



## ARTIFICIAL INTELLIGENCE TEMPERATURE CONTROLLER AI-218/2181 User Manual

### I. Main features

- Designed specially for plastic machinery, food process machinery, packaging machinery and so on. Easy to learn and operate and lowest cost.
- Universal power supply 100~240VAC. 50/60Hz.C/F selectable.
- Freely choose input and output types, modularized ,prompt delivery,best service after sale.
- Armed with AT and AI PID Intelligent control algorithm function.
- Burnt-proof design results in lower power consumption, higher reliability and stability. Its power and I/O terminals pass 4KV/5KHz pulse crash proof experiment.
- Qualified with ISO9001, ISO14001 ,CE,and CQC, satisfying European RoHS Standard.

### II. Model Code Symbol

The type of AI-218 is made up of 4 parts:

AI-218	A	G	L0
Part 1 (Series)	Part 2 (Size)	Part 3 (Oupt)	Part 4 (AUX)

#### Part 1 stands for Model series

AI-218, standard artificial intelligence temperature controller 0.3%FS±1℃ accuracy. 0.1℃ display resolution.

Based on AI-218, AI-2181 is with nPID function.

#### Part 2 stands for Front panel dimension

Size	Front Panel width×height	Cut Out width×height	Depth Behind Mounting Surface
A	96×96mm	92 <sup>+0.5</sup> ×92 <sup>+0.5</sup> mm	100mm
A1	96×96mm	92 <sup>+0.5</sup> ×92 <sup>+0.5</sup> mm	70mm
B	160×80mm	152 <sup>+0.5</sup> ×76 <sup>+0.5</sup> mm	100mm
C	80×160mm	76 <sup>+0.5</sup> ×152 <sup>+0.5</sup> mm	100mm
C1	80×160mm	76 <sup>+0.5</sup> ×152 <sup>+0.5</sup> mm	70mm
D	72×72mm	68 <sup>+0.5</sup> ×68 <sup>+0.5</sup> mm	95mm
D1	48×48mm	45 <sup>+0.5</sup> ×45 <sup>+0.5</sup> mm	78.5mm
D2	48×48mm	45 <sup>+0.5</sup> ×45 <sup>+0.5</sup> mm	95mm
E	48×96mm	45 <sup>+0.5</sup> ×92 <sup>+0.5</sup> mm	100mm
E1	48×96mm	45 <sup>+0.5</sup> ×92 <sup>+0.5</sup> mm	70mm
F	96×48mm	92 <sup>+0.5</sup> ×45 <sup>+0.5</sup> mm	100mm
F1	96×48mm	92 <sup>+0.5</sup> ×45 <sup>+0.5</sup> mm	70mm

#### Part 3 indicates the module installed in OUP socket.

L Relay contact output module (Capacity: 2A/250VAC, normal open)

G SSR voltage output module (30mA/5VDC)

#### Part 4 indicates Auxiliary alarm output

N (or none) no module installed

L0 Relay contact output module (Capacity: 2A/250VAC, normal open / normal close)

L2 Relay output module omron brand(1A/250VAC)

L5 Dual relay Output module (Capacity: 2A/250VAC, normal open, support AU1 and AU2 alarm output)

Remark: For D1-size instrument, OUP (output module) is SSR mounted with driving voltage 30mA/5VDC. AU1 is also selectable as relay alarm output (NO+NC, 2A/250VAC). D1 is not in modular design.

### III. Technical Specification

1. **Input type** :K, S, R, E, J, N, Pt100

2. **Instrument Input range**:

K(0-1300℃), S(0-1700℃), R(0-1600℃), E(0-1000℃),J(0-1200℃), N(0-1300℃),PT100(-200~+800℃)

3. **Measurement accuracy**: 0.3%FS±1℃ /0.1℃

4. **Control mode**:

On-off control mode, or PID control with the function of parameter auto tuning.

5. **Output**: SSR 5VDC/30mA output ,Relay contact output ,open normally

6. **Alarm function**: High Alarm, Lower limit alarm,Deviation High Alarm.

7. **Power supply voltage rating**: 100-240VAC, -15%, +10% / 50-60Hz.

8. **Power consumption**: ≤3W.

9. **Ambient temperature**: -10~+60℃, Humidity: 0~90RH%

### IV. Basic display status

#### 1. Change given Set Value:

When powered on, it shows the basic display status, upper window displays real process value (PV) while lower window displays the set value (SV). If the real value overruns measure range(thermocouple breaks for example), upper window will display "orAL" and the highest and lowest values, at this time, controller will automatically stop controlling the output.

In controller's face, basically there are 6~10 LED lights,OP1,AU1,AU2,RUN which respectively stand for output, first alarm, second alarm, and working condition.

#### 2. Change SV setting

In basal display status, if the parameter lock "Loc" isn't locked, we can set setpoint (SV) by pressing (◀), (▽), (▲). Press (▽) key to decrease the value, (▲) key to increase the value, and (◀) key to move to the digit expected to modify. Max parameter of SPL and SPH, is limited to be 0~400C.



Press (▽) can decrease the value, press and keep pressing it can make quick decrease



Press (▲) can increase the value, press and keep pressing it can make quick increase



Press (◀) can change the targeted digit number of value

#### 3 AI artificial intelligence control and auto tuning:

When AI artificial intelligence control method is chosen, the PID parameters can be obtained by running auto-tuning. In basal display status, press (◀) for 2 seconds, the "At" parameter will appear. Press (▲) to active the auto-tuning process. During auto tuning, the instrument executes on-off control. After 2-3 times of on-off action, the instrument will obtain the optimal control parameter value. If you want to escape from auto tuning status, press and hold the (◀) key for about 2 seconds until the "At" parameter appear again. Change "At" from "on" to "oFF", press (○) to confirm, then

the auto tuning process will be cancelled.

Note1 : AI-218 is with advanced PID, which makes it high accuracy.

Note2: If the setpoint is different, the parameters obtained from auto-tuning are possible different. So you'd better set setpoint to an often-used value or middle value first, and then start auto-tuning. Depending on the system, the auto-tuning time can be from several seconds to several hours.

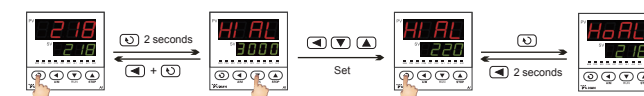
Note3: Setting of CHYS may have influence on AT.. The lower value of CHYS the higher accuracy. But too low CHYS isn't advice, CHYS=2.0 is advice.

Note4: At the beginning after AT, the result maybe not table but it will get best result after a time.



### V. Parameter Setting:

In basal display status, press (○) and hold for about 2 seconds can access Field Parameter Table. Pressing (○) can go to the next parameter; pressing (◀), (▽), (▲) can modify a parameter. Press and hold (◀) can return to the preceding parameter. Press (◀)(don't release) and then press (○) key simultaneously can escape from the parameter table. The instrument will escape automatically from the parameter table if no key is pressed within 30 seconds. Setting Loc=808 and then press (○) can access System Parameter Table.



### VI. Parameters and settings

Field parameter table (Press (○) and hold for 2 seconds to access)

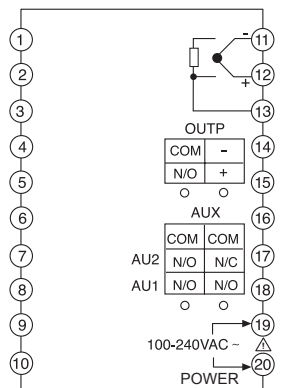
Code	Name	Description	Setting Range	Default value
HIAL	High limit alarm	Alarm on when PV (Process Value) >HIA; alarm off when PV<HIA-AHY Please refer to AOP description for AU1,AU2.		3000℃
LoAL	Lower limit alarm	Alarm on when PV (Process Value) <LoA; alarm off when PV>LoA-AHY In case of electric short, it'll alarm after it's second time lower than LoAL.		-999
HdAL	Deviation high alarm	Alarm on when PV-SV>HdA; alarm off when PV-SV<HdA-AHY When HdAL is max, alarm function is null.	-999~+3000℃	3000℃
LdAL	Deviation low alarm	Alarm on when PV-SV<LdA; alarm off when PV-SV>HdA-AHY When LdAL is minimum, alarm function is null		-999
Loc	Parameter Lock	Loc=0: Allowed to modify parameters and do AT Loc=1: Allowed to modify parameters but cannot AT Loc=2: Allowed to modify parameters and AT Loc=4-255: NOT allowed to modify parameters except Loc. Loc=808, Set to 808 and press (○), allowed modify all parameters	0~255	0

AHYS	Hysteresis	Avoid wrong frequent alarm caused by wrong value setting	0~200	2
AOP	Alarm Output assignment	AoP is to define the place of HIAL,LoAL, HdAL alarms like : $AOP = \begin{matrix} 0 & 4 & 0 & 3 \\ \text{LdAL} & \text{HdAL} & \text{LoAL} & \text{HIAL} \end{matrix};$ Value 0~4."0" means never alarm,"1" and "2" represents the alarm outputs from AL1 and AL2 respectively. "3" and "4" represents the alarm outputs from AU1 and AU2 respectively. E.g. AOP=403 means HIAL alarm from AU1, HdAL from AU2.LoAL no alarm	0~444	Depends on module added
Ctrl	Control mode	onoF:On-off control, used in normal case. APId: high precision control PID mode. nPIId: Standard PID algorithm with anti-integral-saturation function..	onoF/ APId	APId
Act	Direct/reverse acting function	rE:Reverse acting.Increase in measured variable causes a decrease in the output,such as heating control. dr:Direct acting.Increase in measured variable causes an increase in the output,such as refrigerating control. rEbA:Reverse acting with low limit alarm and deviation low alarm blocking at the beginning of power on. drbA:Direct acting with high limit alarm and deviation high alarm blocking at the beginning of power on.	rE Dr rEbA drbA	rE
p	Proportional band	Proportional band in PID with unit $^{\circ}\text{C}/\text{F}$ . Notes: normally use At to confirm P, I, D and Ctl .But can set known correct value.	1~999	30
I	Time of Integral	Time of integral in PID.No integral effect when I=0 unit is 1 second	0~9999 Sec	100
d	Time of Derivative	Time of derivative in PID.No derivative effect when d=0	0~999.9 Sec	50.0
Ctl	Control period	Small value can improve control accuracy. For SSR output, generally 0.5 to 3.0 seconds. For Relay output, generally 15~40 seconds, because small value will cause the frequent On-Off of mechanical switch and shorten its service life. Ctl is recommended to be 1/4 ~ 1/10 of derivative time. When control under on-off control,Ctl use as restart delay time after off,for protect compressor application.	0.5~120 Sec	2.0/20
CHYS	Control Hysteresis	CHY is used for on-off control, if PV > SV, output turns off; PV<SV-CHYS, output turns on.	0~200	2

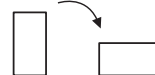
InP	Input specification	<table border="1"> <tr> <th>InP</th> <th>Input spec</th> <th>InP</th> <th>Input spec</th> </tr> <tr> <td>0</td> <td>K</td> <td>1</td> <td>S</td> </tr> <tr> <td>2</td> <td>R</td> <td>3</td> <td>Spare</td> </tr> <tr> <td>4</td> <td>E</td> <td>5</td> <td>J</td> </tr> <tr> <td>6</td> <td>Spare</td> <td>7</td> <td>N</td> </tr> <tr> <td>8-20</td> <td>Spare</td> <td>21</td> <td>Pt100</td> </tr> </table>	InP	Input spec	InP	Input spec	0	K	1	S	2	R	3	Spare	4	E	5	J	6	Spare	7	N	8-20	Spare	21	Pt100	0~21	0
		InP	Input spec	InP	Input spec																							
		0	K	1	S																							
		2	R	3	Spare																							
		4	E	5	J																							
6	Spare	7	N																									
8-20	Spare	21	Pt100																									
dPt	Resolution	"0" means 1 $^{\circ}\text{C}$ or 1F, "0.0" means 0.1 $^{\circ}\text{C}$ /F	0/0.0	0.0																								
Scb	Input Shift	Scb is used to make input shift to compensate the error produced by sensor or input signal. PV_after_compensation= PV_before_compensation + Scb. Note:normally set it as 0	-200 ~ +400	0																								
FILt	PV input filter	The value of FILt will determine the ability of filtering noise. If great interference exists, then you can increase parameter "FILt" gradually to make momentary fluctuation of measured value less than 2 to 5. When the instrument is being metrological verified, "FILt" s can be set to 0 or 1 to shorten the response time.	0~40	1																								
Fru	Power frequency and display unit	50Cmeans 50Hz,display unit is $^{\circ}\text{C}$ . 50F,means 50Hz,display unit is $^{\circ}\text{F}$ . 60Cmeans 60Hz,display unit is $^{\circ}\text{C}$ . 60Fmeans 60Hz, display unit is $^{\circ}\text{F}$ .		50C																								
OPH	Output highest limit	Minimum value of SV	-999~+3000	0																								
SPH	Upper limit of SV	Maximum value that SV		40																								

## VII. Installation and wiring

### Wiring graph for instruments with dimension A, B, E and F:

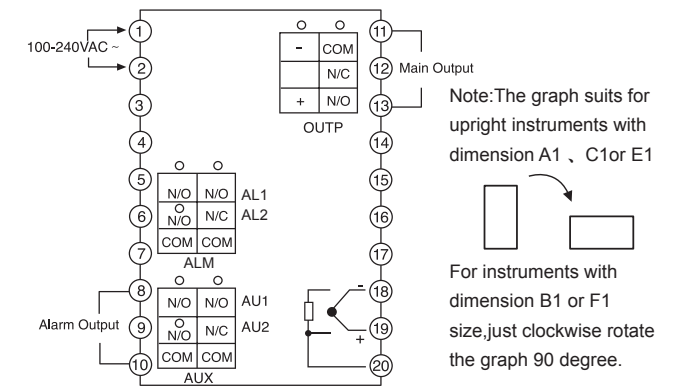


Note:The graph suits for upright instruments with dimension A, C or E



For instruments with dimension B or F size,just clockwise rotate the graph 90 degree.

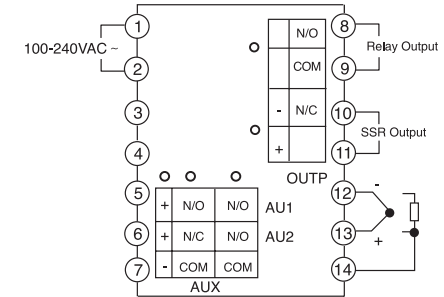
### Wiring graph for instruments with dimension A1, E1 and F1:



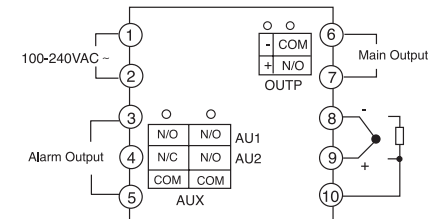
Note:The graph suits for upright instruments with dimension A1、C1or E1

For instruments with dimension B1 or F1 size,just clockwise rotate the graph 90 degree.

### Wiring graph for D dimension(72X72mm)instruments:



### Wiring graph for D1/D2 dimension(48X48mm)instruments:



Note:

1. After the connection of thermocouple with compensation wire and the cover of plastic panel, it cannot change with common wire. Pay attention to the correct connection of wire and lead.
- 2.As CE requires, please use product that can stand over 2300V when controller is connected with extra Solid state relay.