩ	12
0 ～ 400Ω	rE	-1999 ～ 9999	12bit	0.5%F.S±3digits	0.2mA	13
* 4 ～ 20mA	4A	-1999 ～ 9999	12bit	0.5%F.S±3digits	<50Ω	14
* 0 ～ 10V	1U	-1999 ～ 9999	12bit	0.5%F.S±3digits	>1MΩ	15

*Note: please specify signal input requirements when ordering.

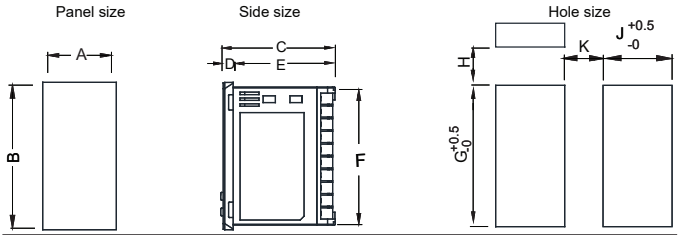
3. Isolation mode diagram



" // ": with isolation. "——": without isolation.

Note: When the auxiliary power supply is used as the power supply for external sensors, if the sensors are non-isolated, the inputs are not isolated from 4-20mA output and RS485 communication. When there are 4-20mA output and RS485 communication at the same time, they are not isolated from each other.

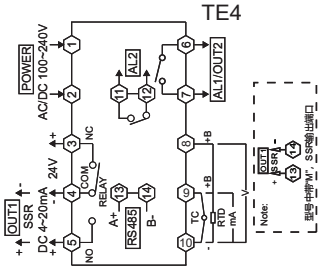
V. Dimensions and installation hole size



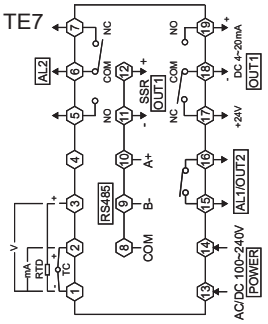
Model	A	B	C	D	E	F	G	H(Min)	J	K(Min)
4:(48*48)	48	48	73	6.5	66.5	44	45	25	45	25
6:(48*96)	48	96	73	6.5	66.5	90	91.5	25	45	25
7:(72*72)	72	72	73	6.5	66.5	66	67.5	25	67.5	25
8:(96*48)	96	48	73	6.5	66.5	44	45	25	91.5	25
9:(96*96)	96	96	73	6.5	66.5	90	91.5	25	91.5	25

VI. Connection diagram

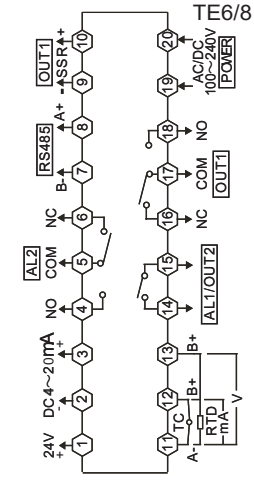
TE4



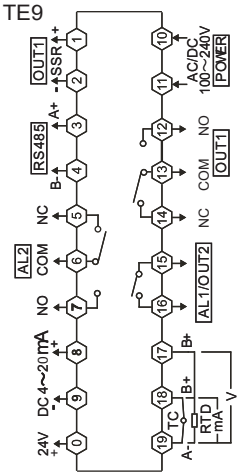
TE7



TE6/8



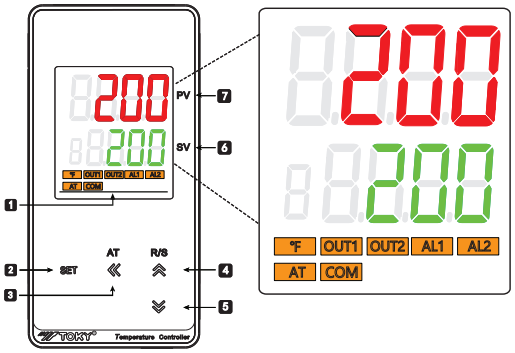
TE9



Connection diagram symbol & function description

Type	Symbol	Explaination	Function description
Input	TC	Thermocouple	TC input wiring, positive/negative. Switched by INP menu. Support K, J, E, T, N,R, S, B, etc.
Input	RTD	Thermal resistance	RTD input. Normally , it is 3-wire. +B, +B: are same color cable/short-circuit line. -A&B: connect thermal resistance. For 2 wires Rtd, need to short connect +B and +B
Input	mA	Analog	4-20mA input terminal (for models with X)
Input	V	Analog	0-10V/0-5V signal input terminal (For models with X)
Communication	RS485	A+send B-receive	RS485 communication wiring. COM as shielded cable, A+: send. B-: receive.
Alarm 1/2nd output	AL1/OUT2	COM: common terminal NO: normally open	AL1: adjust parameters AL1, AD1, HY1 Cooling output 2: set OT as PID heating-cooling. When cooling control, AL1 dose not work, hide related alarm 1 menu.
Alarm 2 output	AL2	COM: common terminal NO normally open NC normally closed	2nd alarm, adjust parameters AL2, AD2, HY2.
Relay output	OUT1 RELAY		OUT1 as relay output control terminal, set by OT&ACT.
SSR output	OUT1 SSR	+positive -negative Set by OT/ACT.	OUT1: SSR output control terminal
4-20mA output	4-20mA		OUT1: analog output/regulation output wiring.
Auxiliary power	DC 24V	+positive -negative	External power supply for sensor

VII. Panel Illustration

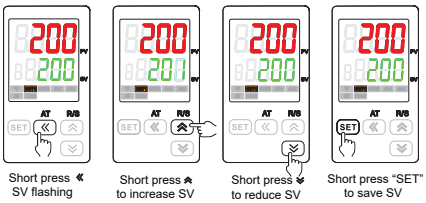


No.	Symbol	Name	Function
1	℉/℃	℉/℃ (Orange)	Temperature unit selection.
	OUT1	OUT1 (Orange)	Main control output indicator, indicates when output ON.
	OUT2	OUT2 (Orange)	Cooling output indicator, indicates when output ON.
	AL1	AL1#(Orange)	1st alarm output indicator, lights on when alarm output, lights off when no alarm output.
	AL2	AL2#(Orange)	2nd alarm output indicator, lights on when alarm output, lights off when no alarm output.
	AT	AT(Orange)	Auto-tuning indicator, lights on when it is on auto-tuning status.
	COM	COM (Orange)	The communication indicator will keep on flashing when communication is in progress.
2	SET	SET function key	Menu key/confirm key, to enter/exit the modification mode, or to confirm/save the modified parameter.
3	«	Shift/AT key	Activate key/shift key/AT auto-tuning key (long press to enter/exit auto-tuning in measurement control mode).
4	»	Increase key/R/S	Add key, in measurement control mode, long press it to switch RUN/STOP mode, or check the menu in reverse order.
5	˅	Decrease key	Reduce key, check the menu in sequence.
6	SV	Display window(Green)	Display window of set value/parameter, displays "STOP" when control is stopped.
7	PV	Display window(Red)	Display window of measurement value/parameter code.

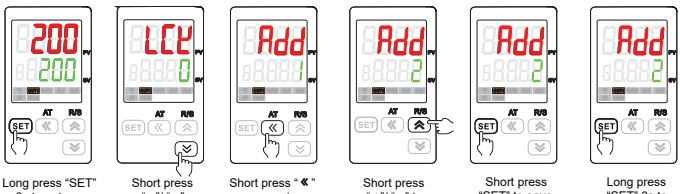
VIII. Operation process and menu illustration

1. Operation process & method

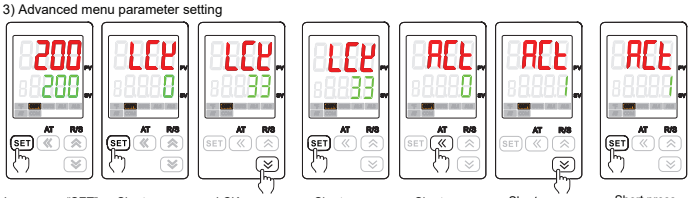
1) Modify the target set value



2) Common menu parameter setting



3) Advanced menu parameter setting



2. Examples of operation

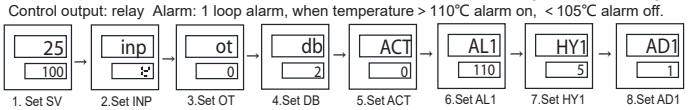
1) Example 1 for switching control output

Sensor indicator: K model, measurement temperature -50~1300℃

Control target temperature: 100℃ Control mode: heating

Control requirement: ON/OFF control, when temperature = 100℃ stops heating, < 98℃ reheating.

Control output: relay Alarm: 1 loop alarm, when temperature > 110℃ alarm on, < 105℃ alarm off.



1. Set SV as 100 | 2.Set INP menu as K | 3.Set OT menu as 0 | 4.Set DB menu as 2 | 5.Set ACT menu as 0 | 6.Set AL1 menu as 110 | 7.Set HY1 menu as 5 | 8.Set AD1 menu as 1

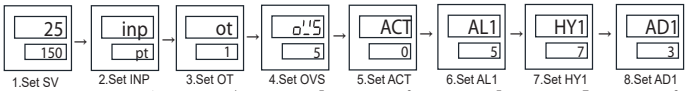
2) Example 2 for PID control output

Sensor indicator: PT100 model Control output: SSR Measurement temperature: -200~600℃

Control target temperature: 150℃ Control mode: heating Control requirement: PID control

Alarm: 1 loop alarm, when alarm value > set value 5℃ alarm on, < 2℃ alarm off.

Note: please turn on auto-tunning when debugging for the first time to control the temperature stablily. There is no need to repeat if the temperature control is stable after auto-tunning.



1.Set SV as 150 | 2.Set INP menu as pt | 3.Set OT menu as1 | 4.Set OVS menu as 5 | 5.Set ACT menu as 0 | 6.Set AL1 menu as 5 | 7.Set HY1 menu as 7 | 8.Set AD1 menu as 3

IX. Menu Illustration

□: Parameters that are always displayed no matter under what model or control mode.

▨: Some parameters that are hidden according to different model and control mode.

1. Common menu description

No.	Symbol	Name	Illustration	Setting range	Factory setting
1	AL1	AL1	1st alarm value. Note: deviation values are treated as absolute values when set as negative numbers. Attachment (1): alarm parameters&output diagram.	FL-FH	10
2	HY1	HY1	1st alarm hystersis. See attachment (1).	0-1000	1
3	Ad1	AD1 (1)	1st alarm mode. Note: when AL1 relay is used as OUT2 (cooling output) should set AD1=0 at first (close the alarm function). The 2nd alarm function is invalid when AD1>6. See attachment (1).	0-12	3
4	AL2	AL2	2nd alarm value. See attachment (1).	FL-FH	5
5	HY2	HY2	2nd alarm hystersis. See attachment (1).	0-1000	1
6	Ad2	AD2 (1)	2nd alarm mode. See attachment (1).	0-6	4
7	PS	PS	Pan amend value, display value= actual measured value+pan amend value.	-1999 ~ 9999	0
8	inP	INP	Input measured signal type selection. Note: the following parameters need to be set properly after modification: SV, AL1, HY1, AL2, HY2, P, OVS, DB.	Refer to signal table P. 3	K1
9	ot	OT	Control mode. 0: ON/OFF heating control. Relevant parameter: DB 1: PID heating. Relevant parameters: P,I,D,OVS,CP,ST,SPD,PDC. 2: ON/OFF cooling control. Relevant parameter: DB PT setting is required when compressor control. 3: PID heating&cooling (cooling control OUT2 outputs by AL1 relay) Relevant parameters: P,I,D,OVS, CP,CP1,PC, DB,ST,SPD,PDC. 4: Over temperature control output. Relevant parameter: DB 5: PID cooling. Relevant parameters: P,I,D,OVS,CP,ST,SPD,PDC.	0-5	1
10	A-A	A-M	Auto/manual switch AUTO(0): fixed AT-controlling. MAN(1): fixed manual-controlling. AM(2): a key switch auto/manual.	AUTO -AM	AUTO
11	P	P	Propotion band, the smaller the value, the faster the system responds, otherwise it will be slower. When P=0, PID will be invalid. The unit is the same as the measurement value.	0-9999	30
12	I	I	Integration time, the smaller the value, the stronger the effect. Otherwise, it will be weaker. It will not work when I=0. Unit:s	0-9999	120
13	d	D	Differential time, the larger the value, the stronger the effect, or it will be weaker. It will not work when D=0. D can be set to 0 when controlling fast system, e.g. pressure/spped. Unit:s	0-9999	30
14	oVS	OVS	Overshoot limit. In the PID control process, output is forced to close when PV(Process Value)> SV(Set Value) + OVS (Overshoot). The smaller the value, the smaller the PID adjustment range, the lower the control stability. Please set an appropriate value according to the actual situation.	0-9999	5
15	CP	CP	OUT1 control cycle. SSR output should be set as 1, relay output should be set as 4~200. Unit:s	1-200	20
16	CP1	CP1	OUT2 relay output cycle. Unit:s	4-200	20
17	PC	PC	OUT2 cooling proportional coefficient. The larger the value, the greater the cooling effect.	0.1-100	10.0
18	db	DB	Bit control hystersis (Positive numbers work the same as negative) When OT=3, work as cooling control dead zone. (Positive and negative numbers work differently) Modify this parameter appropriately based on demical point position after changing INP.	-1000 ~1000	5
19	LCK	LCK	Lock function. 0001: SV cannot be modified 0010: menu set value can be read only 0033: enter the advanced menu 0123: restore the factory setting (power-off&restart are needed)	0-9999	0

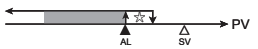
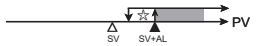
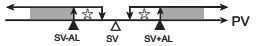
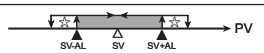
2. Advanced Menu description

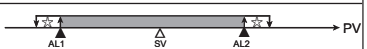
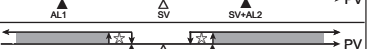
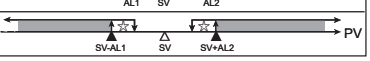
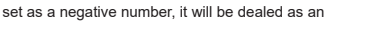
No.	Symbol	Name	Illustration	Setting range	Factory setting
20	ACt	ACT	Control output 0: relay/SSR output 1: SSR (code M) 2: 4~20mA regulation output 3: effective for TE 4/7, 4~20mA analog output Note: set as 0/a default as analog output for TE 6/8/9	0~2 (TE 6/8/9) 0~3 (TE 4/7)	0
21	AE1	AE1	1st loop alarm extension function See attachment (2) alarm extension function table.	0~5	0
22	AE2	AE2	2nd loop alarm extension function. See attachment (2) alarm extension function table.	0~5	0
23	dP	DP	Decimal point position. Maximum set up to one demical point when input TC/RTD.	0~3	0
24	dtr	DTR	PV fuzzy tracking value, setting this value properly on some occasions can get a more stable control display value, this value is unrelated to actual measured value. Note: after setting this value, when alarm value=set value, alarm output operation is subject to actual measured value. Set as 0 to close this function.	0.0-2.0 (0-20)	1.0 (10)
25	Ft	FT	Filter coefficient.The higher the value, the stronger the effect.	0-255	10
26	Ut	UT	Temperature unit setting ℃: Celsius ℉: Fahrenheit Note: no unit for linear signal input.	(25)℃ (26)℉	(25)℃

No.	Symbol	Name	Illustration	Setting range	Factory setting
27	FL	FL	Range of lower&upper limit. Temperature input keeps the factory setting without modification. For 4~20mA/0~10V input, set the lower&upper limits to the corresponding range E.g. 0~10V corresponds to -20~50 measurement, set FL= -20, FH=50. Range: -1999 - 9999. Associate with DP menu.	Refer to signal parameter table	-50
28	FH	FH			1200
29	brL	BRL	Lower & upper limit of the 4~20mA analog process value. E.g. 0~100 correspond to 4~20mA, set brL= 0, brH = 100. Note: analog output can be reversed. E.g. 100~0 corresponds to 4~20mA.	FL~FH	-50
30	brH	BRH			1200
31	oLL	OLL	Lower&upper limit of output amplitude. Limit output current amplitude, only effective for 4~20mA regulation output. E.g. for the motor can not be stopped when invertor control, you can set the output lower limit OLL as 10%. For output can not be full power at the beginning of the heating control, you can set output upper limit OLH as 80%	-5.0-100	0
32	oLH	OLH		0.0-105	100
33	St	ST	Power-on auto-tuning switch 0: power-on regular control 1: automatically enter PID parameters auto-tuning status after power-on. Long press AT key to exit auto-tuning.	0~1	0
34	SPd	SPD	Adjust PID control speed. Option: 0 (N) none 1 (S) slow 2 (SS) slower 3 (SSS) slowest 4 (F) fast 5 (FF) faster 6 (FFF) fastest	0~6	N
35	PdC	PDC	PID algorithm selection. 0(FUZ): advanced fuzzy PID algorithm 1(STD): regular PID algorithm	0~1	FUZ
36	Pt	PT	Compressor start-up relay. Unit: s.	0~9999	0
37	bAd	BAD	Communication buad rate. 0 (4.8): 4800. 1 (9.6): 9600. 2 (19.2): 19200.	0~2	9.6
38	Add	ADD	Modbus slave device address	1~247	1
39	PrtY	PRTY	Communication parity bit setting. 0: NO 1: ODD 2: EVEN	0~2	N0
40	dtC	DTC	Communication data transport sequence 000. 1st bit: function reserve. 2nd bit: byte sequence exchange. 3rd bit: function reserve.	Refer to Com. protocol③	0
41	CAE	CAE	User self-calibration usage setting. Y: turn on N: turn off This parameter is for input signal except TC/RTD.	0 (N) 1 (Y)	N
42	CAL	CAL	User self-calibration lower limit input operation. After adding the low end signal to the signal input terminal, YES flashes. After confirming and displaying OK, low end calibration is completed.	YES/OK	YES
43	CAH	CAH	User self-calibration upper limit input operation. After adding the high end signal to the signal input terminal, YES flashes, after confirming and displaying OK, the input signal high end calibration is completed.	YES/OK	YES
44	SSA	SSM	Panel key switch RUN/STOP operation. This setting is only related to panel operation, not communication. 0: stop 1: run	0 ~ 1	0
45	VEr	VER	Software version, read only.	———	

Attachment (1) Alarm parameters and output logic diagram:

Symbol description: "☆" means HY, "▲" means alarm value, "△" means SV value.

Alarm code	Alarm mode	Alarm output (AL1 & AL3 are independent from each) Image: the hatched section means the alarm action
1	Absolute value upper limit alarm	
2	Absolute value lower limit alarm	
3	※Deviation value upper limit alarm	
4	※Deviation value lower limit alarm	
5	※Deviation value upper /lower limit alarm	
6	※Interval value upper /lower limit alarm	

Alarm code	Alarm mode	The following two sets of alarm parameters (AL1,AL2) are used in combination, AL1 alarm output, AD2 must be set as 0.
7	Absolute value upper & lower limit interval alarm	
8	※Deviation value upper & lower limit interval alarm	
9	※Deviation value upper limit&absolute value lower limit interval alarm	
10	※Abosute value upper limit&deviation value lower limit Interval alarm	
11	Absolute value upper& lower limit alarm	
12	※Deviation value upper& lower limit alarm	

※When the alarm value with deviation alarm is set as a negative number, it will be dealed as an absolute value.

Attachment (2) Alarm extension function table

AE1/AE2 value	Alarm handling when it displays over limit	Power on, alarm inhibition or not.
0	Alarm status remains the same	Power on, no alarm inhibition. (Output as long as the alarm conditions are met)
1	Forced alarm output	
2	Forced alarm close	
3	Alarm status remains the same	Power on, alarm inhibition. (Do not output before the PV value reaches the SV for the first time, after that work normally.)
4	Forced alarm output	
5	Forced alarm close	

X.Checking methods of simple fault

Display info	The exclusion method
LLLL/HHHH	Check whether the input is disconnected, check the FH value and FL value, determine whether the working environment temperature is normal, check whether the input signal is selected correctly.

XI. Key function operation

1. Stop mode
   1) In measurement and control mode, long press“ R/S ”key to enter Stop mode, SV window displays “STOP”, main control stop/output at minimum.
   2) In STOP mode, long press“ R/S ” key to exit STOP mode, short press SET key to modify SV.
   3) In stop mode, alarm output and analog output keeps working.
2. PID auto-tuning operation：
   1) Please switch off the control output load power or set the meter as STOP mode before auto-tuning.
   2) PV is required to meet the conditions before auto-tuning: PV should much less than SV under PID heating control. PV should much greater than SV under PID cooling control.
   3) Please set a proper alarm value or eliminate the alarm condition before auto-tuning, in case being affected by alarm output when auto-tuning.
   4) Set the PID type and SV value, the factory default is fuzzy PID control.
   5) Set as PID control. Please set the output to a proper range if there are OLL & OLH output limits, factory default is OLL=0%, OLH=100%.
   6) Exit STOP mode, or switch on the load power, and long press AT key immediately to enter auto-tuning mode, then the AT indicator lights on.
   7) The auto-tuning process takes time, in order not to affect the results, please do not modify parameters or power-off.
   8) When AT indicator lights off, it exits auto-tuning mode automatically, PID parameters will be updated automatically, and then the meter will control automatically and exactly.
   9) Long press AT key, measure beyond the range, display abnormal, switch to STOP mode, power-off, etc., the above will all abort the auto-tuning process.
   10) Note: when there is an output limit operation, the best PID parameters are sometimes not available even in auto-tuning mode.
   11) Experienced users can set a proper PID parameter according to their experience.
3. PID heating&cooling propotional control
   1）Set the control mode OT as 3.
   2）PID heating control act on OUT1, PID cooling control act on OUT2.
   3）PID cooling control OUT2 will output by AL1 alarm function terminal.
   4) Set the cooling start offest DB > 5 to ensure the cooling output dose not affect the PID heating control.
   5) Please set the cooling control cycle CP1&cooling proportional coefficient to a suitable value.
   6) The cooling control control starts to work when the PV value exceeds the SV+DB value. The more the PV value exceeds, the longer the OUT2 output time is.
4. Auto/manual switched by one key
   1）After entering the common menu, set parameter A-M as "AM".
   2）Back to measurement control interface, press SET key to switch auto/manual tuning.
   3）When switch to the manual tuning, the lower window will display the output, M0~M100 (corresponding to 0%~100%), press the increase/decrease key to directly adjust the output.
   4) Before switching to the auto-tuning, the SV value can be modified first by pressing the left key in order to achieve non-disturbing switching.

XII. Communication procotol

The device uses Modbus RTU communication protocol for RS485 half-duplex communication, read function number 0x03, write function number 0x10 or 0x06, adopting 16-bit CRC verification, the device does not return check error. The factory setting defaults address as 1, baud rate 9600, no parity, 8 data bit, 1 stop bit, data type as 16 signed (unsigned) integer.

Data frame format：

Start bit	Data bit	Stop bit	Check bit
1	8	1	Set in the PRTY menu

Communication abnomal handling：for abnormal response, set the function number as the highest bit 1. E.g. if the function number requested by the host is 0x03, the corresponding function number returned by the slave should be 0x83.

Error code：

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

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

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

The communication cycle：it refers to the time from the completion of the host data request to the completion of the slave data return. That is: communication cycle = request data send time +slave reply time + response delay time + response return time. Take the 9600 baud rate as an example: the single measurement data communication period > 250ms..

1. Read register

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

The address code of SV is 0x2000 ("0x" represents for hexadecimal), because SV data type is a 16-bit integer (2 bytes),seizes 1 data register. The memory code of decimal integer 200 convert to hexadecimal code is 0x00C8.. Note: when reading data, should read DP value or confirm DP menu value first to ensure the decimal point postion, after that convert the read data to get the actual value. Conversely, it should convert the data to corresponding ratio before writing the data in meter.

Host request (read multiple registers)							
1	2	3	4	5	6	7	8
Device 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	0x03	0x20	0x00	0x00	0x01	0x8F	0xCA

Slave normal response (read multiple registers)						
1	2	3	4	5	6	7
Device add	Function code	Quantity of date bytes	Data high bit	Data low bit	※CRC code low bit	※CRC code high bit
0x01	0x03	0x02	0x00	0xC8	0xB9	0xD2

Function code abnormal response（e.g. host request address is 0x2011）

Slave abnormal response（read multiple registers）				
1	2	3	4	5
Device add	Function code	Error code	※CRC code low bit	※CRC code high bit
0x01	0x83	0x02	0xC0	0xF1

2. Write multiple registers

E.g. Host use 0x10 function code write SV（SV=150）

ADD code of SV is 0x2000, because SV is integer (2 byte), occupies 1 data register. The hexadecimal code of decimal integer 150 is 0x0096.

Host request (Read multiple registers)										
1	2	3	4	5	6	7	8	9	10	11
Meter ADD	Function code	Start add high bit	Start add low bit	Data byte length high bit	Data byte length low bit	Data byte length	Data high bit	Data low bit	※CRC code low bit	※CRC code high bit
0x01	0x10	0x20	0x00	0x00	0x01	0x02	0x00	0x96	0x07	0xFC

Slave normal answer (write multiple registers)							
1	2	3	4	5	6	7	8
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 uses 0x06 function to write SV（SV=150）

Host request (write single register)							
1	2	3	4	5	6	7	8
Meter add	Function code	Add high bit	Add low bit	Data high bit	Data low bit	※CRC code low bit	※CRC code high bit
0x01	0x06	0x20	0x00	0x00	0x96	0x02	0x64

Host request (write single register)							
1	2	3	4	5	6	7	8
Device add	Function no.	Add high bit	Add low bit	Data high bit	Data low bit	※CRC code low bit	※CRC code high bit
0x01	0x06	0x20	0x00	0x00	0x96	0x02	0x64

Slave abnormal response（write single register）				
1	2	3	4	5
Device add	Function no.	Error code	※CRC code low bit	※CRC code high bit
0x01	0x86	0x02	0xC3	0xA1

Parameter address mapping table

No.	Add (register no.①)	Variable name	Register quantity	Read/ write	Note
1	0x2000 (48193)	Set value SV	1	R/W	
2	0x2001 (48194)	1st loop alarm value AL1	1	R/W	
3	0x2002 (48195)	1st loop alarm hysteresis HY1	1	R/W	
4	0x2003 (48196)	2nd loop alarm value AL2	1	R/W	
5	0x2004 (48197)	2nd loop alarm hysteresis HY2	1	R/W	
6	0x2005 (48198)	Display lower limit FL	1	R/W	
7	0x2006 (48199)	Display upper limit FH	1	R/W	
8	0x2007 (48200)	Analog output lower limit BRL	1	R/W	
9	0x2008 (48201)	Analog output upper limit BRH	1	R/W	
10	0x2009 (48202)	Control output lower limit OLL	1	R/W	
11	0x200A (48203)	Control output upper limit OLH	1	R/W	Default with 1-digit decimal
12	0x200B (48204)	Overshoot limit OVS	1	R/W	
13	0x200C (48205)	Heating&cooling control dead zone DB		R/W	
14	0x200D (48206)	Cooling proportional coefficient PC		R/W	Default with 1-digit decimal
15	0x200E (48207)	Pan amend PS	1	R/W	
16	0x200F (48208)	Display fuzzy tracking value DTR		R	No decimal point when engineering
17	0x2010 (48209)	Process value PV	1	R	
18	0x2011 (48210)	Output quantity MV	1	R/W	0~100
19	0x2012 (48211)	Auto/manual switch A-M	1	R/W	0: auto 1: manual 2: auto/manual
Reserve					
20	0x2100 (48449)	1st loop alarm mode AD1	1	R/W	
21	0x2101 (48450)	2nd loop alarm mode AD2	1	R/W	
22	0x2102 (48451)	1st loop alarm extension mode AE1	1	R/W	
23	0x2103 (48452)	2nd loop alarm extension mode AE2	1	R/W	
24	0x2104 (48453)	Control mode OT	1	R/W	
25	0x2105 (48454)	Output mode ACT	1	R/W	
26	0x2106 (48455)	Run/stop operation	1	R/W	1：RUN 2：STP 3：RUN AT 4：STOP AT
27	0x2107 (48456)	Decimal point DP	1	R/W	
28	0x2108 (48457)	Display unit UT	1	R/W	25 (℃) 26 (°F)
29	0x2109 (48458)	Filter constant FT	1	R/W	
30	0x210A (48459)	Proportional coefficient P	1	R/W	No decimal digit
31	0x210B (48460)	Integration time I	1	R/W	No decimal digit
32	0x210C (48461)	Derivation time D	1	R/W	No decimal digit
33	0x210D (48462)	Control rate fine-tune SPD	1	R/W	
34	0x210E (48463)	Heating control cycle CP	1	R/W	No decimal digit
35	0x210F (48464)	Cooling control cycle CP1	1	R/W	No decimal digit
36	0x2110 (48465)	Cooling delay time PT	1	R/W	No decimal digit
37	0x2111 (48466)	Input signal selection INP	1	R/W	Refer to signal table
38	0x2112 (48467)	Meter address ADD	1	R/W	
39	0x2113 (48468)	Communication baud rate BAD	1	R	
40	0x2114 (48469)	Communication data transmission sequence DTC	1	R	Note ③
41	0x2115 (48470)	PID algorithm type PDC	1	R	
42	0x2116 (48471)	Lock key LCK	1	R	
43	0x2117 (48472)	Meter name	1	R	
44	0x2118 (48473)	Output status	1	R	Note ②
45	0x2119 (48474)	Odd/even parity	1	R	

R：read only R/W：Read/write

Note ①：The register number is the address converted to decimal, plus 1 and then added the register identification code 4 in front. E.g. The register number of the data address 0x2000 is 8192 + 1 = 8193 and then added 4 in front, that is 48193. Related applications can be referred to Siemens S7-200 PLC.

Note ②：Measurement status indication.

When the data bit is 1, it indicates execution. When it is 0, it indicates no execution.

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

Note ③：DTC communication data transmission sequence description

DTC：□ □ □ — Reverse

Byte tranfer sequence: When it is 0, sequence is 1, 2 ; When it is 1, sequence is 2, 1

Reverse

XIII. Version and revision history

Date	Version	Modification
2025.07.22	A/0 version	frist time edition