

# T55L Multi-channel temperature controller user manual

(16 channel) For T55L-A version



## Features:

- With measurement display, control output, RS485 Communication, alarm function.
- Different PID arithmetic for option, and with auto-tuning function.
- With multi-channel control load power distribution function.
- This product is used in industrial machinery, machine tools, general measuring instruments and equipment

National High-tech Enterprise/ National Standard Drafting Unit



Hotline: 400-0760-168

Version: KKT55L-16N-A01E-A/2-20230302

The instruction explain instrument settings, connections, name and etc, please read carefully before you use the temperature controller. Please keep it properly for necessary reference.

## I. Safe Caution

### ⚠ Warning

- 1) When the failure or abnormal of products lead to a system of major accidents, please set the proper protection circuit in the external.
- 2) Please don't plug in before completing all the wire. Otherwise it may lead to electric shock, fire, fault.
- 3) Not allow to use outside the scope of product specification, otherwise it may lead to fire, fault.
- 4) Not allow to use in the place where is inflammable and explosive gas.
- 5) Do not touch power terminal and other high voltage part when the power on, otherwise you may get an 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 a nuclear facility and human life associated medical equipment.
- 2) The product may occur radio interference when it used at home. You should take adequate countermeasures.
- 3) The product get an electric shock protection through reinforced Insulation. When the product is embedded in the devices and wiring, please subject to the specification of embedded devices.
- 4) In order to prevent surge occurs, when using this product in the place of over 30m indoor wiring and wiring in outdoor, you need to set the proper surge suppression circuitry.
- 5) The product is produced based on mounting on the disk. In order to avoid to touch the wire connectors, please take the necessary measures on the product.
- 6) Be sure to observe the precautions in this manual, otherwise there is a risk of a major injury or accident.
- 7) When wiring, please observe the local regulation.
- 8) To prevent to damage the machine and prevent to machine failure, the product is connected with power lines or large capacity input and output lines and other methods please install proper capacity fuse or other methods of protection circuit.
- 9) Please don't put metal and wire clastic mixed with this product, otherwise it may lead to electric shock, fire, fault.
- 10) Please tighten screw torque according to the rules. If not, it may lead to electric shock and fire.
- 11) In order not to interfere with this products to dissipate heat, please don't plug casing around the cooling vent hole and equipment.
- 12) Please don't connect any unused terminal.
- 13) Please do the cleaning after power off, and use the dry cleaning cloth to wipe away the dirt. Please don't use desiccant, otherwise, it may casue the deformation or discoloration of the product.
- 14) Please don't knock or rub the panel with rigid thing.
- 15) The readers of this manual should have basic knowledge of electrical, control, computer and communications.
- 16) The illustration, example of data and screen in this manual is convenient to understand, instead of guaranteeing the result of the operation.
- 17) In order to use this product with safety for long-term, regular maintenance is necessary. The life of some parts of the equipments are by some restrictions, but the performance of some will change for using many years.
- 18) Without prior notice, the contents of this manual will be change. We hope these is no any loopholes, if you have questions or objections, please contact us.

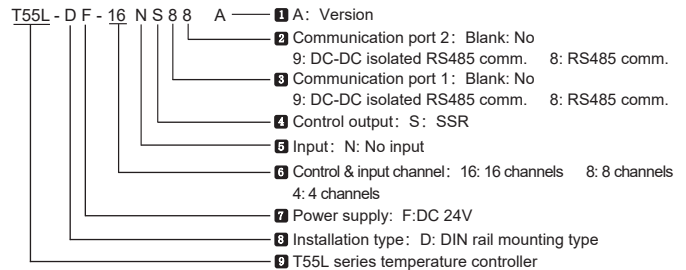
### ⚠ Caution of Install & Connection

1. Installation
- 1) This product is used in the following environmental standards. (IEC61010-1) [Overvoltage

### ⚠ Caution of Install & Connection

- category II, class of pollution 2].
- 2) This product is used in the following scope: environment, temperature, humidity and environmental conditions. Temperature: 0~50°C; humidity: 45~85%RH; Environment condition: Indoor warranty. The altitude is less than 2000m.
  - 3) Please avoid using in the following places  
 The place will be dew for changing temperature; with corrosive gases and flammable gas; with vibration and impact; with water, oil, chemicals, smoke and steam facilities with Dust, salt, metal powder; and with clutter interference, static electric and magnetic fields, noise; where has air conditioning or heating of air blowing directly to the site; where will be illuminated directly by sunlight; where accumulation of heat will happen caused by radiation.
  - 4) On the occasion of the installation, please consider the following before installation. In order to protect heat saturated, please ensure adequate ventilation space. Please consider connections and environment, and ensure that the products below for more than 50mm space. Please avoid to installed over the machine of the calorific value (Such as heaters, transformer, semiconductor operations, the bulk resistance). When the surrounding is more than 50, please using the force fan or cooling fans. But don't let cold air blowing directly to the product. In order to improve the anti - interference performance and security, please try to stay away from high pressure machines, power machines to install. Don't install on the same plate with high pressure machine and the product. The distance should be more than 200mm between the product and power line.
  2. Cable caution
  - 1) In order to reduce the power cables and the load power cables on the effect of this product, please use noise filter in the place where easy to effect. You must install it on the grounding of the disk if you use the noise filter, and make the wiring to be shortest between noise filter output side and power connectors. Don't install fuse and switch on the wiring of noise filter output side, otherwise it will reduce the effect of noise filter.
  - 2) It takes 5s from input power to output. If there is a place with interlocking actions circuit signal, please use timer relay.
  - 3) Please use twisted pair with a shield for analog output line, can also connect the common-mode coil to the front-end of the signal receiving device to suppress line interference if necessary, to ensure the reliability of signal.
  - 4) Please use twisted pair with a shield for remote RS485 communication cable, and deal with the shield on the host side earth, to ensure the reliability of signal.
  - 5) This product don't have the fuse; please set according to rated voltage 250V, rated current 1A if you need; fuse type: relay fuse.
  - 6) Please use suitable slotted screwdriver and wire.  
 Terminal screw cap size: φ3mm, distance 3.81mm  
 Recommended tightening torque: 0.2N.m  
 Proper cables: 0.5 ~ 1.5mm single cable/multiple core cable
  - 7) Please don't put the Crimp terminal or bare wire part contact with adjacent connector.

## II. Model Illustration



## III. Specifications

### 1. Electrical parameters:

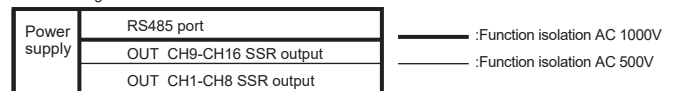
Control output type	SSR
Control output capacity	DC 24V Max 100mA@25°C (Derating ratio 8%/10°C) Withstand voltage of each channel: 100V
Sampling rate	1 times per second per channel
Power supply	DC 24V
Standby power	≤3W (Not including the energy consumption of any output or external feed)
Full-load power	< 50W (Sixteen-loop control outputs)
Environment	Indoor use, temperature: -20 ~ 85°C no condensation, humidity: < 95%RH, altitude < 5000m
Storage environment	-40 ~ 100°C, no condensation
Communication port	RS485 port Modbus-RTU protocol
Insulation impedance	Input, output, power cabinet > 20MΩ
ESD	IEC/EN61000-4-2 Contact ±4KV / Air ±8KV perf. Criteria B
Pulse triap anti-interference	IEC/EN61000-4-4 ±2KV perf. Criteria B
Surge immunity	IEC/EN61000-4-5 ±0.5KV perf. Criteria B
Voltage drop & short interruption immunity	IEC/EN61000-4-29 0% ~ 70% perf. Criteria B
Dielectric strength	Power and input/output AC1000V, 1min
Total weight	About 560g
Shell material	Galvanized cold rolled sheet
Panel material	PVC film and PEM silicone key
Power-off data protection	10 years

### 2. Measurement signal parameters:

Input type	Symbol	Measurement range	Accuracy	Communication code	
PT100	PT100-1	Pt 100	0 ~ 150.0	0.1°C	8
	PT100-2	Pt 200	-200~600	1°C	21
JPT100	JPT100-1	JPt 100	-199.9~500.0	0.1°C	9
	JPT100-2	JPt 200	-200~500	1°C	22
CU50	CU50-1	CUS 50	-50.0~150.0	0.1°C	10
	CU50-2	CUS 20	-50~150	1°C	23
CU100	CU100-1	CUD 100	-50.0 ~ 150.0	0.1°C	11
	CU100-2	CUD 20	-50 ~ 150	1°C	24
0~400 Ω	r-t	-1999~9999			13

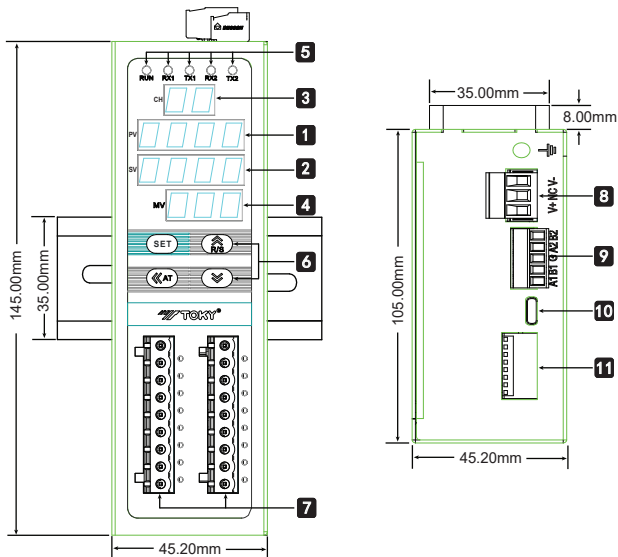
- \*Note: 1) The measurement range and accuracy of each input type depend on the acquisition module. This parameter table is limited to the factory default values of the associated FL, FH, DP and other menus.  
 2) At present, only the acquisition module of PT100-1 measurement signal is released, and other requirements need to be customized.

### 3. Isolation diagram:



#### IV. Panel illustration and wiring diagram

##### 1. Dimension and installation size



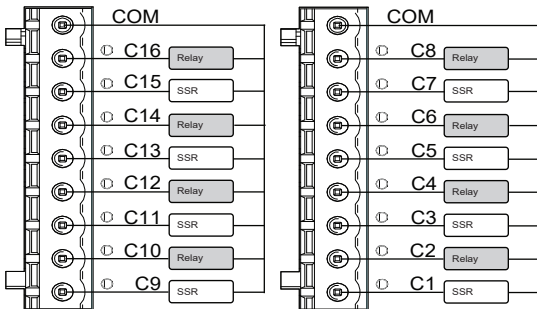
##### 2. Panel illustration

No.	Symbol	Name	Description
1	PV	PV display (Red)	Measured value or parameter menu symbol
2	SV	SV display (Red)	Set value or parameter set value; when it displays "STOP", control stop.
3	CH	Channel display (Red)	Channel number
4	MV	Control output display (Red)	Control output display window
5	RUN	Operation indicator (Green)	Always on when the meter is running
	RX1	COM1 indicator (Green)	When COM1 receives data, it flashes once
	TX1	COM1 indicator (Green)	When COM1 sends data, it flashes once
	RX2	COM2 indicator (Green)	When COM2 receives data, it flashes once
TX2	COM2 indicator (Green)	When COM2 sends data, it flashes once	
6	SET	SET key	Menu key/ confirm key, press it to enter/exit parameter modification mode, saving modified value, and switch between channels.
	⏪	Shift/AT key	Activation key/shift key/AT auto-tuning key, in measurement control mode, keep pressing it to enter/exit auto-tuning.
	⏩	Add key / R/S	Add key/menu up key; in measurement control mode, keep pressing it to switch between RUN & STOP mode.
	⏴	Decrease key	Decrease key/ menu down key

##### 3. Control & alarm output terminal (As shown above 7)

###### 1) Alarm function on

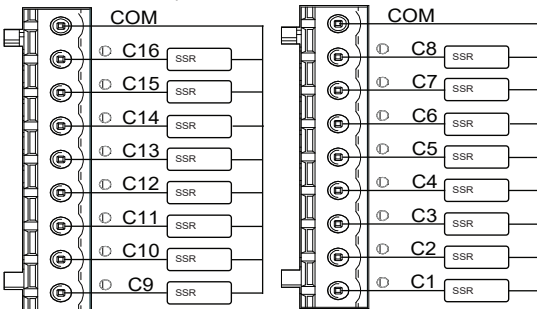
When alarm on, for terminal C1~16, odd number is used as control output, and even number is used as alarm output. For example, C1 is used as control output OUT1, C2 is used as alarm output of OUT1; C3 is used as control output OUT1, and so on.



(The eight channel temperature controller does not include this terminal)

###### 2) Alarm function off

When the alarm function is turned off, terminals C1~16 correspond to the temperature control outputs of channels 1~16 one by one.

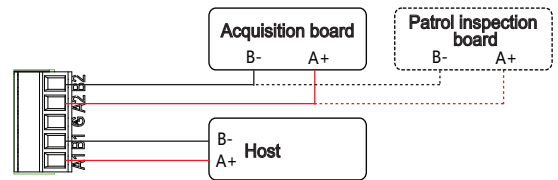


(The eight channel temperature controller does not include this terminal)

##### 4. Power supply terminal (As shown above 8)



5. RS485 communication port (As shown on the left 9)  
RS485 communication port, A1/B1 connects the host which is called as COM1, A2/B2 connects acquisition board, which is called as COM2.

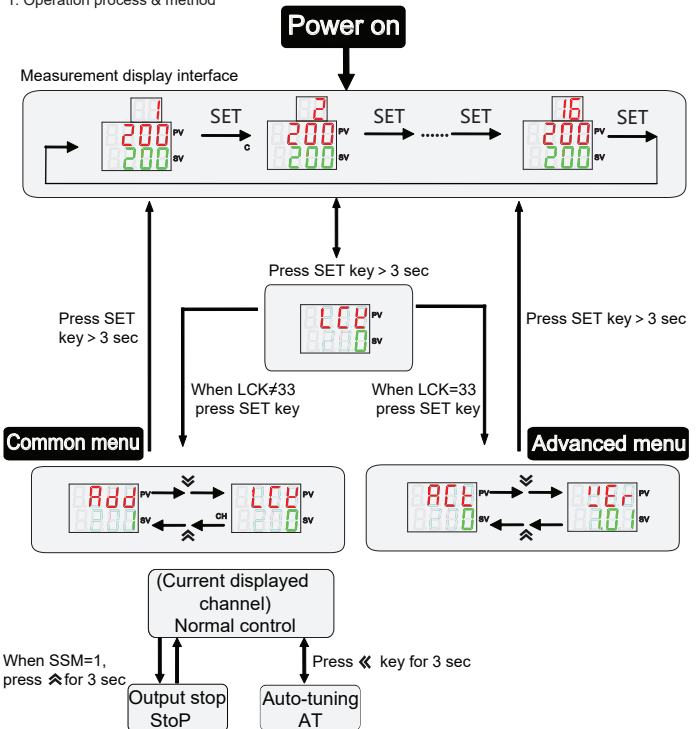


##### 6. Thumb switch (As shown on the left 11)

Address of this meter (ADD1)										
0	0	0	0	-	-	-	-	-	-	1
1	0	0	0	-	-	-	-	-	-	2
0	1	0	0	-	-	-	-	-	-	3
1	1	0	0	-	-	-	-	-	-	4
0	0	1	0	-	-	-	-	-	-	5
1	0	1	0	-	-	-	-	-	-	6
0	1	1	0	-	-	-	-	-	-	7
1	1	1	0	-	-	-	-	-	-	8
0	0	0	1	-	-	-	-	-	-	9
1	0	0	1	-	-	-	-	-	-	10
0	1	0	1	-	-	-	-	-	-	11
1	1	0	1	-	-	-	-	-	-	12
0	0	1	1	-	-	-	-	-	-	13
1	0	1	1	-	-	-	-	-	-	14
0	1	1	1	-	-	-	-	-	-	15
1	1	1	1	-	-	-	-	-	-	16
Baud rate(BAD1)										
-	-	-	-	0	0	-	-	-	-	38400
-	-	-	-	1	0	-	-	-	-	19200
-	-	-	-	0	1	-	-	-	-	9600
-	-	-	-	1	1	-	-	-	-	115200
Temperature control switch										
-	-	-	-	-	-	-	-	0	-	ON
-	-	-	-	-	-	-	-	1	-	OFF

#### V. Operation process and menu illustration

##### 1. Operation process & method



- In normal measurement control mode, keep pressing "SET" key for 3 sec to enter the parameter menu viewing mode, press "CH" key to switch the display channel, the channel number is displayed in the CH indication window, parameters displayed on the panel correspond to the displayed channel.
- In menu viewing mode, press "⏴" or "⏵" key to check the common menu parameters circularly.
- In menu viewing mode, press "⏪" key to flash the viewed menu parameter value to enter the parameter modification mode, and each press of the key can move one bit to the left in cycle.
- In parameter modification mode, press "⏴" or "⏵" key once to increase or decrease the flashing data bit by one.
- In parameter modification mode, after the parameter is modified, press "SET" key to save the modified value, and keep pressing it for 3 sec to exit to the menu viewing mode.

f. In normal measurement control mode, keep pressing “<math>\llcorner</math>” key for 3 sec to enter the PID auto-tuning state.

h. In normal measurement control mode, keep pressing “<math>\boxtimes</math>” key for 3 sec to enter/exit the running mode or stop mode; in stop mode, the SV window displays “STOP”.  
Note: SSM menu should be set as 1 to enable the operation function.

### VI. Menu illustration

□: No matter what model, what control mode it is, these parameters will be displayed always.  
▣: According to different model and control mode, these parameters will be hidden.

#### 1. Common menu illustration

No.	Symbol	Name	Illustration	Setting range	Factory setting
1	PV	PV	Measured value, it will flash or display LLLL/HHHH when the value overflow measure range. Unit: °C/°F or no unit.	Refer to measured signal table	No
2	SV	SV	Target temperature set value, unit: °C/°F or no unit.	SL~SLH	100.0
3	CH	CH	Channel number display window	1~99	
4	LCK	LCK	Lock function; 0001:SV value cannot be changed; 0010: menu set value can be read only; 0033: advanced menu can be accessed; 0123: menu restore factory setting	0~9999	0
5	ADD1	ADD1	Communication address for this meter, which is set by thumb switch, and its value cannot be changed by this menu.	1~16	1
6	BAD1	BAD1	COM1 RS485 comm. baud rate with Host, cannot be changed by this menu. 0: 1200; 1: 2400; 2: 4800; 3: 9600; 4: 19200; 5: 38400; 6: 57600; 7: 115200;	0~7	5
7	PRT1	PRT1	COM1 communication parity check setting NO(0): No, ODD(1): Odd, EVEN(2): Even	0~2	0
8	DTC1	DTC1	COM1 communication data transport sequence 000; 1st bit function reserved; 2nd bit is byte sequence exchange; 3rd bit function reserved.	Refer to communication protocol	0
9	ADD2	ADD2	Acquisition board (temperature control) comm. address	1~16	1
10	ADD3	ADD3	Acquisition board (patrol inspection) comm. address	1~16	2
11	BAD2	BAD2	COM2 RS485 comm. baud rate with acquisition board 0: 1200; 1: 2400; 2: 4800; 3: 9600; 4: 19200; 5: 38400; 6: 57600; 7: 115200;	0~7	5
12	PRT2	PRT2	COM2 communication parity check setting NO(0): No, ODD(1): Odd, EVEN(2): Even	0~2	0
13	DTC2	DTC2	COM2 communication data transport sequence 000; 1st bit function reserved; 2nd bit is byte sequence exchange; 3rd bit function reserved.	Refer to communication protocol	0
14	AD1	AD1	Alarm mode. 0: alarm off, 1: patrol inspection alarm, 2: over-temperature alarm	0~2	0
15	AL1	AL1	Max temperature deviation value. When the patrol alarm is on, if the difference between patrol temperature and control temperature is greater than this value, the alarm delay timing is enabled. When the over-temperature alarm is on, if the temperature control measured value exceeds the set value, the alarm will be triggered immediately.	FL ~ FH	130.0
16	DL1A	DL1A	Alarm delay timing. When the alarm delay time is greater than the set value, alarm will turn on. Unit: second	0~9999	0
17	OT	OT	Control mode, 0: ON/OFF heating control; 1: PID heating control; 2: ON/OFF cooling control; 3: Reserved; 4: Over temperature cooling output; 5:PID cooling.	0~5	1
18	P	P	Proportional band, the smaller the value is, the faster the system responds, otherwise, it is slower. Increasing the proportional band can reduce the oscillation, but will increase the control deviation. Decreasing the proportional band can reduce the control deviation, but will cause the oscillation. Unit: same as the PV	0~9999	5.0
19	I	I	Integral time, the smaller the value is, the stronger the integral action is, otherwise, it is weaker, and the more it tends to eliminate the deviation from the set value. The deviation may not be eliminated if the integral effect is too weak. Unit: sec	0~9999	100
20	D	D	Differential time: The system oscillation can be prevented by reducing the differential action to a suitable value. The larger the value is, the stronger the differential action is. Unit: sec	0~9999	25
21	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 appropriate value according to the actual situation. This function is unavailable when it is set to 0	0~9999	0
22	A-M	A-M	Auto-manual control switch, AUTO(0): auto control only; MAN(1): manual control only;	AUTO~AM	AUTO
23	CP	CP	OUT1 control cycle. For SSR control output, it should be set as 1. Unit: sec	1 ~ 200	1
24	DB	DB	ON/OFF control hysteresis(Negative hysteresis control), or cooling control and compressor refrigeration control dead zone. After change the INP setting, please change this parameter according to the decimal point position.	-199.9 ~ 999.9	0.5
25	INP	INP	Optional input signal. See the corresponding table of input signal parameters for details. Note: other relevant parameters need to be modified after setting this menu.	refer to input signal parameters table (page 2)	PT1
26	PS	PS	Amend value, display value= actual measured value + amend value	-1999 ~ 9999	0

#### 2. Advanced menu illustration

No.	Symbol	Name	Illustration	Setting range	Factory setting
27	ACT	ACT	Control Mode, 0 ~ 1: SSR Output or Transistor output	0~1	0
28	DP	DP	Decimal point setting is effective under the linear signal input	0~3	1
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 as 0 to close this function. The temperature input unit: Fahrenheit or Celsius. The linear signal input unit: Engineering Digits	0.0 ~ 2.0 (0~20)	1.0
30	SSM	SSM	Press the Add key on the panel to switch the RUN/STOP operation, 0: prohibited, 1: OPEN	0 ~ 1	1
31	SLL	SLL	Low limit of target setting value range	FL~FH	FL
32	SLH	SLH	High limit of target setting value range	FL~FH	FH
33	FL	FL	Measure range low limit, the setting value must be less than measure range high limit	Refer to measured signal parameter table	0.0
34	FH	FH	Measure range high limit, the setting value must be more than measure range low limit.	Refer to measured signal parameter table	150.0
35	OLL	OLL	Output low limit, limit the output low limit current amplitude. Setting value must be less than high limit setting	-5.0 ~ 100.0	0.0
36	OLH	OLH	Output high limit, limit the output high limit current amplitude. Setting value must be greater than low limit setting	0.0 ~ 105.0	100.0
37	FT	FT	PV digital filter coefficient, the larger the value, the stronger the filtering effect	0 ~ 255	10

No.	Symbol	Name	Illustration	Setting range	Factory setting
38	PT	PT	Compressor start delay time, unit: sec	0 ~ 9999	0
39	PDC	PDC	PID algorithm option: 0(FUZ): Advanced fuzzy PID arithmetic; 1(STD): normal PID arithmetic	FUZ/STD	FUZ
40	UNIT	UNIT	Temperature unit setting °C: Celsius °F: Fahrenheit, note: this unit setting is only for temperature measurement signals, " " : No unit display	(25)°C (26)°F	(25)°C
41	PRS	PRS	Setting parameter reserve position: 0 (EEP):EEPROM with power failure protection; 1(RAM): RAM without power failure protection. Description of setting parameter storage location: EEP and RAM. EEP means that the setting parameters are written into EEPROM and can be permanently saved after power failure. It is generally used for factory setting parameters of equipment. Because EEPROM has the limit of writing times, too many and too frequent writes will be damaged; RAM: it means that the parameters are stored in RAM without writing limit and will not be damaged due to frequent writing. The parameters set after the equipment is powered off will not be saved. After power on, they will be restored to the parameters saved in EEPROM by the equipment manufacturer. It is usually used for frequent parameters writing when communicating with the upper computer PLC. The method of using this parameter is to set this parameter to EEP first. After the equipment factory has finished debugging the equipment and set the parameters, the parameters are saved in EEPROM, and then PRS is modified to RAM, and the equipment is delivered to the user for use, so as to prevent erroneous modification or long-term communication writing data from damaging the EEPROM.	EEP/RAM	EEP
42	RSS	RSS	RUN/STOP reserve position: 0 (EEP):EEPROM with power failure protection; 1(RAM): RAM without power failure protection. this parameter method: if the instrument is required to be in stop mode every time when it is powered on, first set RSS to EEP, and then set "start stop operation" = STOP. This setting parameter will be saved for a long time; Then set RSS to RAM. When using, the upper computer starts/stops the instrument, which is stored in RAM. After power on again, the instrument still enters STOP mode.	EEP/RAM	EEP
43	LPH	LPH	The actual power of each channel load, used for the total power limit; Unit: KW. When set to 0, this channel don't participate in power limitation	0.0 ~ 999.9	0.0
44	SLPL	SLPL	Total power limit, limits the power distribution of each participating channel when the total power of channel output controls exceeds the total power limit value; Unit: KW; Set to 0, no power limit function	0.0 ~ 999.9	0.0
45	DN	DN	Display the number of channels, indicating the number of measurement channels actually used by the instrument	1 ~ 16	12
46	DNS	DNS	Display the starting channel number, which is used to indicate number of channel 1 in multi-machine application. For example: when DNS=3, CH3~CH18 represent 1~16 channels respectively	1 ~ 84	1
47	DNT	DNT	Channel cycle display time, 0 means cancel automatic cycle display	0 ~ 99	4
48	CN	CN	Patrol inspection channel number, 0: close patrol inspection	0 ~ 8	12
49	MSV	MSV	Multi set value activating switch, 0: OFF, 1: ON	0 ~ 1	0
50	FSPV	FSPV	Percentage of 1st segment target value to set value.	0.0~100.0	85.0
51	FSVI	FSVI	Effective decision interval for reaching the 1st target value	0.0~100.0	3.0
52	FSVT	FSVT	Holding time after reaching the first target value. Unit: sec	0~9999	1
53	SSVP	SSVP	Second segment target value progressive switch, 0: OFF, 1: ON	0 ~ 1	0
53	SSVF	SSVF	Progressive coefficient of 2nd segment target value	0.0~100.0	80.0
54	VER	VER	Software version		

### VII. Key function operation

- RUN/STOP (Monitoring) mode operation
  - SSM is set to enable panel operation; otherwise, it can only be modified during communication.
  - Under the measure mode, long press “<math>\boxtimes</math>” key to enter the STOP mode, SV window will display “STOP”, main control output will stop or keep the minimum output.
  - Under STOP mode, long press “<math>\boxtimes</math>” key to exit STOP mode, press “<math>\llcorner</math>” key to modify SV value.
  - Under STOP mode, alarm output and analog output work normally.
- PID auto-tune operation:
  - Before auto-tune procedure, please switch off the control output load power, or set the meter as STOP mode.
  - Before auto-tune procedure, 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 larger than SV.
  - Before auto-tune procedure, please set a proper alarm value or eliminate the alarm condition, in order to prevent the auto-tune procedure from being affected by alarm output.
  - Set PID type and SV value; the factory default setting is fuzzy PID.
  - Set as PID control, if there is OLL & OLH output limiting, please set the output to a proper range; factory default setting is OLL=0%, OLH=100%.
  - Exit STOP mode, or switch on the load Power, immediately long press “<math>\llcorner</math>” key to enter auto-tune mode, then the AT indicator light is on.
  - The auto-tune procedure will take some time, in order not to affect auto-tune result, please don't modify the parameters or power-off.
  - When AT light goes out, it automatically exits auto-tune mode, PID parameters will be updated automatically, and then the meter will control automatically and exactly.
  - During the auto-tune procedure, below actions will cause the termination of the process, long press “<math>\llcorner</math>” key, measure beyond the scope, abnormal display, switch to STOP mode, power-off, etc.
  - Note: In the occasions with output limiting operation, sometimes, even if the auto-tune is carried out, the best PID parameters still cannot be obtained.
  - Experienced users can set a proper PID parameter according to their experience.
- Single channel power limit:
  - OLL and OLH are used to limit the minimum to maximum range of the single channel output control amount, which is 0 to 100% by default.
  - The OLL setting value must be less than the OLH setting value.
  - If the OLH setting value is too small, the control efficiency and speed will be affected, and the target value may not be reached.
  - The single-channel power limit cannot realize the total power limit function.
- Total power limit function:
  - When the actual power LPH setting value of each channel is greater than 0, that is, this channel participates in the function of total power limit SLPL and power even distribution.
  - If the total power limit value SLPL is set too small, it will affect the control response speed of each limit channel, or even fail to reach the target value. Therefore, it should be set appropriately according to the actual situation.
  - After setting the LPH and SLPL values, the controller will automatically stagger and distribute the load power evenly to avoid the impact of the simultaneous full power output of each channel on the grid.
  - The channel that is performing auto-tuning will temporarily exit the total power limit, and will automatically recover after the auto-tuning is completed.
- Signal input
  - The temperature signal of this series of products only supports COM2 communication input for the time being, and needs to be used with the acquisition board. The address of the acquisition board is set by the menu ADD2
  - When the COM2 temperature request message does not return, the PV of each channel of the instrument will flash and display NONE, and the PV value obtained by the host computer communication COM1 is 0x7FFF (32767)
- Patrol inspection function
  - Set the number of inspection channels through the CN menu, up to 16 channels, when CN=0, turn off the inspection function.
  - The measurement value of the inspection is obtained by reading the communication IPV (x2B10~0x2B1F) register, and the inspection correction value is read and written through the IPS (0x2B10~0x2B1F) register
- Alarm function
  - When the internal alarm function of the controller needs to be turned on, the AD1 menu needs to be set. AD1=1 turns on the inspection alarm; AD1=2 turns on the over-temperature alarm.
  - Inspection alarm: When the difference between the measured temperature PV and the inspection temperature IPV is greater than the set value of AL1, the alarm timing will start, and the alarm output will be turned on when the time reaches the set value of DL1A (unit: second).
  - Over-temperature alarm: When the measured temperature PV exceeds the set value of the alarm value AL1, the alarm will be output immediately.
  - When there is alarm output, the output terminal adopts the alternate output mode. For example, when DN=6, CN=6, the output terminal C1 corresponds to OUT1 temperature control, C2 corresponds to OUT1 inspection alarm, C3 corresponds to OUT2 temperature control, C4 corresponds to OUT2 inspection alarm, and so on.



## VIII. Simple troubleshooting method

Display	How to troubleshoot
LLLL/HHHH	Check whether the input is disconnected; check the FH value and FL value; whether the working temperature is normal & the input signal selection is correct.
No display after power on	Check whether the voltage is normal; whether the contact is poor; whether the grid harmonics are too large.
No output	Check whether the wiring is correct; whether the contact is poor, whether the ACT/OT menu setting is wrong;
No communication	Troubleshoot hardware connection, instrument settings, software read settings; binary conversion error; address error; data error.

## IX. Protocol

It uses Modbus RTU communication protocol, read 04 area to keep the register function number be 0x03, write function number 0x10 or 0x06, adopts 16-bit CRC check, it does not return the check error. 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/Even

### 1. Read register

Example: The host reads PV1 value (PV1=200)

The register address of PV1 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 is converted to hexadecimal as 0x00C8. Note: When reading data, you should first determine the decimal point position and convert the read data to get the actual value.

Read multiple registers	Device address	Function code	Start ADD High bit	Start ADD Low bit	Data Length high bit	Data Length low bit	CRC code	CRC code
Host request	0x01	0x03	0x20	0x00	0x00	0x01	0x8F	0xCA
Slave responds normally	0x01	0x03	0x02 no. of bytes		0x00	0xC8	0xB9	0xD2
Slave abnormal response	0x01	0x83	0x02 Error code Example: host request add is 0x2011		0xC0	0xF1		

### 2. Write multiple registers

Example: The host writes multiple registers (using function code 10) write SV1 value (SV1=150)

The register address of SV1 is 0x2110, because the data type of SV1 is 16-bit integer (2 bytes), 1 register. The decimal integer 150 is converted to hexadecimal as 0x0096. Before writing data, convert the data to the corresponding magnification and then write the data to the meter.

Host request (write multiple registers)											
Meter add	Function code	Start ADD High bit	Start ADD Low bit	Data length high bit	Data length low bit	Data byte length	Data high bit	Data low bit	CRC code	CRC code	
0x01	0x10	0x21	0x10	0x00	0x01	0x02	0x00	0x96	0x15	0xAC	
Slave responds normally (write multiple registers)											
Meter add	Function code	Start ADD High bit	Start ADD Low bit	Data length high bit	Data length low bit	※CRC code low bit	※CRC code high bit				
0x01	0x10	0x21	0x10	0x00	0x01	0x0A	0x30				

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

Write single register	Meter add	Function code	Add high bit	Add low bit	Data high bit	Data low bit	CRC	CRC
Host request	0x01	0x06	0x21	0x10	0x00	0x96	0x02	0x5d
Slave normal responds	0x01	0x06	0x21	0x10	0x00	0x96	0x02	0x5d
Slave abnormal response	0x01	0x86 function code		0x02 error code		0xC3	0xA1	

### Communication abnormal handling:

When responding abnormally, set the highest bit of the function number to 1. For example: if the function number requested by the master is 0x03, the corresponding item of the function number returned by the slave is 0x83.

### Error type code:

0x01---Illegal function: The controller does not support the function number sent by the host.  
0x02---Illegal address: The register address specified by the host exceeds the allowable range of the controller parameter address.  
0x03---Illegal value: The write data value sent by the host exceeds the controller's allowable range.

### Instrument parameter address mapping table

NO	Address (register number ①)	Parameter name	Parameter description	Register	Read/write	Remark
1	0x2000 ~ 0x200F(48193 ~ 48208)	PV1 ~ PV16	Temperature control measurement	1	R	
2	0x2010 ~ 0x201F(48209 ~ 48223)	STA1 ~ STA16	Status value	1	R	②
Unlisted address reserved						
3	0x2100 ~ 0x210F(48449 ~ 48464)	MV1 ~ MV16	PID control output	1	R/W	
4	0x2110 ~ 0x211F(48465 ~ 48481)	SV1 ~ SV16	Setting value	1	R/W	
5	0x2120 ~ 0x212F(48481 ~ 48496)	RSA1 ~ RSA16	Working switch	1	R/W	0:RUN 1:STOP 2:AT
6	0x2130 ~ 0x213F(48497 ~ 48512)	SSM1 ~ SSM16	Panel R/S enable switch	1	R/W	0:STOP 1:RUN
7	0x2140 ~ 0x214F(48513 ~ 48528)	SLL1 ~ SLL16	Setpoint lower limit	1	R/W	
8	0x2150 ~ 0x215F(48529 ~ 48544)	SLH1 ~ SLH16	Setpoint upper limit	1	R/W	
Unlisted address reserved						
9	0x2200 ~ 0x220F(48705 ~ 48720)	INP1 ~ INP16	Input type	1	R/W	
10	0x2210 ~ 0x221F(48721 ~ 48736)	FL1 ~ FL16	Measured range upper limit	1	R/W	
11	0x2220 ~ 0x222F(48737 ~ 48752)	FH1 ~ FH16	Measured range upper limit	1	R/W	
12	0x2230 ~ 0x223F(48753 ~ 48768)	DP1 ~ DP16	Decimal point	1	R/W	
Unlisted address reserved						
13	0x2300 ~ 0x230F(48961 ~ 48976)	PS1 ~ PS16	Temperature control correction value	1	R/W	
14	0x2310 ~ 0x231F(48977 ~ 48992)	FT1 ~ FT16	Show Filter Coefficients	1	R/W	
15	0x2320 ~ 0x232F(48993 ~ 49008)	DTR1 ~ DTR16	Show trace value	1	R/W	
Unlisted address reserved						
16	0x2400 ~ 0x240F(49217 ~ 49232)	OLL1 ~ OLL16	Output limit lower limit	1	R/W	
17	0x2410 ~ 0x241F(49233 ~ 49248)	OLH1 ~ OLH16	Output limit upper limit	1	R/W	
18	0x2420 ~ 0x242F(49249 ~ 49264)	UNIT1 ~ UNIT16	Measurement display units	1	R/W	
19	0x2430 ~ 0x243F(49265 ~ 49280)	PRS1 ~ PRS16	Set parameter save location	1	R/W	0:ROM 1:RAM
20	0x2440 ~ 0x244F(49281 ~ 49296)	RSS1 ~ RSS16	RUN/STOP Save location	1	R/W	
Unlisted address reserved						
21	0x2500(49473)	DN	Display channels quantity	1	R/W	
22	0x2501(49474)	DNS	Display the starting channel number	1	R/W	
23	0x2502(49475)	DNT	Channel cycle display time	1	R/W	
24	0x2503(49476)	CN	Patrol channels quantity	1	R/W	
25	0x2504(49477)	RSA_TOTAL	Working status master switch	1	R/W	0:RUN ④ 1:STOP 2:AT
26	0x2505(49478)	AL_TOTAL	Alarm master switch	1	R/W	0:OFF 1:ON ⑤
27	0x2506(49479)	SV_TOTAL	Setting value master switch	1	R/W	0:OFF 1:ON

Continued from the front chart

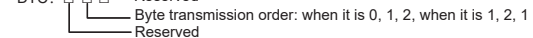
No	Address (register number)	Parameter name	Parameter description	Register	Read & write	Remark
28	0x2600 ~ 0x260F(49729 ~ 49744)	AL11 ~ AL116	Patrol temperature max deviation	1	R/W	
29	0x2610 ~ 0x261F(49745 ~ 49760)	DL1A1 ~ DL1A16	Alarm delay time	1	R/W	
30	0x2620(49761)	AD1	Alarm method	1	R/W	
Unlisted address reserved						
31	0x2800 ~ 0x280F(410241 ~ 410256)	OT1 ~ OT16	Control method	1	R/W	
32	0x2810 ~ 0x281F(410257 ~ 410272)	P1 ~ P16	Proportional band	1	R/W	
33	0x2820 ~ 0x282F(410273 ~ 410288)	I1 ~ I16	Integration time	1	R/W	
34	0x2830 ~ 0x283F(410289 ~ 410304)	D1 ~ D16	Differential time	1	R/W	
35	0x2840 ~ 0x284F(410305 ~ 410320)	OVS1 ~ OVS16	Overshoot limit	1	R/W	
36	0x2850 ~ 0x285F(410321 ~ 410336)	MSV1 ~ MSV16	Multi-stage target value switch	1	R/W	0: disabled 1: open
37	0x2860 ~ 0x286F(410337 ~ 410352)	FSPV1 ~ FSPV16	1st segment target value %	1	R/W	
38	0x2870 ~ 0x287F(410353 ~ 410368)	FSV1 ~ FSV16	Stable range of 1st segment target value	1	R/W	
39	0x2880 ~ 0x288F(410369 ~ 410384)	FSVT1 ~ FSVT16	Stable range of 1st segment target value	1	R/W	
40	0x2890 ~ 0x289F(410385 ~ 410400)	SSVP1 ~ SSV16	Stable range of 1st segment target value	1	R/W	0: disabled 1: open
41	0x28A0 ~ 0x28AF(410401 ~ 410416)	SSVF1 ~ SSVF16	1st segment target value progressive coefficient	1	R/W	
Unlisted address reserved						
42	0x2900 ~ 0x290F(410497 ~ 410512)	CP1 ~ CP16	Main control cycle	1	R/W	
43	0x2910 ~ 0x291F(410513 ~ 410528)	DB1 ~ DB16	Bit control hysteresis	1	R/W	
44	0x2920 ~ 0x292F(410529 ~ 410544)	AM1 ~ AM16	Manual switch	1	R/W	
45	0x2930 ~ 0x293F(410545 ~ 410560)	CP11 ~ CP116	Cooling Control Cycle	1	R/W	Reserved
46	0x2940 ~ 0x294F(410561 ~ 410576)	PC1 ~ PC16	Cooling Scale Factor	1	R/W	Reserved
Unlisted address reserved						
39	0x2A00 ~ 0x2A0F(410753 ~ 410768)	ACT1 ~ ACT16	Control Execution Mode	1	R/W	
40	0x2A10 ~ 0x2A1F(410769 ~ 410784)	PT1 ~ PT16	Compressor cooling start delay	1	R/W	
41	0x2A20 ~ 0x2A2F(410785 ~ 410800)	PDC1 ~ PDC16	PID type	1	R/W	
42	0x2A30 ~ 0x2A3F(410801 ~ 410816)	LPH1 ~ LPH16	Actual load power (KW)	1	R/W	
43	0x2A40(410817)	SLPL	Total load power limit (KW)	1	R/W	
Unlisted address reserved						
44	0x2B00 ~ 0x2B0F(411009 ~ 411016)	ALEN1 ~ ALEN8	Alarm sub-control switch	1	R/W	
45	0x2B10 ~ 0x2B1F(411025 ~ 411040)	IPV1 ~ IPV16	Patrol temperature value	1	R	
45	0x2B20 ~ 0x2B2F(411041 ~ 411046)	IPS1 ~ IPS16	Patrol correction value	1	R/W	
Unlisted address reserved						
46	0x2F00(412033)	ADD1	Local address	1	R	
47	0x2F01(412034)	BAD1	COM1 baud rate	1	R	
48	0x2F02(412035)	PRT1	COM1 check bit	1	R	
49	0x2F03(412036)	DTC1	COM1 data sending sequence	1	R	
50	0x2F04(412037)	LCK	Password lock function	1	R	
51	0x2F05(412038)	NAME	Instrument name	1	R	
52	0x2F06(412039)	ADD2	Acquisition board (temperature control) address	1	R/W	
53	0x2F07(412040)	ADD3	Acquisition board (inspection) address	1	R/W	
54	0x2F08(412041)	BAD2	COM2 baud rate	1	R/W	
55	0x2F09(412042)	RPT2	COM2 check bit	1	R/W	
56	0x2F0A(412043)	DTC2	COM2 data sending sequence	1	R/W	③

R: Read; R/W: Read & write

Note ①: The register number is formed by converting the address into decimal plus 1, and then adding the register identification code 4 in front, for example: the register number of the data address 0x2000 is 8192+1=8193 and then adding 4 in front, that is, the register number 48193; Related applications can be seen such as Siemens S7-200 PLC. Note ②: channel status indication, when the data bit is 1, it means execution, and when it is 0, it means it is not executed.

D10	D9	D8	D7	D6	D5	D4	D3	D2	D1	D0
NONE	___	AT	HHHH	LLLL	°C	°F	AL2	AL1	___	OUT1

Note ③: Description of DTC communication data transmission sequence

DTC:    Reserved  


Note ④: Temperature control switch priority: DIP switch >> RSA\_TOTAL master control switch >> RSA1~16 working switch = panel operation. Only when the high priority is on, the sub-priority switch can be operated. By writing parameter 2 through communication RSA\_TOTAL, all channels can enter the PID self-tuning state.

Note ⑤: Patrol alarm switch priority: AL\_TOTAL master control switch >> AL1~AL8 sub-control switch. Only when the high priority is on, the sub-priority can be operated.

## X. Version and revision records

Date	Version	Modified content
2022.12.08	A/0	First version
2023.02.13	A/1	Content modification
2023.03.02	A/2	Content modification

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