

Intelligent Temperature Controller User Manual

Applicable for AI208X-A version



Features

- Optional input signal types.
- PID arithmetic and with auto-tuning function.
- Different control types (please refer OT parameters).
- RUN/STOP function can be switch.

National High-tech Enterprise/ National Standard Drafting Unit

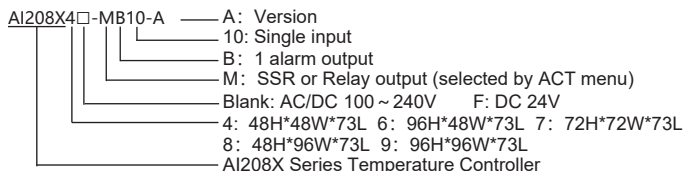


Hotline: 400-0760-168

Version: KKA1208X-A01ET01-A/0-20220825

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. Model Illustration



II. Order Information

No.	Model	Control output	Alarm
1	AI208X-4/6/7/8/9-MB10	RELAY/SSR	1

III. Specifications

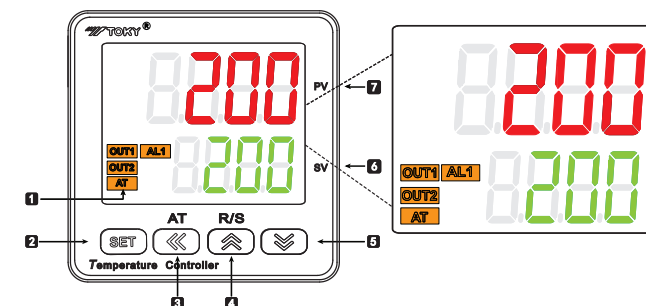
1. Electrical parameters:

Sample rate	2 times per second
Relay capacity	AC 250V /3A lifespan of rated load>100,000 times
Power supply	AC/DC 100 ~ 240V (85-265V) ,DC 24V
Power consumption	< 10VA
Environment	Indoor use only, temperature: 0~50°C no condensation, humidity < 85%RH, altitude<2000m
Storage environment	-10 ~ 60°C, no condensation
SSR output	DC 24V pulse voltage, load<30mA
Insulation impedance	Input, output, power VS meter cover > 20MΩ
ESD	IEC/EN61000-4-2 Contact ±4KV /Air ±8KV perf.Criteria B
Pulse triaip 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, output, power: 1500VAC 1min, <60V low voltage circuit: DC500V, 1min
Total weight	About 400g
Cover material	The shell and panel frame PC/ABS (Flame Class UL94V-0)
Panel material	PET(F150/F200)
Power failure memory	10 years, times of writing: 1 million times
Panel Protection level	IP65(IEC60529)
Safety Standard	IEC61010-1 Overvoltage category II , pollution level 2, levelII (Enhanced insulation)

2. Measured signal specifications:

Input type	Symbol	Measure range	Resolution	Accuracy	Input impedance /auxiliary current
K	ℰ	-50 ~ 999	1°C	0.5%F.S±3digits	> 500kΩ
J	ℰ	0 ~ 999	1°C	0.5%F.S±3digits	> 500kΩ
E	ℰ	0 ~ 850	1°C	0.5%F.S±3digits	> 500kΩ
T	ℰ	-50 ~ 400	1°C	0.5%F.S±2°C	> 500kΩ
PT100	ℰ	-200 ~ 600	1°C	0.5%F.S±3digits	0.2mA
CU50	ℰ	-50 ~ 150	1°C	0.5%F.S±3°C	0.2mA
CU100	ℰ	-50 ~ 150	1°C	0.5%F.S±1°C	0.2mA

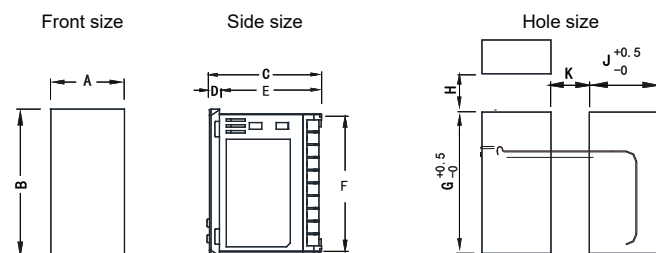
IV.Panel Illustration



No.	Symbol	Name	Function
1	OUT1	OUT1 (Orange)	Main control output indicator, the light turns on when the output is on.
	OUT2	OUT2 (Orange)	Cooling output indicator, the light turns on when the output is on.
	AL1	Alarm 1# (Orange)	1st alarm output indicator, the light turns on when alarm output is on, the light turns off when alarm output is off.
	AT	AT indicator(Orange)	Auto tune indicator, the light turns on when the controller enter the auto tune status.
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, press and hold it to enter/exit auto tune mode)
4	>>	UP key/ R/S	Add key, in measure and control mode, press and hold it to shift RUN/STOP mode, press it to check the menu in reverse order.
5	>>	DOWN key	Reduce key, check the menu in sequence
6	SV	Display (green)	Set value / timer / parameter display window, the control is stopped when it displays "STOP"
7	PV	Display (red)	Measured value/ parameter menu display.

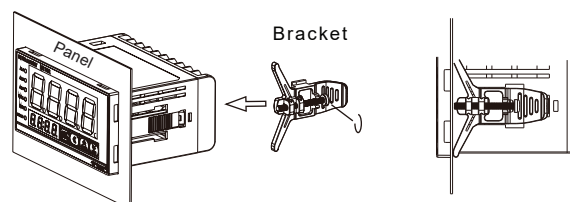
V. Dimension and installation

1. Dimension



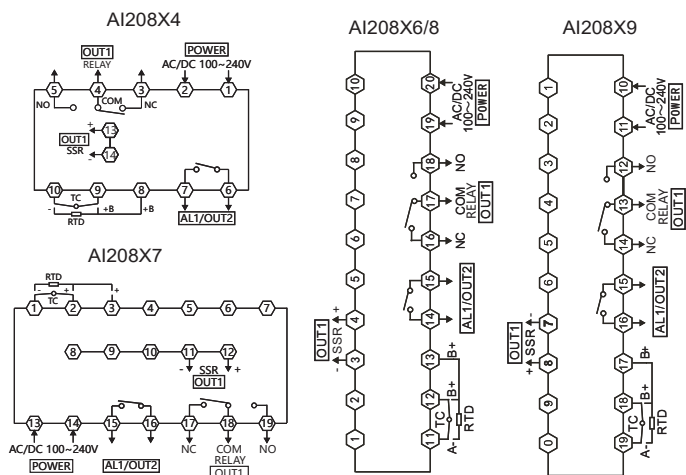
Model	A	B	C	D	E	F	G	H(Min)	J	K(Min)
4:(48*48)	48	48	73	6.5	66.5	44	45	25	45	25
6:(48*96)	48	96	73	6.5	66.5	90	91.5	25	45	25
7:(72*72)	72	72	73	6.5	66.5	66	67.5	25	67.5	25
8:(96*48)	96	48	73	6.5	66.5	44	45	25	91.5	25
9:(96*96)	96	96	73	6.5	66.5	90	91.5	25	91.5	25

2. Installation



Installation method: put the meter into the cutout hole, then place the bracket on the installation slot of the meter housing, and push the bracket toward the panel until the meter is clamped (as shown above).

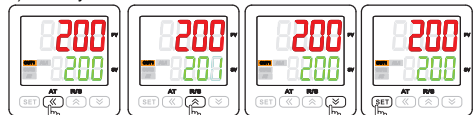
VI. Wiring diagram



VIII. Operation process and menu illustration

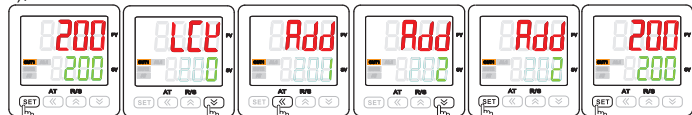
1. Operation process & method

1)、Modify SV Value



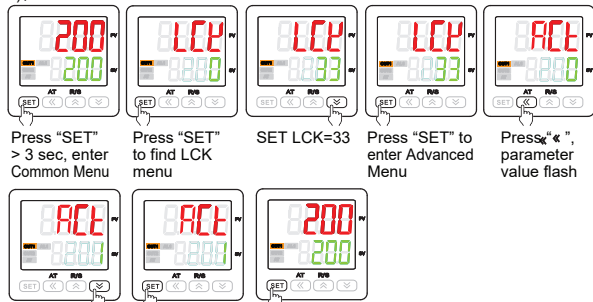
Press "←" SV value flash
Press "▲" Increase SV value
Press "▼" Reduce SV value
Press "SET" Save SV value

2)、Common Menu



Press "SET" > 3 sec, enter Common Menu
Press "▲" or "▼", move among menus
Press "←", parameter value flash
Press "▲" or "▼", modify parameter value
Press "SET", save modified value
Press "SET" > 3 sec, exit Common Menu

3)、Advanced menu



Press "SET" > 3 sec, enter Common Menu
Press "SET" to find LCK menu
SET LCK=33
Press "SET" to enter Advanced Menu
Press "▲", parameter value flash

Press "▲" or "▼", modify parameter value
Press "SET", save modified value
Press "SET" > 3 sec, exit Advanced Menu

IX. Menu Illustration

NOTE: The meter will hide unrelated parameters according to OT parameter setting. We suggest to set the OT parameter before using the meter for the first time.

□: No matter what model, what control mode it is, it will always display these parameters.

■: According to different model, control mode, these parameters will be hidden.

1. Regular Menu

No.	Symbol	Name	Illustration	Setting range	Factory setting
1	AL1	AL1	1st alarm value. Note: the minus is dealt as absolute value when it is as deviation alarm.	FL~FH	10
2	HY1	HY1	1st alarm hysteresis	0~100	1
3	AD1	AD1	1st alarm mode. Note: when AL1 is used as OUT2 (cooling output), should set the value AD1=0 (close alarm function). When AD1>6, 2nd alarm function is invalid	0~13	3
4	ATH	ATH	Alarm mode for temperature holding timer. STT(0): alarm output turns on when the timing begin. CPL(1): alarm output turns on when the timing is done.	0~1	CPL(1)
5	ALT	ALT	Alarm duration for temperature holding timer. The alarm duration for timer can be set freely, once the duration time is up, the alarm will turn off automatically. If it is set as 0, the alarm wouldn't turn off by itself.	0~999 Unit: min	0
6	THT	THT	Temperature holding process timer. Set the timer as 1~999, once the target temperature is reached, the controller will hold this temperature, the timer will start timing, and SV window will display the remaining time. Once the time is up, the control output (OUT) will turn off. Set the timer as 0, there is no timing function, control output (OUT) will stay turning on.	0~999 Unit: min	5

No.	Symbol	Name	Illustration	Setting range	Factory setting
7	THR	THR	Temperature holding process activation interval. When PV value reaches the temperature range $SV \pm THR$ for 5 seconds, the temperature holding process will be activated at once.	0~999	0
8	THC	THC	Action after the timing is done. STP(0): control output turns off after the timing is done. HLD(1): control output stays turning on after the timing is done.	0~1	STP(0)
9	PS	PS	Amend value, display value= actual measured value + amend value	-199~999	0
10	INP	INP	Optional input measured signal type: refer to input signal parameters table. Note: after the setting, need to modify other relevant parameters too.	K~CU100	K
11	OT	OT	Control mode. 0: ON/OFF heating control, parameter: DB. 1: PID heating control, parameters: P, I, D, OVS, CP, ST, SPD. 2: Compressor cooling control, parameter: DB, PT. 3: PID heating & cooling control (cooling control OUT2 will output through AL1 relay), parameters: P, I, D, OVS, DB, CP, CP1, PC, ST, SPD. 4: Over temperature cooling output, parameter: DB	0~4	1
12	P	P	Proportional band. The smaller the value is, the faster the system responds, otherwise, it is slower. Increasing proportional band can reduce the oscillation, but it will increase the control deviation. Reducing proportional band can reduce control deviation, but it will cause oscillation	0~999	30
13	I	I	Integral time. The smaller the value, the stronger the integral action, the better performance on eliminating the deviation between PV and SV. If the integral action is too weak, the deviation might not be eliminated.	0~999 Unit: sec	120
14	D	D	Differential time. Reducing it to a suitable value can prevent the oscillation of the system. The greater the value, the stronger the differential action.	0~999 Unit: sec	30
15	OVS	OVS	Overshoot limit. During PID control process, when $PV(\text{measured value}) > SV(\text{set value}) + OVS(\text{overshoot limit})$, 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.	0~999	5
16	DB	DB	ON/OFF control hysteresis (positive and negative numbers work the same); when OT=3, it is the dead zone for cooling control (positive and negative numbers work differently); after change the INP setting, please change this parameter according to the decimal point position.	0~100	5
17	CP	CP	OUT1 control cycle, 1: SSR control output, 4~200: relay control output. Unit: sec	1~200	20
18	CP1	CP1	OUT2 relay output cycle. Unit: sec	4~200	20
19	PC	PC	OUT2 cooling proportionality coefficient. The higher of value, the stronger of cooling effect.	1~100	10
20	LCK	LCK	Lock function. 001: SV value can't be modified. 010: menu set value can be checked only, can't be modified. 033: enter the advanced menu. 123: menus reset to factory setting.	0~999	0

2. Secondary menu illustration

No.	Symbol	Name	Illustration	Setting range	Factory setting
21	ACT	ACT	Control execution type. 0: relay output. 1: SSR output	0~1	0
22	ST	ST	Auto-tune activation after power-on. 0: work normally after power-on 1: automatically enter PID parameters auto-tune status after power-on; press and hold « AT key to exit auto-tune..	0~1	0
23	SPD	SPD	PID control speed adjustment. Option: 0(N) no function, 1 (s) slow, 2 (ss) medium slow, 3 (SSS) very slow, 4 (F) fast, 5 (FF) medium fast, 6 (FFF) very fast	0~6	0(N)
24	PT	PT	Compressor activation delay time, unit: sec	0~999	180
25	AE1	AE1	1st alarm extensions function, refer to alarm extension function table	0~5	0
26	FL	FL	Measure range low limit. The set value must be less than measure range high limit	Refer to measured signal table	-50
27	FH	FH	Measure range high limit. The set value must be more than measure range low limit.	Refer to measured signal table	999

No.	Symbol	Name	Illustration	Setting range	Factory setting
28	DP	DP	Decimal point setting	0 ~ 1	0
29	FT	FT	Filter coefficient. The higher the value, the stronger the filter function.	0~255	10
30	UT	UT	Temperature unit	°C, °F	°C
31	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 the alarm set value is equal to SV set value, alarm output operation is subject to actual measured value. Set as 0 to close this function.	0.0~2.0	1.0
32	SSM	SSM	Enable R/S key to switch RUN/STOP operation. 0: Forbidden 1: Enable This setting is for panel operation only, not for communication operation.	0 ~ 1	1
33	VER	VER	Software version	_____	

IX. Alarm function logic diagram:

(1) Symbol illustration: “☆” means HY, “▲” means alarm value, “△” means SV value

Alarm code	Alarm mode	Alarm output (AL1 & AL2 are independent from each other) Image:the hatched section means the alarm action
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	Timer alarm STT: alarm output before the timing begins. CPL: alarm output after the timing is done.	

Alarm code	Alarm mode	The below two alarm parameters(AL1,AL2) are used in combination, AL1 alarm output, AD2 must be set as 0
8	High and low limit absolute value interval alarm	
9	※High and low limit deviation value interval alarm	
10	※High limit absolute value and low limit deviation value interval alarm	
11	※High limit deviation value and low limit absolute value interval alarm	
12	High/low limit absolute value alarm	
13	High/low limit deviation value alarm	

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

(2) Alarm extension function table

AE1/AE2 value	Alarm handling method when it displays HHHH/LLLL	Power on, alarm inhibition
0	Alarm status remains the same	Power on, no alarm inhibition
1	Force alarm output	(As long as the alarm condition is met, alarm output immediately.)
2	Force alarm close	
3	Alarm status remains the same	Power on, alarm inhibition
4	Force alarm output	(After power on and before the PV value reaches the SV for the first time, the alarm will not output. After that alarm work normally)
5	Force alarm close	

X. Key function operation

1. RUN/Stop mode

- Under the measure mode, press and hold “R/S” key > 3 sec to enter STOP mode, SV window will display “STOP”. Under STOP mode, press and hold “R/S” key to exit STOP mode.
- Under STOP mode, SV value can still be modified and operation mode can still be switched.
- Under STOP mode, main control output will stop.

2. PID auto-tune operation:

- Usually, the default PID parameters of this product are not suitable for all occasions; please use auto-tuning function to get a suitable PID parameter.
- The meter will enter control output since the power input, please set the meter as STOP mode to not affect the auto-tuning result, or switch off the power of control output load. No matter how to operate, should ensure that the set value is greater than the current measured value; the greater the drop, the better.
- Before auto-tuning, please set the proper alarm value, or remove the alarm condition to avoid the effect of alarm output.
- Set SV value.
- Set parameter OT as 1 (PID control).
- Under the condition of PV value at normal room temperature, please exit STOP mode or input the load power, and keep pressing “AT” key to enter auto-tuning mode, then AT indicator turns on.
- Auto-tuning need a period, to ensure the auto-tuning result, please don't modify parameters or power-off during auto tuning.
- When AT light is off, it will exit the auto-tuning mode. PID will update automatically, and the meter will control automatically and precisely.
- During auto-tuning procedure, press “AT” key, measure beyond the range, display abnormally, shift to “STOP” mode, power-off will stop the auto-tuning.
- Experienced user can set the proper PID parameter with their rich experience.

3. PID heating & Cooling control operation (suitable for injection molding machine and extruder)

- Set the control mode OT to 3. (heating and cooling control)
- PID heating control act on OUT1; Cooling control act on OUT2.
- Cooling control OUT2 will make output by AL1 alarm relay.
- Please set the cooling start offset to a value larger than 5, to ensure the cooling would not affect PID heating control.
- Please set the cooling control cycle CP1 to a proper value, and change the cooling scaling factor to a proper value.
- When PV value > SV+DB value, the cooling control start to effect; the bigger value of PV, the longer output time of OUT2.

4. Temperature holding operation

- Enter the menu to set THT and THC to activate the temperature holding mode.
- After entering the temperature holding mode, the measurement interface will unlock the TH and AL pages, which are used to display the remaining time of temperature holding timer and alarm duration respectively.
- In measuring mode, press “SET” to display SV, TH and AL by turn. The upper row LED will flash SV, TH or AL for one second, and the second row LED will display the value.
- In measuring mode, when the temperature rises or cools to the temperature range SV±THR and stays for 5 seconds, the temperature holding process will be activated. Meanwhile, the controller will automatically enter the TH page to display the remaining time of the temperature holding process. The 5 seconds that the target temperature stays when activating the temperature holding process will be included in the holding time.
- During the temperature holding process, the user can press the shift key “<” to modify the TH value, then the remaining time will be refreshed after the modification. Example: when the remaining temperature holding time is 5 minutes 30 seconds, and the TH page displays 6, if TH is modified to 10, then the remaining holding time will be refreshed as 9 minutes 30 seconds. This modification does not affect the THT value.
- In the case that the meter is powered off when the temperature holding timer or alarm timer is not over, it will automatically enter the STOP mode when it is powered on again. The user can press “SET” key to display the remaining time of both the temperature holding process and the alarm before power failure. Please be noted, if press the “R/S” key at this time, the controller will reset the temperature holding process according to the THT value, and cannot continue the previous state.
- Modifying the SV value in any state will reset the temperature holding process. The user can reset the SV value if they want to restart the temperature holding process after the last one is over.

XI. Checking methods of simple fault

Display	Checking methods
LLLL/HHHH	Checks whether the input disconnection and whether normal of FH/ FL value, working environment temperature and whether input signal is selected correctly.

XII. Version and Revision Record

Date	Vesion	Revision Record
2022.08.25	A/0	First edition