Intelligent Temperature Controller Manual

Features

⊙Support multi thermcouple and thermal resistance signal input
⊙Adopt Fuzzy PID algorithm control , self-tuning has no overshoot
⊙ Multi control modes are optional, please refer to OT parameter
⊙RUN/STOP function One-click switching
⊙Heating-cooling dual outputs

National high-tech enterprise/National standard drafting unit

Service line：400-0760-168 Version：KKT110B-A01E-A/0-20250310

This manual explains the controller setting, wiring, and the name of each part. Please read it carefully before using the product, and operate it correctly based on understanding the content.

I. Model Illustration

T110□-□□-□-□
- Extention function code
- 001-999：Functional specification configuration code (tell us your function requirement, we will offer you the code)
- P1：AC/DC 100～240V P2：DC 24V
- A1：96W*96H C1：48W*48H D1：72W*72H E1：48W*96H F1：96W*48H
- A：Three digits display B：Four digits display
- T110A Series intelligent temperature controller

Note 1: The buzzer alarm is a customized model;
Note 2: 48 * 48 size without buzzer selection
Note 3: The models with RS485 communication, no alarm 2 and SSR output

II. Function configuration selection table

	Code	Function
Power Supply	P1	AC/DC 100-240V
	P2	DC 24V
Signal Input	W2	Tc/Rtd input (support long cable compensation)
	W3	Tc/Rtd input
	T1	Tc input
	P1	Rtd input (support long cable compensation)
	P2	Rtd input
	X1	linear (mA/V) input
Main control output 1	M1	Relay+SSR Output
	R1	Relay output
	G1	SSR Output
Main control output 2 / Alarm 1	R1	Relay output
	N	No Alarm 1
Alarm 2	R1	Relay alarm 2
	B1	Buzzer alarm 2
	N	No Alarm 2
Communication	C1	RS485 Communication (Not isolated)
	C3	RS485 Communication (DC-DC isolated)
	N	No Communication
Shell material	F1	White HB Flame retardant grade
	F2	White V0 Flame retardant grade

Model example: ① T110B-C1P1-T1G1NNNF1
Function description: 48W * 48H/ 4 digit display/100-240V power supply/Tc signal input /SSR output/No alarm 1/No alarm 2/No communication/White HB flame retardant
②T110B-C1P1-W2M1R1NC3F1
Function description: 48W * 48H/4 digit display/100-240V power supply/Tc/Rtd(long cable compensation function) signal input/normally relay +SSR output/ alarm 1 relay output/no alarm 2/RS485 communication (DC-DC isolation)/white HB flame retardant

III. Specifications

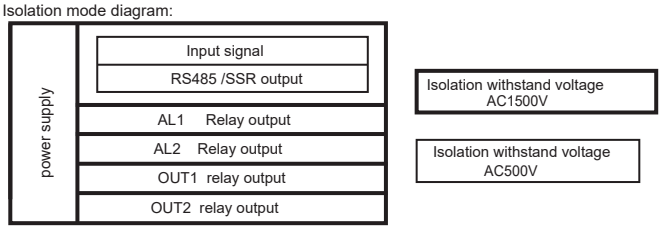
1. Electrical parameters:

Sampling rate	8 times/second
Relay capacity	AC 250V /3A Life of rated resistive load>100,000 times
Power supply	AC/DC 100 ~ 240V (85-265V), DC 24V
Power consumption	< 4VA
Environment	Indoor use , temperature: -10~50℃ no condensation, humidity < 85%RH, altitude<2000m
Storage environment	-10 ~ 60℃,no condensation
SSR output	DC 5V pulse voltage, load<30mA
Communication port	RS485 port Modbus-RTU protocol
Insulation impedance	Input, output, power to meter cover > 20MΩ (excluding SSR output)
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 voltage	Signal input and output and power supply 1500VAC for 1 minute Note:For ssr outout, pease choose solid state relay with isolation protection

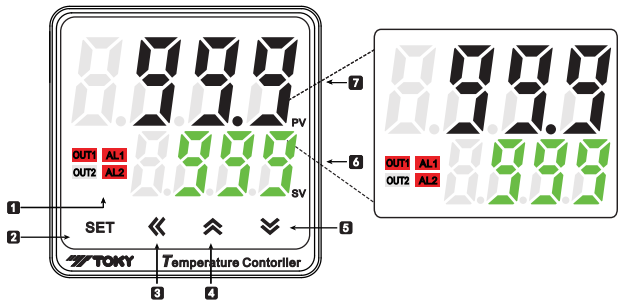
2. Measured signal specifications :

Input	symbol	Measure range ℃	Measure range ℉	resolution	Accuracy (25±5℃)	Input impedance/ auxiliary current	Comm. code
K1	K1	-50～1200	-60～2200	1℃	0.3%F.S±1℃	>500KΩ	0
K2	K2	-50.0～999.9	-60.0～999.9	0.2℃	0.3%F.S±1℃	>500KΩ	16
J1	J1	0～1200	0～2200	1℃	0.3%F.S±1℃	>500KΩ	1
J2	J2	0.0～999.9	0～999.9	0.2℃	0.3%F.S±1℃	>500KΩ	17
E1	E1	0～850	0～1500	1℃	0.3%F.S±1℃	>500KΩ	2
E2	E2	0.0～850.0	0～999.9	0.3℃	0.3%F.S±1℃	>500KΩ	18
T1	T1	-50～400	-60～750	1℃	0.3%F.S±1℃	>500KΩ	3
T2	T2	-50.0～400.0	-60.0～750.0	0.4℃	0.3%F.S±1℃	>500KΩ	19
B	b	250～1800	250～3200	1℃	0.5%F.S±2℃	>500KΩ	4
R	r	-10～1700	-10～3000	1℃	0.5%F.S±2℃	>500KΩ	5
S	S	-10～1600	-10～2900	1℃	0.5%F.S±2℃	>500KΩ	6
N1	n1	-50～1200	-60～2200	1℃	0.3%F.S±1℃	>500KΩ	7
N2	n2	-50.0～999.9	-60～999.9	0.2℃	0.3%F.S±1℃	>500KΩ	20
PT100-1	Pt1	-200.0～600.0	-200.0～999.9	0.2℃	0.3%F.S±1℃	0.2mA	8
PT100-2	Pt2	-200～600	-300～1100	1℃	0.3%F.S±1℃	0.2mA	21
JPT100-1	JPt1	-200.0～500.0	-200.0～900.0	0.2℃	0.3%F.S±1℃	0.2mA	9
JPT100-2	JPt2	-200～500	-300～900	1℃	0.3%F.S±1℃	0.2mA	22
CU50-1	Cu51	-50.0～150.0	-60.0～300.0	0.2℃	0.5%F.S±3℃	0.2mA	10
CU50-2	Cu52	-50～150	-60～300	1℃	0.5%F.S±3℃	0.2mA	23
CU100-1	Cu01	-50.0～150.0	-60.0～300.0	0.2℃	0.5%F.S±3℃	0.2mA	11
CU100-2	Cu02	-50～150	-60～300	1℃	0.5%F.S±3℃	0.2mA	24
0～50mV	0.5V	-1999～9999		12bit	0.3%F.S±3digits	>500KΩ	12
0～400Ω	rt	-1999～9999		12bit	0.3%F.S±3digits	0.2mA	13
* 4～20mA	4.20	-1999～9999		12bit	0.3%F.S±3digits	<50Ω	14
* 0～10V	1V	-1999～9999		12bit	0.3%F.S±3digits	>1MΩ	15

3. Isolation mode diagram:



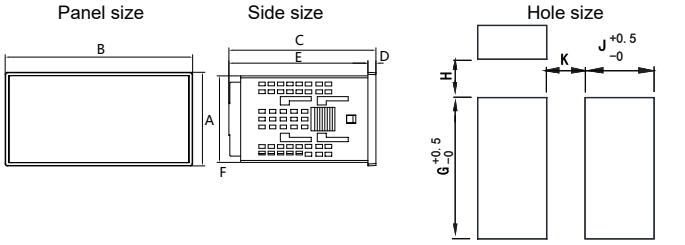
IV. Panel Illustration



No.	Symbol	Name	Function
1	OUT1	OUT1 (red)	Main control output indicator, lights on when output ON
	OUT2	OUT2 (red)	Cooling output indicator, lights on when output ON.
	AL1	Alarm 1# (red)	1st alarm output indicator, lights on when alarm output, lights off when no alarm output.
	AL2	Alarm 2# (red)	2nd alarm output indicator, lights on when alarm output, lights off when no alarm output.
2	SET	SET key	Menu key/confirm key, to enter or exit the modification mode, or to confirm and save the modified parameter.
3	«	Shift/AT key	Activate key/ shift key/ AT auto tune key (in measure and control mode, long press to enter/exit auto tune)
4	»	Add key	Add key, in measure and control mode,long press to shift RUN/STOP mode, or check the menu in reverse order.
5	ˇ	Reduce key	Reduce key, check the menu in sequence
6	SV	Display (green)	Set value / parameter display window, When it displays " STOP" , it means stop controling.
7	PV	Display (white)	Measured value/ parameter code display window

V. Dimension

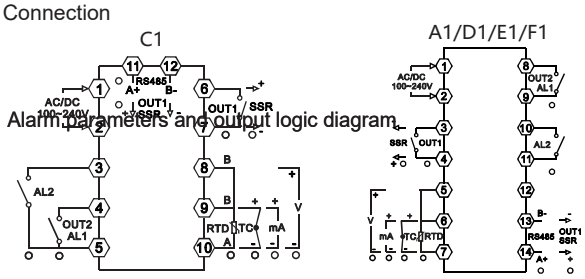
1. Overall dimensions and hole dimensions



Model	A	B	C	D	E	F	G	H(Min)	J	K(Min)
A1:(96*96)	96	96	79	4.3	74.7	91	91.5	25	45	25
C1:(48*48)	48.5	48.5	73	4.2	72.8	45	45.5	25	45	25
D1:(72*72)	72	72	79	4.3	74.7	67	67	25	67.5	25
E1:(48*96)	48.5	95.5	78.5	4.1	74.4	45	91.5	25	91.5	25
F1:(96*48)	95.5	48.5	78.5	4.1	74.4	91.5	45	25	45	25

VI. Connection

C1 A1/D1/E1/F1



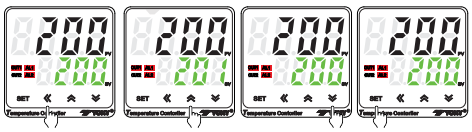
Alarm parameters and output logic diagram

Note: In the actual wiring diagram, solid circles indicate have this function, while hollow circles indicate no this function.
Solid or hollow dots will be marked according to the actual function.

VII. Operation process and menu illustration

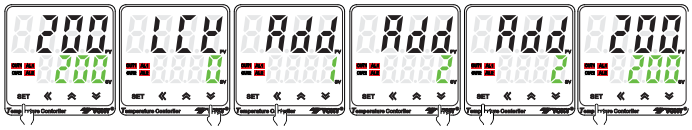
1. Operation process & method

1)、Modify SV Value



Press"«" SV value twinkle | Press "˄" increase SV value | Press "˅" reduce SV value | Press"SET" Save SV value

2)、Set Common menu



Press "SET" > 3s enter to Common menu | Press "˄"or "˅" switch menu | Press "«" parameter twinkle | Press "˄"or "˅" modify parameters | Press "SET" save parameters | Press "SET" > 3s Exit the menu

3)、Set Advanced menu

Long Press "SET" > 3s enter to Common menu | Press the "SET" switch to LCK menu | SET LCK=33 | Short Press"SET" enter to Advanced menu | Press "«" parameter flashing

Press"˄"or "˅" modify parameters | Short Press" SET" save parameters | Long Press "SET" > 3s Exit the menu

VIII. Menu Illustration

▭: No mater what model, what control mode it is, it will always display these parameters.
▭: According to different model, control mode, there are some hidden parameters.

1. Monitoring interface Description

No.	Symbol	Name	Illustration	set range	default
1	SV	SV	set target value	SLL ~ SLH	200
2	SP-M	SP-M	In the current slope heating status, can check current slope heating target value	——	——
3	td	TD	Appointment timing remaining time, unit: minute	0 ~ 9999	0
4	tH	TH	heat preservation timing remaining time, unit:minute	0 ~ 9999	0

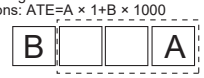
2. Common Menu Illustration

No.	Symbol	Name	Illustration	set range	default
—	PSW	PSW	full menus display password, enter 0033 to enter common menu	0 ~ 9999	0
1	AL1	AL1	1st alarm value, note: the minus is dealed as absolute value when it is as a deviation value.	FL ~ FH	10
2	HY1	HY1	1st alarm hystersis	0 ~ 1000	1

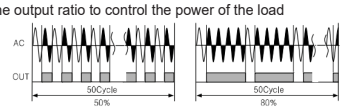
No.	Symbol	Name	Illustration	set range	default
3	Ad1	AD1	the 1st alarm mode,note: when AL1 is used as OUT2 (cooling output), should set the value AD1=0 (close alarm function). When 6＜AD1＜13 , AL2 is invalid	0 ~ 14	3
4	AtH1	ATH1	The 1st heat preservation mode alarm trigger condition, AD1=13 takes effect, attached (1) 0001: alarm when heat preservation is completed; 0010: When the temperature exceeds the effective range [SV-THR, SV+THR] , during heat preservation, make alarm 0100: Alarm at the beginning of heat preservation, which can be used for feeding reminders after preheating; The above alarm modes can be freely combined according to requirement, alarm will be triggered when meet any condition	0、1、10、11、100、101、110、111	1
5	AL2	AL2	2nd alarm value	FL ~ FH	5
6	HY2	HY2	2nd alarm hystersis	0 ~ 1000	1
7	Ad2	AD2	The 2nd alarm mode, please refer to the alarm and output logic diagram for details	0 ~ 14	4
8	AtH2	ATH2	The 2nd heat preservation mode alarm trigger condition, AD2=13 takes effect, function is same with ATH1	0、1、10、11、100、101、110、111	10
9	LbA	LBA	Loop break alarm time, unit: second	0 ~ 9999	10
10	Lbd	LBD	loop break alarm not sensing temperature band, unit :℃/F	0 ~ 9999	10
11	LbF	LBF	loop break alarm judgment amplitude，Unit:℃/LBA,℉/LBA	0 ~ 9999	2
12	PS	PS	Display correction value, display value= actual measured value + display correction value	-1999 ~ 9999	0
13	InP	INP	Optional input measured signal type. Note: after setting, be noted to modify these relevant parameters :SV、AL1、HY1、AL2、HY2、P、OVS、DB	refer to measured signal specification (page 3)	K1
14	ot	OT	Control mode. 0: ON/OFF heating control, related parameters: DB; 1: PID heating, related parameters: P, I, D, OVS, CP, ST, PDC; 2: ON/OFF cooling control, related parameter DB; PT needs to be set for compressor control 3: PID heating and cooling (cooling control OUT2 is through AL1 relay), related parameters: P, I,D,P1,OVS, CP,CP1,PC,DB, ST, SPD,PDC; 4: Overtemperature cooling output, related parameters: DB; 5: PID cooling, related parameter P,I,D,OVS, CP, ST, SPD,PDC	0 ~ 5	1
15	A-A	A-M	Manual control and automatic control switch, AUTO(0): fixed automatic control; MAN(1): fixed manual control; AM(2): Hand automatic one key switch TH(3): Thermal insulation timing function	AUTO~TH	AUTO
16	tHd	THD	Appointment timing (unit: minutes)	0 ~ 9999	0
17	tHt	THT	heat preservation timing (unit: minutes)	0 ~ 9999	0
18	tHr	THR	heat preservation starting interval, i.e. when PV reaches [SV-THR, SV+THR] and remain 5 seconds, then start heat preservation . If you need to trigger a countdown timing, when starting to heat preservation , you need to set bigger value,	0 ~ 9999	0
19	tHC	THC	The control action after finishing heat preservation: STOP: stop temperature control ; HOLD: keep heating preservation	STOP、HOLD	STOP
20	P	P	Proportional band. The smaller the value is, the faster the system respond. Otherwise, it is slower. When P=0, PID control is invalid;Resolution keep the same with PV value.	0 ~ 9999	30
21	I	I	Integral time. The smaller the value, the stronger the integral , action. Otherwise, it is weaker. Unit: second	0 ~ 3200	120
22	d	D	Differential time. The greater the value, the stronger the differential action. D=0, no derivative action. When control pressure, speedand other quick response system, can set D as 0. Unit: second	0 ~ 3200	30
23	P1	P1	OT=3, OUT2 cooling PID parameter function and setting same as above	0 ~ 9999	30
24	I1	I1		0 ~ 3200	120
25	d1	D1		0 ~ 3200	30
26	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. Please set the suitable value according to the actual situation.	OFF、1 ~ 9999	OFF
27	CP	CP	OUT1 control cycle, 1: SSR control output,4-200: relay control output. Unit:second	1.0 ~ 200.0	20.0
28	CP1	CP1	OUT2 relay output cycle; Unit: second	4.0 ~ 200.0	20.0
29	db	DB	ON/OFF control hysteresis (positive and negative numbers have the same effect). please adjust decimal point position appropriately after modifying INP parameter.	-1000~1000	5
30	LCK	LCK	Password lock function; 0001: SV value cannot be modified; 0010: Menu settings can only be viewed, cannot be modified; 0033: Can enter the advanced menu; 0123: Menu reset to factory setting, need to power off and restart ,	0~9999	0

3. Advanced menu description

No.	Symbol	Name	Illustration	Setting range	default
31	ACt	ACT	Control execution mode. 0: relay output or SSR output (Main control output 1 is R1, G1) 1: SSR output (when the main control is M1) 4: SSR drive output control, OUT1 relay is used as AL2 alarm output.(Main control output 1 is M1 and no alarm output 2) 2, 3 , 5 are reserved.	0 ~ 1,4	0
32	AE1	AE1	Alarm1 extension function: Menu option：AE1=A×1+B×10+C×100 C B A 1. A: overlimit alarm and power on alarm inhibition A | Alarm handling mode for display overlimit | Whether inhibit alarm when power on 0 | alarm status remains the same | No inhibition 1 | force alarm output 2 | force alarm close 3 | alarm status remains the same | Inhibition 4 | force alarm output 5 | force alarm close 2. B: Alarm indication B=0， No alarm indication; B=1， When the alarm is triggered, the lower line led flashes and display alarm information 3. C: alarm reset C=0, no alarm reset C=1, enable alarm reset function in heat preservation mode, when heat preservation starts or ends, triggering an alarm, press any button to clear the alarm status	0~5、10~15、100~105、110~115	0
33	AE2	AE2	AL2 Second alarm extension function; Description as above	0~5、10~15、100~105、110~115	0
34	dP	DP	The decimal point position. You only can be set to one decimal point when input signal is Tc and Rtd.	0 ~ 3	0

No.	Symbol	Name	Illustration	Set range	default
35	dtr	DTR	PV fuzzy tracking value, setting this value appropriately in some situations can obtain stable display value. Note: After setting the menu, When the alarm set value is equal to the SV set value, the alarm output is executed based on actual measurement value. set it as 0 to close the function	0.0 ~ 2.0 (0~20)	1.0 (10)
36	Ft	FT	filter coefficient, the larger value, the stronger filtering effect	10 ~ 255	10
37	Ut	UT	Temperature unit setting: ℃: Celsius, ℉: Fahrenheit Note: Linear signal input without units	(25)℃ (26)℉	(25)℃
38	Cb	CB	Cold end compensation correction zero offset	-199.9~199.9	0.0
39	Ck	CK	Cold end compensation correction slope	0.000~2.000	1.000
40	FL	FL	Measurement range low and high limit . For Tc/Rtd input, no need to modify the default setting. For 4~20mA/0~10V, set the corresponding low and high limit range. eg. 0~10V corresponds to measurement -20~50, set FL as -20, set FH as 50. Range -1999~9999 is related with dP decimal point menu.	refer to measured signal specification	-50
41	FH	FH		refer to measured signal specification	1200
42	SLL	SLL	Limit the target setting value range low limit	FL~FH	-50
43	SLH	SLH	Limit the target setting value range high limit	FL~FH	1200
44	brA	BRM	analog mode : PV(0):PV analog output, SV(1):SV analog output	PV、SV	PV
45	brL	BRL	4~20mA analog output corresponds to the low and high limit of measured value. Eg: 0~100 according to 4~20mA, should set brL as 0, set brH as 100. Note: Reversible analog output, 100~0 corresponds to 4~20mA	FL~FH	-50
46	brH	BRH		FL~FH	1200
47	oLL	OLL	Output limit lower limit, when set value ＜ 0.0,only effective for 4-20mA	0.0 ~ 100.0	0.0
48	oLH	OLH	Output limit high limit, when set value ＞100.0,only effective for 4-20mA	0.0 ~ 100.0	100.0
49	oLL1	OLL1	OUT2 cooling output limit low limit	0.0 ~ 100.0	0.0
50	oLH1	OLH1	OUT2 cooling output limit high limit	0.0 ~ 100.0	100.0
51	oLHR	OLHM	Output high limit effective range: For heating control, when PV<OLHM , OLH become effective For cooling control, PV＞OLHM, OLH become effective	FL ~ FH	1200
52	SFSt	SFST	Soft start time, the time required from 0% to 100% output. unit: second. Note: If need to set new SFST value , please wait till finishing the present soft start.	0 ~ 9999	0
53	St	ST	Power on running mode, 0: Normal control, reset to thermal insulation status in insulation mode; 1: Automatically enter PID parameter self-tuning status, press the AT key more than 3seconds to exit self-tuning; 2: stop operation status; 3: Maintain the running status before power off ; 4: Maintain current temperature , use current measured temperature as target temperature, but doesn't save and cover the original SV;	0~4	0
54	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
55	PdC	PDC	PID algorithm selection, 0 (FUZ): Advanced Fuzzy PID algorithm; 1 (STD): Common PID algorithm	0~1	FUZ
56	AtE	ATE	PID self-tuning extension function: Menu options: ATE=A × 1+B × 1000  1. A: Auto-tuning timeout time (unit: minutes) When self-tuning exceeds the set value, the self-tuning will exit and keep PID parameters before auto-tuning. set range A ∈ [1999] 2. B: Auto-tuning algorithm selection (when PDC set as FUZ, it becomes effective) B=0，90% tuning algorithm; B=1，50% tuning algorithm	1~1999	1180
57	SPC	SPC	PID parameters application in different industry field; The controller is built in ten sets of commonly used PID parameters. Customer can invoke the PIDD parameters based on according industry field. Refer to Appendix (2)	NULL、PID0~PID9	NULL
58	Pt	PT	Compressor start delay time, unit: s	0~9999	0
59	SSrA	SSRM	SSR drive output execution mode, 0: standard; 1: cycle control; refer to Appendix (1)	0~1	0
60	CYLE	CYLE	cycle control time gears selection, the bigger value,the longer cycle control time.	0~2	0
61	bAd	BAD	Communications Baud Rate 0 (4.8): 4800; 1 (9.6): 9600;	0~1	9.6
62	Add	ADD	Modbus slave device address	1~247	1
63	PrtY	PRTY	Communication parity check setting, 0:NO check 1:ODD check 2: EVEN check	0~2	N0
64	dtC	DTC	Comm. data transport sequence 000; 1st bit function reserved; 2nd bit is byte sequence exchange; 3rd bit function reserved.	refer to communication protocol note (3)	0
65	SPrt	SPRT	Set value of temperature rise slope, setting OFF has no such function, unit: ℃/minute. When SPRT setting is valid, the PID is running, if the measured value is lower than the given value, the temperature will rise to the given value at the temperature rise speed limit defined by SPRT. Unit: per minute. If SPRT=5, the temperature will rise to the given value at 5 ℃ per minute.	OFF、1~9999	OFF
66	CAE	CAE	User self-calibration enable function, this parameter is only for input signals except TC/RTD; Y:enable the self-calibration parameters; N: don' t use self-calibration parameters.	0 (N) 1 (Y)	N
67	CAL	CAL	Self-calibration low limit input operation, after adding 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
68	CAH	CAH	Self-calibration high limit input operation, after adding the high end signal to the signal input terminal,flash YES to activate, after confirm and display OK, input signal high end calibration is completed.	YES/OK	YES
69	SSA	SSM	Panel key switch RUN/STOP, 0: Disabled 1: 1: Enabled This setting is only related to the panel operation , not related with communication	0～1	1
70	AUt	MVM	Panel key switch display MV output percentage, 0: Disabled 1: Enabled , When A-M=AUTO is enabled, you can short press "SET" button to switch display the output percentage.	0～1	0
71	LCt	LGT	LED brightness adjustment, the higher value, the greater brightness	1～8	4
72	AU1	MU1	Convenient user menu. User can set and associate any common menus. When set value is not NONE, this function is enabled. Press SET key more than 3seconds in meter monitoring interface to enter menus, it will Priority display the setted covenient menus. If need to check and set other menus , press 0033 to enter the advanced menus .	NONE、AL1~VER	NONE
73	AU2	MU2			
74	AU3	MU3			
75	AU4	MU4			
76	AU5	MU5			
77	AU6	MU6			
78	AU7	MU7			
79	AU8	MU8			
80	VEr	VER	Software version, read-only	————	

Attached(1) cycle control:
After enabled, the controller will take a certain control cycle as the base, and repeatedly change the cycle according to the output ratio to control the power of the load



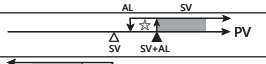
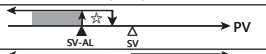
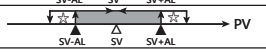
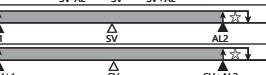
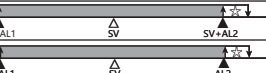
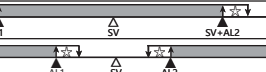
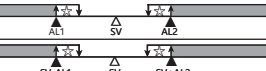
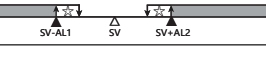
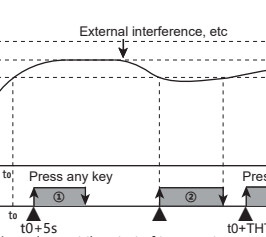
Attached (2) Common PID parameters Comparison table in SPC industries

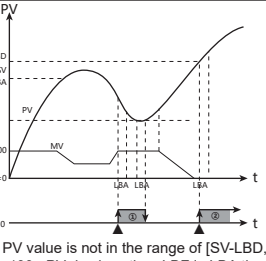
No.	Name	Industry	Parameter		
			P	I	D
1	PID0	Single-screw extruder	23	568	143
2	PID1	Twin screw extruder	33	900	220
3	PID2	Vertical packaging machinery	10	120	30
4	PID3	Shoe machine	15	295	65
5	PID4	Lithium battery coating machine(cathode)	55	550	70
6	PID5	Lithium battery coating machine (anode)	40	160	40
7	PID6	Laminator	350	20	15
8	PID7	Vertical three-side sealing packaging machine	240	406	101
9	PID8	Electric oven	284	210	52
10	PID9	Experimental resistance furnace	97	336	840

※Due to differences between devices, the above parameters are not suitable for all devices of the same type and are for reference only.

IX.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	Close alarm	
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-low limit deviation value interval alarm	
9	※High absolute and low deviation value interval alarm	
10	※High deviation and low limit absolute value interval alarm	
11	High-low limit absolute value alarm	
12	※ High-low limit deviation value alarm	
13	Temperature holding mode relevant alarm	 ① ATH=x1xx, alarm at the start of temperature preservation ② ATH=xx1x, When temperature exceeds the effective range [SV-THR, SV+THR] during temperature holding process, it makes alarm ③ ATH=xxx1, alarm when fiinishing temperature preservation

Alarm code	Alarm mode	Alarm output (AL1 & AL2 are independent from each) Image:the hatched section means the alarm action
AD1/AD2 =14	LBA Alarm	 When the PV value is not in the range of [SV-LBD, SV+LBD]; When MV=100 , PV rise less than LBF in LBA time ,① alarm When MV=0, PV drop less than LBF in LBA time , ② alarm

X. Key function operation

1.RUN/STOP operation

1) Under the measure mode, press ≪ key＞3second, to enter STOP mode, SV window will display STOP. Press ≪ again to exit STOP mode.
2). Even in STOP status, can modify SV value and RUN/STOP mode switch,
3). In stop mode, the main control output stops

2. PID parameter setting and auto-tune operation:

1) The default PID parameters are not suitable for all occasions . In order to obtain the most suitable PID parameters, please use auto-tuning function.
2) Since the controller will make control output soon after power on. To not affect the self-tuning effect, set to the monitoring mode first; or temporarily disconnect the control output load power supply. In any case, make sure that the set value is larger than the current measure value , the larger, the better.
3) In order not to be affected by the alarm interlock output, please set appropriate alarm value in advance; or eliminate the alarm impact .
4) Set the SV value , OT parameter set as 1 (PID control)
5) When PV value is at normal room temperature, exit monitoring mode or put the load power into it, and immediately press AT key ＞3S to enter auto-tuning mode.At this time, the lower row display alternately with SV value and "AT.
6) It will take a certain time for auto-tuning, in order to get good auto-tuning effect, please do not modify parameters or disconnect power in auto-tuning mode.
7) When AT light is off , it will automatically exit auto-tuning, and PID parameters automatically update.
8) During self-tuning process, press and hold the AT key, measurement out of range, display abnormally, switch to the "STOP" status, power off ect, will stop self-tuning.
9) Experienced users can also set reasonable PID parameters based on experience.

3. PID heating and cooling control operation (suitable for injection molding machines, extruders, etc.)

1) Set the control mode OT as 3.
2) Heating control acts on OUT1; The cooling control acts on OUT2, and after the cooling function takes effect, AL1 function is invalid.
3) Please set the cooling control period CP1 as a appropriate value, and set the cooling proportion coefficient PC as a appropriate value.

XI. Communication protocol

Meter adopts Modbus RTU communication protocol, 04 area holding register read function code is 0x03, write function code 0x10 or 0x06. Adopt 16 digit CRC check, the meter does not return error check. The data type is a 16-bit signed or unsigned integer.

Note: Except for some parameters (refer to parameter address mapping table), each time power-on can allow the modified parameter value sent by the host to write to the chip 50 times, more than 50 times only can write to the cache, when modifying parameters by manual or auto-tuning values in cache will be overwritten by chip internal storage, so keep writing the parameters by RS485 if exceed 50times.

Data frame format:

Start bit	Data bit	Stop bit	Check bit
1	8	1	ODD/EVEN/NONE PRTY

1. Read register

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

The register address of SV is 0x2000 ("0x" stands for hexadecimal) because the data type of SV is a 16-bit integer (2 bytes), 1 register. The decimal integer 200 hexadecimal code is 0x00C8.

Note: When reading data, read the DP value first to confirm the decimal point position and then convert the read data to get the actual value.

Read multi-register	Meter Address	Function code	Start add. high bit	Start add. high 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 normal answer	0x01	0x03	0x02 byte number		0x00	0xC8	0xB9	0xD2
Slave abnormal answer	0x01	0x83	0x02 error code eg: the host request address is 0x2011				0xC0	0xF1

2. Write multi-register

For example: Host use 0x10 function code write SV (set value 150)

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

Host request (write multi-register)										
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	CRC code
0x01	0x10	0x20	0x00	0x00	0x01	0x02	0x00	0x96	0x07	0xFC

Slave normal answer (write multi-register)							
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 write single-register 0x06 function code 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 normal answer	0x01	0x06	0x20	0x00	0x00	0x96	0x02	0x64
Slave abnormal answer	0x01	0x86 function code		0x02 error code			0xC3	0xA1

Handling of abnormal communication:

Error code:

0x01--- Illegal function: the function code sent from host is not supported by meter
0x02--- Illegal address: the register address designated by host beyond the address range of meter.
0x03--- Illegal data: written data value sent from host exceeds the corresponding meter data range

Meter parameters address mapping table

: If writing times exceeds 50 times each time power on, only write to the cache.
: No limit for writing times

No.	Add(Register No①)	Variable name	Register	R/W	Remark
1	0x0000 (40001)	mapping address 1	1	—	1. Read and write 0x2200~0x2209 configured register data. 2. The read and write feature after mapping register is the same as the register before mapping.
2	0x0001 (40002)	mapping address 2	1	—	
3	0x0002 (40003)	mapping address 3	1	—	
4	0x0003 (40004)	mapping address 4	1	—	
5	0x0004 (40005)	mapping address 5	1	—	
6	0x0005 (40006)	mapping address 6	1	—	
7	0x0006 (40007)	mapping address 7	1	—	
8	0x0007 (40008)	mapping address 8	1	—	
9	0x0008 (40009)	mapping address 9	1	—	
10	0x0009 (40010)	mapping address 10	1	—	

11	0x2000 (48193)	Set value SV	1	R/W	
12	0x2001 (48194)	1st alarm value AL1	1	R/W	
13	0x2002 (48195)	1st alarm hysteresis HY1	1	R/W	
14	0x2003 (48196)	2nd alarm value AL2	1	R/W	
15	0x2004 (48197)	2nd alarm hysteresis HY2	1	R/W	
16	0x2005 (48198)	Display low limit FL	1	R/W	
17	0x2006 (48199)	Display high limit FH	1	R/W	
18	0x2007 (48200)	reserved	1	R/W	

No.	Add(Register No①)	Variable name	Register	R/W	Remark
19	0x2008 (48201)	reserved	1	R/W	
20	0x2009 (48202)	Control output low limit OLL	1	R/W	Default 1 decimal point
21	0x200A (48203)	Control output high limit OLH	1	R/W	Default 1 decimal point
22	0x200B (48204)	Overshoot limit OVS	1	R/W	
23	0x200C (48205)	Heat & Cool control dead zone DB	1	R/W	
24	0x200D (48206)	reserved	1	R/W	
25	0x200E (48207)	Amend value PS	1	R/W	
26	0x200F (48208)	PV fuzzy tracking value DTR	1	R	only temperature signal has decimal point
27	0x2010 (48209)	Measured value PV	1	R	
28	0x2011 (48210)	Output percentage MV	1	R/W	-100~100
29	0x2012 (48211)	Auto-Manual switch A-M	1	R/W	0: Automatic 1: Manual 2: Manual-Auto 3: Thermal insulation
30	0x2013 (48212)	reserved	1	R/W	
31	0x2014 (48213)	reserved	1	R/W	
32	0x2015 (48214)	set value low limt SLL	1	R/W	
33	0x2016 (48215)	set value high limit SLH	1	R/W	
34	0x2017 (48216)	Panel R/S swith SSM	1	R/W	
35	0x2018 (48217)	reserved	1	R/W	
36	0x2019 (48218)	reserved	1	R/W	
37	0x201A (48219)	slope heating display value SP-M	1	R	
38	0x201B (48220)	slope heating set value SPRT	1	R/W	
39	0x201C (48221)	Control loop fault alarm time LBA	1	R/W	
40	0x201D (48222)	loop break alarm not sensing temperature band LBD	1	R/W	
41	0x201E (48223)	loop break alarm judgment amplitude LBF	1	R/W	
42	0x201F (48224)	The 1st heat preservation alarm configuration ATH1	1	R/W	
43	0x2020 (48225)	The 2nd heat preservation alarm configuration ATH2	1	R/W	
44	0x2021 (48226)	Appointment timing THD	1	R/W	
45	0x2022 (48227)	heat preservation timing THT	1	R/W	
46	0x2023 (48228)	heat preservation starting interval THR	1	R/W	
47	0x2024 (48229)	The control action after finishing heat preservation THC	1	R/W	
48	0x2025 (48230)	reserved	1	R/W	
49	0x2026 (48231)	OUT2 cooling output limit low limit OLL1	1	R/W	
50	0x2027 (48232)	OUT2 cooling output limit high limit OLH1	1	R/W	
51	0x2028 (48233)	Output high limit effective range: OLHM	1	R/W	
52	0x2029 (48234)	soft start time SFST	1	R/W	
53	0x2100 (48235)	The heating output H_MV	1	R	OT=3 Heating and cooling mode output
54	0x2101 (48236)	The cooling output C_MV	1	R	
reserve					
55	0x2100 (48449)	AL1 alarm mode AD1	1	R/W	
56	0x2101 (48450)	AL2 alarm mode AD2	1	R/W	
57	0x2102 (48451)	AL1 Alarm extension function AE1	1	R/W	
58	0x2103 (48452)	AL2 Alarm extension function AE2	1	R/W	
59	0x2104 (48453)	control mode OT	1	R/W	
60	0x2105 (48454)	Output mode ACT	1	R/W	
61	0x2106 (48455)	Run/Stop operation	1	R/W	1: RUN 2: STOP 3: start auto-tuning 4: stop auto-tuning
62	0x2107 (48456)	decimal point DP	1	R/W	
63	0x2108 (48457)	Unit display UT	1	R/W	25 (℃) 26 (°F)
64	0x2109 (48458)	Filter coefficient FT	1	R/W	
65	0x210A (48459)	Proportional band P	1	R/W	
66	0x210B (48460)	Integral time I	1	R/W	
67	0x210C (48461)	Differential time D	1	R/W	
68	0x210D (48462)	PID control speed adjustment SPD	1	R/W	
69	0x210E (48463)	OUT1 control cycle CP	1	R/W	1 decimal point default set
70	0x210F (48464)	OUT2 cooling control cycle CP1	1	R/W	1 decimal point default set
71	0x2110 (48465)	cooling start delay time PT	1	R/W	
72	0x2111 (48466)	Input signal selection INP	1	R/W	refer to input signal table
73	0x2112 (48467)	meter address ADD	1	R/W	
74	0x2113 (48468)	Baud rate BAD	1	R	
75	0x2114 (48469)	Comm. data transport sequence DTC	1	R	note③
76	0x2115 (48470)	PID algorithm type: PDC	1	R	
77	0x2116 (48471)	Lock function LCK	1	R	
78	0x2117 (48472)	meter name	1	R	
79	0x2118 (48473)	output status	1	R	note②
80	0x2119 (48474)	Odd and even Parity PRTY	1	R	
81	0x211A (48475)	reserved	1	R/W	
82	0x211B (48476)	reserved	1	R/W	
83	0x211C (48477)	Cold end correction offset CB	1	R/W	1 decimal point default set
84	0x211D (48478)	The cold end correction slope CK	1	R/W	3 decimal point default set
85	0x211E (48479)	OUT2 cooling proportionality coefficient P1	1	R/W	
86	0x211F (48480)	OUT2 cooling Integral time I1	1	R/W	
87	0x2120 (48481)	OUT2 cooling Differential time D1	1	R/W	
88	0x2121 (48482)	Running mode after power-on ST	0	R/W	

No.	Add(Register No①)	Variable name	Register	R/W	Remark
89	0x2122 (48483)	PID self-tuning extension ATE	1	R/W	
90	0x2123 (48484)	industry PID parameter invoke SPC	1	R/W	
91	0x2124 (48485)	cycle control frequency CYLE	1	R/W	
92	0x2125 (48486)	Brightness adjustment LIGHT	1	R/W	
93	0x2126 (48487)	SSR control mode SSRM	1	R/W	
94	0x2127 (48488)	RS running switch	1	R/W	④ 0 : off 1: on
95	0x2128 (48489)	AT auto-tuning switch	1	R/W	
97	0x2129 (48490)	WR commuication write times	1	R	present commuication write times (maximum 50times eachtime power on)
reserved					
94	0x2200 (48705)	Map address 1 configuration	1	R/W	default:0x2010 (PV)
95	0x2201 (48706)	Map address 2 configuration	1	R/W	default:0x2118(output status)
96	0x2202 (48707)	Map address 3 configuration	1	R/W	default:0x2011 (MV)
97	0x2203 (48708)	Map address 4 configuration	1	R/W	default:0x2000 (SV)
98	0x2204 (48709)	Map address 5 configuration	1	R/W	default:0x2106 (RSA)
99	0x2205 (48710)	Map address 6 configuration	1	R/W	default:0x2012 (A-M)
100	0x2206 (48711)	Map address 7 configuration	1	R/W	default:0x210A (P)
101	0x2207 (48712)	Map address 8 configuration	1	R/W	default:0x210B (I)
102	0x2208 (48713)	Map address 9 configuration	1	R/W	default:0x210C (D)
103	0x2209 (48714)	Map address 10 configuration	1	R/W	default:0x210E (CP)

104	0x2300 (48961)	convenient user menu MU1 configuration	1	R/W	configuration based on customer's specific requirement
105	0x2301 (48962)	convenient user menu MU2 configuration	1	R/W	
106	0x2302 (48963)	convenient user menu MU3 configuration	1	R/W	
107	0x2303 (48964)	convenient user menu MU4 configuration	1	R/W	
108	0x2304 (48965)	convenient user menu MU5 configuration	1	R/W	
109	0x2305 (48966)	convenient user menu MU6 configuration	1	R/W	
110	0x2306 (48967)	convenient user menu MU7configuration	1	R/W	
111	0x2307 (48968)	convenient user menu MU8 configuration	1	R/W	

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

Note①: The register number is composed of converting the address to decimal plus 1, and then adding register identification code 4 in front of it. For example: data address 0x2000 register number is 8192 + 1 = 8193 and then 4 is added in front, that is, the register number 48193.Related application, please refer to Siemens S7-200 PLC.

Note ②: Measurement status indication. When data bit is 1, it means execution, and 0 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: □ □ □ — Reserved
Byte transfer order: 0: the sequence is 1, 2; 1: the sequence is 2, 1
Reserved

Note④: Precautions for working switch RSA, running switch RS, and auto-tuning switch AT

1)"Work switch RSA" cannot be written to "AT(3)" repeatedly, and "Auto-tuning switch AT" cannot be written to "on (1)" repeatedly, otherwise it may cause start auto-tuning again after finishing auto-tuning.

2)In the self-tuning state, the "working switch RSA" keep to be "AT(3)", and automatically jumps to "RUN(1)" after finishing auto-tuning . Writing "RUN(1)" or "STOP(2)" during auto-tuning process will cause to stop auto-tuning , while writing "on" to the "Run Switch RS"(1) , it does not affect self-tuning implementation.

3) The cusage is as follows:

(1) Working switch RSA: only write once when need to switch the status, read the register check after writing;

(2) Running switch RS+ auto-tuning switch AT: During "running switch RS" keep writing status; if need to start the auto-tuning. "Run switch RS" needs to be in the "on(1)" status, and write "On (1)" once in "Auto-tuning Switch AT" to read the register verification.

XII. Simple troubleshooting methods

Display	troubleshooting methods
LLL/HHH	Check whether the sensor is disconnected, poor contact or incorrect wiring; Check FH value and FL value; Check whether the work temperature and ambient temperature is out of range; Check if the input signal is selected correctly (INP menu)

XIII. Version

Date	Version	Modified content
2025.03.10	A/0	--------